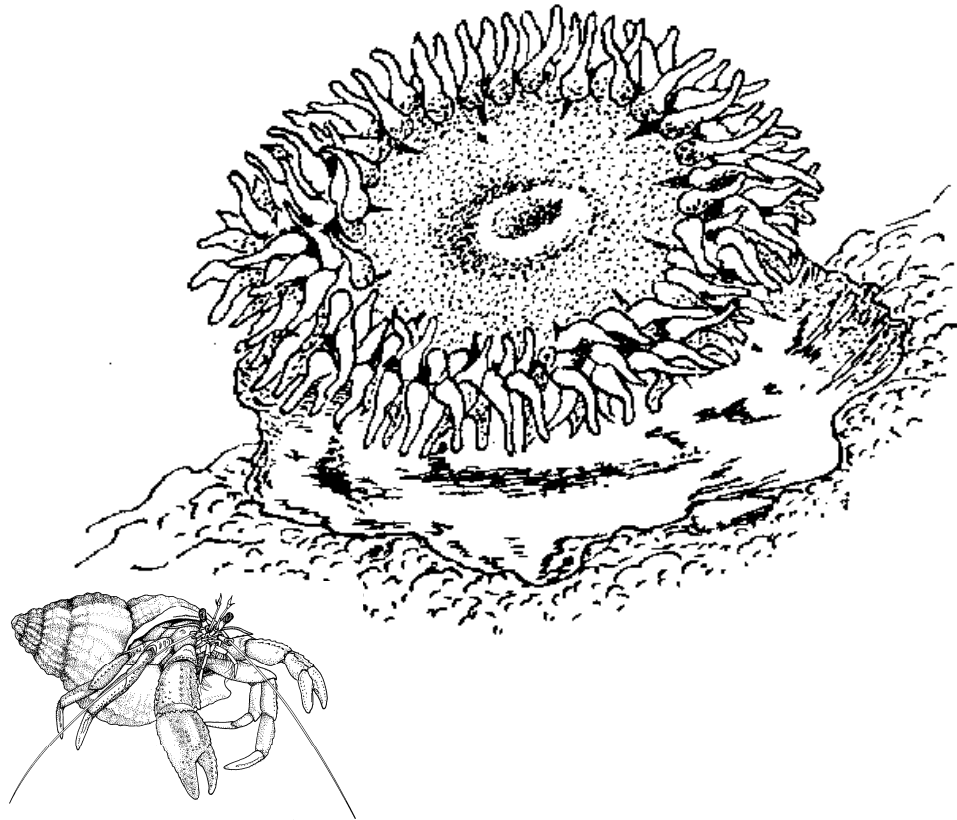


Tidepool Talk



**Lab Program Curriculum
Grades 1-3**



OREGON COAST AQUARIUM

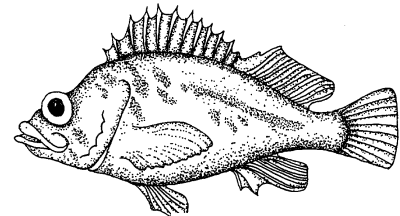
Program Description

This 45-60 minute lab program introduces students to four intertidal animals and their adaptations for feeding, motion, protection and sight. During this program your students will hear a brief introduction to tidepools and adaptations and then travel to four stations to study some invertebrates that live in tidepools. Students will then have an opportunity to touch the animal at their station. After this program your students will understand the difference between a vertebrate and an invertebrate and be familiar with four invertebrates found along the Oregon coast. They will also learn how to handle ocean animals carefully and understand some similarities and differences between themselves and animals of the sea. Participating in this program will help your student to meet the grade three common curriculum goals and benchmarks listed on the back of this sheet.

Chaperones will be asked to take an active role in the lab program, which is designed so that they read informational cards in English to the students in their group. It will also be the chaperone's responsibility to monitor the students' behavior during the lab program.

Before your visit:

- Using pictures from magazines or drawings make ocean plant and animal cards. Use these and the enclosed **animal flash cards** to familiarize students with organisms they may see at the Aquarium. Incorporate appropriate vocabulary, play concentration or use them as flash cards for plant and animal identification.
- Have your students make a **Flashcard Notebook** using the flashcards provided. They can take this on their field trip to help identify animals at the Aquarium.
- Use the **Tidepool Dilemmas** to start a discussion about social responsibility and the marine environment.
- Have your students complete the enclosed **A Few Words About Invertebrates** to familiarize them with the words they will be hearing in their lab program.
- As your students color each of the enclosed **coloring sheets**, have them list the body parts they notice and guess what purpose each part might serve.



Rockfish

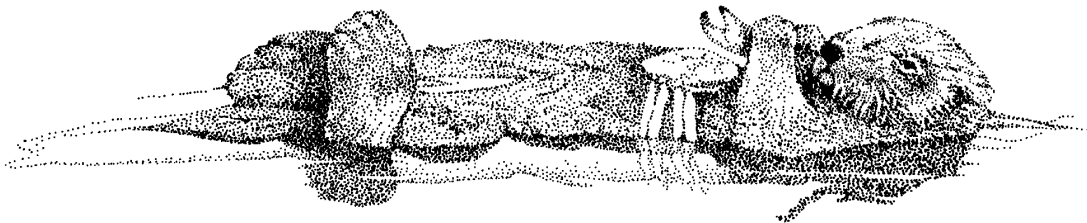
- Use the **Trying Out Taxonomy** activity to introduce your students to classification.
- Use the activities in the **self-guided** materials to further prepare your students for their self guided tour of the Aquarium.

During your visit:

- Provide you students with copies of the **Oregon Coast Aquarium Student Guidebook**. A master copy of the pages needed to create this booklet is included in the center of the self-guided packet.
- An **Oregon Coast Aquarium Chaperone Guidebook** is also located there. This book will allow your chaperones to more effectively direct their students as they use their activity books.

After your visit:

- Have each student draw their favorite invertebrate from the Aquarium and list some of the characteristics of it. For example, if it is an octopus they might list beak, siphon and suction cups.
- Have your students sing **Found A Sea Star** to review sea star characteristics and behavior,
- Use the **Animal Flash Cards** or their **Flash Card Notebook** to review the characteristics and adaptations of the animals they saw at the Aquarium.



Tidepool Talk addresses the following Oregon Common Curriculum Goals and Benchmarks:

Oregon State Benchmarks and Common Curriculum Goals

Science

LIFE SCIENCE (ORGANISMS)

- **Common Curriculum Goal (Organisms):** Understand the characteristics, structure, and functions of organisms.

Content Standard: Describe the characteristics, structure, and functions of organisms.

Grade 3 Benchmark: Describe the basic needs of plants and animals.

Grade 5 Benchmark: Classify organs by the system to which they belong.

LIFE SCIENCE: (DIVERSITY/INTERDEPENDENCE)

- **Common Curriculum Goal:** Understand the relationships among living things and between living things and their environments.

Content standards: Explain and analyze the interdependence of organisms in their natural environment.

Grade 3 Benchmark: Describe a habitat and the organisms that live there.

Grade 5 Benchmark: Describe the relationship between characteristics of specific habitats and the organisms that live there.

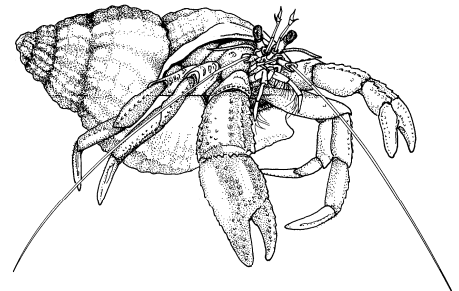
Career Related Curriculum Standards

PROBLEM SOLVING:

Content Standard: Apply decision-making and problem-solving techniques in school, community, and workplace.

Criteria:

- Identify problems and locate information that may lead to solutions.
- Identify alternatives to solve problems.
- Assess the consequences of the alternatives.
- Select and explain a proposed solution and course of action.
- Develop a plan to implement the selected course of action.
- Assess results and take corrective action.



English/Language Arts

GRADE 2

READING

- **Common Curriculum Goal:** Analyze words, recognize words, and learn to read grade-level text fluently across the subject areas.

DECODING AND WORD RECOGNITION

- Read regular multi-syllabic words.
- Use letter-sound correspondence knowledge to sound out unknown words.

VOCABULARY

- Understand, learn, and use new vocabulary that is introduced and taught directly through orally read stories and informational text as well as student-read stories and informational text.



- Develop vocabulary by listening to and discussing both familiar and conceptually challenging selections read aloud.

READ TO PERFORM A TASK

- Read written directions, signs, captions, warning labels, and informational books.

Tidepool Talk addresses the following
National Science Education Standards:

LIFE SCIENCE CONTENT STANDARD C

Grades K-4:

- The characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Rocky Shore

Background Information

Life on the Rocks

On most rocky shores there are two high tides and two low tides each day. At high tide, surging waves send cold seawater crashing onto Oregon's rocky shores. At low tide, much of the rocky shore is exposed. Animals found in this habitat live in certain zones depending on their ability to withstand environmental pressures during both low and high tides. Zones include the **spray zone** (nearest to shore), **high tide zone**, **mid tide zone**, **low tide zone** and **subtidal zone** (the area never uncovered, even during the lowest low tide of the year). The area of the rocky shore that is between the edge of the low tide zone and the spray zone is called the **rocky intertidal zone**. When the tide is completely out (at low tide) in the rocky intertidal zone habitat, you will find pools of water left behind in the rocks. These are referred to as **tide pools**. What you find in a tide pool will depend on the depth of the tide pool and where it is located within the rocky intertidal area.

