Sea Grass Habitat Loss and Carrying Capacity

Grade Level: 4

Subject Area: Biology, Earth Science, Mathematics

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

Setting: Classroom

Sunshine State Standards:[Ex: SC.D.1.3.1] see Appendix A

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
    - o Construct an energy pyramid containing producers and consumers in a Florida spring habitat.
    - o Worksheet 1
- ❖ Activity B
   - o Construct a bar graph to depict the data in Table 1.
    - o Worksheet 2
- ❖ Activity C
   - o Group activity: Carrying Capacity Worksheet

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.
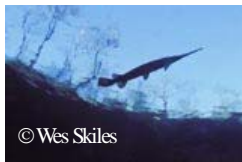
Reptiles and Amphibians: The American alligator, the largest reptile in North America, and the loggerhead musk turtle, which attains a maximum size of only five inches, live in the springs.
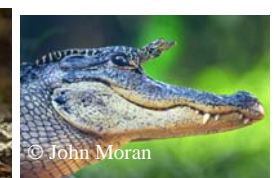
Mammals and Birds: Springs are home to many of the most recognizable mammals and birds found in Florida. Some, like the great blue heron, deer and otters, can be found at the springs year-round. In the winter the springs, which maintain a constant water temperature of 72 degrees, provide a warm-water 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.
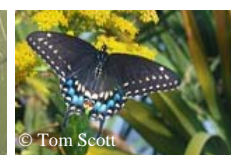
Florida's springs support a variety of plant life, including ancient cypress trees, rare orchids and lillies, and lush underwater carpets of eel grass.
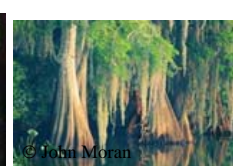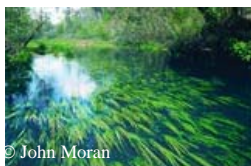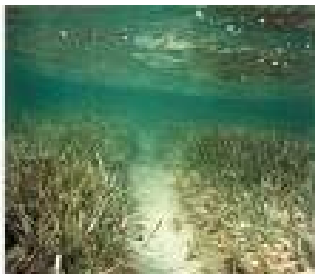
WHAT'S DINNER FOR A MANATEE?
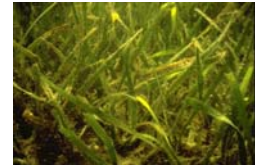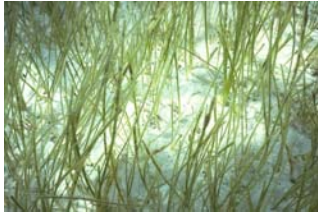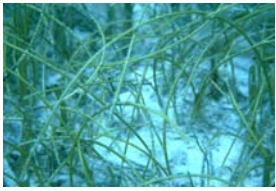
- ❖ Manatees spend about six to eight hours a day feeding.

- ❖ 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

Relationship of Seagrass Growth to Florida Population Growth

20

15

16.5

15.2

13.0

10.7

10

7.1

5.0

4.7

4.0

5

2.7

3.0

2.5

2.0

0

1950   1960   1970   1980   1990   2000

☐ seagrass growth (per million acres)

