RECURRENT INGESTION OF GRIT BY COMMON NIGHTHAWKS (*CHORDEILES MINOR*)

ALAN E BURGER[1]

Department of Biology, University of Victoria, Victoria, BC V8W 3N5 Canada; aburger@uvic.ca

ABSTRACT—Grit ingestion is widespread among birds, as an aid for grinding up food and as a dietary supplement of calcium, but is less common among insectivores, especially aerial feeders like nightjars (Caprimulgidae). I report recurrent visits by Common Nighthawks (*Chordeiles minor*) to a gravel driveway in British Columbia at dusk over a 4-y period. These ground visits were highly consistent (nighthawks landed during 93% of 72 dusk watches) and visits were highly concentrated both in time (95% of time on the ground between 10 and 57 min after sunset) and space (91% of the birds' time was spent in 2 areas comprising only 31% of the visible study site). Birds pecked at the ground in 97% of 198 focal-animal watches. In 43 visits the nighthawks picked up or swallowed some item; in 24 cases this was a small piece of gravel and no other items were identified. Surveys of ground arthropods in the study area over 3 y showed that potential prey were sparse (mean <2 insects m^{-2}) and the most common insects were unsuitable prey (tiny 3-mm ants). I conclude that the only reason for the nighthawks to consistently visit this gravel area was to ingest grit. The gravel ingested was crushed limestone, which might support a calcium uptake hypothesis. Grit ingestion, occurring within a restricted dusk period, might not explain why nightjars often sit on gravel roads at night, which is a major source of mortality for several species. Information on ground behavior in Caprimulgidae is important for understanding their mortality risks and conservation.

Key words: British Columbia, calcium uptake, Caprimulgidae, *Chordeiles minor*, Common Nighthawk, grit ingestion, ground behavior, roadkill

Ingested grit (small stones) is well known among granivorous and plant-eating birds as an important agent for grinding up food and in some cases providing mineral supplements (Gionfriddo and Best 1996, 1999). Its role among insectivorous birds is less known. Aerial insectivores typically rarely ingest grit (Gionfriddo and Best 1996, 1999). Among nightjars (Family Caprimulgidae), grit has been found in the gut contents of several species, but not in all species sampled (Jenkinson and Mengel 1970; Brigham and others 2020), and the process and frequency of grit uptake by these birds is poorly known. In insectivores, grit is assumed to aid in grinding up hard-bodied insects. Barclay (1994) suggested that calcium constraints might limit the reproductive output in females of aerial insectivores (birds and bats), especially in birds like nightjars and hummingbirds that have short legs and are therefore less able to ingest calcium-rich grit on the ground. This hypothesis has not been rigorously examined in these taxa. Clearly there is still much to learn about the occurrence and function of ingested grit in groups such as nightjars.

Many species of nightjars are known to frequently rest on roads at night. Ingestion of grit in these locations has been reported or implied (Stanford 1954; Foley 2018), but some studies suggest that grit ingestion might not be the primary reason for this behavior (Winterbottom 1954; Poulin and others 1998; Jackson 2003; Camacho 2013). Collisions with vehicles are a major cause of mortality for nightjars in many parts of the world, and a better understanding of the reasons for their visits to open gravelly areas might improve efforts aimed at their conservation.

I report recurrent and highly consistent visits by Common Nighthawks (*Chordeiles minor*) to a gravel driveway in southern British Columbia, Canada, and show that the primary, and probably only, purpose of these visits was to ingest small bits of gravel. This is the first quantitative study of grit ingestion by Caprimulgids.

[1] Current address: *PO Box 1305, Logan Lake, BC V0K 1W0 Canada*

Methods

Study Area

Common Nighthawks were observed visiting the gravel driveway of my erstwhile home in the Voght Valley (UTM: Zone 10U, 0652060 E, 5531100 N), 30 km southwest of Merritt, in the southern interior of British Columbia, Canada. Most of the gravel was pale, crushed limestone (reacted with a weak acid) mixed with lesser amounts of darker crushed rock, which is clearly evident in an aerial view (Fig. 1). The surrounding habitat is within the Interior Douglas-fir biogeoclimatic zone (Meidinger and Pojar 1991), and is a mix of open grassland and forest, dominated by Lodgepole Pine (*Pinus contorta*), Ponderosa Pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and Aspen (*Populus tremuloides*). I maintained records of the occurrence of nighthawks within 10 km of the study area between 2007 and 2019 during daily birding observations. Nighthawks migrate into this area in early June and leave in late August (pers. obs.), a residence time similar to those in other parts of British Columbia (Campbell and others 2006).

