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Management of hunting animals population as breeding work. Part I: Impact of hunting and breeding work on animal conditions

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Abstract: *Management of hunting animals population as breeding work. Part I: Impact of hunting and breeding work on animal conditions.* The paper shows that rational management of game populations is a set of breeding practices. These mainly involve creation of appropriate conditions that will be most beneficial for normal development and reproduction of animals. However, game breeding is considerably more difficult and hunters face problems that differ from those encountered by breeders of domesticated animals. This part is focused on hunting work that can determine and primarily improve the ontogenic quality of animals. Unlike in livestock breeding, the size of the home range and living conditions of game animals can be improved by enrichment of the feed and shelter base, regulation of the population size by culling weak/diseased individuals, and minimization of stress factors. The results confirming the impact of the hunting and breeding treatments are illustrated in a population of roe deer.

Key words: breeding, hunting management, ontogenic quality

INTRODUCTION

The term "breeding" is usually used with reference to livestock animals. As specified by the Act of 2007 on organization of breeding and reproduction of farm animals, breeding is a set of practices targeted at improvement of the hereditary traits (genotype) of livestock, which comprises assessment of utility and breeding values of farm animals, selection, and choice of individuals for mating in normal breeding conditions. Hunting management is a breeding practice but it is more difficult than farm breeding, since game animals cannot be directly influenced and controlled by humans. Game breeding does not involve typical breeding treatments, there are no breeding registers or books, and the animal mating and reproduction are not controlled. Nevertheless, man can improve the ontogenic quality of game inhabiting a given area in a specific way, e.g. by regulation of the population size of species through reduction or selective culling. The impact on the density of game animals is of great importance in natural hunting grounds, as it facilitates management of habitat, thereby reducing stress associated with excessive density. The basis of game breeding is to provide an adequate living space and an appropriate sex and age structure in animal populations.

THE MAIN COMPONENTS OF GAME MANAGEMENT

Rational hunting management consists mainly in creation of appropriate conditions that will be most beneficial and ensure normal development and reproduction of game animals to great extent. The protection and management of hunting animal resources are regulated by the Hunting Law (1995). The most important statutory targets of hunting management in relation to wild animals include:

- protection, preservation of diversity and rational exploitation of hunting animal populations;
- protection and modelling of the natural environment aimed at improvement of the living conditions;
- maintenance of an appropriate population size of hunting animal species – regulation of the number of animals and maintenance of environmental balance.

This indicates that the two major objectives of hunting management are associated with modelling of an appropriate game living habitat. For persistence, individual species need specific ecological living conditions, primarily related to the nutritional and lifestyle requirements. An appropriate environment for deer (Cervidae) is provided by forest and field habitats. The amount and quality of feed available to animals varies between different regions. The feed base provided by the groundcover and understorey in mixed forest complexes growing on rich soils differs from that available in dry pine forests. Therefore, the basic analysis of the possibilities and principles of game management in a specific region should involve determination of the species for which the area will offer optimal conditions and the mode of providing the species with adequate living conditions. Another step should consist in determination of the appropriate density of animals, which is the allowable number of animals of a given species per area of land that can inhabit a hunting complex, with the provision that the damage caused by these animals to cultivated fields or forests will be economically tolerable, i.e. until there is a need for application of technical methods of protection (Haber et al. 1977).

Hunting mammals classified as the so-called big game are herbivores (except for the omnivorous wild boar). A detailed analysis of deer feed has shown that, depending on the season of the year, shoots, buds, leaves, needles and bark of trees and forest shrubs account for 35–75% of the total feed intake. Besides nutrition, animals need appropriate shelter conditions to reproduce, raise their offspring, and avoid danger, e.g. posed by predators. Foresters and hunters are able to shape and improve the animal living conditions. Enrichment of the feed base is necessary mainly in forest hunting grounds, as field habitats offer sufficient amounts of available food. In field areas comprising large-scale cultivations, creation of shelters is more necessary (Haber et al. 1977).

