

Dear Teacher:

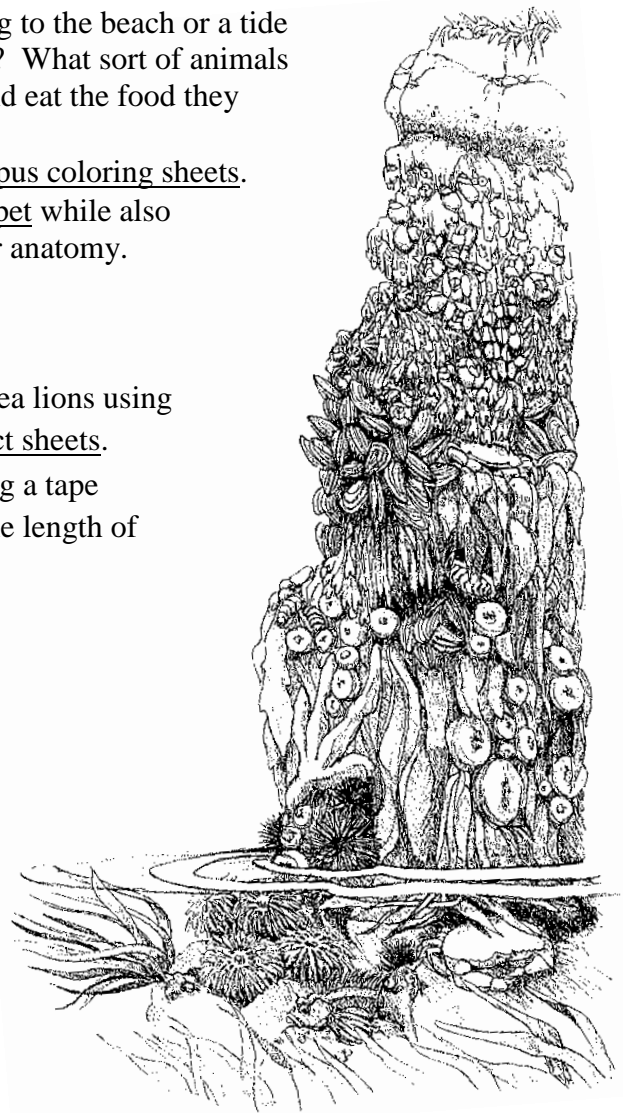
During the **No Bones About ‘Em** assembly program an Aquarium educator will introduce students to the rough environment of the rocky intertidal zone using a PowerPoint presentation, costumes and a song and dance. This program will focus on some of the unique adaptations of four marine invertebrates: barnacles, sea stars, sea anemones and octopuses. Students will compare their own adaptations to those of these amazing animals.

**Before your assembly program:**

- Ask students of their experiences with going to the beach or a tide pool. Was it a sandy beach or rocky beach? What sort of animals lived there? How do you think they find and eat the food they eat?
- Color the [Sea Star](#), [Sea Anemone](#) and [Octopus coloring sheets](#).
- Create a masterpiece with the [Octopus Puppet](#) while also learning all about the different parts of their anatomy.

**After your assembly program:**

- Review the differences between seals and sea lions using the [Sea Star](#), [Sea Anemone](#) and [Octopus fact sheets](#).
- Conduct the [How Big Am I?](#) activity. Using a tape measure, have your students measure out the length of each animal.



Participating in this program and using the pre and post curriculum will help your students meet Oregon science standards and Ocean Literacy Principles.

**No Bones About ‘Em assembly program: Grades K-2**

**Goal:** To identify four different tide pool invertebrates and their adaptations that help them to survive in that environment.

**Cognitive Objectives:**

1. Explain that tide pool invertebrates have adaptations that help them survive in the rocky intertidal zone.
2. Explain where tide pools are found.
3. Identify four different tide pool animals: barnacle, sea star, sea anemone and octopus
4. Compare and contrast how these animals are covered, protect themselves, move and eat.

**Affective Objectives:**

1. Students will feel that their stewardship of the rocky intertidal zone is important for its survival.
2. Students will be inspired to learn more about tide pool invertebrates.

**Oregon Science Standards:**

- K.2P.1 Examine the different ways things move.
- 1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
- 1.2L.1 Describe the basic needs of living things.
- 2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.

**Ocean Literacy: Essential Principles and Fundamental Concepts**

- 5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

## Rocky Intertidal Zone Background Information

### The rocky intertidal zone

Twice a day along the Oregon coast, the tide comes in and the tide goes out as the sun and moon exert a gravitational pull on the earth's oceans. During low tide a large portion of the shore is exposed. This area between the high tide line and the low tide line is called the **intertidal zone**.

Oregon's rocky intertidal zone is an abundantly rich, temperate habitat. This is because the region's mild winters leave no threat of ice or prolonged freezing, and because summer's coastal fogs shade organisms from the hot sun. Also, plants of the intertidal zone, such as phytoplankton and seaweeds, are supplied with ample amounts of nutrients by the seasonal upwelling of deep sea waters.

This rocky intertidal environment is a conglomeration of crannies, crevices and tide pools that provide an incredible variety of habitat. This diversity of habitat insures a diversity of species, both animal and plant.

### It's a rough life

Life in the intertidal zone is by no means a quiet, peaceful existence. Tidal changes provide these organisms with the basic necessities of moisture, oxygen, food and waste removal. But they also create a number of stresses which must be overcome. Organisms living here must tolerate exposure to air and sunlight, temperature and salinity fluctuations, fierce wave action, predation and competition from other species for space.

