

# Non-Avian Reptiles of the state of Rio de Janeiro, Brazil: status of knowledge and commented list

Jane C.F. Oliveira<sup>1,4</sup>; Rodrigo Castellari Gonzalez<sup>2,5</sup>; Paulo Passos<sup>2,6</sup>; Davor Vrcibradic<sup>3,7</sup> & Carlos Frederico Duarte Rocha<sup>1,8</sup>

<sup>1</sup> Universidade do Estado do Rio de Janeiro (UERJ), Instituto de Biologia Roberto Alcântara Gomes (IBRAG), Departamento de Ecologia (DECOL), Rio de Janeiro, RJ, Brasil.

<sup>2</sup> Universidade Federal do Rio de Janeiro (UFRJ), Museu Nacional (MN), Departamento de Vertebrados. Rio de Janeiro, RJ, Brasil.

<sup>3</sup> Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Centro de Ciências Biológicas e da Saúde (CCBS), Instituto de Biociências. Rio de Janeiro, RJ, Brasil.

<sup>4</sup> ORCID: <http://orcid.org/0000-0001-5084-1420>. E-mail: [janeherpeto@gmail.com](mailto:janeherpeto@gmail.com) (corresponding author)

<sup>5</sup> ORCID: <http://orcid.org/0000-0001-7164-8363>. E-mail: [rodcastgon@gmail.com](mailto:rodcastgon@gmail.com)

<sup>6</sup> ORCID: <http://orcid.org/0000-0002-1775-0970>. E-mail: [atractus@gmail.com](mailto:atractus@gmail.com)

<sup>7</sup> ORCID: <http://orcid.org/0000-0002-6355-3441>. E-mail: [davor.vrcibradic@gmail.com](mailto:davor.vrcibradic@gmail.com)

<sup>8</sup> ORCID: <http://orcid.org/0000-0003-3000-1242>. E-mail: [cfdrocha@gmail.com](mailto:cfdrocha@gmail.com)

**Abstract.** We assessed the current knowledge on non-avian reptile species composition in the state of Rio de Janeiro (RJ), southeastern Brazil. We used published data in indexed journals and verified voucher specimens housed in the herpetological collections of the Museu Nacional (UFRJ), and the Laboratory of Reptiles (ZUF RJ). We also confirmed vouchers from Instituto Vital Brazil (IVB) and from the Museum of Comparative Zoology (MCZ). We compiled a list containing 149 species of reptiles, distributed among Testudines (N = 15), Crocodylia (N = 1) and Squamata (N = 133; six amphisbaenians, 38 lizards and 89 snakes). Our results add 20 species to the previous list known for the state. Four species recorded are endemic to the state of Rio de Janeiro (*Anolis neglectus*, *Glaucomastix littoralis*, *Leposternon scutigerum*, and *Liolaemus lutzae*). We identified that 21 reptile species recorded in RJ state (nearly 15% of the total) are included in some threat category either in the IUCN, Brazilian (ICMBio) or state lists of endangered species. We also report that seven of the reptiles recorded are non-indigenous to the state: *Cnemidophorus aff. lemniscatus* (= *Cnemidophorus cryptus*), *Anolis sagrei*, *Trachemys scripta*, *Trachemys dorbigni*, *Hemidactylus mabouia*, *Crotalus durissus terrificus*, and *Rhinoclemmys punctularia*. The checklist presented here provides a comprehensive database for further research on the herpetofauna of the Brazilian Atlantic Forest.

**Key-Words.** Atlantic Forest; Conservation; Crocodylia; Squamata; Testudines.

## INTRODUCTION

One of the most important steps for the conservation of a given region is the compilation of reliable data on its species composition. Brazil is megadiverse (Rodrigues, 2005), and the country's non-avian reptile (hereafter – reptile) fauna represents a considerable component of its biodiversity. The Brazilian reptile fauna comprises ca. 842 valid species, arranged in the orders Testudines (37 species), Crocodylia (six species) and Squamata (799 species, which includes 75 amphisbaenians, 282 lizards, and 442 snakes) (Costa & Bérnils, 2018). The Atlantic Forest (AF) is considered a hotspot for biodiversity conservation (Myers *et al.*, 2000; Colombo & Joly, 2010) housing a third of the country's reptile richness, *i.e.*, approximately 300 species (Tozetti *et al.*, 2018). Despite its considerable biological diversity, the AF has suffered intense deforestation over the past five centuries,

and its current scenario is extremely concerning (Pinto *et al.*, 2006; Rocha *et al.*, 2007; Bergallo *et al.*, 2009; Colombo & Joly, 2010).

The state of Rio de Janeiro (RJ), in southeastern Brazil, is located entirely within the Atlantic Forest domain. Nowadays, the forest cover of Rio de Janeiro is reduced to only 820,164 hectares (SOS Mata Atlântica/INPE 2017/2018), although the original forest cover of the state is estimated to have been approximately 4,294,000 hectares in 1500 (SOS Mata Atlântica/INPE 1992/1993; Rocha *et al.*, 2003). This remaining forest is composed almost entirely of small, isolated fragments, with limited connectivity among them (Ranta *et al.*, 1998; Rocha *et al.*, 2006; Ribeiro *et al.*, 2009; Colombo & Joly, 2010). The state's once-continuous forest has been reduced to 15,159 fragments smaller than 100 hectares, 42 fragments of 100-1,000 ha, three remnants of 1,000-5,000 ha, and only three larger than 5,000 ha (Rocha *et al.*,

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<http://www.revistas.usp.br/paz>

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2006). Additionally, many areas of Rio de Janeiro state are poorly sampled, especially for reptiles (*e.g.*, Vrcibradic *et al.*, 2011), indicating persistent knowledge bias on the composition of the reptile communities in many areas (Rocha *et al.*, 2009a).

