



Cabrillo Marine Aquarium Lesson Plan

Grade Level: Fifth Grade through High School (9th-12th Grades)

Title: A Lesson on Bony Fish Classification

Objective: Students will learn to classify living things according to structural features and identify that they have patterns of similarities and differences. Students will also be able to identify a diversity of animals using simple keys and describe some of their adaptations to help them thrive in their environment.

Next Generation Science Standards: MS-LS2-1 , MS-LS2-4

Time to Complete: 50 minutes

Materials Provided by CMA: *Reading Handout: Bony Fish Scientific Classification, Worksheets: Vertebrates with Class, Spine or Spineless, The Name Game of Classification!*

Materials Provided by Teacher: Access to *Reading Handout* and *Worksheets*

- ❖ NOTE: Many fishes are protected by California State Law. It is illegal to collect or possess fish or any parts of a fish (bones, skin etc.) without a valid permit.

Vocabulary: Classification, features, observed features, structural features, vertebrates, invertebrates, mammal, fish, sharks, amphibians, birds, reptiles, terrestrial, aquatic, animal kingdom, hierarchy, endothermic, exothermic, kingdom, phylum, class, order, family, genus, species, taxonomy, binomial nomenclature, zoologist

Lesson Background:

Humans have a natural tendency to sort items into groups. Sorting into groups allows items to be organized which allows for easier understanding. Sorting animals into groups is like any other form of grouping; animals that have similar features are placed into similar groups. These are kept separate from those animals that have different features. When this is done with animals it is called *classification*. Those belonging to the same group will have more features in common than those belonging to any other group.

The advantages of classifying:

- makes identifying animals much easier
- allows *relationships* occurring between and within animal groups to be observed
- allows people to communicate information about animals more easily



The particular group that an animal will be placed into is determined by *features* each animal possesses that can be easily *observed* (a fish has fins and a bird has wings). Such features are called *structural features* and it is these that are generally used to classify animals. Features such as behavior, color and size are not usually used in classification schemes. This is best seen using an example. Consider an eel, a whale, and a polar bear. While all three are *vertebrates*, the whale and the polar bear have a number of important features in common, such as giving live birth and feeding their young milk. The eel does not possess these same features. Therefore, whales and polar bears are placed into the *mammal* group, and the eel into the *fish* group. Mammals and fish are two of the five groups of animals that are classified as vertebrates. Can you name the other three groups? (*amphibians, reptiles, birds*)

General Animal Class Characteristics and Traits of Vertebrates:

“Fish” (including sharks and bony fishes)

- **Ectothermic** or cold-blooded, the body temperature of the animal is dependent on the temperature of its surroundings
- Live in the water
- Use gills to take in oxygen from the water
- Usually have scales for protection & fins for swimming
- Usually lay eggs (however, most sharks have live birth)

Amphibians

- Ectothermic
- Live part of their life in water & part on land
- Have gills when they are young to take in oxygen from the water and develop lungs as they grow to take in oxygen
- Usually have moist, smooth skin
- Usually lay jelly-like eggs

Reptiles

- Ectothermic
- Have dry, thick scaly skin
- Breathe with lungs
- Usually lay soft, leathery eggs

Birds

- **Endothermic** or warm-blooded; remain at almost a constant internal temperature
- Have feathers, wings & beaks
- Breathe with lungs
- Hatch from eggs

Mammals

- Endothermic (warm-blooded)
- Have hair or fur
- Have lungs to breathe oxygen from the air
- Feed their young milk
- Give live birth to young, sometimes will lay eggs



Lesson Outline:

Activity 1: Vertebrates with Class

Read aloud *Reading Handout: Bony Fish Scientific Classification*, then have the students complete the *Worksheet: Vertebrates with Class*. Discuss what groups the animals should be classified in and any clues that helped in sorting them out.

Here are some questions to help in sorting animals according to their similar traits:

- Where does the animal live? Is it terrestrial or aquatic?
- Does it have fur, feathers or scales?
- Does it breathe with gills or lungs?
- Are the young born alive or are they hatched from eggs?
- Is it endothermic or ectothermic?

An **invertebrate** is an animal without a backbone or skeleton inside its body. They represent over 95% of the planet's animal species. Some invertebrates have a soft body, while others have a hard outer covering. Scientists classify invertebrates from simple to complex, according to their physical characteristics. Invertebrates are animals without a backbone and are broken up into many Phyla (singular Phylum). The simplest of these is **Porifera**, commonly known as the sponges. Many sponges live in the ocean and, although it may not look or behave like a typical animal, it is an actual living organism. The next group, hollow-bodied animals, is called the **cnidarians** and includes sea jellies, corals & sea anemones. These animals are aquatic and have a hollow center and one body opening. The next group is the **annelids**, the scientific term for worms. They are soft-bodied animals that can be either **terrestrial** or **aquatic**. Examples are earthworms and leeches. The fourth group is called the **mollusks**. Mollusks have a soft body, but many also have a hard outer shell. Some live on land and others are aquatic. Examples of this group include snails, clams, sea slugs, squid and octopus. The next group is the **arthropods**. These animals have an outer skeleton, jointed legs and segmented bodies. This is the largest group in the **animal kingdom**. This group includes insects, spiders, crustaceans (crabs, lobster, and shrimp) and millipedes. The last group is called the spiny-skinned **echinoderms**. This group of animals has sharp spines on the outside of their bodies, which form a hard skeleton for protection. Echinoderms live exclusively in the marine environment. Some examples are sea stars, sand dollars and sea urchins.

