



BRITISH COLUMBIA MOUNTAIN GOAT SOCIETY

SMITHERS BC CANADA

MTGOATS@BCNORTH.CA

Counting Mountain Goats – Smithers Method

November 27, 2023

Summary

We recommend a new method for acquiring data on aerial surveys for mountain goat populations. The method uses a high-resolution camera to photograph mountain goats and create a permanent media record that can be reviewed at any time. The method increases the ability of staff to determine the age and sex of the surveyed population using post-production analysis.

Current method

Local helicopter pilot Rob Henderson reports that mountain goat surveys are often flown 50 to 100 meters from an alpine slope. Two passes are required, one at low elevation and another at a higher elevation. Circling to repeat a pass are sometimes necessary to take a second look (personal comment, 2023). The aerial survey crew records all observations on paper forms or on computer.

Shortcomings

Flying 50 to 100 meters from mountain goats can be invasive. Repeat or circling passes may prolong the stress response. Stress from the first flight pass may develop into higher stress levels on subsequent passes. Mountain goats do not habituate well to close helicopter fly-bys.

The observers have only a short time to ascertain the gender, age and number of goats. There is little opportunity to review the scene in order to understand the social context amongst the goats, or to note the terrain in detail.

Smithers Method – rationale

Photographing mountain goats during aerial surveys allows an analysis in post-production. Photos can supplement and/or verify any visual sightings during the survey

flight. Photos can be reviewed by staff with different observation skills. Photos can reveal the social context and interactions within the goat herd. Photos can aid in determining the true number of mature males, key data for determining harvest rates. Photos are a permanent historical record that can be analysed by new technologies years after the survey flight.

Flights with a camera can be flown at 250 meters distance from the mountain slope, rather than the 50 to 100 meters normally flown today. The extra distance has two advantages. Stress levels in the mountain goats are reduced and the field of view recorded by the camera is widened. There may be enough coverage so that only one flight pass is necessary rather than two.

The Smithers Method uses a combination of camera, audio recorder and GPS. The GPS is used to navigate the survey flight along a pre-determined route. The camera takes photos of mountain goats and the audio unit records all conversation within the helicopter.

The clock time on all three units is synchronized to the extremely accurate time on the GPS. In post-production, the photos can be located on a map using geo-tagging with Adobe Lightroom software. The audio recorder documents the discussion amongst the crew on details such as the gender and age of the goats. The audio recording can be synchronized to a slideshow of the photos, to produce an integrated record of the flight.

Smithers Method – equipment

Most still and movie cameras are not suitable for aerial surveys. Telephoto lenses have too narrow a field of view. Most standard camera lens are too low resolution. The Fujifilm GFX 100s is a large format camera with the necessary resolution for aerial ungulate surveys. The same camera is used on helicopter flights to photograph individual bolts on high tension electrical transmission towers. Photos of bolts on the towers reveal the amount of rust and wear and are used to calculate when the bolts need to be replaced.

Each photo from the GFX 100s is 102 MB and prints out at 1.143 meters wide (45 inches). Pixel dimension at 4:3 ratio is 11648 x 8736. Weight of the camera with the lens is approximately 1090 grams and the camera is easy to use hand-held. Each camera battery is good for approximately 450 frames. The time stays accurate even when a battery is swapped out.

A 45mm lens is used with a view angle of 62.6 degrees and f-stop of 2.8 to 32. The field of view of the lens at a distance of 250 meters (821 feet) from the slope is 300 meters (984 feet). In other words, one photo can cover 300 meters of a mountain slope both vertically and horizontally .

Survey flights are often conducted in the months of February and March. At that time of year, mountain goats often stay in the elevation band between 1310 meters (4300 feet) and 1645 meters elevation (5400 ft), a vertical field of view of 335 meters (1100 feet). That is close to the field of view of the camera at 250 meters distance from the slope. Two photos from the same aerial position can provide more than enough overlap.

