ACTIVITY 26

HIDE AND SEEK

WHAT DOES IT LOOK LIKE UNDER WATER? WHAT DO ANIMALS SEE? IS CAMOUFLAGE THE SAME BELOW WATER AS ABOVE?

SCIENCE SKILLS:
- observing

CONCEPTS:
- Color patterns that are easy to see in air may be very well camouflaged under water.

MATH AND MECHANICAL SKILLS PRACTICED:
- drawing
- cutting with scissors

SAMPLE OBJECTIVES:
- Students will be able to explain why color patterns that are easy to see in air may be hard to see under water.
- Students will experience the problems predators face when searching for camouflaged prey and develop foraging strategies for these prey.

INTRODUCTION:
Some colors of light (wavelengths) are absorbed faster than others when passing through water, particularly red and yellow. Blues are transmitted best. These facts have interesting consequences for color and color patterns and their distribution among animals that live in water. Fish that live in shallow, well-lighted water may have color vision. But what do most fish see? Fish that live in murky or muddy water may be almost blind and depend on touch or electrical fields to sense their surroundings.

In this exercise your students will experience what the world looks like to fish that live far enough below the surface that the world looks blue, the only color to effectively penetrate very deep.

MATERIALS:
For class:
- blue cellophane from school art supply store
- stapler
- clear tape
- string
- underwater photographs cut from magazines that show bright colors and others that are of wide views that are predominantly blue; ***SCUBA*** magazines or ***National Geographic*** are good sources

For each student:
- red construction paper about 6" x 9"; half a sheet
- other contruction paper or card or poster stock about 4" x 11"
- scissors
- pencil

LESSON PLAN:

BEFORE CLASS: Have the students review their knowledge of fish anatomy in drawing and cutting out a fish made of red construction paper. Did they remember paired pectoral and pelvic fins, the tail (caudal), dorsal and anal fins? Explain that the red color is typical of many California saltwater fish that hang out around rocks in 10 m (33 ft) or more of water. Many shallow water nocturnal fish are also red, and red is a very common color for deep sea animals in general.

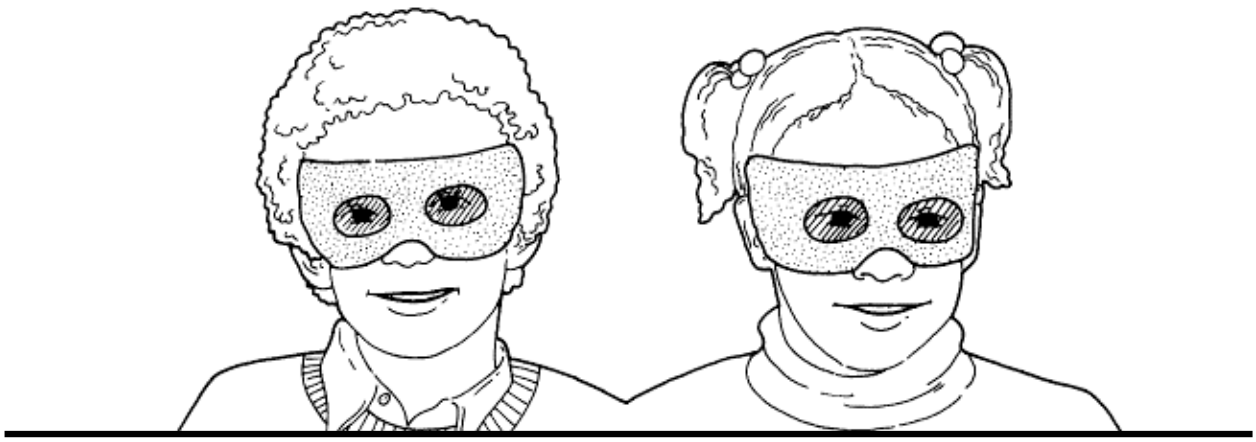
Have each student construct a pair of goggles using the provided pattern or an aide or parent might make a permanent set for your use. Inexpensive blue cellophane available in rolls from school art supply stores is folded in three layers or four layers over the eye holes. (Test whether three or four layers gives the best result when looking at a red fish on a black background. The quality of the cellophane changes from time to time so testing it is a good idea.) Tape the cellophane in place. Staple or tie strings which will hold the goggles on a child's head to hold the goggles in place. Explain they will use the goggles to see as fish see. Do not allow students to wear the blue goggles for more than five minutes. Wearing them for a long time may bleach (temporarily) some of their visual pigments selectively. This does not do permanent damage, but it can feel weird to have your color vision temporarily change. It takes much longer than 5-10 minutes for this to happen.

