Does Citizen Science Really Work?
Results of a Master's Thesis on Mountain Goat Population Estimates
By Jami Belt

Citizen science is a term that describes scientific programs and projects in which volunteers, some with no prior scientific training, perform research-related tasks. Citizen science programs offer a cost-effective method for monitoring wildlife over large geographic areas and for long periods of time, while fostering a greater appreciation and awareness of research issues. The number of these programs is growing exponentially as participation and interest by the public increases and funding for ecological research diminishes. But the jury is still out about whether citizen science provides reliable data. Few studies have compared results from data collected by volunteers to results collected from more traditional methods (e.g., biologists and/or aerial surveys).

Mountain goats are the icon of Glacier National Park, yet little is known about their current population status and distribution across the park. Most of our knowledge about mountain goats in Glacier comes from a pivotal study conducted in the 1970's by Doug Chadwick. Recent declines in goat numbers at a prominent mineral lick in Glacier and throughout the neighboring Bob Marshall Wilderness, as well as the uncertainty of how climate change may be affecting them, identified mountain goats as a high priority species needing further research.

Mountain goats are also an ideal species for citizen science due to being highly visible, charismatic, and easy to identify. In 2008, with support from the Glacier National Park Fund, the High Country Citizen Science program was born. One of the primary objectives of the program was to enlist citizen scientists to hike to mountain goat habitat throughout the park and count how many goats were present. During the course of 2008 to 2009, we trained 140 people to count mountain goats.

To ensure that this citizen science program would indeed detect potential changes in Glacier's goat population, research was needed to determine whether citizen science observations are a useful method for monitoring mountain goat populations. We also hoped to shed some light on the reliability of citizen science programs in general. To this end, I embarked upon a Master's thesis project to compare estimates of mountain goat abundance by volunteers at sites throughout Glacier to estimates by biologists and aerial surveys at a smaller number of sites.

Because volunteers are expected to have more highly variable skill levels than biologists, it was important to directly measure differences in detection probability, or the percentage of goats seen by volunteers versus the percentage

Photo by Travis Rosenkoetter

Even when she's not conducting surveys or training citizen science volunteers, Jami Belt's passion for goats seems to follow her wherever she goes!

seen by biologists. To do this, Glacier's citizen science volunteers teamed up with park biologists to do 76 side-by-side surveys. Communication was not allowed during these surveys. Comparing the results of these double observer surveys gave insight into which factors were causing differences in goat detection. Surprisingly, volunteer experience, as measured by a self-ranking survey, had no influence on whether volunteers had high or low detection probability. Mountain goat group size influenced detection probability more than any other

factor; as mountain goat group size increased, the percentage of goats detected by volunteers moved much closer to the percentage detected by biologists.

These double observer surveys also yielded an average detection probability for volunteers and biologists. As we anticipated, biologists saw a higher percentage (81%) of mountain goats on average than volunteers (65%). Therefore, abundance estimates of mountain goats by volunteers would be expected to be significantly lower than estimates by biologists and aerial surveys. But this was not the case. The population estimates by citizen scientists and biologists overlapped, and citizen science estimates were nearly identical to aerial survey estimates. But why?

Each of our survey sites provided a glimpse into a potential mountain goat home range or rough territories in which wildlife live, but observers could only see a portion of the home range due to topographic features blocking their view. Goats move around a great deal within their home range, which means that not all mountain goats living in the area were visible during each survey. Because volunteers were able to conduct more frequent surveys at each site, they had an increased likelihood of seeing a higher percentage of the goats inhabiting each home range.

Essentially, the likelihood of being in the right place at the right time goes up the more often you are in the right place. More frequent site visits by volunteers balanced out their lower detection probability resulting in abundance estimates that were close to those of biologists, but were actually less variable. In short, when volunteers can conduct far more surveys than

biologists can for an equal amount of funding, the resulting population estimates are statistically similar, at least in the case of mountain goats.

Now that the park had a viable baseline population estimate of mountain goats, an important question remained. Could citizen science mountain goat surveys reliably detect a significant decline in population size if one occurred over a period of say, 10 years? Due to the variability in our population estimates, we found that neither estimates by volunteers or biologists had sufficient statistical power to detect a 30% decline in mountain goat population size. However, by reducing the number of sites and increasing the number of surveys at each site, the ability to detect a decline of this level could be reached. These results underscore the

importance of evaluating a citizen science programs early in their establishment and modifying the survey design if necessary.

The value of engaging the public in research is huge, but more evaluations are needed to ensure that citizen science data is reliable and valuable to managers.

Jami Belt defended her thesis in September 2010.

She currently coordinates the Citizen Science Program at the Crown of the Continent Research Learning Center.

Become a Citizen Scientist

The CCRLC is looking for dedicated individuals who wish to assist with our research efforts as wildlife observers and citizen scientists. Participation in the program requires attending a 3-8 hour training session (depending on the project) and signing up as a park volunteer. Current citizen science projects include:
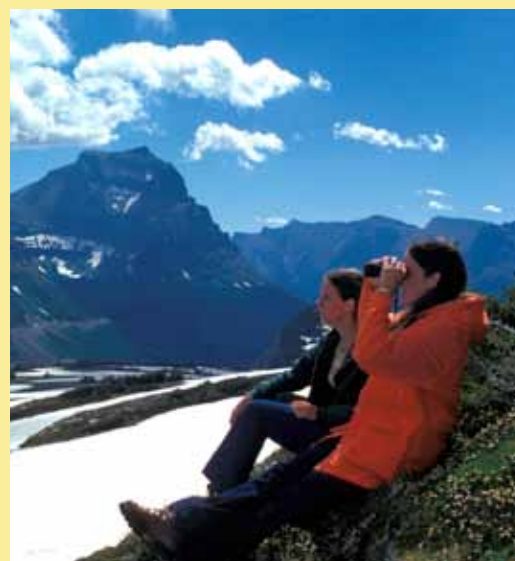
Common Loon Monintoring: Survey Glacier National Park's hundreds of lakes to document presence of Common Loons and breeding and nesting behaviors.

High Country: Collect data on the number and distribution of three species of concern for Glacier National Park: mountain goats, pikas, and Clark's Nutcrackers.

Noxious Weed Mapping: Survey Glacier National Park's 700+

miles of hiking trails to determine the distribution and extent of noxious weeds invading the park.

For more information, please contact Citizen Science Coordinator Jami Belt (jami_belt@nps.gov).

NPS Photo