Diets of the Tengmalm's Owl *Aegolius funereus* and the Ural Owl *Strix uralensis* in Central Finland

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The diets of the breeding Tengmalm's Owl and Ural Owl were studied in Central Finland in 1976–84. Ural Owls used more voles than Tengmalm's Owls, 92 % and 74 %, respectively. The most important prey species of the Ural Owl was *Arvicola terrestris* and those of the Tengmalm's Owl were *Clethrionomys* voles and *Microtus agrestis*. The annual variation in food composition was larger in the Tengmalm's Owl than in the Ural Owl. Fluctuations in the numbers of breeding Ural Owls were, and the numbers of breeding Tengmalm's Owls were not correlated with the numbers of voles eaten. Breeding success, estimated by the number of fledglings, was dependent on the proportion of voles in the diet.

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Introduction

The Tengmalm's Owl and the Ural Owl are fairly abundant owl species of the boreal coniferous forests (taiga) of Central Finland. In this study I compare the differences in diet between these two owl species by analysing prey remains from nests in the same study area.

Study area, material and methods

The study area in Central Finland (c. 63°30´N, 26°30´E) covers the communes of Kiuruvesi and partly Pielavesi. The food remains were collected from nest-boxes in 1976–84. Before examination the pellets and other remains were softened in water. The material consists of 67 Tengmalm's Owl and 32 Ural Owl nests.

The number of individual prey animals was determined mainly by counting the mandibles (Fredga 1964, Sulkava & Sulkava 1971, Korpimäki 1981). However, the number of water vole, *Arvicola terrestris*, individuals was counted from thigh bones. I compared the number of mandibles and thigh bones in 24 nests of the Ural Owl. As a result the number of water vole mandibles was only 20.7 % of the number of thigh bones. On the other hand, there were 20.6 % more mandibles than thigh bones of the small vole species (*Microtus* and *Clethrionomys*). Larger prey animals were often brought without their heads to the nestlings (see also Lundberg 1976). Shrews were determined according to the measures given in Skarén & Jäderholm 1985. It was impossible to definitely distinguish between *Clethrionomys glareolus* and *C. rutilus* (Kaikusalo & Skarén 1978), therefore these species were combined. The weights of small mammals were obtained by weighing individuals snap-trapped during April and June in the study area and from the measurements presented by Siivonen (1974). Bird weights were taken from v. Haartman et al. (1963–72). Weight values are given in Table 1.

Results

Prey species composition

There were 6907 prey animals in 67 Tengmalm's Owl nests, and 1739 in 32 Ural Owl nests (Table 1). I have also included the stored prey in the Tengmalm's Owl nests. Voles were the dominant prey; 74 % for the Tengmalm's Owl and 92 % for the Ural Owl. In the Tengmalm's Owl the most numerous

Table 1. The food of the breeding Ural Owl and Tengmalm's Owl in Central Finland in 1976–1984. Weights of prey in parenthesis after the species name.

Species	*Strix uralensis*				*Aegolius funereus*				
	n	%	(Range%)	Weight%	n	%	(Range%)	Weight%	Stored prey individuals%
Ondatra zibethica (1000g)	1	0.1	(0–7.7)	0.8	–	–		–	–
Arvicola terrestris (150 g)	590	33.9	(4.7–60.6)	69.1	35	0.5	(0–10.1)	3.2	1.3
Microtus agrestis (30g)	743	42.7	(9.1–68.8)	17.4	2322	33.6	(0–73.8)	43.0	32.5
Clethrionomys glareolus/rutilus (22g)	267	15.3	(0–33.3)	4.6	2784	40.3	(11.2–62.8)	37.8	36.3
Myopus schisticolor (30g)	–	–		–	3	0.0	(0–0.8)	0.1	–
Microtidae	1601	92.0	(66.0–100)	91.9	5144	74.4	(21.7–98.8)	84.7	80.5
Rattus norvegicus (200g)	11	0.6	(0–4.5)	1.7	1	0.0	(0–0.7)	0.1	–
Mus musculus (15g)	3	0.2	(0–4.7)	0.0	24	0.4	(0–2.0)	0.2	0.7
Micromys minutus (8g)	5	0.3	(0–4.8)	0.0	32	0.5	(0–10.0)	0.2	1.3
Muridae	19	1.1	(0–4.8)	1.8	57	0.9	(0–10.0)	0.5	2.0
Sorex isodon (14g)	–	–		–	71	1.0	(0–6.3)	0.6	–
Sorex araneus/isodon (11.5g)	21	1.2	(0–7.0)	0.2	294	4.3	(0–35.4)	2.1	–
Sorex araneus (10g)	32	1.8	(0–16.7)	0.3	756	11.0	(0–39.2)	4.7	–
Sorex caecutiens (9g)	–	–		–	61	0.9	(0–11.8)	0.3	–
Sorex minutus (5g)	–	–		–	41	0.6	(0–10.0)	0.1	–
Sorex minutissimus (2.5g)	–	–		–	2	0.0	(0–1.3)	0.0	–
Neomys fodiens (15g)	15	0.9	(0–4.5)	0.2	34	0.5	(0–3.3)	0.3	–
Soricidae	68	3.9	(0–19.3)	0.7	1259	18.3	(0.6–55.0)	7.9	14.9
Pteromys volans (130g)	2	0.1	(0–2.0)	0.2	–	–		–	–
Sciurus vulgaris (290g)	1	0.1	(0–1.3)	0.2	–	–		–	–
Mustela nivalis (50g)	4	0.2	(0–3.3)	0.2	–	–		–	–
Lepus timidus (1000g)	3	0.2	(0–3.2)	2.3	–	–		–	–
Eptesicus nilssoni (10g)	1	0.1	(0–3.0)	0.0	–	–		–	–
Bird, fowl-size (1000g)	2	0.1	(0–2.3)	1.6	–	–		–	–
Bird, trush-size (60g)	11	0.6	(0–3.8)	0.5	75	1.1	(0–10.2)	2.8	–
Bird, chaffinch-size (25g)	20	1.2	(0–5.5)	0.4	238	3.4	(0–50.0)	3.7	–
Bird, warbler-size (10g)	5	0.3	(0–5.5)	0.0	134	1.9	(0–41.3)	0.8	2.6
Aegolius funereus (120g)	2	0.1	(0–2.8)	0.2	–	–		–	–
Aves	40	2.3	(0–11.0)	2.7	447	6.4	(0–61.7)	7.3	2.6
Total	1739	100.0		100.0	6907	100.0		100.0	n=154
Nests	32				67				

