Wyoming Gray Wolf Monitoring and Management: 2023 Annual Report

Prepared by the Wyoming Game and Fish Department in cooperation with the National Park Service, U.S. Fish and Wildlife Service, USDA-APHIS-Wildlife Services, and Eastern Shoshone and Northern Arapahoe Tribal Fish and Game Department to report the status and management of the gray wolf population in Wyoming from January 1, 2023 through December 31, 2023.

EXECUTIVE SUMMARY

At the end of 2023, the gray wolf (wolf) population in Wyoming remained above minimum recovery criteria, making 2023 the 22nd consecutive year Wyoming has exceeded the numerical, distributional, and temporal recovery criteria established for wolves by the U.S. Fish and Wildlife Service. At least 352 wolves in ≥43 packs (including ≥24 breeding pairs) inhabited Wyoming statewide on December 31, 2023. Of the total, there were ≥192 wolves and ≥27 packs (including ≥17 breeding pairs) in the Wolf Trophy Game Management Area (WTGMA), ≥124 wolves and ≥11 packs (including ≥6 breeding pairs) in Yellowstone National Park, ≥12 wolves and ≥2 packs (including ≥1 breeding pair) in the Wind River Reservation, and ≥24 wolves and ≥3 packs (including ≥0 breeding pairs) resided in areas where wolves are designated primarily as predatory animals in Wyoming. A total of 118 wolf mortalities were documented statewide in Wyoming in 2023: 47 in the WTGMA, 59 in areas where wolves are primarily designated as predatory animals, 6 in Yellowstone National Park, and 6 in the Wind River Reservation. Mortality was from human causes = 104 (88% of mortalities), natural causes = 12 (10%), and unknown causes = 2 (2%). Sixty-seven wolves were captured and radio-collared for monitoring and research in 2023.

In 2023, the Wyoming Game and Fish Department implemented a wolf hunting season with the biological objective to stabilize the wolf population at approximately 160 wolves in the WTGMA. A mortality limit of 40 wolves was divided between 13 hunt areas in the WTGMA and 1 hunt area in the Seasonal WTGMA (hunt area 12). Wolf hunting seasons were open from September 15 to December 31, 2023 with the exception of hunt area 12 (opened on October 15, 2023) and hunt area 13 (closed March 31, 2024). The hunting season for each hunt area closed at the season end date or when the mortality limit was met, whichever occurred first. A total of 27 wolves were killed during the 2023 wolf hunting season. In addition, the 2022 wolf hunting season extended from January 1 to March 31, 2023 in hunt area 13, during which no wolves were taken.

Wolves were confirmed to have killed or injured 49 head of livestock (41 cattle, 3 sheep, 4 goats, and 1 horse) statewide in Wyoming in 2023. Statewide, wolf-livestock conflicts were the lowest recorded since 2003. Eighteen wolves were lethally and legally removed by agencies or the public in an effort to reduce livestock losses to wolves (7 in the WTGMA, 6 in predatory animal areas in WYO, 5 in the Wind River Reservation).

Suggested Citation: Wyoming Game and Fish Department, U.S. Fish and Wildlife Service, National Park Service, USDA-APHIS-Wildlife Services, and Eastern Shoshone and Northern Arapahoe Tribal Fish and Game Department. 2024. Wyoming Gray Wolf Monitoring and Management 2023 Annual Report. K.J. Mills and C.D. Atkinson, *eds*. Wyoming Game and Fish Department, 5400 Bishop Blvd. Cheyenne, WY 82006.

Available for download at:
https://wgfd.wyo.gov/sites/default/files/2024-04/2024%20annual%20wolf%20report.pdf

COVER PHOTO: 1152F, the 9-year-old breeding female of the Klondike Hill pack, returning to her den site in the Upper Green River drainage north of Pinedale, WY. After her death from natural causes in late August 2023, the Klondike Hill breeding male (1345M) was killed by the newly forming Water Dog Lakes pack in October 2023, leaving an uncollared subadult and pups remaining in Klondike Hill. Based on subsequent observations of the Water Dog Lakes pack, we believe they adopted the remaining pups and subadult from Klondike Hill and assumed a portion of their former territory.

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BACKGROUND

Beginning in 1995, the U.S. Fish and Wildlife Service reintroduced 41 gray wolves (wolves) into Yellowstone National Park, Wyoming as a nonessential experimental population under the Endangered Species Act with the goal of reestablishing a recovered gray wolf population in the northern Rocky Mountains. The U.S. Fish and Wildlife Service was the federal agency charged with administering, monitoring, and managing the wolf population following reintroduction until wolves reached recovery levels and Endangered Species Act protections could be removed ("delisting"). The wolf population expanded quickly in number and distribution throughout northwest Wyoming. The population met the required recovery criteria by late 2002 and has exceeded the recovery criteria every year since. More information on wolves and the history of the wolf reintroduction program can be found on the U.S. Fish and Wildlife Service website and the Wyoming Game and Fish Department website at the following links:

https://www.fws.gov/species/gray-wolf-canis-lupus

https://wgfd.wyo.gov/wyoming-wildlife/large-carnivore/wolves-wyoming

Endangered Species Act protections were removed for wolves (i.e., "delisting") in Wyoming in September 2012 following the approval of the Wyoming Gray Wolf Management Plan, Wyoming Game and Fish Commission regulations, and Wyoming Statutes by the U.S. Fish and Wildlife Service (Wyoming Game and Fish Commission 2011, U.S. Fish and Wildlife Service 2012). This delisting decision was challenged in U.S. District Court in Washington, D.C., which overturned the delisting and relinquished management authority for wolves in Wyoming back to the U.S. Fish and Wildlife Service in September 2014. The District Court decision was subsequently appealed by the U.S. Fish and Wildlife Service and State of Wyoming in the U.S. Court of Appeals in Washington, D.C., which ruled in favor of the U.S. Fish and Wildlife Service and State and returned management of wolves to the State of Wyoming on April 25, 2017. Since delisting, wolves have been monitored and managed by the National Park Service in Yellowstone National Park and Grand Teton National Park, the Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department in cooperation with the U.S. Fish and Wildlife Service Lander Fish and Wildlife Conservation Office on tribal lands in the Wind River Reservation, the U.S. Fish and Wildlife Service on the National Elk Refuge, and the State of Wyoming in all remaining areas of Wyoming outside these jurisdictions. Each management agency has different laws, regulations, and/or management plans governing wolf management and, accordingly, each jurisdiction has varying wolf management objectives and philosophies. The following is a summary of wolf management direction by agency.

National Park Service

The National Park Service is responsible for monitoring and managing wolves in national parks in Wyoming. The National Park Service's primary wolf management approach is to allow natural processes to occur within the boundaries of national parks with minimal human intervention. More information on National Park Service wolf programs in Wyoming can be found at the following links:

https://www.nps.gov/yell/learn/nature/wolves.htm
https://www.nps.gov/grte/index.htm

Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department

The Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department, in cooperation with the U.S. Fish and Wildlife Service Lander Fish and Wildlife Conservation Office, is responsible for monitoring and management of wolves on tribal lands within the boundary of the Wind River Reservation. The Wind River Reservation Wolf Management Plan designates wolves as a trophy game animal on tribal lands within the Reservation. For more information, see the Wind River Reservation Wolf Management Plan at:

https://fws.gov/media/wind-river-wolf-plan

National Elk Refuge

The National Elk Refuge, managed by the U.S. Fish and Wildlife Service, was established to provide winter habitat and supplemental winter feeding for the Jackson Elk Herd. The U.S. Fish and Wildlife Service is responsible for management of all wildlife species, including wolves, within National Elk Refuge boundaries. More information on the National Elk Refuge can be obtained at:

https://www.fws.gov/refuge/national_elk_refuge/

Wyoming Game and Fish Department

The Wyoming Game and Fish Department's wolf management framework is more complex than the National Park Service's and the Wind River Reservation's and warrants more detailed explanation. As required by State statute [W.S. 23-1-101(a)(xii)(B)(I) and (II)] and Wyoming Game and Fish Commission Regulation Chapter 21 Gray Wolf Management (Chapter 21), wolves in areas under the State's jurisdiction are managed under the dual classifications of trophy game animal and predatory animal as outlined in the Wyoming Gray Wolf Management Plan and approved by the U.S. Fish and Wildlife Service (Wyoming Game and Fish Commission 2011, U.S. Fish and Wildlife Service 2012). According to the regulatory documents listed above, there are 3 wolf management zones outside Yellowstone National Park and tribal lands within the Wind River Reservation (this area is referred to as WYO throughout the report), as follows:

1. *Wolf Trophy Game Management Area (WTGMA):* Wolves are designated as trophy game animals year-round within the WTGMA and are actively monitored and managed by the Wyoming Game and Fish Department with the goal of maintaining the state's commitment of ≥100 wolves and ≥10 breeding pairs (a pack with at least 1 adult male and 1 adult female wolf that successfully raise at least 2 pups of the year until December 31) solely within this area. Wolves in the WTGMA are managed similar to other trophy game species (e.g., black bears and mountain lions) and may only be taken by the public when in the act of doing damage to private property, in self-defense, under the authority of a lethal take permit, or by licensed hunters during an open wolf hunting season. Livestock owners who have confirmed livestock damage caused by wolves in the WTGMA may qualify for compensation from the Wyoming Game and Fish Department.
2. *Seasonal WTGMA:* Wolves are designated as trophy game animals in the Seasonal WTGMA from October 15 through the last day of February of the subsequent year and as predatory animals from March 1 to October 14 each year. Wolves may be taken by the public similar to wolves in the WTGMA while they are designated as trophy game animals, or may be taken as predatory animals for the remainder of the year (see below). Livestock owners who have confirmed livestock damage caused by wolves in the

Seasonal WTGMA may qualify for compensation from the Wyoming Game and Fish Department on a year-round basis regardless of the date damage occurred.

3. *Areas when and where wolves are designated as predatory animals:* Wolves are designated year-round as predatory animals in areas outside the WTGMA and also within the Seasonal WTGMA from March 1 to October 14 (see above). Predatory animals are not managed under the jurisdiction of the Wyoming Game and Fish Department and may be taken anytime in any legal manner. Livestock owners who have confirmed wolf depredation on livestock outside the WTGMA/Seasonal WTGMA do not qualify for compensation from the Wyoming Game and Fish Department unless their private land is bisected by the WTMGA or Seasonal WTGMA boundary.

The Wyoming Game and Fish Department wolf management objective is to maintain a recovered wolf population in the WTGMA while balancing the need to minimize wolf conflicts with livestock and maintain wild ungulate herds. Wyoming's Gray Wolf Management Plan also seeks to incorporate public hunting opportunity into its wolf population management strategy (Wyoming Game and Fish Commission 2011). Wolves are not actively monitored or managed where designated as predatory animals, including the Seasonal WTGMA. Therefore, data presented in this report will focus primarily on the WTGMA, with data presented for predatory animals if available and/or applicable.

For more information on the wolf management framework in Wyoming, including the Wyoming Gray Wolf Management Plan and wolf management and hunting regulations, please visit the following link:

https://wgfd.wyo.gov/wyoming-wildlife/large-carnivore/wolves-wyoming

Wolf Population Delisting Criteria and Post-Delisting Monitoring

The U.S. Fish and Wildlife Service set specific recovery criteria for wolves in the northern Rocky Mountains that were required to be met prior to delisting. The wolf population in the northern Rocky Mountains must also continue to meet or exceed the U.S. Fish and Wildlife Service's recovery criteria into the foreseeable future post-delisting to ensure the population remains recovered. The U.S. Fish and Wildlife Service required a minimum recovery criteria of ≥300 wolves and ≥30 breeding pairs in the northern Rocky Mountains for 3 consecutive years. These criteria were developed using input from many wolf experts from around the world.

Additionally, the U.S. Fish and Wildlife Service developed additional recovery criteria that required the states to maintain a 50% safeguard above minimum recovery criteria (i.e., ≥450 wolves and ≥45 breeding pairs in the northern Rocky Mountains) to qualify for delisting and further ensure the population did not drop below minimum recovery goals. The delisting criteria were then subdivided equally among the states of Montana, Idaho, and Wyoming, resulting in a minimum population requirement of ≥150 wolves and ≥15 breeding pairs in each state at the end of the calendar year. Under the terms of the delisting agreement between Wyoming and the U.S. Fish and Wildlife Service, the state of Wyoming committed to maintain wolves at or above the minimum delisting criteria of ≥100 wolves and ≥10 breeding pairs in WYO, with Yellowstone National Park and the Wind River Reservation providing the additional ≥50 wolves and ≥5 breeding pairs necessary to meet the ≥150 wolf and ≥15 breeding pair requirement for the state (U.S. Fish and Wildlife Service 2012).

Under the Endangered Species Act, states are required to manage delisted species in a sustainable manner to ensure the population will remain above the minimum delisting criteria into the foreseeable future. Once delisting occurs, the U.S. Fish and Wildlife Service is required,

in cooperation with the states, to monitor the status of delisted species for a minimum of 5 years. The primary goal of post-delisting monitoring was to provide the U.S. Fish and Wildlife Service with a mechanism for evaluating the status of the population and ensure states are managing the delisted population at or above minimum delisting criteria. The 5-year post-delisting monitoring period concluded at the publication of the 2021 annual report in April 2022. However, the agencies in Wyoming charged with wolf monitoring and management responsibility have continued to work cooperatively and have generated this report to provide a consistent and transparent annual presentation of statewide wolf population data.

Reporting Wolf Population Data by Jurisdiction

Generally, states are solely responsible for monitoring and managing delisted species. In Wyoming, however, multiple jurisdictions contain significant portions of the wolf population and/or suitable wolf habitat, primarily Yellowstone National Park and tribal lands on the Wind River Reservation, where the state does not have management authority. This sharing of large portions of the wolf population adds complexity to management in Wyoming and made it difficult to determine which jurisdiction was responsible for what proportion of minimum delisting criteria. Therefore, it was necessary to clarify how many wolves and breeding pairs each jurisdiction would contribute toward minimum delisting criteria (i.e., ≥150 wolves and ≥15 breeding pairs in Wyoming at the end of the calendar year) as follows:

1. The Wyoming Game and Fish Department committed to maintain ≥100 wolves and ≥10 breeding pairs in the WTGMA in northwest Wyoming. While the state does not have management authority over wolves in all areas in the WTGMA such as Grand Teton National Park and the National Elk Refuge, these areas are small and the wolf packs using them are not solely contained within their boundaries. Therefore, wolves in Grand Teton National Park and the National Elk Refuge are included in the WTGMA.
2. Combined, Yellowstone National Park and Wind River Reservation are expected to contribute the remaining ≥50 wolves and ≥5 breeding pairs necessary to meet the total ≥150 wolf and ≥15 breeding pair requirement. Data for these jurisdictions are reported independently in the body of this report.

