

# RECOMMENDATIONS REGARDING MANDATORY TAGGING AND TOOTH EXTRACTION TO OBTAIN AGE-AT-HARVEST DATA FROM BLACK BEARS HARVESTED IN MONTANA

APRIL 12, 2021

## Recommendations:

**Recommendation 1** – Eliminate Physical Inspection and Implement Mandatory Tooth Submission for Harvested Black Bears

**Recommendation 2** – Investigate Deploying Periodic DNA Hair Traps to Provide Independent Population Estimation

## Background

Hunters that harvest black bears in Montana currently must report their take through 1) the harvest reporting line within 48 hours in bear management units with quotas and 2) present the hide and skull to the Department within 10 days for inspection, tagging, and possible tooth extraction for aging. The first requirement provides important harvest data with little expense on behalf of the agency, the second requirement provides a method to obtain age-at-harvest data, verification of sex and species of harvested animals, and an opportunity to interact with a segment of the hunting public. The Department is considering eliminating the mandatory check for black bears pending further analysis to make supported management recommendations relative to black bear management.

The black bear inspection, tagging, and tooth extraction process was adopted in 1985. From an enforcement perspective, this provides an opportunity to verify that harvests of the lawful sex and species are accurately reported. Tagging the hide provides evidence that the harvested animal complies with regulations regarding take. From a biological perspective, the tooth extraction provides a means for collecting accurate age-at-harvest data, which can assist in evaluating the level of exploitation of black bear populations, particularly when combined with other biological data.

Age and sex of harvested black bears can provide insight into the level of exploitation by hunting. For example, Beecham and Zager (1992) provided some general insights that have been subsequently adopted by many state wildlife agencies. Montana's bear harvest objectives used similar criteria, specifically that the total harvest should comprise <40% females, the median age of harvested females should be  $\geq 6$  years, and the median age of harvested males should be  $\geq 4$  years.

In 1994, the Department completed a Programmatic Environmental Impact Statement (PEIS) for black bears (Montana Fish, Wildlife, and Parks 1994), and an analysis of Beecham and Zager's (1992) harvest data suggested female bears were being harvested at near the maximum proportion to maintain a stable population. The PEIS suggested the need for studies to assess black bear

demography in representative populations, which would allow the evaluation and refinement of harvest criteria used to manage black bear populations in Montana. Although harvest data are commonly used to assess black bear population status, interpretation of harvest data are difficult and often give contradictory signals (Garshelis 1990). Interpreting these data in Montana was particularly challenging at the time of the PEIS because bear population structure, size, and trend were relatively unknown for much of Montana. The PEIS recommended that if black bear harvest does not meet these objectives in any 3 consecutive years, all available data should be analyzed to determine how management should change (Montana Fish, Wildlife, and Parks 1994).

As a result, the Department initiated the Statewide Black Bear Management Program (BBMP) in 2000, which involved 1) a bear radiocollaring study in the Swan Valley to evaluate black bear reproduction, harvest rates, and survival and 2) a DNA mark-recapture program to assess black bear densities and harvest rates across multiple areas in Montana, and 3) evaluating current black bear harvest criteria and management. Mace and Chilton-Radandt (2011) concluded that Montana's harvest statistics met all 3 criteria only 17% of the time. They further concluded that the use of these parameters was insufficient to assess annual black bear population trends. Mace and Chilton-Radandt (2011) recommended that the use of these criteria be discontinued for managing black bear harvest, but they recommended other approaches, including the DNA mark-recapture methods. Using the population estimates from DNA mark-recapture methods allowed the Department to assess harvest using total female mortality (including nonhunting mortality). Bunnell and Tate (1980) recommended that total female mortality rates should not exceed 16%, and hunters should not harvest >5% of the estimated female population.

