A potential recovery of a population of the sand lizard *Liolaemus lutzae* Mertens, 1938 in an area within its range: a lizard endemic and threatened with extinction

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Abstract

The endemic and threatened lizard *Liolaemus lutzae* has a relatively small geographic range restricted to only 200 km of along the coast of Rio de Janeiro State, Brazil, which are habitats under intensive anthropic disturbance. At the Barra da Tijuca beach, in Rio de Janeiro city an estimate of the population abundance made in 1991, compared to a previous estimate made in 1984, showed a considerable decrease (about 65%). Most of the decrease was attributed to anthropic disturbances that locally affected the beach vegetation, the species habitat. In this study we present estimates made in 2002 and in 2006 at the same area and compare them with the estimates of 1984 and 1991, using the same methodology in order to make comparable the data from different samplings years and to evaluate the present status of the local population. The estimated indexes of *L. lutzae* abundance in 2002 and in 2006 were higher than that of 1991. There was a significant increase in the mean number of recorded lizards in 2002 compared to 1991, but the mean number of lizards sighted in 2006 remained stable when compared with that of 2002. Our data based on the index of abundance recorded suggested that the number of *L. lutzae* at Barra da Tijuca beach recorded increased, which can be indicative of a potential recovery of the local population.

Keywords: Liolaemus lutzae, endemic lizard species, population recovery, restinga, threatened species.

Uma possível recuperação de uma população do lagarto de areia *Liolaemus lutzae* em uma área de sua ocorrência: um lagarto endêmico e ameaçado de extinção

O lagarto endêmico e ameaçado de extinção *Liolaemus lutzae* possui distribuição geográfica relativamente reduzida a apenas 200 km ao longo da costa do Estado do Rio de Janeiro, Brasil, hábitats sobre intensa pressão de degradação. Na praia da Barra da Tijuca, cidade do Rio de Janeiro, uma estimativa do tamanho populacional feita em 1991 foi comparada a uma estimativa anterior feita em 1984, mostrou considerável decréscimo populacional (aproximadamente 65%). Grande parte deste decréscimo foi atribuída a distúrbios antrópicos que afetaram localmente a vegetação de praia, o hábitat da espécie. Neste estudo, apresentamos estimativas feitas em 2002 e 2006 na mesma área e as comparamos com as estimativas de 1984 e 1991 Utilizamos a mesma metodologia, de modo a avaliar o presente status da população local. Os índices estimados da densidade populacional em 2002 e 2006 foram maiores que em 1991. Houve aumento significativo no número médio de lagartos amostrados em 2002 em comparação a 1991, porém o número médio de lagartos observados em 2006 permaneceu estável quando comparado às amostragens de 2002. Nossos dados sugerem que, após 2002, houve um aumento no número de *L. lutzae* registrados na praia da Barra da Tijuca com uma potencial recuperação da população local.

Palavras-chave: Liolaemus lutzae, espécies endêmicas, recuperação de população, restinga, espécie ameaçada.

1. Introduction

The lizard *Liolaemus lutzae* (Mertens, 1938) (Liolaemidae) is an endemic and threatened species and has a relative small range restricted to beaches of sand dune habitats (called "restingas") of Rio de Janeiro state in Brazil (only 200 km extent of range). These areas are under intensive anthropic disturbance (Rocha et al., 2003; 2007) and, as a result, some populations have dramatically declined in different localities along its range (e.g. Rocha and Bergallo, 1992; but see Rocha et al., 2003). This species is currently included in the Checklist

of Brazilian Threatened Fauna as critically endangered (IBAMA, 2003; Martins, 2005; Rocha et al., 2008).

At the Reserva Ecológica de Marapendi, a Conservation Unit in Rio de Janeiro state, Brazil, a study estimating population status of *L. lutzae* indicated that there was a considerable decline from 1984 to 1991 (Rocha and Bergallo, 1992). The estimated population loss was about 65% and was attributed to the wide range of anthropic disturbances on the beach habitat, which lead to the loss of vegetation (Rocha and Bergallo, 1992). The main disturbances the authors reported at that time were: the alteration of the beach habitat due to road construction, the traffic of vehicles on the remaining beach vegetation, and the removal of vegetation for the establishment of commercial trailers and volleyball sand-courts (Rocha and Bergallo, 1992). These problems remained until 2000 when the Secretaria de Meio Ambiente (Environmental Bureau) of the municipality of Rio de Janeiro started in 2001 a program for environmental recovery of the area. Among the actions carried out were the removal of the of commercial trailers and volleyball sand-courts installed on the vegetation, the building of a fence to prevent the entrance of vehicles onto the beach habitat and the establishment of specific passages for access to the beach in order to reduce the trampling on vegetation and the recovery of the beach area vegetation by planting seedlings and adults of different plant species.

Considering the significant improvement in the recovery of the beach vegetation at the Reserva Ecológica de Marapendi that followed such a program, it is important to know the present status of the local population of *L. lutzae*. Thus, in this study we present estimates of an index of the population abundance of *L. lutzae* at the Reserva Ecológica de Marapendi, Rio de Janeiro State, in 2002 and in 2006 and compare with the estimates of 1984 and 1991 presented by Rocha and Bergallo (1992).