For purposes of this report, data are presented on the wolf population as a whole in Wyoming and are further summarized by the three primary jurisdictions to allow for proper evaluation of the wolf population both statewide and by individual jurisdiction.

WYOMING GRAY WOLF MONITORING AND MANAGEMENT: 2023 ANNUAL REPORT

WOLF POPULATION MONITORING

SUMMARY OF WOLF POPULATION MONITORING STATEWIDE

At the end of 2023, the gray wolf (wolf) population in Wyoming remained above minimum recovery criteria, making 2023 the 22nd consecutive year Wyoming has exceeded the numerical, distributional, and temporal recovery criteria established for wolves by the U.S. Fish and Wildlife Service. At least 352 wolves in ≥43 packs (including ≥24 breeding pairs) inhabited Wyoming statewide on December 31, 2023. Of the total, there were ≥192 wolves and ≥27 packs (including ≥17 breeding pairs) in the Wolf Trophy Game Management Area (WTGMA), ≥124 wolves and ≥11 packs (including ≥6 breeding pairs) in Yellowstone National Park, ≥12 wolves and ≥2 packs (including ≥1 breeding pair) in the Wind River Reservation, and ≥24 wolves and ≥3 packs (including ≥0 breeding pairs) resided in areas where wolves are designated primarily as predatory animals in Wyoming. A total of 118 wolf mortalities were documented statewide in Wyoming in 2023: 47 in the WTGMA, 59 in areas where wolves are primarily designated as predatory animals, 6 in Yellowstone National Park, and 6 in the Wind River Reservation. Mortality was from human causes = 104 (88% of mortalities), natural causes = 12 (10%), and unknown causes = 2 (2%). Sixty-seven wolves were captured and radio-collared for monitoring and research in 2023.

Wolf Population Monitoring in the WTGMA

Population and Breeding Pair Status

The census of the minimum number of wolves in the Wolf Trophy Game Management Area (WTGMA; see map in Figure 1) on December 31, 2023 was determined using standard wolf monitoring methods. The number of wolves in individual packs and the number of lone, dispersing wolves were counted during telemetry flights and capture operations, observations by, or confirmed by, qualified agency personnel, or pictures of known packs taken with remote cameras. Only observations obtained by agency personnel from December 2023 through March 2024 were included to ensure they were reflective of the minimum number of wolves present on December 31, 2023. Miscellaneous, mostly solitary, wolves were included in the population census only if the animal was documented as described above and was not a known member of an identified wolf pack. Packs that formed in late 2023 and early 2024 are included in the "miscellaneous" wolf category if they had not established a stable territory. Packs with territories overlapping jurisdictional boundaries (e.g., state, national park, tribal boundaries, etc.) and packs overlapping the WTGMA boundary were assigned to the area which held the majority of their documented locations during 2023. The final minimum population census was the sum of all pack counts and miscellaneous wolves known to be present in the WTGMA on December 31, 2023 (see Table 1).

Breeding pair status for packs in the WTGMA was also determined using the same methods since wolves were reintroduced to the northern Rocky Mountains. Denning behavior was confirmed for individual packs using aerial and ground telemetry and ground investigations during spring. Reproductive packs (with pups) were confirmed using observations made during aerial and ground monitoring efforts, investigations of potential den and rendezvous sites, howling surveys,

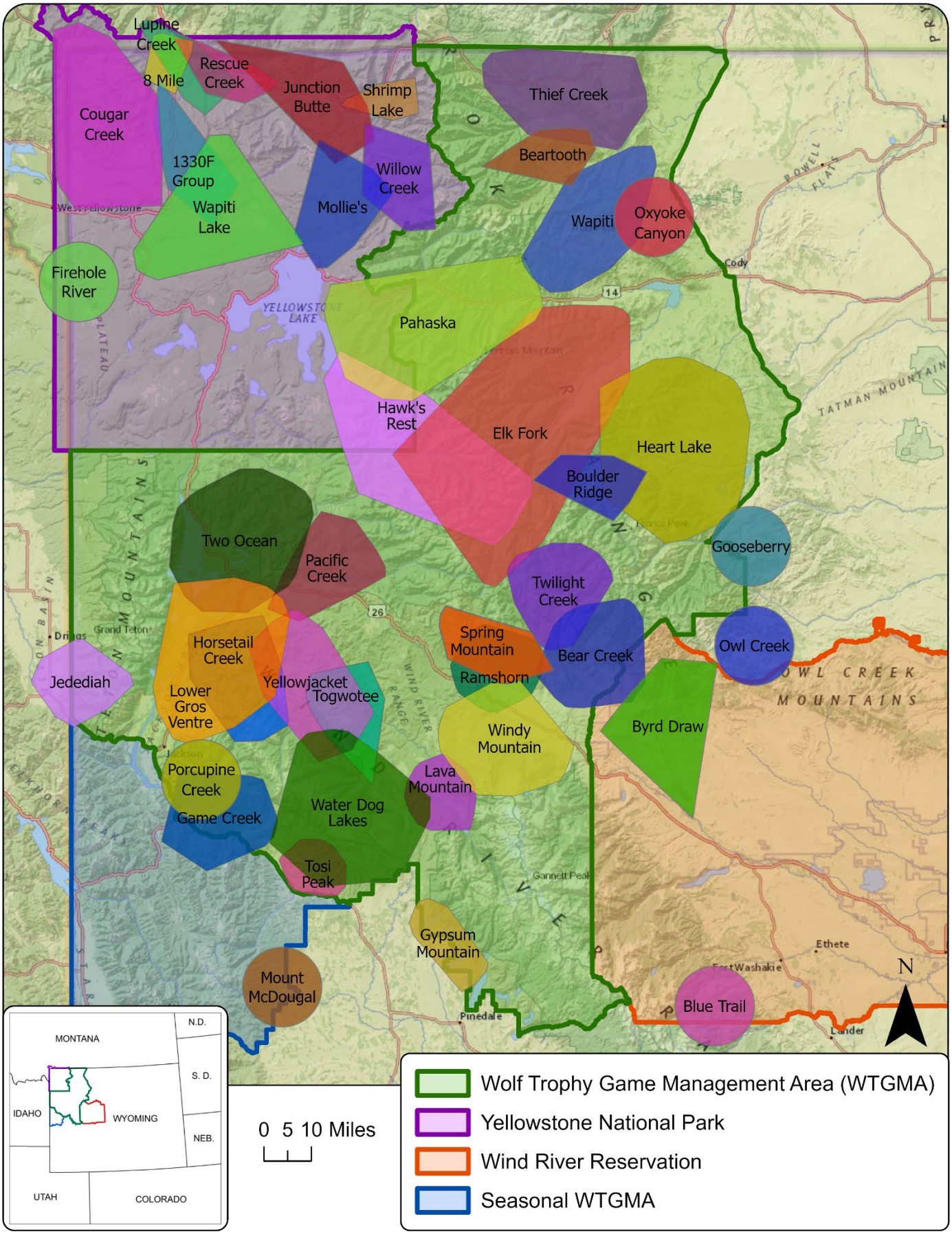

Figure 1. Wolf management areas and home ranges of wolf packs in Wyoming in 2023.

Table 1. Wolf packs, minimum pack size at the end of the calendar year, wolf mortality, and wolf-livestock conflicts in Wyoming in 2023.

WOLF PACK[1,2]	MINIMUM PACK SIZE	DOCUMENTED MORTALITIES[@] NATURAL	HUMAN[3]	UNKN[4]	HUNTING[5]	PRED. ANIMAL[6]	CONTROL[7]	KNOWN DISPERSED	MISSING[8]	CONFIRMED CONFLICTS[9,@] CATTLE	SHEEP	DOGS	OTHER
WOLF TROPHY GAME MANAGEMENT AREA													
Bear Creek^	6		2		2			1		1			
Beartooth	4							2		5			
Boulder Ridge	5		1							1			
Elk Fork Creek	5				2			1					
Game Creek	8				1								
Gypsum Mountain*	9				1	[3]	1,[2]			5,[4]			
Hawk's Rest^	10				1			1	1				
Heart Lake	5				3			1		3			
Horsetail Creek	8						4	1	1				1
Jedediah^	2				[5]								
~~Klondike Hill~~		1,[1]			1								
Lava Mountain	4									4			
Lower Gros Ventre	13				1			4	1				
Oxyoke Canyon	8						2			12			
Pacific Creek	16				3								
Pahaska^	6			1	1								
Porcupine Creek	7	1											
Ramshorn	6	1			1								
Spring Mountain	4	1	1										
Thief Creek	5	1			1								
Togwotee	11				2			2	1				
Tosi Peak	4		1		1								
Twilight Creek	2												
Two Ocean	12												
Wapiti	9				2					2			
Water Dog Lakes	7												
Windy Mountain	6				1					1			
Yellowjacket	10				1			2					
Misc. wolves	4	1	1		2					2			
WTGMA TOTAL	**192**	6	6	1	27	-	7	15	4	36	0	0	1
PREDATORY ANIMAL AREAS													
Seasonal Wolf Trophy Game Management Area													
~~Dog Creek^~~						12							
Mount McDougal	2					6							
~~Salt River Range~~									1				
Misc. wolves													
Year-round Predatory Animal Area													
Gooseberry	3		[1]			4							
Owl Creek^	4					8	1,[4]				2		
Misc. wolves	15		1			21	5			5	1		4
PRED. AREAS TOTAL	**24**	1	1	0	0	51	6	0	1	5	3	0	4
WYO Total	**216**	**7**	**7**	**1**	**27**	**51**	**13**	**15**	**5**	**41**	**3**	**0**	**5**
YNP Total	124	5	0	1	0	0	0	8	6	0	0	0	0
WRR Total	12	0	0	0	1	0	5	1	0	0	0	0	0
WYOMING TOTAL	**352**	**12**	**7**	**2**	**28**	**51**	**18**	**24**	**11**	**41**	**3**	**0**	**5**

1 Underlined packs are counted as breeding pairs on December 31, 2023.
2 Strikethough packs were not documented during 2023 and/or did not exist on Dec. 31, 2023 and are not displayed in Figure 1.
3 Excludes wolves killed in control actions and legal hunting.
4 Number of wolves that died of unknown causes.
5 Number of wolves legally taken during the regulated hunting season. Excludes wolves taken illegally that applied to the mortality limit.
6 Number of wolves taken by the public as predatory animals. Wolves killed from packs assigned to the WTGMA are counted in the Predatory animal area total.
7 Number of wolves killed in lethal control actions, including agency-directed control, defense of private property and on lethal take permits.
8 Collared wolves that became missing.
9 Number of conflicts between wolves and livestock/domestic animals confirmed in WYO. "OTHER" = 1 injured colt by the Horsetail pack and 4 injured goats.
@ Mortalities and Conflicts that occurred in adjacent jurisdictions/management areas are presented in brackets and are not included in respective column totals.
^ Border pack shared with Idaho, Yellowstone National Park or the Wind River Reservation; assigned to WYO.
* Border pack with the predatory animal area; 5 wolves assigned to the WTGMA, 4 wolves to the predatory animal area.

reports confirmed by qualified agency personnel, pictures taken with remote cameras, or a combination of methods. If 1 adult male and 1 adult female and ≥2 pups were adequately documented at the end of the calendar year, they were counted as a known breeding pair. The Wyoming Game and Fish Department will continue using approved methods for monitoring the wolf population while also investigating alternative methods for future wolf monitoring and management.

As of December 31, 2023, ≥192 wolves in ≥27 packs, including ≥17 breeding pairs, were documented in the WTGMA (Figures 1, 2, and 3; Table 1). Pack size ranged from 2 to 16 and averaged 7.1 wolves per pack (Figure 4; Table 1). Similar to previous years, wolf packs were distributed in largely exclusive territories across suitable habitat in the WTGMA (Figure 1).

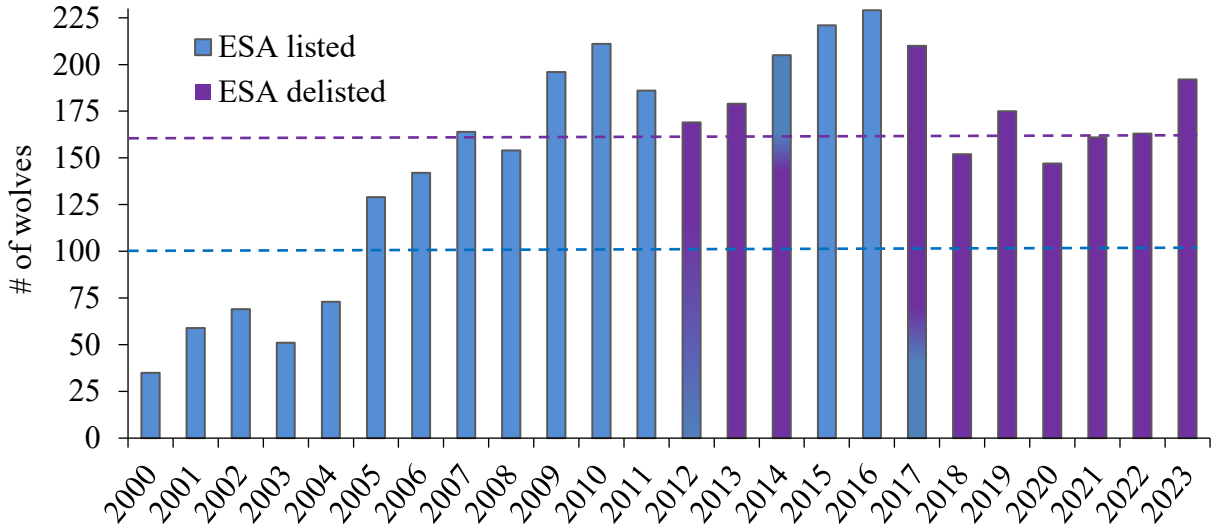

Figure 2. Minimum number of wolves in the WTGMA at the end of the calendar year. (Endangered Species Act status [listed vs. delisted] is included for comparative purposes. The blue dashed line indicates the ≥100 wolf minimum population commitment; the purple dashed line indicates the 160 wolf population objective for the WTGMA.)

