Sex and Age Structure of a Forest Roe Deer Population under Hunting Pressure[1]

Bogusław FRUZIŃSKI & Lesław ŁABUDZKI

Fruziński B. & Łabudzki L., 1982: Sex and age structure of a roe deer population under hunting pressure. Acta theriol., 27, 26: 377—384 [With 3 Tables & 3 Figs.]

Studies were made from 1974—1979 of sex and age structure in a population of roe deer, *Capreolus capreolus* (Linnaeus, 1758) living in a wooded area about 8,000 ha in extent. The population was subject to fairly intensive utilization as game (from 12% to 23.5%). The ratio of males to females in the population varied during the study period from $1:1.2$ to $1:2.5$, and was created chiefly by the effect of natural winter mortality. The age distribution of the population exhibited a decided predominance of faws (on an average about 42% of the population numbers) and a small proportion of animals from 1—3 years old. It was found that utilization of does is random in character and is distributed proportionately over all age classes. The criteria applayed in Poland for selective shooting of bucks cause excessive shooting of individuals of medium age (3—5 years old).

[Dept. of Game Management, Academy of Agriculture, Wojska Polskiego 71d, 60-625 Poznań, Poland]

1. INTRODUCTION

Sex and age structure of a population under natural conditions is the resultant of the action of intrapopulation mechanisms, most often specific for the given species and habitat factors. It is the latter which cause mortality due to predators and to climatic conditions to be unequal in relation to sex and age of individuals (Petrusewicz, 1978). Sex and age structure are of decisive importance to the functioning of the population, and determine, *inter alia,* the extent of increase, spatial organization and even mortality indices. They are particularly important in the case of populations of species with a fairly long life cycle, such as the roe deer (Fruziński & Łabudzki, 1982). Sex and age structure also act indirectly on the individual quality of animals, two of the manifestations of which are body weight and strength of antlers (Szczerbiński, 1964).

Under conditions of hunting management utilization of the population is of decisive importance as it may act selectively and consequently lead to disturbance of the population structure. It is relatively easy to

shape sex ratio by appropriate shooting, but shaping the age structure in a roe deer population is difficult, owing to subjective criteria for estimating age of deer by hunters, particularly in relation to does, and on account of the specific criteria for selective shooting applying in Poland, which involve preferred utilization of certain age classes only of bucks.

The purpose of the study was to define sex and age structure in a roe deer population, *Capreolus capreolus* (Linnaeus 1758), in a large wooded area and to determine the effect exerted on these structures by the way in which the population is utilized for game purposes.

The studies were carried out from 1974—1980 at the Game Management Experimental Centre at Zielonka, belonging to the Academy of Agriculture in Poznań, and which includes a stretch of wooded land about 8000 ha in extent. Pinestands decidedly predominate there (85.2%) often with an admixture of oak and partly uniform oakwoods (about 10%). The distribution of biotopes and age classes of the treestands is also diversified (Fruziński, Łabudzki & Wlazełko, 1983).

The numbers of roe deer in different years were determined by means of driving censuses (Pucek *et al.*, 1975). A census of this kind was carried out twice a year, in spring and autumn.

2. MATERIAL AND METHODS

There is considerable difficulty in determining sex structure in the case of roe deer living in a forest habitat. Direct observations supply relatively little data and are extremely time-consuming, and the results they produce often depend on weather conditions, times of day and year, different sexual activity etc. It is therefore essential to obtain a very large amount of data in order to ensure that results are objective. Direct observations of roe deer were recorded on special cards, stating the sex of the animals observed, their exact localization, and date and hour of observation. Data were obtained on a total of 9,737 individuals (Table 1).

Use was also made of material obtained during driving censuses. Autumn drives were carried out at the beginning of November when the majority of the bucks still carry antlers. The observers were colleagues experienced in field work.

Many of the data were also supplied by observations of roe deer along lines transecting the forest, carried out systematically in a separate part of the range (Fruziński, Łabudzki & Wlazełko, 1983). Assuming that shooting, at least in relation to females, is random, data obtained from shooting in different seasons were used to define age structure of the population. Age was defined on the basis of tooth wear in the mandibles collected (Rieck, 1970; Pielowski, 1970). Age was estimated for a total of 366 bucks and 327 does. Both the amount and intensity of utilization of these animals was carefully recorded in all seasons.

3. RESULTS

There were considerable fluctuations in sex structure during the study period, with more distinct stabilization in 1977 and 1978 (Table 1). As from the hunting season of 1974/75 the combined index of utilization

of roe deer in the Zielonka range systematically increased, from about 12⁰/o to 23.5⁰/o, of the spring numbers of the basic herd (Table 2), although this was not accompanied by clearly more intensive utilization of does. On an average during the course of 5 seasons the utilization of the two sexes was balanced: 38.6⁰/o of bucks, 38.2⁰/o of does and 23.2⁰/o of fawns (Table 3). There was, however, more intensive shooting of females in the fawn class, on an average level of about 75⁰/o.

