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The effect of hunting on sex ratio in populations of ungulates in Middle Urals

Key words: Moose, Wild Boar,
Sibirian Roe Deer, sex ratio, Ural, Russia

The problem of conformity of the structure of hunting bag to the structure of real population in ungulates has been widely discussed in literature. A number of authors recognize the fact of perversion of the hunting sample structure because of prevalent shooting of the animals of certain sex and age (BUTURLIN, 1934; JAZAN, 1967; JURGENSON, 1968; GLUSHKOV, 1975, 1982; TIMOFJEEVA, 1974; VERESCHAGIN, RUSAKOV, 1979 and many others). The majority of researchers think the adult animals to be a group, shot selectively in the ungulates populations in the absence of limitations differentiating the hunting on youngs and older individuals. Concerning the selected pressure of hunting on different sexes the common-accepted point of view falls to of prevalent shooting of males for at least one species – the moose (*Alces alces* L.). Some authors report about possibility of prevalent extraction of males while hunting the wild boar (BRIEDERMANN, 1986; PROSTAKOV, 1996).

The prevalent extraction of representatives of one intrapopulational group sooner or later will lead to increasing of the proportion of others, in particular, the mentioned higher prevalent extraction of males in moose and wild boar populations must lead to increasing the proportion of females.

The analysis of large number of work of the researchers, devoted to evaluation of sex ratio in moose population, shows rather inconsistent picture of dynamics of this parameter. During the period covered by researches (about 30 years, 50-s, 60-s and 70-s) no shift of sex ratio to prevalence of females has been detected on the main part of a species distribution area. The significant change in sex ratio has been observed only as a result of a legal limitation of shooting the females (such a practice took place in a number of region, in particular in the beginning of XX century).

So, E. K. TIMOFJEEVA (1974) analyzing such cases notices that such measures can lead to a significant perversion of a population structure towards an increase the proportion of females (up to ratios of 1:2,4; 1:3 and even 1:9). This, in turn, can lead to decreasing of reproductive potential and degradation of population, especially taking into account the absence of clear polygamy in mooses.

Comparing the data on male/ female relation in hunting bags (55,5% of males) and based on visual observations of animals (52,1%) in Leningrad region in 1960-s, E.K. TIMOFJEEVA concludes that males seem to be a selectively shot group. Analyzing the data of other authors she resumes that prevalence of males in populations can be observed only on part of species distribution area.

According to data analyzed by V. N. BOLSHAKOV and B. S. KUBANTSEV (1984) in the majority of moose populations the prevalence of females

had been observed, however it's necessary to mention that the proportion of females did not exceed 60%. According to a literature data, reviewed by N.L. LEBEDEVA (1986) the prevalence of females among adult animals had been marked in 5 cases from nine. V. D. KHERUVIMOV (1969) analyzing the sex ratio in moose population in Tambov region (European part of Russia), notes that prevalence of females in population was fixed basing either on data from visual observations and total shooting.

In general, analysis of literature data allows to suggest that predominant shooting of males does not lead to a significant perversion of moose's population structure. Some prevalence of males in embryos (average 53-54% with variation from 46 to 58 percent; TIMOFJEEVA, 1984; VERESCHAGIN, RUSAKOV, 1979) was compensated by predominant shooting of adult males and, with existing in those years low hunting quotas, led to a relatively low domination of females in population.

The sex ratio in the populations of European and Siberian roe deer is also shifted to females. In Europe and on the most of European part of Russia the proportion of females among roe deers varies from 54 to 68 percent (GEPTNER et al., 1961). According to the data of T. RANDVEER (1989) in Estonia this value is about 64,5%, and in Denmark male/female relation is equal to 1:2 (STRANDGAARD, 1972, cit. by FILONOV, 1993). The prevalence of male among adult animals was marked only in Swedish population of roe deer (BORG, 1970, cit. by FILONOV, 1993). The situation in populations of Siberian roe deer is, in fact, identical to the ones of European roe deer. The data on sex ratio of roe deers in Il'mensky Nature Reservation (South Urals) shows the prevalence of females since the middle of 40-s (USHKOV, 1947; AVERIN, 1949), in the end of 60-s the proportion of this sex in the population was 69% (DVORNIKOV, 1984). In Khingansky Nature Reservation (Far East of Russia) the proportions of males and females were respectively 45 and 55 percent (DARMAN, 1986). The same data on South Siberia reports M. N. SMIRNOV (1978). In support of the trend for prevalence of females in roe deer populations it's necessary to note that the data presented by A. A. DANILKIN (1992) shows that not depending of population density the proportion of females is always equal or higher then the one of males.

The estimations of the sex ratio in wild boar's populations in Europe and European part of Russia shows, that it is close to 1:1 (BRIEDERMANN, 1986; PROSTAKOV, 1996) or the prevalence of males is observed (IVANOVA, 1980, VATOLIN, 1980 and others). The analysis of hunting bags made by these authors had shown an absolute prevalence of males (the male/female ratio in most samples is not lower than 2:1). The study of sex ratio dynamics in real populations, based on data obtained from visual observations, made by N. N. PROSTAKOV (1996), had shown an increased proportion of males in hunting bags in compare to natural population. It allowed this author to make a conclusion about the selective shooting of males. The same conclusion was made by L. BRIEDERMANN (1986) comparing the proportion of sexes among shot and captured animals. However, O. S. RUSAKOV and E. K. TIMOFJEEVA (1984) after analyzing the changes in sex ratio in the hunting samples from North-West of Russia taken on the different phases of population dynamics, had marked a constancy of males' prevalence and an absence of a shift to females. Basing on these results they supposed that a higher proportion of males seems to be typical feature of the northern population of Sus scrofa and the dominance of male in hunting samples does not indicate increased hunting pressure on them.

In this paper we 've tried to analyze the dynamics of sex ratio among adult animals of three ungulate species, living on the territory of Sverdlovsk region (Eastern part of Middle Urals), estimate the direction of selective shooting, arising from a number of reasons and the consequences of possible selective extraction of one of the sexes.

Material and methods

The system of exploitation of ungulates populations is based on selling of individual or group licenses (or permissions) which in Soviet time were divided to „permissions for sports hunting" (further „sports licenses") and „the licenses for professional hunting" (further „professional permissions"). In the last case the hunter had to sale the meat of the shot animal to the state

Table 1 The number of animals, the data on which had been used for analysis.

