Beiträge zur
JAGD
&WILD
forschung · 36

Agrita Žunna, Jānis Ozoliņš, Alda Stepanova, Aivars Ornicāns, Guna Bagrade, Riga/Latvia

Food habits of the lynx (*Lynx lynx*) in Latvia based on hunting data

Key words: *Lynx lynx*, diet, stomach content, Latvia

Introduction

Diet of Eurasian lynx *Lynx lynx* has been studied rather well throughout Europe and Russia (Nowicki 1997, Jędrzejewska, Jędrzejewski 1998), however information on their feeding habits in Latvia is still comparatively scarce. Previous study of lynx diet in Latvia in late 1990s covered only three year period and sample size was rather limited (Andersone et al. 2003).

Lynx is a game animal in Latvia and as such it holds an interest of wildlife managers and hunters. Predation of lynx may be an important factor in mortality of its prey species, mostly wild ungulates (Okarma et al. 1997, Nybakk 2002), thus potentially causing some conflicts with hunter community. At the same time availability of prey can determine spatial organization and density of the lynx population (Schmidt 1997, Herfindal 2005), therefore interaction between lynx and its prey species can be important in relation to the population conservation of this predator.

Potential prey base for lynx in Latvia includes wild ungulates (roe deer *Capreolus capreolus*, red deer *Cervus elaphus*, moose *Alces alces* and wild boar *Sus scrofa*), two hare species (*Lepus europaeus* and *Lepus timidus*), rodents, wild birds and medium sized carnivores (Timm et al. 1998).

Wolf *Canis lupus* can be considered as a competitor of the lynx for the available prey. Studies of wolf diet in Latvia shows that main prey items for this predator are wild ungulates (mainly roe deer and wild boar) and beavers *Castor fiber* (Žunna et al. 2009). An overlap of the diets of those two predators has been recorded in previous study (Valdmann et al. 2005).

During last decade data about lynx diet has been collected as a part of lynx population monitoring and thus sex, age, date and place of harvested individuals is known. Analyses of these data can give a more thorough insight in lynx feeding habits in Latvia and also give some information about lynx impact on their prey species.

Material and methods

Food habits of lynx in Latvia were studied from 2000 to 2010. Study was based on analyses of 203 stomachs obtained from harvested lynxes all over the country. Hunting season for lynx in Latvia lasts from December till March, therefore data obtained from harvested animals covers only winter diet.

Food remains were found in 140 stomachs. Fresh stomach contents were weighed (1 g precision) and prey remains found in stomachs (mainly hairs, bones and feathers) were used to

identify prey species. When necessary microscopic slides of hair found in stomachs were prepared in order to identify species according to the keys by Teerink (1991) and our own reference collection. Mostly remains of one prey species were found in stomach contents, however in three cases two prey species were found. In those samples the relative volume (in percents) was estimated for each item by sight. Then the relative volume index was used to calculate the weight from the total mass of stomach content in grams. Cervid species (roe deer and red deer) in some cases were not separated during the analysis due to their very similar hair structure and consequently possible identification mistakes. Also species of small rodents (i.e. *Arvicola terrestris, Clethrionomys glareolus, Microtus sp.* and *Apodemus sp.*) were not identified.

Diet was quantified by two indices – frequency of occurrence and ratio of stomach content biomass. Frequency of occurrence was calculated dividing the number of stomachs containing a particular prey item by total number of stomachs containing food remains.

Ratio of stomach content biomass was calculated dividing the total weight of particular food item in samples (the total weight of a prey species or category) by the total weight of stomach contents.

Sex of animals was determined during examination and autopsy of 199 harvested lynxes. Stomachs of 76 males and 123 females were available. The difference between sexes in our sample did not result from a shaped sex ratio in population. Samples were somewhat biased as one of the main aims of the lynx monitoring is to study the demographic status of the population. Therefore whole carcasses of the female lynxes were collected more often in order to determine reproductive status while collecting skulls from the male lynxes was sufficient.