Breeding and hunting practices that can bring long-term benefits to game animals include enriching the species composition to tree stands, management of mid-forest meadows, and establishment of hunting plots. Reconstruction of the tree stand by planting undergrowth or understorey species serves not only animals but also forests. Forest

monocultures usually offer scanty feed and shelter bases. Reestablishment of the tree stand by introduction of climax species yields a plant community with greater resistance to diseases and weather conditions, thereby improving the living conditions of animals, which become an integral part of the habitat. Additionally, more rapid methods can be employed, e.g. enhancement of the productivity of mid-forest meadows by regulation of water relations, appropriate fertilization, planting appropriate species, and proper management. Foresters and hunters engaged in wild animal breeding can diversify the composition of animals' diet by establishment of special feed and browse plots, i.e. areas with sown or planted vegetation serving animals as stump feed. Particularly important is the introduction of winter crops in order to provide food rich in nutrients and water in the most demanding period, i.e. winter. This method not only increases and diversifies the natural feed base but also stops animals within tree stands, thus limiting damage to forest and field crops. The so-called feed-shelter areas among the hunting plots deserve attention. The basic goal of these plots is to provide animals with sufficient protection (Haber et al. 1977). When animals are provided safety in a given area, it is advisable to introduce plant species that will serve as their food. One of the methods to achieve this breeding goal may be the introduction of mid-field tree planting in the agricultural landscape. The method proved to be effective in single-species tree stands, in which understoreys or biocoenotic foci were introduced. Given the specificity and distinctness of agricultural ecosystems, the biocoenotic role of balks, mid-field refugia, or roadside shrub and tree plantings should be taken into account and exploited (Sporek and Sporek 2016). These small, forested areas surrounded by cultivated fields with intensive agriculture constitute flora and fauna refugia and "emergency stores" for species, which can restore their population in favourable circumstances. With their multi-layered vegetation system, they constitute the most effective shelters for free-living animals and provide sites of rest, birth, migration, and offspring rearing (Sporek 2002). Additionally, they provide a shelter at the time of human activity associated with conducting agrotechnical treatments and crop harvesting. Mid-field tree plantings are therefore one of the species-richest refugia in the agricultural landscape (Sporek 2009).

When there is a thick and persistent snow-cover, particularly when additionally covered by ice, winter crops, heather patches, or berry shrubs can be uncovered and paths can be created without startling game animals. This will enable the animals to obtain food and move around the refugium, thus preventing unnecessary losses of energy while searching and digging for food. Besides appropriate shelter and feed conditions, game animals should be provided with access to water. By taking care of natural waterholes or properly constructed artificial reservoirs, hunters can make water available to wild-living animals (Haber et al. 1977).

In this way, man can manage, to some extent, the habitat, i.e. an area where the animal's daily activities take place. It has its temporal and spatial dimension (Dzięciołowski 1994). By way of

comparison, the home ranges of wild-living animals correspond to livestock's cowsheds or piggeries, and enrichment of the feed and shelter base and management of the habitat as an element of targeted wild animal breeding is one of the most important practices, as indicated by the examples described above.

Additionally, the feeding of game animals must be rational. The practice of feeding animals in the hunting management has different importance than in the case of livestock animals. Game animals have adapted to the changing climate and prepare to adverse conditions by intensive feeding and fat storage in autumn, development of a denser and warmer hair coat, or migration into more favourable areas. Nevertheless, by feeding wild animals, i.e. enriching rather than replacing their natural feed base, man can contribute to improvement of their health. There are conflicting opinions on the question whether feeding wild animals is beneficial and indispensable or rather harmful and unnecessary; yet, this practice is widely applied in many regions of the world (Gill 1986, Putman and Staines 2004). In the case of game animals, the reasons why such practices are implemented are specified in the literature as (1) maintenance or an increase in the body weight and improvement of the wintering conditions; (2) enhancement of the effectiveness of reproduction and rearing; (3) increased winter survival rates; (4) maintenance of a high density of hunting animals and improvement of the trophy quality; and (5) reduction of damage in forestry and agriculture (Calenge et al. 2004, Geisser and Reyer 2004, Putman and Staines 2004, Sahlsten et al. 2010). In some cases, feeding may have a positive effect in view of the risk of infection with some diseases, as it improves the resistance of animals otherwise weakened by stress, age, or drought (De Vos et al. 2001), as many parasites and disease vectors tend to attack undernourished individuals (Cunningham-Rundles et al. 2005).

