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

Photo by Bob Bonde, U.S. Geological Survey, Southeast Ecological Science Center, Sirenia Project

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

Photo © Robert Rattner

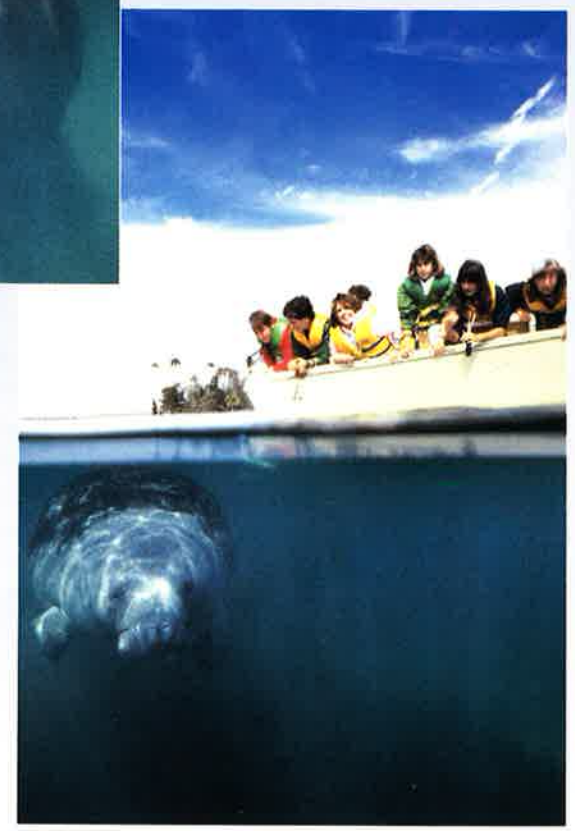

Photo © Robert Rattner

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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Manatees
An Educator's Guide

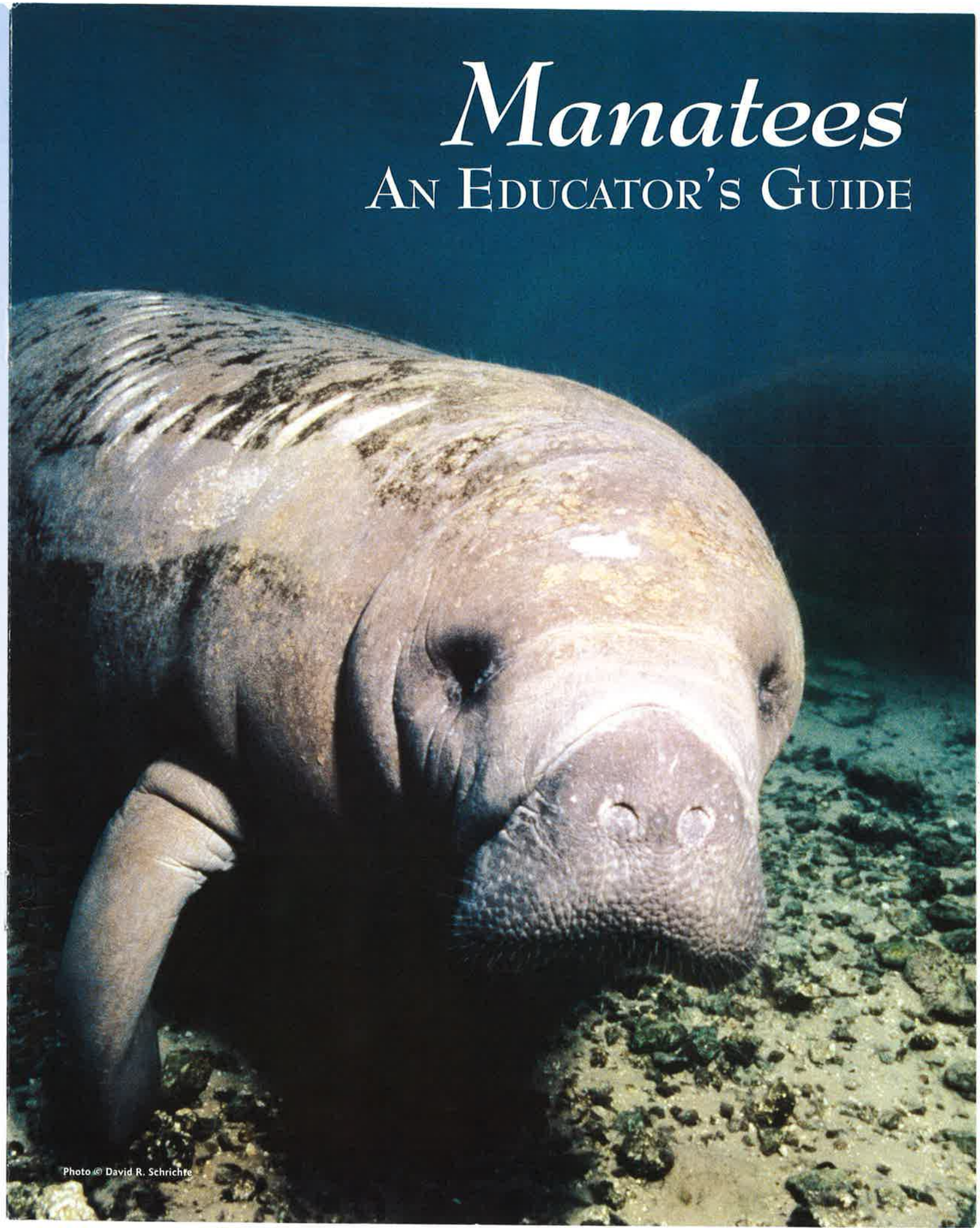
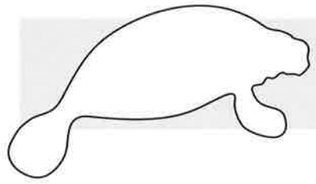