The absolute age of animals was determined by counting cement increment lines in root slices of a canine (Klevezal 1998). According to that lynxes were divided in two age groups – animals under age 1 (n=53) and adult animals (n=119).

Since there is a certain partition in spatial structure of the lynx population in Latvia (Fig. 1), geographical differences in lynx diet between east and west parts of country were also examined. The border between both study areas was assumed from Riga city southwards to frontier with Lithuania. From eastern part 164 stomachs were obtained, from western part – 39 stomachs.

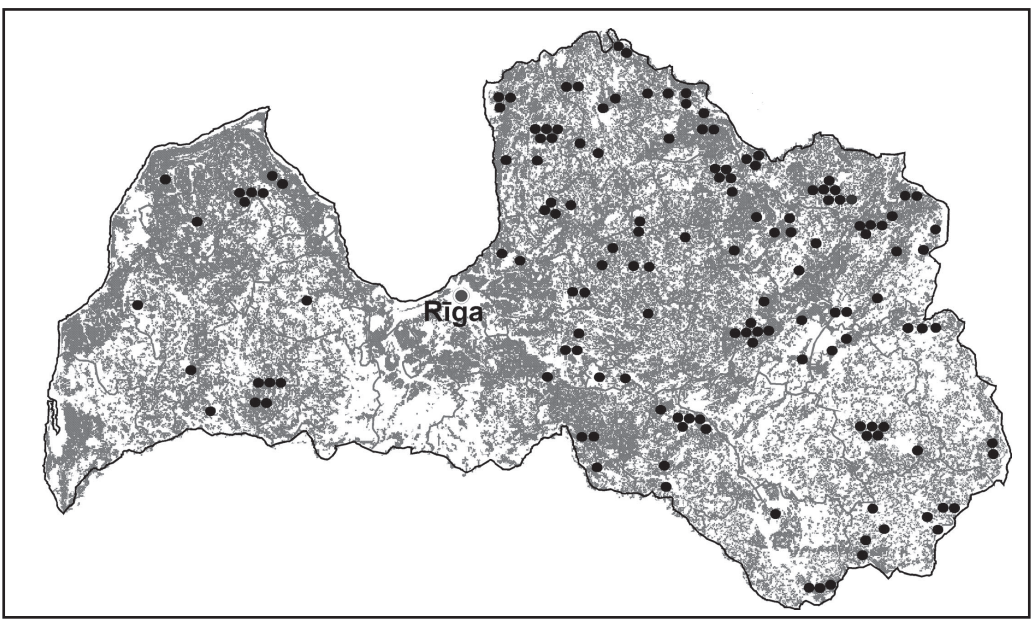

Fig. 1 Distribution of harvested lynxes during the hunting season 2009/2010

Abundance of prey species is characterized by game statistics recorded by Latvian State Forest Service. In order to ensure a sustainable management of lynx population in Latvia, the State Forest Service (SFS) is involved in monitoring dynamics, prey abundance, hunting bags and conflicts with animal husbandry (Ozoliņš et al. 2007). These data are not necessarily published on a regular basis but freely available to researchers, students and public media by browsing website www.vmd.gov.lv or personal communications. As the number of the hunters and their hunting efforts are quite stable, the annual hunting bags are suggested to be least biased indices.

The Kolmogorov-Smirnov test was used to test normality of the samples and the Mann-Whitney U-test was used to test statistical differences between samples (Fowler et al. 2006).

The proportion validity test was used to test statistical differences in empty stomachs (Liepa 1974).

Results

Cervids (mostly roe deer) were the main prey of lynx in Latvia found in 90,1 % of examined stomachs and comprising 91,9 % of consumed biomass (Table 1). Inter alia, stomach analyses showed that roe deer was found undoubtedly in at least 81,4 % of stomachs containing cervid remains and comprised at least 66,4 % of biomass of the consumed cervids.

