

Grizzly Bears

OVERVIEW

The grizzly bear (*Ursus arctos horribilis*) is one of two species of bear that are native to the Yellowstone area. The black bear (*Ursus americanus*) is smaller on average than the grizzly bear, and has a much larger range across the United States. The grizzly bear also differs from the black bear in that it has a large muscle mass above its shoulders; a concave, rather than straight or convex, facial profile; and its behavior is much more aggressive. In coastal Alaska and Eurasia, *Ursus arctos* is known as the brown bear.

Distribution and Population Size

North America is currently home to an estimated 30,000 grizzly bears in Alaska, 20,000 in Canada (most of them in the Yukon and British Columbia), and 800–1,000 in the lower 48 states. The Greater Yellowstone Ecosystem and northwestern Montana are the only areas south of Canada in which significant populations of grizzly bears remain. Many populations in Eurasia are isolated, small, and endangered, but a population estimated at more than 30,000 still resides in the tundra and taiga forest of Russia, and extends into adjacent areas of North Korea, Mongolia, and China.

The tracking of radio-collared bears indicates that grizzly bears have re-occupied former habitat in the GYE, especially the southern portion, since the 1970s, and expanded their occupied habitat by nearly 50% (Schwartz et al. 2002). The grizzly bear's extensive movements and reclusive habits make population estimates difficult, but the most reliable estimates can be obtained for females with cubs of the year. Therefore, the number of different females with cubs observed during aerial and ground surveys is used to determine a minimum population estimate for the GYE. Females can be differentiated by the number of cubs they have and the pelage color combinations of their family group; some wear radio collars. Based on counts of females with cubs, the total estimated GYE grizzly bear population was 579 in 2009.

Physical Description

The grizzly bear's color varies from blond to black, often with pale-tipped guard hairs that give the animal a grizzled appearance. In the GYE, many grizzly bears have a light brown girth band. However, the coloration of black and grizzly bears is so variable that it is not a reliable means of distinguishing the two species. Grizzly bears are generally 1½ to 2 times larger than black bears of the same sex and age class within the same geographic region, and they have

longer, more curved claws. Adult grizzly bears stand about 3½ feet high at the shoulder. Adult males weigh 200–700 pounds; adult females, 200–400 pounds (Blanchard 1987). Despite their bulk, grizzly bears are agile and can run up to 45 mph. They can climb trees, but their long claws and weight make this difficult.

Ecology

Habitat

Bears are omnivores with relatively unspecialized digestive systems that can only poorly digest the cellulose and other structural components of plants. They therefore typically forage for plants in phenological stages of highest nutrient availability and digestibility. The life-time range of a male grizzly bear in greater Yellowstone covers approximately 800–2,000 square miles; for females, 300–550 square miles (Blanchard and Knight 1991). Although grizzly bears make substantial use of forested areas, they make more use of large, non-forested meadows and valleys than do black bears. The longer, less curved claws and larger shoulder muscle mass of the grizzly bear makes it better suited to forage for plants that must be dug from the soil, as well as for rodents and their caches.

Grizzly bear food consumption is influenced by annual and seasonal variations in available foods, but over the course of a year, army cutworm moths, whitebark pine nuts, ungulates, and cutthroat trout are the highest-quality food items available to them in the GYE. They also eat a wide variety of plant foods, prey on small mammals, and scavenge meat when available from winter-killed carcasses, road-killed wildlife, and animals killed by other predators. They will eat human food and garbage where they can get it.

Bears are generally solitary, although they may tolerate the presence of other bears when food is not limited. Grizzlies have a social hierarchy in which adult male bears dominate the best habitats and food sources, generally followed by mature females with cubs, then by other single adult bears. Subadult bears, who are just learning to live on their own away from mother's protection, are lowest on the social ladder and are most likely to be living in poor-quality habitat or in areas nearer to roads and developments.

