YELLOWSTONE

WOLF

PROJECT

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Yellowstone Wolf Project

Annual Report
2007

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Wolf logo on cover and title page: Original illustration of wolf pup #47, born to #27, of the Nez Perce pack in 1996, by Melissa Saunders. Treatment and design by Renée Evanoff.

All photos not otherwise marked are NPS photos by Douglas Smith and Daniel R. Stahler.

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Background

Although wolf packs once roamed from the Arctic tundra to Mexico, they were regarded as dangerous predators, and gradual loss of habitat and deliberate extermination programs led to their demise throughout most of the United States. By 1926, when the National Park Service (NPS) ended its predator control efforts, there were no gray wolf (*Canis lupus*) packs left in Yellowstone National Park (YNP).

In the decades that followed, the importance of the wolf as part of a naturally functioning ecosystem came to be better understood, and the gray wolf was eventually listed as an endangered species in all of its traditional range except Alaska. NPS policy calls for restoring, where possible, native species that have been eliminated as a result of human activity. Because of its large size and the abundant prey, the greater Yellowstone area (GYA) was identified in the recovery plan as one of three areas where the recovery of wolf populations had a good chance of succeeding.

The U.S. Fish and Wildlife Service (USFWS) has the primary responsibility for ensuring compliance with the Endangered Species Act (ESA) and oversees the multi-state wolf recovery program. The USFWS had proposed that 30 breeding wolf pairs with an equitable and uniform distribution throughout the three Rocky Mountain recovery areas (greater Yellowstone, central Idaho, and northwest Montana) for three successive years would constitute a viable and recovered wolf population. Recovery goals were met in 2002, and the USFWS has proposed delisting throughout the northern Rocky Mountain recovery area. A final decision on that rule is expected in February 2008.

Following an extended period of public planning and input, wolf restoration to the GYA began in 1995, when 14 wolves were brought to the park from Alberta, Canada, held in acclimation pens for 10 weeks, and then released. Initial founder wolves, named for the geographic locales at which they were acclimated, were the Crystal Creek, Rose Creek, and Soda Butte packs on Yellowstone's northern range. In 1996, an additional 17 wolves were transplanted from British Columbia and released in more widespread locations throughout the park. In 1995–96, a companion effort to restore wolves to central Idaho occurred, using a simpler technique without acclimation. Although the original plan, outlined in *The Reintroduction of Gray Wolves to Yellowstone and Central Idaho, Final Environmental Impact Statement* (1994), called for annual translocations from Canada for up to five years, additional transplants were deemed unnecessary by 1997 because the founder wolves had higher reproduction, lower mortality, and less movement from the GYA than was originally expected.

Five full-time employees worked for the Yellowstone Wolf Project in 2007: Project Leader Douglas Smith, and Biological Science Technicians Debra Guernsey, Erin Albers, Rick McIntyre, and Matthew Metz. Dan Stahler split time between graduate work at the University of California, Los Angeles, and working in the park as a project biologist. The Wolf Project was able to hire paid seasonal staff through the Yellowstone Park Foundation and Yellowstone Association to assist in several key aspects of our annual work. Paid seasonal staff included Nicole Legere, Abby Nelson, and Libby Williamson. Additional volunteers staffed the early (November–December) and late (March) winter study periods (see Acknowledgments and Appendix I).

Wolves reintroduced into Yellowstone were classified by the USFWS as "nonessential experimental" under section 10(j) of the Endangered Species Act and are managed outside the park under special rules that permit flexibility in addressing wolf conflicts with livestock and other wildlife management goals. It was anticipated that as the wolf packs established their territories, some would hunt and/or reside outside the park on other public or private land, and that some of the 412,000 livestock in the GYA would be preyed upon. The special rules contained provisions for addressing the possibility of conflicts with livestock.

To facilitate monitoring and research, all of the wolves brought from Canada were radio-collared before release, and YNP maintains radio collars in all wolf packs within the park. Wolf Project staff monitor population dispersal, distribution, reproduction, mortality, and predation on ungulates. Monitoring and management activities for the first two years of the project are documented in *The Yellowstone Wolf Project, Biennial Report 1995–96*. Subsequent project activities are presented in annual reports.

2007 Summary

At the end of 2007, at least 171 wolves in 11 packs and various groups occupied Yellowstone National Park (YNP). There were fewer packs than in 2006, but the remaining packs were larger and there were more non-pack wolves (e.g., loners, temporary pairs, etc.). This represents a 26% increase from 2006 and closely matches the population peak of 174 in 2003. Ten packs counted toward the breeding pair objective for the Yellowstone Recovery Area; the Hayden Valley pack lost both breeders late in the year and did not count. One new pack, the Gardner's Hole pack, formed but did not survive until the end of 2007 (despite producing pups). This was the first year since reintroduction that no new packs formed. One radio collared wolf from Idaho dispersed into the park in late 2007.

Pack size ranged from 4 to 22 wolves and averaged 14.2, a higher average than in previous years. Average number of pups per pack in early winter was 5.8.

Reproduction and pup survival (83%) was good in 2007. Each of the 12 packs present in summer had pups. The only pup produced by the Gardner's Hole pack was on its own at the end of the year and unlikely to survive. Three packs had more than one litter: the Slough Creek and Oxbow Creek packs from the northern range, and the Hayden Valley pack (the first recorded case of an interior pack having more than one litter).

Not counting over-summer pup mortality, six collared wolves died in 2007. These included two old adults (>5 years) and four adults (2–5 years). Four were males and two were females. As in past years, the leading cause of mortality was intraspecific strife (67%).

Twenty-two wolves were captured and collared in eight packs. Of these, 11 were adults, 11 were pups, and 15 were female, 7 were male. At year's end, 57 of 171 (33%) wolves were collared. Three types of radio collars were deployed: 1) VHF, 2) downloadable Global Positioning System (GPS), and 3) ARGOS. Placement of collars was dependent on monitoring objectives, and VHF radio collars were still the most commonly used collar.

Wolf Project staff documented 323 kills (definite, probable, and possible combined) made by wolves in 2007, including 272 elk (84%), 11 bison (3.4%), 7 wolves (2%), 4 deer (1%), 4 coyotes (1%), 3 moose (<1%), 2 black bears (<1%), 1 pronghorn (<1%), 1 golden eagle (<1%), 1 red fox (<1%), 1 otter (<1%), and 16 unknown prey (5%). The composition of elk kills was 41% bulls, 21% calves (0–12 months), 16% cows (1–9 years old), 12% old cows (≥10 years old), and 10% elk of unknown sex and/or age. Bison kills included 6 calves (unknown sex), 3 bulls, and 2 adults of unknown sex. Preliminary examination of winter predation rates in 2007 shows a decrease in kill rate compared to previous years. Winter predation rates for the period of 1995–2000 showed wolves residing on the northern range killed an average of 1.8 elk/wolf/30-day study period. Changes in prey selection (a shift from elk calves to bull elk) and an increase in scavenging on winter-killed ungulates by wolf packs factor in to this decrease.

Research on summer predation by wolves increased this year due to one downloadable GPS collar working in the Leopold pack. Matthew Metz began a graduate project studying summer predation with John Vucetich at Michigan Technological University. Research on wolf population genetics and disease continued in 2007. Two graduate students continued to gather data in 2007: Emily Almberg studied wolf diseases with L. David Mech at the University of Minnesota, and Daniel Stahler studied social behavior and genetics at the University of California, Los Angeles, with Robert Wayne.

Mange was documented in Mollie's pack and contributed to one wolf's mortality. However, major mortality from mange or other diseases was not detected.

Wolf management activities included closures of den sites and hazing of habituated wolves. Public outreach to park visitors continued with 11,075 contacts in the field with visitors watching wolves. Wolf Project staff counted 32,600 people viewing wolves during the summer season. Wolf Project staff gave 71 public presentations and 52 interviews to all forms of media. Visits to backcountry hunters near the park boundary in the Gallatin National Forest continued during fall, and Wolf Project staff were accompanied by USFWS special agents Dominic Domenici and Gary Mowad.

Additional information on wolves in Yellowstone National Park is available at www.nps.gov/yell/naturescience/wolves.htm, www.greateryellowstonescience.org, and www.r6.fws.gov/wolf/.

