ZOOLOGIA 32 (4): 317–320, August 2015
http://dx.doi.org/10.1590/S1984-46702015000400007

SHORT COMMUNICATION

Approaches to capturing the Black and White Tegu *Salvator merianae* (Squamata: Teiidae)

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ABSTRACT. The use of traps is extremely important in several types of ecological studies, and may assist in the capture of individuals in areas that are difficult to access. In the present study, we compared the effectiveness of wooden (Schramm) versus "Tomahawk" traps to capture *Salvator merianae* (Duméril & Bibron, 1839) lizards. The study was conducted in Eldorado do Sul, Rio Grande do Sul, Brazil. Field data were collected from August 2013 to March 2015, during the reproductive period of the species. The study involved two types of baited traps: i) "Tomahawk", made of galvanized steel; and ii) Schramm, a wooden trap. The capture rate of the Schramm wooden traps was 1.63 individuals/day, and of the "Tomahawk" was 0.36 individuals/day. These results are important for researchers working with large lizards and may help to increase sampling efficiency for these organisms.

KEY WORDS. Capture; ecology; traps; Tomahawk.

The sampling methodology, and its effectiveness, are of primary importance for the acquisition of reliable data (Mangini & Nicola 2006). Traps can assist in the capture of animals in areas that are difficult to access and can increase the sampling effort of a given study. Traps can be extremely effective in several types of ecological studies, including faunal inventories, comparisons of relative abundances, studies on population ecology, monitoring of fauna, and in the collection of tissue and blood samples as well as biometrical data (Vanzolini & Papavero 1967, Gibbons & Semlistsch 1981, Campbell & Christman 1982, Mengak & Guynn 1987, Greenberg et al. 1994, Cechin & Martins 2000, Oliveira et al. 2007). In herpetological studies, particularly those involving reptiles, pitfalls – baited traps made out of pet bottles and PVC tubes – and loop traps – e.g., snare traps – are commonly used (Morton et al. 1988, Schemnitz 2005).

The choice of a sampling method takes into consideration factors such as the species being studied (and consequently its diet, behavioral traits, and individual body size) and the habitat and topography of the study areas, and logistical restrictions such as the time of sampling and the financial resources available (Garden et al. 2007). Consequently, it is difficult to find references that endorse a given method or a combination of methods for all research projects (Garden et al. 2007), even for the same species or animal group.

Boxes, cages and snare traps are widely employed in the capture of a wide variety of birds, reptiles and mammals (Mangini & Nicola 2006). These traps can be made in different sizes and out of different materials and can have one or more entries (Cechin & Martins 2000, Reed et al. 2000, Mangini & Nicola 2006, Souza et al. 2011). Mangini & Nicola (2006) suggested that some lizard species can be captured using baits and box or cage traps. In this study, we compare between the efficacy of wooden traps (Schramm trap) and "Tomahawk" traps to capture *Salvator merianae* (Duméril & Bibron, 1839) lizards.

The study was conducted at the Experimental Agronomic Station of Universidade Federal do Rio Grande do Sul (EAS/UFRGS), located at Km 146 of BR 290, in Eldorado do Sul, Rio Grande do Sul, Brazil (30°05'29"S and 51°40'15.4"W). According to Köeppen's classification, the climate there is subtropical, with warm humid summers (Cfa fundamental type). The average annual rainfall is 1,440 mm, with a monthly average of 120 mm (Bergamaschi & Guadagnin 1990). EAS/UFRGS owns an area of 1,580 ha with open-field vegetation, some areas with dense vegetation, and cultivated areas (Thomas et al. 1998).

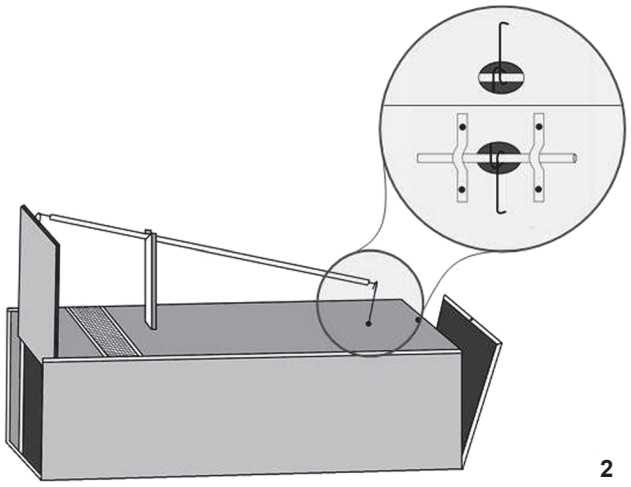
Field data were collected on the weekends from August 2013 to March 2015, which corresponded to the reproductive period of *S. merianae* lizards (September to March), totaling 5,600 hours of sampling. Given that our objective was to capture individuals for tagging, we selected, as sampling points, places where active lizards had been observed in activity or that were near their shelters and/or burrows. The spatial distribution of the traps was changed periodically during the sampling period

