Yellowstone National Park
Wolf, Cougar, & Elk Project
Wyoming, Montana, Idaho

Yellowstone Center for Resources
National Park Service
Department of the Interior

Yellowstone Wolf, Cougar, and Elk Project Annual Report

2024

Summary

At the end of December 2024, there were 108 wolves in nine packs (seven breeding pairs) living primarily in Yellowstone National Park (YNP). Pack size ranged from four to 25, averaging 11.8 members. Throughout YNP, a minimum of 41 pups were produced, with three other litters of pups that were presumed born but died before they could be observed. Thirty-seven pups survived (90%) to the end of the year with 22 in the four northern packs and 15 in the five interior packs. At the end of 2024, pups comprised 34% of the wolves living in YNP.

Several packs dissolved or shifted territories during this past year, and some new packs formed. Three packs dissolved in early 2024 (Lupine Creek, Firehole River, and the 1330F/1336M group), while three packs shifted their territories out of YNP (1384F group, Shrimp Lake, and Willow Creek), and one previously Wyoming-based pack shifted to spend much of their time within YNP (Hawk's Rest). Two new packs formed and then produced and successfully raised pups to the end of the year (Bliss Pass and Dunanda Falls). Six long-term packs remained stable (8 Mile, Rescue Creek, Junction Butte, Mollie's, Wapiti Lake, and Cougar Creek).

The cougar population in YNP is not censused each year; however, radio collars on a subset of the population along with monitoring through camera-traps inform annual population estimates. Estimates from 2014-2017 indicated a population of 34-42 cougars using northern YNP, with some additional cougars using other portions of YNP from spring to fall only. While current population estimates are not available, preliminary work indicates cougar abundance has likely remained similar in recent years. Contemporary population estimates are underway using remote camera data starting in winter of 2020/2021 (see Graduate Research section for details).

In stark contrast to the severe winter of 2022-2023, the 2023-2024 winter was quite mild with above average temperatures and below-average snowfall. Ungulates in YNP were generally in good to excellent condition for most of the winter and this likely influenced wolf and cougar kill rates, biomass consumption, and movements. Although poor weather conditions and scheduling issues cancelled the traditional fixed-wing aircraft elk count in early 2024, MTFWP conducted an elk classification count via helicopter in March 2024 and observed 5,597 elk in the Northern Yellowstone elk herd. Aerial counts underestimate the true number of elk because sighting conditions vary each year from good to poor depending on vegetation or snow cover, elk group sizes, and behavior. Even in good conditions, observers miss some elk, yet overall population trends can be inferred with this method.

Carnivore-Prey Relationships

Project staff detected 211 kills definitely, probably, or possibly made by wolves in 2024: 126 elk (59.7%), 47 bison (22.3%), five mule deer (2.4%), five deer (undetermined if mule deer or whitetail deer, 2.4%), five moose (2.4%), five pronghorn (2.4%), two wolves (<1%), one coyote (<1%), one white-tailed deer (<1%), and 14 unidentifiable species (6.6%, most were likely ungulates). The composition of wolf-killed elk was 41% calves, 6% yearlings, 25% adult females, 25% adult males, 2% of unknown age and sex, and 1% adults of unknown sex. The composition of wolf-killed bison was 30% calves, 9% yearlings, 36% adult females, 19% adult males, 6% adults of unknown sex. Staff also recorded wolves scavenging on 52 ungulate carcasses throughout the year.

Project staff detected 56 kills definitely, probably, or possibly made by cougars in 2024: 20 elk (35.7%), nine deer (undetermined if mule deer or whitetail deer, 16.1%), seven mule deer (12.5%), five coyotes (8.9%), four pronghorn (7.1%), two badgers (3.6%), two red foxes (3.6%), two white-tailed deer (3.6%), and one (<2%) each of bighorn sheep, yellow-bellied marmot, mountain goat, skunk, and an undetermined ungulate.

The above totals represent a combination of carcasses detected using intensive, strategic efforts during specific seasons with the addition of opportunistic observations during the rest of 2024. Wolf and cougar predation was intensively monitored for four and a half months of 2024—Late Winter (March), Early winter (mid-November to mid-December), and Summer (May 1 through July 17).

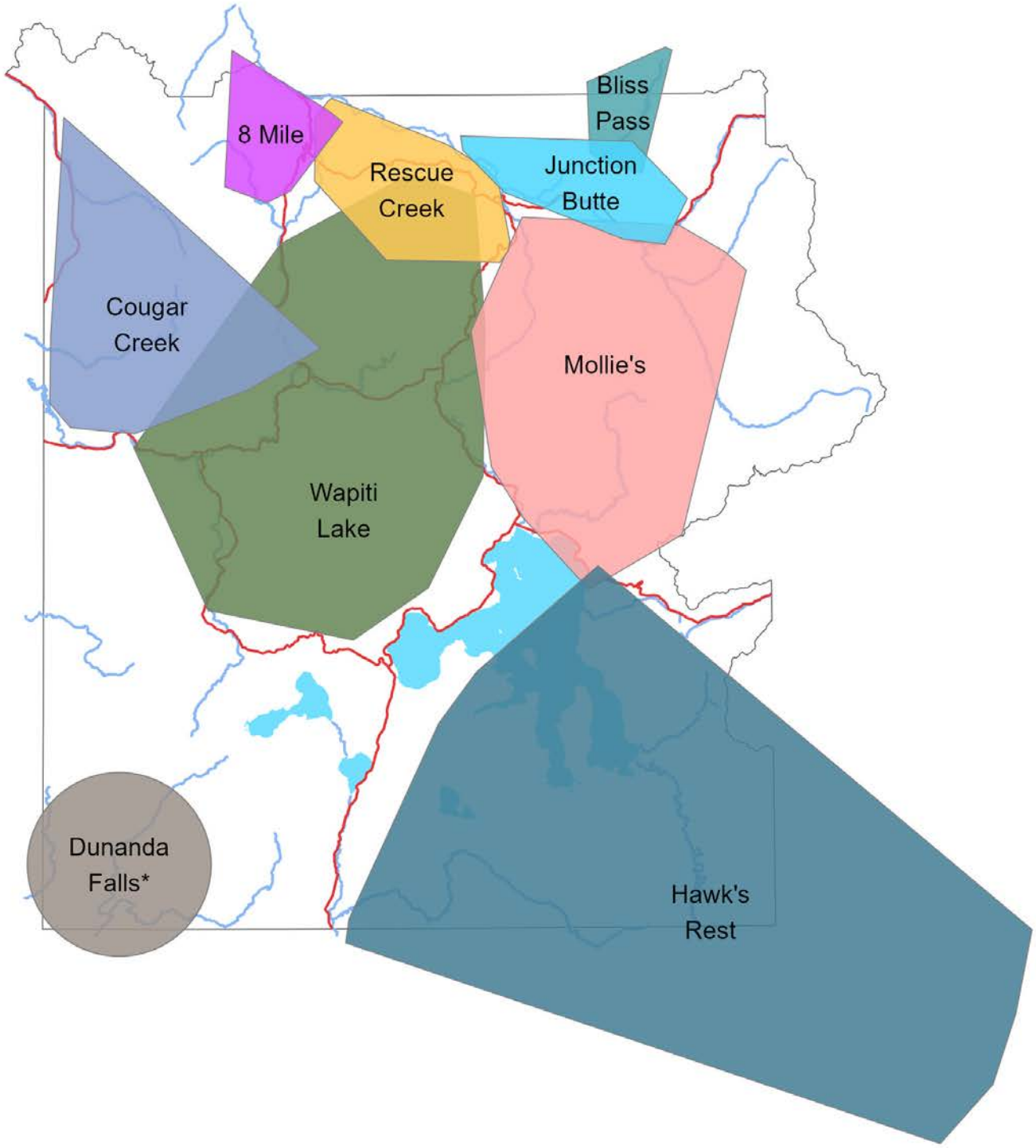
Predation Studies

Late Winter—During the 30-day March 2024 study period, three teams (air, ground, and GPS [Global Positioning System] cluster-search crew) collectively discovered 53 ungulate carcasses fed on by wolves. In addition, wolves were tracked to one bull elk that was under ice, but the wolves were unable to reach it to obtain any biomass. The air crew was able to fly on 19 of the 30 days and routinely tracked most packs in YNP. The ground crew observed the Rescue Creek pack for 29 of the 30 days. The GPS cluster-crew hiked or

