Lake Clark
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Lake Clark National Park & Preserve
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Carrying Capacity and Alaskan Brown Bears
Student Activity Guide

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Lesson Overview

Lake Clark National Park and Preserve sits on the coast of Cook Inlet and is home to one of the largest brown bear populations in the state of Alaska.

Park biologists work year round to study the brown bears that call Lake Clark home. They observe the bears' diet, competition (both for mating and preferential habitat), and longevity. With rich vegetation, a large supply of bivalves, and spawning salmon, Lake Clark offers plenty of food for bears to thrive. This contrasts drastically with the interior of the state, where food is scarcer and bear populations are comparatively low.

Data gathered by park biologists gives an inside-look at the lives of bears, providing us with the opportunity to explore the idea of carrying capacity (i.e., how many animals can live in a given area).

Activity One: Reading

Read the following introduction to the concept of carrying capacity and Alaskan brown bears.

What is Carrying Capacity?

The carrying capacity of a particular species is the maximum population size that the environment can sustain of that species. Factors that affect carrying capacity include resource availability, climate, competition for resources, and boundaries, as well as the interrelationship between these factors.

Introduction to Brown Bears in Alaska

Brown or grizzly bears (Ursus arctos) live in a diverse array of ecosystems from the Pacific Northwest into northern Canada and Alaska. Historically, they ranged as far south as California. In Alaska, brown bears live a variety of habitats, from the coastal salt marshes to the mountainous interior of the state. Bears are extremely adaptable, capable of using whatever resources they encounter to survive.

Brown bears spend much of their time searching for food, frequenting both high and low elevations. They are omnivorous, eating both plants and animals. Depending on what is available in a particular habitat, a bear's diet may consist of some or all of the following: lush grasses, succulent herbs, tender shoots, flowers, leaves, roots, bulbs, tubers, mosses, horsetails, willows, berries, insects, larvae, grubs, fungi, birds, eggs, acorns, cones, nuts, small mammals, big game (sheep, moose, and caribou), and fish.

Studies have shown that bears are acutely aware of the nutrients they need and will attempt to maintain a balanced diet as much as possible. In some cases where a variety of food is available, bears will forgo eating protein, such as salmon, in favor of berries and roots in order to keep a well-balanced diet. Even though plant foraging is more time consuming than salmon fishing, bears will split their time eating each resource, since berries have a high concentration of carbohydrates not found in salmon. In habitats that do not provide a substantial amount of meat for bears to consume, the bears will primarily eat vegetation.

Bears will generally travel many miles over a variety of terrain to find the food resources they need to survive. However, biologists have found that bears that rely on salmon streams tend to have smaller home ranges compared to those who forage far and wide for vegetation and small mammals throughout the year. Studies have also shown that bears that have access to salmon streams tend to have larger litters than those that do not have access.

Even within the state of Alaska, the size of bears can vary greatly depending on the environment. For instance, a full grown male bear in the interior of Alaska usually weighs around 600 pounds at the most, while a coastal adult male bear generally weighs between 800 and 1,000 pounds.

In addition to size differences, biologists have also seen differences in bear population densities in different locations throughout the state. There are 27 bears per 1000 square kilometers in Denali National Park, which is located in interior Alaska, far from salmon spawning grounds. Meanwhile, in the coastal areas of Lake Clark National Park, one of the largest wild salmon spawning grounds in the world, population densities of 147 bears per 1000 square kilometers are common.

Population density is affected by the presence of resources, as well as the amount of competition for these resources. Bears in both Lake Clark and Denali National Parks have competition from other bears, as well as other predators, like wolves. Additionally, food is not equally abundant in both places.

Bears are one of the few large mammals that enter a sort of hibernation in the winter, which can last 3-5 months out of the year. Before going into hibernation in the late fall, bears need to gain enough weight to supply them with the energy, in the form of fat reserves, to survive the winter. Bears enter what is known as hyperphagia, or a time of extreme feeding activity in summer and fall, where nearly 80% of their diet is centered on fats and lipids.

Bears are a natural conduit for nutrients within their ecosystems. They transport the nutrients found in their food (e.g., salmon, berries, carrion) to the plants of their habitat through their scat and the carcasses they leave behind. These nutrients scattered around by defecating bears allow more plants to thrive than could without bears (and their poop!). In coastal areas, bears pass marine-derived nitrogen, along with other nutrients, from the fish they eat into the soil. Thanks to the movement of bears, this marine-derived nitrogen has been found in plants and soil up to 5 miles away from salmon spawning grounds. The nutrients spread by salmon-eating bears cause plants to grow up to 3 times faster than plants with no salmon influence.

