# An Alternative Interpretation of the Historical Evidence Relating to the Abundance of Wolves in the Yellowstone Ecosystem

■ Charles E. Kay

*The plan to reintroduce wolves in Yellowstone is predicated, in part, on the premise that large numbers of wolves inhabited that ecosystem before the National Park Service eliminated them from the park. According to some, wolves were a relatively common sight in Yellowstone when it was declared the United States' first national park in 1872. To test this assertion, I conducted a continuous-time analysis of first-person journals written by people who explored Yellowstone between 1835 and 1876. During that period, 20 different parties spent a total of 765 days travelling through the Yellowstone Ecosystem, yet no reliable observer reported seeing or killing even a single wolf, and on only three occasions did explorers report hearing wolves howl. The available historical journals do not suggest that wolves were common in Yellowstone during the 1835–1876 period. Those same journals indicate that ungulates were also rarely encountered in the park. Bison were reportedly seen only three times (none of which were in the park) and elk were seen on only 42 occasions, or an average of one elk observation per party in 18 days. The fact that a number of parties broke into small groups and spread out to hunt makes these observation rates all the more meager. Moreover, while the explorers were in Yellowstone, their journals contain 45 references to a lack of game or a shortage of food. Historically, Yellowstone contained few ungulates, and accordingly, wolves were rare. An Aboriginal Overkill hypothesis is presented to account for the observed rarity of ungulates and wolves.*

## *Introduction*

During the 1920's, the U.S. National Park Service exterminated wolves from Yellowstone National Park, while other federal and state agencies eliminated wolves (*Canis lupus*) from the remainder of the Greater Yellowstone Ecosystem (Weaver 1978). In 1978, the wolf was listed as an endangered species throughout the United States except for Minnesota, where wolves are classified as a threatened species, and Alaska where they are managed as a game animal under state regulations (U.S. Fish and Wildlife Service 1987).

Under provisions of the Endangered Species Act of 1973, the U.S. Fish and Wildlife Service (1987) formulated a recovery plan for wolves in the northern Rocky Mountain including Yellowstone. The plan calls for reintroducing wolves into the Yellowstone Ecosystem, and is supported by the Fish and Wildlife Service, the Park Service, and various environmental organizations. Wolf recovery, however, is opposed by the states of Montana, Wyoming, and Idaho as well as by livestock producers and some sportsmen.

The plan to reintroduce wolves in Yellowstone is predicated, in part, on the premise that large numbers of wolves inhabited the ecosystem before they were eliminated by predator control efforts. According to some, "[wolves] were a relatively common sight in Yellowstone when it was declared the nation's first national park in 1872" (Anonymous 1987a:B1). Randall (1980:188) claimed that "when trappers and explorers reported on the Yellowstone region in the mid-1800's, they sang [of] a land teeming with bison, elk, mule deer, bighorn sheep, and antelope. The great carnivores — grey wolf, grizzly bear, and mountain lion — flourished." Federal agencies contend that Yellowstone Park could support at least 10 wolf packs totalling 100–150 animals and imply that number of wolves has always inhabited the park (National Park Service and Fish and Wildlife Service 1990a, 1990b). Based on wolf habitat requirements and prey densities, the remainder of the ecosystem could support another 600 or so wolves, discounting political considerations (Bennett 1994).

To test the assertion that wolves were common in the Greater Yellowstone Ecosystem prior to predator control, I conducted a continuous-time analysis of first-person journals written by people who explored the area between 1835 and 1876.

