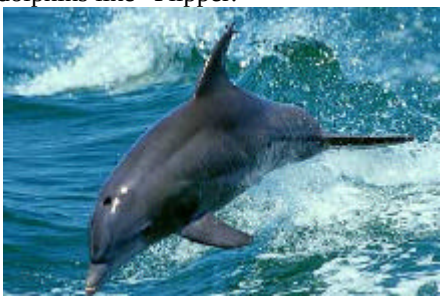
GULF OF MEXICO – HOME TO WHALES AND DOLPHINS

People are often surprised to learn that the Gulf of Mexico has whales and many types of dolphins – not just the well-known bottlenose dolphins like "Flipper."



Bottlenose Dolphin Keith Mullin, NMFS

Over 20 different species of whales and dolphins (cetaceans) live in the Gulf. Here we present to you some of the recent findings of research funded by the Minerals Management Service (MMS) in cooperation with other Federal agencies and research organizations.

Fishing and recreational boats often see bottlenose dolphins and a close relative, the Atlantic spotted dolphin, but only historic whaling accounts of hunting Gulf of Mexico sperm whales in the 1800s and the beaching of dead or sick cetaceans (strandings) gave hints that many more species lived in the Gulf. In the last 25 years, studies using airplanes and research vessels have been conducted to survey cetaceans in the northern Gulf of Mexico (U.S. waters). Results show that, indeed, just two species, the bottlenose dolphin and the Atlantic spotted dolphin are common in shallow waters – waters up to 200 meters (656 feet) in depth – called the "continental shelf" by oceanographers. Beyond 200 meters depth, the ocean floor normally descends more rapidly – the "continental slope" – into deep ocean water. When surveys moved from shallow "shelf waters" to deeper "slope waters", many surprising discoveries resulted!

Atlantic Spotted Dolphins NMFS

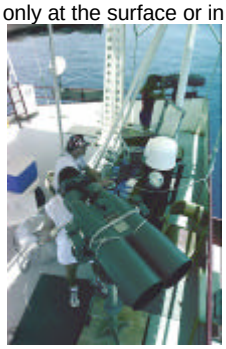
Aerial survey research begun by MMS and U. S. Fish and Wildlife Service (FWS) in the 1980s provided a first look at a complex deepwater cetacean community. In 1989, the National Marine Fisheries Service (NMFS), with MMS funding support, began additional aerial and vessel surveys in "slope waters." These surveys (*see Looking (and Listening) for Cetaceans in the Gulf*) added more details on both the types and numbers of cetaceans in the deepwater community and indicated that the Mississippi River Delta area had a particularly high number of cetaceans.

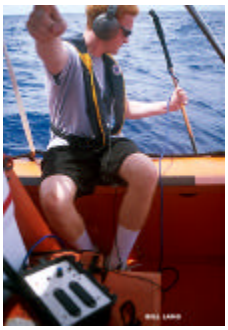
Man has hunted cetacean species for centuries, many to the brink of extinction. The U.S. passed two laws to stop this exploitation. The Marine Mammal Protection Act (MMPA) legally protects all cetaceans and other marine mammals, such as seals and manatees, from hunting and other activities that may harm them. Animals thought to be at risk of extinction are given additional protection under the Endangered Species Act (ESA). All cetaceans are "protected species" – those most threatened by past hunting are also "endangered species."

For MMS, which regulates offshore oil and gas activities, a key question is whether any industry activities might harm cetaceans. The Federal agencies that enforce the Endangered Species and Marine Mammal Protection Acts are NMFS and FWS. By 1989, it was certain that many types of cetaceans lived in the deepwaters of the Gulf. There were thousands of animals out there and it was projected that industry would eventually operate in many deepwater areas. Through meetings and workshops with marine mammal experts, NMFS, FWS, other agencies and industry, a series of protected species study programs were planned and conducted to obtain more information on Gulf of Mexico cetaceans. GulfCet I (1992-1994), funded by MMS and NMFS and conducted by researchers from Texas A&M University (TAMU) and NMFS, focused on obtaining more information on distribution and abundance of cetaceans. GulfCet II (1996-1997), funded by MMS through the U.S Geological Survey, Biological Resource Division, continued with the same research groups and provided additional survey information. The Gulf of Mexico has different types of waters and complex currents – somewhat like habitats and weather on land. These studies also began to look at why animals are concentrated in some areas and less common in others. In 2000, a new study program was begun with NMFS, the Office of Naval Research (ONR), and several groups of academic researchers to continue studies on cetaceans and their relationships to the physical environment (see, *Cetaceans and Where They Live*). This was followed by the Sperm Whale Seismic Study (SWSS) begun in 2003 and to end in 2005. MMS is working with ONR, the National Science Foundation and a coalition of oil and seismic companies to study sperm whales in great detail and how they react to seismic vessels.