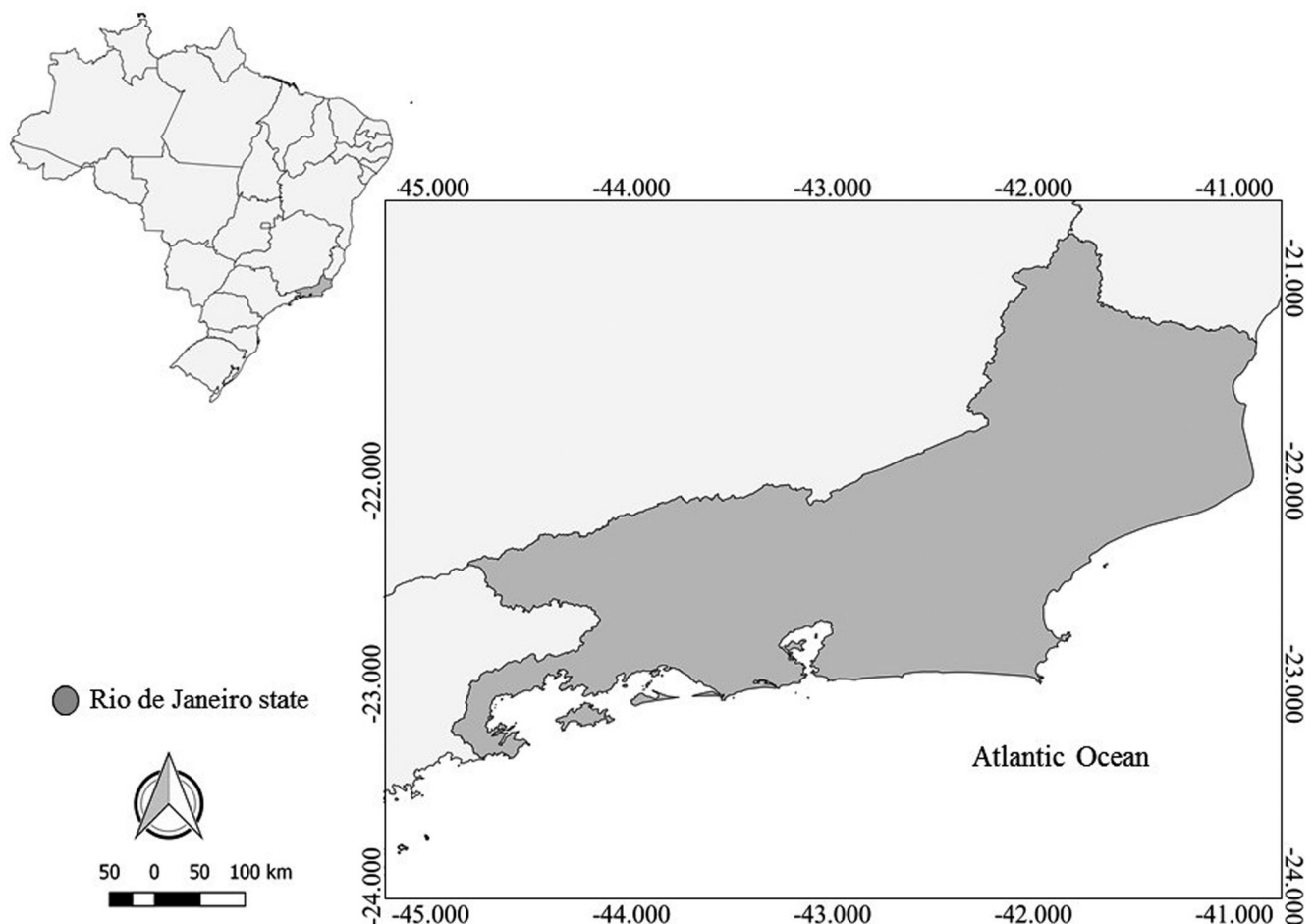
The first comprehensive inventory on the reptile species of RJ state was published about 15 years ago (Rocha *et al.*, 2004), in which 127 species of reptiles were known to occur in the state (one crocodylian, seven amphisbaenians, nine chelonians, 28 lizards and 82 snakes). A number of subsequent studies have increased the knowledge on reptile composition of RJ by inventorying areas in the state (*e.g.*, Citeli *et al.*, 2016; Rocha *et al.*, 2018; Martins *et al.*, 2019) extending the geographic distribution of some species (*e.g.*, Silveira, 2008; Goyannes-Araújo *et al.*, 2009; Hamdan *et al.*, 2015), describing new taxa (*e.g.*, Fernandes *et al.*, 2010; Prates *et al.*, 2020), and providing new records of non-indigenous species (*e.g.*, Siciliano *et al.*, 2014; Oliveira *et al.*, 2018). The recent advances, along with a number of additional taxonomic adjustments through the years (*e.g.*, Sturaro *et al.*, 2018; Hoogmoed *et al.*, 2019), made the species list of RJ become outdated. Therefore, there was a need to update the state's species list in order to facilitate conservation and management strategies and, to reinforce the need for studies on the current species distribution.