	83/84	84/85	85/86	88/89	90/91	91/92	92/93	93/94	94/95	95/96
Moose	>2000	>2000	>2000	1897	-	-	2823	2799	1689	1213
Wild boar	-	-	-	-	289	-	255	358	261	260
Roe deer	-	-	-	-	-	565	530	593	-	-

organization, while in case of hunting with sports license the hunter paid money for the possibility of hunting itself and could use the meat for his own purposes. Until 1996 the main factor managing the hunting impact on animals populations was the shooting quota, which did not exceed in average 10-15% of the total animals number for moose and 20-30% for the roe deer and wild boar. During the study period no legal limitations for shooting the animals on age and sex had been constituted.

For the analysis we used the data about the date of getting the game, sex and age of shot animal that the hunter had to fix in a special form (on the license), which they return to hunting authorities. The number of analyzed licenses is presented in Table 1.

The fact of prevalent shooting of one of intrapopulational groups had been identified by method, suggested by V. S. SMIRNOV and N. S. KORITIN (1979). The idea of this method is that the lack of selective extraction could be indicated by determining occasional or not changing ratio of structural groups among the animals got in the beginning, middle and the end of hunting season. The prevalent extraction could be indicated by finding the decreasing of the proportion of some structural group during the hunting season. In this case the perversion of a real population structure in a hunting bag will be exposed in a sample taken in the beginning of hunting season with the high general level of a hunting pressure on the population. The main condition for using this approach is the suggestion that the excess of probability of shooting the animal belonging to a selectively extracted group on the probability of shooting the animal from non-selectively extracted group is constant during the whole hunting season.

In this study the hunting season had been divided into three parts. The division was based not on chronological principle, but on the number of shot animals in order to smooth out the differences in hunting pressure and also because of variations in the duration of hunting season in different years.

Since 1996 the prohibition of shooting the adult females and separate quotas for adult and young animals (with significant increasing of proportion of juveniles) were established for all three species.

Results

The regular censuses of the number of animal in ungulates populations are made in Sverdlovsk district since the end of 50-s according to unified for Soviet Union and then for Russia method which is called „winter route censuses" (Metodicheskije ukazanija..., 1990). This method is based on calculating the number of new (less than 24 hours old) animal tracks per route unit. The analyses of censuses data falls down to recalculation of the number of tracks to a number of individuals, taking into account the average daily movement length of the animal.

The moose population size in Sverdlovsk district varied in the following way. After reaching a relatively high level (about 20.000 individuals) in the end of 50-s – beginning of 60-s, in the end of 60-s the number of animals sharply decreased (Fig.1). After this a long slow growth was observed till the beginning of 80-s. The number of animals reached its peak value – 27.000 individuals – in 1983. In the end of 80-s the population size again decreased approximately to a level of 20.000 animals. Since that time the process of a catastrophic decline of moose population, only once broken by non-significant growth in 1995, has been observed. In total, in 1997 the moose population presented about 55-60% from maximum reached in 1983.

The abundance of roe deer population in Sverdlovsk region for a long time stayed on a relatively low level, about 4000 individuals (the

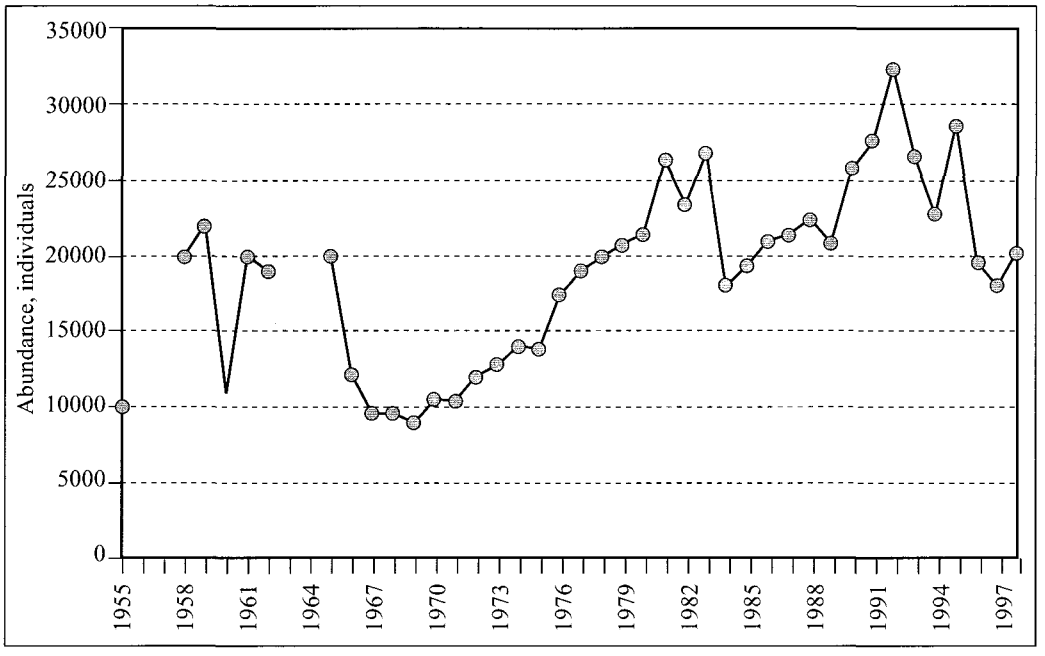

Fig. 1 Dynamics of moose population abundance in Sverdlovsk district

authors possess the data since the end of 60-s, Fig. 2). The explosive population growth began since 1990, the peak value of 15.000 individuals was reached in 1994. The period of population growth coincided with the increasing of animals' number in the areas bordering with Sverdlovsk district in South – Kurgan and Chelyabinsk districts.

The wild boar is a new species of Middle Urals fauna. The settling of Sverdlovsk region by the wild boar was a result either of its introduction and species natural expansion to the northern and north-eastern parts of Russia. The works on its introduction took place in 70-s, independently, at the same time several reports of the animals' runs-in to the territory of Sverdlovsk region were made (Markov, 1997a, 1999). After reaching the peak value in 1991 the population of wild boar in the study area has been declining until 1993 and then after some growth in 1994 a decreased animals' abundance took place again (Fig. 3). Hunting the wild boar has been allowed since 1987.