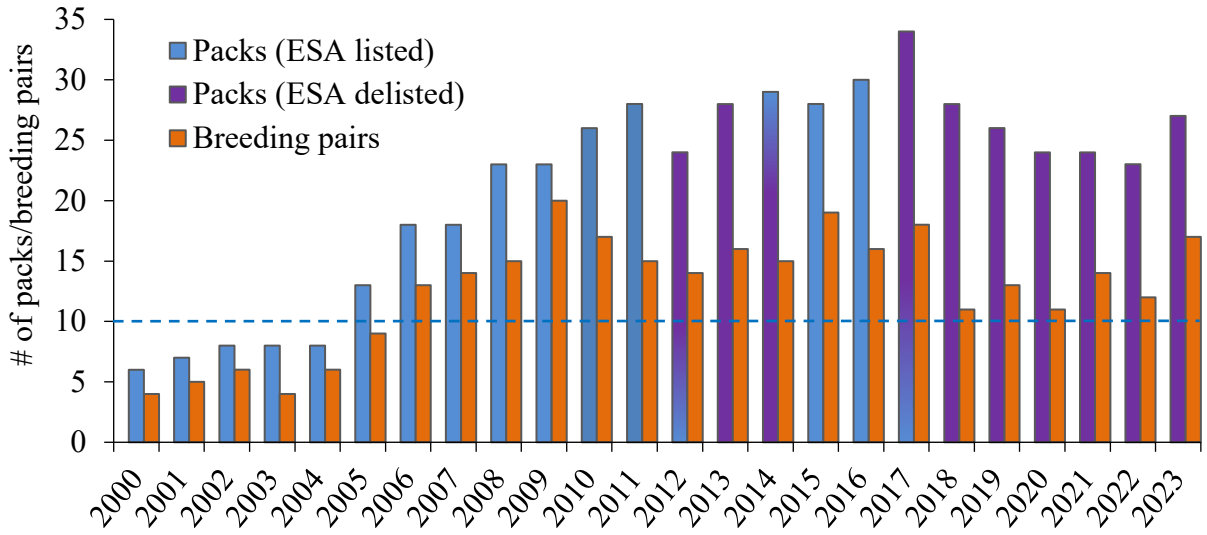

Figure 3. Minimum number of wolf packs and breeding pairs in the WTGMA at the end of the calendar year. (The dashed line indicates the ≥10 breeding pair minimum recovery criterion)

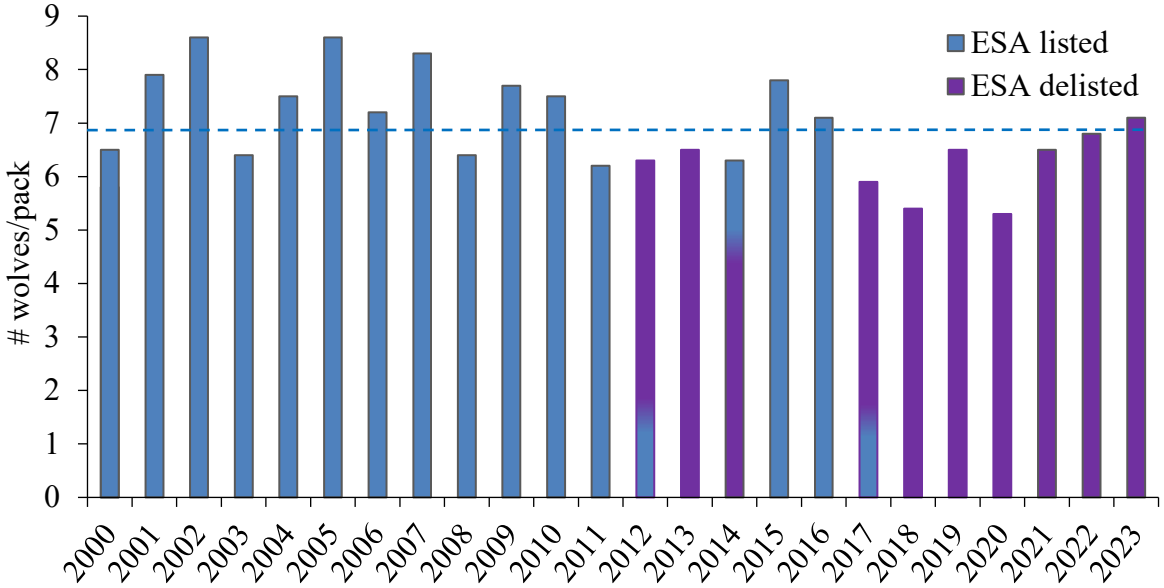

Figure 4. Average pack size for wolf packs in the WTGMA at the end of the calendar year. (The dashed line indicates the average pack size [6.9 wolves per pack] from 2000-2023)

Mortality

Wolf mortality was monitored in the WTGMA using multiple methods. The primary method used to identify wolf mortalities not associated with hunting was through the tracking of radio-collared wolves. This information allows managers to monitor collared wolves for mortality status and investigate the site to evaluate cause-specific mortality and collect carcasses for further evaluation through necropsy. Wolf hunting mortality in the WTMGA was monitored via mandatory reporting and registration by successful hunters as required in the Wyoming Game and Fish Commission Chapter 47 Gray Wolf Hunting Season (Chapter 47) regulation and Wyoming Statute 23-1-304(d). This requirement allowed Wyoming Game and Fish Department personnel to document mortality, collect information on wolves taken during the hunt, update mortality limits in the WTGMA/Seasonal WTGMA, and close wolf hunting seasons if the mortality limit was met. Cooperating agencies also provided information on wolf mortalities, including wolves killed in control actions by USDA Wildlife Services. Wolf mortalities from all causes were documented and confirmed, including those found by the public, cooperating agencies, and Wyoming Game and Fish Department personnel.

In 2023, 47 wolves were known to have died in the WTGMA (Figure 5; Tables 1 and 2). Causes of mortality included: hunting = 27; conflict control = 7; other human causes = 6; natural causes = 6; and unknown causes = 1 (Figure 5; Tables 1 and 2). Conflict control mortalities included 6 wolves from agency-directed lethal control actions and 1 wolf taken under the authority of a lethal take permit as authorized by the Wyoming Game and Fish Commission Chapter 21 regulation. The 6 wolf deaths from other human causes included 2 wolves killed by vehicle strikes, 2 wolves wounded during hunting seasons and not recovered, and 2 illegal kills (1 shot illegally and 1 killed after the hunting season closed). Natural mortalities included 4 wolves killed by other wolves, 1 predated by a mountain lion, and 1 wolf that died of starvation/old age. The number of wolves that died in the WTGMA in 2023 (47 wolves; Figure 5) was the lowest recorded since 2010 and was less than the average number of mortalities from 2012-2022 (average = 73.5 wolves). Human-caused mortality accounted for 85.1% of all wolf mortalities and 16.7% of all wolves recorded in the WTGMA in 2023 (Table 2). The overall mortality rate

was 19.7% of all wolves known to have been alive in the WTGMA in 2023, which was below the average mortality rate for 2012-2022 (28.4%) and was the lowest recorded since 2011 (Table 2).

Table 2. Summary of wolf mortality by cause of death in the WTGMA in 2023.

Cause of death	Total	% of mortality	% of wolves
Hunting	27	57.4	11.3
Conflict control	7	14.9	2.9
Other human causes	6	12.8	2.5
All Human Causes	40	85.1	16.7
Natural	6	12.8	2.5
Unknown	1	2.1	0.4
Total Mortality	47	100.0	19.7

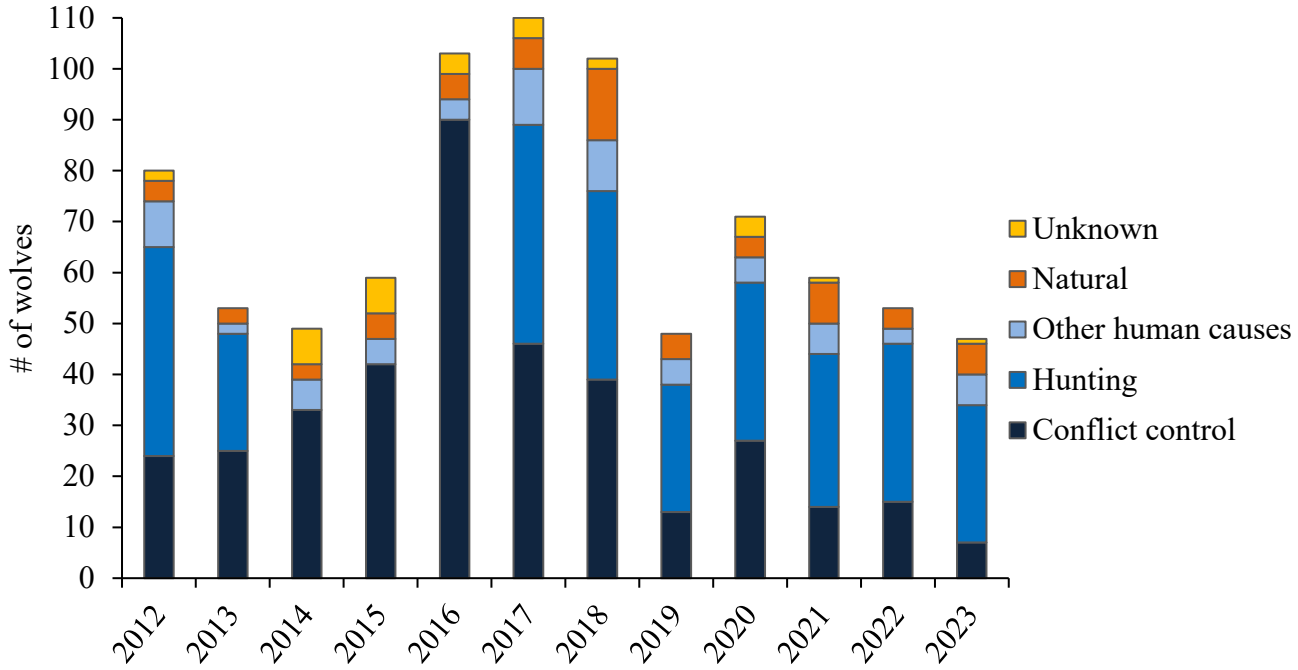

Figure 5. Number of wolf mortalities by cause of death in the WTGMA during the calendar year. (Wolves were listed under the Endangered Species Act in portions of 2014-2017)

Disease Monitoring

Disease presence and prevalence in wildlife populations is generally density-dependent, meaning the risk of a particular disease impacting a population increases as population density increases. Wolves are no exception, with evidence that the presence and prevalence of both sarcoptic mange (*Sarcoptes scabiei*: mange) and canine distemper virus (distemper) infections in wolf populations are most common at high population and wolf pack densities (Almberg et al. 2010, 2012). Both diseases may kill adult and juvenile wolves, but primarily manifest population declines through increased pup mortality and low pup recruitment (Almberg et al. 2009). While evidence for mange and distemper has been present in the wolf population in Wyoming, they have had little impact in most years on wolf population dynamics outside Yellowstone National

Park (Jimenez et al. 2010, Almberg et al. 2012). Management actions such as hunting and conflict control in the WTGMA appears to have held the wolf population below the threshold where disease outbreaks are more probable, however, the WTGMA wolf population increased rapidly following the reinstatement of Endangered Species Act protections in 2014 and remained at relatively high density from 2015 through early 2018 (Figures 2 and 3). This increase in population density in WTGMA was correlated with an increase in detection of distemper (Figure 6) and mange in the wolf population through 2018. Documentation of disease in the WTGMA wolf population declined and has remained low since 2018 when wolf density in the WTGMA was reduced following Endangered Species Act delisting and return to state management in 2017 (Figures 2, 3 and 6). The Wyoming Game and Fish Department will continue to monitor disease in the WTGMA wolf population and whether change in population density continues to correlate with disease prevalence.

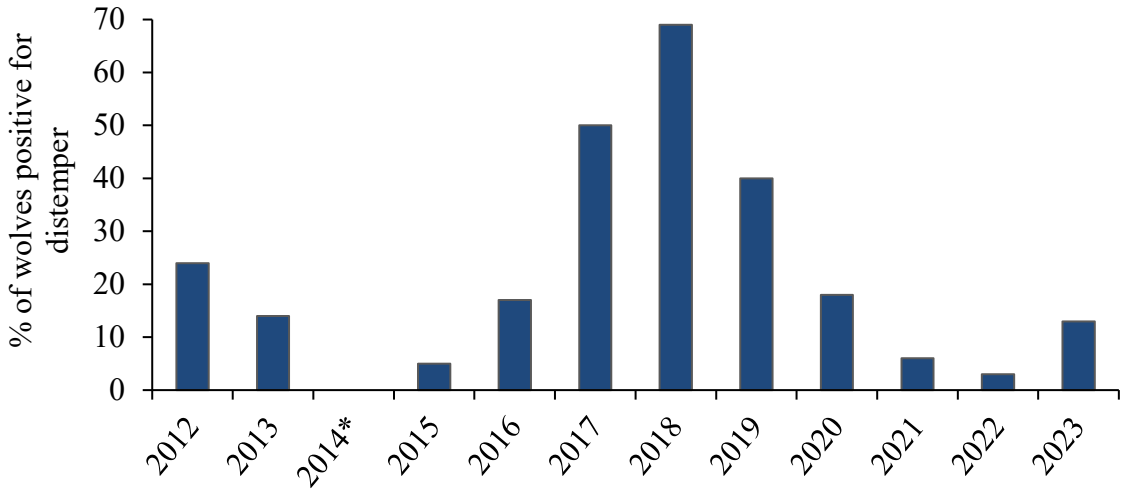

Figure 6. Proportion (%) of wolves captured in winter (November through March) that tested positive for canine distemper virus in the WTGMA. (*Too few wolves were captured following Endangered Species Act relisting of the wolf population in 2014 to allow for an adequate sample)

Mange: Mange is a contagious skin disease caused by mites and is commonly found in wolf populations throughout the world. Mange was first detected in Wyoming outside Yellowstone National Park in 2002 (Jimenez et al. 2010). As expected, documentation of mange continued to remain low in the WTGMA in 2023. During winter capture efforts, individuals from two packs showed evidence of hair loss consistent with mange infection (Game Creek and Gypsum Mountain), but no mortality due to mange was documented in 2023. Mange was not a factor affecting broader wolf survival or population dynamics in the WTGMA in 2023.

Distemper: Distemper is a contagious viral disease that infects species such as domestic dogs, coyotes, foxes, raccoons, skunks, and wolves. Based on other areas of the world that have experienced epizootic distemper infections, these diseases will occasionally cause mortality, particularly among juveniles. Outbreaks usually remain localized in specific areas/years and do not threaten regional wolf population viability. The proportion of wolves captured during winter that tested positive for distemper infection increased from 2015 through 2018 (Figure 6) and was correlated with increasing wolf population and wolf pack density in the WTGMA (Figures 2 and 3). Decreasing prevalence of distemper has been correlated with a reduction in wolf population and wolf pack density in the WTGMA and subsequent stability around the population objective from 2018-2022 (Figures 2, 3 and 6). Distemper prevalence increased in 2023 based on

prevalence rates for wolves captured in winter 2023-2024 (Figure 6). This increase is likely correlated with increased wolf population density in the WTGMA in 2023 (Figure 2). In fact, all wolves that tested positive for distemper in 2020 and 2021 were older wolves, which likely were exposed to distemper when the virus was common throughout the population (approximately 2017-2019: Figure 6), whereas 4 of the 6 wolves that tested positive in 2023-2024 were juveniles or yearling wolves, which supports the likelihood that the recent uptick in distemper prevalence is related to new infections as the population increased.

