PARAMETERS AND STATE VARIABLES OF WOLF POPULATION *(CANIS LUPUS* L.) FROM THE SOUTH SIDE OF FĂGĂRAŞ MOUNTAINS

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Key words: geographycal distribution, population, metapopulation, state and dynamic variables, sex ratio

INTRODUCTION

In the economy of nature, wolf (*Canis lupus* L.), through its position in the tropho-dynamic systems, represents an important link in the proccesses of circuit of matter and flux of energy and, in the same time, an important regulation factor of prey animal populations.

As numerical effective are discussed, the highest ones are in Romania, 3000, probably 4000 induviduals, reprezenting almost 35% from all european countries. from all european countries. On the world-wide, Kazahstan is the country with the highest numerical effectives, around 90,000 individuals, comparing with 60,000 in Canada, with 60.000 individuals, but with a territory 3.5 biger than of Kazahstan. http://www.nwf.org/News-and Magazines/NationalWildlife/Animals/Archives/2007/ Romanias-Wolves-In-the-Crosshairs-of-Conflict.aspx

"At the European level, wolf forms a big metapopulation with different fragments" in Spania, Italia, Franţa, Elveţia, Sloveania, Grecia, Croaţia, Serbia, România, Bulgaria, Polonia, Estonia, Lituania, Ucraina, Rusia europeană, Finlanda, Suedia, Norvegia, Germania http://www.iucnredlist.org/apps/redlist/details/3746/1 / Geographycal distribution of wolf stretches at the planetar level, excepting some zones as South Australia, the majority of african teritory, as well as some insular areas from the United States. Russia and Canada are to be mentioned with large territories with most numerous wolf populations. It is saying that, at the origins, from all mammals, the wolf had the largest distribution, except man ://www.macalester.edu/~montgomery/graywolf.html (59). Until now, the researches that have been done on the wolf were on different subjects: the influence of habitat on the population densities (Georgescu M., Georgescu G., 1996, Russell Lande, Steiner Engen and Bernt-Erik Saether, 2009); the influence of snow cover on the wolf behaviour and its strategies in relation with deer (Nelson M. E., Mech L. D., 1986, Gula R., 2004, Mitteldorf J. et al., 2002, Atkinson K.); trophyc interactions between wolf and deer utilizig mathematical models Lotka – Volterra (Gardini et al., 1989, Abrams P., 2000, Acklech S. A., 2000, Chung H. L., 2000, Sayto Y et al., 2001, Jensen A. L., Miller D.H., 2001, Hoppensteadt F. C., 2006, Takeuchi Y et al., 2006, Kazanci K., 2007, Li Chiun-Xia et al., 2005, Fang N., Chen X. X., 2008, Wang Y.M., 2008, Krivan V., Cressman R., 2009, Mandu R., 2010). The present paper focuses on state parameters and state variables of wolf population from the South side of Făgăraş Mountains.

MATERIAL AND METHODS

Selection and organization of research areas

The researches were undertaken on the South part of Făgăraş Mountain, in an area placed between the administrative limits of Forestry Argeş Department, Forestry Arrondissements of Aninoasa, Câmpulung, Domneşti, Muşăteşti and Rucăr. Wolf habitats existing in the areas of those arrondissements, represent hunting funds which, in turn, are divided in other areas, with surfaces and limits well determined. The entire searched area covered 61800 hectars and was divided in three hunting funds (districts), each of it comprising a specific number of surfaces as follows: 1.Hunting Fund Râuşor comprised two surfaces: Voievoda = 9600 hectars and Şeţu = 7600 hectars; 2. Hunting Fund Râul Târgului comprised four surfaces: Portăreasa = 6100 hectars, Huluba = 5400 hectars, Frăcea = 6000 hectars and Dobreiaşu = 5300 hectars; 3. Hunting Fund Stoeneşti comprised three surfaces: Leaota = 7500 hectars, Fegeţel = 6800 hectars, and Valea lui Coman = 7500 hectars. In view of the surface selections, was taken into account all type of habitats, so that to be represented beech and coniferous forests and also alpine goal. Into the chosen areas for researches were met a great variety of surfaces like valleys, tops and a large variety of biotops for wolf. Besides, there was an alternance of forests, pastures and even agricultural surfaces. Age of individuals was established during the time of periodical observations of pack of wolfs, knowing that young individuals hold up one᾿s head and the croupe is straight, whereas adult individuals hold down one᾿s head and the croupe is kept on behind. Depending on the type of habitat, on an altitudinal transekt, there were established observation points, so that wolfs were followed on the entire time of

1996 -2006 through direct numberings. There were done three numberings in each season, one week interval between them.