Yellowstone Wolf Pack Territories, 2007

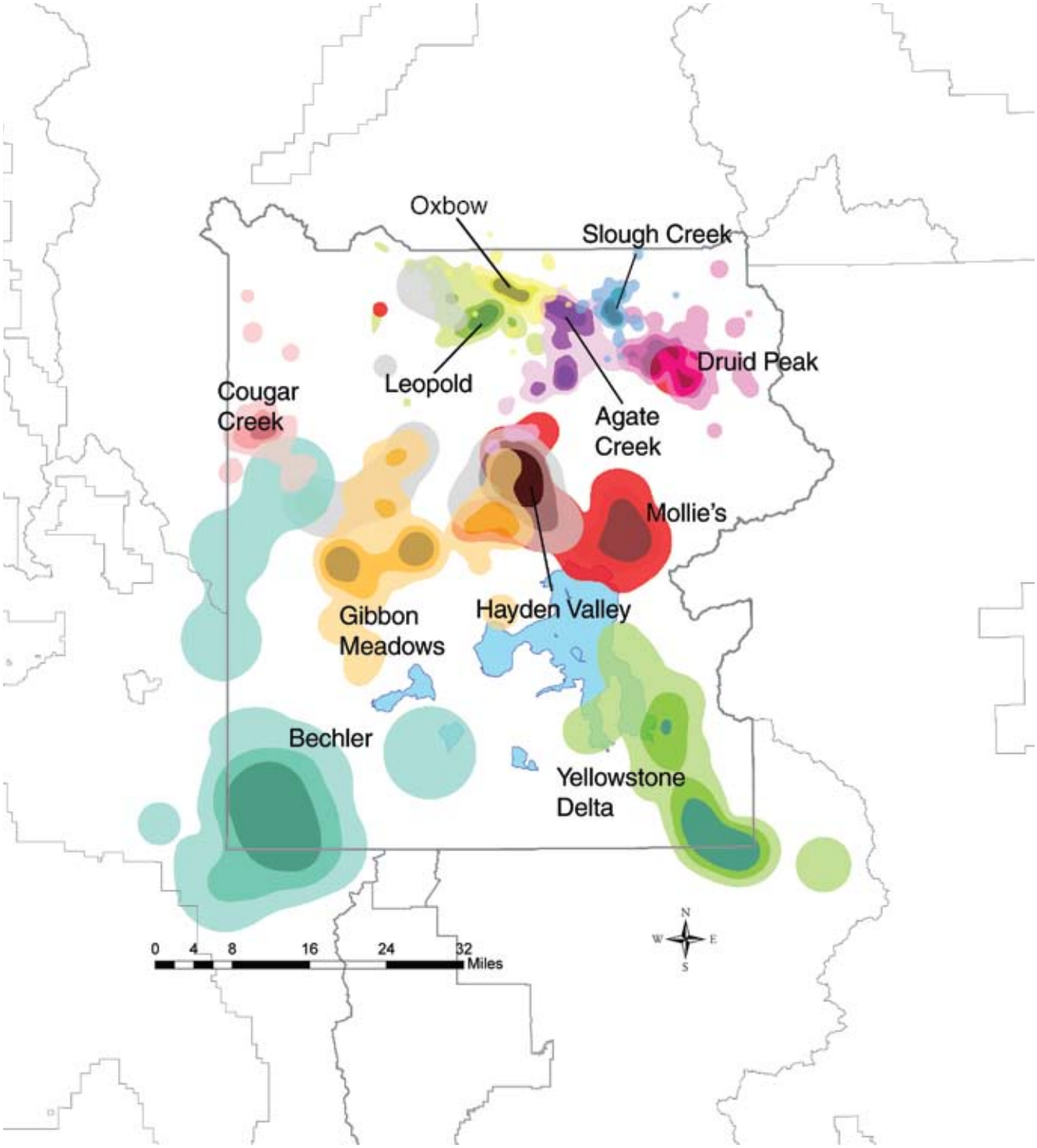


Figure 1. Wolf pack territories in Yellowstone National Park in 2007, plotted as kernel estimates. Darker colors depict higher use, or core, territories.

Grizzlies and wolves often compete for access to carcasses, with grizzlies usually prevailing.

The Yellowstone Wolf Population

Population and Territory Status

At the end of 2007 at least 171 wolves in 11 packs (10 breeding pairs), 3 non-pack groups, and 7 loners occupied Yellowstone National Park (Figure 1, Table 1). This represents a 26% increase over the 2006 population (Figure 2) and is approximately equal to the population peak in 2003 (174 wolves). Both the northern range and interior wolf populations increased, but despite its comparatively small area (11% of the park), the northern range supported 55% of YNP wolves.

One new pack (Gardner's Hole) formed in 2007 but the status of this pack at the end of the year was unknown. It had likely dissolved, meaning no new packs formed in 2007, a first since reintroduction. A radio-collared lone wolf from Idaho (B271, Steele Mountain pack) dispersed into Yellowstone late in the year.

Five packs (81 wolves, up 8% from 2006) plus 13 wolves unassociated with packs made up the northern range wolf population (a 25% increase). Despite more wolves this is two fewer packs than in 2006, as the Hellroaring Creek and Swan Lake packs were gone. The increased population was due to larger pack sizes of the remaining packs. Six packs (75 wolves, up 23% from 61) plus two loners made up the interior wolf population (a 26% increase). No packs were lost and none were gained although the status of the Hayden Valley pack was uncertain at the end of the year due to the loss of both breeding wolves (alphas). This pack, which existed between two larger packs—Mollie's to the east and Gibbon Meadows to the west—was attacked in late October by Mollie's and both alphas were killed. The remaining four wolves (three pups and one yearling) wandered the park but because none were radio-collared it was hard to track their movements and determine their status (see inset story, page 6). Pack size ranged from 4 (Hayden Valley at year's end) to 22 (Yellowstone Delta) and averaged 14.2, an increase from 10.5 in 2006.

Pack	Adults	Pups	Total
Northern Range			
Leopold	13	3	16
Oxbow Creek	8	8	16
Agate	8	9	17
Slough	7	9	16
Druid	9	7	16
Gardner's Hole Group	1	1	2
#469F Group	4	0	4
#527F/B271M Idaho Wolf	2	0	2
Loners/Non-Pack Wolves	5	0	5
Northern Range Totals	**57**	**37**	**94**
Non-Northern Range			
Mollie's	9	5	14
Yellowstone Delta	16	6	22
Bechler	8	3	11
Cougar Creek	3	4	7
Gibbon Meadows	11	6	17
Hayden Valley (no collars)	1	3	4
Loners/Non-Pack Wolves	2	0	2
Non-Northern Range Totals	**50**	**27**	**77**
Total	**107**	**64**	**171**

Underline denotes breeding pair.

Table 1. Yellowstone National Park wolf population, December 2007.

Wolf–wolf clashes were again documented in 2007,

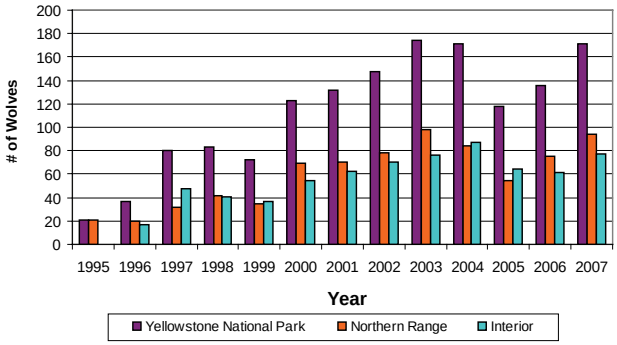
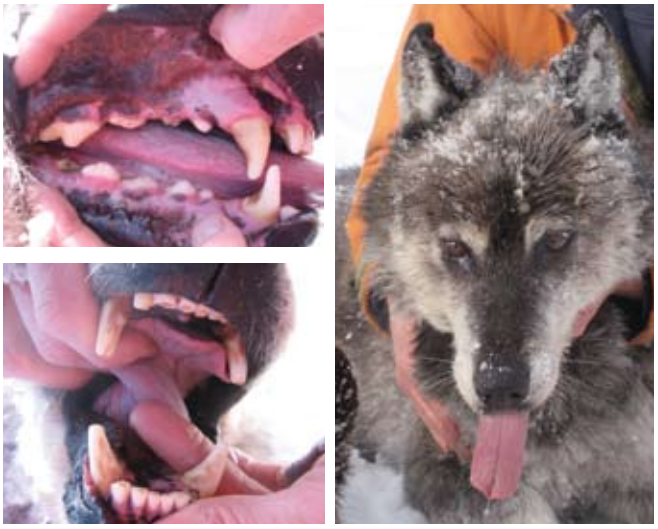


Figure 2. Yellowstone National Park early winter wolf population, 1995–2007.



At age 10, Yellowstone Delta #126F's teeth are worn down.

especially on the northern range where wolf density was highest.

Average age at death has increased nearly every year since reintroduction, and two notably old wolves died in 2007: male wolf #193 from Mollie's pack at 9 years of age (the first documented mange-related death in the park) and male wolf #113 from the Agate Creek pack at 10 years of age. Both wolves held alpha status late into their lives. After losing his dominant status, wolf #113M remained in the pack and was tolerated by his son the new alpha. (By contrast, an ex-alpha female wolf would typically not be tolerated by her pack.) Other notably old wolves were #151, alpha female of the Cougar Creek pack, at 9 years of age; #126, presumably the alpha female of the Yellowstone Delta pack, at 10 years of age; and #192, alpha male of the Bechler pack, at 9 years of age.

Across the park, wolf distribution was unchanged and has been so for several years, indicating that all available wolf habitat is settled. Pack turnover, when it occurs, is always within the occupied wolf range and new areas of settlement have so far not been recorded.

