

## Reptiles recorded in Marinheiros Island, Patos Lagoon estuary, southern Brazil

Fernando Marques Quintela<sup>1,2\*</sup>, Igor Gonçalves Medvedovsky<sup>3</sup>, Chyntia Ibarra<sup>4</sup>, Luís Fernando de Matos Neves<sup>2</sup>,  
Mario Roberto Chim Figueiredo<sup>2</sup>

**Abstract.** We present a first list of reptile species of Marinheiros Island, Patos Lagoon estuary, southern Brazil. Between March 2006 and July 2010 we conducted 47 field trips in the various island environments, including arbustive dunes and plains, humid and sandy woods, swamps, saltmarshes, grasslands, herbaceous formations, intermittent lakes and agroecosystems. A total of 18 species were recorded, including three chelonians, three lizards, one amphibia, ten snakes and one crocodylian. Two of the recorded dipsadids, *Clelia rustica* and *Philodryas olfersii*, had not been found in previous surveys conducted in adjacent peninsular areas.

**Keywords.** reptilian fauna, estuarine island, *Caiman latirostris*, *Clelia rustica*, *Philodryas olfersii*.

### Introduction

Reptilian inventories in Brazilian insular environments are scarce, with some few studies conducted in the southeast (e.g., Hoge, 1950; Müller, 1968; Rocha and Van-Sluys, 2006; Carvalho et al., 2007; Cicchi et al., 2007; 2009; Centeno et al., 2008) and in the northeast (Rocha et al., 2002). These studies provide important data on ecological and evolutionary features of reptiles in the peculiar habitats of insular formations. For example, classical theories of island biogeography (MacArthur and Wilson, 1967) were supported in studies of snake assemblages on 18 oceanic islands in São Paulo State (Cicchi et al., 2007), where species richness was positively related to area and negatively related to distance from the mainland. Other studies (Müller, 1968; Carvalho et al., 2007; Centeno et al., 2008; Cicchi et al., 2009) also demonstrated that species richness on oceanic islands is generally lower when compared to the adjacent mainland.

More than 50 species of terrestrial reptiles have been reported on coastal islands of southeast and northeast Brazil (Hoge, 1950; Müller, 1968; Rocha et al., 2002; Rocha and Van-Sluys, 2006; Carvalho et al., 2007; Cicchi et al., 2007; 2009; Centeno et al., 2008), including endemic species of pit vipers (*Bothropoides alcatraz* and *B. insularis*) (Cicchi et al., 2007), and threatened species, such as the lizards *Mabuya caissara*, *Liolaemus lutzae* and *Cnemidophorus littoralis* (Carvalho et al. 2007; Cicchi et al., 2009). In parallel, many insular environments in Brazil are threatened due to tourism, pollution, exploitation of natural resources and introduction of exotic fauna (Rocha et al., 2002; Cicchi et al., 2007; Quintela et al., 2009). Thus, survey efforts in island reptilian fauna are extremely important, since these represent the basis for conservation programs.

In the State of Rio Grande do Sul, southernmost Brazil, peninsular areas have been subject to more surveys than have the island (Gomes and Krause, 1982; Lema, 1994; Quintela et al. 2006; Quintela and Loebmann, 2009). In estuarine island environments, data on reptile occurrence are restricted to a few observations recorded by Quintela et al. (2006) in Marinheiros Island, which were gathered in a survey of continental reptiles in Rio Grande municipality, southern Rio Grande do Sul State.

Marinheiros is the largest island in an archipelago formed by eight main islands and several islets in Patos Lagoon estuary (Vieira, 1983). It remained isolated from Rio Grande peninsula until 2004, when the construction of a bridge was finished. The link with the peninsula brought social and economic benefits to the locals, but

