

SHORT COMMUNICATION

## Preventing injuries caused by radiotelemetry collars in reintroduced red-rumped agoutis, *Dasyprocta leporina* (Rodentia: Dasyproctidae), in Atlantic Forest, southeastern Brazil

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**ABSTRACT.** Reintroduction has been recognized as a powerful conservation tool, but in order to ensure its success, animal monitoring is highly recommended. One way to monitor released animals is to put radiotelemetry collars on them. These devices, however, can harm the subjects, causing serious wounds. Our objectives in this work were to describe the injuries caused by a radiotelemetry collar model on reintroduced agoutis and to propose modifications to it. We equipped agoutis with TXE-311C radio collars (Telenax Wildlife Telemetry) before releasing them in the wild. They acquired serious wounds and one animal died. We then modified the collar structure to reduce its width and retention of water. After these modifications, the injuries did not occur again. As reintroduction is an expensive conservation strategy, any improvement that maximizes its probability of success is important. We believe that the improvements we propose here have the potential to enhance the success of reintroductions and to increase animal welfare. This recommendation is more important when captive animals are re-introduced, because they tend to have lower immunity, particularly when they are released in rainy habitats.

**KEY WORDS.** Animal welfare; marking effects; radiocollars; rainforest; rodents; telemetry.

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Human exploitation of natural environments has had serious effects on populations and species, bringing them closer to extinction (HUGHES *et al.* 1997, TERBORGH 1999, DAVIDSON *et al.* 2009). To mitigate these effects, reintroduction has been recommended and increasingly used worldwide (WOLF *et al.* 1996, FISCHER & LINDENMAYER 2000). Since the recovery of the American bison (*Bison bison* Linnaeus, 1758, Bovidae) in 1907, probably the first mammal reintroduction project, the number of such studies has increased every year (KLEIMAN 1989, FISCHER & LINDENMAYER 2000, SEDDON *et al.* 2007).

Given that reintroduction is an expensive conservation strategy, any improvement that maximizes its probability of success is important (IUCN 1998, FISCHER & LINDENMAYER 2000). One way to enhance this probability is by linking scientific theory and practical conservation efforts (ARMSTRONG & SEDDON 2007, SEDDON *et al.* 2007). In this context, an important technique to get information on reintroduced animals is monitoring, a practice considered indispensable nowadays (IUCN 1998,

EWEN & ARMSTRONG 2007). Monitoring is achieved through the use of bio-logging devices such as radiotelemetry collars. These devices can greatly contribute to conservation, but they can also harm the animals, causing serious wounds and stress on them (HAWKINS 2004, KOOYMAN 2004, KRAUSMAN *et al.* 2004). Therefore, any equipment refinement that can improve animal welfare and reduce suffering should be implemented (HAWKINS 2004).

Most animals used in reintroduction programs come from captive stocks (FISCHER & LINDENMAYER 2000, JULE *et al.* 2008). From capture to monitoring, the many procedures to which these animals are subjected can cause stress and lower their immunity (TEIXEIRA *et al.* 2007; DICKENS *et al.* 2009). As captive individuals have lower post-release survival rates when compared with individuals taken from natural populations, equipment improvement can make the difference between the failure and the success of a given reintroduction program (WOLF *et al.* 1996, FISCHER & LINDENMAYER 2000, JULE *et al.* 2008).

Herein, we describe the injuries in reintroduced agoutis (*Dasyprocta aff leporina* Linnaeus, 1758, Dasyproctidae) caused by a VHF radiotelemetry collar model that favors retention of water. We then propose modifications to the collar that prevent those injuries. We hypothesized that 1) a reduction in the width of the collar and 2) the use of material that does not absorb water could prevent injuries in agoutis with low immunologic response.

The study was carried out in the Tijuca National Park (TNP), the world's largest urban forest (3,953 ha). TNP is located in the center of the city of Rio de Janeiro, Maciço da Tijuca Mountains (22°55'-23°00'S and 43°11'-43°19'W; ICMBIO 2008). The altitude there varies between 80 m and 1,021m. The vegetation of the TNP is composed of typical Atlantic Rain Forest species, and some exotic trees (especially *Artocarpus heterophyllus* and *Eucalyptus* spp.) introduced in the area during the reforestation program at the end of the nineteenth century (ICMBIO 2008). The climate is tropical with rainy summers and dry winters. Annual precipitation exceeds 2,000 mm and mean temperatures vary between 18 and 22°C (ICMBIO 2008).

In the 1970s, agoutis were already considered rare in the PNT, which resulted in the release of 25 individuals, apparently without success (COIMBRA-FILHO & ALDRIGHI 1972, COIMBRA-FILHO *et al.* 1973). The species had not been seen in the Park for the last two decades, leading to the conclusion that it was extinct in the area. In August 2009, an agouti reintroduction program was initiated at the PNT.

