

APPLICATION PROTOCOL
Yellowstone Grizzly Bear Demographic Recovery Criteria
November 2012

To evaluate Demographic Recovery Criterion #1, the Interagency Grizzly Bear Study Team will use the following procedures to estimate total population size:

1. Raw observations of sightings of females with cubs of the year will be separated into observations of unique females and repeat observations of the same female using the methods of Knight et al. (1995, p. 246).
2. The Chao2 estimator (Keating et al. 2002, p. 173) will be applied to sighting frequencies of unique females with cubs of the year to estimate the number of females with cubs of the year in the population.
3. The number of unique females with cubs of the year obtained from the Chao2 estimator each year will be added to the dataset and the model averaging process described in the Supplement to the Reassessing Methods Document (Interagency Grizzly Bear Study Team 2006, pp. 2-10)
4. The predicted number of females with cubs of the year obtained from the model fit will be used as the best estimate of the total number of independent females in the population accompanied by cubs of the year for that year.
5. The purpose of the model is to get the best estimate of the current number of females with cubs of the year borrowing information from past estimates, recognizing that with each iteration some change is expected. Estimates of females with cubs of the year for previous years will not be retrospectively adjusted with data from the current year.
6. The predicted number of females with cubs of the year will be divided by the proportion of females ≥ 4 years old estimated to be accompanied by cubs of the year (transition probability = 0.289). The resulting value represents the best estimate of the total number of females in the population ≥ 4 years old.
7. The number of females ≥ 4 years old will be divided by the estimated proportion of females ≥ 4 years old in the population of females ≥ 2 years old (0.77699). The resulting value is the best estimate of the number of independent females (≥ 2 years old) in the population that year.
8. The number of independent males in the population will be based on the estimated ratio of independent males to independent females (0.63513) derived via stochastic modeling described in the Supplement to the Reassessing Methods Document (Interagency Grizzly Bear Study Team 2006, pp. 10-11). The number of independent females in the population will be multiplied by 0.63513 and the resulting value represents the best estimate of the number of independent males that year.
9. The number of cubs of the year in the annual population estimate will be calculated directly from the model-predicted estimate of females with cubs of the year (Interagency Grizzly Bear Study Team 2006, p. 17). The number of cubs of the year will be estimated by multiplying the modeled estimate by the mortality-adjusted mean litter size (2.04) observed from 2002–2012.
10. The number of yearlings will be estimated by multiplying the estimated number of cubs from the previous year by the mean survival rate for cubs (0.638) observed from 2002–2012.

Comment [rs1]: Frank/Mark: please replace the highlighted terms with the updated transition probabilities and ratios that include 2012 data (highlighted below).

Comment [rs2]: Mark: will the updated analyses that include 2012 data be published in a document we can cite since the 2012 Workshop Report only includes data through 2011?

DRAFT AND SUBJECT TO CHANGE

11. The estimated total population size will then be calculated as the sum of the estimates of each age and sex class:
 - a. independent females + independent males + cubs of the year + yearlings = estimate of total population size
12. Estimates of uncertainty about the number of independent females, independent males, dependent young, and total population size will be derived following methods detailed in the Supplement to the Reassessing Methods Document (Interagency Grizzly Bear Study Team 2006, pp. 10–15).
13. If the AICc weight favors the quadratic term (i.e., >0.5) in modeling the rate of change of females with cubs (Interagency Grizzly Bear Study Team 2006, pp. 4–8), a full review of the population's demographics will be undertaken by the Study Team to better understand population status.

To evaluate Demographic Recovery Criterion #2, the Interagency Grizzly Bear Study Team will use the following procedures to document distribution of females with offspring in Bear Management Units:

To evaluate Demographic Recovery Criterion #3, the Interagency Grizzly Bear Study Team will use the following procedures to establish annual sustainable mortality rates and count numbers of grizzly bear mortalities:

1. Based on demographic analyses using data from 2002-2012, the sustainable mortality limit for independent females is 9% of the population estimate of independent females.
2. Unknown and unreported mortality will be estimated based on the methods of Cherry et al. (2002, p. 179) and the Reassessing Methods Document (Interagency Grizzly Bear Study Team 2005, pp. 39-41).
3. The sustainable mortality limit for independent males is 15% of the population estimate of independent males.
4. The sustainable mortality limit for dependent young (cubs and yearlings) is 9% of the annual estimate of dependent young. Only human-caused deaths (reported known and probable) will be tallied against this threshold. Unknown and unreported mortality will not be estimated for dependent young.
5. Sustainable mortality limits will be established annually following methods detailed in Cherry et al. 2002. Because we are using model-averaged estimates, annual variability among years has been addressed and we recommend annual mortality limits based on the current year.
6. Dead bears reported in years subsequent to the actual year of mortality will be tallied against the estimated year of death and mortality total will be recalculated for that year. If mortality exceeds the threshold for that year, the difference (total mortality minus threshold) should be counted against the current years' threshold. If sex of the dead bear cannot be determined, sex will be assigned randomly using ratio of 1:1 male:female (Interagency Grizzly Bear Study Team 2012, p.).

Comment [rs3]: Frank/Mark: may want to revise this now that's it shifted. Or not? Your call. In previous drafts, Frank suggested "If AICc model weights favor models indicating decline"

Comment [rs4]: Frank/Mark: could you please add this language for the distribution criterion?

Comment [rs5]: Mark: Please update based on the addition of 2012 into the dataset.

Comment [rs6]: Is this right? Does Cherry et al. really address the calculation of mortality limits?

Comment [rs7]: Frank/Mark: Is the revised sex ratio in the Workshop Report? I couldn't find it just by searching for "sex ratio."