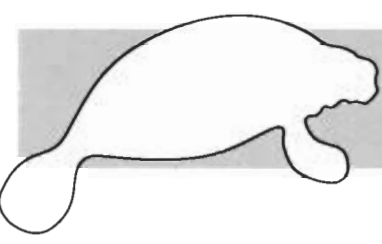


Manatees

AN EDUCATOR'S GUIDE





Florida Manatee Fast Facts

KINGDOM: *Animalia*

PHYLUM: *Chordata*

CLASS: *Mammalia*

ORDER: *Sirenia*

FAMILY: *Trichechidae*

GENUS: *Trichechus*

SPECIES: *Manatus*

SUBSPECIES: *Latirostris*

DESCRIPTION: West Indian manatees are large, gray aquatic mammals with whale-like bodies that taper to a flat, paddle-shaped tail. They have two forelimbs, called flippers, with three to four nails. Their head and face are wrinkled with whiskers on the snout.

SIZE: The average adult manatee is about three meters (9.8 feet) long and weighs between 362–544 kilograms (800–1,200 pounds).

BEHAVIOR: Manatees are passive, slow-moving animals. Most of their time is spent eating, resting and traveling. Manatees are often shy and reclusive.

SIGHT: Manatees can distinguish between different-sized objects, colors and patterns and have been known to respond to visual cues from distances of up to 35 meters (115 feet) away.

HEARING: Anatomically, manatees have large ear bones and have a good sense of hearing. However, their optimal hearing is most likely in the higher frequency range.

COMMUNICATION: Manatees make sounds that can be described as chirps, whistles or squeaks.

Most communication appears to be between mothers and calves.

HABITAT: Manatees are found in shallow, slow-moving rivers, estuaries, saltwater bays, canals and coastal areas, particularly where seagrass beds or freshwater vegetation flourish.

RANGE: West Indian manatees are found throughout the wider Caribbean basin and within the southeastern United States. Florida manatees are concentrated in Florida in the winter but can be found as far west as Texas and as far north as Virginia in the summer.

FOOD: Manatees are herbivores. They eat aquatic plants and can consume about 10–15% of their body weight in vegetation daily.

RELATED SPECIES: The West Indian manatee belongs to the scientific order Sirenia and the Florida manatee is a subspecies of the West Indian manatee. Other sirenians include the Amazonian manatee, dugong, Steller's sea cow (extinct), and West African manatee.

REPRODUCTION: As with most large mammals, manatees have a low reproductive rate. Female manatees are not sexually mature until they are about five years old, and males are mature at approximately nine years of age. On average, one calf is born every two to five years, and twins are rare.

MORTALITY: Many manatee mortalities are human-related. Most human-related manatee mortalities

in Florida are caused by watercraft collisions. Manatees are also crushed and/or drowned in canal locks and flood control structures. They can accidentally ingest fishhooks, litter and fishing line or become entangled in crab trap lines. Manatees can also die from natural causes such as cold-related disease, gastrointestinal disease and pneumonia.

LEGAL PROTECTION: Manatees in Florida are protected under two federal laws: The Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Manatees are also protected by the Florida Manatee Sanctuary Act of 1978.

CONSERVATION: The *Florida Manatee Recovery Plan* is coordinated by the U.S. Fish and Wildlife Service and sets forth a list of tasks geared toward recovering manatees from their current endangered status. These tasks include: the development of site-specific boat speed zones for manatee protection, implementation of management plans, posting of regulatory speed signs, levying fines for excessive speed in designated areas, public acquisition of critical habitat, creation of sanctuaries, manatee research, and education and public awareness programs.

If you see an injured, dead, tagged or orphaned manatee, or if you see a manatee being harassed, please call **1-888-404-FWCC (3922)**, **#FWC** on your cellular phone or use **VHF Channel 16** on your marine radio.

Table of Contents

| | Page |
|---|-------------|
| Save the Manatee Club | 2–3 |
| West Indian Manatees: Natural History | 4–5 |
| Sirenians of the World | 6–7 |
| Sirenian Scientific Classification | 8 |
| Aquatic Mammals | 9 |
| Florida Manatee Habitat | 10 |
| The Four Necessary Elements of Habitat | 11 |
| The Hydrologic Cycle | 12 |
| Threats to Manatee Survival | 13–14 |
| Conservation Efforts | 15 |
| Tracking Manatee Movement | 16 |
| Other Manatee Research Programs | 17 |
| It's the Law! | 18 |
| Manatee Protection Tips | 19 |
| Growth Management | 20 |
| Classroom Resources | 21 |
| What You Can Do To Get Involved | 22–23 |
| Classroom Activity Ideas | 24–26 |
| Classroom Activity: Public Opinion Poll | 27 |
| Cooperative Learning Activity: Sirenian Species | 28–29 |
| Manatee Pre/Post Test | 30 |
| Habitat Pre/Post Test | 31 |
| Answer Keys | 32 |
| The Great Mammal Match-Up | 33 |
| Glossary | 34 |
| References | 35 |
| Notes | 36 |

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This is the 6th edition of *Manatees: An Educator's Guide*. The material in this guide is based on information from the following sources: the Florida Department of Environmental Protection, the Florida Fish and Wildlife Conservation Commission, Florida Power & Light Company, the Marine Mammal Commission, Save the Manatee Club, Sea World Orlando, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey, Florida Caribbean Science Center, Sirenia Project.

Special thanks to Patti Thompson and Judith Vallee, Save the Manatee Club; Dr. Daryl Domning, Howard University; and Dr. Daniel Odell, Sea World Orlando, for reviewing this updated version of the educator's guide. In addition, special thanks to Alice Bamberger, Chris Taylor and Carrie Grant-Snyder from the University of Central Florida College of Education for reviewing the classroom resources section of the guide. Thanks also to the Caribbean Conservation Corporation for activity ideas and format used in the classroom resources section of the guide.

The front cover photo features a Crystal River manatee with boat propeller scars. Special thanks to David R. and Theresa L. Schrichte for their donation of the image. Special thanks also to Robert Ratner and to the U.S. Geological Survey, Florida Caribbean Science Center, Sirenia Project for the donation of photos for the back cover.

Note: An eight-page insert and the four-color poster, *Sirenians of the World*, should accompany this guide.

Text and artwork may be copied for educational purposes only and must include reference to Save the Manatee Club as the source.



Save the Manatee® Club

Save the Manatee Club (SMC) was founded in 1981 by former Florida Governor Bob Graham (now a U.S. Senator) and singer/songwriter Jimmy Buffett. The Club was started with the mission to protect endangered manatees and their habitat. Today, SMC is the world's leading manatee conservation organization.

SMC is a membership-based, national nonprofit organization that is funded primarily by the Adopt-A-Manatee program. Funds from the adoption program go toward public awareness and education programs, manatee research, rescue and rehabilitation efforts, and advocacy and legal action to ensure better protection for manatees and their habitat.

The following information is a description of SMC major accomplishments and current programs.

Public Awareness Programs

Each year, SMC sends out press releases on manatee issues to local, state and national media. Jimmy Buffett also records public service announcements that are distributed to radio and television stations throughout the United States. SMC staff handle many requests for manatee information, and the Club maintains a toll-free telephone number for this purpose. In addition, SMC maintains a Web site on the Internet, and SMC staff answer e-mail questions about manatees from the public.

SMC also produces public awareness waterway signs that alert boaters to the presence of manatees.

The signs are distributed free to Florida shoreline property owners through Florida Fish and Wildlife Conservation Commission offices. Additionally, SMC produces waterproof decals for boats that have tips on how to reduce manatee injury and death. In conjunction with the U.S. Fish and Wildlife Service (USFWS) and the Florida Audubon Society, SMC has produced brochures highlighting the problems associated with feeding manatees. All three of the above projects have been funded in part by the Disney Wildlife Conservation Fund.

In addition, SMC has created a brochure with manatee protection tips for divers, swimmers and boaters with support from the Professional Association of Diving Instructors (PADI) and the USFWS. SMC and the Army Corps of Engineers produced a brochure with tips for boaters to help reduce manatee mortalities at Florida's canal lock structures. SMC also produces outdoor signs discussing the problems of feeding, touching and giving manatees water that have also been distributed at manatee viewing areas throughout Florida.

Recently, SMC started programs in Broward County and the Florida Keys to recycle monofilament fishing line and to educate the public about the dangers of discarded line to manatees and other wildlife.

Education Programs

SMC provides free manatee education packets and staff interviews for students. An educator's guide,

four-color poster, and coloring and activity book are distributed free to educators across the U.S. and internationally. In addition, SMC has produced a video titled *Manatee Messages: What You Can Do!* The video has been distributed free to schools, libraries, state parks and environmental education centers throughout Florida. The Club also offers free in-service programs to educators throughout Florida and provides volunteer speakers to schools and civic groups in Florida and select areas across the U.S. In addition, SMC staff work with local governments in Florida on manatee education and public awareness initiatives.

International Activities

SMC has funded studies of manatees in Costa Rica, Guatemala and Mexico. SMC also funded a tracking program of manatees in Belize and a program to educate villagers in Nicaragua. SMC has given funds to the Caribbean Stranding Network in Puerto Rico to care for orphaned manatees. SMC has also provided health assessment support for manatees in Belize, Colombia, Venezuela, Jamaica and Mexico. SMC provided supplementary food for three captive manatees in Jamaica and is currently working on a plan for their release. Club funds also helped to monitor a Florida manatee in the Bahamas. The Club has produced educational materials that have been distributed in South America and the Wider Caribbean, and SMC staff are currently working on an international edition of the educator's guide that

will also be funded by the Disney Wildlife Conservation Fund. In addition, SMC staff have been appointed to the I.U.C.N. – World Conservation Union.

Research Studies

SMC has provided funds for equipment used in manatee research such as computers, cameras, diving gear, canoes, two-way radios, sanctuary buoys and radar equipment. The Club has also assisted state and federal governments with research projects such as aerial surveys, sea-grass studies, telemetry studies, manatee photo identification projects, population modeling and the compilation of over two decades of research data on the Blue Spring manatee population in Florida. The Club has also funded physiological studies and has provided funds for a manatee tagging program in southern Georgia. In addition, the Club coordinates a volunteer manatee sighting network.

Rescue and Rehabilitation Funding

SMC has provided funds for equipment used in manatee rescue and rehabilitation efforts, including nets, an isolation pool, a manatee care building and diving equipment. SMC also helped fund a USFWS project to help re-acclimate manatees to the wild and donated funds to help build a shelter for injured manatees awaiting transport in the Florida Keys. The Club also provides funding for manatee rescue organizations both in and outside of Florida. In 1996, SMC contributed funding for equipment, aerial surveys and manatee care and feeding during the red tide epizootic in southwest Florida. In addition, SMC has donated seven boats and trailers to various agencies and organizations for manatee rescue and research purposes.



Jimmy Buffett, at far left, and former Florida Governor Bob Graham, far right, (now a U.S. Senator) announce the formation of the Save the Manatee Committee at a press event in 1981. (Photo by Richard Wells, Orlando Sentinel Star)

Conservation and Advocacy Programs

SMC has been part of the U.S. Manatee Recovery Team and has participated in drafting and revising the *Florida Manatee Recovery Plan*. Club staff also serve on the state of Florida's Manatee Technical Advisory Council and make recommendations on many state and local task forces. In addition, SMC staff have reviewed plans, made recommendations and lobbied to implement manatee protection in Florida's "key" manatee counties. SMC has provided comments on permit applications for marine events and coastal development. SMC staff address manatee issues before Florida's Governor and Cabinet and state and federal regulatory agency heads. In addition, SMC continues to lobby for a strong federal Endangered Species Act and Marine Mammal Protection Act.

As necessary, SMC also files legal challenges against projects that may have adverse effects on manatees and their habitat. SMC intervenes on the state's behalf when a boat speed rule is challenged. SMC has also challenged state and federal

programs that were not strong enough to ensure adequate manatee protection and reached landmark agreements that will result in additional manatee protection measures. Through SMC's efforts, these agreements will include the adoption of boat speed zones and manatee safe havens and the inclusion of important conservation measures as part of coastal development projects in Florida.



For more information on manatees or the Adopt-A-Manatee program, contact:
Save the Manatee Club
500 N. Maitland Ave.
Maitland, FL 32751
1-800-432-JOIN (5646).

To obtain more manatee information and current links to other manatee information sites on the Internet, visit the SMC Web site at:
www.savethemanatee.org

West Indian Manatees: Natural History

Description

West Indian manatees are large, gray aquatic mammals. Their whale-like body tapers to a flat, paddle-shaped tail. They have two forelimbs, called flippers, on their upper body and no hind limbs. Sparse hair is found on their entire body. Their head and face are wrinkled, and their snout has stiff whiskers. The manatee's closest land relatives are the elephant and the hyrax, a small, gopher-sized mammal.

Adult manatees have been known to exceed lengths of nearly four meters (13 feet) and weigh over 1,587 kilograms (3,500 pounds); however, this is quite above average. The average adult manatee is about three meters (9.8 feet) long and weighs between 362–544 kilograms (800–1,200 pounds). At birth, manatees are about one meter (between 3–4 feet) long and weigh between 27–31 kilograms (60–70 pounds).

Anatomy and Physiology

In spite of their size, manatees have relatively little body fat. They are herbivores (plant eaters), so their metabolic rate is low compared with carnivorous (flesh-eating) aquatic mammals. These factors may account, in part, for their susceptibility to cold temperatures. Generally, temperatures below 20° C (68° F) are considered too cold and are potentially lethal to manatees.

A large percentage of the manatee's body is taken up by the digestive (gut) tract, which includes the stomach and intestines. The plants that manatees eat have a low nutritional value, so they make up for that by eating large quantities of them. Gut microorganisms also help in digestion.

Both the lungs and the diaphragm of a manatee extend the length of the body cavity and so are oriented in the same horizontal plane as the manatee in the water. An unusual anatomical feature of manatees is that each lung is in a separate cavity. Instead of one diaphragm like people, manatees have separate "hemi-diaphragms." Besides breathing, the lungs help the manatee with buoyancy control. Manatees replace a large percentage of air in their lungs with each breath and can therefore prolong intervals between breaths. In fact, studies have shown that manatees can renew about 90% of the air in their lungs in a single breath as compared to humans who renew about 10% (Pabst, Rommel and McLellan in Reynolds and Rommel 1999).

One of the most interesting things about manatees is that they keep replacing their teeth as long as they live. Except for the first three teeth to erupt in each row, all of their teeth are molars. Their teeth are unique because they are constantly replaced. New teeth form at the back of the jaw, wear down as they move forward, and eventually fall out (Domning and Hayek 1986). This constant tooth replacement is an adaptation to the manatee's diet, which often includes abrasive plants that are mixed with sand.

Surprisingly, manatees have fairly good visual acuity and can distinguish between different-sized objects, colors and patterns (Reynolds and Odell 1991). Their eyes are small, and they have a nictitating membrane that can be drawn across the eyeball for protection.

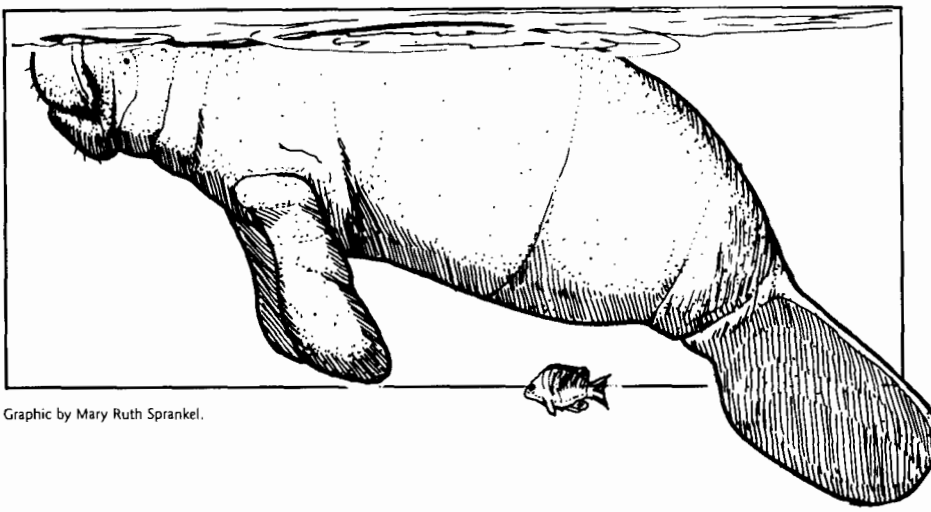
On the whole, however, the sensory systems of manatees have not been well studied. Anatomically,

manatees have extremely large ear bones and may have a good sense of hearing (Bullock et al. 1982). They emit sounds underwater that are used in communicating with one another. These sounds can be described as chirps, whistles or squeaks. It is not believed that they are used for navigational purposes. Vocalizations may express "fear," "anger" or sexual arousal. They are also used to maintain contact, especially when manatees are feeding or traveling in turbid water. Most common are vocalizations between mothers and calves. A mother and calf once separated by a flood gate vocalized constantly for three hours until reunited (Reynolds 1981).

Adult manatees move through the water primarily by the up-and-down movements of the tail. The front flippers, which have three to four nails, are used for steering, lateral movement or crawling over the water bottom and also for putting food into the mouth. Manatees with missing or damaged tails rely more heavily on their flippers for locomotion.

