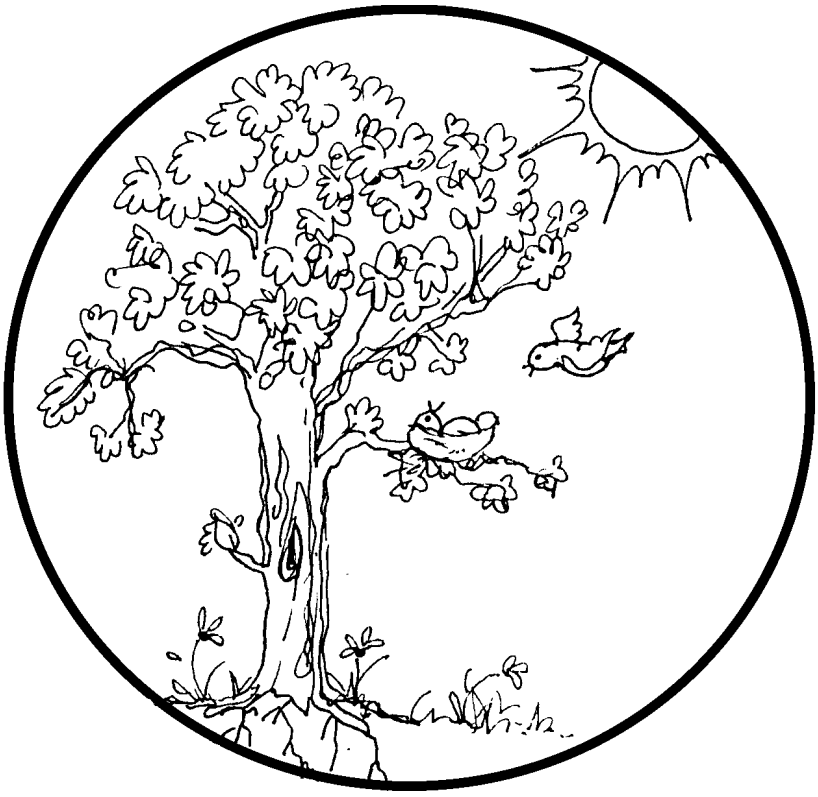
Life Cycle

Diversity in a Balance

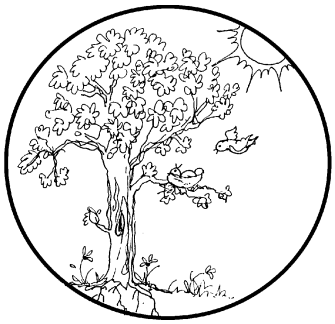
FIFTH GRADE

NATURAL ENVIRONMENT



2 WEEKS
LESSON PLANS AND
ACTIVITIES

LIFE CYCLE
OVERVIEW OF FIFTH GRADE



ORGANISMS

WEEK 1.
PRE: *Identifying animal and plant cell parts.*
DURING: *Exploring the different organelles of a cell.*
POST: *Exploring the importance of RNA and DNA.*
WEEK 2.
PRE: *Explaining the importance of reproduction.*
DURING: *Comparing asexual and sexual reproductive strategies.*
POST: *Comparing characteristics of the 5 kingdoms.*

HUMAN BIOLOGY

WEEK 3.
PRE: *Comparing functions of specific body systems.*
DURING: *Calculating calorie intake.*
POST: *Comparing how and where digestion takes place.*
WEEK 4.
PRE: *Comparing the three types of muscle tissue.*
DURING: *Calculating reflex time.*
POST: *Defining different components of the medical profession.*

PLANT LIFE

WEEK 5.
PRE: *Analyzing the structure of plant cells.*
DURING: *Observing different plants under the microscope.*
POST: *Demonstrating photosynthesis.*
WEEK 6.
PRE: *Exploring the diversification of plant reproduction.*
DURING: *Comparing reproduction of a gymnosperm and angiosperm.*
POST: *Discovering how seeds are dispersed.*

NATURAL ENVIRONMENT

WEEK 7.
PRE: *Exploring coral species.*
DURING: *Exploring and distinguishing the different types of corals.*
POST: *Discussing the requirements of corals.*
WEEK 8.
PRE: *Comparing autotrophs and heterotrophs.*
DURING: *Exploring the eating habits of an owl.*
POST: *Interpreting data obtained from owl pellets.*

LIFE CYCLE - NATURAL ENVIRONMENT (5A)

PRE LAB

Students use the internet to research corals.