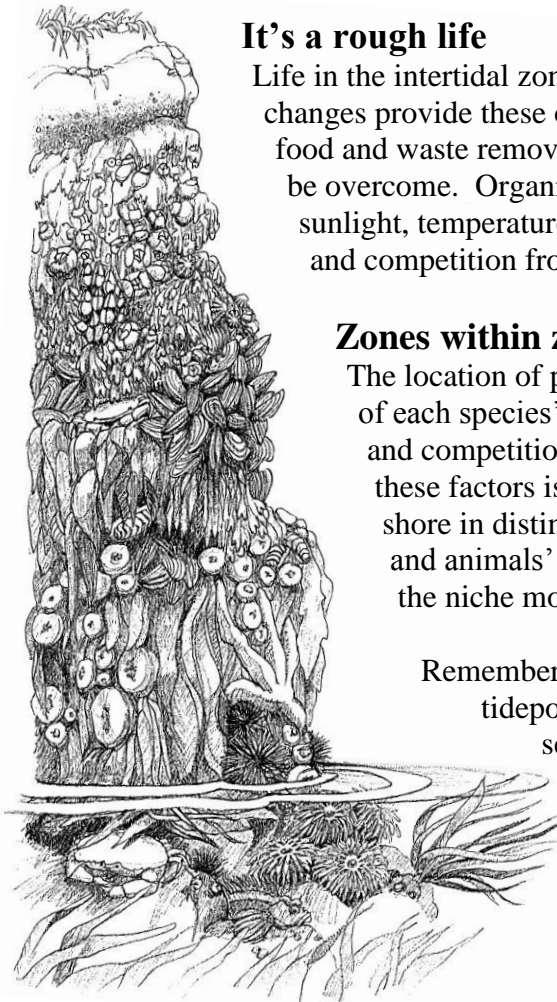
### Zones within zones

The location of plants and animals within the intertidal zone is a function of each species' ability to cope with exposure, wave action, predation and competition for space. Because the level of ability to cope with these factors is different for each species, they are distributed along the shore in distinct bands or zones. This **zonation** is a result of plants' and animals' interactions with each other and the environment to find the niche most suitable to their basic needs of food and shelter.

Remember, we have an impact on this fragile ecosystem. When tidepooling, watch where you step and always return animals, seaweeds and rocks to the place and position you found them.

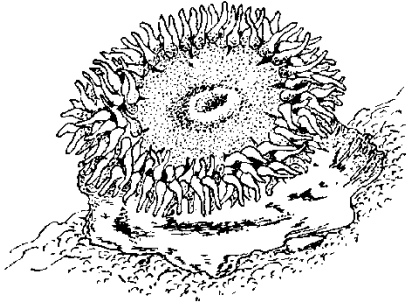
### Plants and animals of the rocky intertidal zone

Although some fishes are found in this area, the most abundant animals living here are **invertebrates**. Some common invertebrates found here are crabs, sea stars,



sea anemones, sea urchins, snails, chitons, mussels and barnacles.

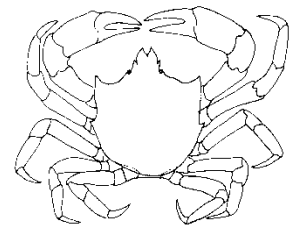
All of the animals living in the intertidal zone have developed **adaptations** – physical characteristics and behaviors – that enable them to survive in this rough-and-tumble environment. Some organisms are flat; some close themselves up; some hold on tight and some go with the flow. Some animals change color to avoid predators and some have built-in defenses.



To insure survival, each species has unique ways of defending itself, of reproducing, of feeding and of hiding. Most organisms rely on a combination of several adaptations to secure their place in the rocky intertidal. For example, spindly-legged kelp crabs cling to seaweeds to keep from being washed away with the current, and some cover their exoskeletons with seaweed to hide from predators. Kelp crabs are also often the color of the seaweed they live on. Snails and limpets have hard shells to protect their soft bodies and a very strong foot to hold on tight in the crashing waves.

Sea anemones have soft, flexible bodies to move with the flow of water, and tentacles covered with stinging cells to capture and stun their prey.

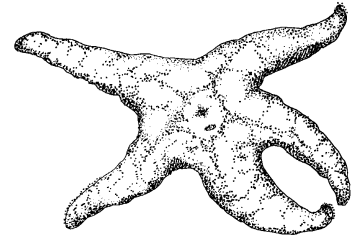
Seaweeds also are abundant in the intertidal zone, where they can get plenty of sunlight and also provide a rich habitat for many of the animals living there. Like animals, seaweeds must be adapted for survival in this environment. Some, like coralline algae and sea lettuce, are short and live in shallow water with tiny holdfasts securing them to rocks. Others, like many kelps, have long, flowing fronds that spread out across the rocks, absorbing sunlight and shading invertebrates. Most are flexible, like sea palms, and bend with the push and pull of the waves. Seaweeds come in a variety of shades of green, red and brown. They provide similarly colored animals with a place to hide and find food.



