



Cabrillo Marine Aquarium Lesson Plan

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

Title: Taxonomy: A Lesson on Whale 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: Whale Scientific Classification, Worksheets: Classification and Taxonomy (Vertebrates with Class, Spine or Spineless, The Name Game of Classification!), Worksheet: Jelly-Belly Dichotomous Key, Worksheet: Whale Dichotomous Key*

Materials Provided by Teacher: Photocopies of *Reading Handout* and *Worksheets*, bag of Jelly Belly (49 flavors) or photos

Vocabulary: Classification, features, observed features, structural features, vertebrates, invertebrates, mammal, bony fish, shark, amphibian, bird, reptile, terrestrial, aquatic, animal kingdom, cartilage, hierarchy, endothermic, exothermic, kingdom, phylum, class, order, family, genus, species, taxonomy, binomial nomenclature, zoologist

Lesson Background – Adaptation for NGSS & Distance Learning

Distance Learning Adaptation: In these times of distance learning, this lesson can be modified in the following ways:

- Synchronous live discussion on a video conferencing platform (zoom, google meet, etc.) If your classroom is currently using class discussions, then this lesson can be introduced with the following conversation to introduce the concept.
 - You can host the entire lesson “live” via the mentioned video conferencing platforms. To enhance the lecture portion, display the provided media either through share screen, or utilizing a virtual white board like JamBoard, which is compatible with GoogleClassroom or ZiteBoard.
- A-synchronous / self-pace assignment. If your classroom is using an asynchronous model for instruction (such as take-home packets, or self-paced

online modules) this lesson can be easily adapted. This lesson can be based on a pre-recorded video or a hard copy worksheet.

- For take home packets, we would suggest synthesizing the lecture to a few key questions and facts for students to read along with family.
- For prerecorded video, we would recommend the educator recording themselves to ask these questions, and guide students to the same conclusions.
- If your classroom is using EdPuzzle (online learning video tool) Educators can easily use the voiceover function over our provided content and include questions during the course of the video.

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 these are generally used to classify animals. Features such as behavior, color and size are not 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 that the eel doesn't possess. 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?

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

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. For distance learning, this chart can easily be recreated on any word processing software if students do not have PDF editing software.

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 babies born alive or are they hatched from eggs?
- Is it endothermic or exothermic?

An **invertebrate** is an animal without a backbone or skeleton inside its body. They represent over 95 percent 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. Let's switch gears and discuss the classification of invertebrates. These are animals without a backbone.

To identify an animal as an invertebrate, it should have no backbone. This means they are spineless!

That's it! There are so many different types of invertebrates that making a list of common traits or characteristics is almost next to impossible.

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!

For distance learning, this worksheet can also easily be recreated to be a word document. Also, educators can have students submit a simple list of which animals they believe are vertebrates and invertebrates.

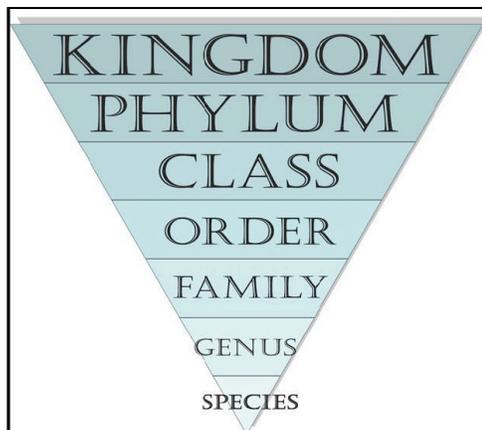
Activity 3: Classifying the Class

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.

For distance learning, this question could be posted as a question in a google question, even prior to the lesson. This question could also be an interactive way to start the lesson.

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.

For distance learning this can be submitted on your virtual classroom platform, and have students comment on other phrases that they enjoy.

Activity 5: The Name Game of Classification!

Have students pick their favorite shark, skate, or ray species and write out its classification.

*Refer to the *Reading Handout: Whale Scientific Classification* also make copies of the *Worksheet: The Name Game of Classification!*

This assignment can easily be recreated without this worksheet. Students can simply list the taxonomic break down of their chosen animal.

Activity 6: Dichotomous Key *requires a bag of Jelly Belly (49 flavors)

Hand out 5-6 jelly beans to each student. Have students use the *Worksheet: Jelly-Belly Dichotomous Key* to identify the flavors they have been given. They can then test their results by tasting the jelly beans!

For distance learning, you can still use this worksheet, and ask that students purchase their own small bag of jelly beans. However, not all students have the resources to do so. To continue the original Jelly Belly key, educators can provide pictures of single flavor jelly beans, easily accessible over Google Images.

Dichotomous keys can be created for any group of items. Educators could take photos of any household items, and create a dichotomous key based on those items. When creating a dichotomous key, it is important that all questions are phrased as “yes or no” questions. To create your own dichotomous key, gather your objects in question (anywhere from 5-10) and list both shared and unique characteristics of each item. Organize characteristics from general to specific. Then divide items by those characteristics and whether they

have them or not, divide items to become increasingly more specific. You can create a dichotomous key diagram to organize your items, and eventually create the dichotomous key.

Activity 7: Whale Dichotomous Key

Have students complete the *Worksheet: Whale Dichotomous Key*. Check the answers as a class using *Worksheet: Whale Dichotomous Key Answer Key*.

For distance learning, educators could supplement or modify this activity with additional pictures of mentioned whales. If the worksheet is incompatible for any reason, the dichotomous key can be posted alone and students can submit their answers separately.

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 blue whale is given the scientific name *Balaenoptera musculus*, 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/>