PARAMETERS AND STATE VARIABLES OF RED DEER POPULATION *(CERVUS ELAPHUS*) FROM THE SOUTH SLOPE OF THE FĂGĂRAŞ MOUNTAINS

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Numerical structure (abundance, dynamics, natality, mortality, rates of natality and mortality, natality growth and sex ratio) of red deer population from the South slope of the Făgăraş Mountains has been studied. Since red deer population is formed of 9 subpopulations, with opened circulation corridors between them, we appreciated that, on the South slope of the Făgăraş Mountains, it is a metapopulation. The dynamics of individual numbers from 1996, the first year of researches till 2006, the last year of researches, was as follows: Voievoda: 35-27/9600 ha; Şeţu: 25-18/7600 ha; Portăreasa: 20-14/6100 ha; Huluba: 15-12/ 5400 ha; Frăcea: 20-13/ 6000 ha; Dobreiaşu: 15-11/5300 ha; Leaota: 25-18/7500 ha; Făgeţel: 20-14/6800 ha and Valea lui Coman: 25-18/7500 ha, with a total number of 200 individuals in 1996 and 145 in 2006. As an average, numerical density was 1 individual to 4.3 ha. In all areas, a decrease in number of individuals was noticed between 1996 and 2006, comprised between 8 individuals (Voievoda) and 3 individuals (Huluba). Rate of mortality was higher in females than in males, especially during the winter time when they are pregnant. Because of that, sex ratio was modified, with a higher number of males than of females.

Key words: red deer, estate and dynamic variables, population, metapopulation, sex ratio.

INTRODUCTION

Cervus elaphus (red deer) is exclusively a forestry animal and prefers forest massives on large surfaces, which ensure him food and quietness. The researches that have been done on red deer were on different subjects, such as: general peculiarities (Badea, 1964; Almăşan, 1967; Georgescu *&* Georgescu, 1996; Lungu, 2006), the influence of snow cover on the deer behaviour and its strategies in relation with wolf (Atkinson *&* Janz, 1994; Mitteldorf *et al*., 2002), trophic interactions between wolf and deer utilizig mathematical models Lotka - Volterra (Gardini *et al*., 1989; Abrams, 2000; Ackleh *et al*., 2000; Levin, 2002; Mitteldorf *et al*., 2002; Li Chun-Xia *et al.,* 2005; Darimont *et al*., 2004; Krivan, 2008; Krivan *&* Cressman, 2009; Mandu, 2010 a, b), economic and cynegetic importance (Goicea, 2000).

Generally, red deer keeps major limits of his areal from the south part of Făgăraş Mountains. Inside of his areal, there are some changings of his preferred habitat, depending on the season. In this way, after autumnal concentrations of

individuals, determined by pairing in the places of belling, herds of individuals, differentiated on sexes, are found at higher altitudes during the winter, established, for a short time, near the limits of forest, looking for herbal vegetation, still existing in this area. Because of covering the soil with a snow layer, deer is coming down in the lower places, with a preference for the the south parts of the mountain. After passing of the winter season, deer reoccupies all the stations from inside his areal.

MATERIAL AND METHODS

SELECTION AND ORGANIZATION OF RESEARCH AREAS

The researches were undertaken on the south part of the Făgăraş Mountains, in an area placed between the administrative limits of Forestry Argeş Department, Forestry Arrondissements of Aninoasa, Câmpulung, Domneşti, Muşăteşti and Rucăr. Red deer and wolf habitats existing in the area of those arrondissements, represent hunting funds which, in turn, are divided in other areas, with surfaces and limits well determined. Thus, the area where observations have been made and data were collected (about 61800 ha) was divided in three hunting funds, each comprising a specific number of surfaces as follows: Hunting Fund Râuşor comprised two surfaces: Voievoda (9600 ha) and Şeţu (7600 ha); Hunting Fund Râul Târgului with four surfaces: Portăreasa (6100 ha), Huluba (5400 ha), Frăcea (6000 ha) and Dobreiaşu (5300 ha); Hunting Fund Stoeneşti including three surfaces: Leaota (7500 ha), Făgeţel (6800 ha) and Valea lui Coman (7500 ha).

