

Predator-Prey Relationships

Summary

Students will:

1. Understand ecological systems.
2. Provide experiences to help citizens increase their sensitivity and stewardship for the environment.
3. Understand that ecological interrelationships cross political boundaries and effects can be global.
4. Understand the cause-and-effect relationship between human attitudes and behavior and the environment.

Setting

Classroom

Objectives

Students will:

1. Explain the relationships and interdependency between predators and prey.
2. List factors that can affect the size of a wildlife population.
3. Explain how people's attitudes towards predators may form.
4. Describe how predators at the top of the food pyramid function as an ecological barometer.
5. Describe the osprey's adaptations that make it an efficient bird of prey.
6. Describe the wolf's adaptations that make it an efficient predator.
7. Explain the current threats against ospreys, wolves, and other predators.

Materials

Activity #1:

- One small paper bag per "aquatic insect"
- Approximately 18-20 different "food chips"-- white and colored paper dots, poker chips, etc. (or any other material that can be easily picked up). 30 pieces per student is recommended in a proportion of two-thirds white to one-third colored pieces.
- One name tag per student

Activity #2:

- One large bag of M&M'S candies (enough for each student to have 10-15 candies)

Activity #3:

- Two or three fairy tales in which wolves or other predators play a role
- One copy of Rudyard Kipling's *All The Mowgli Stories*
- One copy of any non-fiction book about wolves
- Paper and pencil for each student

Activity #4:

- Paper and pens and/or tape recorders for taking notes
- Information about local laws and regulations affecting wildlife and/or predators

Background

Predators have been misunderstood by humans. When thinking about predator-and-prey relationships, most people usually sympathize with the cute little rabbit or the beautiful, brown-eyed deer that has to live in fear of blood-thirsty killers. But, as wildlife biologists know, it is the predators that are in trouble, not their prey. A large number of them are even on the endangered species list.

Humans are responsible for the majority of the troubles facing predators. People tend to feel animosity toward animals that kill other animals. Throughout history, humans have waged a war against predators, which they feared would prey upon their livestock or their children. This hostility extends even further, stemming from myths and fairy tales that portray predators as bad or evil. As a result of these negative connotations, North American predators, including eagles, wolves, mountain lions, and grizzly bears, were hunted almost to the point of extinction.

Unless people understand the vital role that predators play in maintaining the delicate balance of nature, predators will remain in trouble. In recent years, much more emphasis has been placed upon the importance of studying and maintaining predator populations and habitats. We can greatly benefit by utilizing them as a barometer of environmental health and for detecting potential problems before they reach serious levels.

When something disrupts the food chain at the bottom, it is magnified at each succeeding level. When it reaches the top, the disturbance appears as a major environmental disruption. This makes raptors and other predators at the top of the food chain especially vulnerable when the chain becomes unbalanced. For example, the chemical DDT was once widely used as a pesticide. Insects, fish, and small mammals absorbed the chemical as it washed into the water and food systems. Ospreys and other birds then accumulated

toxic levels as they consumed the poisoned prey. This resulted in high rates of weakened eggshells, inability to reproduce, and death by pesticide poisoning. The bald eagle, brown pelican, and peregrine falcon were placed on the endangered species list because of their severe population depletions. Because of this environmental barometer, people have begun to realize the potential danger to humans and are trying to find safer pesticides. (For more information about food chains, go to Lesson #2: It's All Interconnected.)

Both predators and prey have special adaptations that enable them to survive. The differences in food sources are very important. An herbivore usually has an abundance of food readily available, but it has to eat a large amount for sustenance. And while it is eating, it must avoid predators that are looking for their own dinner. In contrast, predators must work much harder to obtain their food. Prey is much scarcer than plants, and it must be captured and killed to be eaten. However, meat is a more concentrated source of nutrients, so carnivores don't have to eat as often as herbivores.

Physical adaptations help both predators and prey to survive. Prey species must often rely on escape as their best defense. They usually have a well-developed sense of hearing and can hear something approaching long before they can see it. Eyes of most prey species are located towards the sides of their heads, enabling them to see a broader range. However, they often don't notice a predator until it moves. Most hunted animals also have a keen sense of smell.