Seasonal Food Sources

Bears spend most of their time feeding, especially during "hyperphagia," the period in autumn when they may put

on more than three pounds of weight a day until they enter their dens. From September through October in years when whitebark pine nuts are available, they are the most important bear food. Other items consumed during fall include pond weed root, sweet cicely root, grasses and sedges, bistort, yampa, strawberry, globe huckleberry, grouse whortleberry, buffaloberry, clover, horsetail, dandelion, ungulates, ants, false truffles, and army cutworm moths.

From late March to early May, when they come out of hibernation, until mid May, ungulates—mostly elk and bison—comprise a substantial portion of the grizzly bear's diet. Grizzly bears feed on ungulates primarily as winter-killed carrion, and also through predation on elk calves (Gunther and Renkin 1990). Grizzly bears dig up caches made by pocket gophers. Other items consumed during spring include grasses and sedges, dandelion, clover, spring-beauty, horsetail, and ants. When there is an abundance of whitebark seeds left from the previous fall, grizzly bears will feed on seeds that red squirrels have stored in middens.

In addition to grasses and sedges, dandelion, clover, spring-beauty, whitebark pine nuts, horsetail, and ants, from June through August, grizzly bears consume thistle, biscuitroot, fireweed, and army cutworm moths. Predation on elk calves is largely over by mid-July, after which grizzly bears are rarely able to catch them. Starting around mid-summer, grizzly bears begin feeding on strawberry, globe huckleberry, grouse whortleberry, and buffaloberry. By late summer, false truffles, bistort, and yampa are included in the diet as grasses, sedges, and dandelion become less prominent.

Yellowstone cutthroat trout. In areas surrounding Yellowstone Lake, bears feed on cutthroat trout from early May through mid August; however, greatest use occurs during spawning in June and July. Due to their high digestibility and protein and lipid content, spawning cutthroat trout are one of the highest sources of net digestible energy for grizzly bears in the Yellowstone ecosystem. For a two-month period, spawning cutthroat trout are some bears' primary source of food (Mattson et al. 1991).

Grizzly bears in Yellowstone National Park are believed to be most successful when fishing small shallow streams or shallow riffle areas in larger streams. Larger streams with few or no shallow riffles show no evidence of bear fishing activity, and bear fishing success appears to be correlated more closely with fish density/m³ of water than with fish density/linear stream distance. Bear fishing activity peaks during the downstream migration of post-spawning cutthroat trout. Post-spawners are generally fatigued from their upstream migration and building redds, and many streams have become more shallow by this time, making it easier for bears to catch fish (Reinhart and Mattson 1990).

Grizzly bears are known to have preyed on Yellowstone cutthroat trout in at least 36 different streams tributary to Yellowstone Lake. However, bear activity at those streams declined dramatically since 1989, corresponding to a decline in YCT abundance as a result of the presence of non-native lake trout in Yellowstone Lake, whirling disease, and drought. Unlike YCT, lake trout spawn in the lake, making them unavailable to bears.

Ungulates. The Yellowstone ecosystem is unique among areas inhabited by grizzly bears in North America because of the substantial use of ungulates as food by grizzly bears. Based on calories available per gram ingested, ungulates rank as the second highest source of energy available to grizzly bears in the Yellowstone ecosystem. Ungulates are also important to bears because they provide a high quality food source during early spring before most vegetal foods become available to bears. Grizzly bears scavenge on winter-killed elk and bison carcasses in spring, prey on newborn elk calves during late-spring and early summer, prey on and scavenge rut-weakened and rut killed elk, bison, and moose in late summer and fall, and usurp wolf-killed elk and bison carcasses throughout the spring, summer, and fall.

Army cutworm moths. These moths migrate from Great Plains agricultural areas to the Rocky Mountains and aggregate in high-elevation talus slopes where they provide the highest source of digestible energy available to grizzly bears in the GYE (Craighead et al. 1995). Grizzly bears excavate the moths from the talus and consume them by the thousands from July through September. Moth aggregations often occur in the same sites year after year, generally high elevation areas dominated by talus and scree and adjacent to areas with abundant alpine flowers, but the size and location of these sites fluctuates from year to year. The percentage of confirmed sites with documented use by bears also varies from year to year.