Photo © David R. Schrichte



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. It appears that they can hear sounds at a wide range of frequencies, but their sound localization is poor.

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. Each summer, sightings of Florida manatees occur in other southeastern states including Alabama, Georgia, and South Carolina. Manatees have been documented as far west as Texas and as far north as Massachussetts.

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. Manatees are not sexually mature until they are about five years old. On average, one calf is born every two to five years, and twins are rare.

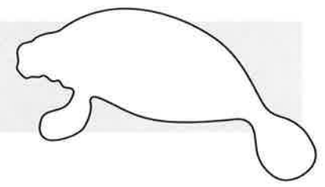
MORTALITY: Many manatee mortalities are human-related. Most human-related manatee mortalities in Florida are caused by watercraft collisions. Manatees are also crushed and/or drowned in canal locks and flood control structures. They can accidentally ingest fishhooks, litter, and fishing line, or become 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** or ***FWC** on your cellular phone, or use **VHF Channel 16** on your marine radio.

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.

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.

Notes

Table of Contents

For more manatee education materials and resources for teachers and students, please visit our web site at ***www.savethemanatee.org/info***

 Produced by Save the Manatee Club and partially funded through the generous support of the Disney Wildlife Conservation Fund. Edited by Nancy Sadusky with assistance from Valerie Gohlke. Graphics by Mary Ruth Sprankel.

This is the 7th 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, Southeast Ecological 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 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 Sea Turtle Conservancy and Mary Bourassa for activity ideas 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. Schrichte for donation of the image. Special thanks also to Robert Rattner and to the U.S. Geological Survey, Southeast Ecological Science Center, Sirenia Project for the donation of photos for the back cover.

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Save the Manatee® Club

Save the Manatee Club (SMC) is an award-winning 501c3 nonprofit conservation organization, established in 1981 by singer/songwriter Jimmy Buffett and former Florida Governor and U.S. Senator Bob Graham. Its mission is to protect endangered manatees and their aquatic habitat for future generations. SMC raises public awareness; educates; sponsors research, rescue, rehabilitation, and release efforts; supports land acquisition; promotes aquatic habitat protection; advocates for improved protection measures, and aids education and conservation efforts in other countries. SMC supports policies that are based on the best scientific data available. The organization's Adopt-A-Manatee program is internationally recognized.

