DARWIN 2009

Exploration is Never Extinct

What Would I Do Without You?

Lesson Plan

grades 5-7

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Introduction

What Would I Do Without You?

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This lesson plan was developed as part of the "Darwin 2009: Exploration is Never Extinct" initiative in Pittsburgh. Darwin2009 includes a suite of lesson plans, multimedia, on-line resources and art. Find all information on-line at: **www.sepa.duq.edu/darwin.**

This lesson plan was originally developed for the Pittsburgh Zoo & PPG Aquariums in Pittsburgh, PA.

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Pittsburgh Zoo & PPG Aquarium

Goals

1. To introduce the concepts of ecological interactions, including neutralism, competition, and antagonism, with a focus on predation.
2. To use the various animal exhibits at the zoo to show how coevolution works.
3. To use the various animal exhibits at the zoo to show common features among prey and common features among predators.

Learning Objectives

1. Students will be able to define predation.
2. Students will be able to define coevolution.
3. Students will be able to apply the concepts of coevolution.
4. Students will be able to connect how coevolution and adaptation relate.
5. Students will be able to analyze various predators and prey.
6. Students will be able to compare the similarities and differences among predators and among prey.
7. Students will be able to explain how the animals at the zoo have coevolved and adapted.

Materials, Resources, and Preparation

1. Read the introductory material provided in this lesson plan to learn more about key concepts such as predation and coevolution.
2. Make 1 copy per student of the worksheet (page 12) to use during the Visit Activity.

Teacher Pages

What Would I Do Without You?

Vocabulary

1. **Symbiotic Relationship-** A relationship in which two organisms from different species live in close, direct contact with one another.
2. **Mutualism-** A symbiotic relationship in which both organisms benefit.
3. **Commensalism-** A symbiotic relationship in which one organism benefits and the other is not harmed.
4. **Parasitism-** A symbiotic relationship in which one organism lives off of the other organism; the first organism benefits but the second is harmed.
5. **Antagonism-** When one species benefits from hurting another species. This usually involves one species eating another.
6. **Predation-** The relationship between two species when one, the predator, feeds on the other, the prey.
7. **Coevolution-** When the evolution of one species is very closely related to the evolution of another species.
8. **Mimicry-** When one species evolves to resemble or copy the appearance or behavior of another species.
9. **Adaptation-** The alteration in an organism's behavior or physiology resulting from natural selection. This change occurs over an extended period of time. Adaptations are tailored to the organism's environmental niche.

Overview

Life forms constantly interact with each other in a variety of ways.

When different organisms or species live in close, direct contact with organisms from other species, they have a **symbiotic relationship. Parasitism** (one organism benefits and the other is harmed), **mutualism** (both organisms benefit from working together), and **commensalism** (one organism benefits and the other is not harmed) are types of symbiosis.

In an **antagonistic relationship**, one species benefits at the expense of another. One example of this is **predation**, in which one organism, the predator, feeds on another organism, the prey. Both predators and prey have evolved over time to be more fit in their role. The characteristics of their environment determine what it means to be fit, what traits will be favorable for predators or prey. For example, a grassy hill makes being short a favorable trait for both predators and prey, because shorter animals will be able to hide better in the grass than tall ones. Individuals that are more fit survive longer and produce more offspring then less fit organisms, so the favorable traits are passed on to the following generations. When a trait becomes common to most members of the

species, it is called **adaptation**. Predators and prey often have special adaptations that help them survive in their particular roles.

One common adaptation is **camouflage**. Both predators and prey utilize this particular feature in a way that is beneficial. Prey use it to hide from predators, while predators use it to disguise their presence while hunting.

While we generally only think about how the environment helps to shape a species, other life forms also play a major role! In fact, many species have adapted in response to the evolution of other species with which they interact. This is referred to as **coevolution**. This is found commonly between species that are related as predator and prey. For instance, a predator may develop features that specifically help to kill a particular prey. Other predators are more opportunistic, meaning they kill and eat almost anything, and they adapt in more general ways. Some common coevolutionary adaptations of predators include sharp claws, sharp teeth, fangs, and stingers. Prey use passive defenses, such as hiding, mimicry, camouflage, or growing thick hides. With mimicry, a snake may appear to be poisonous, to dissuade attackers, yet it does not have to spend the energy to actually produce the poison. Prey also use active defenses, like fighting back or running away, in addition to using alarm calls and chemical defenses, such as poison or foul smells.

