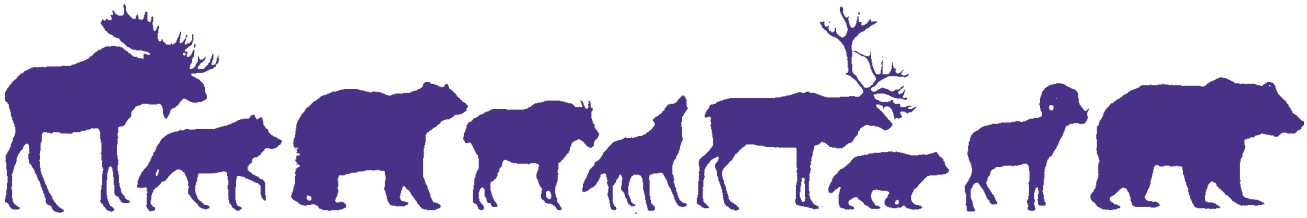

Alaska's Wildlife for the Future

ALASKA WILDLIFE CURRICULUM TEACHER'S GUIDE

K-12

Teacher Background Information, Illustrations, and Resources, Student Activities and Investigation

CORRELATED TO THE STATE STANDARDS

Alaska Department of Fish and Game

Alaska's Wildlife for the Future

REVISION 2001

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The Alaska State Legislature funded this revision of *Alaska Wildlife Curriculum* in support of wildlife conservation education.

The *Alaska Wildlife Curriculum* is a resource for educators teaching today's youth about Alaska's wildlife. We dedicate this curriculum to you and your students.

ALASKA'S WILDLIFE FOR THE FUTURE is part of the *Alaska Wildlife Curriculum* that includes:

Alaska's Ecology & Wildlife
Alaska's Forests & Wildlife
Alaska's Tundra & Wildlife
Alaska Ecology Cards

These materials have been field tested in classrooms throughout Alaska. Our thanks to the many teachers, students, and resource agency staff who have worked with and evaluated these materials. Because of your work, these materials are accurate, and well used.

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The Alaska Department of Fish and Game has additional information and materials on wildlife conservation education. We revise the *Alaska Wildlife Curriculum* periodically. For information, or to provide comments, please contact us:

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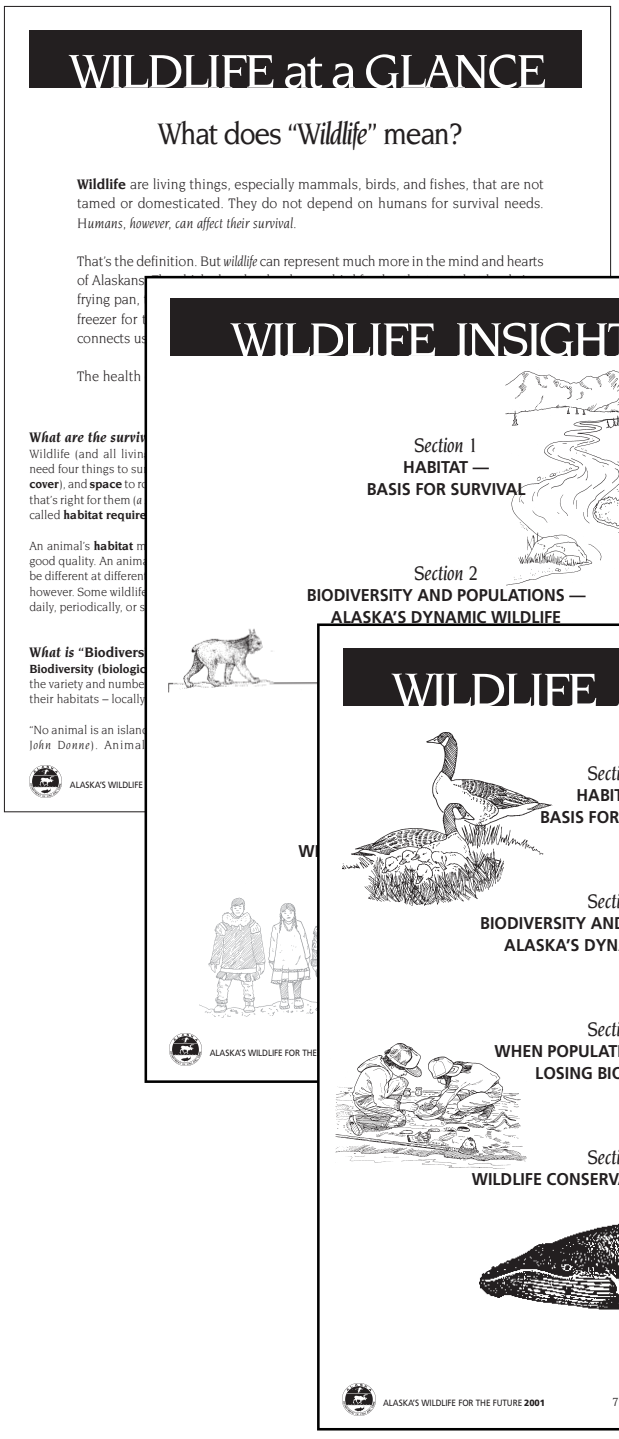
or visit our web site:
http://www.state.ak.us/adfg/

How to use this curriculum



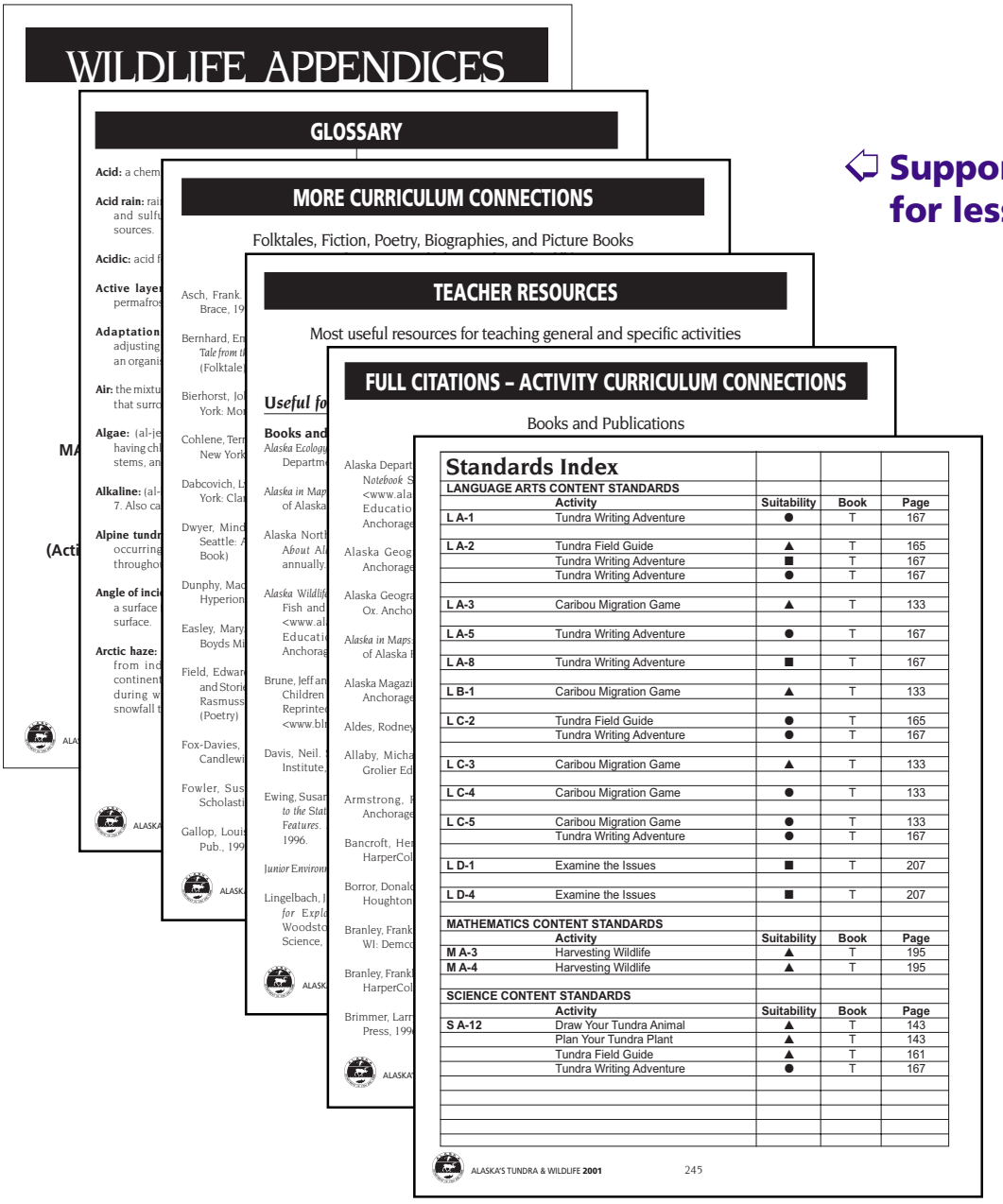
General Overview

Background Information

Activities

Student Activity boxes provide a quick planning reference

How to use this curriculum CONTINUED



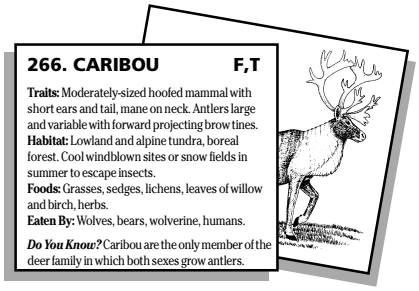
Support materials for lesson planning.

ALASKA ECOLOGY CARDS

Alaska Ecology Cards* – Student-directed learning resources in ready-to-copy sheets applicable to all books in the *Alaska Wildlife Curriculum.

Several lessons require or may be improved by use of the Alaska Ecology Cards. *To order, contact the Division of Wildlife Conservation/Wildlife Education.*

For more animal facts, refer to the Alaska Wildlife Notebook Series *available on the Web at* www.state.ak.us/adfg/



Alaska's Wildlife for the Future

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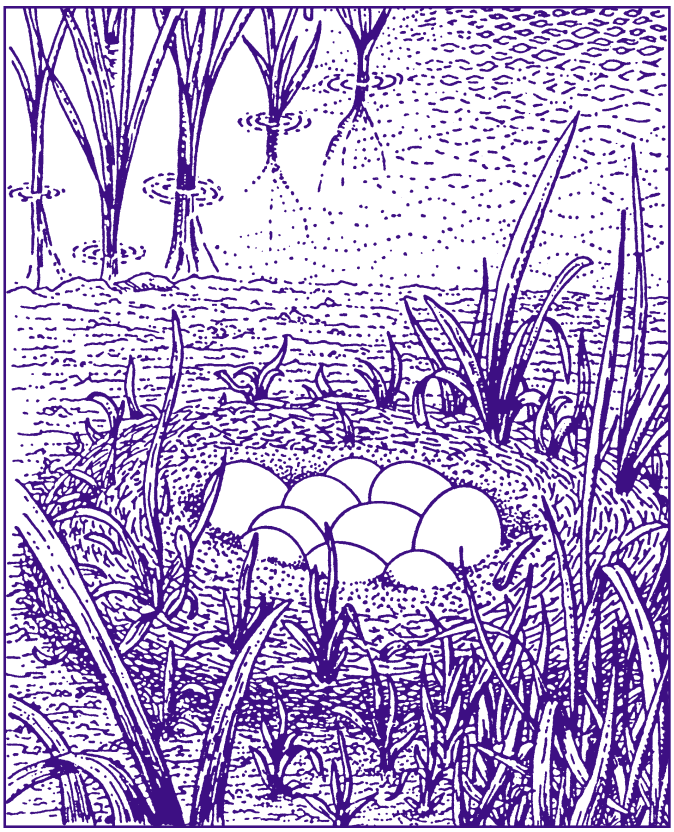


WILDLIFE at a GLANCE

What does "*Wildlife*" mean?

Wildlife are living things, especially mammals, birds, and fishes, that are not tamed or domesticated. They do not depend on humans for survival. H*umans, however, can affect their survival.*

That's the definition. But *wildlife* can represent much more in the mind and hearts of Alaskans. The chickadee that lands on a bird feeder, the trout that lands in a frying pan, the Vs of geese flying north in the spring, and the moose filling the freezer for the winter – all fall on a spectrum of appreciation for wildlife that connects us to living things of the land, no matter what our points of view.

The health of Alaska's wildlife is directly linked to the quality of our lives.

What are the survival needs of wildlife?

Wildlife (and all living things, including humans) need four things to survive: **food, water**, **shelter** (*or* **cover**), and **space** to roam in an easily reached place that's right for them (*a suitable arrangement*). These are called **habitat requirements.**

An animal's **habitat** must contain all four things in good quality and quantity. An animal's habitat requirements may be different at different seasons and times in its life, however. Some wildlife use multiple habitats, either daily, periodically, or seasonally.

What is "Biodiversity" *and does it matter?*

Biodiversity (biological diversity) is a measure of the variety and number of different living things and their habitats – locally, regionally, and globally.

Animals live in a community or **ecosystem** with their own roles to fulfill – producer, consumer, detritivore – to keep their habitat, and the encompassing ecosystem, healthy.

Biodiversity allows ecosystems to respond with flexibility to damage or change. The more diverse the ecosystem, the more options there are to respond to change – such as the decline of one prey species.

Biological diversity is an important measurement in understanding how human activities can influence the future of wildlife and our Earth.

How is biodiversity measured?

When scientists describe or measure the amount of biodiversity in a particular place, they do two things:

(1) They identify and count the number of different **species**.

(2) They count the **population** – the number of individuals of each species in that area.

Populations fluctuate normally, right?

Animal populations change over time. Every population has a maximum size it can reach before the species exceeds the available habitat. This maximum number is the **carrying capacity** of an area. It is a "ceiling" for the population.

Numbers may briefly soar past the ceiling under favorable conditions (mild winters, abundant food) causing a **population explosion**. Inevitably, deaths drop numbers below the carrying capacity when individuals cannot find resources needed to survive. Something that keeps a population of animals from increasing is called a **limiting factor**. It could be a shortage of food, water, shelter, or space as well as disease, predation, climatic conditions, pollution, hunting, poaching, and accidents.

If populations continue to decline?

Because of the dinosaurs, everyone is familiar with the word **extinct —** gone forever. We also have a vocabulary for other levels of population decline.

Endangered: in danger of extinction in all or a major part of its habitat.

Threatened: at risk of becoming endangered.

Extirpated: no longer existing in an area of former abundance, but still existing elsewhere on Earth. (*Example: muskox were extirpated from Alaska after* 1865, *but some remained in Greenland and Canada*.)

Reintroduced: a species that has been moved by humans to a place where it originally occurred but has been absent. (*Example: muskox were reintroduced to Alaska in* 1930s)

What are the alternatives?

While people are the key to many problems facing wildlife, we are also the key to many of the solutions.

CONSERVATION: the use of natural resources in a way that assures their continuing availability for future generations.

WILDLIFE MANAGEMENT: the application of scientific knowledge and technical skills to sustain the abundance and variety of wildlife and its habitat while providing for diverse use of wildlife.

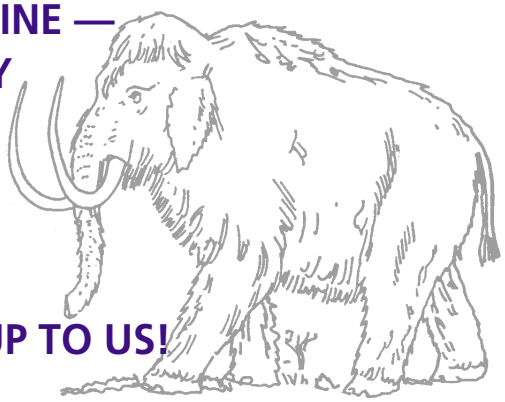
Both are public participation processes in Alaska.

WILDLIFE INSIGHTS

Section 1
HABITAT —
BASIS FOR SURVIVAL

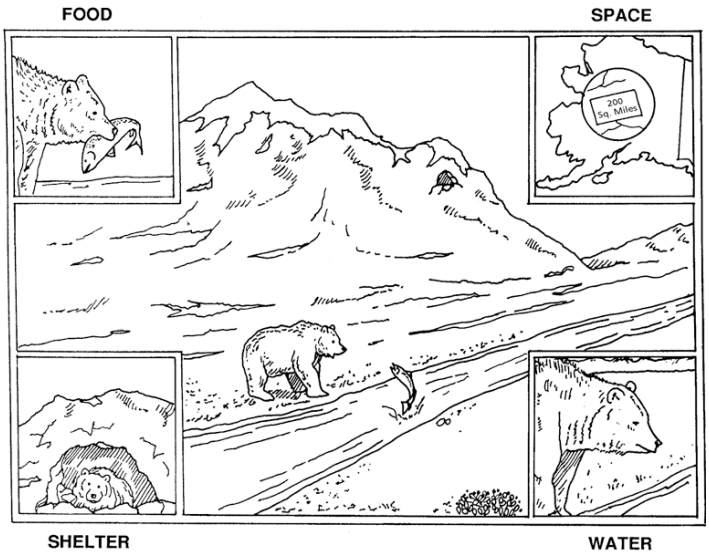
Section 2
BIODIVERSITY AND POPULATIONS —
ALASKA'S DYNAMIC WILDLIFE

Section 3
WHEN POPULATIONS DECLINE —
LOSING BIODIVERSITY



Section 4
WILDLIFE CONSERVATION IS UP TO US!

Habitat – Basis for Survival



FOOD: We wouldn't live long if we only had branches to eat, but a moose would.

WATER: We require freshwater to drink, but a harbor seal lives all its life in saltwater.

SHELTER: We can build a house on a hilltop, but a salmon would die up there.

SPACE: Swans that can nest, feed, and hide in a square mile of tundra would not survive in a square mile of city streets and buildings.

To survive, all living things need **food**, **water**, **shelter** (*or* **cover**), and **space** to roam in a place that's right for them (*a suitable arrangement*). These are called **habitat requirements** *or* **survival needs**.

Insects, spiders, frogs, worms, as well as plants, fish, birds, and mammals can live only where the environment provides these necessities.

- Polar bears cannot survive in a Southeast Alaska even though there are food, water, shelter, and space – they are NOT *the right kind* of food, water, shelter, and space for an arctic marine mammal! The environment that meets all of the needs of an animal is called its **habitat**.

- The habitat of the red squirrel, for example, is a spruce forest – a place where trees provide plentiful seeds to eat, hiding places to escape from predators, and nesting areas to raise young squirrels.

SEASONAL VARIATIONS

An animal's habitat requirements may be different at different seasons and times in its life. Some wildlife use multiple habitats, either daily, periodically, or seasonally. Here are two examples:

- A female polar bear will den (shelter) from November through April to give birth to cubs. After the cubs are old enough to emerge from the den, she will not use a den again until the next time she is pregnant.

- A brown bear will dine hungrily on tender roots and sedges in spring when few other foods are available. When salmon swim into nearby

streams from the ocean, the brown bear will walk past sedges to fish for the high protein salmon. In early fall, the bear will leave the salmon stream and gorge itself on berries.

SECRET TO SPOTTING WILDLIFE

The key to understanding habitat – and knowing where to find an animal – is to look at each animal's specific needs and where in nature those needs are met. The *Alaska Ecology Cards* available as part of this curriculum are handy references for habitat and food requirements of Alaska organisms from all five kingdoms (animals, plants, fungi, monerans, and protists).

Habitat comes in all sizes.

- Mosquitoes are infamous for their abundance in Alaska, but their habitat needs can be met in a small area. Both male and female mosquitoes sip plant nectar for food, but the female needs a blood meal from a warm-blooded animal to produce the eggs she will lay on the surface of any nearby water.

- Sandpipers that migrate to Alaska each summer need a shoreline for feeding and dry ground for nesting, but they also need their several thousand-mile-long migratory flight path and the winter shore and land area to take care of their yearly habitat needs.

When asking why an animal is found on the south-facing slope of a mountain and not on north-facing slopes, it is also important to understand the influences of topography, soil, sunlight, temperature, wind, snow, and permafrost. The **nonliving** elements of the environment affect the things that can live there. The science of **ecology** is the study of the interactions between and among **living things** and their nonliving environment.

ALASKA'S HABITATS

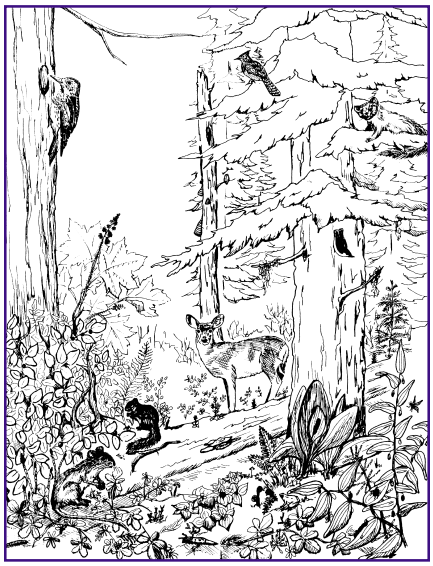
Other books in this *Alaska Wildlife Curriculum* focus INSIGHTS and Student Activities on the ecology of specific Alaska habitats. See *Alaska's Tundra & Wildlife* and *Alaska's Forests & Wildlife*. See also Section 3 of *Alaska's Ecology* for summaries and highlights of specific habitats and activities related to them.

ADAPTATIONS

All living and nonliving things together make up an **ecosystem**. There are many ways in which living things are finely **adapted** to survive and thrive in their ecosystem. Over time, the **physical characteristics** of a species change and that species fills a **niche**. Lynx, for example, are suited for winter climates with heavily furred, wide paws that spread out their body weight across the snow, much like snowshoes prevent people from sinking in deep snow. The large claws of the brown bear aid in fishing and digging. Wolves splay out their feet when heading downhill, over ice, or mud for better balance and grip.

For illustrations and discussion of adaptations of living things to Alaska's cold climates, see the 10 "Adaptation Fact Sheets" in Section 3 INSIGHTS of *Alaska's Tundra & Wildlife*.

Biodiversity & Populations – Alaska's Dynamic Wildlife



Biodiversity (biological diversity) is a measure of the variety and number of different organisms and ecosystems – locally, regionally, and globally.

A **species** is a population of organisms that are alike and that are able to breed and produce fertile offspring under natural conditions.

Section 2
WILDLIFE INSIGHTS

WHY IS BIODIVERSITY IMPORTANT?

Biodiversity is a measurement of concern in the 21st century. All living things exist in biotic communities – **ecosystems** – with a complex web of roles. Each species has adapted to fill specific **niches** (detritivores, producers, consumers, for example).

Biodiversity allows ecosystems to respond with flexibility to damage or change.

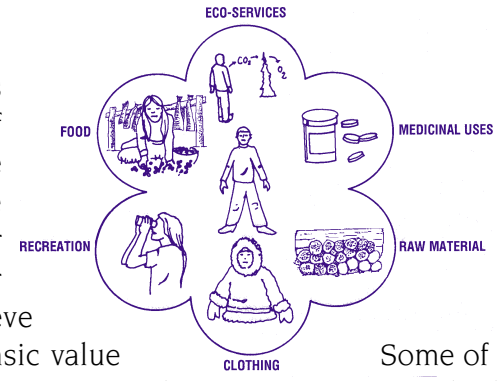
- The more numerous the detritivores are in an ecosystem, the better that job will continue to be done if one or more species are weakened or removed.
- If a forest is attacked by spruce bark-beetles, that forest will be radically changed if only one kind of tree – spruce – grew there.
- If the only wetland in town is removed, no wetland species can survive there.

Biological diversity is an important measurement in understanding how human activities can influence the future of wildlife and our Earth.

HUMANS BENEFIT FROM BIODIVERSITY

Humans benefit directly from the multitude of living things that we use for food, shelter, clothing, medicines, and raw materials for other products. The moose meat that stocks the freezer, the spruce trees that provide wood for homes, and the plants gathered for teas, soaps, or herbal medicines are examples of direct uses of living things in Alaska.

INDIRECT. We also benefit indirectly from living things. Insects pollinate food crops or control pest species in warmer climates where a majority of our fruits, vegetables, and grains are grown. Many Alaskans enjoy recreational activities that involve a variety of living things, such as bird watching, nature study, hunting, fishing, and gardening.



INTANGIBLE. Some benefits are intangible. Each type of living thing is a unique element of the world. While many people value other living things because of their utility, some people believe that all species have intrinsic value even if there is not an existing or potential human use.

EARLY WARNING SYSTEM. Changes in the distribution and abundance of wildlife populations may indicate more widespread changes in environmental conditions. For example, changes in lichen species may show that levels of harmful air pollutants have increased in an area. These changes may be an "early warning" of environmental changes that could be affecting human health.

ECO-SERVICES. Forests convert carbon dioxide, minerals, and sunlight into food for themselves and release **oxygen** that humans and animals breathe. Bacteria and fungi recycle minerals and energy as they break down dead things for their food and clean up the planet. Marshes and bogs filter out **pollutants** from the water passing through them. Forests can prevent flooding by slowing rainwater runoff. They also help maintain the **water cycle** by returning water to the atmosphere by transpiration.

DIVERSITY LOW, BUT INTACT IN ALASKA

The roster of Alaska's wildlife is small in comparison with the number of species in the world (*see table* "*How many species ... a sampling*"). Our state's biodiversity is noteworthy because it is remarkably intact. Less than a handful of known species have gone extinct in historical times (*see* INSIGHTS *Section* 3). Relatively few Alaska species of plants, mammals, fish, birds and invertebrates are on the endangered or threatened species list: <www.r7.fws.gov> or E*ndangered Species* <endangered.fws.gov> (US Fish & Wildlife Service).

Some of our species incorporate diversity in their survival. Black bears eat different foods throughout the spring, summer and fall. By eating what becomes available, their population does not react as severely to one change (loss of one prey species, for example) in their habitat. (*See student activity* "How Many Bears Can Live in this Forest?")

How many species ... a sampling





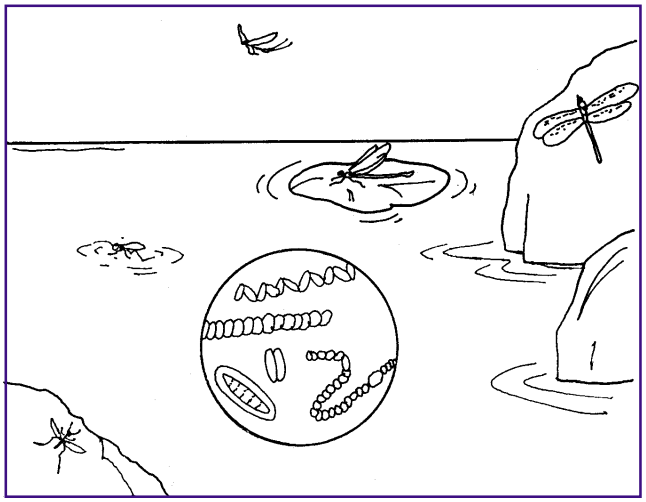
	ALASKA	WORLD
Amphibians	6	+4,200
Birds	452	+9,000
Fishes	430	+18,800
Mammals	108	+4,000
Plants	+1,500	+248,000
Reptiles	0	+8,300

ALERT FOR CHANGES IN BIODIVERSITY

Today, changes in biodiversity are attracting more attention from scientists and the public because the global rate of species extinction is rapidly increasing. People want scientists to keep track of changes in wildlife **populations** to alert us before a species is in danger and Earth's biodiversity is diminished.

Appreciating the importance and value of all species is also the key to developing attitudes of respect, responsibility, stewardship, and action for the environment.

MICROHABITATS & BIODIVERSITY



If you look closely at the environment, you will notice that differences exist even on a small scale. These small "mini-environments" are called **microhabitats**. Within each microhabitat, there are living things adapted to minute variations in conditions.

In a pond, for example, fish and many plants live below the surface of the water while the water strider and other insects are adapted for life on the surface. Some insects are even adapted for life on the underside of the surface of the water.

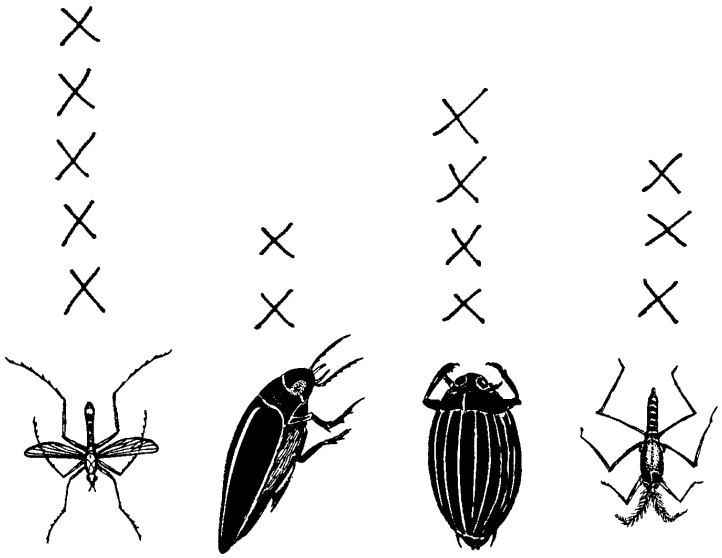
On land, some insects live inside the bark of a tree while others are found among the lichens on top of the bark. Some plants live on the tops of tussocks in the tundra while others thrive in the wetter troughs between the tussocks.

How Scientists Measure Biodiversity

When scientists describe or measure the amount of **biodiversity** in a particular place, they do two things:

(1) identify and count the number of different **species**
(2) count the number of individuals of each species.

Scientists often compare small areas in order to draw conclusions about the biodiversity of a larger area.



Questions to be Answered

Wildlife managers try to predict and monitor changes in species diversity after forest fires, beetle outbreaks, drought or floods, human development, or as one animal high on the food chain becomes more abundant or scarce. Questions that scientists ask and try to answer include the following.

- How do changes in a plant community (forest, wetland, tundra, etc.) affect wildlife that depend on that community for some or all of their habitat needs?
- Who eats whom?
- What other species may be impacted because of the web of connections of living things in an ecosystem?
- How many individual animals might be affected if the habitat is lost?
- How significant will the loss of individuals be to the continuance and abundance of the population?
- Will elimination of one population or species from an area result in the loss of other populations or species?
- What is the **carrying capacity** for a population? (*How much habitat is needed to support a population*?)
- How can impacts to wildlife be balanced against **human needs** and desires that lead to land use changes?

IDEAS FOR COLLECTION & FIELD TRIP SITES

After break-up (spring, summer, fall):

- Ponds, streams, wetlands, intertidal areas
- Vegetated area of your school grounds
- Forest with several successional stages in close proximity
- Aquarium - classroom or public facility
- Classroom terrarium
- Dig a hole under grass or other area with organic layer
- Garden or flowerbed
- Lawn
- Pile of leaves
- Decomposing tree stump, log, or snag
- Rock outcrop
- Top of a pingo or cottongrass tussock
- Wet trough of tundra polygons (permafrost areas)

After freeze-up or snowfall (winter):

- Snow-free areas under large trees - in the leaf litter
- On and under tree bark (*insects*, *lichens*, *moss*)
- Under the snow where snow is deep enough to insulate the area and keep temperatures above freezing (*check for unfrozen plants or small animal tunnels*)
- On the surface of the snow after a thaw
- Also ask local naturalists and Native elders in your community to help you find living things during different seasons of the year.

Wildlife Populations

A **population** is all the individuals of a single species that live and multiply or raise their young in a specific area.

DYNAMICS OF POPULATION CHANGE

Maintenance of **biodiversity** means maintaining the populations of our diverse wildlife and their habitats. How does one measure when a species is trouble? What are natural up and down population trends?

Animal populations change over time. Animals die because of predation, starvation, hunting, disease, accidents, extreme weather challenges, old age, and loss of habitat. Populations lose animals because they **emigrate** (*move away*), or gain from others **immigrating** into the area.

Bottom Line is Habitat

Ultimately, every population is shaped by the amount of available **habitat** (*food, water, shelter, and space*). Often, the key is the availability of one necessity that is in shortest supply.

- When drought dries small ponds (*shelter*), nesting and brood rearing sites for ducks are limited. This results in fewer ducklings being born and even fewer young ducks surviving to fly south.

- A shortage of prey (*food*) such as lemmings in a tundra area may trigger an emigration of snowy owls that prey on the lemmings. This phenomenon occurred periodically on the Arctic Coastal Plain of Alaska. Between 1986 and 1991, biologists estimated that the snowy owl population varied from zero to approximately 4,000 owls in response to changing populations of lemmings.

The relationship between predator and prey species is important to understanding population dynamics of wildlife. Although predators are often the major factor limiting growth of a prey population, prey populations (as illustrated by the lemmings) can also limit the size of predator populations (the snowy owls) if the prey are the only source of food available.

Humans Influence Habitat

Humans and our activities affect the dynamics of wildlife populations. Our actions can alter or wipe out habitat. Lawns and ballfields in Anchorage provide feeding areas for Canada geese which rarely nested in the city historically. The clearing of land to develop roads and the construction of buildings for homes and industry decreases available habitat for other wildlife. Timber harvests and mining can change or remove food and shelter and change the temperature or clarity of water.

CARRYING CAPACITY OF HABITATS

Every population has a maximum size it can reach before the species exceeds the available habitat. This maximum number is the **carrying capacity** of an area. It is a "ceiling" for the population.

POPULATION EXPLOSIONS. Numbers may briefly soar past the ceiling under favorable conditions (mild winters, abundant food) causing a population explosion. Inevitably, deaths drop numbers below the carrying capacity when individuals cannot find resources needed to survive.

POPULATION CRASHES. Populations of **herbivores** (plant-eating animals) such as deer and caribou may crash precipitously if they exceed carrying capacity. This is because they can damage or kill their plant food sources through heavy browsing or grazing. The heavily-browsed lichens and shrubs can take years to recover. Herbivore populations that have crashed are limited while their food supplies recover. In this situation, the animals actually reduce the carrying capacity of their habitat temporarily.

Limiting Factors

Something that keeps a population of animals from increasing is called a **limiting factor**. For wildlife it could be a shortage of food, water, shelter, or space. Or it could be diseases, predation, climatic conditions, pollution, hunting, poaching, and accidents that affect either the number of births, the number of deaths, or both.

Limiting factors in a habitat affect its carrying capacity.

- For example, the availability of willow browse is a limiting factor for moose. More moose cows have twins (versus single calves) that survive their first winter in areas where willows are abundant.

- Another limiting factor for moose is snow depth. More moose die during a winter when deep snow covers willow shrubs for a long time.

- The depth of snow also affects the ability of moose to avoid predators. Thus, a winter with deep or long lasting snow will lower the carrying capacity of an area (*and the moose population*) compared to winters when the snow is shallower or less persistent.

A healthy wildlife population fluctuates from year to year as limiting factors and the carrying capacity of the habitat change. Some animal species have a wider range of tolerance – they eat a variety of food and can diversify when one food is in short supply, for example. The populations of these species tend to stabilize at a certain level, while other species' populations fluctuate widely.

Population Cycles

Certain species display cyclic patterns of growth and decline. Lynx and snowshoe hare populations in Alaska and elsewhere are a classic example of a predator/prey/plant cycle. (*see following* "Predator-Prey" *Fact Sheet and the activity* "*Predator-Prey Predicament in Section* 2). Among the larger mammals, moose and wolves also go through peaks and troughs of abundance, with each species' population size dependent on the other.

TRACKING WILDLIFE POPULATIONS

One of the main jobs of wildlife managers in Alaska is to track the ups and downs of wildlife populations and to determine the causes. They do so because Alaska wildlife is managed on the principle of sustaining human uses of wildlife into the future. Rises or drops can indicate a change in the health of a population, its habitat, and other members of its **food chain**.

HELPING ACTIONS. Serious population changes may call for human intervention – changes in harvest regulations, habitat protection, and/or habitat enhancement. Wildlife managers work to maintain healthy populations that permit a variety of human uses of wildlife.

PEOPLE CARE. Many Alaskans and visitors hunt, trap, photograph, or view our wildlife. People who depend on animals become concerned when populations change. Wildlife managers allow harvests of populations (hunting and trapping) when the predicted rate of reproduction is high enough to replace the animals harvested.

TAILOR PLAN TO SITUATION. In Alaska, certain populations of geese are high (*Canada geese in Anchorage*) while other populations remain low (*Emperor geese on the Yukon-Kuskokwim Delta*). Management plans for these populations must be designed differently, for different results.

WORRISOME LOWS AND HIGHS. Wildlife managers worry that small populations of wildlife may become extinct. If populations are small or have declined to low numbers, people may need to make special efforts to help them increase or recover.

Wildlife managers are also concerned about large populations for the overall health of the population (*avoiding crashes*) and impacts on the health of the ecosystem and human health.

How Are Populations Counted?

Wildlife managers study *populations of animals* (rather than *individual* animals) to keep track of changes in animal abundance.

(1) Wildlife biologists must determine population boundaries in order to know which animals are part of the same population before they can study how populations change. They also need to know the best time of year to see and count all the animals.

(2) Then they need to count the animals within those boundaries, repeating their counts over years to detect changes and trends.

Determining population boundaries. The first question - which animals are part of the same population? - involves finding out which animals live and raise their young in the same area year after year. This can be difficult because some Alaska wildlife species move over long distances and gather in groups only briefly. Biologists try to make accurate counts of all animals in a population, but they are not always able to do so.

Caribou for example. Herds may spread out over tens of thousands of square miles during winter. Where does one caribou population end and another begin? Fortunately for biologists, caribou herds gather into separate areas after calving. Biologists can **census** (*count each animal*) at this time of year.

Counting the animals. Not all wildlife species come together in groups at certain times of year. Many animals are hard to see during a survey. A moose in a dense stand of spruce trees may be impossible to spot even from an airplane. Because it is often difficult to census all animals in a wildlife population, biologists often choose a smaller area within the whole and count that portion of the population (a **sample**).

From sample to whole. From that sample, they **estimate** the size of the total population. They multiply the results by the number of same-size areas in the whole habitat. (*For example, if they just counted one-tenth of the habitat, they multiply their census number by* 10 *to get an estimate of the entire population.*) While this is a simplification of the process wildlife biologists use to determine population, it illustrates the general concept.

Many variances are included in an actual census, sometimes involving complex equations.

POPULATION EXPLOSIONS

Linear or Exponential Growth?

EXAMPLE: *Students.* If a population were to increase linearally, it would grow at a constant rate. For example, if your class size increased at the linear rate of 2 students per year, at the end of 5 years, there would be 2 times 5, or 10 new students.

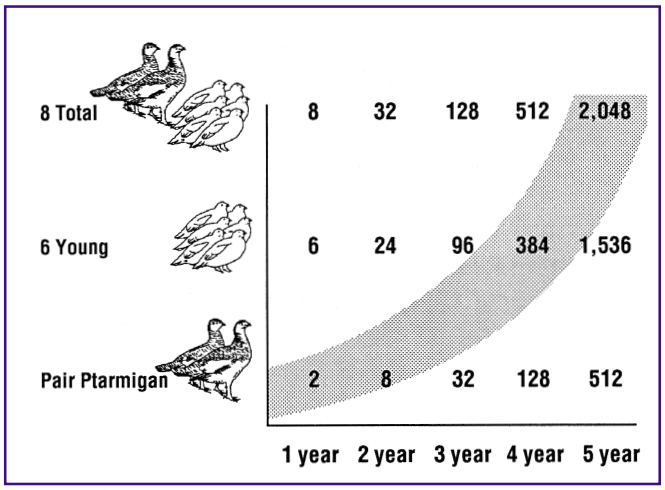
If, however, the number of students in your classroom increased **exponentially**, each year there could be two new students for each existing student. A class of 25 students would add 50 new students the first year. In the second year the 25 original and 50 new students (75 total) would increase by 150 new students. Those 225 students would grow to 675 and then to 2025 by the fifth year. **Exponential growth occurs at an increasing rate through time.**

Potential Rates

Most animal populations grow at an exponential rate because each female has the **potential** to give birth to more than one offspring in each generation. Thus, the number of females ultimately determines how fast the population can grow.

EXAMPLE: P*tarmigan.* A pair could nest and raise 6 chicks in one year. The next year, if half of the chicks were female and all survived, the 3 chicks and the original female would each raise 6 chicks, 3 of which would be female who would, in turn, each raise 6 chicks.

At the end of two years, *assuming no deaths occurred*, the original population of 2 would have grown to 32. After 3 years there would be 128, in 5 years there would be 2,048, and after 9 years this imaginary ptarmigan population would have grown to include over a million birds.



Actual Rates

The larger the population is, the faster it grows. The faster it grows, the larger the population becomes. Although all animal populations have the potential to grow at an exponential rate, the actual **growth rate** for each species varies because each has a different pattern of births. The pattern or rate of births is influenced by:

(1) the time between generations
(2) the length of gestation (pregnancy)
(3) the number of young born each time a female gives birth
(4) the age at which a female first gives birth
(5) the average reproductive life of females.

- Female red-backed voles produce 4 - 8 young up to 6 times each year and give birth to their first young at 3 - 6 weeks of age. In one year, one female red-backed vole can give birth to 24 - 48 young. That's a lot of voles!

- In contrast, humpback whales produce 1 calf every 2 years and begin breeding at 6 to 12 years old.

Factor in Deaths

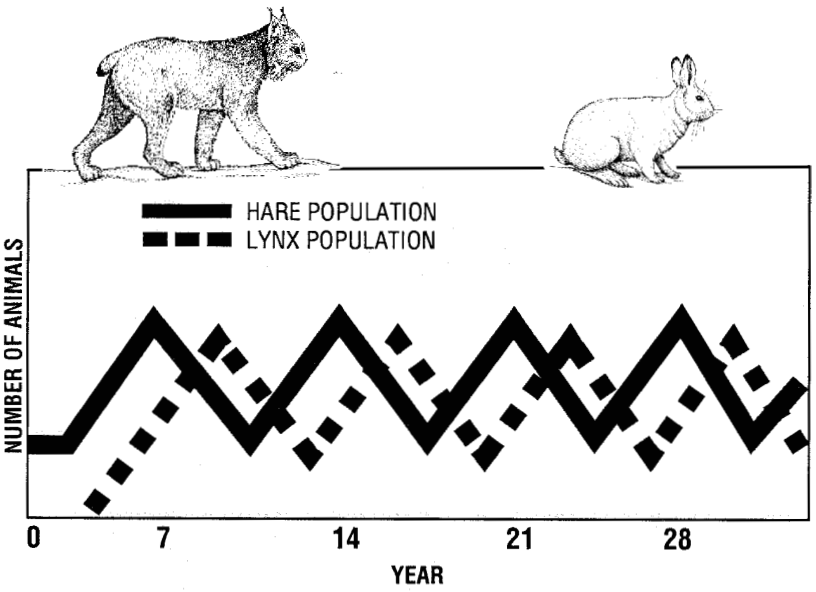
In reality, animal populations do not grow as rapidly as their reproductive rate would predict because deaths occur. The size of a population at any point is a result of both births and deaths.

For example, a biologist surveys a moose population each winter. The change in the size of the population from one winter to the next is a result of both the number of calves that were born into the population and the number of adults and young that died.

PREDATOR-PREY

Predators often limit the population growth of the animals they eat. Prey populations, in turn, limit the size of predator populations if they are the only source of food available. If the prey animals eat plants, then plants also can affect this relationship.

Alaska's best example of a predator-prey-plant relationship is the cycle of lynx and snowshoe hare populations.



Snowshoe Hare Explosions

Snowshoe hares prefer early successional stages of forests (*see* Alaska's Forests &Wildlife). They need branches of willow, birch, and aspen at heights they can reach. Hares reproduce "like rabbits!" and multiply rapidly.

As their population increases, they begin to destroy the plants they eat. In defense, gnawed willow and birch produce chemicals that either taste bad or affect the hare's ability to digest food. Without being able to eat their favorite foods and consuming all others, many hares starve. Others may become diseased. Their once-high population drops ("crashes") to a low level within 2 - 3 years.

Without the pressure of browsing hares, the vegetation recovers. But it takes 3 - 5 years before snowshoe hares will have enough food to increase again.

Lynx is Right Behind

And what's happening to the lynx? Lynx are uniquely adapted to prey on snowshoe hares, their main food source. As hare numbers increase, more lynx kittens are born and survive. The lynx population will continue to rise until snowshoe hares crash.

The peak in the lynx population is usually a year behind the peak of snowshoe hares. Lynx can support themselves and their kittens on the still relatively abundant hares for an extra year or two, which adds to the hares' swift decline. Then, as hares become scarce, the lynx population crashes.

Predictable Cycles

The cycle of population explosion and crash in this predator-prey-plant-food chain may take 8 -14 years but is usually 9 - 11 years. This cyclic pattern, recorded for more than 200 years, occurs across most of northern North America with remarkable regularity.

WILDLIFE FACTS

HERMIT CRAB CHALLENGE

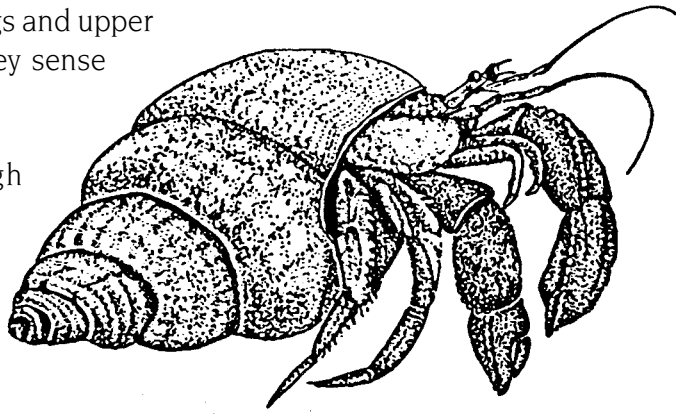
Hermit crabs are found in shallow tidepools along parts of Alaska's coastline. Hermit crabs have a highly visible **habitat** need. They use empty snail shells as **shelter** to protect their soft lower bodies. They live in the abandoned shells of snails and rarely leave these "borrowed" homes.

HABITAT: If you are able to take an intertidal field trip, you and your students will likely spot hermit crabs in tidepools or shallow, rocky intertidal areas. You can easily observe how hermit crabs use their shells for shelter.

BEHAVIOR: Hermit crabs move slowly pulling themselves and their shell around, then quickly withdraw their legs and upper body into the shell if they sense danger.

ADAPTATIONS: Through evolution, hermit crabs have become physically adapted and dependent on the use of the shells. Unlike other crustaceans, which are armored with hard coverings over their entire body, the abdomen of hermit crabs is soft and shaped to fit the coiled and tapering snail shells. A hermit crab without a shell is vulnerable to **predation** or injury and will likely survive only a short time.

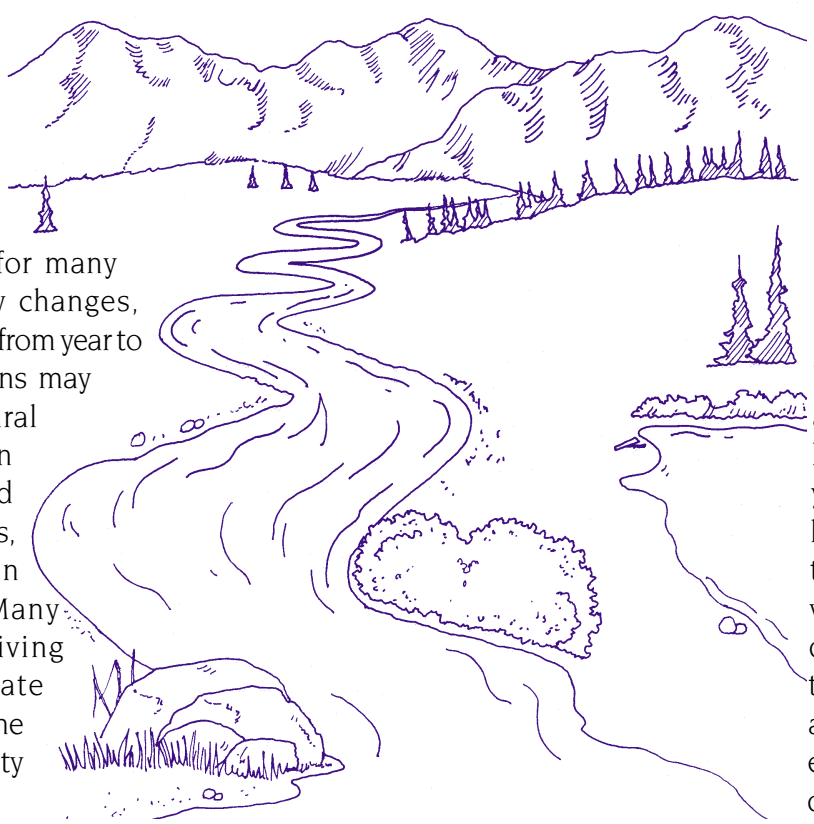
LIFE'S CHALLENGE: It is critical that hermit crabs find new shells. Like other living things, they grow during their lifetime, and need to find bigger shells periodically. Finding exactly the right size of empty shell may not be easy for growing hermit crabs. If the right size shell is not available, then the crab may die.



LIMIT TO SURVIVAL: The number of suitable shells is a **limiting factor**. It limits the number of crabs that survive in a **population**.

CARRYING CAPACITY

Carrying capacity may be defined as the number of plants or animals of a given species that an area of land or water can support. It is the largest **population** a unit of **habitat** can support on a year-round basis, or during the most critical period for the species.



Carrying capacity for many species constantly changes, both seasonally and from year to year. Yearly variations may be caused by natural disasters, changes in rainfall and temperature patterns, or human interventions. Many populations of living things fluctuate naturally around some level. Carrying capacity affects that level.

other and brown bears. Adult bears run adolescent bears out of the area or occasionally kill them. These young bears must keep moving until they find an area vacated by the death of an adult. If they do not find an area for themselves, eventually they will die.

A population may be *below* carrying capacity, such as in the spring following a hard winter, or temporarily *above* it. The latter situation inevitably results in a decline of the population by deaths through disease, emigration, and/or lowered reproductive rate until it drops below carrying capacity.

Black Bear Example

Black bear habitat limits populations especially through the influences of shelter, food supply, and the social tolerances or territoriality of the animal.

- **Shelter** or **cover** is a prime **limiting factor**. Black bears need thick cover to hide from each
- When **food** supplies are reduced, competition becomes more intense. Some adult bears might temporarily move to seldom-used portions of their home ranges, sometimes many miles away. Most bears, however, must live on what food is available in their area. These individuals may become thin, occasionally starve, or in the case of young bears, be killed or forced from the area by more aggressive adults.

Through these "adjustments," the total bear population remains within the carrying capacity of the habitat.

WHAT'S ON A BEAR'S MENU?

Kenai Café

If you are an average adult male black bear living on the Kenai Wildlife Refuge in Alaska, you weigh 170 pounds, have a 165 square-mile home range, and eat six pounds of food each day.

You are an **omnivore**, eating both plants and animals. In the spring, your diet is a mix of animals (80.3%) and plants (19.7%). When the salmon run, your diet changes to primarily salmon (58%) and other animals (24%) and plants (18%) supplement your needs. You chose from a diverse menu including:

Vegetation

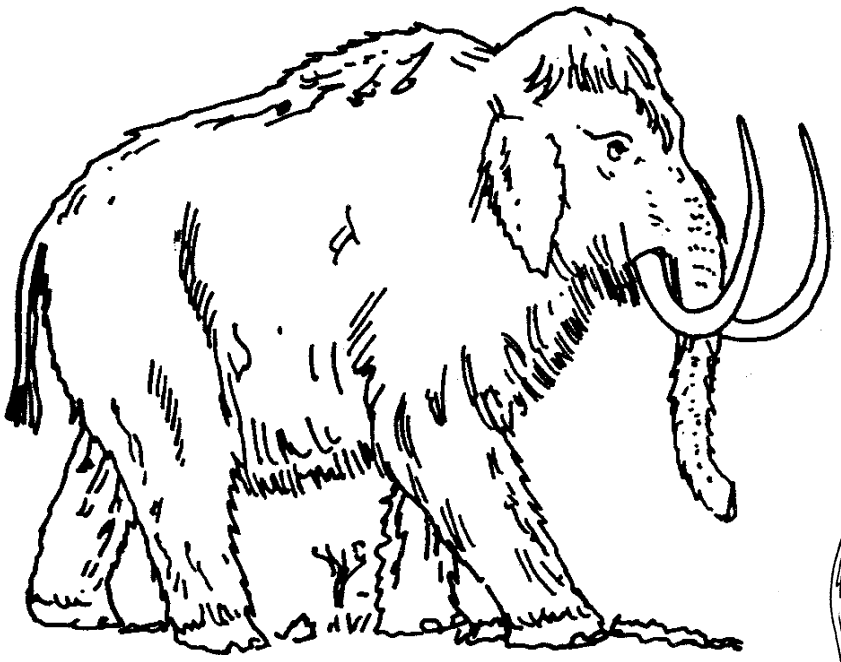
- Berries from a variety of plants
- Devil's club
- Horsetail
- Sedge and grass
- Clover
- Leaves
- Mosses
- Flowers

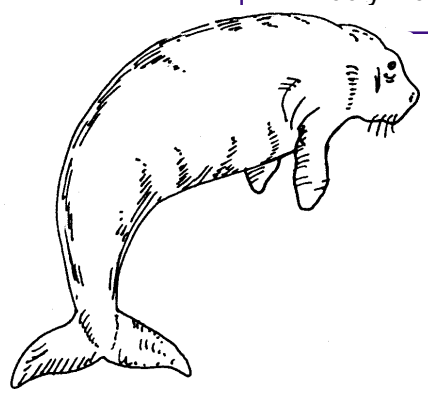
Animals

- Moose
- Salmon
- Insects and insect larvae
- Snowshoe Hare
- Birds
- Small mammals

When Populations Decline – Losing Biodiversity

About 65 million years ago, the North Slope of Alaska resounded to the thud of dinosaurs. About 15,000 years ago woolly mammoths grazed beside glaciers. They are gone now. As the climate changed, the American mastodon, Pleistocene camel and saber-toothed cat were unable to adapt and disappeared.





LIFE AND DEATH IN CHANGE

The world we live in is dynamic. Environmental change – with life and death consequences – can come from changes in the **nonliving** elements of our ecosystem (*climate, floods, drought, fires, volcanic eruptions, earthquakes*) and the **living things** (*through competition, predation, disease, and actions of humans*). Or the cause can be a combination of elements.

DINOSAUR DID IT WITHOUT US! Change can lead to **extinction** of some of Earth's life forms. We know that many species have come and gone since the earliest fossil records dating to four billion years ago. Dinosaurs, the most famous example, disappeared when they were unable to adapt to their new environment. The cause of that change is still under debate – but at least we know humans were not to blame!

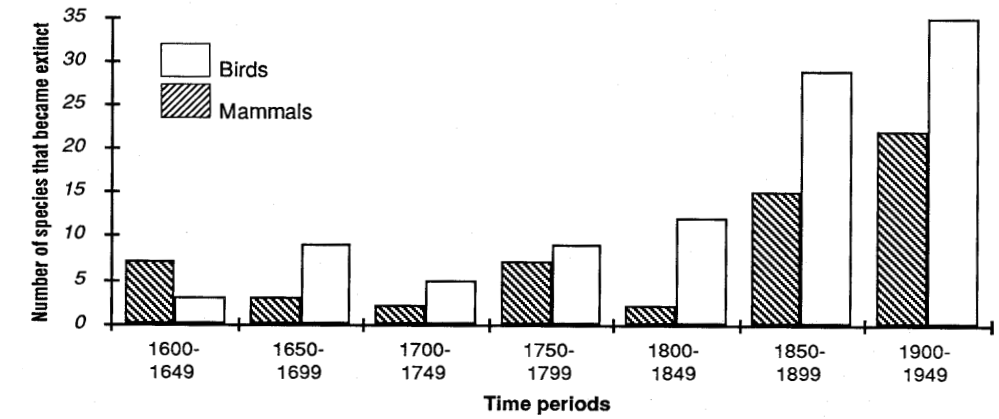
HUMANS SPEED THE DECLINE. Recent humans, armed with technological advances and an appetite for resources, have been speeding the decline or extinction of habitats and/ or species around the world. In 2000, the extinction of the first primate, the West African Monkey, was announced.

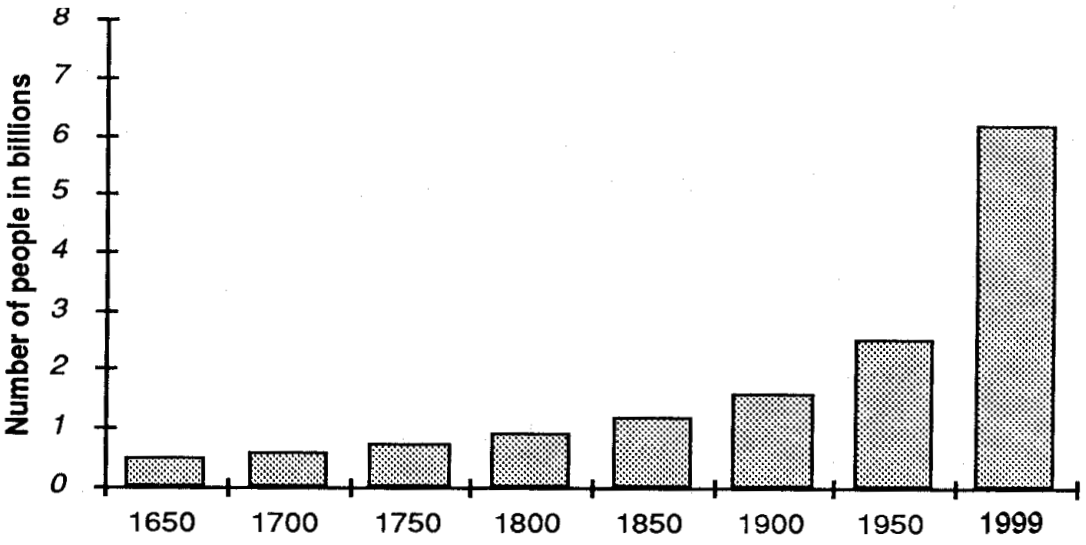
LOOKING FOR THE CAUSES. Sometimes it is a challenge to distinguish between human-caused and natural ecosystem changes such as in the current decline of species in Alaska's Bering Sea. Understanding how our actions have caused loss in biodiversity in the past will help us understand how to prevent future losses and reverse current declines.

Alaska's contributions to diversity

The biological diversity of Alaska is unique because our ecosystems remain relatively healthy and intact, compared to many other parts of the world. Alaska's low human population, combined with vast tracts of undeveloped land, provide vital habitat to plants and animals that need open spaces free from human development.

BIG RESPONSIBILITY. For some kinds of animals, Alaska is the only habitat home they use. Almost all Emperor geese, for example, breed on the Yukon-Kuskokwim Delta and winter in our Aleutian Island chain. For other animals, Alaska is crucial to their survival for migration stop-overs or spring nesting.





OPEN SPACE RESERVOIR. We serve as a stronghold for species no longer found, or in trouble, in the Lower 48 states including bears, wolves, salmon, and lynx. Recent efforts to reintroduce species to their former ranges in the Lower 48 have relied on individual animals from Alaska and Canada. For example, wildlife managers are capturing Alaska lynx for reintroduction in Colorado. The success of these efforts depends on many factors; but without healthy populations in Alaska, reintroduction could not be possible.

No *Complacency Allowed*

Although we can boast about many healthy populations of fish and wildlife in Alaska, we are also facing an increasing number of species in trouble. Declines in wild residents of the Bering Sea ecosystem in particular remind us that we cannot be complacent.

CHALLENGE TO MONITOR. One of the main tasks of wildlife managers is to conduct population counts to help recognize declines. Our vast and remote landscape allows many of our species to thrive, but at the same time makes it more challenging and expensive to track population ups and downs with needed regularity.

HEALTHY RECORD. To date we have been able to turn around declines in peregrine falcons, geese, and sea otters. No Alaska species is known to have become extinct in the 20th century; and few have been lost since the large-scale extinctions that occurred at the end of the Pleistocene period 10,000 years ago. (*See following "Extinct Alaska Species" Fact Sheet."*)

LAWS PROTECT WILDLIFE

Some of the first wildlife laws in this nation were written to protect Alaska's resources. In the early 1900s, laws were passed to protect sea otters, fur seals, and migratory birds from over-hunting.

ENDANGERED SPECIES ACT. In 1973, Congress passed the Endangered Species Act to protect populations that are threatened or endangered. Teams of specialists from state and federal agencies and other organizations work together to reverse the population decline, protect habitat, and reduce threats to survival. (*See following "Endangered Alaska Species" Fact Sheet.*)

ALEUTIAN SUCCESS STORY. As a result of human efforts, some previously declining wildlife populations are now recovering. The Aleutian Canada goose population had dropped to 790 birds in 1975 and was one of the first animals in Alaska to be protected under Endangered Species status. Through extensive management efforts, the population recovered to 7,000 in 1991 when the Aleutian Canada goose was moved from the Endangered listing to threatened status. In 2001, with a population of 37,000, Aleutain Canada goose populations are stable and they are no longer listed.

Today the Aleutian goose population is stable at 25,000. Recovery measures included harvest management (changes in hunting levels), protection of winter resting habitat, and removal of non-native predators (introduced foxes) that preyed on nesting geese and their goslings.

Habitat loss as a result of human activities is now the leading cause of extinction of wildlife populations.

Vocabulary of Extinction

Wildlife managers use the following definitions to categorize populations.

Extinct: (adjective) gone forever. No longer existing on Earth.

Extinction: (noun) the process by which a species becomes extinct or the event of becoming extinct.

Extirpated: (past participle) no longer existing in an area of former abundance, but still existing elsewhere on Earth. (*Example: muskox from Alaska after* 1865)

Endangered: (adjective) in danger of extinction in all or a significant portion of its range (*from* U.S. *Endangered Species Act of* 1973).

Threatened: (adjective) at risk of becoming endangered. A significant risk exists that the species will become endangered in the near future (*from* U.S. *Endangered Species Act of* 1973).

Note: The federal Endangered Species Act has no specific population numbers or levels that are to be used to determine whether a species or population is threatened versus endangered.