The following information is a description of SMC's major accomplishments and activities.

Public Awareness Programs

Each year, SMC sends out press releases and public service ads on manatee issues to local, state, national, and international media. Jimmy Buffett and other celebrities also record 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 produces public awareness waterway signs, boat decals, and waterproof banners that alert boaters to the presence of manatees. They are distributed free to Florida boaters and shoreline property owners. The Club also produces posters with a manatee conservation message that are distributed free to marinas, schools, libraries, businesses, and other organizations.

In conjunction with the U.S. Fish and Wildlife Service (USFWS), SMC has produced brochures highlighting the problems associated with feeding manatees.

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.

SMC has started programs in Broward County and the Florida Keys to recycle monofilament fishing line and is one of the partners in the statewide Monofilament Recovery and Recycling Program, which works 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 the video *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 provides volunteer speakers when available to schools and civic groups in Florida and select areas across the U.S. In addition, SMC staff work with local, state, and national agencies and organizations on manatee education and public awareness initiatives.

International Activities

SMC has funded studies of manatees in West Africa, 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, Aquasis in Brazil, and Wildtracks in Belize to care for orphaned and injured manatees. The Club provided funding toward enforcement efforts of park rangers at the first manatee sanctuary established in the Dominican Republic. SMC has also provided health assessment support and care for manatees in Belize, Colombia, Venezuela, Jamaica, and Mexico. SMC provided supplementary food for three captive manatees in Jamaica. Club funds also helped to monitor a Florida manatee in the Bahamas and helped establish a no-entry sanctuary to protect manatees in Belize. The Club has produced educational materials that have been distributed in West Africa, Central and South America,

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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.

and the Wider Caribbean. In addition, SMC staff make recommendations on sirenian issues to the IUCN – World Conservation Union.

Research Studies

SMC has provided funds for equipment used in manatee research such as computers, cameras, diving gear, canoes, research boats, two-way radios, sanctuary buoys, and tracking equipment. The Club has also assisted state and federal governments with research projects such as aerial surveys, seagrass 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 to assist in manatee research and management plans.

Rescue and Rehabilitation Funding

SMC staff handle reports from the public on injured manatees and help facilitate rescues. SMC has also 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. SMC has 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

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

trailers to various agencies and organizations for manatee rescue and research purposes, including a pontoon boat to Homosassa Springs Wildlife State Park to educate the boating public and to aid in manatee rescue operations.

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 served 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 and other crucial areas and coordinated grass roots efforts on these issues. 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 resulted in additional manatee protection measures. Through SMC's efforts, these agreements 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 current information on manatees, the Adopt-A-Manatee® program, or Save the Manatee Club activities, visit our web site at ***www.savethemanatee.org***.

Save the Manatee Club
500 N. Maitland Ave.
Maitland, FL 32751
1-800-432-JOIN (5646)

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).

Another interesting thing 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.

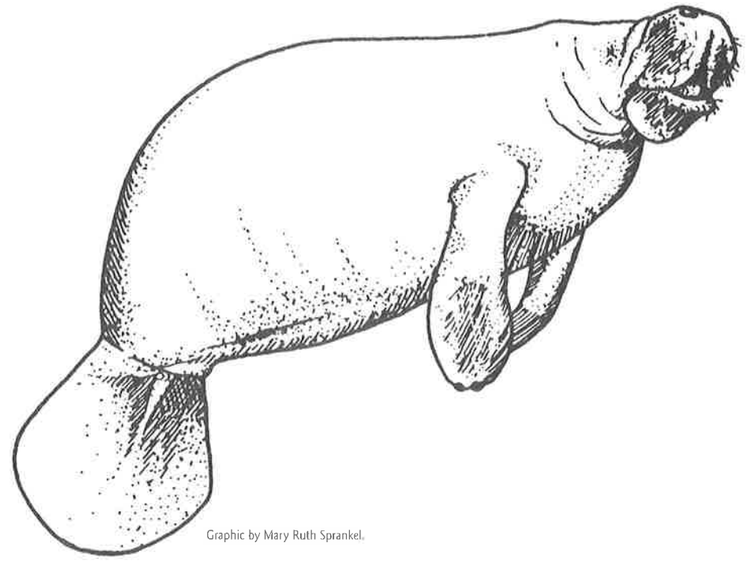
On the whole, however, the sensory systems of manatees have not been well studied. Anatomically, manatees have extremely large ear bones and may have a good sense of hearing (Bullock et al. 1982). They emit sounds underwater that are used in communicating with one another. These sounds can be described 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 an average of every three to five minutes. Intervals between breaths

