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Analyses on prey composition of overwintering Great Grey Shrikes *Lanius excubitor* in southern Finland

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Diet composition of Great Grey Shrikes *Lanius excubitor* was studied during nine winter seasons (October–March) in southern Finland. In pellets, the main preys were *Microtus*-voles (35.4% of vertebrates by number), the harvest mouse *Micromys minutus* (27.5%), the common shrew *Sorex araneus* (14.8%), the house mouse *Mus musculus* (7.0%) and birds (7.0%). Invertebrates constituted about 0.1–1.7% of the total prey biomass. The shrikes hunted birds in an opportunistic manner, no preference for larger species within the suitable size-range was evident but tits dominated in the diet (61.2%). Compared to other species this was not due to favourable availability or prey selection but rather a result of higher vulnerability. The relationship between diet diversity and prey availability was studied using snow cover as an indicator for reduced availability of small mammals. Accordingly, the use of voles decreased in midwinter and during periods with snow, whereas birds and especially mice showed a corresponding increase. However, the overall vertebrate prey diversity was only slightly increased. A comparison between studies in northern and central Europe revealed a higher vertebrate prey breadth in the north. These observations are discussed in the light of optimal foraging theories predicting increased prey diversity in conditions with lower availability.

1. Introduction

According to foraging theories, a predator may apply an opportunistic prey selection by hunting randomly on suitable prey in a favoured habitat or may prefer prey with the highest net energy, usually larger prey within the size-range of the species (Stephens & Krebs 1986). Shrikes *Laniidae* are generally considered to be prey opportunists (Lefranc & Worfolk 1997). Thus, no preference for size should occur but the final diet would be an outcome of factors, such as prey abundance, availability and vulnerability, which vary with habitat and season (Newton 1986, Solonen 2000). In addition, prey manageability is a vital factor when considering prey preferences (Palmer 1981, Tornberg 1997).

In the winter, the Great Grey Shrike *Lanius excubitor* is dependent on the availability of small vertebrates. *Microtus*-voles represent the majority of prey in most locations (Lefranc & Worfolk 1997), but compared to other small mammals these voles are also relatively less available to avian predators in conditions with snow cover (Sonerud 1986). Hence, a snow cover would be expected to change the relative number of mammals and other vertebrate prey captured. According to the optimal foraging theory, the overall prey diversity should also increase with lower prey availability (Emlen

1966). In fact, although the Great Grey Shrike is considered a poor predator on adult birds, many studies have confirmed the greater role of birds in periods with snow (e.g. Leivo 1942, Olsson 1984a, Schön 1997), not necessarily through increased hunting activity but possibly due to elevated prey vulnerability (Olsson 1984a, Karlsson 2001).

Due to the habit of perching in open habitats and within a fairly small area, the Great Grey Shrike is an appropriate species to relate hunting frequency and success to factors such as prey availability or final diet composition. In Finland, the diet has been studied in Ostrobotnia (about 63°N) (Grönlund *et al.* 1970, Huhtala *et al.* 1977), but with the exception of Leivo (1942), who monitored impaled prey in the 1930s, no study has been described from the more frequent winter grounds in the southern coastal area. In this work the following issues will be discussed: (1) diet data from southern Finland and a comparison with previous studies; (2) effects of snow cover on the vertebrate prey composition and diversity and the accordance with foraging theories; and (3) proportion of different bird species in the diet affecting the role of prey selection and species differences in vulnerability.

2. Material and methods

The study was performed at four locations in coastal SW Finland: (1) Kaarina, Rauvola (60°25´N, 22°17´E); (2) Parainen, Nilsby (60°20´N, 22°25´E); (3) Parainen, Hoggais (60°19´N, 22°15´E) and (4) Parainen, Sydmo (60°17´N, 22°08´E). The sex distribution and the precise number of individuals studied are not known. Since the Great Grey Shrike is territorial on its winter grounds (Olsson 1984a), the locations are referred to as territories 1–4. The habitat distribution was fairly similar in all territories with the exception of *Poaceae*-dominating dry meadows that showed significant differences ($\chi^2_3 = 7.65$, $P < 0.05$) (Table 1) (see also Karlsson 2001). Territory 1 was located in the near vicinity of a suburban area of the city of Turku, whereas territories 2–4 were rural.

Table 1. Habitat distribution (%) in the four locations studied. The distributions and total areas are based on the largest observed yearly territory. The results are based on complete seasons only in territories 1 and 2. For each territory the number of seasons used for diet studies and the number of pellets collected are included.

