



YELLOWSTONE WOLF PROJECT



ANNUAL REPORT
2004

Yellowstone Wolf Project

Annual Report
2004



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Yellowstone National Park, Wyoming

YCR-2005-02



Suggested citation: Smith, D.W., D.R. Stahler, and D.S. Guernsey. 2005. Yellowstone Wolf Project: Annual Report, 2004. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, YCR-2005-02.

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

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

TABLE OF CONTENTS

Background	<i>iv</i>
2004 Summary	<i>v</i>
Territory Map	<i>vi</i>
The Yellowstone Wolf Population	1
Population and Territory Status	1
Reproduction	3
Mortalities	3
Status of Original Reintroduced Wolves	5
Pack Summaries	5
Chief Joseph Pack	5
Swan Lake Pack	5
Leopold II Pack	5
Geode Creek Pack	7
Agate Creek Pack	7
Slough Creek Pack	8
Druid Peak Pack	8
Specimen Ridge Pack	9
Mollie's Pack	9
Yellowstone Delta Pack	9
Hayden Valley Pack	10
Nez Perce Pack	10
Biscuit Basin Pack	10
Cougar Creek Pack	10
Gibbon Meadows Pack	10
Bechler Pack	11
Wolf Capture and Collaring	11
Wolf Predation	11
Wolf-Prey Relationships	11
Composition of Wolf Kills	12
Winter Studies	12
Summer Studies	13
Wolf Management	14
Area Closures	14
Druid Road Management Project	14
Wolf Depredation Outside Yellowstone	15
Collaborative Research	15
Wolf Project Students—Direct Assistance	15
Other Research—Indirect Assistance	16
Public Involvement	16
Volunteer Program	16
Seasonal Staff	16
Visiting Scholars Program	17
Acknowledgments	17
Appendix	18
Volunteer Roster, 2004	18
Publications	18

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.

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

The U.S. Fish and Wildlife Service (USFWS) has the primary responsibility for ensuring compliance with the Endangered Species Act and oversees the multi-state wolf recovery program. The USFWS has 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.

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

Three full-time employees worked for the Yellowstone Wolf Project in 2004: Project Leader Douglas Smith, and Biological Science Technicians Debra Guernsey and Dan Stahler. Rick McIntyre worked as a seasonal employee on the Druid Peak Pack Road Management Project. Emily Almberg also worked on the Road Management Project, with the help of funds from the Yellowstone Park Foundation (YPF) and the Yellowstone Association (YA). Other biological field technicians who worked the summer season through YPF and YA were Matt Metz (who also worked the fall season during October and November), Katie Yale, and Janice Stroud. Additional volunteers (*see Acknowledgments and Appendix*) staffed the early (November–December) and late (March) winter study periods.

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 on up to half of the wolves in the population. 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.

2004 SUMMARY

At the end of 2004, at least 171 wolves in 16 packs occupied Yellowstone National Park (YNP). This represents no gain of wolves from 2003, marking the second year since reintroduction that the wolf population did not increase (1999 was the other year). Four new packs formed: Hayden Valley, Gibbon Meadows, Biscuit Basin, and Specimen Ridge. Each of the 16 packs counts toward the breeding pair objective for the Yellowstone Recovery Area.

At least 86 pups were born and 59 (69%) survived in 16 packs, which was slightly less than the long-term average of >75% pup survival. The number of pups per litter ranged from one to nine, with an average of 5.1 pups counted at den sites in May and June. Average pup survival per pack was 3.7 pups. Pup survival was highly variable by pack.

Mange was reported for the first time inside Yellowstone National Park. A Chief Joseph wolf was sighted on Daly Creek with hair loss. This is the only location in Yellowstone National Park where mange has been observed, and so far, no mortalities have resulted from mange. Mange is common on all sides of the park except the south, where it is unrecorded.

All of the 31 originally reintroduced wolves are dead, and all wolves currently alive in the population are descendants of reintroduced wolves.

Twenty-one wolves were captured and collared in 2004: 20 via darting from a helicopter and one (Slough Creek wolf #453M) after being accidentally caught in a coyote trap. At the end of 2004, 40 (24%) of the 171 wolves that use Yellowstone National Park were radio collared.

The Wolf Project deployed five GPS collars in the 2004 capture season to enhance understanding of 1) seasonal predation patterns; 2) spatial and temporal interactions with other wolf packs and carnivores; 3) movements with respect to dens during pup-rearing season; and 4) territory size, use, and overlap.

Project staff detected 295 kills (definite, probable, and possible combined) made by wolves in 2004, including 240 elk (81%), 19 bison (6%), 1 moose (<1%), 4 deer (1%), 4 pronghorn (1%), 1 badger (<1%), 2 cougars (1%), 6 coyotes (2%), 1 golden eagle (<1%), 2 grizzly bear cubs (1%), 1 raven (<1%), 3 wolves (1%), and 11 unknown prey (4%). The composition of elk kills was 18% calves (0–12 months), 16% cows (1–9 years old), 16% old cows (≥ 10 years old), 38% bulls, and 12% elk of unknown sex and/or age. Bison kills included 4 calves (unknown sex), 8 cows, 5 bulls, and 2 of unknown sex and age.

Winter kill rates for 1995–2000 showed that wolves residing on the northern range killed an average of 1.8 elk per wolf per 30-day study period during the winter. Using the same method for calculating kill rates, wolves on the northern range killed an average of 1.1 elk/wolf/30-day study for the period 2001–2004. This 40% decrease suggests changing ecological conditions for wolves in this part of the park.

Summer prey selection and kill rates were determined via GPS technology.

In summer 2004, Wolf Project staff increased monitoring efforts on summer carcasses to document scavenger utilization and behavioral interactions between wolves and scavengers.

To prevent human disturbance of young pups, visitor entry was closed to areas surrounding the Druid Peak pack's den. No other closures for wolves were instituted. Close monitoring of wolves and people continued around the Druid Peak pack den in Lamar Valley, a program that has been in place since 2000.

Wolf Project staff published eight peer-reviewed journal articles or book chapters in 2004.

The long-term drought continued in 2004. Lack of moisture in both summer and winter may be a factor in the wolf–elk relationship.

Additional information on wolves in Yellowstone National Park is available at <www.nps.gov/yell/nature/animals/wolf/wolfup.html> and <www.r6.fws.gov/wolf/>.

Yellowstone Wolf Pack Territories, 2004

(using 95% of wolf locations)