Abundance of cervids in Latvia, especially of a roe deer, has increased considerably during last decade (Fig. 2).

Other food items (hares, small rodents, beaver, racoon-dog *Nyctereutes procyonoides*, and earthworms) were rarely found. None of them exceeded 3,1 % of occurrence and of stomach content biomass. In two stomach samples remains of chickens were found. Other two samples contained rather unusual items – wood chippings and rubber.

Mass of stomach contents varied from 5 to 1165 g, the average mass was 333,5 g. Mass of the stomach contents was not normally distributed (Kolmogorov-Smirnov test, $P < 0{,}001$) as for the most part it was under 400 g (Fig. 3).

Almost one third (31,0 %) of all stomachs were empty.

There were slight differences in the diet composition of young and adult animals (Table 2), however they were not significant (U-test, $P > 0{,}05$). Significant differences (U-test, $P < 0{,}05$) were found when comparing variances of stomach content biomass between lynxes

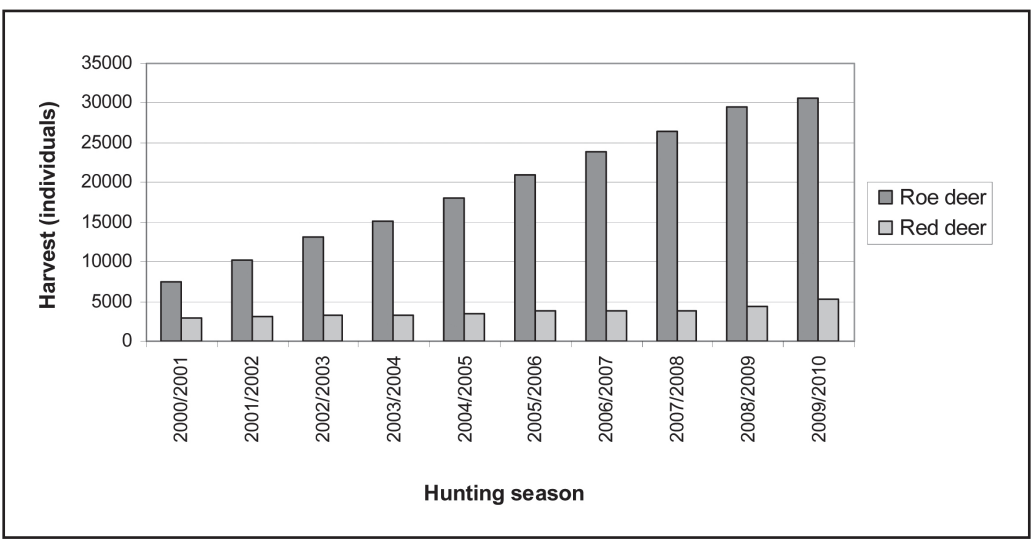

Fig. 2 Changes in abundance of two main ungulate species within last decade

under age 1 and adult animals both in total consumed biomass and in biomass of consumed cervids.

Stomach contents of young lynxes were on average lighter (249,9 g; 15–835 g) than those of adult lynxes (327,7 g; 5–1165 g), however due to the variance distribution pattern (Fig. 3) comparison of mean values appeared not applicable. Adult lynx more often had empty stomachs (32,8 %) than young animals (28,3 %), although differences were not statistically significant ($P > 0,1$).

Diet of male and female lynxes was very similar (Table 3) and statistically significant differences were not found either in stomach contents or consumed biomass (U-test, $P > 0,05$).