RESULTS AND DISCUSSIONS

The size of population

On the South part of Făgăraş Mountains, there were 9 pack of wolfs, each of those 9 surfaces corresponding

to one pack of wolfs. Pack of wolfs were different as number of individuals and presented different amplitudes of numerical dinamic between 1996 and 2006. The number of individuals, on each area, in 1996, year of research starting, and in 2006, the final year of research, was as follows (Table 1): Voievoda = 2 - 2; Şeţu = 1 - 1; Portăreasa = 2 - 3; Huluba = 0 - 2); Frăcea = 2 – 2; Dobreiaşu = 0 - 2; Leaota = 2 - 3; Făgeţel = 2 – 4; Valea lui Coman = 2 – 3. From the point of view of numerical effectives, in Râuşor Fund, with the areas of Voievoda and Şeţu, there were 3 individuals which showed a uniform distribution in the yearly dynamics; in Râul Târgului Fund, with Portăreasa, Huluba, Frăcea and Dobreiaşu areas, there were higher number of individuals than in the Râuşor Basin. Thus, there were 9 individuals, which showed a higher amplitude in yearly dynamics than Râuşor Basin, from 4 to 9 individuals, during

the same period of time. In Stoeneşti Fund, with Leaota, Făgeţel and Valea lui Coman areas, there were 10 individuals at the end of 2006, and 6 individuals in 1996, with an increase of numerical effective with 4 individuals (Table 1).

Numerical density

Wolf numerical density was, in all areas, much subunitary, the smallest one being registered in Şeţu aria, one individual to 76 square kilometers, and the highest one, one individual to 17 square kilometers,in

Făgeţelu, Dobreiaşu and Huluba areas. (Table 1, Figure 2). It is evidently that the density is correlated with the number of individuals and also with the extent of aria. Wolf, with a strong territoriality behavior, needs much space for its predatory and reproductive activity.

Natality and mortality

Starting with the second year of life, a she wolf could give birth to between 3 and 8 whelps. On this base, could be thought an increase with a considerable number of individuals in a period of 11 years. On the contrary, because of mortality, the increase of individuals was only with one or two borns in some areas, while in the others, the number of individuals remained the same in 2006 as in 1996 (Table 1, Figure1).

Table 1. Wolf numbers, on observation years, in searched areas

Areas	Observation years Number of individuals										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Voievoda	2	2	2	2	2	2	2	2	2	2	2
Şeţu	1	0	1	0	0	0	1	1	1	1	1
Portăreasa	2	2	3	3	3	4	4	3	3	3	3
Huluba	0	0	1	2	2	2	2	2	2	2	2
Frăcea	2	2	2	3	3	4	5	3	3	3	2
Dobreiaşu	0	0	2	2	2	3	4	2	2	2	2
Leaota	2	2	2	3	3	3	3	3	3	3	3
Făgeţel	2	2	3	4	4	4	4	4	4	4	4
Valea lui Coman	2	2	3	3	3	3	3	3	3	3	3

Table 2. Numerical density of wolf population in 2006

Aria	Total number of individuals	Total area (km^2)	Numerical density	
			Number of individuals/ km^2	Number of square kilometers/one individual
Voievoda	2	96	0,021	48
Şeţu	1	76	0,013	76
Portăreasa	3	61	0,049	20,3
Huluba	2	54	0,037	27
Frăcea	2	60	0,033	30
Dobreiaşu	2	53	0,038	26,5
Leaota	3	75	0,04	25
Făgeţelu	4	68	0,059	17
Valea lui Coman	3	75	0,04	25
Average density	22	618	0,036	32,75

Wolf mortality owed to both endogene causes (deseases, fightings between males during the mating time), and exogene ones, all of them being done by man, killing wolfs. Rate of natality (Table 3, Figure 2), was low, with the highest one (15%) in the area of Făgeţel, and the lowest one in the area of Huluba (6%). Rate of mortality (Table 3, Figure 3), was close to natality rate, the highest one (14%) being in the areas of Voievoda, Portăreasa, Leaota and Făgeţel, and the lowest one (3%) in the area of Huluba. It is to point out that both natality and mortality rates had the lowest values in Huluba area, meaning that the main cause of mortality was endogene one, the influence of man being insignificance in this area.

