ENRICHMENT: Night Hike

Objectives and Summary: This series of activities is designed to be used on Teacher's Choice night. They focus on gaining an understanding of some common nocturnal adaptations, and on general sensory awareness.

Background: Nocturnality is a behavior characterized by being active during the night and sleeping during the day. The common adjective is *nocturna*l, versus *diurnal* meaning the opposite (animals that are active during the daylight, and sleep at night).

Nocturnal creatures generally have highly developed senses of hearing, smell, and specially adapted eyesight. Some animals, such as cats and ferrets, have eyes that can adapt to both low level and bright day levels of illumination. Others, such as some bats, have eyes that can function only at night; many nocturnal creatures including some owls have large eyes in comparison with their body size to compensate for the lower light levels at night.

Diurnal animals, including squirrels and songbirds, are active during the daytime. *Crepuscular* (creatures active during the twilight hours of dawn and dusk) species, such as rabbits, skunks, cats, and coyotes, are often erroneously referred to as nocturnal.

Specifically, nocturanlity can offer many different benefits:

Resource Competition: Being active at night is a form of niche differentiation, where a species' niche is partitioned not by the amount of resources but by the amount of time. i.e. Hawks and owls can hunt the same field or meadow for the same rodents without conflict because hawks are diurnal and owls are nocturnal. This means they are not in direct competition for each other's prey.

Water conservation and thermal regulation: Another benefit is to avoid the heat of the day. This is especially true in arid biomes like deserts, where nocturnal behavior prevents creatures from losing precious water during the hot, dry daytime.

Many plant species native to arid biomes have adapted so that their flowers only open at night when the sun's intense heat cannot wither and destroy their blossoms. These flowers are pollinated by bats, and other nocturnal creatures.

Predation/Avoiding Predation: One of the reasons that lions prefer to hunt at night is that many of their prey species (zebra, antelope, impala, wildebeest, etc.) have poor night vision. Many species of small rodents are active at night because most of their potential predators are diurnal. Also, there are many diurnal species that exhibit some nocturnal behaviors. For example, many seabirds and sea turtles only gather at breeding sites or colonies at night to reduce the risk of predation to themselves and/or their offspring.

(Adapted from Wikipedia)

Standards:

Materials (Found in your night hike bag in the teacher tool box)

- Colored squares of construction paper (1 per student)

- Candles (1-4)
- Lighter or matches
- Film canister with a scented cotton ball

Location and Duration: The perimeter trail area, or Fire Sculpture-Snoqualmie Valley Trail loop. 10-60+min, depending on which activities you choose.

HS Leader Role: Your HS leaders may have been trained to facilitate some of these night hike activities. If so you may wish to task them with leading an element or two. Otherwise, direct your leaders in helping to manage the fox walk line, help manage wet noses/hands during the wet noses activity, get tea lights lit and set out, etc.

Procedure

Introduction (Fox Walk/Deer Ears): Use these 2 sensory awareness activities to start your night hike. They are intended to help students begin to notice their non-visual senses, and to allow for a review of the concept of adaptations.

In a circle, have a conversation about student experiences with coyotes/dogs and with deer. Ask questions designed to have students recall how deer react to sound, and how and why predators walk in a certain way (demonstrate a toe-heel walk, vs. our typical heel-toe gait. The former lends itself to quiet). Demonstrate the power of deer ears by directing the group to firmly cup hands behind their ears and ***make sure there is no gap between head and hands. Remove hats and hoods*.** Next, face a distant sound (like I-90). Remove and replace the deer ears in succession, and marvel at the benefit to your hearing. Finally, lead the group on a short (5min) and silent fox/coyote walk, stopping occasionally to apply your deer ears. Conclude with a short debrief. What did students notice along the way? What did they hear? Was it easier to fox walk in some locations compared to others?

Conclude by stating that the senses of hearing and touch are some examples of senses heavily relied upon by nocturnal animals. Review/discuss nocturnal vs. diurnal. Can students list some other examples of nocturnal adaptations?

Alternative Intro

Give students the scenario: "You are a nocturnal animal who wants to go hunting at night. It is far too dark for you to see and you don't want to trip while you're hunting. What other sense can you use to feel your way along the ground?" (*The sense of touch*.)

Have students form a single-file line and put their hands on the shoulders of the person in front of them. You stand at the front of the line. Encourage the group to stay silent and keep their eyes closed so they can use their other senses to figure out where they are walking. Lead the group around a field or trail, walking over different mediums (grass, cement, etc.) and up or down slight hills.

