

Large winter falcons and their Rock Pigeon (*Columba livia*) prey at an urban grain terminal in Edmonton, Alberta: an update

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Abstract

In winter, Gyr Falcon (*Falco rusticolus*) and Prairie Falcon (*Falco mexicanus*) frequent a 96-year-old grain terminal, in Edmonton, Alberta, hunting Rock Pigeon (*Columba livia*). This phenomenon was reviewed shortly after it was first noticed by others in 1998 and, since then, we have observed hunting success and methods of Gyrfalcons and Prairie Falcons that were similar but not identical to earlier observations, with success rates of 21.0% and 10.6%, respectively, compared with 10.6% and 26.0% earlier. The most frequently observed hunting strategy for both species was a repeated upward attack on swirling Rock Pigeon flocks, resulting in success rates of 10.7% and 11.4%, respectively. Notably, 50% of downward dive hunts made by Gyrfalcons were successful, although only eight hunts using this method were recorded. The falcons were mildly selective with respect to pigeon colour morphs, with an apparent preference for pied colouration. Contrary to previous interpretations, Rock Pigeon do not appear to eat spilled grain on the building to any great extent; instead, the terminal may simply provide abundant roosting sites, which attain surface temperatures roughly 10°C warmer than ambient on sunny days and at temperatures below –20°C when the building is warmed internally.

Key words: Gyr Falcon; Prairie Falcon; Rock Pigeon; *Falco rusticolus*; *Falco mexicanus*; *Columba livia*; grain terminal; predation; colour preference; thermoregulation; Alberta

Introduction

The Alberta Grain Terminal in Edmonton, Alberta (53.5846°N, 113.5480°W) is home to a large population of Rock Pigeon (*Columba livia*), which in turn attract raptors of several species. The Canadian National rail corridor serves the terminal, and the building has been in operation for 96 years (Lamb 2015). The terminal is now operated by Cargill Inc., who removed the older name and modernized the interior of the facility. We retain the name Alberta Grain Terminal here, for continuity with previous literature and local usage.

Dekker and Lange (2001) investigated the hunting methods and success rates of Gyr Falcon (*Falco rusticolus*) and Prairie Falcon (*Falco mexicanus*) at the terminal, shortly after this phenomenon was first noticed. Since then, numerous additional insights have emerged, and this study summarizes our own obser-

vations at the terminal over 14 years. As well, we examined possible preferences of the falcons among pigeon colour morphs, because observers at the terminal had suggested that dark pigeons were preferred targets for predation and easier to see against the light sky or snow-covered ground. We also investigated the role of the building as an internally warmed and/or sun-warmed roost, using thermal imaging. Dekker and Lange (2001) proposed that the terminal was both a roost and a food source, but they emphasized the importance of spilled grain and canola seeds on the roof of the grain-loading annex as the major attractant for pigeons at the terminal.

Frequently, we also observed Merlin (*Falco columbarius*) at the terminal and, less frequently, Peregrine Falcon (*Falco peregrinus*), Bald Eagle (*Haliaeetus leucocephalus*), Northern Goshawk (*Accipiter gentilis*), Cooper's Hawk (*Accipiter cooperii*), and Rough-

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legged Hawk (*Buteo lagopus*), but we do not include data from these species here. Since we gathered our data, Bald Eagles have become more common and the large falcons less so, perhaps as a consequence. The terminal represents a rare opportunity to observe these raptors in an urban, albeit industrial, setting, and the terminal is also unusual because of the abundance of perches it provides on its south face, in part because of its age. In our experience, more modern terminals lack such perches, and are not as attractive to pigeons or raptors.

Methods

Observations of raptor hunting

We observed falcons at the terminal, opportunistically but usually at mid-day, during the winters of 1996–1997, 2002–2004, 2011–2013, and 2015–2018. We also took photos, with metadata, of hunting falcons during the winters of 2013–2018. We made additional observations in 2019–2020, but these were not included in the analyses that follow. Following Dekker and Lange (2001), we classified a hunt as a visible prey-capture attempt, including multiple sequential attempts, considered terminated when the falcon either perched or flew away. We observed from a parking lot about 100 m south of the terminal, at about 130 Street and 126 Avenue NW (for a map of the location see Acorn *et al.* 2018). Hunting methods were classified *post hoc*, and six hunting categories were established: attack on pigeon on ground, downward pass through swirling pigeons, upward pass through swirling pigeons, downward dive from the top of the terminal, level flight attack, and upward pursuit of an individual pigeon. All records included the species involved, but only some specified the type of hunt, because this was sometimes difficult to determine in the moment. Success rates and frequencies of hunting-method use were compared between the two falcon species.

