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.

GLOSSARY

ADAPTATION	Modification of an organism in order to survive within its habitat.
BENTHOS	The substrate at the bottom of a body of water; the adjectival form of benthos is benthic.
BERM	A flat, terrace-like area of sand just above the high-tide zone on a beach.
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.
BIVALVE	A Mollusk having two shell hinged together. e.g. clam, oyster and mussel.
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.
DICHOTOMOUS KEY	A tool used to identify organisms based on their physical features.
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.
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."
FOOT	The wide, flat or wedge-shaped muscle of mollusks used for crawling, adhering and/or digging.
GILL	An organ used for underwater breathing or respiration by fishes and some invertebrates.
HABITAT	The particular area in which an organism normally lives.
HERBIVORE	An animal that eats plants.
ICHTHYOLOGY	The study of fish.
INVERTEBRATE	An animal without a backbone.
MUDFLAT	The salty soil area of land between the lowest low and highest low tide that is flooded with sea water daily and upon which very few plants grow.
NEKTON	Swimming animals of open water, the adjectival form of nekton is nektonic.
NUTRIENTS	The raw materials necessary for continuing life processes.
OMNIVORE	An organism that eats both plant and animal material.

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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.
SALT MARSH	Salt-water wetland between terrestrial and marine ecosystems; salt marshes can also be seasonal or tidal wetlands.
SCAVENGER	An organism that is an opportunistic feeder; scavengers usually include dead and decaying animal flesh in their diets.
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.
VERTEBRATE	An animal with a backbone. The back bone can be made of bone or of cartilage like in some fish (sharks and rays).
VIVIPAROUS	Reproductive strategy where mothers bear young that are nourished through a placental attachment (live birth).
WETLANDS	Areas that periodically have waterlogged soils, support plants adapted to wet soil, and are covered or occasionally submerged by water.
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.

GEOGRAPHY

Make a map of the Bay Area, or a 3-D model of the Bay Area. Emphasize the mountains, and the Hayward and San Andreas Faults. Clay, or a mixture of baker's dough works well.

GRAPHING

Make a tide table. Have the students check the newspaper each day for the tides. Then record each day on a graph. Watch how the tides go up and down each day and get higher and lower as the month progresses.

Activities/Curriculum links:

http://aswc.seagrant.uaf.edu/kindergarten/investigation-1.html
https://coast.noaa.gov/estuaries/curriculum/
https://dataintheclassroom.noaa.gov/
http://www.noaa.gov/resource-collections/hands-on-science-activities
http://www.noaa.gov/resource-collections/hands-on-science-activities
https://coast.noaa.gov/estuaries/curriculum/human-impacts-on-estuaries-terrible-spill-in-grand-bay.html
http://www.afterschoolalliance.org/STEM-curriculum.cfm

POST-VISIT ACTIVITIES

WEB OF LIFE

Have the students stand in a circle. Ask the students about the habitat they just saw (this will work for any habitat). Ask them where in that habitat all energy begins, (sun).

- Hand the student who answered correctly a ball of yarn.
- Ask what uses the sun's energy to create food (plants). Have them name a plant they saw.
- Have the student with the ball of yarn (still hanging on to the end of the string) toss the ball itself over to the "plant" student.
- Ask, "Who uses plants for energy?" And continue this discussion using herbivores, carnivores, decomposers, and of course, humans,
- With each completed step, students continue to toss the yarn to each other around the circle, creating a complex and interrelated food web.
- Now pick a random student. Because of hunters, or pollution, or loss of habitat (several reasons apply), the component he or she represents has died and must sit down. As he does so, he inadvertently creates a tug on the yarn, thus affecting other aspects of the web of life. Every student, then, who feels a tug on the yarn they are holding is affected in some way by the death of that one individual, and must sit down and tug on their own yarn.

Eventually, all students will be seated and you can discuss the results

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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/
https://dataintheclassroom.noaa.gov/
http://www.noaa.gov/resource-collections/hands-on-science-activities
http://www.noaa.gov/resource-collections/hands-on-science-activities
https://coast.noaa.gov/estuaries/curriculum/human-impacts-on-estuaries-terrible-spill-in-grand-bay.html
http://www.afterschoolalliance.org/STEM-curriculum.cfm