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CENSUSING ROE DEER *(Capreolus capreolus)* POPULATIONS FOR HUNTING MANAGEMENT: A LOCAL EXPERIMENT IN ORDER TO INCREASE THE BENEFIT/COST RATIO

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ABSTRACT - At present, in the most part of their Italian range, roe deer are censused for hunting purposes by observations from fixed points during spring "green sprouting". Difficulties arise because it is impossible to count the entire population, due to the huge number of observers needed to cover all the observable area (i.e. open lands) in any managed district. In three study areas, representative of the most common habitat situation found in the hunting districts of the province of Forlì-Cesena, we compared the results of exhaustive countings with the results obtained by taking into account only about a half of the points (and therefore of the observers) required for the complete count. The average roe deer's density obtained was 21.8/km^2 from complete censuses and 20.8/km^2 from partial censuses, suggesting that this method remains highly reliable which allows a simplification of censusing.

Key words: density, censusable surface, censused surface, actual density, *Capreolus capreolus*, Italy.

INTRODUCTION

The estimation of population size and density of roe deer is usually regarded as one of the main difficulties in the hunting management of this forest-dwelling and secretive ungulate (Tosi and Toso, 1992). The protocol proposed by the Istituto Nazionale per la Fauna Selvatica (I.N.F.S.) indicates two methods: drive census, and sight census by observations from fixed points during spring sprouting (Meriggi, 1990). Since 1994 roe deer censuses in the province of Forlì-Cesena have been conducted using the latter method. Results have gradually improved, especially with the adoption of simultaneous counting in each census area, in order to reduce double countings. However, difficulties still exist in collecting as well as in correctly interpreting the data. The main problems include the great number of operators required to cover all the area to be measured and the correct calculation of the actual density. In complex, highly fragmented territories in the entire area to be censused (i.e. open lands) could be covered only by a huge number of observers. If we consider, for instance, a typical sample area (Fig. 1), it can be seen that in order to census a surface of about 800 ha, 9 observers are needed.

In this paper we tested the reliability of countings obtained by reducing the number of observers (and therefore the cost of the census) by about 50% (Fig. 1), aiming to maximise the benefit/cost ratio of census operations. This method appears to be very effective for practical, economic and human resource management purposes.

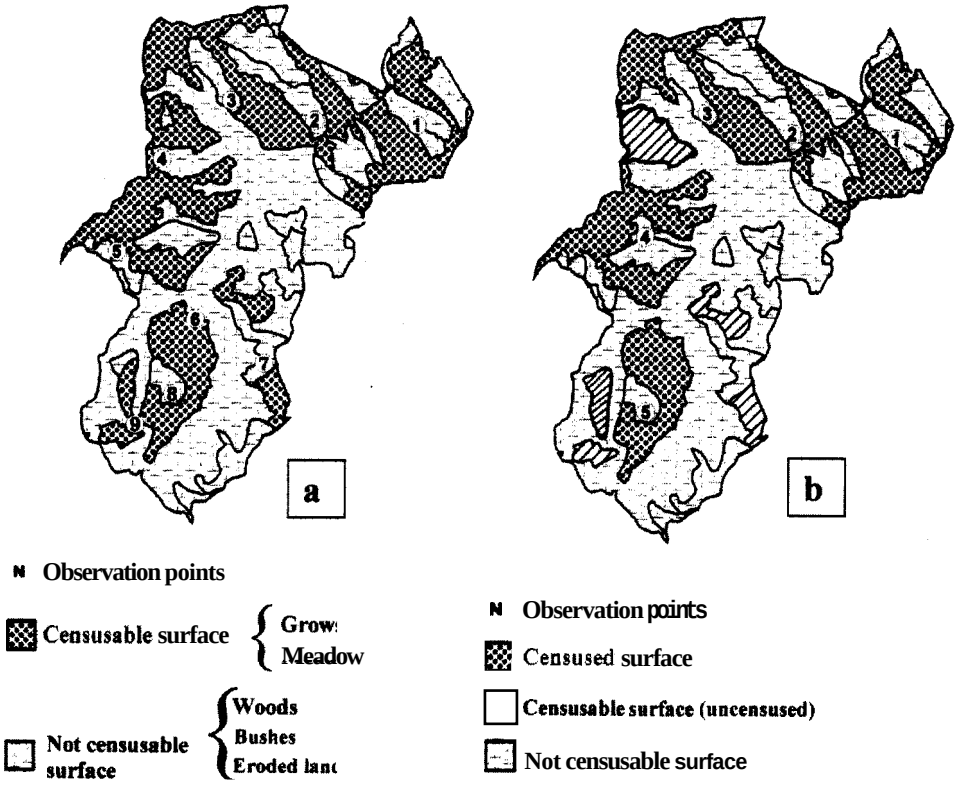

Figure 1 - a. Map of the censusable and not censusable surfaces in a sample area, and of the observation points (numbered) needed to obtain a complete count. b. Map of the censused area resulted from the 50% reduction of the number of the observation points.