(every weekend), and all traps were checked every hour from 08:00 am to 06:00 pm. The traps were distributed in similar environments: open areas with little herbaceous vegetation and where sun incidence was similar. Some burrows were close to human constructions; however, the traps were on grass, and both models of traps were present in all of the sampling sites at different times. The study involved two types of traps: i) the "Tomahawk", manufactured by Gabrisa Aramados (São Paulo – Brazil), which is built from galvanized steel and measures 115 x 55 x 60 cm (Fig. 1); and ii) the Schramm, a wooden trap, which was developed by us. The Schramm trap is made of four wooden boards (30 x 90 cm) on the sides, a bottom that can be open (32 x 27 cm), a door with a closing system (32 x 27 cm), and a baiting and triggering system, formed by a wooden batten (71 cm) and a wire-based trigger (Fig. 2). There is a screen on the front top of of the Schramm trap (12 cm x 6 cm), which allows air to enter the trap, making it less stuffy. This screen is made of wire, which also allows the researcher to check for captured animals without the need to open it, generating less stress on the lizards. The entrance of the trap is composed of a free-fall door system that, when armed, is supported by wooden slats and is connected to the firing trigger. When the animal tries to remove the trigger bait, the wooden slats supporting the door are disturbed, closing the trap. The rear door is hinged at the bottom and has a safety pin to prevent the trapped animal from opening it. The main function of this back door is to facilitate the removal of trapped animals (Fig. 2). The "Tomahawk" traps were baited with eggs and bacon, whereas the wooden trap was baited only with bacon due to its triggering system, in which the trigger is attached to the roof of the trap. We chose these baits because *S. merianae* is known to have a generalist and opportunistic diet that includes meat and eggs (Winck et al. 2011), to which we added the smell of bacon.

Ten "Tomahawk" traps and three wooden traps were used in this study, with a total sampling effort of 5,600 trap/hours: 4,880 hours for the "Tomahawk" traps and 720 hours for the wooden traps. Knowing that the activity of this species is diurnal, we decided to close the traps at night.

The following features of each captured individual were recorded: snout-vent length (SVL – cm), tail length (TL – cm), body mass (g), and sex (determined through secondary traits) as well as tail regeneration and/or the absence of phalanges (the latter data were collected to visually assist the identification of individuals). All captured animals were marked with numbered tags and released in the same place where they had been captured. The place of capture of each lizard was geo-referenced using a GPS (Global Positioning System). We also recorded the time of capture and the substrate temperature (°C) of the trap location.

The capture effort of each model of trap throughout the study was calculated by summing the field hours of that type of trap and multiplying it by the number of traps of each model. Effectiveness rates were calculated for each model of trap by



Figures 1-2. (1) Metallic trap used in the study. (2) Scheme of the wooden trap (Schramm trap) developed for the study. Photo: Arthur Schramm.

dividing the number of lizards captured in that type of trap by each method's total capture effort – adapted from the calculation of the capture effort of Maciel et al. (2003) and Davis & Winstead (1987). The number of males and females and adults and juveniles captured with each model of trap were compared using the Fisher test (Zar 1999). The SVL (cm) and body mass (g) of captured lizards were compared between the trap models using the Mann-Whitney test (Zar 1999). The analyses were performed using PAST software, version 2.17 (Hammer et al. 2001).

The ten "Tomahawk" traps captured 74 *S. merianae* individuals (50 captures and 24 recaptures), with an effectiveness of 0.0152 individuals/hour. In contrast, the Schramm wooden traps captured 49 individuals, with a total effectiveness of 0.068 individuals/hour (27 captures and 22 recaptures). Thus, the Schramm wooden traps showed a capture rate of 1.63 individuals/day, whereas the "Tomahawk" traps showed an approximate rate of only 0.36 individuals/day. Importantly, recaptured individuals may have been captured the first time in a different type of trap or even through manual capture; previously

caught lizards were captured in both trap models. Thirteen domestic animals were captured with "Tomahawk" traps, four cats and nine dogs. On the other hand, no domestic animals were captured by the Schramm traps.

When analyzing the morphological data of the individuals captured by the "Tomahawk" traps, we found that SVL varied from 20.5 cm to 43.5 cm and that body mass varied from 600 g to 7500 g; the individuals caught by the Schramm trap, on the other hand, had a SVL that ranged from 22.5 cm to 44 cm and a body mass that ranged from 300 g to 4,750 g. The snout-vent-length of captured individuals differed significantly between the two trap types (U = 34.5, df = 114, p = 0.005), but their weight did not (U = 1173, df = 107, p = 0.142) (Figs. 3-6). No significant differences were found in the capture frequency of males and females (χ^2 = 1,536, df = 1, p = 0.2903), but a significant difference between the two models of traps was found in the capture frequency of adults and juveniles (χ^2 = 13.99, df = 1, p = 0.000).

