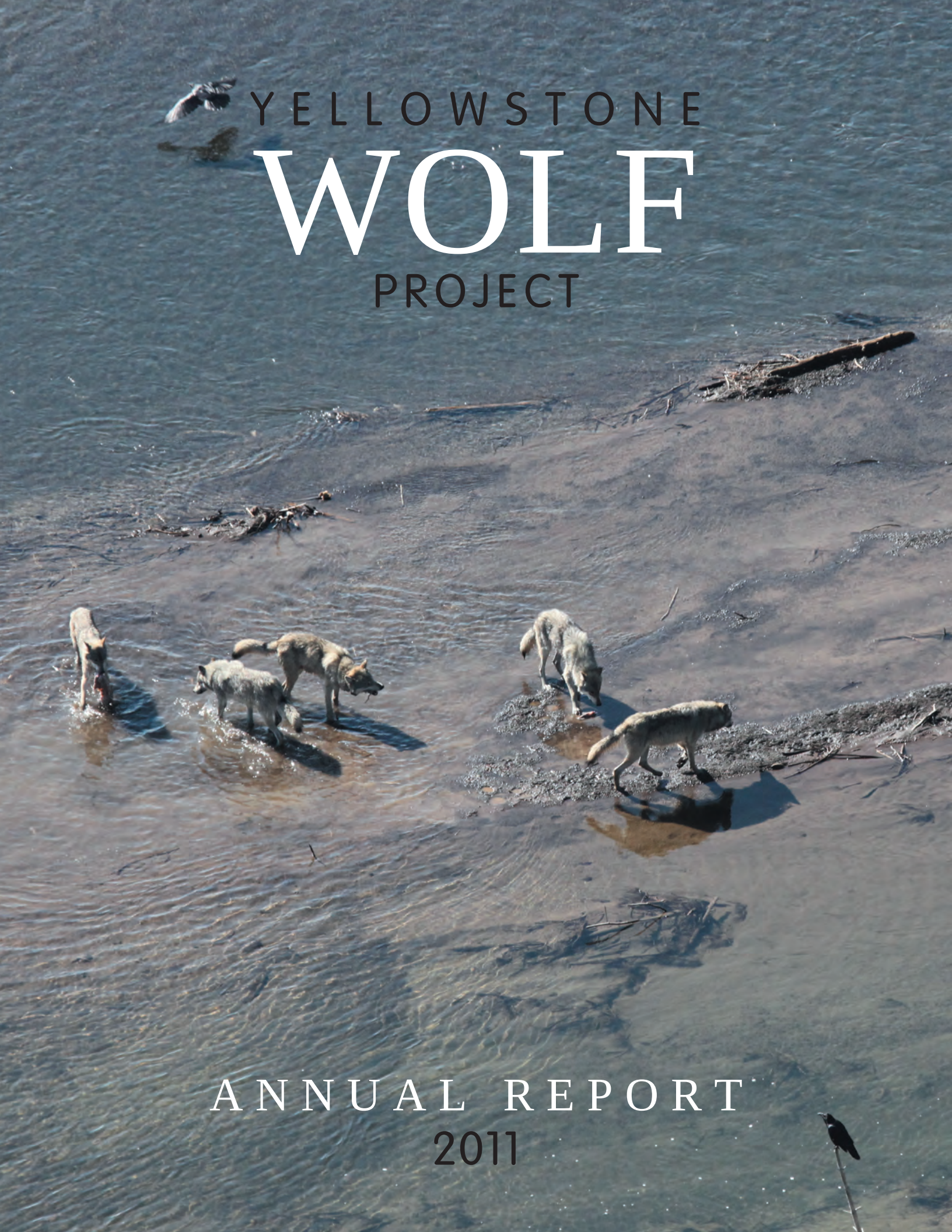

YELLOWSTONE WOLF PROJECT

ANNUAL REPORT 2011

Yellowstone Wolf Project

Annual Report
2011

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National Park Service
Yellowstone Center for Resources
Yellowstone National Park, Wyoming

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All photos not otherwise marked are NPS photos.

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Background

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

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

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

The US Fish and Wildlife Service (USFWS) has the primary responsibility for ensuring compliance with the Endangered Species Act and oversees the multi-state wolf recovery program. The USFWS had proposed that 30 breeding wolf pairs with an equitable and uniform distribution throughout the three Rocky Mountain recovery areas (greater Yellowstone, central Idaho, and northwest Montana) for three successive years would constitute a viable and recovered wolf population. Recovery goals were met in 2002, and gray wolves were removed from the endangered species list in Idaho and Montana in 2009; the USFWS did not accept the wolf management plan proposed by the state of Wyoming. In August 2010, a United States district judged ruled against a 2009 USFWS decision to remove the wolf from the endangered species list in only part of the recovery area (only Montana and Idaho had USFWS-approved wolf management plans), and wolves are protected in all three states again.

Four full-time NPS employees worked for the Yellowstone Wolf Project in 2011: Project Leader Douglas Smith, Project Biologist Daniel Stahler, and biological science technicians Erin Stahler and Rick McIntyre. Other paid and volunteer staff were Colby Anton, Nate Bowersock, Lisa Baril, Nick Bromen, Brannon Forrester, Jared Green, Allison Greenleaf, Josh Irving, Ryan Kindermann, Ky Koitzsch, Lisa Koitzsch, Hans Martin, Matthew Metz, Nathan Muhn, Brendan Oates, Mark Paulson, Emily Perry, Rebecca Raymond, Julie Tasch, Liv Visgirda, Jamie Walton, and Hilary Zaranek. Some of these staff members were paid technicians with funding provided by the Yellowstone Park Foundation.

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

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

2011 Summary

At the end of 2011, at least 98 wolves in 10 packs and including 2 loners occupied Yellowstone National Park (YNP). The number of breeding pairs (8) was the same as in 2010, when the population size was 97. However, the northern range wolf population has declined approximately 60% since 2007, mostly because of a smaller elk population, the main food of northern range wolves. The interior wolf population has declined less, probably because they augment their diet with bison. The severity of mange continued to decline in 2011, although some packs still showed signs of the mite. There was no evidence that distemper was a mortality factor as it was in 1999, 2005 and 2008. Pack size ranged from 3 (Agate Creek) to 19 (Mollie's) and averaged 10.2; the long-term average is 10. All nine packs that we had information on had pups. (We could not assess the reproductive status of the Bechler pack.) The average number of pups in early winter for packs that had pups was 4.1, compared to 4.8 in 2010 and 3.8 in 2009. A total of 34 pups in YNP survived to year end, four less than in 2010.

Project staff detected 343 kills (definite, probable, and possible combined) made by wolves in 2011, including 267 elk (78%), 15 bison (4%), 18 deer (5%), 1 moose (<1%), 2 pronghorn (<1%), 2 bighorn sheep (<1%), 2 badgers (<1%), 1 jackrabbit (<1%), 14 coyotes (4%), 1 raven (<1%), 7 wolves (2%), and 13 unknown prey (4%).

The composition of elk kills was 27% calves, 3% yearlings, 44% cows, 18% bulls, 3% adults of unknown sex, and 6% of unknown sex and age. Bison kills included 5 calves, 1 yearling, 2 cows, 6 bulls, and 1 adult of unknown sex.

Other research topics included population genetics, population regulation, disease, hunting behavior, spatial analyses of territory use, wolf pack leadership, multi-carnivore-scavenger interactions, breeding behavior, dispersal, and observations of wolf, grizzly bear, and bison interactions in Pelican Valley.

In 2011, twelve wolves from six packs were captured and collared. At year end 17% of the wolf population was collared. Wolf management activities included den site closures, several hazing events, and one removal of a food-conditioned wolf. Staff continued to manage wolf viewing areas in Slough Creek and Lamar Valley and other places where wolves were frequently sighted. Wolf Project staff made 17,635 visitor contacts during 2011 and estimated that 25,000 people observed wolves in the park. Wolf Project public outreach included 241 talks and 84 interviews.

Additional information on wolves in Yellowstone National Park and previous annual reports are available at *www.nps.gov/yell/naturescience/wolves.htm, www.greateryellowstonescience.org*, and *www.westerngraywolf.fws.gov*.

The Mary Mountain Pack continued to reside in Yellowstone's interior, with the core of their territory extending from Sentinel Meadows to Hayden Valley.