Our results show that sex ratio in the hunting samples of moose is significantly shifted to males. In this sense our data coincides with the data of a number of cited authors. The difference of our data from the information presented by other researchers fall down to the observed trend of monotonous decreasing of the proportion of adult females in the hunting bags during 12-year period from 1983 to 1996 (Table 2), which was only slightly broken in the hunting seasons of 1992-1993 and 1993-1994. In total, the proportion of females in hunting bag decreased from 45,6% in the hunting season of 1983-1984 to 37,2% in the season of 1995-1996. In other words, during a 12-year period the proportion of females decreased for 9%. The reliability of the process is based on the large bulle of the analyzed samples.

The same process of female proportion decrease in hunting bags with time is observed in wild boar but its intensity is even high than in moose. Since 1990 during 6 hunting seasons the proportion of females in a sample decreased from 37,4% to 25,8%, i. e. for 11% (Table 3).

The question could be asked whether we really observe the process of decreasing of adult females proportion in the population or a low proportion of females in hunting samples presents an artifact resulting from a prevalent shooting of males.

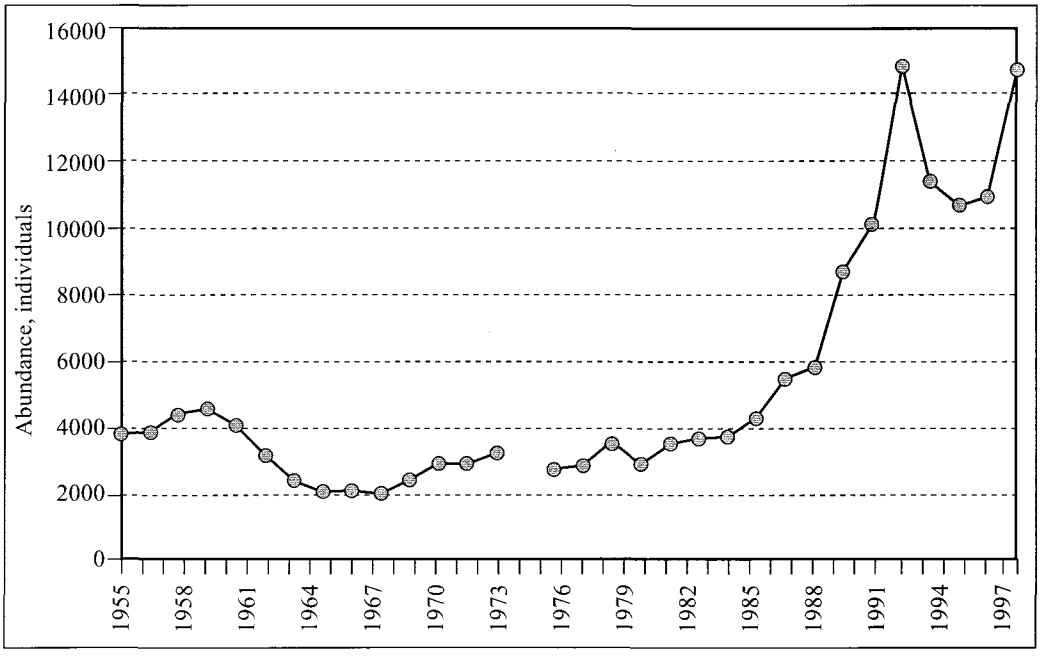

Fig. 2 Dynamics of roe deer population abundance in Sverdlovsk district

Let's examine how the adult females proportion among shot animals changes during the hunting season. Let's also keep in mind that the absence of any changes or random changes will indicate the absence of prevalent extraction. The decreasing of proportion of females during the season will indicate the increased pressure of hunting on this group. Fig. 4 presents the dynamics of the proportion of adult females in moose hunting sample in the beginning, the middle and the end of hunting season. As could be seen, in all 5 studied seasons a slight but clear decraese of proportion of females from the beginning to the end of the season could be observed. These results appeared to be indentical to the ones received before using a different method of data analysis (POGODIN, KORITIN, 1997).

Rather clear trend of decreasing of the proportion of adult females could also be observed in the hunting samples of roe deer (Fig.5). The samples of three hunting seasons were analyzed and in all of them the trend of decreasing of proportion of this group from beginning to the end of season, indicating the prevalent shooting of females could be seen.

Table 2 The sex ratio of the adult moose shot in Svedlovsk region

Hunting season (year)	1983/84	1984/85	1985/86	1988/89	1992/93	1993/94	1994/95	1995/96
The proportion of females	0,456	0,438	0,427	0,415	0,437	0,438	0,392	0,372
Total number of shot animals	>2000	>2000	>2000	1897	2823	2799	1689	1213

Table 3 The sex ratio of adult wild boars shot in Sverdlovsk region

Hunting season	90/91	92/93	93/94	94/95	95/96
The proportion of females	0,374	0,345	0,3	0,28	0,258
Total number of animals shot	289	255	358	261	260

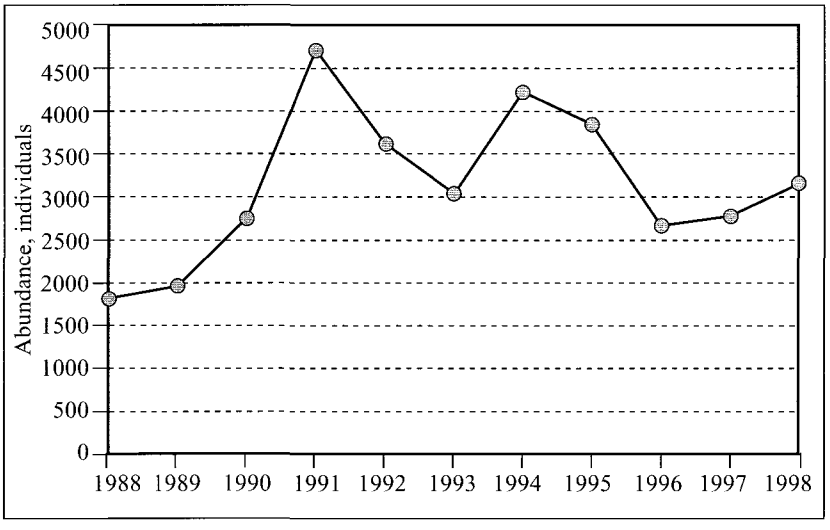

Fig. 3 Dynamics of wild boar (Sus scrofa) population abundance in Sverdlovsk district