Here, we provide an updated list of the reptiles occurring in the state of Rio de Janeiro, which we hope will

serve as an important database for future research on the state's reptile fauna.

## MATERIAL AND METHODS

We compiled the existing records of the reptile species composition of Rio de Janeiro state (Fig. 1) from the following data sources: (1) voucher specimens housed in the herpetological collection of the Museu Nacional (MNRJ) and Zoological Collection (ZUFRJ), both part of the Universidade Federal do Rio de Janeiro (UFRJ). We also considered vouchers from the Instituto Vital Brazil (IVB), in Niterói, state of Rio de Janeiro, and from the Museum of Comparative Zoology, Cambridge, USA; (2) scientific papers published in indexed journals (*e.g.*, SCOPUS, Scielo, Web of Science). In the search for literature data, we accessed bibliographic databases searching for academic articles by using the combination of keywords: "squamata\*" and Rio de Janeiro; "herpeto\*" and Rio de Janeiro; "new and reptile and Rio de Janeiro"; "snake\*" and Rio de Janeiro; "lizard\*" and Rio de Janeiro". We restricted our search to papers published between 2000 and 2019. We excluded from the list all species which the occurrence in Rio de Janeiro could not be confirmed either by a voucher or a published report. In the herpetological collection, we identified the species based on the appropriate taxonomic reviews available for each reptil-



**Figure 1.** State of Rio de Janeiro (enlarged figure in right frame) located in southeastern Brazil (in darker gray in the upper left figure).



ian group. We considered that the consulted collections adequately represent the species occurring in the state of Rio de Janeiro.

We followed the nomenclature of Costa & Bérnils (2018) except for the genus *Anolis* (*lato sensu*), for which we decided to use the most conservative proposal (Poe et al., 2017 instead of Nicholson et al., 2018). We adopted Borges-Martins' (1998) classification of the *Ophiodes* species, given that this is the most complete review of the group, although data have not yet been published. Additionally, we also considered nomenclatural changes posterior to the publication of Costa & Bérnils (2018), such as the synonymizations of *Cercosaura ocellata ocellata* with *C. olivacea* Gray, 1845 (Sturaro et al., 2018), *Sibynomorphus* with *Dipsas* (Arteaga et al., 2018), and *Uromacerina ricardinii* with *Cercophis auratus* (Hoogmoed et al., 2019) and the transfer of *Mastigodryas bifossatus* to the genus *Palusophis* (Montingelli et al., 2019).

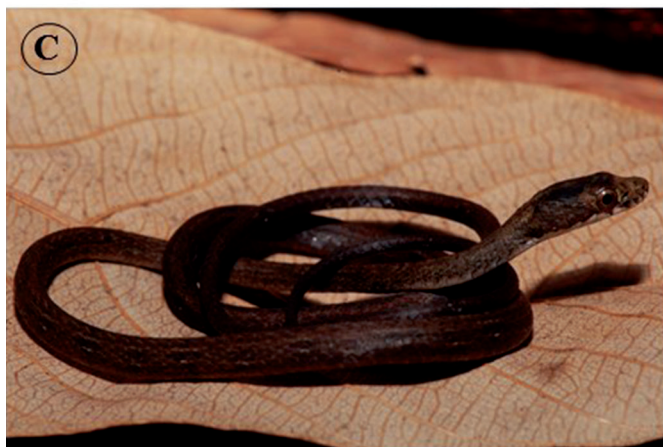
We classified each reptile species as endemic to the state of Rio de Janeiro based on scientific papers published (see literature review method above). We also consulted lists containing the conservation status of each species in the state of Rio de Janeiro (Rocha et al., 2000), the red book of Brazilian fauna (ICMBio, 2018), and the IUCN Red List (2019). The classification is standardized by the IUCN categories, i.e., Data Deficient (DD), Near Threatened (NT), Endangered (EN), Vulnerable (VU),

Critically Endangered (CR), or Probably Extinct (PEX – following Rocha et al., 2000).

## RESULTS AND DISCUSSION

We compiled a list of 149 reptile species currently known to occur in the state of Rio de Janeiro (Table 1, Fig. 2), belonging to Crocodylia (N = 1), Testudines (N = 15), and Squamata (N = 133, including six amphisbaenians, 38 lizards and 89 snakes). Overall, 18 of these species were previously addressed in the literature as subspecies (Table 1), but as none of these species are represented by more than a single subspecies in Rio de Janeiro state, so each taxon was counted as a single species for the estimates of species richness.

The total reptile species richness confirmed here for Rio de Janeiro state ( $N_{\text{total}} = 149$ ) represents approximately 19% of the reptiles reported to occur in Brazil ( $N_{\text{total}} = 795$ ; Costa & Bérnils, 2018), and around half of the ca. 300 reptile species believed to occur in the Atlantic Forest Biome (Tozetti et al., 2018). When analyzed by order, the proportion of the Brazilian reptiles found in Rio de Janeiro state varied considerably. The six amphisbaenians from this state, for example, represent 8% of the 72 species known to occur in Brazil, whereas at the opposite extreme, the 15 turtles represent 42% of the Brazilian



**Figure 2A-D.** Some reptile species recorded in Rio de Janeiro state: (A) *Corallus hortulanus* (Photo: Pedro Pinna), (B) *Bothrops jararacussu* (Photo: Pedro Pinna), (C) *Cercophis auratus* (Photo: Pedro Pinna), (D) *Amerotyphlops brongersmianus* (Photo: Pedro Pinna).



chelonian fauna (36 species). Rio de Janeiro also has 14% (N = 38) of the 276 Brazilian lizard species, 17% (N = 1) of six crocodylians, and 22% (N = 88) of its 405 snake species. These results reinforce the importance of the Atlantic Forest biome for the conservation of the reptile biodiversity of Brazil.