Behavior

Manatees spend approximately six to eight hours a day feeding (Reynolds and Odell 1991) and rest approximately two to twelve hours a day (Lefebvre and Frohlich 1986). They graze for food along the water bottom and on the surface of the water. They may rest submerged at the bottom or just below the surface of the water, coming up to breathe on an average of every three to five minutes. Intervals between breaths depend upon activity level. When manatees are using a great deal of energy, they may surface to breathe as often as every 30 seconds. When



Graphic by Mary Ruth Sprankel.

Trichechus Trivia

- A manatee's age can be determined by the annual growth rings in its ear bones.
- Of all the mammals in the world, manatees and sloths are the only mammals with six cervical (neck) vertebrae. All other mammals (even giraffes!) have seven cervical vertebrae.
- Manatees don't necessarily have daily routines or cycles. In general, they will feed, rest or travel at any time of the night or day.
- Newborn manatee calves are capable of swimming to the surface on their own and vocalize at or soon after birth.
- Scientists don't know what cues manatees follow, but they seem to know when cold weather is coming and seek warm water areas.
- A manatee cannot turn its head sideways, so it must turn its whole body around.
- Water conducts heat away from the body of a mammal up to 25 times faster than does air.
- Manatees do not have eyelashes.
- A manatee can move one side of its lip pads independently of the other side.
- Flatulence is common in manatees.
- Manatees sometimes groan when they stretch.

resting, manatees have been known to stay submerged for up to 20 minutes.

Manatees are agile and have been observed in loosely organized, playful activities such as bodysurfing (Reynolds 1981). They are not territorial animals. Because manatees have evolved with few natural enemies, they have not needed the protection or cooperation of a herd. Consequently, they are semi-social, somewhat solitary animals. They sometimes gather in small, informal groups, but they have no leader or real herd structure. Manatee aggregations (gatherings) are largely due to common habitat requirements such as warm water, fresh water or food sources.

Breeding and Reproduction

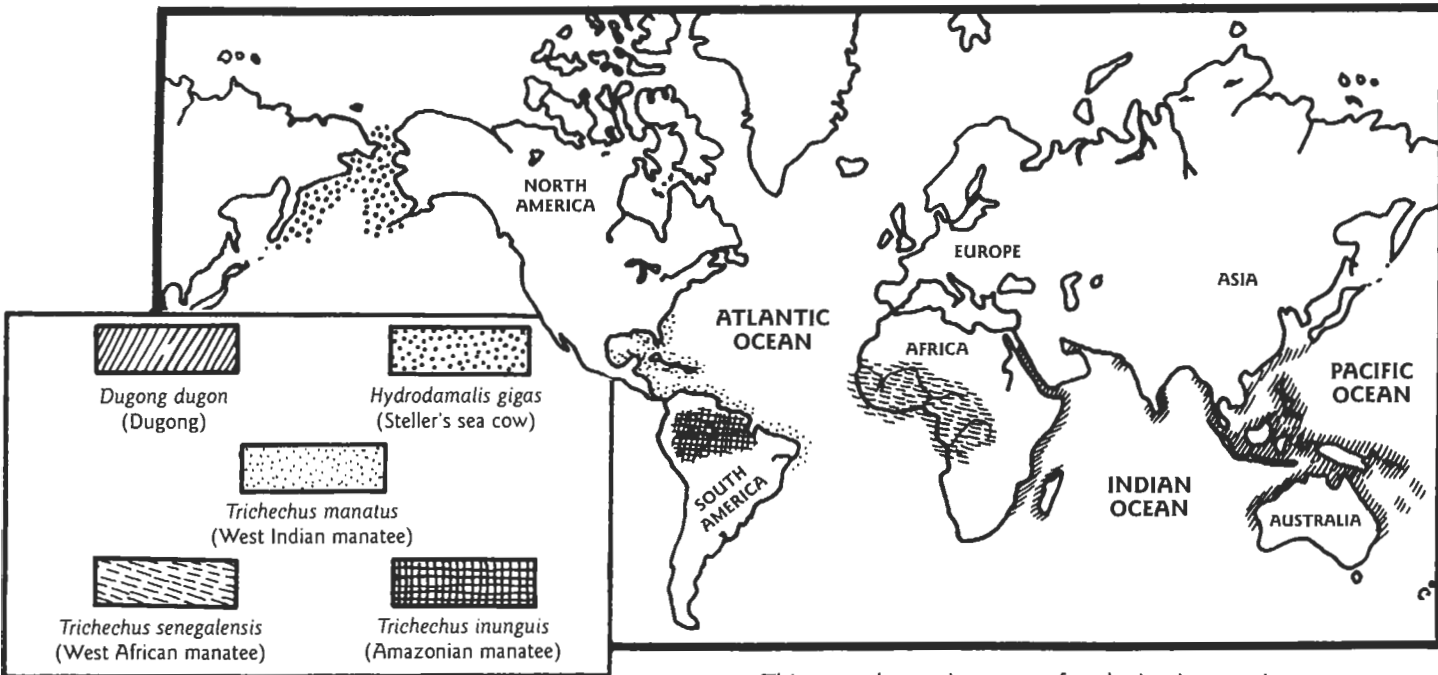
Manatees do not form permanent pair bonds like some animal species. During breeding, a single female, or cow, will be followed by a group of a dozen or more males or bulls, forming a mating herd. They appear to breed indiscriminately during this time; however, age experience of some males in the herd probably plays a role in breeding success. Although breeding and birth may occur at any time during the year, there appears to be a broad spring-summer calving peak.

The reproductive rate for manatees is low. Female manatees are not

sexually mature until about five years of age. Males are mature at approximately nine years of age, although some males mature earlier. On average, one calf is born every two to five years; twins are rare. Intervals between births range from two to five years. A two-year interval may occur when a cow loses a calf soon after birth. The gestation period is about a year. Males assume no responsibility for raising the calf. Mothers nurse their young for one to two years, so a calf may remain dependent on its mother during that time. Calves nurse underwater from teats located behind the mother's flippers and begin to eat plants a few weeks after birth.

Manatees are probably capable of living long lives. In fact, it is thought that they can live 60 years or more. One manatee living in captivity is now over 50 years old. Because of the many perils in the wild, however, longevity is uncertain. In particular, recent research conducted at the Florida Fish and Wildlife Conservation Commission's Florida Marine Research Institute shows cause for concern. This research revealed that few manatees were living past the age of 30 and the majority of animals died between the age of 0 and 10 years – nowhere near their estimated life expectancy of 60 years (Bolen 1998; Bolen et. al. 1999).

Sirenians of the World



This map shows the range of each sirenian species.

Manatees and dugongs belong to the scientific order Sirenia. In ancient mythology, “siren” was a term used for monsters or sea nymphs who lured sailors and their

ships to treacherous rocks and shipwreck with mesmerizing songs. Throughout history, sailors sometimes thought they were seeing mermaids when they were probably seeing manatees or dugongs. With

a little imagination, manatees have an uncanny resemblance to human form that could only increase after long months at sea. In fact, manatees and dugongs may have helped to perpetuate the myth of mermaids.

Outside of Florida, not much is known about the population of West Indian manatees or other sirenians in the world. By far, the largest population of West Indian manatees is found in the United States, primarily in Florida. Elsewhere, they are found in small population pockets throughout their range. All sirenian species in the world are listed as endangered.

Members of the extant order Sirenia are found in aquatic habitats throughout the tropics and subtropics. Sirenians are the only completely aquatic mammals that are herbivores. Because of their herbivorous nature, all sirenians are found in relatively shallow waters where sunlight can penetrate and stimulate plant growth.



Graphics by Mary Ruth Sprankel.

Sirenians of the World

Family: *Trichechidae*

WEST INDIAN MANATEE

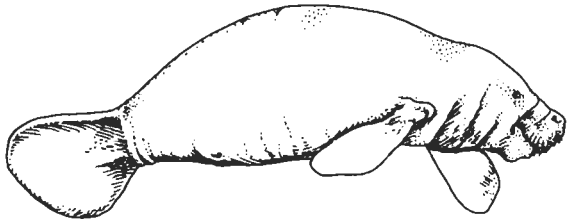
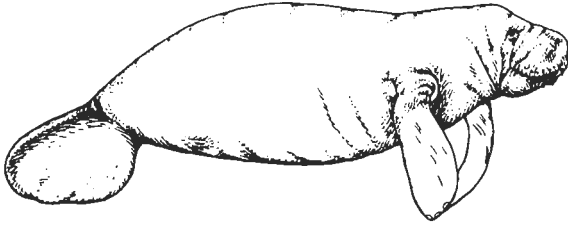
Trichechus manatus

Subspecies:

Trichechus manatus latirostris (Florida manatee)

Trichechus manatus manatus (Antillean manatee)

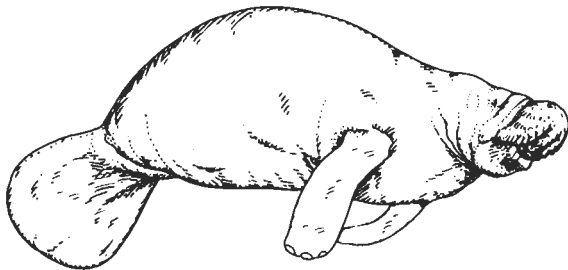
Florida manatees are found in the southeastern United States, mostly in Florida. Antillean manatees are found in the coastal and inland waterways of eastern Mexico, Central America, the Greater Antilles, and along the northern and eastern coasts of South America. Both Florida manatees and Antillean manatees can be found in salt, fresh or brackish waters and feed on marine, estuarine and freshwater vegetation.



AMAZONIAN MANATEE

Trichechus inunguis

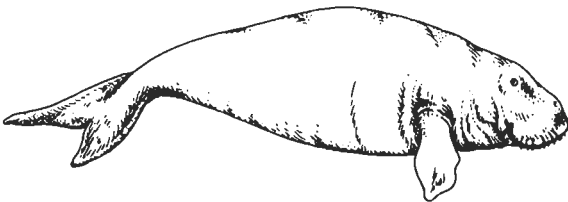
Amazonian manatees are found in the waters of the Amazon River and its tributaries in South America. The smallest member of the family *Trichechidae*, the Amazonian manatee has smooth skin and no nails on its flippers and feeds on freshwater vegetation.



WEST AFRICAN MANATEE

Trichechus senegalensis

The West African manatee is very similar in size and appearance to the West Indian manatee and lives in similar habitat. West African manatees are found in West African coastal areas, but little is known about this species because they have not been widely studied.



Family: *Dugongidae*

DUGONG

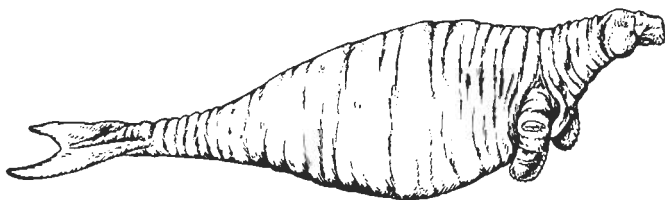
Dugong dugon

Dugongs are found in the Indo-Pacific region of the world. They have smooth skin and a notched tail fluke. They feed on seagrasses and are hunted for food by humans. Dugongs have tusks, but these tusks characteristically erupt through the gums only in males and normally remain unerupted in female dugongs.

STELLER'S SEA COW

Hydrodamalis gigas

At one time, the Steller's sea cow was found in the cold waters of the Bering Sea, but it was hunted to extinction within 27 years of its discovery in 1741. The largest sirenian on record, the Steller's sea cow grew up to nine meters (30 feet) in length and weighed around four metric tons (approximately 4.4 tons).



Adapted from original graphics by Mary Ruth Sprankel. Graphics not to scale.

Sirenian Scientific Classification

KINGDOM: *Animalia*

PHYLUM: *Chordata*

CLASS: *Mammalia*

Mammals breathe air, nurse their young, have backbones, are warm-blooded and have body hair at some stage of their development. Manatees and dugongs are aquatic mammals. They have a body shape similar to that of whales and seals, even though they are not closely related. Whales and dolphins belong to the scientific order Cetacea. Seals, sea lions and walruses (referred to collectively as "pinnipeds") belong to the order Carnivora.

ORDER: *Sirenia*

The Order Sirenia includes all manatees and dugongs. All sirenians are herbivores. They have long, streamlined bodies with no distinct neck. They have flippers and a tail that they use for movement. The bones of a sirenian are solid and heavy. Most of the bones, especially the ribs, contain no marrow. However, marrow is found in the vertebrae and in the sternum. In addition, the size of a sirenian's brain is considered small in relation to their large body size.

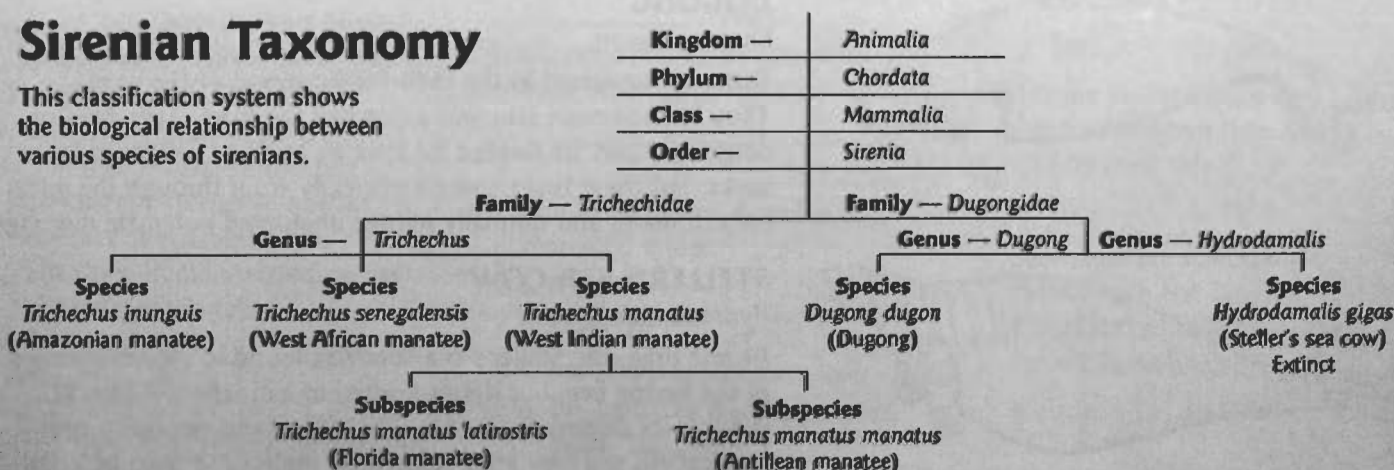
FAMILY: *Trichechidae or Dugongidae*

Manatees and dugongs fall into two families. The Family Trichechidae includes West Indian, Amazonian and West African manatees. The Family Dugongidae includes dugongs and the extinct Steller's sea cow, so the dugong is the only living member of the Family Dugongidae.

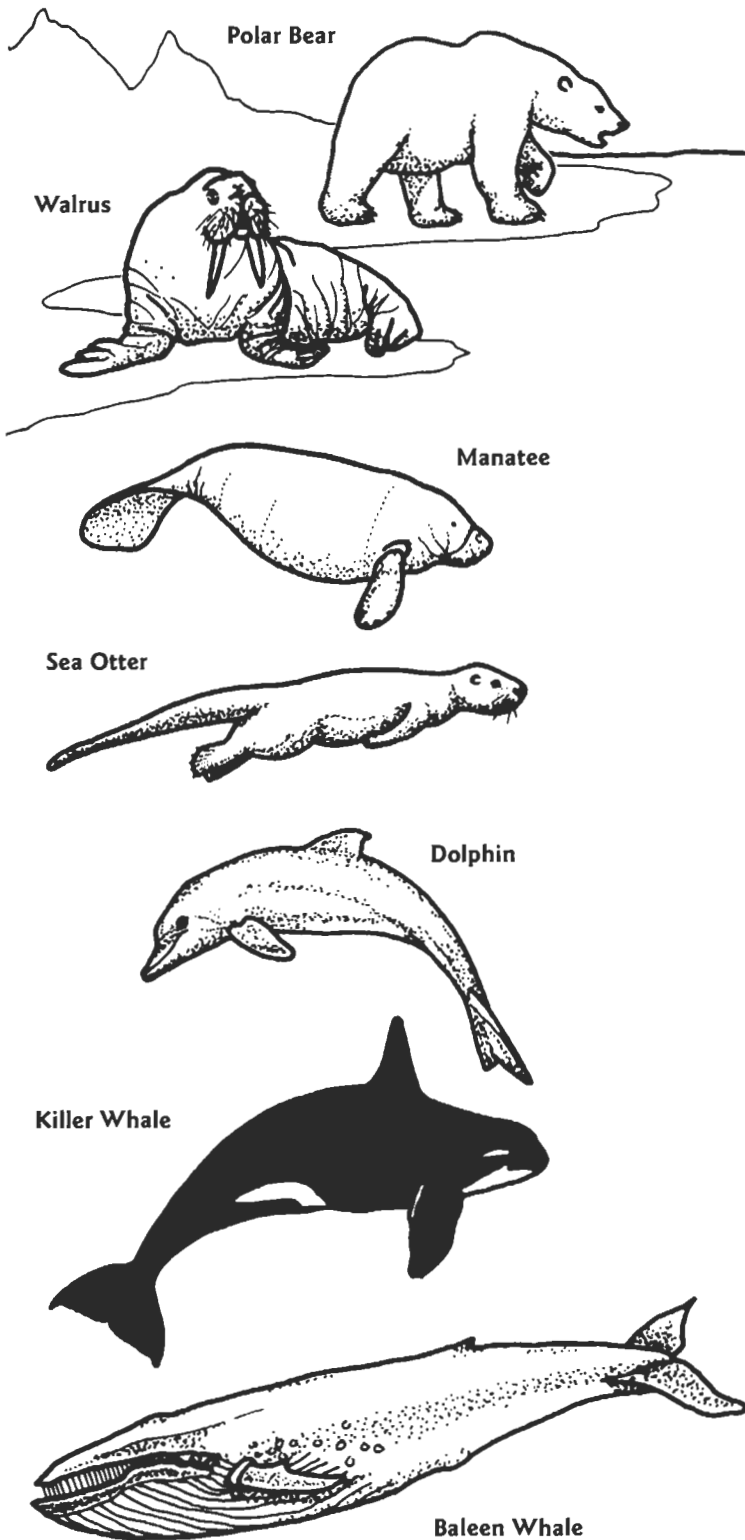
GENUS and SPECIES: Family Trichechidae and Family Dugongidae encompass two existing genera (*Trichechus* and *Dugong*). The genus *Trichechus* includes the Amazonian manatee, the West African manatee and the West Indian manatee. In addition, the West Indian manatee is divided into two subspecies: the Florida manatee and the Antillean manatee, which is found in the coastal and inland waterways of Central America, along the northern coast and eastern coasts of South America, and in spotty populations throughout the wider Caribbean basin. Recent genetic studies using mitochondrial DNA suggest that Florida manatees are descended from Antillean manatees that crossed the Florida Straits from Cuba or the other Greater Antilles (Garcia-Rodriguez et al. 1998). Future studies of nuclear DNA will shed light on pedigree fingerprinting, phylogeography and population status.