Falcon preferences with respect to pigeon colouration

Photographs of large pigeon flocks ($n = 1821$) taken in 1999, 2012, 2015, and 2016, were used to determine the frequencies of colour type (wild type, lighter than wild type, darker than wild type, brown, and pied) and to test the assumption that pigeon morph frequencies remained roughly stable over time. Photographs of large falcons grasping or obviously targetting pigeons with their talons ($n = 81$ for Gyr Falcon, $n = 18$ for Prairie Falcon), including many obtained from amateur photographers and birders, were also scored for pigeon colour morph. All pigeon images were scored for wing and body colouration separately. *G*-tests were used to test for differences between expected and observed frequencies of morphs among the four years, and of pigeon

morphs chosen as prey by falcons. *G*-tests were performed in the statistical program R, version 0.99.36 (R Core Team 2019).

Thermal characteristics of the building

To quantify the thermal profile of the terminal, we took infrared photographs of the south face, using a Reveal RW (Seek Thermal, Santa Barbara, California, USA) handheld thermal imager, between November 2018 and February 2019. The imager provides temperature information for a central point on the sensor, in real time, and we attempted to capture the average temperature of the brick wall on the upper face of the building while avoiding any reflective hotspots from windows. We imaged only the south face, because pigeons were rarely if ever seen on the other sides of the building, which also lack ledges or other perches. Simultaneously, the built-in thermometer in a 2016 pickup truck (Ford F-150, Ford, Dearborn, Michigan, USA), parked in the location described above, was used to measure ambient temperature. Conditions were classified as either sunny or cloudy, to assess direct insolation of the building. During February 2019, images of a bare, south-facing cliff, approximately as high as the terminal and located along the valley of the North Saskatchewan River, were also obtained.

Results and Discussion

Hunting methods and success rates for large falcons

We observed falcons at the terminal only from about mid-November to mid-March. We recorded 128 successful and unsuccessful hunting attempts, including 62 for Gyr Falcon and 66 for Prairie Falcons (summarized in Figures 1 and 2). Hunting success rates were the reverse of those observed by Dekker and Lange (2001): 21.0% for Gyr Falcon and 10.6% for Prairie Falcon compared with 10.6% and 26.0%, respectively, reported by Dekker and Lange. Dekker and Lange's data were collected over two winters and were, therefore, based on a small number of individual falcons, whereas our findings were based on multiple additional individuals, over 13 winters. Placed in the context of the extensive dataset gathered by Dekker

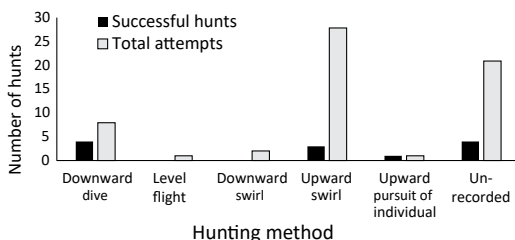


FIGURE 1. Hunting methods used by Gyr Falcon (*Falco rusticolus*) at the Alberta Grain Terminal in Edmonton, Alberta, Canada.

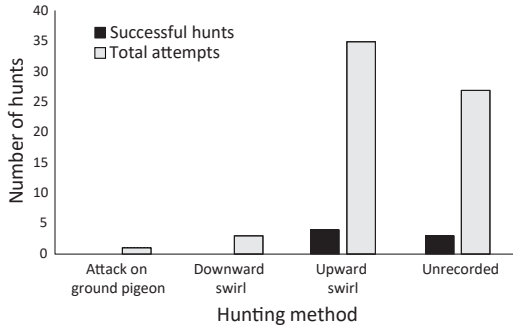


FIGURE 2. Hunting methods used by Prairie Falcon (*Falco mexicanus*) at the Alberta Grain Terminal in Edmonton, Alberta, Canada.

(2009), the average hunting success for large falcons at the terminal fell within the general range reported for Gyrfalcons and Prairie Falcons in other situations, Peregrines in a variety of situations, and Merlins hunting passerines and shorebirds, but lower than those for an experienced breeding pair of Peregrines hunting mostly immature gulls from the stack of a power plant on an Alberta lake (30.3%) or for Peregrines hunting Dunlin (*Calidris alpina*) over the saltmarsh shore zone along the Pacific coast (44%).

