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PREY ITEMS FROM SNOWY OWL (*Bubo scandiacus*) PELLETS DURING THE 2011-2012 IRRUPTION IN KANSAS

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Abstract – During the Snowy Owl (*Bubo scandiacus*) irruption of 2011-2012 a total of 12 pellets from four localities in north-central Kansas were analyzed for prey contents. The remains of 20 individual organisms representing nine different taxa were identified, five birds (n = 13) and four mammals (n = 7). Red-winged Blackbird (*Agelaius phoeniceus*) was the most abundant taxa with seven individuals; followed by prairie vole (*Microtus ochrogaster*) with three individuals; hispid cotton rat (*Sigmodon hispidus*) and American Coot (*Fulica americana*) each with two individuals, two unidentified passerines; a Pied-billed Grebe (*Podilymbus podiceps*), a Dark-eyed Junco (*Junco hyemalis*), a *Peromyscus* spp. and an eastern mole (*Scolopus aquaticus*). Five pellets (41.7%) contained enough food to provide the minimal sustenance for wintering owls, thus, supporting the hypothesis that the majority of owls during irruptive years probably never return to the breeding grounds.

INTRODUCTION

Snowy Owls (*Bubo scandiacus*) are known for their irruptions into other locations of North America beyond the normal wintering ranges. Shelford (1945) postulated that this may be associated with prey availability (lemmings) resulting in irruptions in the northeast. Such events were described as being cyclic in nature (Gross 1944, 1947). Thus, it was generally assumed the irruptions were caused by shortages in prey, forcing birds away from normal winter ranges. However, more recent work indicates that these irruptions are not periodic and vary from year to year (Kerlinger *et al.* 1985). Therefore, movements of Snowy Owls are not predictable, vary from region to region, and the relationship to prey populations is not fully understood (Parmelee 1992, Holt *et al.* 1999). In the northern Great Plains the Snowy Owl is a regular winter resident (Kerlinger and Lein 1986), becoming more sporadic southward, where it becomes a rare and irregular

winter visitant in Kansas (Thompson *et al.* 2011). Kerlinger *et al.* (1985) and Parmelee (1992) considered Kansas to be within the normal winter range for this species.

During the winter of 2011-2012, Snowy Owls irrupted into the interior of North America venturing into the southern plains as far south as north-central Texas (Lockwood *et al.* 2012, Robbins and Otte 2013). Robbins and Otte (2013) documented a minimum of 154 reports of Snowy Owls in Kansas during this time period, the majority of which appeared to be hatching year individuals. A majority of the salvaged individuals were emaciated.

Irruptions in Kansas are sporadic (Thompson *et al.* 2011), therefore little is known about the food habits of Snowy Owls in the southern plains and Kansas (Subramaniam *et al.* 2011). It is generally accepted that many, if not most, individuals during such episodes, especially in more southern latitudes, are not physiologically fit to make it back to the breeding grounds. Herewith, we report the contents of 12 pellets collected from north-central Kansas during the winter irruption of 2011-2012.

METHODS

Snowy Owl pellets were collected from four sites: Pool 2 at Cheyenne Bottoms (38.461211°N, 98.68312°W), Barton County in central Kansas; intersection of Eden Rd and 1900 Ave (38.871300°N, 97.279556°W), Dickinson County in north-central Kansas; Lucas Swim Beach (38.948117°N, 98.548256°W) and Minooka Park (38.940869°N, 98.571886°W), both at Wilson Lake, Russell County in north-central Kansas (Table 1). Pellets were individually wrapped and sent to Northern Oklahoma College for analysis. Two pellets from Dickinson County were combined since morphological features indicated they were separated either at time of collection, or upon transport, thus there measurements were combined. We followed the protocol of Woodman *et al.* (2005) and Subramaniam *et al.* (2011), weighing, measuring length and width, and dissecting each pellet for osteological pieces, skulls, and feathers. Taxa were identified to genus or species level when possible.

Additionally, we examined photographs, same used by Robbins and Otte (2013), of owls at each location to ascertain the sex, when possible, of individuals using the area. While no owls were observed regurgitating pellets, if the sex of a bird was determined for the specific location, we attempted to see if sex correlated with pellet size. We assume, since females are larger, pellets also would be larger. We also attempted to determine if differences in prey items correlated with sex based on the literature (Boxall and Lein 1982).