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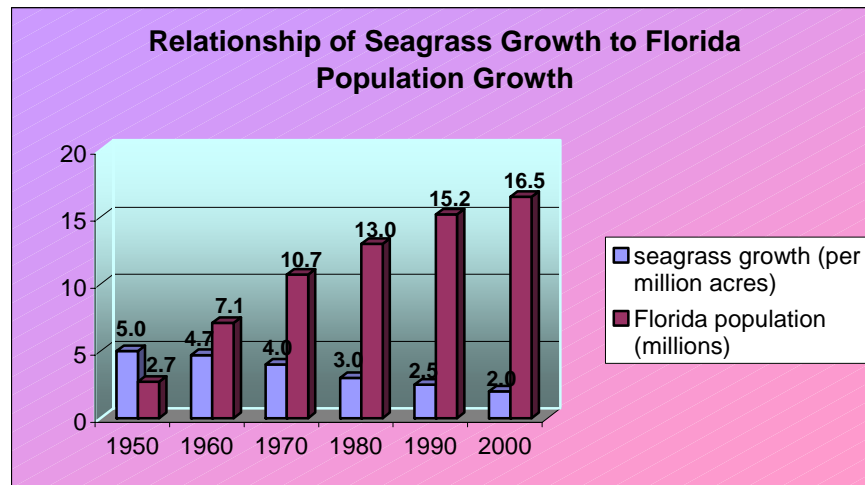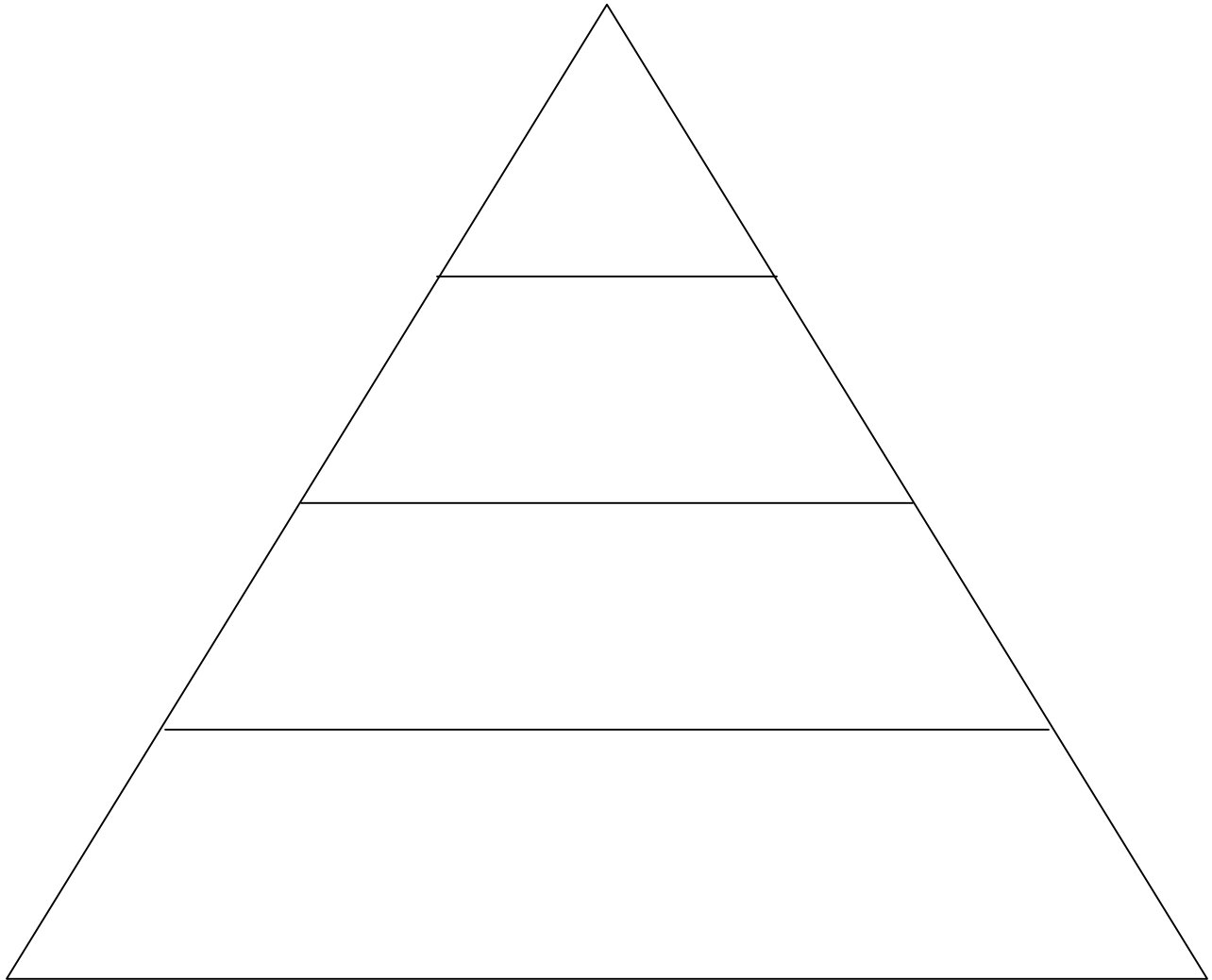
This graph shows the inverse relationship of Florida seagrass habitat decline to the increase in Florida human population.

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 Data[3]

