MAST ACADEMY OUTREACH

MIDDLE SCHOOL PROGRAM

Adventures Aboard
The
Land SHARC
(Science Hands-On And Related Careers)

Pre-Site Package

MAST Academy

Maritime and Science Technology High School

Miami-Dade County Public Schools

Miami, Florida

MAST ACADEMY OUTREACH

LAND SHARC PRE-SITE PACKAGE

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Competency Based Curriculum
Grade 8

Earth/Space Science - Honors

III. 4. Describe the effects of different cycles on the biotic and abiotic characteristics of the earth.
5. Describe Earth's oceans with respect to sizes and composition, ocean topography, sediments, ocean floor movements, currents, waves, tides, ocean life and environments, resources and pollution.
3. Knows the ways in which humans today are placing their environmental support systems at risk.
1. Explain the interconnectedness of the systems on Earth and the quality of life.
2. Describe how the world ecosystems are shaped by physical factors that limit their productivity.

Algebra I - Honors

I. 8. Use technology (e.g., calculators, computers) and manipulatives as tools to discover number patterns.
II. 5. Solve real world problems involving measurement.
9. Solve real-world and mathematical problems involving exact/estimates of measurement and effects of measurement errors on calculations.
V. 1. Collect, organize, analyze, and interpret data by constructing charts, tables, and graphs to predict and explain outcomes.

M/J U.S. History

IV 3. Give examples of the impact of technology on the development of the American society.
VI. 1. Use appropriate skills and resources to access, analyze, and synthesize information.

M/J Language Arts 3- Advanced

I. 16. Interprets functional reading material, such as newspapers, periodicals, manuals, instructions, schedules, common forms, maps, graphs, charts, tables.
III. 2. Extends the vocabulary development expectations for the seventh grade using eighth grade or higher vocabulary in reading, writing, and speaking.
4. Acquires and strengthens a personal, active vocabulary in speaking and writing in Interdisciplinary/integrated contexts.
IV. 1. Follows verbal directions.
5. Asks appropriate, challenging questions for elaboration or clarification during activities such as interviews and discussions.
11. Demonstrates appropriated listening and/or viewing skills in a variety of settings, such as viewing film, television, drama, music and dance.
V. 2. Interprets and/or constructs questionnaires and graphics, such as charts, tables, graphs, maps, labels, and signs.

TEACHER INSTRUCTIONS
Land SHARC Pre-Site Package

***Show the Land SHARC Pre-site DVD for instructions to prepare you and your students for this experience. Please return the video to MAST Academy, Location 7161 after viewing it.**

1. Review the pre-site activities and choose those that are appropriate for your class(es) to complete. Make class copies of those pre-site activities. OMIT THE ANSWER KEYS. Have students complete each one. Some of the activities require materials other than pen or pencil. Below is a list of materials you will for those activities.

   Turtlegrass Community and Marine Food Chains: markers or colored pencils

   Sponges: samples of natural and artificial sponges

   Determining Salinity by Evaporation: (This can be done as a demonstration.)

beakers	graduated cylinders	balances
thermometers	sea water	beaker tongs
hot plate	watches	safety goggles

   The Effect of Salinity on Living Tissue: (This can be done as a demonstration.)

test tubes	test tube racks	balances
sea water	graduated cylinders	fresh water
labels	potato cores	

   Measuring Specific Gravity Using a Soda Straw Hydrometer:
   (This can be done as a demonstration.)

markers	plastic soda straws	graduated cylinders
clay	spoon	salt
water	unknown salt solution	

   Introduction to Plankton

Scissors	colored paper	glue, glue sticks, or tape

2. Grade each activity. Answer keys are provided. The grade for the pre-site package will be incorporated into a total grade of pre-, on-, and post-site activities to be used to award Certificates of Recognition.

3. Aboard the Land SHARC, teams of students will rotate through ten lessons. Before the Land SHARC arrives, divide your class into ten equal teams and assign each team a number 1 – 10. This number indicates where each team will start their Land SHARC adventure.

SCIENTIFIC CLASSIFICATION

As many as five million different kinds of organisms are found on Earth. People have been classifying these organisms for centuries. The classification of living things as producers or consumers is but one way to categorize marine life. Another way is phylogenetically. Phylogenetic classification reflects evolutionary relationships between organisms rather than food relationships.

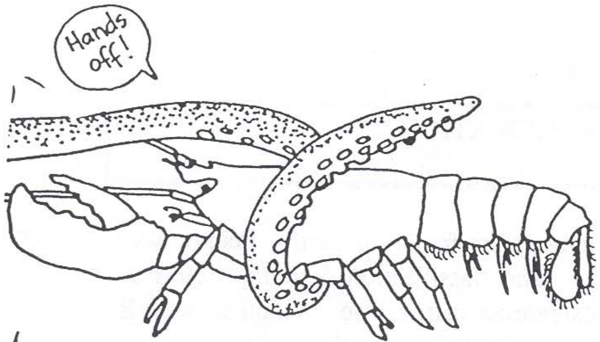
In phylogenetic classification, those organisms with a common evolutionary descent and similar fundamental characteristics are grouped together. The largest and most general phylogenetic subdivision is the kingdom. The Plant Kingdom and the Animal Kingdom are the most familiar.

Members of a kingdom are further divided into phyla (singular: phylum). Within the Animal Kingdom there are approximately twenty-nine phyla. Each phylum is divided into classes. These in turn are followed by other lower divisions: order, family, genus, and species. Each organism has a scientific name consisting of two parts: the generic name, which is always capitalized, and the species name, which is never capitalized. Thus Callinectes sapidus is the Blue Crab.

On the Land SHARC you will observe organisms that live in a turtle grass community. You will be asked to classify each organism by phylum. The following list of phylum names will familiarize you with characteristics and examples of the phyla represented.

PHYLUM	CHARACTERISTICS	EXAMPLES
Tracheophyta	plants with true roots, stems, leaves	seagrasses
Porifera	animals with pores	sponges
Coelenterata Cnidaria	stinging cells, simple body cavity	Jellyfish, sea anemone, coral, sea fan
Mollusca	soft-bodied animals	Clam, snail, octopus
Echinodermata	spiny-skinned animals	starfish, sea urchin, sea cucumber, sea biscuit
Arthropoda	Joint-legged animals with an exoskeleton	crab, shrimp, lobster
Chordata	Animals with a notochord	Fish, birds, reptiles, amphibians, mammals

On the next page are pictures of organisms from each of the phyla listed above. Try to identify each organism by its common name. Then, write the name of the phylum to which it belongs on the line underneath each picture. Next, make each organism a cartoon character by adding traits to the picture (note #10.) Color the pictures using markers or colored pencils



1. ______________________

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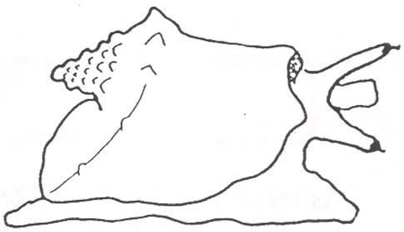

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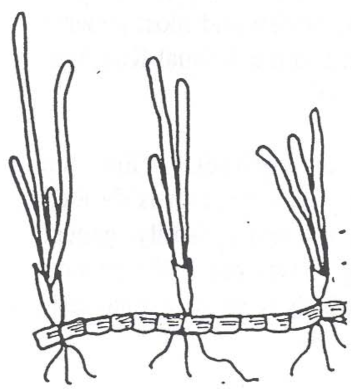