Sirenian Taxonomy

This classification system shows the biological relationship between various species of sirenians.



Aquatic Mammals



Aquatic mammals are specially adapted animals that live totally or partially in the water. They are found in either marine or fresh water. Some aquatic mammals, like manatees, can live in both.

Aquatic mammals are highly adapted to live in aquatic environments. Their streamlined bodies facilitate swimming. Some have layers of body fat, or blubber, to provide insulation against low water temperatures. Other adaptations help them to see, breathe and navigate in the water.

Though aquatic mammals have much in common because of their physical structure and aquatic habitat, each is adapted to its own particular lifestyle and niche. Aquatic mammals that live in cold areas or deep water have developed better insulation than manatees require in their tropical home. Predators or carnivores such as the polar bear and killer whale must have speed, strength and weapons such as sharp, biting teeth or claws to catch and kill prey. The manatee's vegetarian diet requires grinding molars and less proficient swimming ability.

Sirenians and cetaceans (whales and dolphins) never leave the water during their lifetime. Calves are born and nursed in the water. Breeding, resting and feeding are all done in the water, too. Some aquatic mammals – seals and polar bears for instance – go ashore to breed and raise their young, returning to the ocean to feed. Aquatic mammals must surface to breathe air. In fact, some whales and seals must dive to great depths to find food, so their breath-holding capacity must be greater. Manatees find food in shallow water, so they do not share this characteristic with whales. Many dolphins, like the bottlenose dolphin, are shallow divers.

Although all aquatic mammals share some common characteristics and problems, each is unique and occupies a special niche in the aquatic environment.

Graphics by Mary Ruth Sprankel. Graphics not to scale.

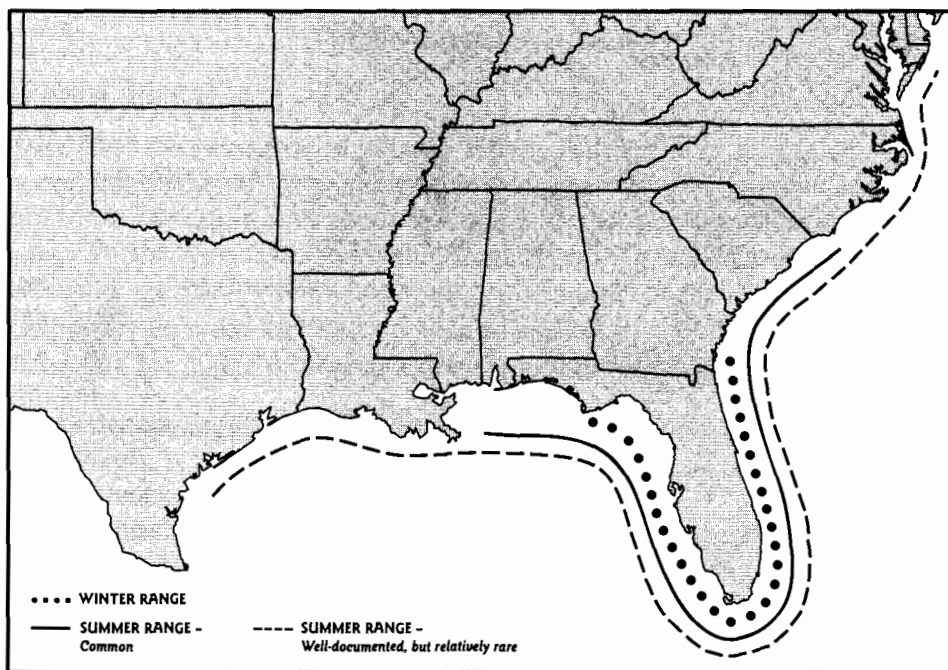
Florida Manatee: Habitat

Florida manatees are found in shallow, slow-moving rivers, bays, estuaries and coastal water ecosystems of the southeastern United States. They can live in fresh, brackish or salt water. Manatees prefer waters that are about one to two meters (3–7 feet) deep. Along the coast, manatees tend to travel in water that is about three to five meters (10–16 feet) deep, and they are rarely seen in areas over six meters (20 feet) deep. This habitat provides them with sheltered living and breeding

Food for Thought

Many manatee feeding areas are particularly vulnerable to destruction by dredge and fill activities, a method for deepening streams, swamps or coastal waters by excavating solids from the bottom and depositing the resulting mud (spoil) elsewhere. Sometimes, the purpose of dredging is to create new uplands with the spoil material. Surface water run-off from nearby construction sites or agricultural lands, as well as herbicide spraying, can also harm or destroy seagrass beds. An increasingly common cause of seagrass bed destruction is called "prop scarring," which frequently occurs when a boat's propeller tears and cuts up the roots, stems and leaves of seagrass.

While coastal and estuarine vegetation has declined in many areas, quite another problem is occurring in Florida's freshwater bodies. In recent years, the state has experienced an influx of exotic species. Although these plants may be a nuisance to navigation, in some areas they are the main food source available for manatees.



Range of the Florida manatee.

areas, a steady, easily obtainable food supply and warm water – all of which they need to survive.

Range

Florida manatees are somewhat migratory. In the winter, usually November through March, the manatee population is concentrated primarily in Florida. Water temperatures below 21° C (70° F) usually cause manatees to move into warm refuge areas. Manatees are susceptible to cold-related disease, and they congregate near natural springs or warm water effluents of power plants.

In the summer months, manatees are much more widely distributed. They travel freely around Florida's rivers and coastal waters. A few manatees may range as far west as Texas and as far north as Virginia (one manatee was even documented in Rhode Island), but these sightings are rare. Summer sightings in Alabama, Georgia and South Carolina are relatively common.

Food

Manatees are herbivores, feeding on a large variety of submerged, emergent and floating plants. Manatees can eat 10–15% of their body weight in vegetation daily. A 453-kilogram (1,000-pound) manatee, for example, would probably eat between 45–68 kilograms (100–150 pounds) of food a day. Seagrass beds and freshwater submerged aquatic vegetation are important food sources for manatees. Listed below are some main types of marine and freshwater vegetation in Florida that they prefer to eat:

Marine Vegetation

- *Syringodium filiforme*/Manatee grass
- *Thalassia testudinum*/Turtle grass
- *Halodule wrightii*/Shoal grass
- *Ruppia maritima*/Widgeon grass

Freshwater Vegetation

- *Hydrilla verticillata*/Hydrilla*
- *Vallisneria neotropicalis*/Tapegrass, Eelgrass
- *Eichhornia crassipes*/Water hyacinth*
- *Pistia stratiotes*/Water lettuce

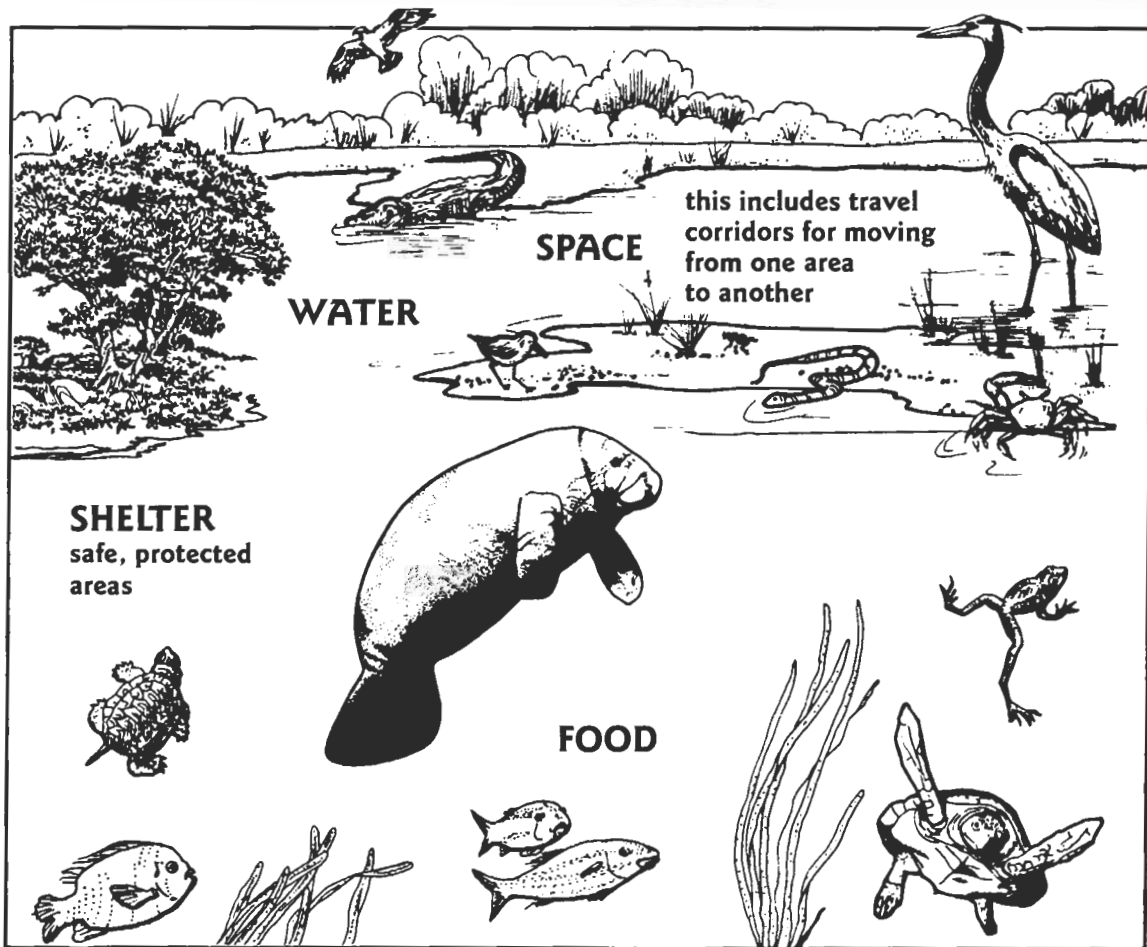
*Non-native, or exotic, vegetation

The Four Necessary Elements of Habitat

Suitable habitat for manatees must provide four basic elements: food, water, space and shelter.

Food: Considering the amount of food that manatees eat, suitable habitat must provide an abundance of aquatic plants to sustain the manatees using the area.

Fresh Water: Manatee intake of water occurs while eating aquatic plants as well as actively drinking. Research suggests that manatees in salt water can go without drinking fresh water for extended periods. This may explain why manatees can go so easily from freshwater to marine environments. It also means that people do not need to give manatees water from hoses. Manatees can take care of



Graphic by Mary Ruth Sprankel.

their own fresh water needs.
Space: Manatees require space to move about. They are migratory and the space (range) they require is influenced by seasonal change.

Travel corridors, or passageways, are necessary for manatees to move back and forth between summer and winter habitats or between feeding and resting or calving areas. It has been documented that many manatees have preferred habitats they return to each year.

Shelter: Manatees must have safe, protected areas away from harassment, boat traffic and strong current. Shelter continues to become harder and harder for manatees to find. As a result, manatees are using less favorable habitat where high boat traffic and harassment occur. Such conditions may account for a large portion of human-related mortality.

Sharing Space

Manatees share their habitat with many living things. It is not uncommon, for example, to see a manatee swimming near a tarpon, resting next to a sea turtle or surfacing beside a brown pelican in a marine environment. Sharks, rays, snook, snapper, flounder and oysters are found in the manatee's marine environment as well. However, manatees are also found in fresh water. In the manatee's freshwater habitat, you can find river otters and fish such as largemouth bass, sheepshead, gar and bluegills. You can also find freshwater turtles and frogs. Freshwater invertebrates would include snails, mollusks and insects. Some species that are found in both freshwater and marine environments include ospreys, bald eagles, alligators, herons, egrets and snakes.

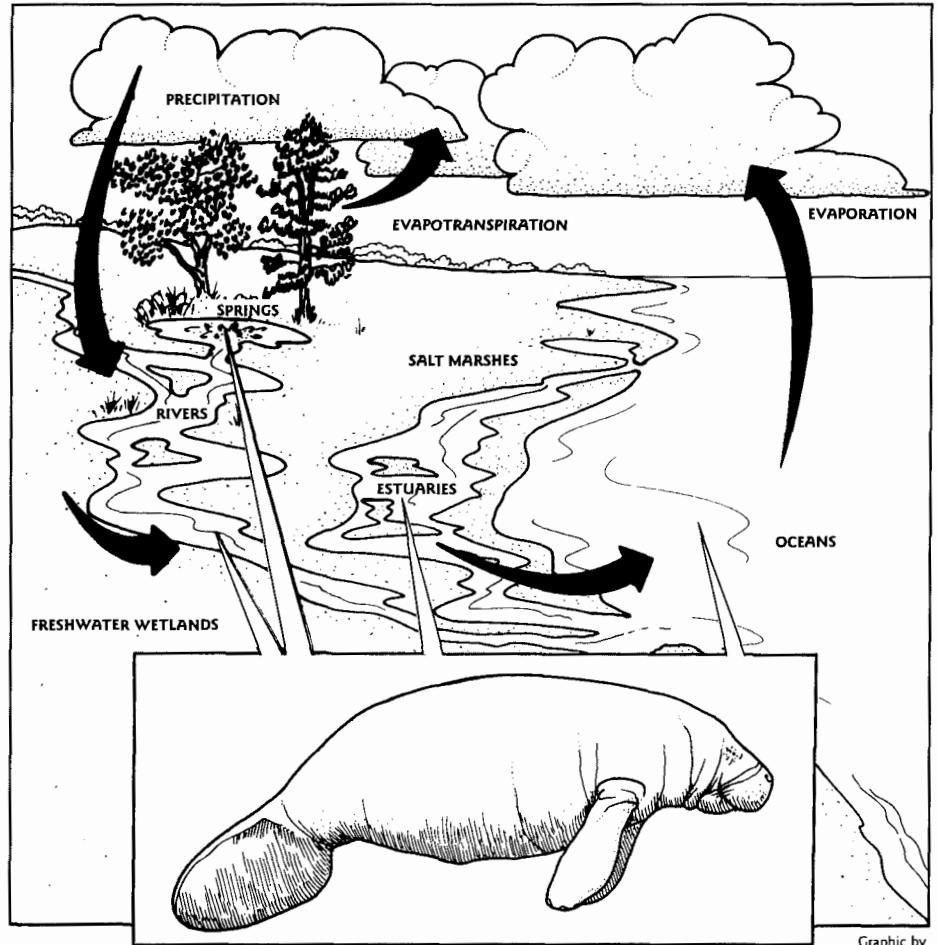
The Hydrologic Cycle

If manatees are to be protected, their habitat must also be preserved. Manatees, humans, and all forms of life are dependent on water. In Florida, it is imperative to understand the importance of water – where it originates and where it goes. The quality and quantity of our water supply affects both our health and the health of manatees as well.

Water covers three quarters of the earth's surface and much of Florida's surface area. All water on the planet is part of the hydrologic cycle and is constantly circulating from one part of the system to another in finite amounts. In other words, what we have is what we get!

