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## NATURAL HISTORY OBSERVATIONS ON *LIOLAEMUS MAGELLANICUS*, THE SOUTHERNMOST LIZARD IN THE WORLD

FABIAN M. JAKSIĆ AND KURT SCHWENK

**ABSTRACT:** Observations on the natural history of *Liolaemus magellanicus* from Tierra del Fuego, Chile are presented. This species is patchily distributed in areas of coastal scrub and coastal steppe, reaching high local densities. Two color morphs are described: grey-olivaceous and green. Color dimorphism is not related to sex or body size of adults; all neonates are grey-olivaceous. Reproductive maturity appears to occur at snout-vent lengths of >48 mm for males and 60 mm for females. Females are ovoviviparous, having a relative clutch mass of 0.322 (mean for five specimens) and a mean litter size of 5.5 neonates (range 3-8). Birth occurs during the midsummer (January and February), probably 1 yr after copulation. Based on a sample of feces and a single stomach, *L. magellanicus* appears to be largely or entirely herbivorous, despite its small size (ca. 6 g). Field cloacal temperatures (mean for 20 specimens = 27 C) are significantly lower than for central Chilean species of *Liolaemus*.

**Key words:** Reptilia; Lacertilia; Iguanidae; *Liolaemus*; Tierra del Fuego; Chile; Natural history; Habitat; Behavior; Color dimorphism; Biometry; Reproduction; Diet; Body temperature

VERY little is known about the biology of the southernmost lizard in the world, *Liolaemus magellanicus* (Iguanidae). This species is distributed in Chile from Balmaceda (45°55' S, 71°41' W) south to Punta Arenas (53°09' S, 70°55' W) and to Tierra del Fuego Island, where it is the only lizard present (Donoso-Barros, 1966; see Instituto Geográfico Militar, 1970, for a map). Most of the records from neighboring Argentina are in Santa Cruz Province (Ceï, 1971), but Bottari (1975) reported the presence of *L. magellanicus* also on the Argentinian side of Tierra del Fuego Island, between latitudes 53°35' S and 54°17' S. Both Donoso-Barros (1966) and Bottari (1975) suggested that this species is extremely scarce on the island. Its presence on Tierra del Fuego is of particular interest due to the stringency of the environment; cold temperatures prevail nearly all year and snow cover is present half the year. Here we report natural history observations of *L. magellanicus* on the Chilean side of Tierra del Fuego where it lives at its geographic, and presumably, climatic limit.

### MATERIALS AND METHODS

Observations were recorded on 24, 25 and 26 January 1982, during the austral

midsummer. Only the upper half of Tierra del Fuego Island was surveyed, between latitudes 52°30' S and 53°39' S and longitudes 68°37' W and 70°22' W. This part of the island is very flat, steppe-like in aspect, with vegetation consisting mainly of small shrubs and bunchgrass (see Goodall, 1979; Instituto Geográfico Militar, 1970). Both coastal and interior areas were surveyed equally. At each locality, FMJ walked slowly through the area, recording all lizard sightings as well as the position of lizards with regard to perches and refuges. Any given area was abandoned if no lizards were seen within half an hour of presumably favorable climatic conditions. Since all mornings and evenings were overcast during the three-day period of the survey, observations usually started at about 1100 h and lasted no later than 1900 h. A total of 909 km was travelled within the island, and 21 specimens were collected. All but two were killed in early March 1982, preserved in alcohol, and later deposited in the Museum of Vertebrate Zoology, University of California, Berkeley.

The following measurements were taken from specimens collected: (A) Fresh weight at capture time (WT, in g), recorded with a Pesola scale with precision to

0.1 g. (B) Preserved snout to vent length (SVL, to 0.1 mm). (C) Preserved tail length (TL, to 0.1 mm), only if the tail was intact. (D) Activity field temperature (AFT, in C), recorded with a quick-reading Schultheis thermometer (0.1 C precision) inserted into the cloaca.

All females collected were kept separate from each other and from males until early March to assess their reproductive status (gravid or not). Litter size was also evaluated on an individual basis. Males were categorized as reproductive or non-reproductive after preservation, based on size of testes. Testes shorter than 3 mm were considered non-reproductive and those larger than 7 mm as reproductive. Females were examined for the presence of eggs in their oviducts or follicles in their ovaries. Fresh feces of all specimens were gathered and analyzed under a dissecting microscope.