Answer Keys



Graphic by Mary Ruth Sprankel.

Habitat Pre/Post Test (located on page 32) 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
Literretras — 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 31) Answer Key

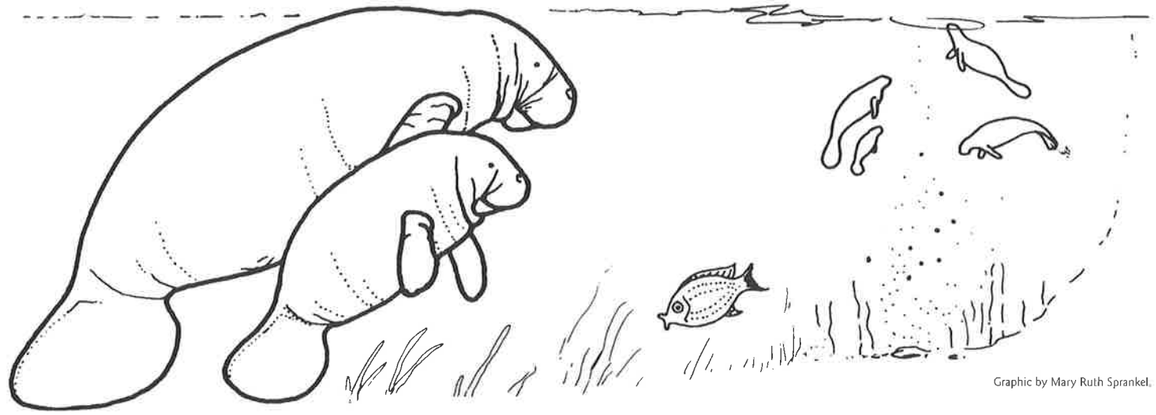
Fill-in-the-Blank

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, Massachusetts, 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.

Habitat Pre/Post Test



Graphic by Mary Ruth Sprankel.

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

1. Habitats where manatees are found must provide them with which of the following:
   A. A breeding area
   B. Sheltered living
   C. Food supply
   D. All of the above

2. The four necessary elements of manatee habitat are:
   A. Food, water, space, shelter
   B. Water, shelter, sky, trees
   C. Fish, sun, metal, water
   D. Rain, food, stars, space

3. Manatees are susceptible to cold-related disease. The lower end range of water temperatures they can tolerate is:
   A. 7° to 13° C (45° to 55° F)
   B. 31° to 33° C (88° to 92° F)
   C. 20° to 22° C (68° to 72° F)
   D. –23° to –29° C (–10° to –20° F)

4. Manatees are herbivores, but they probably *wouldn't* eat which of the following plants?
   A. Hydrilla
   B. Douglas fir tree
   C. Tapegrass
   D. Water lettuce

5. Although Florida manatees are migratory, they do not migrate to which of these places?
   A. Florida
   B. Louisiana
   C. North Carolina
   D. Montana

6. What sirenian is found around the northern part of Australia?
   A. Amazonian manatee
   B. Steller's sea cow
   C. Dugong
   D. West Indian manatee

