GRIZZLY SURVIVAL

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Early Accounts

The journals of Lewis and Clark include detailed references to the "monstrous beast" which they designated as the brown, yellow, white, or variegated bear. This seemingly monstrous bear was the grizzly (*Ursus arctos horribilis)*, which they claimed was the fiercest, largest, and most intelligent quadruped on the North American continent. Excerpts from Lewis' journal reveal the sense of awe that he felt toward the grizzly.

Monday April 29th 1805

> Set out this morning at the usual hour; the wind was moderate; I walked onshore with one man. About 8 A.M. we fell in with two brown or yellow (white) bear; both of which we wounded; one of them made his escape; the other after my firing on him purused [sic] me seventy or eighty yards; but fortunately had been so badly wounded that he was unable to pursue so closely as to prevent my charging my gun. We again repeated our fire and killed him. It was a male not fully grown; we estimated his weight at 300 lb. not having the means of ascertaining it precisely. The legs of this bear are somewhat longer than those of the black, as are it's tallons and tusks imcomparably [sic] larger and longer. ...It's colour is yellowish brown, the eyes small, black, and piercing; the front of the forelegs near the feet is usually black; the fur is finer, thicker and deeper than that of the black bear. ...it is a much more furious and formidable anamal, [sic] and will frequently pursue the hunter when wounded. It is astonishing to see the wounds they will bear before they can be put to death. The Indians may well fear this anamal equiped as they generally are with their bows and arrows or indifferent fuzees, but in the hands of skillful riflemen they are by no means as formidable or dangerous as they have been represented.

Native Americans both feared and revered the grizzly bear. Blackfeet Indians avoided the grizzly and regarded it as a sacred animal of great supernatural and physical power. To the Blackfoot, the grizzly was part bear and part human, and only the buffalo received greater veneration. Blackfeet traditions indicate that when there are medicine bundles hanging in the tipi, it is necessary to refer to the grizzly bear using descriptive terms, but not the generic name of the bear. In speaking of a particular grizzly, "sticky mouth" is a term often used by the Blackfeet (Hallowell, 1926, p. 47).

Native Americans created ceremonies to express the meaning of their relationships with bears. These ceremonies might occur before or after killing the bear. In a painting by George Catlin, for example, *The White Cloud,* head chief of the Iowas, is depicted wearing a necklace of grizzly claws and painted as if ready to hunt the huge animal. In some tribes, a necklace of grizzly claws was thought to provide great courage and strength to the wearer.

The anthropologist, A. Irving Hallowell (1926, p. 57), studied the relationship between humans and animals, making the following observation about Ojibway traditions:

> In addition to the apologetic note which characterizes so many of the conciliatory speeches made to bears, ...there are several variant features worthy of notice....one of the most interesting and important of these is the custom of telling the beast that its slayers are not its slayers. That is, the responsibility is frequently shifted to a fictitious agency. In North America the clearest case of this sort I have found recorded is in Henry's account of the Ojibway, in which the animal is assured that an Englishman put it to death and not an Indian.

From these early accounts of grizzly behavior and folklore, scientists have expanded knowledge of grizzly habitat and behavior. They have challenged the image of the grizzly as "monstrous" and at the same time have confirmed these behaviors under certain conditions, such as when provoked by humans.

Credit: Photo by Gerald and Buff Corsi © California Academy of Sciences

Characteristics

The largest documented grizzly was shot on Kodiak Island in 1894, weighing 1,656 pounds (753 kg) (Busch, 22). However, grizzlies over 1,000 pounds are rare, most range approximately between 200 and 700 pounds. One of the reasons humans are so attracted to bears is that they are similar to the human form when standing upright. Male grizzlies can measure 8 feet (2 m) from nose to tail. Despite their massive size, grizzlies can easily run 35 miles (53 km) per hour. "One sow grizzly was known to have

chased a truck full of park wardens at a speed of just over 40 miles per hour for a short distance before returning to her cubs" (Busch, 24). Strength more than speed is the primary basis for grizzly survival. "The power of these animals is just awesome," stated biologist Gordon Stenhouse after watching a large grizzly run effortlessly down a steep mountain slope with a 300-pound sheep in its mouth (Busch, 24).