## 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?

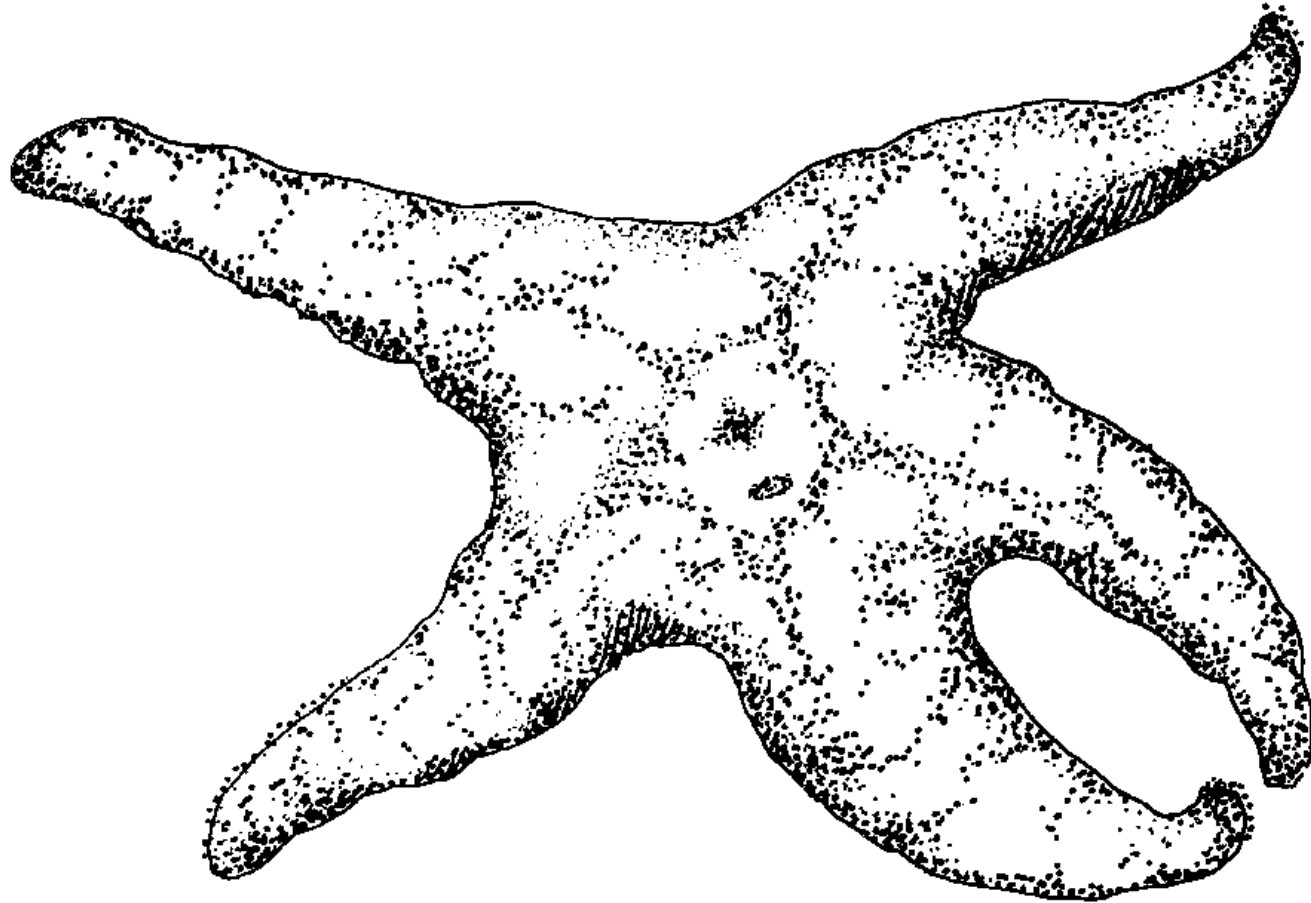
- Ochre stars eat mussels, barnacles, snails, limpets, chitons and other invertebrates (animals without backbones).
- Ochre stars eat by pushing their stomach into the shell of their prey. They leave their stomach there until it is done digesting its meal.

### 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.



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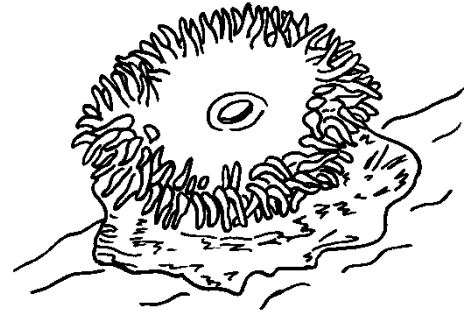
# Ochre sea star

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# 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?

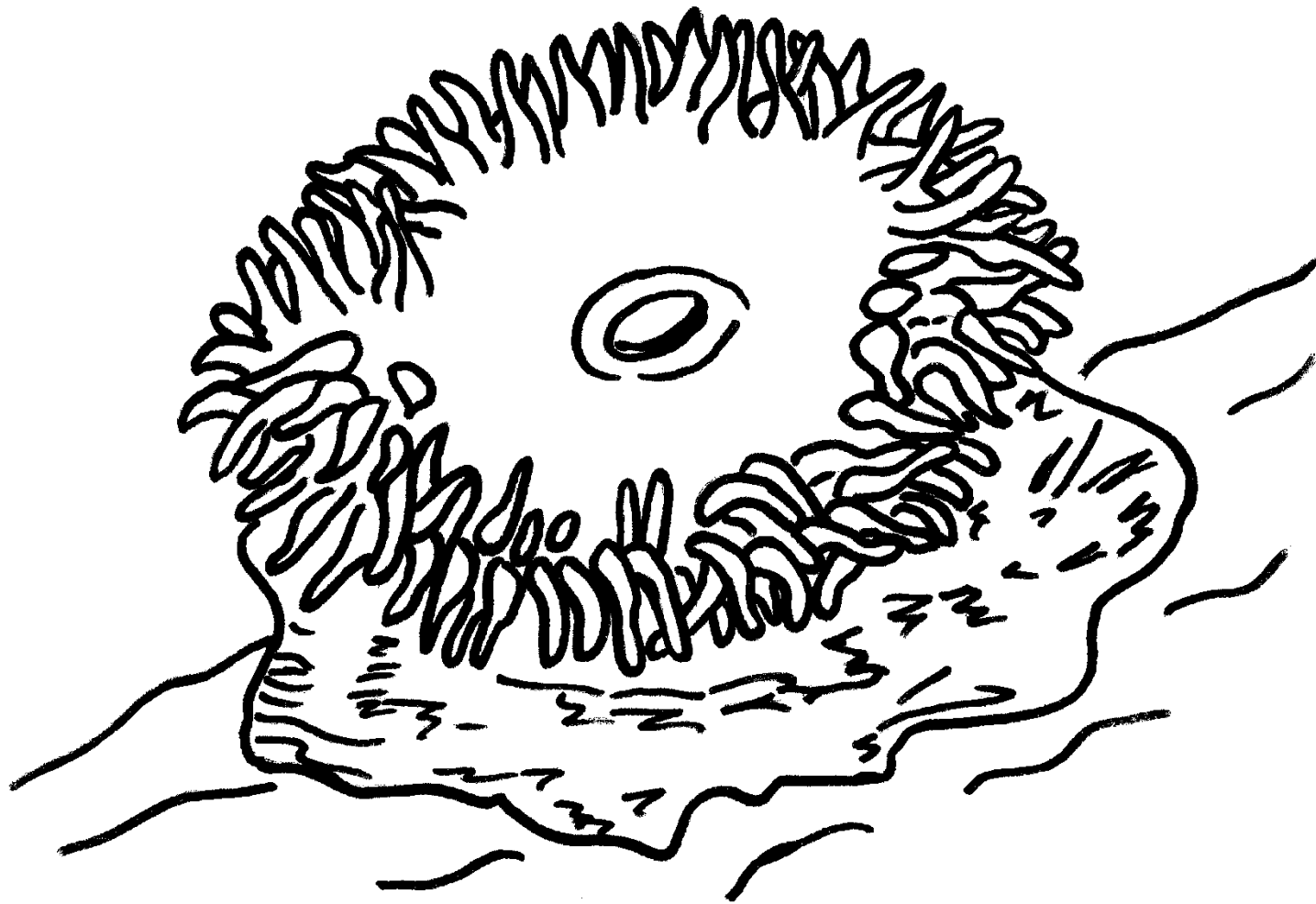
- Giant green anemones are found from Florida to Alaska.
- They live on rocks in tide pools.

