Ring marking in lizards: positive and negative aspects of a new marking method

Uso de anilhas em lagartos: aspectos positivos e negativos de um novo método de marcação

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ABSTRACT

Marcação com anilhas em lagartos: aspectos positivos e negativos de um novo método de marcação. Studies on population ecology need data on demographic parameters, which are obtained by long-term studies that rely on individuals’ identification. Concerning lizard marking methods, several protocols are known and widely used, though the choice may be limited to the nature of the study, the desired number of recaptures and time and budget constraints. Marking with rings consists of using an aluminum ring, colored and/or numbered, which can be used on the individuals’ wings or legs, thus allowing the recognition of individuals. Field work was carried out from February 2010 to January 2011. Collections were seasonal and lasted 15 days each. Individuals were actively searched and manually captured. Marking was performed by placing numbered aluminum rings, which were adapted from metal rings normally used on bats. Throughout the study, 790 individuals of Homonota uruguayensis were marked and 290 (41.04 %) were recaptured. Individuals smaller
than 27 mm could not be marked. In this study, this marking method proved to be an effective alternative, since it is easily used in the field and it also identifies individuals accurately.

**Keywords:** Geckos, toe-clipping, population

**1 INTRODUCTION**

Studies in population ecology require data on survival, age, reproduction, immigration and emigration, and are essential to better understand reptile life histories (Paulissen & Meyer 2000). This information is obtained through long-term studies that require individual identification. Differences in individuals in size, shape, behavior, habitat or sensitivity to human presence can also influence the selection of an adequate marking method (Beausoleil *et al.*, 2004). However, there is a consensus that no marking method encompasses all those characteristics (Fisher & Muth, 1989; Thobjarnarson, 1998; Hayes *et al.*, 2000; Paulissen & Meyer, 2000; Bloch & Irschick, 2004; Ferner, 2007; Clemann *et al.*, 2009). There will always be trade-off between the acquisition of information and the perturbation caused by obtaining it (Beausoleil *et al.*, 2004). The various types of marking can affect animals in three main ways: when marking (causing injuries); by the presence of the marking (hindering movement, for example); and by the visibility of the marking (resulting in greater risk of predation) (Beausoleil *et al.*, 2004).

Several marking methods have been used in lizards: toe-clipping (Paulissen & Meyer, 2000; Bloch & Irschick, 2004; Caruccio *et al.*, 2010); paint (Tinkle, 1967); colored cloth stripes tied on the tail base (Beausoleil *et al.*, 2004); heat or freezing, colored hair elastics (Lima 2005, Ribeiro & Sousa, 2006); colored beads (Fisher & Muth, 1989, Hayes *et al.*, 2000); and passive integrated transponder...
PIT) tags, elastomers and radiotelemetry (Ferner, 2007). Despite the great diversity of methods available for some groups, the choice may be limited by the species, the nature of the study, the number of recaptures required, and restrictions of time and budget (Hayes et al., 2000; Beausoleil et al., 2004). There are other very efficient marking methods used in tetrapods. Among these, the most common is the use of metal rings for birds (FAO, 2007; Euring, 2007) and bats (Ortêncio & Reis-Filho, 2009). This marking consists of fixing an aluminum ring, colored and/or numbered, on the specimen’s wings or legs, allowing its recognition (Júnior et al., 2001).

Currently, the most common marking method used in lizard research is toe-clipping (Beausoleil et al., 2004; Ferner, 2007; Clemann et al., 2009). This method has been shown to be successful in numerous studies because it causes limited damage and has an effect on survival that can be neglected (Hudson 1996; Paulissen & Meyer, 2000; Borges-Landáez & Shine, 2003; Bloch & Irschick, 2004; Ferner, 2007). Toe-clipping was tested on Hemidactylus turcínus (Gekkonidae) to determine the influence on the species’ movements and ability to climb (Paulissen & Meyer, 2000). Although authors did not observe any negative aspects of the marking, it was recommended that the method must be carefully used in gekkonids, because the loss of claws can hinder the climbing ability of these species.

Homonota uruguayensis occurs from west and northeast Uruguay to south-southwest Rio Grande do Sul State (Brazil) (Lema, 1994), and it is the only native gecko of this region. It is a terrestrial species restricted to the sandstone-basalt rocky outcrops of the Pampa Biome (Vaz-Ferreira & Sierra de Soriano, 1973); it has both diurnal and nocturnal habits (Carreira et al., 2005) and refuges under rocks (Gudynas & Gambarotta, 1980) and between cracks. This study describes an individual marking method for lizards based on bird and bat rings and was tested in a population of Homonota uruguayensis (Squamata, Phyllodactylidae) from southern Brazil; we aimed to broaden the options for marking methods that can be applied in individuals of various sizes and in climbing species.

2 MATERIAL AND METHODS

Field work was carried out between February 2010 and January 2011, totaling four expeditions – one for each season (autumn, winter, spring and summer) – which lasted 15 days each. Days were divided into 6-hour interval (0 h-5:59 h, 6 h-11:59 h, 12 h-17:59 h and 18 h-23:59 h), alternating six work-hours and six rest-hours (first week – 1st and 3rd shifts; second week – 2nd and 4th shifts), thus making it possible to cover the whole species’ activity period (Vieira, R.C. - personal observation) and to replicate each shift six times, in every expedition. Individuals were actively searched and manually captured.
Individuals captured received a numbered 2 x 4 mm ring, placed on the individual’s ankle or thigh base (Figure 1) with the aid of special pliers.

Figure 1: Homonota uruguayensis marked with aluminum ring in the study area of Rosario do Sul municipality, Rio Grande do Sul State, Brazil.