Canine Parvovirus: Canine parvovirus is a contagious disease that has caused significant population level impacts for wolf populations throughout North America, primarily in the 1980s (Kreeger 2003). The U.S. Fish and Wildlife Service and Yellowstone National Park have surveyed for evidence of canine parvovirus while managing Wyoming wolf populations and found a high rate of infection (>80% of wolves exposed) with no apparent deleterious effects to individual wolves or the population (Almberg et al. 2009, Jimenez et al. 2012). The Wyoming Game and Fish Department has not tested samples for canine parvovirus to date, but continues to retain samples from captured wolves that could be tested for canine parvovirus or other diseases if the need arises in the future.

Population Trend

The Wyoming Game and Fish Department closely monitors and manages the wolf population in the WTGMA because this is the area that corresponds to the available suitable habitat required for long-term viability of a wolf population in Wyoming outside Yellowstone National Park and would, therefore, maintain the number of wolves and breeding pairs required to meet population commitments outlined in the Wyoming Gray Wolf Management Plan (Wyoming Game and Fish Commission 2011). Wolf population dynamics diverged from long-term trends in the WTGMA in 2023 (Figures 7 and 8; see also Figures 14 and 15). The WTGMA end of year wolf population increased in 2023 by 18% as a result of higher than normal recruitment (Figures 3 and 7) and low mortality (Figure 5; see also Figure 15). Wildlife populations experience inevitable variation through time that may not be predicted. Such deviations provide opportunity to evaluate long-term population trends and refine management approaches.

Breeding pairs increased from ≥12 in 2022 to ≥17 in 2023 (42%) and remained above the minimum breeding pair commitment of ≥10 breeding pairs (Figure 3; Table 1). Recruitment, as measured by the proportion of packs that qualified as a breeding pair, was well above the long-term average (Figure 7), and was divergent from lower recruitment levels measured in the majority of years since 2017 (Figure 8). Litter sizes (4.6 pups per pack in 2023) were lower than the previous 3 years (5.0 pups per pack from 2010-2022), but were equal to the long term average (4.6 pups per pack from 2012-2022). Recruitment was higher than average, not as a result of increased litter size, but rather as a result of the number of litters born compared to previous years (22 litters born comprising at least 101 pups in 2023 vs. an average of 16 litters born comprising at least 78 pups from 2020-2022). Also notable was the detection of multiple litters in 3 different packs in summer 2023 (Gypsum Mountain, Ramshorn, and Wapiti), which has not been documented in the WTGMA since the Lava Mountain pack produced multiple litters in 2014. Disease outbreaks primarily affect juvenile survival and recruitment in wolf populations as described above. However, evidence of disease has declined and has remained low in the WTGMA (Figure 6). The slight increase in detection of distemper in 2023 is likely the result of increasing wolf population density in the WTGMA, but did not appear to affect the wolf population dynamics in 2023 (Figure 6).

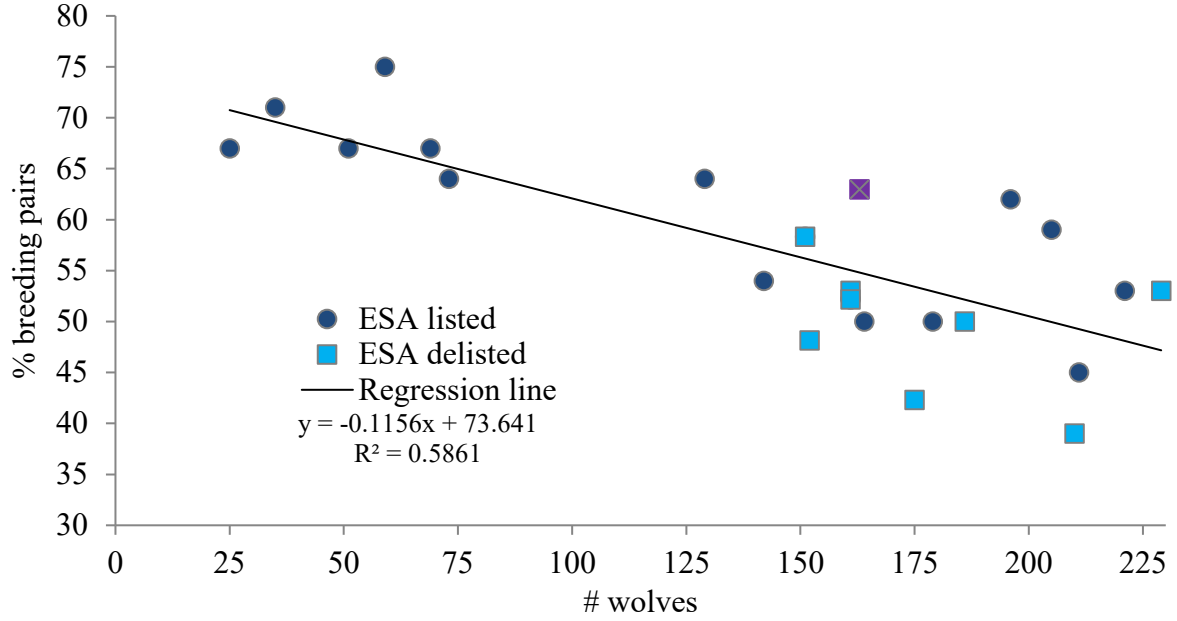

Figure 7. Minimum number of wolves present in the WTGMA at the beginning of the calendar year compared to the proportion (%) of packs that qualified as a breeding pair in the WTGMA at the end of the calendar year from 2000-2023. ("■" indicates the 2023 data point)

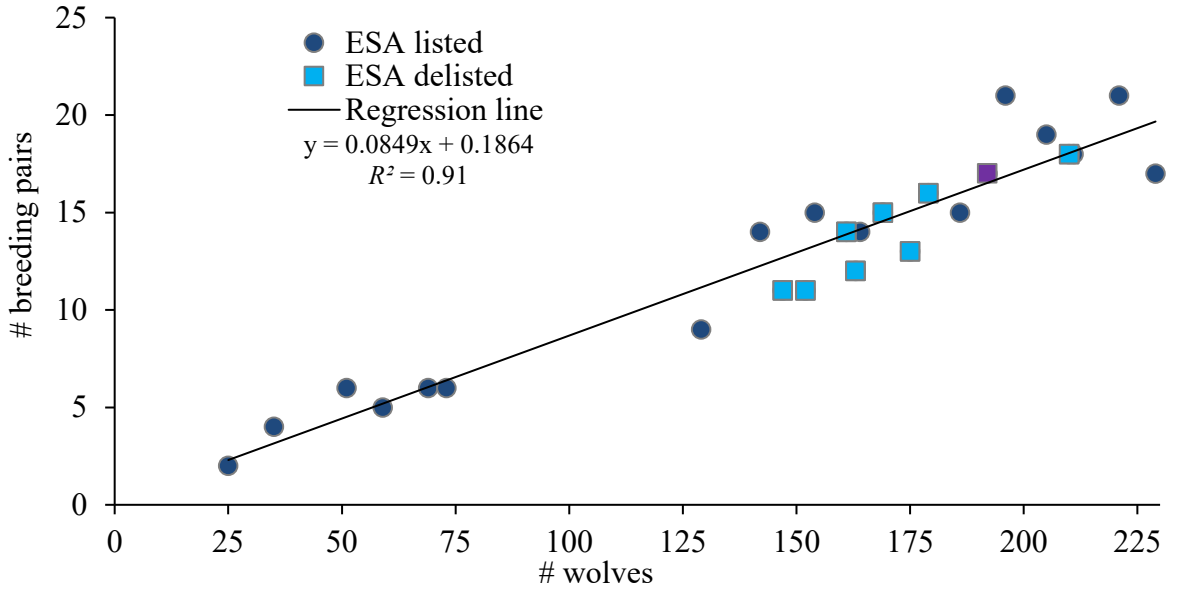

Figure 8. Minimum number of wolves and breeding pairs in the WTGMA at the end of the calendar year from 1999-2023. ("■" indicates the 2023 data point)

As highly social carnivores, wolf packs constitute the primary functioning unit of any given wolf population. Thus, it is necessary to also monitor and evaluate elements of wolf pack demography in the WTGMA, in addition to the population objectives outlined above, to ensure the wolf population is robust to management actions and meets objectives in the Wyoming Gray Wolf Management Plan (Wyoming Game and Fish Commission 2011). The number of wolf packs in the WTGMA increased from ≥23 packs in 2022 to ≥27 packs at the end of 2023 (Figure 3). There was a documented trio of wolves near Dubois, WY that was included in the 2023 population census and 4 other wolves reported in the South Fork Shoshone River that could not be verified by publication of this report. Otherwise, there was no evidence suggesting the

presence of wolf packs in the WTGMA that were not documented. Average pack size at the end of 2023 (7.1 wolves per pack) was slightly higher than 2022 (6.8 wolves per pack), and was reflective of the increased population that resulted from increased recruitment in the WTGMA (Figures 2, 3, and 4). Four new wolf packs established in 2023, including: the Porcupine Creek, Ramshorn, Twilight Creek and Water Dog Lakes packs (Figure 1; Table 1). The Klondike Hill pack formed in 2023 when two collared dispersers joined and produced pups, however, both breeders died prior to the end to 2023 and we believe the remaining juveniles and a subadult from the Klondike Hill pack were adopted by the newly formed Water Dog Lakes pack after they killed the breeding male in October 2023 (see cover photo; Table 1). To further evaluate pack dynamics, we reconstructed pack tenures (i.e., the duration an individual pack persisted on the landscape) for 101 packs documented in the WTGMA from 1997-2023 using published annual wolf reports. Average tenure for wolf packs in the WTGMA is influenced by both persistence of established, long-term packs (increases average pack tenure) and the number of new packs that form in a given year (reduces average pack tenure). In the WTGMA, average wolf pack tenure increased slightly in 2023 (Figure 9). The pack formation rate in the WTGMA in 2023 was slightly below the 10-year average (4 packs formed in 2023 vs. 4.3 packs formed per year on average) while pack dissolution rate was well below the 10-year average (1 pack dissolved in 2023 vs. 4.4 packs dissolved per year on average). In general, average tenure of wolf packs established in the WTGMA has increased through time, and has remained high after the implementation of wolf hunting seasons in 2017 (Figure 9). The relatively long tenures documented for wolf packs from 2017-2023 while wolves in Wyoming have been delisted demonstrate Wyoming Game and Fish Department management is resulting in a wolf population around the desired objective while allowing packs to maintain stable social structure that enables long-term persistence of packs on the landscape in the WTGMA (Figure 9).

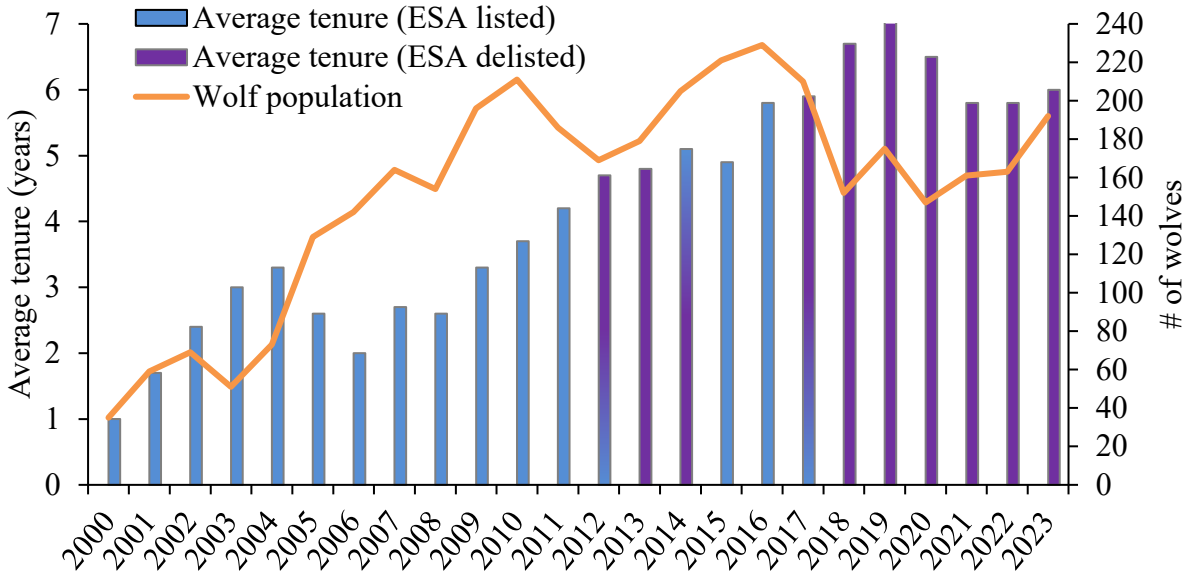

Figure 9. Wolf population trend and average tenure in years for wolf packs in the WTGMA from 2000-2023.

Overall, the wolf population in the WTGMA has largely followed the basic precepts of population theory over the course of recolonization and transfer to state management (e.g., density-dependence as seen in Figure 7 and Figure 14 in the *"Development of 2023 Wolf Hunting Seasons"* below). Predictable population responses to natural and human-caused perturbations allow for more precise estimation of the impact of management decisions, allowing for responsive adaptive management as population conditions shift through time. In addition, the

dual population objectives of wolf numbers and breeding pairs incorporates an added level of complexity for managing the wolf population in the WTGMA. However, throughout wolf recolonization in the WTGMA, the minimum number of breeding pairs has remained highly correlated to the minimum number of wolves in the WTGMA (Figure 8). This strong correlation allows for a high level of confidence in predicting how management actions, such as wolf hunting seasons, may impact both population and breeding pair numbers (Figure 8). The Wyoming Game and Fish Department continues rigorous monitoring and data analysis to aid in making robust management decisions for the wolf population in the WTGMA.

Genetic Monitoring

Genetic monitoring is an essential component of wolf management in the northern Rocky Mountain wolf metapopulation. The U.S. Fish and Wildlife Service determined that, in addition to minimum population criteria, genetic interchange must also occur between the three wolf recovery areas in the northern Rocky Mountains. To monitor whether this delisting criterion is met, the U.S. Fish and Wildlife Service requires that all states collect and analyze genetic samples from wolf populations in the northern Rocky Mountains. Analysis of genetic interchange will be conducted cooperatively between the U.S. Fish and Wildlife Service and the states of Wyoming, Montana, and Idaho on a periodic basis (possibly every 12-20 years following 3-5 wolf generations: Wyoming Game and Fish Commission 2011). Genetic samples will continue to be collected from wolves in the WTGMA to ensure enough genetic information is available to determine whether genetic interchange is occurring in the northern Rocky Mountains.

In 2023, genetic samples were collected from 77 wolves in the WTGMA that will be used in analysis of genetic interchange. Genetic samples were collected from 35 wolves that died and 42 wolves captured for monitoring purposes. As required by Chapter 47, 26 samples were acquired from wolves legally taken during authorized wolf hunting seasons in the WTGMA in 2023.