Both practices described above, i.e. establishment of home ranges and feeding, are specific elements of zoohygiene in the conventional livestock breeding. Game animals inhabit not only forest complexes but also fields. The structure of agricultural crops is constantly changing, and there is an increasing proportion of large-scale maize and wheat cultivation. In such monocultures, some animal species find not only food but also good protection conditions. Continuous human interference in the environment and mild winters contribute to a steady increase in the animal population size. Hence, the third purpose of hunting, i.e. management of an appropriate population size in a specified area, should be borne in mind. However, the intended regulation of the number of game animals through culling should be carried out taking into account the variability of the dynamics of the population present in the habitat on a local scale as well as the heterogeneity of the environment, diversity of forest ecosystems, microclimate, and presence and density of developments.

All deviations, i.e. excessive or insufficient density, substantially change the reproduction rate and pose stress to animals. This information is of great importance for the design of optimal harvesting of animals (Krupka 1989). As written by Krawczyński in his handbook for foresters and hunters (1947):

"the uncritical accusation of unnecessary killing of innocent animals on hunts is ridiculous, as game animals were created to be used; yet, there is a need for the awareness that animal reproduction and hygiene depends on rational and appropriate culling, either by hunting or breeding-selective practice". Without proper selective culling "roe deer undergo degeneration and bucks exhibit regress of antlers". In the case of elks, which "wander over long distances with no return (…), at a certain maximum population size in a given area, a further increase in the number of the animals is unnoticeable".

The regulation of the game population size by culling should proceed in an analogous way as livestock culling. These practices should be aimed at retaining the healthiest and fittest animals in the hunting grounds to ensure the best genes in the subsequent generations. The principle is to eliminate any deviations from the breeding target from the population. It is mandatory that diseased animals as well as those that clearly do not fulfil the body and antler weight criteria and the oldest individuals should be eliminated (Dzięciołowski 1994). Besides the selective culling, the practice of the so-called sanitary culling is employed in the case of occurrence of a disease or its threat (The act on the protection of animal health and the control of infectious animal diseases of 2004). The primary and fundamental task will always be to maintain populations of free-living animals in good health. An optimal population size in a given area prevents transmission of diseases. Growing numbers of wild animals can contribute to the spread of vectors of parasites into new areas in the natural environment where they have not been present before. Infections with new species of parasites are a very dangerous phenomenon and can lead to falls of a large number of animals (Burliński et al. 2011).

In game breeding, excessive density of animals should be prevented, as it results in constant stress associated with a shortage of food and proper shelters, which may lead to deterioration of immunity, increased prevalence of diseases, weakness, and mortality (in winter). Overpopulated herds with excessive numbers of females and juvenile animals exhibit new appetitive (e.g. imitative, consummatory) behaviour influencing the health status. Overpopulation in large ungulates has a negative impact on the function of forest ecosystems and causes local damage to forest crop cultivation, thus exacerbating the economic hunting-related problem of damage (Szukiel 1994).

Such elements as density, habitat quality, genetic structure, climate etc. are regarded to be key predictors of the body size in even-toed ungulates. It is highly important that managers of nature should pay particular attention to the dependence of animal body size on living conditions and, in the case of hunting animals, to the hunting ground and harvesting sizes (Zannese et al. 2006). One of the parameters of an appropriate density of wild ungulates in the habitat is the ontogenic quality reflected in e.g. body weight and size, antler quality, and reserves of adipose tissue (Czyżowski et al. 2008). At an appropriate quality of hunting grounds and controlled harvesting, the animal fitness can be improved and the population size can even be restored, as in the case of the red deer and elk in Poland.