[3]Durako, 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 (meters^2)
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 and Kathy Wood and Janet Gray. Adapted by Alexa Bracht and Georgia Zern
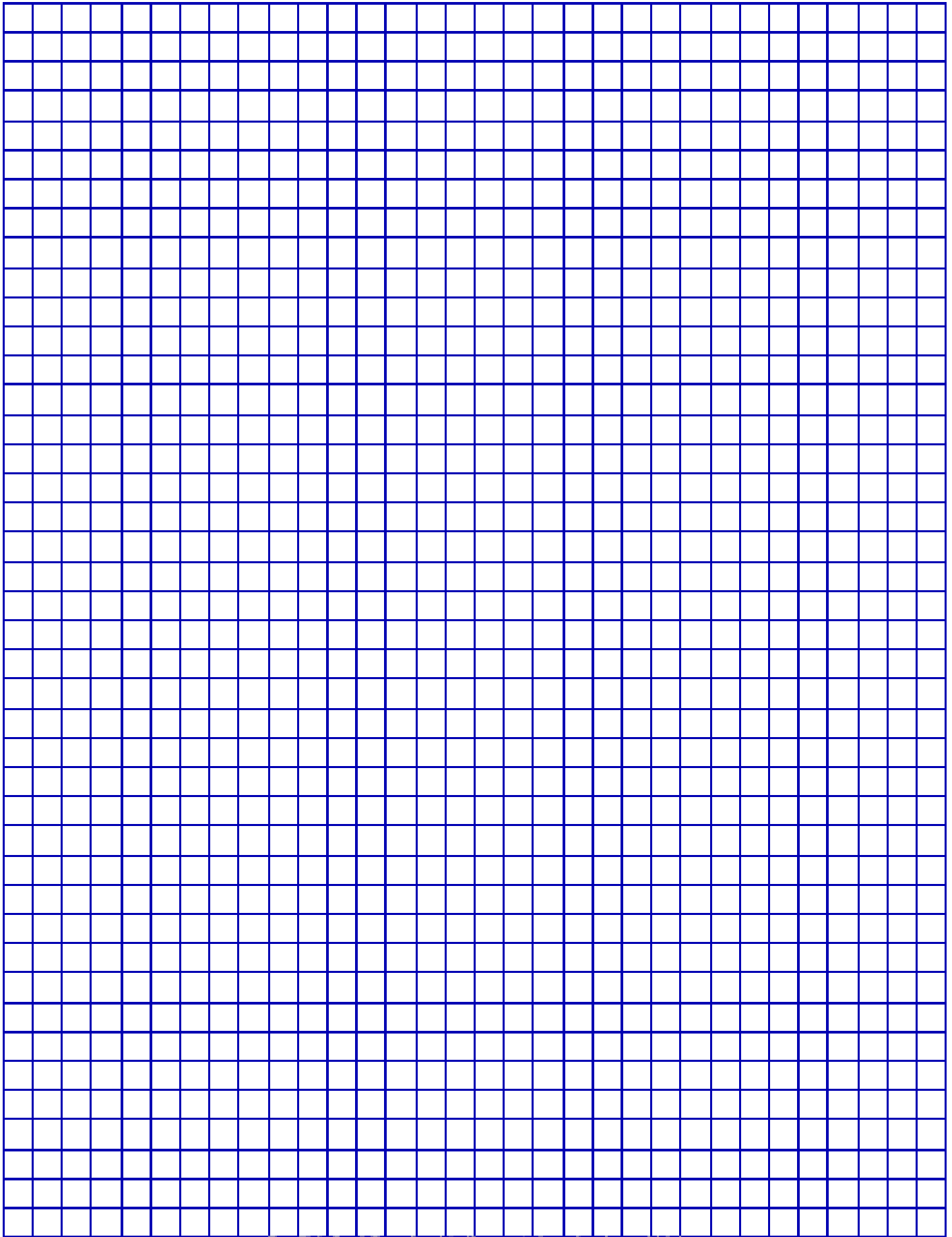
Worksheet 2

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 3000 lbs, but the average manatee weighs between 800 and 1200 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 1056 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.**ecosystem:** An integrated unit of a biological community, its physical environment, and interactions

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.

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

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.

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

Appendix A

SC.B.1.2.1 Know how to trace the flow of energy in a system (e.g., as in an ecosystem).

SC.B.1.4.1 Understand how knowledge of energy is fundamental to all the scientific disciplines (e.g., the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth).

SC.B.2.2.3 Know that the limited supply of usable energy sources (e.g., fuels such as coal or oil) places great significance on the development of renewable energy sources.

SC.B.2.3.1 Know that most events in the universe (e.g., weather changes, moving cars, and the transfer of a nervous impulse in the human body) involve some form of energy transfer and that these changes almost always increase the total disorder of the system and its surroundings, reducing the amount of useful energy.

SC.D.1.1.2 Know that life occurs on or near the surface of the Earth in land, air, and water.

SC.D.1.2.2 Know that 75 percent of the surface of the Earth is covered by water.

SC.D.1.2.3 Know that the water cycle is influenced by temperature, pressure, and the topography of the land.

SC.D.1.2.4 Know that the surface of the Earth is in a continuous state of change as waves, weather, and shifts of the land constantly change and produce many new features

SC.D.1.2.5 Know that some changes in the Earth's surface are due to slow processes and some changes are due to rapid processes.

SC.D.1.3.1 Know that mechanical and chemical activities shape and reshape the Earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.

SC.D.1.3.3 Know how conditions that exist in one system influence the conditions that exist in other systems.