The biological samples obtained will be retained for future analyses regarding genetic interchange between wolf subpopulations in the northern Rocky Mountains as outlined in the Wyoming Gray Wolf Management Plan (Wyoming Game and Fish Commission 2011). Such an analysis was conducted in 2021 using samples from 2010-2018 (Wildlife Genetics International, in preparation); this analysis concluded a high level of genetic diversity continues to exist within each wolf recovery area in the northern Rocky Mountains. In addition, individuals with ancestry representing each recovery area were present in each wolf recovery area in the northern Rocky Mountains, indicating sufficient genetic interchange to maintain genetic diversity into the foreseeable future.

Capture and Telemetry Collaring

Very high frequency (VHF) and global position system (GPS) telemetry collars are the primary tools used for monitoring wolf populations in the WTGMA. VHF collars were used for general monitoring purposes and GPS collars provided more fine-scale data for specific monitoring or research projects. Each wolf captured was fitted with a collar and, during capture processing, personnel collected morphological information, genetic samples, and blood for disease testing. Collared wolves were released on site and monitored to document territories, movements (including dispersal), pack size, pack composition, breeding status and success, survival, to mitigate livestock conflicts, and to aid in law enforcement investigations.

Thirty-nine additional wolves from 18 packs in the WTGMA were collared through aerial capture techniques in 2023, including 7 recaptures. A total of 83 wolves in 25 packs and 5 single wolves were monitored in the WTGMA during calendar year 2023, including individuals collared in previous years. At the end of 2023, there were 51 wolves in 25 packs being monitored with telemetry collars in the WTGMA (27% of the 192 wolves present in the WTGMA at the end of 2023). Winter wolf capture efforts continued through March 2024 in conjunction with the year-end population census, at which point a total of 93 wolves in 28 packs were being monitored via telemetry collars in the WTGMA (approximately 50% of the WTGMA population in March 2024). The proportion of collared individuals is generally highest at the end of winter following aerial capture efforts in March and decreases throughout the remainder of the year as pups are born in April and collared wolves die, disperse, or collars fail.

Predatory Animal Areas

As of December 31, 2023, there were ≥24 wolves in ≥3 packs, including no breeding pairs, in the predatory animal areas (including the Seasonal WTGMA) in Wyoming (Figure 1; Table 1). Fifty-nine wolf mortalities were documented in predatory animal areas in 2023, including: 51 taken by the public under Wyoming Statute [W.S. 23-1-101(a)(viii)] as predatory animals, 6 taken by USDA Wildlife Services, 1 natural mortality and 1 killed in a vehicle strike (Table 1). Wolf captures included 2 wolves from 2 packs and 3 single wolves in the predatory animal areas (5 total). At the end of 2023, 2 wolves were being monitored via telemetry collars in predatory animal areas in Wyoming. Thirty-five genetic samples were collected from wolves that died in predatory animal areas in 2023.

Wolf Population Monitoring in the Wind River Reservation

Population and Breeding Pair Status

The Wind River Reservation minimum wolf population and breeding pair estimates were determined using analogous methods as described for the WTGMA. Wolves first recolonized the Wind River Reservation in 2003 and are currently distributed across the Wind River and Owl Creek Mountain ranges (Figures 1 and 10). The wolf subpopulation in the Wind River Reservation slowly increased through 2013 and has since fluctuated between 10 and 20 wolves (Figure 9). As of December 31, 2023, ≥11 wolves in ≥2 packs, including ≥1 breeding pair, were documented on the Wind River Reservation (Figures 1 and 10; Table 3). The Arrow Mountain pack may still be present in the Wind River Reservation but was not documented at the end of 2023.

Capture and Telemetry Collaring

One wolf from the Byrd Draw pack was captured and telemetry-collared in the Wind River Reservation in 2023.

Mortality

Five wolves were killed by Wildlife Services in lethal control actions in the Wind River Reservation in 2023 (Table 3).

Table 3. Wolf packs, minimum pack size at the end of the calendar year, wolf mortality, and wolf-livestock conflicts in Yellowstone National Park and the Wind River Reservation in 2023.

WOLF PACK[1,2]	MINIMUM PACK SIZE	DOCUMENTED MORTALITY[3] NATURAL	HUMAN[4]	UNKN	HUNTING	CONTROL	KNOWN DISPERSED	MISSING[5]	CONFIRMED CONFLICTS[6] CATTLE	SHEEP	DOGS	OTHER
Yellowstone National Park northern range												
8 Mile^	25	1					1					
Junction Butte	11	2		1	[1]		2	2				
Lupine Creek^	6				[2]		1					
Rescue Creek	15	1			[1]							
Shrimp Lake~	7											
Misc. wolves	5				[3]							
Yellowstone National Park non-northern range												
Cougar Creek^	11	1						3				
Firehole River@	6				[1]			1				
Mollie's	13				[1]		2					
Wapiti Lake	15						1					
Willow Creek~	8				[1]		1					
1330F/1336M group	2											
Misc. wolves	0											
YELLOWSTONE NATIONAL PARK TOTAL[7]	**124**	**5**	**0**	**1**	**0**	**0**	**8**	**6**	**0**	**0**	**0**	**0**
Wind River Reservation												
~~Arrow Mountain*~~						1			1			
Blue Trail*	9				1,[5]							
Byrd Draw*	2				[6]		1					
Misc. wolves	1					4						
WIND RIVER RESERVATION TOTAL[8]	**12**	**0**	**0**	**0**	**1**	**5**	**1**	**0**	**1**	**0**	**0**	**0**
TOTAL in YNP and WRR	**136**	**5**	**0**	**1**	**1**	**5**	**9**	**6**	**1**	**0**	**0**	**0**

1 Underlined packs qualified as breeding pairs on December 31, 2023.
2 Strikethough packs were not documented during 2023 and/or did not exist on Dec. 31, 2023 and are not displayed in Figure 1.
3 Includes hunting and trapping mortality. Wolves taken in hunts outside Yellowstone National Park are not included in totals but are indicated in brackets ([x]).
4 Excludes wolves killed in control actions and legal hunting.
5 Collared wolves that became missing in 2023.
6 Includes livestock and domestic animals confirmed killed or injured by wolves.
7 Mortality and confirmed conflicts with livestock by wolf packs assigned to Yellowstone National Park that occured in WYO are reported in Table 1.
8 Mortality and confirmed conflicts with livestock by wolf packs assigned to the Wind River Reservation that occured in WYO are reported in Table 1.
@ Border pack with ID, assigned to Yellowstone National Park.
^ Border pack with MT, assigned to Yellowstone National Park.
~ Border pack with WYO, assigned to Yellowstone National Park.
* Border pack with WYO, assigned to the Wind River Reservation.

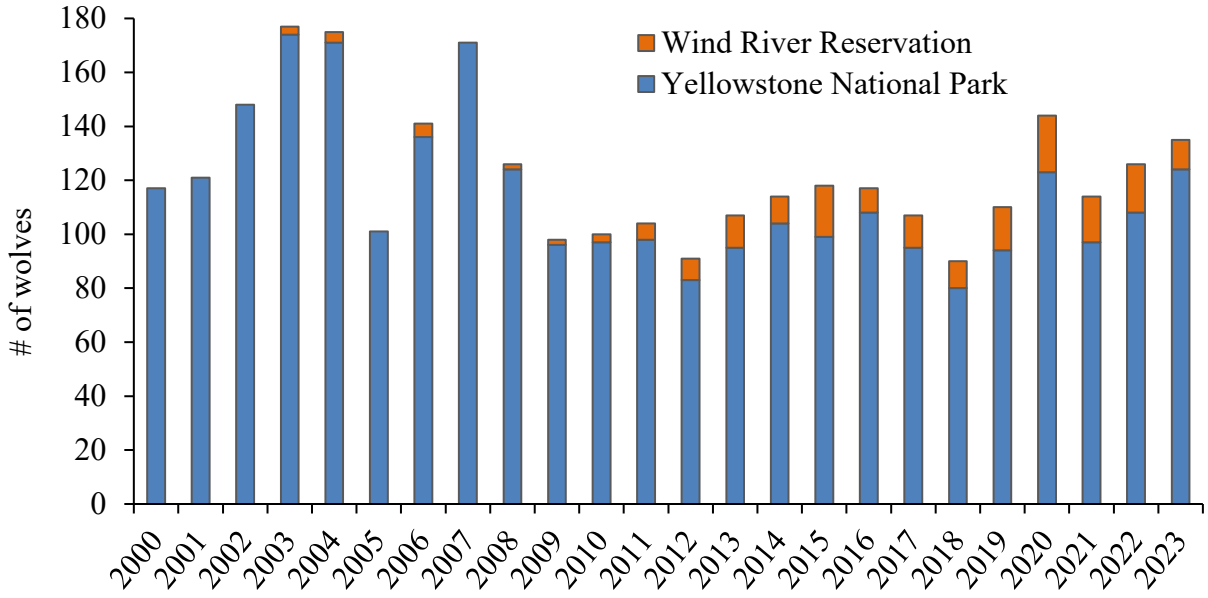

Figure 10. Minimum number of wolves in Yellowstone National Park and the Wind River Reservation at the end of the calendar year.

Wolf Population Monitoring in Yellowstone National Park

Population and Breeding Pair Status

As of December 31, 2023, there were ≥124 wolves in ≥ 11 packs (≥6 breeding pairs) living primarily in Yellowstone National Park. Pack size ranged from 2 to 25, averaging 10.8 members. Throughout Yellowstone, a minimum of 58 pups were produced, with at least 1 additional litter that was born but died before it could be observed. Forty-six pups survived (79%) to the end of the year with 30 in the 6 northern packs (3 breeding pairs) and 16 in the 5 interior packs (3 breeding pairs). At the end of 2023, pups comprised 37% of the wolves living in Yellowstone.

One new pack called 1386F's group dissolved approximately six months after forming when 3 of the 6 pack members were killed during wolf hunting seasons outside of Yellowstone. Another new group, called 1330F/1336M group, formed in fall 2023. At the end of 2023, we recorded more lone wolves (5) than the 10-year average (1.2).

Prior to litters being born in April of 2023, there were approximately 96 adult wolves in Yellowstone. At least 58 pups were born to 10 packs. Two packs produced multiple litters this year: 8 Mile (18 pups from 3 litters), and Junction Butte (7 pups from 2 litters). The Lupine Creek, Rescue Creek, Shrimp Lake, Willow Creek, Mollie's, Wapiti Lake, Firehole River, and 1386F group had 1 litter each. The Cougar Creek pack did not den according to field observations. Of the minimum 58 pups produced in all packs, 46 (79%) survived to the end of the year. Pup survival was mostly high with the exception of the Junction Butte and Lupine Creek packs, which had at least 7 and 5 pups, respectively, but by the end of the year had only 1 surviving pup each. The 1386F group exhibited denning movements but lost their pups before they could be counted.

Capture and Telemetry collaring

Twenty-seven wolves from 9 packs were captured and collared in 2023. New collars were deployed on 11 pups, 7 yearlings, 5 adults, and 1 old adult wolf. Older or nonfunctional collars were replaced on 2 adult wolves. In addition to fitting the radio collar, staff took blood samples for disease screening, 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 in case a collar is dropped or chewed off and the wolf is recaptured in the future. Twelve of the collars were GPS which send data through satellites, can be programmed remotely, and are used to evaluate habitat selection, movement patterns, prey selection, biomass consumption, and interspecific interactions during certain seasons. These collars last for approximately 2 years and are programmed to record locations at fix rates ranging from 4 to 48 times per day, depending on the season and study objectives. The other 15 collars were VHF, which simply emit a tracking beacon and have a battery life generally lasting at least 5 years. The Yellowstone Wolf Project goal is to have approximately 25%-30% of the wolves collared to gather information for dozens of long-term monitoring and research objectives. At the end of 2023, 33 of the 124 wolves (27%) in Yellowstone were collared.

Mortality

Six wolves died in Yellowstone in 2023, including 5 collared wolves and 1 uncollared wolf (Table 3). Four wolves were killed by other wolves and 2 wolves died from injuries sustained

while hunting large ungulates (Table 3). An additional 10 wolves assigned to the Yellowstone subpopulation were killed by hunters outside the Park in 2023, including 8 in Montana, 1 in Idaho, and 1 in Wyoming.

Disease Monitoring

Disease was not detected in the Yellowstone wolf population in 2023. The 1386F group lost their pups before den emergence and the Junction Butte pack lost all but 2 of their pups from 2 litters to unknown causes in May of 2023. The pup carcasses could not be recovered so disease testing was not possible. These pups may have died of non-disease related causes such as drowning, predation, or malnutrition.

WOLF MANAGEMENT

SUMMARY OF WOLF MANAGEMENT STATEWIDE

In 2023, the Wyoming Game and Fish Department implemented a wolf hunting season with the biological objective to stabilize the wolf population at approximately 160 wolves in the WTGMA. A mortality limit of 40 wolves was divided between 13 hunt areas in the WTGMA and 1 hunt area in the Seasonal WTGMA (hunt area 12). Wolf hunting seasons were open from September 15 to December 31, 2023 with the exception of hunt area 12 (opened on October 15, 2023) and hunt area 13 (closed March 31, 2024). The hunting season for each hunt area closed at the season end date or when the mortality limit was met, whichever occurred first. A total of 27 wolves were killed during the 2023 wolf hunting season. In addition, the 2022 wolf hunting season extended from January 1 to March 31, 2023 in hunt area 13, during which no wolves were taken.

Wolves were confirmed to have killed or injured 49 head of livestock (41 cattle, 3 sheep, 4 goats, and 1 horse) statewide in Wyoming in 2023. Statewide, wolf-livestock conflicts were the lowest recorded since 2003. Eighteen wolves were lethally and legally removed by agencies or the public in an effort to reduce livestock losses to wolves (7 in the WTGMA, 6 in predatory animal areas in WYO, 5 in the Wind River Reservation).

