2017 Wyoming Grizzly Bear Job Completion Report

Wyoming Game and Fish Department
Large Carnivore Section
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INTRODUCTION

This completion report summarizes grizzly bear work completed by the Wyoming Game and Fish Department's (Department) Large Carnivore Section (LCS) and regional personnel during 2017. In the past, this information was included in multiple reports that were not readily available to agency personnel, the legislature, or the public. This report allows the Department to present information pertaining to grizzly bears in Wyoming in one cohesive document available to all interested parties.

POPULATION MONITORING – TRAPPING SUMMARY

Annual trapping of grizzly bears by the Department for population monitoring is similar to the annual monitoring programs for other species such as elk and deer. While the methods may differ, the goal is the same; to collect the data necessary to conserve and manage the populations. In addition, data collected during annual monitoring has been extremely useful in answering many important questions regarding the Greater Yellowstone Ecosystem (GYE) grizzly bear population.

Data on grizzly bear survival and reproduction, biological samples, body condition, and collar locations are vital components of the overall population monitoring program. This information provides data that enables us to accurately monitor the grizzly bear population in relation to recovery goals in the GYE.

To maintain a representative sample of marked grizzly bears in the population, trapping crews systematically trap in occupied grizzly bear habitats. Trapping crews move to new areas as collars are deployed and trapping ceases by early fall to avoid conflicts with hunters during big game hunting seasons. The following summarizes trapping efforts for the 2017 season.

2017 WGFD Dubois/Moccasin Basin Grizzly Bear Trapping Summary

For 2017, trapping efforts focused on the Horse Creek, Long Creek, and Warm Springs areas of the Shoshone National Forest and the Moccasin Basin/North Fork Fish Creek area on the Bridger-Teton National Forest from 30 May to 28 July, 2017. Information from collared grizzly bears provides data on survival, reproduction, distribution, habitat use, and movements of grizzly bears.

Trapping occurred on 18 sites. All traps, baits, scent lures, and other equipment were removed from sites on or before 28 July and warning and closure signs were removed on or before 1 August. Eighteen grizzly bears were captured in 17 capture events (two juvenile grizzly bears were captured in one event). Eleven grizzly bears were radio-telemetered with collars or ear tag transmitters (Table 1). Three black bears were also captured and released.

Table 1. Grizzly bears captured in the Horse Creek/Long Creek/Warm Springs areas of the Shoshone National Forest and Moccasin Basin/North Fork Fish Creek on the Bridger-Teton National Forest, 2017.

Bear ID	Capture Date	Sex/Age Class	Location	Collar
889	6/1/17	Yearling male	Elkhorn Ridge	VHF ear tag
891	6/5/17	Adult male	Charlie Cr	GPS collar
892	6/8/17	Adult male	East Fk Long Cr	GPS collar
G227	6/11/17	Subadult male	Winchester Meadows	No collar
G228	6/12/17	Adult male	Double Cabin	No collar
893	6/16/17	Adult female	Charlie Cr	GPS collar
894	6/16/17	Adult male	Elkhorn Ridge	GPS collar
895	6/18/17	Adult female	Tappan Cr	GPS collar
G229	6/19/17	Subadult male	East Fk Long Cr	No collar
896	6/20/17	Subadult female	Tappan Cr	VHF collar
G230	6/23/17	Subadult male	Elkhorn Ridge	No collar
816	6/30/17	Adult male	Gravel Pit	GPS collar
898	6/30/17	Adult female	Trout Cr	GPS collar
---	7/2/17	Two 2yr old offspring of 898	Enos Cr	No collars
900	7/10/17	Yearling female	Beauty Park	VHF ear tag
G231	7/12/17	Yearling female	Beauty Park	No collar
905	7/20/17	Adult female	Beauty Park	GPS collar

This 20 year old male grizzly bear was monitored for an additional two years before succumbing to natural mortality, likely in the form of intraspecific killing by another grizzly bear(s).

GRIZZLY BEAR OBSERVATION FLIGHTS

The Department and other members of the Interagency Grizzly Bear Study Team (IGBST), conduct observation flights in order to monitor the Greater Yellowstone grizzly bear population and estimate abundance. In 2017, the Grizzly Bear Observation Units (GBOUs) in the southern portion of the Greater Yellowstone Ecosystem (GYE; Figure 1) were flown once in an effort to reduce flight time and because grizzly bears in these GBOUs are very difficult to observe. This survey was conducted in June to maximize the potential for grizzly bear observations in these GBOUs. An exception to this were GBOUs 26A and 26B, which were flown once in June and once in July due to higher numbers of grizzly bears in these GBOUs. The remaining GBOUs in the northern GYE were flown in July and August. During the first round of flights a comparable number of grizzly bears were observed (including June flights) than in 2016. A total of 197 total grizzly bears were observed in the Wyoming GBOUs in 2017 compared to 202 bears observed in 2016. The number of females with cubs-of-year (Fcoy or COY) groups observed during Round 1 was also slightly lower than that of 2016, with 18 observed compared to 20 in 2016 (Table 2).

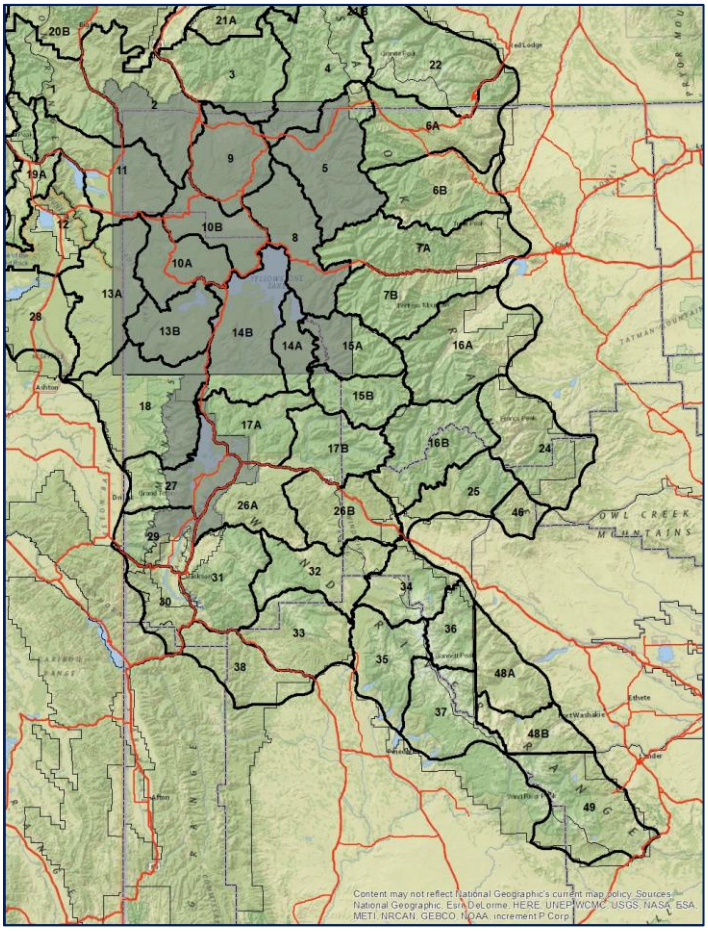


Figure 1. Grizzly Bear Observation Units (GBOUs) in the Wyoming portion of the Greater Yellowstone Ecosystem.

Table 2. Composition of grizzly bears observed in Round 1 during 2017 observation surveys in Wyoming.

		Females with COY			Females with Yearlings			Females with 2 Year Olds			All Other Grizzly Bears	Total No. Bears Observed
		# of COY			# of Yrlngs			# of 2 Yr Olds				
Date	Unit	1	2	3	1	2	3	1	2	3		
7/21	6A	0	1	0	0	0	0	0	0	0	0	3
7/21	6B	0	1	0	0	1	0	0	0	0	4	10
7/22	7A	0	0	0	0	0	0	0	0	0	12	12
7/23	7B	0	1	0	0	0	0	0	0	0	18	21
7/26	15A	0	1	0	0	1	0	0	0	0	1	7
7/27	15B	0	0	0	0	0	0	0	0	0	3	3
7/24	16A	3	3	1	1	1	1	0	0	0	17	45
7/25	16B	1	1	1	0	0	1	0	0	0	16	29
7/20	17A	0	1	0	0	0	0	0	0	0	8	11
7/19	17B	0	1	0	0	0	0	0	0	0	2	5
7/29	24	1	1	0	1	1	0	0	2	0	23	39
7/30	25	0	0	0	0	1	0	0	0	0	4	7
6/29	26A	0	0	0	0	0	0	0	1	0	0	3
6/15	26B	0	0	0	1	0	0	0	0	0	0	2
6/30	29	0	0	0	0	0	0	0	0	0	0	0
6/18	30	0	0	0	0	0	0	0	0	0	0	0
6/19	31	0	0	0	0	0	0	0	0	0	0	0
6/20	32	0	0	0	0	0	0	0	0	0	0	0
6/21	33	0	0	0	0	0	0	0	0	0	0	0
6/22	34	0	0	0	0	0	0	0	0	0	0	0
6/23	35	0	0	0	0	0	0	0	0	0	0	0
6/24	36	0	0	0	0	0	0	0	0	0	0	0
6/25	37	0	0	0	0	0	0	0	0	0	0	0
6/26	38	0	0	0	0	0	0	0	0	0	0	0
6/27	49	0	0	0	0	0	0	0	0	0	0	0
All Areas		5	11	2	3	5	2	0	3	0	108	197

Only the northern GBOUs were flown during the second round of flights, with the exception of GBOUs 26A and 26B. The number of grizzly bears observed in Round 2 was similar to the number observed during the first round of flights. The number of grizzly bears observed during Round 2 decreased slightly to 189 in 2017 from 197 the previous year. However, 39 coy were observed during Round 2 flights; an increase of 16 bears over the number observed in 2016 (Table 3).

Table 3. Composition of grizzly bears observed in Round 2 during 2017 observation surveys in Wyoming.

		Females with COY			Females with Yearlings			Females with 2 Year Olds			All Other Grizzly Bears	Total No. Bears Observed
		# of COY			# of Yrlngs			# of 2 Yr Olds				
Date	Unit	1	2	3	1	2	3	1	2	3		
8/16	6A	0	0	0	0	0	0	0	0	0	0	0
8/16	6B	1	1	0	0	0	0	0	0	0	19	24
8/17	7A	0	2	0	0	0	0	0	0	0	15	21
8/18	7B	0	0	0	0	0	0	0	0	0	15	15
8/24	15A	0	0	0	1	0	0	0	0	0	0	2
8/24	15B	0	1	0	0	0	0	0	0	0	3	6
8/23	16A	2	4	1	1	1	0	0	0	1	14	43
8/22	16B	0	4	0	1	0	0	1	0	0	5	21
8/15	17A	0	0	0	0	0	0	0	0	0	1	1
8/14	17B	0	2	1	0	0	0	0	0	0	8	18
8/25	24	0	1	0	1	2	0	0	0	0	27	38
8/28	25	0	0	0	0	0	0	0	0	0	0	0
7/28	26A	0	0	0	0	0	0	0	0	0	0	0
7/18	26B	0	0	0	0	0	0	0	0	0	0	0
All Areas		3	15	2	4	3	0	1	0	1	107	189

MOTH SITE USE BY GRIZZLY BEARS

Taken from: *Grizzly Bear Use of Insect Aggregation Sites* *(Dan D. Bjornlie, Wyoming Game and Fish Department; and Mark A. Haroldson, Interagency Grizzly Bear Study Team)*

Army cutworm moths (*Euxoa auxiliaris*) were first recognized as an important food source for grizzly bears in the GYE during the mid 1980s (Mattson et al. 1991*b*, French et al. 1994). Early observations indicated that moths, and subsequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. Because insects other than army cutworm moths may be present and consumed by bears (e.g., ladybird beetles [Coccinellidae family]) as well, we generally refer to such areas as "insect aggregation sites." Within the GYE, observations indicate army cutworm moths are the primary food source at these sites.

