

WYOMING WOLF RECOVERY 2008 ANNUAL REPORT

*A cooperative effort by the U.S. Fish and Wildlife Service,
National Park Service, and USDA Wildlife Services*



Photo: Ben Jimenez

This cooperative report presents information on the status, distribution, and management of wolves in Wyoming, including Yellowstone National Park, from January 1, 2008 through December 31, 2008.

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SUMMARY

For the sixth consecutive year, the overall gray wolf (*Canis lupus*) population in Wyoming (WY) exceeded the numerical, distributional, and temporal recovery goals established by the U.S. Fish and Wildlife Service (USFWS). In 2008, >302 wolves in >42 packs inhabited WY, including Yellowstone National Park (YNP). Approximately 178 wolves inhabited WY (outside YNP) and 124 wolves lived inside YNP. Of the 42 packs identified in WY, 22 were classified as breeding pairs producing > 83 pups that survived until 31 December. Wyoming (outside YNP) recorded 30 packs (16 breeding pairs) and YNP had 12 packs (6 breeding pairs). Average pack size was 5.7 wolves in WY (outside YNP) and 9.3 wolves in YNP. The total wolf population in WY decreased approximately 16% in 2008. The number of wolves declined 5% in WY (outside YNP) and 27% in YNP. We recorded 79 dead wolves in WY (outside YNP). Causes of mortality included: agency control = 46; wolves killed in the WGFD predator area while delisted = 11; under investigation = 8; natural = 3; vehicles = 2; capture related = 1; and unknown = 8. Not counting over-summer pup mortality, YNP recorded 17 dead wolves. Causes of mortality included: intraspecific pack strife = 10; disease and unknown = 5; and malnutrition = 2.

We managed wolf population growth and wolf distribution in WY (outside YNP) to minimize chronic loss of livestock from wolves and promote wolf conservation by maintaining the WY wolf population well above recovery objectives. In 2008, wolves killed \geq 67 livestock (41 cattle and 26 sheep). Agency control efforts removed 46 depredating wolves (approximately 18% of the WY wolf population outside YNP) to reduce livestock losses due to wolves.

Numerous ongoing research projects investigated predator-prey interactions, wolf population dynamics, elk habitat selection, disease, genetics, interactions between wolves and other predators, and livestock depredations.

GREATER YELLOWSTONE RECOVERY AREA - WYOMING

PERSONNEL

Personnel in Wyoming outside Yellowstone National Park

In 2008, the U.S. Fish and Wildlife Service (USFWS) monitored and managed wolves in Wyoming (WY) outside Yellowstone National Park (YNP) with the assistance from the U.S. Department of Agriculture Wildlife Services (WS), National Park Service (NPS), and Wyoming Game and Fish Department (WGFD). USFWS personnel were Project Leader Mike Jimenez, biologist Susannah Woodruff, law enforcement agents Dominic Domenici (Resident Agent-in-Charge, Casper), Tim Eicher (Special Agent, Cody), and Roy Brown (Special Agent, Lander).

WS personnel involved with wolf management in Wyoming during 2008 were: State Director Rod Krischke; District Supervisors Craig Acres, Jim Pehringer, and Rod Merrell; Casper office personnel Roberta Despain, Vivian Meek, and Lisa Warner; Specialists Arnold DeBock, Tracy Frye, Michael Peterson, Dave Fowler, Steve Richins, Shane Huseby, Brad Seaman, Dave Johnson, Phil Heagy, Dan Bragg, Nordell Putnam, Monty Nicholson, Jeremy Hippenstiel, Robert Wells, and Grant Beldin; and Pilots Miles Hausner, Kelly Huseby, and Ted Jensen.

NPS biologists involved in monitoring wolves in Wyoming included Sarah Dewey and Steve Cain from Grand Teton National Park (GTNP).

WGFD biologists assisting in wolf monitoring during summer 2008 were Scott Becker, Ken Mills, and Bob Trebelcock.

Personnel in Yellowstone National Park

Three full-time employees worked for the Yellowstone Wolf Project in 2008: Project Leader Douglas Smith and Biological Science technicians Erin Albers and, Rick McIntyre. Daniel Stahler split time between graduate work at UCLA and working in the park as the project biologist. After 13 years working on the Wolf Project, Debra Guernsey left in April. Other paid and volunteer staff were as follows: Sarah Bassing, Colin Bennell, Kira Cassidy, Nick Ehlers, Sarah Hardy, Joshua Irving, Laura Kelly, Ky Koitzsch, Lisa Koitzsch, Nicole Legere, John Linch, Sarah Lykens, Laurie Lyman, Dan MacNulty, Mike Peterson, Rebecca Raymond, Jessie Walton and Libby Williamson. Some of these people were paid technicians through the Yellowstone Park Foundation and Yellowstone Association.

MONITORING

Monitoring in Yellowstone National Park

Population Status: Yellowstone National Park (YNP) (8,987 km² (3,472 mi²)) is a small portion (~14%) of the GYA (63,700 km² [24,600mi²]) wolf recovery area. In 2007 YNP wolves comprised about 38% of the entire GYA wolf population. In 2008 YNP contained about 28% of the GYA wolf population. At the end of 2008 at least 124 wolves in 12 packs (6 breeding pairs),

2 non-pack groupings, and 6 loners occupied YNP. This represents a 27% decline since 2007 and is the lowest breeding pair count since wolves achieved the minimum of 30 breeding pairs in the northern Rocky Mountains in 2000. Both the northern range (NR) and interior wolf population declined, and for the first time in several years the interior wolf population was larger than the NR population. Intraspecific strife and disease were the likely causes of the decline. Although a few cases of mange have been documented in recent years in YNP, 2008 showed a marked increase in occurrence, with at least four packs, two non-pack groupings, and several loners showing signs of mange (>10 individuals), ranging from light to severe.

There were four new packs in 2008, three of which formed on the NR. The Quadrant Mountain Pack was a group of wolves in 2007, attempted denning in 2008, and had a defined territory in the old Swan Lake/Gardners' Hole Pack territories, so became a named pack in 2008. Evert's Mountain Pack carved out a section of Leopold territory and had at least three pups. The Blacktail Deer Plateau Pack formed via partial splitting of Druid Peak and Agate Creek and ranged widely but slightly favored Blacktail Deer Plateau. The Canyon Pack, dispersers from Mollie's and Hayden Valley, formed in the interior. A radio collared lone wolf from Idaho (B271; Steel Mountain Pack) left YNP during summer and settled east of the park in late 2008.

Lost packs were Leopold and Oxbow Creek; Hayden Valley dispersed from the park for a total of three. Several others declined and their future status is in question (Slough Creek, Agate Creek).

Despite pack additions and losses, wolf range and distribution was mostly unchanged in 2008, a pattern similar for the last several years. Overall pack size ranged from 4 (Quadrant Mountain, Agate Creek, Cougar Creek) to 25 (Gibbon Meadows) wolves and averaged 9.3, which was smaller than the long term average as most packs decreased in size. Average number of pups per pack in early winter was 1.8.

Two notably old wolves survived through 2008. Wolf #126F, the probable breeding female in the Yellowstone Delta Pack turned 11, and the longtime white alpha male, #192, of Bechler turned 11 too. Wolf #302M, a visible and well-known wolf on the NR turned 8. Other old wolves still alive at the end of the year were #472F of Agate Creek (7-8), #586M of Mollie's (6-8), #587M of Canyon (7-8), #482M of Gibbon Meadows (7-8), and #538M of Gibbon Meadows (7-9).

Northern Range (NR): An almost complete reorganization of the NR occurred in 2008. The Leopold Pack which had formerly occupied Blacktail Deer Plateau and formed in 1996, dissolved in 2008, and the Blacktail Deer Plateau Pack filled their vacancy. Oxbow Creek Pack disappeared with no known surviving members, and a new unnamed group led by old Slough Creek wolf #527F filled in behind Oxbow Creek. Agate Creek was reduced to probably four wolves and were untrackable due to no functioning radios. Slough Creek was similarly reduced, last observed in 2008 at 7 wolves, but with no radio collars to track them of unknown status. Late 2008 movements suggested that they may have dispersed from the park. Druid Peak, although losing wolves through dispersal and suffering high pup mortality (as did all packs on the NR) survived 2008 the most intact. Despite the overturn, six packs occupied the NR at the

end of the year, up one from last year, but the population declined from 94 in 2007 to 56 in 2008 (-40%).

Splitting packs, dispersing wolves, and high mortality caused a social rearrangement among NR wolves resulting in a re-configuration of packs and wolves. Several smaller 'groups' (#527 Group, #471 Group, an unnamed trio) were also present late in the year suggestive of possibly more new pack formation. Such circumstances on the NR have not been present since the early days of wolf recovery when pairs of wolves or small groups were able to establish. Since that time small groups/packs were at a competitive disadvantage against typically larger packs and not able to maintain themselves on the landscape resulting in failure to form a pack.

Interior: The interior was much more stable with six packs (same as in 2007) and the population only declined from 77 to 68 (-11%). One pack, Hayden Valley, was lost as it dispersed to a new location west of the park, but it was replaced by the Canyon Pack, which had two pups but neither survived. All the other interior packs survived the year, but except for Gibbon Meadows, declined in number. Gibbon Meadows increased to 25 wolves (largest in the park); Mollie's decreased by only one wolf (13), but Delta lost the most at 13 wolves (from 22 in 2007 to 9 in 2008). Cougar Creek lost their longtime and only alpha female in September at 10 years of age, but a loose pack (often located apart, but re-grouped by year end) of 4 hung-on in their traditional territory. Bechler too maintained itself (decline from 11 to 9), despite living where it is thought to be marginal (few wintertime ungulates).

Reproduction: Over-summer pup survival was very poor in 2008. Seventy-seven pups were born and 22 survived (29%), one of the poorer survival rates recorded. Disease was very probable and canine distemper virus (CDV) is once again suspected. At year's end 17% of the population was comprised of pups, much lower than usual. Two of 11 packs present in spring appeared to have no pups at all (Quadrant Mountain and Cougar Creek), yet Quadrant Mountain localized briefly around a partially dug den but no evidence of pups was ever found. Cougar Creek did not localize. Blacktail Deer Plateau pack formed in 2008 so had no pups. Leopold, Oxbow Creek, Agate Creek, Slough Creek, and Canyon all had pups but none of them survived. Leopold had 24 pups and lost all of them. Evert's Mountain, Druid Peak, Mollie's, Yellowstone Delta, Bechler, and Gibbon Meadows all had pups and some of them survived. Gibbon Meadows had the most survive with 6 followed by Druid with 5 (but down from 18 born). Average number of pups surviving was 1.8. Two packs, Leopold and Druid Peak both from the NR, had >1 litter.

Mortalities: Not counting over-summer pup mortality, 17 collared wolves died in 2008, the most of any year. These included 2 old adults (> 5 years), 10 adults (2-5 years), and 5 yearlings. Five males and 12 females died. Ten wolves died of intraspecific strife (58%), a single year high; other causes of mortality were malnutrition (only the second and third recorded cases), disease, and unknown.

Wolf Capture and Collaring: Twenty-eight wolves were captured and collared in ten packs. One old adult, 5 adults, 6 yearlings, and 16 pups were caught, 11 of which were male and 17 were female. At year's end, 32 of 124 (26%) 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.

Yellowstone National Park Wolf Packs in 2008

Quadrant Mountain Pack: (4 wolves - 4 adults, 0 pups) Formerly known as the #469F group, this pack was officially named the Quadrant Mountain Pack during early winter 2008. Led by #469F, a gray female formerly of Leopold, and #695M a black wolf of unknown origin this pack is only four wolves. During the 2008 breeding season #469 dispersed from Leopold territory and joined three other wolves in the Gardner's Hole/Rainbow Lake area, formerly Swan Lake and Gardner's Hole wolf pack territories. Since then, the core of their territory has stabilized in Gardner's Hole but the pack's movements often stretch toward Sepulcher Mountain and Reese Creek. Territorial overlap with other packs was limited and wolf-wolf clashes were not recorded during early winter 2008 as this territory exists at the western edge of the northern wolf range with no packs immediately to the west. They localized around a shallow den for a couple weeks, but there was no evidence of pups. This isolation may have protected them from both CDV and mange as they showed no signs of either.

Evert's Mountain Pack: (8 wolves – 5 adults, 3 pups) Related to the Leopold pack, the Evert's Mountain Pack formed in 2008 and carved out a section of the Leopold territory. They are one of the few northern range packs to successfully raise pups in 2008 with three at the end of the year. It is likely that they contributed to the demise of the Leopold Pack as they killed the alpha male and possibly others. Their movements were centered on Mount Evert's, but they also radiate towards the Yellowstone River, Rescue Creek, and Turkey Pen. These limited data suggest that, similar to the Oxbow Creek Pack, Evert's has colonized a portion of former Leopold territory. Interestingly #470F, originally a Leopold wolf, and now an Evert's Mountain Pack member, despite two dispersals and three packs, has always resided within the territorial boundaries of her natal pack. Mange was documented on at least one individual in this pack.