## Study Area

The Greater Yellowstone Ecosystem encompasses 7.3 million hectares in northwest Wyoming, south-central Montana, and northeastern Idaho (Clark and Zaunbrecker 1987) and contains the headwaters for three of the major river systems in the western United States; the Yellowstone-Missouri, the Snake-Columbia, and the Green-Colorado. The Yellowstone Ecosystem is now home to over 200,000 ungulates including, in order of occurrence, elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), moose (*Alces alces*), white-tailed deer (*O. virginianus*), bighorn sheep (*Ovis canadensis*), pronghorn antelope (*Antilocapra americana*), bison (*Bison bison*), and mountain goats (*Oreamnos americanus*) (Glick et al. 1991). A description of Yellowstone's climate, physiography, vegetation, and wildlife management history are provided in Houston (1982), Despain et al. (1986), Boyce (1989), Despain (1990), Kay (1990), and Glick et al. (1991).

## Methods

As part of my research on the historical distribution and abundance of wildlife throughout the West, I conducted a continuous-time analysis of accounts left by early Yellowstone explorers. This included the following journals. 1) Osborne Russell (1965) five separate trips between 1835 and 1839; 2) William Raynolds (1868) 1860; 3) Walter Delacy (1876) 1863; 4) Bart Henderson (1867) 1867; 5) Cook-Folsom-Peterson Expedition (Cook et al. 1965) 1869; 6) Bart Henderson (1870) 1870; 7) Washburn Expedition, three accounts by Gillette (1870), Doane (1875), and Langford (1972) 1870; 8) Barlow-Heap Expedition (Barlow and Heap 1872) 1871; 9) Hayden survey (1872) 1871; 10) Frank Bradley (Bradley 1873) 1872; 11) Sidford Hamp (Brayer 1942) 1872; 12) William Blackmore (1872) 1872; 13) Jones Expedition (Jones 1875) 1873; 14) Earl of Dunraven (Dunraven 1967) 1874; 15) William Ludlow (Ludlow 1876) 1875; 16) General Strong (Strong 1968) 1875; and 17) Doane Expedition, two accounts by Doane (1876), and Server (1876–77) 1876.

This list includes the earliest first-person accounts for the Yellowstone Ecosystem (Haines 1977) including all such journals cited by Houston (1982: 204–208). Other published first-person journal accounts of comparable quality are not known to exist (Haines 1977). There are other narrative accounts of Yellowstone exploration, but these are not included in my analysis because historians have determined that narrative accounts are not as accurate as first-person journals written at the time of the event (White 1991:613–632). Even "the humblest narrative is always more than a chronological series of events" (McCullagh 1987:30). The ideological implications of most narrative historical accounts are "no different from those of the narrative form in fiction" (Galloway 1991:454), because narrative accounts are always influenced by prevailing cultural myths (White 1991:618).

Standard techniques, developed and employed by historians to judge the validity of historical accounts (Forman and Russell 1983), were used to gauge the accuracy of all the Yellowstone journals cited above (Kay 1990: Chapter 9). To overcome problems of selection bias, I systematically recorded all observations of wolves, ungulates, and other large mammals found in these historical accounts. Data were tabulated in three ways.

First, game seen. I listed the observer, the date of his trip, the length of his trip within the Greater Yellowstone Ecosystem, the size of the party, and the number of occasions on which the explorers actually saw wolves and other game animals. Seeing one animal was recorded as a single observation, and if they reported two or more animals together at a time, that was also recorded as a single observation for that species. When an explorer reported killing one or more animals of a particular species at a time, that was recorded as one sighting of that animal. The number of references to abundant game where the species were not identified was also included.

Second, game sign encountered or referenced. I listed the number of occasions when specific animal sign, usually tracks, was seen or referenced. For instance, if explorers said they were going deer hunting, that was recorded as a single reference to deer. Included in these counts are any references to hearing specific animals, such as wolves howling or mountain lions (*Felis concolor*) screaming, as well as references to Native American artifacts. For example, Osborne Russell (1965), who met Native Americans on Yellowstone's northern range, noted that they had various animal skins. Each of those observations was recorded as a single reference to that species. I also listed the number of occasions on which Native Americans were seen or their sign, trails, and the like were referenced. In addition, I included the number of references made by each party to a lack of food or lack of game. Acts such as shooting a horse for food were considered a single reference to a food shortage.