Yellowstone Wolf Pack Territories, 2011

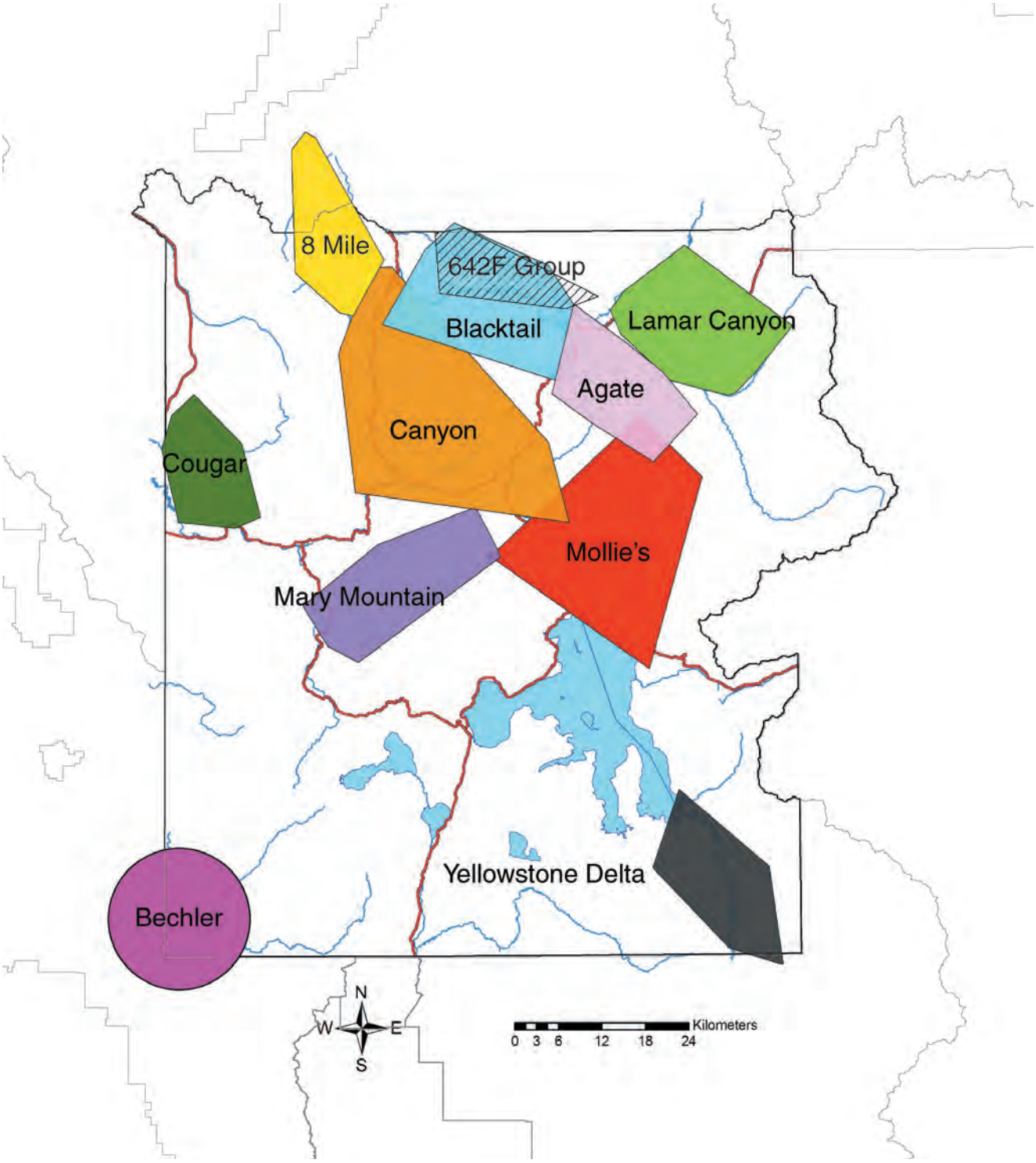

Figure 1. Wolf packs that had some or all of their territory within Yellowstone National Park in 2011. The Bechler pack has no collared wolves, so the estimated territory is represented by a circle. The Yellowstone Delta pack locations represented here are data collected only within the park, though the total territory range extends beyond the park boundary.

Mollie's pack in early December.

The Yellowstone Wolf Population

Population and Territory Status

At the end of 2011, at least 98 wolves in 10 packs (8 breeding pairs) and including 2 loners occupied Yellowstone National Park (fig. 1; Table 1). This is the same population size (97 wolves) as in 2010 and it indicates a stable population (fig. 2). The number of breeding pairs (8) also remained the same. The wolf population has declined approximately 60% since 2007, mostly because of a smaller elk population, the main food source of northern range wolves. The interior wolf population has declined less, probably because they augment their diet with bison. The severity of mange continued to decline in 2011, although some packs still showed signs of the mite. There was no evidence that distemper was a mortality factor as it was in 1999, 2005 and 2008. Pack size ranged from 3 (Agate Creek) to 19 (Mollie's) and averaged 10.2; the long-term average is 10.

This decline in the park-wide population since its peak in 2003 at 174 was brought about by disease and food stress, suggesting a long-term lower population

Table 1. Yellowstone National Park wolf population estimates, December 31, 2011.

Pack	Adults	Pups	Total
Northern Range:			
8-Mile	5	2	7
Agate	3	0	3
Blacktail	10	5	15
Lamar Canyon	6	5	11
Loners/Non-pack (642F)	2	0	2
Northern range total	**26**	**12**	**38**
Non-northern Range:			
Bechler (estimated)	unk	unk	4
Canyon	5	2	7
Cougar Creek	4	3	7
Mary Mountain	5	5	10
Mollie's	12	7	19
Yellowstone Delta	8	5	13
Loners/Non-pack	1	0	1
Non-northern range total	**35**	**22**	**60**
Total	**61**	**34**	**98**

Note: Underline denotes breeding pair.

equilibrium for YNP wolves, especially on the northern range. Northern range wolves have declined 60% since 2007, compared to 23% for interior wolves during the same period. Northern range wolves are more dependent on elk as a food source, and elk have declined 60% since 2007. Wolf packs in the interior also prey on bison, which were widely available in 2011. Disease impacts have also likely played a role in the wolf decline on the northern range because of higher canid density (wolves, coyotes, and foxes) than in the interior.

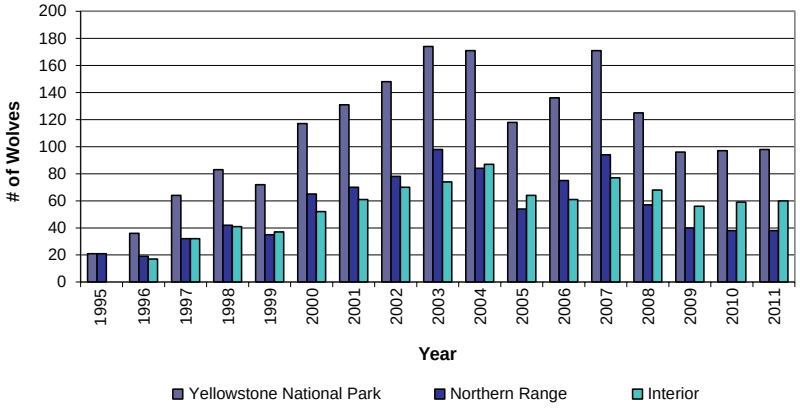

Figure 2. Yellowstone National Park early winter wolf population, 1995–2011.

Two packs (Quadrant Mountain and Grayling) disbanded in 2011. The territory near Mammoth and Gardiner that had been used by the Quadrant Mountain pack was taken over by the 8-mile pack from outside the park. The area used by the Grayling pack north of West Yellowstone remained unoccupied by a wolf pack. The Madison pack spent time in the park but was not considered a YNP pack.

Reproduction

All nine packs that we had information on (excluding the Bechler pack) had pups (fig. 3). The average number of pups per pack in early winter was 4.1, compared to 4.8 pups/pack in 2010 and 3.8 in 2009. A total of 34 pups in YNP survived to the end of the year in 2011, four less than in 2010.

Cougar Creek pack pups.

Mortalities

Ten radio-collared wolves died in YNP in 2011 (table 2). Intraspecific mortality was again the leading cause (6 deaths, 4 of them in the Agate Creek pack). One wolf died from a vehicle strike, and one from an altercation with an elk or bison. One wolf that had traveled outside the park was legally shot during the hunting season in Montana, and a dispersed member of the Blacktail pack was illegally killed outside the park near Gardiner, Montana, about four weeks after the legal hunting in that zone had closed.

Continued high mortality from conflict between wolves suggests food stress. Disease, primarily distemper and possibly mange, has also played a role in the population decline.

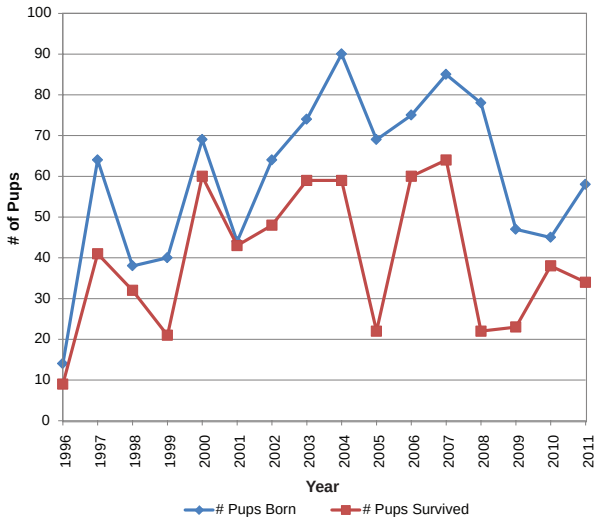

Figure 3. Yellowstone National Park pups born and survived until year end, 1995–2011.

Table 2. Confirmed mortalities of collared Yellowstone National Park wolves, 2011.

Wolf #/Sex	Age Class	Pack	Date of Death	Cause of Death
647M	Adult	Grayling Creek	3/14/2011	Vehicle
646F	Adult	Unknown	4/26/2011	Natural unknown
495M	Old adult	Mollie's	8/24/2011	Interspecific
642F	Adult	642F Group	10/5/2011	Harvest
586M	Old adult	Agate Creek	10/25/2011	Intraspecific
692F	Adult	Loner	11/5/2011	Illegal
715F	Adult	Agate Creek	11/25/2011	Intraspecific
641M	Adult	Agate Creek	12/17/2011	Intraspecific
636M	Adult	Mary Mountain	12/1/2011	Intraspecific
775M	Yearling	Agate Creek	12/22/2011	Intraspecific

Pack Summaries

Northern Range Packs

8-Mile Pack *(7 wolves: 5 adults, 2 pups)*

Named after a creek in Paradise Valley where it originated, the 8-mile pack was considered a boundary pack (a pack that ranges in and out of the park) until it settled on a territory in the park in 2011. It was observed in January in the Sepulcher Hills and could be tracked around Gardiner and Mammoth because one of its members, a large black male (SW763), had been collared by the state of Montana (the SW stands for southwest Montana). It likely displaced the Quadrant Mountain pack, of which only one member remained by late 2011. The 8-mile pack had 10 pups in 2011 but many were observed with mange by late summer and only two survived to year-end, possibly because of the mange infection. In addition to interacting with Quadrant, they were observed being chased by the Blacktail pack in November, but it was unknown if any 8-Mile pack mortalities resulted.