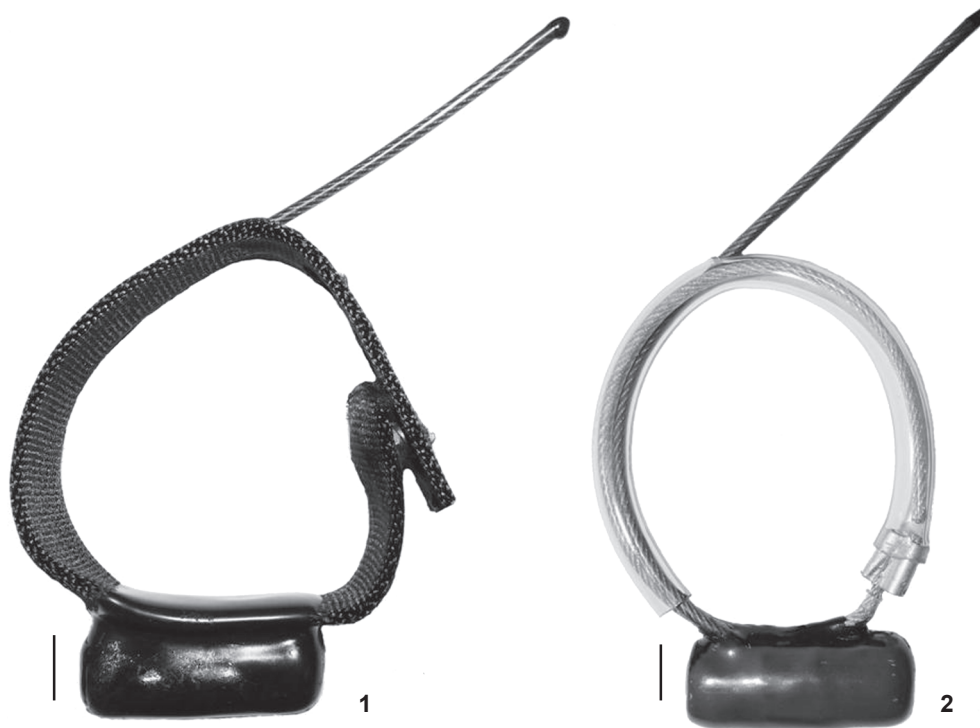
The animals originally came from a semi-captive population living at a municipal Park at the center of Rio de Janeiro city (Campo de Santana). That population was fed daily. As part of the reintroduction pre-release procedure we kept nine agoutis in the Rio de Janeiro Zoo, where they were subjected to health screening involving blood and fecal analysis during the quarantine period (minimum period of 96 days; mean  $\pm$  sd = 151.9  $\pm$  35.6; longer than the minimum of 35 days recommended by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) for rodents) (IUCN 1998, MATHEWS *et al.* 2006). According to the results of blood and fecal analyses, the animals were healthy with respect to pathogens and diseases, but had low leukocyte count (mean = 3,273  $\pm$  1,400 leukocytes/mm<sup>3</sup>, n = 9; reference levels for captive rodents = 9,545  $\pm$  3,906 leukocytes/mm<sup>3</sup>; LANGE & SCHMIDT 2006). This result suggest some degree of immunodeficiency. In November 30, 2009, six of the nine agoutis were taken to the pre-release adaptation enclosure (10 x 10 m, wire mesh fenced pen where wood shelters, food and water were provided for all of them) and kept there for two weeks. Before release we equipped the animals with TXE-311C radiocollars (Telenax Wildlife Telemetry, Playa del Carmen, México). After two rainy weeks (with a total rainfall of 375.6 mm), we observed with our naked eyes that our subjects had developed neck injuries around the collars (the agoutis' necks were red, with wounds; the animals were scratching it and trying to remove the collars). We then

took the animals back to the Zoo for examination and treatment of their injuries. The agoutis' necks were all irritated and some were bleeding, with some mucus discharge. All individuals had fungal (*Candida* sp. and *Mucor* sp.) and bacterial (*Staphylococcus* sp.) infections that favored an infestation by New World screwworm fly larvae (*Cochliomyia hominivorax* Coquerel, 1858, Calliphoridae) under their collars. One agouti died while the others survived under distinct levels of larval infestation. Aiming to prevent new injuries, we modified the original collars, replacing the original tubular nylon flat fabric collar (recommended for use in rabbits and hares, Telenax Wildlife Telemetry; Fig. 1) with a steel cable wrapped in a Tygon tubing (Fig. 2). After a minimum period of five weeks, we equipped all five recovered agoutis, plus three additional ones, with the new collars, and took them to the adaptation enclosure. These eight animals were divided into two groups; the first (five animals) was transported to the enclosure in 18 January 2010; and the second (three specimens) in 23 March 2010. The tests performed showed that the collar did not lose power due to the proximity between the steel cable and the transmitting antenna. The receptor's range remained about 300 m. The animals were monitored daily until release.