Whitebark pine nuts. The seeds of the whitebark pine, which are high in fat and calories, are an important food for grizzly bears and other wildlife. In the GYE, the abundance of whitebark pine nuts produced in a year is a predictor of the grizzly bear's annual rate of survival and reproduction. Meat from ungulates becomes more important during years with poor whitebark pine cone crops.

Denning

Bears' annual denning behavior probably evolved in response to seasonal food shortages and cold weather. Bears hibernate during the winter months in most areas of the world. Duration of denning depends on latitude, and varies from a few days or weeks in Mexico to six months or more in Alaska, but pregnant females tend to den earlier and longer than other bears. The average denning period in the GYE for grizzly bear females without cubs is about



five months, but it is 20 days more for other females, and 20 days fewer for males. The timing of den entry has also been correlated to weather and snow conditions, with most movement occurring from late September to late November (Haroldson et al. 2002).

Excavated dens in the GYE usually cannot be reused because runoff causes them to collapse in the spring after they were dug; however, grizzly bears will occasionally re-use a den, especially those located in natural cavities. Greater Yellowstone dens are typically dug in sandy loam, clay loam, or rocky silt soils and located on the mid to upper one-third of 30–60° slopes at 2,500–2,700 meters in elevation. Grizzly bears often excavate dens at the base of a large tree on densely vegetated, north-facing slopes. This is advantageous in greater Yellowstone because of prevailing southwest winds that accumulate snow on northerly slopes and insulate dens from sub-zero temperatures.

The excavation of a den is typically completed in 3–7 days, during which a bear may move up to one ton of material. The den includes an entrance, a short tunnel, and a chamber. To minimize heat loss, the den entrance is usually just large enough for the bear to squeeze through; a smaller opening will be covered with snow more quickly than a large opening. The chamber is dug slightly larger than the bear, allowing for efficient heat retention. Males and females with young tend to dig larger dens. After excavation is complete, the bear covers the chamber floor with bedding material such as spruce boughs or duff, depending on what is available at the den site. The bedding material has many air pockets that trap body heat.

Hibernating mammals such as chipmunks and ground squirrels experience a drastic decrease in body temperature during hibernation, and they must awaken every few days to raise their body temperature, move around, urinate, and eat. The body temperature of a hibernating bear, however, remains above 88°F (31°C), which is within 12°F (11°C) of their normal body temperature of 100°–101°F (37.7°–38.3°C). This enables bears to react more quickly to danger than hibernators who have to warm up first. Because of their well-insulated pelts and their lower surface area-to-mass ratio compared to smaller hibernators, bears lose body heat more slowly, which enables them to cut their metabolic rate by 50–60%. Respiration in bears, normally 6–10 breaths per minute, decreases to 1 breath every 45 seconds during hibernation, and their heart rate drops from 40–50 beats per minute during the summer to 8–19 beats per minute during hibernation.

Bears sometimes awaken and leave their dens during the winter, but they generally do not eat, drink, defecate, or urinate during hibernation. They live off of a layer of fat built up prior to hibernation. The urea produced from fat metabolism (which is fatal at high levels) is broken down, and the resulting nitrogen is used by the bear to build

protein that allows it to maintain muscle mass and organ tissues. Bears may lose 15–30 % of their body weight and increase lean body mass during hibernation.

When temperatures warm up and food is available in the form of winter-killed ungulates or early spring vegetation, bears emerge from their dens. Grizzly bear emergence in the GYE begins in early February, and most bears have left their dens by early May. Males are likely to emerge before females. The males, subadults, and solitary females usually leave the vicinity of their dens within a week of emergence, while females with cubs typically remain within 3 km of their dens until the second half of May (Haroldson et al. 2002).