Natural growth

Because of mortality, wolf population did not registered a natural growth as high as natality was. The highest rate of natural growth was in the areas of Frăcea and Făgeţel (17%), where the numbers of new borns were the highest ones and different man activities were not as much present as in the other areas, the pressure of man on wolf being smaller. The lowest natural growth was in the area of Şeţu, (zero),

where the number of new borns were equal with the number of dead individuals and different man activities were present throught the year and put pressure on wolf (Table3, Figure 4). As mentioned, wolf is an animal which supports the highest pressure of man. Unfortunately, activities of man went deeply into the wolf environment, on the one hand. On the other hand, wolf came down near the neighbourhood of man settlements, looking for food. In other words, increasing meetings of man and wolf caused its high mortality rate and the declining of wolf numbers.

Sex ratio

Wolf individuals, both adults and juvenils, mainteined o constant sex ratio on the entire sudied time (Table 4). In other words, individual eliminations from population, through endogene or exogene causes, were almost the same, no matter the sex. In some areas, sex ratio was low modified, as in the areas of Portăreasa (0.5), Frăcea (0.5), Leaota (0.5) and Valea lui Coman (2) In these cases, the mortality of males and females was different, aleatory, through the play of complex intraspecific relationships.

Table 3. Natality, mortality and natural growth in the population of wolf from the south slope of Făgăraş Mountains during the period of 1996 – 2006

| Aria	Number of born individuals	Number of dead individuals	Natural growth	Natality rate		Mortality rate		Rate of natural growth	
				Number	%	Number	%	Number	%
Voievoda	6	5	1	0,55	13	0,45	14	0,1	9
Şeţu	4	4	0	0,36	8	0,36	12	0	0
Portăreasa	6	5	1	0,55	13	0,45	14	0,1	9
Huluba	3	1	2	0,27	6	0,1	3	0,17	15
Frăcea	6	4	2	0,55	13	0,36	12	0,19	17
Dobreiaşu	4	2	2	0,36	8	0,18	5	0,18	16
Leaota	6	5	1	0,55	13	0,45	14	0,1	9
Fageţel	7	5	2	0,64	15	0,45	14	0,19	17
Valea lui Coman	5	4	1	0,45	11	0,36	12	0,09	8
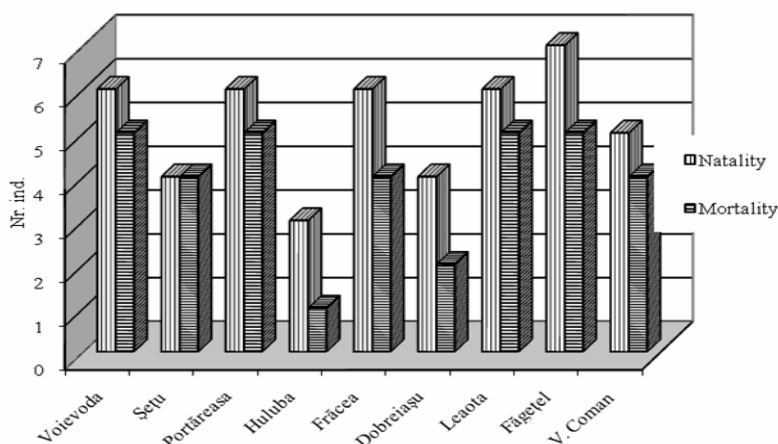
Figure 1. Natality and mortality (individual numbers) in wolf population during the time of 1966 – 2006
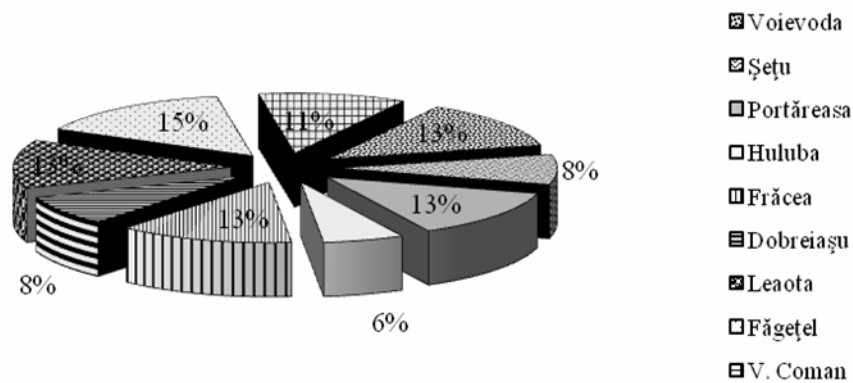
Figure 2. Natality rate in wolf population (%) during the time of 1996 – 2000
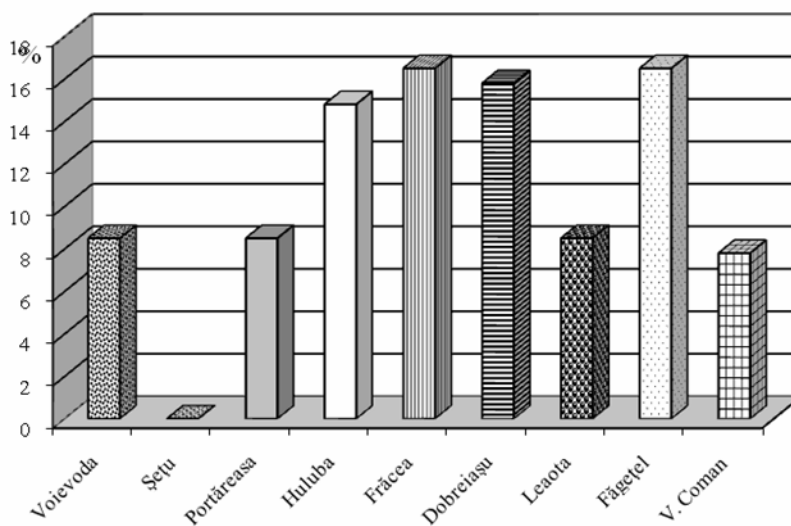

