FOLIA MALACOLOGICA
Vol. 19(1): 51–53
ISSN 1506-7629
The Association of Polish Malacologists
& Faculty of Biology, Adam Mickiewicz University
Poznań 2011
doi:10.2478/v10125-011-0008-5

AGE STRUCTURE AND GROWTH RATE OF *ZONITOIDES NITIDUS* (O. F. MÜLLER, 1774) (GASTROPODA: PULMONATA: GASTRODONTIDAE)

ELŻBIETA KUŹNIK-KOWALSKA

Department of Invertebrate Systematics and Ecology, Institute of Biology,
Wrocław University of Environmental and Life Sciences, Kożuchowska 5b, 51-631 Wrocław, Poland
(e-mail: elzbieta.kowalska@up.wroc.pl)

ABSTRACT: Growth rate and age structure of *Zonitoides nitidus* (O. F. Müller) were studied based on monthly samples from a population in Muszkowice (SW. Poland). The life cycle is probably a three-year cycle: juveniles hatch from June till October, and winter over at a size of 2.0–4.5 whorls. The growth rate is ca. 0.5–1.0 whorl/month.

KEY WORDS: terrestrial pulmonates, Gastrodontidae, *Zonitoides nitidus*, growth rate, age structure

INTRODUCTION

Zonitoides nitidus (O. F. Müller, 1774) is a Holarctic species inhabiting almost the whole of Europe, though it is rare and in places absent on its southern fringes; its range extends to southern Africa and Asia Minor. In Poland it is common in the lowlands, and less so in the mountains where it usually does not exceed 800 m a.s.l. (RIEDEL 1988). It is found on wet meadows, on shores of water bodies, in swampy scrub and alder carrs. This paper presents the results of field observations on some of life cycle parameters of *Z. nitidus*.

MATERIAL AND METHODS

Seasonal dynamics of age structure of the population of *Zonitoides nitidus* was assessed based on monthly quantitative samples, taken from May till November 2006, each month from a total area of 1 m^2. Leaf litter, herbs and a 2–3 cm layer of soil were removed from each such square and sorted manually three times: directly after bringing the sample to the laboratory, and twice after drying the sample for a few days and separating it into fractions on sieves of 10 × 10 and 5 × 5 mm mesh. Only live snails were included in the analysis.

The sampling plot was situated in Muszkowice near Henryków, near the boundary of the nature reserve Muszkowicki Las Bukowy (Fig. 1) (for detailed description of the area see KUŹNIK-KOWALSKA 2006).

The number of whorls was used as equivalent of age, since, because of considerable differences in size among individuals of the same number of whorls, it reflects age and growth more exactly than shell measurements (cf. POKRYSZKO 1990, HELLER et al. 1997). Division into age classes is presented in Table 1. Whorls were counted with EHRMANN'S (1933) method.

Table 1. Overall abundance of consecutive age classes of *Zonitoides nitidus*; values from seven months combined

Age class	Number of individuals
I (1.2–2.5)	392
II (2.6–3.0)	132
III (3.1–3.5)	133
IV (3.6–4.0)	103
V (>4.1)	54

Fig. 1. Habitat of *Zonitoides nitidus* in Muszkowice. Photo author

RESULTS AND DISCUSSION

The number of embryonic whorls ranges from 1.2 to 2.5; the number of whorls in adults is up to 5.75 (KUŹNIK-KOWALSKA in prep.). The abundance and proportion of particular age classes in *Zonitoides nitidus* in consecutive months is presented in Figs 2 and 3.