Animals that are preyed upon often live in groups, since there is safety in numbers, especially when feeding. If one animal senses danger, the entire group is alerted and can run for safety or dive into a protective shelter. Some species that are unable to run swiftly have developed other protective adaptations. Some examples are a porcupine's quills, a skunk's odor, venomous bites or stings, horns or antlers, an offensive taste, the protective coverings of the armadillo and turtle, and certain body postures, such as an owl ruffling its feathers to appear bigger, or an opossum playing dead.

Predators have a different approach to survival than do prey species. They have very good senses of smell and sight and tend to be very curious about every movement and scent. Rather than being afraid, they like to investigate new things. Predators usually have their eyes placed towards the front of their head, giving them three-dimensional, binocular vision, which is vital to their ability to catch prey. Predators also rely on speed and quickness, and their strong jaws and sharp teeth.

Predation is an absolutely essential part of the delicate balance of the environment. It is just as important to the prey species as it is to the predators, although this is often misunderstood. Hunters go for the easiest meal they can find, so they weed out the elderly, sick, or very young of a species. This makes the remaining population stronger and healthier. Without predators to maintain a proper balance in prey species, their populations would escalate to unnatural levels, and many animals would die of starvation or disease.

To understand the value of predation, it is important to remember that among all animals, the fiercest competition is between members of the same species – between muskrats and muskrats – rather than between members of different species – mink and muskrats. Animals of the same kind need exactly the same kind of food, shelter, nesting areas, and mates – and these resources are limited. When there are more animals trying to live in an area than there are resources available, the competition between them becomes disastrous. Some die of starvation, as one takes food from another. Others die of exposure, driven from protected territories by their own kind. Finally, overpopulation and severe competition seem to create social problems. Surrounded by too many of their own kind, animals become abnormally aggressive, irritable, may not mate readily, bear fewer and weaker young, sometimes fail to care for their litters, or may even destroy them.

Therefore, neither the hunter nor the hunted is wrong, good, or evil. Understanding their relationship and the integral part they play in a healthy ecosystem is essential to understanding our natural world.

Procedure

Activity #1: Predators, Prey, and the Food Chain

1. This activity illustrates the interdependence between predators and prey and how predators at the top of the food chain act as environmental barometers. It demonstrates the consequences of accumulation of pesticides in the environment and their effect upon predators and their prey.
2. Divide the students into three groups. In a class of 26 students, for example, there should be 2 "ospreys," 6 "fish," and 18 "aquatic insects." (There should be three times as many fish as ospreys and three times as many aquatic insects as fish.) Give each student a name tag that identifies what species he/she is.
3. Give each "aquatic insect" a small paper bag, which represents the stomach of whatever species is holding it. Distribute the "food chips" around in a large open space (open area outside, gym floor, or classroom space).
4. Give the students their instructions. The aquatic insects are the first to go looking for food. The ospreys and fish are to watch quietly on the sidelines. (The predators are watching their prey!) The insects have 30 seconds to collect as much food as possible and put it in their stomachs (bags).
5. The fish are now allowed to hunt the insects, while the ospreys still remain on the sidelines. The amount of time allowed should depend on the size of the playing area; 15 seconds may be enough in a classroom, while 60 seconds could be given in a large playing field. Each fish should have enough time to catch one or more insects. Each insect that is caught by a fish (tagged) must give its bag of food to the fish and then sit on the sidelines.

6. Now it's time for the ospreys to hunt the fish. The same rules apply, allowing 15-60 seconds of hunting time. All fish that are caught must go to the sidelines. Any fish still alive may continue to hunt for aquatic insects, and the remaining insects can continue gathering food chips. The ospreys simultaneously hunt the fish. At the end of the designated time period, all students should gather in a circle with their food bags.

7. Ask all students who are "dead," having been consumed, to identify what predator ate them. Next, ask the ospreys to empty their food bags onto the floor and count the number of white pieces and colored pieces that were in their "stomach." Write down the results. Then have any "living" insects and fish count their food pieces and list these results also.