It is important to remember that many animals can be both predators and prey, and therefore have a combination of these traits. Scorpions, for example, use venom to eat small insects, but they also have thick exoskeletons to provide protection from predators.

It is also significant to remember that there are limitations to evolutionary adaptations. For example, both zebras and lions have evolved to become faster; as the lion chases the zebra, the zebra runs away from the lion. However, this does not mean that the zebra will continue to become faster and faster due to physiological and environmental limitations. Keep in mind though, that adaptations usually evolve over long periods of time and many generations.

Pre-Visit

What Would I Do Without You?

Time: 40 minutes

Introduction

1. Tell students that animals can interact with each other in a variety of ways.
2. Tell students there are various types of relationships animals can have. Some of these include:
   - **Neutralism**
   - **Competition**
   - **Antagonism**
3. Ask students if they can name some examples of each type.
4. Tell students that they are going to talk about one of those relationships today: **Predation**.
5. Ask students what they know about predator-prey relationships:
   - What makes a predator/prey?
   - What behaviors do predators/prey have that makes them successful?
   - What are some factors that affect predator/prey relationships?
   - What happens when there are too many prey? Or, too many predators?
   - What happens when there are too few of each animal?
   - How can the environment influence predator and prey relationships?

Optional Scenarios:

To help your students explore the dynamics of the relationship between predator and prey, try out some of these different scenarios.

The following assume a class size of 18; please note the ratios.

Game 1: What happens with too many predators?

Set-up: 3 prey, 8 resources (3 water, 3 food, and 3 shelter), and 7 predators

Game 2: What happens when there aren't enough resources?

Set-up: 10 prey, 4 resources (1 water, 2 food, and 1 shelter), and 4 predators

Game 3: What makes a balanced system?

Set-up: 7 prey, 10 resources (3 water, 3 food, and 4 shelter), and 1 predator

Activity - Predator Versus Prey Game

1. In this game, your students will play out the different roles involved in an ecosystem that has predators, prey, and several variants of resources that the prey need.
2. The game can play out several initial scenarios. (See left for suggestions.) Let your students play several rounds for each set-up.

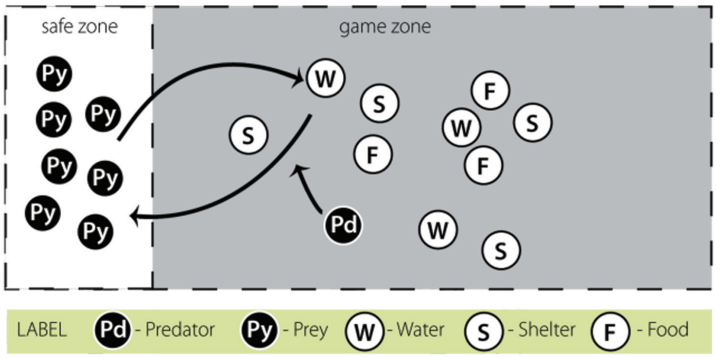
Set-Up

1. Take students into an open area to play this game.
2. Determine an area of the space to be a "safe" zone. In the safe zone, prey cannon be captured. Also, determine an area of space to be the "game" zone. In the game zone, prey can be captured.
3. Students will be predators, prey, or resources. Assign each student to their role. Your can refer to the "Optional Scenarios" box for suggestions.
   - Prey students will start the game in the safe zone.
   - Predator students will start the game in the game zone.
   - Resource students will also start in the game zone. They must remain still until tapped by a prey student. They can choose to be either food, shelter, or water, and will indicate what resource they are using the appropriate hand symbol.

Shelter *Food* *Water*

How to Play

1. At the beginning of the round, the resource students will be turned with their backs to the prey students.
2. To begin each round, randomly call either "*food*," "*shelter*," or "*water*." When this happens, the resource students will turn around to face the prey students; the prey will run and attempt to tag the appropriate resource and return to the safe zone. A tagged resource must run to the safe zone too. The predators will try to tag prey while they run through the game zone.



Imagine that you have called "Water!" Prey attempt to tag water resources and return to the safe zone, while predators attempt to tag either prey or any tapped water resource.