OBJECTIVE:

1. Reviewing systems of classification.
2. Exploring coral species.

VOCABULARY:

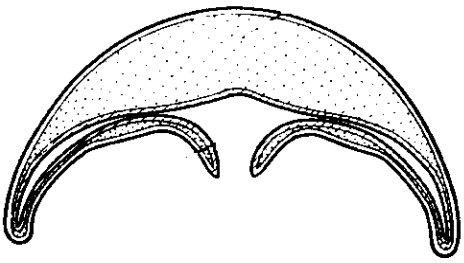
classification
corals
phylum
species

MATERIALS:

Internet

BACKGROUND:

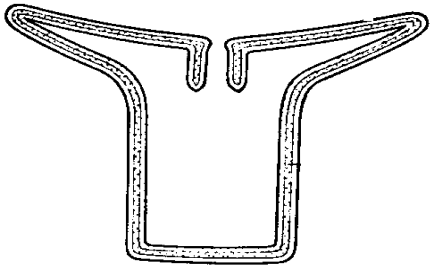
Corals belong to the phylum that includes hydroids, jellyfish, and sea anemones. All Cnidaria possess the following: radial symmetry, sac-like body with a central body cavity; body wall containing 3 basic cell layers; single opening that acts as mouth and anus and surrounded by food capturing tentacles; possess stinging cells (called nematocysts) situated on the tentacles.



This "medusa" form is found in free living Cnidaria.

Corals usually take on one or two forms, a polyp or a medusa (see figures). If you take your hands, palms down and open and close your fingers, that represents a medusa. If you place your hands palms up and repeat the same motion, this represents a polyp. The medusa can move freely, like a jellyfish, but the polyp remains stationary (i.e. corals). This is a good way to demonstrate the relationships between corals and other cnidarians.

Corals belong to the Class Anthozoa, along with the sea anenomes, sea fans, sea pansies, and many others. Since this group can't run out and get a hamburger, they have to wait for the food to come to the polyp. The polyp has its tentacles out waiting for debris (goodies that fall in the water column). This is called suspension feeding. When a tidbit hits its tentacles the



Polyp

tenacle brings the food toward the stomach where it is digested (raptorial feeding). Because the corals are stationary, they have developed different protection strategies using their skeletons.

Corals can be solitary or colonial (more than one). Massive colonial corals have individual polyps that range in size from 1-3 mm in diameter. The solitary corals can reach up to 25 cm in diameter. Most people think of corals as big massive structures, but few realize that these structures are really a colony of the same species who have built a common skeleton. Because calcium carbonate is more abundant in warm water, corals tend to build larger structures in warm water. Corals in colder water tend to be smaller and solitary. The Pacific coast has small solitary corals that are bright orange which are commonly mistaken for sea anenomes.

The shape of the skeleton varies from encrusting, spherical masses, to upright and branching growth forms. There are basically three taxonomic types of living corals: the cerianthipathanians (including black and thorny corals), hexacorallians (including stony corals), and octocorallians (including pipe and blue corals).

The cerianthipatharians have simple unbranched tentacles. Many of these corals have the fleshy part of the organism on the outside of the skeleton. Included in this group is the black coral, used in jewelry making.

The hexacorallians are a diverse group with over 5300 living species. The group grows septa (supporting "bars" where the organisms "sits") in multiples of six, hence the derivation of "hexa." Included in this group are sea anemones and the scleractinia or stony corals.

The stony corals are very common reef builders because they make a robust and white skeleton that tends to be massive. Also included are the brain, lettuce, and mushroom corals. The skeleton is composed of calcium carbonate and is secreted at the base of the polyp. The base contains radiating calcareous septa that help give the polyp support. The skeleton provides a substrate on which the polyp attaches with its fellow corals and protection against fish which like the tender corals for a snack. The octocorallian corals possess 8 tentacles that are pennate (looking like a feather). The skeleton is made of calcium carbonate and/or a horny (organic) material. The calcium carbonate however is not massive like in the stony coral and therefore not as robust. The octocorallian include the sea pens, sea fans, red coral, sea pansies, and pipe corals. This group tends to be more colorful in shades of red, blue, yellow, and brown.

PROCEDURE:

1. Discuss with students the concept of classification. There are currently six kingdoms that are recognized: Archaea, Bacteria, Protista, Fungi, Animalia, and Plantae. Each of the kingdoms is divided into phyla which are groupings of organisms that have similar characteristics. Each of the phyla are broken into families, families are broken into genera, and genera are divided into species. Classification is a useful tool that people use for naming organisms, and for getting a general relationship of how the organisms are grouped. The way biologists and paleontologists classify organisms has to do with key characteristics of a group, whether it is the way an organism eats, moves, or its physical

structure. The higher the taxonomic classification the more likely it will change as more information is obtained by scientists.

2. Since corals may be new to students, discuss what corals are. If you have a few samples show students the range of structures that corals have.

3. Use the Internet search engines to find more information on corals.

LIFE CYCLE - NATURAL ENVIRONMENT (5A)

LAB

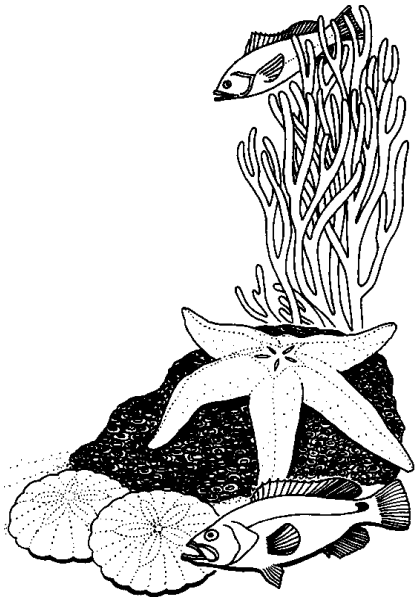
Students compare corals.