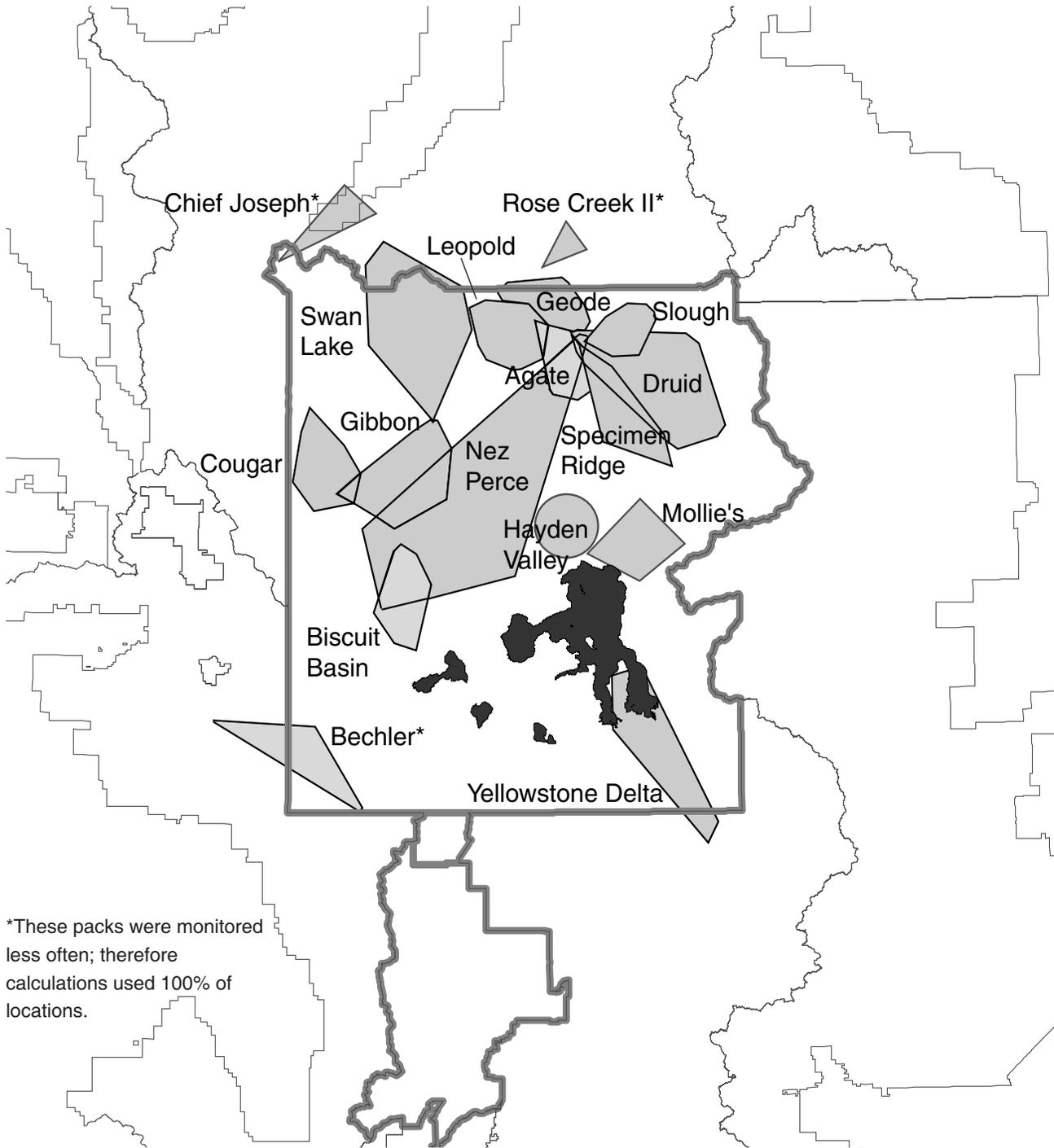


Figure 1. Wolf packs that had some or all of their territory within Yellowstone National Park in 2004.



Wolves often travel in single file in deep snow, as seen here with the Cougar Creek pack.

THE YELLOWSTONE WOLF POPULATION

Population and Territory Status

At the end of December 2004, at least 171 wolves in 16 packs occupied Yellowstone National Park (Table 1, Figures 1 and 2). This represents no gain of wolves from 2003, marking the second year since reintroduction that the wolf population did not increase (1999 was the other year). The Rose Creek and Buffalo Fork packs, which historically used the park, moved north onto Gallatin National Forest lands, and are no longer counted as park packs. Four new packs formed (Biscuit Basin, Gibbon Meadows, Hayden Valley, and Specimen Ridge), and two packs were lost through emigration. In the Madison–Firehole area, a dispersing wolf from the Nez Perce pack had pups and created the Biscuit Basin pack, which ranges in the Old Faithful area. A dispersing wolf from the Cougar Creek pack helped form the Gibbon Meadows pack, which ranges in the Gibbon Meadows/Gibbon River area. The Hayden Valley pack was probably formed by another dispersing Nez Perce wolf, but no wolves in this pack are collared, so genetic samples are unavailable for making this determination. Dispersing wolves from the Mollie’s and Druid Peak packs formed the Specimen Ridge pack. These wolves are not regularly tracked, because the Mollie’s wolf died and none of the remaining wolves are radio collared. Each of the 16 packs counts

Pack/Group*	Adults/ Yearlings	Pup Count Nov–Dec	Total Pack Size
<u>Agate Creek</u>	9	2	11
Bechler	2	2	4
Biscuit Basin	5	6	11
Chief Joseph	7	2	9
Cougar Creek	7	5	12
<u>Druid Peak</u>	7	2	9
<u>Geode Creek</u>	7	5	12
Gibbon Meadows	6	2	8
Hayden Valley (no collars)	2	2	4
<u>Leopold</u>	12	11	23
Mollie’s	4	2	6
Nez Perce	12	2	14
<u>Slough Creek</u>	7	8	15
<u>Specimen Ridge</u>	3	2	5
<u>Swan Lake</u>	7	2	9
Yellowstone Delta	15	4	19
Totals	112	59	171

*Underline denotes northern range (NR) pack.

Table 1. Yellowstone National Park wolf population, December 2004.

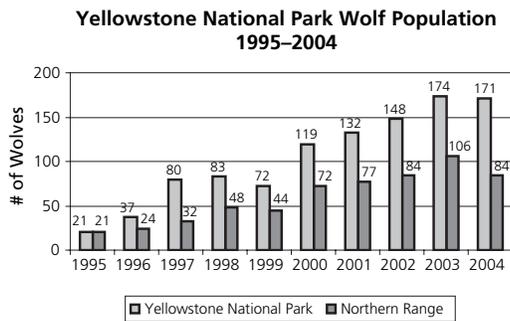


Figure 2. Yellowstone National Park early winter wolf population, 1995–2004.

toward the breeding pair objective for the Yellowstone Recovery Area. (Note: The total count for the wolf population is derived from packs that den inside Yellowstone National Park. Some of these packs, most notably the Chief Joseph and the Yellowstone Delta, have significant portions of their range outside the park.)

Seven of the 16 packs (84 wolves) used the northern range, and nine packs (87 wolves) used the rest of the park. Pack size ranged from four (Bechler and Hayden Valley) to 23 (Leopold), and averaged 12.4, the largest average pack size for any year so far. Pack size was slightly larger on the northern range (mean = 14.5) than elsewhere in the park (mean = 10.8). The largest pack on the northern range is now the Leopold pack, a pack that has previously been a more moderate size (10–15 wolves).

The largest wolf pack on the northern range has shifted between three packs since reintroduction: Rose Creek, Druid Peak, and Leopold. The Rose Creek pack reached 24 wolves early on (in 1998), occupied a large territory, and dominated territorial encounters. In 2001, the Druid Peak pack increased to 37 wolves, perhaps the largest of any pack ever recorded. This shift heralded the beginning of a long decline for the Rose Creek wolves that persists to this day; the Rose Creek pack no longer uses Yellowstone National Park. The Druid Peak pack pushed west, usurping territory from Rose Creek, but eventually lost control of this new area and returned to their traditional area of use, primarily Lamar Valley. This old Rose/Druid territory came to be used by four packs that were spawned from the Druids: Agate Creek, Slough Creek, Geode Creek, and Buffalo Fork (no longer inside Yellowstone National Park). Now, the Rose and Druid packs are small (<10 wolves), and the historically stationary Leopold pack is expanding its territory, or at least behaving as such. The Leopolds, which have used a very

consistent, stable territory in the past, have been making first-time, extra-territorial forays—suggesting that larger pack size confers territorial advantages for wolves on the northern range.

Competitive relationships between packs are usually not as intense in the park's interior, because these packs typically do not have close neighbors. Therefore, inter-pack skirmishes are fewer, and no territorial advantage is evident for large packs. This dynamic may be changing, as there is some evidence of increased interpack conflict occurring in the Madison–Firehole region, where the body condition of two of the four resident packs is fair-to-poor.



At 23 wolves, the Leopold pack was the largest pack in YNP in 2004.

Packs in the interior are also different from northern range packs for other reasons. Most importantly, northern range wolves live in a prey-rich elk environment in the winter, whereas winter prey for interior wolves is limited to few elk (most elk migrate) and many bison, which are difficult to kill. Snow is also deeper in the interior, and thermal areas are common; both of these factors affect ungulate vulnerability. More prey, yet more wolves competing for it, has led to greater population instability on the northern range. Pack sizes decline more during winter on the northern range than in the interior, and wolves (especially pups) are beginning to show body condition declines and increased mortality on the northern range. These are early indicators, but clearly life for a wolf is different in the north. A complete picture of the differences is yet to form.

Wolf distribution was largely unchanged from 2003.

Wolf range continued to be the northern range, Pelican Valley, the Madison–Firehole, north of the Madison River, Thorofare, and Bechler. One of the new packs that formed (Biscuit Basin) sandwiched itself into occupied territory in the Madison–Firehole, but it appears that this pack also leaves the park for significant periods of time. Another new pack (Gibbon Meadows) established itself in a little-used section of the Gibbon Meadows–Norris area. An uncollared group of four wolves was consistently reported in Hayden Valley, also an area without a previously resident pack. Reports included pups, indicating reproduction. Without radio collars, further information is lacking, and future tracking will be difficult.

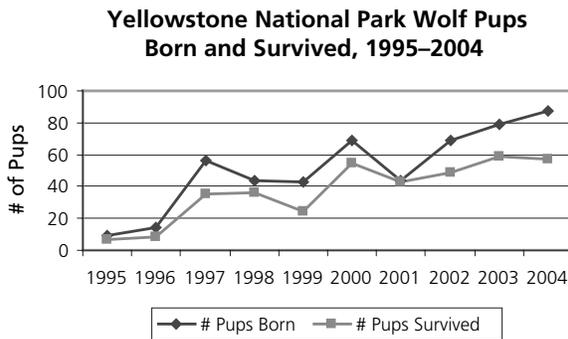


Figure 3. Yellowstone National Park pups born and survived, 1995–2004.

