Marine Mystery Organisms INSTRUCTOR GUIDE

MODIFICATIONS FOR DIFFERENT STUDENTS AND TEACHING SITUATIONS

VISUALLY IMPAIRED. The video is explanatory even without the images. The exercise can be read by a screen reader. The PowerPoint lesson includes captions for each slide that can be read by a screen reader or converted into an annotated pdf to be read by a screen reader. The PowerPoint slide materials have been tested for color blind students (<u>http://www.colorblindness.com/coblis-color-blindness-simulator/</u>) and do not lose any significant formatting.

HEARING IMPAIRED. The video includes closed captions, and the PowerPoint includes annotations for each slide. Videos selected as "reveals" do not all provide subtitles, but most are meant to show what the organisms look like, and how they behave or exist, and do not necessarily need narration.

ENGLISH AS A SECOND LANGUAGE. If a class includes a high percentage of ESL students, assigning the video before class will help them come to class prepared to do the exercise, as they may not be able to pick up the vocabulary in class as well the other students. The closed captions on the lesson video are useful for students who may struggle to keep up with a fast-paced live lecture. More than most students, ESL students could benefit from being first encouraged to practice matching the words with definitions to become familiar with the unfamiliar English words before attempting this exercise.

DIFFERENT CULTURES. If a community is coastal, consider using examples of some organisms that students might have encountered either at the beach or on their dinner plates. LARGE CLASSES AND/OR NO PRINTING BUDGET. This exercise is easily done using a PowerPoint or by converting it into an online exercise in a Learning Management System (LMS; available as a supplemental IMS QTI import file). If done through the use of PowerPoint slides shown in class, students with visual impairments should be given a pdf of the question slides ahead of time. A PowerPoint worksheet and Canvas export package are available as supplemental files.

SHORT CLASS PERIODS. The exercise should not take the students longer than about 20 minutes. Students can be assigned to watch the video before coming to class, perhaps going over the practice problems embedded in it before starting the exercise in class. Discussing the answers can be time-consuming, especially if the students watch all the videos in the accompanying PowerPoint answer slides. Videos can be skipped and posted instead in an LMS to be watched outside of class. Alternatively, instead of doing it as a paper or PowerPoint exercise, use the online version (provided as a supplemental IMS QTI import file), which includes embedded videos in answer feedback that they can look at after class is over.

INTRODUCTORY COURSE FOR GENERAL SCIENCE MAJORS OR OCEANOGRAPHY MAJORS. A way to make this exercise slightly more advanced is to pick organisms all from one ecosystem and then have the students attempt to recreate the food web based on what they learned about the different roles of organisms in the ecosystem from this introductory exercise.

MODIFICATIONS TO PREVENT CHEATING, PLUS QUESTIONS FOR EXAMS

This exercise is easily modified to add new organisms every semester or rotate through a variety of organisms if students posting answers online from previous semesters is a problem. This list also serves as a source of ideas for test questions for summative assessment.



Dandelion Siphonophore

DESCRIPTION

This organism is named for a plant found on land but is composed of a colony of individuals that live in the ocean. The colony looks like a beachball tethered to the seafloor with thin "guywires." Like their close relatives, the solitary jellyfish, the individuals within the colony use tentacles to capture small prey in the water around them, feeding themselves through their mouth and then digesting their prey in their digestive cavities. Some members of the colony may be specialized in reproduction.

IMAGE CREDITS/SOURCES

Image courtesy of the NOAA Office of Ocean Exploration and Research, 2017 Laulima O Ka Moana.

https://oceanexplorer.noaa.gov/okeanos/explorations/ex1706/logs/july30/ welcome.html

VIDEO LINK https://sanctuaries.noaa.gov/earthisblue/wk247-dandelion-siphonophore.html

AMAZING FACT

These animals were first discovered near deep-sea mid-ocean ridge hydrothermal vents. ANSWERS prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Cyanobacteria

DESCRIPTION

Stromatolites are rocky structures created by colonies of these photosynthetic organisms. The simple, single-celled organisms link to form filaments that then form mats on the seafloor. As the tides go in and out, sand and mud get trapped in these sticky layers, which eventually build up to form rock-like mounds on the seafloor. Today stromatolites are found in rare parts of the shallow marine environment, but in the past, they were much more abundant in the shallow ocean. These organisms were responsible for first putting oxygen into Earth's atmosphere billions of years ago.