Figure 4. Rate of natural growth (%) of wolf population during the time of 1996 - 2006

Table 4. Sex ratio in wolf population from the south
side of Făgăraş Mountains

Crt. number	Aria	Female numbers	Male numbers	Sex ratio
1.	Voievoda	1	1	1
2.	Şeţu	1	0	0
3.	Portăreasa	1	2	0,5
4.	Huluba	1	1	1
5.	Frăcea	1	1	1
6.	Dobreiaşu	1	1	1
7.	Leaota	1	2	0,5
8.	Făgeţel	2	2	1
9.	Valea lui Coman	2	1	2

Age structure

In searched surfaces, it was noticed that the shape of 9 age pyramids, corresponding to all 9 areas, showed either a pyramid with the number of adults equal with the number of juveniles (Făgeţel, Dobreiaşu, Huluba, Voievoda), either a pyramid with a number of adults higher than the number of juvenils (Leaota, Frăcea, Portăreasa), either a pyramid with zero juvenils (Şeţu), either a pyramid with the number of juveniles higher than the number of adults (a single case). Theoretically, when the base of an age pyramid, represented by juvenils, is numerically smaller than that of adults, respective population is no stable, is no viable. On the contrary, when the base of such pyramid, represented also by juvenils is higher than that of adults, respective population is stable, is viable. Because there were no natural or other kind of bariers between all those 9 surfaces, not to allow free circulation of individuals from one to another surface, we consider that, in the South part of Făgăraş Mountains, there was a metapopulation, formed by 9 subpopulations. The highest number of individuals, 4, was identified in the area of Făgeţel, 2 juvenils and 2 adults. In oher 3 areas (Dobreiaşu, Huluba, Voievoda) were identified 2 individuals in each of them 1 juvenil and 1 adult. In the areas where the number of juveniles was smaller than that of adults, four surfaces (Portăreasa, Frăcea, Leaota Valea lui Coman) the number of juvenils was 1 and the number of adults was 2. In the single case, Valea lui Coman, the number of juveniles was higher than the number of adults, 2 juvenils and 1 adult (Figure 5). One of the explanations of those differences was connected with the fact that the mothers of new borns had, sometimes, to leave them, loking for food. Evidently, new borns were much more exposed to danger, to other predators and to man. Indeed, that is the status of wolf population from the South side of Făgăraş Mountains.