3. The round is over when all of the surviving prey and any tagged resources have returned to the safe zone.
4. At the end of the round:
   - The resources that were tagged and made it to the safe zone become prey.
   - The prey that were taken by predators become predators.
   - The prey that did not catch a resource become resources.
   - The predators that did not catch prey become resources.
5. Before starting the next round, all resources should turn their backs to the prey students, and choose what resource they will be by making the appropriate hand symbols.
6. Play several rounds.

Discussion

1. At the end of the game, discuss various aspects of the game:
   - What happened when there was too much or too little of one of the resources?
   - How about when there were too many prey?
   - How about when there were too many predators?
   - What made the prey easy targets?
   - What made the predators better at their job?
   - What would have made it more difficult for prey to be captured?
   - What would have made it easier for predators to capture prey?
2. Encourage students to think about how the features of the predator and prey are related.

   For example, if it is advantageous for the prey to be fast, then the predator must be faster; if the prey can hide, the predator needs better eyes, etc.
3. Next, introduce the concept of **coevolution**. Explain to students that coevolution has been studied in predator-prey relationships. Explain that as predators evolved, the prey had to adapt in order to survive, and as the prey evolved, the predators had to adapt in order to have enough food to eat; all in reaction to the environment.
4. Explain the concept of **adaptation**. Some examples include:
   - Predators have claws, teeth, fangs, and stingers.
   - Prey use passive defenses (hiding) or active defenses (fighting back) against the predator.
   - Prey use defense mechanisms, such as alarm calls, camoflage, and thick hides.
   - Prey can use chemical defenses against predators, such as poison or foul smells.
   - Prey may use **mimicry** as well.

Visit

What Would I Do Without You?

Time: 35 minutes

Materials:

- 1 copy per student of Do You See What I See? worksheet (page 12)
- pencils
- clipboards
- notebook

Note:

Listed on the worksheet are some examples of common animals found in some zoos. You do not have to visit all of the animals on the worksheet, but the more examples you collect, the more fun the analysis will be! If you can, try to contact your local zoo to modify these worksheets to include the animals at your zoo.

If you can't go to the Zoo, bring the Zoo to your own classroom!

- Assign each student one of the animals listed in the worksheet at the end of this lesson plan (page 12).

- Bring in books for your students, spend a day at the library, and/or allow them to use the Internet to find information about their animal. They should write a brief report about their animal (They can write an essay or the text for an exhibit sign!) and include an illustration (They can print a picture or draw one!) of their animal.

- Hang the students' reports and illustrations around the classroom. During the Zoo Visit (as described to the right), have the students rotate around the room, and complete their worksheets based on their peers' descriptions and drawings!

Activity

1. Remind your students about your previous discussion of the evolutionary relationship between predator and prey.
2. Hand out "Do You See What I See?" worksheet (page 12) and pencils.
3. Explain to students that during their visit, they will observe various animals. Each student should record their observations for each animal on their sheet.
4. As you tour the zoo, take your students to visit the suggested list of animals on the worksheet (page 12).
5. As you visit each animal habitat, ask your students the following questions:
   - Can you name predators or prey of this animal?
   - Which features of this animal would be useful as a predator?
   - Which features of this animal would be useful as prey?
6. If the animal in question is in the worksheet, please remind your students to record their observations.

Post-Visit

What Would I Do Without You?

Time: 35 minutes

Materials:

- completed "Do You See What I See?" worksheets

Activity

1. Pass back the "Do You See What I See?" worksheets to the students.
2. Make this chart on the board:

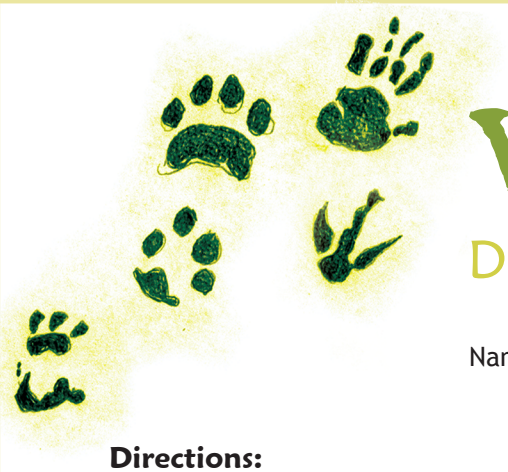
Predators	Prey

3. Review the concept of predator and prey if necessary.
4. Ask students to look at the animals on their worksheets that they observed during their visit to the zoo. Tell them to guess whether the animal was mostly a predator or a prey. Fill in the chart accordingly. See Answer Chart 2 on page 14.
5. Remind your students that these distinctions are not cut and dry. Most animals prey on different animals, and are in turn, prey to other animals. Some examples are:
   - Meerkat
   - African Painted Dog
   - River Otter
   - Leopard
   - Bluegill
   - Brook Trout
6. Ask your students to look at the "eye placement" column on their worksheets and, according to the breakdown on the board, draw conclusions. See Answer Chart 1 on page 13.
7. Explain to students that most predators have eyes on the front of their head to be able to catch prey, because it allows them to judge distance. Most prey have eyes on the side of their head to see predators sneak up on them.
8. Ask students to compare/contrast the animals within each category.
   - What are some features that make the predators similar?
   - What are some features that make the predators different?
   - What are some features that make the prey similar?
   - What are some features that make the prey different?

9. Talk about common adaptations that most of these predators/prey have.
   - Camouflage
   - The ability to perform mimicry
   - Sharp teeth
   - Thick hide
   - Poisonous defenses
   - The placement of their eyes
   - The ability to run fast
10. Ask the students to match up a predator with its prey, and circle the groupings on the chart.

Predators	Prey
African Painted Dog	Giraffe
Lion	Turkey

11. After all of the pairs are matched, ask students if they can think of any characteristics within the pair that have evolved together.
    (See chart on page 12.)
12. Revisit the concept of coevolution by noting that both types of animals are continuously evolving in order to survive.



Worksheet

Do You See What I See?

Name: _____

Directions:

What do you see at the zoo? Look at the animals listed below and answer the following two questions for each animal. When you are finished, return this worksheet to your teacher.

Animal	Where are the eyes located on the animal's head? (Front? Sides?)	What is one feature this animal has that shows it has adapted to its environment?
Meerkat		
Giraffe		
Kodiak Bear		
Zebra		
Northern Sea Otter		
Blue Gill		
Black Bear		
Turkey		
Leopard		
Peafowl		
Emperor Scorpion		
Lion		
Reindeer (Caribou)		
African Painted Dog		
Purpil Urchins		
North American River Otter		
White Tail Deer		
American Alligator		
Reeve's Muntjac		
Tiger		

Answer Chart 1

What Would I Do Without You?

Directions:

What do you see at the zoo? Look at the animals listed below and answer the following two questions for each animal. When you are finished, return this worksheet to your teacher.

Animal	Where are the eyes located on the animal's head? (Front? Sides?)	What is one feature this animal has that shows it has adapted to its environment?
Meerkat	Front	* Each animal is open to a myriad of answers from students that could be relevant. Common answers may be sharp claws, sharp teeth, camouflage, poisons, etc.*
Giraffe	Side	
Kodiak Bear	Front	
Zebra	Side	
Northern Sea Otter	Front	
Blue Gill	Side	
Black Bear	Front	
Turkey	Side	
Leopard	Front	
Peafowl	Side	
Emperor Scorpion	Top and Side	
Lion	Front	
Reindeer (Caribou)	Side	
African Painted Dog	Front	
Purpil Urchins	No eyes	
North American River Otter	Front	
White Tail Deer	Side	
American Alligator	Side	
Reeve's Muntjac	Side	
Tiger	Front	

Answer Chart 2

What Would I Do Without You?

Predator	Prey	Coevolutionary Adaptations
Meerkat	Emperor Scorpion	M - Some resistance to venom. ES - Venemous barb on tail.
Lion	Giraffe	L - Hunt in groups. G - Strong defensive kick.
Kodiak Bear	Reindeer (Caribou)	KB - Great strength. R - Great speed.
African Painted Dog	Zebra	APD - Great endurance. Z - Good hearing.
Northern Sea Otter	Purple Urchin	NSO - Intelligence. PU - Spines.
North American River Otter	Blue Gill	NARO - Agility. BG - Quick swimmer.
Black Bear	Turkey	BB - Good sense of smell. T - Good vision.
American Alligator	White Tail Deer	AA - Eyes and nostrils high on head for stealthy hunting at waters edge. WTD - Quick reflexes.
Leopard	Reeve's Muntjac	L - Camouflage for stealthy hunting. RM - Good sense of smell.
Tiger	Peafowl	T - Sharp claws for holding prey. P - Flight.