Reproduction

At least 86 pups were born and 59 (69%) survived in 16 packs, which was slightly less than the long-term average of >75% pup survival (Figure 3). The Druid Peak, Leopold, and Geode Creek packs each had two litters of pups. The number of pups per litter ranged from one to nine, with an average of 5.1 pups counted at den sites in May and June. Average pup survival per pack was 3.7 pups. Pup survival was highly variable by pack. Despite two litters, only two pups in the Druid Peak pack survived. The Bechler, Agate, Swan Lake, Specimen Ridge, Chief Joseph, Gibbon Meadows, Hayden Valley, Mollie's, and Nez Perce packs also had only two surviving pups. Packs that had good pup survival were the Geode Creek, Leopold, Slough Creek, Biscuit Basin, Cougar Creek, and Yellowstone Delta packs. Den sites were again visited in 2004, and scats were collected for summer food habit studies. Seven (58%) of 12 den sites were reused by packs that had denned before.

Mortalities

Twenty wolves were known to have died in Yellowstone National Park during 2004 (Table 2). These included 3 old adults (>6 years old), 10 adults (2–5 years), 2 yearlings, and 5 pups, consisting of 9 males, 9 females, and 2 of unknown sex. All of the wolves that died within Yellowstone National Park died of natural causes (Figure 4).

Six wolves (30%) died due to intraspecific strife, 4 (20%) to vehicle strikes, 3 (15%) to control actions (these began the year inside Yellowstone National Park, traveled outside, and were shot due to livestock depredations), 6 (30%) to natural unknown causes, and 1 (5%) to unknown causes.

The mortality rate for collared wolves from 2004 to 2005 was 20%, which is the 10-year average. Mortality has ranged from a low of 9% in 1998, to a high of 43% in 1997. The 10-year average intraspecific mortality rate is 3%, which increased to 5% in 2004. This was likely the result of increased social stress, especially on the northern range.

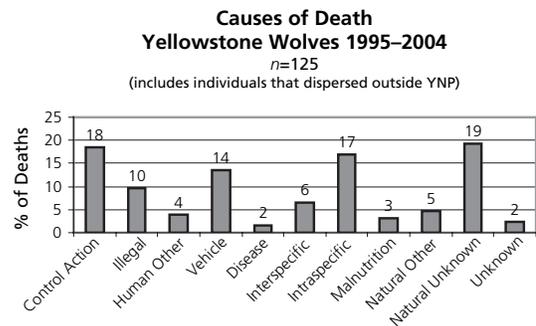


Figure 4. Yellowstone National Park causes of death for wolves, 1995–2004.



Territorial skirmishes that result in wolf deaths are increasing. Number 227M, the alpha male of the Geode Creek pack, was killed by Leopold wolves.

# of Deaths	Wolf #/Sex	Age Class	Color	Pack	Date of Death	Cause
1	021M	Adult	Black	Druid Peak	6/12/2004	Natural Unknown
2	042F	Adult	Black	Druid Peak	2/1/2004	Intraspecific
3	072M	Adult	Gray	Disperser from Nez Perce to Green River	3/19/2004	Control Action
4	103F	Adult	Black	Disperser from Agate Creek	3/28/2004	Vehicle
5	174F	Adult	Gray	Mollie's	12/4/2004	Unknown
6	194M	Adult	Black	Specimen Ridge	10/15/2004	Natural Unknown
7	206M	Adult	Gray	Swan Lake	3/24/2004	Intraspecific
8	214M	Adult	Gray	Disperser from Nez Perce	1/23/2004	Control Action
9	215M	Adult	Gray	Disperser from Nez Perce	1/22/2004	Illegal
10	217F	Adult	Gray	Slough Creek	1/10/2004	Intraspecific
11	249M	Adult	Gray	Disperser from Nez Perce to "Ennis Lake" Group	3/12/2004	Control Action
12	261M	Adult	Gray	Slough Creek	6/8/2004	Natural Unknown
13	293F	Adult	Gray	Disperser from Swan Lake	6/1/2004	Vehicle
14	332F	Adult	Gray	Disperser from Sheep Mtn. to Green River	9/10/2004	Control Action
15	342F	Yearling	Gray	Nez Perce	5/19/2004	Natural Unknown
16	351M	Yearling	Gray	Disperser from Geode Creek	2/4/2004	Human Other
17	386F	Adult	Black	Druid Peak?	2/1/2004	Intraspecific
18	393M	Adult	Gray	Chief Joseph	3/16/2004	Human Other
19	422F?	Pup	Black	Unknown, Northern Range	3/18/2004	Unknown
20	434F	Adult	Black	Probable Cougar Creek	8/11/2004	Vehicle
21	435U	Pup	Gray	Druid Peak	7/23/2004	Natural Unknown
22	451F	Pup	Gray	Gibbon Meadows	9/24/2004	Vehicle
23	466U	Unknown	Gray	Unknown, Poss. Nez Perce, Biscuit Basin, or Gibbon	12/12/2004	Natural Unknown
24	467M	Yearling?	Gray	Nez Perce?	12/1/2004	Natural Unknown

Table 2. Yellowstone National Park wolf mortalities, 2004.



The Gibbon Meadows pack takes a break while traveling in deep snow.

Mange was reported for the first time inside Yellowstone National Park. A Chief Joseph wolf was sighted on Daly Creek with hair loss. This is the only location in Yellowstone National Park where mange has been observed, and so far, no mortalities have resulted from mange. Mange is common on all sides of the park except the south, where it is unrecorded.

Status of Original Reintroduced Wolves

All of the 31 originally reintroduced wolves are dead. The last to die was wolf #41F, originally of the Druid Peak pack, who was shot in a control action east of the park. She had a severe case of mange at the time of death. The last wolf to die in the park was her sister, #42, who was with the Druid Peak pack when she was killed by wolves from Mollie's pack in late January 2004. All wolves currently alive in the population are descendants of reintroduced wolves. 🐾



Doug Smith examines #487, the large alpha male of the Yellowstone Delta pack.

PACK SUMMARIES

Chief Joseph Pack

Once solidly a Yellowstone National Park pack, the Chief Joseph pack now spends most of the year outside the park. They are counted as part of the Yellowstone National Park population because they still use their traditional den site in the northwest corner of the park. In summer, and especially in winter, they range north and west outside the park. At year's end, they numbered nine wolves, two of which were pups. A report in late summer indicated that this pack has mange. It is the only Yellowstone National Park pack known to have this hair loss-causing mite.

Swan Lake Pack

In 2003, the Swan Lake pack was the largest in the park, at 20 wolves. However, they numbered only nine wolves at the end of 2004, two of which were pups, indicating poor pup production and/or survival. The pack continues to reside in the Swan Lake area without interference from the much-larger Leopold pack.

Longtime alpha female #152 is believed to still be with the pack, although her radio collar no longer functions. It is currently unknown which wolf is the alpha male of this pack. Swan Lake wolf #206M, the possible alpha male, was killed by other wolves in the heart of Swan Lake territory in March 2004. It is possible that he was killed by pack mates, as no other wolf packs were known to be in the area at the time of his death.

Traditionally a park pack, Swan Lake made several trips outside Yellowstone during 2004, and during one of those trips was involved in killing a tethered beef calf. No action was taken because the wolves did not depredate again, nor did they stay in the vicinity of the private property where the calf was killed. In the month of February, this pack was also known to frequent the administrative and housing areas of Mammoth Hot Springs in search of elk.

Leopold II Pack

In 2004, the Leopold pack continued to use its core territory while becoming the largest pack in Yellowstone. The pack had historically been one of the most stable packs both in terms of size and territory use. Since the pack's formation in 1996, only one pair bred (#2M and #7F), probably contributing to this pattern. In 2002, things changed with the death of #7 and the ousting of #2 by a new male from outside the pack (#2 died a month later). In 2003, this pack officially became known as Leopold II, signifying that none of the pack's original wolves are left. The insertion of an unrelated male has opened the possibility of multiple litters and therefore affected the potential growth of the pack.

In 2004, the Leopold pack is believed to have had two litters. Twelve pups were born between the alpha female (#209) and an unknown female. These pups led to an increase in pack size from 19 at the end of 2003 to 24 wolves (13 adults, 11 pups) at the end of 2004—the largest number in the pack's history. The Leopolds used large pack size to their advantage by making new forays into Geode territory, scavenging on Geode kills, and traveling outside Yellowstone National Park for the first time. Despite these new ventures, they continue to anchor their



Wolves #42 (far left) and #21 (second from left) died in 2004. Both wolves were highly visible in Lamar Valley, easy to identify, and popular with visitors.