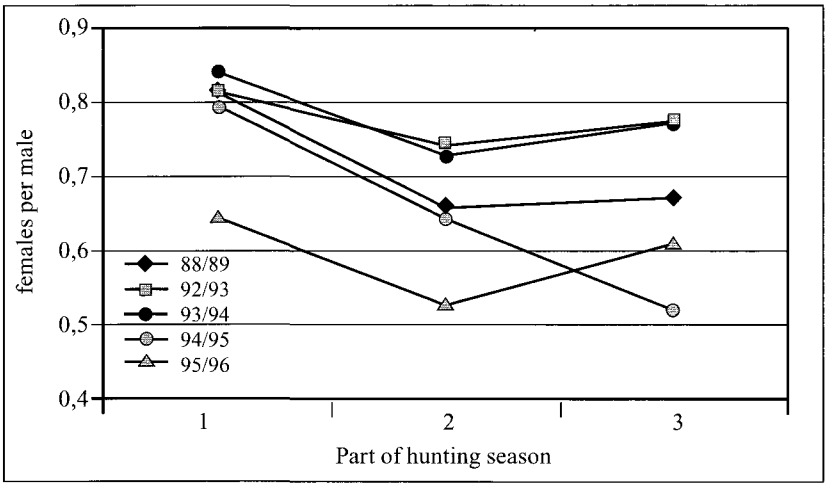

Fig. 4 Changes of sex ratio in the hunting samples of moose during the hunting period

A more contradictory picture exists in the hunting samples of wild boar (Fig.6). In the first season the increasing of the proportion of adult females in the end of hunting season could be seen, which certainly indicates a prevalent extraction of males. In the second season the proportion of females remains almost constant during the whole period of hunting. The last three seasons demonstrate a clear trend to decreasing of the proportion of adult females from the beginning to the end of the hunting season.

So, in two of the three studied ungulate species inhabiting the territory of Sverdlovsk region, in particular in moose and roe deer an inarguable picture of decreasing of the proportion of adult females from the beginning to the end of hunting season could be observed. Analysis of data on wild boar hunting samples shows that in three of five analysed hunting seasons the decrease of the proportion of females from the beginning to the end of seasons could be observed and only in one the decrease of the proportion of males had been detected.

These results allow to conclude about the prevalent shooting of adult females in the ungulates' populations in Sverdlovsk district.

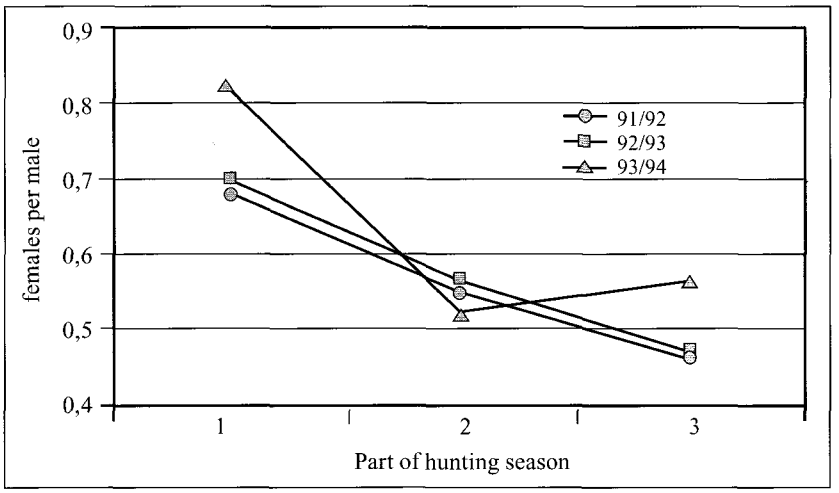

Fig. 5 Changes of sex ratio in the hunting samples of roe deer during the hunting period

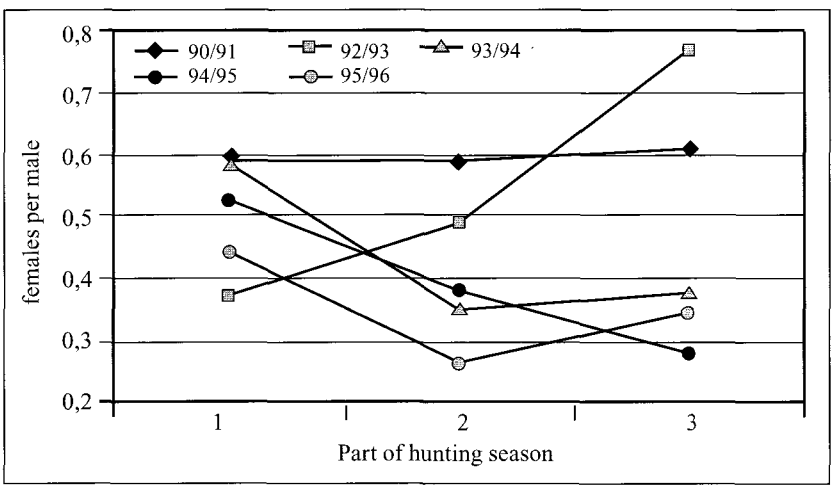

Fig. 6 Changes of sex ratio in the hunting samples of wild boar during the hunting period

The observed change in proportion of females in the end of hunting season in comparision with the beginning of it is rather low which indicates a low value of the shooting selectivity. In other words the excess of probability of shooting a female in case of selective shooting above the one in case of non-selective hunting in considered case is rather low (in comparision to such process in carnivores' populations, see SMIRNOV, KORITIN, 1979), and the consequences of this process can have an effect after years. This also is promoted by a general rather low intensity of withdrawal of ungulates, which, say, for the moose made in Sverdlovsk area on the average not more than 10-15 %.

