Plankton: Background Information & Pre and Post Activities

BACKGROUND INFORMATION

BASIC ECOLOGICAL CONCEPTS

Ecology is the study of the relationships between organisms and their environments. An ecologist asks questions like: Where does this organism live and what characteristics make it particularly suited for that location? How does this organism get its food? What other organisms eat it? By asking questions such as these some basic principles have emerged. Understanding the following basic ecological concepts help us appreciate the complexity of life residing in and around the Bay.

Everything is related to everything else

Perhaps the easiest place to see interdependence in the environment is to look at food. All food on this planet is essentially made by plants through the process of *photosynthesis. Herbivores* are animals, which depend directly on plants for food. *Carnivores* eat herbivores. Take away all of the plants and there would be no animals. Can a plant, then, exist independently of all other organisms? No. Although it doesn't eat, a plant needs *nutrients* and is dependent on *decomposers* (bacteria and fungi) to break down dead organisms, thereby releasing these nutrients for use by the living plant.

Everything depends on something else

All organisms are also dependent on factors in the physical environment. They must have a source of water. Animals must have oxygen to breathe. Plants must have sunlight to perform photosynthesis. You can probably think of many more examples of how organisms are dependent on their environments.

Everything must go somewhere

No object ever disappears completely from the face of the earth. It may be broken down into atoms and be used to build something else, but those atoms are still there. In this way, nature deals with waste by recycling. Any plant or animal that does not become food for some animal becomes food for decomposers, which free the nutrients to be used again. Anything that cannot be decomposed must remain in the environment as it is. What are some examples of this kind of waste? The next time you throw something away, you might remember that there really is no "away" to throw it to.

Earth's resources are limited

How often do you run out of time to do what you want or need to do? Everyone knows that each day only has so much time in it, and that we have to be careful how we use it if we are going to accomplish everything we need to. The earth's available resources are like time in that we have to be careful how we use them, or they might run out. There is only so much gold, so much

petroleum, so much fresh water, so much food, and so much space. All organisms are limited by the availability of resources, but humans have a special opportunity and a special responsibility. Although plants cannot make a decision to conserve clean water, humans can. To do this intelligently we must find out how much of each resource is available and then we must budget our use. We must also think about recycling. The earth can recycle its components naturally but humans must make special efforts to preserve the natural resources.

PLANKTON ECOLOGY

In addition to benthic organisms, marine organisms can be classified as nektonic (swimming organisms whose movement is independent of water circulation) and planktonic (drifting or weakly swimming organisms that cannot move against water currents).

The plankton we will be studying are microscopic, and consist of either tiny plants (phytoplankton) or animals (zooplankton). Phytoplankton plays the same role as plants on land. They are producers, meaning they can make their own energy, and produce oxygen and food for animals. Zooplankton are consumers; they eat phytoplankton and other zooplankton.

Zooplankton can be further divided into two groups: holoplankton - organisms that spend their entire life as plankton, and meroplankton - organisms that begin are plankton in their larval stages, but become benthic or nektonic as they grow and mature. An example of meroplankton is a barnacle larva. Planktonic for the first part of its life, it will mature into a benthic, sessile (sedentary) adult.

PLANKTONIC ADAPTATIONS

During the program we will investigate adaptations that allow organisms to lead a planktonic life. Phytoplankton, for example, need to be up at the top of the water in order to carry on photosynthesis. How can they control their buoyancy, and resist sinking to the bottom? Many of them have developed a way to produce and store oil, which is more buoyant than water, and this characteristic helps them to stay up top. Zooplankton, which feed on phytoplankton, must stay near the top of the water to be near their food source, so they have evolved hairy appendages (legs and flagellum) to slow their settling rate, and a light-sensitive eye spot.