## 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 is to help 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.



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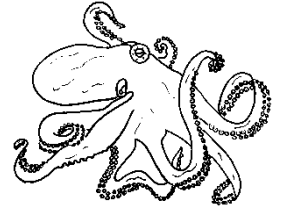
# Giant Green Anemone

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## Giant Pacific Octopus

### What does an octopus look like?

- Giant Pacific octopuses are red to reddish brown with wrinkled, folded skin. They can change their skin color and texture to help them blend in with their environment.
- Each of the octopus's eight arms has a double row of sucker used for walking along the seafloor and grabbing prey.
- What looks like the octopus's head is actually its body, and is called the mantle. This is where the octopus's brain, gills, and other organs are.



### How big are they?

- The largest Giant Pacific octopus recorded had an arm span of over 27 feet. This is about as long as a classroom!
- They can weigh from 10 to 200 pounds.

### Where do they live?

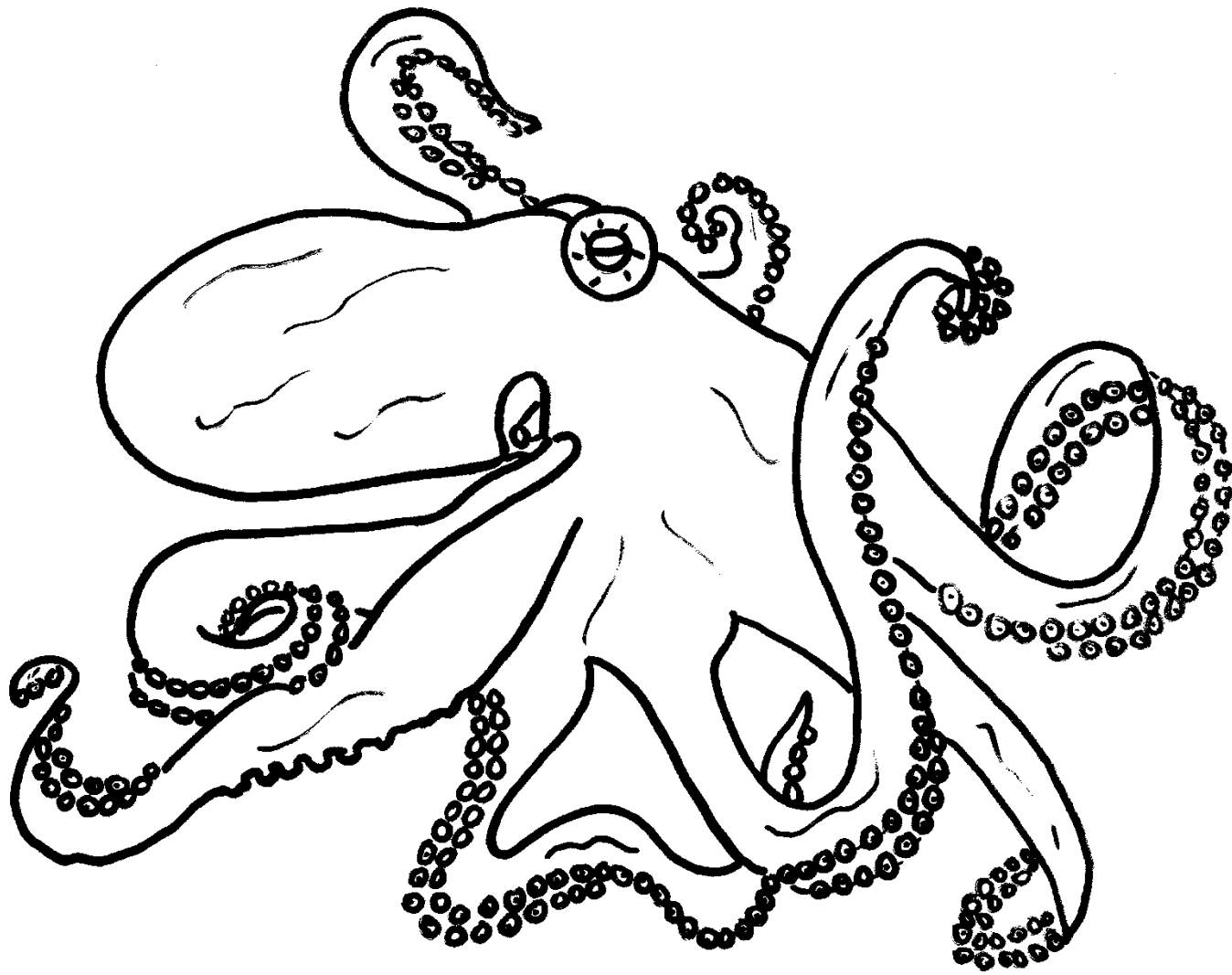
- Giant Pacific octopuses live along the coast of California, Oregon, Washington, British Columbia and Alaska.
- Their homes are rocky dens, tide pools or water down to 328 feet deep.
- Sometimes they litter the entrance to their lairs with rocks and empty shells; this is called an "octopus's garden."

