Comparative Food Niche Analysis of Strix Owls in Belarus

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Abstract.—Three Strix species breed sympatrically in Belarus. The Tawny Owl (Strix aluco) is one of two commonest owl species in the country, and is distributed throughout the whole territory. Its' range overlaps widely with two other species, the Ural Owl (S. uralensis) which is common in the forests of the northern part and the Great Gray Owl (S. nebulosa) which occurs in a rather limited area in the southern region. The diet of all three species was studied from 1986-1996 by the analysis of pellets collected mainly near nests. All owls preyed mainly on voles and shrews, but niche differences between them are apparent. The Great Gray Owl appeared to be a vole specialist, while the Tawny Owl had the most diverse diet, often feeding on mice, anurans, insects, and birds. The food niche of the Ural Owl was between these extremes.

During the last 2 decades, studies on the trophic structure of raptor communities have attracted special attention (Herrera and Hiraldo 1976, Jaksic 1988, Jaksic and Delibes 1987, Jerdzejewski et al. 1989). Marti et al. (1993) summarized the main results and set research priorities in this area. One of their observations was that a shortage of good quality data on raptor diets limited wide geographic analyses. Hence, I prepared this summary on the diets of these three Strix species, Tawny (S. aluco L.), Great Gray (S. nebulosa Forster), and Ural (S. uralensis Pall.) Owls breeding in Belarus. The distribution of these species in Belarus are quite different. The Tawny Owl is widespread, being the second most common owl species in the country (Fedyushin and Dolbik 1967), and widely sympatric, with the other two species inhabiting mainly northern (Ural Owl) and southwestern regions of the country (Great Gray Owl) (Fedyushin and Dolbik 1967, Mikkola 1983). The ranges of the Great Gray and Ural Owls overlap slightly; only few widely dispersed Great Gray Owl pairs are known to breed within the range of the Ural Owl. All three species are small rodent specialists and competitive interactions between them have been reported (Lundberg 1980, Mikkola 1983). My aim was to report on the diet and to provide food niche statistics for all three of these species in Belarus.

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MATERIALS AND METHODS

Dietary sampling data were collected in different Districts of Belarus from 1986-1996 (fig. 1). Pellets collected near nests, and to a lesser extent at roosting sites, represent the bulk of the sample. Some additional data were obtained by the extraction of bones from nests after fledging and by stomach analysis (six Tawny Owls and one Ural Owl).

Pellets were carefully dissected with all bone and chitin remnants extracted. Identification and counts of prey species were carried out using the skull and lower jaws for mammals, all bones for birds, pelvic bones for amphibians, and head capsules and elytra for insects. Reference collections and publications (Görner and Hackethal 1988, Puzek 1981) were used to identify prey. Analytical techniques described by Marti et al. (1993) were used. Prey weight data were obtained from files of the Belarusian Ornithological Society, unpublished materials of M. Pikulik and V. Sidorovich (Institute of Zoology, Minsk), and my own material. Predator weights were taken from Marti et al. (1993).

RESULTS

Data on the prey species studied are given in table 1 and table 2. Shrews and voles appeared to be the most important prey categories for all Strix species in Belarus. The Great Gray Owl is a small mammal specialist prefering Microtus voles, the other two owl

