UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

AUG 2 8 2006

Mr. Robert P. LaBelle
Acting Associate Director for Offshore Minerals Management
Minerals Management Service
1849 C Street NW, Mailstop 4000
Washington, DC 20240-0001

Dear Mr. LaBelle:

The National Marine Fisheries Service (NOAA Fisheries Service) has prepared a biological opinion that evaluates the effects of the removal of offshore structures in the Gulf of Mexico Outer Continental Shelf on threatened and endangered species. Specifically, the biological opinion assesses the effects of the proposed activities on the sperm whale (*Physeter macrocephalus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempi*), hawksbill sea turtle (*Eretmochelys imbricata*), and the leatherback sea turtle (*Dermochelys coriacea*). This biological opinion also addresses the concurrent action by the NMFS' Permits, Conservation, and Education Division to issue an incidental harassment authorization under the Marine Mammal Protection Act (MMPA) for the incidental take of marine mammals during the proposed activities.

After considering the status of threatened and endangered species, the environmental baseline of the area, and the direct, indirect, and cumulative effects of the action on the threatened and endangered species, the biological opinion concludes that the proposed action is not likely to jeopardize the continued existence of threatened or endangered species in the action area. The action area does not contain designated critical habitat and therefore is not likely to destroy or adversely modify critical habitat.

The incidental take statement (ITS) included with the opinion exempts the take of listed sea turtle species if the reasonable and prudent measures and terms and conditions are implemented. The ITS does not include exemption of take of sperm whales. When the incidental take of marine mammals is authorized under section 101(a)(5) of the MMPA, NOAA Fisheries Service will amend the ITS for marine mammals, as appropriate. The ITS makes adjustments to the proposed mitigation scenarios for explosive severance in MMS' Programmatic Environmental Assessment. The Appendix to the opinion contains the final mitigation scenarios.

We included several conservation recommendations (on page 90) that would minimize adverse effects to sea turtles from the explosive-severance removals in the Gulf of Mexico OCS and develop information on the effects of explosions on sea turtles. In order for the Office of Protected Resources and Southeast Regional Office Protected Resources Division to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

This biological opinion concludes the consultation for the proposed action. Reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this biological opinion; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

I look forward to continued cooperation with Minerals Management Service during future section 7 consultations. If you have questions regarding this opinion, contact me or Angela Somma at (301) 713-1401.

Sincerely,

James H. Lecky
Director, Office of Protected Resources

cc: Joe Christopher, Regional Supervisor for Leasing and Environment
Jill Lewandowski, Protected Species Coordinator

Enclosure

Endangered Species Act Section 7 Consultation

Biological Opinion

Action Agencies	**Minerals Management Service**
	National Marine Fisheries Service, Permits, Conservation and Education Division
Actions	**Permitting Structure Removal Operations on the Gulf of Mexico Outer Continental Shelf**
	Authorization for Take of Marine Mammals Incidental to Structure Removals on the Gulf of Mexico Outer Continental Shelf
Consulting Agency	**National Marine Fisheries Service, Endangered Species Division**
Approved by	
Date	AUG 28 2006

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. § 1531 *et seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. When the action of a federal agency may affect a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected. Formal consultations on most listed marine species are conducted between the action agency and NMFS. Consultations are concluded after NMFS' issuance of a biological opinion (opinion) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. If jeopardy or destruction or adverse modification is found to be likely, the opinion must identify the reasonable and prudent alternatives (RPAs) to the action, if any, that would avoid jeopardizing any listed species and avoid destruction or adverse modification of designated critical habitat. If jeopardy is not likely, the opinion also includes an incidental take statement (ITS) which specifies the amount or extent of incidental taking anticipated from the proposed action. Non-discretionary reasonable and prudent measures to minimize the impact of the incidental taking are included along with the implementing terms and conditions, and conservation recommendations are made.

The present consultation considers Minerals Management Service's management of the removal of offshore structures in the Gulf of Mexico. This document constitutes NMFS' opinion on the effects of these activities on threatened and endangered species and critical habitat, in accordance with section 7 of the ESA. Specifically, this opinion analyzes the effects of offshore structure removal on endangered sperm whales (*Physeter macrocephalus*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback sea turtles (*Dermochelys coriacea*), and on threatened loggerhead sea turtles (*Caretta caretta*).

This opinion is based on the following information sources:

- Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf Programmatic Environmental Assessment prepared by the Minerals Management Service;
- Explosive Removal of Offshore Structures Information Synthesis Report prepared by Continental Shelf Associates;
- Recovery Plans for the Atlantic populations of green, loggerhead, Kemp's ridley, hawksbill, and leatherback sea turtles;
- Published scientific studies; and
- Unpublished data maintained at NMFS Galveston Laboratory.

Consultation History

By letter dated May 12, 2005, Minerals Management Service (MMS) requested a formal consultation with NMFS on the permitting and management of all structure removal operations on the Gulf of Mexico OCS. Structure removal operations may affect several endangered and threatened marine species. Given that these operations would also harass several marine mammal species, MMS applied to NMFS Permits, Conservation and Education Division for an incidental take authorization under the Marine Mammal Protection Act. Subsequently, the Permits, Conservation and Education Division requested a formal consultation on May 13, 2005, for issuance of the authorization to MMS.

MMS and NMFS recognized that the use of underwater explosives can harm sea turtles, fish, and other marine life, and has consulted with the Corps of Engineers, MMS, and other agencies for the use of explosives during structure removals. Prior to 1988, consultations on the removal of offshore structures were completed as removals were proposed. Recognizing that many structure removals shared the same characteristics, a consultation was completed on all removals that used charges set at least 15 feet below the sediment surface and used no more than 50 lbs of high velocity explosives per detonation. On July 25, 1988, NMFS issued a biological opinion describing the potential impacts from these removals in the Gulf of Mexico explosives on endangered and threatened sea turtles. A detailed analysis of effects to sperm whales was not included in the opinion. NMFS concluded that structure removals in the Gulf of Mexico were not likely to jeopardize the continued existence of listed species.

Since completion of the consultation in 1988, only one consultation with MMS involving explosive structure removals was completed. The informal consultation, concluded October 7, 2003, included only those removals using explosive charges of five pounds or less. NMFS concurred with MMS' determination that the use of charges of 5 pounds or less, used 15 feet below the sea floor, are not likely to adversely affect listed species. Avoidance of adverse effects was expected with the following:

- the placement and detonation of explosives within piles and caissons, 15 feet below the sediment surface;
- 60-minute pre-detonation surveys for sperm whales in water depths greater than 200 m;
- 30-minute pre-detonation surveys for sea turtles in all depths;
- adequate environmental conditions for observation of animals within zones of impact;
- restrictions on the time of surveys and detonations to daylight hours; and
- other survey and reporting measures.

Only two explosive-severance removals using 5 lbs of explosives have occurred.

Structure removal methods and regulatory requirements have changed since the completion of the 1988 opinion. Offshore structures have been installed further offshore with developments in drilling and production technologies. Production in deeper waters of the Gulf has potential impacts on deep water species like the sperm whale. Over the past 15 years more information has become available on sperm whale population density estimates, sperm whale behavior, and how marine mammals are affected by sound in the sea. MMS' Environmental Assessment addresses all water depths in the Gulf of Mexico OCS, new decommissioning operations technology, and new marine protected species information.

The Environmental Assessment describes a mitigation program according to a range of explosive weights used in a structure removal. The mitigation program was developed during a Explosive-Severance Mitigation Workshop organized by MMS and held in New Orleans on May 11-12, 2004. Attendees included staff from NMFS Headquarters and Southeast Regional Office, explosive-severance contractors, industry representatives, and MMS engineers and scientists. The purpose of the workshop was to present, discuss, and substantiate mitigation necessary to adequately protect MPS during explosive-severance activities performed for structure decommissions.

The Endangered Species Division requested additional information for the assessment of effects to sea turtles and sperm whales. Some information was conveyed via email and mail. Staff of the Endangered Species Division also had several phone conversations with staff of Minerals Management Service (Gulf of Mexico Region and headquarters). Conference calls were held among all involved parties within NMFS and MMS on January 19 and 20, 2006 to discuss the mitigation measures and other aspects of explosive-severance removals. In addition, staff of NMFS and MMS discussed the need to include endangered baleen whales to the consultation. Listed baleen whales are considered rare within the Gulf of Mexico. However, sightings of a right whale mother and calf sparked concerns that right whales and other baleen whales could be affected by structure removal operations. MMS is taking steps to instruct operators that all activities will need to immediately cease and asked that this measure be noted as part of the proposed action. NMFS must be contacted to determine what further actions are needed.

A draft of the biological opinion was provided to MMS in late April 2006. MMS shared the draft with industry representatives, compiled their and agency comments, and sent them to NMFS in late July 2006. Staff of MMS and NMFS participated in a conference call on the major comments on June 21, 2006 prior to preparing the submittal of comments. Changes were made to the draft biological opinion to address MMS concerns. A record of the comments and discussions are contained in the administrative record for the consultation.

Description of the Proposed Actions

Platforms and other structures are installed on the outer continental shelf to produce hydrocarbons. When the fossil fuel reservoir is depleted or when the structures reach the end of their economic life, decommissioning is inevitable. Since 1947, when production in the Gulf of Mexico first began, 5981 structures have been installed in the Gulf of Mexico and over 2000 structures have been removed (2002). Figures 1 and 2 show the locations of the platforms and wells, respectively. Although the majority of the decommissions (or removals) follow depletion of a reservoir, a few are removed because of structural damage from collision with a barge, hurricane event, or other causes. The age of structures when removed vary from under ten years to over 30 years. In compliance with MMS' Outer Continental Shelf Lands Act regulations, operators are required to remove seafloor obstructions from their leases within one year of lease termination or after a structure has been deemed obsolete or unusable. Operators must submit an application for well, platform, or other structure removals to MMS for approval (30 CFR Part 250).

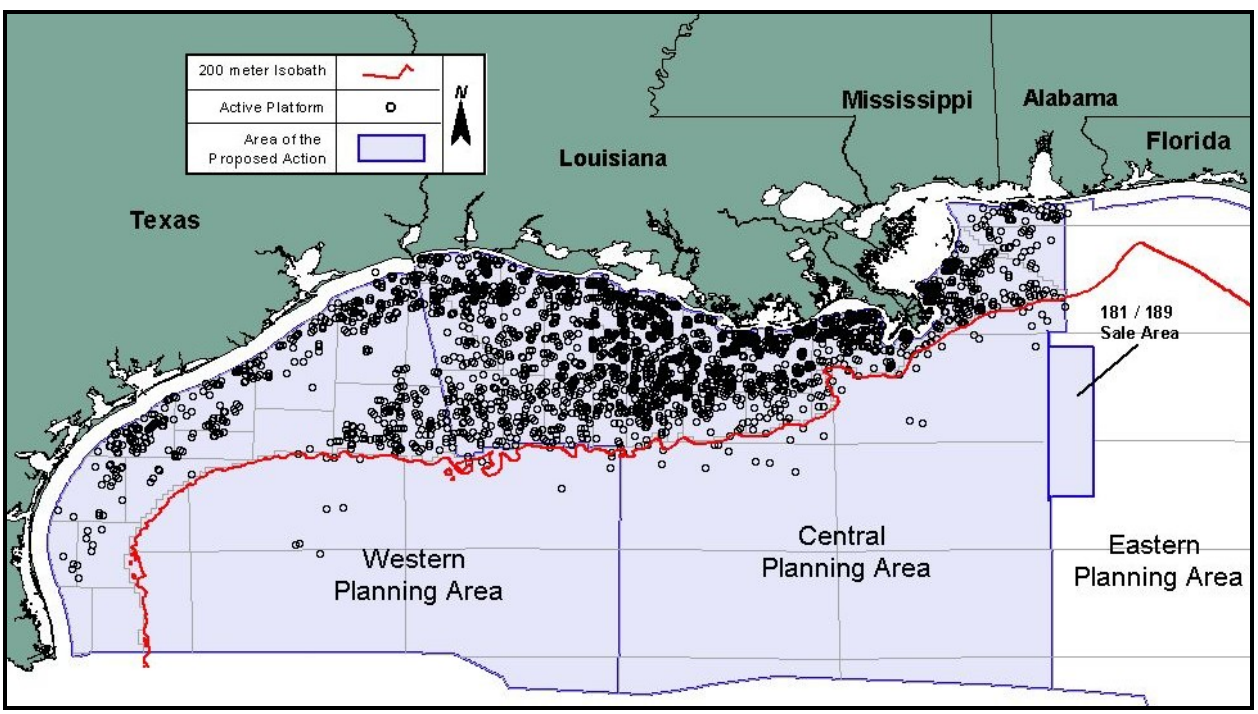

Figure 1. Area of the proposed action showing active platform distribution

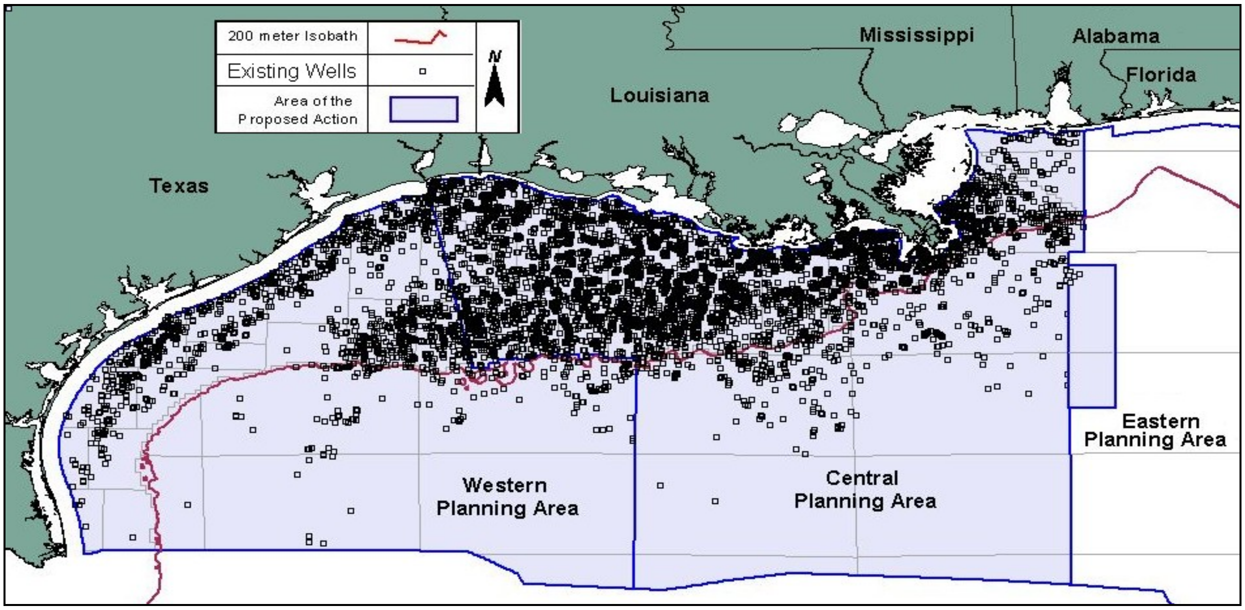

Figure 2. Area of the proposed action showing existing well distribution

The actions considered within this document include the removal of oil and gas development structures on the Gulf of Mexico outer continental shelf, as described in MMS' Environmental Assessment. This consultation also includes the associated authorization to take marine mammals incidental to the use of explosives in structure removals. The authorization, issued by NMFS pursuant to the Marine Mammal Protection Act, would be implemented via governing regulations, followed by Letters of Authorization to explosive-severance removal companies annually.

MMS' regulations require the operator to sever bottom-founded objects and their related components at least 4.6 m (15 ft) below the mudline. Structures that would be severed for removal, referred to as target structures, include the following:

- Wellheads and conductors
- Subsea wellheads and conductors
- Subsea production devices (valve assemblies to produce the well, test the system, or shut-in operations)
- Jacketed platforms
- Caissons
- Well protectors (small piled jackets with or without a support deck)
- Cables, chains, and mooring lines
- Suction pile anchors
- Pipelines
- Cement structures and foundations

Structures are usually completely removed, with components being refurbished and reused, sold for scrap, or sent as waste to the landfill. However, approximately 10% of structures that have been decommissioned have been toppled-in-place within an artificial reef or towed to an approved reef site (Kaiser et al. 2002). Partial removal of structures have occurred in only a handful of cases for large, heavy structures. Operators schedule most of their removal projects from June to December when seas are generally calm.

For each structure-removal operation, a project management team develops a decommissioning plan and schedule. The team could be within the company, an independent third party, or a specialized unit within a decommissioning contractor group. Decommissioning operations may employ a single 'turn-key' salvage contractor (offers a complete removal package) or up to three levels of subcontractors. Currently, there are eight removal project management companies, ten derrick/lift vessel companies, about 25 nonexplosive-severance companies, and three explosive-severance companies. Only three companies provide 'turn-key' contracts, for only nonexplosive-severance work.

To accomplish these removals, a host of activities is required to (1) mobilize necessary equipment and service vessels, (2) prepare the decommissioning targets (e.g., piles, jackets, conductors, bracings, wells, pipelines, etc.), (3) sever the target from the seabed and/or into manageable components, (4) salvage the severed portion(s), and (5) conduct final site-clearance verification work. Prepatory work could include pipeline flushing and securing, equipment removal, tank/deck cleaning, and survey work. The topside equipment such as living quarters, generators, and processing equipment are removed and taken to shore. The deck section is then detached, lifted from the platform, and transported by barge. Conductors and piles are severed 15 feet below the mudline. The jacket is then disconnected from the seabed and lifted onto a cargo barge. Depending on the target, a complete removal decommissioning operation may span several days or weeks, and in some cases even months.

The use of explosives is the preferred method for severance of structures from their foundations. Although mechanical severance techniques are available, such methods can be less reliable and be more costly, particularly as water depth increases. Explosives are generally placed below the mudline, inside or outside of the target members. Occasionally, specialized explosive devices are required to sever targets that are in open water, above the mudline such as to sever chains, cables, and pipelines (DEMEX Division of TEi Construction Services 2003).

There are currently over 4,000 bottom-founded, "traditional" structures (e.g., jacketed platforms, caissons, and well protectors) and 29,500 well-related structures in the area of the proposed action. During the ten-year period from 1994 to 2003, there was an average of 156 platform removals per year, with over 60% using explosive severing tools. During the same period, the number of platform installations was slightly lower, with an average of 116 structure commissionings taking place per year. This trend is becoming more common as new structure sitings move into the deepwater fields, and the numerous facilities in the maturing, shallow-shelf fields are aging and requiring removal.

Pre-Severing Operations

The first step in a structure-removal operation is the development of a decommissioning plan and schedule. It is the responsibility of a project management team to assess the nature of the operation, taking into consideration, among other things, the target structure(s), marine conditions, available services (e.g., lift vessels, severing subcontractors, etc.), and initial operator preferences.

The first set of these activities to occur on the Gulf of Mexico OCS involve the onsite mobilization of lift and support vessels, specialized equipment, and load barges necessary to receive the salvaged structure. The primary mobilization bases would be Fourchon, Cameron, Morgan City, New Iberia, and Intracoastal City in Louisiana and Galveston, Port Aransus, and Port Arthur in Texas. Figure 3 shows the location of most of these ports. The primary salvage yards for the scrapping or refurbishment of structures are Morgan City (Amelia) and New Iberia in Louisiana and Port Arthur in Texas.

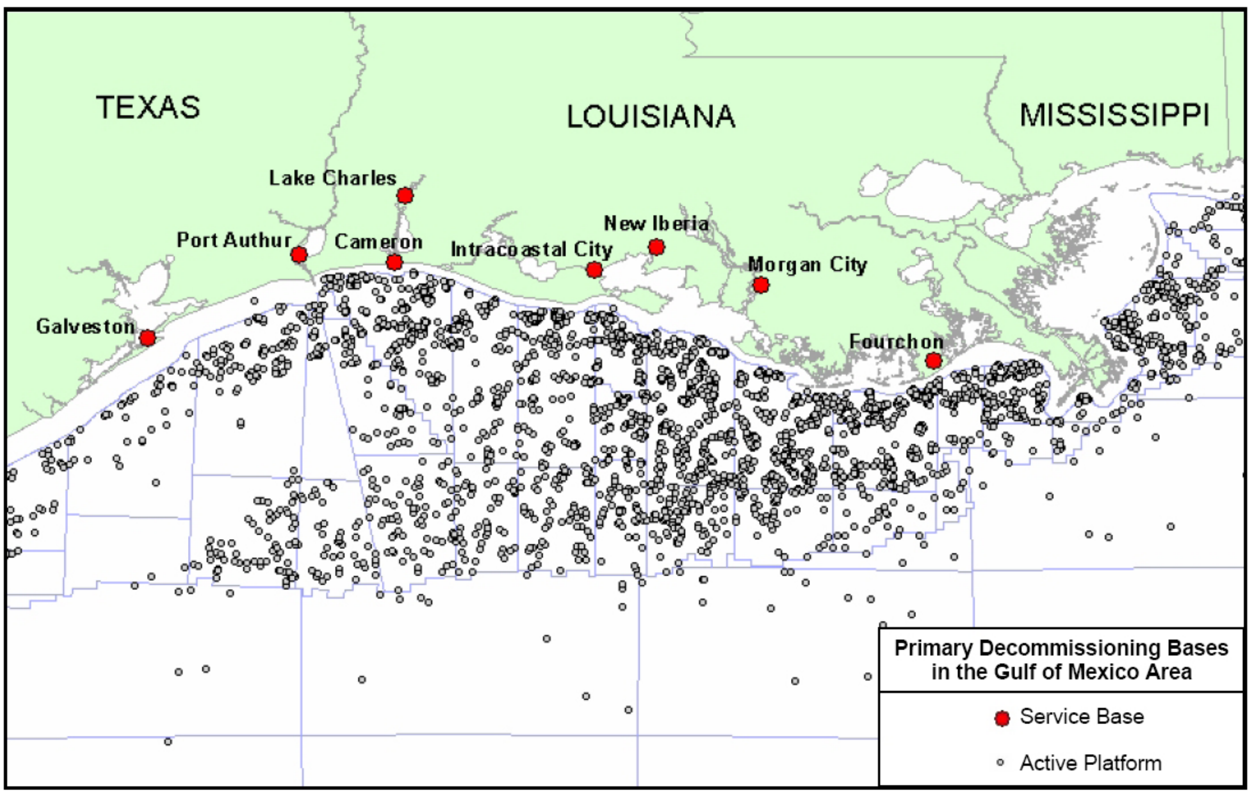

Figure 3. Primary decommissioning bases in the Gulf of Mexico

Any requisite preparatory work commences on and near the structure, which could include pipeline flushing and securing, equipment removal, tank/deck cleaning, and survey work. When set, all of the necessary personnel (e.g., welders, equipment operators, severing technicians), vessels (e.g., derrick/jack-up barge, tugs, load barges), and support equipment (e.g., severing tools, ROV's) are mobilized on station at the structure site. Once the lift vessel is on location and positioned, personnel and equipment are staged to begin preliminary work on the structure. For subsea targets such as casing stubs, divers or ROV's are used to assess the target, conduct any necessary surveys, and assist in either deploying or conducting the below mudline (BML) severing methodology.

For surface structures such as caissons and jacketed platforms, a temporary gangway is secured to allow the cutting crews and riggers access to the structure. Depending on the size and design of the platform, modules such as generator shacks and berthing compartments, as well as other large components (e.g., flaring booms, crane assemblies), may need to be cut/disconnected from the topsides and removed. The remaining topsides assembly is then cut from the piles/jacket, lifted, and secured on the load barge. When required, welders connect scaffolds and bracing around the open piles to allow for personnel and equipment access. If internal pile severing will be conducted, crews then install and operate jetting equipment down the pile to washout the existing mud plug (most often sequentially). Once all piles are jetted and gauged (i.e., internal clearance verification) to the proper cut depth, all unneeded equipment is removed from the structure and the severing operations can commence.

To mitigate any potential impacts to biological resources MMS will require operators to conduct surveys and reporting prior to mobilizing on site and conducting any seafloor disturbing activities. For the biological surveys, operators are to follow Notice to Lessees (NTL) No. 2004-05, which requires lessees to avoid or mitigate impacts to topographic features, live bottoms (pinnacle trend features and low relief features such as sea grass communities), and potentially significant biological features. MMS will also require operators to conduct surveys and reporting to avoid impacts to potential archaeological resources. The guidelines for these surveys and reporting are detailed in NTL No. 2005-G07.

Severing Operations

There are two primary methodologies used in the Gulf for cutting decommissioning targets; nonexplosive and explosive severance. The choice of severing tool used depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions. Despite advancements in nonexplosive-severance methods and the requisite marine protected species mitigation measures, MMS expects explosive-severance activities to continue being used in at least 63% of all platform removals for the foreseeable future.

Kaiser et al. (2005) provided projections of removals by modeling structure removal processes. Their report provides "pessimistic" and "optimistic" averages from 2002 to 2021 for removals using explosive-severance (Table 1). MMS then used the forecast modeling, historical trends, and industry projections to estimate that between 170 and 273 explosive-severance activities would occur annually (MMS 2005). These estimates are summed from the numbers of explosive-severance removals in each of 5 blast weight categories, which are further divided by depth of water (Table 2). These estimates are somewhat speculative due to the unquantifiable decision factors and the lack of pertinent, well-related data for the model.

Table 1. Projected number of structure removal operations using explosive severing tools (Kaiser et al. 2005)

Forecasting Model I ("Pessimistic")					
Forecast Period	Caissons	Well Protectors	Jacketed Platforms	Forecast Period Total	Annual Average for Period
2002-2006	111	73	288	472	94
2007-2011	152	63	386	601	120
2012-2016	114	46	382	542	108
2017-2021	99	37	276	412	82
Forecasting Model II ("Optimistic")					
Forecast Period	Caissons	Well Protectors	Jacketed Platforms	Forecast Period Total	Annual Average for Period
2002-2006	199	105	494	798	160
2007-2011	232	106	502	840	168
2012-2016	134	63	371	568	114
2017-2021	28	0	205	233	47

Annual Range for Forecast Period For Projected Structures Removed Using Explosive Severing Tools	
2002-2006	94-160
2007-2011	120-168
2012-2016	108-114
2017-2021	47-82

Nonexplosive methods include abrasive cutters (sand and abrasive-water jets), mechanical cutters (e.g., carbide or rotary), diamond wire cutting devices, and cutting facilitated by commercial divers using arc/gas torches. These methods are relatively slow and potentially harmful to human health and safety (primarily for diver severances) but have little to no impact on the marine environment and are not discussed further in this opinion. For a detailed discussion of these methods, refer to the MMS' Programmatic Environmental Assessment (2005).

There is a wide range of explosive materials available for use in severing charges in Gulf of Mexico decommissioning activities. Severing contractors are responsible for assessing the type of material needed based upon its characteristics in relation to the target size and design, specific marine conditions, and potential methods of charge deployment. Explosive-severance activities use specialized charges to achieve target severance. Unlike most nonexplosive methods, severance charges can be deployed on multiple targets and detonated nearly-simultaneously (i.e., staggered at an interval of 0.9 sec) effecting rapid severances. These devices can be deployed and operated by divers, remotely-operated vehicles (ROV), or from the surface.

Table 2. Explosive-severance projections according to explosive severance scenario and water depth (MMS 2005)

Blasting Category	Charge Configuration*	Species-Delination Zone	Annual Projections (low)	(high)
Very-small	BML *(0-10 lb; 0 –4.5 kg)*	Shelf (<200 m)	22	31
		Slope (>200m)	3	7
	AML *(0-5 lb; 0-2.3 kg)*	Shelf (<200 m)	11	17
		Slope (>200 m)	4	8
Small	BML *(>10-20 lb; 4.5-9.1 kg)*	Shelf (<200 m)	33	44
		Slope (>200 m)	7	12
	AML *(>5-20 lb; 2.3-9.1 kg)*	Shelf (<200 m)	9	16
		Slope (>200 m)	3	8
Standard	BML *(>20-80 lb; 9.1-36.3 kg)*	Shelf (<200 m)	42	61
		Slope (>200 m)	6	13
	AML *(>20-80 lb; 9.1-36.3 kg)*	Shelf (<200 m)	12	19
		Slope (>200 m)	5	10
Large	BML *(>80-200 lb; 36.3-90.7 kg)*	Shelf (<200 m)	9	16
		Slope (>200 m)	1	4
	AML *(>80-200 lb; 36.3-90.7 kg)*	Shelf (<200 m)	2	4
		Slope (>200 m)	0	1
Specialty	BML *(>200-500 lb; 90.7-227 kg)*	Shelf (<200 m)	1	2
		Slope (>200 m)	0	0
	AML *(>200-500 lb; 90.7-227 kg)*	Shelf (<200 m)	0	0
		Slope (>200 m)	0	0
		Total	**170**	**273**

* BML is below mudline and AML is above mudline

Explosive-severance activity or "detonation event" for most removal targets lasts for only several seconds. For complex targets or in instances where the initial explosive-severance attempts are unsuccessful, more than one detonation event may be necessary per decommissioning operation. Hours or days would be needed to implement mitigation measures and redeploy new charges.

There are three types of charges used in severing structures in the Gulf of Mexico: bulk charges, shaped charges, and fracturing charges. Bulk charges are used most often. Bulk charges are designed to sever targets using the mechanical distortion and subsequent ripping resulting from the shock wave and expanding gas bubble released during the detonation. The charge may be placed in a section of polyvinylchloride (PVC) pipe or in layers of steel and/or concrete to confine and focus the detonation. The charges are placed either inside or outside of the target.

Shaped charges are placed in special housings designed to create a void between the explosive material and target wall. Employing a phenomenon known as the Monroe Effect, the shock wave deforms the shaped housing into a high-velocity plasma jet within the void. The formed jet cuts through steel targets. Shaped charges are much more efficient in cutting targets, thereby greatly reducing the net explosive weight needed to sever similar-sized targets. Shaped charges can be deployed internal or external to the target structure.

Fracturing charges are currently the least used explosives cutting tools in the Gulf. Generally available as "plaster" or shock-refraction cutters, fracturing charges sever targets by taking advantage of the reflected shock wave resulting from the initial force developed during detonation (National Research Council 1996). The wave propagation results in spalling or fracturing of the target wall opposite of the charge, with the ensuing gas bubble expanding and causing the completion of the cut. Not very effective on wells or grouted piles, fracturing charges are primarily available in the form of an adhesive-backed tape, which has always required divers for deployment (Continental Shelf Associates Inc. (CSA) 2004). Severing contractors are currently working on improvements to the charges, including charge delivery systems that could negate the need for divers.

Post-Severing Operations

Once the operator completes their severing activities, the structure must be removed from the seabed and transported to its final destination (i.e., salvage yard, alternative location, reef site, etc.). Similar to its pre-severing duties, the on-station lift vessel is responsible for the post-severing hoisting of the cut material out of the water and onto a load barge or comparable vessel. If the lift vessel cannot pull the structure free from the sediment, on-station supervisors will decide whether or not to reattempt the severing method or to revert to a backup cutter.

All of the lifted components are ultimately arranged on the load barge and sea-fastened (i.e., welded and braced) to the deck to facilitate transport to its final destination (e.g., new location, salvage, recycling, or reefing).

Though rarely used in the Gulf, a company may also need to employ a process called "progressive transport" or "hopping," which allows for the controlled, surface-accessible dividing of oversized jackets. Following the severance of a structure from its foundation, welders install closure plates atop of all exposed jacket legs or piles. Valve assemblies built into each of the closure plates allow compressed air to evacuate water from the tubulars, deballasting the jacket and making it buoyant (Twachtman Snyder & Byrd Inc. 2000). After being hoisted by and secured to the stern of a lift vessel, the jacket is then towed to a previously-surveyed location in shallower water. The set-down locations are expected to be far enough offshore to allow for backloading onto a barge. At the new site, the jacket is ballasted and set back onto the seafloor, exposing several additional feet of the structure above the water. From this position, welders can return to the jacket and set up scaffolding, which allows them to remove the closure plates and begin cutting all of the necessary legs, piles, and diagonal/vertical bracing. Once complete, the severed jacket section is rigged, lifted, and secured to a load barge. If the lift vessel is still not capable of lifting the remaining jacket assembly, welders reattach the closure plates, and the procedure is repeated until a complete lift and load can be accomplished (TSB and CES 2004).

The use of jacket hopping is expected to be extremely rare. However, in instances when proposed, MMS will require surveys of the route from the initial structure location to each site that the structure would be set down.

Site Clearance

After all decommissioning work is completed and the structure is salvaged, operators are required to perform site-clearance work to ensure that the seafloor of their lease(s) have been restored to prelease conditions. Based upon requirements found in Subpart Q of the OCSLA regulations (30 CFR Part 250.1740 to 250.1743), operators have the option of either trawling (with commercial nets) or conducting diver, high-resolution sonar, or ROV surveys over the following structure-based grid areas:

Surface-Accessible Wells ....91 m (300 ft) radius around well
Subsea Wells..183 m (600 ft) radius around well
Jacketed Platform.......................................402 m (1,320 ft) radius around platform
Single-Well Caisson/Well Protector...........183 m (600 ft) radius around structure
Subsea Template or Manifold.....................183 m (600 ft) radius around structure

NTL 98-26 specifies that platforms and single-well caissons/well protectors located in water depths less than 300 feet must be trawled in two directions. The regulations contain specific trawling requirements that are designed to facilitate the removal of any small objects or obstructions (e.g., tools, containers, batteries) that may have been lost or discarded during the operational life of the structure.

To avoid the occasion where an unknown obstruction (manmade or biological) could be damaged or cause damage to the trawling equipment, operators choose to conduct diver, sonar, and/or ROV surveys of the grid area. A high-frequency sonar system is used to determine geodetic positions for each seafloor obstruction, and a dispatched diver(s) or ROV recovers or investigates the object (Loggin, pers. com. 2003). Unlike trawling, survey-led recovery activities only disturb the seafloor in a limited area around the obstruction, reducing the potential for additional impacts to the benthic environment.

If site clearance is conducted using trawl nets, MMS will require the following mitigation for the protection of sea turtles that could be incidentally caught:

- use trawl net(s) with a minimum mesh size no smaller than 4 inches;
- abide by maximum trawl times of 30 minutes, allowing for the removal of any captured sea turtles;
- resuscitate and release any captured sea turtles as per the guidelines described in ESA regulations at 50 CFR Part 223.206(d)(1); and
- include a description and/or identification of any sea turtles captured in the net, resuscitated, released, or killed.

Proposed Mitigation for Explosive-Severance[1]

MMS and NMFS developed plans for avoiding or minimizing the impacts to marine life during explosive-severance removals during the Explosive-Severance Mitigation Worship held in May 2004. The measures are designed to detect sea turtles and marine mammals and take steps to avoid exposing any detected individuals from blasts. In addition, MMS is requiring all operators to cease their activities immediately if any baleen whales are observed, to avoid impacts to listed baleen whales which occur only rarely in the Gulf of Mexico.

Different mitigation scenarios were developed for specific ranges of charge weights and the placement of the explosives (i.e., above or below mudline) because the level of pressure and energy released during detonation is related to the amount and placement of the explosives (Table 2 or 3). Five blasting categories were developed based upon the specific range of charge weights needed to conduct future OCS structure removals.

Depending upon the design of the decommissioning target and variable marine conditions, the charges developed under each of these categories could be used either below-mudline (BML) or above-mudline (AML). Charges set below-mudline would be placed 4.6 m (15 ft) below the sediment surface. Above-mudline cuts could be made anywhere within the water column.

The five blasting categories can also be used within two species-specific delineation zones: OCS shelf (<200 m or 656 ft) and OCS slope (>200 m). Because of animal distributions and densities, explosive-severance activities taking place on the shelf have a greater opportunity to impact sea turtles (i.e., green, loggerhead, leatherback, Kemp's ridley, and hawksbill) and coastal dolphins. Explosive work in slope waters has the potential to impact deepwater dolphins and whales (e.g, sperm whale), as well as sea turtles.

