Grizzly Bear Recovery Plan

Supplement: Revised Demographic Recovery Criteria for the Yellowstone Ecosystem

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Date

Demographic Recovery Criteria for the Grizzly Bear Population in the Greater Yellowstone Ecosystem

In 2007, we supplemented the 1993 Grizzly Bear Recovery Plan with revised demographic criteria for the Greater Yellowstone Ecosystem (GYE) population (72 FR 11376, March 13, 2007). Since that time, new information relevant to these demographic criteria has become available. Consistent with Task Y11 of the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1993, p. 44) that directs the Service to "Reevaluate and refine population criteria as new information becomes available," we are revising the demographic criteria based on updated demographic analyses and the best available science.

We released draft revisions to the demographic recovery criteria for the GYE grizzly bear population for public comment and peer review on March 22, 2013 (78 FR 17708). We revised parts of the 2013 draft revisions and released new draft revisions to the demographic recovery criteria for public comment and peer review on March 11, 2016 (81 FR 13174).

We updated portions of demographic recovery criteria 1 and 3 for the GYE grizzly bear population based on new scientific analyses and information. The second criterion pertaining to the distribution of females with offspring remains unchanged. The current demographic recovery criteria to be appended to the 1993 Recovery Plan are:

- Demographic Recovery Criterion 1—Maintain a minimum population size of 500 grizzly bears[1] and at least 48 females with cubs-of-the-year within the Demographic Monitoring Area (DMA) as shown in figure 1, as indicated by methods established in published, peer-reviewed scientific literature and calculated by the Interagency Grizzly Bear Study Team (IGBST) using the most updated Application Protocol, as

[1] This number is required to maintain short-term genetic fitness in the next few decades. It is not a population target, but a minimum.

posted on their website. If the estimate of total population size drops below 500 in any year or below 48 females with cubs-of-the-year in 3 consecutive years, this criterion will not be met. The 48 females with cubs-of-the-year metric is a model-averaged number of documented unique females with cubs-of-the-year.

Figure 1. The Demographic Monitoring Area (DMA) within which all demographic criteria would be assessed.

- Demographic Recovery Criterion 2—Sixteen of 18 bear management units within the Recovery Zone (figure 2) must be occupied by females with young, with no 2 adjacent bear management units unoccupied, during a 6-year sum of observations. This criterion is important as it ensures that reproductive females occupy the majority of the Recovery Zone and are not concentrated in one portion of the ecosystem. If less than 16 of 18 bear management units are occupied by females with young for 3 successive 6-year sums of observations this criterion will not be met (table 1).

Figure 2. Greater Yellowstone Ecosystem grizzly bear recovery zone boundary showing bear management unit (BMU) and subunit boundaries for application of Demographic Criterion 2.

Table 1. Recovery criterion 2 is measured by the number of occupied BMUs for each 6-year sum of observations.

6-year period	Number of BMUs occupied by females with young by year								Criteria met (16 of 18 occupied at least once)
	2008	2009	2010	2011	2012	2013	2014	2015	
2008–2013	18	18	18	16	15	18			Yes
2009–2014		18	18	16	15	18	18		Yes
2010–2015			18	16	15	18	18	17	Yes

- Demographic Recovery Criterion 3—Maintain the population within the DMA around the 2002–2014 model-averaged Chao2 population estimate (average = 674; 95% CI = 600–747; 90% CI = 612–735) by maintaining annual mortality limits for independent females, independent males, and dependent young as per table 2. These adjustable mortality rates were calculated as those necessary to manage the population to the model-averaged Chao2 population estimate of 674 bears which occurred during the time period that the population had a relatively flat population trajectory. If mortality limits are exceeded for any sex/age class for three consecutive years and any annual population estimate falls below 612 (the lower bound of the 90% confidence interval), the IGBST will produce a Biology and Monitoring Review to inform the appropriate management response. If any annual population estimate falls below 600 (the lower bound of the 95% confidence interval), this criterion will not be met and there will be no discretionary mortality, except as necessary for human safety.

