Diets of Nesting Boreal Owls, *Aegolius funereus*, in Western Interior Alaska

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Boreal Owls, *Aegolius funereus*, a circumboreal species, are relatively common throughout interior Alaska where suitable habitat exists. Although research has been conducted on the conspecific Tengmalm's Owl in Eurasia, little is known concerning their requirements in North America, especially in Alaska. Along with other aspects of Boreal Owl ecology, I investigated prey selection and predation rates using nest boxes in western interior Alaska during springs of 1995–1997 based on a total of 778 prey items found in nest boxes. As with studies elsewhere, microtines were the most important dietary component. I hypothesize that plant phenology would influence prey selection during the nesting season because of variations noted in proportions of Northern Red-backed Voles, *Clethrionomys rutilus,* a forest-dwelling species, and Meadow Voles, *Microtus pennsylvanicus,* generally preferring more open areas. From the differences noted in proportions of these two species in the diet, I suspect that Meadow Voles are selected for when grasses and sedges are short. When vegetation growth obscures this prey item, Boreal Owls apparently switch to a higher proportion of Northern Red-backed Voles.

Key Words: *Aegolius funereus*, Alaska, Boreal Owl, *Clethrionomys*, diet, *Microtus*, nest boxes, polygyny.

Boreal Owls (*Aegolius funereus* L.) are listed as common throughout interior Alaska (Armstrong 1980). Few natural nest sites have been documented, although Boreal Owls and the Eurasian conspecific, Tengmalm's Owl, readily use artificial nesting structures (Franz et al. 1984; Sonerud 1989; Korpimaki 1992). Because of their status as predators at or near the top of the food chain, owls are often viewed as bio-indicators of the health of an ecosystem. In part because the U.S. Forest Service has designated the Boreal Owl as a "sensitive species" requiring special management, basic ecological data are important to collect, analyze, and understand, especially in ecosystems that have not been subjected to man's various modifications. These baseline data are useful for measuring and understanding changes due to habitat alteration or modification.

As part of a larger investigation of Boreal Owl ecology in the Upper Kuskokwim River Basin, Alaska, direct observations of prey items in nest boxes during incubation and brood-rearing periods were used to quantify changes in the nesting-season diet. Other aspects of this investigation will be presented elsewhere (Whitman, in preparation).

Study Area

This study was conducted in western interior Alaska near the village of McGrath (62°55′N, 155°30′W). Elevations ranged from 90 m to 150 m above MSL. Bottomlands associated with the Kuskokwim River floodplain were dominated by White Spruce (*Picea glauca*), Balsam Poplar (*Populus balsamifera*), or Paper Birch (*Betula papyrifera*), with understories consisting largely of woody shrubs (*Salix alaxensis*, *Vaccinium* spp. and *Alnus crispa*). Poorly drained sites were often dominated by Eastern Larch (*Larix laricina*). Upland sites away from the river were generally Black Spruce (*P. mariana*) with small copses of Quaking Aspen (*Populus tremuloides*) and Paper Birch. Generally, understory vegetation in the upland sites was mat and cushion lichens (largely *Cladina* spp.) and Red Cranberry (*Vaccinium vitis-idaea*).

Climate in the area was largely continental, with cold winters (mean January temperature –23°C, extremes to –60°C) and moderate summers (mean July temperature +15°C, extremes of +30°C). Mean annual precipitation was 41 cm, most falling as snow. Snow cover at McGrath generally lasts from early October through April, and sometimes accumulates to depths over 125 cm.

Human influence in the area has been light. There were less than 500 residents of McGrath, and no roads access the village. Travel was usually facilitated by small boats or aircraft in the summer. In winter, snowmachines were the primary mode of transportation. Only very light logging has occurred, with most products being firewood and saw lumber for local use.

Methods

In the study area segment where Boreal Owl diets were investigated, 36 artificial nesting boxes, constructed of rough-cut 2.5 cm spruce lumber, were placed in suitable trees near access corridors (along navigable rivers or roadways). In 1995, only one

active site was used for the diet investigation. During both 1996 and 1997, all boxes were visited two or three times early in the incubation period to determine use. In 1996, 14 active nest sites were visited an average of 8.6 times during incubation and brood-rearing periods, for a mean of 3.9 days between visits. In 1997, 14 active nest boxes were visited at a mean rate of 8.2 days between examinations. Access to the boxes was aided by use of an aluminum extension ladder and cordless electric screw-gun for removing and replacing the tops of boxes. Following the nesting season, boxes were cleaned and repaired, and a 5–7 cm layer of clean wood chips was placed in each box for nesting duff.

