

2012 WYOMING GRAY WOLF POPULATION MONITORING AND MANAGEMENT ANNUAL REPORT



Photo: WGFD

Prepared by the Wyoming Game and Fish Department in cooperation with the U.S. Fish and Wildlife Service, National Park 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 wolf population in Wyoming from January 1, 2012 to December 31, 2012.

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LIST OF ACRONYMNS

CDV – Canine distemper virus

CPV – Canine parvovirus

ESA – Endangered Species Act

GTNP – Grand Teton National Park

NER – National Elk Refuge

NPS – National Park Service

NRM – Northern Rocky Mountain Gray Wolf Distinct Population Segment

Plan – the Wyoming Gray Wolf Management Plan and Addendum as approved by USFWS in 2012

TFGD – Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department

USFWS – United States Fish and Wildlife Service

WGFC – Wyoming Game and Fish Commission

WGFD – Wyoming Game and Fish Department

WHA – Wolf Hunt Area

WRR – Tribal lands in the Wind River Reservation

WS – United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services

WTGMA – Wolf Trophy Game Management Area

WYO – that portion of the state of Wyoming outside YNP and tribal lands in WRR

YNP – Yellowstone National Park

NOTE: Any use of the word “Wyoming” refers to all lands within the exterior boundary of the state including all portions of YNP that are within the state, GTNP, NER and WRR.

EXECUTIVE SUMMARY

At the end of 2012, the gray wolf (*Canis lupus*) population in Wyoming remained above minimum delisting criteria, making 2012 the 11th consecutive year Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by the U.S. Fish and Wildlife Service (USFWS). At least 277 wolves in ≥ 43 packs (including ≥ 21 breeding pairs) inhabited Wyoming on December 31, 2012. Of the total, there were ≥ 83 wolves and ≥ 10 packs (including ≥ 6 breeding pairs) inside Yellowstone National Park (YNP), ≥ 8 wolves and ≥ 2 packs (≥ 0 breeding pairs) in the Wind River Reservation (WRR), and ≥ 186 wolves and ≥ 31 packs (including ≥ 15 breeding pairs) in Wyoming outside YNP and WRR (referred to hereafter as WYO). A total of 136 wolf mortalities were documented statewide in Wyoming in 2012 (124 in WYO, 11 in YNP, and 1 in WRR). Causes of mortality included: human-caused = 120 (control = 43, hunter harvest = 66, vehicles = 5, illegal = 4, other = 2); natural = 14; and unknown = 2. A minimum of 277 wolves were alive at the end of 2012 and 136 wolves (33%) were known to have died in 2012, for a total of 413 wolves known to be alive during 2012. Forty-seven wolves were captured and radio-collared in 2012. Forty-four radio-collared wolves were being monitored at the end of 2012 in Wyoming (16% of the year end population). The WGFD spent \$569,271.31 to monitor and manage wolves in WYO in 2012, including compensation payments for livestock depredation.

Following delisting in September 2012, WGFD instituted a wolf hunting season with the biological objective to reduce the wolf population by approximately 11% in the Wolf Trophy Game Management Area (WTGMA) and Seasonal WTGMA and secondly to provide recreational hunting opportunity to Wyoming sportsmen. Wolf harvest was focused primarily in areas with high rates of historic wolf-livestock conflict and/or areas with relatively high wolf densities in an attempt to reduce livestock damage and excessive predation on ungulate herds. A mortality quota of 52 wolves was subdivided between 12 Wolf Hunt Areas (WHAs) in northwest WYO. Wolf hunting seasons were open from October 1, 2012 to December 31, 2012 with the exception of WHA 12, which opened on October 15, 2012. A total of 41 wolves were legally harvested and 1 wolf was illegally killed during the hunting season. Wolves could also be taken anytime without a license, and in any legal manner where they are designated as predatory animals. Twenty-five wolves were harvested by the public under predatory animal status following delisting in 2012.

Wolves were confirmed to have killed 157 head of livestock (44 cattle, 112 sheep, and 1 horse) and 3 dogs in 2012, all of which occurred in WYO. An additional 5 cattle and 1 dog were injured by wolves but survived. Sixteen packs (48% of 33 packs in WYO and 36% of 45 packs statewide in Wyoming, including 2 packs that were removed following confirmed livestock depredations) were involved in ≥ 1 depredation; 11 packs (33%) were involved in ≥ 2 depredations; and 9 packs (27%) were involved in ≥ 3 depredations in 2012. Agency control efforts removed 43 depredating wolves in an effort to reduce livestock losses due to wolves (40 by USFWS before September 30, 2012 and 3 by WGFD after September 30, 2012; 14% of the wolf population in WYO known to be alive during 2012). The State of Wyoming paid \$195,264.00 in 2012 to compensate livestock owners who lost livestock to wolves.

BACKGROUND

In 1995 and 1996, USFWS reintroduced 31 wolves into YNP, Wyoming as a nonessential experimental population under the Endangered Species Act (ESA) with the goal of reestablishing a sustainable gray wolf population in the northern Rocky Mountains (NRM). The USFWS was the federal agency charged with administering, monitoring, and managing the wolf population following reintroduction until wolves reached recovery levels and ESA protections could be removed (i.e., referred to as “delisting”). The wolf population expanded quickly in number and distribution throughout northwest Wyoming, and reached the required delisting criteria by late 2002 and has exceeded the criteria every year since. More information on wolves and the background and history of the wolf reintroduction program in Wyoming can be found on USFWS’s Gray Wolves in the NRM website and the Wyoming Game and Fish Department’s (WGFD) Wolves in Wyoming website at the following links:

<http://www.fws.gov/mountain-prairie/species/mammals/wolf/>
<http://wgfd.wyo.gov/web2011/wildlife-1000380.aspx>

In August 2011, USFWS and the state of Wyoming finalized a cooperative planning effort which outlined a mutually agreed upon wolf management framework for the wolf population in Wyoming. The Wyoming Gray Wolf Management Plan (and an addendum that was added for clarification; referred to collectively as the “Plan” hereafter), applicable state statutes and Wyoming Game and Fish Commission (WGFC) regulations were subsequently revised and given final approval by USFWS on September 10, 2012. Wolves were delisted in Wyoming as of September 30, 2012. During the 2012 calendar year, USFWS monitored and managed wolves in Wyoming from January 1, 2012 through September 29, 2012. The WGFD monitored and managed wolves following delisting in Wyoming outside of YNP, Grand Teton National Park (GTNP), WRR, and the National Elk Refuge (NER) from September 30, 2012 to December 31, 2012. Monitoring and management of wolves was conducted by the National Park Service (NPS) in YNP and GTNP, the Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department (TFGD) on tribal lands in WRR, and the USFWS on NER.

As mentioned above, once wolves were delisted, wolf management responsibility was transferred to multiple jurisdictions in Wyoming. Each management agency has different laws, regulations, and/or management plans governing wolf management and, accordingly, wolf management objectives and philosophies vary by jurisdiction. The following is a summary of the management direction by agency.

NPS

The NPS is responsible for monitoring and managing wolves in national parks in Wyoming. The NPS’ primary wolf management approach is to allow natural processes to occur within the boundaries of national parks with minimal human intervention. More information on the NPS in Wyoming, including more detailed reports on wolf monitoring and management in YNP, can be found at the following links:

<http://www.nps.gov/yell/naturescience/wolves.htm>

<http://www.nps.gov/grte/index.htm>

TFGD

The TFGD is responsible for wolf monitoring and management of wolves on tribal lands within the boundaries of WRR. The Wolf Management Plan for the Wind River Reservation designates wolves as a trophy game animal, but there was no open hunting season in 2012 and wolves could only be legally killed to defend life or property. For more information, see the Wolf Management Plan for the Wind River Reservation at:

http://www.fws.gov/mountain-prairie/species/mammals/wolf/Wind_River_Res_Wolf_Plan_2007_0413.pdf

USFWS

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

<http://www.fws.gov/nationalelkrefuge/>

WGFD

Wolves in WYO are monitored and managed by WGFD. The WGFD wolf management approach is to maintain a recovered wolf population in Wyoming while balancing the need to minimize, to the extent practical, wolf conflicts with livestock and wild ungulate herds. Wyoming's plan also seeks to incorporate sport hunting opportunity into the strategy for managing the wolf population. Wyoming's wolf management framework is more complex than NPS and WRR'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 Plan and approved by USFWS. 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. 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 members of the public when in the act of doing damage to private property, under the authority of a lethal take permit, or by licensed hunters during an open wolf hunting season. Livestock owners who have confirmed wolf depredations on livestock in the WTGMA may qualify for compensation from the state.
2. *Seasonal WTGMA:* Wolves are designated as trophy game animals in the Seasonal WTGMA from October 15 through the end 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 wolf depredation on livestock in the Seasonal WTGMA may qualify for compensation from the state.

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 may be taken anytime without a license, 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 state.

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

<http://wgfd.wyo.gov/web2011/wildlife-1000380.aspx>

Wolf Population Delisting Criteria and Post-Delisting Monitoring

The USFWS set specific recovery goals for wolves in the NRM that were required to be met prior to delisting. The wolf population in the NRM must also continue to meet or exceed USFWS' delisting criteria post-delisting to ensure the population remains recovered. The USFWS 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 NRM for 3 consecutive years. These criteria were developed using input from >25 wolf experts across North America and the world. Additionally, USFWS developed delisting criteria that required the states to maintain a 50% buffer above minimum delisting criteria (i.e., ≥ 450 wolves and ≥ 45 breeding pairs in the NRM) 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 Wyoming including YNP, GTNP, NER, and WRR at the end of the calendar year. Under the terms of the delisting agreement between Wyoming and USFWS, 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 YNP and WRR providing the additional buffer of ≥ 50 wolves and ≥ 5 breeding pairs necessary to meet the ≥ 150 wolf and ≥ 15 breeding pair requirement for the state.

Under the ESA, 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, USFWS is required, in cooperation with the states, to monitor the status of delisted species. The primary goal of post-delisting monitoring is to provide USFWS 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 authority and will provide USFWS with the necessary information required for their post-delisting monitoring evaluation for the 2012 calendar year.

Reporting Wolf Population Data by Jurisdiction

Generally, states are solely responsible for monitoring and managing delisted species. In Wyoming, however, the wolf population ranges over multiple large jurisdictions where the state does not have management authority, primarily YNP and WRR. This sharing of large portions of the wolf population complicated 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 USFWS and state of Wyoming agreed on a framework that would assign proportions of the minimum delisting criteria to the 3 major 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 GTNP and NER, these areas are small and the majority of wolf packs are shared among these jurisdictions and are, therefore, assigned to WYO.
2. YNP, in combination with WRR, is expected to contribute the remaining buffer of ≥ 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 major jurisdictions (i.e., WYO, YNP, and WRR) to allow for proper evaluation of the wolf population both statewide and by major jurisdiction.

MONITORING

Wolf Population Monitoring Statewide

At the end of 2012, the gray wolf population in Wyoming remained above minimum delisting criteria, making 2012 the 11th consecutive year Wyoming has exceeded the numerical, distributional, and temporal delisting criteria established by USFWS. At least 277 wolves in ≥ 43 packs (including ≥ 21 breeding pairs) inhabited Wyoming on December 31, 2012. Of the total, there were ≥ 83 wolves and ≥ 10 packs (including ≥ 6 breeding pairs) inside YNP, ≥ 8 wolves and ≥ 2 packs (≥ 0 breeding pairs) in WRR, and ≥ 186 wolves and ≥ 31 packs (including ≥ 15 breeding pairs) in WYO. A total of 136 wolf mortalities were documented statewide in Wyoming in 2012 (124 in WYO, 11 in YNP, and 1 in WRR). Causes of mortality included: human-caused = 120 (control = 43, hunter harvest = 66, vehicles = 5, illegal = 4, other = 2); natural = 14; and unknown = 2. A minimum of 277 wolves were alive at the end of 2012 and 136 wolves (33%) were known to have died in 2012, for a total of 413 wolves known to be alive during 2012. Forty-seven wolves were captured and radio-collared in 2012. Forty-four radio-collared wolves were being monitored at the end of 2012 in Wyoming (16% of the year-end population). The WGFD spent \$569,271.31 to monitor and manage wolves in WYO in 2012, including compensation payments for livestock depredation.