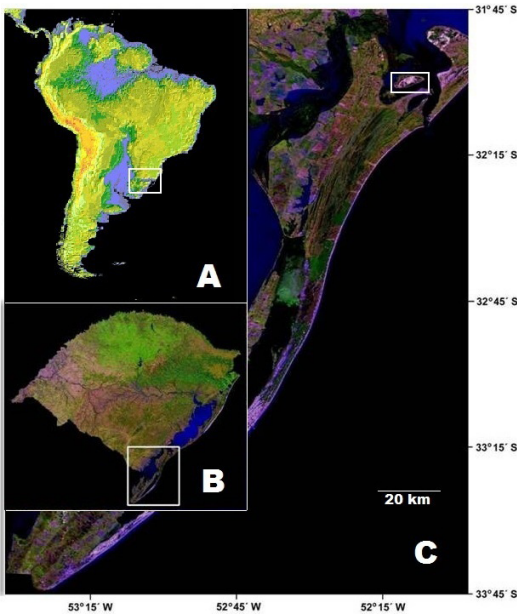
1 Programa de Pós-Graduação em Biologia Animal, Universidade Federal do Rio Grande do Sul, Avenida Bento Gonçalves 9.500, Bairro Agronomia, Porto Alegre, RS, Brasil, CEP 91501-970; e-mail: fmquintela@yahoo.com.br

2 Ranário Experimental (REURG), Universidade Federal do Rio Grande – FURG, Departamento de Oceanografia, Rio Grande, RS, Brasil, CEP 96201-900;

3 Rua Herval do sul 246, Cassino, Rio Grande, RS, Brasil, CEP 96208-040;

4 Rua João Pessoa 1203. Bairro Cidade Baixa, Porto Alegre, RS, Brasil, CEP 90040-001.

\* Corresponding author



**Figure 1.** Study area. Rio Grande do Sul State (A), southern coastal plain and Patos Lagoon estuary (B) and Marinheiros Island (C).

also represents, a new and serious threat to the integrity of its natural environments due to increasing of tourism and resource exploitation. Many reptiles are extremely sensitive to habitat alteration. In Rio Grande do Sul, destruction and characterization of natural environments are the major factors of extinction and inclusion of species in the threat categories (Di-Bernardo *et al.*, 2003). With the aim to contribute to the understanding of reptilian communities in estuarine subtropical islands as well as its conservation, we present a first assessment of reptilian fauna of Marinheiros Island, southern Rio Grande do Sul.

## Material and Methods

Marinheiros Island (31°58'-32°02'S, 52°05'-52°12'W; 3 m.a.s.l.) is located in Patos Lagoon estuary, Rio Grande municipality, Rio Grande do Sul State (Figure 1). It was the first island to emerge from the estuary at about 5,000 years ago, in a process of lagoon sediment deposition (Vieira, 1983). The island cover an area of 62 km<sup>2</sup> (Vieira, 1983), and hosts a diversity of natural environments, ranging from saltmarshes and grasslands to more structured peat and sandy woods (Quintela *et al.*, 2009).

From March 27 2006 to July 2 2010 we conducted 47 field trips to the island. Ten seasonal intensive sampling (average duration 36 hours; diurnal and nocturnal periods) were conducted from March to December 2006 and from July 2009 to July 2010. Thirty-seven random sampling (average duration six hours; 26 diurnal and 11

nocturnal) were conducted from April 2006 to June 2010. The total effort was approximately 582 hours of visual search. The period between random sampling varied from 17 to 51 days.

Species were recorded by active search in three localities known as Porto Rey (31°02'S, 52°09'W), Marambaia (31°00'S, 52°06'W) and Koréia (31°59'S, 52°07'W). In such localities, sampled areas could be grouped in the following physiognomies or habitats: arboreal formations (Af)- humid and sandy woods with predominance of native arboreal species; swamps (Sw)- palustrine permanent or intermittent waterbodies with high coverage of emergent macrophytes, mainly *Typha domiguensis* and *Scirpus giganteus*; herbaceous formations (Hf)- plain areas with predominance of herbaceous vegetation; arbustive dune (Ad)- dune formations with arbustive coverage; saltmarsh (Sm)- areas frequently flooded by estuarine water that are covered mainly by gramineous *Spartina densiflora* and herbaceous *Scirpus olney*; intermittent shallow lakes (Sl)- a set of intermittent shallow lakes and pools which are usually dry during the periods of low rainfall (January-March); agroecosystems (Ag)- anthropogenic habitat composed by plantations, irrigation and drainage channels; arbustive plain (Ap)- plain areas adjacent to saltmarshes with predominance of arbustive vegetation, mainly *Myrsine parvifolia* ("capororoca"); grassland (Gr)- areas with predominance of gramineous vegetation.