A laser range finder is used to check the correct distance from the helicopter to the mountain slope in order to ensure that image resolution is consistent. The distance is checked from time to time during the flight until the crew has enough experience to know the distance by sight. Equipment list with cost including tax:

FujiFilm GFX100s medium format camera	10919.98
FujiFilm G 45mm f2.8 lens	2463.99
Garmin 276cx GPS	1136.79
Sony PX470 Audio Recorder	112.00
Aircraft Spruce 11 10499 audio adapter	149.88
Nikon Prostaff 1000 Laser Rangefinder	313.59
Total	15096.23



Figure 1 Smithers Method kit

Smithers Method – flight procedure

A survey route is entered into the GPS before the flight. Batteries are charged on all equipment. Camera and audio recorder time settings are synchronized with GPS time before the flight. The audio recorder is plugged into the helicopter audio system using the provided adapter. The audio recorder remains switched on for the flight. The GPS remains on for the entire flight and is set to record a track of the entire flight. The camera can be switched off and on during the flight. It automatically records the time stamp of each photo.

An observer/navigator sits front left alongside the pilot. The observer and the pilot watch for mountain goats ahead. The observer has the GPS and tells the pilot when to turn to keep to the route. A camera operator sits in the back beside a second observer who marks goat sightings on a data sheet and doubles as a spotter. Meanwhile, the audio recorder automatically captures all comments by the crew.

The flight is conducted so that the camera operator in back is always facing the alpine slope. The camera is hand-held and settings are set to Manual, ISO 400, shutter speed 1/800 second, and f/stop 11. These settings may be refined with experience but worked well in testing. Exposure compensation can be adjusted using ISO or shutter speed. The camera uses auto back button focus and the 45 mm lens. Photo format is set to 16 bit RAW.

The flight is 250 meters from slope and ideally above the top edge of timber. Photos can be taken quickly, both when goats are spotted and when there is a possibility that goats may be only visible in post-production.

Smithers Method – post-production

RAW photo images are downloaded into Adobe Lightroom to be converted to JPEG format. The GPS track in GPX format is downloaded into the same folder with the JPEG images. JPEG images plus the GPX track are imported into the MAP module in Adobe Lightroom where GPS location data is geo-tagged to each photo.

Geo-tagged JPEG photos and GPX track are imported into Google My Map to create a map of the survey area with photo waypoints. This map can be distributed. Each JPEG image is reviewed to determine number of mountain goats, gender and age at each photo location.

Testing

We have tested the entire system in a moving car on rural roads. We photographed farm buildings that we knew were 250 meters from the road. The photos were excellent. Any mountain goat image at that distance would be acceptable. Each photo

was geo-located on Google Earth within 20 meters of the true position – more than accurate enough.

On April 4, 2023, we flew a test flight in a Bell 206 helicopter with pilot Rob Henderson. We tested the camera for motion blur while taking photos of mountain slopes. All photos were clear with no motion blur, with the shutter speed set to 1/800. We also flew several different distances from mountain slopes ranging from 50 meters to 250 meters. The greater distance resulted in excellent camera field of view. The next test will be a helicopter flight this winter with the camera, GPS and audio recorder operating together. After that, the system will be ready to fly a test aerial survey by March of 2024.

An attached photo shows the high resolution and wide field of view using the 45mm lens. See if you can find the mountain goat in the photo. We failed to see this goat from the helicopter. We only discovered the goat during a review of the photo after the flight: an excellent example how the camera can supplement visual spotting. The distance from the helicopter to the slope in the photo was not determined.

Discussion

Initially the camera will supplement written data but eventually we predict that camera images and audio recording will make in-flight written data unnecessary. Instead, all members of the flight crew will be able to spend their time observing mountain goats and keeping a running commentary on the audio recorder. The commentary can follow a template determined in advance of the flight. The Smithers Method adds valuable data to aerial ungulate population surveys. At the same time, the method can be held to consistent standards that conform to current provincial guidelines.

Attached photo: SingleGoat2Sharpened.jpg 60.9 MB - download full version at:
https://drive.google.com/file/d/1gVo7beHSHrEEzgvb_BgjvOju6gCrEfgc/view?usp=sharing

Jim Easterday, Director

Len Vanderstar, R.P.Bio, Director

British Columbia Mountain Goat Society

Smithers BC

250-847-4802

mtgoats@bcnorth.ca

www.mtgoats.ca

www.bcmountaingoatsociety.ca