MATERIAL AND METHODS

The censuses were conducted in three private hunting reserves located in the province of Forli-Cesena, indicated as area 1 (612 ha), area 2 (760 ha) and area 3 (884 ha). They were selected because they represent habitat conditions which are most commonly associated to roe deer hunting management in this province. The areas are characterised by patchy oak (*Quercus pubescens*) woods and arable lands, interspersed with bushy, uncultivated and eroded parts. The only other ungulate species present in the three reserves is the wild boar *(Sus scrofa)*, particularly abundant in the area 3.

In each area land cover was analysed using Geographical Information Systems (ArcView, ArCad and Topol), allowing a quick and accurate calculation of various land use and habitat types. A number of observation points were fixed to cover all the open lands, then the surface of censusable and censused surface was calculated for the total study area and for every observation point. The resulting maps, containing the observation limits, were then given to the observers.

The censuses were conducted between 3/28/98 and 5/3/98 (during "green sprouting") by qualified members of the hunting

Table 1 - Observation points needed for the complete count, censused surface and number of roe deer counted.

AREA 1 total surface: 612 ha			AREA 2 total surface: 760 ha			AREA 3 total surface: 884 ha		
Observation points	Censused surface ha	N° of animals counted	Observation points	Censused surface ha	N° of animals counted	Observation points	Censused surface ha	N° of animals counted
1	66	24	1	83	36	1	50	11
2	97	34	2	74	43	2	57	13
3	103	32	3	77	39	3	69	15
4	115	39	4	93	29	4	45	17
5	38	14	5	41	16	5	64	18
			6	29	22	6	47	21
			7	33	16	7	97	22
						8	96	21
Total	419	143	Total	436	201	Total	525	138

Table 2 - Surfaces, N° of animals counted and estimated, density in the subsets of the points included and excluded from the partial count.

		Censused surface (ha)	% on the censusable	N° of animals counted	Density related to the censused surface	N° of estimated animals
AREA 1						
Points examined	2, 3, 4	315	15.2	105	33.3	139
Points discarded	1,5	104	24.8	38	36.5	153
AREA 2						
Points examined	1, 2, 3, 4	327	75	147	44.9	196
Points discarded	5, 6, 7	109	25	54	49.5	215
AREA 3						
Points examined	2, 3, 5, 7, 8	383	73	89	23.2	122
Points discarded	1, 4, 6	142	27	49	34.5	181

Table 3 – Results obtained from the complete and the partial censuses in the three study areas.

	AREA 1	AREA 2	AREA 3
Animals counted (partial census)	105	147	89
Total censusable surface	419	436	525
Estimated animals	139	196	122
Actual estimated density (on the total area)	22.7	25.8	13.8
Animals counted (total census)	143	201	138
Actual density	23.3	26.4	15.6

"Club del Capriolo" of Forli. The censusing period was selected also because it coincides with the highest degree of dispersion of individuals, that is when breeding males become territorial (Perco and Perco, 1980). Six simultaneous sessions were carried out in each area (four in early morning and two in late afternoon) by observers each of which were provided with binoculars and telescopes, recording cards and maps in scale 1:8000.

The collected data were analysed to calculate the density (D) as the number of observed animals (N) divided by the surface (S), where S can be computed as total, censusable and censused, surface. Then we calculated new density values by taking into account only about 50% of the observation points. Each'point in our original set was characterised by a measured censusable surface; we ranked the points by means of their censusable surfaces and then we excluded the 50% of the points with the smallest censusable surface. Density values referred to the entire area were calculated by means of the formula:

$D = (N*B/C)/A$

where N is the number of observed animals, B is the surface of the entire censusable area, C is the censused surface, and **A** is the surface of the entire area.

RESULTS

Table 1 shows the number of observation points necessary in each area for a complete census, the corresponding censused surface and the number of animals counted. Table 2 shows the censused surface, the number of animals counted, the density and the estimated number of animals following a partial count. It can be seen that the number of observers has been reduced from 20 in a total count to 12 in a partial one. Table 3 shows the comparison between the actual densities (total counts) and the densities estimated from partial counts.

DISCUSSION

The average density figures obtained from total censuses (21.8/kmq) are very similar to those obtained from partial censuses (20.8/kmq). The slight underestimation, which is quite aaceptable for managing purposes, is probably due to the fact that the average surface covered by each point was 45.2 ha in a total census and 87.8 ha in a partial census. In fact, the concentration of roe deer is usually higher in small clearings than in large ones, so the density resulted in being inversely related to the average dimension of the surface censused by each observer. These preliminary results suggest that this method produces accurate figures which require only about half of the censusing effort. The basic requirement in order to obtain a reliable density is knowledge of the surface for all habitat types. The improvement of techniques and instruments has provided new powerful tools (e.g. the Geographical Information System) that allow complex analysis (Gellini and Matteucci, 1993; Cicognani *et al.*, 1995; Preatoni and Pedrotti, 1995) and that are essential in wildlife management.

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