Blacktail Deer Plateau: (8 wolves - 8 adults, 0 pups) A new pack in 2008 formed by six Druid Peak males and four Agate Creek females joining in November. This is thought to be a rare way a pack forms as family pack formation (pair with offspring) are more common. They were led by an 8 year old wolf from Druid Peak, #302M, and a 2 year old uncollared gray from Agate Creek. They traveled widely, from Little America to Blacktail Deer Plateau, due probably to territory vacancies across most of the northern range. Besides another 2 year old female, the rest of the pack consists of all yearlings, one of which is #642F from Agate Creek. One female disappeared after an interaction with Druid Peak in late November. A gray male dispersed from the pack in December. Mange was documented on at least one individual in this pack.

Agate Creek: (4 wolves - 4 adults, 0 pups) A large pack in 2007 (17 wolves), the Agate Creek Pack declined to only 4 wolves at the end of 2008, and none of them had functional radio collars making tracking difficult. No pups survived and only two were observed at their densite, but neither of them were seen after June. Interpack clashes resulted in two mortalities: #643F and #644F were killed during separate encounters with the Druid Peak Pack. In November four Agate females (#642F, "Half-tail," an uncollared black, and an uncollared gray) dispersed and joined six Druid males, including #302M creating the Blacktail Deer Plateau Pack (*see below*).

This left the main Agate Creek Pack with only 4 wolves: alphas #472F and #383M, and two other adults. Mange was documented on at least one individual in this pack.

Slough Creek: (7 wolves - 7 adults, 0 pups) Formed in 2002, the Slough Creek Pack was stable and competitive in territorial skirmishes. But they too lost numerous wolves in 2008 and had no surviving pups. Their status at the end of the year was uncertain and none of the remaining wolves were radio collared. This decline was unexpected as all three adult females appeared pregnant; only two pups were ever observed at their densite at Slough Creek, which was monitored all daylight hours as it was visible from the road. Wolf Project staff investigated the den area in late summer and found the remains of one of the pups. Adult wolf #629M separated from the pack in July, looked sick, and spent two weeks alone before dying. Cause of death was unknown, but disease was a possible cause. Then five wolves were killed by other wolves: beta #526F, alpha #380F, yearling #631F, yearling #630F, and an uncollared female yearling. This left the Slough Pack with only one collared wolf, alpha male #590M, and he dispersed becoming a lone wolf. In December, 7 wolves were spotted near Hellroaring Creek, but no other locations were known and some movements may be outside of the park.

Druid Peak: (13 wolves - 8 adults, 5 pups) Compared to other northern range packs, Druid Peak fared the year well. After denning in the backcountry the past three seasons, they moved back to their traditional densite near Soda Butte Creek. Multiple females in this pack bred and 18 pups were observed. Different sized pups indicated at least three litters were born. Only 5 pups survived to year's end. In November, eight year old #302M and five yearling males dispersed and joined with four Agate females creating the Blacktail Deer Plateau Pack. Two other wolves, both two year old females, dispersed in late 2008. The Druid Pack was led by alphas #480M and #569F. The pack greatly expanded their territory into Slough Creek, Little America, and Tower killing several Slough Creek and Agate Creek wolves in the process. Only one adult male (#480) is known to be in the pack along with seven adult females (569F, 571F, 645F), and five pups.

Mollie's: (13 wolves – 10 adults, 3 pups) Mollie's continued to anchor their movements in Pelican Valley and preyed on bison again in winter. Wolf-bison-grizzly bear studies continued in late March for the eleventh year. One litter of pups is suspected but only three survived to year's end. They abruptly moved to the southeast side of the valley mid-summer coincident with a forest fire that broke out in the LeHardy rapids area spreading quickly to the Sulfur Hills where they have previously denned. Mange was on the increase as several wolves were observed with hair loss.

Canyon: (4 wolves – 4 adults, 0 pups) This pack formed in the spring of 2008 and is likely comprised of dispersing Hayden Valley (one female) and Mollie's (two males) wolves. They had two pups, which were temporarily stashed on a move between homesites in a road culvert below the main highway near Canyon, but neither of them survived. One lived into September but was not seen after that. Although filling in behind the Hayden Valley Pack, which moved to an outside the park territory, these wolves occasionally spend time on the northern range, especially around Mammoth Hot Springs.

Yellowstone Delta: (13 wolves – 11 adults, 2 pups) Declining to nearly half of its robust pack size from 2007, this pack continues to roam the remote southeast corner of the park. The pack's

alpha female (126F) is Yellowstone's oldest known female at 11 years old, and presumed to still be reproductively active in 2008. During a brief trip to the east of the park in March, some pack members were responsible for livestock depredation leading to the lethal removal of four wolves, marking the first known occasion of depredation in this pack's history. As in most years, our ability to monitor this pack is impeded by collar malfunction and individual death and disappearance.

Bechler: (9 wolves – 6 adults, 3 pups) Since its formation in 2002, the Bechler Pack has remained relatively stable in its territory in the southwest corner of Yellowstone. While ample elk, deer, moose, and beaver are available to Bechler wolves in the summer and fall, deep snows require the pack to venture outside of YNP into Idaho and Wyoming in search of prey. This pack of nine is still led by its founding alpha pair – the distinctly white 192M and an uncollared silver-black female. Born in the Rose Creek pack in 1997, 192M is nearing 12 years of age and is Yellowstone's oldest known male wolf. The pack remains challenging to collar because of their infrequent presence within YNP during winter months.

Cougar Creek: (4 wolves – 4 adults, 0 pups) No pups were produced in 2008 possibly because the long-time alpha female was badly injured in March by an elk or bison. She was observed on numerous occasions and looked badly injured. She hobbled around on three legs for a couple months, not able to keep up with the pack and surviving by scavenging on carcasses. The hard winter probably aided her by increasing the number of carcasses in late winter. She eventually died in September at 10 years of age. No subordinate female had pups and no wolves localized around a den site. Through summer, pack movements were less cohesive than other packs, possibly due to the absence of pups, but by winter the four remaining wolves had started traveling together again. One of these wolves, #632F, only has three legs, lost possibly in a snare along the park boundary, but so far she is able to keep up with the pack, although at times she is left behind.

Gibbon Meadows: (25 wolves – 19 adults, 6 pups) The one pack making it through in 2008 with improved status the Gibbon Meadows Pack had the most pups and is now the largest pack in the park. Usurping historic Nez Perce Pack territory but expanding into Hayden Valley, this pack thrived while others declined. They preyed on both bison and elk. A bison killing pack some of the male wolves in this pack are very large, especially #482, the alpha male, who was re-collared last year and was too big to weigh in deep snow.

Monitoring wolves in Wyoming outside Yellowstone National Park

Population Status: We combined 3 census techniques to estimate the total number of wolves in WY: 1) direct observations of wolves; 2) winter track counts of wolves traveling in snow; and 3) confirmed reports of wolf sightings from other agencies. We defined a pack as ≥ 2 wolves traveling together using a defined home range. A breeding pair was defined as ≥ 1 adult male and ≥ 1 adult female in a pack producing ≥ 2 pups that survived through 31 December of that year. We counted the number of wolves in packs containing radio collared wolves using visual observations from the ground and aerial telemetry flights. We tracked wolves in winter and counted the different sets of wolf tracks in snow. In areas where repeated sightings were

confirmed, we incorporated those observations into our estimates. We averaged the high and low population estimates to calculate other statistics used to describe the wolf population in WY. Visual observations from telemetry flights in early January 2009 were also used to improve our year-end estimates.

From 1999 through 2008, we maintained radio collars on 20-25% of the wolf population in WY each year to monitor their movements, locate den and rendezvous sites, document breeding success, locate wolves to mitigate livestock conflicts, and aid in law enforcement. We used VHF radio collars for general monitoring purposes and used various types of GPS collars for specific research projects. In 2008, we monitored 39 radio collared wolves (22% of the population) in 18 packs (60% of the packs). A total of 27 wolves were radio collared in 2008 (19 VHF and 8 GPS collars).

As of 31 December 2008, we estimated that ≥ 178 wolves inhabited western WY. Thirty packs contained 170 wolves and another >8 single wolves were located throughout the western portion of the state (Figure 1 and Table 1). Pack size ranged from 2 to 13 and averaged 5.7 wolves.

Population Growth: In 2004, we reported that the wolf population increased 23% from 82 wolves in 2003 to 101 wolves in 2004. In 2005, the wolf population increased 33% from 101 wolves in 2004 to 134 wolves in 2005. The number of wolves increased 31% in 2006 to >175 wolves. The wolf population in WY increased 7% to 188 wolves in 2007, but decreased 6% to 178 wolves in 2008 (Figure 2).

Reproduction: A total of 19 packs produced ≥ 61 pups. Sixteen packs (producing 56 pups) met the USFWS breeding pair definition of ≥ 1 adult male and ≥ 1 adult female with ≥ 2 pups surviving through 31 December. Breeding pairs in 2008 included: Washakie, Pinnacle Peak, Buffalo, Carter Mtn., Absaroka, Beartooth, Butte Creek, Pahaska, Pacific Creek, Antelope, Chagrin River, Phantom Springs, East Fork, Dog Creek, Rim, and Sunlight Packs (Figure 3). Mean litter size was 3.2 pups per litter and ranged from 1-8 pups (Figures 4). We were not able to confirm pup production in: Snake River, Big Piney, Prospect, Green River, and Popo Agie Packs. No pups were produced in Black Butte, Huckleberry, Whiskey Basin, Bold Mountain, Elk Fork Creek, or Deer Creek Packs. Greybull River, South Fork, and Lava Mtn. did not contain ≥ 2 adults and ≥ 2 pups on 31 December 2008.

Mortalities: In 2008, a total of 79 wolves (31% of the total population) were known to have died in WY. Causes of mortality included: agency control = 46 (58% of documented mortality); wolves killed in WGFD Predator Area while delisted = 11 (14%); under law enforcement investigation = 8 (10%); natural = 3 (4%); vehicles = 2 (3%); capture related = 1 (1%); and unknown = 8 (10%).

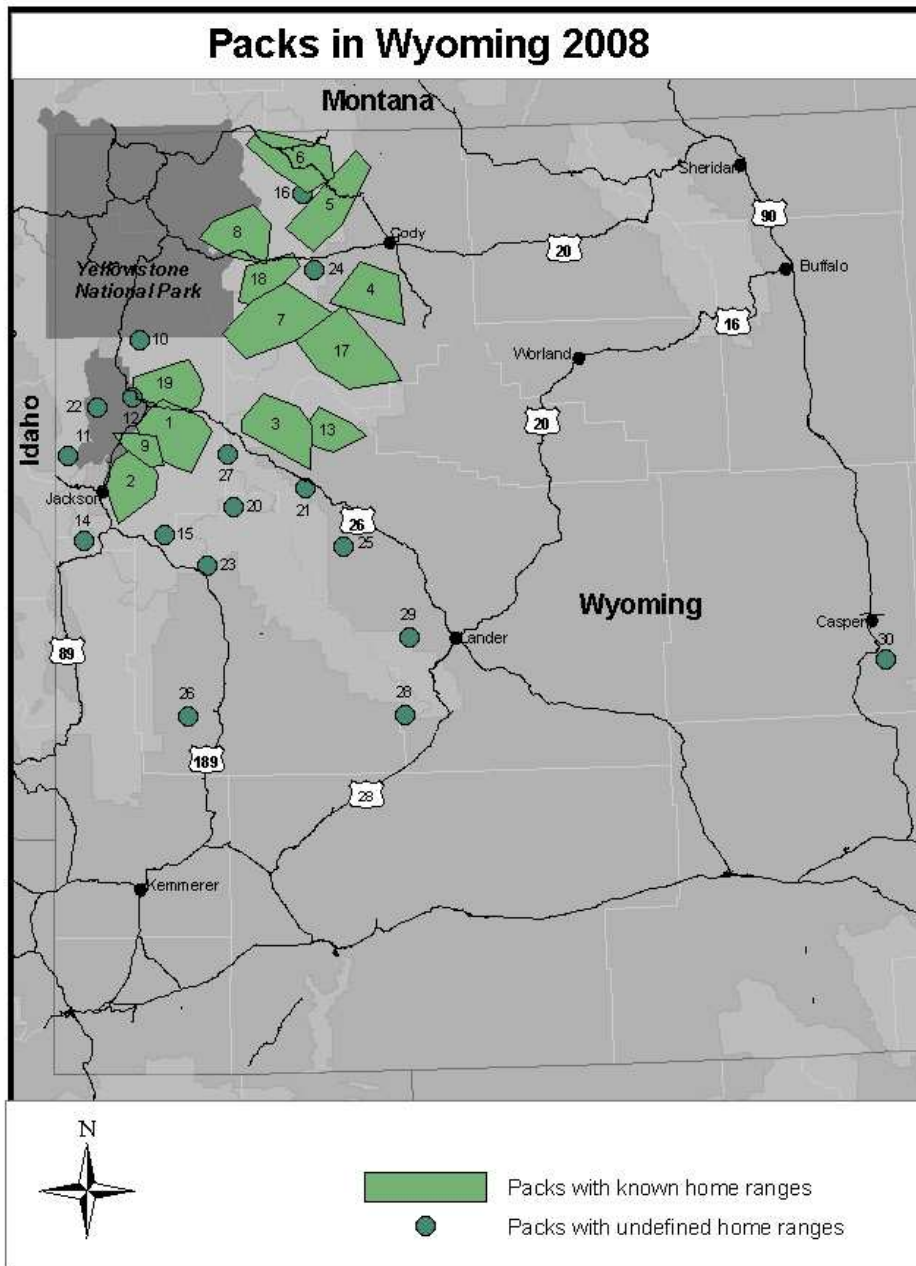


Figure 1. Home ranges of confirmed wolf packs in Wyoming outside Yellowstone National Park, 2008.