Observations of Common Nighthawks

Observations of nighthawks on the ground were made from inside my house, looking through a large window that was partly screened with potted plants, which minimized my profile. About 75% of the driveway area was in view, an area of 387.8 m^2 (Fig. 1). I used binoculars (8.5×42) for observing behavior and for tracking birds in low-light conditions. No lights were on inside or outside the house during observations.

Observations began 10 to 15 min before sunset (on average 30 min before the 1st bird landed; range = 2–58 min) and ended 1 h after sunset. In 3 instances when birds were still present 1 h after sunset, observations ended 10 min after the last bird had left. On average, observations ended 21 min after the last bird had departed (range = 10–42 min). During focal-animal observations of a single bird I recorded: (1) times of arrival and departure; (2) the patch of driveway in which the bird spent the most time in each visit; (3) the estimated distance that the bird moved during a visit (using sitting body length of approximately 20 cm as a guide); (4) the number of times that the bird made a peck at the ground; and (5) any additional behavior (preening, dust-bathing, or interactions among birds). When more than 1 nighthawk was on the ground, I made focal-animal observations of 1 bird and recorded the arrival and departure times and locations of any others.

It was not possible to differentiate individual birds and there were instances when nighthawks were seen to depart and then return to the ground area. Some birds likely made $\geq$2 successive visits to the area in 1 evening. Consequently, it was impossible to record the cumulative time and activity of each individual, and data were therefore analysed per visit, defined as the time that a nighthawk was visible on the ground.

Videos of Common Nighthawks ingesting bits of gravel in the study area have been posted on YouTube (see Appendix: Supplementary Material). Videos were made in low-light conditions using a Canon 300 mm F4 telephoto lens on a Canon 7D Mk II camera set at ISO 2500.

Local Counts of Flying Common Nighthawks

As part of a general survey for nightjars across Canada, I undertook dusk surveys in 4 routes within 30 km of my home using a standard protocol (Knight and others 2017). Fifteen dusk surveys (total time 29.4 h), undertaken between 18 June and 9 July over 6 y (2014 through 2019), provided data on the periods of nighthawk flight activity (birds seen flying or aerial vocalizations heard). Surveys began 30 min before sunset and ended 90 to 105 min (mean 95 min) after sunset when all the stations had been sampled. The number of birds active in each minute, relative to local sunset times, was calculated and then plotted in 5-min intervals for comparison with my ground observations.

Counts of Potential Prey on the Ground

To investigate the possibility that nighthawks might be attracted to ground prey, I did systematic counts of potential prey on the ground (insects and other arthropods). Prey counts were done in 2 zones where nighthawks regularly landed (see results): Zone A (in 2016, 2017, and 2018) and Zone C (in 2017 and 2018). In addition, in 2018 counts were done at randomly located points in the remaining observation area, at locations where nighthawks

FIGURE 1. Upper: View of the study area from the observation station. The 2 zones in which Common Nighthawks most often landed and spent most time are outlined (A and C). These 2 zones made up 31% of the 388 m^2 area of gravel driveway visible from the observation station. Lower: Aerial view of the study area showing the gravel driveway and preferred areas A and C.

seldom landed. Counts were made both before and, using a powerful flashlight, immediately after the evening watches. In each sampling period I searched six 1-m^2 non-overlapping quadrats at each site, delineated with a 1-m^2 wooden frame. Sampling sites were selected as locations where nighthawks had recently spent time or, in areas not visited, using a random blind stone throw. All insects, spiders and other invertebrates were counted. Most potential prey were ants and these were classified into 3 size classes, with approximately 3-, 6-, and 10-mm body lengths. Arthropods were not identified to species.

Statistical Analysis

Data were collated and analyzed using MS Excel. Trends were tested using StatPlus for Mac (www.analystsoft.com); in all cases reported here second-order polynomial equations provided the best fit to the data (higher R^2 values), compared to linear, logistic or exponential equations. Means are given ± SD (standard deviation) and range is provided where informative.