Wolf Population Monitoring in WYO

Capture and Radio-collaring

Radio-collars are the primary tool used for monitoring wolf populations in WYO and throughout the NRM. Wolves were captured using foothold traps or darted/netgunned from a helicopter. Radio-collars were affixed to captured wolves and personnel collected morphological information, genetic samples, and blood for disease testing. Radio-collared wolves were released on site and monitored to document territories, movements (including dispersal), pack numbers, pack composition, breeding status and success, to mitigate livestock conflicts, and to aid in law enforcement investigations.

Twenty-eight wolves were radio-collared in 2012 (helicopter capture = 11; trapping = 17), including 5 recaptures. At the end of 2012, there were 27 radio-collared wolves in 16 packs and 2 collared wolves in pairs that formed in December 2012, for a total of 29 collared wolves (16% of the year-end population). Winter capture efforts continued through mid-March 2013 in conjunction with 2012 year-end population surveys, at which point a total of approximately 50 wolves (28% of the population) were radio-collared. From 1999-2012, radio-collars were maintained on approximately 20-25% of the wolf population each year. VHF radio-collars were used for general monitoring purposes and various types of GPS and ARGOS collars for specific research projects.

Population and Breeding Pair Status

The minimum population for wolves in WYO on December 31, 2012 was estimated using standard wolf monitoring methods that have been used since reintroduction. The number of

wolves in individual packs was estimated at the end of the year by counting wolves from the air during aerial telemetry flights, capture operations, observations verified by qualified agency personnel, or pictures of known packs taken with remote cameras. Only pack observations obtained from winter 2012-13 were included to ensure they were reflective of the minimum number of wolves present on December 31, 2012. The majority of pack counts ($\geq 96\%$) were obtained after mid-December, with counts taken after December 31 receiving deference. The few counts made prior to mid-December were of 2 small packs (≤ 3 wolves) and a few single wolves found primarily outside the WTGMA/Seasonal WTGMA. Single wolves were included in the estimate only if the observations were verified by qualified agency personnel and the animal was not a member of a known pack. Standard techniques used by USFWS prior to delisting were used to identify and assign trans-boundary packs to their appropriate jurisdiction both between jurisdictions within Wyoming, and between Idaho and Montana. The final minimum population estimate was the sum of all pack counts and single wolves known to be present in WYO on December 31, 2012.

Breeding pair status was determined using methods utilized since wolves were reintroduced. Denning behavior was verified for individual packs using aerial and ground telemetry and ground investigations during spring. The presence of pups with packs was verified using observations made during aerial and ground monitoring efforts using telemetry equipment, investigations of potential den and rendezvous sites, howling surveys, public reports verified 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. Breeding pairs will continue to be documented using this method for at least the post-delisting monitoring period, but WGFD is also investigating the use of more efficient methods to determine breeding pair status over the long term. The model reported in Mitchell et al. (2007) for Wyoming is an efficient method for estimating breeding pairs based on pack size. This method uses historic data for un hunted wolves in Wyoming to estimate the probability that a pack with ≥ 4 wolves is a breeding pair. The probability that each pack is a breeding pair can then be summed to produce an estimate of the number of breeding pairs in the population. Mitchell et al.'s model will be applied to packs of ≥ 4 members with unknown breeding pair status to determine how many of these packs were likely to be breeding pairs at the end of 2012. The results of this model will only be considered as informative and will be reported as an estimated number of breeding pairs in addition to the confirmed number of breeding pairs. The WGFD will only use breeding pairs confirmed using field data to meet the ≥ 10 breeding pair minimum delisting criterion for at least the duration of the post-delisting monitoring period but will continue to evaluate the utility of alternative methods for estimating breeding pairs with the goal of replacing current intensive and invasive field efforts with more efficient methods in the future.

As of December 31, 2012, ≥ 186 wolves in ≥ 31 packs were documented in WYO, of which ≥ 169 wolves in ≥ 26 packs resided primarily within the WTGMA/Seasonal WTGMA (Figure 1 and Table 1, respectively). Pack size ranged from 2-13 and averaged 5.5 wolves/pack. Fifteen packs qualified as breeding pairs on December 31, 2012, all of which were located primarily within the WTGMA (Figure 1 and Table 1, respectively). Breeding pair status could not be determined for 7 packs with ≥ 4 members at the end of the calendar year. Using the model reported in Mitchell et al. (2007), 4 packs would likely have qualified as breeding pairs in addition to the 15

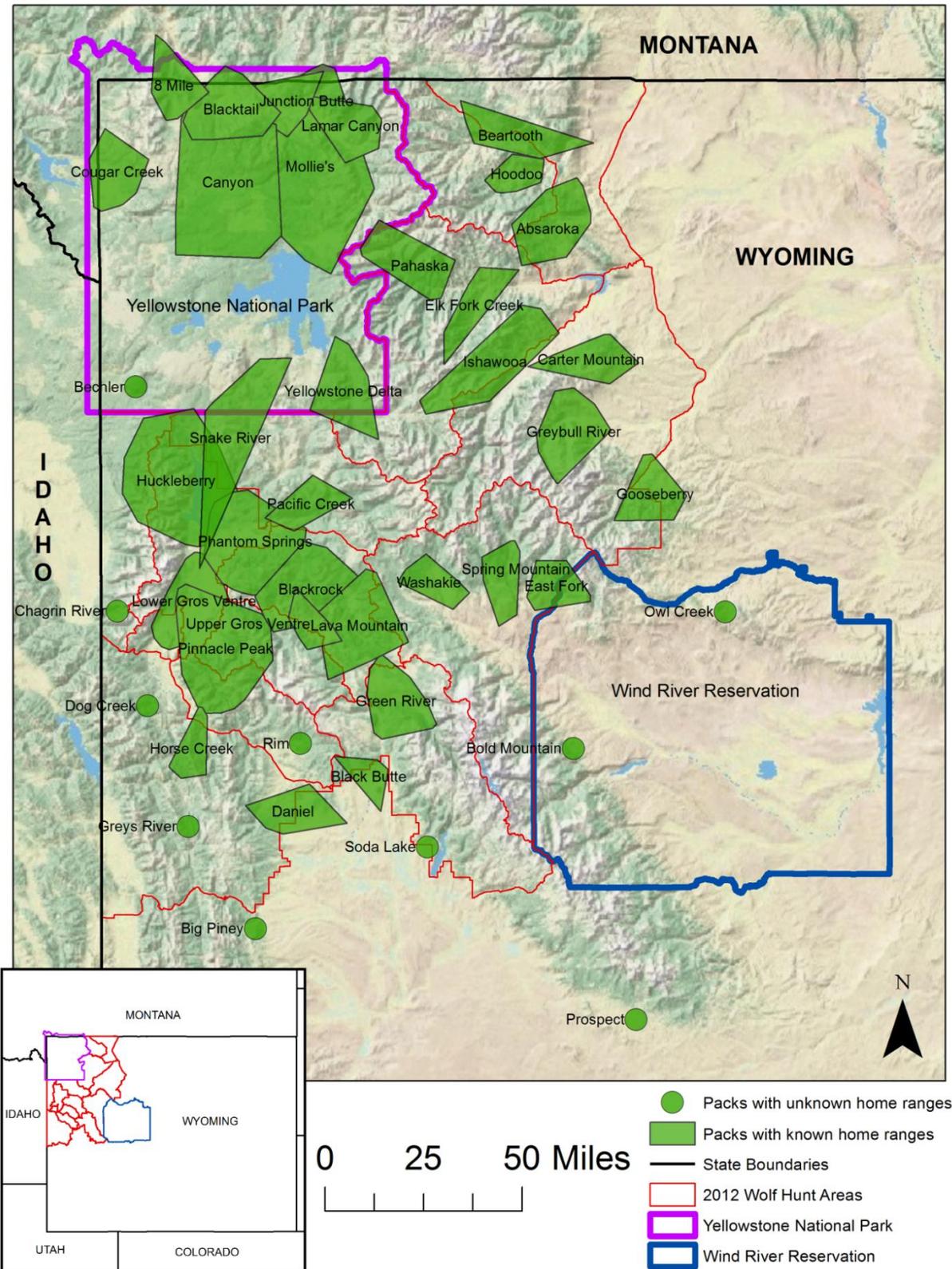


Figure 1. Home ranges of confirmed wolf packs in Wyoming in 2012.

Table 1. Wolf packs, population data, and depredation information for confirmed wolf packs in WYO and WRR in 2012. (Note: The column “REF #” refers to the reference number in the NRM wolf annual report compiled by USFWS covering all states in the NRM wolf recovery area.)

REF #	WOLF PACK ^{1,2}	RECOV		MIN. ESTIMATED PACK SIZE DEC 2012	DOCUMENTED MORTALITIES				KNOWN		CONFIRMED LOSSES ⁶			
		AREA	STATE		NATURAL	HUMAN ³	UNKN ⁴	HARVEST ⁵	CONTROL ⁶	DISPERSED	MISSING ⁷	CATTLE	SHEEP	DOGS
Wyoming Outside Yellowstone National Park and the Wind River Reservation (WYO)														
148	<u>Absaroka</u>	GYA	WY	6		1		3						
149	Beartooth	GYA	WY	3				2			1			
150	Big Piney	GYA	WY	2				4						
151	Black Butte	GYA	WY	2				1						
152	<u>Blackrock</u>	GYA	WY	7	1			2						
153	<u>Carter Mountain</u>	GYA	WY	8				1						
154	Chagrin River ⁹	GYA	WY	6		2							1	
	Clark	GYA	WY						3	1		3		
155	Daniel	GYA	WY	2				11						
156	Dog Creek	GYA	WY	3				1		1				
157	<u>East Fork</u>	GYA	WY	5				1						
158	Elk Fork Creek	GYA	WY	4				1						
159	<u>Gooseberry</u>	GYA	WY	4				2	3			3		
160	Green River	GYA	WY	4				3	5			19		
161	<u>Greybull River</u>	GYA	WY	9	2			2		1				
162	Greys River	GYA	WY	4				2	6				24	
163	Hoodoo	GYA	WY	4				3	3	1		5		
164	Horse Creek	GYA	WY	3							1		44	
165	<u>Huckleberry</u>	GYA	WY	7						1				
166	<u>Ishaw ooa</u>	GYA	WY	9		1		1	2	1		3		
167	<u>Lava Mountain</u>	GYA	WY	10				2		1		1		
168	<u>Lower Gros Ventre</u>	GYA	WY	5										
	New Fork	GYA	WY						4			2		
169	<u>Pacific Creek</u>	GYA	WY	13				2						3
170	<u>Pahaska</u>	GYA	WY	8		2	1	3						
171	<u>Phantom Springs</u>	GYA	WY	8			1	3	3			1		1
172	<u>Pinnacle Peak</u>	GYA	WY	10	1	1		1		3				
	Pope Agie	GYA	WY											
173	Prospect	GYA	WY	3					5				10	
174	Rim	GYA	WY	3								1		
	Seab Creek	GYA	WY											
175	Soda Lake	GYA	WY	3										
	South Fork	GYA	WY											
176	<u>Spring Mountain</u>	GYA	WY	6				1	3			2		
	Sunlight	GYA	WY											
177	Upper Gros Ventre	GYA	WY	4		1		2			1			
178	Washakie	GYA	WY	6					1			1		
	Wiggins Fork⁸	GYA	WY											
	Misc/Lone wolves	GYA	WY	15		1		12	5			3	33	
	WY Total	GYA	WY	186	4	9	2	66	43	10	3	44	112	3
Wind River Reservation (WRR)														
179	Bold Mountain	GYA	WY	3										
180	Owl Creek	GYA	WY	5		1				1				
	WRR Total	GYA	WY	8	0	1	0	0	0	1	0	0	0	0
	Wyoming Total (outside YNP)			194	4	10	2	66	43	11	3	44	112	3

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

² Strikethrough packs were not documented during 2012 and/or did not exist on Dec. 31, 2012 and are not displayed in Figure 1.