Currently, the Department has not replicated population estimation efforts using the hair trap approach, although an integrated population model (IPM) that incorporates data (including the population estimates obtained using the hair trap methods) collected by the agency is being investigated. The IPM would rely on age-at-harvest data obtained through teeth extracted from harvested black bears. Inferences from the IPM regarding the current population size of female black bears and harvest rate would be limited because only the Mace and Chilton-Radandt (2011) population estimate exists and no other independent estimate exists to calibrate model performance. However, the multiple sources of data incorporated in the IPM work together to increase the reliability of model predictions. Population estimates from the IPM without an independent population estimate to calibrate the model will lead to increasingly wide confidence intervals around subsequent population estimates.

### **Determining the Need for Physical Inspection, Tagging, and Tooth Extraction**

Determining if there remains a need for a physical inspection, tagging, and tooth extraction may best be evaluated by examining several questions. Evaluation of this aspect of reporting does not have any apparent bearing on the requirement for hunters to call in their harvest within 48 hours in units with quotas. Consequently, this evaluation should not influence that aspect of mandatory reporting. This evaluation focuses on mandatory physical inspection, tagging, and tooth extraction.

1. Why did Montana implement mandatory physical inspection, tagging, and tooth extraction?

Following harvest practices used for hunting grizzly bears in Montana, the Department adopted the mandatory physical inspection, tagging, and tooth collection for black bears. Physical inspection provides a method by which to ensure harvested bears are accurately reported, and sex and species may be verified. Law enforcement reports that a grizzly bear is harvested inadvertently harvested and tagged with a black bear license only rarely (2 known instances in Region 1). Mace and Chilton-Radandt (2011: 8; Table 3) evaluated occurrences of grizzly bear mistaken identification and found 28 grizzly bears were mistakenly killed by hunters during 1999–2008 across 3 grizzly bear recovery zones in Montana. This averaged an annual unlawful take of  $\leq 1$  grizzly bear per western Montana recovery zone.

An individual that intentionally kills a grizzly bear is unlikely to report the harvest in any fashion.

Hide tags were recently eliminated. Tagging the hide allowed a taxidermist to verify that the animal has been inspected by Department personnel. Without the Department-affixed tag, the hunter still must present the carcass tag (as with a deer, elk, or antelope) as evidence of lawful harvest. There is no CITES requirement that black bears receive a tag, except in some instances where harvested black bears or taxidermy may be shipped internationally, and those instances require a different tagging process.

Tooth extraction provides the Department with an opportunity to determine age-at-harvest for black bears because the tooth may be cross-sectioned, and an estimate of age may be obtained through counting cementum annuli. The age data is used in assessing exploitation levels by comparing median ages of harvested male and female black bear with established criteria to determine if harvest occurs at appropriate levels, if harvest may be liberalized, or if restrictions on harvest are necessary. Currently, this is especially useful in bear management units in which harvest is controlled using quotas (e.g., Regions 5 and 6), and these data are currently being used to inform the pilot IPM.

2. What is the cost of physical inspection, tagging, and tooth extraction?

Department personnel physically inspect about 1,400–1600 harvested bears annually. These physical inspections may be conducted by personnel in multiple divisions, and the majority of the inspections are probably not conducted by Wildlife Division personnel. Additionally, the number of inspections is not evenly distributed throughout the state, with Region 1 inspecting about 40%, Region 2 inspecting about 22%, and Region 3 inspecting about 20% of the annual harvest. Biologists estimate that it takes about 20–30 minutes to complete a physical inspection on average. This is a conservative estimate that does not include travel time for inspections, travel to deliver samples, or time committed to staying near the office on busy days. Physical inspections annually require between 475–800 human resource hours to complete, or (at \$28/hr) \$13,300–22,400/year. Sectioning and reading of teeth costs about \$5.10/tooth for black bear, or about \$7,650 annually for 1,500 teeth. Total estimated cost ranges from \$20,950–30,050 annually.

3. What are age-at-harvest data used for?

Age-at-harvest data are currently used to determine median age of male and female black bears harvested during hunting seasons in Montana. The median age provides the Department with an estimate of the level of exploitation and gives the Department guidance on when to amend season structure or quota (when applicable). However, Mace and Chilton-Radandt (2011) found that the current metrics that rely on harvest data were not adequate to evaluate changes in bear populations.