Compared to the previous inventory of Rocha *et al.* (2004), our results led to the removal of 11 species and the addition of 31 species, representing an increase of 20 species (Table 1). Taxa were removed from the list for two reasons: the result of taxonomic arrangement of some groups, such as the restriction of *Atractus maculatus* to northeastern Brazil (Passos *et al.*, 2010), and the exclusion of taxa with no voucher specimens in a museum collection to corroborate the occurrence of the species in the state (e.g., *Lepidodactylus lugubris* and *Oxyrhopus rhombifer*).

The taxa added to the list (Table 1) refer to the description of new taxa, such as *Dipsas sazimai* (Fernandes *et al.*, 2010) and *Anolis neglectus* (Prates *et al.*, 2020) and the addition of new records of non-indigenous taxa, such as *Cnemidophorus* aff. *lemniscatus* (as *C. cryptus*; Oliveira *et al.*, 2015), and *A. sagrei* (Oliveira *et al.*, 2018) whether or not a viable population had been established. Another reason was the extension of the geographic range of some species, such as *Anolis fuscoauratus* (Goyannes-Araújo *et al.*, 2009).

We recorded four endemic reptile species to Rio de Janeiro state: *Anolis neglectus*, *Glaucmastix littoralis*, *Leposternon scutigerum*, and *Liolaemus lutzae*. Three of these are also considered to be threatened: *Liolaemus lutzae*, *Glaucmastix littoralis*, and *Leposternon scutigerum* (Table 1). *Glaucmastix littoralis* is currently known to occur at only four localities: Barra de Maricá, Restinga da Marambaia, Jurubatiba National Park, and Grussaí. *Liolaemus lutzae* occurs in coastal areas from Restinga da Marambaia to Cabo Frio (Rocha *et al.*, 2009b), while *L. scutigerum* is known to occur between the coastal municipalities of Macaé and Niterói. These three species occur in Restinga habitats (sandy coastal plain formations) and are threatened primarily by the ongoing fragmentation and loss of habitats to coastal development (Rocha *et al.*, 2003). In the past, these restingas covered almost the whole of the coast of Rio de Janeiro state, except for rocky sectors (Rocha *et al.*, 2003), but are now subject to an accelerated process of degradation due to the expansion of real estate in the area. *Anolis neglectus* was recently described from Parque Nacional da Serra dos Órgãos, in the municipality of Teresópolis and the population is restricted to a small secondary montane Atlantic Forest vegetation within this Park.

We confirmed the presence of seven non-indigenous reptile taxa in Rio de Janeiro state: *Trachemys scripta*, *T. dorbigni*, *Rhinoclemmys punctularia*, *A. sagrei*,



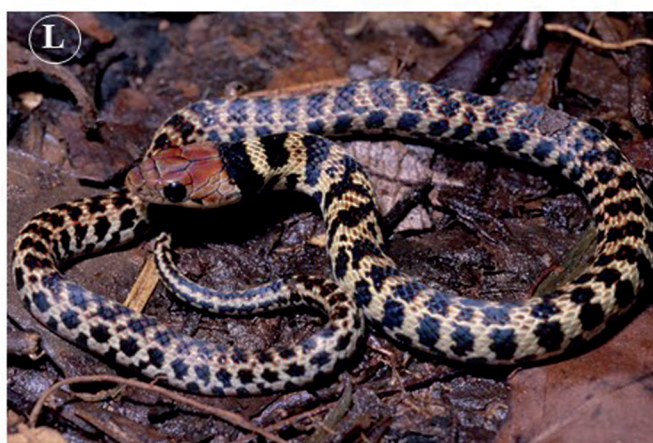
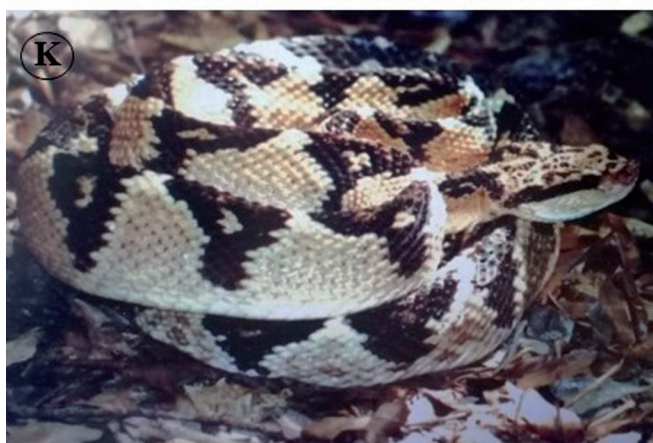
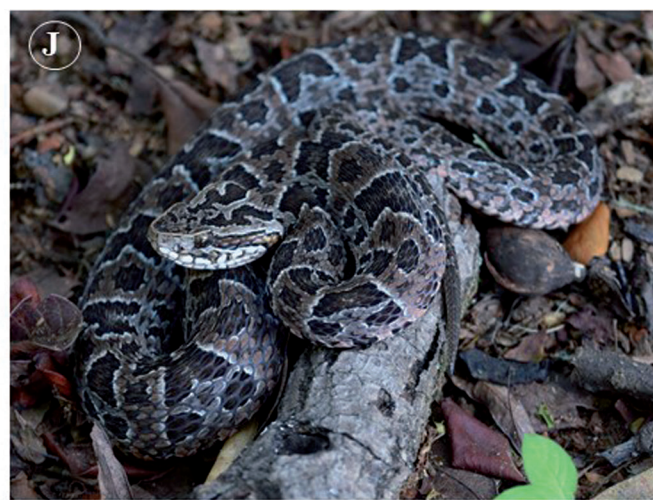
**Figure 2E-H.** Some reptile species recorded in Rio de Janeiro state: (E) *Leposternon scutigerum* (Photo: Pedro Pinna), (F) *Hydromedusa maximiliani* (Photo: Pedro Pinna), (G) *Liolaemus lutzae* (Photo: Patrícia Almeida-Santos); (H) *Anolis neglectus* (Photo: Leandro Drummond).