³ Excludes wolves killed in control actions and legal harvest.

⁴ Includes wolves that died of unknown causes.

⁵ Number of wolves legally harvested in 2012.

⁶ Includes agency lethal control under federal/state regulations and wolves legally killed by private citizens to defend livestock or under terms of a lethal take permit.

⁷ Collared wolves that became missing in 2012.

⁸ Includes only domestic animals confirmed killed by wolves. Does not include 5 calves and 1 dog that were injured by wolves but survived.

⁹ Border pack shared with the State of Idaho; dens in Wyoming.

⁹ The Wiggins Fork pack was replaced by the Spring Mountain pack in 2012.

breeding pairs confirmed by field data, which would yield an estimate of 19 breeding pairs in WYO on December 31, 2012. The WGFD spent \$569,271.31 to monitor and manage wolves in WYO in 2012, including compensation payments for livestock depredation.

Population Trend

The WYO end of year wolf population was reduced 17% from ≥ 224 wolves at the end of 2011 to ≥ 186 wolves at the end of 2012 and remained above the minimum delisting criterion of at least 100 wolves (Figure 2). This minimum population level was similar to the minimum wolf population in WYO from 2006-08. In 2012, WGFD implemented hunting seasons to reduce the wolf population by about 11% in the WTGMA/Seasonal WTGMA from ≥ 192 wolves at end of year 2011 to ~ 172 wolves at end of year 2012. The primary goal of hunting seasons was to reduce the population in areas with historically high livestock conflict and high relative wolf-ungulate densities to reduce livestock damage and excessive predation on ungulates using public harvest. The hunting season was also designed to provide managed and sustainable recreational hunting opportunity for wolves in WYO. The results of the 2012 hunting season showed implementation of the WGFC harvest strategy achieved the desired reduction (12% actual decline vs. 11% predicted) with a population of ≥ 169 wolves in the WTGMA/Seasonal WTGMA at the end of 2012. Likewise, harvest of wolves designated as predatory animals successfully reduced wolf numbers in areas exemplified by low habitat suitability, low re-colonization potential and historically high wolf-livestock conflicts. The WGFD will consider the results of the 2012 wolf hunting season, mortality and recruitment rates, and commitments made in the Plan and other regulatory documents to develop responsible and appropriate wolf hunting seasons in 2013 that will ensure the wolf population remains above minimum delisting criteria.

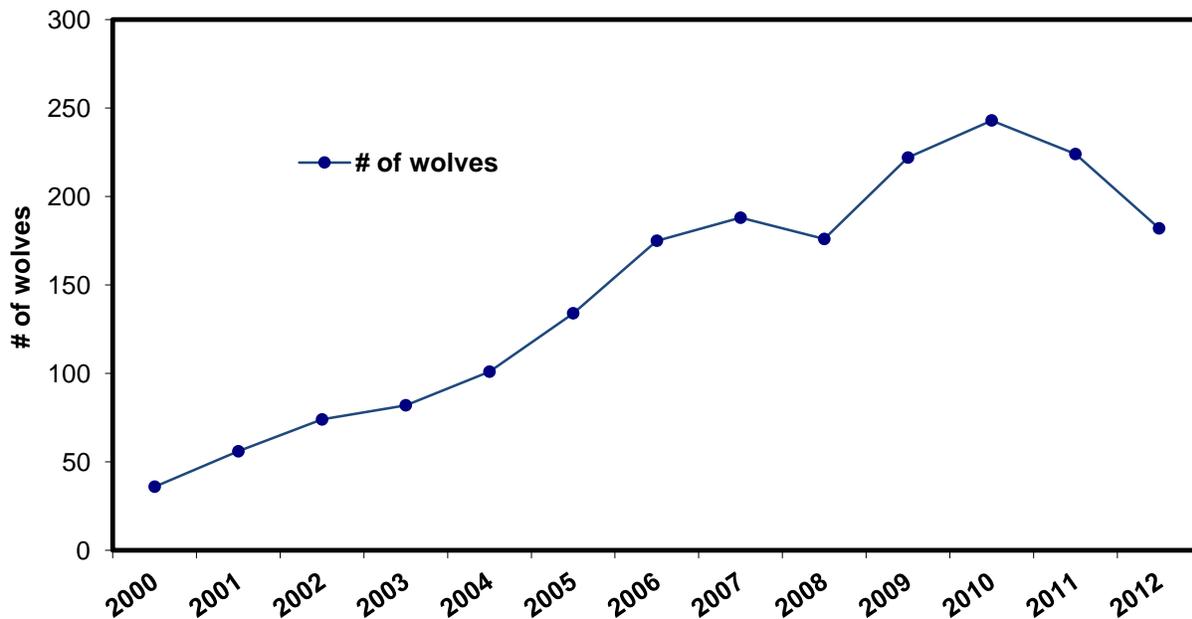


Figure 2. Wolf population trend in WYO from 2000-12.

The number of wolf packs in WYO declined 14% from ≥ 36 in 2011 to ≥ 31 at the end of 2012 (Figure 3). This reduction occurred because 2 packs were removed in control actions following confirmed livestock depredations in areas where livestock depredation has been chronic in the past (Clark and New Fork), 4 packs reported at the end of 2011 but not found during 2012 were dropped from the population estimate (Scab Creek, South Fork, Sunlight, and Popo Agie), and 1 pack historically assigned to WYO was assigned to YNP because they denned in YNP in 2012 (Snake River). However, 2 new packs were discovered in 2012 (Blackrock and Greys River), bringing the net reduction in number of packs between 2011 and 2012 to 5. No wolf packs were known to have been directly or indirectly eliminated by legal harvest during the 2012 hunting seasons.

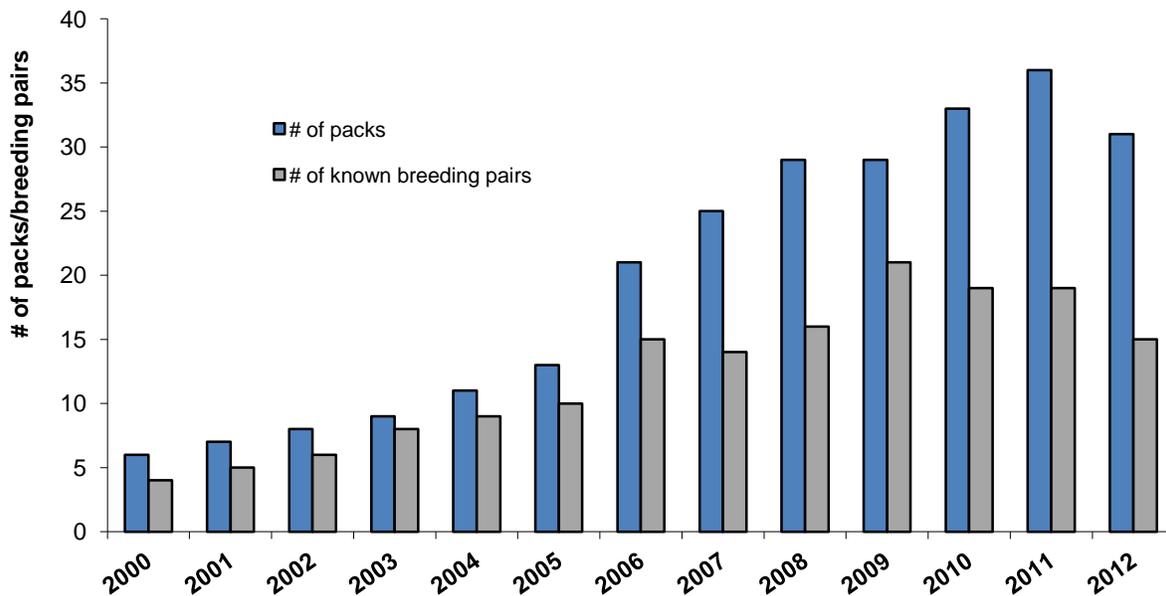


Figure 3. Number of wolf packs and confirmed breeding pairs in WYO from 2000-12.

There were 4 additional pairs of wolves documented during 2012-13 monitoring efforts that may produce pups in 2013. These pairs were not reported as packs because they were newly formed in late 2012 or early 2013 and WGF D will determine whether they persist in 2013 prior to designating them as packs. In addition to known packs, there was evidence of 2 additional packs in WYO that could not be confirmed prior to publication of this report. These include a potential pack of up to 6 wolves west of Labarge, WY, and 1 lone wolf documented in the vicinity of Warm Spring Creek west of Dubois, WY may be a member of an undocumented pack. There was 1 additional pair of wolves counted in the upper South Fork of the Shoshone River southwest of Cody, WY that may be part of a pack with ≥ 2 additional members that could not be verified.

The number of known breeding pairs declined 21% from ≥ 19 in 2011 to ≥ 15 at the end of 2012 (Figure 3). Eight packs identified as breeding pairs in 2011 also qualified as breeding pairs at the end of 2012 (East Fork, Gooseberry, Greybull, Ishawooa, Pacific Creek, Pahaska, Phantom Springs, and Pinnacle Peak). Seven packs that were not identified as breeding pairs in 2011 qualified as breeding pairs in 2012 (Absaroka, Blackrock, Carter Mountain, Huckleberry, Lava

Mountain, Lower Gros Ventre, and Spring Mountain). Eleven packs that were breeding pairs in 2011 were not identified as breeding pairs at the end of 2012 for the following reasons: 3 from control mortality following confirmed livestock depredations that occurred prior to delisting (New Fork, Prospect, and Green River); 6 from unidentified factors not related to known causes of mortality (Beartooth, Chagrin, Dog Creek, Soda Lake, Washakie, and Wiggins Fork); 1 was reassigned to YNP, but was not a breeding pair in 2012 (Snake River); and 1 from a combination of legal and illegal harvest (Upper Gros Ventre). Also, harvest of several wolves from the Daniel pack (when the pack occupied the area where wolves are designated as predatory animals) prevented this pack from qualifying as a breeding pair. Overall, it appeared that natural factors unrelated to known mortality sources were the primary cause of non-breeding status for 6 packs, with other causes of known mortality, including human-caused mortality, contributing to the non-breeding status of 4 packs. Despite increased human-caused mortality from the 2012 hunting season, most packs in the WTGMA appear to be stable based on monitoring conducted during winter 2012-13.

Mortality

Wolf mortality was monitored in WYO using multiple methods. Radio-collars were the primary method used for determining wolf mortalities occurring from non-hunting related causes. Radio-collars were programmed to change pulse rate after the collar remained motionless for 5 hours, thereby allowing managers to monitor collared wolves for mortality status and collect carcasses for necropsy to determine the cause of death. Wolf hunting mortality was monitored via reporting and registration by successful hunters as required in WGFC regulation Chapter 47. This requirement allowed WGFD to document mortalities, collect information on harvested wolves, update mortality quotas, and close seasons quickly once the mortality quota was met. Cooperating agencies also provided information on wolf mortalities, including wolves killed in control actions by WS. Wolf mortalities from all causes were documented and verified, including those found by the public, cooperating agencies, and WGFD personnel.