Water is found in many forms – solid, liquid and gas – and in many bodies such as oceans, bays, estuaries, rivers, springs, lakes, wetlands and aquifers. Surface water evaporates. It is carried through the earth's atmosphere as vapor, and then it falls as precipitation. Precipitation, or rain, that falls over land can become runoff and eventually flows into lakes, rivers or wetland areas. Some precipitation percolates into the ground to replenish the aquifers. Water is absorbed by plants, which in turn give some water back to the atmosphere from the surface of their leaves. This recycling is called transpiration. Much of Florida's groundwater is stored in aquifers, which provide most of Florida's drinking water. Sometimes groundwater flows underground to an opening in the substrate and becomes a natural upwelling or spring.

Florida has about 320 known springs. Several of the larger springs accessible to manatees are havens in winter months because the water



Graphic by
Mary Ruth Sprankel.

temperature of springs is relatively constant throughout the year, averaging about 22° C (72° F). When surrounding river waters chill, manatees move into these springs to keep warm. Springs serve as refuges for manatees and as important indicators of the health of hydrologic conditions.

Much of Florida's surface area is covered by wetlands. The term "wetlands" describes many different types of aquatic environments, including coastal and inland marshes, ponds, bogs, wooded swamps, bottomland hardwood forests and wet meadows. Wetlands intercept runoff before it reaches rivers and estuaries and are a natural water treatment facility. In many parts of

the state, wetland areas help to prevent salt water intrusion into fresh water supplies, which would make drinking water unpotable. Wetlands remove silt and filter out many pollutants, including harmful chemicals, all of which can pollute manatee habitat and human water supplies. However, if pollutants are concentrated in high levels, wetlands can be altered or destroyed and their usefulness diminished or eliminated entirely.

Manatees move through a variety of aquatic habitats in Florida and are dependent on the health of these aquatic ecosystems as well as the integrity of the hydrologic cycle. All life forms on earth are similarly dependent to various degrees.

Threats to Manatee Survival

Over the years, researchers have attempted to identify and quantify West Indian manatee distribution, population size and causes of mortality in order to understand manatees and the threats to their survival. They have isolated several causes of manatee deaths, most of which are directly related to human contact or encroachment. If these sources of mortality are not controlled, manatees may become extinct.

Natural Mortality

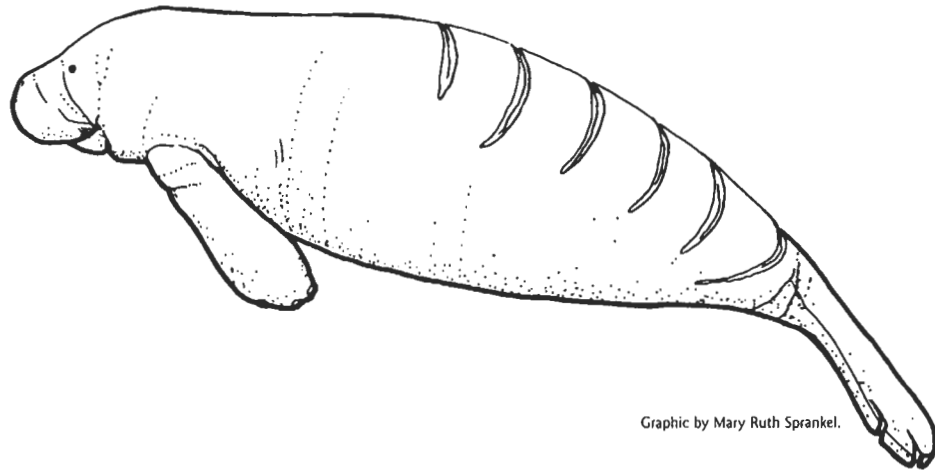
As with all wild animal populations, a certain percentage of manatee mortalities is attributed to natural causes of death such as cold stress, gastrointestinal disease, pneumonia and other diseases.

Cold Weather

During winters in Florida that have been unusually cold, an increase in manatee mortality has been documented. Manatees cannot tolerate temperatures below 20° C (68° F) for long periods of time. Researchers believe that individuals affected by the cold cannot produce enough metabolic heat to make up for heat loss in the environment.

Red Tide

Red tide is a term used for the proliferation or "blooms" of tiny marine organisms called dinoflagellates. The organism's plant pigments can cause the water to appear red, green or yellow. Microscopic, but found in great abundance, these organisms give off a toxic by-product that affects the central nervous system of creatures in the area of the bloom. The toxins accumulate in shellfish or other filter feeders like sea squirts



Graphic by Mary Ruth Sprankel.

ingested by manatees as they feed in surrounding grassbeds. In 1996, outbreaks of red tide in southwest Florida contributed to about 150 manatee deaths. These deaths, however, were not caused by ingestion of the toxin but rather by breathing in a concentrated aerosol form of the toxin found in the supersaturated layer of air just above the water's surface.

Human-Related Mortality

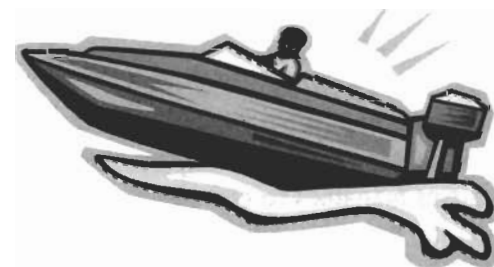
Any species of animal living in the wild will suffer losses from natural causes and can usually overcome those losses. But manatees, as well as many other wild animal populations, must also deal with a high number of additional mortalities from human-related causes. Because human-related manatee deaths are preventable, this area is the most logical place to begin in order to reduce mortalities.

Watercraft Collisions

Watercraft-related manatee mortality is the leading identified cause of manatee death in Florida. West Indian manatees can swim up to 32 kilometers (20 miles) per hour in short bursts, but they usually only swim about three to eight kilometers (three to five miles) per hour.

Because manatees are slow-moving, need to surface to breathe air, and prefer shallow water, they are vulnerable to collisions with boats. Consequently, manatees suffer injury and death due to the crushing impact of the hull and/or slashing of the propellers. In the case of large power vessels and barges moving through shallow waters, manatees may be caught between the vessel and the water bottom, or the vessel and a docking structure, and crushed.

Most worrisome is the fact that watercraft collisions are the leading cause of death of reproductive-age manatees. Large mammals like the manatee that have a long potential life span and a low reproductive rate normally have a low adult mortality rate. Losing reproductive, adult female manatees can be doubly lethal if they are pregnant or have a dependent calf.



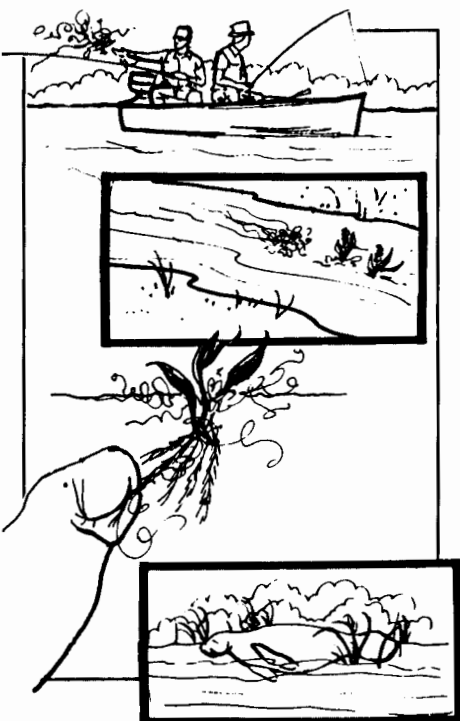
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Pollution

Water pollution can be caused by many of the items we use in our daily lives like pesticides, herbicides and detergents. Storm water runoff and industrial chemicals may poison waterways and food sources that manatees utilize. Oil exploration and possible oil spills are potential threats to all marine and estuarine habitats.

Litter

Debris in the waterway, such as discarded fishing line and hooks, plastic six-pack holders and plastic bags are dangerous to manatees and other forms of wildlife. Entanglement in or ingestion of litter has caused manatee injury and death. Crab trap lines and hoop nets used by commercial fishermen can also cause entanglement problems for manatees.



Graphic by Mary Ruth Sprankel.

Harassment

Harassment refers to any act that causes manatees to change their natural behavior. This can include approaching or chasing manatees. Touching, poking or riding manatees is also considered harassment. In

addition, feeding manatees or giving them water from a hose can also be considered harassment. Harassment can force manatees to leave preferred habitat such as warm water refuges, or it can lead to the separation of a mother and calf – both of which can be life-threatening situations. Feeding manatees or giving them water disrupts the manatee's normal behavior and conditions them to take food or water from people. Because they have become accustomed to humans, some manatees have been harassed or fed dangerous, non-food items.

Flood Control Structures

Manatees can be crushed in closing floodgates and canal locks that are used to protect against salt water intrusion and flooding. This problem is particularly acute in south Florida where there are many water control structures. Manatee deaths from drowning have also occurred when the tremendous suction that is created by water rushing through opening gates pins animals under the water. In recent years, the South Florida Water Management District and the U.S. Army Corps of Engineers have been working to monitor the opening and closing of these structures. They have added prototype mechanical devices and sensors in some locations to reverse gate action when a manatee is detected to prevent this type of death from occurring.

Perinatal (Dependent Calf)

Perinatal, which means "around birth," includes all manatees less than 150 centimeters (about 5 feet) in length. This is not really a "cause of death" category. Instead, it means that the manatee died around the time of birth and was not determined to have died from human-related causes (Manatee Salvage Database). All wild populations

Did You Know That Throwing Fishing Line in Florida Waters is Against the Law?

Manatees are sometimes unintentionally killed or injured by fishing activities. They can drown in nets or die from infection caused by entanglement in crab trap lines, monofilament fishing line or hooks. Sometimes manatees survive but with amputated or mutilated flippers. It is now a second-degree misdemeanor to intentionally discard any monofilament fishing line or netting into or onto the waters of the state of Florida.

of animals have a relatively high, inherent rate of death among newborns, but the number of manatee calf mortalities appears to be increasing in recent years. Scientists are not sure yet if this is true, but they are very concerned about this category of death and are looking closely at possible causes. Unfortunately, most calf carcasses are very decomposed by the time they are discovered. This limits scientists' ability to determine cause of death.

Loss of Habitat

Ultimately, loss of habitat is the most serious long-term threat facing manatees and other Florida wildlife today. The growth in human population and its added pollution, litter and boat traffic has degraded and/or eliminated manatee habitat. Many freshwater and marine grassbeds have been lost due to water pollution, herbicides, surface runoff, propeller dredging, and dredge and fill projects. There are very few places left where manatees are free from the danger and harassment posed by human activity.

Conservation Efforts

Manatees are listed by the U.S. Fish and Wildlife Service as an endangered species under the Endangered Species Act of 1973. A species is listed as endangered when it is considered in danger of extinction. Many other species are listed as threatened, which means they are likely to become endangered in the foreseeable future. The listing of a species as endangered or threatened brings it under the protection of the law and signals that efforts should be intensified to save it through various recovery actions such as habitat protection and minimization of human-related impacts. The conservation and recovery of a species is a complex endeavor. It involves research, education, and the establishment of laws and guidelines.

STEP 1:

Research

As a first step, scientific research must be conducted to learn what manatees need to survive, how they behave, and what the threats are to their continued existence. With data, scientists can provide the information and documentation that can lead to their protection.

STEP 2:

Education

Because so many manatees are injured or killed by human activity, education and regulation of human activities must also be heavily stressed. Florida is growing at an alarming rate, and many of the people moving here are attracted

by the state's natural beauty. They are drawn by Florida's spectacular beaches, warm temperatures and fascinating wildlife. While Floridians may take pride in the unique wildlife found here, many people have no idea how their everyday actions threaten such life.

People who are thrilled to see a pelican or manatee also need to know that boat collisions kill manatees, that pesticides poison coastal birds, and that destruction of habitat for new buildings has a perilous impact on the state's natural resources. Unless Florida's residents and visitors understand and respect Florida's wildlife, they will continue to unknowingly mistreat it. Public awareness and concern are necessary to insure that sound protection for natural resources will be legislated and enforced.

STEP 3:

Laws and Guidelines

Establishing and enforcing laws and guidelines is the third vital step in the conservation of endangered species. Establishing regulatory zones, developing and implementing management plans, acquiring land, creating protection zones and penalizing violators of the law are essential if manatees are to be protected. However, these protective mechanisms cannot be executed without strong citizen support and involvement. It is never too early to start. Young people should be introduced to local, state and national government processes that shape natural resource policies so they are aware that they have a voice in our earth's future and their own quality of life.

Extinction Isn't A Myth

Extinction means the last individual of a living species has died or been killed, and the species has vanished from the earth forever. If manatees become extinct like the Steller's sea cow, they will never return.

Extinction has been a part of the natural evolutionary process since life began. Mass extinctions occurred during a few geological periods, probably because of abrupt geological or climatological changes. During most of the geological periods, new species formed at a rate greater than that of extinction, and the earth's biological diversity gradually increased. Today, however, there is evidence that the world may be experiencing a massive reduction of this diversity. Human population growth and habitat destruction are the cause, and it appears that the consequence will be the loss of a substantial part of the earth's living resources.

Some biologists estimate that over one million species will go extinct in our lifetime. According to the U.S. Fish and Wildlife Service, there are currently almost 1,500 species listed as endangered and over 300 species listed as threatened worldwide. Of course, these figures don't take into account the many species that are endangered but not listed as such, or not even discovered yet, by scientists.

Tracking Manatee Movement

An important part of manatee research involves determining animal movements and critical habitat.

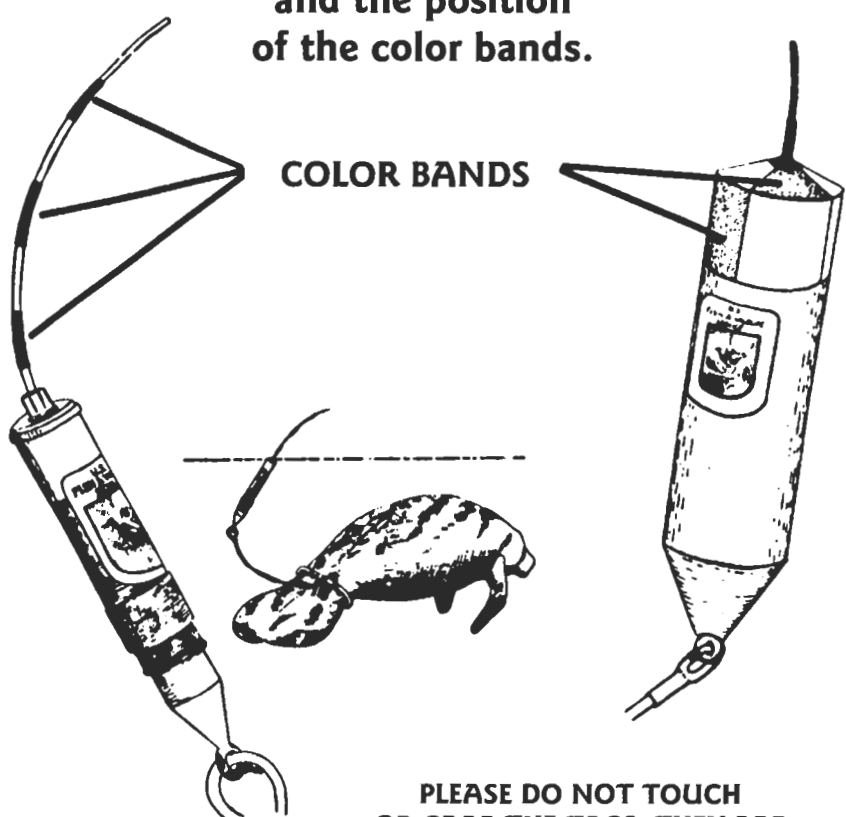
This research is conducted by the U.S. Fish and Wildlife Service, the U.S. Geological Survey Sirenia Project, and the Florida Fish and Wildlife Conservation Commission's Florida Marine Research Institute.

One way that researchers monitor manatees is by using satellite tracking devices. The satellite tracking device, or "tag," is a transmitter encased in a floating tube. The tag assembly consists of a belt that fits around the base of the manatee's tail, and about a one-meter (four-foot) long, flexible nylon tether that is attached to the tracking device. The tag assembly does not harm the manatee or affect its freedom of movement, and it is designed with a "weak link" so it will break loose if it becomes entangled in vegetation or debris. Radio signals sent from the transmitter are received by polar orbiting satellites and analyzed to yield accurate location data on the manatee. Sensors built into the unit give additional data on water temperature and the manatee's activity. Researchers can access this information daily by computer.

Researchers have been able to record some interesting and informative manatee movements as a result of the tagging program. One manatee made a 321-kilometer (200-mile) trip from Brevard County to Port Everglades in less than 10 days. Another manatee moved between Fernandina Beach and Brevard County, Florida, seven times, making this 241-kilometer (150-mile) trip in less than four days on at least one occasion. She swam nearly 72 kilometers (45 miles) per

Manatee Tags

**If you see a manatee with a transmitter,
please call this toll free number:
1-888-404-FWCC or #FWC
on your cellular phone.
Note when and where seen
and the position
of the color bands.**



COLOR BANDS

**PLEASE DO NOT TOUCH
OR GRAB THE TAGS. THEY ARE
HARMLESS TO THE MANATEE.**

**YOUR REPORTS HELP WITH RESEARCH
ON THE ENDANGERED MANATEE.**

Graphic by Mary Ruth Sprankel.

day and traveled into the Atlantic Ocean and along the beach for several portions of the journey. Another manatee named Chessie traveled all the way from Florida to

Rhode Island and back! These long-distance movements had not previously been documented for individual manatees.