Table 1. Composition of confirmed wolf packs in Wyoming outside Yellowstone National Park in 2008.

REF #	WOLF PACK	RECOV AREA	STATE	MINIMUM ESTIMATED PACK SIZE DEC 2008			CONFIRMED LOSSES				
				ADULT	PUP	TOT	CONTROL	CATTLE	SHEEP	DOGS	OTHER
Wyoming Outside Yellowstone National Park											
1	<u>Buffalo</u>	GYA	WY	7	2	9	0	0	0		
2	<u>Pinnacle Peak</u>	GYA	WY	4	6	10	0	0	0		
3	Washakie	GYA	WY	6	4	10	0	1	0		
4	<u>Carter Mtn.</u>	GYA	WY	2	6	8	2	2	0		
5	<u>Absaroka</u>	GYA	WY	3	2	5	2	2	0		
6	<u>Beartooth</u>	GYA	WY	4	4	8	0	1	0		
7	<u>Butte Creek</u>	GYA	WY	5	4	9	0	0	0		
8	<u>Pahaska</u>	GYA	WY	5	4	9	0	0	0		
9	<u>Antelope</u>	GYA	WY	4	4	8	0	0	0		
10	<u>Snake River</u>	GYA	WY	4	?	4	0	0	0		
11	<u>Chagrin River</u>	GYA	WY	3	2	5	0	0	0		
12	<u>Phantom Springs</u>	GYA	WY	5	4	9	0	0	0		
13	<u>East Fork</u>	GYA	WY	4	4	8	3	2	0		
14	<u>Dog Creek</u>	GYA	WY	4	2	6	1	0	12		
15	<u>Rim</u>	GYA	WY	4	2	6	0	0	0		
16	<u>Sunlight</u>	GYA	WY	2	2	4	7	6	0		
17	Greybull River	GYA	WY	0	3	3	2	1	0		
18	Elk Fork Creek	GYA	WY	3	0	3	0	0	0		
19	<u>Pacific Creek</u>	GYA	WY	9	4	13	0	0	0		
20	Green River	GYA	WY	3	0	3	0	11	14		
21	Whiskey Basin	GYA	WY	3	0	3	0	0	0		
22	Huckleberry	GYA	WY	3	0	3	0	0	0		
23	Black Butte	GYA	WY	2	0	2	1	0	0		
24	South Fork	GYA	WY	3	1	4	8	4	0		
25	Bold Mtn	GYA	WY	2	0	2	0	0	0		
26	Big Piney	GYA	WY	7	?	7	0	0	0		
27	Lava Mtn	GYA	WY	2	1	3	0	0	0		
28	Prospect	GYA	WY	2	?	2	0	0	0		
29	Popo Agie	GYA	WY	≥2	0	≥2	0	0	0		
30	Deer Creek	GYA	WY	2	0	2	0	0	0		
Sub-total				109	61	170	26	30	26	0	0
Misc. wolves											
	Crandall	GYA	WY	0	0	0	6	4	0		
	Soda Lake	GYA	WY	0	0	0	4	0	0		
	Daniel	GYA	WY	0	0	0	0	0	0		
	Gooseberry	GYA	WY	0	0	0	6	3	0		
	Big Horn	GYA	WY	1	0	1	0	0	0		
	Misc./Lone wolves	GYA	WY	7	0	7	4	4	0		
WY Total (outside YNP)				117	61	178	46	41	26	0	0

Underlined packs are counted as breeding pairs toward recovery goals.

Crandall, Soda Lake, and Gooseberry Packs were removed by agency control to reduce livestock depredations.

Wolves in the Daniel Pack were killed in the WGFD Predator Area while wolves were delisted.

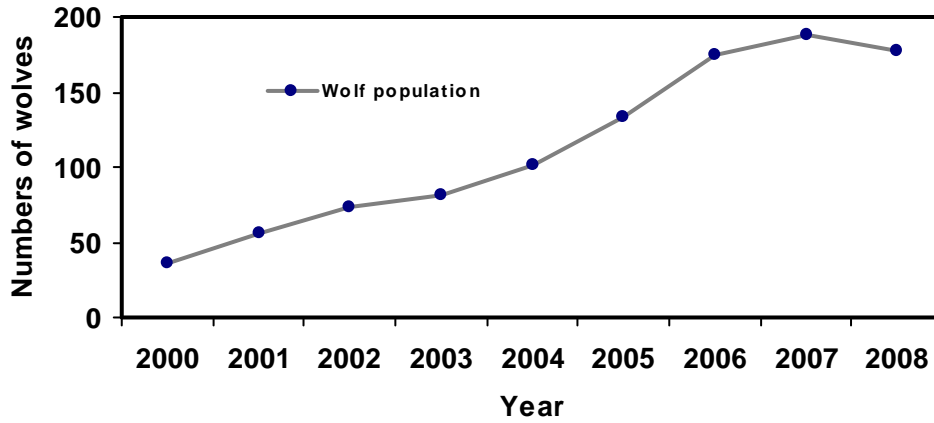


Figure 2. Wolf population growth in Wyoming outside Yellowstone National Park, 2000 - 2008.

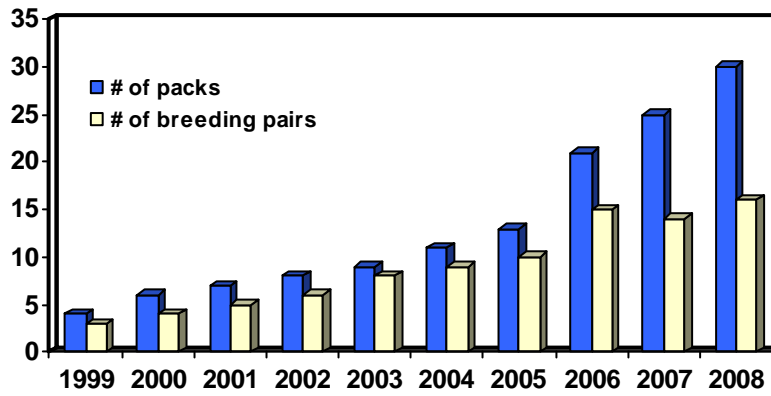


Figure 3. Number of wolf packs and breeding pairs in Wyoming outside Yellowstone National Park, 1999 – 2008.

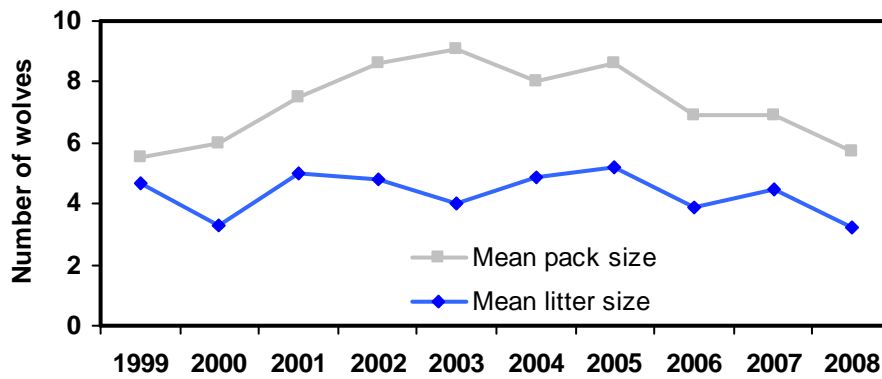


Figure 4. Mean pack size and mean litter size for wolves in Wyoming outside Yellowstone National Park, 1999 - 2008.

Pack assignment to states and national parks in Wyoming: Wolf packs are defined as ≥ 2 wolves traveling together in a defined home range. Packs are assigned to specific states or national parks based on which area contains the majority of the packs annual home range. Breeding pairs are defined as ≥ 1 adult male and ≥ 1 adult female with ≥ 2 pups surviving through 31 December of that year. Breeding pairs are assigned to the state or park where wolves den and raise pups. However, if wolves den in one state or park, but the majority of their home range is located outside that state or park, those wolves are assigned to the area that includes the majority of their home range.

Wyoming contains 2 national parks (YNP and GTNP). In 2008, YNP had 12 wolf packs, including 6 breeding pairs that denned within the boundaries of YNP. One YNP pack's home range (Bechler Pack) straddled the Wyoming-Idaho state border; however, the majority of the pack's home range was in YNP.

GTNP had 1 wolf pack (Huckleberry Pack) which had the majority of its home range inside the park. GTNP had 2 breeding pairs (Buffalo and Phantom Springs) that denned within the park; however, the Buffalo Pack's home range was mostly outside the park boundaries. The home range of the newly formed Phantom Springs Pack was not determined because none of the wolves were radio collared.

The home range of the Chagrin River Pack straddled the Wyoming-Idaho state border, but the pack denned in Wyoming and spent most of the year within the state of Wyoming.

Disease Surveillance:

Mange

Sarcoptic mange is a highly contagious skin disease caused by mites (*Sarcoptes scabiei*) that burrow into the epidermis of the host animal and create tunnels where females lay eggs. Larvae hatch from eggs, which molt through 2 nymph stages and continue to burrow new tunnels in the epidermis. The 2-week life cycle is completed after the second nymph stage molts to adults. Each stage can add to the tunnel system but most tunneling is done by adult females. Burrowing in the epidermis and allergic responses by the hosts to excretions from the mites causes pruritis (severe itching) which leads to progressive skin damage as the host animal bites, scratches, and rubs the affected area. Infested animals generally suffer from alopecia (loss of hair), hyperkeratosis (thickening of the skin), seborrhea (excessive discharge from sebaceous glands causing an oily coat, scales, and surface crust on the skin), scabs, ulcerations, and lesions. Severe cases can affect the animal's entire body and can lead to emaciation, poor body condition, and death from secondary infections or hypothermia in winter due to hair loss. Mange is spread from infested animals to new hosts by direct contact, contact with areas contaminated with mites (ie: bedding sites or dens), or contact with common rubs used by infested animals.

Mange is fairly common in wolf populations through out the world, including wolves in Canada, Alaska, Wisconsin, Minnesota, and Michigan. Based on other areas that have experienced epizootic mange infestations, mange in the northern Rocky Mountain wolf population will most likely be localized in specific areas and not threaten regional wolf population viability. From

1995 through 2008, we have identified wolves infested with sarcoptic mange in WY and Montana. Mange has not been confirmed in any wolves in Idaho. Although a few cases of mange have been documented in recent years in YNP, 2008 showed a marked increase in occurrence, with at least four packs, two non-pack groupings, and several loners showing signs of mange (>10 individuals), ranging from light to severe. In 2008, Wyoming (outside YNP) had ≥ 4 packs containing wolves infested with mange (Absaroka, Sunlight, South Fork, and Antelope Packs).

Canine Distemper and Canine Parvovirus

Canine distemper (CDV) and canine parvovirus (CPV) are highly contagious diseases that infect domestic dogs, coyotes, fox, raccoons, skunks, and wolves. Forty-five percent of WY wolves tested since 2001 were exposed to CDV and 97% of wolves tested were exposed to CPV. Based on other areas of the world that have experienced epizootic CDV and CPV infections, these diseases in the northern Rocky Mountain wolf population will most likely occasionally cause some mortality, particularly among pups, but will be localized in specific areas/years, and not threaten regional wolf population viability.

Brucellosis

Blood taken from wolves captured in Wyoming during 2008 tested negative for *Brucella canis* and *Brucella abortus*. Test results from winter 2009 blood samples were not available in time for this annual report, but results will be published in the USFWS Wyoming Weekly Report when testing is completed.

RESEARCH

Research in Yellowstone National Park

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 monitored for two winter-study sessions in 2008 during which wolves were intensively radio-tracked for 30-day periods in March and from mid-November to mid-December. The Blacktail (Nov-Dec), Druid Peak (March and Nov-Dec), Leopold (March), Oxbow Creek (March), and Quadrant Mountain (Nov-Dec.) Packs were the main study packs monitored by three-person ground teams and all packs park-wide were monitored from aircraft. In addition, ground crews opportunistically monitored the Slough Creek, Agate Creek, Hayden Valley, and Mollie's Packs, along with two newly formed groups of wolves, collecting prey selection and kill rate data. The Cougar Creek 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. Project staff recorded behavioral interactions between wolves and prey, predation rates, total time wolves fed on carcasses, percent consumption of kills by 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.

Composition of Wolf Kills

Project staff detected 576 kills (definite, probable, and possible combined) made by wolves in 2008, including 463 elk (80 %), 23 bison (4%), 19 deer (3 %), three moose (<1%), five pronghorn (<1%), two bighorn sheep (< 1%), one beaver (< 1%), three grouse (< 1%), one golden eagle (<1%), two ravens (< 1%), 13 coyotes (2%), one grizzly bear (< 1%), one cougar (< 1%), one red fox (<1%), one otter (<1%), 11 wolves (2%), and 26 unknown prey (5%). The composition of elk kills was 27 % calves (0–12 months), 16 % cows (1-9 years old), 15 % old cows (\geq 10 years old), 32 % bulls, and 10 % elk of unknown sex and/or age. Bison kills included four calves, three cows, seven bulls, and nine unknown sex adults.