8. Inform the students that each of the colored food chips represents a DDT, a pesticide that was sprayed onto nearby forests to combat insect damage and loss of timber. This pesticide is highly toxic and often is carried into the surrounding water systems, where it enters and accumulates in the food chain. Therefore, all of the aquatic insects that were not eaten by fish may now be considered dead from the pesticide if they have any colored food chips in their stomach. Any fish with half or more of their food supply contaminated are also dead. The osprey with the highest number of colored food chips will not die yet; however, it has accumulated so much of the pesticide in its body that the egg shells produced by it and its mate during the next nesting season will be so thin that the eggs will break. The other ospreys are not visibly affected at this time, but will continue to accumulate pesticides to toxic levels as long as they eat contaminated prey.

9. Discuss what the students just experienced. What are their observations about the food chain, how it works, how toxic substances can enter the food chain, and how it affects both predators and prey at all levels of the pyramid.

Activity #2: M&M's Game: Predator Populations

1. Explain that each student represents an osprey, which is a predatory bird. Therefore, the class as a whole represents a single predator population. Next, explain that ospreys prey upon fish as their food source. Bullheads are their favorite food. Show the students a bag of M&M'S and explain that the candy represents bullheads.

2. Give each student 10 M&M'S and explain that in this game, ospreys reproduce every five minutes, each pair producing one offspring. Then tell the students they may eat the number of bullheads they think are necessary for the osprey to survive.

3. Allow five minutes to eat the prey. Afterwards, identify those who ate none of their M&M'S. Explain that they represent ospreys that died from lack of food. Identify those who ate all, or all but one, of their M&M'S. These children get no more food, as there are no longer any reproducing pairs of prey left. Therefore, the predators will die of starvation. These losses represent losses to the osprey population. Those who ate a limited number of prey are the ones who will survive. They then are given one additional M&M for every two M&M'S that they still have. This represents the birth of more prey.

4. It should be clear to the students that they will survive best if they eat only a limited number of their M&M'S. If they eat none, or if they eat them all, they are out of the game, just as a real predator dies under the same conditions. Explain that animals require a minimum number of individuals in a given population in order to reproduce. If animals of a given species become so scarce that they cannot find a mate during the breeding season, the species is doomed. Consequently, predators must not over-hunt their prey when meeting their own energy needs. The interrelationship between predators and prey is much more complex than illustrated by this game, because in the wild, not only do the prey die and give birth, but the predators do also. This interdependency is a crucial aspect of the web of life.

(Adapted from Concepts and Critters. Oklahoma Department of Wildlife Conservation)

Activity #3: Words CAN Hurt!

1. Discuss how you think most people form their attitudes about the environment, wildlife, and predators.
2. Examine several fairy tales, such as "Little Red Riding Hood," that involve predatory animals. Take note of the words used to describe the animals in the story, both predators and prey (including humans). Make a list of predatory animals such as eagles, ospreys, wolves, grizzly bears, mountain lions, bobcats, coyotes, foxes, and sharks. Make a list of prey animals such as rabbits, squirrels, prairie dogs, deer, and elk. Beside each animal, write words that were used in the stories, as well as other words that come to mind when thinking about the animal. For example, "sly fox," "savage wolf," "man-eating grizzly," "cuddly bunny," "graceful deer," and "cute squirrel."
3. Discuss the effect that these words have upon the opinion of the reader towards predators. For example, was the wolf in "Little Red Riding Hood" represented honestly and accurately in the story?
4. Read the first chapter in Kipling's book *All the Mowgli Stories*, in which Mowgli, the jungle boy, is first brought to the wolf pack. Again note the words used to characterize wolves. How does the characterization compare with that in the fairy tales? Which is the most accurate? Which is most likely to damage the reputation of wolves and other predators? How do they differently affect the reader's opinion of predators? Can even fictional stories about an animal hurt the animal? (For example, could they create a desire in humans to own wild animals as pets? Wildlife rarely does well in captivity and should be left in the wild whenever possible.)
5. Tell the students what scientists have learned about wolves by studying them in the wild. Read a passage describing wolf family structures and behavior from the non-fiction book. Note how wolf packs are organized, how pups are raised, and what wolves normally eat when the natural food supply is in proper balance. Relate the use of prey by wolves to the background information on predator/prey relationships. (An alternate

activity for older students is to have them do independent research about wolf behavior and present a written or oral report.)