With both charge configurations (BML/AML) and species-delineation zone (shelf/slope), MMS developed 20 specific, mitigation scenarios to address severance activities that could be conducted under the five blasting categories (Table 3). Operators applying for structure-removal permits using explosive severance would indicate the appropriate scenario based upon the removal location and their severance needs. In addition to other application data, the noted scenario requirements would be considered during subsequent National Environmental Policy Act analyses.

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[1] In this section we describe the mitigation program as it was developed during the Explosive-Severance Mitigation Worship held in May 2004 and subsequently proposed by MMS and described in their 2005 Environmental Assessment. During the consultation, modifications and adjustments were made to several aspects of the mitigation. However, the overall structure and requirements of the mitigation remain the same. The Appendix to this biological opinion contains the mitigation program with all of the changes.

Table 3. Blasting Categories and Associated Mitigation Scenarios				
Blasting Category	Configuration *(Charge Range)*	Impact-Zone Radius	Species-Delineation Zone	Mitigation Scenario
Very-Small Blasting	BML *(0-10 lb)*	261 m (856 ft)	Shelf (<200 m)	A1
			Slope (>200 m)	A2
	AML *(0-5 lb)*	293 m (961 ft)	Shelf (<200 m)	A3
			Slope (>200 m)	A4
Small Blasting	BML *(>10-20 lb)*	373 m (1,224 ft)	Shelf (<200 m)	B1
			Slope (>200 m)	B2
	AML *(>5-20 lb)*	522 m (1,714 ft)	Shelf (<200 m)	B3
			Slope (>200 m)	B4
Standard Blasting	BML *(>20-80 lb)*	631 m (2,069 ft)	Shelf (<200 m)	C1
			Slope (>200 m)	C2
	AML *(>20-80 lb)*	829 m (2,721 ft)	Shelf (<200 m)	C3
			Slope (>200 m)	C4
Large Blasting	BML *(>80-200 lb)*	941 m (3,086 ft)	Shelf (<200 m)	D1
			Slope (>200 m)	D2
	AML *(>80-200 lb)*	1,126 m (3,693 ft)	Shelf (<200 m)	D3
			Slope (>200 m)	D4
Specialty Blasting	BML *(>200-500 lb)*	1,500 m (4,916 ft)	Shelf (<200 m)	E1
			Slope (>200 m)	E2
	AML *(>200-500 lb)*	1,528 m (5,012 ft)	Shelf (<200 m)	E3
			Slope (>200 m)	E4

The monitoring requirements and methodologies for the 20 scenarios were developed in coordination with explosive-severance experts and protected species scientists from NMFS and MMS, taking into consideration marine protected species (sea turtles and marine mammals) characteristics and surfacing rates, calculated impact parameters, and current mitigation requirements. The mitigation scenarios include aerial and/or surface surveys prior to detonations within specified impact zones and post-detonation surveys. If listed species, or marine mammals, are sighted within the impact zones operators must take certain steps to minimize the possibility of the animal's exposure to detonations. While charge criteria and reporting requirements are standard for all scenarios, the survey requirements and requisite times vary.

Terms and Methods Used in the Mitigation Scenarios (see footnote 1 on page 12)

The definitions for impact zone and other terms used in the mitigation scenarios are provided below, followed by the methods used in the scenarios.

Impact Zone (Term; All Scenarios)

The impact zone is the area (a horizontal radius around a decommissioning target) in which a protected species could be affected by the pressure and or acoustic energy released during the detonation of an explosive-severance charge. As discussed later in this biological opinion, the impact zone radii were derived using conservative pressure/energy propagation data from Applied Research Associates, Inc.'s UnderWater Calculator (UWC). The monitoring surveys and associated time periods were designed to allow for adequate detection of protected species that may be present within each impact zone based upon potential species and the overall size of the impact area.

Predetonation Survey (Term; All Scenarios)

A predetonation (pre-det) survey refers to any marine, protected species (MPS) monitoring survey (surface, aerial, or acoustic) conducted prior to the detonation of any explosive severance tool. The primary purpose of pre-det surveys is to allow detection of any possible MPS within the scenario-specific impact zone and to continue monitoring the animal(s) until it leaves the area for the allotted time period.

Postdetonation Survey (Term; All Scenarios)

A post-detonation (post-det) survey refers to any protected species monitoring survey (surface, aerial, or post-post-det aerial) conducted after the detonation event occurs. The primary purpose of post-det surveys is to detect any protected species that may have been stunned, injured, or killed by the detonation and resultant pressure/energy release. The post-det surveys are key in providing essential reporting information on the effectiveness of the pre-det survey efforts.

Waiting Period (Term; All Scenarios)

Variable by scenario, the waiting period refers to the time in which detonation operations must hold before the requisite monitoring survey(s) can be reconducted. The purpose of a waiting period is to allow any inbound or previously detected outbound protected species to exit the impact zone under their own volition.

Company Observer (Term; Scenarios A1- A4 Only)

Trained company observers will be allowed to perform protected species detection surveys for Very-Small blasting scenarios A1-A4. An "adequately-trained" observer is an employee of the company or severance contractor who has attended observer training courses offered by private or government entities. Company will be required to provide copies of personnel training certifications to MMS' Gulf of Mexico Region Office prior to conducting A1-A4 removal operations.

NMFS Observer (Term; Scenarios B1-E4)

NMFS observers are required to perform protected species detection surveys for all blasting scenarios with the exception of Scenarios A1-A4. These observers are qualified NMFS employees or third-party contractors delegated under the Platform Removal Observer Program (PROP) of NMFS' Galveston Laboratory. Generally, two observers will be assigned to each operation for detection survey duties. However, because mitigation-scenarios C2, C4, D2, D4, E2, and E4 require a minimum of three (3) observers for the simultaneous surface, aerial, and acoustic surveys, at least two (2) "teams" of observers will be required. The PROP Manager will determine each "team" size depending upon the nature of the operations, target structure configuration, support vessel accommodations, and other environmental monitoring conditions.

Surface Monitoring Survey (Method; All Scenarios)

Surface monitoring surveys are to be conducted from the highest vantage point available on the structure being removed or proximal surface vessels, such as crew boats or derrick barges. Surface surveys will be restricted to daylight hours only (legal sunrise to legal sunset), and the monitoring will cease upon inclement weather or when it is determined that marine conditions are not adequate for visual observations.

Aerial Monitoring Survey (Method; Scenarios B1-E4)

Aerial monitoring surveys are to be conducted from helicopters running low-altitude search patterns over the impact zone. Aerial surveys will be restricted to daylight hours only, and they cannot begin until the requisite surface monitoring survey has been completed. Aerial surveys will cease upon inclement weather, when marine conditions are not adequate for visual observations, or when the pilot/removal supervisor determines that helicopter operations must be suspended. Aerial surveys are required for all severance scenarios with the exception of scenarios A1-A4.

Acoustic Monitoring Survey (Method; Scenarios C2, C4, D2, D4, E2, and E4)

Acoustic monitoring surveys are required to be conducted on all Standard, Large, and Specialty blasting scenarios conducted on slope (>200 m) activities (scenarios C2, C4, D2, D4, E2, and E4). Contractors conducting acoustic surveys will be required to use NOAA-approved passive acoustic monitoring devices and technicians. Acoustic surveys will be run concurrent with requisite pre-detonation surveys; beginning with the surface observations and concluded at the finish of the aerial surveys when the detonation(s) is allowed to proceed.

Post-Post-Det Aerial Monitoring Survey (Method; Scenarios C4, D2, D4, E2, and E4)

Post-post-det aerial monitoring surveys will be conducted within 2 to 7 days after detonation activities conclude, by either helicopter or fixed-wing aircraft. Observations are to start at the removal site and proceed leeward and outward of wind and current movement. Any injured or dead protected species must be noted in the survey report, and if possible, tracked and collected after notifying NMFS. Post-post-det aerial surveys are only required for mitigation scenarios C4, D2, D4, E2, and E4.

Specific Mitigation Requirements (see footnote 1 on page 13)

As noted, the charge criteria and reporting requirements listed above will be standard for all decommissionings employing explosive-severance activities. However, depending upon the severance scenario, there are six different MPS monitoring surveys that could be conducted before and after all detonation events. The specific monitoring requirements, survey times, and impact zone radii for all explosive-severance scenarios are summarized in Table 4.

The 20 explosive-severance scenarios correspond roughly with 8 basic mitigation processes that vary only in differences in impact zone ranges and survey times. Each of the scenarios is described in detail in Appendix E of MMS' Environmental Assessment.

MMS' proposed mitigation involves the use of company or NMFS observers in pre-detonation monitoring and post-detonation monitoring. For the very small blasting categories, company observers are proposed. For all of the other categories, NMFS observers are proposed.

Generally, two NMFS observers (PROP or contracted personnel) would perform marine protected species detection surveys for those scenarios taking place in waters <200m. For scenarios in waters >200 m, at least 3 observers are needed for simultaneous surface, aerial, and acoustic monitoring. If necessary, the PROP Manager would determine if additional observers are required to compensate for the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication with company and blasting personnel; and
- Devote the entire, uninterrupted survey time to marine protected species monitoring.

Before severance charge detonation, NMFS observers will conduct the surface monitoring survey of the impact zone for the specified time period (60, 90, 120, 150, or 180 minutes; Table 4). The monitoring will be conducted from the highest vantage point available from either the decommissioning target or proximal surface vessels. Once the surface monitoring is complete (i.e., the impact zone cleared of marine protected species), one of the NMFS observers will transfer to a helicopter to conduct the aerial monitoring survey for the specified time period (Table 4). The helicopter will transverse the impact zone at low speed/altitude in a specified grid pattern. As per PROP-approved guidelines, the helicopter will transverse the impact zone at low speed/altitude in a specified grid pattern.

For those scenarios with passive acoustic monitoring, NMFS-approved passive-acoustic-monitoring devices and technicians will be used for detection of sperm whales during the surface and aerial monitoring.

If during the aerial survey a marine protected species is:

- Not sighted (and not detected acoustically), proceed with the detonation;
- Sighted outbound and continuously tracked clearing the impact zone (and not detected acoustically), proceed with the detonation after the monitoring time is complete to avoid reentry;
- Sighted outbound and the MPS track is lost (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 30 min, and

        - Reconduct the 30, 45, 60, or 90 min aerial monitoring surveys; or
    - Sighted inbound (and detected acoustically),
        - Halt the detonation,
        - Wait 30 min, and
        - Reconduct the aerial monitoring survey.

After severance charge detonation, the NMFS observer would conduct an aerial monitoring survey of the impact zone to detect for impacted MPS for 30 or 45 minutes (Table 4). The post-post-detonation aerial survey would also be conducted by the NMFS observer 2 to 7 days after the detonation.

If a marine protected species is observed shocked, injured, or dead, the operations would cease, attempts would be made to collect/resuscitate the animal in consultation with the Sea Turtle Stranding and Salvage Network Coordinator, and NMFS SERO would be contacted. If no MPS are observed to be impacted by the detonation, the NMFS observer would record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A example flowchart of the monitoring process and associated survey times for standard severance-scenarios C2 and C4 is provided in Figure 4.

Authorization for Take of Marine Mammals Incidental to Explosive-Severance Removals

NMFS Permits, Conservation and Education Division proposes to authorize the take of marine mammals incidental to explosive-severance removals of structures. The authorization is implemented via governing regulations, followed by Letters of Authorization to operators for one-year periods. The authorization would expire after 5 years and is likely to be renewed.

The proposed rule includes the same terms and methods described above. The mitigation measures required by the rule include the following:

- If marine mammals are observed within, or about to enter, the marine mammal impact zone…detonation must be delayed until either the marine mammal(s) are outside that zone or actions are successful in removing them from the identified marine mammal impact zone;

- Aerial survey must be repeated prior to detonation of charges if marine mammals are found within or bound for the impact zone.

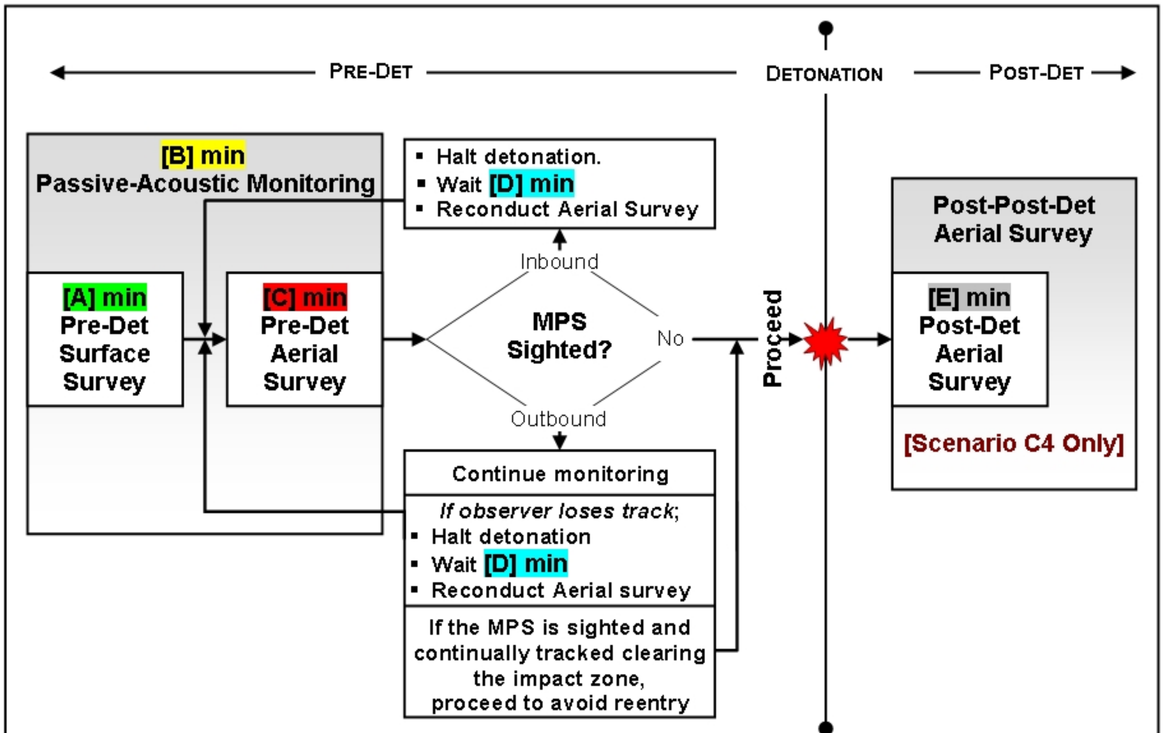
- Detonation of explosives must occur no earlier than 1 hour after sunrise and no later than 1 hour before sunset

- If weather and/or sea conditions preclude adequate aerial, shipboard, or subsurface surveillance, detonations must be delayed until conditions improve sufficiently for surveillance to be undertaken

Table 4. Survey and time requirements for all explosive-severance scenarios

Blasting Category	Configuration *(Charge Range)*	Impact Zone Radius	Scenario	Pre-Det Surface Survey (min)	Pre-Det Aerial Survey (min)	Pre-Det Acoustic Survey (min)	Post-Det Surface Survey (min)	Post-Det Aerial Survey (min)	Post-Post-Det Aerial Survey (Yes/No)
Very-Small	BML *(0-10 lb)*	261 m (856 ft)	A1	60	N/A	N/A	30	N/A	No
			A2	90	N/A	N/A	30	N/A	No
	AML *(0-5 lb)*	293 m (961 ft)	A3	60	N/A	N/A	30	N/A	No
			A4	90	N/A	N/A	30	N/A	No
Small	BML *(>10-20 lb)*	373 m (1,224 ft)	B1	90	30	N/A	N/A	30	No
			B2	90	30	N/A	N/A	30	No
	AML *(>5-20 lb)*	522 m (1,714 ft)	B3	90	30	N/A	N/A	30	No
			B4	90	30	N/A	N/A	30	No
Standard	BML *(>20-80 lb)*	631 m (2,069 ft)	C1	90	30	N/A	N/A	30	No
			C2	90	30	120	N/A	30	No
	AML *(>20-80 lb)*	829 m (2,721 ft)	C3	90	45	N/A	N/A	30	No
			C4	90	60	150	N/A	30	Yes
Large	BML *(>80-200 lb)*	941 m (3,086 ft)	D1	120	45	N/A	N/A	30	No
			D2	120	60	180	N/A	30	Yes
	AML *(>80-200 lb)*	1,126 m (3,693ft)	D3	120	60	N/A	N/A	30	No
			D4	150	60	210	N/A	30	Yes
Specialty	BML *(>200-500 lb)*	1,500 m (4,916 ft)	E1	150	90	N/A	N/A	45	No
			E2	180	90	270	N/A	45	Yes
	AML *(>200-500 lb)*	1,528 m (5,012 ft)	E3	150	90	N/A	N/A	45	No
			E4	180	90	270	N/A	45	Yes

Note: Odd-numbered scenarios, such as A1 and A3, take place for removals in waters less than 200 m deep and even-numbered scenarios take place in waters greater than 200 m deep.



Scenario	Pre-Det Surface [A]	Passive Acoustic [B]	Pre-Det Aerial [C]	Waiting Period [D]	Post-Det Aerial [E]
	(Minutes)				
C2	90	120	30	30	30
C4	90	150	60	45	30

Figure 4. Surveys and monitoring process for standard severance-scenarios C2 and C4.

- Multiple charge detonations must be staggered at an interval of 0.9 sec (900 msec) between blasts

- Aerial surveys for scenarios B1 to E4 are to be conducted from helicopters running low-altitude search patterns over the extent of the potential impact area. Aerial surveys will be restricted to daylight hours only, and they can not begin until the requisite surface monitoring survey has been completed. Aerial surveys will cease upon inclement weather, when marine conditions are not adequate for visual observations, or when the pilot/removal supervisor determines that helicopter operations must be suspended.

- Acoustic monitoring surveys are required to be conducted on all Standard, Large, and Specialty blasting scenarios conducted on slope (>200 m) activities (Scenarios C2,C4, D2, D4, E2, and E4). Contractors conducting acoustic surveys will be required to use NMFS-approved passive acoustic monitoring devices and technicians. Acoustic surveys will be run concurrent with requisite pre-detonation surveys, beginning with the surface observations and concluded at the finish of the aerial surveys when the detonation is allowed to proceed.

- Post-post-detonation aerial monitoring surveys, required for scenarios C4, D2, D4, E2, and E4, will be conducted within 2 to 7 days after detonation activities conclude, by either helicopter or fixed-wing aircraft. Observations are to start at the removal site and proceed leeward and outward of wind and current movement. Any injured or killed marine mammals or sea turtles are to be noted in the survey report, and if possible, tracked and collected after notifying NMFS.

Action Area

The action area for this consultation encompasses the Federal waters of the northern Gulf of Mexico, designated as the Western and Central Planning Areas by MMS. A portion of the Eastern Planning Area is also included. The action area is depicted in Figures 1 and 2, which show the locations of platforms and wells. Federal waters begins seven miles from Texas and three miles from Louisiana, Mississippi, and Alabama. Although Federal waters from Florida begin 10 miles offshore, the portion of the Eastern Planning Area within the action area is over 100 miles from Florida. Water depths in the area range from 4 to 3,400 m.

The action area also includes the areas within state waters where vessels would traverse to and from target structure sites and ports in Lousiana and Texas (Figure 3). The primary mobilization bases would be Fourchon, Cameron, Morgan City, New Iberia, and Intracoastal City in Louisiana and Galveston, Port Aransus, and Port Arthur in Texas. The primary salvage yards for the scrapping or refurbishment of structures are Morgan City (Amelia) and New Iberia in Louisiana and Port Arthur in Texas.

Status of the Species

NMFS determined that the action being considered in this biological opinion may affect the following species listed under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.; ESA):

Species	Status
Sperm whale (Physeter macrocephalus)	Endangered
Green sea turtle (*Chelonia mydas*)	
Rangewide	Threatened
Mexican breeding population	Endangered
Florida breeding population	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Kemp's ridley sea turtle (*Lepidochelys kempi*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata)*	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered

Critical habitats designated for the leatherback, hawksbill, and green sea turtles are located outside of the action area and thus would not be affected.

Species Not Likely to be Adversely Affected

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) are an anadromous fish listed as threatened in 1991. The known range of Gulf sturgeon include rivers, estuaries, and marine waters off of Louisiana, Mississippi, Alabama, and Florida. Some Gulf sturgeon would be present in the action area, however, this species is not likely to be adversely affected based on what is currently known about their use of marine habitats. In the cool autumn months (October and November), adult Gulf sturgeon migrate to marine and estuarine waters where they feed opportunistically on benthic invertebrates, predominantly amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans. Most structure removals occur in the spring and summer months when Gulf sturgeon are in their riverine habitats. Capture and tagging records suggest that Gulf sturgeon occupy shallow waters close to shore. Two records of Gulf sturgeon in offshore waters were reported in 1965, one found in waters 6 meters deep and the other incidentally caught in a fishery that operated out to 55 meter (180 ft)-depth waters (see the Gulf Sturgeon Recovery Plan). Gulf sturgeon tagged in October 2002 were tracked to areas between 0.80 to 1.61 km (1/2 to 1 mile) from shore in water depths ranging from 3.7 to 6.1 m (12 to 20 feet; website http://www.fws.gov/panamacity/programs/gulfsturg-recov.html#monitoring). After some time in coastal sandy bottom habitat, Gulf sturgeon appear to move into the Gulf of Mexico but their locations are unknown.

We do not know whether Gulf sturgeon undertake extensive offshore migrations during the winter months. One hypothesis is that Gulf sturgeon spread along the coast in nearshore waters in depths less than 10 m (33 ft). The alternative hypothesis is that they migrate far offshore to the broad sedimentary plateau in deep water west of the Florida Middle Grounds. The data support the first hypothesis (see *Federal Register*, Vol. 68, p. 13374). Given that these data support an assumption that Gulf sturgeon remain in shallow waters and that sturgeon are in their marine habitat when fewer structure removals occur, Gulf sturgeon are unlikely to be in areas (in Federal waters) where structures are being decommissioned. The Gulf sturgeon are not likely to be adversely affected because the probability that a Gulf sturgeon would be present during a decommissioning is so low as to be discountable.

Critical habitat for Gulf sturgeon was designated within the major river systems that support the seven currently reproducing sub-populations and associated estuarine and marine habitats (see 50 CFR Part 226.214). We examined the likelihood of overlap between Gulf sturgeon in their riverine habitat and their designated critical habitat and the routes and ports used in mobilizing equipment and personnel or unloading severed structures. Gulf sturgeon critical habitats, located east of Lake Pontchartrain, have not been designated near any of the ports used in structure removals. These critical habitats and any Gulf sturgeon in these habitats would not be affected.

Several endangered baleen whales have been sighted occasionally in the Gulf of Mexico. The sparse records of the blue whale (*Balaenoptera musculus*), sei whale (*B. borealis*), fin whale (*B. physalus*), humpback whale (*Megaptera novaeangliae*), and right whale (*Eubalaena glacialis*) suggest that these species are rare within the Gulf of Mexico. Wursig et al. (2000) compiled existing records of these whales within the Gulf. Two stranded blue whales were reported, one found in Texas and the other in Louisiana. There are three records of sei whale strandings in eastern Louisiana and one from the Florida panhandle. Fin whales have stranded in the Gulf on five occasions. Three confirmed sightings of fin whales have also been documented. Humpback whales were hunted near the Florida keys, but are uncommon in the Gulf proper. Humpback records in the Gulf include a sighting in May 1997 of six humpbacks about 250 km east of the Mississippi Delta at a depth of 1000 m (3,280 ft) and three acoustic recordings. Two right whales were observed swimming off Sarasota, Florida, in 1963, and a stranded right whale (apparently struck by a vessel) was documented in Texas in 1972. Right whales were also observed recently within the Gulf: a mother and calf pair was documented off of Panama City and Corpus Cristi Bay, Texas, in March/April 2004 and January 2006, respectively (Zoodsma, pers.com. 2006). With such infrequent records of these species, any occurrence of these species are likely to be accidentals from the Atlantic Ocean or Caribbean Sea.

The probability that any of these baleen whales would be exposed to structure removal operations is likely to be extremely low. Although over 100 removals could take place annually, the likelihood that a baleen whale would be present within the area of a removal is discountable. In addition, MMS will instruct operators that all activities will need to cease immediately and NMFS must be contacted if any endangered baleen whale is seen. Therefore, NMFS concludes that the blue, sei, fin, humpback and right whales are not likely to be adversely affected.

Species Likely to be Adversely Affected

The five species of sea turtles listed above and the sperm whale are regularly found throughout the Gulf of Mexico. These species have been sighted on numerous occasions during aerial and vessel-based research surveys. They are also observed from platforms and vessels, although such sightings are generally not recorded. Sea turtles are expected to be relatively more abundant around the shelf waters, as compared to the slope waters, whereas sperm whales would likely be found only around structures in waters 500 m (1640 ft) or deeper.

The following subsections are synopses of the best available information on the life history, distribution, population trends, and current status of the five species of sea turtles. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991a), hawksbill sea turtle (NMFS and USFWS 1993), Kemp's ridley sea turtle (NMFS and USFWS 1992b), loggerhead sea turtle (NMFS and USFWS 1991b), and leatherback sea turtle (NMFS and USFWS 1992a); Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-e); sea turtle status reviews and biological reports (NMFS and USFWS 1995, Marine Turtle Expert Working Group (TEWG) 1998 and 2000, NMFS SEFSC 2001).

The sea turtle subsections focus primarily on the Atlantic Ocean populations of these species because these are the populations that may be directly or indirectly affected by the proposed actions. However, these species are listed as global populations (with the exception of Kemp's ridleys and northwestern Atlantic Ocean and Florida greens, whose distribution is entirely in the Atlantic). The global status and trends of these species, therefore, are included as well, to provide a basis and frame of reference for our final determination of the effects of the proposed action on the species as listed under the ESA.

Sperm Whale

The sperm whale is the largest of the toothed whales, reaching a length of 18.3 meters in males and 12.2 meters in females (Odell 1992). Sperm whales are distributed in all of the world's seas and oceans. For the purposes of management, the International Whaling Commission (IWC) defines four stocks: the North Pacific, the North Atlantic, the Northern Indian Ocean, and Southern Hemisphere. However, Dufault et al.'s (1999) review of the current knowledge of sperm whales indicates no clear picture of the worldwide stock structure of sperm whales.

Listing Status

The sperm whale was listed as endangered under the ESA in 1973. There is no critical habitat designated for sperm whales.

Distribution

In general, females and immature sperm whales appear to be restricted in range, whereas males are found over a wider range and appear to make occasional movements across and between ocean basins (Dufault et al. 1999). Females and juveniles form pods that are generally within tropical and temperate latitudes between 50^{o} N and 50^{o} S, while the solitary adult males can be found at higher latitudes between 75^{o} N and 75^{o} S (Reeves and Whitehead 1997). The home ranges of individual females seem to span distances of approximately 1,000 km (621 mi) (Best 1979; Dufault and Whitehead 1995). However, occasionally females travel several thousand kilometers across large parts of an ocean basin (Kasuya and Miyashita 1988).

In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. Sperm whales are the most abundant large cetacean in the Gulf of Mexico, and represent the most important Gulf cetacean in terms of collective biomass. These whales were once hunted in Gulf waters. There is evidence based on year-round occurrence of strandings, opportunistic sightings, whaling catches, and recent sperm whale survey data that sperm whales in the Gulf of Mexico may be found throughout deep waters of the Gulf of Mexico (Davis et al. 2002; Hansen et al. 1996; Schmidly 1981). NMFS suggests in the Marine Mammal Stock Assessment Report that sperm whales in the Gulf of Mexico constitute a distinct stock (Waring et al. 2004). Seasonal aerial surveys have confirmed that sperm whales are present in the northern Gulf of Mexico in all seasons. Sightings are more common during summer (Mullin et al. 1994), but may be an artifact of movement patterns of sperm whales associated with reproductive behavior, hydrographic features, or other environmental and seasonal factors.

Recent research of the genetic stock structure of Gulf of Mexico sperm whales, gender composition, and kinship patterns during 2000, 2001 and 2002 indicate a distinct matrilineal population structure in the Gulf of Mexico (Engelhaupt pers. comm. 2003). In this study eighty-nine individuals (including satellite-tagged, D-tag tagged, opportunistic, and stranded whales) were genotyped using both mtDNA and microsatellite techniques and gender determined using molecular sexing techniques. MtDNA analyses showed that groups are comprised of both single and mixed matrilines, which combined with the relatedness levels, may provide additional evidence for Whitehead et al.'s (1991) suggestion that sperm whale groups are comprised of "constant companions and casual acquaintances." Only four mtDNA haplotypes were found in the northern Gulf, with two being unique (on a global scale) to the Gulf of Mexico population (Engelhaupt pers. comm. 2003).

Life history

Evidence suggests that the disproportionately large head of the sperm whale is an adaptation to produce vocalizations (Cranford 1992; Mullet 1972; Norris and Harvey 1972). This suggests that vocalizations are extremely important to sperm whales. Their vocalizations are relatively well-studied (such as Goold 1999a; Goold and Jones 1995; Rendell and H.Whitehead 2003; Weilgart and Whitehead 1997; Weilgart and Whitehead 1988). Long series of monotonous, regularly spaced clicks are associated with feeding and are thought to be produced for echolocation. Sperm whales also utilize unique stereotyped click sequence "codas" (Mullins et al. 1988; Watkins 1977), according to Weilgart and Whitehead (1988) to possibly convey information about the age, sex, and reproductive status of the sender. Groups of closely related females and their offspring have group-specific dialects (Weilgart and Whitehead 1997).

Sperm whales generally occur in waters greater than 180 m (590 ft) in depth. While they may be encountered almost anywhere on the high seas, their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Waring et al. (1993) suggest sperm whale distribution in the Atlantic is closely correlated with the Gulf Stream edge. Bull sperm whales migrate much farther poleward than the cows, calves, and young males. Because most of the breeding herds are confined almost exclusively to warmer waters, many of the larger mature males return in the winter to the lower latitudes to breed. It is not known whether Gulf sperm whales exhibit similar seasonal movement patterns. Their presence in the Gulf is year-round and it is highly likely that this group offshore of the Mississippi River delta represents a resident population. Davis et al.

(2000; Davis et al. 2002) reported that low salinity, nutrient-rich water may occur over the continental slope near the mouth of the Mississippi or be entrained within the confluence of a cyclone-anticyclone eddy pair and transported over the narrow continental shelf south of the Mississippi River delta. This creates an area of high primary and secondary productivity in deep water that may explain the presence of the resident population of endangered sperm whales within 100 km of the Mississippi River delta (Davis et al. 2000; Townsend 1935; Weller et al. 1996).

Deepwater is their typical habitat, but sperm whales also occur in coastal waters at times (Scott and Sadove 1997). When found relatively close to shore, sperm whales are usually associated with sharp increases in bottom depth where upwelling occurs and biological production is high, implying the presence of a good food supply (Clarke 1956), and with the movement of cyclonic eddies in the northern Gulf (Davis et al. 2000, 2002).

Sperm whales are noted for their ability to make prolonged, deep dives, and are likely the deepest and longest diving mammal. Typical foraging dives last 40 minutes and descend to about 400 m (1310 ft), followed by approximately 8 minutes of resting at the surface (Gordon 1987; Papastavrou et al. 1989). However, dives of over 2 hours and deeper than 3.3 km have been recorded (Clarke 1976; Watkins et al. 1985; Watkins et al. 1993) and individuals may spend extended periods of time at the surface to recover. Descent rates recorded from echo-sounders were approximately 1.7 m/sec and nearly vertical (Goold and Jones 1995). There are no data on diurnal differences in dive depths in sperm whales. Dive depth may be dependent upon temporal variations in prey abundance.

Cephalopods (i.e., squid, octopi, cuttlefishes, and nautili) are the main dietary component of sperm whales. The ommastrephids, onychoteuthids, cranchids, and enoploteuthids are the cephalopod families that are numerically important in the diet of sperm whales in the Gulf of Mexico (Davis et al. 2002). Other populations are known to also take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes, especially mature males in higher latitudes (Clarke 1962; Clarke 1979). Postulated feeding and hunting methods include lying suspended and relatively motionless near the ocean floor and ambushing prey; attracting squid and other prey with bioluminescent mouths; or stunning prey with ultrasonic sounds (Norris and Mohl 1983; Würsig et al. 2000). Sperm whales occasionally drown after becoming entangled in deep-sea cables that wrap around their lower jaw, and non-food objects have been found in their stomachs, suggesting these animals may at times cruise the ocean floor with open mouths (Würsig et al. 2000, Rice 1989).

Female sperm whales attain sexual maturity at the mean age of 8 or 9 years and a length of about 9 m (30 ft) (Kasuya 1991; Würsig et al. 2000). The mature females ovulate April through August in the Northern Hemisphere. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born at a length of about 4 m (13 ft), after a 15 to 16 month gestation period. Sperm whales exhibit alloparental (the assistance by individuals other than the parents in the care of offspring) guarding of young at the surface (Whitehead 1996), and alloparental nursing (Reeves and Whitehead 1997). Calves are nursed for 2 to 3 years (in some cases, up to 13 years); and the calving interval is estimated to be about 4 to 7 years (Kasuya 1991; Würsig et al. 2000).

Males have a prolonged puberty and attain sexual maturity at between age 12 and 20, and a body length of 12 m, but may require another 10 years to become large enough to successfully compete for breeding rights (Kasuya 1991; Würsig et al. 2000). Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979).

The age distribution of the sperm whale population is unknown, but they are believed to live at least 60 years. Potential sources of natural mortality in sperm whales include killer whales and the papilloma virus (Lambertsen et al. 1987).

Status and Trends

The primary factor for the population decline that precipitated ESA listing was commercial whaling in the 18th, 19th, and 20th centuries for ambergris and spermaceti. The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900. A commercial fishery for sperm whales operated in the Gulf of Mexico during the late 1700s to the early1900s, but the exact number of whales taken is not known (Townsend 1935). The over harvest of sperm whales resulted in their alarming decline in the last century. From 1910 to 1982, there were nearly 700,000 sperm whales killed worldwide from whaling activities (IWC Statistics 1959-1983). Sperm whales have been protected from commercial harvest by the IWC since 1981, although the Japanese continued to harvest sperm whales in the North Pacific until 1988 (Reeves and Whitehead 1997). Since the ban on nearly all hunting of sperm whales, there has been little evidence that direct effects of anthropogenic causes of mortality or injury are significantly affecting the recovery of sperm whale stocks (Perry et al. 1999), yet the effects of these activities on the behavior of sperm whales has just recently begun to be studied.

One estimate of the current global population of sperm whales is 361,400 (CV=0.36) which may be about 32% of its pre-whaling number (Whitehead 2002). As with any population estimate of large whales, much uncertainty about this estimate remains (Whitehead 2003). We are certain that the species declined significantly with commercial whaling, but we do not have information to know if the species worldwide population is increasing, stable, or declining. One estimate of the rate of increase, at 0.9% per year maximum by the IWC, suggests that if the species is increasing it is occurring only very slowly.

The Gulf of Mexico sperm whale abundance has recently been estimated at 1,213 whales (CV = 0.35) (Mullin and Fulling 2003), calculated from an average of estimates from 1996-2001 surveys. The minimum population estimate is 911 sperm whales. There are insufficient data to determine population trends for the species or for the population in the Gulf of Mexico at this time (Waring et al. 2004).

Threats

Since sperm whales were listed under the ESA, concerns for the effects of anthropogenic activities on the physiology and behavior of marine mammals has received much attention. Evidence shows that whales are injured or killed by collisions with ships, ingestion of plastic debris, and interactions with fisheries (see Whitehead 2003).

Sperm whales have been identified as species of concern in the Gulf of Mexico in relation to shipping, seismic surveys, and mineral production, although the studies of the effects of seismic pulses on sperm whales have been relatively few and have been largely inconclusive. However, many reported reactions to anthropogenic noise deserve special attention in assessing impacts to sperm whales and marine life in general. Sperm whale vocalization and audition are important for echolocation and feeding, social behavior and intragroup interactions, and to maintain social cohesion within the group. Anthropogenic sources from vessel noise, noise associated with oil production, seismic surveys, and other sources have the potential to impact sperm whales (e.g., behavioral alteration, communication, feeding ability, disruption of breeding and nursing, and avoidance of locales where audible sounds are being emitted). Andrew et al. (2002) reported that over a 33-year period, increases in shipping sound levels in the ocean may account for 10 dB increase in ambient noise between 20 to 80 Hz and between 200 to 300 Hz, and a 3 dB increase in noise at 100 Hz on the continental slope off Point Sur, California. Although comparable data are not available for shelf waters in the Gulf of Mexico, the amount of vessel traffic and industrial noise in the Gulf of Mexico may contribute to similar increases in ambient noise there.