The age-at-harvest data is currently an input into the developing IPM for improved black bear population modeling. Age data are the primary component of this model and the least expensive data to obtain. Vital rates from the BBMP and scientific literature such as reproduction and survival are incorporated, which have no additional cost to obtain. Together, these sex, age, and vital rate data within the IPM framework provide a reasonable approximation of bear population trend and allow biologists to simulate the effects of various levels of harvest on future population size and trend. Yet the IPM benefits from occasional density estimates to re-calibrate the population trend.

Hair traps have been used once in Montana to estimate black bear population size and harvest rates across multiple representative areas, but these traps have not been repeated and no independent estimates are available. As a method of estimating population size, hair traps do not rely on age-at-harvest data and inspections, tagging, and tooth extraction are not needed for this technique. When hair traps were used for population estimation, representative areas are selected, and hair traps are distributed on a generally regular interval approximating a  $5 \times 5$  km grid. Hair snagged in the traps are analyzed for DNA markers to identify individuals and a mark-recapture analysis provides a population estimate and harvest estimate (where applicable). During the initial hair trapping conducted by Mace and Chilton-Radandt (2011), DNA costs alone approached \$25,000 annually, and this cost did not include labor or equipment. They were able to sample 1–2 representative areas annually. The largest array of hair traps that they implemented was 402. These are labor intensive approaches. Monitoring these hair traps involved the efforts of 20–38 volunteers at each site, and Nevada contracted a similar effort that cost about \$120,000 annually. Hair traps may be a viable option for estimating bear populations, but more information is needed on the frequency and arrangement across the state.

4. What is the potential need for age-at-harvest data in the future?

The Department often receives demands for better population estimates for all wildlife species, and black bears are no different. Several approaches remain plausible for the foreseeable future.

- a. Continue to monitor black bear harvests using existing age-at-harvest data to determine the median age of harvested male and female black bears. Median age may still be used to infer level of exploitation and adjust seasons and quotas accordingly. However, Mace and Chilton-Radandt (2011) did not recommend this approach because harvest data alone were insufficient to gauge whether black bear populations would be in decline on an annual basis. Estimated financial costs would be about \$30,000/year.

- b. Implement a regular hair trap survey to determine periodic population estimates in representative areas, similar to a "trend" survey area. No age-at-harvest data would be needed for this approach. Further evaluation of data would be needed to inform survey frequency. Estimated financial costs would be about \$120,000/year.
- c. Implement the IPM statewide to model black bear populations, which would require data regarding the age structure of the population to increase the reliability of model predictions. Many data sources from Mace and Chilton-Radandt (2011), including the DNA and radiocollaring results, food productivity, and age-at-harvest information, are currently being used to inform pilot IPMs, and using these data seems logical to continue. Age-at-harvest data alone does not provide population estimates and IPM confidence intervals increase annually without an independent population estimate. Estimated financial costs would be about \$30,000/year.
- d. Implement the IPM statewide to model black bear populations and include regular independent population estimates using hair traps to calibrate the IPM. This approach would probably still rely on age-at-harvest data for the best modeling performance, but periodic calibration with an independent population estimate would be necessary. Using age-at-harvest data would reduce the frequency of optimal calibrations with an independent estimate. Estimated financial costs would be about \$150,000/year.

### **Methods to Obtain Age-at-harvest Data**

Cementum aging from teeth extracted from harvested black bears is the most precise method for determining age-at-harvest. Estimates from tooth wear are often inaccurate and largely imprecise with bears, particularly females.

Three apparent options exist to obtain teeth for cementum aging. First, the Department may continue to require mandatory physical inspection, tagging, and tooth extraction by Department personnel. This is an option that is currently accepted by the hunting public and has become a routine practice.

