Hair from Bear Rubs—A Valuable Source of Information

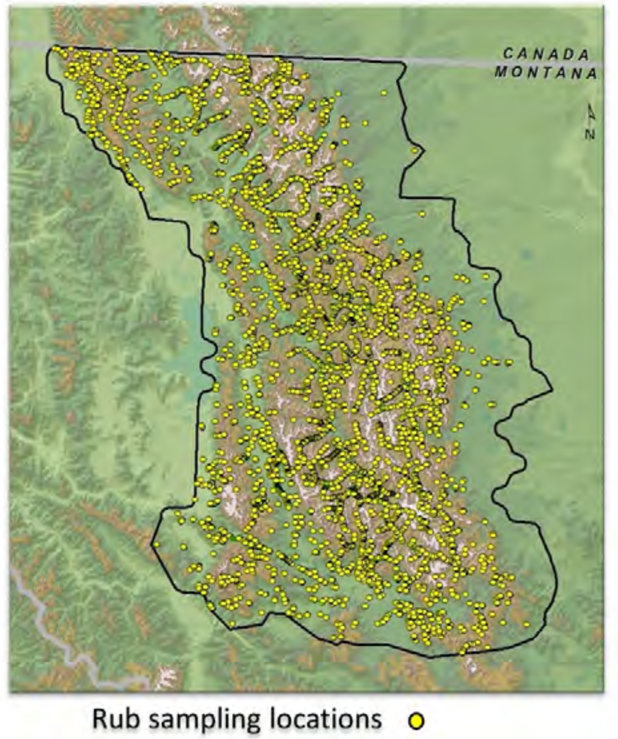
Trying to monitor changes in the size of a bear population and frustrated with the small sample size due to budget constraints? Have you considered that many species provide easy-to-obtain samples by rubbing on all sorts of things and leaving hair throughout their range?

Surveys conducted annually in Glacier NP, USA, 1983–1997 to investigate the use of passive bear sign deposition to monitor bear population trend revealed the high prevalence and wide geographic extent of bear rubbing and resulting hair deposition (K. Kendall, unpublished data). Further, bears like to use trails and roads, making bear rubs easy to find and collect.

Based on those observations, we used unbaited rubs to supplement a baited hair corral grid in the sampling scheme of several studies designed to estimate brown bear (*Ursus arctos*) population size (Kendall et al. 2008, 2009, 2016). We found rub sampling was an efficient way to boost sample coverage. Although the number of rubs we sampled far outnumbered corrals, the cost involved in the rub surveys was approx. 25% of sampling at corrals. In those studies, rubs detected 20–57% of the total number of bears estimated for these populations. This, however, was a conservative estimate of detection rates, as rub surveys were only conducted in a portion of each study area and minimal sampling occurred during late summer or fall when female activity at rubs peaks (Kendall et al. 2009, 2016, Whittington et al. 2016). It is important to note that female abundance and density estimates derived from rub data could be negatively biased if sampling is weighted toward early summer when female detection rates are very low

Year	Individual bears detected at natural rubs	Total estimated population	Proportion of population detected at rubs
2004	274	765	36%
2009	248	889	28%
2010	334	917	36%
2011	321	945	34%
2012	355	974	37%

Number and proportion of individual brown bears detected at natural rub sites in the Northern Continental Divide Ecosystem of Montana, 2004–2012. Population abundance was estimated with capture-recapture in 2004 (Kendall et al. 2009) and projected through 2012 using an estimated annual growth rate (Mace et al. 2012). Table adapted from Kendall et al. (2019).



Locations in northwestern Montana, USA, of naturally-occurring bear rub sites where the brown bear population was sampled by collecting hair for genetic identification of individuals 2004 and 2009–2012.

(Boulanger et al. 2008) but that bias can be reduced by inclusion of samples collected later in summer and in fall.

Realizing that rub surveys could detect a substantial portion of the population, we set out to see if this sampling approach could be used to monitor population trend (Kendall et al. 2019). Our work was conducted in the largely roadless 33,200 km^2 Northern Continental Divide Ecosystem (NCDE) in the Rocky Mountains of Montana. We used rub data from a 2004 study of population size in the NCDE (Kendall et al. 2009) and from 2009 to 2012 when we visited rubs at least twice annually to collect hair and extended our sampling period into September–October. We annually surveyed approx. 3,500 – 4,800 trees, power poles, and posts irregularly distributed throughout our study area. Genetic analysis of the hair was used to identify bear species (brown or American black [*U. americanus*]), individual identity, and sex.