Documented takes of sperm whales primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and longline fisheries. Sperm whales have learned to depredate sablefish from longline gear in the Gulf of Alaska and toothfish from longline operations in the south Atlantic Ocean. No direct injury or mortality has been recorded during hauling operations, but lines have had to be cut when whales were caught on them (Ashford et al. 1996). Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Sperm whales have been taken in the pelagic drift gillnet fishery for swordfish, and could likewise be taken in the shark drift gillnet fishery on occasions when they may occur more nearshore, although this likely does not occur often. Although no interaction between sperm whales and the longline fishery have been recorded in the U.S. Atlantic, as noted above, such interactions have been documented elsewhere.

The Southeast U.S. Marine Mammal Stranding Network received reports of 16 sperm whales that stranded along the Gulf of Mexico coastline from 1987 to 2001 in areas ranging from Pinellas County, Florida to Matagorda County, Texas. One of these whales had deep, parallel cuts posterior to the dorsal ridge that were believed to be caused by the propeller of a large vessel; this trauma was assumed to be the proximate cause of the stranding. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales occurring in nearshore areas.

Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. In the Atlantic, developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS 1991b). Within the continental United States, loggerhead sea turtles nest from Texas to New Jersey. Major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf of Mexico coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS-SEFSC 2001). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996). Recent genetic analyses on female loggerheads nesting in Japan suggest that this “subpopulation” is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data has been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In addition, the abundance of loggerhead turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (2) a south Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Marquez 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS-SEFSC 2001). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. Nesting beach fidelity reduces the likelihood of recolonization of nesting beaches with sea turtles from other subpopulations.

Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys NMFS SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm (16-24 in) straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U. S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in Northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year round in offshore waters off of the mid-Atlantic region where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads move up the Atlantic coast , occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in Mid-Atlantic and Northeast areas until late fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (≥11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population Dynamics and Status

A number of stock assessments (Heppell et al. 2003; NMFS-SEFSC 2001; TEWG 2000) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (TEWG 2000; NMFS-SEFSC 2001). Between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182, annually with a mean of 73,751 (TEWG 2000). On average, 90.7% of these nests were of the south Florida subpopulation and 8.5% were from the northern subpopulation (TEWG 2000). The TEWG (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation is increasing, while no trend is evident (may be stable but possibly declining) for the northern subpopulation. However, a more recent analysis, including nesting data through 2004, indicates there is no longer a discernable long-term trend in the south Florida nesting subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Programs) because of recent poor nesting years. Another consideration that may add to the importance and vulnerability of the northern subpopulation is the sex ratios of this subpopulation. NMFS scientists have estimated that the northern subpopulation produces 65% males (NMFS-SEFSC 2001). However, new research conducted over a limited time frame has found opposing sex ratios (Wyneken et al., in press) so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations (the Dry Tortugas, Florida Panhandle, and Yucatán) are much smaller subpopulations but no less relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico from 1987-2001 where survey effort was consistent during the period.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 145 km (90-mile) length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 hurricane season. Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid nests and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the Atlantic highly migratory species (HMS) pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995; Bolten et al. 1994; Crouse 1999). Loggerheads in the benthic environment in waters off the coastal U.S. are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries (see further discussion in Section 4, Environmental Baseline).

Summary of Status for Loggerhead Sea Turtles

In the Pacific Ocean, loggerhead turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. The NMFS recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. There are no detectable nesting trends for the two largest western Atlantic subpopulations: the South Florida subpopulation and the northern subpopulation. Because of its size, the South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The nesting range of the green sea turtles includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in the southeastern United States between Texas and North Carolina and the U. S. Virgin Islands (U.S.V.I.) and Puerto Rico (NMFS and USFWS 1991a). Principal U. S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington 1992). Green sea turtle nesting also occurs regularly on St. Croix, U.S.V.I, and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996).

Pacific Ocean

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Eckert 1993; Seminoff et al. 2002). In the western Pacific, the only major (>2,000 nesting females) populations of green turtles occur in Australia and Malaysia, with smaller colonies throughout the area. Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2004). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations:

Michoacan, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). There is also sporadic green turtle nesting along the Pacific coast of Costa Rica.

Atlantic Ocean

Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Suriname. In U.S. Atlantic waters, green turtles nest in small numbers in the U.S. Virgin Islands and in Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach and Broward Counties. The remainder of the description for green turtles focus on the Atlantic population.

Life History and Distribution

The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982; Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm (7.9 to 9.8 in) carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997; NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Guseman and Ehrhart 1992) (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). It is known that current nesting levels in Florida are reduced compared to historical levels, but the extent of the reduction is not known (Dodd 1981). However, green sea turtle nesting in Florida has been increasing since 1989

(Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Total nest counts and trends at index beach sites during the past decade suggest the numbers of green sea turtles that nest within the southeastern United States are increasing.

Although nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging and breeding grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore worm rock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida) show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002).

It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero. Trends at Florida beaches were previously discussed. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) showed a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999), and more recent information continues to show increasing nest counts (Troëng, S. and E. Rankin 2004). Therefore, it seems reasonable that there is an increase in immature green sea turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U. S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991).

Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many natural and anthropogenic threats similar to other sea turtles. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in 1989. However, given the species' late sexual maturity, caution is warranted about over-interpreting nesting trend data collected for less than 15 years.

Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the precursor of the ESA on June 2, 1970, and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle, with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm (24.6 to 37.0 in) straight carapace length. The species occurs in all ocean basins, although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical of the marine turtles, ranging from approximately 30°N latitude to 30°S latitude. They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993). There are five regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999b). There has been a global population decline of over 80% during the last three generations (105 years) (Meylan and Donnelly 1999).

Pacific Ocean

Anecdotal reports throughout the Pacific indicate that the current Pacific hawksbill population is well below historical levels (NMFS 2004b). It is believed that this species is rapidly approaching extinction in the Pacific because of harvesting for its meat, shell, and eggs as well as destruction of nesting habitat (NMFS 2001). Hawksbill sea turtles nest in the Hawaiian Islands as well as the islands and mainland of southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, and Australia (NMFS 2004b). However, along the eastern Pacific Rim where nesting was common in the 1930s, hawksbill's are now rare or absent (Clifton et al. 1982, NMFS 2004b).

Atlantic Ocean

In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the United States, nesting occurs in Puerto Rico, the U.S. Virgin Islands, and the southeast coast of Florida. Nesting also occurs outside of the United States and its territories in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Outside of the nesting areas, hawksbills have been seen off of the U.S. Gulf of Mexico states and along the eastern seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993).

Life History and Distribution

The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997, Crouse 1999a, NMFS 2004b). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to their nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999a; Richardson et al. 1999). Clutch size is larger on average (up to 250 eggs) than that of other turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm (8.6-9.8 in) in straight carapace length (Meylan and Donnelly 1999a; Meylan 1988), followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (van Dam and Diez 1998).

The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (León and Diez 2000; Mayor et al. 1998; van Dam and Diez 1997).

Population Dynamics and Status

Estimates of the annual number of nests at hawksbill sea turtle nesting sites are on the order of hundreds to a few thousand. Nesting within the southeastern United States and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr) (Eckert 1995, Meylan 1999a, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute's Statewide Nesting Beach Survey data 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999b).

Threats

As described for other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, fishery interactions, and poaching in some parts of their range. There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

Summary of Status for Hawksbill Sea Turtles

Worldwide, hawksbill sea turtle populations are declining. They face many of the same threats affecting other sea turtle species. In addition, there continues to be a commercial market for hawksbill shell products, despite protections afforded to the species under U.S. law and international conventions.

Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States.

Life History and Distribution

The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the Eastern Seaboard of the United States and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Henwood and Ogren 1987; Lutcavage and Musick 1985; Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards

(Shaver 1991). Pelagic stage Kemp's ridleys presumably feed on the available Sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with over 10,000 nests recorded in 2005; Gladys Porter Zoo, unpublished data) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimp fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold stunning. Although cold stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and five green turtles were found on Cape Cod beaches (R. Prescott, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast waters in a given year, oceanographic conditions and the occurrence of storm events in the late fall. Many cold-stunned turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to other sea turtles. For example, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

Summary of Kemp's Ridley Status

The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year from 1985 to 1999. In recent years, totals have exceeded 8,000 nests per year (Gladys Porter Zoo, unpublished data). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids, thus 'lag effects' as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995b). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996a). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt it may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, Spotila et al. (1996) represents the best overall estimate of adult female leatherback population size.

Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (NMFS and USFWS 1998; Sarti et al. 1996; Spotila et al. 1996b; Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to two nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000, Suarez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suarez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suarez 1999).

In the western Pacific Ocean and South China Seas, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. The poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals also threaten leatherback turtles in the western Pacific.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-99 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean, and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8-17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS's assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: if no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004b).

Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS-SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS-SEFSC 2001). Genetic analyses of leatherbacks to date indicate that within the Atlantic basin there are genetically different nesting populations; the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the Sargassum areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (3280 ft) (Eckert et al. 1989; Hays et al. 2004).

Life History and Distribution

Leatherbacks are a long-lived species, living for over 30 years. They reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). They nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schulz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of 145 cm (57.1 in) curved carapace length (ccl) or less, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm (39.4 in) ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1-4,151 m (3.3-13,620 ft), but 84.4% of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads, from 7-27.2°C ; however, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals. Recent satellite telemetry data from 38 foraging male and female leatherbacks collected off Nova Scotia during the summer months indicate they spend the summer months foraging in the rich waters off Nova Scotia and begin to migrate into southern waters around October (James *et. al*, 2005). Some migrate and forage along the US southeast continental slope, others head directly to waters off of nesting beaches in South America, and others stay out in the deep pelagic waters. All returned around February and March the following year. The U.S. northeast and Canadian coastal and pelagic waters are clearly an important migratory corridor as well as foraging ground.

Population Dynamics and Status

The status of the Atlantic leatherback population is less clear than the Pacific population. The total Atlantic population size is undoubtedly larger than in the Pacific, but overall population trends are unclear. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. According to NMFS SEFSC (2001) the nesting aggregation in French Guiana has been declining at about 15% per year since 1987. However, from 1979-1986, the number of nests was increasing at about 15% annually which could mean that the current 15% decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). In Suriname, leatherback nest numbers have shown large recent increases (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population may show an increase (Girondot 2002 in Hilterman and Goverse 2003). The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980s, but the magnitude of nesting is much smaller than that along the French Guiana coast (NMFS SEFSC 2001). Also, because leatherback females can lay 10 nests per season, the recent increases to 400 nests per year in Florida may only represent as few as 40 individual female nesters per year.

In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to characterize the current status. Numbers at some nesting sites are increasing, but are decreasing at other sites. Tag return data emphasize the wide-ranging nature of the leatherback and the link between South American nesters and animals found in U.S. waters. For example, a nesting female tagged May 29, 1990, in French Guiana was later recovered and released alive from the York River, Virginia. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95%), though individuals from West African stocks were surprisingly absent (Roden et al. In press).

There are a number of problems contributing to the uncertainty of the leatherback nest counts and population assessments. The nesting beaches of the Guianas (Guyana, French Guiana, and Suriname) and Trinidad are by far the most important in the western Atlantic. However, beaches in this region undergo cycles of erosion and reformation, so that the nesting beaches are not consistent over time. Additionally, leatherback sea turtles do not exhibit the same degree of nest-site fidelity demonstrated by loggerhead and other hardshell sea turtles, further confounding analysis of population trends using nesting data. Reported declines in one country and reported increases in another may be the result of migration and beach changes, not true population changes. Nesting surveys, as well as being hampered by the inconsistency of the nesting beaches, are themselves inconsistent throughout the region. Survey effort varies widely in the seasonal coverage, aerial coverage, and actual surveyed sites. Surveys have not been conducted consistently throughout time, or have even been dropped entirely as the result of wars, political turmoil, funding vagaries, etc. The methods vary in assessing total numbers of nests and total numbers of females. Many sea turtle scientists agree that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). No such region-wide assessment has been conducted recently.

The most recent, complete estimates of regional leatherback populations are in Spotila et al. (1996). As discussed above, nesting in the Guianas may have been declining in the late 1990s but may have increased again in the early 2000s. Spotila et al. (1996) estimated that the leatherback population for the Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. We believe that the current population probably still lies within this range, taking into account the reported nesting declines and increases and the uncertainty surrounding them. We therefore choose to rely on Spotila et al.'s (1996) published total Atlantic population estimates, rather than attempt to construct a new population estimate here, based on our interpretation of the various, confusing nesting reports from areas within the region.

NMFS has assembled a Leatherback Expert Working Group comprised of academic and government agency scientists from the U.S. and abroad to further examine the issue of leatherback sea turtle populations and distribution. A report of their findings is expected some time in late 2006.

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps their attraction to the light sticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than mouth hooked or swallowing the hook. According to observer records, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (NMFS SEFSC 2001). The U.S. fleet accounts for only 5-8% of the hooks fished in the Atlantic Ocean, and adding up the under-represented observed takes of the other 23 countries that actively fish in the area would lead to annual take estimates of thousands of leatherbacks over different life stages. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured is not as high).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the Mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS SEFSC

2001). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherbacks interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the mid-Atlantic states are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54-92%.

Poaching is not known to be a problem for nesting populations in the continental U.S. However, the NMFS SEFSC (2001) notes that poaching of juveniles and adults is still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44% of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts et al. 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001, for a description of take records). Leatherbacks are known to drown in fishnets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lagueux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50-95% (Eckert and Lien 1999). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS-SEFSC 2001).

Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is much more confounded, although the picture does not appear nearly as bleak as in the Pacific. The number of female leatherbacks reported at some nesting sites in the Atlantic Ocean has increased, while at others they have decreased. Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic: leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal and international waters. Poaching is a problem and affects leatherbacks that occur in U.S. waters. Leatherbacks also appear to be more susceptible to death or injury from ingesting marine debris than other turtle species.

Environmental Baseline

By regulation, environmental baselines of opinions include the past and present impacts of all state, Federal, and private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process. The environmental baseline for this biological opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The following information summarizes the primary human and natural phenomena in the northern Gulf of Mexico that are believed to affect the status and trend of sperm whales and sea turtles in the action area.

The northern Gulf of Mexico is influenced by the Loop Current of the Gulf of Mexico and freshwater inputs from the Mississippi and Atchafalaya rivers. The Loop Current is a clockwise movement of water from the Caribbean Sea that exits the Gulf between Cuba and Florida. Extensions of the Loop Current pinch off and form anticyclonic (warm-core) eddies, which migrate to the west and dissipate. These eddies can interact with cyclonic (cold-core) eddies and locally increase biological productivity by bringing nutrient-rich cold waters from below to mix with surface waters. Freshwater inputs, particularly during the spring, infuse pollutants, nutrients, and sediments into the Gulf. The massive influx of nutrients can result in phytoplankton blooms, followed by growths of bacteria which consume the available oxygen in the water column, causing hypoxic (low dissolved oxygen) or anoxic conditions in the summer. Low oxygen conditions are correlated with reduced abundance of benthic and demersal organisms, reduced species richness, and biomass. Despite the apparent disruption to the ecology of some areas caused by nutrient-rich waters, such waters in offshore areas may stimulate concentrations of zooplankton and micronekton organisms which are correlated with higher concentrations of cetacean prey. Thus, these hydrographic factors likely influence the prey distribution and other aspects of the habitat for listed species in the action area. Davis et al. (2002) suggests that the continental slope near the mouth of the Mississippi, with locally enhanced primary and secondary productivity, explains the presence of the population of sperm whales within 100 km of the Mississippi River delta.

In addition to being a biologically important area, the action area has a history of established economic activities. The area continues to be used for oil, gas, and mineral development, maritime vessel traffic, and commercial fisheries. These activities affect listed species in the action area, as well as by scientific research activities directed at them.

The sperm whale is found throughout the northern Gulf of Mexico, usually in waters deeper than 500 m (1,640 ft). Although females have been tracked to move throughout the Gulf of Mexico, they show a strong site fidelity to a relatively small area approximately 100 km (62.1 mi) offshore of the Mississippi River delta and a group of sperm whales are regularly sighted within this region.

The surveys conducted during GulfCet I and II programs (Davis and (eds.) 1996; Davis et al. 2000) recorded leatherback, loggerhead, and Kemp's ridley sea turtles in the continental shelf and slope of the action area. The leatherback is the most abundant sea turtle in waters over the northern Gulf of Mexico continental slope (Mullin and Hoggard 2000 in Davis 2000). Leatherbacks appear to spatially use both continental shelf and slope habitats in the Gulf (Fritts et al. 1983, Collard 1990), but primarily utilize pelagic waters deeper than 200 m (656 ft) (Davis and Fargion 1996) throughout the northern Gulf of Mexico. Recent surveys suggest that the region from the Mississippi Canyon to DeSoto Canyon, especially near the shelf edge, appears to be an important habitat for leatherbacks (Mullin and Hoggard 2000). Temporal variability and abundance suggest that specific areas may be important to this species, either seasonally or for short periods of time. Leatherbacks have been frequently sighted in the Gulf of Mexico during both summer and winter (Mullin and Hoggard 2000).

Loggerhead turtles have been primarily sighted in waters over the continental shelf, although many surface sightings of this species have also been made over the outer slope, approaching the

2,000-m (6562-ft) isobath. Sightings of loggerheads in waters over the continental slope suggest that they may be in transit through these waters to distant foraging sites or while seeking warmer waters during the winter. Although loggerhead are widely distributed during both summer and winter, their abundance in surface waters over the slope was greater during winter than in summer (Mullin and Hoggard 2000).

Kemp's ridleys generally remain within the 50-m isobath of coastal areas throughout the Gulf of Mexico (Renaud 2001). The nearshore waters of the Gulf of Mexico are believed to provide important developmental habitat for juvenile Kemp's ridley and loggerhead sea turtles. Ogren (1988) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern Gulf of Mexico. Analyses of stomach contents from Kemp's ridleys indicate a nearshore foraging behavior (Plotkin 1995) of a predominance of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991).

Green sea turtles are found throughout the Gulf of Mexico and hawksbill are expected to be in warmer, shallower waters.

Several biological opinions on the operation of fisheries, oil and gas exploration and development, and military training describe how listed species within the Gulf are potentially or actually affected. Similar state and private activities also affect listed species.

Fisheries

Sea turtles are known to be taken in several Federal fisheries. The fisheries with the most impact on sea turtles include the highly migratory species fishery and shrimp fishery. The information presented below describe impacts to sea turtles in an area much broader than the action area because the fisheries cover areas in and outside of the Gulf of Mexico.

Highly Migratory Species (HMS) Fishery. On June 1, 2004, NMFS completed an opinion on the continued operation of the Atlantic HMS pelagic longline fishery in the Atlantic, Gulf of Mexico, and Caribbean. NMFS found that the continued prosecution of the pelagic longline fishery was likely to jeopardize the continued existence of leatherback sea turtles. However, NMFS implemented a reasonable and prudent alternative (RPA) to allow for the continuation of the pelagic longline fishery without jeopardizing that species. The 47 provisions of the RPA included measures to: (1) reduce post-release mortality of leatherbacks; (2) improve monitoring of the effects of the fishery; (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action; and (4) take management action to avoid long-term elevations in leatherback takes or mortality. All other sea turtles were found not likely to be jeopardized. The following amount of annual incidental take is anticipated in the future (2005 and beyond): 588 leatherbacks per year, 635 loggerheads, and a total of 35 individuals per year of either green, hawksbill, Kemp's ridley, and olive ridley turtles. The use of circle hooks instead of J-hooks and turtle release gear is expected to reduce the mortality of sea turtles captured in longline gear.

Shrimp Fisheries. The southeast shrimp trawl fishery affects more sea turtles than all other activities combined (National Research Council 1990). On December 2, 2002, NMFS completed the opinion for shrimp trawling in the southeastern United States under proposed revisions to the Turtle Excluder Device (TED) regulations (68 FR 8456, February 21, 2003). NMFS determined that the shrimp trawl fishery with the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl-related mortality by 94% for loggerheads and 97% for leatherbacks. Yet, the estimated mortalities with the regulation could be as high as 80 (CI: 0-296) leatherbacks, 3948 (CI: 1221-8498) loggerheads, 19,972 (CI: 1633 – 90074) Kemp's ridleys, and 1440 (CI: 3 - 8408) greens annually (Epperly et al. 2002).

Other Fisheries. State fisheries involve gear which are known to cause interactions with sea turtles. Although the specific past and current effects of these fisheries on listed species are currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on Gulf of Mexico coastlines. Most state data are based on extremely low observer coverage, or data on sea turtles were not collected; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem. Additional information on impact of take (i.e., associated mortality) is also needed for analysis of impacts to sea turtles from these fisheries. Certain gear types may have high levels of sea turtle takes, but very low rates of serious injury or mortality. For example, hook-and-line takes rarely are dead upon retrieval of gear, but trawls and gillnets frequently result in immediate mortality. Leatherbacks seem to be susceptible to a more restricted list of fisheries, while hardshell turtles, particularly loggerheads, seem to appear to get caught in almost all state fisheries.

Vessel Operation

Commercial traffic and recreational pursuits can adversely affect sea turtles through propeller and boat strikes. The Sea Turtle Stranding and Salvage Network reports many records of vessel interaction (propeller injury) with sea turtles off Gulf of Mexico states such as Florida, where there are high levels of vessel traffic. The extent of the problem is difficult to assess because it is difficult to determine whether the majority of sea turtles are struck pre- or post-mortem. Private vessels in the Gulf of Mexico participating in high-speed marine events (e.g., boat races) are a particular threat to sea turtles.

Military Exercises

Section 7 consultations were completed for military exercises in the Gulf of Mexico. The U.S. Air Force use the Gulf of Mexico for military training and weapons testing, such as air-to-air and air-to-surface operations and mine warfare exercises and testing. Nine military warning areas and 5 water test areas cover over 32 million acres of the northern Gulf. The vessel operations and ordnance detonation activities are expected to affect listed species of sea turtles and biological opinions for these activities have been completed. U.S. Air Force operations in the Eglin Gulf Test Range in the eastern Gulf of Mexico may also kill or injure sea turtles. Air-to-surface gunnery testing is estimated to kill a maximum of 3 loggerheads, 1 leatherback, 1 green, and 1 Kemp's ridley annually (October 20, 2004 biological opinion). Precision-strike weapons would also be tested in the Gulf and 1 leatherback, 10 loggerhead, 1 Kemp's, 3 green sea turtles over 5 years are may be taken during these events (March 14, 2005 biological opinion). The Naval Explosive-ordnance Disposal School is expected to take 1 Kemp's, 4 loggerheads, 1 green over a 5-year period, lethally or non-lethally (Oct. 25, 2004 biological opinion). The biological opinion for the Air Force's Santa Rosa Island Utilization Plan (completed October 12, 2005) suggests that 13 loggerhead and 4 green sea turtles would be taken annually during training exercises in the surf zone.

OCS Oil and Gas Activities

Many section 7 consultations have been completed on MMS oil and gas lease activities. Biological opinions issued on July 11, 2002 (lease sale 184), November 29, 2002 (lease sales 185, 187, 190, 192, 194, 196, 198, 200, 201), and August 30, 2003 (lease sales 189 and 197), have concluded that in addtion to vessel strikes, sea turtles could be affected by seismic surveys and marine debris. NMFS anticipates the harassment of sea turtles from seismic surveys but there may be mortalities associated with vessel strikes and ingestion of debris. Seismic surveys may also affect sperm whales. A study to test whether and how sperm whales respond to seismic pulses is underway.

In the most recent consultation with MMS, NMFS Southeast Regional Office developed measures and recommendations for minimizing the risk of vessel collisions with listed species, such as having vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking protected species (see MMS Notice to Lessees No. 2003-G10). The measures were publicized to all oil and gas operators within the Gulf.

Explosive-severance removals of offshore structures are known to take sea turtles. The Army Corps of Engineers and MMS oversees structure removals in state and Federal waters, respectively. Although the Incidental Take Statement issued in 1988 for explosive-severance removals (MMS activities) included take of 30 sea turtles per year, only 4 total have been documented so far.

Research Permits

NMFS has issued several permits for scientific research of sea turtles and sperm whales, under section 10(a)(1)(A) of the ESA. There are currently 11 active permits allowing activities within the Gulf of Mexico. Authorized activities range from photographing to capturing, tagging, and tissue sampling. Much of these activities would take place in shallow waters close to shore where sea turtles are expected. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of turtles annually. The research activities are expected to be non-lethal.

Other Sources of Potential Impacts

Listed species may also be affected by hurricanes.

Several hurricanes occur in the action area each year. In 2005, the most notable were Hurricanes Katrina and Rita which had most impact along the northern central and eastern Gulf of Mexico. The flooding, storm surges, and winds from the hurricanes resulted in the destruction of nesting beaches, washing out of nests, and hatchlings being unable to reach the surf. The effects on sea turtle population numbers and trends are not yet known. We do not have any accounts of how the hurricanes affected sperm whales.

Status of Species in the Action Area

Sperm Whales

There is no data on the population trends for the group of sperm whales in the Gulf of Mexico. The extent of effects of anthropogenic noises on the sperm whale population dynamics is not known but effects to their behavior, prey availability, hunting success, and other disruptions to normal behaviors are possible. However, the measures being implemented by MMS to address exposure of sperm whales to high levels of seismic airgun sounds should minimize any potential hearing loss. Any disturbances that arise from vessel traffic or directed research is expected to be short- term.

Sea Turtles

Sea turtles have been taken in fishery gear in the Gulf of Mexico and are probably threatened by the other activities discussed above. The use of TEDs should mitigate much of the mortality that had been occurring in the shrimp trawls, thus contributing to an increase in the growth rate of sea turtle populations. It is not possible to know how many sea turtles are actually taken by the various activities because they are difficult to detect and killed or injured sea turtles may not be observable. Sea turtles in the action area likely continue to be at risk from vessel strikes, incidental capture in fishing gear, and oil and gas development-related activities, such as oil spills and release of contaminants.

As for population trends, those observed for the sea turtle nesting populations in the Atlantic overall probably reflect the trends occurring within the action area. The increase in nesting Kemp's ridley sea turtles and green sea turtles suggest these populations are increasing and a comparable increase may be occurring in the action area. The nesting trends for the northern subpopulation of loggerheads and the south Florida subpopulation, the two largest nesting populations in the U.S., are stable or declining. The status of leatherbacks and hawksbills in the Atlantic is unclear. The multitude of human- and natural activities affecting sea turtles cause concern regarding the status of loggerheads, hawksbill, and leatherback sea turtles.

Effects of the Action

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are directed to insure that their activities are not likely to jeopardize the continued existence of any listed endangered and threatened species or result in the destruction or adverse modification of designated critical habitat. “Jeopardize the continued existence of” is defined in regulations as to engage any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

Components of the structure removal operations would result in environmental impacts that would co-occur in space and time with individuals of sperm whales and loggerhead, green, hawksbill, Kemp’s ridley, and leatherback sea turtles. In this section, we describe the probable risks of the structure removal activities on individual animals and then integrate those individual risks to identify consequences to the populations, and then to the species. We examined the scientific and commercial data available to determine whether and how these individuals, populations, and species are likely to respond given exposure to the physical and chemical impacts associated with structure removal operations.

We measure risks to individuals using their “fitness,” the ability to survive and reproduce. In particular, we examine the scientific and commercial data available to determine if an individual’s probable responses to the agency action’s effects are likely to have consequences for the individual’s growth, survival, annual reproductive success, and lifetime reproductive success. When individual animals exposed to an action’s effects are expected to experience reductions in fitness, we would expect reductions in the abundance, reproduction rates, or growth rates (or increase the variance in these measures) of the population those individuals represent. On the other hand, when animals are *not* expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations. We then analyze the viability of the populations to determine the risks to the species.

In determining whether individual sperm whales or sea turtles would be affected, it is necessary to analyze when, where, and how an animal would be exposed to the various activities associated with removing offshore structures. We will first describe the environmental changes brought about by components of the action, whether physical or chemical, and then whether and how animals will be exposed to these changes. Depending on the physiology of the animal, it could be susceptible to the change such that it “responds” to the environmental change. An animal’s response may include physical injury or a change in behavior patterns. These responses could lead to changes in an animal’s ability to survive or reproduce. If we reasonably expect the effects to result in reductions in reproduction, numbers, or distribution, we determine if these reductions can be expected to result in an appreciable reduction in the listed species’ likelihood of surviving or recovering in the wild.

There is much we do not know or understand about sperm whales and sea turtles. During the analysis, we made several assumptions about their offshore habitats, hearing abilities, and behaviors to reach our conclusions. For most situations we have some information to apply to the Gulf of Mexico but for those with little to no data we erred on the side of species conservation. To avoid Type II errors, i.e., concluding that the animal was not affected when in fact it was in situations with many unknowns or uncertainties, we assumed an effect would occur, thereby providing the “benefit of the doubt” to the species.

For some of those animals that respond behaviorally or physiologically to the sounds associated with the vessels, explosions, or increased turbidity from sediment suspension, the response could rise to the level of harassment such that an animal is “taken.” The ESA does not define harassment. However, in this biological opinion, we define harassment as an act which creates the likelihood of injury to an individual animal by disrupting one or more behavioral patterns that are essential to an individual animal’s life history or to the animal’s contribution to a population, or both. In the open ocean, it is difficult to observe harassment of an animal because animals dive or stay submerged. We can not know in most instances if behavioral patterns would be disrupted, if it is not able to complete some reproduction-related, feeding, or other activity, or if the animal is likely to be injured. In order to avoid committing a Type II error, we assume that animals are harassed when their behavior appears to be disrupted, such as ceasing to feed or exhibiting avoidance reactions upon exposure to human-made sounds. Information on whether an animal would be disrupted by certain environmental factors are available through published studies and observations. At times, information on closely related species were applied to the listed species considered in this opinion.

Overview of Impacts from Decommissioning

As described in the Description of the Proposed Action section, the offshore structure decommissioning process involves the following:

- mobilization of supply and personnel vessels,
- setting up structures for severing,
- explosive or mechanical severance,
- removal of severed structures, and
- site clearance.

There will also be pre and post-detonation surveys for marine resources. Aspects of these activities could adversely affect sperm whales or sea turtles (Table 5). We first describe the environmental effects generally, setting aside those that are unlikely to adversely affect listed species. For those effects that could take or otherwise adversely affect listed species, a full discussion follows.

Mobilization to the target site involves the movement of vessels from ports. The physical presence of the vessel, vessel noise (from the propellers and engine), and discharges of contaminants and debris alters the environment around the vessel. Sperm whales and sea turtles are at risk from collisions with the vessels, ingestion of debris, and intake from chemical contaminants. During pre-severing operations, equipment and vessels are anchored or moored into place and bottom substrate is removed from inside or around the target structure to the required depth (i.e., 15 feet). Substrate is removed from inside the structure if the charge is to be placed inside and outside the structure if the charge is to be placed external to the structure.

Table 5. Summary of environmental effects resulting from components of the proposed action (see the Description of the Proposed Action section for a detailed discussion of the components)

Action		Change in Environment	Impact on listed marine species
Mobilization	Lift vessels and support vessels are mobilized to the structure site.	Vessel presence and noise; discharges of chemicals and debris from the vessels	Potential for collisions; behavioral disruptions from vessel presence and/or noise; exposure to chemicals and debris
Pre-severing operations	Surface structures are removed and loaded on a barge. Scaffolds and bracing around open piles may be erected. Jetting equipment may be used inside the pile to wash out the existing mud plug. All piles are jetted and gauged to the proper cut depth.	Suspension of sediments	Reduced visibility
Severance of target structure	Abrasive, mechanical, diver, or other cutters are used to sever the targets	Minor air and water quality changes	Minimal to no impact
	Bulk or shaped explosive charges are used to sever the targets	Shock waves; Pressure waves/blasts of noise	Injury and death of animals, particularly sea turtles; temporary or permanent reductions in hearing abilities; behavioral disruptions
Removal/Transport of severed structures	Structures are lifted out of the water and loaded onto barges for transport. On the rare occasion when a structure can not be lifted onto a barge, the company can use “progressive transport” or “hopping” to transport the structure to shore.	Vessel presence and noise; discharges of chemicals and debris from the vessels; damage to benthic habitats at each “set-down” location	Behavioral disruptions from vessel presence and/or noise; exposure to chemicals and debris; little to no impact on listed species from set-downs given the limited use of “progressive transport”
Site clearance	Trawling is typically used to clear a site of lost and discarded objects after structures are removed. Using high-resolution sonar, divers or ROV’s could also be used to clear a site of seafloor obstructions.	Trawling net dragged over the sea floor damaging sea bottom structure	Incidental capture of animals, particularly sea turtles
Mitigation measures – pre and post-detonation surveys	Aerial or surface surveys will be conducted before and after explosive-severance removals.	Presence of vessels/aircraft and noise	Behavioral disruptions from vessel presence and/or noise

Anchoring can destroy benthic habitats used by sea turtles. The high pressure water used to "jet" substrate away from the structure suspends sediments and increases turbidity which could also affect the listed species.

Mechanical severance is expected to have some minor air and water quality impacts that are unlikely to have effects on listed species and thus will not be discussed further. Although we do not have measurements of the sound levels emitted by the machinery used in mechanical severance operations, the levels are such that human divers can be in the water. Explosive severance, however, is the primary concern during the entire operation because it could lead to the injury or immediate death at close proximities, or non-lethal hearing effects further away.

Removal and transport of the severed structures are not likely to lead to any environmental impacts beyond the effects mentioned from vessels. Some "jacket-hopping" may occur but is rarely used. Any damage that may occur to the sea floor at sites where the jacket is set down is limited and is unlikely to result in effects to sperm whales or sea turtles. Site clearance activities using trawl nets may affect sea turtles, as demonstrated in fisheries that use trawl nets.

A single decommissioning operation would take place over a period of days or weeks. The environmental impacts described would all be temporary. Furthermore, any "artificial" habitat provided by the structure would be cleared.

Exposure of Listed Species to Environmental Impacts

The action area is large but each decommissioning event will take place in a small portion of the action area. Multiple decommissioning events would occur each year, in a variety of locations. Listed species may be present at some of the removals but not all of them, and may be present in only one component of the removals. The location of the animal during decommissioning activities determine whether sperm whales or sea turtles would be exposed to the environmental impacts. We do not have information on whether sea turtles or sperm whales would be present at target structures during decommissioning but know from existing information that we can expect them at some of the structures.

Sperm whales

Sperm whales are dispersed around the northern Gulf of Mexico but concentrations of female and juvenile sperm whales are regularly sighted over the shelf edge in the vicinity of the Mississippi River delta in waters that are 500 to 2,000 m (1,640 to 6,562 ft) in depth. Large adult males are occasionally sighted in the Gulf. Consistent sightings in the region indicate that sperm whales likely occupy the northern Gulf throughout all seasons.

Sperm whales dive deeply, apparently for foraging. Whitehead (2003) provides a summary of the diving data collected for sperm whales. Deep dives usually last 30 to 45 minutes, although sometimes a whale stays under water for over an hour. Dives are usually separated by periods of 7 to 10 minutes spent breathing at the surface. Sperm whales can spend roughly 15 minutes ascending and descending, with about 15 to 30 minutes foraging. Whitehead (2003) estimates that these long, deep foraging dives take up about 62% of an animal's life.

Sperm whales could be exposed to vessel traffic during mobilization and removal of severed structures, detonations, and aerial/vessel monitoring during their periods at the water surface. At the surface sperm whales risk collisions with vessels traveling to or from a target site. As sperm whales dive to demersal habitat, they could be close to detonations. Any sperm whales at a target site would be exposed to the presence of vessels and people. Further away from detonations, sperm whales may be able to hear the blasts.