LOOKING (AND LISTENING) FOR CETACEANS IN THE GULF

Cetacean surveys are a fundamental research activity used to determine which species are "out there," how many exist, and where and when they most likely occur. The Gulf of Mexico is a large body of water – slightly over a half-million square miles of surface area. To search that area would alone be a challenge; but the Gulf of Mexico has another dimension, water depth, and cetaceans spend more time underwater than at the surface. In truth, there is more unknown about cetaceans than known, and one reason for this is that marine biologists, at best, see cetaceans in the wild only at the surface or in clear, near-surface waters.





The population estimates and much of what we know about Gulf cetaceans are results of trained observers spending countless hours looking for whales and dolphins from airplanes and research ships. The primary research tools are the human eye and binoculars. Onboard ships, special 25x "big eyes" binoculars [photo] are used. On calm, clear days trained observers can detect cetaceans nearly six miles away. The ship will then move closer to identify and count animals, note behavior, and record the location of the sighting. The ships and airplanes follow survey "transects" – a known survey route across a small strip of Gulf waters. All Gulf waters are not surveyed and even where surveys exist, cetaceans are only at the surface for a small amount of time. Population estimates are made based on how many animals are actually seen along with calculations on the number that most likely were not seen (submerged) and how many additional animals would possibly exist in waters not surveyed.

Most of a cetacean's world is dim to dark. Light penetrates only the surface of deepwater and shallow coastal water is often clouded and murky. Unlike light, sound is effectively transmitted through water and cetaceans use hearing as a primary sense. Most cetaceans also produce sound to communicate and many also use sound reflections (echo-location) to detect prey and navigate in the water column. Just as birdwatchers often listen as much as look when locating birds in dense brush or woods, sound is another method to study cetaceans. Underwater microphones (hydrophones) are now used on many surveys to listen for cetaceans.

What follows is a very brief introduction to the most abundant Gulf of Mexico cetaceans. Additional references and websites are recommended for readers seeking more detailed information. In addition to the bottlenose and Atlantic spotted dolphins found in coastal and shallow waters, the GulfCet studies have shown that 18 cetacean species are found in deeper waters. Another six species of large baleen whales are rare visitors to the Gulf of Mexico. These whales feed on plankton and small fish by straining water through a "net" of plates (baleen) in their mouth. That none of the most common large whales, such as humpback and fin whales, reside in Gulf waters may seem surprising. Scientists think that Gulf of Mexico waters do not have the abundant near-surface food required by baleen whales and the Gulf is simply "out of the way" for these species' migratory routes.

Juvenile Humpback Whale in GOM MMS

Only one baleen whale, the Bryde's whale (*Balaenoptera edeni*), resides in the Gulf. The number of Bryde's whales is low, perhaps fewer than 50 for those areas of the Gulf surveyed. Bryde's whales are closely related to blue, fin and sei whales. Unlike its cousins, Bryde's whales remain almost exclusively in warm waters. Adults may weigh as much as 30 tons and reach 50 feet in length.

Bryde's whale Wayne Hoggard, NMFS

Two other "large whales" also reside in the Gulf, but these are toothed whales. They have no baleen plates and, like dolphins, have jaws with teeth. Both of these whales are ones many people recognize – the killer whale and sperm whale.

Nearly 150 killer whales or orcas (*Orcinus orca*) are estimated to live in the Gulf of Mexico. The whale is actually the largest member of the dolphin family with males growing to 30 feet in length and weighing 30 tons, females to 26 feet. Historically, as their name implies, killer whales were considered vicious predators – a warm-blooded shark of sorts. The modern image is more benign – trained killer whales are stars both in movies and sea aquarium shows. Killer whales are very intelligent and move in complex social groups or "pods" in the wild. Nevertheless, the gentle giant of shows and movies is also a very effective hunter. Orcas have diverse diets that include fishes, sea turtles, birds, and other cetaceans. In the Gulf, orcas have been observed attacking and feeding on dolphins.