	Territory			
Habitat	1	2	3	4
Arable fields	67	69	53	61
Dry meadows	21	14	31	25
Wet meadows	4	5	7	5
Reed beds	8	12	10	9
Total (ha)	200	160	80	75
Seasons (n)	5	6	2	2
Pellets (n)	672	467	60	8

Diet data were collected from late September to early April in 1992/93–2001/02 (except 1993/94). The methods used were field observations of shrikes, searching for impaled prey (n = 97) and pellets (n = 1208). Feather specimens of consumed birds were also collected in order to get additional information on bird prey. To avoid double counting, feather specimens were removed as thoroughly as possible and impaled prey items were marked by cutting off a part of the tail or the tail feathers.

Pellets were collected beneath perches or roosting sites, mainly in territories 1 and 2 (Table 1). In pellets, invertebrates were principally classified according to orders and mammals and birds according to species based on jaws, beaks and feathers present. To obtain a general picture of the diet, pellets were analysed by two different approaches: (1) percentage of prey by number based on the number of heads (all vertebrates and *imago* insects), cephalothoraxies (spiders) or whole items (insect *larvae*); and (2) percentage of prey according to wet weights. Sources used for average prey weights are presented in Appendix 1.

To evaluate seasonal changes in the diet, 510 pellets were placed on a time scale of a month, i.e. October–March. Furthermore, to analyse changes attributed to the presence of a snow cover, part of the pellets were categorised according to snow conditions, i.e. pellets ejected during periods with (256 pellets) or without a snow cover (309 pellets).

The vertebrate diet diversity was assessed by Shannon's Index (H'), which amplifies with increased prey breadth (Levin 1968, Herrera & Hiraldo 1976). The formula used was:

$$H' = -\sum P_i ln(P_i) \qquad (1)$$

where P_i = proportion of total sample belonging to *i*th species and $\ln(P_i)$ = the natural logarithm of P_i. To allow comparison with previous studies, the prey groups were standardised to voles, mice, shrews, birds and reptiles.

Prey vulnerability was studied among passerine birds by comparing relative prey availability, the number of hunting efforts and final diet composition. To gather data on the relative availability, all small passerine birds observed within an approximate radius of 100 m from the perching shrike were systematically recorded whenever a determination of species was possible. The relative availability is measured as the number of days (%) the species in question was observed (n = 144 days of observation). To obtain data on prey selection, each observed bird hunting was recorded and the target species was determined when possible (n = 60 hunting efforts, 187 h of field observation). Abundances of mammals were not monitored.

The general p × q contingency table was used to test differences in the vertebrate prey distribution attributed to season, location and snow. Relationships between availability, hunting observations and diet content of passerine birds were analysed with Pearson's correlation coefficient. In all tests a level of $P < 0.05$ was considered significant.

3. Results

According to pellet content, the main invertebrate prey (n = 495) were beetles, mainly mid-sized ground beetles (*Carabidae*) (59.6%), spiders (30.7%) and *Hymenoptera* (7.7%). *Hymenoptera* were chiefly Wasps *Vespidae*. Beetles dominated in the autumn and spiders in the winter. The ratio of invertebrates to vertebrates in the pellets was calculated to measure the relative use of invertebrates. The ratio varied from 3.36 in October to a low of 0.16 in midwinter. On a weight basis these ratios would correspond to about 1.7% and 0.1%, respectively, based on the average wet weights of mid-sized *Carabidae* and spiders (0.10 g and 0.02 g, own measurements) and the average weight of vertebrate prey (19.2 g, Appendix 1).

In pellets the most important mammal species were: the field and/or common vole *Microtus agrestis*; *M. rossiaemeridionalis* (35.4% of all vertebrates); the harvest mouse *Micromys minutus* (27.5%); the common shrew *Sorex araneus* (14.8%); and the house mouse *Mus musculus* (7.0%) (Appendix 1). Among bird species, the Great Tit *Parus major* and the Blue Tit *P. caeruleus* represented about 60% of all birds. On a weight basis, the average diet composition was: voles 63.9%; mice 21.8%; shrews 8.3%; birds 5.9% and reptiles less than 1%. The diet composition of vertebrates (mammals/birds/reptiles) did not diverge depending on the sampling method (pellets, impaled prey or field observation) ($\chi^2_4 = 0.30$, ns), nor did the distribution of voles, mice, shrews and birds differ between pellets and impaled prey ($\chi^2_3 = 4.42$, ns).