Front cover: Members of the Mollie's Pack rally after an unsuccessful elk hunt in Lamar Valley.. NPS PHOTO: E. Stahler

2024 Yellowstone Wolf Pack Territories

(95% minimum convex polygons of aerial locations)



Note: Some wolf pack territories include transboundary movements not displayed here.

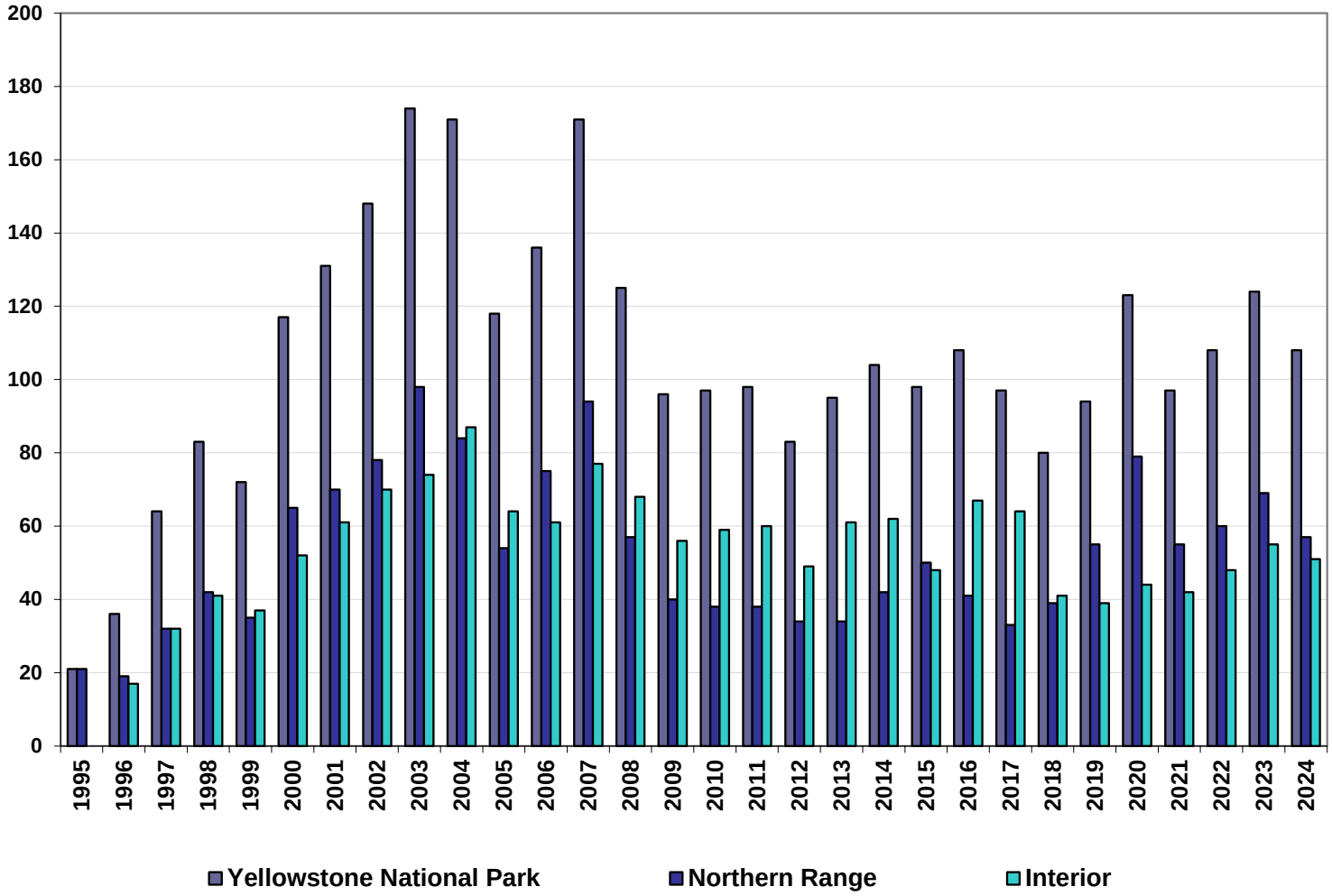
*Unable to map territory in detail as only five aerial locations were recorded for this pack

Yellowstone Wolf Population as of 12/31/2024

	Adults	Pups	Total
NORTHERN RANGE			
8 Mile	13	5	18
Rescue Creek	13	7	20
Bliss Pass	3	5	8
Junction Butte	5	5	10
loners (1048M)	1	0	1
Northern Range Total	**35**	**22**	**57**
NON-NORTHERN RANGE			
Cougar Creek	4	2	6
Dunanda Falls	2	2	4
Hawk's Rest	7	0	7
Mollie's	8	0	8
Wapiti Lake	14	11	25
loners (1410F)	1	0	1
Non-Northern Range Totals	**36**	**15**	**51**
YNP TOTAL	**71**	**37**	**108**

underline denotes a breeding pair

Yellowstone National Park Wolf Population 1995-2024



Dr. Matt Metz hired as Wolf Project Biologist

In late summer 2024, Dr. Matt Metz was hired by the NPS as the Project Biologist for the Yellowstone Wolf Project. Matt succeeds a distinguished line of predecessors that have held this position: Doug Smith, PhD (1994-1997), Kerry Murphy, PhD (1998-2001), and Dan Stahler, PhD (2002-2022). The Project Biologist helps run the day-to-day logistics of the program and leads key parts of monitoring and research such as population dynamics and seasonal predation studies.

Matt is no stranger to the project, having first joined the Wolf Project in 2002 as a volunteer technician. Matt then went on to complete a M.S. in 2010 through Michigan Technological University, a PhD in 2021 from the University of Montana, and worked as a Yellowstone Forever-funded Research Associate for the project. These efforts contributed key milestones in the project's goals to understand wolf-prey dynamics. As the project has fully integrated cougars and elk into the primary responsibilities, Matt's role is pivotal to our mission, encompassing comprehensive monitoring, management, scientific research, and education about the park's carnivore populations, interactions with prey and other species, and ecosystem processes.

Project Biologist Matt Metz services an autonomous recording unit as part of the wolf bioacoustics study. These devices record Yellowstone's soundscapes 24/7 with the goal of detecting wolf vocalizations to use as a passive monitoring tool and to study wolf communication. NPS PHOTO: J. Frank

"Metz's extensive experience and skills position him to continue and enhance the project's legacy of excellence in Yellowstone's rich history of wildlife management and research. There are few who have dedicated as many years as Matt has to our program's mission, and we're fortunate to have him as part of the NPS team." - Dan Stahler, Project Leader."