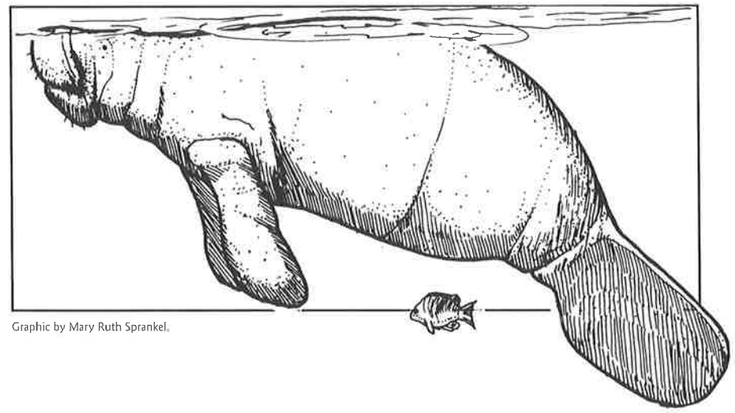
7. What animal would you most likely find sharing its home with a manatee?
   A. Snowy owl
   B. Grizzly bear
   C. Gray wolf
   D. Turtle

8. Seagrass beds are an important feeding area for manatees. Which of the following is a cause of seagrass bed destruction?
   A. Surface water run-off
   B. Herbicide spraying
   C. Prop dredging
   D. All of the above

9. In which area would you most likely find manatees during colder weather?
   A. Under icebergs
   B. In power plant outflows
   C. Resting on the beach
   D. 5–10 miles out at sea

10. 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:
    A. Central American waterways
    B. Indian Ocean
    C. Bering Sea
    D. Lake Erie

(See Answer Key on page 33.)



Graphic by Mary Ruth Sprankel.

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 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. The age of sexual maturity for females and males is about five years. On average, one calf is born every two to five years and 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 capable of living more than 60 years. However, the many threats they face in the wild, particularly from human activities, can significantly shorten their lifespan. In particular, research conducted at the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife 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).

Trichechus Trivia

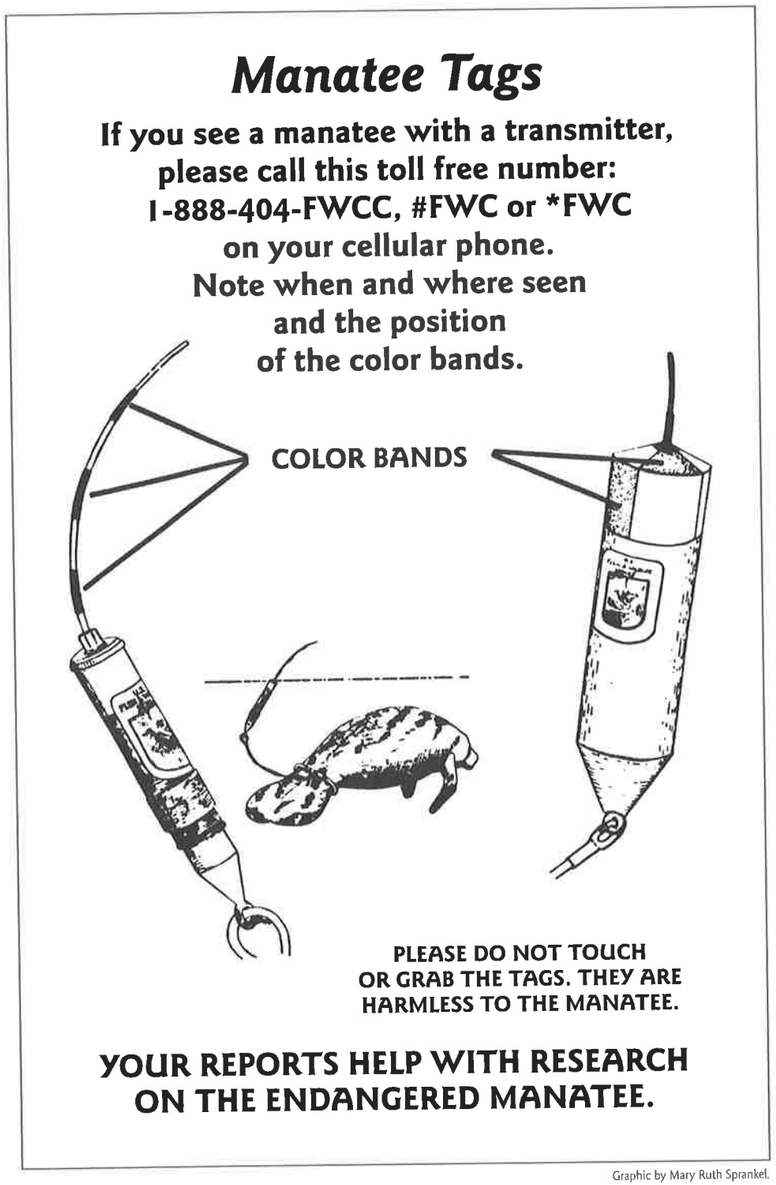
- A manatee's age can be determined by the annual growth rings in its ear bones.
- Of all the mammals in the world, manatees and sloths are the only mammals with six cervical (neck) vertebrae. All other mammals (even giraffes!) have seven cervical vertebrae.
- Manatees don't necessarily have daily routines 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.

