Lesson Plan 14

Light at the Bottom of the Deep, Dark Ocean?

Focus
Feeding adaptations of some deepwater organisms

Focus Question
What are some adaptations that might help deep-sea fishes to find food in the dark deep ocean?

Learning Objectives
Students will experience the impact of bioluminescence on finding food and becoming prey in the deep ocean.

Students will be able to describe the positive and negative values of being able to produce light.

Materials
For the class:

- ☐ Long table in open space that can be made dark; push several tables together, pull down shades and turn off lights; cover table with black paper
- ☐ Bag or two of Skittles candy

For each student:

- ☐ Deep Sea Dive Goggles from All That Glitters; use hole punched at each end and tie 18-inch strings (or use paper clips and very long rubber bands) in holes so they may be worn hands free as a mask
- ☐ Flashlight
- ☐ Student worksheet
- ☐ Snack-size plastic bags

Audio/visual Equipment
None

Teaching Time
Two 45-minute periods

Seating Arrangement
Students take turns in large groups depending on size of the table and number of flashlights

Key Words
Adaptation
Camouflage
Photic zone
Aphotic zone
Bioluminescence

Background Information
This exercise should be preceded by *All that Glitters....* It uses some of the same equipment and assumes that the students have an understanding of light, light in the ocean and bioluminescence. The students should have already worked with colors in the ocean.

Deep-sea fish use color to help hide—they may be camouflaged. Red is good camouflage since red light disappears in shallow water. Black is also useful in the dark. In this exercise students will apply what they have learned about color.

Finding food in the deep sea may be aided by use of bioluminescence—fish may have light organs that illuminate the surrounding water, revealing prey. On the other hand, when a fish lights up looking for prey, it exposes itself to predation by a larger fish. Bioluminescence is an adaptation to life in the deep sea. It may be useful for communication among members of a species, for attracting a mate, it may illuminate prey or attract prey, and it is used for counter-illumination to obscure its outline against the lighter surface.

In this exercise, students will be deep-sea fish with light organs that are used to illuminate prey so that they can eat them. They may also eat what they can find in the dark. The teacher will be the large predatory gulper eel.

Learning Procedure

1. The day before this exercise, remind the students of what they learned in *All that Glitters...* about light and color in the deep ocean. Suggest that they dress in clothing that would make good camouflage in the deep sea for the next class. Red or black would be best, with long sleeves and good coverage, but do not tell them this—leave it up to them. Students wishing to go to extremes might choose to bring a face covering ski mask. For this activity they will be modeling the behavior of deep-sea fish that feed using bioluminescence.

2. To do this exercise, select the first set of students, give them flashlights, plastic bags and goggles. Spread Skittles 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 Skittles eaten by color versus those left on the table by color.

5. Allow all students time for reflection by having each student fill out the Student Worksheet. Then have a class discussion about the questions.

The BRIDGE Connection

www.vims.edu/bridge/biology.html

The "Me" Connection

Research the characteristics of deep-sea fishes verses surface-water fishes with regard to vision and bioluminescence. Compare with human vision and eyes as well as our sources of illumination.

Connection To Other Subjects

Physical Science, Chemistry

Evaluation

Student Worksheets may be collected for assessment; classroom participation in activity and discussion.

Extensions

Have students visit http://oceanexplorer.noaa.gov to check out the 2002 Islands in the Stream Ocean Exploration.

Research the chemistry of bioluminescence and its distribution among different kinds of organisms. Which species make their own light and which have mutualistic symbionts that produce the light for them.

Write a paragraph about how you felt as a deep-sea animal that uses bioluminescence.

Resources

www.biolum.org – Information about bioluminescence

Student Handout

1. What color clothing did you choose to wear to class? Why did you select these items? Were they effective? What evidence do you have for this conclusion?

2. Did you do anything special to cover your face, hair or other parts that might show up well? If so, what? Did it work well and why?

3. 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?

4. 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?

5. Did you benefit from another's flash of light? How?

6. Did the colors of the prey influence those items eaten? If so, in what way?