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Management of hunting animals population as breeding work Part III: Hunting and breeding work on introduced fauna

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Abstract: *Management of hunting animals population as breeding work. Part III: Hunting and breeding work on introduced fauna.* This part of the study presents the practice of introduction of non-native species in Poland. The examples of the fallow deer and mouflon illustrate problems that may be encountered by hunters and foresters in alien species breeding. Particular attention in the management of populations of these species in Poland should be paid to their density and abundance so that they do not endanger native animals. Furthermore, the population quality is one of the objectives of hunting management, and introduction of individuals (with higher ontogenic quality) originating outside the occurrence range into populations can be an important tool for improvement of the quality of game animals and prevent problems related to high inbreeding.

Key words: breeding, game animals, introduction, non-native species

INTRODUCTION

Introduction of game species in the territory of Poland was usually carried out in a period when the notion of ecology was unknown and was aimed at enhancement of the attractiveness of hunts. The Convention on Biological Diversity (CBD) and the Bern Convention define alien species are those that have been transferred (introduced) intentionally or accidentally outside their natural occurrence range through direct or indirect human activity. The Act of April 16 (Dziennik... 2004) specifies alien species as those occurring outside their natural geographical range. The introduction of little-known animals into new areas is always associated with a certain danger to domestic fauna and flora. Cases of invasions, acclimatization, or high mortality of animals can be observed. However, individuals that adapt to living in new areas only to some extent should constantly be supervised. In the initial phase of introduction when the population size of introduced species is low, inbreeding and associated frequent pathologies may be observed. Problems of this type are encountered in classic livestock breeding. One of the many breeding procedures involves improvement of hereditary traits (genotype), i.e. improvement of the ontogenic quality leading to greater resistance and better health status of animals. These practices are applied in the breeding of introduced game species.

INTRODUCTION OF FALLOW DEER

The history of the fallow deer (*Dama dama*) is associated with domestication thereof. The first animals in Poland were

introduced to closed breeding and hunting grounds in Silesia in the 13th century. Since the 17th century, they were mainly kept in menageries or as a park species. Possession of fallow deer indicated the richness and status of the menagerie owner. They were released into open hunting grounds in the second half of the 19th century. It is estimated that one of the largest fallow deer populations in Poland comprising 1,500 individuals lived in the Białowieża Primeval Forest. Additionally, the species was present in Pszczyna forests. Unfortunately, World War I contributed to a significant decline in the population size. The last individual of the species was shot in the Białowieża Primeval Forest in 1930. In the interwar period, the population of this species comprised 2,650 individuals (1936). World War II took its toll as well: the occurrence range of the species decreased and the population size declined to approximately 2,000 individuals. Periodic protection was introduced, which led to an increase in the population size to 2,500 animals in 1949.

The fallow deer owes the current distribution worldwide to humans. The species was introduced in Australia, New Zealand, and even to Africa. The main reason for this venture was sports, in particular when there were no comparable endemic species available for hunting. Furthermore, the presence of this species raised the economic status and offered an attractive addition to the diet. Ecology was unknown and endemic fauna was not appreciated at that time (Dzięciołowski 1994).

Fallow deer occur in Europe sympatrically with red deer and roe deer. Competition for feed between these species can therefore be assumed. In the division of ruminants into concentrate selectors and roughage eaters, *Dama dama* represents the group of intermediates. It mainly feeds on grasses and herbs as well as leaves and shoots of all shrubs and deciduous trees. Nevertheless, the feeding of this species is less harmful than that of the typical shoot eaters such as the elk or roe deer. This trait and the seasonal changes in animal behaviour prevent overlapping of the niches of these species. In different seasons of the year, they feed on different plants in different communities. The complementary use of resources by fallow deer and roe deer increases the capacity of their co-habitats. This may have contributed to the successful introduction of *Dama dama* in Europe with no harm to native species (Dzięciołowski 1994).

Fallow deer can inhabit forest areas but also stays in the open areas of crop fields. In their homeland, i.e. Asia Minor, *Dama dama* inhabited dry and warm Mediterranean-Aegean and Mediterranean-South-Anatolian landscapes. The vegetation of this region is dominated by pine and xerophytic scrubs. At present, the species lives in deciduous and mixed forests, coniferous forests, shrubs communities, savannas, or tundra (Dzięciołowski 1994).

Management of the fallow deer must take into account its parallel occurrence with others native species. Therefore, its density should be lower in areas of co-occurrence of elk and roe deer populations than in habitats characterised by a low population size of other Cervidae species. The improvement of natural feeding conditions offered to fallow deer mainly involves introduction of grass

feeding grounds with an admixture of legume plants.