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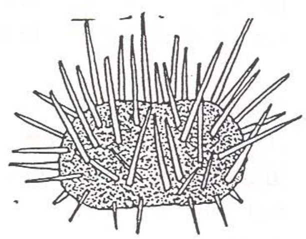

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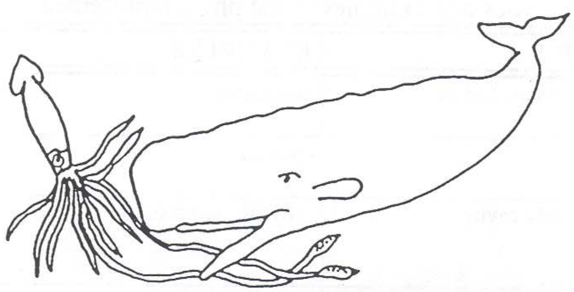

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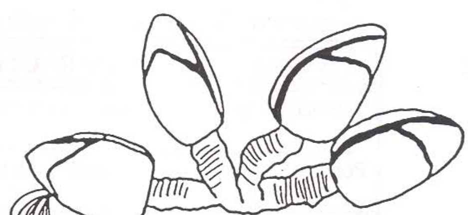

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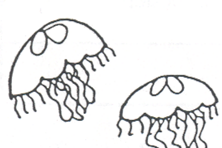

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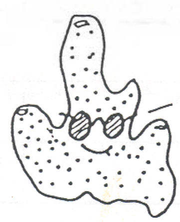
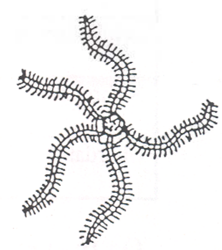


10. ______________________

11. ______________________



12. ______________________

Pictures from: <u>The Seaside Naturalist</u>, Deborah A. Coulombe, Prentice Hall, Inc., N.J., 1984.

TURTLEGRASS COMMUNITY

Turtle grass, scientifically known as Thalassia testudinum, forms tropical marine meadows in waters of moderate depth. The grass begins growth in bedrock depressions and has a tendency to trap and stabilize sediment. The leaves originate from short vertical shoots and the roots penetrate outward and downward.

Turtle grass is very important in oxygen production. A turtle grass bed can sometimes be heard hissing from the rapid bubbling of oxygen off the leaves. The oxygen is produced from photosynthesis carried on by the turtle grass. Since turtle grass makes its own food, it is considered a producer in the food chain.

With the decline of the green sea turtle, there is very little direct grazing on turtle grass leaves. However, when leaves are sloughed off, they decay rapidly and enter the food chain with 90% or more of the original energy eventually used by animals.

In addition to providing oxygen and energy, turtle grass is an environment for many plants and animals. Small anemones, hydroids, marine worms, and many other animals may frequently be seen growing on the grass. Snails, hermit crabs, brittle stars and small crustaceans called amphipods crawl about on the blades. Mud shrimp and worms make their burrows in bedrock depressions on the sides of the grass beds, and a variety of fish hide in and about the leaves.

ON THE FOLLOWING PAGE IS A DRAWING OF A TURTLE GRASS COMMUNITY. STUDY THE DRAWING AND ANSWER THE QUESTIONS. COLOR THE PICTURE.

ON THE LAND SHARC YOU WILL OBSERVE EXAMPLES OF ORGANISMS LIVING IN TURTLE GRASS COMMUNITIES.

1. How many different kinds of organisms can you find? ______________________

2. How many Echinoderms can you find?______________________________

   Put the number 2 next to or on each one.

3. How many Mollusks can you find? ______________________________

   Put the number 3 next to or on each one.

4. Name and label one Chordate in the picture. ______________________

5. How many Arthropods can you find? ______________________________

   Put the number 5 next to or on each one.

6. Name and label one Coelenterate in the picture. ____________________

7. Why is turtle grass important to the marine environment? ______________

____

Picture from: The Seaside Naturalist. Deborah A. Coulombe, Prentice Hall, Inc. N.J. 1984.

SPONGES

Why study sponges? They are important for two reasons. First, they offer a large number of hiding and living places for smaller animals. They also pump seawater in and out as a means of removing food and oxygen for themselves. In doing this, sponges filter and help cleanse the water.

A sponge doesn't look like an animal. They don't run, see, or hear. They have no organs, arms, or spines. Yet, it is an animal. Sponges probably evolved from one-celled animals that lived in colonies millions of years ago. The cells became dependent upon each other and lived together for mutual benefit.

A sponge is the most primitive animal on Earth. There are about 10,000 different kinds. They live only in water in both tropical and polar seas. The vast majority live in saltwater. While most prefer shallow water, some can be found in water as deep as 3.5 miles. They are sessile animals, living attached to rocks, coral, shells, boats, piers, etc. They range in size from microscopic to 6 feet in diameter.

The single most important characteristic of a sponge is that it is a system of holes, pores, chambers, and compartments. Water is circulated through these openings into an internal cavity, the spongocoel, where food and oxygen are extracted. The water then exits through a large excurrent pore, the osculum. Some sponges are supported internally by a network of flexible spongin fibers. The commercial bath "sponge" is actually the spongin skeleton with all of the living material removed. Other sponges have skeletons composed of spongin and hard mineralized spicules. The spicules are either calcareous or siliceous in chemical composition.

Comparing Natural and Synthetic Sponges

For this activity you will need examples of commercial sponges and natural sponges. Natural sponges can be obtained at shell shops or you can go beachcombing and gather sponges.

Examine the sponges. Observe them with a magnifier.

1. Name 2 similarities between natural and synthetic sponges.

   ____

   ____

2. Name 2 differences between natural and synthetic sponges.

   ____

CORALS

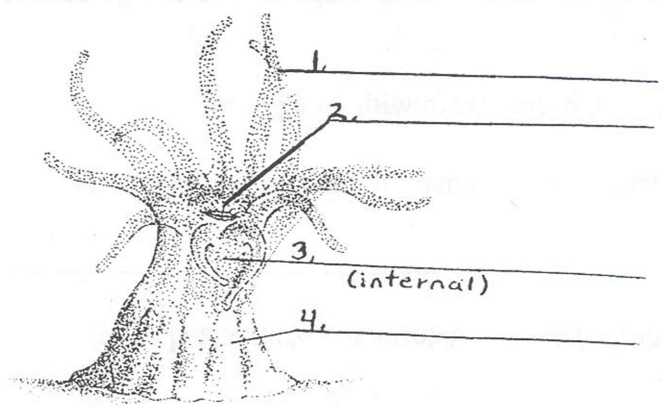
The world's oceans create a variety of habitats for flora and fauna, but none is more interesting and beautiful than the coral reefs of South Florida. These complex ecosystems, flourishing with marine life, develop from one minute creature - the coral.

Corals are animals, but they are many times mistaken for plants since they often look like bushes covered with tiny, delicately colored flowers. The objects we find dried and bleached are not, of course, the whole animals, but merely the limy skeletons that the animals secrete around their bodies. The living tissue, which is often brightly colored, is confined to a thin outer layer that scarcely conceals the form of the skeleton. Most coral skeletons are constructed by colonies of hundreds of individuals working together to produce a highly organized and complex structure.