In 2012, 124 wolves were known to have died in WYO (Table 1), 89 of which were in the WTGMA/Seasonal WTGMA and 35 of which were outside the WTGMA/Seasonal WTGMA. The overall mortality rate was 40% for wolves known to have been alive during 2012 (186 wolves alive on December 31, 2012 plus 124 wolf mortalities for a total of 310 wolves). Causes of mortality included: control = 43 (35% of all mortality causes; 24 in the WTGMA, 7 in the Seasonal WTGMA, and 12 in areas where wolves were designated as predatory animals); public harvest = 66 (53%; 41 under trophy game animal status and 25 under predatory animal status); unknown = 2 (2%); human = 9 (7%; vehicle strikes = 4, illegal kills = 4, and accidental = 1); and natural = 4 (3%: Table 1). The number of wolves that died in 2012 (124 wolves) was higher than in 2011 (51 wolves) primarily because hunting removed 66 wolves in addition to wolves that died of other causes. Causes of mortality other than hunting were slightly higher in 2012 (58 wolves) compared to 2011 (51 wolves), which also contributed to higher mortality in 2012. This level of mortality reduced the population as intended, while ensuring the population remained well above minimum delisting criteria.

Disease Monitoring

Mange: Sarcoptic mange is a highly contagious skin disease caused by mites (*Sarcoptes scabiei*) and is commonly found in wolf populations throughout the world. Mange was first detected in WYO in 2002. Between 2002 and 2008, 4 packs east of YNP and at least 1 pack near Jackson, WY were suspected of having mange (Jimenez et al. 2010). During early 2012 signs of mange (alopecia and seborrhea) were observed in the Beartooth pack west of Cody, WY. Mange may have led to at least some wolf deaths in the pack, possibly the reason only a small pack of 3 non-breeding wolves could be documented in the Beartooth pack's traditional territory at the end of 2012.

Canine Distemper Virus and Canine Parvovirus: Canine distemper virus (CDV) and canine parvovirus (CPV) are highly contagious diseases that infect domestic dogs, coyotes, foxes, raccoons, skunks, and wolves. Over 80% of wolves in WYO routinely test positive for exposure to CDV and CPV. Based on other areas of the world that have experienced epizootic CDV and CPV infections, these diseases will occasionally cause some mortality, particularly among pups. However, outbreaks usually remain localized in specific areas/years and do not threaten regional wolf population viability. There was no documented mortality caused by CDV or CPV during 2012. Blood samples were collected from many wolves captured during the winter of 2012-13 to screen for diseases, but results were not available for inclusion in this report. Results from the sampling will be published in the 2013 report and will provide more accurate information on prevalence of CDV and CPV in the WYO wolf population.

Genetic Monitoring

The USFWS determined that, in addition to minimum population criteria, genetic interchange must also occur between the 3 wolf recovery areas (Central Idaho, Northwest Montana, and the Greater Yellowstone Area) in the NRM. To monitor whether this delisting criterion is met, USFWS requires that all states collect and analyze genetic samples from wolf populations in the NRM. Analysis of genetic interchange will be conducted cooperatively between USFWS and the states of Wyoming, Montana, and Idaho on a periodic basis (possibly every 12-20 years following multiple 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 NRM.

In 2012, genetic samples were collected from >110 wolves that will be used in analysis of genetic connectivity. Genetic samples were collected from wolves captured for monitoring purposes, killed in control actions, harvested, and those that died from other causes. As required by wolf hunting regulations, 41 samples were submitted by all successful wolf hunters who harvested wolves designated as trophy game animals and samples were voluntarily submitted by successful wolf hunters for 23 of 25 wolves taken in areas where they are designated as predatory animals.

Wolf Population Monitoring in WRR

Population and Breeding Pair Status

Wolves first re-colonized WRR in 2003 and are currently distributed across the Wind River and Owl Creek mountain ranges. As of December 31, 2012, ≥ 8 wolves in ≥ 2 packs (Bold Mountain and Owl Creek) and ≥ 0 breeding pairs were documented on WRR (Table 1). The East Fork pack also uses portions of WRR, but is assigned to WYO because the majority of its territory and denning activities occur outside WRR. Breeding is likely to be occurring because there have been wolves consistently documented in these areas for the past ≥ 4 years. However, breeding pair status was not confirmed because monitoring in these areas was relatively infrequent. Additional packs may have been present within WRR but were not verified in 2012.

Mortality

One wolf was legally killed in the Owl Creek Mountains by a tribal member out of concern for human safety in December 2012. This was the only wolf mortality documented on WRR in 2012 (Table 1).

Wolf Population Monitoring in YNP

Capture and Radio-collaring

Nineteen wolves from 9 packs were captured and radio-collared in 2012: 1 old adult, 7 adults, 2 yearlings, and 9 pups of which 14 were females and 5 were males. Both VHF and downloadable GPS collars were deployed. As of the end of 2012, 18% of the population was collared (15 wolves).

Population and Breeding Pair Status

At the end of 2012, ≥ 83 wolves in ≥ 10 packs (≥ 6 breeding pairs) occupied YNP (Table 2). This is approximately a 15% decline from the recent 3 years where the population had stabilized around 100 wolves. Breeding pairs declined slightly from ≥ 8 in 2011. The wolf population has declined by about 50% since 2007 mostly because of a smaller elk population, the main food of northern range wolves. The interior wolf population has declined less, probably because they augment their diet with bison. Twelve wolves that are normally counted as part of the YNP sub-population were legally harvest in surrounding states (Idaho = 2, Wyoming = 3, Montana = 7) during the 2012 hunting seasons. The severity of mange continued to decline in 2012, although some packs still showed signs of the mite. There was no evidence of CDV being a mortality factor as it was in 1999, 2005 and 2008. Pack size ranged from 4 (Blacktail and Snake River) to 11 (Lamar Canyon, Cougar, and Yellowstone Delta) and averaged 10, which is the long-term average.

The 2012 wolf population of ≥ 83 wolves was significantly smaller than the park-wide population peak of ≥ 174 wolves in 2003. The population decline was primarily due to disease and food stress and suggests long-term lower population equilibrium for YNP wolves, especially on the

Table 2. Confirmed wolf packs, population data, and depredation information for packs present in YNP in 2012. (Note: The column “REF #” refers to the reference number in the NRM wolf annual report compiled by USFWS covering all states in the NRM wolf recovery area.)

REF #	WOLF PACK ¹	RECOV AREA	STATE	MIN. ESTIMATED PACK SIZE DEC 2012	DOCUMENTED MORTALITIES					KNOWN DISPERSED	MISSING ⁴	CONFIRMED LOSSES ⁵			
					NATURAL	HUMAN ²	UNKN ³	HARVEST ⁸	CONTROL ⁶			CATTLE	SHEEP	DOGS	OTHER
Yellowstone National Park Northern Range															
181	<u>8 Mile</u>	GYA	WY/MT	10											
	<u>Agate</u> ⁷	GYA	WY	0	1										
182	Blacktail	GYA	WY	4	2										
183	<u>Junction Butte</u>	GYA	WY	9	2										
184	<u>Lamar Canyon</u>	GYA	WY	11											
	Misc/Lone wolves	GYA	WY	0	1										
Northern Range Total				34	6	0	0	0	0	0	0	0	0	0	
Yellowstone National Park Non-Northern Range															
185	<u>Bechler %</u>	GYA	WY/ID	10											
186	<u>Canyon</u>	GYA	WY	8											
187	<u>Cougar Creek</u>	GYA	WY	11											
	<u>Mary Mountain</u> ⁷	GYA	WY	0	3										
188	<u>Mollie's</u>	GYA	WY	5	1				1						
189	<u>Snake River</u>	GYA	WY	4											
190	<u>Yellowstone Delta</u>	GYA	WY	11	1										
	Misc/Lone wolves	GYA	WY	0											
Non-Northern Range Total				49	4	1	0	0	0	1	0	0	0	0	
YNP Total in Wyoming				83	10	1	0	0	0	1	0	0	0	0	

- 1 Underlined packs are counted as breeding pairs toward recovery goals.
 - 2 Excludes w olves killed in control actions and law ful harvest.
 - 3 Does not include pups that disappeared before w inter.
 - 4 Collared w olves that became missing in 2012.
 - 5 Includes agency lethal control under federal regulations. Includes w olves killed by private citizens to defend livestock or under terms of a lethal take permit.
 - 6 Includes only domestic animals confirmed killed by w olves.
 - 7 Pack did not exist on Dec. 31 2012 and is not displayed on the map; see pack narrative
 - 8 Number legally harvested by humans in 2012.
- * See narrative for summary of w olves harvested from each YNP pack outside of YNP
 % Border pack shared w ith State of Idaho; dens in Wyoming.
 ^ Border pack shared w ith State of Montana, dens in YNP portion of Montana.

northern range. Northern range wolves declined 60% since 2007 compared to only 23% for interior wolves during the same period. Wolves in the interior of YNP have probably declined less than northern range wolves because they regularly prey on bison, which are still widely available in the interior, and are less dependent on elk. Disease impacts have also likely played a larger role in the wolf decline on the northern range because of higher canid density (wolves, coyotes and foxes) than in the interior where density was lower.

Two packs were lost, but a new pack was added to the YNP population in 2012. The Agate Creek and Mary Mountain packs were lost when the majority of each pack’s members died, dispersed, or disappeared during the year. The Snake River pack previously existed at the south boundary of YNP and was assigned to WYO in previous years, but field observations and radio-collar data revealed denning and regular use inside YNP in 2012, so it was moved to the YNP population count.

Six of 10 packs, along with a lone female (originally from the Mollie’s pack but joined the newly formed Junction Butte pack after producing pups in 2012) produced pups this year. The average number of pups per pack in early winter for those packs producing pups was 2.6, compared to 4.1 in 2011 and 4.8 in 2010. A total of 18 pups in YNP survived to the end of the year in 2012, slightly more than half those surviving in 2011. Reduced pup recruitment contributed to the population decline in 2012. Four packs did not produce pups in 2012. The alpha females of the

Agate Creek and Mary Mountain packs were pregnant but died near their whelping dates; both packs disbanded soon after. Two other packs did not reproduce despite having at least 1 (Yellowstone Delta) or as many as 9 adult females (Mollie's).

Mortality

Eleven wolf mortalities were recorded in YNP in 2012, including 9 radio-collared wolves and 2 uncollared wolves (Table 2). Intraspecific aggression was the leading cause of natural mortality (8 wolf deaths) and 2 wolves died of unknown natural causes. One wolf that dispersed from the Yellowstone Delta pack was killed by a vehicle in South Dakota and was included in the YNP summary.

Wolves that use territories primarily inside YNP that died in surrounding states in 2012 are recorded in the respective state's annual reports. Twelve wolves were legally harvested (Idaho = 2, Wyoming = 3, and Montana = 7) outside YNP from 7 of 10 (70%) trans-boundary packs: Junction Butte (3 wolves), Blacktail (1 wolf), Mollie's (1 wolf), Lamar Canyon (2 wolves), 8-Mile (2 wolves), Bechler (2 wolves), Snake River (1 wolf). Effects on reproduction, pack dynamics, and territory are being monitored to determine if harvest has affected pack social function as do other natural forms of mortality. Wolves often quickly fill vacant biological and social niches that are a result of wolf losses from any cause.

