# ***Plankton Lab***

# **Though our tows at sea differ a little from what you may experience in the lab, the principles are the same. Below is a lesson outline and activity for collecting, studying, and fixing plankton. There are also directions attached to make your own sieve, plankton net, and how to make a 10% formalin and Rose Bengal stain.**

# **Lesson Overview**

 This activity is designed to introduce participants to plankton that is found in your local waters, as well as give them a broad definition and some examples of the role of plankton in the marine world. The students conduct a plankton tow and study their sample under compound microscopes in the lab. They identify the organisms on their slide, and are challenged to discuss why plankton play an imperative role in this and other ecosystems in the world.

# **Objectives**

1. Students will collect plankton, using plankton net, for observation.
2. Students will sieve out the plankton into a concentrated collection for study.
3. Students will identify the type and species of plankton on their slide.
4. Students will define plankton in their written observations when they classify the type and species of plankton.
5. Students will record observations based on the plankton on their slide.

# **National Science Education Standards**

C: Life Science

 ~Diversity and Adaptations of organisms

F: Science in Personal and Social Perspectives

 ~Populations, resources, and environments

# **Ocean Literacy Essential Principals and Fundamental Concepts**

4: The ocean makes Earth habitable

1. Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.

5: The ocean supports a great diversity of life and ecosystems.

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

# **NGSSS**

SC.D.2.3 The student understands the need for protection of the natural systems on Earth.

SC.G.1.3.2 The student knows that biological adaptations include changes in structures, behaviors, or physiology that enhance the reproductive success in a particular environment.

SC.G.1.3.4 The student knows that the interactions of organisms with each other and with the nonliving parts of their environments result in the flow of energy and the cycling of matter throughout the system.

SC.H.1.2.1 The student knows that it is important to keep accurate records and descriptions to provide information.

# SC.H.1.2.2 The student knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results.

# **Vocabulary**

**Plankton:** any organism in the water that is at the mercy of the winds, waves, tides, and currents.

**Zooplankton:** microscopic animals

**Phytoplankton:** microscopic plants and bacteria

**Meroplankton:** organisms that are plankton for only a period in their life cycle (i.e. fish larvae)

**Holoplankton:** organisms that are plankton their entire life (i.e. copepods)

**Macroscopic:** something that can be clearly seen without the aid of a microscope (i.e. jellyfish).

**Microscopic:** something that is not clearly visible with the naked eye (i.e. saltwater mite).

# **Materials**

~ Compound microscopes

~ Well slides and cover slips

~ Eye droppers

~ A bucket and small plastic bowl for each group

~ A light (to place on the collected plankton in the large bowl)

~ Worksheet

~ Plankton net

~ Zooplankton and coastal plankton reference books

# **Background Information**

 **Plankton** comes from a Greek word that means, “to wander.” **Plankton** are living organisms found in water that are at the mercy of wind, waves, current, and tides. They are not all **microscopic** though. Many can grow to lengths of 100 feet or more, which are considered **macroscopic**. Most **plankton** can be found in two kingdoms: plant and animal. The plant plankton are called **phytoplankton**, and the animal plankton are the **zooplankton**. Seaweeds, algae, diatoms, and dinoflagellates are all considered examples of **phytoplankton**. **Zooplankton** are more numerous in that they include the larval stages of most fish species and arthropods, as well as animals that remain **plankton** for their entire existence, or **holoplankton**. Some examples are jellyfish, Portuguese man-of-war (siphonophores), copepods, mites, and many forms of **phytoplankton**. The **plankton** that only began their life cycle as plankton are called **meroplankton**. These are the organisms that are too weak to swim against tides, etc. when they are young. Many of the strongest swimmers in the ocean began as **plankton**. Examples of **meroplankton** would be fish larvae, shrimp, barnacles, and many other crustaceans. **Meroplankton** have characteristics that they lose as they mature. Some observable morphological changes are: they are no longer thin and transparent; many have long appendages that fall away as the organism’s physique changes into a stronger swimmer for the adult portion of their life. The reason for the long appendages is to hold the animal up in the water column through means of displacement. They are also transparent for the purpose of camouflage, since most of their predators would be looking up in the water column; the light passes through the plankton and allows them to “disappear.”

