

Meet the Manatees



Science & Math

Grades: 3-5

Objective: Students will

- construct an energy pyramid to demonstrate the flow of energy within a manatee's environment.
- discuss what effects the reduction of seagrass growth would have on producers and consumers in the food chain.
- construct graphs that depict the data provided, including seagrass growth, and manatee sea grass consumption.
- answer questions and solve problems based on information shown in the graphs.

Source: Volusia County

Sea Grass Habitat Loss and Carrying Capacity

Grade Level: 3-5

Subject Area: Biology, Earth Science, Mathematics

Duration: Teach: 15 minutes, Activity: 20 minutes, Discussion: 20 minutes

Setting: Classroom



Next Generation Standards:

Science:

Body of Knowledge **SC.4.P** Physical Science

Supporting Idea 10: **SC.4.P.10** Forms of Energy

Body of Knowledge **SC.4.E** Earth and Space Science

Supporting Idea 6: **SC.4.E.6** Earth Structures

Body of Knowledge **SC.4.N** Nature of Science

Supporting Idea 1 **SC.4.N.1** The Practice of Science

Supporting Idea 2 **SC.4.N.2** The Characteristics of Scientific Knowledge

Math:

Domain-Subdomain **MAFS.4.MD** Measurement and Data- **MAFS.4.MD.2** Cluster 2 Represent and Interpret Data

Domain-Subdomain **MAFS.4.OA** Operations and Algebraic Thinking Cluster 3 **MAFS.4.OA.3** Generate and Analyze Patterns

Objectives:

- Students will construct an energy pyramid to demonstrate the flow of energy within a Spring environment.
- Students will discuss what effects the reduction of seagrass growth would have on other producers and consumers in the food chain.
- Students will construct graphs that depict the data provided, including seagrass growth, and manatee sea grass consumption.
- Students will answer questions and solve problems based on information shown in the graphs.

Materials: graph paper, handouts (Anatomy of a Spring, What's Dinner for a Manatee?, Home of the Manatee), example data for seagrass growth, bar graphs depicting seagrass population growth, handouts.

Vocabulary: carrying capacity, consumer, ecosystem, double-bar graph, energy, energy pyramid, environment, estuary, food chain, food web, habitat, ingestion, population growth, interval, lagoon, mean, median, mode, natural resource, niche, outlier, predator, prey, producer, range, sea grass bed

Background/Preparation: Background information on manatee diet and habitat. Discuss how population growth and development along the waterways has affected the state of the waterways, and the ability for seagrass to grow there. Use the websites in this activity to research information about sea grass/spring habitats.

Teach/Activities:

Try different techniques to teach about manatees' use of their habitat, their eating habits, the effects of habitat loss on sea grass growth and manatee population. Possible options include:

- traditional lecture
- games
- handouts
- drawing/art projects

- **Activity A**
 - Construct an energy pyramid containing producers and consumers in a Florida spring habitat.
 - Worksheet 1

- **Activity B**
 - Construct a bar graph to depict the data in Table 1.
 - Worksheet 2

- **Activity C**
 - Group activity: Carrying Capacity Worksheet

Created by Bryan Keller, Kathy Wood, Janet Gray. Adapted by Alexa Bracht, Georgia Zern, Louise Chapman.

Anatomy of a Spring

A spring is one of the only natural areas in the state that you can encounter so many of Florida's resident plants and animals in one geographic area.

Fish: Florida's spring waters provide a natural aquarium for many of the state's most common and unique fish species. Some, like the American Mullet, **migrate to the springs from the ocean**. Others, like the Bullhead Catfish, live in the dark recesses of the springs' underwater caves emerging only at night to feed.



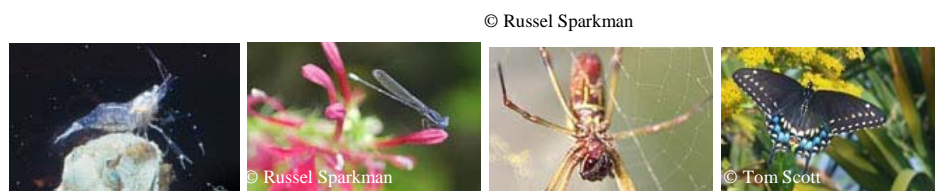
Reptiles and Amphibians: The American alligator, the largest reptile in North America, and the loggerhead musk turtle, which attains a maximum size of only five inches, live in the springs.