Third, game shot. I listed the number of wolves and other large animals that each explorer reportedly killed within the Greater Yellowstone Ecosystem. In nearly every instance, those people recorded the exact number of animals killed. At the time, explorers were free to kill any animals they saw. There were no state game laws and even after Yellowstone Park was established, shooting animals for camp food was permitted for a number of years.

Yellowstone was not "officially" discovered by Europeans until 1869 and was one of the last regions to be explored in the western United States (Haines 1977). Fur trappers,

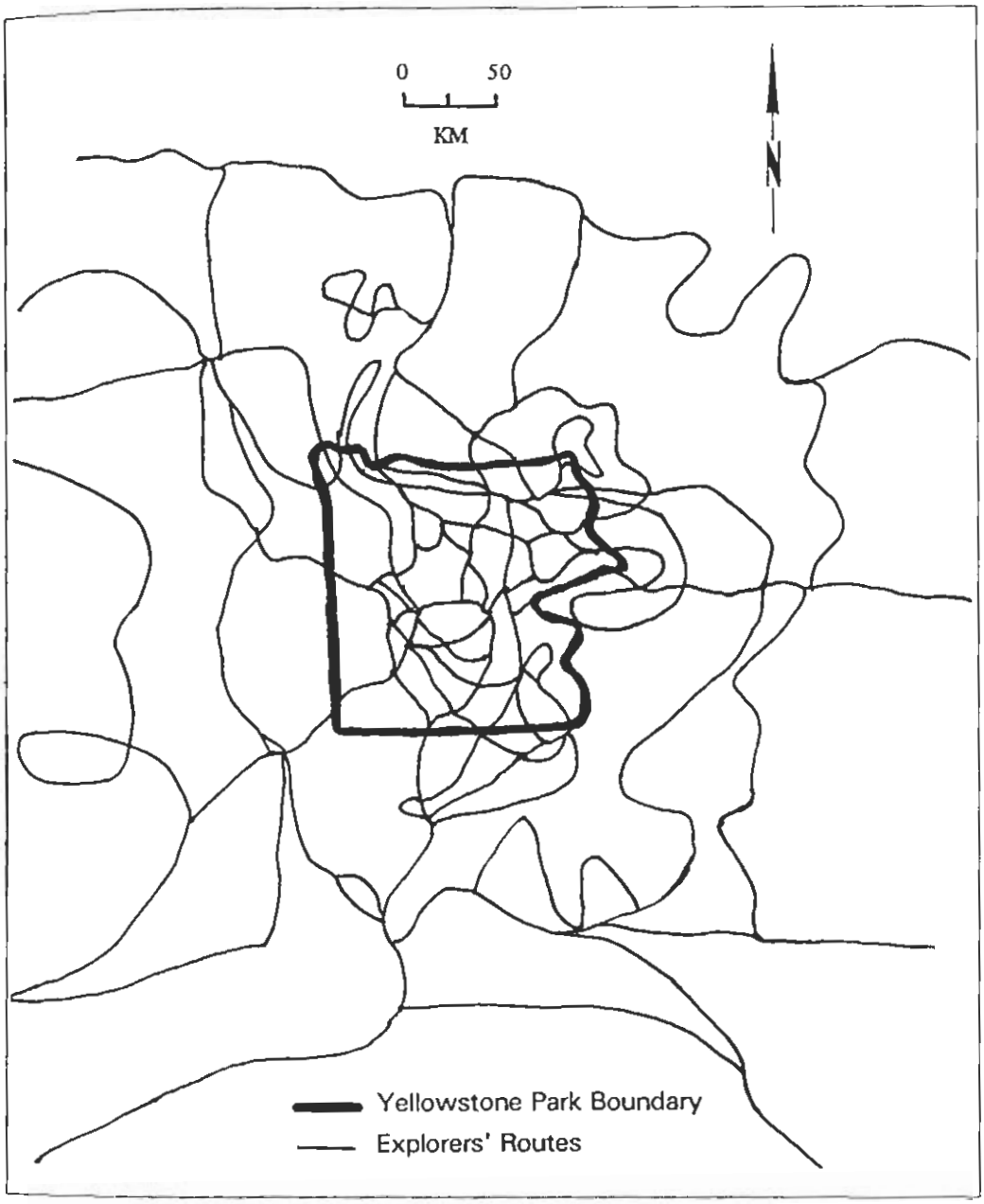


**Fig. 1** *Approximate routes travelled by people who explored the Greater Yellowstone Ecosystem between 1835 and 1876. Some routes were used by more than one expedition.*

such as John Colter, probably visited the area as early as 1807–1808 but only Osborne Russell (1835–1839) left a written account known to have survived (Haines 1977). Russell's journal, however, was not published until 1914, well after the official "discovery" of Yellowstone. Unlike other regions of the West, Yellowstone was not on established travel routes, and therefore was subject to less direct European disturbance than other areas (Haines 1977).

## *Results*

Early explorers visited most parts of the Greater Yellowstone Ecosystem, though their travels were concentrated along routes to major scenic attractions such as thermal areas, Yellowstone Lake, and Yellowstone Falls (Fig. 1). Between 1835 and 1876, 20 different expeditions spent a total of 765 days travelling through the Greater Yellowstone Ecosystem, yet no one reported killing a single wolf. There was only one account of a wolf sighting. In 1870, Henderson (1870:57) reported that "soon after camping [in Yellowstone's Lamar Valley] our camp was attacked by wolves." During the 765 days, wolf sign was reported on only three occasions (Table 1). In 1836, Osborne Russell (1965:46) reported that he heard "the occasional howling of the solitary wolf" east of Yellowstone Park. While camped in Lamar Valley in 1864, Cook et al. (1965:27) observed that "the wolf scents us afar and the mournful cadre of his howl adds to our sense of solitude." In 1876, Doane (1876:13) reported that

he heard "a pack of wolves howling far down the...shore" of Yellowstone Lake.