Read more about Matt's research in *Yellowstone Wolves: Science and Discovery in the World's First National Park*, 2020.

skied a total of 610 kilometers (379 miles) to investigate 323 GPS clusters—182 clusters for two wolves in the Rescue Creek pack, 121 clusters for two wolves in the Junction Butte pack, and 20 clusters for cougar F223. For wolves, a cluster was defined as two or more location fixes within 100 meters of each other within a three-day span, and for cougars, two location fixes within 200 meters of each other within a six-day span. In winter, GPS collars are set to take a location fix every hour for wolves and every three hours for cougars.

For all carcasses detected for wolves, forty-one (77%) of the ungulate carcasses found were killed by wolves, including 18 elk, 14 bison, one deer, one moose, four pronghorn, and three ungulates of undetermined species. Of the elk, two were calves (11%), six were adult females (33%), eight were adult males (44%), and two were yearlings (11%).

The wolves also scavenged on nine bison, two elk, and one ungulate of undetermined species that died of non-wolf-related causes. For cougar F223, the crews discovered five ungulate kills: one adult female elk, one yearling male elk, and three deer fawns (one mule deer, one white-tailed, and one undetermined deer species).

Early Winter—During the 30-day November-December 2024 early winter study period, the three teams collectively discovered 66 ungulate carcasses fed on by wolves. The air crew was able to fly on 20 of the 30 days and routinely tracked most packs in YNP. One ground crew observed the Junction Butte pack for 21 of the 30 days and another crew observed the Rescue Creek pack for 25 of the 30 days. The GPS cluster-search crew hiked or skied over 705 kilometers (438 miles) to investigate 199 GPS clusters from one Rescue Creek pack wolf (84 clusters), one Junction Butte pack wolf

Front cover. The 8 Mile Pack travels by a group of alert bull elk without engaging, seeming to sense from afar their unlikely chance of a successful hunt. NPS PHOTO: D. Stahler

(71 clusters), and two cougars: F210 (25 clusters) and F223 (19 clusters). Fifty-eight (88%) of the ungulate carcasses found were killed by wolves, including 41 elk, 10 bison, five deer, one moose, and one ungulate of undetermined species. Of the elk, 13 were calves (32%), eight were adult females (20%), 15 were adult males (37%), two were yearlings (5%), one was an adult of unknown sex (2%), and two were of unknown age and sex (5%). The wolves also scavenged on four bison and four elk that died of non-wolf-related causes. Cluster crews found the two cougars killed five deer, one elk calf, one bighorn sheep lamb, four coyotes, one red fox, and one carcass of undetermined species.

Summer—During the two-and-a-half month May 1 through July 17 predation study period, the GPS cluster-search crew hiked over 1043 kilometers (648 miles) to investigate 502 GPS clusters from two wolves in the Rescue Creek pack (425 clusters) and one cougar, F223 (77 clusters). The crew discovered that the wolves had fed on 67 fresh ungulate carcasses. Fifty-eight (87%) of the ungulate carcasses found were killed by wolves, including 45 elk, five bison, five deer, one moose, one pronghorn, and one ungulate of undetermined species. Of the elk, 29 were neonate calves (64%), four were yearlings (9%), eight were adult females (18%), and four were adult males (9%). The wolves also scavenged on four bison, two elk, one deer, one pronghorn, and one ungulate of undetermined species that died of non-wolf-related causes.

Cougar F223 killed ten elk, four deer, three pronghorn, two badgers, one red fox, one marmot, and one skunk. Of the elk, two were adults, two were female yearlings, five were calves, and one was of unknown sex and age class.

WOLF RESEARCH

Mortality

Eight radio-collared wolves died in 2024. Five were legally killed during the wolf hunting season in Montana—1388F from Lupine Creek, 1336M from the 1330F/1336M group, 1491F from 8 Mile, 1493M from 8 Mile, and 1414F from Cougar Creek. In addition, 1232M from Lupine Creek was poached in Montana. Only one collared wolf was confirmed killed by other wolves in 2024—907F from Junction Butte.

Lastly, 1330F died just outside of YNP but the carcass was heavily scavenged and cause of death could not be determined.

In addition to collared wolves, nine uncollared wolf mortalities were documented. Of those, eight were due to humans, including seven legally killed by hunters in Montana (one wolf from Bliss Pass, three from 8 Mile, two from Junction Butte, and one from Cougar Creek), plus the uncollared alpha male of the Junction Butte pack was poached in Montana. The last uncollared wolf mortality (unknown pack of origin) was found near Mount Everts and was likely killed by other wolves.

Disease

There was no indication of diseases in wolves in 2024. Based on localization of radio-collared wolves, several litters of pups were likely born but died before they could be counted. Early deaths of pups are sometimes attributed to disease outbreaks but overall normal pup production and high survival in other packs suggest that any early losses were more likely due to predation, drowning, limited pack member support of denning female, or other accidents.

Reproduction

Prior to the birth of the 2024 litters, there were approximately 108 adult wolves in YNP in April 2024. At least 41 pups were then born to nine packs. Three packs produced multiple litters: 8 Mile (five pups from one litter and an unknown number from the second litter that probably died very early), Junction Butte (two litters of three pups each), and Wapiti Lake (at least two litters with a total of 12 pups). Six packs produced one litter each (Bliss Pass, Cougar Creek, Dunanda Falls, Hawk's Rest, Mollie's, and Rescue Creek). The Firehole River, Lupine Creek, and 1330F/1336M packs all dissolved in early 2024 and were not present by the denning season, and the Shrimp Lake and Willow Creek packs both shifted their territories outside of YNP before spring. The 1384F group produced pups but seemed to use areas outside of YNP with enough frequency that this pack did not count toward the official YNP population.

Of the minimum 41 pups produced in YNP packs, 37 (90%) survived to the end of the year. This is considered a maximum as three litters (one from 8 Mile, Mollie's, and Hawk's Rest) died before they could be counted.

Although we classified Mollie's pack as having one litter of pups when the pregnant female (1410F) localized and gave birth, the rest of her pack mates did not attend her den. She raised an unknown number of pups seemingly by herself until late June but then stopped attending the area, presumably because the pups died (unknown cause). Wolf 1410F then remained a lone wolf through 2024.

2024 Yellowstone Wolf Mortalities

Wolf #/sex	Date of Death	Age	Pack	Cause of Death
1330F	1/26/2024	adult	1330F/1336M group	Unknown
1388F	1/26/2024	yearling	Lupine Creek	Hunter-killed in MT, Region 3
1232M	2/2/2024	adult	Lupine Creek	Poached in MT
1336M	2/13/2024	adult	1330F/1336M group	Hunter-killed in MT, Region 3
uncollared	9/15/2024	adult	Bliss Pass	Hunter-killed in MT, WMU 316
1491F	10/24/2024	yearling	8 Mile	Hunter-killed in MT, WMU 313
uncollared	10/24/2024	yearling	8 Mile	Hunter-killed in MT, WMU 313
uncollared	10/24/2024	yearling	8 Mile	Hunter-killed in MT, WMU 313
uncollared	10/24/2024	yearling	8 Mile	Hunter-killed in MT, WMU 313
1493M	10/24/2024	yearling	8 Mile	Hunter-killed in MT, WMU 313
1414F	12/14/2024	adult	Cougar Creek	Hunter-killed in MT, Region 3
uncollared	12/17/2024	adult	Junction Butte	Hunter-killed in MT, Region 3
uncollared	12/19/2024	adult	Junction Butte	Hunter-killed in MT, Region 3
uncollared (pittag 1413M_1481M)	12/20/2024	adult	Cougar Creek	Hunter-killed in MT, Region 3
907F	12/22/2024	old adult	Junction Butte	Intraspecific
uncollared	12/23/2024	yearling/adult	Unknown	Intraspecific
uncollared	12/24/2024	old adult	Junction Butte	Poached in MT

**For details about the regulations and boundaries of wolf hunting units outside YNP in Montana, please see the MTFWP website.*

Capture

Thirty-four wolves from eight packs were captured and collared in 2024—23 in February and 11 in December. New collars were deployed on 11 pups, 10 yearlings, six adults, and two older wolves. Older or nonworking collars were replaced on four adult wolves—1273M and 1393M from Rescue Creek, 1389F from 8 Mile, and 1410F from Mollie's. In addition, 1481M, a yearling from Cougar Creek, was collared and determined through genetic analysis to have been previously collared and numbered 1413M as a pup but the first collar had been chewed off.

