

Framework to manage inside the DMA to stabilize the population at the 2002-2014 average estimated population level of 674.

Management Framework	Background and Application Protocol
1. Area within which mortality limits apply.	19,279 square miles Demographic Monitoring Area (DMA) ¹ (Figures 1 and 2).
2. Management objective.	To maintain the population at the average estimate for 2002-2014, a period of population stability (674 using the Chao 2 ² methodology).
3. Population estimator.	The model-averaged Chao2 population estimator will be used as the population measurement tool unless another scientifically sound method becomes available. The average Chao2 population estimate for 2002-2014 was 674 (average lower 95% CI = 600; average upper 95% CI = 747).
4. Allocation process for managed mortalities	Management within the mortality limits within the DMA. Coordination among the states to manage within the mortality limits within the DMA. The Wind River reservation will receive a portion of the available mortality limit based on the % of the WRR geographic area within the DMA.
5. Management review by the Study Team every 5 years to assure that management actions are achieving the objective of a stable population at the estimated number at time of delisting.	The management review will assess if the management system is achieving the desired objective to maintain a stable population at the 2002-2014 average estimated population size based on the model-averaged Chao2. The management review is a science-based process that will be led by the Study Team (which includes all state and federal agencies and the WRR Tribes) using all recent available scientific data to assess population numbers and trend against the management objective. Vital rates such as age/sex-specific survival and reproductive rates will also be reevaluated using the most recent data to adjust sustainable mortality levels as necessary.

¹ See maps on p. 5.

² The Chao2 methodology (Keating et al. 2002; Cherry et al. 2007) as established by the Study Team uses a model-averaged result of sightings of females with cubs as per Harris et al. (2007).

6. Mortality limit % for independent <u>FEMALES</u> based on the results of the model-averaged Chao2 methodology.					
	<674	674 ³	675-747	>747	
	<7.6%	7.6% ⁴	9%	10%	
7. Mortality limit % for independent <u>MALES</u>.	<674	674 ³	675-747	>747	
	<15%	15%	20%	22%	
8. Mortality limit for % of dependent young.	<674	674 ³	675-747	>747	
	<7.6%	7.6%	9%	10%	
9. <u>Example</u> of background level of annual mortalities from management and other causes - Using average yearly total mortality of independent bears (≥2 years) from all causes including unknown/unreported estimates, This example uses the average 2011 to 2014.	38 expected independent bear deaths/year due to management, illegals, and other deaths (17 F, 21 M) (This includes dead bears from inside the DMA only.) Note that this is only an example of the expected background level of annual mortalities. This number may vary from 38/year and will have to be factored into the numbers presented in items #10 through #14 below.				
10. <u>Total mortality limit independent FEMALES</u> (≥2 years).	<600 (as an example) at <7.6% mortality	600-673 <7.6% mortality	674 at 7.6% mortality	675-747 at 9% mortality	>747 at 10% ⁵ mortality
	<16	16 to 17	18	21 to 23	≥26
11. <u>Total mortality limit independent MALES</u> (≥2 years).	<600 at <15% mortality	600-673 <15% mortality	674 at 15% mortality	675-747 at 20% mortality	>747 at 22% mortality
	<31	31 to 34	35	47 to 52	≥57

³ Population estimates based on model-averaged result of the annual application of the Chao2 estimator. The mortality limits in numbers of bears for independent females, independent males, dependent, respectively, change as the annual Chao2 population estimate changes.

⁴ A 7.6% independent female mortality rate will result in population stability using the updated vital rates (IGBST 2012).

⁵ A 10% mortality level of females will result in rapid return to lower population numbers with resulting rapid reductions in available discretionary mortality. Such a high female mortality rate will result in inconsistent year to year discretionary mortality levels and challenges in season setting and management.

12. Examples of the number of independent female and male bears “available” for hunting and additional management removals inside the DMA. This is the number available in excess of the expected annual mortality from other causes.	Examples: For 674 bears: (manage for population stability) F limit = 18 – 17 background mortalities = 1 F available (1 state, 0 WRR) M limit = 35 – 21 background mortalities = 14 M available (14 state, 0 WRR) For 747 bears: (manage for population decline) F limit = 23 – 17 F background mortalities = 6 F available (6 state, 0 WRR) M limit = 52 – 21 M background mortalities = 31 M available (30 state, 1 WRR) (+ any mortalities outside the DMA)				
13. State allocation⁶ (all 3 states) Allocation ⁶ among states will be determined by the states	600 (as an example)	674 ⁷	675-747	>747	
	F: 0 M: 10⁸	F: 1 M: 14⁷	F: 4 to 6 M: 25 to 30	F: ≥9 M: ≥35	
14. Wind River Reservation allocation (based on % of reservation within the DMA).	600 (as an example)	674	675-747	>747	
	F: 0 M: 0	F: 0 M: 0	F: 0 M: 1	F: 0 M: 1	

⁶ Actual mortality limit for males and females would be calculated annually by the IGBST based on the model-averaged chao2 for the year and the previous year’s mortality numbers for independent males and females and dependent young.

⁷ Between 600 and 674 there would be a fraction of an adult female available.

⁸ For practical application, with 0 or 1 female available and the difficulty of the average hunter to distinguish between males and females in the field, the states may consider what hunting management for males is actually available.

Literature Cited

- Cherry, S., G. C. White, K. A. Keating, M. A. Haroldson, and C. C. Schwartz. 2007. Evaluating estimators of the number of females with cubs-of-the-year in the Yellowstone grizzly bear population. *Journal of Agricultural, Biological, and Environmental Statistics* 12:195–215.
- Harris, R. B., G. C. White, C. C. Schwartz, and M. A. Haroldson. 2007. Population growth of Yellowstone grizzly bears: uncertainty and future monitoring. *Ursus* 18: 167–177.
- Interagency Grizzly Bear Study Team. 2012. Updating and evaluating approaches to estimate population size and sustainable mortality limits for grizzly bears in the Greater Yellowstone Ecosystem. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, Montana. [http://www.nrmssc.usgs.gov/files/norock/IGBST/GYEGBMortWksRpt2012\(2\).pdf](http://www.nrmssc.usgs.gov/files/norock/IGBST/GYEGBMortWksRpt2012(2).pdf)
- Keating, K. A., C. C. Schwartz, M. A. Haroldson, and D. Moody. 2002. Estimating numbers of females with cubs-of-the-year in the Yellowstone grizzly bear population. *Ursus* 13:161–174.



Figure 1. Map showing PCA vs. DMA. Red line is the PCA (23,828 sq. km). Green area is the DMA (49,931 sq. km).

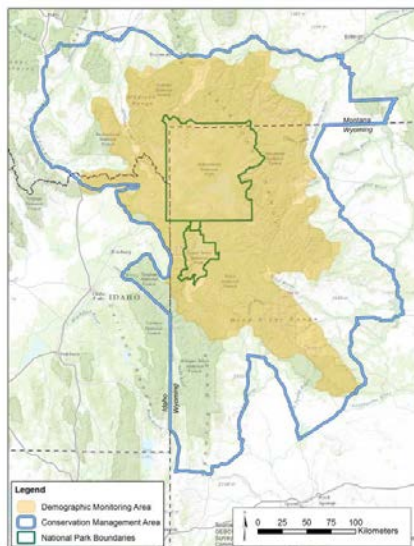


Figure 2. Blue line = old area where mortalities counted (95,225 sq. km); tan area = new mortality count area or the DMA (49,931 sq. km).