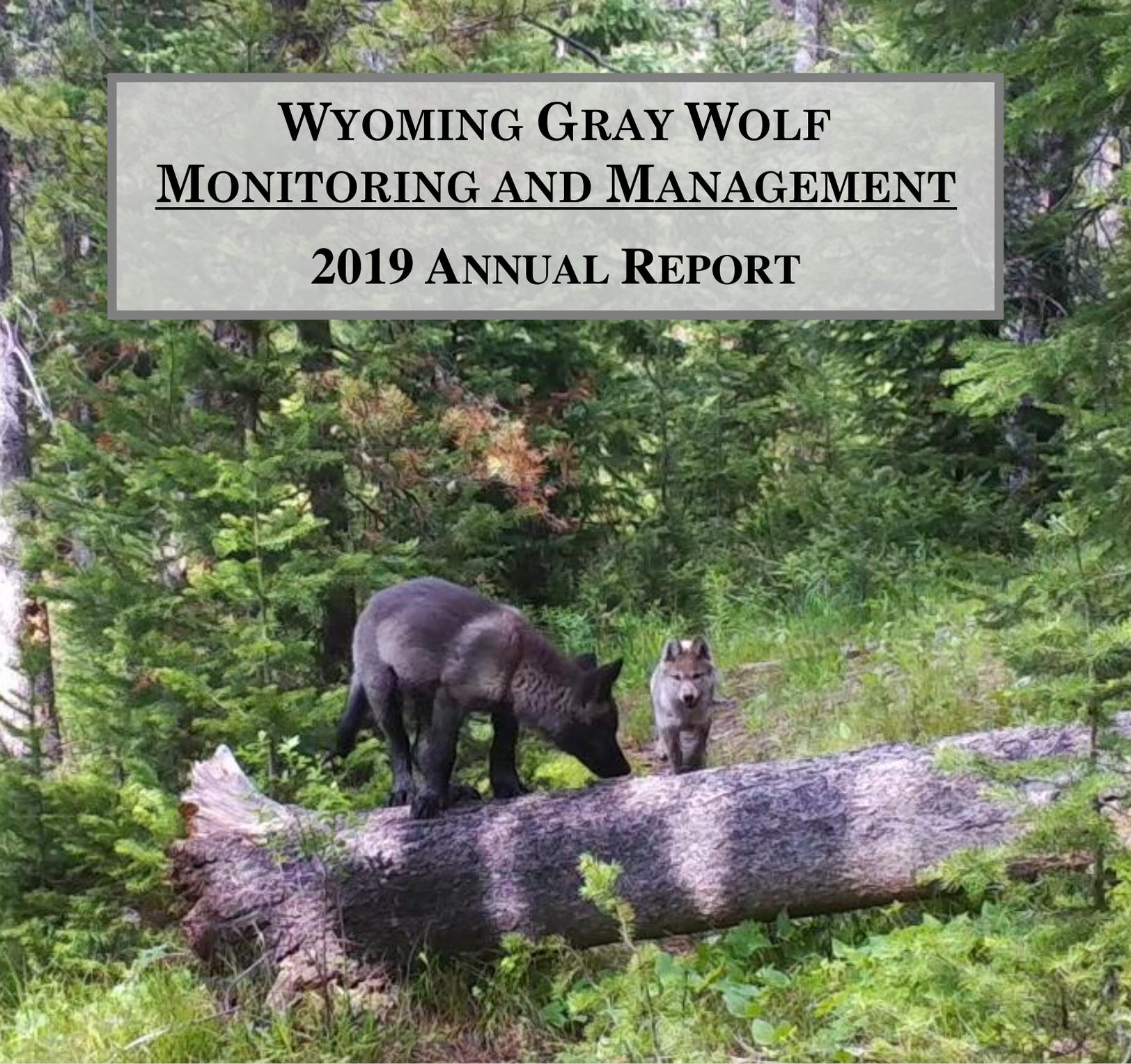


WYOMING GRAY WOLF MONITORING AND MANAGEMENT

2019 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 fulfill the U.S. Fish and Wildlife Service requirement to report the status, distribution and management of the gray wolf population in Wyoming from January 1, 2019 through December 31, 2019.



EXECUTIVE SUMMARY

At the end of 2019, the wolf population in Wyoming remained above minimum delisting criteria; making 2019 the 18th consecutive year Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by the U.S. Fish and Wildlife Service. At least 311 wolves in ≥ 43 packs (including ≥ 22 breeding pairs) inhabited Wyoming on December 31, 2019. Of the total, there were ≥ 94 wolves and ≥ 8 packs (≥ 7 breeding pairs) in Yellowstone National Park, ≥ 16 wolves and ≥ 3 packs (1 breeding pair) in the Wind River Reservation, and ≥ 201 wolves and ≥ 32 packs (≥ 14 breeding pairs) in Wyoming outside Yellowstone National Park and the Wind River Reservation (WYO). In WYO, ≥ 175 wolves in ≥ 27 packs resided primarily in the Wolf Trophy Game Management Area where wolves are actively monitored and managed by the Wyoming Game and Fish Department and ≥ 26 wolves in ≥ 5 packs in areas where wolves are designated primarily as predatory animals and are not actively monitored. A total of 96 wolf mortalities were documented statewide in Wyoming in 2019: 92 in WYO, 3 in Yellowstone National Park, and 1 in the Wind River Reservation. Causes of mortality included: human-caused = 88 (92% of mortalities); natural = 7 (7%); and unknown = 1 (1%). Eighty-four wolves were captured and telemetry collared for monitoring and research in 2019.

In 2019, 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 Wolf Trophy Game Management Area. A mortality limit of 34 wolves was divided between 14 hunt areas in WYO. Wolf hunting seasons were open from September 1, 2019 through December 31, 2019 with the exception of hunt area 12 (opened on October 15, 2019) and hunt area 13 (ended March 31, 2020). The season for each hunt area closed when the mortality limit was met or at the season end date, whichever occurred first. A total of 26 wolves (25 legal and 1 illegal) were killed during the wolf hunting season in WYO. Wolves could also be taken in any legal manner in WYO where they are designated as predatory animals. Twenty-three wolves were taken by the public under predatory animal status in 2019.

Wolves were confirmed to have killed 70 head of livestock (42 cattle, 27 sheep and 1 donkey) and 1 dog statewide in Wyoming in 2019. An additional 11 cattle (9 calves and 2 cows/yearlings) and 1 donkey were confirmed as injured by wolves. Nineteen packs were involved in ≥ 1 livestock conflict statewide in Wyoming and 1 dog was killed by wolves in Yellowstone National Park. Thirty wolves were lethally removed by agencies or the public following livestock conflict in an effort to reduce livestock losses to wolves.

A total of $\geq \$1,918,753$ was spent on wolf monitoring and management activities in Wyoming in 2019 for ALL jurisdictions combined as follows: Wyoming Game and Fish Department = \$1,021,920 (~\$543,676 directly toward wolf management, including \$106,183 for livestock damage compensation); USDA Wildlife Services = \$2,226; Wyoming Animal Damage Management Board = \$67,308; Grand Teton National Park = \$121,000; Wind River Reservation = \$6,300; and Yellowstone National Park = \$700,000.

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Available for download at:

https://wgfd.wyo.gov/WGFD/media/content/PDF/Wildlife/Large%20Carnivore/WYWOLF_ANNUALREPORT_2019.pdf

See the full video of the front cover of this report at:

<https://wgfd.wyo.gov/Wildlife-in-Wyoming/Wildlive> OR <https://youtu.be/O8AGXe4UQIY>

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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 reached the required delisting 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/mountain-prairie/es/grayWolf.php>

<https://wgfd.wyo.gov/Wildlife-in-Wyoming/Large-Carnivore/Wolves-in-Wyoming>

Wolves were delisted 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 the 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 boundaries of the Wind River Reservation. The Wind River Reservation Wolf Management Plan designates wolves as a trophy game animal. For more information, see the Wind River Reservation Wolf Management Plan at:

https://www.fws.gov/mountain-prairie/es/species/mammals/wolf/Wind_River_Res_Wolf_Plan_20070413.pdf

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

Wolves in Wyoming outside Yellowstone National Park and the Wind River Reservation within the Wolf Trophy Game Management Area (WYO; see #1 below) are monitored and managed by the Wyoming Game and Fish Department. The Wyoming Game and Fish Department wolf management approach is to maintain a recovered wolf population in Wyoming while balancing the need to minimize wolf conflicts with livestock and 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). Wyoming'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 law, wolves in WYO 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). There are 3 wolf management "zones" in WYO, 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. 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 of 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 WTGMA or Seasonal WTGMA boundary.

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

<https://wgfd.wyo.gov/Wildlife-in-Wyoming/Large-Carnivore/Wolves-in-Wyoming>

Wolf Population Delisting Criteria and Post-Delisting Monitoring

The U.S. Fish and Wildlife Service set specific recovery goals 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 delisting criteria post-delisting to ensure the population remains recovered. The U.S. Fish and Wildlife Service developed minimum delisting criteria of ≥ 300 wolves and ≥ 30 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) 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 delisting criteria that required the states to maintain a 50% safeguard above minimum delisting criteria (i.e., ≥ 450 wolves and ≥ 45 breeding pairs in the northern Rocky Mountains) to ensure the population never fell below minimum delisting 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 is required 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. The primary goal of post-delisting monitoring is 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. This annual report is a product of cooperation between all agencies in Wyoming with wolf monitoring and management responsibility and provides the U.S. Fish and Wildlife Service with the required information for their post-delisting monitoring evaluation for the 2019 calendar year.

Reporting Wolf Population Data by Jurisdiction

Generally, states are solely responsible for monitoring and managing delisted species. In Wyoming, however, multiple areas contain significant portions of the wolf population and/or suitable wolf habitat where the state does not have management authority, primarily within Yellowstone National Park and the Wind River Reservation. 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). The U.S. Fish and Wildlife Service and state of Wyoming agreed on a framework that would assign proportions of the minimum delisting criteria to the 3 primary jurisdictions as follows:

1. The state of Wyoming is responsible for maintaining ≥ 100 wolves and ≥ 10 breeding pairs in WYO. While the state does not have management authority over wolves in all areas in WYO such as Grand Teton National Park and the National Elk Refuge, these areas are small and the wolf packs using these areas are not solely contained within their boundaries. Therefore, wolves in Grand Teton National Park and the National Elk Refuge are assigned to WYO.
2. Yellowstone National Park, in combination with the Wind River Reservation, is expected to contribute the remaining ≥ 50 wolves and ≥ 5 breeding pairs necessary to meet the ≥ 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 3 primary jurisdictions (i.e., WYO, Yellowstone National Park, and the Wind River Reservation) to allow for proper evaluation of the wolf population both statewide and by individual jurisdiction.

WYOMING GRAY WOLF MONITORING AND MANAGEMENT **2019 ANNUAL REPORT**

WOLF POPULATION MONITORING

SUMMARY OF WOLF POPULATION MONITORING STATEWIDE

At the end of 2019, the wolf population in Wyoming remained above minimum delisting criteria; making 2019 the 18th consecutive year Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by the U.S. Fish and Wildlife Service. At least 311 wolves in ≥ 43 packs (including ≥ 22 breeding pairs) inhabited Wyoming on December 31, 2019. Of the total, there were ≥ 94 wolves and ≥ 8 packs (≥ 7 breeding pairs) in Yellowstone National Park, ≥ 16 wolves and ≥ 3 packs (1 breeding pair) in the Wind River Reservation, and ≥ 201 wolves and ≥ 32 packs (≥ 14 breeding pairs) in Wyoming outside Yellowstone National Park and the Wind River Reservation (WYO). In WYO, ≥ 175 wolves in ≥ 27 packs resided primarily in the Wolf Trophy Game Management Area where wolves are actively monitored and managed by the Wyoming Game and Fish Department and ≥ 26 wolves in ≥ 5 packs in areas where wolves are designated primarily as predatory animals and are not actively monitored. A total of 96 wolf mortalities were documented statewide in Wyoming in 2019: 92 in WYO, 3 in Yellowstone National Park, and 1 in the Wind River Reservation. Causes of mortality included: human-caused = 88 (92% of mortalities); natural = 7 (7%); and unknown = 1 (1%). Eighty-four wolves were captured and telemetry collared for monitoring and research in 2019.