MANAGEMENT

Wolf Management Statewide

Following delisting in September 2012, WGFD instituted a wolf hunting season with the biological objective to reduce the wolf population by approximately 11% in the WTGMA/Seasonal WTGMA and secondly to provide recreational hunting opportunity to Wyoming sportsmen. Wolf harvest was focused primarily in areas with high rates of historic wolf-livestock conflict and/or areas with relatively high wolf densities in an attempt to reduce livestock damage and excessive predation on ungulate herds. A mortality quota of 52 wolves was subdivided between 12 WHAs in WYO. Wolf hunting seasons were open from October 1, 2012 to December 31, 2012 with the exception of WHA 12, which opened on October 15, 2012. A total of 41 wolves were legally harvested and 1 wolf was illegally killed during the hunting season. Wolves could also be taken anytime without a license, in any legal manner in WYO where they are designated as predatory animals. Twenty-five wolves were harvested by the public under predatory animal status following delisting in 2012.

Wolves were confirmed to have killed 157 head of livestock (44 cattle, 112 sheep, and 1 horse) and 3 dogs in 2012, all of which occurred in WYO. An additional 5 cattle and 1 dog were injured by wolves but survived. Sixteen packs (48% of 33 packs in WYO and 36% of 45 packs statewide in Wyoming, including 2 packs that were removed following confirmed livestock depredation) were involved in ≥ 1 depredation; 11 packs (33%) were involved in ≥ 2 depredations; and 9 packs (27%) were involved in ≥ 3 depredations in 2012. Agency control efforts removed 43 depredating wolves in an effort to reduce livestock losses due to wolves (40

by USFWS before September 30, 2012 and 3 by WGFD after September 30, 2012; 14% of the wolf population in WYO known to be alive during 2012). The State of Wyoming paid \$195,264.00 in 2012 to compensate livestock owners who lost livestock to wolves.

Wolf Management in WYO

Hunting

Wolf Hunting Season Background: The WGFD implemented regulated wolf hunting as a population management tool in WYO following removal of ESA protections. Wolf hunting regulations (Chapter 47: Gray Wolf Hunting Seasons) were approved in April 2012 by the WGFC. Chapter 47 governs wolf hunting in WYO and was part of the management framework evaluated and approved by USFWS during the delisting process. Chapter 47 outlined specific WHAs, mortality quotas, season dates, reporting requirements, and other wolf hunting regulations in areas of WYO where and when wolves were designated as trophy game animals (the WTGMA and the Seasonal WTGMA from October 15 to the last day of February of the subsequent year). There were no hunting season dates or quotas for wolves occupying areas where and when they were designated as predatory animals and, accordingly, wolves could be hunted anytime without a license, in any legal manner in these areas. Chapter 47 included reporting requirements for wolves taken in areas designated as predatory animals and required that radio-collars, if present, be surrendered to WGFD at the time the wolf was registered.

The Plan required WGFD to delineate WHAs smaller than the 4 WHAs proposed in WYO in 2008. This allowed harvest to be focused where wolf conflicts with livestock and/or ungulate herds may be occurring while allowing for lower levels of harvest in core population areas where conflicts were minimal. Multiple factors were considered in determining WHA boundaries including distribution of livestock conflicts, areas where wolf predation may be impacting ungulate herds, land status and ownership (e.g., private lands, national parks, national forest land, etc.), seasonal changes in wolf designation (i.e., Seasonal WTGMA), and boundaries that were easily recognizable by WGFD and hunters. Eleven WHAs were delineated throughout the WTGMA to spatially distribute wolf mortality and the Seasonal WTGMA was included as a 12th WHA (Figure 4).

The WGFD held wolf hunting seasons in conjunction with fall big game hunting seasons. The majority of elk and/or deer seasons opened during mid-September and many elk seasons did not close until mid-November to late December. Wolves were delisted starting September 30, 2012, so open hunting seasons were set from October 1 to December 31, 2012. The wolf hunting season in WHA 12 (i.e., the Seasonal WTGMA) differed from the other 11 WHAs and opened on October 15 (the date wolves changed from predatory to trophy game animal designation as prescribed by statute) to December 31, 2012. Wolf harvest was limited by mortality quotas established for each WHA using a general license hunting structure in each WHA. Legal and illegal wolf harvest during the open hunting season counted toward these mortality quotas. The season for each WHA closed when the mortality quota was met or at the season end date, whichever occurred first.

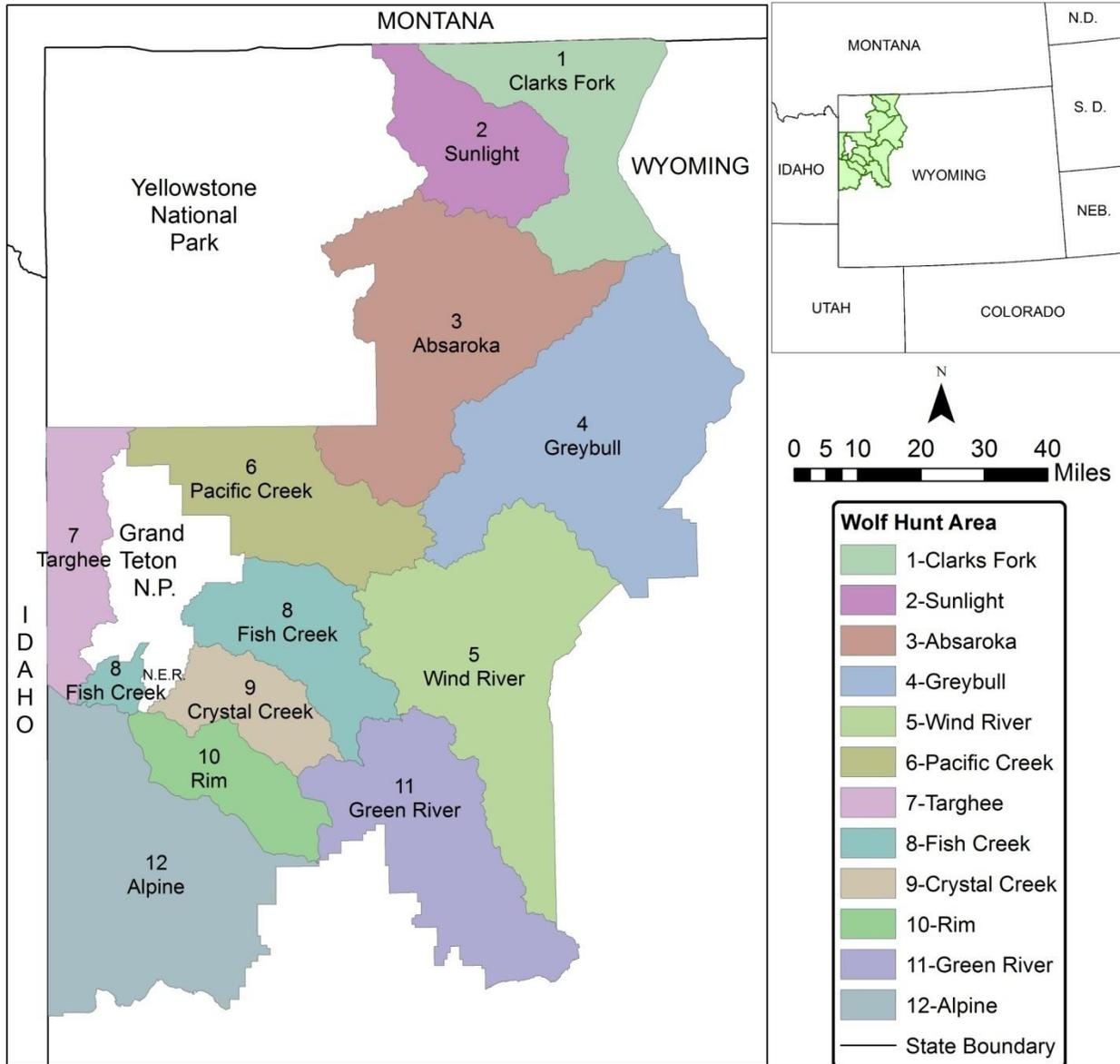


Figure 4. Wolf Hunt Areas delineated for the 2012 wolf hunting season in the WTGMA/Seasonal WTMGA in northwest Wyoming.

Total wolf mortality quotas were set to reduce the population from ≥ 192 wolves at the end of 2011 to approximately 172 wolves and 15 breeding pairs in the 12 WHAs at the end of 2012. The estimated human-caused mortality rate required to stabilize wolf population growth, natural mortality, estimated recruitment rates, and estimated non-harvest human-caused mortality rates (e.g., mortalities from control actions, illegal kills outside the hunting season, vehicle kills, etc.) were considered in the mortality quota calculation. The WGFD estimated the population would be reduced in the 12 WHAs from 192 wolves at the beginning of 2012 to approximately 172 wolves at the end of 2012 if 45.5% of the wolves present at the beginning of 2012 died from all human-caused mortality. The average non-harvest human-caused mortality rate for the previous 3 years (18.5%) was then subtracted from 45.5% to obtain a 27% harvest rate, which equaled a total mortality quota of 52 wolves when applied to the minimum wolf population estimate of

≥192 wolves present in the 12 WHAs at the beginning of 2012. The total quota of 52 wolves was then sub-divided among the 12 WHAs. WHAs with larger wolf populations, higher levels of livestock conflicts, and/or those where impacts to ungulates were a concern received a larger proportion of the total quota. This approach may ultimately reduce wolf-livestock conflicts and predation pressure on ungulate herds. However, monitoring will be required over several years to determine whether this occurs.

Wolf Hunting in the WTGMA/Seasonal WTGMA: A total of 4,492 wolf hunting licenses (4,294 resident and 198 nonresident licenses) were sold for the 2012 wolf hunting season. A total of 42 wolves out of the 52 wolf mortality quota were taken during open wolf hunting seasons in the 12 WHAs, 1 of which was illegally harvested and applied to the mortality quota (Table 3). Eight of the 41 legally harvested wolves (17%) were radio-collared, which was similar to the proportion of radio-collared wolves in the population (~16% of the population was collared prior to the 2012 hunting season) suggesting that there was no hunter selection for or against collared wolves. All hunters who legally harvested a wolf complied with reporting and registration requirements, including submission of a genetics sample. Six of the 12 WHAs closed once the mortality quota in those WHAs was met and 6 WHAs closed on the season end date of December 31, 2012. The quota was exceeded by 1 wolf in WHA 8 because 2 wolves were harvested at the same time in different locations when only 1 wolf was remaining on the mortality quota (Table 3). Harvest was spatially well distributed across WHAs, with harvest occurring in 20 of 26 packs (77%) that regularly use the 12 WHAs. Twenty-one packs had ≤2 wolves harvested (81%) and 3 wolves were harvested from each of the remaining 4 packs. Most harvest occurred in October (69%) and declined through November (21%) and December (10%). There was little difference between the gender of harvested wolves (22M vs. 19F), fewer black wolves than gray wolves were harvested (17 black vs. 24 gray), and nearly equal proportions of adults (>2 years old), subadults (1-2 years old), and pups (>1 year old) were harvested (12 adults vs. 15 subadults vs. 14 pups).

Three wolves from 2 trans-boundary packs (Lamar Canyon and Snake River) that were assigned to YNP at the end of 2012 were harvested in WYO during the wolf hunting season and are reported in the results of Tables 1 and 3. The Snake River pack had historically been assigned to WYO, but monitoring of a radio-collared wolf that dispersed from the Huckleberry pack in WYO and joined the Snake River pack in 2012 revealed they dened in YNP in 2012 so they were reassigned to YNP for end of 2012 population reporting. One wolf was legally harvested from the Snake River pack >6 miles from the YNP boundary in a portion of its traditional territory. Two wolves were legally harvested from the Lamar Canyon pack in WYO in 2012 after the pack travelled out of YNP into WYO. Both wolves were harvested >14 miles outside the YNP boundary in an area where portions of the migratory elk herd shared between YNP and WYO spend the winter. The cause of this pack's unusual movements may be linked to the continued reduction in available winter prey as the northern range elk herd declines, which may have prompted the pack to seek prey outside YNP boundaries in WYO. The removal of these 3 wolves is not expected to have significant impacts on the portion of the Wyoming wolf population present in YNP.