*Cnemidophorus* aff. *lemniscatus*, *Hemidactylus mabouia*, and *Crotalus durissus terrificus*. The red-eared turtle, *T. scripta*, whose native range is the eastern United States (e.g., Ernst & Lovich, 2009; Powell et al., 2016), was recorded in Tijuca National Park, but it was probably released intentionally into the wild, given that the species was encountered in a highly impacted area within the urban zone of the city of Rio de Janeiro (Dorigo, 2017). The Black-Bellied Slider, *T. dorbigni*, was originally known to occur only in the Brazilian state of Rio Grande do Sul (Fritz & Havas, 2006), thousands of kilometers to the south of Rio de Janeiro, and is also likely to have been released into the wild, rather than reaching the state unaided (Salles & Silva-Soares, 2010). Although we have no evidence that either *T. scripta* or *T. dorbigni* has established a viable wild population in the state of Rio de Janeiro, it does seem possible that established populations can be found in urban parks, particularly in the state capital. *Rhinoclemmys punctularia*, a semi-aquatic turtle, naturally distributed in the Amazon region, north of Brazil (Ávila-Pires et al., 2010; Wariss et al., 2012), was recorded in the Pássaros Natural Municipal Park in the municipality of Rio das Ostras, and also in the municipality of Cabo Frio, in eastern Rio de Janeiro state. While *R. punctularia* may also have been introduced into Rio de Janeiro via the illegal pet trade, the possibility that it represents a relictual population cannot be ruled out altogether (Siciliano et al., 2014), given

that a second *Rhinoclemmys* species has been recently discovered (currently under description by Caramaschi et al., in prep.) in the neighboring state of Espírito Santo.

Three non-indigenous lizard species are known to have established populations in the state: *Anolis sagrei* (Oliveira et al., 2018), *Cnemidophorus* aff. *lemniscatus* (formerly treated as *Cnemidophorus cryptus*; Oliveira et al., 2015), and *Hemidactylus mabouia* (e.g., Rocha & Bergallo, 2011). *Anolis sagrei* and *C. aff. lemniscatus* were recently discovered within the perimeter of Galeão International Airport on Ilha do Governador island, in the eastern extreme of the state capital, Rio de Janeiro (Oliveira et al., 2018). *Anolis sagrei* is native to Cuba, the Bahamas, and the Cayman Islands, but has been detected as an invasive species in several countries in the Americas and Asia (e.g., Kolbe et al., 2004). *Anolis sagrei* was suggested to have been transported to that site in RJ unintentionally in the cargo of arriving aircraft (Oliveira et al., 2018). Lizards of the *Cnemidophorus lemniscatus* complex are known to occur in the Amazon region and the records in southeastern Brazil are probably introduced populations (Oliveira et al., 2015). We are currently conducting a molecular analysis of *C. aff. lemniscatus* in an attempt to identify the origin of these lizards (Oliveira et al., in prep.). By contrast, the presence of the African gecko *H. mabouia* in Rio de Janeiro is much older, dating back to colonial times, when it crossed the Atlantic Ocean at



**Figure 2I-L.** Some reptile species recorded in Rio de Janeiro state: (I) *Crotalus durissus* (Photo: Edson Ferreira Santiago); (J) *Bothrops neuwiedi* (Photo: Marcelo Ribeiro Duarte); (K) *Lachesis muta* (Photo: Marcos Felipe da Rocha Pinto); (L) *Erythrolamprus poecilogyrus poecilogyrus* (Photo: Otávio Marques).

**Table 1.** Reptile species recorded in the Rio de Janeiro state, southeastern Brazil along with their conservation status. Threatened species lists: ICMBio = Livro Vermelho da Fauna Brasileira Ameaçada de Extinção ICMBio/MMA (2018); IUCN = The International Union for Conservation of Nature's Red List of Threatened Species (IUCN, 2019); RJ = Rio de Janeiro State List of Endangered Species (Rocha *et al.*, 2000). Status: \* = Non-Indigenous species in Rio de Janeiro; CR = Critically endangered; DD = Deficient data; EN = Endangered; <sup>END</sup> = endemic reptile species of Rio de Janeiro state; LC = Least Concern; Pex = Probably extinct; VU = Vulnerable.