SC.D.1.4.1 Know how climatic patterns on Earth result from an interplay of many factors (Earth's topography, its rotation on its axis, solar radiation, the transfer of heat energy where the atmosphere interfaces with lands and oceans, and wind and ocean currents).

SC.D.1.4.3 Know that changes in Earth's climate, geological activity, and life forms may be traced and compared.

SC.D.2.1.1 Understand that people influence the quality of life of those around them.

SC.D.2.2.1 Know that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

SC.D.2.3.2 Know the positive and negative consequences of human action on the Earth's systems.

SC.D.2.4.1 Understand the interconnectedness of the systems on Earth and the quality of life.

SC.F.1.1.1 Know the basic needs of all living things.

SC.F.1.1.2 Know how to apply knowledge about life processes to distinguish between living and non-living things.

SC.F.1.1.4 Understand that structures of living things are adapted to their function in specific environments.

SC.F.1.3.7 Know that behavior is a response to the environment and influences growth, development, maintenance, and reproduction.

SC.F.2.1.2 Know that there are many different kinds of living things that live in a variety of environments

SC.G.1.1.2 Know that plants and animals are dependent upon each other for survival.

SC.G.1.1.3 Know that there are many different plants and animals living in many different kinds of environments (e.g., hot, cold, wet, dry, sunny, and dark).

SC.G.1.2.3 Know that green plants use carbon dioxide, water, and sunlight energy to turn minerals and nutrients into food for growth, maintenance, and reproduction.

SC.G.1.2.5 Know that animals eat plants or other animals to acquire the energy they need for survival.

SC.G.1.4.1 Know of the great diversity and interdependence of living things.

SC.G.2.1.1 Know that if living things do not get food, water, shelter, and space, they will die.

SC.G.2.1.2 Know that the activities of humans affect plants and animals in many ways.

SC.G.2.2.2 Know that the size of a population is dependent upon the available resources within its community

SC.G.2.2.3 Understand that changes in the habitat of an organism may be beneficial or harmful.

SC.G.2.3.1 Know that some resources are renewable and others are nonrenewable.

SC.G.2.3.3 Know that a brief change in the limited resources of an ecosystem may alter the size of a population or the average size of individual organisms and that long-term change may result in the elimination of animal and plant populations inhabiting the Earth.

SC.G.2.3.4 Understand that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.

SC.G.2.4.4 Know that the world ecosystems are shaped by physical factors that limit their productivity.

SC.G.2.4.5 Understand that the amount of life any environment can support is limited and that human activities can change the flow of energy and reduce the fertility of the Earth.

SC.H.1.1.1 Know that in order to learn, it is important to observe the same things often and compare them.

SC.H.1.2.5 Know that a model of something is different from the real thing, but can be used to learn something about the real thing.

MA.A.1.2.4 Understand that numbers can be represented in a variety of equivalent forms using whole numbers, decimals, fractions, and percents.

MA.A.1.3.1 Associate verbal names, written word names, and standard numerals with integers, fractions, and decimals; numbers expressed as percents; numbers with exponents; numbers in scientific notation; radicals; absolute value; and ratios.

MA.A.2.1.1 Understand and apply the concepts of counting (by 2s, 3s, 5s, 10s, 25s, 50s), grouping, and place value with whole numbers between 0 and 100.

MA.A.3.1.3 Add and subtract whole numbers to solve real-world problems, using appropriate methods of computing, such as objects, mental mathematics, paper and pencil, and calculator.

MA.D.1.3.2 Create and interpret tables, graphs, equations, and verbal descriptions to explain cause-and-effect relationships.

MA.D.1.4.1 Describe, analyze, and generalize relationships, patterns, and functions using words, symbols, variables, tables, and graphs.

MA.D 2.2.2 Use informal methods, such as physical models and graphs, to solve real-world problems involving equations and inequalities.

MA.E.1.1.1 Display solutions to problems by generating, collecting, organizing, and analyzing data using simple graphs and charts.

MA.E.1.1.2 Display data in a simple model to use the concepts of range, median, and mode.

MA.E.1.1.3 Analyze real-world data by surveying a sample space and predicting the generalization onto a larger population through the use of appropriate technology, including calculators and computers.

MA.1.2.1 Solve problems by generating, collecting, organizing, displaying, and analyzing data using histograms, bar graphs, circle graphs, line graphs, pictographs, and charts.

MA.E.1.4.1 Interpret data that has been collected, organized, and displayed in charts, tables, and plots.

MA.E.3.1.2 Decide what information is appropriate and how data can be collected, displayed, and interpreted to answer relevant questions.

AT.6.1.1.1 Share responsibility with others in small group work.

AT.8.1.4.4 Evaluate methods to resolve environmental problems.