Blacktail Deer Plateau Pack *(15 wolves: 10 adults, 5 pups)*

With 15 members, the Blacktail Deer Plateau Pack was the largest pack on the northern range again this year. Still led by long-time alphas #693F and #778M, they maintained their core territory on Blacktail Plateau with some expansion into other areas. This territory is larger than that occupied by the previous pack (Leopold) in this area, probably because the reduced wolf density across the northern range has allowed expansion. This greater area and wide travel from Stephens Creek to Lamar Valley resulted in interactions with at least five other wolf packs. In November they temporarily usurped the Stephens Creek to Swan Lake Flats portion of the 8-mile pack's territory. Wolf #693F and likely two uncollared females denned in the Blacktail Plateau area. They all eventually shared a den and a total of five pups of unknown maternity survived until year end. Females #642 and #752 dispersed in February and formed a group with two males from the former Mt. Everts pack, #684 and #685. Blacktail disperser #692F rejoined the Blacktail wolves for a month while #693F was denning, but after that she was mostly alone. Four wolves, including #777M, traveled

The Blacktail pack, with 15 wolves, was the largest pack on the northern range in 2011.

away from the pack in November and December, but three returned by the end of the year. Most of the pack's wolves were infected with mange.

Agate Creek Pack *(3 wolves: 3 adults, 0 pups)*

Seemingly pressed between three other packs, the Agate Creek pack experienced high mortality in 2011 because of other wolves. In March long-time pack member #471F, who had been absent since 2008 and without a functioning collar since 2010, re-joined the pack in which she was born in 2003. She had started the short-lived Lava Creek pack, but after its dissolution she presumably became a lone wolf. Although Agate Creek pack structure had changed significantly since her departure, she still shared kinship with #715F and her offspring. As 2011 progressed, mortality resulting from intraspecific conflicts had a marked impact on Agate Creek pack structure. Regular trespasses by the Blacktail, Lamar Canyon, and Mollie's packs during fall and early winter resulted in thedeath of four collared wolves (alpha female #715, alpha male #641, #586M, and #775M) and the possible death of three others. From a mid-summer high count of 13, this group was reduced by year end to 3 wolves, the new alpha female #471 (8.5 years old) and two yearlings, neither of them males of breeding age. By the end of 2011 no pack member had a functioning collar, requiring tracking based on visual observation only.

Lamar Canyon Pack *(11 wolves: 6 adults, 5 pups)*

The Lamar Canyon pack was the most stable of the northern range packs. Led by founding members #755M and an uncollared gray female, the "06 female," the pack thrived in the northeast corner of the park, preying primarily on elk and mule deer. The pack started the year with five other members including #754M and #776F. Unfortunately, 776F's GPS collar was chewed off in early March. In April the pack localized in the former Druid Peak pack den area in the eastern Lamar Valley, where the "06 female" produced a litter of five pups, all of which survived through the year. An uncollared gray male yearling dispersed from the pack in late summer. The pack's territory expanded this year to cover the entire Lamar Valley and extend west through Slough Creek and east across the park boundary. They were often observed outside the park in the Silver Gate and Cooke City areas. In early winter, the pack likely interacted with the neighboring Blacktail Deer Plateau and Agate Creek packs; one encounter ended with a fatal attack on the Agate alpha female. At the end of the year, most of the pack had mange; the "06 female" had the least severe case.

642F's Group *(1 adult)*

This group formed when females #642 and #752 dispersed from the Blacktail Deer Plateau pack and joined former Mt. Everts pack males #684 and #685, both of whom had non-functioning collars. Based on data from their GPS collars, it was determined that the two females shared the same natal den hole. Five pups were seen but maternity is unknown. The males were seen once in March and not again until August. It is unclear if #685M was actually a group member or more of an interloper. The pack moved their pups to a ren-

At eight years of age, the nearly white #471F rejoined the Agate pack.

Led by founding member #755M (above), the Lamar Canyon pack thrived in 2011.

A new group briefly formed in 2011 when former Blacktail Deer Plateau females, #642 and #752, and former Mt. Everts pack males, #684 and #685, came together.

dezvous site near Mom's Ridge in Little America that was visible from the road. A black female yearling, presumably a Blacktail wolf, was seen with the group. The Blacktail pack made frequent visits to the area and likely killed the pups. The males, who were not seen after mid-September, were likely displaced or killed by the Blacktail pack. An uncollared gray male was seen with the females for a few days until the Blacktail wolves invaded again in late September. Wolf #642F and the yearling were legally harvested in the Montana wolf hunt in October. By year end, #752F had traveled alone in Montana, Wyoming, and Idaho.

Interior Packs

Mollie's Pack *(19 wolves: 12 adults, 7 pups)*

Yellowstone's largest pack and still firmly anchored to Pelican Valley, Mollie's pack made several uncharacteristically long visits to the northern range, resulting in several clashes with packs there. After alpha #495M was found dead in Pelican Valley in September, a necropsy revealed that the likely cause was an ungulate kicking him. His mate, #486F, disappeared shortly afterward, and without a functional radio-collar her fate was unknown, but she too likely died. In early December, Mollie's pack traveled to Hayden Valley where they encountered the Mary Mountain pack and killed the alpha male #636. The tracking plane arrived just minutes after this interaction occurred and observed #636M dead in snow covered with blood and Mollie's pack leaving the area about a half-mile away. Almost immediately after this interaction, a two-year-old male (#758) from Mollie's pack began spending time near the Mary Mountain pack in Hayden Valley. Over a period of about a week, he was able to integrate himself into the pack, replacing #636 as the breeding male. Only two collars remained in Mollie's pack (#686F and #779F) at the end of the year. Mollie's pack has typically visited the northern range each winter for brief periods, but a trip in early December was longer and more extensive than usual and had not ended by year end. Mollie's pack displaced and were dominant to the resident northern range packs in areas it traveled through—Specimen Ridge, Agate Creek, Slough Creek, and Lamar Valley. Late year observations indicate that #686F has replaced #486F as the dominant female within the pack. There was no known successor to #495M.

A Mollie's pack wolf with carcass in thermal area.

Canyon Pack *(7 wolves: 5 adults, 2 pups)*

As in previous years, the Canyon pack was one of the most visible and habituated packs in the park in 2011. With a large territory ranging from Hayden Valley to Mammoth Hot Springs, they typically spent time around Mammoth in the winter; denning and summer activities

D. STAHLER

Mollie's Pack

by Matt Metz

Since the restoration of wolves to Yellowstone National Park began in 1995, many individual wolves and wolf packs have become well known to those who observe them. Through these observations, we have come to better understand how the challenges of a wolf's life may vary greatly among individuals and packs. In many ways, the story of the Mollie's pack highlights the challenges of being a wolf in one of Yellowstone's harshest environments. But it did not start that way. Originally named for Crystal Creek on the northern range where the pack was among the first released in March 1995, the pack's six members found a landscape that contained few other wolves and plentiful elk.

By the time the pack denned in April 1996, however, three of the pack members had dispersed. The pack's alpha male and any pups that were born were killed at the den by the recently released Druid Peak pack of six wolves. Soon afterwards, the two remaining Crystal Creek wolves relocated to Pelican Valley in the park interior. This became the core territory for what was renamed Mollie's pack in 2000 in honor of the late director of the U.S. Fish and Wildlife Service, Mollie Beattie. Pelican Valley offered safety from other wolf packs but also new challenges.

Our observations of Mollie's pack from the airplane throughout the year and by ground crews during multi-week late winter camping trips have highlighted the difficulty of life there. First, Mollie's pack resides in an area with a largely migratory prey base. Unlike on the northern range, elk are typically present throughout most of the park's interior only from late May through early November. Mollie's pack preys primarily on elk during that period, and has two options for the remainder of the year: to travel to where elk are present or prey on bison that remain in the park interior during the winter (fig. 1).

During elk migratory periods in the fall and spring, Mollie's pack is often seen in Hayden Valley where it has occasionally encountered other wolf packs. In mid-winter Mollie's pack has sometimes sought elk on the northern range, where the resident wolf packs have typically met them with hostility. Because of this territorial hostility and the fact that northern range packs have usually had more wolves, Mollie's pack has much more commonly attempted to bring down a bison with their teeth. Observed interactions have sometimes lasted multiple days, most often in the core of the pack's territory near Pelican Valley, although the pack has also been found looking for a vulnerable bison in Hayden Valley. When attempting to bring down an animal that can weigh 10 to 12 times as much as you do, finding a more vulnerable animal is generally helpful. Bison vulnerability increases during the winter, and Mollie's pack is therefore more likely to

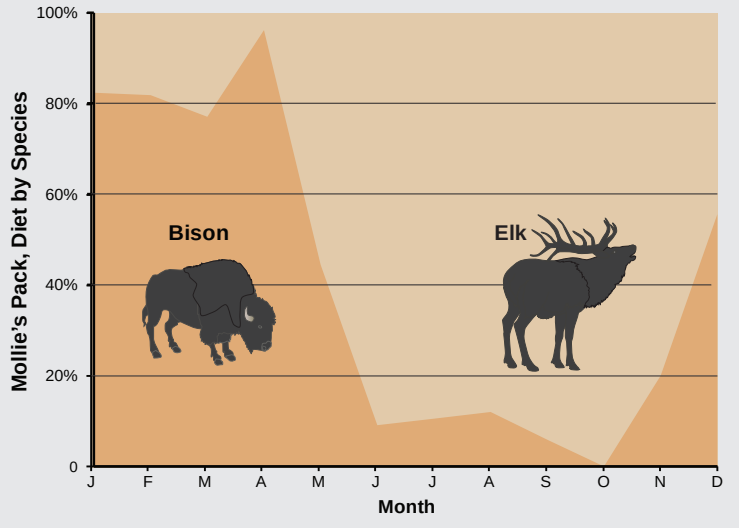

Figure 1. During winter, Mollie's pack must either travel to where elk are present or prey on bison that remain in the park interior.

D. STAHLER

Grizzly bears frequently take control of carcasses provided by Mollie's pack.

be found in Pelican Valley by late winter and early spring when some bison die as a result of the winter's harshness.

Although this should make life a little easier for Mollie's pack, Pelican Valley is also home to a dense population of grizzly bears that emerge from their dens during this time and seem to enjoy a free meal provided by the wolves. During late winter, bison carcasses are often taken over by an emerging grizzly or two. In summer, after the elk have returned and life was supposed to be a little easier, Mollie's pack is often found bedded near an elk kill. However, we usually also observe that a grizzly bear is controlling the carcass. As many as nine grizzly bears have been observed on a kill by Mollie's pack. It must be frustrating to not only have grizzly bears take over your food source, but know that it is going to happen while you are vigorously working toward acquiring your next meal. But that is how life has been for the wolves in Mollie's pack.

