Status and Management Prospects of the Wolf *Canis lupus* L. in Latvia

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Historically, wolves in Latvia were considered as a pest to be exterminated by all means possible. To assess the impact of unlimited persecution, wolf demography was studied between 1998 and 2000 by collection of samples from harvested animals. Laboratory examination of ovaries and uterus was used to determine if a female was in reproductive condition. Placental scars, swelled post-birth sites in uterine horns or fetuses were counted. The skulls were collected and the age of harvested wolves was determined by counting the number of incremental lines in the tooth cement. The main demographic indices are the following: sex ratio – 1:1.3 (n=84); the average number of embryos per female wolf - 6.0 (n=10; SD = 1.89). The ratio of young wolves in hunting bag is smaller than expected taking into account the fertility of females. Unlimited hunting is believed to have a reflection in the age and sex structure of the wolf population. Certain suggestions concerning sustainable wolf management with presumably lesser impact on population structure are given. They provide for closed hunting during the breeding season and for a legally prescribed opportunity to close the hunting comprehensively after appointed hunting bag is reached.

Key words: wolf, hunting, population structure, species conservation

Introduction

The wolf is a typical representative of the carnivorous mammals of the eastern Baltic. It has inhabited the land area of present–day Latvia since the post-glacial era, dating back to the 9th millennium BC (Tauriņš 1982; Timm et al. 1998). Humans have from time immemorial held wolf as his competitor in hunting wild ungulates. More recent animal husbandry has only intensified this conflict. The attacks on domestic animals were the principal reason why humans exterminated wolves, though their pelt and meat could be of use (Von Ende 1982, Сабанеев 1998). Occasional assaults on people, especially children, only aggravated the situation (Корытин 1990; Павлов 1990; Jhala, Sharma 1997).

In the modern times, the dynamics of the wolf population over the most part of its natural distribution range essentially depends on hunting policy. According to the hunting statistics, in the 1930s and 1960s, the wolf population of Latvia was on the verge of extinction. It gradually stabilised again by the end of the 1970s. During the 1980s, the wolf population was stable and distributed evenly throughout Latvia, contrary to the situation in most of the countries of west Europe, where wolf was found only in Spain and Italy (Boitani 2000). In the early 1990s, greatly due to the changing political situation in Latvia, there was for some years no control over the wolf population. Viable populations of ungulates of the late 1980s and early 1990s created excellent feed resources for carnivores. This situation resulted in another rapid growth of the wolf population, reaching nearly 1,000 individuals in official statistics. In Europe, the 1990s also were noted for an increase in the wolf population and widening of its distribution range. As a result of natural migration, wolf appeared in such countries as Switzerland, France, Austria, etc., where it had been absent for more than a century (Boitani 2000).

Currently, wolves are recognized as an intrinsic part and parcel of natural ecosystems, and a number of countries favour its re-introduction. In Latvia, however, it is vice versa; wolves are considered a nuisance to be exterminated by all means possible, resulting in another anti-wolf campaign launched in the mid-1990s.

A pronounced population decrease was reflected in the game statistics of late 1990s. However, the wolf population is not considerably threatened yet. Suggestions about initiation of sustainable management and conservation strategy were caused by political choice of Baltic nations of joining the EU. The new political way should be accompanied by development of the new economy, new international liability and new attitude to nature management. That is why in controlling wolf we should be guided by the good data on population status rather than emotions.

The goal of the given study is to contribute to the conservation of wolf, done against the background of sweeping changes in the country's political and economic situation. Hereby we inform the management and policy-making institutions about some specific features of the population ecology found out in wolves of Latvia during the last two years.