The role of *Microtus*-voles, mice and birds changed significantly through the season (Table 2). Voles showed the highest prevalence in the autumn (54.5%) and in late winter/early spring (51.3%), whereas the proportion was low in midwinter (16.7%). In midwinter, the harvest mouse (45.2%) was the most important prey. The highest proportion of birds was in February when the frequency (23.4%) exceeded that of voles (17.0%) and shrews (19.1%). The house mouse was mainly found in pellets collected in midwinter (12.0%), but was completely absent in the autumn samples. The diversity index (H') varied from 1.11 (autumn) to 1.32 (February).

Table 2. P-values of Chi-square tests comparing differences in the diet composition on a seasonal basis (October–March), due to the presence of snow cover and between territories (T1–T3). ns = not significant.

	Seasonal (df = 5)	Snow (df = 1)	Location (df = 2)
Micromys minutus	ns	ns	ns
Mus musculus	< 0.01	< 0.001	ns
Voles total	< 0.001	< 0.05	ns
Shrews total	ns	ns	ns
Birds total	< 0.01	< 0.025	< 0.025

The presence of a snow cover was associated with significant changes in the average vertebrate diet (Table 2). These were an increase in the house mouse as prey (1.9% during snow-free periods versus 12.4% during periods with snow), a decrease in *Microtus*-voles (45.1% vs. 30.8%) and an increase in birds (4.9% vs 12.4%). The role of the harvest mouse (32.5% vs. 29.6%) and shrews (14.6% vs. 14.8%) was independent of snow cover. In pellets collected during periods with snow the diversity index (H') was 1.27 (n = 169 prey) and in the absence of snow, 1.16 (n = 206 prey).

Compared to previous studies in northern and central Europe, small mice were of higher importance (Table 3). Shannon's Index for prey diversity (H' = 1.25) was comparable with previous studies in northern Europe (H' = 0.98–1.19,) but considerably higher than in central Europe (H' = 0.34–0.54) (Table 3). On a local basis mammals showed no significant deviations between territories 1–3, but birds were more frequently taken in the suburban territory 1 (10.1% of vertebrates) than in the rural territories 2 (4.0%) and 3 (1.0%) (Table 2). Mice were the most numerous preys in six of the studied seasons/territories (n = 9), voles in two and shrews in one (Figure 1).

The composition of bird species in the diet did not differ between pellet content and recorded feather remains (χ^2_{14} = 13.07, ns). Hence, these results were combined to relate diet with prey availability and hunting efforts. The number of observed hunting efforts correlated significantly with the relative availability (r = 0.805, P < 0.001) and with the prevalence in the diet (r = 0.625, P < 0.01) of the species. However, compared to the number of hunting observations, tits were significantly more frequent in the diet than the pooled group of other bird species, mainly different finches (*Fringillidae*) and the Yellowhammer (*Emberiza citrinella*) (Table 4) (χ^2_1 = 12.44, P < 0.001).

4. Discussion

As observed in previous studies (Lefranc & Worfolk 1997) *Microtus*-voles constituted the bulk of the diet by weight. However, small mice showed a more important role than in previous studies and outnumbered voles in several seasons. The harvest mouse and to a lesser extent the house mouse were the species that contributed to this high incidence. The harvest mouse is not found in mainland Sweden, where *Apodemus*-mice were the more frequent prey (11.7%, Olsson 1986) compared to my study (1.6%). The harvest mouse may be a more easily detectable and manageable prey than voles due to its minute size and habit of climbing in the vegetation, giving a better energy yield per gram prey. For the Great Grey Shrike, which is a fairly small bird (weight 65g, Solonen 1994)

Table 3. Distribution (%) of vertebrate prey in northern and central Europe. All studies are pellet analyses except ref. 3, which was based on impaled prey only. The references are: 1) This study, 2) Huhtala *et al.* 1977, 3) Leivo 1942, 4) Olsson 1986, 5) Oeser 1974, 6) Grünwald 1984, 7) Schön 1997, 8) = Bassin *et al.* 1981. Fin = Finland, Swe = Sweden, Ger = Germany, Swi = Switzerland. H' corresponds to Shannon's index for prey diversity.