Mammals and Birds: Springs are home to many of the most recognizable mammals and birds found in Florida. Some, like the great blue heron, deer and otters, can be found at the springs year-round. In the winter the springs, which maintain a constant water temperature of 72 degrees, provide a warm-water refuge for species like the manatee.



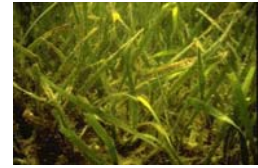
Invertebrates: By far the most secretive of spring species are invertebrates like the freshwater shrimp and the albino cave crayfish. Often no more than a couple inches in size, these tiny animals comprise some of the rarest species in Florida.



Florida's springs support a variety of plant life, including ancient cypress trees, rare orchids and lillies, and lush underwater carpets of eel grass.



WHAT'S DINNER FOR A MANATEE?

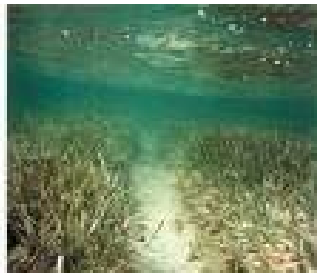


- Manatees spend about **six to eight hours** a day feeding.
- Manatees **eat seagrasses** but will try to eat any plants. They have been observed eating aquatic plants, and shore plants, including trees, hanging out over the water. They have been observed drifting in the current, casually snatching and eating plants as the current pushed them along. They **chew constantly**; the sound of their teeth grinding is audible underwater.
- Manatees feeding in seagrass beds either **crop** the seagrass leaves or **dig** into the sediment with their flippers to eat the entire plant.
- Manatees usually **eat about 8 - 10% of their body weight per day** in fresh plants per day.
- Though manatees are described as "**herbivorous**", they are also eating (and gaining protein from) the small animals that are on the plants, including shrimp, crayfish, crabs, insects, snails, leeches, nematodes, worms, anemones and starfish.
- Manatees in Florida feed on more than **60 species of plants** including turtle grass, manatee grass, shoal grass, mangrove leaves, various algae, water hyacinth, acorns, and hydrilla.

HOME OF THE MANATEE

- Manatees live in slow-moving rivers, estuaries, canals and coastal areas, particularly where seagrass beds flourish. During the winter, they migrate to warm water springs where the water temperature remains at **72 degrees Fahrenheit**.
- **Loss of habitat** is one of the most serious threats to the manatee, as it is for many of Florida's wildlife.
- Many **freshwater and marine grass beds have been reduced** or eliminated by water pollution, herbicides, dredge and fill projects and surface runoff. **Rapid human population growth** and associated boat traffic along Florida's coasts and waterways have caused seagrass scarring. This results in degraded and eliminated manatee habitat areas.