Since their discovery, numerous bears have been counted on or near these aggregation sites due to excellent sightability from a lack of trees and simultaneous use by multiple bears. However, complete tabulation of grizzly bear presence at insect sites is extremely difficult. Only a few sites have been investigated by ground reconnaissance and the boundaries of sites are not clearly known. In addition, it is likely that the size and location of aggregation sites fluctuate from year to year with moth abundance and variation in environmental factors such as snow cover.

Since 1986, when insect aggregation sites were initially included in aerial observation surveys, our knowledge of these sites has increased annually. Our techniques for monitoring grizzly bear use of these sites have changed in response to this increase in knowledge. Prior to 1997, we delineated insect aggregation sites with convex polygons drawn around locations of bears seen feeding on moths and buffered these polygons by 500 m. However, this technique overlooked small sites due to the inability to create polygons around sites with fewer than 3 locations. During 1997–1999, the method for defining insect aggregation sites was to inscribe a 1-km circle around the center of clusters of observations in which bears were seen feeding on insects in talus and scree habitats (Ternent and Haroldson 2000). This method allowed trend in bear use of sites to be annually monitored by recording the number of bears documented in each circle (i.e., site).

We developed a new technique in 2000 (D. Bjornlie, Wyoming Game and Fish Department, unpublished data) that delineates sites by buffering only the locations of bears observed actively feeding at insect aggregation sites by 500 m; this distance was used to account for error in aerial telemetry locations. The borders of the overlapping buffers at individual insect sites are dissolved to produce a single polygon for each site. These sites are identified as "confirmed" sites. Because these polygons are only created around feeding locations, the resulting site conforms to the topography of the mountain or ridge top where bears feed and does not include large areas of non-talus habitat that are not suitable for cutworm moths. Records from the grizzly bear location database from July 1 through September 30 of each year are then overlaid on these polygons and enumerated. This new technique substantially decreased the number of sites described in prior years, in which locations from both feeding and non-feeding bears were used. Therefore, we use this technique for the annual analysis completed for all years. Areas suspected as insect aggregation sites but dropped from the list of confirmed sites using this technique, and sites with only one observation of an actively feeding bear or multiple observations in a single year, are termed "possible" sites and will be monitored in subsequent years for additional observations of actively feeding bears. These sites may then be added to the confirmed sites list. When possible sites are changed to confirmed sites, analysis is done on all data back to 1986 to determine the historic use of that site. Therefore, the number of bears using insect aggregation sites in past years may change as new sites are added, and data from this annual report may not match that of past reports. In addition, as new observations of actively

feeding bears are added along the periphery of existing sites, the polygons defining these sites increase in size and, thus, more overlaid locations fall within the site. This retrospective analysis brings us closer each year to the "true" number of bears using insect aggregation sites in past years.

Analysis of grizzly bear use of confirmed sites in 2016 resulted in an additional observation of actively feeding grizzly bears on one possible site, which resulted in this site being classified as confirmed. In addition, there was one observation of an actively feeding grizzly bear at a previously undocumented site and therefore, one new possible site was added in 2016. Thus, there were 31 confirmed sites and 14 possible sites for 2016.

Analysis of grizzly bear use of insect aggregation sites in 2017 resulted in an additional 163 observations of actively feeding grizzly bears on previously identified confirmed sites. In addition, there were five observations of an actively feeding grizzly bears at previously undocumented sites and therefore, five new possible sites were added in 2017. Thus, there were 31 confirmed sites and 19 possible sites for 2017.

Overall insect aggregation site use by grizzly bears in 2017 (n = 296) was higher than 2016 (n = 217), but still slightly below peak the years of 2012–2014 (Table 3). The number of grizzly bears observed on sites and the percentage of confirmed sites with documented use by grizzly bears varies from year to year, suggesting that some years have higher moth activity than others (Figure 2), which may be due to variable snow conditions or the number of moths migrating from the plains. In 1993, a year with unusually high snowpack, the percentage of confirmed sites used by bears (Figure 2) and the number of observations recorded at insect sites (Table 23) were very low. In all other years, the percentage of insect aggregation sites used by grizzly bears varied between 50% and 80% (Figure 2).

The increase in use of insect aggregation sites by grizzly bears in 2017 is also apparent when bears observed only during regularly conducted observation flights (see "***Observation Flights***") are included (Figure 3). Because effort, as measured by hours flown, in the bear management units containing all confirmed insect aggregation sites has remained consistent since 1997, the change in the number of grizzly bears using insect aggregation sites suggests this increase was not due to change in observation effort (Figure 3). The increase in reported observations of grizzly bears using insect aggregation sites from ground-based observers and our increased use of GPS collars with satellite technology has resulted in the need to censor these locations to prevent a bias in comparisons with previous years. Therefore, the number of aerial telemetry locations and observations from Table 3 reflect this change and may differ from previous annual reports.

The IGBST maintains an annual list of unique females observed with cubs (see Table 5 in "***Estimating Number of Females with Cubs***"). Since 1986, 1,169 initial sightings of unique females with cubs have been recorded, of which 327 (28.0%) have occurred at (<500 m, n = 305) or near (<1,500 m, n = 22) insect aggregation sites (Table 24). In 2017, 12 of the 58 (20.7%) initial sightings of unique females with cubs were observed at insect aggregation sites; lower than the mean of 28.5% for the previous five years (2012–2016, Table 24).

Survey flights at or near (<1,500 m) insect aggregation sites contribute to the count of unique females with cubs; however, the contribution from these flights is typically low, with a 10-year mean of 13.0 initial sightings/year since 2008 (Table 4). If these sightings are excluded, a similar trend in the annual number of unique sightings of females with cubs is still evident (Figure 4), suggesting that other factors besides observation effort at insect aggregation sites are responsible for the increase in sightings of females with cubs over time.

Table 4. Summary statistics for grizzly bear use of confirmed insect aggregation sites , Greater Yellowstone Ecosystem, 1986–2017.

Year	Number of confirmed sites[a]	Number of sites used[b]	Number of aerial telemetry locations	Number of ground or aerial observations
1986	4	2	7	5
1987	5	3	3	17
1988	5	3	11	28
1989	9	7	9	41
1990	14	11	9	77
1991	16	12	12	169
1992	17	11	6	107
1993	18	3	1	2
1994	18	9	1	31
1995	20	11	7	39
1996	21	14	21	67
1997	22	15	17	83
1998	25	21	10	182
1999	25	14	26	156
2000	25	13	48	95
2001	26	18	23	127
2002	27	20	30	251
2003	27	20	9	163
2004	27	16	2	134
2005	29	19	16	197
2006	29	16	15	146
2007	29	19	19	161
2008	29	22	17	179
2009	31	23	9	170
2010	31	18	3	132
2011	31	19	9	162
2012	31	22	16	252
2013	31	22	25	295
2014	31	24	11	343
2015	31	21	13	210
2016	31	19	10	207
2017	31	21	20	276
Total			435	4504

[a] The year of discovery was considered the first year a telemetry location or aerial observation was documented at a site. Sites were considered confirmed after additional locations or observations in a subsequent year and every year thereafter regardless of whether or not additional locations were documented.

[b] A site was considered used if ≥1 location or observation was documented within the site during July–September of that year.

Table 5. Initial sightings of unique females with cubs on or near insect aggregation sites, Greater Yellowstone Ecosystem, 1986–2017.

Year	Number of unique females with cubs[a]	Number of sites with an initial sighting[b]	Initial sightings			
			Within 500 m[b]		Within 1,500 m[c]	
			n	%	*n*	%
1986	25	0	0	*0*	0	*0*
1987	13	0	0	*0*	0	*0*
1988	19	1	2	*10.5*	2	*10.5*
1989	16	1	1	*6.3*	1	*6.3*
1990	25	4	4	*16.0*	5	*20.0*
1991	24	7	13	*54.2*	14	*58.3*
1992	25	5	7	*28.0*	9	*36.0*
1993	20	1	1	*5.0*	1	*5.0*
1994	20	3	5	*25.0*	5	*25.0*
1995	17	2	2	*11.8*	2	*11.8*
1996	33	7	7	*21.2*	8	*24.2*
1997	31	8	11	*35.5*	11	*35.5*
1998	35	10	13	*37.1*	13	*37.1*
1999	33	3	6	*18.2*	7	*21.2*
2000	37	6	9	*24.3*	10	*27.0*
2001	42	7	13	*31.0*	13	*31.0*
2002	52	11	18	*34.6*	18	*34.6*
2003	38	11	20	*52.6*	20	*52.6*
2004	49	11	17	*34.7*	17	*34.7*
2005	31	5	7	*22.6*	8	*25.8*
2006	47	11	15	*31.9*	16	*34.0*
2007	50	10	17	*34.0*	17	*34.0*
2008	44	7	11	*25.0*	14	*31.8*
2009	42	4	6	*14.3*	7	*16.7*
2010	51	7	9	*17.6*	9	*17.6*
2011	39	6	7	*17.9*	7	*17.9*
2012	49	6	13	*26.5*	13	*26.5*
2013	58	8	14	*24.1*	15	*25.9*
2014	50	11	21	*42.0*	23	*46.0*
2015	46	7	11	*23.9*	13	*28.3*
2016	50	7	13	*26.0*	17	*34.0*
2017	58	7	12	*20.7*	12	*20.7*
Total	1,169		305		327	
Mean	36.5	6.1	9.5	24.1	10.2	25.9

[a] Initial sightings of unique females with cubs; see Table 5.

[b] Insect aggregation site is defined as a 500-m distance around a cluster of observations of bears actively feeding.

[c] This distance is 3 times what is defined as an insect aggregation site for this analysis because some observations may be of bears traveling to and from insect aggregation sites.

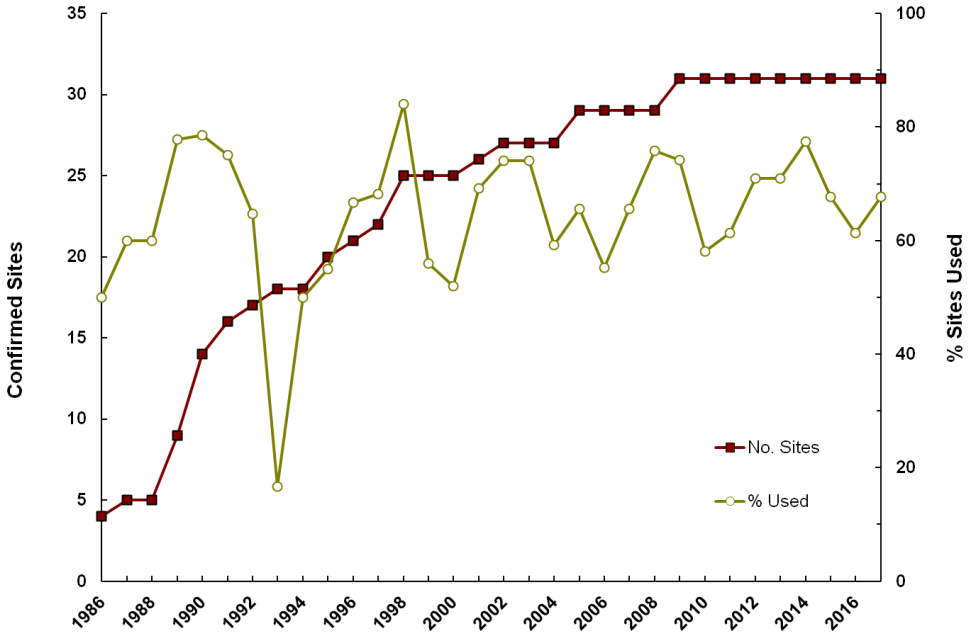


Figure 2. Annual number of confirmed insect aggregation sites and percent of those sites at which telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2017.