## RESULTS AND DISCUSSION

### *Distribution, Habitat and Behavior*

*Liolaemus magellanicus* was found at only two localities on Tierra del Fuego, Onaisín (53°24' S, 69°19' W, about 2 m above sea level, 98 km east of Porvenir city), and Cabo Espíritu Santo, at the lighthouse (52°40' S, 68°37' W, 67 m above sea level, 70 km east of Cerro Sombrero city). Both collecting sites (about 91 km apart) are less than 200 m from the coastline, but differ in their physiognomy, vegetation and soil. The vegetation at Onaisín is coastal scrub with sparse dwarf shrubs and cushion plants dominated by *Mulinum* sp.; the soil is sandy and heavily mined by the fossorial rodent *Ctenomys magellanicus* (Ctenomyidae). Cabo Espíritu Santo supports a coastal steppe homogeneously covered by the bunchgrass *Festuca* sp.; the soil is sandy-clayish and fossorial rodents are absent. At Onaisín, 21 specimens of *L. magellanicus* were sighted between 1315 h and 1715 h; 20 were perched on sand mounds at the entrance of *Ctenomys* burrows, one was perched on a low shrub about 10 cm

above the ground. Nineteen of these specimens ran into burrows when approached; two of them ran into the base of the closest shrub. Seven specimens could be easily dug out from the burrows, and one was caught on the surface. One instance of possible courtship behavior was observed, with one lizard moving closely alongside another. The day was overcast at the beginning of the observation period, changing to cloudy and sunny later on. At Cabo Espíritu Santo, 13 lizards were found within a 100 m radius of the lighthouse under debris. No lizard was seen in the open. The collecting period was between 1315 h and 1645 h, with fairly hot weather for local standards and cloudless skies until 1530 h. Several other localities with similar physiognomy and vegetation to Onaisín and Cabo Espíritu Santo were surveyed, but no *L. magellanicus* were observed. Our impression is that this species is distributed mainly in coastal areas of Tierra del Fuego Island (see also Bottari, 1975), with scattered populations that reach relatively high local densities.

### *Color Patterns and Morphological Variation*

As there are detailed descriptions of the external morphology of *L. magellanicus* (Donoso-Barros, 1966; Peters and Donoso-Barros, 1970; Ceï, 1971), we do not repeat this information here. However, a previously unreported phenotypic trait in this species deserves comment. The population at Onaisín had the standard grey-olivaceous coloration, which appeared fairly cryptic against the sandy substrate found in that locality. The population at Cabo Espíritu Santo, however, comprised individuals of two different dorsal colorations: grey-olivaceous and greenish. Two of the 13 specimens collected at this locality were bright green and two others were pale green. The difference in coloration was not associated with any noticeable change in the pattern of dorsal stripes and spots. The greenish pheno-

TABLE 1.—Statistics for four variables measured in *Liolaemus magellanicus*. SVL = snout-vent length; TL = tail length; WT = fresh weight; AFT = activity field temperature; REG TL = regenerated tail. Figures are mean  $\pm$  2 standard errors (sample size in parentheses), except for REG TL, which are proportional frequencies. *P* = significance level of the difference between sexes as evaluated with a two-tailed Mann-Whitney *U*-test; REG TL was evaluated with a  $2 \times 2$  contingency table.

Variables	Males	Females	<i>P</i>
SVL (mm)	53.0 $\pm$ 4.3 (11)	62.9 $\pm$ 4.5 (9)	0.02
TL (mm)	53.3 $\pm$ 4.4 (9)	59.4 $\pm$ 2.9 (7)	0.10
WT (g)	5.6 $\pm$ 1.3 (11)	pregnant 9.5 $\pm$ 1.4 (5) non-preg 6.5 $\pm$ 2.5 (3)	0.02 0.10
AFT (C)	27.2 $\pm$ 0.8 (11)	26.7 $\pm$ 1.1 (9)	0.10
REG TL (%)	18.2 (11)	22.2 (9)	0.55

type is not a sexual dimorphism, but is more common in the females collected. It is interesting to note that the greenish phenotypes were found only in the locality covered by the greenish bunchgrass, *Festuca* sp.

As no significant differences in SVL, TL and WT were found between localities ( $P > 0.05$ , Mann-Whitney *U*-test), these data were pooled. Females have significantly greater SVL than males, but sexes do not differ in TL; gravid females are significantly heavier than males, but non-gravid ones are not (Table 1). This latter observation may be due to the small sample size of non-gravid females ( $n = 3$ ). Otherwise, *L. magellanicus* presents a size dimorphism that is evident in SVL but not in WT. Although this seems contradictory, males may be stouter than females at any given SVL.

The frequency of regenerated tails in the combined sample was 20%. This figure is lower than any reported for other *Liolaemus* species (Jaksić and Fuentes, 1980). As these authors noted, the low proportion of regenerated tails may indicate that *L. magellanicus* is infrequently preyed upon, or that predator attacks on this species are frequently successful.

### Reproduction

*L. magellanicus* is known to be ovoviparous, with reported litter sizes ranging from two (Donoso-Barros, 1966) to five and nine (Cei, 1971). Nothing is present-

ly known about its gestation period or age at sexual maturity. At Onaisín, four males and three females were collected. The two smaller males (SVL  $\leq 48$  mm) were non-reproductive while the largest two males (SVL  $\geq 54$  mm) were reproductive. Two of the three females were examined. Both (SVL  $\geq 64$  mm) had enlarged follicles in their ovaries. The females at this locality had apparently given birth recently, because one very small individual was collected here. It measured SVL = 26 mm, TL = 26 mm, WT = 0.6 g. These measurements are indistinguishable from those recorded for known neonates (see below).

