

Population Patterns

Common Core Standards

Math

- 6.SP.B.4
- 6.SP.B.5
- 6.SP.B.5a
- 6.SP.B.5b
- 7.SP.B.3
- 7.SP.A.2
- 8.SP.A.1

Vocabulary

- Population
- carrying capacity
- predator-prey relationship
 - habitat

Summary: Students are introduced to ecological concepts related to food webs and population dynamics through an interactive game. Through a graphing exercise, students gain insight into how predator-prey relationships function, and how organisms interact with the habitat resources required to survive.

Time: 45 minutes

Grade Level: 3rd to 8th

Goals

- introduce applied biological and mathematical concepts to students
- engage students through an interactive, kinesthetic activity to illustrate ideas of population dynamics

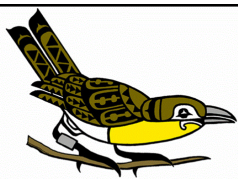
Learner Objectives

Students will... .

- participate in a game to simulate principles of population dynamics
- graph population change over time according to habitat availability, and predator-prey relationships



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Background Information

A **population** is a group of organisms of the same species living in a geographic area. For some wildlife biologists, the study of population dynamics is a major part of studying both the health of a particular species and its interaction with the environment.

A study of population dynamics considers the size of a population, how it changes over time, and the ecological factors that affect these changes. When scientists want to estimate the size of a population, they will use available data to create a simulation, or population model. Population models are characterized primarily by four main drivers of population size: birth rates, death rates, immigration rates, and emigration rates. In nature, many factors affect these variables. Generally, the ability of members of a population to attain food and breed successfully are the primary drivers of population size. Other examples of influences on population size are weather conditions, disease, predators, pollution, and habitat destruction.

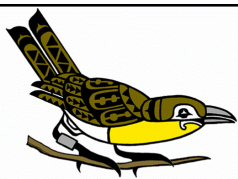
Habitat is closely linked to population size, as it is the sum of all resources needed for a species' survival. For the purposes of this exercise, **habitat** is defined as resources of food, cover, and water. In the following activity, students will see a direct correlation between limited resources and rates of survival. The amount of individuals that a certain area can support as related to the limited habitat resources is referred to as **carrying capacity**. If a population exceeds the carrying capacity of an area, the population will be forced to either decline or emigrate to a new area.

Getting Ready

- Read over background information.
- If no outdoor area is available for use, arrange an open space in the classroom that is large enough for students to stand in two lines, facing each other. The larger the area, the more fun the activity will be!

Discuss!

- Ask students to define habitat. Provide students with examples of habitat for different plants or animals that they might find in their local area.
- Pose a scenario to illustrate how limited habitat resources can affect population size. *For example, during a dry season the mice and voles will have less available food and they won't have extra energy to use toward reproduction, causing a decrease in their population the following year. Furthermore, the owls that feed on mice and voles are not able to find as much food and therefore they also are not able to produce as many offspring.* Ask students to imagine what the following year might look like in terms of both available resources and population growth or decline. Have a few students share different possible scenarios for the following year.
- Tell the students that they now are going to “act out” a scenario as a “test” to see what can happen to a population over time.



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Activity

This activity was adapted from “Oh, Deer,” a Project WILD activity. Project WILD is a national environmental education program developed by the Western Regional Environmental Education Council.

1. Split the group into two equal parts
Group 1 = birds
Group 2 = habitat
2. Explain the habitat signs that the habitat people can pretend to be and that the birds are searching for:
Food—hand over mouth
Water—holding a water bottle to mouth
Shelter—hands over head like roof
Space—arms out wide
3. Have each group turn their back to each other
Birds pretend to be one of the actions to be “in search of”
Habitat people pretend to be a part of the habitat
4. Have each group turn around and birds can fly to find what they need, while habitat people stay where they are.
Birds that found their matching resource will “survive” and the habitat resource they took becomes a bird in the next round
Birds that did not find their matching resource will “die” and become a part of the habitat. (*This can be an opportunity to discuss how nutrients are recycled in nature through decomposition*)
This is the completion of one “round” of the activity.
5. After each “round” is completed, record the number of surviving birds as a bar graph on the chalkboard. Repeat enough rounds to illustrate how the population fluctuates up and down like a wave, or a sine graph.
Ask students to draw the line of where the carrying capacity is on the graph of their activity. (refer to graph at the end of the lesson)
6. Tell students that they now will observe the effects of an additional variable in their system. Choose a student to be a hawk if your class size is under 15, and two students if it is more than 15. The hawk will be in the middle of the two groups of students and can ‘tag’ birds as they are finding their habitat resources. (*Depending on the size of the area, and the interaction of the students, you may choose to limit the hawks to a particular spot*)
7. Continue a few rounds with the hawks included, and record the number of birds after each round. Ask the students to notice the graph, and if there are any changes in the pattern they see. *Students should observe the number of birds from one round to another does not change as dramatically.*



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Conclusion

1. Ask students to discuss how the population could “crash.” *If there is a resource that is limited, and/or an event that limits the resource while the population is already at a critically low point, the entire population is at risk of going extinct. This is why some species become designated as “endangered” by the US government.*
2. Ask students to think of any other ways in which the population could have less dramatic “ups and down.” *Students may answer; if the birds depended on more types of resources, such as multiple types of food, or maybe their population fluctuates with other individuals immigrating into their area. In general, if there is more complexity added to this system, the population will be more stable.*
3. Ask student to think of how we can measure bird populations in real life. What information do we need to gather in order to understand a population? *To understand a population, the basic information we need is **births, deaths, emigrations, immigrations** - basically all influences on the number of birds in populations. Some birds are easier to count than others, and humans cannot directly watch a whole population of birds over time. The best way to get information about births, deaths, emigrations, immigrations of birds in a population is through banding them. Research biologist band birds, and are able to gather information about them over time once they are recaptured. GPS, or Global Positioning Systems and also “bird-cams” or cameras that attach to the bird are also possible ways to track birds but are more expensive and logistically difficult.*

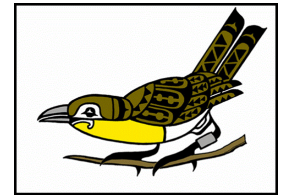
Link to KBO Lessons:

Further population studies: birds are one group of animals that we have a lot of data for. We can monitor a given bird population to assess the health of an ecosystem. Check out the other relate KBO lessons below:

- **Exploring eBird:** Students participate in contributing data to an international citizen science project, eBird, that gathers information for bird conservation and research. The eBird website features graphs of citizen science data and provide students with a great opportunity to analyze
- **Banding Station Visit:** Students will learn about local birds, bird identification, and the bird banding process. Bird banding is the most effective way to look at a bird population.

Extension Ideas

Another population that we have a lot of data for is humans! To look at more population graphs, and related information check out the US Census website at <http://www.census.gov/>.



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Below is a model graph for a population. Over time (as you continue record data after each round of the activity) the population size will go back down, and continue up and down as a wave. The population is limited by the carrying capacity, and if it decreases to a very low point, the population will go extinct.