OBJECTIVE:

1. Observing corals.
2. Exploring and distinguishing the different types of corals.

VOCABULARY:

classification
coral
polyp
tropical



MATERIALS:

Life Cycle - Natural Environment (5A)
Coral Display Kit
Magnifier Kit
Swift- GH Microscope

BACKGROUND:

Individual corals make up a colony of corals. Individual polyps live in their own little structures within the main frame of the other corals. Only corals of the same species share colonies with other corals; although various species of corals can live very close to each other.

The information below should correspond to the samples in the Coral Display Kit.

ANTHOZOA

CLASS CERIANTIPTHIA

BLUE CORAL - *Helipora* species (blue colored specimen)

This Indo-Pacific blue coral, *Heliopora*, is relatively rare. It has a massive lobed skeleton dissected by cylindrical canals. The blue tint of the skeleton is masked in life by the brown polyps, and is due to the presence of iron salts. It is used in jewelry because of its color.

CLASS ALCYONARIA = Octocorals

BLACK SEA FANS - Order Gorgacea (black delicate fan structure)

The main stem is firmly attached to a hard surface by a plate or a tuft of creeping branches. The stems contain a central strengthening rod, consisting of a horny material (gorgonin). The short polyps occur all over the branches of the colony being absent only

on the main stem.

RED ORGAN PIPE CORAL - *Tubipora* sp. (red specimen)

The common name is derived from the parallel rows of tubes making up the calcareous skeleton of the colony. When the polyps are expanded, the red skeleton may be completely obscured. Colonies can reach 30 cm or more in diameter. Found in the Indo-Pacific.

OCTOPUS CORAL - Order Telestacea (lavender specimen)

The colonies consist of simple or little-branched stems growing up from a root-like base. The stems, which are modified elongated polyps, bear lateral polyps. The skeleton consists of spicules frequently joined by calcareous and horny secretions.

Telestaceans are found in deeper waters of both tropical and temperate regions.

CLASS ZOANTHARIA = Hexacorals

STAGHORN CORAL - *Acorpora* species (white, long straight specimen)

Another of the fast growing reef builders, staghorn coral forms thickets, sometimes of great size, with a lattice-work of loosely connected branching coral colonies. Colonies may be yellow, brown or cream color with white tips (where the growth takes place).

Staghorn thickets are found not often seaward of the reef flat, where they may adorn the tops of buttresses at moderate depths. They are also found forming patch reefs in protected lagoons and shore zones in shallow water connected to other colonies (if at all), and are encrusted with algae, sponges, and tunicates. Damselfishes frequently stake out their territories in staghorn as well as elkhorn coral.

ELKHORN CORAL - *Acorpora* species (creamy white, smoother specimen that look like a reindeer's horn)

The fast growing branching colonies of this coral are sometimes 4 meters or more across. The flattened (or thick and cylindrical) branches are brown to yellow with white tips The white tips are due to lack of symbiotic algae, the zooxanthellae, in areas of new growth.

Elkhorn coral competes by growing rapidly and by shading or over-topping its neighbors. It often dominates shallow fore reef zones on windward, wave-swept shores. It is sometimes toppled by storm surf, but may re-grow from its new positions (broken fragments regenerate to form new colonies). This capability may partially explain its wide distribution.

BRANCHING, BRUSH, OR BROWN STEM CORAL - *Madracis* (specimen with brown spots with branching tips)

These yellow to cream-colored colonies may be several meters across and are formed of thin delicate branches packed tightly together. The more massive colonies form gently rounded mounts.

This coral is found at moderate depths on buttress tops, flanks, and fore reef slopes. Brittle stars and other invertebrates are often harbored between the branches. Inner parts of the branches are dead and are encrusted with algae, sponges, and other attached invertebrates. The brittle branches of the coral are easily damaged by divers and boat anchors.

POCA CORAL - *Montipora* species white, small polyps, crinkled, some have small red specks on them.

Poca forms flat, leafy colonies which may reach 2 meters or more across. It often

grows in dense masses over reef slopes in the Indo-Pacific.

MUSHROOM CORAL - *Fungia* species (individual polyp, circular specimen with large septa).

A common species reaching 20 cm in diameter, which is found on reefs and lagoons in the Indo-Pacific. As adults, all species are free-living, but when young they are often seen in clumps, each polyp attached to the bottom by a stalk.

LUMPY PORITES - *Porites* species (specimen is white, flat, with polyps that are elevated a little above the surface).

This encrusting *Porites* may form mounds or flat sheets up to 60 cm in diameter. The surface is dotted with low, irregular mounds. The color may range from yellow and tan to bright green.

This species exhibits different growth forms under different conditions (such as depth). It takes spherical or mounding shapes in shallow water, but becomes flat and plate like in deeper or shaded locations. It also grows in shallow lagoons, mangrove swamps and intertidal pools.

FLOWER CORAL - *Eusmilia* species (white, large polyps that give the appearance of being squished).

The branching colonies of this coral are brown, green, or yellow and have one large polyp at the top of each branch. Colonies form mounds which may be 1 meter or more across.