RESULTS

Twelve total pellets were analyzed from four localities (Table 1). Pellets were collected between 10 January and 5 March 2012. Pellets had an average mass of 11.58 g (range 3.64-20.57 g), average length of 81.35 mm (range 48.75-159.23 mm), and an average width of 35.26 mm (range 23.38-62.54 mm) (Table 1). The remains of 20 individual organisms representing nine different taxa were identified: 13 birds of five taxa; and seven mammals representing four taxa (Table 1). Red-winged Blackbird (*Agelaius phoeniceus*) was the most abundant taxa with seven individuals (35% of prey items); followed by prairie vole (*Microtus ochrogaster*) with three individuals (15%); hispid cotton rat (*Sigmodon*

hispidus) and American Coot (*Fulica americana*) each with two individuals (10% each), and two unidentified passerines (10%); a Pied-billed Grebe (*Podilymbus podiceps*) (5%); a Dark-eyed Junco (*Junco hyemalis*) (5%); a *Peromyscus* spp. (5%, skulls too fragmented to differentiate); and an eastern mole (*Scolopus aquaticus*) (5%) (Table 2). The largest pellets contained birds. The majority of small pellets contained mammals (Table 1).

Photographs analyzed indicated that both male and female owls were present at Cheyenne Bottoms (Figure 1 and 2), with up to a total of four individuals present during the irruption (Robbins and Otte 2013). Based upon size of the pellets at Cheyenne Bottoms, five of the seven appear to be from males, and two from females (largest two). Avian prey was most frequently found in pellets from Cheyenne Bottoms. The Dickinson County bird is a female (Figure 3). Pellet size reflects a female, and prey content was all mammalian. Images examined from the Lucas Swim Beach area and Minooka Park, appear to show the same young male (ex. Figure 4, other photographs available). However, pellet size is suggestive of both male and female owls present, with the female selecting avian prey and the male, mammalian. Thus, a minimum of up to six owls may have been present from all sites combined.

DISCUSSION

Pellet size was consistent with two pellets from Kansas (Subramaniam *et al.* 2011), six from Oklahoma (Morgan 1985), and 51 from Michigan (Chamberlin 1980). However, two pellets were longer (Cheyenne Bottoms, 159.23 mm; Wilson Lake, 121.49 mm) than any reported by Subramaniam *et al.* (2011) and Chamberlin (1980). Four of our pellets (Cheyenne Bottoms, 27.47 g, 20.57 g; Wilson Lake, 18.19 g, 17.26 g) were heavier than those reported by Morgan (1985) from Oklahoma. The Cheyenne Bottoms pellet (mass = 27.47 g, length = 159.23 mm) containing three Red-winged Blackbirds is the largest pellet recorded in Kansas or Oklahoma to date.

Prey items (birds and small mammals) were consistent with Snowy Owls wintering in the northern Great Plains (Boxall and Lein 1982, Parmelee 1992), a previous report in Kansas (Subramaniam *et al.* 2011), and of four pellets examined from Missouri during this irruption (Robbins and Otte 2013). At a wetland in Wisconsin during the winter irruption of 1960-1961 *Microtus* spp., muskrat (*Odonata zibethicus*), and waterfowl were the dominant prey (Keith 1963).



Figure 1. Female Snowy Owl (*Bubo scandiacus*) present at pool 2, Cheyenne Bottoms, Barton County, Kansas, 7 January 2012. Photograph by Rob Graham.



Figure 2. Male Snowy Owl present at pool 2, Cheyenne Bottoms, Barton County, Kansas, 19 February 2012. Photograph by Rob Graham.



Figure 3. Female Snowy Owl present at the intersection of Eden Rd and 1900 Ave, Dickinson County, Kansas, 30 December 2011. Photograph by Chad Volkman.



Figure 4. Male Snowy Owl present at Minooka Park, Wilson Lake, Russell County, Kansas, 17 February 2012. Photograph by Matt Beckman.

Table 1. Morphological data on Snowy Owl (*Bubo scandiacus*) pellets and prey remains during the 2011-2012 irruption in Kansas.

LOCATION	MASS (g)	LENGTH (mm)	WIDTH (mm)	CONTENT (n)	DATE
*CB Pool #2	20.57	106.41	40.69	Red-winged Blackbird (2)	19 February 2012
(38.461211°N, 98.68312°W)	10.23	63.17	33.02	Red-winged Blackbird	"
	3.64	54.08	23.38	Hispid Cotton Rat	"
	5.89	48.75	29.40	Red-winged Blackbird	"
	27.47	159.23	29.35	Red-winged Blackbird (3)	"
	7.62	54.72	25.92	Dark-eyed Junco	"
	7.83	52.64	28.28	Pied-Billed Grebe/ Unidentified Passerine (2)	"
Dickinson County	7.14	83.37	62.54	Hispid Cotton Rat/ Prairie Vole	10 January 2012
(38.871300°N, 97.279556°W)	8.62	88.37	48.45	Prairie Vole (2)/ <i>Peromyscus</i> spp.	"
Wilson Reservoir					
Lucas Swim Beach	4.54	57.16	38.73	Eastern Mole	6 February 2012
(38.948117°N, 98.548256°W)					
Minooka Park	18.19	121.49	30.77	American Coot	5 March 2012
(38.940869°N, 98.571886°W)	17.26	86.83	32.61	American Coot	5 March 2012
AVERAGE:	11.58	81.35	35.26	n = 20	