Table 2. Total mortality rates used to establish annual total mortality limits for independent females, independent males, and dependent young[2] inside the DMA using the model-averaged Chao2 population estimator. These mortality limits are on a sliding scale to achieve the population goal inside the DMA of the model-averaged Chao2 population size of 674 between 2002–2014 (95% CI = 600–747). For populations less than 600, there will be no discretionary mortality except as necessary for human safety.

	Total Grizzly Bear Population Estimate*		
	≤674	675–747	>747
Total mortality rate for independent FEMALES	**<7.6%**	**9%**	**10%**
Total mortality rate for independent MALES	**15%**	**20%**	**22%**
Total mortality rate for DEPENDENT YOUNG	**<7.6%**	**9%**	**10%**
***Total mortality*: Documented known and probably grizzly bear mortalities from all causes including but not limited to: management removals, illegal kills, mistaken identity kills, self-defense kills, vehicle kills, natural mortalities, undetermined-cause mortalities, grizzly bear hunting, and a statistical estimate of the number of unknown/unreported mortalities.**			

*using the model-averaged Chao2 population estimator

Background

In 2000, we began a process to reevaluate and update methods to determine the status of the GYE grizzly bear population, estimate population size, and determine the sustainable level of mortality in the GYE. The Wildlife Monograph: "Temporal, Spatial, and Environmental Influences on The Demographics of Grizzly Bears in The Greater Yellowstone Ecosystem" (Schwartz et al. 2006); the report: "Reassessing Methods to Estimate Population Size and Sustainable Mortality Limits for the Yellowstone Grizzly

[2] Total mortality rates are based on the mortality percentage of the respective population segment relative to the population estimates.

Bear" (Interagency Grizzly Bear Study Team 2005); and the report: "Reassessing Methods to Estimate Population Size and Sustainable Mortality Limits for the Yellowstone Grizzly Bear Workshop Document Supplement 19-21 June, 2006" (Interagency Grizzly Bear Study Team 2006) provided the scientific basis for revising the demographic recovery criteria in the GYE in 2007. Similarly, the revisions we are implementing through this Supplement to the Recovery Plan are based on updated demographic analyses using the same methods as before (Schwartz et al. 2006), as reported in the Interagency Grizzly Bear Study Team's 2012 report: "Updating and Evaluating Approaches to Estimate Population Size and Sustainable Mortality Limits for Grizzly Bears in the Greater Yellowstone Ecosystem." This 2012 Study Team report provides the scientific basis for the changes proposed below.

We proposed to change the first and third criteria because they no longer represent the best scientific data or the best technique to assess recovery of the GYE grizzly bear population. Specifically, these criteria warrant revision because: (1) There are updated demographic analyses for 2002–2011 indicating that the rate of growth seen during the 1983–2001 period has slowed and sex ratios have changed; (2) there is consensus among scientists and statisticians that the area within which we apply mortality limits should be the same area we use to estimate population size; and (3) the need exists to make the demographic criteria dynamic so that the IGBST can incorporate results from updated demographic analyses and implement new scientific methods based on peer-reviewed, scientific literature as they become available.

These criteria will replace the 2007 Demographic Criteria and are hereby appended to the Yellowstone chapter of the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1993, p. 44) and the 2016 Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Ecosystem.

More information about Revisions to Demographic Criterion 1:

The biological intent of this revision is identical to the 2007 criterion: to maintain a minimum population size of at least 500 animals, which exceeds the genetic recommendations of Miller and Waits (2003). The only change is that this criterion no longer specifies which scientific method must be used to assess the criterion. The current method (2016) used to estimate population size is the model-averaged Chao2 population estimator and this method will continue to be used until another scientifcally valid method is developed. We eliminated the criterion's dependence on a specific method (e.g., Chao2) so that the IGBST can rapidly implement improved scientific methods as they become available in the peer reviewed literature. Methods used to estimate population size will be available online for review in the Application Protocol posted on the IGBST's website (http://nrmsc.usgs.gov/research/igbst/research). The number 500 is not a population goal nor is there any intention to manage down to 500 bears. The number 500 represents a minimum population size necessary to assure no short-term negative effects of loss of genetic diversity.