The youngest age class (I: 1.2–2.5 whorls) appeared in June, reached its maximum abundance in August and then its abundance decreased gradually till November, as a result of growth and mortality (see also below) combined. Class II (2.6–3.0 whorls) was

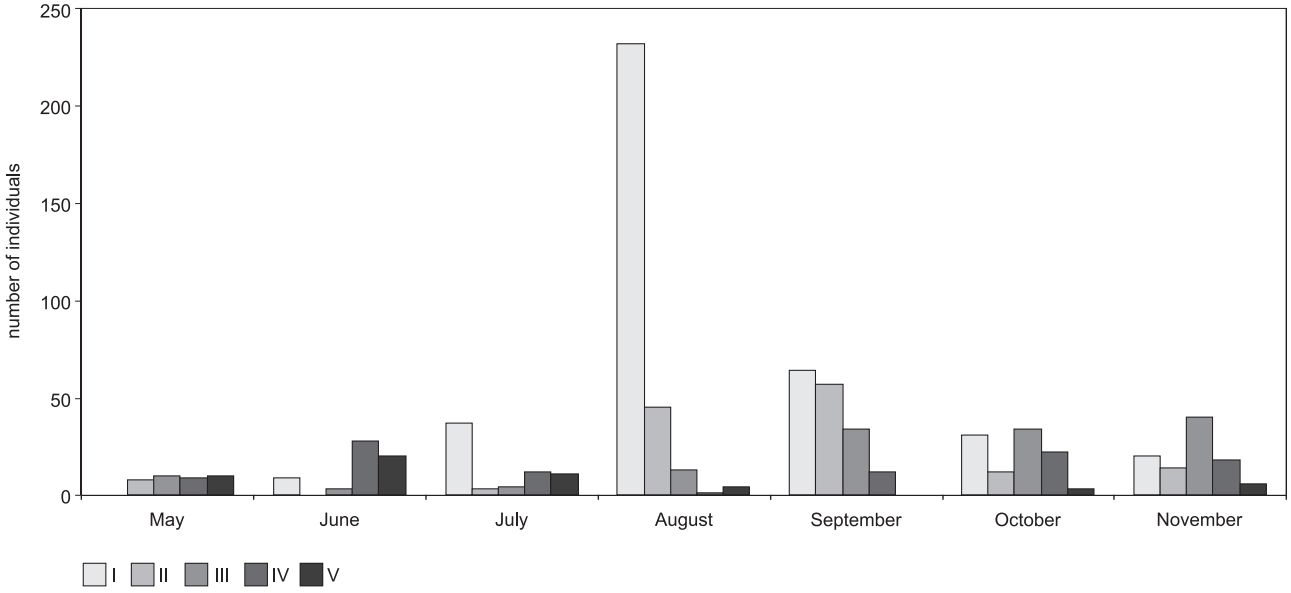

Fig. 2. Abundance of consecutive age classes of *Zonitoides nitidus* in Muszkowice from May till November