In addition to fitting a radio collar on each of the 34 captured wolves, staff took blood samples for disease screening and pedigree analysis, a whisker for isotopic diet analysis, body and tooth measurements, and weights. A uniquely-identifying pit-tag was inserted under the skin near the shoulder of each wolf in the event a collar is dropped or chewed off and the wolf is recaptured in the future.

Twenty-one of the 34 collars have GPS capabilities to collect and send location data through satellites, can be programmed remotely, and are used to evaluate habitat selection, movement patterns, prey selection, biomass consumption, and multi-species interactions. GPS collars last for at least two years and are programmed to record locations from four to 48 times per day, depending on the season and study objectives. For the first time, staff deployed GPS collars with biologgers that can record auditory, acceleration, and magnetometer (i.e. orientation and movement patterns) data. These collars were programmed to record locations as frequently as every 10 minutes (144 times per day) to document detailed movements that correspond with the audio data. The remaining 13 of the total 34 collars were VHF (Very High Frequency), which emit a tracking beacon and have a battery life of at least five years. Each year's collaring goals are designed to maintain an adequate number of collars in each pack to gather information for monitoring and research objectives as well as for academic collaborations and interagency communications. Prior to the late 2024 collaring efforts, there were 37 collars distributed throughout the nine park packs.

Bioacoustics

The Wolf Project continued to advance the bioacoustics monitoring program in 2024 with the deployment of autonomous recording units (ARUs) at several packs' summer homesites as well as with the establishment of a survey grid of ARUs across northern Yellowstone. Beginning in November, 26 ARU stations were deployed using a randomized grid system spaced approximately six kilometers apart and maintained through the end of the year recording continuous audio of Yellowstone's soundscape. Sound data from this grid of recorders will be analyzed using a machine learning wolf vocalization classifier being developed with the purpose of effective and efficient detection of as many wolf vocalization events as possible. Data from direct behavioral observations, aerial and ground VHF tracking data, and GPS-collar movement data of individuals will be leveraged and integrated with wolf howling data. From this, a variety of goals will be pursued, ranging from the development of non-invasive monitoring tools, to studying spatial and temporal patterns in wolf vocalizations, pack and individual identity, and within- and between-pack communication.

In addition, some collars deployed in December contained audio recording technology (see Capture section above for description of GPS collar biologgers) designed to record all sounds emanating from and surrounding the collared wolf during certain time periods. This is the first time this technology has been used on wolves in the wild. These data will provide a unique individual-level perspective on the sounds wolves make, as well as integrate with our ARU grid system.

Wolf Management

Wolf management in YNP included temporary closures around the Junction Butte, Rescue Creek, and Wapiti Lake den areas to protect the young pups from disturbance and allow the adult wolves to travel near the den unimpeded. The closures were lifted after several months when the wolf pups were increasingly mobile.

Habituated behavior by wolves is carefully monitored through frequent observations of wolves in YNP and staff attempt to correct the behavior through aversive conditioning as soon as possible. We recorded a few cases of habituated behavior in 2024 from the 8 Mile, Rescue Creek, and Wapiti Lake packs. Aversive conditioning is performed by trained staff during a teachable moment when the wolf makes the decision to be in close proximity to humans or vehicles. Yellowstone wolves that are wary and avoid humans can still live successfully in the park largely uninfluenced by human behavior, and threats to human safety are nearly eliminated. It can be difficult to successfully execute aversive conditioning unless staff monitor the wolf of concern daily for many hours.

For more information on wolf management in Yellowstone, please visit: go.nps.gov/YELLwolfMGMT.

2024 Yellowstone Wolf Capture

Wolf #/sex	Date of Capture	Age	Color	Pack	Collar Type
1477F	2/19/2024	yearling	black	Junction Butte	GPS
1478F	2/19/2024	yearling	gray	Junction Butte	GPS
1479F	2/19/2024	pup	black	Junction Butte	VHF
1480F	2/19/2024	old adult	black	Cougar Creek	GPS
1481M	2/19/2024	yearling	black	Cougar Creek	VHF
1482M	2/19/2024	old adult	black	Cougar Creek	GPS
1484M	2/20/2024	yearling	gray	Rescue Creek	VHF
1273M	2/20/2024	adult	black	Rescue Creek	GPS
1393M	2/20/2024	adult	black	Rescue Creek	GPS
1483M	2/20/2024	yearling	gray	Mollie's	VHF
1485M	2/20/2024	yearling	gray	Mollie's	VHF
1410F	2/20/2024	adult	black	Mollie's	GPS
1486M	2/20/2024	pup	black	Wapiti Lake	GPS
1487F	2/21/2024	yearling	black	Shrimp Lake	VHF
1488M	2/21/2024	adult	gray	Shrimp Lake	GPS
1489M	2/21/2024	pup	black	Rescue Creek	VHF
1490F	2/21/2024	adult	black	Rescue Creek	VHF
1491F	2/21/2024	pup	black	8 Mile	GPS
1492M	2/21/2024	pup	gray	8 Mile	VHF
1493M	2/22/2024	pup	gray	8 Mile	VHF
1494F	2/22/2024	yearling	gray	8 Mile	GPS
1495F	2/22/2024	pup	gray	8 Mile	VHF
1389F	2/22/2024	adult	gray	8 Mile	GPS
1507F	12/17/2024	yearling	gray	8 Mile	GPS
1508F	12/17/2024	yearling	gray	8 Mile	GPS
1509F	12/17/2024	pup	gray	8 Mile	GPS
1510M	12/17/2024	adult	gray	Bliss Pass	VHF
1477F	12/17/2024	adult	black	Bliss Pass	GPS
1485M	12/17/2024	adult	gray	Mollie's	GPS
1511M	12/19/2024	pup	black	Rescue Creek	GPS
1512F	12/19/2024	yearling	black	Rescue Creek	GPS
1513F	12/19/2024	pup	black	Rescue Creek	GPS
1514F	12/19/2024	pup	black	Rescue Creek	GPS
1273M	12/19/2024	adult	black	Rescue Creek	VHF

Leading Edge pilot Jim Pope skillfully maneuvers the helicopter into position to netgun 1485M of the Mollie's Pack for recollaring. NPS PHOTO: J. SunderRaj

A grizzly bear, newly emerged from its winter den, lopes along with members of the Wapiti pack at Fountain Flats in hopes of of a bison carcass feast. NPS PHOTO: E. Stahler

Wolf Hunting Seasons Near YNP

Outside of the YNP boundary, in the states of Montana, Wyoming, and Idaho, wolves can be hunted and trapped during certain times of the year. Each state has different regulations including season dates and bag limits. Wolves from packs monitored by YNP staff occasionally travel outside of YNP borders and are legally killed by hunters and trappers. Each year we record wolves killed near the shared boundary between northern YNP and Montana due to the ease of human-access and the presence of the Northern Yellowstone ungulates. Prior to the 2024-2025 MT wolf hunting season, the Montana Fish and Game Commission made an adjustment to the wolf hunting unit north of the YNP border. What was previously one wolf management unit (WMU 313) with a quota of six wolves was split into two units (WMU 313 and 316) with quotas of three wolves each, similar to the MT wolf management unit structure from 2013-2020.