Rocky Intertidal Zones:

Spray zone

- The area just beyond the highest high tide
- Kept wet by salt water spray
- Flooded with water during storms
- Inhabitants include barnacles, snails and limpets

High tide zone

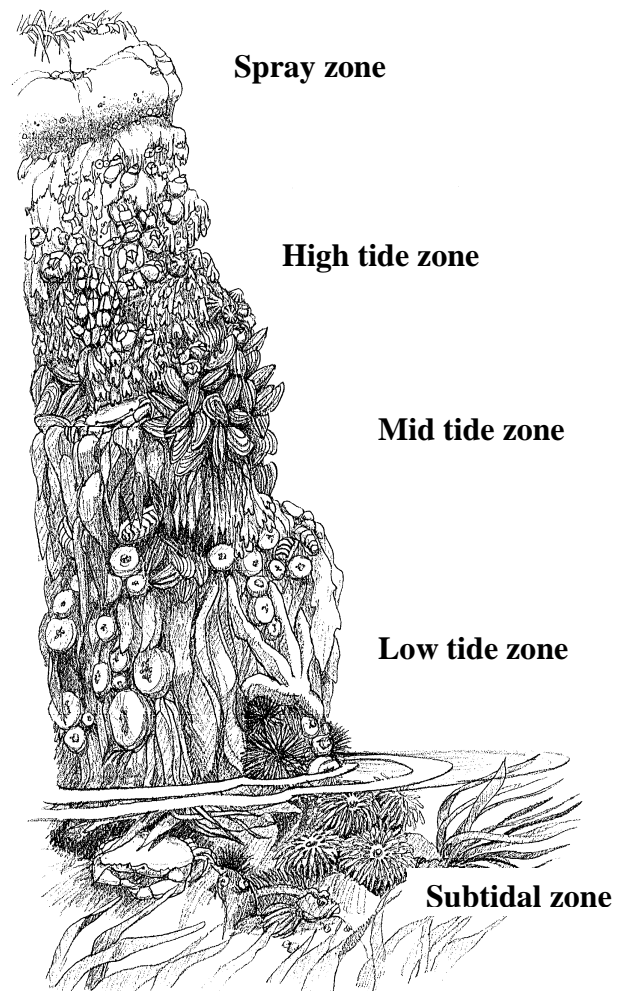
- Uncovered most of the time, except at high tide
- Hit by crashing waves at high tide
- Inhabitants include barnacles, snails, limpets, shore crabs and clingfishes
- Seaweeds include rockweed and sea moss

Middle tide zone

- Exposed to air twice a day during low tides
- Crashing waves occur as tide comes back in
- Inhabitants include mussels, snails, limpets, ochre sea stars, hermit crabs, gooseneck (leaf) barnacles, chitons, anemones, sponges, tube worms, ribbon worms, porcelain crabs, red rock crabs and sculpins (a small fish)
- Seaweeds include surf grass, sea palm, coralline algae

Low tide zone

- Occasionally exposed to air during low tides
- Covered by water most of the time
- Crashing waves as the tide comes back in
- Close to the edge of the water, even when uncovered
- Inhabitants include snails, limpets, chitons, red sea cucumbers, purple sea urchins (occasionally red as well), nudibranchs (sea slugs), sunflower sea stars, sponges, brittle



- stars, blood stars, six-rayed stars, shrimps, kelp crabs and tunicates (sea squirts)
- Seaweeds include feather boa kelp, sea lettuce, surf grass, oar weed (also called *Laminaria*)

Subtidal zone (nearshore seafloor, also referred to as the surf zone)

- Always covered by water
- Constant surging current
- Varying degrees of wave action depending on seasons and weather
- Inhabitants include many of the animals listed in the zones above, various small fishes (also found in tide pools) including gunnels, sculpins, clingfish, snail fish, decorated warbonnets, monkeyface pricklebacks and wolf-eels. Red octopus, giant Pacific octopus and abalone are also found in rocky subtidal areas and tide pools.

Organisms found in this habitat are among the toughest in the survival business. This is because the conditions of their habitat change throughout the day.

At LOW TIDE organisms experience:

Challenges

- Exposure to air
- Exposure to sun
- Exposure to rain or snow
- Land and air predators

Benefits

- Less chance of exposure to large aquatic predators
- Gentler currents or none at all

At HIGH TIDE organisms experience:

Challenges

- Crashing waves
- Strong currents
- Larger aquatic predators

Benefits

- Incoming food such as plankton
- Fresh, cold saltwater rich in oxygen

Adaptations

Organisms have developed adaptations that enable them to survive in their living conditions and to feed, escape predators and reproduce. These adaptations include shape, size, coloration, defensive behaviors, breeding and feeding habits. Like organisms in other habitats, rocky intertidal organisms rely on a combination of adaptations to insure their survival. For example, a snail's muscular foot helps them to hold on tightly in heavily surging currents, move securely along the rocks or sand. Some snails will also grab food with their foot.

Rocky Shore Vocabulary



If you can't find it here, try: <http://www.mhhe.com/biosci/pae/glossaryt.html>

abdomen (AB-doh-men): the main division of the body behind the thorax of an arthropod

adaptation (A-dap-TAY-shun): a characteristic, such as a body part, color pattern or behavior, that helps an organism survive in its environment

alga (AL-guh) [plural: **algae (AL-jee)**]: a member of certain phyla of the kingdom Protista (*proe-TIS-tuh*) (once considered plants). Most seaweeds are algae.

annelid (a-NELL-id): a member of the phylum **Annelida (a-NELL-ih-dah)**, worms that have a definite head, a well developed vascular, respiratory and nervous system and whose body is divided into a linear series of segments. Earthworms, sandworms, tube worms, clamworms and leeches are annelids.

antenna (an-TENN-ah) [plural: **antennae (an-TENN-ee)**]: a sensory appendage on the head of arthropods, or the second pair of the two such pairs of structures in crustaceans

Aristotle's lantern: the jaw structure, including five teeth, of a sea urchin

arthropod (ARR-thruh-pod): a member of the phylum **Arthropoda (ar-THRAH-poe-dah)**, a group of invertebrates with segmented bodies and jointed appendages. Crabs, barnacles, shrimps, insects and ticks are arthropods.

asexual reproduction: reproduction by a single individual by budding, dividing or breaking

benthic (BENN-thik): living in, on or within a substrate; the region near or on the bottom of rivers, lakes or the sea

bilateral symmetry (bie-LATT-uh-rul): an arrangement in which the right and left halves of the body are mirror images of each other

bioluminescence (BIE-oh-LOOM-ih-NESS-ens): a method of light production by living organisms in which usually certain proteins (luciferins), in the presence of oxygen and an enzyme (luciferase), are converted to oxyluciferins, causing the organism to glow

bivalve (BIE-valv): a member of the class **Bivalvia (bie-VAL-vee-ah)**, a group of molluscs with a pair of shells hinged together. Clams, mussels and oysters are bivalves.

broadcast fertilization: a method of reproduction in which eggs and sperm are released into the water, where fertilization and development occur

budding: asexual reproduction by formation of a new individual from a small bud on the parent organism

byssal (BISS-'l) threads: strong, sticky threads secreted by some mollusks, used to attach the animal to the substrate.

calcareous (cal-CARE-ee-uss): containing calcium carbonate

camouflage (CAMM-uh-flazh): a behavior, shape, color or color pattern that helps a plant or animal blend in with its surroundings

carapace (CARR-uh-pace): in crustaceans, the hard part of the exoskeleton that covers the head and thorax

cephalopod (SEFF-uh-luh-pod): a member of the class **Cephalopoda (SEFFuh-luh-POE-dah)** (meaning “head foot”) within the phylum Mollusca

cerata (ceh-RAH-tah): projections from the body surface of nudibranchs

chitin (KIE-t’n): a material that forms part of an arthropod’s skeleton

chiton (KIE-t’n): a member of the phylum Mollusca and the class Polyplacophora, with eight plates in place of a single shell

chlorophyll (KLORE-oh-fil): green pigment found in plants and in some animals, necessary for photosynthesis

chromotophore (croe-MAT-uh-fore): a pigment-containing cell that can be used by an animal to vary its external coloration

cilia (SILL-ee-ah): hairlike appendages that can move together in a waving motion, used by some simple animals for locomotion and by more developed animals for moving fluids within the animal

class: the taxonomic group under phylum and above order

cloning: the ability of some organisms to create genetically identical copies of themselves asexually

cnidarian (nie-DAIR-ee-un): a member of the phylum **Cnidaria (nie-DAIR-ee-ah)**, a group of invertebrates with baglike bodies, stinging cells and typically with tentacles. Cnidarians include hydroids, sea anemones, jellyfishes and corals.

colony: a group of organisms in which more or less distinct individuals live together and interact in mutually advantageous ways

consumer: an organism that eats another organism

crustacean (cruh-STAY-shun): a member of the class **Crustacea (kruh-STAY-shah)**, a group of arthropods with jointed legs, gills for breathing and usually a shell, which the animal must shed periodically in order to grow. Crabs, lobsters, beach hoppers, shrimps and barnacles are crustaceans.

decomposer (DEE-kum-POE-zer): an organism that causes the decay of dead plants and animals. Bacteria and fungi are decomposers.

deposit feeder: an animal that engulfs masses of sediments and processes them through its digestive tract

detritus (dih-TRIE-tus): disintegrated material such as particles of uneaten food, fecal pellets and fragments of dead plants or animals

diatom (DIE-uh-tahm): a single-celled, aquatic alga

dorsal (DOR-sul): on the back, or upper, surface of a bilaterally symmetrical animal

echinoderm (ee-KIE-nuh-derm): a member of the phylum **Echinodermata (ee-KIE-nuh-der-MAH-tah)**, a group of invertebrates with hard, spiny skeletons, radially symmetrical bodies and a water vascular system. Sea stars, sea urchins, sand dollars and sea cucumbers are echinoderms.

ecosystem (EE-coe-sis-tum): a community of organisms interacting with each other, plus the environment in which they live and with which they interact. An ecosystem includes nonliving components (minerals, soil, etc.), living components, and the climate

endoskeleton (EN-doe-SKE-leh-tun): an internal skeleton

exoskeleton (EK-so-SKE-leh-tun): a hard external covering

family: the taxonomic group below order and above genus

filter feeder: an organism that eats by filtering, or straining, small particles of food from the water

food chain: a sequence in which organisms eat and are eaten, in a transfer of energy along the chain

genus (*GEE-nuss*) [plural: **genera (*GEH-neh-rah*)**]: a taxonomic classification; a group of similar species

gill: a respiratory organ used for uptake of oxygen and release of carbon dioxide in aquatic animals

habitat: the place where an organism lives; its home

hermaphrodite (*her-MA-fruh-dite*): an animal with both female and male reproductive organs at some point in its life

intertidal zone: the part of the shore between the highest high tides and the lowest low tides

invertebrate (*in-VER-tuh-brut*): an animal without a backbone

krill: shrimp-like crustaceans that are the primary food of some whales and fishes

larva (*LAR-vuh*) [plural: **larvae (*LAR-vee*)**]: an early developmental stage of an animal, which bears little or no resemblance to the adult

madreporite (*MA-druh-PORE-ite*): a sieve-like, porous plate that enables fluid to pass in and out of the water vascular system in echinoderms

mantle: in mollusk with shells, the portion of the body wall that lines and secretes the shell; in octopuses, squid and cuttlefish the mantle forms the body wall

medusa (*meh-DOO-sah*): the free-swimming, umbrella-shaped form of some cnidarians, with tentacles hanging down like a fringe

megalops (*MEG-uh-lops*): a larval stage just before the adult stage in marine crabs, when the eyes are very large, the number of appendages is complete and the abdomen is quite long

metamorphosis (*MEH-tuh-MOR-fuh-sis*): a radical physical change occurring in the development of an animal

mollusc (*MOLL-usk*): a member of the phylum Mollusca (*moh-LUSS-kah*), a group of invertebrates with soft bodies often enclosed completely or partially by a mantle and a shell. Snails, clams, octopuses, chitons, slugs and nudibranchs are molluscs.