All prey items were examined to determine species, and feet of rodents and birds were removed with fingernail clippers and discarded to assure against future duplication. Mammal identifications were usually based on gross characteristics, although dental examinations were required on four young specimens. Birds were identified based on feather characters. With the exception of bird and mammal feet, no prey items were removed from the nest boxes. Due to time constraints, no attempt was made to examine prey remains based on analyses of the detritus "brick" in the floor of nest boxes following fledging.

Changes in proportions of prey items in Boreal Owl diets during the nesting season were based on frequency of occurrence, and were analyzed and presented in 5-day increments. Samples were collected between 11 May–15 June in 1995, and 20 April–5 June during 1996. In 1997, diets were examined only during 20–24 April and 16 May–5 June.

Results

Due to differences in number of active boxes as well as number of nest site visits, we documented 37 individual prey items during 1995, 530 items during 1996, and 201 during 1997. Most prey found in nest boxes was mammalian, comprising 95%, 98% and 96% of the identified prey in 1995, 1996, and 1997, respectively (Table 1). In his summary of Boreal Owl diets, Hayward (1994) indicated a heavy dependence on microtines throughout their North American range where studies have been undertaken. Insects, amphibians, and reptiles were non-existent in the Alaska prey remains, and birds were represented only rarely.

During 1995, the nesting season diet depicted in

TABLE 1. Diet of nesting Boreal Owls (*Aegolius funereus*) in western Interior Alaska during 1995–1997 based on prey items recorded from nest boxes.

			1995		1996		1997	
			no.	%	no.	%	no.	%
MAMMALIA								
	Microtidae							
		Clethrionomys rutilus	4	10.8	271	50.2	101	50.2
		Microtus pennsylvanicus	30	81.1	221	40.9	72	35.8
		Microtus xanthognathus			10	1.9	17	8.5
		Lemmus sibiricus			7	1.3		
		Subtotal	**34**	**91.9**	**509**	**94.3**	**190**	**95.5**
	Zapodidae							
		Zapus hudsonius	1	1.7	2	0.4		
		Subtotal	**1**	**1.7**	**2**	**0.4**		
	Soricidae							
		Sorex spp.			19	3.5	2	1.0
		Subtotal			**19**	**3.5**	**2**	**1.0**
	Leporidae							
		Lepus americanus					1	0.5
		Subtotal					**1**	**0.5**
		TOTAL MAMMALIA	**35**	**94.6**	**530**	**98.1**	**193**	**96.0**
AVES								
	Spruce Grouse	*Falcipennis canadensis*			1	0.2		
	Gray Jay	*Perisoreus canadensis*			1	0.2	1	0.5
	Boreal Chickadee	*Poecile hudsonica*			1	0.2	1	0.5
	Swainson's Thrush	*Catharus ustulatus*			1	0.2		
	Varied Thrush	*Ixoreus naevius*			1	0.2		
	American Robin	*Turdus migratorius*			1	0.2		
	Yellow-rumped Warbler	*Dendroica coronata*	1	2.7	1	0.2		
	White-crowned Warbler	*Zonotrichia leucophrys*			1	0.2		
	Common Redpoll	*Carduelis flammea*	1	2.7			6	3.0
	unknown passerine	not identified			2	0.4		
		TOTAL AVES	**2**	**5.4**	**10**	**1.9**	**8**	**4.0**
		GRAND TOTAL	**37**	**100.0**	**540**	**100.0**	**201**	**100.0**

Table 1 was from a single nest box. This box was visited daily from hatching of the first owlet on 11 May until fledging on 15 June. No fresh prey items were found in this box after 28 May, although obviously, the attendant male continued to deliver food to the box. As the dietary needs of the brooding female and her five young were high, prey items were probably consumed soon after the prey was delivered by the male. Although the primary reason for daily nest visits was to gather growth data on the hatchlings (Whitman, in preparation), prey occurrence was recorded. During both 1996 and 1997, diet data were collected from 14 active nest boxes. As with 1995, fresh prey found in boxes during 1996 and 1997 declined during later brooding periods.

When frequency of occurrence of prey items was analyzed by 5-day periods during 1996, incidence of Northern Red-backed Voles (*Clethrionomys rutilus*) was relatively high during early incubation (late April), then declined. During the last half of May and early June, however, their incidence was again quite high (Figure 1). During the late-April through mid-May period when incidence of Northern Red-backed Voles in the diet declined, their occurrence was replaced by a higher incidence of Meadow Voles (*Microtus pennsylvanicus*). Other prey items made up a relatively small proportion of the diet throughout the nesting period.

Discussion

In North America, data from three investigations indicates that Boreal Owls rely heavily on microtines. In Canada, Bondrup-Nielsen (1978) found 76% of prey items were *Clethrionomys* or *Microtus*. In Colorado, these two genera made up 79% of the diet (Palmer 1986), and in Idaho, Hayward et al. (1993) indicated microtines made up 55% of the prey. Not unlike our observations, birds made up less than 10% of the diet in all previous North American studies.