Other Manatee Research Programs

With a better scientific understanding of manatees, responsible management and recovery projects can be undertaken. In addition to the manatee tracking program, the rescue and rehabilitation, carcass salvage, photo identification/scar pattern, and synoptic survey programs are all designed to provide scientific data that can help manatee conservation efforts in Florida.

Rescue and Rehabilitation

Sightings of sick, injured, orphaned, tagged or harassed manatees can be reported to the Florida Fish and Wildlife Conservation Commission (FWCC). Wildlife officials will investigate and, if need be, coordinate the rescue of sick, injured or orphaned manatees. Sea World Orlando, Homosassa Springs Wildlife State Park, Lowry Park Zoo, the Miami Seaquarium and the Dolphin Research Center are all rehabilitation facilities in Florida that are authorized to capture, transport and/or treat these animals under the joint supervision of the U.S. Fish and Wildlife Service and the FWCC. In addition to these facilities, other entities are involved in verification of injury, rescue and transportation under the supervision of the rescue coordinator at FWCC's Florida Marine Research Institute. Sea World Orlando, Lowry Park Zoo and the Miami Seaquarium are the only facilities authorized for critical care and rehabilitation of injured or sick manatees or orphaned calves.

The Salvage Program

The Manatee Carcass Salvage Program is operated by FWCC's

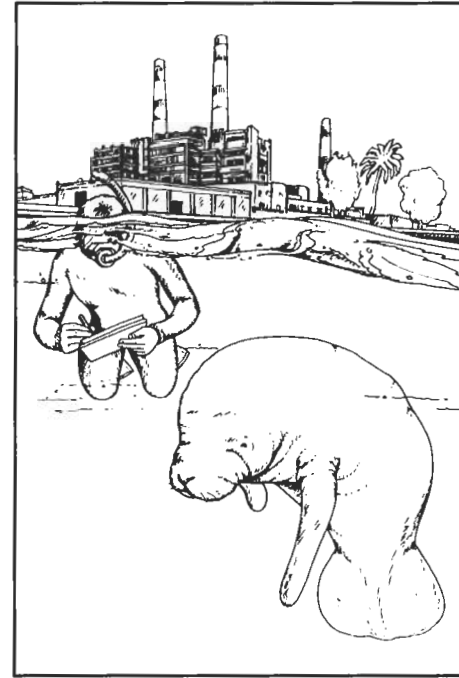
Florida Marine Research Institute. Its purpose is to examine manatees found dead in Florida and other parts of the southeastern United States to try to determine the cause of death. Anyone can help by calling to report the sighting of a dead manatee. By doing a necropsy (animal autopsy) on dead animals, scientists can determine some causes of manatee deaths. Other valuable information can be collected concerning length, weight, stomach contents and pathology. Cause of death is divided into categories (see insert in this guide) and quantified so researchers can better understand the dangers to manatees.

MIPS Program

Most adult manatees inhabiting Florida waters are scarred from collisions with boats. Researchers can use these scars to identify individual animals. By observing an individual over the course of time, researchers can learn many things about migration, travel, important habitat and other behavioral factors, as well as determining life history aspects such as population trends.

The U.S. Geological Survey Sirenia Project, in cooperation with the FWCC, maintains a Photo CD-based computerized database of distinctively scarred manatees statewide. This database is called the Manatee Individual Photo-Identification System (MIPS). Currently the MIPS holds nearly 2,000 records of individual manatees with unique features.

Manatees are often photographed for inclusion in the MIPS when they are gathered at warm water refuges in the winter and at various areas they frequent in the summer.



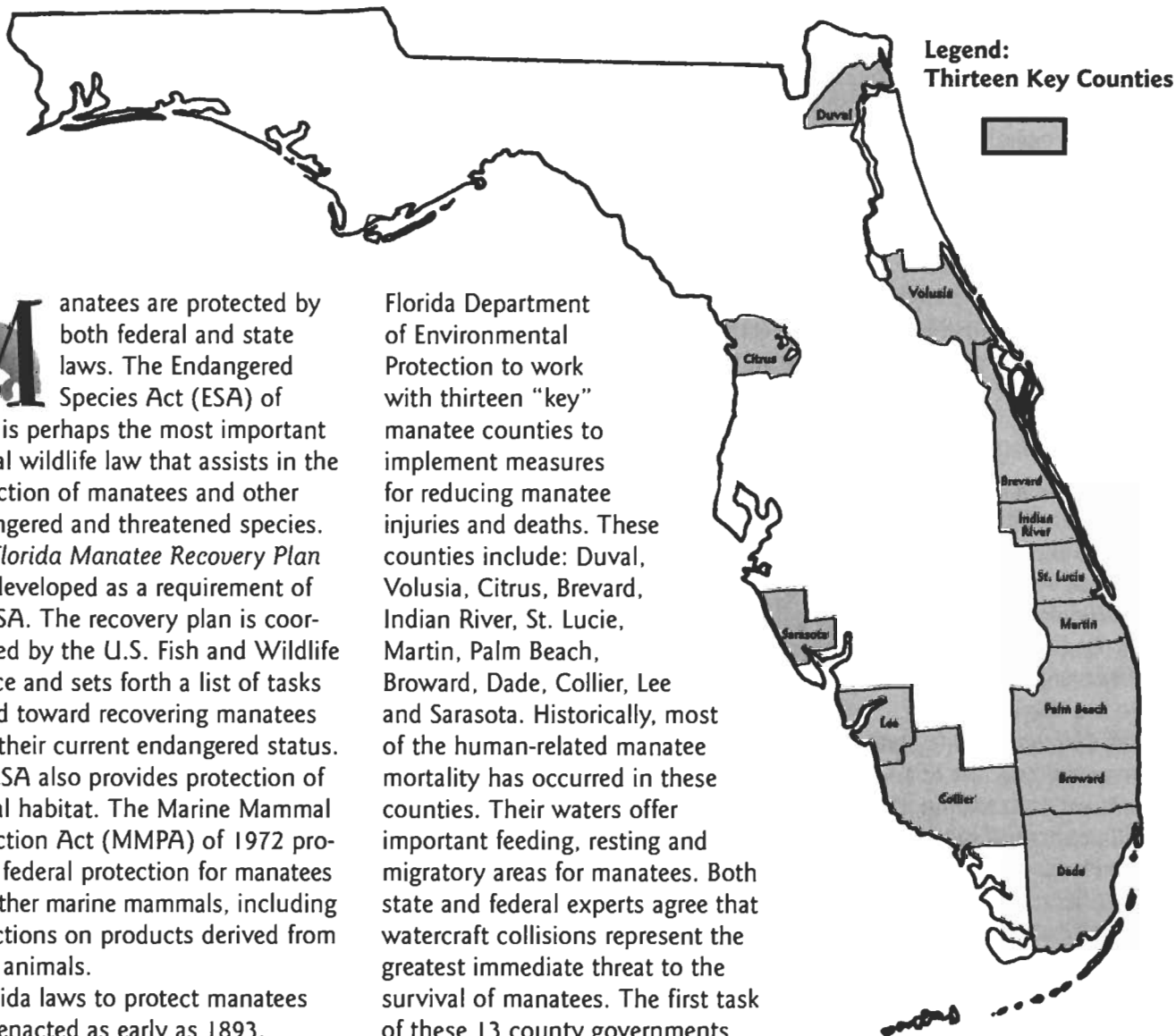
© Robert Rattner. Adapted from original photograph.

Captive manatees reintroduced to the wild and wild manatees that are radiotagged and released are also photographically documented.

Synoptic Survey Program

A synoptic survey is a statewide aerial survey that shows manatee distribution in winter and gives a minimum population count at a particular point in time. Researchers conduct the surveys following major cold fronts that cause manatees to be gathered at warm water sources around Florida. It is evident that there is a tremendous amount of variability among the survey results. That is because the manatee counts from the synoptic surveys are very dependent on weather conditions. Factors such as wind, glare, water clarity (turbidity), and the cold front's length and severity all affect the researchers' ability to see and count manatees.

It's The Law!



Manatees are protected by both federal and state laws. The Endangered Species Act (ESA) of 1973 is perhaps the most important federal wildlife law that assists in the protection of manatees and other endangered and threatened species. The *Florida Manatee Recovery Plan* was developed as a requirement of the ESA. The recovery plan is coordinated by the U.S. Fish and Wildlife Service and sets forth a list of tasks geared toward recovering manatees from their current endangered status. The ESA also provides protection of critical habitat. The Marine Mammal Protection Act (MMPA) of 1972 provides federal protection for manatees and other marine mammals, including restrictions on products derived from these animals.

Florida laws to protect manatees were enacted as early as 1893. Manatees are also protected by the Florida Manatee Sanctuary Act of 1978. Anyone convicted of violating Florida's state law faces a possible maximum fine of \$500 and/or imprisonment for up to 60 days. Conviction on the federal level is punishable by a fine of up to \$100,000 and/or one year in prison.

Manatee Protection In Florida

In October of 1989, Florida's Governor and Cabinet directed the

Florida Department of Environmental Protection to work with thirteen "key" manatee counties to implement measures for reducing manatee injuries and deaths. These counties include: Duval, Volusia, Citrus, Brevard, Indian River, St. Lucie, Martin, Palm Beach, Broward, Dade, Collier, Lee and Sarasota. Historically, most of the human-related manatee mortality has occurred in these counties. Their waters offer important feeding, resting and migratory areas for manatees. Both state and federal experts agree that watercraft collisions represent the greatest immediate threat to the survival of manatees. The first task of these 13 county governments, working with the state, was to develop site-specific boat speed zones for manatee protection. Their second task is to develop comprehensive manatee protection plans. Among other things, these manatee protection plans will include a boat facility siting element, manatee sighting and mortality information, identification of land acquisition projects for manatee protection, law enforcement coordination, and an education and public awareness program.

It should be noted, however,

that in recent years other counties besides the original key counties are being identified as important habitat for manatees, and watercraft-related mortality in some of these counties is rising at an alarming rate. These counties include: Hillsborough, Pinellas, Manatee, Charlotte, Glades and Monroe. Speed zones and manatee protection plans will need to be developed for these counties as well.

Manatee Protection Tips

When Operating Your Boat, Please Observe These Regulatory Signs:



Slow Speed is the speed at which the boat is operating off-plane and settled into the water.



Idle Speed is the minimum speed that will maintain steerage of the vessel.



This sign appears at a manatee refuge area. No swimming, boating or diving is allowed in the refuge area.



This sign appears at the end of a protected area. You will see it as you leave the area.

When Boating

- Wear polarized sunglasses. They can eliminate the glare of the sun and help you to see below the water's surface.
- Stay in deepwater channels when boating. Avoid boating over seagrass beds and shallow areas where manatees might be feeding (but be aware that manatees also use deepwater channels when traveling).
- Look for a snout, back, tail or flipper breaking the surface of the water, or a swirl or flat spot on the water that is created by the motion of the manatee's tail when it dives or swims.
- If you see a manatee when operating a powerboat, remain a safe distance away – 15 meters (50 feet) is the suggested minimum. If you want to observe the manatee, cut the motor, but do not drift over the animal.
- If you like to jet-ski, water-ski or participate in high-speed water sports, choose areas that manatees do not or cannot frequent, such as a land-locked lake or waters well offshore.
- Obey posted speed zone signs and keep away from posted manatee sanctuaries.

Stash Your Trash!

- Recycle your litter or throw it in a proper trash container. Debris in waterways, such as discarded plastic bags or six-pack holders, is dangerous to manatees and other forms of wildlife.
- Discard monofilament line or fishing hooks properly (better yet, recycle it!). Not only are they dangerous for manatees, other aquatic animals and swimmers, but discarding monofilament line into or onto the waters of the state of Florida is against the law.

Hands Off

- Resist the urge to feed manatees or give them water. Not everyone loves manatees and feeding them or giving them water could encourage them to swim to people who might be cruel to them. Their natural feeding patterns may also be altered by encouraging them to "hang around" waiting for food or water. When hand-fed lettuce or water from a hose is no longer available, manatees may not know where to find or how to identify natural, reliable sources of food.
- "Look, but don't touch" is the best policy when swimming or diving. By quietly observing manatees from a distance, you will get a rare opportunity to see the natural behavior of this unique animal. Any other actions might be considered harassment, which is against the law.

Call 1-888-404-FWCC, #FWC on your cellular phone or use VHF CHANNEL 16 on your marine radio if you spot an injured manatee.

Growth Management

A very serious threat to manatees, as well as to Florida's whole environment, is our growing population. Manatee habitat and the habitat of many other species in Florida has been lost due to the staggering amount of development that has occurred in recent years.

Other stresses on Florida's environment resulting from ineffective growth management include water, air, and soil pollution, salt water intrusion, soil and beach erosion, and degradation of our living coral reefs. Even the disposal of our garbage has become a problem of great magnitude. To put it simply – we are running out of space to put our garbage.

One of the most serious problems related to human population growth in Florida is a rapidly diminishing supply of drinking water. Huge amounts of water from our aquifers are being used for such purposes as agriculture and municipal water supplies. Irrigating the hundreds of golf courses in Florida requires a tremendous amount of water. As the aquifers are drawn down from human demands, water managers are scrambling to identify other sources of water to meet future needs. Increasingly, surface waters from lakes and rivers will be used as well as desalination of coastal waters. All of these withdrawals will likely pose serious threats to manatee habitat.

The problem of overpopulation is by no means unique to Florida,

however. Species extinction, pollution and the depletion of resources we see happening in Florida are occurring around the world. Besides environmental damage, population growth is also at the root of poverty, urban deterioration and economic stagnation.

There are no easy answers. Many nations are now attempting massive education programs, promoting widespread use of contraceptives

What we must consider, in order to protect our fragile environment, is an array of strategies – national and international as well as statewide – to address and defuse the causes of this destructive explosion in the state's population (see, for example, Kolankiewicz and Beck 2001, *Overpopulation = Sprawl in Florida*).

As Florida continues to grow, critical decisions about managing our fragile environment will become more and more difficult.

We cannot afford to make decisions based on inadequate knowledge, because the resulting impacts are often irreversible and very costly. Floridians must learn to determine the long and short-term consequences of their decision-making and of the many government policies that have direct effects on population growth. Even with the most careful planning, continued population growth will be increasingly incompatible with protection of

the environment, and dealing with its effects will increasingly require an environmentally aware and informed society.

Therefore, it is up to us to become knowledgeable about local, national and world issues and to involve our students in these issues. We must let them know the proper procedures for getting involved in local, statewide and nationwide planning to effect positive change and bring our runaway growth under control.

and sterilization, and/or offering incentives for those who limit their families to one child. However, these attempts have so far proven unequal to the magnitude of the problem. If overpopulation is not controlled, disaster may lie ahead. Where population growth is concerned, the only sensible "growth management" is to bring our growth in population under control.

Large numbers of new residents continue to stream into Florida, in part from overseas, but especially from other parts of the United States.



Graphic by Navin Patel. Graphic Production, Inc.

Classroom Activities: Ideas for Supporting Manatee Studies

The following section contains a collection of activities that you can incorporate into an existing classroom unit on manatees or Florida ecology. Please note that these activities are not “stand alone” educational experiences, but they can be useful in enriching and enhancing the student’s discovery of his or her knowledge about manatees. The activities in this

guide are designed to give you ideas that you can use to complement what the student is learning both in and out of the classroom. Research has shown that the brain seeks patterns and connections while learning. Many of the activities in this guide can be effective in helping students to find patterns in their other studies related to manatees.

Two tests are included in this section that feature questions on

manatees, sirenians of the world and habitat issues. You might consider using the same tests before and after teaching the manatee unit to assess student progress.

Elementary educators: The coloring and activity book, *Manatees: Florida’s Gentle Giants*, should accompany this guide and features additional activities and information suitable for elementary-level students.

These guidelines were taken from North American Association for *Environmental Educator’s (NAAEE) Environmental Education Materials: Guidelines for Excellence*. You may wish to incorporate them into your lesson plans when planning your manatee or Florida ecology unit.

How to Insure a Well-Balanced Presentation of Education Materials

- Environmental education materials should reflect sound theories and well-documented facts about subjects and issues.
- Make sure your sources of information are clearly referenced.
- Present factual information in language appropriate for educating and not propagandizing.
- Balance your presentation with differing viewpoints and theories.
- The materials you share should communicate a consensus among scientists or other experts.
- The materials should also encourage learners to explore different perspectives and form their own opinions.
- Always encourage an atmosphere of respect for different opinions and openness to new ideas.
- Have students collect their own data and see how it compares with the experts.
- Learners should be challenged to use and improve their critical thinking and creative skills.

If you would like more information on NAAEE, please contact them at 410 Tarvin Road, Rock Spring, GA 30739. Phone: (706) 764-2926, Fax: (706) 764-2094, www.naaee.org.

What You Can Do To Get Involved

Adopt a Manatee and Support Manatee Conservation and Education Efforts

Have your class adopt a manatee through Save the Manatee Club (SMC). The \$15 adoption fee goes directly to support manatee conservation and education efforts. See the enclosed SMC brochure or contact information on page 3 of this guide.