CONCLUSIONS

Because there are no natural barriers or other kind of unsurmountable obstacles for free circulation of wolfs, we consider that there is one population with 9 subpopulaions on the South side of Făgăraş Mountains, each subpopulation being located in one from those 9 areas. Because of mortality, only 9 individuals, in 11 years, were added to the numerical effective of the population. Since wolf is a protected animal and the low is severe, the mortality was mainly because of endogene causes (natural deseases and fightings between males). Numerical density of wolf population was subunitary, in each area, the highest one being 1 individual to 17 square kilometers, registered in Făgeţelu aria, and the smallest one, 1 individual to 76 square kilometers, registered in Şeţu aria. As an average, numerical density of wolf was 0.036 individuals to 1 square kilometer and 32.75 square kilometers to one individual. Wolf is an animal with a territoriality behaviour, so it needs large area for its reproductive and predation activities. Sex ratio was nearly constant, on the entire time of researches, mortality being roughly the same of males as of females. As age structure, population from the South side of Făgăraş Mountains is vulnerable one, its supporting base of age pyramid, represented by juvenils, being numerically smaller than that of adults, in the majority of areas. Theoretically, such a population is unstable, with a predictable declining in individuals.
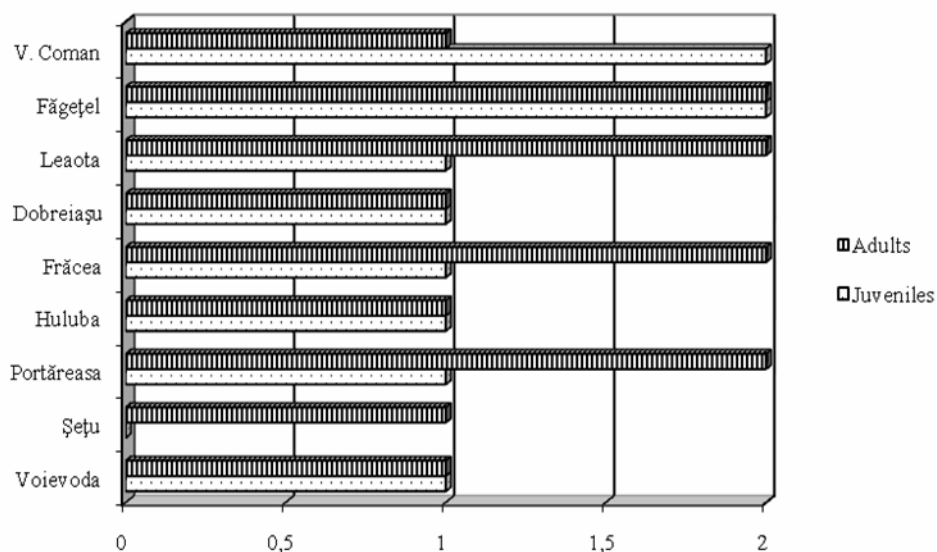

Figure 5. Age structure of wolf population from the South side of Făgăraş Mountains

ABSTRACT

Researches on wolf population from the South side of Făgăraş Mountains – Argeş County were done from 1996 till 2006, in order to establish its state parameters (individual numbers, density of individuals, age structure, sex ratio) and also its state variables (natality and mortality). The dynamic of individual numbers from 1996, the first year of researches, till 2006, the last year of researches, was as follows: Voievoda: 2-2; Şeţu: 1-1; Portăreasa: 2-3; Huluba: 0-2; Frăcea: 2-2; Dobreiaşu: 0-2; Leaota: 2-3; Făgeţel: 2-4; Valea lui Coman: 2-3. There were a total number of 13 individuals in 1996 and 22 in 2006. In some areas, an increasing number of individuals was realised between 1996 and 2006: Portăreasa = 1; Huluba = 2; Dobreiaşu = 2; Leaota =1; Făgeţel = 2; Valea lui Coman = 1; there were no increase, no decrease in numbers in the remaining areas. As an average, in all areas, rate of mortality was 0.35%, and this figure was mainly because of endogene factors. As age structure is taking into account, only one area (Valea lui Coman), had pyramid base, represented by juveniles, numerically higher than that of adults, which means, theoretically, that respective subpopulation was most viable than other all wolf subpopulations.

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