molt: the casting of hair, feathers, skin, horns, carapace and other parts just before their replacement

monera (*moe-NARE-ah*): the kingdom that include organisms characterized by the absence of a nucleus and membrane-bound organelles. Often called bacteria.

nauplius (*NOW-plee-us*): a larval stage in lower groups of crustaceans having only three pairs of appendages and a single, median eye

nekton: actively swimming organisms, essentially independent of wave and current action; not plankton

nematocyst (*neh-MA-tuh-sist*): (means “thread bag”) stinging structures that cnidarians use to capture food and for protection

niche (*nich*): the functional role and position of a species (population) within a community or ecosystem, including what resources it uses, how and when it uses the resources, and how it interacts with other populations

oceanography (*OE-shuh-NAH-gruh-fee*): the study of the oceans and their biology, geology, chemistry and physics

omnivore (*AHM-nih-vore*): an organism that eats both plants and animals

operculum (oe-PER-cyoo-lum): the hard pad on the foot of some gastropod snail which is used to seal the opening of the shell

order: the taxonomic group beneath class and above family

organism: a living thing, such as a plant or an animal

pedicellaria (PEH-dih-seh-LAIR-ee-ah): microscopic pincerlike structures around spines and gills of certain echinoderms for keeping their bodies free from debris; may also be used as defense against predators

pelagic (peh-LA-jik): pertaining to the region that includes all offshore, or open water, areas of the ocean, from the low tide mark on out

photic (FOE-tik) zone: the upper layer of the ocean, where enough light filters through the seawater for phytoplankton to photosynthesize; about the upper 100 feet

photosynthesis (FOE-toe-SIN-theh-sis): process by which green plants and some algae use the sun's energy to convert water and carbon dioxide into sugar and oxygen

phylum (FIE-lum) [plural: phyla (FIE-lah)]: a taxonomic classification; a group of similar classes

physiology: a branch of biology dealing with the organic processes and phenomena of an organism or any of its parts or of a particular bodily process

phytoplankton (FIE-toe-PLANK-tun): photosynthesizing members of the plankton, mostly plants and algae

planktivore (PLANK-tih-vore): an animal that feeds on plankton

plankton (PLANK-tun): organisms suspended in water that drift with the currents and swim only weakly or not at all. Divided into phytoplankton (*FIE-toe-PLANK-tun*) (photosynthesizing members, mostly bacteria and algae) and zooplankton (*ZOE-PLANK-tun* or *ZOO-PLANK-tun*) (nonphotosynthesizing members, mostly animals and animal-like protists).

polyp (POLL-ip): the sessile, stalk-like form of some cnidarians (or a stage in the life cycle of some cnidarians), attached to a surface at one end, with a circle of tentacles surrounding the mouth at the other end

predator: an animal that kills and eats other animals

radial symmetry: an arrangement (round, star-shaped, etc.) of similar body parts around a central point

radula (RA-dyoo-lah): the filelike band of teeth that snails, chitons and many other molluscs use to scrape, tear and bore

respiration: the absorption of oxygen from the environment

rostrum (ROSS-trum): the forward projection of the snout or head area

salinity (suh-LIH-nih-tee): the amount of salts dissolved in water

scavenger: an organism that eats dead plants and animals or their parts

sedentary: having limited or no locomotion

sediment: matter that settles to the bottom of a liquid, or deposited by water, wind or glaciers

segmentation: divided into sections

sessile (SEH-s'l): a stationary organism attached to the substrate

shellfish: refers to an aquatic animal with a shell including clams, mussels, crabs and shrimp

siliceous (sill-IH-shus): containing silica

siphon (SIE-f'n): the tube or tubelike part of an animal's body through which water, air or food passes

species (SPEE-seez) [singular and plural]: a group of organisms that have common physical structures and can interbreed and produce fertile offspring

substrate (SUB-strate): the surface (sand, rock, wood or even another animal) on which an animal lives

subtidal: below the lowest tides

suspension feeder: an animal that feeds by filtering out detritus or other particles suspended in the water around it

taxonomy (tak-SAHN-uh-mee): the science of classifying or grouping organisms according to their morphological and physiological characteristics

tentacle: a slender, flexible appendage. The tentacles of cnidarians are filled with nematocysts.

test: the shell, or covering, of animals such as sand dollars and sea urchins

thorax (THOR-ax): the portion of the body between the head and the abdomen

tide: the regular rise and fall of sea level caused by the gravitational pull of the sun and moon, the rotation of the earth and other factors

tide pool: a pool of water left on the shore when the tide goes out

toxin: a chemical that can be harmful to living things

tube feet: soft, hollow, movable extensions of some echinoderms' water vascular system, which aid in locomotion, feeding and grasping

valve: in bivalves such as mussels, one of the two halves of the shell

ventral (VEN-trul): pertaining to the underside of an animal's body

vertebrate (VER-tuh-brut): a member of the subphylum Vertebrata (VER-tuh-BRAH-tah), a group of animals that have a segmented spinal column. Mammals, fishes, birds, reptiles and amphibians are vertebrates.

water column: the area in the water between the ocean surface and the ocean floor

zoea (ZOE-ee): an early larval form of certain decapod crustaceans, such as crabs

zonation: the arrangement of the organisms in a community in to recognizable bands, according to tolerance of such factors as exposure to air and temperature

zooplankton (ZOE-uh-PLANK-tun): nonphotosynthesizing members of the plankton, mostly animals

Flash Card Notebook

Lesson at a glance:

This activity will allow students to identify some of the animals they will see at the Aquarium.

Oregon State Benchmarks and Common Curriculum Goals

LIFE SCIENCE (ORGANISMS)

- **Common Curriculum Goal (Organisms):** Understand the characteristics, structure, and functions of organisms.
Content Standard: Describe the characteristics, structure, and functions of organisms.
Grade 3 Benchmark: Describe the basic needs of plants and animals.

LIFE SCIENCE: (DIVERSITY/INTERDEPENDENCE)

- **Common Curriculum Goal:** Understand the relationships among living things and between living things and their environments.
Content standards: Explain and analyze the interdependence of organisms in their natural environment.
Grade 3 Benchmark: Describe a habitat and the organisms that live there.
Grade 5 Benchmark: Describe the relationship between characteristics of specific habitats and the organisms that live there.

Materials:

- A copy of the flash cards for each student
- 25 solid colored 3x5 inch index cards for each student
- Crayons
- Glue for each student
- Scissors for each student (or pre-cut the flashcards)
- A hole punch
- Yarn or a binder ring



Background information:

This activity will introduce the students to some of the animals they will see at the Aquarium during their visit.

Activity:

1. Hand each student a set of flashcards, index cards, glue and scissors (if appropriate).
2. Have the students attach their flash cards to the index cards with the picture of the animal on one side and the information on the opposite side.
3. Have the students color the pictures of the animals.
4. Have the students decorate two of the remaining index cards. These will be the cover of their notebook.
5. Place the remaining six index cards at the back of the picture cards and inside the cover.
6. Punch a hole in the left hand corner of each animal card. Tie the cards together using either yarn or a binder ring to complete the notebook.
7. During or following their visit to the Aquarium, have your students draw some of the other animals they saw at the Aquarium.
8. Have the students write interesting facts they learned on their trip on the opposite side of their picture.
9. Have the students share their notebooks with their classmates.

Summary:

1. Review what the students learned about the animals at the Aquarium.

Continuation:

1. Have the students identify which animals are predators and which animals are prey animals. Can they create a food chain using the animals in their notebooks?

Assessment:

1. Have the students write a story about the animals in their notebook.
2. Have the students draw a picture of the animals in their notebook. Are they able to place the animals in their correct habitats? Are they able to label the animals in their drawing?

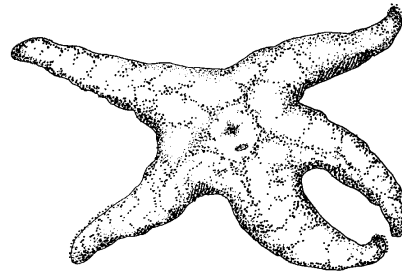
Ochre sea star

Size: Up to 12 inches across from tip to tip.

Color: They may be yellow, brown, orange, reddish, or purple.

Diet: Mussels, barnacles, snails, limpets, and chitons.

Did you know? Ochre stars have many tube feet used for moving and holding onto rocks and prey. The ochre star eats by holding onto the shell of its prey with its tube feet, then pushing its stomach out of its body and into the shell of its prey to digest the meat.



OREGON COAST AQUARIUM



OREGON COAST AQUARIUM

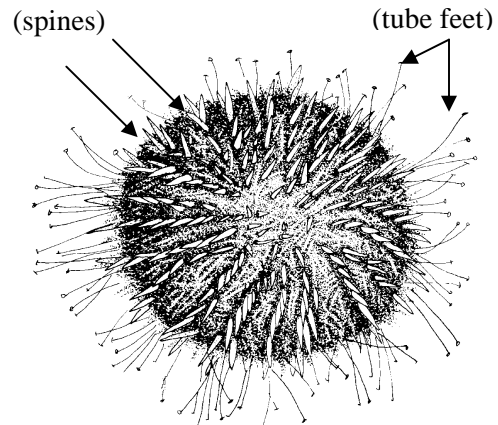
Purple sea urchin

Size: Grow to about four inches across.

