COUNTING GLACIER'S MOUNTAIN GOATS

WITH HELP FROM A SMALL ARMY OF VOLUNTEERS

By Jami Belt

Citizen Science coordinator for Glacier National Park's Crown of the Continent Research Learning Center

Photos courtesy of NPS

"What should we do with that when the lightning makes it over Gunsight Pass?" asked Brian, the volunteer helping me survey mountain goats in Glacier National Park. He was staring at the spotting scope tripod sticking out of my backpack. We were four miles up the trail, well above tree line, and the storm clouds were moving in fast. Less than five minutes into our survey, the wind was tearing the data sheets from our hands, and sheets of rain and graupel were blotting out many of the cliff faces.

What were we doing up there? And why would somebody volunteer for such arduous work? It is all for the purpose of understanding and conserving Glacier's mountain goats in a changing world.

Getting to Know Goats

Mountain goats are one of Glacier's most iconic species, but little is known about their status and distribution throughout the park. The last count, conducted over a small section of the park, wrapped up in the late 1970s. Since then, many regions with native mountain goat herds in Montana, Alberta, Washington, and Idaho have seen declines in their annual aerial counts. Because of these declines and the relatively slow reproductive rates of mountain goats, some management areas have responded by lowering harvest quotas. Other regions are looking into winter motorized recreation as a possible source of population stress.

How are goats doing in Glacier National Park? A snapshot count at a well-used mineral lick was down from 10 years earlier, prompting questions about the population as a whole. However, since Glacier's goats are not exposed to hunting and motorized winter recreation, it's possible that stressors relating to changes in their alpine environment may be at work. The mountain goat is a species of winter, well-adapted to blend into the white background of its rugged snowy mountaintops. Questions abound. How might populations fare in response to diminished snow pack? Can goats continue to evade predators if upward-creeping tree lines begin to surround their rocky outcrops? Will nannies be able to adjust the timing of birthing to take advantage of an earlier peak in seasonal forage?

If Glacier National Park wants to assess whether habitat changes are having effects at the population level, it must start with a population estimate. This is a challenging prospect. Aside from funding issues, helicopter surveys over Glacier's extensive goat range do not have public support. Surveys would have to be done from the ground. But that would require a small army, numbering well beyond the park's small staff. Glacier's biologists decided to build their army the modern way, by recruiting volunteers. They set their sights on the seemingly endless supply of park visitors who choose to hike the back-country world where mountain goats roam.

In 2008 Glacier National Park launched the High Country Citizen Science Program, recruiting and training volunteers to help park managers gather baseline information about selected alpine species that may be vulnerable to climate change impacts. More than 150 local residents, visitors, and students volunteer each year, providing the boots-on-the-ground needed to monitor wildlife in the million acres of Glacier National Park. Traversing the high-elevation trails, these volunteers count mountain goats at 36 survey sites across the park. The purpose is to develop annual population estimates that help scientists detect long-term changes in goat numbers. Braving the harsh conditions in mountain goat country, these volunteers have conducted more than 1,000 goat surveys thus far.

Enlisting these citizens in a mountain goat science project undoubtedly fosters stewardship and an awareness of the issues facing the park's wildlife. But would it provide a reliable population estimate? That is the question I set out to answer for my master's research at the University of Montana, under the supervision of Boone and Crockett Professor Paul Krausman. As the project biologist, I commenced a series of "double-observer" surveys using a random selection of our volunteers to measure the detection probability of our mountain goat counts. Detection probability, the percentage of goats detected compared to the actual number present on the mountainsides, is needed to develop a reliable population estimate. It was also the reason Brian and I had ventured up to Gunsight Pass on such a stormy day.

Ups and Downs of Goat Surveys

Heading into the mountains, we watched the menacing cumulus clouds building to the west of us. I pressed on anyway, determined not to let this become the fourth day in a row of being chased off the mountain by a thunderstorm. Brian and I set up our spotting scopes and started the clock on our hour-long sampling period. I came to my senses when three billies, moving faster than I have ever seen, ran from the open meadows to the narrow overhanging cliff bands on the opposite side of Gunsight Basin. Goats fleeing from the oncoming weather is a good sign that we should do the same, so down the trail we went at a human pace, descending the four miles to get below tree line and a safe location to face the deluge. Wringing out our soaked socks, we watched the clouds rise and dissipate, revealing a bluebird sky. Then back up we climbed, not without a bit of grumbling, to regain the 2,000-foot elevation of the survey site.

Brian and I pulled out new, dry data sheets and started again, our two scopes side-by-side but no words passing between us. For the double-observer method to correctly estimate the number of mountain goats that we were missing during our counts, the two

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surveyors have to count goats simultaneously without influencing each other's results. So I stifled the urge to exclaim "Brian, there are those billies that had run for cover!" as I watched them slowly meandering their way back to the lush green forage, now eight of them in a widely spread cluster.

You would think that a stark white animal should be hard to miss. But finding the cryptic goats against the backdrops of shiny scree fields, dirty spring snowfields, and shadowy rock walls is like a treasure hunt without a map. Besides the eight males, I counted 14 goats in nursery groups of nannies with their clean white young of the year and some scruffy yearlings, and five more scattered adults. Brian detected 18 of the 27 goats, a result in keeping with our findings that trained volunteers detect on average 65 percent of the mountain goats present compared to an average 80 percent detection rate by biologists. Not too bad for volunteers with highly varied skill levels.