Reduce Trash and Recycle

Have each class member bring in all plastic, paper and cardboard trash collected at home in a 24-hour period. Discuss the amount the whole school might collect in one day. How about the whole city, the state or the nation? Discuss the magnitude of non-biodegradable solid wastes. Where does it end up? Some marine animals and birds mistake plastic trash for food such as jellyfish, while others become entangled in plastic trash. Ask students to research recycling in your area and list ways to reduce trash.

Brainstorm About Ways To Protect Manatees

Ask each student to think of ideas people could do to help protect manatees. Have them divide their activities into two groups, "On Land" and "In the Water," and come up with ten ideas for each group. To get started, take a look at the "Manatee Protection Tips" page of this guide. Ask students to research ways that manatees are protected and identify how they might get involved.

Change Personal Behavior

Have your students consider what behavior they could change to lessen their impact on the environment for a minimum of a week.

First, consider activities we do on a daily basis that impact the earth negatively. Ask each student to come up with two personal behaviors or habits he or she would be willing to change. These activities could be as simple as walking instead of being driven, turning off lights when leaving a room, or pulling weeds to limit the use of pesticides. They could cut their shower time in half to save water and pick up trash when they see it on the ground. Hold a class discussion. What if everyone changed that same behavior? What kind of impact would that have?

Next, ask the students to construct a written contract that includes their new behavior. Have them report after a week to see how they did and what a difference they think their new behavior made.

Encourage Students To Become Involved Politically

Students need to know that, as individuals, they have a voice in governmental processes. When they make their wants and needs known, they can improve the world. When they remain silent, they give their power away to others. No one is too young to get involved! Students can participate by researching issues at the local level. They can write letters, send e-mail and attend county commission or city council meetings. They can help their community make wise choices between pressures for growth and needs for strong environmental protection.



Graphic by Navin Patel,
Graphic Production, Inc.

Tips for Writing Letters to Decision-Makers

1. Original letters count most and a regular letter usually carries more weight than an e-mail. Express your views in your own words and, if possible, include a personal experience in your letter.

2. Address one issue at a time and be brief. One page is perfect, but you could go to two. Legible, handwritten letters are fine.

3. Your first sentence should state where you live, especially if you are a constituent of the elected official to whom you are writing.

4. The first paragraph should explain why you are writing and what you want the person to do.

5. Ask for a response. For example: "I look forward to hearing how you will vote."

6. Be polite in the letter and thank the reader for considering your views. Remember, when elected officials receive enough letters about a particular issue, their opinions can be influenced.

Be sure students understand the importance of being well informed. Letter writing is a very powerful tool for effecting change.

Source: Caribbean Conservation Corp.

Write Letters to Elected Officials

There are a number of issues affecting manatees and their habitat that involve local, state and federal governments. Students can visit the Save the Manatee Club Web site at www.savethemanatee.org and go to the "Take Action!" page to find current information.

If students would like to help, they can write a letter or send an e-mail to Florida's governor to show strong support for manatee protection in the state of Florida. Next, they can write their U.S. senator and representative (if you live in Florida, students can also write their state senator and representative) to tell them how important manatees are and ask them to support protection for manatees and their habitat and to keep other environmental laws strong. You can find contact information for all of these people at the "Take Action!" page on the SMC Web site.

Organize Recycling and Cleanup Efforts

The best way to get your students involved in recycling at home is to show them how it's done. Start a recycling program at school and make it the students' project by putting them in charge. Have them find out what products are made from recycled materials and what materials are recyclable. Students could also start a monofilament line recycling program in their community.

In addition, students can organize a cleanup effort of local waterways or participate in organized cleanups. To find out more about how to organize a cleanup or participate in one, contact your local city or county environmental resources department or contact the following organizations:

Keep Florida Beautiful

2615 N. Monroe St., Ste. 200
Tallahassee, FL 32303-4027
800-828-9338
www.keeppflbeautiful.org

St. John's River Water Management District

Coordinates the annual St. John's River Cleanup
Post Office Box 1429
Palatka, FL 32178-1429
386-329-4500
sjr.state.fl.us

The Ocean Conservancy

Coordinates the International Coastal Cleanup
1725 DeSales St., NW, Ste. 600
Washington, DC 20036
202-429-5609
www.cmc-ocean.org

Keep America Beautiful

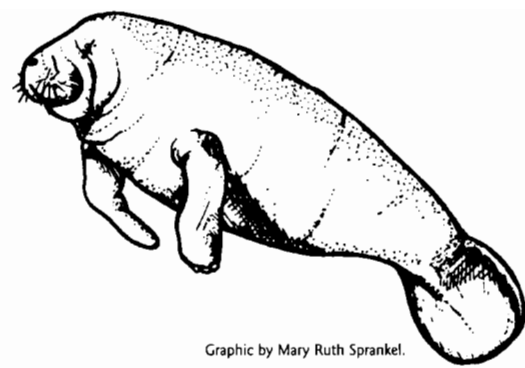
Coordinates the annual Great American Cleanup
1010 Washington Boulevard
Stamford, CT 06901
203-323-8987
www.kab.org

Discuss Why Different Policies Have Different Effects

Have each student think of reasons why people move to Florida. If some of your students are recent arrivals, invite them to share the reasons why their families moved here. Discuss the reasons behind those reasons (e.g., lack of jobs and the government policies that contribute to that condition; lower taxes in Florida and the demographics behind opposition to a state income tax) and have students think of how different policies might have different effects.

Get to the Bottom of Complex Questions

A technique that some people have found useful in getting to the



Graphic by Mary Ruth Sprankel.

bottom of complex questions is simply to ask "Why?" several times in a row. A classroom discussion structured this way might follow a path something like this: "Why are manatees endangered in Florida?" "Because so many of them are killed by boats." "Why are so many manatees killed by boats?" "Because there are so many boats out on the water." "Why are there so many boats out there?" "Because people need boats to do things on the water." "Why do people need to do things on the water?" "Some people make a living that way; others just like to use boats for recreation." "Why do so many people need to do those things?"

Encourage students to use the "why" technique to get to the bottom of complex questions surrounding the protection of manatees and their habitat as well as other issues.

Discuss "Quality of Life" Issues

Ask the students to identify environmental changes that might affect their quality of life, i.e. diminishing water supply, green spaces and loss of biodiversity. How would their quality of life be affected by the extinction of a species? How about the quantity of potable water or the loss of protected green spaces? Is the quality of life affected by increasing human populations? These are just a few suggestions. Ask your students to think of others and compare the thresholds of various students on different quality of life issues.

Classroom Activity Ideas

The following activity ideas are offered to help you use the information in this guide in your classroom.

We have tried to include activities that incorporate art, math, geography, political science, writing and biology. These activities can be easily modified for any grade level by adjusting the amount of detail.

What Do Manatees Need to Survive in Their Environment?

Ask students to decide what manatees need to survive in their environment.

From this discussion, inquire as to other questions students might have about manatees and their environment. Allow the students to research and explore just how manatees have come to survive as long as they have. Perhaps students could also identify ways that they can help protect the environment so manatees

can continue to survive. The manatee habitat display activity (see following page) could be a great outcome from the student's research.

Comparison Studies

There are several comparison studies students can do on the topic of manatees and their habitat. First, ask students to compare their weight to a manatee. The average weights of the West Indian manatee and the Steller's sea cow are given earlier in this guide. Bring a scale to class and have 10 students volunteer to be weighed individually. Keep track of each student's weight and see how many students it takes to add up to the weight of one West Indian manatee. What about the Steller's sea cow? Next, do the same exercise for length (see chart below).

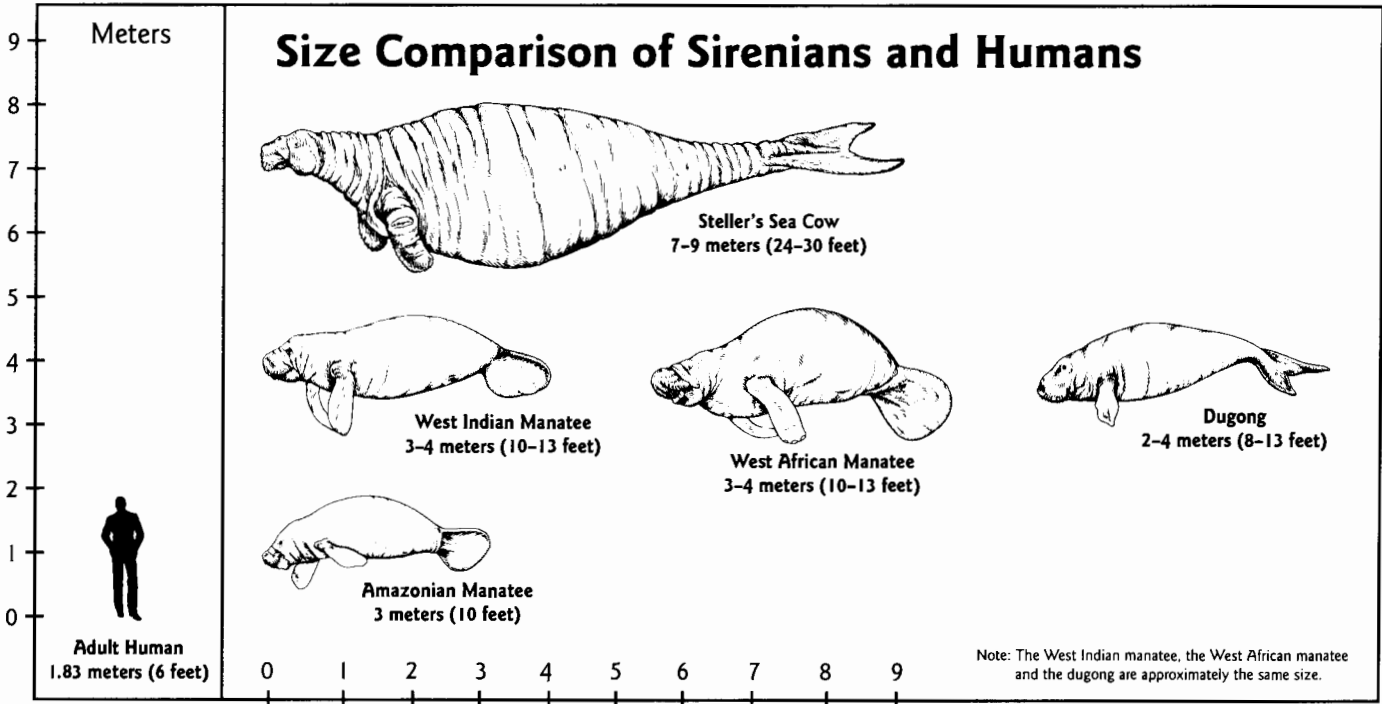
In addition, ask students to compare the amount of food they eat to the amount of food the manatee

needs. They can examine weight, caloric value and health benefits, among other things. They can also compare an herbivorous diet with an omnivorous or carnivorous diet and the anatomical differences between herbivores, omnivores and carnivores.

Finally, encourage a comparison study that focuses on marine and freshwater animals that live in the Florida manatee's habitat. Is there any competition for resources?

Explore the Technology Involved in Tracking Manatees

Radio signals from manatee tracking devices are received by polar orbiting satellites and analyzed to yield locational data. Sensors built into the unit give additional data on water temperature and the manatee's activity. Researchers access the information daily by computer.



Source: Adapted from an original graphic by the Caribbean Conservation Corp.

1. Have the class research information about satellites. What are they? How do they work? How do they get up in space? What does “polar orbiting” mean and why is this kind of satellite useful?

2. Contact an electronics expert at your local high school, vocational school or community college. Ask him or her to be a guest speaker and give information on radio signals. How does the information from the transmitter get up to the satellite and down to the researchers? What do the terms “uplink” and “downlink” mean? How are research data decoded by the computer?

3. Have the students explore other things that use radio communications. For example: a television, radio, microwave, garage-door opener and cellular telephone all use radio signals.

Create a Manatee Myth

Sailors throughout history often thought they were seeing mermaids when they were really seeing manatees. “Sirenia,” the name of the scientific order to which manatees belong, comes from the ancient mythological word “siren,” a term used for monsters or sea nymphs who lured sailors and their ships to ruin with their mesmerizing songs. Create a mythological story about sailors and manatees incorporating facts from this guide.

Make a Manatee Habitat

Make a plaster cast or use materials like papier maché and paint to create a manatee habitat such as a spring run. You can also create a diorama in an aquarium. Include aquatic vegetation, trees, fish, access to a river, sanctuary signs, boats and people. Create posters or murals showing manatees and threats to their survival. You could even turn your classroom into a manatee habitat!

Write Laws to Protect Sirenians

Ask students to investigate how laws to protect manatees and their habitat are formed at different levels of U.S. government: federal, state, county or city. Next, divide students into groups that represent the various government levels. They can also create an international government. Each group should be in charge of developing recommendations to protect the sirenian species and habitat within their area. Have the groups write a report on their law and give an oral presentation to the class. They can make use of research materials such as the educator’s guide, the Internet and other resources in the library to write their report and create their presentation.

The students’ law should answer these questions: Why are sirenians endangered? What specific actions are necessary to save them? How will these actions be carried out? Where will the money come from? How can the public help? What will be the penalties for breaking the law? How will it be enforced? Does the governmental entity (the United Nations, for example, or a state wanting a less restrictive law than the federal government) really have the legal authority to pass and enforce such a law? If not, why not? What about entities such as the World Bank or the World Trade Organization? How can rules about something like trade have an effect on wildlife? In addition, have students research the Endangered Species Act. How does their law compare to the ESA? Have students find out more about other organizations that work to preserve wildlife. Are they private or governmental? What do they do?

Establish a Class Manatee Sighting and Mapping Program

Jemp is a West Indian manatee who was rescued in July 1995. One month later, he was tagged and released in Tampa Bay. Over the years, Jemp’s travels have taken him up and down the west coast of Florida. Jemp has been spotted in waters near Port Charlotte, St. Petersburg, Everglades City, Tampa Bay, Sarasota and Port of the Islands.

1. Have students find these areas on a map and plot Jemp’s favorite hang-outs with pushpins. Find the latitude and longitude of these locations.

2. Calculate the distance Jemp has traveled between these spots. Figuring that manatees swim an average of 3–8 kilometers (3–5 miles) per hour, how long would it take Jemp to get from one destination to another? Why do you think he chooses these particular spots?

3. Visit a Web site on the Internet that has manatee tracking information (see insert for Internet Resources) and do a search for tracking programs for other species.

Cast a Deciding Vote

Ask students to imagine that they are serving as city commissioners for a coastal county in Florida. The city commission has to cast the deciding vote on a marina project that could have an impact on manatees and wetland habitats by increasing boat traffic on the waterways. However, the marina project will also create new jobs through construction and tourism, and the town is dependent on tourists and recreational boaters.

Ask the students to research the pros and cons of the situation, decide how they will vote, and be prepared to defend their position. You might have students write and give speeches or create public service

Continued on page 26

announcements based on their research and decisions (see *Create a Speech* or *Public Service Announcement* on this page).

Stress that governmental decisions are often complex. Politicians must balance their own beliefs and interests with the varied interests and concerns of a multi-faceted constituency. Ask students to think of ways to reach a middle ground. Perhaps the marina could be modified to lessen the impact to manatees and their habitat, or the number of law enforcement officers for the area could be increased.

Discuss Threats to Manatees

Discuss the major threats to manatees today: loss of habitat (due to pollution and other causes), watercraft collisions, litter (such as fishing line or plastic bags), harassment and flood gate/canal lock structures. Which is the most serious threat and why? Ask students to research a specific area of Florida and compare how it has changed in the last 20, 50 or 100 years. Have them draw a picture representing the habitat of 20 years ago, and then have them cross out a portion to represent the percentage lost. Discuss the causes of this habitat loss and the consequences of this loss for manatees and other species. Also, discuss what can be done to reduce or eliminate these threats.

Discuss How Water-Related Issues Affect Our Lives and the Lives of Wildlife

Locate the five water management districts in Florida and their boundaries (see Web site under Internet Resources on insert). Have the students draw the district boundaries on their map and identify the major water systems each one regulates. If you live outside Florida, identify the major water systems in your area. Ask students to pick a particular

part of the state where water is an important issue (perhaps their own county) and research that area. Write to water management districts, local governments, chambers of commerce and newspapers to obtain information. Have they experienced any droughts in recent years? Floods? Forest fires? Discuss these issues in class. What influences do water issues have on wildlife? In addition, discuss and identify watersheds, aquifers and recharge areas and their importance to humans and the environment. What are the conflicts surrounding competing interests for these natural resources?

Create a Speech or Public Service Announcement

Manatees are sometimes unintentionally killed or injured by fishing activities. They drown in nets or they can die from infection caused by entanglement in crab trap lines, monofilament fishing line or hooks. In Florida, it is a second-degree misdemeanor to intentionally discard any monofilament fishing line or monofilament netting into or onto the waters of the state.

1. Have students write a public service announcement (PSA) appropriate for television or radio to educate the general public regarding the threats that discarded monofilament can cause to wildlife. Students may create a video or audiotape, or they could perform the PSA "live" in front of the class. The recommended length of the PSA is 30 seconds. Ask a TV or radio station to broadcast the PSA or play it over the intercom at school.

2. Suggest that students create educational posters or an ad for a magazine or newspaper about the threats that discarded monofilament line creates for wildlife. Have students cut out or draw pictures, write the copy and make the advertisement

appealing to the general public. Students could vote privately and award a group "winner." Submit the ad for publication in an actual newspaper or magazine or publish it in the school newspaper.