Activity #4: Changing Attitudes

1. Discuss with the students whether they think that people's attitudes about predators and their role in the environment can change over time, for example, a generation. Can they think of any specific changes that may have occurred?

2. Conduct a survey of senior citizens in the community. Compile the results and analyze the changes, if any, in attitudes towards predators over the years.

3. Some possible interview questions are:

- How do you feel about wildlife in general? Does wildlife live in your neighborhood? What kind of wildlife lived in your neighborhood when you were a child?
- What animals, if any, are no longer seen that once were?
- What animals, if any, are more common now than they once were?
- What were some attitudes you remember having about predators when you were a child? Which of these attitudes, if any have you changed during the past 20 years? What has caused these changes, if any?
- What laws, if any, did you know about when you were young that affect wildlife and the environment? What laws do you know about now that affect them? Do you think these laws are necessary?
- What general changes, if any, do you feel there have been in our society's attitudes towards predators and their role in the environment?

4. The students may also interview other age groups within the community, as well as specific interest groups, such as wildlife managers, members of the city council, farmers, ranchers, animal welfare group members, hunting club members, members of preservationist organizations, office workers, etc. Compare the results within the different groups.

5. Discuss possible solutions to the problem of animosity towards predators.

(Adapted from Project Wild, Western Regional Environmental Education Council, Inc.)

Wrap-up/conclusion

Discussion

1. What are alternative methods of controlling pest damage that are less harmful to predators and their prey, as well as the entire ecosystem?

2. What are various ways that pesticides can enter an aquatic food chain? How would this affect ospreys?

3. How do you personally feel about predators? How did you form this opinion? Has it changed over the years, or might it change in the future? Does education about predators and prey affect your personal attitude towards them?

Extensions

1. Draw and discuss food webs for various types of ecosystems, such as prairie, boreal, woodland, wetland, arctic tundra, rainforest, river, and ocean ecosystems. What predator and prey species are found in each one? What similarities in the food web systems are found in all ecosystems?

2. Visit a wildlife center that specializes in predators, such as The Raptor Center in St. Paul, Minn., or the International Wolf Center in Ely, Minn.

3. Observe and discuss various ways, in addition to stories, in which predators are often misrepresented. Some suggestions are cartoons, comic books, animated movies, and advertisements.

Resources

- *Amazing Birds of Prey*. Jemima Parry Jones, Alfred A. Knopf, 1992 (for younger readers)
- *A Society of Wolves: National Parks and the Battle Over the Wolf*. Rick McIntyre, Voyageur Press, 1996
- *Bears - Their Life and Behavior*. William Ashworth and Art Wolfe, Crown Publishing, Inc., 1992
- *Birds of Prey*. Floyd Scholz, Stackpole Books, 1993
- *Colors for Survival - Mimicry and Camouflage in Nature*. Marco Ferrari, Thomasson-Grant, 1993
- *The Infinite Web*. Robert Silverberg, Dial Press, 1977
- *The Way of the Wolf*. L. David Mech, Voyageur Press, 1991
- *The Wind Masters - The Lives of North American Birds of Prey*. Pete Dunne, Houghton Mifflin Co., 1995
- *The Wolves of Isle Royale: Broken Balance*. Rolf O. Peterson, Willow Creek Press. 1995
- *The World of the Coyote*. Wayne Grady, Sierra Club, 1994
- *Understanding the Bird of Prey*, Nick Fox, Hancock House
- *Wild Cats of the World*. Barbara Sleeper and Art Wolfe, Crown Publishing, Inc., 1994

Lesson designed by

Carolyn Lane and Mike Kennedy, The Raptor Center