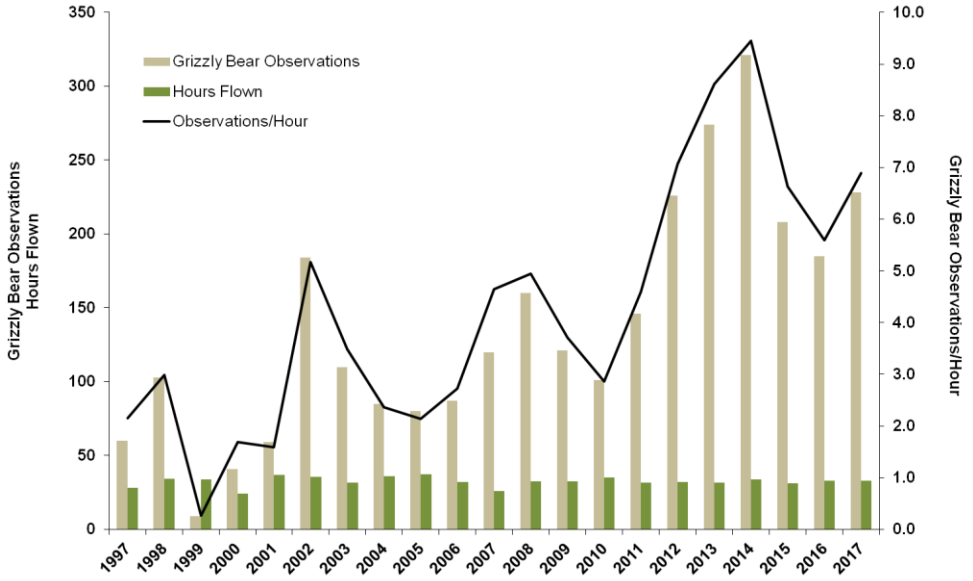


Figure 3. Number of grizzly bears observed (tan bars) on insect aggregation sites during observation flights only, hours flown (green bars) for these bear management units (BMU), and grizzly bear observations per hour (black line) during observation flights of BMUs containing all known insect aggregation sites, Greater Yellowstone Ecosystem, 1997–2017.

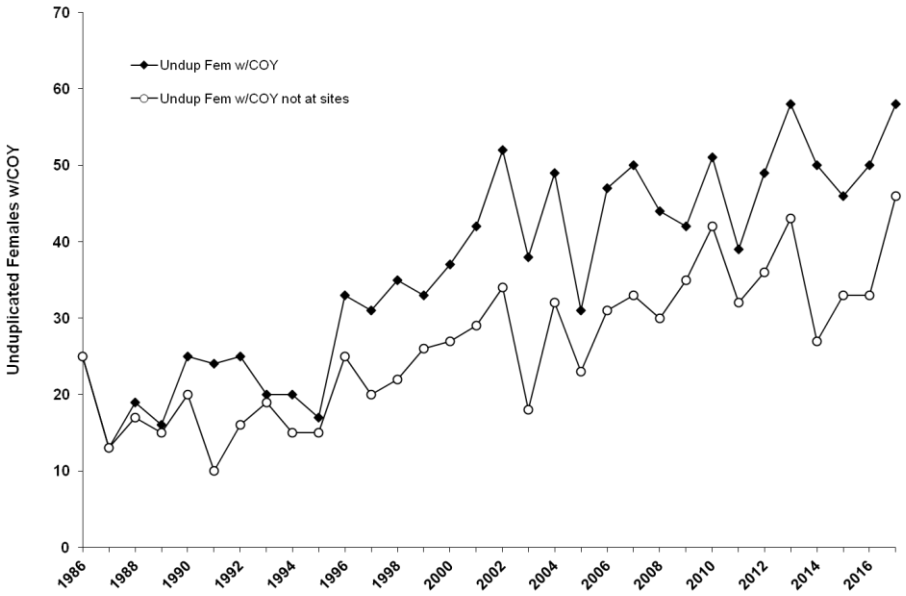


Figure 4. Total number of unique females with cubs observed annually in the Greater Yellowstone Ecosystem and the number of unique females with cubs not found within 1,500 m of known insect aggregation sites, 1986–2017.

Grizzly bears rolling rocks in search of moths (photo by J. Binfet).

2017 GRIZZLY BEAR POPULATION STATUS

The Department annually evaluates the status of the GYE grizzly bear population in order to maintain a recovered population. There are three recovery criteria that are assessed annually: 1) overall population size, 2) distribution of breeding females, and 3) evaluation of mortality. All of these criteria are specific to the DMA and are consistent with the Wyoming Grizzly Bear Management Plan (2016) and the 2016 Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Ecosystem (hereafter - 2016 Conservation Strategy). These data along with each recovery criteria are summarized below.

Demographic Recovery Criteria 1*: Maintain a minimum population size of 500 animals and at least 48 females with cubs-of-the-year within the DMA –* ***EXCEEDED***. Using the approved methods established in peer-reviewed scientific literature the IGBST estimated the grizzly bear population within the DMA at 718 individuals (Table 6.) based on a model averaged Chao2 estimate of 57 females with cubs-of-the-year (Figure 5.)

Table 6. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size derived using the Chao2 estimate for females with cubs of the year within the Demographic Monitoring Area, 2017.

		95% CI	
Segment	Estimate	Lower	Upper
Independent females (≥2 years old)	250	199	301
Independent males (≥2 years old)	250	195	305
Dependent young (cubs and yearlings)	217	196	238
Total	718	640	796

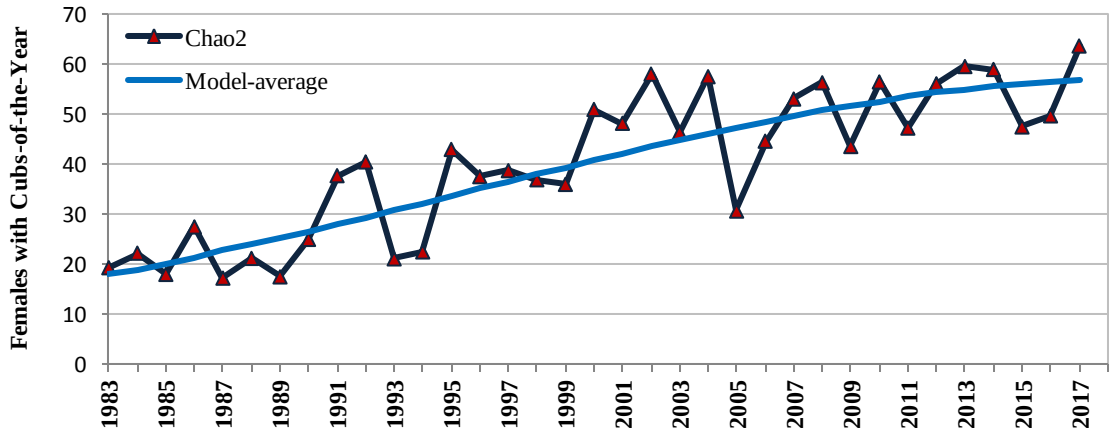


Figure 5. Annual estimates of females with cubs-of-the-year using Chao2 methodology and incorporation of the model average technique.

Demographic Recovery Criteria 2: *Sixteen of 18 bear management units (BMUs) within the PCA must be occupied by females with young, with no two adjacent bear management units unoccupied, during a 6-year sum of observations –* ***EXCEEDED***. This criterion has been exceeded since 1999 and in 2017 the Department documented females with young (cubs-of-the-year, yearlings, and/or two year olds) in 17 of 18 BMUs; furthermore expansion of the breeding population continues to be documented beyond the PCA and DMA boundaries.

Family group of grizzly bears crossing Wyoming Highway 120 in Park County east of the DMA boundary.

Demographic Recovery Criteria 3: *Maintain the population within the DMA around the 2002–2014 model-averaged Chao 2 estimate of 674 (95% CI = 600–747; 90% CI = 612–735) by maintaining annual mortality limits for independent-age (≥2 years old) females, independent-age males, and dependent young (cubs and yearlings) as shown in Table 2 of the 2016 Conservation Strategy –* ***MET (BELOW ALL MORTALITY THRESHOLDS)****.* Current mortality threshold rates based on a population size of 718 are 9% for independent females and dependent young, and 20% for independent males (Wyoming Grizzly Bear Management Plan (2016) and 2016 Conservation Strategy). All estimates of mortality for GYE grizzly bears in the DMA were below mortality thresholds (Table 7). It should be noted that for every reported loss of independent aged grizzly bears there is an estimate of "unknown/unreported loss" included in order to derive an estimate of "total mortality" which is used to compare to the annual mortality thresholds.

Table 7. Annual estimates and mortality statistics by population segment for grizzly bears in the Demographic Monitoring Area (DMA), Greater Yellowstone Ecosystem 2017. Only human-caused losses are counted against the mortality threshold for dependent young.

Population segment	2017 Estimate	Known/Probable Mortalities	Unknown/Unreported Mortalities[a]	Estimated Total Mortality	Mortality Limit	Mortality Threshold
Dependent young	217	12[b]		12[b]	22.5	BELOW
Independent Females	250	12	9	21	22.5	BELOW
Independent Males	250	20	13	33	50.0	BELOW

[a] Unknown, unreported mortality estimated based on Cherry et al. (2002).

[b] Documented 12 human-caused mortalities for Dependent Young toward thresholds.