In view of the surface selections, all types of habitats were taken into account, so that to be represented beech and coniferous forests and also alpine goal. Into the chosen area for researches a great variety of surfaces were met like valleys, tops and a large variety of biotopes for red deer. Besides, there is an alternance of forests, pastures and even agricultural surfaces.

THE ESTABLISHMENT OF INDIVIDUAL NUMBERS

Depending on the type of habitat, there were established the observing points, following an altitudinal transect, so that the individual numbers of red deer were counted starting with 1996 till 2006, in the form of “seen deers”. Numbering of deers was easy to do in the alpine goals and pastures, especially in the twilight. Numberings were done on the same transect, each year. There were done three numberings in each season, one week interval between them, establishing the individual number in each herd and those averages on each season. The numbers of deers were established through direct numbering from points of observations.

RESULTS AND DISCUSSION

THE SIZE OF POPULATION

Red deer population is formed of 9 subpopulations, located in the areas already presented. Because of open corridors, there is a circulation between the individuals of those subpopulations, so that all those subpopulations make a metapopulation with 9 subpopulations, with a total number of 200 individuals, at the beginning of researches (1996), and 145 individuals in 2006, the year when researches have been stopped (Table 1) . Numerical dynamics of red deer, during the period 1996-2006, was marked, in all surfaces, by a diminution of individuals, comprised between 8 individuals, Voievoda, and 3 individuals, Huluba (Table 1, Fig. 1). At the same time, diminution of the number of individuals was the highest in Şeţu, Frăcea, Leaota and Valea lui Coman surfaces, namely 7 individuals, whereas in Portăreasa and Făgeţel surfaces, 6 individuals. Except for Huluba surface, where the diminution of individual numbers was the smallest one, 3 individuals, the diminution of individual numers in all other surfaces was relatively uniform, with values comprised between 6 and 8 individuals. Generally, the diminution of individual numbers was due to poaching, on the one hand, but also to the wolf attacks, especially during the winter time, when his food is mainly made by deer, on the other hand. After the first three years, 1996, 1997 and 1998, when a relatively constancy of numerical abundance was noticed, a diminution of it in all surfaces followed, with higher or lower numbers, depending on the surface.

NUMERICAL DENSITY

Numerical density of red deer was mainly the same in all searched surfaces, with very small variations between them (Table 2). Maximal amplitude between individual numbers on square kilometer was 0.07, but the number of square kilometers for an individual was 1.3 for Voievoda and Făgeţel surfaces. The other surfaces were very similar, no matter how large they are, an idea that confirms the necessity of an optimum surface for each individual to carry on his vital activities for food, reproduction and shelter. In other words, mean numerical density of deer, in all 9 searched surfaces, was 1 individual to 4.3 square kilometers. Confronted by these average surfaces, all the other surfaces deviate till 1 square kilometer, most of them with values up to 0.5 square kilometer, confirming the existence of an optimal surface for deer.

NATALITY AND MORTALITY

The mortality, due to different causes, was higher than natality, so, at the end of 2006, individual number of deer was smaller than in 1996, in all surfaces

(Tables 1, 3; Fig. 2). In these conditions, natality and mortality rates were high, evidently higher for mortality. The highest mortality was in Voievoda surface, where the difference between alive born and dead individuals was 8 individuals, which determined a diminution of number of individuals from 35, in 1996, to 27, in 2006 (Table 1). The small difference between natality and mortality was of 3 individuals and it was registered in Huluba surface, which caused a diminution of number of individuals from 15 in 1996, to 12 individuals in 2006 (Table 3).