Life Cycle

Grizzly bears reproduce slowly compared to other terrestrial mammals. Females rarely breed before age four, and typically become pregnant once every three years. Grizzly and black bears breed from May through July, and bears may mate with multiple partners during a single season. Because implantation of a fertilized egg in the uterus is delayed, the embryo does not begin to develop until late November or December, about one month after the mother has dened. This appears to allow her to conserve energy until she enters her den, where in late January or early February she gives birth to one or two cubs, sometimes three, rarely four. At birth the cubs are hairless and blind, are about eight inches (20 cm) long, and weigh from 8 to 12 ounces (224–336 g). The cubs do not hibernate. They sleep next to the sow, nurse, and grow rapidly. At ten weeks of age, grizzly bear cubs weigh about 10–20 pounds (4.5–9.0 kg).

Male bears take no part in raising cubs, and may actually pose a threat to younger bears. Grizzly bear cubs usually spend 2½, and sometimes 3½ years with their mother before she or a prospective suitor chases them away so that she can mate again. Females frequently establish their home range in the vicinity of their mother, but male cubs disperse farther.

Grizzly bears may live 15 to 30 years in the wild.

Grizzly Bears, Black Bears, and Wolves

Grizzly bears are more aggressive than black bears, and more likely to rely on their size and aggressiveness to protect themselves and their cubs from predators and other perceived threats.

Grizzly bears, black bears, and gray wolves have historically co-existed in much of the same range throughout a large portion of North America. The behavior of bears and wolves during interactions with each other are dependent upon many variables such as age, sex, reproductive status, prey availability, hunger,



aggressiveness, numbers of animals, and previous experience in interacting with the other species. Most interactions between the three species involve food sources, and they are usually characterized by mutual avoidance. Few instances of direct mortality to either species have been documented. Wolves sometimes kill bears, but usually only cubs.

Wolves prey on ungulates year-round, while bears feed on ungulates primarily as winter-killed carcasses; ungulate calves in spring; wolf-killed carcasses in spring, summer, and fall; and weakened or injured male ungulates during the fall rut (Mattson et al. 1991). Bears may benefit from the presence of wolves by usurping wolves at carcasses that wolves have killed, making carcasses more available to bears throughout the year. If a bear wants a wolf-kill, the wolves will try to defend it, but they usually fail to chase the bear away, although female grizzlies with cubs are seldom successful in taking a wolf-kill.

Status in Greater Yellowstone

Legal Status

The grizzly bear was listed as a threatened species in the GYE under the Endangered Species Act in 1975 because of the frequency of human-caused grizzly bear mortalities, loss of habitat, and geographic isolation from other grizzly bear populations. The Yellowstone grizzly bear recovery area encompasses about 9,500 square miles, including Yellowstone and Grand Teton national parks, the John D. Rockefeller, Jr., Memorial Parkway, and significant portions of the surrounding national forests as well as some Bureau of Land Management, state, and private lands in Idaho, Montana, and Wyoming.

The GYE grizzly population was estimated at 136 in 1974 (Craighead et al. 1974), and the population appeared to decline into the 1980s. The U.S. Fish and Wildlife Service completed its first Grizzly Bear Recovery Plan in 1982. The Interagency Grizzly Bear Committee (IBGC), established in 1983 to improve communication and cooperation among federal and state administrators, set forth several regulations designed to reduce human-caused grizzly bear mortality on federal lands. These regulations, in combination with favorable environmental conditions, appeared to halt the population decline. In 1998, when the GYE grizzly bear population was estimated to be a minimum of 344, it met all of the demographic criteria required by the recovery plan for delisting. These requirements included: a minimum of 45 female bears distributed throughout the designated recovery zone and human-caused mortality at levels that would allow further population growth.