A mature coral **polyp** lives permanently attached to the ocean bottom, and is essentially a tube made out of a jelly-like substance. At one end of the tube is an opening or **mouth** that is used to take in food and to expel waste material. This opening is surrounded by a number of hollow, flexible **tentacles**, which serve to carry food into the polyp's body. Inside the body is a cavity, called the **gastrocoel**, where food is digested.

The coral polyp is surrounded by an external skeleton that is produced by the polyp. This **limestone** exoskeleton, continually secreted by the coral, is made from calcium and carbonate taken from sea water. After extracting **calcium carbonate** from the sea, a polyp deposits layers of the material around the lower half of its body so that it forms a kind of cup. A polyp can pull its whole body, including its tentacles, inside the limestone cup, or **corallite**. The hard material provides a **shelter** for the soft animal.

Use the information in the above reading to identify and label the structures of the coral polyp drawing below. Write the appropriate word on each line.



MARINE FOOD CHAIINS

All forms of life in the ocean are tied together in **food chains**. The **food web** is the total of all the food chains in the plant and animal communities. The food chain starts at the top of the ocean where there is sufficient sunlight for photosynthesis. The plants, including **phytoplankton (microscopic plants)** tap energy from the sun and nutrients from the sea to produce food and oxygen. These plants are the basis for all animal life in the marine environment. Microscopic animals, called **zooplankton**, feed directly on plant life. Small fish eat the zooplankton, then larger fish eat the small fish, and so on.

Plants are **primary producers** because they are the primary source of food in the food chain. Animals are **consumers** and are classified by orders. The more an animal depends on plants for its food supply, the lower the order to which that animal belongs.
Since zooplankton feed directly on phytoplankton, they are **first-order consumers**. Other first-order consumers might include fish, mollusks, crustaceans, and even whales that feed directly on plankton.

Second-order consumers feed on first-order consumers. This order includes many fish and birds. Large sharks are representative of **third-order consumers**. These animals feed on lower orders and are in little danger of being eaten themselves.

Several animals fit into two or more categories of consumers. Birds, for example, may be first, second, or third-order consumers, depending on what they are eating.

Scavengers and **decomposers** (microscopic bacteria and fungi) play a special role in the food chain. They eat dead plant and animal material and release the nutrients from this dead material back into the water or onto the ocean floor. Other marine organisms use this nourishment for growth.

On the following page is an illustration of a Florida Estuary Food Web. Use that to complete the chart below by making a checkmark in the appropriate column(s) to describe each organism. Some will fit into more than one category, so check all that apply. Then answer the questions color the picture.

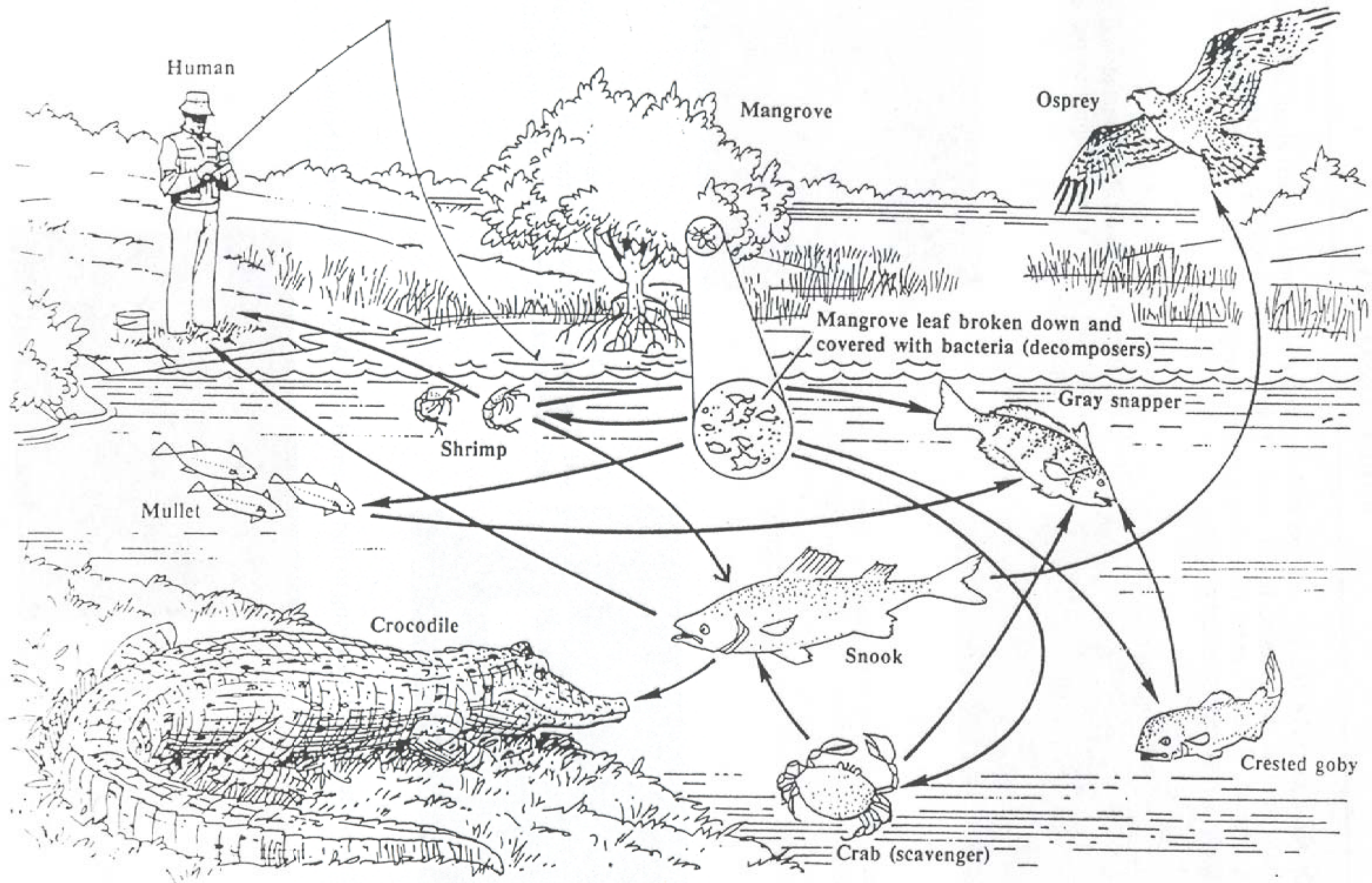
On the Land SHARC you will use a computer program called "Field Trip to the Sea" to create marine food chains.

Organism	**Producer**	**First-Order Consumer**	**Second-Order Consumer**	**ThirdOrder Consumer**	**Scavenger**	**Decomposer**
Human						
Mangrove						
Snook						
Shrimp						
Osprey						
Crocodile						
Mullet						
Crab						
Crested goby						
Gray Snapper						
Bacteria						

1. Create a food chain consisting of one primary producer, one decomposer, one scavenger, one first-order consumer, and one second-order consumer.

2. Create your own food chain.

Food Web of a Florida Estuary



THE ARROWS POINT TO THE ORGANISMS RECEIVING ENERGY.
THIS MEANS THAT THE ORGANISM RECEIVING ENERGY IS FEEDING ON
THE ORGANISM FROM WHICH THE ARROW IS COMING.