Reference	1	2	3	4	5	6	7	8
Country	Fin	Fin	Fin	Swe	Ger	Ger	Ger	Swi
Lat.(N)	60°	63°	60°	59°	51°	51°	49°	47°
Mammals	92.7	96.4	78.2	86.7	98.7	96.8	95.3	92.3
Voles	37.5	57.7	63.6	54.1	88.5	91.2	87.2	90.1
Mice	36.3	24.4	10.9	11.7	7.7	0.8	2.4	0.5
Shrews	19.0	14.3	3.6	20.9	2.8	4.8	5.7	1.7
Birds	7.0	3.6	21.8	13.1	1.3	3.2	3.8	7.7
Reptiles	0.3	0	0	0.2	0	0	0.9	0
Prey (n)	731	168	55	1114	78	125	211	222
H'	1.25	1.06	0.98	1.19	0.46	0.38	0.54	0.39

to be hunting vertebrates, prey manageability is probably of great importance. The killing of a large vole is laborious and may even include risks of injury (Olsson 1984b, own observations). Prey management also includes transportation, impaling and handling of the prey, all factors that are less energy consuming for small vertebrate prey. Palmer (1981) showed theoretically that predators may profit more from a short handling time than by hunting prey with a higher energy content. Hence, as suggested by Kauppi and Rajala (1975), the harvest mouse may be a more profitable prey than voles if the abundance is high enough to compensate for its small size.

Great Tits and Blue Tits were the most frequent bird prey, but this was not an outcome of

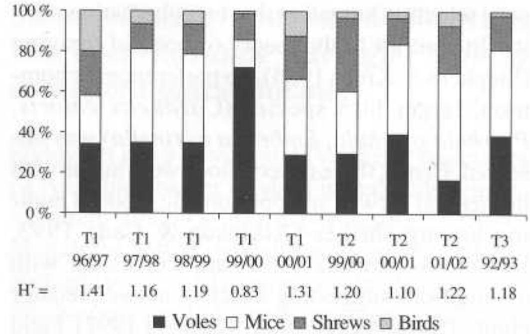

Fig. 1. Local and yearly variation in the vertebrate diet. Only years and territories when pellets were collected throughout the season (October–March) are included. Shannon's index (H') corresponds to the vertebrate prey diversity.

Table 4. The relative availability (% of days the species has been observed within a radius of 100 m from the perching shrike), hunting efforts (% of all hunting observed) and the proportion (% of birds) of the species in the diet. The relative availability is provided for species considered suitable prey, i.e the size of a starling or smaller. The diet is the combined data from pellet analyses, impaled prey and feather remains.

Species	Relative availability	Hunting efforts	Proportion (%) in the diet
Carduelis chloris	55.5	16.7	5.8
Pyrrhula pyrrhula	45.1	10.0	4.9
Emberiza citrinella	33.3	3.3	8.3
Carduelis flammea	28.5	3.3	2.5
Parus caeruleus	24.3	11.7	27.3
Parus major	23.6	10.0	32.2
Carduelis carduelis	20.8	5.0	5.8
Carduelis spinus	12.5	5.0	4.1
Bombycilla garrulus	10.4	0	0.8
Fringilla coelebs	9.0	8.3[1]	1.7
Anthus pratensis	9.0	1.7	0
Carduelis cannabina	8.3	0	0
F. montifringilla	6.9	0	0.8
Alauda arvensis	6.9	3.3	0.8
Sturnus vulgaris	6.3	0	0
Emberiza schoeniclus	5.6	0	0
Regulus regulus	2.8	1.7	1.7
Passer domesticus	2.8	0	0
Loxia sp.	2.8	0	0
Motacilla alba	2.8	0	0
Parus ater	2.1	3.3	1.7
Panurus biarmicus	2.1	0	0
Aegithalos caudatus	1.4	0	0
Parus sp.	–	8.3	0
Small unknown bird	–	8.3	0.8
Total	–	100	100
n	144 days	60	121