Introduced: (adjective) a species that has been moved by humans to an area where it was never known to occur. (*Example: arctic fox to many Aleutian Islands*)

Reintroduced: (adjective) a species that has been moved by humans to a place where it originally occurred but has been absent. (*Example: muskox to Alaska in 1930s – see also "Extirpated"*)

Exotic: (adjective) a species has been introduced into an area where it never could occur naturally. (*Example: Norway rat, ring-necked pheasant*)

NOTE: *The US Fish & Wildlife Service maintains the threatened and endangered species list. Check* <*www*.endangered.fws.gov> *or contact your local* USFWS *office.*

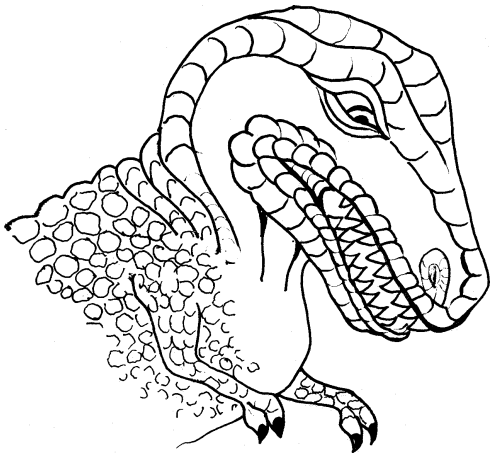
Extinct Alaska Species

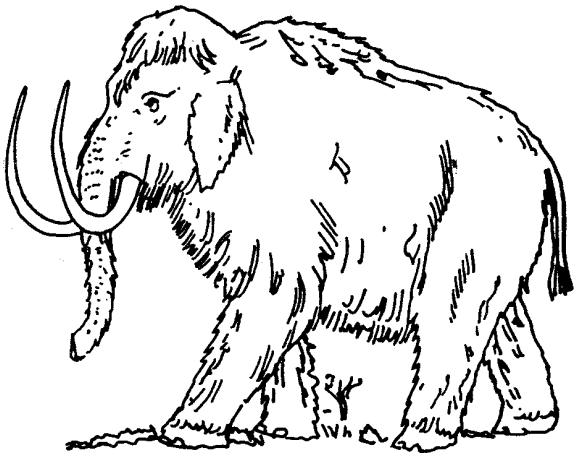
Age Of Dinosaurs
Albertasaurus
Tyrannosaurus
Dromiosaurus
Edmontasaurus (hadrosaurs)
Pachyrhinosaurus(ceratopsian)
Troodon
Plesiosaurs
Turtle

Pleistocene/Ice Age
Muskox (2 species)
Large-horned bison
Ground sloth
*Woolly mammoth
American mastodon
Short-faced bear
Lion-like cat
Pleistocene camel
Stag-moose
Saber-toothed cat

Human Occupation
*Steller's sea cow
*Spectacled cormorant

(* *see following* Natural History Wildlife Facts)





Species No Longer Present in Alaska

Horse
Badger
Taiga antelope
Yak

These species disappeared during the Pleistocene period.

They entered Alaska via the Bering Land Bridge from Asia. Alaska populations were separated from populations in what is now the western United States when glaciers and ice sheets reached their maximum extent. They were cut off from Asian populations when the ice sheets receded and ocean levels rose to submerge the land bridge.

These animals were unable to adapt to changing conditions in Alaska, yet they survived in other areas where conditions remained favorable.

Species Reintroduced to Alaska

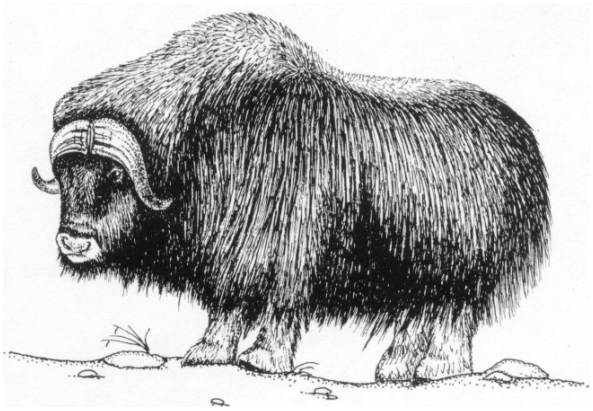
Elk
Bison
Muskox

These animals have returned to Alaska as a result of translocations from other areas where they still live in abundance.

- **Elk** did not survive the Pleistocene period in Alaska. Roosevelt elk populations now live on Afognak Island and islands in Southeast Alaska because of reintroduction efforts.

- The steppe **bison** became extinct during the Pleistocene era, but the wood bison survived in Alaska until approximately 500 years ago. The plains bison, moved from Montana in 1928, live in Alaska today.

- Two species of **muskoxen** became extinct during the Pleistocene, but a third species survived until the late 1800s. This species was eliminated from Alaska by over-hunting and other factors. Muskoxen were reintroduced from Greenland in 1930 with a herd of 34 muskox. By 2000 the muskox population had grown to more than 3,400 muskox in Alaska



Exotic (Non-Native) Species Introduced to Alaska

European rabbit
Norway rat
House mouse
Raccoon
Rock dove (pigeon)
Brook trout
Northern pike

People have accidentally or without thinking introduced a variety of plants, insects, and microscopic organisms that do not belong in Alaska.

Red foxes, while native to some areas of Alaska, were dropped off on many Aleutian Islands where they had never occurred before. There they preyed on eggs and young birds, **extirpating** Aleutian Canada geese and reducing other nesting birds on many islands.

Release of non-native wildlife into the wild is now regulated under law. Harm can be caused by: direct predation on native species, introduction of diseases and parasites, and competition with native species for food. **Translocations** of native species to areas where they do not occur naturally also can trigger these types of problems. Proposed translocations in Alaska receive careful study.

Endangered Alaska Species

A few Alaska species and sub-species have declined rapidly and are listed as endangered under the federal Endangered Species Act of 1973.

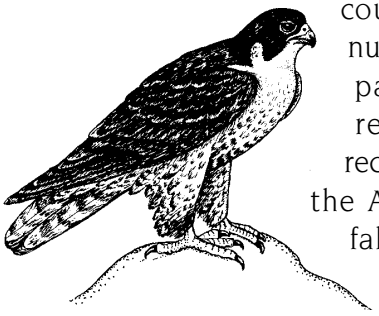
This list changes over time. *For a current listing, check* <endangered.fws.gov> *or call the* US Fish & Wildlife Service, Endangered Species office *at* 907-786-3505 *in* Anchorage. *For a copy of the* Endangered Species Act, *go to* <endangered.fws.gov/esa.html>

Humans Rally to Help

Being named on the Endangered Species List provides protection for the species from additional threats to survival. When species are listed, management agencies must increase efforts for **population** recovery.

When a species is endangered or threatened, a special **recovery team** of biologists develops a plan return the species to abundance. This **recovery plan** must identify a threshold population number for changes in status to "recovered."

PEREGRINE FALCON RECOVERS. The Arctic peregrine falcon was listed as endangered in Alaska until biologists counted a certain number of nesting pairs. Then the recovery team recommended that the Arctic peregrine falcon's status be changed to "threatened." Continued success led to recovery and removal (**delisting**) from the Endangered Species List in 1994.



CONTINUED MONITORING. Biologists will monitor the populations closely to ensure that the population remains stable.

(*The Alaska Raptor Kit is available on loan from the Alaska Department of Fish and Game in Fairbanks and Douglas, and from* ARLIS *in Anchorage.*)

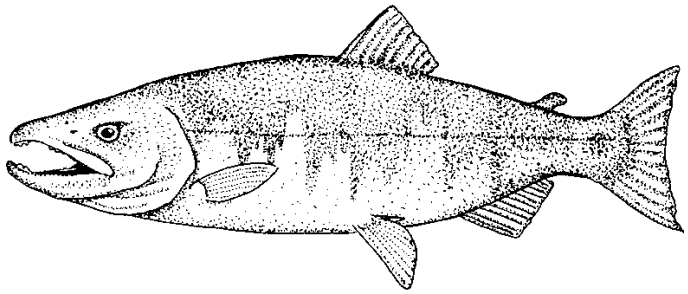
Habitat May Need Help Too

Endangered species recovery often demands more than just monitoring population numbers. Biologists decide which areas are critical habitat for survival and then take steps to protect these areas from destruction.

The State of Alaska also maintains a list of endangered species considered in danger of extinction by the Alaska Department of Fish and Game. Once a species is placed on the state list, state-owned habitat is protected and people need a special permit to harvest any animals of that species.

Alaska Species Threatened or Endangered in the Lower 48

Some species have healthy populations in Alaska but are threatened or endangered elsewhere in the Nation.



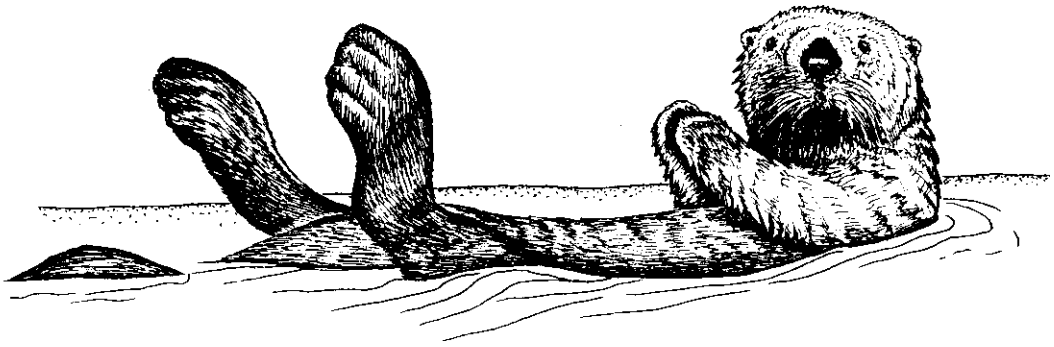
Examples:

Brown/grizzly bear (threatened in Lower 48)

Gray wolf (endangered in Lower 48 and Mexico)

Sea otter (threatened along the Pacific Coast)

Salmon populations (some populations endangered in the Pacific Northwest)



Alaska Species of Concern

Some species native to Alaska are being studied because of declining populations, rarity, restricted distribution, dependence on limited habitat, or sensitivity to environmental disturbance.

Examples:
Alexander Archipelago wolf
Beluga whale (Cook Inlet population)
Black scoter
Brant
Dusky Canada goose
Emperor goose
Harbor seal
King eider
Kittlitz's murrelet
Marbled murrelet
Montague tundra vole
Northern goshawk (Queen Charlotte Island subspecies)
Short-tailed albatross
Spectacled eider
Steller's eider

Want to Learn More?

Many **migrant neotropical songbirds** are being studied for listing as threatened or endangered. These songbirds nest in Alaska and spend the winter in the tropical forests of Central and South America (the "Neotropics"). Scientists suspect Alaska songbird populations may be reduced because declines already have been documented for similar songbird species that nest in Northeastern United States and winter in the Neotropics. In these wintering areas, forest habitats are rapidly being logged, mined, or cleared for agriculture. House and feral predatio on songbirds is also effecting their populations. Scientists are gathering more information on these species.

For updates on songbirds, refer to Journey North <www.learner.org/jnorth>

For annotated Alaska species at risk, refer to the Alaska Natural Heritage Program <www.uaa.alaska.edu/enri/aknhp_web>

Factors Behind Declines

Animals are more prone to population decline and extinction if they…

… interfere in some way with human activities.
At times, some animals kill livestock, eat or ruin crops, or feed on animals that humans like to eat. Animals may threaten our safety or property. If wildlife interfere with human activities, they are often shot or poisoned.

… are in high demand by humans.
If a species has a high economic or other use value to people, it could become endangered or extinct unless its harvest is carefully regulated and enforced. *For example, a substance from the Pacific yew tree has been a successful treatment for some forms of cancer and is now in high demand.*

… migrate.
Animals that migrate usually depend on several different habitat areas and connecting corridors or greenbelts. If habitat areas are destroyed along the migration route, their population may be more vulnerable.

… are high on the food chain.
These animals tend to be larger, with slower reproductive rates, and are more susceptible to over-harvest or habitat loss.

… have very specific habitat requirements.
Some animals have adapted to eating only one type of food or living in one type of area. They can become endangered if their food source or habitat area disappears.

… are sensitive to pollution.
Many animals have difficulty adapting to changes in their environment. *For example, birds of prey are very sensitive to chemicals introduced into their environment, such as pesticides.*

… have a low number of offspring and long gestation periods.
If populations of these species decline, they recover slowly and could become extinct if multiple factors affect them. *Compare the offspring of a northern red-backed vole that has up to 48 young a year to that of a black bear that has two young every other year. If all offspring reproduce at the same rate, the sixth generation of 382,205,952 voles will be produced in six years, whereas the sixth generation of 11 black bears will be produced in 12 years.*

… are naturally rare.
Some animals are rare throughout their range, and others have a very limited range. Small populations with limited distributions are particularly vulnerable to environmental changes, habitat destruction, or human-caused problems.

Adapted from National Wildlife Federation. Endangered Species: Wild and Rare, *NatureScope, Washington* DC, 1988.

For more information on the Endangered Species Act and the status of species, browse <endangered.fws.gov> (US Fish & Wildlife Service).

Bald Eagle

The bad news....

Bald eagle populations in the Lower 48 declined due to a combination of factors.

- **Pesticides** accumulated in their bodies, making them sick or thinning their egg shells.
- In many areas water pollution, over-fishing, and destruction of wetlands caused populations of the eagle's primary **prey**, fish, to decline.
- Nest sites became scarce as large old trees were cut for human uses such as lumber, firewood, and to clear the land for development.
- Additionally, many eagles were illegally shot by farmers and ranchers who feared eagles killed their livestock.

The good news ....

Bald eagle populations in the Lower 48 are recovering and were removed from Endangered Species listing in 1999. Many steps have been taken to ensure the survival of this bird.

What happened?

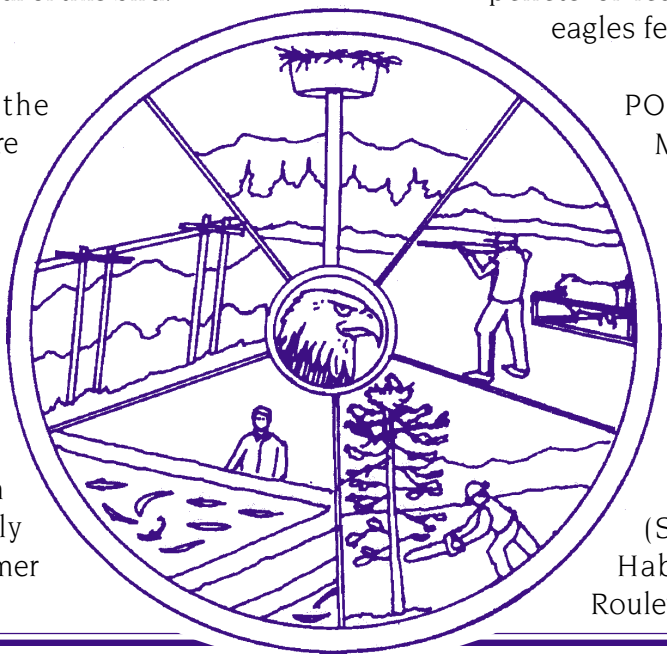
FEWER KILLED. As the public became more aware of the eagle's plight and strict laws were enacted, fewer eagles were killed.

ALASKA EAGLES BOOST POPULATION. Biologists captured some eagles from healthy populations in Alaska and successfully moved them to their former Lower 48 habitats.

NEST SITES PROTECTED. Nesting habitat is now protected and artificial nest sites have been built where natural nest sites were limited or lost. Biologists and utility companies are working together even in Alaska to design power lines that will not electrocute eagles if they land on them.

DDT PESTICIDE BANNED. The use of pesticides such as DDT are banned. DDT thins eggshells and accumulates in tissues of adults and their prey.

LEAD SHOT BANNED. Waterfowl hunters are helping by using steel shot when they hunt instead of lead shot. Ducks and geese ate stray pellets of lead shot which poisoned eagles feeding on them.



POLLUTION CLEAN UP. Many people are working to clean up polluted rivers and lakes, protect wetlands, and restore fish populations. All these steps have helped provide a healthier environment for the eagles – and for us.

(See activities "Musical Habitats" and "Habitat Roulette" in Section 3)

Brown (Grizzly) Bear

Brown bears, also known as grizzly bears, once roamed throughout western North America from northern Mexico to the Canadian Arctic, and from the Great Plains west to the Pacific Coast.

HABITAT SHRINKS. Their historically extensive **habitat** has been greatly reduced, lost to expanding human populations. Today the only remaining grizzly bear **populations** in the Lower 48 states are in remote areas of the Rocky Mountains in Idaho, Montana, and a corner of Wyoming.

SLOW TO REPRODUCE. Most brown bear populations in the Lower 48 states are small. Only a few cubs are produced each year. An individual female bear (*sow*) does not have cubs until she is between 4 and 9 years old, and even then she can produce only 1 - 3 cubs every 3 - 5 years. If the number of adult females that die each year increases even slightly, small brown bear populations will decline.

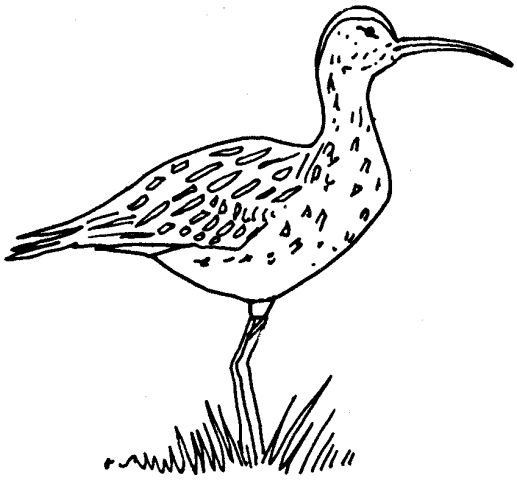
DEATH STALKS THE BEARS. Brown bear populations in the Lower 48 declined historically as a result of unlimited killing as well as habitat loss. Bears were killed for phides, food, fear, and to protect livestock. Development in brown bear habitat has increased humans contact with bears. Human-bear conflicts frequently result in the death of the bear.

BEARS NEED SPACE. Brown bears may travel over large distances during a year. Although the range or space used by a male often overlaps the ranges of more than one female, males and females are together only briefly during the mating season.

(See activity "Habitat Roulette" in Section 3)

Eskimo Curlew

Numenius borealis



SPECIES STATUS: ENDANGERED

A flock of Eskimo curlews seen in 1860 was estimated to be more than one mile long and nearly one mile wide. There are many reports of single flocks that, upon landing, covered 40 to 50 acres of land. Between 1870 and 1890, the Eskimo curlew population declined sharply. No large flocks have been seen since 1900. In the past 85 years, Eskimo curlews have been reported only a few times in the Canadian Arctic, along the Texas coast, and in Nebraska. The last confirmed sighting in Alaska was in 1886.

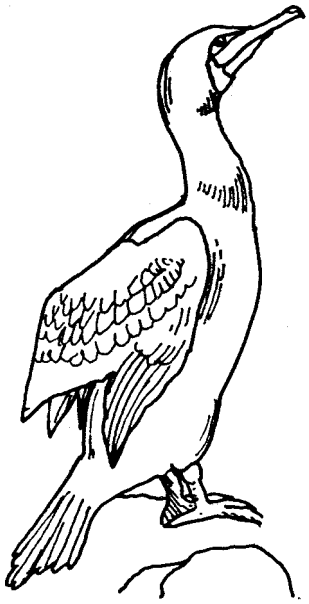
In fall, these arctic nesting birds flew in large flocks east along the coast of the Arctic Ocean to Labrador, then over open ocean for 2,000 miles to the Caribbean, and southward to wintering grounds on the high grassy plains of Argentina and Chile. Each spring, they returned north along a route through the central United States and Canada.

The large flocks and unwary behavior of the curlew made the bird an easy target for hunters. The harvest of curlews was uncontrolled. **Market hunters** along the Atlantic coast killed as many as they could whenever southbound curlews were blown into the coast by storms. As the curlews returned north, market hunters in Texas, Kansas and Nebraska killed curlews by the thousands. Wagonloads of curlews were shipped and sold as food. One record of a hunt indicates that in a single day, market hunters killed more than 7,000 curlews. Unable to withstand this uncontrolled human harvest, the curlew population plummeted.

The Eskimo curlew may be extinct. There have been no verified sightings of the Eskimo curlew for many years.

Spectacled Cormorant

Phalacrocrax perspicaillatus



SPECIES STATUS: EXTINCT

A large, nearly flightless seabird, the spectacled cormorant lived on a few remote islands of the western Aleutian Islands. Scientists believe they were once abundant because Georg Wilhelm Steller reported the birds as existing in "most copious" numbers. Steller was a naturalist who traveled with the 1741 Russian expedition lead by Vitus Bering to determine what land lay east of Siberia.

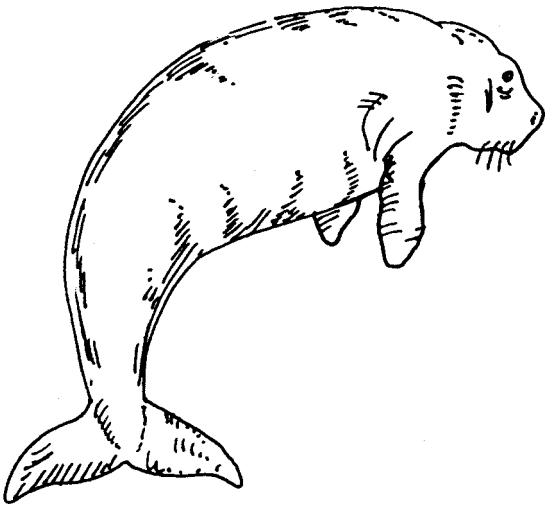
Steller wrote about this large black bird while shipwrecked on a tiny island near the western end of the Aleutians, later named Bering Island. In midwinter, he and the other stranded sailors killed the slow moving and unwary cormorants for food. Steller wrote, "They weighed 12 - 14 pounds, so that one single bird was sufficient for three starving men."

Almost nothing is known about the life of this bird except that it fed on fish, similar to other cormorants. Steller was the only naturalist to see the bird alive. Other scientists learned of the species through Steller's writings and from specimens brought to museums in 1837.

The population of spectacled cormorants declined quickly as whalers, fur traders, and Aleuts (brought to Bering Island by the Russian-American Company) killed the birds for food and clothing. By 1850, less than 100 years after Steller first saw these seabirds, the spectacled cormorant became extinct. Steller's records, six specimens, and two skeletons in museums are the only evidence that this species existed.

Steller's Sea Cow

H*ydrodamalis gigas*



POPULATION STATUS: EXTINCT

Georg Wilhelm Steller was a naturalist who traveled to Alaska with the Russian expedition lead by Vitus Bering in 1741. He was the first and only Western scientist to see a live Steller's sea cow. Steller sighted this unique marine mammal when Bering's ship, the *St. Peter*, ran aground on a small island near the western end of the Aleutian Islands. A small population of sea cows lived in the waters around this island and a nearby island. These islands were later named Bering and Copper. This area apparently was the only place in the world where Steller's sea cows lived.

Far larger than the largest male walrus, a Steller's sea cow measured up to 25 feet long. A single animal probably weighed up to 8,800 pounds. Steller and the Russians saw sea cows clustered in herds along the shore of the island. "These animals," he wrote, "are busy with nothing but their food. The back and belly are constantly seen outside the water, and they munch along just like land animals with slow, steady movement forward."

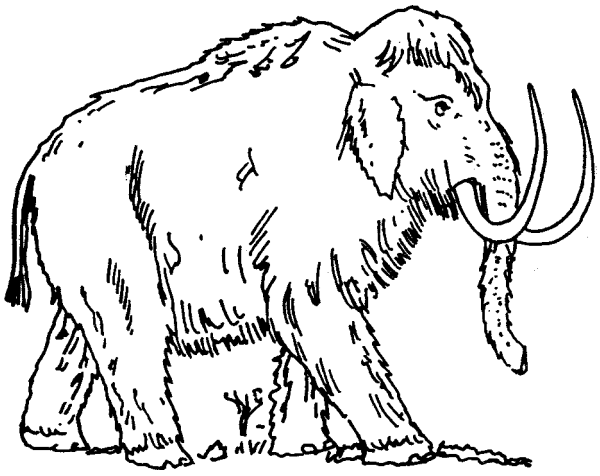
The population of sea cows was small when Steller first described the giant creature. Some scientists think that the entire population included less than 2,000 individuals. The sea cow's habitat was restricted to a small area of the ocean where the temperature of the water was suitable.

The slow-moving animals were an easily hunted source of food for the Russians exploring the Alaska coast. The crew on Steller's ship were the first Russians to hunt and eat the sea cow. By 1768, only 27 years after Steller first sighted them, the entire population had been killed by sailors, seal hunters, and fur traders. The sea cows were killed for food and skins to make boats. This amazing animal, which lived in the Bering Sea just over 200 years ago, now exists as a few intact skeletons and pieces of skin in museums.

Woolly Mammoth

Mammuthus primigenius

TIME PERIOD: 11,000 - 14, 000 YEARS AGO



SPECIES STATUS: EXTINCT

The woolly mammoth was Alaska's member of the elephant family. Like today's elephants, mammoths were large animals that traveled in herds and had two white tusks and a trunk. Unlike elephants of today, the mammoths were covered with long, dark hair.

Mammoths lived in Alaska when much of the world's northern areas were covered by glaciers and ice sheets, but much of Interior Alaska was ice-free. Many scientists believe Interior Alaska was part of a huge grass-covered area that stretched into Asia across a land bridge in the area that is now the Bering Sea. Woolly mammoths fed on grasses in these areas. The mammoth and many other animals that lived on the grassy plain all became extinct about the same time.

What caused the extinction of the mammoth and the other animals? The answer remains a mystery. Scientists have two theories. One is that the climate changed quickly as the ice sheets began to melt. Winters became colder and more snow fell, making it difficult for animals with short legs like the mammoth to move about and find food. As the climate continued to change, the grasslands became forests. Animals that were adapted to life in the grassland could not adapt to life in the forest and they perished. Scientists who favor the theory of changing climate study the ancient remains of plants, but it is difficult to date these remains exactly.

The second theory is that humans crossed a land bridge between Asia and Alaska. Some scientists believe that these people hunted the animals until they were extinct. These scientists believe the mammoths and other animals could not adapt to these new predators. Fossils show that during the Ice Ages in Asia, people hunted mammoths. They ate mammoth meat, used the skins for clothing, and used the skins and bones to construct shelters.

Wildlife Conservation Is Up to Us!

We may come from differing points of view [see accompanying Teacher's Guide], but a majority of Alaskans agree healthy fish and wildlife populations are important to our quality of life now and in the future. Wild mammals, birds, and fish are integral to our state's cultural and economic identity.

Section 4
WILDLIFE INSIGHTS

VARIETY OF PERSPECTIVES

Alaskans have a long tradition of dependence on the natural world. Plants, fish, and wildlife provided all that Alaska indigenous peoples needed to survive and define themselves spiritually and culturally.

Respect for Wildlife Reaps Benefits

Traditional Native Alaskan beliefs and practices demonstrated respect for wildlife, including an intolerance for waste.

- An **Aleut** hunter, for example, dressed in elegant clothes when hunting to please the spirits of the sea animals so necessary for survival.
- The **Tlingit** burned or returned all unneeded animal remains to the water so that animal spirits could report to their kind on the respectful treatment by humans. This would ensure the reproduction of future generations of animals.
- **Athabaskans** performed elaborate ceremonies of respect for animals, both those hunted and those respected because of their spiritual power.
- **Inupiat** hunters on the sea ice had a ritual to show respect for the seals that gave themselves to the hunter in a successful hunt. In that ritual, they gave them a drink of fresh water.

- The implements of Bering Sea **Yup'ik** peoples were designed to please to the animals. The Yup'ik believed that the spirit of a seal killed for food would remain in the animal's bladder. The bladders of all animals harvested in a year were kept until the annual Bladder Festival. The animals' spirits were treated as honored guests and then the bladders were thrown into the sea to ensure that more seals would return to the hunters.

Wildlife Continues to Lure Newcomers

In historic times, waves of Russians, Europeans, and Americans came to Alaska in search of wealth from the land. They trapped furbearing animals for the international fur market and, as a result, established settlements, some which remain today. Others came to harvest whales and fish.

Wildlife and fish were Alaska's first economy and they continue to be important mainstays today.

Alaska has become a destination for people who value a direct relationship with wildlife. Many who settled in Alaska have a heritage of hunting and fishing passed down through generations. They depend on local fish and wildlife for food and a connection to the natural world.

The beauty and mystique of Alaska's wildlife and wildlands continues to draw people to Alaska. Today, more than ever before, wildlife viewing is an important part of Alaskan life. This **"non-consumptive use"** of wildlife is expected to increase, possible impacting habitat.

CONSERVATION IS EFFECTIVE

Because of their commitment to wildlife, both Native and non-Native residents of Alaska are active in wildlife conservation efforts. These include the public process of the Alaska Board of Game, local and regional advisory committees, and hunting and conservation groups.

We have not always managed sustainably. (*refer to* INSIGHTS *Section* 3, *When Populations Decline*). The muskox, **extirpated** from Alaska by 1865, is case in point. (*See accompanying "Muskox Returns to Alaska" Fact Sheet*). Their **habitat**, the coastal tundra ecosystem, was still intact. Conservation measures starting with the reintroduction of a small herd in 1930 succeeded in reestablishing the muskox as a viable member of Alaska's tundra ecosystem.

MANAGING WILDLIFE FOR MANY INTERESTS

Reintroduction of formerly abundant species is one tool to help wildlife recover. But many people agree it is wiser and less expensive to avoid the need for reintroduction by practicing conservation in the first place.

CONSERVATION: the use of natural resources in a way that assures their continuing availability for future generations; the wise and intelligent use or protection of natural resources.

WILDLIFE MANAGEMENT: the application of scientific knowledge and technical skills to protect, preserve, conserve, limit, enhance, or extend the value of wildlife and its habitat.

- **Wildlife managers** use a variety of techniques including regulating harvests, sustaining habitat, and changing habitat for selected species. Modern wildlife management blends the science of gathering data and reaching conclusions with the art of decision-making that occurs during political and legal processes.

- **Social issues** arise over concerns for equal access to wildlife. Wildlife is a natural resource owned in common, but people sometimes compete for its use or have different values, beliefs, and opinions about appropriate behavior of people toward wildlife. Social issues surround "tradeoff" decisions about whether to do something that will alter wildlife habitat or populations.

- **Technology** also plays a key role in many wildlife issues. The tools available to study wildlife are becoming increasingly sophisticated – from satellites to genetic markers. In Alaska, the accessibility of wildlife and their vulnerability to over-harvest has been altered by the technology of motorized vehicles, airplanes, and modern hunting weapons.

Traditional Knowledge Joins Team

Alaska Natives have lived with and relied upon wildlife for thousands of years. Generations have passed on information about habitat needs, population trends, interrelationships between species, migration patterns, and behavioral traits. Observational skills and memories regarding wildlife continue to be an important part of Native tradition.

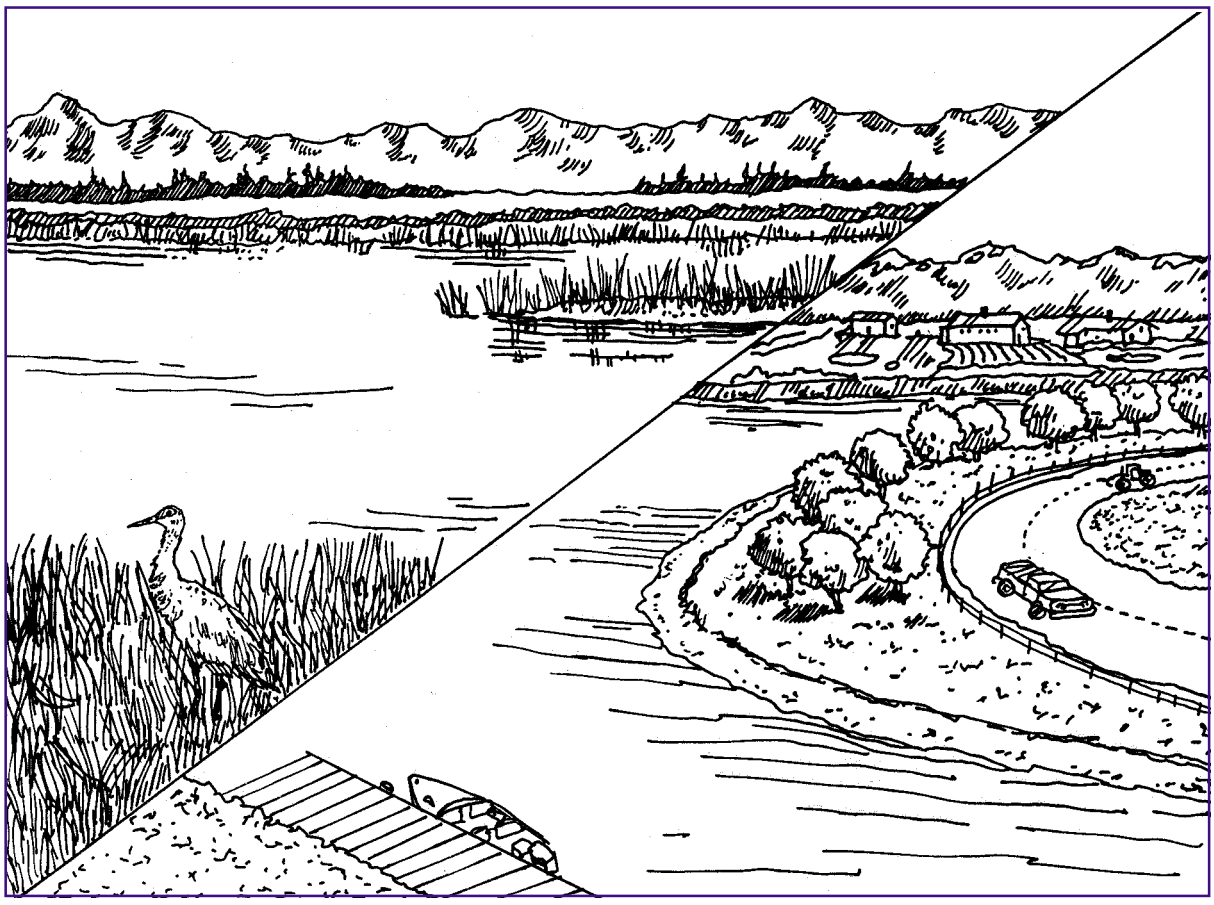
In the past, wildlife managers looked only at data that could be quantified scientifically. They considering Native knowledge as "anecdotal." Now traditional knowledge and western science are seen as complementary. Wildlife managers rely on local hunters for **traditional ecological knowledge** of the health, location, and local historical trends of animals.

Rural citizens and wildlife managers are creating working relationships on advisory boards and in **co-management** of species. Cooperative decisions are being made on regulations, methods of data collection, and methods of reporting harvest information. Successful management of geese on the Yukon-Kuskokwim Delta, walrus, bowhead whales, and the Western Arctic caribou are examples of the benefits of co-management.

For more information on wildlife managers, see following "Workers for Wildlife" Fact Sheet.

Public Has Vital Role

In the United States, *wildlife is a resource owned by the people and managed for their common use.* In Alaska, the authors of the state constitution in 1959 mandated management of fish, wildlife, and other renewable



resources on the principle of **sustained yield** (sustaining human uses into the future).

The Alaska Constitution calls for a participatory system of wildlife management with a Board of Fish and Board of Game. Board members are appointed by the Governor and confirmed by the state legislature. Once appointed, members gather information through a public process to set policies for regulations to be carried out by the Department of Fish and Game, Fish and Wildlife Protection, and the Department of Public Safety. (*See following "Tracking Wildlife Regulations" Fact Sheet.*)

What Can You Do?

Alaskans feel passionately about wildlife and wild places. The future of Alaska's wildlife depends on you. What can you do?

- Increase your knowledge of wildlife and the ecosystems that support all living things.
- Participate in public hearings
- Support Board members
- Participate on advisory committees
- Attend and speak at Board meetings
- Support wildlife research and management projects
- Act on behalf of wildlife and wild places
- Determine how your actions affect wildlife and act responsibly. (*Consider how you develop the land where you live, what you buy as a consumer, what impact your food choices have on the environment, for example.*)

We can continue to harvest fish and wildlife if we limit harvests to numbers each population can sustain. We can watch, photograph, and enjoy wildlife if we minimize our impact to avoid disturbance of sensitive species at critical times and in crucial areas. And we can continue to develop Alaska, if we maintain adequate areas of wildlife habitat and limit and plan development to minimize habitat loss.

Dealing with Differing Viewpoints

Controversy is pervasive, even valued, in a democratic society. Controversy occurs when a person's or group's ideas, conclusions, theories, or opinions are in opposition to those of another person or group.

The study of controversial subjects is essential to the education of all citizens in a free society. In preparation for contributing to a healthy society, students must learn to gather and examine evidence; differentiate opinion, fact, and inference; evaluate differing viewpoints with objectivity; and define and justify their personal points of view.

By stressing the use of facts to justify decisions, the importance of developing alternatives, and use of appropriate problem solving skills, teaching about controversial issues can impart real "survival skills" while bringing relevancy to the classroom.

What is controversial in one place and time may not be in another. In Alaska, wildlife-related topics are often controversial. As a state, our identity, tradition, heritage, and economy are linked to wildlife. Although most school curriculum is built around activities that present factual, non-controversial information, there are some topics and activities that are potentially controversial within Alaskan communities. Rather than avoiding these topics, we encourage you to use the following guidelines.

Curriculum Selection & Lesson Preparation:

- Determine whether a specific issue is grade-level appropriate and relevant to the student.
- Choose issues that relate directly to the curriculum being studied and to the goals and objectives of this study.
- Determine whether enough factual information can be gathered on the various points of view related to an issue.
- Be clear about what alternative positions will be presented in dealing with a controversial issue.
- Decide on your own opinion/position on the topic so that you can recognize your own biases.
- Use community resources and expertise, making sure that you choose people and materials to present more than one side of an issue, while being sensitive to differing cultural values in your presentation and selection. Have students prepare questions for guest speakers.
- Design the unit to teach citizenship skills such as critical thinking, listening, decision making, and problem solving as well as loyalty to democratic principles.
- Use your community resources to adapt issues for local relevance, while presenting the "big picture" as well.
- Examine curriculum content and topics for cultural bias and include cultural sensitivity and respect for diversity.

In the Classroom:

- Develop a climate of trust, respect, and openness to free inquiry in the classroom as well as respect for the student's right to privacy, right to hold opinions and perspectives, and value the strength of diversity in our society.
- Distinguish between fact and opinion when analyzing issues.
- Teach students to identify value-laden language that reveals built-in biases in materials. Look for these biases with different perspectives – such as "timber harvest destroys wildlife habitat" versus "timber harvest alters wildlife habitat."
- Have students scrutinize their own values that determine their positions on an issue.

- Have students gather information from as diverse an array of sources as possible.
- Determine if facts were "left out" or slanted because of the bias of the presenter or the materials.
- Teach students to raise questions which clarify the important positions in a controversy rather than attacking positions with which they do not agree.
- Recognize stereotyping and avoid the polarization that results. People and groups should not be strictly categorized. Include multiple players in the same "role" in simulations. Have these players hold different opinions to break down stereotyping.
- Use additional information, community resources, and pointed questioning to assist students in 1) viewing differences in values and opinions as positive and 2) learning to disagree without degrading others. Emphasize that different points of view are not "right" or "wrong."
- Include activities such as simulations, role-playing, creative writing, music, and dramatizations. This will encourage students "to take positions temporarily" on issues that are different from the ones they currently hold in order to clarify the basis for differences. Have students explain how people within a group or a role could hold different views.
- Use realistic simulations and role playing activities where compromise and tradeoff situations are likely.
- Ask students to evaluate the effects of decisions made on future actions and problems.
- Include effects on different populations and aesthetic, social, cultural and long-term economic costs and benefits in any cost/benefit analysis or identification of impacts.
- Be as politically and religiously neutral as possible on value sensitive issues and clearly delineate your own opinions when presenting them.
- Work on finding agreement on controversial issues by using techniques such as nominal group approach or finding common words (in differing viewpoints).
- When possible, let students choose the topic or issue to be studied.
- Provide opportunities for students to make decisions and engage in actions dealing with the issue.

With the Community:

- Anticipate the controversial issue in the curriculum and inform parents about how the issues will be treated before they are introduced. Invite them to attend lessons on these topics.
- Be clear about the community values held and be cautious when examining opposing ones.
- If criticized for including a controversial issue in your lessons, do not respond defensively or with anger. Discuss your goals and your methods with critics so they can appreciate your sensitivity to their concerns.
- Before teaching the unit, obtain the support of the school administrator.
- Teach about the "real world" with an emphasis on problem solving, critical thinking, and citizenship skills.

Text by the Alaska Department of Education with the Alaska Steering Committee for Project Learning Tree and the Alaska Resources Kit: Minerals, Teacher Advisory board.

Adapted from the Project WILD handout, "The Teacher's Role in Dealing with Controversial Issues" by C.E. Knapp; the pamphlet, "Curriculum Guidelines," by the National Council for the Social Studies; and a journal article in Environmental Education & Information, Vol. 3, #4, 1984, "The Handling of Controversy and Problem Solving in Environmental Education." Reprinted here by permission from the Alaska Department of Education.

Muskox Returns to Alaska

The muskox is a large, shaggy **herbivore** (*plant eater*) called "*oomingmak*" or "the animal with skin like a beard" in Inupiaq.

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Alaska Wildlife Notebook Series ADFG

Natural History:

NO TO BE CONFUSED! Muskoxen do not have musk glands nor are they closely related to oxen. Muskoxen are ancient Ice Age animals related to sheep, goats, and the takin of the Himalayas.

WEIGHING IN. Male muskox may weigh 600 to 800 pounds at maturity. Mature females weigh between 400 to 500 pounds. A young muskox (*calf*) weighs only 22 - 31 pounds at birth. Adults are 3 - 5 feet tall. They live in the arctic regions of Alaska, Greenland, and Canada where their long, thick fur coats let them survive -50°F temperature and blizzard winds.

DEFENSIVE BEHAVIOR. Muskoxen are often found in herds of 20 - 30. Both sexes have stout, pointed horns which they use vigorously when challenged. To defend their young, both males and females form a line or circle around the calves, facing the threatening predator. Their circle defense works relatively well against natural predators, particularly wolves.

History in Alaska

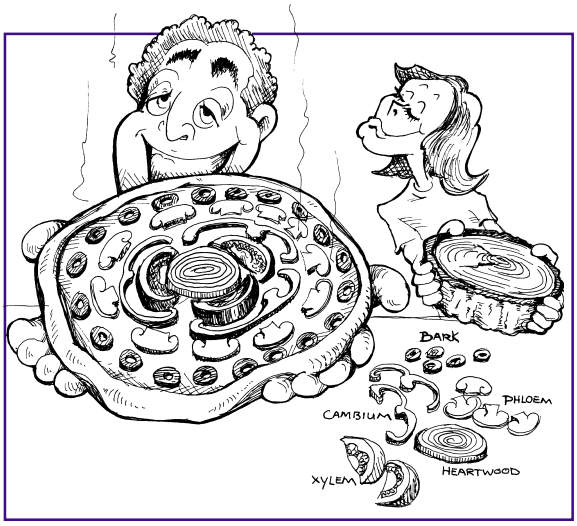
NO MATCH FOR RIFLES. Despite surviving the Ice Age and the thousands of years since then, Alaska's muskox herds were no match for hungry whalers and hunters looking for food. Alaska's original muskox population disappeared by 1865, due primarily to over-hunting.

ONLY ISOLATED SURVIVAL. By 1900, muskoxen survived only in Canada and eastern Greenland.

CONSERVATION RETURNS MUSKOX. In an effort to spread the population to more areas to guard against extinction, wildlife officials captured 34 Greenland animals for **reintroduction** to Alaska in 1930. These muskox were released on Nunivak Island between 1935-1936. By 1968, the population had grown to an estimated 750 muskox.

HERDS RETURN TO FORMER HOMES. Relocation efforts dispersed muskox to other areas of western and northern Alaska. By 2000, Alaska's muskox population numbered more than 3,400 in seven established breeding groups.

Our Place in the Food Web



From early hunter/ gatherer time through the development of agriculture in America, we as humans could easily see our role as **consumers** in the **food web**.

Current Status

FOOD? FROM A SHELF! Urbanization and corporate farming have distanced many of us from the hunt, garden, and fields. For many, the process of gathering food means going to (*or ordering from*) grocery stores.

MORE PEOPLE ON EARTH. The world **population** tally turned 6 billion in the fall of 1999, and estimates predict that number will double in 40 years (1.7% *annual growth rate*). The U.S. population of more than 265 million is growing at a rate of 1.1% annually. Our population will double in 65 years.

LESS HABITAT. At the same time, the amount of available open space (wilderness and cropland) continues to decline while human development (roads, cities, airports, industry, and housing) increases.

Food for Thought

SURVIVAL NEEDS STAY THE SAME. One natural rule that has not changed is the list of basic survival needs. All living things require food, water, shelter, and suitable space. Humans as well as wildlife survive by those requirements.

QUESTIONS THAT MUST BE ASKED. Where and how we acquire food directly and/or indirectly impacts wildlife. We must eat, as living beings, as part of the food web. But what we eat and where we gather our food are choices. W*hat did you have for dinner*? W*here did it come from*? H*ow much energy was required to process and transport it*? H*ow much land and wildlife were displaced to produce your meal*?

THROUGH LAYERS OF VALUES. For non-starving humans, food is usually more complex than the calories we use to heat our bodies. What we eat, how we gather food, and how we prepare it are all part of our cultural identity. Values surrounding food exist across a spectrum from people who only eat vegetables to people who eat meat in every meal, from people who eat processed food from stores to people who harvest all their food directly from the land.

ALWAYS CONSEQUENCES. Food continues to be a personal choice. These choices, in a variety of ways, impact wildlife and the **habitat** they need to survive.

(F*or current population figures, check the instant counter on* <www.overpopulation.org> W*orld Population Awareness*.)

Supernatural History of Raven

RAVEN - Known as *Yetl* (Tlingit), N*ankilslas* "He Whose Voice is Obeyed" (Haida), T*xamsem* "Giant" (Haida). Other Northwest Coast Indian names translate as: "Chief," "Real Chief," "Great Inventor," and "Greedy One."

CHARACTERISTICS

Raven is a character in legends and tales all over the world. In some tales Raven is a bird, in others, Raven is a human who can turn himself into a bird. In still others, Raven is a supernatural being in a raven's cloak.

In many tales, Raven is greedy and hungry. Some Native American stories are about a Great Flood at the beginning of the world. Raven is sent to find land, but he fails to return because he is feeding on the corpses of the animals that did not survive the flood. As punishment for not returning, Raven turns black and eats dead things today. A similar biblical story describes a raven as the bird sent from Noah's Ark to find land, but the raven never returns.

ROLE IN THE ENVIRONMENT

According to many northern Native cultures, Raven created the world. He created the land, the waters, humans, and other animals. He stole the daylight, the moon, and the stars from people or animals who were keeping them captive and set them free for the world.

Odin, lord of the Nordic gods, kept two ravens perched on his shoulders; he called them H*ugin* (Thought) and M*unin* (Memory). At dawn, he sent them out to inspect the ends of the earth. They returned at the end of day and whispered all they had seen to Odin, who advised the other Norse gods.

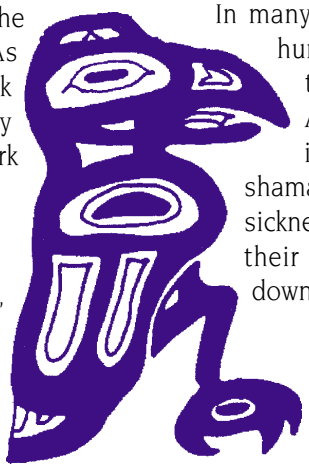
RELATIONSHIP WITH OTHER ANIMALS

According to the Nunamiut Eskimo, wolves learn the location of caribou by watching the behavior of ravens.

Raven is now black, but many stories relate how he was once white and was later turned black. Some Inupiat and Yup'ik stories say this occurred when the birds were painting each other. In one version, Raven and Loon were painting each other. Raven did a good job painting the Loon, but when it was his turn to be painted, he wouldn't stay still. Loon became angry. Finally, Loon dumped the black soot she was using for paint all over Raven and he became completely black.

In many tales, Raven is a trickster, often fooling or even hurting or killing other animals. According to a traditional Tlingit tale, crows are Raven's nephews. They were once white and were turned black as part of a trick by Raven. Raven went fishing with the crows, but only Raven caught fish. After the crows left the beach, Raven ate all of the fish. When the crows returned, Raven accused the crows of theft. Then he threw ashes on them to turn them black. Another traditional Tlingit tale explains how Raven's mother became Loon after Raven killed a loon and had his mother climb into the loon's skin.

RELATIONSHIPS WITH HUMANS



In many tales, Raven stole fire and gave it to humans. He also taught humans how to do the things they needed to do to survive. Athabaskan hunters call on ravens for help in moose hunting. Koyukon Athabaskan shamans invoked Raven's power to scare away sickness by mimicking their sounds, spreading their arms like wings, and hopping up and down.

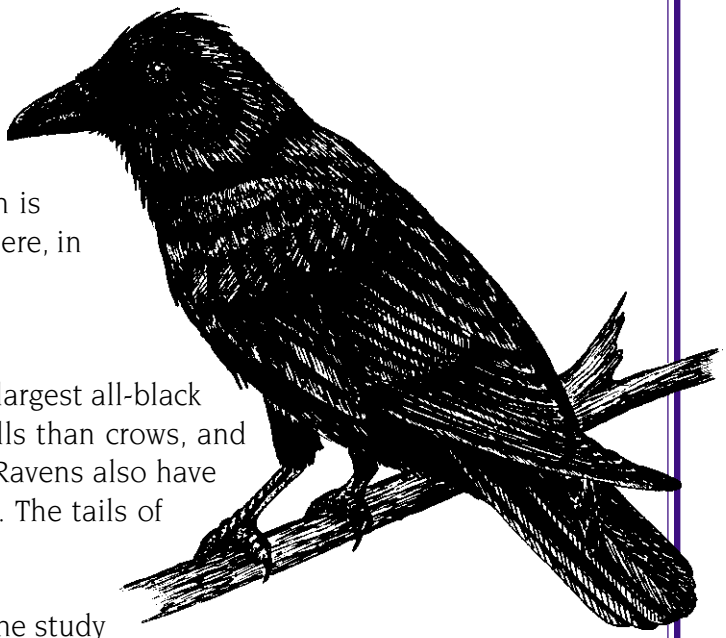
In a biblical story, ravens brought food to the Prophet Elijah when he was in the wilderness.

Ravens were carried on ships by Vikings, Babylonians, and Romans and sent to find land. If the raven did not return, that was a sign it found land and they would follow its direction. Iceland was discovered when the Vikings flew four ravens in four directions and sailed after the raven that did not return.

Ravens warned the guards of Charles II of England that Oliver Cromwell was beginning a sneak attack. Since that day, the Yeoman Raven Master has kept six ravens at the Tower of London for the British royalty. (Wild ravens have been exterminated in London.)

Among many northern indigenous peoples, it is traditionally taboo to kill a raven and they must be released unharmed from traps. The Buryat of Siberia believe anyone who kills a raven will die soon. According to traditional Bering Strait SiberianYupik beliefs, killing a raven makes the Raven Father very angry and he will send bad weather. A traditional Tlingit belief is that it is unlucky to kill a raven.

Natural History of Ravens in Alaska



The common raven, C*orvus corax*, is a member of a family of birds known as the Corvidae that includes the jays, crows, and magpies. The raven is found throughout most of the Northern Hemisphere, in many types of habitats.

General description

The raven is the largest species of songbird and largest all-black bird in the world. Ravens have larger, stouter bills than crows, and the tip of the upper beak is more down-curved. Ravens also have shaggy throat feathers, and a wedge-shaped tail. The tails of crows are square-cut.

Ravens can produce an assortment of sounds. One study in Alaska discovered that ravens have more than 30 types of vocalizations.

Life history

Although it is not known for sure, ravens probably breed at 3 - 4 years of age and mate for life. Although they are believed to be long-lived, no one knows how long wild ravens live. One captive bird lived 29 years.

When ravens are not breeding, they often form loose flocks during the day and gather for roosting at night. As many as 800 ravens have been seen in one roost near Fairbanks.

Ravens do not make long migrations as many birds do. Breeding birds use a traditional nesting site each year. When not breeding, they may fly 30 - 40 miles each day from the place where they roost at night to where they feed during the day.

Food habits

Ravens consume a variety of plant and animal matter. They scavenge and sometimes prey on small animals. Ravens will hide or cache food supplies. Ravens also have the habit, like some hawks and owls, of regurgitating undigested parts of their food in the form of a pellet. An analysis of hundreds of pellets left by roosting ravens at Umiat, indicated that possibly as much as half of their winter diet was small mammals, probably captured live by the ravens.

Management

The Migratory Bird Treaty of the United States, Canada, Mexico, Japan and Russia protects migratory birds. The treaty was amended in 1972 to protect ravens and other corvids as well. No hunting of ravens is allowed anywhere in Alaska. They can only be killed in the defense of one's property.

Adapted from Alaska's Wildlife Notebook Series. *Alaska Department of Fish and Game.*

Scenario: Moose and the Alaska Railroad

MOOSE COUNTRY. The Alaska Railroad between Anchorage and Fairbanks passes through the Matanuska-Susitna Valley where large numbers of moose typically spend the winter. The moose travel great distances in search of willow and other shrubs they need for food. Willows are plentiful near the tracks because they grow well in the cleared areas.

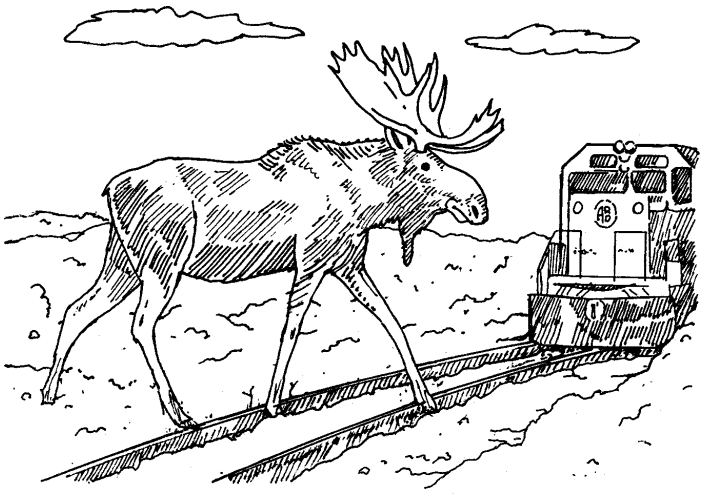
RAIL TRAILS. When snows are deep, moose often use the plowed railroad tracks as a trail. They spend less energy along the tracks than traveling through deep snow. Unfortunately, this attraction to the tracks is often fatal. During the winter of 1955-56, 366 moose were killed; in 1984-85, 382; in 1989-90, 711 moose died. One 60-mile section of track between Houston and Talkeetna is especially deadly. (*For additional information contact the Alaska Railroad at* (907) 265-2300.)

RUNNING INTO TROUBLE. Moose traveling on the tracks or feeding nearby often react to an approaching train by running ahead of the train rather than moving off into the deep snow. They have traditionally escaped threats from predators such as wolves by running; however, they can't outrun trains on railroad tracks. When snow is very deep they can become trapped on the tracks. Plowed snow on either side of the tracks creates berms that are too high to cross.

HOWLING FAILURE. Railroad managers do not want to schedule fewer trains. They have tried slowing the trains down, but moose continue to be hit. They have tried blowing whistles, using bright lights, and even playing wolf howls, but these methods have not scared the moose off the tracks.

WHAT TO DO? Consider the following possibilities and any others you can think of. Assume that you have a limited amount of money to spend each year, but you want to develop a plan that will result in the lowest number of moose/train collisions. Consider the costs and benefits of each possible course of action to people and to the moose population.

- Issue more hunting permits to reduce the size of the moose population
- Cut the willows and other shrubs near the tracks
- Capture and translocate moose to other areas away from the railroad
- Build a fence on both sides of the tracks
- Send a pilot car in front of the train to "sweep" the tracks ahead of each train
- Plow winter trails from the tracks to other areas
- Feed the moose hay or other foods



ADF&G Approach: Moose and the Alaska Railroad

The following are solutions considered by the Alaska Department of Fish and Game to the dilemma of moose being struck by the trains of the Alaska Railroad.

A. FENCE. A fence would be costly to build and maintain along 60 miles of railroad and could cut off moose from a portion of their winter range.

B. CAPTURE. Translocating moose away from the railroad or allowing more moose hunting may not solve the problem because other moose would eventually move into the area.

C. HUNTS. Wildlife managers considered winter moose hunts to temporarily thin the moose population, but such hunts would be difficult in the deep snow. The hunts would also be difficult to schedule because the severity of the winter cannot be predicted.

D. SWEEPER CARS. During the winters of 1989-90, wildlife managers asked the railroad to use a pilot car to go ahead of the trains and chase moose from the tracks before the train passed. Wildlife managers also recommended development of a network of packed trails parallel to and branching away from the railroad. These trails were used to divert moose from the plowed railroad where it was easy for them to walk.

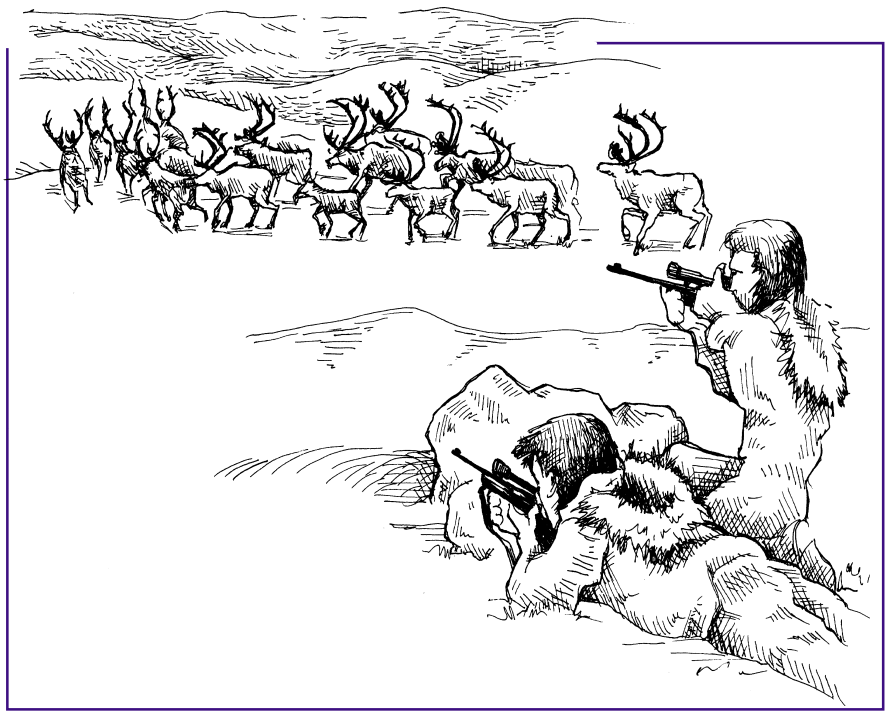
E. FEEDING. Hay was placed at the end of the packed trails to hold the moose away from the railroad. However, feeding hay to moose to reduce starvation is a questionable solution for several reasons: (1) biologists wonder whether people should artificially support the moose populations above their carrying capacity during severe winters, (2) feeding moose is expensive, and (3) the digestive systems of moose are not designed to process hay.

F. WORK TOGETHER. In 1991, the Alaska Railroad and the Alaska Department of Fish and Game signed an agreement to work together to keep the train-caused moose deaths below 75 each year. A variety of methods will be used including (1) a pilot car to clear moose from the tracks before scheduled trains during problem periods, (2) removing shrubs that provide food for moose from beside the tracks, (3) packing trails next to the tracks to divert moose from the railway, and (4) timber harvest and other techniques to increase the winter food supply of willows and other shrubs in areas away from the railroad.

A long-term solution to avoid similar problems along the railroad and highways would be to avoid routes through known moose **winter concentration areas**. The department recommended construction of fencing and a moose underpass under a busy section of highway in Anchorage. The underpass was built in a traditional crossing area that moose use to move between winter and summer ranges. The extensive fencing needed to divert moose toward the underpass.

NOTE: By 1998-99, after implementing some of the management strategies listed above, the number of collisions had dropped to 85 moose. Working together contributes to wildlife conservation.

Hunting Regulation Vocabulary



Bag limit: the maximum number of animals of any one species a hunter can kill in a given area in a single season.

Board of Game: Governor-appointed, legislatively-approved board of Alaska citizens that uses public and agency information to set regulations regarding wildlife harvests.

Drawing permit: a permit issued to a limited number of hunters by means of a lottery. Hunters must apply and agree to obey the conditions spelled out in that permit.

Game Management Units: division of Alaska into 26 geographical units for managing game. Within these **GMUs**, there may be smaller units, identified with letters. For example, GMU 21B is an area north of Ruby and south of Tanana. Maps of the state's GMUs are available in the *Alaska Hunting Regulations* book and on the ADF&G website. When making proposals, it is important to familiarize yourself with the GMUs that are part of your concern.

Hunting Regulations: laws defined by the Board of Game and signed into law by Alaska's lieutenant governor.

Permit hunt: a hunt in which permits are required; may be drawing, registration, or Tier II permits.

Season: the period of time set to legally hunt a certain species. Hunting seasons are determined through the Board of Game process.

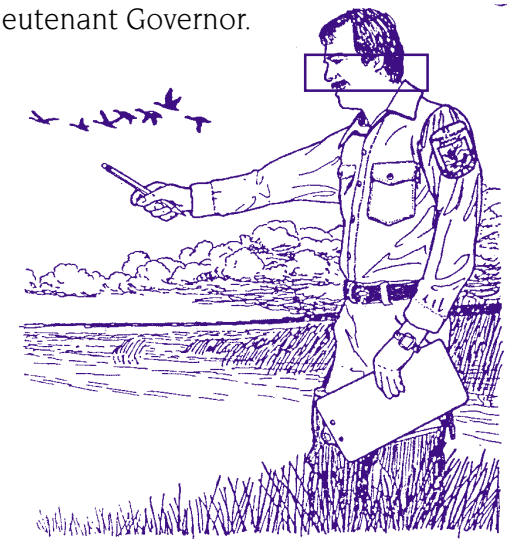
Statutes: laws passed by the state legislature that the Board of Game must follow. The Board of Game cannot create regulations outside of authority given to them by legislative statute.

Tier II: the Board of Game has identified specific game populations that are customarily and traditionally used for subsistence. In times of shortage, non-subsistence hunting is eliminated. If further hunting reductions are required, Tier II permits are given to hunters *based a predetermined scoring system*. Lots of hunters score the same; the lottery occurs only for the last few remaining permits when the number of hunters with identical scores exceeds the number of permits remaining.

Tracking Wildlife Regulations

In Alaska, **wildlife management** relies heavily on hunting to maintain healthy and productive wildlife **populations**. The wildlife management **regulations** that control hunting are created through extensive public involvement. Tracking the process involves many residents:

- **Alaska Board of Game (*or Board of Fish*):** The Governor appoints seven public members who then must be confirmed by the Alaska State Legislature.
- **Fish and Game Advisory Committees:** About 80 communities have advisory committees with up to 15 elected members.
- **Alaska Department of Fish and Game:** Biologists and other staff from the Division of Wildlife Conservation and Division of Subsistence.
- General public.
- Commissioner of the Alaska Department of Fish and Game.
- Alaska Department of Law.
- Alaska Department of Public Safety, Division of Fish and Wildlife Protection.
- United States Fish and Wildlife (USFWS) liaison.
- Lieutenant Governor.



Board of Game

Meeting two to three times a year, the Board of Game sets hunting regulations. The board does not have time to consider every regulatory topic at each meeting. Instead, it deals with topics on a rotating basis. After setting the next meeting's agenda, the board issues a ***Call for Proposals*** and sends it to various agencies, groups, and individuals. The announcement is also published in Alaska newspapers.