RADIO TELEMETRY

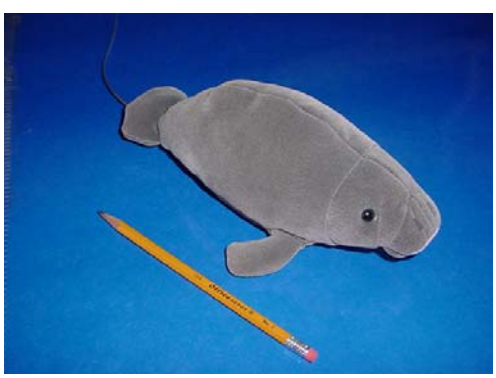
On the Land SHARC, you will use radio telemetry equipment to learn about how manatees and other animals are tracked in the wild. There are three basic parts of the radio telemetry equipment. The first is the transmitter pictured below.

The transmitter is worn on the manatee and contains a radio crystal that sends a radio signal to the directional antenna pictured below.

The directional antenna picks up the radio signal. By pointing the antenna in different directions, you can determine the general direction in which to find the manatee by the loudest beeping signal.

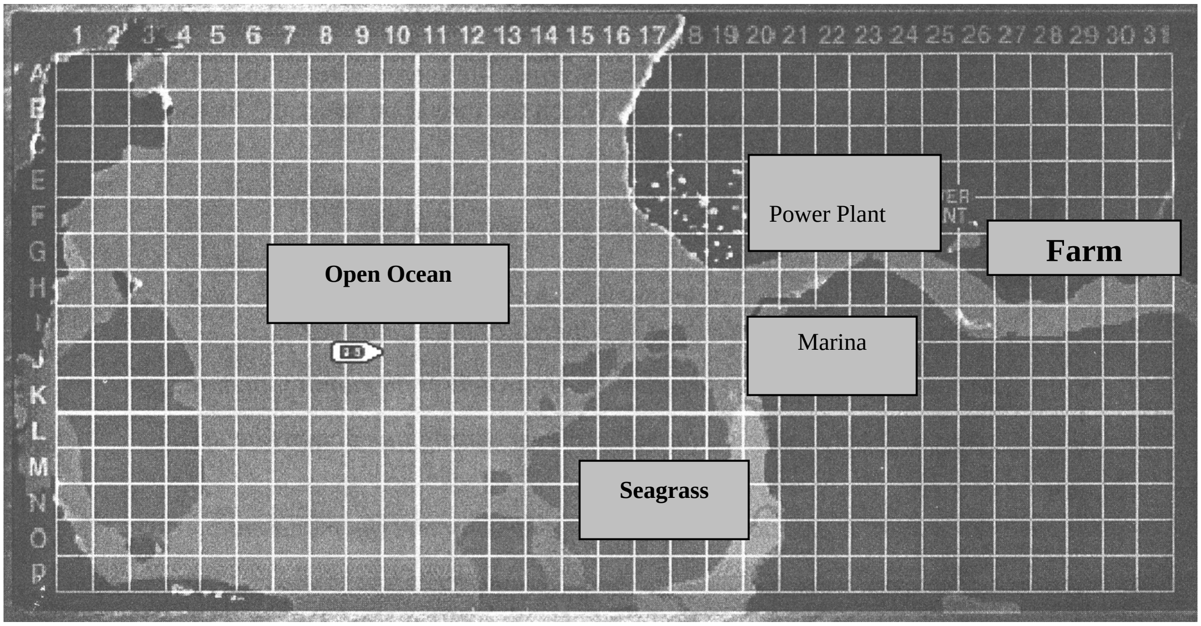
The antenna is attached to the receiver pictured to the left. The receiver sends out the beeping signal when a radio signal is being sent out from the transmitter.

The manatee you will be trying to find is named "Pee Wee" and is pictured below.



Activity:

Below is a manatee tracking grid. Below the grid is a data table showing the locations of two manatees every month for one year. For each month, put an X on the grid for Mighty Mo's location. Put an O on the grid for Pee Wee's locations. Mighty Mo is the mother of Pee Wee. Then answer the questions below.



Month	Mighty Mo's Location	Pee Wee's Location
January	G25	H25
February	H20	G21
March	G24	G23
April	G22	G22
May	H17	I18
June	F10	F11
July	N11	N12
August	O16	O17
September	P17	P16
October	G17	J14
November	H19	I14
December	H26	H21

1. During which month(s) are manatees in the seagrass? ___________________________________

2. During which month(s) are manatees near the power plant?______________________________

3. During which month(s) are manatees in the open ocean?_________________________________

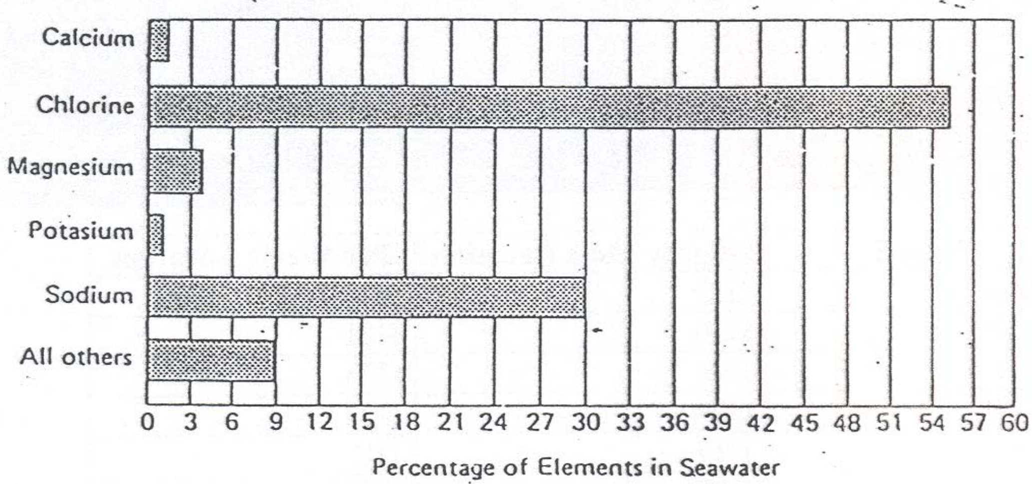
4. If the side of each grid box is one-fifth of a kilometer in length, how far does Mighty Mo travel from September to October? ____

5. If a manatee calf separates from its mother at age two, during which month did Pee Wee become two years old?____

EXPERIMENT
DETERMINING SALINITY BY EVAPORATION

Introduction
Seawater contains a mixture of minerals, mostly salts. If you evaporate a sample of sea water, you end up with most of the elements known to man. Yet more than 99 percent of sea salts are made up of only six elements: chlorine, sodium, magnesium, sulfur, calcium, and potassium. These salts are necessary for animal and plant growth.

Common salt, or sodium chloride, is made up of the elements sodium and chlorine. What other elements are found in seawater? The bar graph, or histogram, below shows the main elements dissolved in seawater. The graph shows the percentage of the total mass of dissolved substances that each element makes up. Study this graph. Then answer the questions below.



1. In the spaces below, list the percentages of the elements found in seawater.

   calcium__________ chlorine__________ magnesium__________

   potassium__________ sodium__________ all others__________

2. Which two elements are the most abundant in sea water? What familiar substance is made up of these elements?
   ____

   ____

But just how salty is seawater? In the following experiment, you will determine this.

PURPOSE:

To calculate the percent of salt as well as the salinity of the sample of seawater.

MATERIALS

Beaker (150 or 250 ml)	Balance and weights
Thermometer	Graduated cylinder
Seawater	Hot plate
Beaker tongs	Stopwatch or timer
Tray - heat resistant	Safety goggles

PROCEDURE: Fill in the tables under **Data** as you complete each step.