The polyps are generally retracted during the day, but extend long transparent tentacles for feeding on plankton at night.

STAR CORAL - *Montastrea* species (white, with starlike polyps, slightly elevated).

The flat plates, hemispheres, and mounds formed by this common and very important reef-builder are sometimes massive. The colonies are brown, to gray, to green. Polyps are closed during the day.

The star coral often forms massive mounds that are important structural elements of buttresses and other fore reef elements at moderate depths. Colonies become more plate-like as depth increases. This frequently is the dominant reef-builder in buttresses and fore reef slopes.

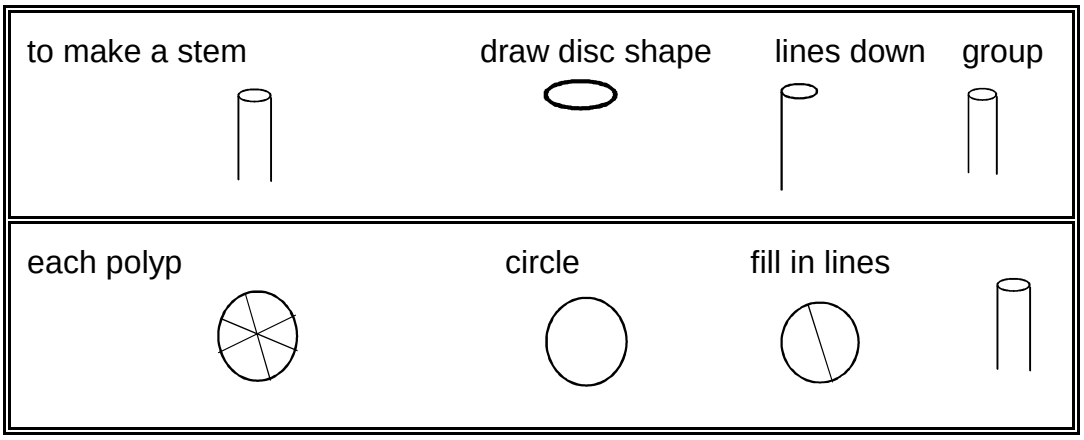
LEAF CORAL - *Montipora* species (slightly green, small holes, flatten).

Leaf corals form flat, leafy colonies which may reach 2 meters or more across. They often grow in dense masses over reef slopes in the Indo-Pacific.

PROCEDURE:

1. Discuss the different display corals that you have. The names are not as important as observing the different characteristics of the corals. In the coral display module, there is detailed information on each type of coral.

2. Give students a package of corals. Provide hand lenses or Swift-GH microscopes to observe the corals in detail. Students should draw what they see on their lab sheets. You might want to help students draw the individual polyps by going over the following art instructions.



3. There may be more than 4 different types of corals that the students have. If they want to draw more, use the back of the lab sheet. After they finish drawing their specimens, see if they can match their specimens with the display materials.

4. Emphasize with students that there are many types of corals, each with its own characteristics. Make sure students realize that corals belong to the Animal Kingdom, and that they are invertebrates.

LIFE CYCLE - NATURAL ENVIRONMENT (5A)

PROBLEM: Can you study the environment of an organism without knowing the physical characteristics of that organism?

PREDICTION:_____

MATERIALS: bag of assorted corals, hand lens, MICROSCOPE

PROCEDURE: Group similar looking corals. Examine with a magnifying glass or microscope and draw a picture of each different type.

Compare with instructor's specimens and determine which specimens you have.

CONCLUSIONS: What characteristics can be used to group corals together?

_____
_____
_____

LIFE CYCLE - NATURAL ENVIRONMENT (5A)

POST LAB

Students use information to determine worldwide occurrences of coral.

OBJECTIVE:

1. Plotting the location of coral reefs on a world map.
2. Discussing the requirements of corals.

VOCABULARY:

environment
requirement

MATERIALS:

World Placemats
Hydrographic Globe or bathymetric map

BACKGROUND:

A coral's living requirements can help one predict where large numbers of coral may live in the world. They need shallow water that is clean (sediment free) and prefer warm water. Using these requirements have students look on a map and predict where corals live.

PROCEDURE:

1. Go over with students where warm ocean currents may occur on the World Placemats. Warm water would be found around the equator especially.