The word "grizzly" comes from the Old French term *grisel,* meaning grayish. A typical grizzled appearance comes from the interspersal of silver-tipped hair scattered throughout the bear's coat (Busch, 27). Although most grizzly bears are a medium brown, their fur color ranges from golden to dark brown. Grizzlies shed their fur between June and August. This molted fur is often gathered by squirrels for lining their dens.

Scientists study the teeth of mammals for clues about their diet and age. The molars of most carnivores are *carnassial,* which means that they are sharply pointed and can be used to shear off bits of meat (Busch, 30). In grizzlies, however, the molars are *occludal,* meaning they are broad with flat crowns, which is an adaptation for crushing vegetation. Human molars have a regular pattern of bumps and hollows, whereas the surface of grizzly molars is irregular, "as if carnassials had been modified, which is what has happened during the evolution of the bear"(Busch, p. 30). Studying the rings on the teeth provides clues about the age of the grizzly, a process very similar to studying tree rings.

Credit: Credit: Smithsonian Institution Photo

The tracks of grizzlies have sometimes been mistaken for human footprints. The grizzly tracks have large hindpaw imprints and smaller forepaw prints. Grizzlies walk in a *plantigrade* fashion, placing their feet on the sole. By contrast, dogs are *digitigrade* walkers, meaning they walk on their toes, an adaptation for improved running speed (Busch, 33). The hindprint of a large grizzly can measure 10 to 12 inches (25 to 30 cm) long and 6 inches (15 cm) wide. One way to distinguish grizzly tracks from black bear tracks is by the size of the claw marks. Grizzly claws are longer, leaving 1 to 2 inch impressions.

Credit: Roger W. Barbour ©

Habitat Changes in the Northwest

Frank and John Craighead are two naturalists, and brothers, who began a longitudinal study of the grizzly in 1959 in Yellowstone National Park and four adjacent national forests. John Craighead was a leader of the Montana Cooperative Wildlife Research Unit at the University of Montana. Frank represented the Environmental Research Institute of Moose, Wyoming. The ecosystem, which was home to one of the largest remnant populations of grizzlies in the lower forty-eight states, encompassed about 5 million acres. At the time their study began, the grizzly was not overhunted. Reliable scientific information on the grizzly was extremely limited due to the grizzly's shyness, its tendency to be nocturnal, its wild and rugged habitat, and the dangers of getting close to the bears. The Craigheads' research investigated how much territory and privacy the grizzly needed, how the presence of greater numbers of humans in the ecosystem might affect them, and how large a viable population is. The Craigheads knew that their research was important if the Yellowstone ecosystem should continue as a refuge for grizzlies.

The Craigheads captured the bears in a culvert trap or tranquilized them with a dart. Once immobilized, a small numbered metal tag was clamped in each ear and plastic rope markers of various distinctive colors were inserted. The markers enabled the Craigheads to recognize individual bears from a distance. Originally, the Craigheads intended their research to be on a long-range basis. They observed the behavior of individual bears from year-to-year, kept track of changes in the social organization of the bear community, and tried to determine the size, composition, and growth trends of the population and the natural and imposed factors that influenced the population.

The Craigheads concluded from their research that the grizzly is a tough, rugged individual adapted to survive to the age of thirty years or more. The grizzly does not have enemies, with the exception of the white man and his rifle. Prior to the arrival of the white man, conflicts between bears and man occasionally terminated in the death the bear or the man, but these events were rare. Their more natural causes of death were the result of old age, trichina (roundworm) infection, infanticide, and occasional combat wounds from "being gored by a bison or large bull elk the grizzly has tried to bring down"(Craighead, 1979, p. 178).

Due to changes in administrative policy in Yellowstone Park in 1968, the Craigheads' field work was terminated. According to Frank Craighead, "the new policies were very nearly disastrous to the grizzly community"(Craighead, 1979, p. 11). His book Track of the Grizzly outlines the impact of policy changes up to the 1970s. To understand the long-term significance of the Craigheads' research, consult http://www.lewis-clark.org/griz/gri_mmnu.htm, http://www.lewis-clark.org/griz/griz_graph.htm and http://www.lewis-clark.org/griz/map_grizbr.htm for reports on reintroducing this species into the Bitterroot Mountains. This site explains some of the conservation efforts underway on behalf of the grizzly, turning around the temporary population reduction that began in the 1970s.