Material and methods

The age structure of the wolf population of Latvia was studied between 1998 and 2000. The State Forest Service helped us find hunters who volunteered in providing information on the animals killed and their skulls for research. Initial co-operation with hunters was started already in 1997 when State Forest Service distributed questionnaires about morphometric characteristics of shot wolves and their division into three easier definable age classes: juveniles, yearlings, and wolves aged two years and older. Preliminary knowledge about body weight, height, length as well as the length of tail and hind foot was obtained (Andersone, Ozoliņš 2000a) from the whole Latvia. The animals used for the given study were collected both in east and west Latvia. However, the distribution of the samples collected was not really random and depended on how successfully it was managed to motivate the local hunters to assist in the research work. The subsample from the harvested animals (sample number = 84 wolves) was taken starting from the autumn of 1998 and until the spring of 2000 (Fig. 1), and accounts for 19% of the total harvested animals in this period. Eighteen freshly killed adult female wolves of total 31 were available for necropsy. Visual examination of ovaries and uterus was used to determine if a female had been reproducing (Kirkpatrick 1980). Placental scars, swelled post-birth sites in uterine horns or fetuses were counted. The uterine horns were opened before visual examination. Sometimes it became necessary to press them between two glass plates and to look through against a light source. The scars of previous pregnancy stood out as darkened purple or violet spots. To determine what proportion of adult females was reproductively active, the date, when a wolf was killed, was taken into account as well. Adult females without fresh breeding evidences in uterus and ovaries from March till December were assumed as non-breeding.

Figure 1. Black dots show the localities in Latvia where the wolves, included in this study, were hunted down, years 1998-2000. The distribution of forest and administrative borders of forestry districts are shown in grey

To determine the age of the individual, each of the skulls collected for research purposes had one canine removed and its root (1-1.5cm long) sawn off. The tooth was then placed back in the jaw in order not to spoil the trophy. The individual's age was determined by counting the number of incremental lines in the tooth cement of the given piece of tooth root. Techniques recommended by Kunz et al. (1996) or Sutherland (2000) and properly described by Klevezal were used (Клевезаль 1988), including decalcification, freezing, sectioning, staining and mounting on a glass slide for microscopic examination.

Official hunting statistics available from the monograph by A. Kalniņš (1943) about the period before World War II were compared with more recent information published by J. Ziediņš (1990) and provided by State Forest Service (1990-2000). Supposedly biased trends in statistics by any economical or political reason were discussed on the base of personal communication with officials who previously worked on game management issues (Krūmiņš et al.).

Results

The total sex ratio in our sub-sample was 1:1,3 (males : females). However statistically, the difference from equal distribution was not of high significance at this sample size (χ^2=0,862; P<0,3; d.f.=1; n.s.). This ratio was not equal for all age classes (Fig. 2). The largest numerical predominance of females over males was found within wolf cubs aged up to 1 year (1:2.4 - χ^2=1,505; P<0.25; d.f.=1) and in the 4th year of life (1:2,7

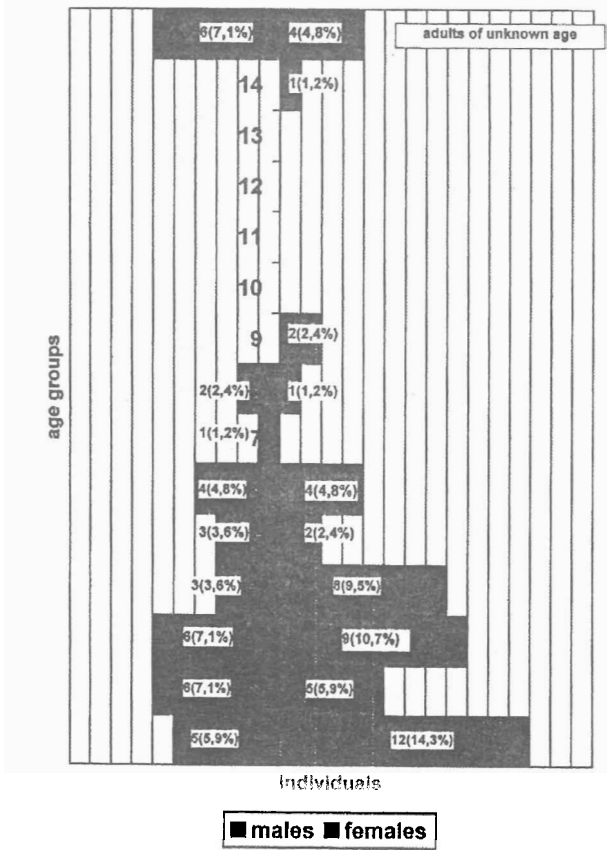

Figure 2. The age and sex structure of hunted wolves (n=84)

- χ^2=1.198; P<0.3; d.f.=1; n.s.). By the comparing the general age distribution of all females with that of males, no statistically significant differences were found (χ^2=8.018; P<0.5; d.f.=9; n.s.). The oldest wolf was 13 years old. That animal appeared to be a still reproductively active female having 6 fresh placental scars and lactating till being shot in May.