Wolf Population Monitoring in WYO

Population and Breeding Pair Status

The minimum number of WYO in Wyoming on December 31, 2019 was determined using standard wolf monitoring methods used since reintroduction. The number of wolves in individual packs was estimated at the end of the year by counting wolves during aerial telemetry flights and capture operations, observations by, or confirmed by, qualified agency personnel, or pictures of known packs taken with remote cameras. Only pack observations obtained by agency personnel from December 2019 through March 2020 were included to ensure they were reflective of the minimum number of wolves present on December 31, 2019. Miscellaneous wolves were included in the estimate only if the animal was not a member of a known pack. In WYO, wolf monitoring is most intensive in the Wolf Trophy Game Management Area (WTGMA) with less intensive monitoring in the Seasonal WTGMA and predatory animal areas (Figure 1). Packs with territories overlapping jurisdictional boundaries (e.g., state, national park, tribal boundaries, etc.) were assigned to the jurisdiction which held the majority of their documented locations during 2019. The final minimum population count was the sum of all pack counts and miscellaneous wolves known to be present on December 31, 2019.

Breeding pair status 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. The presence of pups with packs was confirmed using observations made during aerial and ground monitoring efforts,

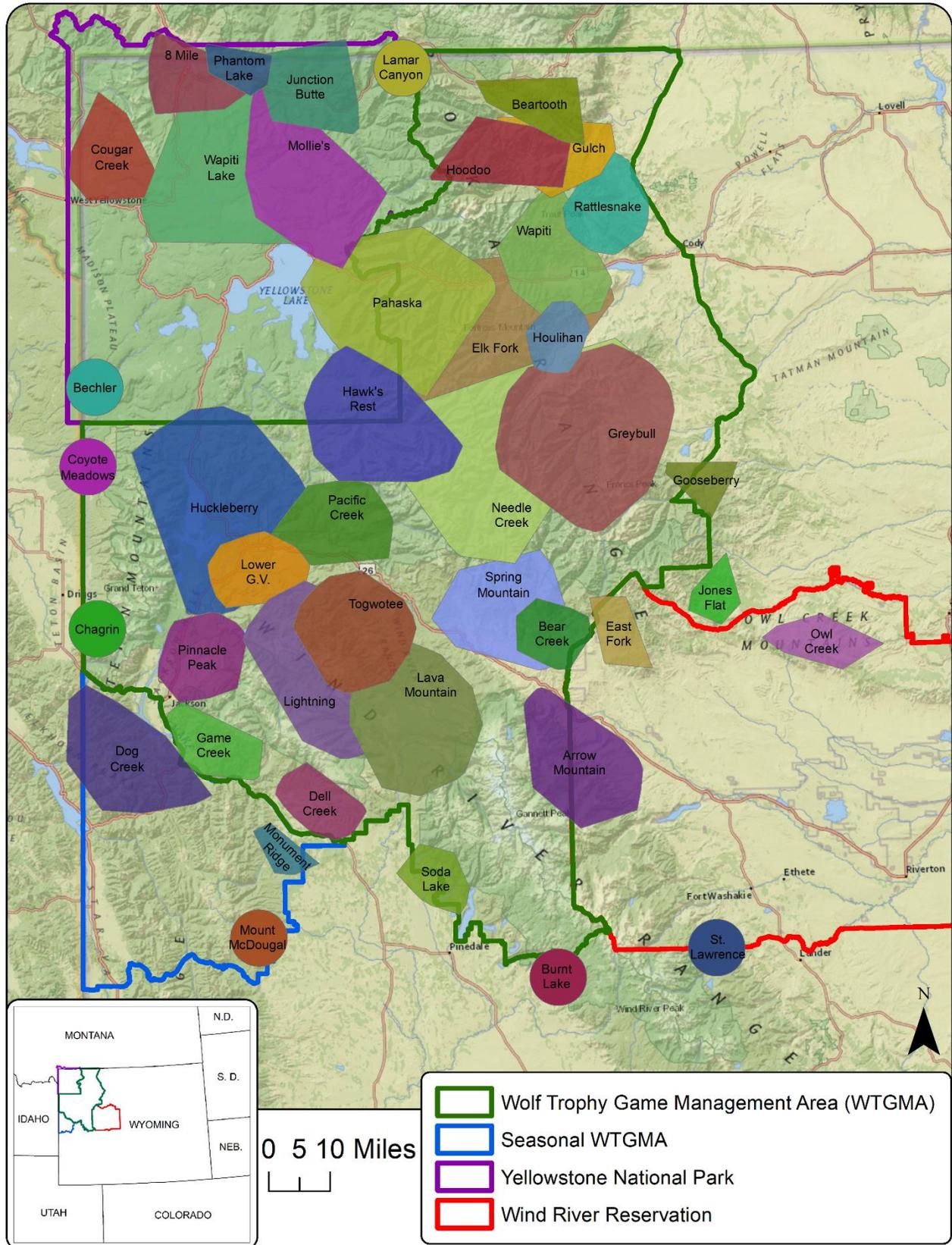


Figure 1. Home ranges of confirmed wolf packs in Wyoming on December 31, 2019.

Table 1. Wolf packs, wolf mortality, and livestock killed by wolf packs in WYO and statewide in 2019.

WOLF PACK ^{1,2}	MINIMUM PACK SIZE	DOCUMENTED MORTALITIES						KNOWN		CONFIRMED LOSSES ⁹			
		NATURAL	HUMAN ³	UNKN ⁴	HUNTING ⁵	PRED.	ANIMAL ⁶	CONTROL ⁷	DISPERSED	MISSING ⁸	CATTLE	SHEEP	DOGS
Absaroka		1			2			1			3		
<u>Bear Creek</u>	9				1								
Beartooth	2						2				6		
Burnt Lake	3						3	4			1		
<u>Carter Mountain</u>								2			1		
Chagrin [^]	2				1								
<u>Coyote Meadows[^]</u>	7							2			5		
<u>Dell Creek</u>	8		1								3		
<u>Dog Creek[^]</u>	7						1						
<u>East Fork[^]</u>	2							1					
Elk Fork Creek	4	1			1								
<u>Game Creek</u>	7	1	1		2								
<u>Gooseberry</u>	6						1	2	1				
Greybull River	3				1				1		2		
Gulch	4							3			3		
Hawk's Rest [^]	2												
<u>Hoodoo[^]</u>	11				1			1	1		2		
Houlihan	5				1				2		1		
<u>Huckleberry</u>	17		3						2				
Jones Flat	2						2						
<u>Lava Mountain</u>	9				1					1	1		
Lightning	2	1							1		2		
<u>Lower Gros Ventre</u>	12		1		1								
Monument Ridge	3		1							1	1		
Mount McDougal	2				1		3						
Needle Creek	3	1								1			
<u>Pacific Creek</u>	9				2								
<u>Pahaska[^]</u>	14				3				2				
<u>Pinnacle Peak</u>	10				2			1			1		1
<u>Prospect</u>								2					
<u>Rattlesnake</u>	8				1			1			1		
<u>Rim</u>							2						
Snake River													
Soda Lake	2			1				5	1		5		
Spring Mountain	3												
Togwotee	4				1								
<u>Wapiti</u>	5				2				1				
<u>Warm Springs</u>											2		
Wood River		1							1				
Misc wolves (WTGMA)	9				1					1	2		
Misc wolves (Other)	5						11	5			27		
WYO Total	201	6	7	1	25	23	30	15	4	42	27	0	1
Yellowstone N.P. Total	94	0	3	0	0	0	0	13	0	0	0	1	0
Wind River Res. Total	16	1	0	0	0	0	0	1	0	1	0	0	0
WYOMING TOTAL	311	7	10	1	25	23	30	29	4	43	27	1	1

1 Underlined packs are counted as breeding pairs toward recovery goals.

2 Strikethrough packs were not documented during 2019 and/or did not exist on Dec. 31, 2019 and are not displayed in Figure 1.

3 Excludes wolves killed in control actions and legal harvest.

4 Number of wolves that died of unknown causes.

5 Number of wolves legally taken in trophy game hunts. Includes 1 wolf from the Mollie's pack assigned to Yellowstone National Park.

6 Number of wolves taken by the public as predatory animals. Includes 1 from the Owl Creek and 2 from the St. Lawrence packs assigned to the Wind River Reservation.

7 Number of wolves killed in lethal control actions. Includes 2 wolves from the Owl Creek and 1 wolf from the St. Lawrence packs assigned to the Wind River Reservation.

8 Collared wolves that became missing.

9 Number of livestock and domestic animals confirmed killed by wolves in WYO. Does not include 11 cattle and 1 donkey injured by wolves.

[^] Border pack shared with Idaho, Yellowstone National Park or the Wind River Reservation; assigned to WYO.

investigations of potential den and rendezvous sites, howling surveys, reports confirmed by qualified agency personnel, pictures taken with remote cameras, evaluations of changes in pack size, 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 Wind River Reservation and Yellowstone National Park minimum wolf population and breeding pair estimates were counted using analogous methods. 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, 2019, ≥ 201 wolves in ≥ 32 packs, including ≥ 14 breeding pairs, were documented in WYO; ≥ 175 wolves in ≥ 27 packs resided primarily in the WTGMA and ≥ 26 wolves in ≥ 5 packs resided in areas where wolves are designated primarily as predatory animals (Figures 1 and 2; Table 1). Pack size ranged from 2 to 17 and averaged 5.8 wolves per pack (Figure 3). Fourteen packs qualified as breeding pairs on December 31, 2019; 13 were located in the WTMGA and 1 was located in WYO outside the WTGMA (Figures 1 and 4; Table 1).

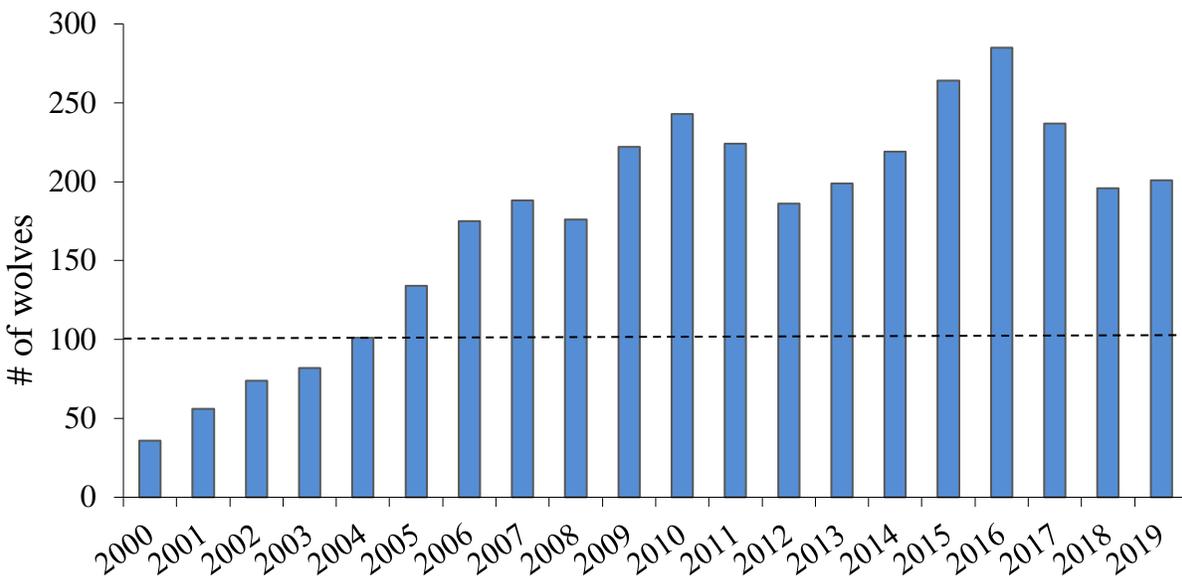


Figure 2. Minimum number of wolves in WYO from 2000-2019. (The dashed line indicates the ≥ 100 wolf minimum Endangered Species Act delisting criterion)

Population Trend

The WYO end of year wolf population increased slightly from ≥ 196 wolves at the end of 2018 to ≥ 201 wolves at the end of 2019 and remained above the minimum delisting criterion of at least 100 wolves (Figure 2). Breeding pairs increased from ≥ 13 in 2018 to ≥ 14 in 2019 and remained above the minimum delisting criterion of at least 10 breeding pairs (Figure 4). Eight packs identified as breeding pairs in 2018 also qualified as breeding pairs at the end of 2019 (Coyote Meadows, Hoodoo, Huckleberry, Lava Mountain, Lower Gros Ventre, Pacific Creek, Pahaska, Pinnacle Peak; Table 1). Six packs not identified as breeding pairs in 2018 qualified as breeding pairs in 2019 (Bear Creek, Dell Creek, Game Creek, Gooseberry, Rattlesnake, Wapiti; Table 1).