### What do they eat?

- They eat shrimps, crabs, scallops, clams, abalones, smaller octopuses and fishes.

### Did you know?

- Octopuses don't have teeth. Instead, they have a beak that looks like a parrot's beak. An octopus can fit through anything that its beak can fit through, because that is the only hard part of its body.
- Some scientists believe that the octopuses are the most intelligent of all the invertebrates.
- Octopuses are related to squid, snails and clams.



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# Giant Pacific Octopus

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## Octopus Puppet

**Lesson at a glance:** Students will learn about octopus adaptations while assembling a paper octopus puppet.

### **Oregon Content Standards:**

#### SCIENCE

- **Kindergarten:** K.2P.1 Examine the different ways things move.
- **First Grade:** 1.1 Structure and Function: Living and non-living things have characteristics and properties.

### **Ocean Literacy: Essential Principles and Fundamental Concepts**

#### **5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.**

### **Materials:**

- ❑ Octopus puppet pattern (included with this activity)
- ❑ Red butcher or construction paper
- ❑ Large (1”) googly eyes
- ❑ White crayons or hole reinforcers (about 240 per puppet)
- ❑ Pipe cleaners (pieces large enough to make a ring around their thumbs)
- ❑ Sand paper
- ❑ Scissors
- ❑ Staplers and/or tape
- ❑ White glue (for googly eyes)
- ❑ Overhead transparency (or handout) of octopus external anatomy
- ❑ Overhead transparency (or handout) of octopus puppet pattern
- ❑ **Giant Pacific Octopus** fact and coloring sheet

### **Background information:**

Octopuses belong to the phylum **Mollusca**, meaning “soft.” Molluscs have soft bodies, a muscular foot, a mantle, gills within the mantle and some have a tongue called a **radula** (*RA-dyoo-lah*). Members of the phylum Mollusca include snails, slugs, clams, oysters and squid. Octopuses are members of the class **Cephalopoda**, meaning “head foot.” Other cephalopods include squid, cuttlefish and nautilus. There are many different species of octopus including the giant Pacific and red octopuses found along the west coast of North America and the infamous blue-ringed octopus of Australia. The puppet created in this activity is meant to be a giant Pacific octopus, the largest species of octopus in the world.

An **adaptation** is a characteristic, such as a body part, color pattern or behavior, that helps an organism survive in its environment. Octopuses and other cephalopods have many unique adaptations that set them apart from the other molluscs. For example, octopuses have a beak for crushing their hard shelled prey and their eight muscular tentacles (arms) are quite different from the foot of a snail or clam.

Octopuses are the only molluscs that don't have any hard body parts supporting their mantle (the body cavity). Even the squid and cuttlefish have a form of internal shell. Octopus adaptations are described in more detail in the activity section. For more information about octopuses and other cephalopods refer to the **Giant Pacific Octopus fact and coloring sheet**.

**Activity:**

**Preparation:**

1. Create pattern templates using old file folders or poster board.
2. Trace the pattern pieces onto red butcher or construction paper.
3. Trace radula (tongue) onto sandpaper.
4. Cut out the pattern pieces or have your students cut them out.
5. Copy the included octopus and beak pictures onto an overhead transparency or project with your computer on the front board.

**Pre-activity:**

1. Introduce your students to the cephalopods by showing pictures if possible. Explain that cephalopod means "head foot." What appears to be the head is actually their body, while their tentacles are actually what is referred to as a "modified foot." This implies that at some time in their evolution, the cephalopods had one muscular foot similar to a snail's foot. As they evolved, their single foot developed into several tentacles used for grabbing prey and moving along the seafloor.
2. Provide students with a copy of the **Giant Pacific Octopus fact and coloring sheet**.

**Activity:** (Hand out parts as you go, or give each student a set of parts.)

1. Show students the octopus picture on the overhead projector and talk about what they already know about octopuses. Cover up the beak picture for now.
2. Have students cut out their octopus parts, if you haven't done it already.
3. Have students begin by identifying the mantle piece of their puppet-to-be.  
*Optional:* Have students crumple up their mantle pieces to give it the appearance of wrinkly octopus skin. Discuss the following information:
  - The mantle on a clam or snail surrounds the internal organs and is attached to the shell which it secretes. Octopuses don't have a shell; however, their mantle does surround and protect their internal organs, including their brain, gills, liver, kidneys, reproductive organs, ink sac and all three of their hearts! Yes, the octopus and its relatives have three hearts. They have one main heart (the systemic heart) and two gill (branchial) hearts. The main heart pumps the blood throughout the octopuses body, while the gill hearts are responsible for pumping the blood through the gills.
4. Have students roll their **siphon** piece into a tube and staple or tape their siphon at either end. It should be the diameter of a toilet paper roll.
5. Have students fasten the siphon at the base of the mantle piece. Discuss the following:

- Octopuses can propel themselves through the water by forcing water from inside their bodies out through their siphon. They can determine the direction that they will go by moving their siphon up, down or from side to side.
  - Usually the octopus's mantle will be leading the way when they've used their siphon to jet away.
  - When an octopus feels threatened, it will also squirt ink through its siphon.
6. Have students match up each side of their octopus tentacle pieces so that they fit under the mantle, and tape or staple them together. The tentacle pieces will overlap a little bit for them to fit at the base of the mantle piece.
  7. Have students attach the tentacles to the mantle.
    - "Octo" means eight, and all octopuses have eight **tentacles** (also called arms). Their eight tentacles surround their mouth.
  8. Have students make two rows of sucker discs on the underside of each tentacle using hole reinforcers or by drawing them on with a white crayon. Discuss the following: NOTE: *Putting on the reinforcers can take a long time so you may want to save this for last or have students finish them later.*
    - An octopus has eight muscular tentacles (arms). Each muscular tentacle is covered with two rows of **sucker discs**. The octopus can move each disc independently as it moves along in search of food or a good hiding spot. These sucker discs are extremely sensitive to touch and are also used for detecting smells. This helps the octopus to find its prey and avoid predators. It also helps the octopus become familiar with the texture of its surroundings so that it may change the appearance of its own skin to blend in. Octopuses can make themselves appear bumpy like gravel, sharp like jagged rocks or smooth like the sandy seafloor.
    - Octopuses can also change the color of their skin to match their surroundings.
  9. Have students attach the small wristband onto the back of the octopus's mantle, at the base. When the students stick their arm through the armband, their hand will act as the octopus's **beak**. Uncover the beak picture as you discuss this adaptation.
    - When an octopus finds its prey, it will sneak up on it and then pounce on top of it, trapping it under its "arm web." Once the animal is trapped, the octopus will then grasp it with its sharp, parrot-like beak and crush its body while injecting paralyzing chemicals into its body. The octopus will also inject enzymes that turn the meat into a soupy substance that is easily consumed.
  10. Glue a large googly eye on each side of the base of the octopus's mantle. Octopuses have relatively large **eyes** and can see fairly well, especially at night. Most octopuses are nocturnal and will sleep most of the day, coming out of their caves, cracks and crevices in the evening to hunt until dawn.
  11. Have students wrap the flat end of their sandpaper octopus tongue (radula) around their pipe cleaner. They will tape the folded end to the back of the sandpaper to secure it. Have them wrap the pipe cleaner around their thumb so that the rough side of the sandpaper will be on the inside of their beak (hand).
    - Octopuses also have a sharp, scraping tongue called a **radula**. The radula helps the octopus to clean out the shells of their prey.

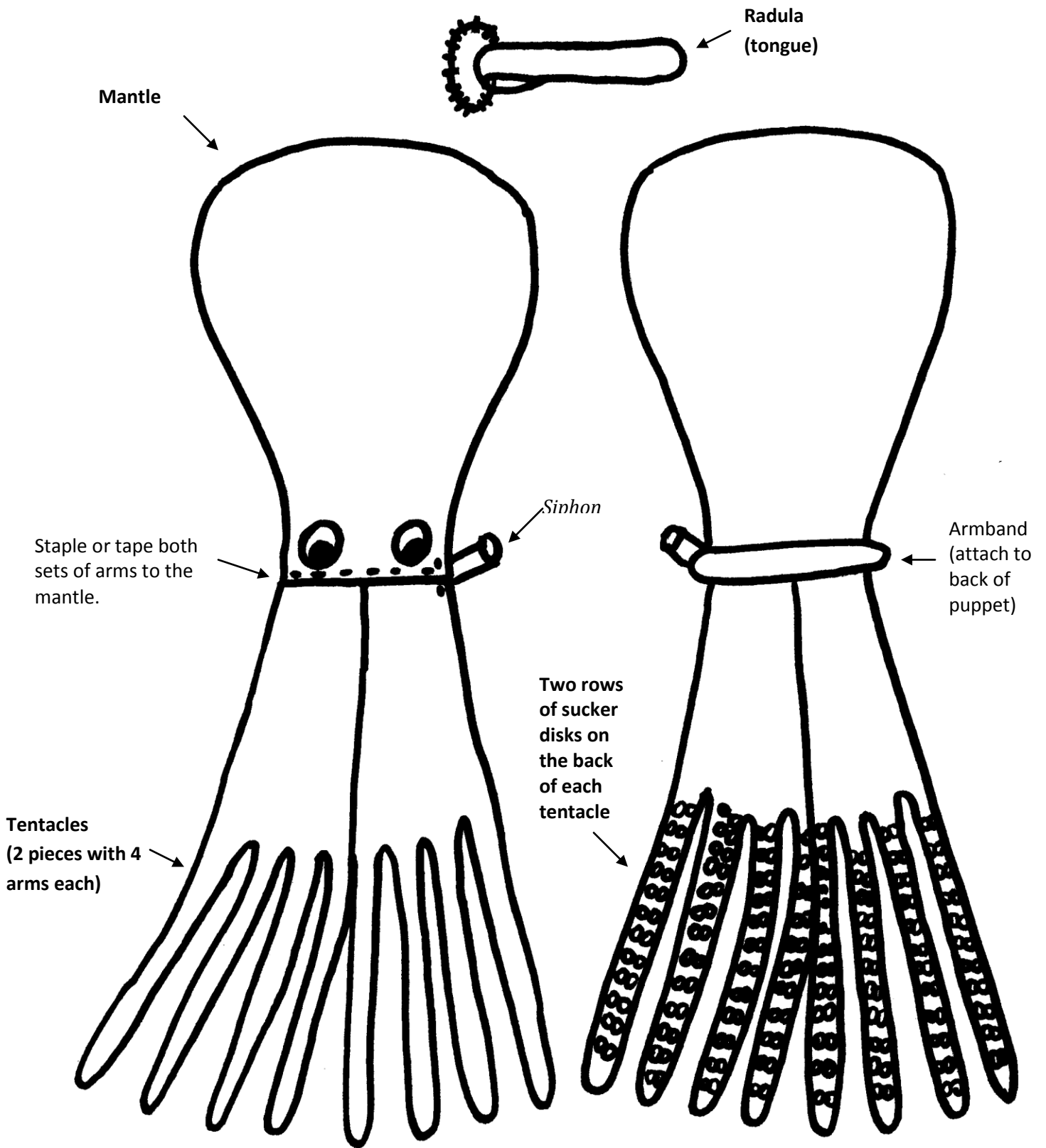
**Summary:**

1. Review octopus adaptations by having students describe the adaptations on their puppet.
2. Introduce additional octopus adaptations and “fun facts.” For example:
  - Octopuses can fit their entire bodies through a space the size of their beak.
  - Most octopuses live less than five years and usually die soon after laying or fertilizing their eggs.
  - The largest octopus on record was a giant Pacific octopus, 30 feet long from tentacle tip to tentacle tip.