prey were *Clethrionomys* voles (40 %), whereas according to weight the most important prey was the field vole (43 %). In the Ural Owl the field vole was the most numerous prey (43 %) and the water vole was the most important prey according to weight (69 %).

The proportion of voles in Tengmalm's Owl nests varied between 22 and 99 % and in the Ural Owl nests between 66 and 100 %. The great variability in the proportion of voles may be due to variation in the locally dominant prey animals. In the Tengmalm's Owl only 6.4 % of the prey were birds. Shrews were found in every nest (18 % of prey animals). Both in the Tengmalm's Owl and the Ural Owl the proportion of mice was of minor importance. Individual Tengmalm's Owls seemed to be food specialists; in single nests the highest proportion of shrews was 55 % and that of birds 62 %.

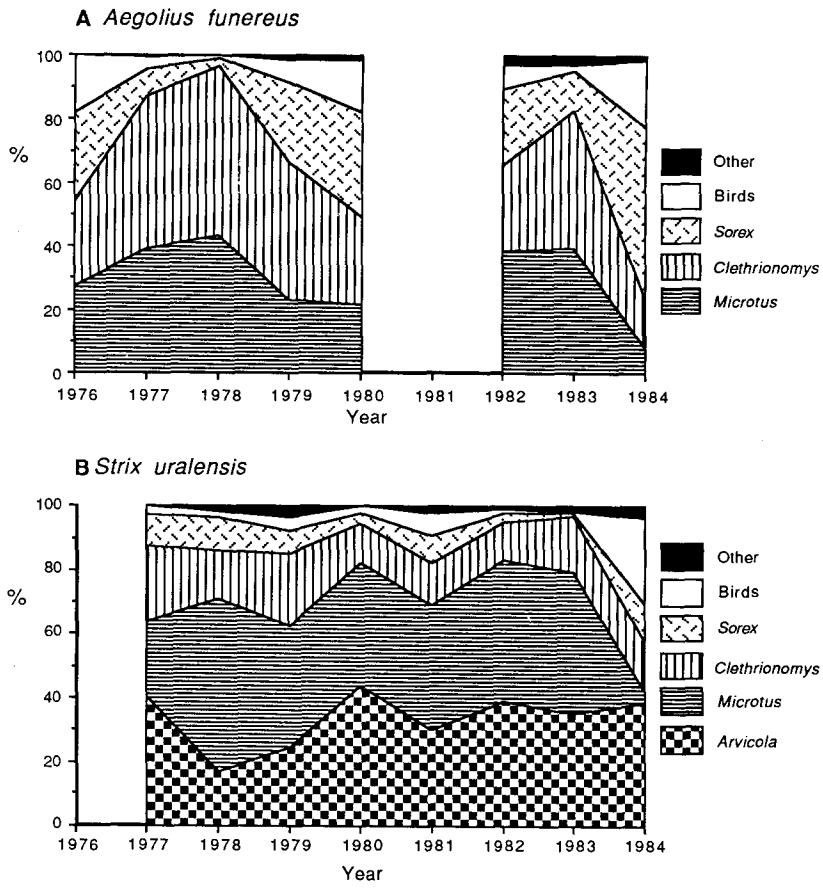

Fig. 1. The annual variation in food composition (individual %) in (A) *Aegolius funereus* and (B) *Strix uralensis*.