Killer whale Carol Roden, MMS

Perhaps as well known as the killer whale, is the sperm whale (*Physeter macrocephalus*). Moby Dick was a large, male sperm whale with a distinctive squared-head (most pronounced in older males) and likely measured nearly 60 feet in length. However, a "white whale," such as the fictional Moby, is extremely rare. Sperm whales are typically dark gray to black in color. Mature male sperm whales, much less white ones, are uncommon in the Gulf. Nearly all of the estimated thousand individuals are females, calves, and immature whales. Females have a more rounded head and the largest are approximately 40 feet in length. The difference

in size and appearance of male and female sperm whales is quite pronounced. Sport fishing boats cruising offshore in the Mississippi River delta waters may see sperm whales while looking for tuna or other large billfish. This species is being studied in more detail by SWSS.

Though not as impressive in size or as well known as killer and sperm whales, smaller toothed whales and dolphins that inhabit deep Gulf waters are a diverse and fascinating group. By far the most common is the pantropical spotted dolphin (*Stenella attenuata*). NMFS surveys estimate that nearly 92,000 animals live in northern Gulf (U.S.) waters. They are often attracted to vessels and "ride" in the bow wave – bowriding. The white-tipped nose can be very pronounced, looking almost like a ping-pong ball being pushed along by an animal swimming near the surface.

Pantropical spotted dolphin Carol Roden, MMS

The Clymene dolphin (*Stenella clymene*) is another acrobatic dolphin that will leap and spin; is estimated to have a Gulf population near 17,000 individuals. This dolphin appears more compact than a spinner and has a short beak. Interestingly, this type of dolphin was not recognized as a distinct species until 1981 and relatively little is known about it. It seems likely that it was confused with spinner dolphins during early survey work, particularly in accounts from airplane transects.

Clymene dolphin Carol Roden, MMS

Once considered the second most numerous dolphin in the Gulf, with a population of over 11,000, is the spinner dolphin (*Stenella longirostris*). The spinner dolphin does, in fact, spin and earns its name for high-spinning leaps and somersaults. It's a relatively small, sleek dolphin with a distinctive long, slender beak that is dark gray to black in color.

Spinner dolphin Carol Roden, MMS

The common bottlenose dolphin (*Tursiops truncatus*) is the dolphin most likely to be seen in Gulf waters, often following shrimp boats. It is also found along coastlines in many parts of the world, and perhaps represents the most often seen and best-studied cetacean species in the wild. "Flipper" can be found both in shallow and deep waters and scientists now believe a coastal form and a larger offshore form of this species exist. Although the most numerous dolphin in all Gulf waters, it is not the most abundant dolphin in deep Gulf waters. The NMFS surveys indicate that fewer than 3,000 offshore individuals live here.

Bottlenose dolphin (offshore form) Carol Roden, MMS

The next most abundant species of dolphin, the striped dolphin (*Stenella coeruleoalba*), has a population of nearly 6,500 in the northern Gulf, but resides in deepwater only. This dolphin will bowride and, like spinner and Clymene dolphins, jump and somersault out of the water. It is

named for the long black stripe that runs from its eye along most of its body.

Striped dolphin Carrie Hubard, NMFS

Although in the same family as dolphins, the melon-headed "whale" (*Peponocephala electra*), if not quite melon-headed, does lack a dolphin-like beak. Otherwise, melon-headed whales are about the same size as other dolphins (up to 9 feet in length), swim in groups, will jump out of the water, and may mix with other groups of dolphins. In the Gulf, they are most often seen with Fraser's or rough-toothed dolphins. The NMFS scientists estimate the Gulf population at nearly 3,500 individuals.

Melon-headed whales Carrie Hubard, NMFS

The Atlantic spotted dolphin (*Stenella frontalis*) is Flipper's freckled friend in shallow waters of the Gulf. Its spots become more pronounced with age and young animals are difficult to distinguish from bottlenose dolphins. It often bowrides and is an acrobatic swimmer. Like the bottlenose dolphin, it is abundant in shallow waters and is far less common in deeper waters. NMFS surveys estimate only about 200 individuals occur in deeper waters. This does not include thousands of animals in coastal waters.