The influence of the quality of the environment on the weight of this species was evidenced in the studies of 15 hunting grounds in Holstein and Hesse (Ueckermann and Hansen 1983). No winter-feeding was carried out in these hunting grounds, as the impact of the natural environmental potential was analysed. In poor hunting grounds with bonitation values below 55, the mean dressed weight of does ranged from 29.8 to 39 kg. At bonitation rates of 73 and 76, the carcass weight was more stable, i.e. on average 37.5–39.7 kg. Additionally, no damage to the forest area was recorded at a density of 10 fallow deer per 100 ha. At a density from 14 to 25 per 100 ha of the forest area, the damage was negligible, but became economically significant at a density exceeding 30 individuals per 100 ha. These studies, which were carried out in rich environments with high bonitation rates (Ueckermann and Hansen 1983), prove that management of an environment to be favourable to animals and maintenance of suitable density are the most important elements in breeding practice.

The size of fallow deer populations in the country has doubled over the last several years (from 2005/2006 to 2015/2016). However, a marked slowdown in this trend was recorded in 2011––2015. In 2015, the population size in leased hunting districts was estimated at 20.4 thousand animals, which was by 2% lower than the value recorded in the previous year (20.8 thousand). However, the number of hunting districts in which the species was recorded was still increasing from 250 in the 1990s (Dzięciołowski 1994) to 687 in 2011, 751 in 2013, and 785 in 2015 (i.e. 17% of all districts). In spring 2015, fallow deer were present in 47 hunting districts; they were recorded for the first time in the Białystok district. They were not reported from only two districts, i.e. Łomża and Przemyśl. The districts in the west of the country were usually characterised by higher densities of fallow deer per forest area unit, compared with the eastern part. The highest density in 2015 was noted in the Leszno district – 23.1 individuals per 1,000 ha, followed by Poznań (11.1) and Toruń (10.1). Some districts, especially those with a low fallow deer population size, are characterised by a recent increase in the number of these animals (Panek and Budny 2015). In the future, a substantial increase in the population size of the species can be expected. This may be associated with a greater negative impact of fallow deer on the native *Crevidae* populations involving competition in forest ecosystems (Obidziński et al. 2012). Such a phenomenon is likely to appear at considerable population sizes, which should be controlled by humans.

Chapman and Chapman (1975) reported that the common method for fallow deer stocktaking based on counting animals' traces underestimates the population size of this species. The authors indicate that fallow deer round-up and direct counting of escaping animals yield more realistic assessment of their numbers. The authors do not find any data supporting the idea that the quality of the antlers can be improved by selective culling or resettlement of fallow deer for the so-called "blood refreshment". The studies described above indicate that *Dama dama* is well adapted to the conditions

prevailing in Poland. Particular attention in the management of populations of these species should be paid to their density and population size so that they do not endanger native animal populations.

INTRODUCTION OF MOUFLONS

The mouflon (*Ovis aries musimon*) is an non-native species in Poland. At the beginning of the 20th century, it was introduced in the Sudety Mountains to enhance the attractiveness of hunts. It was transferred from Slovakia to the surroundings of Bielawa in the Sowie Mountains in Lower Silesia in 1901. Next, the species was introduced in the area of other mountain ranges (Karkonosze, Góry Wałbrzyskie, Masyw Śnieżka) and in lowlands (Nowakowski et al. 2009). Before World War II, approximately 300 individuals inhabited these areas. As in the case of other species, the mouflon population size declined during the war. In 1950, the abundance of the species was estimated at 700 individuals (Szczepkowski 1973, Błaszczyk 2007). Ten years later there was a rapid decrease in the number of mouflons in Lower Silesia to the level of 130 individuals. Subsequent introduction attempts did not bring expected results and this situation did not change for another twenty years (Huruk 1995). Unlike in Poland, the mouflon population size in the neighbouring countries was substantially higher, i.e. 14,370 individuals in Czechoslovakia and 3,000 in the former East Germany (Röhrs 1986). Despite the failure, the species introduction in Poland was continued. The population size of mouflons increased from 500 to 1,600 individuals in 1985–1995 (Nowakowski et al. 2009). More than ten years later, the population of wild sheep in Poland comprised approximately 3,000 individuals, with a majority living in Lower Silesia (70%) (Łabędzki et al. 2007). Currently, the population from the Sowie Mountains counts about 1,830 individuals and is the largest population of this species (Bobek et al. 2014). The second largest population with its approximately 250 animals inhabits the area of Jawor Forest District. The total mouflon population in Poland comprises 1,000 individuals (Solarz 2008).