At Cabo Espíritu Santo, seven males and six females were collected. Of the five males examined, one was non-reproductive (SVL = 45 mm), another (SVL = 47 mm) was of intermediate reproductive status, as judged from the size of its testes (testis length = 3.9 mm), while the remaining males (SVL ranged from 61–64 mm) were reproductive according to our criterion. All six females were gravid (SVL ranged from 60–71 mm), and gave birth to 3, 5, 5, 6, 6 and 8 ( $\bar{x} = 5.5$ ) neonates between 1 and 7 February. Neonates were pale-greyish with a similar pattern of dorsal stripes and spots as the adults, regardless of maternal color (a photograph can be seen in Cei, 1971). Measurements taken on the largest litter of neonates were SVL = 24.0  $\pm$  0.5 mm, WT = 0.6  $\pm$  0.07 g ( $\bar{x} \pm 2$  SE;  $n = 8$ ), and TL = 24.1  $\pm$  0.9

mm ( $n = 7$ ; one tail was broken during storage). Of four females examined about one month after giving birth, all had enlarged follicles in their ovaries (SVL ranged between 61 and 70 mm).

Males apparently become reproductively mature at  $>48$  mm SVL. Females seem to be reproductively mature at 60 mm SVL, though we have only negative evidence for their non-reproductive status below this size. The gestation period remains unknown. However, females give birth during January and February (i.e., midsummer; see also Cei, 1971) and it seems likely that they mate immediately thereafter, giving birth again 1 yr later. Thus, gestation is either 11 or 12 mo, or sperm storage occurs.

As neonates of one litter were weighed (see above), a crude estimate of relative "clutch" mass (sensu Vitt and Congdon, 1978) can be made using the figure 0.6 g per neonate times the number of neonates in a given litter, over total weight of the gravid female. Relative "clutch" mass of five females of *L. magellanicus* is  $0.322 \pm 0.084$  ( $\bar{x} \pm 2$  SE). The grand mean for 16 iguanid species reported by Vitt and Congdon (1978) is  $0.272 \pm 0.034$ . These figures are not significantly different ( $t = 1.277$ ;  $df = 19$ ;  $P > 0.21$ ), which is interesting because the comparison involves oviparous, insectivorous lizards with the ovoviviparous, presumably herbivorous *L. magellanicus*.

#### Food Habits

Donoso-Barros (1966) reported that *L. magellanicus* is mainly insectivorous, including some vegetation in its diet. Cei (1971) stated that in Santa Cruz Province (continental Argentina), this species is omnivorous, though with a greater incidence of arthropods in its diet. We found nothing but plant material in the feces of each specimen and in the stomach of one female at Cabo Espiritu Santo. It is not known whether *L. magellanicus* in Tierra del Fuego is truly more herbivorous than its conspecifics on the mainland. It is re-

markable that such a small lizard (6 g), with a very short growing season available and a reproductive investment comparable to that of other iguanids (see above), feeds on plant material at all; the low conversion efficiency of lizards should make a diet of plants energetically unfeasible below a body size of 50 g (Pough, 1973; Iverson, 1982). Greene (1982), however, has discussed several exceptions (including *Liolaemus* spp.) to this contention.

#### Activity Field Temperatures

Cloacal temperatures of *L. magellanicus* were recorded at both Onaisín and Cabo Espiritu Santo. At Onaisín, the lizards had to be dug out while at Cabo Espiritu Santo they were picked up without chase. As no significant differences in activity field temperatures (AFT) were detected between localities, data were pooled, keeping sexes separate. Males do not differ from females in their AFT (27.2 C versus 26.7 C; see Table 1). *L. magellanicus* has a lower mean AFT ( $27.0 \pm 0.7$ ,  $n = 20$ ;  $\bar{x} \pm 2$  SE) than those reported for eight central Chilean *Liolaemus* species ( $35.1 \pm 0.6$ ,  $n = 349$ ; Fuentes and Jaksić, 1979). A lower preferred temperature in *L. magellanicus* may be adaptive in that it would allow both a daily and seasonal extension of its activity period in the cold climate of Tierra del Fuego. Alternatively, it is possible that the high latitude of Tierra del Fuego does not allow sufficient insolation for an elevation of body temperature by basking.

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HERPETOLOGISTS' LEAGUE  
STUDENT PRIZE

The Student Prize Committee of the Herpetologists' League, consisting of Harry Greene, Bayard Brattstrom and Margaret Stewart, judged the paper by L. L. Woolbright titled "Sexual dimorphism in *Eleutherodactylus coqui* (Anura: Leptodactylidae)" the winner of the student prize competition.

HERPETOLOGISTS' LEAGUE  
STUDENT POSTER

William E. Duellman, judge of the Student Poster Competition, declared Robert Macey the winner for his poster titled "The effects of ecology and geography on a hybrid zone between two subspecies of *Ensatina eschscholtzi*."