1. Weigh empty beaker using the balance.
2. Measure 50 ml seawater using a graduated cylinder and pour into the beaker.
3. Weigh beaker with the seawater in it.
4. To determine weight of seawater, subtract #1 from #3.
5. Place beaker with seawater on hot plate and evaporate all the water. As the water is being evaporated, record the temperature every 2 minutes.

NOTE: Record the time and temperature at which the seawater begins to boil. CAUTION: Don't let the beaker boil completely dry as beaker will crack. Be sure to wear safety goggles.

6. Remove beaker from hot plate using tongs and place on tray until beaker cools.
7. Weigh beaker with dry salt residue left in it.
8. To find the weight of salt, subtract the weight of the beaker from the weight of the beaker with salt residue.
8. The percent of salt is found by multiplying the weight of residue by 100 and then dividing by the weight of seawater used.
9. The salinity of ocean water is commonly expressed by so many parts of salt material per 1000 parts of water. We use the symbol 0/00 to express parts per thousand. To determine parts per thousand take the per cent of salt and multiply by 10.

DATA:

Steps 1 - 4

Weight of beaker and water = ________________grams
Weight of beaker = ________________grams
Weight of water = ________________grams

Step 5

Starting Temp. __________ 10 min. __________ 20 min. _________

2 min. __________ 12 min. __________ 22 min: _________

4 min. __________ 14 min. __________ 24 min. _________

6 min. __________ 16 min. __________

8 min. __________ 18 min. __________

Boiling Temperature ______________

Steps 7 - 9

Weight of beaker and dry salt = ______________grams
Weight of empty beaker = ______________grams
Weight of salt = ______________grams

To calculate percent of salt in sample:

Weight of salt ______grams X 100 = ________________
weight of water

Percent of salt = _________%

To calculate salinity:

Percent of salt ______ X 10 = ________________0/00

QUESTIONS:

1. The salinity of seawater usually ranges from 25 parts per thousand to 34 parts per thousand. Does your sample fall in that range?

____

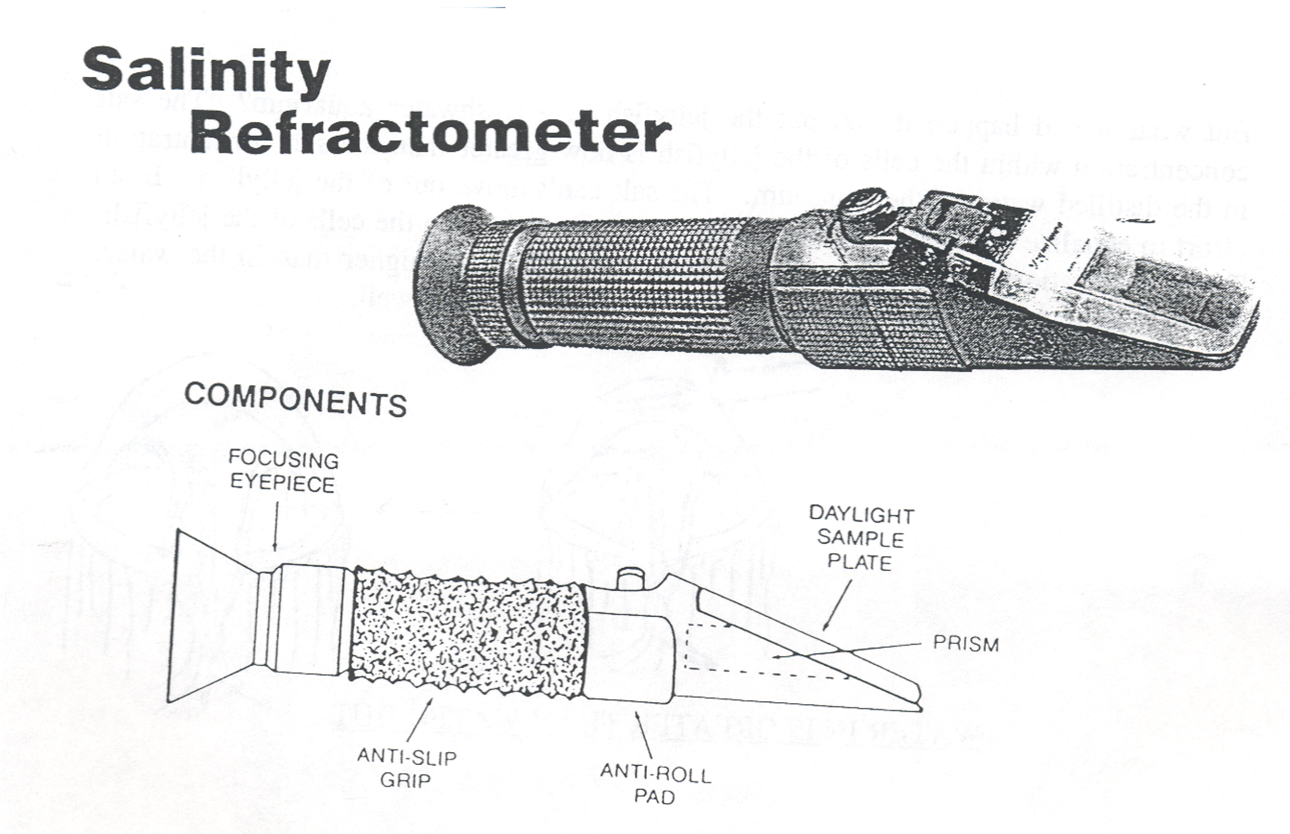
2. Compare the salinity of seawater that you obtained with the results of other groups. Do they differ? If so, what might have caused the differences?

____

3. At what temperature did the sea water boil?______________________________

4. Is this higher or lower than the boiling point of water?______________________

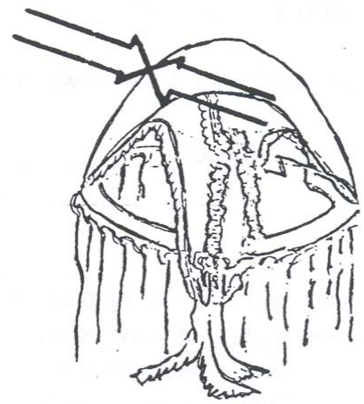
5. Why do you think there is a difference?__________________________________



On the Land SHARC, you will use a refractometer to determine the salinity of sea water. Because of the salt particles in sea water, light waves refract or are bent more in sea water than in fresh water. The refractometer measures this degree of refraction to measure salinity.

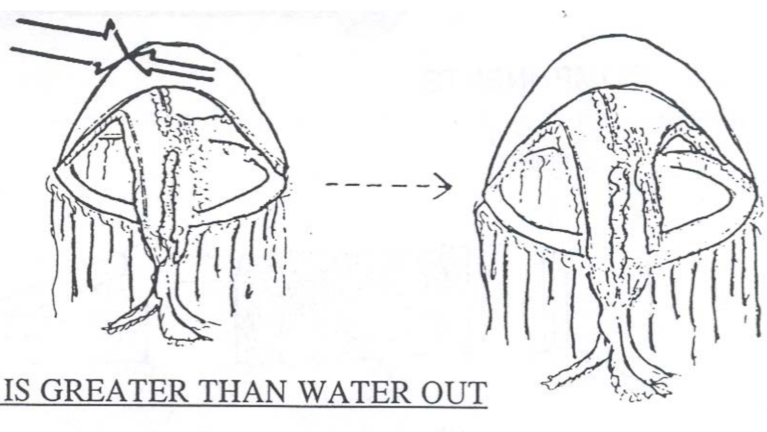
HOW SALINITY AFFECTS LIVING THINGS

Living cells are largely water with a few dissolved salts and other materials. The materials inside the cell, for the most part, stay there. Water, however, can move into and out of the cell. How is this important? In living cells the water tends to move into or out of the cell until the concentration of salts "salinity" inside the cell equals the concentration of salts outside the cell. What does this mean? Let's look at a jellyfish and see. Our jellyfish is floating peacefully in the sea. The salt concentration within its cells is equal to the salt concentration in the water around it. The same amount of water enters its cells as leaves them.