The natural mouflon occurrence range extends from the Mediterranean Sea to central Asia. In Europe, the species mainly lives in Sardinia and Corsica. As a thermophilic animal living in specific conditions, the mouflon cannot survive in the Polish climate without human help and breeding procedures. The sizes of non-fed populations decline and the species disappears. Another threat is posed by predators and poaching, as the species exhibits low resistance to these dangers and may become prey of all larger enemies (Okarma and Tomek 2008).

The feed base for mouflons consists of herbaceous plants, primarily grasses and perennials, which account for up to 80% in spring and summer. In winter, mouflons feed on tree and shrub shoots (up to 56%), search for herbaceous vegetation under the snow cover, and eat dry leaves or bark. At a high snow cover, they have difficulty in finding food. Bark biting has also been observed in root sprouts and lower parts of trunks as well as seedlings and cuttings of deciduous trees in forest plantings. Mouflons feed all day with short intervals and at night (Heroldová 1988, 1996, Heroldová et al.

2007). Although, the species prefers the components of herbaceous vegetation, it has been found that approximately one third of the diet is composed of sprouts of tree species and their bark. This suggests a negative impact of the species on its habitats, especially at an excessive density of these animals (Homolka 1991).

Investigations of the influence of this species on the habitat in Czech Drahanská Vrchovina Highland (southern Moravia) demonstrated a density of 2 mouflons/km^2, 1 deer/km^2, and 7,5 roe deer/km^2 in the area. It was shown that mouflons were not a demanding species and were able to thrive in a habitat with a typical plant species composition that is suitable to roe deer and red deer. Tree species were the most important component of the mouflon's diet (on average 85%). The diet comprising shoots of deciduous trees and shrubs dominated in the vegetation season while spruce trees constituted a large proportion of food in winter. In winter, especially after snowfall hindering access to food, mouflons visited hayracks and used the feed supplied by hunters or foresters. These studies suggest an adverse effect of overpopulation of the species on forests (Homolka 1991).

Furthermore, mouflons live in isolated herds, attach to their habitat, and rarely wander over long distances (Frąckowiak et al. 2007). The absence of gene flow between populations was found to weaken them and cause occurrence of anomalies, e.g. abnormal coiling of horns, which consequently stabbed the animal's neck. The deformation was revealed in approximately 95% of males. In 2006, another 177 animals were introduced from Slovakia and the Czech Republic in order to increase the gene pool and prevent inbreeding (Pleśniarski et al. 2007).

The calculations made for the purpose of improving the genetic structure of the local population was based on the assumption that the number of mouflons in the area was about 550 individuals, thus the introduction of 177 animals from Slovakia and the Czech Republic should have eliminated adverse effect of inbreeding (Nowakowski 2002). However, 8 years after the introduction, no essential improvements were seen in the horns of the harvested rams. If the hypothesis of a high degree of homozygosity in the local population is true, the effect of introduction was severely limited, because in 2006 the population number of mouflons in the studied area was actually about 1,400 animals, thus 2,5 times higher than given in the hunters estimates. Therefore, the introduced animals did not constitute 32% of the local population size but only 12.6%. The second, competing hypothesis should also be taken into account, i.e. that the reason for the abnormal coiling of their horns is the excessive density of the mouflon population co-habiting the same area with a population of red deer. Between 2007 and 2013 in the Sowie Mountains there was an increase in the density of mouflons to the level of 68.8 animals/1000 ha and precious red deer to 54.1 individuals/1000 hectares of forest, which certainly degraded the quality of the potential food of these animals. The winter diet of mouflons in the studied area was composed predominantly of grasses, sedges and browse, i.e. by fodders of low nutritional value (Bobek et al. 2014).

The quality of animal populations can be controlled in multiple ways. One of them is the so-called "blood refreshment", i.e. mating related with unrelated animals. Mating of related animals often lowers the quality of one or more phenotypic traits or even degeneration, as described above in the case of the mouflon (Nowicki 1985, Nowicki and Kosowska 1995). Although "blood refreshment" is an effective procedure used commonly in husbandry (Nowicki 1985), the possibility of its effective application in the case of game animals is very poorly known. In hunting management, one of the objectives of management is the quality of the population and introduction to the population of individuals from the other place (of higher individual quality), it can be an important tool to improve the quality of game, but maintaining the appropriate densities adapted to the amount of food in the hunting ground plays a key role.