Atlantic spotted Dolphin Carol Roden, MMS

Risso's dolphin or grampus (*Grampus griseus*) is another dolphin, like the melon-headed whale, that lacks a beak. It can grow to slightly over 12 feet in length and its gray to brown body is often covered with light lines of scars. It tends to avoid vessels and rarely bowrides. Grampus is considered a deepwater species but has often been sighted near or at 200-meter depths. An estimated 2,000 animals occur in the Gulf.

Risso's dolphins Keith Mullin, NMFS

Short-finned pilot whales (*Globicephala macrorhynchus*) are another member of the dolphin family (delphinids) that have a blunt, rounded head and no beak. Adult males can grow to 20 feet in length and weigh 20 tons while females are smaller (17 feet, 1.2 tons). This species is always in groups; a lone individual would be a rare sighting. Pilot whales will often make news headlines because of their mass strandings. Tens to over a hundred animals will beach themselves for reasons not understood by scientists. Like grampus, this "whale" rarely bowrides. About 2,300 animals occur in the Gulf.

Short-finned pilot whale Bill Lang, MMS

The last of the more common dolphins found in the Gulf is the rough-toothed dolphin or "steno" (*Steno bredanensis)*. Steno is a rather distinctive dolphin that in some ways seems "reptilian" in appearance and the way it moves. Relative to other Gulf dolphins, steno has a smooth sloping forehead (melon, for dolphin anatomy) and is nicknamed "flathead" in some Caribbean Islands. It very rarely jumps completely out of the water and skims the surface with a distinctive head-up motion. Groups will bowride in the bow waves and wake of passing vessels and are often found near floating mats of seaweed (sargassum mats). It will also venture into shallow waters at times. Several mass strandings on Florida beaches have occurred. GulfCet surveys estimate a Gulf population of about 850 individuals.

Rough-toothed dolphin Bill Lang MMS

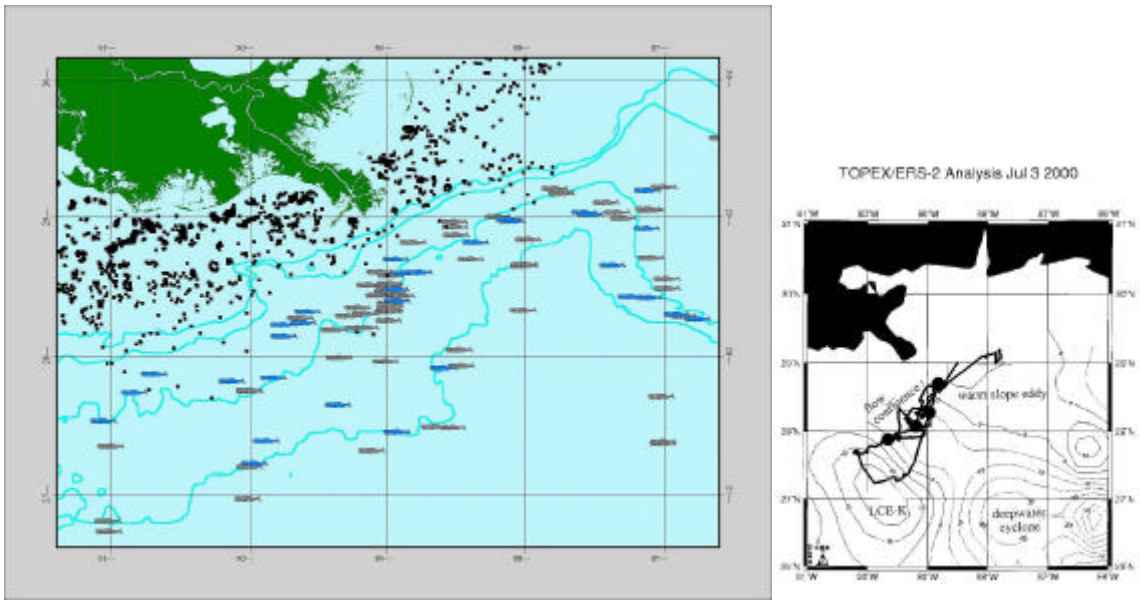
Additional species of cetaceans are found in the Gulf of Mexico. One group, the beaked whales, consists of particularly elusive animals that are rarely seen during surveys, but perhaps are more numerous than survey information would indicate. In general, this group is composed of deep-diving cetaceans that feed on deepwater fish and squid. Those species found in the Gulf avoid boats and are most often submerged. Very little is known about their natural history.

