Group Size Changes and Age/Sex Composition of Harvested Wolf *(Canis lupus)* in Estonia

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The average size of observed groups of wolf *Canis lupus* in Estonia decreased from 4.58 in November - December to 2.07 in February. Single animals and pairs dominated in February. Of 31 harvested wolves 16 % were pups; 10 % were subadults and 74 % adults. The overall male : female ratio of all animals was 2 : 1. The mean age of adults was 5.3 years (5.4 for males and 4.8 for females). The oldest animal in the sample was a ten (10)-year-old male.

Key words: age, *Canis lupus,* groups, sex

Introduction

The wolf *Canis lupus* has inhabited the territory of Estonia since Early Pre-boreal (Lõugas & Maldre 2000). During the 19th century wolves were mainly hunted in order to reduce the number of human victims (Rootsi 2001, 2003), later the need to protect cattle prevailed. In Estonia, like in neighbouring Russia, small-scale farming dominated, farmers usually owning one or two cows and horses, and a few sheep. In this situation, the loss of a single cow or horse was crucial to the rural people and wolves were considered as serious enemies. During the second half of the 20th century, farming approach dominated in the Estonian game management and wolves were hunted to protect and promote wild ungulates (Valdmann 2001).

Excluding the years with unstable snow cover, hunting pressure on wolves was heavy during the whole period after WW II, usually 15-30% of the population was removed annually. But the emphasis in the local wolf control was on their numerical status, while other biological factors were overlooked.

Wolf exploitation in general has different consequences, among them the decrease of the group size is easiest to detect and is reported from most areas, where wolves are controlled (Haber 1996, Jedrzejewska *et al.* 1996).

Remaining single wolves or pairs are more likely to attack dogs in farmyards (Kojola & Kuittinen 2002).

Apart from direct mortality, hunting may also cause injuries. In Latvia, 48.4 % of wolf injuries were of anthropogenic origin - firearm shots and leg-hold trap scars (Andersone & Ozolins 2000); injured wolves may specialize in scavenging.

In areas of low wolf density single wolves can mate with dogs (Andersone *et al.* 2001).

Hunting caused mortality can be age and sex specific as vulnerability frequently varies among individuals, often because of systematic differences based on size, age or sex. Sex and age ratios may also be affected by migration (Pulliainen 1965).

In our paper, we analysed wolf group size in the beginning of winter and in late winter, and the age and sex composition of a sample of killed wolves.

Material and methods

Wolf group sizes in Estonia were registered from 1977 to 1999. In total 154 wolf groupings were registered. Observations were carried out in November-December and repeated in February. Hunters from different Estonian regions provided part of observations.

As the observers were mostly experienced wolf hunters, we expect little bias in determining the actual wolf group sizes.

Group sizes between these two periods were compared using Kruskal-Wallis non-parametric test (Statistica 5.0)

We sexed and aged 31 wolves, killed during sport hunting. *Cementum annuli* count in canines was selected as the most accurate method for aging of harvested animals (Klevezal & Kleinenberg 1967, Grue & Jensen 1979, Goodwin & Ballard 1985, Ozoliņš *et al.* 2001). Due to the previous good results with ungu-

late teeth, we mostly followed the method by G. Klevezal (1988).

Canines were decalcified in 6% solution of HNO_3, and longitudinal sections were used. Hematoxylin was used for staining. *Cementum annuli* were counted in Zeiss microscope with magnification 50-100, and photographed with digital camera SensiCam 12 bit Cooled imaging.

As the first annulus deposition in wild grey wolves occurs between 18 and 22 months of age, one full year was added (Goodwin & Ballard 1985). Root openings were checked in addition (Dobrinski 1985). According to their age, the animals were classified:– pups - less than 12 months; subadults - 1-2 years and adults 2 or more years old.

The *Chi*-square test was used to estimate sex ratio differences among analysed wolves (Statistica 5.0).

Results

Wolf group sizes in November -December (mean 4.58) and in February (mean 2.07) differed significantly; H (8, N = 29) = 20.05; p ϒ 0.05 (Figure 1).