Advisory Committees

Fish and Game Advisory Committees provide local forums to discuss fish and wildlife issues and make recommendations to the boards. There are approximately 80 community-based fish and game advisory committees. They meet prior to the *Call for Proposals* deadline to develop proposals that address the board's agenda. Advisory committees meet after proposals are published to comment and provide opposing or supporting arguments.

How to Make Proposals

Any individual or group in the state can propose a change to a hunting regulation:

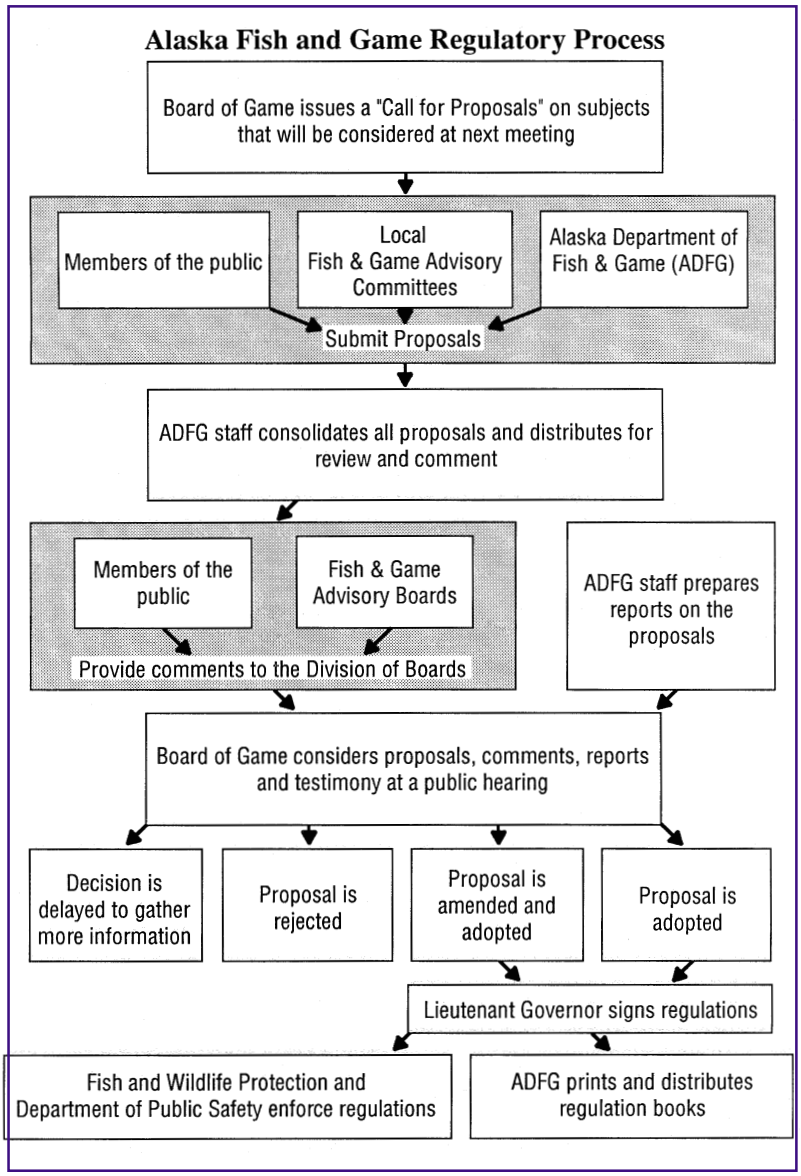
1. Submit proposals using the *Regulation Proposal Form* (sample provided for student use – *see activity* "I Propose...!" *in Section* 4).
2. Write proposals using clear, concise language.
3. If possible, include the Alaska Administrative Code number (*for example*, 5AAC 92.990. DEFINITIONS) for the regulation addressed or provide the general heading and page number (*for example*, "DEFINITIONS" *page* 18-19) in the current regulation book.
4. State the problem and the reasons why the regulation should change.
5. Submit the proposal to the board before the deadline.

Tracking Wildlife Regulations (Cont.)

Tracking the Proposals

After all proposals are reviewed, they are printed and sent out for public comment. Any individual or group in the state may attend board meetings to express their views and ideas about the proposals.

Before the board votes on a proposal, members must consider written comments, public testimony, and biological information such as wildlife population health and environmental changes, social factors including historic use patterns, and all pertinent court rulings.



Next Step for Approval

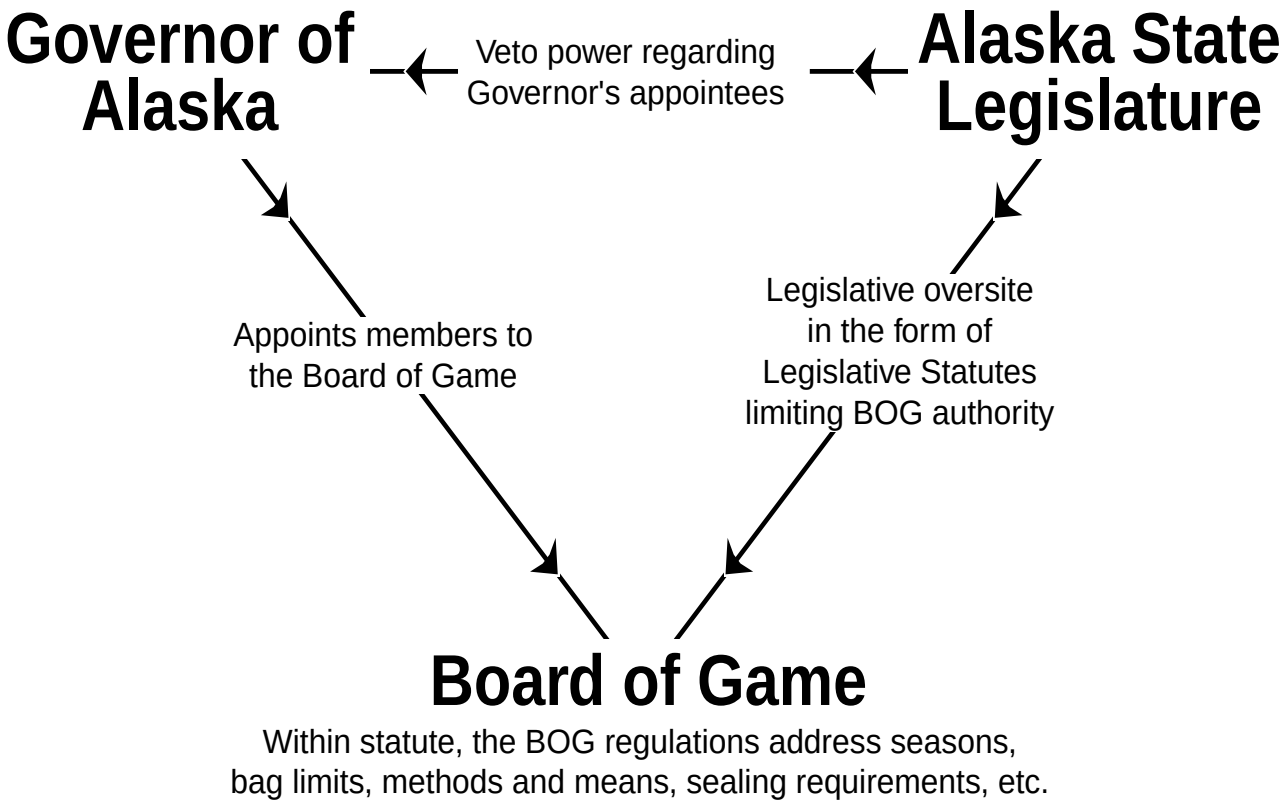
After the board meeting adjourns, Alaska Department of Fish and Game staff draft the regulations to be entered into the Alaska Administrative Code. The Alaska Department of Law reviews these changes. If approved by the lawyers, the Lieutenant Governor signs the new regulations into law.

For Use by the Public

The Alaska Department of Fish and Game creates summaries and "public" versions, written in lay terms. These will become the "Alaska State Hunting Regulations" a publication available free to the public in print and website formats. Regulations are enforced by the Alaska Department of Public Safety's Division of Wildlife Protection.

NOTE: Waterfowl fit under a different process of regulation because Alaskans share these migratory birds with other states and other nations. The U.S. Fish and Wildlife Service sets harvest guidelines and then works with state waterfowl representatives to set rules and state allocations. Alaska is in the Pacific Flyway.

Checks & Balances for Wildlife Regulations



Workers for Wildlife

People work with wildlife in a variety of jobs in Alaska. The Alaska Department of Fish and Game (ADF&G) is responsible for managing most of the wildlife and fish in Alaska while the U.S. Fish and Wildlife Service manages marine mammals and waterfowl.

Staffs of these agencies work as research biologists, management biologists, technicians, educators, naturalists, computer specialists, engineers, administrative staff, and a variety of other jobs.

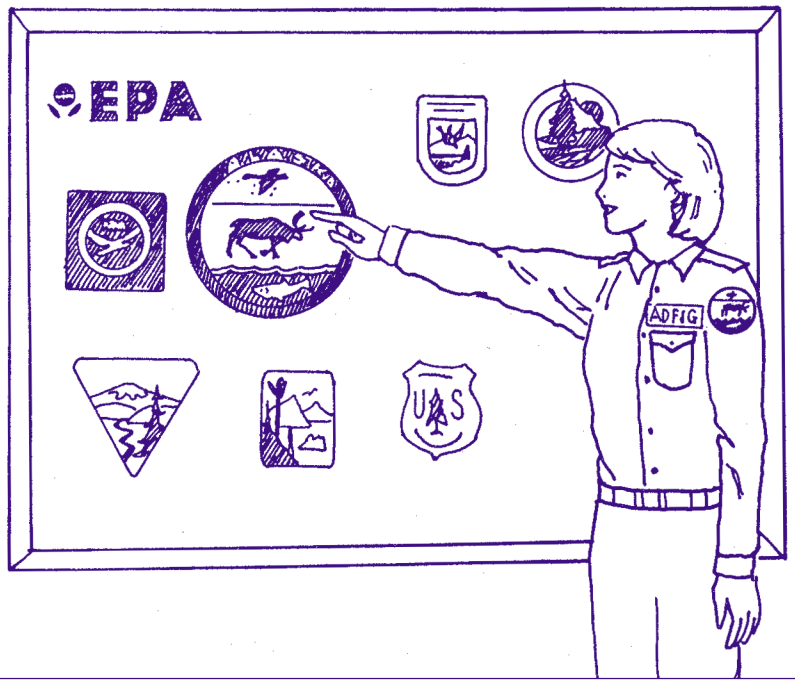
RULE-MAKING BOARDS. ADF&G biologists gather information about wildlife populations and harvests. They use this information to make recommendations to the Board of Game and the Board of Fisheries about regulations that set seasons and bag limits for hunting and fishing.

NOTE: Any Alaskan citizen can propose new regulations or changes in existing regulations to the Board, which then votes on all the proposals received (see "Tracking Wildlife Regulations" Fact Sheet in this section).

MIGRATORY BIRDS. Alaska is part of the Pacific Flyway Council. ADF&G and rural subsistence hunters make recommendations to the US Fish and Wildlife Service on migratory bird management. Waterfowl biologists work together with villagers to manage migratory birds that nest throughout Alaska.

NONGAME SPECIES. ADF&G biologists also gather information about wildlife habitat relationships and wildlife species that are not harvested – called nongame species. Staff members are also part of teams restoring threatened or endangered species. They help the public enjoy wildlife by developing viewing areas and preparing information and educational materials about Alaska wildlife.

MANY PARTNERS. ADF&G often works in cooperation with public, private, and governmental organizations including Native organizations, conservation and hunting groups, USDA Forest Service, National Park Service, National Marine Fisheries Service, and the Bureau of Land Management. Many of these organizations make decisions that affect wildlife on the lands they manage. ADF&G biologists provide information and recommendations to land managers to help them minimize negative impacts to wildlife and their habitat.



Wildlife-related Organizations and Careers

A. ***Alaska Department of Fish and Game*** (fisheries and wildlife research, management, and education) <www.state.ak.us/adfg> Also refer to "Workplace Alaska" on Alaska's web site for state jobs in biology<www.state.ak.us>

B. **US *Fish and Wildlife Service*** (research and management of fish and wildlife, conservation education, nature interpretation) <www.r7.fws.gov>

C. **US *Geological Survey – Alaska Biological Science Center*** (wildlife research on federal lands and in shared ecosystems: studies of fisheries, migratory birds, marine mammals, freshwater and wetlands) <www.absc.usgs.gov>

D. ***National Park Service*** (park planning and management, wildlife biology, ecology, law enforcement, recreation, education) <www.nps.gov>

E. **USDA *Forest Service*** (planning and management, wildlife biology, hydrology, ecology, geology, recreation, fire management and control, personnel, budgeting) <www.fs.fed.us>

F. ***Bureau of Land Management*** (land-use planning, wildlife biology, ecology, education, entomology, nature interpretation, personnel, fire management and control) <www.blm.gov>

G. ***Alaska Department of Natural Resources*** (land-use planning, management, fire management and control) <www.dnr.state.ak.us/>

H. ***Native groups*** (wildlife management, land-use planning, environmental education, natural resource law, **lobbying**) Contact groups in your area, the Alaska Native Knowledge Network's regional coordinators <www.ankn.uaf.edu> or the Alaska Native Heritage Center **<**www.alaskanative.net>

I. ***University of Alaska*** or other universities – (research and teaching in wildlife, fisheries, ecology, and management) Contact the Cooperative Extension Service <www.uaf.edu/coop-ext/>

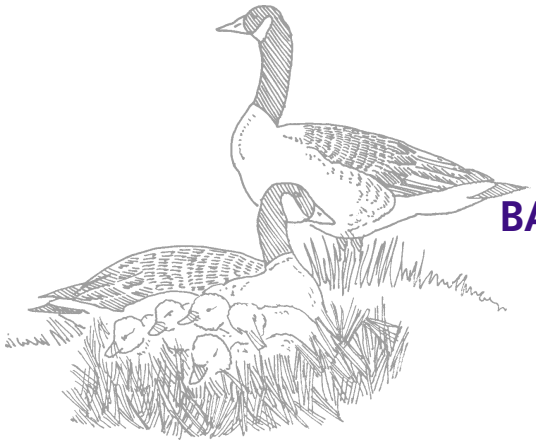
J. ***Conservation organizations*** (These groups use people with careers in biology, ecology, lobbying, natural resource law, conservation, resource education, natural history interpretation, marketing and fund-raising) Examples include: *Alaska Outdoor Council* and *Alaska Fish and Wildlife Conservation Fund* <www.alaskaoutdoorcouncil.org> Official state affiliate of the NRA.
Alaska Trappers Association <www.alaskatrappers.org>
National Audubon Society <www.audubon.org>
National Wildlife Federation <www.nwf.org>
The Nature Conservancy <www.tnc.org>
The Wilderness Society <www.wilderness.org>

K. ***Tourist guiding companies*** ("ecotourism" guides must be knowledgeable about wildlife) Alaska Wilderness Recreation and Tourism Association <www.awrta.org>

L. ***Jobs in* Natural Resources** <www.cyber-sierra.com/nrjobs/natres.html> Job openings in the field of Natural Resources. Has links to many career offerings.

M. ***Occupational* Handbook** <stats.bls.gov/ocohome.htm> National source of career information.

WILDLIFE ACTIVITIES

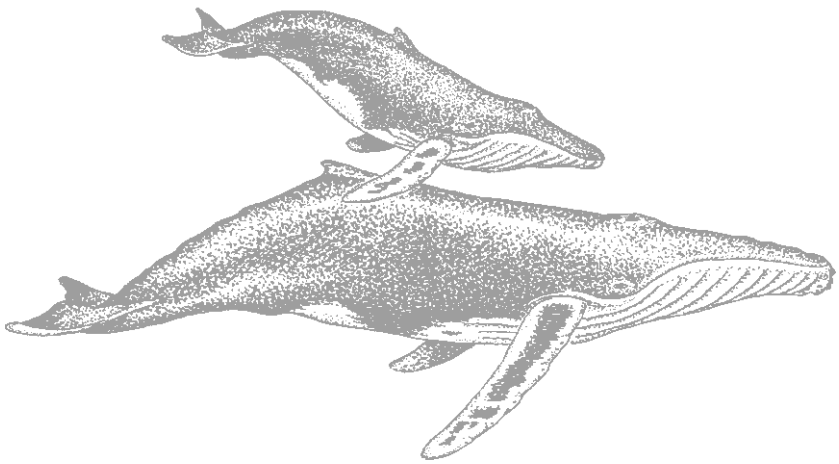


Section 1
HABITAT —
BASIS FOR SURVIVAL

Section 2
BIODIVERSITY AND POPULATIONS —
ALASKA'S DYNAMIC WILDLIFE

Section 3
WHEN POPULATIONS DECLINE —
LOSING BIODIVERSITY

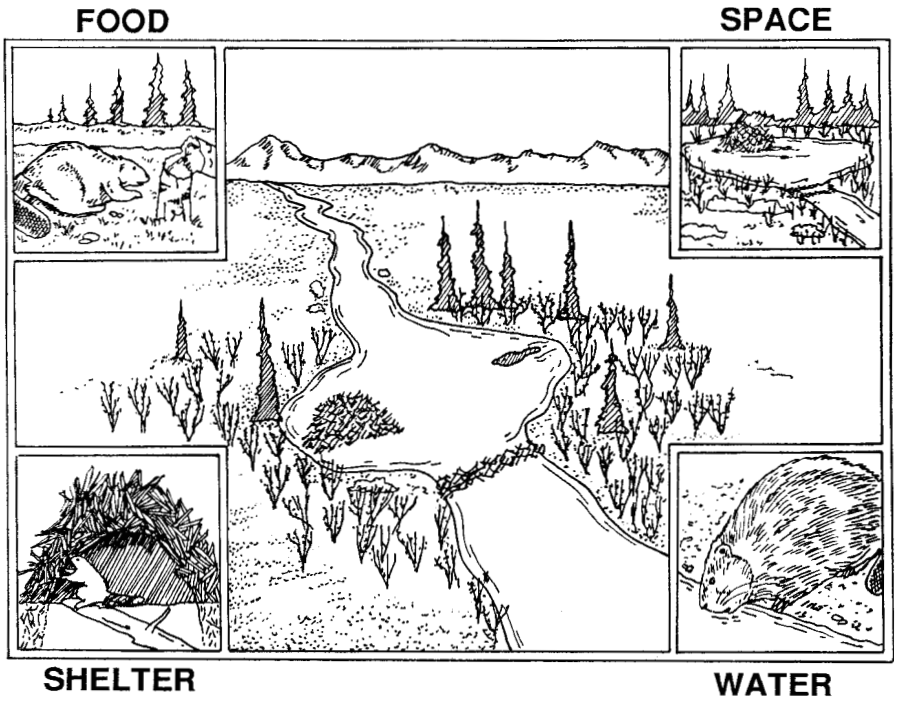
Section 4
WILDLIFE CONSERVATION IS UP TO US!



Habitat Grid

1 EXTENSION

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 1
WILDLIFE ACTIVITIES

Grade Level: K - 5

Subjects: Language arts, science

Skills: Categorizing, listing, research, synthesizing data into tables, reading, writing

Duration: 2-3 class periods

Group Size: Whole class and individuals or pairs

Setting: Indoors

Vocabulary: Cover, food, habitat, predators, shelter, space, species, survival needs, water, wildlife

Objective:

Students will name the four things humans and all other life forms need to survive by describing the habitat of an Alaska wildlife species.

Teaching Strategy:

Students compile information about wildlife habitat needs on a grid.

Complementary Activities:

"Habitat Boxes," "Who am I?," *and* "The *Habitat Times*" *in this section*. "Population Posters" *and* "Hermit Crab Game" *in Section* 2. "Musical Habitats" *in Section* 3.

Materials:

Butcher paper or following Habitat Grid Worksheet. *Alaska Ecology Cards* or other images of wildlife, images of pets, reference materials about Alaska wildlife (*see Curriculum Connections or Teacher Resources*).

Background:

See INSIGHTS *Section* 1, *Habitat – Basis for Survival.*

Procedure:

1. Brainstorm a list of Alaska wildlife and a list of domestic pets.

2. Write three headings across a chalkboard: *People - Pets - Alaska Wildlife.*

3. Ask students what sort of things people need to survive. *To help focus the answers on survival rather than on the extras like television or bicycles, suggest that they pretend they are lost in the woods or on the tundra for a few nights.* List the students' ideas in a column under the word "People." Do the same for "Pets" and "Alaska Wildlife."

4. Ask students to group ideas together into categories based on what they have in common. *For example, "cookies" might be combined with "soup" under "food."*

5. Ask students to remove from the list all but the most important survival needs of people, pets, and Alaska wildlife. The most basic survival needs will be the same for each of the groups: food, water, shelter, and space (in suitable arrangement). A *good way to test whether an item is essential is to apply the item to*

an obscure living thing (*such as, does an ice worm need warmth? does a bacteria that lives in your stomach need light?*).

6. Make a large Habitat Grid on butcher paper (*see Worksheet example*). Model filling in one row for the students, and tell them they will research the information for the rest of the grid.

7. Students (working individually or in pairs) choose an Alaska animal species and research its survival needs. F*or example, moose need buds and branches of small trees for food and bigger trees for shelter from winter storms and predators*. Questions to research might include: • What size is your animal? • What does it eat? • Where does it get its water? • How does it hide from other animals? • Where does it find shelter? • How big of an area does it move around in during a year? • Is it active during the day or at night?

8. Each student writes a short research summary about their animal using the following format:

(1) What do I already know about this animal?
(2) What do I want to know about this animal and its habitat?
(3) Where might I look to find out more about my animal?
(4) What did I learn when I looked for information on my animal? Was the information easy or hard to find?
(5) Did I find the answer to my original questions about this animal? If yes, what are they?

9. Using the information in their reports, help the class fill in information about the habitat needs of the animals on the Habitat Grid.

VARIATION FOR YOUNGER STUDENTS
If making the Habitat Grid is too difficult for your class, combine a brainstorming session about habitat needs of various wildlife species with making the mural in *Section* 2 Activity: "*Population Posters*."

After you have made a list of fish and wildlife common to your area, discuss the four components of "habitat" (food, water, shelter, and space in a suitable arrangement). Why are these animals able to live in your area? Could a giraffe live on the tundra? Could a polar bear live in a jungle? Develop a class definition for habitat. Have the students include what you have discussed in their mural.

Evaluation:

1. Using paint or another art medium, students create a picture of an Alaska wildlife species that shows all elements of the habitat in the illustration. This could be used to illustrate their stories or their research paper.

2. List four things plants, animals, and other organisms need for survival.

3. Use the following "Who am I?" activity as an evaluation.

EXTENSION:

Write stories for class book. Students write a story about the animal that they researched. The story will include the four components of habitat. Put the stories together in a class book of Alaska animals and share with other classes or the school.

Credit:

Adapted from "The Beautiful Basics" and "Everybody Needs a Home," P*roject* WILD K-12 A*ctivity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

B*ears for Kids* (Fair)

C*aribou Journey* (Miller)

C*atching the* Wind (Ryder)

D*eneki* (Berry)

D*isappearing Lake* (Miller)

F*light of the Golden Plover* (Miller)

Moose for Kids (Fair)

Polar Bear Journey (Miller)

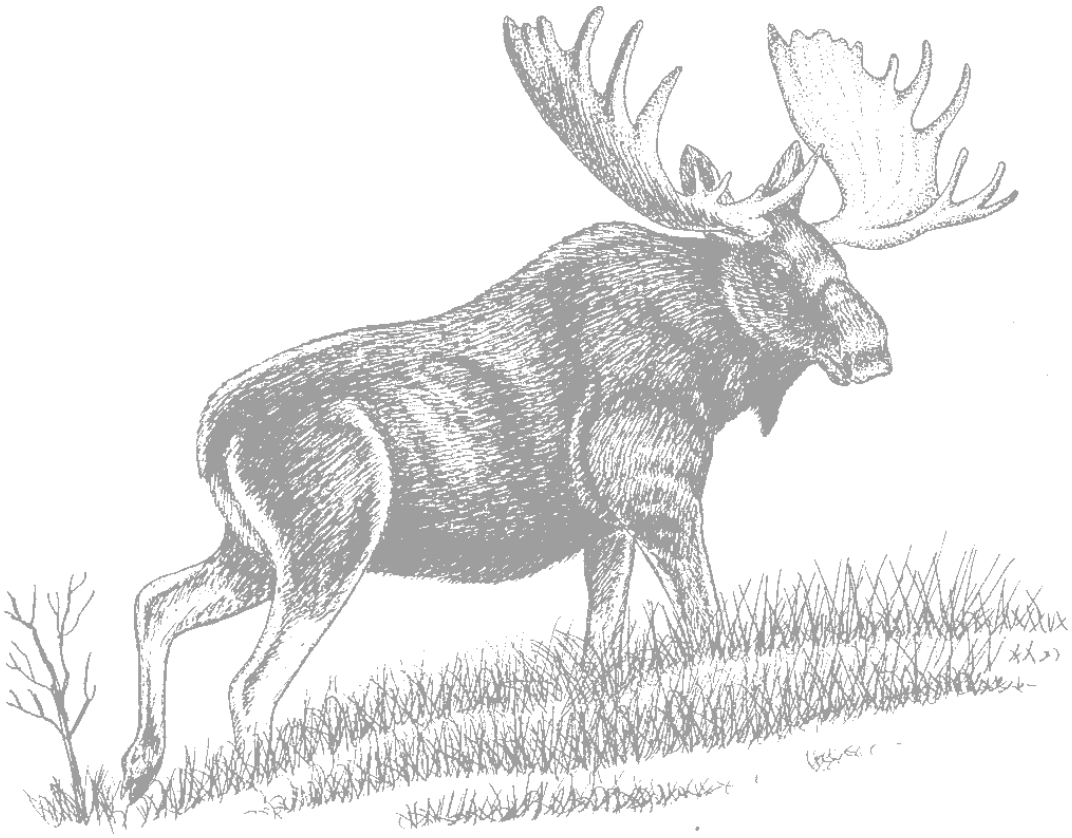
The River of Life (Miller)

Wolves for Kids (Wolpert)

Website:
Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Teacher Resources:

(See appendix)

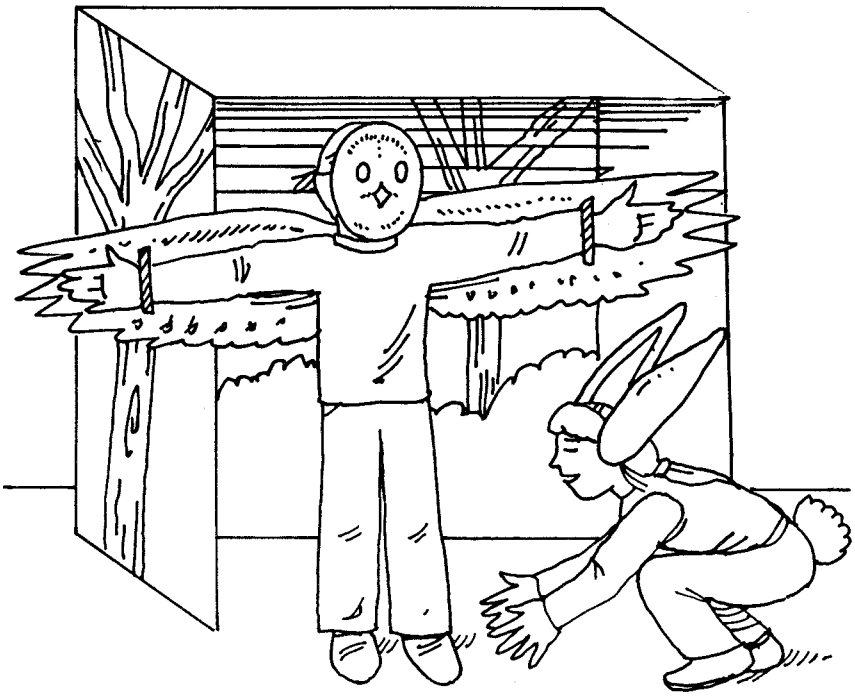


Habitat Grid Worksheet

ALASKA SPECIES	FOOD	+ WATER	+ SHELTER	+ SPACE	+ SUITABLE ARRANGEMENT	= HABITAT
Example: Moose	Willows, sedges	Streams or ponds	Forest stand or willow shrubs	Large home range	Need places protected from deep snow in winter. Need places with ponds in summer.	Forest

Habitat Boxes

4 EXTENSIONS ***ALERT: ALASKA ECOLOGY CARDS OPTIONAL***



Section 1
WILDLIFE ACTIVITIES

Grade Level: K - 3

Subjects: Science, language arts

Skills: Speaking, creative dramatics, writing, research

Duration: 1-2 hours (more if make costumes)

Group Size: Small groups

Setting: Indoors

Vocabulary: Food, habitat, names of local animals and plants, shelter, space, water

Objectives:

1. Students will use vocabulary related to local plants and animals.

2. Students will demonstrate knowledge of wildlife habitat.

Teaching Strategy:

Students use creative dramatics and props to act out a local animal's life in its habitat. Reinforces kinesthetically the knowledge gained in "Habitat Grid."

Complementary Activities:

"Habitat Grid" *and* "Who am I?" *in this section*. "Population Posters" *in Section* 2. "Musical Habitats" *and* "Distant Thunder – Dinosaurs" in Section 3.

Materials:

Butcher paper for drawing habitat scene *or* boxes large enough for children to climb into. Paint, items for natural or student-made props (*forest examples – spruce cones, sticks, rocks; tundra – moss, dried berries, cotton grass*), animal costumes for children (plastic noses, paper masks, or additional materials to make costumes). *Alaska Ecology Cards* or other wildlife resource materials.

Background:

See INSIGHTS *Section* 1, *Habitat – Basis for Survival.*

Procedure:

1. As a class, brainstorm kinds of wildlife that live in your area. Discuss the **habitat** needs of each animal (**food**, **water**, **shelter**, and **space** in appropriate arrangement). Refer to the previous activity "Habitat Grid," the *Alaska Ecology Cards*, or the following Curriculum Connections).

2. Divide the class into small groups. Each group will choose an animal and then construct its animal's habitat on a large sheet of butcher paper *or* on the inside and/or outside of a box (they may paint pictures, arrange the props, etc.).

3. Each student will create an animal costume (noses, masks, head bands with animal pictures) and act out

the animal's life history, highlighting its adaptations to its environment. Younger students may need some assistance.

Evaluation:
Students make oral presentations about their animal's habitat needs.

EXTENSIONS:
A. **Turn research into a play.** Each group makes up a play about their animal in its habitat. Invite parents to watch the play. Older students can write a narrative.

B. **Write stories about animals.** Students write stories about their animal. They might write about "a day in the life" of their animal. Organize the book with chapters that reflect the cycle of the seasons. Compile the stories in a book along with pictures of students in costume.

C. **Use "Di's Story" as basis for play.** Read "Di's Story" from *Alaska's Tundra & Wildlife* of the *Alaska Wildlife Curriculum*. Create a play out of one or more seasons.

D. **Create habitat dioramas.** Students create a diorama of their animal's habitat inside a shoebox using modeling clay and items from nature or the classroom.

Curriculum Connections:
(See appendix for full citations)

Books:
Alaska Wildlife Notebook Series (ADF&G)

Bears for Kids (Fair)

Caribou Journey (Miller)

Deneki (Berry)

Moose for Kids (Fair)

Polar Bear Journey (Miller)

White Bear, Ice Bear (Ryder)

Wolves for Kids (Wolpert)

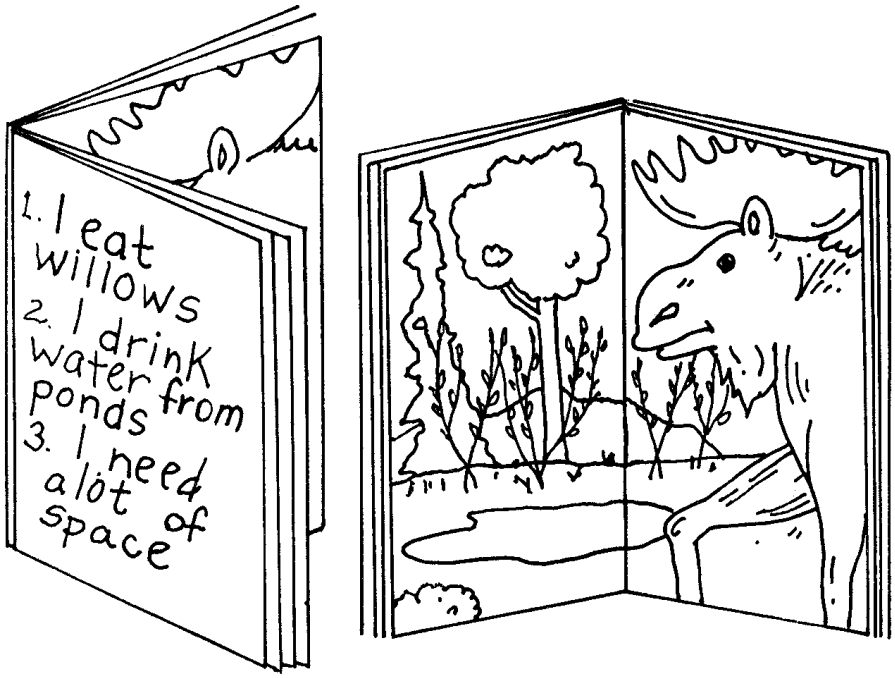
Website:
Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Teacher Resources:
(See appendix)

Who am I?

3 EXTENSIONS

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 1
WILDLIFE ACTIVITIES

Grade Level: 2 - 6

Subjects: Language arts, science

Skills: Drawing, inferring, predicting, writing

Duration: 2-3 sessions (45 minutes each) or 1 session plus learning center time to complete individual books

Group Size: Individual

Setting: Indoors

Vocabulary: Arrangement, cover, food, habitat, space, species, water

Objective:

Students will review their knowledge of habitat requirements of Alaska wildlife.

Teaching Strategy:

Students create a riddle book using facts about Alaska wildlife and habitats.

Complementary Activities:

"Habitat Grid" *and* "Habitat Boxes," "Interview a Muskox," *and* "The H*abitat Times*" *in this section*. "Population Posters" *in Section 2 and* "Musical Habitats" *in Section 3*.

Materials:

Butcher paper Habitat Grid or worksheet from preceding activity "Habitat Grid" (*in this section*). Paper, markers, crayons, glue, scissors, *Alaska Ecology Cards* or other reference materials, magazines or other sources with pictures of animals.

Background:

See INSIGHTS *Section 1, Habitat – Basis for Survival.*

Procedure:

1. If the habitat grid has been completed, tape it where the entire class can see it. Review the habitat requirements for one or more animals on the Habitat Grid. If the grid is blank, complete it as a class using the *Alaska Ecology Cards* or other reference materials.

2. Model to the class how to make a riddle book using moose as an example:
   (a) Fold one piece of paper in half to make a book.
   (b) Use the information on the Habitat Grid to write clues about moose on the front of the book:
      1. I eat willows.
      2. I drink water from ponds.
      3. I need a large space to find food and escape predators.
   (c) Open the book, draw a picture of the animal in its habitat, and write the name of the animal across the two inside pages of the book.

3. Spread students out. Students will create their own riddle book. To make their pictures, students may get ideas from the *Alaska Ecology Cards* or illustrations from magazines.

4. Collect the completed riddle books. Pass them out to the class again, making sure that no student receives his or her own book.

5. Remind students that all the animals are on the Habitat Grid. Ask each student to read the clues on the front of the book that she or he received. The other students then guess which animal fits the habitat riddle before opening the book to see if they were right.

Evaluation:

1. Create an imaginary animal. Students then create the habitat for the imaginary animal.

2. Observe whether or not students used all elements of the animal's habitat somewhere in their illustration.

EXTENSIONS:

A. **Display the riddles.** Make a hallway display of the riddles or put them into a class book.

B. **Read riddles to other classes.** Students read riddle books to another class so they can guess the answers.

C. **Add riddles to learning station.** Make a riddle corner and keep the class riddles for students to use as a learning station.

Credit:

Adapted from Joseph Cornell's "Animal Clue Game" in *Sharing the Joy of Nature*, Dawn Publications, Nevada City, NV, 1989.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Alaska's Mammals (Smith)

Mammals of Alaska (Alaska Geographic)

Website:

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Teacher Resources:

(See appendix)

Schoolyard Habitat Map
1 EXTENSION

Section 1
WILDLIFE ACTIVITIES

Grade Level: 7 - 12

State Standards: S A-12, S A-14, S A-15

Subjects: Science, geography, mathematics, art, technology

Skills: Mapping, observing, coordinating, communication, observation, hypothesize, compiling data

Duration: 3-5 sessions

Group Size: Pairs

Setting: Outdoors & computer lab

Vocabulary: Ecosystem, habitat, species

Objectives:
1. Students will describe the ecosystem surrounding their school.

2. Students will determine what factors support life in their schoolyard.

3. Students will determine what habitat needs their schoolyard provides to wildlife.

Teaching Strategy:
Students will study the schoolyard to map the living and nonliving elements that comprise the ecosystem around their school.

Complementary Activities:
"Can Do!" *in Section* 4. *Many* "Forest Learning Trail" *activities in* Alaska's Forests & Wildlife *or the* "Investigating (Nonliving / Living Things)" *activities in* Alaska's Ecology.

Materials:
For each group: Graph paper, color pencils, clip boards, tracing paper, rope or twine, measuring tapes, stakes, multiple colors of flagging tape, compasses. Aerial photographs or topographical maps of the school and immediate surrounding area if available. Plant and animal field guides. Habitat maps from atlases, the Internet, or state and federal agencies to illustrate mapping (*see following Curriculum Connections*).

Background:
See INSIGHTS *Section* 1, *Habitat – Basis for Survival.*

Procedure:
IN ADVANCE, select an area of the schoolyard that can be divided into relatively equal study plots for groups of students. If possible, choose an area that will be undisturbed for the duration of the project so that grid lines and stakes can remain between sessions.

1. IN CLASS, introduce **habitat** and explain to students that topography, soils, water, and sunlight are important habitat features that often determine what life forms will be supported in an area.

2. Show students maps of **soils**, **topography**, **water**, **vegetation**, and **species** . Explain that they will be creating a similar map of their schoolyard that will include all of these parts of an **ecosystem**.

3. They will be looking for answers to questions such as: In the schoolyard, where does water pool or drain? Does the soil absorb water? What vegetation lives in different sections of the schoolyard and why? What animals, live or travel through the schoolyard? What habitat is available to the animals that use the schoolyard?

4. Explain to the students that to gather information for their map, they will break the schoolyard into connected plots of roughly equal size using stakes, twine, and measuring tape. The lines formed by the twine will create a large grid that lines up with the directions on a compass. *If aerial photographs of the school are available, use an acetate overlay to draw grid lines on the photo to demonstrate this point.*

5. Students will also create grid lines within their plots using string. The string will then be used to accurately draw in details. Determine the size of the plots and assign each group a plot of equal size. Also determine the length/size of the grids within the plots (3 x 3 yards or meters square works well).

6. As a group, standardize the symbols that will represent land features and create a key all students will use. Do this for each session before going outside (*What colors and shapes will represent willow, spruce? What symbol will represent a path or the perch of a magpie or the tracks of a snowshoe hare?*)

OUTDOORS
SESSION ONE
1. Students determine and set a North-South line and an East-West line.

2. From these lines, students work in groups to set boundaries for large study plots.

3. When large plots have been created, small groups create the grid lines within their assigned plot.

4. Students make a baseline map of their assigned plot showing major locating features and grid lines. Each map and subsequent overlay should be drawn to scale using the grid lines created in the plot. *Because all plots are measured using the same measurements, map pages can be laid out and connected to illustrate the entire study area.*

SESSION TWO
Using tracing paper and color pencils (or drawing on photocopied baseline maps from Session One), each group evaluates and records its study plot's contour, water flow, pooling, and soils composition (clay, gravel, etc.).

SESSION THREE
1. Students evaluate and record vegetation on another tracing paper overlay or a photocopy of the baseline map.

2. On another overlay or photocopy base map, students record animal signs and sightings. (*See also "Mammal" "Bird," and "Insect" activities in either Alaska's Ecology or Alaska's Forests & Wildlife.*)

NOTE: At the end of the outdoor sessions, students will have three sheets of tracing paper that, when held up together, represent the nonliving and living elements of their schoolyard ecosystem. Within these maps, habit information for the animals sighted abounds!

INDOORS
1. Using computer programs, students determine how best to illustrate their plots. Students create, color, and code maps of the schoolyard.

2. Discuss what each group found.

3. Ask students to describe what vegetation lives in well-drained soil, what plants do well around the edges of pooling? Do some plants only appear to live where the ground is higher (*drier*) or depressed (*wetter*)? Can some plants survive heavy foot traffic?

4. What happens to soil in areas without plant life?

5. What animals and animal signs have the students recorded on their maps? Ask students to share observations and hypotheses regarding what wildlife use different plants and habitats in their schoolyard.

Evaluation:

1. Students make oral presentations, highlighting the nonliving and living elements of the ecosystem within their plot.

2. Students state what wildlife use the schoolyard and what specific habitat needs their schoolyard provides.

3. Students suggest what wildlife could use their schoolyard if modifications to the habitat were made.

EXTENSION:

Students may wish to alter their schoolyard ecosystem to invite or discourage certain plants or animals. Perhaps your schoolyard has been inundated with **non-native** plants. Or perhaps your schoolyard lacks avian visitors and residents. Lead a discussion of what kinds of plants and wildlife your students want to have in their schoolyard.

• Students write or call community members, botanists, geologists, and biologists for additional information.

• Write a proposal to school administrators for making changes to the schoolyard ecosystem. Include what kinds of plants will attract (or discourage) specific wildlife.

• If the proposal is approved, create an action project (*See "Can Do!" in Section 4: Wildlife Conservation Is Up To Us!*)

Credit:

Contributed by Robin Dublin, Alaska Department of Fish & Game, Anchorage, Alaska.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska in Maps: A Thematic Atlas

Alaska's Mammals (Smith)

Alaska's Trees and Shrubs (Viereck)

Discovering Wild Plants (Schofield)

Field Guide To Alaskan Wildflowers (Pratt)

Mammals of Alaska (Alaska Geographic)

Wild Edible and Poisonous Plants of Alaska (Heller)

Websites:

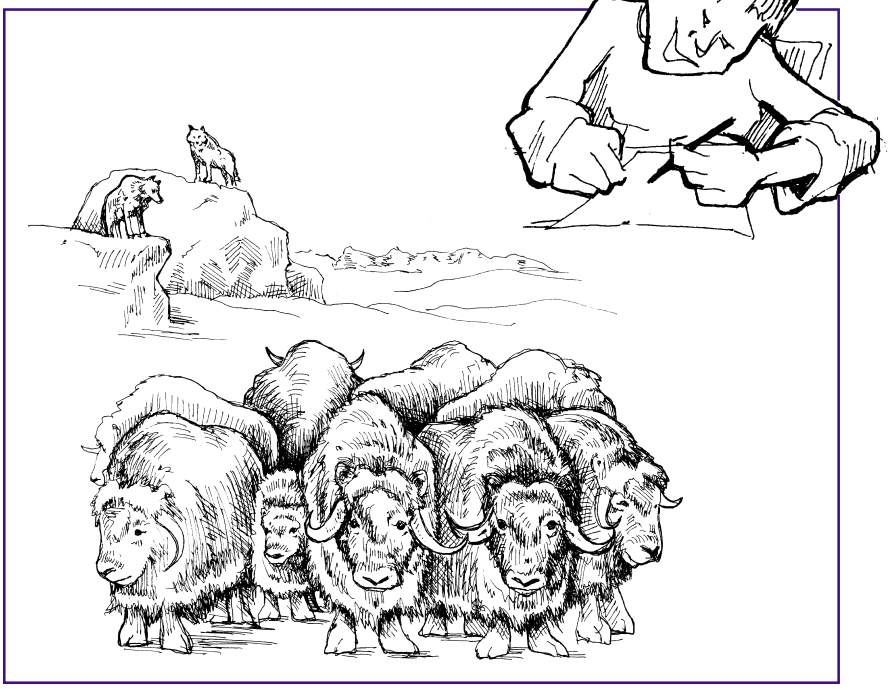
Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Various atlas websites <www.maps.com> or <www.3datlas.com>

Teacher Resources:

(See appendix)

Interview a Muskox
2 EXTENSIONS



Section 1
WILDLIFE ACTIVITIES

Grade Level: 4 - 8

State Standards: L A-3, L A-4, L A-5, L A-6

Subjects: Science, language arts

Skills: Interviewing, note taking, research, reading, speaking, writing

Duration: 2-4 sessions, 30-45 minutes each

Group size: 2

Setting: Indoors

Vocabulary: Alaska wildlife names, anthropomorphism, diversity, habitat, interview, prey, variety

Objectives:
1. Students will state that Alaska is home for diverse forms of wildlife.

2. Students will describe the habitat and adaptations of wildlife.

Teaching Strategy:
Students research and interview to discover information about Alaska wildlife.

Complementary Activities:
"Habitat Grid," "Who Am I," *and* "The H*abitat Times*" *in this section*. "Biodiversity on Display" *in Section* 2 *and* "Habitat Roulette" *in Section* 3.

Materials:
Pictures and information about at least 15 kinds of Alaska wildlife, writing materials.

Background:
See INSIGHTS *Section* 1, *Habitat – Basis for Survival*. See also companion curriculum book *Alaska's Tundra & Wildlife*: INSIGHTS *Section* 3, *Adaptation fact sheets*.

Procedure:
BEFORE CLASS, post pictures or names of at least 15 different Alaska animals.

1. IN CLASS, tell students that a magazine or television program has asked them to provide the information for a special issue or program about the **diversity** of wildlife that live in Alaska.

2. Divide the class into research teams of two. Assign or let each pair choose an animal from the posted pictures. (*Don't allow any duplication*.)

3. Brainstorm a list of questions for each research team to answer. Have each team record the questions. The list should include:
- Where in Alaska does your animal live?
- How big is your animal?
- What type of **habitat** does it use?
- What does it eat?
- Who **preys** on it?
- Does it live in Alaska year-round?
- What does it do in the winter?

4. Direct teams to use reference materials and take notes to answer the questions.

5. Synthesize the information in either or both of the following ways:

(a) ORAL PRESENTATION: One team member role-plays the researched animal. The other student role-plays an inquisitive reporter. The reporter asks questions, and the animal responds by elaborating on the answers found through their joint research. These **interviews** could take the form of a news show, talk show, or puppet show, for example.

CAUTION: *Students may have a tendency to project inapplicable human characteristics to animals, especially because the interview format puts the animals in a human situation. Assist the students in avoiding* **anthropomorphism**. *Stress that they should try to see the world by what the animal sees and experiences, without interpretation.*

(b) WRITTEN PRESENTATION: Each team works together to write a news or magazine article about its animal. The articles can be compiled to make a class book, "Everything You Always Wanted to Know about Alaska Animals."

Evaluation:

1. Students name five animals and one important need or adaptation that each animal has for survival.

2. Students describe the role of three of Alaska's animals in their ecosystem.

EXTENSIONS:

A. **Share information with other classes.** Share interviews with younger classes.

B. **Use research to make posters.** Make posters that illustrate or advertise an animal and its importance to the diversity of Alaska's ecosystems.

Credit:

Adapted from "Interview a Spider," *Project* WILD K-12 *Activity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Alaska's Bears (Alaska Geographic)

Alaska's Bears (Sherwonit)

Alaska's Birds (Armstrong)

Alaska's Fish (Armstrong)

Alaska's Mammals (Smith)

Mammals of Alaska (Alaska Geographic)

Website:

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

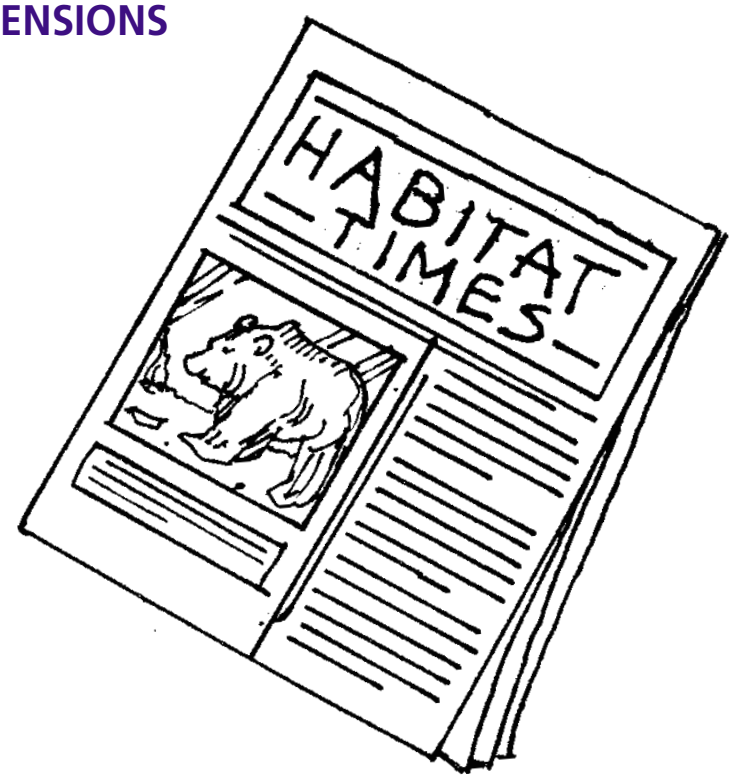
Animals of the Arctic <tqjunior.thinkquest.org/3500>

Teacher Resources:

(See appendix)

The Habitat Times

3 EXTENSIONS



Section 1
WILDLIFE ACTIVITIES

Grade Level: 2 - 8

State Standards: L A-4, LA-5, S A-14, Geo E-5

Subjects: Language arts, science, social studies

Skills: Research, writing, vocabulary development

Duration: Several sessions

Group Size: Whole class or small groups

Setting: Indoors

Vocabulary: Alaska animal names, habitat, newspaper, article

Objectives:

1. Students will describe the habitat requirements of Alaska wildlife.

2. Students will describe the impact of human actions on wildlife habitat.

Teaching Strategy:

Students write stories about an animal's habitat needs and experiences and make a class newspaper to summarize their findings.

Complementary Activities:

"Habitat Grid," "Interview a Muskox" *in this section*. "Biodiversity on Display" *in Section 2 and* "Habitat Roulette" *in Section 3*.

Materials:

Curriculum Connections resources, chart paper, writing materials, paper.

Background:

See* INSIGHTS *Section 1, Habitat – Basis for Survival.

Procedure:

1. Discuss or review with the class the **habitat** requirements of wildlife (**food**, **water**, **shelter**, and **space** in a suitable arrangement).

2. Brainstorm a list of local animals. List the ideas on chart paper. Students will choose one animal and research its habitat needs.

3. Brainstorm a list of dangers the animals might encounter while trying to meet their habitat needs (*predators, bad weather, accidents, etc.*). List the ideas on chart paper.

4. Then brainstorm actions by people that might be destructive to animal habitat (*off road vehicle use, paving open lands, cutting trees, filling in wetlands, polluting streams, and littering fields*). List the ideas on chart paper.

5. Students write and illustrate stories based on the life of each of their animals. In each story the animal must seek its habitat requirements and encounter obstacles caused by people, predators, natural events (*for an example, refer to "Di's Story" in the companion*

curriculum book Alaska's Tundra &Wildlife). Encourage students to consider a **variety** of outcomes.

Possible endings include: the animal becoming food for other animals or humans, humans saving the animal's habitat, or habitat destruction forcing the animal to leave its home.

VARIATION FOR YOUNGER STUDENTS
You may choose to make a class book or have the class write a story together. For independent writing, you could use a sentence frame, for example,
"I am a _____."
"I'm looking for a _____."

6. Have the students compile the stories into a wildlife newspaper. Additional stories could be written about narrow escapes or challenging efforts to obtain food. Others could feature how to keep human food out of reach of wildlife and other safety precautions.

7. Add other sections to the newspaper including comic pages, letters to the editor, for example. Have students use watercolors to make fingerprint animals. A black marker can be used to add details.

Evaluation:

Determine whether the correct habitat requirements are addressed in each story.

EXTENSIONS:

A. **Use knowledge to write book reviews.** Students read books about Alaska wildlife and write book reviews.

B. **Draw habitat maps.** Students draw maps showing the different elements of the animal's habitat and research range maps illustrating where in the populations live in Alaska.

C. **Synthesize study with a web page or newspaper.** Develop a web page or the newspaper around a theme that is part of a unit of study.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Alaska's Bears (Alaska Geographic)

Alaska's Bears (Sherwonit)

Alaska's Birds (Armstrong)

Alaska's Fish (Armstrong)

Alaska's Mammals (Smith)

Mammals of Alaska (Alaska Geographic)

Roadside (Bellamy)

Wump World (Peet)

Website:

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

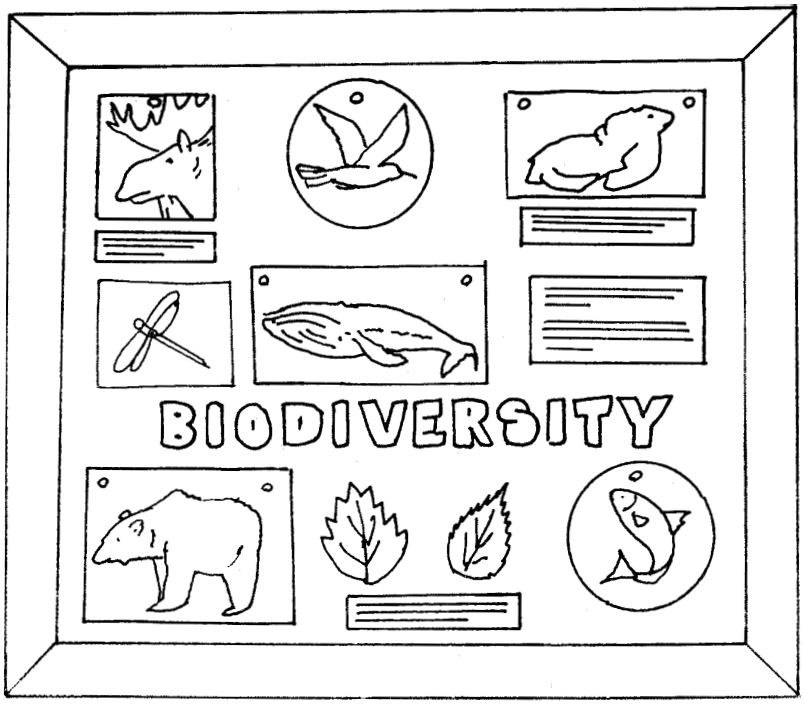
Animals of the Arctic <tqjunior.thinkquest.org/3500>

Teacher Resources:

(See appendix)

Biodiversity on Display

4 EXTENSIONS ***ALERT: ALASKA ECOLOGY CARDS OPTIONAL***



Section 2
WILDLIFE ACTIVITIES

Grade Level: K - 4

Subjects: Science, language arts

Skills: Classification, observation, speaking, writing

Duration: Several short sessions

Group Size: Class

Setting: Indoors

Vocabulary: Biodiversity, difference, diversity, environment, evidence, variety, wildlife

Objectives:

1. Students will define the terms *diversity* and *biodiversity*.
2. Students will describe a variety of living things in their environment.

Teaching Strategy:

Students construct a display and describe biodiversity through "Show and Tell."

Complementary Activities:

"Scavenge for Biodiversity" *and* "Population Posters" *in this section*. "Habitat Grid" *in Section* 1.

Materials:

Bulletin board or poster paper and tape. Pictures of Alaska wildlife from sources such as the *Alaska Ecology Cards*, photographs from the ADF&G website or others, or magazines.

Background:
See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife.*

Procedure:

IN ADVANCE, start the "Biodiversity on Display" area using a bulletin board, poster paper on the wall, or a dedicated portion of your chalkboard. Write the title on the display and place a few color pictures of Alaska wildlife on the display to stimulate students' imaginations.

1. Ask the students what the illustrations have in common (*they are all living things*). Then ask them to point out the **differences** among the living things pictured.

2. Explain that **diversity** means *variety* or *all of the differences*. Tell them that they will be gathering **evidence** of **biodiversity** or the ***variety*** *and abundance of living things* to display on the bulletin board.

3. Over a period of time (which you decide), ask students to bring evidence of different types of living things and things that were once alive. Brainstorm what type of evidence students could bring to class.

Examples: pictures from magazines; stories about how a living thing was used in their homes (food, clothing, items made of wood); small items that are parts of living things (seeds, leaves); something they have seen, smelled, or heard that was evidence of a living thing nearby.

4. If the students in your class are from a variety of cultural backgrounds, encourage the sharing of stories about plants and animals that are told in their homes and the ways in which living things are used in the home.

5. Have a "Show and Tell" session each day to introduce more evidence. Ask students to tape the objects on the display and "tell" their stories and observations. Students and/or the teacher keep a record of all observations.

Evaluation:

Each student selects five distinctly different creatures from the display board and explains one or two traits about that animal that makes it different from the others in their group (*long beak vs. short beak, cat-like vs. dog-like, for example*).

EXTENSIONS:

A. **Gather items on a field trip.** Gather evidence during a field trip (*see following activity "Scavenge for Biodiversity"*) and add this to the display. Students classify the objects in a display in several different ways (*venn diagrams, in living/non-living groupings, plant/animal groupings, for example*).

B. **Show and Tell others.** Invite parents or other classes to view your display.

C. **Make a diorama.** Students make a diorama to show where the items were found in their natural environment.

D. **Use size as criteria.** Give students a set of dimensions (for example, 3 cm long and 2 cm wide), and then ask students to find objects that fit that description. Have them measure all objects on the display and classify them by size.

Curriculum Connections:

(See appendix for full citations)

Books:

Crinkleroot's Guide to Knowing Animal Habitats (Arnosky)

Do Animals Need Umbrellas? (Parker)

Fur, Feathers and Flippers (Lauber)

Teacher Resources:

(See appendix)

Scavenge for Biodiversity

3 EXTENSIONS

Section 2
WILDLIFE ACTIVITIES

Grade Level: 1 - 5

State Standards: S A-12

Subjects: Science, language arts

Skills: Classification, comparison, counting, following directions, group discussion, listening, observation

Group Size: Individuals or small groups

Duration: Variable

Setting: Outdoors

Vocabulary: Biodiversity, biology, diversity, soil

Objectives:

1. Students will investigate biological diversity.
2. Students will make comparisons.
3. Students will make observations about aspects of biodiversity.

Teaching Strategy:

Students discover, explore, and observe the diversity of life outdoors.

Complementary Activities:

"Biodiversity on Display" *and* "Microdiversity – Under Your Nose!" *in this section*. "Habitat Grid" *in Section* 1 *and* "Musical Habitats" *in Section* 3.

Materials:
F*or each student*: five "Biodiversity Cards" (*following*) selected for your area or season (laminated or copied on waterproof paper for a rainy climate).

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife.*

Procedure:

IN ADVANCE, select an area for the scavenger hunt – in the schoolyard or on a field trip.

1. IN CLASS, distribute the cards. Use them on the school grounds or on a field trip. F*or younger students, read the directions on the cards.*

2. Ask students to report back on what they found or didn't find.

Evaluation:

Each student portrays a living thing he or she observed.

VARIATION: Provide a set of cards with names of living things and have each student pick a card to role play.

EXTENSIONS:

A. **Customize the scavenger cards.** Make your own cards for your area or for different seasons. Illustrate cards for students who cannot read.

B. **Gather biodiversity evidence.** Students bring back evidence (drawings or descriptions) of different living things for use in the "Biodiversity on Display" (*see previous activity*) bulletin board.

C. **Bird feeder diversity study.** Make a class bird feeder(s) with different kinds of food (*sunflower, suet, peanuts, for example*) and observe how many and what kinds of birds come to the feeder. Students observe which birds eat what kind of food. Discuss how a variety of seeds may increase the variety of birds.

Credit:

Adapted from "Biodiversity: the spice of life," *Biological Diversity Makes a World of Difference*, National Park Service and National Parks and Conservation Association, Washington, DC, 1990.

Curriculum Connections:

(See appendix for full citations)

Books:

Biodiversity (Patent)

Crinkleroot's Guide to Knowing Animal Habitats (Arnosky)

Do Animals Need Umbrellas? (Parker)

Fur, Feathers and Flippers (Lauber)

Media:

Think about the Planet (Audio Tape) (Rodden)

Websites:

Alaska Biological Science Center
<www.absc.usgs.gov>

Alaska Natural Heritage Program
<www.uaa.alaska.edu/enri/aknhp_web>

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

Teacher Resources:

(See appendix)

Biodiversity Cards

Find a biodiverse place (a place with many living things).	Find a place with nothing living in or on it.	Find a tree or bush with smooth bark.	Find a rock with a living thing on it.
Find a place with more than one type of animal track.	Find an animal with six legs. *Treat it with care.*	Find a plant.	Pick a place to stand and count how many different plants you can see.
Find two flowers that look the same but smell different.	Find different seeds.	Find a leaf that is hairy and one that is smooth.	Find an animal home. *Watch without touching.*

Biological Diversity Cards

Watch a plant for five minutes and count the different insects that visit it.	Find a plant that grows in a sunny spot and one that grows in a shady spot.	Turn over a rock. How many different living things did you find? *Put rock back when done. This habitat is someone's home.*	Find a plant or an animal in the shape of a triangle, circle, oval, or square.
Listen. What sounds of living things do you hear?	Find as many different kinds of leaves as you can.	What wild plants do you see that can be used for food?	Find animals living in the soil.
Find animals living in the snow.	Find three different animals. What words describe their shapes?	Find the largest and the smallest leaves on a shrub or tree.	How many different colors of flowers can you find?

Microdiversity – under your nose!

8 EXTENSIONS

Section 2
WILDLIFE ACTIVITIES

Grade Level: 2 - 8
State Standards: S A-12, S B-1
Subjects: Science, math, language arts
Skills: Analyzing data, categorizing, classifying, comparing, contrasting, observation, predicting, recording data
Duration: 1-3 sessions
Group Size: 3-4
Setting: Indoors and/or outdoors
Vocabulary: Diversity, habitat, microhabitat, organism, species

Objectives:

1. Students will make predictions about the presence or absence of life in a microhabitat.
2. Students will search for a variety of living things.
3. Students will define *organism*, *species*, and *diversity*.

Teaching Strategy:

Through guided discovery, students make observations then classify and analyze data in the classroom. The activity can also be conducted on a field trip - *see Extensions*.

Complementary Activities:

"How Many Animals Live Here" *and* "Biodiversity Field Trip" *in this section*. "Habitat Grid" *in Section* 1.

Materials:

Observation equipment: hand lenses, microscopes, white trays, tweezers, paper for notes (*may need waterproof paper*), pencils, cardboard clipboards, poster paper. "What We Found Worksheet" (*following*).
For outdoor collections: appropriate collection equipment for the selected site (bug boxes, bug "condos," containers, pond nets, kick nets for bottom-dwellers in streams, bottom dredges).

Background:
See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife*: "*Microhabitats & Biodiversity*" and "*Ideas for Collection & Field Trip Sites*" *Fact Sheets*.