Sperm whales are generally found in waters deeper than 500 meters, and thus may be affected by only the structure removals in those waters. Removals of structures in deep waters are expected to increase in the future as oil and gas extraction takes place in deeper waters. Current projections range from 29 to 63 explosive-severance removals per year in waters greater than 200 m (656 ft) deep (Kaiser et al. 2005). Only a fraction of these removals would be waters greater than 500 m (1,640 ft) deep. Furthermore, sperm whales would likely be exposed to only a portion of the structure removal activities because they are dispersed throughout the Gulf and usually move large distances each day. Generally sperm whales travel while foraging covering several kilometers within a few hours. Whitehead (2003) compiled information on sperm whale movements in the South Pacific and found females and immature males move an average of 4 km in a hour, 20 km in 6 hours, and 70 km in 24 hours. The movement of sperm whales horizontally within the Gulf is likely related to foraging success. Data shows that females and immature whales move in a fairly straight track when feeding success is poor and a recurving track when success is good, leading to 24-hour displacements of about 70 km when conditions are poor and 25 km when they are good (Whitehead 2003). There is less data on mature males. However, males traveling with females behave similarly (Whitehead 2003).

With potentially multiple explosive-severance removals each year in deep waters, some sperm whale may be exposed to some aspect of the removals, such as a moving vessel or explosion, possibly even several times during its lifetime. Some whales may never be exposed to platform removal activities. The total number of sperm whales that are exposed to removals are likely to be small due to the relatively small number of removals expected in deeper waters. Sperm whales are usually found in waters deeper than 500 m and would likely be exposed only to removal operations occurring in the deeper waters. Prior to 2001, approximately 33 structures were installed in waters deeper than 200 m, 3 of which have been removed (Kaiser et al. 2005). Although relatively few structures are installed and subsequently removed in waters deeper than 200 m, these structures are could have sperm whales present from time to time based on the frequency of sperm whale sightings at offshore platforms.

Whenever a sperm whale is exposed to activities at a structure removal, it would likely be for a short duration because sperm whales are not stationary. In some instances sperm whales may remain within the vicinity of a platform removal, driven by high foraging success or other motivations. MMS used the Acoustic Integration Model (AIM) which uses sperm whale density estimates, diving behavior, and other paramters to estimate the number of whales that could be exposed to detonations at pressure levels above 12 psi. The model results indicate up to 2 sperm whales per year may be exposed to detonations. Given that detonations are brief, whereas other removal activities may be underway for weeks or even months, additional sperm whales may be exposed to other structure removal activities.

Sea Turtles

Sea turtles are found in all parts of the northern Gulf, inhabiting coastal waters as well as shelf waters. Turtles may be present in any of the areas where platform removal activities would occur.

Although loggerhead, Kemp's ridley, hawksbill, green, and leatherback sea turtles can be found throughout the Gulf, sea turtles are more often sighted in the eastern half, particularly along the shores of Florida. In certain areas of the Gulf, investigators have found concentrations of particular species and life stages. For example, green sea turtles are regularly captured in Texas coastal waters less than four meters deep (Landry, pers. com.). Individuals of immature hawksbills, juvenile green turtles, juvenile Kemp's ridley, and juvenile loggerheads appear to exhibit site fidelity to foraging areas based on radio and sonic telemetry, mark-recapture, and other methods (see Epperly et al. 2002).

Extensive surveys undertaken by the Southeast Fisheries Science Center of the Gulf during the fall of 1992-94 and 1996 show strong geographic differences in sighting rates and species composition. A total of 637 sightings of sea turtles were made in the Gulf of Mexico waters less than 40 fathoms in depth (Epperly et al. 2002). In general, sighting rates were much higher in the eastern Gulf and inshore strata than in the western Gulf. Loggerhead turtles were sighted throughout the Gulf, though had a very low occurrence in the offshore strata in the Western Gulf. Kemps' ridley turtles were sited primarily in the inshore strata and most commonly occurred in the eastern Gulf. Green turtles occurred further offshore and were primarily sighted in the southern portion of the Florida Gulf coast. Hawksbill turtles likewise occurred primarily in southwest Florida. Leatherback turtles were more broadly distributed and were observed primarily in the offshore strata.

The action area includes waters at least three miles from the coastline. Loggerhead sea turtles appear to be relatively more abundant than other species on the continental shelf and are the most often caught turtle in the shrimp fishery, which operates in a variety of depths, to over 80 meters (Epperly et al. 2002). The loggerhead sea turtle has been the most frequently sighted species at offshore oil and gas structures (see Tables 6a and 6b).

Sea turtles could be exposed to the presence and noise of passing vessels, as they travel to or from structure removal sites. Sea turtles could also be exposed to discharges from vessels. These exposures would be temporary, because sea turtles are mobile, the vessel transient, and any discharges would move and be diluted by currents. We can not know how many sea turtles would be exposed to these potential stressors.

For platform removals, we used past data gathered by observers and maintained at NMFS Galveston Laboratory to evaluate the magnitude of harm to sea turtles during explosive-severance removals.

Table 6a. Total number of sea turtle sightings observed by NMFS and non-NMFS personnel combined at structure removal sites. The total number of structures removed are provided for comparison purposes.

Species	1987-1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Loggerhead	165	34	32	38	16	6	20	42	203	124	76	80	110
Green	5	--	1	2	--	--	9	--	1	8	1	--	1
Leatherback	5	3	--	3	1	4	4	--	--	5	--	5	1
Hawksbill	16	--	--	--	1	--	--	--	--	--	--	--	--
Kemp's ridley	1	--	1	--	--	--	2	--	--	20	13	11	12
Unknown	40	11	13	4	2	8	22	9	30	30	19	28	33
Total turtles	232	48	47	47	20	18	57	51	234	187	109	124	157
Structures removed	437	106	131	81	85	50	133	60	98	110	65	66	108

Table 6b. Total number of individual sea turtles observed by NMFS and non-NMFS personnel combined at structure removal sites during1987-2003. The total number of explosive structure removals is provided for comparison.

Species	1987-1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Loggerhead	40	16	6	11	4	3	12	19	32	62	37	24	30
Green	3	--	1	1	--	--	3	--	1	6	--	--	1
Leatherback	2	2	--	1	1	4	4	--	--	5	--	5	1
Hawksbill	1	--	--	--	1	--	--	--	--	--	--	--	--
Kemp's ridley	1	--	1	--	--	--	2	--	--	14	5	6	8
Unknown	31	10	12	3	2	8	22	9	16	30	18	23	20
Total turtles	78	28	20	16	8	15	43	28	49	117	60	58	60
Structures removed	437	106	131	81	85	50	133	60	98	110	65	66	108

There are several anecdotal accounts of sea turtles residing at specific platforms or other hard bottom structures, at least briefly or seasonally. Most marine turtle species commonly inhabit areas characterized by topographic relief such as exposed rock features and reefs (Carr 1954, Booth and Peters 1972, Stoneburner 1982, Witzell 1982 cited in CSA 2004). Offshore oil and gas structures also provide topographic relief in areas and have been shown to attract marine turtles (Fuller and Tappan 1986, Rosman et al. 1987, Gitschlag and Renaud 1989, Lohofener et al. 1989, Gitschlag 1990, Lohoefener et al. 1990, Gitschlag and Herczeg 1994 as cited in CSA 2004). Offshore structures may provide foraging opportunities for sea turtles, particularly for the omnivorous adult loggerhead. Juvenile sea turtles may tend to have specialized diets and can be found occupying a particular habitat. However, as some sea turtles become more developed, their diets can become more varied (Landry, pers. com). Offshore structures support algae, barnacles, and other foods of loggerheads and other sea turtles. In addition, organic discards if a human-occupied platform and release of fish and bait by recreational fishers may attract loggerheads and other sea turtle species. Although sightings of sea turtles around offshore platforms lead to speculation that such structures are places to feed and rest or refuge from predators and strong currents (NRC 1996), sea turtles may also use offshore structures for other purposes.

The only available formal study examining sea turtle associations with platforms was conducted by Lohoefener (1988, 1990), who used aerial surveys to analyze sea turtle presence around platforms in study sites offshore of Louisiana. For the study sites east of the Mississippi River, from the shore to 13 fm isobath, they estimated that the probabilities of at least one sea turtle being within 500 m of a platform range from about 30% and within 1000 m more than 50%. In areas west of the river in water depths 7 to 34 fm, the probability that sea turtles were within 1,000 m of any randomly selected platform was far less, estimated to be about 7%. These may be underestimates because of the amount of time a sea turtle spends at the surface. Also, only large sea turtles can be observed from aerial surveys. Smaller sea turtles, like Kemp's ridleys are not likely to be detected, especially in the turbid water offshore of Louisiana. Thus, the study does not allow speculations on the spatial distribution of juvenile sea turtles. The difference in probabilities may be explained by the higher abundances of sea turtles offshore of the Chandeleur and Breton Islands, where turtles were about 6 to 30 times more abundant than west of the river.

When they examined several platform characterizations, the platforms with associated sea turtles tended to be smaller unmanned platforms that were closer to shore than the other platforms (Lohoefener et al. 1990).

The Galveston Laboratory of the NMFS Southeast Fishery Science Center has been gathering information on the presence of sea turtles and marine mammals at nearly all explosive structure removal operations (Gitschlag and Herczeg 1994, Gitschlag et al. 1997, and Sea Turtle Observer Program Annual Reports for 1987-1991, 1994, 1995, 1996, and 1997). Surface surveys are begun at least 48 hours prior to detonations and aerial surveys are conducted within one hour prior to detonations. Search areas include at least a 1000-meter radius around a structure. The field data are compiled into the number of sea turtle observations by species, structure type (e.g., platform, caisson, and casing stub), water depth, geographic area, distance from structure removals, and time of day. The results show that sea turtles were sighted at 21% of the structures removed from 1986 to 2002 (298 structures of 1,416 removed). Tables 6a and 6b show the number of each species of sea turtles sighted at structures, prior to explosive-severance. In more recent years, sea turtles have been sighted at a higher proportion of the structures.

At 190 of these structures with sea turtles sightings, only one sea turtle was sighted. At 108 of these structures, more than one sea turtle was sighted. The number of sea turtles at these structures is based on recognizable markings or characteristics of sea turtles, but is also based on the professional judgment of the observer on-site (Gistschlag, pers.com.). Gitschlag (pers.com.) estimated the mean number of sea turtles per structure removed to be 0.38 (=544/1416). Most of the sea turtles are loggerheads, but hawksbill, green, Kemp's ridley, and leatherback sea turtles have also been found within areas surveyed during removal operations.

These data are likely underestimates of the turtles present around structures. There are a number of potential biases associated with the surveys. Turtles, particularly the juveniles, are relatively small and easily missed by observers. Also, they spend a considerable amount of time below the surface where they are not available to the survey. Visibility bias is likely to vary among the different species and life stages because of the varying levels of sightability. For example, loggerheads spend 80 to 94% of their time below the surface. Juvenile hawksbill sea turtles can spend 92% of their time underwater during the day and 86% of the time at night (see Croll et al. 1999). Generally, sea turtles in temperate latitudes spend less than 10% of their time at the surface and dive durations can exceed an hour. Nonetheless, this is the best information available and we use these numbers to determine how many sea turtles could be exposed to explosive-severance removal detonations.

Future operations will include removals further off shore where there may be lower densities of sea turtles. However, removal of structures in all water depths above 4 meters will continue. We used data from observer reports, provided by NMFS Galveston Laboratory, to estimate the numbers of sea turtles exposed to detonations and that could be injured/killed.

For the years 1986 to 2002, sea turtles were observed at 21% of the explosive-severance removals (at least one turtle was observed at 298 structures of 1,416 removed). Observers determined the number of sea turtles at each structure using visible characteristics. The mean number of sea turtles found per structure removed is 0.38. Since the implementation of monitoring and mitigation measures during platform removals in the Gulf of Mexico OCS, only 4 sea turtles have been found injured or killed by detonations. This may also be an underestimate, because killed sea turtles are likely to sink to the ocean bottom (Gitschlag et al. 1997). The sea turtles that were harmed were likely the same individuals that were observed during the pre-detonation surveys.

With MMS' projected number of structure removals, there could be an average of 3 sea turtles that are reported killed or injured annually. These turtles would most likely be loggerheads. Hawksbills, green, Kemp's ridley, or leatherbacks could also be injured or killed, but in the past affected turtles were loggerheads, and loggerheads are the most sighted turtle around offshore structures. These estimates are the result of multiplying the mean number of sea turtles found per structure removed using explosives (0.38), the proportion of structures with sea turtle sightings where a sea turtle was injured or killed (0.013 = 4/298), and the average number of explosive-severance structure removals per period (Table 7).

Table 7. Estimates of the number of sea turtles killed/injured and exposed to detonations based on forecasts of explosive-severance removals provided by MMS and observer data compiled by NMFS Galveston Laboratory. These estimates reflect the numbers of sea turtles that may be observed, which may not reflect actual numbers injured, killed, or exposed.

Year	Annual removals using explosives*	Average no. of removals per year	Estimated No. sea turtles injured or killed per 5-year period	Estimated no. of sea turtles exposed to detonations annually
2002-2006	94-160	127	1 or 2	48
2007-2011	120-168	144	2	55
2012-2016	108-114	111	1 or 2	42
2017-2021	47-82	65	1	25
--	170-273*	222	3	84

* The forecasts from 2002 to 2021 periods are from Kaiser et al. (2005) modeling of structure removals. The last row is MMS' annual projections based on the forecast modeling, historical trends, and industry projections.

Sea turtles could also be exposed to explosions without major physical injuries. We can not predict with accuracy how many sea turtles may be exposed, but past data suggest an average of 84 sea turtles per year could be found around the structure during the period. We arrive at this estimate by multiplying the mean number of sea turtles found at structures during surveys and the average number of structure removals (using a value of 0.38 sea turtles observed per structure removal for 1,416 structures). These estimates were made assuming the sea turtles that were sighted during the pre-detonation surveys were exposed to non-lethal levels of impulse, energy, and pressures. Since 2000, the sightings of loggerheads has increased, as well as sightings of Kemp's ridleys. This limited data suggests that more than 84 sea turtles could be exposed per year. These would be mostly loggerheads based on past sightings. Green, hawksbill, and leatherback sea turtles are only occasionally sighted at structures that are slated for removal whereas the sightings of Kemp's ridleys have increased in the past few years.

The above estimates contain many uncertainties. First, we do not have necessarily reliable forecasts of structure removals. Second, it is not possible to know if all injured and killed sea turtles are observed following detonations. Sea turtles that are immediately killed by blasts are likely to sink to the ocean bottom and unlikely to rise to the surface unless decomposition results in the accumulation of gas within the carcass. We may be underestimating the number of sea turtles affected. Third, the mitigation measures proposed for all future removals could be effective in precluding the injury or mortality of sea turtles, in which case we are overestimating the number of sea turtles killed or injured. Nonetheless, past experience and the information from pre- and post-detonation surveys suggest that few sea turtles would be injured or killed. Furthermore, although the number of sightings of loggerheads and Kemp's ridleys has risen since 1999, there has only been one report of an injured (stunned) sea turtle.

As the number of explosive-severance removals increase, or the number of sea turtles occurring at structures increase, we may see an increase in the number injured or killed. In the worst case scenario where 3 loggerhead turtles are killed or injured each year, and assuming all injured sea turtles eventually die, up to 18 loggerhead sea turtles could be killed over the next 6 years. If 84 sea turtles are exposed to detonations annually, there could be over 2,900 sea turtles, mostly loggerheads and Kemp's ridleys, affected over the next 6 years. Only dozens or less of hawksbills, greens, and leatherbacks may be exposed to detonations or other activities at structures to be removed. Given the uncertainties discussed above, these numbers are unlikely to be an accurate prediction. In addition, these estimates reflect what could be observed, not the actual numbers killed or injured by detonations or exposed to detonations.

Mobilization

During equipment and vessel mobilization, sea turtles and sperm whales at, or close to, the surface of the water risk colliding with vessels, exposure to vessel discharges, and disturbance or masking of environmental sounds from vessel noise.

Data show that vessel traffic is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al. 1997). Numbers of OCS-related vessel collisions with sea turtles offshore are unknown, but are thought to be orders of magnitude less than other human causes (such as fishing-related mortality) (Lutcavage et al. 1997). It is expected that some sea turtles could be impacted during decommissioning activities due to vessel traffic. Two or 3 vessels, including a lift vessel, crew boat, and sometimes an additional vessel with equipment, could be used to transport equipment and personnel for each removal operation. There is a low likelihood that any one vessel would strike a sea turtle or sperm whale but with hundreds of trips each year, a few sea turtles of any species and sperm whales could be struck. However, based on structure removals and associated vessel traffic over the past five years and projections for the next five to twenty years this risk of collision is not expected to increase measurably.

Vessel discharges to marine waters include sanitary waste or sewage; domestic waste such as water from shipboard sinks, laundries and galleys; bilge and ballast waste; cooling water; and deck drainage. Section 312 of the Clean Water Act establishes sanitary waste discharge standards and is implemented jointly by the U.S. Environmental Protection Agency and U.S. Coast Guard. The number of personnel involved in a structure removal is dependent upon the size of the project. Up to 6,000 gal/day domestic wastewater and 4,000 gal/day of sanitary wastewater could be generated from a large derrick barge. This volume estimate is based on a crew of 200 people and generation rates of 30 gal/person/day for domestic waste and 20 gal/person/day for sanitary waste (see MMS 2005). Smaller vessels that employ smaller crews will produce smaller sanitary and domestic waste volumes. Trash and debris are retained and transported to shore for disposal in accordance with the Marine Plastic Pollution Research and Control Act, which implemented Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL). The sanitary waste and sewage discharge would result in elevated levels of fecal coliform in the waters surrounding the vessels. These levels would dissipate with the currents.

We do not have information on whether sea turtles would be adversely affected, directly or indirectly, by these wastewater discharges. Any exposure to such discharges, however, would be localized and temporary. After a removal operation is complete the barges and other vessels

would return to service bases or move to other locations and the discharges would be diluted and eventually decompose.
Noise from service-vessel traffic and aircraft may elicit a startle reaction from sea turtles and sperm whales, resulting in a short-term disruption of activity patterns. Migratory corridors used by sea turtles that are close to service bases may be impacted by increased vessel and aircraft disturbance. Sea turtles and sperm whales may swim and dive away from vessels but also may cease to feed, rest, or interact with conspecifics. Although disruptions in behaviors could lead to a temporary loss in feeding, resting, or other activities, sea turtles and sperm whales that are aware of vessels and respond by moving away from an approaching vessel reduce their risk of being struck. Any disruptions are expected to be temporary and affected animals would be motivated to resume their activities soon after the vessels have passed.

Pre-Severance Activities

During pre-severance preparation, vessel anchoring, excavation for BML severing, the use of explosives, and lifting or toppling of the severed structure will cause sediment disturbances and an increase in turbidity within at least a portion of the water column. The area and depth of disturbed sediment would be dependent upon the number and size of service vessels and the number of anchors set, the size of the excavated area, the depth of the BML cut, the method of explosive severance (internal or external) and size of charge.

The characteristics of the sediment would further influence the amount of disturbance that would occur. In waters 100-200 ft (30-60 m) deep, where most of the removals would occur, the majority of sediments are characterized as very soft (National Research Council 1996). Conventionally piled platforms are likely to have mud mats near the bottom of the jacket, which provided temporary support before the piles were installed. If the structure has mud mats that increase the horizontal surface area, a larger area of sediments will be disturbed when the structure is toppled in place or removed.

Some sediment may contain trace concentrations of persistent organochlorine pesticides and metals from inland agricultural and industrial practices. These sediments were transported by the Mississippi River and other rivers and deposited in coastal/marine waters. The presence of pollutants carried by river discharges is much more common in the sediments of coastal waters and is less likely in deeper waters where the structure removals will occur. Low levels of petroleum hydrocarbons may also be present in sediments as the result of urban runoff, low-level discharges associated with oil transport, or offshore natural seeps. Petroleum hydrocarbons may also be present in sediments adjacent to wells from past practices or spills. Any remaining hydrocarbons would be the fractions within the crude that are less water soluble and most resistant to biodegradation. Sediments close to oil and gas wells may contain residuals of drilling muds and cuttings that settle to the seafloor adjacent to the point of discharge. Levels of barium, total mercury, and other metals above background levels may be present as a result of barite used in drilling.

The USEPA limited the toxicity and free oil content of the discharged muds and cuttings through the NPDES discharge permit. In 1993, the USEPA reduced the allowable level of total mercury in barite to 1 ppm. Mercury in sediments is a concern because it potentially bioaccumulates in aquatic organisms. Trace amounts of mercury in barite is predominantly inorganic mercuric sulfate and mercuric sulfide (Trefrey 1998 in MMS 2005). Because barite is nearly insoluble in seawater, mercury and other trace metals are trapped in the barite mineral structure and would not become soluble in water or available for bioaccumulation.

Sediment disturbance and excavation will cause a temporary increase in suspended solids, or turbidity, in the immediate area of the activity and possibly the resuspension of sediment contaminants including petroleum hydrocarbons or metals. Sediment resuspension and transportation is an ongoing naturally-occurring process. Sediment disturbances during a structure-removal action would be similar to sediment displacement for the purpose of pipeline placement or water jetting and riserless drilling, standard practices employed during the initial drilling of a well. Sediment disturbance would occur in a limited area over a time period of less than a week or month for the most extensive removal projects. Therefore, the resuspension of any sediment caused by anchoring, sediment excavation, or removal of severed structure would result in a temporary increase of suspended matter, which would rapidly disperse and resettle to the seafloor. Typical conditions would resume at the completion of the removal activity.

The effect of decreased clarity of water or exposure to petroleum hydrocarbons or metals in suspended sediments on sea turtles and sperm whales is not known. Due to the dispersion of suspended sediments, any exposures that do occur would be brief. The potential for ingestion, skin absorption, or other exposure pathway of contaminants is low for any single animal. Also, the amount of exposure to contaminants in this manner would be small. Thus, the contribution of any hydrocarbons or metals available during structure removals would likely be negligible and not result in harm to sea turtles or sperm whales.

Explosive Severance

The largest concern with structure removals is the use of explosives for severance. In operations of explosive-severance removal of offshore structures, most of the structural members to be severed are cylindrical metal structures protruding from the bottom sediment, such as support legs, piles, or well conductors. A variety of explosives are used to disconnect structures from their foundation under the sea floor, such as pentaerythritol tetranitrate (PETN), cyclonitrite (RDX), trinitrotoluene (TNT), Composition B, and C-4 (DEMEX 2003). Explosives are placed inside or outside of these structures such that the energy from a blast will sever the target by mechanically distorting (ripping), jet cutting, or fracturing the material. MMS requires that explosives be used 4.6 m (15 feet) below the mud line for any charge used to sever a structural component. However, explosives may be used above the mud line when necessary to divide structures above the foundation.

A detonation sends a shock wave (a sharp change in pressure over a narrow region, traveling through a medium) and acoustic wave through the water and sediment and releases heat, gaseous by-products, and chemicals. Within a short distance from the blast, generally taken to be three to ten diameters of the explosive's charge, thermal and direct detonation effects take place. Beyond this range, the shock wave and expanding gaseous reaction products have the most impact.

The use of explosives releases carbon dioxide and nitrogen, two common atmospheric gases naturally present in water as the result of atmospheric exchange and biological processes. Carbon monoxide gas is also formed. Carbon monoxide is a toxic gas that binds preferentially to the iron in hemoglobin. Carbon monoxide is a product of incomplete combustion and is not normally found in natural waters. When released to the water, these gases will both dissolve in the water and escape to the surface atmosphere (Young 1972). The increase of gaseous by-products of explosives in the water will cause very short-term, minor alterations to the dissolved gas concentrations in the water in the immediate area of the explosion. The impacts from the temperature increase and gas release would be negligible because each removal is a single, short-term event (MMS 2005).

Chemicals within the detonator are also released. Detonators may include milligrams or less of lead and mercury. Less than 1 gram of detonator is used for military explosions, which are orders of magnitude larger than the mass of explosives used for structure removal (Young, 1972). The Mississippi River discharge and atmospheric deposition contribute greater amounts of lead and mercury to the Gulf each year than would be released from small detonators that would be used for structure removal. The amount of lead and mercury added to offshore waters from the use of some detonators would be too small to measure and would have no impact on water quality (MMS 2005).

An initial shock pulse causes pressure to increase, then pressure falls below ambient pressure then rises to a second maximum known as the first bubble pulse. The time between the shock and the first bubble pulse is 0.17 to 0.5 seconds, depending on the size of the explosive (Demarchi et al. 1998 in CSA 2004). The original shock wave is the primary cause of harm to aquatic life at substantial distances from the shot point. The positive impulse is computed from the integral of the initial positive pressure pulse over time, with units in pascal-seconds. The expanding gases, if they do break into the water column from the substrate where the explosion occurs, can set up a pulsating bubble whose recurring pressure waves may also contribute significantly to the harm. The pressure waves would be audible to some marine life. The broadband source levels of charges measuring 0.5-20 kg are in the range of 267-280 dB re 1 μPa (at a nominal 1-m distance), with dominant frequencies below 50 Hz (Richardson et al. 1995). Explosions are considered the loudest of the man-made sounds in the ocean environment.

A blast may also create a region of cavitation (defined as the formation of partial vacuums in a liquid by high intensity sound waves) in the upper portions of the water column. Cavitation occurs when compression waves generated by an underwater explosion propagate to the surface and are reflected back through the water column as rarefaction (reduction in density) waves. Since water can sustain little tension, it will cavitate if the rarefaction is strong enough to reach the vapor pressure of water. The direct effects of cavitation on marine animals or sea turtles are unknown but may be similar to that observed for terrestrial mammals. A study of caged fish exposed to underwater explosions failed to establish a direct relationship between cavitation and injury (Gaspin et al. 1973). The cavitation that may be associated with explosive-severance removals were not analyzed or studied in field experiments, and thus, our jeopardy analysis does not include this aspect of the impacts from explosions.

The location of the explosive in the surrounding media is of the greatest influence in determining the acoustic levels generated in the water column by an underwater detonation. The acoustic impact of the buried charge explosion can vary significantly depending on the nature of the sediment and could range in principle from an essentially open-water shot (unconfined explosive detonated within the water column) to a completely confined shot with no venting of explosion gases into the water column. The presence of the metal structure being severed, which may act as containment and will absorb a portion of the explosive energy, further complicates the scenario.

The manner in which shock and acoustic waves propagate from the source into the ocean is also influenced by the ocean environment. Shock waves are usually absorbed by sea bottoms and surfaces and may have lesser effects in shallow waters (Gaspin pers. com. 2005). Noise propagation in shallow water environments, however, can reflect many times from the sea surface and bottom and reduce transmission loss. In these cases, sea surface roughness and sea bottom characteristics are often very important. Fewer surface and bottom interactions occur in deeper water. However, refractive effects due to differential temperature and salinity profiles can cause sound to be trapped in small depth channels and can lead to sound focusing.

Effects of Underwater Explosions

The shock wave and blast noise from explosions are of most concern to marine animals. Depending on the intensity of the shock wave and size and depth of the animal, an animal can be injured or killed. Further from the blast, an animal may suffer non-lethal physical effects. Outside of these zones of death and physical injuries, marine animals may experience hearing-related effects with or without behavioral responses. Figure 5 lists examples of physical injury or other effects that are possible within these zones surrounding the blast.

Injuries resulting from a shock wave take place at boundaries between tissues of different density. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg 2000). Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner 1982; Hill 1978; Yelverton et al. 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble (Reidenberg and Laitman 2003). Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton et al. 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten 2000). Sound-related damage associated with blasts can be theoretically distinct from blast injury, particularly far from the blast. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten 1995). Sound-related trauma can be lethal or sublethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage to the ears includes tympanic membrane rupture, fracture of the ossicles,

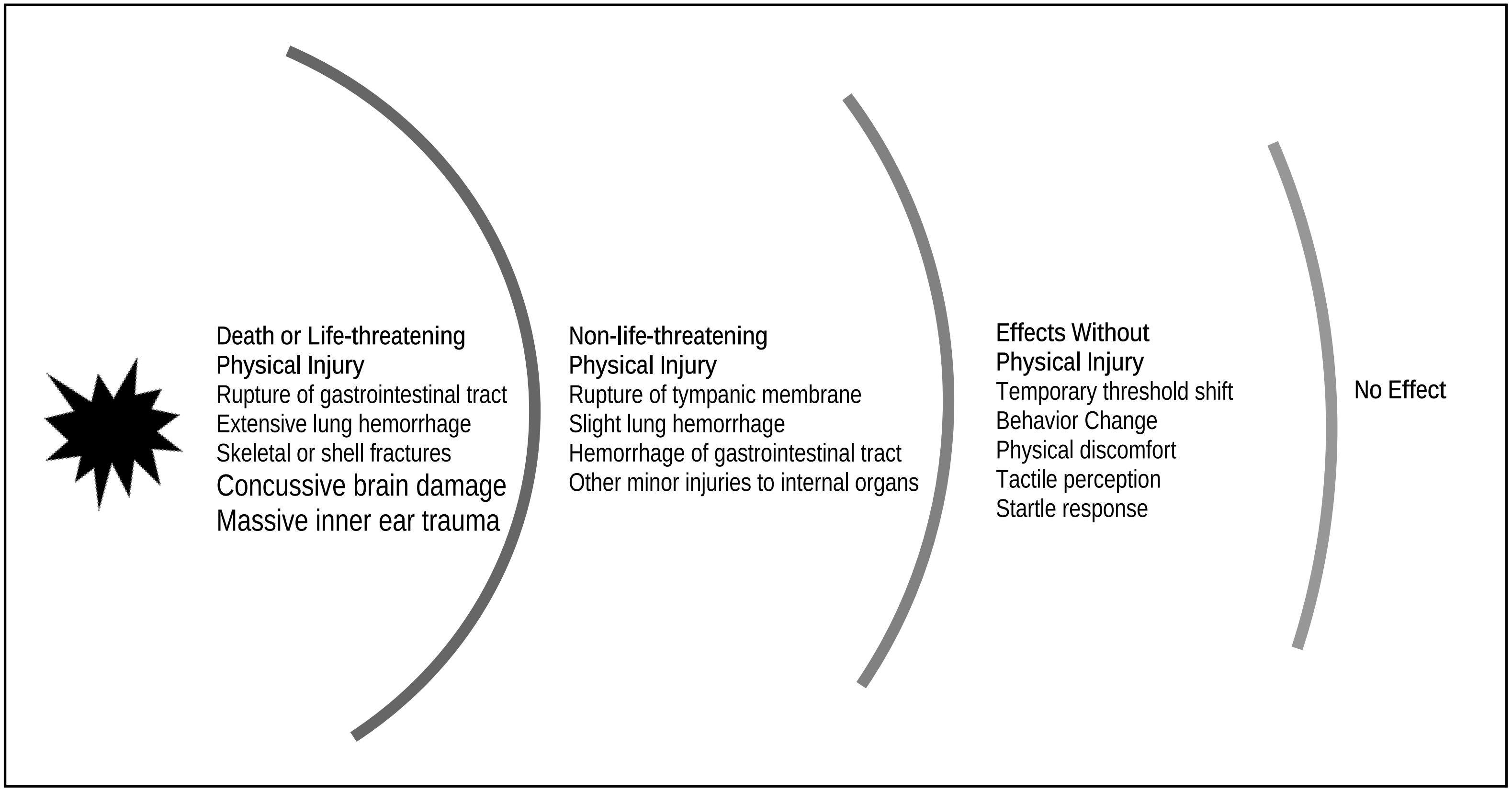


Figure 5. Zones of potential impact for marine vertebrates with gas-fluid interfaces that are exposed to an explosion. The initial high peak pressure shock wave and secondary waves of an explosion can cause death and severe injuries to animals close to the source. With increasing distance, the spreading pressure waves result in less damage to animals. At some distance from the explosion, the pressure waves behave like sound waves. The lists of effects are not exhaustive. (Compiled from CSA 2004 and Ketten 1995.)

damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten 1995).

Although we have information on the consequences of exposure to blasts, there are only a few records of blast effects on sea turtles and no information for sperm whales. It is not possible to know the levels of overpressure to which sea turtles and sperm whales could be exposed during explosions. With no information on what exposures lead to these injuries for sea turtles and sperm whales, we must infer from the information presented above and data from other animals.

Blast exposure can be measured as peak pressure (in psi units), impulse (kPa-s or Psi-s units), or energy levels (dB re 1 μPa2-s or kPa-m or psi-in); many of the available models measured or estimated impulse while others provided peak pressure or energy. Several models were developed to estimate the levels and/or range at which harmful effects would occur (Richmond et al. 1973, Yelverton et al. 1973 Yelverton 1981, Goertner 1982, Wright 1982, O'Keeffe and Young 1984, O'Keeffe 1985, Young 1991, Craig and Hearn 1998, and Craig 2001 as cited in CSA 2004). These have been based on the degree of damage suffered by submerged terrestrial mammals at various impulse levels (as determined primarily by Yelverton et al. 1973); on the physical dependence of the impulse on charge weight, charge depth, range, and mammal depth; and, in some cases, on the relationship between the animal's weight and its susceptibility to injury and death (after Yelverton 1981).

Below is a summary of these studies. These available models show the ranges within which an animal could suffer injuries due to explosions. A means for observing free-ranging animals underwater during future detonations for structure removals does not exist. Nonetheless, these models provide results similar to that selected by MMS for use in estimating impact zones. These zones were then used to estimate numbers of sperm whales that could be exposed to blasts and also an area to exclude marine protected species. For sea turtles, we estimated the number that could be exposed to detonations and the number that may be injured or killed by detonations using information from the Platform Removal Observer Program. Some of the models and studies described below can be applied to sea turtles because sea turtles have gas-filled organs that are susceptible to shock waves and pressures similar to the terrestrial animals that were the subject of the studies and formed the basis for subsequent models. These models describe impulse levels where injuries could occur and may provide approximates zones around an explosion where a sea turtle may be injured or killed or suffer other effects. However, we do not have good information on the density or distribution of sea turtles around offshore structures. We do have much information on the sightings of sea turtles prior to past structure removals, standard procedures for pre-detonation and post-detonation surveys, and records of sea turtles injured or killed by blasts. This information from the Platform Removal Observer Program, from 1987 to 2003, is the best information for estimating the number of sea turtles that could be harmed from future explosive-severance removals.

Richmond et al. (1973) and Yelverton et al. (1973) conducted a series of tests to assess the injuries arising from underwater explosions using sheep, dogs, and monkeys. Yelverton et al. (1973) developed the following underwater-blast criteria:

- An impulse of 275.8 Pa-s (40 psi-msec) would result in a high incidence of moderately severe injuries including a high probability of eardrum rupture. An injured animal should recover on its own.
- An impulse of 137.9 Pa-s (20 psi-msec) would cause slight blast injuries and a high incidence of eardrum rupture.
- An impulse of 34.5 (5 psi-msec) would not cause any injury and can be considered a safe level for mammals.

Richmond et al. (1973) used his studies on dogs underwater to state that an impulse of 155.8 Pa-s would result in 50% eardrum rupture.

These studies formed the foundation for the development of several equations to determine the range at which injuries would not occur. Yelverton (1981) produced new equations for computing the impulse level at which injury would occur, factoring in the weight of the mammal. His equation ($\ln[I] = 3.888 + 0.386 \ln[m]$, where I is impulse in Pa-s and m is body mass in kg) suggested no physical injuries would occur to a 100-kg animal at impulses 289 Pa-s or less, and to a 1,000-kg mammal exposed to impulses of 702 Pa-s.

Young (1991) calculated safe distances for several marine animals from underwater explosions of various sizes, given a blast depth of 61 m (200 ft). These calculations were for open-water blasts. For a 12.2-kg (27-lb) dolphin calf at the surface, the safe range from a 22.7-kg (50-lb) charge was estimated to be about 422 m (1,385 ft). The estimated safety distances for adult odontocetes and baleen whales were 530 m (1,739 ft) and 300 m (984 ft) respectively. Young (1991) calculated marine turtle safe ranges as $R = 560\ W^{1/3}$ (units are feet and pounds) based on estimates of safe ranges as established by the NMFS for explosive platform removals. His calculated safe ranges are based on data from land mammals that indicate levels of effects that are not injurious and are to be used in the initial stages of planning.