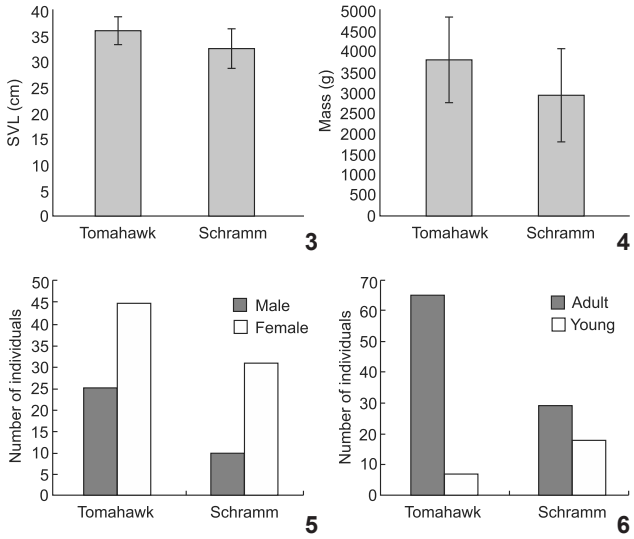
In the "Tomahawk" traps, 58 injured and a single dead animal were observed. On January 19, 2014, at about midday, one adult female of *S. merianae* was found dead in a "Tomahawk" trap. The temperature of the "Tomahawk" trap was 45°C (substrate) and 31.4°C (air). In similar conditions (same day, time and substrate), we recorded a substrate temperature of 30°C in a Schramm trap.

Reptiles are widely sampled and are usually better detected using pitfall traps (which come in a wide variety) and direct observation (Morton et al. 1988, Garden et al. 2007). However, large lizards usually do not fall into pitfalls, making it difficult to choose a method for this group (see Cechin & Martins 2000 for a study using pitfalls for small and average-sized lizards).

Although there have been several studies that focused on the effectiveness of different methods of sampling reptiles, these mostly refer to pitfall traps, neglecting live traps such as cages (Crosswhite et al. 1999). Doan (1997) captured large lizard species of *Tupinambis* (Daudin, 1810) using large-sized Sherman traps (88.5 x 31 x 31 cm) camouflaged in the environment. However, the capture effectiveness for those lizards was not reported.

The Schramm trap was able to capture smaller individuals than the "Tomahawk" trap (we found a significant difference between the sizes of the captured individuals and between the number of juveniles and adults). We observed that some juvenile lizards were not captured in the "Tomahawk" traps, either because they jumped over the triggering pedal to eat the bait or because they were very light, thus rendering the triggering mechanism of the "Tomahawk" trap ineffective (even though there were no significant differences in the body mass of the captured lizards).

The wooden trap presented here as an alternative for capturing *S. merianae* has the advantage of immobilizing adult individuals while not causing trauma during the capture process. In addition, the Schramm trap impedes the captured individual from seeing the researcher approaching the trap, thus limiting the animal's stress responses (Mangini & Nicola 2006). Another ad-



Figures 3-6. Distribution of captures in both types of trap used according to (3) size, (4) weight, (5) gender, and (6) age, at Eldorado do Sul, RS, Brazil.

vantage related to the wooden trap is that it maintains a favorable temperature for the activity of the studied species. Because they are made out of metal, the "Tomahawk" traps used are prone to overheating, eventually leading to trauma or death of the animals captured. Yet another observed advantage of wooden traps was the fact that no domestic animals were captured by them. They are small enough to hinder their entry while allowing in individuals in the size range of *S. merianae*. The "Tomahawk" traps captured domestic animals, causing bait loss and damage to the trap's structure when they attempted to escape.

On the other hand, there are some disadvantages associated with the wooden trap that should be taken into consideration. First, this trap cannot be dismantled, which makes it difficult to transport it over long distances. The "Tomahawk" traps, on the other hand, can be folded and are easier to transport. In addition, the resistance of the wooden traps may be lower because sites that are very humid or experience a high frequency of rain can decrease the resistance of the material.

Even though we did not initially intend to test different trapping mechanisms for *S. merianae*, our results indicate that the use of wooden traps can be an alternative strategy to increase capture efficiency for *S. merianae*. This strategy may also be effective for other species with similar eco-morphological features. Unquestionably, our results do not suggest the "definitive best choice" of trap for all future studies, but they provide a comparison with the aim of informing and improving the future selection of methods for capturing lizards.

In addition, the fact that *S. merianae* has been reported as having invasive potential in some parts of the world (Klug et al. 2015), highlights the importance of finding efficient cap-

ture techniques for it. The information presented in this study regarding the success and effectiveness of these two models of trap in capturing lizards is important in widening our understanding of the methods used in research. We believe that this work makes an important contribution for researchers working with large lizards. We recommend that all researchers publish their successes and problems in wildlife surveys to widen our understanding of the usefulness and effectiveness of different methods in the capture of different species in diverse types of habitat. We are grateful to Mr. Paulo César de Oliveira for his help in preparing the material utilized.

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Submitted: 8 October 2014
Received in revised form: 9 April 2015
Accepted: 1 June 2015
Editorial responsibility: Diego Astúa de Moraes