A second option would be to eliminate the mandatory inspection and request a voluntary submission of teeth of harvested bears from successful hunters. This approach was used during the past year to reduce the potential for human contacts that might lead to increased spread of Covid 19. An extremely small and statistically inadequate sample was obtained in this fashion, but the Department did not employ extensive outreach. Improved outreach and information would probably improve voluntary compliance with our need for this data. Based on a survey of states that use voluntary tooth submission by Jessy Coltrane (attached), 44% compliance is about average and probably insufficient for the purposes described here.

A third option would be to eliminate the mandatory inspection and institute a mandatory tooth submission from harvested black bears by successful hunters. According to Legal, this requirement can be addressed simply through Commission Rule during the regular season setting

process. Law Enforcement has indicated that monitoring compliance would not likely present a substantive challenge. Jessy Coltrane surveyed a number of states and prepared a report (attached) that addresses many questions relative to implementation. States that implement mandatory tooth submission average 86% compliance, whereas states that implement voluntary tooth submission average 44% compliance. Tooth breakage during extraction differs little when conducted by a hunter or a biologist. A number of instructional videos already exist on the internet that could assist any hunter identify and extract the correct tooth if needed, and the Department could include additional information about the process on our website and within our printed regulations.

### **Recommendation 1 – Eliminate Physical Inspection and Implement Mandatory Tooth Submission for Harvested Black Bears**

By eliminating the mandatory physical inspection, the Department will realize a reduction in the commitment of 475–800 human resource hours. Although eliminating mandatory physical inspection will not generate any real financial savings, the human resource commitment may be reallocated to other activities. While time spent inspecting black bears will decrease dramatically, some of that time savings may be redirected by Law Enforcement personnel to pursue hunters that fail to comply with mandatory tooth submissions. The actual financial cost for determining the age of hunter harvested black bear teeth should change little, as the number of teeth submitted by successful black bear hunters should be similar to what the Department collects currently. Hunters should prefer this approach in that it eliminates the need for the physical inspection and reduces their time commitments. The Department would lose an opportunity to interact with hunters, and some hunters that inadvertently take the wrong species or misidentify sex would not be immediately detected. Inadvertent taking of the wrong species is still likely to be detected at taxidermists or other reporting. Age-at-harvest data would remain available regardless of what monitoring method the Department employs into the future.

### **Recommendation 2 – Investigate Deploying Periodic DNA Hair Traps to Provide Independent Population Estimation**

Although replacing mandatory physical inspections with mandatory tooth submissions of harvested bears by hunters would provide equivalent data and assessments, the recommendations of Mace and Chilton-Randandt (2011) remain relevant. The IPM may provide greatly improved power and modeling capability when compared with older modeling approaches, but no independent assessment exists to provide a population estimate for comparison and calibration of the IPM. While labor intensive, deploying periodic DNA hair traps would assist the Department in estimating black bear population sizes and harvest rates across multiple representative areas in Montana. Further, the combination of both age-at-harvest data and DNA population estimates will help inform the IPM and increase the reliability of model predictions.

Other means of obtaining population density estimates may be worth investigating. Automated trail camera systems are being investigated for other species (e.g., bighorn sheep on Wild Horse Island) and may provide an independent density estimate in the future. No reliable alternate method currently exists, but a less expensive alternative may become available in the future.

Evaluating alternative independent density estimates as they become available will remain important.

### **Literature Cited**

Beecham and P. Zager. 1992. Black bear management plan: 1992-2000. Idaho Dep. Fish and Game, Boise, USA.

Bunnell, F. L., and D. E. N. Tait. 1980. Bears in models and in reality: implications to management. *International Conference on Bear Research and Management* 4:15–23.

Garshelis, D.L. 1990. Minnesota Status Report. *Eastern Workshop of Black Bear Research and Management*. 10:1990.

Mace, R.D., and T. Chilton-Radandt. 2011. Black bear harvest research and management in Montana: Final Report. Montana Department of Fish, Wildlife and Parks, Wildlife Division, Helena, Montana, USA.

Montana Fish, Wildlife, and Parks. 1994. Final environmental impact statement, management of black bears in Montana. Montana Fish, Wildlife, and Parks, Helena, Montana, USA