DURING CLASS:

METHODS: When the students are not in the classroom, distribute all the red fish around the room against dark backgrounds - green, blue, brown black, magenta etc. Turn the classroom lights off and create dim light. It is dark in 10 or 15 m of water. Pin or tape the fish to bulletin boards, prop on shelves, put them in corners on the floor. Hold a pair of goggles up to check that you are placing the fish against backgrounds with the same value.

Meet the class outside the room with the goggles. When the goggles are in place, have the students enter the room and sit down. Tell them they are predators searching for red fish in 10 m of water. They are wearing the goggles because blue is the primary color of light that penetrates very far into water. Have them start searching for the fish at the same time. Time them if you want to repeat the exercise without the goggles.

Stop them before all the fish are found and have them sit back down. Remove their goggles. Now can they see the fish they missed? Why were the fish hard to see? The filter allowed only blue light through. The fish reflect only red. Under water there would be no red to see so the fish look black. If you wish, repeat the exercise without the goggles to compare the time it takes to find the fish when red is visible.



RESULTS AND DISCUSSION:

A fish that appears very colorful to us (red) may, in fact, be very well CAMOUFLAGED from predators. The fish is hard to see because red light is missing as it is being absorbed by the water and, therefore, cannot be reflected to the predator's eyes.

Use the color photographs to illustrate. Any colorful underwater photograph was shot with a flash which provided all the wavlengths of light. Any photo in which the predominant color is blue shows what it really looks like under water.

CONCLUSIONS:

You cannot make judgments about animals based on human perceptions. Fish in shallow, clear water may see things in a way that is similar to us, but fish that live in dark, murky water or deep water probably do not have color vision and may use vision very little, depending on other senses.

EXTENSIONS:

1. What about other senses? Can your students think of another sense that water animals might depend on? Sound is one good choice. Have them try an experiment using sound. Call it "Swamp." You should do Swamp outside. You will need blindfolds for the class because Swamp happens at night. Designate all but one of your students as frogs. How do frogs find mates? The males call and the females find them by the sounds. Have your students ever heard frogs calling? Students can do their own interpretation of this sound. It may range from the peep of spring peepers to the bonk of a bull frog. Half the frogs are female and half are male. Assign half to be male callers and half to be female searchers. The male frogs will call and the females will find them by following the sound. A male frog may call as many females as he can. When the female finds a male, she should hang on to him and stay put. The male can stop calling after finding one female or keep calling, it is up to the individual to choose.

The remaining student is the alligator. It will find frogs to eat by following the frogs' calls, but it can also eat frogs it bumps into accidently. Any frog touched by the alligator is considered eaten and removes its blindfold and leaves the pond. The teacher can keep other animals from leaving the pond by telling them to turn back when they get too far apart.

Let Swamp run until some of the males have more than one mate and some of the frogs have been eaten. Have the students sit down and talk about their strategies for searching. How did it feel to be in the dark with the possibility of being eaten? Would it have been better or worse if the females had been calling too? Would even more frogs have gotten eaten? Did more males get eaten than females? Consider that calling made the frogs more vulnerable. The males are more expendable than the females since one male can mate with more than one female.

2. What about fish that live in very murky water and depend on touch and taste (or smell) to decide what to eat? Could you put together a variety of food items, some desirable and some not, which your students could find while blindfolded? Would they be willing to decide whether or not to eat something they could not see? Many animals must do so. Catfish use whiskers to feel their food and sense its chemical composition. This activity might make a great Halloween party with spaghetti for worms, etc. Just make sure that everything is edible, if not good to eat by kids' standards.