Preliminary examination of winter predation rates in 2008 shows a decrease in kill rate compared to earlier 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. In recent years, this rate has decreased by 50% to approximately 0.9 elk/wolf/30-day study period. Changes in prey selection (shift to bull elk), an increase in scavenging on winter-killed ungulates, and a suspected decrease in the number of vulnerable prey available to wolves factor in to this decrease in kill rates. When examined, however, not as elk killed/wolf, but rather biomass consumed (kg/wolf/day), kill rates have been stable since 1995. The wolf-elk interaction continues to be a primary focus of predation studies in YNP. Since wolf reintroduction, the elk population has declined approximately 50% with wolves being one factor. Other factors include other predators, management of elk outside YNP, and possibly long-term drought.

Winter Studies

March - During the 2008 March winter study (30 days), study packs were observed for 472 hours from the ground. The number of days wolf packs were located from the air ranged from 15 (Cougar Creek) to 18 (Druid, Leopold, Oxbow, Agate, Slough, and several sub-groups). A total of 113 carcasses utilized by wolves were discovered by air and ground teams, made up mostly of wolf kills, with some winter-killed ungulates scavenged upon. These carcasses included 91 elk, 17 bison, one bighorn sheep, and four unknown species. Among elk, nine (10%) were calves, 43 (48%) were cows, 33 (37%) were bulls, and five (5%) was of unknown sex adult. In addition, eight bison and one bighorn sheep were killed by wolves. Seventeen of the discovered ungulate carcasses (five bison, 11 elk, one unknown species) were winter-killed and scavenged by wolf packs. Documenting the consumption of biomass from ungulates not killed by wolves is important to 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 in the spring.

November-December - During the 2008 November–December winter study (30 days), wolves were observed for 292 hours from the ground. The number of days wolf packs were located from the air ranged from two (Bechler) to 14 (Mollie's, Druid Peak, 471F's group). Aerial monitoring was affected by poor weather conditions. A total of 38 ungulate carcasses utilized by wolves were discovered by air and ground teams. These were made up mostly of wolf kills, with some winter-kill and other natural-caused mortalities scavenged upon. Project staff documented fewer

kills being made this early winter with 28 elk (50% bulls, 36% cows, 7% calves, and 7% unknown sex adult), three bison (1 bull, 1 cow, 1 calf), and two moose being killed by wolves. Five carcasses (two bull bison, three bull elk) were scavenged by wolf packs.

The significance of bull elk in the early winter prey selection continues to be of interest as we attempt to understand the changing patterns in the availability of vulnerable prey. With good 2008 summer and fall forage for ungulates, it may be that post-rut bull elk represent greater vulnerability than cow and calf groups.

Summer Predation

During summer 2008, Wolf Project staff, in collaboration with Michigan Technological University, continued 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, pack cohesiveness, grizzly bear kleptoparasitism of carcasses, 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 scats collected at den and rendezvous sites. However, this technique is limited by a lack of knowledge regarding whether wolves were feeding upon freshly killed prey or scavenging on older carcasses and offers a very incomplete record. Although scats were again collected in 2008, GPS collar technology was used to facilitate a greater understanding of summer predation patterns.

During the 2008 capture season, Wolf Project staff deployed four 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 with respect to dens during pup rearing season; and 4) territory size, use, and overlap. Using GPS collars with downloadable technology, the goal was to perform weekly data gathering downloads from 1 May to 31 July 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 composition of prey killed by wolves, including neonate elk calves.

The 2008 summer predation season proved to be our most successful to date. GPS collars were placed upon Leopold wolves #624F (2 year-old) and #625F (yearling) and Oxbow wolves #626F (yearling) and #627M (alpha male) (Fig. 5). The GPS collars deployed on the wolves all obtained greater than 99% of possible locations, with the exception of Leopold wolf #624F when she was in the den after giving birth to a litter of pups. Summer predation staff worked intensively to search clusters, hiking over 1600 miles during the 3+ month field season. While searching clusters, staff recorded the presence of wolf sign, wolf-killed prey, carcasses scavenged upon by wolves (classified as either fresh or old), and small prey killed by wolves (for example, blue grouse). During this effort, a minimum of 150 suspected kills were found at identified clusters.

We hope to incorporate genetic analyses of neonate bone shards to further investigate this, as neonate kill sites are difficult to identify. Of the kills detected, almost 90% were elk, with deer making up most other kills found. Differences did exist between prey composition between packs, as Oxbow killed more neonate elk and deer, while Leopold focused mostly on bull elk

outside of the June elk calving period. Differences between prey killed by the two packs are likely influenced by prey availability within their respective territories. However, both packs did have elevated May predation rates, as winter weather extended into late spring this year. Elk killed by wolves revealed poor bone marrow into June. Analysis of data collected is ongoing in preparation for publications. Another intensive field season is scheduled for 2009.

Population Genetics

Collaborative efforts between the Yellowstone Wolf Project and the University of California, Los Angeles continued in 2008. Dan Stahler attended UCLA for the spring quarter and continued data collection in the YNP population throughout 2008. Having completed the 2008 field season and advancing to candidacy in September, Stahler will begin analyzing 14 years of data on reproduction, breeding behavior, and territoriality. Incorporating genetic data and pedigrees, Stahler will test hypotheses on the role of kinship in behavioral and life history strategies associated with reproductive success and territoriality.

The larger scale analyses of genetic diversity and gene flow between the three Rocky Mountain recovery areas was ongoing throughout 2008. Preliminary results show very high genetic diversity within all three recovery areas, as well as high genetic exchange between Central Idaho and Northwest Montana. However, lower levels of gene flow were documented between the GYA and the other recovery areas. Ongoing analyses will address issues of population connectivity and migratory exchange among recovery areas and the theoretical importance this has for genetic diversity and long-term population sustainability. Completion of this project is expected in early 2009.

Disease

Research on disease in the Yellowstone wolf population is ongoing. During the summer of 2008, Emily Almborg at the University of Minnesota continued research on diseases affecting Yellowstone wolves. Both high pup and adult mortality this year is associated with another disease outbreak, probably canine distemper virus (CDV). Three necropsies on adult wolves showed evidence of CDV. High pup mortality was correlated with CDV in 1999 and 2005, so some adult and most of the pup mortality is probably due to CDV. Other diseases such as canine parvovirus (CPV), canine adenovirus (CAV-1), canine herpesvirus, and canine coronavirus are also possible and samples are being analyzed. Serology results from wolves captured during the 2006/2007 season suggest that exposure to CPV and CAV-1 remain high.

Sarcoptic mange was documented for the first time in 2005/2006 within the core of Yellowstone National Park in the Mollie's Pack. Since then, and especially in 2008, mange has spread considerably and is now present throughout the park and in many packs (Everts, Blacktail, Agate, Mollies, 471F's group, and several loners). Ongoing monitoring for mange is an important project objective.

Collaborative Research

The wolf project and 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 graduate students worked in collaboration with the Wolf Project in 2008: 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. Stahler's project focuses on combining behavioral data gathered in the field with genetic data gleaned from DNA samples and overlaying the two techniques to better understand wolf social behavior. Stahler works with Dr. Robert Wayne at the University of California at Los Angeles. AlMBERG's project focuses on wolf diseases both from a current and historical perspective. With severe mortality caused by disease in 2008, 2005, and 1999, AlMBERG plans to elucidate the role of diseases for wolf population ecology in the Northern Rockies. AlMBERG works with Dr. L. David Mech and the University of Minnesota. Metz's project focuses on summer predation patterns in wolves by incorporating downloadable GPS collar technology and modeling techniques. Metz works with Dr. John Vucetich and Michigan Technological University.

Title: Behavioral, ecological, and genetic influences on life-history strategies and social dynamics of gray wolves.

Graduate Student: Daniel Stahler, doctoral student

Committee Chair: Dr. Robert Wayne, University of California, Los Angeles.

Project Summary: The evolution of complex societies, such as 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 is 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 it is 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 a better understanding of how social and ecological conditions are related to wolf population dynamics and conservation.

Project Activity in 2008: Coursework, wrote research proposal, conducted field work, published paper on Yellowstone genealogy and genetic diversity, defended proposal and advanced to Ph.D candidate.

Anticipated Completion Date: 2010

Title: A comprehensive survey of the infectious diseases and parasites of Yellowstone wolves: Implications for population dynamics and management

Graduate Student: Emily Almberg, doctoral student

Committee Chair: Dr. L. David Mech, University of Minnesota, St. Paul

Project Summary: In 1999 and 2005, the Yellowstone wolf population experienced significantly reduced pup recruitment suggestive of a disease outbreak. Despite fuelling 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 (i) identify and describe the spatial and temporal patterns of select pathogens and parasites in the Yellowstone National Park (YNP) and the Greater Yellowstone Ecosystem (GYE) wolf populations, (ii) to attempt to understand the impacts of disease on population parameters such as adult wolf mortality and pup survival, (iii) to track the distribution, prevalence, and population-level effects of sarcoptic mange among wolves in YNP and the GYE, and (iv) 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 2008: Completion of coursework, data collection, and thesis preparation.

Anticipated Completion Date: May 2009

Title: Summer patterns of prey selection and kill rates for gray wolves.

Graduate Student: Matt Metz, Master's student

Committee Chair: Dr. John Vucetich, Michigan Technological University

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.

Project Activity in 2008: Data collection, coursework, grant writing

Anticipated Completion Date: May 2010

Other Research or Collaborative Work with the Wolf Project

<i>Topic</i>	<i>Collaborator</i>	<i>Institution</i>
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, Bear Management Office/YCR
Wolf-carnivore interactions	Howard Quigley	Beringia South
Wolf population genetics	Robert Wayne, Bridgett vonHoldt, John Pollinger	University of California, 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, Roy Renkin, Bill Ripple, David Cooper, Tom Hobbs, Don Despain, Nathan Varley	Univ of Alberta, USGS, YCR, Colorado State Univ.
Wolf –aspen	William Ripple, Eric Larsen, Roy Renkin, Matt Kauffman	Oregon State University, Univ of Wisconsin at Stevens Point, YCR, Univ. of Montana
Wolf –trophic cascades	L. David Mech; Mark Boyce, Nathan Varley; Rolf Peterson Dan MacNulty John Vucetich	USGS; University of Alberta; Michigan Technological University University of Minnesota
Wolf predation	Tom Drummer, John Vucetich, Rolf Peterson	Michigan Technological University
Wolf survival	Dennis Murray	Trent University

Research in Wyoming outside Yellowstone National Park

Title: Wolf habitat selection in a variety of land-use types: assessing the impact of elk and cattle distribution on wolf habitat use and cattle depredation patterns in the Absaroka Range of Wyoming.

Graduate Student: Abby Nelson, University of Wyoming, Laramie, Wyoming.

Major advisors: Matt Kauffman and Steven Buskirk, University of Wyoming.

Cooperators: U.S. Fish and Wildlife Service, USDA Wildlife Services, and Wyoming Game & Fish Department.

Project Summary: In collaboration with the US Fish and Wildlife Service and the Wyoming Game and Fish Department, the University of Wyoming Cooperative Fish and Wildlife Research Unit concluded the second year of data collection for the Absaroka wolf – cattle project. The first objective of this study is to analyze the changes in wolf habitat selection in response to seasonally driven elk and cattle distribution within three wolf pack territories in the Absaroka Range of Wyoming. The second objective is to locate wolf-killed cattle and native prey using fine-scale spatial data from wolf GPS collars. Ultimately, an analysis of kill sites incorporating wolf habitat use, ungulate distribution and landscape attributes will provide a gradient of risk for cattle depredations and will supply wildlife managers with information on species, age and sex of native wild ungulates that are killed by wolves in the study area.

To meet the first objective, wolf habitat selection information was collected throughout 2008 by one Argos GPS collar in the Sunlight pack. To address the second objective, two additional Lotek GPS collars were deployed in the summer and fall of 2008. Kills were located in the Crandall and Beartooth pack territories by searching GPS location clusters based on a 20-minute fix rate. In 2008, eight deer and nine elk were located as probable wolf kills associated with the Beartooth and Crandall packs. An additional three wolf-killed unknown ungulate young-of-year were located (identification pending on sample analysis). Non-wolf-killed (scavenged) carcasses found at wolf GPS clusters included 3 horses, 1 deer, 11 elk, 1 bull moose, 6 domestic cattle, 1 bison, 1 badger, and 4 hunter-killed elk/deer carcasses. Twelve depredations occurred within the study area in 2008 (Absaroka (1), Crandall (5), Sunlight (5), Beartooth (1)). With the conclusion of the final field season in 2008, the results will be analyzed throughout 2009.

Title: Absaroka Elk Ecology Project

Graduate Student: Arthur Middleton, University of Wyoming, Laramie, Wyoming.

Major advisor: Matt Kauffman, University of Wyoming.

Cooperators: U.S. Fish and Wildlife Service and Wyoming Game & Fish Department.