Brown bears play an integral role in their ecosystem, whether they are in the interior of Alaska or along the coast. Without them, nutrient flow in the ecosystem would lessen and prey species might become unhealthily large. The health of Alaska's wild spaces depends on the health of brown bear populations.

Activity One: Response

Based on the introductory reading, thoroughly answer the following questions.

1. Define carrying capacity in terms of brown bears in Lake Clark vs. brown bears in Denali.

2. There is always a competition for resources amongst a species, community, and ecosystem. Provide a list of species that might compete with brown bears for resources in Alaska. Be sure to think outside the scope of obvious competition. Provide reasons for why each other species might be a competitor with brown bears.

3. In what ways could a bear compensate when facing increased competition for resources?

4. How might bear hibernation stress the environment where bears live? Provide justification.

5. Propose a conclusion about what might happen to those plants that rely on marine-dissolved nitrogen if the bears were no longer around. How would that affect the ecosystem?

6. Bears were once present as far south as California. Over time they have disappeared in most of the lower 48 states. How might the influx of humans have influenced bear populations?

7. In recent years, bear viewing and bear photography have become the most popular activities for visitors to the park. How could the increased appeal of tourism and wild bear viewing affect the populations of bears over time?

Activity Two: Research Data

The following table shows data gathered by Lake Clark National Park biologists in the month of July for a number of years. The locations at the top of the chart are coastal "hotspots" in the park where bears are typically found. Look at the map on the following page and find each of these spots along Lake Clark National Park's coast. While these five locations are the most common places to see bears, they are not the only ones. The category "Other Locations" covers any places bears were spotted other than those five hotspots.

The table shows the percentage of total number of bears observed by location. For instance, on 7/12/04, 33.77% of bears our biologist spotted were in Chinitna Bay.

Use the information in the table to create a graph by location and date. Explain why, within the same ecosystem and park, bears would choose one location over the other. What trends, if any, do you see amongst bear populations by location?

	Chinitna Bay	North Tuxedni Bay	Shelter Creek	Silver Salmon Creek	South Tuxedni Bay	Other Locations
7/12/04	33.77%	15.58%	24.68%	3.90%	22.08%	0%
7/13/05	34.92%	7.94%	12.70%	6.35%	31.75%	6.34%
7/20/05	31.03%	31.03%	13.79%	10.34%	0.00%	13.81%
7/10/08	32.58%	20.08%	6.06%	5.30%	20.08%	15.9%
7/15/09	69.35%	6.53%	5.53%	8.54%	7.54%	2.51%
7/13/11	36.94%	14.18%	4.85%	8.21%	25.75%	10.07%
7/20/12	50.61%	11.59%	6.10%	3.05%	22.56%	6.09%
7/9/13	51.78%	14.72%	5.08%	9.14%	15.74%	13.19%
7/26/13	65.08%	3.17%	3.17%	14.29%	7.94%	6.35%
7/08/14	65.08%	20.35%	4.07%	9.88%	18.02%	3.49%
Total	45.59%	14.37%	6.68%	7.49%	18.58%	7.29%

This map shows the area where biologists conducted brown bear surveys on the Cook Inlet coast of Lake Clark National Park.

Activity Three: Assessment

Read through the following instructions on your assessment of carrying capacity and bears in Alaska.

You will be responsible for:

1. Researching and gathering information on brown bear habitat similarities and differences between Denali National Park and Lake Clark National Park. Identify the following:

- Food sources
- Competition for resources
- Limiting factors for carrying capacity
- Habitat range
- Density of bear populations

2. Creating a Venn Diagram, or other method of comparison, showing the similarities and differences between Denali bears and Lake Clark bears

- Be sure to include food availability, prey, availability of resources, territory rang es, and other things you found in your research.

3. Creating a diagram or drawing of how bears fit into the ecosystem

- You can create a food web or other model that shows a brown bear's role in its environment

4. Writing a one-page analysis of carrying capacity and Alaska bears, including the following information:

- An analysis of bears on the interior vs. bears on the coast
- The impact of any differences between populations
- An analysis of factors that might limit an increased bear population
- Future expectations on bear population sustainability

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