Well-nourished animal females give birth to healthier and stronger offspring in the subsequent generation, while males develop stronger antlers and pass on better genes. Therefore, the body or carcass weight is one of the most important indicators of the ontogenic quality of animals. It depends on many factors, e.g. the species, sex, age, or physiological status of the animal (Bobek et al. 1984). In many game species, body weight varies not only throughout their lifetime but also in the different seasons of the year. The differences can be induced by various external factors such as weather conditions and anthropopressure or can be associated with the behaviour and physiological condition of the animal (oestrus, pregnancy, lactation etc.). The effects of these factors can be modified be regulation of the appropriate density of individual animal species in a given area.

The status of the native game species, i.e. the red deer, roe deer, or elk, in Poland underwent substantial changes in the past. This was often the result of human activity, which exerted a direct and indirect impact on the population size and distribution of wild-living animals.

IMPACT OF BREEDING-HUNTING PRACTICES ON THE ROE DEER POPULATION

The European roe deer (*Capreolus capreolus* L.) is the most numerous representative of the Cervidae family in Poland and Europe. The species is characterised by high plasticity and, hence, can live in different habitats. The roe deer thrives in open areas, treeless areas and arable fields, lowland and mountain areas, and large and small forest complexes (Pielowski 1999).

The roe deer, which is the least stress--resistant species of all Polish cervids (Reimoser 2012), exhibits population variability on a local scale, in a relatively small area, and within a short time. Animal falls are frequently noted in the case of food shortages and adverse weather conditions. However, there have been no large fluctuations in the population size of this species in recent years. Thanks to feeding, appropriate regulation of the population size in culling practice, and minimisation of stress by frequent harvesting of this species in individual hunts, the population size of roe deer it did not undergo a drastic decline. Slight fluctuations numbers of this species have not led to the need to undertake actions to rebuild populations.

At the turn of the 20th and 21st centuries, the population size of roe deer in Poland exhibited an upward trend. However, the population of this species has recently stabilised at approximately 800 thousand individuals (797 thousand in spring 2015). Roe deer harvesting per unit area, i.e. the density of these animals in individual regions of the country, is more levelled than in the case of other Cervidae (Panek and Budny 2015).

The examples mentioned below present the variability of selected morphological features of European roe deer related to improvement of the ontogenic quality of certain populations resulting from the biological traits of the species and implemented breeding-hunting practices. The investigations have shown a varied ontogenic quality of bucks in Poland determined from the body and antler

weight (Chrzanowski 1977, Fruziński et al. 1982, Dziedzic 1991, Żurkowski and Chartanowicz 1998, Drozd et al. 2000). As specified by Bergmann rule, the mean body mass increases from 12 kg in southern Europe and 16–20 kg in Poland to ca. 30 kg in northern Sweden (Pielowski 1999, Brzuski et al. 1997).

The investigations conducted in Poland confirm this rule, and the weight of adult animals is often similar or higher than the upper limit of this range. In a small area near Kraków, the mean carcass weight (without the head) was 15.1 kg in the second year, 17.3 kg in the third year, and 17.9 kg over the fourth year of animals' life. Another parameter analysed was the mean skull weight, which was in the range of 316.4–407.1 g in roe deer from Miechów Upland and Proszowice Plateau and 272.7–328 g in this species from the Jurassic Landscape Parks. An analogous trend was observed for of the antler weight in males. In individuals in the third and in the fourth year of life, the heaviest antlers were developed by individuals from Miechów Upland and Proszowice Plateau (mean 361.9 g), whereas the lowest and shortest antlers were noted in the Jurassic Landscape Parks (approx. 340 g and by 2.9–2.6 cm shorter) (Wajdzik et al. 2007).

As shown by these examples, the environment managed by humans has a major impact on animal body weight and, hence, their ontogenic quality (Dziedzic 1991). The bucks characterised by the highest body weight and the best parameters analysed represent a field ecotype from the area north of Kraków (Miechów Upland and Proszowice Plateau), in contrast to the roe deer living in the Jurassic Landscape Parks. Animals from field ecosystems are fitter and heavier on average by ca. 1.2 kg than forest animals (Fruziński et al. 1982, Pielowski 1993, Brzuski et al. 1997, Wajdzik and Jamrozy 2001).