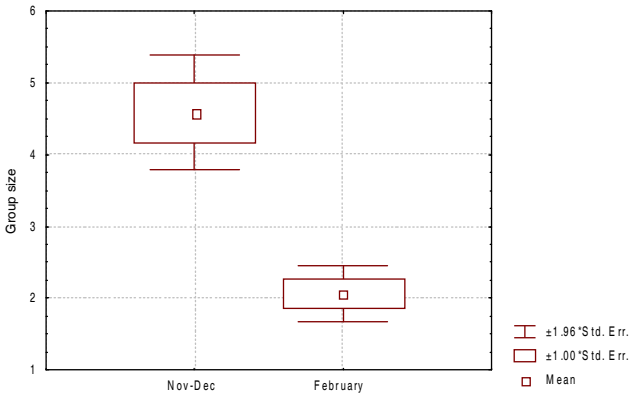

Figure 1. Wolf group sizes in Nov-Dec in February in Estonia

In November -December wolf groups were regular and consisted usually of 4-5 animals (Figure 2), in February groups were mostly fragmented and singles and pairs dominated (Figure 3.)

From a sample of 31 harvested wolves 16 ± 6.6 % were pups; 10 ± 5.6 % were subadults and 74 ± 7.9% adults.

The overall male: female ratio of all animals checked was 2 : 1. Obviously due to the small sample, it did not differ significantly from 1:1 (corrected *chi*-square 1.1, df =1, p >0.05). The mean age of adults was 5.3 ±0.4 yrs (5.4 ±1 for males and 4.8 ± 0.5 for females). The oldest animal in the sample was a ten (10)-year-old male.

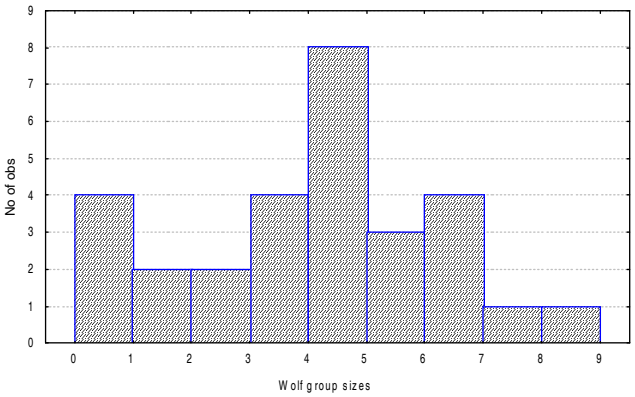

Figure 2. Composition of the different wolf groups in Estonia (Nov-Dec)

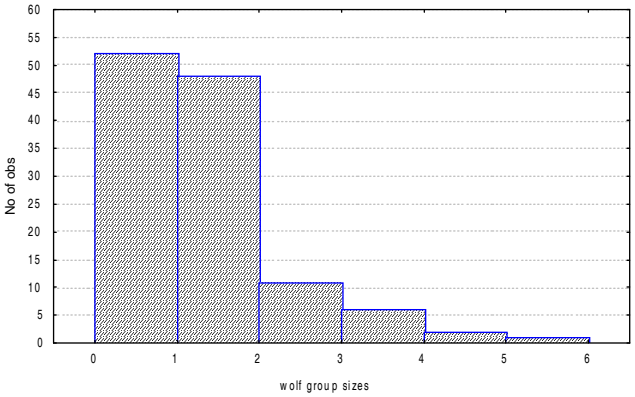

Figure 3. Composition of the different wolf groups in Estonia (February)

Discussion

During the study period, wolf groups in Estonia showed a seasonal decrease from 4.58 in November-December to 2.07 in February (Figure 1), losing on average 2.5 members. Although the mean size of remaining wolf groups in February was two, there were many single wolves left at that time (Figure 3.). Larger wolf groups, present in Nov-Dec (Fig.2), were almost absent in February (Figure 3).

The same tendency was observed in neighbouring northeastern Russia and Russian Altai where wolves are also hunted. Similarly, the largest groups there were recorded in November and the smallest in spring February - March (Novikov 1970; Bondarev 2002).

In the protected Polish part of the Bialowieza forest group size remained stable throughout winter (3.6-4.2), in contrast to the Belorussian part, where wolves were also hunted and the pack lost on average two

members during winter (Jedrzejewska & Jedrzejewski 1998). Survivors sometimes broke apart and no longer formed a pack. By March, the typical pack was also a pair and 14% of wolves were singles (Jedrzejewska *et al.* 1996).

The relatively large number of single wolves in November-December (Figure 2) can be caused by the wolf hunt during summer-autumn, which was legal until 2002 or by migration from the neigbouring Russia and Latvia.