PUBLICATIONS AND UPDATES

Personnel with the Department's LCS have been authors and/or collaborators of multiple peer-reviewed research papers and popular articles on grizzly bear ecology in recent years. These publications are merely examples of relevant information available for GYE grizzly bears and continue to be essential in demonstrating the recovery of the population. These publications are not opinion based or internet blogs, but rather represent the science and data that drive management and conservation of grizzly bears

For information specific to the Wyoming Game and Fish Department's grizzly bear management program, including links to publications, reports, updates, and plan visit: https://wgfd.wyo.gov/Wildlife-in-Wyoming/More-Wildlife/Large-Carnivore/Grizzly-Bear-Management

Additional information regarding other publications, annual reports, and peer-reviewed literature for the Yellowstone population of grizzly bears is summarized on the United States Geological Service web site at https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-science_center_objects=0#qt-science_center_objects

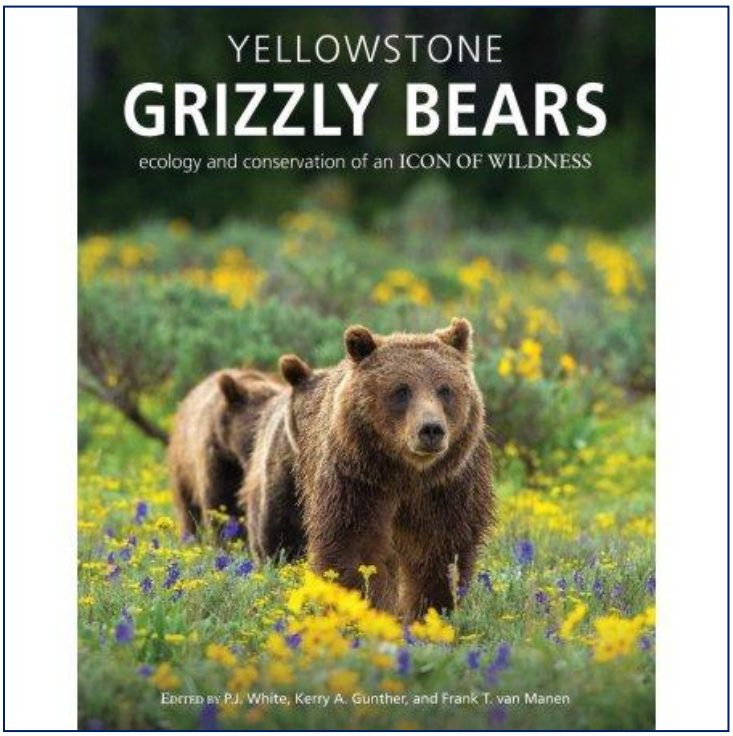
Potential paths for male-mediated gene flow to and from an isolated grizzly bear population

Peck, C. P., F. T. van Manen, C. M. Costello, M. A. Haroldson, L. A. Landenburger, L. L. Roberts, D. D. Bjornlie, and R. D. Mace. 2017. Potential paths for male-mediated gene flow to and from an isolated grizzly bear population. Ecosphere 8(10):e01969. 10.1002/ecs2.1969

Abstract
For several decades, grizzly bear populations in the Greater Yellowstone Ecosystem (GYE) and the Northern Continental Divide Ecosystem (NCDE) have increased in numbers and range extent. The GYE population remains isolated and although effective population size has increased since the early 1980s, genetic connectivity between these populations remains a long-term management goal. With only ~110 km distance separating current estimates of occupied range for these populations, the potential for gene flow is likely greater now than it has been for many decades. We sought to delineate potential paths that would provide the opportunity for male-mediated gene flow between the two populations. We first developed step-selection functions to generate conductance layers using ecological, physical, and anthropogenic landscape features associated with non-stationary GPS locations of 124 male grizzly bears (199 bear-years). We then used a randomized shortest path (RSP) algorithm to estimate the average number of net passages for all grid cells in the study region, when moving from an origin to a destination node. Given habitat characteristics that were the basis for the conductance layer, movements follow certain grid cell sequences more than others and the resulting RSP values thus provide a measure of movement potential. Repeating this process for 100 pairs of random origin and destination nodes, we identified paths for three levels of random deviation (θ) from the least-cost path. We observed broad-scale concordance between model predictions for paths originating in the NCDE and those originating in the GYE for all three levels of movement exploration. Model predictions indicated that male grizzly bear movement between the ecosystems could involve a variety of routes, and verified observations of grizzly bears outside occupied range supported this finding. Where landscape features concentrated paths into corridors (e.g., because of anthropogenic influence), they typically followed neighboring mountain ranges, of which several could serve as pivotal stepping stones. The RSP layers provide detailed, spatially explicit information for land managers and organizations working with land owners to identify and

prioritize conservation measures that maintain or enhance the integrity of potential areas conducive to male grizzly bear dispersal.

Yellowstone grizzly bears: Ecology and conservation of an icon of wildness



Yellowstone grizzly bears : ecology and conservation of an icon of wildness / editors, P.J. White, Kerry A. Gunther, and Frank T. van Manen ; contributing authors, Daniel D. Bjornlie [and thirteen others] ; managing editor, Jennifer A. Jerrett. Yellowstone National Park, [Wyoming]: National Park Service, Yellowstone National Park ; [Bozeman, Montana] : U.S. Geological Survey, Northern Rocky Mountain Science Center, 2017.

***Bear Wise Wyoming Program* – An Updated Web Page**

In addition to peer-reviewed publications and population articles, personnel in the LCS strive to provide relevant information to anyone interested in grizzly bears. In response to public comment, personnel from the LCS, the Wildlife Division, and Cheyenne Headquarters updated the Department's web page to a more user-friendly format that is aimed at increasing awareness and safety for people who live, work and recreate in grizzly bear country. Please visit the page at:
https://wgfd.wyo.gov/Wildlife-in-Wyoming/More-Wildlife/Large-Carnivore/Grizzly-Bear-Management/Bear-Wise-Wyoming for more information.

2017 GRIZZLY BEAR DISCUSSIONS WITH THE PUBLIC

The Department regained management authority for grizzly bears outside of National Park Service lands and the Wind River Reservation during the summer of 2017. In order to facilitate open discussions and garner public feedback, Department personnel held public forums about current and future grizzly bear management across Wyoming during late Fall and early Winter, 2017. Public feedback was sought on five components of the 2016 Wyoming Grizzly Bear Management Plan (Monitoring, Research, Conflict Management, Outreach and Education, and Hunting). Meetings were well attended and productive, providing hundreds of ideas and suggestions for the future of Wyoming grizzly bear conservation and management as well as providing insight into potential grizzly bear hunting regulations. The following information represents the synthesis of comments received by the Department and presented to the Wyoming Game and Fish Commission (Commission) in January 2018.

MONITORING	
Comment and/or Category	**Number**
Use of Public Information and Citizen Science Ideology	41
Alternative Monitoring Methods, Continue Evaluation of Methods	20
More Accurate Population Estimate	19
Monitoring Outside DMA - "Count All Bears"	16
Technological Advances - Drones, Apps	8
Genetics and Connectivity	8
Trail Camera Use	8
"Real-Time" Information and Updates	7
Funding for Monitoring	6
Make Results and Information More Available	6
WRR Collaboration	6
Climate Change	5
Foods and Body Condition	5
Reduce/Stop Collaring and Monitoring	5
Expansion	4
Data Gathered through Hunting	3
Habitat Monitoring	3
Monitoring Den Sites	3
Increased Monitoring of "Conflict" Bears	3
Surveys	3
Totals	179

RESEARCH OPPORTUNITIES	
Comment and/or Category	**Number**
Analysis of Conflicts, Management, and Relocation	22
Foods and Body Condition	18
Interactions Among Other Carnivores/Ungulates	18
More Accurate Population Estimate	15
Continued Evaluation of Demographics	15
Bear Distribution/Movements and Humans	12
Density Dependence, Infanticide, Carrying Capacity	10
Funding for Research	10
Predation, Additive Impacts, Kleptoparasitism	9
Genetics and Connectivity	9
Habitat research	7
Disease	5
Moth Ecology	4
Bear Spray and Bears (Behavioral Responses)	4
Latest Tools and Technology	3
More Data on Sub-adult Ecology	3
Reduce Research, Reduce Money Spent	2
Totals	166

CONFLICT MANAGEMENT	
Comment and/or Category	**Number**
Explore "Other" Methods (Non-lethal, Aversive Conditioning)	30
Food Storage, Regulations, and Enforcement	20
Public Education on the Program and Transparency	17
Definitions of Conflict, Conflict vs. Problem Bears	17
Evaluation of Relocation	14
Livestock and Conflicts	12
Defense of Life Investigations and Information Sharing	11
Impact to conflict management through hunting	8
Move Bears to Areas Outside GYE/Move to YNP	8
Depredation Tags - Hunting of Conflict Bears	7
Human Dimensions	7
Interagency Collaboration	7
Public and Hunter Surveys	5
Signage and Closures - Better Understanding	5
"Real-time" information	4
Bear Spray Required	4
Approve Current Program	3
Mandatory Removal of Gut piles	3
More Proactive Agency Removal	2
Totals	184

OUTREACH AND EDUCATION (BEAR WISE WYOMING)	
Comment and/or Category	**Number**
More Education and Transparency	54
Information More Readily Available to Public	27
Bear Spray Info and Education	20
Collaboration - Money - Donors	19
Schools and Education	18
Increase our Footprint of Education	14
Education for Visitors, Tourists, Nonresidents	14
Food Storage and Regulations	12
Increased Public Involvement	8
Use of Apps and Technology	5
Funding (License Plate Registration, Grizzly Bear Stamp)	4
Quantification of Efficacy	3
Totals	198

HUNTING AND HARVEST MANAGEMENT	
Comment and/or Category	**Number**
Hunting to Target Conflict Bears - Expansion	41
License Costs, License Types	38
Mandatory Education/Training/Test	25
Limited Quota Draw (Priority List) and Reporting	24
Impact of Hunting on Grizzly Bear Behavior and Ecology	21
Season Dates - Hunt Areas to Distribute Harvest	19
Money - Funding for Program, Accountability, Equitable Distribution	18
Buffers to Protect Areas (National Parks, Rockefeller Parkway), Individuals, Revenue	17
Liberal Harvest Outside DMA, Predator Zone	17
No Hunting - Hunting Moratorium, Management vs. Hunting	15
No Baiting	10
Similar Approach to Existing (Black Bear, Mountain Lion)	9
Protect Females, Male Hunting Only	9
Allow Baiting - Regulated	8
Residency Splits	7
Evaluate Impacts to Tourism and Economy	7
Caliber Requirements, Archery	6
No Spring Hunting	6
Fines for Illegal Killing	5
Salvage of Meat	4
How Hunting may Impact Human Perceptions	4
Positive Benefits of Hunting	4
General Support	4
Guide Requirement - GF guide	4
Depredation Tags	3
Alteration of Statutory Classification	3
No Trapping	2
Bear Spray (Mandatory Use)	2
Protections from Hunting on Moth Sites	2
Totals	334

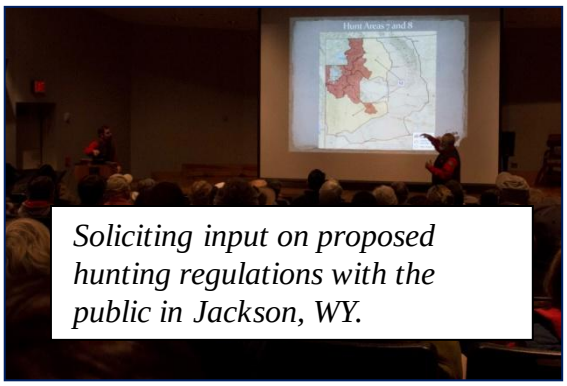
GRIZZLY BEAR HUNTING SEASON REGULATION DEVELOPMENT

Following the November and December public forums, the Commission directed the Department to develop a hunting regulation for grizzly bears. Over 3,300 individual comments regarding grizzly bear hunting were collected, and within those individual submissions, multiple comments were received resulting in over 9,500 comments that were presented to the Commission and considered during the development of the grizzly bear hunting regulation. On May 23, 2018, the Commission approved the Chapter 68: Grizzly Bear Hunting Season regulation) submitted by the Department. The 2018 hunt will be the first grizzly bear hunting season in Wyoming since 1974. The regulation is available at: https://wgfd.wyo.gov/regulations.