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.

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 day and traveled into the Atlantic Ocean and along the beach for several portions of the journey. Another manatee was sighted in Cape Cod, Massachusetts! These long-distance movements had not previously been documented for individual manatees.



Graphic by Mary Ruth Sprankel.

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.

For more manatee education materials and resources for teachers and students, please visit our web site at ***www.savethemanatee.org/info***

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 2000 P Street NW, Suite 540, Washington, DC 20036. Phone: 202-419-0412, www.naaee.org.

Growth Management

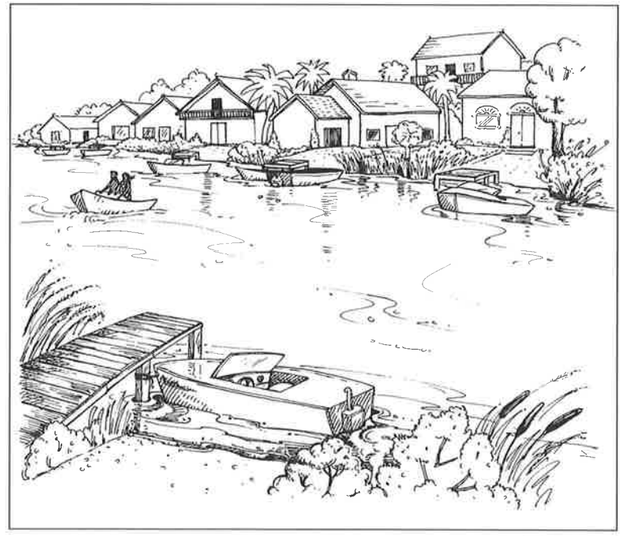
A very serious threat to manatees, as well as to Florida's whole environment, is our growing population. Manatee habitat and the habitat of many other species in Florida has been lost due to the staggering amount of development that has occurred in recent years.

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 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.



Graphic by Navin Patel.

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

Other Manatee Research Programs

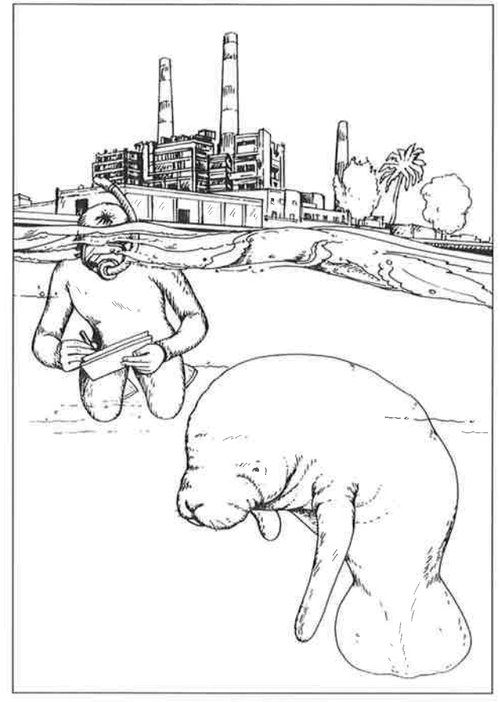
With a better scientific understanding of manatees, responsible management and recovery projects can be undertaken. In addition to the manatee tracking program, the rescue and rehabilitation, carcass salvage, photo identification/scar pattern, and synoptic survey programs are all designed to provide 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, Lowry Park Zoo, and the Miami Seaquarium are the three critical care facilities in Florida 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 the FWCC.