It is complicated to separate natural factors affecting wolf winter group sizes from those caused by hunting. Wolf packs may disintegrate and reunite and pack size in the usual sense is not the same as hunting group size as not all members may take part of the hunting (Mech & Boitani 2003). Rut may affect wolf group sizes- in the Russian Altai number of wolf pairs during rut increased from 14 till 35 while group size accordingly decreased. But after the rut group sizes (excluding groups with more than 8 members) reached almost the previous level (Bondarev 2002).

Based on the data from protected areas, we conclude that similarly to other hunted wolf populations, intensive wolf hunting mainly causes changes in the wolf group sizes in Estonia.

Due to the relatively heavy wolf hunting in Estonia, especially during the 1990s when up to 40-50% of the population was removed, such an impact could be expected.

Does this reduction in the group size affect wolves' choice of prey?

Two hypotheses have been brought out to explain why wolves live in packs- because it facilitates their acquisition of larger prey (Mech 1970, Nudds 1978, Rodman 1981) and kin-selection hypothesis (Schmidt & Mech 1997). We believe that although single wolves can kill larger prey such as moose or bison (Carbyn *et al.* 1993, Thurber & Peterson 1993, Bondarev 2002); kill rate will be lowered and the probability for wolves to get killed or injured in the process will be increased (Kochetkov 1988, Haber 1996). From the Russian Altai it has been reported that prey choice shifting occurs at the pair level and then wounded or sick moose are preferred (Bondarev 2002). Our studies of the wolf diet in Estonia have demonstrated preference of smaller ungulates and avoidance of moose in wolf winter diet (Valdmann *et al.* 1998). In boggy areas, where roe deer densities are somewhat lower and moose and wild boar dominate, wild boar is preferred (Kübarsepp & Valdmann 2003).

Changes in kill rates were impossible to detect due to the lack of radio-telemetry studies, but kill losses to scavengers due to the permanent persecution of the remaining wolves seemed to be quite common.

However, we have experienced, that when persecuted, wolf groups can cover relatively long distances and return to the previous territory within 1-2 weeks.

Some mutilated animals, obviously being wounded by firearms, are known to become scavengers. There are also locations were wolves started to kill dogs regularly, but it has not been possible to track these killings to any specific animal.

The obtained composition of age groups in the sample is similar to the data from Latvia and Poland (Okarma 1989, Andersone & Ozoliņš 2000, Ozoliņš *et al.* 2001). The relatively small fraction of pups may be caused by the very high hunting intensities, causing pair bonding difficulties (Haber 1996); or by altered social and territorial structure (Ozoliņš *et al.* 2001, Kotchetkov 2002).

The question about hunting biases remains open. Collecting pups from dens, which is still popular in neighbouring Russia, has never been popular in Estonia. Shooting at bait sites is also very little used and most wolves are still killed using fladry or drive hunts. This type of hunting may also to be selective, wolves in larger packs having higher chances to escape (Jedrzejewska *et al.* 1996).

Sex ratio in a large sample from Russia (976 wolves, killed using both aerial and terrestrial hunting techniques), was close to 1 : 1 (Suvorov 2003). The dominance of males in our sample can be caused by the tendency of males to migrate into unoccupied areas (Pulliainen 1965).

The presence of significant wolf immigration from neighbouring areas in Russia and Latvia locations during previous years has been proved by the positive general balance towards immigration as shown by the transboundary Latvian-Estonian project involving borderguards (Andersone *et al.* 2001).

We tend to conclude, that during the study period the local wolf population was intensively replenished by wolves from neighbouring areas. Immigration from neighbouring Russia was probably greatly promoted by the proximity of the boundary zone on the Russian side, where hunting was prohibited. The older wolves in our sample (> 8 years; n = 3) may have also originated from there.

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ИЗМЕНЕНИЕ ПОПУЛЯЦИОННЫХ ГРУППИРОВОК И ПОЛОВОЗРАСТНОЙ СОСТАВ ДОБЫТЫХ ВОЛКОВ (*CANIS LUPUS*) В ЭСТОНИИ

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Резюме

Группировки волка в Эстонии в среднем уменьшилисъ с 4.58 в ноябре и декабре до 2.07 в феврале, пары и одиночки доминировали в феврале. Из 31 добытого волка 16 % составляли сеголетки, 10% переярки и 74 % взрослые. Соотношение полов было 2:1 в пользу самцов. Средний возраст самцов был 5.3 года, а самок - 4.8 года. Старший в выборке был десятилетний самец.

Ключевые слова: возраст, *Canis lupus,* группировки, пол