Each of the above localities was surveyed during intensive seasonal sampling while random sampling was restricted to one locality. Diurnal active searches consisted of random walks in a given habitats with an average effort of two observers. Nocturnal active searches comprised walks in pre-defined transects and repetitive drives in local roads, with an average effort of two observers on foot and one in vehicle. Each habitat was sampled at least twice per season.

Pitfall traps and arboreal traps were used between March and July 2006. Two pitfall traps composed by four plastic buckets (52 L) and 20 m drift fences were installed, one in the edge of swamp and the other in herbaceous formation (Marambaia). Arboreal traps consisted of four 1m-long PVC pipes, which were installed on arboreal vegetation in sandy woodlands, at a height of 1.5 to 2.0 m. Buckets and pipes remained opened during the entire period of utilization and were monitored every day.

Species identification was based in literature (Lema, 1994; 2002; Quintela and Loebmann, 2009) and in previous knowledge of the first author. Voucher specimens were deposited in the herpetological collection at the *Museu de Ciências Naturais*, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil.

## Results and Discussion

A total of 18 reptile species were recorded in Marinheiros Island, including three chelonians, three lizards, one amphibiaena, ten snakes and one crocodylian. Dipsadidae was the most representative family, with nine species recorded (Table 1). *Hemidactylus mabouia* is an exotic species, native to Africa (Quintela and Loebmann, 2009) while *Ophiodes* sp. represents a taxon

**Table 1.** Species of reptile recorded in Marinheiros Island, Rio Grande do Sul, southern Brazil, types of records, absolute number of encounters (N), relative frequency of encounters (FR%) and habitat of encounters, including: active search (1), pitfall traps (2), arboreal traps (3) capture by locals (4), arboreal formations (Af), swamps (Sw), herbaceous formations (Hf), arbustive dune (Ad), saltmarshes (Sm), intermittent shallow lakes (Sl), agroecosystems (Ag), arbustive plain (Ap), grassland (Gr).

Taxon	Record	N (FR%)	Habitat
Testudines			
Emydidae			
<i>Trachemys dorbigni</i> (Duméril & Bibron, 1835)	1	60 (37.9)	Ag, Sl
Chelidae			
<i>Acanthochelys spixii</i> (Duméril & Bibron, 1835)	1	2 (1.2)	Sl
<i>Hydromedusa tectifera</i> Cope, 1869	1, 2	2 (1.2)	Ag, Hf
Squamata			
Gekkonidae			
<i>Hemidactylus mabouia</i> (Moreau de Jonnes, 1818)	1	2 (1.2)	Ap
Anguidae			
<i>Ophiodes</i> sp. (Spix, 1824)	2	1 (0.6)	Hf
Teiidae			
<i>Tupinambis merianae</i> (Duméril & Bibron, 1839)	1, 2	17 (10.7)	Ad, Ap, Ag, Hf, Sw
Amphisbaenidae			
<i>Amphisbaena trachura</i> Cope, 1885	1	26 (16.4)	Ap
Dipsadidae			
<i>Clelia rustica</i> (Cope, 1878)	1	3 (1.8)	Ap, Hf
<i>Helicops infrataeniatus</i> (Jan, 1865)	1	11 (6.9)	Ag, Sl, Hf
<i>Liophis jaegeri</i> (Günther, 1858)	1	7 (4.4)	Ap, Sw, Gr
<i>Liophis poecilogyrus</i> (Cope, 1860)	1	7 (4.4)	Ap, Hf, Sl, Gr
<i>Philodryas aestiva</i> (Duméril, Bibron e Duméril, 1854)	1	4 (2.5)	Af, Ag, Ap
<i>Philodryas olfersii</i> (Lichtenstein, 1823)	1, 3	6 (3.7)	Af, Ad, Ap
<i>Philodryas patagoniensis</i> (Girard, 1857)	1	5 (3.1)	Ad, Hf, Sm
<i>Sibynomorphus ventrimaculatus</i> (Boulenger, 1885)	1	2 (1.2)	Ap
<i>Xenodon dorbignyi</i> (Duméril, Bibron e Duméril, 1854)	1	2 (1.2)	Ap, Hf
Viperidae			
<i>Rhinocerosophis alternatus</i> (Duméril, Bibron e Duméril, 1854)	1	1 (0.6)	Sm
Crocodylia			
Alligatoridae			
<i>Caiman latirostris</i> (Daudin, 1801)	4		Sm
<b>Total</b>		158 (100)	

not formally described, which is also found in peninsular Rio Grande (Borges-Martins, pers. comm.).