2. Methodology

This work was carried out in 2002 and 2006, at the beach (23° 00' 92.7" S and 43° 24' 81.9" W) of the *restinga* of the Reserva Ecológica de Marapendi, a Conservation Unit, located within Rio de Janeiro city, in Rio de Janeiro state, southeastern Brazil. *Restingas* are quaternary coastal ridges with sandy substrate covered with herbaceous and shrubby vegetation.

A total of six 30-minute transects were done in 2002 and another six in 2006 (totaling 180 minutes per year). Transects were done using the same criteria as those previously done in 1984 and 1991, and at the same sampling site, with the same hourly interval (from 08:30 to 10:00 AM, which corresponds to the peak of activity of *L. lutzae*; Rocha, 1988; 1995), and under the same weather conditions (i.e. sunny days), to preserve conditions similar to those under which the previous former estimates were done (Rocha and Bergallo, 1992). To make comparable the data from the different studies and samplings years, we carefully followed the same methodology used in those previous studies which could in turn better allow the present status of the local population. Also, because marking lizards was not operational (due to difficulties of capturing such lizard species in a habitat where they escape easily and rapidly to their holes), we opted to perform all transects toward the same direction to avoid the recounting of individual lizards and in this case making each observation independent. This method proved to efficiently estimate the number of effective lizards seen along a particular area. During each transect, observers walked at a moderate pace along the beach habitat (see Rocha, 1996). We estimated a standardized index of *L. lutzae* relative abundance for each year of sampling by dividing the total number of lizards sighted at that particular year by the total time (in minutes) spent in transects in that year. This estimated index of abundance was expressed as individual/min/man. To verify if there was an increase of the population abundance after the recovery of the area, we compared the mean number of lizards recorded in transects between 1991 and 2002 using a Two-Sample *t*-test (Zar, 1999). This same test was also used to verify if there was a stabilization of the mean number of lizards following the environmental recovery program (comparing the samples of 2002 and 2006). Basic statistics are presented as arithmetic mean ± standard deviation.

3. Results and Discussion

The abundance estimates of *L. lutzae* recorded in 2002 and 2006 at the Reserva Ecológica de Marapendi were, respectively, 0.5 and 0.4 ind/min/man (Table 1). These abundance values were higher than those of 1991 (0.1 ind/min/man) when the population stock decreased due to habitat degradation, and close to the value of 1984 (0.3 ind/min/man), when the population was not yet influenced by those reported factors causing the destruction of the beach habitat (Rocha and Bergallo, 1992).

There was a significant increase ($t = -4.27$, $df = 8$, $p < 0.05$) in the mean number of recorded lizards in 2002 (15.2 ± 3.1) when compared to 1991 (7.5 ± 2.1) (Rocha and Bergallo, 1992). However, the mean number of lizards sighted in transects in 2006 (12.5 ± 6.5) did not differ significantly ($t = 0.90$, $df = 10$, $p = 0.39$) from the value of 2002 (Table 1) suggesting that the population has stabilized. Our data are suggestive that the increase in population abundance detected in 2002 probably resulted from the recovery of the beach habitat, because some portions that were previously negatively affected by different sources of disturbance are now completely covered by the beach vegetation.

The recovery of the vegetation of the beach habitat is important for *L. lutzae* because the plants of these areas are also an important food source to these lizards (Rocha, 1991), especially the leaves and flowers of four species (*Blutaparon portulacoides*, *Alternanthera maritima*,

Table 1. Time spent in transects (TT), Index of estimated relative abundance (A) and mean number of lizards (± standard deviation) for the population of the sand lizard *Liolaemus lutzae* at Restinga da Reserva Biológica de Marapendi, in Barra da Tijuca beach, Rio de Janeiro State, Brazil in different years of sampling. Data from 1984 and 1991 are provided by Rocha and Bergallo (1992).

Year	TT (min)	A (ind/min/man)	Number of lizards
1984	243	0.3	21.2 ± 3.3
1991	237	0.1	7.5 ± 2.1
2002	180	0.5	15.2 ± 3.1
2006	180	0.4	12.5 ± 6.5

Ipomoea pes-caprae and *I. litoralis*; Rocha, 2000). Other plants, such as the sand palm *Allagoptera arenaria* and the cactus *Cereus fernambucencis*, are sources of shelter and thermoregulation sites (Rocha, 1988; 1991). Moreover, a number of arthropods that constitute part of the diet of *L. lutzae* (Rocha, 1989) live among the beach vegetation (Rocha, 1996).

Considering that the beach habitat is the specific environment of *L. lutzae*, it is important to preserve the vegetation to permit the maintenance of the local populations. Our data have shown that the recovery of the beach habitat at the Reserva Ecológica de Marapendi may be a good example that an increase of the abundance of *L. lutzae* along its range could be attained if the beach habitats along its range are recomposed. Thus, this study is a good example of how the recovery of habitat quality potentially can affect positively populations of *L. lutzae* and may help to create constructive strategies to prevent local extinctions of the species along the beaches of Rio de Janeiro state.

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