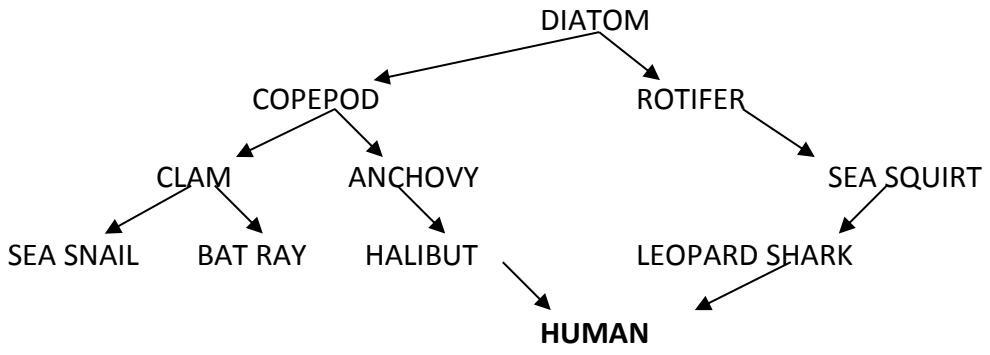
Another adaptation among plankton is their reproductive capacity, which is very high. Diatoms can reproduce both sexually and asexually (cloning or budding), allowing one diatom to create as many as one million offspring in three weeks. Copepods are capable of producing offspring every four days, and these young mature and can reproduce after just one week! Their lifespan is approximately one year.

PLANKTON IN THE FOOD WEB

Producers are the foundation of almost all food webs. Phytoplankton (namely diatoms), are the bulk of the producers in the South Bay. These are eaten by small zooplankton, which in turn are eaten by bigger zooplankton (namely copepods). The environment is diverse enough that it is better described in terms of food webs rather than simple chains. Copepods, for example, eat detritus (dead animals and plant material) as well as phytoplankton. In turn, copepods can be eaten by top dwelling fish such as anchovies, or by benthic dwellers such as clams. There are many interweaving paths through which energy - in the form of food - is transferred through the ecosystem.

Example of a Food Web

Arrows show which direction energy travels



PHOTIC ZONE

The amount of light penetration, or how deep light goes into the water is called the photic zone. This is important in studying plankton because the photic zone is the area where photosynthesis can occur, and therefore where plankton is found. We can measure this depth using a Secchi disk. This is a white disk that we lower into the water until it is barely visible. That is the point of maximum light penetration, and using the metric measurements on the line, we can estimate the photic zone of the water.

GLOSSARY

ADAPTATION	Modification of an organism in order to survive within its habitat.
BIODEGRADABLE	Something capable of being broken down to simple compounds, especially into harmless products, by the action of microorganisms.
BIODIVERSITY	The richness, abundance and variety of life across all trophic levels of which all ecological systems, including the planet earth, are comprised.
BRACKISH	Water that has more salt than fresh water but not as much as seawater.
CAMOUFLAGE	Method of hiding in which organisms blend in with their surroundings.
CARAPACE	In crustaceans, a hard portion of the exoskeleton that covers the fused head and thorax.
CARNIVORE	An animal that consumes other living animals.
COMMUNITY	A group of plants or animals living in the same area and depending on one another for survival.
CONSUMER	An organism that gets its nutrients by eating other organisms.
CRUSTACEAN	An animal with a hard outside shell, antennae, mandibles and compound eyes. e.g. crabs, shrimps and barnacles.
DECOMPOSER	An organism that breaks down organic material and releases simple substances usable by other living things. Examples of decomposers are bacteria and fungi.
DECOMPOSITION	The breakdown of substances into inorganic forms.
DEPOSIT FEEDER	An animal that feeds by ingesting substrate and filtering out the small organic particles on the substrate.
DETRITIVORE	An animal that eats detritus.
DETRITUS	Dead plant and animal material.
DIATOM	A type of microscopic, one-celled photosynthetic organism. All diatoms are surrounded by a silica shell and most are a golden brown in color.
DISSOLVED OXYGEN	Oxygen that has dissolved in water and can be used for respiration.
ECOLOGY	The study of relationships between organisms and their environment.
ENDANGERED	An organism that is threatened with extinction.
ENVIRONMENT	The sum of all physical and biological factors that affect an organism.
ESTUARY	A semi-enclosed body of water where salt water and fresh water meet and mix.
EXOSKELETON	A hard encasement deposited on the surface of an animal, such as the outer covering of arthropods that provides protection from abrasion, predation, desiccation, etc.