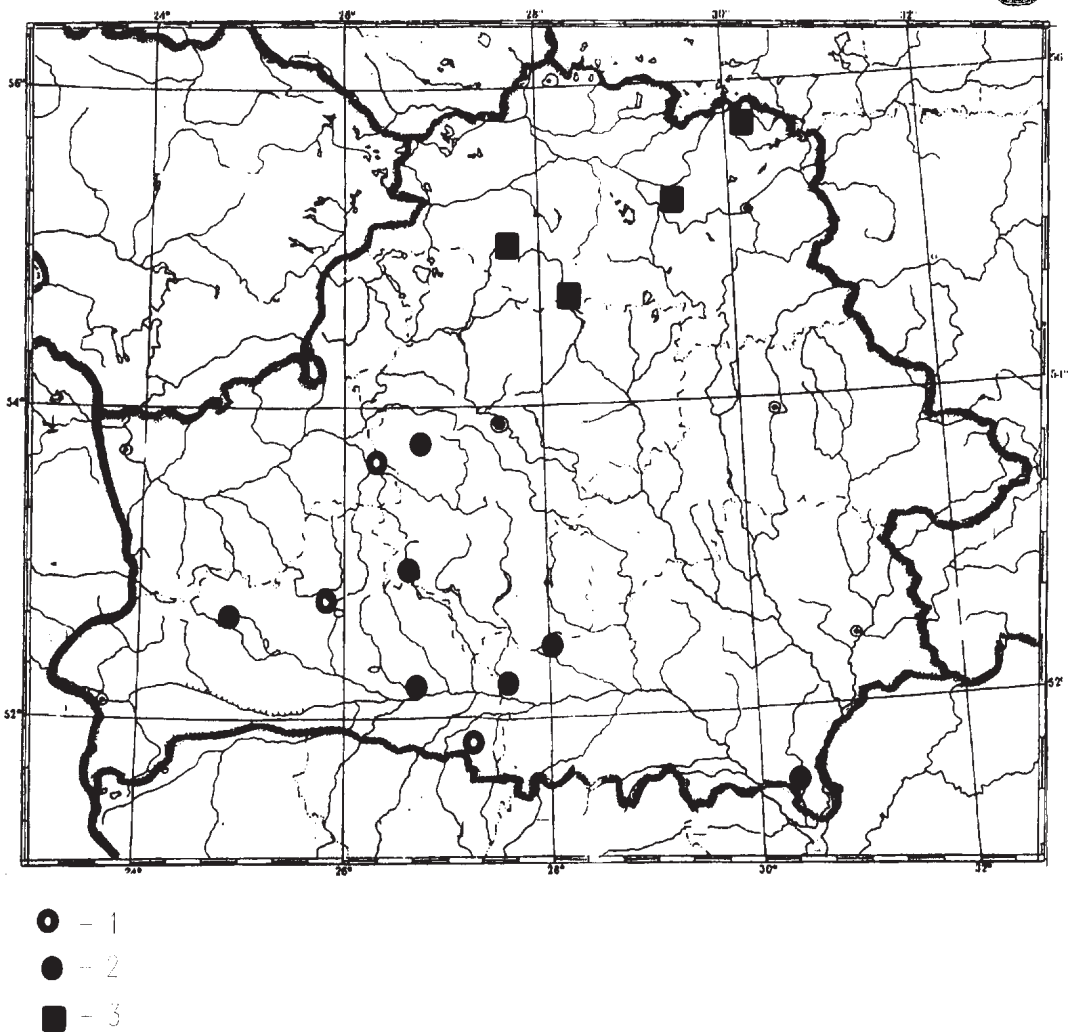

Figure 1. — Main sampling sites in dietary studies of Strix owls in Belarus, samples of no less than 75 prey items were collected in every site. 1 — Great Gray Owl (Strix nebulosa). 2 — Tawny Owl (S. aluco). 3 — Ural Owl (S. uralensis).

Table 1.—Diet of Strix owls in Belarus.

Prey category	Percent of number of prey items		
	S. uralensis	*S. aluco*	*S. nebulosa*
Sorex spp.	17.0	17.1	24.9
Other *Insectivora*	6.2	1.9	2.4
Mustelidae	0.2	0.2	0.2
Gliridae	0.2	2.1	-
Muridae	0.8	12.1	0.9
Microtus spp.	37.8	20.8	61.0
Clethrionomys glareolus	24.3	20.2	6.4
Arvicola terrestris	3.6	1.2	4.0
Other *Rodentia*	0.9	0.7	0.2
Birds	3.5	5.2	-
Anurans	3.5	9.3	-
Beetles	2.0	8.3	-
Total number of prey	613	1,517	454

Table 2.—Complete list of prey species and their occurrence in the diets of Strix owls in Belarus.

