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NOTES

EXAMINATION OF OWL PELLETS FOR NORTHERN POCKET GOPHERS AT CRESCENT LAKE NATIONAL WILDLIFE REFUGE, NEBRASKA—Analysis of regurgitated pellets from owls is a well-known and nondestructive method that provides useful information regarding diet (Errington 1930). This technique also is used to examine composition of small mammal communities and distribution of prey species (e.g. Kamler et al. 2003, Torre et al. 2004, Poole and Matlack 2007). In western Nebraska, two species of owls that regularly breed in the region are the common barn owl (*Tyto alba*) and great horned owl (*Bubo virginianus*). In the early 1970s, Rickart (1972) studied the diet of both species at Crescent Lake National Wildlife Refuge (CLNWR), Garden County, Nebraska. Rickart (1972) recovered 447 prey items representing 14 taxa of small mammals from regurgitated pellets, including remains of 3 northern pocket gophers (*Thomomys talpoides*) from pellets of great horned owls. Those findings extended the range of *T. talpoides* about 60 km northeast from Cheyenne County into the Sandhill Region of Nebraska, a region and soil type where *T. talpoides* previously has not been documented in the state (Jones 1964). Prior to our study, we attempted to locate voucher material of mammals from Rickart (1972) without success (E. Rickart, Utah Museum of Natural History and R. Timm, University of Kansas, Natural History Museum; pers. comm.). Thus, we initiated our study to determine whether tangible evidence (e.g., a voucher specimen) could be obtained for the presence of *T. talpoides* at the refuge, which may represent an isolated population in need of conservation. We also compared the diet of owls from the refuge in the early 1970s (Rickart 1972) to diets based on recent collections of owl pellets (this study).

In August and October 2008, we collected owl pellets and pellet debris (e.g., bones from crumbling older pellets) at CLNWR. Pellets and pellet debris were collected at the refuge headquarters (41°45.644'N, 102°26.398'W; NAD 83) from underneath several large trees (eastern redcedar, *Juniperus virginiana* and cottonwood, *Populus deltoides*) used by both species, below and inside 3 nest boxes attached to windmills used by barn owls (41°44.046'N, 102°25.022'W; 41°44.524'N, 102°25.577'W; and 41°44.699'N, 102°24.357'W; NAD 83), and from the base of a tree under a nest of a great horned owl (41°44.780'N, 102°23.046'W; NAD 83). In addition to pellets collected in 2008, we also obtained pellets and pellet debris collected from 6 localities throughout the refuge by a previous researcher in 2002 (J. A. White, University of Nebraska at Omaha; 1) tree northeast of Boyd Pond, great horned owl; 2) cottonwoods in wilderness area, 41°41.057'N, 102°13.690'W, unknown species of owl included in “both species” in Table 1; 3) trees at headquarters as described above used by both species; 4) trees southwest of Harrison

Lake, 41°45.040'N, 102°30.883'W, great horned owl; 5) north of Island Lake, 41°45.123'N, 102°23.583'W, barn owl; 6) just off refuge in abandoned house and under eastern redcedars, 41°44.410'N, 102°27.870'W; great horned owl observed but placed in “both species” in Table 1 due to likelihood of barn owls also using site).

To extract identifiable material from pellets, we immersed each pellet in water and allowed it to soak for 1–3 minutes. Pellets were gently pulled apart using forceps, and hair was separated from bones. We kept only cranial and dentary bones of vertebrates, which were dried and originally stored in individually labeled plastic bags for each pellet. To identify prey items to the lowest taxonomic level, we used various taxonomic keys (e.g., Carraway 1995) and comparative voucher material housed at the University of Nebraska at Kearney and University of Nebraska State Museum, Lincoln. Only craniums were tabulated to determine frequency of prey, but some dentary bones were used to positively identify cranial material, such as between *Peromyscus* and *Onychomys*. For 6 species of mammals infrequently documented in diets ($n \leq 6$), we included in tabulations the occurrence of mandibular material that lacked a corresponding cranium. We deposited ≤ 6 cranial and dentary materials of each species in the natural history collections, Division of Zoology, University of Nebraska State Museum, Lincoln, Nebraska, USA.