A PERSONAL REFLECTION ON THE END OF AN ERA: DRUID WOLVES #21 AND #42

by Rick McIntyre

June 11, 2004, seemed like a typical day in Lamar Valley, the center of Druid pack territory. The Druid wolves were feeding on a freshly killed elk just after first light. Word spread quickly through the valley, and soon scores of park visitors were watching the pack. As always, one wolf stood out due to his size and charisma: #21, the Druid's alpha male. For most of the people present that morning, #21's reputation had preceded him. This was an historically important, highly visible wolf—but today would prove to be the last time he was seen.

Number 21 was just over nine years old, the oldest known wolf in the park. He had been born to the Rose Creek pack's #9, one of the original reintroduced Canadian wolves, in April 1995. Number 21 was one of the pups rescued by Yellowstone National Park and U.S. Fish and Wildlife Service personnel after their sire, #10, was shot and killed near Red Lodge, Montana. The pups were subsequently adopted by #8, a low-ranking yearling from the Crystal Creek pack. Number 9 accepted #8 as her mate, and he became the Rose Creek pack's alpha male. Number 21 eventually became the pack's beta male, helping #8 and #9 raise litters in 1996 and 1997.

Number 21 joined the Druid pack in late 1997, after the Druids went out of the park to the east and both adult males, #31 and #38, were illegally shot and killed. The surviving three adult females and five pups returned to Lamar Valley and ran into #21, who acted friendly toward them. The adult females tested #21 by snapping at him, but soon accepted #21 as the Druids' second alpha male. He adopted the pups of #38, just like

#8 had adopted him. With at least seven (#40, #41, #42, #103, #105, #106, #286) different females, #21 sired many pups from 1998 to 2004, including 21 pups in 2000. Many of his offspring have dispersed and started new packs, and now have pups of their own.

Number 21 appeared to be a benevolent pack leader, playwrestling with younger males and often letting other wolves feed first at a kill. When pups harassed him by biting his tail or ears, #21 would often just walk away; I once saw him cross the road and hide in some bushes to get away from pups that were bothering him. Of course, he also used his great size and strength to benefit his pack. If the younger wolves were attacking an elk but could not pull it down, #21 would run in and help bring it down. As he grew older and slower, that ability to quickly kill an elk enabled him to continue to contribute to the pack's welfare.

Number 42, the Druids' alpha female, was #21's longtime companion. Together, these were the most watched and most "famous" of the Yellowstone wolves; #42 was even prominently featured in a National Geographic documentary filmed by Bob Landis. Both were black wolves that turned gray as they aged. Number 42, who arrived in Yellowstone from British Columbia in 1996, had become the Druids' third alpha female by being part of a group of wolves that killed her sister—a previously undocumented occurrence—who was alpha female from 1997 to 2000. Number 42 produced five, possibly six, litters of Yellowstone wolves—a total of 31 pups, 27 of which survived at least one year.

Number 42 died of natural causes on February 1, 2004. Her remains were found at the west end of Specimen Ridge, near a bull elk carcass. It appeared that other wolves had killed her, probably Mollie's pack, whose territory centers around Pelican

Valley. The Druid and Mollie's wolves likely encountered each other at the carcass site and fought. Nearly nine years old at the time of her death, #42 was the last of the original Canadian wolves still living in the park. When another of #42's sisters died in Sunlight Basin two weeks after #42, all of the original reintroduced wolves were dead.

Whatever transpired to lead to the death of #42, all the younger wolves and #21 survived and made it back to their territory. There was some evidence that #21 may not have known what had happened to #42. Over the next few days he did more howling than usual and traveled extensively to the pack's most commonly used areas, including their highly visible annual den site at the east end of the valley, indicating that he may have been searching for her.

After #42's death, #21 carried on with the pack. He mated with #286, a young pack member that was not his daughter. She returned to the traditional Druid den site in early April and gave birth to a litter of at least six pups. As he had for so many other litters of pups, #21 worked hard to feed and care for them.

Those of us who were watching #21 on the morning of June 11 knew that #21 was very old for a wild wolf, and that he might not survive much longer. Later that day, the pack went to their rendezvous site at Chalcedony Creek and bedded down. In the evening, a bull elk walked into the meadow and several wolves chased him. I remember seeing #21 jump up with the other wolves, but he did not join in on the chase. Over the next few days we saw Druid wolves, but not #21. His radio collar was no longer working, which meant we might never know what had happened to him. Some people were desperate to know his fate; anxious others preferred not to know.

In July, an outfitter contacted park rangers to report a dead radio-collared wolf high on Specimen Ridge. He had brought the collar down with him, and gave it to a ranger. It was #21's. Yellowstone Wolf Project staff rode out to find his carcass.

Number 21 died at one of the pack's summer rendezvous sites, a late summer site that the pack has used for many years, and will likely use for many more. We found his remains under a tree at the edge of a meadow. There was no sign of struggle or violence, and although his cause of death remains undetermined, it was likely natural. Number 42 had died only a few miles west of that meadow, on the same ridge.

Both #42 and #21 were unusually long-lived wolves, each around nine years of age; the average life span of a wolf in Yellowstone is 3.4 years. During their years together, the two were rarely apart, and when they were separated they found each other again quickly. In 2001, their Druid pack numbered 37, the largest known wolf pack in history. They may be gone, but their legacy—passed on through their DNA as well as human memories—will live on.



movements in the Blacktail Deer Plateau area, where late-winter food is plentiful in the form of bull elk weakened by the rut and winter.

Geode Creek Pack

Pup production was notable in the Geode Creek pack in 2004. Five pups—more than were born in the previous two years—survived to year's end. Two litters totaling 11 pups were suspected. Founding alpha female #106 continued to lead the pack, and produced one of the litters. The other reproducing female is unknown, but was either #353 or #391 (genetic identification of pups is pending). The litters were born in the same cliff den that was used communally by the two females.

The pack grew in size from 7 in 2003, to 11 at year's end in 2004. The six adults included yearling #374M from the Druid Peak pack. He dispersed into the Geode Creek pack in the fall, and became a subordinate member. Winter study crews observed #374M as a fully accepted pack member in November and December. He participated in all pack activities and was subordinate to both the alpha and beta males. Dispersing into a pack in Yellowstone in this subordinate manner has now been documented on at least four occasions.

The Geode Creek pack continued to withstand pressure from the larger Leopold and Slough Creek packs, and persisted mostly in the Cottonwood and Hellroaring areas. Black and grizzly bears, plentiful cougars, other wolves, and elk migration routes all create instability in the Geodes' range, possibly contributing to the fluctuations observed in their numbers. Wolf #353F, for example, is only loosely associated with the pack, despite being collared with them and possibly being one of their breeding females. This pack is of special interest to Wolf Project staff, as they were the focus of the initial phase of the summer predation study in 2004, and will again be the main focus of the study in 2005 (see page 13).

Agate Creek Pack

The Agate Creek pack had a single litter in 2004. Pup survival was poor, as only two of six pups made it to year's end. Despite this, a total of 11 wolves were counted in November and December. The pack continued to use the Specimen Ridge and Antelope Creek areas. They also used the Little America area below Specimen Ridge on a regular basis in winter, often in the presence of either the Slough Creek or Druid Peak packs.

The Little America area is often used by dispersing



Two Agate Creek wolves try unsuccessfully to bring down an elk near Tower Falls.

males during the breeding season in an attempt to find females from one of these resident packs. Wolf #295M of the Agate pack, however, moved to the Mammoth area during the breeding season of 2004. He was successful in finding yearling #290F from the Leopold pack and an older female wolf of unknown origin. Initially, it seemed the Agate wolf had found a role as a breeder in this new group. However, #295M was back in his subordinate role with the other Agate wolves by late March as they prepared to provide for the year's pups.

The Agate Creek pack continued to be led by alpha male #113M. The only other known founding member of the pack died in 2004. Wolf #103F, who left the pack in late 2003, was killed by a vehicle at Elk Creek in March.

Slough Creek Pack

The Slough Creek pack had eight surviving pups and numbered 15 wolves at year's end, making them the second-largest pack on the northern range. Their numbers and large physical size allowed them to make inroads into Druid Peak territory in Lamar Valley in 2004. At twice the pack size of the famed Druids, the Slough Creek pack clearly had the upper hand. The Slough Creek wolves have traditionally ranged up and down Slough Creek, but appear ready to annex new territory.

The origin of this pack is a mixture of Mollie's wolves from Pelican Valley and the Druid pack, and two wolves that were caught in 2004 and moved between the Slough Creek and Mollie's packs, wolves #378 and #379. The two wolves seemed to slip in and out of the two packs without notice, although they were both clearly subordinate in the Slough Creek pack.

Druid Peak Pack

The Druid Peak pack continued to be one of the most visible packs in Yellowstone National Park. While the Druids historically numbered 37 wolves in 2001, the pack gradually declined in size to 11 wolves in 2002, 17 in 2003, and only 7 animals at the end of 2004.