There has, however, been a decided shift in favour of females in the population during the last two years (Table 1), chiefly as the result of the severe and snowy winter of 1978/79 and the administration order to cease shooting does during the 1979/80 season.

There is distinct predominance of fawns in the population's age structure, and these, according to results obtained by driving, form 42⁰/o of the population numbers (Fruziński & Łabudzki, 1982). Among the other age classes, the percentage of which in the population was determined by means of establishing the age of shot individuals, by far the largest number consists of animals of medium age — 3—5 years old (Fig. 1), forming jointly 40.6⁰/o of the bucks and 36⁰/o or does.

Table 1

Sex composition of 9,737 roe deer observed over the period from 1974—1980.

Year	Males	Females	Sex ratio
1974	492	842	1 : 1.7
1975	685	991	1 : 1.4
1976	665	825	1 : 1.2
1977	444	693	1 : 1.5
1978	407	638	1 : 1.5
1979	300	540	1 : 1.8
1980	296	744	1 : 2.5
Total	3580	6157	1 : 1.7

Table 2

Numbers and utilization of roe deer at Zielonka from 1974—1979.

Hunting season	Numbers in spring			Numbers of individuals shot			Exploitation ratio, ⁰/o		
	M	F		M	F		M	F	
1974/5	464	806	1270	59	92	151	12.7	11.4	11.9
1975/6	650	940	1590	91	104	195	14.0	11.0	12.3
1976/7	662	828	1490	104	82	186	15.7	9.9	12.5
1977/8	445	692	1137	117	151	268	26.2	21.8	23.6
1978/9	372	611	983	111	120	231	29.8	19.6	23.5

4. DISCUSSION

The sex structure of the roe deer population is a variable value. Sex ratio is formed by, *inter alia,* the effect of the different natural mortality index of does and bucks, and of shooting. Habitat mechanisms are probably of particular importance, since even in a population not subject to hunting pressure at Kalø sex ratio was from 1 : 1.8 to 1 : 2.2 in favour of does (Strandgaard, 1972). In other roe deer populations also it exhibits predominance of females (Nikolandie, 1968; Prusaite *et al.,* 1974).

Variations in sex structure at Zielonka were the result primarily of the effect of the habitat on the population during the winter period, since intensity of shooting was similar in relation to both male and female individuals (Table 2 and 3). Intensive utilization of female fawns (on an average 75⁰/o of animals shot in this age class) undoubtedly contributed to stabilization of sex structure on the level accepted by the authors, *i.e.,* 1 : 1.5. The necessity for intensive utilization of females in order

Table 3

Utilization structure of the roe deer population at Zielonka from 1974—1979.

Hunting season	Bucks		Does		Fawns	
	N	⁰/o	N	⁰/o	N	⁰/o
1974/5	50	32.4	68	45.4	33	22.2
1975/6	69	35.4	71	36.4	55	28.2
1976/7	97	52.1	58	31.2	31	16.7
1977/8	90	33.6	109	40.7	69	25.7
1978/9	91	39.4	86	37.2	54	23.4
Mean	79.4	38.6	78.4	38.2	48.4	23.2

to achieve approximately balanced sex ratio is also due to certain intrapopulation mechanisms. Sex ratio among embryos at Zielonka was 1 : 1.25 in favour of females (Fruziński & Łabudzki, 1982). In many European populations sex ratio during embryonic development and in newborn fawns is, however, more or less balanced (Borg, 1970; Kurt, 1968; Prior, 1968; Nikolandie, 1968; Strandgaard, 1972). This shows, that a tendency to maintain a balanced sex ratio is also more advantageous from the population aspect. The sex ratio of 1 : 1 recommended in hunting practice is, however, difficult to obtain, not only from population aspect but also as the result of the effect of the habitat. At Zielonka sex structure was distinctly shifted in favour of females as the result of the severe and snowy winter of 1978/79, when natural mortality was about 32.3⁰/o (Fruziński & Łabudzki, 1982) and, according to data which have not as yet been sufficiently documented, applied to a greater

degree to males than females. Borg (1970) also observed greater natural mortality among males, although his explaining this by the reproductive behaviour of males does not seem convincing.

Intrapopulation and habitat factors determine whether maintainance of balanced sex structure requires more intensive utilization of the fameales.

On account of methodical difficulties there are not many source data on the age composition of roe deer populations, and the age pyramids most frequently given for game management planning are usually theoretical in character and very regular in shape. As the result of unequal natural mortality and shooting in different age classes the representation of these classes in the population is not equal.