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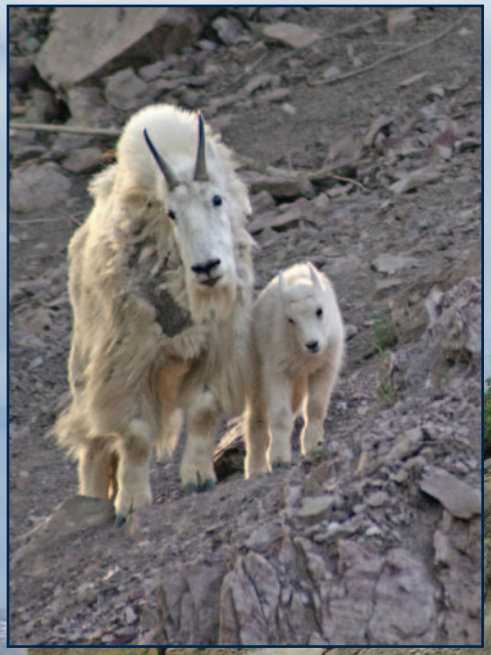

Making Sense of Goat Numbers

Our estimate of detection rates by volunteers is a critical piece of the puzzle. Knowing how many goats are missed during each survey allows us to correct our density estimate of goats within the visible areas of our ground surveys. Interestingly, the percentage of goats seen by volunteers on the ground are a bit higher than rates reported for helicopter surveyors. This is encouraging because aerial surveys are the most commonly-used approach and considered the gold standard for goat monitoring. But it is not really surprising. Volunteers have more time to study the terrain than a helicopter cruising by a goat at over 50 miles per hour. On the other hand, aerial surveys can see almost all of the terrain in an area, while ground surveys can only see goats in terrain that is not blocked from view. We need to visit each survey site many times to account for those goats not present in the viewshed.

Gunsight Mountain was named in 1891 by George Bird Grinnell, a co-founder of the Boone and Crockett Club, to commemorate a hunting trip in search of mountain goats and bighorn sheep. This mountain is a stronghold for the bearded climbers. Yet during other surveys at this site, we have seen a huge variation in the number of goats counted, from a high of 36 to a low of zero. In fact we record a lot of zeros, during surveys where we know the goats are out there but may be just on the other side of the ridge. It turns out that in spite of having relatively small home ranges, goats move around a lot within their home turf and getting a good count is often a matter of being in the right place at the right time. It is not as exciting for volunteers when no goats are spotted. But each time a zero count is reported, we get a better understanding of how many goats we might be missing because they are not available to be counted during our one-hour survey. We use this insight about the percentage of surveys during which goats are visible, combined with counts of the largest number ever seen during a survey, to get an overall detection probability.

The Power of Citizen Science

Herein lies the power of citizen science. While volunteers may miss some of the goats, they can visit the survey sites far more frequently than biologists, often more than 12 times each year. Frequent surveys are a huge boon for a species like goats, which are relatively abundant but not always present to be counted on the days that you made the arduous trek into their habitat. By being there more often, volunteers can better capture the variability of counts at each site, and are more likely to be there on a day when the largest number of goats from each home range is visible at the survey site.

Often it is the impressive volume of data that makes citizen science work, and that makes the concept so attractive to researchers. Citizen science programs have emerged nationwide, monitoring species from whale sharks to ladybugs. The sky is the limit, as in the case of citizen science programs that

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perform the time-consuming work of searching telescope images for new celestial bodies. These programs often use social media and crowd-sourcing to solicit observations from a huge number of people, giving participants from many different backgrounds a chance to contribute to research and to learn about the important and often tedious work of science.

Many National Parks and other agencies have started engaging volunteers to help monitor wildlife and plants on their lands. Glacier National Park's program also monitors common loons, American pikas, invasive plants, and migrating raptors. Since the program was established, we have trained over 700 participants and more than 300 high school and university students, who have contributed more than 25,000 hours of survey effort. Like much of the research conducted in national parks today, our program is funded by a partner organization, the Glacier National Park Conservancy. The relatively low cost of managing a large team of volunteers means that our program, like many citizen science efforts, can be conducted over a longer term than many traditional research projects that are limited to two or three years of funding. Monitoring species for many years enables us to begin looking for trends in wildlife populations that may be linked to climate-related habitat changes, or shifts in species distributions that occur over decades.

Citizen science is not a panacea, however, and cannot fully replace research conducted by biologists. The research questions that can be tackled using citizen science programs are often driven by what data collection methods volunteers can be expected to perform reliably. This inversion of the scientific method may not work for many programs with highly specific research objectives. But for programs with broader goals, citizen science can provide an ideal partnership.

Participants are volunteers after all. While we would love it if all of our mountain goat surveys were done when the goats are most active, it is hard to convince volunteers that they should hike the 12 miles in grizzly country in the wee hours so as to reach the survey site before first light. We have also discovered that many volunteers are not comfortable using topographical maps, thus limiting our ability to get precise locations of where goats are seen that could be used to inform us about habitat use. But the baseline population data we have obtained provides a vital jumping-off point for future research. Encouragingly, our estimate of 1.1 to 1.4 mountain goats per square kilometer matched the estimate obtained during helicopter surveys conducted over a portion of Glacier National Park. If the population dips by 30 percent over a decade (based on International Union of Conservation and Nature criteria for re-classifying mountain goats as vulnerable), we could detect it with the help of our small army of volunteers. In the meantime, we are learning more than we anticipated about mountain goat distribution and predation and are building up a strong constituency of informed wildlife stewards. Most importantly, we are giving hundreds of people a reason to sit still, slow down, and just observe wildlife, a task that, in the words of one of our volunteers, "is one of the most powerful forms of therapy around." ■

Jami Belt is the Citizen Science coordinator for Glacier National Park's Crown of the Continent Research Learning Center, leading monitoring programs for common loons, mountain goats, pikas, and invasive plants. She is also the author of *Invasive Plants of the Crown of the Continent Ecosystem*. She treks around the mountains surrounding Columbia Falls, Montana, with her family.