WATER IN = WATER OUT

But what would happen if you put the jellyfish in a freshwater aquarium? The salt concentration within the cells of the jellyfish is now greater than the salt concentration in the distilled water of the aquarium. The salt can't move out of the jellyfish. In an effort to equalize the concentrations, water begins to move into the cells of the jellyfish. The concentration of salts in the cells is reduced but it's still higher than in the water. More water moves into the jellyfish and the jellyfish begins to swell.



WATER IN IS GREATER THAN WATER OUT

1. Will the concentration on the outside ever equal the concentration on the inside of the jellyfish?

____

2. What will eventually happen to our jellyfish?

____

You panic! Thinking quickly, you grab the jellyfish and move it into a tank of salt water. Unfortunately for our jellyfish, the salt concentration is 70 0/00 about twice what it's used to. Again, the salt can't move out of the jellyfish.

3. What will happen to make the inside and outside concentrations of salt more equal?

____

4. What will happen to our poor jellyfish?

____

5. Draw what you think will happen below.

<u>WATER IN IS LESS THAN WATER OUT</u>

The movement of water into and out of cells is called <u>osmosis</u>. In real animals the situation is more complex than shown above. Animals and plants have developed mechanisms to handle the small changes in salinity that normally occur where they live. Drastic changes in salinity however, cannot be dealt with and the cells of the animal or plant behave like those of our imaginary jellyfish.

In the following experiment you will have a chance to perform one technique commonly used for the determination of salinity.

EXPERIMENT
THE EFFECT OF SALINITY ON LIVING TISSUE

Most marine plants and animals have to deal with small changes in the salinity of the waters in which they live. A few marine fish are anadromous, they spend part of their lives in freshwater and part in salt water. Salmon for instance, are born in freshwater streams, migrate to the sea where they mature, and return to the freshwater stream where they hatched to reproduce and die. How do these changes in salinity affect the plants and animals? How do plants and animals adapt to these changes? Perhaps we can learn something about the process by observing the effect of different salinities on living tissue.

Purpose

To determine the effects of salinity changes on living tissue.

Materials:

test tubes (2)
centimeter ruler
balance
graduated cylinder
labels
fresh water
sea water
test tube rack
potato cores (2)

Procedure:

1. Obtain two empty test tubes. Label one "salt water" and the other "fresh water".
2. Fill each tube about three quarters full with the correct solution. Place the tubes in a test tube rack.
3. Obtain two potato cores. Describe the two cores: Use centimeter ruler to measure length and width; use graduated cylinder to find volume of water displaced.

	Potato core 1 (salt water)	**Potato core 2 (fresh water)**
color		
weight		
volume of water displaced		
length		
width		

4. Place potato core 1 in the tube of salt water.

5. Place potato core 2 in the tube of freshwater.

6. Place the two tubes aside and let them stand for at least 1/2 hour.

7. When the time has elapsed, remove the potato cores and describe:

	Potato core 1 (salt water)	**Potato core 2 (fresh water)**
Color		
Weight		
volume of water displaced		
Length		
Width		

<u>Analysis and Interpretation:</u>

1. Calculate the percentage change in weight and the percentage change in volume of water displaced by each potato core. This is easy, here's how:

$$\frac{\text{Weight of core before soaking}}{\text{Weight of core after soaking}} \quad \text{X } 100 = \text{percentage change}$$

$$\frac{\text{Volume of core before soaking}}{\text{Volume of core after soaking}} \quad \text{X } 100 = \text{percentage change}$$

2. Which potato core had the greatest change?__________________________________

3. What most likely happened to cause any change in weight or volume?

____

____

4. Use the diagram below to show whether the water moved into or out of the potato.

5. a. Danny Devious wants to change the surroundings of his pet sea cucumber. Danny has put his pet into a tank of fresh water. What is going to happen to the living tissue of the sea cucumber? ______________________________

____

b. Danny notices something wrong. "Aha! I forgot the salt." Quickly, he adds a pound of table salt. The resulting salt solution is about twice the concentration of sea water. Assume that Danny's pet was still living, what is now going to happen to the living tissue of the sea cucumber? ______________________________

____

The movement of water into and out of living cells is called osmosis. Plants and animals living in aquatic environments have developed many specialized structures and behaviors to help them deal with the inflow and outflow of water.

6. What is the problem fish have to deal with in water saltier than their tissue fluids? ________

____

____

7. What is the problem fish have to deal with in water less salty than their tissue fluids? ______

____

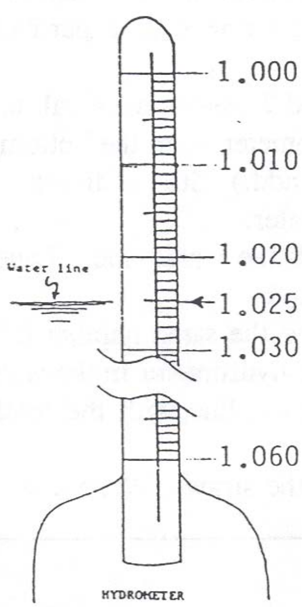
____

EXPERIMENT
MEASURING SPECIFIC GRAVITY USING A SODA STRAW HYDROMETER

An instrument that measures the specific gravity of a liquid is called a hydrometer. This is a weighted glass cylinder that floats in water. You may have observed that the higher an object floats in water, the saltier the water is. This is the basic principle for determining specific gravity using a hydrometer.

But, how are salinity and specific gravity related? Specific gravity is the ratio of the density of a substance relative to the density of pure water at 4 degrees Celsius. The specific gravity of pure fresh water at 4 degrees Celsius is 1.000. This provides the standard. As something (like salt) is added to pure water, the density of the water increases and the hydrometer reads above 1.000. The terms density and specific gravity, are usually interchangeable. Since seawater is more dense than fresh water due to the presence of salt, the specific gravity of sea water increases when salinity increases and visa versa. So a hydrometer will float higher in seawater than in fresh water because the sea water is more dense (has more salt particles.)

On the Land SHARC, you will use a hydrometer like the one shown below to determine specific gravity. The cylinder has a thin glass tube at the top with a scale printed inside. The higher the salinity, the higher the tube floats and the larger the number that lines up with the water's surface.



Purpose:

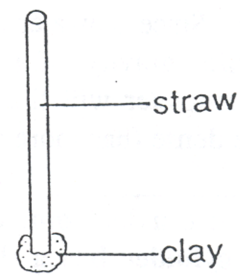
To construct a soda straw hydrometer to determine specific gravity of sea water.

Materials:

plastic soda straw
permanent marker
plasticine clay
spoon
unknown salt solution
100 ml graduated cylinder or similar container
salt
water

Procedure:

1. Press a small ball of plasticine clay into one end of a straw. The clay should act as a plug so water cannot get into the straw.