Annual variation in the diet

In the Tengmalm's Owl the diet varied considerably between years (Fig. 1). It seems that the decreased vole prey is nearly compensated by shrews and birds, especially shrews. By weight, birds exceeded shrew proportions in several years, however, the Tengmalm's Owl did not nest in the study area in 1981.

Ural Owls clearly used more voles than Tengmalm's Owls, the annual proportions being 58% – 97%. The water vole and the field vole alternated as the staple food. Water vole was the most important prey animal; 49% – 80% of the food as calculated by weight. Only a few birds and shrews were in the diet, except in 1984.

Diet vs. breeding success

In 1976–84 altogether 90 Tengmalm's Owl nests and 46 Ural Owl nests were found. Nest-boxes were made for both owl species, but also natural holes and stump-nests were found.

Tengmalm's Owl pairs producing 5–7 fledglings utilized almost entirely only voles, the vole proportion in the diet being nearly 90 % (Fig. 2). In the Ural Owl there is no marked dependence between the proportion of voles in the diet and the number of fledglings. However, the vole proportion is clearly smallest, when there is only one fledgling in the nest (Fig. 2).

In both species the number of prey animals brought to the nest increases with the number of fledglings (Fig. 3), however, the increase rate is steeper in the Ural Owl. In the Tengmalm's Owl the total prey weight per fledgling is relatively constant, about 650 g, except in the case of one fledgling. The respective pattern in the Ural Owl is quite different; the prey weight/fledgling increases steadily from one to four fledglings. The Ural Owl, therefore, does not seem to take any risk when raising many young,

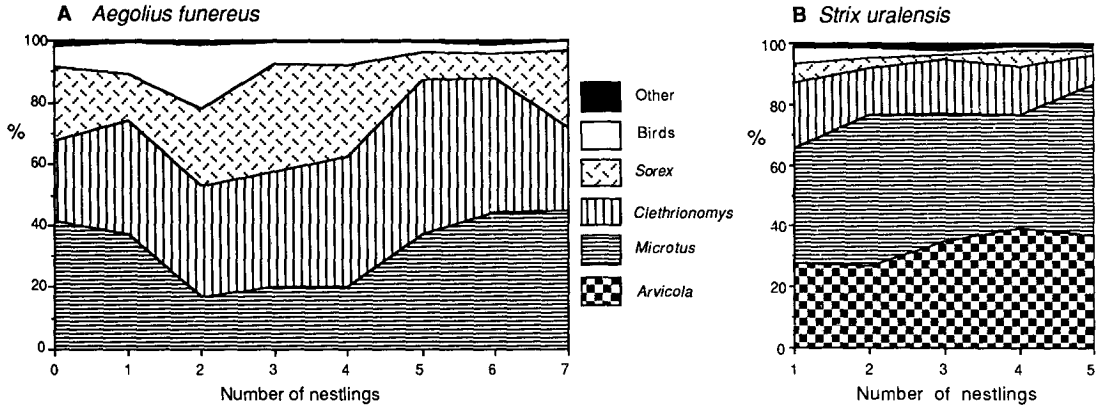

Fig. 2. The prey animal composition vs. the number of fledglings in (A) *Aegolius funereus* and (B) *Strix uralensis*.