Táxon	Conservation status		
	IUCN	ICMBio	RJ
<b>TESTUDINES Batsch, 1788</b>			
<b>Chelidae Gray, 1825</b>			
<i>Acanthochelys radiolata</i> (Mikan, 1820)	—	LC	DD
<i>Hydromedusa maximiliani</i> (Mikan, 1820)	VU	DD	—
<i>Hydromedusa tectifera</i> Cope, 1869	—	LC	—
<i>Mesoclemmys hoguei</i> (Mertens, 1967)	CR	CR	VU
<i>Phrynops geoffroanus</i> (Schweigger, 1812)	—	—	—
<b>Cheloniidae Opperl, 1811</b>			
<i>Caretta caretta</i> (Linnaeus, 1758)	VU	EN	VU
<i>Chelonia mydas</i> (Linnaeus, 1758)	EN	VU	VU
<i>Eretmochelys imbricata</i> (Linnaeus, 1766)	CR	CR	VU
<i>Lepdochelys olivacea</i> (Eschscholtz, 1829)	VU	EN	VU
<b>Dermochelyidae Fitzinger, 1843</b>			
<i>Dermochelys coriacea</i> (Linnaeus, 1766)	VU	CR	VU
<b>Emyridae Rafinesque, 1815</b>			
<i>Trachemys scripta</i> (Thunberg In Schoepff, 1792)*	—	—	—
<i>Trachemys dorbigni</i> (Duméril & Bibron, 1835) *	—	—	—
<b>Geoemydidae Theobald, 1868</b>			
<i>Rhinoclemmys punctularia</i> (Daudin, 1801)*	—	LC	—
<b>Testudinidae Batsch, 1788</b>			
<i>Chelonoidis carbonarius</i> (Spix, 1824)	—	—	LC
<i>Chelonoidis denticulatus</i> (Linnaeus, 1766)	—	LC	—
<b>CROCODYLIA Gmelin, 1789</b>			
<b>Alligatoridae Cuvier, 1807</b>			
<i>Caiman latirostris</i> (Daudin, 1802)	LC	LC	EN
<b>SQUAMATA Opperl, 1811 (Amphisbaenia)</b>			
<b>Amphisbaenidae Gray, 1825</b>			
<i>Amphisbaena alba</i> Linnaeus, 1758	LC	LC	—
<i>Amphisbaena darwini</i> Duméril & Bibron, 1839	—	LC	—
<i>Leposternon infraorbitale</i> (Berthold, 1859)	LC	LC	—
<i>Leposternon microcephalum</i> Wagler in Spix, 1824	—	LC	—
<i>Leposternon scutigerum</i> (Hemprich, 1820) <sup>END</sup>	DD	EN	—
<i>Leposternon wuchereri</i> (Peters, 1879)	—	LC	—
<b>SQUAMATA Opperl, 1811 (lizards)</b>			
<b>Anguidae Gray, 1825</b>			
<i>Diploglossus fasciatus</i> (Gray, 1831)	—	LC	DD
<i>Ophiodes fragilis</i> (Raddi, 1826)	—	—	—
<i>Ophiodes striatus</i> (Spix, 1824)	—	—	—
<b>Dactyloidae Fitzinger, 1843</b>			
<i>Anolis fuscoauratus</i> (D'Orbigny in Duméril & Bibron, 1837)	—	LC	—
<i>Anolis neglectus</i> Prates, Melo-Sampaio, Queiroz, Carnaval, Rodrigues and Drummond, 2020 <sup>END</sup>	—	—	—
<i>Anolis punctatus</i> (Daudin, 1802)	—	LC	—
<i>Anolis sagrei</i> Duméril & Bibron, 1837*	—	—	—
<b>Gekkonidae Gray, 1825</b>			
<i>Hemidactylus mabouia</i> (Moreau de Jonnés, 1818)*	—	—	—
<b>Gymnophthalmidae Fitzinger, 1826</b>			
<i>Cercosaura olivacea</i> Gray, 1845	—	—	—
<i>Cercosaura quadrilineata</i> Boettger, 1876	—	—	—
<i>Colobodactylus dalcyanus</i> Vanzolini & Ramos, 1977	DD	EN	—
<i>Ecpleopus gaudichaudii</i> Duméril & Bibron, 1839	LC	—	—
<i>Heterodactylus imbricatus</i> Spix, 1825	LC	LC	—
<i>Leposoma scincoides</i> Spix, 1825	LC	LC	—
<i>Micrablepharus maximiliani</i> (Reinhardt & Luetken, 1862)	LC	LC	—
<i>Placosoma cordylinum</i> Tschudi, 1847	LC	LC	—
<i>Placosoma glabellum</i> (Peters, 1870)	LC	LC	—
<b>Iguanidae Gray, 1827</b>			
<i>Iguana iguana</i> (Linnaeus, 1758)	—	LC	—