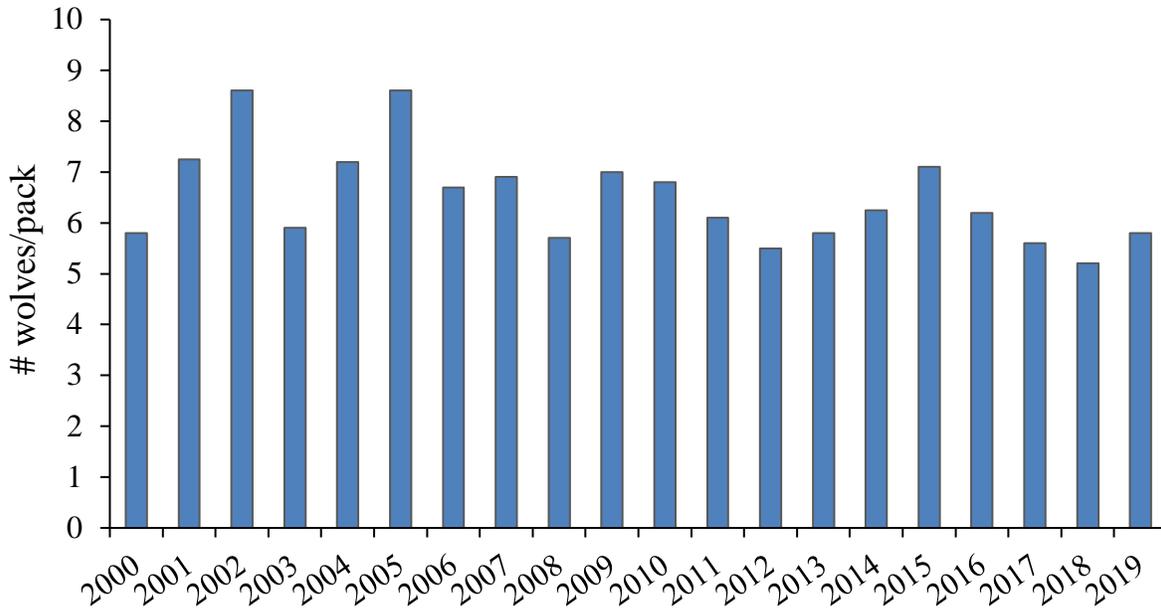


Figure 3. Average wolf pack size at the end of the calendar year in WYO from 2000-2019.

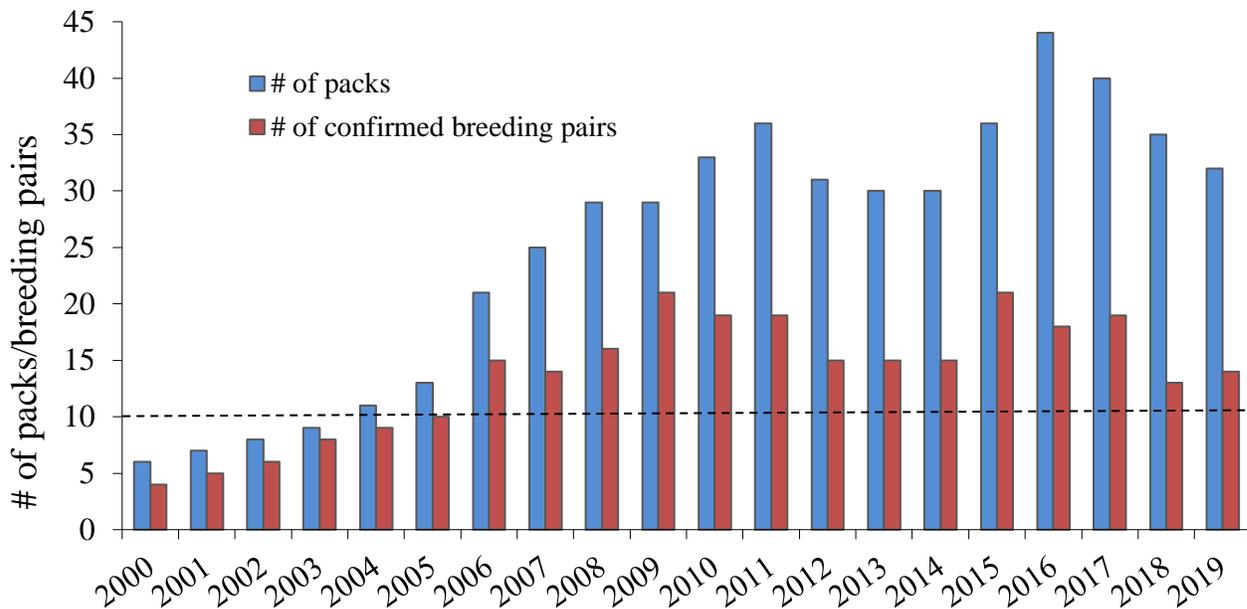


Figure 4. Minimum number of wolf packs and confirmed breeding pairs in WYO from 2000-2019. (The dashed line indicates the ≥ 10 breeding pair minimum delisting criterion)

The number of wolf packs in WYO was reduced from ≥ 35 packs at the end of 2018 to ≥ 32 packs at the end of 2019 (Figure 4). Two new packs established in 2019 (Bear Creek and Hawk’s Rest); the Warm Springs pack may have shifted to occupy the new Bear Creek territory because the Bear Creek pack was discovered just after all documentation of the Warm Springs pack ceased (Figure1; Table 1). Seven packs documented at the end of 2018 did not exist on December 31, 2019 (Table 1). Multiple pairs and trios formed in 2019 and early 2020 that are not included as packs because they had not established a stable territory. There was little

evidence suggesting the presence of wolf packs in the WTGMA that were not documented in the minimum end of 2019 wolf population estimate. The vast majority of wolf observations recorded in WYO could be attributed to documented packs included in this report. Average pack size at the end of 2019 (5.8 wolves per pack) was slightly higher than in 2018, primarily as a result of increased reproduction and larger litter sizes as predicted by the data (Figures 3 and 5).

The Wyoming Game and Fish Department most closely monitors and manages the wolf population in the WTGMA because this is the area the state determined would be relied upon to host the necessary wolves and breeding pairs to meet recovery criteria (Wyoming Game and Fish Commission 2012). The slight increase in population parameters in the WTGMA was the result of a density-dependent increase in reproduction and lower human-caused mortality than predicted. Density-dependent mechanisms are factors that increase mortality and/or reduce recruitment of young when wildlife populations are at high density, causing a resultant limitation or reduction of population growth. Lower population density was a factor in lower wolf mortality measured in 2019 compared to 2018 (Figure 6). Similarly, we predicted 23% of wolves present at the beginning of the year would die from human causes other than hunting, when the actual mortality rate was much lower (12%; see Table 2). Lower wolf density in 2019 also correlated with increased minimum litter size (5.3 pups per pack in 2019 vs. 4.1 in 2018) and a higher proportion of packs qualifying as breeding pairs at the end of the year (48% in 2019 vs. 39% in 2018; Figure 5). Disease prevalence and impacts are also generally reduced at low population density and, unlike in 2018, evidence of disease was limited and appeared to factor little in WTGMA wolf population dynamics in 2019 (see “*Disease monitoring*” below). These relationships have been relatively predictable in the WTGMA wolf population through time, and will continue to guide management decisions in the future.

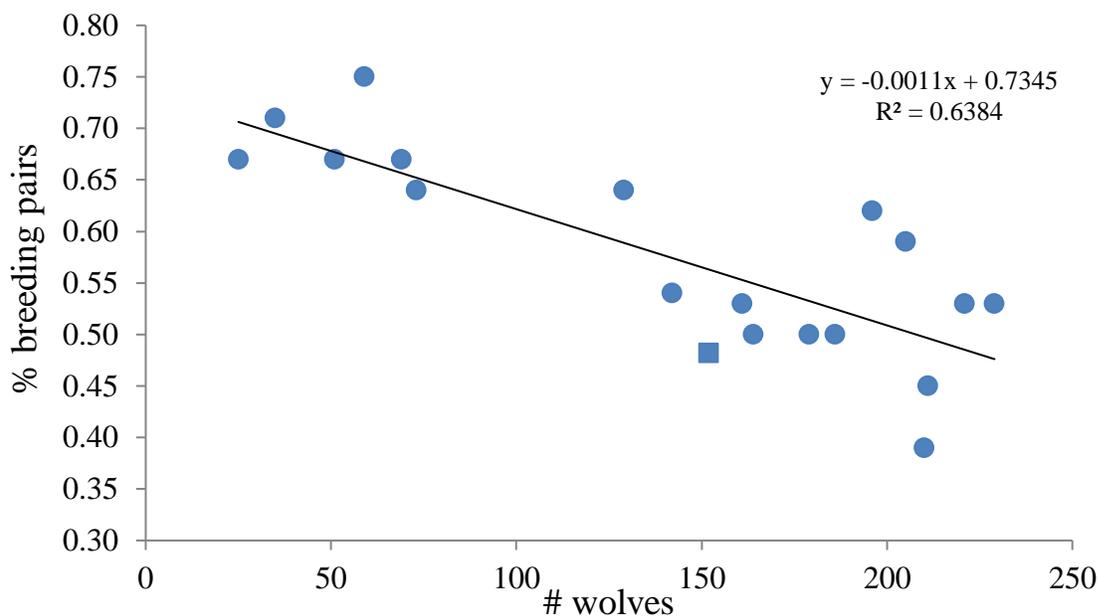


Figure 5. Minimum number of wolves present in the WTGMA compared to the proportion (%) of packs that qualified as a breeding pair in the WTGMA at the end of the calendar year from 2000-2019. (Excludes a statistical outlier in 2009; “■” indicates the data point for 2019)

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 Wyoming. VHF collars were used for general monitoring purposes and GPS collars provided more fine scale data for specific monitoring or research projects. Wolves were captured using ground or aerial capture techniques. Collars were affixed to captured wolves and 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, to mitigate livestock conflicts, and to aid in law enforcement investigations.

Sixty wolves from 28 packs were collared in 2019 in WYO (aerial = 58; ground = 2), including 6 recaptures. At the end of 2019, there were 59 wolves in 25 packs and 2 single wolves that were being monitored with telemetry collars (61 wolves total; 30% of the year-end population in WYO). Twenty-eight collared wolves died in 2019 (30% of wolf mortalities). Winter wolf capture efforts continued through March 2020 in conjunction with year-end population surveys, at which point a total of 79 wolves in 27 packs and 4 single wolves were being monitored via telemetry collars (83 wolves total; approximately 41% of the WYO population in March 2020). The proportion of collared individuals is generally highest at the end of winter following aerial capture efforts and decreases throughout the remainder of the year as pups are born and collared wolves die, disperse, or when collars fail.

Mortality

Wolf mortality was monitored in WYO using multiple methods. The primary method used to identify wolf mortalities not associated with hunting was through the tracking of telemetry collared wolves. The information provided by tracking collars 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 and predatory animal areas was monitored via mandatory reporting and registration by successful hunters as required in 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 harvested wolves, update mortality limits in the WTGMA/Seasonal WTGMA, and close wolf hunting seasons when 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 2019, 92 wolves were known to have died in WYO; 48 in the WTGMA, 6 in the Seasonal WTGMA, and 38 in areas where wolves are designated as predatory animals year-round (Figure 6; Tables 1 and 2). Causes of mortality included: conflict control = 30; predatory animal take by the public = 23; hunting = 25; natural = 6; other human causes = 7; and unknown causes = 1 (Figure 6; Tables 1 and 2). The 7 wolf deaths from other human causes included 3 illegal kills (2 in WTGMA, 1 in predatory animal area), 3 vehicle collisions in Grand Teton National Park, and

1 from other causes. One wolf (counted in the “other human causes” in Table 2) was illegally killed in addition to 25 legal kills during the open wolf hunting season in the WTGMA and Seasonal WTGMA, yielding a total of 26 wolves counted toward the hunting season mortality limit.

