the number of ventral scales of individuals are statistical sex-specific. But the range of possible deviations in sex-specific ventral scale numbers within populations has to be proved to ensure the application of this method.

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Reproductive cycle and clutch size in female sharp-snouted rock lizards, *Lacerta oxycephala*

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The sharp-snouted rock lizard, *Lacerta oxycephala* Dumeril and Bibron, 1839, is a peculiar member of the phylogenetically old lacertid group Archeolacerta. It is a stenoendemic Balkan species, restricted in its range to a narrow zone along the Adriatic coast from the river Krka to the northwestern part of Albania, including also some off-shore islands. This relatively small lizard is distinct in morphology from other Balkan lacertids by having a flattened short body, with a pointed snout, and blue underparts. In an ecological sense, *L. oxycephala* is peculiar as being the most petricole specialist among Balkan lacertids, inhabiting mostly sunny cliffs, rock-pavements, walls and similar habitats.

Almost nothing is known about reproductive biology and other life-history characteristics of the species with only a few observations on clutch size, incubation period, size of hatchlings, etc. (see Bischoff, 1984). In this paper we present the main characteristics of the female reproductive cycle, as well as details of clutch and egg size. Knowledge of the reproductive potential of this endemic species is most valuable, in particular, for its conservation and protection.

The sharp-snouted rock lizard is among the most abundant species in rich lizard communities in the Skadar Lake region (Montenegro), especially on islands were it can be found allotopically and syntopically with other lacertids. We studied reproductive biology of lizards from Beska, Gorica Smojs, Gorica Zalug, and Mali Moracnik Skadar lake islands. Females were collected in 1991 (April and June) in order to obtain eggs for this study, as well as for other investigations (Aleksić and Tucić, 1994), and in 1992 (April, May, July and October) for the study of annual reproductive cycle. Sampled individuals were measured and dissected before permanent storage in 70% alcohol. Specimens were deposited at the Georg Dzukić's herpetological collection, Institute for Biological Research, Belgrade. Body measurements included snout-vent length (SVL) and mass. During autopsy, measurements of ovarian follicle diameter were taken by an dial callipers under a stereoscopic dissecting microscope. Coelomic fat bodies were removed, dry blotted, and weighed. An estimate of egg volume (V), taken as an overall measure of laid egg size, was calculated using the formula $V = 4/3\pi a^2 b$, where a is half the shortest diameter and b is half the longest diameter. Relative clutch mass (RCM) was expressed as the ratio of clutch mass to the total body mass including clutch. Reproductive condition of each female was established according to presence or absence of vittelogenic follicles in ovaries and internal marks of recent oviposition (widened oviducts indicated postparturiency).

Gravid females were maintained separately in vivaria until oviposition (for more details see Aleksić and Tucić, 1994). Postparturient females were killed by deep freezing and dissected later to check for the presence of vitellogenic follicles. Each deposited egg was measured and weighed within five minutes of excavation. An index of SVL-adjusted dimensions for fat body mass was estimated using residuals from the least-squares regression line between SVL and fat body mass.

Immature females of the sharp-snouted rock lizards were characterized by transparent to white follicles up to 2 mm in diameter. Larger follicles invariably showed signs of vitellogenesis. The smallest reproductively active female was 53.34 mm SVL and this figure was taken to represent the size of the first reproduction of *L. oxycephala* from the Skadar Lake region.

The April sample 1992 was characterized by 10 out of 11 collected females being reproductively active, with follicles in various stages of vitellogenesis. In the May 1992 sample five females out of 12 sampled showed signs of producing their second clutch (simultaneous occurrence of postparturient signs and vitellogenic follicles), three being at the beginning of the reproductive period (vitellogenic follicles in ovaries) and four

Table 1. Fat body mass (range and adjusted means ± SE), and percentage of reproductively active females, in the samples studied. n = sample size.

Sample	n	Range	Adjusted mean ± SE	%
April	11	0.00-0.177	0.051 ± 0.016	90.9
May	12	0.002-0.048	0.019 ± 0.019	66.7
July	8	0.007-0.027	0.019 ± 0.023	0
October	10	0.043-0.256	0.117 ± 0.017	0

smaller females were immature. In the July and October 1992 sample there were no signs of reproductive activity among collected females. Oviductal eggs were not found in any lizard.

Finding females that carried vitellogenic follicles in the April sample (1992) leads to the conclusion that they left hibernation several weeks earlier, i.e. in the middle of March. The presence of females with widened oviducts in the May sample (sign of postparturition) points to the first week of April as the time of the beginning of copulation. Similar patterns for reproductive activities have been given by other authors (Muller, 1902; Kammerer, 1903; Wiedmann, 1909; Schreiber, 1912). This probably means that the reproductive season lasted until the end of June or the first week of July.

Two clutches occurred in some females 1991 and 1992, reported here for the first time. Presence of vitellogenic follicles in females that laid eggs in captivity, as well as finding females with postparturient signs carrying vitellogenic follicles, confirmed this. According to our data the first egg laying period in nature was during May, and the second lasted from the second half of June to the first part of July. Finding vitellogenic follicles in females that laid eggs (in vivaria) in June 1991 suggests the possibility of a third clutch of that female. We found no signs of reproductive activity in July.