Prey Species/type	Percent of number of prey items		
	S. uralensis	***S. aluco***	***S. nebulosa***
Neomys fodiens	4.6	0.9	2.0
Sorex araneus	7.6	5.3	15.7
S. minutus	2.8	3.3	6.6
S. caecutiens	0.3	0.2	-
Sorex spp. *(Araneus + caecutiens)*	6.3	8.3	2.6
Crocidura spp.	-	0.1	-
Talpa europaea	1.6	0.9	0.4
Mustela erminea	0.2	0.1	0.2
M. nivalis	-	0.1	-
Sciurus vulgaris	0.3	-	-
Sicista betulina	0.6	0.7	0.2
Glis glis	-	0.7	-
Dryomys nitedula	-	0.4	-
Muscardinus avellanarius	0.2	1.0	-
Apodemus spp.	0.8	9.7	0.2
Mus musculus	-	0.1	-
Micromys minutus	-	2.0	0.7
Rattus spp.	-	0.3	-
Microtus arvalis/epiroticus	2.9	10.6	0.4
M. agrestis	32.6	4.5	28.7
M. oeconomus	2.3	6.7	31.9
Clethrionomys glareolus	24.3	20.2	6.4
Arvicola terrestris	3.6	1.2	4.0
Bonasa bonasia	0.7	0.1	-
Crex crex	-	0.1	-
Sterna hirundo	-	0.1	-
Columba palumbus	0.3	-	-
Dendrocopus major	-	0.1	-
Riparia riparia	-	0.1	-
Phylloscopus spp.	0.2	0.2	-
Turdus merula	0.2	0.3	-
T. iliacus	0.2	0.1	-
Turdus spp.	0.7	0.5	-
Ficedula hypoleuca	-	0.3	-
Sturnus vulgaris	0.2	0.3	-
Garrulus glandarius	0.2	0.2	-
Certhia familiaris	-	0.2	-
Parus major	-	0.7	-
Parus spp.	0.3	0.9	-
Carduelis flammea	0.2	-	-
C. spinus	-	0.1	-
Carduelis spp.	0.3	0.9	-
Bufo bufo	-	0.1	-
Pelobates fuscus	-	3.0	-
Rana arvalis	-	1.4	-
Rana temporaria	0.8	1.0	-
Brown frog spp.	2.7	2.2	-
Green frog spp.	-	1.6	-
Dytiscus spp.	2.0	1.2	-
Nicrophorus humator	-	0.1	-
Silpha spp.	-	0.1	-
Geotrupes spp.	-	1.8	-
Melolontha spp.	-	3.8	-
Polyphila fullo	-	0.7	-
Prionis coriarius	-	0.5	-
Saperda carcharias	-	0.1	-
	N = 613	N = 1517	N = 454

species prey upon a wider variety of prey. The diet of Tawny Owls is especially diverse, and the importance of six trophic categories approaches or exceeds 10 percent. Ural Owls prey upon as many prey categories as Tawny Owls, but their diet is closer to great grays than to tawnies (table 4); prey categories other than voles and shrews comprise only ca. 10 percent of the Ural Owls' diet.

The use of insects by Tawny Owls and preference for heavier Microtus oeconomus Pall. by Great Gray Owls are reflected by the difference in mean prey mass (table 3). However, mean weights of vertebrate prey correlate with predator size (table 3). The gradient of prey specialization from Tawny to Great Gray Owls is also supported by the number of prey species and niche breadth indices (table 3).

Table 5 represents the diet and niche statistics from a pair of neighboring Tawny and Great Gray Owl nests (internest distance was 900 m). Both species had specialized diets, with Great Gray Owls emphasizing the use of bank voles (Clethrionomys glareolus Schreber) (compare tables 1 and 2). Common prey categories, excluding bank voles, were used in similar proportions (table 5). Niche breadth for each species was wider and diet overlap between them was smaller (0.382) than for pooled diet data (see tables 3, 4, and 5).

