

Use of Camera Traps in Mohave Ground Squirrel Studies

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Camera traps have been used in recent years detect Mohave ground squirrels (*Xerospermophilus mohavensis*). This technique has great promise as an alternative or supplement to traditional live trapping. However, there is no generally accepted methodology for use of camera traps in Mohave ground squirrel (MGS) studies. We would like to present suggestions to standardize camera trapping methods based upon our field experience since 2009. We also present other recommendations related to the more effective use of camera traps for MGS studies.

It is important that there be consistency in how camera trap data are collected. This consistency includes, but is not limited to, uniformity in: 1) the type of camera traps used and the specifications; 2) how cameras are setup in the field; and 3) the method that bait is distributed to animals in the field. All of these variables can strongly influence the detectability of ground squirrels and other animals of interest, as well as the quantity and quality of the data being collected.

Number and timing of camera trap sessions:

We recommend a minimum of 2 trapping sessions between mid-March and mid-May when adult squirrels are known to be active. Timeframes beyond mid-May will increase the chances of detecting dispersing juvenile MGS which are not representative of a resident population. We suggest at least a 3 week separation between trapping sessions.

Camera trap specifications and settings:

Camera traps differ in many aspects, from recording medium (still photo and/or video), recording duration per trigger, color and/or b&w, detection range, picture/video quality, trigger speed, flash or infrared, delay between triggers (i.e., recovery time), detection sensitivity, cost, power draw, memory storage, durability, and reliability. These differences can lead to variations in animal detectability and reduce consistency in data collection. It is important to use cameras that have been shown to be effective under harsh field environments and will last over multiple years. Trigger speeds, recovery times and the number of photos taken per sec vary between cameras which take photos, with the fastest cameras triggering in 0.05 sec with a recovery time of 0.50 sec, versus slower versions triggering in 2.0 sec with recovery times upwards of 8.0 sec. Cameras that record video have even slower trigger speeds and recovery times between triggers which needs to be considered if using video.

To effectively detect MGS presence, we suggest that camera traps have fast trigger speeds (less than 0.50 sec), quick recovery times (about 1.0 sec or less), and take at least 1 photo per second to reduce the chances of missing MGS visits. Consideration should also be given to the downloading speed of the secure digital (SD) card that is used within the camera unit. Download speed will influence how many photos can be taken per sec. Cards with at least 60 Mb/sec

downloading speed are recommended. Card reliability is also a very important factor to make sure that data collection is not compromised, we therefore recommend speaking with researchers who have used SD regularly in the field to determine which brands offer the best reliability. To minimize the number of field visits to maintain camera trap sites, it is recommended to use larger storage SD cards if possible, especially for camera sites placed in remote areas. It is also important to collect data 24 hours/day if possible to identify all ground squirrel activity, as well as other animals in the area, especially potential predators and food competitors.

Camera setup in the field:

We suggest that camera traps have identical setup configurations, or as similar as possible if using different cameras, so that data collection will be more uniform in nature. We have found that 5 foot U-posts (about 3-3.5 inches wide) work well for securing cameras, though other methods could be used. Cameras can be attached to clips on the posts using bailing wire. If the location is not too steep or rocky, posts can be hammered into the ground and then tilted at an angle to get the desired field of view. We suggest that the field of view not be too large because vegetation movement within the detection zone can cause many false detections. Most cameras allow for remote triggering of activity to allow the person setting up the equipment to know that their activity simulating the animal's presence is working, but that doesn't necessary guarantee that the picture is centered. A variety of devices capable of reading secure digital cards (e.g., laptops, cellular phones, electronic tablets, etc.) can be used to record images and make sure that pictures are centered. We suggest that bait stations be located about 4-5 ft in front of cameras in a centered position. It is important to center the bait to give the camera the most time available to detect animal movement through the detection zone. It is also important to keep cameras away from any vegetation that could sway in front of the camera during windy conditions. Of course for security purposes, sometimes it is necessary to hide cameras behind vegetation and limit proximity to any used trails or roads when possible. To lessen the chances of someone stealing cameras, ground anchors can be used. Cameras should be placed in a northerly facing direction to lessen the impact of direct sun onto the recorded images.

Equipment and site maintenance:

Cameras will have to be periodically visited to replace data storage cards, batteries, and bait. We suggest using lithium batteries if possible to extend the life of the camera trap. Some camera traps allow for upwards of 32 gb of data storage using secure digital cards which can allow the camera to run for weeks at a time depending on the amount of animal activity. The most limiting factor associated with camera traps is the availability of bait to draw animals to the cameras. There are at least four methods that could be used to distribute bait during camera trapping sessions (daily placement of smaller piles of bait, blocks of bait for extended use, automated feeders, and perforated pvc pipe containing grain), though no specific large scale testing has been done to test which type of bait or which method of bait presentation is the most effective for detecting MGS. It is important that this information be documented because these factors may influence species detectability. It is also important to limit personnel time entering study areas which may influence animal behavior. If possible it is best to visit sites during early morning hours when animals are not active.

Methods of bait presentation:

Manual placement of small bait piles (e.g., 4 way horse feed) onto the ground requires replacement each day. There is concern that food placed at camera trap stations throughout the desert might draw in ravens and other potential predators. To possibly reduce this issue, it has been suggested that pvc tubes filled with bait could be used to lessen the likelihood of ravens or other predators visiting the site due to the lack of a food reward. However, it is also possible that without a food reward, ground squirrels might not visit as readily as with other methods thereby reducing detectability. Also, squirrels might be more focused on getting at food within the tubes and not as vigilant in watching for predators as with other methods. Others have used bait blocks at camera traps to lessen personnel time in resupplying feed stations on a daily basis, though this method still has potential issues with predators congregating on site. Automated feeders are also starting to be field tested as a way to reduce human presence and logistical costs, but results are limited at this point. This method will likely have issues with predator presence as well.

Other Recommendations:

- 1) Suggest collecting vegetation data, especially on shrubs, in combination with camera trapping. It is important to not only understand where MGS are distributed on the landscape, but if other factors influence their presence and sustainability on the landscape. Vegetation is an important factor in species presence and it would be beneficial to collect such data in concert with large scale camera trapping. A greater understanding of the relationship between MGS presence and vegetation is especially important when considering climate change issues.
- 2) Suggest field testing different bait methods (bait in the open, bait in pvc tubes, bait blocks, or automated feeding stations) to see which method is most effective.
- 3) It is important to determine the relative number and spacing of camera traps needed to adequately sample conventional trapping grid sizes to compare detection rates with conventional trapping surveys. At what point is there a diminishment in return based on MGS detection rate based on the number of camera used for a specific sized grid?
- 4) It is important to test if camera traps can be used to determine bait preferences of ground squirrels to various food samples to improve catchability at live traps.
- 5) It is important to test if PIT tag readers can be effectively used to identify pit-tagged individuals that visit feeding stations.
- 6) Suggest utilizing camera traps first in an area before live trapping to detect MGS presence to improve the cost effectiveness of future live-trapping surveys.
- 7) Suggest using human-based listening stations to survey for ground squirrel presence along transects using playback calls of MGS vocalizations and their responses to human presence heard by surveyors.

8) Suggest using camera trapping to document MGS presence during times of the year outside conventional trapping periods for the species (i.e., mid to late winter and early-mid summer). Equipment use is not restricted by weather conditions like trapping surveys are.

9) It is important to determine aboveground MGS behavioral activity patterns using camera traps. Cameras could be placed at known burrow entrances to document above/below ground activity. This could be used in concert with weather stations to better understand the thermoregulatory behavior of MGS.