

BRIEF REPORT

Use of Traps to Capture Black and Gold Howlers (*Alouatta caraya*) on the Islands of the Upper Paraná River, Southern Brazil

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Howlers (genus *Alouatta*) are widely captured with the use of anesthetic projectiles; however, no capture protocol involving the use of traps has been described to date. In the present study we describe the first efficient capture program for black and gold howlers (*Alouatta caraya*) using traps, which was implemented on the islands of the upper Paraná River in southern Brazil. We constructed two trap models with either manual or automatic activation (trap A with two entrances and guillotine-type doors; trap B with one entrance and a guillotine-type door). The traps were suspended in the canopy by means of vertical climbing techniques, and were baited regularly and abundantly with bananas and mangoes. We captured 70 howlers (86% using manual activation and 14% using automatic activation) on four different islands. We restrained 41 of these animals and measured their body mass, which averaged $5.30 \text{ kg} \pm 1.79$. Given our results, we suggest that the system described in the present study represents an alternative capture program for howlers in areas that have low food diversity and no other mammal species that will compete for the bait, as has been observed in riparian environments, islands, and forest fragments. *Am. J. Primatol.* 69:241–247, 2007. © 2006 Wiley-Liss, Inc.

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INTRODUCTION

Few studies have described or reported the use of traps to capture neotropical primates. Some authors have even underscored the inefficiency of such methods [Fernandez-Duque & Rotundo, 2003; Müller & Schildger, 1994]. In the case of howlers (genus *Alouatta*), capture programs are generally carried out with the use of anesthetic projectiles shot by special weapons [Glander et al., 1991], and no study has reported the use of traps for this species. It is difficult to capture howlers using traps because they have a folivorous diet [Milton, 1980], which hinders their attraction to baits. In addition, the presence of sympatric species, such as capuchin monkeys (*Cebus*) and coatis (*Nasua*), that are potential competitors for the baits used in traps could also hinder the implementation of a collection protocol using this method (personal observations).

Our goal in the present study is to describe the techniques and trap models used to capture black and gold howlers (*Alouata caraya*) on the islands of the upper Paraná River corridor in southern Brazil. Our team has monitored primates in this area since 2003. The results shown in this study suggest that the use of traps is an efficient alternative method for capturing these animals in suitable environments.

MATERIALS AND METHODS

Study Area

The islands where we captured the animals (Mutum Island, 1050 ha; Porto Rico Island, 94 ha; Gaivota Island, 5 ha; and Japonesa Island, 1,070 ha) are located in the flood plains of the upper Paraná River in the municipality of Porto Rico (22°46'42'S 53°24'56'W), northwestern state of Paraná, on the border with the state of Mato Grosso do Sul. This region belongs to the Area for Environmental Protection (APA) of the islands and riparian forests of the Paraná River. In this area the river forms a system of archipelagos that are covered for the most part by flooded forests, which are classified as alluvial semideciduous seasonal forests [Souza et al., 2004]. According to Souza et al. [2004], these sites have low arboreal diversity, with *Cecropia pachystachya* being the most dominant tree species. The riparian environments of the Paraná River islands are known to harbor dense populations of howlers of the species *Alouatta caraya*. Local densities on the islands of the medium portion of the river can vary between 1.8 and 4.25 individuals/ha [Kowalewski & Zunino, 2004; Zunino et al., 2001]. The observed density on Mutum Island, one of the capture sites in the high portion of the river, is 2.16 individuals/ha [Aguiar, 2006]. As on other islands of the Paraná River, howlers are the only large-bodied mammals present. This is in contrast to the forests on the river margins, where coatis and capuchin monkeys are abundant (*Cebus nigritus* and *C. cay* on the left and right margins, respectively [Aguiar, 2006]).

Methods

After we chose the howler groups to be captured, we visited these areas for a period of 2–4 weeks to determine where the trap would be set up. The chosen site was based on the observed frequency of the animals feeding or resting. We used vertical climbing equipment to build fixed platforms on the canopy in an experimental phase to provide bait for the animals. We used this arboreal stratum because it is the most commonly used by howlers [Sussman, 2000]. After we confirmed that the animals were visiting the feeding platforms (i.e., by direct

observation, analyzing bite marks on fruits, or finding fecal deposits on the platform or the soil beneath), we installed the traps. We built two arboreal trap models (Fig. 1) that could be operated manually or automatically: trap A, $1.60 \times 0.80 \times 0.80$ m, with two entrances and guillotine-type doors; and trap B, $1.20 \times 0.60 \times 0.60$ m, with one entrance and a guillotine-type door. Both models were built using 2.7×2.7 cm wire mesh.