In early 2024, two wolves from park packs were killed by hunters north of YNP in Montana. Both wolves were in MT Region 3 and outside of the quota-limited WMU 313. Between September and the end of 2024, ten wolves from park packs were killed: one in WMU 316, five in WMU 313, two in MT Region 3 along the northwestern boundary of YNP, and two in MT Region 3 just outside of the closed quota-limited WMU 313. The five wolves killed in WMU 313 were all from the 8 Mile pack shot on the same day and

this exceeded the quota of three wolves. Four wolves from this event were checked-in to Montana Fish, Wildlife, and Parks (MTFWP) by multiple hunters and the additional take was legal. The fifth dead wolf was apparently not found by the hunters, and YNP staff found it by tracking the collar mortality beacon. This mortality was considered a wounding loss by MTFWP wardens following a field investigation. See the Mortality section for more details. In past years wolves from YNP packs were also killed in Wyoming and Idaho but in 2024, no kills were recorded in those states.

YNP staff use radio collars and intensive, year-round observations to determine which wolves are killed when packs travel outside of YNP. This science-based information in combination with communication with state agencies is critical to understanding transboundary wolf management issues.

Pack Summaries

8 Mile (18 wolves: 13 adults, 5 pups)

Beginning the year as the park's largest pack at 25, 8 Mile continued to be led by the aging leaders, 1328F (born in 2018) and 1326M (born in 2017), who again produced a litter of pups. The pack lost five wolves on October 24th just outside the YNP boundary when four wolves, including yearling 1491F, were legally shot and turned in by hunters. This was one wolf over the quota of three for Montana Wolf Management Unit 313. A fifth wolf, yearling 1493M, was shot during the same event and died but was not recovered by the hunters and is considered a "wounding loss." Several other wolves died or dispersed throughout the year including two-year-old 1494F who appeared to be establishing her own pack outside of YNP and lived for 39 days beyond park borders before being shot by a hunter in Montana.

Lupine Creek (0 wolves)

After yearling 1388F was legally killed in Montana and 1232M was poached in WMU313 outside the park a few days later, there was only one suspected sighting of two members of the Lupine Creek pack in February. An audio-recording unit near their 2023 denning area recorded no wolves and this suggested the pack had dissolved.

Rescue Creek (20 wolves: 13 adults, 7 pups)

The Rescue Creek pack emerged as a major force in northern YNP as their pack size has grown and the leaders have gained experience with age. Lead female 1490F produced a large litter of seven pups and all of them survived to the end of the year. Several younger Rescue Creek males spent time with younger female wolves from the Junction Butte pack during the breeding season and all but 1484M returned to their respective packs soon after. 1484M dispersed for several months in the summer and was often located near Norris Geyser Basin with an uncollared gray wolf. This seemed to be the start of a new group but by fall 1484M returned to the Rescue Creek pack and the fate of his uncollared companion is unknown. Due to the location and accessibility of their territory, their pack size, and known composition, the Rescue Creek pack is often the focus of our more intensive research efforts including winter and summer predation studies and bioacoustics research.

1384F group (0 wolves)

Although this group did not have any working radio collars, we were able to monitor them using trail cameras. Frequent video captures even revealed details of their social dynamics and reproductive statuses. The lead female was 1384F from the Junction Butte pack, who had dispersed in October 2023. Two uncollared females were likely her sisters from Junction Butte, and the pack's two males were of unknown origin. The pack produced pups and by October at least two were seen with the pack adults. This pack was not seen in November or December and we suspected they had shifted out of YNP. This was confirmed when 1384F was shot by a hunter in Montana in mid-December over 24 kilometers (15 miles) from the YNP boundary.

Bliss Pass (8 wolves; 3 adults, 5 pups)

The Bliss Pass pack began in early 2024 when 1437M (a disperser from Hawk's Rest that was loosely associated with the Junction Butte pack in 2023) was found with a female wolf of unknown origin, but possibly from Junction Butte. The pair produced a litter of five pups and were joined by an uncollared male of unknown origins. On the first day of the MT wolf hunting season the female adult was killed just north of the YNP border, leaving the five pups with two adult males. Within a few weeks, 1477F from the Junction Butte pack joined them, taking on the female leadership role and adopting the pups. This pack generally uses the Slough Creek drainage and has a small territory, which may be facilitated by high numbers of ungulates (elk, bison, deer, and moose) in the area from spring to early winter.

Junction Butte (10 wolves: 5 adults, 5 pups)

At 11 years old, lead female 907F produced the 10th litter of pups in her life—the most for any wolf in 30 years of YNP wolf research. Three pups emerged from the den at approximately one month old and two of them survived the summer. Uncollared adult female, 1386F (collar chewed off in fall 2023 but still recognizable), from Junction Butte, who had dispersed to a den separate from the pack in the spring, returned to the main pack with her three pups in July. The pack raised all five pups together. The last few weeks of 2024 introduced major disruption to the pack when they took a

rare extra-territorial foray out of the park resulting in two adults being legally killed in Montana. Then, when some of the pack returned to their territory core, 907F was killed by the Rescue Creek pack, and a few days later the long-time lead male was poached outside the park in Montana. The concentrated losses will likely result in shifting pack dynamics as new leaders emerge and/or join the pack and some wolves disperse.

Mollie's (8 wolves: 8 adults, 0 pups)

Despite a major shift in pack dynamics at the beginning of the year, with the disappearance of seven uncollared pack members including the two most dominant males, the two most dominant females, and three of the four pups, the Mollie's pack seemed to recoalesce by spring. Wolf 1410F, the only pregnant female still in the pack, localized but the remaining pack members did not attend her or the pups. Two nonpregnant females including former—and once again current—leader 1090F, one yearling, and the six adult males spent a large portion of time in Lamar Valley and in the upper Lamar River corridor. 1410F lost her pups and did not return to the Mollie's pack by the end of the year. Elder wolf 1048M dispersed for the fourth time in his life at age 9.5. Trail cameras in the Mollie's territory in 2024 did not capture any evidence of the seven missing wolves and their fate is unknown.

Wapiti Lake (25 wolves: 14 adults, 11 pups)

With several sexually-mature females, the pack produced at least two litters and combined them in late summer. A high count of 12 pups was recorded early and 11 were still alive by the end of the year. The pack's adults also had very high survival with 14 out of 15 still alive at the end of 2024. Social hierarchies may have shifted recently as the three adult males all seem to be dominant at different times and several females show leader behavior depending on the season. It seems the pack adults were adept at sharing leadership duties and intra-pack strife appeared to be low.

Cougar Creek (6 wolves: 4 adults, 2 pups)

Capture operations in February finally marked and sampled the long-time lead female of the Cougar Creek pack, now 1480F, and genetic analysis confirmed she was the offspring of 953F (also known as 1204F when she was collared a second time after the first was chewed off). This also confirmed that the Cougar Creek pack has had an unbroken lineage through the female line starting with wolf 151F (also known as 96F when she was collared a second time after the first was chewed off), who founded the pack 24 years ago. Perhaps unsurprisingly, given their large pack size in 2022 and 2023, the Cougar Creek pack split in March with one wolf dispersing out of YNP to the west and at least four others dispersing to the north. Wolf 1480F gave birth to two pups at the age of seven. More often than in the past, the pack traveled near and occasionally beyond the boundaries of YNP and in December two pack members were killed by hunters in Montana.