Craig and Hearn (1998), and Craig (2001) used Goertner's (1982) method to determine the distance from underwater explosions to various injury levels, using lowest body mass and lowest impulses for the onset of slight lung injury, extensive lung hemorrhage, and extensive lung injury. The results of these calculations produced results slightly more conservative than the Yelverton equations. The calculations for these three injury levels were used to predict the zones of no injury, 1-percent mortality, and 50-percent mortality for marine mammals in the U.S. Navy's two recent ship shock EIS's (WINSTON CHURCHILL and SEAWOLF).

Ketten (1995) suggests the compulsory injury zones are the areas within 30 to 50 kPa peak overpressure in water and/or 240 dB re 1 μPa based on MaAnuff and Booren (1976), Yelverton and Richmond (1981), Phillips et al. (1989), Richmond et al. (1989), and Myrick et al. (1989).

Outside of the zone where injuries are likely, a sea turtle or sperm whale may experience hearing related effects. Temporary threshold shift (TTS), a reduction in an animal's sensitivity to sounds, is the mildest form of hearing damage that occurs during exposure to a strong sound (Kryter 1985). TTS is the process whereby exposure to a strong sound results in a non-permanent elevation of the minimum hearing sensitivity threshold. TTS can last from minutes to hours or days. The magnitude of TTS depends on the level and duration of noise exposure, among other considerations (Ward 1997). Also, generally 5 to 15 psi is accepted as the value at which TTS and even minimal injury is rare (see Ketten 1995).

Single or occasional occurrences of mild TTS do not cause permanent auditory damage in terrestrial mammals, and presumably do not do so in marine mammals. Very prolonged exposure to noise strong enough to elicit TTS, or shorter-term exposure to noise levels well above the TTS threshold, can cause permanent threshold shift (PTS) at least theoretically. Sound impulse duration, peak amplitude, and rise time are the main factors thought to determine the onset and extent of PTS. The health of the receiver's ear may also influence PTS. At least in terrestrial mammals, the received sound level from a single noise exposure must be far above the TTS threshold for there to be any risk of PTS (Kryter 1985, Richardson et al. 1995). Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial animals.

At greater distances from the blast, sperm whales and sea turtles may not experience any physical injuries but may be able to "feel" the blast, be startled, respond to the sound with a change in behavior, or may also tolerate the sound.

Impact Zone Estimation

Some of the methods mentioned above provide a means to estimate a zone of impact for marine animals. It is not possible to know which is most appropriate for use in explosive-severance removals, or if any are truly relevant. The methods are founded on data from terrestrial animals and theories of blast propagation, and validation with measurements using live animals in the marine environment is not expected due to the inhumane nature of such studies. Nonetheless, we need a means to identify zones around a blast where listed species may be injured or otherwise affected, at least to exercise protective measures.

MMS relied on the "UnderWater Calculator" (UWC), developed by ARA, to estimate the propagation of blast waves from charges detonated 15 feet below the mud line inside a pile, leg, conduit or other structural element. Table 8 shows the results for all of the blasting categories. The UWC was selected because it provided estimates of the overall reduction of energy released into the water column resulting from below-mudline (BML) detonations, where the pressure and acoustic energy is absorbed by the surrounding sediments and the severance target. The majority of explosions during structure removals would occur below the ocean floor. The UWC also provided propagation estimates for open-water/AML.

The criteria of 12 psi peak pressure and 182 dB re 1 μPa^2-sec were used in determining the zones where animals should be excluded. The 12 psi peak pressure criterion is based on a model created by Ketten (1995), which she derived through examination of ear trauma studies and models of the effect of blast over pressure on the structure of the ear (CSA 2004). The 182 dB re 1 μPa^2-sec energy criterion is derived from data by Ridgway et al. (1997) showing that average

TTS of 9.5 dB was induced in bottlenose dolphins by 1-second tones at 192 and 201 dB rms. They used 192 dB rms as a conservative estimate for TTS and estimated the energy that induced TTS for brief tonal signals to be 182 dB re 1 µPa2-s a a conservative pulse duration of 100 ms (Sigurdson et al. 2001 as cited in CSA 2004). These levels may indicate the onset of TTS for marine mammals, which are assumed to be the most sensitive to sounds. In the UWC, the 12 psi consistently provided for larger zones than the 182 dB re 1 µPa2-sec. The impact zones include the areas where sea turtles and sperm whales would be injured. The criterion is likely to also provide for zones where TTS or other harm to auditory systems could occur.

The UWC may be a method that yields impact zones larger than what would be found during explosive-severance removals. Field measurements acquired during the development and testing of engineered charges (Saint-Arnaud et al. 2004) suggest that the UWC overestimates the impact radii. MMS contracted with an industry team to develop an explosive charge system that would require less explosive to sever offshore structures through the use of an engineered charge. The team obtained data on peak overpressures and estimated impulse and energy flux density levels from the engineered charges (shaped charge with explosive weight of 4.05 lbs) as well as bulk charges (50 lbs). Some inconsistencies in the data, inexplicable readings, and non-working sensors lead to questions about the reliability of the information. However, the usable field measurements appeared to consistently yield lower values for peak pressure, impulse, and energy flux density than the UWC (Saint-Arnaud et al. 2004).

Table 8. Impact Zone Radii for Blasting Categories and Severance Scenarios

Blasting Category	Severance Scenarios	Configuration *(Charge Range)*	12 psi Impact Zone Radii
Very-Small Blasting	A1, A2	BML *(0-10 lb)*	261 m (856 ft)
	A3, A4	AML *(0-5 lb)*	285 m (935 ft)
Small Blasting	B1, B2	BML *(>10-20 lb)*	373 m (1,224 ft)
	B3, B4	AML *(>5-20 lb)*	522 m (1,714 ft)
Standard Blasting	C1, C2	BML *(>20-80lb)*	631 m (2,069 ft)
	C3, C4	AML *(>20-80lb)*	829 m (2,721 ft)
Large Blasting	D1, D2	BML *(>80-200 lb)*	941 m (3,086 ft)
	D3, D4	AML *(>80-200 lb)*	1,126 m (3,693 ft)
Specialty Blasting	E1, E2	BML *(>200-500 lb)*	1,500 m (4,916 ft)
	E3, E4	AML *(>200-500 lb)*	1,528 m (5,012 ft)

Within these impact zones, sperm whales or sea turtles very close to the blast may be killed or sustain a life-threatening injury while those animals further from the blast could experience minor physical injuries, TTS, or exhibit a behavioral response. The distance at which these effects occur would differ for each species, depending on their size; smaller animals would suffer more severe effects further from the blast.

Sperm Whale

Potential Physical Injuries

Impacts of explosive severance on sperm whales could include death, injuries to internal organs and auditory system, physical discomfort, and behavior disruptions.

The only published accounts of non-auditory physical injuries to marine mammals exposed to blasts involve sea lions, northern fur seals, dolphins, porpoises and dugongs (Fitch and Young 1948, Reiter 1981, H.F. Hanson 1954, Leatherwood and Reeves 1989, Zhou and Xingduan 1991, Baird et al. 1994 as cited in CSA 2004). Lien et al. (1993) found that humpback whales remained in an area where there were repeated large underwater detonations. Two beached humpbacks had damaged auditory organs, consistent with the types of damage caused by explosions (Ketten et al. 1993). Although there are observed effects of explosives on marine mammals, there is little quantitative data on the impulses needed to cause various kinds of effects, and those that exist are based on experiments with terrestrial animals. Most of the data are qualitative in nature.

Given that sperm whales have gas-filled organs, they would be susceptible to damage from blasts. Physical injuries could include those observed by Ketten et al. (2003) and Reidenberg and Laitman (2003) when they exposed dead marine mammals to underwater blasts. Damage was consistent with what would be expected in live animals and included apparent hemorrhages at the blubber-muscle interface and in gas-containing organs and the gastrointestinal tract, ruptures of the liver and spleen, and contusions of the kidney. Compression also appears to cause air to enter tissues adjacent to air spaces in dead marine mammals exposed to explosives.

Sperm whales would need to be very close to the blast to suffer such life-threatening injuries. Although we can not know what exposure levels would bring about injuries, peak blast overpressure of 1,034 kPa (150 psi) are associated with 50% tympanic membrane rupture (Ketten 1998).

MMS used the Acoustic Integration Model (AIM) to determine the number of marine mammals that could be exposed to various sound levels from detonations. Modeling results indicate 1 or 2 sperm whales would be exposed to detonations each year. A fraction of these exposures may be at levels that cause injury. The UWC show the area within which injuries could occur is relatively small. The zone where peak pressures are above 100 psi range from a radius of 46 m (151 ft) for the very-small, BML blasting category to 239 m (784 ft) for the specialty, AML blasting category. If we assume injuries to sperm whales would occur at some pressure level above 100 psi, a sperm whale would not be injured unless it was inside these impact radii.

MMS proposes to conduct aerial, surface, and passive-acoustic monitoring surveys in areas and for blasting scenarios where sperm whales are at higher risk for exposure to detonations. Detonations would not proceed unless sperm whales, as well as other marine protected species, are deemed out of the impact zones. The combination of these measure should prevent some sperm whales from exposure to detonations at levels that would result in injuries.

Any injuries to sperm whales within the Gulf may have consequences on feeding abilities, breeding success, or care of calves. A reduction in these abilities could be temporary. If an animal is debilitated long-term, its survival and reproduction could be reduced. With possibly two sperm whales exposed to detonations annually and far less exposed to pressure or impulse levels that could cause injury or death, few if any sperm whales would suffer a reduction in fitness (ability to survive and reproduce).

Hearing-related Effects

Sperm whales are likely susceptible to auditory damage, such as permanent threshold shift, with exposure to high level sounds and would likely alter their behavior with exposure to sounds at lower received levels.

The hearing abilities of sperm whales can be inferred from the hearing abilities of other marine mammals, their anatomy, and a single auditory brainstem response (ABR) study of a sperm whale neonate that stranded in Texas in September 1989. The calf's ABR wave response peaked at frequencies from 2.5 to 60 kHz, which are similar to those reported for other mammals and very similar to those observed in other odontocetes (Carder and Ridgway 1990). Low-frequency hearing was not tested. These data suggest that, at least for immature animals, sperm whales may have medium- and high-frequency hearing abilities similar to other smaller odontocete species tested to date. Whether this is true for adult sperm whales is unknown, however, we may assume they are able to hear in the range of their clicks and creaks (0.1 to 20 kHz). Also, sperm whales often reacted (by becoming silent) when exposed to pulsed sounds at frequencies ranging from a few kHz up to at least 24 kHz (Richardson et al. 1995). Assuming sperm whales are able to hear a wide range of frequencies, we can expect this species would be able to hear explosions associated with structure removals, with possible behavioral responses. Animals may also be capable of experiencing TTS if they are exposed to high levels of sounds.

PTS and TTS may occur within and outside of the zones where some minor injuries may occur. Finneran et al. (2000, 2002) obtained data on peak pressure levels that may cause TTS in marine mammals. Finneran et al. (2000) used an "explosion simulator" to generate impulsive sounds with pressure waveforms resembling those produced by distant underwater explosions. No substantial (i.e., 6 dB or larger) masked threshold shifts (MTTS) were observed in any of the subjects (two bottlenose dolphins and 1 beluga) at the highest received level produced, approximately 70 kPa (10 psi) peak pressure, 221 dB re 1 μPa peak-to-peak pressure, and 179 dB re 1μPa^2-s total energy flux density (EFD). Finneran et al. (2002) used a watergun for similar studies. MTTSs of 7 and 6 dB were observed in the beluga at 0.4 and 30 kHz, respectively, approximately 2 minutes following exposure to single impulses with peak pressures of 160 kPa (23 psi), 226 dB re 1 μPa, and total EFD of 186 dB re 1 μPa^2-s. Thresholds returned to within 2 dB of the pre-exposure value approximately 4 minutes post-exposure. No MTTS was observed in the single bottlenose dolphin tested at the highest exposure conditions: peak pressure of 207 kPa (30 psi), 228 dB re 1 μPa pk-pk pressure, and 188 dB re 1 μPa^2-s total EFD (Finneran et al. 2002).

Further from the blast, sperm whales would likely hear the sounds without any physical injuries. Sperm whales may exhibit subtle changes in behavior, conspicuous changes in activities, or displacement. Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Reactions to sounds, if any, depend on the species, its experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal does react to an underwater sound by changing its behavior or moving a small distance, the impacts of the change may not be significant to the individual. On the other hand, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on the animal could be significant. Structure removal operations would take place over weeks at most. Thus, prolonged displacement is not expected.

There is some evidence of disruptions of vocalization and behavior from sonars (Goold 1999b; Watkins et al. 1985; Watkins et al. 1993; Watkins and Schevill 1975), pingers (Watkins and Scheville 1975), and other sounds (André et al. 1997; Bowles et al. 1994). Other studies have shown a lack of response, including an experiment using detonations. Sperm whales did not alter their vocal activity when exposed to levels of 173 dB re 1 μPa rms from TNT detonators (Madsen and Mohl 2000). These studies demonstrate sperm whales will respond to certain human-caused sounds, although responses vary.

Although one published study suggests sperm whales do not respond to detonations at certain received levels, the variability in responses that can occur among individuals preclude a conclusion that all sperm whales would not respond. Responses of sperm whales to sounds are likely to depend on age and sex of animals, as well as other factors. The sounds from explosive-severance blasts would occur as a single blast or a series of several blasts detonated at 0.9-sec intervals. Sperm whales that hear these sounds could be startled, particularly if sound levels are high. In the case of migrating whales, the observed changes in behavior appear to be of little or no biological consequence to the animals. They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors (CSA 2004) and any sperm whales migrating in the vicinity of blasts may respond similarly. If a diving sperm whale is exposed to detonations, it may suspend foraging and feeding temporarily. Disruptions of communication among sperm whales are not expected given that exposures to blast sounds are for a few seconds at most. In summary, any behavioral impacts are expected to be temporary and not result in impacts to an individual's overall feeding success, migration, communication, or other behaviors critical for its survival or reproduction.

Sea turtles

Physical Injuries

Impacts of explosive severance on sea turtles could include death, injuries to internal organs and auditory system, physical discomfort, and annoyance. The observations gathered thus far demonstrate that sea turtles will exhibit external injuries or be killed by explosions used in structure removals (see Table 9). Klima et al. (1988) compared sea turtle strandings with the frequency and location of offshore structures and found a positive relationship. Fifty-one turtle strandings, loggerhead and green sea turtles, occurred following a series of near-shore

Table 9. Underwater explosion effects on sea turtles as described in O'Keefe and Young (1984) and Klima et al. (1988)									
Charge Weight Lbs (kg)	Charge Depth Ft (m)	Water Depth Ft (m)	Species	Sea Turtle Weight Lbs (kg)	Turtle Depth Ft (m)	Range Ft (m)	Peak Pressure Psi (kPa)	Sea Turtle Impacts	
								Immediate	1 hr after blast
O'Keeffe and Young (1984); Pressure estimates are Navy's (1999)									
1,200 (544)	60 (18.3)	120 (36.6)	Unidentified	400 (181)	Unknown	500-700 (152-213)	258-178 (1,758-1,213)	Mortal injury	--
			Unidentified	200-300 (91-136)	Unknown	1,200 (366)	99 (675)	Minor injury	--
			Unidentified	200-300 (91-136)	Unknown	2,000 (610)	57 (388)	None	--
Klima et al. (1988)									
203 (92)	14.8 (4.5)	29.5 (9.5)	Kemp's ridley	14.8 (6.7)	14.8 (4.5)	750 (229)	16.3 (111)	Unconscious	About 2 cm of the cloacal lining everted through the anal opening, streaks of pink coloration ventrally at the base of the throat and flippers, lasting about 3 weeks
			Kemp's ridley	1.3 (0.6)	14.8 (4.5)	1,200 (366)	10.3 (70)	Unconscious	Normal appearance and behavior
			Loggerhead	8.8 (4.0)	14.8 (4.5)	1800 (549)	6.5 (44)	None visible	Abnormal pink coloration caused by dilated blood vessels at the base of the throat and flippers; lasted about 3 weeks
			Loggerhead	9.3 (4.2)	14.8 (4.5)	750 (229)	16.3 (111)	Unconscious	Abnormal pink coloration caused by dilated blood vessels at the base of the throat and flippers; lasted about 3 weeks
			Loggerhead	12.1 (5.5)	14.8 (4.5)	1,200 (366)	10.3 (70)	Unconscious	Abnormal pink coloration caused by dilated blood vessels at the base of the throat and flippers; lastedabout 3 weeks
			Loggerhead	15.0 (6.8)	14.8 (4.5)	3,000 (915)	4.1 (28)	Unconscious	Abnormal pink coloration caused by dilated blood vessels at the base of the throat and flippers; last about 3 weeks
			Kemp's ridley	2.9 (1.3)	14.8 (4.5)	1,800 (549)	6.5 (44)	Non visible	Normal appearance and behavior
			Kemp's ridley	3.3 (1.5)	14.8 (4.5)	3,000 (915)	4.1 (28)	Non visible	Normal appearance and behavior

explosions. Although the cause of death of the stranded turtles could not be determined, other data demonstrate that sea turtles will be killed or injured by explosions.

O'Keefe and Young (1984) describe three sea turtles that were unintentionally exposed to three underwater detonations carried out by the Naval Coastal Systems Center off Panama City, Florida in 1981, although helicopter surveys were conducted prior to the detonations. Tests involved 1,200 lb (544 kg) of TNT in water of about 120 ft depth. One turtle was killed, another received minor injuries, and the third appeared unaffected. Turtle depths were not known but assuming a mid-water depth, the turtles would have been exposed to 239, 161, 85, and 47 psi (35, 23, 12, 7 kPa) at ranges of 500, 700, 1,200, and 2,000 ft (152, 213, 366, and 610 m).

Klima et al. (1988) placed four Kemp's ridley and four loggerhead turtles in cages at four distances from an offshore platform scheduled for removal using explosive charges. The cages were suspended at a depth of 15 ft (4.5 m) over a seafloor of 30 ft (9m) depth prior to the simultaneous detonation of four, 50.75 lb (23 kg) charges of nitromethane, placed inside the platform's support pilings at a depth of 16 ft (5m) below the seafloor. The Kemp's ridleys and loggerheads exposed at 750 ft and 1,200 ft, as well as one loggerhead exposed at 3,000 ft, were rendered unconscious. The Kemp's ridleys exposed at 750 ft also sustained slight physical injury, showing an eversion of cloacal lining through its vent. Remaining Kemp's ridleys at more distant ranges were apparently unharmed. All loggerheads displayed abnormal pink coloration of soft tissues around the eyes and external nares, and at the base of the throat and flippers, reportedly caused by a dilation of blood vessels. This condition persisted in these individuals for a period of about three weeks.

These data did not include concurrent pressure measurements. Assuming the peak shock wave pressures for buried charges such as those used in this platform removal were 10% of expected free-field values for non-buried charges (Conner 1990), pressures were calculated for a two pound TNT charge using standard similitude equations and weak shock theory (Gaspin 1983). Since the water depth of this platform removal was extremely shallow (30 ft [9 m]), multiple shock wave pulses and bulk cavitation resulting from bottom- and surface reflected shock waves could have affected the turtles.

Sea turtles were also observed injured during post-detonation surveys following detonations for structure removals (Table 10). Two had cracked shells, a third that was initially observed injured died before it was retrieved, and a fourth appeared stunned (listless behavior).

Noninjurious effects and other lethal or non-lethal injuries can be reasonably inferred from documented effects to other marine vertebrates with gas-containing organs. These impacts are dependent on the size, type, and depth of explosive charge, the size and depth of the sea turtle in the water column, overall water column depth, and distance between the explosive charge and turtle (see CSA 2004). Despite the list of factors, there is no quantitative information that would allow estimates of the zones for each of these types of impacts.

Table 10. Sea turtles injured or killed by explosions during removal of offshore structures 1987-2005 (Gitschlag, pers.com.)					
Date	Charge Depth Ft (m)	Water Depth Ft (m)	Species	Sea Turtle Weight Lbs (kg)	Condition
October1990	15 BML	39	Loggerhead	100 lbs (Estimated)	Cracked shell
November1997	20 BML	89	Loggerhead	100 lbs (Estimated)	Cracked shell
July1998	25 BML	72	Loggerhead	127 lbs (Weighed)	Dead
August 2001	20 BML	60	Loggerhead	125-150 Lbs (Estimated)	Stunned*

*This loggerhead sea turtle exhibited little movement after rising to the surface and appeared initially unable to dive at the approach of the observer. The turtle could not be recovered for closer examination (Gitschlag, pers.com.).

Sea turtles that are beyond the zones where physical injury could occur may be able to "feel" the shock wave in soft tissue areas, such as areas around the eyes, mouth, external nares, or hear the blast. Data pertaining to the tactile perception of marine turtles from an explosive shock wave are not available. However, it is reasonable to assume that their skin is sensitive to tactile stimulation. Based on studies conducted on human subjects, reports of tactile perception associated with low-level or distant underwater detonations range from a sensation of pressure, to "stings" of varying degree when exposed to shock waves (Department of the Navy 2001). It is expected that marine turtles may experience similar sensations when exposed to low intensity or distant shock waves. Such exposure would be brief and could cause a momentary startle response. If exposed to stronger shock waves, strong tactile responses (moderate to strong stings) would likely occur along with injuries to their auditory system and internal organs.

As discussed earlier, a few (possibly 3 based on MMS' projections of explosive-severance removal) loggerhead sea turtles could be injured or killed per year. Other species of sea turtles may also be injured. This estimate is based on past observed injuries and mortalities from explosive-severance removals where aerial and surface surveys were used to clear a zone around the detonations. These measures seem generally effective based on the small number of injuries observed following detonations. The measures clearly do not, and can not, prevent all injuries or mortalities. Two of the injured sea turtles listed in Table 9 were not seen before the blast and 1 injured turtle was seen before the blast. In 3 other instances, the measures were clearly effective in preventing apparent injuries; 3 sea turtle sighted before the blast was observed unharmed after the blast (Gitschlag pers.com. 2006). The proposed mitigation measures may be similarly effective in minimizing the number of injured or killed turtles, and the projections of injured/killed turtles made using the observer data incorporate the use of the mitigation measures.

Sea turtles killed by explosions lead to a reduction in the population number and reproduction. If not killed immediately, injured sea turtles may not be able to feed successfully, reproduce, or complete other activities. These turtles, in the worst case, would not survive, leading to consequences on the number and reproduction of their respective population.

Hearing-related Effects

The anatomy of sea turtle ears and measurements of auditory brainstem responses of green and loggerhead sea turtles demonstrate that sea turtles are sensitive to sounds, with an effective hearing range within low frequencies (Bartol et al. 1999; Lenhardt et al. 1983; Moein et al. 1994; Ridgway et al. 1969). Although external ears are absent, sea turtles have a tympanum composed of layers of superficial tissue over a depression in the skull that forms the middle ear. The tympanum acts as additional mass loading to the ear, allowing for reduction in the sensitivity of sound frequencies and increasing low frequency, bone conduction sensitivity (Bartol et al. 1999; Lenhardt et al. 1985). Lenhardt et al. (1983) and Moein et al. (1993, 1994) found that bone-conducted hearing appears to be an effective reception mechanism for sea turtles (loggerhead and Kemp's ridley) with both the skull and shell acting as receiving surfaces for water-borne sounds at frequencies of 250 to 1,000 Hz. Based on this information, it is reasonable to assume that sea turtles are sensitive to sounds produced by underwater explosions, and the air-filled middle ear, or tympanic cavity, is sensitive to associated pressure effects (CSA 2004). It may be presumed that detonations of low intensity or of sufficient distance to be detected but not injurious may lead to a startle response or perhaps temporary disorientation (CSA 2004).

To date the hearing ability and sensitivy for leatherback sea turtles has not been examined and is not known. However, it may be reasonable to assume leatherbacks are also likely to hear low frequency sounds.

Studies have shown sea turtles to respond to environmental noise. Some possible reactions to low frequency noise include startle responses and rapid swimming (McCauley et al. 2000) and swimming towards the surface at the onset of the sound (Lenhardt 1994). Recent investigations reported that green and loggerhead sea turtles increased their swimming activities, with more erratic behaviors at higher exposure levels (McCauley et al. 2000).

There is limited evidence of TTS in sea turtles. In the 1994 study of juvenile loggerheads, sponsored by the Army Corps of Engineers (Moein et al. 1994), sea turtles were contained in a pen in shallow water as they were exposed to pulses from a single airgun. Both behavioral and physiological responses were observed. The turtles avoided airgun pulses, at received levels at 175 to 180 dB re 1 μPa, but habituated by the 3rd presentation of the sounds. In some cases, habituated animals remained close to the airgun as it was operating. In 10 to 15% of the sea turtles exposed to airgun pulses, a temporary shift in auditory responses was measured. Received levels causing the shift are not known.

The above studies suggest that sea turtles exposed to detonations, at levels that could result in hearing-related effects, could respond with similar behaviors. Sea turtles may swim to the surface or swim away from severance operations. Some turtles may experience TTS. The consequences of these behavior disruptions or TTS include interruption of feeding, resting, or other behaviors. Although the behavioral responses are expected to be temporary, the platform removal would result in some loss of habitat for any sea turtles that used the area for prolonged periods. Sea turtles would need to relocate to other parts of the Gulf. Sea turtles migrate long and short distances. Whether a sea turtle moves away from a structure due to detonations or from the removal of habitat, the relocation would fall within their normal range of behaviors. Changes in location are not likely to result in changes to a turtle's ability to survive or reproduce.

Post-Severance Activities

Following severance, the structure would be transported to one of the service bases, unless it will be toppled in place or moved to a different underwater location. Any sea turtles or sperm whales in the area or along the route of vessels would be exposed to vessel presence and noise. Site clearance using trawl nets would pose a threat to sea turtles. The potential impacts associated with vessel operations were discussed earlier. The potential impacts from site clearance trawling is detailed below.

Site Clearance

After OCS structures are removed, contractors are employed to trawl the salvage area with commercial nets (i.e., otter/shrimp trawls) to retrieve any objects or obstructions (e.g., tools, containers, batteries) that may have been lost or discarded during the operational life of the structure. Current guidelines in MMS's Notice to Lessees and Operators (NTL) No. 98-26, Minimum Interim Requirements for Site Clearance (and Verification) of Abandoned Oil and Gas Structures in the Gulf of Mexico, instruct trawling contractors to remove turtle-excluder devices (TED's) from their nets to allow for debris collection. However, without TED's, sea turtles near the seafloor in a trawl path could be captured and drawn into the nets with the salvaged debris.

In addition to discomfort and/or possible non-lethal injuries from contact with the netted debris, captured sea turtles could become exhausted as struggling from forced submergence leads to energy consumption, oxygen depletion, and other stress-related impacts (National Research Council 1990). Depending upon conditions at the time of capture, the turtle could drown if kept submerged, especially if tow times exceed 60 minutes (Henwood and Stuntz 1987).

To minimize harm of sea turtles if they are caught in the trawl net, MMS requires trawlers to limit tow times to 30 minutes. However, tow times in the past have been even shorter due to the amount of debris gathered in the net. Brief tow times would likely be effective in minimizing the stress of sea turtles caught in the net and prevent drowning.

Summary for Sperm Whales

The structure removal activities that could affect sperm whales include vessels and aircraft presence associated with structure removals and explosions. Sperm whales could also be affected by the changes in water quality resulting from vessel discharges and suspended sediments, but we do not have information on how these water quality impacts would affect sperm whales.

Few sperm whales are expected to be exposed to activities associated with structure removals. As sperm whales spend most of their time in waters that are 500 meters or deeper, only a portion of the removals could affect them. Sperm whales could respond to passing vessels or aircraft by altering their behaviors or individuals could be within hearing range of blasts used to sever structures. Some sperm whales may also be close enough to detonations to experience hearing impairment or even pressure-related injuries. The potential for such harm would be minimized by the mitigation measures. Passive acoustic monitoring may be effective in detecting sperm whales because this species typically produces clicks and creaks as it dives. In conjunction with extended aerial and surface surveys, the presence of sperm whales could be somewhat determined.

MMS estimated 2 sperm whales per year could be exposed to blasts within the impact zone. With sperm whales found often in groups of at least 2 whales, exposures to detonations may affect multiple whales simultaneously. The probability that any sperm whale would be within the 100 psi zone is extremely low. Thus, sperm whales are unlikely to be exposed to injurious pressure levels. Sperm whales may be somewhat more likely to experience TTS if exposed to the blasts because the ear is the organ most sensitive to pressure. A few sperm whales will likely hear explosions during removals in deep (greater than 500 m) waters and may react by ceasing to forage, feed, communicate with conspecifics, diverting their path of travel or some other behavioral disruption. Some of the reactions may be considered harassment of the affected animal assuming the disruptions lead to a likelihood of injury by preventing successful feeding or reproduction. As discussed earlier, any behavioral impacts are expected to be temporary and not result in impacts to an individual's overall feeding success, migration, communication, or other behaviors critical for its survival or reproduction.

In the rare event that one or two sperm whales would be killed or lethally injured by a detonation, there may be some consequences to the group of sperm whales within the Gulf. Most of the whales within the Gulf are females and juveniles. Death of a female would result in the loss of its potential contribution to future generations, as well as the obvious reduction in population number. The death of a male could also result in the loss of reproduction. There could also be impacts on the social structure of sperm whale groups, but such impacts given our current state of knowledge would be speculative. With the long life span of sperm whales, the loss of one or two individuals could impair the growth of the Gulf of Mexico group of whales. This loss, however, in a population of approximately 1,200 whales (the recent estimate for the Gulf of Mexico population) is not likely to be detectable. In addition, we do not know if this group is influenced by immigration and emigration of whales from the Atlantic Ocean and thus, a small change (one or two whales, male or female) in numbers and reproduction is not likely to affect population growth rate. Even if we assume a decline in this group's growth rate as a result of the mortalities, the decline would be temporary and insignificant. Thus, we are not likely to see an appreciable effect on the species' numbers, reproduction, or distribution.

Summary for Sea Turtles

Sea turtles could be impacted by degradation of water quality and its associated short-term effects, vessel collisions, site-clearance trawling, and the physical effects of underwater explosions. The potential for lethal effects could occur from the detonations of explosive-severance tools (and associated pressure wave), chance collisions with OCS service vessels associated with decommissioning activities, and potential capture in site-clearance trawls. We do not know the number of deaths that could occur with collisions with service vessels and do not anticipate mortality during site-clearance trawls because of the limitation on tow times. There have been no reported decommissioning-related vessel collisions or site-clearance trawling impacts on sea turtles. As for explosive removal, past experience indicate some loggerhead sea turtles could be killed or injured. Most decommissioning activities, however, are expected to have sublethal effects on marine turtles. Sea turtles may alter their behaviors when a vessel approaches, and thereby suspend feeding, resting, or interacting with conspecifics. Such disruptions are expected to be temporary without affecting the overall survival and reproduction of individual turtles.

Since PROP began monitoring in 1987, there have been only four documented occasions of impacts to marine turtles (all loggerheads) from explosive severances on the OCS; one killed, one stunned, and two injured. Mitigation developed by MMS in coordination with NMFS may decrease the likelihood that explosive-severance will contribute to sea turtle injury or mortality in the Gulf of Mexico. However, all of the measures use surface sightings and observers will not be able to detect submerged turtles unless they are very close to the surface.

A few sea turtles would likely be killed by the use of explosives during future structure removals in the Gulf of Mexico. Our estimates, based on past observer data, suggest that up to 18 loggerhead sea turtles could be reported killed or severely injured between 2006 and 2011 (assuming up to 3 sea turtles affected each year for the 6-year period, with 170 to 273 structures removed each year). Although no hawksbill, Kemp's ridley, green, or leatherback sea turtles were reported as killed or injured by explosions since 1987, these turtles are found around offshore structures and may also be injured or killed. These sea turtles could also suffer from harm to their auditory organs or experience behavioral disruptions when exposed to pressure or energy levels below which severe physical injuries could occur. Any mortality of or injuries to these species would likely be rare, resulting in only a few affected turtles.

The affected turtles may be juveniles or adults. We do not have information on whether an injured adult sea turtle would be able to successfully reproduce or whether an injured juvenile sea turtle would eventually become a reproducing adult. Turtles that experience auditory damage could also be prevented from successful reproduction, for situations such as female sea turtles relying on their hearing to find nesting beaches.

Sea turtle mortality resulting from blasts could result in the loss of reproductive value of the adult turtle. An adult loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2 to 4 years, with 100 to 130 eggs per clutch. The death of an adult female could preclude the production of thousands of eggs and hatchlings, though most of these would not survive to sexual maturity, and thus an individual's contribution to future generations would be eliminated.

The TEWG (1998) estimated the total loggerhead population of benthic individuals in U.S. waters – a subset of the whole Western Atlantic population – at over 200,000. Some of the assumptions in producing that estimate have been questioned (TEWG 2000), but the estimate likely is the correct order of magnitude. If this is accurate, the mortality of 18 sea turtles over the next 6 years, or even double this amount, would be less than 1/100 of 1% of the total eastern U.S. population. The effect of this loss of individuals on the population, let alone the species, would not be detectable. It is likely that the U.S. populations of sea turtles would not be appreciably affected and the loss of these individuals would be replaced.

The probability of a Kemp's ridley, green, hawksbill, or leatherback sea turtle being injured or killed is low. However, these sea turtles have been sighted at offshore platforms and may constitute the turtles which were not identified to the species. If a few of any of these species, such as 2 or 3 individuals over the next 6 years, were to be killed, there is not likely to be consequences to their populations. We have more confidence with such conclusions for the Kemp's ridley and green turtle populations, for which nesting numbers have increased. The total population of Kemp's ridleys is not known, but nesting has been increasing significantly in the past several years (9 to 13% per year) with a trajectory that should meet or exceed recovery goals. The total population of green turtles is not known, but nesting activity in Florida and the major Caribbean nesting beach at Tortuguero, Costa Rica, has increased over the long-term.

As for the hawksbill and leatherback, the nesting trends are not positive and thus the loss of individuals and their potential contribution to future generations could exacerbate their risk of extinction. The total Atlantic population size for leatherbacks has been estimated at approximately 27,000 and may be decreasing overall based on declines in the largest western Atlantic nesting assemblage in French Guiana-Suriname trans-boundary area. However, some nesting populations are increasing. The total Atlantic and Caribbean population size for hawksbills is not known. Of the 65 geopolitical units worldwide, where estimates of relative hawksbill nesting density exist, 38 of them have hawksbill populations that are suspected or known to be in decline and an additional 18 have experienced "well-substantiated declines" (NMFS and USFWS 1995a). Despite the possibility that the loss of 2 or 3 leatherbacks or 2 or 3 hawksbills over the next 6 years could reduce the numbers or growth of these species, trends resulting from the loss of these individuals would not likely be detectable. Individuals lost due to explosive removals would likely get replaced. Although we speculate on the consequences of the death of hawksbill, leatherback, and other species, past experience with structure removals suggests these species are unlikely to be affected.

Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area considered in this Opinion. Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The oil and gas exploration and development, fisheries, military exercises, vessel traffic, and other human activities summarized in the Environmental Baseline would continue in the action area. Additional future non-Federal activities may include an increase in vessel traffic which would further increase collision risks for sea turtles and sperm whales.

Integration and Synthesis of Effects

The 170 to 273 annual structure removals using explosive-severance, combined with the variety of human activities described in the environmental baseline, may result in repeated impacts to sea turtles within the Gulf of Mexico. Most of these interactions are expected to be non-lethal. For example, a sea turtle may dive when a vessel is approaching. These impacts on their behaviors are expected to be temporary without consequence to an individual's survival or reproduction. Conversely, sea turtles are known to die from vessel strikes and explosions. Although we do not have information on deaths related to vessel strikes, we used data gathered since 1987 to estimate a number of sea turtles that could be killed or injured. As explained earlier, up to 18 loggerhead sea turtles could be killed or injured and a few, possibly 2 or 3, sea turtles of the other species could also be lethally affected (assuming injuries lead to death). Actually, if steps are taken to resuscitate and rehabilitate injured sea turtles, many injured sea turtles may not die. Even if all injured sea turtles are taken out of the population, the reduction in numbers, reproduction, and distribution would not likely be appreciable for any of the sea turtle species.