Comparison of the mean carcass weight of the roe deer harvested in the around of Kraków showed that it was similar to the values reported from West Volhynia, Roztocze, Opolszczyzna, Piska Primeval Forest, Lubelszczyzna, or surroundings of Poznań. The mean weight buck carcass from Opolszczyzna, Piska Primeval Forest, and Poznań (forest ecotype) was 12.8 kg, 14.9 kg, and 16.3 kg in two-year-olds, three-year-olds, and over four-year-olds, respectively. In turn, these values reported from West Volhynia, Roztocze, and Lubelszczyzna were 15.3 kg, 17.3 kg, and 18.9 kg, respectively (Szczerbiński et al. 1972, Dziedzic 1991, Chartanowicz et al. 1992, Żurkowski and Chartanowicz 1998, Wajdzik and Jamrozy 2001). The animals living in eastern Poland are characterised by the best ontogenic quality in the country.

It has been proved that the resistance to seasonal changes in the availability of food resources is reflected by the size of the body and, simultaneously, the size of the skeleton. In particular, the length of the mandible is an important indicator in many Cervidae species. Larger mandibles have been found in animals living in better conditions. The greatest increase in the mandible length is observed between birth and the first year of life, and up to four years, when the length can increase by approx. 1 cm per year. This suggests that environmental conditions in which a young animal lives have a great impact on its final size and fitness. The mandible length was also compared with the density of roe deer in the southern part

of Belluno (Italy). It was found that the density value decreased from the north southwards of this region and was 0.44 and 0.33 animals per 1 km^2, respectively. The harvesting rate declined throughout the study period in the southern, which may have contributed to an increased density and a slight reduction of the mandible length in subsequent generations. In turn, the same harvesting rate was maintained in the north and the length of the bone in fawns was constant or increased minimally (Zannese et al. 2006). This has evidenced that, besides the living environment, animal density has a great impact on animal fitness and the regulation of the animal population size may be successfully carried out by man. Additionally, one parameter can be used to assess whether the management of Cervidae populations in a given area is conducted properly.

CONCLUSIONS

There are considerable effects of human interference on the populations of free-living animals. This study has demonstrated that hunting can bring positive effects in the management of the spatial, sex, and age structure of animals, thereby determining the ontogenic quality of individuals. Due to the possibility of reduction of the population size, e.g. by culling, the density of individuals in a given area can be regulated, which results in development of stronger antlers by males or giving birth to healthier offspring by females. Furthermore, the side effects (e.g. economic) of the density regulation practice include reduction of damage to hunting grounds and minimisation of road collisions. Nevertheless, it should be borne in mind that the regulation of the animal population size should be carried out based on knowledge of the quality of the biotope, number of inhabiting animals, and the number of natural enemies of the animals, since optimal densities may vary between ecosystems, depending on the species and habitat.

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Streszczenie: *Gospodarowanie populacjami zwierząt łownych jako hodowla. Część I: Wpływ prac łowiecko-hodowlanych na kondycję zwierząt.* W pracy wykazano, że racjonalne gospodarowanie populacjami zwierząt łownych to zespół zabiegów hodowlanych. To przede wszystkim tworzenie odpowiednich warunków, najbardziej korzystnych, odpowiadających w możliwie największym stopniu właściwemu rozwojowi i rozmnażaniu się zwierzyny. Hodowla zwierząt łownych jednak jest o wiele trudniejsza, a myśliwi napotykają się na problemy zupełnie inne niż hodowcy zwierząt udomowionych. W części tej zwrócono uwagę na prace łowieckie, dzięki którym można kształtować, a przede wszystkim poprawiać kondycję osobniczą zwierząt. Porównując hodowlę zwierząt dzikich do udomowionych, areały osobnicze zwierząt dzikich można poprawiać poprzez wzbogacanie bazy żerowej i osłonowej, regulowanie liczebności poprzez odstrzał osobników słabych/chorych czy też minimalizowanie czynników stresogennych. Wyniki potwierdzające wpływ zabiegów łowiecko-hodowlanych przedstawiono na populacji sarny.

Słowa kluczowe: hodowla, gospodarka łowiecka, kondycja osobnicza

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