Given their lack of scientific training, Yellowstone's early explorers may have mistaken coyote (*Canis latrans*) howls or other animal calls for those of wolves. During this era, coyotes were frequently called wolves or prairie wolves even by trained observers. Moreover, Native Americans often imitated wolf howls for communication, especially while on raiding parties or when near Europeans (Trenholm and Carley 1964). Reports of animal sign are always less reliable than reports of sighting or kills (Kay 1990).

## *Discussion*

### *Historical Abundance*

Although Henderson (1870) recorded seeing wolves in Yellowstone, that may not have been a valid sighting because evidence shows he was not a reliable observer. Henderson reported seeing and killing more game in Yellowstone than any other early explorer. In fact, he reported seeing and killing more elk, bison, deer, and bears than nearly all the explorers before or after him (Kay 1990). He reported having "27 bearskins" in camp, most of which, judging from the text, were grizzlies (*Ursus arctos*). He also reported seeing moose on Yellowstone's Northern Range and implied that they were common. If he, in fact, killed 20 or more grizzlies, that would represent over 10% of the current grizzly bear population in the entire Greater Yellowstone Ecosystem (Knight and Eberhardt 1985). In addition, Houston (1982:131) stated that there were no verified observations of moose on the Northern Range until 1913. Finally, there is no evidence that wolves ever "attacked" a camp similar to Henderson's anywhere in North America (U.S. Fish and Wildlife Service 1987).

This suggests that Henderson exaggerated or invented some of his diary entries. His entry of July 24 sheds some light on his observational abilities. On that day, he travelled through Yellowstone's Upper Lamar Valley and reported it contained "thousands of hot or boiling springs." Today, there are fewer than 50 hot springs in the Lamar Valley including lower Cache Creek (Bryan 1979). This small thermal area never contained "thousands" of hot springs and certainly did not when Henderson visited that area in 1870 (Bryan 1979). There is little doubt Henderson's diary entry on this point represents a gross exaggeration. Thus, it is unwise to rely on any of the wildlife observations in Henderson's journal.