2. Add fresh water to your cylinder until the water is about 1 inch from the top.
3. Put the straw hydrometer in the fresh water. Remove or add clay until the hydrometer just rests on the bottom of the container.
4. Mark the water level on the straw with a permanent marker and label it zero (meaning no salt added).
5. Remove the hydrometer. Add 2 teaspoons of salt to the water. (NOTE: If this is not enough to raise the hydrometer from the bottom, add more salt but keep track of how many teaspoons you add.) Stir to dissolve all the salt in the water. Put the hydrometer back in the water.
6. Use the marking pen to mark the water line. Label the line with the number of teaspoons of salt that you added.
7. Remove the hydrometer. Add the same number of teaspoons of salt to the water that you added in #5. Put the hydrometer in the water.
8. Mark the water line. Label the line with the total number of teaspoons of salt added.
9. Examine the calibrations on the straw. Write a statement about the scale created on the soda straw. ____

____

10. Use your hydrometer to test the unknown salt solution:
    a. Place the hydrometer in the solution.

b. Mark the water line with a letter U.
c. Look at the U mark and your scale.
d. Estimate the number of teaspoons of salt that were dissolved in the unkown sample.
e. Write your estimate here: _________teaspoons of salt.

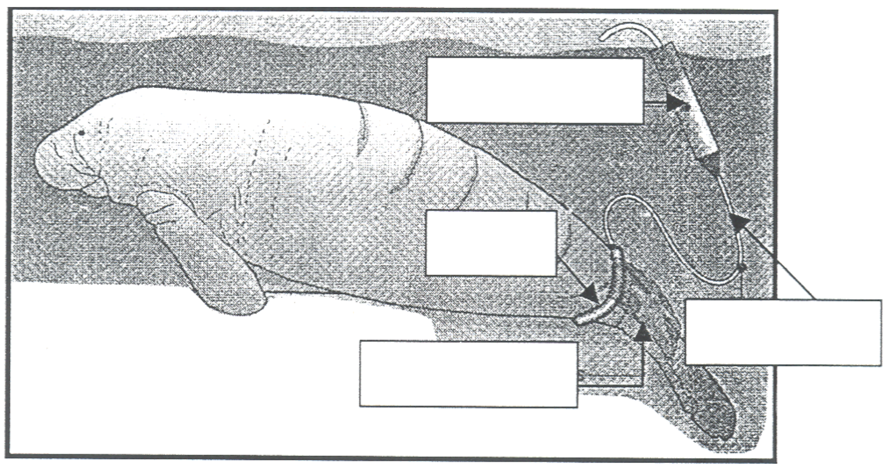
Your soda straw hydrometer is not as sophisticated as the hydrometer you will use on the Land SHARC. And, of course, the scale is different. But, they both operate on the same principles.

TRACKING MANATEE MOVEMENT

Directions: As you read the following paragraph, place the bold, underlined words in the correct boxes in the diagram below and then answer the questions.

In December of 2002, scientists captured 13 manatees at Apollo Beach, Florida and fitted them with the most-up-to-date radio and satellite tracking equipment the state has ever used. When the new satellite gear is coupled with radio telemetry devices the manatees will be wearing, scientists will get the most information they have ever had about manatee movement.

The heart of the new telemetry system is a Telonics Global Positioning Satellite Tag. The radio and satellite tag assembly allows researchers to follow individual manatees without causing them harm or discomfort and the assembly is designed to come off if it gets entangled in an object. The **tracking device** is a transmitter encased in a floating tube. The tag assembly consists of a **belt** that fits around the base of the tail and a **four-foot nylon tether** is attached to the tracking device. A **one by one foot tracking flag** helps the observer to see the manatee.



When the manatee surfaces, the buoys send information to a satellite operated by the National Oceanic and Atmospheric Administration (NOAA), which compiles it for the Florida Fish and Wildlife Conservation Commission. Manatees are also being fitted with a depth, time and temperature recorder. This information will be integrated with the satellite tracking information. In the past, researchers received four positions a day. Now they can receive readings every 20 minutes for many hours each day. This new technology is just the beginning of learning more about manatees so that we can better protect them and adopt meaningful regulations.

1. What new information will scientists learn about manatees with depth, time and temperature recordings attached to them? ____

    ____

2. What new information will scientists learn about manatees now that they can track them every 20 minutes?____

AN INTRODUCTION TO PLANKTON

Directions:

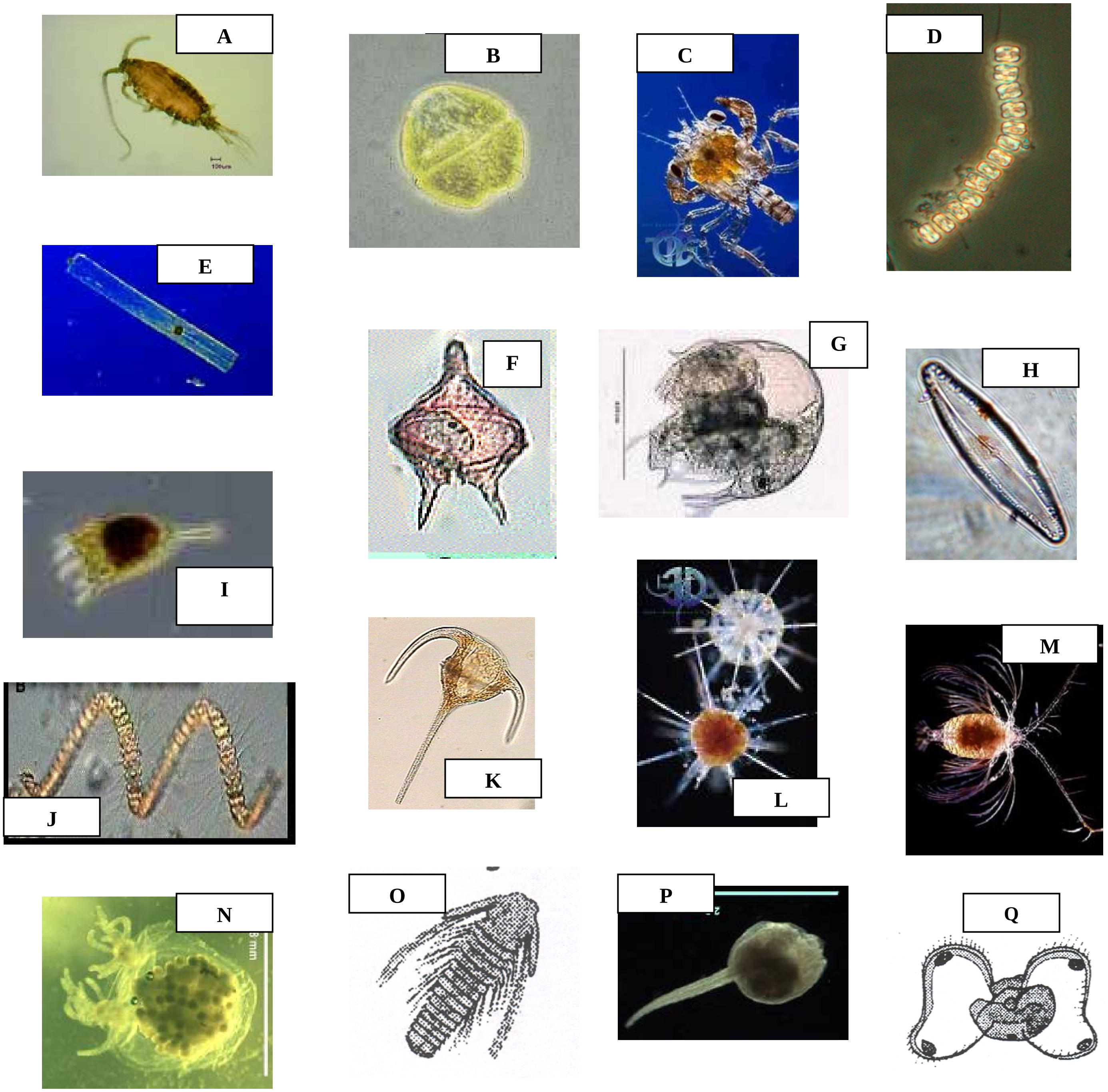
1. Read the information below about plankton.
2. Use scissors to cut out the plankton pictures on the next page.
3. Place the pictures into two groups. One group will be for those you think are phytoplankton; the second group for those you think are zooplankton.
4. In the table below, check the appropriate column for each picture and give a brief reason for your choices.
5. Your teacher will now place you in teams.
6. Compare your list with the list of everyone in your team.
7. Come to a consensus and then rearrange one set of pictures into the two groups based on what the whole team thinks.
8. Using glue, glue sticks or tape, markers and colored paper, make a small poster of your plankton pictures putting them into the two groups of plankton and labeling the groups. One person from each team will justify their choices to the whole class.
9. Your teacher will hold a class discussion about which plankton were the easiest and most difficult to classify and why and how your team worked out their final plankton groups.