In collaboration with the U.S. Fish and Wildlife Service, the University of Wyoming and the Wyoming Game and Fish Department are entering the third year of the Absaroka Elk Ecology Project between Cody, WY and Yellowstone Park. The project's primary objectives are to 1) determine proportion of migratory and resident elk in the Clark's Fork herd unit; 2) determine the routes and timing of seasonal movements by migratory elk; 3) increase understanding of elk use of private lands for improved habitat conservation; and 4) understand the influence of wolves on elk habitat selection, movements, and behavior. The project relies on a sample of approximately 70 GPS-collared elk cows in the Clark's Fork herd, and 1-2 GPS-collared wolves in each of three resident wolf packs. Unexpectedly, preliminary project data has shown very low

pregnancy rates among migratory Clarks Fork elk, suggesting an acute nutritional stress might limit migrant productivity. To investigate this possibility, the project has initiated biannual recaptures of collared elk to determine body condition and reproductive status. The first two of five recaptures were completed during March and September 2008. In winters 2009 and 2010, a Ph.D. student from the University of Wyoming's Cooperative Fish and Wildlife Research Unit will conduct field observations to quantify time budgets of collared elk. The body condition of these elk will in turn be related to their winter behavior to evaluate whether condition influences the strength of their antipredator behaviors. Ultimately, this study aims to address applied questions relevant to elk and wolf management, as well as conceptual questions relevant to our understanding of ungulate-predator interactions in temperate ecosystems. Field work on this project will be completed in summer 2010, with analysis and reporting to follow.

Title: Habitat selection, condition, and survival of Shiras moose in northwest Wyoming

Graduate Student: Scott Becker, University of Wyoming, Laramie, Wyoming.

Major advisors: Wayne Hubert and Matt Kauffman, University of Wyoming.

Project Summary: Seasonal movements, habitat selection, physiological health, and demography of Shiras moose (*Alces alces shirasi*) were studied in the Jackson Valley of northwest Wyoming. Moose congregated on low-elevation ranges during winter and migrated to more dispersed, mid-elevation ranges during summer. Moose selected winter habitat dominated by deciduous shrubs, whereas they selected summer habitat that was more variable. Blood parameters indicated that moose were in moderate physical condition. Ultrasonic rump fat measurements were relatively high, but there were indications of nutritional deficiencies. Diseases and parasites appeared to have minimal population-level effects. Population modeling suggested that the moose population was more likely to be declining than stable or increasing and the population growth rate was influenced primarily by late-winter and early-spring adult female mortality. Pregnancy rates were high, but calf production was relatively low. Neonate and annual calf survival were relatively high. Habitat quality appeared to be the primary factor limiting population growth while the effects of predation appeared to be less important.

Other Collaborative Research Projects with the USFWS Wolf Recovery Program

Topic	Collaborators	Institution
Lead ingestion by scavenging carnivores in the Yellowstone ecosystem	Tom Rogers	University of Montana
Summer food habits of wolves in GTNP and YNP determined by scat analysis	Bonnie Trejo Steve Cain Doug Smith	Humbolt State Univer. GTNP YNP
Population genetics of wolves in the GYA	Robert Wayne Bridgett vonHoldt	University of Calif. Los Angeles
Wolf Movements/Dispersals	Doug McWhirter L.D. Mech, Doug Smith	WGFD, USGS, NPS

Absaroka Elk Project	Arthur Middleton, Matt Kauffman	University of Wyoming
Absaroka Wolf-Elk-Livestock	Abby Nelson, Matt Kauffman	University of Wyoming

MANAGEMENT

Management in Yellowstone National Park

Area Closures

To prevent human disturbance of denning wolves during the sensitive period of pup rearing, visitor entry was closed to some of the areas surrounding dens in the park. Land surrounding the Druid Peak Pack's den area was closed until July 1 in the eastern end of Lamar Valley. Thousands of visitors were still able to observe adults and pups from a safe distance, providing both protection to the pack and enjoyment to visitors. Den sites for the Leopold, Mollie's, and Agate Creek Packs were protected from disturbance coincidental to closures for bear management in the park. The areas around the remaining park packs' den sites were not closed because of historically low visitor use.

Wolf-Visitor Road Management

The 2008 Druid Road Management Project season started on 27 May and ended on 27 September, a period of 124 days. This was the ninth year of the project. The 2008 season was very different from recent years. The Druid Peak Pack, after denning in the backcountry the past three seasons, denned at their traditional site, a site used every denning season from 1997-2004. The site is in a forested area, a half mile north of the road and two large pullouts. There was also evidence of an additional den on the opposite side of the road occupied by one or more other Druid mother wolves. Those females later relocated to the main den area. Most sightings of the 16 Druid adult wolves occurred when they crossed the road as they travelled to the main den or left the den on a hunt. Pups were first seen at the main den on 13 June. On 9 and 10 July the adults moved at least 18 pups across the road to the south. Those pups later followed the adults south to a rendezvous site at Cache Creek. Sightings dropped drastically until 19 August when Druid adults and pups traveled back to Lamar Valley and rendezvoused at Chalcedony Creek, an area highly visible to visitors.

The Slough Creek Pack returned to their 2005 and 2006 den site after using an alternative site last year. This traditional site, on an open slope west of Slough Creek, is highly visible to visitors and wolves were seen in the area nearly daily in the early part of the season. Two pups were first

seen in late May coming out of their natal den, but soon one of those pups disappeared. The adults and one surviving pup were seen almost daily in the den area through mid-July. When the last pup died in mid-July, the adults did not spend as much time in the den area, but still were often seen in the general area.

The Agate Creek Pack exhibited very different behavior from past seasons. Possibly due to high Yellowstone River levels, the pack began the denning season on the east side of the river, rather than at previously used den sites. The pack was rarely seen in their traditional Antelope Creek rendezvous site, an indication that none of their pups survived. The pack was seldom seen from the ground the entire summer.

The Hayden Valley Pack, the most visible pack last season, is no longer in Yellowstone National Park after losing both of their alphas in a conflict with the Mollies Pack last October 2007. Two males from the Mollies Pack and a light gray Hayden female formed the Canyon Pack and were seen in the area formerly used by the Hayden Pack.

Table 2. Visitor Contacts in Yellowstone National Park, 2000-2008.

Year	Roving Visitor Contacts	# of Talks	# of People at 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%)
2008	8,660	358	3,925	12,585	35,000	830 hrs	124/124 (100%)

Habituated Wolves

In June two Druid Peak wolves in Lamar Valley were hazed by a ranger with rubber bullets. The wolves exhibited fearless behavior around people and were considered habituated so hazing was deemed necessary. After hazing the wolves were never again seen near people so the action was considered a success.

In the interior the Canyon pack also showed fearlessness of vehicles along the road, usually when people drove up along-side of them. Previously the Hayden Valley Pack, occupying the same area, exhibited similar behavior. Travel along the road may be easiest here in summer due to blowdown and regenerating lodgepole pine off the road effectively funneling the wolves along the road corridor. This is unlike the situation along the northern highway in YNP as there are many off-road travel options for wolves keeping people and wolves apart. Attempts to haze the Canyon wolves were unsuccessful because they were not located by park staff with hazing equipment at the proper time (e.g., showing habituated behavior).

Management in Wyoming outside Yellowstone National Park

Livestock Depredation & Management

Potential livestock depredations in WY were investigated by WS, USFWS, and WGFD. Depredations were classified as confirmed, probable, or other based on specific criteria agreed upon by the USFWS and WS. The following livestock depredation statistics were based on reported livestock losses and do not reflect lost or missing livestock. In 2008, wolves in WY were responsible for killing at least 67 livestock (Table 3). Confirmed livestock depredations included 41 cattle (35 calves; 6 cows/yearlings) and 26 sheep (Appendix Tables 2, 5a, and 5b). Thirteen additional probable sheep depredations and 3 injured cattle were reported.

Table 3. Confirmed livestock depredations in Wyoming outside Yellowstone National park, 1999 - 2008.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cattle	2	3	18	23	34	75	54	123	55	41
Sheep	0	25	34	0	7	18	27	38	16	26
Dogs	6	6	2	0	0	2	1	1	2	0
Goats	0	0	0	0	10	0	0	0	0	0
Horses	0	0	0	2	0	1	0	1	0	0
Wolves controlled	1	2	4	6	18	29	41	44	63	46

Number of Packs Involved in Depredations

Since 1999, the WY wolf population has increased annually and wolves have recolonized new areas in northwest WY. Wolves living in areas with relatively high native ungulate densities and relatively low exposure to domestic livestock caused fewer conflicts with livestock producers. Wolves that recolonized areas where large numbers of livestock graze on private and public lands were responsible for chronic depredations on domestic livestock. Ten of the 30 known packs in WY were involved in at least 1 depredation in 2008 (Figure 5).

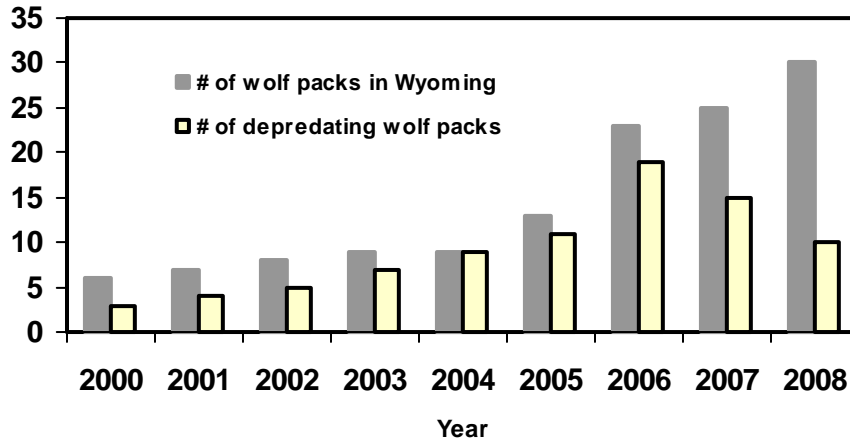


Figure 5. Annual number of wolf packs in Wyoming outside Yellowstone National Park and number of wolf packs that are involved in at least 1 livestock depredation/given year.

Frequency of Livestock Losses to Individual Producers

In 2008, we documented 14 producers who experienced depredations by wolves. Each depredation event was recorded as confirmed and included all cattle, sheep, dogs, and horses that were killed or injured by wolves. Six producers (43%) experienced multiple depredation events by wolves and 8 producers (57%) experienced a single depredation by wolves in 2008 (Figure 6).



Figure 6. Frequency of multiple and single losses of all confirmed wolf depredations, 2008.

Time of Year and Location of Livestock Depredations

Cattle depredations followed a seasonal pattern in 2008 with the highest number of depredations occurring in late summer from August through October (Figure 7). In 2008, confirmed cattle depredations occurred in 3 counties: Park 56% (n=23), Sublette 37% (n=15), and Fremont 7% (n=3) (Figure 8). Of the 41 confirmed cattle depredations, 23 (56%) were on public lands and 18 (44%) were on private property.

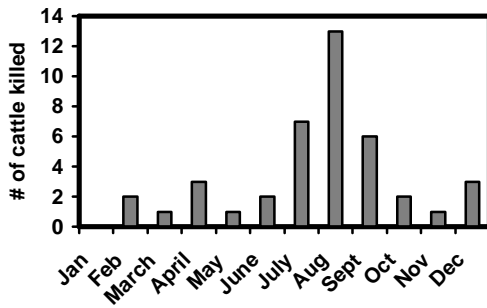


Figure 7. Number of confirmed cattle depredations/month, 2008.

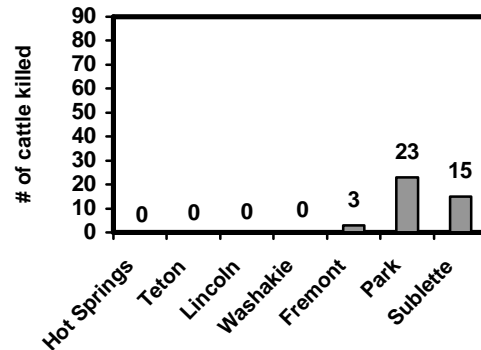


Figure 8. Number of confirmed cattle depredations/county, 2008.

In 2008, sheep depredations occurred during June, August, and September (Figure 9) in 3 counties: Sublette 50% (n=14), Lincoln 43% (n=12), and Johnson 7% (n=2) (Figure 10). All of the 26 confirmed sheep depredations occurred on public land.

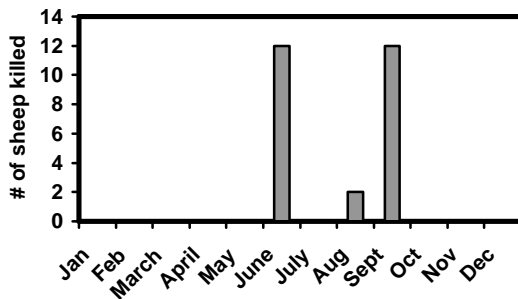


Figure 9. Number of confirmed sheep depredations/month, 2008.

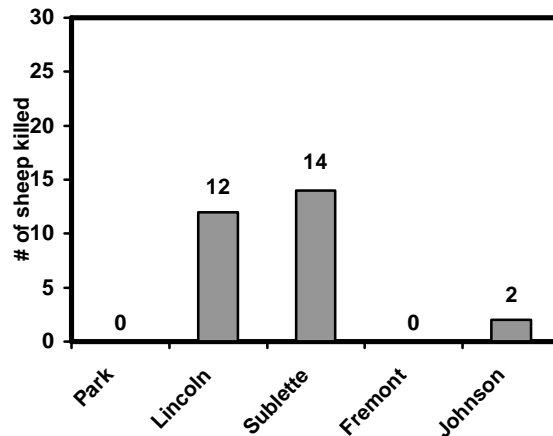


Figure 10. Number of confirmed sheep depredations/county, 2008.