Table 4.—Food niche overlap between Strix owls in Belarus (prey species level).

	S. uralensis	***S. aluco***	***S. nebulosa***
S. uralensis		0.633	0.667
S. aluco			0.448

Table 5.—Diet of two Strix species in neighboring nests, April-May 1995, Svyatitsa study area, Liahavichi District, Belarus.

Prey category	**Percent of number of prey items**	
	S. aluco	***S. nebulosa***
Sorex spp.	15.2	16.7
Neomys fodiens	2.2	-
Sicista betulina	10.9	-
Apodemus spp.	8.7	-
Microtus spp.	28.3	26.1
Clethrionomys glareolus [1]	6.5	54.2
Arvicola errestris	2.2	4.2
Birds [2]	17.1	-
Frogs	4.3	-
Beetles	4.3	-
Total prey	46	24
Food niche breadth (species level)	14.21	7.04

[1] Chi-square test, $P < 0.001$
[2] Chi-square test, $P < 0.01$

DISCUSSION

Pooled diet data from different Belarus localities, years, and in part, seasons, were compared with generalized data in Cramp (1985), Martí et al. (1993), and Mikkola (1983). All three owl species had a rather specialized diet compared to other European studies. The diet of Belarusian Ural Owls differed considerably from Fenno-Scandian birds with respect to water vole (Arvicola terrestris L.) and shrew proportions. Ural Owls in Central Europe ate more mice and fewer shrews than Belarusian birds (Mikkola 1983). The proportions of water voles and shrews in the diet affect mean prey size and prey/predator mass ratio, which in

Table 3.—Main food niche indices of Strix owls in Belarus.

Niche statistics	***S. uralensis***	***S. aluco***	***S. nebulosa***
Geometric mean weight of prey	22.1[1]	15.4[1,2]	25.3[2]
Mean prey weight — SD	49.6	27.4	25.5
Prey/Predator mass ration, percent (%)	2.7	3.5	2.5
Minimal number of prey species	29	51	13
Food niche breadth (species level)	5.48	12.96	4.55

[1] Mann-Whitney test, $P < 0.05$
[2] Mann-Whitney test, $P < 0.01$

Belarus are about one-half the values reported elsewhere (Marti et al. 1993). Tawny Owls have an extremely diverse diet; maximal niche breadth reported for this species was 10.4 (Marti et al. 1993). Main prey proportions reported are for gray and bank voles (18-21 percent, respectively) and mice, anurans, and beetles (8-12 percent) (Cramp 1985, Mikkola 1983). Tawny Owl prey sizes correspond well to other reported values (Marti et al. 1993). Great Gray Owls in Belarus ate a relatively high proportion of shrews. Furthermore, the inclusion of root voles accounts for the two-fold increase in Belarusian Great Gray Owl diet niche breadth compared to Fenno-Scandian data (Mikkola 1983, Marti et al. 1993).

All three Strix species breeding in Belarus represent quite different diets with significant differences in prey category composition, niche breadth, and mean prey size. Dietary overlap correlates inversely with owl species range overlap, i.e., species with wider sympatry have less similar diet. It may reflect the absence of actual dietary competition at present as a result of past competition which shaped recent food niches of these species. This conclusion is preliminary and tentative as present data may be biased by sampling protocol, i.e., uneven geographical, habitat, and seasonal distribution of the samples. Data collection in actual sympatric situations (the same small study area during the same season) are needed for further investigation of food resource partitioning between these congeneric species.

Surprisingly, the only available data of this kind (with small sample sizes of prey animals) suggests that competition is important. Significant differences in the proportion of bank vole use, and switching of Tawny Owls from this preferred prey (Cramp 1985, Mikkola 1983) to others not used by potential competitors foraging nearby, may be attributed to Tawny Owls being excluded from the better hunting habitats by territorial and larger Great Gray Owls.

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