Will there always be this sort of struggle for Mollie's pack? At the end of 2011, they again visited the northern range, where the landscape has changed in recent years. The northern range wolf population has declined, and when Mollie's pack of 19 wolves arrived, it was larger than any pack they could have encountered. They went where they pleased and did as they desired. The Agate Creek pack took the brunt of it, as Mollie's pack killed at least two Agate Creek wolves in late December, including the alpha male #641, who was born into Mollies pack in 2007. As 2011 came to a close, Mollie's pack was spending much of its time on the northern range, although still making return trips to Pelican Valley. What the future holds for them is unknown, although for the time being at least, life seems at least a little easier.

take place in the interior. This pack is still led by #712M and an uncollared white female. Three pups were sighted early in the year and two survived until the end of the year. The pack used their traditional rendezvous site in Hayden Valley and was viewed by many park visitors throughout the summer. A female pup was killed by the Blacktail Plateau pack when the Canyon pack ventured into Mammoth in late December. After a female yearling was seen being fed by visitors in late spring, it had to be hazed several times to halt its behavior of approaching people (see section on Habituated Wolves below).

Mary Mountain Pack
(10 wolves: 5 adults, 5 pups)

The Mary Mountain Pack continued to reside in Yellowstone's interior, with the core of their territory extending from Sentinel Meadows to Hayden Valley. Newly collared alpha female #794 and alpha male #636 were the breeding pair again in 2011. Five pups were counted in the fall, all of which survived to year's end. The composition of the pack, however, changed when Mollie's pack entered Hayden Valley and killed #636M on December 1. Over the next ten days, daily winter study monitoring flights observed two-year-old #758M from Mollie's pack becoming the new alpha male of the Mary Mountain pack. During the first week, #758M was often bedded approximately 200 meters from the Mary Mountain wolves. But only 10 days after his natal pack killed #636M, #758M was seen interacting with the pups of the Mary Mountain pack. The next day, with alpha female #794 behind him, #758M was observed leading the Mary Mountain pack in travel, and his ascent to alpha male of the Mary Mountain pack was complete.

Yellowstone Delta Pack
(13 wolves: 8 adults, 5 pups)

The Yellowstone Delta pack continues to thrive in the most remote area of the lower 48 states, near the delta of the Yellowstone River. This is another pack that has significant portions of its territory outside the park, perhaps up to 50%, but they continue to den in the park most years and are thus considered a YNP pack. Wolf #760M, the largest wolf of the 433 wolves recorded in the park since 1995,weighed 147lbs when recollared this year, with

After the death of alpha male #636 in a territorial encounter with Mollie's pack, the Mary Mountain pack accepted Mollie's wolf #758M as the new breeding male.

no evidence of recently ingested meat adding to his total weight. A pup, #780M, was also collared but his collar was chewed off by other members of the pack in late summer. The pack again had 5 pups that survived to the end of the year. The pups showed some signs of mange but none of the cases were severe. Genetic testing of samples taken from pups during the early days of the pack's existence revealed that #126F, who was thought to be the alpha female of the pack, was not the mother of the pups she raised, so it is unknown who was the breeding female. Wolf #760M and #575F (non-functioning collar) are thought to be the pack's current alphas.

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

For the third straight year, eight-year-old #478F and five-year-old #689M led this usually cohesive pack that includes two-year-olds #757F and an uncollared black as well as three black pups produced by #478F at a new den site near Maple Creek. Lack of territorial strife and low wolf density has helped this pack remain dominant and established in the northwest region of the park. The Cougar Creek pack is atypical in that all members are black and have only produced black pups in their last few successful litters. This relates to recent research that explains the mechanisms influencing the variation in coat color differences and heritability throughout Yellowstone's population.

The Cougar Creek pack is atypical in that all members are black and have only produced black pups in their last few successful litters.

Bechler Pack
(Estimated 4 wolves, unknown sex/age)

Information about this uncollared pack in the southwest corner of the park is derived from exploratory aerial reconnaissance or reports from rangers and visitors. Based mostly on tracks from late season reports, four wolves were thought to be using the Bechler area. Aerial monitoring did not locate a den or any pups. Pups could have been missed, but without evidence of them this pack was not considered to have a breeding pair. Efforts to place collars in this pack, which have been unsuccessful in the last several years, will continue, but helicopter capture is difficult when no wolves in the pack are currently collared.

Other Wolves

#692

Former Blacktail Deer Plateau wolf #692F traveled long distances as a lone wolf. She was seen near the Hoodoo pack in the Crandall Creek area east of the park, led by a relative, #525F, who was previously with the Agate Creek pack. She rejoined the Blacktail wolves for a month, but was only seen alone after May. She made trips to the interior of Yellowstone and to Jardine, Montana. Unfortunately, she was illegally killed by a poacher in early November. For a wolf in autumn who traveled so widely she was in excellent condition with no signs of mange.

#578

Former Gibbon Meadows pack wolf #578F was last seen in Little America with three uncollared black wolves in April. Her collar was five years old and had not been functioning. Her signal was very weak and could only be tracked when she was very close. Her group has not been seen since then.

#587

Former Canyon pack wolf #587M was seen near Old Faithful in June and possibly near Norris Hot Springs in August. He is 10 or 11 years old and his collar is no longer functional.

Clear Creek Group

This group of three adults and four pups was first documented on tracking flights in July near Clear Creek. Because this group has no collars, they could not be tracked and were not included in the end of the year count. They may have left the park.

Snake River Pack

This pack usually dens just inside the park border but spends most of the time outside the park. Three or four pups were seen at the den site on one occasion. The pack count and composition is unknown.

Former Blacktail Deer Plateau wolf #692F (pictured above and above right) traveled long distances as a lone wolf in 2011.

Wolf Project staff process an Agate pack wolf during capture operations.

Wolf Capture and Collaring

Twelve wolves from six packs were captured and radio-collared in 2011: one old adult, 5 adults, 1 yearling, and 5 pups of which 8 were males and 4 females (table 3). Both VHF and downloadable GPS collars were deployed. As of the end of 2011, 17% of the population was collared.

Wolf Predation

Wolf–Prey Relationships

Wolf–prey relationships were documented by observing wolf predation directly and by recording the characteristics of prey at kill sites. Wolves were intensively radio-tracked and observed for two 30-day periods, in March and from mid-November to mid-December. The Agate Creek, Blacktail, and Lamar Canyon packs were the main study packs monitored by three-person ground teams and aircraft during both winter-study sessions.

Five other packs (Canyon, Cougar Creek, Mary Mountain, Mollie's, Quadrant) were monitored from aircraft. The Yellowstone Delta pack was monitored less intensively because of logistical constraints and the Bechler pack (no radio collars) could not be located. Data from downloadable GPS collars were also used to detect predation by the Agate Creek and Blacktail packs during winter studies and a May to July monitoring period.

During these established predation studies, and opportunistically throughout the year, project staff recorded behavioral interactions between wolves and prey, kill 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.

Composition of Wolf Kills

Project staff detected 343 kills (definite, probable, and possible combined) made by wolves in 2011, including 267 elk (78%), 15 bison (4%), 18 deer (5%), 1 moose (<1%), 2 pronghorn (<1%), 2 bighorn sheep (<1%), 2 badgers (<1%), 1 jackrabbit (<1%), 14 coyotes (4%), 1 raven (<1%), 7 wolves (2%), and 13 unknown prey (4%). The composition of elk kills was 27% calves, 3% yearlings, 44% cows, 18% bulls, 3% adults of unknown sex, and 6% of unknown sex and age. Bison kills included 5 calves, 1 yearling, 2 cows, 6 bulls, and 1 adult of unknown sex.

Given the controversy regarding the impact of wolves on ungulate populations, how wolves are affecting elk continues to be a primary focus of predation studies in YNP. The northern range elk population has declined since wolf reintroduction (fig. 4). In addition to wolves, factors affecting elk population dynamics include other

Table 3. Yellowstone Wolf Project collaring operations, 2011.

Capture Date	Wolf #/ Sex	Age	Color	Pack
1/3/2011	586M	Old adult	Gray	Agate Creek
	641M	Adult	Gray	Agate Creek
	775M	Pup	Gray	Agate Creek
	776F	Pup	Gray	Lamar Canyon
1/27/2011	777M	Pup	Gray	Blacktail
	778M	Adult	Gray	Blacktail
	779F	Pup	Black	Mollie's
	752F	Yearling	Black	Blacktail
1/28/2011	760M	Adult	Gray	Yellowstone Delta
	780M	Pup	Gray	Yellowstone Delta
3/23/2011	636M	Adult	Gray	Mary Mountain
	794F	Adult	Black	Mary Mountain

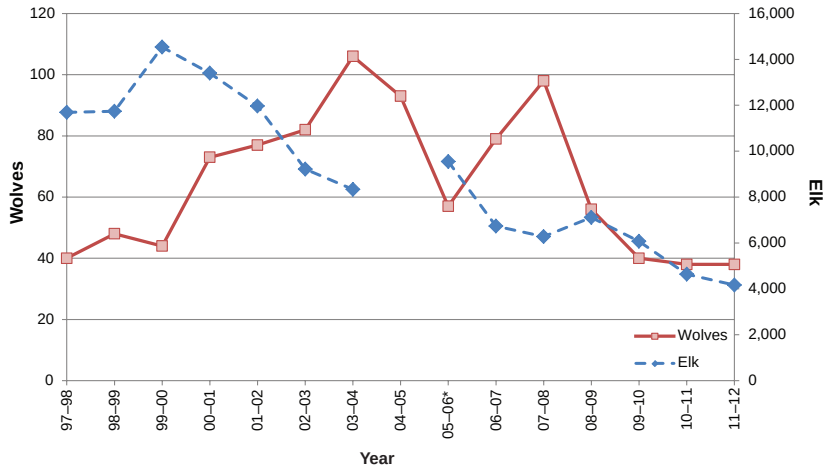

Figure 4. Yellowstone National Park northern range elk and wolf population counts, 1995–2011.

predators, management of elk outside the park, and weather patterns (e.g., drought, weather severity). Weather patterns influence forage quality and availability, ultimately impacting elk nutritional condition. Consequently, changes in prey selection and kill rates through time result from complex interactions among these factors.