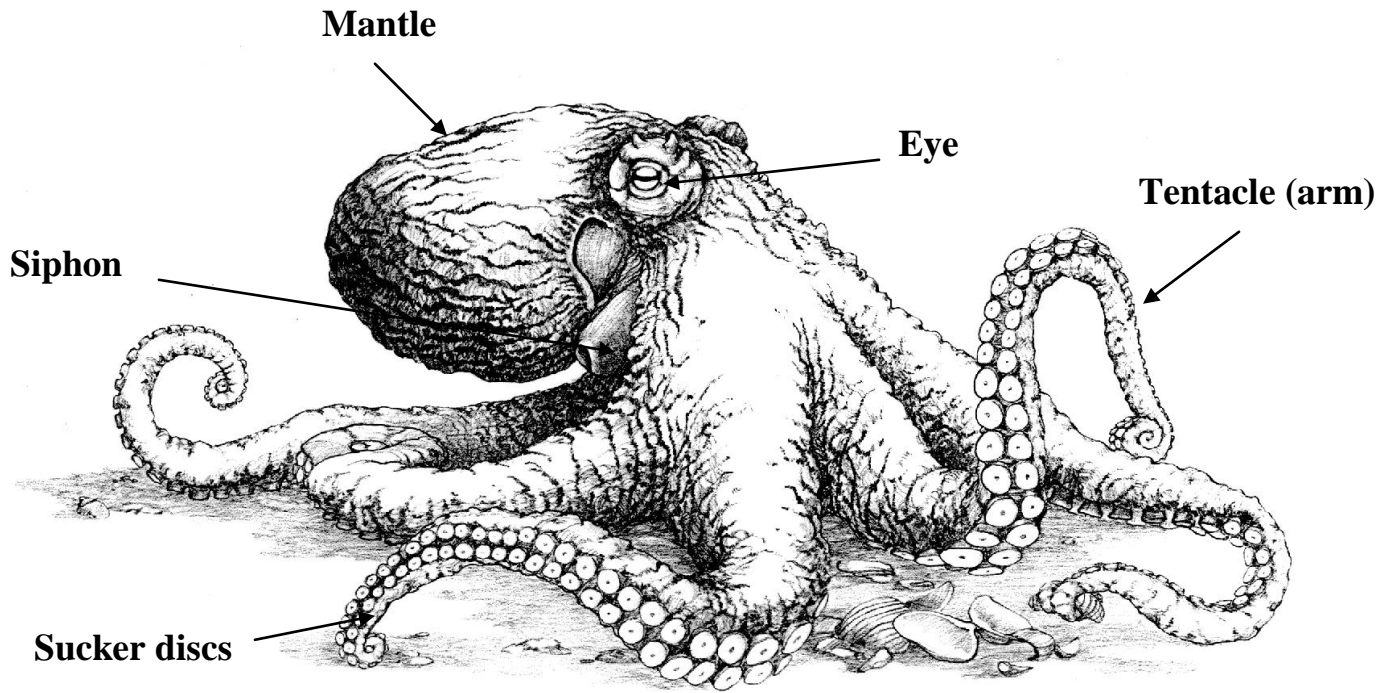
**Extensions:**

1. Show the octopus footage from the videos found online. [www.arkive.org](http://www.arkive.org) is a great resource

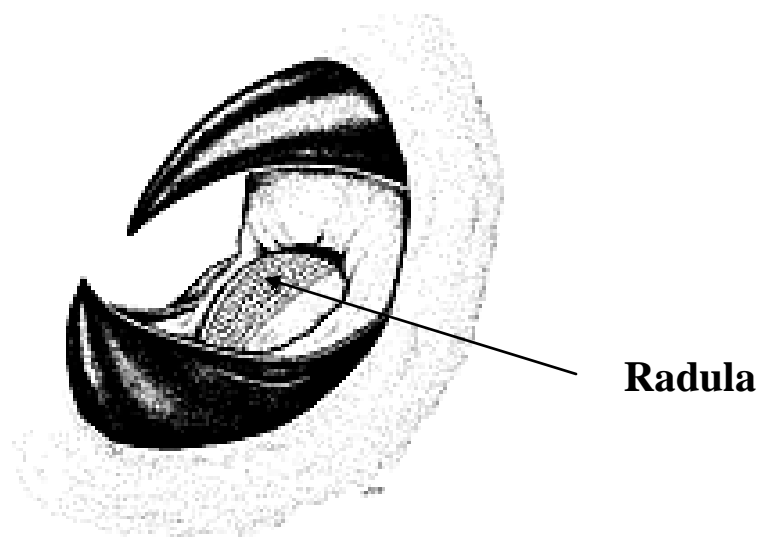
# Octopus Puppet Diagram



# Octopus Anatomy



## Giant Pacific Octopus



## Octopus beak

# How Big Am I?

**Lesson at a glance:** Students will measure out the maximum lengths of a variety of ocean animals.

## **Oregon Content Standards:**

### SCIENCE

- **First Grade:** 1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
- **Second Grade:** 1.1 Structure and Function: Living and non-living things have characteristics and properties.
- **Third Grade:** 3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.

### MATH

- **Kindergarten:** K.1.2 Connect numbers, including written numerals, to the quantities they represent, using various physical models and representations.
- **Second Grade:** Use rulers and other measurement tools to estimate and measure length in common units.

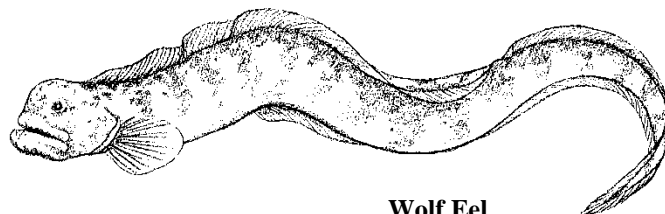
## **Ocean Literacy: Essential Principles and Fundamental Concepts**

### **5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.**

- 5.a. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

## **Materials:**

- Two 60-foot lengths of clothesline
- Cable ties
- Laminating materials
- Permanent markers
- A measuring tape for each small group of students
- Two copies of the attached animal pictures with their lengths.