After an appropriate length of time, stop the group and bring them together. Ask them discuss:

- Where did we walk?
- How did you know where we were traveling? *(Encourage students to relate how they used their other senses, especially touch and hearing, to notice changes in the terrain.)*
- How is this similar to an adaptation of a nocturnal animal? *(At night, it is very dark, so animals cannot always rely on their senses to see. Many animals have a hyper-developed sense of touch to help them survive at night. Dogs have sensitive hairs on the bottom of their paws that let them feel the terrain as they walk on it. Cats and other animals have whiskers that allow them to feel ahead of them in the dark. Raccoons have sensitive paws that they use to hunt for food.)*

Lesson/Activity

Colored Squares

1. Ask students what it is like seeing at night. Are there as many colors as there are during the day? Why is that? (*Most animals have specialized cells in their retinas called rods and cones. Cones help to see in color and detail. Rods are used in low-light situations, and help us see moving objects that we do not need to see in great detail*.)
2. "We are going to test how well our cones (the cells that see color and detail) work at night."
3. Once outside or in a low light/dark environment, pass out one square of construction paper to each student. Tell students to look at their square and determine what color they think it is. Look at the color of the squares held by the person next to them. Do they disagree or agree with their neighbors about these colors? What are they?
4. Now, either turn on the lights (if inside) or go around the circle with a flashlight. Have students take another look at their colored squares. Does the color look different now? Any surprises?
5. The lesson here is that to accurately see color we need lots of light. What might this tell you about the nocturnally adapted eye? (*Many nocturnal animals are color blind. Some bats for instance, have no cones at all. On the upside, they are extremely good at detecting motion*.)
6. ***Please recollect as many colored squares at the end of this activity/night hike as possible and return them to the baggy.***

Deer Ears Long Distance Challenge

1. Have students line up, either standing or sitting. Ask everyone to sit quietly and listening for one minute. What kind of noises do they hear?
2. Ask students to think of an animal that might have excellent hearing (*like a black tailed deer*). How are their ears different than ours? *(Review deer ears if you did it for the Intro, or point out that deer have ears that are much larger and cup-like, and demonstrate deer ears as described in the intro.)*
3. Ask students how else the ears of nocturnal animals are adapted to hear better. *(Many animals can pivot their ears to redirect them towards a sound.)* Have students practice "flipping" their coyote ears so that they can listen to sounds directly behind them.

4. "We are going to test our deer ears. How far away do you think I can stand while talking in my normal voice, and still be heard by you, if you are using your deer ears?" *(take a few guesses from the group)*

5. Line up students near an open space. Tell them that you will be speaking a direction in your normal/quiet conversational voice ("Raise your right hand," "clap twice," "can you hear me now?" etc.) for them to follow. If they successfully follow your instruction, you will move backwards away from them to make it more difficult. Continue giving instructions and backing away until they can't hear you anymore. As you return to the group count your paces (count every time your ***right foot lands, not both right and left, as one pace).*** An average sized adult will take about 20 paces in 100ft. Compare the actual distance to what students guessed beforehand.

Note: Everyone will be surprised by the power of deer ears. You will be able to be clearly heard from between 200-300ft away. If you wish to enhance or extend this activity, you could compare deer ears to our regular human ears by running the long distance challenge twice, one with and once without deer ears.

Wet Noses

1. "What are some animals that have a good sense of smell?" (Dogs, etc. Many different nocturnal animals have a great sense of smell too) What is a dog's nose like? *(It is usually wet.)*

2. "We are going to discover if having a wet nose improves your sense of smell!"

3. Have students stand or sit in a line or circle. Walk by them with a scented film canister, allowing them to smell the cotton ball/other material inside.

4. Next, direct students to use the water you will pour from a water bottle (just a few drops is fine) into their cupped and outstretched hands to wet the outside and insides of their nostrils. The wetter and more thorough the better!

5. Repeat the smell test again, this time with the wet nose.

6. Debrief: Was the scent stronger with a wet nose or a dry nose?

7. Why does having a wet nose help dogs smell better? *(It helps them pick up scent particles in the air and allows the scent particles to stick to their scent receptors better, also, dogs have roughly 200 million scent receptors, whereas humans only have 5 million.)*

8. Why is having a strong sense of smell a good adaptation for nocturnal animals? *(Nocturnal animals often have a hard time seeing in dim light. Having a strong sense of smell allows them to use another sense to "see" what is going on around them. Predators can sniff out where their prey has been in the past, and prey animals can pick up hints that a predator is coming.)*

Extension: Try having students identify different objects by smell, if you have access to a variety. You could try plastic bags filled with various scents: coffee, toothpaste, grass clippings, etc. Does having a wet nose make this process easier?

Bat/Moth

1. Ask students for ideas of what different types of animals rely on their sense of hearing to find prey. (*For instance, bats, who use echolocation*.)
2. Give instructions for Bat/Moth, a game similar to "Marco-Polo." Students make a large circle in an area that is flat and without hazards. Blindfold one student in the center of the circle. She becomes the "bat." Now select 2 students to be the "moths." The object of the game is for the bat to track down and tag a moth.
3. The bat uses "echolocation" to find the moths. The bat does this by clapping twice to make an echo-locating squeak. The moth then claps twice to simulate the sound wave bouncing off them. The bat takes two steps in the direction of the moth, and the slower moth can take one step away. The bat repeats this until it tracks down and tags the moth. ***Discuss safety concerns, and agree on rules.***
4. Rotate students in and out of Bat/Moth. If you need to move through people quickly, you can put multiple bats or multiple moths in play at once.
5. Debrief: Why is it important for nocturnal animals to have a strong sense of hearing? *(There is little light at night, so nocturnal animals must depend on their other senses to survive).*
6. What are some other specific nocturnal adaptations related to hearing? *(Owls have asymmetrical ear canals, which allow them to "triangulate" the location of their prey. Owls also have special feathers that allow them to fly silently through the night. Many different types of whales use echo location to hunt in deeper and darker parts of the ocean).*