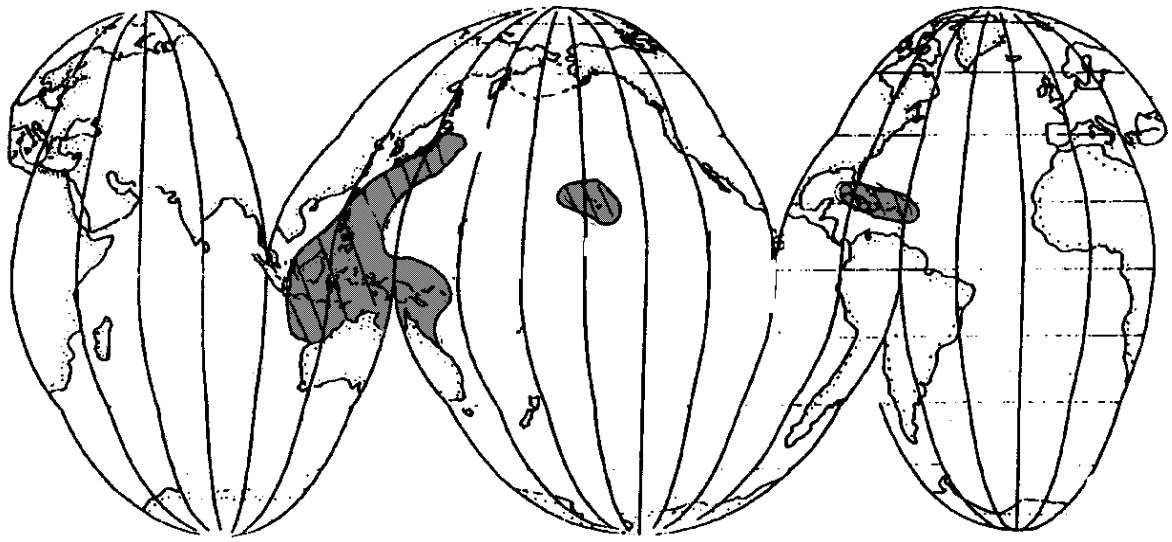
2. If you have a Hydrographic Globe, have students identify shallow areas. This would be around the Carribean, Australia, Bering Sea, Arctic Sea and Mediterranean to name a few.

3. See if students can locate sediment free area. A clue would be that no large rivers would be close.

4. If students can find these three parameters, then they should be able to predict where corals live. Remember, that there may be submerged islands that can also be good for coral growth.

Bering Sea and Arctic Sea are too cold; Mediterranean is too polluted. The Pacific and Atlantic both have shallow areas.

The map below delineates areas that have large coral reefs.



Shaded areas are where coral reefs are presently found.

LIFE CYCLE - NATURAL ENVIRONMENT (5B)

PRE LAB:

Students make a diagram of consumers and producers.

OBJECTIVE:

1. Comparing autotrophs and heterotrophs.
2. Defining a food web.

VOCABULARY:

autotroph
consumer
food pyramid
heterotroph
producer
tropic level

MATERIALS:

worksheet
paper
scissors

BACKGROUND:

An ecosystem occurs when living animals, plants, and microbes form a community which includes producers and consumers. Producers are those organisms that make their own food using sunlight, nutrients, and water. Producers are autotrophs or organisms that utilize the sunlight and chlorophyll within the plant to produce energy for the plant to grow. Heterotrophs are those organisms on the food pyramid that eat producers.

Students have learned about coral and where they live. Coral are consumers. In some cases they depend on algae that grow within the coral for food in what is termed symbiotic relationships. Coral are also debris feeders and rely upon whatever "falls" into their tentacles to be put in their stomachs. The eating habits of coral are complicated.

The food web concept is an extension of the food chain. The food chain simply traces who eats whom within an ecosystem (a community of organisms interacting with one another and with their environment. By itself, it doesn't give the whole picture of what is really going on in an ecosystem. Many animals feed on several different types of food, humans eat several different kinds of plants and animals. Because of these more complex eating patterns, different food chains intermix and form a "web-like" pattern called the food web.

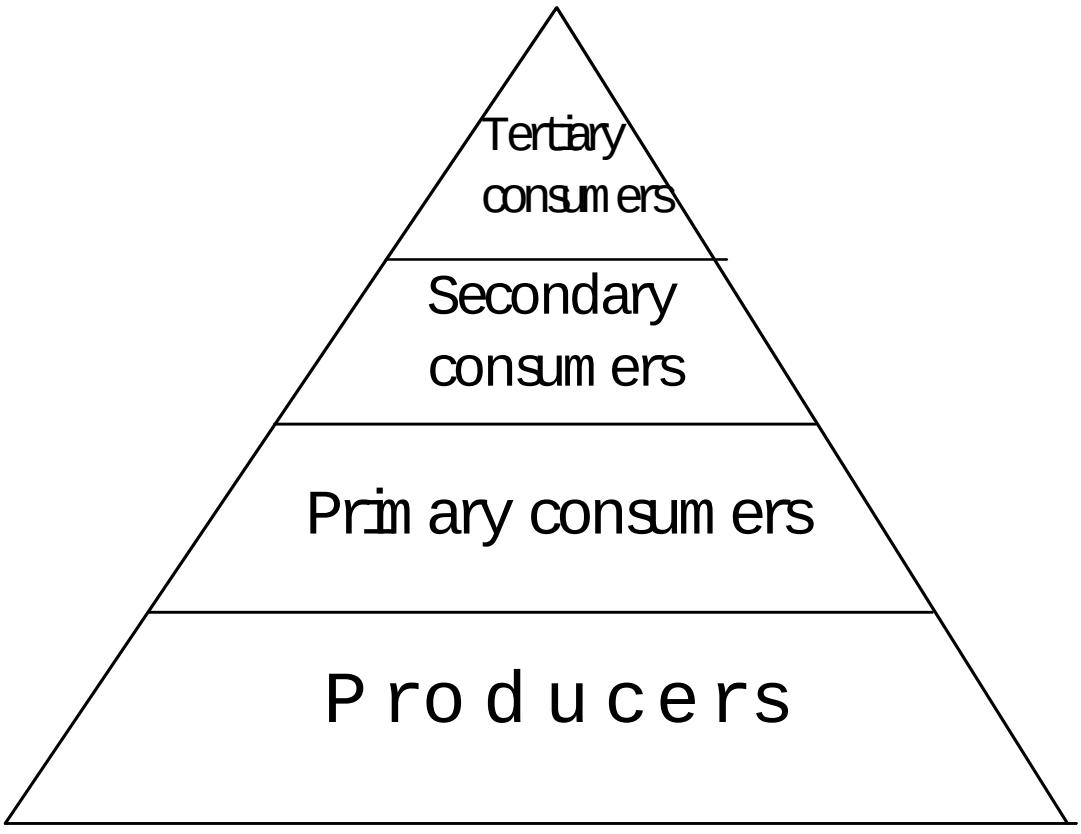
PROCEDURE:

1. Within the food web there are different tropic levels. Students should cut out the pictures and glue a piece of paper into Producers, Primary Consumers, Secondary and Tertiary Consumer as in the diagram below.

2. Tell the students that energy loss becomes greater as you go up the pyramid and the number of organisms becoming less in number as you go up.

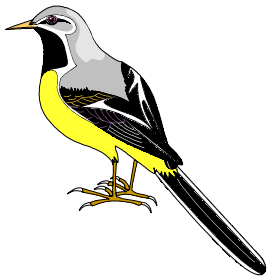
3. Ask students what the difference between a carnivore and a top carnivore means. A top carnivore could eat another organism that is also a carnivore. A herbivore would be the producer.

4, **The answers are as follows:** Producers: 2,3,8; Primary consumers:5,6,10,11; Secondary Consumers: 1,4,9; Tertiary consumer: 7.

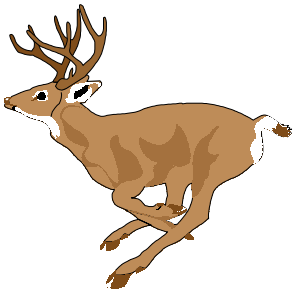


LIFE CYCLE - NATURAL ENVIRONMENT (5B) PRE

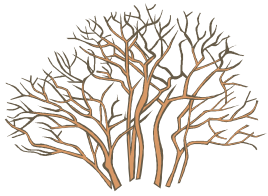
DIRECTIONS: Cut out the pictures below and glue them onto the blank land-food pyramid in the correct sequence (energy loss becoming greater as you go up the pyramid and the number of organisms becoming less in number as you go up.)



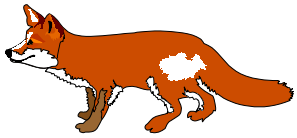
1



2

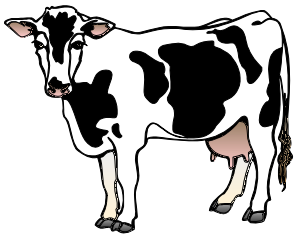


3

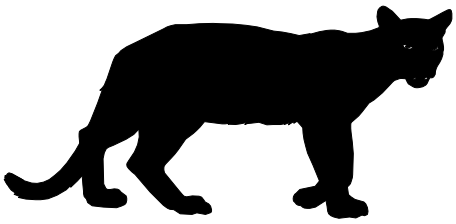


4

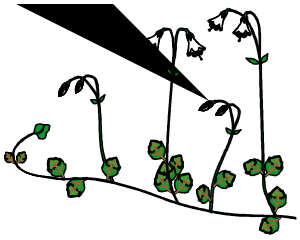
5



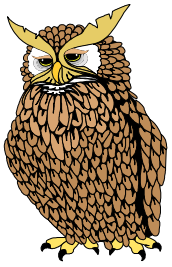
6



7



8



9

10

11

12

LIFE CYCLE - NATURAL ENVIRONMENT (5B)

DURING LAB:

Students determine the type and age of rodents from owl pellets.

OBJECTIVE:

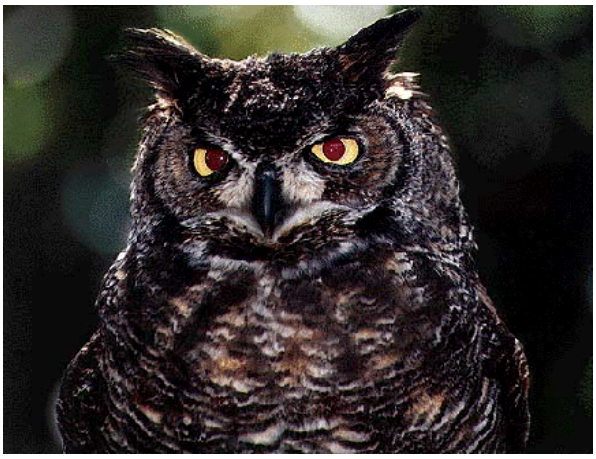
1. Defining an organism's role in the food web.
2. Exploring the eating habits of an owl.