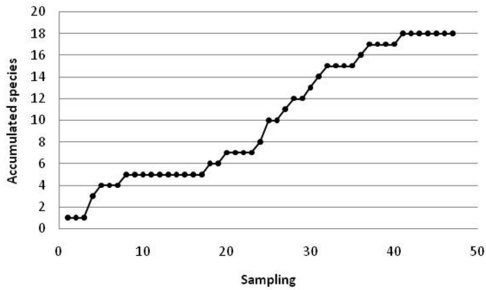
Except for *Ophiodes* sp. and *Caiman latirostris*, all remaining species were recorded by active search. *Ophiodes* sp., *Tupinambis merianae* and *Hydromedusa tectifera* were caught in pitfall traps. An individual of *C. latirostris* was captured by a local in his propriety, while sightings were reported by other locals in the same area. An individual of *Philodryas olfersii* was caught in an arboreal trap. Voucher specimens are listed in Table 2.

Absolute and relative frequencies of captures of each species are shown in Table 1. The curve of accumulated species (Figure 2) showed a tendency to stabilize, and no new recorded occurred in the last seven field expeditions, indicating that the results may represent an approximate characterization of the local reptilian

fauna.

Arbustive plains (Ap) was the habitat with the highest number of recorded species (nine), followed by Hf (eight), Ag and Sl (four), Ad and Sm (three each), Af and Gr (two each) (see Table 1).

Species richness (S) recorded in Marinheiros Island (S=18) represented 52% of the richness recorded in peninsular Rio Grande and ESEC Taim (S=34) (Gomes and Krause, 1982; Lema, 1994; Quintela et al., 2006). This result was not unexpected, as species richness observed on the island is generally lower when compared to its adjacent mainland (Ricklefs, 2003). For example, Cicchi et al (2009) recorded eight species (five lizards and three snakes) while Rocha et al. (2002) found only three species of lizard in the oceanic islands of Anchieta and Abrolhos Archipelago, respectively.



**Figure 2.** Accumulated species number in function of number of samplings (field trips).

Centeno *et al.* (2008) recorded 20 species of snakes in São Sebastião Island, while 27 species were found in the nearest mainland.

Among the species recorded in the present studies, one snake and two lacertilians had already been recorded in previous surveyed oceanic islands. *Liophis poecilogyrus* was found in Cardoso Island (Cicchi *et al.*, 2007) and *Tupinambis merianae* was recorded in Marambaia (Carvalho *et al.*, 2007) and Anchieta (Cicchi *et al.*, 2009) islands. The exotic gekkonid *Hemidactylus mabouia* was in the islands of Marambaia (Carvalho *et al.*, 2007), Anchieta (Cicchi *et al.*, 2009) and Abrolhos Archipelago (Rocha *et al.*, 2002), this last distant approximately 70 km from the continent.

Except for the dipsadids, *Clelia rustica* and *Philodryas olfersii* (Figure 3), all the remaining species had already been recorded in peninsular areas of Rio Grande municipality and Taim Ecological Station (ESEC Taim) (Gomes and Krause, 1982; Quintela *et al.*, 2006). It is worth noticing that *Clelia rustica* and *P. olfersii* were found in the municipality of Canguçu while *P. olfersii* was recorded in the municipality of Pelotas, localities which are distant about 73 and 40 km northward from Marinheiros Island, respectively (Quintela, pers. comm.). Other two dipsadids, *Liophis semiaureus* and *Oxyrhopus rhombifer*, were also found in Leonídeo Island, originally separated only about 1.3 km from Marinheiros (Quintela, pers. comm.).