Decidedly the most numerous age class consists of individuals below one year of age (fawns), which in 1950 in Denmark formed approximately 50% of the autumn population numbers, a complete sample having been taken by means of total elimination of roe deer by shooting
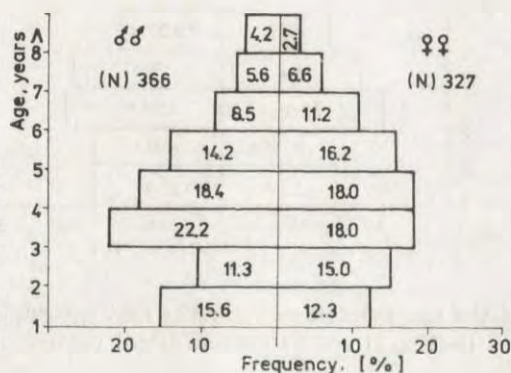

Fig. 1. Sex and age pyramid of the roe deer population at Zielonka.

(Andersen, 1953). Under Danish conditions also, in a population in no way subjected to hunting pressure, fawns formed about 34.3% (from 16 to 47%) of the autumn population numbers (Strandgaard, 1972). At Zielonka the youngest age class formed on an average 42% of the population (from 38 to 48.5%).

Apart from fawns the most numerous group consists of individuals from 3—5 years old, in the case of both females and males (Fig. 1). The percentage of animals 1—3 years old is relatively small, which may be due to higher natural mortality, with simultaneous fairly considerable utilization of fawns for game purposes. The proportion of animals 2—3 years old is also small in the population exempt from

hunting exploitation, which at Kalø was 12% in the case of does and 10% for bucks (Strandgaard, 1972).

Shooting of females was planned and carried out entirely at random, without any attempt at selecting age classes. The right part of the age pyramid (Fig. 1) probably reflects the factual representation of natural conditions is formed primarily under the influence of climatic factors and predator pressure and is also distinguished by highest mortality in the youngest age classes. In populations living in extreme climates it is usual to have a small percentage of young animals, *e.g.* according to Blusma (1974), in Lithuania the roe deer population consisted of 34.5% fawns, 7.3% individuals 1½ years old and 58.2% of older roe deer.
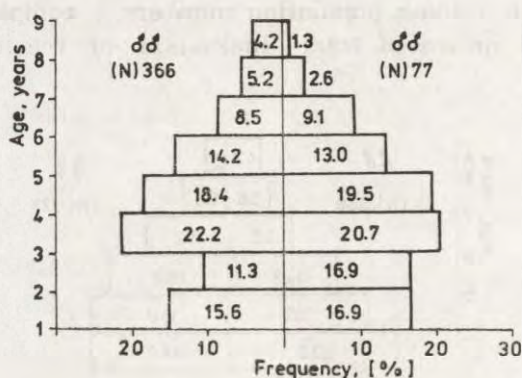

Fig. 2. Comparison of the age pyramid of roebucks shot according to selective rules (left part) and at random (right part).

Even in a mild climate and without shooting (Kalø) the proportion of analogical age classes is similar, even though diversified in different years. In 1965, for instance, there were 42% of fawns, 13% of animals 1½ years old and about 44% of older individuals of both sexes. The low percentage in the Zielonka population of females 1½ years old (Fig. 1) thus confirms certain population regularities and shows the suitability of the method for defining the population's age structure on the basis of analysis of the mandibles of shot animals, if this is random in character, as in the case of females. Shooting of bucks in hunting practice results to some extent in selective shooting of certain age classes. The youngest age classes, particularly those of animals 2—3 years old, are clearly under-utilized, with simultaneous intensified utilization of bucks from 3—5 years old (Fig. 1—3), and

consequently the most productive part of the population is most inten-
sively utilized. The causes of this state of affairs are subjective in
character. The large strong antlers in bucks of this age, with simulta-
neous frequent occurrence of some anomalies in antlers, makes such
trophies attractive, whereas poorly developed antlers and the small
body of the youngest bucks discourage hunters from shooting them.

When shooting was consistently carried out at random in part of the
range of 77 males (every buck encountered was shot regardless of the
quality of its antlers), this resulted in increased utilization of the
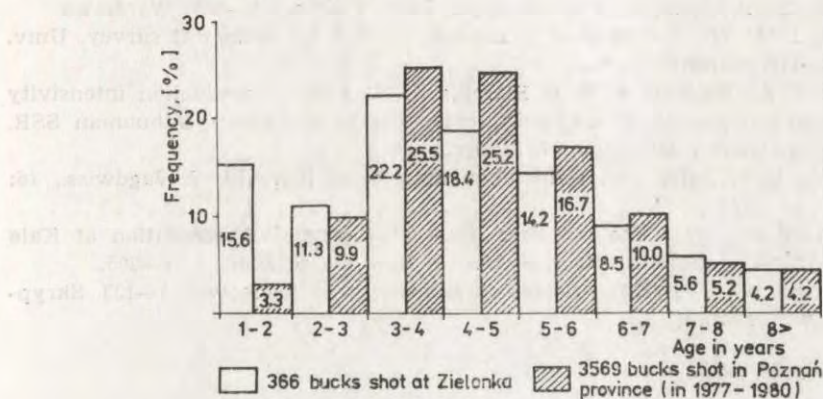youngest age classes (Fig. 2).