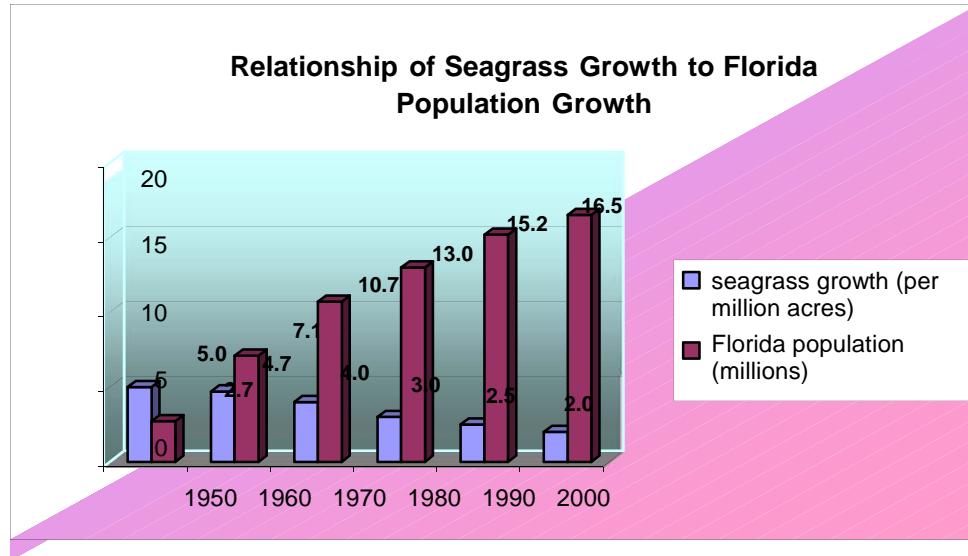
Examples of scarred seagrass beds



Examples of healthy seagrass beds



Seagrass Growth

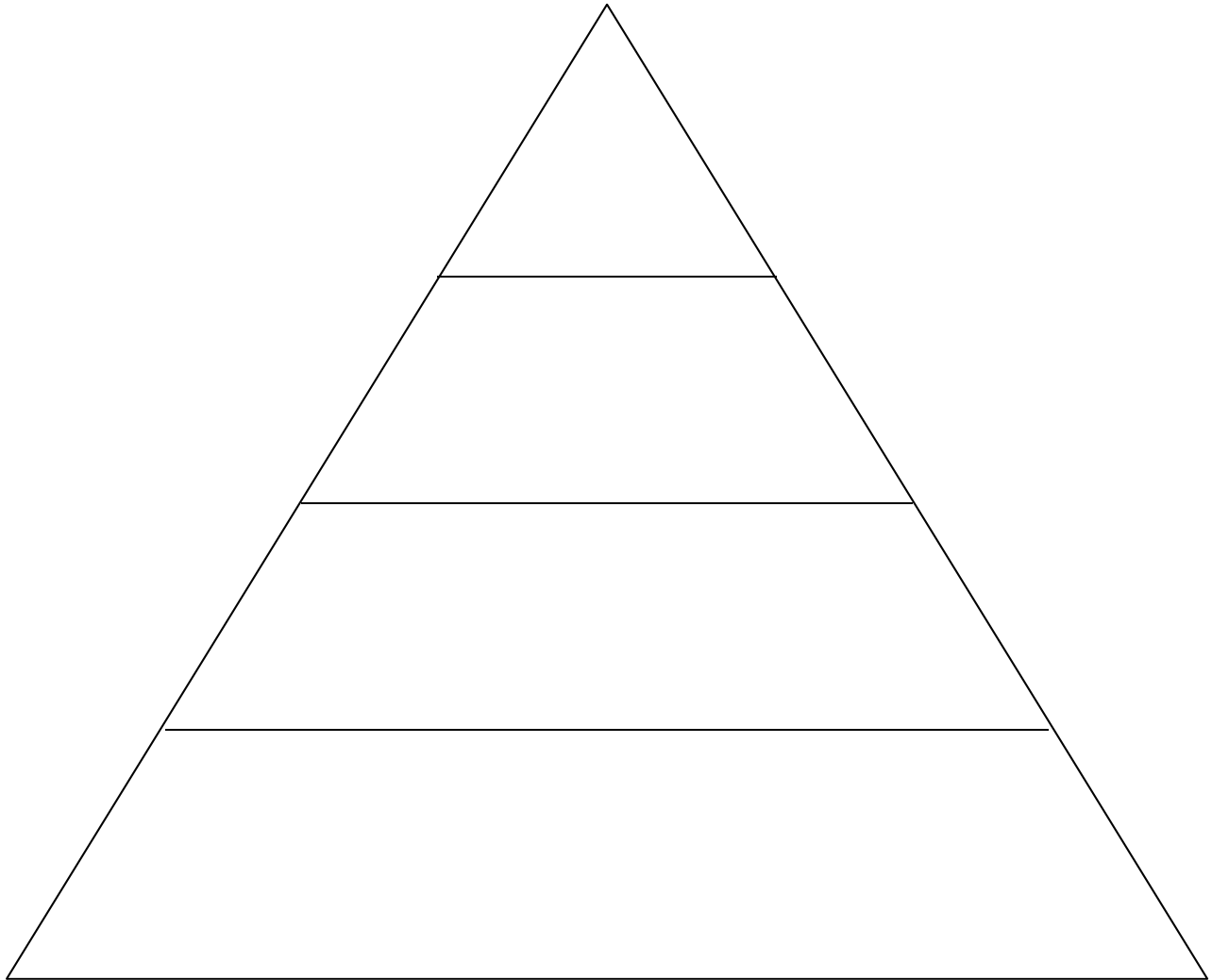


This graph shows the inverse relationship of Florida seagrass habitat decline to the increase in Florida human population.

Activity A.

Energy Pyramid

1. Construct an energy pyramid containing producers and consumers in a Florida spring habitat. Label the producers and consumers and describe their relationships in the space below.



Worksheet 1

Define the following words:

habitat-

ecosystem-

environment-

natural resource-

prey-

predator-

food chain-

food web-

energy-

producer-

consumer-

niche-

1. What do manatees eat?

2. How does the development of new homes on wetlands affect sea grass beds?

3. Discuss how changing the environment, such as the construction of a dock along a waterway, affects the natural environment?