Assuming that the number of fresh placental scars is equal to that of embryos during last pregnancy, the average number of embryos per female wolf was 6.0 (n=10; SD = 1.89). In one case a female wolf was shot in spring and 10 equally developed embryos were found in the uterus. The wolf was 5 years old. Besides, no relationship between fertility and age was found in our sample. Reproduction evidences (fresh placental scars, lactation, rut) were found in 83% of 18 checked female wolves being at least 2 years old. Thirteen other adult females were not checked for this purpose mostly because of heavily damaged internal organs.

Our own experience with estimating wolf age confirms that the age was rather over than underestimated by hunters. Therefore we, decided to not use preliminary data on age structure of earlier measured wolves in this analysis but just to demonstrate that differences in body size between young and adult animals might be not remarkable. Measurements of wolf bodies were collected since 1997 when we at the beginning mostly used assistance of hunters (see for data Andersone, Ozoliņš 2000a). The data were pooled according to a rough estimate of animal's age class by hunters and summarized in the frame of other study. For example, comparing body length, the cubs aged up to 1 year were outstanding as the smallest ones (♂♂ juveniles/yearlings: t=5.081; P<0.01; ♀♀ juveniles/yearlings: t=3.724; P<0.01), while yearlings were quite similar to adults, especially in females (♂♂ yearlings/adults: t=2.533; P=0.05; ♀♀ yearlings/adults: t=1.411; P>0.1 n.s.).

Discussion and conclusions

The research, based on a sub-sample from the harvested animals, has indicated that there are few peculiarities in the population structure of this sample compared to classic patterns of typical stable or increasing population (Одум 1975). Attention should be drawn to the age distribution, illustrated by percentage of the whole sample population. For the age above 3 years, the pyramid is regarded as optimal, while an insufficient number of the youngsters stands out quite clearly (Fig. 2). When adding up all adult females in the representative sample (n = 31) and by knowing that 83% of them were capable of having cubs, and the average number of embryos was 6, one has to conclude that, theoretically, the number of cubs in their first year should have amounted to 154 that might be 70% of the population. However, the existing figures are very different, and cubs of the first year only represent 20% of the total hunting bag. There is no reason to believe that cubs have a better survival rate than older animals during hunting. Instead, it may have something to do with the mortality of cubs and/or embryos showing results different from the indices of potential fertility in females, estimated by counting placental scars and embryos. In addition, the killing of pregnant and lactating females by hunters also reduces the number of cubs survived. A disruption of the population structure, both spatial and social, caused by hunting could be a reason for the existing age distribution. It is mentioned in the literature that the spatial distribution of wolf is most strongly affected by the intensity of hunting. It disrupts the integrity of the pack's territory, as the animals increase their home range to avoid hunters (Bibikov 1985). The total wolf population includes also individuals that live solitary. Under normal conditions, about 60% of all the wolves live in packs (Bibikov 1985). Stamping out es-

tablished packs of wolves enlarges the ratio of solitary animals, disrupting the balance in the system predators – ungulates. For stray wolves, entering a territory, it may take years to adapt themselves to the groupings of ungulates there (Кудактин 1984).

The "right" shape of age pyramid of 2-year old and older wolves might indicate that the native population of wolves has reproduced more successfully in 1996 and 1997 – i.e. 3 years ago. This assumption agrees with the curve of population dynamics (Fig. 3) and the fact that snow conditions in winter 1995/96 were comparatively hard for ungulates providing rich food for wolves in their turn. Additionally, there might be an influx of those wolves from Belarus and Russia that have just reached sexual maturity – the 3rd age group - and are roaming about in search of new territories.

could be mistaken for adults and therefore provided to researchers.