Livestock Depredation Control Actions

Control actions in response to confirmed livestock depredations included trapping and radio collaring wolves; intensive monitoring; increasing riders on grazing allotments; harassing wolves with rubber bullets and cracker shells; moving livestock to different pastures; lethally removing wolves through agency control actions; and issuing Shoot-on-Sight (SOS) permits to livestock producers. Non-lethal control was routinely considered but was often not applicable in many areas in WY due to: 1) specific wolf packs chronically killing livestock year after year; 2) unpredictable travel patterns and movements by wolves; and 3) very large wolf home ranges that cover vast areas when cattle were on public grazing allotments. When non-lethal control methods were not effective, wolves were lethally removed in an attempt to prevent further livestock depredations.

We managed wolf population growth and wolf distribution to minimize chronic loss of livestock from wolves and promote wolf conservation by maintaining the WY wolf population (outside YNP) well above recovery objectives. In 2008, 46 depredating wolves (approximately 18% of the WY wolf population outside YNP) were removed to reduced livestock depredation (Figure 12). In addition to agency wolf control, 7 Shoot-on-Sight (SOS) permits were issued to private individuals in 2008, but no wolves were killed using SOS permits.

Incidental Takes

Two wolves were killed by legally placed M-44's used for coyote control. One wolf was taken by a private county trapper and 1 wolf was killed by a W.S. trapper.

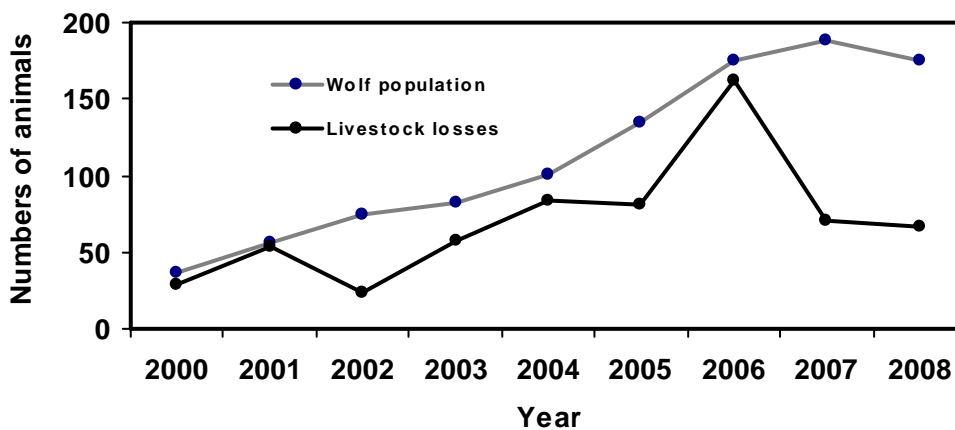


Figure 11. Annual wolf population size and number of confirmed livestock losses/year in Wyoming outside Yellowstone National Park, 2000 - 2008.

Compensation for Livestock Depredations

Under Chapter 28 of the Wyoming Game and Fish Commission (WGFC) Regulations, compensation for confirmed livestock depredations by wolves was authorized in the northwest corner (approx. 12% of the state) of Wyoming where the WGFC classified wolves as trophy game animals in 2008. Compensation for livestock lost to wolves was not authorized in the rest of the state.

(iii) “Sheep in areas set forth by Commission regulations where gray wolves are classified as trophy game animals. To determine the amount of compensation due to a claimant for sheep believed to be missing as a result of being damaged by gray wolves, in areas occupied by wolves, the Department shall utilize the following formula:

(A) Number of individual sheep confirmed by the Department or its representative killed by gray wolf multiplied by seven (7) multiplied by the value of livestock equals the amount of compensation.”

(iv) “Calves in areas set forth by Commission regulations.....the Department shall use the following formula:

(A) Number of individual calves confirmed by the Department or its representative killed by gray wolf multiplied by seven (7) multiplied by the value of livestock equals the amount of compensation.”

From July 2008 through December 31, 2008, the WGFD paid \$101,429.22 to compensate cattle producers and wool growers who lost livestock to wolves.

Delisted Wolves and State Management in 2008

Wolves in the northern Rocky Mountains (NRM) were delisted on March 28, 2008. On July 18, 2008, the U.S. Federal Court in Missoula, Montana issued a preliminary injunction that immediately reinstated temporary Endangered Species Act (ESA) protections for gray wolves in the NRM. On October 14, 2008, the court vacated the final delisting rule and remanded it back to the USFWS. The court dismissed the case without considering its merits, thereby ending the lawsuit and re-establishing full ESA protection for gray wolves in the NRM.

During March 28 through July 18, wolves were delisted in WY and managed by the WGFD. Under the Wyoming Wolf Management Plan, wolves were managed as Trophy Game Species in approximately 12% of the state in the northwest corner of WY. Wolves were designated as Predators in the remaining 88% of the state, which allowed for the unregulated year-round killing of wolves. Licenses were not required and bag limits or quotas for the number of wolves killed were not established. A total of 17 wolves were killed in WY under state management and included: 9 wolves (including 5 wolves that comprised the Daniel Pack in Sublette County) killed by private individuals; 2 wolves aerial gunned by private individuals permitted by the Wyoming Department of Agriculture; and 5 wolves (including 4 wolves that comprised the Soda Lake Pack in Sublette County) killed by federal agency control actions in response to livestock depredations. One additional radio collar was located transmitting a mortality mode signal in the Predator Area; however, the collar was not retrieved and the wolf was presumed dead.

Wolf Packs in Wyoming outside YNP in 2008

Twenty-six confirmed wolf packs had their territories in northwest WY with relatively high native ungulate densities and relatively low seasonal exposure to domestic livestock. Livestock depredations in these areas were relatively few and sporadic in 2008. Pack size and composition are based on our best estimates as of 31 December 2008.

Buffalo Pack (9 wolves: 7 adults/2 pups) The Buffalo Pack formed in 2006 and usurped the Teton Pack from their territory the same winter. The pack normally produces larger litters, but only 2 pups survived in 2008. This pack dens in GTNP but the majority of its home range is in the adjacent national forest.

Pinnacle Peak Pack (10 wolves: 4 adults/6 pups) The Pinnacle Peak Pack was documented in fall 2007 when a 2-year old radio collared female dispersed from the Buffalo Pack. The pack dens on the National Elk Refuge (NER) and its home range is on the NER and National Forest.

Washakie Pack: (10 wolves: 6 adults/4 pups) This pack has been implicated in numerous depredations since 1998; however, in 2008, cattle were removed from a large portion of their home range, and there was 1 confirmed depredation. After 1 wolf was removed in a control action in fall 2008, no additional depredations were reported.

Carter Mountain Pack: (8 wolves: 2 adults/6 pups) In past years, chronic depredations have been documented in the Carter Mountain Pack. In 2007, all but one wolf was removed in control actions. The pack reformed in 2008 and killed 1 cow. Two wolves were removed in a control action and no additional depredations were recorded.

Absaroka Pack: (5 wolves: 3 adults/2 pups) Due to chronic depredations, all but 2 wolves were removed from the Absaroka Pack in control actions in 2007. There were 2 confirmed depredations in 2008 and two wolves were removed in a control action. This pack continues to persist in spite of chronic mange infestations and repeated cattle depredations.

Beartooth Pack: (8 wolves: 4 adults/4 pups) The Beartooth Pack killed at least 1 calf in 2008 and 4 cattle in 2007; however, no previous depredations were confirmed in 2004, 2005, or 2006.

Butte Creek Pack (9 wolves: 5 adults/4 pups) This pack was documented in summer 2008 when 2 radio collared wolves dispersed from the South Fork Pack. This pack was not involved in any depredations in 2008.

Pahaska Pack: (9 wolves: 5 adults/4 pups) The Pahaska Pack was first documented in 2007. Radio contact with the Pahaska Pack was lost when the only radio collared wolf in the pack dispersed >150 miles to southern WY. The wolf was later killed by a legally placed M-44 near Cokeville, WY. The Pahaska Pack was not involved in any livestock conflicts in 2007 or 2008.

Antelope Pack (8 wolves: 4 adults/4 pups) The Antelope Pack was a new pack in 2008 and was a split from the Huckleberry Pack.

Snake River Pack: (4 wolves: 4 adults/? pups) Reproduction in the Snake River Pack was not documented in 2008. Their remote location did not allow confirmation of reproduction or pack composition. The Snake River Pack has not been involved in any livestock conflicts.

Chagrin River Pack: (5 wolves: 3 adults/2 pups) Wolves were first documented in the Driggs area in 2005 when a radio collared male dispersed from the Teton Pack. Contact was lost in 2006 when this collar was chewed off. In 2007, agency reports of howling of more than 2 wolves indicated the presence of wolves, but there was no confirmation of pack structure and actual numbers. In summer 2008, USFWS followed up on reports from a hunter leading to the discovery of a missing radio collared wolf from the Huckleberry Pack with 5 other wolves.

Phantom Springs Pack: (9 wolves: 5 adults/4 pups) Numerous agency and citizen reports led to the documentation of this pack in 2008. This pack possibly formed from members of the Huckleberry Pack. The pack's home range has not been determined due the lack of any radio collared wolves.

East Fork Pack: (8 wolves: 4 adults/4 pups) The East Fork Pack was first documented in 2005, but is suspected to have been around since at least 2004. In 2006, a radio collared disperser from the adjacent Washakie Pack joined the East Fork Pack. The East Fork Pack killed 2 cattle in 2005, 2 cattle in 2006, 6 cattle in 2007, and 2 cattle in 2008. Three wolves were removed in control actions in 2008.

Dog Creek Pack: (6 wolves: 4 adults/2 pups) This pack was discovered in summer 2008 when at least 12 sheep were killed on a public grazing allotment. One wolf was removed in a control action and no more depredations were reported. Numerous sightings of wolves and reports of wolves howling assisted in documenting pack size and composition. We will attempt to radio collar Dog Creek wolves next spring to enhance our monitoring efforts.

Rim Pack (6 wolves: 4 adults/2 pups) This pack was first discovered in April 2008 when a 3-year old radio collared male dispersed from the Pinnacle Peak Pack. Numerous agency reports led to the confirmation of pups. The radio collared wolf died in late fall 2008, and thus, little is known about the home range of this pack.

Greybull River Pack: (3 wolves: 0 adults/3 pups) This pack has been involved in chronic depredations due to high numbers of livestock in this area. In 2007, 8 wolves were controlled for confirmed depredations of 2 cattle. At least 1 cow was killed in 2008 and 2 wolves were removed. No further depredations were reported.

Elk Fork Creek Pack: (3 wolves: 3 adults/0 pups) This pack was documented in 2008 when a radio collared wolf dispersed from the Pahaska Pack.

Pacific Creek Pack: (13 wolves: 9 adults/4pups) The Pacific Creek Pack was first documented in 2004. Mange was found on two members of this pack in winter 2006 during capture efforts, but no known deaths occurred from the mange. Reproduction was documented in both 2006 and 2007, but was not confirmed in 2008. The Pacific Creek Pack has had no known depredations since 2005.

Whiskey Basin Pack: (3 wolves) This pack was first documented in winter 2008. Numerous photos consistently show 3 wolves. Little is known about this pack, but capture and monitoring efforts will begin in spring of 2009.

Huckleberry Pack: (3 wolves: 3 adults/0 pups) The Huckleberry Pack formed in 2006 and possibly combined with the Sage Pack in 2007. Members of this pack split and formed the Antelope Pack and possibly the Phantom Springs Pack. The home range of this pack was almost entirely within the boundaries of Grand Teton National Park.

Black Butte Pack: (2 wolves) This pack formed and reproduced in 2006, but chronic depredations have led to numerous control actions. At the end of 2007, there were at least 2 uncollared wolves in the Black Butte Pack. A dispersing radio-collared male from the Jackson area was located here in late summer 2008 with 1 other wolf.

Bold Mountain Pack (2 wolves) Agency reports led to the documentation of this pack in late summer 2008. Numerous photos taken from remote sensing cameras have consistently shown 2 wolves traveling together in the area. Reproduction was not confirmed and little is known about this pack. Collaborative capture efforts with the Wind River Indian Reservation will occur in 2009 in an effort to further monitor this pack.

Big Piney Pack: (7 wolves) Multiple wolves were again found in the Big Piney region in fall 2008. In the past, depredations have been chronic in this area in the past, but no depredations were confirmed in 2007 or 2008. Pack composition is unknown.

Lava Mountain Pack: (3 wolves: 2 adults/1 pup) USFWS has received reports of wolves in this area since 2006. A telemetry flight documented > 1 adult and 1 pup. Field investigations by USFWS in summer 2008 confirmed the pack and discovered the carcass remains of 1 pup at a den site. Numerous hunter and livestock producer reports continued through the fall, but little more is known about the pack.

Prospect Pack: (>2 wolves) Since 2005, the Prospect Pack has been implicated in multiple depredations—33 sheep in 2005, and 22 cattle in 2006. No depredations were reported in 2007 or 2008. At the end of 2007, at least 3 wolves were confirmed in the Prospect Pack. Two wolves were killed while wolves were delisted and were classified as predators in this area.