 **Plankton** are important to many ecosystems in many ways. The **phytoplankton** convert carbon dioxide into oxygen. They contribute an estimated 70% of the earth’s atmospheric oxygen. This also affects the global temperatures. The larger the **phytoplankton** population, the more CO^2 is pulled from the atmosphere, thus lowering the levels of greenhouse gas and the global temperatures. **Phytoplankton** are also good indicators of change in an ecosystem since they need specific conditions to grow. They are affected by the slightest changes, and any change in their populations will affect other larger animal populations. Scientists follow changes in **plankton** to predict, and possibly prevent, harm from occurring higher up in the food chain and in the ecosystem. Pollution is also an issue in that it can be found in the **plankton**, and be accumulated in the organisms that consume them all the way up to the top of the food chain. **Plankton** also affect the economy. Many fisheries are depending upon the successes of fish populations to mature, but they can be affected by the presence of a higher number of another species that may compete for food. Since **plankton** are the base of the aquatic food chain, the smallest change in their populations will trickle down to affect many aspects of the ocean’s ecosystems. Much emphasis is being put on studying the migration patterns and species populations of **plankton**. To understand how these animals live and interact, will also give scientists, and fisheries, a better picture of what to expect from future fish populations.

# **Procedure**

1. If you are choosing to have the students make their own plankton nets, and then conduct their tows, please follow the link for that activity before going further.
2. Next tell the students they will be doing a plankton tow for their own studies, and will be using a smaller version of the plankton nets that are used on the research ships. Take the students outside to the sea wall or shore and explain that the net works much in the same way that we make macaroni and cheese: straining out the water and keeping the “noodles,” the plankton. Have the students line up and each grab a piece of the rope to walk the net along the sound, or off of the sea wall. (If time is a factor and the tow has already been done, explain the method of collection to the students)
3. At your study site, instruct the students to find an area to wade with their nets. They should drag the net just below the surface in one direction for at least 1-2 minutes, walking slowly.
4. When the time is up, have them come back to the shore, empty their cod end’s contents into their group’s bucket, and proceed back to the class.
5. Have the groups get their sieve and small bowl. They will then pour the contents of the large bucket through the sieve while the excess water drains into the small bowl.
6. Empty the excess water from the small bowl and using a light stream of water, rinse the contents on the sieve into the small bowl, this will be where they draw from to fix their slides. (You can add a touch of tonic water to the sample, this relaxes the plankton for easier study but does not fix for long-term use)
7. Have the students each sit at a microscope, and instruct them not to touch anything just yet.
8. Ask the students what they think a definition of “plankton” would be. Prompt them that there are many different types and classifications of plankton, so a specific, detailed definition will not be able to include everything that is considered plankton. (Also, it is not the guy on Sponge Bob…though he was inspired by an adult copepod)
9. After some discussion, give them the full definition of plankton. Clarify what it means to be “at the mercy of” or give an example of how the plankton are “controlled” by the elements.
10. Continue on to discuss that there are two main kingdoms of plankton: Plant and Animal. One is called Phytoplankton and the other is called Zooplankton, challenge the students to say which is the name for the plants and which is the name for animals (Prompt with asking which one carries on “photosynthesis,” linking phytoplankton with plants. Another clue may be in asking: “When you go to the zoo, what do you see as the main attraction?” linking the word zooplankton with animals.)
11. Ask the students what some examples of each may be. (Phyto: algae, seaweed, diatoms, red tide, etc. Zoo: larvae, jellyfish, copepods, man-of-war, etc.)
12. Talk about how plankton are important to ecosystems everywhere. They are the base of the ocean’s food chains, and also a major part of maintaining the global temperatures and O^2 levels. Ask the students why scientists would put forth such an effort to study plankton in depth, and what may happen if certain types were no longer found in the world’s waters.
13. At this point you can have the students prepare the slides, or if you are choosing to prepare the slides, use this time to go over basic microscope use with the class, pointing out the functions of each part. Have them become familiar with focusing using their fingers or pencils as objects of study while you are finishing with the slides.
14. Pass the slides out and ask the students to fill out their sheets, making observations and working together to ID the organisms in their sample.
15. At the close of the lab, have some students share what they observed, and ask them to describe what their plankton looked like. Have them figure why the larvae, etc. would be transparent or colored similar to their surrounding environment.
16. Ask the students if they know what “migration” is. Talk to them about one of the largest migrations in the world: plankton movement each day. Every day they move down from the surface, and at night they return closer to the top. Have the students figure out what reasons there may be for this. (Predators that feed in the daytime at the surface, while others come up from the depths to feed at night).
17. Make sure all slides are returned and cleaned, and all scopes are off at the close of the lab.

# **Assessment**

 Students should have completed the worksheet, recording observations related to the plankton’s appearance, behavior, and type. They should be able to identify if the plankton is phytoplankton or zooplankton, as well as make an educated guess if the species is meroplankton or holoplankton. After they have drawn and recorded what they see, the students should apply information from the lecture to draw, or describe, what they think the meroplankton will look like when fully grown.

# **Extension**

You can have students choose a particular genus they observed in the lab, and have them complete a research project on that type of plankton and their role in the ocean’s systems. They should be able to explain the type, location, environmental requirements, and current research pertaining to their plankton in a class presentation.