With respect to hunting method, the most common method used by both falcon species was a repeated upward attack on swirling pigeon flocks: 28 and 35 hunts, respectively, with success rates of 10.7% and 11.4%. No other raptors observed at the terminal used the upward swirling attack method. Dekker and Lange (2001: 397) also found this to be the preferred hunting method for Gyrfalcon and Prairie Falcon, which they described as “repeated attacks on pigeon flushes”. This method is unusual for Gyrfalcon, which generally pursue one prey item for up to several kilometres through the air (Bent 1938; Potapov and Sale 2005).

Gyrfalcon also employed a downward dive from the top of the terminal, resulting in a 50% success rate in the eight hunting attempts observed. This method involves pursuit of an individual pigeon, and, although a high success rate reveals that it is efficient, it is not the most frequent method used by raptors hunting at the terminal. Perhaps specific factors, such as injured or weak pigeons, influence Gyrfalcon to use this hunting method. Rarely, Prairie Falcon have been observed using the downward dive hunting method at the terminal; however, all three Prairie Falcon hunts of this type we observed were unsuccessful. Dekker and Lange (2001) found that Prairie Falcon use this method successfully.

Unfortunately, hunting method was not apparent for 39.2% of the observed hunts. With up to a thousand birds in flight at a time it is often difficult to track

the movements of the falcons and to adequately observe the moment when a pigeon has been taken. It was not unusual to suddenly notice a large falcon carrying prey. As well, hunts reported to us by birders and photographers often failed to indicate the method. Overall, however, our results indicate that Gyrfalcon and Prairie Falcon have such similar hunting styles and success rates that they are functionally equivalent in their ecological effects at the terminal, differing only insofar as Gyrfalcon can generally displace Prairie Falcon when both are present.

Falcon preferences with respect to pigeon colouration

Analysis of pigeon images showed no significant differences in frequency of colour morphs among years, supporting the assumption that morph ratios have remained relatively constant. Morph ratios among pigeons targetted by falcons (Figure 3, Table 1) were similar to those in the overall population, except for pied pigeons, which appeared to be over-represented among the prey in the pooled Gyrfalcon and Prairie Falcon data. We pooled data for both falcon species to increase the sample size for analysis and because the birds appeared to use similar hunting techniques.

The notion among birders and photographers at the terminal that falcons can track dark pigeons more easily against a light background does not appear to be supported by our data, but a slight tendency for falcons to prefer pied pigeons could conceivably be influenced by the same mechanism. It is perhaps noteworthy that Rock Ptarmigan (*Lagopus muta*), which have colouration roughly comparable to pied-winged pigeons, are frequent prey for Gyrfalcons at higher latitudes and make up 50–95% of their diet biomass throughout the circumpolar region (Nielsen and

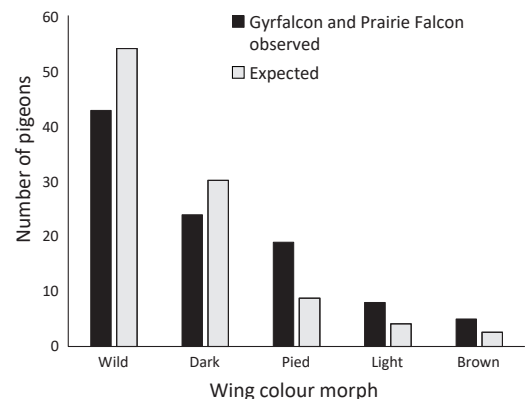


FIGURE 3. Combined Gyrfalcon (*Falco rusticolus*; $n = 81$) and Prairie Falcon (*Falco mexicanus*; $n = 18$) kills of Rock Pigeon (*Columba livia*), by colour morph, at the Alberta Grain Terminal in Edmonton, Alberta, Canada.

TABLE 1. Rock Pigeon (*Columba livia*) colour morphs targetted by Gyrfalcon (*Falco rusticolus*) and Prairie Falcon (*Falco rusticolus*) at the Alberta Grain Terminal in Edmonton, Alberta, Canada. *P* values in bold type indicate a significant difference ($P < 0.05$) between proportion of targetted prey and proportion in the general population.

Colour morph	<i>G</i> -test results (<i>P</i> values)					
	Wild	Dark	Pied	Light	Brown	All other
Wild		5.50E-06 (0.998)	5.113 (0.024)	2.062 (0.151)	1.338 (0.247)	2.325 (0.127)
Dark			4.352 (0.037)	1.894 (0.169)	1.264 (0.261)	0.905 (0.341)
Pied				0.021 (0.884)	0.016 (0.900)	4.548 (0.033)
Light					7.37E-06 (0.998)	1.380 (0.240)
Brown						0.837 (0.360)
All other						

Pétursson 1995; Booms *et al.* 2008). Potapov and Sale (2005) suggest that Gyrfalcons are the selective agents responsible for polymorphism in *Lagopus* spp. In general, however, falcons at the terminal were only mildly selective with respect to pigeon colour morphs and do not appear to be driving changes in pigeon polymorphism at this location.