Visit Manatee Viewing Areas – In Person or via the Internet

If you live in or near Florida, Ohio or southern California, you can arrange a field trip for your class to see manatees in order to help students experience these animals first hand (see insert for a list of places to view manatees). If a field trip is not possible, you may experience manatees "live" through a virtual tour by visiting the Web sites of manatee facilities (see insert for Internet Resources).

Manatee Word Scramble

This activity uses words and concepts related to manatees and dugongs, and it is useful as a review of previously introduced materials. The activity can also be used to stimulate a class discussion of concepts associated with manatees, other sirenian species, habitat and additional issues. The following words are selected from the glossary at the end of the guide and scrambled: *Cixto, Mslamam, Tysmescoe, Qudnog, Vireobrhe, Apdroetr, Enasirni, Cfruaes rawet, Litterretras, Sleatwnd, Bathiat, Qydorhlcio lycec, Diel depes, Bricksha, Aitcuaq, Spyreco, Minear, Nolago, Oxtice piesces, Greeddanen.*

Students can work individually or in groups to unscramble each word. After they unscramble the words, ask the students to use each word in a sentence and then discuss the meaning of the word and how it relates to manatees. (See answers to Manatee Word Scramble on page 32.)

Classroom Activity: Public Opinion Poll

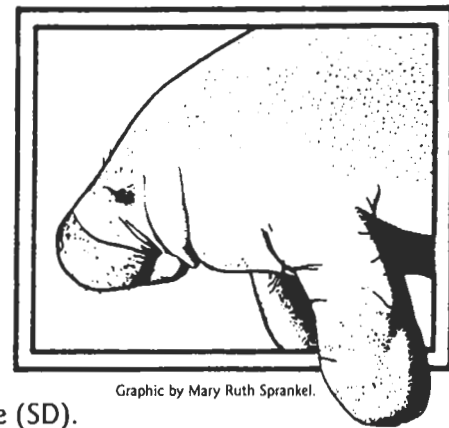
Grade Levels 7–12

Objective:

The goal of this assignment is to encourage students to think about their attitude and the attitudes of others. The questions can be used to initiate group discussion on manatee and habitat protection issues. You can also tailor the questions to make them more specific to issues in your area.

Assessment:

For each question circle one of the following choices: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) or Strongly Disagree (SD).



Graphic by Mary Ruth Sprankel.

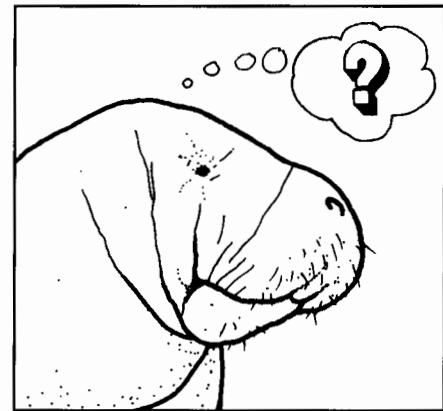
- | | | | | | |
|--|----|---|---|---|----|
| 1. If I owned a boat, I would follow posted speed zone signs in manatee areas. | SA | A | U | D | SD |
| 2. I think one way to help protect manatees is to increase the current fine for breaking the boating speed limit in manatee protection areas. | SA | A | U | D | SD |
| 3. I believe funding for enforcement of speed limits on Florida waterways should be increased. | SA | A | U | D | SD |
| 4. I think the manatee population is increasing, so there is no need to protect them. | SA | A | U | D | SD |
| 5. If I were swimming or boating and saw manatees, I would observe them from a distance. | SA | A | U | D | SD |
| 6. If I owned a house on the water, I think it would be okay to build a dock over a seagrass bed. | SA | A | U | D | SD |
| 7. It is important for someone to monitor the opening and closing of flood control structures so manatees are not crushed or drowned. | SA | A | U | D | SD |
| 8. Florida's economy will be ruined if additional manatee protection measures are adopted. | SA | A | U | D | SD |
| 9. In order to help protect manatees, I believe we should reduce the speed limit for boats on more of Florida's waterways. | SA | A | U | D | SD |
| 10. I don't think manatees are indigeneous (native) to Florida, so it's not important to protect them. | SA | A | U | D | SD |
| 11. I believe the biggest threat to manatees comes from speeding boats. | SA | A | U | D | SD |
| 12. I think the best way for people to appreciate manatees is to touch them when they are swimming or diving. It's a way to get people interested in helping them. | SA | A | U | D | SD |
| 13. If I owned a boat, I don't think I would like anyone telling me how fast I should drive it. | SA | A | U | D | SD |
| 14. More manatees are dying every year, so I believe more should be done to protect them. | SA | A | U | D | SD |
| 15. I believe that there should be more manatee sanctuaries in Florida and those sanctuaries should be off-limits to boats and jet skis. | SA | A | U | D | SD |

Post Activity Discussion:

Use the statements above to encourage each student to share his or her thoughts about manatee and habitat protection issues. Ask for volunteers to comment on the impacts or benefits of each statement. In addition, discuss public opinion polls and how they work. You could ask students how they think the general public would respond to the statements and why. Discuss the difference between attitudes that arise from emotion versus opinions derived from scientific fact. You might also ask how students could change their own attitudes or attitudes of others.

This activity could be used a second time at the end of the unit to measure if students' attitudes change as a result of learning about manatees and their habitat. Students can also research these issues by using material from the educator's guide, the Save the Manatee Club Web site at www.savethemanatee.org or other research sources. In addition, you might ask the students to design their own public opinion poll and survey other students in the school.

Cooperative Learning Activity: Sirenian Species



Graphic by Mary Ruth Sprankel.

Grade Levels 6–10

Objective: This cooperative learning activity is designed as an introduction to the sirenian species of the world. Students will learn to work together and also learn some interesting facts about the natural history and habitat of each species. At the same time, they will be improving their cooperative learning skills. After completing this activity, each student will be able to:

1. Explain at least one fact about a sirenian species.
2. Compare the different geographical areas of the world where manatees and dugongs are found.
3. Chart the scientific classification of sirenians.
4. Describe the habitat of the various sirenian species.

Preparation:

Make one copy of the Sirenian Species Cards (see following page) for each group of five students in your class. Cut the cards out for the students or provide each group with a pair of scissors.

Exercise Instructions:

1. Divide your class into groups of five students. Each student should have a blank piece of paper and a pen or pencil.
2. Ask each student in the group to be responsible for one sirenian species (dugong, West Indian manatee, West African manatee, Steller's sea cow or Amazonian manatee). Have the student write the name of the sirenian species that they choose at the top of the paper and make six spaces to write in sirenian facts. For example:
Dugong
1.
2.
3.
4.
5.
6.
3. Give each group a set of the 10 Sirenian Species Cards. If you have provided scissors, ask each group to cut the cards out.
4. Mix the cards up and place them in a stack. Have the group decide which student will go first, second, third and so on.
5. The first student should choose one card and read the three facts on the card aloud, one fact at a time.
6. After each set of facts on the card is read, the group should decide which sirenian the card is referring to. The student who has that particular sirenian's sheet should fill in the facts from the card on their sheet. Follow this same procedure for all the students in the group until each of the five students has read the facts on two cards.
7. When the cards have all been read and the fact sheets are filled in, ask the students to answer the following questions with the information they have obtained:
 - From the information you have, can you tell which sirenian weighed the most?
 - Which species of sirenian is the smallest?
 - Which sirenian is/was found in cold water?
 - Two of the sirenians have notched tail flukes. Which ones are they?
 - Which sirenian averages three to four meters (10 to 13 feet) in length?
 - People who live in the United States are most familiar with which sirenian?
 - Which sirenian is/was without any teeth?
 - Which sirenian inhabits the western coast of Africa?
 - Which sirenian is extinct?
 - Which sirenian lives exclusively inland?

Card Answers:

1. dugong, 2. dugong, 3. Steller's sea cow, 4. Steller's sea cow, 5. West Indian manatee, 6. West Indian manatee, 7. West African manatee, 8. West African manatee, 9. Amazonian manatee, 10. Amazonian manatee.

Sirenian Species Cards



1. Sirenian Species

Can be seen around Australia
Prefers coastal ecosystems
Has no nails on the flippers



2. Sirenian Species

From the Kingdom Animalia
Has a notched tail fluke
2–4 meters (8–13 feet) in length



3. Sirenian Species

Hunted to extinction in 1768
Inhabited cold waters
Weighed around 4 metric tons
(approximately 4.4 tons)



4. Sirenian Species

Lived in the Bering Sea
7–9 meters (24–30 feet) in length
Toothless



5. Sirenian Species

Classified under Phylum Chordata
This is the sirenian most familiar
to people living in the United States
Found in fresh or brackish water



6. Sirenian Species

This species is strictly
an herbivore
3–4 meters (10–13 feet) in length
Average weight 362–544 kilograms
(800–1,200 pounds)



7. Sirenian Species

Found mostly on the
west coast of Africa
Belongs to the Class Mammalia
Has nails on the flippers.



8. Sirenian Species

This mammal lives in warm
tropical waters
3–4 meters (10–13 feet) in length
Similar in size and appearance
to the West Indian manatee



9. Sirenian Species

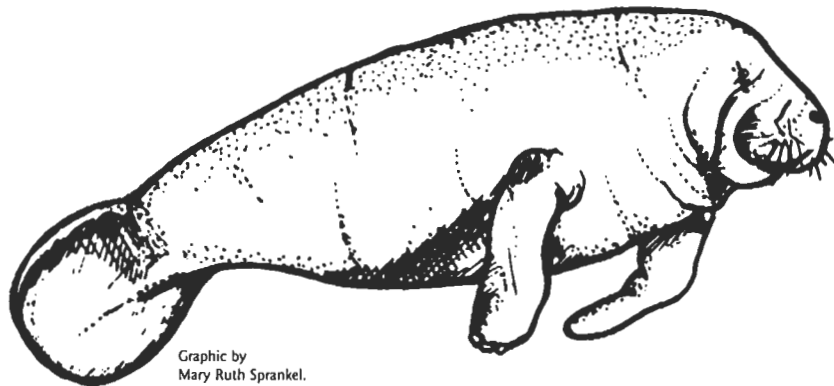
Part of the Sirenian order
This animal lives exclusively in
inland, freshwater areas
Smallest member of the Family Trichechidae



10. Sirenian Species

Not known to be territorial
or aggressive
Up to 3 meters (10 feet) in length
Threatened by hunting pressures
from native people

Manatee Pre/Post Test



Graphic by
Mary Ruth Sprankel.

Objective: Test your knowledge about manatees. The first 10 questions are fill-in-the-blank and multiple choice questions and the second half of the test features true and false questions. After completing the manatee unit in your class, take the test again and see how much you learned!

1. On average, manatees eat about _____% of their body weight in vegetation daily.
2. Manatees have few natural enemies and it is believed that they can live up to _____ years.
3. Manatees are the only aquatic mammals that are _____.
4. Manatees are slow-moving animals, although they have been known to swim up to _____ mph in short bursts. On average, manatees swim at about _____ mph.
5. Data from research have shown that many manatee mortalities are directly related to human contact or encroachment. List three human-related causes of manatee mortality.

6. Manatees may look alike to us, but researchers have a unique way of telling them apart. How do they do it?

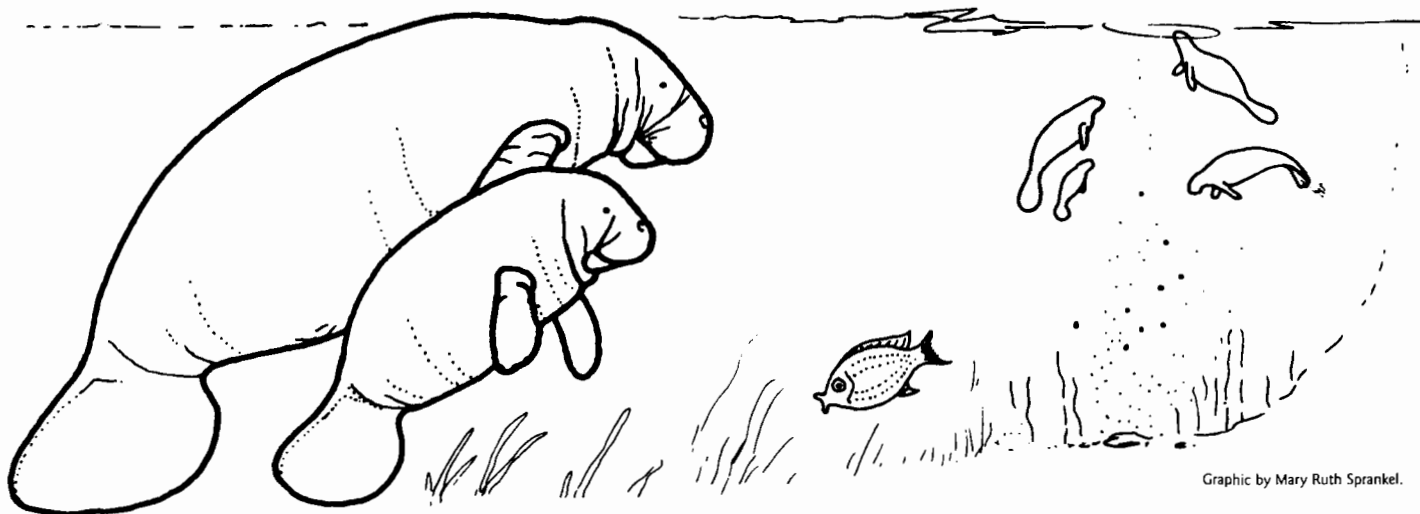
7. Florida manatees are a migratory species. In the winter months, they are found primarily in _____.
In the summer months, they are more widely dispersed and may go as far north as _____ and as far west as _____.
8. Manatees have a low reproductive rate. It is believed that one calf is born every _____ year(s) and a calf may remain dependent on its mother for up to _____ years.
9. Manatees communicate with each other underwater by _____.
10. The West Indian manatee is protected under:
a. federal law
b. state law
c. both federal and state law
d. the manatee is not protected under law

True or False

1. Manatees live in salt, brackish or fresh water.
a. True b. False
2. The Steller's sea cow population is increasing.
a. True b. False
3. Manatees tend to travel in groups.
a. True b. False
4. The federal Environmental Protection Agency (EPA) coordinates the *Florida Manatee Recovery Plan*, a list of tasks geared toward recovering manatees from their current endangered status.
a. True b. False
5. Manatees are native to Florida.
a. True b. False
6. Manatees breathe underwater through gills on the sides of their necks.
a. True b. False
7. Manatees prefer shallow, slow-moving bodies of water.
a. True b. False
8. Fish and algae make up the majority of a manatee's diet.
a. True b. False
9. Female manatees are very aggressive when they have a calf by their side.
a. True b. False
10. Manatees are scientifically classified in the Phylum Chordata, which means they have a backbone.
a. True b. False

(See Answer Key on page 32.)

Habitat Pre/Post Test

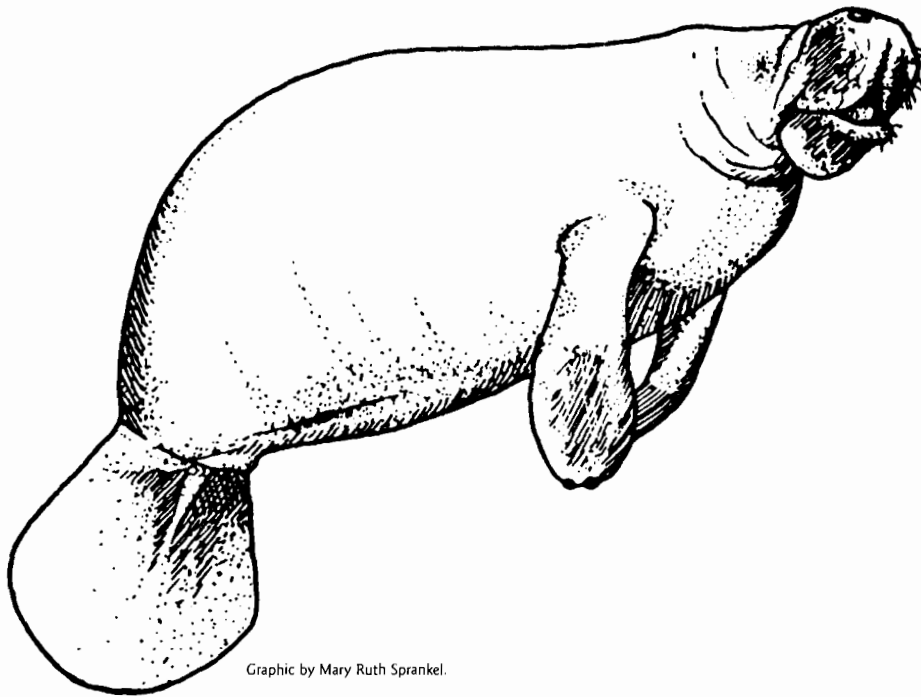


Objective: This will test your knowledge about manatee habitat and habitat for sirenians around the world. There are ten multiple choice questions.