A **vertebrate** is an animal with a backbone and in internal skeleton. Examples include **fishes, amphibians, reptiles, birds, and mammals**. All vertebrates belong to the Phylum Chordata. Chordates are animals possessing a notochord, a hollow dorsal nerve cord, pharyngeal slits, an endostyle, and a post-anal tail for at least some period of their life cycles.



Activity 2: Spine or Spineless!

Next have the students complete the *Worksheet: Spine or Spineless*. Discuss if the animal is an invertebrate or a vertebrate and what were some clues that helped with sorting it out!

To identify an animal as an invertebrate, it has no backbone. This means they are spineless! There are many different types of invertebrates that making a list of common traits or characteristics is almost next to impossible. Vertebrates have a spine.

Vertebrates (V): Shark, Sea Lion, Eagle, Sea Turtle, Fish, Whale, Gull, Pelican, Sea Snake, Eel, Seal Orca, Dolphin

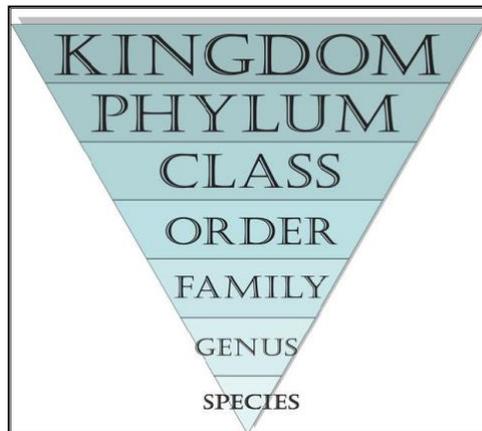
Invertebrates (I): Octopus, Clam, Crab, Oyster, Mussel, Snail, Lobster, Sponge, Shrimp, Coral, Sea Anemone, Squid, Abalone, Worm, Seastar, Sea Urchin, Sea Jelly (Jellyfish)

Activity 3: Classifying the Class

Different levels of classification are called *taxonomic groups*. Think of these groups like a person's address. In order for mail to reach a person it must have the correct country, state, city, suburb, street and home address. You start with a very general idea that can include many things (country or *kingdom*) and finish with a very specific thing (a home address or a *species*). This arrangement is called a *hierarchy*.

Discuss with students ways in which they classify themselves (by individual names, class year, sports team, school club, etc.) Discuss with the students ways in which they could classify members of their own class.

This diagram shows how an animal is classified into the various taxonomic groups.



The top levels have the most animals, and they get narrower and narrower as you go down. So, by the time you get to the species, there is only one animal in the group. You can imagine these levels as an upside-down triangle.

Every animal on the planet, down to the most microscopic creature you can imagine, can be classified according to this system.

You can remember the order for this classification system with a catchy phrase like the examples below (the first letter of each word is the first letter of the level of classification):

*King Penguins Congregate On Frozen Ground Sometimes.
Keep Ponds Clean Or Frogs Get Sick.*

Activity 4: The Phrase Craze

Have your students create their very own phrase to help them remember the order of classification and have them share it with their fellow classmates.

Activity 5: The Name Game of Classification!

Have students pick their favorite fish species and write out its classification.

*Refer to the *Reading Handout: Bony Fish Scientific Classification* also give access to the *Worksheet: The Name Game of Classification!*

Lesson Wrap-up:

Every recognized species on earth (at least in theory) is given a two-part scientific name. This system is called "**binomial nomenclature**." These names are important because they allow people throughout the world to communicate easily about animal species. This works because there are sets of international rules about how to name animals and zoologists try to avoid naming the same thing more than once, though this does sometimes happen. These naming rules mean that every scientific name is unique. For example, if the kelp bass is given the scientific name *Paralabrax clathratus*, no other animal species can be given the same name. So, if you are a Russian scientist studying relatives of sunfish and you want to specifically discuss "bluegill sunfish" with a Canadian researcher, you should both use the scientific name, rather than common name, so you know that you are both talking about the same organism.

Scientific names are often descriptive, suggesting something about the animal. For instance, long-ear sunfishes have long gill flaps making them look like they have long ears. The species name, *megalotis*, means "big ears" in Latin. Another example is the yellow-headed blackbird, whose scientific name is *Xanthocephalus xanthocephalus*, which literally means "yellow head."

Scientific names also sometimes bear the names of people who are experts in a particular field, so naming a species after them is a sign of respect for all their work. *Acanthochondria hoi*, a parasitic copepod, is named after a professor named Dr. Ho. Some scientific names reflect the common names given to these animals by native peoples, such as *Oncifelis guigna*, a small, South American cat species called guigna by



people of Chile and Argentina. Finally, they may also contain references to regions where the species is found, such as the parasitic, marine leech discovered recently on the Giant kelpfish, named *Heptacyclus cabrilloi* which has only been found at Cabrillo Beach in San Pedro, California. **Taxonomy**, the science and process of naming living organisms is a field that is constantly changing. When our scientific understanding of animals change it may also mean that the scientific name changes as well.

Lesson Extensions:

Go to the *Integrated Taxonomic Information System* web site: <http://www.itis.gov/>. In the search box, put in your favorite fish species and write out its classification.

References:

- Tarango Zoo
<http://www.taronga.org>
- Mensa For Kids
<http://www.mensaforkids.org>
- Animal Diversity Web
<http://animaldiversity.ummz.umich.edu/>
- Integrated Taxonomic Information System
<http://www.itis.gov/>