The number of wolves that died in 2019 was roughly half the number of wolves that died in 2018 (Figure 6). Wolf hunting in the WTGMA yielded fewer mortalities compared to 2017 and 2018, as did take of wolves designated as predatory animals by the public (Figure 6). Natural mortality included 3 wolves killed by other wolves, 1 wolf killed and consumed by a mountain lion, and 1 from unidentified natural causes. The number of wolves that died from natural causes in 2019 was lower than in 2018 but remained slightly higher than previous years (usually <5%; Table 2).

Table 2. Summary of wolf mortality in WYO in 2019 by cause of death and wolf management area. (Number of wolves known to be alive in 2019 was calculated as 201 alive at end of 2019 + 92 total mortalities in 2019 = 293 total wolves)

Cause of death	Total	% of mortality	% of wolves alive in 2019	WTGMA	Seasonal WTGMA	PRED
Hunting	25	27.2	8.5	25	0	0
Predatory Animal Take	23	25.0	7.8	0	4	19
Control	30	32.6	10.2	13	0	17
Other human causes	7	7.6	2.4	5	1	0
Natural	6	6.5	2.0	5	1	1
Unknown	1	1.1	0.3	0	0	1
Total Mortality	92	100.0	31.4	48	6	38

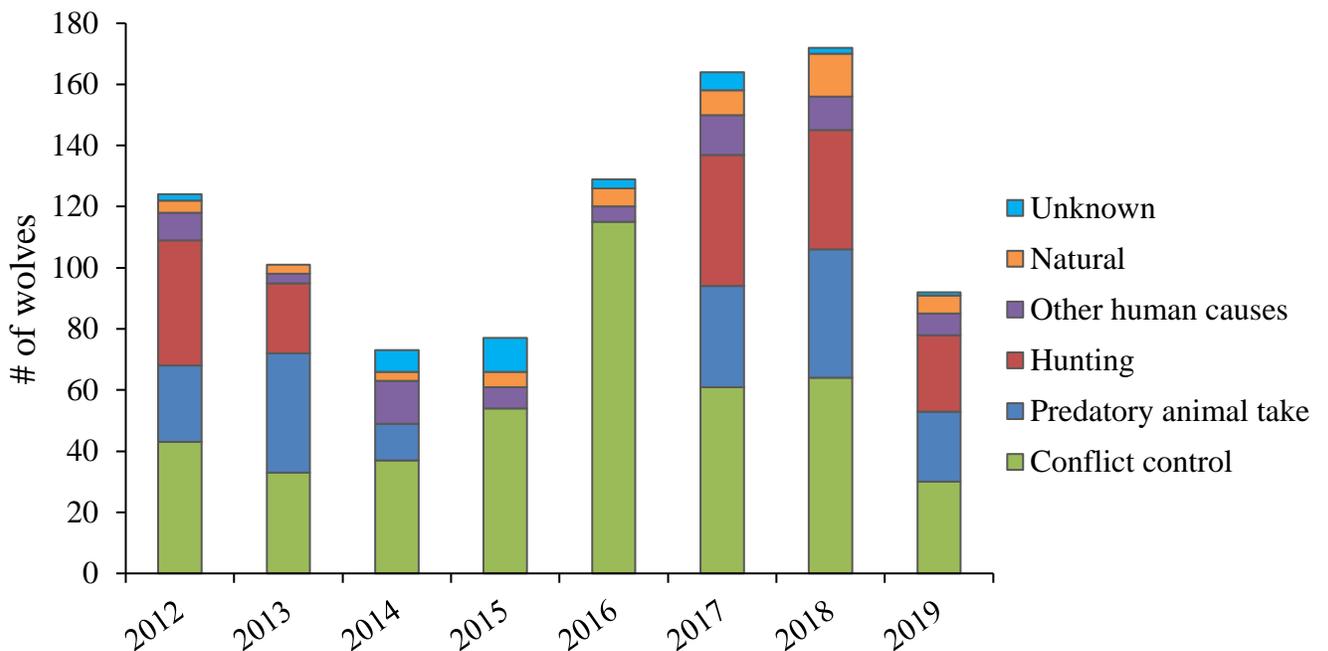


Figure 6. Number of confirmed wolf mortalities by cause of death in WYO from 2012-2019. (Wolves were listed under the Endangered Species Act in portions of 2014-2017)

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 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 on wolf population dynamics outside Yellowstone National Park (Jimenez et al. 2010, Almberg et al. 2012). Human-caused mortality in the wolf population in WYO appears to have held the population below the threshold where disease outbreak would be more likely, however, the WYO 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 4). This increase in population density in WYO was correlated with an increase in detection of mange and distemper in the WYO wolf population through 2018. Documentation of disease in the WYO wolf population was markedly reduced during 2019, most likely because wolf density was reduced in late 2018 and 2019 (Figure 2). The Wyoming Game and Fish Department will continue to monitor the disease in the WYO wolf population and whether reduced population densities correlate with reduced disease.

Mange: Mange is a highly contagious skin disease caused by mites and is commonly found in wolf populations throughout the world. Mange was first detected in WYO in 2002 (Jimenez et al. 2010). As expected, documentation of mange was lower in WYO in 2019 than 2018. No mortalities were detected from suspected mange in 2019. One wolf captured in winter 2019/20 from the Game Creek pack showed signs of slight mange infection. The Game Creek pack used the same territory and homesites used formerly by the Horse Creek pack, which was effectively removed by mange infection in 2018. Another solitary wolf with signs of mange was also observed during capture operations in Sunlight Basin. The Wyoming Game and Fish Department will continue to monitor mange in WYO wolves and how it correlates with reduced wolf density.

Distemper: Distemper is a viral disease that infects 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 pups. 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 7) and was correlated with increasing wolf population density in WYO (Figures 2 and 7). The proportion of wolves that tested positive during winter capture in 2019 decreased compared to 2018, and was correlated with a reduction in wolf population density from the start of 2018 through the start of 2019 (Figures 2 and 7). There were no documented mortalities caused by distemper during 2019.

Canine Parvovirus: Canine parvovirus is a disease that caused significant population level impacts for wolf populations throughout North America primarily in the 1980’s (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 if the need arises in the future.

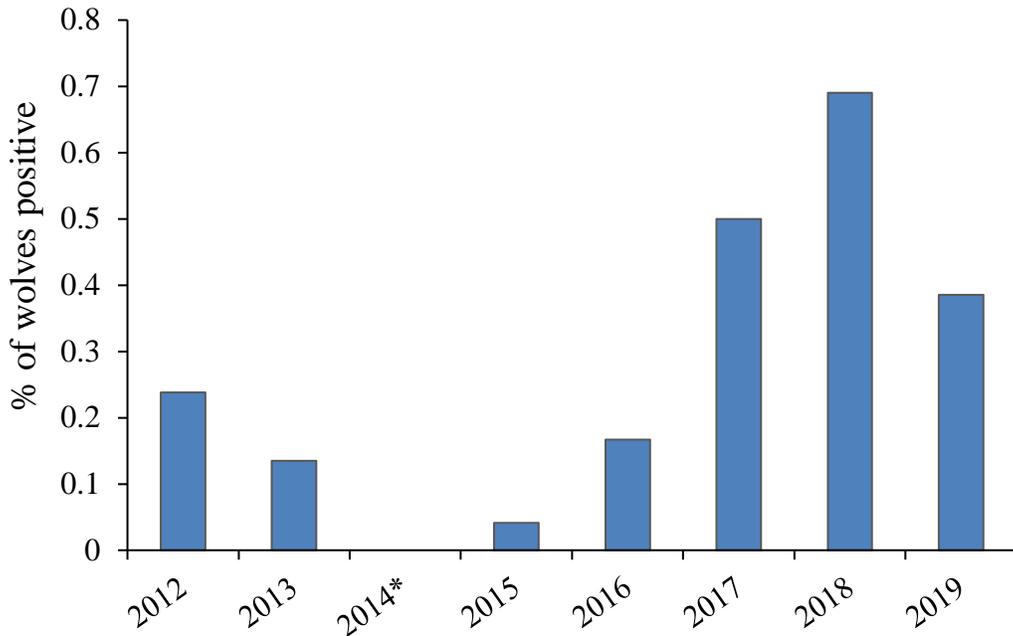


Figure 7. Proportion of wolves captured in winter (November through March) that tested positive for canine distemper virus in WYO. (*Too few wolves were captured following Endangered Species Act relisting of the wolf population in winter 2014/2015 to allow for an adequate sample)

Genetic Monitoring

The U.S. Fish and Wildlife Service determined that, in addition to minimum population criteria, genetic interchange must also occur between the 3 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 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). Genetic samples will continue to be collected from wolves in WYO to ensure enough genetic information is available to determine whether genetic interchange is occurring in the northern Rocky Mountains.

In 2019, genetic samples were collected from 120 wolves that will be used in analysis of genetic interchange. Genetic samples were collected from 60 wolves that died and 60 wolves captured for monitoring purposes. As required by Chapter 47, 25 samples were submitted from wolves taken during authorized hunting seasons and samples were voluntarily submitted by members of the public for 17 of 23 (74%) wolves taken as predatory animals.

Wolf Population Monitoring on the Wind River Reservation

Population and Breeding Pair Status

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 8). The wolf subpopulation in the Wind River Reservation slowly increased through 2013 and has since fluctuated between 10 and 20 wolves (Figure 8). As of December 31, 2019, ≥ 16 wolves in ≥ 3 packs, including ≥ 1 breeding pair, were documented on the Wind River Reservation (Figures 1 and 8; Table 3). The Arrow Mountain pack, formerly assigned to WYO, was assigned to the Wind River Reservation because they spent $>60\%$ of their time on the Reservation during calendar year 2019.

Capture and Telemetry Collaring

No wolves were captured in the Wind River Reservation in 2019.

Mortality

One wolf from the Arrow Mountain pack was killed by a mountain lion within the Wind River Reservation in 2019 (Table 3).

Wolf Population Monitoring in Yellowstone National Park

Population and Breeding Pair Status

There were ≥ 94 wolves in ≥ 8 packs, including ≥ 7 breeding pairs, living primarily in Yellowstone National Park at the end of 2019 (Figure 8, Table 3). Overall, wolf numbers have been relatively stable from 2009 to 2019 (80-108 wolves; Figure 8). After dropping to 80 in 2018, numbers rebounded this year with high adult survival and several packs producing multiple litters. Seven breeding pairs was the same as the average over the last decade. Pack size in 2019 ranged from 4 to 19, averaging 11.5 in size. Park-wide, 61 pups were produced and 42 survived (69%) to year end, with more in northern Yellowstone (27) than the interior (15) of the park. At the end of 2019, pups comprised 45% of the park population, higher than the average percentage (32%) over the last 10 years.

Capture and Telemetry collaring

Twenty-four wolves from 6 packs were captured and collared in 2019. Six of these replaced old or malfunctioned transmitters. A number of measurements and biological samples were also taken while the wolf was sedated. Twelve females and 12 males were captured. A female from the Cougar Creek pack was collared and her genetic markers indicate she is actually 953F from Cougar Creek, whose collar was chewed off in 2017.

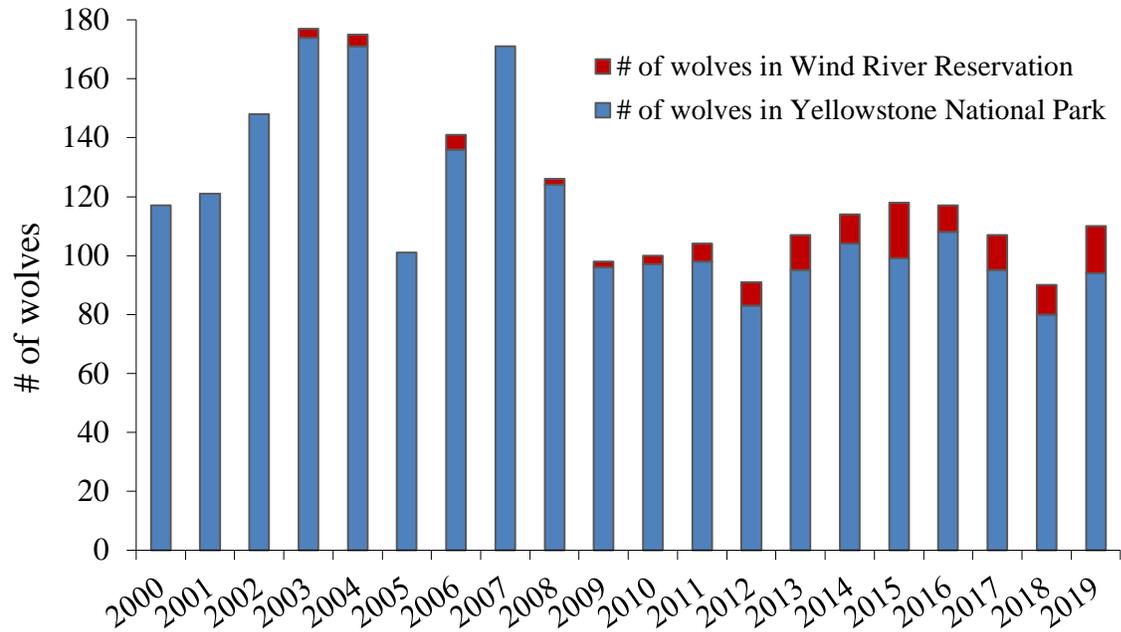


Figure 8. Minimum number of wolves in Yellowstone National Park and the Wind River Reservation from 2000-2019.