Thermal characteristics of the building

Our observations do not corroborate the suggestion that pigeons feed on spillage on the roof of the grain-loading annex, and perhaps the source of spillage has been repaired. We observed only occasional groups of pigeons feeding at roof or ground level and then almost always inside the grain loading bays of the annex at times when workers and rail cars were not present. Although some grain does spill from the bottom of hopper cars, there is no longer reason to expect spillage higher in the terminal infrastructure.

On cloudy days warmer than -20°C ($n = 24$) the mean surface temperature of the south face of the terminal was only 1.2°C warmer than mean ambi-

ent temperature (Figure 4). However, on cloudy days when ambient temperatures dropped below -20°C ($n = 5$), the terminal surface temperature was $7\text{--}10^{\circ}\text{C}$ warmer than ambient, likely because the terminal releases heat internally, presumably in response to cold outdoor conditions. On sunny days ($n = 5$), terminal surface temperatures were on average 13.8°C warmer than ambient, and maximally 23°C warmer than ambient, presumably as a result of direct insolation of the south face of the terminal.

Pigeons in natural situations are often found roosting on cliffs and nesting in crevices on such cliffs (Peterson *et al.* 1966). In Edmonton, the 22-story terminal (Lamb 2015) towers above the surrounding warehouses and neighbourhoods and offers a thermally comparable structure (Figure 5), with pipes, brackets, windowsills, and various other complex horizontal surfaces suitable for roosting. Solar and internal warming of the south face seems to attract pigeons, but an abundance of pigeons on days when the south face is at ambient temperature demonstrates that

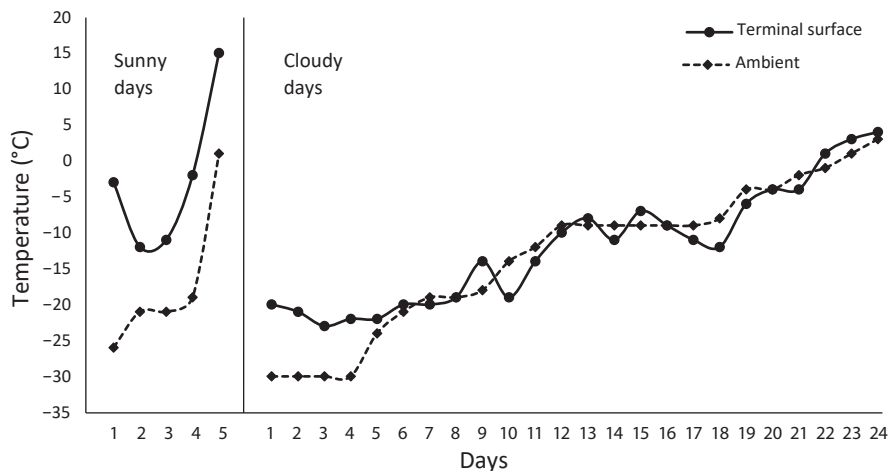


FIGURE 4. Surface and ambient temperature of the south face of the Alberta Grain Terminal in Edmonton, Alberta, Canada, on sunny ($n = 5$) and cloudy ($n = 24$) days in winter, 2019.

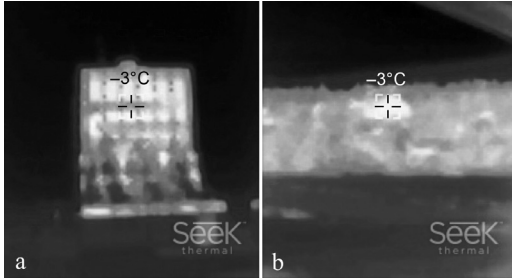


FIGURE 5. a. Thermal image of the south face of the Alberta Grain Terminal in Edmonton, Alberta, Canada, on a sunny day (9 February 2019), with a surface temperature of -3°C and ambient temperature of -26°C . b. Thermal image of a bare cliff face on the North Saskatchewan River (12 February 2019) on a sunny day with a surface temperature of -3°C and ambient temperature of -21°C .

elevated temperatures are not essential to the birds. The attraction of the terminal to pigeons is, therefore, a complex matter of roosting surfaces, ground-level food, and temperature, which together attract pigeons despite the risk of predation by large falcons.

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