The Chapter 68, Grizzly Bear Hunting Season regulation represents the culmination of multiple meetings with the public in regards to grizzly bear management and decades of work by the public and the Department to recover grizzly bears. The adopted regulation is based on decades of experience managing large carnivores within the parameters established to maintain a recovered grizzly bear population in the GYE. Management of grizzly bears is a collaborative effort between Idaho, Montana, and Wyoming and coordination with the National Park Service, U.S Forest Service, Bureau of Land Management and the Wind River Reservation.

Primary Components of the Regulation include:

- The Department taking a layered approach to harvest allocation, with conservative mortality limits near the core of the population (Primary Conservation Area (PCA)) and more liberal opportunity farther away from the PCA. Hunt area boundaries and mortality limits are derived to direct hunting into areas of higher conflict potential.
- Within the Demographic Monitoring Area (DMA) available harvest is determined by previous year's population size and estimated mortality. Hunting will be regulated by an overall female and male mortality limit. Licenses will be allocated through a license issuance list and there shall not be more hunters in the field at any given time than the available female mortality. This is meant to ensure female mortality limits are not exceeded for the GYE.
- Outside the DMA, hunting will be regulated through a limited quota license draw.
- Hunters will be required to take a mandatory training course on grizzly bear ecology, management, and safety prior to entering the field.
- Hunters will be provided electronic devices that enable them to immediately report harvest and location of harvest regardless of location.
- Baiting will not be allowed within the DMA.
- Females with young and dependent young are protected from harvest.



Soliciting input on proposed hunting regulations with the public in Jackson, WY.

GRIZZLY BEAR CONFLICT MANAGEMENT

Introduction

Human-grizzly bear interactions and conflicts in Wyoming are typically a result of grizzly bears seeking unnatural foods in association with people and property, close encounters with humans, or when grizzly bears kill livestock. The number and location of human-bear conflicts is influenced by unsecured unnatural attractants (e.g. human foods and garbage), natural food distribution and abundance, grizzly bear numbers and distribution, and human and livestock use patterns on the landscape.

The management technique of capturing grizzly bears in areas where they may come into conflict with people and relocating them to remote locations is a common practice throughout the world. Relocating bears achieves several social and conservation functions: (a) reduces the chance of property damage, livestock damage, or human interactions in areas where the potential for conflict is high; (b) reduces the potential for grizzly bears to become food conditioned and/or human habituated which often results in destructive and/or dangerous behaviors; (c) allows grizzly bears the opportunity to forage on natural foods and remain wary of people; and (d) could prevent removing grizzly bears from the population which may be beneficial in meeting population management objectives.

The Department relocates and removes black and grizzly bears as part of routine management operations. The decision to relocate or remove a bear is made after considering a number of variables including age and sex of the animal, behavioral traits, health status, physical injuries or abnormalities, type of conflict, severity of conflict, known history of the animal, human safety concerns, and population management objectives. Grizzly bears are relocated in accordance with state and federal law, regulation, and policy.

In 2005 the Wyoming Legislature created Wyoming Statute §23-1-1001 as follows:

> (a) Upon relocating a grizzly bear or upon receiving notification that a grizzly bear is being relocated, the department shall provide notification to the county sheriff of the county to which the grizzly bear is relocated within five (5) days of each grizzly bear relocation and shall issue a press release to the media and sheriff in the county where each grizzly bear is relocated;
>
> (b) The notice and press release shall provide the following information:
>
> (i) The date of the grizzly bear relocation;
> (ii) The number of grizzly bears relocated; and
> (iii) The location of the grizzly bear relocation, as provided by commission rule and regulation;
>
> (c) No later than January 15 of each year the department shall submit an annual report to the Joint Travel, Recreation, Wildlife, and Cultural Resources Interim committee. The annual report shall include the total number and relocation area of each grizzly bear relocated during the previous calendar year. The department shall also make available the annual report to the public.

Subsequently, the Commission promulgated Chapter 58 Notification of Grizzly Bear Relocation Regulation to further direct the implementation of W.S. §23-1-1001 as follows:

Section 1. Authority. This regulation is promulgated by authority of W.S. §23-1-1001.

Section 2. Definitions. Definitions shall be as set forth in Title 23, Wyoming Statutes, Commission regulations, and the Commission also adopts the following definitions:

(a) "County Sheriff" means the County Sheriff's Office in the county where a grizzly bear is relocated.

(b) "Location of the grizzly bear relocation" means the proper name of the drainage in which a grizzly bear is relocated and the estimated number of miles from the relocation site to the nearest municipality, topographical feature or geographic location.

(c) "Provide a press release" means the Department shall provide to the County Sheriff and the media in the county in which a grizzly bear is relocated, a press release including the location of the grizzly bear relocation, number of grizzly bears relocated, date of the relocation and the reason the grizzly bear was relocated.

Section 3. Notification of relocation. Upon relocating a grizzly bear or upon receiving notification that a grizzly bear is being relocated, the Department shall notify the County Sheriff of the date, number of grizzly bears relocated, the location of the grizzly bear relocation and the reason of the relocation via direct telephone conversation, written or electronic correspondence, or personal contact within five (5) days of the date of the relocation. The Department shall provide a press release to the County Sheriff and the media in the county where a grizzly bear is relocated of the date, number of grizzly bears relocated, the location of the grizzly bear relocation and the reason of the relocation within five (5) days of the date of relocation of any grizzly bear.

WYOMING GAME AND FISH COMMISSION

By:

_____

Mike Healy, President

Dated: January 22, 2014

CONFLICT MANAGEMENT – CAPTURES, HANDLING AND RELOCATION

During 2017, the Department captured 30 grizzly bears in 31 capture events in an attempt to prevent or resolve conflicts (Figure 6). Most captures were lone grizzly bears of all age classes, including 7 females and 23 males (one male caught in two separate conflicts). Nineteen (61%) of the capture events were in Park County, 8 (26%) occurred in Sublette County, 2 (6%) in Fremont County, 1 (3%) in Teton county, and 1 (3%) in Hot Springs County.

Of the 31 capture events, 12 captures were a result of bears killing livestock (primarily cattle), 6 were captured for obtaining pet, livestock food, or damaging fruit trees. Two bears were non-target captures, and 11 bears were captured for frequenting developed sites, residential areas or livestock production areas. Of the 31 capture events, there were 15 relocation events, 3 bears were released on site because they were non-target captures or part of a family group, and 13 bears were removed from the population. All relocated grizzly bears were released on U.S. Forest Service lands in or adjacent to the PCA (Figure 7). Of the 15 relocation events, 8 (53%) bears were released in Park County, 2 in Fremont County (13%), and 5 (33%) were released in Teton County (Table 8).

Eleven of the 13 bears removed from the population were lethally removed, and 2 orphaned yearling grizzly bears habituated to human activities were placed into a zoo facility (Table 6). While each situation is unique, grizzly bears were removed due to a history of previous conflicts, a known history of close association with humans, or they were deemed unsuitable for release into the wild (e.g. orphaned cubs, poor physical condition, or human safety concern). Removals took place after much deliberation and consideration was given to the unique characteristics of each conflict. Attempts to obtain locations on marked grizzly bears through aerial telemetry were made approximately every 14 days.

As the grizzly bear population expands, more unique situations and conflict opportunities arise, often in areas far from suitable habitat.

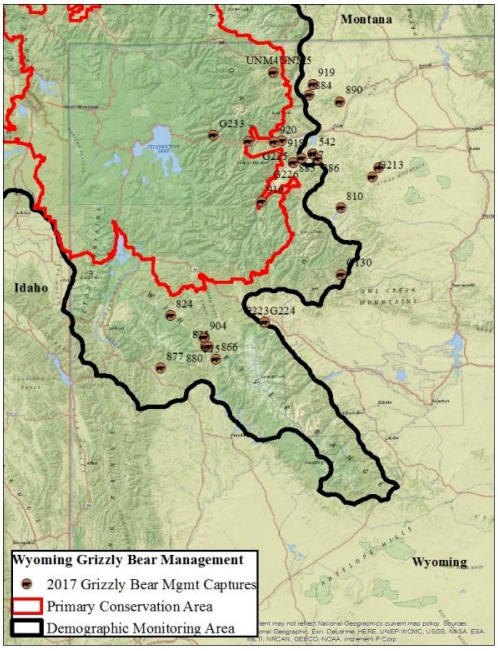


Figure 6. Management capture locations (n = 31) for grizzly bears captured, relocated, or released on site in conflict management efforts in the Wyoming portion of the Greater Yellowstone Ecosystem during 2017. Grizzly bears with "G" in front of their number were marked but not fitted with radio collars (typically because they were too young to be collared). Grizzly bears identified with "NA" were grizzly bears removed from the population without being given an identification number. Please note that the mapping software combines some locations at this scale. A complete list is provided in Table 6.

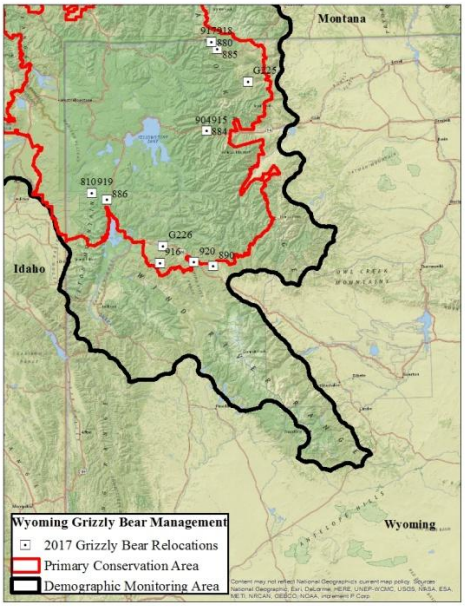


Figure 7. Release locations (n = 18; 15 relocated, and 3 released on site) for grizzly bears captured, relocated, or released on site in conflict management efforts in Wyoming portion of the Greater Yellowstone Ecosystem, 2017. Grizzly bears with "G" in front of their number were ear-marked but not fitted with a radio collar upon release, typically because they were too young to be collared. Because of the mapping scale, some locations are combined at one symbol and are not always distinct on the map. A complete list is provided in Table 6.

Table 8. Summary of grizzly bear conflict management captures in Wyoming portion of the Greater Yellowstone Ecosystem, 2016. Grizzly bears identified with "NA" were removed from the population without receiving an identification number.