PLEASE CONSIDER: The following procedure describes an in-class activity. If your class is going to collect its own samples outdoors, you will need to decide if it is necessary for students to bring back the samples for observation, or if samples can be left in place while making careful observations, drawings, and notes in the field.

When making your decision, please consider the effects of collecting specimens on the area you visit. Some sites may be damaged by heavy use (for example, mussel beds in the intertidal zone) and heavily used field trip sites may not be able to withstand collections by several classes.

Procedure:

IN ADVANCE, collect samples of pond water, leaf litter, or other substances from different microhabitats that contain, but not appear to contain, a variety of living things.

1. IN CLASS, show the class each sample and ask, "Do you think there is anything alive in this sample?"

2. Tally the "yes" and "no" answers as two different predictions. Write names and initials in the "yes" and "no" columns.

3. Divide the students into small groups. Provide one sample to each group. Ask students to carefully explore their sample for living things or signs that living things have been there (*include sounds and smells*!).

4. Give paper, pencils, and a clipboard to each group to record their observations.

5. Students draw pictures or use descriptions of what they find if its don't know the names.

6. Students identify the **microhabitats** where the collection occurred (*for example, on the surface of water, in the water, on the soil, in the soil*) for use in their notes. Younger students can draw pictures that show where the **organism** was found.

7. Reunite the groups to discuss the observations. Were there a lot of different kinds of living things? In which microhabitat sample did they find the most **species** of animals? The most plants?

8. Introduce or reinforce the concept of the **diversity** of life - *the variety of plants and animals that live in a certain place*. Which group observed the highest diversity? Why is one type of microhabitat more diverse than another?

9. Compile the observations by making a grid (*see following "What We Found Worksheet"*) on poster paper to show the results. Use descriptive phrases for the different types of organisms if names are not known. Encourage discussion about possible classification schemes.

10. Explain that scientists must go through the same process to decide if they are observing the same or different organisms in different parts of the world (*you can illustrate this process by reading descriptions out of a field guide*). Introduce common names of the organisms as well as local variations of names. Include English and other languages to make this a multilingual lesson.

11. Compare the results of the observations with the students' predictions.

12. Keep the completed grids for use in the activity "How Many Animals Live Here?" in this section.

Evaluation:

1. Give each student a sample from the same "unknown" habitat and ask each student to make predictions and investigate the number of organisms in the sample.
2. Ask the students how many species the class observed. Have the students think of a microhabitat that would be more diverse and one that would be less diverse.

EXTENSIONS:

A. **Habitat field trip.** Take a class field trip and identify outdoor microhabitats. The entire lesson could be taught on a field trip or students can collect from microhabitats for observation in the classroom.

B. **Guest bug expert.** Invite an entomologist (who studies insects) to the classroom to identify the insect species found.

C. **Compare and contrast to another season.** Repeat the exercise in a different season with collections from the same microhabitats and compare results.

D. **Math lesson in comparisons.** Calculate the total number of species and individuals on the sheets (column addition). Which species is most numerous? Which is least numerous?

E. **Math lesson in story problems.** Students write their own story problem about the species they observed. *For example, if there were 20 damselfly larva in the pond water collected and three died, how many would be left?*

F. **Write articles.** Students write an article for the school newspaper or parent newsletter describing this activity.

G. **Use field guides.** Students use identification guides to correctly identify each species found.

H. **Write class story or Big Book.** Help students write a class story or develop a "Big Book" about this project. Include students' reactions to the number of different species found.

Credit:

Adapted from "Who Lives Here?" OBIS, Lawrence Hall of Science, University of California, Berkeley, CA, 1998.

Curriculum Connections:

(See appendix for full citations)

Books:

A *Dead Log* (Green)

A *Freshwater Pond* (Hibbert)

Handful of Dirt (Bial)

Insects: A *Guide to Familiar American Insects* (Cottam)

National Audubon Society Field Guide to North American Insects and Spiders (Milne)

One Small Square: *Arctic Tundra* (Silver)

One Small Square: *Backyard* (Silver)

One Small Square: *Pond* (Silver)

One Small Square: *Woods* (Silver)

Peterson's Field Guide to Insects (Borror)

A *Tidal Pool* (Steele)

Under a Stone (Green)

Websites:

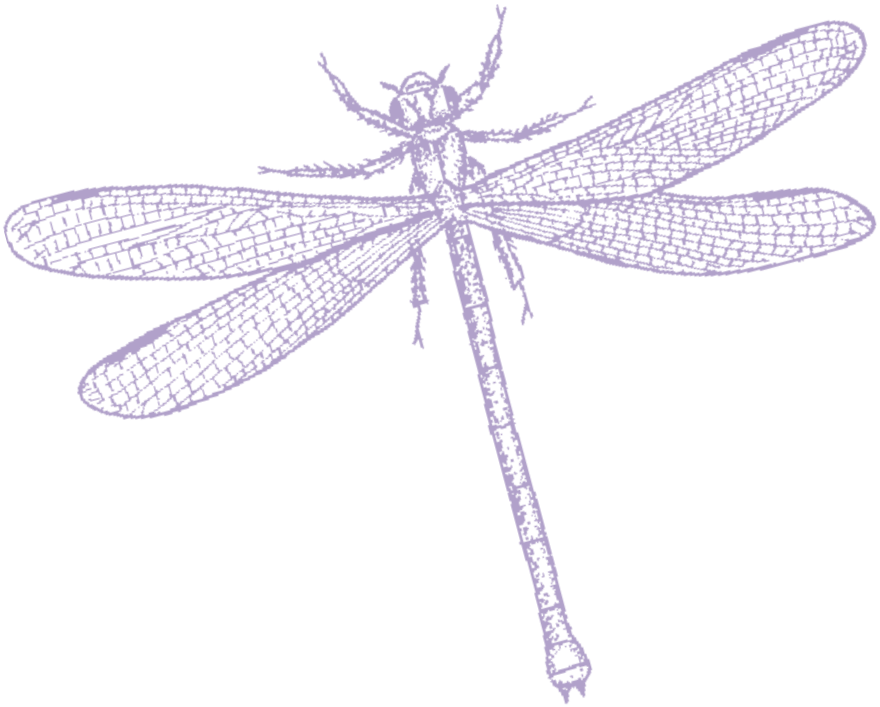
Alaska Biological Science Center
<www.absc.usgs.gov>

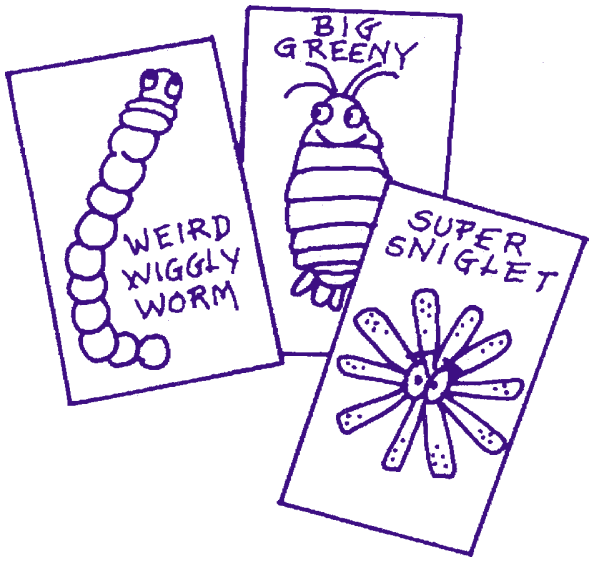
Alaska Natural Heritage Program
<www.uaa.alaska.edu/enri/aknhp_web>

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

Teacher Resources:

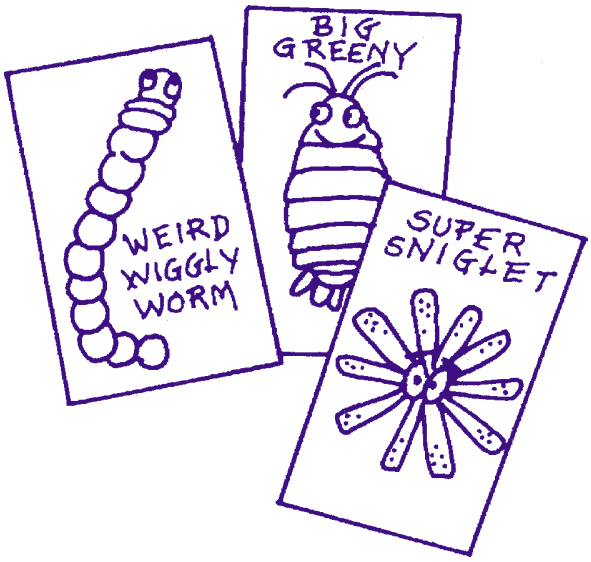
(See appendix)





What We Found Worksheet

Name of Critter	Habitat Group 1	Habitat Group 2	Habitat Group 3	Total of Each Species
Green bug with 6 legs	2	0	3	5
Black worm	1	1	4	6
Diamond backed black & green bug	3	5	0	8
The Big Greeny	1	0	1	2
Total Number of Species	**7**	**6**	**8**	**21**

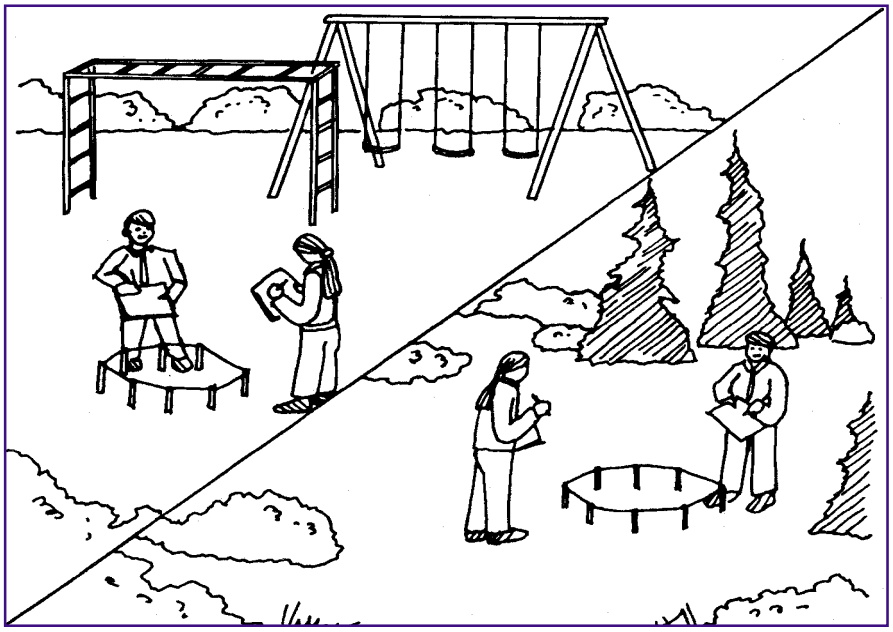


What We Found Worksheet

Name of Critter	Habitat Group 1	Habitat Group 2	Habitat Group 3	Total of Each Species
Total Number of Species				

Biodiversity Field Trip

7 EXTENSIONS *ALERT: ALASKA ECOLOGY CARDS OPTIONAL*



Section 2
WILDLIFE ACTIVITIES

Grade Level: 5 - 7

State Standards: S A-12, S B-1

Subjects: Science, geography

Skills: Classifying, collecting data, observing, predicting

Duration: 1-2 sessions

Group Size: 2-3

Setting: Outdoors

Vocabulary: Biodiversity, evidence, habitat, line transect, predict, species

Objectives:

1. Students will define *species*.
2. Students will observe biological diversity in the form of species diversity.
3. Students will compare species diversity in different habitat types.

Teaching Strategy:

Students investigate two habitat types and compare the biological diversity.

Complementary Activities:

"Microdiversity – Under Your Nose!" *and* "How Many Animals Live Here?" *in this section*. "Habitat Grid" *and* "Interview a Muskox" *in Section 1*

Materials:

For each group: a circular item to identify a plot (*hula-hoop, stakes and string, for example*), hand lens, small ruler, a field notebook, clipboard, pencils.
OPTIONAL: plant field guides and *Alaska Ecology Cards*.

Background:

See INSIGHTS *Section 2, Biodiversity and Populations – Alaska's Dynamic Wildlife*: "*Microhabitats & Biodiversity*" and "*Ideas for Collection & Field Trip Sites*" *Fact Sheets*.

Background:

In this activity, students measure **species diversity** in much the same manner as scientists. A **species** is a population of organisms that are alike, and that are able to produce offspring that can breed again.

Scientists often compare small areas in order to draw conclusions about the biodiversity of a larger area. Selecting *sample sites that represent a larger area* and classifying species are tools to measure biodiversity.

When your students use the results of their survey to predict the effects of habitat changes, they are facing the same questions that wildlife managers encounter. Managers try to predict and monitor changes in species diversity after forest fires, beetle outbreaks, drought or floods, human development, or as one animal high on the food chain becomes more abundant or scarce. Questions that scientists ask and try to answer include the following.

- How do changes in a plant community (forest, wetland, tundra, etc.) affect wildlife that depend on that community for some or all of their habitat needs?

- Who eats whom?

- What other species may be impacted because of the interelationships of living things in an ecosystem?

- How many individual animals might be affected if the habitat is lost?

- How significant will the loss of individuals be to the continuance and abundance of the population?

- Will the elimination of one population or species from an area result in the loss of other populations or species?

- What is the **carrying capacity** for a population (How much habitat is needed to support a population)?

- How can impacts to wildlife be balanced against **human needs** and desires that lead to land use changes?

Procedure:

IN ADVANCE, select two outdoor areas that are distinct "habitat types" (*for example, a pond and a paved playground, a forest and a lawn, a wet tundra site and a pingo*). If you can find an area with two habitat types in close proximity, you can split the class and complete data-gathering in one day; otherwise, it will require two field trips.

1. IN CLASS, define or review the definition of **species** – *a population of organisms that are alike and are able to produce offspring that can breed again*.

2. Describe the **habitats** you have chosen and ask them to **predict** what types of living things/species (or **evidence** of living things) they might find in each one.

3. Make a chart with two columns, one for Site 1 and one for Site 2. For each type of habitat, record student predictions under the heading "Species Predictions." Under each heading, make two columns, one for "Plants," and one for "Animals." Leave room to list "Species Found" after the field trip.

4. Divide the class into groups. Give each team a clipboard, small ruler, and hand lens. Each team will keep a field notebook. Explain that they will be making detailed notes and sketches of each species, not collecting plants and animals.

OUTDOORS (or in class)

1. Teams set up study areas at the site by creating circular plots of equal size.

2. Tell students that the goal is to find the greatest number of different plant and animal species within their study area. Students will need to look closely to determine whether the plants and animals they observe are different species. F*or example, a young plant, a dead plant, and a mature plant of the same species may look different, but they should count as one species*.

3. If students don't know a name for each plant or animal, they should make notes or sketches and give it a descriptive name (for example, "white flowered plant"). Allow 20 or more minutes for them to make their lists.

4. Repeat steps 1-3 in the second habitat type.

5. After completing the activity in both habitat types, ask the teams to count the number of species they found in each plot.

BACK IN CLASS

1. Add the heading "Species Found" to the charts you made and list the different species found. Total the number of different organisms found in each habitat type.

2. Define the term **biodiversity** (*the variety and abundance of living things*). Explain that one measure of biodiversity is the number of species in a particular area. Lead a discussion by asking the following questions:

- What site had the highest diversity of species?
- Why might one habitat type have more or less species diversity than another?
- What positive and negative effects can people have on the biodiversity of an area? If you visited an area that people had disturbed or developed as one of your sites, use that as the example.

- Of the organisms that live in this areas, which ones did you find?
- Would you find more or different species at a different season?
- If you were to spend more time doing this study, what other species do you think we would see?
- What are the nonliving things that might affect these living things (for example, soil, rain, sunshine)?

Evaluation:

1. Students define *species*.
2. Students describe local examples of areas with high or low species diversity and discuss why this is so.

EXTENSIONS:

A. **Compare habitats along a line.** Stretch a 100-foot-long rope "line transect" so that it crosses two habitats. Students walk along the transect and list all the species they see within 6 inches of the line (*students can use a small ruler to check the distance*). Use field guides to identify unknown species or make descriptive notes to research species back in the classroom. Review the transect data to determine which plants and animals are found in both habitats and which are only found in one or the other.

B. **Focus on local animals.** Discuss whether common local animals have specialized habitat requirements. Discuss their abilities to travel, or disperse to other areas of similar habitat. Can they travel feet? Yards? Miles?

C. **Learn local plant knowledge.** Invite a bilingual teacher, elder or knowledgeable community member to teach plant names and traditional uses in different languages and cultures.

D. **Turn drawings into guide book.** Make drawings of species found in the plot. Then compile a classroom guide book.

E. **Study life in soil samples.** Take samples of soil to search for organisms in the soil. (*See the activity "Microdiversity" in this section.*)

F. **Expand on local habitat types.** Discuss how different habitat types could meet the habitat requirements of different animals, using local examples.

G. **Compare diversity at other seasons.** Return to the sites at a different season and compare the data.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Alaska's Birds (Armstrong)

Alaska's Fish (Armstrong)

Alaska's Mammals (Smith)

Alaska's Trees and Shrubs (Viereck)

Biodiversity (Patent)

Dena'ina K'et'una=Tanaina Plantlore (Kari)

Discovering Wild Plants (Schofield)

Field Guide To Alaskan Wildflowers (Pratt)

Mammals of Alaska (Alaska Geographic)

Nauriat Niginaqtuat=Plants That We Eat (Jones)

Wild Edible and Poisonous Plants of Alaska (Heller)

Websites:

Alaska Biological Science Center
<www.absc.usgs.gov>

Alaska Natural Heritage Program
<www.uaa.alaska.edu/enri/aknhp_web>

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

Teacher Resources:

(See appendix)

Wildlife Conservation Conference

2 EXTENSIONS

Section 2
WILDLIFE ACTIVITIES

Grade level: 10 - 12

State Standards: L A-1, L A-3, L C-2, S A-14, CS B-2

Subjects: Science, geography, language arts, technology

Skills: Researching, writing, communication, oral presentations

Duration: 2 sessions

Group Size: 1-2

Setting: Indoors

Vocabulary: Wildlife names and terms

Objectives:

1. Students will give oral presentations on specific species of wildlife.

2. Students will provide the scientific, common and local name, life history, population and trend, range, predators and prey, and habitat requirement information for a specific species of Alaskan wildlife.

3. Students will present adaptation strategies, field sign and track information, local uses and stories relating to their chosen species.

Teaching Strategy:

Students will research Alaskan wildlife species and provide an oral presentation, using technology to create slides and charts.

Complementary Activities:

"Habitat Grid," "Schoolyard Habitat Map," *and* "The Habitat Times" *in Section* 1. "Gone Forever" *in Section* 3 *and* "Exploring Wildlife Issues" *in Section* 4.

Materials:

Access to research materials on the web, in the library, in the community. Computers and computer projector (*overheads can be used if equipment is unavailable*). Track casting materials, skulls and hides from loan collections, samples gathered from local community members.

Background:

See* INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife.

Procedure:

1. Introduce the activity by reminding students that mysteries still surround some Alaskan wildlife. Until recently, where Spectacled Eiders wintered or how far polar bears traveled were unknown. Many more questions about wildlife remain unanswered.

2. Tell students they will become experts specializing in one species of wildlife. They will research their animal in-depth and present this information in a professional manner, as conservation professionals.

3. Brainstorm or provide a list of Alaska wildlife species in your area from which to select the species for specialization. Each pair will have a different species.

4. Students gather information including:
- scientific, common, and local names
- life history
- population, population trends, and management practices
- seasonal ranges (gather and/or create maps)
- predators and prey
- habitat adaptation strategies
- field sign and track information
- behavioral information (calls, territory, mating, parenting, etc.)
- local, regional, statewide, global uses of the species
- stories relating to their chosen species

4. Students create oral presentations including computer presentations, hand-on collections (photographs, track castings, scat, etc). *When applicable, the presentations can follow an order that represents a food chain. For example, students presenting lynx will follow students providing presentations on snowshoe hare.*

VARIATION
Require students to take notes from other presentations and test them on the information to enhance listening and note taking skills.

Evaluation:
Students will demonstrate knowledge in each of the concept areas mentioned above relating to the species of their choice.

EXTENSIONS:
A. **Dramatize research for others.** Students write stories about their chosen animal and perform these stories to younger students after practicing and critiquing them for their class. Stories may include traditional myth, personal experience, and information gathered in the above activity.

B. **Archive research for future users.** Students can store computerized presentations on a school library computer, post them to the school web page, or make CD-ROMs for future reference by other students and teachers.

Curriculum Connections:
(See appendix for full citations)

Books:
Alaska Wildlife Notebook Series (ADF&G)

Alaska's Bears (Sherwonit)

Alaska's Birds (Armstrong)

Alaska's Fish (Armstrong)

Alaska's Mammals (Smith)

Encyclopedia of the Animal Kingdom (Kerrod)

Facts on File Wildlife Atlas (Kerrod)

Mammals of Alaska (Alaska Geographic)

Media:
Alaska Wild! Free video clips for multimedia reports.

Websites:
Alaska Biological Science Center
<www.absc.usgs.gov>

Alaska Natural Heritage Program
<www.uaa.alaska.edu/enri/aknhp_web>

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu**>**

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

Animals of the Arctic <tqjunior.thinkquest.org/3500>

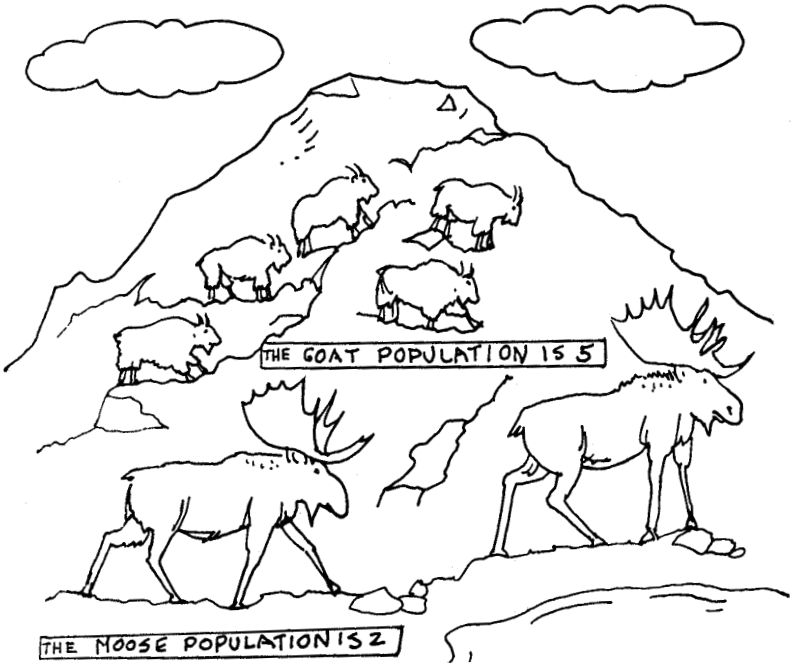
Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Teacher Resources:
(See appendix)

Population Posters

5 EXTENSIONS

ALERT: ALASKA ECOLOGY CARDS OPTIONAL



Section 2
WILDLIFE ACTIVITIES

Grade Level: K - 2

Subjects: Science, art, math

Skills: Cutting, gluing, categorizing, creating sentences, counting

Duration: 1-3 sessions

Group size: 1-5

Setting: Indoors

Vocabulary: Population, species, names of local wildlife

Objective:

1. Students will categorize wildlife into populations.
2. Students will count wildlife populations.

Teaching Strategy:

Students make a mural showing representative populations of five common species living in their area.

Complementary Activities:

"Don't Put All Your Eggs in One Basket" *in this section*.
"Habitat Grid" *in Section* 1.

Materials:

Poster paper, colored construction paper, drawing materials, glue.
OPTIONAL: *Alaska Ecology Cards* or other sources with pictures of animals.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife.*

Procedure:

1. Brainstorm kinds of wildlife **species** common in your area. Write **wildlife** names on a large piece of poster paper.

2. Have students choose five favorite animals.

3. Divide the class into five groups and assign one of the animals to each group.

4. Distribute construction paper to each group (*for example, brown for bears and moose, white for mountain goats*).

5. Have students draw their special animal to create a **population** of their animal. Let students determine the size of their population. For younger students, you may want to provide models of the animals for them to draw and afterward make photocopies to multiply their "populations."

6. Students work in groups on a class mural. Using a large sheet of poster paper, students draw a landscape similar to the local landscape.

7. Students glue their animal populations onto the mural in appropriate places.

8. Hang the finished product (*which represents several animal populations in the local landscape*).

9. Ask the class to count the number of individuals in each animal population on the mural. Tally the results on the chalkboard.

10. Using the mural, discuss the term "population." A wildlife **population** includes all the animals of a single species that live and raise their young in a specific area.

11. Ask the students to describe their population. Write what the students say onto strips of paper. Encourage students to use "population" in their answer. Attach sentence strips like labels to the mural. E*xample*: *You would ask*, "H*ow many bald eagles are in the bald eagle population*?" *and write the answer* "25 *bald eagles are in the bald eagle population*."

VARIATION FOR YOUNGER STUDENTS
Combine this activity with the younger student variation of "Habitat Grid" in Section 1.

Evaluation:

Ask students whether a population could include two or more different kinds of animals (N*o*).

EXTENSIONS:

A. **Add habitat needs to mural.** Refer to the activity "Habitat Grid" in Unit 1. Discuss the habitat needs of the animals on the mural. Students then will include the habitat requirements in their drawings for the mural.

B. **Add plant examples to mural.** Collect plant materials on a field trip or photocopy pictures of local plants and glue them onto the mural.

C. **Spin off into water cycle.** Use construction paper to make ponds, clouds, etc. Discuss and draw the water cycle.

D. **Count animals in photographs.** Students count wildlife from aerial photographs, posters, or magazine photos. Request aerial photographs from Alaska Department of Fish and Game or US Fish and Wildlife Service.

E. **Count human populations.** What is the human population of your classroom, school, community?

Curriculum Connections:

(See appendix for full citations)

Books:

1,2,3, *Moose* (Helman)

Alaska Wildlife Notebook Series (ADF&G)

More Wild Critters (Jones)

Northwest Animal Babies (Helman)

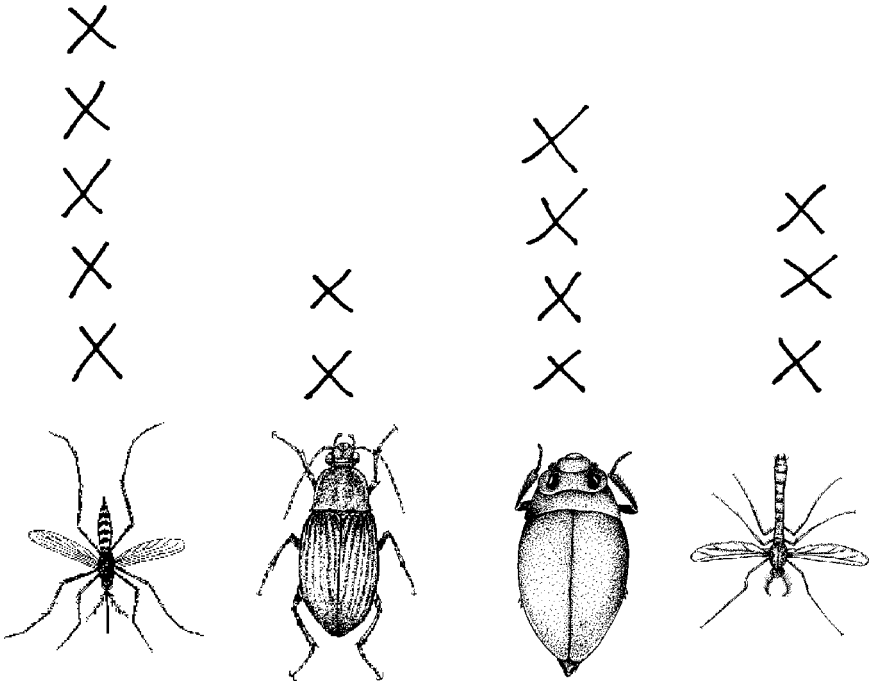
Wild Critters (Jones)

Teacher Resources:

(See appendix)

How Many Animals Live Here?

3 EXTENSIONS



Section 2
WILDLIFE ACTIVITIES

Grade Level: 3 - 8
State Standards: M A-3, M B-1, M B-6
Subjects: Science, math, language arts
Skills: Categorizing, column addition, counting, estimating, measuring, multiplication, sampling
Duration: 2 sessions
Group Size: 4-6
Setting: Indoors or outdoors
Vocabulary: Census, count, estimate, habitat, measure, organism, population, sample

Objectives:

1. Students will count the population of animals in a small area.
2. Students will estimate the size of the population over a larger area.

Teaching Strategy:

Students estimate population sizes by counting animals in sample areas.

Complementary Activities:

"Microdiversity – Under Your Nose!" *in this section*. "Habitat Grid" *in Section* 1 *and* "Habitat Roulette" *in Section* 3.

Materials:

Indoors: Beans, Popsicle sticks, popcorn, or other objects that are easy to see, count, and clean up; measuring sticks; paper and pencils; poster paper.
Outdoors: *for each group* – collecting equipment appropriate for the area you wish to census (bottom scraper for ponds or lakes, net strainer [*old nylon stockings or panty hose are suitable*], collecting trays or containers [*white works best for visibility of organisms*]); four marker sticks at least 1 /2 meter long; clipboard; paper and pencils; poster paper.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife*: "*Microhabitats & Biodiversity*" and "*Ideas for Collection & Field Trip Sites*" *Fact Sheets*.

NOTE: *This activity can be done in the classroom with objects such as beans or popcorn, or outdoors with observations or collections of organisms.*

Procedure:

CLASSROOM ACTIVITY

1. Create a population in the classroom or gymnasium using beans, Popsicle sticks, popcorn, or similar items.

2. Tell the students that they will become wildlife managers today who need to know size of an animal's **population** this year, in order to know if it is increasing, decreasing, or stable.

3. Explain that each group will count the animals in a small area to get an idea of how many might be in the entire area. In other words, students will conduct a **census** in a small area, which is a **sample** of the entire area. Then they will **estimate** the population in the larger area, using the procedure outlined in the Outdoor Activity section below.

OUTDOOR ACTIVITY

IN ADVANCE, select a field trip site (*see the list of potential field trip sites in* INSIGHTS *Section* 2: *"Ideas for Collection & Field Trip Sites" Fact Sheet*).

- Determine the collecting equipment you will need to collect animals. During the winter, it is possible to census the number of animal tracks made by individual animals in an area.

- Mark a half-meter length with a marking pen on one of the four marker sticks for each group.

1. Identify the boundaries of the study site (pond, lake, rock outcrop, meadow, etc.). Ask the students to guess how many animals of different types are in the area. Name several animals they are likely to encounter in a census.

2. Students brainstorm how they could count all of the animals. Animals may be hard to see or find. Counting each one may be very time-consuming and difficult. Help them think about the challenges of being sure they have really caught or counted all the animals.

3. Students should discuss why they would not want to change animal **habitat** (*such as draining the pond to count the fish, digging up an anthill to count the ants*) just to get a count.

4. Divide the class into small groups. Explain that each group will count the animals in a small area to learn how many might be in the entire area. In other words, students will conduct a **census** in a small area, which is a **sample** of the entire area.

5. Give each group paper, pencils, and a clipboard to record their census data. Demonstrate how to use the marker sticks to outline a square sample area. Use the stick with the half-meter mark on it to measure each side of the square. Mention that each team's sample area should be at least a meter away from any other team's sample area.

6. Teams begin their census. If they are working in a pond, stream, or area of soil, students scoop bottom sediment inside the sample area to a depth of approximately 1 inch. They should rake the scoop in straight rows until the entire area is uncovered to a depth of 1 inch. The scooped sediment is emptied into a strainer and rinsed to strain out mud. The leftover scrapings are then placed in observation trays.

7. Students will draw a picture of each type of animal they observe. Students should write the number found next to the picture.

8. Reunite the groups. Give the teams a few minutes to share their discoveries. Ask them whether they would change their guess about how many animals of a certain type lived in the area.

9. F*or older students*: Ask them to guess how many samples would be needed in order to count all of the ____ (*name of an animal*) in the population. Would it be 10 times or 100 times or 1,000 times? To estimate the size of the population, students multiply the number of a species they found (*for example*: 6 *water striders*) by the number of samples they would need to cover the population's area (*for example*: *an area of* 4 *square meters would require* 64 1 /2 *meter square samples*). The population would be 6 x 64, or 384 water striders.

10. Return collected organisms to their habitat.

BACK IN THE CLASSROOM

1. Use poster paper to list the species and census numbers (*see example of a grid in the* "M*icrodiversity" activity in this section, but use the heading* "Our Census").

2. Encourage a discussion. How many species of animals were found? Which species were most numerous? Which were least numerous? Why did each team catch different kinds and numbers of species? (*Some possible explanations are differences in sample*

areas, unevenness of distribution of organisms, differences in counting and scooping techniques).

3. Write **population** on the chart and arrive at a class definition. Emphasize that a population includes only one type of animal or species.

Evaluation:

Have students make and illustrate a "population" book, using their data or numbers in sequence from 1-10 and the names of animals in your area. Each page of their book will have the sentence frame, "This is the population of _____(number) _____(name of animal) in _____(name of habitat)." *For example, "This is the population of* 10 *moose in the forest." Have students draw the population of the animals in their habitat on each page.*

EXTENSIONS:

A. **Research local wildlife populations.** Students will research local wildlife populations. Contact the Alaska Department of Fish and Game office in your area for population data on a species of interest to students. Invite wildlife biologists, local experts, or long-term residents and Native elders into the classroom to share their knowledge. They may be willing to lead or assist on a field trip.

B. **Census things in schoolyard.** Students brainstorm ways to census or estimate highly visible organisms in the schoolyard (types of plants, insects, spiders, animals that leave tracks, birds that come to a feeder, etc.). As you discuss these, be sure to emphasize the difference between a census and an estimate (see background information).

C. **Compare in another season.** Students can conduct the activity during a different seasons of the year. They should compare census numbers and estimated populations and try to explain the differences.

Credits:

Adapted from "How Many Organisms Live Here?" OBIS, Lawrence Hall of Science, University of California, Berkeley, CA. Distributed by Delta Education, Inc., Box M, Nashua, NH 03061-6012.

Curriculum Connections:

(See appendix for full citations)

Books:

One Small Square: Arctic Tundra (Silver)

One Small Square: Backyard (Silver)

One Small Square: Pond (Silver)

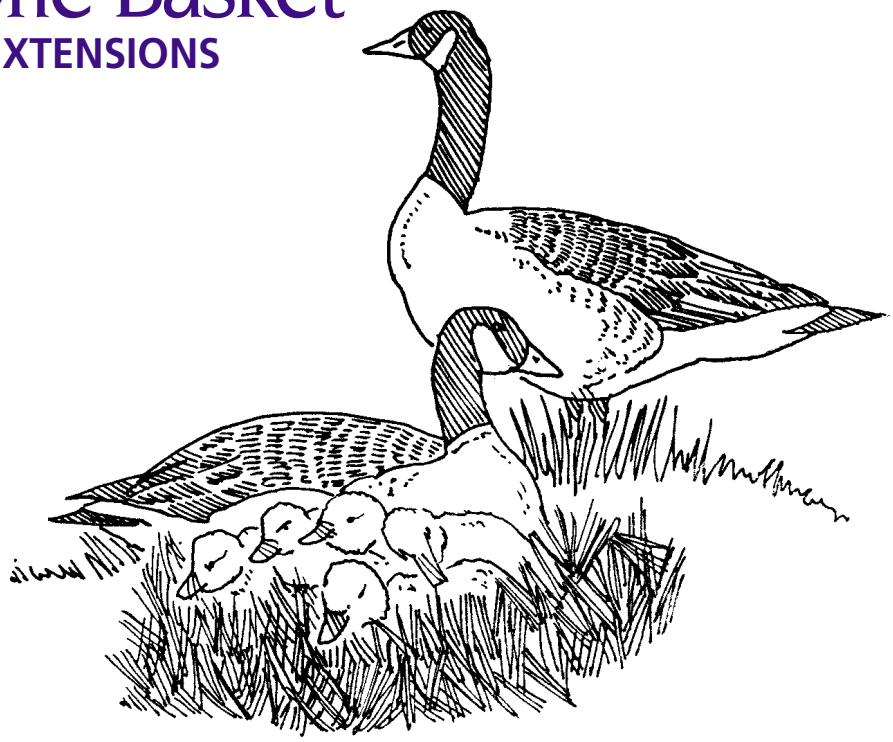
One Small Square: Woods (Silver)

Teacher Resources:

(See appendix)

Don't Put All Your Eggs in One Basket

3 EXTENSIONS



Section 2
WILDLIFE ACTIVITIES

Grade Level: K - 4

State Standards: M B-4

Subjects: Science, math, art, language arts

Skills: Counting, comparing, predicting, drawing conclusions

Duration: Two 30-minute sessions

Group Size: Individual

Setting: Indoors

Vocabulary: Clutch, declining population, extinct, population, production

Objectives:

1. Students will learn that animal populations grow through births.

2. Students will observe the relationship between the size of a population and the number of young that are born each year.

Teaching Strategy:
Students simulate a population of nesting geese and analyze the results of the simulation.

Complementary Activities:
"Population Posters" *in this section*. "Habitat Grid" *and* "Habitat Boxes" *in Section* 1 *and* "Musical Habitats" *in Section* 3.

Materials:

Paper cups (1 *per student*), photocopies of Goose Pair Silhouettes, dry grass, cotton batting, beans, poster paper, glue or tape.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife.*

NOTE: The following activity can be adapted for overpopulation. For population information regarding geese in your area, contact Alaska Department of Fish and Game or the U.S. Fish and Wildlife Service.

Procedure:

1. Give a paper cup to each student. Place the grass, cotton batting, and beans in a central location. Tell the students that they will each be making a goose nest by gluing the grass and batting in the cup.

2. After the students have made the nests, give each student the goose illustrations and have them cut out pairs of geese.

3. Tell the students that each pair of geese will produce five eggs each year. Students collect five beans each and place them in their nests.

4. Create a large graph on the poster paper with two columns. Label the left-hand column "Pairs of Geese" and the right-hand column "Number of Eggs" (*see illustration*). Explain that a goose population will have a certain number of pairs. (*See the activity "Population Posters" in this unit if you have not introduced the term "population" to your class.*)

5. Begin filling in the chart. Start with "one pair of geese." Ask a student to bring a goose pair silhouette for the chart. The geese can be taped or glued to your chart. Move to "two pairs of geese." Again ask students to bring the pairs. Continue until the population has 20 pairs.

6. Explain to the students that the number of eggs laid by each pair varies. For the purpose of this activity, however, each goose pair will lay five eggs. Begin with "one pair of geese" and draw a nest (circle) and fill it with five eggs. Ask the class to count the number of eggs in the egg column and write down that number. Continue this process for the increasing number of pairs (*Older students can do this by multiplication.*)

7. Compare the number of eggs laid by the largest population with those of smaller populations. Encourage students to think of things that could happen to geese so there would be fewer geese in a population (*they could be eaten by predators, harvested by hunters, die from accidents, or starve to death because there was too little food*).

8. Which population would recover quickest if each population lost 10 geese? (*The smallest population would become extinct; other small populations would take a long time to recover because there would be fewer eggs each year compared to the larger populations. The largest population would recover the quickest.*)

9. Explain that people are concerned about very small populations of wildlife because they may be in danger of extinction.

Evaluation:

Students choose a species and create a skit. The skit should depict the growth of the population through births.

Pairs of Geese	Number of Eggs
1 Pair of Geese	5 Eggs
2 Pair of Geese	10 Eggs
3 Pair of Geese	15 Eggs
4 Pair of Geese	20 Eggs

EXTENSIONS:

A. **Use urban goose example.** Conduct the same activity, using the Anchorage goose population. Discuss wildlife management concerns (*car and plane accidents, contamination of the watershed, etc.*). Contact the U.S. Fish and Wildlife Service or Alaska Department of Fish and Game office in Anchorage (or nearest you) for goose population data. Use the information to estimate what future populations will be, based on historic and current growth and decline. *Timely information is available on the website* <www.r7.fws.gov>

B. **Write or draw accompanying story.** On poster paper, the students as a class will write a story about what they learned. Place the story next to the graph. Younger students can draw their story or dictate as you write.

C. **Enhance the math problems.** The activity assumed that all female geese laid the same number of eggs. Explain to the students that female geese do not always lay the same number of eggs. Each student should choose the number of beans to place in their nest. The number should be between 3 and 7. Hide the nests around the room or on the school grounds and then have the students conduct a nest search and count the total number of eggs. Older students can calculate the average **clutch** size (*number of eggs per nest*) by adding the numbers in each nest and dividing the total by the number of nests.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

Alaska's Birds (Armstrong)

Watching Water Birds (Arnosky)

Websites:

Alaska Science Forum <www.gi.alaska.edu/ScienceForum> Article of particular interest: *Urban Geese Choose Summer in the City.*

Anchorage Canada Goose Project. Alaska Biological Science Center <www.absc.usgs.gov> (link Waterfowl)

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

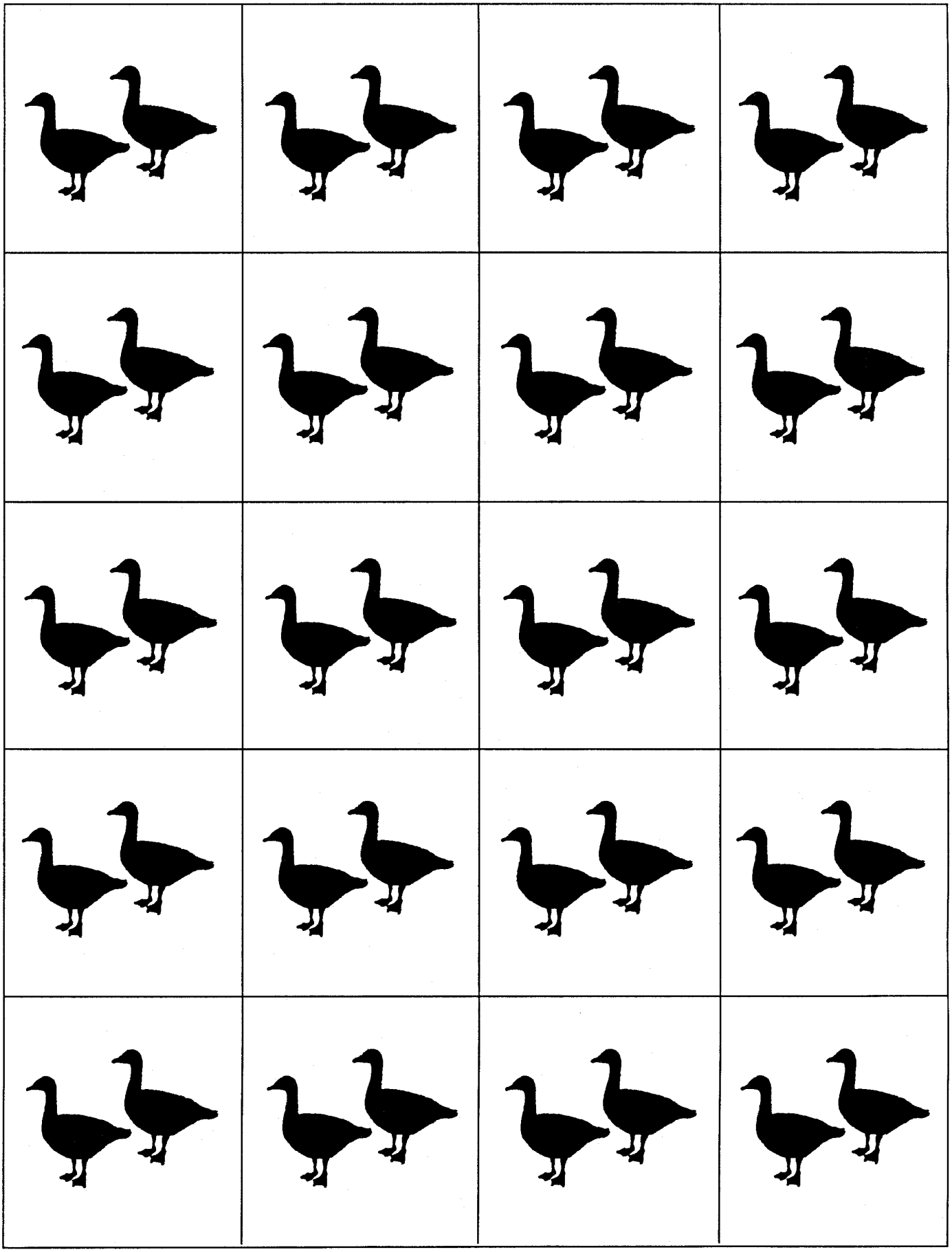
Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Urban Geese in Anchorage <www.r7.fws.gov/mbm/ancgeese> Current goose activity and goose management

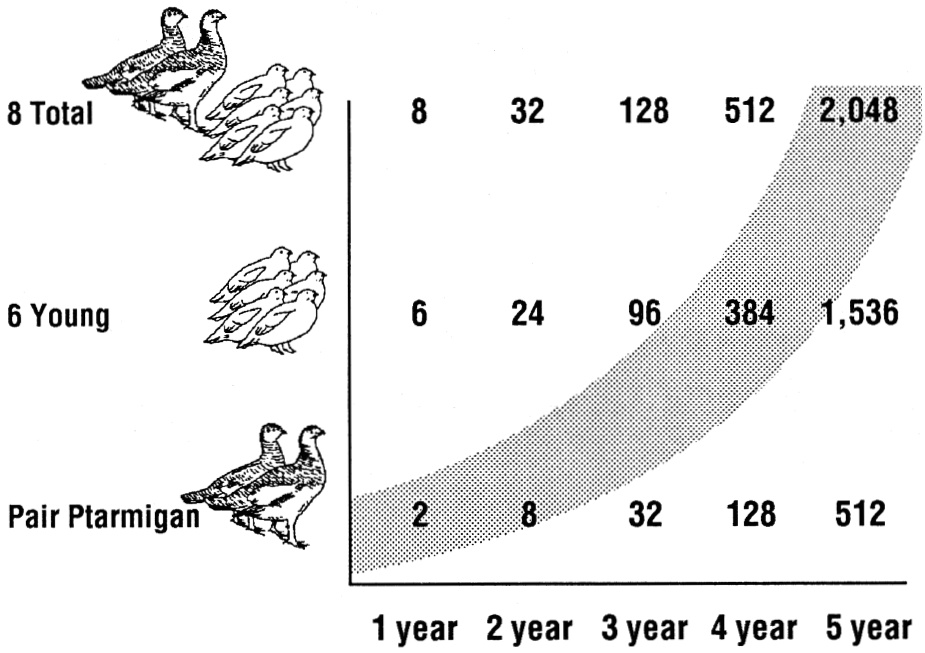
Teacher Resources:

(See appendix)

Goose Pair Silhouettes



Population Explosions
2 EXTENSIONS



Section 2
WILDLIFE ACTIVITIES

Grade level: 6 - 8

State Standards: M A-3, M A-4, M A-6

Subjects: Math, science

Skills: Addition, calculation, division, graphing, multiplication

Duration: 1 period

Group size: 1-3

Setting: Indoors

Vocabulary: Axis, exponential, graphs, linear, potential, reproductive rates, rate of population increase

Objectives:
1. Students will describe the potential for exponential growth in populations.

2. Students will list two factors that determine the rate of population growth.

Teaching Strategy:
Students discover the concept of exponential growth while calculating population sizes.

Complementary Activities:
"Graphic Populations" *and* "How Many Bears Can Live in this Forest?" *in this section*. "Gone Forever" *in Section* 3.

Materials:
F*or each student*: graph paper, pencils, copies of "Population Explosion Problems Worksheet" and "Population Explosion Discussion Worksheet" (*following*).
OPTIONAL: calculators.

Background:
See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife*: "*Population Explosions*" and "*Carrying Capacity*" *Fact Sheets*.

NOTE: In this activity your students assume that no deaths occur so that they can witness the implications of exponential growth. Other activities in this section illustrate the factors which slow or limit growth and stabilize or cause declines in populations.

Procedure:
1. Hand out the "Population Explosion Problems Worksheets." Students can work individually or in groups with calculators.

2. Ask students to discover what would happen to the two wildlife populations if animals continued to be born, but no animals died.

3. Students calculate the number of animals in each population for several years (assuming that no animals die and half of the young born in each generation are females) and graph their results.

4. Write the following equations on the board:

Reproductive rate =
Number of young produced/female/year

Rate of population increase =
Number of animals in the population in Year X

Number of animals in the population in Year X- I

5. Students use these equations to determine and compare the reproductive rates and rates of population increase for each animal.
For example, a female vole produces six young three times a year, so the reproductive rate is 18 young/ female/ year. In Year 2, the rate of increase of the vole population will be 8,194 voles (number of voles at the end of Year 2) divided by 128 (number of voles after Year 1) for a 6,400 percent rate of increase.

6. Follow-up Discussion: The student groups should complete the "Population Explosion Discussion Questions" worksheet to prepare for a class discussion.

7. The class reviews the answers to the worksheets together.

Evaluation:

1. Describe the shape of the curve on a graph that showed the potential growth of a wolf population (or of another species). (*All students should draw the "J-shaped" curve associated with exponential growth.*)

2. Describe three factors that affect the rate of population growth. (*Number of young born each year, how often female gives birth, age of female when she first gives birth.*)

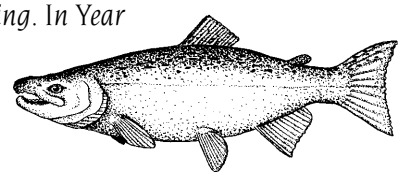
EXTENSIONS:

A. **Research human population trends.** Students research human population growth and trends. Predict what will happen to the population in their community, in Alaska, the United States, the world. Create mathematical equations using the human population. Discuss how our growth affects wildlife.

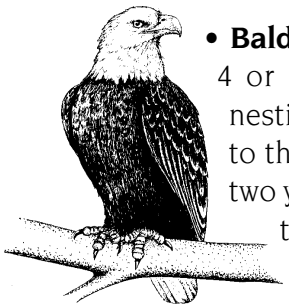
B. **Calculate and graph salmon, eagle, whale populations.** Students calculate the number of animals in the following populations (*answers are given in italics*). Graph the growth for each population. Be sure to label each graph. Compare the growth rate of these populations with the vole and ptarmigan populations.

• A female **silver salmon** can lay 2,400 - 4,500 eggs once in her lifetime. Silver salmon only lay eggs when they are 4 years old and die soon after they spawn. Assuming all eggs survive to adulthood, each female salmon laid 3,000 eggs, and half of the eggs are female, how many salmon would there be after 2, 3, 4, or 5 years if there was 1 pair in Year 1?

(*Because silver salmon don't spawn until they are 4 years old, there will be 3,000 salmon in Years 1,2 and 3. During Year 4, 1,500 females will produce 3,000 eggs each for a total of 4,500,000 eggs. The total salmon in Year 4 would be 4,500,000 since the original breeding adults die almost immediately after spawning. In Year five the total population of silver salmon is* 4,500,000.)



Note: The next two problems are more difficult because of the lag time before animals begin reproducing. You may want to work them out as a class, following each generation and its reproduction through several years or give them as extra-credit problems. The "Tables for Eagle and Whale Populations" (*following*) will help students keep track of the populations.



• **Bald eagles** first nest when they are 4 or 5 years old. Once they begin nesting, a pair of adults can raise up to three chicks each year, but one or two young is more common. Assume that eagles pair up and nest when they are 5 years old, after which they nest every year. Each pair of nesting birds produces two healthy eaglets. Starting with one pair of eagles which breed in Year 1, how many eagles would there be after 2, 4, 8, 12 years? Remember that only half of the young will be female.

(*The eagle population will be 6 at the end of Year 2, 10 at the end of Year 4, 30 after Year 8, and 90 after Year 12.*)

• **Humpback** whales can raise only one calf every two years. Young whales don't breed until they are 6 -12 years old. Assume they begin breeding when they are 9 years old. One pair of whales breeds in Year 1 and produces a female calf. Assuming only half the calves are females, how many whales would there be at the end of Year 2? Year 4 ? Years 6? Year 12? D*on't forget the lag time between birth and breeding - and that only females give birth to calves*. The first calf will be ready to breed in 9 years, however, it will have to wait for a second calf of the opposite sex, before it can breed**.**

(*The whale population will be* 3 *after Year* 2, 4 *after Year* 4, 6 *after Year* 8, 9 *after Year* 12. I*t would take* 12 *years to produce two calves old enough to breed; one would be* 9 *years old at the end of Year* 9 *and the second would be* 9 *years old at the end of Year* 11.)

Credits:

Adapted from *Alaska Wildlife Week: Wildlife for the Future*, Alaska Department of Fish and Game, Anchorage, AK, 1985; and *Teach About Geese*. US Fish and Wildlife Service, Anchorage, AK, 1988.

Curriculum Connections:

(See appendix for full citations)

The Bald Eagle Returns (Patent)

Biodiversity (Patent)

Come Back Salmon (Cone)

Endangered Animals: 140 *Species in Full Color* (Kest)

Websites:

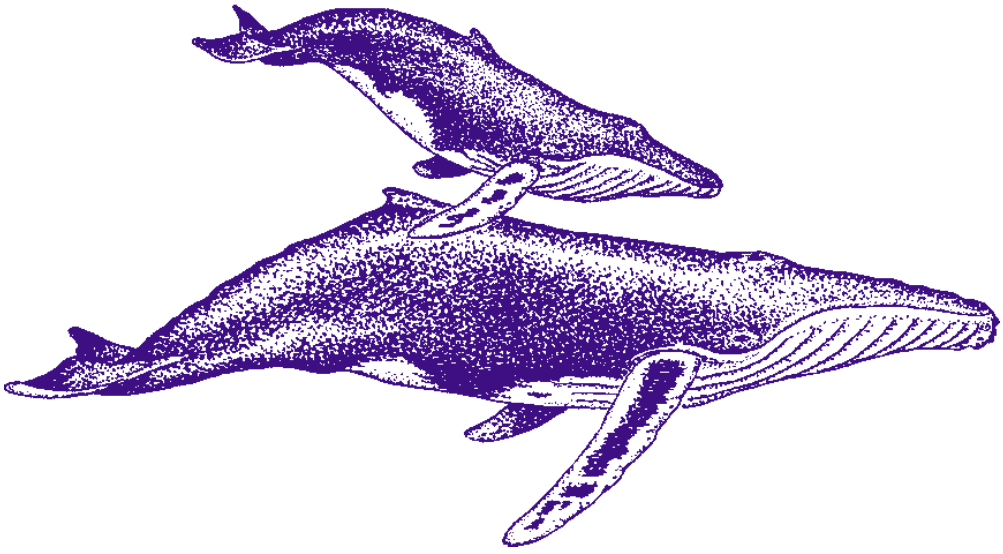
Alaska Science Forum <www.gi.alaska.edu/ScienceForum> Articles of particular interest: *Double Trouble* #838 and I*nnumerable Whales* #1178 and numerous articles on salmon populations.

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

World Population Awareness
<www.overpopulation.org>

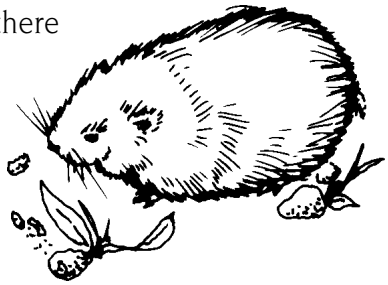
Teacher Resources:

(See appendix)



Population Explosion Problems Worksheet

1. What would happen to a population of **red-backed voles**? In Year 1, there are 2 voles, a male and female. Each female can produce 5-9 young each time she bears a litter and she can bear young 3-4 times each year. Young voles can breed at 3 weeks of age (so they are ready for the next breeding in this exercise). How many voles will there be at the end of year 1, 2, 3, 4 and 5? **(Assuming no voles died, each female had 6 young in each litter, and each vole alive at the beginning of the summer bred 3 times.)**



YEAR 1:

lst breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6= _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults)
_____ adults produced _____ young, total of _____

2nd breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6 = _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults)
_____ adults produced _____ young, total of _____

3rd breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6 = _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults)

YEAR 2:

lst breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6 = _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults)

2nd breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6 = _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults)

3rd breeding

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 6 = _____ (number of young)
_____ (number of young) + _____ (number of adults) = _____ (total adults at end of year 2)

(repeat for Years 3, 4 and 5)

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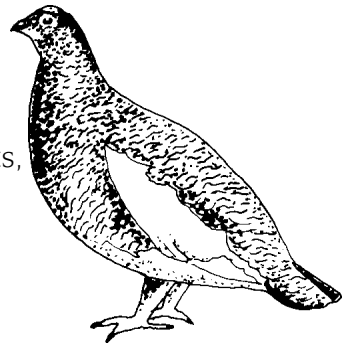
Population Explosion Problems Worksheet

VOLESCONTINUED

Year 3 - total adults at end of:
1st breeding _____ 2nd Breeding _____ 3rd breeding _____
Year 4 - total adults at end of:
1st breeding _____ 2nd Breeding _____ 3rd breeding _____
Year 5 - total adults at end of:
1st breeding _____ 2nd Breeding _____ 3rd breeding _____



2. What happens to this ptarmigan population? In Year 1 there are 2 adults, 1 male and 1 female. Ptarmigan can begin nesting when 1 year old, and each female lays 8 eggs. How many ptarmigan will there be at the end of Year 1_____, Year 2_____, Year 3_____, Year 4_____, Year 5_____?

YEAR 1:

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 8 = _____ (number of young)
_____ (number of young) + 2 (number of adults) = _____ (total adults)

YEAR 2:

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 8 = _____ (number of young)
_____ (number of young) + 2 (number of adults) = _____ (total adults)

YEAR 3:

_____ (number of adults) ÷ 2 = _____ (number of females)
_____ (number of females) x 8 = _____ (number of young)
_____ (number of young) + 2 (number of adults) = _____ (total adults)

(repeat for Years 4 and 5)
Option: how many ptarmigan will there be after year 10?

B. Graph the growth for each population. Be sure to label each graph.

How are the graphs similar?

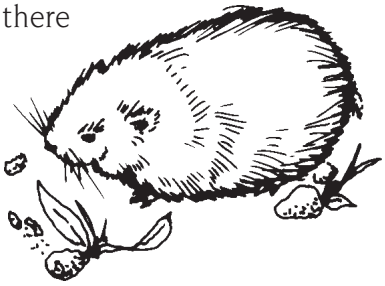
How are the graphs different?

Why are they different?

What factors determine the reproductive rate of a species?

Population Explosion Answers

1. What would happen to a population of r**ed-backed voles**? In Year 1, there are 2 voles, a male and female. Each female can produce 5-9 young each time she bears a litter and she can bear young 3-4 times each year. Young voles can breed at 3 weeks of age (so they are ready for the next breeding in this exercise). How many voles will there be at the end of year 1, 2, 3, 4 and 5? **(Assuming no voles died, each female had 6 young in each litter, and each vole alive at the beginning of the summer bred 3 times.)**



YEAR 1:

lst breeding

2 (number of adults) ÷ 2 = **1** (number of females)
1 (number of females) x 6 = **6** (number of young)
6 (number of young) + **2** (number of adults) = **8** (total adults)
2 adults produced **6** young, total of **8**

2nd breeding

8 (number of adults) ÷ 2 = **4** (number of females)
4 (number of females) x 6 = **24** (number of young)
24 (number of young) + **8** (number of adults) = **32** (total adults)
8 adults produced **24** young, total of **32**

3rd breeding

32 (number of adults) ÷ 2 = **16** (number of females)
16 (number of females) x 6 = **96** (number of young)
96 (number of young) + **32** (number of adults) = **128** (total adults)

YEAR 2:

lst breeding

128 (number of adults) ÷ 2 = **64** (number of females)
64 (number of females) x 6 = **384** (number of young)
384 (number of young) + **128** (number of adults) = **512** (total adults)

2nd breeding

512 (number of adults) ÷ 2 = **256** (number of females)
256 (number of females) x 6 = **1,536** (number of young)
1,536 (number of young) + **512** (number of adults) = **2,048** (total adults)

3rd breeding

2,048 (number of adults) ÷ 2 = **1,024** (number of females)
1,024 (number of females) x 6 = **6,144** (number of young)
6,144 (number of young) + **2,048** (number of adults) = **8,192** (total adults at end of year 2)

(*repeat for* Years 3, 4 *and* 5)

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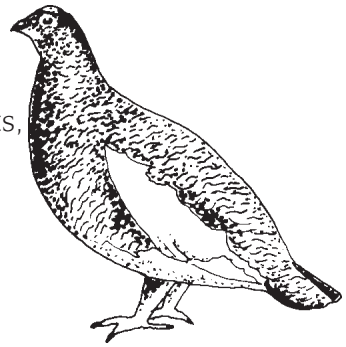
Population Explosion Answers

VOLES CONTINUED

Year 3 - total adults at end of:
1st breeding **32,778** 2nd Breeding **131,072** 3rd breeding **524,288**
Year 4 - total adults at end of:
1st breeding **2,097,152** 2nd Breeding **8,388,608** 3rd breeding **33,554,432**
Year 5 - total adults at end of:
1st breeding **134,217,728** 2nd Breeding **536,897,912** 3rd breeding **2,147,483,648**



2. What happens to this ptarmigan population? In Year 1 there are 2 adults, 1 male and 1 female. Ptarmigan can begin nesting when 1 year old, and each female lays 8 eggs. How many ptarmigan will there be at the end of Year 1 **10**, Year 2 **50**, Year 3 **250**, Year 4 **1,250**, Year 5 **6,250**?

YEAR 1:

2 (number of adults) ÷ 2 = **1** (number of females)
1 (number of females) x 8 = **8** (number of young)
8 (number of young) + 2 (number of adults) = **10** (total adults)

YEAR 2:

10 (number of adults) ÷ 2 = **5** (number of females)
5 (number of females) x 8 = **40** (number of young)
40 (number of young) + **10** (number of adults) = **50** (total adults)

YEAR 3:

50 (number of adults) ÷ 2 = **5** (number of females)
25 (number of females) x 8 = **200** (number of young)
200 (number of young) + **50** (number of adults) = **250** (total adults)

(repeat for Years 4 and 5)
Option: how many ptarmigan will there be after year 10? **19,531,250**

B. Graph the growth for each population. Be sure to label each graph.
How are the graphs similar? **(Both show exponential growth.)**

How are the graphs different? **(The voles increase more rapidly than the ptarmigan.)**

Why are they different? **(The voles breed three times each year.)**

What factors determine the reproductive rate of a species? **(Number of breeding females, how often they breed each year, number of young born each time a female gives birth, the age at which a female first gives birth. Mortality (deaths) also determines the number of animals added in each generation)**

Population Explosion Discussion Questions

1. Compare the graphs and the annual rates of increase in each population. Describe the differences in the shape of the curves on the graphs. How does the rate of increase affect the shape of the curve?

2. What were the factors that affected the rate of population increase?

3. The results in the graphs assume that no animals died in any of the populations. How would you expect animal deaths to change the graphs?

4. If a catastrophe killed 90% of both the vole and ptarmigan populations, which population would recover more quickly? Why?