Picture	Phytoplankton	Zooplankton	Reason
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			
L			
M			
N			
O			
P			
Q			

Introduction: Plankton is the term used to describe tiny plants and animals that live in the ocean. The word plankton comes from the Greek work “planktos” which means to drift. They are the foundation of ocean food webs. Phytoplankton are planktonic plants made of algae. They can photosynthesize due to the presence of chlorophyll and so must remain in the photic (light) zone or the top 30 meters of the sea in order to receive sunlight for photosynthesis. Phytoplankton are found in a wide array of shapes, incorporating adaptations which help keep them from sinking. They may have long spines or bristles and some live in long chains. Many are round and all have a very large surface area relative to body size which helps keep them afloat.

Planktonic animals that eat other plankton are referred to as zooplankton. Zooplankton are made up of tiny animals and single-celled protozoans. They are often wide and flat with long spines and bristles, but they have an advantage over phytoplankton – they can swim. Tiny movements of their appendages can propel them and keep them in the photic zone near their food source. Many zooplankton are able to move up and down in a water column, pursuing food during the night in the photic zone when they are less likely to be seen by predators and escaping predators during the day in the darker, deeper zones.

Plankton Pictures



Plankton Photo Sources:

http://www.cnas.missouristate.edu/zooplankton/alphabetical%20listing.htm
http://www.smhi.se/oceanografi/oce_info_data/plankton_checklist/dinoflagellates/dino_frame.htm
http://www.imagequest3d.com/stock/plankton.htm
http://www.bigelow.org/foodweb/chain3.html
http://www.serc.si.edu/labs/phytoplankton/guide/sppindx.jsp

ANSWER KEYS (100 total points)

Scientific Classification (6 total points – 1 for each picture)

1. octopus - Mollusca
2. lobster - Arthropoda
3. snail - Mollusca
4. turtle grass - Tracheophyta
5. sea urchin - Echinodermata
6. squid - Mollusca
7. whale - Chordata
8. barnacle - Arthropoda
9. jellyfish - Coelenterata
10. sponge - Porifera
11. sea fan - Coelenterata
12. brittlestar - Echinodermata

Turtle Grass Community (7 total points - 1 for each question)

1. 17
2. 4 (sea urchin, sea cucumber, starfish, brittlestar)
3. 2 (snails)
4. fish or seahorse
5. 8 (shrimp, amphipods, crabs, hermit crabs)
6. sea anemone
7. nursery for marine larvae, roots keep sandy bottom stable

Sponges (4 points – 2 for each question)

1. and 2. Answers will vary.

Corals (4 total points – 1 for each label)

1. tentacles
2. mouth
3. gastrocoel or stomach
4. limestone cup or corallite

Marine Food Chains (13 total points–1 for each organism in the chart; 1 for each question)

Organism	Producer	First-Order Consumer	Second-Order Consumer	Third-Order Consumer	Scavenger	Decomposer
Human			**x**	**x**		
Mangrove	**x**					
Snook			**x**			
Shrimp		**x**				
Osprey				**x**		
Crocodile				**x**		
Mullet		**x**				
Crab					**x**	
Crested Goby		**x**				
Gray Snapper		**x**	**x**			
Bacteria						**x**

1. One example is mangrove (primary producer) leaves decompose by bacteria (decomposer), crab (scavenger) feed on decomposed leaves, snook (first-order consumer) eats crab and shrimp, human (second-order consumer) eats snook.
2. Answers will vary.

Telemetry (12 total points – 4 for grid; 2 for each question)

For grid, check accuracy of student grids.

1. August, September
2. June, March, April
3. June
4. 2 km
5. October

Experiment: Determining Salinity by Evaporation (14 points total – see point values below)

1. (6 points)
   calcium = 1.5%
   chlorine = 55%
   magnesium = 4%
   potassium = 1%
   sodium = 30 %
   all others = 8.5%
2. (2 points)
   chlorine and sodium
   salt

Data Tables - 1 points for correct salinity.

1. 5. answers will vary (1 point for each question)

How Salinity Affects Living Things (5 total points)

1. yes
2. The jellyfish may eventually burst.
3. Water will move out of the jellyfish.
4. Jellyfish will shrink.
5. Drawing will show jellyfish shrinking.

Experiment: The Effect of Salinity on Living Tissue (7 total points – 1 for each question)

1. answers will vary
2. answers will vary
3. Potato core in salt water shrunk because water moved out of its cells.
   Potato core in fresh water swelled because water moved into its cells.
4. Diagrams:
   Fresh water show arrow pointing into core.
   Salt water show arrow pointing out of core.
5. a. The sea cucumber will swell.
   b. The sea cucumber will shrink.
6. Water will move out of the cells of the fish and they will shrink.
7. Water will move into the cells of the fish and they will swell.

Experiment: Measuring Specific Gravity with a Soda Straw Hydrometer
(7 total points – 5 points for making hydrometer; 1 point for each question)

1. answers will vary
2. answers will vary

Tracking Manatee Movement (8 total points- 2 for each label, 2 for each question.)

Labels in order from top to bottom: tracking device, belt, one by one foot tracking flag, four-foot nylon tether

1. They will learn what depth manatees like at certain times and temperatures. They will learn what temperatures manatees prefer and they will learn where they go at specific times.
2. The will learn how fast they can travel and their exact location at different times during the day and at night.

An introduction to Phytoplankton (13 total points for data table)

Picture	Phytoplankton	Zooplankton	Reason
A		X	has appendages
B	X		
C		X	has appendages
D	X		
E	X		
F	F		
G		X	has appendages
H	H		
I		X	has small appendages
J	X		
K	X		
L	L		
M		X	has appendages
N		X	has appendages
O		X	has appendages
P		X	has appendages
Q		X	has wing-like appendages

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Revised 5/9/03