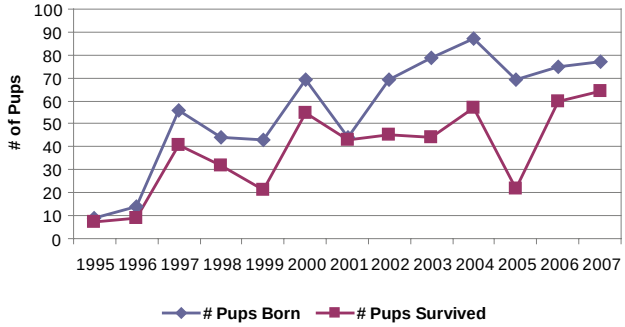


Figure 3. Yellowstone National Park pups born and survived, 1995–2007.

Reproduction

Over-summer pup survival was excellent in 2007. Seventy-seven pups were born, 64 survived (83%), and there was no sign of disease mortality (Figure 3). At year's end, 37% of the population was comprised of pups. All 11 packs reproduced; however, due to the loss of both the alpha male and female in the Hayden Valley pack at the end of the year, this pack did not count as a breeding pair. Three packs had more than one litter of pups. The Hayden Valley pack was the first pack in the park interior to have more than one litter. The other two were the Slough Creek and Oxbow Creek packs on the northern range. The average litter size per pack with only one female breeding was seven pups (pups counted at dens in May and June). An average of 5.8 pups survived per pack (pups counted with packs in November and December).

Wolf Project staff visited all den sites except those within the Bechler and Gibbon Meadows territories.

Mortalities

Not counting over-summer pup mortality, six collared wolves died in 2007 (Table 2). These included two old adults (>5 years) and four adults (2–5 years). Four were males and two were females. The leading cause of mortality (67%) was intraspecific strife.

# of Deaths	Wolf #/Sex	Age Class	Pack	Date of Death	Cause of Death
1	287M	Adult	Hellroaring	2/14/2007	Intraspecific
2	348M	Adult	Disperser from Druid Peak	5/8/2007	Unknown
3	497M	Adult	Mollie's	5/6/2007	Vehicle
4	524F	Adult	Agate Creek	7/4/2007	Intraspecific
5	540F	Old adult	Hayden Valley	10/30/2007	Intraspecific
6	541M	Old adult	Hayden Valley	10/30/2007	Intraspecific

Table 2. Confirmed mortalities of collared Yellowstone National Park wolves, 2007.

Leopold wolves attacking bull elk on Blacktail Deer Plateau, May 2007. Wolves are reluctant to attack when elk stand their ground, preferring to attack a fleeing animal.

Pack Summaries

Leopold *(16 wolves: 13 adults, 3 pups)*

The Leopold pack continued to thrive on their longtime territory centered around the Blacktail Deer Plateau. The pack was led by the alpha pair of #534M and #209F (who bred together for the fourth time during 2007). Number 209 is only the third alpha female and #534 the second alpha male in the pack's history. The pair produced the sole litter of pups for the pack, of which at least three (out of four) survived to year's end. This pack was the subject of intensive summertime study due to the presence of a downloadable GPS collar that recorded fixes on wolf #593M 48 times/day (see Summer Studies, page 9), revealing new areas of use for this pack and a spatial/temporal pattern of prey use throughout the summer that was previously unknown. Bull elk were the predominate prey in early summer but in late summer cow elk, elk calves, and deer were taken south of Blacktail Deer Plateau.

Oxbow Creek *(16 wolves: 8 adults, 8 pups)*

Formed in 2006 and led by former Leopold wolf #536F, this relatively new pack produced two litters totaling 12 pups. Number 470F produced one litter of only one pup that died in transit when the pack moved from their natal den to a second den site. Eight out of 11 pups produced from the other litter survived to year's end. During 2007, the pack expanded their territory across the Yellowstone River into old Rose Creek, Geode Creek, and Hellroaring Creek territory, possibly seeking to leave behind the cramped quarters next to Leopold. Oxbow Creek was the fourth pack in 10 years to occupy this territory, historically an area of high pack turnover. Other territories nearby supported only one pack during the same period. By December, #470F began spending time away from the pack, possibly positioning herself for the upcoming breeding season and a chance at her own pack. Wolf Project staff hoped to study the summertime predation of this pack in 2007, but a malfunctioning GPS collar prohibited any such study.

Agate Creek *(17 wolves: 8 adults, 9 pups)*

Nine pups were born and all of them survived until the end of the year. Long-time alpha #113M was injured before the breeding season and did not breed in 2007, but his son did. Despite losing alpha status, #113M was tolerated in the pack until his death in October at 10 years of age.

Agate Creek pack wolves on a kill. The rocky terrain may have helped lead to the elk's death.

The right front foot of Slough Creek wolf #621F shows a healed break that may have slowed her when she was pursued and killed by Druid wolves.

A Druid Peak bull elk kill in Soda Butte Creek. Wolf kills are scavenged by at least 12 vertebrate and several hundred invertebrate species.

Slough Creek *(16 wolves: 7 adults, 9 pups)*

During late 2006 this pack lost its alpha male due to intraspecific aggression. The breeding vacancy was quickly filled by a wolf from the Agate Creek pack, but this wolf was hit by a car in September. Within days of this alpha's death, another yearling from Agate Creek (#590M) replaced him. This pack clashed often with other packs. Three wolves in this pack were killed by wolves from neighboring packs, one of whom had a broken foot that had fused, which may have inhibited her ability to escape the attack. Nine of 13 pups survived to year's end. Idaho wolf #B271 temporarily associated with the Slough Creek pack but did not join them or form a new pack with any of them.

Druid Peak *(16 wolves: 9 adults, 7 pups)*

All seven pups born survived. The pack denned near a backcountry campsite where a permit was mistakenly issued and use of the campsite caused the wolves to prematurely abandon the natal den and move the pups to a more remote site. Surprisingly, no pup mortalities were documented. The pack reclaimed some of their old territory in Lamar Valley that Slough Creek had usurped, attacking and killing at least two Slough Creek wolves. Yearling #570M dispersed in the fall, leaving the pack with two adult males (#480 and #302), seven adult females, and seven pups.

Mollie's *(14 wolves: 9 adults, 5 pups)*

Mollie's occupied its typical territory in Pelican Valley but began moving west into Hayden Valley, usurping territory and killing both Hayden Valley alphas. Longtime alpha male #193 died at nine years of age, the first mange-related death recorded in YNP. (At least one other case of mange was documented but it never developed into major hair loss.) The pack continued to prey on bison in winter and faced competition from grizzly bears over use of carcasses from March through October.

Above: Mollie's pack wolves closely following bison through the Astringent Creek thermal area. Below: Mollie's pups resting in late summer.

Druid Peak wolves confronting a grizzly bear. These interactions seldom lead to adult mortalities, though grizzly bear cubs have been killed.

Yellowstone Delta *(22 wolves: 16 adults, 6 pups)*

This was the largest YNP pack in 2007. Occupying the remote southeast corner of the park and ranging into Wyoming, this pack has traditionally denned within YNP and continued to do so. Though difficult to capture, five wolves were collared in 2007. The pack has been the subject of cooperative studies between the Wyoming Game and Fish Department and YNP.

Bechler *(11 wolves: 8 adults, 3 pups)*

Due to its remote location, this pack, like the Yellowstone Delta pack, is difficult to capture and collar. After an ARGOS collar dropped off another pack member, only the nine-year-old, long-time alpha male was radio-collared at the end of the year. The pack denned and spent much of their time within YNP, but also ranged into Wyoming and Idaho.

NATHAN VARLEY

The Hayden Valley breeding pair.

Cougar Creek *(7 wolves: 3 adults, 4 pups)*

Living on the west side near West Yellowstone, this pack rarely leaves the park despite living close to the boundary. After producing no pups in 2006, probably due to the advanced age of the nine-year-old breeding female, the pack successfully produced four pups in 2007, doubling its size.

Gibbon Meadows *(17 wolves: 11 adults, 6 pups)*

A large and stable pack that resides in the Madison–Firehole area, this pack's size increased by five wolves in 2007. Like Mollie's pack, this pack has access to many bison in winter, as well as some elk. Unlike previous winters, the pack preyed more on elk than on bison.

Hayden Valley *(4 wolves: 1 adult, 3 pups—not a breeding pair)*

Living the past several years in Hayden Valley between two larger packs (Mollie's and Gibbon Meadows), this pack finally got squeezed out (see inset story, page 6). In late October, Mollie's pack killed both Hayden Valley alphas and the surviving wolves subsequently traveled widely. During these travels, one pup was probably killed by the Gibbon Meadows pack near Old Faithful. An adult female bred outside the pack, returned, and the pack produced two litters this year, the first time multiple litters in an interior pack have been documented. No wolves is this pack are collared.

The Hayden Valley Pack

Both Breeders Killed, Pack Survives

A late forming pack, the Hayden Valley wolves have roamed the sweeping meadows and geyser studded hills of Hayden Valley since 2004. Situated in the middle of the park, the area offers a boom-bust existence: plentiful elk and bison in summer, access to a major fall elk migration route, but perilous times in the winter with no elk and few bison, whose vulnerability depends on winter severity. Wedged between two larger packs—Gibbon Meadows to the west and Mollie's to the east, both of whom used Hayden Valley and sometimes pushed the smaller pack aside—the Hayden Valley wolves often struggled to survive.