During our 5 years of bear rub sampling, we detected 28–37% of the population annually. To estimate local and overall density and population trend, we used our genetic detection data in spatial capture-recapture models. These models enabled us to visualize how overall density changed over time and how it varied spatially within the ecosystem. Sex-specific density estimates and maps for each year helped us understand factors driving changes in the population.

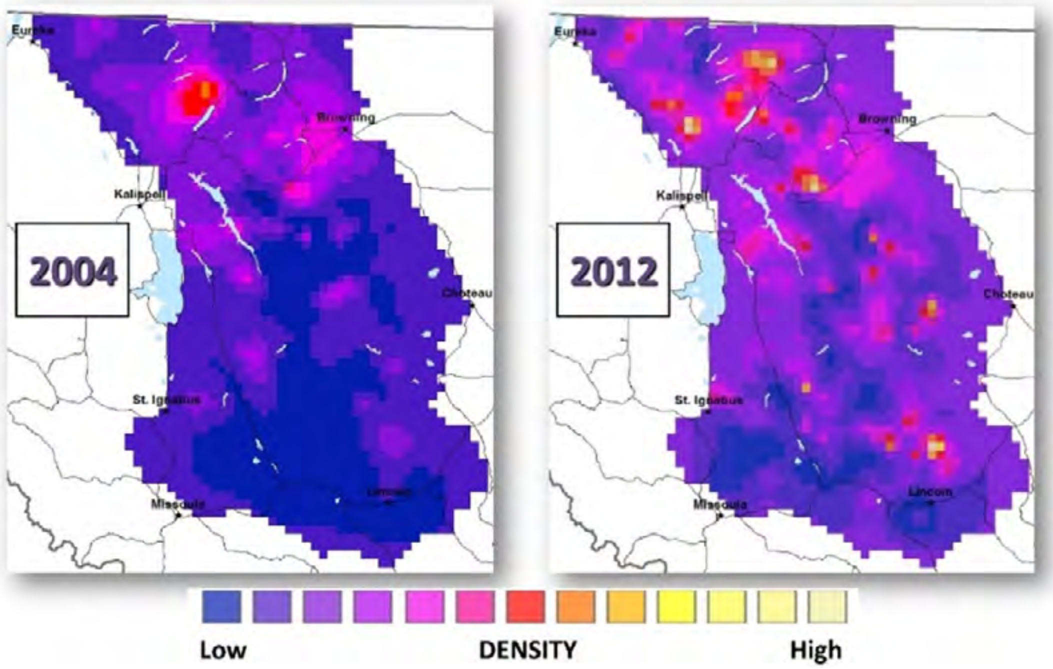
Total and sex-specific population trend estimates and maps allowed us to see how population growth varied throughout the ecosystem and over time. While the total population increased at an annual rate of 4.3% (95% CI = 1.7 – 6.9%) for the period 2004–2012, growth was more pronounced in the southern half of the NCDE where initial density was lowest. Density remained fairly stable in the northern half, which included Glacier National Park, where density in 2004 was highest.

We found that individuals sampled at rubs that were not detected by hair corrals made substantial contributions to our extended genetic dataset of over 1,100 individuals. These data have provided valuable ancillary information on metrics such as gene flow, genetic diversity, population structure, number of breeders, and fitness (Mikle et al. 2016). For example, we used our data to identify an area of incipient fragmentation across a travel corridor (Kendall et al. 2009).