Table 1 Diet composition of lynx in Latvia from 2000 to 2010

Food item	Frequency of occurrence, %	Stomach content biomass, %
Roe deer	73,3	61,0
Unidentified cervids	16,8	30,9
Small rodents	3,1	0,5
Hares	3,1	3,1
Beaver	2,3	1,9
Domestic birds	1,5	1,5
Wild boar	0,8	0,4
Racoon-dog	0,8	0,8
Earthworms	0,8	0,01

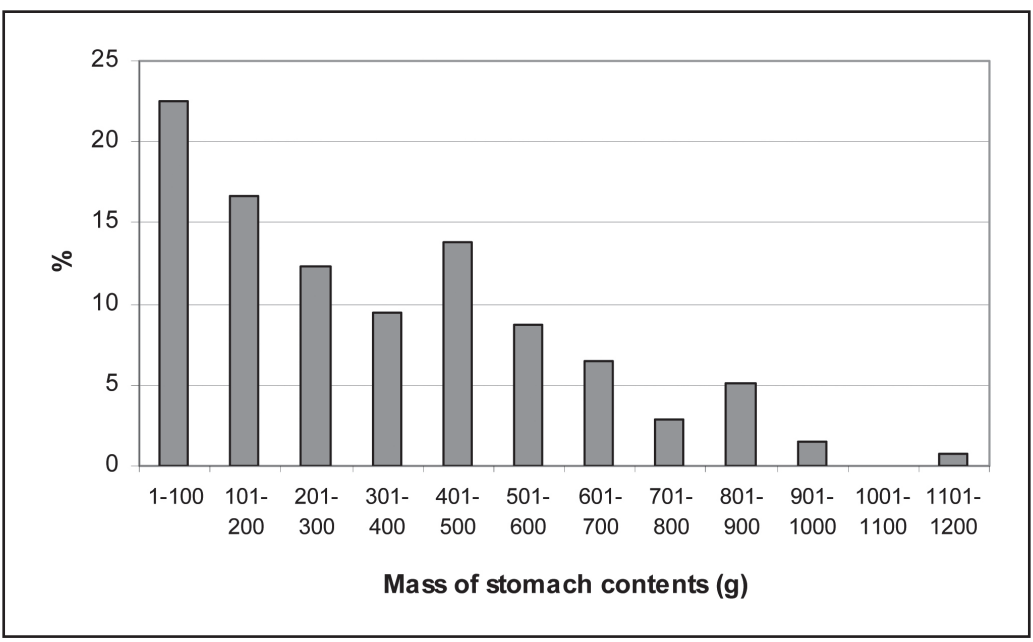

Fig. 3 Distribution of biomass from examined stomach contents (totally empty stomachs are excluded)

The average mass of stomach contents of male lynxes was larger (367,1 g; 6–1165 g) than that of female lynxes (313,8 g; 5–930 g). No significant differences were found in percentage of empty stomachs between male (28,9 %) and female (30,9 %) lynxes ($P > 0,1$).

Some differences were found in diet of lynxes from eastern and western parts of Latvia (Table 4). Consumption of cervids was higher in the west, also hares were found only in stomachs from west Latvia, while small rodents, beavers and wild boar were found in stomachs from east Latvia. Nevertheless no statistically significant differences (U-test, $P > 0,05$) were found in frequencies of food items, total consumed biomass, biomass of consumed cervids or other food items.

The average mass of stomach contents in the eastern part (342,3 g; 5–1165 g) was slightly higher than in the western one (303,0; 15–835 g). Percentage of empty stomachs in the east was noticeably higher (33,5 %) than that in the west (20,5 %), however differences were not statistically significant ($P > 0,1$).

Table 2 Diet composition of young and adult lynxes

Food item	Lynx under age 1		Adult lynx	
	Frequency of occurrence, %	Stomach content biomass, %	Frequency of occurrence, %	Stomach content biomass, %
Roe deer	75,0	62,7	73,4	62,0
Unidentified cervids	9,4	21,6	19,0	31,0
Small rodents	3,1	0,1	2,5	0,2
Hares	3,1	0,9	3,8	4,4
Beaver	-	-	2,5	2,2
Domestic birds	6,3	8,2	-	-
Wild boar	3,1	2,1	-	-
Racoon-dog	3,1	4,3	-	-
Earthworms	3,1	0,04	-	-