Color: Purple.

Diet: Urchins eat mostly kelp and other brown and red seaweeds. They will sometimes catch small animals with their tube feet.

Did you know? A sea urchin's jaw is called Aristotle's lantern. The jaw has five teeth, and they are strong enough to scrape holes in the rocks for urchins to sit in. The holes also allow the urchin to stay cool and wet when the tide goes out.



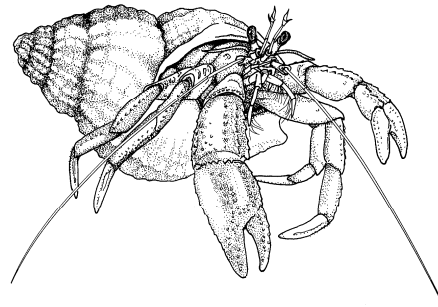
Hermit crab

Size: Anywhere from an inch to over one foot wide. They usually pick a shell slightly bigger than their body so they can grow into it.

Color: They vary in color, but most are brown and dull green with white patches.

Diet: Hermit crabs are scavengers and will eat anything they can fit in their mouth, including dead animals, plants and sometimes even small fish.

Did you know? When a hermit crab senses danger, it quickly pulls its whole body inside its shell for protection.



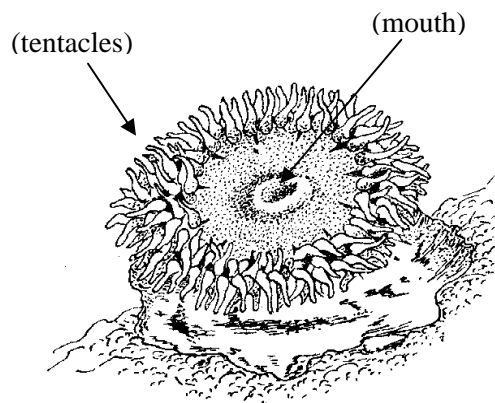
Giant green sea anemone

Size: About seven inches across and 12 inches tall.

Color: Bright green when they live in the sunlight. If they live where there is no sunlight, they may be almost white.

Diet: Crabs, shrimp, small fishes, sea urchins and mussels.

Did you know? They sting their prey with their sticky tentacles, pass it to their mouth and then digest it. You should never stick your finger inside an anemone's mouth because you might damage it.



Giant Pacific octopus

Size: Arm span to about 16 feet; weigh from 10 to 200 pounds. The largest Giant Pacific octopus recorded had an arm span of over 27 feet – about as long as a classroom!

Color: Red to reddish-brown. They can change their skin color and texture to help them blend in with their environment.

Diet: Shrimps, crabs, scallops, abalones, clams, smaller octopuses and fishes.

Did you know? Researchers consider the octopus to be the smartest of all invertebrates, with about the same intelligence as a house cat.



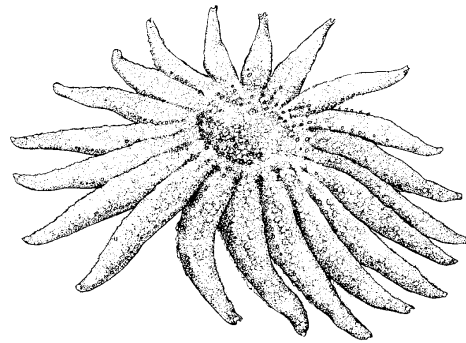
Sunflower sea star

Size: Can grow to 50 inches wide. Sunflower stars begin life with five or six arms and grow more with age (up to 24).

Color: Usually orange, purplish-gray, brown, red or yellow.

Diet: Sea urchins, clams, snails, crabs, mussels and even other sea stars.

Did you know? Sunflower stars are the largest and most active of the Pacific coast sea stars. They can move at a speed of four feet per minute and have about 15,000 tube feet to help them along.



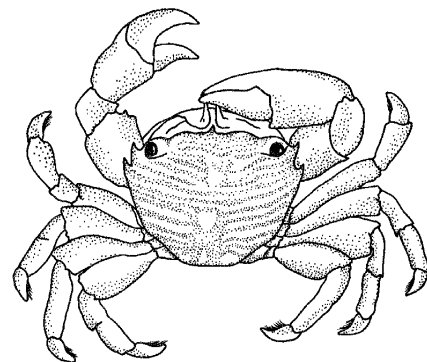
Purple shore crab

Size: About two inches wide.

Color: Usually purple with dark spots on the claws. Sometimes may be olive-colored or dark brown.

Diet: Purple shore crabs scrape green algae off the rocks and also eat dead animal matter.

Did you know? Often this crab is found hiding under rocks and will come out at night to look for food. When discovered, they will often walk sideways to escape and find a new hiding spot.



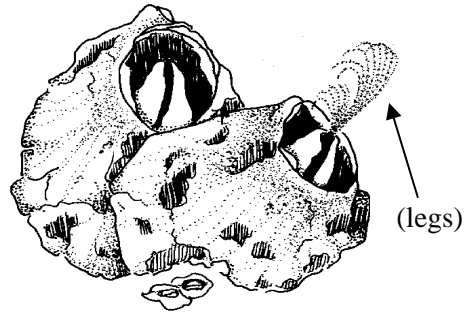
Giant acorn barnacle

Size: Grow to be five inches tall and four inches wide.

Color: Outer shell is white; legs are pink.

Diet: Acorn barnacles use their feathery legs to sweep tiny, drifting plants and animals, called plankton, out of the water and into their mouth.

Did you know? Acorn barnacles are one of the world's largest barnacles. They can close up their volcano-shaped shell at low tide to keep from drying out and open it up again so that they can feed during high tide.



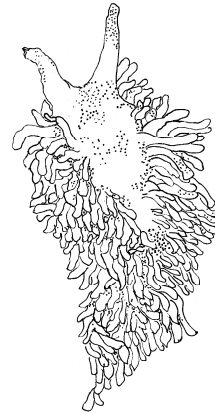
Shag-rug nudibranch

Size: Up to four inches long.

Color: Grayish-colored, tan, and pink.

Diet: It feeds on sea anemones such as the plumose anemone and aggregating anemone. It eats at least once a day consuming up to 100 percent of its body weight.

Did you know? The shag-rug nudibranch is a hermaphrodite, which means it has both male and female characteristics. Nudibranchs fertilize each other's eggs. It gets its name from its shaggy looking appearance.



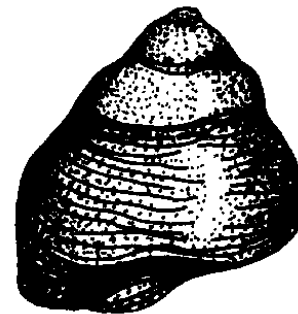
Black turban snail

Size: Grow to about one inch wide.

Color: Purple-black shell often with a white patch toward the top.

Diet: Soft seaweed, scraping it off the rocks with its rough tongue, called a radula.

Did you know? Black turban snails are estimated to live as long as 80 to 100 years. Native peoples of the Pacific Northwest often cracked open black turban snails and ate them raw.



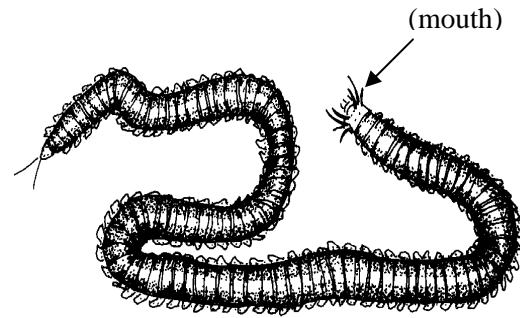
Clam worm

Size: Six to 12 inches long.

Color: Blue-green, copper-red to dull green.

Diet: They feed on algae and other small invertebrates they find by burrowing in the sand or mud.

Did you know? Also called the “pile worm”, its body is made up of 200 segments, each with a pair of tiny “legs” (looking much like a centipede). It has pincher-like claws in the mouth so be very careful if you pick one up. It has been known to deliver a nasty bite!



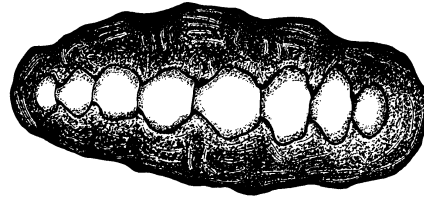
Black katy chiton

Size: Up to five inches long.

Color: Black with a white diamond-shaped shells across the back.

Diet: A variety of seaweeds and algae that cover the rocks.

Did you know? It has eight overlapping shell plates called valves. When the black katy chiton is disturbed, the jointed valves allow it to roll up into a ball for protection. The valves of dead chitons often wash up on the shore, and are known to beachcombers as “butterfly shells”.



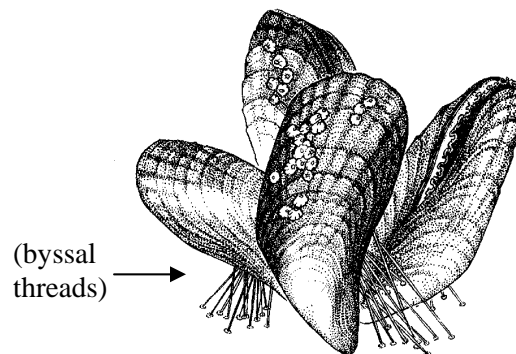
Mussel

Size: Grow to 10 inches long.

Color: Blue-black with thin streaks of brown.

Diet: Mussels open their shell just a little bit to eat plankton and tiny, dead plants and animals (called detritus) drifting through the water.

Did you know? A mussel’s predator is the ochre star. Other predators include shorebirds, gulls, crabs, snails, sea otters and humans. Mussels are firmly attached to the rocks by byssal threads. The byssal threads keep mussels from being swept away by crashing waves or strong currents.



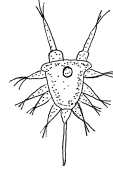
Zooplankton

Size: Most zooplankton (animal plankton) are so tiny you need a microscope to see them.

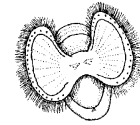
Color: Most zooplankton are clear in color. Sometimes you can look through their bodies and see what they have eaten!

Diet: Zooplankton eat phytoplankton (plant-like plankton) or smaller zooplankton.