Winter Studies

March. During the 2011 March winter study (30 days), study packs were observed for a total of 436 hours from the ground. Because of poor weather conditions, wolf packs were only located from the air for 6 days. The number of days wolf packs were located ranged from 5 (Mary Mountain) to 6 (Agate, Blacktail, Canyon, Cougar, Lamar Canyon, Mollie's, and Quadrant).

A total of 83 carcasses fed upon by wolves were discovered by air and ground teams. Of these, 68 (82%) were killed by wolves, which included 59 elk, 6 bison, 2 bighorn sheep, and 1 deer. Among elk, 11 (19%) were calves, 4 (7%) were yearlings, 35 (59%) were cows, 8 (14%) were bulls, and 1 (2%) was of unknown sex and age. Wolves also fed upon 7 elk and 8 bison that they did not kill, most of which died from severe winter conditions. The rate at which wolves acquired prey, both through their kills and through scavenging winter-killed carcasses, was high compared to most late winters, and was likely the result of ungulates being in very poor nutritional condition due to the significantly higher than average snow depth (2010–2011).

November–December. During the 2011 November-December winter study (30 days), study packs were observed for a total of 253 hours from the ground. Air crews were able to locate packs on 13 days, and the number of days wolf packs were successfully located ranged from 3 (Yellowstone Delta) to 13 (Agate, Blacktail, Cougar, Lamar Canyon, Mary Mountain, and Mollie's). A total of 32 carcasses fed upon by wolves were discovered by air and ground teams. Of these, 29 (91%) were killed by wolves, which included 26 elk, 2 bison, and 1 deer. Among elk, 3 (12%) were calves, 1 (4%) was a yearling, 11 (42%) were cows, and 11 (42%) were bulls. The wolves also fed upon 3 bull elk that they did not kill. In comparison to other early winter study periods, kill rates were low, as was the percentage of calves in the wolves' diet.

GPS Collars and Winter Predation. During March, we successfully searched GPS clusters of wolves, 775M of the Agate Creek pack, and 777M of the Blacktail pack. For the Agate Creek pack, all carcasses were

During two 30-day winter study periods, volunteers and staff observe wolves from the ground and by air.

Wolves acquire prey through both their kills and scavenging winter-killed carcasses like this bull elk.

Wolf Project staff move an elk carcass away from the road to allow wolves and scavengers to feed undisturbed.

detected by GPS clusters, and traditional monitoring methods found ~85% of all carcasses. However, for the Blacktail pack, only ~70% of carcasses were detected through GPS clusters; traditional monitoring methods found ~80% of all carcasses.

By November–December, although Agate 775M was still present, we could not download his locations because his GPS collar had malfunctioned. However, we were able to search GPS clusters of Blacktail 777M's locations for the first week of winter study. During this period, most carcasses detected by GPS clusters were not found via our traditional monitoring methods. Unfortunately, 777M and three other Blacktail wolves then left the pack for the remainder of winter study during which we did not search his GPS locations.

As in previous years, we suspect that differences in the detection of carcasses between GPS clusters and traditional monitoring methods were influenced by prey size, pack size, carcass location, and the time of day that wolves were present at a carcass. We plan to continue this work in 2012 as our results in 2011 suggest that neither our traditional methods nor GPS clusters always detect predation events during winter, and our most complete assessment of prey composition and kill rate may therefore come through combining data acquired through these methods.

Summer Predation

In 2011, the Yellowstone Wolf Project continued to assess the predation patterns of wolves during from May through July. We searched the GPS clusters of Blacktail 777M for this entire period, and GPS clusters of Agate 775M during June until his collar malfunctioned. Through this effort, we found 67 suspected kills or fresh carcasses of ungulate prey, which included 59 elk, 2 deer, 5 bison, and 1 unknown species. Accordingly, 88% of the ungulates detected through GPS clusters from 1 May–31 July were elk, which is similar to most previous years. Among elk, 53% were neonate calves, 3% were 11–14 month old elk, 29% were cows, and 15% were bulls.

Population Genetics

Collaborative efforts between the Yellowstone Wolf Project and the University of California, Los Angeles (UCLA) continued working with genetic samples from YNP wolves in 2011. Dan Stahler received his doctorate at UCLA, and submitted one of several manuscripts for publication resulting from his research involving molecular data on YNP wolves.

Stahler and Smith continued to collaborate on a National Science Foundation grant awarded to co-principal UCLA investigators Dr. Robert Wayne and Dr. John Novembre that aims to further understand the evolutionary and ecological dynamics of coat color in wolves. Previous work has shown that black wolves get their dark coat color from a genetic mutation that first occurred in dogs, and was likely introduced and selected in wild wolf populations through mating with dogs that came into North America with humans thousands of years ago. Given that the number of gray and black wolves in Yellowstone is roughly equal, it has been hypothesized that there are fitness trade-offs associated with the gene responsible for coat color. Separately, Smith and Stahler became co-investigators on a Natural Environment Research Council

grant with collaborators Dr. Tim Coulson (Imperial College) and Dr. Dan MacNulty (Utah State University) that integrates population genetic data on YNP wolves with ecological, population dynamics, and life history datasets. This research has led to a paper in the journal Science (see "YNP Wolf Publications" below) that explores wolf adaptation to climate change under varying environmental conditions, and helps explain the maintenance of coat color genetics in YNP wolves by showing that black heterozygotes have survival advantages over gray and black homozygous genotypes. Work on both studies is ongoing.

The Wolf Project is also collaborating with UCLA on a new project that will be the first to sequence entire genomes of wild wolves. A DNA sample from 302M is being used for whole genome sequencing that will create his genetic map, allowing us to better understand how genes may impact wolf behavior, health, life history, and canid evolution.

Disease

Our most active area of disease research continued to be on sarcoptic mange, an infection caused by the mite (*Sarcoptes scabiei*), which reached epidemic proportions on the northern range in 2009. The mite is primarily transmitted through direct contact and burrows into its host's skin, where it feeds and lays its eggs. This process can initiate an extreme allergic reaction in the host, causing the host to scratch infected areas, resulting in hair loss and secondary infections. While the epidemic of mange subsided this past year, the infection is still present at lower prevalences throughout the park.

In 2008, the Yellowstone Wolf Project began a partnership with the U.S. Geological Survey to address questions about how mange is affecting individual wolves and their overall population in the Yellowstone region. This collaboration continues to include Paul Cross, Mike Ebinger, and Catherine Haase of the U.S. Geological Survey, Rebecca Raymond, Colby Anton and Nate Bowersock of the Wolf Project, Emily Almberg and Peter Hudson of Penn State University, and Andy Dobson of Princeton University. This team submitted a manuscript for publication in 2012 that describes the invasion of *Sarcoptes scabiei*, into the park and documents its negative impacts on pack size and growth rates. Ongoing analyses will assess the individual and pack-level risk factors for infection and will explore the impacts of mange on individual survival and reproduction.

Headway has been made on the use of thermal imagery to measure the heat loss associated with mange-induced hair loss. In collaboration with the Grizzly Wolf Discovery Center in West Yellowstone, we have undertaken pilot work with several of their captive wolves to develop the methods needed to model heat loss from wolves in the wild. Ultimately, these measurements will enable us to estimate the caloric costs of infection and infer how mange alters the energy balance that wolves must maintain for survival.

Ongoing disease surveillance detected two animals infected with canine distemper virus along the park's western boundary in 2010. However, serological data from the rest of the park suggested that these were isolated cases and that canine distemper did not spread into the park. However, the first two cases to be found in the park of bordetella, a respiratory infection caused by the bacterium, *Bordetella brochiseptica*, were detected in a wolf and a coyote.

A Blacktail wolf with slight symptoms of mange, which persisted at lower prevalences this year throughout the park.

Mange, an infection caused by a mite (Sarcoptes scabiei) *that burrows into its host's skin, results in hair loss and secondary infections.*

Wolf Management

Area Closures

To prevent human disturbance of denning wolves during the sensitive period of pup rearing, visitor entry was closed to areas surrounding the dens and rendezvous areas of the Canyon, Madison and Lamar Canyon packs for various times this summer. One of three dens for Blacktail and Mollie's pack den sites were protected from disturbance coincidental to area closures for bear management in the park. Areas around the other packs' den sites were not closed because historically low visitor use made it unlikely these dens would be disturbed.

Wolf Road Management Project

Since wolf reintroduction began in Yellowstone, the Lamar Valley has become the premier location worldwide to observe free-ranging wolves. The main pack of interest was initially the Druid Peak pack, which denned in or near the Lamar Valley from 1997 through 2009. This year differed with the emergence of the Lamar Canyon pack as a very visible pack.

Yellowstone staff established the Wolf Road Management Project 12 years ago to better deal with the opportunities and problems that accompany increasing visitor numbers. The objectives for this program are: 1) human safety, 2) wolf safety, 3) visitor enjoyment; and 4) wolf monitoring and research. A record number of visitor contacts were made by staff in the 2011 season (17,635 people) and the summer season was characterized by high wolf-viewing opportunities.

Exclosure Hill Rehabilitation Project

For many years the wolf pack in the area on the north side of the road southeast of the Lamar Ranger station used a rendezvous site near the outlet of Chalcedony Creek. Without a designated trail or parking area, wolf watchers were damaging the vegetation and compacting the soil by parking their cars adjacent to the road and walking along the slope and top of a nearby hill.

Volunteers rehabilitate a heavily used roadside wildlife viewing area.

Wolf project staff devote time and energy to managing the potential hazards created by wolves and visitors on roadsides.

Working with Ranger and Maintenance divisions, we devised a plan that would mitigate these problems while allowing people to continue to use this wildlife viewing area. On a single day in October 2011, 30 volunteers through the Yellowstone Country Guardians Leadership Challenge program, helped install more than 40 restoration signs, setup several erosion control systems, removed debris and trash, tilled and reseeded degraded areas, and designated a newly established trail. Overall time spent on the project exceeded 150 hours. We hope that this work will set a precedent for what can be done to help remedy the impacts of a heavily used roadside wildlife viewing area.