Table 3 Diet composition of male and female lynxes

Food item	Male lynx		Female lynx	
	Frequency of occurrence, %	Stomach content biomass, %	Frequency of occurrence, %	Stomach content biomass, %
Roe deer	68,0	49,5	76,3	67,4
Unidentified cervids	20,0	42,9	15,0	24,2
Small rodents	4,0	0,5	1,3	0,5
Hares	4,0	2,2	2,5	3,6
Beaver	2,0	1,3	2,5	2,3
Domestic birds	2,0	1,5	1,3	1,5
Wild boar	-	-	1,3	0,6
Racoon-dog	2,0	2,1	-	-
Earthworms	-	-	1,3	0,01

Table 4 Diet composition of lynxes in east and west parts of Latvia

Food item	East Latvia		West Latvia	
	Frequency of occurrence, %	Stomach content biomass, %	Frequency of occurrence, %	Stomach content biomass, %
Roe deer	75,9	74,6	72,5	57,6
Unidentified cervids	6,9	11,8	19,6	35,6
Small rodents	10,3	1,9	1,0	0,1
Hares	-	-	3,9	3,9
Beaver	10,3	9,8	-	-
Domestic birds	-	-	2,0	1,8
Wild boar	3,4	1,9	-	-
Racoon-dog	-	-	1,0	0,9
Earthworms	-	-	1,0	0,01

Discussion

Similarly to other European countries main prey for lynx in Latvia are wild ungulates, mostly roe deer (Breitenmoser 1993, Nowicki 1997, Okarma et al. 1997, Jobin et al. 2000, Bluzma 2003, Kozlo 2003, Valdmann et al. 2005, Odden et al. 2006, Sidorovich 2006).

Unlike in some northern parts of Europe and Russia where hares comprise relatively large part of lynx diet (Nowicki 1997, Danilov et al. 2003, Matyushkin et al. 2003, Valdmann 2003), in Latvia hares are rarely found in the diet of this predator. It can be due to the availability of various prey species in the country. Hare density in Latvia has declined since early 20th century (Taurins 1975) and nowadays it is still rather low. That might explain low percentage of hares in lynx diet and during this research period it has decreased even more compared to the previous studies of lynx diet in Latvia in late 1990s (Andersone et al. 2003).

Occurrence of other food items is similar to the data from other studies of lynx diet in Europe and Russia (Nowicki 1997, Jędrzejewska, Jędrzejewski 1998, Jobin et al. 2000, Danilov et al. 2003, Kozlo 2003, Valdmann et al. 2005). No wild birds where found in winter diet of lynx in Latvia although as seen in other studies birds can constitute a rather notable part of the lynx diet (Nowicki 1997, Danilov et al. 2003, Matyushkin et al. 2003).

In comparison with the previous study of lynx diet in Latvia, consumption of ungulates is slightly higher in this research period which might be due to the increase of ungulate density since the beginning of 2000s. Also more food items (e.g. wild boar, small rodents, beavers, racoon-dog) were found in lynx diet in this research period than in the previous one, however this is most likely because of a larger sample size and not so much because of the actual changes in lynx diet during last decade. In any case contribution of small prey items to consumed biomass was low and rather insignificant in relation to the main food items.

While lynxes can do noticeable damage to livestock in some regions of its distribution (Stahl 2001, Odden et al. 2002, Vengušt 2006) no actual depredation upon domestic animals was found in our study. In two cases when chicken remains were found in stomachs of young lynxes it is know that animals were feeding at a garbage site. Data from State Forest Service report that lynx depredation on domestic animals in last ten years has been recorded only twice in Latvia (SFS data). Accordingly lynx do not posses serious threats to domestic animals.

Although the average mass of the stomach contents was lighter than found in previous study, percentage of empty stomachs, especially in female lynxes, was lower than it was recorded

earlier (Valdmann et al. 2005). This may indicate that feeding conditions of lynxes in Latvia during winter season currently has improved as prey base of wild ungulates has increased during the last decade.