As for sperm whales, they could be exposed to only a fraction of the structure removals. Sperm whales are often sighted from offshore structures, indicating that they are regularly exposed to human activities. We do not have information on how often sperm whales are struck by vessels and whether all vessel strikes would lead to death. They have been observed to dive or swim away from vessels, as well as respond with behavior changes upon exposure to various sounds. Any behavioral disruptions from activities associated with structure removals would likely be temporary. MMS estimates that 2 sperm whales per year could be exposed to explosives. With the mitigation measures, these exposures could be minimized. The likelihood that a sperm whale would be injured is low, given that few detonations in deep waters would take place and the need to be close to the explosives upon detonation to suffer injury. Sperm whales may be somewhat more likely to suffer hearing impairment. The probability that even one sperm whale would be killed by a detonation is low. In the event one does, the reduction in the numbers, reproduction, and distribution would not be appreciable.

Conclusion

After reviewing the current status of the sperm whale, leatherback sea turtle, hawksbill sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle, and green sea turtle, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the biological opinion of NMFS that the implementation of the proposed action, as described in this opinion, is not likely to jeopardize the continued existence of these species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

These measures are non-discretionary and must be binding conditions of the MMS' permits for structure removals and NMFS Permits, Education and Conservation Division's marine mammal incidental take authorization, as appropriate, for the exemption in section 7(o)(2) to apply. MMS and NMFS have a continuing duty to regulate the activities covered by this incidental take statement. If MMS or NMFS fail to assume and implement the terms and conditions or fails to require the applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permits and authorizations, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, MMS (and NMFS) must report the progress of the action and its impact on the species to NMFS SERO and Office of Protected Resources as specified in the incidental take statement.

NMFS Endangered Species Division is not including marine mammals in the ITS at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act. Following issuance of such authorizations, the Service intends to amend this incidental take statement for marine mammals, as appropriate.

Amount of Take

NMFS anticipates that the removals of offshore structures in the Gulf of Mexico Outer Contintental Shelf may result in the incidental take of listed species. Green, loggerhead, Kemp's ridley, hawksbill, and leatherback sea turtles may be exposed to explosions, captured in trawl nets during site clearance, or struck by vessels associated with removal operations. We expect some sea turtles may be killed, wounded, harmed, harassed by exposure to explosions while some sea turtles may be captured and harmed by trawl nets. Sea turtles struck by vessels could be killed or wounded.

An incidental take, by injury or mortality, of 3 sea turtles per year or 18 sea turtles during the next 6 years is anticipated during detonations. Most of these would be loggerhead sea turtles. Thus, a reasonable estimate could be 15 loggerheads and 3 total of any of the other species (Kemp's ridley, green, hawksbill, or leatherback) for a 6-year period. Sea turtles have not been captured in site clearance trawl nets. However, mitigation measures are proposed because a sea turtle may be captured. NMFS anticipates 1 sea turtle of any species may be captured in a trawl net.

In addition to the take by injury or mortality from detonations and capture in a trawl net, take of sea turtles, by harassment, is anticipated. Up to 84 sea turtles per year may be exposed to detonations and other aspects of removal operations, some of which would be harassed. Again, mostly loggerheads would be harassed but the other sea turtle species may be harassed as well. Assuming all exposed sea turtles are harassed, since we can not determine which individuals will be, we anticipate up to 84 sea turtles of any species would be taken annually by harassment.

These take estimates are based on MMS' projections of 170 to 273 explosive-severance removals per year (see Table 7 of the biological opinion).

Harassment of sea turtles is not readily observed. Assuming any behavioral response of sea turtles to aerial surveys, vessel approaches, or exposure to detonation sounds leads to harassment would ensure that we avoid Type II errors. Monitoring of the number of sea turtles observed around removals before and after detonations would be needed to track the number of sea turtles that could be harassed or otherwise taken.

Sperm whales may also be exposed to explosions and be killed, wounded, harmed, or harassed. However, an exemption for take of sperm whales is not included at this time because incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act.

Effect of Take

As discussed in the biological opinion, MMS' permitting of structure removals in the Gulf of Mexico OCS and associated authorization for incidental marine mammal takes from NMFS is not likely to result in jeopardy to loggerhead, Kemp's ridly, green, hawksbill, or leatherback sea turtles.

Reasonable and Prudent Measures

The reasonable and prudent measures described below are necessary and appropriate to minimize incidental take of green, loggerhead, Kemp's ridley, hawksbill, and leatherback sea turtles from the proposed actions.

MMS and NMFS Permits, Conservation and Education Division shall ensure that operators involved in the removal of offshore structures:

1. Comply with all of the measures specified in the mitigation program for explosive severance, as developed by MMS and NMFS and modified in the Terms and Conditions of this Incidental Take Statement (see the Appendix to the Biological Opinion for a description of the entire program).
2. Use available means after blasts to locate injured or killed sea turtles.
3. Implement measures to minimize stress and harm of sea turtles during site clearance trawling.
4. Implement steps aimed at avoiding collisions with sea turtles.

In addition, MMS shall review the activities to ascertain the need for a site-specific section 7 consultation in conjunction with site-specific NEPA reviews. Site-specific reviews should be conducted to determine whether the information contained in the biological opinion, and in MMS' Programmatic Environmental Assessment (2005), are applicable to each removal. If not, a site-specific section 7 consultation must be conducted.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, MMS and NMFS Permits, Conservation and Education Division must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are nondiscretionary.

To comply with Reasonable and Prudent Measure 1, MMS and NMFS Permits, Conservation and Education Division must ensure explosive-severance contractors or operators comply with all of the measures in the appropriate mitigation scenario. The mitigation scenarios shall be followed according to MMS' proposal with the following changes:

- The company observers to be used for the pre-detonation and post-detonation surveys for scenarios A1, A2, A3, and A4 must have completed training in monitoring sea turtles according to MMS/NMFS training criteria.
- NMFS understands all decisions on explosive composition, configuration, and usage need to be made by the qualified explosive contractors in accordance with the applicable explosive-related laws and regulations. However, if the qualified explosive contractors find options in the amount and type of materials used, the option that would result in smaller impact areas shall be chosen.
- MMS must adjust the impact zone radii in permits and in the mitigation measures as soon as possible if field verification tests show the UWC underestimated the impact zone.
- Detonations must only occur during daylight and during a time that would allow for post-detonation surveys.
- Scare charges shall not be used to clear impact zones of sea turtles.
- Surface monitoring surveys shall be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges.
- Flight patterns during pre-detonation and post-detonation surveys shall follow the procedures listed in Table A-1 of the Appendix. At any time during the survey period, the flight path may be altered to investigate sightings and confirm their location in reference to the impact zone.
- MMS must require operators to provide for review a plan for the use of passive acoustic monitoring for marine mammal detection in the relevant mitigation scenarios (C2, C4, D2, D4, E2, and E4). The plan may include on-site monitoring protocols, description of the passive acoustic system, software used, recording and storage of data, and other aspects of acoustic monitoring. Operators must also report on an assessment of the usefulness, effectiveness, and problems encountered with the use of the method.
- Unless other methods are available, observations during the post-post-detonation survey are to start at the removal site and proceed leeward and outward of wind and current movement. A 7nmi x 7 nmi grid centered near the removal site will be surveyed. This grid includes eight, parallel transect lines each measuring 7 nmi long and spaced approximately 1 nmi apart. Any injured or dead MPS must be recorded in the survey report and NMFS SERO must be notified. NMFS SERO may request that the carcass be tracked and collected if possible.

To comply with Reasonable and Prudent Measure 2, MMS shall:

- Allow, when feasible, site clearance trawling to be conducted as soon as possible following detonation, to maximize the possibility of capturing killed sea turtles that sank after being killed by a blast

To implement Reasonable and Prudent Measure 3 (site-clearance trawling), MMS shall require the measures as proposed as part of the action and shall also require immediate notification if a sea turtle is captured. The terms and conditions include the following:

- Trawl nets shall have a minimum stretched mesh size of 4 inches at the cod end and 2 inches elsewhere. Trawl nets shall have a maximum stretched mesh size of 6 inches
- Abide by maximum trawl times of 30 minutes, allowing for the removal of any captured sea turtles
- Resuscitate and release any captured sea turtles as per the guidelines described in ESA regulations at 50 CFR Part 223.206(d)(1)
- Include a description and/or identification of any sea turtles captured in the net, resuscitated, released, or killed
- Trawlers must immediately contact NMFS SERO if a sea turtle is captured in the trawl net

To implement Reasonable and Prudent Measure 4 (avoiding collisions with sea turtles), MMS shall require all vessel operators associated with structure removals to implement the measures identified in NTL No. 2003-G10. If MMS finds any indications the measures provided in the NTL No. 2003-G10 are not effective, MMS shall revise the measures as appropriate.

MMS shall review the activities to ascertain the need for a site-specific section 7 consultation in conjunction with site-specific NEPA reviews. Site-specific reviews should be conducted to determine whether the information contained in the biological opinion, and in the programmatic environmental assessment, are applicable to each removal. If not, a site-specific section 7 consultation should be conducted. Additional reasonable and prudent measures and terms and conditions may be required for these structure removals if determined to be necessary during any site-specific section 7 consultation.

Monitoring Reports

The observers shall prepare monitoring reports (also referred to as the trip report) for each removal. MMS shall have the company observer prepare a monitoring report for each removal operation under scenarios A1-A4. For scenarios B1-E4, the monitoring report responsibilities will be assumed by the NOAA Fisheries' MPS observer. For scenarios A1-A4, the company observer will be responsible for recording the data. The reports should follow a standard format, which will be determined by NMFS and MMS. Trip reports must be submitted within 30-days of completion of the severance activities. Trip reports for Al-A4 scenarios will be sent to NOAA Fisheries SERO and PROP, as well as to MMS, at the following addresses:

NMFS Southeast Region
263 13th Avenue, South, St. Petersburg, FL 33701
Attention: Assistant Regional Administrator, Protected Resources Division

NMFS Galveston Laboratory
4700 Avenue U, Galveston, TX 77551
Attention: PROP Manager

In addition, MMS/NMFS must provide an annual report to NMFS SERO and NMFS Office of Protected Resources describing the total annual structures removed, sea turtles sightings during pre-detonation surveys, sea turtles sightings during post-detonation surveys, visibility during the surveys, details of sea turtles (including loggerhead, green, Kemp's ridley, hawsbill, and leatherback sea turtles) that were observed injured, killed, or otherwise affected and the measures taken for each sea turtle. These annual reports should be combined with the MMPA reporting requirements, as appropriate.

The reports shall be sent to:

NMFS Southeast Region
263 13th Avenue, South, St. Petersburg, FL 33701
Attention:Assistant Regional Administrator, Protected Resources Division

NMFS Office of Protected Resources
1315 East-West Hwy, Silver Spring, MD 20910
Attention: Director

In the event that a listed species is injured or killed during the severance operations, the detonations will cease and the observer will contact NOAA Fisheries Southeast Regional Office at 727-824-5312. If an animal does not revive, effort should be made to recover the animal in consultation with the appropriate NOAA Fisheries Stranding Coordinator. The Sea Turtle Stranding and Salvage Network can be reached at 305-361-4595, and the SERO Marine Mammal Stranding Coordinator can be reached via a 24-hour pager at 305-862-2850.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on a listed species or critical habitat, to help implement recovery plans, or to develop information.

The following conservation recommendations would minimize adverse effects to sea turtles from the explosive-severance removals in the Gulf of Mexico OCS and develop information on the effects of explosions on sea turtles:

1. MMS and NMFS should encourage the use of non-explosive severance methods that are safe and effective.

2. Field verification tests should be continued, data analyzed, and impact zones adjusted as necessary, particularly before large and specialty blasts (explosives greater than 80 lbs) are used. NMFS Office of Protected Resources and Southeast Regional Office should be notified of the results of the tests, data analysis, and impact zone adjustments as soon as they are available.

3. MMS should continue to encourage development of shaped charges or other engineering advancements that minimize the amount of explosives needed to sever structures. Explosives use could also be minimized by building in removal considerations when installing offshore structures.

4. MMS should research and develop active sonar to locate sea turtles (and marine mammals or other species of interest) underwater. This method, if effective, feasible, and does not affect marine protected species, could be used in conjunction with aerial and other surveys during pre- and post-detonation surveys of structure removal operations.

5. MMS should notify operators to have any divers or appropriate sonar involved in a removal operation opportunistically search for sea turtles within the impact area following a detonation event.

6. During the post-post-detonation surveys required for scenarios C4, D2, D4, E2, and E4, appropriate methods or technologies should be used when available to determine the best area for searches of dead marine protected animals. MMS and NMFS should confer on the type(s) of any tracking transmitter devices or methods to be used for this purpose.

7. MMS and NMFS should examine and quantify the effectiveness of aerial surveys in detecting sea turtles and sperm whales around structures. Information from the analysis could be useful in validating or refining the survey protocols.

8. MMS should have severance operators conduct post-post-detonation surveys for all large and specialty blasting scenarios (D1 to D4 and E1 to E4).

In order for the Office of Protected Resources and Southeast Regional Office Protected Resources Division to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on MMS' permitting of structure removals in the Gulf of Mexico OCS and NMFS' authorization to incidentally take marine mammals during explosive-severance removals. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Literature Cited

Aguilar R, Mas J, Pastor X. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle, *Caretta caretta*, population in the western Mediterranean. In: Richardson JI, Richardson TH, editors. Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation.: U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 1-6.

André M, Terada M, Watanabe Y. 1997. Sperm whale (Physeter macrocephalus) behavioural response after the playback of artificial sounds. The Red House, Station Rd, Histon, Cambridge CB4 4NP (UK), [URL http //ourworld.compuserve.com//homepages/iwcoffice]: International Whaling Commission.

Andrew RK, Howe BM, Mercer JA. 2002. Ocean ambient sound: Comaparing the 1960s with the 1990s for a receiver off the California coast. Acoustics Research Letters Online February, 2002:65-70.

Ashford JR, Rubilar PS, Martin AR. 1996. Interactions between cetaceans and longline fishery operations around South Georgia. Marine mammal science 12(3):452 (5 pages).

Balazs GH. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago. In: Bjorndal KA, editor. Biology and Conservation of Sea Turtles. Washington, D.C.: Smithsonian Institution Press. p 117-125.

Balazs GH. 1983. Recovery records of adult green turtles observed or originally tagged at French Frigate Shoals, northwestern Hawaiian Islands. 36. 47 pp. p.

Balazs GH. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. In: Shomura RS, Yoshida HO, editors. Proceedings of the workshop on the fate and impact of marine debris, 27-29 November, 1984: U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SWFC. p 367-429.

Balazs GH, Chaloupka M. 2004. Thirty-year recovery trend in the once depleted Hawaiian green sea turtle stock. Biological Conservation 117(5):491-498.

Bartol SM, Musick JA, Lenhardt ML. 1999. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). Copeia(3):836.

Best PB. 1979. Social organization in sperm whales, *Physeter macrocephalus*. In: Winn HE, Olla BL, editors. Behavior of Marine Animals, Vol. 3. New York: Plenum.

Bjorndal KA. 1997. Foraging ecology and nutrition of sea turtles. In: Lutz PL, Musick JA, editors. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press.

Bjorndal KA, Wetherall JA, Bolten AB, Mortimer JA. 1999. Twenty-six years of green turtle nesting at Tortuguero, Costa-Rica: An encouraging trend. Conservation Biology 13(1):126-134.

Bolten AB, Bjorndal KA, Martins HR. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. 201. 48-55 p.

Bolten AB, Wetherall JA, Balazs GH, Pooley SG. 1996. Status of Marine Turtles in the Pacific Ocean Relevant to Incidental Take in the Hawaii-Based Pelagic Longline Fishery. National Marine Fisheries Service, Honolulu, HI. Honolulu Lab.; Florida Univ., Gainesville. Archie Carr Center for Sea Turtle Research.

Boulon R, Jr. 2000. Trends in sea turtle strandings, U.S. Virgin Islands: 1982 to 1997. 436. 261-263 p.

Bowles AE, Smultea M, Wuersig B, DeMaster DP. 1994. Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test. Journal of the Acoustical Society of America 96(4):2469.

Caldwell DK, Carr A. 1957. Status of the sea turtle fishery in Florida. Transactions of the 22nd North American Wildlife Conference:457-463.

Carder DA, Ridgway SH. 1990. Auditory brainstem response in a neonatal sperm whale (Physeter spp.). Journal of the Acoustical Society of America 88(Suppl. 1):S4.

Carr A. 1963. Panspecific reproductive convergence in Lepidochelys kempi. Ergebnisse der Biologie 26:298-303.

Carr A. 1984. So excellent a fishe: a natural history of sea turtles. New York, New York: Charles Scribner's Sons. 280 pp. p.

Castroviejo J, Juste-B J, Perez Del Val J, Castelo R, Gil R. 1994. Diversity and status of sea turtle species in the Gulf of Guinea islands. Biodiversity and Conservation 3(9):828-836.

Chan EH, Liew HC. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956-1995. Chelonian Conservation and Biology 2(2):192-203.

Clarke MR. 1962. Significance of cephalopod beaks. Nature 193:560-561.

Clarke MR. 1976. Observation on sperm whale diving. Journal of the Marine Biological Association (U.K.) 56:809-810.

Clarke MR. 1979. The head of the sperm whale. Scientific American 240(1):106-117.

Clarke R. 1956. Sperm whales of the Azores. Discovery Rep. 28(237-298).

Conner JG, Jr. 1990. Underwater blast effects from explosive severence of offshore platform legs and well conductors. Silver Spring, MD: Naval Surface Warfare Center. NAVSWC-TR-90-532. 146 p.

Continental Shelf Associates Inc. (CSA). 2004. Explosive removal of offshore structures: Information synthesis report. New Orleans, LA: U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. OCS Study MMS 2003-070.

Craig JC. 2001. Physical impacts of explosions on marine mammals and turtles—final environmental impact statement. Appendix D: Shock trial of the WINSTON S. CHURCHILL (DDG 81). Bethesda, MD: U.S. Dept. of the Navy, Naval Surface Warfare Center, Carderock Division. 43 p.

Craig JC, Hearn CW. 1998. Physical impacts of explosions on marine mammals and turtles—final environmental impact statement. Appendix D: Shock testing the SEAWOLF submarine. Bethesda, MD: U.S. Dept. of the Navy, Naval Surface Warfare Center, Carderock Division,. 42 p.

Cranford TW. 1992. Directional Asymmetry in the Odontocete Forehead. American Zoologist 32(5):140A.

Crouse DT. 1999. The consequences of delayed maturity in a human-dominated world. In: Musick JA, editor. Life in the Slow Lane: Ecology and Conservation of Long-Lived Marine Animals. p 195-202.

Davis RW, (eds.) GSF. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico: Final Report. Volume II: Technical Report. New Orleans, LA: U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. OCS Study MMS 96-0027. 357 p.

Davis RW, Evans WE, Wursig B. 2000. Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations Volume II: Technical Report. Texas A&M University at Galveston and National Marine Fisheries Service. USGS/BRD/CR - 1999-001. 346 p.

Davis RW, Ortega-Ortiz JG, Ribic CA, Evans WE, Biggs DC, Ressler PH, Cady RB, Leben RR, Mullin KD, Wursig B. 2002. Cetacean habitat in the northern oceanic Gulf of Mexico. Deep-Sea Research 49:121-142.

DEMEX Division of TEi Construction Services I. 2003. Explosive technology report for structure removals in the Gulf of Mexico. DEMEX Office, Picayune, MS.

Department of the Navy. 2001. Shock Trial of the Winston S. Churchill (DDG81): Final Environmental Impact Statement, February 2001. Prepared by Continental Shelf Associates, Inc.

Dodd CK. 1981. Nesting of the green turtle, *Chelonia mydas* (L.), in Florida: historic review and present trends. Brimleyana 7:39-54.

Dodd CK, Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). 88(14). 110 pp. p.

Doughty RW. 1984. Sea turtles in Texas: a forgotten commerce. Southwestern Historical Quarterly 88:43-70.

Dufault S, Whitehead H. 1995. An assessment of changes with time in the marking patterns used for photoidentification of individual sperm whales, *Physeter macrocephalus*. Marine mammal science 11(3):335 (9 pages).

Dufault S, Whitehead H, Dillon M. 1999. An examination of the current knowledge on the stock structure of sperm whales (*Physeter macrocephalus*) worldwide. Journal of Cetacean Research and Management 1:1-10.

Dutton PH. Molecular ecology of *Chelonia mydas* in the eastern Pacific Ocean; 2003.

Eckert KL. 1993. The biology and population status of marine turtles in the North Pacific Ocean. Final Report to SWFSC, NMFS, NOAA Honolulu, HI.

Eckert SA. 1997. Distant fisheries implicated in the loss of the world's largest leatherback nesting population. Marine Turtle Newsletter 78:2-7.

Eckert SA. 1999. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute. Technical Report 99-294.

Eckert SA, Eckert KL, Ponganis P, Kooyman GL. 1989. Diving and foraging behavior of leatherback sea-turtles (*Dermochelys coriacea*). Canadian Journal of Zoology 67:2834-2840.

Eckert SA, Lien J. 1999. Recommendations for eliminating incidental capture and mortality of leatherback turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation network (WIDECAST). 2000-310. 7 pp. p.

Ehrhart LM. 1979. A survey of marine turtle nesting at Kennedy Space Center, Cape Canaveral Air Force Station, North Brevard County, Florida, 1-122. Unpublished report to the Division of Marine Fisheries, St. Petersburg, Florida, Florida Department of Natural Resources.

Ehrhart LM. 1983. Marine turtles of the Indian River Lagoon System. Florida Scientist 46:337-346.

Ehrhart LM, Witherington BE. 1992. Green turtle. In: Moler PE, editor. Rare and Endangered Biota of Florida, Volume III. Amphibians and Reptiles: University Presses of Florida. p 90-94.

Epperly S, Avens L, Garrison L, Henwood T, Hoggard W, Mitchell J, Nance J, Poffenberger J, Sasso C, Scott-Denton E and others. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. 490. 88 pp. p.

Ernst LH, Barbour RW. 1972. Turtles of the United States. Lexington, Kentucky: University of Kentucky Press. 347 pp. p.

Finneran JJ, Schulundt CE, Carder DA, J.A. Clark JAY, Gaspin JB, Ridgway SH. 2000. Auditory and behavioral responses of bottlenose dolphins (*Tursiops truncatus*) and beluga whale (*Delphinapterus leucas*) to impulsive sounds resembling distant signatures of underwater explosions. Journal of the Acoustical Society of America 108(1):417-431.

Finneran JJ, Schulundt CE, Dear R, Carder DA, Ridgway SH. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111(6):2929-2940.

Frazer NB, Ehrhart LM. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985:73-79.

Frazer NB, Limpus CJ, Greene JL. 1994. Growth and age at maturity of Queensland loggerheads. U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 42-45.

Fritts T, Stinson M, Marquez R. 1982. Status of sea turtle nesting in southern Baja California, Mexico. Bull. South. Calif. Acad. Sci. 81:51-60.

Garduño-Andrade M, Guzmán V, Miranda E, Briseno-Duenas R, Abreu A. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata*) nestings in the Yucatán Peninsula, Mexico (1977-1996): data in support of successful conservation? Chelonian Conservation and Biology 3(2):286-295.

Gaspin JB. 1983. Safe swimmer ranges from bottom explosions. Silver Spring, MD: Naval Surface Weapons Center, White Oak Lab, Def. Tech. Info. Cent. NSWC/WOL.TR-83-84.

Goertner JF. 1982. Prediction of underwater explosion safe ranges for sea mammals. Silver Spring, MD: U.S. Dept. of the Navy, Naval Surface Weapons Center. NSWC/WOL TR 82-188. NTIS ADA 139823. 25 p.

Goff GP, Lien J. 1988. Atlantic leatherback turtles, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. The Canadian Field-Naturalist 102:1-5.

Goold JC. 1999a. Behavioral and acoustic observations of sperm whales in Scapa Flow, Orkney Islands. Journal of the Marine Biological Association of the United Kingdon 79:541-550.

Goold JC. 1999b. Behavioral and acoustic observations of sperm whales in Scapa Flow, Orkney Islands. Journal of the Marine Biological Association (U.K.) 79:541-550.

Goold JC, Jones SE. 1995. Time and frequency domain characteristics of sperm whale clicks. Journal of the Acoustical Society of America 98(3):1279.

Gordon JCD. 1987. Behaviour and ecology of sperm whales off Sri Lanka. Ph.D. dissertation, University of Cambridge, Cambridge, England.

Guseman JL, Ehrhart LM. 1992. Ecological geography of Western Atlantic loggerheads and green turtles: evidence from remote tag recoveries. In: Salmon M, Wyneken J, editors. Proceedings of the 11th Annual Workshop on Sea Turtle Biology and Conservation.: U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 50 (abstract).

Hansen LJ, Mullin KD, Jefferson TA, Scott GP. 1996. Visual surveys aboard ships and aircraft. In: Davis RW, Fargion GS, editors. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final report. Volume II: Technical report. OCS Study MMS 96-0027. New Orleans: Minerals Management Service, Gulf of Mexico OCS Region.

Hatase H, Kinoshita M, Bando T, Kamezaki N, Sato K, Matsuzawa Y, Goto K, Omuta K, Nakashima Y, Takeshita H and others. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. Marine Biology 141(2):299-305.

Hays GC, Houghton JD, Isaacs C, King RS, Lloyd C, Lovell P. 2004. First records of oceanic dive profiles for leatherback turtles, Dermochelys coriacea, indicate behavioural plasticity associated with long-distance migration. Animal Behaviour 67(4):733-743.

Henwood TA, Ogren LH. 1987. Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Science 9(2):153-159.

Henwood TA, Stuntz WE. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fishery Bulletin 85:813-817.

Heppell SS, Crowder LB, Crouse DT, Epperly SP, Frazer NB. 2003. Population models for Atlantic loggerheads: past, present and future. In: Bolten A, Witherington B, editors. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Institute Press. p 255-273.

Hildebrand H. 1963. Hallazgo del area de anidacion de la tortuga "lora" *Lepidochelys kempii* (Garman), en la costa occidental del Golfo de Mexico (Rept. Chel.). Ciencia Mexico 22(4):105-112.

Hildebrand H. 1982. A historical review of the status of sea turtle populations in the Western Gulf of Mexico. In: Bjorndal KA, editor. Biology and Conservation of Sea Turtles. Washington, D.C.: Smithsonian Institution Press. p 447-453.

Hill SH. 1978. A guide to the effects of underwater shock waves on Arctic marine mammals and fish. Patricia Bay, Sidney, BC: Institute of Ocean Sciences. Pacific Marine Science Report 78-26. 50 p.

Hirth H. 1980. Some aspects of the nesting behavior and reproductive biology of sea turtles. American Zoologist 20:507-523.

Hirth HF. 1971. Synopsis of biological data on the green sea turtle, *Chelonia mydas*. FAO Fisheries Synopsis 85:1-77.

Hirth HF. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). 97(1). 120 pp. p.

Johnson SA, Ehrhart LM. 1994. Nest-site fidelity of the Florida green turtle. In: Schroeder BA, Witherington BE, editors. Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation. U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 83.

Kaiser MJ, Mesyanzhinov DV, Pulsipher AG. 2002. Explosive removals of offshore structures in the Gulf of Mexico. Ocean and Coastal Management 45(2002):459-483.

Kaiser MJ, Mesyanzhinov DV, Pulsipher AG. 2005. Modeling structure removal processes in the Gulf of Mexico. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La.

Kasuya T. 1991. Density dependant growth in north Pacific sperm whales. Marine Mammal Science 7(3):230-257.

Kasuya T, Miyashita T. 1988. Distribution of sperm whale stocks in the North Pacific. Sci Rep Whales Res Inst 39:31-75.

Ketten D, Lien J, Todd S. 1993. Blast injury in humpback whale ears: Evidence and implications. Journal of the Acoustical Society of America 94(3, Pt. 2)):1849-1850.

Ketten DR. 1995. Estimates of blast injury and acoustic trauma zones for marine mammals from underwater explosions. In: Kastelein RA, J.A. Thomas, and P.E. Nachtigall, editor. Sensory systems of aquatic mammals. Woerden, The Netherlands: De Spil Publishers. p 391-407.

Ketten DR. 2000. Cetacean ears. In: Au WWL, Popper AN, Fay RR, editors. Hearing by whales and dolphins. New York, NY: Springer-Verlag. p 43-108.

Klima EF, Gitschlag GR, Renaud ML. 1988. Impacts of the explosive removal of offshore petroleum platforms on sea turtles and dolphins. Marine Fisheries Review 50(3):33-42.

Lagueux CJ, Campbell C, Herbst LH, Knowlton, Weigle. 1998. Demography of marine turtles harvested by Miskitu Indians of Atlantic Nicaragua. 412. 90 pp. p.

Lambertsen RH, Kohn BA, Sundberg JP, Buergelt CD. 1987. Gential papillomatosis in sperm whale bulls. Journal of Wildlife Diseases 23(3):361-367.

Landsberg PG. 2000. Underwater blast injuries. Trauma and Emergency Medicine 17(2):Internet website: www.scuba-doc.com.

Lenhardt ML. 1994. Seismic and very low frequency sound induced behaviors in captive loggerhead marine turtles (*Caretta caretta*). In: Bjorndal KA, editor. Proc. 14th Annu. Sympos. Sea Turtle Biol. & Conserv. NOAA Tech. Memo. NMFS-SEFSC-351. p 238-241.

Lenhardt ML, Bellmund S, Byles RA, Harkins SW, Musick. JA. 1983. Marine turtle reception of bone-conducted sound. J. Aud. Res. 23(119-125).

Lenhardt ML, Klinger RC, Musick JA. 1985. Marine turtle middle-ear anatomy. J. Aud. Res. 25:66-72.

León YM, Diez CE. 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground. In: Abreu-Grobois FA, Briseno-Duenas R, Marquez R, Sarti L, editors. Proceedings of the 18th International Sea Turtle Symposium: U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 32-33.

Lewison RL, Freeman SA, Crowder LB. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecology Letters 7:221-231.

Limpus CJ, Limpus DJ. 2003. Loggerhead Turtles in the Equatorial Pacific and Southern Pacific Ocean: A Species in Decline. In: Bolten AB, Witherington BE, editors. Loggerhead Sea Turtles: Smithsonian Institution.

Lohoefener R, Hoggard W, Mullin K, Roden C, Rogers C. 1988. Distribution and relative abundance of surfaced of sea turtles in the north-central Gulf of Mexico: spring and fall 1987. In: Schroeder BA (Compiler). 1988. Proceedings of the Eight Annual Conference on Sea Turtle Conservation and Biology. NOAA Technical Memorandum, NMFS-SEFSC-214. p 47-50.

Lohoefener R, Hoggard W, Mullin K, Roden C, Rogers C. 1990. Association of sea turtles with petroleum platforms in the north-central Gulf of Mexico. OCS Study MMS 90-0025. Prepared under MMS Contract 14-12-0001-30398 by National Marine Fisheries Service Mississippi Laboratories/Pascagoula Facility.

Lutcavage M, Musick JA. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2):449-459.

Lutcavage ME, Plotkin P, Witherington B, Lutz PL. 1997. Human impacts on sea turtle survival. In: Lutz PL, Musick JA, editors. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press. p 387-409.

Madsen PT, Mohl B. 2000. Sperm whales (*Physeter catodon* L. 1758) do not react to sounds from detonators. Journal of the Acoustical Society of America 107(1):668-671.

Marcano LA, Alio-M JJ. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. 436. 107 pp. p.

Marquez R. 1990. FAO Species Catalogue; Sea Turtles of the World. An annotated and illustrated catalogue of the sea turtle species known to date. FAO Fisheries Synopsis 125(11):81 pp.

Mayor P, Phillips B, Hillis-Starr Z. 1998. Results of stomach content analysis on the juvenile hawksbill turtles of Buck Island Reef National Monument, U.S.V.I. In: Epperly S, Braun J, editors. Proceedings of the 17th Annual Sea Turtle Symposium: U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 230-232.

McCauley RD, Fewtrell J, Duncan AJ, Jenner C, Jenner M-N, Penrose JD, Prince RIT, Adhitya A, Murdoch J, McCabe. K. 2000. Marine seismic surveys: Analysis of airgun signals; and effects of air gun exposure on humpback whales, sea turtles, fishes and squid. Rep. from Centre for Marine Science and Technology, Curtin Univ., Perth, W.A., for Austral. Petrol. Prod. Assoc., Sydney, N.S.W. 188 p.

Meylan A, Donnelly M. 1999a. Status Justification for Listing the Hawksbill Turtle (*Eretmochelys imbricata*) as Critically Endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation and Biology 3(2):200-224.

Meylan A, Schroeder B, Mosier A. 1995. Sea turtle nesting activity in the state of Florida. Florida Marine research Publications 52:1-51.

Meylan AB. 1988. Spongivory in hawksbill turtles: a diet of glass. Science 239:393-395.

Meylan AB. 1999a. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean region. Chelonian Conservation and Biology 3(2):189-194.

Meylan AB. 1999b. The status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean Region. Chelonian Conservation and Biology 3(2):177-184.

Meylan AB, Donnelly M. 1999b. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata)* as critically endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation and Biology 3(2):200-204.

Milton S, Leone-Kabler S, Schulman A, Lutz P. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science 54(3):974-981.

Minerals Management Service. 2005. Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf, Programmatic Environmental Assessment. New Orleans: MMS Gulf of Mexico Region. MMS 2005-013.

MMS. 2005. Structure-removal operations on the Gulf of Mexico Outer Continental Shelf Programmatic Environmental Assessment. New Orleans, LA: U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. MMS 2005-013.

Moein SE, Musick JA, Keinath JA, Barnard DE, Lenhardt M, George R. 1994. Evaluation of seismic sources for repelling sea turtles from hopper dredges. Virginia Inst. Mar. Sci., [Gloucester Point], VA, for U.S. Army Corps of Engineers. 33 p.

Mrosovsky N. 1981. Plastic Jellyfish. Marine Turtle Newsletter 17:5-7.

Mullet GM. 1972. Graphical illustration of simple (total) and partial regression. American Statistician 26:25-27.

Mullin KD, Fulling GL. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603-613.

Mullin KD, Jefferson TA, Hansen LJ, Hoggard W. 1994. First sightings of melon-headed whales (*Peponocephala electra*) in the Gulf of Mexico. Marine Mammal Science 10(3):342.

Mullins J, Whitehead H, Weilgart LS. 1988. Behavior and vocalizations of two single sperm whales, *Physeter macrocephalus,* off Nova Scotia. Canadian Journal of Fisheries and Aquatic Sciences 45(10):1736-1743.

Murphy TM, Hopkins SR. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. LaMER, Inc. Green Pond, South Carolina. p 67 pp.

Musick JA, Limpus CJ. 1997. Habitat utilization and migration in juvenile sea turtles. In: Lutz PL, Musick JA, editors. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press. p 137-164.

National Research Council. 1990. Decline of the sea turtles: causes and prevention. Washington, D.C.: National Academy Press.

National Research Council. 1996. An assessment of techniques for removing offshore structures. Washington, DC: National Academy Press.

NMFS-SEFSC. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. Miami, Florida. 455. 343 pp. p.

NMFS, USFWS. 1991a. National Marine Fisheries Service Recovery plan for the U.S. Population of Atlantic Green Turtle. Washington, D.C.

NMFS, USFWS. 1991b. National Marine Fisheries Service Recovery plan for the U.S. Population of loggerhead turtle. Washington, D.C.

NMFS, USFWS. 1992a. National Marine Fisheries Service Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. Washington, D.C.

NMFS, USFWS. 1992b. National Marine Fisheries Service Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). St. Petersburg, Florida.

NMFS, USFWS. 1993. National Marine Fisheries Service Recovery plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean and Gulf of Mexico. St. Petersburg, Florida.

NMFS, USFWS. 1995a. National Marine Fisheries Service Status reviews for sea turtles listed under the Endangered Species Act of 1973. Silver Spring, Maryland.

NMFS, USFWS. 1995b. Recovery plan for U.S. Pacific populations of the leatherback turtle (*Demochelys coriacea*). Silver Spring, Md.: National Marine Fisheries Service. viii, 51, 10 p. p.