Did you know? Some zooplankton will grow up to become fishes, shrimps, crabs, octopuses, or other invertebrates. Jellyfish are the largest kind of zooplankton and can be up to 6 feet wide and 100 feet long (including tentacles).



barnacle nauplius



snail larva



copepod



crab larva



sea urchin larva



OREGON COAST AQUARIUM

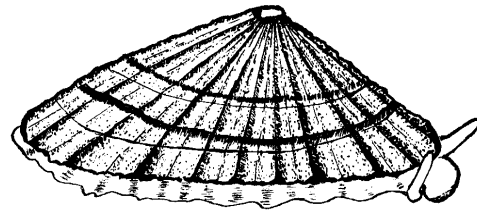
Keyhole limpet

Size: Grow to about three inches long.

Color: Usually grayish, sometimes olive green with bluish-white markings.

Diet: It uses its rough, scraping tongue, called a radula, to feed on algae growing on the rocks.

Did you know? This animal has a soft body and a hard shell shaped like a volcano. It takes in water under the edges of the shell, passes it over its gills and out through the hole in the top of the shell. Waste, eggs and sperm are also released through this hole.



OREGON COAST AQUARIUM

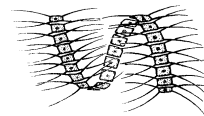
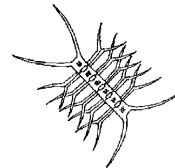
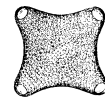
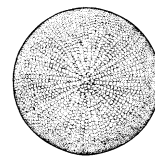
Phytoplankton

Size: Phytoplankton are very small and can only be seen with a microscope. The largest is about one millimeter wide, about the width of a piece of thread.

Color: Varies from tan, yellow to greenish.

Diet: They don't eat! They get their energy from the sun – a process called photosynthesis.

Did you know? All phytoplankton are plantlike organisms that live near the surface of the water because they need a lot of sun. When there is a lot of phytoplankton in the water, it sometimes turns the ocean green, red or brown.



OREGON COAST AQUARIUM



OREGON COAST AQUARIUM

Dilemmas

Lesson at a glance:

This lesson is designed to give students an opportunity to examine their values and beliefs related to the environment and to practice discussing environmental issues without placing judgments.

Oregon State Benchmarks and Common Curriculum Goals

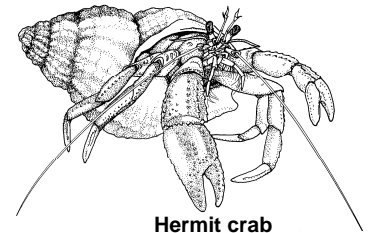
CAREER RELATED CURRICULUM STANDARDS

PROBLEM SOLVING:

Content Standard: Apply decision-making and problem-solving techniques in school, community, and workplace.

• **Criteria:**

- Identify problems and locate information that may lead to solutions.
- Identify alternatives to solve problems.
- Assess the consequences of the alternatives.
- Select and explain a proposed solution and course of action.
- Develop a plan to implement the selected course of action.
- Assess results and take corrective action.



Hermit crab

Materials:

- Dilemma cards

Background information:

Discussing environmental ethics can be difficult. There are many sides to every issue, and often the feelings for one position or another are strong. In presenting this activity to students, stress the importance of not placing judgment, and listening to perspectives other than their own. Understanding all sides can provide a bigger picture of the issues. It is not the intent of this activity to prescribe right and wrong answers for the students.

Activity:

1. Divide students into groups of four or five.
2. Give each group a dilemma card and have one member read the dilemma and give the choices or answers to the rest of their group.
3. Students in the group should decide on their own what their response would be. They have each group discuss their choices among themselves. Students should be able to defend their reasoning.

Summary:

Discuss each dilemma as a class. The final point is that there are several sides to any issue and usually there isn't one right answer. Stress the importance of gaining an understanding of all positions.

Extension:

Have students make up their own dilemmas regarding local or national issues

Adapted from "Ethi-reasoning," Project Aquatic, Boulder, Colorado, 1992.

Dilemmas

<p>1. It's your first time visiting the tide pools and you are excited to find hundreds of little hermit crabs running around. You love hermit crabs! You've even got one at home that you bought at the pet store. His name is Herman. Lately, you've felt that Herman is lonely and you'd like to get him a friend. Your classmate suggests bringing one of these tidepool hermits home to Herman. What should you do?</p>	<p>4. You just found the coolest crab. It's different than anything you've ever seen before. It is about the size of your palm. It has thick, red claws with little black tips and its back is covered with red and white stripes. There are even tiny barnacles growing on its back. You pick it up and run over to show the rest of your class. They are all totally amazed by this little critter. Now you're standing with this cool little crab in your hands; what should you do with it?</p>
<p>2. While you are touring through the tide pools at a local state park you see a European green crab. You learned in class that the green crab is an invasive species. People accidentally carry invasive species into habitats where they don't belong. Sometimes invasive species can upset the balance of the ecosystem. You don't want that to happen—you love these tide pools. What should you do?</p>	<p>5. Your class is having a great time at the tide pools. While you are trying to peek up under a ledge looking for abalone you hear a friend call your name. He has the most amazing thing to show you. "My dad showed me this. When you poke one of these goopy green blobs, they squirt water!" Sure enough, when he pokes a green sea anemone, a stream of water squirts out. "Try it!" he squeals. What should you do?</p>
<p>3. Your class is visiting the most amazing tide pools you've ever seen. There are living things everywhere. You are being very careful not to squish anything when you walk. Suddenly, you hear shouting. A group of your classmates has found an octopus! The fastest way to get there is over a bed of mussels and barnacles. You don't want to step on them, but the octopus might be gone if you take the long way. What should you do?</p>	<p>6. It's your first time in the tide pools and you are learning a lot. While stepping carefully from rock to rock, you and your buddy find a sea star. Your friend tells you that sea stars have hundreds of tiny suction-cup tube feet that help them hold onto the rock, and a mouth right in the middle of its body—only underneath. You don't believe her. How will you find out if she's telling the truth?</p>



Choices

<p>4.</p> <ol style="list-style-type: none"> a. Turn around and put it back right where you found it. b. Put it in the closest tide pool since they all seem the same to the crab and you want to get it back in the water fast. c. Take it back to your school and put it in an aquarium for everyone to enjoy. d. Feed it to that hungry sea gull that has been following you. After all, it's part of the circle of life, right? e. Other. 	<p>1.</p> <ol style="list-style-type: none"> a. Put one of the little hermit crabs in your pocket and get him home as fast as possible. b. Leave the tidepool hermit crabs where they are, since they need water to breathe and wouldn't survive the trip in your pocket. c. Put the hermit under a rock and come back for him later with some water in a dish to transport him home. d. Scold your classmate severely for even suggesting such a thing. e. Other.
<p>5.</p> <ol style="list-style-type: none"> a. Tell him he's poking a sea anemone and that it needs that water to survive. b. Tell your teacher or chaperone about his behavior. c. Say no thanks and walk away. d. Poke <u>him</u> with a stick while screaming "HOW DO YOU LIKE IT!?" e. Other. 	<p>2.</p> <ol style="list-style-type: none"> a. Do nothing. It's not up to you to deal with green crabs. b. Tell the park ranger or your teacher. c. Leave it, but decide to do a report on green crabs at school and share it with your community. d. Stomp it good. e. Other.
<p>6.</p> <ol style="list-style-type: none"> a. Leave the sea star where it is and ask your teacher if your friend is telling the truth. b. Smile and nod then check at the library later to see if she is right. c. Carefully pull it off the rock. d. Use a pocketknife to cut the suckers loose. e. Other. 	<p>3.</p> <ol style="list-style-type: none"> a. Get over there as fast as you can. The mussels are strong enough to support your weight and octopuses are really hard to find! b. Stay on bare rock only and risk not seeing the octopus. c. Step lightly and quickly over the mussels and get back on bare rock as quick as you can. d. Stay where you are but throw rocks towards your classmates to scare the octopus away. If you can't see it, no one will! e. Other.



Dilemmas Assessment Rubric

Student Name: _____

CATEGORY	4	3	2	1	Score
Respect for other classmates	All statements, body language, and responses were respectful and were in appropriate language.	Statements and responses were respectful and used appropriate language, but once or twice body language was not.	Most statements and responses were respectful and in appropriate language, but there was one sarcastic remark.	Statements, responses and/or body language were consistently not respectful.	
Information	All information presented in the discussion was clear, accurate and thorough.	Most information presented in the discussion was clear, accurate and thorough.	Most information presented in the discussion was clear and accurate, but was not usually thorough.	Information had several inaccuracies OR was usually not clear.	
Use of Facts/Statistics	Position was well supported with several relevant facts, statistics and/or examples.	Position was adequately supported with relevant facts, statistics and/or examples.	Position was supported with facts, statistics and/or examples, but the relevance of some was questionable.	Position was not supported.	
Presentation Style	Student consistently used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Student usually used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Student sometimes used gestures, eye contact, tone of voice and a level of enthusiasm in a way that kept the attention of the audience.	Student had a presentation style that did not keep the attention of the audience.	



A Few Words about Invertebrates

Lesson at a glance:

Students will listen, practice reading and demonstrate comprehension skills while becoming familiar with some of the vocabulary they will encounter during a marine invertebrate unit.

Oregon State Benchmarks and Common Curriculum Goals

English/Language Arts

GRADE 2

READING

- **Common Curriculum Goal:** Analyze words, recognize words, and learn to read grade-level text fluently across the subject areas.
DECODING AND WORD RECOGNITION
 - Read regular multi-syllabic words.
 - Use letter-sound correspondence knowledge to sound out unknown words.VOCABULARY
 - Understand, learn, and use new vocabulary that is introduced and taught directly through orally read stories and informational text as well as student-read stories and informational text.
 - Develop vocabulary by listening to and discussing both familiar and conceptually challenging selections read aloud.READ TO PERFORM A TASK
 - Read written directions, signs, captions, warning labels, and informational books.

Materials:

- Copies of **What is an Invertebrate?** reading (1 per student)
- Copies of **A Few Words About Invertebrates Word Search** (1 per student)
- A Few Words About Invertebrates Word Search** (Teacher Key)
- Dictionary (optional)

Background:

Invertebrates are animals without backbones and account for 97 percent of all animal species. Examples of marine invertebrates include barnacles, crabs, sea urchins, mussels, sea stars and octopuses. These invertebrates have a wide variety of adaptations to protect against predators and other environmental challenges. An **adaptation** is a characteristic, such as a body part, color pattern or behavior that helps an organism survive in its environment.