Wolf Management in the WTGMA

Hunting

Wolf Hunting Season Background: Chapter 47 governs wolf hunting in the WTGMA and was part of the management framework evaluated and approved by the U.S. Fish and Wildlife Service during the delisting process. Wolf hunting regulations for 2022 and 2023 were authorized by the Wyoming Game and Fish Commission and outlined specific hunt areas, mortality limits, season dates, and other wolf hunting regulations in the WTGMA and Seasonal WTGMA. As reported in the 2022 annual wolf report, the 2022 wolf hunting season included season dates for hunt area 13 that extended from January 1 to March 31, 2023. Take occurring during this extended season is included in this report. For the 2023 wolf hunting season, the Wyoming Game and Fish Department delineated 14 wolf hunt areas in the WTGMA and Seasonal WTGMA (Figure 11). Some hunt areas were combined under one mortality limit to accommodate specific wolf pack movements and management objectives (Table 4). As outlined

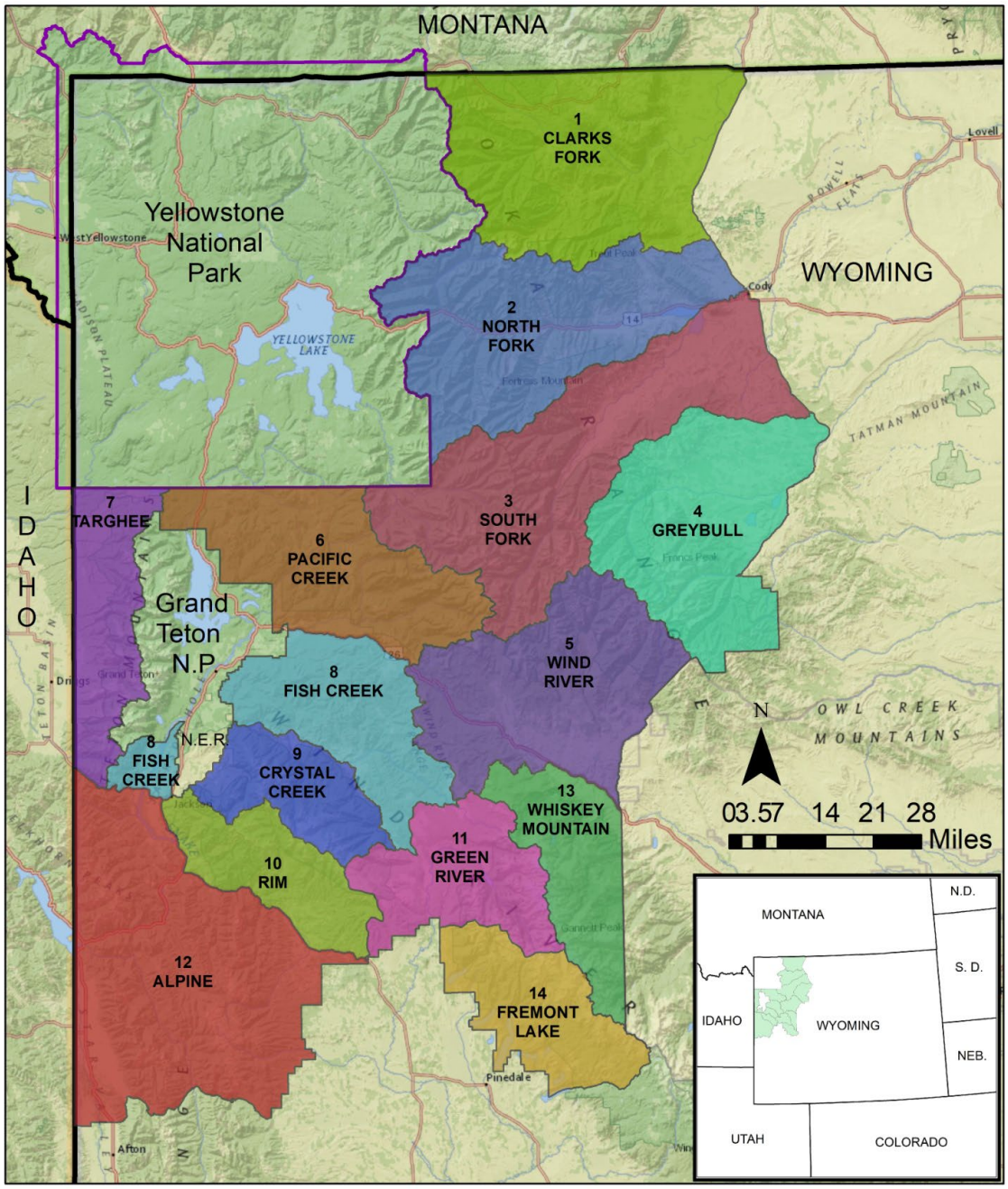

Figure 11. Wolf hunt areas for the 2023 wolf hunting season in northwest Wyoming.

in the Wyoming Gray Wolf Management Plan, the Wyoming Game and Fish Commission-approved wolf hunting seasons were in conjunction with big game hunting seasons and ran Seasonal WTGMA (Figure 11). Some hunt areas were combined under one mortality limit to accommodate specific wolf pack movements and management objectives (Table 4). As outlined in the Wyoming Gray Wolf Management Plan, the Wyoming Game and Fish Commission-approved wolf hunting seasons were in conjunction with big game hunting seasons and ran primarily from September 15th to December 31st (Table 4; Wyoming Game and Fish Commission 2011). The wolf hunting season opening date was shifted from September 1st in 2018-2019 to September 15th in 2020-2023 to reduce the proportion of juveniles taken in the hunt. The season in hunt area 13 was extended to end March 31st to allow greater opportunity to harvest wolves in areas used by the wintering Whiskey Mountain bighorn sheep herd (Figure 11; Table 4). The wolf hunting season in hunt area 12 (the Seasonal WTGMA) differed from the

other 13 hunt areas by opening on October 15 (the date wolves changed from predatory animal to trophy game animal designation as prescribed by Wyoming Statute 23-1-101(a)(xii)(B)(II)) and closed on December 31, 2023 (Figure 11; Table 4). Mortality related to wolf hunting was regulated by hunt area specific mortality limits that were defined under a general license structure. Hunters could purchase up to 2 wolf hunting licenses for wolf seasons in 2023. Legal and illegal wolf mortality that occurred during the open hunting season counted toward established mortality limits. The season for each hunt area closed when the mortality limit was met or at the season end date, whichever occurred first.

Wolf mortality limits were determined using data collected annually on wolf population dynamics and human-caused mortality in the WTGMA. All forms of mortality, in addition to estimates of recruitment and wolf population demographics, were considered in the mortality limit calculation. The Wyoming Game and Fish Department predicted the population would be stabilized around 160 wolves (and 14 breeding pairs) at the end of 2023 in the WTGMA if 37.1% of the wolves present at the beginning of 2023 died from all human-caused mortality. The predicted, non-hunting, human-caused mortality rate (15.3%) was then subtracted from 37.1% to obtain a 21.8% wolf hunting mortality rate. This rate equaled a total mortality limit of 38 wolves when applied to the minimum wolf population estimate of ≥163 wolves present in the WTGMA at the beginning of 2023 (i.e., the end of 2022 minimum wolf population). The total mortality limit of 38 wolves was then sub-divided among 13 hunt areas in the WTGMA (Table 4, Figure 11). An additional 2 wolves were included in the total mortality limit to be applied to hunt area 12 (the Seasonal WTGMA), for a total mortality limit of 40 wolves (Table 4, Figure 11).

Table 4. Summary of the 2023 wolf hunting season in the WTGMA and Seasonal WTGMA (i.e., hunt area 12).

WGFD WOLF HUNTER HARVEST SUMMARY 2023				1/1/2024	
HUNT AREA(s)	MORTALITY LIMIT FROM REGULATIONS	SEASON DATES GENERAL	HARVEST COUNTED TOWARDS LIMIT*	AREA STATUS	DATE/TIME AREA CLOSED
1, 2	9	Sep. 15 - Dec. 31	5	CLOSED	1/1 Per Regulation
3, 4	5		5	CLOSED	11/6 @ 5:40 PM
5	3		4	CLOSED	10/5 @ 11:10 AM
6, 7	5		3	CLOSED	1/1 Per Regulation
8, 9, 11	10		6	CLOSED	1/1 Per Regulation
10	2		2	CLOSED	12/5 @ 4:45 PM
12	2	Oct. 15 - Dec. 31	0	CLOSED	1/1 Per Regulation
13	3	Sep.15 - Mar. 31	1	OPEN	
14	1	Sep. 15 - Dec. 31	1	CLOSED	12/1 @ 7:20 AM
Total 2023 Mortality Limit	40	**Total 2023 Harvest**	27		

* All legal harvest or illegal human-caused gray wolf deaths that occur during an open hunting season will apply to the mortality limit.

Wolf Hunting in the WTGMA and Seasonal WTGMA: In 2023, a total of 2,438 wolf hunting licenses were sold to 2,243 individuals (1,980 residents and 263 nonresidents), slightly above the average from 2017-2022 (2,322 licenses). A total of 195 individuals purchased the maximum allowed, 2 hunting licenses in 2023. A total of 27 wolves were taken in the 14 hunt areas during open wolf hunting seasons in autumn 2023 (Tables 1, 2 and 4). Four of the 10 hunt areas/hunt area combinations closed prior to the established December 31, 2023 closing date due to the mortality limit being met (Table 4). The mortality limit for hunt area 5 was exceeded by 1 wolf

because 2 wolves were killed when only 1 wolf remained on the mortality limit (Table 4). One hunter failed to comply with reporting requirements.

Hunting related mortality during the wolf hunting season in autumn 2023 was recorded in 17 of 30 packs (57%) that regularly used the WTGMA (includes Shrimp Lake and Willow Creek assigned to Yellowstone National Park; Table 1). Two additional wolves were taken that did not belong to established packs (Table 1). Harvest occurred during each month of the season, with most occurring in October and December (Figure 12). Wolf harvest has generally been decreasing through time in September and October and increasing in November and December (Figure 12). Of the 27 wolves taken during the 2023 hunting season, more were male (11 females:16 males) and more subadults (9 juveniles:11 subadults:7 adults) were taken. For all wolf hunting seasons combined, a higher proportion of young wolves (juveniles and subadults) have been taken in earlier months with the ratio shifting toward adults through the end of the hunting season in December (Figure 13). The Department will continue to monitor the results of wolf hunting seasons to determine the impact of hunting on wolf population dynamics and to assist in making management decisions in the future.

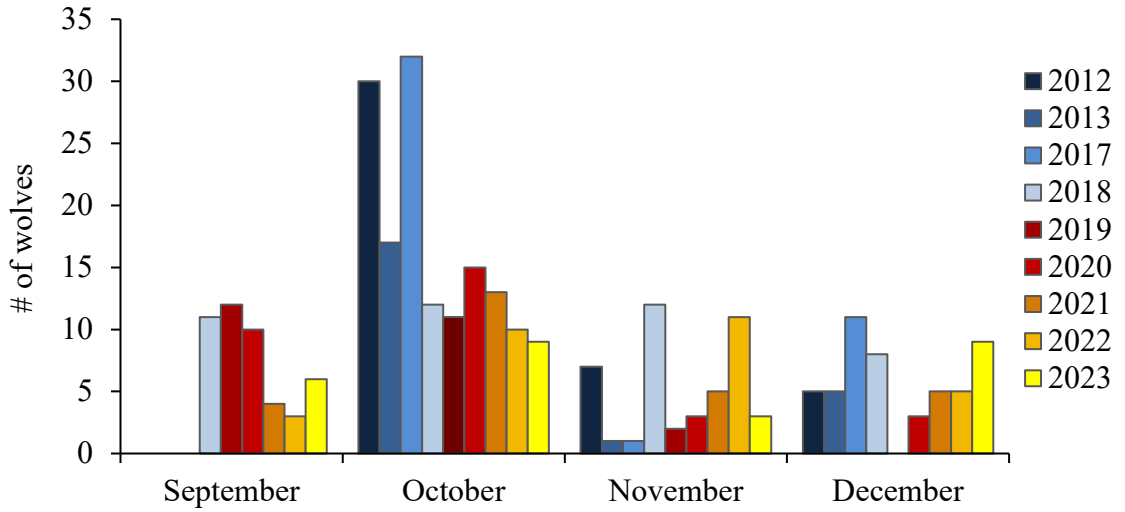

Figure 12. Number of wolves harvested during wolf hunting seasons by month and year in the WTGMA and Seasonal WTGMA in northwest Wyoming. (2012, 2013 and 2017 had Oct. 1st openers; 2018-2019 had Sept. 1st openers; 2020-2023 had Sept. 15th openers)

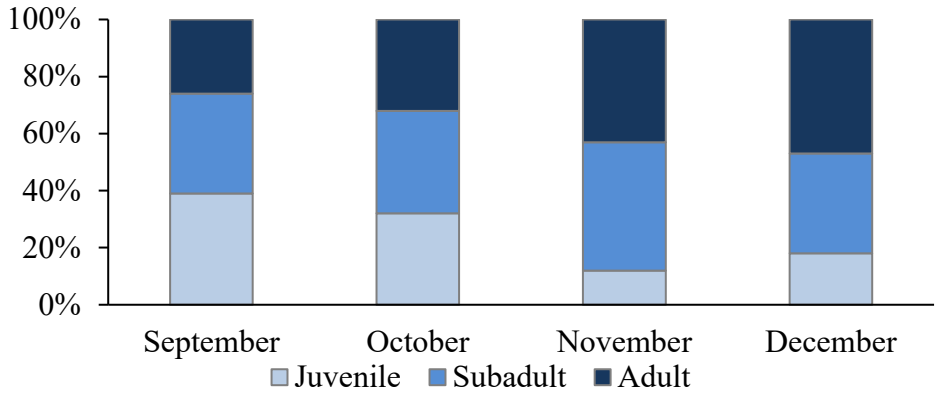

Figure 13. Proportion (%) of adult (>2 years of age), subadult (1-2 years of age), and juvenile (<1 year of age) wolves taken during wolf hunting seasons by month in the WTGMA and Seasonal WTGMA in northwest Wyoming during all wolf hunting seasons: 2012, 2013, 2017-2022. (Seasons started Oct. 1st in 2012- 2017, Sept. 1st in 2018-2019, and Sept.15th in 2020-2023)

Development of 2024 Wolf Hunting Seasons: In 2023, the end of year wolf population in the WTGMA was 32 wolves above the population objective of 160 wolves and was 3 breeding pairs above the corresponding objective of 14 breeding pairs set during the wolf hunting season setting process (Figures 2 and 3; Table 1). From 2018-2022, the Wyoming Game and Fish Department consistently maintained an end of year wolf population within 10% of the population objective (Figures 2, 5, and 7). However, the wolf population exceeded previous trends in pup recruitment while simultaneously experiencing low mortality in 2023, resulting in the population increasing by 18% (Figure 2). The efficacy of the season-setting process employed by the Wyoming Game and Fish Department is dependent on analysis of long-term wolf population trend data for the WTGMA, including recruitment (i.e., breeding pairs: Figures 7 and 8) and mortality (Figures 14 and 15). To that end, the Department will continue to take an adaptive management approach for setting 2024 wolf hunting seasons as outlined in the Wyoming Gray Wolf Management Plan (Wyoming Game and Fish Commission 2011).