Wolf Hunting Outside the WTGMA/Seasonal WTGMA: A total of 25 wolves were harvested under predatory animal designation in 2012 (Table 3). Two of the 25 harvested wolves (8%)

Table 3. Summary of hunting seasons and wolf harvest in WYO in 2012; available online on the WGFD website at:

http://wgfd.wyo.gov/web2011/Departments/Hunting/pdfs/WOLF_SUMMARY0003880.pdf

WOLF SUMMARY 2012				4/1/2013 9:30 AM	
Note:	Hunt Areas highlighted in yellow indicate total harvest is one away from quota.				
Note:	Hunt Areas highlighted in orange indicate total harvest is at quota.				
Note:	Hunt Areas highlighted in pink indicate total harvest is over quota.				
	AREA	QUOTA FROM REGS	SEASON DATES GENERAL	HARVEST COUNTED TOWARDS QUOTA *1	AREA CLOSED
	1	4	October 1 - December 31	4	12/26/2012 @ 837 AM
	2	8		8	12/6/2012 @ 910 AM
	3	8		7	12/31/2012 per Regulation
	4	3		3	10/21/2012 @ 1:30 PM
	5	5		3	12/31/2012 per Regulation
	6	3		3	10-20-2012 @ 2:30 PM
	7	1		0	12/31/2012 per Regulation
	8	7		8	11-24-12 @ 2:40 PM
	9	2		2	10-29-2012 @ 2:10 PM
	10	2		0	12/31/2012 per Regulation
	11	7		3	12/31/2012 per Regulation
	12	2		October 15 - December 31	1
	Total 2012 Trophy Quota	52	Total 2012 Trophy Harvest	42	
STATE WIDE	PREDATORY	No Quota	Total 2012 Predatory Zone Harvest	25	
*1 All legal or illegal human-caused gray wolf mortalities associated with hunting during the open season will be counted towards the quota.					
* Two wolves were illegally killed after the hunt area had closed and were not included in the hunt area total. The two mortalities will be factored into the 2012 minimum wolf population estimate. For further information see the December Wyoming Gray Wolf Management Month Update at: http://wgfd.wyo.gov/web2011/wildlife-1000380.aspx					
One wolf initially counted as a hunter harvest was a federal trapper control action.					

were radio-collared, which is less than the proportion of radio-collared wolves in the population (~16% of the population was collared prior to the 2012 hunting season). All persons who harvested a wolf under predatory animal designation complied with reporting requirements during 2012. Most wolves harvested under predatory animal designation were taken on private lands (60%), on Bureau of Land Management lands intermixed with private lands (20%), or at the interface of US Forest Service and private lands (<1.5 miles from private lands; 8%). The 3 wolves killed on interior US Forest Service lands were taken south of the Seasonal WTGMA boundary and at least 2 of which belonged to the Greys River pack, which caused extensive livestock damage in 2012. Tissue samples were voluntarily submitted for 23 of 25 wolves taken as predatory animals and will be included in the evaluation of genetic interchange between recovery areas. There was no difference between the gender of harvested wolves (12M vs. 13F) and slightly fewer black wolves than gray wolves were harvested (11 black vs. 14 gray). Most wolves taken as predatory animals were adults and subadults (12 adults vs. 8 subadults vs. 3 pups), which is expected because most wolves outside the WTGMA/Seasonal WTGMA would be single dispersing wolves or members of small establishing packs that did not produce pups in 2012. Few wolves have successfully formed packs and reproduced outside the WTGMA/Seasonal WTGMA even after 17 years of ESA protections because of chronic livestock damage.

Development of 2013 Wolf Hunting Seasons: Wolf hunting regulations are revised annually using an adaptive management approach that includes internal review within WGFD and an extensive public input process. Data collected during the previous and current year will be used to develop 2013 wolf hunting regulations, including the response of the population to the first year of wolf hunting. This data and other commitments made in the Plan and regulatory documents will be used to develop responsible, appropriate, and scientifically defensible wolf hunting seasons in 2013 that will ensure the wolf population remains above minimum delisting criteria. The WGFC will finalize the 2013 wolf hunting regulations in July 2013, which is later in the year than they were approved in 2012 (April 2012). This later approval date will allow WGFD to use the most relevant and recent data possible when developing wolf hunting season regulation recommendations.

Livestock Depredation

From 2000-09, the WYO wolf population increased annually, and since then stabilized between 200 and 250 wolves. During this period of wolf population growth, wolves also expanded in range and recolonized new areas. Beginning in 2006, USFWS switched to a more aggressive approach to wolf control following confirmed livestock depredation, leading to a decrease in the number of livestock losses despite an increase in the overall wolf population. Since 2000, wolves have commonly recolonized areas outside the WTGMA/Seasonal WTGMA, but have rarely persisted more than a year or 2 before being removed for confirmed livestock depredation. These persistent damage problems and subsequent control actions limited range expansion of wolves into unsuitable habitat even while under ESA protections. The state of Wyoming developed its wolf management framework to likewise restrict wolf range expansion into these areas of unsuitable habitat and high livestock density by designating wolves as predatory animals in these areas. Predatory animal designation is a tool that allows livestock producers more flexibility in protecting their livestock as well as liberal public harvest of wolves where conflicts

are common. In general, wolves living in areas with relatively high native ungulate densities and relatively low exposure to domestic livestock have caused fewer conflicts with livestock than wolves that recolonized areas of unsuitable habitat where large numbers of livestock grazed on private and public lands, especially those areas outside the WTGMA.

During 2012, reported livestock depredations in WYO were investigated by WGFD, WS, and USFWS. Only confirmed depredations were documented in this report and are based on specific criteria within WGFC Regulations (Chapter 28), and require verified evidence at the scene or on the livestock carcass indicating wolves were more likely than not responsible for the death of the individual livestock. In the majority of verified cases, this evidence includes bite marks from wolves with pre-mortem hemorrhaging and tissue damage on the livestock carcass affirming that wolves were directly responsible. The following livestock depredation statistics were based on confirmed livestock losses only.

In 2012, wolves in WYO were responsible for killing 157 head of livestock and 3 dogs. Confirmed livestock depredations included 44 cattle (31 calves and 13 cows/yearlings), 112 sheep, and 1 horse (Tables 1 and 4). An additional 5 calves and 1 dog were verified to have been injured by wolves but these animals recovered from their injuries. Confirmed sheep depredations were the second highest recorded in Wyoming since 2000, primarily because 2 new wolf packs became established in the Seasonal WTGMA during summer 2012 and caused significant depredation on summer sheep grazing allotments (Figure 5). There were also multiple single or small groups of wolves that killed sheep on summer sheep grazing allotments and on mixed private/public lands where wolves are designated as predatory animals. Most depredations occurred before delisting and before the beginning of the 2012 hunting season.

Table 4. Confirmed livestock depredations and number of wolves killed in control actions in WYO from 2000-12.

Depredations	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cattle	3	18	23	34	75	54	123	55	41	20	26	35	44
Sheep	25	34	0	7	18	27	38	16	26	195	33	30	112
Dogs	6	2	0	0	2	1	1	2	0	7	0	1	3
Goats	0	0	0	0	10	0	0	0	0	0	0	0	0
Horses	0	0	0	2	0	1	0	1	0	0	1	1	1
Wolves Controlled	2	4	6	18	29	41	44	63	46	31	40	36	43

Number of Packs Involved in Confirmed Depredations: Sixteen packs (48% of WYO packs in 2012) were involved in ≥ 1 depredation (Table 1 and Figure 6); 11 packs (33%) were involved in ≥ 2 depredations; and 9 packs (27%) were involved in ≥ 3 depredations in 2012. The Green River pack was responsible for 43% of cattle depredations (19 cattle). Three packs were responsible for 70% of sheep depredations [Greys River (24 sheep), Horse Creek (44 sheep), and Prospect (10 sheep)], all of which occupied territories with high domestic sheep numbers outside the WTGMA. Together, these 4 packs were responsible for 61% of all confirmed depredations.

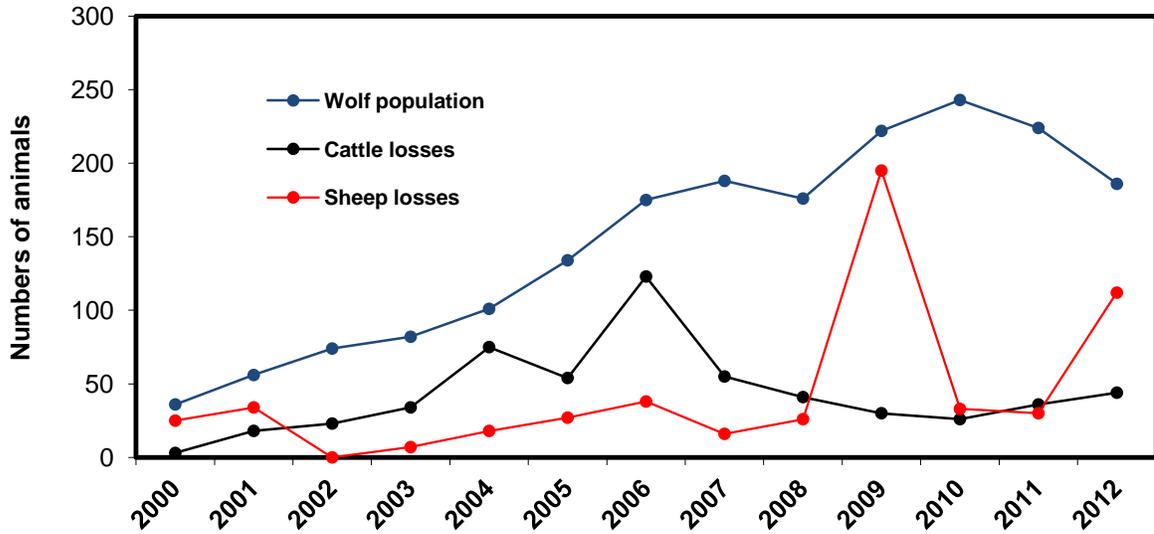


Figure 5. Annual wolf population size and number of confirmed cattle and sheep depredations/year in WYO from 2000-12.

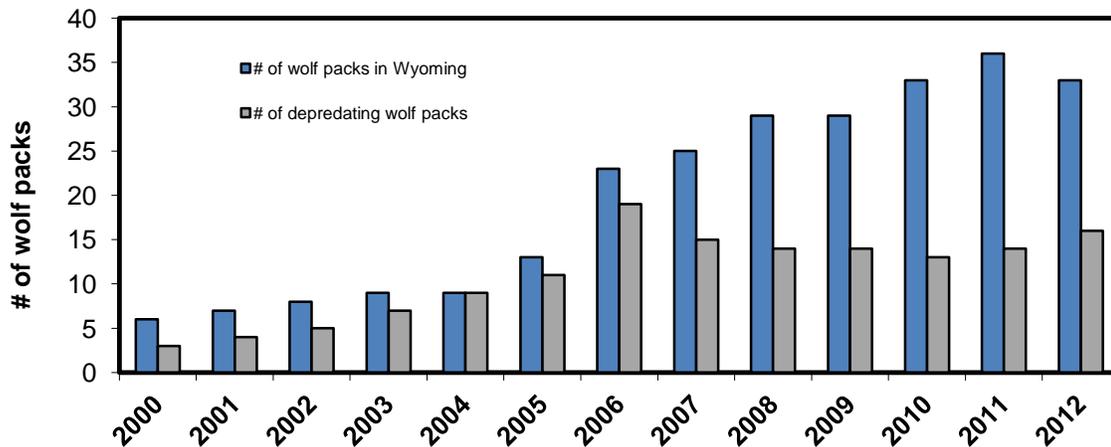


Figure 6. Annual number of wolf packs and number of wolf packs that were involved in ≥ 1 confirmed livestock depredation/year in WYO from 2000-12.