Date	ID	Capture county	Relocation site	Release county	Reason for capture
3/24/2017	NA	Park			Removed for goat depredation and frequenting ranch buildings
4/12/2017	877	Sublette			Removed for frequenting developed areas and multiple food rewards
4/22/2017	G223	Fremont	On Site; Wind River; Private	Fremont	Cattle depredation; released on-site to join family group
4/23/2017	G224	Fremont	On Site; Wind River; Private	Fremont	Cattle depredation; released on-site to join family group
4/29/2017	884	Park	Mormon Creek; Shoshone National Forest	Park	Non-target capture at a garbage conflict
5/9/2017	G225	Park	Painter Gulch; Shoshone National Forest	Park	Frequenting developed areas
5/10/2017	885	Park	Pilot Creek; Shoshone National Forest	Park	Frequenting developed areas
5/10/2017	G226	Park	Blackrock Creek; Shoshone National Forest	Teton	Frequenting developed areas
5/22/2017	886	Park	John D. Rockefeller Parkway	Teton	Frequenting calving pasture and harassing cattle
6/2/2017	890	Park	Long Creek; Shoshone National Forest	Fremont	Frequenting agricultural areas and developed sites
7/9/2017	824	Teton			Removed for repeated cattle depredations
7/19/2017	904	Sublette	Mormon Creek; Shoshone National Forest	Park	Removed for repeated cattle depredations
7/21/2017	825	Sublette			Removed for repeated cattle depredations
7/21/2017	880	Sublette	Fox Creek; Shoshone National Forest	Park	Cattle depredations
8/2/2017	G130	Hot Springs			Removed for repeated cattle depredations
8/5/2017	866	Sublette			Removed for repeated cattle depredations
8/11/2017	810	Park	Grassy Lake; Bridger Teton National Forest	Teton	Breaking into grain shed
8/11/2017	UNM4	Park			Live removal to zoo for human habituation and bold behavior
8/11/2017	UNM5	Park			Live removal to zoo for human habituation and bold behavior
9/9/2017	G213	Park			Removed for repeated conflict history
9/12/2017	904	Sublette			Removed for repeated cattle depredations
9/14/2017	915	Sublette	Mormon Creek; Shoshone Forest	Park	Cattle depredation

Table 8. Continued.

Date	ID	Capture county	Relocation site	Release county	Reason for capture
9/24/2017	UNM6	Sublette			Removed for repeated cattle depredations
9/27/2017	916	Park	Spread Creek; Bridger-Teton National Forest	Teton	Breaking into chicken coop
9/30/2017	917	Park	Fox Creek; Shoshone National Forest	Park	Frequenting developed areas
9/30/2017	G233	Park	On Site; Shoshone River; private	Park	Non-target capture
10/3/2017	918	Park	Fox Creek; Shoshone National Forest	Park	Frequenting residential areas
10/17/2017	919	Park	Grassy Lake; JDR Memorial Parkway	Teton	Frequenting developed areas
10/25/2017	NA	Park			Removed for bold behavior and property damage
11/2/2017	542	Park			Removed for food rewards and conflict history
11/3/2017	920	Park	Wind River; Shoshone National Forest	Fremont	Frequenting developed areas and acquiring livestock feed

CONFLICT MANAGEMENT – CONFLICT VERIFICATION AND REPORTING

Department personnel investigated and recorded 186 human-grizzly bear conflicts in 2017 (Table 9, Figure 8). As a result of education and conflict prevention efforts, the general pattern of conflicts is relatively steady within currently occupied habitat (Figure 9). However, as occupied grizzly bear range has expanded, conflicts continue to occur in areas further from the Grizzly Bear PCA and outside the DMA, often on private lands (Figure 10). Human-grizzly bear conflicts have increased in areas where grizzly bears have not been present in recent history.

Although joint education and attractant storage efforts of the Department, U.S. Forest Service, non-governmental organizations, and the public has reduced conflicts in many areas, the number of grizzly bear conflicts in Wyoming were high this year. Grizzly bears frequent lower elevation habitats and developed areas regularly during the non-denning period. Grizzly bear-cattle depredation was the most frequent type of conflict documented in 2017. The annual variation in livestock depredation incidents is not easily explained. Although most human-bear conflicts are correlated with natural food abundance, the number of cattle and sheep killed annually do not follow the same pattern. As grizzly bears expand further into human-dominated landscapes, human bear conflicts increase. These conflicts result in negative outcomes for both grizzly bears and people. The Department continues to explore options to reduce grizzly bear-livestock conflicts.

The majority of conflicts in 2017 occurred on public lands outside of the PCA (Figures 9 and 10). The distribution of conflicts is indicative of an expanding grizzly bears population outside the DMA. As bears expand and occupy habitats commonly used by humans, there is a greater potential for conflicts to occur. Education and conflict-prevention efforts will continue to focus on areas of Wyoming where bears and people coexist. Management actions to address conflicts will also continue to consider human values and effects the management action will have on the grizzly bear population.

Table 9. Type and number of human-grizzly bear conflicts in Wyoming portion of the Greater Yellowstone Ecosystem, 2017.

Conflict type	Number	Percent (%)
Cattle	138	74
Property Damage	10	5
Animal Death	7	4
Garbage	7	4
Pet-Livestock-Birdfeed	6	3
Aggression Toward Human	5	3
Human Injury	5	3
Fruit Trees	3	2
Unsecured Attractant	2	2
Properly stored game	1	<1
Animal Injury	1	<1
Sheep	1	<1
Total	186	100

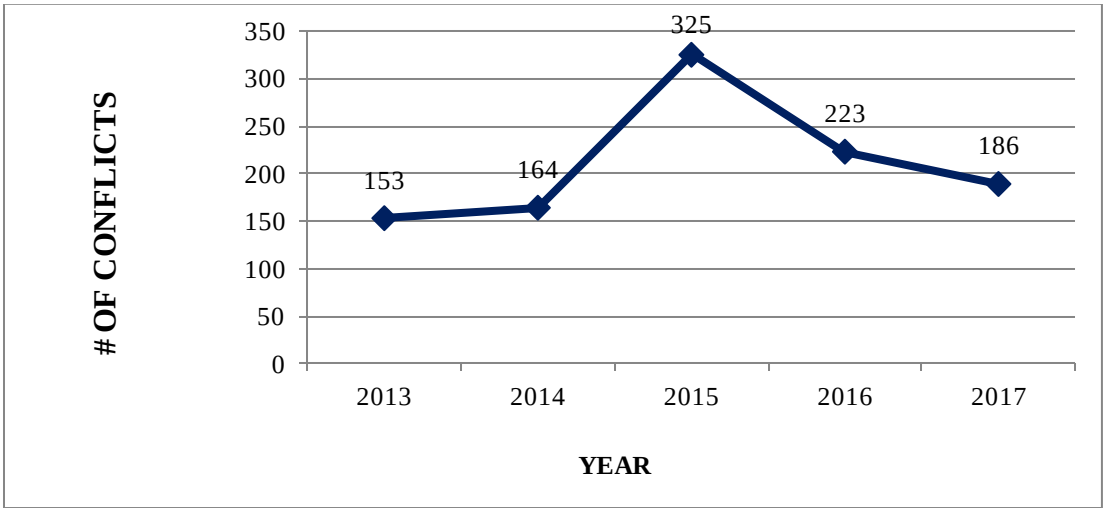


Figure 8. Number of human-grizzly bear conflicts documented in Wyoming, 2013 - 2017.

Long-term trends in the number of conflicts is likely a result of the grizzly bear population increasing and distribution expanding into areas used by humans on public and private lands. As the GYE grizzly bear population expand into less suitable habitat, the potential for bears to encounter food sources such as garbage, pet food, livestock and livestock feed, and other attractants will result in increased property damage and threats to human safety. Conflict

prevention measures such as attractant storage, deterrence, and education are the highest priority for the Department. In general, there is an inverse relationship between social tolerance and biological suitability for bear occupancy in areas further from the PCA due to development, land use patterns, and various forms of recreation. Although prevention is the preferred option to reduce conflicts, each situation is managed on a case-by-case basis through education, securing of attractants, relocation or removal of individual bears, or a combination of conflict resolution methods.

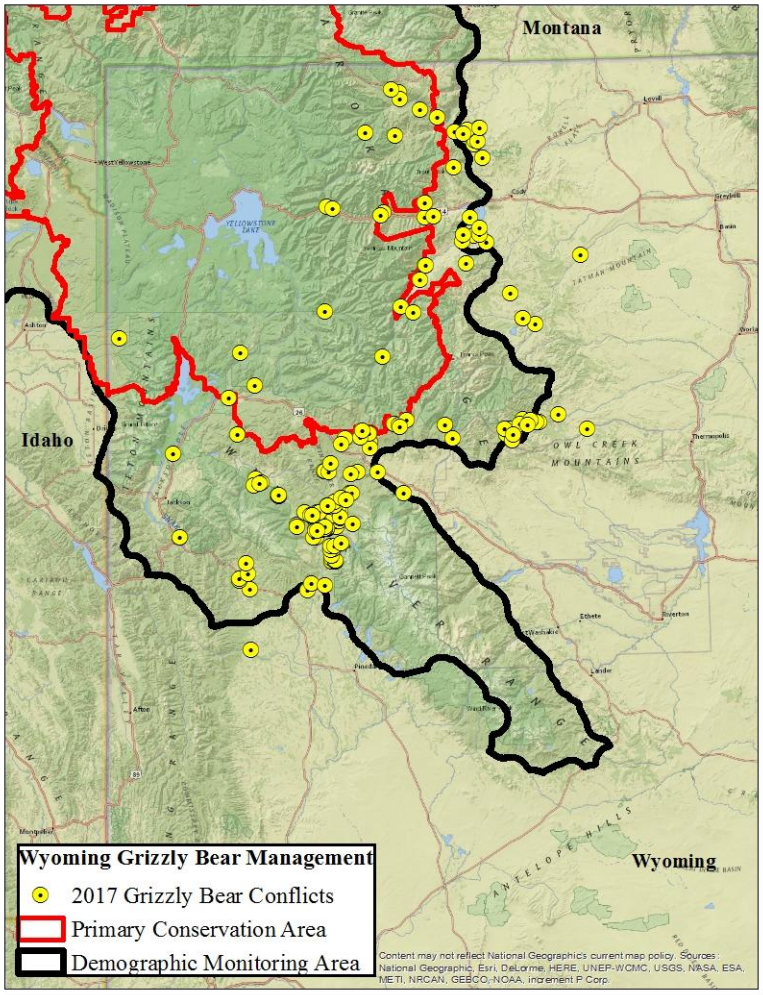


Figure 9. Location of human-grizzly bear conflicts in Wyoming portion of the Greater Yellowstone Ecosystem outside of National Parks (n = 186) in relation to the Grizzly Bear Primary Conservation Area and the Demographic Monitoring Area, 2017.

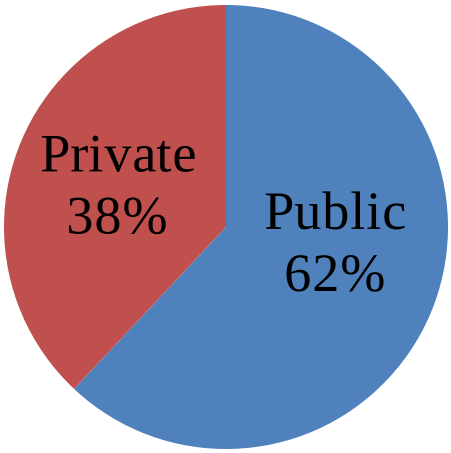


Figure 10. Percent of human-grizzly bear conflicts on private and public lands in Wyoming portion of the Greater Yellowstone Ecosystem, 2017.

MONITORING AND CONFLICT MANAGEMENT – GRIZZLY BEAR MORTALITIES

Within Wyoming, outside of the National Parks and Wind River Reservation, there were 30 known or probable human-caused grizzly bear mortalities within the DMA. Management removals accounted for 10 of these mortalities in 2017. Eight of the 10 bears removed from the population were lethally removed, and 2 human-habituated, orphaned yearling grizzly bears were placed into a zoo facility in Nebraska. While each situation is unique, grizzly bears were removed due to a history of previous conflicts, a known history of close association with humans, or they were deemed unsuitable for release into the wild (e.g. orphaned cubs, poor physical condition, or human safety concern). Removals occur after consideration is given to a multitude of factors unique to each conflict situation. We also lethally removed 3 grizzly bears outside of the DMA in areas not suitable for long term viability of bears. The bears removed outside the DMA were all involved in conflict situations, which is congruent with the notions of how suitable habitat is defined and conservation within a DMA.