From 1998 to 2003, the GYE grizzly bear population increased at an annual rate of 4% to 7% and expanded its range by nearly 50%. (Schwartz et al. 2006). In 2004 the minimum population estimate was 431 bears (Schwartz et al. 2005). Based on the finding that the GYE grizzly bear population was discrete from other grizzly bear populations, with different genetic characteristics (Miller and Waits 2003) and occupying habitat where terrestrial mammals are a primary source of nutrition (Jacoby et al. 1999), in 2005 the USFWS designated it a distinct population segment and determined that there were sufficient numbers and distribution of reproductive age grizzly bears in the GYA to provide a high likelihood that the species would persist and be well distributed for the foreseeable future. Although the USFWS officially removed grizzly bears in the GYA from threatened species status on April 30, 2007 (USFWS 2007), a lawsuit led to a court ruling in September 2009 that the USFWS must restore its threatened species status. The USFWS is considering whether to appeal the judge's decision.

Threats to Grizzly Bears

More than 80% of the grizzly bear mortalities in the GYE result from human causes, including collisions with vehicles, self defense kills, illegal shootings, and bears that are removed because they have caused property damage. Of the 31 reported grizzly mortalities in the GYE in 2009, 24 were human caused (2003–2008 range: 7–32). These deaths included 13 that were hunting-related (reportedly self defense or mistaken for black bear); 2 others in self-defense, 4 management removals, and 2 road kills. Human activity also poses a less direct threat to the grizzly bear population insofar as it causes a decline in the availability of suitable habitat and food sources, which can result in human–bear conflicts when bears seek and are able to gain access to human foods.

The Yellowstone cutthroat trout population has been reduced in Yellowstone Lake and its tributaries as a result of the illegal introduction of exotic lake trout (*Salvelinus namaycush*) and whirling disease, which is caused by an exotic parasite, *Myxobolus cerebralis*.

Whitebark pine stands have deteriorated in many areas of the northern Rocky Mountains because of an exotic fungus (*Cronartium ribicola*) that causes white pine blister rust. Although an infected tree may survive for decades, its ability to produce cones is often compromised. A more immediate threat to whitebark pine in the GYE is the mountain pine beetle (*Dendroctonus ponderosae*), a native insect. Mild summers and winters favor outbreaks, while cold winters and hot summers tend to decrease beetle activity and increase brood mortality. Mountain pine beetle infestations are more likely to occur in trees that



are already stressed for some other reason, such as lack of moisture, pathogens, or mistletoe.

The long-term impact of the current decline in YCT and whitebark pine on the grizzly bears that make use of those food sources is difficult to predict. However, bears are highly adaptable animals and currently make use of several high quality-food sources whose availability may vary greatly from year to year. In northwest Montana, whitebark pine has been significantly depleted by extensive infections of white pine blister rust, yet the bear populations there have apparently adjusted by switching to other foods.

Management in Yellowstone

Historical Management

Prohibitions against the killing of bears in Yellowstone National Park were not systematically enforced until the mid-1880s. By the 1890s, access to garbage pits in the park was enabling many bears to survive largely on human foods, and the dumps became popular tourist attractions. As bears in the park became habituated to human foods, they lost their fear of people and were more likely to approach areas used by people in search of food. The first accounts of black bears begging for handouts along park roads were reported by 1910, and such activity was commonplace by the 1920s. However, similar behavior in grizzly bears was not reported.

As park visitation and the number of bear–human conflicts began to increase, park managers became more concerned with the situation. Between 1931 and 1959, an average of 48 park visitors were injured by bears and an average of 138 cases of bear-caused property damage were reported each year. To reduce the number of such problems, the park began a bear management program in 1960 that included expanded efforts to educate visitors about safety in bear habitat, stricter enforcement of regulations prohibiting the feeding of bears, prompt removal of garbage and the use of bear-proof garbage cans, and removal of habituated bears and bears that had been involved in conflicts with people.

Table 1. Comparison of pre-dump (1958–1970) and post-dump (1983–2002) GYE grizzly bear data.

	Pre-dump	Post-dump
Average number of females producing cubs annually	14 females	25 females
Average number of cubs produced annually	31 cubs	51 cubs
GYE population estimate	312 bears	471 bears
Acres occupied	5 million	8.5 million

By 1970, the number of bear-caused human injuries had decreased only slightly, to 45 per year, and the park initiated an intensive bear management program to close the garbage dumps in the park and restore the bear populations to subsistence on natural foods. Consequently, the number of bear-inflicted human injuries and bear-caused property damages in the park declined significantly, but many people believed the bear population also declined substantially (Table 1). In 1973, the resulting controversy led to the formation of the Interagency Grizzly Bear Study Team (IGBST), an interdisciplinary group of scientists that today includes representatives from the National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Forest Service, Montana State University, and the states of Idaho, Montana, and Wyoming.