In February, #42F, the Druid alpha female of nearly five years, was killed by Mollie's pack on Specimen Ridge. A relatively low-ranking female, #286F, became the new alpha and bred with #21M, the long-standing alpha male. Another low-ranking female, #376F, was seen breeding with a non-Druid wolf. Both females denned—#286F at the traditional den site and #376F at a secondary den site to the south. The Druid wolves split their time between both sites, feeding and caring for #286F's six pups, and #376F's two pups. Only two of the eight pups are believed to have survived to the end of the year.

On June 12, #21M was found to be missing from



Deb Guernsey and Doug Smith process a wolf while Mark Duffy (center) of Central Copters looks on. Mark did all of the helicopter piloting for capture operations in 2004.

the pack, and in mid-July, an outfitter found his body at the east end of Specimen Ridge. He is believed to have died of natural causes. In #21M's absence, two non-Druid males, #302M and an uncollared, black wolf, started spending time in the Druid pack's territory. For a good part of the summer, #253M, the beta male of the pack, appeared to be the new alpha, and successfully chased off these intruders. However, when the Druids returned from their two-month stay at their Cache/Calfee rendezvous site, #302M and the uncollared male were fully integrated into the pack. The uncollared, black wolf became the new alpha male, and the new group returned without #253M, #376F, #373M, #350M, one yearling, and two pups. It is unknown whether these wolves have stayed together. A yearling male, #374M, later dispersed into the Geode pack, and #348M and #349M, both yearlings, dispersed to unknown locations in December.

The Druids continued to use their historic territory, which spans from the park's Northeast Entrance through Soda Butte and the Lamar Valley, into Little America, and south into the Cache/Calfee river drainages. The Druid pack continued to be bounded by the Slough Creek, Agate, and Specimen Ridge packs to the north and west, and perhaps occasionally by an unknown pack to the east. By the end of the year, the Slough Creek pack was spending more time on the northwestern boundary of the Druids' territory and occasionally making incursions. It will be important to document the developing relationship between these neighboring packs in the next year.

Specimen Ridge Pack

The Specimen Ridge pack was founded in 2004 by a former Druid female wolf, nicknamed "U-Black;" a former Mollie's wolf, #194M; and a large, uncollared gray male. U-Black and #194M successfully bred, denned on Specimen Ridge in Little America, and produced five pups. By late summer, the pack moved southeast to a rendezvous site on Mirror Plateau and remained difficult to track for much of the early fall. In December, #194M, the only collared wolf in the pack, was found dead. In November and December, there were several brief sightings of U-Black, accompanied by the large gray male and at least two pups in Little America. Little is known about the boundaries of the Specimen Ridge pack's territory; however, they likely compete for resources with the four much-larger local Geode, Agate, Druid, and Slough Creek packs.

Mollie's Pack

Mollie's pack appears to be splitting up. Only six wolves were counted in early December 2004: four adults and two pups. At year's end, #174 (the alpha female) and her yearling son were both dead, her mate, #193, was missing, and the other collared wolves (#378 and #379) had returned to the Slough Creek pack, where they spend significant periods of time. No other Mollie's pack wolves had been found by late December. This pack has existed in Pelican Valley since 1996, and is unique due to its isolation and dependence on bison in late winter. Pack sizes have fluctuated greatly from year to year, ranging from a high of 16 wolves in 1998, to a low of 4 in 2000, possibly due to the harsh conditions of central Yellowstone. Wolves #174F and #193M are only the second female and male alphas for the pack, and their simultaneous death and disappearance, respectively, may make it difficult for the remaining wolves to survive as a pack in Pelican Valley.

Mollie's pack is still the focus of late winter study and observation in Pelican Valley. Wolf-bison-grizzly bear interactions are intense. Wolf kills are important for the entire system at this time of year, with many species dependent on them.

Yellowstone Delta Pack

Yellowstone's most remote pack, Yellowstone Delta, continues to thrive. They den and spend most of the summer inside the park (they are one of the more traditional denning packs in the park), but travel widely

during the rest of the year, including significant forays into the Bridger-Teton National Forest. This is a difficult pack to capture and collar, as well as to keep collars on, because they tend to chew collars, removing them more often than any other pack. Most collar chewing occurs among young wolves, who typically chew the collars off of each other. Wolf #126F, the likely alpha female (genetic tests pending), has been the Wolf Project's connection with this pack since 1999, because her collar has stayed on. At 19 wolves, this pack was the second-largest in the park in 2004, and the largest non-northern range pack. They maintain one of the larger territories in the ecosystem, and several wolves from this pack have dispersed south into Wyoming wolf packs.

Hayden Valley Pack

Little is known of this new pack, as none of them wear radio collars. Frequent and reliable sightings of four wolves and the unmistakable, white alpha female has confirmed their existence in the Hayden Valley area. Two adults and two pups make up this newly established pack.



Dan Stabler with #227M. Originally collared as a pup in the Yellowstone Delta pack, this wolf later became the alpha male of the Geode Creek pack.

Nez Perce Pack

The Nez Perce pack, the longtime core of the wolf population in the Madison–Firehole area, continued to do well in 2004. Still one of the few all-grey packs in the ecosystem, there were 14 wolves at year's end with at least two pups, but likely more. Their territory was largely the same, primarily the Firehole River drainage, but they denned in a new location and traveled widely and for longer periods in early winter. One trip was to the northern range, where they interacted with resident packs and killed several elk over the course of two weeks. Increased wolf density in the Madison–Firehole area may partly explain this pack's more frequent movements. This pack, like Mollie's, relies on bison to some degree in late winter (and possibly spring as well; scat analyses are pending).

Biscuit Basin Pack

A new pack in 2004, this pack was formed by the dispersal of female #340 from the Nez Perce pack. Collared in November 2003, this young female struck out on her own and settled next door to the longtime Nez Perce pack. Denning in the Lone Star area, they overlapped with the Nez Perce pack, especially during early winter 2004, as well as periods when the Nez Perce pack was gone from the area (see above). Numbering 11 wolves (5 adults, 6 pups) at year's end, they appear to be at a competitive disadvantage to the Nez Perce wolves.

Cougar Creek Pack

Formed in 2001, the Cougar Creek pack is thriving in an area thought to be marginal for wolf establishment prior to their colonization. Ranging primarily between Madison Junction and West Yellowstone and rarely leaving the park, this pack subsists on bull elk and bison in winter and may augment their diet with beaver in summer (scat analyses pending), as their area of the park is more densely populated with beaver than most. Condition of these wolves, when handled, has been good to excellent. Female alpha #151 was re-collared in 2004, continuing monitoring of this wolf that was originally collared as a pup in the Leopold pack in 1999.

Gibbon Meadows Pack

The Gibbon Meadows pack was another new pack in the Madison–Firehole area in 2004, although there had been reports of wolves in this area prior to their establishment (referred to as the Gibbon group). This pack

formed from dispersing wolves from the Cougar Creek and probably Nez Perce packs. They reproduced in 2004, having at least two surviving pups. Their range is primarily the Gibbon River corridor to Norris Junction, with occasional trips to the northern range. They numbered eight wolves at the end of 2004.

Bechler Pack

Like Mollie's pack, the Bechler pack struggles to maintain its numbers. Beginning the year with eight wolves, they ended it with four. All collared wolves were lost or had their collars chewed off, leaving old male #192 as the only collared wolf again. This pack ranges into the Targhee National Forest, and probably has benefited from recent mild winters, which have created a wider distribution of ungulates. 

WOLF CAPTURE AND COLLARING

Twenty-one wolves were captured and collared in 2004: 20 via darting from a helicopter and one (Slough Creek wolf #453M) after being accidentally caught in a coyote trap. Ten pups and 11 adults (11 males, 10 females) were caught in six packs (Table 3). The 2004 capture season began in late 2003, so these wolves do not represent the total number captured for the winter (17 were captured in November–December 2003). At the end of 2004, 40 (24%) of the 171 wolves that use Yellowstone National Park were radio collared. 