During the second adaptation period in the enclosure, the agoutis showed some fur loss but no injury under the collars. As the animals equipped with the original collar model, both groups were exposed to rainy days in the first two weeks. The first group was subject to a total rainfall of 81.6 mm within this period, whereas the second group was exposed to a total of 529.8 mm of rainfall – an amount higher than that endured by the subjects fitted with the original collars.

After the release we monitored the animals by radiotracking and paid special attention to their necks, using binoculars. The radiotracking and observation of animals following release demonstrated that there was no change in the behavior of the agoutis (for instance attempts to remove the collars) and that the injuries did not develop again. Moreover, all but one subject were still alive 11 months after the release (monitoring period). The examination of the carcass of the dead female revealed its death was not related to collar injuries. The animal had a deep posterior injury and mostly likely died as a consequence of it. In the monitoring period there were several events of intense rain (e.g. 99.8 mm 15 January 2010; 87.4 mm 25 February 2010; 295.2 mm 06 April 2010). Total rainfall in those months were: February 167.4 mm, March 485.6 mm, April 630.4 mm, May 111 mm, June 111.8 mm, July 359.8 mm, August 66.8 mm, September 86.2 mm, October 210.8 mm, November 166.2 mm and December 205.8 mm.

Investigators who use radiotelemetry collars should try to minimize animal injury (WHITE & GARROT 1990), as it has been shown that the equipment can cause serious wounds in different animal species (KRAUSMAN *et al.* 2004). These wounds can cause biases in the experiments and, in the worst cases, bring suffering and death to the animals (HAWKINS 2004). In



Figures 1-2. Collars used for agoutis reintroduced in Tijuca National Park, Rio de Janeiro, Brazil: (1) original collar – Telenax Wildlife Telemetry®, México; (2) modified collar for minimizing injuries: Telenax transmitter and antenna coupled with the modified collar – steel cable wrapped in a Tygon tubing. Scale bars = 1.0 cm.

the case of mammal reintroductions, often with small number of founders, any death can lead to the failure of the program, as reintroduction success is positively correlated with the number of animals released (GRIFFITH *et al.* 1989, WOLF *et al.* 1996, FISHER & LINDENMAYER 2000).

Infestation by *C. hominivorax* was responsible for the death of two reintroduced red howler monkeys (*Alouatta seniculus* Lacepede, 1799, Atelidae) in French Guiana. As in our case, the infestation happened in the rainy season (RICHARD-HANSEN *et al.* 2000). The rain and retention of moisture seem to correlate with the beginning of the infestation. The moisture accumulated under the collars probably favors the appearance of dermatitis and creates a suitable environment for the development of fungi and bacteria. The irritation leads the animals to scratch their necks, and the flies use the resultant wounds as entrance points on which they deposit their eggs.

The changes made to the collar in this research prevented infestation in two ways: by reducing the collar width and by avoiding moisture retention, making the equipment waterproof. The original collar was 1.8 cm wide. Our changes reduced it threefold (0.6 cm), without increasing its weight (~35 g). This procedure allowed the collar to have more mobility around the animals' necks, reducing the possibility of hurting any specific point. The avoidance of moisture retention reduced

the development of funguses, which was the main cause of the wounds in our case.

Wildlife telemetry companies (as Telenax Wildlife Telemetry) have several collar models – some similar to the one modified here – and each researcher should pick the more appropriate to his/her study. We recommend that researchers pay special attention to the width of the collars they pick, and their potential to retain humidity. This recommendation is even more important when it comes to reintroduced animals, because they have low immunity, particularly those released in rainy habitats.

## ACKNOWLEDGEMENTS

We are indebted to Fundação Parques e Jardins which provided the animals for reintroduction. We thank the Instituto Chico Mendes para Conservação da Biodiversidade (ICMBio) for a license to conduct this project and also for the logistical help provided in the TNP. We thank all animal handlers of the Fundação Parque Zoológico da Cidade do Rio de Janeiro for their help with agouti manipulation and the staff of PNT for helping with animal care during the adaptation period. We also thank the Foundation director L.P. Fedullo for allowing the use of their premises and for supporting the project. We thank

Fundação O Boticário de Proteção à Natureza, Parque Nacional da Tijuca and Programa de Pós-Graduação em Ecologia da Universidade Federal do Rio de Janeiro for funding.

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Submitted: 03.III.2012; Accepted: 16.X.2012.

Editorial responsibility: Fernando de C. Passos