More information about Revisions to Demographic Criterion 3:

Demographic Criterion 3 requires sustainable mortality limits to be calculated each year. As in the past, these mortality limits are based on scientific analyses that calculate the level of mortality the grizzly bear population can tolerate without declining (i.e., the sustainable mortality rate; table 2). The sustainable mortality rates established in the 2007 Demographic Criteria were based on data obtained between 1983 and 2002 from radio-collared bears and the modeling results of Harris et al. (2006). When these Demographic Criteria triggered a demographic review by the IGBST in 2011, they examined more recent data from 2002–2011 and compared the results of these new analyses with those from the previous time period. Between 2002 and 2011, population growth slowed and sex ratios changed, with more independent males in the population than previously documented (IGBST 2012). When sustainable mortality rates were re-

calculated with these recent data, the IGBST found rates had changed for some age and sex classes. Specifically, the sustainable mortality rate for independent females from all sources changed from 9.0% to 7.6% and the sustainable mortality rate for dependent young from human causes only also changed from 9.0% to 7.6% (IGBST 2012). Because these rates represent the best available science, we revised Demographic Criterion 3 to reflect these new demographic analyses. The language in Demographic Criterion 3 allows results from demographic analyses to be implemented as they become available and sustainable mortality rates adjusted accordingly within the DMA.

While the general biological intent of this proposed revision is similar to the 2007 criterion (i.e., to assure population health through application of data-based mortality limits to each sex/age class), there is one important difference. The new rates are based on the level of mortality that will result in maintaining the population around the same population size at which the population began to demonstrate density-dependent population regulation from 2002 to 2014 instead of the 2007 approach that applied mortality limits that assured the population would be stable to increasing with 95% confidence and only a 5% chance of population decline. Because there are several indications the population is at or approaching carrying capacity within the DMA and population growth has slowed (see Schwartz et al. 2006; IGBST 2012; Bjornlie et al. 2014), managing human-caused mortality at levels that will maintain the population within the DMA at the average size since 2002 is reasonable and biologically sound.

Like the methods adopted in 2007, Demographic Criterion 3 continues to count deaths of independent (at least 2 years old) male and female grizzly bears from all sources against annual mortality limits while counting only known and probable human-caused mortalities against annual mortality limits for dependent young (less than 2 years old). For independent females and males, counted mortalities include: (1) known and probable human-caused mortalities; (2) reported deaths due to natural and undetermined causes; and (3) calculated unreported human-caused mortalities. The IGBST will continue to use the methods of Cherry et al. (2002) to estimate unknown/unreported mortalities each year based on the number of known, reported deaths (Cherry et al. 2002,

p. 179; IGBST 2005, pp. 39–41) until and unless new and improved scientifically methodology becomes available.

Annual mortality limits will be measured and applied within the DMA shown in figure 1. The IGBST developed this DMA using USFWS suitable habitat (see 72 FR 14866, March 29, 2007) as a base layer then adding areas that could serve as mortality sinks (e.g., cities) because these areas could have disproportionate effects on the population generally contained within the suitable habitat zone (IGBST 2012). Mortalities outside of the DMA will be recorded and reported but do not count against the sustainable mortality limits for that year. Table 3 shows the mortalities in the previous monitoring area and inside the DMA in 2014 and 2015. Figure 3 shows the numbers of mortalities in 2015 inside and outside the DMA. Grizzly bear occupancy will not be actively discouraged outside the DMA and grizzly bears will not be persecuted just because they are present there.

Table 3. An example of the mortality limits for various age/sex classes in the previous monitoring area and the DMA in 2014 and 2015 identified in this Supplement.