Differences between diets of young and adult animals could be expected as young animals do not have hunting skills as good as adults and thus they might choose to hunt smaller prey (Okarma et al. 1997). Significant differences found in total consumed biomass and in consumed biomass of cervids between young and adult animals show that although cervids are still primary prey for young animals they also rely more on other food items (e.g. wild boar, racoon-dog, domestic birds, earthworms) than adult lynxes. However beavers were found only in the diet of adult lynxes. Most likely kittens lack hunting skills to catch beavers while individual adult lynxes might have specialized on hunting those animals.

Percentage of the roe deer was slightly higher in diet of young animals while percentage of unidentified cervids (part of which might be red deer) was higher in adult lynxes. It is more likely that only adult lynxes would choose to prey on red deer and even then they usually select fawns and hinds (Okarma et al. 1997, Kamler et al. 2004).

More differences might have been found in diet of subadults, however sample size of this age group was too small to do a qualitative comparison.

Kittens in the beginning of their life mostly depend on their mothers. Accordingly mother provides food for them (Jędrzejewska, Jędrzejewski 1998, Tumanov 2003) and in most cases young lynxes have difficulties to survive on their own if they lose their mother. As seen in our study, when left alone, young lynxes are sometimes forced to feed on garbage or other unsuitable items. Rubber and wood chippings were found in stomachs of two young animals. One with the rubber in its stomach was found dead from starvation in late October. Most likely young animal had lost its mother and had not managed to get any prey on its own. In other cases stomachs of two young lynxes contained remains of chickens found at a garbage site. Both of the kittens were shot at the same location and most likely were siblings, who also might have lost their mother at the beginning of the hunting season. Mortality of young lynxes in Latvia is rather high (Ozoliņš et al. 2007) and obviously early loss of mother due to the hunting or other reasons contributes to it.

More diversity was expected between male and female diets as female lynxes often has kittens to feed and their diet could be more diverse due to the increased need of food (Jędrzejewska, Jędrzejewski 1998), yet their diets were rather similar. However when comparing diet of only adult males and diet of adult females combined with young lynxes, it can be seen that diet of males consist only of cervids, hares and rodents, while diet of females and kittens is more diverse, suggesting that family groups and single females kill more small prey, as found also in other studies (Jędrzejewska, Jędrzejewski 1998).

In the diet of female lynxes percentage of identified roe deer remains is higher than in the diet of male lynxes. Most likely females similarly to the young lynxes choose to prey upon roe deer more specifically than male lynxes, while males are more likely to prey on red deer from time to time (Okarma et al. 1997)

Unlike in Estonian study, where wild boar was found only in diet of male lynxes (Valdmann et al. 2005), we found remains of a wild boar in a stomach of a young female lynx.

Geographical differences in lynx diet in certain regions were observed in several studies (Danilov et al. 2003, Molinari-Jobin et al. 2007).

These differences usually were caused by the most available prey species in the region or in some occasions by the behaviour of a certain prey species in different habitats (Molinari-Jobin et al. 2007). Lynx diet in Latvia did not differ much geographically and the reason for it might be the distribution of their preferred prey – roe deer. While distribution of other wild ungulates changes from west to east of the Latvia, roe deer is abundant all over the country. Differences in other food items were not that significant so as to indicate any variety in lynx diet between east and west parts of Latvia. Also percentage of empty stomachs did not differ significantly. Accordingly general feeding conditions of lynxes are good all over the country.

Conclusions

Our study shows that feeding conditions of lynxes in Latvia at least in winter season are good and availability of prey should not be in any way limiting factor to the lynx population. However it would be useful to continue to survey lynx feeding habits including study of their diet in summer season. Also more thorough analyses could be done to compare diets of lynx and wolf in order to get a better idea of the food competition between these predators.