Results

Frequency, Timing, and Duration of Ground Visits

Over 11 y between 2007 and 2019, Common Nighthawks were 1st recorded as present flying over or near the study area (spring arrivals) between 1 and 13 June (mean: 7 June). The last birds seen in autumn were not recorded but, generally, the species departed on migration in late August. In 2016, no nighthawks were recorded on 4 dusk watches from 26 to 30 August when the birds had evidently migrated (no calling or birds in flight observed), and these watches were omitted from further analyses. My observations therefore covered the entire period of residence and breeding.

Nighthawks were recorded to land within the observation area during 67 of 72 (93%) watches across 4 y (Table 1). Nighthawks generally

TABLE 1. Summary of observation effort and presence of landed Common Nighthawks in the observation area.

Year	2016	2017	2018	2019	All years
Date range of observations	22 June to 23 August[1]	23 June to 31 July	11 June to 16 August	15 June to 9 August	11 June to 23 August
No. of watches	15	25	19	13	72
No. of watches when nighthawks landed	15 (100%)	23 (92%)	18 (95%)	11 (85%)	67 (93%)
No. of visits recorded	35	133	90	63	321

[1] Data from watches from 26 through 30 August 2016 were not included in any analyses because the nighthawks were assumed to have left the area on migration (see text).

arrived and left alone, but occasionally 2 or 3 birds arrived together and up to 5 birds were sometimes visible on the ground at the same time.

In total, 321 bird visits were observed (Table 1), but the full set of data was not obtained for all visits. Nighthawks were on the ground from 11 min before sunset to 60 min after sunset, with 95% of the time on the ground between 10 and 57 min after sunset (Fig. 2). Ground activity was highly concentrated in time, close to the midpoint of the more widely spread flight activity (Fig. 3). The median timing of ground and flight records was similar (31 and 26 min after sunset, respectively).

The duration of ground visits averaged 169 s (2.8 min), but was highly variable (SD = 170 s; range = 10–1278 s; $n = 298$ visits). There was a slight tendency for visits to be longer early in the season, although date explained only 18% of the variation in visit duration (Fig. 4A; $R^2 = 0.18$). Duration of visit did not vary with the time of day, relative to sunset time (Fig. 4B; $R^2 = 0.06$).

Use of Zones within the Observation Area

During preliminary observations it was obvious that nighthawks often landed and spent most time in 2 zones of the study area (zone A = 23.7 m^2 and zone C = 95.3 m^2; Fig. 1). These zones comprised 6.1 and 24.6%, respectively, of the 387.8 m^2 visible observation area, or 30.7% combined. The rank in preference for either A or C changed across the 4 y of study, but overall 90.6% of the 839.6 min that nighthawks were on the ground were spent in either zone A or C (Table 2). Similarly, 89.7% of 321 landing events were made in either zone A or C. The gravel area between A and C was not readily visible from the observation post, but additional unquantified observations of this area suggested it was not heavily used.

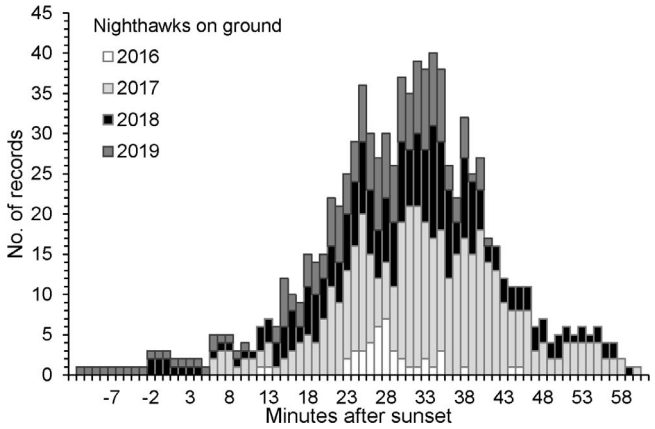

FIGURE 2. Distribution of time on the ground by Common Nighthawks, 2016–2019, relative to local sunset. The number of minutes that a nighthawk was recorded on the ground during each visit is included in the plot (2016: 21 visits, 39 min; 2017: 127 visits, 396 min; 2018: 90 visits, 247 min; 2019: 62 visits, 164 min; total: 300 visits, 846 min).