A pair of wolves first sighted by visitors in 2003 was notable because the female wolf was virtually white, one of only two white wolves in the park. Genetic samples revealed she was of Nez Perce pack descent, a now extinct pack to the west. It is not known where the male came from, but probably from a northern range pack. By 2004 the pair had produced two pups, only modestly increasing their pack size to four, which seemed dubiously small to cope with life amidst the bison and nearby larger packs. They denned perhaps too near the road, thrilling visitors and eventually interacting with them as they wove their way through the traffic stopped to observe them. However, in winter they were hard to find and collaring efforts were unsuccessful until 2006, when both alphas were captured and dubbed #540F and #541M. "The white wolf" always trumped her number with visitors. In hand they looked middle-aged, so without knowing exactly, we estimated them at 5–6 years old. They were in good shape, but 2006 was a snowy winter, possibly making bison easier prey that year. It was hard to say how they fared after that, but their movements out of the valley suggested hard times. They were always a little too tolerant of people, causing much worry and discussion among Wolf Project staff, but they never became a problem.

After 2004, they had pups in 2005, 2006, and 2007, but pack size remained small, either because of small litters or poor pup survival, probably hindering them against the bison and the bigger packs. Their pups grew up in front of adoring visitors in summer, with the pups on one side of the Yellowstone River, the road and people on the other. Some nights hundreds would gather to watch them, and veteran wolf watchers said it was the best viewing they had ever experienced.

JASON OGLE

Wolf #541M (standing left), and #540F (far right) were killed by Mollie's pack in 2007.

Then in October 2007, the pack clashed with Mollie's pack near Canyon. Mollie's had shifted into Hayden Valley the previous year, and one male from Mollie's pack may have even bred with a subordinate Hayden Valley female. When the male did not stick around, #540 and #541 helped to raise the pup. Nonetheless, this did not spare them the attack by Mollie's, who by all accounts routed them, killing both alphas. Mollie's pack was just too big and had lots of big wolves, including big male wolves—bison killers. A blood trail tracked by park staff indicated that the white wolf took hours to die as she staggered through the Canyon area.

Seemingly wiped out, the pack carried on without their leaders. Four pups and a young female fled Hayden Valley but clashed with Gibbon Meadows wolves near Old Faithful and lost a pup. Down to just four wolves, they were later joined by a male wolf. They traveled widely, almost like a pack without a territory trying to avoid interactions with other packs. They headed north and at year's end had settled at the edge of the northern range. They are again living near the territories of several large packs as they are without many options to relocate. Although they are still hard to track because there are no radio collars in the pack and their fate is uncertain, reports of them pop in sporadically from visitors and park staff. Who knows? Maybe one of the pups will turn white and return someday to Hayden Valley.

Other Wolves

Several temporary or unknown associations or groups of wolves, along with loners, made up the remainder of the YNP wolf population. The 2006 Hellroaring pack dissolved and the Gardner's Hole pack (which formed in the same area as the Swan Lake pack) had likely dissolved by year's end as well. Individual wolves from both the Leopold and Slough Creek packs traveled separately from their packs and associated with other wolves during late 2007. Idaho wolf #B271 unsuccessfully attempted to pair with a Slough Creek wolf.

Wolf Capture and Collaring

Twenty-two wolves were captured and collared in eight packs in 2007 (Table 3). Eleven adults and 11 pups were caught, 15 females and 7 males. At year's end, 57 of 171 (33%) wolves were collared.

Three types of radio collars were deployed: 1) VHF, 2) downloadable GPS, 3) and ARGOS. Placement of collars was dependent on monitoring objectives, but VHF radio collars are still the most commonly used collar by the program.

Elk often run to water to evade wolves. Here the water was too shallow and these Mollie's wolves were successful in catching their prey.

Capture Date	Wolf #/ Sex	Age	Color	Pack
12/31/2006	527F	Adult	Black	Slough Creek
	569F	Adult	Gray	Druid Peak
	570M	Pup	Gray	Druid Peak
	571F	Pup	Gray	Druid Peak
1/1/2007	572F	Adult	Black	Yellowstone Delta
	573M	Pup	Gray	Yellowstone Delta
	574F	Pup	Black	Yellowstone Delta
	575F	Adult	Gray	Yellowstone Delta
	576F	Adult	Gray	Yellowstone Delta
1/5/2007	577M	Pup	Gray	Gibbon Meadows
	578F	Pup	Black	Gibbon Meadows
1/29/2007	470F	Adult	Black	Oxbow Creek
	586M	Adult	Gray	Mollie's
	587M	Adult	Gray	Mollie's
	588F	Pup	Black	Oxbow Creek
	589F	Pup	Gray	Oxbow Creek
1/30/2007	209F	Adult	Black	Leopold
	383M	Adult	Gray	Agate Creek
	590M	Pup	Black	Agate Creek
	591F	Pup	Gray	Leopold
	592F	Adult	Gray	Leopold
	593F	Pup	Gray	Leopold

Table 3. Yellowstone Wolf Project collaring operations, 2007 calendar year.

Wolf Predation

Wolf–Prey Relationships

Wolf–prey relationships were documented by observing wolf predation directly and by recording the characteristics of wolf prey at kill sites. Wolf packs were intensively radio-tracked for two 30-day winter-study sessions in March and from mid-November to mid-December. The Leopold, Druid Peak, Agate Creek (March 2007), and Oxbow Creek (November–December 2007) packs were the four main study packs monitored by three-person ground teams, and all packs were monitored from aircraft. In addition, ground crews opportunistically monitored the Slough Creek, Hellroaring, and Mollie's packs, collecting prey selection and kill rate data. The Cougar Creek, Hayden, and Gibbon Meadows packs were monitored from aircraft only. The Yellowstone Delta and Bechler packs were rarely located by ground or air due, in part, to their absence from the park or poor conditions for aerial monitoring in southern YNP. Wolf Project staff recorded and entered into a database behavioral interactions between wolves and prey, predation rates, the total time wolves fed on their kills, percent consumption of kills by wolves and scavengers, characteristics of wolf prey (e.g., sex, species, nutritional condition), and characteristics of kill sites. In addition, similar data were collected opportunistically throughout the year during weekly monitoring flights and ground observations.

Doug Smith processing a bull elk kill in summer.

Composition of Wolf Kills

Wolf Project staff detected 323 kills (definite, probable, and possible combined) made by wolves in 2007, including 272 elk (84%), 11 bison (3.4%), 7 wolves (2%), 4 deer (1%), 4 coyotes (1%), 3 moose (<1%), 2 black bears (<1%), 1 pronghorn (<1%), 1 golden eagle (<1%), 1 red fox (<1%), 1 otter (<1%), and 16 unknown prey (5%) (Figure 4). The composition of elk kills was 41% bulls, 21% calves (0–12 months), 16% cows (1–9 years old), 12% old cows (≥10 years old), and 10% elk of unknown sex and/or age. Bison kills included 6 calves (unknown sex), 3 bulls, and 2 unknown sex adults.

Preliminary examination of winter predation rates in 2007 shows a decrease in kill rate compared to the first years after restoration (Figure 5). Winter predation rates for the period of 1995–2000 showed wolves residing on the northern range killed an average of 1.8 elk/wolf/30-day study period (Figure 6). Changes in prey selection

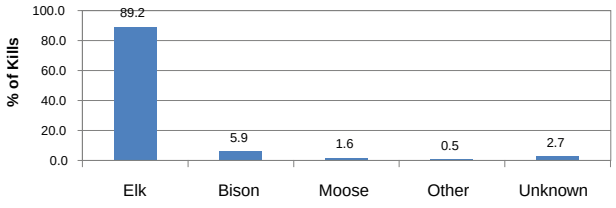


Figure 4. Winter prey selection by wolves in Yellowstone National Park, 2006–2007 (n=185).

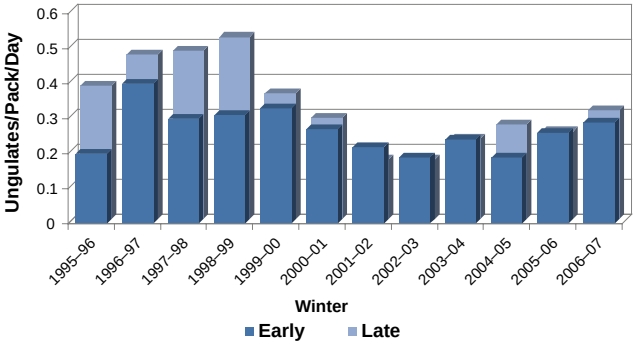


Figure 5. Minimum kill rates for wolf packs on the northern range, 1995–2007.

