Snowshoe Hare Population Cycles in Denali

A Data Analysis Lesson Plan

Featuring population data collected by the Denali Wildlife Team, National Park Service

Essential Question

How do scientists estimate the size of wildlife populations and predict how population sizes may change over time?

Background

There are many ways to study animals. One way to learn about an animal is to study the size of its population. A population is the number of animals of the same species in an area. For example, a forest might have a population of red squirrels, or a lake might have a population of trout. Populations can fluctuate, or change over time, due to limiting factors. These are environmental conditions that affect an animal's survival, such as the amount of food and water or the number of predators.

Photo 1: Snowshoe Hare |NPS Photo

Snowshoe hares (*Lepus americanus*) are small mammals in the rabbit family that are common in the spruce forests of North America. Their name comes from their large hind feet that act like snowshoes, allowing them to stay on top of the snow.

Snowshoe hare populations are known for fluctuating, or going up and down, over time. Some years conditions support a large population of hares and you'll see them every day, while other years there are few hares and seeing one is a big treat!

Snowshoe hares are an important food source for many predators, including owls, goshawks, eagles, and lynx. Knowing if snowshoe hare populations are high or low allows scientists to predict the population sizes of their predators. For example, scientists have observed that the number of lynx in Denali often decreases a year or two after the number of snowshoe hares declines, and increases when snowshoe hares become more abundant. In other words, snowshoe hare population sizes are a limiting factor for lynx populations.

Park scientists wanted to learn more about the pattern of the population fluctuations of snowshoe hares in Denali. Is there a certain number of years between the rise and fall of the population sizes? They began to study how many hares there were in certain study locations to look for patterns.

The snowshoe hare pellet plot study began in 2012. Students assist wildlife technicians in collecting the data, making the project Denali National Park and Preserve's biggest Citizen Science program as of 2024.

To estimate hare population numbers, scientists and student assistants count the number of hare scat pellets (poop/feces) left behind by hares each year within a given area. Each study location is sampled once per year over many years. All scat pellets that are counted are removed from the study plots so that they are not counted again the next year.

Photo 2: A student collecting pellet plot data | NPS Photo

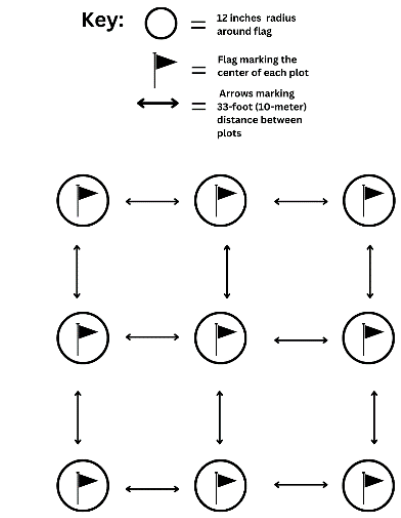


Photo 3: A key describing the layout of the study locations.

There are 10 total study locations, five located in forested areas (spruce habitat) and five in shrubby areas (willow habitat). There are 50 study plots per location, for a total of 500 plots. Each plot is a circle with a 12-inch (0.3 meter) radius and an area of 452 square inches (0.3 square meters). That's slightly smaller than the area of a 26-inch bicycle wheel. The plots within each location are in a 33-foot (10-meter) grid pattern.

Scientific Question

Is there a certain number of years between the rise and fall of the snowshoe hare population in Denali? Could it be a pattern? If so, what might the pattern look like in 5 years? In 15?

Scientific Data and Analyses

Number of Pellets Found Per Year											
2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
3,282	6,418	2,259	319	640	1,210	5,423	5,796	3,193	545	905	273

Question 1:

What data will you graph to answer the questions?

Independent Variable:

Dependent Variable:

Draw A Bar Graph on a separate piece of paper:

Interpret the Data:

Using the graph, you drew:

Identify the years with the most pellets found (peaks):

Identify the years with the least pellets found (troughs):

How many years are between each of these (peak to peak or trough to trough):

Connect the Data to What You Have Learned:

Make a claim that answers the scientific questions:

What evidence was used to write your claim? Reference specific parts of the table or graph:

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the changes in animal populations:

Your Next Steps as a Scientist

Scientists have established that snowshoe hares have a population cycle of 8–10 years, but they are not entirely sure why! There are so many possible limiting factors. But there are other ways to study the data Denali scientists have collected.

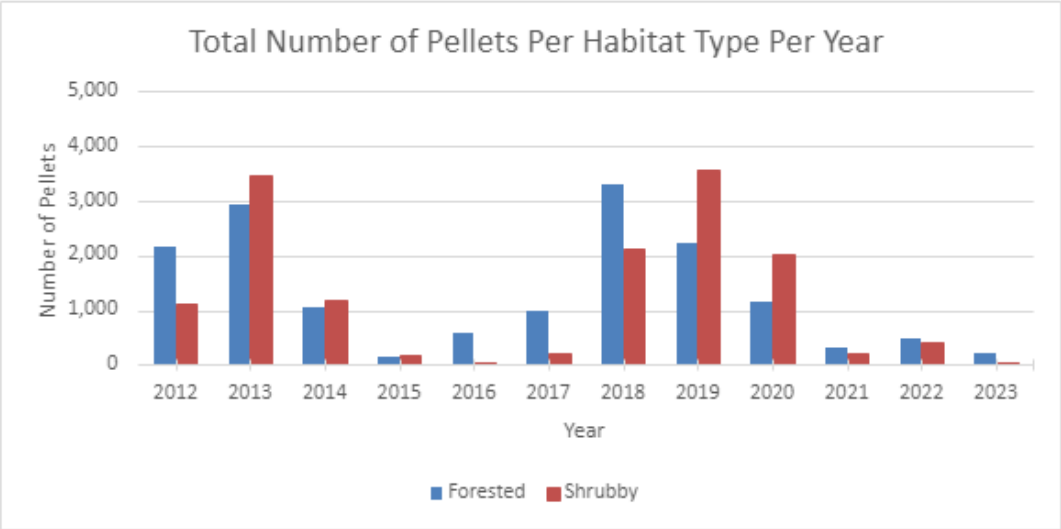
Recall the background information from the beginning. Remember when we talked about how there are 5 study locations in forested habitats and 5 in shrubby habitats? This means we also have data comparing the population numbers of hares in different habitats.

First, we must specify what defines a habitat. The forested habitats are dominated by low plants and ground cover as well as tall spruce trees and some deciduous trees like aspen, birch, and poplar. The shrubby habitats are dominated by willow shrubs that can grow waist to chest high or taller. The ground here often has moss and lichens, and other low-lying plants.

What new question(s) should be investigated for this new data? How do your questions build on the research that has already been done?

Observe the following data and answer the following questions:

Total Number of Pellets Found Per Habitat Per Year		
	Forested Habitat	**Shrubby Habitat**
2012	2,148	1,134
2013	2,937	3,481
2014	1,068	1,191
2015	134	185
2016	593	47
2017	986	224
2018	3,306	2,117
2019	2,226	3,570
2020	1,160	2,033
2021	319	226
2022	495	410
2023	221	52



A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies. What is your hypothesis based on the data above?

What are some limiting factors that might be found in each habitat?

Do the population highs and lows happen in the same year in both habitats? If the two habitats are different, why might that be?

After answering the two previous questions, is your hypothesis the same or different? Why or why not?