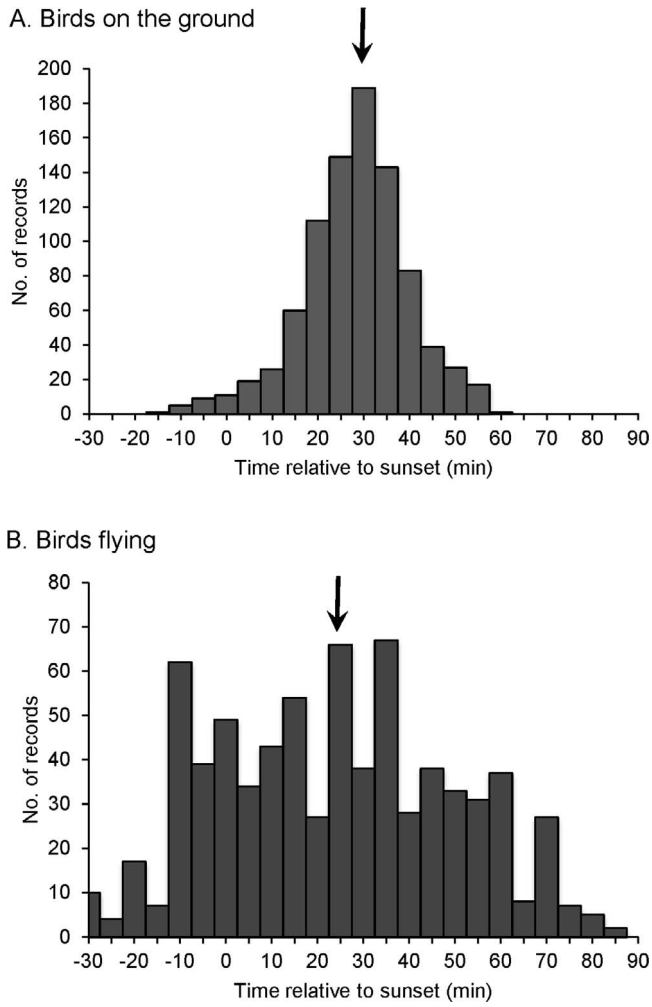

FIGURE 3. Comparison of activity periods of Common Nighthawks on the ground (A; $n = 846$ records – see Fig. 2) and in flight during standardized census surveys (B; $n = 733$ records), plotted in 5-min intervals (the x-axis label shows the beginning of each 5-min interval). The arrows indicate the medians (31 and 26 min after sunset, respectively).

Behavior of Birds on the Ground

On landing, nighthawks usually sat immobile for a few seconds. In 280 visits where behavior was recorded, 268 (95.7%) of the birds walked, moving a mean distance of 91 cm (SD = 130 cm, range = 10–1100 cm). In most cases, the birds shuffled along a few 10s of cm at a time, but in a few instances they moved quite rapidly for 1 to 4 m at a time. A few birds flew from 1 part of the observation area to the next, but because some similar movements likely took the birds out of sight, the proportion flying between ground sites could not be calculated.

Out of 198 visits with focal-animal observations, nighthawks pecked at the ground or picked up an object (hereafter pecking) in 191 instances (96.5%). The number of pecks per visit was highly variable (mean = 13; SD = 12; range = 0–77; $n = 198$). Objects being picked up could be identified using binoculars or in videos only during early parts of each observation period, owing to decreasing light levels. During 45 visits, the nighthawk picked up or swallowed some item; in 26 cases this was a small piece of gravel and no other items were identified. Nighthawks appeared clumsy in ingesting bits