[1]Includes 3 (5.0%) cases of *F. coelebs/montifringilla.*

prey selection but rather due to higher vulnerability. In contrast to the theory of optimal foraging (Stephens & Krebs 1986), no preference for common, larger bird species (*Carduelis chloris*, *Pyrrhula pyrrhula*, *Emberiza citrinella*) was observed. Hence, these observations were in line with the general view of an opportunistic mode of hunting among shrikes (Atkinson & Cade 1993, Lefranc & Worfolk 1997) and consistent with assumptions suggesting a lack of active predator choice (Sih & Moore 1990, Tornberg 1997). Field observations of wader hunting hawks showed a similar pattern, i.e. the hawks attacked many different species but were successful only with some species (Cresswell & Whitfield 1994). The Great Grey Shrike catches birds mainly by surprise on the ground or by chasing the prey in trees, bushes and other vegetation in order to flush the prey into flight from the protective branches (Cade 1967). A lesser ability to escape the attacking shrike is one probable reason for the clear difference between tits and other bird species. Compared to finches and the Yellowhammer, the flight of tits is fairly slow and not adapted to open spaces. In the winter the flocking behaviour, a common strategy against avian predation (eg. Spencer 1982), is strong among finches and Yellowhammers, whereas tits form loose groups with a few individuals only. However, these results cannot be generalised for several reasons. Firstly, the vulnerability is a function of individual preferences, hunting habitat, season, location and the abundance of other suitable prey (Newton 1986, Tornberg 1997, Solonen 2000). Secondly, the Great Grey Shrike is territorial throughout the season and may show territory fidelity (Olsson 1984a); therefore, pseudoreplication must be considered as a possible source of error, especially since only a few locations and an unknown number of individuals were studied. Thirdly, the method used to measure availability of bird species is impaired by species differences in observability. Thus, some bird species most likely occurred in the vicinity of shrikes considerably more frequently than recorded. This is probably most evident for tits of coniferous forests, i.e. *Parus cristatus*, *P. montanus*, and *P. ater*. However, these species were infrequent or absent in the shrike diet, probably due to their habit of avoiding open areas and favouring a habitat unsuitable for shrikes.

The abundance of mammals was not monitored in this work, but assuming that also mammals were preyed upon in a similar opportunistic manner, the final role of each prey would depend on prey abundance, availability, vulnerability and manageability. Consequently, the shrikes should use habitats in which the prey species are most favourable in these respects. It has been suggested that differences in the habitat use of prey species and the hunting behaviour of the predator are the ultimate factors affecting the diet composition (Solonen 1997). It was previously observed that shrikes favoured arable fields in conditions lacking snow when invertebrates were actively hunted, but widened the habitat used during periods with snow, when especially the use of meadows and reed-covered wetlands increased, but also visits to human habitation were observed (Karlsson 2001). This would explain the importance of harvest and house mice in midwinter or during periods of snow. The former species inhabits vegetation-rich meadows and reed-beds (Siivonen & Sulkava 1997), while the house mouse was not confined to the suburban location but occurred also in the rural areas where shrikes perched occasionally on or near farms, a likely habitat for this species of mice. Thus, the seasonal and snow-related differences of vertebrate prey taken would at least to some extent be due to different habitat use.

The regional comparison performed in this study showed a broader spectrum of vertebrate prey in northern than in central Europe. By assuming harder winter conditions in the north, this would be in line with the optimal foraging theory that predicts an increased prey breadth in conditions with lower availability (Emlen 1966). In prey specialists such as the Long-eared Owl *Asio otus*, which uses fairly similar habitats during the winter, the prey diversity is similar in both regions (Källander 1977), probably reflecting the rather opportunistic prey selection by shrikes. In North America, Atkinson and Cade (1993) found that the diet breadth of breeding *Lanius excubitor invictus* was about 80% of the winter diet. In the present study area the presence of snow cover was used as an indicator of lower prey availability and, accordingly, the average hunting frequency for ground-living prey showed a clear negative correlation with snow depth (Karlsson 2001). However, the prey diversity was only slightly affected by snow. In snow-free conditions the diversity index was about 91% of the index noted in the presence of snow and similarly, in the autumn the vertebrate prey breadth was about 84% of that observed in winter. However, a wider habitat selection during periods with snow (Karlsson 2001) may also provide a more diverse community of small mammals and, in the light of the opportunistic mode of hunting, an increased prey breadth, fully in accordance with the optimal foraging theory. Thus monitoring of the local populations of small mammals would have put more light on the general prey selection by the Great Grey Shrikes.

The results presented in this work were consistent between methods, i.e. pellet analyses, searching for impaled prey or field observations. Also, the bird diet did not differ between pellet content and feather sampling. However, pellet analysis was the only method that revealed the use of invertebrates, since none were found impaled.

5. Conclusions

Microtus-voles were on a weight basis the most important prey but the Great Grey Shrikes used considerably more mice, *Micromys minutus* and *Mus musculus*, compared to previous studies. Consistent with foraging theories, the vertebrate prey diversity was higher in northern Europe than in central Europe. The studied shrikes showed significant changes in the vertebrate diet in the course of the season and as a response to snow cover. These changes were at least partly a consequence of different habitat selection. When hunting birds, the shrikes did not prefer larger species within the suitable size-range but selected prey in an opportunistic manner.