NMFS, USFWS. 1998. Recovery plan for U.S. Pacific populations of the leatherback turtle (Dermochelys coriacea). Silver Spring, Md. vii, 65 p. p.

Norris KS, Harvey GW. 1972. A theory for the function of the spermaceti organ of the sperm whale (Physeter catodon L.). In: Galler S, Schmidt-Koenig K, Jacobs G, Belleville R, editors. Animal Orientation and Navigation. Washington: NASA Special Publications. p 397-417.

Norris KS, Mohl B. 1983. Can odontocetes debilitate prey with sound? American Naturalist 122(1):85-104.

O'Keeffe DJ, Young GA. 1984. Handbook on the environmental effects of underwater explosives. Dahlgren, VA, and Silver Spring, MD: U.S. Dept. of the Navy, Naval Surface Weapons Center.

Odell DK. 1992. Sperm whale (*Physeter macrocephalus*), family Physeteridae, order Cetacea. In: Humphrey SR, editor. Rare and endangered biota of Florida. Gainesville: Univ. Press Fla.

Ogren LH. 1989. Distribution of juvenile and sub-adult Kemp's ridley sea turtle: Preliminary results from 1984-1987 surveys. In: Caillouet CW, Landry AM, editors. First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, Oct. 1-4, 1985. Galveston, Texas: Texas A&M University. p 116-123.

Papastavrou V, Smith SC, Whitehead H. 1989. Diving behavior of the sperm whale, *Physeter macrocephalus*, off the Galapagos Islands. Canadian Journal of Zoology 67:839-846.

Perry SL, DeMaster DP, Silber GK. 1999. The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Marine Fisheries Review 61(1):1-74.

Pritchard PCH. 1969. Endangered species: Kemp's ridley turtle. Florida Naturalist 49:12-19.

Pritchard PCH. 1982. Marine turtles of the South Pacific. In: Bjorndal KA, editor. Biology and Conservation of Sea Turtles. Washington, DC: Smithsonian Institution Press. p 253-262.

Pritchard PCH. 1996. Are leatherbacks really threatened with extinction? Chelonian Conservation and Biology 2(2):303-305.

Reeves RR, Whitehead H. 1997. Status of the sperm whale, *Physeter macrocephalus*, in Canada. Canadian Field-Naturalist 111(2):293-307.

Reidenberg JS, Laitman JT. 2003. Appearance of odontocete respiratory tissues after exposure to blast parameters. In: Gisner R, editor. Environmental consequences of underwater sound, 12-16 May 2003. Bethesda, MD: Office of Naval Research, Life Sciences Research Office. p 30.

Renaud ML. 1995. Movements and submergence patterns of Kemp's ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29:370-374.

Rendell LE, H.Whitehead. 2003. Vocal clans in sperm whales (*Physeter macrocephalus*). Proceedings of the Royal Society of London, Series B: Biological Sciences 270:225-231.

Richardson JI, Bell R, Richardson TH. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. Chelonian Conservation and Biology 3(2):244-250.

Richardson WJ, Greene CR, Jr., Malme CI, Thomson DH. 1995. Marine Mammals and Noise. New York: Academic Press. 576 p.

Richmond DR, Yelverton JT, Fletcher ER. 1973. Far-field underwater blast injuries produced by small charges. Albuquerque, NM: Lovelace Foundation. DNA 3081T.

Ridgway SH, Wever EG, McCormick JG, Palin J, Anderson JH. 1969. Hearing in the giant sea turtle, *Chelonia mydas*. Proceedings of the National Academy of Sciences (U.S.) 64:884-890.

Saint-Arnaud D, P. , Pelletier WP, Fowler J. 2004. Oil platform removal using engineered explosive charges: In-situ comparison of engineered and bulk explosive charges—final report. Herndon, VA.: U.S. Dept. of the Interior, Minerals Management Service, Technology Assessment and Research Program.

Sarti M, Eckert SA, T. NG, Barragan AR. 1996. Decline of the worlds largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter 74:2-5.

Schmid JR, Witzell WN. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempii*): cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2(4):532-537.

Schmidly DJ. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. U.S. Department of Interior, U.S. Fish and Wildlife Service Biological Services Program. FWS/OBS-80/41. 165 p.

Schroeder BA, Foley AM. 1995. Population studies of marine turtles in Florida Bay. In: Richardson JI, Richardson TH, editors: Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, U.S. Department of Commerce NOAA Technical Memorandum, NMFS-SEFSC. p 117.

Schulz JP. 1975. Sea turtles nesting in Surinam. Zoologische Verhandelingen, Lieden, Netherlands. 143:1-143.

Scott TM, Sadove SS. 1997. Sperm whale, *Physeter Macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. Marine Mammal Science 13(2):317-321.

Seminoff JA, Alvarado J, Delgado C, Lopez JL, Hoeffer G. 2002. First direct evidence of migration by an East Pacific green seaturtle from Michoacan, Mexico to a feeding ground on the Sonoran Coast of the Gulf of California. The Southwestern naturalist 47 Part 2:314-315.

Shaver DJ. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology 25(3):327-334.

Shaver DJ. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. Journal of Herpetology 28(4):491-497.

Shoop CR, Kenney RD. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Spotila JR, Dunham AE, Leslie AJ, Steyermark AC, Plotkin PT, Paladino FV. 1996a. Worldwide Population Decline of *Demochelys coriacea*: Are Leatherback Turtles Going Extinct. Chelonian Conservation and Biology 2(2):209-222.

Spotila JR, Dunham AE, Leslie AJ, Steyermark AC, Plotkin PT, Paladino FV. 1996b. Worldwide population decline of Dermochelys coriacea: Are leatherback turtles going extinct? Chelonian Conservation and Biology 2(2):209-222.

Spotila JR, Reina RD, Steyermark AC, Plotkin PT, Paladino FV. 2000. Pacific leatherback turtles face extinction. Nature 405:529-530.

TEWG. 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. 409. 96 pp. p.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. 444. 115 pp. p.

Townsend CH. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica (NY) 19(1-2):1-50+6 maps.

Trefrey JH. 1998. Forms of mercury and cadmium in barite and their fate in the marine environment: A review and synthesis - Unpublished. Report prepared for Exxon Production Research Company.

Twachtman S, & Byrd, Inc. and Center for Energy Studies, Louisiana State University (TSB and, CES L. 2004. Operational and socioeconomic impact of nonexplosive removal of offshore structures. . New Orleans, LA: U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region OCS Study MMS 2004-074. 59 p.

Twachtman Snyder & Byrd Inc. 2000. State of the art of removing large platforms located in deep water. Herndon, VA: U.S. Dept. of the Interior, Minerals Management Service, Technology Assessment and Research Program MMS TAR Project No. 372.

van Dam R, Diez C. 1997. Predation by hawksbill turtles on sponges at Mona Island, Puerto Rico. Proceedings of the 8th International Coral Reef Symposium 2:1421-1426.

van Dam R, Diez C. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. Journal of Experimental Marine Biology and Ecology 220(1):15-24.

Waring GT, Fairfield CP, Ruhsam CM, Sano M. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fish. Oceanogr. 2(2):101-105.

Waring GT, Pace RM, Quintal JM, Fairfield CP, Maze-Foley K. 2004. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2003.

Watkins WA. 1977. Acoustic behavior of sperm whales. Oceanus 2:50-58.

Watkins WA, Moore KE, Tyack P. 1985. Sperm whale acoustic behaviors in the southeast Caribbean. Cetology 49:1-15.

Watkins WA, Notarbartolo Di Sciara G, Daher MA, Fristrup KM, Howald TJ. 1993. Sperm whales tagged with transponders and tracked underwater by sonar. Marine Mammal Science 9(1):55-67.

Watkins WA, Schevill WE. 1975. Sperm whales (*Physeter catodon*) react to pingers. Deep-Sea Research 22(3):123-129.

Weilgart L, Whitehead H. 1997. Group-specific dialects and geographical variation in coda repertoire in South Pacific sperm whales. Behavioral Ecology and Sociobiology 40(5):277-285.

Weilgart LS, Whitehead H. 1988. Distinctive vocalizations from mature male sperm whales (*Physeter macrocephalus*). Canadian Journal of Zoology 66:1931-1937.

Weller DW, Wursig B, Whitehead H, Norris JC, Lynn SK, Davis RW, Clauss N, Brown P. 1996. Observations of an interaction between sperm whales and short-finned pilot whales in the Gulf of Mexico. Marine mammal science 12(4):588 (6 pages).

Whitehead H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. Marine ecology progress series 242:295 (10 pages).

Whitehead H. 2003. Sperm Whales: Social Evolution in the Ocean. Chicago: University of Chicago Press.

Whitehead H, Waters S, Lyrholm T. 1991. Social organization of female sperm whales and their offspring: constant companions and casual acquaintances. Behavioral ecology and sociobiology 29(5):385-390.

Witzell WN. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): Suggested changes to the life history model. Herpetological Review 33(4):266-269.

Würsig B, Jefferson TA, Schmidly DJ. 2000. The Marine Mammals of the Gulf of Mexico. College Station, TX: Texas A & M University Press. 232 pp. p.

Yelverton JT. 1981. Underwater explosion damage risk criteria for fish, birds, and mammals 102nd meeting of the Acoustical Society of America, Carillon Hotel, 30 November - 4 December 1981. Miami Beach, FL: Acoustical Society of America. p 19.

Yelverton JT, Richmond DR, Fletcher ER, Jones RK. 1973. Safe distances from underwater explosions for mammals and birds. Albuquerque, NM: Lovelace Foundation for Medical Education and Research for the Defense Nuclear Agency, Washington, DC. DNA 3114T. 67 p.

Young GA. 1972. Guidelines for evaluating the environmental effects of underwater explosion tests. Silver Spring, MD: U.S. Dept. of the Navy, Naval Ordnance Laboratory,. NOLTR 72-211.

Young GA. 1991. Concise methods of predicting the effects of underwater explosions on marine life. Silver Spring, MD: U.S. Dept. of the Navy, Naval Surface Weapons Center. NAVSWC-MP-91-220.

Zug GR, Parham JF. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea* (Testudines: Dermochelyidae): a skeletochronological analysis. Chelonian Conservation and Biology 2(2):244-249.

Zurita JC, Herrera R, Arenas A, Torres ME, Calderón C, Gómez L, Alvarado JC, Villavicencio R. 2003. Proceedings of the Twenty-second Annual Symposium on Sea Turtle Biology and Conservation 2002. Miami, FL: U.S. Department of Commerce, NOAA, NMFS. NOAA Technical Memorandum NMFS-SEFSC-503.

Appendix

Mitigation for Removals Using Explosive-Severance

Mitigation for Explosive-Severance Removals

Minerals Management Service (MMS) and the National Marine Fisheries Service (NMFS) developed a mitigation program for use during explosive-severance removals. Until safe and economical, non-explosive methods are developed to sever oil and gas structures from their foundations, industry will rely on explosive tools. Shaped and fracturing charge designs are being developed and refined. Such charges require smaller amounts of explosives than bulk charges. Minimizing the amount of explosives used in a removal is the first mitigation step an operator can take. Smaller amounts correspond to smaller impact zones where marine animals, such as sea turtles and marine mammals could be harmed. The mitigation requirements are less for smaller weight explosives.

The underwater detonation of these cutting tools results in the release of shock (pressure) waves and acoustic energy that has the potential to harass, injure, or kill marine protected species (MPS) such as marine mammals and sea turtles. Since the level of pressure and energy released during detonation is primarily related to the amount of the explosives used, five blasting categories were developed based upon the specific range of charge weights needed to conduct current and future outer continental shelf (OCS) decommissionings. Depending upon the design of the decommissioning target and variable marine conditions, the charges developed under each of these categories could be arranged for use in two primary configurations: below-mudline (BML) or above-mudline (AML) cutting (Figure A-1).

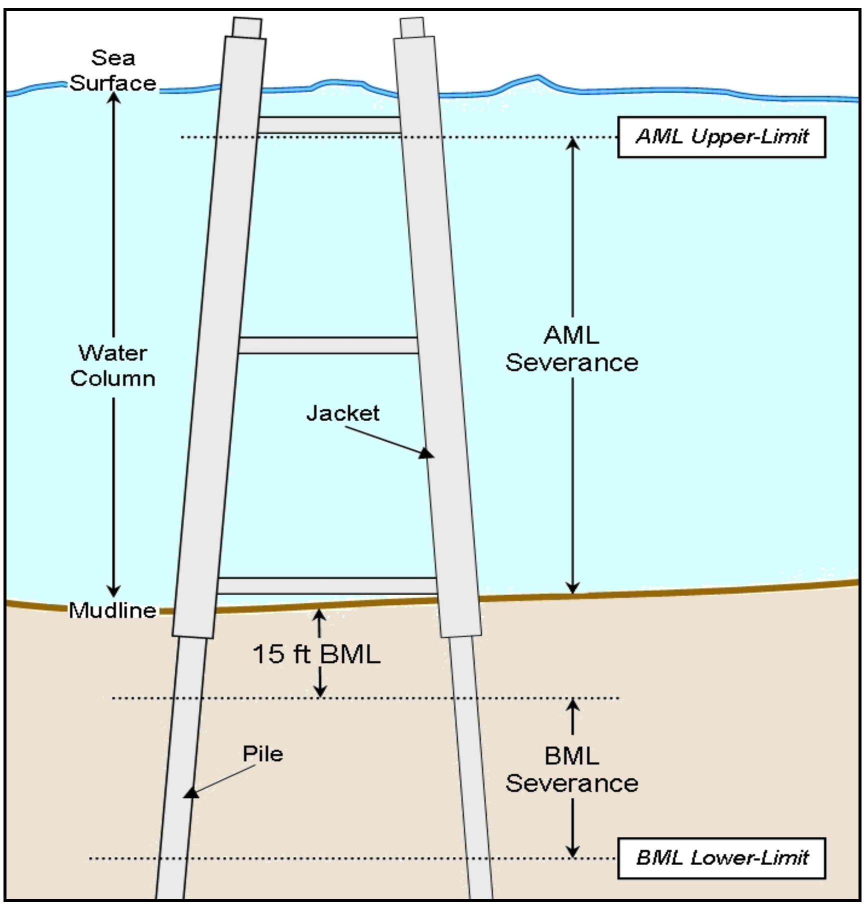


Figure A-1. Explosive-Severance Charge Configurations.

Charges configured for BML severance are generally deployed internal to the target; however, with adequate sediment jetting, external charge deployments are possible. Since they are most often conducted to conform with OCSLA requirements, BML severances range from 15 ft BML to a lower-limit dependent upon the lift vessel's ability to break suction on the severed target. Because of the closed-tubular design of most jacket assemblies, AML charges are designed for external deployment. Capable of placement at any point above the seabed, the AML upper-limit will be determined by blasting experts, considering the charge size/design and the need for human health and safety. Projected primarily for use in mid-water jacket sectioning, AML severance increases decommissioning options, but it does not negate an operator's lease responsibility or minimum cut requirements under the OCS Lands Act.

The five blasting categories (Table A-1) can also be used within two species-specific delineation zones: OCS shelf (<200 m) and OCS slope (>200 m). Because of animal distributions and densities, explosive-severance activities taking place on the shelf have a greater opportunity to impact sea turtles (i.e., green, loggerhead, leatherback, Kemp's ridley, and hawksbill) and coastal dolphin (i.e., bottlenose, Atlantic spotted, and rough-toothed). In addition to the sea turtles and coastal dolphin, explosive work in slope waters has the potential to impact deepwater dolphin (e.g., Fraser's and pan-tropical spotted) and a number of different whales (e.g., sperm and melon-headed).

Considering both charge configuration (BML/AML) and species-delineation zone (shelf/slope), MMS developed 20 specific, mitigation scenarios to address severance activities that could be conducted under the five blasting categories (Table A-1). Operators applying to MMS for structure-removal permits using explosive severance would indicate the appropriate scenario based upon the removal location and their severance needs. In addition to other application data, the noted scenario requirements would be considered during subsequent National Environmental Policy Act analyses and under the Endangered Species Act, if appropriate.

The monitoring requirements and methodologies for the 20 scenarios were developed in coordination with explosive-severance experts and protected species scientists from NMFS and MMS, taking into consideration MPS characteristics and surfacing rates and calculated impact parameters. While charge criteria and reporting requirements are standard for all scenarios, the individual survey requirements and requisite times vary. General descriptions of the charge criteria, monitoring terms/methods, and reporting requirements are provided below. The specific survey, time, and methodology requirements for each explosive-severance scenario follow. The mitigation will be integrated into MMS's removal-permitting process and conveyed to operators as conditions of permit approval.

General Requirements

Charge Criteria

The charge criteria discussed below (e.g., charge size, detonation staggering, and explosive material) are applicable for all of the explosive-severance scenarios conducted under the proposed action.

Charge Size (All Scenarios)

The options available under the multiple explosive-severance scenarios allow for the development of any size charge between 0 and 500 lb. Most often determined in the early planning stages, the final/actual charge weight establishes the specific mitigation scenario that must be adhered to as a permit condition. Charges greater than 500 lb are prohibited and their proposed usage will require additional NEPA analyses and site-specific MMPA authorization and ESA consultation.

Table A-1. Blasting Categories and Associated Mitigation Scenarios

Blasting Category	Configuration *(Charge Range)*	Impact-Zone Radius	Species-Delineation Zone	Mitigation Scenario
Very-Small Blasting	BML *(0-10 lb)*	261 m (856 ft)	Shelf (<200 m)	A1
			Slope (>200 m)	A2
	AML *(0-5 lb)*	293 m (961 ft)	Shelf (<200 m)	A3
			Slope (>200 m)	A4
Small Blasting	BML *(>10-20 lb)*	373 m (1,224 ft)	Shelf (<200 m)	B1
			Slope (>200 m)	B2
	AML *(>5-20 lb)*	522 m (1,714 ft)	Shelf (<200 m)	B3
			Slope (>200 m)	B4
Standard Blasting	BML *(>20-80 lb)*	631 m (2,069 ft)	Shelf (<200 m)	C1
			Slope (>200 m)	C2
	AML *(>20-80 lb)*	829 m (2,721 ft)	Shelf (<200 m)	C3
			Slope (>200 m)	C4
Large Blasting	BML *(>80-200 lb)*	941 m (3,086 ft)	Shelf (<200 m)	D1
			Slope (>200 m)	D2
	AML *(>80-200 lb)*	1,126 m (3,693 ft)	Shelf (<200 m)	D3
			Slope (>200 m)	D4
Specialty Blasting	BML *(>200-500 lb)*	1,500 m (4,916 ft)	Shelf (<200 m)	E1
			Slope (>200 m)	E2
	AML *(>200-500 lb)*	1,528 m (5,012 ft)	Shelf (<200 m)	E3
			Slope (>200 m)	E4

Detonation Staggering (All Scenarios)

Multiple charge detonations shall be staggered at an interval of 0.9 sec (900 msec) between blasts to prevent an additive pressure event. For decommissioning purposes, a "multiple charge detonation" refers to any configuration where more than one charge is required in a single detonation "event."

Explosive Material (All Scenarios)

There are many important properties (e.g., velocity, brisance, specific-energy) related to the explosive material(s) used in developing severance charges. Material needs vary widely depending upon target characteristics, marine conditions, and charge placement. Since specific material and personnel safety requirements must be established and followed, all decisions on explosive composition, configuration, and usage should be made by the qualified (i.e., licensed and permitted) explosive contractors in accordance with the applicable explosive-related laws and regulations.

If the qualified explosive contractors find options in the amount and type of materials used, the option that would result in smaller impact areas should be chosen.

Monitoring Terms and Methods

The following monitoring terms are general descriptions of the terminology applicable to all explosive-severance activities. The monitoring methods are observation activities (i.e., visual or electronic surveys) designed to detect MPS in the vicinity of decommissioning operations. The requisite survey(s) and related time-period(s) will vary depending upon the nature of the severance-scenario.

Impact Zone (Term; All Scenarios)

The impact zone is the area, marked by the horizontal radius around a decommissioning target, in which an MPS could be affected by the pressure and/or acoustic energy released during the detonation of an explosive-severance charge. As discussed in Appendix E of MMS' Environmental Assessment, the impact zone radii were derived using conservative pressure/energy propagation data from Applied Research Associates, Inc.'s UnderWater Calculator (UWC). The monitoring surveys and associated time periods are designed to allow for adequate detection of MPS that may be present within each impact zone based upon potential species and the overall size of the impact area. If MPS are detected within the impact zone, a detonation must not proceed. The mitigation scenarios are designed to prevent MPS from exposure to the high levels of pressure or acoustic energy. Steps for tracking animals and additional monitoring are detailed in each of the scenarios.

MMS must adjust the impact zone radii if field verification tests show the UWC underestimated the impact zone. Field verification tests should be completed, data analyzed, and impact zones adjusted as necessary, before large and specialty blasts (explosives greater than 80 lbs).

Predetonation Survey (Term; All Scenarios)

A predetonation (pre-det) survey refers to any MPS monitoring survey (surface, aerial, or acoustic) conducted prior to the detonation of any explosive severance tool. The primary purpose of pre-det surveys is to allow detection of any MPS within the scenario-specific impact zone and to continue monitoring the animal(s) until it leaves the area or wait for the allotted time period.

Postdetonation Survey (Term; All Scenarios)

A postdetonation (post-det) survey refers to any MPS monitoring survey (surface, aerial, or post-post-det aerial) conducted after the detonation "event" occurs. The primary purpose of post-det surveys is to detect any MPS that may have been impacted (stunned, injured, or killed) by the detonation and resultant pressure/energy release. The post-det surveys are key in providing essential reporting information on the effectiveness of the pre-det survey efforts.

Waiting Period (Term; All Scenarios)

Variable by scenario, the waiting period refers to the time in which detonation operations must hold before the requisite monitoring survey(s) can be reconducted. The purpose of a waiting period is to allow any inbound or previously detected outbound MPS to exit the impact zone under their own volition.

Company Observer (Term; Scenarios A1- A4 Only)

Trained company observers will be allowed to perform protected species detection surveys for Very-Small blasting scenarios A1-A4. An "adequately-trained" observer is an employee of the company or severance contractor who has attended observer training courses offered by private or government entities in accordance with MMS/NMFS training criteria. Companies will be required to provide copies of personnel training certifications to MMS' Gulf of Mexico Region Office prior to conducting A1-A4 removal operations.

NMFS Observer (Term; B1-E4)

NMFS observers are required to perform MPS detection surveys for blasting scenarios B1 to E4. These observers are qualified NMFS employees or contractors delegated under the Platform Removal Observer Program (PROP) of NMFS' Galveston Laboratory. Generally, two observers will be assigned to each operation for detection survey duties. However, because mitigation-scenarios C2, C4, D2, D4, E2, and E4 require a minimum of three (3) observers for the simultaneous surface, aerial, and acoustic surveys, at least two (2) "teams" of observers will be required. The PROP Manager will determine each "team" size depending upon the nature of the operations, target structure configuration, support vessel accommodations, and other environmental monitoring conditions.

Surface Monitoring Survey *(Method; All Scenarios)*

Surface monitoring surveys are to be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. Surface surveys will be restricted to daylight hours only, and the monitoring will cease upon inclement weather or when it is determined that marine conditions are not adequate for visual observations.

Aerial Monitoring Survey *(Method; Scenarios B1-E4)*

Aerial monitoring surveys are to be conducted from helicopters running low-altitude search patterns over the extent of the potential impact area. Aerial surveys will be restricted to daylight hours only, and they cannot begin until the requisite surface monitoring survey has been completed. Aerial surveys will cease upon inclement weather, when marine conditions are not adequate for visual observations, or when the pilot/removal supervisor determines that helicopter operations must be suspended. Aerial surveys are required for all severance scenarios with the exception of scenarios A1-A4.

A trained observer should sit in one of the seats in the front of the cockpit. This is typically on the port side of the aircraft next to the pilot. Whenever possible, a second observer should sit on the opposite side of the aircraft so that both sides of the aircraft are surveyed. If additional observers are available, seating should be adjacent to a window. Communications equipment should be provided which allows the pilot and observers to talk to each other and which provides clear communications. Table A-2 describes the patterns of flight for segments of 30, 45, 60, and 90-minute surveys.

For post-detonation surveys, the beginning of the post-detonation survey should generally concentrate on the area near the center of the impact zone for the first 5-10 minutes. Remaining time should cover the entire impact zone using expanding and contracting circles as in the pre-detonation 30 minute aerial survey. The area around the center of the impact zone should be surveyed repeatedly. If strong currents are present, the downcurrent area should be surveyed outside the impact zone to an appropriate distance for a reasonable period of time. This will vary with the size of the impact zone. In the absence of strong currents, follow the protocol for the pre-detonation 30 minute surveys except that any or all of the 5 min survey designated to be conducted outside the impact zone may be redirected to the area inside the impact zone depending on the situation.

Table A-2. Flight patterns during pre-detonation surveys. All surveys should begin at the center of the impact zone. At any time during the entire survey period it may be necessary to alter the flight path to investigate sightings and confirm their location in reference to the impact zone.

Flight Path	30-minute	45-minute	60-minute	90-minute
The flight path should follow gradually expanding circles ("spiraling or corkscrewing") out from the center of the impact zone to the perimeter of the impact zone. This should be followed by gradually contracting circles until the aircraft returns to the center of the impact zone (the structure being removed). Repeat the pattern for the specified time period.	10 minutes	20 minutes	25 minutes	40 minutes
The aircraft should survey outside of the impact zone to a distance approximately equal to the radius of the impact zone to determine if any protected species (sea turtles or marine mammals) might be moving into the area. Expanding and contracting circles should again be used for the flight path.	5 minutes	5 minutes	5 minutes	5 minutes
The aircraft should survey inside the impact zone and follow the same procedures as during the first part of the survey. However, near the end of the survey period the flight path should usually be concentrated near the center of the impact zone since this is where animals will have the highest risk of severe impact.	15 minutes	20 minutes	30 minutes	45 minutes

Acoustic Monitoring Survey (Method; Scenarios C2, C4, D2, D4, E2, and E4)

Acoustic monitoring surveys are required to be conducted on all Standard, Large, and Specialty blasting scenarios conducted on slope (>200 m) activities (C2, C4, D2, D4, E2, and E4). Contractors conducting acoustic surveys will be required to use NOAA-approved passive acoustic monitoring protocols, devices, and technicians. Acoustic surveys will be run concurrent with requisite pre-det surveys; beginning with the surface observations and concluded at the finish of the aerial surveys when the detonation(s) is allowed to proceed. If feasible, passive-acoustic monitoring should be continued until the end of the post-det monitoring period. If any MPS are detected acoustically, the contractor will immediately contact surface and aerial observers to alert them on the presence of MPS individuals.

Given that passive acoustic monitoring devices are not available at the time of this writing, operators must provide a plan for the use of passive acoustic monitoring for marine mammal detection in the relevant mitigation scenarios (C2, C4, D2, D4, E2, and E4) to MMS for review. The plan may include on-site monitoring protocols, description of the passive acoustic system, software used, recording and storage of data, and other aspects of acoustic monitoring. Operators must also report on an assessment of the usefulness, effectiveness, and problems encountered with the use of the method.

Post-Post-Det Aerial Monitoring Survey (Method; Scenarios C4, D2, D4, E2, and E4)

Post-post-det aerial monitoring surveys will be conducted within 2 to 7 days after detonation activities conclude, by either helicopter or fixed-wing aircraft. Current tracking transmitters will be released at an appropriate time during detonation events and used by observers as a guide on the location to focus the survey efforts. In the event that the transmitters are lost, observations are to start at the removal site and proceed leeward and outward of wind and current movement. A 7 nmi x 7 nmi grid centered near the removal site will be surveyed. This grid includes eight, parallel transect lines each measuring 7 nmi long and spaced approximately 1 nmi apart. Any injured or killed MPS must be noted in the survey report. NMFS SERO must be notified. If possible, NMFS SERO may request that the carcass be tracked and collected. Post-post-det aerial surveys are only required for mitigation-scenarios C4, D2, D4, E2, and E4.

Reporting Requirements

All explosive-severance activities in the GOM are subject to the reporting requirements listed in this section. The information collected under these requirements will be used by MMS and NMFS to continually assess mitigation effectiveness and the level of MPS impacts.

Reporting Responsibilities and Filing Times

The observers shall prepare monitoring reports (also referred to as the trip report) for each removal. MMS shall have the company observer prepare a monitoring report for each removal operation under scenarios A1-A4. For scenarios B1-E4, the monitoring report responsibilities will be assumed by the NOAA Fisheries' MPS observer. For scenarios A1-A4, the company observer will be responsible for recording the data. The reports should follow a standard format, which will be determined by NMFS and MMS. Trip reports must be submitted within 30-days of completion of the severance activities. Trip reports for Al-A4 scenarios will be sent to NOAA Fisheries SERO and PROP, as well as to MMS, at the following addresses:

NMFS Southeast Region
263 13th Avenue, South, St. Petersburg, FL 33701
Attention: Assistant Regional Administrator, Protected Resources Division

NMFS Galveston Laboratory
4700 Avenue U, Galveston, TX 77551
Attention: PROP Manager

In addition, MMS/NMFS must provide an annual report to NMFS SERO and NMFS Office of Protected Resources describing the total annual structures removed, sea turtles sightings during pre-detonation surveys, sea turtles sightings during post-detonation surveys, visibility during the surveys, details of sea turtles that were observed injured, killed, or otherwise affected and the measures taken for each sea turtle. These annual reports should be combined with the MMPA reporting requirements, as appropriate.

The reports shall be sent to:

NMFS Southeast Region
263 13th Avenue, South, St. Petersburg, FL 33701
Attention: Assistant Regional Administrator, Protected Resources Division

NMFS Office of Protected Resources
1315 East-West Hwy, Silver Spring, MD ZIP
Attention: Director

MMS Gulf of Mexico Region
1201 Elmwood Park Blvd, New Orleans, LA 70123-2394
Attention:Regional Supervisor, Office of Leasing & Environment

Information Requirements

In addition to basic operational data (e.g., area and block, water depth, company/platform information), the trip reports must contain all of the applicable information listed in Table A-3.

Table A-3. Minimum Information Requirements for Explosive-Severance Monitoring Reports

Information Type	Details
Target	• Type/Composition – pile, caisson, concrete piling, nylon mooring, etc. • Diameter and thickness
Charge	• Type – bulk, configured-bulk, linear-shaped, etc. • Charge weight/material – RDX, C4, HMX, etc. • Configuration – internal/external, cut depth (BML), water depth (AML), etc. • Deployment method – diver, ROV, from surface, etc.
Monitoring	• Survey Type – pre-det and post-det; surface, aerial, etc. • Time(s) initiated/terminated • Marine Conditions
Observed/Detected MPS	• Type/number – basic description or species identification (if possible) during all survey types (surface, aerial, and acoustic and both during pre- and post-detonation periods) • Location/orientation – inside/outside impact zone, inbound/outbound, etc. • Any "halted-detonation" details – i.e., waiting periods, re-surveys, etc. • Any "Take-Event" details – actual MPS injury/mortality

Take-Event Procedures

In the event that an MPS is shocked, injured, or killed during the severance activities, the operations will cease and the observer will contact MMS at (504) 736-3245 and NMFS' Southeast Regional Office (SERO) at (727) 824-5312. As noted above, details concerning the take event are required to be recorded in the trip report. If the animal does not revive, effort should be made to recover the carcass in consultation with the appropriate NOAA Fisheries' Stranding Coordinator. The Sea Turtle Stranding and Salvage Network can be reached at (305) 362-4595, and the SERO Marine Mammal Stranding Coordinator can be reached via a 24-hour pager at (305) 862-2850. As noted above, details concerning the take event are required to be recorded in the trip report.

Specific Requirements

As noted, the charge criteria and reporting requirements listed above will be standard for all decommissionings employing explosive-severance activities. However, depending upon the severance scenario, there are six different MPS monitoring surveys that could be conducted before and after all detonation events. The specific monitoring requirements, survey times, and impact zone radii for all explosive-severance scenarios are summarized in Table A-4.

Table A-4. Survey and Time Requisite Summary for All Explosive-Severance Scenarios

Blasting Category	Impact Zone Radius	Scenario	Pre-Det Surface Survey (min)	Pre-Det Aerial Survey (min)	Pre-Det Acoustic Survey (min)	Post-Det Surface Survey (min)	Post-Det Aerial Survey (min)	Post-Post-Det Aerial Survey (Yes/No)
Very-Small	261 m (856 ft)	A1	60	N/A	N/A	30	N/A	No
		A2	90	N/A	N/A	30	N/A	No
	293 m (961 ft)	A3	60	N/A	N/A	30	N/A	No
		A4	90	N/A	N/A	30	N/A	No
Small	373 m (1,224 ft)	B1	90	30	N/A	N/A	30	No
		B2	90	30	N/A	N/A	30	No
	522 m (1,714 ft)	B3	90	30	N/A	N/A	30	No
		B4	90	30	N/A	N/A	30	No
Standard	631 m (2,069 ft)	C1	90	30	N/A	N/A	30	No
		C2	90	30	120	N/A	30	No
	829 m (2,721 ft)	C3	90	45	N/A	N/A	30	No
		C4	90	60	150	N/A	30	Yes
Large	941 m (3,086 ft)	D1	120	45	N/A	N/A	30	No
		D2	120	60	180	N/A	30	Yes
	1,126m (3,693ft)	D3	120	60	N/A	N/A	30	No
		D4	150	60	210	N/A	30	Yes
Specialty	1,500 m (4,916 ft)	E1	150	90	N/A	N/A	45	No
		E2	180	90	270	N/A	45	Yes
	1,528 m (5,012 ft)	E3	150	90	N/A	N/A	45	No
		E4	180	90	270	N/A	45	Yes

Accounting for similar pre- and post-det surveys, the 20 explosive-severance scenarios correspond roughly with 8 basic mitigation processes that vary only in differences in impact zone ranges and survey times. The survey-time requisites were established by NMFS and MMS protected species scientists, taking into consideration likely MPS and their surfacing rates. The mitigation process details for each of the explosive-severance scenarios follows.

Very-Small Blasting Category

Shelf (<200 m) and Slope (>200 m) Scenarios A1, A2, A3, and A4

An operator proposing explosive-severance activities conducted under the very-small blasting category will be limited to 5-lb (AML) and 10-lb (BML) charge sizes and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

A1 and A2: 261 m (856 ft)
A3 and A4: 293 m (961 ft)

Required Observers

Owing to the small impact zone and in an effort to encourage industry to develop and use smaller/more effective cutting charges, company observers would be allowed to conduct the MPS monitoring for all of the very-small blasting scenarios. To qualify as an "adequately trained" observer, operator/contractor personnel must attend observer training courses offered by private or government entities in accordance with MMS/NMFS training criteria. In addition to meeting all monitoring and reporting requirements, company observers would:

- Brief appropriate crew of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (i.e., 2-way radio, visual signals, etc.) with blasting personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring and not secondary tasking.