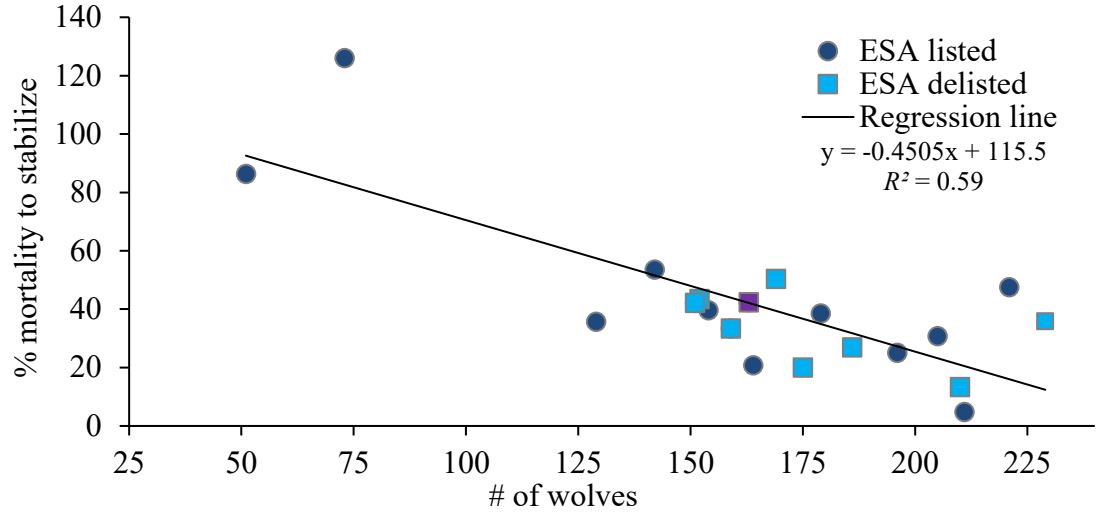

Figure 14. Minimum number of wolves at the beginning of the calendar year and the proportion (%) human-caused mortality that would have been required to stabilize wolf population growth during the calendar year in the WTGMA from 2004-2023. ("■" indicates the 2023 data point)

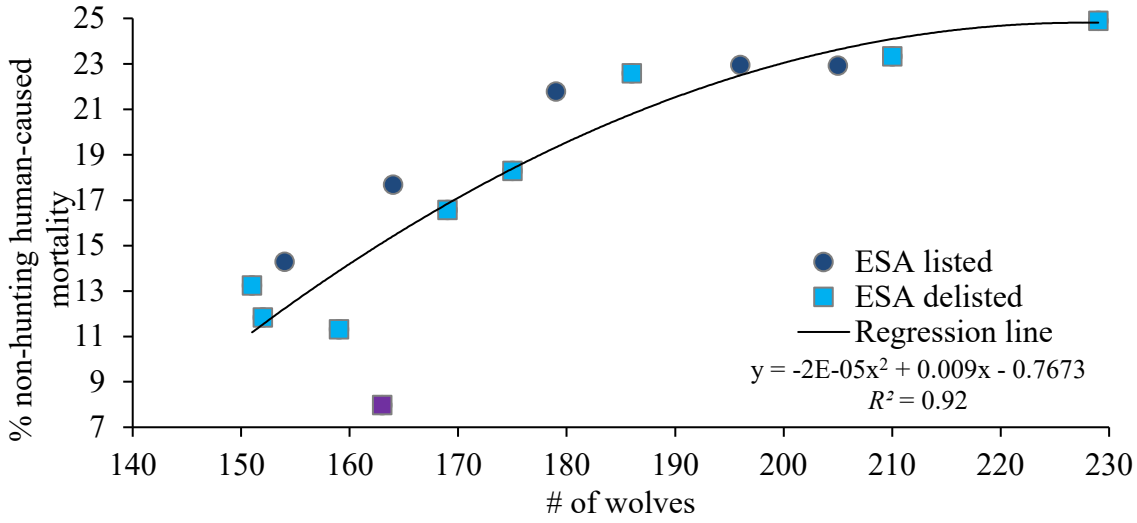

Figure 15. Minimum number of wolves at the beginning of the calendar year and proportion (%) of wolves present in the WTGMA at the beginning of the calendar year that were killed by non-hunting human-causes during the calendar year from 2008-2023. (Statistical outliers from 2011 and 2016 are excluded; "■" indicates the 2023 data point)

Wolf-Livestock Conflicts

As in previous years, the Wyoming Game and Fish Department investigated all livestock that were reported as killed or injured by wolves (i.e., conflicts) in the WTGMA (Figure 1). Only confirmed livestock conflicts are documented in this report consistent with Wyoming Game and Fish Commission Chapter 28: Regulation Governing Big or Trophy Game Animal or Game Bird or Gray Wolf Damage Claims (Chapter 28), which requires confirmed evidence at the scene or on the livestock carcass indicating wolves were more likely than not responsible for the death or injury of the individual livestock. All suspected conflicts between livestock and wolves are expected to be reported in the WTGMA because verification is required to qualify for damage compensation and/or for wolf management actions to be initiated.

In 2023, wolves killed or injured 37 head of livestock in the WTGMA (Figure 16; Tables 1 and 5). Livestock confirmed as killed or injured by wolves included 36 cattle (24 calves and 12 cows/yearlings) and 1 colt horse (Figure 16; Tables 1, 5 and 6). The number of wolf-livestock conflicts remained relatively similar from 2021 to 2023, and was the lowest since 2010 (Figure 16; Tables 5 and 6). Management actions included capture and collaring wolves, intensive monitoring, lethal removal, non-lethal depredation prevention measures, and issuance of 15 lethal take permits to livestock producers (10 initial permits and 5 permits that were renewed due to continued livestock conflict). Seven wolves were killed in response to livestock conflicts in the WTGMA; 6 in agency-directed lethal control actions and 1 under authority of lethal take permits (Figures 5 and 16; Tables 1, 2 and 5).

Table 5. Confirmed wolf-livestock conflicts and wolves killed in conflict control actions in the WTGMA by calendar year.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Cattle	38	15	26	41	46	44	60	81	141	87	55	48	51	38	39	36
Sheep	14	37	0	0	1	19	3	19	0	0	0	0	0	0	0	0
Dogs	0	0	0	0	4	1	0	0	0	1	0	0	1	5	0	0
Horses/other	0	1	1	0	0	2	0	1	0	0	2	2	10	1	5	1
Total livestock killed/injured	52	53	27	41	51	66	63	118	141	110	57	50	62	44	44	37
Wolves killed	32	21	32	28	19	24	29	25	90	46	39	12	27	14	15	7

Number of Packs Involved in Confirmed Livestock Conflicts: Ten packs (33% of 30 packs total in 2023) that use the WTGMA were involved in ≥1 livestock conflict in 2023 (includes Willow Creek and Shrimp Lake assigned to Yellowstone National Park: Figure 17; Table 1). Three packs were responsible for 1 confirmed conflict with livestock (25% of conflict packs; 10% of all packs), 2 packs were responsible for 2 confirmed conflicts with livestock (17% of conflict packs; 7% of all packs), and 5 packs were responsible for ≥3 confirmed conflicts with livestock (42% of conflict packs; 17% of packs; Table 1). The number of packs involved in livestock depredation has steadily declined every year (except 2021) since Endangered Species Act protections were removed in 2017 (Figure 17).

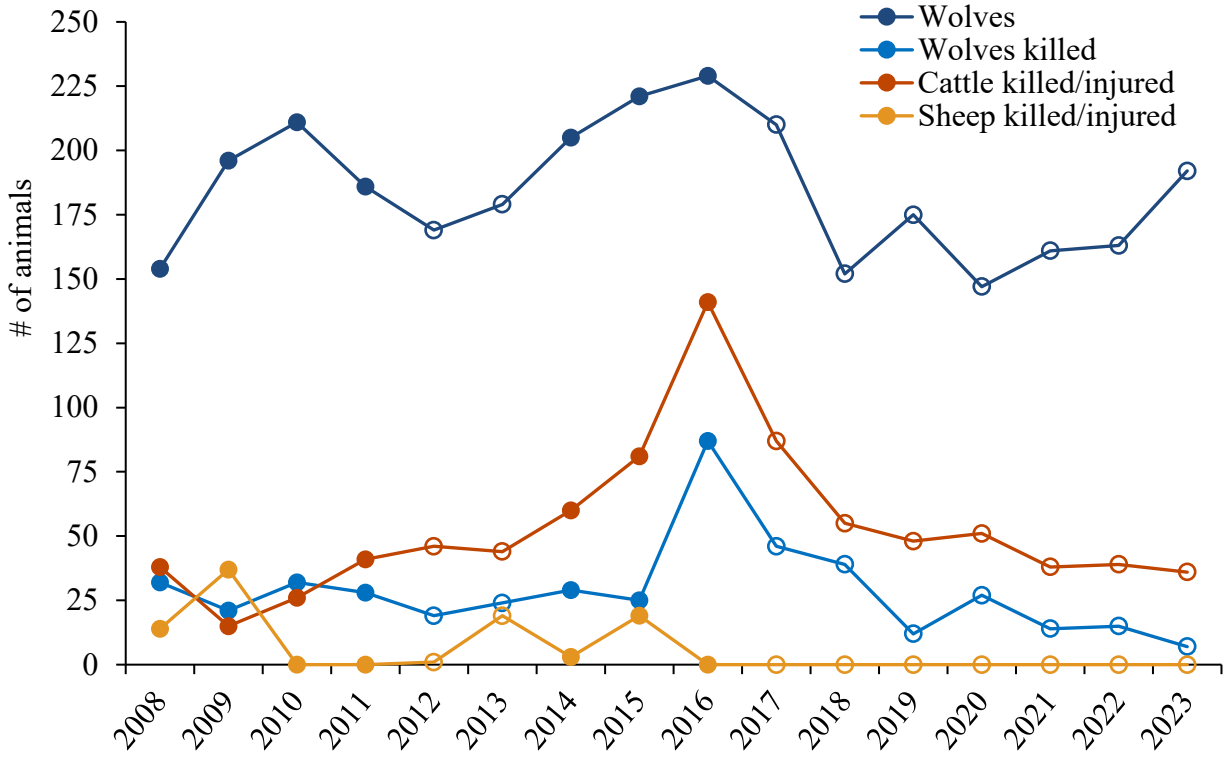

Figure 16. Number of wolves in the, confirmed wolf-livestock conflicts and wolves killed in conflict control actions in the WTGMA by calendar year. (Filled circles indicate years where wolves were not hunted, open circles indicate years with wolf hunting seasons.)

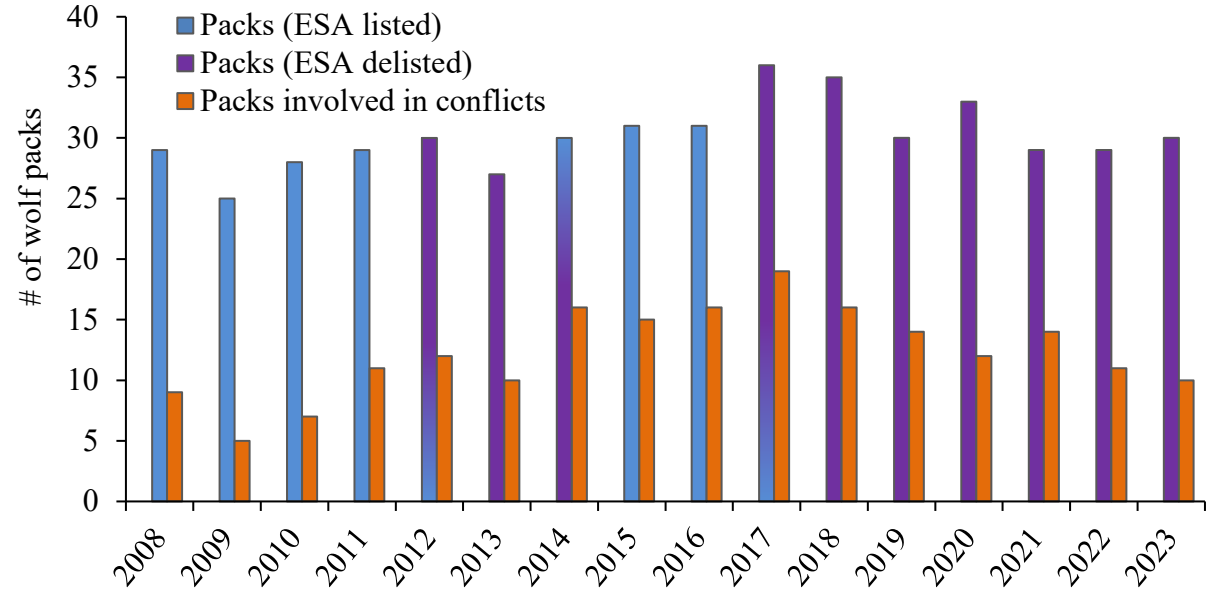

Figure 17. Minimum number of wolf packs present during the calendar year and number of wolf packs that were involved in ≥1 confirmed wolf-livestock conflict in the by calendar year.

Location of Livestock Conflicts: Land ownership is recorded for all instances of confirmed wolf-livestock conflict in the WTGMA as part of routine investigations of reported conflicts. Of 37 wolf-livestock conflicts in the WTGMA in 2025, 58% were on public land (21 cattle) and 42% were on private land (15 cattle and 1 colt horse: Table 6). Wolf hunt area 1 had the highest confirmed wolf-cattle conflicts, while conflicts in other hunt areas were significantly lower (Table 7).

Table 6. Proportion (%) of wolf-cattle conflicts that occurred on private or public lands in the WTGMA from 2017-2023.

Year	2017	2018	2019	2020	2021	2022	2023	Average
Public	49%	45%	71%	63%	47%	56%	58%	56%
Private	51%	55%	29%	37%	53%	44%	42%	44%

Table 7. Confirmed wolf-livestock conflicts in the WTGMA (Hunt areas 1-11, 13 & 14) by wolf hunt area in 2024.

Hunt area	1	2	3	4	5	6	7	8	9	10	11	13	14	Total
Cattle	17	2	1	3	4	0	0	0	0	0	4	0	5	36
Sheep	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Total	17	2	1	3	4	0	0	1	0	0	4	0	5	37

Seasonal Trend in Livestock Conflicts: Patterns of wolf-cattle conflict in 2023 were similar to previous years but were less frequent except in July (Figure 18). Confirmed wolf-cattle conflicts began in May, peaked in July, and ceased by the end of October (Figure 18). Overall, the magnitude of monthly conflicts between wolves and cattle has declined since Endangered Species Act protections were removed in Wyoming in 2017 (Figure 18). Notably, the Wyoming Game and Fish Department has not verified any conflicts between wolves and cattle from November through March since 2021 (Figure 18).