Activity:

1. Give your students a copy of **What is an Invertebrate?** Have students read individually, read aloud as a class or make an overhead transparency of the reading and share with the whole class. For some students, using a dictionary may be helpful.
2. Give them the **A Few Words About Invertebrates Word Search** activity to help them become more familiar with some of the words.
3. Use the **A Few Words About Invertebrates Word Search** (Teacher Key) to check student work.

Summary:

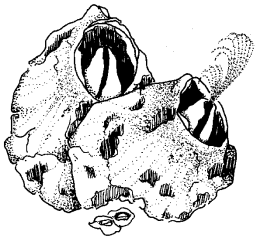
- Go over the answers to the word search with your students. Review the characteristics of each animal as you go through each section of the worksheet.

What is an Invertebrate?

I have bones. You have bones.

Cats and dogs have bones. Fish have bones.

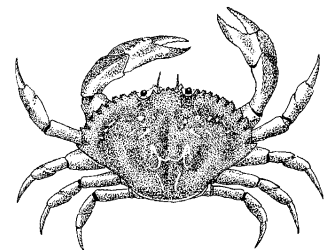
Up and down your back is a line of bones. This is called your backbone. Each bone in your backbone is called a vertebra. Animals with a backbone are called **vertebrates**. Some animals do not have backbones. They are called **invertebrates**. Barnacles, crabs, sea urchins, mussels and sea stars are invertebrates.



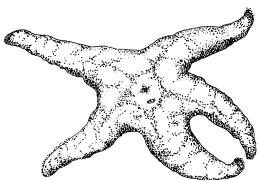
Barnacles live on rocks. Barnacles also live on animals like whales and crabs. Barnacles have a **shell**. This shell is hard and looks like a small volcano. Their body is protected inside this shell. Barnacles have 12 small legs that look like feathers. The legs come out of the shell to eat.

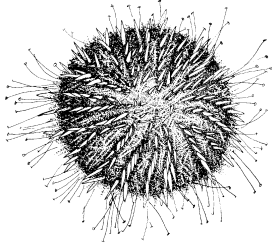
The legs grab tiny plants and animals from the water. Tiny plants and animals that live in the water are called **plankton**. Plankton are food for many sea animals.

Crabs have legs, too! How many legs do crabs have? A crab has ten legs. The legs help the crab move. Crabs have a body covered with a hard shell. The shell protects it from being eaten by other animals.



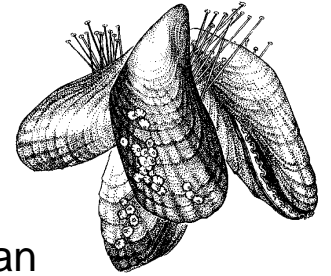
Sea stars have **tube feet**. Tube feet help sea stars move and hold tight to the rocks. Sea stars can even smell with their tube feet! Sometimes sea stars are called starfish.





Sea urchins have a hard shell covered with spines. The spines are hard and pointy. Sea urchins also have tube feet. Tube feet help the sea urchin hold onto the rocks. Tube feet also help the sea urchin move and grab food.

Mussels are also invertebrates. Mussels have a soft body inside two hard shells. Mussels live on rocks. Strong threads hold the mussels to the rocks.



Did you know that an octopus is an invertebrate? An octopus has a soft body. It does not have a shell. The octopus is very good at hiding. It can also change color and squirt ink to protect itself.

Invertebrates have **adaptations**. Adaptations help an animal survive. Adaptations help animals eat, move and protect themselves. Do you remember how sea stars hold tight to the rocks?

Did you know we have adaptations, too? What body parts help you to eat? Compare how you eat to how a barnacle eats. Imagine if you had feathery legs coming out of your mouth!

What helps you run? Compare how you move to a sea star. Imagine what it would be like to move with tube feet!

A Few Words about Invertebrates

Word Search

Find the following words in the word search below:

invertebrate
plankton
adaptation

tube feet
spines
barnacle

shell
crab
octopus

mussel
sea urchin
sea star

i	h	b	q	e	s	e	a	s	t	a	r	y	k
n	w	a	g	h	j	m	k	l	c	v	v	z	e
v	m	r	x	a	d	a	p	t	a	t	i	o	n
e	q	n	o	i	m	u	s	s	e	l	r	d	i
r	f	a	o	q	z	r	y	m	n	k	a	v	x
t	z	c	s	p	l	a	n	k	t	o	n	g	t
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r	k	o	p	s	h	e	l	l	r	t	s	z	e
a	w	r	h	j	t	c	i	p	d	o	a	i	f
t	x	s	p	i	n	e	s	z	y	p	a	h	e
e	b	t	m	a	e	r	t	u	k	u	c	g	e
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A Few Words about Invertebrates

Word Search

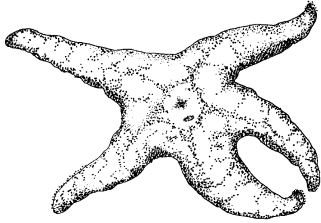
(Teacher Key)

i		b			s	e	a	s	t	a	r		
n		a											
v		r		a	d	a	p	t	a	t	i	o	n
e		n			m	u	s	s	e	l			
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t		s	p	i	n	e	s			p			e
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	s	e	a	u	r	c	h	i	n	s			t



Found a Sea Star

(Sung to the tune of "Found a Peanut")



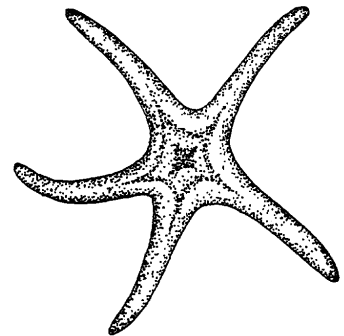
Found a sea star, found a sea star
Found a sea star on a rock.
The other day I found a sea star,
Found a sea star on a rock.

Its skin was bumpy, its skin was bumpy,
It was bumpy with short spines.
When I touched it, it was bumpy.
It was bumpy with short spines.

It had tube feet, it had tube feet.
It had tube feet for hanging on.
Its tube feet are like suction cups.
It had tube feet for hanging on.

It took its stomach out, it took its stomach out,
It took its stomach out to eat.
It used its stomach to eat a mussel.
It took its stomach out to eat.

I saw its eye spots, I saw its eye spots,
Saw its eye spots on each arm.
Sea stars see light and dark,
With the eye spots on each arm.



Coloring Sheets

and

Coloring Sheets
and
Certificate

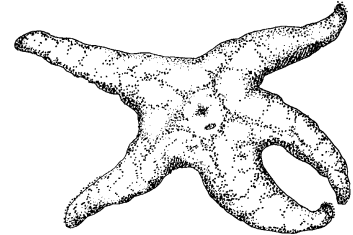


OREGON COAST AQUARIUM

Ochre Sea Star

What do ochre sea stars look like?

- Ochre stars are star-shaped, with five thick, pointed arms.
- They have small white spines covering their bodies to protect them from predators.
- Ochre stars can be orange, brown or even purple.



How big are they?

- Ochre stars can grow as large as 12 inches across from tip to tip.

Where do they live?

- Ochre stars live on rocky shores and on kelp forest floors.
- They can be found all along the Pacific coast.

What do they eat?

- Ochre stars eat mussels, barnacles, snails, limpets, chitons and other invertebrates (animals without backbones).
- Ochre stars eat by pushing their stomach into the shell of their prey. They leave their stomach there until it is done digesting its meal.

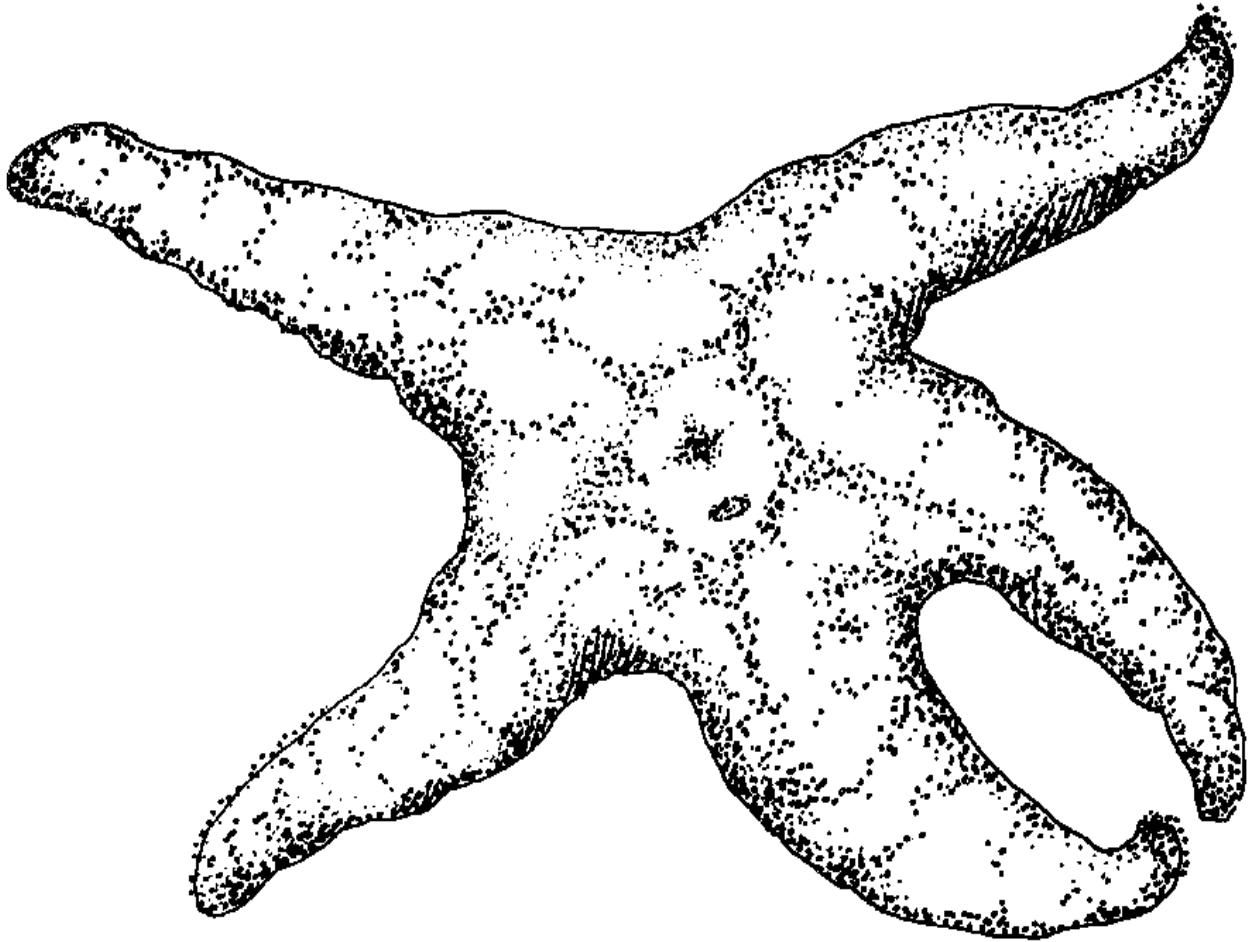
How do they move?