To habituate the animals to the traps, we carried out a systematic baiting effort (8–10 kg of food each time) which lasted for 5 weeks regardless of the trap model used. We baited twice a week during the first weeks, and three times a week during the last two weeks before the animals were captured. During these periods the trap door remained locked open so that the animals could enter and exit freely. First we used bananas as bait (*Musa* sp.); however, they were not accepted by all groups. We therefore chose to supplement the baits with mangoes (*Manguiфера* sp.), a widely cultivated tree species in the region. The simultaneous availability of mangoes and bananas (Fig. 2a) led to successful visitation by all groups. After the habituation phase, the primates started to wait for the arrival

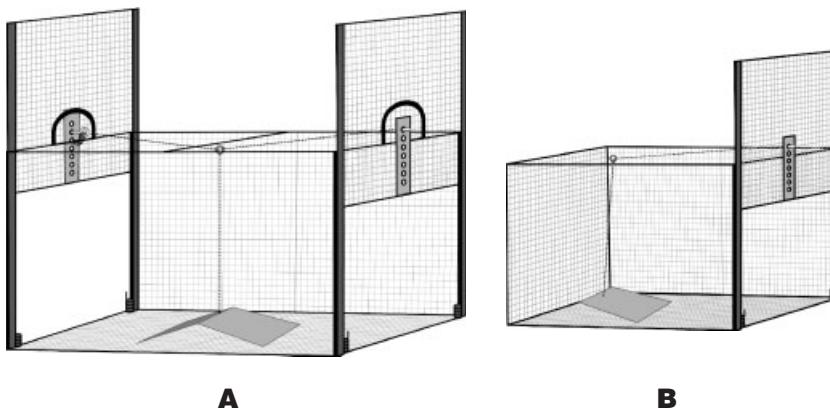


Fig. 1. Arboreal trap models used for the capture of howlers: (A) trap A, $1.60 \times 0.80 \times 0.80$ m, with two entrances and guillotine-type doors; (B) trap B, $1.20 \times 0.60 \times 0.60$ m, with one entrance and a guillotine-type door. Both models were built with a 2.7×2.7 wire mesh.



Fig. 2. Trapped howlers. A: Two adult female black and gold howlers feeding on the bait (mangoes and bananas) provided within the traps. B: Six howlers (adult females and immatures) captured simultaneously using the trap B model.

of the bait, remaining longer in the neighborhood of the trap. After habituation, we provided the baits for the capture events before dawn, aiming at the first howler foraging peak in the morning.

To carry out the captures we built a camouflaged hideout that could be used to manually activate the trap from a distance, and close the door as soon as one or more primates were already inside. We set the other traps to the automatic activation, which was triggered when the animals touched a pedal where the bait was located (Fig. 1), causing the doors to shut. Capture efforts were carried out for 10 days in each group, with collections made every other day, from dawn to 1600 hr.

After the monkeys were captured, we chemically restrained the animals within the suspended trap using Zoletil[®], which was developed for this purpose (Hilst et al., unpublished results). However, to minimize the risks during chemical restraint using Tiletamina/Zolazepan(1:1), we released infants, small juveniles, pregnant females, and animals that were under great stress. The method we used to mark the animals followed that described by Rocha et al. [in press]. Using vertical climbing techniques, a member of our research team went up to where the animals were located and threw blow darts loaded with the anesthetic substance. After the animals were properly handled, we released them near trees where the rest of the group was located, as indicated by another member of the team who was monitoring the group. When this procedure was not feasible, we released the animals on the same trees where they were captured. We did not remove any animal from the neighborhood where it was captured.

RESULTS

Using the traps we captured a total of 70 monkeys, which were divided into eight groups (A–H), on four different islands. Only 41 of these monkeys were handled (see detailed explanation in Materials and Methods). Table I describes the number of captured individuals and their sex/age class [sensu Calegario-Marques & Bicca-Marques, 1993], body mass, and provenance. Of the total number of captured and handled animals, 21 came from four different groups on Mutum Island (groups B–D and H), seven came from a group on Japonesa Island (group E), five came from a group on Porto Rico Island (group A), five came from a group on Gaivota Island (group G), and one came from a group on Óleo Cru Island (group F). Of the 41 monkeys that were handled, 23 (56%) were males

TABLE I. Number of Captured Animals, Their Sex/Age Classes, Body Mass and Provenance (Groups and Islands), Sampled During 10 Days in Each Group, with Collections Every Other Day, from Dawn to 16:00 Hour

Sex	Age	Body weight (kg)		Proceeding
		Mean \pm SD (minimum–maximum)	n	
Male	Adult	7.79 \pm 0.57 (6.60–8.45)	12	Groups A-F and H
	Subadult	4.45 \pm 0.93 (2.75–5.40)	06	Groups A, C, E and H
	Juvenile	3.00 \pm 0.49 (2.20–3.50)	05	Groups A–C and G
Female	Adult	5.01 \pm 0.76 (3.10–6.00)	15	Groups A, B, D, E, G and H
	Juvenile	2.37 \pm 0.24 (2.10–2.55)	03	Groups C and H
Total		5.30 \pm 1.79	41	Eight groups from 4 islands

SD, standard deviation.