Population Explosion Discussion Answers

1. Compare the graphs and the annual rates of increase in each population. Describe the differences in the shape of the curves on the graphs. How does the rate of increase affect the shape of the curve?

(T*he curve is J-shaped for each animal, but the curve takes longer to appear when the rate of increase is lower.*)

2. What were the factors that affected the rate of population increase?

(1) *number of young animals produced by each female*, (2) *how often the females had young*, (3) *the age at which the females began producing young, and* (4) *the population size.*

3. The results in the graphs assume that no animals died in any of the populations. How would you expect animal deaths to change the graphs?

(I*t depends on the rate at which animals die in relation to the rate at which they are born.* I*f more animals die than are added to the population each year, the curve will turn downward; if more are added than die, the curve will be upward, but not as steeply because the curve in the exercise assumes no deaths.*)

4. If a catastrophe killed 90% of both the vole and ptarmigan populations, which population would recover more quickly? Why?

(T*he vole population would recover more quickly because the rate of increase for voles is greater than the rate of increase for ptarmigan.* V*oles produce more young each year and begin reproducing at an earlier age.*)

Table for Eagle and Whale Populations

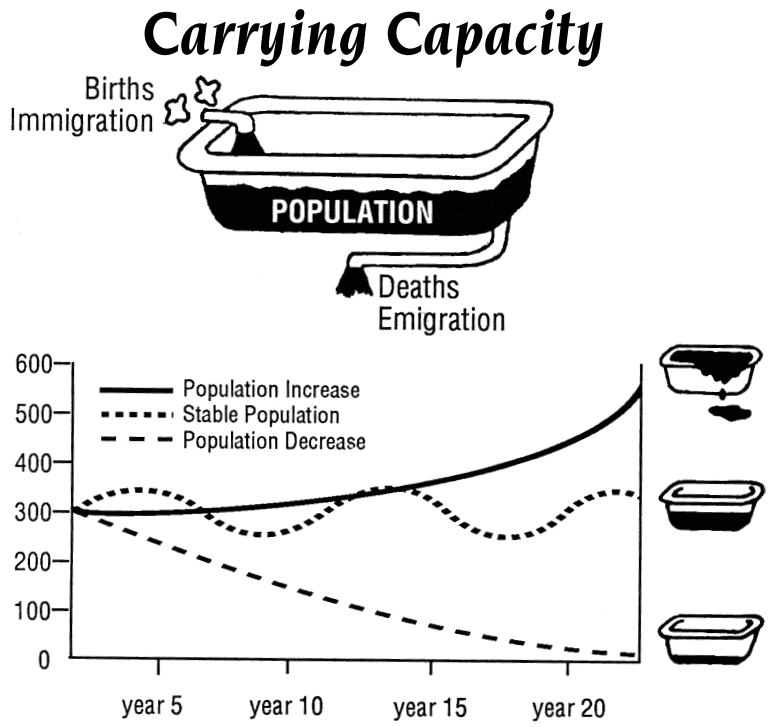
Eagle Table

Year	# of Adults - Female	# of Adults - Male	# of Juveniles					Total Population
			Year 1	Year 2	Year 3	Year 4	Year 5	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Whale Table

Year	# of Adults - Female	# of Adults - Male	# of Juveniles								Total Pop.
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	
1											
2											
4											
6											
8											
10											
12											

Graphic Populations
7 EXTENSIONS



Section 2
WILDLIFE ACTIVITIES

Grade level: 6 - 8

State Standards: M A-4

Subjects: Science, math, language arts

Skills: Analysis, communication, graphing, inference, prediction, reading, synthesis

Duration: 2-3 periods

Group size: 4-8

Setting: Indoors

Vocabulary: Conservation, extinction, graph, population decline, population recovery, stable population

Objectives:

1. Students will compare population trends.

2. Students will determine factors that may cause population declines or increases.

3. Students will discover ways that human actions have contributed to or reversed population declines.

Teaching Strategy:

Students compare graphs for several wildlife populations.

Complementary Activities:
"Population Explosions" *and* "How Many Bears Can Live in this Forest?" *in this section*. "Science, Technology, Society, and Wildlife" *and* "Exploring Wildlife Issues" *in Section* 4.

Materials:

Copies from INSIGHTS Section 2 of *Steller Sea Lion, Northern Pintail, California Condor, and Western Arctic Caribou Herd* — "Wildlife Facts." "What Happened," and "Population Graphs." Graph paper.

OPTIONAL: computer graphing program, overhead projector, overhead graph paper.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife*. Also INSIGHTS *Section* 3, *When Populations Decline* and INSIGHTS *Section* 4, *Wildlife Conservation is Up to* Us!

Procedure:

1. Draw a hypothetical **population** graph on the board or on overhead graph paper to show how a population can grow, stabilize, and **decline**. Discuss the relationship of births and deaths in a population that is growing, **stable**, or declining.

2. Brainstorm the causes of wildlife declines (*see* INSIGHTS *Section 3 for more information*). Categorize the causes of declines under two separate headings, "human-related factors" and "other environmental factors."

3. Use jigsaw grouping (*see description included with this activity*). Divide the class into the lettered groups and

pass out the "Wildlife Population" Fact Sheets (*from* INSIGHTS *Section* 2). Pass out graph paper if you want the groups to graph the data. If not, pass out the corresponding "Population Graphs" at the same time.

4. Encourage students to read the fact sheets, extract the data, and make graphs.

5. Review the graphs to determine the trend of the population (*increasing, declining, or stable*).

6. Students should discuss what factors might have caused the trends in their population. **If a population is declining**, students may predict when their wildlife population would drop to zero (***extinction*** *would occur*) assuming that all factors causing the decline continue.

7. Discuss how human effort through **conservation** management can change a downward trend. *The Cackling Canada goose of the Yukon-Kuskokwim Delta is an example of effective conservation management in Alaska <www.r7.fws.gov>*

8. **If the population is increasing**, discuss how many animals in a population may be too many for the **habitat** to support – if the animals exceed the **carrying capacity** of the habitat.

9. Ask students to predict what will happen if the population grows too large. Discuss how human effort through hunting and other conservation management can contain this population explosion. *The Canada goose population in the Anchorage Bowl is an example <www.r7.fws.gov>*

10. Distribute the "What Happened?" handouts that match each group's wildlife population fact sheet. Ask the groups to make a list of the factors that affected the population trends for their animals. Each student will need a copy of the group's results.

7. After letter groups complete their work, students meet in numbered groups to share the graphs and lists from the lettered groups. Discuss the questions asked about what scientists need to know.

(For example, answers to Sea Lion Population questions: Scientists would need to know whether the populations being counted represented the entire species or if other populations still survived after some populations dropped to zero. They would also need to know the life history, where young are born and raised, and any migratory movements.)

8. For each graph, make a list of human actions that contributed to population declines and a list of human actions that helped reverse population declines. If the population has increased, list what human actions have contributed to the increase and determine if the increase is healthy or cause for concern.

Evaluation:

1. Ask students the relationship between the number of births and the number of deaths in a population at the following points on a population graph:
   (a) Upward graph (*number of births exceeds the number of deaths*)
   (b) Straight line graph (*number of births equals the number of deaths*)
   (c) Downward graph (*number of deaths exceeds the number of births*)

2. Students research wildlife management success stories in Alaska (*Aleutian Canada geese, sea otters, mallards, bowhead whales, muskox, trumpeter swans, or arctic nesting geese*) or elsewhere in the world. List the ways population declines were reversed.

3. Each group presents a skit or play of what they have learned. Perform for the class and end with at least three recommendations how humans can help declining species.

EXTENSIONS:

A. **Computer graphing.** Use a computer program that generates graphs based on population data or present graphs and conclusions to another class through a computer network.

B. **Research and write about other populations.** Research and develop population story examples and "What Happened?" sheets for other Alaskan animals.

Chose a variety of animals that are: (a) healthy, (b) threatened or endangered animals and (c) rapidly increasing.

C. **Discuss wildlife news stories.** Students bring in and discuss news articles on animal populations and how they are changing.

D. **Guest wildlife manager.** Invite wildlife managers to the classroom to discuss population graphs. If the biologist is unable to come to class, ask for sample population graphs of animals in your area, or animals of particular interest to your students.

E. **Guest Native elder.** Invite knowledgeable long-term residents and Native elders to describe changes in local wildlife populations that they have observed over their lifetime. Discuss possible human influences on the changes in local populations.

F. **Graph other animal populations.** Obtain scientific data about local animal populations. Graph the data to see if they are declining, increasing, or stable. Predict what action wildlife managers might take after getting the data.

G. **Peregrine falcon case study.** Study the "Population Graph" of American peregrine falcons from the Upper Yukon River (*in* INSIGHTS *Section* 2). In the late 1960s, populations of the American peregrine falcon populations had declined throughout the United States and the bird was recommended for listing on the federal Endangered Species List.

- *Raptor Kit*. Available on loan from ADF&G in Fairbanks and Douglas or ARLIS in Anchorage. Other Raptor kits are being developed by the Pratt Museum and the Alaska Raptor Rehabilitation Center. For further information check *Guide to Educational Science Kits in Alaska* <www.col-ed.org/ak/kitwebpage.html>

- Between 1968 and 1977, the number of pairs of peregrines that nested each year in the upper Yukon River changed very little. Female falcons were laying the same number of eggs that they did before the population declined. Why didn't the population grow? (*All young birds were not surviving and being added to the population.*) What was the trend of the population after 1977? (*rapid increase*).

- To develop scientific questioning skills, ask students to think of reasons why the peregrine population may have increased.

- (*Scientists learned that the cause of death of young birds was thin eggshells. When the adults sat on the eggs, the eggs were crushed and didn't hatch. Scientists later learned that pesticides such as* DDT *caused the thinning of eggshells. Adult birds ingested* DDT *when they ate smaller birds that had fed on crops sprayed with* DDT.

  In 1972, the United States banned the use of DDT and similar pesticides. It took time for the population to recover, however, because the pesticide is slow to break down in the environment to the point where it is no longer toxic to peregrines and other birds.)

- (*To demonstrate the effect of accumulating toxic substances at the top of a food chain, do the* Project WILD *activity "Deadly Links." See Teacher Resources.*)

Curriculum Connections:

(See appendix for full citations)

Books:

California Condor (Silverstein)

Endangered Animals: 140 Species in Full Color (Kest)

The Peregrine Falcon – Endangered No More (Priebe)

Media:

Steller Sea Lions (Video) (ADF&G)

Websites:

Alaska Biological Science Center <www.absc.usgs.gov>

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

California Condor <www.dfg.ca.gov/hcpb/condor.html> (California Department of Fish and Game, Habitat Conservation Planning Branch)

Ducks Unlimited <www.ducks.org> For information on the Pintail Duck.

Endangered Species <endangered.fws.gov> (US Fish and Wildlife Service)

Steller Sea Lions <www.fakr.noaa.gov/protectedresources/stellers.htm> (National Marine Fisheries Service)

Tundra Peregrine Falcons in the North Yukon <www.taiga.net/coop/indics/peregrin.html>

US Fish and Wildlife Service Alaska region <www.r7.fws.gov>.

US Fish and Wildlife Service Alaska region, Arctic National Wildlife Refuge <www.r7.fws.gov/nwr/arctic> For information on the Western Arctic Caribou herd.

Wildcam: Steller Sea Lion, Chiswell Island <www.nationalgeographic.com/stellercam> Live video camera on Chiswell Island, Alaska.

Teacher Resources:

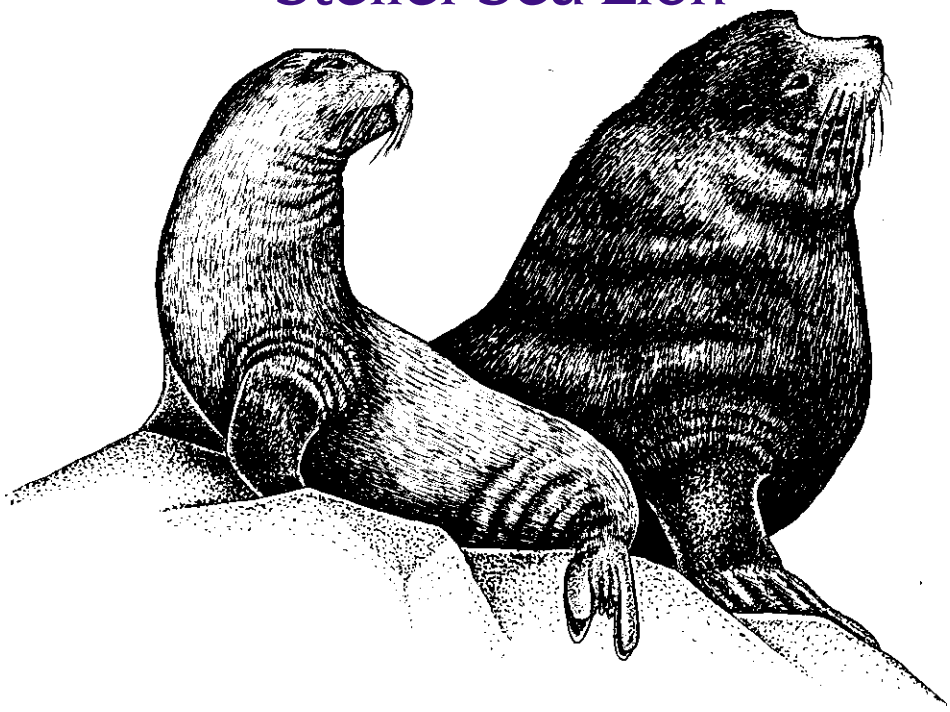
(See appendix)

Jigsaw groupings

Each student meets with 2 groups: **first**, with other students assigned the same **letter** to gather information; second, with other students assigned the same **number** to share the information.

Class Size	*W-group*	*X-group*	*Y-group*	*Z-group*	
	W-1	X-1	Y-1	Z-1	Ones
	W-2	X-2	Y-2	Z-2	Twos
	W-3	X-3	Y-3	Z-3	Threes
16 students	W-4	X-4	Y-4	Z-4	Fours
20 students	W-5	X-5	Y-5	Z-5	Fives
24 students	W-6	X-6	Y-6	Z-6	Sixes
28 students	W-7	X-7	Y-7	Z-7	Sevens
32 students	W-8	X-8	Y-8	Z-8	Eights

Steller Sea Lion



Steller sea lions are marine mammals that live in Alaska's coastal waters from Southeast to the Bering Strait. In 1958, scientists counted 140,000 sea lions in the area between the western Aleutian Islands and the Kenai Peninsula. In just over 30 years, the population fell to 27,754!

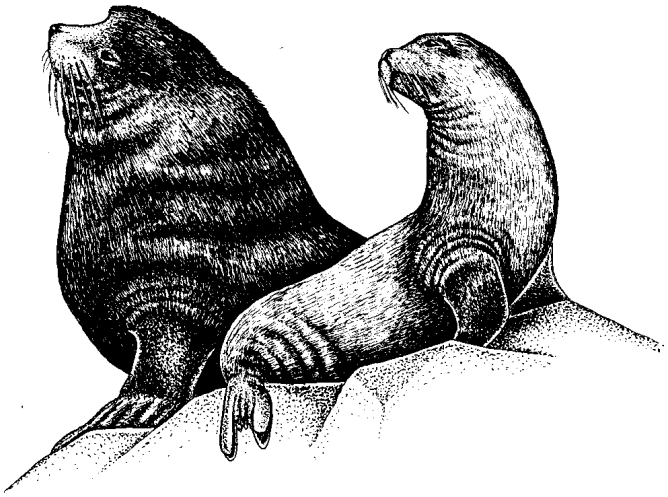
WHERE TO CENSUS? Sea lions are difficult to count accurately much of the year because they spend so much time in and under water and scatter widely. In spring and summer, however, the sea lions gather on **rookery** beaches and rocks where they rest, mate, and raise pups. Non-breeding sea lions gather on nearby **haulouts**.

FLYING RESEARCHERS. Scientists count the sea lion population by flying over the haulouts and rookeries in June when the pups are born. The scientists fly along the coast and count each haulout area separately. While they never see all of the sea lions because some are in the water, scientists can check the population **trend** from the number of sea lions they see. When the groups are too large to count quickly, scientists take photographs and count the animals later using the photos.

DOWNWARD SLIDE. Let's look at the curent population trends of Stellar sea lions in the same area that originally had 140,000. In 1990, the population was 22,754. In 1991, it was 21,737 and for 1992 it fell to 20,629. Studies were then set at two year intervals. In 1994, the population was down to 18,713 and in 1996 there were 17,900 Steller sea lions in that area. In 1998, the population count was 16,315 and in 2000, it was 15,228.

Graph challenge: Graph the population trend. *What percentage of the population have we lost between* 1958 *and* 2000? *When would this population of sea lions drop to zero if the trend continued*? *What questions do biologists need to answer to help the population return to safer levels.*

What Happened? Steller Sea Lion



Since 1958, about 90% of the Steller sea lion population from Kiska to the Kenai Penninsula has disappeared. The population is continuing to decline. Biologists do not know the *precise* cause of decline, but believe food is a factor.

Alaska Natives traditionally hunted sea lions for subsistence (food, clothing, boat coverings, art, tools, etc.). A subsistence harvest continues under provisions of the Marine Mammal Protection Act. Subsistence harvests are not considered to be a major factor in the population decline. Sea lion pups were harvested commercially for their fur until this law was passed in 1972.

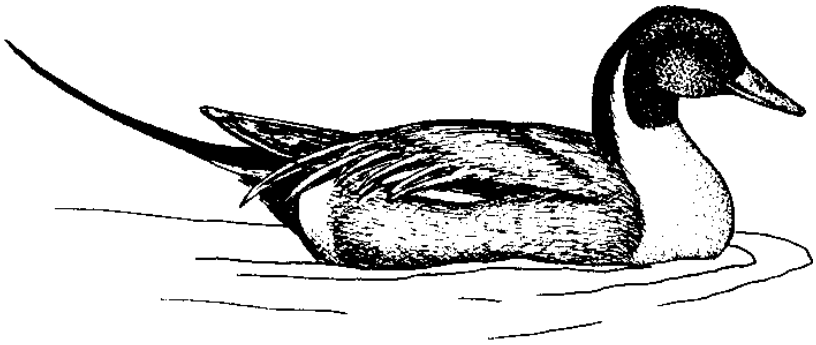
Scientists are trying to find out why young sea lions are not surviving to adulthood. Biologists suspect there is a shortage of food. Commercial fishermen harvest some of the same types of fish that sea lions eat. Fishermen also have shot and killed sea lions in the past because the sea lions feed on fish caught in their nets and hooks. Scientists have detected major changes in prey available for Steller sea lions in the Northern Pacific Ocean. The ocean has been warmer for the past 25 years.

Killer whales prey on sea lions, but scientists have no data showing an increase in killer whale populations. Sea lions also may be threatened by disturbance from development along the coastline (increased boat traffic and water pollution, for example). Also, diseases have not been ruled out as a contributing factor to the decline.

Steller sea lion populations were listed as threatened in 1989. In 1996, the western stock (north of Cordova) were moved to the endangered list. With the exception of subsistence harvest, people are prohibited from shooting sea lions, or disturbing rookeries and haulout areas occupied by sea lions. People cannot come within three miles of these areas. In 1999, the western stock was only 40,000.

Scientists have attached radio transmitters to sea lions to find out where they feed. The signal from the radio is transmitted to a satellite and then sent to a computer. This allows scientists to plot sea lions' movements. When scientists find feeding areas, they attempt to reduce any activities that would disturb feeding sea lions. Scientists are also trying to learn more about the marine ecosystem that supports sea lion populations to pinpoint cause of food shortages. (*For additional information on Steller Sea Lions, check out the video,* Steller Sea Lions In Jeopardy *from your school library.*)

Northern Pintail



The northern pintail is one of the most abundant ducks nesting in Alaska. In 1955, national biologists estimated that 9.2 million pintails nested on the North American continent. They nest in many places, but Alaska and the prairie grasslands of north-central North America are the two most important breeding areas for the pintails.

FLYING RESEARCHERS. Wildlife biologists fly over nesting areas and count pintails at the beginning of summer. The biologists return later in summer to count the number of ducklings. This gives them a measure of how successful the nesting ducks are each year.

ESTIMATED POPULATIONS. In 1960 wildlife biologists estimated 5.2 million pintails on the breeding grounds. In 1965, they estimated 3.8 million. In 1970, the pintail duck population rose to 6.2 million.

In 1975, biologists counted an estimated 6.0 million pintails. In 1980, 4.5 million; in 1985, 2.3 million; in 1990, 2.1 million; in 1995, 2.4 million. In 1999, biologists counted 2.5 million pintails.

Graph challenge: Graph the population trend. When did the pintail population get into trouble? Why? What is the trend in recent years? Is *this population decreasing, stable, or increasing*?

What Happened? Northern Pintail

Overall, pintail populations in the United States remain low. In 1999, the population was estimated at 2.5 million – down 6.7 million in 39 years. Wildlife managers believe many pintails from nesting areas in the "prairie potholes" (*midwestern states and Canadian provinces*) fly to Alaska because their normal habitat is currently unsuitable for nesting. After their long trip, the ducks do not nest or breed successfully.

LOSS OF NEST SITES. One reason for declining pintail numbers is the loss of nesting habitat south of Alaska. This loss follows (1) drought and (2) conversion of land to agriculture. In the Midwest, 10 years of drought dried up many small wetlands used by pintails for nesting. When the wetlands are dry, farmers often plow and plant them. Other wetlands are filled for homes or for industrial development, taking away wetland habitat permanently.

LOSS OF WINTER WETLANDS. More than half the continent's pintail population winters in California where wetlands have been reduced drastically. Only 10 percent of California's original wetlands remain. Many acres have been filled for homes, towns, roads, and industries. Water that would flow into these wetlands has been diverted for city water supplies and farming.

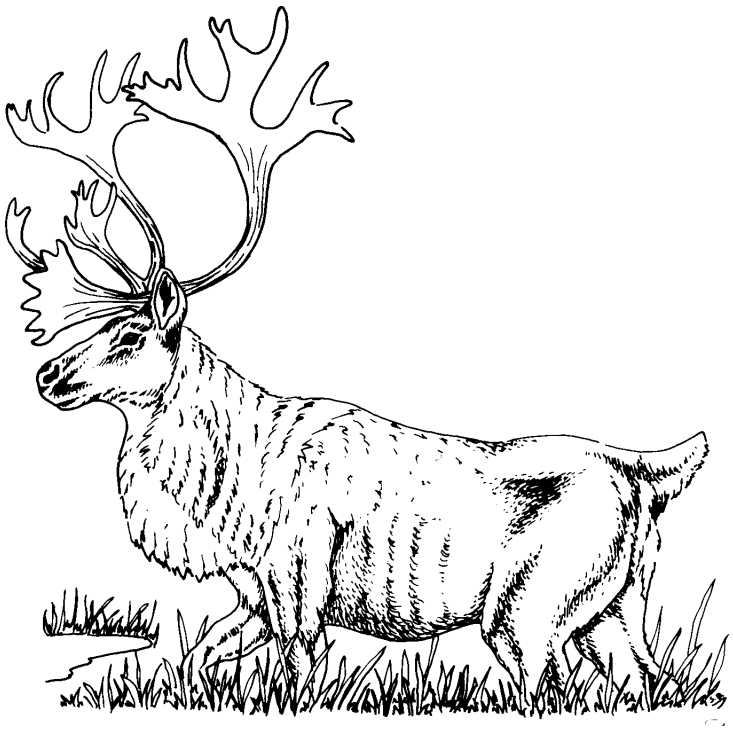
HELP FOR PINTAILS. Rice fields are being restored. They provide food and resting areas for pintails in winter. Other restoration projects have returned important wetland areas for pintails and other migrating waterfowl (*ducks and geese*).

PESTICIDE PROBLEM. Pesticides and other toxic substances used on some of the farms pollute runoff water that drains into California wetlands. The future balance between human development and pintail conservation is still unclear. Wildlife managers are watching pintail populations closely.

HUNTERS' MONEY HELPS PINTAILS. The number of pintails taken by hunters is regulated. Hunters buy hunting licenses and "duck stamps" in order to hunt ducks. The money they pay is then used to study duck populations and to protect wetland habitat.

For more information on pintail restoration, see <www.ducks.org> (Ducks Unlimited), <www.r7.fws.gov> (US Fish and Wildlife Service), or <www.state.ak.us/adfg> (Alaska Department of Fish and Game).

Western Arctic Caribou Herd



Caribou in Alaska separate themselves geographically into more than 30 herds. The Western Arctic herd is the largest herd that stays in Alaska all year. These animals migrate over 140,000 square miles that includes many communities where people traditionally hunt caribou.

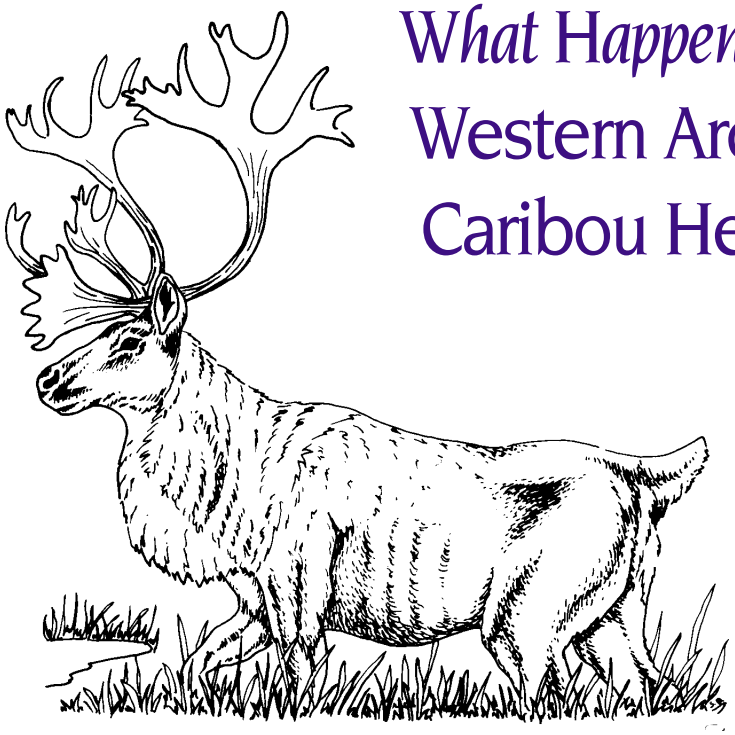
GATHER AFTER CALVING. While the caribou scatter over a very large area for much of the year, the herd migrates toward one calving area where the cows give birth to their calves in late June or early July.

PHOTOGRAPHING THE CENSUS. Wildlife biologists take advantage of this gathering to photograph the herd from the air and count the animals later using the photos. This technique is called photo-censusing.

POPULATION COUNTS. Wildlife managers and the people who live in the herd's territory became very concerned when photocensus counts dropped from 243,000 caribou in 1970 to 75,000 caribou in 1976. Historical estimates of the size of the herd were 240,000 caribou in 1950, and 280,000 caribou in 1965.

Graph challenge: Graph the population trend. *What do you predict will happen to the Western Arctic Caribou Herd population based on this data?*

What Happened? Western Arctic Caribou Herd



Additional photo-censuses in 1978, 1980, 1982, 1986, and 1988 resulted in the following population counts: 107,000 caribou, 138,000 caribou, 172,000 caribou, 229,000 caribou, and 343,000 caribou. In 1990 the herd numbered about 416,000 animals. By 1993 there were 450,000 caribou and in 1996 reached a peak count of 463,000. Biologists counted 430,000 in 1999.

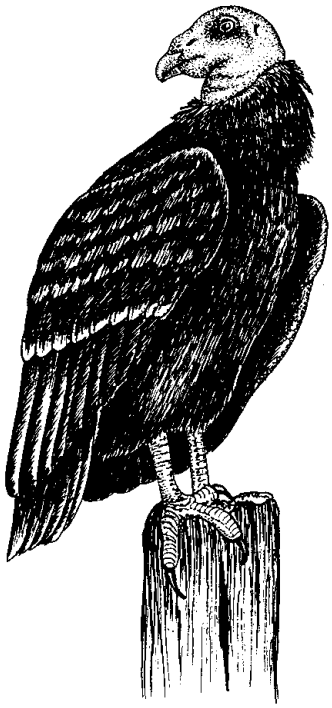
EMERGENCY ACTIONS. When the herd declined in the 1970s, the Alaska Board of Game reduced the harvest of caribou. Wildlife managers asked hunters to take fewer caribou so the population could recover. They also removed some of the caribou's natural predators, wolves and bears.

HEALTHY HERD. Now that the Western Arctic herd is healthy, hunting regulations are more liberal. Even with large numbers of bears and wolves, predators will not have a significant effect on this herd, given its large size. This herd is a very important source of food and cultural identity for the local communities. As with predation, hunting is having little effect on the current size of this herd.

HI-TECH RESEARCH. Wildlife managers census the population every three years. Some caribou have been radio collared and some have been fitted with collars that beam information to satellites. That technology lets biologists follow the movements of the herd and collect data such as the number of calves born every year and the number of adults dying.

WINTER WATCH. Such remote data collection is particularly helpful in monitoring the herds movements during the dark, stormy winter months. Wildlife managers also study the body condition of the animals, how many calves survive the winter, and test for the presence of disease. The Western Arctic herd currently appears stable.

California Condor



The California condor is one of the ancient animals. It survived from the Ice Age when many animals were very large.

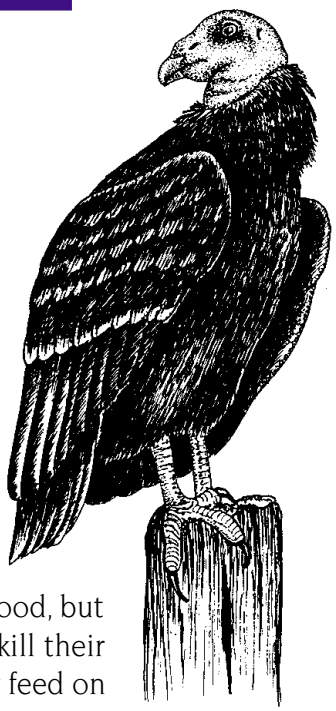
ANCIENT SCAVENGER. The condors is a scavenger that eats dead animals. The condor itself is large so it has a big appetite and must eat a lot in order to survive. Condors probably scavenged on woolly mammoths as the mammoths became extinct 11,000 years ago.

HABITAT SHRINKS. California condors ranged widely until the early 1900s when their habitat shrank to the mountainous and rugged terrain of California and Baja California.

POPULATION SHRINKS. The rugged habitat that protected the condors created challenges when biologists tried to count them. When they finally succeeded, the news wasn't good. In 1940 they estimated there were 65 wild condors. In 1963 they counted 40 condors. In 1978, 30 condors: in 1982, 23 condors: in 1984, 16 condors: and in 1986 there were 3 condors.

Graph challenge: Graph the population trend. P*redict when this species would become extinct.*

What Happened? California Condor



The California condor's habitat became smaller and smaller as towns, farms, industries, and other human habitat grew. The number of dead, large animals – the condors' favorite food – decreased. A few condors were able to survive in California near large ranches because they could feed on dead sheep, cattle, and deer.

HUMAN FEAR IS MISTAKEN. Humans never hunted condors for food, but many condors were killed because people were afraid they might kill their livestock. Condors do not kill animals; they are **scavengers** – they feed on animals once they are dead.

CONDORS DIE. To protect livestock from predators such as coyotes and wolves, people put poisons in the bodies of dead livestock. That killed condors that fed on the carcasses. Scientists also contributed to the population decline. They killed some condors to put in museum displays.

SLOW GROWTH OF FAMILIES. As with many large animals, it takes several years before a condor is old enough to nest. Adult condors do not nest every year. This means that a small condor population would take many years to grow and recover.

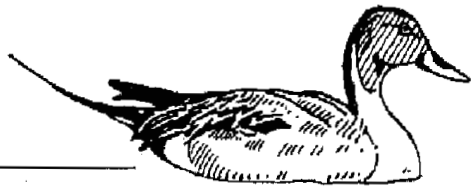
STATE & NATIONAL PROTECTION. In 1953 condors were given special protection under California law. In 1967 they were placed on the first national list of animals likely to go **extinct**. Condors are still on the Endangered Species List.

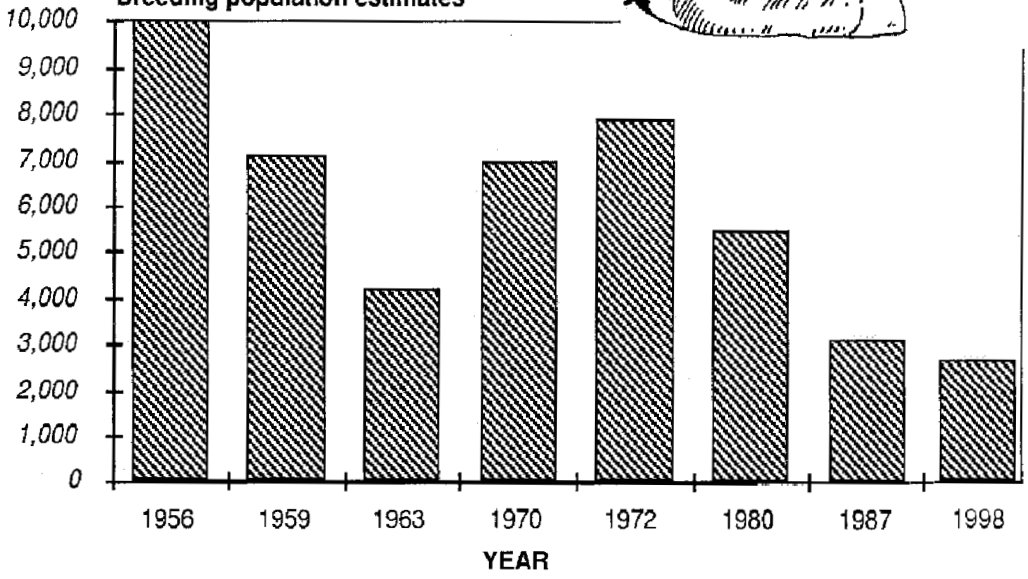
POPULATION SAVED IN ZOOS. The population of California condors living in their natural habitat dropped to 0 in 1987. Fortunately, the species has been saved from extinction – so far. People captured the last 3 condors and put them in zoos with the 21 captured earlier. Under a special program, they helped them survive and raise their young.

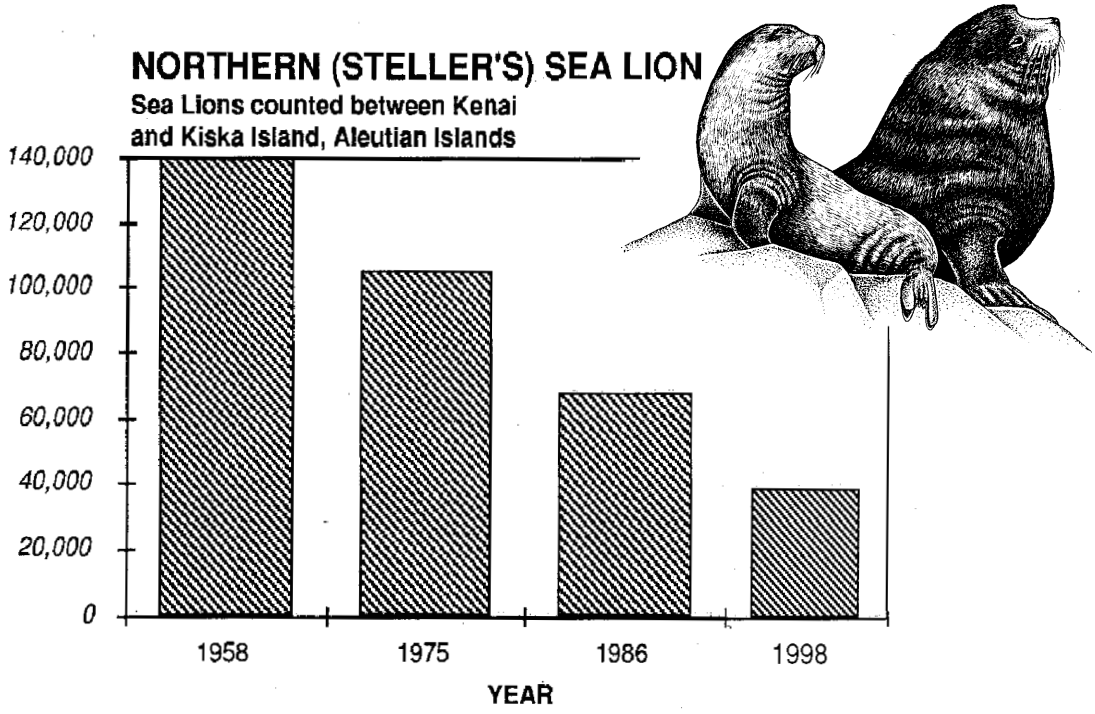
SOME BACK IN THE WILD. In January 1992, enough condor chicks had been raised that two young birds were released to the wild. The total population of captive and released birds in January 1992 was 54. In 2000, the total population was up to 169. The majority remain in captivity, but 36 are living in the wild**.**

For current information, see <www.dfg.ca.gov/hcpb/condor.html> (*California Department of Fish and Game*).

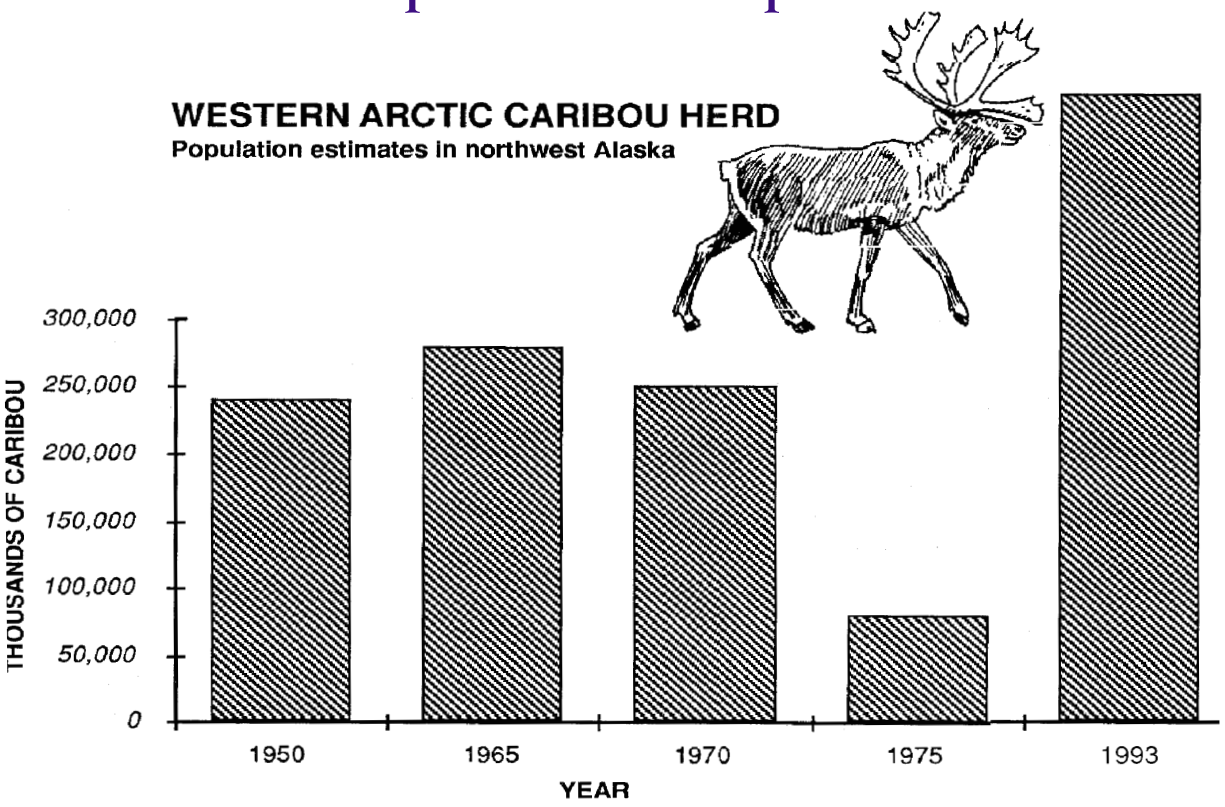
Population Graphs

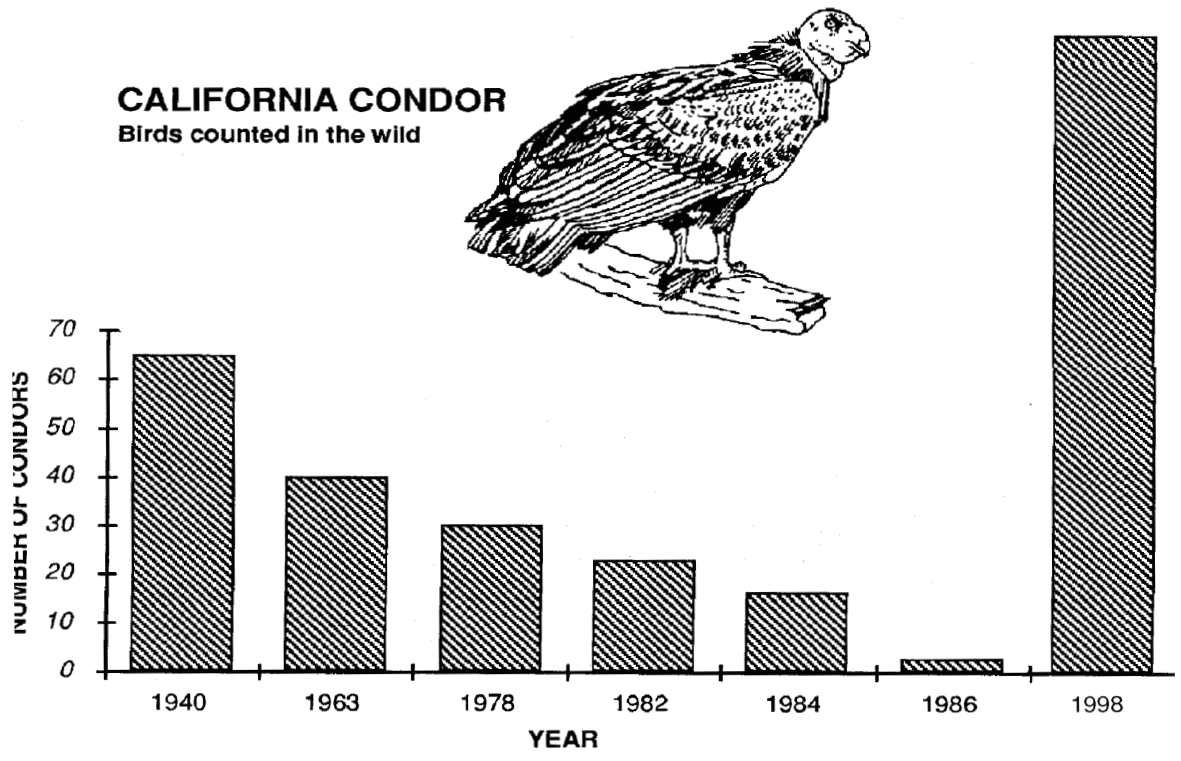




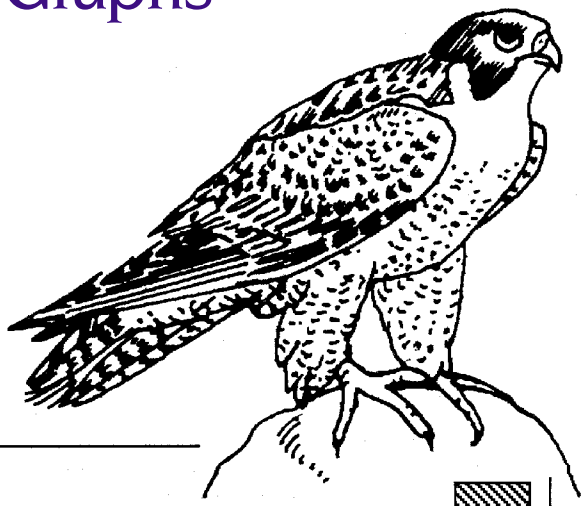


Population Graphs



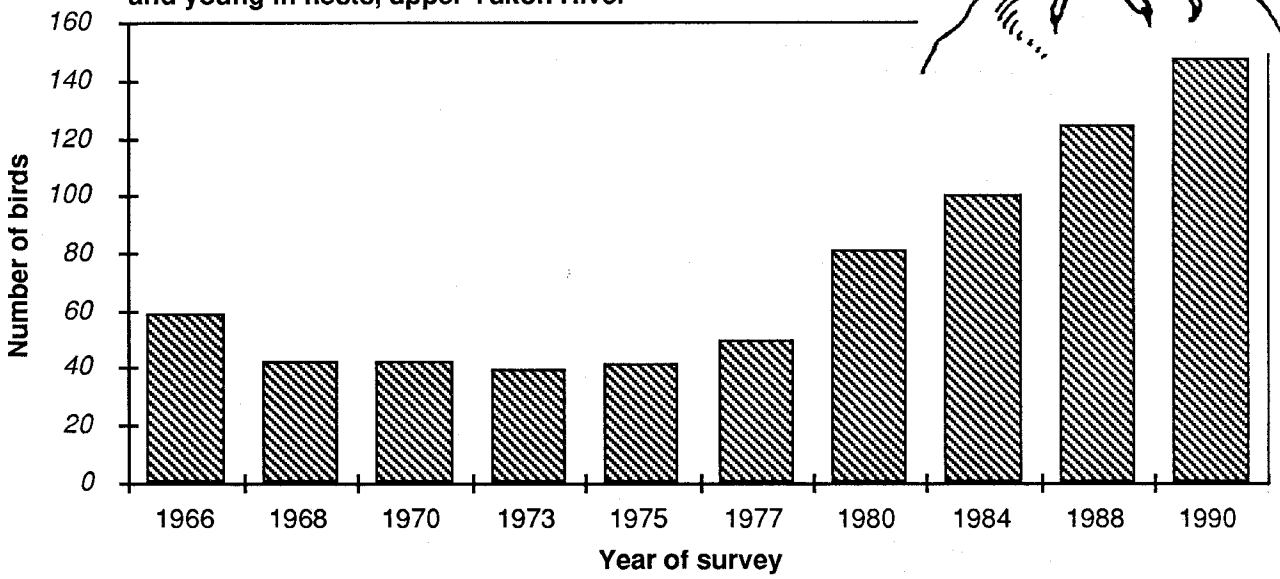


Population Graphs



AMERICAN PERIGRINE FALCON

Counts of nesting pairs, unpaired adults, and young in nests, upper Yukon River



Predator/Prey Predicaments

Section 2
WILDLIFE ACTIVITIES

Grade level: 3 - 6

State Standards: S 14-A

Subjects: Science, physical education

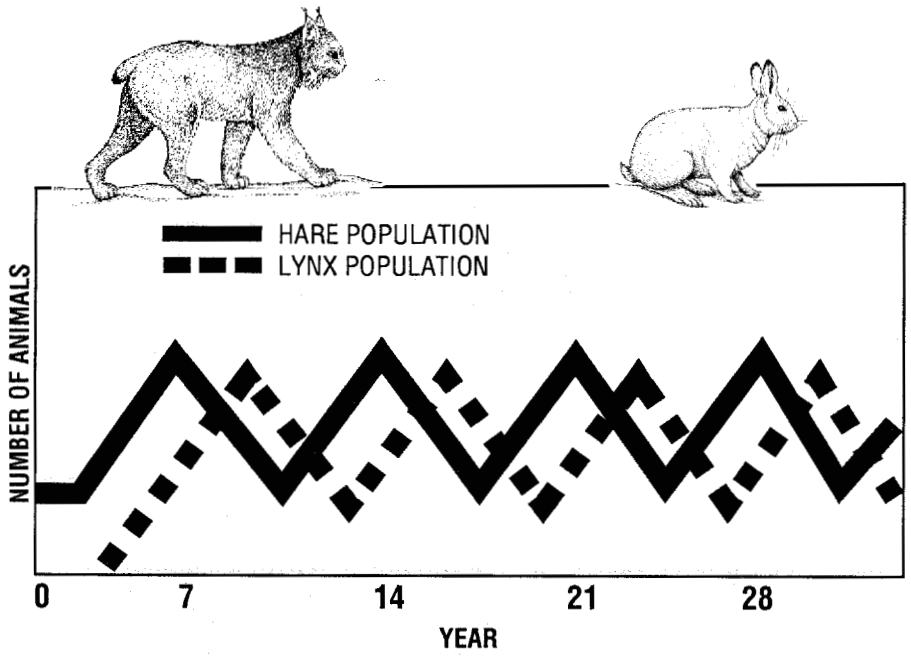
Skills: Analysis, graphing, observation, recording data, summarizing

Duration: 1-2 class sessions

Group size: 15 minimum

Setting: Gym or outdoors

Vocabulary: Cover, food chain, habitat, limiting factor, population, predator, prey, shelter



Objectives:

1. Students will describe the effect of limiting factors on wildlife populations.

2. Students will describe the importance of the predator-prey relationship.

Teaching Strategy:

Students play tag to demonstrate the relationship of predators to their prey.

Complementary Activities:

"How Many Bears Can Live in this Forest" *in this section*.
"Habitat Grid" in Section 1.

Materials:

Food tokens (pieces of cardboard) enough for three per student; armbands to mark predators; 4-5 hula hoops or paper plates to serve as "cover" markers; pencil and paper to record number of captures, if desired.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations*: "*Predator-Prey*" *Fact Sheet*.

NOTE: In four game variations this activity illustrates (1) how predators can limit prey populations, (2) the importance of the various habitat components to prey animals trying to avoid predators, (3) the relationship of predator and prey populations, and (4) the interdependence of food chains. Only Game 2 uses the concept of reproduction and offspring.

Procedure:

1. Select a pair of animals that live in your area. Examples of **predator-prey** relationships include lynx and snowshoe hares, owls and shrews or voles, brown bear and caribou, wolf and moose, and polar bear and seal.

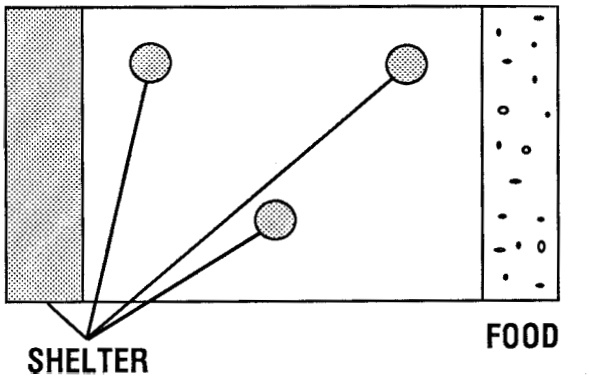
2. Predators often limit the **population** growth of the animals they eat. Prey populations, in turn, limit the size of predator populations if they are the only source of food available. If the prey animals eat plants, then plants can also affect this relationship.

3. Discuss the relationship of predators to their prey in **food chains**. Discuss why there are generally many more prey than predators. (*Predators are larger animals*

which use energy to hunt their prey and need to consume a lot of energy to survive.

3. Divide the class into two groups – predators and prey – with a ratio of one predator for every 5 - 6 prey.

4. Play the game in a gym, on a playground, or field. Identify one "end zone" of the space as the food source and the other "end zone" as **cover** or **shelter**.



5. Place 4-5 hula hoops, circles of string or paper plates in the open area between the cover and the food. These represent additional shelter or cover areas for the prey and can be randomly distributed across the space.

6. Place food tokens in one of the end zones, allowing three food tokens for each prey.

7. Give the directions for each game (*following*). Play all four games if possible.

– Directions for Games –

GAME 1

Use a whistle or another signal to start each round. Limit each round of the game to five minutes (*captured prey and unsuccessful predators tend to get restless*). Replace food tokens after each round.

Play 2 - 3 rounds, recording the number of surviving predators and prey after each round in a graph. Discuss the outcome of each round and compare the graphs.

***Directions for Prey*:**

- Prey line up in their shelter. The task of the prey is to move from their shelter to the food source, collect one food token, and return to their shelter.

- To survive a round, each prey must obtain three food tokens. Three separate trips must be completed from the shelter to the food source.

- Prey animals need to be alert for predators. If they spot a predator, they can use several defensive behaviors: (1) warn another prey that a predator is near, (2) run to the additional shelter or cover areas marked on the field, (3) freeze (*freezing is allowed only when a predator is within five feet*).

- Prey in the cover must have one foot in the **cover area**. Prey that are frozen must stay totally still without talking or moving. At the end of the round, replace food tokens in the end zone and play the next round.

***Directions for Predators*:**

- Predators begin by scattering themselves randomly in the open area. Predators attempt to capture prey by tagging (*capturing*) moving prey. They cannot tag frozen prey.

- Predators must capture (*tag*) two prey in a round in order to survive.

- Captured prey are taken to the sidelines by the predator who captured them. At the end of a round, predators who did not survive stand on the sidelines with the captured prey.

GAME 2

- Play the game again. Explain that successful predators are well fed and tend to ***produce and rear more offspring*** than less successful predators.

- In this game allow captured prey to return the next round as offspring of the successful predators.

- Record the results of 2 - 3 rounds. Compare the outcomes of each round and how the addition of new predators in each round affected the prey

population. (*This quickly leads to the concept of dynamic balance, as prey and predator populations fluctuate in response to each other.*)

GAME 3

- Begin again with the original distribution of predators and prey. In this game, ***limit the amount of cover*** by taking away 2-3 hoops or plates from the center.

- Play 2 - 3 rounds. Record the results. Prey and predators who fail to survive stand on the sidelines and can help graph the results.

- Discuss the effects of loss of shelter on prey animals.

GAME 4

- Begin again. Use the original ratio of predators and prey. In this game, **limit the available food** for prey by placing only 1 - 2 food tokens per animal in the food area.

- Play 2 - 3 rounds. Record the results.

- Discuss how loss of the prey's food affects prey and predator populations.

8. AFTER THE GAMES, return to the classroom. Discuss the factors that affected the survival of predators and prey.

9. After students have had a chance to share their experiences and compare the results of each game, ask them to summarize what they have learned about predator-prey relationships.

10. Encourage students to recognize the **limiting factors** that affected prey populations (*lack of cover, lack of food, abundance of predators*) and predator populations (*abundance or lack of prey*). How do predator-prey relationships regulate the populations of each species?

VARIATIONS:

1. During the game, limit students to walking or assign a different means of locomotion to each animal.

2. Add a second type of prey that eats a different type of food (*for example, one eats only moose, one eats both moose and caribou*).

Evaluation:

1. Students name two sets of predators and prey in your area and describe some of the factors that limit their populations.

2. Students draw a food chain and write an explanation of the factors that would affect the chain.

Credit:

Adapted from "Quick Frozen Critters," *Project* WILD K-12 *Activity Guide*, Western Regional Environmental Education Council, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

The Case of the Missing Cutthroats (George)

Fearsome Hunters of the Wild (Nicoli)

Lynx (Barrett)

Predator! (Brooks)

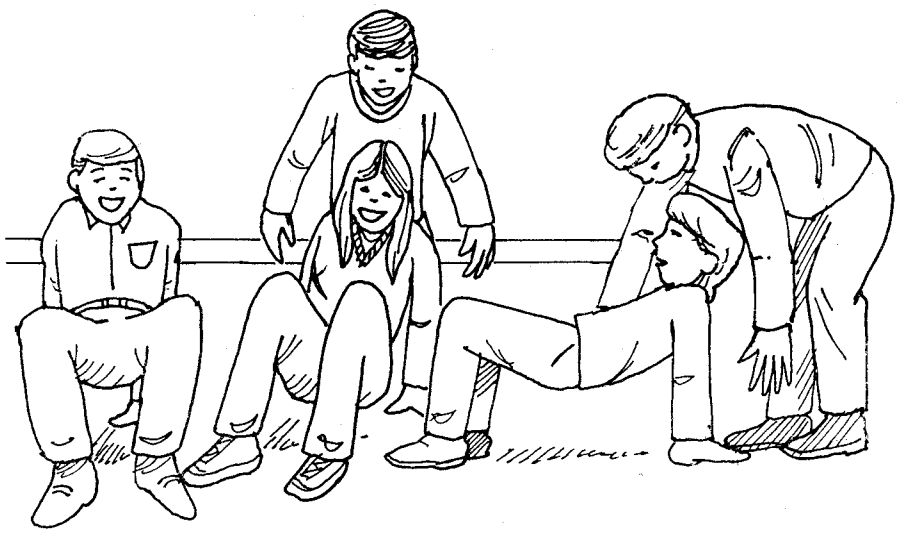
When Hunger Calls (Kitchen)

Who Eat What? Food Chains and Webs (Lauber)

Teacher Resources:

(See appendix)

Hermit Crab Game
3 EXTENSIONS



Section 2
WILDLIFE ACTIVITIES

Grade Level: K - 3

Subjects: Language arts, science

Skills: Auditory memory, drawing conclusions, observation, writing

Duration: 20 minutes

Group Size: 7 minimum

Setting: Indoors

Vocabulary: Habitat, limiting factor, population, predation, shelter

Objectives:
Students will demonstrate how a habitat need can limit the size of a population.

Teaching Strategy:
Students simulate hermit crabs searching for a limited number of shells and discuss the results.

Complementary Activities:
"Population Posters" *and* "Don't Put All Your Eggs in One Basket" *in this section*. "Habitat Grid" *in Section* 1 *and* "Musical Habitats" *in Section* 3.

Materials:
Story to introduce the activity: A *House for a Hermit Crab* by Eric Carle or *Kermit the Hermit* by Bill Peet (*or use the* "Hermit Crab Challenge" *from* INSIGHTS).

Background:
See INSIGHTS *Section* 2, *Biodiversity and Populations – Alaska's Dynamic Wildlife*: "*Hermit Crab Challenge*" Fact Sheet.

Procedure:
1. Read one of the hermit crab stories to the class. If the stories are not available, describe how hermit crabs use shells from the "Natural History Tips."

2. Discuss the life of a hermit crab.

3. Teach the class the poem about the hermit crab. Write it on the board. Tell the students that it will be used for a game.

"I'm a little hermit crab, looking for a shell.
I see one. There it is.
This will suit me very well."

4. OBJECT OF THE GAME: for each hermit crab to find a shell. Some of the students will be shells; some will be hermit crabs.

5. TO BEGIN: divide the class into "shells" and "crabs" with one less "shell" than "crabs." After the class repeats the poem, the "hermit crabs" quickly try to reach a "shell" by crab-walking and crawling under it.

6. SHELL RULES: "shells" stand with arms spread outward, bending over. This position represents a shell.

7. CRAB RULES: tell the class all the hermit crabs are considered one **population**. Have the "crabs" practice crab-walking by moving on their hands and feet, knees bent, with their back toward the floor. To be safe, each "crab" must find a "shell" and get on the floor under the arch formed by the "shell's" arms.

8. After all but one "crab" find a shell; discuss what the "crab" without a shell might do. (*It might move to a new area or a* ***predator*** *might eat it.*)

9. PLAY AGAIN: at the start of each round, have the "crabs" with shells leave their shells so that all hermit crabs are looking for new shells.

10. Discuss the results again and point out to students that the number of successful hermit crabs depends upon the number of shells available. The number of shells is the **limiting factor**.

11. Let the "shell" players be hermit crabs and play the game again.

12. Turn three "shells" into "crabs" and play the game again. This time the number of hermit crabs that find shells will be smaller. Ask the students what factor limited the size of the population (*the number of shells*).

Evaluation:

1. Students choose an animal in their area and list factors that limit the size of that animal's population.

2. Successful playing of the game and participation in discussion.

EXTENSIONS:

A. **Write hermit crab poems.** Have students write their own poems about hermit crabs.

B. **Observe crabs in tide pools or aquarium.** Observe hermit crabs in tide pools. Discuss what might happen to the hermit crab population if too many people collected empty shells at the beach or if the snail population declined.

C. **Create a new game.** Create a similar game choosing a different animal and a different limiting factor.

Curriculum Connections:

(See appendix for full citations)

Books:

House for a Hermit Crab (Carle)

Is This a House for Hermit Crab? (McDonald)

Kermit the Hermit (Peet)

Pagoo (Hollings)

Media:

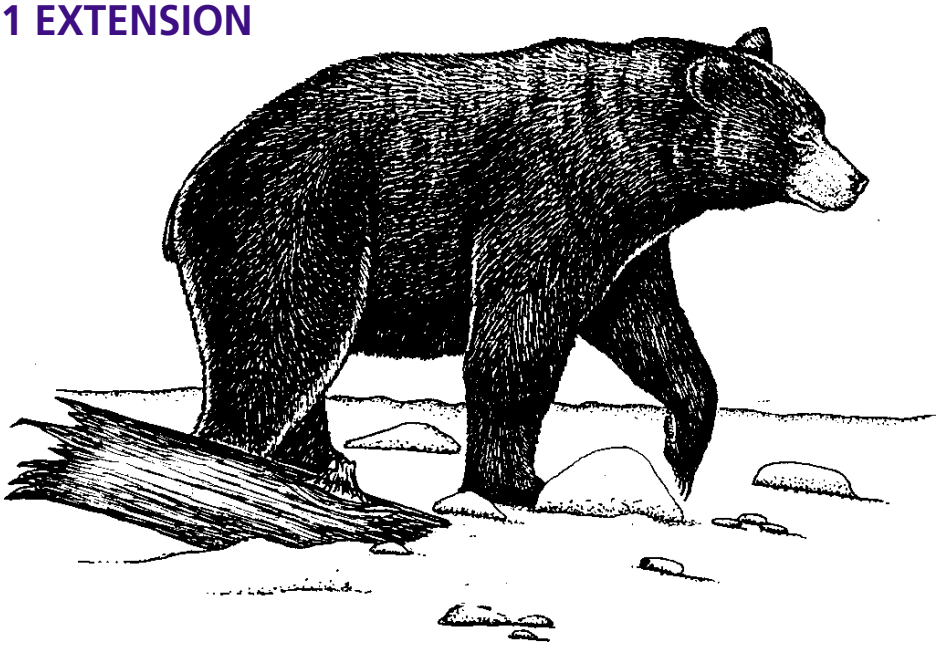
Is This the House for Hermit Crab? (Video)

Teacher Resources:

(See appendix)

How many bears can live in this forest?

1 EXTENSION



Section 2
WILDLIFE ACTIVITIES

Grade Level: 3 - 8

State Standards: S A-14, Geo E-5, M A-3, M A-6, M D-1, M D-2, M D-5

Subjects: Mathematics, physical education, science, social studies

Duration: 20-45 minutes minimum

Group size: 12 or more

Setting: Outdoors and indoors

Vocabulary: Carrying capacity, cover, habitat, limiting factors, omnivore, shelter

Objectives:

1. Students will define *carrying capacity*.

2. Students will describe the importance of carrying capacity for wildlife and people.

Teaching Strategy:

Students role-play as bears, looking for and eating food during this physical activity.

Complementary Activities:

"Predator/Prey Predicaments" and "Graphic Populations" *in this section*. "Habitat Grid" *and* "Interview a Muskox" *in Section* 1. "Habitat Roulette" *in Section* 3.

Materials:

Construction paper (2-3 sheets of each of five colors) or an equal amount of light poster board, one black felt pen, one envelope for each student, pencils, one blindfold.