The proportion of females increases in the populations under a strong hunting pressure. It seems to be an attempt to compensate for the damage sustained by the population (Bibikov 1985). Therefore, we concluded that predominance of females in hunting bag from Latvia could be also a consequence of the effect of the high hunting pressure unless the next years of continued study might confirm that samples would be too small to find out the true trends.

Generally, wolf can actually tolerate a high hunting pressure. Ballard et al. (1987) state that first when the population loss exceeds 30-40% of the size of a stable population, decrease in numbers is unavoidable. Each year from the 1960s until the late 1970s, the number of killed wolves even exceeded officially esti-

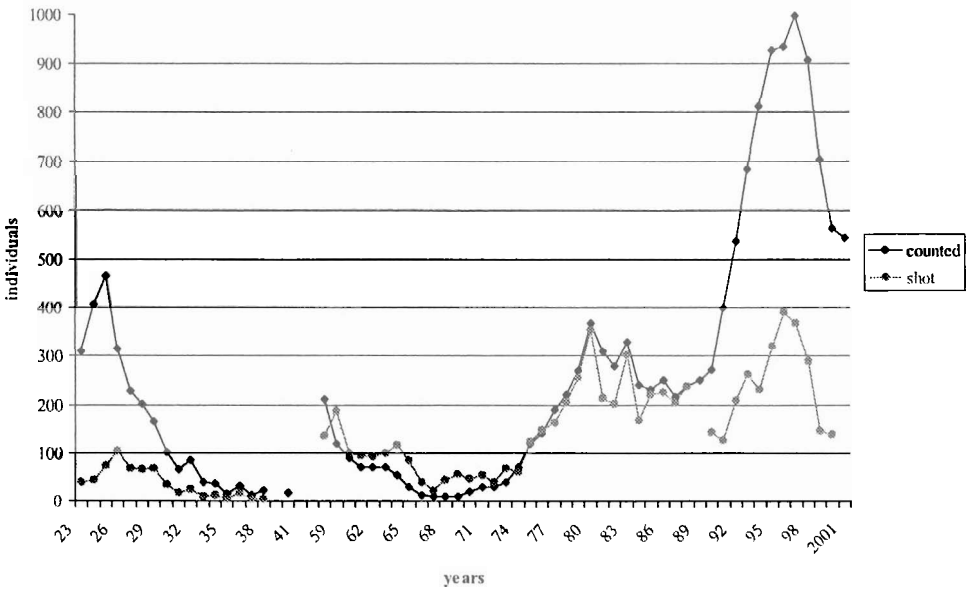

Figure 3. The population dynamics of wolf in Latvia (official statistics). Data **are missing for the WWII period and 1989**

Nearly over the entire range of wolf's distribution, the number of males is higher than females (Bibikov 1985; Рябов 1988; Okarma 1989; Павлов 1990). The natural mortality is higher for females, whereas males are hunted down more frequently (Павлов 1990). In Latvia we found the opposite, the predominance of females over males in several age groups, especially the first year group in the harvest (Fig. 2). Although the statistical significance of this phenomenon was very low, it is remarkable that females greatly dominated in 5 of the total 10 age classes but males dominate in 4 only with comparatively lesser numerical prevalence. A reason may be that females during the first year generally grow so fast that they almost reach the size of an adult. Sometimes we particularly required hunters to report about shot adult females to raise information on fertility in wolves. Consequently, young females

mated population size (Fig. 3). This situation is difficult to explain. The population was really small during that decade. Two reasons, why the hunting bag was higher than the estimated population size, could be mentioned. First, hunters were interested to hide the real wolf number as possible result of Soviet regulations; the more wolves counted the less shooting permits were issued to harvest ungulates. Second, it is possible that the wolves, after the persecution campaign in the post-war period, continually invaded Latvia's territory from Russia, because the hunting intensity in Latvia presumably was higher than in the east, thus providing many spare areas for immigrating wolves, and wolf density in Russia was bigger. We can not tell when exactly the wolf population started to recover in Latvia but by the late 1970s the hunting bag of wolves had increased considerably. It is sim-