When only one of the early explorers reported seeing a wolf, and he is at best unreliable, the most that can be said is that wolves were rare in the Greater Yellowstone Ecosystem during the 1835 and 1876 period of written record. Given the detail in many of these journals, it is doubtful that explorers simply failed to record observations of wolves. Moreover, given the length of time explorers spent in the ecosystem, and the fact that they travelled by horseback or on foot, it is also doubtful that wolves were simply too shy to be seen.

Other records indicate that wolves were not particularly common even after Yellowstone Park was established. From 1880 to the early 1900's, few observations of wolves were recorded in the park (Weaver 1978), and from 1914 to 1926 when the Park Service was actively working to eradicate wolves, only 136 wolves were killed. This may seem like a lot, but it included only 56 adults over a 13-year interval (U.S. Fish and Wildlife Service 1987:1). Park Service records suggest that during this time there were, at most, only four wolf packs in the park and possibly only two (Weaver 1978:11).

### *Why Were Wolves Rare?*

Evidence suggests that there were few wolves in Yellowstone between 1835 and 1876 because there were few ungulate prey. Despite spending 765 days in the Yellowstone Ecosystem, early explorers reported seeing bison only three times, none of which were in the park, and they reported seeing elk on only 42 occasions, or an average of one elk observation per party in 18 days. The fact that a number of parties broke into small groups to hunt makes these observation rates all the more meagre. Despite travelling through areas where hundreds or thousands of ungulates are now commonly seen, early explorers consistently saw little game. For instance, Hayden (1872:131) noted that "our hunters returned, after a diligent search for two and a half days with only a black-tailed [mule] deer, which, though poor was an important addition to our larder."

These same journals also contain 45 references to a lack of game or a shortage of food while the explorers were in Yellowstone (Table 1). While travelling through part of the Yellowstone Ecosystem in 1863 where today large numbers of elk and moose are common, DeLacy (1876:107) noted, "as usual, some men went out to hunt, and others to prospect, but brought in neither gold or game. Up to this time, and for a long time after, we saw nothing larger than rabbits." Colonel Gibbon (1874:136) described how his 1871 Yellowstone exploration party "fell short of provisions, and had to kill squirrels, blue-jays, and a pelican, and finally to grub for wild roots for subsistence." Other parties that ran short of supplies sent for additional food, a round trip of nearly 300 km. Still others shot their horses to survive. Historically, Yellowstone was not a land teeming with game.

A few of these journals, however, do contain narrative references to an abundance of game or that the whole country was swarming with game. Those accounts, though, may have been inspired by political motives or cultural myths rather than fact (see Kay 1990: Chapter 9 for a detailed accounting of observer reliability). During the late 1870's, the U.S. military was lobbying Congress to have Yellowstone Park transferred to its jurisdiction. So Captain Ludlow (1876), General Strong (1968), and others had reason to exaggerate the early abundance of game in the park and the

**Table 1. Historical observations on wolves, Native Americans, and a lack of game in the Greater Yellowstone Ecosystem.**