Hawk's Rest (7 wolves: 7 adults and 0 pups)

Since the Hawk's Rest pack formed in late 2019, they have spent most of their time in Wyoming but occasionally used southern YNP during the summer and fall. Due to their movements, they have previously been counted in the Wyoming (non-YNP) population totals. In 2024 the pack shifted their territory use and denned inside YNP and the two wolves with GPS collars spent 55-80% of their time within the park. The pack stopped attending their homesite in mid-July indicating that any pups that were born were no longer alive but continued to range along the southern shore of Yellowstone Lake down to the Yellowstone Delta and Thorofare.

Firehole River (0 wolves)

There was no sign of the Firehole River pack in 2024. A new group was discovered with pups in the Bechler area (see Dunanda Falls pack summary) and did not seem to be related to the Firehole wolves. Given the establishment of a new pack, the Firehole River pack had likely dissolved in early 2024 through a combination of human-caused mortality, natural-mortality, and dispersal.

Dunanda Falls (4 wolves; 2 adults, 2 pups)

1445M, a disperser from Wyoming's Wapiti pack north-west of Cody (not to be confused with YNP's Wapiti Lake Pack) was found during a YNP wolf tracking flight in September with an adult wolf and four pups. It is unlikely 1445M is the father of the pups given he was consistently located by Wyoming Game and Fish Department with the Wapiti pack prior to moving to the Bechler region late summer. But his presence allowed us to keep tabs on this new pack. By the end of 2024, both adults and two of the pups survived and continued to use the south-west corner of YNP—in former Firehole River and Bechler pack territories.

1330F/1336M group (0 wolves)

In early 2024 this pair shifted their territory to the northern boundary of YNP, likely in search of vulnerable prey during the mild winter. Wolf 1330F died just outside YNP and when YNP and MTFWP staff necropsied the carcass together, it was heavily scavenged and the cause of death could not be determined. A few weeks later, her mate 1336M, and the father to some of the 8 Mile pups born in 2023, was legally shot in Montana.

The Wapiti Pack bides their time at the edge of the Firehole River in hopes of getting an opportunity to attack their bison quarry. NPS PHOTO: D. Stahler

Lone Wolves

1048M

In the fall, 1048M dispersed from the Mollie's pack. Most of the male wolves in the Junction Butte and Rescue Creek packs are his sons or nephews, which likely contributed to his movements through those territories and even some interactions with some of the pack members. By the end of the year, he was alone.

1410F

Although she was seemingly the lead female of the Mollie's pack in early 2024, when 1410F denned, the rest of the pack members did not attend her den or even visit the area. While we never observed any pups at her den, her locations suggested she raised her pups for several months alone before they died from an unknown cause. She traveled alone through the end of the year.

Other Wolves

The Shrimp Lake (~2 wolves) and Willow Creek (~6 wolves) packs both shifted their territories east out of YNP in 2024. Willow Creek occasionally spent some time in the upper Lamar River drainages and Shrimp Lake was in YNP until mid-April but both packs spent less than 50% of their time in YNP and by the end of the year were monitored by Wyoming Game and Fish Department. Shrimp Lake's lead female, 1228F was killed outside the park as she attempted to depredate on chickens at a residence in late June. The Pahaska (~6 wolves) and Two Ocean Plateau (~8 wolves) packs seasonally used eastern and southern portions of YNP and were counted in the Wyoming (non-YNP) population total.

Wolf 1407M traveled widely through most of 2024 and by late November was spending most of his time outside YNP. He was likely forming a new pack with 8 Mile disperser 1494F prior to her death on the last day of the year.

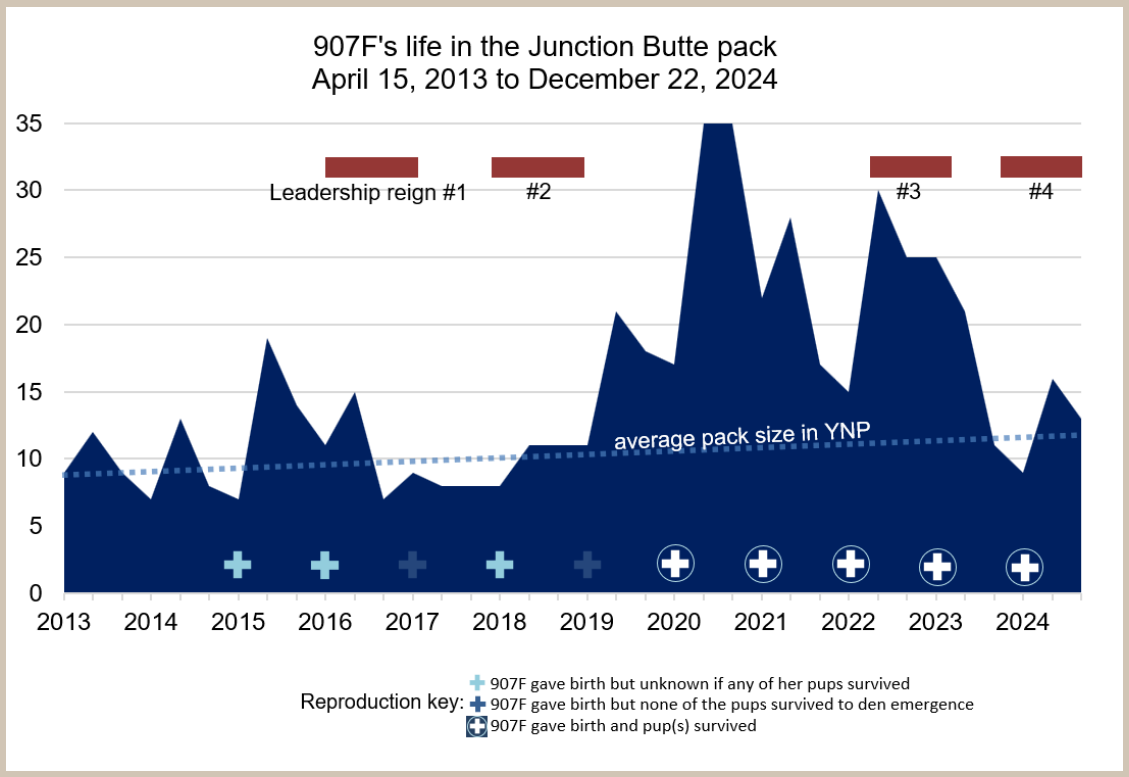
The Chronicled and Mysterious Life of Wolf 907F

By: Kira Cassidy

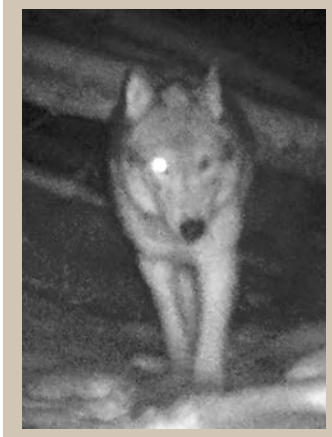
It's easy to boil 907F's life down to some pretty impressive numbers: she was the fifth oldest wolf ever recorded in Yellowstone National Park at 11.7 years, she gave birth to 10 litters of pups throughout her life, she had four separate leadership bouts and lived her whole life in the same pack. From a scientist's standpoint, the length of time she was studied with a radio collar resulted in remarkable numbers: she was tracked 473 times from the air, 1,898 times from the ground, and her GPS collars recorded 26,085 locations. Staff watched her participate in 557 hunts—usually with bison (281) or elk (239)—of which 33 (6%) were successful. We watched 907F and her pack feed on 588 carcasses and chase coyotes 76 times. They were also seen interacting with grizzly bears 31 times, including four times when the bear came too close to 907F's den of small pups, and one bear that traveled alongside the pack for several weeks one fall. Wolf 907F and her pack were responsible for the deaths of at least five wolves during pack-pack conflict and lost at least five of their own in those fights during her lifetime. She was likely present for most of the deaths of her pack mates, including 15 shot by hunters outside of park borders.