VOCABULARY:

food web
population biology

MATERIALS:

rulers
Skeletons by S. Parker
information charts on bones
toothpicks
Life Cycle - Natural Environment (5B)


Great Horned Owl

BACKGROUND:

One of the duties of the U.S. Fish and Wildlife Service is to estimate how many organisms there are in the United States. One way to determine this is to watch wildlife or to develop an indirect way of observing them. In order to find out more about the rodent population in an area, wildlife managers use owl pellets to develop a sense of the rodent population, both in number and in species. One can also track the history of individual owls, and discover information about an owl population.

Wildlife managers collect information on the food that an owl eats by recording the number, percentage, volume, and weight of the ingested animals. They can determine the frequency of what the owls eat since they collect data over time. They look at the number of prey, how often it occurs, in what amount and what it is.

PROCEDURE:

In this lab students will develop a food habit study of the owl. In the post lab they will look at the information as a class to determine a rodent population. Students need to prepare the sample, segregate the contents, identify the food items, record the day it was collected, and finally appraise the data to obtain results.

1. Give each pair of students a pellet. Have them disaggregate the material by

using their hands, forceps, tweezers, or toothpicks.

2. Have them determine the volume of the fur by stuffing the fur component into a graduated cylinder and reading how much volume it takes up.

3. Students will be able to determine if the bones are mature or not by looking at the growth. When growth is complete, the cartilage is replaced by solid bone, so that the cap and shaft are fused firmly together. The presence of a cartilaginous zone or lines representing its recent presence or its complete absence are criteria of use in aging many mammal bones. (See information on bones).

4. Students should also be able to determine how many animals there are by looking at the number of bones.

LIFE CYCLE - NATURAL ENVIRONMENT (5B)

PROBLEM: How can you determine the food habit of a Great Horned owl?
PREDICTION:

_____

MATERIALS: reference material, tweezers, tray, owl pellet

PROCEDURE: Record the day that your owl pellet was collected (out of 15 possible days). Record this number on the data sheet below. First separate the bones from the other fur material. Measure the volume of fun in a graduated cylinder and record your results.

volume of fur _____

Look at the materials other than the bones under the microscope. Describe the contents.

_____

_____

Where do you think it came from?

_____

Look at the bones and record what you see. Use the Eyewitness Books on *Skeletons* to help you identify what parts of the body they came from. Draw what you have trouble describing. Use the back of this sheet if necessary.