| Observer | Date[1] | Length of trip (days) | Size of party | Number of occasions wolves were reported | | | Number of references to a lack of game or food | Number of references to Native Americans |
|---|---|---|---|---|---|---|---|---|
| | | | | Seen | Killed | Sign | | |
| 1. Osborne Russell | | | | | | | | |
| a. | 1835 | 61 | Varied, usually | - | - | - | - | 3 |
| b. | 1836 | 34 | 3-4, but some | - | - | 1 | - | 1 |
| c. | 1837 | 56 | groups contained | - | - | - | - | 3 |
| d. | 1838 | 15 | up to 60 people | - | - | - | 1 | - |
| e. | 1839 | 68 | | - | - | - | 1 | 2 |
| Subtotal | 1835-3 | 2~~34~~ 234 | | - | - | 1 | 2 | 9 |
| 2. William Raynolds | 1860 | 26 | 32+ | - | - | 1 | 3 | 9 |
| 3. Walter DeLacy | 1863 | 27 | 13-40 | - | - | - | 2 | 5 |
| 4. Bart Henderson | 1867 | 13 | 4 | - | - | - | - | 2 |
| 5. Cook-Folsom-Peterson Expedition | 1869 | 22 | 3 | - | - | 1 | 2 | 5 |
| 6. Bart Henderson | 1870 | 68 | 5 | 1 | - | - | - | 4 |
| 7. Washburn expedition | | | | | | | | |
| a. Langford | 1870 | 29 | 19 | - | - | - | 8 | 8 |
| b. Doane | 1870 | 29 | 19 | - | - | - | 1 | 7 |
| c. Gillette | 1870 | 35 | 19 | - | - | - | - | 2 |
| 8. Barlow & Heap Exped. | 1871 | 41 | 17 | - | - | - | 1 | 4 |
| 9. Hayden survey | 1871 | 39 | 40 | - | - | - | 1 | - |
| 10. Frank Bradley | 1872 | 55 | 12 | - | - | - | 1 | - |
| 11. Sidford Hamp | 1872 | 17 | 8-35 | - | - | - | - | - |
| 12. Willian Blackmore | 1872 | 21 | 20-30 | - | - | - | - | 6 |
| 13. Jones Expedition | 1873 | 44 | 45 | - | - | - | 8 | 2 |
| 14. Earl of Dunraven | 1874 | 30 | 7 | - | - | - | 7 | 3 |
| 15. William Ludlow | 1875 | 15 | 22 | - | - | - | - | - |
| 16. William Strong | 1875 | 14 | 35 | - | - | - | 6 | - |
| 17. Doane Expedition | 1876 | 64 | 6-8 | | | | | |
| a. Doane | | | | - | - | 1 | 6 | - |
| b. Server | | | | - | - | - | 3 | - |
| Total[2] | 1835-76 | 765 | Varied | 1 | - | 3 | 45 | 53 |

1 For exact dates and trip routes, see Kay (1990: Chapter 9).
2 Does not include duplicate sightings or references to the same event.

**Fig. 2** *Yellowstone National Park's Mammoth Hot Springs as it appeared in 1872. According to the Park Service, 12,000 to 15,000 elk have wintered on Yellowstone's northern range for the last several thousand years and those elk have always had a dramatic impact on the park's woody vegetation. The agency contends that aspen, willows, and conifers were as heavily browsed or high-lined by ungulates in the early years of the park's existence as they are today. The Park Service believes that high-lined conifers are natural and not a sign of overgrazing. Yet, in this 1872 photograph, as well as in all other historical photographs, conifers show no sign of ungulate browsing or high-lining. Instead, the trees have branches that extend to ground level, except where light ground fires killed the lower branches. Today, all trees around Mammoth Hot Springs have had their lower branches consumed as high as the starving elk can reach. Historical photographs of the more palatable aspen and willows also do not show evidence of ungulate browsing. Despite what certain narrative historical accounts may appear to suggest, the available physical evidence indicates that large numbers of resource-limited elk and other ungulates did not winter in Yellowstone until after the national park was established (see Kay 1990, Chadde and Kay 1991, Kay and Wagner 1994 for additional early photographs). William H. Jackson photograph (F-28,835) courtesy of the Colorado Historical Society, Denver, Colorado.*

amount of poaching which supposedly occurred. By discrediting the early civilian administrators and showing that they were incapable of protecting Yellowstone, the military hoped to sway Congress (Haines 1977). In that they were successful, for the military was given control over Yellowstone in 1886 and ran the park until the National Park Service was created in 1916 (Hampton 1971).