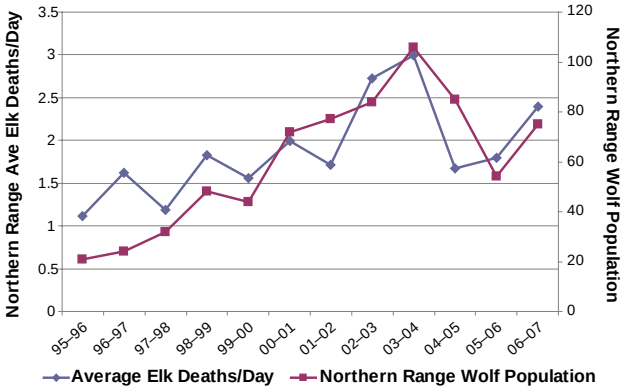


Figure 6. Average elk deaths per day, 1995–2007.

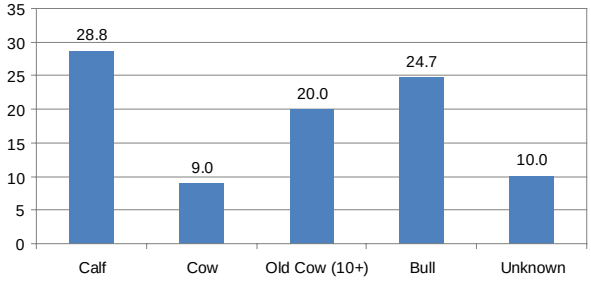


Figure 7. Winter wolf-killed elk on Yellowstone's northern range, 1995–2007 (n=1,516).

(a shift to bull elk from elk calves, Figure 7) and an increase in scavenging on winter-killed ungulates by wolf packs factor in to this decrease in kill rates.

Winter Studies

March. During the 30-day March 2007 winter study, packs were observed for 372 hours from the ground. The number of days wolf packs were located from the air ranged from 8 (Hellroaring) to 21 (Leopold).

Druid Peak wolves hunting a bull elk in December 2007. The hunt covered 1.7 miles but was unsuccessful when the elk stopped running and stood its ground.

Sixty-six definite or probable wolf kills were detected, including 57 elk, 6 bison, 2 moose, and 1 unknown species. Among elk, 14 (25%) were calves, 29 (51%) were bulls, 13 (23%) were cows, and 1 (2%) was an adult of unknown sex. In addition, 14 ungulates (10 bison, 3 elk, 1 moose) that died from other natural causes were scavenged by wolf packs. Documenting the consumption of biomass from ungulates not killed by wolves is important in explaining variation in kill rates through time. Lower than expected kill rates, particularly for larger wolf packs, can sometimes be explained by increased scavenging of winter-killed ungulates.

November–December. During the 30-day November–December 2007 winter study, wolves were observed for 347 hours from the ground. The number of days wolf packs were located from the air ranged from 12 (Gibbon) to 14 (Leopold, Slough Creek, Oxbow Creek, Agate Creek, Druid Peak, Mollie's, Cougar Creek). Aerial monitoring was affected by poor weather conditions. Forty-seven definite or probable wolf kills were detected. Wolf Project staff only documented elk being killed by wolves, and their breakdown includes 18 (38%) bulls, 14 (30%) cows, 14 (30%) calves, and 1 (2%) of unknown sex and age.

After a switch during the early winter study of 2006 to selection for calves, this year returned to the previous years' pattern of selection for bulls. Although difficult to test, Wolf Project staff hypothesized that 2007's drought conditions resulted in poor forage quality that, when coupled with the energetically costly behavior of rutting bull elk, make this age and sex class more vulnerable to predation in early winter compared to females and calves.

Summer Studies

During summer 2007, Wolf Project staff continued efforts to document summer predation patterns of wolves. Documenting the predatory habits of wolves in summer is problematic due to the lack of snow for tracking, increased nighttime activity of wolves, lack of pack cohesiveness, and smaller prey packages leading to quick consumption and loss of evidence. Traditionally, the best data concerning wolf summer food habits have come from analysis of scat contents collected at den and rendezvous sites (Figure 8). Although this effort on scat collection continued in 2007, GPS collar technology was used to facilitate a greater understanding of summer predation patterns.

During the 2007 capture season, Wolf Project staff deployed three downloadable GPS collars on the northern range to enhance understanding of: 1) seasonal predation patterns; 2) spatial and temporal interactions with other wolf packs and other carnivores; 3) movements

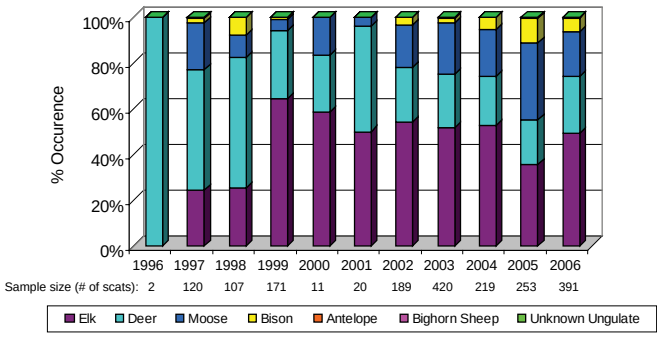


Figure 8. Percent occurence of ungulate species in summer wolf scats in Yellowstone National Park, 1996–2006.

Biological technicians Libby Williamson (above), Matt Metz, and other Wolf Project staff hiked more than 400 miles looking for wolf kills and documented 30.

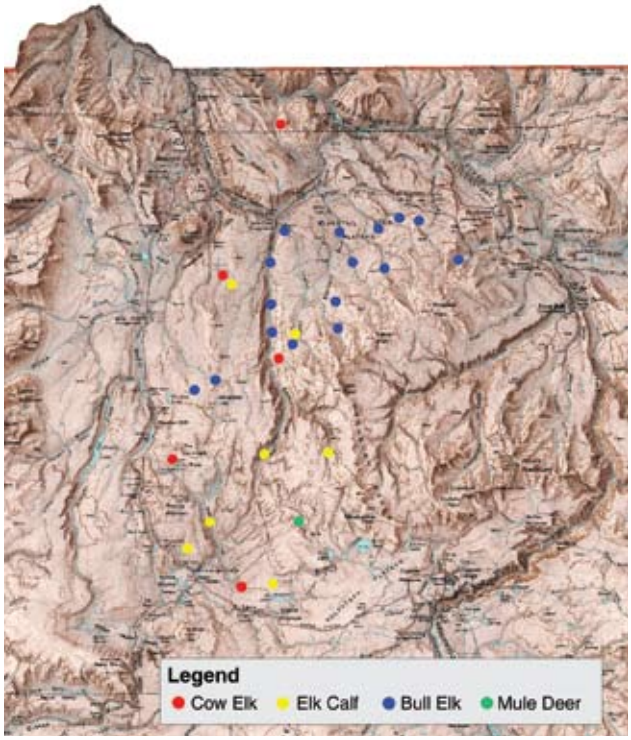


Figure 9. Leopold wolf #593F's kill distribution and prey selection, May 1–August 1, 2007.

with respect to dens during pup rearing season; and 4) territory size, use, and overlap. Using GPS collars with downloadable data acquisition technology, the goal was to perform weekly data gathering on collars programmed to collect location data every 30 minutes. This approach has proven successful in prior years for summer predation studies by yielding high-resolution wolf movement data revealing wolf prey selection and kill rates, even for newborn elk calves.

As has been the case over the past several years, malfunctioning collars made summer predation patterns challenging to document. Oxbow wolf #589F and Druid #570M had GPS collars that failed shortly after collaring. However, the GPS collar deployed on a Leopold yearling female (#593F) functioned well, allowing us to obtain our best summer predation sequence to date. Wolf Project staff worked intensively to locate and perform weekly downloads on #593F's collar, as well as map and search clusters for potential kills. Over the summer, crew members hiked more than 450 miles in the Leopold pack's territory to investigate clustered GPS points. During this effort, a total of 30 wolf kills were documented including 29 elk (58% bulls, 24% calves, 17% cows) and one mule deer doe (Figure 9). Several patterns emerged. First, there was a selection for bulls overall, which may reflect seasonal vulnerability, as well as availability in the Leopold pack's territory. The majority of bull elk (80%) killed in May had gelatinous bone marrow, indicating that they had not yet recovered from winter's effects. Second, as the summer progressed, wolves began to kill elk calves and cows more, indicating a response to their availability and vulnerability within the pack's territory. More intensive field work and modeling efforts are planned for summer 2008 to understand the relationship between pack size, prey availability, and number of GPS-collared wolves to elucidate summer predation patterns.

Population Genetics

Collaborative efforts between the Wolf Project and the University of California at Los Angeles, continued in 2007. With Dan Stahler attending UCLA for the first half of 2007, the Wolf Project and members of Dr. Robert Wayne's canid genetics lab published the first round of analyses on Yellowstone wolf genetics in the journal *Molecular Ecology* (see Appendix II). These analyses addressed an important question concerning the reintroduction of endangered species by examining the degree to which genetic variation is preserved and the behavioral mechanisms involved. By analyzing DNA from hundreds of Yellowstone wolves over the first 10 years of recovery, it was found that the population maintained high levels of genetic variation with low levels of inbreeding. The genealogies of major pack lineages were reconstructed based on genetic and field data, allowing us to discover that Yellowstone wolves avoid inbreeding through a wide variety of behaviors, including absolute avoidance of breeding with related pack members, male-biased dispersal to packs where they breed with non-relatives, and

female-biased subordinate breeding. We documented a greater diversity of breeding patterns in Yellowstone than previously observed in any other natural wolf population. Inbreeding avoidance is nearly absolute despite the high probability of within-pack inbreeding opportunities and extensive kinship ties between adjacent packs.