- Like other sea stars, ochre stars have many tube feet that they use for moving and holding onto rocks and prey.

Did you know?

- Like other sea stars, ochre stars have a small red dot on the tip of each arm. This called an eyespot. The eyespots detect light and dark but do not see shape or color like a person's eyes do.
- You should never try to pull a sea star off the rocks, since you might tear its tube feet.





Ochre Star



OREGON COAST AQUARIUM

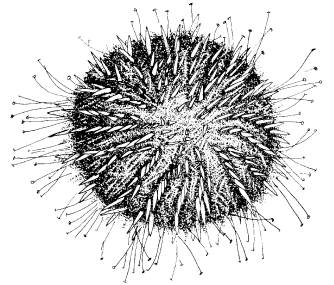
Purple Sea Urchin

What do purple sea urchins look like?

- Purple sea urchins are flat on the bottom and rounded on the top.
- They are covered with purple spines as sharp as toothpicks.
- In between their spines are long tubes with suction cups on the end. These are called tube feet. Tube feet are used for grabbing food, moving, and holding onto the rocks.

How big are they?

- Purple sea urchins can grow to four inches across. That is about the size of half a tennis ball or soft ball.



Where do they live?

- They usually live in rock crevices protected from the crashing waves or in kelp forests.
- Purple sea urchins live along the Pacific coast from British Columbia to Baja California, Mexico.

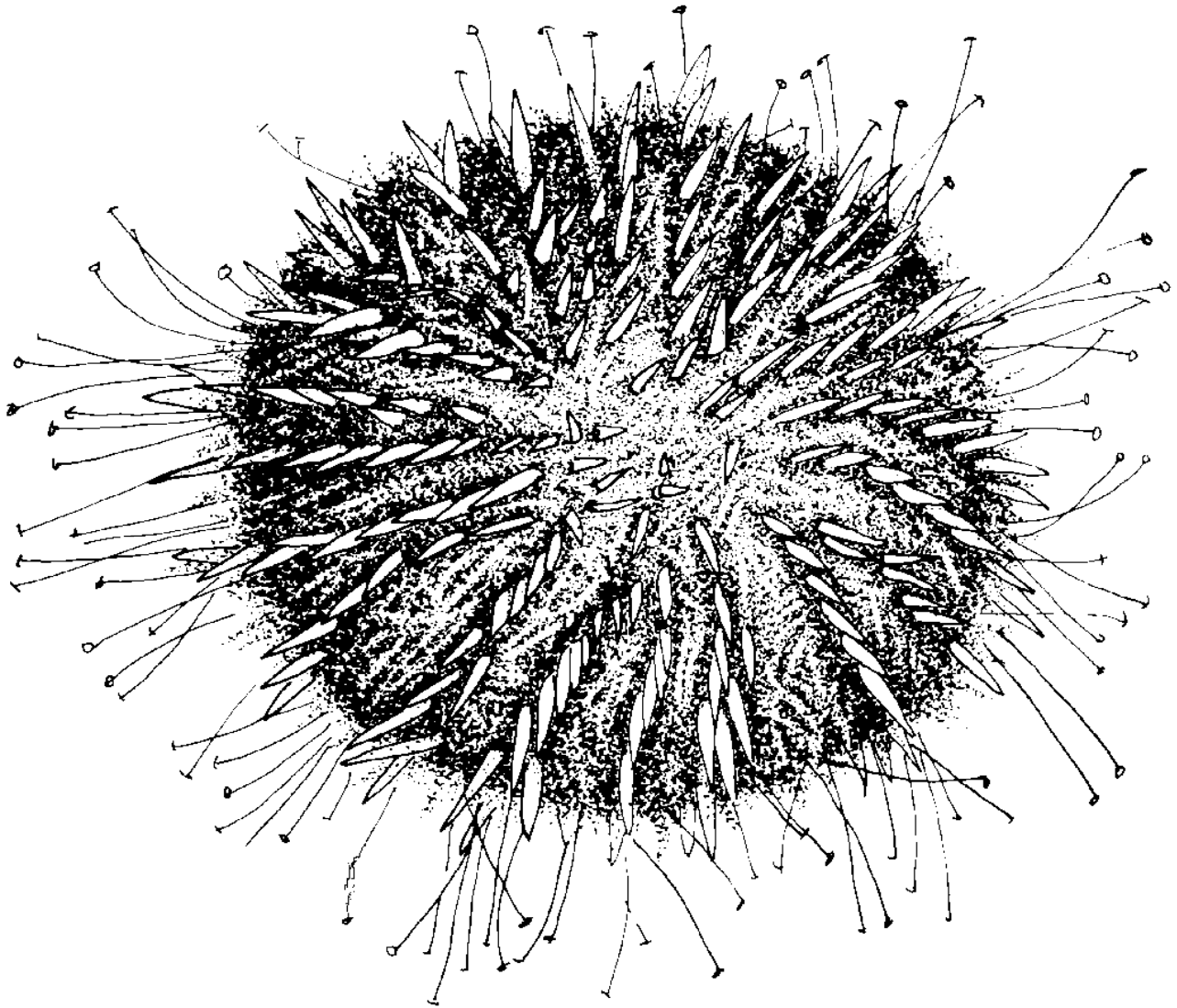
What do they eat?

- Urchins eat mostly kelp and other brown and red seaweeds. They will sometimes catch small floating animals with their tube feet. They have also been known to catch and eat unsuspecting snails.
- Sea urchins have five sharp teeth on the underside of their body. They use their teeth to scrape off small pieces of their food as they eat.

Did you know?

- Sea urchins can use their teeth and spines to make holes in the rocks. By doing this, they are making their own tide pool so they can stay wet at low tide.
- Sea urchins are related to sea stars, sand dollars and sea cucumbers.
- All of these animals can smell with their tube feet!
- Sea otters, wolf-eels, sea stars and people all like to eat sea urchins.



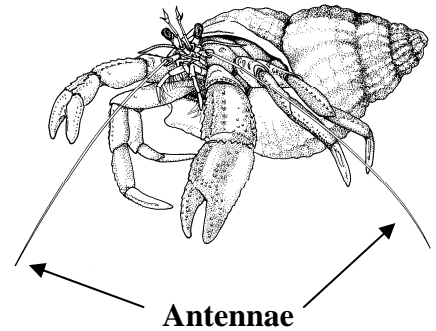


Sea Urchin



OREGON COAST AQUARIUM

Hermit Crab



What do hermit crabs look like?

- Hermit crabs carry a shell on their back. If a hermit crab grows too big for its shell, it will find a new, better-fitting shell to move into.
- Hermit crabs have long antennae to help them feel around as they look for food.
- Hermit crabs have one large claw and one smaller claw. They use the large claw to hold onto their food. They use the small claw to put the food into their mouths.

How big are they?

- Hermit crabs can be anywhere from an inch to over one foot wide.

Where do they live?

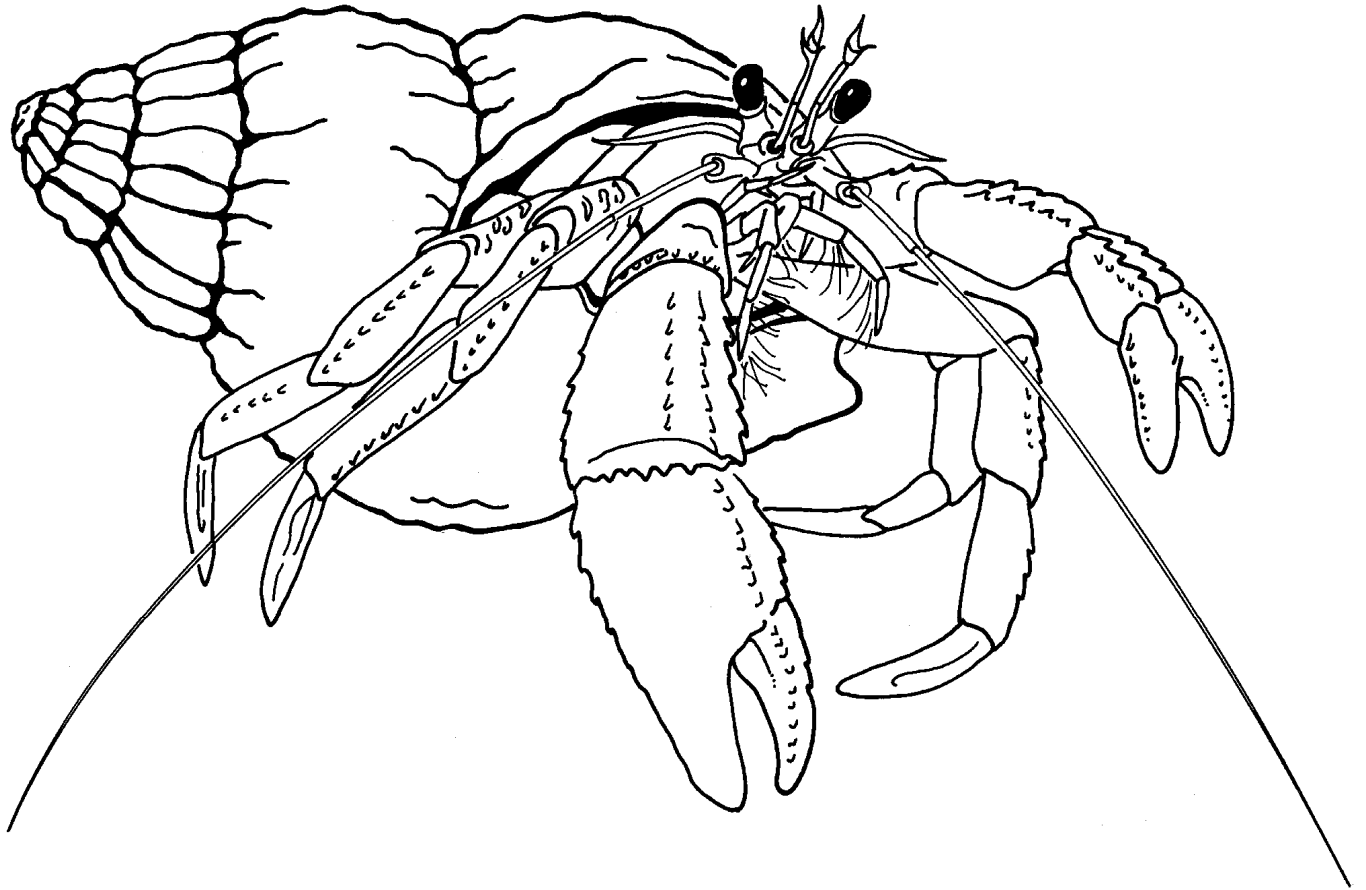
- Hermit crabs usually live in the shallow areas of most ocean waters.
- They rarely leave the security of their shell. If they sense danger, they will tuck themselves back into their shell and block the opening with their big claw.