Narrative and secondhand accounts of an abundance of game may also have been inspired by cultural myths of the day. White (1991:618) noted that daily journals kept by early western travellers often differ from their latter narrative accounts because the narratives were written to conform with accepted social myths. Unlike journals, which were usually written for personal use, narratives were written for publication and had to conform to accepted social traditions if they were to be widely read and financially successful. During the 1800's, the myth that the Intermountain West was a "Garden of Eden" teeming with wildlife colored many narrative accounts (White 1991:613–632).

Others, however, have cited those passages to support their belief that tens of thousands of ungulates have always inhabited Yellowstone (Murie 1940, Gruell 1973), and that wintering ungulates have always had a dramatic impact on the park's plant communities (Houston 1982). They believe that Yellowstone is not now nor has ever been overgrazed by native ungulates (Despain et al. 1986). They contend that high-lining of conifers and of other woody vegetation is "natural" and not a sign of overgrazing (Houston 1982).

Photographs taken in the park between 1871 and 1890, though, do not show any evidence of ungulate browsing or high-lining (Kay and Wagner 1994). Repeat photosets (n = 125) show that since Yellowstone Park was established

aspen (*Populus tremuloides*) and tall willows (*Salix* spp.) have declined 95% as a result of repeated ungulate browsing, not other factors (Kay 1990, Chadde and Kay 1991). Since conifers and other woody vegetation in the earliest images were 70 to 100 years old or older when they were first photographed and since they showed no evidence of ungulate browsing, this would indicate that few, if any, ungulates wintered in Yellowstone from the late 1700's through the 1870's (Fig. 2). These photographs do not support the contention that Yellowstone was always home to thousands of ungulates (Kay and Wagner 1994). Instead, they support the conclusion that few ungulates inhabited the ecosystem prior to European arrival, thus explaining why wolves were rare.

### *Why Were Ungulates Rare?*

In addition to their historical rarity, ungulates, and especially elk, were also rare prehistorically (Kay 1990). Although a complete discussion of this subject is beyond the scope of this paper and has been presented elsewhere (Kay 1994), I offer the following observations and hypothesis.

Studies of contemporary ungulate populations typically focus on whether they are limited by resources (food), severe winter weather, carnivorous predation, disease, or some combination thereof. In pondering what factors limited ungulate numbers in pre-Columbian times, most authors invoke these same influences. The role of Native Americans is generally not considered, dismissed out of hand, or glossed over with a few cursory statements (Jobes 1991:388). Although not often explicitly stated, the idea that prehistoric humans lived a brutish existence where they spent every waking moment in the quest for food underlies most biologists' dismissal of Native Americans as important ecological factors (Simms 1992). Anthropologists, however, abandoned this stereotype of "primitive" people more than 20 years ago (Lee and DeVore 1968). Anthropologists have shown that hunter-gatherers had more leisure time than the average person living in today's "most advanced" western civilizations (Hawkes and O'Connell 1981). Sahlins (1972) even went so far as to call hunter-gatherers "the original affluent society."

Based on my research and analysis, I believe that prior to European contact, predation by Native Americans was the major factor limiting the numbers and distribution of ungulates in Yellowstone and throughout the Intermountain West (Kay 1994). My Aboriginal Overkill hypothesis arises from analyses of: 1) the efficiency of Native American predation, including cooperative hunting, use of dogs, food storage, use of non-ungulate foods, and hunting methods; 2) optimal-foraging studies; 3) tribal territory boundary zones as prey reservoirs; 4) ungulate species ratios in archaeological contexts compared with those of present ungulate communities; 5) sex and age of ungulates killed by native peoples; 6) impact of European diseases on aboriginal populations; 7) lack of effective aboriginal conservation practices; and 8) the apparent synergism between aboriginal and carnivore predation. Accordingly, none of the North American ungulate-predator systems studied to date represents the conditions that existed prior to European arrival.