The selectivity of shooting the ungulates can result from a number of factors. They can be united in three large groups. The first group, according to V. S. SMIRNOV and N. S. KORITIN (1979), is formed by natural factors. They include the differences in wariness at animals of different sex, in daily movement length etc. A few publications on this subject (TIMOFJEEVA, 1974; NIKULIN, 1978) report that daily movement length of adult moose males is slightly higher in comparision to females. On the other

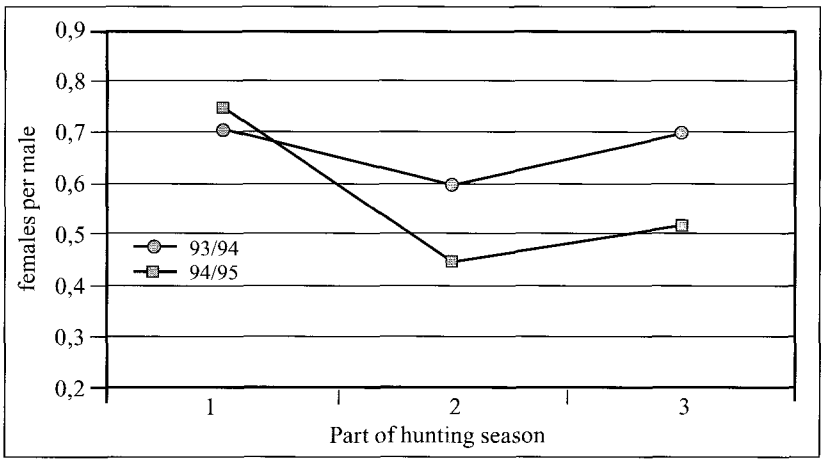

Fig. 7 Changes of sex ratio during the hunting season in the samples of moose shot under professional licenses

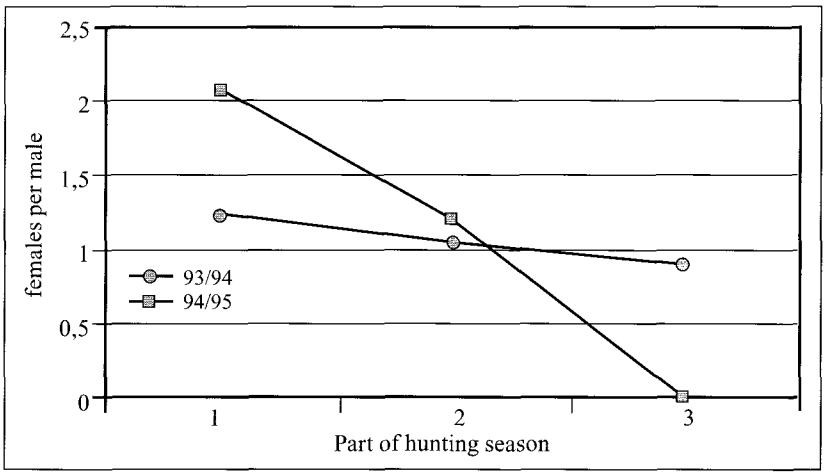

Fig. 8 Changes of sex ratio during the hunting season in the samples of moose shot under sports licenses

hand, N. M. GORDIJUK (1993, 1994) analyzing a big set of data showed that on the protected territories the daily movement length of adult female moose is much higher than the one of male. E. S. KANAKOV discovered a significant difference in biotopical preferences of mooses of different sex: the sex ratio in the groups of animals inhabiting the pine forests was significantly shifted to males, and among the animals that lived in leafy forests females made a majority.

The differences in behavior between males and females was also shown for roe deer. Thus, a number of authors (FLINT, KRZYWINSKY, 1997; SAN JOSE, LOVARI, FERRARI, 1997; TURNER, 1978, cit. by TIMOFJEEVA, 1984) report on a higher activity of males at rut time and in sever winters and a higher tendency of males to solitary living.

Marked differences in activity between males and females were reported also for wild boar. Thus A. A. VORONIN (1980) presents data that the daily movement length of a group of animals consisting of adult females and offsprings is about 10-12 km, while a daily movement length of adult males does not exceed 4,2 km. After disturbance the groups of the mentioned type move on distance of 10-12 km, while for adult males this distance was about 1-2 km and after disturbance they returned on the previous place. So, all the examined species are characterized by sex-connected differences in activity and

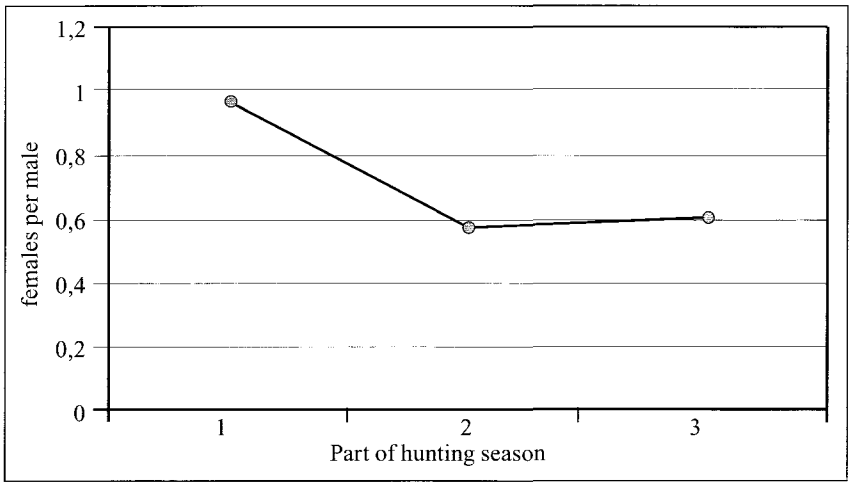

Fig. 9 Changes of sex ratio during hunting season 1990/91 in the samples of wild boar shot under sports licenses

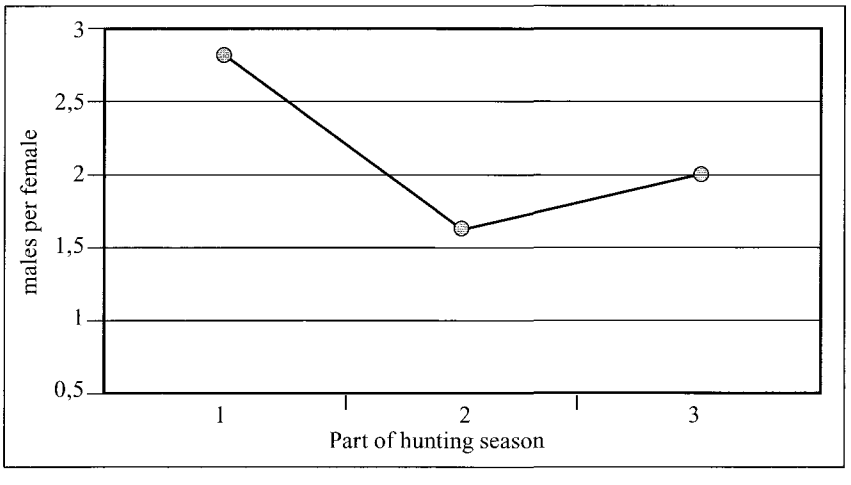

Fig. 10 Changes of sex ratio during hunting season 1990/91 in the samples of wild boar shot under professional licenses