Habituated Wolves

Of the three wolves that closely approached people in 2011, two were successfully hazed. The third wolf was hazed each of the seven times it was known to have approached people, but the hazing was not effective. Once hazing loses effectiveness, wolves can become more interested in people and human foods. Once we documented that this wolf was food-conditioned and clearly showed interest that was not correctable by hazing, the wolf was lethally removed. This is the second time it has been necessary to remove a food-conditioned wolf since wolves were reintroduced in YNP.

Wolf Management Outside Yellowstone

Information on wolf management and recovery status in the greater Yellowstone revocery area in 2011 is available at *www.westerngraywolf.fws.gov*.

Collaborative Research

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

Wolf #712M faces off with a bison.

Wolf Project Students: Direct Assistance

Two graduate students were partially funded by their work in collaboration with the Wolf Project in 2011: Kira Cassidy-Quimby and Alessia Uboni. Cassidy-Quimby is a long-time employee on the project who has moved on to work in a new capacity. Uboni became a collaborator after working as a GIS technician in Yellowstone Center for Resources.

Title: Individual participation in intraspecific encounters and the benefits of aggression in gray wolves of Yellowstone National Park
Graduate Student: Kira Cassidy-Quimby, Master of Science candidate
Committee Chair: Dr. L. David Mech, University of Minnesota, St. Paul

Title: Wolf spatial analysis: habitat use and territorial patterns
Graduate Student: Alessia Uboni
Committee Chair: Dr. John Vucetich, Michigan Technological University

Yellowstone Wolf Project Research

Predator–Prey. A major objective for Yellowstone wolf research is wolf–prey relationships. Biannual 30-day winter studies (November 15-December 14 and March 1-30) ongoing for 15 years are designed to record early and late winter predation patterns. More recently, summer predation patterns have been studied using downloadable GPS collar data (May through July) along with scat collection for diet analysis. GPS collars are now also being used simultaneously with winter studies. During these established predation studies, and opportunistically throughout the year, project staff record behavioral interactions between wolves and prey, kill rates, total time wolves feed on carcasses, percent consumption of kills by scavengers, characteristics of wolf prey (e.g., sex, species, nutritional condition), and characteristics of kill sites.

Hunting Behavior. This aspect of wolf–prey relationships has been a research focus in Yellowstone largely through the efforts of long-term collaborator Dr. Dan MacNulty. With the availability of longitudinal data from repeated observations of individually-known wolves hunting prey, behavioral, ecological and evolutionary dynamics of predation have been uniquely studied. Recent published research has focused on predatory performance of wolves with respect to age, body size, and group size, and their relationship to ecological and evolutionary dynamics.

Pelican Valley Wolf, Grizzly Bear, and Bison. Starting in 1999, the Yellowstone Wolf Project has monitored wolves, bison, and grizzly bears from a hilltop observation point in Pelican Valley for two to four weeks in March. The primary goal of this study is to document the behavioral interactions between wolves, bison, and grizzly bears in order to: 1) identify patterns of wolf predation on bison; 2) determine how the risk of wolf predation influences bison foraging behavior, movement, and habitat use; and 3) assess the importance of wolf-killed ungulates for grizzly bears emerging in early spring.

Population Dynamics. Using data from a radio-marked population, year-round research focuses on understanding the major components of wolf population dynamics (births, deaths, immigration, and emigration). Monitoring efforts through ground and aerial tracking and observations provide annual census size, territory size and use, reproductive success, cause-specific mortality, survival, and other life history patterns. Data on social

Elk antlers in winter.

behavior and pack structure are collected to investigate patterns of dispersal, social stability, territoriality, and age structure. Necropsies of all recovered wolf carcasses provide cause-specific mortality data.

Dispersal. The ecological, demographic, and genetic implications of dispersal are important areas of research for Yellowstone wolf biologists. Using radio collar tracking information and genetic techniques from other project objectives, current research aims to understand basic demographic patterns of dispersal (age, sex, distance, season) along with the influence of wolf density, pack structure and size, kinship, and breeder loss in a naturally regulated system. Additionally, migrant detection analysis using molecular techniques will assess gene flow and genetic connectivity to other regional wolf populations.

Breeding Behavior. During January and February each year, project staff monitor Yellowstone packs for courtship and breeding behaviors. The opportunity to study breeding behavior in wild wolves is unprecedented, and this study is designed to investigate the role of interacting social and ecological factors influencing individual attempts to breed and their relative fitness consequences.

Wolf Pack Leadership. The purpose of this study is to determine the nature of leadership in wild wolf packs by defining when leadership is asserted and by which wolves in the hierarchy. Due to the difficulty of observing wild wolves in a natural environment, leadership has been an unexplored aspect of wolf behavior. By observing packs with recognizable individuals, leadership behavior can be distinguished between identified dominant (alpha) and non-dominant (non-alpha) wolves. This study gathers data to determine under what circumstances leadership behavior is demonstrated and how it is correlated to breeding status, social status, environmental conditions, and season.

Wolf Capture and Handling. Each year, approximately 20-30 wolves are helicopter darted and radio-collared in order to obtain data on morphometrics, disease, genetic sampling, age, sex, breeding status, and condition. Both VHF and GPS collars are deployed, and provide the basis for nearly all other aspects of Yellowstone's wolf research program.

Disease. Research on the disease ecology of Yellowstone wolves is ongoing. The majority of disease monitoring comes from extracting and analyzing blood samples. Serum and blood profile analyses record disease exposure and prevalence. Nasal, rectal, and ocular swabs collected on both live and dead wolves also aid in documenting disease and cause of death. Disease screening includes parvovirus, distemper, and infectious canine hepatitis. Additionally, a population-wide sarcoptic mange monitoring effort has begun using an individual-based monthly documentation of mange occurrence, severity, and recovery in all packs through the use of direct observations, handling, aerial photographs, and thermal imagery.

Population Genetics. Annual sampling of blood, tissue, and scats from live and dead wolves is used to study genetic diversity, population structure, parentage and kinship, gene flow, and selection of fitness related traits. In combination with ecological and behavioral datasets, genetic data supports research on evolutionary and ecological dynamics in the Yellowstone population. Examples of current research questions include: regional population genetic structure; evolutionary history and selection for coat color; evolution of life history traits; and effect of kinship on breeding strategies, territoriality, and strife. Additionally, whole genome sequencing on Yellowstone wolves is underway through collaboration with UCLA.

Multi-carnivore and Scavenger Interactions. Research is ongoing to understand the degree to which exploitative and interference competition is occurring among Yellowstone's carnivores. Data are collected on all observed wolf–bear, wolf–cougar, and wolf–coyote interactions. Additionally, data on scavenger species diversity, abundance, and carcass utilization at wolf kills are collected to understand how these interactions influence structure and function of the ecosystem.

Wolf Spatial Dynamics. Thousands of wolf radio locations, both VHF and GPS, have been gathered since wolves were reintroduced to YNP in 1995. Rigorous analyses using these data have begun examining questions concerning habitat use and territoriality. Year-to-year changes in territory use are being related to variables such as elk density and distribution, intraspecific strife, pack size, and reproduction. Other analyses underway are habitat use (using Resource Selection Functions), travel, territory size, summer vs. winter, and night vs. day, as well as comparisons between GPS and VHF collars.

Wolf watchers at Slough Creek, one of the best places in the world to observe wild wolves.

Staff and Public Involvement

Staff and Volunteers

Four full-time NPS employees worked for the Yellowstone Wolf Project in 2011: Project Leader Dr. Douglas Smith, Project Biologist Dr. Daniel Stahler, and Biological Science Technicians Erin Stahler and Rick McIntyre. Other paid and volunteer staff were Colby Anton, Nate Bowersock, Lisa Baril, Nick Bromen, Brannon Forrester, Jared Green, Allison Greenleaf, Josh Irving, Ryan Kindermann, Ky Koitzsch, Lisa Koitzsch, Hans Martin, Matthew Metz, Nathan Muhn, Brendan Oates, Mark Paulson, Emily Perry, Rebecca Raymond, Julie Tasch, Liv Visgirda, Jamie Walton, and Hilary Zaranek.

Outreach

Yellowstone Wolf Project staff gave 241 formal talks and 84 interviews. Talks were at both scientific conferences and to general audiences. Interviews were to all forms of media. Staff assisted 25,000 people viewing wolves in the field year-round, making 17,635 visitor contacts and giving 664 informal talks.

Visiting Scholars

Olof Liberg, one of the leading experts on wolves in Europe and project lead for SKANDULV, the wolf research and management organization for Scandinavia,

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

Year	Visitor contacts	Informal talks	# of people at talks	Total contacts	# of people seeing wolves	Time wolves visible (hours)	Days wolves visible
2000	6,760	83	1,833	8,593	8,145	283.2	77/82 (94%)
2001	9,375	288	1,552	10,927	11,210	368	125/125 (100%)
2002	9,450	244	1,952	11,402	12,414	460	126/126 (100%)
2003	9,375	258	2,064	11,439	9,827	415	124/124 (100%)
2004	9,450	226	2,260	11,710	8,721	395	126/126 (100%)
2005	6,200	125	1,250	7,450	11,695	790	124/124 (100%)
2006	6,500	200	2,000	8,500	13,640	620	124/124 (100%)
2007	8,775	230	2,300	11,075	32,600	750	117/117 (100%)
2008	8.660	358	3,925	12,585	35,000	830	124/124 (100%)
2009	10,040	602	5,245	15,285	31,000	750	124/124 (100%)
2010	9,975	561	6,250	16,225	38,000	850	126/126 (100%)
2011	10,420	664	7,215	17,635	25,000	600	126/126 (100%)

The 2011 Wolf Project staff and volunteers (back row, left to right): Dan Stahler, Joshua Irving, Colby Anton, Julie Tasch, Nate Bowerstock, Jared Green, Hans Martin, Brannon Forrester, Doug Smith; (front row, left to right): Rebecca Raymond, Liv Visgirda, Ryan Kindermann, Matt Metz, Nate Muhn, Erin Stahler.