Background:

See INSIGHTS *Section* 2, *Biodiversity and Populations*: "*Carrying Capacity*" and "*What's on a Bear's Menu?*" *Fact Sheets*.

NOTE: The food tokens in "How Many Bears" are divided into proportions similar to a Kenai black bear's diet from "What's on a Bear's Menu?" in INSIGHTS.

The following estimates of total pounds of food for one bear in 10 days are used for this activity:

roots	3 pounds =	5%
berries	19 pounds =	32%
insects	9 pounds =	15%
meat	11 pounds =	18%
plants	18 pounds =	30%
	60 pounds =	100% in 10 days

Procedure:

IN ADVANCE, cut the paper or poster board into 2" x 2" or 2" x 3" pieces. For a classroom of 30 students, make 30 cards of each color as follows (*for classes with 12-20 students, see guide at end of activity*).

O*range* for **roots** (wild sweet pea); mark 30 pieces "R-2."

B*lue* for **berries** (cranberries, devil's club berries, raspberries); mark five pieces "B-26," mark 25 pieces "B-10. "

Y*ellow* for **insects** (worms, larvae, ants); mark five pieces "I-11," mark 25 pieces "I-5."

R*ed* for **meat** (mice, rodents, hare, birds, moose); mark five pieces "M-14," mark 25 pieces "M-6."

G*reen* for **plants** (leaves, grasses, and herbs); mark five pieces "P-22," mark 25 pieces "P-10."

1. IN CLASS, ask students why there are not millions of bears nearby. Brainstorm **limiting factors** that keep wildlife **populations** in check (*food, water, shelter or cover, predators, disease, for example*).

2. Tell the students that **carrying capacity** may be defined as the number of plants or animals of a given species that an area of land or water can support. It is the largest population a unit of **habitat** can support on a year-round basis, or during the most critical period for the species.

3. Tell the students that today they will become bears to focus on food as a limiting factor. In nature, a variety of factors influence the actual carrying capacity of an area.

4. Student write their name on their envelope. They will put the food they "eat" in these envelopes.

TO PLAY THE GAME

1. In a fairly large open area (50 feet square), scatter the colored "food" pieces of paper. (*There should be less than 60 pounds of food per student so that there is not enough food in the area for all the "bears" to survive.*)

2. Students place their envelopes on the ground (perhaps anchored with a rock) at the starting line around the perimeter of the field area.

3. Students stand over their envelopes on the starting line. Give them the following instructions:

- "You are now black bears. All bears are different, just like you and I. Among you is a young male bear who has not yet found his own territory. Last week he met up with a larger male bear in the big bear's territory, and before he could get away, he was hurt. He has a broken leg." (*Assign one student as the crippled bear. He must hunt by hopping on one leg.*)

- "Another bear is a young female who investigated a porcupine too closely and was blinded by the quills." (*Assign one student as the blind bear. She must hunt blindfolded.*)

- "The third special bear is a sow (*a mother bear*) with two small cubs. She must gather twice as much food as the other bears." (*Assign one student as the sow.*)

4. Do NOT tell the students what the colors, initials, and numbers on the pieces of paper represent. Tell them only that the pieces of paper represent various kinds of bear food. Bears are **omnivores**, they like a wide assortment of foods, so they should gather different colored squares.

5. Students must walk into the "forest." Black bears do not run down their food; they gather it. When students find a colored square, they should pick it up (*one at a time*) and return it to their envelope ("stomach") before picking up another colored square.

6. Pushing and shoving – any competitive activity – is acceptable as long as it is under control. Snatching food right out from under the blind bear or the crippled bear is natural, but stealing from other envelopes is impossible because the food has already been consumed and is therefore not allowed.

7. Remind students that if bears fight (*which they seldom do*) they can become injured and unable to gather sufficient food. Out of control competitiveness can be rewarded with an injury, assigned by the teacher, or removal of food to represent energy lost.

8. When all the colored squares have been gathered, students pick up their envelopes containing the food they gathered and return to class.

1. BACK IN THE CLASSROOM, explain what the colors and numbers represent. Ask each student to add up the total number of pounds of food that she or he gathered (*total of meat, insects, berries, or plant materials*). Each should write the total weight on the outside of his or her envelope.

2. Using a chalkboard, write "blind," "crippled," and "sow with cubs." Ask those bears how much food they ate. Write the amounts after their role.

3. Ask each of the other students how much food they found. Record each response on the chalkboard.

4. Tell the students each bear needs 60 pounds to survive. Which bears survived? Is there enough to feed all the bears? If not, how many bears can live in this habitat?

5. Ask the students to calculate a class total for all the pounds of food they gathered as bears. Divide the total by the 60 pounds needed by an individual bear (approximately) in order to survive in a 10-day period.

6. Considering the class results, how many bears could the habitat support? What percentage of the bears survived? What percentage would have survived

KENAI CAFETERIA

What's on a bear's menu?

If you are an average adult male black bear living on the Kenai National Wildlife Refuge in Alaska you weigh 170 pounds, have a 165 square mile home range, and eat six pounds of food each day. Your diet is typically composed of the following foods:

36.0%	**fruits and berries**
17.6%	lowbush cranberry
7.2%	devil's club
4.2%	twisted-stock
7.0%	miscellaneous berries
34.0%	**animal matter**
13.6%	insects
10.7%	moose
3.5%	hare
2.6%	birds
2.0%	insect larvae
1.6%	fish, small animals
30.0%	**green vegetation**
13.6%	horsetail
5.6%	grass, sedge
4.9%	clover
3.9%	leaves and moss
2.0%	flowers

N*ote*: Bear research on the Kenai National Wildlife Refuge indicates that a mature black bear could typically eat about 6 pounds of food per day in a 10-day period.

Bear Food Tokens for 12 to 20 Participants

These formulas can be used for groups of less than 25 participants (see the procedure for groups of 25-30).

Participants	**12**
Total Food	586
Roots (orange)	15-2s
Berries (blue)	2-26s, 13-10s
Insects (yellow)	2-11s, 13-5s
Meat (red)	2-14s,13-6s
Plants (green)	2-22s, 13-10s

Participants	**18**
Total Food	864
Roots (orange)	22-2s
Berries (blue)	4-26s,17-10s
Insects (yellow)	4-11s,17-5s
Meat (red)	4-14s,17-6s
Plants (green)	4-22s,17-10s

Participants	**15**
Total Food	720
Roots (orange)	18-2s
Berries (blue)	3-26s, 15-10s
Insects (yellow)	3-11s,15-5s
Meat (red)	3-14s, 15-6s
Plants (green)	3-22s, 15-10s

Participants	**20**
Total Food	960
Roots (orange)	24-2s
Berries (blue)	4-26s,20-10s
Insects (yellow)	4-11s,20-5s
Meat (red)	4-14s, 20-6s
Plants (green)	4-22s, 20-10s

had the food been evenly divided? In each case, what percentage would not survive? What other limiting factors would influence the survival of individual bears and populations of bears in an area?

7. Discuss what would happen to the bears that did not get 60 pounds of food. Would they all starve? How many pounds did the blind bear collect? Will it survive?

8. What about the sow with cubs? Did she get twice the amount needed to survive? What will happen to her cubs? Will she feed cubs first, or herself? Why? What would happen to her if she fed the cubs? What if she ate first? If the cubs die, can she have more cubs in the future during richer years?

(The sow will eat first and the cubs will get what food, if any, is left. The sow must survive; she is the key to a continued bear population. She can have more cubs in her life; only one cub needs to survive in order for the population to remain stable.)

9. Discuss the idea that a given area of black bear habitat can only support a limited number of bears. How many bears survived in this activity? Could the carrying capacity change? Under what condition? Discuss which aspects of the carrying capacity for this class area were realistic and which were not.

10. An example: A *gallon bucket is only able to contain one gallon of liquid, and no more. That is its carrying capacity.* What about your classroom? Let's say there are 25 students, one teacher, desks, tables, and equipment. At present, there is room enough for all. It is reasonably comfortable and you can work and learn in the space.

11. What if we brought in another group of 25 students, desks, tables, and equipment? What if we brought in a third group of students? What is the carrying capacity of your classroom? Or, what if the size of your classroom was cut in half? What would that reduction in available habitat do to the carrying capacity of the area?

12. Talk about the bucket, the classroom, and the bear habitat. What similarities and differences are there in carrying capacity?

13. Conclude with a discussion that any piece of land can support only so many plants and/or animals. That is the land's *carrying capacity*. Could the earth's carrying capacity be decreased as a result of some human activities? To what extent can individual people and societies exert a positive influence on the global environment?

Evaluation:

1. Define *carrying capacity*.

2. Describe some of the factors which determine carrying capacity for a species of animal.

3. Explain why carrying capacity is important for wildlife.

EXTENSION:

Math challenge. Students record how many pounds of each of the five categories of food each gathered. Students convert these numbers into percentages of the total pounds gathered. Provide the students with the background information on Kenai black bears so that they can compare their percentages. Students guess how healthy their bear would be. How do the bear's dietary requirements compare with those of humans for balance and nutrition?

Credit:

Adapted from "How Many Bears Can Live In This Forest?" *Project* WILD K-12 *Activity Guide*, Council for Environmental Education, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska's Bears (Alaska Geographic)

Alaska's Bears (Sherwonit)

Bears for Kids (Fair)

Biodiversity (Patent)

Living in Harmony with Bears (Stonorov)

Living with Bears in the Kenai Peninsula Borough (The Nature Conservancy)

Websites:

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Animal Diversity Web
<animaldiversity.ummz.umich.edu>

Mammals on the Kenai National Wildlife Refuge
<kenai.fws.gov/mammals.html>

Teacher Resources:

(See appendix)

Musical Habitats
1 EXTENSION

Section 3
WILDLIFE ACTIVITIES

Grade Level: K - 4

State Standards: S A-14

Subjects: Art, science

Skills: Analysis, drawing conclusions, projection

Group Size: I-4, whole class

Setting: Indoor

Vocabulary: Endangered, Endangered Species List, habitat, migrate, nest, shelter, territory, threatened

Objective:
Students will demonstrate how habitat loss affects wildlife populations.

Teaching Strategy:
Students create habitat for one pair of bald eagles and simulate the effects of habitat loss on populations.

Complementary Activities:
"Distant Thunder" *in this section*. "Habitat Grid" *and* "Habitat Boxes" *in Section* 1. "Population Posters" *in Section* 2. "Can Do!" *in Section* 4.

Materials:
Recorded music, paper or cardboard, crayons or marking pens, scissors, glue, colored construction paper.
OPTIONAL: *To illustrate the story for young students, pictures of eagles, their nest tree, nest, and salmon.*

Background:
See INSIGHTS *Section 3, When Populations Decline – Losing Biodiversity*: "Bald Eagle" Fact Sheet.

Procedure:
1. Explain that during the time a pair of eagles is raising their young, they live in an area called a nesting **territory** where they can find all their **habitat** needs – *food, water, shelter, and space in a suitable arrangement.*

2. Each nesting territory can only support one pair of eagles and their young. When the young eagles get bigger and are able to fly, they fly away and find their own territory. The adult eagles will often **migrate** somewhere else during winter; but next summer they will return to the same nesting territory to nest again.

3. Read and write on the board (or use pictures) the following description of bald eagle habitat requirements:
"Bald eagles eat fish, especially salmon. Bald eagles live near a lake or the ocean where they find their food. Bald eagles build their nests in large, old trees with large tops. They also perch in tall, old trees to look for fish in the water."

4. Tell students they will be using art supplies to make a territory that will meet all the habitat needs of a pair of bald eagles (you may want to write "*food, water, shelter, and space*" on the board as a reminder). They can draw or cut the construction paper and glue it onto the paper or cardboard.

5. Distribute art supplies. Each student will make a habitat for one pair of bald eagles. After the students complete their territories, have them share what they did in small groups.

6. Ask the class if they can think of ways bald eagle habitat could be changed or lost (*not enough salmon return, not enough large, old trees for nesting, polluted lakes and oceans, for example*). Explain that if the eagles cannot meet all of their habitat needs, they can no longer live in that territory. Tell them they will be playing a game to find out what happens to an eagle population when habitat is lost.

7. Tell each student to place his or her habitat under a desk or a chair.

8. Students will be a pair of bald eagles. They must find a place to live. Remind them that each habitat is enough for only one pair of bald eagles. The student must sit in the chair above the habitat when the music stops.

9. Play rounds of "musical chairs," removing one or more territories from beneath the chairs or desks each round. Let the students know what is happening to the habitat. F*or example, say "a nesting tree was cut down, one habitat is destroyed" or "a lake was polluted, habitat for two eagles was destroyed" as you remove the habitat*). Do this in such a way that the students need to move farther to get to the remaining territories.

10. If a student sits in a chair or desk with no territory, that student is out of the game and can help you remove habitat. Continue the game until only one territory remains.

11. Ask the following questions:
- What would happen to eagles that cannot find a territory with all of their habitat needs? (*They would have to find a territory somewhere else or die.*)
- What happened to the population of eagles as habitat was removed? (I*t got smaller.*)
- What would happen to eagles if the last eagle died? (*They would be* **extinct**.)

Evaluation:
Students choose an animal other that an eagle and create a similar game, including ways their animals' habitat could be lost or restored.

EXTENSIONS:
Add "endangered" status to the game. Define the term **endangered –** *in danger of becoming extinct*. Play the game again and ask the students to decide when the eagle population should be considered **threatened** and when it should be considered endangered. (*There is no set population size that triggers the listing so the students can discuss what they consider a small population.*) When is the population extinct? (*When the population drops to zero.*)

After the students choose a population level that will trigger an endangered label, play the game a third time. When the population reaches the low level set by the students and becomes endangered, have the students who are no longer living eagles help repair the habitat to stabilize the population. Students could also make rules about what people should not be allowed to do that would affect the eagles' habitat.

Curriculum Connections:
(See appendix for full citations)

Books:
The Bald Eagle Returns (Patent)

Eagles for Kids (Gieck)

Soaring with the Wind, the Bald Eagle (Gibbons)

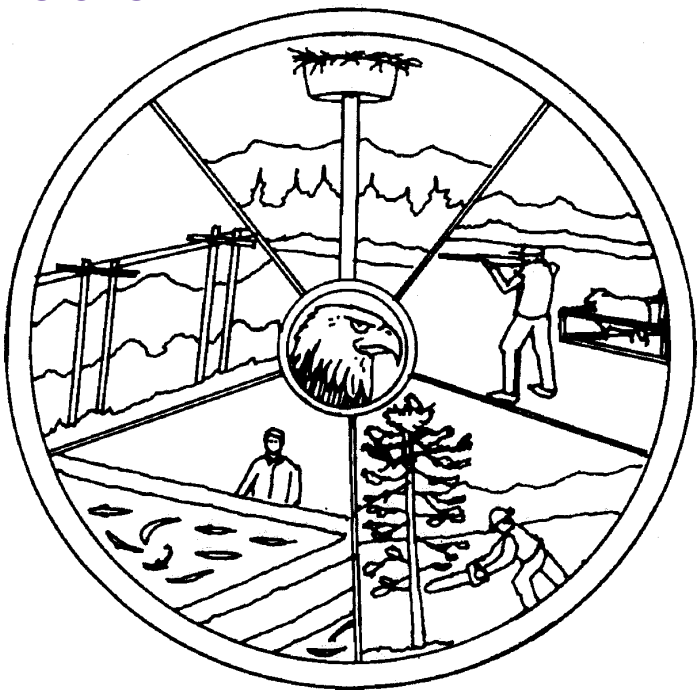
Three River Junction: A Story of an Alaskan Bald Eagle Preserve (Burnham)

Media:
Eagles (Video)

Teacher Resources:
(See appendix)

Habitat Roulette

3 EXTENSIONS



Section 3
WILDLIFE ACTIVITIES

Grade Level: 6 - 8

State Standards: M A-3, S A-14, Geo E-5

Subjects: Social studies, science, math

Skills: Inferring, graphing, summarizing

Duration: 45 minutes, 30 minutes debriefing

Group Size: 10-15

Setting: Indoors

Vocabulary: Endangered, extinction, habitat, habituated, population, restoration, threatened

Objective:

Students will describe the impact of habitat loss to wildlife.

Teaching Strategy:

Students play a survival game that demonstrates the role of habitat loss and other factors that may result in declining, endangered or extinct populations.

Complementary Activities:

"Last Curlew" *in this section*. "Habitat Grid" *and* "Interview a Muskox" *in Section* 1. "Biodiversity Field Trip," "Graphic Populations," and "How Many Bears Can Live in this Forest?" *in Section* 2. "Can Do!" *in Section* 4.

Materials:

Bald Eagle and Brown Bear Cards (*following*), blank paper, markers for making labels.

Background:

See INSIGHTS *Section 3, When Populations Decline – Losing Biodiversity*: "*Bald Eagle*" *and* "*Brown (Grizzly) Bear*" *Fact Sheets.*

Procedure:

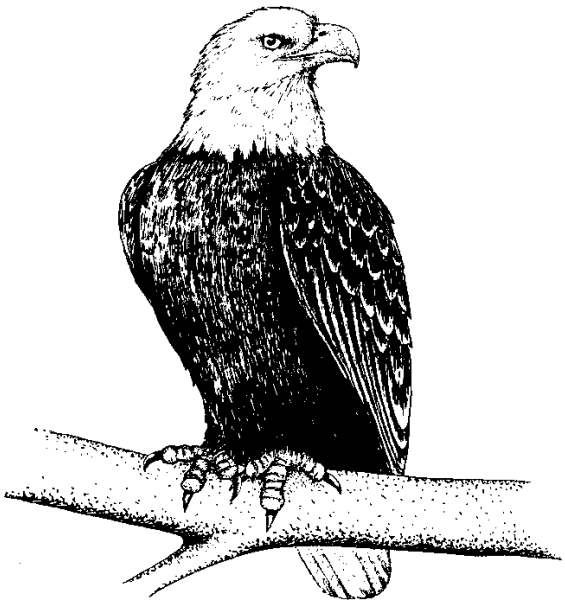
1. Ask the students to define **habitat** (*water, food, shelter, and space in a suitable arrangement*). Ask them how important habitat is to the survival of wildlife **populations**?

2. Divide the class into two groups, brown bears and eagles. Each group will then divide itself into two groups – adults and young. If the number is uneven, extra students should join the group of young. [NOTE: *if the class is smaller, play one animal game at a time.*]

3. At the beginning of the game, the adult bears and eagles stand and the young remain sitting. The seated students represent potential offspring yet to be born.

4. Explain to students that at the end of the game if 1/2 of the team (*tell them the actual number*) or less remains standing, they will be considered a **threatened** species. If 1/4 or less of the students remain standing, the species will be considered **endangered**. The goal for each group is to increase their population so that more than 1/2 of the team would be standing at the end of the game.

5. The game is designed for four rounds, each round representing a year. [*For your information, during the four years the eagle population will increase and the bear population will decrease regardless of your class size.*] The game will be more powerful if the students do not know the outcome before playing.



1. **GAME INSTRUCTIONS:** At the beginning of the game, each standing eagle represents two adult eagles, a male and a female, and wears a tag "*Adult – 2 eagles.*"

2. Each standing student on the bear team represents one bear and wears a tag "*Adult – 1 bear.*" (*Explain that bears do not pair up like eagles to raise their young; the male bear does not spend time with the female bear, except to mate.*).

3. Newborn animals will not begin reproducing during the game (*bears do not normally reproduce until at least age* 5; *eagles, after age* 4 *or* 5.)

4. Read the cards provided, year by year, alternating between the eagle cards and the bear cards. Students sit or stand, following the directions on the cards.

For example, after you read "Biologists transplant three healthy eaglets from Alaska into nests of adult eagle pairs. Two of the three young survive," a seated member of the eagle group stands and writes "*Young - 2 eagles*" on a card. When an animal dies, standing students remove the appropriate number of animals and join their seated team mates.

5. To calculate the size of the eagle and bear populations at the end of each year: add the number of adults standing to the number of young standing for each team.

6. At the end of the game, determine the final population sizes. Review the cards as a class and note the destruction or **restoration** of habitat. Discuss which factors influenced the population negatively and positively.

7. Brainstorm a list of other possible causes of habitat loss. Discuss ways that humans can help populations recover. Discuss some ways you can help maintain wildlife habitat in your community.

Evaluations:

1. List three causes of habitat loss.

2. Design a set of cards that would be applicable to the importance of habitat for the health of other species in Alaska.

EXTENSIONS:

A. **Counter destruction with restoration.** Students develop management plans to restore habitat, reversing losses that resulted from human activities.

B. **Play with a random setup.** Shuffle cards and do another set of rounds in an unpredictable order.

C. **Research local habitat loss.** Students research how habitat loss has affected local or state wildlife populations. Students look for data about the size of declining populations, and then graph the size of the population over time. Contact your local Alaska Department of Fish and Game (ADF&G) office or see the ADF&G website for more information.

Curriculum Connections:
(See appendix for full citations)

Books:
Alaska's Bears (Alaska Geographic)

Alaska's Bears (Sherwonit)

Alaska's Magnificent Eagles (Alaska Geographic)

The Bald Eagle Returns (Patent)

Bears for Kids (Fair)

Biodiversity (Patent)

Eagles for Kids (Gieck)

The Grizzly Bear (Silverstein)

Living in Harmony with Bears (Stonorov)

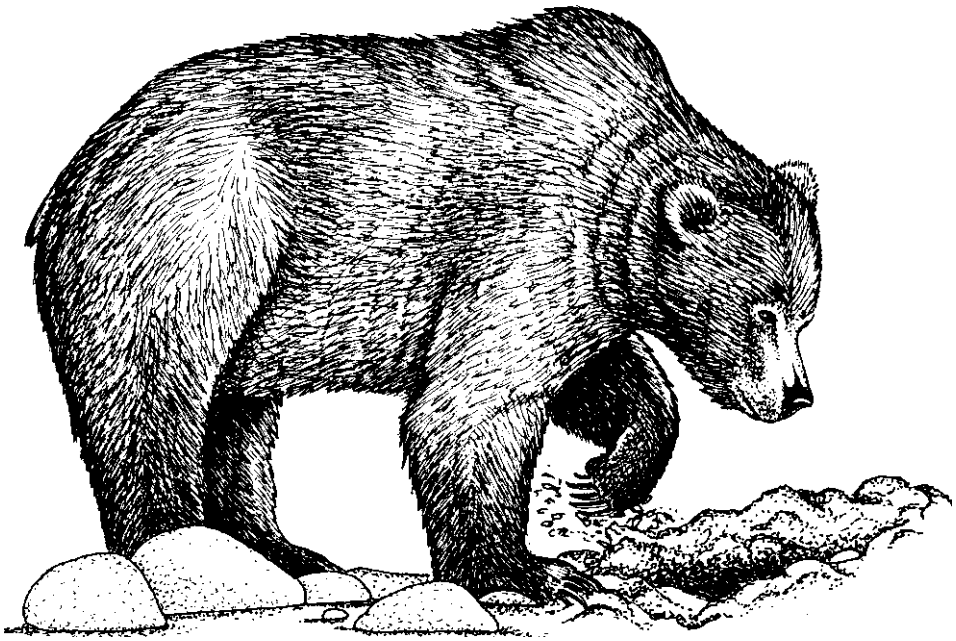
Media:
Alaska's Wildlife (Video) (ADF&G)

Alaska's Grizzlies (Video) (Hardesty)

Gathering of Bears (Video)

Website:
WildCam: Bear, McNeil River Sanctuary
<www.nationalgeographic.com/bearcam>
Live video camera at the McNeil River Bear Sanctuary, Alaska.

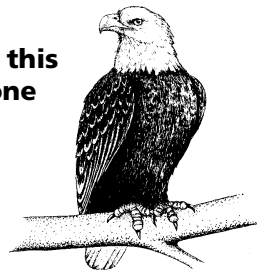
Teacher Resources:
(See appendix)



Bald Eagle Cards

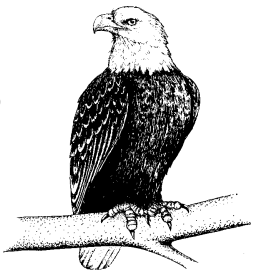
Remember, each eagle pair is represented by one student.

Year 1



Salmon runs are plentiful this year. All eagles produce one young.

Year 2



A. 1 young eagle is caught in plastic netting at a dump and dies of starvation. Biologists and community members work together to cover waste to keep this from happening again.

B. 1 young eagle flies into a power line and dies from injuries The utility company works with biologists to design power lines that won't hurt eagles in the future.

C. People shoot 2 adult eagles which they think are a threat to their pets and live-stock.

D. The remaining adult eagle pairs each produce 2 eggs. 2 pairs produce eggs with thin eggshells because they have DDT in their system and the eggs are crushed. The other pair(s) each raise 2 young.

Year 3

A. Loggers cut down 2 eagle nest trees in an area they are clear-cutting. 1 adult eagle pair finds a nesting platform. 1 pair cannot locate a new nest site and does not breed that year.

B. 2 adult eagles feed on waterfowl that swallowed lead shot. The lead shot was left when hunters missed ducks while hunting. The lead pellets fall to the bottom of lakes and ponds. The ducks swallow the lead shot along with their food to aid in digestion. Although hunters no longer use lead shot, old lead remains in ponds. The 2 eagles are poisoned by the lead in the ducks and die.

C. The remaining adult eagles produce eggs, but all eggs are crushed because of DDT poi-soning and thin eggshells. DDT is banned.

D. Biologists transplant 3 healthy eaglets from Alaska into nests of adult eagle pairs. 2 of the 3 young survive.

Year 4

A. Adult eagle pairs have very low levels of DDT, so they are able to raise 1 young each.

B. A pesticide spill in a stream kills many salmon, reducing the food supply for the eagles. 3 young eagles starve to death.

Brown Bear Cards

Year 1

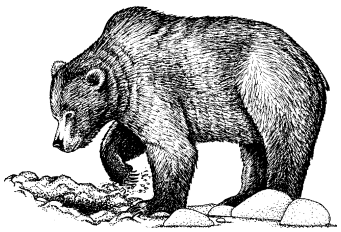
A. Food was fairly plentiful for bears last summer. 2 sets of twin cubs (4) were born during the winter.

B. The berry crop fails this summer and fish runs are smaller than usual. 1 female bear *(1 student)* searches for food in the garbage dump of a nearby town and becomes habituated to human food. The bear is killed by people fearful that the bear might hurt someone. The bear had twin cubs. The twins (2) die of starvation when they are unable to find enough food on their own to survive.

Year 2

A. Because of the lack of food during the summer, 1 sow *(1 student)* and 1 cub were not able to put on enough fat so they die of starvation during the winter.

B. 3 cubs are produced this year by the remaining bears.



Year 3

A. A mine is developed. The mine site, construction camp, and road system reduce the amount of habitat for bears. Bears crowd together in a smaller area to search for food. An adult male encounters a sow with a pair of young bears and chases them out of the area. The sow and the 2 cubs are not able to find suitable habitat. The 2 cubs die.

Year 4

A. Logging occurs in the area. The bears lose cover in the areas that are clear-cut. One adult bear *(1 student)* is shot near the logging camp when people encounter it and think the bear is going to charge.

B. 1 adult bear *(1 student)* is killed accidentally by a loaded logging truck on the logging road system.

C. For each remaining adult bear, 1 cub is born.

Habitat Roulette Results

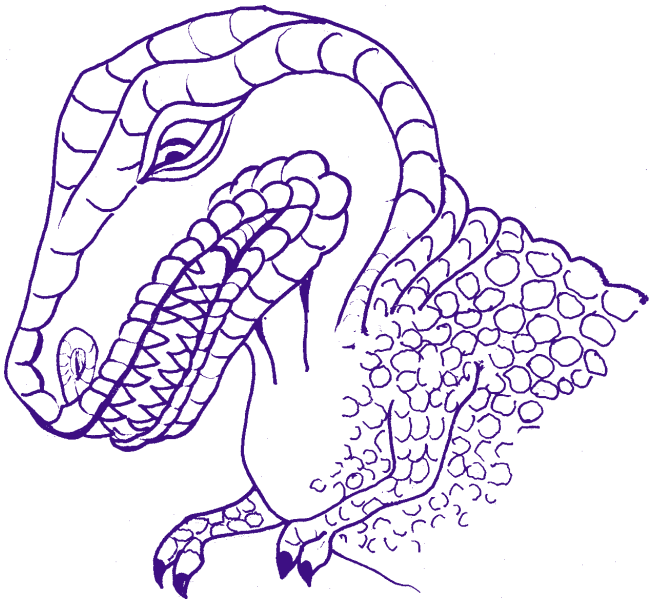
Examples of Class Organization

Class of 20			Teacher is recorder	
	Bald Eagle Population = 10		**Brown Bear Population = 10**	
	5 pairs of adults	5 unborn young	5 adults	5 unborn young
	Number of students standing		**Number of students standing**	
End of Yr. 1	5 pr.	5 young	4	2 young
End of Yr. 2	4 pr.	5 young	3	4 young
End of Yr. 3	3 pr.	7 young	2	2 young
End of Yr. 4	3 pr.	7 young	0	2 young
	Population = 13		**Population = 2**	

Class of 25			One student records	
	Bald Eagle Population = 12		**Brown Bear Population = 12**	
	6 pairs of adults	6 unborn young	6 adults	6 unborn young
	Number of students standing		**Number of students standing**	
End of Yr. 1	6 pr.	6 young	5	2 young
End of Yr. 2	5 pr.	6 young	4	4 young
End of Yr. 3	4 pr.	8 young	3	2 young
End of Yr. 4	4 pr.	8 young	1	3 young
	Population = 16		**Population = 5**	

Class of 30			One student recorder for each group	
	Bald Eagle Population = 14		**Brown Bear Population = 14**	
	7 pairs of adults	7 unborn young	7 adults	7 unborn young
	Number of students standing		**Number of students standing**	
End of Yr. 1	7 pr.	7 young	6	2 young
End of Yr. 2	6 pr.	7 young	5	4 young
End of Yr. 3	5 pr.	9 young	4	2 young
End of Yr. 4	5 pr.	9 young	2	4 young
	Population = 19		**Population = 6**	

Distant Thunder
5 EXTENSIONS



Section 3
WILDLIFE ACTIVITIES

Grade Level: K - 3

State Standard: S A-14

Subjects: Reading, science

Skills: Listening, observation, reading comprehension, vocabulary

Duration: 1-2 sessions

Group Size: Whole class or small groups

Setting: Indoors

Vocabulary: Dinosaur, extinct, extinction, food chain, habitat, predator, prehistoric, prey

Objectives:
1. Students will define "extinct" and "extinction."

2. Students will relate the changes in Alaska habitats to the extinction of animals.

Teaching Strategy:
Students read along or listen to a story about dinosaurs and participate in a group discussion of extinction.

Complementary Activities:
"Musical Habitats" *in this section*. "Habitat Grid," "Habitat Boxes," *and* "Who Am I?" *in Section* 1. "Population Posters," Don't Put All Your Eggs in One Basket," *and* "Hermit Crab Game" *in Section* 2.

Materials:
Thunderfeet: Alaska's Dinosaurs and other Prehistoric Critters by Shelley Gill and Shannon Cartwright and accompanying audiocassette with lyrics by Hobo Jim.

Note: The following page numbers are based on Thunderfeet. If this book is not available, a different dinosaur story book could be substituted and the questions modified.

Background:
See INSIGHTS *Section* 3, *When Populations Decline – Losing Biodiversity.*

Procedure:
1. Read the book *Thunderfeet* to your class or in reading groups. Be sure to show the students the colorful illustrations.

2. Ask the following questions after reading the text on the indicated page.

- *Page* 1: "Alaska's biggest critters roam this land no more." Can you think of a word that means that the **dinosaurs** are all gone? (**Extinct** - *if they have trouble remembering the word, have them think of "ex" by imagining x-ing something out.*)

- *Page* 5-6: Hadrosaur

What did the hadrosaur need to live? (**Water**, *Plants for* **food**, *forest for* **shelter** *and nest materials. Together these make up the hadrosaur's* ***habitat***.)

• *Page* 7-8: Troodon
What did troodon eat? (*hadrosaur eggs*)
What did the hadrosaur eat? (*plants*)
Can you describe a prehistoric **food chain**? (*plant-hadrosaur-troodon*)
Which animal is a **predator**? (*troodon*)
Which animal is the **prey**? (*hadrosaur*)

• [OPTIONAL: Play the first song on the tape, then ask what other animal eats hadrosaurs? (*tyrannosaurus*)]

• *Page* 9-10: Tyrannosaurus
What kind of animal was Tyrannosaurus? (*a predator*)

• *Page* 11: Ceratops
What kind of habitat did Ceratops need? (*horsetails for food, water, cypress forest for shelter*)

• *Page* 13-14: Plesiosaur
What happened to the dinosaurs in Alaska and everywhere else? (*They became* **extinct**, *but scientists don't know exactly how this occurred.*)

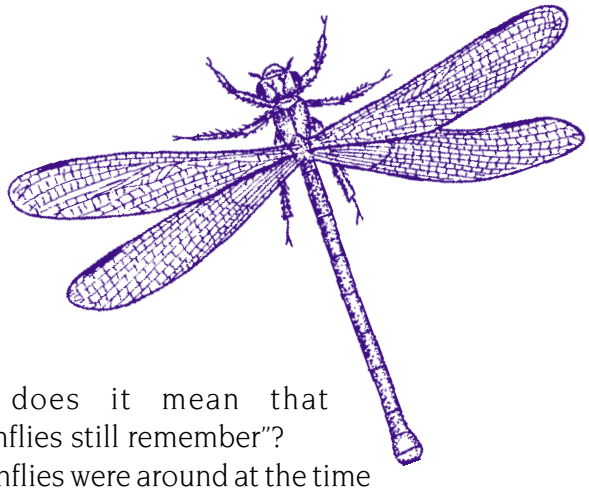
• *Page* 15-16: Mammals
Which animals in the picture survived after the dinosaurs? (*mammals*)
What familiar animal do you see that lived at the time of the dinosaurs? (*the dragonfly – turn back to pages* 5, 10, *and* 11 *to help students answer the question*)

• *Page* 19-20: Mastodon scene
Can you see any animals in this picture that you know are not extinct? (*moose*)

• *Pages* 19-24: Pleistocene animals
Were there other kinds of animals that once lived in Alaska that no longer live here? (*Yes, mastodons, camels, sloths, short-faced bears, mammoths, yaks, ponies, lions*)
What did these animals eat? (*The mastodon, sloth, pony, and camel are shown eating grass; the short-faced bear is shown chasing the camel; the narrative hints that lions eats ponies.*)

• *Page* 25-26: Camel/muskox scene
Do you see animals here that you know are not extinct? (*wolf, moose, caribou, muskox*) Do you see one that is extinct? (*Pleistocene camel*)

• *Page* 29 - 30:
What happened to most of the animals? (*They became extinct.*)



• What does it mean that "dragonflies still remember"? (Dragonflies were around at the time of the dinosaurs and they are around today.)

• If the dragonfly didn't go extinct, what do you think this means about dragonfly habitat? (*Dragonflies have been able to find food, water, and shelter in the right arrangement for all this time.*)

• What happened to the habitat of dinosaurs? (*It changed so that dinosaurs could no longer survive.*) Do you think there could be dinosaurs again?

3. Play the audiocassette of songs and help students learn the songs and sing along.

Evaluation:

Ask the following questions at the end of the story:
• Did dinosaurs live in Alaska? (*Yes!*)
• How do we know there were dinosaurs and other prehistoric animals in Alaska? (*Scientists have found their teeth and bones.*)
• If there were no more dinosaurs or woolly mammoths in Alaska but there were still some dinosaurs somewhere else, would they be extinct? (*No*)

EXTENSIONS:

1. **Art of extinction.** Create prehistoric animal art projects. To reinforce the understanding of the word "extinct," students could make buttons with an extinct animal illustration inside a circle with an "X" across it.

2. **Parade of prehistoric animals.** Using the "Let's Have a Parade" song on the *Thunderfeet* tape, have a prehistoric parade with students acting out the animals in the story. Students could make costumes based on the illustrations in *Thunderfeet*.

3. **Write story through dragonfly eyes.** Write a story that illustrates what a dragonfly would have seen living among the dinosaurs.

4. **Fossil field trip or guest speaker.** Contact local experts to find out if there is a field trip site in your area where your students could see fossils. Invite experts into your classroom to describe local fossils and their significance. If your class is in Fairbanks or can visit Fairbanks, take a field trip to the University of Alaska Museum to see the Blue Babe and mastodon exhibits.

5. **Dinosaur film time.** Watch videos and/or filmstrips about dinosaurs.

Curriculum Connections:

(See appendix for full citations)

Books:

Mammoth Mountain (Gill)

Thunderfeet (Gill)

Wild and Woolly Mammoths (Aliki)

A Woolly Mammoth Journey (Miller)

Media:

Prehistoric Animals (Video)

Thunderfeet (Audio Tape)

Website:

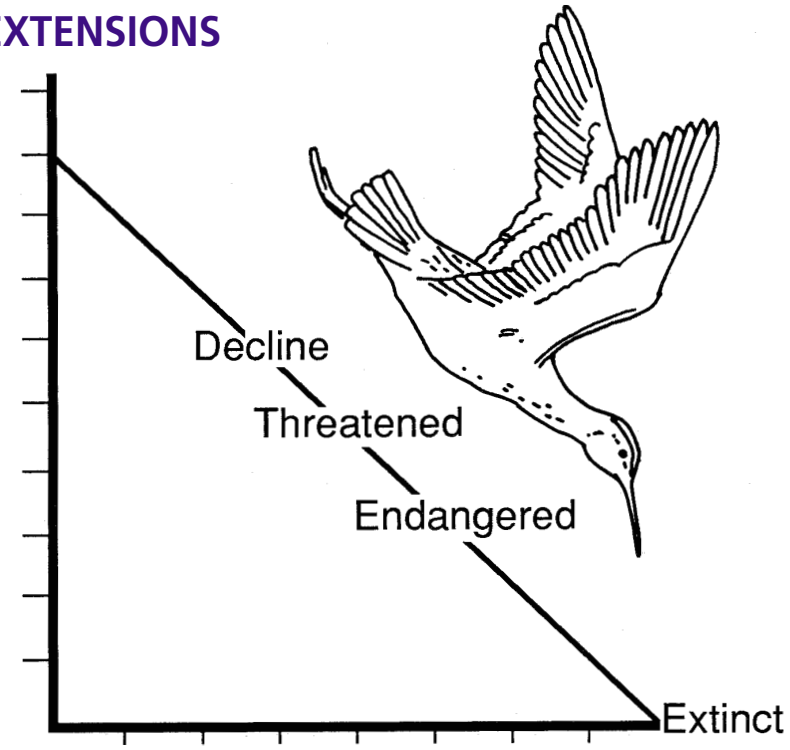
Dinosaurs on Alaska's North Slope <www.ak.blm.gov/ak930/akdino.html>

Teacher Resources:

(See appendix)

The Last Curlew

4 EXTENSIONS



Section 3
WILDLIFE ACTIVITIES

Grade level: 4 - 6
State Standards: L A-4, L A-5, L C-5
Subjects: Language arts, science, social studies
Skills: Classification, concept mapping, editing, personification.
Duration: 2 writing periods (library session optional)
Group size: 2-4
Setting: Indoor
Vocabulary: Endangered, extinct, extinction, individual, population, species, survival, threatened

Objectives:

1. Students will explain and describe the process of extinction.

2. Students will list three causes of extinction or endangerment.

3. Students will list three characteristics of extinct species.

Teaching Strategy:

Each students write a story in the first person as if they are the last individual of a species.

Complementary Activities:

"Habitat Grid" *and* "Interview a Muskox" *in Section* 1. "How Many Animals Live Here?" *in Section* 2. "Can Do!" *in Section* 4.

Materials:

"Eskimo Curlew," "Spectacled Cormorant," "Steller's Sea Cow" Fact Sheets (*in* INSIGHTS *Section* 3) and other resource materials (*see Curriculum Connections*).

Background:

See INSIGHTS *Section* 3, *When Populations Decline – Losing Biodiversity* "*Curlew*," "*Cormorant*," and "*Sea Cow*" *Fact Sheets*.

Procedure:

1. Introduce the terms **extinct**, **extinction**, **endangered**, and **threatened** from the fact sheets.

2. Tell students that in Alaska several kinds of wildlife became extinct after the Age of Dinosaurs 65 million years ago and at the end of the Ice Age (Pleistocene Epoch 10,000 years ago. Some others became extinct less than 300 years ago.

3. Students choose which fact sheet they would like to read. Students reading the same fact sheets meet in groups of 2 - 3 to study them.

VARIATION: Students research an extinct animal during library and computer lab periods.

4. Each group develops a concept-map using "bubbles" or lines (*see sample*) of the important events and factors that caused the species to become endangered or extinct.

5. Each student writes a story from the point of view of the last surviving member of the species. The story will describe the struggles of the animal to survive and the obstacles that stand in its way.

6. Students meet in groups of 2 - 4 for a writers' workshop in which the group reacts and comments on each story. Students then rewrite their stories based on the feedback from the writers' workshop.

7. Compile a class list of the different causes of extinction described in the fact sheets or other research. Make a second list of the characteristics of each species that made it vulnerable to becoming endangered or extinct. (*The sea cow, for example, needed a habitat that was only found in a small area. Also, the sea cow moved very slowly making it easy to kill by humans.*)

Evaluation:

1. Students' stories should reflect an understanding of extinction and factors that lead to it.

2. List three causes of extinction.

3. Choose an extinct species and list three characteristics that led to its extinction.

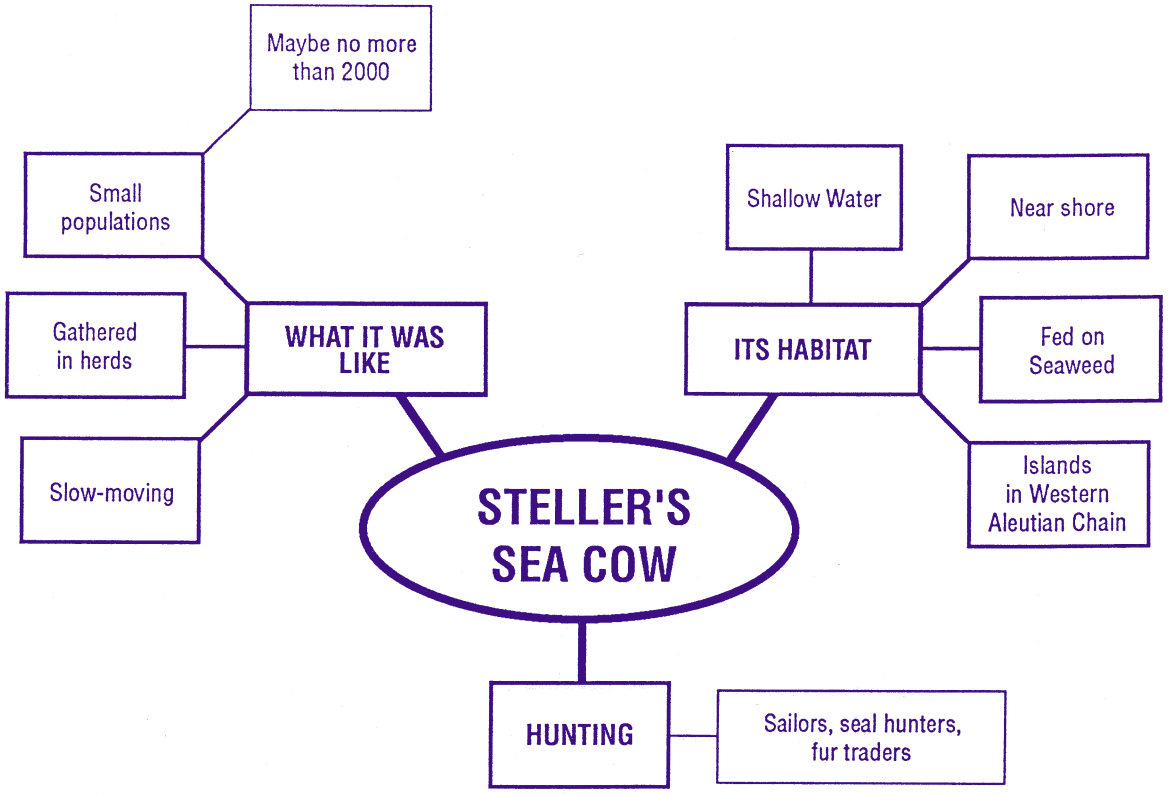
EXTENSIONS:

A. **Script good human behavior.** Students view the Star Trek movie "The Final Frontier" about the extinction of humpback whales. Rewrite the plot with human behavioral changes that allow the whales to survive.

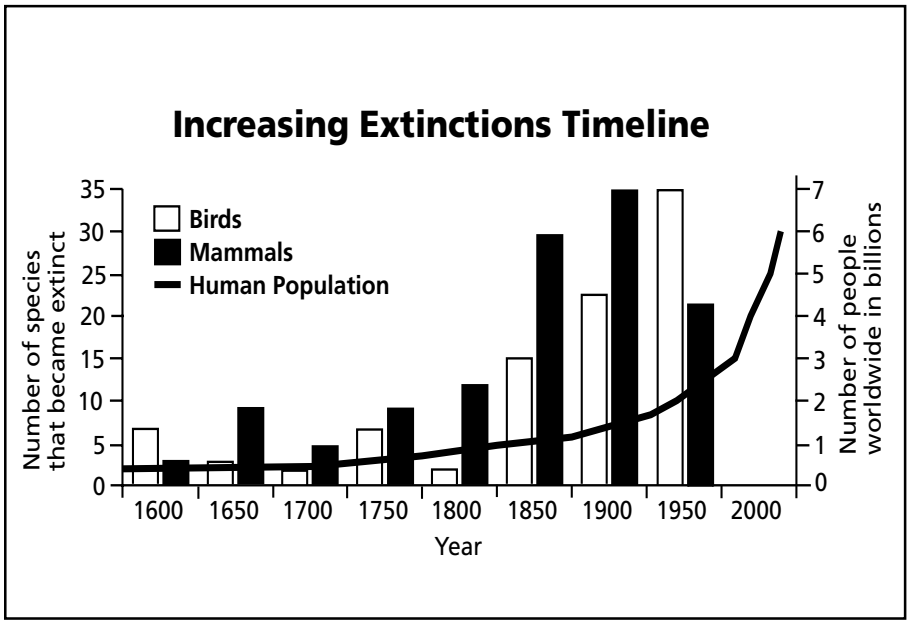
B. **Poetry for survival.** Students write poems about the survival of an endangered species.

C. **Research focus on extinct animals.** Students research other extinct animals.

D. **Audio experience.** Students listen to the "Song of Life" segment of NPR's *Life on the Brink* cassette and discuss the finality of extinction.



Gone Forever
4 EXTENSIONS



Section 3
WILDLIFE ACTIVITIES

Grade Level: 5 - 8

State Standards: L E-4, Geo E-5

Subjects: History, math, reading, science, social studies

Skills: Classifying, generalizing, graphing, summarizing

Duration: Two 30-45 minute sessions

Group Size: 2-4, whole class

Vocabulary: Endangered, extinct, population, species, threatened

Objectives:
1. Students will define *extinction*.
2. Students will give examples of extinctions from both natural and human causes.
3. Students will relate causes of extinction to extinct species.
4. Students will determine the extent to which humans have accelerated the rate of extinction.

Teaching Strategy:
Students create a timeline of extinct species in cooperative groups.

Complementary Activities:
"Habitat Roulette" *in this section*. "Habitat Grid" *and* "Interview a Muskox" *in Section* 1. "Population Explosions" *and* "How Many Bears Can Live in this Forest?" *in Section* 2.

Materials:
For each student: copy of "Extinction Timeline Worksheet" (*following*) and "Woolly Mammoth" Fact Sheet (*in* INSIGHTS *Section* 3).
For each group: copy of "Great Auk," "Passenger Pigeon," "Spectacled Cormorant," and "Steller's Sea Cow" Fact Sheet (*in* INSIGHTS *Section* 3).

Background:
See INSIGHTS *Section* 3, *When Populations Decline – Losing Biodiversity*: "*Auk*," "*Pigeon*," "*Cormorant*," "*Sea Cow*," and "*Woolly Mammoth*" *Fact Sheets*.

Procedure:
1. Discuss the concepts of **species** and **extinction**. *Scientists estimate that globally we now lose anywhere from* 100 *to* 1,000 *species each year.*

2. Ask students to list as many extinct species as they can.

3. Brainstorm a list of factors that might cause a species to become extinct.

4. Assign each group a historical time period (1750-1800, 1800-1850, 1850-1900, and 1900-1950). Have them work cooperatively (*sharing materials, assigning jobs or roles, etc.*) Give each group a fact sheet for the species that became extinct during its time period (*save the "Woolly Mammoth" Fact Sheet for later use*).

5. Group members read their fact sheets to learn why their species became extinct and discuss the factors leading to extinction.

6. Use the "Extinction Timeline Worksheet" to develop a timeline of extinctions on paper or computers showing the numbers of mammals and birds that became extinct in seven time periods (*see example*). Then, students identify the time period for their species and label their graph.

7. Each group shares the information it learned about why their species became extinct with the rest of the class. Place the names of the species the groups studied on the graph with an arrow to indicate the time period in which each became extinct.

8. Distribute copies of the "*Woolly Mammoth" Fact Sheet* and give students time to read it. Discuss the different causes of extinction the students have learned from all of the fact sheets. Compare the potential causes of the prehistoric extinction of the woolly mammoth with the potential causes of extinctions during historic times.

9. Ask students whether the numbers of bird and mammal extinctions are increasing or decreasing and why this might be happening. (*Increasing — the current rate far exceeds that of the last 65 million years.*)

10. Show the class the graph of the growth of the world's human population and relate it to the graph of bird and mammal extinctions. *The accelerated rate of extinction has been directly linked to the exploding human population and to the high rate of natural resource consumption by the industrialized world.*

11. Generate a list of characteristics of species that would make them vulnerable to extinction (*examples: demand by humans, unable to adapt rapidly to environmental changes, migratory habits, small populations, low birth rates*).

Evaluation:

1. Define *extinction*.
2. Give examples of extinctions from both natural and human causes.
3. Give examples of ways humans have accelerated the rate of extinction.
4. Give students three examples of human actions that can slow the rate of extinction.

EXTENSIONS:

A. **Research endangered species.** Conduct a library and Internet research project on an endangered species. Hold a mini-symposium to present student findings.

B. **Current extinctions.** Students research the last 50 years, identifying what species have gone extinct including hypotheses or why extinction occurred.

C. **Tropical forest extinctions.** Many people are concerned about the rate at which the tropical rainforest is being logged and cleared for timber products, farming, ranching, mining, and other development. This is occurring at a rapid rate in Central and South America and in South Pacific and Asian countries such as Indonesia. Have your students research the tropical rain forest ecosystem and the issues of deforestation and wildlife loss.

D. **Math problems: extinction.** E. O. *Wilson, an expert on biodiversity, has estimated the extinction of species in tropical forests as high as 17,500 species each year at the current rate of deforestation. (Of 10 million species worldwide, 5 million species occur in these rainforests.)*

- Using the above information, calculate the annual rate of extinction in the rainforest resulting from this type of habitat loss each year (*Answer: approximately 1 species per 1,000 species per year*).
- Compare this rate to past global extinction rates of 1 species per 1 million species per year or 1 species per 10 million species per year (*1,000 to 10,000 times higher*).
- If the current rate of deforestation continues, the tropical rain forests will be eliminated by 2135. Ask students to calculate their age in 2135, when the rainforests are predicted to disappear.

4. **Make a poster with the facts.** Make a poster about one of the species which answers all the following questions about its extinction: who, what, where, when, why, and how?

Extinction Timeline Worksheet

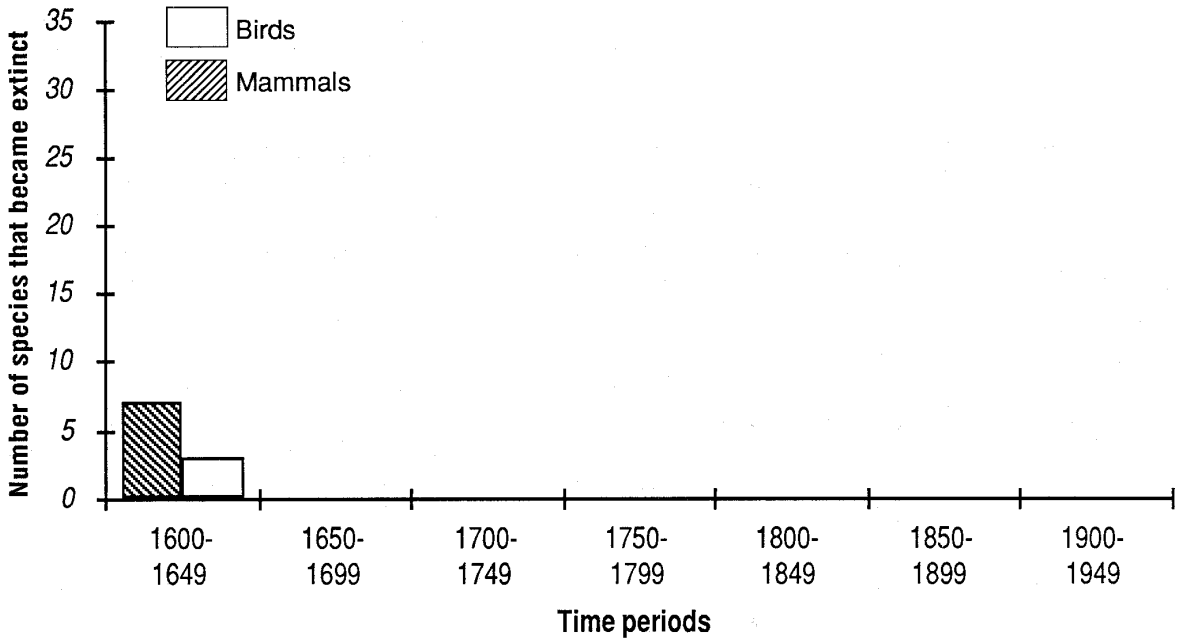
DATA:

Number of species of birds that became extinct:

Between 1600 and 1649: 3
Between 1650 and 1699: 9
Between 1700 and 1749: 5
Between 1750 and 1799: 9
Between 1800 and 1849: 12
Between 1850 and 1899: 29
Between 1900 and 1949: 35

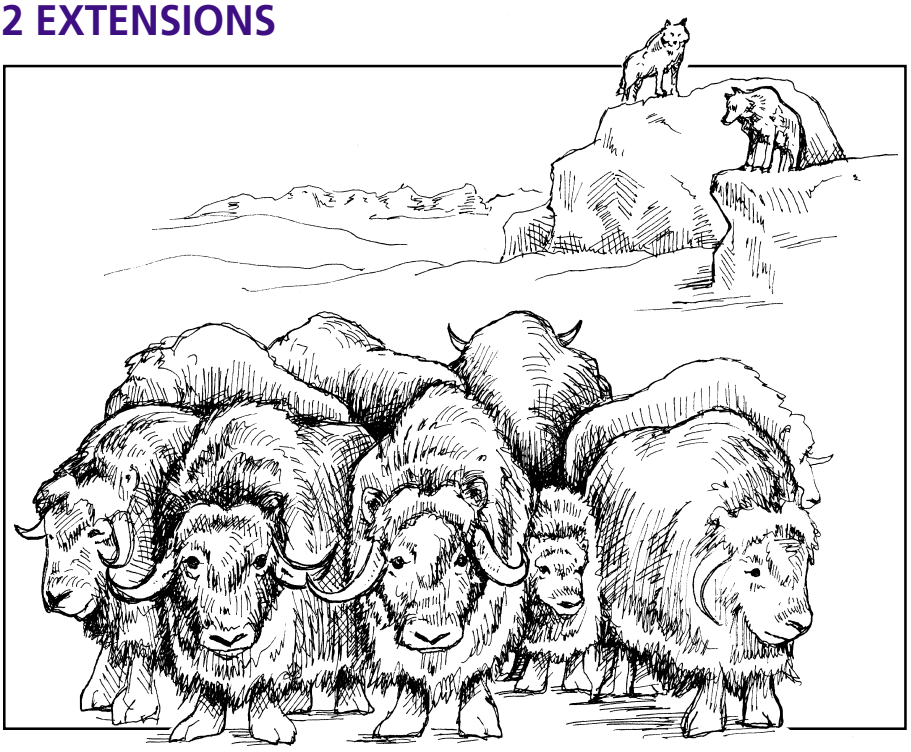
Number of species of mammals that became extinct:

Between 1600 and 1649: 7
Between 1650 and 1699: 3
Between 1700 and 1749: 2
Between 1750 and 1799: 7
Between 1800 and 1849: 2
Between 1850 and 1899: 15
Between 1900 and 1949: 22



Muskox Returns to Alaska

2 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 4 - 9
State Standards: S A-14
Subjects: Science, physical education
Skills: Analysis, description, discussion, evaluation, generalization, kinesthetic concept development, observation, psychomotor development
Duration: 20-35 minutes
Group Size: 15-50 (following based on 33)
Setting: Outdoors
Vocabulary: Adaptation, bag limit, defense, game, limiting factors, management, predator, prey, sustain

Objectives:

1. Students will evaluate the effectiveness of some adaptations in predator/prey relationships.

2. Students will describe the importance of predator/prey relationships as limiting factors in wildlife populations.

3. Students will understand the need for wildlife management.

Teaching Strategy:

Students simulate muskoxen and wolves in a physical activity and then add humans to game.

Complementary Activities:

"Wildlife Use Interview "*and* "Eye of the Beholder" *in this section*. "Habitat Grid" *and* "Interview a Muskox" *in Section* 1. "Graphic Populations," "Predator-Prey Predicaments" *and* "How Many Bears Can Live in this Forest?" *in Section* 2

Materials:

Two colors of flags/flagging tape/or colorful rags – as many as there are wolves and calves.

Background:

See INSIGHTS *Section* 4, *Wildlife Conservation* Is *Up to Us*! "*Muskox Returns to Alaska*" Fact Sheet and "*Teacher's Guide for Dealing with Differing Viewpoints*."

NOTE: This activity does not illustrate all the complexities of predator/prey relationships; however, it does illustrate broad concepts and (in step 6 and beyond) the need for hunting regulations.

Procedure:

IN ADVANCE, decide on a location for the game. This is a highly involved activity! It is best done outdoors, in an open, grassy area. It is possible to do the activity indoors – even in a classroom if tables, chairs, and desks can be moved to create a large space for movements including "tag-like" running.

1. Using the table as a guide, divide your students into the four animal roles. (*For example, a group of* 33 *students would break down into three wolves, six bulls,* 12 *cows and* 12 *calves*.) Each will have a distinctive behavior.

Total Players	Wolves	Bulls	Cows	Calves
15-18	2	3	Equal number or one more cow than calf	
19-28	2	4	"	"
29-35	3	6	"	"
36-45	4	8	"	"
46-50	5	10	"	"

Cows:
The cows should choose a lead cow to watch for **predators**. The cows should pick a signal that the lead cow will use to warn the herd of the approach of predators.

- When the lead cow signals that predators are near, all the cows move to form a circle around the calves to protect the calves. With the calves in the center of a circle, the cows stand with their backs to the calves, facing outward to watch the wolves.
- The cows can move very little. Mostly, they stay firmly in one place, moving their upper bodies to block the wolves from reaching the calves.
- The cows cannot touch the wolves with their hands or feet.

Calves:
Calves typically stay close to their mothers, but the animals do not always stay clustered – except when predators appear!

- The calves depend on the cows for protection. Each calf holds onto a cow with both hands around the cow's waist.
- They only follow the cow's lead. Calves cannot influence the cows' movement.

Bulls:
In this game (*for classroom management and safety*), the bulls are the active defenders of the cows and the calves. (I*n nature, both sexes vigorously defend the young.*)

- As the predators near, the bulls form a circle around the cows (who in turn are forming a circle around the calves). The bulls form as tight a circle as they can around the cows and calves, never any farther than one step in front of the circle of cows.
- The bulls can move – but only in a clockwise direction around the circle of cows.
- The bulls can use their hands. As the wolves attack the herd, the bulls try to "kill" them by pulling the flag out of their back pocket, or wherever the flag is attached to the wolf.
- When a bull kills a wolf, the wolf moves off to the side, "dead," to watch the remainder of the activity.

Wolves:
Wolves begin the activity out of sight of the herd. They try to get as close as possible to the herd without being detected.

- Wolves typically work as a unit so they can plan a strategy for surprising the herd in order to kill the calves for food.
- The wolves are mobile, able to move at any time in any direction.

They can use any maneuver (*except pushing and shoving*) to break the herd's defenses.

- Once a wolf kills a calf – by pulling the calf's flag out of its pocket – temporarily stop the game and move the calf's carcass to the side, where it too can watch the remainder of the activity.

Sound Effects: This is not a quiet activity much of the time. Wolves should be howling – communicating – with each other in predetermined ways as signals and as part of their tactics to startle and confuse the muskoxen. The muskoxen grunt and snort loudly.

SUMMARY OF THE GAME:
2. Start the game with the muskox herd spread out and grazing quietly. Wolves are out of sight of herd. Wolves move in to attack herd. When lead cow spots wolves, the herd begins **defense**. A circle is formed, with calves in the center, cows facing out in a circle around the calves, and bulls in an outer circle, also facing the wolves. Each should behave appropriately, as described above.

3. A round can end in several ways:
Several wolves are injured or killed.
The wolves give up in frustration with no success in killing a calf.
The wolves could kill one or more calves and settle down to eat as the herd moves away.

4. After the excitement and enthusiasm have peaked, sit down with the students to discuss what happened and what the game represents in terms of (a) animal **adaptation**, (b) predator/**prey** relationships, and (c) **limiting factors**.

5. Ask the students to describe and evaluate the predatory behavior of the wolves and the various defense behaviors of the muskoxen. What would happen if the wolves could not get into the herd? What would happen if the wolves always got into the herd? Ask the students to distinguish between what would be actual behaviors of muskoxen contrasted with their behaviors in this activity.

6. Play the game again (*this round will be very short*) introducing **hunters** with guns.
- Hunters are given no restrictions on their **bag limit.**
- All muskox have flags for this activity.
- Hunters approach the herd, which moves into formation when alerted.
- Hunters kill muskoxen by calling out their names.
- When a muskox hears its name, it drops its flag and dies.
- This round ends when all the muskoxen are dead.

7. Discuss the history of muskoxen in Alaska (*from* INSIGHTS S*ection* 4). Explain that over-hunting, while not the sole source of population decline, was a major factor. The **adaptation** muskoxen have against natural predators does not work against a rifle. What then is the human responsibility towards muskoxen now that reintroduction of these animals has been successful?

NOTE: C*reate a discussion atmosphere where students with differing viewpoints can talk about their views regarding hunting. Discuss what is currently allowed by law* (hunting by limited permits, determined by the Board of Game).

FOR OLDER STUDENTS

8. Explain the Alaska Board of Game process, hunting regulations, bag limits, and hunting permits.

9. Play another round where the class sets an appropriate number of hunters. If each hunter's bag limit is one bull muskox, how many bulls can hunters remove from this herd while **sustaining** the population?