IMAGE CREDITS/SOURCES

Stromatolites growing in Hamelin Pool Marine Nature Reserve, Shark Bay in Western Australia. Photo by Paul Harrison, Reading, UK, <u>CC BY-SA 3.0</u>. https://www.usgs.gov/media/images/stromatolites-australia

VIDEO LINKS

https://www.pbs.org/wgbh/nova/video/these-boulders-are-alive/ https://ket.pbslearningmedia.org/resource/nvmn-sci-stromatolites/wgbh-novamaking-north-america-stromatolites-worlds-oldest-living-fossil/

AMAZING FACT

The oldest known fossils are cyanobacteria, dated at 3.5 billion years old, from western Australia.

ANSWERS
prokaryote
eukaryote
eukaryote
plankton
nekton
benthos
pelagic
benthic
autotroph
heterotroph
photoautotroph
chemoautotroph
phytoplankton
zooplankton



Diatoms

DESCRIPTION

These large, complex cells may live as solitary individuals, or may attach to each other to form colonies. They secrete siliceous skeletons—skeletons composed of a glass-like material. They need sunlight to produce food, so they are abundant floating in the uppermost layer of the ocean water where certain nutrients are available.

IMAGE CREDITS/SOURCES

Image courtesy Prof. Gordon T. Taylor, Stony Brook University - corp2365, NOAA Corps Collection https://en.wikipedia.org/wiki/Diatom#/media/File:Diatoms_through_the_

microscope.jpg

VIDEO LINK https://www.youtube.com/watch?v=Ygty9HxhFK4

AMAZING FACT

Not all diatoms are pelagic. Some of them attach to the seafloor or other objects, and some are even adapted to living in pools of intensely cold and salty water in sea ice in Antarctica.

ANSWERS prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Sponges

DESCRIPTION

These organisms are often vase-shaped and attached to the seafloor. They can be found at all depths, from the shallow sea to the deep ocean. They are multi-cellular, but are the simplest form of multicellular life, as the cells are not organized into tissues or organs. Their shapes allow them to filter water through their skeleton, collecting tiny food particles in the water that they use for food.

IMAGE CREDITS/SOURCES

Image courtesy of the NOAA Office of Ocean Exploration and Research, 2019 Southeastern U.S. Deep-sea Exploration.

https://oceanexplorer.noaa.gov/okeanos/explorations/ex1907/logs/nov11/ media/glasssponge-hires.jpg

VIDEO LINKS

https://oceanexplorer.noaa.gov/video_playlist/start/canyon_ spongeapalooza.html https://oceanexplorer.noaa.gov/news/oer-updates/2020/sponge-discovery.html

AMAZING FACT

Although you may be more familiar with sponges with a soft, organic skeleton that you might use to wash your car, some sponges have mineralized skeletons, including the "glass sponges" whose stiff skeletons are composed of glass-like silica. ANSWERS prokaryote eukaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Sargassum

DESCRIPTION

These multi-celled organisms form large individuals that consist of branch-like stipes and leaf-like fronds. They have gas-filled sacs that keep them floating in the uppermost part of the ocean, because if they sank into deeper water, they would not be able to produce food and would die.

IMAGE CREDITS/SOURCES

University of Southern Mississippi Gulf Coast Research Laboratory https://www.aoml.noaa.gov/news/tracking-sargassum/

VIDEO LINK https://sanctuaries.noaa.gov/earthisblue/wk247-dandelion-siphonophore.html

AMAZING FACT

Sargassum is so abundant in one part of the Atlantic Ocean that it is called the Sargasso Sea. The Sargasso Sea provides shelter for some juvenile sea turtles.