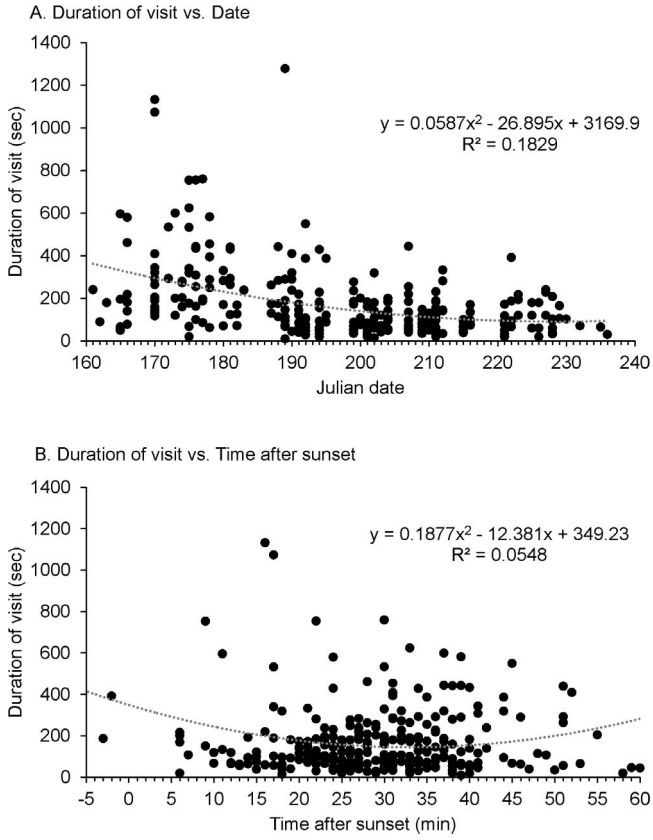

FIGURE 4. Visit duration compared with date (A) and time of day (B). In each case a second-order polynomial gave the best fit trendline to the data (equations shown).

of gravel; multiple pecks at the ground were usually made before a piece of gravel was seized in the beak, and in at least 11 of the 26 instances the bird dropped 1 or more gravel pieces. Videos show that birds sometimes mouthed bits of gravel and then spat them out a few seconds later (see Appendix: Supplementary Material). All 17 stones picked up by 5 birds in the videos were light-colored limestone, selected from a mix of light and dark gravel in front of the bird. Birds were observed picking up as many as 11 pieces of gravel in a single visit, but in most cases only 1 to 3 stones were swallowed.

Neither the distance walked ($R^2 = 0.013$), nor the number of pecks per visit ($R^2 = 0.043$) varied with time relative to sunset (polynomial trend-

TABLE 2. Percentage of time that Common Nighthawks spent in zones A and C and in parts of the observation area outside zones A and C in each year. See Figure 1 for zone locations. Some birds were on the ground in more than 1 zone during a single visit.

Zone in the observation area	2016	2017	2018	2019	All years
Zone A only	70.7	55.3	23.1	43.9	44.3
Zone A + other area	0.0	2.7	0.0	4.9	2.2
Zone C only	0.9	25.1	61.1	41.3	37.7
Zone C + other area	0.0	0.9	5.3	0.0	2.0
Visited both A and C	0.0	9.5	0.0	1.7	4.8
Other zones only (not A or C)	28.4	6.6	10.6	9.7	9.4
Included zones A or C during a visit	71.6	93.4	89.4	90.3	90.6
Total time birds were on the ground (min)	38.7	389.8	246.8	164.2	839.6