Table 1

Number of red deer, in the observation years, on the searched surfaces

Surface	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Voievoda	5	35	35	34	33	33	30	30	27	27	27
Şeţu	25	25	25	21	22	22	20	20	18	18	18
Portăreasa	20	19	18	18	17	12	12	12	14	14	14
Huluba	15	15	14	13	13	14	12	12	12	12	12
Frăcea	20	20	18	16	16	16	13	13	13	13	13
Dobreiaşu	15	15	14	13	13	13	11	11	11	11	11
Leaota	25	24	24	22	21	21	18	18	18	18	18
Făgeţel	20	21	21	20	18	18	14	14	14	14	14
Valea lui Coman	25	25	25	23	21	21	18	18	18	18	18

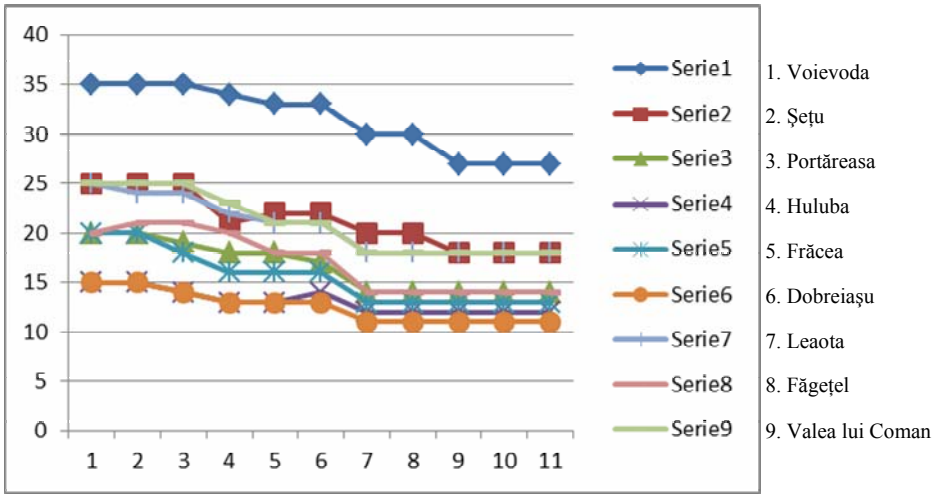

Fig. 1. Deer numerical dynamics during 1996-2006.

Table 2
Numerical density of red deer in 2006

Surface	Total number of individuals	Total surface (km^2)	Numerical density	
			Number of individuals/km^2	Number of km^2/ one individual
Voievoda	27	96	0.28	3.5
Şeţu	18	76	0.23	4.2
Portăreasa	14	61	0.23	4.3
Huluba	12	54	0.22	4.5
Frăcea	13	60	0.22	4.6
Dobreiaşu	11	53	0.21	4.8
Leaota	18	75	0.24	4.2
Făgeţel	14	68	0.21	4.8
Valea lui Coman	18	75	0.24	4.2

Table 3
Natality and mortality of red deer on the south slope of the Făgăraş Mountains during 1996-2006

Hunting fund	Number of individuals at the beginning of period	Number of individuals born	Number of individuals dead	Number of individuals at the end of time	Natural growth	Natality rate	Mortality rate	Natural growth rate
Voievoda	35	80	88	27	-8	7.3	8	-0.7
Şeţu	25	63	70	18	-7	5.7	6,6	-0.9
Portăreasa	20	44	50	14	-6	4	4.5	-0.5
Huluba	15	30	33	12	-3	2.7	3	-0.3
Frăcea	20	43	50	13	-7	3.9	4.5	-0.6
Dobreiaşu	15	33	37	11	-4	3	3.4	-0.4
Leaota	25	55	62	18	-7	5	5.6	-0.6
Făgeţel	20	46	52	14	-6	4.2	4.7	-0.5
Valea lui Coman	25	54	61	18	-7	4.9	5.5	-0.6