The primary objectives of the IGBST are to monitor the status of the GYE grizzly bear population, patterns of habitat use, and land management activities as they affect the bear population. The IGBST coordinates data collection and analysis of grizzly bear long-term monitoring and research to pool limited economic and personnel resources, prevent duplication of effort, and address information needs throughout the ecosystem. Since 1975, 595 grizzly bears have been radio-monitored (Schwartz et al. 2009).

Conflicts with Humans

Grizzly bear-inflicted injuries to humans in developed areas within Yellowstone National Park averaged approximately one per year during the 1930s through the 1950s, and four per year during the 1960s. Grizzly bear-caused human injuries in developed areas then decreased to one injury every two years (0.5/year) during the 1970s. The number of grizzly bears that were relocated from frontcountry areas dropped from an average of about 50 per year during the 1960s to less than 1 per year in the 1990s. From 1980 to 2002, only two grizzly bear-caused human injuries occurred in a developed area. In the recorded history of YNP, five known bear-caused human fatalities and one possible fatality have been documented in the park.

Human injuries from grizzly bears, previously rare in the backcountry, increased to an average of about one per year starting in the 1970s. In 1983, a new grizzly bear management program in the park established “bear management areas” where backcountry use may be restricted at certain times of year because of high levels of bear activity. The 16 bear management areas encompass 464,638 acres (21% of the park), including 206,100 acres where off-trail travel is prohibited, 161,211 acres closed to human entry on a seasonal basis, 63,867 acres restricted to day-use-only, and 33,460 acres that are closed to human entry for part of the summer, then restricted to day-use-



only for the remainder of the summer. As more data on bear activity is collected, restrictions may be adjusted or areas may be added or deleted from the program.

In 995 grizzly bear–human conflicts that were documented in the GYE from 1992 to 2000, slightly more than half took place outside the designated recovery zone; 59% occurred on public land, and 41% on private land. Although incidents of bears’ damaging property and obtaining anthropogenic foods were inversely correlated to the abundance of naturally occurring bear foods, livestock depredations occurred independent of the availability of bear foods (Gunther et al. 2004).

During the summer of 2010, two humans were killed by grizzly bears in the GYE, the first such fatalities since 1986. Both incidents occurred on national forest, and both of the bears involved were euthanized.

Current Management

Most of the park’s roads and developments are located in prime bear habitat. The large number of both bears and people in the park therefore makes a bear management program essential to both ensure both human safety and maintain viable bear populations. Those two goals are reflected in the main components of the bear management program in YNP: 1) Bear research and monitoring to maintain scientifically credible data on black and grizzly bear population numbers and trends, and to preserve and maintain the processes affecting the genetic integrity, distribution, abundance, and behavior of black and grizzly bears within the park; and 2) Minimizing bear–human conflicts by enforcing park regulations, controlling traffic in bear jams, using warning signs or closures of backcountry areas when necessary, and educating park visitors and employees about how to prevent bear–human conflicts and what to do when they occur; preventing bears from obtaining access to human foods; minimizing human interference with and influence on bears; and employing aversive conditioning or bear trapping when necessary to prevent human injuries or property damage. For a list of projects associated with Yellowstone’s grizzly bear management program,