Pre-Det Monitoring

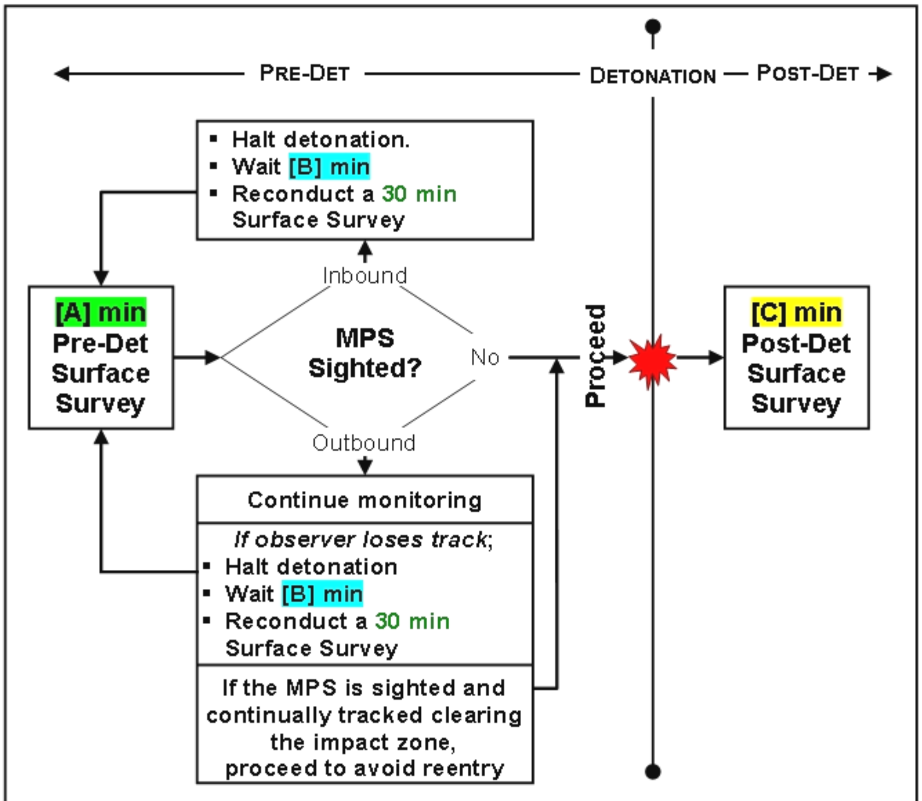
Before severance charge detonation, the company observer will conduct a 60 min (Scenarios A1 and A3) or 90 min (Scenarios A2 and A4) **surface monitoring survey** of the impact zone. The monitoring will be conducted from the highest highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. If during the survey an MPS is:

- **Not sighted**, proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone**, proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct a 30 min **surface monitoring survey**; or
- **Sighted inbound**
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct a 30 min **surface monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the company observer will conduct a 30 min **surface monitoring survey** of the impact zone to detect for impacted MPS. If an MPS is observed shocked, injured, or killed, the detonations will cease, attempts should be made to collect/resuscitate the animal, and the observers will contact MMS and NMFS as per the take event procedures described on page A-7 of this appendix. If no MPS are observed to be impacted by the detonation, the observer is to record all of the necessary information as per the conditions detailed in MMS's permit approval letter (i.e., MMPA/ESA incidental-take requirements) and prepare a trip report for routing to MMS and NMFS.

A flowchart of the monitoring process and associated survey times for very-small severance-scenarios A1, A2, A3, and A4 is provided in Figure A-2.



Scenario	Pre-Det Surface [A]	Waiting Period [B]	Post-Det Surface [C]
	(Minutes)		
A1	60	30	30
A2	90	30	30
A3	60	30	30
A4	90	30	30

Figure A-2. Surveys, time requisites, and monitoring process for very-small severance-scenarios A1, A2, A3, and A4.

Small Blasting Category

Shelf (<200 m) and Slope (>200 m) Scenarios B1, B2, B3, and B4

An operator proposing explosive-severance activities conduced under the small blasting category will be limited to 20-lb charge sizes (AML or BML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

B1 and B2: 373 m (1,224 ft)
B3 and B4: 522 m (1,714 ft)

Required Observers

Generally, two NMFS observers are required to perform MPS detection surveys for small-blasting scenarios. If necessary, the PROP Manager will determine if additional observers are required to compensate for the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company and blasting personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

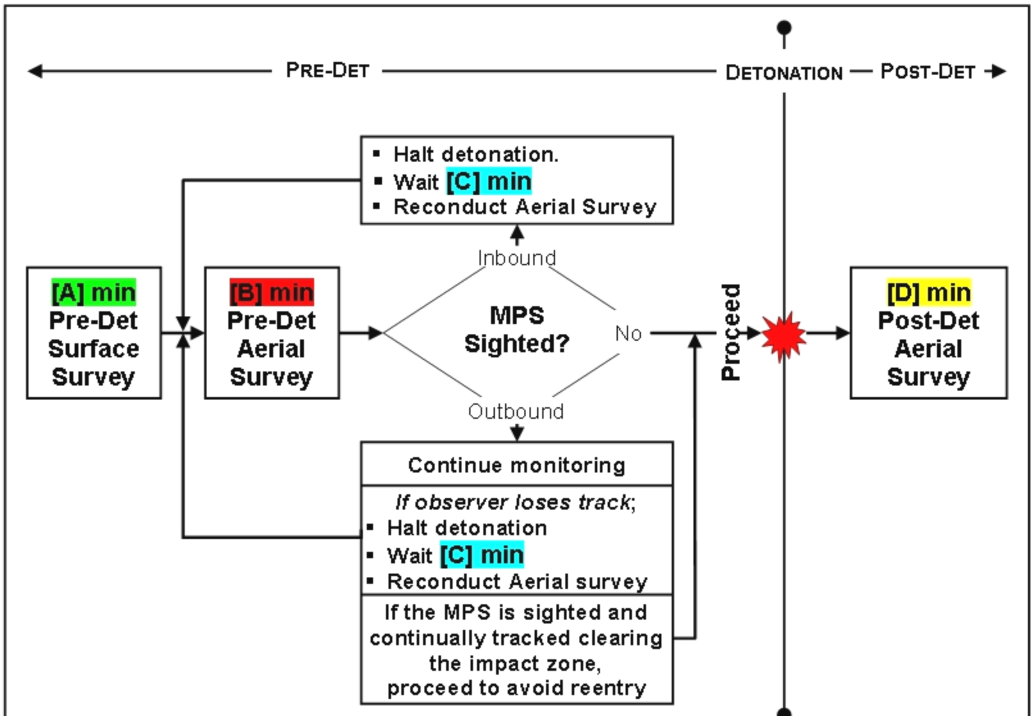
Before severance charge detonation, NMFS observer(s) will conduct a 60 min (B1 and B3) or 90 min (B2 and B4) **surface monitoring survey** of the impact zone. The monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), NMFS observer(s) will conduct a 30 min **aerial monitoring survey** by helicopter. When two NMFS observers are on site, NMFS may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will traverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted**, proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone**, proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct a 30 min **aerial monitoring survey**; or
- **Sighted inbound**,
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct a 30 min **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 30 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix. If no MPS are observed to be impacted by the detonation, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for small severance-scenarios B1, B2, B3, and B4 is provided in Figure A-3.



Scenario	Pre-Det Surface [A]	Pre-Det Aerial [B]	Waiting Period [C]	Post-Det Aerial [D]
	(Minutes)			
B1	60	30	30	30
B2	90	30	30	30
B3	60	30	30	30
B4	90	30	30	30

Figure A-3. Surveys and monitoring process for small severance-scenarios B1, B2, B3, and B4.

Standard Blasting Category

Shelf (<200 m) Scenarios C1 and C3

An operator proposing shelf-based (<200 m), explosive-severance activities conduced under the standard blasting category will be limited to 80-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

C1: 631 m (2,069 ft)
C3: 829 m (2,721 ft)

Required Observers

Generally, two NMFS observers are required to perform MPS detection surveys for standard-blasting, shelf scenarios C1 and C3. If necessary, the PROP Manager will determine if additional observers are required to compensate for the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company and blasting personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

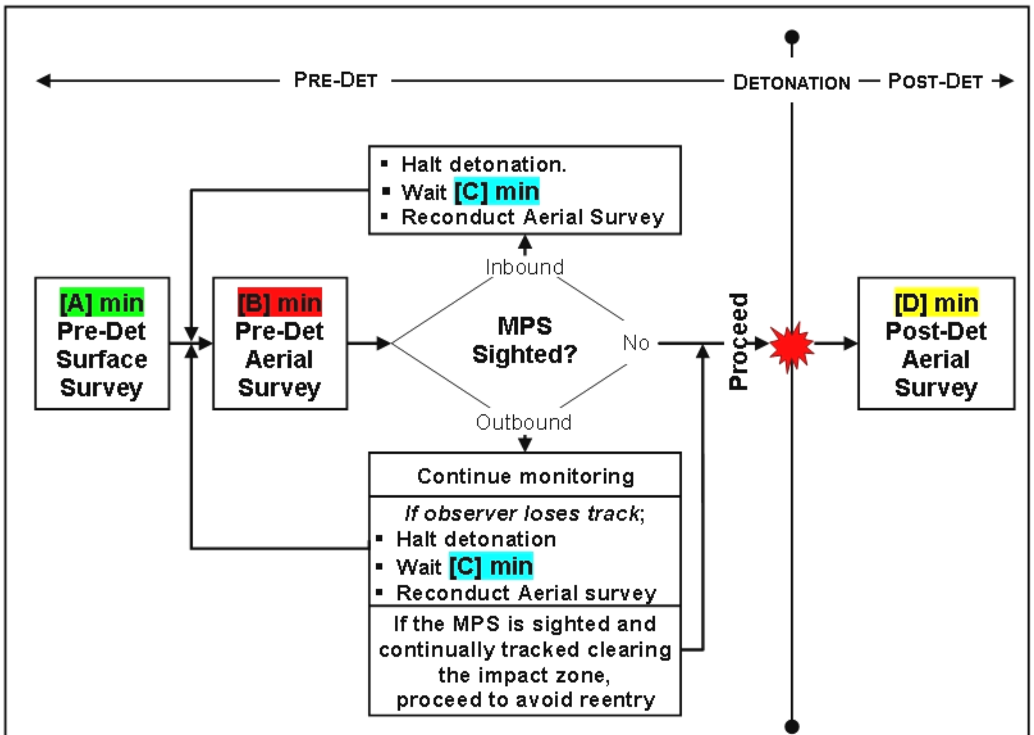
Before severance charge detonation, NMFS observer(s) will conduct a 90 min **surface monitoring survey** of the impact zone. The monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), NMFS observer(s) will conduct the **aerial monitoring survey** by helicopter for 30 min (Scenario C1) or 45 min (Scenario C3). When two NMFS observers are on site, NMFS may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will traverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted**, proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone**, proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 30 min while continuing to monitor opportunistically, and
    - Reconduct the 30 min (C1) or 45 min (C3) **aerial monitoring survey**; or
- **Sighted inbound**,
    - Halt the detonation,
    - Wait 30 min while continuing to monitor opportunistically, and
    - Reconduct the 30 min (C1) or 45 min (C3) **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 30 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix. If no MPS are observed to be impacted by the detonation, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for standard severance-scenarios C1 and C3 is provided in Figure A-4.



Scenario	Pre-Det Surface [A]	Pre-Det Aerial [B]	Waiting Period [C]	Post-Det Aerial [D]
	(Minutes)			
C1	90	30	30	30
C3	90	45	30	30

Figure A-4. Surveys and monitoring process for standard severance-scenarios C1 and C3.

Slope (>200 m) Scenarios C2 and C4

An operator proposing slope-based (>200 m), explosive-severance activities conduced under the standard blasting category will be limited to 80-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

C2: 631 m (2,069 ft)
C4: 829 m (2,721 ft)

Required Observers

Since standard-blasting, slope scenarios require a minimum of three (3) NMFS observers (PROP or contracted personnel) for the simultaneous surface, aerial, and acoustic monitoring surveys, at least two (2) "teams" of observers will be required. The PROP Manager will determine each "team" size depending upon the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company, blasting, and acoustic monitoring personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

Before severance charge detonation, NMFS observers will begin a 90 min **surface monitoring survey** and a 120 min (Scenario C2) or 150 min (Scenario C4) **passive-acoustic monitoring survey** of the impact zone. The surface monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. The acoustic monitoring will be conducted using NOAA-approved passive-acoustic monitoring protocols, devices, and technicians. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), the acoustic survey will continue while one or two of the NMFS observers transfer to a helicopter to conduct a 30 min (Scenario C2) or 60 min (Scenario C4) **aerial monitoring survey**. The PROP Manager may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will transverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted or detected** (acoustically), proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone and not detected** (acoustically), proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 30 min (C2) or 45 min (C4) while continuing to monitor opportunistically, and
    - Reconduct the 30 min (C2) or 60 min (C4) **aerial monitoring survey**; or
- **Sighted inbound or detected** (acoustically),

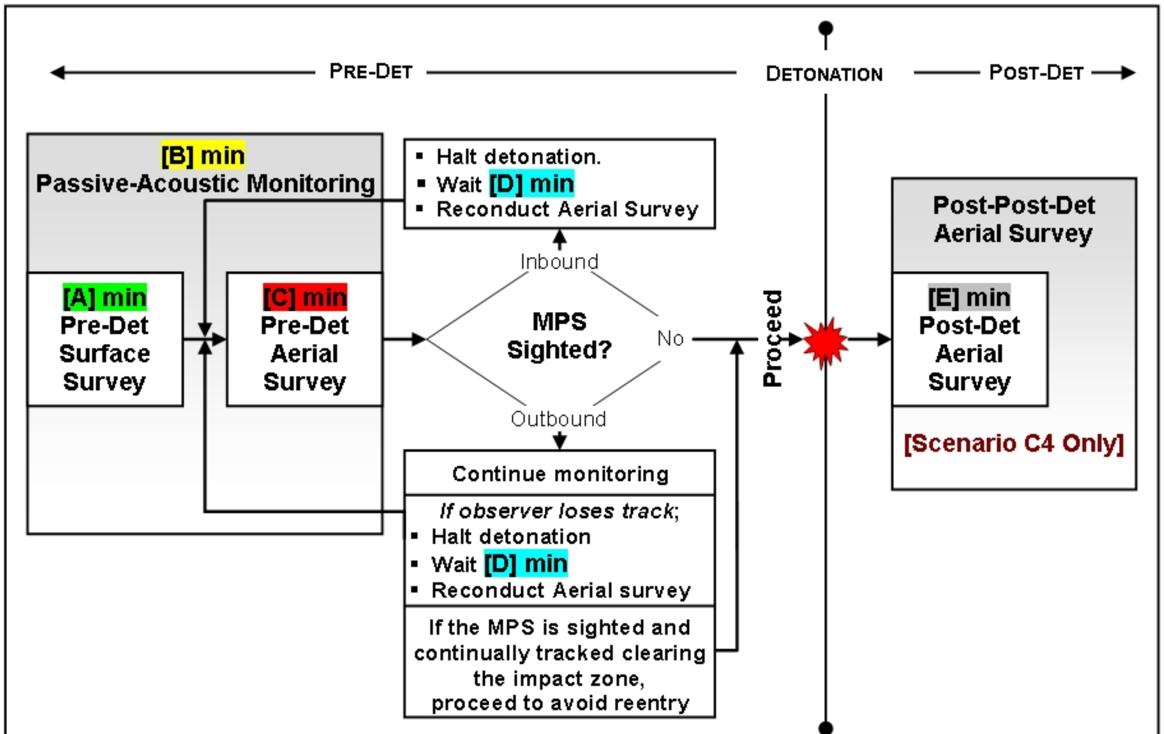
- Halt the detonation,
- Wait 30 min (C2) or 45 min (C4) while continuing to monitor opportunistically, and
- Reconduct the 30 min (C2) or 60 min (C4) **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 30 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If feasible, **passive-acoustic monitoring** should be continued until the end of the post-det monitoring period. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-9 of this appendix.

Scenario C4 also requires a **post-post-det aerial monitoring survey** to be conducted within 2-7 days after detonation activities conclude, conducted by helicopter or fixed-wing aircraft. Current tracking transmitters will be released at an appropriate time during detonation events and used by observers as a guide on the location to focus the survey efforts. In the event that the transmitters are lost, observations are to start at the removal site and proceed leeward and outward of wind and current movement. A 7 nmi x 7 nmi grid centered near the removal site will be surveyed. This grid includes eight, parallel transect lines each measuring 7 nmi long and spaced approximately 1 nmi apart. Any injured or killed MPS must be recorded, and if possible, tracked and collected after notifying NMFS SERO. If no MPS are observed to be impacted during either aerial survey, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for standard severance-scenarios C2 and C4 is provided in Figure A-5.



Scenario	Pre-Det Surface [A]	Passive Acoustic [B]	Pre-Det Aerial [C]	Waiting Period [D]	Post-Det Aerial [E]
	(Minutes)				
C2	90	120	30	30	30
C4	90	150	60	45	30

Figure A-5. Surveys and monitoring process for standard severance-scenarios C2 and C4.

Large Blasting Category

Shelf (<200 m) Scenarios D1 and D3

An operator proposing shelf-based (<200 m), explosive-severance activities conduced under the large blasting category will be limited to 200-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

D1: 941 m (3,086 ft)
D3: 1,126 m (3,693 ft)

Required Observers

Generally, two NMFS observers are required to perform MPS detection surveys for large-blasting, shelf scenarios D1 and D3. If necessary, the PROP Manager will determine if additional observers are required to compensate for the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company and blasting personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

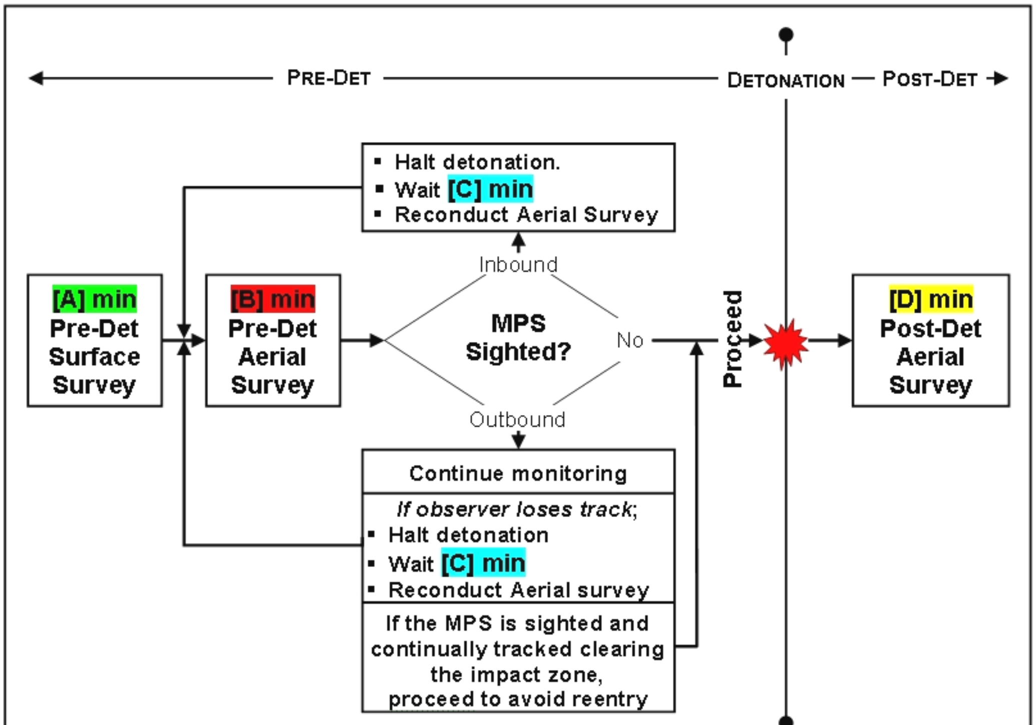
Before severance charge detonation, NMFS observers will conduct a 120 min **surface monitoring survey** of the impact zone. The monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), one or two NMFS observers will transfer to a helicopter to conduct a 45 min (Scenario D1) or 60 min (Scenario D3) **aerial monitoring survey**. NMFS may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will traverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted**, proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone**, proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct the 45 min (D1) or 60 min (D3) **aerial monitoring survey**; or
- **Sighted inbound**,
  - Halt the detonation,
  - Wait 30 min while continuing to monitor opportunistically, and
  - Reconduct the 45 min (D1) or 60 min (D3) **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 30 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix. If no MPS are observed to be impacted by the detonation, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for large severance-scenarios D1 and D3 is provided in Figure A-6.



Scenario	Pre-Det Surface [A]	Pre-Det Aerial [B]	Waiting Period [C]	Post-Det Aerial [D]
	(Minutes)			
D1	120	45	30	30
D3	120	60	30	30

Figure A-6. Surveys and monitoring process for large severance-scenarios D1 and D3.

Slope (>200 m) Scenarios D2 and D4

An operator proposing slope-based (<200 m), explosive-severance activities conduced under the large blasting category will be limited to 200-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

D2: 941 m (3,086 ft)
D4: 1,126 m (3,693 ft)

Required Observers

Since large-blasting, slope scenarios require a minimum of three (3) NMFS observers (PROP or contracted personnel) for the simultaneous surface, aerial, and acoustic monitoring surveys, at least two (2) "teams" of observers will be required. The PROP Manager will determine each "team" size depending upon the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company, blasting, and acoustic monitoring personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

Before severance charge detonation, NMFS observers will begin a 120 min **surface monitoring survey** and a 180 min (Scenario D2) or 210 min (Scenario D4) **passive-acoustic monitoring survey** of the impact zone. The surface monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. The acoustic monitoring will be conducted using NOAA-approved passive-acoustic monitoring protocols, devices, and technicians. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), the acoustic survey will continue while one or two of the NMFS observers transfer to a helicopter to conduct a 60 min **aerial monitoring survey**. The PROP Manager may decide to have two observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will transverse the impact zone at low speed/altitude in the specified grid pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted or detected** (acoustically), proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone and not detected** (acoustically), proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 45 min while continuing to monitor opportunistically, and
    - Reconduct the 60 min **aerial monitoring survey**; or
- **Sighted inbound or detected** (acoustically),
    - Halt the detonation,

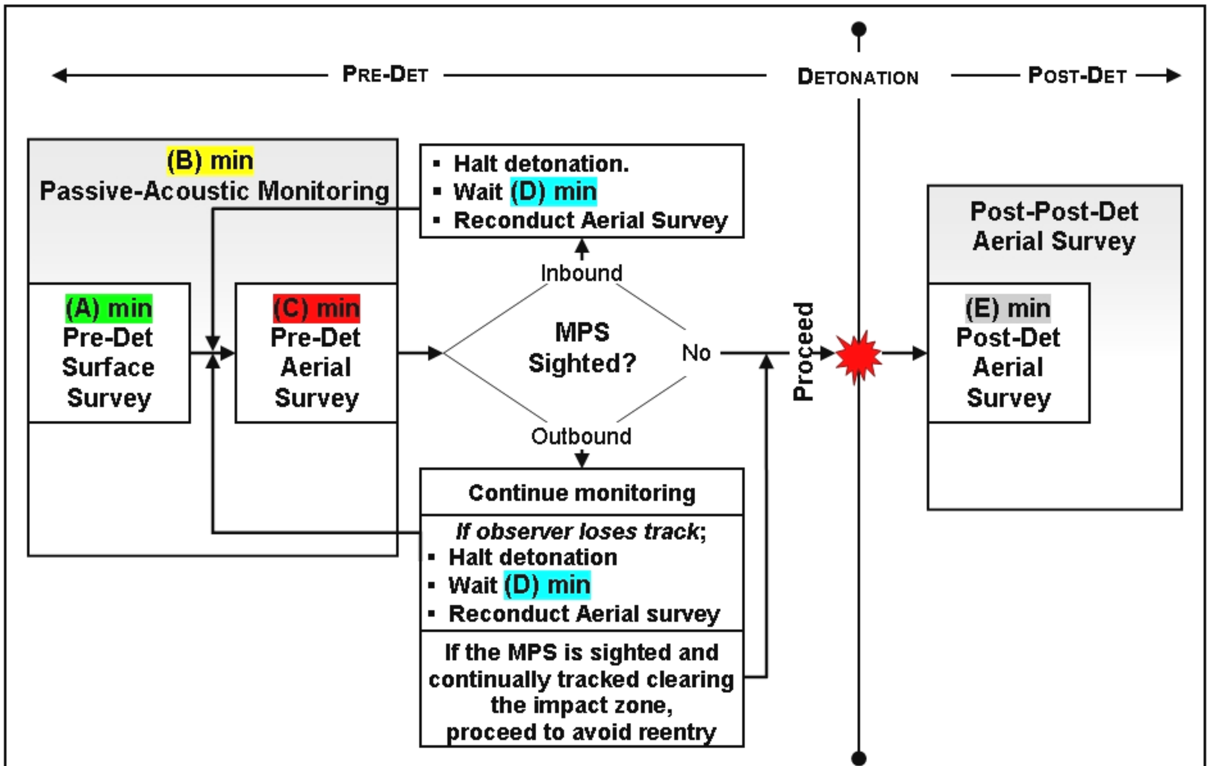
- Wait 45 min while continuing to monitor opportunistically, and
- Reconduct the 60 min **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 30 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If feasible, **passive-acoustic monitoring** will continue until the end of the post-det monitoring period. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix.

Scenarios D2 and D4 also require a **post-post-det aerial monitoring survey** to be conducted within 2-7 days after detonation activities conclude. Current tracking transmitters will be released at an appropriate time during detonation events and used by observers as a guide on the location to focus the survey efforts. In the event that the transmitters are lost, observations are to start at the removal site and proceed leeward and outward of wind and current movement. Any injured or killed MPS must be recorded in the survey report and NMFS SERO must be notified. NMFS SERO may request that the carcass be tracked and collected if possible. If no MPS are observed to be impacted during either aerial survey, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the standard monitoring process and associated survey times for large severance-scenarios D2 and D4 is provided in Figure A-7.



Scenario	Pre-Det Surface [A]	Passive Acoustic [B]	Pre-Det Aerial [C]	Waiting Period [D]	Post-Det Aerial [E]
	(Minutes)				
D2	120	180	60	45	30
D4	120	210	60	45	30

Figure A-7. Surveys and monitoring process for large severance-scenarios D2 and D4.

Specialty Blasting Category

Shelf (<200 m) Scenarios E1 and E3

An operator proposing shelf-based (<200 m), explosive-severance activities conduced under the specialty blasting category will be limited to 500-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

E1: 1,500 m (4,916 ft)
E3: 1,528 m (5,012 ft)

Required Observers

Generally, two NMFS observers (PROP or contracted personnel) are required to perform MPS detection surveys for specialty-blasting, shelf scenarios E1 and E3. If necessary, the PROP Manager will determine if additional observers are required to compensate for the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company and blasting personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

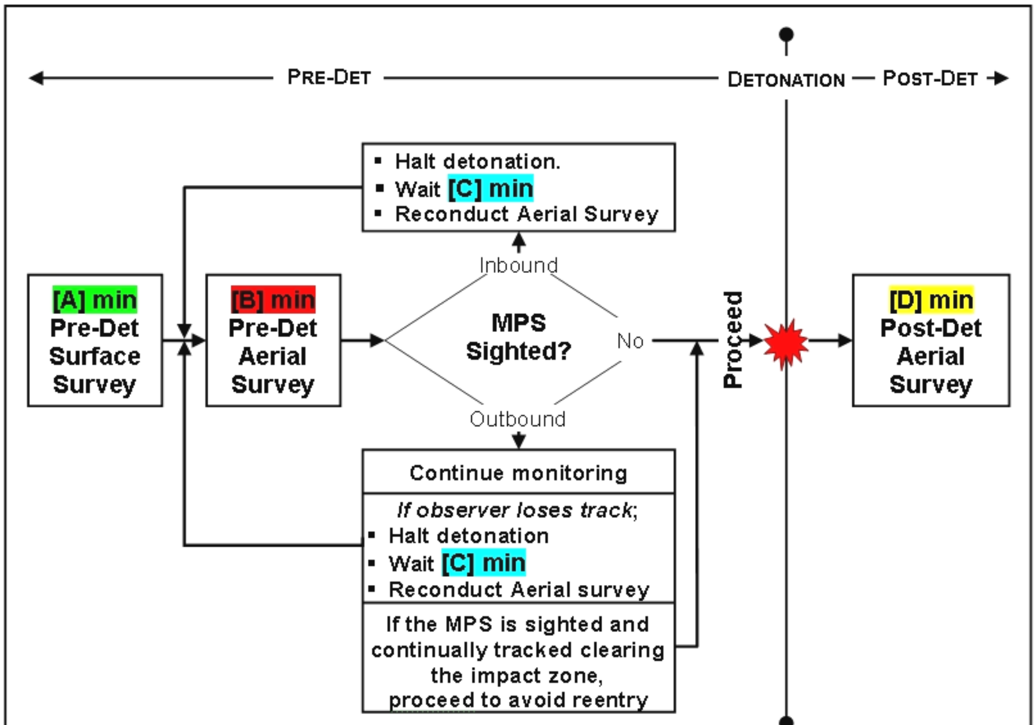
Before severance charge detonation, NMFS observers will conduct a 150 min **surface monitoring survey** of the impact zone. The monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), one or two of the NMFS observers will transfer to a helicopter to conduct a 90 min **aerial monitoring survey**. The PROP Manager may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will traverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted**, proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone**, proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 45 min while continuing to monitor opportunistically, and
    - Reconduct the 90 min **aerial monitoring survey**; or
- **Sighted inbound**,
    - Halt the detonation,
    - Wait 45 min while continuing to monitor opportunistically, and
    - Reconduct the 90 min **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 45 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix. If no MPS are observed to be impacted by the detonation, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for specialty severance-scenarios E1 and E3 is provided in Figure A-8.



Scenario	Pre-Det Surface [A]	Pre-Det Aerial [B]	Waiting Period [C]	Post-Det Aerial [D]
	(Minutes)			
E1	150	90	45	45
E3	150	90	45	45

Figure A-8. Surveys and monitoring process for large severance-scenarios E1 and E3.

Slope (>200 m) Scenarios E2 and E4

An operator proposing slope-based (>200 m), explosive-severance activities conduced under the specialty blasting category will be limited to 500-lb charge sizes (BML or AML) and conduct all requisite monitoring during daylight hours out to the associated impact-zone radii listed below:

E2: 1,500 m (4,916 ft)
E4: 1,528 m (5,012 ft)

Required Observers

Since specialty-blasting, slope scenarios require a minimum of three (3) NMFS observers (PROP or contracted personnel) for the simultaneous surface, aerial, and acoustic monitoring surveys, at least two (2) "teams" of observers will be required. The PROP Manager will determine each "team" size depending upon the complexity of severance activities and or structure configuration. In addition to meeting all reporting requirements, the NMFS observers would:

- Brief affected crew and severance contractors of the monitoring efforts and notify topsides personnel to report any sighted MPS to the observer or company representative immediately;
- Establish an active line of communication (such as 2-way radio) with company, blasting, and acoustic monitoring personnel; and
- Devote the entire, uninterrupted survey time to MPS monitoring.

Pre-Det Monitoring

Before severance charge detonation, NMFS observers will begin a 180 min **surface monitoring survey** and a 270 min **passive-acoustic monitoring survey** of the impact zone. The surface monitoring will be conducted from the highest vantage point(s) and/or other location(s) that provide the best, clear view of the entire impact zone. These vantage points may be on the structure being removed or proximal surface vessels such as crewboats and derrick barges. The acoustic monitoring will be conducted using NOAA-approved passive-acoustic monitoring protocols, devices, and technicians. Once the surface monitoring is complete (i.e., the impact zone cleared of MPS), the acoustic survey will continue while one or two of the NMFS observers transfer to a helicopter to conduct a 90 min **aerial monitoring survey**. The PROP Manager may decide to have both observers fly the aerial survey or have one observer continue surface monitoring while the other observer flies the survey. The helicopter will transverse the impact zone at low speed/altitude in the specified pattern (Table A-1 on page A-5). If during the aerial survey an MPS is:

- **Not sighted or detected** (acoustically), proceed with the detonation;
- **Sighted outbound and continuously tracked clearing the impact zone and not detected** (acoustically), proceed with the detonation after the monitoring time is complete to avoid reentry;
- **Sighted outbound and the MPS track is lost** (i.e., the animal dives below the surface),
    - Halt the detonation,
    - Wait 45 min while continuing to monitor opportunistically, and
    - Reconduct the 90 min **aerial monitoring survey**; or
- **Sighted inbound or detected** (acoustically),
    - Halt the detonation,

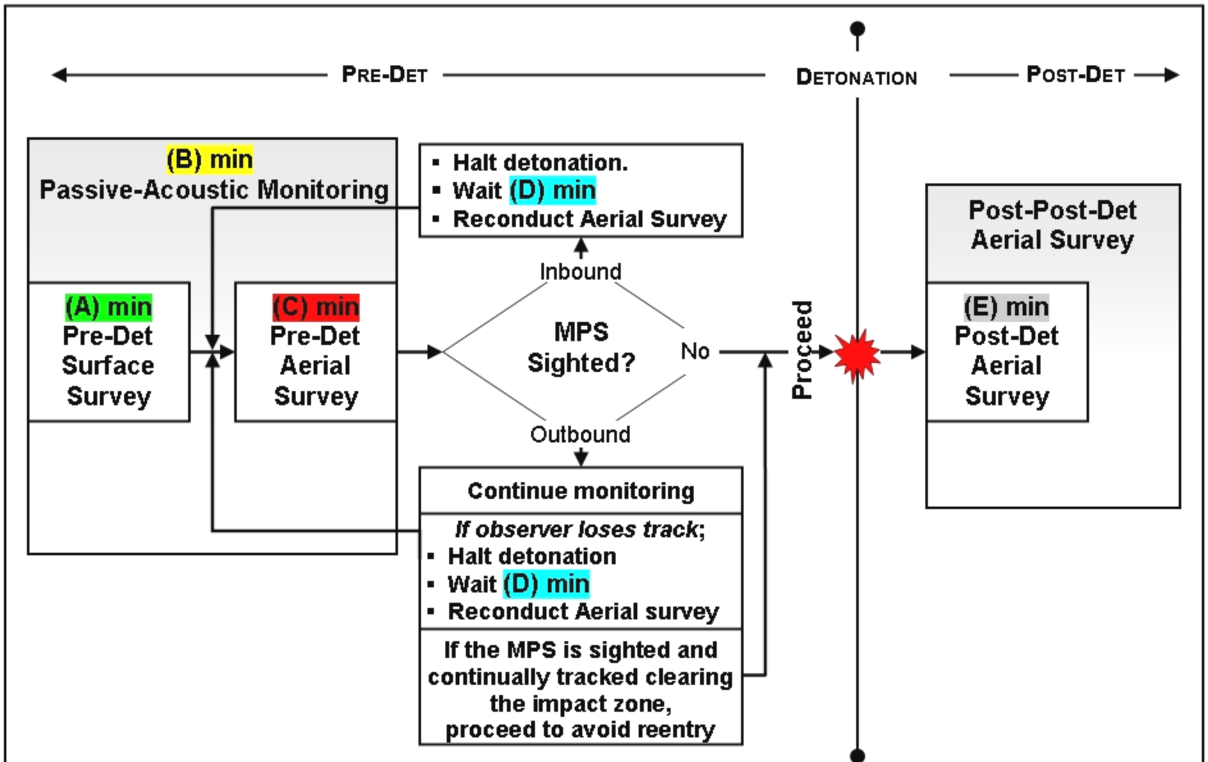
- Wait 45 min while continuing to monitor opportunistically, and
- Reconduct the 90 min **aerial monitoring survey**.

Post-Det Monitoring

After severance charge detonation, the NMFS observers will conduct a 45 min **aerial monitoring survey** of the impact zone to detect for impacted MPS. If feasible, **passive-acoustic monitoring** will continue until the end of the post-det monitoring period. If an MPS is observed shocked, injured, or killed, the operations will cease, attempts will be made to collect/resuscitate the animal, and NMFS SERO will be contacted as per the take event procedures described on page A-7 of this appendix.

Scenarios E2 and E4 also require a **post-post-det aerial monitoring survey** to be conducted within 2-7 days after detonation activities conclude. Current tracking transmitters will be released at an appropriate time during detonation events and used by observers as a guide on the location to focus the survey efforts. In the event that the transmitters are lost, observations are to start at the removal site and proceed leeward and outward of wind and current movement. Any injured or killed MPS must be recorded in the survey report and NMFS SERO must be notified. NMFS SERO may request that the carcass be tracked and collected if possible. If no MPS are observed to be impacted during either aerial survey, the NMFS observers will record all of the necessary information as per the conditions detailed in MMS's permit approval letter and PROP guidelines for the preparation of a trip report.

A flowchart of the monitoring process and associated survey times for specialty severance-scenarios E2 and E4 is provided in Figure A-9.



Scenario	Pre-Det Surface [A]	Passive Acoustic [B]	Pre-Det Aerial [C]	Waiting Period [D]	Post-Det Aerial [E]
	(Minutes)				
E2	180	270	90	45	45
E4	180	270	90	45	45

Figure A-9. Surveys and monitoring process for large severance-scenarios E2 and E4.