Popo Agie Pack: (2 wolves) Wolves were confirmed in the Sinks Canyon area in 2008, with reports of at least 2 wolves. We were not able to confirm pack size or pack composition.

In 2008, home ranges of 6 wolf packs in WY overlapped areas where large numbers of domestic livestock grazed on private and public lands.

Green River Pack: (3 wolves: 3 adults/0pups) With several thousand cattle grazing in the Upper Green River drainage, the Green River Pack has been removed several times since 2002 due to chronic depredations. The pack killed >10 cattle in 2002, >9 cattle and 1 sheep in 2003, >20

cattle in 2004, >10 cattle in 2005, >27 cattle in 2006, >12 cattle in 2007, and >11 cattle and 14 sheep in 2008. Control actions were ongoing in 2008; however, no wolves were removed. The pack did not reproduce 2008 and currently consists of 3 wolves.

Sunlight Pack: (4 wolves: 2 adults/2 pups) The Sunlight Pack has occasionally killed livestock in the past, but during summer 2008 the pack repeatedly killed cattle on private property and public grazing allotments. All but 4 wolves were removed from this pack in 2008 in an effort to stop depredations. Mange has been documented in this pack since 2003.

South Fork Pack: (4 wolves: 3 adults/1 pups) The South Fork Pack formed in 2005 and have since been implicated in numerous depredations killing >3 cattle in 2005, >19 cattle in 2006, >1 cattle in 2007, and at least 4 cattle in 2008. Eight wolves were removed in control actions in an effort to stop the depredations. In 2008, for the second consecutive year, this pack was not considered a breeding pair.

Crandall Pack : This pack formed in winter 2008 as a split from the Sunlight Pack. Depredations began in late summer 2008 and 2 wolves were controlled. Continued depredations led to the removal of the entire pack. There were no wolves remaining in this pack at the end of 2008.

Soda Lake Pack: There were 5 wolves in this pack at the end of 2007. In early 2008, this pack killed at least 3 calves and 4 wolves were removed in an agency control action. There was no evidence of this pack at the end of 2008.

Gooseberry Pack: The Gooseberry Pack formed in 2006 when the lone remaining wolf from the Owl Creek Pack paired with another wolf. The new pack was implicated in numerous depredations in 2006 and 2007. The entire pack of 6 wolves was removed in control actions in 2008 after they repeatedly killed cattle..

Misc. Wolves/Unconfirmed Packs

Big Horn (1 wolf) Wolves have dispersed to the Big Horn Mountains on numerous occasions over the last several years; however, no packs and no reproduction have been confirmed. In 2007, 4 sheep were killed by wolves. Two wolves have been killed by M-44's. In 2008, it appears that ≥ 1 wolf has dispersed to the Big Horn Mountains.

Other packs

Daniel Pack: There were 4 wolves in the Daniel Pack at the end of 2007. In early 2008, this entire pack was killed by private individuals when wolves were delisted and WY designated wolves as predators in this area. There was no evidence of wolves in this pack at the end of 2008.

OUTREACH

Outreach in Yellowstone National Park

Yellowstone Wolf Project staff gave 156 talks and 78 interviews. Talks were at both scientific conferences and to general audiences. Interviews were to all forms of media.

For the 8th straight year wolf project staff rode horseback into outfitter camps near YNP to discuss wolf issues. Accompanying Smith and Tom Olliff, YCR Director were USFS Gallatin Forest Wildlife Biologist Dan Tyers, USFS Gallatin Forest Gardiner District Ranger Ken Britton, and USFS Gallatin Forest Supervisor Mary Erickson.

Outreach in Wyoming outside Yellowstone National Park

In 2008, the WY wolf recovery program continued to give numerous formal presentations to public schools, universities, wildlife symposiums, state and federal management agencies, livestock association meetings, state legislature committees, and environmental groups. We were also interviewed for numerous magazine, newspaper, and television feature stories.

USFWS LAW ENFORCEMENT

Enforcement efforts continue in WY. The Office of Law Enforcement continues to use traditional enforcement along with programs designated to prevent illegal killing of wolves. Fast and appropriate response to wolf problems by the USFWS and Wildlife Services has done much to ensure that individuals do not become frustrated and illegally kill wolves. Currently, the State of Wyoming has no laws to protect wolves in >85% of the state.

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We thank our pilots Dave Stinson and Bob Hawkins from Sky Aviation, Roger Stradley of Gallatin Flying Service, and Steve and Lisa Robertson. Laboratory work was done by Mattson's Laboratory in Milltown, Montana.

Numerous agencies and agency personnel have contributed to the recovery program and we thank Dave Skates, Pat Hnilicka, and Laurie Connel (USFWS Lander); USFS Dale Deiter and Terry Hersey at Bridger-Teton National Forest; Shoshone National Forest; Steve Cain and Sarah Dewey from Grand Teton National Park; Steve Kallin, Tom Reed, Eric Cole, and Dan Huckel at the National Elk Refuge; Bureau of Land Management; and Wyoming Game and Fish Department.

Table 2a: Wyoming Wolf Packs (Outside of Yellowstone National Park) and Population Data for Wyoming's Portion of the Greater Yellowstone Recovery Area, 2008.

REF #	WOLF PACK 1	RECOV AREA	STATE	MINIMUM ESTIMATED PACK SIZE DEC 2008			DOCUMENTED MORTALITIES			KNOWN DISPERSED	MISSING 4	CONTROL 5	CONFIRMED LOSSES 6					
				ADULT	PUP	TOT	NATURAL	HUMAN 2	UNKN 3				CATTLE	SHEEP	DOGS	OTHER		
Wyoming Outside Yellowstone National Park																		
85	<u>Buffalo</u>	GYA	WY	7	2	9		1	1			0	0	0				
86	<u>Pinnacle Peak</u>	GYA	WY	4	6	10			1	2		0	0	0				
87	<u>Washakie</u>	GYA	WY	6	4	10						2	0	1	0			
88	<u>Carter Mtn.</u>	GYA	WY	2	6	8						2	2	0				
89	<u>Absaroka</u>	GYA	WY	3	2	5						2	2	0				
90	<u>Beartooth</u>	GYA	WY	4	4	8	1	1				0	1	0				
91	<u>Butte Creek</u>	GYA	WY	5	4	9						0	0	0				
92	<u>Pahaska</u>	GYA	WY	5	4	9				1		0	0	0				
93	<u>Antelope</u>	GYA	WY	4	4	8		1				0	0	0				
94	Snake River	GYA	WY	4	?	4						0	0	0				
95	<u>Chagrin River</u>	GYA	WY	3	2	5						0	0	0				
96	<u>Phantom Springs</u>	GYA	WY	5	4	9						0	0	0				
97	<u>East Fork</u>	GYA	WY	4	4	8						1	3	2	0			
98	<u>Dog Creek</u>	GYA	WY	4	2	6						1	0	12				
99	<u>Rim</u>	GYA	WY	4	2	6			1			0	0	0				
100	<u>Sunlight</u>	GYA	WY	2	2	4						2	7	6	0			
101	Greybull River	GYA	WY	0	3	3			1			2	1	0				
102	Elk Fork Creek	GYA	WY	3	0	3						0	0	0				
103	<u>Pacific Creek</u>	GYA	WY	9	4	13				1		0	0	0				
104	Green River	GYA	WY	3	0	3						0	11	14				
105	Whiskey Basin	GYA	WY	3	0	3						0	0	0				
106	Huckleberry	GYA	WY	3	0	3	1			1	1	0	0	0				
107	Black Butte	GYA	WY	2	0	2						1	0	0				
108	South Fork	GYA	WY	3	1	4						8	4	0				
109	Bold Mtn	GYA	WY	2	0	2						0	0	0				
110	Big Piney	GYA	WY	7	?	7						0	0	0				
111	Lava Mtn	GYA	WY	2	1	3			1			0	0	0				
112	Prospect	GYA	WY	2	?	2		2				0	0	0				
113	Popo Agie	GYA	WY	2	0	2						0	0	0				
114	Deer Creek	GYA	WY	2	0	2						0	0	0				
Sub-total				109	61	170	2	5	6	4	6	26	30	26	0	0		

Table 2a: Wyoming Wolf Packs (Outside of Yellowstone National Park) and Population Data for Wyoming's Portion of the Greater Yellowstone Recovery Area, 2008.

REF #	WOLF PACK 1	RECOV AREA	STATE	MINIMUM ESTIMATED			DOCUMENTED			KNOWN	CONFIRMED LOSSES 6					
				PACK SIZE DEC 2008			MORTALITIES				DISPERSED	MISSING 4	CONTROL 5	CATTLE	SHEEP	DOGS
				ADULT	PUP	TOT	NATURAL	HUMAN 2	UNKN 3							
<u>Misc. wolves</u>																
	<u>Crandall</u>	GYA	WY	0	0	0		1	2			6	4	0		
	<u>Soda Lake</u>	GYA	WY	0	0	0						4	0	0		
	<u>Daniel</u>	GYA	WY	0	0	0		5				0	0	0		
	<u>Gooseberry</u>	GYA	WY	0	0	0			1			6	3	0		
	Misc./Lone wolves	GYA	WY	8	0	8	1	4	4			4	4	0		
WY Total (outside YNP)			WY	117	61	178	3	15	13	4	6	46	41	26	0	0

- 1 Underlined packs are counted as breeding pairs toward recovery goals.
- 2 Excludes wolves killed in control actions.
- 3 Does not include pups that disappeared before winter.
- 4 Collared wolves that became missing in 2008.
- 5 Includes agency lethal control and take by private citizens under 10j regulation.
- 6 Includes only domestic animals confirmed killed by wolves.
- 7 Pack did not exist on December 31, 2008 and is not displayed on the map; see pack narrative.
- 8 See narrative text for explanation

FINAL_Table_2a_2b_2c_GYA_3-15-09.xls

Table 2b: Yellowstone National Park (YNP) Wolf Packs and Population Data for YNP's Portion of the Greater Yellowstone Experimental Area, 2008.

REF #	WOLF PACK 1	RECOV AREA	STATE	MINIMUM ESTIMATED			DOCUMENTED			KNOWN DISPERSED	MISSING 4	CONTROL 5	CONFIRMED LOSSES 6				
				PACK SIZE DEC 2008	ADULT	PUP	TOT	NATURAL	HUMAN 2				UNKN 3	CATTLE	SHEEP	DOGS	OTHER
<u>Yellowstone National Park Northern Range</u>																	
115	Quadrant Mountain	GYA	WY	4	0	4											
116	<u>Everts (470F)</u>	GYA	WY	5	3	8											
117	527F Group	GYA	WY	3	0	3											
118	471F Group	GYA	WY	3	0	3											
119	Blacktail Deer Plateau	GYA	WY	8	0	8											
120	Agate	GYA	WY	4	0	4	2			3							
121	Slough	GYA	WY	7	0	7	5			1	1						
122	<u>Druid</u>	GYA	WY	8	5	13				1							
	Misc/Lone wolves	GYA	WY	6	0	6	8			3	3						
Northern Range Total					48	8	56	15	0	0	8	4	0	0	0	0	
<u>Yellowstone National Park Non-Northern Range</u>																	
123	<u>Mollie's</u>	GYA	WY	10	3	13				1							
124	<u>Yellowstone Delta</u>	GYA	WY	7	2	9	1				1						
125	Ylwstne Dlta Sub Gp	GYA	WY	4	0	4											
126	<u>Bechler</u>	GYA	WY	6	3	9											
127	Cougar Creek	GYA	WY	4	0	4	1										
128	<u>Gibbon Meadows</u>	GYA	WY	19	6	25					1						
129	Canyon (587M)	GYA	WY	4	0	4											
Non-Northern Range Total			WY	54	14	68	2	0	0	1	2	0	0	0	0	0	
YNP Total in WY		GYA	WY	102	22	124	17	0	0	9	6	0	0	0	0	0	
WY Total (outside YNP)					117	61	178	3	15	13	4	6	46	41	26	0	0
WY STATE TOTAL			WY	219	83	302	20	15	13	13	12	46	41	26	0	0	

- 1 Underlined packs are counted as breeding pairs toward recovery goals.
- 2 Excludes wolves killed in control actions.
- 3 Does not include pups that disappeared before winter.
- 4 Collared wolves that became missing in 2008.
- 5 Includes agency lethal control and take by private citizens under 10j regulation.
- 6 Includes only domestic animals confirmed killed by wolves.
- 7 Pack did not exist on December 31, 2008 and is not displayed on the map; see pack narrative.
- 8 See narrative text for explanation

FINAL_Table_2a_2b_2c_GYA_3-15-09.xls

Table 2c: Wolf Population Data for the Greater Yellowstone Recovery Area, 2008.

WOLF PACK 1	RECOV		MINIMUM ESTIMATED PACK SIZE DEC 2008			DOCUMENTED MORTALITIES			KNOWN			CONFIRMED LOSSES 6			
	AREA	STATE	ADULT	PUP	TOT	NATURAL	HUMAN 2	UNKN 3	DISPERSED	MISSING 4	CONTROL 5	CATTLE	SHEEP	DOGS	OTHER
WY in GYA (Table 2b)	GYA	WY	219	83	302	20	15	13	13	12	46	41	26	0	0
MT in GYA (Table 1b)	GYA	MT	80	42	130	4	10	1	7	4	27	15	85	0	4
ID in GYA (Table 3c)	GYA	ID	5	5	17	0	1	1	0	0	10	5	0	1	1
GYA RECOVERY AREA	GYA	WY/MT/ID	304	130	449	24	26	15	20	16	83	61	111	1	5

- 1 Underlined packs are counted as breeding pairs toward recovery goals.
- 2 Excludes wolves killed in control actions.
- 3 Does not include pups that disappeared before winter.
- 4 Collared wolves that became missing in 2008.
- 5 Includes agency lethal control and take by private citizens under 10j regulation.
- 6 Includes only domestic animals confirmed killed by wolves.
- 7 Pack did not exist on December 31, 2008 and is not displayed on the map; see pack narrative.
- 8 See narrative text for explanation.