What do they eat?

- Hermit crabs are scavengers that crawl across the ocean floor looking for tiny bits of seaweed and dead animals to eat.

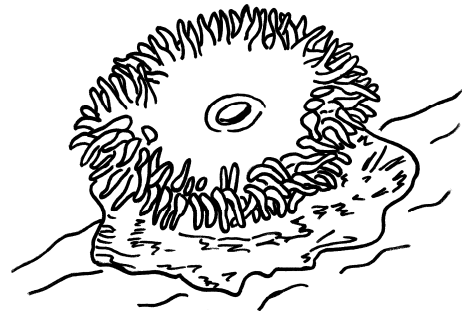
Did you know?

- A hermit crab's eyes are on stalks. This helps them to get a better all-around view of their environment.
- Some hermit crabs live on land and can breathe air, but most hermit crabs live in the ocean and use gills to breathe underwater.



Hermit Crab

Giant Green Sea Anemone



What does an anemone look like?

- Giant green anemones are bright green if they live in the sunlight. If they live in caves, they are pale and almost white. Their green color comes from the algae (tiny plants) that live inside their bodies.
- They have many tentacles surrounding their mouth. Their mouth looks a lot like a belly button.

How big are they?

- They can grow to be seven inches across and 12 inches tall. Their tentacles can be up to nine inches long.
- Anemones will fold their tentacles and close up their bodies to help them stay moist at low tide and to protect themselves from predators.

Where do they live?

- Giant green anemones are found from Florida to Alaska.
- They live on rocks in tide pools.

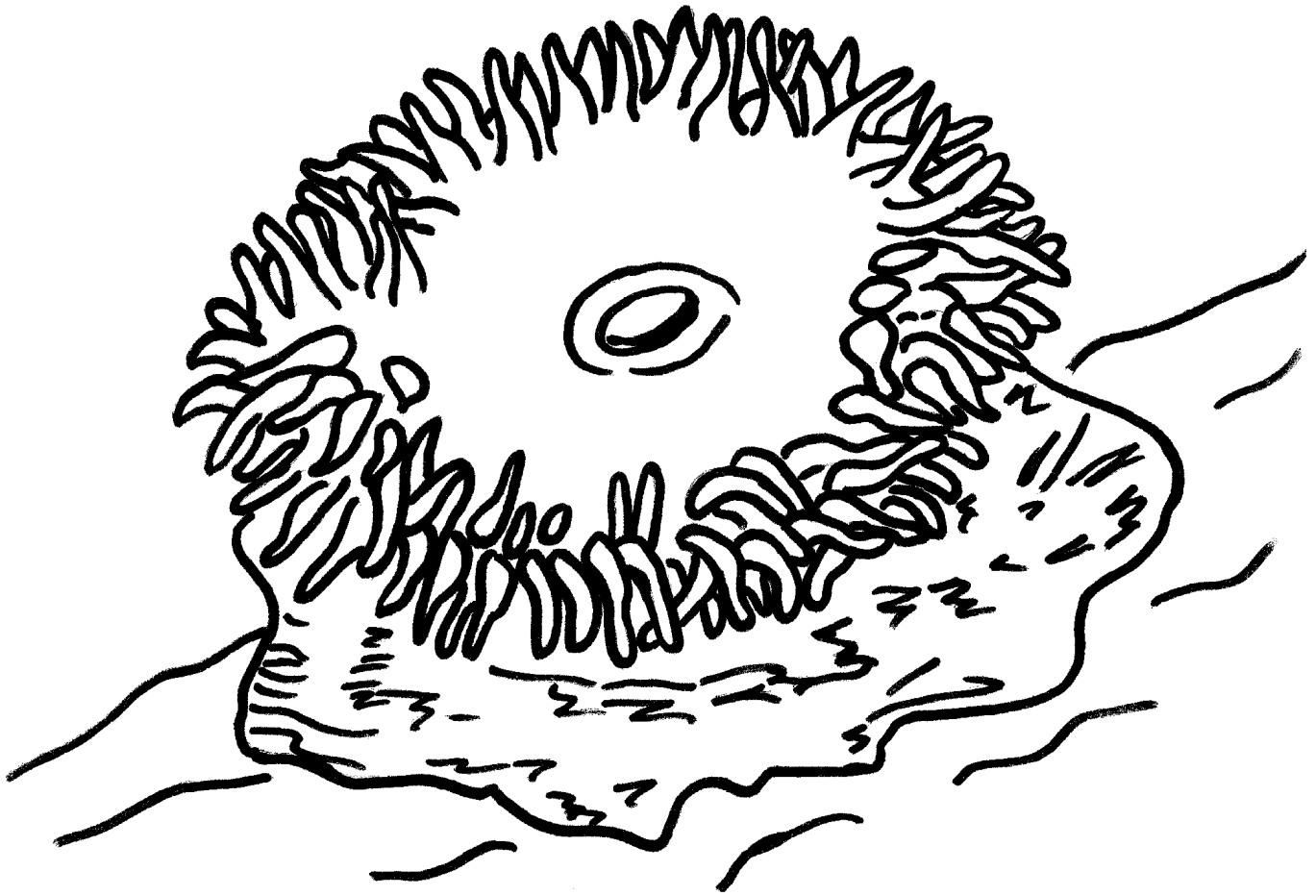
What do they eat?

- They eat crabs, shrimp, small fishes, sea urchins, mussels and plankton.
- They sting their prey with their sticky tentacles, pass it to their mouth and then digest it in their gut.

Did you know?

- Anemones often cover their bodies with pieces of shell and gravel. This helps them reflect sunlight so they can stay wet and keep cool.
- You should never stick your finger inside an anemone's mouth because you might damage it. Besides, they also go to the bathroom through their mouth!
- It's okay to touch an anemone's sticky tentacles with your fingers because your skin is thick enough to protect you from their stinging cells.
- Anemones are related to jellyfish.





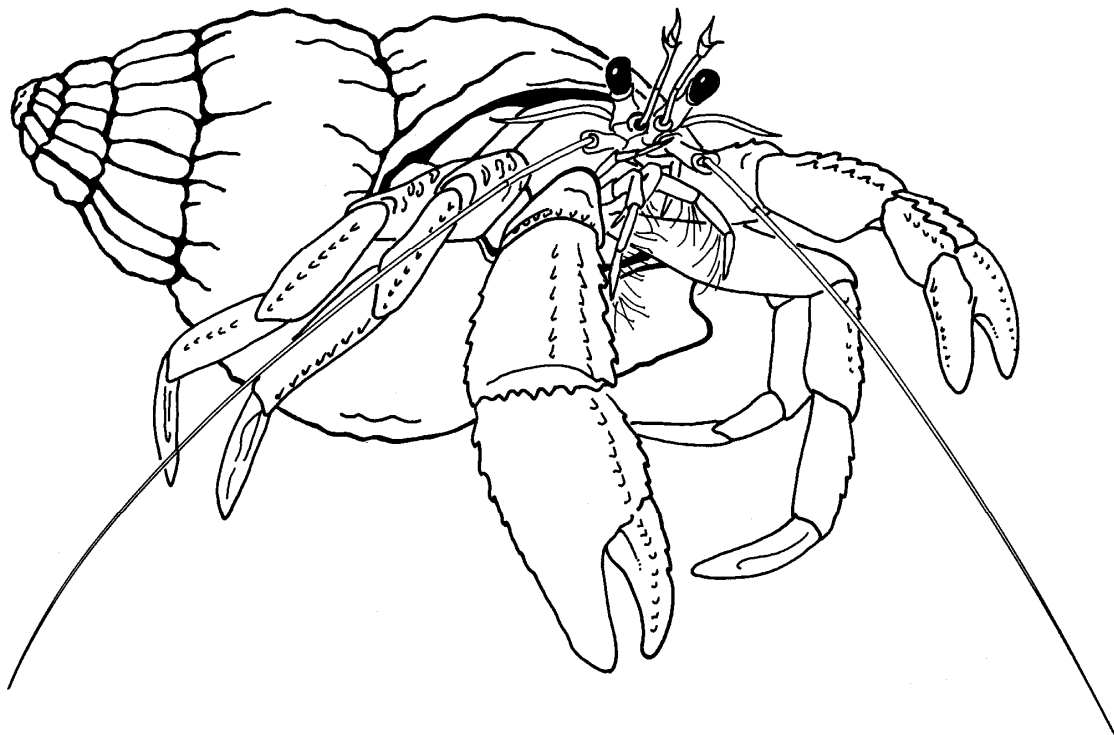
Giant Green Sea Anemone



OREGON COAST AQUARIUM

Has explored the world of invertebrates in

Tidepool Talk



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