Wolf Project staff receive helicopter training prior to capture operations and winter study monitoring activities.

canoed and rode horseback in the Yellowstone backcountry in September 2011, gaining a true feel for Rocky Mountain wolf country. Dr. Liberg also gave a presentation to YNP staff and explained wolf management issues in Scandinavia, particularly the trade-off in social tolerance between wolf protection and legalized wolf hunting, which is a pressing issue in Europe.

Acknowledgements

We continue to be impressed and thankful for the many people who come forward every year to work with and help Yellowstone wolves. First and foremost is the Wolf Project staff, including volunteers, who with their tireless support help us accomplish all the research, conservation and education activities year-round. The Yellowstone wolf watching community over the years has always helped when they can and to them we are truly grateful. We also thank the many generous individuals, foundations and organizations that have provided approximately $5 million to the Wolf Project since 1996 through their gifts and grants to the Yellowstone Park Foundation.

These generous contributions to the Yellowstone Park Foundation provide more than 60% of the Wolf Project annual budget and enable studies on disease transmission, genetics, predation habits, and the social dynamics of Yellowstone's wolf packs in the ecosystem. This valuable support ensures that programs to educate visitors and help them see wolves in Yellowstone continues to meet the Park's growing number of visitors coming to see wildlife. Learn more at *www.ypf.org*.

Critical to our success is the continued support from Canon U.S.A, Inc., anonymous donors, the Tapeats Fund, the Twin Spruce Foundation, the Perkins-Prothro Foundation, generous participants in the Wolf Collar Sponsorship Program, and the National Science Foundation grant DEB-0613730. Thank you to all of our steadfast supporters.

We also appreciate safe piloting from Roger Stradley of Gallatin Flying Service, Steve Ard of Tracker Aviation, and Bob Hawkins of Sky Aviation. We greatly appreciate the above support and donations which we use to better understand and protect the amazing wild wolves of Yellowstone.

YELLOWSTONE
PARK FOUNDATION
15TH ANNIVERSARY

Appendices

Appendix I. Wolf Project Volunteer Roster, 2011

Table I-1

Name	Period of Involvement	Hours Worked
Lisa Baril	11/21–12/20/2011	104
Nate Bowersock	1/4–6/5/2011	936
Nick Bromen	2/28–4/1/2011	264
Brannon Forrester	11/14–12/17/2011	272
Jared Green	11/14–12/17/2011	272
Allison Greenleaf	2/28–4/1/2011	264
Ky Koitzsch	2/28–4/1/2011	264
Lisa Koitzsch	2/28–4/1/2011	264
Hans Martin	11/14–12/17/2011	272
Nathan Muhn	11/14–12/17/2011	272
Brendan Oates	2/28–4/1/2011 and 11/14–12/11/2011	488
Mark Paulson	2/28–4/1/2011	264
Emily Perry	2/28–4/1/2011	264
Julie Tasch	2/28–4/1/2011 and 10/3–12/17/2011	776
Liv Visgirda	11/14–12/17/2011	272
Hilary Zaranek	3/1–3/18/2011	32
Total Volunteer Hours*		**5,280**

*Based on the standard biological field technician GS-5 hourly rate.

Appendix II. Publications in 2011

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Wolf Project staff at North Butte.

Appendix III. Interviews Given by Wolf Project Staff, 2011

Date	Interviewer
Doug Smith:	
January	Matt Brown, Associated Press
	Montana Public Radio
	Dan Pierson, *Bozeman Daily Chronicle*
	Brett French, *Billings Gazette*
	Ralph Maughn, Wolf blog
	KTVQ TV Billings
	Kurt Repanshek, *National Parks Traveler*
	Cory Hatch, *Jackson Hole Guide*
	Matt Brown, Associated Press
	Wyoming Public Radio
	Jim Horan, writer
	Livingston Enterprise
	Minami Tamura, NAK Broadcasting Company, Japan
	Audrey Simpson, German Television
February	David Hull, writer
	Linnea Ericsson, Swedish Public Radio
	Scott Rockholm, Rockholm Production
	Rob Thornberry (2 interviews), Idaho Falls *Post Register*
	Brandon Loomis, *Salt Lake Tribune*
	Antione Nochy, University of Montpellier, France
	Abel Segretin, French/German Public Television-Arte
March	*60 Minutes* Australia (2 interviews)
	Beth Pratt, Xanterra, YNP
	Donna Healy, *Billings Gazette*
	Lisa Reuter, Yellowstone Association
	Laurie Kiessel, Earth Island
	Melinda Moyer, *Scientific American*
	French Public Television
April	Nate Schweber, Writer
	Mark Kurlansky, Audobon Magazine
	David Hart, Izaak Walton League
	National Geographic Television
May	Breeana Laughlin, University of Montana
	Montana PBS
	Melissa Gaskill, *Men's Journal*
June	Molly O'Brien, NRDC
	Dutch Television News, RTL News, Nederland
	Jennie Miller, NRDC
July	Ilona Popper, Freelance writer
	Mark Kurlansky, *Audobon Magazine*
	Jenny Marder, PBS

Date	Interviewer
Doug Smith (cont.):	
	Thomas Brender, Defenders of Wildlife
	Polly Brewster, *Oprah Magazine*
August	Greater Yellowstone Coalition
	PBS-MacNeil/Lehrer News Hour
	Men's Journal
September	NRDC
	BBC Television (2 interviews)
	Land Letter online news
	Jordan Reed, *Men's Journal*
	Brian Nophle, *Salt Lake Tribune*
	Henrik Ekman, Swedish Television
October	Cory Hatch, *Jackson Hole Guide*
	Stephen Mills, BBC Wildlife Magazine
	Mags Lightbody, BBC Television
	Kara Rogers, Freelance writer
	Leslie Kaufman, *New York Times*
November	Ellen Miller, Michigan Technical University
	Carly Flandro, *Bozeman Daily Chronicle*
December	Carly Flandro, *Bozeman Daily Chronicle*
Dan Stahler:	
March	National Geographic Television
	Bob Landis, filmmaker
August	*Jackson Hole News*
October	Yellowstone Park Foundation
December	*Bozeman Daily Chronicle*
	Bozeman Daily Chronicle
	Billings Gazette
	Livingston Enterprise
Colby Anton:	
March	Antoine Nochy, Universite Montpellier, France
	Abel Segretin, French Public Television
Rick McIntyre:	
January	Aaron Lake Smith, *The Thread*
	Bob Landis, Rise of the Black Wolf DVD
February	Al Jazerra Cable News
	Linnea Ericssoon, Swedish Public Radio
March	*60 Minutes* Australia
	Kevin Rhodes (Bob Landis biography)
	French TV (Spleen Productions)
August	PBS interview and assistance
September	PBS interview and assistance
	Natural Resources Defense Council

Appendix IV. Talks Given by Wolf Project Staff, 2011

Date	Group	Location
Doug Smith:		
January	Darby High School	YNP
	Old Faithful Evening Program	YNP
February	New Mexico Wilderness Alliance	YNP
	The Wild Side Tours	YNP
March	The Wild Side Tours	Gardiner, MT
	University of Montana wildlife class	YNP
	Yale University wildlife policy class	YNP
	Yellowstone Association Institute (YAI) class	YNP
April	Grizzly Bear Steering Committee	Jackson, WY
	University of Nevada–Reno biology seminar	Reno, NV
May	Greater Yellowstone Coalition group	Gardiner, MT
	NPS interpretive staff training	YNP
June	U.S. Forest Service carnivore class	Gardiner, MT
	Greater Yellowstone Coalition board meeting	Gardiner, MT
	YAI class	YNP
	Defenders of Wildlife board	YNP
August	Defenders of Wildlife	YNP
November	Houston Zoo (day 1)	Houston, TX
	Houston Zoo (day 2)	Houston, TX
	Swedish University of Agricultural Science (day 1)	Uppssala, Sweden
	Swedish University of Agricultural Science (day 2)	Uppssala, Sweden
	Imperial College	London, England
December	Snowcoach snowcoach driver orientation training	YNP
	NPS interpretive staff training	YNP
Dan Stahler:		
January	Prescott College	YNP
	The Wild Side Tours	Gardiner, MT
February	The Wild Side Tours	Gardiner, MT
	British Columbia Institute of Technology/The Wild Side Tours	Gardiner, MT

Date	Group	Location
Dan Stahler (cont.):		
March	The Wild Side Tours	Gardiner, MT
April	Canon Inc. USA	Lake Success, NY
May	Yellowstone Park Foundation board meeting	YNP
	Colorado State University	YNP
July	Wolf Conservation Center, The Wild Side Tours	Gardiner, MT
	YAI class: Yellowstone Wolves, Research Update	YNP
September	International Wolf Center, The Wild Side Tours	Gardiner, MT
	YYAI class: Roosevelt Rendezvous	YNP
October	U.S. Geological Survey	Bozeman MT
Ryan Kindermann:		
August	Lethbridge College	YNP
Rick McIntyre:		
January	Yellowstone Association Winter Wildlife Tour	YNP
	Yellowstone Association Wildlife Tour	YNP
	University of Wisconsin at Whitewater Yellowstone winter ecology class	YNP
	Xanterra wildlife tour	YNP
	Yellowstone Association/Xanterra press tour	YNP
	Yellowstone Association wolf tour	YNP
	YAI class: Winter Photography In Yellowstone	YNP
	YAI class: Winter In Yellowstone Digital Photography Workshop	YNP
	Prescott College (AZ) wildlife management class field trip	YNP
	National Geographic Expeditions tour group	YNP
	Prescott College (AZ) wildlife management class field trip	YNP
YAI class:	The Living History of Yellowstone's Wolves	YNP
	National Geographic Expeditions tour group	YNP
	Vermont Commons School (South Burlington, VT) YA field trip	YNP
	Yellowstone Association Winter Wonderland Tour	YNP
	Vermont Commons School YA field trip	YNP
	Teton Science School/Wildlife Expeditions Tour	YNP
	Yellowstone Institute winter retreat	YNP
February	Appalachia Mountain Club Yellowstone trip	YNP
	New Mexico Wilderness Alliance	YNP
	YAI class: The Wolves of Yellowstone	YNP
	Rocky Mountain College (Billings, MT) Yellowstone winter ecology class	YNP
	Colorado Rocky Mountain School (Carbondale, CO)	YNP
	Yellowstone Institute winter wolf retreat	YNP
	Greater Yellowstone Coalition	YNP
	Boise (ID) High School Ecology Club Yellowstone trip	YNP
	Yellowstone Association Winter Wonderland Tour	YNP
	Star Lane School (Casper, WY) YAI class	YNP
	Star Lane School (Casper, WY) YAI class	YNP
	YAI class: Watching Winter Wildlife	YNP
March	Yellowstone Association Winter Wonderland Tour	YNP
	Cody (WY) Middle School	YNP
	Northwest Academy High School (Naples, ID)	YNP
	YAI class: Writing the Wild	YNP