But there are many things that cannot be quantified—the elements that make up the unique lived-experience of a sentient, wild being. We cannot measure 907F's excitement seeing her pack mates arrive to deliver meat to her and her pups as they waited at the den. We cannot weigh her fear as the much-larger Mollie's pack let out a group howl surprisingly close by. We cannot calculate her relief when the pack brought down a bull elk after finding nothing to eat for 12 days. We cannot count her joy as her whole pack swarmed around her in a mass of wagging tails and licking muzzles. Despite being one of the most well-documented wild wolf lives ever, there are so many ways 907F's life remains immeasurable. While scientific research is often about reporting general patterns with averages and expected variations, the depth of a living being's existence remains, beautifully and wondrously, mysterious.

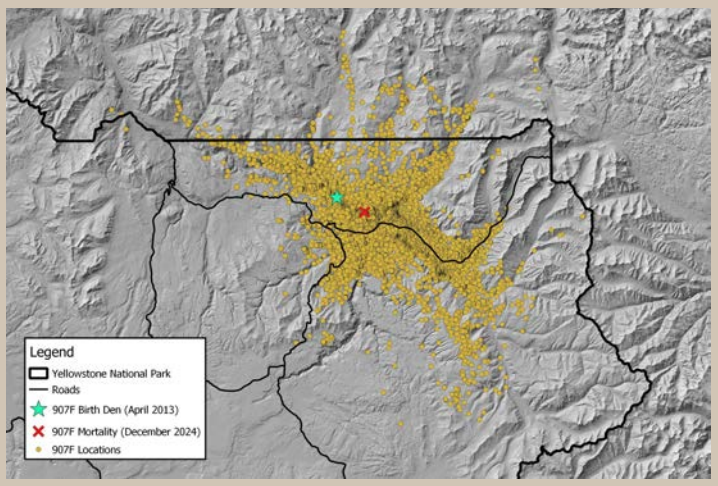
Within this pile of gray pups born in 2013 is 907F before she was first collared and given her numbered ID later in the year. NPS PHOTO: D. Smith



Life history highlights of 907F for leadership roles, reproduction, and pack sizes throughout her nearly 12 years of life. NPS INFOGRAPHIC: K. Cassidy



A nightime trail camera image reveals 907F's missing left eye from lack of eyeshine. NPS PHOTO.

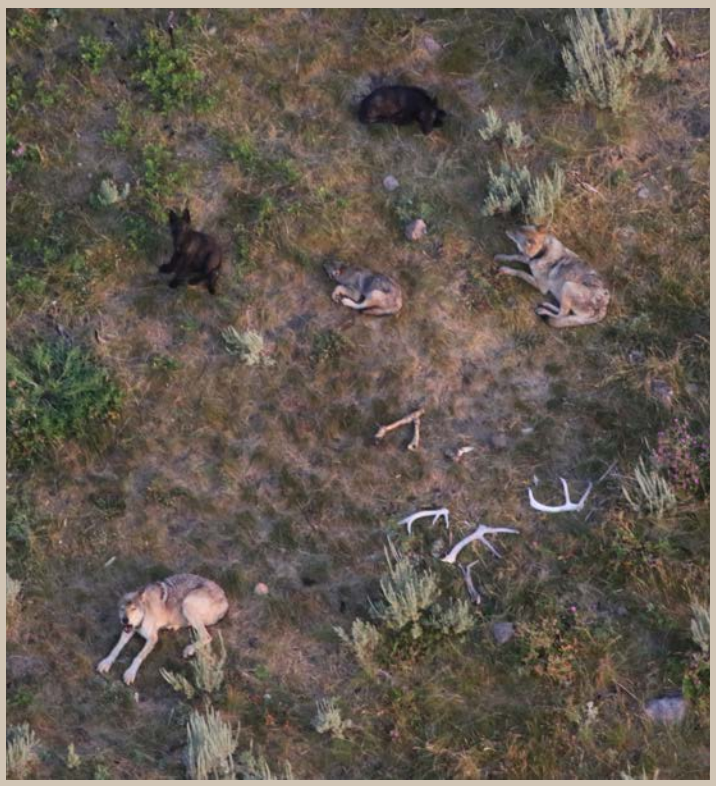


All aerial VHF and GPS collar locations of 907F since first collared as a pup in 2013 through 2024. Also included are 907F's birth (green star) and death (red X) sites.

907F initiating a chorus howl with the pack (far left gray wolf). NPS PHOTO - N. Tatton.

A November 2024 trail camera image displays 907F's larger than average female physical stature. Even in her death, defending her family and territory from a rival pack, 907F embodied what Yellowstone is all about. It's a place where these carnivores have a chance to live a successful life and die the way of the wolf.

907F and pack members share a November bull elk meal with a grizzly at a fresh kill. NPS PHOTO: D. Smith.



907F bedded amongst her 10th and last litter of pups (and their antler chew toys) in July, 2024. NPS PHOTO: K. Cassidy

NOTE: A simple search will pull up many articles about the life and death of 907F if you are interested in more information about this extrodinary wolf.

Cougar F210 watches one of her kittens wrangle a mule deer buck carcass during mealtime. Trail cameras are deployed at some fresh cougar kills to study cougar feeding patterns and scavenger dynamics. NPS PHOTO

COUGAR RESEARCH

At the beginning of 2024, three cougars wore radio collars in northern YNP: two females (F210, F223) and one male (M229). Both females' collars were replaced early in the year and proved critical for the intensive predation studies (see Carnivore-Prey Relationships and Predation Studies sections above). In November, staff watching F223 feed on a coyote she killed also documented four three-month-old kittens traveling with her. On a tracking flight a few days later, F210 was observed with two four-month-old kittens. For most of the year, cougar M229 was likely the dominant breeding male from Tower Junction generally north of the Yellowstone River, and at least 20 miles (32 km) to the west. As the year went on, his movements became more transboundary with large movements in and out of the park. He overlapped territories with both collared females and likely several uncollared females until he was illegally shot in Montana in late October.

By the end of the year, the two collared females, F210 and F223 continued to travel with their kittens through northern YNP. In addition to the marked cougars, research also includes noninvasive population estimates using a trail camera survey design (see Graduate Research section for details).

Biologist Jack Rabe examines adult female cougar F223's foot pad during her 2024 recapture for GPS collar replacement. Etched into the feet of a cougar are the stories of many miles of wild Yellowstone experiences. NPS PHOTO: D. Stahler

ELK RESEARCH

At least seven distinct elk herds use all portions of YNP from spring through late fall. All herds, except one, migrate to low elevation areas in the surrounding states during the winter. The Northern Yellowstone elk herd generally uses northern YNP in the lower Yellowstone River drainages out to Paradise Valley in the winter. This herd is intensively monitored and studied by YNP staff and MTFWP. While the interagency fixed-wing elk count was cancelled in 2024 due to weather and schedule issues, MTFWP did complete an elk classification survey by helicopter in March. This survey detected 5,597 elk in the units used by the Northern Yellowstone elk herd, slightly lower than the three-year average.