In addition to this publication, a larger scale analysis of genetic diversity and gene flow between the three Rocky Mountain recovery areas was nearly complete at the end of 2007. These analyses will address issues of population connectivity and migratory exchange among recovery areas and the importance this has for genetic diversity and long-term population sustainability.

Disease

Research on disease in the Yellowstone wolf population is ongoing. During summer 2007, Emily Almberg and technicians Rebecca Raymond and Jerod Merkle collected wolf scats from 12 packs (one of these packs was no longer in existence by year's end) as part of a pilot study on non-invasive disease monitoring. Samples are currently being screened for canine parvovirus (CPV) and canine adenovirus type-1 (CAV-1), two viral pathogens shed in fecal material, known to cause morbidity/mortality in domestic dog populations, and known to be circulating through Yellowstone.

Serology results from wolves captured during 2006 and 2007 suggest that exposure to CPV and CAV-1 remain high. The majority of adult wolves handled in 2006–07 demonstrated previous exposure to canine distemper virus (CDV), most likely as a result of living through the 2005 CDV outbreak within Yellowstone. However, pups handled during the same time exhibited very low levels of exposure, suggesting the virus had been largely cleared from the park by the summer of 2006. Ongoing research seeks to identify the various factors influencing the frequency of distemper outbreaks in Yellowstone, including the role of multiple host species.

Sarcoptic mange was documented for the first time in 2005–06 within the core of Yellowstone National Park in Mollie's pack. Despite concerns that mange would spread to the rest of the pack, there seems to be little evidence that this was the case; to date, Mollie's pack no longer exhibits clinical symptoms of the disease. Mange, however, was again documented within the park in late 2007. Two wolves inhabiting Gardner's Hole territory and one wolf associated with a pair of dispersers near Druid territory are exhibiting the characteristic hair-loss associated with mange. Ongoing monitoring will allow us to determine whether these remain isolated cases or whether the mite will spread within the park. Mange remains fairly prevalent outside of Yellowstone National Park.

Program Objectives

As defined by the Environmental Impact Statement, objectives for the wolf program rely on a foundation of monitoring population dynamics and predator–prey ecology, which in turn inform management of wolves and communication of science with the public.

Yellowstone Wolf Project objectives.

Wolf Management

Area Closures

On the northern range, temporary closures were instituted around the den sites of the Oxbow Creek, Slough Creek, and Druid Peak packs during the highly sensitive periods following the birth of pups. All closures were lifted by mid-May. In the interior, the Hayden Valley pack denned close to a trail and was highly visible from the road, leading to a temporary closure of a section of hiking trail and to off-trail hiking. Despite this level of protection, this pack was viewed from across the Yellowstone River by hundreds of people at close proximity. Possibly because of prolonged close contact with people, this pack is the most human-tolerant of any in the park, which is cause for concern for both the pack's and human welfare. In addition, a temporary closure to off-trail travel was implemented along a section of trail near the den site of the uncollared Snake River pack in the south entrance area.

Wolf Road Management Project *(formerly Druid Road Management Project)*

Since wolf reintroduction, Lamar Valley and other areas in the park have become premier locations to observe free-ranging wolves. The main pack of interest has been the Druid Peak pack, which denned in the valley from 1997 through 2004. Since then, when the Druid Peak pack has not been visible, other packs such as Slough Creek or Agate Creek have been able to fill the void. Each year visitor numbers have grown and in 2000, park divisions including the Yellowstone Center for Resources (YCR), Resource and Visitor Protection, and Division of Interpretation cooperated to better deal with the opportunities and problems that accompany these increasing numbers of wolf watchers. As a result, the Druid Road Management Project was initiated, with the following objectives: 1) human safety: protect visitors that are viewing wolves alongside the road, and control both traffic along the road and parking to prevent an accident; 2) wolf safety: protect wolves from vehicle strikes, permit wolves to cross roadways without harassment from visitors, and protect the closed area around the den from visitor intrusion; 3) visitor enjoyment: through protection of natural wolf behavior, preserve visitor opportunity to view wolves and interpret wolf and other wildlife ecology to visitors; and 4) wolf monitoring and research: continue to monitor and study the denning behavior, predation, activity, and interactions of wolves with other wildlife. Since the Druid Peak pack is less visible now, the project has evolved to manage other packs and educate visitors where they encounter wolves.

The 2007 Wolf Road Management Project season started on May 29 and ended on September 22, a period of 117 days. This was the eighth year of the project. At least 32,600 people observed wolves while the road management crew was working; however, independent researchers (J. Duffield et al., University of Montana) in the park estimate the number of visitors observing wolves was closer to 310,046. The crew made 8,775 visitor contacts and gave 230 informal talks to 2,300 visitors for a total of 11,075 visitor contacts. Wolves were in view for 750 hours and visible 117 out of 117 possible days of the project (Table 4).

The 2007 season was very different from recent seasons. The Slough Creek pack, highly visible in previous years, denned out of sight of the road. The adult Slough wolves were only periodically visible during the first half of the season. In August and September, the pack used rendezvous sites in locations that at times enabled visitors to see adults and pups.

The Slough Creek pack traveling single file in deep snow.

The Druid Peak pack also denned out of sight of the road and was not often visible during the early part of the season. The Druids were more visible during the later part of the season. The Agate Creek pack denned in their usual area at Antelope Creek and was occasionally visible during the first two thirds of the season. In mid-August, visitors regularly saw the adults and pups. The Agates had been visible for a much longer period in 2006 and far more visitors saw them that year.

Due to the lower number of wolf sightings during the first half of the season on Yellowstone's northern range, the road management crew often traveled to Hayden Valley. The Hayden Valley pack was highly visible to visitors beginning in early July and was seen on a nearly daily basis through the end of the season.

Habituated Wolves

In December two wolves, a gray male adult and a black female pup, probably from the defunct Gardner's Hole pack, were frequently seen in Mammoth and exhibited a lack of fear of humans. After being spotted and photographed in the Mammoth housing area, the pup was hazed with cracker shells. Neither wolf frequented Mammoth again, and the hazing was considered a success. Both wolves had a mild case of mange.

An unsuccessful hazing event was attempted on the uncollared and hard-to-track Slough Creek alpha male who had been approaching people and lying in the road. He was later unintentionally struck and killed by a vehicle.

Year	Visitor Contacts	Informal Talks	# of People at Informal Talks	Total Contacts	# of People Seeing Wolves	Time Wolves Visible	Days Wolves Visible
2000	6,760	83	1,833	8,593	8,145	283.2 hrs	77/82 (94%)
2001	9,375	288	1,552	10,927	11,210	368 hrs	125/125 (100%)
2002	9,450	244	1,952	11,402	12,414	460 hrs	126/126 (100%)
2003	9,375	258	2,064	11,439	9,827	415 hrs	124/124 (100%)
2004	9,450	226	2,260	11,710	8,721	395 hrs	126/126 (100%)
2005	6,200	125	1,250	7,450	11,695	790 hrs	124/124 (100%)
2006	6,500	200	2,000	8,500	13,640	620 hrs	124/124 (100%)
2007	8,775	230	2,300	11,075	32,600	750 hrs	117/117 (100%)

Table 4. Visitor contacts while working on the road management project during summer.

Calf with bull elk in summer.

Wolf Depredation Outside Yellowstone

Information on wolf depredation in the greater Yellowstone recovery area is available at www.r6.fws.gov/wolf/annualrpt07.

Collaborative Research

The Wolf Project and the Yellowstone Park Foundation provided financial and in-kind support for collaborative research with scientists at other institutions, including universities, interagency divisions, and non-government research organizations. These investigations required Wolf Project staff to assist graduate students and outside researchers in their efforts to better understand wolf ecology, ecosystem function, and conservation work, much of which is pioneering research.

Wolf Project Students: Direct Assistance

Three students worked in collaboration with the Wolf Project in 2007: Daniel Stahler, Emily Almberg, and Matt Metz. All three are long-time employees on the project that have moved on to work in a new capacity and are partially supported by project funding. Dan's project focuses on combining behavioral data gathered in the field with genetic data gleaned from blood samples and overlaying the two techniques to better understand wolf social behavior. Dan works with Dr. Robert Wayne at the University of California at Los Angeles. Emily's project focuses on wolf diseases both from a current and historical perspective. With severe mortality caused by disease in 2005 and evidence of a smaller outbreak in 1999, Emily plans to explore the role of diseases for wolf population ecology. Emily works with Dr. L. David Mech at the University of Minnesota. Matt's project focuses on summer predation patterns in wolves by incorporating downloadable GPS collar technology and modeling techniques. Matt works with Dr. John Vucetich at Michigan Technological University.