Many books and Internet sites provide detailed information on cetaceans found in the Gulf of Mexico. Two recent publications that deal specifically with the Gulf of Mexico may be of particular interest. Rhode Island Sea Grant has published the *Guide to Marine Mammals & Turtles of the U.S. Atlantic & Gulf of Mexico*. The 1999 edition is out-of-print; however, Sea Grant is reprinting the guide. Information on obtaining a copy is available by calling (401) 874-6842. A more detailed academic account of Gulf marine mammals and GulfCet studies was published by Texas A&M University Press, *The Marine Mammals of the Gulf of Mexico* (http://www.tamu.edu/upress/BOOKS/2000/wursig.htm). Texas A&M has a GulfCet website (http://www.tamug.tamu.edu/gulfcet/index.html) .

CETACEANS AND WHERE THEY LIVE

Anyone who hunts, fishes, goes bird watching or does gardening soon realizes there are good locations to find animals or grow plants and there are bad places. Smart fishermen know that, in addition to the proper bait or lure, tides, water temperature, season, and even weather will determine where and when to fish. Cetaceans, like fish, do not just swim around in Gulf waters randomly. A good deal of research on cetaceans seeks to learn how whales and dolphins interact with their environment and what factors determine why they prefer some areas and avoid others.

In some ways a cetacean's world is upside down relative to ours. Because cetaceans are mammals with lungs (not gills), they need to return to the water's surface to breath. Water depth to them is perhaps more like height to us. Man (without oxygen masks) can climb only so high in the mountains, and similarly, cetaceans have limitations on water depth. Some cetaceans, like sperm whales and beaked whales, have evolved with physical characteristics that allow deep dives and extended periods of "holding their breath," while other species always remain near the water surface. Cetacean species often appear to prefer certain depths of water; for instance, bottlenose dolphins often swim in shallow creeks, but you would not expect to find a spinner dolphin there.



Ship (gray) and airplane (blue) sightings of sperm whale groups indicate sperm whales prefer water depths of about1000 meters off the Mississippi River delta. Further studies on ocean currents and types of water in the Region, such as information from TOPEX satellite images, indicate whales favor certain areas along these depths.

Water depth alone is not the whole story. Preferred prey and feeding methods among cetaceans varies. Some species feed mostly at night, while others feed during daylight. Some catch prey near the surface, while others dive deeply. A cetacean's location is often related to the location of its food. That is a common principle to land ecology also, but again, the marine world is upside down and literally floating. The base of the marine food chain is not plants as we know them (trees, shrubs, and grasses), but very small plants, often single cells, that float near the ocean surface. This floating plant material, or phytoplankton, needs both sunlight and nutrients to grow. For cetaceans, the marine food chain starts with phytoplankton. Small animals (zooplankton) feed on the phytoplankton, then small planktonic predators feed on plankton and so on, up to larger fish and squid—"up to" in size of the animal, but often "down to" in location, as many animals can feed on what sinks down. Others move up and down in the water column, feeding at night in the surface waters and moving to deep (and darker) waters during the day to avoid predators.

Areas with abundant phytoplankton support zooplankton that, in turn, attract fish and other larger predators. In deepwater, where light does not penetrate to the bottom, areas of high phytoplankton growth or productivity are very important and appear to influence the distribution of many other marine animals including cetaceans. Understanding how the surface activity of phytoplankton productivity ultimately affects animals in the depths below is one of the more difficult problems for marine scientists.

Air has winds and water has currents; but unlike air, water also carries dissolved chemicals – essential nutrients like phosphate and nitrogen. For phytoplankton, ocean water acts as both air and soil. Furthermore, a basic principle in the Gulf of Mexico and all other marine environments is the concept of water moving in currents. These currents vary in terms of temperature, salinity, and chemical contents. Physical and chemical oceanographers study these different currents and watermasses and have identified certain types of water movements, such as counter-clockwise rotating eddies. Under ideal conditions of light and nutrients, phytoplankton will grow rapidly (phytoplankton bloom). Nutrients will be consumed and, without a new source of nutrients, the surface water (where light penetrates) will become nutrient poor. However, in

counter-clockwise rotating eddies and other conditions, such as frontal zones (where different water masses "collide"), the deeper water that is relatively rich in nitrogen is mixed upwards to the surface. As more information is gathered, oceanographers are recognizing types of watermasses in the Gulf of Mexico that are planktonic oases and others that are deserts.

