OIMB GK12 CURRICULUM

5th Grade **60 minutes**

BIOLUMINESCENCE

Oregon Science Content Standards:
5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

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

Goals: Students will be able to

- identify bioluminescence as a characteristic of some deep-sea organisms
- describe how bioluminescence is used by different deep-sea organisms
- understand how bioluminescence is an adaptation for life in the deep sea.

Concepts:

- Many animals in the deep sea use bioluminescence for camouflage, to attract prey, and to communicate with each other.

Materials:

- PowerPoint of animals exhibiting bioluminescence. Excellent photographs of luminescent organisms can also be found at the website www.lifesci.ucsb.edu/~biolum/organism/photo.html
- 7 Small glow sticks (note: glow-in-the-dark tape cut into squares or glow-in-the-dark objects such as glow-in-the-dark wall decorations could be used instead)
- Morse code strips (photocopied from worksheet). Photocopy the codes and cut into individual code strips. You will need pairs of codes—one code per student, but each code going to at least 2 separate students. For those codes where reading the code upside down will result in the wrong code, arrows indicate the direction the code needs to be read, *from left to right*.

Tips:

- The activity needs to be done in a completely dark room—perhaps in the cafeteria, on the stage, or in a room with no windows.
- Provide plenty of time for practicing with Morse Code. If there isn't enough practice, then some of the students will not be able to transmit or read the correct signal. Make sure that all of the students in front are facing the class, and that all of the seated students can see all of the glow sticks. The students in front may need to hold them at their own eye-level.

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Background:

See the website www.lifesci.ucsb.edu/~biolum/organism/photo.html for information and pictures.

Lesson Plan:

1. Turn off all of the lights in the room and have the students imagine how they could send a message to a friend across the room if they could not use their voice. Ask the students to imagine how they would find a candy bar in the dark room. Turn on the lights, and have the students list their ideas.
2. Have students guess the meaning of the term *bioluminescence*. Contrast this to fluorescence/phosphorescence. *In fluorescence and phosphorescence, an external light is absorbed and reemitted. The affect lasts longer in phosphorescence (e.g. glow in the dark stickers, glow stick). In bioluminescence, light is produced by a chemical reaction taking place inside an organism, rather than from the absorption and reemitting of an external light.*
3. After defining bioluminescence, have the students identify any animals that they have learned about or seen, such as fireflies or plankton, which exhibit bioluminescence.
4. Show the students pictures of different organisms exhibiting bioluminescence (use the website above or attached PowerPoint). Discuss the reasons why animals in the deep sea might exhibit bioluminescence- for camouflage, to attract prey, or for communication. Stress the importance of bioluminescence used as communication in the dark.
5. Explain the Morse code briefly to the students. Dashes are LONG, and Dots are SHORT. Draw several examples of brief Morse codes on the board, and have the students recite the code out loud. For example, draw .._._ on the board, and all together, have the students recite "short short looooooong short looooooong". Continue practicing until the students understand how to read the code.
6. Hand out the Morse code strips. Advise the students that their code needs to be kept secret, so that their neighbors don't know what their code is. Have them look at their code and figure out (silently) what their Morse code signal is. They need to commit it to memory for the activity. Give them enough time to do so, before having them hide their strips in their pockets or under their notebooks.
7. Stand in front and demonstrate to the students how to use the Morse code with the glow sticks. Cover the glow stick with your hand (this is why the short sticks need to be used). Then, remove your hand very briefly, and cover the glow stick again, to demonstrate "short". Then, remove your hand for 3 or 4 seconds before covering the glow stick again to demonstrate "long". Use the codes that you practiced on the board earlier to demonstrate how you use the glow stick to transmit the code through the dark. After showing the students how to send a code a few times with the lights on, turn the lights off and demonstrate it again, so that the students can see what it will look like in the dark.
8. Now, tell the students that the object of this activity is for students to find a partner in the class, in the dark. Their partner is a student in the class who has the Morse code that matches their own. Call up about 7 students to the front of the room. For visibility, they all need to be in front, in the line of sight of every other child in the classroom. Give each one a glow stick, and then turn off the lights. Have the

students transmit their OWN Morse code using the glow stick to the other seated students in the class. Have the students seated in the class pay attention to each of the different signals at the front of the class, to see if their partner is up in front. If the seated students think that their partner is up in front, have them wait at their seats until the lights are turned back on. When the lights are turned back on, have the seated students bring their Morse code strip and come to the front of the room and stand next to their partner. Check to see if any of the paired students are actually partners, and discuss difficulties in transmitting and reading the code. Make adjustments as necessary.

9. Repeat as necessary, until at least one group is correctly partnered, or until all students have had a chance to either transmit their code, or find their matching partner.
10. As an extension, predators in the deep sea may mimic other animals' signals. The teacher can stand up front with the students, and transmit codes to the class that mimic the codes of other students seated in the class. Then, when the lights come back on and some students come up to the teacher to be "partners", explain that you are a predator, and that you mimicked their signals to attract them to you so that you could eat them!
11. At the end of the activity, discuss again with the students ways in which bioluminescence is used in the deep sea. Discuss why this is a necessary adaptation for organisms living in the deep sea. Discuss limitations that were encountered in the class activity, and relate the difficulties to difficulties that organisms in the deep sea might encounter.

Assessment: Have the students write a journal response, or a paragraph, where they assume the identity of any bioluminescent deep sea creature. Have them explain what it is like to live in the deep sea, why they exhibit bioluminescence and the problems that they encounter by being bioluminescent.

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