Seasonal Trend in Livestock Depredations: Confirmed cattle depredations followed a seasonal pattern in 2012 that was similar to 2011. Depredation began in early spring and increased through late summer with a peak in July-September before declining in late autumn (Figure 7). Most sheep depredations occurred in July and August, similar to the pattern observed in 2011 (Figure 8). This trend follows the pattern of open range summer grazing of livestock where livestock are distributed over large grazing allotments overlapping wolf distribution in northwest Wyoming.

Location of Livestock Depredations: In 2012, 80% (125 livestock) of all confirmed wolf depredations (27 cattle and 98 sheep) were on public land and 20% (31 livestock) of all depredations (17 cattle and 14 sheep) were on private land. Sixty-one percent (27 cattle) of

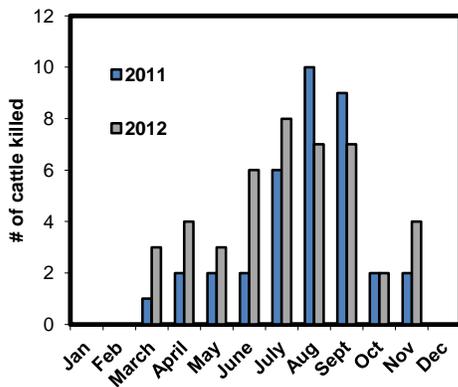


Figure 7. Number of confirmed cattle depredations/month in WYO from 2011-12.

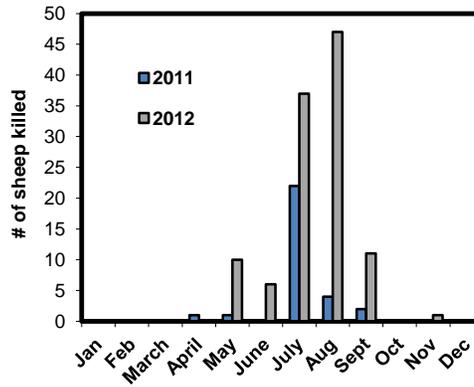


Figure 8. Number of confirmed sheep depredations/month in WYO from 2011-12.

cattle depredations were on public land and 39% (17 cattle) of cattle depredations were on private property. Eighty-seven percent (98 sheep) of sheep depredations occurred on public land and 13% (14 sheep) on private property (Figure 9).

In 2012, confirmed cattle depredations occurred in all but 2 WHAs, with most occurring in WHA 11 (41% of cattle depredations). Confirmed sheep depredations occurred primarily in WHA 12 (61% of confirmed sheep depredations), which is the Seasonal WTGMA, and in areas of the state where wolves are designated as predatory animals (38% of confirmed sheep depredations: Table 5).

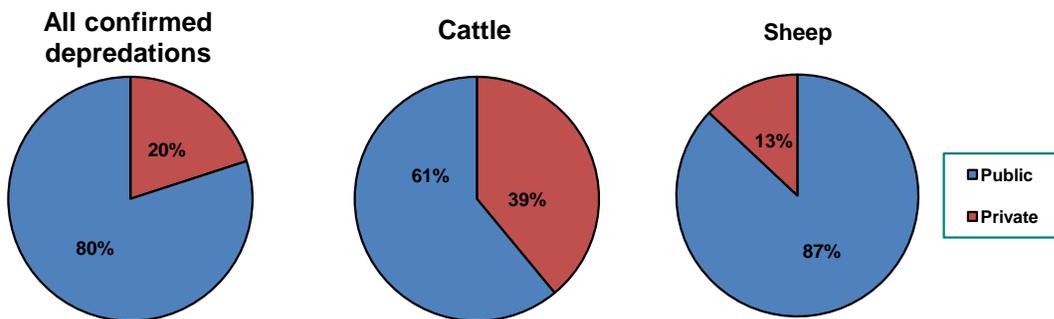


Figure 9. Land status where confirmed wolf depredations occurred in 2012.

Table 5. Confirmed cattle and sheep depredations in WYO by Wolf Hunt Area (WHA) and in areas of the state where wolves are designated as predatory animals (“Pred”) in 2012.

WHA	1	2	3	4	5	7	8	9	10	11	12	Pred	Total
Cattle	3	5	3	3	3	0	4	1	1	18	0	3	44
Sheep	0	0	0	0	0	1	0	0	0	0	68	43	112
Total	3	5	3	3	3	1	4	1	1	18	68	46	156

Management actions in response to confirmed livestock depredations included trapping and radio-collaring wolves, intensive monitoring, lethal removal through agency control actions, and issuing 24 shoot-on-sight permits (USFWS) and 3 lethal take permits (WGFD) to livestock producers. Two wolves were killed in 2012 under authority of federally issued shoot-on-sight permits and no wolves were killed under the authority of state issued lethal take permits. Non-lethal control was routinely considered, but was often not applicable or cost-effective in many areas in WYO due to: 1) specific wolf packs chronically killing livestock year after year; 2) unpredictable travel patterns and movements by wolves; and 3) very large wolf home ranges that covered vast areas including very large grazing allotments. In instances when non-lethal control methods were ineffective, wolves were killed through agency control actions in an attempt to prevent further livestock depredations. In addition to monies spent by WGFD, WS spent \$207,024.00 to investigate possible depredations and conduct control actions.

The level of lethal control where wolves were designated as predatory animals was disproportionately high compared to the number of wolves that existed in these areas. Approximately 12% of the wolf population lived in areas where wolves were designated as predatory animals, yet 28% of control-related wolf mortality occurred in this area in 2012. Likewise, approximately 7% of the wolf population lived in the Seasonal WTGMA, yet 16% of control-related wolf mortality occurred in this area in 2012. Removal rates where wolves were designated as predatory animals and in the Seasonal WTGMA were >2x higher than expected based on population size. Alternatively, control-related mortality was proportionately low in the WTGMA which supported 81% of the wolf population, but had only 56% of the control-related mortality. High depredation and removal rates relative to population size for wolves designated as predatory animals and for wolves within the Seasonal WTGMA support Wyoming's wolf management framework. This framework should contribute to reducing wolf-livestock conflict and the need for wolf agency removal in these areas in the future.

Compensation for Livestock Depredations: The WGFD paid \$195,264.00 to compensate livestock producers who lost livestock to wolves during 2012, including \$142,569.00 from the State of Wyoming and \$52,694.00 from the federal Wolf Livestock Demonstration Project Grant Program. Chapter 28 of WGFC regulations and state statute authorizes compensation only for damage that occurs in the WTGMA/Seasonal WTGMA. Livestock depredations in areas of the state where wolves are designated as predatory animals year-round are not eligible for compensation under statute or WGFC regulation Chapter 28.

Unacceptable Impacts to Ungulates or Elk Feedgrounds

Under the Plan, state statute, and WGFC Commission Regulation Chapter 21, WGFD 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.” 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 (hunting seasons aside) were taken in 2012 to address unacceptable impacts on a wild ungulate population or herd or to address wolf-caused conflicts on state-operated feedgrounds because none were documented. Analyses of impacts to ungulate populations remain part of ongoing management of wolves and their prey in Wyoming.

Wolf Management in WRR

Wolves could be taken only to defend life or property under WRR’s Wolf Management Plan in 2012. There were no public hunting seasons in WRR in 2012. One wolf was legally killed in 2012 for defense of life (Table 1).

Wolf Management in YNP

Area Closures

To prevent human disturbance of denning wolves during the sensitive period of pup rearing, visitor entry was closed to areas surrounding the dens and rendezvous areas of the Canyon and Lamar Canyon packs for various times in summer 2012. Den sites for the Blacktail Deer Plateau and Junction Butte packs were protected from disturbance coincidental to area closures for bear management in the park. Other packs’ den sites were not closed because historically low visitor use made it unlikely these dens would be disturbed.

Wolf Road Management Project

Since wolf reintroduction began in YNP, the Lamar Valley has become the premier location worldwide to observe free-ranging wolves. From 1996-2009, the main pack of interest was the Druid Peak pack, which denned in or near Lamar Valley most years. Since the dissolution of the Druid pack, the focus has been on the Lamar Canyon pack, which denned in 2011 and 2012 at the same sites historically used by the Druid pack.

YNP staff established the Wolf Road Management Project 13 years ago to better deal with the opportunities and problems that accompany increasing visitor numbers. The objectives for this program are: 1) human safety, 2) wolf safety, 3) visitor enjoyment, and 4) wolf monitoring and

research. A record number of visitor contacts were made by staff in the 2012 season (17,978 people) and the summer season was characterized by high wolf-viewing opportunities.

Habituated Wolves

There were fewer cases of habituated wolves in 2012. The Canyon and Lamar Canyon packs exhibited the most habituated behavior, with most of the behavior occurring during the spring and summer. Both packs den relatively close to park roads and must maneuver around park visitors and vehicles more often than packs in the backcountry. An uncollared yearling in the Lamar Canyon pack may have been tossed food by a visitor when the wolf was traveling near the roadway. The next time the wolf showed habituated behavior, she was hazed with cracker shells and afterward did not show signs of further habituation.

RESEARCH

Wolf Research in WYO

Research Completed in 2012

Jimenez, M.D., E.E. Bangs, D.W. Smith, D.K. Boyd, C.M. Mack, J. Holyan, S. Nadeau, C.A. Sime, V.J. Asher, E.H. Bradley, K. Laudon, S.A. Becker, S. Woodruff, and D.E. Ausband. In preparation. Wolf dispersal in the northern Rocky Mountains in Western United States: 1993-2008.

Middleton, A.D. 2012. The influence of large carnivore recovery and summer conditions on the migratory elk of Wyoming's Absaroka Mountains. PhD Dissertation. University of Wyoming, Laramie, USA.

Nelson, A.A., M.J. Kauffman, A.D. Middleton, M.D. Jimenez, D.E. McWhirter, J. Barber, and K. Gerow. 2012. Elk migration patterns and human activity influence wolf habitat use in the Greater Yellowstone Ecosystem. *Ecological Applications*. 22(8):2293-2307.

Stephenson, J., M. Jimenez, S. Dewey, and S. Cain. In preparation. Wolf predation patterns in an area of low winter elk density in northern Jackson Hole.

Trejo, B.S. 2012. Comparison of 2 methods used to characterize the summer diet of gray wolves (*Canis lupus*). M.S. Thesis. Humboldt State University, Arcata, CA, USA.

Ongoing Research

Title: Winter wolf predation patterns in Grand Teton National Park, WY.

Collaborators: J. Stephenson, S. Dewey, and S. Cain, GTNP; M. Jimenez, USFWS.

Description: This research is a continuation of previous winter wolf predation research in GTNP and is aimed at investigating winter wolf predation patterns on wolf packs that inhabit portions of GTNP through 2014.

Title: Summer wolf predation patterns in Grand Teton National Park, WY.

Collaborators: J. Stephenson, S. Dewey, and S. Cain, GTNP; M. Jimenez, USFWS.

Description: In 2011 and 2012, GTNP personnel documented summer predation patterns of the Phantom Springs pack with the aid of GPS collars. This research will continue in 2013, with an expected completion date of 2014.

Title: Change in elk cow:calf ratio during the winter period in the Upper Gros Ventre and Upper Green River drainages.

Collaborators: Wyoming Game and Fish Department

Description: This research is aimed at investigating whether WGFD can reliably measure changes in the cow:calf ratio of elk herds during winter using an early and late winter survey in addition to standard post-season surveys conducted during mid-winter. If the surveys produce reliable results, they could be used to detect changes in cow:calf ratios during the wintering period and, if necessary, could prompt further research in determining the cause of changes. This project is expected to run through spring 2014.