Grizzly bear taken in self-defense by an outdoor recreationist. 2017 was a relatively high year for self defense grizzly bear mortalities (n=9).

2017 BEAR WISE WYOMING PROGRAM UPDATE

Introduction

The Bear Wise Community/Wyoming Program is a proactive initiative that seeks to minimize human-bear (black and grizzly) conflicts, minimize management-related bear mortalities associated with preventable conflicts, and to safeguard human communities in northwest Wyoming. The overall objective of Bear Wise is to promote individual and community ownership of ever-increasing human-bear conflict issues, moving toward creating a social conscience regarding responsible attractant management and behavior in bear habitat. This project seeks to raise awareness and proactively influence local waste management infrastructures with the specific intent of preventing conflicts from recurring. Strategies used to meet the campaign's objectives are: 1) minimize accessibility of unnatural attractants to bears in developed areas; 2) employ a public outreach and education campaign to reduce knowledge gaps about bears and the causes of conflicts; and 3) employ a bear resistant waste management system and promote bear-resistant waste management infrastructure.

This section provides a summary of Bear Wise Wyoming Program accomplishments in 2017. Past accomplishments are reported in the 2006 - 2016 annual reports of the IGBST and in the 2011-2016 Grizzly Bear Annual Job Completion Reports of the Wyoming Game and Fish Department.

Background

In 2004, a subcommittee of the IGBST conducted an analysis of causes and spatial distribution of grizzly bear mortalities and conflicts in the GYE for the period of 1994–2003. The analysis identified that the majority of known, human-caused grizzly bear mortalities occurred due to agency management actions in response to conflicts (34%), self-defense killings (primarily by big game hunters) (20%), and vandal killings (11%). The report made 33 recommendations to reduce human-grizzly bear conflicts and mortalities with focus on 3 actions that could be positively influenced by agency resources and personnel: 1) reduce conflicts at developed sites; 2) reduce self-defense killings; and 3) reduce vandal killings (Servheen et al. 2004).

To address action number 1, the committee recommended that a demonstration area be established to focus proactive, innovative, and enhanced management strategies where site conflicts and agency management actions had historically been high. The Wapiti area in northwest Wyoming was identified as having one of the highest concentrations of black bear and grizzly bear conflicts in the GYE. The North Fork of the Shoshone River west of Cody was then chosen as the first area composed primarily of private land to have a multi-agency/public approach to reducing conflicts at developed sites.

In 2005, the Department began implementation of the Bear Wise Community Program. Although the program's efforts were focused primarily in the Wapiti area, the Department initiated a smaller scale project in Teton County to address the increasing number of black and grizzly bear conflicts near Jackson, Wyoming. For the last 12 years, the Programs in northwest Wyoming have deployed a multi-faceted education and outreach campaign in an effort to minimize human-

bear conflicts and promote proper attractant management. Although a wide array of challenges remain and vary between communities, many accomplishments have been made and progress is expected to continue as Program efforts gain momentum. In an effort to broaden the scope of the program, this work was rebranded as the Bear Wise Wyoming Program.

Wapiti Project Update

The Wapiti Bear Wise Community Program continues to utilize radio, television and print media, mass mailings, and the use of signing on private and public land to convey the educational messages surrounding human-bear conflict prevention. Conflict prevention information is also disseminated through public workshops and presentations and by contact with local community groups, governments, the public school system, and various youth organizations. To compliment educational initiatives, the program uses an extensive outreach campaign that assists the community in obtaining and utilizing bear-resistant products and implementing other practical methods to manage attractants. Ongoing efforts and new accomplishments for 2017 are as follows:

Cody Area Bear Wise Program Update

- The Carcass Management Program continues to provide a domestic livestock carcass removal service for livestock producers located in occupied grizzly bear habitat within Park County, Wyoming. The program has been traditionally funded by the Park County Predator Management District and Wyoming Animal Damage Management Board. In addition to those donors, the program received contributions from Park County Commissioners, Wyoming Outdoorsmen, and the Memorial Bear Fund. The program provides livestock producers and owners with an alternative to the use of on-site carcass dumps, which are a significant bear attractant and indirectly contribute to numerous human-bear conflicts. Since June 2008, 978 domestic livestock carcasses have been removed from private lands.

- Recommendations concerning the proper storage of garbage and other attractants are provided to the Park County Planning and Zoning Commission for new developments within the greater Cody area. The Coordinator reviews proposed developments on a case-by-case basis, attends monthly meetings, and contacts applicants directly to discuss conflict prevention measures. To date, these comments have been adopted as either formal recommendations or as a condition of approval for 22 new developments within Park County.

- In the Cody Region, LCS personnel erected 19 temporary electric fences around bee apiaries to minimize conflicts. There were also several electric fences temporarily placed around apple orchards and other larger seasonal attractants to deter bear conflicts.

- Our Bear Wise Wyoming Program Coordinator filmed an interview for Eastman's Hunting TV discussing how to safely recreate and hunt in bear country in addition to stressing proper game retrieval techniques in bear country. The two part episode aired in December and had large viewership on the Outdoor Channel.

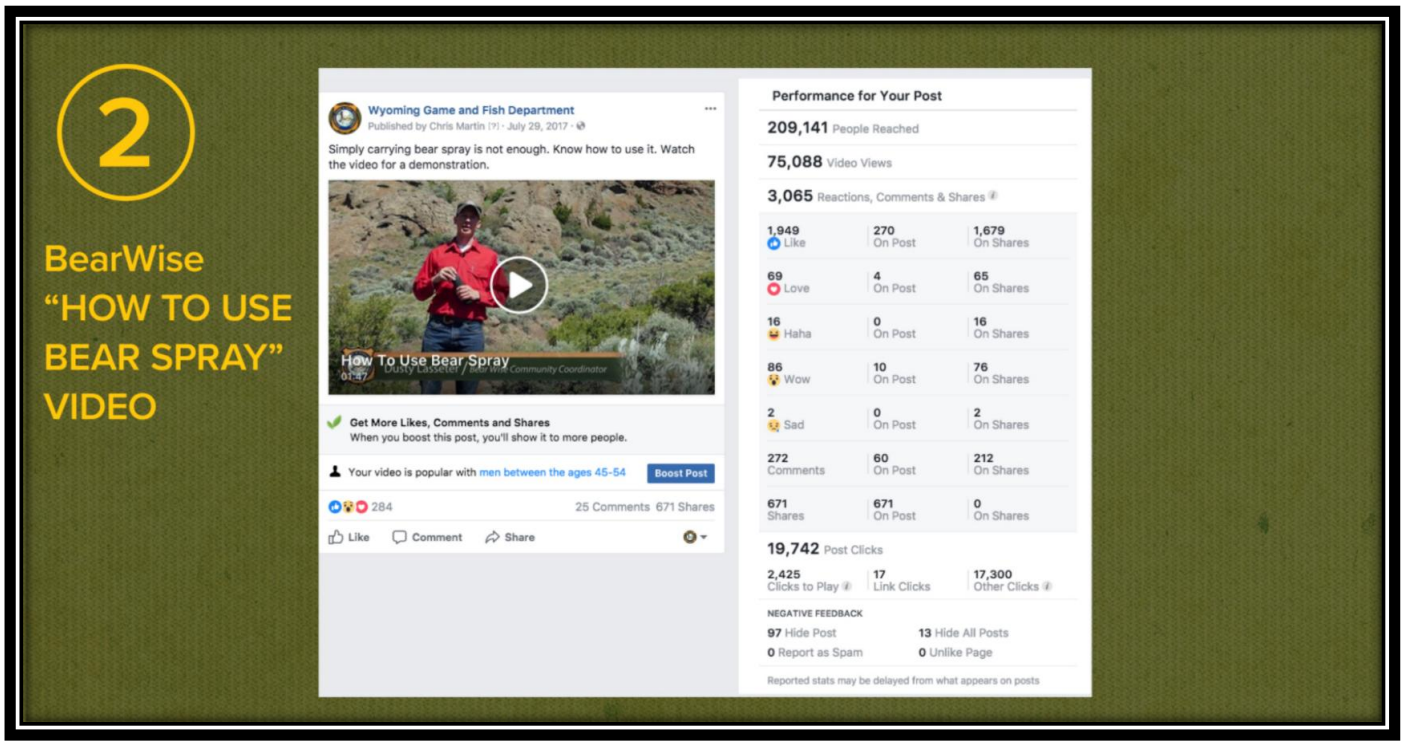
- In the spring, LCS personnel conducted 11 "Living in Large Carnivore Country" workshops across Wyoming. The objective of these workshops is to reach out to the public and give them the opportunity to learn how to live with bears, mountain lions, and wolves. In 2017 we gave presentations and hands on demonstrations to 187 attendees.

- This year with grants from Wyoming Outdoorsmen, Bowhunters of Wyoming, Rocky Mountain Elk Foundation, and Western Bear Foundation, the Department was able to purchase 200 cans of bear spray to be distributed to sportsmen. One hundred cans of bear spray were distributed to licensed hunters at the Department's Cody check station and 100 cans were distributed similarly at Jackson Hole and Greater Yellowstone Visitor Center. Sportsmen where asked to voluntarily fill out a short survey to gather a better understanding how the Bear Wise Wyoming Program can better meet constituent needs.

- A public service announcement (PSA) was recorded by Department personnel on "Staying Safe in Bear Country" and broadcast over the radio in the spring of 2017 on the Bighorn Basin Radio Network. Large Carnivore Section personnel also took part of several radio interviews.

- Grant funding was secured to erect a permanent electric fence around the Park County Landfill. Funding came from Wyoming Outdoorsmen, Bureau of Land Managment, Park County Commissioners, and Greater Yellowstone Coalition. The electric fence will be installed in early 2018, with help from Western Bear Foundation volunteers removing the existing fence.

- After completing several short video PSAs about recreating in bear country, they were placed on the Department Facebook page. In 2017, 3 of the top 10 viewed Facebook posts were Bear Wise PSAs resulting in thousands of individuals viewing proactive announcements to reduce the potential for conflicts.



- Educational black bear/grizzly bear identification materials were distributed to individuals and to local sporting goods stores in the Cody, Pinedale, and Lander areas and mailed to black bear hunters who registered bait sites with the Department in areas surrounding the GYE.

- Numerous informational presentations were given that focused on human-bear conflict prevention to audiences including the Park, Fremont, Hot Springs, and Big Horn County public school systems, homeowners associations, Boy Scouts, 4-H members, DANO Youth Camp, Paint Rock Hunter Management Program, guest ranches, and college students. Frequent one-on-one contacts were made during the 2017 conflict season in areas where the occurrence of human-bear conflicts has historically been high.

- A "Working Safely in Bear Country" workshop was conducted for the Park County

Weed and Pest District, Bureau of Land Management, West Park Hospital, 307 Health Center, Rocky Mountain Power, and Bighorn National Forest employees.

- A booth containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and the proper use of bear spray was staffed at the Lander Winter Fair, Cody RV Show, Dubois Museum Days, Powell Outdoor Safety Day, and Wyoming Outdoorsmen Banquet.