Descriptive statistics of fat body mass in females from April, May, July and October 1992 are given in table 1. We found significant differences among fat body mass among sampling periods (ANCOVA, $F = 9.52$, $P < 0.001$). Adjusted values in the April, May, July samples were significantly smaller than in the October sample (ANOVA for multiple comparisons, $P < 0.05$); abdominal lipid accumulation resumed at the end of the activity season.

The reproductive cycle was also analysed through changes in the size and number of vitellogenic follicles in the 1992 samples. In the April sample, 10 out of 11 females carried one to three (mean ± SE = 2.24 ± 0.28) vitellogenic follicles from 2 to 6 mm in diameter (mean ± SE = 3.18 ± 0.50). In the May sample, eight out of 12 females carried one or two (mean ± SE = 1.68 ± 0.38) vitellogenic follicles from 2 to 7.2 mm in diameter (mean ± SE = 2.45 ± 0.50). Only transparent follicles were observed in the July and October samples. There was no significant correlation among female size and number of vitellogenic follicles in any sample ($P > 0.05$). Number of vitellogenic follicles (ANCOVA, $F = 1.32$, $P > 0.05$), and the size of the largest vitellogenic follicles (ANCOVA, $F = 0.43$, $P > 0.05$) from the left ovary, showed non-significant differences among samples.

Table 2. Body size, clutch size, and clutch characteristics (per female). n = sample size.

	n	Range (mode)	Mean ± SE
Snout-vent length (mm)	102	55.68-70.63	62.90 ± 0.25
Body mass (g)	84	2.260-6.100	4.132 ± 0.080
Clutch size	102	2-(4)-6	3.49 ± 0.09
Clutch volume (mm^3)	46	389.92-1585.44	841.74 ± 43.28
Mean egg volume (mm^3)	46	148.20-396.36	256.80 ± 8.91
Clutch mass (g)	46	0.394-1.610	0.932 ± 0.048
Mean egg mass (g)	46	0.142-0.442	0.285 ± 0.011
Relative clutch mass	46	0.092-0.359	0.209 ± 0.009

Table 3. Statistics on the laid eggs by *L. oxycephala*. Sample size is 147.

	Range	Mean ± SE
Egg mass (g)	0.127-0.453	0.256 ± 0.007
Egg length (mm)	9.40-16.89	12.26 ± 0.11
Egg width (mm)	4.67-7.80	6.25 ± 0.06
Egg volume (mm^3)	124.16-463.53	256.80 ± 5.95

Data obtained on clutch and egg characteristics from females that were kept in vivaria during 1991 and 1992 showed that the smallest female that oviposited was SVL = 55.68 mm, and the largest was SVL = 70.63 mm (table 2). Clutch size ranged from 2 to 6 eggs (mode = 4 eggs) with mean ± SE = 3.49 ± 0.09. Until this study only clutches of two to four eggs have been observed (Bischoff 1984, and references therein); thus reproductive output of this lizard is greater than previously thought. Laid egg size, expressed in terms of egg volume, appeared to be variable within the same clutch; extreme values differed by a factor of 2.7 (table 2). Relative clutch mass for *L. oxycephala* (mean ± SE = 0.209 ± 0.009) was similar to values for other Balkan lacertids (*Podarcis taurica*, *P. melisellensis* and *P. muralis*). Laid egg dimensions (pooled data) are presented in table 3. Egg size (expressed as a volume), which includes intra- and interindividual differences, ranged from 124.2 to 463.5 mm^3. These extremes differed by a factor 3.7, which indicates that intraclutch egg size variability was more pronounced than differences between females.

A significant positive correlation existed among female size and clutch size ($r = 0.271$, $P < 0.001$), as has been found in most lizard species (e.g. Dunham et al., 1988). The relationship among female size and clutch size is given by the regression: clutch size = 0.103 SVL − 2.978. Clutch size was significantly correlated with clutch mass ($r = 0.666$, $P < 0.001$), clutch volume ($r = 0.698$, $P < 0.001$), RCM ($r = 0.631$, $P < 0.001$), and mean egg length per female ($r = 0.284$, $P < 0.05$), but not with mean egg width per female ($r = 0.104$, $P > 0.05$).

As has been already pointed out, vitellogenic follicles were found in an appreciable number of females that laid eggs. The number of vitellogenic follicles in those females was treated as their (potential) second clutch. Differences between these subsequent clutches appeared significant; first clutch (laid eggs) was significantly larger than second clutch (vitellogenic follicles) in both the 1991 and 1992 samples (Mann-Whitney, Wilcoxon test: $Z = 1.97$, $P < 0.05$ and $Z = 2.54$, $P < 0.01$; respectively).

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Pregnancy does not increase the risk of mortality in wild viviparous lizards (*Sceloporus grammicus*)

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Several authors investigating the cost of reproduction in lizards and snakes have hypothesized that gravid females should suffer greater mortality than non gravid ones because the added weight of pregnancy hampers mobility and enhances the risk of predation (Vitt and Congdon, 1978; Vitt, 1981; Vitt and Price, 1982; Seigel and Fitch, 1984). Gravid females, however, may behaviorally circumvent the added predation risk by reducing their activity or becoming cryptic (Vitt and Congdon, 1978; Vitt, 1981; Vitt and Price, 1982; Seigel and Fitch 1984). Studies testing these hypothesis have verified that the extra