The Salvage Program

The Manatee Carcass Salvage Program is operated by the FWCC. 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 and quantified so researchers can better understand the dangers to manatees.



© Robert Rattner, Adapted from original photograph.

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.

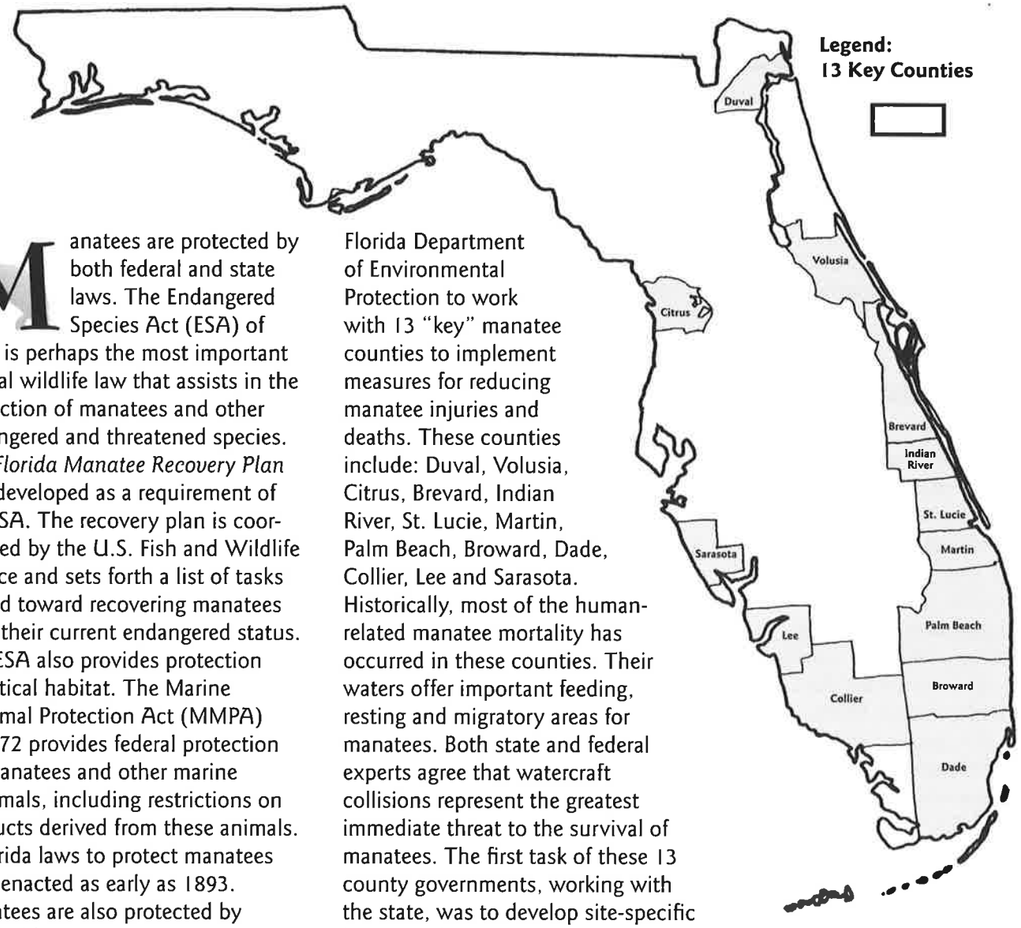
The U.S. Geological Survey Sirenia Project, in cooperation with the FWCC, maintains a Photo CD-based computerized database of distinctively scarred manatees statewide. This database is called the Manatee Individual Photo-Identification System (MIPS).

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. 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 13 "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** or ***FWC** on your cellular phone, or use **VHF CHANNEL 16** on your marine radio if you spot an injured manatee.

Did You Know?
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.