Table 3. Wolf packs, minimum pack size, mortality, and livestock killed by wolf packs present in Yellowstone National Park and the Wind River Reservation in 2019.

WOLF PACK ^{1,2}	MINIMUM PACK SIZE	DOCUMENTED MORTALITY ³					KNOWN		CONFIRMED LOSSES ⁶			
		NATURAL	HUMAN ⁴	UNKN	HUNTING	CONTROL	DISPERSED	MISSING ⁵	CATTLE	SHEEP	DOGS	OTHER
Yellowstone National Park Northern Range												
<u>8 Mile</u> [^]	17						1					
<u>Phantom Lake</u>	11											
<u>Crevice Lake</u>	0						2					
<u>Junction Butte</u>	18		2									
<u>Lamar Canyon</u>	7										1	
Misc wolves	2		1									
Yellowstone National Park Non-Northern Range												
<u>Bechler</u> [%]	4											
<u>Cougar Creek</u>	6						4					
<u>Mollie's</u> [*]	10											
<u>Wapiti Lake</u>	19						6					
Misc wolves												
Yellowstone National Park Total⁷	94	0	3	0	0	0	13	0	0	0	1	0
Wind River Reservation												
<u>Arrow Mountain</u> [*]	10		1				1					
<u>Owl Creek</u> [*]	4										1	
<u>St. Lawrence</u> [*]	2											
Misc/Lone wolves												
Wind River Reservation Total⁸	16	1	0	0	0	0	1	0	1	0	0	0
Total in Yellowstone N.P. and Wind River Res.	110	1	3	0	0	0	14	0	1	0	1	0

1 Underlined packs qualified as breeding pairs on December 31, 2019 and count toward recovery goals.
2 Strikethrough packs were not documented during 2019 and/or did not exist on Dec. 31, 2019 and are not displayed in Figure 1.
3 Excludes wolves assigned to Yellowstone National Park that were killed outside Yellowstone National Park.
4 Excludes wolves killed in control actions and legal harvest.
5 Collared wolves that became missing in 2019.
6 Includes only livestock and domestic animals confirmed killed by wolves.
7 Mortality in and confirmed livestock killed by wolf packs assigned to Yellowstone National Park that occurred in WYO are reported in Table 1.
8 Mortality in and confirmed livestock killed by wolf packs assigned to the Wind River Reservation that occurred 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 the Wind River Reservation. Mortality and depredation that occur in these packs but outside the Wind River Reservation are reported in Table 1.

Mortality

Only 3 wolves were known to have died in Yellowstone National Park in 2019 (Table 3). Wolf 1118F was injured by a hunter in 2018 but survived until September 2019 when her GPS collar sent a mortality signal. Yellowstone personnel will attempt to recover the collar in summer 2020. In addition, 2 pups from Junction Butte were hit and killed by a vehicle in late November. Three wolves were killed in state hunting seasons outside Yellowstone National Park, including 2 Phantom Lake pups in Montana and 1 Mollie's wolf in Wyoming. For the second year in a row Yellowstone personnel recorded no intraspecific-caused mortality, which is usually the leading cause of natural mortality in the park. However, deaths of uncollared wolves from natural causes are rarely found and recorded.

Disease Monitoring

There was no evidence of any major disease mortality in 2019. The wolf density on the northern range in Yellowstone is the highest it has been in over 10 years (approximately 50-70 wolves/1000 km², depending on movements of the Wapiti Lake and Mollie's packs), which may facilitate disease transmission over the next year.

WOLF MANAGEMENT

SUMMARY OF WOLF MANAGEMENT STATEWIDE

In 2019, 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 34 wolves was divided between 14 hunt areas in WYO. Wolf hunting seasons were open from September 1, 2019 through December 31, 2019 with the exception of hunt area 12 (opened on October 15, 2019) and hunt area 13 (ended March 31, 2020). A total of 26 wolves (25 legal and 1 illegal) were killed during the wolf hunting season. Wolves could also be taken in any legal manner in Wyoming where they are designated as predatory animals. Twenty-three wolves were taken by the public under predatory animal status in 2019.

Wolves were confirmed to have killed 70 head of livestock (42 cattle, 27 sheep and 1 donkey) and 1 dog statewide in Wyoming in 2019. An additional 11 cattle (9 calves and 2 cows/yearlings) and 1 donkey were confirmed as injured by wolves. Nineteen packs were involved in ≥ 1 livestock conflict statewide in Wyoming and 1 dog was killed by wolves in Yellowstone National Park. Thirty wolves were lethally removed by agencies or the public following livestock conflict in an effort to reduce livestock losses to wolves.

Wolf Management in WYO

Hunting

Wolf Hunting Season Background: Chapter 47 governs wolf hunting in WYO 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 2019 were approved by the Wyoming Game and Fish Commission and outlined specific hunt areas, mortality limits, season dates, and other wolf hunting regulations in WYO.

The Wyoming Game and Fish Department delineated 14 wolf hunt areas in the WTGMA and Seasonal WTGMA for 2019 (Figure 9). The Wyoming Game and Fish Department combined the mortality limit for hunt areas 6 and 7 to allow for greater flexibility for the public. The mortality limits for hunt areas 8, 9 and 11 were also combined because the packs present in these hunt areas regularly cross hunt area boundaries in the broader Gros Ventre River drainage, thus a combined mortality limit provided a more comprehensive approach to wolf management in these areas (Figure 9; Table 4). As outlined in the Wyoming Gray Wolf Management Plan, approved wolf hunting seasons were in conjunction with big game hunting seasons in autumn and ran primarily from September 1st to December 31st (Table 4). The season in hunt area 13 was extended to end March 31st to allow great opportunity to harvest wolves in areas used by the wintering Whiskey Mountain bighorn sheep herd. 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, 2019. Wolf hunting mortality was regulated by mortality limits established for each hunt area using a general license hunting structure. Hunters could purchase up to 2 wolf hunting licenses for the 2019 season. Legal and illegal wolf mortality that occurred during the open hunting season counted toward these mortality limits. The season for each hunt area closed when the mortality limit was met or at the season end date, whichever occurred first.

Total wolf mortality limits were set to stabilize the WTGMA wolf population at approximately 160 wolves. 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 slightly increased in the WTGMA from ≥ 152 wolves at the beginning of 2019 to approximately 160 wolves at the end of 2019 if 44% of the wolves present at the beginning of 2019 died from all human-caused mortality. The average non-hunting human-caused mortality rate since 2009 (23%) was then subtracted from 44% to obtain a 21% wolf hunting mortality rate, which equaled a total mortality limit of 32 wolves when applied to the minimum wolf population estimate of ≥ 152 wolves present in the WTGMA at the beginning of 2019 (i.e., the end of 2018 minimum wolf population). The total mortality limit of 32 wolves was sub-divided among 13 hunt areas in the WTGMA. An additional 2 wolves were included in the total mortality limit to be applied to hunt area 12, the Seasonal WTGMA (Table 4).

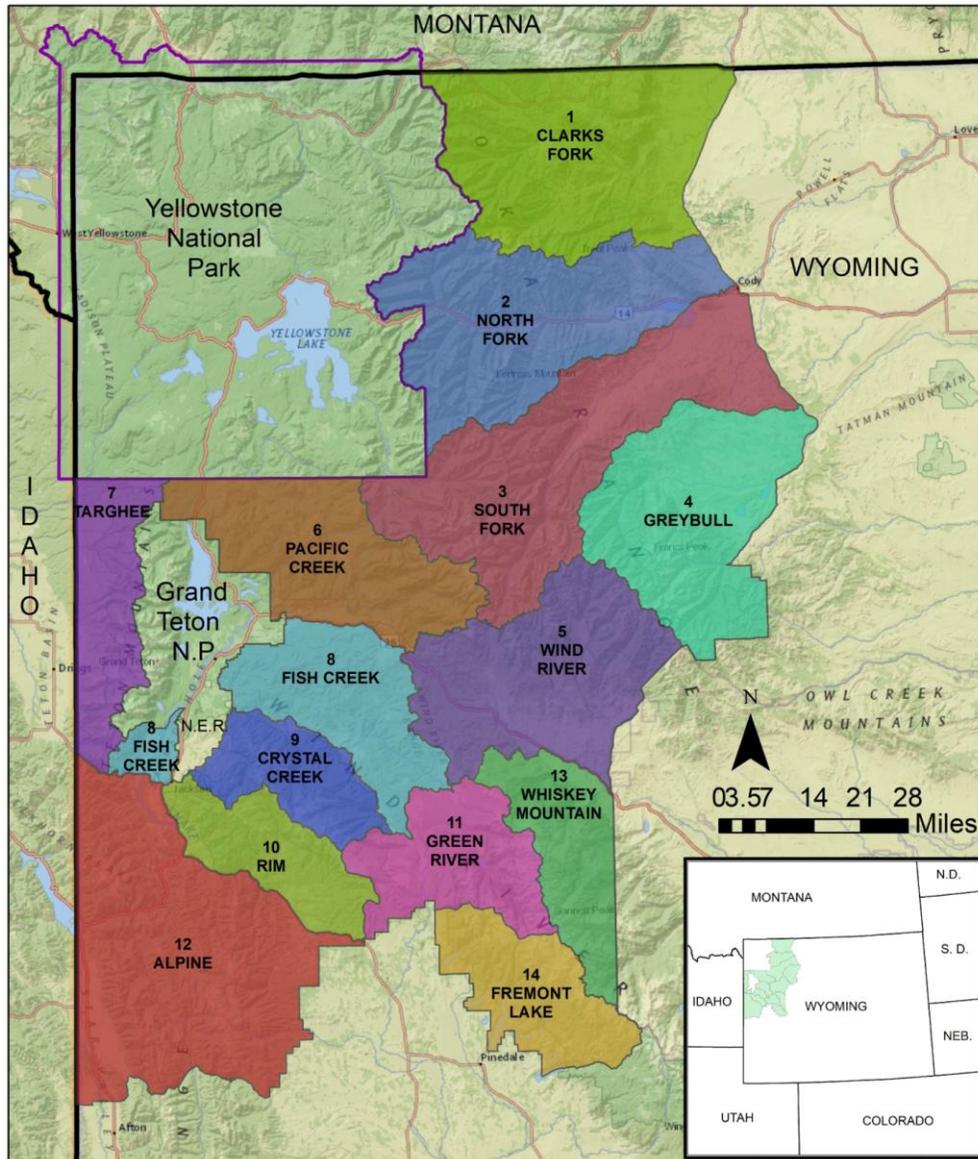


Figure 9. Wolf hunt areas for the 2019 wolf hunting season in northwest Wyoming.

Wolf Hunting in the Trophy Game Areas: A total of 1,885 wolf hunting licenses were sold to 1,778 individuals (1,625 residents and 153 nonresidents) for the 2019 wolf hunting season, which was lower than the number of licenses sold in previous years (>2,500 licenses annually). One hundred seven individuals purchased 2 wolf hunting licenses. A total of 26 wolves out of the 34 wolf mortality limit were taken during open wolf hunting seasons in the 14 hunt areas; 25 were legally taken and 1 was illegally killed during the hunting season and was applied to the mortality limit (Table 4). Six of the 14 hunt areas closed prior to the established December 31, 2019 closing date (Table 4). Two individuals each killed 2 wolves during the hunting season. Five of the 25 legally hunted wolves (20% of wolves legally taken) wore a functioning telemetry collar, which was less than the proportion of collared wolves in the WTGMA at the beginning of the hunting season (approximately 28% collared) suggesting that there was not hunter selection for collared wolves. All hunters who legally killed a wolf complied with reporting and registration requirements.