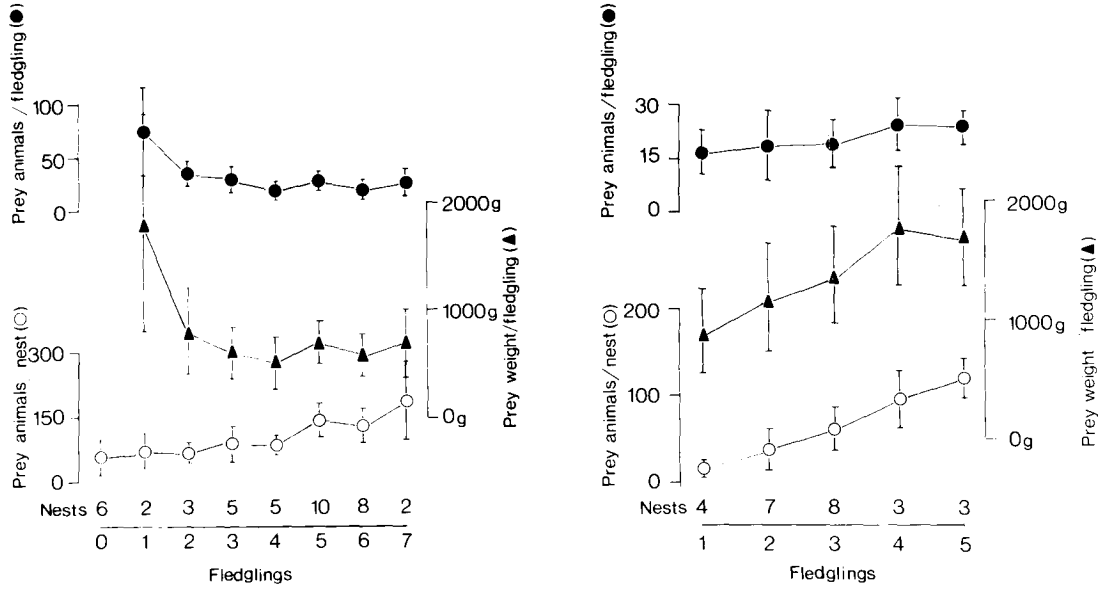

Fig. 3. The prey animal amount vs. the number of fledglings (•) and nests (o) in (A) *Aegolius funereus* and (B) *Strix uralensis*.

whereas the opposite is possible with the Tengmalm's Owl (Fig. 3).

Discussion

The population fluctuations of small mammals have been established to be one of the main reasons why population size and breeding success in owls should be regulated (Cody 1966, Linkola & Myllymäki 1969, Lundberg 1976, Korpimäki 1981). In my study period, there were three peak phases (1977, 1979–80, 1983) and three low phases (1978, 1981, 1984) in the Tengmalm's Owl. In 1981 the Tengmalm's Owl did not breed at all in the study area; however, the Ural Owl breeding population was moderate and the vole proportion in their diet exceeded 80 %.

Korpimäki (1981) has estimated the food requirements of the Tengmalm's Owl to average 670 g/nestling during the whole nestling period, and the respective figure for the Ural Owl is 2500 g/nestling (Scherzinger 1974). My estimate for the Tengmalm's

Owl is quite in accordance with Korpimäki's figure, but my estimate for the Ural Owl is markedly lower than found earlier, which might be due to unobserved losses from nest remains.

In the Tengmalm's Owl nests, which produced only one fledgling, there seemed to be quite a lot of extra food (Fig. 3). Evidently the lack of preyed food is not the only reason for low breeding success, although it is probably the most important factor. In the Ural Owl the prey weight/nestling seems to increase with the number of fledglings (from 1 to 4 fledglings). There seems, therefore, to be risk differences between the species in the production of young; the availability of prey must probably be many times greater before the Ural Owl is able to increase its brood size. However, different years with different prey availability have been combined in Fig. 2, so a thorough, comparative pattern is still not possible to determine.

In Finland the most common prey species in the diet of the Tengmalm's Owl is the bank vole (Klaus et al. 1975, Korpimäki 1981, Sulkava & Sulkava 1971) and in Sweden *Microtus* voles (Fredga 1964, Mikkola 1983). In Central Europe the vole proportions are lower and the importance of mice is greater (Uttendörfer 1952, Gasow 1968, Scheuren 1970, Schelper 1972, Klaus et al. 1975). One important reason for this difference is the distribution of *Apodemus* mice; they are very abundant in Central Europe, but are lacking in my study area. The Ural Owl almost entirely used voles, perhaps the local circumstances do not favour utilization of bird prey.

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Selostus: **Helmi- ja viirupöllön ravinto ja sen vaikutus pesintään Keski-Suomessa**

Helmi- ja viirupöllön pesimäaikaista ravintoa tutkittiin Keski-Suomessa vuosina 1976–84. Saaliseläinten lukumäärä määritettiin alaleukojen perusteella. Vesimyyrän yksilömäärät laskettiin kuitenkin reisiluista, sillä alaleukoja löytyi vain 20.7 % reisiluiden perusteella arvioidusta määrästä.

Myyrät olivat sekä helmi- että viirupöllön tärkein saaliseläinryhmä (osuudet 74.4% ja 92.0%). Viirupöllön runsain saaliseläin oli peltomyyrä, mutta painon mukaan laskien tärkeimmäksi saaliseläimeksi kohosi vesimyyrä; vastaavasti helmipöllöllä *Clethrionomys*-myyrät ja peltomyyrä (taulukko 1). Myyräsaaliin vuotuinen vaihtelu oli suurempi helmipöllöllä (kuva 1).

Pesinnän onnistumista arvioitiin lentopoikasmäärällä, joka molemmilla pöllöillä oli riippuvainen syödystä myyräosuudesta (kuva 2). Helmipöllön pesimäpopulaatio ei kuitenkaan ollut yhteydessä syötyyn myyrämäärään, mutta viirupöllön pesivien parien määrään myyräravinto heijastui paremmin.

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