Regarding sampled habitats, eleven Squamata species were found in arbustive and arboreal formations (Af, Ad and Ap), which correspond to 79% of the richness recorded for this order in the present study. The species *H. mabouia*, *P. patagoniensis* and *X. dorbignyi*, however, had not been recorded previously in arbustive/arboreal *restinga* formations in southern coastal plain (Quintela *et al.*, 2006; Quintela and Loebmann, 2009). Ricklefs (2003) refers as “ecological expansion” as

the phenomena where species spread to the habitats normally occupied by others species in mainland, which may also occur in reptile assemblages in estuarine islands. Arbustive formations are extended in great part of Marinheiros Island and the coverage provided by *Myrsine parviflora* patches probably results in different conditions of temperature, humidity, potential prey spectrum and other features, when compared to the open areas of grass/herbaceous formations. Reptile communities in estuarine islands, however, may differ from mainland in ecological aspects, as a result of specific adaptations to the habitat conditions.

The broad-snouted caiman was categorized as Endangered until 1996 and is now cited as Lower Risk/least concern (IUCN, 2010). Previously, individuals of *C. latirostris* were observed occasionally in peninsular saltmarshes in Rio Grande, the saltmarshes in marginal areas of Marinheiros, and in other estuarine islands. These habitats may represent important habitats for *C. latirostris* in Patos Lagoon estuary. In private properties and unprotected areas, however, caimans are more vulnerable to hunting, a practice observed in estuarine and peninsular areas of Rio Grande do Sul (Quintela and Loebmann, 2009), where individuals are opportunistically shot and captured with hooks (Quintela, unpublished data). Therefore, as a way to minimize threats to *C. latirostris*, an adequate program for the species conservation in the estuarine area and coastal *restingas* is recommended.

During a previous amphibian survey in Marinheiros, Quintela *et al.* (2009) detected several threats to anuran communities, including water and soil pollution by pesticides and increase of human activities due tourism. The first may be also affecting reptilian communities through trophic levels transport, while the latter can promote the increase of meetings and consequent death of individuals. Threats for reptiles in insular environments were also reported by Cicchi *et al.* (2007), who cited urban expansion, deforestation, fire, presence of domestic animals, introduced wild fauna, among others. Domestic animals may also represent a threat for reptilian populations in Marinheiros, once domestic dogs and cats were commonly observed in the natural environments.

The importance of Marinheiros Island for estuarine herpetofauna had been already demonstrated for anuran amphibians (Quintela *et al.*, 2007; 2009). In regard to reptiles, the island hosts a significant richness, including populations of species still not found in peninsular areas of the external southern coastal plain of Rio



**Figure 3.** *Clelia rustica* (A) and *Philodryas olfersii* (B) collected in Marinheiros Island, Rio Grande do Sul, southern Brazil. Photos: Fernando M. Quintela.

Grande do Sul. Finally, our recommendations for reptile conservation in Marinheiros Island are: a) creation of private reserves of natural patrimony (RPPN's), as relevant areas are included in private properties; b) the monitoring of saltmarshes and other sites where *C. latirostris* occurs; c) implement tourism management and environmental policies; d) promote environmental education in local communities.

**Table 2.** Voucher specimens from Marinheiros Island deposited in the reptilian collection of Museu de Ciências Naturais of Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil.

Taxon	Vouchers
<i>Trachemys dorbigni</i>	MCN 17077
<i>Hydromedusa tectifera</i>	MCN 15959
<i>Ophiodes</i> sp.	MCN 15969
<i>Tupinambis merianae</i>	MCN 17078
<i>Amphisbaena trachura</i>	MCN 17076
<i>Clelia rustica</i>	MCN 17067, 17068
<i>Helicops infrataeniatus</i>	MCN 17060-17063
<i>Liophis jaegeri</i>	MCN 17070-17071
<i>Liophis poecilogyrus</i>	MCN 17058, 17059
<i>Philodryas aestiva</i>	MCN 17075
<i>Philodryas olfersii</i>	MCN 17074
<i>Philodryas patagoniensis</i>	MCN 17072, 17073
<i>Sibynomorphus ventrimaculatus</i>	MCN 17064, 17065
<i>Xenodon dorbignyi</i>	MCN 17069
<i>Rhinocerocephalus alternatus</i>	MCN 17057

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