Table 4. Summary of wolf hunting seasons and wolves taken during hunting seasons and as predatory animals in WYO in 2019.

WGFD WOLF HUNTER HARVEST SUMMARY 2019				1/2/2020	8:00 AM	
HUNT AREA	QUOTA FROM REGULATIONS	SEASON DATES	HARVEST COUNTED TOWARDS QUOTA ¹	AREA STATUS	DATE/TIME AREA CLOSED	
		GENERAL				
1	4	Sep. 1 - Dec. 31	4	CLOSED	9/11/2019 22:10	
2	6		6	CLOSED	11/6/2019 17:00	
3	2		2	CLOSED	9/24/2019 17:25	
4	2		1	CLOSED	12/31/2019 Per Regulation	
5	1		1	CLOSED	10/3/2019 10:30	
6, 7	3		3	CLOSED	10/20/2019 12:00	
8, 9, 11	7		6	CLOSED	12/31/2019 Per Regulation	
10	2		2	CLOSED	9/29/2019 21:00	
12	2		Oct. 15 - Dec. 31	1	CLOSED	12/31/2019 Per Regulation
13	4		Sep.1 - Mar. 31	0	OPEN	
14	1	Sep. 1 - Dec. 31	0	CLOSED	12/31/2019 Per Regulation	
Total 2019 Trophy Quota	34	Total 2019 Trophy Harvest	26			
STATE WIDE PREDATORY	No Quota	Total 2019 Predatory Animal Take²	23			

¹ All legal harvest or illegal human-caused gray wolf deaths that occur during an open hunting season will apply to the quota.

² Total harvest for Gray Wolves designated as predatory animals.

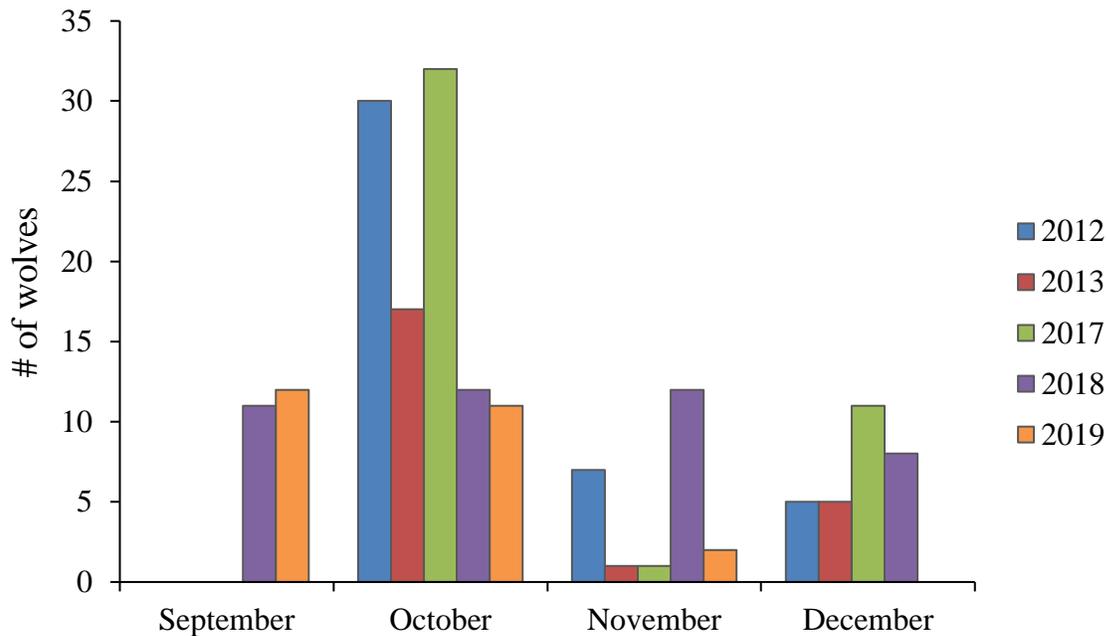


Figure 10. Number of wolves taken during wolf hunting seasons by month and year in the WTGMA and Seasonal WTGMA in northwest Wyoming.

Hunting mortality was recorded in 18 of 29 packs (62%) that regularly use the 14 hunt areas (Table 1). Of the 18 packs that had ≥ 1 wolf taken in the hunt, 12 packs had 1 wolf taken (67%), 5 packs had 2 wolves taken (28%), and 1 pack had ≥ 3 wolves taken (6%). Hunting mortality primarily occurred in September and October with little mortality in November and no mortality in December (Figure 10). Females and males were taken in similar proportion (13 females: 11 males: 1 wolf was hermaphroditic). Slightly more gray than black colored wolves (14 gray:11 black) and a similar proportion of age cohorts were taken in the hunt. For all wolf hunting seasons combined, more juveniles and fewer adults have been taken in earlier months and the ratio shifts toward adults toward the end of the hunting season in December (Figure 11).

Development of 2020 Wolf Hunting Seasons in the WTGMA: The 2019 end of year wolf population in the WTGMA was slightly higher than the end of year population objective set during the wolf hunting season setting process (+9%; 175 wolves vs. the 160 wolf population objective). The WTGMA wolf population was slightly less resilient to human-caused mortality than predicted (i.e., the 2019 data point is below the average line in Figure 12). However, human-caused mortality unrelated to hunting was well below the long-term average, which allowed the WTGMA wolf population to increase (Figure 13). The Wyoming Game and Fish Department will continue to take an adaptive management approach for setting 2020 wolf hunting seasons as outlined in the Wyoming Gray Wolf Management Plan (Wyoming Game and Fish Commission 2011).

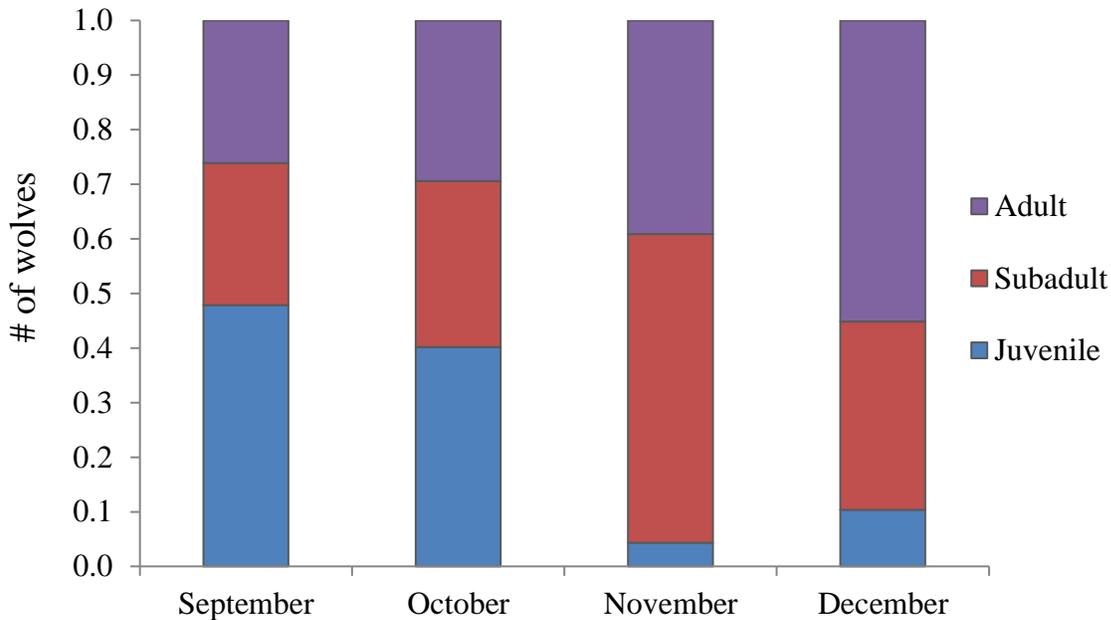


Figure 11. Proportion of adult (≥ 3 years old), subadult (1-2 years old), and juvenile (< 1 year old) wolves taken during wolf hunting seasons by month in the WTGMA and Seasonal WTGMA in northwest Wyoming during all wolf hunting seasons; 2012, 2013, 2017-2019. (September seasons were only open in 2018-2019)

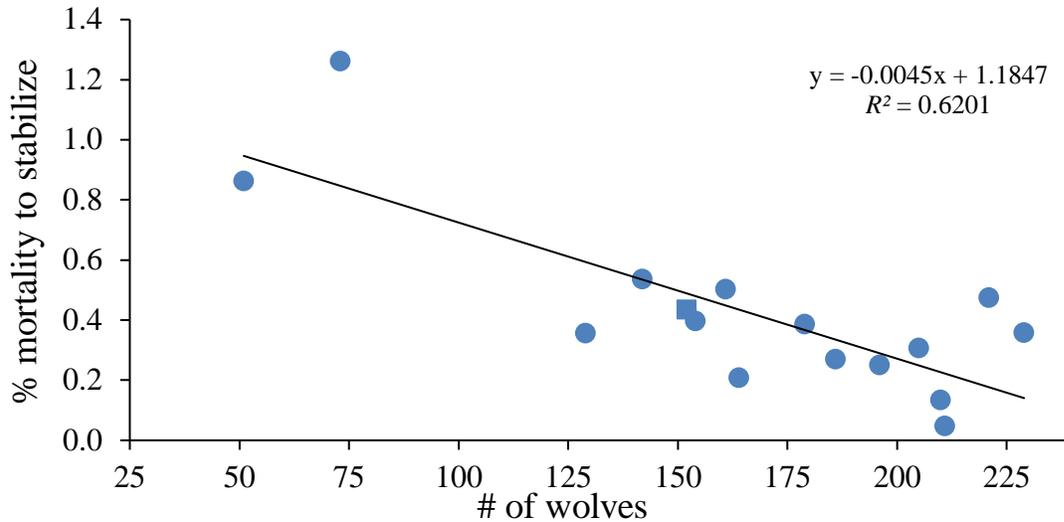


Figure 12. Minimum number of wolves in the WTGMA compared to the percent human-caused mortality required to stabilize wolf population growth in the WTGMA from 2004-2019. (The “■” indicates the 2019 data point)

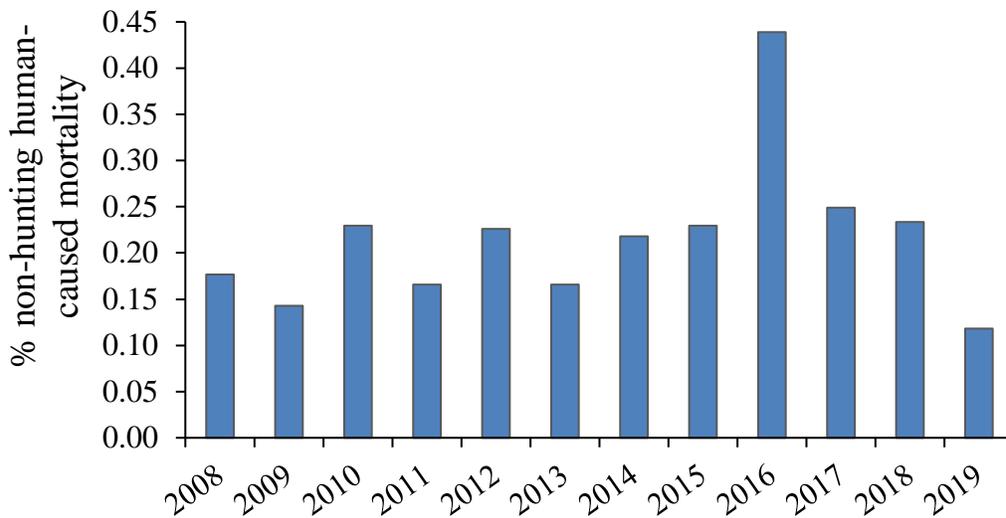


Figure 13. Proportion of wolves present in the WTGMA at the beginning of the calendar year that were killed by non-hunting human-causes during the calendar year.