Activity B. Construct a graph depicting the data in the table below.

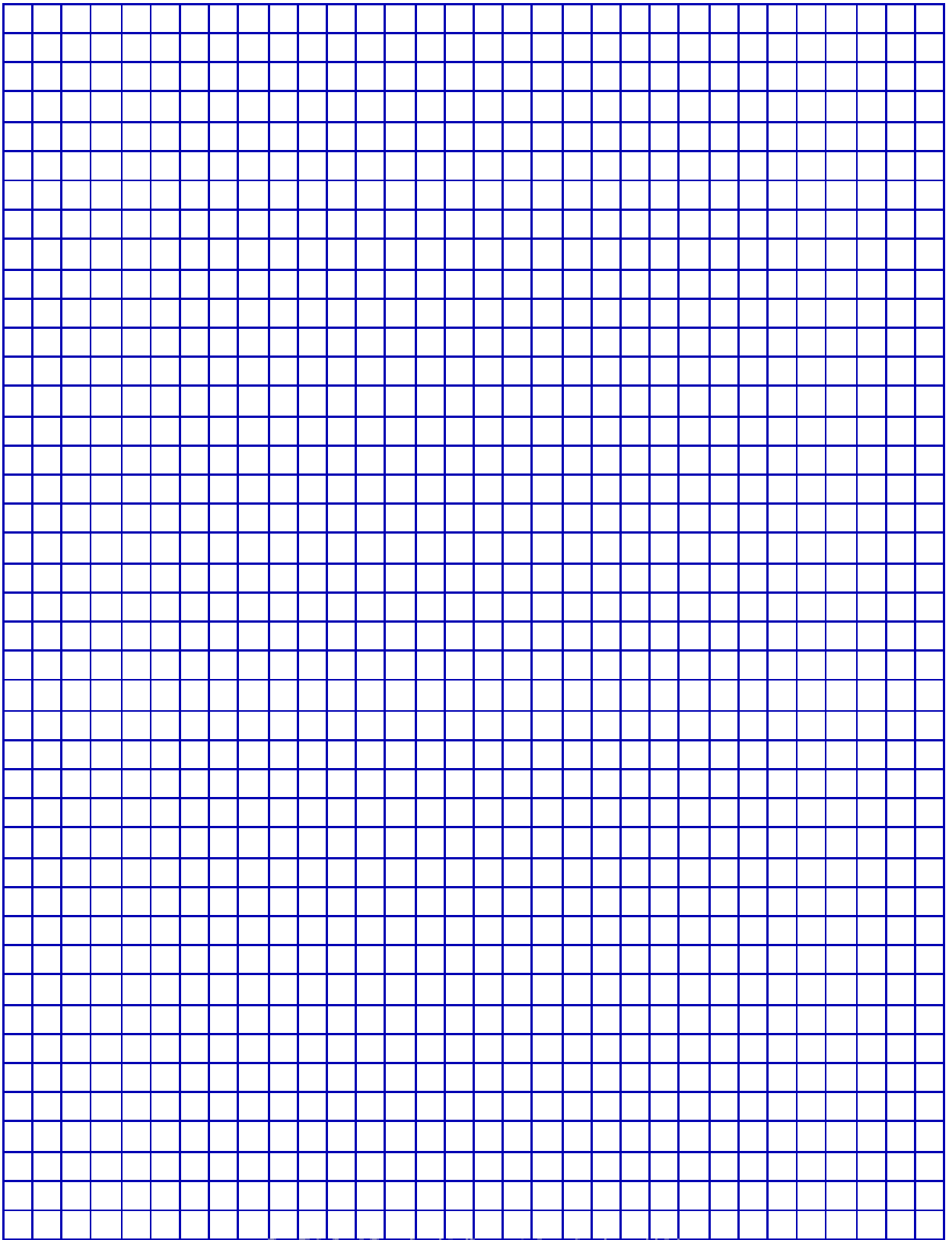
Table 1.

Example Seagrass Growth Data³

³Durako, M.J., R.C. Phillips, and R.R. Lewis, III, (eds.) 1987. Proceedings, of the symposium on subtropical-tropical seagrasses of the southeastern United States; 12 August 1985. PMRP No. 42./ FSG Rpt. 84. 209 pg.