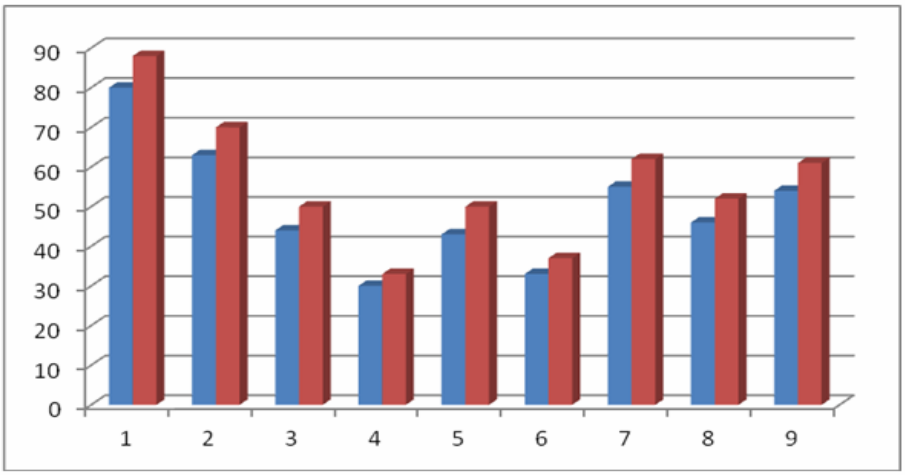

Fig. 2. Natality (short columns) and mortality (high columns) in red deer population during the period 1996-2006. (1 – Voievoda; 2 – Şeţu; 3 – Portăreasa; 4 – Huluba; 5 – Frăcea; 6 – Dobreiaşu; 7 – Leaota; 8 – Făgeţel; 9 –Valea lui Coman).

NATURAL GROWTH

Because of higher mortality than natality, natural growth of deer population was negative in all surfaces. Comparing the diminution of individual numbers in all surfaces, it was between 88 individuals, in Voievoda surface, where the mortality was the highest, and 33 individuals, in Huluba surface, where the mortality was the lowest (Table 3). Taking into account this situation, in the conditions that deer population decreased so much and with a decreasing tendency for the following years, natural growth rate was negative in all surfaces (Table 3). Because of that, there were taken special measures to maintain their number of individuals to optimal values.

SEX RATIO

Sex ratio of red deer population, looking for a total number of individuals of 145 and an area of 61800 hectars, was modified, given the normal of 1/1 (Table 4). That happened because females were easier killed by wolves, especially during the winter time, when they were pregnant, compared with male individuals, who can better protect themselves against wolves, their antlers being used as strong army in the battle with wolves. Thus, from 88 individuals killed, 72 were females. From 22 individuals killed at the beginning of April till the end of October, only 2 were males. From 66 killed deer at the beginning of autumn months and all the winter time, 52 were females and only 14 were males. Winter months represented the most favorable time for killing deer. That was not only because females were pregnant, but also because wolves used special strategies, organizing themselves in packs of wolves, which does not happen during the summer time.

Table 4

Sex ratio of red deer population (in the favour of males) on the south part of the Făgăraş Mountains

Surfaces	**Total individual numbers**		**Sex ratio**
	Males	**Females**	
Voievoda	17	10	0.59
Şeţu	13	5	0.38
Portăreasa	10	4	0.4
Huluba	8	4	0.5
Frăcea	10	3	0.3
Dobreiaşu	8	3	0.4
Leaota	13	5	0.4
Făgeţel	9	5	0.6
Valea lui Coman	13	5	0.4
TOTAL	101	44	0.44

CONCLUSIONS

The researches that were done in order to find out some parameters and state variables of red deer population on the south slope of the Făgăraş Mountains, between 1996-2006, have finalized with the following conclusions:

The researches were done in an area of 61800 ha, formed by three hunting funds. Searched surfaces are forests (72%) and secondary pastures (28%), located at different altitudes, starting with hill forests (Voievoda, 900 m), forests and pastures from inferior mountain level (Şeţu), forests and pastures from superior mountain level (1400 m), up to forests from superior mountain level, forests from superior limit of forest vegetation (1900 m), and subalpine pastures (2400 m). The size of population was evidenced not only through the individual numbers, but also through their numerical density. The obtained values were almost the same as those known from literature. Mortality was determined by endogenous causes, as were sicknesses, and also by exogenous ones, such as poaching. The poaching of red deer was high in all seasons, being one of the main reasons which influenced the individual dynamics. Mortality rate was higher onto Voievoda and Şeţu surfaces, located at lower altitudes, where the influence of man was strong, than those surfaces located at higher altitudes. Sex ratio was 0.44, and that was because of a smaller number of females than of males. Females are easier killed by wolves, especially during the winter time when they are pregnant (Mandu, 2010 a, b).

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