Large Carnivore Section personnel meet with the public at Pinedale's Rendezvous Days.

- By utilizing the bear trailer, bear safety booths, educational workshops, and giving 45 additional requested presentations the Bear Wise Wyoming Program directly reached approximately 3,500 people in northwest Wyoming. While the level of interaction differed from person to person it added awareness to public on bear safety and proactive measures to lessen conflicts. Work such as this also does not quantify the effect workshop participants have in spreading the word to other members of the public in regards to bear safety and conflict resolution.

- A seasonal mailing containing human-bear conflict prevention information and the availability of conflict prevention resources was delivered to residents in and around Dubois.

- The redesigned 2017 Antelope, Deer, and Elk Hunting Regulation brochure had a section on being Bear Aware. Specifically, there is information regarding game retrieval and

handling, how to react to an aggressive/defensive bear encounter, how to properly use bear spray, and what to do if a bear comes into camp.

- Western Bear Foundation received a grant to put in 4 bear boxes for campsites in occupied bear habitat. The bear boxes were put on Commission managed lands to prevent human-bear conflicts and provide campers with the means to securely store attractants. Department personnel volunteered time in kind to properly place the bear boxes.

Joe Kondelis from Western Bear Foundation and Miles Proctor from the Department's Habitat and Access Branch mix cement to place a bear box.

Pinedale Area Bear Wise Program Update

In 2011, a Bear Wise Community effort was initiated targeting residential areas north of Pinedale, Wyoming where the occurrence of human-bear conflict has increased in recent years. Accomplishments for the Pinedale area in 2017 are as follows:

- The Department hosted a "Living in Lion, Bear, and Wolf Country" workshop in Pinedale. Approximately 15 people attended the workshop.

- Bear safety presentations were given to the Boy Scouts of America at "Camp New Fork".

- Presented bear safety and carnivore biology information at Pinedale Science Camps at Green River Lake.

- Hunting in Bear Country presentations were given to hunter safety classes throughout the Region.

- Multiple bear safety presentations were given to a variety of constituents in the Pinedale area: staff members of the Sublette County Chamber of Commerce and Sublette County Visitor's Center and personnel from the Pinedale and Big Piney Ranger Districts – U.S. Forest Service, the Pinedale Bureau of Land Management office, Sublette County Weed and Pest and search and rescue volunteers, and multiple other discussions with livestock producers and recreationists.

- The Department hosted a bear safety booth at Pinedale's Rendezvous Days Celebration, contacting hundreds of participants over a 3-day period. Pinedale's Rendezvous Days attracts approximately 10,000 people over the 4 day event and Department employees contact an estimated 1,000 constituents.

- Large Carnivore Section personnel manned a bear booth at the Sublette County Conservation District's "Spring Expo" and reached approximately 200 people.

Jackson Hole Bear Wise Program Update

The Bear Wise Jackson Hole program continues educational and outreach initiatives in an effort to minimize human-bear conflicts within the community of Jackson and surrounding areas. In 2016, the program's public outreach and educational efforts included the use of signage, public workshops and presentations, distribution of informational pamphlets, promoting awareness about bear spray, carcass and fruit tree management, and utilizing our bear education trailer.

- A bear education trailer was purchased in August 2010 with funding contributions from the Department, Grand Teton National Park, Bridger-Teton National Forest and Jackson Hole Wildlife Foundation. Two bear mounts (1 grizzly bear and 1 black bear) have been placed in the trailer along with other educational materials. The bear mounts were donated to the Department through a partnership with the United States Taxidermist Association and the Center for Wildlife Information. The trailer was displayed and staffed at various events and locations including Grand Teton National Park, Jackson Elk Fest, Fourth of July Parade and the National Elk Refuge Visitor Center.

- Public service announcements were broadcast on 4 local radio stations in Jackson for a total of 6 weeks throughout the spring, summer, and fall of 2016. The announcements

focused on storing attractants so they are unavailable to bears and hunting safely in bear country.

- Numerous educational talks were presented to various groups including homeowner's associations, guest ranches, youth camps, Jackson residents, tourists, school groups and Teton County employees.

- Door flyers with detailed information about attractant storage and bear conflict avoidance were distributed in Teton County residential areas where high levels of bear/human conflicts were occurring.

- A considerable amount of time was spent removing ungulate and livestock carcasses from residential areas and ranches in the Jackson Region.

- Worked with the residents at a north Jackson sub-division and a property management company to pick apples from 70 crab apple trees that were a significant bear attractant.

- Refrigerator magnets featuring tips about proper attractant management were distributed to Teton Village homeowners, Aspens Property Management and Jackson Hole Mountain Resort lodging.

- Numerous personal contacts were made with private residents in Teton County. This has proven to be a useful way to establish working relationships with residents and maintain an exchange of information about bear activity in the area.

- A booth containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and the proper use of bear spray was staffed at the Jackson Hole Antler Auction and Kids Fishing Day.

- Assisted hunting outfitters and with the installation and maintenance of electric fence systems around their field camps and located in the Bridger-Teton National Forest.

- Assisted Teton County Transfer Station staff with the installation and maintenance of an electric fence enclosure around their dead animal pit.

- Assisted an apiary owner with the installation and maintenance of an electric fence around his bee hives.

- Assisted the Department's Fish Division with the installation of 2 electric fences around their field camps at Brooks Lake.

- Signage detailing information on hunting safely in bear country, bear identification, recent bear activity, and proper attractant storage were placed at U.S. Forest Service trailheads and in private residential areas throughout Teton County.

- Consultations took place with businesses and residences regarding sanitation infrastructure and compliance with the Teton County Bear Conflict Mitigation and Prevention Land Development Regulations (LDR).

- Bear Aware educational materials were distributed to campground hosts in the Caribou-Targhee National Forest, hunters, and numerous residents in Teton County.

- Several radio and newspaper interviews were conducted regarding conflict prevention in the Jackson area.

- Educational black bear/grizzly bear identification materials were distributed to black bear hunters who registered bait sites with the Department in the Jackson Region.

- Worked with a Jackson sanitation company and the Jackson Hole Wildlife Foundation on placing new bear resistant garbage cans at Teton Village homes.

Continuing Bear Wise Wyoming Program Efforts

Objectives for 2018 include continuing to expand the program to the other areas of the state where human-bear conflicts are a chronic issue, and to focus educational and outreach efforts in the Cody area on locations that have not adopted proper attractant management methods. The Department is also working to assist the U.S. Forest Service with providing bear proof storage and meat poles at targeted areas in the Cody Region.

The Wapiti and Pinedale Bear Wise Community Programs face the ongoing challenges of: 1) the absence of ordinances, regulations, or laws prohibiting the feeding of bears; 2) providing educational opportunities to seasonal summer residents and the lack of organized community groups and; 3) decreased public tolerance for grizzly bears due to record numbers of human-bear conflicts. The future success of the Bear Wise Wyoming Program lies in continued community interest and individual participation in proper attractant management.

Objectives for the Bear Wise Jackson Hole Program in 2018 will be focused on supporting Teton County and local waste management companies with projects that will help disseminate information and achieve compliance with the recently adopted Teton County Bear Conflict Mitigation and Prevention LDR. In addition, more work will be done to identify areas within the city limits of Jackson and Star Valley communities where better attractant management and sanitation infrastructure is needed.

The recent implementation of the Teton County Bear Conflict Mitigation and Prevention LDR has greatly reduced the amount of available attractants on the landscape and is a tremendous step forward for the Bear Wise Jackson Hole Program. The new challenge facing the Department is achieving compliance with this regulation especially during years with low conflict and residents become complacent with the LDR. The Bear Wise Jackson Hole Program will convey the importance of compliance and strive to maintain public support for the LDR through public outreach and education. In order for the Jackson program to be successful, the program must continually identify information and education needs within the community while being adaptive to changing situations across different geographic areas. This will require the Department to coordinate with other government agencies and local non-government organizations working across multiple jurisdictions to develop a uniform and consistent message. If this level of coordination is achieved, the Department will be more effective in gaining support and building enthusiasm for Bear Wise Jackson Hole, directing resources to priority areas, and reaching all demographics.

Literature Cited

Servheen C., M. Haroldson, K. Gunther, K. Barber, M. Bruscino, M. Cherry, B. Debolt, K. Frey, L. Hanauksa-Brown, G. Losinski, C. Schwartz, and B. Summerfield. 2004. Yellowstone mortality and conflict reduction report: presented to the Yellowstone Ecosystem Subcommittee (YES) April 7, 2004

2017 INFORMATION AND EDUCATION ACCOMPLISHMENTS

- Electronic and Print Media
  - As per Wyoming Statute, grizzly bear relocation from one county to another must be announced through local media and to the local sheriff of the county into which the bear was relocated. Each announcement is posted in a timely fashion to the Department website. In 2017, 15 notifications were distributed and posted on the website.
  - Department personnel issued multiple educational news releases throughout the season informing readers and listeners of bear safety, behavior, conflict avoidance, food storage and natural food availability.
  - Department personnel conducted multiple radio, print, and television interviews regarding bear safety and information on grizzly bear ecology and conservation throughout Wyoming. Information is widely disseminated in this manner.

- Grizzly Bear Management Web Page
  - The Department grizzly bear management web page continues to be maintained and updated on a regular basis in order to provide timely information to the public regarding grizzly bear management activities conducted by the department. The web page contents include various interagency annual reports and updates and links to other grizzly bear recovery web sites. Based on public comment, the Bear Wise Wyoming Program page has been updated to contain additional information in multiple formats in order to reach the varied stakeholders taking into account the different perceptions and use of media formats in order to reach the widest breadth of the public possible.

- Hunter Education
  - Every hunter education class in Wyoming is required to discuss how to hunt safely in bear country. To assist instructors, most have been provided inert bear spray canisters for demonstration purposes and DVDs entitled "Staying Safe in Bear Country, A Behavioral Based Approach to Reducing Risk." A section on bear safety is included in the student manual. Approximately 5,000 students are certified each year.

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EXPENDITURES FOR GRIZZLY BEAR MANAGEMENT BY THE DEPARTMENT – FISCAL YEAR 2018

The Department's 2018 fiscal year (FY) occurred from July 1, 2017 – June 30, 2018. During the course of FY 18, the Department conducted annual population monitoring, responsive conflict management, Bear Wise Wyoming programs, and other statutory and regulatory obligations in regards to damage compensation and law enforcement for grizzly bears. During FY 18 the Department directed $1,319,156.99 of funds toward grizzly bear conservation and management. Direct program expenditures are reported by primary work activities conducted during FY 18. The figures reported below do not represent all Department expenses incurred during this FY:

- Conflict Prevention: $242,216.19*
- Annual Monitoring: $237,305.52
- Additional Public Contacts and Education: $56,736.54*
- Intra/Interagency Communication: $44,732.49
- Season Setting and Regulations: $41,617.32
- Law Enforcement: $35,632.91
- Data Analysis and Reporting: $34,845.25
- Damage Compensation for Verified Loss: $564,986.04

**Proactive Bear Wise Wyoming activities are represented both in conflict prevention and public contacts/education categories*

In addition to the direct expenditures, a total of $2,058,047 was allocated to grizzly bear management during FY 18. It should be noted that grizzly bears were officially delisted and under state management during the entire FY 18 time frame.