Wolf Research in YNP

Research Completed in 2012

Almberg, E.S., P.C. Cross, A.P. Dobson, D.W. Smith, and P.J. Hudson. 2012. Parasite invasion following host reintroduction: a case study of Yellowstone's wolves. *Philosophical Transactions of the Royal Society B*. 367(1604):2840-2851.

MacNulty, D.R., D.W. Smith, L.D. Mech, J.A. Vucetich, and C. Packer. 2012. Nonlinear effects of group size on the success of wolves hunting elk. *Behavioral Ecology*. 23:75-82.

Metz, M.C., D.W. Smith, J.A. Vucetich, D.R. Stahler, and R.O. Peterson. 2012. Seasonal patterns of predation for gray wolves in the multi-prey system of Yellowstone National Park. *Journal of Animal Ecology*. 81: 553–563.

Stahler, D.R., D.R. MacNulty, R.K. Wayne, B. vonHoldt, and D.W. Smith. 2012. The adaptive value of morphological, behavioural and life-history traits in reproductive female wolves. *Journal of Animal Ecology*. 82: 222–234.

Ongoing Research

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

prey (e.g., sex, species, nutritional condition), and characteristics of kill sites.

Elk Research: As part of a National Science Foundation – Long Term Research in Environmental Biology grant awarded to the Yellowstone Wolf Project in 2012, a long-term study of wolf impacts on the northern range elk population continues. This work has developed into a large-scale project consisting of 2 objectives: 1) to determine the influence of wolf predation on the survival, recruitment, and age structure of northern range elk herd, and 2) determine the relative influence of top-down and bottom-up factors on the movement of elk in northern YNP, and to evaluate the influence of these movement patterns on elk survival and reproduction. We are now tracking 71 elk instrumented with 30 GPS and 51 VHF radio-collars. Collared elk are monitored for survival and calf recruitment throughout the year.

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

Pelican Valley Wolf, Grizzly Bear, and Bison: Starting in 1999, the Yellowstone Wolf Project has monitored wolves, bison, and grizzly bears from a hilltop observation point in Yellowstone's Pelican Valley for 2-4 weeks during March. The primary goal for this study is to document the behavioral interactions between wolves, bison, and grizzly bears to: 1) identify patterns of wolf predation on bison; 2) determine how the risk of wolf predation influences bison foraging behavior, movement, and habitat use; and 3) assess the importance of wolf-killed ungulates for grizzly bears emerging in early spring.

Population Dynamics: Using data from a radio-marked population, year-round research focuses on understanding the major components of wolf population dynamics (births, deaths, immigration, and emigration). Monitoring efforts through ground and aerial tracking and observations provide annual census size, territory size and use, reproductive success, cause-specific mortality, survival, and other life history patterns. Data on social behavior and pack structure are collected to investigate patterns of dispersal, social stability, territoriality, and age structure. Necropsies of all recovered radio-collared individuals and uncollared wolves provide cause-specific mortality data.

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

Breeding Behavior: During January and February each year, project staff monitor YNP packs for courtship and breeding behaviors. The opportunity to study breeding behavior in wild wolves

is unprecedented, and this study is designed to investigate the role of interacting social and ecological factors influencing individuals' attempts to breed and their relative fitness consequences.

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

Wolf Capture and Handling: Each year, approximately 25-30 wolves are helicopter darted and radio-collared. Handling of individuals provides data on morphometrics, disease, genetic sampling, age, sex, breeding status, and condition. Both VHF and GPS collars are deployed, and provide the basis for nearly all other aspects of YNP's wolf research program.

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

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

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

Wolf Spatial Dynamics: Thousands of wolf radio locations, both VHF and GPS, have been gathered since wolves were reintroduced to YNP in 1995. Rigorous analyses using these locations have begun examining many questions concerning habitat use and territoriality. Year-to-year changes in territory use are being related to variables such as elk density and distribution,

intraspecific strife, pack size, and reproduction. Other analyses underway are habitat use (using Resource Selection Functions; RSF), travel and territory size, summer vs. winter, and night vs. day, as well as comparisons between GPS and VHF collars.

Collaborative Research

Title: Wolf habitat selection at the territory level: seasonal and interannual variation and influence on reproductive success

Graduate Student: Alessia Uboni, completed PhD in Forestry

Committee Chair and University: Dr. John A. Vucetich, School of Forest Resources and Environmental Science, Michigan Technological University

Title: Elucidating evolutionary processes in North American gray wolves: demographic history, coat coloration, and ecotype-specific selection.

Graduate Student: Rena M Schweizer, PhD candidate

Committee Chair and University: Dr. Robert K Wayne, Department of Ecology and Evolutionary Biology, University of California, Los Angeles

Title: Modeling the effects of environmental change on wolf population dynamics

Graduate Student: Dr. Sarah Cubaynes, Post-doctoral research associate

Committee Chair and University: Dr. Tim Coulson, Department of Zoology, University of Oxford.

Title: Survival of Northern Rocky Mountain wolves: Phase II

Graduate Student: Jack Massey, PhD candidate

Committee Chair and University: Dr. Tim Coulson, Department of Zoology, University of Oxford.

Title: Groups and mortality: their effects on cooperative behavior and population growth in a social carnivore

Graduate student: David Ausband, PhD candidate

Committee Chair and University: Dr. Michael S. Mitchell, Advisor, University of Montana, Wildlife Biology Program

Title: Influence of top-down and bottom-up forces on movement and habitat use of northern Yellowstone elk.

Graduate Student: Michel T. Kohl, PhD candidate

Committee Chair and University: Dr. Daniel R. MacNulty, Department of Wildland Resources, Utah State University.

Title: Assessing the impact of wolf predation on the demography and age structure of northern Yellowstone elk.

Graduate Student: Ryan Kindermann, PhD candidate

Committee Chair and University: Dr. Daniel R. MacNulty, Department of Wildland Resources, Utah State University

Title: Dynamics of predator-prey space use in a wolf-bison system.

Graduate Student: Aimee Tallian, PhD candidate

Committee Chair and University: Dr. Daniel R. MacNulty, Department of Wildland Resources, Utah State University

Title: Group composition effects on interpack aggressive interactions in Yellowstone wolves

Graduate Student: Aimee Tallian, PhD candidate

Committee Chair and University: Dr. L. D. Mech, Department of Natural Resources, Science, and Management, University of Minnesota

Title: The dynamics and impacts of sarcoptic mange in Yellowstone's wolves

Graduate Student: Emily Almberg, PhD candidate

Committee Chair and University: Dr. Peter Hudson, Department of Biology, Penn State University

OUTREACH

Outreach in WYO

In 2012 WGFD, personnel gave numerous formal presentations on wolf biology, monitoring, and management to the general public, special interest groups, and other agencies and associations, including 10 public information gathering meetings discussing proposed regulatory changes for wolves in WYO (including an internet-based webinar) and more than 15 Living in Lion, Bear, and Wolf Country Workshops across western Wyoming. WGFD personnel were also interviewed for many magazine, newspaper, and television feature stories. As part of normal wolf monitoring and management activities, WGFD personnel interacted with members of the public on a daily basis and strove to make these interactions positive and informative in order to increase the public's involvement and understanding of wolf monitoring and management throughout Wyoming.

The WGFD, in cooperation with the Wyoming Animal Damage Management Board, produced a brochure titled, "Wolves in Wyoming: A Guide for Livestock Producers" to provide guidance for livestock producers who experience damage to livestock caused by wolves. The brochure is available at WGFD regional offices or by download at the following link:

http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/WOLF_LIVESTOCK_BROCHURE003179.pdf

Outreach in WRR

During fall 2012, tribal members purchasing hunting permits and tags at the Ethete TFGD office were asked to fill out a short survey. The intent was to gather feedback on opinions of tribal hunters pertaining to wolves on WRR. The TFGD surveyed 180 tribal members (17% of the approximately 1,060 tribal members that hunt). Most respondents had seen a wolf on WRR (75%), most believed wolves should be hunted (83%), most would hunt wolves if given the

opportunity (79%), and most believed wolves that depredate on livestock should be killed (81%). Individuals who had seen a wolf held more negative views toward them, responding that they liked wolves less than those who had not seen a wolf and believed wolves would impact big game.

Outreach in YNP

Yellowstone Wolf Project staff gave 280 formal talks and 89 interviews. Talks were at both scientific conferences and to general audiences. Interviews were to all forms of media. Yellowstone Wolf Project staff assisted visitors in the field helping 27,500 people view wolves, making 17,978 visitor contacts and giving hundreds of informal talks.

CONTRIBUTORS

Many personnel contributed to the content of the 2012 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:

- WGFD: Ken Mills and Robert Trebelcock
- USFWS: Mike Jimenez and Scott Becker
- GTNP: Sarah Dewey and John Stephenson
- WS: Rod Krischke, Rod Merrell, Jim Pehringer, and Vivian Meeks

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

- USFWS: Pat Hnilicka
- TFGD: Ben Snyder

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

- NPS: Doug Smith, Dan Stahler, Erin Stahler, Matthew Metz, Kira Quimby, Rick McIntyre, Caitlin Ruhl, Hans Martin, Ryan Kindermann, Nate Bowersock, and Molly McDevitt

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WYO

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Kerry Murphy at the Bridger-Teton National Forest; Andy Pils and Dianne Probasco at the Shoshone National Forest; Steve Kallin, Paul Santavy, Eric Cole, and Marty Meyer at NER also assisted in data collection. We recognize a successful program needs a strong base of support and to all of the above we are indebted.

TFGD

We gratefully acknowledge the following for their assistance with wolf management on WRR: Mike Mazur, and Laurie Connell (USFWS); Ben Snyder, Western Thayer, Ken Smith, Ben Warren, and Lynelle Shakspeare (TFGD).

YNP

We thank the paid and volunteer staff who assisted in monitoring YNP wolves in 2012, including Colby Anton, Aidan Beers, Sarah Cubaynes, Cayley Faurot-Daniels, Jared Green, Josh Irving, Jack Massey, Nathan Muhn, Peter Mumford, Rebecca Raymond, Steve Ruff, Michael Roesch, Joel Ruprecht, Aimee Tallian, Julie Tasch, Jamie Walton, Tanya Wolf, and Travis Wyman. Some of these staff members were paid technicians with funding provided by the Yellowstone Park Foundation.

We continue to be impressed by, and thank, the many interested people who come forward every year to work with YNP wolves. First and foremost are the Wolf Project staff including volunteers, whom without we would accomplish much less. The Yellowstone wolf watching community over the years has always helped when they can and to them we are appreciative. We also thank the many generous individuals, foundations and organizations who provided approximately \$5 million in grants through the Yellowstone Park Foundation to the Wolf Project since 1996. Continued support from Canon U.S.A, Inc., an anonymous donor, The Tapeats Fund, the Twin Spruce Foundation, the Perkin-Prothro Foundation, the participants in the wolf collar sponsorship program, and the National Science Foundation grants DEB-0613730 and DEB-1245373 are also critical to our success and we thank all of those mentioned above.

We also appreciate safe piloting from Roger Stradley of Gallatin Flying Service, Steve Ard of Tracker Aviation, and Bob Hawkins of Sky Aviation.

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- Mitchell, M.S., D.E. Ausband, C.A. Sime, E.E. Bangs, J.A. Gude, M.D. Jimenez, C.M. Mack, T.J. Meier, M.S. Nadeau, and D.W. Smith. 2008. Estimation of successful breeding pairs for wolves in the northern Rocky Mountains, USA. *Journal of Wildlife Management*. 72:881-891.