	Previous monitoring area	**DMA**
Independent female mortalities observed in 2014	**5**	**4**
Independent male mortalities observed in 2014	**15**	**11**
Dependent young mortalities observed in 2014	**2**	**2**
Independent female mortalities observed in 2015	**11**	**10**
Independent male mortalities observed in 2015	**26**	**20**
Dependent young mortalities observed in 2015	**13**	**13**

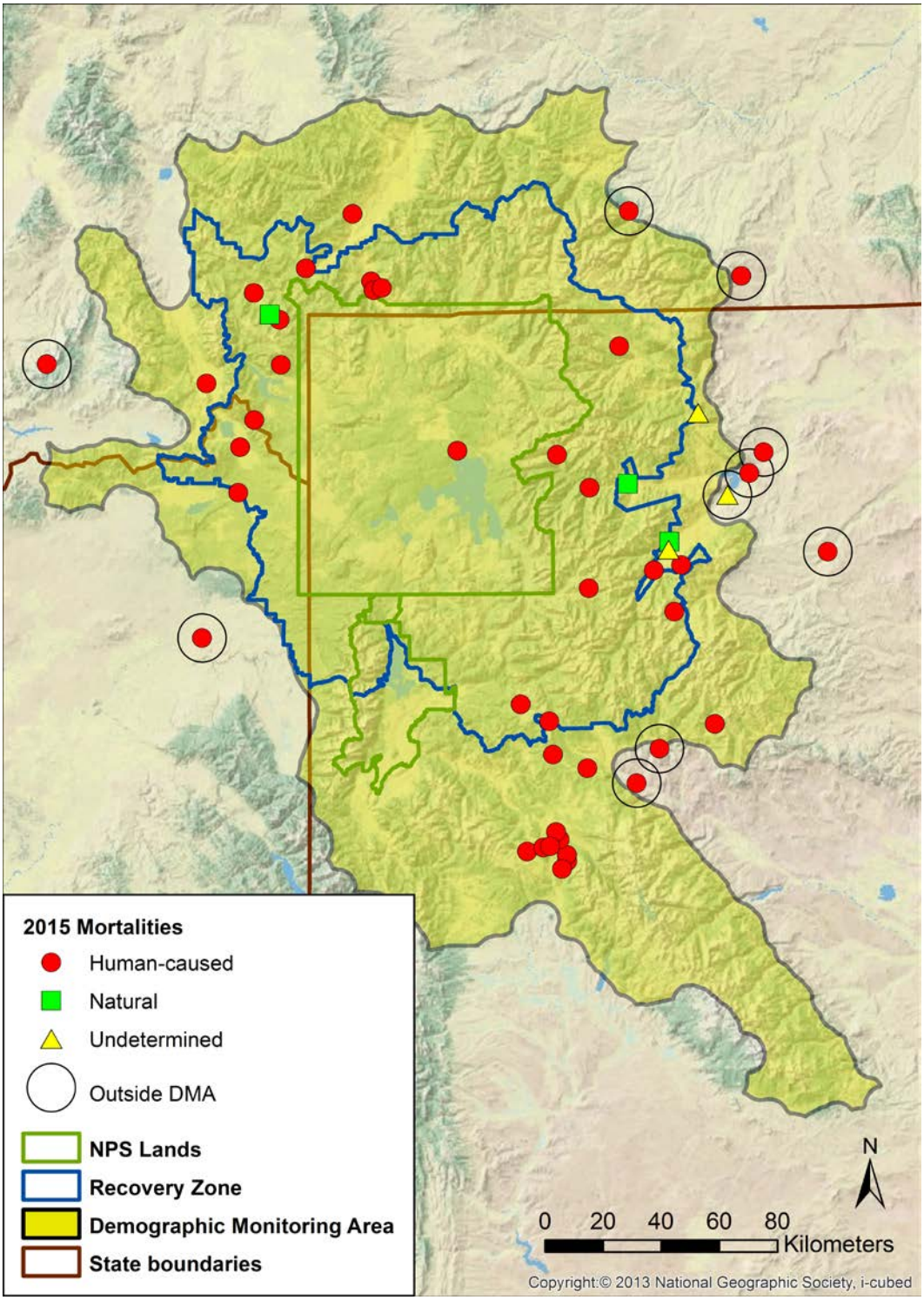

Figure 3. Mortalities inside and outside the DMA in 2015.

