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A Population of *Clethrionomys glareolus pirinus* on the Vitosha Mountain, Bulgaria. II. Natality

[With 2 Tables & 1 Fig.]

Studies were made in 1967 and 1968, using the Standard Minimum method, accepting data from literature on the time at which the reproduction season begins and ends. Variations in numbers of pregnant females were defined and on this basis it was estimated, that 352 and 318 voles were born in respective study years. These results are discussed in the light of results of studies on an isolated island population of *C. glareolus* in Poland.

I. INTRODUCTION

One of the parameters essential for estimation of population production is natality, which can be expressed by the number of young born in a unit of time (Bujalska, Andrzejewski & Petrusewicz, 1968; Petrusewicz et al., 1968). The number of individuals born in a population is, *inter alia*, a function of the number of pregnant females (Bujalska et al., 1968), hence studies must be made to define this parameter.

Earlier studies (Petrusewicz et al., 1968; Petrusewicz et al., 1971) showed that production measured in grams of biomass produced per year of a population of *C. glareolus*, living on an island depends to a great extent on the number of animals born. This results from the fact that production due to reproduction (P_r) forms about $50^0/0$ of total production of biomass (P). It was also shown that the value P_r and, to a great degree P, were maintained on a constant level during the three years of study on the island. This paper presents data on natality in connection with studies on the productivity of free-living populations of *C. glareolus* in Bulgaria.

2. STUDY METHODS AND RESULTS

The studies were carried out in the upper part of the Vitosha Mountain, during four trapping series in 1967 and 1968 (June and September of each year) according to the Standard Minimum method (Grodziński, Pucek & Ryszkowski, 1966).

The number of females was determined and pregnancies were established by autopsy[1].

The following equation was used to estimate the number born:

$$vr = \frac{\overline{\overline{N}}_p TL}{t_p}$$ (Bujalska *et al.*, 1968) where vr — number born, $\overline{N}_p$ — average numbers of pregnant females, T — observation time, L — litter size, t_p — duration of gestation.

The real number of females in a given trapping series was defined by using the equation for linear regression. The distribution of captures of pregnant females on successive trapping days did not permit application

Table 1

Number of adult and pregnant females.

Final day in trapping series	Adult females		Pregnant females	
	1	2	1	2
22 VI 1967	18	21	6	7
21 IX 1967	18	24	5	7
28 VI 1968	7	15	4	8
22 IX 1968	8	14	0	0

1 — Actually caught, 2 — Estimated from linear regression.

of this method to calculation of the numbers of pregnant females, since none was caught on three successive days. It was therefore accepted that the percentage of pregnant females amongst all adult females is the same as that among females actually caught (Table 1).

In order to define variations in the numbers of pregnant females during the 1967 reproductive season, data from the literature (Asdell, 1964; Stefanov & Vasilev, 1965; Bujalska *et al.*, 1968; Bujalska, 1970) showing that the reproduction season in Central Europe generally lasts from April 1 to October 1, were utilized. In 1968, however, the reproduction season was shorter, since during the census made on September 22nd not a single pregnant female was found (Fig. 1).

[1] Litter size was also defined by counting embryos, placental scars and *corpora lutea*, but unfortunately the amount of material proved insufficient to define average litter size.

In order to find the number of pregnant females during the period between April 1 and the June census, the number of adult females was assessed on May 1. The studies made in Poland (B u j a l s k a *et al.*, 1968; B u j a l s k a, 1970) showed that not all adult females which survived the winter began reproduction simultaneously in spring. In the
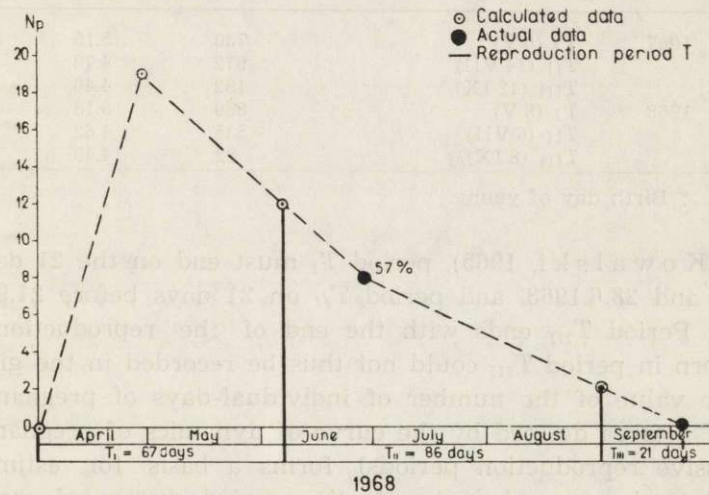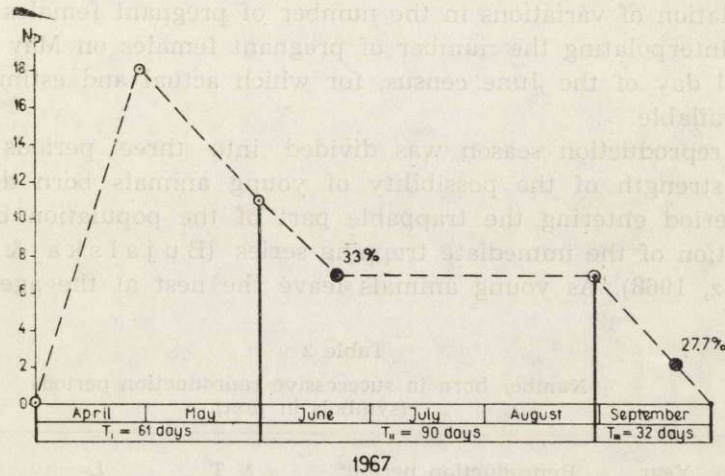