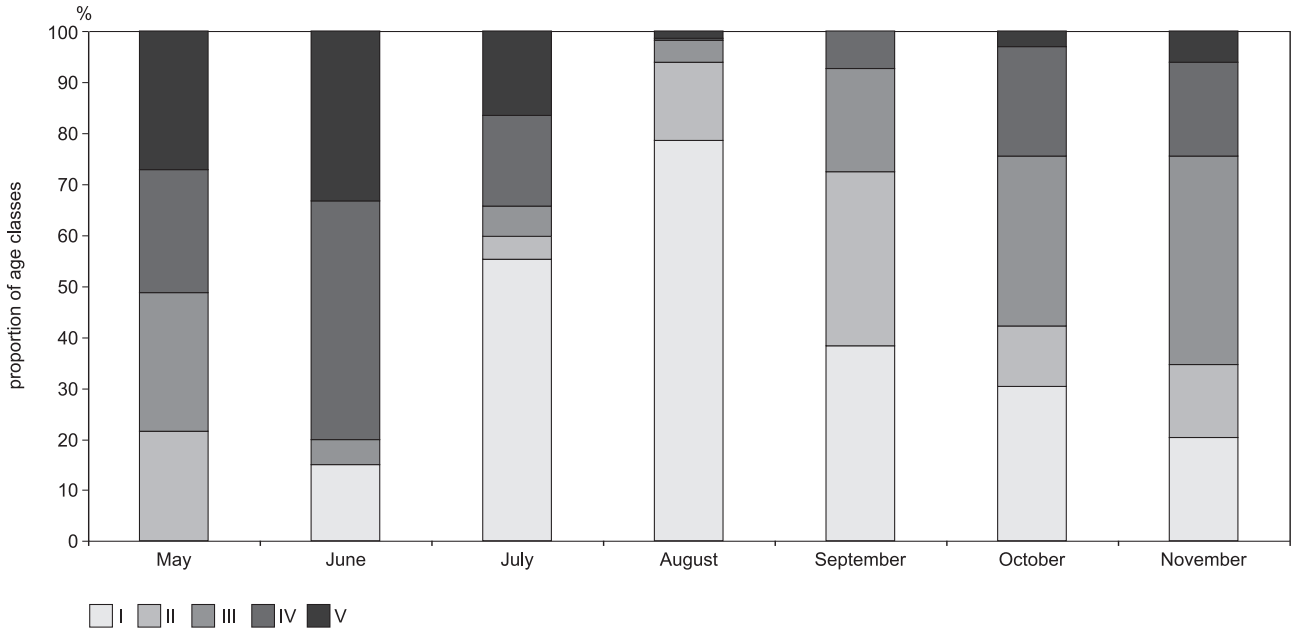

Fig. 3. Proportion of consecutive age classes of *Zonitoides nitidus* in Muszkowice from May till November

present in May and these were probably the smallest and youngest of the juveniles hatched in the previous year. No juveniles of class II were found in June; those that appeared in July were probably the result of growth of this year's earliest hatchlings. Class II reached its maximum abundance in August and September, then individuals of that class became gradually less numerous. Class III individuals (3.1–3.5 whorls) were present in the population since May and then their abundance dropped in June and July; they were probably individuals that had wintered over. This class reached its maximum abundance in November, as a result of recruitment – growth of class II juveniles. Class IV individuals (3.6–4.0 whorls) were present in May and reached their maximum number in June; these individuals were probably the result of growth of the previous year's juveniles. Their number then decreased gradually. The oldest class (V: >4.1 whorls) was poorly represented in May and reached its maximum abundance in June (growth of class IV individuals). No class V individuals were observed in September, which probably resulted from dying out of snails which had reproduced. Class V reappeared in October and November and these individuals resulted from growth of the previous age class.

The reproductive season lasts five months. All age classes except the youngest winter over. The differences in overall abundance of the age classes of *Zonitoides nitidus* indicate a high mortality of the youngest age class, of about 66% (Table 1). The data indicate that the life cycle of *Zonitoides nitidus* is the following. The breeding period (egg-laying and hatching) starts in June and continues till the end of October. The difference between the abundance maxima of consecutive age classes, of roughly one month, suggests that the mean growth rate is 1 whorl per month. The earliest hatched individuals attain 4.0-4.5 whorls till the autumn. Such snails hibernate. Later hatched snails reach only 2.0–3.0 whorls before the winter. In the spring next year the juveniles resume growth and till the autumn they reach as least 4.5 whorls. Such snails hibernate for the second time. *Z. nitidus* becomes mature at the earliest in the first year of life.

REFERENCES

EHRMANN P. 1933. Mollusken (Weichtiere). Die Tierwelt Mitteleuropas, II, 1. Meyer, Leipzig.

HELLER J., SIVAN N., HODGSON A. N. 1997. Reproductive biology and population dynamics of an ovoviviparous land snail, *Lauria cylindracea* (Pupillidae). J. Zool. 243: 263–280.

KUŹNIK-KOWALSKA 2006. Age structure and growth rate of *Aegopinella epipedostoma* (Fagot, 1879) (Gastropoda: Pulmonata: Zonitidae). Folia Malacol. 14: 71–74.

POKRYSZKO 1990. Life history and population dynamics of *Vertigo pusilla* O.F. Müller, 1774 (Gastropoda: Pulmonata: Vertiginidae), with some notes on shell and genital variability. Ann. Zool. 43: 407–432.

RIEDEL A. 1988. Ślimaki lądowe. Gastropoda terrestria. Katalog Fauny Polski 36. PWN, Warszawa.

Received: June 21st, 2010
Accepted: December 8th, 2010