*CB = Cheyenne Bottoms

Based on prey items, Snowy Owls are opportunistic and will consume anything available. In this study, avian prey was the most frequent prey item in wetland habitats, while in grasslands and agriculture fields, small mammals were the dominant prey. This could be a reflection of habitat use and prey availability or the sex of the owl. Boxall and Lein (1982) indicated males fed primarily on mice, while females fed upon larger species and a greater diversity of prey. However, when small mammals are absent, or perhaps more difficult to capture (ex. snow cover), birds can make up the entire diet (Williams and Frank 1979). Unfortunately, none of the owls were observed regurgitating pellets. The differences in pellets from Cheyenne Bottoms would be consistent with differences in size based on gender (see Table 1). The size variation in pellets and prey selection from Wilson Lake suggest that there were additional Snowy Owls around, perhaps a female. The Dickinson County female selected small mammals, which is consistent with the male reported by Subramaniam *et al.* (2011) from Sumner County, Kansas, in similar habitat. It should be noted, however, the Subramaniam *et al.* (2011) owl, an immature male, produced a fairly large pellet, 107.22 mm x 35.36 mm.

Robbins and Otte (2013) indicated 87.5% of specimens salvaged (n = 24) during this irruption were emaciated and starving, supporting the hypothesis that most owls die during irruptive events. This stands in contrast to the condition of birds within the core of their main wintering range, southern Alberta, Canada, where birds are routinely heavier, and in overall good condition (Kerlinger and Lein 1988). Of the pellets we examined, five (41.7%) contained enough food to provide the minimal 236-400 g/day for wintering owls (Gessaman 1972, Boxall and Lein 1989, Parmelee 1992). Our sample size is small and only reflects diet of up to six individuals, and assumes one pellet regurgitated per day. However, for Kansas a more likely requirement based on Boxall and Lein (1989) assessment of wintering owls, near Calgary, would be 236-309g/day. Considering Red-winged Blackbirds were a favorite prey at Cheyenne Bottoms, based on their average mass (see Table 2) about 2-5/day would be required to sustain them. For prairie conditions where the prairie vole was the most common prey, 3.3-6/day would be required (Table 2).

Table 2. Prey composition and abundance from pellets of Snowy Owls (*Bubo scandiacus*) collected during the 2011-2012 irruption in Kansas.

PREY SPECIES	# INDIVIDUALS n = 20 (%)	# OF PELLETS (n = 12) PREY FOUND IN (%)	LIVE* MASS (g)	TOTAL MASS (g)
Avian				
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	1 (0.05)	1 (0.08)	253-568	253-568
American Coot (<i>Fulica americana</i>)	2 (0.10)	2 (0.17)	600-700	1200-1400
Dark-eyed Junco (<i>Junco hyemalis</i>)	1 (0.05)	1 (0.08)	18-30	18-30
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	7 (0.35)	4 (0.33)	32-77	224-539
Unidentified passerine	2 (0.10)	1 (0.08)	--	--
Mammalian				
Eastern Mole (<i>Scolopus aquaticus</i>)	1 (0.05)	1 (0.08)	54-99	54-99
Hispid Cotton Rat (<i>Sigmodon hispidus</i>)	2 (0.10)	2 (0.17)	50-250	100-500
<i>Peromyscus</i> spp.	1 (0.05)	1 (0.08)	19-36**	19-36
Prairie Vole (<i>Microtus ochrogaster</i>)	3 (0.15)	2 (0.17)	49-71	147-213

*Mass and taxonomy for mammals based on Timm *et al.* Mammals of Kansas web page, bird mass is based on Cornell University (2011), and avian taxonomy is based on AOU (1998) through the 54th supplement (Chesser *et al.* 2013).

**Mass range based on *P. leucopus* and *P. maniculatus*.

It is likely, during irruptive years, many of the owls, which are hatching-year individuals (Robbins and Otte 2013), probably die and never return to the breeding grounds. Habitat could play a role, since those favoring wetland habitats with large concentrations of blackbirds and waterbirds might provide adequate sustenance. Prairie habitats and agricultural fields may not provide enough prey, especially if more than one owl is present, or in fields with heavy snow cover. The occasional winter visitant might be able to find enough food to survive, and the probable reason they are often observed in an area for extended periods of time (Shackford 1975, Subramaniam *et al.* 2011).

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