Wolf Eel

<b>Animal</b>	<b>Length</b>
Lined hermit crab	¾ inch
Ochre star	12 inches
Tufted puffin (wingspan)	36 inches
Sunflower star	52 inches
Wolf-eel	5 feet
Leopard shark	6 feet
Brown pelican (wingspan)	7 ½ feet
California sea lion (adult male)	8 feet
Killer whale (adult male)	26 feet
Whale shark	46 feet
Gray whale (adult female)	49 feet
Sperm whale (adult male)	65 feet

**Activity:**

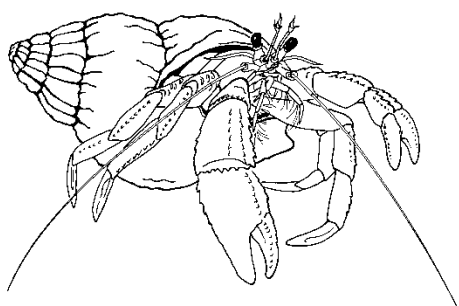
1. Before class, cut apart the pictures, laminate them (this should prevent them from tearing when they are attached to the rope), and punch a hole near the top for attachment to the rope.
2. Divide your class in half (each half will be working with a separate rope).
3. Divide the students from each half into groups of two or three.
4. Give each small group a laminated, punched picture and a marking pen.
5. Ask each small group of students to measure out the length of their animal, all using the same end of the clothesline as a starting point.
6. When they reach their point on the clothesline, have them mark it with a permanent marker and then attach their picture with a cable tie.
7. Ask each small group of students to stand at the length of their animal.

**Summary:**

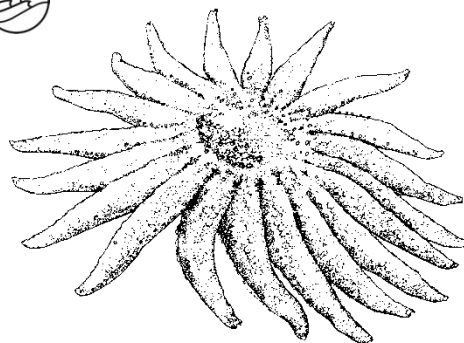
- Have the students share with their classmates the name of their animal and how long it is.
- Did the two sets of measurements match? Why or why not? Relate this question to why scientists do the same experiment many times before they are satisfied that the results are accurate.
- Have the students record how many of their footsteps equal the various lengths.
- Have your students design a bar graph with all of the animals.

**Extensions:**

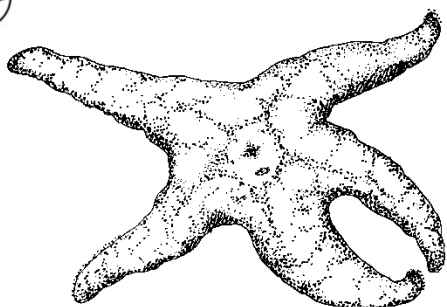
- Have the students write a research report on their animal. Have them include where their animal lives, what and how it eats, and other interesting information. Have them share it with the class.
- Once the animals are researched, have the students create a mural showing where their animals live. Use the pictures again and create a food chain based on the research your students completed on food choices.
- Have your students measure their height. How many of them does it take to equal the length of a wolf-eel, a killer whale, a gray whale or a leopard shark? How many hermit crabs would it take to equal their height?



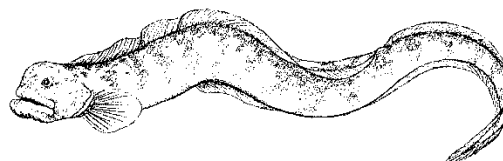
**Lined hermit crab (3/4 inch)**



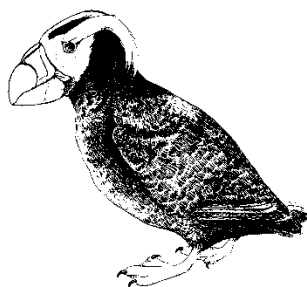
**Sunflower star (52 inches)**



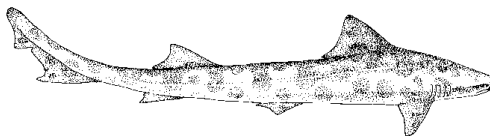
**Ochre star (12 inches)**



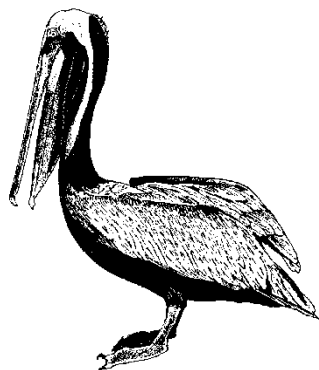
**Wolf Eel (5 feet)**



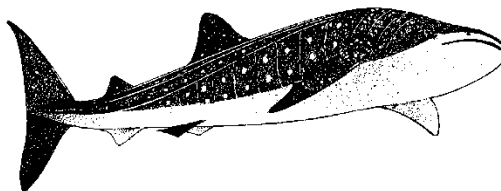
**Tufted puffin (36 inches)  
(wingspan)**



**Leopard shark (6 feet)**



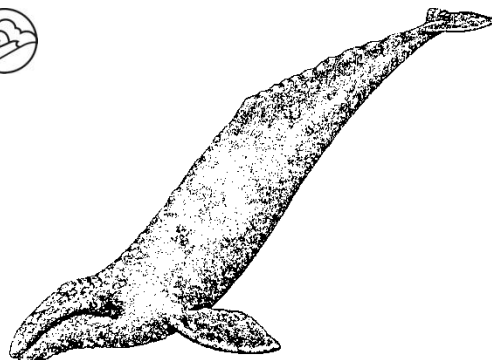
**Brown pelican (7 ½ feet)**  
(wingspan)



**Whale shark (46 feet)**



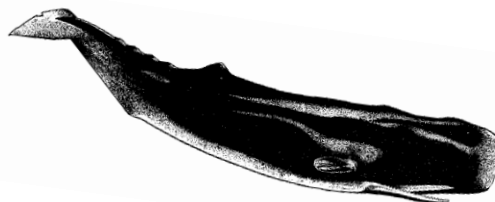
**California sea lion (8 feet)**



**Gray whale (49 feet)**



**Killer whale (26 feet)**



**Sperm whale (65 feet)**