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Lesson Plan for Upper Elementary Students

Grade Levels Fourth and Fifth
Time One to Two Hours

Purpose Students will develop a greater appreciation for the role that humans play in preserving grizzlies and their habitat. The Lewis and Clark expedition lead to an increase in human settlements, resulting in a decrease in the grizzly population.

Previous Knowledge Assume that this lesson will be an extension to lessons describing the Lewis and Clark Expedition. This lesson should follow a viewing of the Smithsonian primary resources featuring the grizzly skull and pictures of the grizzly.

Objectives

1. Given data of grizzly research conducted by Frank C. Craighead, students will make inferences about the recorded deaths of grizzlies.
2. Given internet links, students will investigate the survival patterns of grizzlies in the present time period.
3. Given research, students will make interpretations about the interaction between humans and grizzlies.

Procedure

Motivation. Show students pictures (Handouts 1 and 2) of the range of grizzly habitat in the early 1800s compared with the present. Ask them to hypothesize about the differences over time. Pose questions such as, "What natural factors may have contributed to the reduction of territory?" "What human factors influenced the retraction further north?" Record student responses on board or overhead.

Content Focus. Give a brief biographical sketch of Frank Craighead. Distribute Craighead's *Table 1*: *Recorded deaths of grizzly bears in the Yellowstone Ecosystem, 1959-1967* (Handout 3). In small groups, ask students to makes inferences about the data, emphasize comparisons between human and natural causes. Possible student outcomes: Natural deaths from bear/bear death, disease, age—3; deaths from human intervention—129. Ask more probing questions about the data such as, "Were there changes in the frequency of deaths over time?" "What might account for the changes?"

Explain the important role that Craighead played in bringing awareness of grizzly behavior to park wardens as well as the negative effects that humans can have as a result of ignorance about bears. Explain that while there was a period of negative relationships between the grizzly and humans in the period after Craighead's research was conducted, recent efforts have been more positive.

Direct students to http://www.lewis-clark.org and ask them to research the positive steps that are being taken on behalf of the grizzly.

Closure. Ask students to return to the original questions posed in the beginning of the lesson: "What natural factors may have contributed to the reduction of territory?" "What human factors influenced the retraction further north?" Ask students if they would extend or modify their earlier responses based on their studies of grizzly habitat.

Conclude by pointing out that while investigations of contemporary issues and one longitudinal study cannot give a complete explanation for the reduction of the range of grizzly habitat over a 200 year period, they, nevertheless, illustrate the importance of scientific research which investigates the interrelationships between humans and mammals.

Remind students that Lewis and Clark are viewed as making important contributions as naturalists because of their extensive documentation of the plants and animals they encountered. In light of what happened to the grizzly over the 200 years since they were documented in the Lewis and Clark journals, ask students to identify the factors that contributed negatively to the grizzly ecosystem and what steps were taken to correct the negative impact of human behavior and policies. Student outcomes might include: negative—overhunting, hunting for sport, ignorance about grizzly habitat, human settlement; positive—hunting regulations, national parks as preservation for grizzly, scientific research influencing policy decisions, federal and state policies, educating the public.

Evaluation

- Students' interpretations of historic versus contemporary biogeographic maps
- Students' hypotheses about the factors contributing to the retreating grizzly population
- Students' interpretations of Craighead research on grizzly deaths
- Students' interpretations of relationship between human and animal survival

Background Information

Review information about grizzly and the Craigheads. To navigate the website cited above to the point of viewing contemporary policy efforts, click on the following:

1. Exploration
2. 6. High on the Plains
3. grizzly bears
4. Recovery
5. Recovery Plan (bottom of picture)
6. [Read about Recovery Plan, then...]
   All three choices:
   Record of Decision and Final Rule for Grizzly Bear Recovery in the Bitterroot
   Interagency Grizzly Bear Committee
   National Wildlife Federation

Materials

Smithsonian Web Site: Lewis & Clark as Naturalists
(http://www.mnh.edu/lewisandclark) - grizzly skull, photos of grizzly; Catlin painting *The White Cloud, Head Chief of the Iowas*; pictures of bear range prior to and after 1850; information on changes of bear populations (Craighead or http://www.lewis-clark.org/griz/map_grizbr.htm); reference materials.

Education Standards

National Science Education Standards: (http://www.nap.edu/html/nses/html/)
Life Science C; Science and Technology E; History and Nature of Science G [detailed version below]

National History Standards: (http://w3.iac.net/~pfilio/hstst.htm) 1A [detailed version below]

National Council for the Social Studies: (http://www.ncss.org/) Culture, b., c., d.; Science, Technology, and Society d.