Wolf Hunting in the Predatory Animal Areas: A total of 23 wolves were taken under predatory animal designation in 2019 (Figure 6; Tables 1, 2, and 4). All wolves except 1 killed under predatory animal designation complied with reporting requirements. The wolf not reported was killed and not recovered from the field. Wolves killed as predatory animals were taken using firearms (21 wolves; 91%) and traps (2 wolves; 9%). More male than female wolves (9 females:14 males) were taken as predatory animals and more black colored wolves were taken than gray (9 gray:13 black:1 unreported). Most wolves taken as predatory animals were adults and subadults (15 adults:6 subadults:1 pup:1 unreported), which is expected because the majority of wolves present in largely unsuitable habitat outside the WTGMA/Seasonal WTGMA are mostly single adult and subadult wolves that are dispersing or members of small, newly established packs.

Livestock Conflicts

During 2019, reported livestock that were killed or injured by wolves (“conflicts”) in the WTGMA and Seasonal WTGMA were investigated by the Wyoming Game and Fish Department or USDA Wildlife Services. Wildlife Services conducted investigations for reported livestock conflicts in the year-round predatory animal area. 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 reported conflicts are investigated in the WTGMA and Seasonal WTGMA and provide annual comparisons for the number of confirmed livestock killed or injured by wolves occurring in these areas. All suspected conflict between livestock and wolves that is discovered in the WTGMA and Seasonal WTGMA is expected to be reported because verification is required to qualify for damage compensation and/or for wolf management actions to be initiated. Confirmed livestock conflicts with wolves where they are designated as predatory animals year-round as presented in this report should be considered a minimum.

In 2019, wolves in WYO were responsible for killing 70 head of livestock (Figure 14; Tables 1 and 5). Livestock confirmed to have been killed by wolves included 42 cattle (23 calves and 19 cows/yearlings), 27 sheep/lambs, and 1 donkey (Figure 14; Tables 1 and 5). An additional 11 cattle (9 calves, 2 cows/yearlings) and 1 donkey were confirmed to have been injured by wolves but survived. The total number of livestock killed by wolves in 2019 was similar to 2018. However, the number of cattle killed by wolves was noticeably lower in 2019 and the number of sheep killed was nearly twice as many than in 2018 (Figure 14; Table 5). Management actions included trapping and collaring wolves, intensive monitoring, lethal removal, non-lethal depredation prevention measures, and issuance of 20 lethal take permits to livestock producers (18 initial permits, 2 of which were renewed due to continued livestock conflict). Thirty wolves were killed in response to livestock conflict; 24 in agency-directed lethal control actions and 6 under authority of lethal take permits (Figure 6 and 14; Tables 1, 2 and 5). No wolves were killed in defense of private property as provided in state statute and regulation. Thirteen of the 30 wolves killed were located in the WTGMA and the remaining 17 were in the year-round predatory animal area (Table 2). Non-lethal control, in the form of lighting, scare devices, and electrified fladry, was implemented on several private ranches to prevent conflicts.

Table 5. Confirmed livestock killed by wolves and wolves killed in conflict control actions in WYO from 2007-2019.

Livestock	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Cattle	55	41	20	26	35	44	40	56	72	154	110	54	42
Sheep	16	26	195	33	30	112	33	6	62	88	81	15	27
Dogs	2	0	7	0	1	3	1	0	0	0	1	0	0
Goats	0	0	0	0	0	0	1	0	0	0	0	0	0
Horses/Donkey	1	0	0	1	1	1	0	0	0	1	0	1	1
Livestock killed	74	67	222	60	67	160	75	62	134	243	191	70	70
Wolves killed	63	46	31	40	36	43	33	37	54	113	61	64	30

Number of Packs Involved in Confirmed Livestock Conflicts: Eighteen packs (46% of 39 packs that existed in 2019) in WYO were involved in ≥ 1 livestock conflict in 2019 (Figure 15; Table 1). Of the 18 packs involved in ≥ 1 livestock conflict, 14 packs (78% of conflict packs; 36% of packs in WYO) were involved in ≥ 2 conflicts; and 10 packs (56% of conflict packs; 26% of packs in WYO) were involved in ≥ 3 conflicts. Of the 18 packs that were involved in confirmed cattle conflicts, the Beartooth, Coyote Meadows, and Soda Lake packs were responsible for 38% of those conflicts (Table 1). Wolves not belonging to an identified pack were responsible for 96% of sheep conflicts (26 sheep) in the predatory animal area (Table 1).

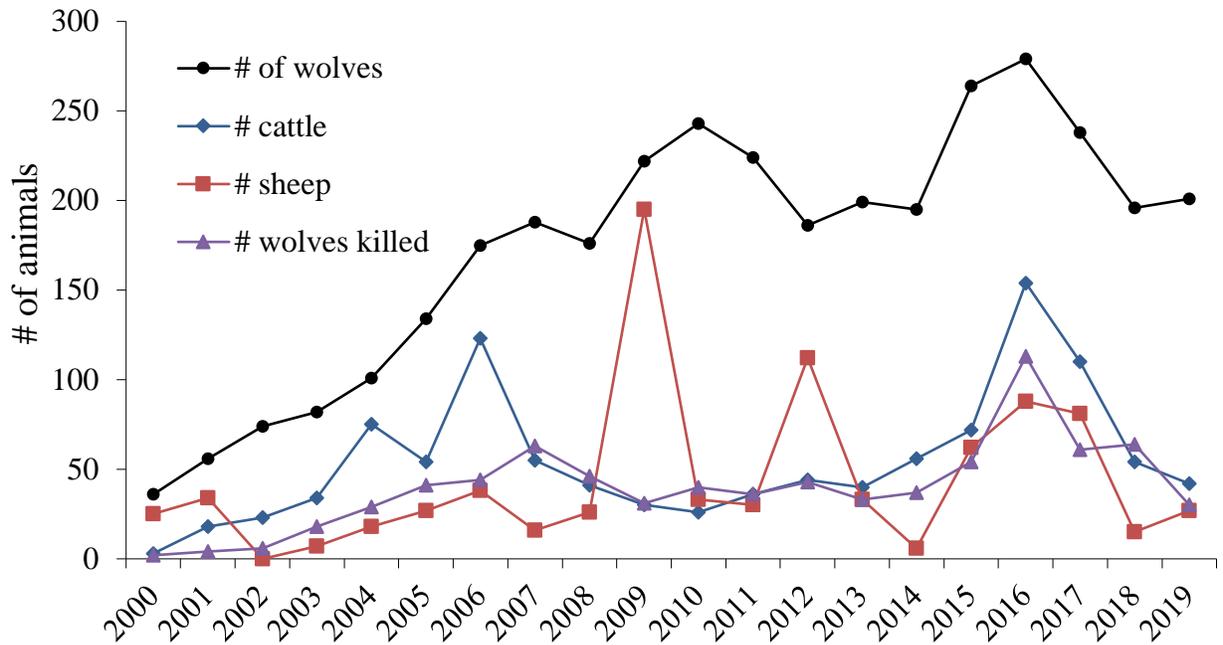


Figure 14. Minimum number of wolves, cattle and sheep killed by wolves, and wolves killed in conflict control actions in WYO from 2000-2019. (Injured livestock are not included)

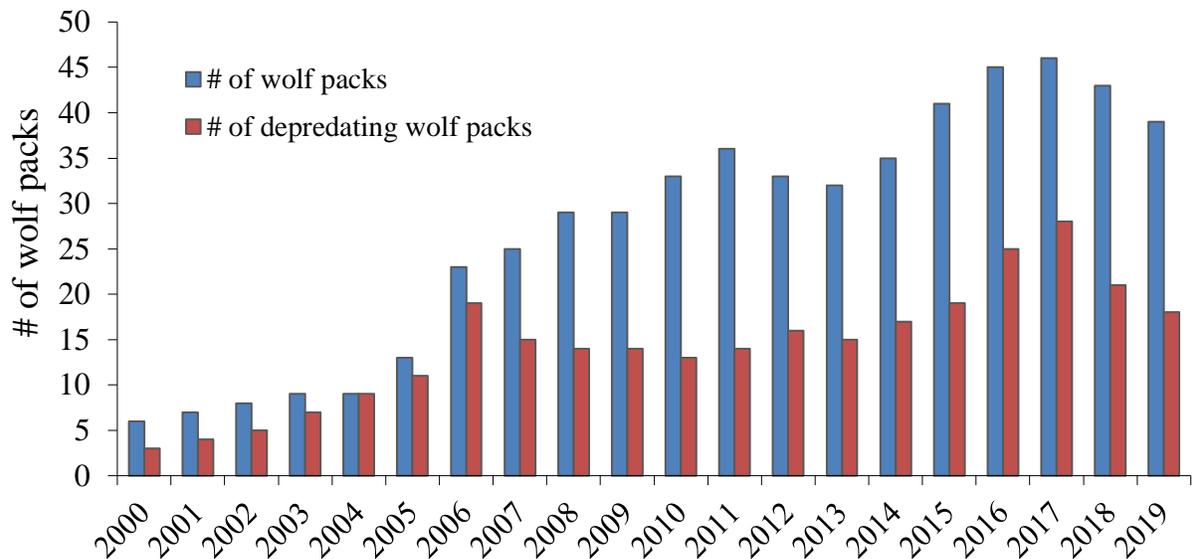


Figure 15. Minimum number of wolf packs present during the calendar year and number of wolf packs that were involved in ≥ 1 confirmed livestock conflict in WYO from 2000-2019.

Location of Livestock Conflicts: Land ownership is recorded for all instances of confirmed wolf-livestock conflict in the WTGMA and Seasonal WTGMA as part of routine investigation of reported conflicts. Land ownership is not consistently recorded for wolf-livestock conflicts in areas where wolves are designated as predatory animals year-round and are not included in this summary. In 2019, 71% (35 livestock; all cattle) of all confirmed wolf-livestock conflicts in the WTGMA and Seasonal WTGMA were on public land and 29% (14 livestock; all cattle) were on private land (Figure 16). Cattle conflicts were twice as high on public land compared to private property (Figure 16). No wolf-sheep conflicts were investigated in 2019 in the WTGMA and Seasonal WTGMA.

In 2019, confirmed wolf-cattle conflicts occurred in all but 2 wolf hunt areas. Hunt area 1 had 30% of all cattle conflicts in WYO (Table 6). Confirmed wolf-sheep conflicts occurred only in the predatory animal area (Table 6).

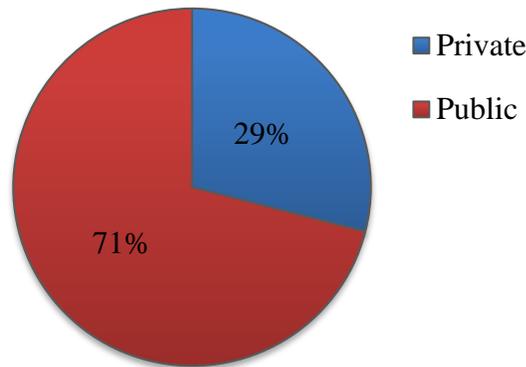


Figure 16. Land status where confirmed cattle conflicts with wolves occurred in the WTGMA and Seasonal WTGMA in 2019. (No sheep conflicts occurred in the WTGMA in 2019)

Table 6. Confirmed cattle and sheep conflicts with wolves in WYO by wolf hunt area (WHA) and in areas where wolves are designated as predatory animals year-round (Pred) in 2019.

WHA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Pred	Total
Cattle	16	1	3	2	4	0	6	2	2	5	5	2	0	1	5	54
Sheep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	27
Total	16	1	3	2	4	0	6	2	2	5	5	2	0	1	32	81

Seasonal Trend in Livestock Conflicts: Cattle conflicts began in March, peaked in mid-summer, and then declined toward autumn (Figure 17). August saw the highest conflicts between wolves and cattle while spring and early summer saw fewer conflicts in 2019 than in 2017 and 2018 (Figure 17). The majority of sheep conflicts occurred in June, with August being the only other month with confirmed conflicts (Figure 18). Overall, sheep conflicts were higher in 2019 than in 2018, however, both years are significantly lower than the previous years (Figure 18). The seasonal trend in wolf-livestock conflict was similar to other years and followed the pattern of open range grazing where livestock are distributed over large areas that overlap wolf distribution in northwest Wyoming during the summer and autumn.

