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# The depredation of Mountain White-crowned Sparrow (*Zonotrichia leucophrys oriantha*) nests by the golden-mantled ground squirrel (*Callospermophilus lateralis*) and long-tailed weasel (*Mustela frenata*)

Savannah R. Troy[1]* and Ross R. Conover[2]

ABSTRACT—The identities of avian nest predators remain unknown in many systems. The Mountain White-crowned Sparrow (*Zonotrichia leucophrys oriantha*) is a high-elevation ground-nesting passerine for which only 4 of 15 suspected nest predator species have been confirmed. In this short communication, we confirm 2 previously suspected but unverified nest predators of *Z. l. oriantha* that were video recorded during the 2016 and 2017 summer breeding seasons. These nest depredation events include a golden-mantled ground squirrel (*Callospermophilus lateralis*) in 2016 and a long-tailed weasel (*Mustela frenata*) in 2017. Both predators were recorded removing nestlings. *Received 1 July 2018. Accepted 22 December 2018.*

Key words: golden-mantled ground squirrel, long-tailed weasel, Mountain White-crowned Sparrow, nest depredation, predator identity

**Depredación de los nidos del gorrión *Zonotrichia leucophrys oriantha* por la ardilla *Callospermophilus lateralis* y la comadreja *Mustela frenata***

RESUMEN (Spanish)—En muchos sistemas de estudio, la identidad de los depredadores de nidos permanece desconocida. El gorrión *Zonotrichia leucophrys oriantha* es una especie de paserina de alta elevación que anida en el suelo, para la cual solo han sido confirmadas 4 de 15 especies que se sospechan como depredadoras. En esta comunicación corta, confirmamos dos de las especies de depredarores del nido de *Z. l. oriantha*, de las cuales solo existían sospechas sin verificar, y que fueron videograbadas durante las temporadas reproductivas en los veranos de 2016 y 2017. Estos eventos de depredación son de la ardilla *Callospermophilus lateralis* en 2016 y la comadreja *Mustela frenata* en 2017. Ambos depredadores fueron registrados sustrayendo polluelos.

Palabras clave: ardilla, comadreja, depredación del nido, gorrión, identidad del depredador

The Mountain White-crowned Sparrow (*Zonotrichia leucophrys oriantha;* hereafter, MWCS) is an altricial passerine that builds open ground nests in mountainous regions of North America. The preferred nesting habitat of MWCS is dense thickets of mixed willow (*Salix* spp.) species in alpine and subalpine meadows (Morton 2002). The nests are cup shaped and constructed from dry grass, twigs, animal hair, and bark. After MWCS eggs hatch, nestlings require 9–11 d of parental care prior to fledging (Morton 2002). In a 19 year study of MWCS in the Sierra Nevada mountains, depredation was the primary cause of nest failure in the 1,132 nests studied, with a mean annual predation rate of 29.9% (Morton 2002).

An understanding of the specific causes of nest failure is a crucial element in predicting avian population trends and guiding effective management strategies. Nest predation has been identified as the principal cause of avian nest failure as well as a primary driver of open-nesting bird assemblages (Martin 1988, Thompson 2007). Despite the known importance of nest predation on bird populations, there remains a gap in our understanding of nest predator identity in many systems and species (Rearden 1951, Morton et al. 1993, Benson et al. 2010).

High-elevation sites in montane ecosystems have relatively few nest predators; however, most of these suspected predators remain unconfirmed (Smith and Andersen 1982, Morton et al. 1993, Morton 2002). A successful method of predator identification has been the use of cameras to monitor nests (Major and Gowing 1994, Hernandez et al. 1997, Thompson et al. 1999, Renfrew and Ribic 2003). In grassland passerines, miniature cameras were able to identify 11 predator species of 10 different bird species' nests (Pietz and Granfors 2000). Another study that used cameras to monitor Dusky Flycatcher (*Empidonax oberholseri*) nests identified 6 species of nest predators, both avian and sciurid (Liebezeit and George 2002).