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Sammanfattning: **Analyser av födovalet hos övervintrande varfåglar *Lanius excubitor* i södra Finland.**

Födovalet hos övervintrande varfåglar studerades på fyra olika lokaler i södra Finland under vinterhalvåren, 1992/93–2001/02 (förutom 1993/94). Metoderna bestod i spybollsanalyser, sökandet av spetsade byten och bytesrester (fågelfjädrar) samt fältobservationer. Lokalernas biotopsammansättning samt antal analyserade spybollar presenteras i Tabell 1.

Närmast under hösten bestod dieten till en del av evertebrater (ungefär 1.7% biomassa). Sammansättningen av vertebrater förändrades signifikant dels under säsongen, dels som ett resultat av snötäcke (Tabell 2). Dessa skillnader var åtminstones till en del ett resultat av skillnader i biotopvalet. *Microtus*-sorkar var det viktigaste bytet på basen av vikt men varfåglarna utnyttjade till större grad möss och speciellt dvärgmusen *Micromys minutus* i jämförelse med tidigare studier (Tabell 3, Appendix 1). Detta var speciellt märkbart under midvintern då dvärgmusen var numerärt det dominerande bytet. I enlighet med teorin om optimal furagering var mångfaldet av vertebrater i födan större i norra än i centrala Europa. Bland potentiella fågelbyten visade varfåglarna ingen preferens för större byten utan byten valdes opportunistiskt. Fågeldieten dominerades dock av talgoxe och blåmes vilket troligen berodde på att dessa arter var lättare byten än övriga arter (Tabell 4). Resultaten kan dock inte generaliseras eftersom endast några få lokaler och ett okänt antal individer studerades. En undersökning av de lokala förekomsterna av små däggdjur kunde också ha gett en större insikt i varfågelns bytesval.

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Appendix 1. Summary of diet data obtained from pellets P (%), impaled prey I (%), field observation O (%) and feather remains F (%). Mean wet weights MW (g) were used to calculate the average proportion of prey based on weight. TW = total weight (g), calculated from the number in pellets and wet weights. Prey weights were obtained from: Siivonen & Sulkava 1997 (mammals), Solonen 1994 (birds) and Schön 1997 (*Lacerta*).

Species	P (%)	I (%)	O (%)	F (%)	MW	TW
Microtus agrestis	16.0	7.2	–	–	35.9	4200
M. rossiaemeridionalis	8.2	1.0	–	–	29.4	1764
M. agr./rossiaem.	11.2	18.6	–	–	32.6	2673
Clethrionomys glareolus	2.1	2.1	–	–	22.6	339
Voles total	37.5	28.9	–	–	–	8976
Micromys minutus	27.5	23.7	–	–	9.6	1930
Mus musculus	7.0	5.2	–	–	14.0	714
Rattus norvegicus, juv.	0.1	0	–	–	57.0	57
Apodemus flavicollis	1.6	1.0	–	–	29.5	354
Mice total	36.3	29.9	–	–	–	3055
Sorex araneus + sp	15.3	24.8	–	–	9.1	1019[1]
Sorex minutus	3.0	0	–	–	3.9	86
Neomys fodiens	0.7	1.0	–	–	12.9	65
Shrews total	19.0	25.8	–	–	–	1170
Mammalia total	92.7	91.8	93.3	–	–	13201
Carduelis flammea	0.1	0	0	1.7	14	28
C. carduelis	0.4	0	0	6.8	18	54
C. spinus	0.4	0	0	3.4	13	39
C. chloris	0.1	1.0	1.7	6.8	29	29
Pyrrhula pyrrhula	0.3	1.0	1.7	3.4	29	58
Parus major	2.5	2.1	1.7	30.5	19	361[2]
P. caeruleus	2.2	0	1.7	27.1	11	176
Certhia familiaris	0.1	0	0	0	9	9
Regulus regulus	0.3	0	0	0	6	12
Emberiza citrinella	0.3	1.0	0	11.9	30	60
Fringilla coelebs	0	0	0	1.7	22	–
F. montifringilla	0	1.0	0	1.7	22	–
Parus ater	0	1.0	0	1.7	9	–
Bombycilla garrulus	0	0	0	1.7	60	–
Alauda arvensis	0	0	0	1.7	37	–
Birds total	7.0	7.2	6.7	100	–	826
Lacerta vivipara	0.3	0	0	–	5	10
Vertebrates total	100	100	100	–	–	14037
n =	731	97	60	59	–	–

[1] Includes unknown shrews.

[2] Includes one specimen of an unknown small passerine.