WOLF PREDATION

Wolf–Prey Relationships

Wolf–prey relationships were documented by observing wolf predation directly and by recording the characteristics of wolf prey at kill sites. Wolf packs were monitored during two winter study sessions, 30-day periods in March and November–December during which wolves were intensively radio-tracked. The Leopold, Geode Creek, and Druid Peak packs were monitored by two-person teams from the ground and from aircraft; the Swan Lake, Agate Creek, Slough Creek, Mollie's, Gibbon Meadows, Biscuit Basin, Nez Perce, Cougar Creek, Bechler, and Yellowstone Delta were monitored from

Capture Date	Wolf #/ Sex	Age	Color	Pack
11/13/2003	048F	Old Adult	Gray	Nez Perce
	194M	Adult	Black	Mollie's
	340F	Adult	Gray	Nez Perce
	341F	Yearling	Gray	Nez Perce
	342F	Pup	Gray	Nez Perce
	343M	Pup	Black	Mollie's
11/22/2003	344F	Yearling	Black	Leopold
	345F	Pup	Gray	Leopold
	348M	Pup	Gray	Druid Peak
11/23/2003	349M	Pup	Black	Druid Peak
	350M	Pup	Black	Druid Peak
	351M	Yearling/Adult	Gray	Geode Creek
	352M	Adult	Gray	Geode Creek
	353F	Adult	Black	Geode Creek
	354M	Adult	Gray	Swan Lake
	355F	Yearling	Gray	Swan Lake
	356M	Yearling	Gray	Swan Lake
	373M	Pup	Gray	Druid Peak
	374M	Pup	Black	Druid Peak
1/14/2004	375F	Pup	Black	Druid Peak
	376F	Pup	Gray	Druid Peak
	377M	Adult	Gray	Slough Creek
	378M	Adult	Gray	Slough Creek
	379M	Adult	Black	Slough Creek
	380F	Pup	Black	Slough Creek
	381M	Yearling	Black	Leopold
	382F	Pup	Gray	Leopold
	383M	Pup	Gray	Agate Creek
	384F	Pup	Gray	Agate Creek
1/15/2004	385M	Pup	Gray	Agate Creek
	388F	Adult	Gray	Cougar Creek
	389M	Yearling	Black	Cougar Creek
2/12/2004	390F	Pup	Black	Cougar Creek
	151F	Old Adult	Gray	Cougar Creek
	391F	Adult	Gray	Geode Creek
	392M	Yearling	Gray	Geode Creek
2/13/2004	395F	Adult	Gray	Yellowstone Delta
	396F	Adult	Black	Yellowstone Delta
	397F	Adult	Black	Yellowstone Delta
	398M	Adult	Gray	Yellowstone Delta
	399F	Adult	Black	Yellowstone Delta
	400F	Adult	Black	Yellowstone Delta
	408M	Pup	Black	Bechler
2/21/2004	409F	Pup	Black	Bechler
	410F	Pup	Gray	Bechler

Table 3. Yellowstone Wolf Project collaring operations, 2004 calendar year.

aircraft only. Yellowstone National Park staff recorded and entered into a database behavioral interactions between wolves and prey, predation rates, the total time wolves fed on their kills, percent consumption of kills by wolves and scavengers, characteristics of wolf prey (e.g., nutritional condition), and characteristics of kill sites. In addition, similar data were collected opportunistically throughout the year during weekly monitoring flights and ground observations. The abundance and sex/age composition of elk within wolf pack territories were also estimated from the ground and from fixed-wing aircraft.

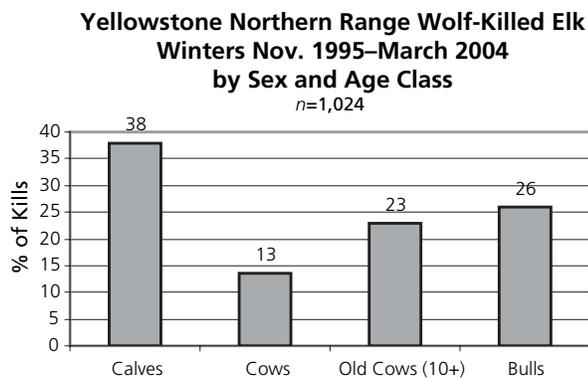


Figure 5. Yellowstone northern range wolf-killed elk by sex and age class, 1995–2004.

Composition of Wolf Kills

Project staff detected 295 kills (definite, probable, and possible combined) made by wolves in 2004, including 240 elk (81%), 19 bison (6%), 1 moose (<1%), 4 deer (1%), 4 pronghorn (1%), 1 badger (<1%), 2 cougars (1%), 6 coyotes (2%), 1 golden eagle (<1%), 2 grizzly bear cubs (1%), 1 raven (<1%), 3 wolves (1%), and 11 unknown prey (4%). The composition of elk kills was 18% calves (0–12 months), 16% cows (1–9 years old), 16% old cows (≥ 10 years old), 38% bulls, and 12% elk of unknown sex and/or age (Figure 5). Bison kills included 4 calves (unknown sex), 8 cows, 5 bulls, and 2 of unknown sex and age.

Kill rates for 1995–2000 showed that wolves residing on the northern range killed an average of 1.8 elk per wolf per 30-day study period during the winter. Using the same method for calculating kill rates, wolves on the northern range killed an average of 1.1 elk/wolf/30-day study for the period 2001–2004. This 40% decrease suggests changing ecological conditions for wolves in this part of the park.

Winter Studies

During the 2004 March winter study (30 days), wolves were observed for 379 hours from the ground. The number of days when individual wolf packs were located from the air ranged from one (Yellowstone Delta and Bechler) to 21 (Leopold, Geode, Druid Peak, and Slough Creek). Sixty-six definite or probable wolf kills were detected, including 56 elk, 6 bison, 2 mule deer, and 2 unknown species. Among elk, 9 (16%) were calves, 14 (25%) were cows, 25 (45%) were bulls, 5 (9%) were adults of unknown sex, and 2 (4%) were of unknown sex and age. During the 2004 November–December winter study (30 days), wolves were observed for 300 hours from the ground. The number of days when individual wolf packs were located from the air ranged from 0 (Rose Creek) to 15 (Leopold, Druid Peak, Geode Creek, and Agate Creek). Fifty definite, probable, or possible wolf

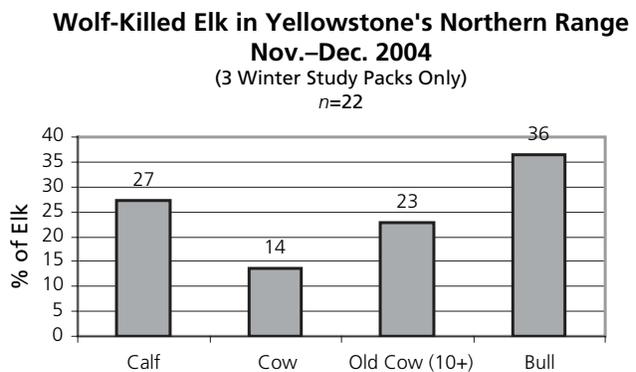
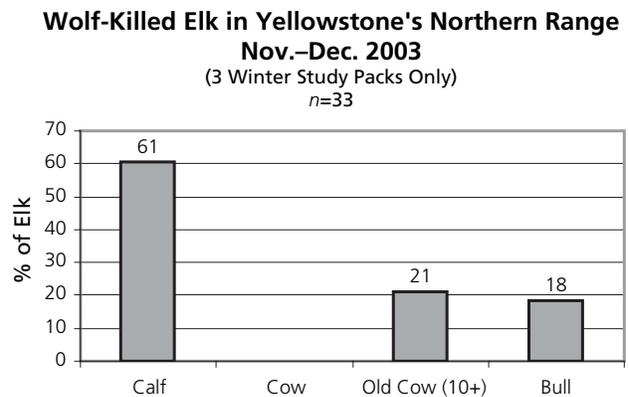


Figure 6. Wolf-killed elk in Yellowstone's northern range detected during the November–December winter study, 2003 and 2004.

kills were detected during the November–December 2004 winter study, including 45 elk, 2 bison, 1 coyote, 1 cougar, and 1 badger. Among elk, 7 (16%) of the kills were calves, 18 (40%) were cows, 19 (42%) were bulls, and 1 (2%) was an adult elk of unknown sex (Figure 6).

Summer Studies

Summer predation. In the summer of 2004, Wolf Project staff continued efforts to document summer predation patterns by wolves. Documenting the predatory habits of wolves in summer is problematic due to the lack of snow for tracking, increased nighttime activity of wolves, lack of pack cohesiveness, and smaller prey packages, leading to quick consumption and loss of evidence. Traditionally, the best data concerning wolf summer food habits have come from analysis of scat contents collected at den and rendezvous sites. Although scat collection efforts continued in 2004, downloadable GPS (Global Positioning System) collars have opened a new door to studying summer wolf predation.

The Wolf Project deployed five GPS collars in the 2004 capture season to enhance understanding of 1) seasonal predation patterns; 2) spatial and temporal interactions with other wolf packs and carnivores; 3) movements with respect to dens during pup-rearing season; and 4) territory size, use, and overlap. Because GPS collars provide more accurate and numerous data compared to traditional radio telemetry collars and reduce reliance on aerial monitoring, the Wolf Project has expanded the GPS collar program. Using GPS radio collars with downloadable data acquisition technology, weekly data gathering this summer has yielded unprecedented information on wolf summer predation patterns. Collars programmed to collect location data every 30 minutes during the summer season have provided researchers with



The Geode Creek pack were successful in bringing down this cow elk.

a fairly comprehensive picture of wolf movements, and allowed wolf kills to be found—even newborn elk calves. The data have allowed researchers to find recent kill sites to collect scavenger data, and in one case, showed where a wolf pack had displaced a cougar from a cow elk kill and scavenged the remainder of the carcass. Data collection methods from summer 2004 will be replicated in summer 2005, provided there is funding.