The MWCS is one of the most thoroughly studied high-elevation bird species, yet we lack

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an understanding of its nest predators. Of the 15 suspected predator species, only 4 have been confirmed either removing eggs, eating eggs, or eating nestlings. Of these, only one species, the Belding's ground squirrel (*Urocitellus beldingi*), has been confirmed eating nestlings (Morton et al. 1993). The other confirmed MWCS nest predators are Clark's Nutcracker (*Nucifraga columbiana*), Cassin's Finch (*Carpodacus cassinii*), and Douglas's squirrel (*Tamiasciurus douglasii*). The objective of this research was to confirm the identity of other suspected MWCS nest predators, including the California Gull (*Larus californicus*), Common Raven (*Corvus corax*), marten (*Martes americana*), badger (*Taxidea taxus*), long-tailed weasel (*Mustela frenata*), and golden-mantled ground squirrel (*Callospermophilus lateralis*). Of these species, the Common Raven, marten, badger, long-tailed weasel, and golden-mantled ground squirrel have been documented in our study site.

## Methods

### Study site

This study was conducted in the montane meadows surrounding the Rocky Mountain Biological Laboratory in the Elk Mountain Range of the Colorado Rocky Mountains during the summer breeding season (May through late July). During this study, all nests were situated within dense thickets of primarily willows or cinquefoil (*Potentilla* spp.). These thickets were interspersed with herbaceous vegetation such as larkspur (*Delphinium* spp.), corn lily (*Veratrum* sp.), osha (*Valerian* sp.), and mountain bluebell (*Mertensia* spp.), and surrounded by forests composed primarily of Engelmann spruce (*Picea engelmannii*) and Douglas fir (*Pseudotsuga menziesii*).

### Nest searching and monitoring

Nests were located by either using behavioral cues or rope-dragging in willow thickets (Conover et al. 2011). Behavioral cues relevant to nesting include adult birds frequenting an area with food in their bill, making a territorial "chipping" vocalization, or returning females flying low into the vegetation and making a "seeping" vocalization (see Morton 2002). If using the rope-dragging method, aluminum cans attached to a rope held by 2 researchers collided with the vegetation and each other, creating a clattering noise that caused the tending female MWCS to flush from their nests. The researchers subsequently searched the flush area for a nest.

After finding a nest, it was monitored every 2–3 d until no longer active (Martin and Geupel 1993). Researchers initially marked nest locations using a hand-held GPS unit and flagging tape placed below the vegetative canopy at approximately 5 m to the north and south. Nests were inspected for eggs, aged based on the 9–13 d MWCS egg incubation period (Morton et al. 1972, Lokemoen and Koford 1996, Jongsomjit et al. 2007), or nestlings, aged based on voucher images (SRT, unpubl. data) for altricial nestling development.

### Nest video recording

Once the oldest nestling was 5–6 d old, cameras were deployed to collect parental behavior data. This age range was selected to reduce the probability of either nest abandonment or human-induced fledging. The 2 nests of interest for this study were located in the East River Valley and Schofield Park, and the recording methods differed slightly for each.

The predation event in the East River Valley was recorded using a camouflaged, color CCD IR security camera (Supplemental Footage 1). The camera was mounted to a 0.5 m tall wooden stake and placed approximately 15 cm from a nest. These cameras were connected to a 15 m extension cord that led to an external ES-TX9 battery and solid-state micro-DVR setup that was concealed in the vegetation. Footage was recorded at $352 \times 256$ frame size and 30 frames $s^{-1}$.

The predation event in Schofield Park was recorded using a GoPro Session camera that was also mounted to a stake at a height framing the nest and connected to another external battery of the same model via a 15 m extension cord (Supplemental Footage 2 and 3). Cameras were deployed from approximately 0700 h to 1400 h and before departing the nest site, researchers monitored live activity to ensure that the parents returned and the camera's presence did not induce nest abandonment. This approach to video monitoring open-cup, nesting passerines does not significantly

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increase predation rates (Pietz and Granfors 2000, Weidinger 2008).

## Results

This report confirms that long-tailed weasels (*Mustela frenata*; hereafter, LTWE) and golden-mantled ground squirrels (*Callospermophilus lateralis*; hereafter, GMGS) are MWCS nest predators based on nest camera footage in 2016 and 2017. The 2 depredated nests were located in the East River Valley (nest coordinates: 38.58336, 106.59571) and Schofield Park (nest coordinates: 39.02583, 107.05132) regions of the Gunnison and White River National Forests, respectively. The depredation events were recorded coincidentally during a parental nest attendance behavior study that ran from 2016 through 2018. During this time, 28 nests were filmed and only the 2 listed, or 7%, recorded predation events. Over the same period, 49 nests were monitored (not all were filmable) and of those, 17 (35%) were depredated at either the egg or nestling stage.