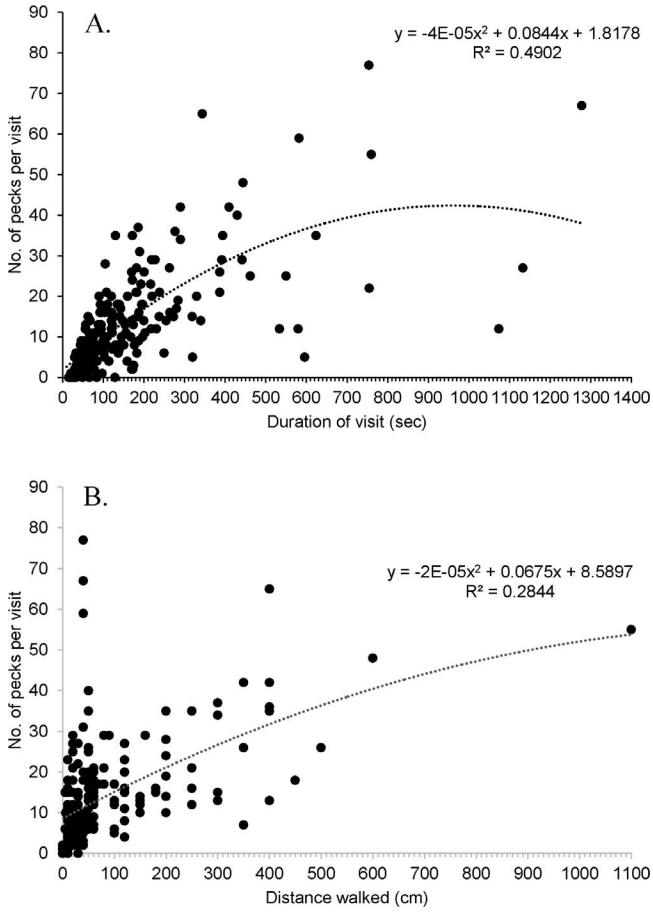

FIGURE 5. Variation in the number of pecks given by Common Nighthawks relative to duration of visit (A) and distance walked (B). In each case a second-order polynomial gave the best trendline fit (equations given).

lines giving the best fit in each case; graphs not included here). The number of pecks per visit did increase with the time on the ground ($R^2 = 0.490$) and the distance walked ($R^2 = 0.284$; Fig. 5).

Social interactions among birds on the ground were rare. Out of 198 visits with focal observations, apparent aggression was seen only 5 times (2.5%); in each instance 1 bird moved quickly towards another with its mouth open which resulted in the other bird taking flight. In contrast, 19 birds either arrived together or walked around within 50 cm of each other without evidence of aggression. The apparent sex of birds (males have brighter white throat patches) was difficult to assess owing to low-light conditions and hunched postures. In 2018 and 2019, 10 males and 11 females were tentatively identified. Prolonged preening (for 33, 90, and 358 s) was observed in 3 visits; a prolonged dust bath (216 s) was observed once.

Potential Prey on the Ground

Sampling for potential prey on ground frequented by nighthawks was done on 71 occasions in 2016, 2017, and 2018, with a cumulative total area of 942 m^2 searched (Table 3). Out of 805 potential prey found, 617 (76.6%) were ants with approximate body lengths of 3 mm, 125 (15.5%) were 6-mm ants, 50 (6.2%) were 10-mm ants, and 13 (1.6%) were other insects or spiders (Table 3). Only 1 (0.12%) of the ants was a winged alate. Ants were found in most searches (88–100%), but occurred at low densities, especially the larger types (Table 3). The densities of

TABLE 3. Summary of potential prey items found during systematic ground searches after (post-obs) and before (pre-obs) observation periods for Common Nighthawks. Mean density ± SD (animals m^{-2}) is shown with maximum in parentheses.

Measure	Post-obs 2016	Post-obs 2017	Pre-obs 2017	Post-obs 2018	Pre-obs 2018
Sampling period	31 Jul – 23 Aug	22 Jun – 31 Jul	26 Jun – 31 Jul	21 Jun – 16 Aug	24 Jun – 16 Aug
No. of days sampled	7	23	16	13	12
Mean area sampled per day (m^2)	5.6	11.3	12.0	18.0	18.0
Density					
All potential prey	1.81 ± 1.30 (4.17)	0.61 ± 0.55 (2.10)	0.69 ± 0.50 (1.83)	1.47 ± 1.55 (5.78)	0.49 ± 0.44 (1.50)
Small 3-mm ants	1.60 ± 1.30 (4.17)	0.47 ± 0.51 (1.90)	0.40 ± 0.46 (1.83)	1.23 ± 1.57 (5.67)	0.35 ± 0.44 (1.33)
Mid-sized 6-mm ants	0.17 ± 0.25 (0.67)	0.07 ± 0.09 (0.25)	0.27 ± 0.33 (1.00)	0.10 ± 0.14 (0.50)	0.11 ± 0.13 (0.39)
Large 10-mm ants	0	0.06 ± 0.08 (0.25)	0.01 ± 0.02 (0.08)	0.12 ± 0.08 (0.28)	0.01 ± 0.03 (0.11)
Other arthropods	0.05 ± 0.08[1] (0.17)	0.01 ± 0.03[2] (0.14)	0.02 ± 0.03[3] (0.08)	0.02 ± 0.05[4] (0.17)	0.01 ± 0.03[5] (0.06)

[1] One fly, 4-mm body length; 1 daddy longlegs (Pholcidae).
[2] One 30-mm grig (*Cyphoderris* spp.).
[3] One 4-mm spider; one 12-mm grasshopper; one 4-mm fly.
[4] One 10-mm caterpillar; two 6-mm beetles; one 2-mm fly.
[5] Two 2-mm flies; one 10-mm winged alate ant.