Graduate Student: Daniel Stahler (PhD candidate)
Committee Chair: Dr. Robert Wayne, University of California at Los Angeles
Title: Behavioral, ecological, and genetic influences on life-history strategies and social dynamics of gray wolves
Project Summary: The evolution of complex societies, such as that seen in wolves, is greatly influenced by how ecological and social constraints impact population structure and mating systems. In combination with the underlying genetic structure of wolf packs, aspects of wolf ecology such as reproduction, dispersal, pack formation, and territoriality are predicted to vary with the abundance and distribution of resources. This research will investigate the link between socioecological conditions and these aspects of wolf ecology in Yellowstone. This project will take advantage of long-term datasets following the 1995 reintroduction: 1) a complete population pedigree of marked individuals resulting from the integration of molecular and field-based behavioral data; and 2) predator–prey and wolf population dynamics. By combining field and laboratory-based data, this study will ask questions concerning breeding strategies, reproductive success, territoriality, and pack interactions and how they are associated with kinship and ecological condition. By combining long-term ecological, behavioral, and molecular datasets, this study will enhance our understanding of the evolution of complex, kin-structured societies, as well as provide

The Leopold crew (left to right): Libby Williamson, Nicole Legere, and Colin Benell.

Indirect Assistance or Collaborative Work with the Wolf Project

Topic	***Collaborator***	***Institution***
Wolf–cougar interactions	Toni Ruth,	Wildlife Conservation Society
Wolf–coyote interactions	Robert Crabtree, Jennifer Sheldon	Yellowstone Ecological Research Center
Wolf–bear interactions	Charles Schwartz, Mark Haroldson, Kerry Gunther	Interagency Grizzly Bear Study Team, YCR Bear Management Office
Wolf–carnivore interactions	Howard Quigley	Beringia South
Wolf population genetics	Robert Wayne, Bridgett vonHoldt, John Pollinger	University of California at Los Angeles
Wolf–elk relationships, Madison-Firehole Watershed	Bob Garrott, Matt Becker, Claire Gower, Shana Dunkley	Montana State University
Wolf–pronghorn	P.J. White, John Byers	YCR, University of Idaho
Wolf–willow	Evelyn Merrill, Francis Singer, Roy Renkin, Bill Ripple, David Cooper, Tom Hobbs, Don Despain, Nathan Varley	University of Alberta, USGS, YCR, Colorado State University
Wolf–aspen	William Ripple, Eric Larsen, Roy Renkin, Matt Kauffman	Oregon State University, University of Wisconsin at Stevens Point, YCR, University of Montana
Wolf–trophic cascades	L. David Mech, Mark Boyce, Nathan Varley, Rolf Peterson, John Vucetich	USGS, University of Alberta, Michigan Technological University, University of Minnesota
Wolf predation	Tom Drummer, John Vucetich, Dan McNulty, Rolf Peterson	Michigan Technological University
Wolf survival	Dennis Murray	Trent University

JON TRAPP

Top: Supercub pilot Roger Stradley flying over Blacktail Deer Plateau. Bottom: Winter capture crew (left to right): Erin Albers, Libby Williamson, Dan Stahler, and Doug Smith.

a better understanding of how social and ecological conditions are related to wolf population dynamics and conservation.
Project Activity in 2007: Coursework, wrote research proposal, conducted fieldwork, published paper on Yellowstone genealogy and genetic diversity.
Anticipated Completion Date: 2010

Graduate Student: Emily Almberg (Master of Science candidate)
Committee Chair: Dr. L. David Mech, University of Minnesota, St. Paul
Title: A comprehensive survey of the infectious diseases and parasites of Yellowstone wolves: Implications for population dynamics and management
Project Summary: In 1999 and 2005, the Yellowstone wolf population experienced significantly reduced pup recruitment suggestive of a disease outbreak. Despite fueling abundant speculation, these two suspected outbreaks have highlighted how little is known about the presence and role of disease in the Yellowstone wolf population. The present study seeks to 1) identify and describe the spatial and temporal patterns of select pathogens and parasites in the Yellowstone National Park (YNP) and Greater Yellowstone Ecosystem (GYE) wolf populations, 2) to attempt to understand the impacts of disease on population parameters such as adult wolf mortality and pup survival, 3) to track the distribution, prevalence, and population-level effects of sarcoptic mange among wolves in YNP and the GYE, and 4) to address the potential role of domestic dogs and sympatric carnivores in pathogen/parasite invasion and persistence in YNP. The study began its first field season in summer 2007.
Project Activity in 2007: Coursework and development of research questions.
Anticipated Completion Date: May 2010

Graduate Student: Matt Metz (Master of Science candidate)
Committee Chair: Dr. John Vucetich, Michigan Technological University
Title: Summer patterns of prey selection and kill rates for gray wolves
Project Summary: The summer predation patterns of wolves are mostly unknown, which creates an important gap of knowledge with regards to wolf yearly kill rates. Currently, wolf kill rates from winter are often projected throughout the year in order to estimate a wolf's impact on the prey population for the entire year. This likely overestimates kill rates (at least in kg/wolf/day, not necessarily in ungulates/wolf/day) due to the data being gathered only in winter, when adult prey become increasingly vulnerable. This data has often been projected for the entire year because of the difficulty of finding kills in the summer due to a lack of snow and increased plant foliage. Additionally, the need to provide for pups and the utilization of small prey items change the foraging strategy of wolves in the summer. Finally, the presence of both grizzly and black bears in Yellowstone may cause wolves to spend only a short time period at a kill. Due to these challenges, GPS collars deployed on individual wolves will help to identify and search clusters in an attempt to find summer kills and then examine their characteristics. Additionally, ecological modeling approaches will be used to incorporate variables of the wolf, pack, landscape, prey, and time of year to improve accuracy of predation rate estimates.
Project Activity in 2007: Summer fieldwork of GPS collar download and cluster search, development of research questions.
Anticipated Completion Date: May 2010

Wolf Project staff and November–December winter study volunteers. Back row from left: Libby Williamson, Nick Ehlers, Doug Smith, Jerod Merkle, and Dan Stahler. Front row from left: Trina Wade, Kira Cassidy, Erin Albers, Matt Metz, Audrey Squires, Deb Guernsey, and Nicole Legere.

Staff and Public Involvement

Staff and Volunteers

Five full-time employees worked for the Yellowstone Wolf Project in 2007: Project Leader Douglas Smith and Biological Science Technicians Erin Albers, Debra Guernsey, Rick McIntyre, and Matthew Metz. Daniel Stahler split time between graduate work at the University of California at Los Angeles and working in the park as the project biologist. Other paid and volunteer staff included: Colin Bennell, Kira Cassidy, Nick Ehlers, Julie Kray, Scott Laursen, Nicole Legere, Sarah Malick, Jerod Merkle, Abby Nelson, Audrey Squires, Trina Wade, and Libby Williamson. Some were paid technicians through the Yellowstone Park Foundation and Yellowstone Association. Volunteers worked a total of 4,660 hours, which was equivalent to about two full-time GS-5 positions worth $8,730.

Outreach

Yellowstone Wolf Project staff gave 76 talks and 52 interviews (see Appendix III and IV). Talks were presented at scientific conferences and to general audiences.

For the seventh year, Wolf Project staff rode horseback into outfitter camps north of YNP in the Gallatin National Forest to discuss wolf issues. Accompanying Stahler and Smith were Domenic Domenici and Gary Mowad of the USFWS. This year's trip was coordinated through the USFS Gardiner District.

Acknowledgements

We thank all of the Wolf Project field technician volunteers, especially winter study volunteers, without whom we could not carry on the vital research and management of wolves. We also thank six major institutions and organizations for their donations and support: an anonymous donor, the Tapeats Foundation, the Perkins-Prothro Foundation, Canon U.S.A., Inc., Yvon and Malinda Chouinard, and the National Science Foundation grant DEB-0613730. Our work would not be possible without their support and involvement. We are also supported by numerous smaller donors, especially through the collar sponsorship program, that add significantly and are also necessary for our research, management, outreach, education, and publications. We know that a successful program needs a strong base of support and to all of the above we are indebted. In terms of this report, we thank Virginia Warner and Tami Blackford, who every

Bechler wolf #192M at nine years of age.

year keep us on track, on time, and under budget. We also thank Jason Ogle for reviewing and providing the photo for the inset story. Finally, in early 2008, it is with both great sadness and gratitude that we say goodbye to Debra S. Guernsey, who for 13 years served the wolves of Yellowstone with unparalleled passion and care. She was a good friend and colleague as well. She will be sorely missed, especially by the project leader with whom she has done so much and helped ever so kindly.

