



Cabrillo Marine Aquarium Lesson Plan

Grade Level: Sixth and Seventh Grades & High School / 9th-12th Grades

Title: *It Takes All Kinds: A Lesson on the Invertebrates of the Sea*

Objective: Students will explore invertebrate diversity and learn about five major invertebrate phyla (groups): Annelida, Cnidaria, Mollusca, Echinodermata, and Arthropoda

California Science Standards: **6th:** 5c, 5d, 5e, 7c, 7d, 7e **7th:** 3a, 3b, 7c, 7d, 7e
Grades 9-12: Biology/Life Sciences

Time to Complete: 50 minutes

Materials Provided by CMA Ocean Discovery Kits: *Graphic: Invertebrate Cut-out Cards*, Invertebrate Specimens, Posters, Books, and Habitat & Ocean DVD's

Materials Provided by Teacher: scissors & copies of *Graphic: Invertebrate Cut-out Cards*

Vocabulary: Invertebrate, phyla, Annelida, Cnidaria, Mollusca, Echinodermata, Arthropoda, terrestrial, aquatic, parasites, segmented, jet propulsion, filter-feeding, byssal threads, radiate, water-vascular system, tube feet, respiration, herbivory, arachnids, subphylum, Crustacea, exoskeleton, abdomen, thorax, antennae, digestive system, reproductive system, appendages, plankton, free-floating, tentacles, nematocysts, carnivorous, toxin

Lesson Background:

Although many people think of animals as only those that have backbones such as fish, birds, amphibians, reptiles, and mammals, over 95% of the world's animals are invertebrates which lack backbones. Invertebrates are included in every animal phylum and although they all share the characteristic of not having a backbone, there is tremendous invertebrate diversity. They range from single-celled animals to highly intelligent organisms such as octopuses. For the purpose of this activity, we will focus on these five invertebrate **phyla: Annelida, Cnidaria, Mollusca, Echinodermata, and Arthropoda.**

Many **invertebrates** have a soft body, like the sea jellies and worms. Others have a hard outer shell, like insects and crustaceans. There are many types of invertebrates. The most common invertebrates include the **annelids** or worms that are both **terrestrial** and **aquatic**. The spiny-skinned, marine **echinoderms** like the sea star and urchin are only found in the ocean. Another group of invertebrates are the **mollusks**, which includes snails, clams and squid. Next group includes the **arthropods** which are the most abundant group of animals

on the planet. Some examples are insects, crustaceans and spiders. Lastly, the **cnidarians** include some familiar animals like the sea jelly and sea anemone.

- Let us go over these 5 groups of invertebrates and their unique characteristics.

Annelids

There are about 12,000 species of annelids (“ringed” worms) known today, including earthworms and leeches. They can be found almost anywhere in the world. Annelids have **segmented** bodies that are divided into sections. They have well-developed internal organs. One common characteristic of annelids is that they do not have any limbs. Some annelids may have long bristles, while others have shorter bristles and seem smooth, like the earthworm. Most annelids are small, measuring fractions of an inch to several inches long, but the giant earthworm of Australia reaches lengths up to 3 m (10 ft). Some worms are considered **parasites**, in that they live inside another living organism.

Molluscs

Most mollusks have a basic body form that includes a head with sensory organs, a large soft mass, and a muscular foot. Some mollusks live on land, such as the garden snail and slug. Other mollusks are **aquatic**, like the oyster, mussel, clam, squid and octopus. Land-living mollusks move slowly on a flat sole called a foot, while many ocean living mollusks move or swim by **jet propulsion**. They propel themselves by ejecting water from their body. For example, the squid ejects water from a cavity within its body, and the scallop ejects water to move by clamping its shell closed. Other ocean-living mollusks, like mussels, attach themselves to rocks or other hard surfaces with **byssal threads**. Mollusks capture food in a variety of ways including **filter-feeding** like clams, scraping algae off rocks like limpets, and stunning prey with poison like cone snails.

Echinoderms

The phylum Echinodermata is comprised solely of marine species and includes sea stars, brittle stars, sand dollars, and sea urchins. Most echinoderms have arms or spines that **radiate** from the center of their body. The central body contains their organs, and their mouth for feeding. All echinoderms have a **water-vascular system** with fluid-filled **tube feet**, which serve a variety of functions including locomotion, feeding, and **respiration**. In most echinoderms, much of the respiration takes place across these tube feet. Echinoderms feed in a variety of ways including filter feeding, **herbivory**, and active predation.