ANSWERS prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Coccolithophores

DESCRIPTION

These single cells include a nucleus as well as specialized chloroplasts that help them harness the energy of sunlight to produce organic molecules. The cell surrounds itself with protective overlapping disc-shaped plates that are made of mineralized calcium carbonate. These plates fall apart after death and become part of sediment on the seafloor.

IMAGE CREDITS/SOURCES

Image courtesy Alison Taylor, University of North Carolina Wilmington Microscopy Facility/Wikimedia Commons

https://www.colorado.edu/today/2015/03/25/shell-shocked-ocean-acidificationlikely-hampers-tiny-shell-builders-southern-ocean

VIDEO LINK

https://www.youtube.com/watch?v=EMNuYOEBOWI

AMAZING FACT

The sedimentary rock chalk, used to decorate sidewalks, is made up of millions of coccolith plates that are millions of years old.

ANSWERS prokaryote eukaryote eukaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph heterotroph chemoautotroph chemoautotroph zooplankton



Orca

DESCRIPTION

This sleek, black and white, highly intelligent top predator can be almost as big as a school bus. They live in groups and hunt their prey, often seals and sea lions, in packs. Because these organisms need to breathe, this form of prey is easier to manage than trying to chase prey into the deep ocean.

IMAGE CREDITS/SOURCES

Photo credit: NOAA Fisheries https://www.fisheries.noaa.gov/species/killer-whale

VIDEO LINK

https://videos.fisheries.noaa.gov/detail/videos/b-roll:-whales-and-dolphins/ video/1092315332001/b-roll:-killer-whales-in-alaska?autoStart=true

AMAZING FACT

Orcas have complex family and social structures. Often a pod will include more than one family, and each family will include multiple generations.

ANSWERS

- prokaryote
- eukaryote
- plankton
- nekton

benthos

pelagic

benthic

autotroph

heterotroph

photoautotroph chemoautotroph phytoplankton zooplankton bacterioplankton



Tuna

DESCRIPTION

These sleek, fast, strong swimmers are popular with commercial and recreational fishermen alike, and you can easily find them at your nearest grocery store. Unfortunately, this has led to them being over-harvested in some parts of the ocean. We might consider ourselves their predators, but for many similar, but smaller organisms in the ocean, our Marine Mystery Organism is a top marine predator.

IMAGE CREDITS/SOURCES

Credit: NOAA https://www.fisheries.noaa.gov/bulletin/atlantic-bluefin-tuna-and-northernalbacore-quotas-and-minor-change-atlantic-tuna-size

VIDEO LINK https://oceantoday.noaa.gov/bluefintuna/

AMAZING FACT

"Tuna" includes many different species, and some are more over-fished than others. If you eat tuna, it pays to know which type you are eating to help prevent over-fishing. ANSWERS prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph heterotroph chemoautotroph chemoautotroph phytoplankton zooplankton



Giant Clams

DESCRIPTION

These organisms live on the seafloor in the Indian and Pacific Oceans. They have two shells formed from hard, mineralized calcium carbonate. They can live to be 100 years old and can be well over a meter in length. When they are not threatened, they slowly part their two shells and feed by slowly filtering water through their bodies to collect food particles in the water. They also get food from photosynthetic organisms that live inside their tissues for protection.

IMAGE CREDITS/SOURCES

NOAA https://www.fisheries.noaa.gov/species/giant-clam-tridacna-spp

VIDEO LINK https://www.youtube.com/watch?v=rgG-HGwlCQ8

AMAZING FACT

These are the largest known clams on our planet. In horror movies, they have been known to trap divers by suddenly clamping their shells together, but in real life, this happens very slowly, and they are not a danger to humans at all. ANSWERS

prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Deep-Sea Corals

DESCRIPTION

These little organisms form colonies and together secrete calcium carbonate skeletons on the seafloor. They live in the cold, deep ocean and must depend for food on dead organic particles raining down from above that they gather with their specialized arm-like tentacles. The tentacles bring the food to the organism's mouth. Compared to similar organisms in the shallow ocean, these specialized food gathering structures are much larger.