In western Finland, Korpimaki (1986, 1988) and Korpimaki and Norrdahl (1989) found that *Microtus* and *Clethrionomys* collectively made up 77% of the diet of Tengmalm's Owls. It appears, however, in both North America and Europe, diets become more varied as latitude decreases, probably simply reflecting a greater diversity of available prey (Kloubec and Vacik 1990). Seasonal and annual variations occur as well in Boreal Owl diets (Hayward 1994).

I suspect that Boreal Owls prefer to hunt in small openings in the forest (either natural or man-made) where grasses and sedges are prevalent. In years of late snow cover, April and early May hunting is probably restricted to sloughed river banks, roadways, and

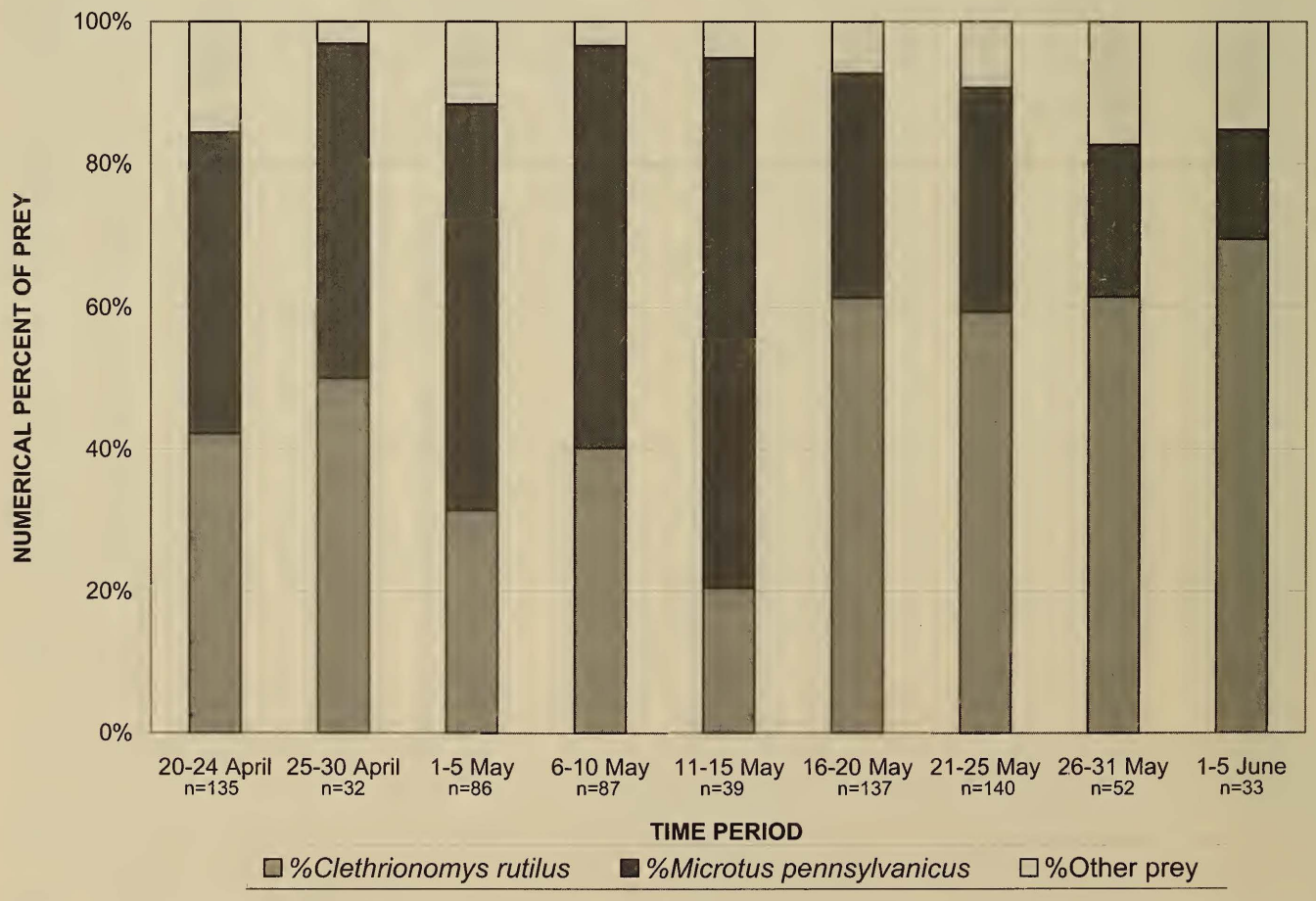

FIGURE 1. Percent frequency of occurrence of major prey items in the diet of nesting Boreal Owls (*Aegolius funereus*) during 5-day intervals during 1995–1997 from western interior Alaska.

small bare patches around the bases of spruce trees. In these situations, Red-backed Voles are probably the predominant prey available. As open meadows become snow-free, these areas appear to be hunted more intensively, as evidenced by the increasing incidence of Meadow Voles as prey items. Then, in late May, as forest environs become devoid of snow (and visibility of Meadow Voles declines) hunting efforts shift back to more heavily forested habitats where understory vegetation is sparse, and Red-backed Voles become the primary target. Amount of snow and plant phenology certainly influences hearing and visibility and thus, hunting success.