FINAL_Table_2a_2b_2c_GYA_3-15-09.xls

Table 4a: Northern Rocky Mountain minimum fall wolf population and breeding pairs* 1979-2008, by Federal Recovery Area.

Minimum Fall Wolf Population by Recovery Area:

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
<u>Recovery Area</u>																														
NWMT	2	1	2	8	6	6	13	15	10	14	12	33	29	41	55	48	66	70	56	49	63	64	84	108	92	59	126	171	230	282
GYA																	21	40	86	112	118	177	218	271	301	335	325	390	453	449
CID																	14	42	71	114	156	196	261	284	368	452	565	739	830	914
TOTAL	2	1	2	8	6	6	13	15	10	14	12	33	29	41	55	48	101	152	213	275	337	437	563	663	761	846	1016	1300	1513	1645

Breeding Pairs by Recovery Area:

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
<u>Recovery Area</u>																														
NWMT								1	2	1	1	3	2	4	4	5	6	7	5	5	6	6	7	12	4	6	11	12	23	18
GYA																	2	4	9	6	8	14	13	23	21	31	20	31	33	35
CID																		3	6	10	10	10	14	14	26	29	40	43	51	42
TOTAL								1	2	1	1	3	2	4	4	5	8	14	20	21	24	30	34	49	51	66	71	86	107	95

* By the standards of the Rocky Mountain Gray Wolf Recovery Plan and wolf reintroduction environmental impact statement, a breeding pair is defined as an adult male and an adult female wolf, accompanied by 2 pups that survived at least until Dec 31. Recovery goals call for 10 breeding pairs per area, or a total of 30 breeding pairs distributed through the 3 areas, for 3 years.

NOTE: Each year, wolf packs discovered in the current year that contain ≥ 2 yearlings and ≥ 2 adults are added to the previous year's breeding pair and population totals; similarly, if evidence in the current year indicates that < 2 pups or < 2 adults survived on December 31 of the previous year, that wolf pack is deleted from the previous year's breeding pair counts and population totals. Therefore, breeding pair counts and population totals are updated in current annual reports.

Table 4b: Northern Rocky Mountain minimum fall wolf population and breeding pairs* 1979-2008, by State.

Minimum Fall Wolf Population by State:

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
<u>State</u>																														
MT	2	1	2	8	6	6	13	15	10	14	12	33	29	41	55	48	66	70	56	49	74	97	123	183	182	152	256	316	422	497
WY																	21	40	86	112	107	153	189	217	234	272	252	311	359	302
ID																	14	42	71	114	156	187	251	263	345	422	512	673	732	846
TOTAL	2	1	2	8	6	6	13	15	10	14	12	33	29	41	55	48	101	152	213	275	337	437	563	663	761	846	1020	1300	1513	1645

Breeding Pairs by State:

Year	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	
<u>State</u>																															
MT									1	2	1	1	3	2	4	4	5	6	7	5	5	7	8	7	17	10	15	19	21	39	34
WY																	2	4	9	6	7	12	13	18	16	25	16	25	25	22	
ID																		3	6	10	10	10	14	14	25	26	36	40	43	39	
TOTAL									1	2	1	1	3	2	4	4	5	8	14	20	21	24	30	34	49	51	66	71	86	107	95

* By the standards of the Rocky Mountain Gray Wolf Recovery Plan and wolf reintroduction environmental impact statement, a breeding pair is defined as an adult male and an adult female wolf, accompanied by 2 pups that survived at least until Dec 31. Recovery goals call for 10 breeding pairs per area, or a total of 30 breeding pairs distributed through the 3 areas, for 3 years.

NOTE: Each year, wolf packs discovered in the current year that contain ≥ 2 yearlings and ≥ 2 adults are added to the previous year's breeding pair and population totals; similarly, if evidence in the current year indicates that < 2 pups or < 2 adults survived on December 31 of the previous year, that wolf pack is deleted from the previous year's breeding pair counts and population totals. Therefore, breeding pair counts and population totals are updated in current annual reports.

Table 5a: Northern Rocky Mountain States Confirmed Wolf Depredation¹, 1987-2008, by Recovery Area.

YEAR	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	TOTAL		
Northwest Montana Recovery Area:																									
cattle	6	0	3	5	2	1	0	6	3	9	16	9	13	10	8	9	6	6	9	6	26	37	190		
sheep	10	0	0	0	2	0	0	0	0	0	30	0	19	2	5	13	3	1	1	1	5	0	92		
other 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	0	1	0	2	1	10	23		
dogs	0	0	0	1	0	0	0	0	3	1	0	0	2	3	1	4	0	0	0	1	3	2	21		
wolves moved	0	0	4	0	3	0	0	2	2	10	7	0	4	0	5	0	0	0	0	0	0	0	37		
wolves killed	4	0	1	1	0	0	0	0	0	4	14	4	9	4	3	9	14	1	2	15	19	50	154		
Greater Yellowstone Recovery Area:																									
cattle											0	0	5	3	4	7	22	33	45	100	61	135	79	60	554
sheep											0	13	67	7	13	39	117	71	90	99	53	41	35	111	756
other 3											0	0	0	0	1	0	0	0	10	4	0	1	13	5	34
dogs											1	0	0	4	7	8	4	1	0	6	2	0	3	1	37
wolves moved											6	8	14	0	0	6	8	0	0	0	0	0	0	0	42
wolves killed											0	1	6	3	9	6	9	23	38	55	60	56	87	83	436
Central Idaho Recovery Area:																									
cattle											0	2	1	9	16	15	10	10	13	24	27	43	78	117	365
sheep											0	24	29	5	57	39	16	15	118	170	190	205	173	244	1285
other 3											0	0	0	0	0	0	0	0	0	0	2	0	0	3	5
dogs											0	1	4	1	6	0	1	4	6	3	9	7	7	11	60
wolves moved											0	5	0	3	15	10	5	0	0	0	0	0	0	0	38
wolves killed											0	1	1	0	5	10	7	14	7	30	41	71	80	131	398
Total, 3 Recovery Areas:																									
cattle	6	0	3	5	2	1	0	6	3	11	22	21	33	32	40	52	64	130	97	184	183	214		1109	
sheep	10	0	0	0	2	0	0	0	0	37	126	12	89	80	138	99	211	270	244	247	213	355		2133	
other 3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	5	10	5	2	3	14	18		62	
dogs	0	0	0	1	0	0	0	0	4	2	4	5	15	11	6	9	6	9	11	8	13	14		118	
wolves moved	0	0	4	0	3	0	0	2	8	23	21	3	19	16	18	0	0	0	0	0	0	0	0		117
wolves killed ²	4	0	1	1	0	0	0	0	0	6	21	7	23	20	19	46	59	86	103	142	186	264		988	

1 Numbers of animals confirmed killed by wolves in calendar year.

2 Includes wolves legally shot by livestock owners. Others killed in government control efforts.

3 Total livestock other than cattle and sheep confirmed killed by wolves between 1987 and 2008 are 21 llamas, 28 goats and 10 horses.

From 1987 to December 2008, Defenders of Wildlife has paid \$1,167,474 for wolf damage to livestock and guard dogs. An additional \$50,000 was donated directly to Montana towards state reimbursement efforts. Information is available at <http://defenders.org/wolfcomp/html>.

Table 5b: Northern Rocky Mountain Confirmed Wolf Depredation¹, 1987-2008, by State.

YEAR	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	TOTAL	
<u>Montana</u>																								
cattle	6	0	3	5	2	1	0	6	3	10	19	10	20	14	12	20	24	36	23	32	75	77	398	
sheep	10	0	0	0	2	0	0	0	0	13	41	0	25	7	50	84	86	91	33	4	27	111	584	
other 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	0	3	2	2	14	17	47	
dogs	0	0	0	1	0	0	0	0	4	1	0	1	2	5	2	5	1	4	1	4	3	2	36	
wolves moved	0	0	4	0	3	0	0	2	8	22	20	0	14	6	17	0	0	0	0	0	0	0	96	
wolves killed	4	0	1	1	0	0	0	0	0	5	18	4	19	7	8	26	34	40	35	53	73	110	438	
<u>Wyoming</u>																								
cattle										0	0	2	2	2	3	18	23	34	75	54	123	55	41	432
sheep										0	0	56	7	0	25	34	0	7	18	27	38	16	26	254
other 3										0	0	0	0	1	0	0	0	10	2	0	1	0	0	14
dogs										0	0	0	3	6	6	2	0	0	2	1	0	2	0	22
wolves moved										0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
wolves killed										0	0	2	3	1	2	4	6	18	29	41	44	63	46	259
<u>Idaho</u>																								
cattle										0	1	1	9	11	15	10	9	6	19	20	29	53	96	279
sheep										0	24	29	5	64	48	54	15	118	161	184	205	170	218	1295
other 3										0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
dogs										0	1	4	1	7	0	2	4	5	3	9	4	8	12	60
wolves moved										0	1	0	3	5	10	1	0	0	0	0	0	0	0	20
wolves killed										0	1	1	0	3	11	7	14	7	17	27	45	50	108	291
<u>Total, 3 States</u>																								
cattle	6	0	3	5	2	1	0	6	3	11	22	21	33	32	40	52	64	130	97	184	183	214	1109	
sheep	10	0	0	0	2	0	0	0	0	37	126	12	89	80	138	99	211	270	244	247	213	355	2133	
other 3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	5	10	5	2	3	14	18	62	
dogs	0	0	0	1	0	0	0	0	4	2	4	5	15	11	6	9	6	9	11	8	10	14	115	
wolves moved	0	0	4	0	3	0	0	2	8	23	21	3	19	16	18	0	0	0	0	0	0	0	117	
wolves killed ²	4	0	1	1	0	0	0	0	0	6	21	7	23	20	19	46	59	86	103	142	186	264	988	

1 Numbers of animals confirmed killed by wolves in calendar year.

2 Includes wolves legally shot by livestock owners. Others killed in government control efforts.

3 Total livestock other than cattle and sheep confirmed killed by wolves between 1987 and 2008 are 21 llamas, 28 goats and 10 horses.

From 1987 to December 2008, Defenders of Wildlife has paid \$1,167,474 for wolf damage to livestock and guard dogs. An additional \$50,000 was donated directly to Montana towards state reimbursement efforts. Information on the compensation program is available at <http://www.defenders.org/wolfcomp.html>.

Figure 5. Northern Rocky Mountain Wolf Breeding Pair Trends, by Recovery Area, 1979-2008

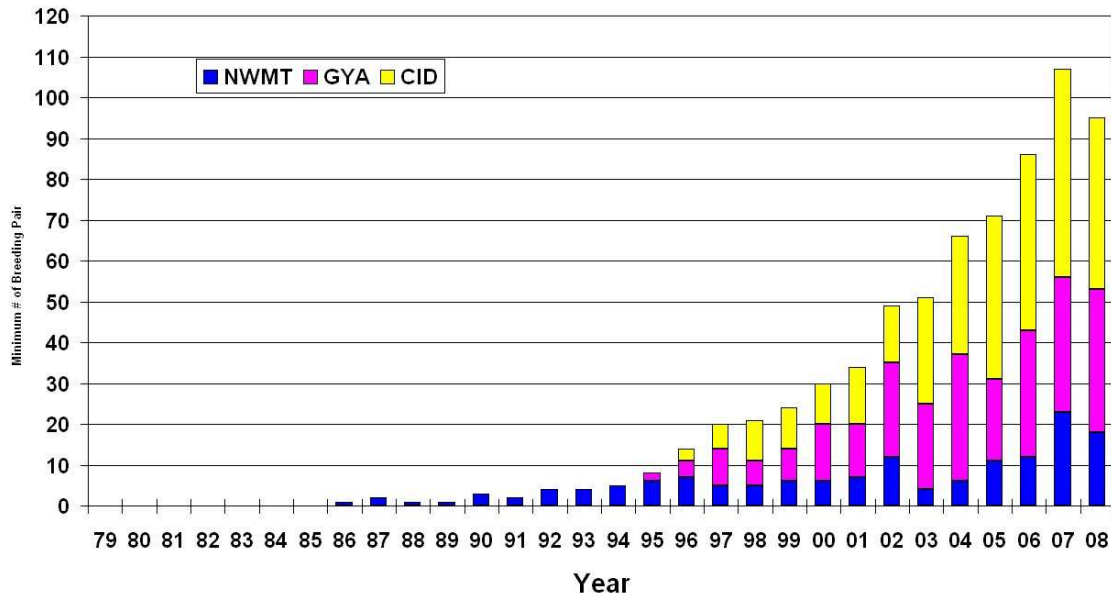


Figure 6. Northern Rocky Mountain Breeding Pair Trends by State, 1979-2008