An additional factor, which unfortunately exerts an adverse effect on the population quality, is trophy hunting, in which individuals with the greatest antlers are harvested. This has been confirmed by investigations conducted in France, where a decrease in body weight (17.8% in females, 18.3% in males) as well as a reduction of the antler size (e.g. by 18–20% of the length) and changes in antler shape were observed over 28 years. A body weight decline in herbivores is very important, as it contributes to short- and long-term demographic effects and has a crucial impact on the life span (Gaillard et al. 2000). It is known currently that weight loss reduces resistance to parasites. In combination with isolation of animal groups, it contributes to a decline in general resistance and increases the susceptibility to diseases (Coltman et al. 2001), which can also be associated with the effects of inbreeding aggravating the unfavourable trends. In Poland, there have been no comprehensive mouflon population studies or a full assessment of the impact of these animals on native habitats, since nature scientists are not informed about planned introductions carried out without any phytosociological or habitat documentation. As indicated in the available Polish studies published by researchers interested in maintenance of mouflon populations, this animal does not have a negative impact on the environment, as the species is not competitive to the native fauna and causes negligible damage to forests (Kamieniarz 1993). Nevertheless, the recent monitoring of Natura 2000 habitats indicates that mouflons in our country exert a certain impact on the environment (Świerkosz et al. 2010).

There is a gap in the data on the appropriate density of mouflons in Europe. The mouflon density was estimated at 3.2 individuals/km^2 in the Cazorla Nature Park Segura y Las Villas, 1.6 individuals/km^2 in the Teide National Park (Tenerife), and 1.6 individuals/km^2 in Serranía de Cuenca (Tores et al. 2014). The investigations conducted by Tsaparis et al. (2008) showed an average density of mouflons in the Mediterranean area to be 22.1 individuals/km^2. The largest concentrations of this species were observed on wasteland or fallow land as well as in coniferous forest complexes, whereas the lowest density was found in maquis communities (scrub vegetation characteristic of the Mediterranean region). Interestingly, the density of mouflons in open

habitats was substantially higher than that of roe deer. The strong preference of grassland areas in this (grazing) species probably reflects the availability of food and contrasts with the more diversified use of habitats by roe deer (selective herbivore) (Tsaparis et al. 2008).

It has been shown that the most optimal density of mouflons in their occurrence range in Poland is 6 animals/100 ha although, German breeders suggest a level of 11–12 individuals/100 ha at intensive feeding practice. The density was reported to exceed 6 individuals/100 ha in subpopulations in the Wałbrzych Forest District (2003), likewise in other the Forest Districts (Jugów, Bardo Śląskie), whereas this value was substantially lower in other districts (Nowakowski et al. 2009). These observations confirm the need for constant supervision aimed at maintenance of this alien species in Poland as well as continuous monitoring and regulation of the population size to keep it at a level that will not threaten its habitat, as the species is more invasive than fallow deer.

CONCLUSIONS

Introduction of alien species can be a positive breeding practice, as demonstrated in the case of fallow deer. Introduction of animals that do not exert a negative impact on the native fauna, easily adapt, and inhabit a niche that has not been fully occupied contributes to the attractiveness of hunting management and increase biodiversity. However, when the introduced species is not adapted, its populations have to be constantly supported by prevention of inbreeding, as in the case of the mouflon. Breeding small populations in small areas isolated by long distances yields such effects. “Blood refreshment”, supply of a proper feeding base, and control of the population size to prevent inbreeding are the tasks for hunters and foresters taking care of the alien fauna. Additionally, the aspect of transmission of unknown pathogens and infections to native fauna should be considered and an excessive increase in the population size of alien species should be prevented to avoid interspecies competition.

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Streszczenie: *Gospodarowanie populacjami zwierząt łownych jako hodowla. Część III: Prace łowiecko-hodowlane na przykładzie fauny obcej*. W pracy przedstawiono zabiegi związane z introdukowaniem obcych gatunków na terenie Polski. Na przykładzie hodowli daniela i muflona wskazano problemy, z jakimi mogą się spotkać myśliwi-leśnicy w hodowli zwierząt obcych. W gospodarowaniu populacjami tych gatunków na terenie Polski należy szczególną uwagę zwrócić na zagęszczenia i liczebność, tak by nie zagrażały rodzimym populacjom zwierząt. Ponadto w gospodarowaniu łowieckim jakość populacji jest jednym z celów zarządzania, a „dosiedlanie" do populacji osobników z zewnątrz (o wyższej jakości osobniczej), może być ważnym narzędziem poprawy jakości zwierzyny oraz zapobiega problemom związanym z wysokim inbredem.

Słowa kluczowe: hodowla, zwierzęta łowne, introdukcje, gatunki nierodzime.

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