At the beginning of 2024, 39 cow elk in the Northern Yellowstone elk herd wore radio collars. Collars are used to research elk movements, predator-prey dynamics, survival and mortality, reproduction, disease, and more. Of these 39 radio collars, 36 were GPS collars, two were VHF collars, and one was a GPS collar that malfunctioned but could still be tracked with a VHF beacon. The average age for the collared elk was just over 12 years, ranging from 5.5 to 21.5 years old.

We documented seven radio-collared elk mortalities this year. Two were killed by wolves, two were legally killed in Montana by hunters, two died of unknown natural causes, and one was hit by a vehicle north of Canyon Junction. Notably, no collared elk mortalities from malnutrition/exposure were confirmed this year as the 2023-2024 was relatively mild. The average age of collared elk at death was 17 years old, ranging from nine to over 22 years old. Only one elk went missing in 2024 when the radio collar beacon failed.

Nineteen new elk GPS collars were deployed in mid-December, distributed across northern YNP. By the end of the year, 51 elk wore working GPS radio collars, including one elk wearing a solar-powered collar to test the efficacy of the alternative power-source with a lighter weight, more streamlined collar.

A new book titled *Northern Yellowstone: Elk Resilience and Adaptation to Changes in Management Policies and the Ecosystem* is available for free download at www.nps.gov/yell/learn/nature/elk.htm. This book, written by park biologists and colleagues, examines the history of elk conservation and management in the United States, compiles the latest scientific information about Yellowstone elk, and discusses both the opportunities for, and challenges to, elk conservation within the Greater Yellowstone Area and across their historic range.

A bull elk and harem of cows feed on Blacktail Deer Plateau in late September. The northern herd continues to be a key part of Yellowstone's food web and ever iconic. NPS PHOTO: D. Stahler

Staff Outreach

Yellowstone Wolf, Cougar, and Elk Project staff gave 136 formal talks, 45 interviews, presented six conference posters, gave nine conference presentations, and led 28 field trips. During the summer months, staff helped educate at least 12,280 people while viewing wildlife and gave 89 informal talks in the field. In addition, Taylor Rabe and Jeremy SunderRaj counseled 23 volunteers or job shadow guests, and Brenna Cassidy taught a 3-day course through Yellowstone Forever. Congratulations to Jack Rabe, whose poster at the Biennial Conference of the Greater Yellowstone Ecosystem in Big Sky, Montana won the Best Student Poster award.

Staff also spent over 500 hours assisting other Yellowstone Center for Resources wildlife programs and park departments such as resource and visitor protection, and search and rescue. Staff were asked by the YNP justice division to provide information for several court cases related to violations of park regulations, which resulted in fines and bans for approaching and harassing wildlife.

Graduate Research

In addition to National Park Service (NPS) and Yellowstone Forever staff research, monitoring, and management projects, the Yellowstone Wolf, Cougar, and Elk Project supports several graduate student collaborations. In 2024, there were four graduate students. Brenna Cassidy, a PhD candidate at the University of Montana advised by Dr. Mark Hebblewhite, focused on gray wolf population dynamics, survival, and cause-specific mortality. Brenna published part of her work in the Journal of Applied Ecology in 2024 (see Publications section below). Jack Rabe, PhD candidate at the University of Minnesota, advised by Dr. Joseph Bump, is examining how carnivores compete for resources across time and space, how such competition impacts predator-prey relationships, and how predation by YNP's diverse carnivore community influences elk population dynamics. Wes Binder, a PhD student at Oregon State University advised by Dr. Taal Levi, has projects focusing on wolf and cougar interactions, estimating cougar density across northern YNP from trail camera detections, and fine-scale predator behavior using advanced GPS and

The success of the Wolf, Cougar, and Elk Projects is due to a skilled and dedicated team of biologists that contribute thousands of hours a year to support YNP's mission. Pictured here is the Early Winter Study Team. Top left to right: Gordy Scott, Jeremy SunderRaj, Sarah Lindsay, Ruby Schipf, Zoë Ward, Mariah Hellebrandt, Ellie Mondach, Michael Procko, Matt Metz, Nick Peterson, Nikki Tatton, Jack Rabe, Caleb Basa. Bottom left to right: Erika Zimmermann, Claire Lacey, Taylor Rabe, Kira Cassidy, Erin Stahler, and Dan Stahler.. NPS PHOTO: D. Stahler

accelerometer data. Cameron Ho, an MSc student at the University of Washington co-advised by Dr. Beth Gardner and Dr. John Marzluff, is exploring how the presence of wolves and cougars impacts winter foraging opportunities for scavengers and how local, naturally occurring carrion impacts raven foraging decisions.

Acknowledgments

We thank the many people who come forward every year to study and support wildlife research in YNP. First and foremost, we thank the Wolf, Cougar, and Elk Project seasonal technicians, without whom we would not be able to complete and continue this research. We thank Yellowstone Forever for their continued support of these programs. We are especially grateful for the many generous individuals, foundations, and organizations that have provided funding for our program, either through Yellowstone Forever, the National Park Service, or through in-kind support. This support funds many of our permanent staff. We appreciate the valuable collaborations with our academic, research, and interagency partners who contribute expertise and vision to many aspects of our programs. We deeply value the safe piloting from Mark Packila of Wildlife Air, Jim Pope and team of Leading Edge, and Troy Woydziak of Baker Aviation. We thank Justin Duffy and his hounds for their skill and dedication toward safe and effective cougar collaring. We thank Jeff Reed of Grizzly Systems for his generous time and knowledge surrounding bioacoustic research. We would not be able to learn and teach about YNP wildlife without all of the aforementioned people and their exceptional skills. Lastly, we also appreciate the efforts of Charissa Reid and Claire Brown for their editing and formatting of this report.

One of the most talented and dedicated members of the team, pilot Mark Packila is our eyes from above and integral to all of Yellowstone's wildlife programs. NPS PHOTO: D. Stahler

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Seasonal Technician Hours

Name	Hours
Caleb Basa	660
Cecilia Di Bernardi	360
Andrei Dinu	600
Vinny Gugliotti	600
Mariah Hellebrandt	300
Ky Koitzsch	1040
Lisa Koitzsch	1040
Sarah Lindsay	300
Ellie Mondloch	300
Zoë Myers	360
Nick Peterson	300
Michael Procko	300
Ruby Schipf	300
Ivy Smith	360
Zoë Ward	300
Erika Zimmermann	300

Back cover: Rescue Creek wolf 1273M gives a striking glare as he wakes up from his December collaring event that replaced his old GPS collar with his new and final VHF collar. Erin Stahler and Kira Cassidy seen in the background finishing up collaring another packmate. NPS PHOTO: D. Stahler

For a complete list of our publications, please visit: go.nps.gov/yellwolves

Citation: Cassidy, K.A., D.R. Stahler, E.A. Stahler, M. Metz, J. SunderRaj, T. Rabe, J. Rabe, N. Tatton, M. Packila, B. Cassidy, W. Binder, C. Lacey, G. Scott, and C. Ho. 2025. Yellowstone National Park Wolf, Cougar, and Elk Project Annual Report 2024. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, WY, USA, YCR-2025-01.

*All photos are NPS unless noted.