Owl Eyes (this activity will work best after having been longer in the dark, towards the end of the night hike)

1. "All this time, your eyes have been adjusting to the dark. Now we are going to test and see how good our night vision really is." Discuss that over time, in low light situations, our pupils dilate to allow more light to enter our eyes. In bright light, our pupils dilate. It takes about 30min for our pupils to reach maximum dilation (this explains why when you suddenly awaken at night that you can often see the objects in your room much better than you could before falling asleep, immediately after the light went off.) Questioning students about the face and eyes of an owl can also help reach this understanding; owls being nocturnal hunters have need of very large pupils.
2. Have everyone cover one eye firmly with one hand. Make sure that students understand that they must keep that eye covered AT ALL TIMES for this experiment to work.
3. Light one or two candles and set them in the middle of the group/smaller expedition groups. Tell students to stare at a candle with their open eye. (If your candles will not work, you can use light from a flashlight shone on the ground or a natural light source, like the moon.)

4. Have students stare at the candle for approximately two minutes. Tell them a story while they are staring to pass the time (example story: The making of Owl)

    - **Summarize or read this example story:** There is an old saying, "wise as an owl". People are always saying that, but the truth is, owls were not always wise.

      Once upon a time, a long time ago, the Everything-Maker was very busy, making all the animals and all the plants and all the rocks and caverns and everything else that covered the earth.

      Owl had not yet been made. He ***had*** been given a voice. And two eyes. And a head and a body and strong wings. Owl was waiting his turn to be formed. "I want a long neck like Swan," Owl told the Everything-Maker. "I want red feathers like Cardinal and a beak like Hawk."

      "Yes, yes," mumbled the Everything-Maker. "Whatever you want. But you must wait your turn." The Everything-Maker looked sharply at Owl. "Your eyes are open again. You know that no one is allowed to watch me work. Turn around and close your eyes. I have no time for you now. I am busy creating Rabbit."

      The Everything-Maker turned his attention back to Rabbit who was shaking with nervousness. "And what do you want, little rabbit?" the Everything-Maker asked encouragingly.

      "Long legs and ears," Rabbit spoke softly. "And fangs. Could I possibly have a fang or two? And claws. I would dearly love to have claws!"

      The Everything-Maker smiled. "I think we could manage some claws and fangs." He smoothed Rabbit's long legs and ears.

      "Silly Rabbit!" Owl hooted loudly. "Why don't you ask for something useful, like wisdom?"

      "This is your last warning, Owl. Be quiet and wait your turn."

      Owl twisted around and glared at the Everything-Maker. "You have to do it," he hooted. "You have to give us what we ask. I demand wisdom!"

      "I warned you, Owl!" shouted the Everything-Maker. He shoved Owl's head down into his body, which made Owl's neck disappear. He gave Owl a shake, which made Owl's eyes widen in fright. He pulled Owl's ears until they stuck out from his head.

      The Everything-Maker snapped his fingers. "I have made your ears big, the better to listen. I have made your eyes big, the better to see. I have made your neck short, the better to hold up your head. I have packed your head with wisdom, as you have asked. Now, use your wisdom and fly away before you lose what I have given."

      Owl was no longer a fool. He flew quickly away, pouting and hooting.

      The Everything-Maker turned back to Rabbit, smiling gently. "Claws," he reminded himself. But Rabbit was gone. Rabbit had hopped hurriedly away, too afraid of the Everything-Maker to stay for his fangs and claws.

As for Owl, Owl knew if he angered the Everything-Maker again, he would lose all that he had gained. Even today, Owl only comes out at night, when the Everything-Maker is fast asleep. As for Rabbit, his claws and fangs are waiting. Perhaps someday... Now, let's see if we can experience a bit of what it is like to see the night like owl does…

5. After two minutes are up, put out the candles. Have the students switch and cover the other eye, and look around their environment. Switch back and forth a few times between the dilated and constricted pupil. They will notice a very significant difference in their ability to see; the original covered eye is still adjusted to the dark, while the eye that was staring at the candle no longer has night vision.

6. Debrief: How are nocturnal animals adapted to see better at night? *(Many nocturnal animals have extremely big eyes with wide pupils, to help them trap more light. Some animals, like cats and sea lions, have a tepidum lucidum, which reflects the light back out again, giving them a "second chance" to see. This is why cats' eyes seem to shine in the dark. Nocturnal animals generally have more rods than cones, allowing them to see shape and movement at night.)*

Conclusion: Conclude the night hike by reviewing some of the nocturnal adaptations you have experienced. What other sensory adaptations to plants or animals use to experience or interact with their environments?

Notes: If your group is particularly loud or talkative, let them know that they are more likely to fully experience nocturnal life and animals on their night hike if they remain quiet and observant.