- Habitats where manatees are found must provide them with which of the following:
 - A breeding area
 - Sheltered living
 - Food supply
 - All of the above
- The four necessary elements of manatee habitat are:
 - Food, water, space, shelter
 - Water, shelter, sky, trees
 - Fish, sun, metal, water
 - Rain, food, stars, space
- Manatees are susceptible to cold-related disease. The lower end range of water temperatures they can tolerate is:
 - 7° to 13° C (45° to 55° F)
 - 31° to 33° C (88° to 92° F)
 - 20° to 22° C (68° to 72° F)
 - 23° to -29° C (-10° to -20° F)
- Manatees are herbivores, but they probably wouldn't eat which of the following plants?
 - Hydrilla
 - Douglas fir tree
 - Tapegrass
 - Water lettuce
- Although Florida manatees are migratory, they do not migrate to which of these places?
 - Florida
 - Louisiana
 - North Carolina
 - Montana
- What sirenian is found around the northern part of Australia?
 - Amazonian manatee
 - Steller's sea cow
 - Dugong
 - West Indian manatee
- What animal would you most likely find sharing its home with a manatee?
 - Snowy owl
 - Grizzly bear
 - Gray wolf
 - Turtle
- Seagrass beds are an important feeding area for manatees. Which of the following is a cause of seagrass bed destruction?
 - Surface water run-off
 - Herbicide spraying
 - Prop dredging
 - All of the above
- In which area would you most likely find manatees during colder weather?
 - Under icebergs
 - In power plant outflows
 - Resting on the beach
 - 5-10 miles out at sea
- Even though the Florida manatee and Antillean manatee are closely related, they do not share the same geographic locations. The Antillean manatee can be found in which of the following places:
 - Central American waterways
 - Indian Ocean
 - Bering Sea
 - Lake Erie

(See Answer Key on page 32.)

Answer Keys



Graphic by Mary Ruth Sprankel.

Habitat Pre/Post Test (located on page 31) Answer Key

1. D
2. A
3. C
4. B
5. D
6. C
7. D
8. D
9. B
10. A

Manatee Word Scramble (located on page 26) Answer Key

- Cixto* — Toxic
Mslamam — Mammals
Tysmescoe — Ecosystem
Gudnog — Dugong
Vireobrhe — Herbivore
Apdroetr — Predator
Enasirni — Sirenian
Cfruaes rawet — Surface water
Litterretras — Terrestrial
Sleatwnd — Wetlands
Bathiat — Habitat
Gydorhlcio lycec — Hydrologic cycle
Diel depes — Idle speed
Bricksha — Brackish
Aitcuaq — Aquatic
Spyrecno — Necropsy
Minear — Marine
Nolago — Lagoon
Oxtice piesces — Exotic species
Greeddanen — Endangered

Manatee Pre/Post Test (located on page 30) Answer Key

Fill-in-the-Blank

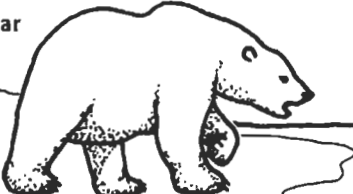



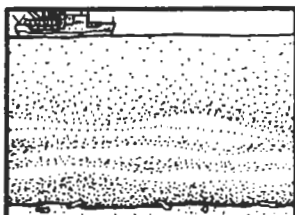

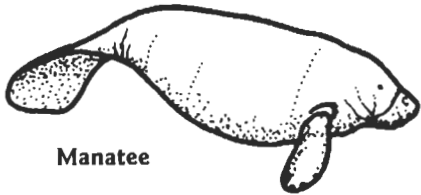
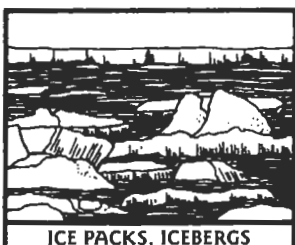
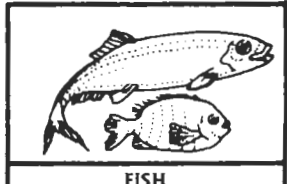

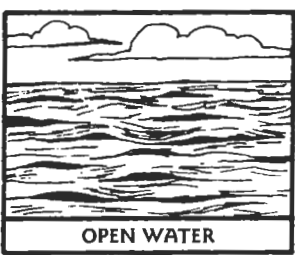
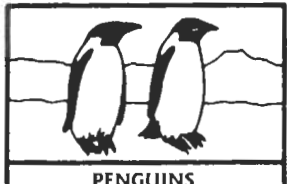

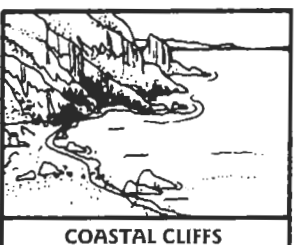
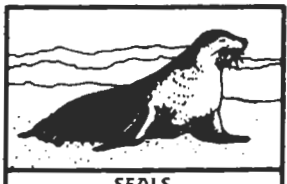
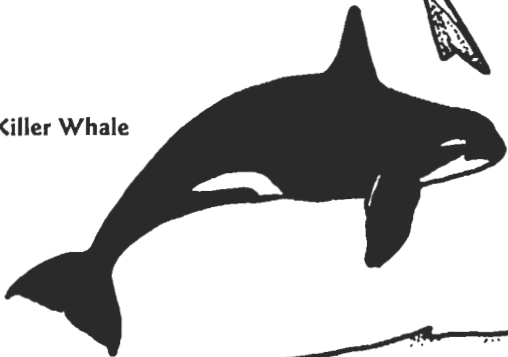
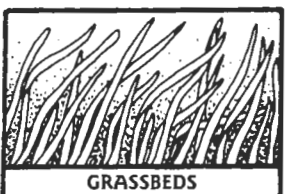
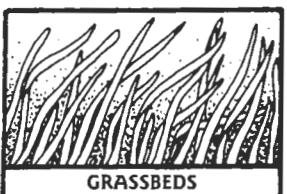
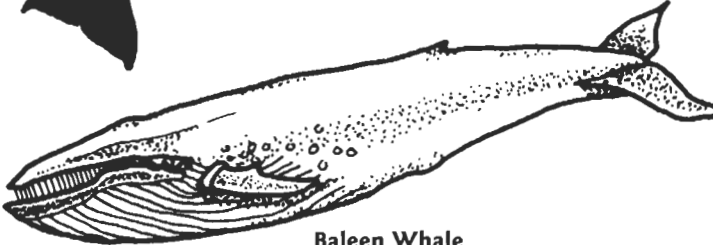
1. 10–15%
2. 60 years
3. Herbivores
4. 20 mph, 3–5 mph
5. Litter, flood gate/canal lock structures, watercraft collisions
6. From their unique, distinctive scars
7. Florida, Virginia, Texas
8. two–five, two
9. Chirps, whistles or squeaks
10. C – Both federal and state law

True or False

1. True.
2. False. The Steller's sea cow is extinct.
3. False. Manatees are semi-social, somewhat solitary animals.
4. False. The *Florida Manatee Recovery Plan* is coordinated by the U.S. Fish and Wildlife Service.
5. True.
6. False. Manatees are mammals and must surface to breathe air.
7. True.
8. False. Manatees are herbivores.
9. False. Manatees are passive animals.
10. True.

The Great Mammal Match-Up

Find the favorite food and habitat of these marine mammals and match them up by using different colored lines for each animal!

| | | |
|---|---|---|
| <p>Polar Bear</p>  |  <p>SHALLOW, WARM RIVER</p> |  <p>PLANKTON</p> |
| <p>Walrus</p>  |  <p>DEEP SEA WATER</p> |  <p>SHELLFISH, OYSTERS</p> |
| <p>Manatee</p>  |  <p>ICE PACKS, ICEBERGS</p> |  <p>FISH</p> |
| <p>Sea Otter</p>  |  <p>OPEN WATER</p> |  <p>PENGUINS</p> |
| <p>Dolphin</p>  |  <p>COASTAL CLIFFS</p> |  <p>SEALS</p> |
| <p>Killer Whale</p>  |  <p>GRASSBEDS</p> |  <p>WHALES</p> |
| <p>Baleen Whale</p>  | | |

Graphics by Mary Ruth Sprankel.

Glossary

AQUATIC — growing or living in the water.

AQUIFER — an underground bed or layer of permeable rock, sand or gravel containing water.

BAY — an inlet of the sea or other body of water, usually smaller than a gulf.

BRACKISH (WATER) — a mixture of fresh and salt water.

CARNIVORE — a flesh-eating animal or plant.

CONSERVATION — the care, protection or management of natural resources.

DREDGE AND FILL — dredging is a method for deepening streams, swamps, or coastal waters by excavating solids from the bottom. Fill is a term used for filling in wetlands.

DUGONG — a sirenian that is entirely marine. Dugongs have forked tails, and tusks are found in males.

ECOSYSTEM — the interacting system of a biological community and its non-living environment.

EFFLUENT — a discharge of water, which may contain pollutants, into the environment.

ENDANGERED — said of any species of wildlife whose prospect of survival is in jeopardy; in danger of extinction due to natural or human-made factors.

ENVIRONMENT — all the conditions, circumstances and influences surrounding and affecting the development of an organism or group of organisms.

ESTUARY — an area where fresh water meets and mixes with salt water.

EVOLUTION — the development of a species, from its original or primitive ancestor to its present, specialized state.

EXOTIC SPECIES — plants or animals that are not native to an area; introduced from another place.

EXTINCT — said of a plant or animal species that no longer exists.

GESTATION PERIOD — the period of time between conception and birth.

GROUNDWATER — water below the surface of the ground, often deep below.

HABITAT — the three-dimensional space a species inhabits that includes all the features needed for survival.

HARASSMENT — persistent bothering or annoying of an animal, so as to change its natural behavior.

HERBIVORE — an animal that feeds on plants.

HYDROLOGIC CYCLE — the circulation of water in a cycle where water evaporates from the ocean and land and returns to the earth as precipitation. This water then flows over the surface, through the ground, or is used by plants before evaporating or transpiring and starting the cycle again.

IDLE SPEED — minimum speed that will maintain the steerage of a vessel.

LAGOON — a shallow, marine water body separated from the sea by sand bars or a barrier island.

MAMMALS — animals that breathe air, nurse their young, have backbones, are warm blooded and have body hair at some stage of their development.

MANATEE PROTECTION AREA — any area with regulations aimed at protecting manatees.

MARINE — inhabiting the sea.

METABOLISM — the chemical and physical processes continuously going on in living organisms and cells.

NECROPSY — a postmortem examination performed on an animal.

NICTITATING MEMBRANE — a thin membrane found in many animals beneath the lower eyelid that extends across the eyeball.

OMNIVORE — an animal that eats both plants and other animals.

PREDATOR — an animal that obtains food primarily by killing and consuming animals.

PREY — an animal killed by a predator as food.

REHABILITATION — bringing or restoring to a normal or optimal state of health by medical treatment.

RIVER — a natural stream of water of considerable volume.

SALT MARSH — an area vegetated by salt-tolerant plants subject to periodic tidal inundation by salt water.

SALT WATER INTRUSION — the invasion of salt water into a body of fresh water, occurring in either surface or groundwater bodies.

SANCTUARY — a place of refuge or protection.

SIRENIA — the taxonomic order to which manatees and dugongs belong.

SLOW SPEED — the speed at which a boat is operating off-plane and settled into the water.

SPRING — a place where water seeps or bubbles from the ground.

SURFACE WATER — water on the surface of the ground, such as lakes, rivers, puddles and the water in the topsoil.

SURFACE WATER RUNOFF — the portion of rainfall or irrigation water that eventually is returned to bodies of water.

TAXONOMY — a system of arranging animals and plants into natural, related groups based on factors common to each other.

TERRESTRIAL — living on land rather than in water.

THREATENED — said of any species of wildlife that may not be in immediate danger of extinction but exists in such small populations that it may become endangered if subjected to increased stress from changes in its environment.

TOXIC — acting as a poison; poisonous.

VANDALISM — destruction of public or private property, including the deliberate harming of a manatee, other wild creature or natural resource.

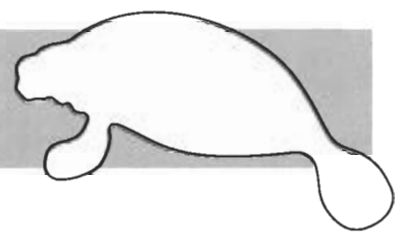
VULNERABLE — an international designation similar to the United States designation of "threatened."

WETLANDS — land where water is the dominant factor determining the nature of soil and the types of plant and animal communities living in the soil or on its surface.

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Manatee FAQ



Q. When will manatees be taken off the endangered species list?

- A.** The *Florida Manatee Recovery Plan* was developed as a requirement of the Endangered Species Act of 1973 (ESA) and is coordinated by the U.S. Fish and Wildlife Service (USFWS). The recovery plan must present objective and measurable recovery criteria and site-specific management actions to minimize or remove threats to the Florida manatee. The USFWS must, to the maximum extent practicable, incorporate into each recovery plan objective measurable criteria which, when met, would result in a determination that the species be removed from the list of endangered and threatened species. In designating these criteria, the USFWS must address the five statutory listing/recovery factors and measure whether threats to the species have been ameliorated or improved. The five listing recovery factors are:
1. The present or threatened destruction, modification or curtailment of a species' habitat or range.
 2. Overutilization for commercial, recreational, scientific or educational purposes.
 3. Disease or predation.
 4. The inadequacy of existing regulatory mechanisms.
 5. Other natural or man-made factors affecting its continued existence.

Q. When will there be enough manatees to be considered "recovered," according to the ESA?

- A.** There is no specific number established that will result in the delisting of manatees as an endangered species.

In addition, not enough is known yet about Florida manatee population trends to say if the manatee population is increasing, decreasing or stable. In two regional subpopulations there is evidence that the numbers are increasing, but these two areas combined make up only about 16% of the total Florida manatee population. In the remaining two regional subpopulations, which comprise 84% of the state's manatee population, the data available are not yet sufficient to reliably estimate the population trends.

Q. Are manatees indigenous (native) to Florida?

- A.** According to sirenian paleontologist Daryl P. Domning, fossil remains of sirenian ancestors show they have inhabited Florida for about 45 million years. Modern manatees have been in Florida for over one million years (probably with intermittent absences during the Ice Ages); i.e., a lot longer than people have lived here. The present Florida manatee (*Trichechus manatus latirostris*) is a subspecies endemic or common to Florida. Genetic studies to date indicate that it is not derived from the populations in Mexico or Central America, but more likely colonized Florida from the Greater Antilles thousands of years ago after the last Ice Age. However, there is no evidence that manatees are now entering Florida from Central America, the Caribbean or anywhere else. The manatees in Florida today have

every right to be considered Florida natives.

Q. Are power plants bad for manatees?

- A.** Although power plants have acted as attractants to manatees who use the plant effluents as winter warm water refugia, the effluents are critically important to manatees during cold spells. Manatees are susceptible to cold stress and cold-related diseases and can die when ambient water temperatures drop below 20° C (68° F).

As coastal development pressures in southeast and southwest Florida have pushed manatees further north, power plant effluents have played a critical role in manatee protection.

Q. How can you tell a female from a male manatee?

- A.** If you look at the underside of a manatee, referencing from the head to the tail, the genital opening in the male manatee is just below the umbilicus (belly button), and the female's genital opening is just above the anus. That's how you can tell a female from a male.

Q. Are manatees ever attacked by sharks?

- A.** Manatees are not usually hunted by sharks because they generally don't share the same habitat. Larger-sized species of sharks are generally found offshore in deeper waters. The smaller shark species that may inhabit lagoons and shallower waters probably would not attack manatees because they are too big. Alligators do not usually attack manatees for the same reason.

A manatee fitted with a radio transmitter is released by U.S. Geological Survey biologists.



Photo by Bob Bonde, U.S. Geological Survey, Florida Caribbean Science Center, Sirenia Project



Photo © Robert Rattner

A researcher records data in the winter at a manatee aggregation (gathering) site near one of Florida's power plants.

Students demonstrate the best way to view manatees in the wild – from a distance. Enjoy manatees, but please don't touch, feed or give them water.

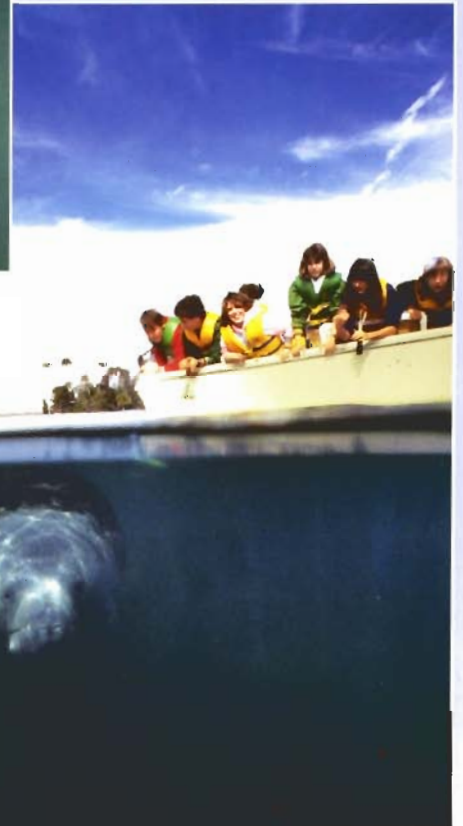


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