National Geography Standards: (http://www.ncge.org/publications/tutorial/)
Environment and Society

National Standards for Art Education:

(http://www.ed.gov/pubs/ArtsStandards.html) Understanding the Visual Arts in Relation to History and Cultures, a-c.

Virginia Standards of Learning:

(http://www.pen.k12.va.us/VDOE/Superintendent/Sols/home.shtml) Science 4.1, 4.5; 6.9; Social Studies 5.6

Science

Science Standards (Taken verbatim from National Science Education Standards, 1996, National Academy Press, 2101 Constitution Avenue, NW, Box 285, Washington, DC 20055).

Content Standards: 5-8 (Those with a * indicate selected standards for *Lewis and Clark as Naturalists* Project)

Science as Inquiry
Physical Science
Life Science*
Earth and Space Science
Science and Technology*
Science in Personal and Social Perspectives
History and Nature of Science*

LIFE SCIENCE (Selected)

Content Standard C: As a result of their activities in grades 5-8, all students should develop understanding of

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

Populations and Ecosystems

- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
- Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that

use wasted materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

Diversity and Adaptations of Organisms

- Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.
- Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptations, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
- Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist.

SCIENCE AND TECHNOLOGY (Selected)

Content Standard E: As a result of activities in grades 5-8, all students should develop

- Abilities of technological design
- Understandings about science and technology

Developing Student Abilities and Understanding

Students in grades 5-8 can begin to differentiate between science and technology, although the distinction is not easy to make early in this level. One basis for understanding the similarities, differences, and relationships between science and technology should be experiences with design and problem solving in which students can further develop some of the abilities introduced in grades K-4. The understanding of technology can be developed by tasks in which students have to design something and also be studying technological products and systems.

In the middle-school years, students' work with scientific investigations can be complemented by activities in which the purpose is to meet a human need, solve a human problem, or develop a product rather than to explore ideas about the natural world. The tasks chosen should involve the use of science concepts already familiar to students or should motivate them to learn new concepts needed to used or understand the technology. Students should also, through the experience of trying to meet a need in

the best possible way, begin to appreciate that technological design and problem solving involve many other factors besides the scientific issues.

[Work]...could be achieved by investigating simple, familiar objects through which students can develop powers of observation and analysis—for example, by comparing the various characteristics of competing consumer products, including cost, convenience, durability, and suitability for different modes of use. Regardless of the product used, students need to understand the science behind it. There should be a balance over the years with the products studied coming from the areas of clothing, food, structures, and simple, mechanical and electrical devices. The inclusion of some non-product-oriented problems is important to help students understand that technological solutions include the design of systems and can involve communication, ideas, and rules.

HISTORY AND NATURE OF SCIENCE (Selected)

Content Standard G: As a result of activities in grads 5-8, all students should develop understanding of

- Science as a human endeavor
- Nature of science
- History of science

Science as a Human Endeavor

- Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

Nature of Science

- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models...
- In areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered...
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists.

History of Science

- Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a

human endeavor, the nature of science, and the relationships between science and society.

- In historical perspective, science has been practices by different individuals in different cultures. In looking at the history of many people, one finds that scientists and engineers of high achievement are considered to be among the most valued contributors to their culture.
- Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.

History

I. National History Standards: Expansion and Reform (1801-1861) (Selected)

Standard 1: Students should understand United States territorial expansion between 1801 and 1861, and how it affected relations with external powers and Native Americans.

1A: Students should be able to demonstrate understanding of the international background and consequences of the Louisiana Purchase, War of 1812, and the Monroe Doctrine by:

9-12 Analyzing the consequences of the Louisiana Purchase for United States politics, economic development, and race relations, and describing its impact on Spanish and French inhabitants. [Explain historical continuity and change]

7-8 Illustrations: Draw upon evidence from the diaries of Lewis and Clark to construct a historical narrative assessing the importance of the newly acquired Louisiana Territory and analyze the effects of the expedition. *Why is it considered one of the most successful scientific expeditions in United States history? How did it contribute to friendly [?] relations with Native Americans in the region? What were its long-term effects?*

Construct a historical argument from the perspective of Native Americans on the impact of territorial expansion. *How did the acquisition of the Louisiana Territory affect Native Americans in the region?*

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