Acknowledgements

We thank the Latvian Foundation of Game Management Development and the Grant of the Science Council for our financing, and countless colleagues for providing technical assistance, in particular A. Zvirbulis, A. Mačtams, A. Upenieks and A. Strazds.

Summary

Diet of lynx *Lynx lynx* in Latvia was studied from 2000 to 2010 and was based on analyses of 203 stomachs. Wild ungulates (mostly roe deer) were the main food of the lynxes. Cervids were found in 90,1 % of samples (91,9 % biomass). Other food items (hares, small rodents, beavers, racoon-dogs, domestic birds and earthworms) did not exceed 3,1 % of occurrence and of stomach content biomass. The average mass of stomach contents was 333,5 g and 31 % of all stomachs were empty.

Statistically significant differences were found comparing variances of total stomach content biomass and biomass of consumed cervids between kittens and adult animals. There were no other significant differences in diet composition, stomach content biomass and percentage of empty stomachs between kittens and adult animals, between sexes and between east and west parts of Latvia.

General feeding conditions of lynxes in Latvia are good and availability of prey should not be in any way limiting factor to the lynx population.

References

Andersone, Z.; Ozolins, Ya.; Pupila, A. & Bagrade, G. (2003): Latvia. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 92–105. – Nauka, Moscow (in Russian with English summary).

Bluzma, P. (2003): Lithuania. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 105–117. – Nauka, Moscow (in Russian with English summary).

Breitenmoser, U.; Haller, H. (1993): Patterns of predation by reintroduced European lynx in the Swiss Alps. – J. Wildl. Manage. **57** (1): 135–144.

Danilov, P.I.; Rusakov, O.S.; Tumanov, I.L.; Belkin, V.V. & Makarova, O.A. (2003): The north-west of Russia. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 31–52. – Nauka, Moscow (in Russian with English summary).

Fowler, J.; Cohen, L. & Jarvis, P. (2006): Practical Statistics for Field Biology. 2nd ed. – Wiley, Chichester.

Herfindal, I.; Linnell, J.D.C.; Odden, J.; Nilsen, E.B. & Andersen, R. (2005): Prey density, environmental productivity and home-range size in the Eurasian lynx (*Lynx lynx*). – Journal of Zoology. **265**: 63–71.

Jędrzejewska, B.; Jędrzejewski, W. (1998): Predation in Vertebrate Communities: The Bialowieza Primeval Forest as a Case Study. – Springer Verlag, Berlin.

Jobin, A.; Molinari, P.; & Breitenmoser, U. (2000): Prey spectrum, prey preference and consumption rates of Eurasian lynx in the Swiss Jura Mountains. – Acta Theriol. **45** (2): 243–252.

Kamler, J.F.; Jędrzejewska, B. & Miścicki, S. (2004): Red deer – a tale of two deer. – In: Jędrzejewska, B. & Wojcik, J.M. (eds.): Essays on Mammals of Białowieża Forest: 51–58. – Mammal Research Institute, Polish Academy of Science, Białowieża.

Klevezal, G.A. (1988): [Age related structures in mammals for zoological studies.] – Nauka, Moskow (in Russian).

Kozlo, P.G. (2003): Byelorussia. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 118–137. – Nauka, Moscow (in Russian with English summary).

Liepa, I. (1974): Biometrija. – Zvaigzne, Rīga. (in Latvian)

Matyushkin, E.N.; Vaisfeld, M.A. & Neifeld, N.D. (2003): The North and North-East of European Russia. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 52–85. – Nauka, Moscow (in Russian with English summary).

Molinari-Jobin, A.; Zimmermann, F.; Ryser, A.; Molinari, P.; Haller, H.; Breitenmoser-Würsten, Ch.; Capt, S.; Eyholzer, R. & Breitenmoser, U. (2007): Variation in diet, prey selectivity and home-range size of Eurasian lynx *Lynx lynx* in Switzerland. – Wildlife Biology **13**: 393–405.