Arthropods

The name "arthropod" may not sound familiar, but you probably know them; you may even have eaten one. This group of unique invertebrates includes crustaceans, **arachnids**, millipedes, and insects. The **subphylum Crustacea** is composed primarily of marine invertebrates like the crab, lobster and shrimp. Most have a hard **exoskeleton** which protects their body. Crustaceans have a head and a body trunk which is often further divided into a **thorax** and **abdomen**. The head has **antennae**, which are part of their sensory system. The abdomen includes the **digestive system** and **reproductive system**. The thorax

or abdomen also has **appendages**, such as legs, for crawling and swimming. Many crustaceans also have claws and hooked legs that help with locomotion and feeding. The barnacle may not look like a typical crustacean, but it uses its feathery legs to capture tiny **plankton** floating by.

Cnidarians

This class of invertebrates is found in aquatic or marine environments. The name Cnidaria comes from the Greek word “cnidos,” meaning stinging nettle. There are about 9,000 species of cnidaria, the most commonly known being the jellyfish, sea anemone, and coral. Cnidaria come in two different body forms: **free-floating** form such as the jellyfish, and the stationary-form such as the sea anemone. Both forms consist of a body surrounded by **tentacles** with stinging cells, called **nematocysts**. The body has a single opening or mouth, for taking in food and expelling waste. Cnidaria lack many specialized organs. They are brainless, heartless & spineless creatures. Yet, they are **carnivorous** and prey on organisms ranging in size from small plankton to larger animals such as sea stars, sea slugs, and fish. They capture prey using their tentacles. When prey comes in contact with the tentacles, harpoon-like stingers inject a **toxin** into the prey, paralyzing or killing it. Humans frequently come in contact with cnidarians, particularly jellyfish. Most toxins from their tentacles do little more than irritate human skin. However, with some forms of Cnidaria, such as the sea wasp, a sting can be deadly.

Procedure:

- Divide the class into groups of 2 or 3 students.
- Pass out the *Graphic: Invertebrate Cut-out Cards* (1 for each group)
- Have students cut the cards and phylum headers, shuffle them and stack the cards in a deck.
- Have students take turns drawing one card at a time and have them place it below the correct phylum (group) header.
- After each turn of the card, have each group discuss the animal traits that scientists might use to help classify it in one of the five phyla.

Example: This *earthworm* is an *annelid* because *it has segmentation and a soft body.*

Lesson Wrap-Up & Discussion:

Discuss with your students which animals belong in the correct phyla and the physical traits that helped them classify each invertebrate group. Give clues as to which animals fit in specific categories. As you give clues, students can rearrange their guesses if needed. Encourage students to take notes during this exercise. Some animals are more obvious than others, but there is only one phylum an animal can be classified under in its adult form.

Answer Key:

CNIDARIA	ANNELIDA	MOLLUSCA	ARTHROPODA	ECHINODERMATA
moon jelly	polychaete worm	periwinkle snail	hermit crab	ochre seastar
sea anemones	sea mouse	bent-nose clam	sand crab	sand dollar
sea nettle	planktonic polychaete worm	octopus	spiny lobster	sea urchin
sea pansy	scale worm	mussels	striped shore crab	brittle star
gorgonian sea fan		market squid	rock crab	bat star
		purple olive snail	acorn barnacles	basket star
			brine shrimp	

Lesson Extensions: Additional Review

Hold up one picture card at a time from among those provided, covering the name of the animal with your fingers. Ask students to name: the animal, the group, the characteristics of that group, and other animals in the same group.

Further Student Exploration: Marine Invertebrate Report

As a class assignment or as a homework report, have students research one particular marine invertebrate discussed in this lesson. Have the student report on its special adaptations, physical features, diet, predators, conservation status, etc. Have students create posters that showcase their invertebrate and give short presentations to explain their posters.

References:

- Kidport: Life in the Sea
<http://ww.kidport.com/RefLib/Science/Animals/Annelids.htm>
- Animal Kingdom: All about the World of Animals
<http://animalkingdom.net/category/invertebrates/>
- The Shape of Life Library
<http://shapeoflife.org/phyla>
- Missouri Botanical Garden: Marine Ecosystems
<http://www.mbgnet.net/>