A GPS collar on Geode wolf #392M performed extremely well, and allowed staff to document 14 kills made by members of the Geode pack from May 3 until June 21. Of these kills, five were neonate elk calves, three were adult bull elk, three were adult cow elk, and three were approximately one year of age. In addition, GPS points allowed Wolf Project staff to document five carcasses scavenged, one belonging to a GPS collared cougar in the Hellroaring study area. Similar studies are planned for 2005.

Summer scavenging. The effects of wolf restoration on scavenger guilds in the Greater Yellowstone Ecosystem is an important aspect of trophic cascade research. Research on wolf and scavenger interactions has been conducted since 1998, through support from Canon U.S.A., Inc., and the Yellowstone Center for Resources. This research, largely conducted in winter, has monitored how wolves influence the abundance and distribution of carrion, both spatially and temporally, as well as how they facilitate food acquisition by other carnivores. Although a great deal has been learned about the magnitude and relative importance of wolf-killed carcasses to winter scavenger communities, little is known about impacts to summer scavengers, both vertebrate and invertebrate. Focusing on summer scavenging will likely lead to a more complete understanding of the ecological relationship between wolves and scavengers as it relates to seasonal variation, abundance, and diversity.

In summer 2004, Wolf Project staff increased monitoring efforts on summer carcasses to document scavenger utilization and behavioral interactions between wolves and scavengers. At the end of the summer study period, scavenging data were collected on three bison and four elk carcasses, for a total of seven carcasses. Most carcasses were observed from early stages of consumption until they were reduced to bone and hide. Every carcass was visited by wolves, grizzly bears, coyotes, bald eagles, golden eagles, ravens, and magpies. A black bear fed on one. Overall, vertebrate scavenger numbers were lower at summer carcasses than in winter. The high count for ravens at a summer carcass in the study area was 47, compared to raven counts exceeding 100 individuals observed

at winter carcasses in the same study area. Preliminary data suggest that in contrast to winter, bears (both grizzly and black) benefit more from wolf kills in summer, and in general, vertebrate scavenger densities are lower at each carcass in summer.

Feeding patterns of wolves in summer are different from that of winter, largely due to the necessity of bringing food from a carcass back to a den site to feed growing pups; this sometimes requires adult wolves to travel miles with food in their mouths and stomachs. This, in turn, allows other vertebrate scavengers to feed on carcasses in the wolves' absence. In winter, wolves would more aggressively defend their food source from scavengers, and an entire pack is typically assembled together. Summer offers another difference in foraging strategies for wolves, in that newborn ungulates are on the landscape. This food source is small and easy to consume in a shorter period, almost exclusively allowing wolves to benefit from their hunting success, leaving little for scavengers. 🐾



After the kill, alpha female #106 runs in to consume her share, even though she did not participate in the hunt.

WOLF MANAGEMENT

Area Closures

To prevent human disturbance of young pups, visitor entry was closed to areas surrounding the Druid Peak pack's den. This closure in the east end of Lamar Valley was about four square miles in size, and was centered on the dens. A no-stopping zone was instituted along the road to Cooke City near the den of the Druid Peak pack, to discourage visitors from parking their vehicles outside established pullouts and prevent them from stop-

ping near wolves that were trying to cross the road near the den. The Daly Creek trail, in the northwest portion of the park, was temporarily closed to off-trail hiking to protect the denning area of the Chief Joseph pack. Den sites for the Leopold and Mollie's packs were protected from disturbance incidental to closures for the Blacktail (March 15–June 30) and Pelican Valley (April 1–July 3) Bear Management Areas. The areas around the den sites of the Slough Creek, Geode, Agate, Specimen Ridge, Nez Perce, Biscuit Basin, Gibbon Meadows, Yellowstone Delta, Bechler, Swan Lake, and Cougar Creek packs were not closed because of historically low visitor use.

Druid Road Management Project

Since wolf reintroduction, the Lamar Valley has become the premier location worldwide to observe free-ranging wolves. The main pack of interest is the Druid Peak pack, which has denned in the valley since 1997. Visitor numbers have grown each year, and in 2000, staff from the Yellowstone Center for Resources, the Division of Resource Management and Visitor Protection, and the Division of Interpretation cooperated to deal with the opportunities and problems that accompany increasing visitor numbers. As a result, the Druid Road Management Project was initiated, with the following objectives: 1) human safety: protect visitors who are viewing wolves along the road, and control both traffic along the road and parking to prevent an accident; 2) wolf safety: protect wolves from vehicle strikes, permit wolves to cross roads without harassment from visitors, and protect the closed area around the den from visitor intrusion; 3) visitor enjoyment: through protection of natural wolf behavior, preserve visitor opportunity to view wolves and interpret wolf and other wildlife ecology to visitors; and 4) wolf monitoring and research: continue to monitor and study the denning behavior, predation, activity, and interactions of wolves with other wildlife.

This was the fifth year that private funds were used to manage wolf viewing in Lamar Valley. Two paid personnel (Rick McIntyre and Emily Almberg) were hired through the Yellowstone Park Foundation, facilitated by a grant from the Twin Spruce Foundation; one other volunteer assisted. The project began on May 16 and ended on September 18, 2004. There were no collisions involving visitors, vehicles, or wolves during the 126 days of the Druid Road Management Project's season, and wolves successfully crossed the road on 81% of their first attempts. Because the wolves spent less time in the rendezvous site in July and August, fewer visitors saw wolves



Katie Yale, Emily Almberg, and Janice Stroud visit the Specimen Ridge den site to collect scat for food content analysis.

this season (8,721) than last year (9,827); it is estimated that wolves were in sight for 395 hours. Visitors contacted this summer numbered 11,710—about the same as in 2003. There was one case of wolf habituation during this field season.

Wolf Depredation Outside Yellowstone

Nine of 10 wolf packs in Wyoming's GYA outside Yellowstone National Park were involved in at least one depredation, and were responsible for at least 122 livestock depredated by wolves in 2004. Confirmed losses included 74 cattle, 16 sheep, 2 horses, and 2 dogs. As a result, 29 wolves were lethally removed in control actions in Wyoming. In the Montana portion of the GYA, 9 of the 17 known wolf packs were involved in confirmed depredations on livestock or guard dogs in 2004. Confirmed losses included 24 cattle, 81 sheep, 2 goats, and 4 herding or guard dogs. As a result, 25 wolves were lethally removed in control actions and/or shoot-on-site permits in 2004. A single calf was confirmed killed by wolves in the Idaho portion of the GYA in 2004, but no wolves were removed for this incident. 🐾

COLLABORATIVE RESEARCH

The Wolf Project and the Yellowstone Park Foundation provided direct and indirect support for collaborative research with scientists at other institutions, primarily universities. Most of the studies represent pioneering work on wolves within the topic of interest.

Wolf Project Students: Direct Assistance

Graduate Student: Shaney Evans (Master of Science candidate)

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

Title: Adult cow elk (*Cervus elaphus*) seasonal distribution and mortality post-wolf (*Canis lupus*) reintroduction in Yellowstone National Park, Wyoming

Project Narrative: As part of a three-tiered study, "Multi-trophic level ecology of wolves (*Canis lupus*), elk (*Cervus elaphus*), and vegetation in Yellowstone National Park, Wyoming," seasonal distributions and movements of elk will be examined to evaluate the behavioral effects of wolves on elk and establish baseline data for future analyses. Individual elk radio-locations will be paired with wolf radio-locations to establish the proximity of elk to wolves. Comparisons of individual differences in cow elk distribution will be investigated with respect to several variables, including age, presence of calf, pregnancy status, nutritional condition, group size, spatial and temporal factors, and wolf density. In addition, a survival analysis will provide information on relative factors influencing mortality of cow elk in Yellowstone's northern range herd.

Project Activity in 2004: Completed mortality report for NPS, thesis writing.

Anticipated Completion Date: May 2005

Graduate Student: Daniel MacNulty (Ph.D. Candidate)

Committee Chair: Dr. Craig Packer, University of Minnesota

Title: A behavioral analysis of the effect of predator and prey densities on wolf predation

Project Narrative: The mathematical expression for a predator's "kill rate" (i.e., kills per predator per time) is fundamental to analyses of predator-prey dynamics. Predictions of dynamics vary widely according to how kill rate models assume that kill rate changes with predator and prey densities. Little is known, however, about the behavioral processes generating

the relationship between kill rate and predator–prey densities, especially in natural environments. This is an important knowledge gap, because it hinders progress in predator–prey theory and confounds predictions of predator–prey dynamics. This study will examine the behavioral mechanisms that cause wolf kill rate to vary with elk, bison, and wolf densities in Yellowstone National Park. The analyses will be based on direct observations of wolves and ungulates recorded during eight intensive, 30-day study periods from 1995 to 2003. Individual-level analyses of wolf kill rate and its behavioral parameters (i.e., attack rate, handling time, search time) will be completed with general linear and non-linear mixed models to account for correlation among repeated measurements of individual wolves. The results are expected to clarify the basic biology underlying models of wolf kill rate, and thereby strengthen attempts to anticipate the effects of wolf predation on ungulate populations.