all potential prey items on the ground were highly variable (note high SD in all samples) and averaged below 2 m^{-2} in all years. There were no consistent changes across the years in density between searches made pre- and post-observation, but in 2018 small 3 mm ants and large 10-mm ants were more common in the post-observation searches (Table 3). The 2 zones most preferred by Common Nighthawks (A and C) did not have higher mean densities of invertebrates compared to other areas seldom used by nighthawks (pre-observation sampling, $n = 12$ d, mean ± SD animals m^{-2}: A: 0.42 ± 0.40; C: 0.19 ± 0.26; Other: 0.85 ± 1.39; post-observation sampling, $n = 13$ d: A: 1.22 ± 0.87; C: 0.54 ± 0.78; Other: 2.64 ± 4.49).

DISCUSSION

Although grit (small stones) has been found in the stomach contents of Common Nighthawks, and in several other nightjars (family Caprimulgidae; Brigham and others 2020), the process and regularity of ingesting grit has not been previously documented. Foley (2018) reported 5 instances of Common Nighthawks ingesting grit on a gravel road in Saskatchewan. Jenkinson and Mengel (1970) describe ingestion of stones by Chuck-wills-widow (*Caprimulgus carolinensis*). They reported stones in gut contents of several other Caprimulgidae, but not in 10 Common Nighthawks that they examined. Rust (1947) reported gravel in the guts of an unspecified number of the 11 Common Nighthawks examined. Jones (1933) described Whip-poor-wills (*Antrostomus vociferous*) regularly landing in a yard, creeping about, and picking up grit. My observations are the first to report recurrent grit ingestion by Common Nighthawks and, to my knowledge, represent the most detailed analysis of this behavior in Caprimulgids.

Based on 4 y of quantitative data, and several prior years of informal observations, grit ingestion by Common Nighthawks was remarkably consistent, both temporally and spatially. Ground visits occurred at dusk throughout the season when nighthawks were present, and during 93% of dusk watches spaced throughout this residence period. The timing of ground visits was highly concentrated in all 4 y, with 95% of the time on the ground occurring between 10 and 57 min after sunset. This peak of ground time occurred mid-way in the period

of dusk flight activity, when nighthawks foraged and gave aerial displays. One possibility is that grit loading occurs after most prey intake to minimize the wing-loading effects of ingested stones.

The temporally concentrated ground visits might have been a tactic to reduce predation risk. Crepuscular predators that regularly occurred in the area include Great Horned Owls (*Bubo virginianus*), Coyotes (*Canis latrans*), and Bobcats (*Lynx rufous*). Diurnal Red-tailed Hawks (*Buteo jamaicensis*) and Cooper's Hawks (*Accipiter cooperii*) would also be active before sunset.

Similarly, ground visits were highly concentrated spatially; 91% of the birds' time on the ground was confined to 2 areas covering 31% of the visible gravel driveway. Although there were slight variations across years in the use of the 2 preferred areas, collectively both areas were consistently preferred in all 4 y. I detected no obvious differences in the types and size distribution of gravel between the preferred areas and the rest of the driveway, but did not examine this in detail. The preferred zones (A and C) were in close proximity to trees and other vegetation (Fig. 1). Nighthawks on the ground close to the forest would likely be vulnerable to forest-dwelling predators (e.g., owls), but perhaps reduced their visibility by avoiding the more exposed open driveway areas. The reduced predation benefits to nightjars by sitting close to dense vegetation (Camacho and others 2017) do not apply in this situation, because vegetation beneath the trees that might hinder a predator's attack was sparse. More detailed investigation of micro-habitat use during grit loading by Common Nighthawks is needed to fully understand their ground-visiting preferences.