_____

_____

_____

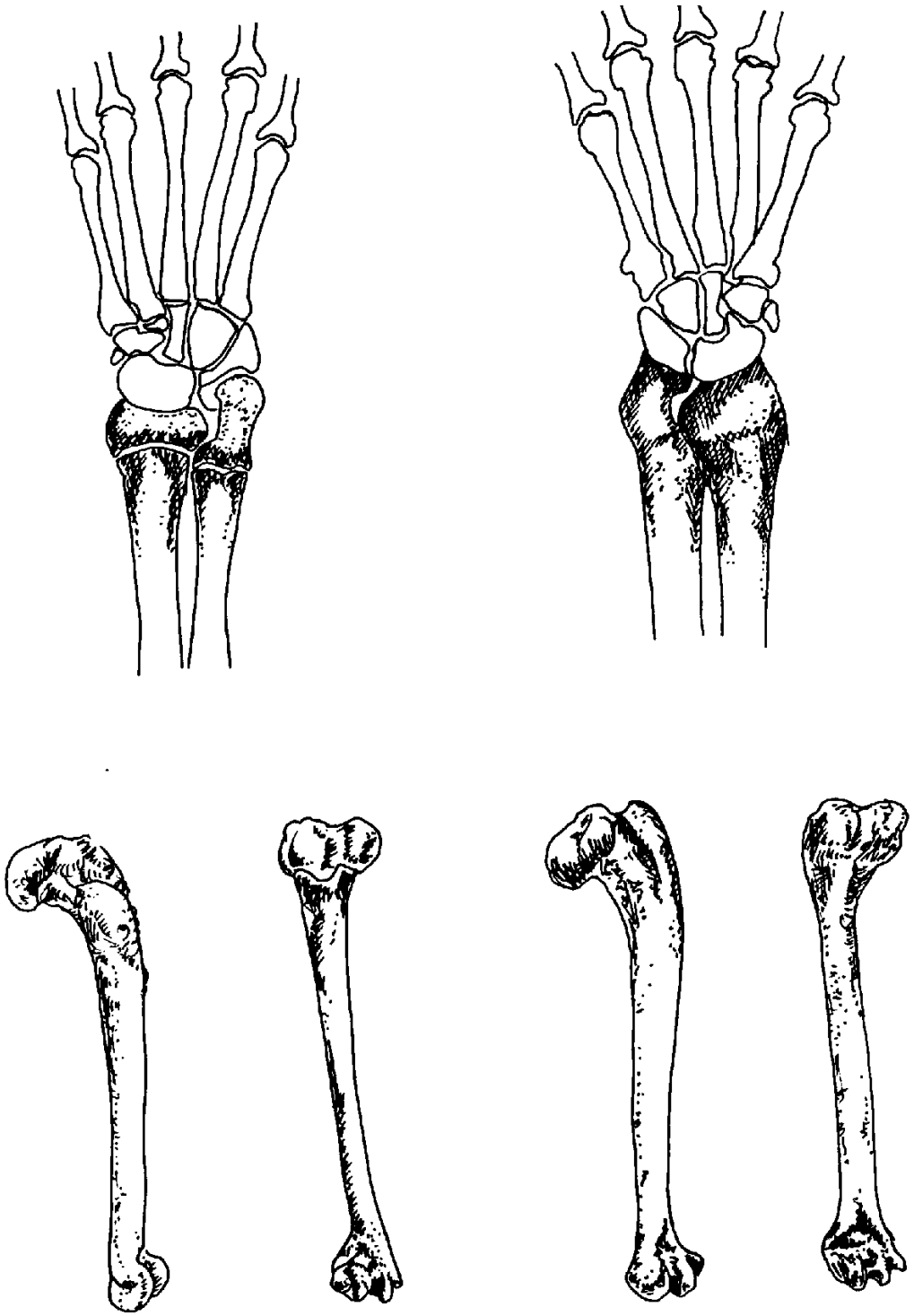
_____

CONCLUSIONS: What did your owl eat on the day assigned to your group?

_____

LIFE CYCLE - NATURAL ENVIRONMENT (5B) DURING

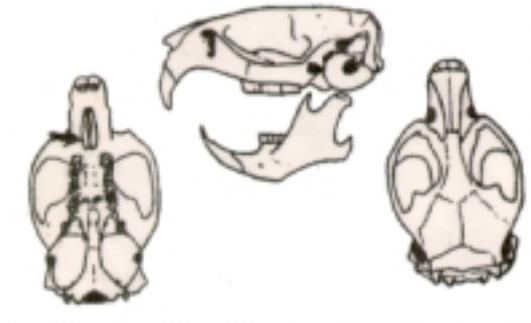
MATURITY OF ANIMAL BONES



LIFE CYCLE - NATURAL ENVIRONMENT (5B) DURING

gopher

mouse



vole

mole

LIFE CYCLE - NATURAL ENVIRONMENT (5B)

Students collect data from owl pellets.

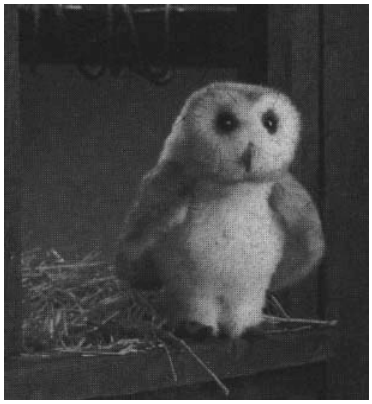
POST LAB

OBJECTIVE:

1. Comparing the bones found in owl pellets.
2. Interpreting data obtained from owl pellets.

VOCABULARY:

demography
population biology



MATERIALS:

lab sheets from previous lab

BACKGROUND:

Owl pellets are used for scientific study of small mammals and their distribution. Owls hunt at night and roost during the day. They are ravenous feeders, eating almost anything that walks, crawls, flies or swims. When an owl roosts, it then will regurgitate what it ate the previous night. Charting the contents of the owl pellet can then help wild life biologists to determine the population and age of what the owls ate.

Owls have no crops like most birds, so indigestible parts (hair, feathers, bones) are passed forward into the proventriculus until regurgitated as pellets. Owls are predators who feed mainly on rodents. A barn owl can eat one and a half times its own body weight in rodents in one evening, reflecting the population of rodents in the area. An owl's talons and beaks are adapted for its diet. An owl kills with its talons rather than its hooked beak. The great horned owl, one of the few enemies of the skunk, approaches a skunk from behind and punches its curved talons through the skull bones and into the brain, killing the skunk instantly.

Wildlife managers are interested in population biology, or the study of the growth and structure of populations together with the factors that regulate their size and cause fluctuations in their density. In fact, this could be called demography which looks at the population dynamics of any organism including humans. The demography of organisms is always changing. For example, a drought is persistent for a few years in an area. One of the first things affected is usually the birth rate. If the rate of birth goes down, the population may suffer and in some cases be totally eradicated.

PROCEDURE:

Have the students complete the worksheet. It is actually an accumulated amount of

data. For each set of owl pellets the information will be different. If you have purchased the module from the Math/Science Nucleus your pellets will reflect a collection period of over 15 days for a Great Horned owl in Fremont, California (San Francisco Bay area).

1. Each student group should describe what they found in their owl pellet. They should justify their number of organisms, as well as the type of organisms.

2. Discuss with students what they think the rodent population is composed of in the area.

3. See if there was any problems. For instance, on day 4 and 5 the only things found in the owl pellets were some kind of crayfish. What could that mean? It may have been raining, and the rodents stayed in their nest.

LIFE CYCLE - NATURAL ENVIRONMENT (5B) POST

CLASS DATA SHEET FOR LIFE CYCLE- NATURAL ENVIRONMENT (5B)

DAY	VOLUME OF FUR	HOW MANY ANIMALS	CONTENTS/COMMENTS