Contrary to common perception, not only did Native Americans have no effective practices to conserve ungulates, but the manner in which those peoples harvested ungulates was the exact opposite of any predicted conservation strategy (Simms 1992). There is also no evidence that Native American's system of religious beliefs prevented aboriginal peoples from overutilizing ungulate populations (Kay 1985a, 1985b). Little correlation exists between how a people say they manage their resources and what they actually do; the difference between emic and etic behavior (Tuan 1970, Kay and Brown 1985). Instead of being "noble savages" who were too wise to overexploit their resources, Native Americans acted in ways that maximized their individual fitness regardless of their impact on the environment (Simms 1992). Because native peoples in Yellowstone and throughout the Intermountain West could subsist on vegetal foods, small mammals, and fish (Wright 1984), they could take their preferred ungulate prey to low levels or extinction without adversely impacting human populations (Simms 1984). Although diminishing returns acts as a homeostatic mechanism to control populations of most predators, like wolves, little such control has operated in the case of man (Cohen 1977:187).

Mech (1977a) reported that wolf packs used the edges of their territories less frequently than the central part of their ranges in order to avoid encounters with neighboring wolves. This reduced predation pressure along the territorial edges, thus permitting more white-tailed deer to survive in those areas and to live to older ages (Hoskinson and Mech 1976). Mech (1977a) could find only one other instance of this buffer zone phenomena in the literature, a paper by Hickerson (1965) entitled "The Virginia deer and intertribal buffer zones in the upper Mississippi Valley." Hickerson (1965:45) noted that, "Warfare between members of the two tribes had the effect of preventing hunters from occupying the best game region intensively enough to deplete the (deer) supply....In the one instance in which a lengthy truce was maintained between certain Chippewa and Sioux, the buffer, in effect a protective zone for the deer, was destroyed and famine ensued."

While Mech could find only a single reference to tribal buffer zones, my research has uncovered at least 100 similar references in historical journals and studies of modern hunter-gatherers. For instance, Lewis and Clark (1893:1197), who made the first recorded exploration of the northern Rockies in the United States, noted that, "With regard to game in general, we observe that the greatest quantities of wild animals are usually found in the country lying between [Indian] nations at war." There is a direct correlation between where Lewis and Clark saw game and where they saw native peoples. Where there were no Native Americans, there was abundant game — primarily on the

plains of eastern Montana — and where Native Americans were common, there was no game. Lewis and Clark would have starved in the mountains if they had not obtained food, primarily fish and roots, from native peoples.

In some instances, tribal territory buffer zones were up to 200 km wide. The presence of tribal territory buffer zones demonstrates that aboriginal hunting limited ungulate numbers and that Native Americans had no effective conservation practices, as predicted by central place optimal-foraging theory. The presence of tribal territory buffer zones can not be explained by wolf predation and suggests that carnivores played a secondary role in limiting ungulate populations during prehistoric times (Kay 1994).

I believe that Native Americans were keystone predators who structured entire ecosystems. It is now commonly recognized that systems with native peoples are entirely different from those without aboriginal populations (Simms 1992). Thus, the modern western concept of wilderness as areas without human influence is a myth (Gomez-Pompa and Kaus 1992). Prior to European arrival, most of North America was owned, used, and modified by native peoples. North America was not a "wilderness" waiting to be discovered but home to tens of millions of aboriginal peoples before European-introduced diseases decimated their numbers (Dobyns 1983, Ramenofsky 1987). While early Yellowstone explorers made, at most, four references to wolves, they made 53 references to native people who once called that ecosystem home (Table 1).

## Conclusion

The information available does not support the belief that wolves were common in Yellowstone at any point in recorded history. There is no historical support for the belief that restoring 10 wolf packs to the park would reestablish the conditions that existed prior to European influences, commonly referred to as "natural" or "pristine" conditions. The data, in fact, suggest that wolves were always rare in Yellowstone.

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# Ecology and Conservation of

# Wolves

# in a Changing World

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