Nighthawks were not on the ground to feed. Only bits of gravel were picked up and swallowed. Analysis of potential arthropod prey over 3 y showed that 3-mm-long ants, too small to be prey, were the most common arthropods. The density of all arthropods was too sparse (mean <2 m^{-2}) to account for the frequency of pecking by the nighthawks. Furthermore, the 2 areas most preferred by nighthawks did not have higher arthropod densities than other less-used areas. In all 4 y there was a nest of larger 6- to 10-mm ants in a section of the driveway that the nighthawks never visited. Rust (1947) described ground feeding by Common Nighthawks on grasshoppers and ant alates (wingless and grounded following their nuptial flights), and concluded that these were important food during stormy weather for those nighthawks that remained in northern Idaho in autumn (September and early October). In contrast, Erickson (2018) described the inability of apparently hungry Common Nighthawks on the ground to seize moths just millimeters in front of them.

Three to 5 Common Nighthawks were seen in the observed area at the same time on several occasions, but social interactions were rare. In most cases birds arrived, walked about, and left alone. Both males and females were recorded. Apparent aggression was observed only 5 times in 198 focal-animal records, but in 19 cases birds arrived together or spent time close together (<50 cm apart) without noticeable incidents. No vocalizations were heard from birds on the ground, but birds in flight overhead regularly called during these visits. Similarly, comfort behaviors like preening and dust bathing were rare. Grit ingestion appears to be the sole reason for Common Nighthawks to regularly spend time on the gravel driveway.

Ingested grit is assumed to facilitate grinding up chitinous bodies of insect prey in Caprimulgidae (Poulin and others 1998; Brigham and others 2020) and in other insectivorous birds (Gionfriddo and Best 1996, 1999). There is speculation that breakdown of hard chitinous exoskeletons of insects might also occur through microbial action in the intestinal caeca (Erickson 2018). Common Nighthawks, in common with some other Caprimulgiformes, have well developed caeca (Clench and Mathias 1995; DeGolier and others 1999). Chitinolytic microbes ~~are~~ have been found in the caeca of some birds (DeGolier and others 1999; Borrelli and others 2017), but not yet confirmed in Caprimulgiformes.

Poulin and others (1998), citing Barclay (1994), also speculated that ingested grit might supplement calcium intake in Caprimulgidae. Grit is an important source of calcium for many bird species (Reynolds and Perrins 2010). Ingestion of limestone gravel from my driveway might therefore support this hypothesis. The light-colored limestone was clearly visible from the air (see Fig. 1), which could explain the repeated use of this area by calcium-seeking nighthawks. Female aerial insectivores producing eggs are presumed to be most in need of dietary calcium

(Barclay 1994), but in my study both males and females ingested grit.

Conclusions

Although I was not able to distinguish individual nighthawks to document the frequency of grit uptake per individual, the regularity and frequency of this behavior at 1 site suggest that this is part of the daily feeding repertoire. Whether nighthawks were ingesting grit for the purpose of grinding hard-bodied insects, as a dietary supplement of calcium, or for both purposes remains unknown. The calcium requirement hypothesis for grit ingestion requires further investigation, including the calcium content of the selected grit and the likely absorption of this mineral from ingested grit.

Common Nighthawks are frequently killed by vehicles while sitting on gravel roads (Campbell and others 2006; Brigham and others 2020). Poulin and others (1998) found that it was predominantly males sitting on gravel roads in the Canadian prairies, and concluded that grit loading was not the primary reason for this behavior. Foley (2018) found that both grit ingestion (reported 5 times) and foraging by sallying (recorded twice) occasionally occurred among Common Nighthawks sitting on a gravel road. There has been a similar debate about the function of sitting on roads in other species of nightjars (Stanford 1954; Winterbottom 1954; Jackson 2003; Camacho 2013). I found that regular visits to preferred gravel areas by both males and females were exclusively for the purpose of grit ingestion. Grit uptake in my study was highly concentrated in time, just after sunset, and might not explain why Common Nighthawks and many other nightjar species sit on roads for prolonged periods later at night. Common Nighthawks are declining in British Columbia and in many other parts of their range (Campbell and others 2006; COSEWIC 2007; Sauer and others 2017). A better understanding of the areas and types of substrate preferred for grit ingestion and other ground-based activities would help to reduce mortality in this species and in many other nightjar species.

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Appendix

Supplementary Material: Two videos of Common Nighthawks ingesting bits of gravel in the study area have been posted on YouTube (https://youtu.be/Lp-czktqtbc; https://youtu.be/Bfd42JXaI_8). In each case clips of pecking activity, in between the long periods of inactivity, have been retained. In each clip the original video is followed by an edited version in slow-motion and cropped; there is no sound.

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