biotopical distribution, which can cause the differences in probability of extraction between males and females during the process of hunting. The second group of factors includes the methods of hunting, which can lead to prevalent extraction of one or another intrapopulational group. Thus, hunting with dogs leads usually to a prevalent extraction of females both for moose and wild boar (SLUDSKIY, 1956; RUSAKOV, TIMOFJEEVA, 1984; ZAGUZOV, 1988; VARNAKOV, 1988; SMIRNOV, 1994, cit. by DANILKIN, 1998) especially if the females are with youngs. During the drive hunting sessions also the females are prevalently extracted (DANILKIN, 1998). It was shown by V. M. GLUSHKOV (1982) that a prevalent extraction of females in moose populations occurs at use of all main methods of hunting: drive, stalking, hunting with laika.

To the third group of factors we attribute the deliberate shooting of some structural group. It concerns mainly hunting for trophy. The effect of this factor could also be distinguished when analyzing the results of hunting under „sports licenses" and „professional permissions".

Various combinations of these factors in each case will determine the sex ratio in the hunting sample. N. K. VERESCHAGIN and O. S. RUSAKOV (1979) had showned that while hunting moose under sports licenses the sex ratio is shifted to females (57,4% of sample) and in case of hunting under „professional permissions" the proportion of this sex in the hunting bag is only

Table 4 The sex ration in the samples of moose hunted in sports purposes and for meat.

Hunting season	The number of licenses analyzed	The proportion of females in the sample	
		Under sports licenses	Under professional permissions
1993/94	2686	51,2	40,0
1994/95	1720	40,7	36,0

39,8%. Similar data were received by these authors also for wild boar.

The analysis of sex ratio made separately for moose hunted under sports and professional permissions had showned that in Sverdlovsk district a similar picture is observed (Table 4). The received differences are not so clear as the ones shown by N. K. VERESCHAGIN and O. S. RUSAKOV, but the general trend remains constant: the proportion of males is higher in the sample of animals shot under professional permissions, the females relatively prevail in the hunting bag of sports hunters.

However, a more detailed consideration of the sex ratio variation during the hunting season shows the following trends (Fig. 7). The number of females per one male among the animals shot under professional permissions in the season of 1993-1994 remained the same in the beginning and in the end of the period of hunting. In 1994-1995 this index slightly decreased to the end of hunting season. The dynamics of sex ratio among the moose shot under sports licenses demonstrate a clear trend of decreasing of proportion of females from the beginning to the end of hunting season (Fig. 8). And in 1994-1995 in the beginning of the hunting season the male/female index was 1:2,5 and in the end of hunting under sports permissions no females were shot. This results indicates a strong preference of hunters to shoot females while hunting moose under sports licenses.

We 've managed to conduct the similar data analysis of the wild boar data only for a single season – 1990-1991. The proportion of males among the animals hunted under professional permissions was 67,9%, for „Sports sample" it was slightly lower – 58,9%. During the hunting season the proportion of females shot under sports licenses decreased (Fig.9), and among the animals got under professional permissions the proportion of females increased and consequently the proportion of males decreased (Fig.10). It should be marked that since 1993 only the sports licenses for hunting the wild boar has been sold and this, probably, has determined a brightly expressed prevalent extraction of females in these hunting seasons. Thus the results of the study made allow to suppose that the decreasing of the proportion of females in the hunting samples of wild boar and moose which could be observed in Sverdlovsk district during the periods from consequently 1990 to 1996 and 1983 to 1996 does not present an artifact and actually results from decreasing of the proportion of this group in natural populations, which in turn results from tenuously expressed prevalent shooting of females. The prevalent extraction of animals of this sex is also typical for the roe deer population.

A gradual accumulation of deficit of females in moose population probably began before 1983. It is quite possible that in some parts of the study area the sex ratio in moose population is shifted to males even more than could be seen from the analyzed data. Undoubtedly, the long-term accumulation of deficit of females became one of the most important reasons of declining of the number of moose in Sverdlovsk region in last years.

Rather contradictive looks the fact of coincidence of the process of prevalent extraction of females from roe deer populations with rapid species' population growth observed in the beginning of 90-s. We suppose, that the reason of it consists, first, in the low proportion of animal shot to the general population size, and, secondly, in the fact that losses of reproductive potential of the population could be reduced by the animals, that migrated to southern parts of Sverdlovsk district from forest-steppe zone where the roe deer population density was and remains very high.

The non-similarity of changes of the proportion of females in the hunting samples of wild boar in the analyzed period is, probably, deter-

mined by differences in the relative number of animals hunted under sports and professional permissions. Thus, since the season of 1993-1994, when the wild boars were hunted only under sports licenses we can observe a clear trend to decreasing of the proportion of females during the period of hunting. In the season of 1990-1991, when the sex ratio in the total sample remained constant (Fig. 6), the proportion of females among the animals hunted under sports licenses decreased (Fig. 9), while among the wild boars hunted under professional permissions the decreasing of the proportion of males could be observed.

It is obviously important to mark, that the effect of a rather small selectivity of extraction of the adult females is amplified by the observed for all ungulates tendency to an increased pressure of hunting on adult animals. The aggregate effect of such impact results in common decline of the reproductive potential of populations of the moose, wild boar and roe deer, that is especially important for the last two species because of their relatively low density of their population in the areas near northern distribution line.

Summary

Paper analyses the effect of hunting on sex ratio and dynamics of populations of moose (*Alces alces* L.), wild boar (*Sus scrofa* L.) and Siberian roe deer (*Capreolus pygargus* Pall.) in the eastern part of Middle Urals. For all three species the prevalent extraction of females in compare with males is shown. The increased pressure of hunting on females is determined in great extent by the purpose of hunting: the selectivity of females' extraction is higher in case of sports hunting than in case of hunting for meat. The selectivity of females' extraction is rather low and the effect of this process could be exposed as a result of long-term accumulation of deficit of females. Supposed that this could be the reason of decrease of moose population in Middle Urals in recent years. The effect of rather low selectivity of females' extraction is strengthened by very high pressure of hunting on adult animals, leading to decreasing of the reproductive potential of ungulates' populations.