Date	Group	Location
Rick McIntyre (cont.):		
March	Mike Nelson's Friends of Wolves group	YNP
	Yellowstone Park Foundation staff	YNP
	YAI class: Winter Wolf Week	YNP
	Yale University class	YNP
	YAI class: Winter Wolf Week	YNP
	Marlboro (VT) College Outdoor Program	YNP
	Polynesia Women's Group–100 Years/110 Women	YNP
	University of Washington class	YNP
	International Wolf Center tour group	YNP
	University of Washington wildlife ecology of the Pacific Northwest class	YNP
	Rocky Mountain College Yellowstone winter ecology class	YNP
	Expedition Yellowstone class, Trevor Day School (New York, NY)	YNP
April		
	Yellowstone Association Naturalist Guide Certification class	YNP
	Expedition Yellowstone class, Ophir Elementary School (Big Sky, MT)	YNP
	Expedition Yellowstone class, Hardin (MT) Intermediate School	YNP
	Expedition Yellowstone class, Hardin (MT) Intermediate School	YNP
	Expedition Yellowstone class, West Yellowstone (MT) Middle School	YNP
	Expedition Yellowstone class, Monforton Elementary School (Bozeman, MT)	YNP
	Aspen (CO) High School Yellowstone trip	YNP
	Yellowstone Association naturalist guide certification class	YNP
	Bishop Berg High School (Goshen, NY)	YNP
	Expedition Yellowstone class, South Burlington (VT) Middle School	YNP
	Washington and Lee College (VA)	YNP
	College of Southern Idaho class (Twin Falls, ID)	YNP
	Central Catholic High School (Billings, MT)	YNP
May	North and South Summit (UT) high schools	YNP
	Teton Science School Tour for Jackson (WY) hotel employees	YNP
	Expedition Yellowstone class, Lander (WY) Elementary School	YNP
	Yellowstone Association wildlife tour	YNP
	Math and Science School (Belle Fourche, SD)	YNP
	Yellowstone Association field trip for board members and donors	YNP
	Greater Yellowstone Coalition field trip	YNP
	Yellowstone Association wildlife tours	YNP
	Colorado State University wildlife class	YNP
	Montana Natural Resources Defense Council Yellowstone trip	YNP
	University of Michigan Yellowstone Energy Adit Interns	YNP
	Yellowstone Association wildlife tour	YNP
	Clemson University Rocky Mountain field ecology class	YNP
	Yellowstone Association wildlife tour	YNP
	Rock Spring (WY) Elementary School Yellowstone field trip	YNP
	Yellowstone Association wildlife tour	YNP
	YAI class: Wolf Ecology and Management	YNP
	YAI class	YNP
June	Bozeman (MT) Sacajewea Middle School	YNP
	Bozeman (MT) Anderson Elementary School	YNP
	San Jose (CA) State University conservation biology class	YNP
	Ecology Project International staff training	YNP

Date	Group	Location
Rick McIntyre (cont.):		
June	Wild Side Wolf and Bear class	YNP
	Yellowstone Association wildlife tour	YNP
	Yellowstone Association wildlife tour	YNP
	Tower Fall Store Delaware North employees	YNP
	Yellowstone Association wildlife tour	YNP
	Indiana State University/Kennesaw State University (GA)	YNP
	Yellowstone Association wildlife tour	YNP
	Ecology Project International (high school students from CA)	YNP
	Yellowstone Association wildlife tour	YNP
	Statesville (NC) High School group	YNP
	Gardiner (MT) Elementary School Summer Camp trip	YNP
	Defenders of Wildlife	YNP
	Gannon University (PA) class	YNP
	Yellowstone Association wildlife tour	YNP
	Ecology Project International (Bishop O'Dowd High School, Oakland CA)	YNP
	Park visitors at Lamar Valley	YNP
	Yellowstone Association wildlife tour	YNP
	Yellowstone Association wildlife tour	YNP
	Safari Yellowstone Tour for veterinarian group	YNP
	California State University at Monterey Bay wildland studies class	YNP
	Yellowstone Association wildlife tour	YNP
	California State University at Monterey Bay wildland studies class	YNP
	Park visitors at Antelope Creek	YNP
	Park visitors at Little America	YNP
	Yellowstone Association wildlife tour	YNP
	Yellowstone Association wildlife tour	YNP
	Rocky Mountain Institute (University of Montana) class	YNP
July	Xanterra wildlife tour	YNP
	Ecology Project International (Montana high school students)	YNP
	Yellowstone Association tour for Chadron (NE) High School	YNP
	Yellowstone Association tour for Chadron (NE) High School	YNP
	National Geographic student expedition	YNP
	Cooke City Visitor Center campfire program	YNP
	Grand Rapids Middle Christian Schools	YNP
	Ecology Project International (Chicago, IL, high school students)	YNP
	Yellowstone Association wildlife tour for Hudson High School (WI)	YNP
	YAI class: Wolves	YNP
	Texas Children's Hospital Yellowstone trip	YNP
	Ecology Project International (high school students from Maryland)	YNP
	Yellowstone Association tour	YNP
	Ecology Project International (high school students from MT and ID)	YNP
	Center for Talented Youth Yellowstone field trip	YNP
	YAI class: What's New in Wolf Research	YNP
August	Wild Kids of Hawaii Yellowstone field trip	YNP
	Park visitors	YNP
	Ecology Project International (high school students from CT)	YNP
	Defenders of Wildlife Yellowstone trip	YNP
	Teton Science School tour	YNP

Date	Group	Location
Rick McIntyre (cont.):		
August	University of Wisconsin at Whitewater class	YNP
	Yellowstone Association wildlife tour	YNP
	University of Wisconsin at Whitewater class	YNP
	University of Wisconsin at Whitewater class	YNP
	Ecology Project International (high school students from Wolf Point, MT)	YNP
	Yellowstone Association wildlife tour	YNP
	Park visitors at Footbridge Lot	YNP
	Yellowstone Association wildlife tour	YNP
	Wildling Museum (Los Alamos, CA) Yellowstone field trip	YNP
September	The Wild Side tour group	YNP
	Yellowstone Association wildlife tour	YNP
	Colorado State University large mammal ecology and conservation class	YNP
	YAI class: Wolves of Yellowstone	YNP
October	YAI class: Autumn Wolf Watching	YNP
	The Wild Side tour group	YNP
	Boulder Creek Academy (Bonner's Ferry, ID) Yellowstone trip	YNP
	YAI class: Wolves of Yellowstone	YNP
	North Dakota State University environmental sciences class	YNP
	Expedition Yellowstone class, Blue Creek Elementary School (Billings, MT)	YNP
	Mark Johnson's tour group	YNP
	Yeshivat High School (Denver, CO) Yellowstone field trip	YNP
	Wild Rockies Field Institute (Missoula, MT)	YNP
	Montana State University class	YNP
November	Capital High School (Helena, MT) Yellowstone field trip	YNP
	The Wild Side Wolf Tour	YNP
	YAI class: Food for the Masses	YNP
	YAI class: Wolf Week	YNP
December	Greater Yellowstone Coalition	YNP
	Yellowstone Association winter naturalist training	YNP
	YAI: Winter Wolf Week	YNP
	Canisius College animal behavior field trip	YNP
	National Geographic Expeditions Yellowstone field trip	YNP
	Yellowstone Association wildlife tour	YNP
	National Geographic Expeditions Yellowstone field trip	YNP
	YAI class: New Year's wildlife	YNP
Colby Anton:		
January	The Wild Side winter wolf retreat	YNP
February	British Columbia Institute of Technology field trip	YNP
March	YAI class: Wolf Week	YNP
	Oregon State University Fish & Wildlife Club field trip	YNP
May	Xanterra employees	YNP
	YAI class	YNP
June	Teton Science School, Rhodes College field trip	YNP
	California State University, Monterey Wildlands Studies Program	YNP
	Utah Boy Scouts of America Troop 595 (Bountiful, UT)	YNP
July	Teton Science School natural history field course	YNP
	Youth Conservation Corps summer employees	YNP

Date	Group	Location
August	Slippery Rock University field trip	YNP
	YAI class: Shaping the Northern Yellowstone	YNP
September	Roosevelt family trip	YNP
	Upper Valley Vocational School field trip	YNP
	Western Illinois University field trip	YNP
	YAI class: Roosevelt Rendezvous	YNP
October	North Dakota State University	YNP
November	YAI class: Wolf Week	YNP
December	YAI class: Wolf Week	YNP
Rebecca Raymond:		
July	Kenya Wildlife Service	YNP
Matt Metz:		
April	College of Southern Idaho	Gardiner, MT
May	Xanterra bus guides	YNP
June	Xanterra employees	YNP
July	YAI class	YNP
Josh Irving:		
May	Pocatello Charter Elementary School	YNP
	YNP employees	YNP
	Interpretive ranger training	YNP
	Hulett High School (Hulett, WY)	YNP
August	Olof Liberg field trip	YNP
September	Lovell Elementary School, NWC Field Station	
	Rocky Mountain Elementary School, NWC Field Station	
	4-H Leaders, WY	YNP
	Colorado State University group	YNP
	Tiga Nature & Photo field trip	YNP
	Powell High School	YNP
	Western Wyoming College	YNP
October	4-H Leaders, Bozeman, MT	YNP
December	Rookery Bay National Estuarine Research Reserve	Naples, FL