IMAGE CREDITS/SOURCES

A red tree coral, seen on a Deepwater Exploration of Glacier Bay National Park expedition. Credit: NOAA Fisheries.

https://www.fisheries.noaa.gov/national/habitat-conservation/ deep-sea-coral-habitat

VIDEO LINK

https://oceantoday.noaa.gov/coralforestsofthedeep/

AMAZING FACT

These deep-sea corals are closely related to the more familiar shallow water corals, many of whom form reefs, but because they live in cold deep water where primary productivity does not occur, they grow much more slowly and form much more delicate colonies. The colonies may be as much as thousands of years old. ANSWERS prokaryote eukaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton

bacterioplankton



Sea Lilies

DESCRIPTION

These organisms attach to the ocean floor with stem-like features. They have many arms that they wave in the water to gather small food particles floating past. The arms then pass the food down to the mouth, where all the arms come together, at the top of a cup-shaped body.

IMAGE CREDITS/SOURCES

Image courtesy of the NOAA Office of Ocean Exploration and Research, 2017 American Samoa. https://oceanexplorer.noaa.gov/multimedia/daily-image/media/20210127.html

VIDEO LINK

https://youtu.be/IFWeqDcAYGk

AMAZING FACT

The animals are very ancient, with fossil examples dating back to almost 500 million years ago. They were known as fossils before they were discovered still living in the modern ocean. ANSWERS prokaryote eukaryote plankton nekton benthos benthos benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton



Pelagibacter

DESCRIPTION

This incredibly tiny and simple cell is extremely common in the world ocean but was not discovered until 2002, because it is very hard to isolate it from seawater samples. Now that we know how to find it, using DNA sequencing instead of microscopes, we find it in almost all ocean water samples. It is less than 1 micromillimeter (one thousandth of a millimeter) in length, yet plays a huge role in recycling organic carbon that is dissolved in ocean water.

IMAGE CREDITS/SOURCES

Image courtesy of the University of Hawaii at Manoa. https://oceanexplorer.noaa.gov/explorations/19gulfofalaska/background/ microbes/microbes.html

VIDEO LINK

None found specifically for *Pelagibacter*, but this video explains the microbial loop very clearly: <u>https://youtu.be/KtxUp2s_HIU</u>

AMAZING FACT

Pelagibacter is almost certainly the most abundant of all the bacteria in the ocean, which means it is also the most abundant on our planet.

ANSWERS prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton

bacterioplankton



Kelp

DESCRIPTION

This organism is attached to the seafloor and grows in cool shallow coastal environments. It cannot live in deeper water. It consists of stems and leaf-like fronds and can grow up to 45 m tall. It is often found in large groups, creating underwater "forests" that provide shelter for many other marine organisms.

IMAGE CREDITS/SOURCES

NOAA https://sanctuaries.noaa.gov/visit/ecosystems/kelp-welcome.html

VIDEO LINKS

https://www.youtube.com/watch?v=GcbU4bfkDA4 https://youtu.be/HGMvPqfcDOk

AMAZING FACT

Kelp forests are similar to the warmer water coral reefs in providing habitat for a rich variety of other organisms that contribute to a complex ecosystem. Kelp forests, like coral reefs, are endangered by human activities, especially climate change.

ANSWERS

prokaryote eukaryote plankton nekton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton



Giant Isopod

DESCRIPTION

This organism is huge, as much as half a meter long, compared to its tiny land-dwelling relatives. It has many segments and legs, and it swims about in the deep ocean, scavenging dead things and preying on other organisms.

IMAGE CREDITS/SOURCES

Image courtesy of the NOAA Office of Ocean Exploration and Research, Gulf of Mexico 2017

https://oceanexplorer.noaa.gov/okeanos/explorations/ex1711/logs/dec21/ media/isopod.html

VIDEO LINK https://youtu.be/jfnHQPkta-Q

AMAZING FACT

Giant isopods eat just about anything, dead or alive, and have even been known to attack sharks! They are closely related to the tiny land animals we call pill bugs.

ANSWERS prokaryote eukaryote plankton plankton benthos pelagic benthic autotroph heterotroph photoautotroph chemoautotroph phytoplankton zooplankton