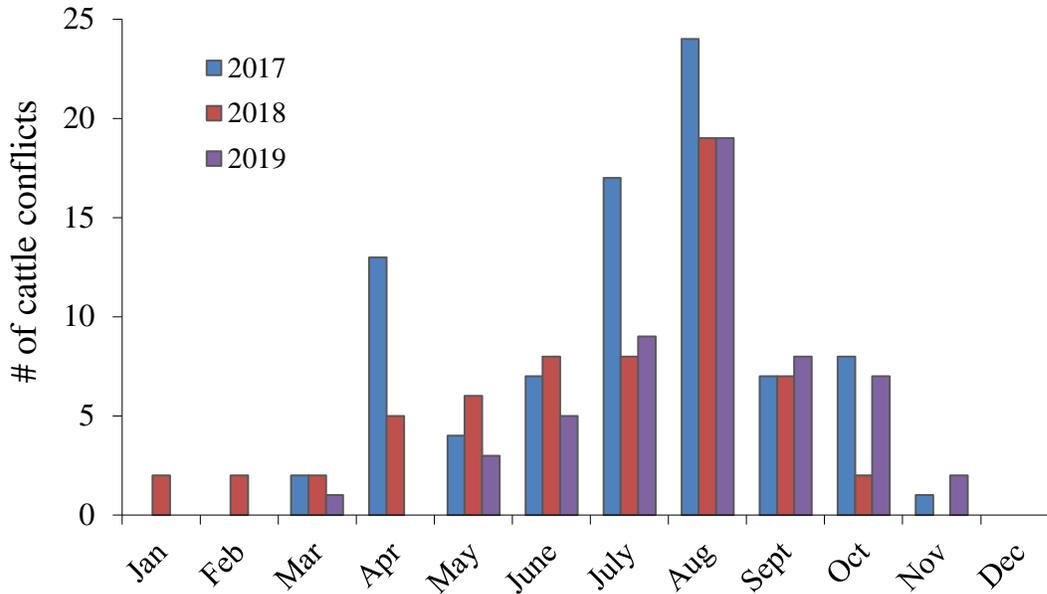


Figure 17. Number of confirmed wolf-cattle conflicts per month in WYO from 2017-2019.

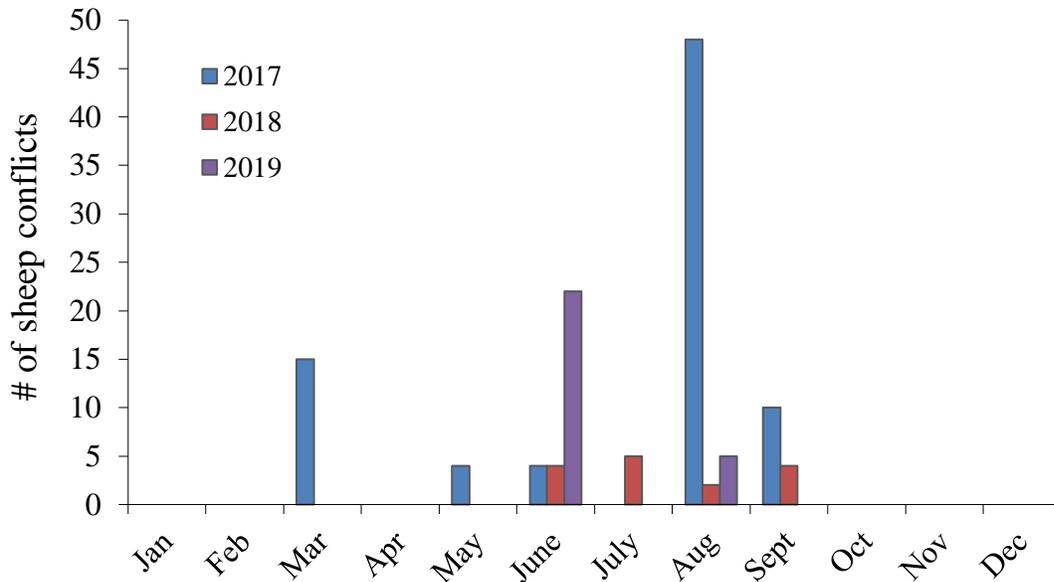


Figure 18. Number of confirmed wolf-sheep conflicts per month in WYO from 2017-2019.

Compensation for Livestock Damage Caused by Wolves: The Wyoming Game and Fish Department paid \$106,183 to compensate 19 livestock producers for livestock killed or injured by wolves during 2019 in the WTGMA and Seasonal WTGMA (Figure 19). Compensation payments declined successively from 2017 to 2019, mirroring synchronous declines in conflict between wolves and livestock following removal of Endangered Species Act protections in 2017 (Figures 2, 14 and 19; Table 5).

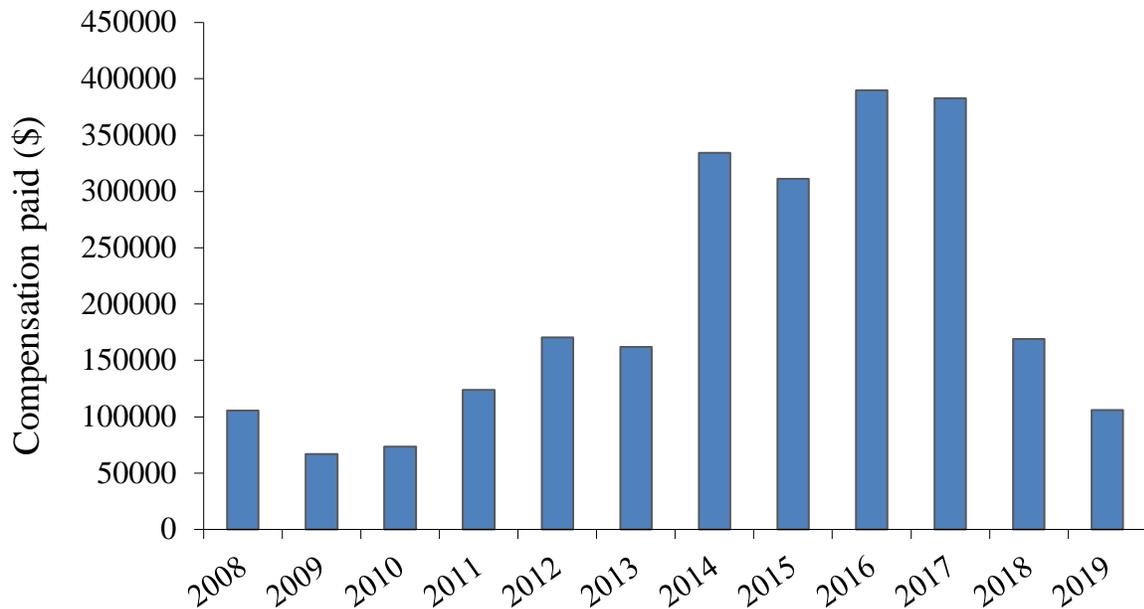


Figure 19. Compensation paid for confirmed livestock damage by wolves in WYO by calendar year 2008-2019.

Unacceptable Impacts to Ungulates or Elk Feedgrounds

Under the Wyoming Gray Wolf Management Plan, Wyoming Statute 23-1-304(j), and Wyoming Game and Fish Commission Chapter 21 Gray Wolf Management (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.

No agency directed lethal removal actions were taken in 2019 as there was no definitive documentation of unacceptable impacts to ungulates or elk feedgrounds caused by wolves. Monitoring and analyses of potential impacts to ungulate populations remain an integral part of ongoing management of wolves and their prey in WYO.

Wolf Management on the Wind River Reservation

In 2019, wolves were classed as a trophy game animal on the Wind River Reservation. Legal take could occur for wolves during a regulated hunting season and for defense of life and property. Reported livestock conflicts with wolves were 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. One calf was confirmed to have been killed by the Owl Creek pack in 2019 (Table 3). No wolves were lethally removed during 2019 (Table 3).

A wolf hunting season was implemented from December 1, 2019 through February 28, 2020 on the Wind River Reservation. 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. Mandatory reporting was required within 48 hours to allow for seasons to be closed once the quota was met. No wolves were taken during the hunt.

Wolf Management in Yellowstone National Park

Wolf management activities in Yellowstone National Park included den site closures and several hazing events. One dog was killed by wolves in Yellowstone National Park in 2019. Staff continued to manage wolf viewing areas in Slough Creek, Lamar Valley, and other areas where wolves were frequently observed.

OUTREACH

Outreach in WYO

In 2019, Wyoming Game and Fish Department personnel gave numerous formal presentations on wolf biology, monitoring, and management to the general public, special interest groups, school groups, civic organizations, other agencies and associations, and at scientific conferences. Public outreach in WYO included public meetings discussing proposed regulatory changes for wolves in WYO and “Living in Large Carnivore Country” workshops across Wyoming where information on wolf biology and ecology and large carnivore safety was presented. Two presentations were also given at Wyoming Game and Fish Commission public meetings. Wyoming Game and Fish Department personnel met with multiple conservation and sportsperson’s non-government organizations and interested members of the public to discuss the status of the wolf population in Wyoming and wolf hunting season proposals. Wyoming Game and Fish personnel were interviewed for numerous magazine, newspaper, radio, and television feature stories. As part of normal wolf monitoring and management activities, Wyoming Game and Fish Department personnel interacted with members of the public on a daily basis and made

every effort to make these interactions positive and informative to increase the public's involvement and understanding of wolf biology, monitoring and management throughout Wyoming.

Outreach in Yellowstone National Park

Public outreach included giving 119 formal talks (6 at scientific conferences), 76 interviews, educating at least 10,000 people while viewing wolves, making at least 15,000 visitor contacts, and giving 158 informal talks in the field.

EXPENDITURES

WYO

The Wyoming Game and Fish Department's 2019 fiscal year (FY19) occurred from July 1, 2018 - June 30, 2019. During the course of FY19, the Wyoming Game and Fish Department conducted annual population monitoring, responsive conflict management, internal and external education and information programs, and other statutory and regulatory obligations in regards to damage compensation and law enforcement for wolves. The Wyoming Game and Fish Department directed approximately \$543,676 of wolf program funds toward wolf management in FY19. Program expenditures are reported by primary work activities conducted during FY19 below, but do not represent all Wyoming Game and Fish Department expenses incurred in this FY:

- Monitoring and management program: \$377,468
- Conflict prevention and management: \$23,710
- Internal and external information and education: \$27,524
- Equipment and administration: \$8,791
- Compensation for verified wolf-livestock conflicts: \$106,183

In addition to specific wolf program funds, approximately \$478,244 was also directed toward wolf monitoring and management activities from all other Department budgets and personnel expenses during FY19, for Department-wide total of \$1,021,920.

Cooperating agencies in WYO also expended funds directed toward wolf monitoring and management in 2019 as follows:

- Grand Teton National Park: \$121,000
- USDA Wildlife Services: \$2,226
- Wyoming Animal Damage Management Board: \$67,308

Wind River Reservation

A total of \$6,300 was spent on wolf monitoring and management in the Wind River Reservation in 2019 (\$4,300 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 \$700,000 was spent on monitoring and managing wolves in Yellowstone National Park in 2019; \$300,000 from federal funding and \$400,000 from private sources.

CONTRIBUTORS

Many personnel contributed to the content of the 2019 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: Ken Mills and Zach Gregory analyzed data and developed the report. Large Carnivore Section: Clint Atkinson, Dan Bjornlie, Mike Boyce, Justin Clapp, Brian DeBolt, Luke Ellsbury, Becky Fuda, Mike Hooker, Andy Johnson, Ryan Kindermann, Dusty Lasseter, Rebecca Lyon, Phil Quick, Sean Ryder, Dan Thompson, and Zach Turnbull
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- Wyoming State Veterinary Laboratory: Katie Bardsley, Joan Edwards, and Donal O'Tool
- Grand Teton National Park: Sarah Dewey and John Stephenson
- Wildlife Services: Mike Burrell, Mike Foster, Vivian Meek, Rod Merrell, and Melissa Souza

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 and Ben Snyder

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

- National Park Service: D.W. Smith, D.R. Stahler, K.A. Cassidy, E. Stahler, M. Metz, C. Meyer, J. Rabe, N. Tatton, J. SunderRaj, L. Carroll, M. Jackson, B. Cassidy, and E. Loggers.

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WYO

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Wind River Reservation

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Yellowstone National Park

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