Region	Seagrass density (meters²)
Indian River, FL	10,479
Loxahatchee River, FL	5,217
Biscayne Bay, FL	1,435
Card Sound, FL	1,085
Bahia Honda, FL	102
Total Atlantic Coast	18,318

Created by Bryan Keller, Kathy Wood, Janet Gray. Adapted by Alexa Bracht, Georgia Zern, Louise Chapman



Worksheet 2

What kind of graph is most suitable for this data set? Why?

Choose a title, and construct a key for the graph.

Identify the following for the graph you created:

Outliers:

Median:

Range:

Mode:

Calculate the mean for the data given in Table 1.

How does the graph change if you eliminate the outliers?

Activity 3.

Manatee Math Exercises

1) Manatees eat for up to **8** hours a day. They eat up to **100** pounds of aquatic plants a day. How many pounds of plants do they eat an hour?

In a day?

2) Manatees chew **2** times per second. They eat for **8** hours a day. How many times do manatees chew a day?

3) Manatees can weigh over 3,000 lbs., but the average manatee weighs between 800 and 1,200 lbs. Try picking up a full gallon jug filled with water. A gallon of water weighs **8.35** lbs. How many gallons of water would it take to equal the weight of a **1,056** lb. manatee?

Determining Carrying Capacity of Seagrass Habitat for a Manatee

Carrying capacity is the number of animals that a habitat can accommodate without overgrazing. Simply put, the carrying capacity is how much grass you have.

It's important to recognize that grazing animals need to eat approximately 10% of their body weight each day. **A 1000-pound manatee will eat 100 pounds of sea grass per day.**

Carrying Capacity Problems

Spring run 1 consists of plant species appealing to manatees. It is in reasonably good condition and produces a total of 4893 pounds of useable forage per growing season. It is 3 acres in size.

Run 2 consists of native plants. It is also 3 acres in size. It produces 3495 pounds of useable forage per growing season.

Problem 1: Estimate the approximate number of months one manatee can graze on Run 1.

Problem 2: Estimate the approximate number of months one manatee can graze on Run 2.

Problem 3: Estimate the approximate number of manatees that Run 1 can accommodate for one month.

Problem 4: Estimate the approximate number of manatees that Run 2 can accommodate for one month.

Problem 5: What will happen if 50 manatees enter Run 1 for two months?

Vocabulary

List

carrying capacity: The maximum number of individuals that a given environment can support without detrimental effects.

consumer: An organism that feeds on other organisms for food.

double-bar graph: A graph consisting of parallel, usually vertical bars or rectangles with lengths proportional to the frequency with which specified quantities occur in a set of data.

ecosystem: An integrated unit of a biological community, its physical environment, and interactions

energy: A quantity that describes the capacity to do work; a source of usable power.

energy pyramid: A pyramidal diagram that compares the amount of energy available at each position, or level, in the feeding order

environment: The sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air.

estuary: The part of the wide lower course of a river where its current is met by the tides.

food chain: Transfer of energy through various stages as a result of feeding patterns of a series of organisms.

food web: (food cycle) The interconnected feeding relationships in a food chain found in a particular place and time.

habitat: The natural environment of an organism; place that is natural for the life and growth of an organism

ingestion: The act of taking food and drink into the body by the mouth.

interval: A set of numbers consisting of all the numbers between a pair of given numbers along with either, both, or none of the endpoints.

lagoon: A body of water cut off from a larger body by a reef of sand or coral, or by a barrier island.

mean: The arithmetic average of a set of numbers.

median: The middle point of a set of ordered numbers where half of the numbers are above the median and half are below it.

mode: The score or data point found most often in a set of numbers.

natural resource: Something, such as a forest, a mineral deposit, or fresh water, that is found in nature and is necessary or useful to humans.

niche: The position or function of an organism in a community of plants and animals.

outlier: A value far from most others in a set of data.

population growth: Increase in the number of people who inhabit a territory or state .

predator: An organism that preys on and consumes animals; usually an animal.

prey: An organism caught or hunted for food by another organism.

producer: An organism that makes its own food from the environment; usually a green plant

range: The difference between the highest (H) and lowest (L) value in a set of data.

sea grass bed: Any of various seaweeds that grow underwater in shallow beds; "seagrass provides a protective environment in which young fish can develop".

Additional Resources

<http://www.learner.org/jnorth/tm/manatee/Resources.html>

<http://sofia.usgs.gov/publications/ofr/2006-1126/manatees.html>

<http://myfwc.com/wildlifehabitats/managed/manatee/>

<http://www.learner.org/jnorth/tm/manatee/HabitatSeaGrass.html>

<http://www.savethemanatee.org/EdGuideSm.pdf>