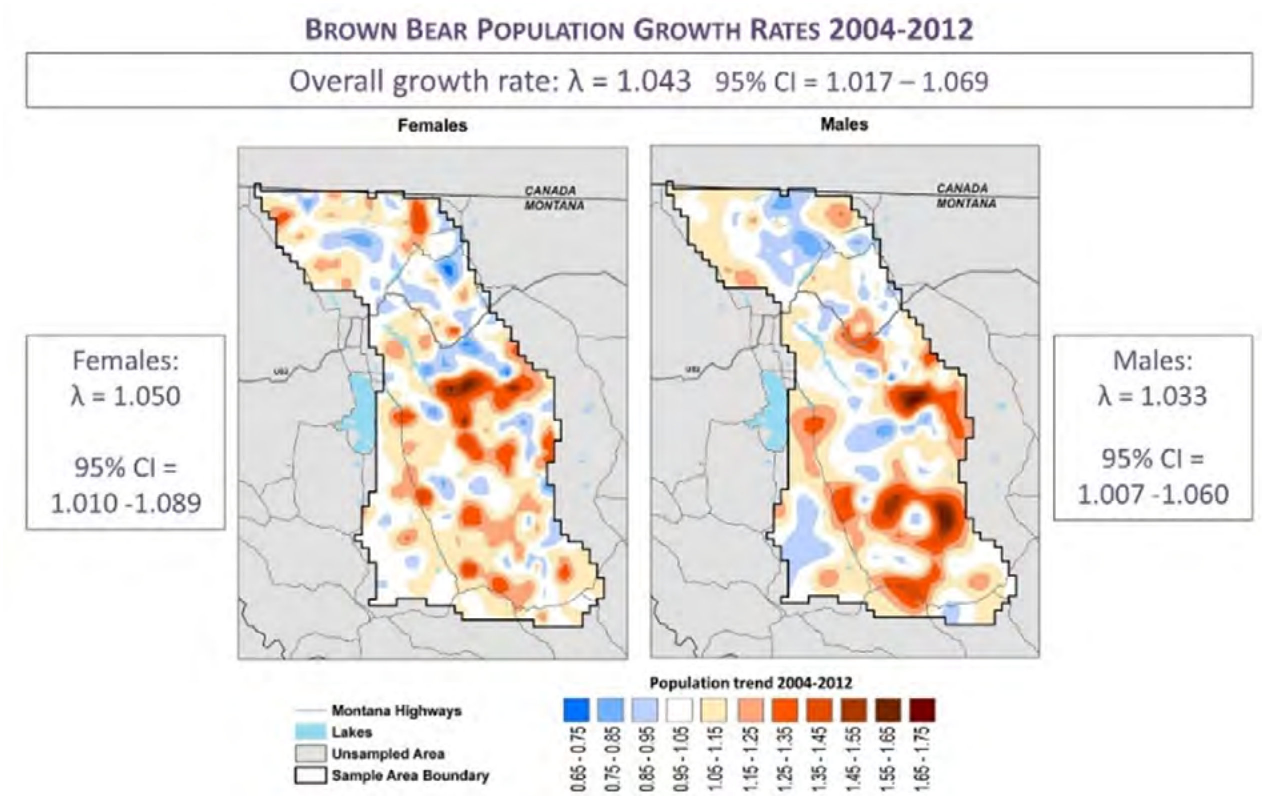
There were many advantages of including rub survey data in our monitoring scheme. We detected a large portion of the female and male brown bear populations at lower cost than with other methods, and we concurrently sampled the sympatric black bear population. We detected nearly a third of the population without using an attractant (lures may alter bear behavior with respect to their capture probability in varying ways). Fieldwork and genetic analysis for our 2009–2012 surveys cost \$89 (€73) per brown bear detection and \$10.50 (€8.99) per km^2 surveyed. Field costs could be reduced in areas accessed by more roads. Because the data collection methods are uncomplicated and do not require much training or experience, we

Adult male brown bear at rub site in Flathead National Forest, MT, USA (left). Black bear cub rubbing on the same tree (right).

Photo credit: A. Macleod.



Change in brown bear density in the NCDE, Montana, USA, as the population grew over an 8-year monitoring period.



Sex-specific annual local rates of change in brown bear density within the NCDE, Montana, USA, 2004–2012. Population trend was calculated as the annual geometric rate of change in grizzly bear density between 2004 and 2012. Growth rates >1.0 denote areas of population growth; rates <1.0 denote areas of population decline. Maps are reproduced from Kendall et al. (2019) under the Creative Commons Attribution 4.0 International License.

were able to use volunteers and existing agency staff to reduce costs.

Rub surveys proved to be an efficient way to sample bear populations and provided a rich source of data for monitoring demographic and genetic trends. Using our rub detection data, we were able to construct spatially explicit capture-recapture models to estimate density and population trend or trajectory that varied over space and time, highlighting exactly where population change was occurring and providing insight into how those patterns developed.

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Adult female brown bear with cubs of the year rubbing on bridge timbers, Flathead National Forest, MT, USA.

Photo credit: A. Macleod.

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