Most owl diets are determined from analysis of nesting cavity "bricks" (Ted Swem, personal communication), from observations of foraging owls, or from regurgitated pellets. From these analyses, investigators are able to document a wider variety of prey over a longer period of the year, but it is difficult to document seasonal shifts in prey selection. Therefore, the data herein are helpful in understanding the seasonal importance of micro-habitats for foraging. Small clearings in otherwise monoculture forests (resulting from small-scale clear-cut logging, remote homestead clearing, small wildfires, and rights-of-way, among other things) may be beneficial to Boreal Owls if they result in habitats that become snow-free earlier in the year.

On one occasion during 1997, the rear half of a juvenile Snowshoe Hare (*Lepus americanus*) was found in a nestbox. Another active nest site, about 400 m from the first, held the front half of a hare. Comparison of the halves and the rareness of hares in the diet confirmed it was but one animal. I suspect one male was responsible for maintaining two females with broods at these particular sites, strongly suggesting polygyny. Although most brooding females were captured at the nest boxes and banded, no attempts were made to mark adult males, so confirmation was not possible. In Europe, polygyny has been documented in Tengmalm's Owl (Solheim 1983; Korpimaki 1991), especially during years of high food abundance.

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Literature Cited

Armstrong, R. H. 1980. Guide to the birds of Alaska. Alaska Northwest Publishing Company, Edmonds, Washington, USA.

Bondrup-Nielsen, S. 1978. Vocalizations, nesting, and habitat preferences of the boreal owl (*Aegolius funereus*) in North America. M.S. thesis, University of Toronto, Ontario. 151 pages.

Bondrup-Nielsen, S. 1984. Vocalizations of the Boreal Owl, *Aegolius funereus richardsoni*, in North America. Canadian Field-Naturalist 98: 191–197.

Franz, A., T. Mebs, and **E. Seibt.** 1984. Several aspects of the population biology of Tengmalm's Owl (*Aegolius funereus*) in southern Westphalia and adjacent areas on the basis of ringing results. Die Vogelwarte 32: 260–269.

Hayward, G. D., P. H. Hayward, and **E. O. Garton.** 1993. Ecology of Boreal Owls in the Northern Rocky Mountains, USA. Wildlife Monographs 124: 1–59.

Hayward, G. D. 1994. Review of technical knowledge: boreal owls. Pages 92–127 *in* Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment. *Edited by* G. D. Hayward and J. Verner. General Technical Report RM-253. Fort Collins, Colorado. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 214 pages 3 maps.

Kloubec, B., and **R. Vacik.** 1990. Outline of food ecology of Tengmalm's owl (*Aegolius funereus* L.) in Czechoslovakia. Tichodroma 3: 103–125.

Korpimaki, E. 1986. Seasonal changes in the food of the Tengmalm's Owl *Aegolius funereus* in western Finland. Annales Zoologici Fennici 23: 339–344.

Korpimaki, E. 1988. Diet of breeding Tengmalm's Owls *Aegolius funereus*: long-term changes and year-to-year variation under cyclic conditions. Ornis Fennica 65: 21–30.

Korpimaki, E., 1991. Poor reproductive success of polygynously mated female Tengmalm's Owls: are better options available? Animal Behaviour 41: 37–47.

Korpimaki, E. 1992. Fluctuating food abundance determines the lifetime reproductive success of male Tengmalm's Owls. Journal of Animal Ecology 61: 103–111.

Korpimaki, E. and **K. Norrdahl.** 1989. Predation of Tengmalm's Owls: numerical responses, functional responses and dampening impact on population fluctuations of microtines. Oikos 54: 154–164.

Palmer, D. A. 1986. Habitat selection, movements and activity of Boreal and Saw-whet Owls. M.S. thesis. Colorado State University, Fort Collins, Colorado, USA.

Solheim, R. 1983. Bygyny and biandry in the Tengmalm's Owl. Ornis Scandinavica 14:51–57.

Sonerud, G. A. 1989. Reduced predation by pine martens on nests of Tengmalm's Owl in relocated boxes. Animal Behaviour 37: 332–333.

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