At the East River Valley nest, a GMGS predation event was recorded on 13 July 2016 (Supplemental Footage 1). A camera was deployed at 0641 h and one nestling, 4–6 d old, was present in the nest. At 1255:39 h, the female MWCS stopped shading her one nestling as she had been for the previous 3 min and 28 s. She left the nest and, after several seconds, a GMGS entered the frame and depredated the nest at 1255:50 h. The GMGS was followed by the female MWCS, who attacked the intruder in an attempt to defend her nestling. However, the GMGS exited the frame and the nest was empty. Since the camera was fixed on the nest, we can confirm the GMGS removed the nestling, but cannot comment on if the nestling was consumed.

At the Schofield Park nest, monitored on 12 July 2017, the camera documented a long-tailed weasel depredation event (Supplemental Footage 2 and 3). The camera was deployed at 0655:00 h and 2 nestlings, each 4–6 d old, were present in the nest. At 0929:25 h, the female left the nest and 3 s later the LTWE was recorded entering the nest. It remained at the nest for 9 s, then left with one nestling in its mouth at 0929:37 h. The parents did not return to the nest but were heard persistently chipping nearby. At 0938:22 h, the LTWE entered the nest again and removed the second nestling, leaving at 0938:28 h. The chipping continued as the female returned to the nest at 0945:17 h, inspecting the remaining 2 eggs (which were infertile) and removing a fecal sac produced when one of the nestlings was removed by the LTWE. The LTWE returned 2 more times at 0947:03 h and 0947:48 h, each time only staying for a few seconds. It inspected the nest but did not remove the 2 remaining eggs. The female's final return to this nest was at 1000:18 h. Likewise, the fixed camera allows us to only confirm the LTWE removed the nestlings as it did not consume them at the nest. The footage of both predation events is available in the online supplement.

## Discussion

It is well documented that rodents will consume both eggs and nestlings from bird nests (Pietz and Granfors 2000, Bradley and Marzluff 2003). The GMGS feeds primarily on fungi and herbaceous leaves, as well as conifer seeds in the fall (McKeever 1964). However, the presence of Dark-eyed Junco (*Junco hyemalis oreganus*) flesh and feathers in GMGS stomach contents indicates they will feed opportunistically on birds (Tevis 1953, Callahan 1993). Additionally, GMGS have been confirmed as predators of Dusky Flycatcher eggs and nestlings (Liebezeit and George 2002) and Mountain Bluebird (*Sialia currucoides*) nests (Warren 1942). As much as the authors could determine, this study represents the first confirmation of GMGS as a predator of MWCS nestlings.

Long-tailed weasels are found throughout North America, including high-elevation montane environments such as the Colorado Rocky Mountains. In Colorado, nearly two-thirds of LTWE's diet consists of rodents, approximately one-eighth of insects, and very small fractions of birds and lagomorphs; this suggests that our avian nest predation event is a relatively rare occurrence (King and Powell 2007). The LTWE has been observed robbing artificial nests (Martin 1993, Picman et al. 1993) and is suspected as a nest predator of several bird species, including the Dark-eyed Junco (Smith and Andersen 1982),

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Red-winged Blackbird (*Agelaius phoeniceus*; Picman et al. 1993), Common Yellowthroat (*Geothlypis trichas*; Pietz and Granfors 2000), and various grassland passerine species (Renfrew and Ribic 2003). As with the GMGS, this footage is the first known confirmation of LTWE depredation of MWCS nestlings.

The confirmation of both the LTWE and GMGS as MWCS nest predators fills a gap in our understanding of predator identity for this species in the Colorado Rocky Mountains. Because our primary study does not pertain to nest predation, we have limited ability to analyze these depredation events in a broader context. However, the sightings raise questions for future avenues of research. Behaviorally, there is a different response between the 2 events: in the GMGS event, the mother flushed from the nest and then physically attacked the intruder; meanwhile, in the LTWE event, the mother flushed from the nest and then both parents were heard chipping off-screen. With more recorded predation events, it would be possible to assess if the behavioral differences are due to random variation or can be explained by predator species. Furthermore, more detailed data about the rates of nest predation by species in these study sites would yield a better overall understanding of the community interactions.

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