References

- Blanchard, B.M. 1987. Size and growth patterns of the Yellowstone grizzly bear. *International Conference on Bear Research and Management* 7:99–107.
- Blanchard, B.M., and R.R. Knight. 1991. Movements of Yellowstone grizzly bears, 1975–87. *Biological Conservation* 58:41–67.
- Craighead, J.C., J.S. Sumner, and J.A. Mitchell. 1995. *The grizzly bears of Yellowstone: Their ecology in the Yellowstone Ecosystem, 1959–1992*. Washington, D.C.: Island Press.
- Craighead, J.J., J.R. Varney, and F.C. Craighead Jr. 1974. A population analysis of the Yellowstone grizzly bears. *Montana Forest and Conservation Station Bulletin* 40. School of Forestry, University of Montana, Missoula, Montana.
- Gunther, K.A., M.A. Haroldson, K. Frey, S.L. Cain, J. Copeland, and C.C. Schwartz. 2004. Grizzly bear–human conflicts in the Greater Yellowstone ecosystem, 1992–2000. *Ursus* 15(1):10–22.
- Gunther, K.A., and R.A. Renkin. 1990. Grizzly bear predation on elk calves and other fauna of Yellowstone National Park. *International Conference on Bear Research and Management* 8:329–334.
- Haroldson, M.A., M. Terner, K.A. Gunther, and C.C. Schwartz. 2002. Grizzly bear denning chronology and movements in the Greater Yellowstone Ecosystem. *Ursus* 13:29–37.
- Jacoby, M.E., G.V. Hilderbrand, C. Servheen, et al. 1999. Trophic relations of brown and black bears in several western North American ecosystems. *Journal of Wildlife Management* 63:921–929.
- Mattson, D.J. 1997. Use of ungulates by Yellowstone grizzly bears, *Ursus arctos*. *Biological Conservation* 81:161–177.
- Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1991. Food habits of Yellowstone grizzly bears. *Canadian Journal of Zoology* 69:1619–1629.
- Miller, C.R., and L.P. Waits. 2003. The history of effective population size and genetic diversity in the Yellowstone grizzly (*Ursus arctos*): Implications for conservation. *Proceedings of the National Academy of Science* 100:4334–4339
- Reinhart, D.P., and D.J. Mattson. 1990. Bear use of cutthroat trout spawning streams in Yellowstone National Park. *International Conference on Bear Research and Management* 8:343–350.
- Schwartz, C.C., M.A. Haroldson, K.A. Gunther, and D. Moody. 2002. Distribution of grizzly bears in the Greater Yellowstone Ecosystem, 1990–2000. *Ursus* 13 (2002):203–212.
- Schwartz, C.C., M.A. Haroldson, and K. West, eds. 2005. *Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2004*. Bozeman, Montana: U.S. Geological Survey.
- Schwartz, C.C., M.A. Haroldson, and K. West, eds. 2009. *Yellowstone grizzly bear investigations: Annual report of the Interagency Grizzly Bear Study Team, 2008*. Bozeman, Montana: U.S. Geological Survey.
- Schwartz, C.C., M.A. Haroldson, and K. West, eds. 2010. *Yellowstone grizzly bear investigations: Annual report*



- of the Interagency Grizzly Bear Study Team, 2009.
Bozeman, Montana: U.S. Geological Survey.
- Schwartz, C.C., S.D. Miller, and M.A. Haroldson.
2003. Grizzly/brown bear. Pages 556–586 in G.
Feldhamer, B. Thompson, and J. Chapman, eds., *Wild
mammals of North America: biology, management,
and conservation*. Baltimore, Md.: Johns Hopkins
University Press.
- USFWS [U.S. Fish and Wildlife Service]. 2007. Final Rule
Designating the Greater Yellowstone Area Population
of Grizzly Bears as a Distinct Population Segment;
Removing the Yellowstone Distinct Population
Segment of Grizzly Bears From the Federal List of
Endangered and Threatened Wildlife; 90-Day Finding
on a Petition To List as Endangered the Yellowstone
Distinct Population Segment of Grizzly Bears.
March 29, 2007 (72 FR 14866). [http://www.fws.gov/
mountain-prairie/species/mammals/grizzly/FR_Final_
YGB_rule_03292007.pdf](http://www.fws.gov/mountain-prairie/species/mammals/grizzly/FR_Final_YGB_rule_03292007.pdf).