Zusammenfassung: Einfluss der Jagd auf das Geschlechterverhältnis in Schalenwildpopulationen im Mittleren Ural

Es wird der Einfluss der Jagd auf das Geschlechterverhältnis und die Dynamik der Populationen von Elch, Wildschwein und Sibirischem Reh im östlichen Teil des Mittleren Ural untersucht. Bei allen drei Arten wird die verstärkte Entnahme von Weibchen mit der Anzahl der Männchen verglichen. Ein ansteigender Jagddruck auf weibliche Tiere wird im großen Maße vom Jagdziel bestimmt. Die Selektion weiblicher Tiere ist bei der reinen Sportjagd höher als bei der Jagd auf Wildbret. Langfristig führt dies zu einem Defizit des weiblichen Geschlechts, was im Mittleren Ural beim Elch eine Ursache für den negativen Trend der Population sein könnte. Besonders der Jagddruck auf adulte Tiere führt zu einem Rückgang des Reproduktionspotentials der Schalenwild-Populationen.

Резюме

Исследования избирательности добычи копытных на Среднем Урале

Проанализировано влияние охоты на соотношение полов и численность популяций лося, кабана и косули в восточной части Среднего Урала (Свердловская область). По-казана наличие избирагельности добычи взрослых самок по сравнению с самцами у всех трех видов копытных. Данная избирательность обусловлена в значительной степени целями добычи животных избирательность добычи самок при спортивной охоте выше, чем при добыче животных с целью продажи мяса. В целом, избирательность изъятия самок относительно невелика и эффект данного процесса проявляется в ходе многолетнего накопления лефицита самок в популяции. Это могло быть одной из причин снижения численности лося в Свердловской области, произошедшего в последние годы. Эффект относительно небольшой избирательности добычи самок усиливается наблюдаемой для всех видов копытных тенденцией к побышенному
прессу охоты на взрослых животных. Совокупный эффект такого воздействия приводит к общему снижению репродуктивного потенциала популяций копытных.

Literature

AVERIN, JU. V. (1949): Ecologia kosuli (Capreolus capreolus pygargus Pall) v Il'menskom zapovednike (The ecology of roe deer in Il'mensky nature reservation). – Tr. Il'menskogo zapoverdika **4**: 9-62.

BOLSHAKOV, V. N.; KUBANTSEV, B. S. (1984): Polovaja struktura populatsiy mlekopitajuschikh i yejo dinamika (The sex structure of mammals' populations and it's dynamics). – Moscow. Nauka, (in russ.).

Briedermann, L. (1986): Schwarzwild. VEB Deutscher Landwirtschaftverlag. – Berlin.

BUTURLIN S. A. (1934): Losi (Moose). – Moscow-Leningrad, (in russ.).

CHERVONNIY, V. V. (1980): Individual'niy uchastok obutanija kabana zimoi (The home range of wild boar in winter) – In: Kopitnije fauni SSSR. Moscow: Nauka, (in russ.).

DANILKIN, A. A. (1992): Struktura populatsii. (The population structure). – In: European and Siberiam roe deer. Moscow: Nauka, (in russ.).

DANILKIN, A. A. (1998): Los' v Rossii: ispolzovanije resursov (The moose in Russia: management of resourses). – Okhota i okhot. Khozjaistvo, ?9, 9-11, (in russ.).

DARMAN, JU. A. (1986): Biologia kosuli Khinganskogo zapovednika.(The biology of roe deer in Khingansky nature reservation. Summary of PhD Thesis). – Moscow.

DVORNIKOV, M. G. (1984) Ekologia i biocenoticheskaja rol' kopitnikh v Il'menskom gosudarstvennov zapoverdike im. V. I. Lenina (Ecology and biocenotic role of ungulates in Il'mensky nature reservation. Summary of PhD Thesis). – Sverdlovsk.

FILONOV, K. P. (1993). Otsenka sostojanija populatsii olenj'ikh (Estimation of Cervidae populations condition). – Moscow: Nauka.

FLINT, A.P.F.; KRZYWINSKI, A. (1997): Sex differences in tame budgeting in roe deer during daring the rut. – Acta Theriologica **42**(3): 312-320:

GEPTNER, V. G.; NASIMOVICH, A. A.; BANNIKOV, A. G. (1961): Mlekopitajuschie Sovetskogo Sojuza (Mammals of Soviet Union). Vol.**1**. – Moscow: Visshaja shkola, (in russ.).

GLUSHKOV, V. M. (1975): K voprosu o vlijanii promisla na polovuju strukturu populatsii losei i ikh razmeschenije. (Concerning the effect of hunting on distribution and sex ratio in moose populations). – Sbornik NTI VNIIOZ. Vol. **5** (8). Kirov. 40-44, (in russ.).

GLUSHKOV, V. M. (1982): Struktura populjatsii losja Vjatskoi taigi i yejo regulirovanije promislom (The structure of moose population in Vjatka taiga region and it's regulation by hunting). – In: Promislovaja teriologia. Moscow: Nauka. 127-135, (in russ.).

GLUSHKOV, V. M. (1985): Upravlenije populatsijami losja: biologicheskije predposilki i prakticheskije vosmozhnosti (Management of moose populations: biological premises and practical possibilities) – In: Upravlenije populatsijami dikikh kopitnikh zhivotnikh. Moscow. 5-13, (in russ.).

GORDIJUK, N. M. (1993): Osobennosti pitanija i ispolzovanija territorii losjami raznogo pola i vozrasta na Juzhnom Urale (Features of feeding and space utilization by moose of different sex and agein South Urals). – Bull. MOIP. Otd. Biol. 98 (3), (in russ.).

GORDIJUK, N. M. (1994): Zimnaja ekologija losja na Juzhnom Urale (Winter ecology of moose in South Urals) – Voprosi ekologii i okhrani okhotnichje-promislovikh zhivotnikh na Juzhnom Urale. Miass. 29-42, (in russ.).

IVANOVA, G. I. (1980): Dinamika chislennosti kabana v Evropeiskoi chasti RSFSR (Wild boar population dynamics in European part of Russian Federation). – In: Kopitnije fauni SSSR. Moscow: Nauka. 161-162, (in russ.).

JAZAN, JU. P. (1967): Vlijanije promisla na populatsju losey (the effect of hunting on moose population). – Okhota i okhot. Khozjaistvo **10**: 18-19, (in russ.).