Project Activity in 2004: Data analysis and thesis writing.

Anticipated Completion Date: September 2005



STAFF AND PUBLIC INVOLVEMENT

Volunteer Program

Twenty volunteers donated a total of 5,636 hours in 2004, worth \$72,084.44 at the GS-05 level (see Appendix). This was equal to approximately three full-time GS-05 employees. Volunteer positions continued to be highly competitive, with three to four applicants for each position. Chosen volunteers received free housing and a \$500/month food stipend.

Most positions are available during winter, when studies of wolf behavior and predation rate take place. A background in a biological science is preferred. Interested persons should mail a cover letter and résumé to the Yellowstone Wolf Project, P.O. Box 168, Yellowstone National Park, Wyoming 82190.

Seasonal Staff

The Wolf Project was able to hire paid seasonal staff through the Yellowstone Park Foundation and Yellowstone Association to assist in several key aspects of annual work. Matt Metz, Janice Stroud, and Katie Yale

Other Research—Indirect Assistance 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–elk relationships in the Madison–Firehole watershed	Bob Garrott, Matt Becker, Claire Gower	Montana State University
Wolf–elk calf mortality	P.J. White, L. David Mech, Shannon Barber	YCR, University of Minnesota
Wolf–pronghorn	P.J. White, John Byers,	YCR, University of Idaho
Wolf–willow	Evelyn Merrill, Francis Singer, Roy Renkin, William Ripple, David Cooper, Tom Hobbs, Don Despain	University of Alberta, USGS, YCR, Oregon State University, Colorado State University
Wolf–aspen	William Ripple, Eric Larsen, Roy Renkin, Matt Kauffman	Oregon State University, University of Wisconsin at Stevens Point, YCR, University of Montana
Wolf–trophic cascades	L. David Mech, Rolf Peterson, Nathan Varley, Mark Boyce, Francis Singer	University of Minnesota, Michigan Technological University, University of Alberta, USGS
Wolf predation	Tom Drummer, John Vucetich, Rolf Peterson	Michigan Technological University
Wolf survival	Dennis Murray	Trent University



Wolf Project staff and winter study volunteers. Front row, from left: Mike Wolcott, Abbey Nelson, Stephani Farris, Scott Larsen. Back row, from left: Emily Almberg, Dan Stahler, Doug Smith, Tim Hudson, Deb Guernsey, Matt Metz, Jessica Auer.

worked for the summer field season and were crucial to the summer predation and summer scavenging studies, as well as other project work. Matt and Janice also worked during several winter months in this capacity. Emily Almberg and Rick McIntyre worked primarily for the Druid Road Management Project during the summer, but also assisted with many other project goals during winter months. All five spent many hours collecting data throughout the year, and contributed largely to the increased research productivity of the Yellowstone Wolf Project.

Visiting Scholars Program

There were three visiting scholars during 2004: Drs. John and Lea Vucetich, and Rolf O. Peterson, all of whom participated in our March winter study. John also worked on an article for publication dealing with elk population fluctuations from 1961 through 2003. The manuscript, with Doug Smith and Dan Stahler as co-authors, examined the impact of weather, elk density, hunter offtake, and wolf predation on the trajectory of elk population. Peterson, a long-term collaborator with the Yellowstone Wolf Project, investigated predator-prey/

trophic cascade research and consulted on his special interest: elk bone collections and measurements. 

ACKNOWLEDGMENTS

The Yellowstone Wolf Project encompasses the work of numerous people, a fine tapestry woven of many threads. As the years go by, we have all been taken aback by the tireless efforts of a growing list of participants. More and more, the Yellowstone Park Foundation (YPF) has taken on a key role in keeping all aspects of our program operating. We thank all of the donors who have supported us through YPF, especially those involved with the collar sponsorship program. They are needed now more than ever. Our winter study could not occur without our volunteers. We thank and admire all of them, both past and present. Several winter study volunteers have stayed on longer than planned. Supported by YPF and the Yellowstone Association, they essentially operate as year-round biological technicians. We cannot accommodate all the requests to volunteer, and thank all who apply for their heartfelt interest, which of course is what gets the wolf work done: passion. Thanks also to Alice

Wondrak Biel, Tami Blackford, and Virginia Warner, of the YCR Resource Information Team, for editing and designing this report. 

APPENDIX

Yellowstone Volunteer Wolf Project Roster, 2004

Name	Period of Involvement	Hours Worked
Almberg, Emily	11/8/2004–12/17/2004 & 2/25/2004–4/9/2004	588
Auer, Jessica	11/8/2004–12/17/2004	300
Bean, Jack	2/25/2004–4/9/2004	288
Billman, Hilary	1/5/2004–1/30/2004	160
Brown, Paul	11/8/2004–12/17/2004	300
Farris, Stephani	11/8/2004–12/17/2004	300
Fenty, Brent	2/25/2004–3/31/2004	288
Geremia, Chris	2/25/2004–3/31/2004	112
Hudson, Tim	11/8/2004–12/17/2004	300
Jones, Jennifer	2/25/2004–4/9/2004	288
Laursen, Scott	11/8/2004–12/17/2004	300
Metz, Matt	2/25/2004–3/31/2004 & 11/8/2004–12/17/2004	588
Napoli, James	6/1/2004–6/18/2004	40
Nelson, Abby	11/8/2004–12/17/2004	300
Patrick, Nichole	2/25/2004–4/9/2004	288
Stroud, Janice	2/25/2004–3/31/2004	288
Vucetich, John	3/4/2004–4/9/2004	160
Vucetich, Lea	3/4/2004–4/9/2004	160
Wilmers, Chris	2/25/2004–4/1/2004	288
Wolcott, Michael	11/8/2004–12/17/2004	300
Total Volunteer Hours		5,636

Publications in 2004

Almberg, E., R. McIntyre, D.R. Stahler, D.W. Smith, B. Chan, M. Ross, J. Knuth Folts, D. Chalfant, and B. Suderman. 2004. Managing wolves and humans in Lamar Valley. Final Report on Druid Road Management Project 2004. YNP Report. 9 pp.

Bangs, E.E., J. Fontaine, T. Meier, C. Niemeyer, M. Jimenez, D. Smith, C. Mack, V. Asher, L. Handegard, M. Collinge, R. Krischke, C. Sime, S. Nadeau, and

D. Moody. 2004. Restoration and conflict management of the gray wolf in Montana, Idaho, and Wyoming. Transactions of the 69th North American Wildlife and Natural Resources Conference, Wildlife Management Institute, pgs. 89–105.

Gunther, K.A., & D.W. Smith. 2004. Interactions between wolves and female grizzly bears with cubs in Yellowstone National Park. *Ursus* 15(2):232–238.

Mech, L.D., R.T. McIntyre, D.W. Smith. 2004. Unusual behavior by bison, *Bison bison*, toward elk, *Cervus elaphus*, and wolves, *Canis lupus*. *Canadian Field Naturalist* 118:115–118.

Robbins, J. 2004. Lessons from the wolf. *Scientific American* June:76–81.

Smith, D.W. 2004. Wolf behavior: Learning to live in life or death situations. *In: Encyclopedia of Animal Behavior*, ed., Marc Bekoff, Greenwood Press, Westport, CT, pgs 1181–1185.

Smith, D.W. 2004. The wolf in fairy tales. *In: Encyclopedia of Animal Behavior*, ed., Marc Bekoff, Greenwood Press, Westport, CT, pgs 39–40.

Smith, D.W., D.R. Stahler, and D.S. Guernsey. 2004. Yellowstone Wolf Project Winter Study Handbook. Yellowstone Center for Resources.

Smith, D.W., T.D. Drummer, K.M. Murphy, D.S. Guernsey, and S.B. Evans. 2004. Winter prey selection and estimation of wolf kill rates in Yellowstone National Park, 1995–2000. *Journal of Wildlife Management* 68:153–166.

Smith, D.W., D.R. Stahler, and D.S. Guernsey. 2004. Yellowstone Wolf Project: Annual Report 2003. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming. YCR-NR-2004-04. pp. 1–18.

Wilmers, C.C. and W.M. Getz. 2004. Simulating the effects of wolf–elk population dynamics on resource flow to scavengers. *Elsevier* 177:193–208. 