Some cetaceans have seasonal migratory routes (something not yet seen or detected in the Gulf of Mexico). There are often preferred locations and seasons for feeding, breeding, and nursery grounds. Most likely, other factors, yet to be discovered, also determine cetacean distributions.

GulfCet II and ongoing studies attempt to determine the location of cetaceans through survey work and compare these locations to results of physical oceanographic studies that map the currents and water types. To date, we know that some areas of the Gulf, such as the Mississippi River delta region, appear to consistently "attract" sperm whales. Preliminary results from GulfCet indicate preferential use of the edges of counter-clockwise eddies or cold-core rings by some cetacean species. As methods to track both cetaceans and understand watermass dynamics improve, new findings may ultimately allow predictions of cetacean locations on the basis of satellite images used to map surface currents and areas of phytoplankton blooms.

SPERM WHALES IN THE GULF OF MEXICO

Sperm whales are the largest cetaceans in the Gulf of Mexico. The sperm whale is named after a large sac inside of the whale's head, called the spermaceti organ. The spermaceti organ is filled with a waxy substance, the spermaceti oil. This oil, prized by whale-hunters, was used for candles and as a lubricant. The large number of sperm whales killed by hunters ultimately led to their being classified as an endangered species.

This endangered species has a resident population in the Gulf of Mexico – a group of whales that remain here year-round. We do not yet know if these are always the same individuals or to what extent sperm whales enter and leave the Gulf of Mexico. Sperm whales remain in deepwater but are most often sighted in the Gulf in areas with water depths of about 1,000 meters. To forage for food, deepwater squid in particular, sperm whales "hold their breath" and can dive to depths of over 2,000 meters.

Sperm whales occur in a region off the Mississippi River delta where oil and gas industry deepwater platforms and seismic surveys also exist. A possible threat to sperm whales is the increasing noise in the marine environment. The potential for noise from oil and gas industry operations, such as seismic surveys and vessel traffic, to damage marine mammal hearing and/or interfere with crucial vocal communications are valid reasons for concern. Sperm whales produce sound to echo-locate their food, to communicate with other sperm whales, and to navigate in the ocean. In July 2000, the MMS, NMFS, and the Navy began the sperm whale acoustic monitoring program (SWAMP) to survey sperm whales and conduct research to determine if and how sperm whales are affected by manmade noise. This was followed in 2002 by the Sperm Whale Seismic Study (SWSS) under the direction of Texas A&M http://seawater.tamu.edu/SWSS/ with MMS the lead Federal agency and cooperative research efforts and/or funding from the Lamont-Doherty Earth Observatory under NSF funding http://www.ldeo.columbia.edu/news/2003/04-15-03mmp.html., the Office of Naval Research http://www.onr.navy.mil/sci_tech/personnel/med_sci/mammal_bio.htm , and a industry coalition of seismic and oil companies http://www.iagc.org/public/gom/list.htm . Additional details on sperm whales, based in part from SWSS studies, may be found at http://www.whoi.edu/institutes/oli/activities/whalelecture.html

Text prepared by Dr. William Lang (MMS) with contributions from Sarah Tsoflias (MMS) and Dagmar Fertl (GeoMarine). Special thanks to Dr. Douglas Biggs (Texas A&M), Carrie Hubard (NMFS), Dr. Jonathan Gordon (St. Andrews U.), Dr. Keith Mullin (NMFS), Caryn Whatley Lang (Tulane University), and Dr. Bernd Würsig (Texas A&M) for reviews and comment. Thanks also to Carol Roden (MMS), Wayne Hoggard (NMFS), Carrie Hubard (NMFS), Keith Mullin (NMFS), and Paul Sutherland (Other World Images,www.sutherlandimages.com) for use of photographs.

RV Gordon Gunter on SWAMP cruise NOAA

RV Gyre on SWSS cruise Jonathan Gordon