Fig. 1. Dynamics of pregnant females on Vitosha mountain (percentage of pregnant females among adults is given).

studies referred to above it was accepted that it takes about a month for all females to participate in reproduction, and a similar assumption was also made in relation to the present study.

The number of adult females in the vole population on Vitosha Mountain on May 1 was calculated by extrapolating the number of

overwintered females in June and accepting the same mortality rate of these females as between the June and September censuses. Then, bearing in mind that the percentage of pregnant females among all adult females on the island was on an average 94 in April from 1966—1968 (B u j a l s k a, 1970) the number of pregnant females was estimated.

Calculation of variations in the number of pregnant females was continued, interpolating the number of pregnant females on May 1 and on the final day of the June census, for which actual and estimated data were available.

Each reproduction season was divided into three periods T_I—T_{III}, on the strength of the possibility of young animals born during the given period entering the trappable part of the population before the complection of the immediate trapping series (B u j a l s k a & P e t r u - s e w i c z, 1968). As young animals leave the nest at the age of about

Table 2

Number born in succcessive reproduction periods
(symbols in text).

Year	Reproduction period*	$\bar{N}_pT$	L	$\overset{\nu}{r}$
1967	T_I (6 V)	730	5.15	171
	T_{II} (14 VII)	672	4.73	145
	T_{III} (12 IX)	182	4.40	36
1968	T_I (8 V)	869	5.13	202
	T_{II} (6 VII)	535	4.62	112
	T_{III} (8 IX)	22	4.40	4

* Birth day of young.

21 days (K o w a l s k i, 1965), period T_I must end on the 21 days before 22.6.1967 and 28.6.1968, and period T_{II} on 21 days before 21.9.1967 and 22.9.1968. Period T_{III} ends with the end of the reproduction seasons. Young born in period T_{III} could not thus be recorded in the given study year. The value of the number of individual-days of pregnant females $\bar{N}_p$ T_I—T_{III} (area defined by the curve of dynamics of pregnant females in successive reproduction periods) forms a basis for estimating the number born in successive reproduction periods in accordance with the above equation.

Variations in litter size during the reproduction season were accepted after Z e j d a (1966), calculating the average weighed litter size for successive reproduction periods. Duration of gestation (22 days) was accepted after B u j a l s k a & R y s z k o w s k i (1966).

The results of calculations (Table 2) and also analysis of variations in the number of pregnant females (Fig. 1) show that in both years the

largest number of young were born in periods T_I, the smallest in T_{III}. Average weighed days of birth (B u j a l s k a *et al.*, 1968) (Table 2), similar in all three periods of the reproduction seasons in 1967 and 1968, confirm the reproductive similarity in both years.

A total of 352 young were born in 1967 and 318 in 1968.

3. DISCUSSION

The three year study period on an island in Poland showed that the number of individuals born during a year was a highly constant value (B u j a l s k a, 1970; P e t r u s e w i c z *et al.*, 1971), being 262, 272 and 253 voles per ha in 1966—1968 respectively. A similar phenomenon would appear to take place in the population living on the Vitosha Mountain; in 1967 and 1968 the number of young born was respectively 59 and 53 individuals per ha. This low number of young born in comparison with the figure for the island is, however, remarkable and may be due to the different ecological conditions under which the two populations of *C. glareolus* lived. These differences may be in the level of primary production, migration or interspecies competition.

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POPULACJA *CLETHRIONOMYS GLAREOLUS PIRINUS* w LESIE ŚWIERKOWYM
MASYWU WITOSZA W BUŁGARII. II. ROZRODCZOŚĆ

Streszczenie

Badania nad *Clethrionomys glareolus* prowadzono w latach 1967 i 1968 stosując metodykę »Standard Minimum«. Wykreślono dynamikę liczebności samic ciężarnych, opierając się na danych empirycznych przeliczonych w oparciu o prostą regresji oraz na danych z literatury (odnośnie terminu rozpoczęcia i zakończenia sezonu rozrodczego) (Ryc. 1). Na tej podstawie oszacowano liczbę urodzonych według wzoru podanego na str. 338. Stwierdzono, że liczba urodzonych była w obu latach podobna i wynosiła 352 i 318 osobników (Tabela 2).

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