10. On a chart, take note of the population (number) of male muskox, female muskox, wolves, and hunters.

11. Play another round with hunters harvesting their allowed bag limit of muskox. Wolves continue their role as before.

12. After that round, count the number of wolves and mark this on your population chart. Count the number of male muskox, female muskox and hunters. Has the muskox population declined? Were male or female muskox killed? Explain that if female muskoxen were killed, the herd has lost future calves.

13. Next, for each surviving female, add one more muskox to your population count to represent next year's offspring. Did the bag limit allow hunters and wolves to hunt while keeping the herds' population **sustainable**? Explain that if too many muskox are killed, their population will decline and require additional wildlife management.

Evaluation:

1. Name a prey species and its predator species. Describe how each is adapted to the other. How does the prey protect itself? How does the predator overcome this protection? Describe the overall effectiveness of each animal's adaptations.

2. Discuss the responsibility of people towards wildlife populations. What role do bag limits and hunting regulations play in maintaining wildlife for the future?

EXTENSIONS:

A. **Research local wildlife management.** Following the last step, lead the class in a brief discussion about wildlife management. Instruct students to select and investigate management issues related to a specific, local **game** population, answering the following questions:
- What has been the population trend?
- How is population information gathered?
- What is this population's typical reproduction rate?

- How does weather affect these animals and what have been the weather trends in relation to the population trends?
- What other natural factors impact this population?
- What human factors affect these animals?
- What have wildlife managers done to maintain a healthy population?
- How large can this population grow without forcing a rapid decline (due to starvation, disease, etc)?
- What current regulations impact this population?
- When students have gathered this information, ask the class to determine what is needed to sustain the population they are investigating. What are the implications of their ideas?
- Invite a biologist into your class to discuss this topic. If that is not possible, write a class letter to a local/regional biologist stating the class' findings and asking for feedback.

B. **Research muskox history and display on map.** Students research more details about the life and history of muskoxen, wolves, and humans – acquiring information about survival needs, habitat, behaviors, and population numbers. As a class or individually, students make a large range map showing the populations of muskox in Alaska. Add their research in text, drawings, and photographs about these amazing animals. Display this map in the class, hall, or library.

Credits:

Adapted from "Muskox Maneuvers," P*roject* WILD K-12 A*ctivity G*u*ide*, Council for Environmental Education, Boulder, CO, 1992. Modified by Robin Dublin, Alaska Department of Fish and Game, Anchorage, Alaska.

Curriculum Connections:

(See appendix for full citations)

Books:

A *is for* A*rctic* (Lynch)

A*laska* W*ildlife* N*otebook* S*eries* (ADF&G)

A*rctic* A*nimals* (Kalman)

M*oose, Caribou and Musk Ox* (Alaska Geographic Society)

Websites:

A*laska* H*unting* R*egulations* <www.state.ak.us/adfg>

A*laska* S*cience* F*orum* <www.gi.alaska.edu/ScienceForum>

A*laska* W*ildlife* N*otebook* S*eries* <www.state.ak.us/adfg>

M*uskox* N*atural* H*istory* <www.muskoxfarm.org>

Teacher Resources:

(See appendix)

Our Place in the Food Web
1 EXTENSION

Section 4
WILDLIFE ACTIVITIES

Grade Level: 7 - 12

State Standards: S A-14, M D-1, M D-2

Subjects: Language arts, mathematics

Skills: Critical thinking, cooperation, role-playing, communication, writing

Duration: 5 sessions

Group Size: 4 work groups (or more)

Setting: Indoors

Vocabulary: Conservation, food, habitat, perishable, preservation, shelter, space, sustainability, water

Did you know?

The average piece of food in the United States travels 1,300 miles from where it is produced to your table.

Human population has increased by as much in the past 30 years as it did in the 100,000 years prior to the mid-20th century.

Objectives:
1. Students will understand that people as well as animals need food, water, shelter, and space to survive.

2. Students will understand what ecological costs are involved in attaining food.

3. Students will support their opinions relating to food and wildlife with factual information.

Teaching strategy:
Students will work in small groups and then role-play using a hypothetical situation to determine how to efficiently feed a community with the least impact to the environment.

Complementary Activities:
"Habitat Grid" *in Section* 1. "Population Explosions," "Graphic Populations," *and* "How Many Bears Can Live in this Forest?" *in Section* 2. "Exploring Wildlife Issues" *and* "Can Do!" *in this section*.

Materials:
For each student: copy of "*Feeding Our Planet Task Force*" worksheet (*following*), paper and pens, resource information on food production.
For class: chalk board or butcher paper, global map.

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation* Is Up *to* Us! "Our Place in the Food Web" and "Teacher's Guide for Dealing with Differing Viewpoints" *Fact Sheets*.

Procedure:
IN ADVANCE, *review the fact sheet "Teacher's Guide for Dealing with Differing Viewpoints."*

DAY ONE
1. Set the stage by reminding students that in their life time the Earth's human population will double, at the current rate of growth. Give each student the "Feeding Our Planet Task Force" worksheet.

2. Facilitate the breakdown into four (*or eight, if you want smaller groups*) subcommittees and assign (*or ask students to self-assign*) one of the four worksheet

proposals to each group. Provide ample time for students to evaluate their proposal strengths and weaknesses and to agree on a recommendation.

3. Instruct each subcommittee to record its findings for all to see on a large chart or centrally located board.

4. Give each group about five minutes to present its analysis and recommendations without comment from other task force members.

5. Following the presentations, facilitate a class discussion to find the best solution for the colony under the given circumstances.

DAY TWO
1. Review the scenario of the first session including the task force's final solution.

2. Ask students to write down what they ate for breakfast, lunch, and dinner the previous day.

3. Ask students to determine energy and habitat costs for the foods on their new list. Include production, harvest, preparation, and transportation. *Our foods require production costs that we often overlook (packaging, transportation between processing steps, etc.).*

4. Ask students to research where these foods came from using books, the Internet, etc. Ask students to be as thorough as possible. You may choose to give an example to demonstrate thorough thought.

5. Instruct students to mark where their foods were produced on the global map. Ask students to define development. Development has positive and negative impacts on wildlife. Ask students to identify some of these impacts.

6. Explain that, in many ways, Alaska is similar to the planet colony of the previous day's worksheet. Lead a discussion on the choices Alaskans make in foods produced locally, regionally, nationally, and internationally. *These choices impact wildlife and wild places in a variety of ways. No matter what we eat, our food comes from the Earth. The question of choice gives each of us the opportunity to lessen or increase our impact.*

Evaluation:

Instruct students to write an opinion piece on their food choices and what they believe is the best way for them to eat, taking into account the costs to the environment for their food, and the following:
- their personal and family values and traditions relating to food.
- their geographical challenges (food transportation, financial costs, ability to harvest food locally).
- ways in which their future choices will minimize costs to wildlife locally and globally.

Grade the opinion piece on its clarity and the depth of support information included.

Credits:

Adapted from "The Feeding Ecology of Alaskans" by Tom Paragi, Alaska Department of Fish and Game, Fairbanks

EXTENSION:

Invite guest speakers. Invite community members involved in food production or distribution to speak to your class: *for example*, farmers, grocery store representatives, air freight companies, fishers, hunters, food banks, or soup kitchens.

Curriculum Connections:

(See appendix for full citations)

Books:

Food (Meltzer)

Food: the Struggle to Sustain the Human Community (Goldberg)

Future Word (Angliss)

Websites:

Food, Land, and People <www.foodlandpeople.org>

Worldwatch Institute <www.worldwatch.org>

Teacher Resources:

(See appendix)

Worksheet: Feeding Our Planet Task Force

Welcome to the task force. You have been selected for your creativity, integrity, and willingness to solve problems. Your task is as follows:

It is the year 2025. Scientists have discovered a planet in another solar system closely resembling Earth! This new planet has animals, plants, and an atmosphere like ours. There is little doubt that humans can live on this new planet, uninhabited by other human or humanoid life forms.

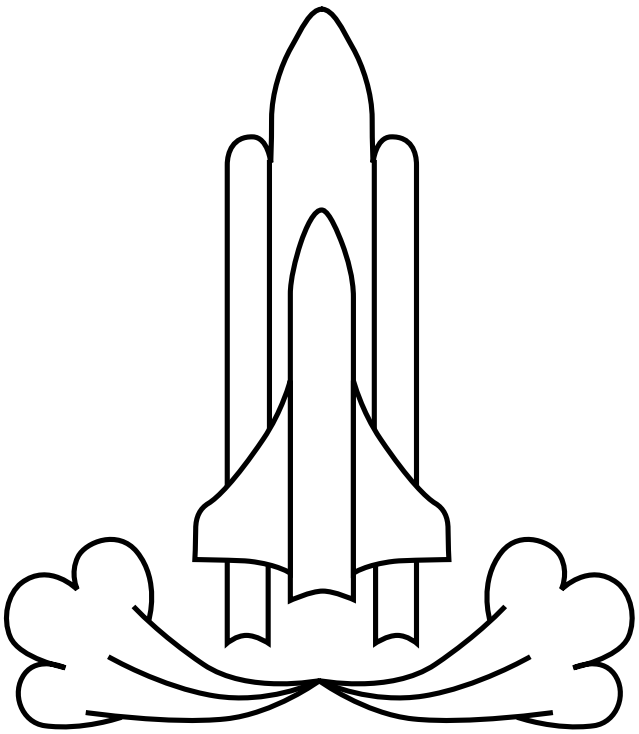
Earth's human population is nearing 10 billion with food, clean water, shelter, and space becoming increasingly limited. An experimental colony of 1,000 people is sent to this new planet.

Upon arrival to this new colony, colonists begin debating how best to provide a long-term food supply. The colony has been instructed by authorities on Earth to seek an "ecologically appropriate" solution to the food issue.

Your job as committee task force members is to find a food solution that has the least impact to both Earth and this new planet.

Colonists have provided the four proposals for your committee to consider. As a committee, you are authorized to develop a solution using these proposals, or to create a new solution.

Please use the following assumptions and ground rules:
(a). Food cannot yet be created in a laboratory setting. Research continues but a solution is still years away.
(b) You cannot suggest a process that will cause complete extinction of a wild plant or animal species on either planet.
(c) All fossil fuel must come from Earth at this time and the future until further exploration of the new planet is complete.



- The fuel allotment for the colony is 400 units per year.
- One space shuttle payload can carry four months of food for the colony.
- Survival needs in addition to food (heat, lighting, etc.) require 100 units of fuel per year.
- Food transportation by space shuttle from Earth occurs in one of two ways: moderately fast for **non-perishable** foods (50 units of fuel per trip), and fast for **perishable** foods (100 units of fuel per trip).

The following proposals have been offered by members of the colony for the task force to consider:
1 The colony will rely on food imported from Earth with a diet based largely on plants (grains, beans, fruits, and vegetables). Farmers on Earth will produce these crops.

2. The colony will rely on food grown locally, a diet based largely on plants (grains, beans, fruits, and vegetables).Land on the new planet will be cleared for this agriculture. Few wild plants will be harvested.

Worksheet: Feeding Our Planet Task Force - Cont.

3. The colony will rely on food imported from Earth using meat at the primary protein. Meat will come from the Earth's domesticated animals on farms, ranches, and the open range.

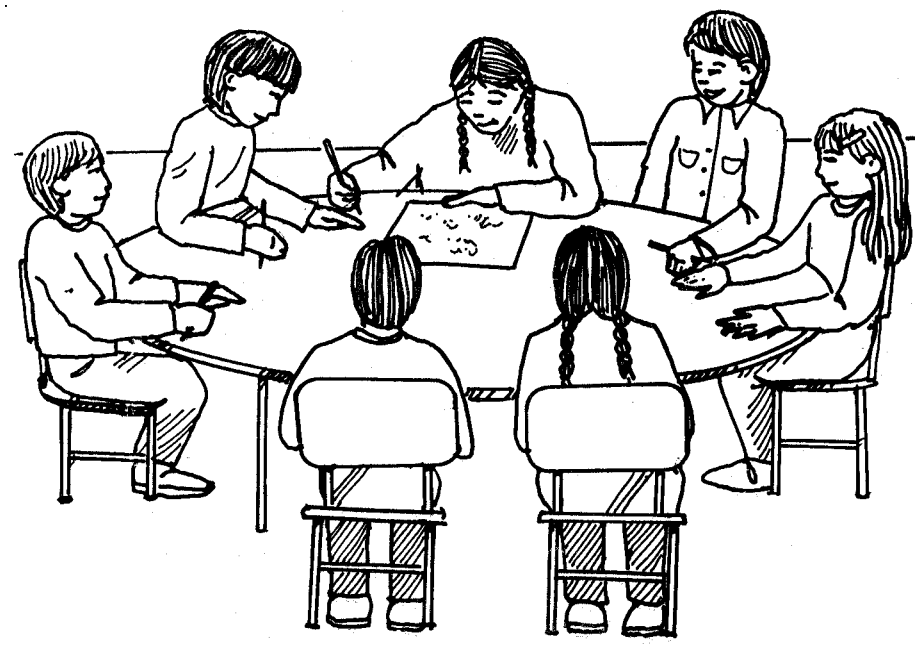
4. The colony will rely on local meat harvested from the new planet's wild and newly domesticated animals.

Your first task is to evaluate the proposals for strengths and weaknesses. Your subcommittee will take **one** of the above proposals, evaluate it, and report back to the larger task force (*the whole class*).

The task force will create a large chart (*similar to the illustration*) of these findings and recommendations. After the results are tallied, the all the members of the task force will determine if one of these solutions is preferable or if a compromise solution is best.

Note: Habitat loss includes food, water, shelter and space) **Imported plant diet** **Local plant diet** **Imported meat diet** **Local meat diet**	**FEEDING OUR PLANET TASK FORCE** **Subcommittees**			
	Imported plant diet	**Local plant diet**	**Imported meat diet**	**Local meat diet**
Production Costs: ❑ Energy ❑ Habitat loss				
Harvest Costs: ❑ Energy ❑ Habitat loss				
Preparation Costs: ❑ Energy ❑ Habitat loss				
Transportation Costs: ❑ Energy ❑ Habitat loss				
Conclusions: (Pro and con)				

Ethi-thinking
1 EXTENSION



Section 4
WILDLIFE ACTIVITIES

Grade Level: K - 8

State Standards: Geo E-5, Geo E-6, CS A-4, CS E-2

Subjects: Language arts, social studies, science

Skills: Analyzing, describing, discussing

Duration: 30 minutes

Group Size: Any

Setting: Indoors/outdoors

Vocabulary: Affect, harm, wildlife

Objective:
Students will evaluate the effects of their actions on wildlife.

Teaching Strategy:
Students generate a list of activities that can help or harm wildlife.

Complementary Activities:
"Habitat Grid" *in Section* 1. "Musical Habitats" *and* "Last Curlew" *in Section* 3.

Materials:
Large paper or chalkboard.

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation* Is Up *to* Us!

Procedure:
1. Students brainstorm things that people do that **affect** wild plants or animals. Make two columns on the board. Label one "Things that **help** wildlife" and label the other "Things that **harm** wildlife."

Positive examples: leaving bird nests alone, feeding birds during the winter, staying away from breeding areas, cleaning up human-made hazards. Negative examples: littering and leaving garbage exposed, feeding wild animals, harassing wildlife, driving vehicles across sensitive habitat.

2. Post the chart for reference during other activities.

Evaluation:
1. Illustrate examples of people doing harmful and helpful things for wildlife.

2. List five things people do that harm wildlife. For each item, describe what other people can do about it.

EXTENSION:
Focus on habitat. Students brainstorm actions that affect the habitat of a particular animal.

Credit:

Adapted from "Ethi-Thinking," *Project Wild* K-12 *Activity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

50 *Simple Things Kids Can Do to Recycle* (EarthWorks Group)

Kid's Guide to Social Action (Lewis)

Our Endangered Earth: What We Can Do to Save It (Langone)

Reducing, Reusing and Recycling (Kalman)

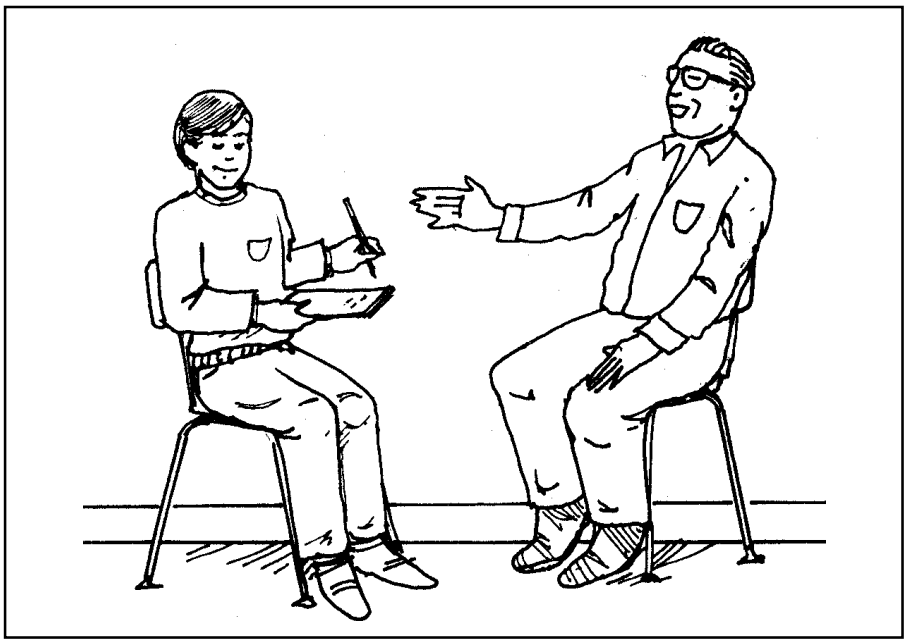
Taking Care of the Earth (Pringle)

Teacher Resources:

(See appendix)

Wildlife Use Interview

4 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 3 - 8

State Standards: L E-4, Geo E-4

Subjects: Language arts, science

Skills: Analyzing results, interviewing, recording data, writing a letter, writing questions

Duration: 2 class periods; out of class interviews

Group Size: Individual

Setting: Community

Vocabulary: Career, interview, survey, wildlife appreciation

Objective:

Students will describe different ways that Alaskans benefit from Alaska wildlife.

Teaching Strategy:

Students conduct an interview and report the results in the form of a letter or video to the persons interviewed.

Complementary Activities:

"Eye of the Beholder," "Science, Technology, Society, and Wildlife," *and* "Our Place in the Food Web" *in this section*. "How Many Bears Can Live in this Forest?" *in Section* 2.

Materials:

Writing paper, poster paper.
OPTIONAL: tape recorder and tapes, video camera and film, still camera and film.

Background:

See INSIGHTS *Section 4, Wildlife Conservation Is Up to Us!* "*Teacher's Guide for Dealing with Differing Viewpoints*."

Procedure:

IN ADVANCE, review the "Teacher's Guide for Dealing with Differing Viewpoints."

1. Discuss ways humans use wildlife by brainstorming categories of use (*such as clothing, food, viewing, and recreation*). Older students can brainstorm questions about economic uses of wildlife.

2. Prepare the class for conducting interviews to find ways that wildlife are used in your community. Ask students to predict what they might find.

3. As a class, generate questions for the interview. Select the most important questions and choose the appropriate number of questions for the grade level.

4. Using a computer, create an interview sheet with the final questions and make enough copies for each student (*see following example "Wildlife Interview Worksheet"*).

5. Students select a person or persons in their community to interview. If available and appropriate, include long-term residents and Native elders from

the community. Be sure to plan the activity in advance to demonstrate respect and provide forewarning.

6. Prepare students for the interviews by rehearsing questions. Discuss possible ways to record interviews (*including writing down answers, tape recording, videotaping, still photography*).

7. After the interviews, use poster paper to generate category headings for the types of uses. E*xamples might be "Food," "Furs," "Jobs," "Recreation," and "Art."*

8. Ask students to tally the number of people interviewed whose use of wildlife is described by the various categories (*see following example "Tally Poster for Results"*).

9. Lead a discussion about the interview results. Write the main conclusions on the board.

10. Students write letters or make video reports to the people they interviewed explaining the class results (a class letter will work for younger children). If an elder is interviewed, brainstorm items to be shared or things to do for the elder to show thanks.

Evaluation:

1. Students draw a picture or write a story titled "Wildlife in My Life." The pieces should describe ways of using or enjoying wildlife in their community.

2. In five minutes students list as many ways as they can that wildlife is used in their community.

EXTENSIONS:

A. **List by time frame.** Students make a list ways that people in their community use or enjoy wildlife over time (*a single day, a single year, and the lifetime of an individual*).

B. **Invite a guest speakers.** Invite members of the community to come talk to your class about how they use or enjoy wildlife.

C. **Compile a wildlife use map.** Include a local map as part of the interview form. Students ask the interviewees where they use or enjoy wildlife. Then, compile a local Wildlife Users' Map, recording local place names. Discuss any threats to wildlife habitat in these areas.

D. **Make rural-urban comparisons.** Swap information with an urban or rural class to complement and compare to information gathered locally. Discuss how the similarities and differences might impact statewide decisions regarding wildlife?

Curriculum Connections:

(See appendix for full citations)

Books:

Living with Wildlife in Anchorage: A *Survey of Public Attitudes* (Whittaker)

Websites:

Alaska Board of Game <www.state.ak.us/adfg>

Alaska Native Heritage Center
<www.alaskanative.net> Links to Native groups. Select Education, the Resources for links.

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

Alaska Trappers Association
<www.alaskatrappers.org>

Ducks Unlimited <www.ducks.org>

Environmental News Network <www.enn.com>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Teacher Resources:

(See appendix)

Wildlife Interview Worksheet

My name is _____

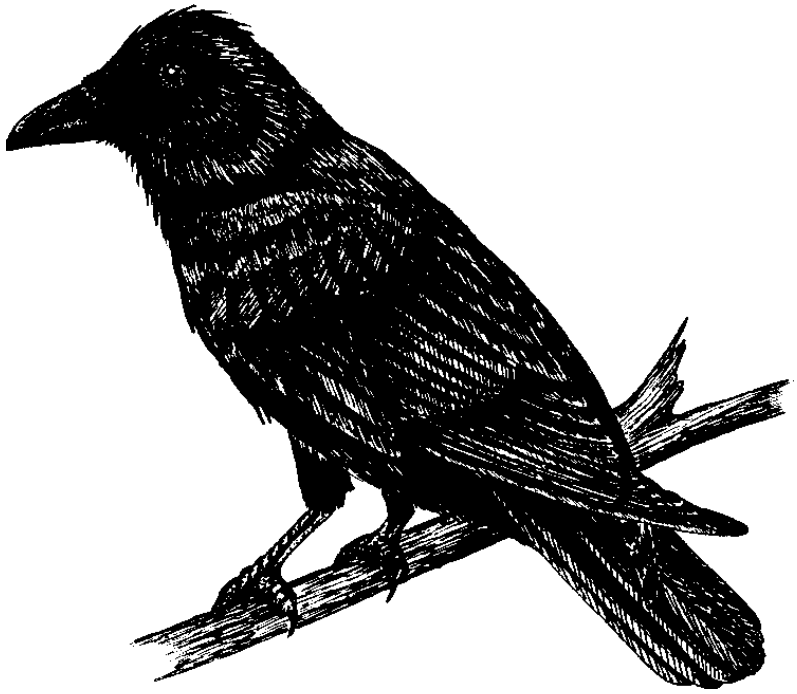
Interviewed _____ **Date** _____

		YES	NO	
1.	**Do you eat wildlife?**	____	____	**What species?** _____
	Do you hunt?	____	____	**What species?** _____
	Do you share your harvest?	____	____	
2.	**Do you wear fur clothing?**	____	____	**What kind?** _____
3.	**Have you ever trapped?**	____	____	**What species?** _____
	For your own use?	____	____	
	To sell?	____	____	
4.	**Does your job depend on wildlife?**	____	____	**How?** _____
5.	**Have you ever photographed wildlife?**	____	____	**What species?** _____
	For your own use?	____	____	
	To sell?	____	____	
6.	**Do you spend time with wildlife to have fun?**	____	____	**In which activities?** _____
7.	**Do you use wildlife to create art?**	____	____	**What types of art?** _____
	For your own use?	____	____	
	To sell?	____	____	

Tally Poster for Results

	Food	Fur	Trapping	Job	Photo	Fun	Art
Yes							
No							
To Sell							
To Keep							

Eye of the Beholder
5 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 4 - 9
State Standards: L E-1, L E-4, S B-1, S B-2, CS B-2
Subjects: Science, language arts, visual arts, social studies
Skills: Analysis, comparing and contrasting, communication, imagination, observation, presentation, reading
Duration: 1-2 sessions
Group Sizes: 1-6
Setting: Indoors or outdoors
Vocabulary: Analysis, congregate, corvids, dispensed, indigenous, migrations, mimicking, natural history, point of view, regurgitating, supernatural, undigested, vocalizations

Objectives:
1. Students will compare descriptions of an animal from scientific and cultural points of view.

2. Students will observe an animal and express their observations employing a variety of viewpoints.

Teaching Strategy:
Students use observation and role-playing to become aware of different attitudes toward wildlife and different types of relationships that people may have with wildlife.

Complementary Activities:
All the activities in this section.

Materials:
F*or each student*: copy of "Eye of the Beholder Worksheet" (*following*) and either "Natural History of Ravens in Alaska" or "Supernatural History of Raven" (*from* INSIGHTS *Section* 4), writing materials.
F*or class*: Chalk board or poster paper, a place where animals can be observed (*ravens in the schoolyard, gulls at the beach, birds at a feeder, insects or fish on a field trip, or a film that shows animals interacting – turn off the volume if it is narrated*).

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation*: "*Supernatural History of Raven*" and "*Natural History of Ravens in Alaska*" Fact Sheets, "*Teacher's Guide for Dealing with Differing Viewpoints*."

Procedure:
1. Divide the class into groups of 4 - 6. Distribute the "*Supernatural History of Raven*" to half of each group and "*Natural History of Ravens in Alaska*" to the other half.

2. Students read the handouts, then discuss what they read. Each group compiles a list of raven characteristics based on scientific information or cultural belief.

3. As a class, use the board or poster paper to list the two categories of knowledge on raven characteristics: "Scientific Raven" and "Supernatural Raven." Students develop the two lists and then

compare and contrast the points of view that produced each list.

4. Ask the students the following questions:
- If biologists wants to know how ravens came to be like they are, what questions might they ask? *The biologist might ask, "Is the black color of the raven an adaptation to its environment?" or, "What role does genetics play the raven's coloration?*
- What questions might traditional storytellers ask if they wanted to know how ravens came to be? *Storytellers might ask, "What do the traditional stories tell us about Raven's color? or, "How did Raven come to be black?"*

5. Brainstorm other points of view about ravens and list the types of observations that might be made from these viewpoints. *Examples could include an artist who takes notice of color and shape; a poet who thinks of descriptive words to create images; an engineer who develops a model; a musician who pays attention to the rhythm of the raven's wing beats; or a hunter who watches ravens to find out where other animals are.*

6. Distribute the "Eye of the Beholder Worksheet" and have the groups discuss the point of view that might have produced each set of observations. (*Answers to* Eye of the Beholder Worksheet: 1. *Scientist*, 2. *Storyteller*, 3. *Artist*, 4. *Poet*, 5. *Journalist*.) NOTE: A matching exercise for younger students works well.

7. Tell the students that they will be observing a group of animals. They will need to take careful notes, and the notes will reflect different points of view. Either choose several points of view that are appropriate for your class or allow students to choose the points of view. *Possible roles include: biologists, artists, poets, journalists, storytellers, musicians, hunters, and engineers.*

8. Allow the students to observe the animals for 15 to 20 minutes and encourage them to make notes. Afterward, students with similar points of view can compare notes.

9. Students combine their observations into an appropriate form: *scientists compile a field report with a list of questions for further study, artists provide a portfolio of raven sketches, poets write a book of raven poems, journalists write a raven news story, musicians create a raven "rap" song, and engineers develop designs for their raven model.*

10. Students share their reports and creations with the rest of the class and school.

Evaluation:

1. Students research scientific information and local cultural beliefs about the wildlife in your area. They write reports or stories to create a class notebook.

2. Students describe three viewpoints toward Alaska's wildlife.

EXTENSIONS:

A. **Invite guest speakers.** Bring in speakers with different points of view from the local community or nearby. (*Examples include hunters, naturalists, trappers, photographers.*) Ask your guests to describe their perspective on local animals and to share their observations with the class.

B. **Find local stories.** Bring in a local traditional storyteller or learn a local story about raven or other wildlife and share it with the class. Work with bilingual/bicultural resource persons to develop other extensions featuring local cultural beliefs about wildlife.

C. **Multi-media viewpoints.** Students photograph, videotape, or draw the animal they observed and write a set of captions from different points of view.

D. **Read *Water Sky* and discuss.** Students read *Water Sky* by Jean Craighead George. Compare and contrast the different points of view regarding the bowhead whale.

E. **Compare and contrast other wildlife knowledge.** Research traditional and scientific information about other Alaskan species. Compare and contrast the information gathered.

Curriculum Connections:

(See appendix for full citations)

Books:

Alaska Wildlife Notebook Series (ADF&G)

How Raven Brought Light to People (Dixon)

Raven: A Trickster Tale from the Pacific Northwest (McDermott)

Raven's Light (Shetterly)

Water Sky (George)

Websites:

Alaska Native Heritage Center
<www.alaskanative.net> Links to Native groups. Select Education, the Resources for links.

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

Alaska Wildlife Notebook Series <www.state.ak.us/adfg>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Teacher Resources:

(See appendix)

Eye of the Beholder Worksheet

Name _____

Directions: Read each of the following observations about ravens. Describe the person who made the observation or predict their occupation.

1. April 4, 1991. 32 degrees, overcast, strong wind from NE. Location: Point Hope garbage dump. Time: 10:32 a.m. A second raven flew in and landed 5 feet from the first raven.

Point of View _____

2. He filled his mouth with the water, then donned his Raven cloak and flew up into the sky. As he flew through the smoke hole, he got soot on his feathers. He flew on, he spit out the water, creating the Stikine River and all the small salmon streams. To this day, raven is black.

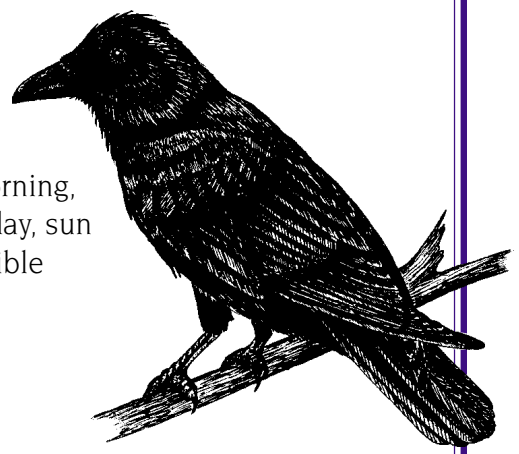
Point of View _____

3. Feathers around the eye are darker, eye is also black. Beak is sharply curved. Morning light is soft, yellows and blues.

Point of View _____

4. Raven-comic, polished ebony feathers, strutting raven talk squawk — life-light gleams in eye.

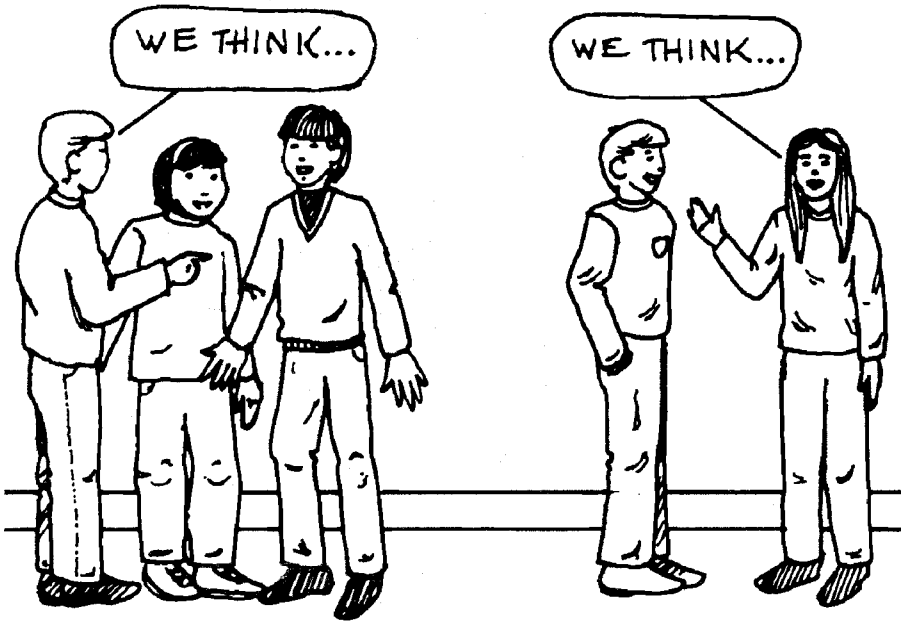
Point of View _____



5. Who? Ravens. What? Feeding on dog-food, When? Tuesday morning, Where? Point Hope village. First raven walks past second. Clear day, sun shining. Kids playing nearby, closest building is the school. Possible headline: Food for Raven Thought.

Point of View _____

Science, Technology, Society, and Wildlife



Section 4
WILDLIFE ACTIVITIES

Grade Level: 7 - 9
State Standards: L D-1, L D-2, CS B-2
Subjects: Science, social studies
Skills: Analyzing, drawing conclusion, inferring, communicating, research, speaking, writing
Duration: Varies
Group Size: Varies
Setting: Indoors
Vocabulary: Assumptions, beliefs, consensus, controversy, facts, interpretation, opinions, society, technology, values, wildlife

Objectives:

1. Students will analyze a wildlife management issue.

2. Students will investigate the issue.

3. Students will devise a solution(s).

Teaching Strategy:

Students select a wildlife management issue and develop an extended case study involving science processes, issue analysis, investigation, and problem-solving.

Complementary Activities:

"Eye of the Beholder," "Our Place in the Food Web," "Moose on the Loose" *and* "Can Do!" *in this section*.

Materials:

Writing materials; research materials such as newspapers, magazines, books, Internet, and guest speakers.

Background:

See INSIGHTS *Section* 4, *Wildlife Conservation* Is Up *to* Us! *"Teacher's Guide for Dealing with Differing Viewpoints."*

Procedure:

1. Select a wildlife issue with these characteristics: (*a*) *it is of interest to your students*, (*b*) *it has a variety of "sides" to the issue, and* (*c*) *there are no clear right or wrong solutions*. If possible, let students choose a local issue or present them with options based on your knowledge of the availability of resources in your community.

The following are examples of issues that can be adapted to local situations:

- A *wildlife population that provides an important local harvest is declining. Should harvests be restricted? What would be the effect of restricted harvests on local people?*

- A *large-scale development project* (*for example, a large mine or landfill*) *is proposed on public land. This project may effect important wildlife habitat in your local area. Should the development be permitted? What are the costs and benefits of the project to wildlife and to people?*

- A *wildlife species has been listed as threatened or endangered under the Endangered Species Act. Should activities be*

prohibited that might affect the species? What should be done through management to increase the population?

- *Other current, specific, wildlife issues such as predator management, or human-bear conflicts*

2. Find out what students already know and feel about the issue. Ask students to list the "**facts**" they know individually, then compare their list with one other person. The pair of students need to come to **consensus** on the "facts."

3. Each pair joins another pair to compare their list of "facts," and so on until a class list of "facts" is created.

4. Discuss the difference between facts, **assumptions**, and **interpretations**. Ask students to verify the accuracy of the fact list through research on the Internet, in the library, and by contacting experts. Discuss the role interpretation can play in determining how people think about an issue.

5. Through discussion, help students realize that facts often evoke positive and negative feelings people have about an issue, and these feelings can affect their ability to believe a fact and to make decisions. *This type of discussion can teach students to distinguish between facts which are true or false, and feelings/ beliefs/ and opinions which are only "false" if based on incorrect information.*

6. Brainstorm aspects of science, technology, and society that are involved in the issue (*see concept maps in this activity*). Each field has contributions to make to help to resolve the issue.

7. Students work in small groups to develop concept maps for each aspect of the issue. Correlate and develop a class concept map.

8. Identify the positions, beliefs, and values of the various players involved in the issue. Bring in guest speakers and provide research materials that address different opinions about an issue. B*e sure to balance the presentations among the various viewpoints and encourage active listening and responses.*

9. Develop an "issue web" concept map. Place the issue in the center and connect each viewpoint and its position, beliefs, and values back to the issue. The completed web gives the "big picture" of the issue and can be used to generate more questions for further research.

10. Help students research information about the issue and identify how citizens can become involved in a public decision-making process. The following are some examples:

- *Research how to develop a proposal for the* Board of Game *to change or create a hunting regulation (refer to flow chart in* INSIGHTS *Section* 4).

- *Find out who is responsible for gathering scientific data about a declining wildlife population and request information.*

- *Research traditional ecological knowledge about a declining wildlife population. Interview elders and active hunters.*

- *Research what has been planned and done so far to restore a threatened or endangered species. Or, find out what has been done to maintain a healthy population of animals. Write testimony and present it at a public meeting about the issue.*

- *Write a letter to the wildlife manager or public official who makes decisions about an issue, seeking additional information and creating a dialogue.*

11. Students develop several positions on the issue after they have gathered factual information and considered a variety of opinions, beliefs, and values that influence possible decisions. Split the class into smaller groups and have each group present one of the positions in either a written statement or debate format. Have them identify both the positive and negative consequences of their positions for both wildlife and different groups in society.

12. Discuss with the class the different solutions. Encourage students to reach consensus on a class position for the issue and develop an "action plan" to communicate their position. *Students should have the opportunity to develop individual "action plans" which fit their level of concern if the class is not in agreement.*

Evaluation:

Students develop a position on the issue and communicate it, using the public decision-making processes they have identified.

Curriculum Connections:

(See appendix for full citations)

Books:

Guardians of Wildlife (Chandler)

Put on Some Antlers and Walk Like a Moose (Sayre)

Websites:

Alaska Board of Game <www.state.ak.us/adfg>

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

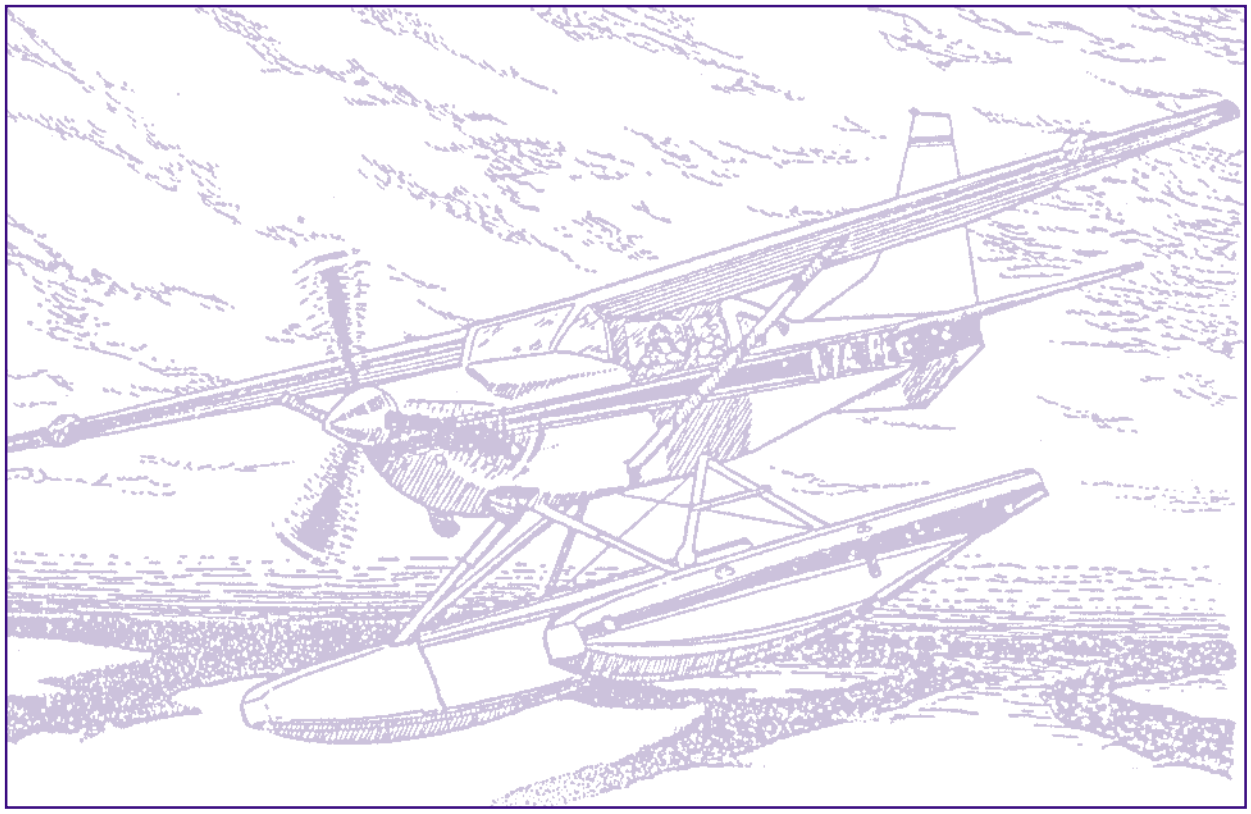
Current wildlife issues information <www.state.ak.us/adfg> and <www.r7.fws.gov>

Environmental News Network <www.enn.com>

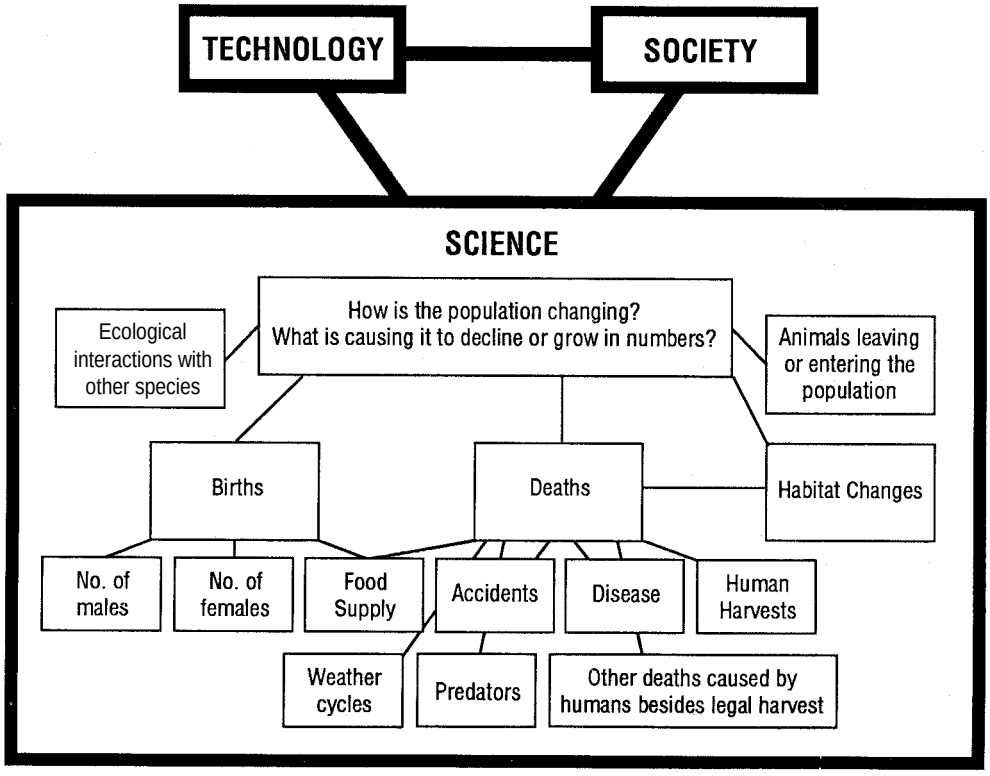
Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Teacher Resources:

(See appendix)

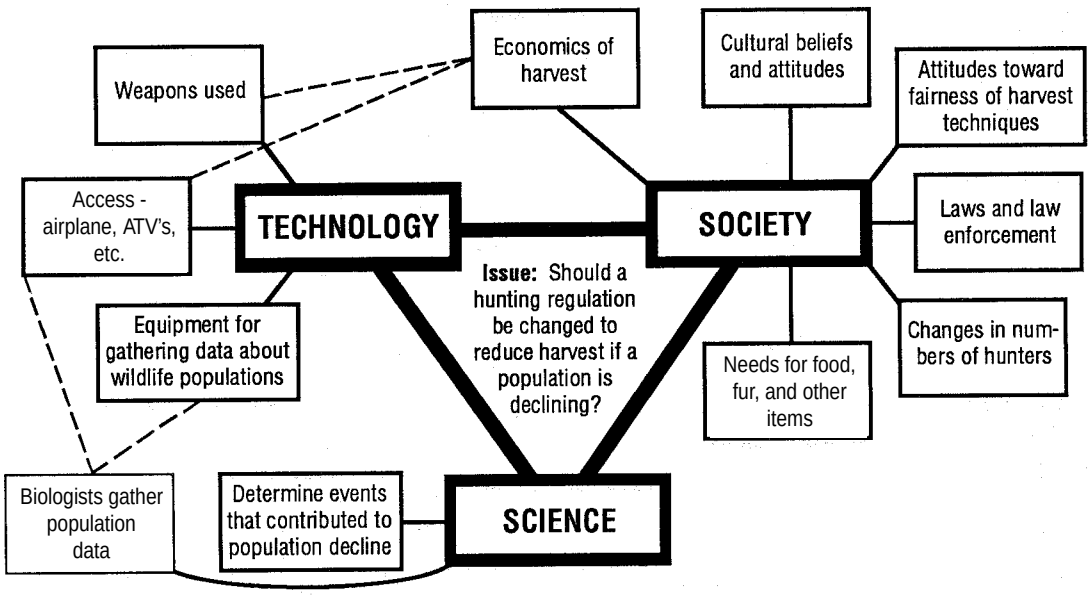


CONCEPT MAP



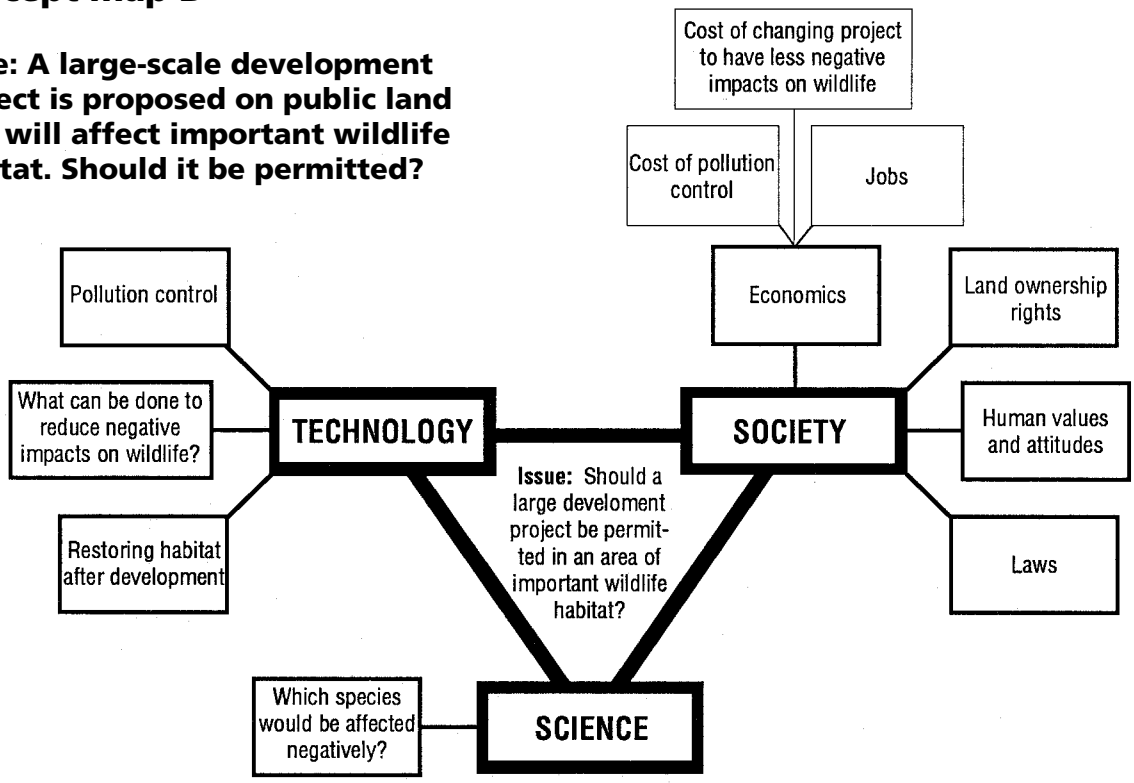
Concept Map A

Issue: A wildlife population that provides an important local harvest is declining. Should the harvest be restricted?



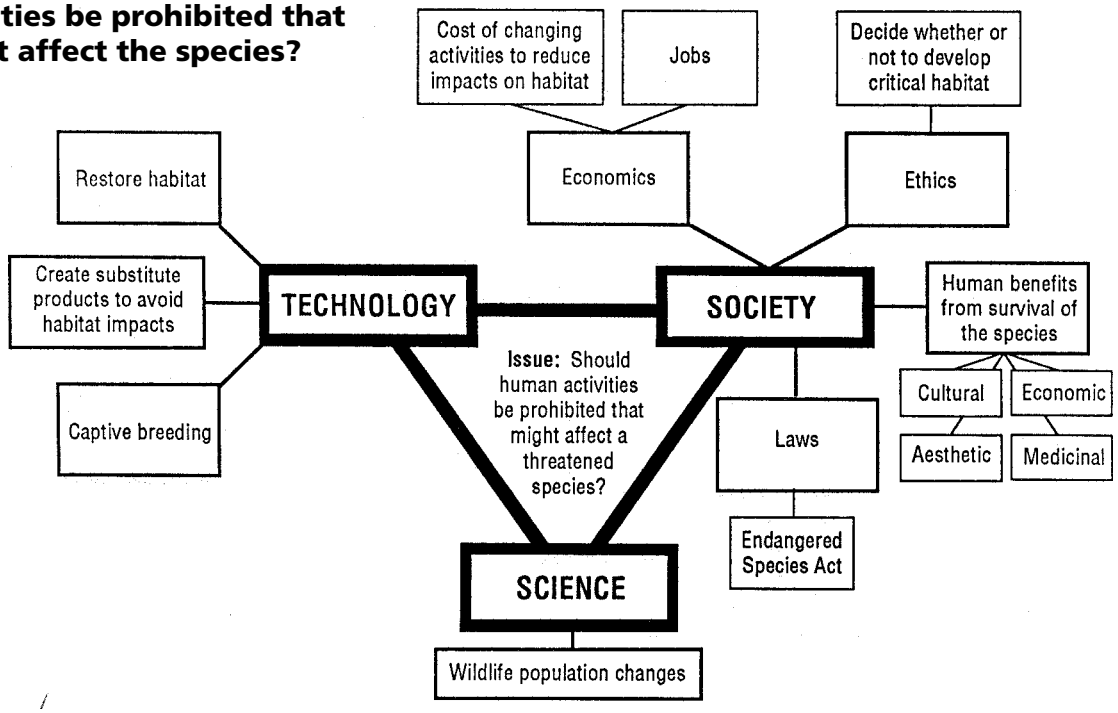
Concept Map B

Issue: A large-scale development project is proposed on public land that will affect important wildlife habitat. Should it be permitted?

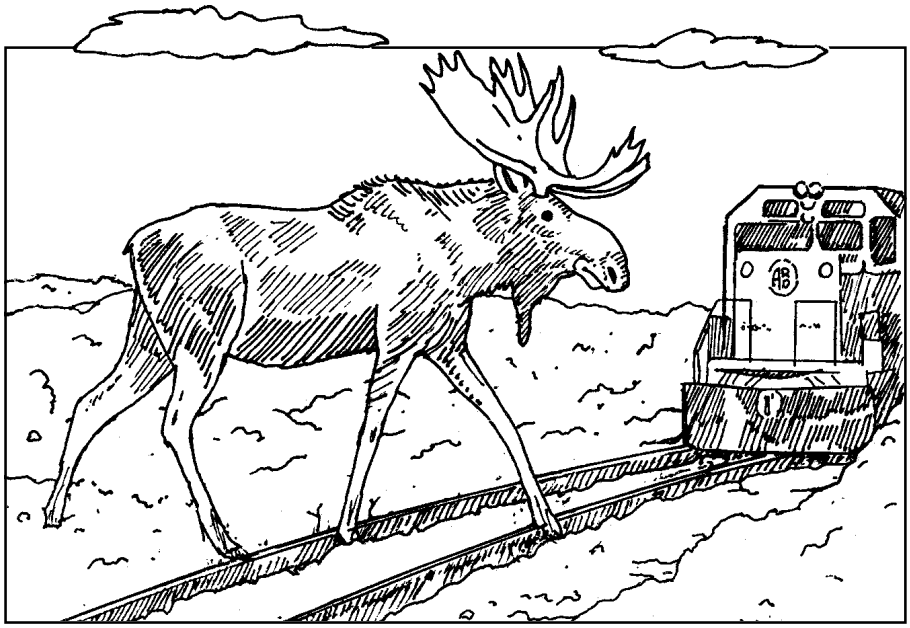


Concept Map C

Issue: A wildlife species has been listed as threatened under the Endangered Species Act. Should activities be prohibited that might affect the species?



Moose on the Loose
6 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 5 - 8

Subjects: Language arts, science, social studies

Skills: Cooperative discussion, analysis, application, evaluation, problem solving, speaking

Duration: 3-4 sessions

Group Size: 4

Setting: Indoors/outdoors

Vocabulary: Environmental group, habitat, land use, live capture, migration, planning, responsibilities, transplant, wildlife manager

Objectives:
1. Students will identify various factors involved in a wildlife management issue.

2. Students will evaluate alternative solutions to a wildlife issue.

Teaching Strategy:
Students make recommendations about a wildlife management issue.

Complementary Activities:
"Eye of the Beholder," "Science, Technology, Society, and Wildlife" *and* "Can Do!" *in this section*.

Materials:
For each student: copy of "Moose and the Alaska Railroad" (*from* INSIGHTS *Section* 4).
For instructor: copy of "ADF&G Approach to Moose and the Alaska Railroad" (*from* INSIGHTS *Section* 4).

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation Is Up to Us!* "*Scenario*: *Moose and the Alaska Railroad*" and "*ADF&G Approach*: *Moose and the Alaska Railroad*" *Fact Sheets*, and "*Teacher's Guide for Dealing with Differing Viewpoints.*"

Procedure:
1. Distribute copies of the scenario to each student and divide the class into groups of four.

2. Assign each student one of the following roles:
- wildlife agency representative
- citizen who lives along the train route
- representative of an environmental organization
- representative of the railroad
- representative from food bank or soup kitchen

3. Students read the scenario and discuss alternative solutions, keeping in mind their assigned roles. Resolve the situation in a way that satisfies everyone in the group.

4. Each member of the group must be able to explain the solution from the perspective of their role. Give students time to do research if needed. If there is not enough information, students may make recommendations for future reference.

5. One member of the group reports the group's solution to the rest of the class. To standardize the reporting, each group must:
- describe the scenario.
- identify and describe alternative solutions.
- state the group's recommended actions and be prepared to justify those actions.

6. After the presentations, you may want to discuss the solutions considered by the Alaska Department of Fish and Game (*from* INSIGHTS).

VARIATION
Each group takes one point of view and develop the best solution from that point of view. Conduct a community (class) meeting where all points of view receive an equal amount of presentation time, then discuss the best compromise.

Evaluation:

1. Students list the factors involved in the moose problem, determine what values must be considered by people attempting to solve the problem, and describe how the problem might be avoided or resolved in the least expensive way.

2. Using a current wildlife issue in your area, apply the processes suggested in this activity.

EXTENSIONS:

A. **Speak to the point.** Students write and make speeches from their point of view. Set up a debate.

B. **Collaborate with similar minds.** Students meet with their point-of-view counterparts from the other groups. They further develop their position to take back to a problem solving group.

C. **Switch roles.** Students in each group switch roles and repeat the activity.

D. **Display a solution.** Make a visual representation of the solution to the problem.

E. **Create bumper stickers.** Develop a bumper sticker that advertises a solution to the problem of collisions between moose and cars or trains. *For example, a citizen's group on the Kenai Peninsula designed a bumper sticker that says "Give Moose a Brake."*

F. **Write to organizations.** Students compile the suggested solutions. Students can then write a letter to the group they represent recommending a particular solution.

Credit:

Adapted from "Deer Crossing," *Project Wild K-12 Activity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:
Living in Harmony with Moose (Stonorov)

Websites:
Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

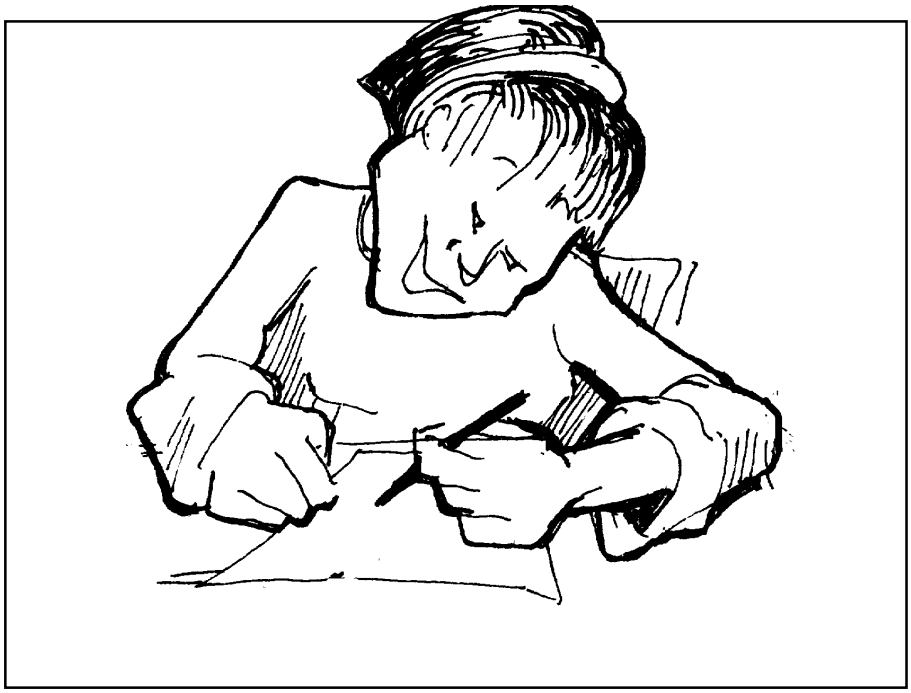
Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

Teacher Resources:

(See appendix)

I Propose ...!
3 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 9 - 12
State Standards: Gov A-1, Gov C-1, Gov C-2, Gov E-2, Gov E-3, Gov E-4, Gov G-2, Gov G-3, Gov G-4, L A-1, L A-4
Subjects: Government & citizenship, social studies, language arts
Skills: Reading, writing, problem-solving, and researching an issue
Duration: 3-4 sessions
Group Size: Small groups/ whole class
Setting: Indoors
Vocabulary: Board of Game, Fish and Game Advisory Committees, game, permit, regulations, season, statutes, wildlife

Objectives:
Students will explain how regulations are created through the Board of Game process.

Teaching Strategy:
Students study a wildlife management issue in depth, study the wildlife regulatory process, and present a mock (or real) proposal to the Board of Game.

Complementary Activities:
"Eye of the Beholder," "Science, Technology, Society, and Wildlife," *and* "Can Do!" *in this section*.

Materials:
Information provided on the Alaska Department of Fish and Game website <www.state.ak.us/adfg> (regarding regulations, Board of Game proposals, wildlife populations, and issues. Paper, pens, chalk board, copies of *Regulation Proposal Form* (*following*).

Background:
See INSIGHTS *Section 4, Wildlife Conservation Is Up to Us!* "*Hunting Regulation Vocabulary*," "*Tracking Wildlife Regulations*" and "*Check & Balances for Wildlife Regulations*" Fact Sheets; and "*Teacher's Guide for Dealing with Differing Viewpoints.*"

Procedure:
IN ADVANCE, If possible, invite a member of the Fish and Game Advisory Committee to explain to students the Board of Game (or Board of Fish) process and discuss locally pertinent wildlife concerns.

If you are planning this activity concurrently with the actual Board of Game meeting, begin once the "***Call for Proposals***" is available (contact your local Fish and Game office or search the Department's website). Use the current "*Call for Proposals*." If you are not conducting this activity concurrently, access old proposals on the same website.

IN ADVANCE, review the "Teachers Guide for Dealing with Differing Viewpoints."

DAY ONE:
1. Brainstorm fish and wildlife related issues, recording these on butcher paper or the chalk board. (If students focus on fish, rather than game, this

activity can be adapted for fish regulations and the Board of Fish.)

2. Discuss the role of hunting (and/or fishing) in Alaska as it relates to managing wildlife populations.

3. Present background information (*from* INSIGHTS *and the website*).

4. Once students are clear about the Board of Game process, provide information about their local Fish and Game Advisory Committee.

5. Give the following assignment: Identify a local or regional wildlife issue or issues that each student wants to research and address.

DAY TWO:
1. On the chalk board, list all issues identified by students.

2. Divide into interest groups that will work together for the remainder of the project.

3. Using the following resources, students research the issue in depth, making sure to include their scientific and social influences:
- newspapers and other media
- the Internet
- the school library
- phone contacts/e-mails with Fish and Game Advisory Committee members, ADFG biologists, community members, etc.
- other sources identified by the students.

4. From that research, each student drafts a proposal for her or his group's issue.

5. Ask each group to integrate its drafts into one proposal. If there are distinctly different proposals, let the groups splinter into smaller groups. *As with the actual Board of Game, there may be many approaches to a specific issue.*

DAY THREE:
1. Students present their finished proposals to the class. If there are several proposals relating to one issue, clump these together and conduct a discussion when all have been presented.

2. As a class, discuss the strengths and weaknesses of each proposal, both in presentation and content.

3. If possible, come to resolution on those solutions the class deems acceptable.

Evaluation:
1. Describe the process by which Alaska wildlife regulations are created and changed.

2. Write a strong regulation proposal with scientific and accurate background information.

EXTENSIONS:
A. **Submit proposals to the Board.** If student-generated proposals are deemed feasible by the class AND if students have permission from their parents (*and you from your administration*), students submit their proposals to the Board of Game and follow them through the process.

B. **Attend meetings and take notes.** Attend Fish and Game Advisory Committee and/or Board of Game meetings. Students record meeting notes and their observations of people providing testimony as well as the committee/ board members. Back in class, students share their observations and discuss their views on the process.

C. **Civic lesson.** Introduce the concept of "checks and balances" in the democratic process. Using the "Checks & Balances for Wildlife Regulations" chart (*from* INSIGHTS *Section* 4), ask students to find places within the Board of Game process where checks and balances exist. Ask students to identify areas where they think the process is effective or problematic. Compare this public process to other public processes to further identify strengths and weaknesses.

Credit:
Contributed by Robin Dublin, Alaska Department of Fish and Game, Anchorage, Alaska.

Curriculum Connections:
(See appendix for full citations)

Books:
Guardians of Wildlife (Chandler)

Websites:
Alaska Board of Game <www.state.ak.us/adfg>

Alaska Hunting Regulations and other related materials <www.state.ak.us/adfg>

Alaska Native Heritage Center <www.alaskanative.net> Links to Native Organizations and subsistence articles. Select Education, then Resources for links.