JAZAN, JU. P. (1975): Nekotorije posledstvija izbiratel'nosti promisla losey (Some consequences of selectivity in hunting moose). – In: Okhot. Khozjaistvo v intensivnom kompleksnom lesnom khozjaistve. Kaunas-Giriopis: 136-138, (in russ.).

JURGENSON, P. B. (1968): Okhotnich'i zveri i ptitsi (Game animals and birds). – Moscow: Lesn. Prom., (in russ.).

KANAKOV, JE. S. (1985): Biologicheskije osnovi ratsionalnogo ispolzovanija resursov losja (Biogicals basics of rational management of resources of moose) – In: Upravlenije populatsijami dikikh kopitnikh zhivotnikh. Moscow.: 14-27, (in russ.).

KHERUVIMOV, V. D. (1969): Los' (The moose). – Voronezh., (in russ.).

KNORRE, JE. P. (1959): Ekologia losja (The ecology of moose). – Trudi Pechoro-Ilychskogo gosudarstvennogo zapovednika, VII: 5-122, (in russ.).

LEBEDEVA, N. L. (1986): Struktura populatsii (Population structure). – In: Biologia i ispolzovanije losja. Obzor issledovanii. Moscow. Nauka: 106-109, (in russ.).

MARKOV, N. I. (1997a.): Sovremennoje sostojanije populatsii kabana v Sverdlovskoi oblasti (Modern condition of wild boar population in Sverdlovsk district). – In: Voprosi prikladnoi ecologii. Kirov: 158-160, (in russ.).

MARKOV, N. I. (1997b): The population dynamics of wild boar in Sverlovsk oblast and it's relation to climatic factors. – Russian Journal of Ecology **28**: 269-274.

MARKOV, N. I. (1999): Biologija kabana na Srednem Urale. PhD Thesis. – Ekaterinburg, (in russ.).

Metodicheskie ukasania po organizatsii provedeniju i obrabotke dannikh zimnego marshrutnogo ucheta okhotnich'ikh zhivotnikh v RSFSR (Methods of conducting and developing the results of winter route censuses). (1990). – Moscow, (in russ.).

NIKULIN, V. F. (1978): Dlina sutochnogo khoda losey v verkhnem Pikam'e (The length of daily movement of moose in upper Prikam'e). – In: Informatsionnije materiali Instituta ekologii rastenii i zhivotnikh. Sverdlovsk: 63, (in russ.).

POGODIN, N. L., Koritin N. S. (1997): Izbiratel'nost' otstrela losja v Sverdlovskoy oblasti (The selectivity of shooting the moose in Sverdlovsk district). – In: Problems of studying biodiversity on population and ecosystem level. Ekaterinburg: 167-175, (in russ.).

PROSTAKOV, N. N. (1996): Kopitnije zhivotnije Tsentral'nogo Chernozem'ja (The ungulates of Cental Chernozem'je). – Voronezh, (in russ.).

RANDVEER, T. E. (1989): Ekologicheskije osobennosti i khozjaistvennoje ispol'zovanije populatsii kosul' (Capreolus capreolus L.) v Estonii (Ecological features and

management of roe deer population in Estonia). Summary of PhD Thesis. – Moscow, (in russ.).

RUSAKOV, O. S. (1982): Regional'nije osobennosti promisla dikikh kopitnikh (Regional features of hunting ungulates). – In: Mlekopitajuschije SSSR. III S'ezd VTO. Vol.II. Moscow: 247, (in russ.).

RUSAKOV, O. S.; TIMOFJEEVA, JE. K. (1984). Kaban (The wild boar). – Leningrad: Izd. LGU. (in russ.)

SAN JOSE, C.; LOVARI S.; FERRARI, N. (1997): Grouping in roe deer: on effect of habitat openness or cover distribution. – Acta Ther., **42**(2): 235-239.

SLUDSKIY, A. A. (1956): Kaban (Morfologia, ekologia, khoz. i epizooticheskoje znachenije, promisel) (The wild boar: morphology, ecology, economical and epizootic importance, hunting). – Alma-Ata, (in russ.).

SMIRNOV, M. N. (1978): Kosulya v zapadnom Zabaikal'e (Roe deer in West Baikal region). – Novosibirsk: Nauka.

SMIRNOV, V. S.; KORITIN, N. S. (1979): Izbiratel'nost' otlova zhivotnikh i vozmozhosti yejo ispolsovanija v ekologicheskikh issledovanijakh (The selectivity of capturing the animals and poosibilities of it's usage in ecological researches). – Sverdlovsk, (in russ.).

TIMOFJEEVA, JE. K. (1974): Los' (The moose). – Leningrad: Izd. LGU, (in russ.).

USHKOV, S. L. (1947): Promislovaja fauna Il'menskogo gos-zapovednika (Game animals of Il'mensky nature reservation). – Tr. Ilmenskogo zapovednika **3**(1): 87-159.

VARNAKOV, A. P. (1988): Ob izmenenii srokov okhoti na kabana (About changing the terms for hunting wild boar). – In: Nauchno-tekhnicheskiy progress – v practicu perestroiki okhotnichjego khozjaistva (nauchnaja konferentsia, nojabr', 1988). Moscow. 100-102, (in russ.).

VATOLIN, B. A. (1980): Rasprostranenije, chislennoct' i vlijanije ekologicheskikh faktorov na kabana v Bryanskoi oblasti (Distribution, abundance and the effect of ecological factors on wild boar in Bryansk district). – In: Kopitnije fauni SSSR. Moscow: Nauka. 131-132, (in russ.).

VERESCHAGIN, N. K.; RUSAKOV O. S. (1979): Kopintije Severo-Zapada SSSR (The ungulates if North-West of USSR). – Leningrad: Nauka, (in russ.).

VORONIN, A. A. (1980): Sutochnaja aktivnost' kabana na yuge Nechernozem'ja (The daily activity patterns of wild boar in the southern part of Nechernozemje region). – In Kopitnie Fauni SSSR. Moscow. 285, (in russ.).

ZAGUZOV, A. V. (1988): O vozmozhnostjakh ratsional'noi ekspluatatsii losja v srednetajozhnom Zaural'e (About the possibilities of rational exploitation of moose in middle taiga zone of Zauralje). – In: Voprosi dinamiki populatsii mlekopitajuschikh. Sverdlovsk. 30-31, (in russ.).

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