We identified 1098 vertebrates including 15 taxa of mammals and 5 unidentified craniums of birds in diets of barn and great horned owls at CLNWR (Table 1). The most prevalent prey item recovered in all of the owl pellets was the meadow vole (*Microtus pennsylvanicus*), whereas the second most common prey item recovered was Ord's kangaroo rat (*Dipodomys ordii*; Table 1). Both species of owls consumed small mammals associated with upland (e.g., *D. ordii* and *Microtus ochrogaster*) and lowland habitats (e.g., *M. pennsylvanicus* and *Ondatra zibethicus*) at CLNWR. Prevalence of *Microtus* in pellets of both owls is consistent with previous studies across Nebraska (Jones 1949, 1952, Rickart 1972, Epperson 1976, Gubanyi et al. 1992, Huebschman et al. 2000). The relative frequency of *D. ordii* in the diet of both owls also is consistent with other studies from western Nebraska (Rickart 1972, Huebschman et al. 2000), where kangaroo rats are abundant in sandy habitats (Jones 1964).

We observed a tendency for larger prey to be captured by great horned owls and smaller prey to be captured by barn owls (Table 1). Great horned owls diets were composed of 28.6% large prey items and barn owls had 3.8% large prey items in their diets (Table 1). Large prey items included plains pocket gophers, cottontails (*Sylvilagus* spp.), common muskrats, long-tailed weasels (*Mustela frenata*), and jackrabbits (*Lepus* spp.); whereas all other species were considered small prey items. Huebschman et al. (2000) also

reported great horned owls feeding on large prey in Nebraska, including plains pocket gophers, cottontails, and jackrabbits (*Lepus* spp.). Prey items of barn owls were generally small (<300 g), with the plains pocket gopher (*Geomys bursarius*) being the largest species frequently eaten. One exception was a mandible of a common muskrat

(*Ondatra zibethicus*) discovered in a pellet of a barn owl, but further examination revealed it was a juvenile based on jaw size and cusp wear. Others also have noted that barn owls generally consume smaller-sized prey than the larger great horned owl (e.g., Marti 1974).

Table 1. Total number (*n*) and percentage frequency (%) of individual prey items identified from regurgitated pellets of barn owls (*Tyto alba*) and great horned owls (*Bubo virginianus*) at Crescent Lake National Wildlife Refuge, Garden County, Nebraska in 2002 and 2008.

Species	<i>Tyto alba</i>		<i>Bubo virginianus</i>		Both species ^a		Totals
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
<i>Microtus pennsylvanicus</i>	135	36.8	12	16.4	249	37.8	396
<i>Dipodomys ordii</i>	85	23.2	26	35.6	148	22.5	259
<i>Microtus ochrogaster</i>	61	16.6	10	13.7	89	13.5	160
<i>Geomys bursarius</i>	13	3.5	15	20.5	80	12.2	108
<i>Reithrodontomys</i> spp.	36	9.8	2	2.7	40	6.1	78
<i>Microtus</i> spp.	9	2.5	1	1.4	18	2.7	28
<i>Perognathus</i> spp.	13	3.5			11	1.7	24
<i>Peromyscus maniculatus</i>	5	1.4			9	1.4	14
<i>Sorex cinereus</i>	1	0.3			5	0.8	6
<i>Cryptotis parva</i>	3	0.8			2	0.3	5
Bird spp.	2	0.5	1	1.4	2	0.3	5
<i>Ondatra zibethicus</i>	1	0.3	2	2.7	1	0.2	4
<i>Sylvilagus</i> spp.			2	2.7	1	0.2	3
<i>Onychomys leucogaster</i>	2	0.5			1	0.2	3
<i>Mustela frenata</i>			2	2.7			2
<i>Scalopus aquaticus</i>	1	0.3			1	0.2	2
<i>Lepus</i> spp.					1	0.2	1
TOTALS	367		73		658		1098