(18 sexually mature (adults and subadults), and five immatures (juveniles)), and 18 (44%) were females (15 sexually mature and three immatures).

Both trap models were shown to be effective. However, starting from the second captured group, we chose to use only the B model because it was smaller and lighter. The manual activation was more efficient than the automatic option (86% of captured animals) because it allowed us to choose which (and how many) animals should be captured. This option allowed the joint capture of a large number of animals (see Fig. 2b). The automatic activation restricted the number of simultaneously captured individuals because it would close the trap as soon as an individual touched the bait, and thus captured few individuals per activation. Captures occurred throughout the entire waiting period. However, there was a marked capture peak (74% of captures) in the morning (from dawn to 1200 hr).

Only four injuries were recorded (6% of the captured animals). Two were found on juveniles and two were found on infants that were carried by females, which attacked them when the observers climbed to the traps. These last injuries were superficial bites and did not cause substantial trauma.

With respect to the body mass data (Table I), the average weight of the captured specimens was $5.30 \text{ kg} \pm 1.79$ ($n = 41$). Adult males averaged $7.79 \text{ kg} \pm 0.57$, subadults averaged $4.45 \text{ kg} \pm 0.93$, and juveniles averaged $3.00 \text{ kg} \pm 0.49$. Adult females averaged $5.01 \text{ kg} \pm 0.76$, and juvenile females averaged $2.37 \text{ kg} \pm 0.24$.

DISCUSSION

We emphasize the efficiency of the baiting efforts, particularly regarding the regularity in amount (8–10 kg of food each time) and periodicity (two to three times a week for a month). This may have worked as a food aggregation, by keeping the animals in areas close to the traps, as previously observed by Di Bitetti [2001] and Rocha et al. [in press] in studies with black tufted capuchin monkeys. The choice of mangoes for bait supplementation in the case of groups that did not visit the feeding platforms during the experimental phases was based on the knowledge of local people, who informed us about the preference of howlers for this fruit. Mangoes are widely cultivated exotic plants in the region. Thus, the use of fruits already known by primates of the region might have worked as a signal for the animals to visit the traps. In addition, the fruits we used as bait are odorous and colorful when ripe. This may signal more appropriately the “available food” cue for primates with trichromatic vision [Jacobs et al., 1996] that live in riparian environments with low food diversity and availability of fruits. The cage-type traps we used were constructed with large dimensions to minimize possible confinement distress of the captured animals, and at the same time to capture the largest possible number of specimens in a single event, thereby optimizing the capture efforts. It is important to underscore that the injuries inflicted on some of the captured animals were due to the bites of adult animals on immatures (possibly from mothers to their infants) when they were confined together. This behavioral problem may be prevented (e.g., by avoiding the capture of infants), given that the manual activation allows us to choose the number and identity of captured animals.

Information regarding the body mass of free-ranging black and gold howlers is scarce. The average mass records we obtained are higher than those found in other studies [reviewed in Nowak, 1999; Redford & Eisenberg, 1992; Sussman, 2000]. This may reflect the large amount of bait provided to the animals 1 month prior to their capture, or may indicate populational variation.

Howlers are the only primates found on the islands of the Paraná River, and often occur in high densities. We concede that these facts may have contributed to our success in capturing them with traps. On the other hand, in environments where the genus *Alouatta* co-occurs with other potentially competitive species, such as coatis, capuchin, and woolly spider monkeys (*Brachyteles*) [Dias & Strier, 2000], the protocols can be hindered by competition or by monopolization of the baits by other species. For instance, the same methods described here have been applied in the riparian forest on the right margin of this portion of the Paraná River, where howlers coexist with capuchin monkeys (*C. cay*) and coatis [Aguiar, 2006]. Although we recorded the visits of howlers to these baits, the other two species promptly consumed the available food and thus hampered the capture of the animals of interest.

We have demonstrated that the use of traps for capturing howlers is a safe, efficient, and minimally invasive method. However, the success of this capture method appears to depend on the species and the environment. In the light of our results, we propose that the capture system described in the present study is an alternative capture protocol for howlers in areas that have low food diversity and no other mammal species that will compete for the baits, as are found in some riparian environments, islands, and forest fragments.

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