



KIDS ENVIRONMENTAL LESSON PLANS

This lesson plan developed by:



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PROGRAM

All That Glitters

Overview:

An activity highlighting what happens to light and colors in the deep sea.

Ocean Literacy Principles:

5. The ocean supports a great diversity of life and ecosystems
7. The ocean is largely unexplored

Key Concepts:

- Experiment with a model of what happens to light and colors as one descends into the ocean
- Describe at least two adaptations to low or no ambient light on the part of deep-sea organisms
- Experience the impact of bioluminescence on finding food and becoming prey in the deep ocean
- Describe the positive and negative values of being able to produce light

Materials:

For whole group:

- Couple of flashlights or glow sticks

Per student:

- Deep sea dive goggles made with:
 - blue plastic sheets (report covers or index separators)
 - rubber bands
 - paper clip
 - binder clip



- small bag or container

Per student pair:

- Red, orange, yellow, green, blue, dark brown, black sheets of paper, felt or foam
 - felt or foam are a bit easier to pick up for the Dark Ocean Game
- Color in the Sea Student Handout Chart

Set-up Prior to Activity:

1. Create deep sea dive goggles: Cut the blue plastic into strips approximately 8.5 inches long by 3 inches wide. Punch a hole in the middle of one end of every strip of plastic. Thread 4-8 sheets of plastic through the regular paper clip. Tie one end of a cut rubber band to this paper clip. Tie the other end of the rubber band to one of the silver ends of the binder clip.
2. Cut colored papers into squares (leaving enough black paper in whole sheets), and separate by colors so that black, brown, red, orange, yellow, green and blue are together.

Duration:

2 hours

Physical Activity:

Moderate

Background:

This activity allows students to explore the nature of light, ask what happens to light as it passes through the ocean and speculate on how deep-sea animals deal with living in the dark. During the 2002 South Atlantic Bight Expedition, Islands in the Stream, two scientists from the Harbor Branch Oceanographic Institution, Dr. Tamara Frank and Dr. Edith Widder, studied vision and bioluminescence in the deep sea.

Of particular interest were animals with large eyes that live on the sea floor in the aphotic zone. Many animals that swim in open water (pelagic) in the mesopelagic or twilight zone have large eyes relative to their body size. Large eyes capture what little light is available. As depth increases below the mesopelagic, eye size in many organisms decreases. For example, two species of bristlemouths, *Gonostoma denudatum*, a mid-water fish, and *Gonostoma bathyphilum*, a deeper water fish, have different eye sizes. The mid-water species has much larger eyes. The deep-water species has much smaller eyes—the result you would expect if eyes had no value in the total absence of light. However, an enigma exists. **Many animals living on the deep-sea floor sea have huge eyes!** One possible value of vision where there is no ambient light is that some deep-sea organisms make their own light—they are bioluminescent.

Activity:

Introduction:



1. Challenge the students to observe what the underwater world looks like by using Deep Sea Diving Goggles. Pass out the black paper, Deep Sea Diving Goggles, and paper squares to each pair of students.
2. Explain that the black piece of paper represents the darkness of the deep sea. Spread the different colored paper squares on the black paper.
3. Use only one layer of the Goggles to observe the colors of the squares. Add another layer and observe. Continue adding layers, simulating what it looks like to go deeper into the ocean. What happened with each color? The blue plastic enables students to see how colors appear in deeper water. The blue plastic filters out other colors just as water absorbs them. Students should observe that the color black disappears first, followed by red, then orange, then yellow. Distribute the Color in the Sea Student Handout chart to each student group if you would like them to quantify their observations.
4. If they were fish wishing to hide in the mesopelagic twilight zone, what colors would be the best camouflage? Black and then red.
5. Introduce bioluminescence using the glowstick or flash light. Demonstrate turning it on. Ask the students for their experiences with bioluminescence: fireflies are the most common among eastern US students. Black light posters are fluorescence—a very different process. Observe the flashlight with the goggles on. How might deep-sea species use the light they make? Discuss counter-illumination, finding a mate, finding prey, attracting prey and startling predators by blinding them. What color would be the most effective for bioluminescence —blue as it penetrates water most easily.
6. Visit the South Atlantic Bight OE expedition on the web and see what the scientists were studying about bioluminescence.

Dark Ocean Game:

1. To do this exercise, select the first set of students; give them flashlights, bags and goggles.
2. Spread felt, foam or paper squares thinly on the black paper on the tabletop and tell them this is their food. They must find it in the dark, wearing the goggles. They are fish living in deep water where there is very little light. They may use the flashlight, their bioluminescent organ, to look for food, but whenever it is on, you may tag them because they are visible to a predator—you. When you tag them, a gulper eel has eaten them. They may only use one hand to collect food using their thumbs and forefingers to pick up one item at a time and place it in their bag. Students not playing will watch to make sure the rules are followed. Anyone being rowdy loses.
3. With goggles in place, dim the lights and let the students begin feeding. If they can see the prey, they may feed without the light, but the light will illuminate almost invisible items. Play until you have tagged about 1/2 of the students. Repeat with another group. The students may keep their bags when tagged. They just have to stop eating.
4. Have the students evaluate the contents of their bags for colors selected. Add up all the felt, foam or paper squares eaten by color versus those left on the table by color.

All that Glitters (cont.)



Discussion:

1. Were certain students less visible to predators than others? Was there something about their clothing that may have helped them stay invisible? What is your evidence for this?
2. How well were you able to see the prey with your flashlight off? On? Did the colors make a difference in your ability to see a prey item?
3. When you used the flashlight, did you develop a strategy that decreased your chances of being eaten by the gulper eel? What did you do to avoid becoming prey?
4. Did you benefit from another's flash of light? How?
5. Did the colors influence those items eaten? If so, in what way?

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Student Handout

Color In The Sea

You are hunting for bits of food in the “twilight zone.” Randomly arrange your colored squares on the black background. Put on your blue goggles to simulate light conditions in the “twilight zone,” using 2 or 3 layers (depending on the ambient light in the room. Quickly pick up the first ten pieces of :food: you see. Record your results. Repeat with another partner, record results. Analyze your overall findings.

Partner	Red	Orange	Yellow	Green	Blue	Black
1						
2						
3						
4						
Total:						