Appendices

Appendix I. Wolf Project Volunteer Roster, 2007

Name	Period of Involvement	Hours Worked
Colin Benell	2/22/2007–3/31/2007	296
Kira Cassidy	2/22/2007–3/31/2007 & 11/9/2007–12/15/2007	592
Nick Ehlers	10/30/2007–12/15/2007	376
Julie Kray	2/22/2007–3/31/2007	296
Scott Laursen	2/22/2007–3/31/2007	296
Nicole Legere	2/22/2007–4/15/2007 & 11/9/2007–12/21/2007	1,092
Sarah Malick	2/22/2007–3/31/2007	296
Jerod Merkle	9/4/2007–12/15/2007	824
Audrey Squires	11/9/2007–12/15/2007	296
Trina Wade	11/9/2007–12/15/2007	296
Total Volunteer Hours*		**4,660**

* Volunteer hours = approx. 2 full-time GS-05 positions

Appendix II. Publications in 2007

Bangs, E.E., and D.W. Smith. In press. Re-introduction of the gray wolf into Yellowstone National Park and central Idaho. IUCN Reintroduction Specialist Group.

Forester, J.D., A.R. Ives, M.G. Turner, D.P. Anderson, D. Fortin, H.L. Beyer, D.W. Smith, and M.S. Boyce. 2007. State-space models link elk movement patterns to landscape characteristics in Yellowstone National Park. *Ecological Monographs* 77:285–299.

Hebblewhite, M., and D.W. Smith. In press. Wolf community ecology: Ecosystem effects of recovering wolves in Banff and Yellowstone National Parks. In *The world of wolves: new perspectives on ecology, behavior and policy*, eds. M. Musiani, L. Boitani, and P. Paquet. University of Calgary Press.

Kauffman, M.J., N. Varley, D.W. Smith, D.R. Stahler, D.R. MacNulty, and M.S. Boyce. 2007. Landscape heterogeneity shapes predation in a newly restored predator-prey system. *Ecology Letters* 10:1–11.

MacNulty, D.R., L.D. Mech, and D.W. Smith. 2007. A proposed ethogram of large-carnivore predatory behavior, exemplified by the wolf. *Journal of Mammalogy* 88:595–605.

Smith, D.W. 2007. Wolf and human conflicts: A long, bad history. In *Encyclopedia of human-animal relationships*, ed. M. Bekoff, 402–409. Greenwood Press.

Smith, D.W., and E.E. Bangs. In press. Reintroduction of wolves to Yellowstone National Park: History, values and ecosystem restoration. In *Reintroduction of Top-order Predators*, eds. M. Hayward and M. Somers. Blackwell Scientific.

Smith, D.W., D.R. Stahler, and M.S. Becker. In press.

Wolf recolonization of the Madison headwaters area in Yellowstone. In *Large mammal ecology in central Yellowstone*, eds. R.A. Garrott and P.J. White. Elsevier Academic Press-Terrestrial Ecology Series.

Smith, D.W., D.R. Stahler, D.S. Guernsey, M. Metz, A. Nelson, E. Albers, and R. McIntyre. 2007. Yellowstone Wolf Project: Annual Report 2006. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2007-01.

Doug Smith giving a talk to an ecology class from Montana State University.

Appendix III. Interviews Given by Wolf Project Staff, 2007

Date	Interviewer
Doug Smith:	
January	BBC London
	Mike Stark, *Billings Gazette*
February	Paul Tolme, *Newsweek*
	Mike Stark, *Billings Gazette*
	Matt Brown, Associated Press
	Matthew Pope, Boston University graduate student
	Elsa Heidorn, Wyoming Public Radio
March	David Nolt, *Livingston Weekly*
	Andrea Pilcher, University of Montana–Western
	Yellowstone Institute educational planning
	Jen Shoemaker, YNP Video Pod
	Sandra Markle, children's author
	Ilona Popper, writer/journalist
	Will Stolenzenberg, science writer
	Ed George, Wyoming Game and Fish Department
April	Jeff Rennicke, *National Parks Magazine*
	Christina Russo, NPR
	Charlie Moore, CNN
	Lafeyette, Indiana, TV Station
	Mike Stark, *Billings Gazette*
May	NOLS, info for semester course
June	Tracy Smith, CBS Evening News
	BBC, Bristol
	Tom Arrandale, *Yellowstone Journal*
	Brodie Farquhar, *Casper Star-Tribune*
July	Anderson Cooper, CNN
	National Geographic, San Francisco
	Defenders of Wildlife
Doug Smith (cont.):	
	Lewiston Tribune
	Oregon Public Broadcast
	Heinz Dungler, University of Salzberg, Austria
	Elizabeth Flesch, Bettondorf High School, Iowa
	Brian Kahn, Montana Public Radio
August	Danny Danzinger, London *Sunday Times*
	Kristen Scharnberg, *Chicago Tribune*
	Peggy Strusaker, NRDC
	Katie Anders, YERC
	Kirsten Weir, *Weekly Reader Magazine*
September	BBC–Bristol, England
	Brian Leith, BBC
	Weber State University Journal
	Jan Fennell, dog trainer
	George Desort, Isinglass Pictures
October	Brian Leith, BBC
	Brodie Farquhar, *Yellowstone Journal*
	Kianna Hohman, Environmental Report
November	Elizabeth Kwork-Hefferan, *Backpacker Magazine*
December	Shona Campbell, ITV television, England
	Ted Brewer, *Companion Dog Magazine*
	Rocky Barker, Idaho Statesman
Dan Stahler:	
August	Wolf recovery in West, independent filmmaker Jose Sanchez
October	French Television Network

Appendix IV. Talks Given by Wolf Project Staff, 2007

Date	Group	Location
Doug Smith:		
January	Montana State University–University of Wyoming field trip	YNP
	Yellowstone Association Institute class, Nathan Varley/Linda Thurston	YNP
February	National Geographic field trip	YNP
	Taylor Outfitting field trip	YNP
	Field trip from England, George Bumann	YNP
	National Geographic tour	YNP
	Winter Study training	YNP
	Greater Yellowstone Coalition field trip	YNP
March	Yellowstone Association Winter Rendezvous	YNP
	University of Minnesota and University of Idaho classes	YNP
	University of Washington, John Marzloff	YNP
	Defenders of Wildlife	YNP
	Grade school group from NYC	YNP
April	MSU Department of Philosophy class, Gordon Brittan	Bozeman, MT
	Yellowstone Park Foundation field trip	YNP
	Lutheran Ministers of Montana	Chico, MT
	MSU Ecology class, Lance Craighead	YNP
	Wolf Park	Indiana
	Wolf Park	Indiana
	NPCA	Minneapolis, MN
May	International Wildlife Film Festival 30th Anniversity	Missoula, MT
	YPF Board field trip	YNP
	YNP interpretive staff training	YNP
May 31–June 1	Yellowstone Association Institute class "Are wolves worth the effort?"	YNP
June	NPCA group	YNP
	Pinhead Institute (X4)	Telluride, CO
	Yellowstone Association Institute class	YNP
July	Gallatin National Forest–Gardiner District seasonal staff	Gardiner, MT

Druid Peak pack wolves in early winter.

Date	Group	Location
Doug Smith (cont.):		
August	American Association of State Colleges and Universities	YNP
	American Democracy Project	YNP
	Canon U.S.A., Inc.	YNP
September	North by Northwest	West Yellowstone, MT
	Yellowstone Association Institute class	YNP
	Weber State University	Ogden, UT
	Weber State Mammology class	Ogden, UT
	Defenders of Wildlife 60th Anniversary	Washington, D.C.
October	IWC Group	YNP
November	Yellowstone Association Institute class	YNP
	Winter Study training	YNP
December	Xanterra snow coach drivers	YNP
	Snowmobile outfitters and guide training	YNP
Dan Stahler:		
June	Yellowstone Association Institute class	YNP
July	Yellowstone Association Institute class	YNP
	Yellowstone Association Institute class	YNP
August	Central Asian Park Managers	YNP
September	Yellowstone Association Institute class	YNP
	Colorado State University Wildlife Deptartment	YNP
	The Wild Side Wildlife Tours, Gardiner	Gardiner, MT
Matt Metz:		
January	National Geographic	YNP
February	British Columbia Institute of Technology	YNP
	Elderhostel Group	YNP
March	Lawrence Academy, Massachusetts	YNP

Nicole Legere transporting a Hayden Valley wolf to another location for processing.

Date	Group	Location
Matt Metz (cont.):		
May	Xanterra summer employees	YNP
	Off The Beaten Path	YNP
	YNP trail crew	YNP
June	Xanterra summer employees	YNP
September	Lethbridge Community College	YNP
October	University of Montana–Western	YNP
Erin Albers:		
May	YNP Law Enforcement, Lamar District	YNP
	Elderhostel Group	YNP
	Xanterra summer employees	YNP
September	Colorado State University	YNP
October	Jeff Corwin, The Travel Channel	YNP
Rick McIntyre:		
June	Xanterra summer employees	YNP
August	Today Show Interview	YNP
December	Max Baucus, senator from Montana	YNP
Libby Williamson:		
May	Xanterra summer employees	YNP
June	YCC wolf seminar	YNP
October	Washington State University graduate students	YNP
Deb Guernsey:		
February	Xanterra winter employees	YNP
June	Xanterra summer empoyees	YNP

Deb Guernsey and Doug Smith processing Hayden Valley wolves #540F and #541M.

Although the Snake River pack dens in YNP, it ranges mostly outside the park in Wyoming and is not counted as a YNP pack.