Alaska Outdoor Council <www.alaskaoutdoorcouncil.org> Official state affiliate of the NRA.

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

Alaska Wildlife Alliance <www.akwildlife.org> For current wildlife issues.

Current wildlife issues information <www.state.ak.us/adfg> and <www.r7.fws.gov>

Office of Subsistence Management, Alaska Region <www.r7.fws.gov/asm/home.html>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

University of Alaska Justice Center <www.uaa.alaska.edu/just/links/natives.html> Links and information on the subsistence issue.

Teacher Resources:
(See appendix)

Sample Regulation Proposal Form

ALASKA BOARD OF FISHERIES AND ALASKA BOARD OF GAME
REGULATION PROPOSAL FORM, P.O. BOX 25526, JUNEAU, ALASKA 99802-5526

BOARD OF FISHERIES REGULATIONS

☐ Fishing Area _____

☐ Subsistence ☐ Personal Use

☐ Sport ☐ Commercial

JOINT BOARD REGULATIONS

☐ Advisory Committee ☐ Regional Council ☐ Rural

BOARD OF GAME REGULATIONS

Game Management Unit (GMU) _____

☐ Hunting ☐ Trapping

☐ Subsistence ☐ Other _____

☐ Resident

☐ Nonresident

Please answer all questions to the best of your ability. All answers will be printed in the proposal packets along with the proposer's name (address and phone numbers will not be published). Use separate forms for each proposal.

1. Alaska Administrative Code Number 5 AAC_____ **Regulation Book Page No.**_____

2. What is the problem you would like the Board to address?

3. What will happen if this problem is not solved?

4. What solution do you prefer? In other words, if the Board adopted your solution, what would the new regulation say?

5. Does your proposal address improving the quality of the resource harvested or products produced? If so, how?

6. Solutions to difficult problems benefit some people and hurt others:

A. Who is likely to benefit if your solution is adopted?

B. Who is likely to suffer if your solution is adopted?

7. List any other solutions you considered and why you rejected them.

DO NOT WRITE HERE

Submitted By: Name _____
Individual or Group

Address_____ **Zip Code**_____ **Phone**_____

Exploring Wildlife Issues
3 EXTENSIONS

Section 4
WILDLIFE ACTIVITIES

Grade Level: 9 - 12

State Standards: L A-1, L A-2, L A-4, L A-5, L B-1, L E-1, L E-2, L E-3, T E-4

Subjects: Language arts

Skills: Reading, writing, analyzing, categorizing, public speaking

Duration: 3-7 periods

Group Size: 1-4

Setting: Indoors

Vocabulary: Bias, values

Objectives:
1. Students will learn to read critically.
2. Students will use the Internet and library to gather supporting facts and opinions on a wildlife conservation issue.
3. Students will study a controversial issue related to wildlife conservation to learn that issues are often complex, requiring creative solutions.
4. Students will clarify their opinions regarding an issue and support their opinions with factual information.

Teaching Strategy:
Students research a wildlife conservation issue and write "Letters to the Editor" that are supported with pertinent and accurate information.

Complementary Activities:
"Eye of the Beholder" *in this section*.

Materials:
Newspaper articles related to a specific wildlife conservation issue; access to websites, biologists, community groups, books, and research papers, etc. Paper, pens, computers.

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation* Is Up *to* Us! "*Tracking* Wildlife Regulations" and "*Teacher's Guide for Dealing with* Differing Viewpoints."

Procedure:
IN ADVANCE, gather news articles on a variety of wildlife conservation-related issues, ideally local. Review the "Teacher's Guide for Dealing with Differing Viewpoints."

DAY ONE

1. After students have browsed through your collection of news articles, ask them to decide on one issue for in-depth study.

2.Ask students to write a one-page paper **in class** stating their current opinions, knowledge, and feelings regarding this issue. Instruct them to include all facts that they know or believe to be true. *These papers should be written without additional research or discussion and will be reviewed when the project is completed.*

DAY TWO-FIVE *or* HOMEWORK
As a class, spend the next week or so gathering as much relevant information, articles, copies of applicable laws and regulations, court cases, news releases, biological data, land ownership information, and Board of Game information.
• If governmental agencies are involved, investigate their agency's mission.
• If non-profit organizations and advocacy groups are involved in this issue, gather information from them as well.
• Interview people in the community who are close to the issue making sure to ask people with a variety of viewpoints.
• Seek out everything you can find related to this issue, leaving no stone unturned!

DAY SIX
1. Divide the class into small groups that will review the gathered materials, analyze the content, and summarize each piece based on what it provides, without adding opinions of the reviewers regarding **bias**, accuracy, or **values**. *This will be a challenge to students who may read and strongly agree or disagree with what they are reading*. Instruct students to address the following:
• Name of organization and source (publication, etc.)
• Facts and opinions stated as factual in the written piece
• A one- or two-sentence summary of the article, report, etc.

2. Ask students to categorize the articles so similar positions are together.

3. Create new groups and ask each group to read through a pile and prepare to speak from that point of view, using facts and information offered in the materials they now posses.

4. Lead a discussion where all views are stated and listened to in a respectful manner.

HOMEWORK
1. Students now write their own opinion pieces in the form of "Letters to the Editor." Keep all written materials available for students to refer as they write.

2. Review and comment on these drafts for content and use of opinions substantiated by accurate information and facts. Also provide feedback regarding grammar, spelling, sentence structure. Explain that a poorly written letter has less impact than a well-written letter.

3. Return letters to students for a final re-write. When letters are completed, grade and return.

4. If students wish to submit their letters for publication, parental letters of permission are recommended.

CONCLUSION
1. Return the original one-page assignment from the first session.

2. Ask students how their opinions changed after studying the issue in detail.

3. Lead a discussion on how their written work changed from the start of the project to the current time. What conclusions have the students drawn?

Evaluation:
Students read their final letters to the class aloud. These letters should provide an opinion, supported by strong arguments and relevant factual information. They should be persuasive as well.

Credits:
Contributed by Mike Sterling, Sand Lake School, Anchorage, Alaska; and Fay Pye and Jayne Kimmet, Alaska Pacific University, Anchorage, Alaska.

Curriculum Connections:
(See appendix for full citations)

Books:
Guardians of Wildlife (Chandler)

Websites:
Alaska Board of Game <www.state.ak.us/adfg>

Alaska Hunting Regulations and other related materials <www.state.ak.us/adfg>

Alaska Native Heritage Center

<www.alaskanative.net> Links to Native Organizations and subsistence articles. Select Education, then Resources for links.

Alaska Outdoor Council <www.alaskaoutdoorcouncil.org> Official state affiliate of the NRA.

Alaska Science Forum <www.gi.alaska.edu/ScienceForum>

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu>

Alaska Wildlife Alliance <www.akwildlife.org> For current wildlife issues.

Current wildlife issues information
<www.state.ak.us/adfg> and <www.r7.fws.gov>

Office of Subsistence Management, Alaska Region <www.r7.fws.gov/asm/home.html>

Staff-written Alaska newspaper articles: Anchorage *Daily News* Archives <www.adnsearch.com> or Fairbanks *Daily News-Miner* <www.newsminer.com>

University of Alaska Justice Center <www.uaa.alaska.edu/just/links/natives.html> Links and information on the subsistence issue.

Teacher Resources:

(See appendix)

Can Do!
1 EXTENSION

Section 4
WILDLIFE ACTIVITIES

Grade Level: 2 - 12
State Standards: L A-3, L A-4, L C1, L C-4, L C-5, Geo E-6, Gov E5, Gov E-5, Gov E-7
Subjects: Social studies, language arts, science
Skills: Analysis, application, description, discussion, evaluation, invention, listing, public speaking, problem-solving, group work, synthesis, writing
Duration: Three 45-minute sessions
Group Size: Any
Setting: Indoors or outdoors
Vocabulary: Alternatives, authority, compromise, constructive, problem, realistic

Objectives:
1. Students will identify a problem involving wildlife on their own school grounds.
2. Students will suggest and evaluate alternative ways to solve or improve the situation.
3. Students will undertake the project.
4. Students will analyze and describe the process they used to solve the problem or improve the situation.

Teaching Strategy:
Students develop a community action project.

Complementary Activities:
All activities. "Schoolyard Habitat Mapping" *in Section 1.*

Materials:
Writing materials, materials specific to chosen project.

Background:
See INSIGHTS *Section* 4, *Wildlife Conservation* Is *Up to* Us!

Procedure:
NOTE: Use your judgment in the course of this activity to assist students in selecting a project that is realistic, constructive, and possible. If the project is unrealistic or the problems insurmountable, the students may get frustrated and develop an attitude of "can't do."

1. Introduce the definition of **problem** – *a difficult situation to be improved, or an opportunity to make things better. Problems can't always be "solved," but situations can usually be improved.*

2. Brainstorm problem on the school grounds that have a negative impact on wildlife. *The list might include:*
- *litter that poses a hazard to some kinds of wildlife;*
- *a muddy area that birds use for water but that has been recommended for paving to minimize dust and mud;*
- *a proposed pesticide spraying that will not only kill the "pest" but perhaps affect other plants and animals;*
- *removal of a tree or shrubs that currently help clean the air, produce oxygen, and provide food and shelter for varying kinds of wildlife.*

3. Look at the list with the students and help them identify problems that they can realistically handle. If students have difficulty deciding between projects, they might give short speeches on why they feel one project should be chosen and then take a vote.

4. After selecting the project, students work in small groups to generate ideas for solving or improving the problem. Each group should devise one plan that includes a written description and illustrations or sketches showing how it will work and how it can be accomplished.

5. Groups present their solution to the rest of the class. Other students may ask questions for clarification. Once all the plans have been presented, ask the students to select the plan that seems most • **constructive**, • **realistic**, • helpful to wildlife, and • apt to make a lasting contribution.

6. Ask students to select an **alternative** plan in case the first is not acceptable to the school **authorities**.

7. Students select representatives to present the proposal to the principal, other appropriate school authorities, and community members or organizations (*consider janitors, other teachers, school board members, the community council, neighbors to the school*).

8. Students make an appointment to present their proposal.

9. Hold a practice session in the classroom prior to the presentation.

10. Delegates report to the class after their official presentation. Are there **compromises** to be made?

11. After approval from all relevant authorities, the class proceeds with their project.

Evaluation:

1. Students analyze their results of their project. Did things work out as they wanted them to? Were there any surprises? How might they have been more effective?

2. Students write reports on the progress and effectiveness of their project.

EXTENSION:

Students choose a wildlife-related issue in their community and follow the local advisory committee process, attending meetings, and following 1-2 proposals throughout the year.

Credit:

Adapted from "Can Do!" *Project Wild K-12 Activity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

50 Simple Things Kids Can Do to Recycle (EarthWorks Group)

Compost Critters (Lavies)

Kid's Guide to Social Action (Lewis)

Our Endangered Earth: What We Can Do to Save It (Langone)

Reducing, Reusing and Recycling (Kalman)

Taking Care of the Earth (Pringle)

Website:

Composting Dog Waste, Fairbanks, Alaska <www.uaf.edu/coop-ext/compost/dogs.html>

Composting Organic Waste in the Anchorage Area <www.uaf.edu/coop-ext/compost/anchorage.html>

Birdhouses for Alaska, Winter Bird-feeding in Alaska and *Landscaping for Wildlife* <www.state.ak.us/adfg>

EPA Office of Solid Waste. *Students' and Teachers' Page* <www.epa.gov/epaoswer/osw/students.htm>

Teacher Resources:

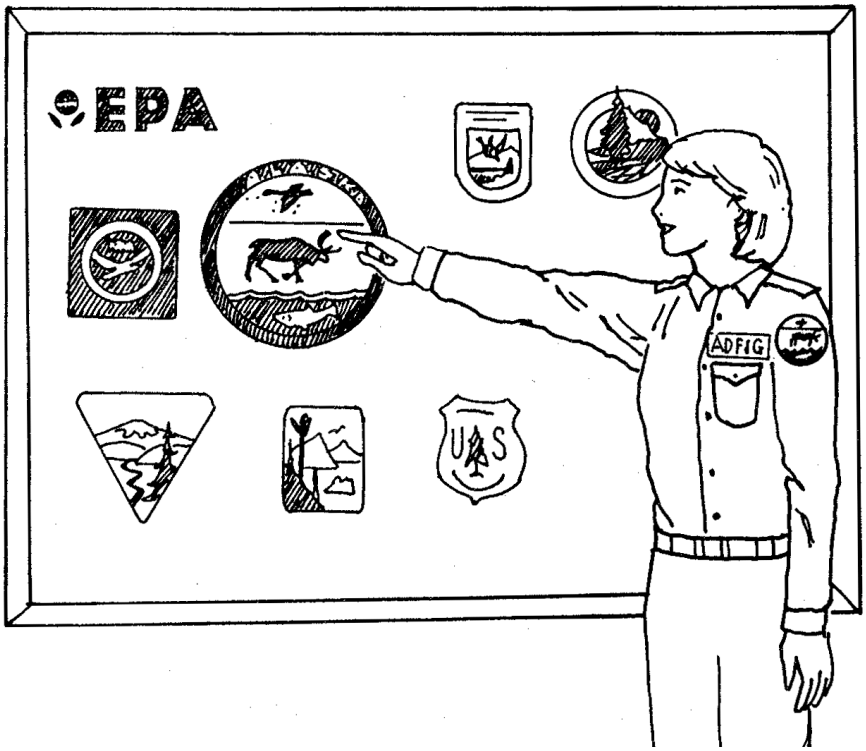
(See appendix)

Project Ideas:

- Plant native shrubs or trees in the schoolyard to provide food and shelter for birds and other animals. Do so with moose in mind to give students room for safe observations.
- Set up and maintain bird feeders.
- Build and place bird houses.
- Develop a local advertising campaign about plastic litter that hurts wildlife.
- Organize or participate in a litter clean-up of your schoolyard or the local area.
- Develop a set of class "rules" for field trips to a natural area. Consider the effects of student activities and how to avoid disturbing wildlife and their habitat.
- Visit refuges or other areas where wildlife management programs are occurring. Arrange to talk with a wildlife manager and ask questions during your visit. Work with the refuge staff to establish how the class can support the refuge.
- "Reduce-Reuse-Recycle" projects help wildlife by reducing the demand for materials whose production results in loss of wildlife habitat. Recycle newspapers, aluminum cans, or anything else that can be recycled in your community.
- Set up a classroom recycling center for toys, paper, or other items that can be exchanged by students and reused.
- Build a school compost box to demonstrate recycling of organic materials as an alternative to landfills or commercial fertilizers that could cause water pollution. (*See* "Create a Classroom Compost Box" *activity in* Alaska's Ecology, *Section 2; or contact the University of Alaska Cooperative Extension Service.*)
- Take a field trip to the grocery store to look for unnecessary packaging of items sold.

Workers for Wildlife

4 EXTENSIONS



Section 4
WILDLIFE ACTIVITIES

Grade Level: 3 - 12

State Standards: Gov C-1

Subjects: Creative dramatics, language arts

Skills: Letter-writing, vocabulary development, writing questions, writing nonfiction, biography

Duration: 5 sessions

Group Size: Individual, whole class

Setting: Indoors

Vocabulary: Career, management, regulations, species, wildlife

Objectives:

1. Students will name the activities of a variety of wildlife management occupations.
2. Students will gather information and portray one wildlife management occupation.

Teaching Strategy:

Students watch a video on wildlife biologists, simulate wildlife careers, and discuss careers in class. Students write questions to wildlife managers, and make a book about being a wildlife manager.

Complementary Activities:

"Wildlife Use Interview," "Eye of the Beholder," "I Propose ...!" *in this section*.

Materials:

Poster paper, paper for writing letters, "*Wildlife-Related Organizations and Careers*" fact sheet (*from* INSIGHTS, *Section* 4). Video "*Alaska's Wildlife: An Inside Glimpse*" by Alaska Department of Fish and Game (*sent to school libraries statewide in* 1998).

Background:

See INSIGHTS *Section* 4, *Wildlife Conservation Is Up to Us!* "*Workers for Wildlife*" and "*Wildlife-Related Organizations and Careers*" Fact Sheet.

Procedure:

1. As a class, brainstorm a list of jobs related to helping or working with wildlife. Help students consider a variety of jobs. (*see fact sheet*).

2. Show parts of the video, "*Alaska's Wildlife: An Inside Glimpse*," for examples of fieldwork that biologists do for research and management.

3. Brainstorm questions the students could ask a "worker for wildlife" about their occupation (*What did they study in school? What do they do in their job?*). Use the following worksheet "*Wildlife Careers Interview*" as an option.

4. Each student chooses a career and writes a letter or e-mail, asking their questions to someone in that occupation.

5. Upon reviewing responses from professionals, portray various jobs using props that represents their work (*for example, rain gear, cameras, binoculars, clipboards, computer maps and charts, etc.*). The other students will guess the occupation.

Evaluation:

1. Teacher observation of creative presentation including job requirements and day-to-day responsibilities.

2. Students name and describe three jobs in Alaska that involve work with wildlife. Students list the type of training that is required for each job.

EXTENSIONS:

A. **Invite a guest speaker/ interviewee.** Invite a wildlife manager or someone whose work relates to wildlife into class and interview them in person. Then make a class "biography" of that person's occupation. *Be sure to prepare the class and provide advance notice to the wildlife manager.*

B. **Turn research into Help Wanted posters.** Research related jobs using the Internet. Make "HELP WANTED" posters for wildlife positions, including all the requirements of the person applying for the job.

C. **Hold a natural resource job fair.** Combine this activity with career day activities or trips to other communities (*see "Forest Careers" activity in Section 5 of* Alaska's Forests & Wildlife *of the Alaska Wildlife Curriculum*).

D. **Work a day in a wildlife-related job.** If you have students who are particularly interested, make arrangements for them to spend part of a day with someone in a wildlife field and report their experience to the class.

Credit:

Adapted from "Wild Work," *Project Wild* K-12 *Activity Guide*, Western Regional Environmental Education Council, Boulder, CO, 1992.

Curriculum Connections:

(See appendix for full citations)

Books:

Put on Some Antlers and Walk Like a Moose (Sayre)

Wildlife Special Agent (Ricciuti)

Media:

Alaska's Wildlife: An Inside Glimpse (Video) (ADF&G)

Connecting with Caribou (Video) (ADF&G)

Wolves of Alaska (Video) (ADF&G)

Websites:

(*see* "Wildlife Organizations & Careers" *Fact Sheet in* INSIGHTS *Section* 4)

Teacher Resources:

(See appendix)

Wildlife Careers

INTERVIEW

DIRECTIONS: Investigate a career related to wildlife. Contact an individual in a wildlife career and use this interview form. You may ask additional questions, or add other information that the person provides on the backside of the paper. Print neatly or type your final copy so others will be able to read it.

Career/Occupation Title: _____

1. What is the function or purpose of this job and how does it relate to wildlife?

2. How does a person in this occupation spend his/her time? What proportion is spent at a desk, in a lab, indoors, outdoors, traveling, in meetings, etc.?

3. In conducting this job, what skills are used? (writing, speaking, working with computers, numbers, measuring, physical labor, using specialized equipment)

4. What training is needed for this job? Academic or vocational? What types of classes are needed and what level of education is required?

5. Where is training available? Does this person recommend a particular school or program for training?

6. What employers might hire people in this occupation? Be specific.

7. What are the typical benefits of this occupation?

   Monetary: $_____/ hour or _____/ year

   What are the personal rewards? – knowledge of doing something worthwhile, value to the community, to the future, chances for travel, security, prestige?

8. Will there be a greater or lesser need for people in this occupation in the future? Specify where jobs are most likely to be available.

9. Will more training be needed in the future than is needed at present?

WILDLIFE APPENDICES

GLOSSARY

MORE CURRICULUM CONNECTIONS
(Folktales, Fiction, Poetry, Biographies, and Picture Books)

TEACHER RESOURCES
(General and Section Specific)

MASTER CITATIONS FOR ACTIVITY CURRICULUM CONNECTIONS

PLANNING TOOLS
(Activities cross-referenced by grade, topic, grade, state standards)

GLOSSARY

Adaptation: the process of adjusting to the environment; a trait that improves a plant or animal's ability to live in a particular environment.

Affect: to act upon or have an effect on something or somebody.

Alaska Department of Fish and Game: state agency that provides research, management, and information regarding fish and wildlife conservation in Alaska. ADF&G is required to implement regulatory processes set forth by the Board of Game and the Board of Fish.

Anthropomorphism: giving human motivation and characteristics to animals and plants.

Assumptions: something believed to be true without proof.

Authority: an individual or group of people with the power to make changes.

Bag limit: the maximum number of animals of any one species that one hunter can kill in a given area in a single season.

Belief: an emotional or spiritual acceptance that something is true.

Bias: prejudice. An unfair dislike or preference for something.

Biodiversity: the variety of living things. The measure of the variety and abundance of living things and biological communities.

Biologist: a person who studies living organisms and their relationship to one another.

Biome: a major ecological community type (as tundra, rainforest, or desert).

Board of Fish: Governor-appointed, legislatively-approved board of Alaska citizens that use public and agency information to set regulations regarding fish harvests.

Board of Game: Governor-appointed, legislatively-approved board of Alaska citizens that uses public and agency information set regulations regarding wildlife harvests.

Carrying capacity: the population (of an animal) that an area will support without undergoing deterioration. The dynamic equilibrium established between any life form and its environment.

Census: a complete count of all the animals in a specific wildlife population

Co-management: bringing together resource managers (with western science) and local citizens (with traditional ecological knowledge).

Community: an interacting population of various species of plants and animals in a common location. All the plant and animals in a particular habitat that are bound together by energy flow and other interrelationships.

Competition: struggle between organisms for limited resources.

Compromise: a way to settle a problem in which different or opposing "sides" usually give a little.

Consensus: an opinion or decision that is shared by the group. Reaching consensus may require compromise.

GLOSSARY CONTINUED

Conservation: the use of natural resources in a way that assures their continuing availability for future generations. The wise and intelligent use or protection of natural resources.

Cover: protection from the elements for many purposes including hiding, traveling, resting, and nesting. Also referred to as **shelter**. One of the four elements necessary for survival.

Difference: not the same.

Diversity: related to ecosystems, variety of species that fill different niches.

Drawing permit: a permit issued to a limited number of hunters by means of a lottery. Hunters must apply and agree to obey the conditions spelled out in that permit.

Ecosystem: a community of living things and its nonliving surroundings linked together by energy and nutrient exchange.

Endangered: a species that is in danger of extinction in all or a significant portion of its range.

Endangered Species List: a roll call of plants and animals in danger of extinction in the United States. The Endangered Species Act requires that these threatened and endangered species and their habitats be protected, monitored, and have recovery plans created to increase their populations. ***Species of Concern*** is different from endangered or threatened – *see definition*.

Estimate: a rough calculation of population size without counting every individual.

Evidence: sign.

Exponential growth: extremely rapid rate of increase.

Exotic species: animals and plants not native to an ecosystem. When humans let them loose, these species may harm or compete with the natural or native species of the area. The State of Alaska has laws to protect against release of exotic species.

Extinct: an organism no longer alive anywhere on earth. Gone forever.

Extinction: the process by which species become extinct. The condition of having been removed from existence. A plant or animal facing extinction is one in danger of vanishing from our world forever.

Fact: something that can be shown to be true, to exist, or to have happened.

Fish and Game Advisory Committee: community-appointed groups that advise the Board of Game and the Board of Fish as regulations are being considered.

Food: energy and minerals in a form living things can use. One of the four elements necessary for survival.

Food chain: the transfer of food energy from living things in one nutritional level to those in another. In a simple food chain, for example, a mammal eats a bird that ate an insect that ate a plant.

Food web: many interconnecting food chains.

Game: any wildlife species sought after by humans for hunting and/or trapping. Wildlife species that are not hunted by humans are called **nongame.**

GLOSSARY CONTINUED

Game Management Units: division of Alaska into 26 small geographical units for managing game. Within these **GMU's**, there may be smaller units, identified with letters. For example, GMU 21B is an area north of Ruby and south of Tanana. Maps of the state's GMU's are available in the *Alaska Hunting Regulations* book and on the ADF&G website.

Habitat: the place where an animal lives that provides food, water, shelter (or cover), and space in a suitable arrangement that an organism needs to survive.

Habitat restoration: human activities that allow wildlife habitat to return to natural conditions following disturbance or to meet the needs of a particular animal.

Harm: to hurt.

Harvest: the intentional gathering of plants and animals for human use. In wildlife management, hunting is considered a form of harvest in which individual animals are killed.

Harvestable surplus: the estimated number of animals that can be hunted or trapped each year by humans without causing a decline in the population.

Haulouts: beaches and islands where marine mammals move onto land to rest.

Herbivore: (erb-uh-vor) any living thing that eats producers such as plants and algae.

Hunting Regulations: laws defined by the Board of Game and signed into law by Alaska's lieutenant governor.

Interpretation: an explanation of the meaning or significance of something.

Introduced species: a species that has been moved by humans into an area where it was never known to have occurred before.

Limiting factor: something that keeps a population of animals or other organisms from increasing. For wildlife it could be a shortage of food, water, shelter, or space. Or it could be diseases, predation, climatic conditions, pollution, hunting, poaching, and accidents that affect either the number of births, the number of deaths, or both.

Linear growth: increase which occurs slowly and steadily by the repeated addition of a specific number to a base number.

Living thing: something that is able to grow and make new things like itself; an organism. Living things are classified into five great groups called "kingdoms" – monerans, protists, fungi, plants, and animals.

Microhabitat: a small habitat within a larger one in which environmental conditions differ from those in the surrounding area.

Migration: seasonal or periodic movement between areas of use, especially breeding grounds and wintering grounds. Migrations may be very long or very short depending upon the species.

Non-consumptive use: to receive benefit from a living organism without taking its life. Opposite of harvest or hunting to kill. Wildlife viewing and nature photography are examples. These activities may have negative impact on the species being viewed and its habitat.

Nonliving thing: something that does not (and cannot) move, grow, and make new things like itself. Air, water, soil, rocks, and energy are examples of nonliving things.

GLOSSARY CONTINUED

Nongame: animals not hunted by humans.

Organism: a living thing.

Oxygen: a colorless, tasteless, odorless element that most living things breathe and need in order to live; plants and algae produce this gas during photosynthesis.

Perishable: food that spoils easily.

Permit hunt: a hunt for which permits are issued through a drawing, registration, or Tier II situation.

Pesticide: chemical substance used to kill pests, especially insects.

Pollutant: something that pollutes. For examples chemicals or wastes that damage air, water, or soil.

Population: the number of a particular species in a defined area.

Population decline: a decrease in numbers of an animal. Occurs when the number of deaths exceed the number of births over a period of time.

Population recovery: an increase in numbers of an animal from a relatively low level. Wildlife populations begin recovery when the number of births exceeds the number of deaths over a period of time.

Predator: an animal that kills and eats other animals.

Predict: to say in advance, to foretell.

Prey: animals that are killed and eaten by other animals.

Problem: difficult situation to be improved, or an opportunity to make things better. Problems can't always be "solved," but situations usually can be improved.

Qualitative: involving quality or kind.

Quantitative: involving measurement of quantity or amount.

Rate of population increase: comparison of the population size at a specific time to a previous population size. An annual rate of population increase compares the population in year x to the population in year x-1.

Realistic: what is achievable or possible.

Reintroduced species: a plant or animal that has been moved by humans to an area where it once occurred.

Reproductive rate: number of young produced by each female in a population in a given period of time.

Rookery: marine animal nursery. Place where marine mammals or birds gather together on land to nest or breed and raise their young.

Sample: a portion, piece, or segment that represents the whole.

Sampling: observing and counting a particular population to estimate its total population size.

Season: a set period of time to legally hunt a certain species. Hunting seasons are determined through the Board of Game process.

GLOSSARY CONTINUED

Shelter: also known as **cover**. Protection from the elements for many purposes including hiding, traveling, resting, and nesting. One of the four elements necessary for survival,

Species: a group of organisms that are alike and are able to breed and produce fertile offspring under natural conditions. A robin is a species of bird.

Species diversity: a measurement of the number of species in a defined area.

Species of Special Concern: any species, subspecies, or population of wildlife native to Alaska that has a long-term trend of decline or is vulnerable to significant decline due to a variety of causes. For more information and a current list, check ADF&G website <www.state.ak.us/adfg>

Stable population: one that fluctuates around a specific number of animals. See also ***population decline.***

Statutes: laws passed by the state legislature that the Board of Game must legally follow. The Board of Game cannot create regulations outside of authority given to them by legislative statute.

Survey: to count wildlife populations for research and management.

Sustained yield: a management goal to take only what can naturally be replaced while maintaining healthy populations. Hunters harvest wildlife based on sustained yield.

Territory: an area defended by an animal against others of the same species. The area used for breeding, feeding, or both.

Threatened: a plant or animal likely to become endangered because of a decline in its population.

Traditional ecological knowledge: knowledge developed over time by observation, regarding the natural world. TEK is an important part of effective co-management.

Transplant: to move organisms from one area to another.

Trend: general direction or tendency.

Values: the importance or worth of a thing to a human. Different humans often have different values. Values are not factual, but influence management decisions.

Variety: a number or collection of different things.

Water cycle: water vapor (*a gas*)in the atmosphere falling to earth as precipitation (*a liquid or solid*: *snow*, *rain*, *hail*, *fog*), making its way into rivers, lakes, and oceans where it evaporates (*vapor*) into the atmosphere to start the process again.

Wildlife: living things, especially mammals, birds, and fishes (but not limited to the animal kingdom), that are not tamed or domesticated. They do not depend on humans for any survival needs.

Wildlife management: the application of scientific knowledge and technical skills to protect, preserve, conserve, limit, enhance, or extend the value of wildlife and its habitat.

MORE CURRICULUM CONNECTIONS

Folktales, Fiction, Poetry, Biographies, and Picture Books Supplementing *Alaska's Wildlife for the Future*

Asch, Frank. *Song of the North*. New York: Harcourt, Brace, 1999. (Poetry)

Bernhard, Emery. *How Snowshoe Hare Rescued the Sun: A Tale from the Arctic*. New York: Holiday House, 1993. (Folktale)

Bierhorst, John. *The Dancing Fox: Arctic Folktales*. New York: Morrow, 1997. (Folktale)

Bugni, Alice. *Moose Racks, Bear Tracks & Other Alaska Kidsnacks: Cooking with Kids Has Never Been Easier*. Seattle: Sasquatch Books, 1999. (Cookbook)

Burnham, Saranne. *Three River Junction: A Story of an Alaskan Bald Eagle Preserve*. Norwalk, CT: Soundprints, 1996. (Picture Book)

Carle, Eric. *House for Hermit Crab*. Saxonville, MA: Picture Book Studio, 1987. (Picture Book)

Carlstrom, Nancy White. *Midnight Dance of the Snowshoe Hare: Poems of Alaska*. New York: Philomel Books, 1998. (Poetry)

Carlstrom, Nancy White. *Raven and River*. Boston: Little Brown, 1997. (Picture Book)

Cohlene, Terri. *Ka-Ha-Si and the Loon: An Eskimo Legend*. New York: Troll, 1991. (Folktale)

Dabcovich, Lydia. *The Polar Bear Son: An Inuit Tale*. New York: Clarion Books, 1999. (Folktale)

Dixon, Ann. *Blueberry Shoe*. Anchorage: Alaska Northwest Books, 1999. (Picture Book)

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Gill, Shelley. *Thunderfeet: Alaska's Dinosaurs and Other Prehistoric Critters*. Homer, AK: Paws IV Publishing, 1998. (Picture Book)

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Helman, Andrea. *1,2,3 Moose: A Pacific Northwest Counting Book*. Seattle: Sasquatch Books, 1996. (Picture Book)

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Howker, Janni. *Walk with a Wolf*. Cambridge, MA: Candlewick Press, 1998. (Picture Book)

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McDonald, Megan. *Is This a House for Hermit Crab?* New York: Orchard Books, 1990. (Picture Book)

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Strasser, Todd. *Grizzly Attack*. New York: Pocket Books, 1998. (Fiction)

Taylor, Harriet Peck. *Ulaq and the Northern Lights*. New York: Farrar Straus Giroux, 1998. (Picture Book)

Von Ammon, Helen. *Musk Ox Babies of the Far North*. San Francisco: Doodlebug Books, 1997. (Picture Book)

Walker, Tom. *Shadows on the Tundra: Alaskan Tales of Predator, Prey, and Man*. Harrisburg, PA: Stackpole Books, 1990. (Hunting Tales)

Media & Website Supplementing *Alaska's Tundra and Wildlife*

Media:

Alaska's Coolest Animals (Video) Anchorage: Sky River Films, 1997.

Playtime with Ahpun & Oreo (Video) Anchorage: Alaska Video Postcards, 1999.

Tell Me a Story from Alaska: Alaska's Three Bears and the Alaska Mother Goose (Video) Anchorage: Sky River Films, 1993.

Websites:

Alaska Zoo <www.alaskazoo.com> researched and written by students at Willow Crest Elementary School, Anchorage, Alaska.

Wild Bear Cam, McNeil River Sanctuary <www.nationalgeographic.com/bearcam> Live video camera at the McNeil River Bear Sanctuary, Alaska.

Wild-eyed Alaska, Gull Island in Kachemak Bay <www.hhmi.org/alaska> Live video camera on Gull Island, Alaska.

TEACHER RESOURCES

Most useful resources for teaching general and specific activities in Alaska's Wildlife for the Future

Useful for All

Books and Publications:

Alaska Ecology Cards – Alaska Wildlife Curriculum. Alaska Department of Fish and Game, 2001.

Alaska Northwest Books. *The Alaska Almanac: Facts About Alaska*. Anchorage: Author, published annually.

Alaska Wildlife Notebook Series. Alaska Department of Fish and Game. Available to download <www.state.ak.us/adfg> or from Wildlife Education, ADF&G, 333 Raspberry Rd. Anchorage, AK 99518.

Alaska Sea Grant College Program. *Alaska Sea Week Curriculum*. (Curriculum Guides include *Discovery: an Introduction*, Kindergarten; *Animals of the Seas and Wetlands*, Grade 1; *Shells and Insects*, Grade 2; *Birds and Wetlands of Alaska*, Grade 4; *Fish and Fisheries*, Grade 5; and *Marine Mammals: Coastal and River Issues*, Grade 6. Can be ordered from <www.uaf.edu/seagrant/Pubs_Videos/edu.html> or Alaska Sea Grant College Program, P.O. 755040-INT, Fairbanks, AK 99775-5040 *or* 907-474-6707 *or* 888-789-0090.

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Cornell, Joseph. *Sharing Nature with Children*. Nevada City, CA: Dawn Publishing, 1998.

Davis, Neil. *Science Nuggets*. Fairbanks: Geophysical Institute, University of Alaska. Reprinted 1999.

Ewing, Susan. *The Great Alaska Nature Factbook: A Guide to the State's Remarkable Animals, Plants, and Natural Features*. Anchorage: Alaska Northwest Books, 1996.

Hefner, Christine. *Literature-Based Science: Children's Books and Activities to Enrich the K-5 Curriculum*. Phoenix: Oryx Press, 1995.

Junior Environment on File. New York: Facts on File, 1996.

Kerrod, Robin. *Encyclopedia of the Animal Kingdom*. New York: Barnes and Noble Books, 1997.

Kerrod, Robin. *Facts on File Wildlife Atlas*. New York: Facts on File, 1997.

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National Audubon Society. *Audubon Adventures: Alaska*. Address: National Audubon Society, 700 Broadway, New York, NY 10003 *or* <www.audubon.org> *or* 212-979-3183.

National Wildlife Federation. *Amazing Mammals I and II*. Philadelphia: Chelsea House, 1999 *or* <www.nwf.org>

Parker, Phillip. *Your Wild Neighborhood*. New York: Thomson Learning, 1995. (Activities and projects)

Sheehan, Kathryn. *Earth Child 2000: Games, Stories, Activities, Experiments & Ideas about Living Lightly on Plant Earth*. Tulsa: Council Oak Books, 1998.

Welch, Joanne. *Our Wild Neighbors: An Educational Resource Book About Alaskan Animals*. National Park Service, 1999.

Media:

Alaska Wild! Free video clips for multimedia reports. Licensed for royalty-free use by teachers and students in non-commercial educational presentations. 1995. Available from Bullfrog Films, P.O. Box 149, Olney, PA 19547. <www.bullfrogfilms.com>

Websites:

Acorn Naturalists <www.acornnaturalists.com> Source for animal tracks materials, books and other curriculum support materials.

Alaska Department of Fish and Game <www.state.ak.us/adfg> Current hunting seasons and regulations by species and game units; photos of wildlife; wildlife information; environmental education. Also, available for download, *Alaska Wildlife Notebook Series*.

Alaska Native Knowledge Network <www.ankn.uaf.edu> *Alaska Standards for Culturally Responsive Schools* and *Guidelines for Preparing Culturally Responsive Teachers for Alaska's Schools* are available online. Ordering information for *Curriculum Resources for the Alaskan Environment* and *Inuuqatigiit* (curriculum from the Inuit perspective) are also available. Science Projects are available from <www.ankn.uaf.edu/Alaska_Alive>

Alaska Natural Heritage Program <www.uaa.alaska.edu/enri/aknhp_web> Current status of Alaska's biodiversity, annotated species at risk project, and excellent links to Alaska biodiversity and biology resources.

Alaska Native Heritage Center <www.alaskanative.net> Information on the Alaska Native Heritage Center with links to Native groups, arts, culture, education, and issues.

Alaska Science Forum <www.gi.alaska.edu/ScienceForum> Treasure of new and archive articles written for general audiences answering science questions and highlighting Alaska's natural science phenomena and research.

Alaska Sea Grant Program <www.uaf.edu/seagrant> Has a useful list of Marine Education publications. Includes ordering information for the Alaska Sea Week Curriculum materials.

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu**>** Magazine and newspaper articles from more than 2,000 magazines and journals, 100 newspapers plus other information.

Anchorage *Daily News* <www.adnsearch.com> Staff-written newspaper articles, current and past. Article citations can be located at no charge. Fee for full text of past articles.

Animal Diversity Web <animaldiversity.ummz.umich.edu/index.html>

BLM Environmental Education <www.blm.gov/education>

Environmental News Network <www.enn.com> Searchable by subject. Good for current news articles.

Fairbanks *Daily News-Miner* <www.newsminer.com> Staff-written newspaper articles, current and past, available on file, no fee.

Guide to Educational Science Kits in Alaska <www.col-ed.org/ak/kitwebpage.html> or contact Stephanie Hoag, c/o SMCNWS, 119 Seward St. #4, Juneau, AK 99802 *or* 907-463-4829.

Loussac Library <lexicon.ci.anchorage.ak.us> Also includes UAA, ARLIS and the Anchorage Museum Library catalogs.

National Biological Information Infrastructure <www.nbii.gov/education> Site for online resources that emphasize the teaching of biology, biodiversity, and ecology.

National Wildlife Federation <www.nwf.org> Has information on environmental education programs and publications.

Project Learning Tree <www.plt.org> Environmental education curriculum K-12 of the American Forest Foundation <www.affoundation.org> Locally supported by the Alaska Department of Natural Resources.

Project WILD <www.projectwild.org> Environmental education curriculum K-12 of the Western Regional Environmental Education Council. Supported locally by the Alaska Department of Fish and Game.

US Geological Survey. Alaska Biological Science Center <www.absc.usgs.gov> Has wildlife photos and reports of current research on Alaska's fish, mammals, birds, and ecosystems.

World Wildlife Fund. *Windows on the Wild* <www.worldwildlife.org/windows> Materials to teach about biodiversity.

Section 1. Habitat - Basis for Survival

Books and Publications:

Alaska in Maps: A *Thematic Atlas*. Fairbanks: University of Alaska Fairbanks, 1998.

Hickman, Pamela. *Habitats*: *Making Homes for Animals and People*. Reading, MA: Addisson-Wesley, 1993. (Activity Book)

Western Regional Environmental Education Council. *Aquatic Education Activity Guide*. Bethesda, MD: Project Wild, 1995.

Western Regional Environmental Education Council. *Taking Action*: *An Educator's Guide to Involving Students in Environmental Action Projects*. Bethesda, MD: Project Wild. For further information <www.projectwild.org>

Western Regional Environmental Education Council. *Wild School Sites*: A *Guide to Preparing for Habitat Improvement Projects on School Grounds*. Bethesda, MD: Project Wild, 1993. For further information <www.projectwild.org>

Media:

Alaska Mammals Kit (K-6) Available from ARLIS. For further information check *Guide to Educational Science Kits in Alaska* <www.col-ed.org/ak/kitwebpage.html>

Topographical Maps. Available from your local sporting goods store *or* USGS, 4230 University Dr., Anchorage, AK 99508

Track Kit. Available from APLIC-Anchorage and Southeast Alaska Visitor Center-Ketchikan. For more information check *Guide to Educational Science Kits in Alaska* <www.col-ed.org/ak/kitwebpage.html>

US Fish and Wildlife Service. A *Home for Pearl*. (Video) Washington, DC: Author, 1990.

Websites:

Audubon On Line Field Guides <www.enature.com> Access to 7 habitat guides including Arctic, forest, wetlands, and ocean/coastal.

National Wildlife Federation. *Schoolyard Habitats*. <www.nwf.org/habitats/schoolyard> Information on how to order the *Schoolyard Habitats Kit*.

OBIS: *Outdoor Biological Instructional Strategies* <www.lhs.berkeley.edu/OBIS/OBISpubs.html> Outdoor activities revolving around ecosystems developed by Lawrence Hall of Science, University of California, Berkeley.

Section 2. Diversity and Populations – Alaska's Dynamic Wildlife

Books and Publications:

Jones, Anore. *Nauriat Niginaqtuat=Plants That We Eat*. Kotzebue: AK: Maniilaq Association, 1983.

Kari, Priscilla Russell. *Dena'ina K'et'una=Tanaina Plantlore*. Anchorage: National Park Service, Alaska Region, 1987.

Russell, Helen. *Ten-Minute Field Trips: A Teacher's Guide to Using the Schoolgrounds for Environmental Studies*. Available for purchase from Acorn Naturalist <www.acornnaturalist.com>

Snively, G. *Beach Exploration: A Curriculum for Grade* 5-10. Fairbanks, AK: Alaska Sea Grant Publications, 1998.

US Fish and Wildlife Service. *Teach about Geese*. K-12 Curriculum covering four species of geese in the Yukon Kuskokwim Delta. Available for purchase from Wizard Word, P.O. Box 1125, Homer, AK 99603 *or* 907-235-8757.

US Fish and Wildlife Service-Alaska. *Wetlands and Wildlife: Curriculum*. Separate sets (teacher's guide, activities, field trip manual) available for grades K-6 and grades 7-12. For information on this curriculum and others available<www.r7.fws> Can be ordered from Wizard Words, P.O. Box 1125, Homer, AK 99603 *or* 907-235-8757.

Western Regional Environmental Education Council. *Aquatic Education Activity Guide*. Bethesda, MD: Project Wild, 1995.

Western Regional Environmental Education Council. *Wild School Sites: A Guide to Preparing for Habitat Improvement Projects on School Grounds*. Bethesda, MD: Project Wild, 1993. For more information <www.projectwild.org>

Media:

Alaska Sea Grant Program. *Walk on the Wild Side*. (Video) Fairbanks: University of Alaska, Fairbanks, 1995.

Geese Kit Available to some schools from the Alaska Science Center, Alaska Pacific University, 4101 University Dr., Anchorage AK 99508. Kits are available for $10 local users fee or a $20 fee plus return postage cost for non-local users. For more information <www.alaskapacific.edu/science> or *Guide to Educational Science Kits in Alaska* <www.col-ed.org/ak/kitwebpage.html>

Life on the Brink series. (Audio Tape or download from the website) <npr.org/programs/RE/brink.html> National Public Radio *or* 1-888-NPR-DISC.

Raptor Kit. Available on loan from ADF&G in Fairbanks and Douglas or ARLIS in Anchorage. Other Raptor kits are being developed by the Pratt Museum and the Alaska Raptor Rehabilitation Center. For further information check *Guide to Educational Science Kits in Alaska* <www.col-ed.org/ak/kitwebpage.html>

Rodden, Remy. *Think about the Planet*. (Audio Tape) Available from Think About Products, Box 5451, Whitehorse, Yukon, Canada Y1A5H4 *or* <www.yukon.net/thinkabout>

Websites:

Audubon On Line Field Guides <www.enature.com> Access to more than 4,800 North American plants and animals as well as 7 habitat guides including Arctic, forest, wetlands, and ocean/coastal.

OBIS: Outdoor Biological Instructional Strategies. *"How Many Organisms Live Here?"* and *"Who Lives Here"* <www.lhs.berkeley.edu/OBIS/OBISpubs.html> Outdoor activities revolving around ecosystems developed by Lawrence Hall of Science, University of California, Berkeley.

US Fish and Wildlife Service - Alaska Region <www.r7.fws.gov> For information on geese link to Migratory Birds.

US Fish and Wildlife Service. *Endangered Species* <endangered.fws.gov>

USGS Alaska Biological Science Center <www.absc.usgs.gov> Go to Waterfowl, and choose "Anchorage Canada Goose Project"

Section 3. When Populations Decline - Losing Biodiversity

Books and Publications:

Alaska Geographic Society. *Alaska's Magnificent Eagles*. Anchorage: Author, 1997.

Alaska Geographic Society. *Prehistoric Alaska*. Anchorage: Author, 1994.

Endangered Species: Critical Issues, Critical Thinking. (ES0030) Part of the National 4-H Council's "On Common Ground" series. Booklet contains role-playing activities for students in which all sides are examined. Available from On Common Ground, National 4-H Council, 7100 Connecticut Avenue, Chevy Chase, MD 20815. (For ages 12-14)

Lewis, Barbara. *The Kid's Guide to Social Action: How to Solve the Social Problems You Choose – and Turn Creative Thinking into Positive Action*. Minneapolis, MN: Free Spirit Publishing, 1998.

National Wildlife Federation. *Endangered Species: Wild and Rare*. Philadelphia: Chelsea House, 1997 *or* <www.nwf.org>

US Fish and Wildlife Service - Alaska Region. *Bald Eagle Basics*. Anchorage, Author, 1993.

Media:

Alaska Geographic. *Alaska's Dinosaurs* and *Alaska's Ice-Age Mammals*. (Posters) Available from Alaska Geographic <www.ak.geo.com>

Song of Life. From the *Life on the Brink* series. (Audio Tape or download from the website) <npr.org/programs/RE/brink.html> National Public Radio *or* 1-888-NPR-DISC.

Star Trek: The Final Frontier (Video) Available from your local video store.

Thunderfeet: Alaska's Dinosaurs and Other Prehistoric Critters. (Audio Tape) C & P Hobo Jim Music Co., 1988. Text by Shelley Gill, music by Hobo Jim.

Websites:

BLM. *Dinosaurs on Alaska's North Slope* <www.ak.blm.gov/ak930/akdino.html>

Section 4. Wildlife Conservation Is Up to Us!

Books and Publications:

Alaska Department of Fish and Game. *Advisory Committee Manual*. Available through Boards Support, Juneau, AK 99811.

Alaska Department of Fish and Game. *Alaska Hunting Regulations*. Available from all ADF&G offices and vendors where hunting licenses are sold.

Garza, Dolly A. *Tlingit Moon & Tide Teaching Resource: Elementary Level*. Fairbanks: University of Alaska Sea Grant, 1999.

Franzmann, Albert W. and Charles C. Schwartz. *Ecology and Management of the North American Moose*. Washington, DC: Smithsonian Institution Press, 1997.

Heinrich, Bernd. *Ravens in Winter*. New York: Vintage Books, 1991.

Heinrich, Bernd. *Mind of the Raven: Investigations and Adventures with Wolf-Birds*. New York: Cliff Street Books, 1999.

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National Wildlife Federation. *Endangered Species: Wild and Rare* (*NatureScope*) Philadelphia: Chelsea House, 1997 *or* <www.nwf.org>

Nelson, Richard K. *Make Prayers to the Raven: A Koyukon View of the Northern Forest*. Chicago: University of Chicago Press, 1986.

Nelson, Richard K. *Shadow of the Hunter: Stories of Eskimo Life*. Chicago: University of Chicago Press, 1983.

Norman, Howard, ed. *Northern Tales: Traditional Stories of Eskimo and Indian*. New York: Pantheon Books, 1990.

Savage, Candace. *Bird Brains: The Intelligence of Crows, Ravens, Magpies and Jays*. San Francisco: Sierra Club Books, 1997.

Strauss, Susan. *The Passionate Fact: Storytelling in Natural History and Cultural Interpretation*. Golden CO: North American Press, 1996.

Media:

Alaska Department of Fish and Game. *Alaska's Wildlife: An Inside Glimpse* (Video) 1997; *Connecting with Caribou* (Video) 1999; *Wolves of Alaska* (Video) 1999.

Box of Daylight (Video) Sealaska Heritage Foundation, 1990. (Sealaska Foundation, One Sealaska Plaza, Suite 201, Juneau, AK 99801)

Websites:

Alaska Department of Fish and Game. *Hunting Regulations* and *Game Board* information <www.state.ak.us/adfg>

Alaska Native Language Center <www.uaf.edu/anlc> Source of Alaska Native tales in Native languages and English. University of Alaska, Fairbanks.

The Wildlife Management Institute<www.jwdc.com/wmi/main.html> Pamphlets on *Placing Hunting in Perspective* and *Placing Wildlife Management in Perspective*.

Western Regional Environmental Education Council. *Taking Action: An Educator's Guide to Involving Students in Environmental Action Projects*. Bethesda, MD: Project Wild. For more information <www.projectwild.org>

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Books and Publications

Alaska Department of Fish & Game. *Alaska Wildlife Notebook Series*. Available to download <www.state.ak.us/adfg> *or from* Wildlife Education, ADF&G, 333 Raspberry Rd., Anchorage AK 99518.

Alaska Geographic Society. *Alaska's Bears*. Anchorage: Author, 1993.

Alaska Geographic Society. *Alaska's Magnificent Eagles*. Anchorage: Author, 1997.

Alaska Geographic Society. *Mammals of Alaska*. Anchorage: Author, 1996.

Alaska Geographic Society. *Moose, Caribou and Musk Ox*. Anchorage: Author, 1997.

Alaska Geographic Society. *Prehistoric Alaska*. Anchorage: Author, 1994.

Alaska in Maps: A *Thematic Atlas*. Fairbanks: University of Alaska Fairbanks, 1998.

Aliki. *Wild and Woolly Mammoths*. New York: HarperCollins, 1996.

Angliss, Sarah. *Future World*: A *Beginner's Guide to Life on Earth in the 21st Century*. Brookfield, CT: Cooper Beech Books, 1998.

Armstrong, Robert. *Alaska's Fish*: A *Guide to Selected Species*. Anchorage: Alaska Northwest Books, 1996.

Armstrong, Robert. *Alaska's Birds*: A *Guide to Selected Species*.. Anchorage: Alaska Northwest Books, 1994.

Arnosky, Jim. *Crinkleroot's Guide to Knowing Animal Habitats*. New York: Simon & Schuster, 1997.

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Berry, William D. *Deneki*: *An Alaskan Moose*. Sunnyvale, CA: Press North America, 1988.

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Borror, Donald. *Peterson's Field Guide to Insects*. Boston: Houghton Mifflin, 1998.

Brooks, Bruce. *Predator*! New York: Farrar Straus Giroux, 1991.

Burnham, Saranne D. *Three River Junction*. Norwalk, CT: Soundprints, 1996.

Carle, Eric. *House for Hermit Crab*. Saxonville, MA: Picture Book Studio, 1987.

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Cottam, Clarence. *Insects*: A *Guide to Familiar American Insects*. New York: Golden Books, 1987.

de Koster, Katie. *Endangered Species*. San Diego: Greenhaven Press, 1998.

Dixon, Ann. *How Raven Brought Light to People*. New York: M.K. McElderry Books, 1992.

Earthworks Group. 50 *Simple Things Kids Can Do to Recycle*. Berkeley, CA: EarthWorks Press, 1994.

Endangered Wildlife of the World. New York: Marshall Cavendish, 1993.

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Facklam, Marjorie. *And Then There Was One: the Mysteries of Extinction*. Boston: Little Brown, 1993.

Fair, Jeff. *Bears for Kids*. Minocqua, WI: NorthWord Press, 1991.

Fair, Jeff. *Moose for Kids: (Moose Are Like That)*. Minocqua, WI: NorthWord Press, 1992.

George, Jean Craighead. *The Case of the Missing Cutthroats: an Ecological Mystery*. New York: HarperCollins, 1995.

George, Jean Craighead. *Water Sky*. New York: Harper & Row, 1987.

Gibbons, Gail. *Soaring with the Wind: The Bald Eagle*. New York: Morrow, 1998.

Gieck, Charlene. *Eagles for Kids*. Minocqua, WI: NorthWord Press, 1991.

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Homer, AK: Paws IV Publishing, 1998.

Goldberg, Jake. *Food: the Struggle to Sustain the Human Community*. New York: Franklin Watts, 1999.

Green, Jen. *A Dead Log*. New York: Crabtree, 1999.

Green, Jen. *Under a Stone*. New York: Crabtree, 1999.

Haines, Tim. *Walking with Dinosaurs: A Natural History*. New York: Dorling Kindersley, 2000.

Heller, Christine A. *Wild Edible and Poisonous Plants of Alaska*. Fairbanks, AK: Cooperative Extension Service, University of Alaska, 1993.

Helman, Andrea. *1,2,3, Moose: A Pacific Northwest Counting Book*. Seattle: Sasquatch Books, 1996.

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Holling, Holling C. *Pagoo*. Boston: Houghton Mifflin, 1957.

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Kalman, Bobbie. *Arctic Animals*. New York: Crabtree Publishing, 1988.

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Kari, Priscilla Russell. *Dena'ina K'et'una=Tanaina Plantlore*. Anchorage: National Park Service, Alaska Region, 1987.

Kerasote, Ted. *Bloodties: Nature, Culture, and the Hunt*. New York: Kodansha America, 1993.

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Kest, Kristin. *Endangered Animals: 140 Species in Full Color*. New York: Golden Books, 1995.

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FULL CITATIONS – ACTIVITY CURRICULUM CONNECTIONS

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Alaska Department of Fish and Game <www.state.ak.us/adfg> Current hunting seasons and regulations by species and game units; photos of wildlife; wildlife information; environmental education. Also available for download: *Alaska Wildlife Notebook Series*.

Alaska Native Heritage Center **<**www.alaskanative.net> Links to Native Organizations and subsistence articles. Select Education, then Resources for links.

Alaska Natural Heritage Program <www.uaa.alaska.edu/enri/aknhp_web> Current status of Alaska's biodiversity, annotated species at risk project, and excellent links to Alaska biodiversity and biology resources.

Alaska Outdoor Council <www.alaskaoutdoorcouncil.org> Official state affiliate of the NRA.

Alaska Science Forum <www.gi.alaska.edu/ScienceForum> Treasure of new and archive articles written for general audiences answering science questions and highlighting Alaska's natural science phenomena and research.

Alaska Statewide Databases, accessed through your local library website or <sled.alaska.edu**>** Magazine and newspaper articles from more than 2,000 magazines and journals, 100 newspapers, plus other information.

Alaska Trappers Association <www.alaskatrappers.org>

FULL CITATIONS – ACTIVITY CURRICULUM CONNECTIONS

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Alaska Wildlife Alliance <www.akwildlife.org> For current wildlife issues.

Anchorage *Daily News* <www.adnsearch.com> Staff-written newspaper articles, current and past. Article citations can be located at no charge. Fee for full text of past articles.

Animal Diversity Web <animaldiversity.ummz.umich.edu/index.html>

Birdhouses for Alaska <www.state.ak.us/adfg>

BLM. *Dinosaurs on Alaska's North Slope* <www.ak.blm.gov/ak930/akdino.html>

California Department of Fish and Game, Habitat Conservation Planning Branch. *California Condor* <www.dfg.ca.gov/hcpb/condor.html>

Defenders of Wildlife. *Endangered Species Learning Center* <www.defenders.org/eslc.html> Has links to other Endangered Species websites.

Ducks Unlimited <www.ducks.org>

EngangeredSpecies.com, the Rarest Info Around <www.endangeredspecie.com>

Environmental News Network <www.enn.com> Searchable by subject. Good for current news articles.

EPA Office of Solid Waste. *Students' and Teachers' Page* <www.epa.gov/epaoswer/osw/students.htm>

Fairbanks *Daily News-Miner* <www.newsminer.com> Staff-written newspaper articles, current and past, available on file, no fee.

Food, Land, and People <www.foodlandpeople.org> For understanding the interrelationships between agriculture, the environment, and people of the world.

Journey North, *a Global Study of Wildlife Migration* <www.learner.org/jnorth> Focus on songbirds, neotropical migrants.

Landscaping for Wildlife <www.state.ak.us/adfg>

Muskox Farm <www.muskoxfarm.org> Has muskox photos and natural history information.

National Marine Fisheries Service. *Steller Sea Lions* <www.fakr.noaa.gov/protectedresources/stellers.htm> Critical habitat, regulation, research, recovery efforts, and restricted fishing areas in Alaska.

Thinkquest's *Animals of the Arctic* <tqjunior.thinkquest.org/3500> good for research papers with extensive links to arctic wildlife. Overview of animals unique to the Arctic; habitat descriptions, pictures, sounds, glossaries, stories, activities.

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United Nations Population Fund. *State of World Population* <www.unfpa.org/swp>.

US Fish and Wildlife Service - Alaska Region <www.r7.fws.gov>

US Fish and Wildlife Service - Alaska Region, Arctic National Wildlife Refuge <www.r7.fws.gov/nwr/arctic> For information on the Western Arctic Caribou herd.

US Fish and Wildlife Service - Alaska Region, Office of Subsistence Management <www.r7.fws.gov/asm/home.html>

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US Fish and Wildlife Service, *Endangered Species Program* <endangered.fws.gov>

US Fish and Wildlife Service - Kenai National Wildlife Refuge. *Mammals on the Kenai National Wildlife Refuge* <kenai.fws.gov/mammals.html>

USGS Alaska Biological Science Center <www.absc.usgs.gov> Has wildlife photos and reports of current research on Alaska's fish, mammals, birds, and ecosystems.

University of Alaska Justice Center <www.uaa.alaska.edu/just/links/natives.html> Links and information on the subsistence issue.

Various atlas websites <www.maps.com> or <www.3datlas.com>

Wildcam: Bear, McNeil River Sanctuary <www.nationalgeographic.com/bearcam> Live video camera at the McNeil River Bear Sanctuary, Alaska.

Wildcam: Steller Sea Lion, Chiswell Island <www.nationalgeographic.com/stellercam> Live video camera on Chiswell Island, Alaska.

Winter Bird-feeding in Alaska <www.state.ak.us/adfg>

World Population Awareness <www.overpopulation.org>

World Watch Institute <www.worldwatch.org>

Yukon Beringia Interpretive Centre <www.beringia.com> Information on the Woolly Mammoth

The Alaska Wildlife Curriculum Cross-Reference

Grade Index: lists activities by grade(s).

Topic Index: lists activities by topic. One activity may cover several topic areas.

Alaska State Standards Index: correlates the lessons by state content standards in 2 different ways: (1) by activity and, (2) by standard. The index grades each activity in its ability to meet the standard. The markings measure whether the activity references, teaches, or assesses the standard.

The 4 books Alaska Wildlife Curriculum series are coded as follows:

Alaska's Ecology	**E**
Alaska's Forests and Wildlife	**F**
Alaska's Tundra and Wildlife	**T**
Alaska's Wildlife for the Future	**W**

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Don't Put All Your Eggs															
in One Basket	W	99	•	•	•	•	•								
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Alaska State Standards Index

This index contains correlations between the Alaska State Standards and the four books of the Alaska Wildlife Curriculum series.

There are two indexes available in the section. The first index lists the standard and all the activities in the book which reference it. The second index references the activity and lists all the standards it meets.

The standards have been ranked with a symbol. Find the explanation below:

- ▲ the lesson only references the standard.
- ● the lesson teaches part of the standard.
- ■ the lesson teaches the standard thoroughly so such an extent that the standard can be assessed.

Listed below are the Alaska State Standards addressed in this series and the abbreviation used in this index. For a complete definition of each standard, refer to the Alaska State Content Standards Booklet or the Alaska Department of Education Web site
http://www.educ.state.ak.us/contentstandards/home.html

L = English/Language Arts

A-1	C-2
A-2	C-4
A-4	C-5
A-5	D-1
A-6	D-2
B-1	E-1
B-2	E-3
C-1	E-4

M = Mathematics

A-3	B-4
A-4	B-6
A-6	D-1
B-1	D-2
B-3	D-5

S = Science

A-12	B-2
A-14	B-5
A-15	B-6
B-1	

Geo= Geography

A-1	E-2
B-1	E-4
C-1	E-5
C-2	E-6
C-3	F-3
E-1	G-3

Gov = Government and Citizenship

C-1	E-5
C-2	F-9
C-7	G-2
E-2	G-3
E-3	G-4
E-4	

A = Arts

A-1	A-5

AC = Alaska Cultural

A-2	E-2

T = Technology

A-3	C-1
B-1	

CS = Cultural Standards

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S B-5	■		
CS B-2	●		
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M A-4	▲		
M A-6	●		
S A-14	●		
Geo E-5	■		
Geo E-6	■		
Graphic Populations		W	113
M A-4	●		
Habitat Boxes		W	67
Does not address a standard			
Habitat Grid		W	63
Does not address a standard			
Habitat Roulette		W	140
M A-3	▲		
S A-14	●		
Geo E-5	■		
Habitat Times		W	76
L A-4	▲		
L A-5	▲		
S A-14	■		
Geo E-5	■		
Hermit Crab Game		W	131
Does not address a standard			
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M A-3	■		
M B-1	▲		
M B-6	■		
How Many Bears Can Live in this Forest?		W	133
M A-3	■		
M A-6	■		
M D-1	●		
M D-2	■		
M D-5	▲		
S A-14	●		
Geo E-5	▲		

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Gov C-1	■		
Gov C-2	▲		
Gov E-2	▲		
Gov E-3	●		
Gov E-4	▲		
Gov G-2	■		
Gov G-3	▲		
Gov G-4	■		
L A-1	●		
L A-4	■		
Interview a Muskox		W	74
L A-3	▲		
L A-4	▲		
L A-5	▲		
L A-6	▲		
Microdiversity- Under Your Nose		W	84
S A-12	▲		
S B-1	▲		
Moose on the Loose		W	177
L D-1	■		
L D-4	▲		
Geo F-3	▲		
Geo G-3	■		
Musical Habitats		W	138
S A-14	▲		
Muskox Returns to Alaska		W	154
S A-14	■		
Our Place in the Food Web		W	158
S A-14	●		
M D-1	▲		
M D-2	●		
Population Explosions		W	103
M A-3	●		
M A-4	■		
M A-6	●		

	Suitability	Book	Page
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Does not address a standard			
Predator-Prey Predicaments		W	128
S A-14	■		
Scavenge for Biodiversity		W	80
S A-12	▲		
Schoolyard Habitat Map		W	71
S A-12	▲		
S A-14	▲		
S A-15	●		
Science, Technology, Society, and Wildlife		W	172
L D-1	■		
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