The marking is rapid, not lasting more than 2 min per specimen, where it becomes more rapid with the researcher’s practice. The rings can be placed by a single person, holding the lizard in one hand and the pliers in the other (Figure 2). In this study, the rings were always applied by a single investigator (R.C. Vieira). The rings utilized were obtained already open, which facilitated the process. The closing of the rings was done with pressure requiring special pliers (R$ 80.00). The rings were made by Anilhas Capri (http://www.anilhascapri.com.br/) and the cost for this study was R$ 1.79 per ring.

Figure 2: Application of aluminum ring in Homonota uruguayensis in the study area of Rosario do Sul municipality, Rio Grande do Sul State, Brazil.
3 RESULTS

Throughout the study, 710 *Homonota uruguyensis* individuals were marked and 290 (41.04%) were recaptured. Mean snout-vent length (SVL) of adult females was 40.16 ± 1.94 mm and the largest specimen measured 49.16 mm. Mean SVL of adult males was 40.40 ± 1.42 mm and the largest individual measured 49.68 mm (Lídia F. Martins - personal observation). Mean SVL of juveniles was 30.25 ± 5.41 mm and the smallest specimen captured measured 17.9 mm. Mean body mass was 1.92 ± 0.32 g for adult females, 2.13 ± 0.24 g for adult males and 0.90 ± 0.58 g for juveniles. The smallest body mass recorded among juveniles was 0.1 g. It was not possible to mark individuals smaller than 27 mm.

We observed that the rings did not hinder the individuals’ movement, and distances recorded varied from 19.29 ± 34.14 m (n = 67) in the non-reproductive season to 13.98 ± 32.55 m in the reproductive season (n = 68). It was also observed that marked individuals continued using the cracks in rocks for refuge (n = 75 individuals). The time span washers remained on individuals seems to be consistent with long-term studies, since individuals marked in the first season (May 2010) were recaptured in all field expeditions.

Throughout the study, 41 loose rings were found at the rocky outcrop. Seven individuals were found dead. However, the rings did not appear to be the cause of death in any of them: one individual was attacked, two were crushed by rocks and four had no apparent injury. Four other individuals were found with no hindlimb and five were found with swollen or atrophied feet. Additionally, 40 captured individuals (5.64%) had no feet; of these, 17 had rings in place (Figure 3), which means that the loss occurred after marking. Another 23 individuals had no foot and no rings; so, it was not possible to identify the cause of foot loss with certainty. Individuals with no right forelimb were also found.

Figure 3: Record of injured *Homonota uruguayensis* individual with (A) and without ring (B) in the study area of Rosario do Sul municipality, Rio Grande do Sul State, Brazil.
The incidence of lizards with regenerated tails was 70.7%, and 11.2% lost all or parts of the tail when captured. Six individuals were found with no tail parts.

4 DISCUSSION

Whenever possible, the effect of marking techniques on individuals and populations should be monitored, and methods should be constantly evaluated (Clemann et al., 2009). Marking with aluminum rings was proved to be efficient in the present study. It is easy use in the field, has a good overall accuracy in identifying individuals, and can be used in smaller lizards (minimum of 27 mm). For groups such as the Gekkota, in which toe-clipping hampers the individuals’ movement, marking with rings is an efficient, medium-cost alternative (compared to the cost of elastomers, for example), which does not hinder the movement of the individuals and which allows the marking of species that takes refuge under rocks and in cracks. It should be pointed out that data on the movement of the species was not described in earlier studies.

In marking a great number of individuals, numbered rings are more suitable than the colored ones. Also, a large number of small-sized individuals (27 to 40 mm) may be marked without the marking being too invasive. For example, if we chose to use toe-clipping marking in this study, it would have been necessary to cut one to four fingers to mark all individuals required (Verrastro, 2001).

The frequency of toe loss in natural populations may indicate the effect of it on survival and the implications for the marking method chosen (Hudson, 1996). If toe loss is common, it means that this loss has a low effect on the species’ survival. In the Homonota uruguayensis population studied, the marking method chosen was crucial because, prior to the study, we had already noticed a high rate of loss of toes, limbs and tail and it is known that toe-clipping is contraindicated for species that naturally lose toes (Beausoleil et al., 2004). Schoener & Schoener (1980) hypothesize that forelimb injuries and losses may result from intraspecific aggressive interactions, while hindlimb injuries and losses would be a direct consequence of predation. Additionally, H. uruguayensis is known for its high rate of tail loss and tail regeneration (Vaz-Ferreira & Sierra de Soriano, 1965). The same was observed in this study, since the percentage of autotomized or regenerated tails was 70%. The loss of hindlimbs and forelimbs in this population seems to be a direct result of predation pressure as individuals apparently do not show aggressive interactions (Vieira, RC - personal observation).

The placement of rings demands training in handling pliers, since these may vary with ring size, which in turn depends on the size of the species studied. Therefore, pilot studies are necessary to identify the ideal ring size for each study (De Beer et al., 2001). The rings found in the rocky
outcrop probably fell off the animal due to this adaptation needed; however, all of them could be reused. The injuries recorded in the population, such as bruised limbs and swollen or atrophied feet are a negative aspect of the marking. When placed too tightly, the rings constrict the limb, cause problems with blood circulation and hinders the animal’s movement. On the other hand, if the ring is not well locked, it may fall off. However, all marked animals that were recaptured at least one time were observed moving about normally.

Due to the lack of knowledge about the ecological aspects of Homonota uruguayensis and other South American Gekkotas, long-term studies should be encouraged. Marking with washers proved to be an efficient technique for long-term studies in geckonids, since the ease of use, low cost and reliability overcome the negative aspects observed in this study. However, it is suggested that new studies conduct an extensive event capture without previous use of rings to calculate the effective rates of injuries or loss from the natural population before using this marking method.

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