Táxon	Conservation status		
	IUCN	ICMBio	RJ
<b>Leiosauridae Frost, Etheridge, Janies &amp; Titus, 2001</b>			
<i>Anisolepis grilli</i> Boulenger, 1891	—	LC	—
<i>Enyalius bilineatus</i> Duméril & Bibron, 1837	—	LC	—
<i>Enyalius brasiliensis</i> (Lesson, 1828)	—	LC	—
<i>Enyalius iheringii</i> Boulenger, 1885	—	LC	—
<i>Enyalius perditus</i> Jackson, 1978	—	LC	DD
<i>Urostrophus vautieri</i> Duméril & Bibron, 1837	—	LC	—
<b>Liolaemidae Frost &amp; Etheridge, 1989</b>			
<i>Liolaemus lutzae</i> Mertens, 1938 <sup>END</sup>	VU	CR	VU
<b>Mabuyidae Mittleman, 1952</b>			
<i>Aspronema dorsivittatum</i> (Cope, 1862)	—	LC	—
<i>Brasiliscincus agilis</i> (Raddi, 1823)	—	LC	—
<i>Notomabuya frenata</i> (Cope, 1862)	—	LC	—
<i>Psychosaura macrorhyncha</i> (Hoge, 1947)	—	LC	—
<b>Polychrotidae Fitzinger, 1843</b>			
<i>Polychrus marmoratus</i> (Linnaeus, 1758)	—	LC	—
<b>Phyllodactylidae Gamble, Bauer, Greenbaum &amp; Jackman, 2008</b>			
<i>Gymnodactylus darwinii</i> (Gray, 1845)	—	LC	—
<b>Teiidae Gray, 1827</b>			
<i>Ameiva ameiva</i> (Linnaeus, 1758)	—	LC	—
<i>Cnemidophorus</i> aff. <i>lemniscatus</i> (Linnaeus, 1758)*	—	LC	—
<i>Glaucomastix littoralis</i> (Rocha, Araújo, Vrcibradic & Costa, 2000) <sup>END</sup>	—	EN	—
<i>Salvator merianae</i> Duméril & Bibron, 1839	—	LC	—
<b>Tropiduridae Bell in Darwin, 1843</b>			
<i>Tropidurus hispidus</i> (Spix, 1825)	—	LC	—
<i>Tropidurus torquatus</i> (Wied, 1820)	—	LC	—
<i>Strobilurus torquatus</i> Wiegmann, 1834	—	LC	—
<b>SQUAMATA Opperl, 1811 (snakes)</b>			
<b>Anomalepididae Taylor, 1939</b>			
<i>Liotyphlops wilderi</i> (Garman, 1883)	—	LC	—
<b>Boidae Gray, 1825</b>			
<i>Boa constrictor constrictor</i> Linnaeus, 1758	—	LC	—
<i>Corallus hortulanus</i> (Linnaeus, 1758)	—	LC	—
<i>Epicrates cenchria</i> (Linnaeus, 1758)	—	LC	—
<b>Colubridae Opperl, 1811</b>			
<i>Chironius bicarinatus</i> (Wied, 1820)	—	LC	—
<i>Chironius exoletus</i> (Linnaeus, 1758)	—	LC	—
<i>Chironius foveatus</i> Bailey, 1955	—	LC	—
<i>Chironius fuscus</i> (Linnaeus, 1758)	—	LC	—
<i>Chironius laevicollis</i> (Wied, 1824)	—	LC	—
<i>Chironius quadricarinatus</i> (Boie, 1827)	—	LC	—
<i>Drymarchon corais corais</i> (Boie, 1827)	—	LC	—
<i>Drymoluber dichrous</i> (Peters, 1863)	—	LC	—
<i>Leptophis ahaetulla liocercus</i> (Wied, 1824)	—	LC	—
<i>Oxybelis aeneus aeneus</i> (Wagler In Spix, 1824)	—	LC	—
<i>Spilotes pullatus pullatus</i> (Linnaeus 1758)	—	LC	—
<i>Spilotes sulphureus poecilostoma</i> (Wied, 1825)	—	LC	—
<i>Tantilla</i> aff. <i>melanocephala</i> (Linnaeus 1758)	—	—	—
<b>Dipsadidae Bonaparte, 1838</b>			
<i>Atractus francoi</i> Passos, Fernandes, Bérnils & Moura-Leite, 2010	—	DD	—
<i>Atractus zebrinus</i> (Jan, 1862)	—	LC	—
<i>Caaeteboia amarali</i> (Wettstein, 1930)	—	LC	—
<i>Cercophis auratus</i> (Schlegel 1837)	—	LC	—
<i>Clelia plumbea</i> (Wied, 1820)	—	LC	—
<i>Coronelaps lepidus</i> (Reinhardt, 1861)	—	LC	—
<i>Dipsas albifrons</i> (Sauvage, 1884)	—	LC	—
<i>Dipsas alternans</i> (Fischer, 1885)	—	LC	—
<i>Dipsas indica petersi</i> (Fischer, 1885)	—	LC	—
<i>Dipsas neuwiedi</i> (Ihering, 1911)	—	LC	—
<i>Dipsas sazimai</i> Fernandes, Marques & Argôlo, 2010	—	LC	—
<i>Dipsas variegata</i> (Duméril, Bibron & Duméril, 1854)	—	LC	—
<i>Echinanthera amoena</i> (Jan, 1863)	—	LC	—
<i>Echinanthera cephalostriata</i> Di-Bernardo, 1996	—	LC	—