ply impossible to shoot more than 90% of the wolf population (200-300 animals) and still observe a population increase as shown in Figure 3. Thus, it is more likely that the wolf population amounted to about 800 individuals already in the early 1980s. One reason for the increase in population size was probably that the ungulate populations also were rich during that period (Ziediņš 1990). The ungulate populations were so big during that period that they could probably support the increase in the wolf population without the hunters feeling any kind of actual competition from the wolf. Then in the 1990s, the situation changed. As a consequence of the collapse of Soviet economy, the ungulate resources were overexploited. Hunters again experienced the wolf as a serious competitor. The hunting statistics of mid 1990s, when 200-300 wolves were killed per season, allow us to assume that the population estimate (of approximately 900 animals in 1994-96) made before harvesting (by late summer but not on March 1 as declared officially) was correct, since the population tolerated without obvious decline such a high hunting pressure from 1992 till 1995. However, the rapid increase in the wolf population during the 1990s might be not true. What is more likely, as stated earlier, the wolf population had already reached 800-900 individuals in the early 80s and then it remained stable until 1996-1997 when almost 400 wolves were shot. The following fast decline in population size occurred, because the critical hunting pressure of over 40% was overstepped. Consequently, in the past few years there has been a decline in the wolf population.

The recent period is noted for a tendency towards fragmentation of the range inhabited by wolf (Fig. 4). North Kurzeme (north-west Latvia) and Latgale (south-east) are becoming the regions where the density of wolf is highest. The sparsely forested Zemgale Plain, lying between the above mentioned regions, hamper east – west migration of wolves. Approximately one thousand years ago wolves lived in the open landscape (Bibikov 1985). The fact that wolf has become a typical forest dweller is of less importance here. Nowadays, in Europe the forest is the most essential habitat for wolf, where it feels safe. If the isolation between the two populations will increase, reducing the genetic diversity of wolf (Randi 1993) may be a result. Already now the morphometric data of skulls show the individuals of the eastern population to be bigger than western ones (Andersone, Ozoliņš 2000b).

In conclusion we propose certain improvements in the management system of wolves in Latvia fitting better into the context of modern species' conservation requirements.

• The hunting season should be closed between April 1 and August 31. In this season, wolf, upon

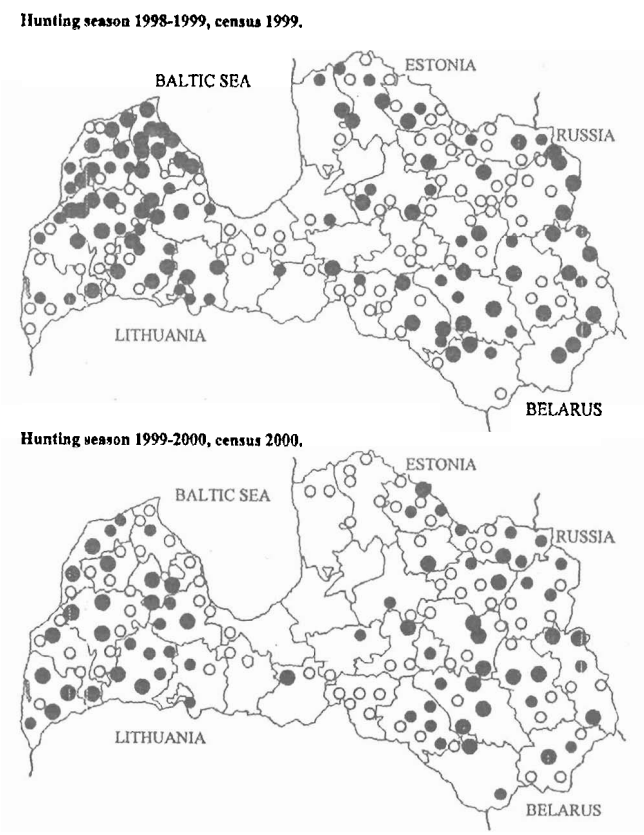

Figure 4. The distribution of wolf in Latvia for the study period. The bigger dark circles stand for the forest districts where more than one wolf was killed; the forest districts where only one wolf was hunted are marked by smaller dark circles; the white circles denote the forest districts where wolves are recorded but none hunted down

drawing up a statement as provided by the regulations, may be harvested only in the places it has inflicted damage, or when found in human settlements, or attacking domestic animals and man (the statement is drawn up *post factum* after the wolf is killed).