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FILTER FEEDER	An animal which extracts food particles by straining the water. Examples of filter feeders are clams, oysters, sponges and some fish.
FOOD CHAIN	A sequence of living organisms in an ecosystem in which members of one level feed on those in the level below and in turn are eaten by those in the level above them.
FOOD WEB	An assemblage of organisms in an ecosystem, including plants, herbivores and carnivores, which shows the relationship of "who eats whom."
HABITAT	The particular area in which an organism normally lives.
HERBIVORE	An animal that eats plants.
INVERTEBRATE	An animal without a backbone.
MOLLUSK	The second largest Phylum of animals. Mollusks have soft bodies, a foot, visceral mass, and a mantle. Most also have a shell made of calcium carbonate. Snails, clams, slugs, squid and octopus are examples of mollusks.
NEKTON	Swimming animals of open water, the adjectival form of nekton is nektonic.
NUTRIENTS	The raw materials necessary for continuing life processes.
OCEANIC ZONE	The area that encompasses the open water that lies beyond the continental shelf.
OMNIVORE	An organism that eats both plant and animal material.
PELAGIC	Living or occurring in the open ocean.
PHOTIC ZONE	Upper sunlight portion of the water column. The depth of the photic zone in the ocean ranges from 30 to 200 meters.
PHOTOSYNTHESIS	The process used by plants to make food; in this process light energy is used to combine carbon dioxide and water to make carbohydrates (sugar and starch); oxygen gas is given off as a by-product.
PHYTOPLANKTON	Algae, usually microscopic, which freely drift in the sunlit portions of the water column.
PLANKTON	Drifting aquatic plants and animals; the adjectival form of plankton is planktonic, and a planktonic organism is called a plankter.
POLLUTION	Harmful impact on the environment resulting from human activities.
PREDATOR	An animal that captures other animals for food.
PREY	An animal caught for food.
PRODUCER	An organism that makes its own food; an example of a producer is a green plant.
RESPIRATION	Process used by animals and plants to release energy from food; this process requires oxygen and releases carbon dioxide and water.
SALINITY	The amount of salt in the water. Measured in parts per thousand.
SCAVENGER	An organism that is an opportunistic feeder; scavengers usually include dead and decaying animal flesh in their diets.

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SIPHONOPHORES	A siphonophore is a relative of jellies. It is a translucent chain of specialized parts, each of which carries out a unique function. Siphonophores can reach lengths of up to 95 feet or more!
SIPHONS	The feeding tubes used by some bivalves (clams and oysters) to filter plankton.
SPECIES	A population of plants or animals that are able to produce viable of with each other and not with other species.
TIDES	The daily rise and fall of the sea level along a shore, occurs twice a day on our local shores.
VERTEBRATE	An animal with a backbone. The back bone can be made of bone or of cartilage like in some fish (sharks and rays).
ZOOPLANKTON	Animal plankton.

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PRE-VISIT ACTIVITIES

You may want to ask your librarian to set aside ecology or marine science books for your class, or ask students to bring books and magazines from home to share.

MEASURING

Using the metric system, we measure plankton in micrometers. Have the students make measuring sticks and send them out on a measuring hike. Tell them to find things of certain lengths. Let them figure out how many microns are in the items they measure.

Activities/Curriculum links:

http://aswc.seagrant.uaf.edu/kindergarten/investigation-1.html
https://coast.noaa.gov/estuaries/curriculum/
http://www.waquoitbayreserve.org/research-monitoring/salt-marsh-carbon-project/teachers/

POST-VISIT ACTIVITIES

TURN YOUR CLASSROOM INTO A BAY

Put blue paper around the classroom and have the students draw in various plants and fish, or have them cut out pictures of marine creatures to put on the blue paper. Let them put some benthic invertebrates on the bottom and plankton on the top!

MOBILES

Let the kids make mobiles of the fish they saw. Take a hanger, some string, some cut-out drawings or pictures of fish and have fun! Attach the fish to the string. Then attach the string at varying lengths to the hanger. Be creative, use pictures of plankton and benthic critters. Possibly take two copies of the fish, glue the edges together, and stuff with some already used paper (recycle it!) and have a 3-D mobile. Older groups can make mobiles in the form of a food chain.

WRITING THANK YOU LETTERS

Write letters to the instructors and/or your class sponsor to tell them about the trip. When we receive letters and pictures back from the kids our instructors remember what a thrill it is to be teachers. The sponsors also enjoy getting direct feedback from the class and teacher to reinforce that they are making a difference for kids learning science. Please include the day, date and time of your trip so we can try to remember your group a little better.

Activities/Curriculum links:

http://aswc.seagrant.uaf.edu/kindergarten/investigation-1.html
https://coast.noaa.gov/estuaries/curriculum/
http://www.waquoitbayreserve.org/research-monitoring/salt-marsh-carbon-project/teachers/

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