^a Pellets and pellet debris of barn owls and great horned owls mixed under trees at headquarters and other sites at the refuge (see text). Other species of owls might occasionally use such sites, but no other species was observed when collecting pellets. In the headquarters area, refuge personnel occasionally observe eastern screech owls (*Otus asio*) nesting in nest boxes. Long-eared owls (*Asio otus*) and short-eared owls (*A. flammeus*) also are reported a few times during a season annually at the refuge whereas other species are seen even less frequently.

We identified 15 mammalian taxa at the refuge. Rickart (1972) reported 2 species that we did not observe—the hispid pocket mouse (*Chaetodipus hispidus*) and northern pocket gopher. Additionally, we identified 3 species that Rickart (1972) did not report—the least shrew (*Cryptotis parva*), common muskrat, and eastern mole (*Scalopus aquaticus*). Rickart (1972) reported *Reithrodontomys* spp. and *Microtus* spp. as the 2 predominant prey items, whereas we observed *Microtus pennsylvanicus* and *Dipodomys ordii* as the 2 most prevalent (Table 1). During the past 35 years, such differences in prey consumed by owls might reflect changes in habitat and concomitant changes in abundance and distribution of mammals. Differences also might reflect locations of owl roosting sites, composition and abundance of prey items in surrounding habitats, foraging tactics of owls, and timing of our sampling. For the 2 species of prey detected by Rickart (1972) that we did not observe in pellets, a recent survey of mammals at CLNWR reported only the occurrence of the *C. hispidus* but not *T. talpoides* (Bogan et al. 2004). In that survey, pocket gophers were trapped at various locations at the refuge (Bogan et al. 2004, K. Geluso, unpublished data).

We did not document a single *T. talpoides* in the diet of owls at CLNWR but observed 108 *G. bursarius* (Table 1). Imler (1945) first reported the presence of a *T. talpoides* captured in a snake trap at CLNWR, but Jones (1964) discounted the record because of the absence of voucher specimens or other conclusive evidence. Subsequently, Rickart (1972) reported the presence of 3 *T. talpoides* in pellet debris of owls at the refuge. We attempted to repeat Rickart's methods to detect *T. talpoides* at CLNWR but were unsuccessful (Table 1). Thus, our research does not support Rickart's (1972) findings. Lack of voucher materials by both Imler (1945) and Rickart (1972) likely will prevent us from determining whether *T. talpoides* has occurred at CLNWR in the past, especially if the species is now extirpated from the region or currently occurs at the refuge in low abundances or in isolated areas. Such examples stress the need for continued support of natural history collections to house voucher specimens.

Mammalian surveys at CLNWR have not reported the least shrew (*Cryptotis parva*) at the refuge in the past (Gunderson 1973, Bogan et al. 2004). Owl pellets collected at CLNWR in 2002 only contained the masked shrew (*Sorex cinereus*, $n = 5$), but pellets collected in 2008 primarily consisted of *C. parva* ($n = 5$ for *C. parva* and $n = 1$ for *S. cinereus*, this study). In recent decades, least shrews apparently have moved westward across western parts of Nebraska (Geluso et al. 2004), as well as in other regions of the Great Plains (Choate and Reed 1988, Backlund 2002, Marquardt et al. 2006). Least shrews are suspected to have moved westward along riverine corridors in the Great Plains (e.g., Geluso et al. 2004). Our current study documents the occurrence of *C. parva* in Garden County, which indicates an additional range expansion for this species away from the North Platte River. We suspect that if *C. parva* has

followed riverine or stream corridors to CLNWR, individuals advanced via Blue Creek, a tributary of the North Platte River.

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