• In specially protected areas wolf hunting is allowed only with a permit of the Ministry of Environmental Protection and Regional Development (for research purposes, in places, were wolf has inflicted serious damage, etc.).

• Opportunity to collect wolf carcasses for further investigations should be guaranteed by law. Therefore, the fact of hunting down a wolf must, within 3 days, be reported to the nearest Forest District Office. A case of accidentally killing a wolf or finding it dead (run down, killed during an assault to livestock, etc.) must, within a day, be recorded by drawing up statement and reporting to the respective Forest District Office.

• Hunting quotas on wolf should be introduced along with the demand for compliance with the above provisions. For the time being it is difficult to establish definite hunting quotas, since it is impossible to evaluate the effect of closed season for wolf, moreover, we have no means of comparison as in Latvia the wolf has over centuries been persecuted without any restrictions. We suggest that the current population status and the results of the hunting season of 1999/2000 should be set as a benchmark in this respect. This is possible as the present population density poses no significant danger to the animal husbandry and most of the hunters' collectives seem accepting it, too. At the same time, the very existence of the species is not under a threat, except for possible isolation between the eastern and western metapopulations. All this implies that for the hunting season to come there is no special reason to decrease the hunting quota for wolf compared to the previous season (150 individuals). As we have no experience of how to divide the hunting quota between the regions of the country, and taking into account that population migration can lead to a high concentration of wolf in some localities, it is suggested that the hunting season should be closed as soon as the number of the previous season is hunted, but not later than by March 31. This can only be done if the State Forest Service sums up the hunting data on a regular basis and the hunters inform the forest authorities on the hunting results within 3 days. The hunting data should be linked to the monitoring research for the given species. In the future, when a clear picture of the population size is available, hunting quotas may be either increased or reduced in addition to changing the duration of the hunting season.

• A unified formal procedure must be established for reporting, recording and checking the damage done by carnivores. In the localities, where regular substantial damage is inflicted by carnivores, special short-term hunting permits may be issued, thus legalising the hunting, done outside the time frame of the hunting season. At the same time, solutions should be sought for compensating the damage caused by wolves to the domestic animal holders. Priority should be given, and the compensation mechanism tested first of all, in relation to protected areas.

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СТАТУС ВОЛКА *CANIS LUPUS* L. И ПЕРСПЕКТИВЫ УПРАВЛЕНИЯ ЕГО ПОПУЛЯЦИЕЙ В ЛАТВИИ

Я. Озолиньш, Ж. Андерсоне, А. Пупила

Резюме

Волки в Латвии всегда считались вредителями, которых следует истреблять всеми возможными методами. С 1998 по 2000 гг. от добытых животных собирали образцы, чтобы изучить влияние неограниченного преследования на популяцию волка. Чтобы определить репродуктивное состояние самок, проводилось лабораторное изучение яичников и маток. В рогах матки подсчитывалось число плацентарных пятен или эмбрионов. Возраст зверей определяли по числу линий прироста в зубном цементе. Основные демографические показатели были следующими: соотношение между самцами и самками – 1 : 1,3 (n=84); среднее число эмбрионов на самку – 6,0 (n = 10; SD = 1,89). Доля сеголеток в взятой пробе меньше чем ожидалось, учитывая плодовитость самок. Высказано предположение, что неограниченная охота отражается в половозрастной структуре популяции волка. Приводятся предложения, касающиеся управления популяцией волка с предположительно меньшим негативным влиянием на ее структуру. Главными мероприятиями могли-бы служить запрет охоты на сезон размножения и система оперативного всеобщего прекращения охоты на волков после выполнения предусматриваемой нормы отстрела.

Ключевые слова: волк, охота, структура популяции, охрана видов