We expect grizzly bears, usually males, to occasionally move through and gradually reoccupy at low densities some of the habitat between the GYE and the Northern Continental Divide Ecosystem (NCDE) in the Highland and Tobacco Root mountain ranges. To allow the opportunity for non-nuisance grizzly bears to move through and reoccupy these mountain ranges at low densities, grizzly bears will not be captured and removed from this area unless there are documented conflicts or threats to human safety, as determined by wildlife agency personnel. As is the case inside the DMA, management emphasis will be on conflict prevention and response. Attractant storage rules are in place on National Forest lands. Additional habitat protections are not necessary for recovery.

Application of the proposed revisions to Demographic Criteria 1 and 3.

The Application Protocols describing the current methods to evaluate, measure and apply these Demographic Recovery Criteria are available as Appendix C in the 2016 Conservation Strategy.

Responses to public comments and peer review

The comment period for the draft *Grizzly Bear Recovery Plan Supplement: Revised Demographic Criteria for the Yellowstone Ecosystem* ran concurrently with the comment period for the proposed rule *Removing the Greater Yellowstone Ecosystem Population of Grizzly Bears from the Federal List of Endangered and Threatened Species* (81 FR 13174, March 11, 2016). We considered all comments received and published a summary of the issues and responses to the issues in the final rule.

Literature Cited

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Appendix A.

Implementation Schedule

The following Implementation Schedule outlines actions and estimated costs for the grizzly bear (*Ursus arctos horribilis*) recovery program over the next 5 years in the GYE. Functioning as a practical guide for meeting the species' recovery goals, this schedule indicates action priorities, action numbers, action descriptions, duration of actions, and estimated costs. In addition, parties with authority, responsibility, or expressed interest in implementing a specific recovery action are identified: however, this neither obligates nor implies a requirement for the identified party to implement the action(s) or secure funding for implementing the action(s). Parties willing to participate may benefit by being able to show in their own budgets that their funding request is for a recovery action identified in an approved recovery plan and, therefore, is considered a necessary action for the overall coordinated effort to recover the grizzly bear. Also, section 7(a)(1) of the ESA, as amended, directs all Federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation threatened and endangered species. The following implementation schedule only covers time and cost estimates related to the demographic recovery criteria discussed in this Supplement. However, the total cost for annual implementation of all recovery actions is approximately $3,773,685. It is not practicable to estimate the total time to recovery as we do not know how long the population will remain listed.

Key to Implementation Schedule Priorities (column 1)

PRIORITY 1 ACTION: An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

PRIORITY 2 ACTION: An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

PRIORITY 3 ACTION: All other actions necessary to provide for full recovery of the species.

Key to responsible parties in column 4:

USFS =	U.S. Forest Service
YNP =	Yellowstone National Park
USGS =	U.S. Geological Survey
MT =	Montana Fish Wildlife and Parks Department
ID =	Idaho Fish and Game Department
WY =	Wyoming Game and Fish Department
GTNP =	Grand Teton National Park

Action Priority	Action Description	Action Duration	Responsible Parties	USFWS Lead	Total (annual) Costs
3	Monitor the number of females with cubs-of-the-year	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$203,920
3	Monitor and investigate grizzly bear mortalities	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS, USFWS	N	$108,235
3	Monitor distribution of family groups	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$78,165
3	Maintain sample of at least 25 radio-collared females	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$462,735
3	Management of grizzly bear-human conflicts	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$2,230,435
3	Conflict prevention via outreach and education	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$210,630
3	Report writing, data analyses, literature publication	Annual	USGS, MT, WY, ID, YNP, GTNP, USFS	N	$25,000

Note: It is anticipated that these annual costs will continue in perpetuity, regardless of listed status, or until cheaper methods to obtain the same quality of information are developed.