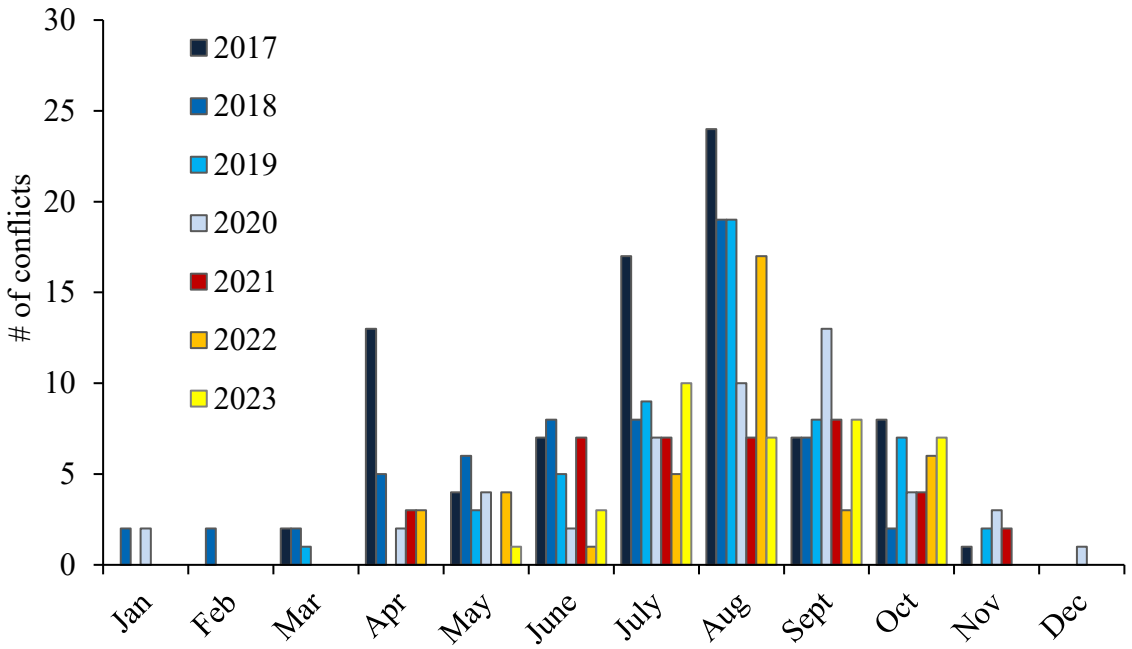

Figure 18. Number of wolf-cattle conflicts per month in the 2018-2023.

Compensation for Livestock Damage Caused by Wolves: In 2023, the Wyoming Game and Fish Department paid $270,710 to compensate 14 livestock producers for livestock killed or injured by wolves in the WTGMA and Seasonal WTGMA (Figure 19). Compensation payments declined from >$300,000 from 2014-2017 to ~$200,000 or less from 2018-2022, mirroring synchronous declines in conflict between wolves and livestock following removal of Endangered Species Act protections in Wyoming in 2017 (Figures 16 and 19). The increase in compensation

payment in 2023 was not related to increased conflict, but was related to significantly increasing market values for cattle. Confirmed sheep conflicts in the Seasonal WTGMA increased from 2019-2022 causing overall compensation amounts to be higher during that timeframe despite stable to decreasing conflicts with cattle in the WTGMA (Figures 2, 16 and 19; Table 5). However, there were no sheep conflicts recorded in the Seasonal WTGMA in 2023. Wolf-sheep conflicts in the Seasonal WTGMA occur during the summer when sheep graze on public allotments and wolves are designated as predatory animals and are not under the management jurisdiction of the Wyoming Game and Fish Department.

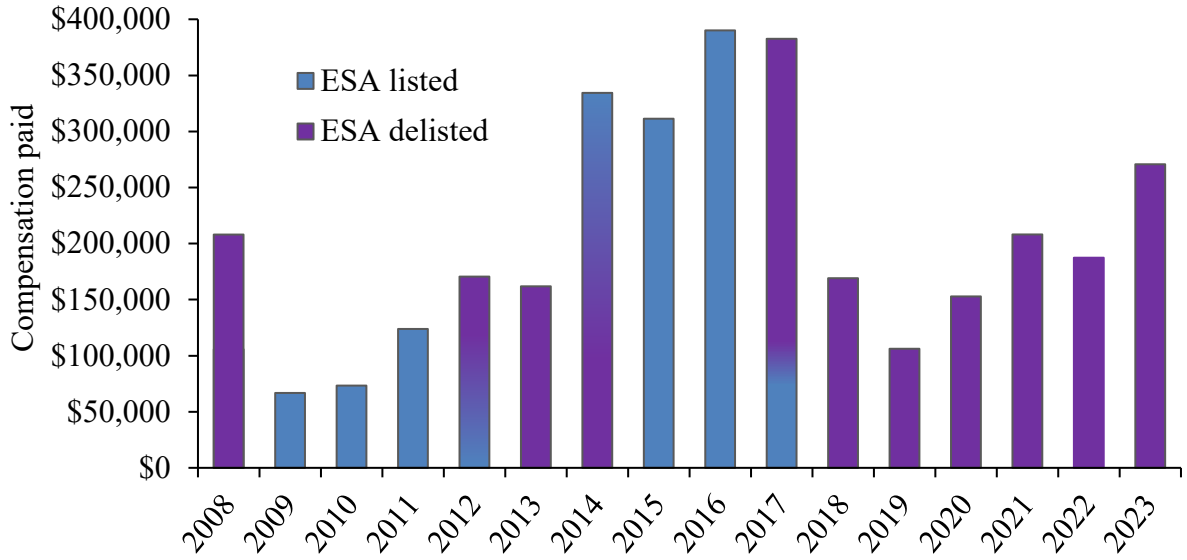

Figure 19. Compensation paid for confirmed livestock damage caused by wolves in the WTGMA (all years) and Seasonal WTGMA (2012-current year) by calendar year.

Unacceptable Impacts to Ungulates or Elk Feedgrounds

Under the Wyoming Gray Wolf Management Plan, Wyoming Statute 23-1-304(j), and Chapter 21 regulation, the Wyoming Game and Fish Department may lethally remove wolves when it is determined that "wolf predation is causing an unacceptable impact on a wild ungulate population or herd" or when a "wolf-wild ungulate conflict has occurred at any state operated elk feedground" (Wyoming Game and Fish Commission 2011). An "unacceptable impact on a wild ungulate population or herd" is defined in Chapter 21 as:

> "Unacceptable impact on a wild ungulate population or herd" means any decline in a wild ungulate population or herd that results in the population or herd not meeting the Commission population management goals, objectives or recruitment levels established for the population or herd. The Department shall determine whether a decline in a wild ungulate population or herd constitutes an "unacceptable impact" and whether wolf predation is a significant factor causing the "unacceptable impact" based upon the best scientific data and information available."

In addition, under Chapter 21, wolves may be lethally removed for conflicts caused at state-operated elk feedgrounds only "when a gray wolf or wolves displace elk from a feedground and it results in one of the following conflicts:"

1. Damage to private stored crops by displaced elk; or,
2. Elk co-mingling with domestic livestock; or,

3. Displacement of elk from a feedground onto a highway right of way causing human safety concerns.

The Wyoming Game and Fish Department did not conduct any lethal removal actions as a result of unacceptable impacts to ungulates or elk feedgrounds caused by wolves in 2023. Monitoring and analyses of potential impacts to ungulate populations remain an integral part of ongoing management of wolves and their prey in the WTGMA.

Predatory animal areas

Wolves were verified to have killed or injured 5 cattle (4 calves, 1 yearling), 3 sheep (1 lamb, 2 adults), and 4 goats in the year-round predatory animal area in 2023 (Table 1). There were no documented conflicts between wolves and livestock confirmed in the Seasonal WTGMA (Table 1). A total of 6 wolves were taken by USDA Wildlife Services to prevent conflicts with livestock in the year-round predatory animal area in 2023 (Table 1).

Wolf Management in the Wind River Reservation

In 2023, wolves were classified as a trophy game animal on the Wind River Reservation. Legal take could occur for wolves during regulated hunting seasons and for defense of life and property. Reported livestock conflicts with wolves on the Wind River Reservation are investigated by the U.S. Fish and Wildlife Service Lander Fish and Wildlife Conservation Office or the Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department.

Two wolf hunting seasons were implemented on the Wind River Reservation that were open during portions of 2023. One season was open from December 1, 2022 through February 28, 2023 and the second was open from December 1, 2023 through February 28, 2024. Season dates were chosen to correspond with the period of the year when wolf pelts are prime. A total quota of 6 wolves was split evenly between 2 hunt areas in the Owl Creek and Wind River Mountains during both seasons. Mandatory reporting was required within 48 hours to allow for seasons to be closed once the quota was met. In January 2023, a trapper legally harvested 1 wolf in the Wind River hunt area within the Blue Trail pack territory. (Table 3). One calf was confirmed to have been depredated by wolves on the Wind River Reservation in 2023.

Wolf Management in Yellowstone National Park

Wolf management in Yellowstone included temporary closures around the Junction Butte and Wapiti Lake den areas to protect young pups from disturbance and allow the adult wolves to travel near the den unimpeded. Once staff confirmed that the Junction Butte pack moved their last few pups to a secondary den area in early June, the closure around their natal den was lifted. Similarly, the Wapiti Lake pack moved their pups into the backcountry during the summer and the closure around their denning area was removed.

Habituated behavior by wolves is carefully monitored in Yellowstone and staff attempt to correct the behavior through aversive conditioning as soon as possible. Personnel recorded few cases of habituated behavior in 2023. Aversive conditioning is performed by trained staff during a teachable moment when the offending wolf moves in close proximity to humans or vehicles.

OUTREACH

WYO

Personnel with the Wyoming Game and Fish Department delivered in person and virtual presentations to multiple school and community groups in 2023. Personnel continued to provide interviews for numerous magazine, newspaper, and television feature stories for local and national media outlets. As part of normal wolf monitoring and management activities, Wyoming Game and Fish Department personnel interacted with members of the public thereby increasing the public's involvement and understanding of wolf biology, monitoring, and management throughout Wyoming. The Wyoming Game and Fish Department also conducted 10 public meetings during the wolf hunting season-setting process in May 2023 as well as providing information on wolf ecology and safety at multiple Living in Large Carnivore Country Workshops held throughout Wyoming.

EXPENDITURES

WYO

During the 2023 calendar year, the Wyoming Game and Fish Department conducted annual population monitoring, responsive conflict management, internal and external education and information, and other statutory and regulatory obligations in regards to damage compensation and law enforcement for wolves. The Department directed approximately $654,711 of wolf program funds toward wolf population monitoring and management in 2023. Program expenditures are reported by primary work activities conducted below, but do not represent the totality of Department expenses incurred:

- Monitoring and management program: $354,716
- Internal and external information and education: $29,285
- Compensation for verified wolf-livestock conflict: $270,710

Cooperating agencies in WYO also expended funds directed toward wolf monitoring and management in 2023 as follows:

- Grand Teton National Park: $121,000
- USDA Wildlife Services: approximately $11,805 (including funds expended for nonlethal projects and for Wyoming Animal Damage Management Board and Wyoming Department of Agriculture projects)
- Wyoming Department of Agriculture: $59,339

Wind River Reservation

A total of $5,000 was spent on wolf monitoring and management in the Wind River Reservation in 2023 ($3,000 by the U.S. Fish and Wildlife Service Lander Fish and Wildlife Conservation Office and $2,000 by the Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department).

Yellowstone National Park

About $1,078,000 was spent on monitoring and managing wolves in Yellowstone National Park in 2023; $328,000 from federal funding and $750,000 from private sources.

CONTRIBUTORS

Many personnel contributed to the content of the 2023 Wyoming Wolf Population Monitoring and Management Annual Report. Thanks go to all those who contributed.

Information presented in this report for the wolf population in WYO:

- Wyoming Game and Fish Department: Large Carnivore Section: Ken Mills and Clint Atkinson (corresponding authors), Mike Boyce, Justin Clapp, Josiah Crump, Brian DeBolt, Justin Dellinger, Luke Ellsbury, Kyle Garrett, Tommy Kelly, Ryan Kindermann, Phil Quick, Kesley Secrist, Scott Stingley, and Dan Thompson.
- Aerial tracking and data collection: Mark Packila.
- Fiscal information: Kindra Brown, Christina Malessa, and Chelsea Ramage.
- Wolf monitoring volunteer: Ron Blanchard.
- Grand Teton National Park: John Stephenson and Sarah Dewey.
- Wildlife Services: Mike Burrell, Mike Foster, Vivian Meek, and Brady Smith.
- Wyoming Game and Fish Wildlife Health Laboratory: Jessica Jennings-Gaines, Maggie Johnson, Katie Luukkonen, and Kara Robbins.
- Wyoming State Veterinary Laboratory: Joan Edwards.
- Wyoming Department of Agriculture: Jerald Johnson.

Information presented in this report for the wolf population on the Wind River Reservation:

- U.S. Fish and Wildlife Service Lander Fish and Wildlife Conservation Office: Pat Hnilicka.
- Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department: Art Lawson.

Information presented in this report for the wolf population in Yellowstone National Park:

- National Park Service: Kira Cassidy, Daniel Stahler, Erin Stahler, Matthew Metz, Jeremy SunderRaj, Taylor Rabe, Nikki Tatton, Mark Packila, Brenna Cassidy, Wes Binder, Claire Lacey, Cameron Ho, Dylan Sanborn, and Gordy Scott.

ACKNOWLEDGEMENTS

WYO

We appreciate exemplary piloting and aerial wolf monitoring from Mark Packila of Wildlife Air, without whom the Wyoming Game and Fish Department's wolf program would not be successful. We also thank Native Range Capture Services for their wolf capture expertise and willingness to go above and beyond to ensure the success of the wolf monitoring program. Ron

Blanchard has been a dedicated and valued volunteer with the wolf monitoring program for over 15 years and has provided invaluable assistance, support, insight, and data throughout that time. We thank numerous regional Wyoming Game and Fish Department biologists and wardens who were instrumental in collecting wolf monitoring data. We also thank staff at the Wyoming Game and Fish Department Wildlife Forensic Laboratory for their assistance with wolf genetic samples. We thank additional personnel at the following agencies for their assistance in wolf monitoring and management: U.S. Forest Service; National Elk Refuge; and Bureau of Land Management. We also thank members of the public and private landowners who assisted the Wyoming Game and Fish Department wolf monitoring and management program in Wyoming. We recognize a successful program needs a strong base of support and to all of the above we continue to be greatly indebted.

Wind River Reservation

We gratefully acknowledge the following for their assistance with wolf conservation: Justin Friday, Ervin Brown, Ben Snyder, Mirah Snyder, and Wilma Wagon (Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department), Mike Mazur and Scott Becker (U.S. Fish and Wildlife Service).

Yellowstone National Park

We thank the many people who come forward every year to study and support wildlife research in Yellowstone National Park. First and foremost, we thank the Wolf and Cougar Project volunteers, without whom we would not be able to complete and continue this research. We thank Yellowstone Forever for their continued dedication and 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. 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, Troy Wozydziak of Baker Aviation, and Stephan Robinson and Grayson Sperry of Ridgeline Aviation. We would not be able to learn and teach about wolves, cougars, and other wildlife without all of these aforementioned people and their exceptional skills.

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