Nowicki, P. (1997): Food habit and diet of the lynx (*Lynx lynx*) in Europe. – J. Wildl. Res. **2** (2).

Nybakk, K.; Kjelvik, O.; Kvam, T.; Overskaug, K. & Sunde, P. (2002): Mortality of semi-domestic reindeer

Rangifer tarandus in central Norway. – Wildlife Biology **8**: 63–68.

Odden, J.; Linnell, J.D.C.; Fossland Moa, P.; Herfindal, I.; Kvam, T. & Andersen, R. (2002): Lynx depredation on domestic sheep in Norway. – J. Wildl. Manage. **66** (1): 98–105.

Odden, J.; Linnell, J.D.C. & Andersen R. (2006): Diet of Eurasian lynx, *Lynx lynx*, in the boreal forest of southeastern Norway: the relative importance of livestock and hares at low roe deer density. – Eur. J. Wildl. Res. **52**: 237–244.

Okarma, H.; Jędrzejewski, W.; Schmidt, K.; Kowalczyk, R. & Jędrzejewska B. (1997): Predation of Eurasian lynx on roe deer and red deer in Białowieża Primeval Forest, Poland. – Acta Theriologica **42**: 203–224.

Ozoliņš, J.; Bagrade, G.; Ornicāns, A.; Pupila, A. & Vaiders, A. (2007): Lynx (*Lynx lynx*) conservation plan. Latvian State Forest research Institute „Silava", Salaspils.

Schmidt, K.; Jędrzejewski, W. & Okarma, H. (1997): Spatial organization and social relations in the Eurasian lynx population in Białowieża Primeval Forest, Poland. – Acta Theriologica **42** (3**)**: 289–312.

Sidorovich, V.E. (2006): Relationship between prey availability and population dynamics of the Eurasian lynx and its diet in northern Belarus. – Acta Theriologica. **51** (3): 265–274.

Stahl, P.P.; Vandel, J.M.; Herrenschmidt, V. & Migot, P. (2001): Predation on livestock by an expanding reintroduced lynx population: long-term trend and spatial variability. – Journal of Applied Ecology. **38**: 674–687.

Taurins, E. (1975): [Game fauna in the Latvian SSR and its rational use in future]. – Okhrana i vosproizvodstvo prirodnykh resursov (Trudy LSHA) **83**: 18–28 (in Russian with English summary).

Teerink, B.J. (1991): Hair of West-European Mammals. – Cambridge University Press, Great Britain.

Tumanov, I.L. (2003): Biological characteristics of carnivores mammals of Russia. – Nauka, Saint-Petersburg (in Russian).

Timm, U.; Pilāts, V. & Balčiauskas, L. (1998): Mammals of the East Baltic. – Proc. Latvian Acad. Sci., Section B. – **52** (1/2): 1–9.

Valdmann, H. (2003): Estonia. – In: Matyushkin, E.N. & Vaisfeld, M.A. (eds.): The lynx. Regional features of ecology, use and protection: 85–92. – Nauka, Moscow (in Russian with English summary).

Valdmann, H.; Andersone-Lilley, Z.; Koppa, O.; Ozolins, J. & Bagrade, G. (2005): Winter diets of wolf *Canis lupus* and lynx *Lynx lynx* in Estonia and Latvia. – Acta Theriologica. **50** (4): 521–527.

Vengušt, G.; Bidovec, A. & Pogačnik, M. (2006): Damage caused by large carnivores on domestic grazing animals in Slovenia. – Slov Vet Res. **43** (4): 169–75.

Žunna, A.; Ozoliņš, J. & Pupila, A. (2009): Food habits of the wolf *Canis lupus* in Latvia based on stomach analyses. – Estonian Journal of Ecology. **58** (2): 141–152.

Address:

Agrita Žunna
Latvian State Forest Research Institute „Silava"
Rīgas iela 111, Salaspils
LV-2169
Latvia
E-Mail: inst@silava.lv