Fig. 3. Comparison of the age distribution of roebucks shot in the Poznań voivod-
ship from 1977—1980 in accordance with selective rules, and roebucks shot at
Zielonka.

Strict observance of the criteria applying to selective shooting has
a selective effect on the population, as is shown by the age structure
of 3,569 bucks shot from 1977—1979 in the Poznań voivodship in
comparison with the age of bucks shot at Zielonka (Fig. 3). This is proof
of the fact that the principles for selective shooting of bucks currently
in force are not entirely sound, since they disturb the proper age
structure of population as the result of excessive utilization of the
medium age classes.

REFERENCES

1. Andersen J., 1953: Analysis of a Danish Roe Deer. Danish Rev. Game Biol.,
   2: 127—155.
2. Blusma P. P., 1974: Sexual differences and age changes of the weight and
   body size in *Capreolus capreolus* L. (*Cervidae*) in Lithuanian SSR. Ist. Intern.
   Theriol. Congress: 75. Moskva.

3. Borg K., 1970: On mortality and reproduction of roe deer in Sweden during the period 1948—1969. Swedish Wildlife, 7: 121—149.

4. Fruziński B. & Łabudzki L., 1982: Demographic processes in the forest roe deer population. Acta theriol., 27: 365—375.

5. Fruziński B., Łabudzki L. & Wlazełko M., 1983: Habitat, density and spatial structure of the forest roe deer population. Acta theriol., 28:

6. Kurt E., 1968: Das Sozialverhalten des Rehwildes. Mammalia depicta, 4: 1—102. Paul-Parey. Hamburg—Berlin.

7. Nikolandie D., 1968: Ökologische Charakterisistik der Rehpopulation in Distrikt Belje. Jeln. Beogard, 7: 73—95.

8. Petrusewicz K., 1978: Osobnik, populacja, gatunek. Państw. Wyd. Nauk: 1—384. Warszawa.

9. Pielowski Z., 1970: Sarna. Państw. Wyd. Roln. i Leśne: 1—215. Warszawa.

10. Prior R., 1968: The roe deer of Cranborne Chase: An ecological survey. Univ. Press: 1—119. Oxford, London.

11. Prusaite J. A., Blaschis A. S. & Blaschis R. N., 1974: Reproduction intensivity and population growth in *Capreolus capreolus* L. (*Cervidae*) Lithuanian SSR. I-st. Intern. Theriol. Congress, 87. Moskva.

12. Rieck W., 1970: Alter und Gebissabnutzung beim Rehwild. Z. Jagdwiss., *16*: 1—6.

13. Strandgaard H., 1972: The roe deer (*Capreolus capreolus*) population at Kalø and the factors regulating its size. Danish Rev. Game Biol., 7: 1—205.

14. Szczerbiński W., 1964: Kilka zagadnień nowoczesnego łowiectwa: 1—133. Skrypty WSR w Poznaniu.

Bogusław FRUZIŃSKI i Lesław ŁABUDZKI

WPŁYW ŁOWIECKIEGO UŻYTKOWANIA NA STRUKTURĘ PŁCI I WIEKU POPULACJI SARNY LEŚNEJ

Streszczenie

W ośrodku „Zielonka" analizowano w latach 1974—1979 strukturę płci i wieku populacji sarn, przy pozyskaniu od 12% do 23,5% (Tabele 2, 3). Struktura płci zmieniała się od 1 : 1,2 do 1 : 2,5, na korzyść osobników żeńskich (Tabela 1) i zależna była głównie od naturalnej śmiertelności zimowej. Struktura pozyskania wynosiła: 38,2% kóz oraz 23,2% koźląt (Tabela 3). Odstrzał osobników żeńskich w klasie koźląt był wysoki, około 75%. Rozkład wiekowy populacji wykazał przewagę koźląt (średnio około 42% jesiennego stanu) oraz nieliczną reprezentację 1—3 letnich (Ryc. 2, 3). Najliczniejszą grupą są osobniki 3—5 letnie (Ryc. 1). Stwierdzono, że pozyskanie kóz ma charakter losowy i rozkłada się na wszystkie klasy wieku. Natomiast obowiązujące w kraju kryteria odstrzału selekcyjnego kozłów powodują nadmierną eksploatację osobników średniowiekowych (Ryc. 2).