Táxon	Conservation status		
	IUCN	ICMBio	RJ
<i>Echianthera cyanopleura</i> (Cope, 1885)	—	LC	—
<i>Echianthera melanostigma</i> (Wagler In Spix, 1824)	—	LC	—
<i>Echianthera undulata</i> (Wied, 1824)	—	LC	—
<i>Elapomorphus quinquelineatus</i> (Raddi, 1820)	—	LC	—
<i>Erythrolamprus aesculapii venustissimus</i> (Wied, 1821)	—	LC	—
<i>Erythrolamprus almadensis</i> (Wagler, 1824)	—	LC	—
<i>Erythrolamprus atraventer</i> (Dixon & Thomas, 1985)	—	LC	—
<i>Erythrolamprus jaegeri jaegeri</i> (Günther, 1858)	—	LC	—
<i>Erythrolamprus miliaris merremi</i> (Wied, 1821)	—	LC	—
<i>Erythrolamprus poecilogyrus poecilogyrus</i> (Wied, 1825)	—	LC	—
<i>Erythrolamprus reginae</i> (Linnaeus, 1758)	—	LC	—
<i>Erythrolamprus typhlus brachyurus</i> (Cope, 1887)	—	LC	—
<i>Helicops carinicaudus</i> (Wied, 1824)	—	LC	—
<i>Imantodes cenchoa</i> (Linnaeus, 1758)	—	LC	—
<i>Leptodeira annulata annulata</i> (Linnaeus, 1758)	—	LC	—
<i>Mussurana montana</i> (Franco, Marques & Puerto, 1997)	—	LC	—
<i>Oxyrhopus guibei</i> Hoge & Romano, 1977	—	LC	—
<i>Oxyrhopus clathratus</i> Duméril, Bibron & Duméril, 1854	—	LC	—
<i>Oxyrhopus petolaris digitalis</i> (Reuss, 1834)	—	LC	—
<i>Oxyrhopus trigeminus</i> Duméril, Bibron & Duméril, 1854	—	LC	—
<i>Palusophis bifossatus</i> (Raddi, 1820)	—	LC	—
<i>Paraphimophis rusticus</i> (Cope, 1878)	—	LC	—
<i>Philodryas olfersii</i> (Liechtenstein, 1823)	—	LC	—
<i>Philodryas patagoniensis</i> (Girard, 1858)	—	LC	—
<i>Pseudoboa nigra</i> (Duméril, Bibron & Duméril, 1854)	—	LC	—
<i>Pseudoboa serrana</i> Morato, Moura-Leite, Prudente & Bérnills, 1995	—	LC	—
<i>Siphophis compressus</i> (Daudin, 1803)	—	LC	DD
<i>Siphophis longicaudatus</i> (Andersson, 1901)	—	LC	—
<i>Siphophis pulcher</i> (Raddi, 1820)	—	LC	—
<i>Taeniophallus affinis</i> (Günther, 1858)	—	LC	—
<i>Taeniophallus bilineatus</i> (Fischer, 1885)	—	LC	—
<i>Taeniophallus occipitalis</i> (Jan, 1863)	—	LC	—
<i>Taeniophallus persimilis</i> (Cope, 1869)	—	LC	—
<i>Thamnodynastes</i> cf. <i>nattereri</i> (Mikán, 1828)	—	LC	—
<i>Thamnodynastes hypoconia</i> (Cope, 1860)	—	LC	—
<i>Thamnodynastes longicaudus</i> Franco, Ferreira, Marques & Sazima, 2003	—	LC	—
<i>Thamnodynastes strigatus</i> (Günther, 1858)	—	LC	—
<i>Tomodon dorsatus</i> Duméril, Bibron & Duméril, 1854	—	LC	—
<i>Tropidodryas serra</i> (Schlegel, 1837)	—	LC	—
<i>Tropidodryas striaticeps</i> (Cope, 1870)	—	LC	—
<i>Xenodon merremii</i> (Wagler In Spix, 1824)	—	LC	—
<i>Xenodon neuwiedii</i> Günther, 1863	—	LC	—
<i>Xenopholis scalaris</i> (Wucherer, 1861)	—	LC	—
<b>Elapidae Boie, 1827</b>			
<i>Micrurus</i> aff. <i>ibiboboca</i> (Merrem, 1820)	—	LC	—
<i>Micrurus corallinus</i> (Merrem, 1820)	—	LC	—
<i>Micrurus decoratus</i> (Jan, 1858)	—	LC	—
<i>Micrurus lemniscatus carvalhoi</i> Roze, 1967	—	LC	—
<b>Leptotyphlopidae Stejneger, 1892</b>			
<i>Trilepida salgueiroi</i> (Amaral, 1955)	—	LC	—
<b>Tropidophiidae Brongersma, 1951</b>			
<i>Tropidophis paucisquamis</i> (Müller, 1901)	—	LC	—
<b>Typhlopidae Merrem, 1820</b>			
<i>Amerotyphlops brongersmianus</i> (Vanzolini, 1976)	—	LC	—
<b>Viperidae Opper, 1811</b>			
<i>Bothrops alternatus</i> Duméril, Bibron & Duméril, 1854	—	LC	—
<i>Bothrops bilineatus bilineatus</i> (Wied, 1821)	—	LC	Pex
<i>Bothrops fonsecai</i> Hoge & Belluomini, 1959	—	LC	DD
<i>Bothrops jararaca</i> (Wied, 1824)	—	LC	—
<i>Bothrops jararacussu</i> Lacerda, 1884	LC	LC	—
<i>Bothrops neuwiedii</i> (Wagler, 1824)	—	LC	DD
<i>Crotalus durissus terrificus</i> (Laurenti, 1768)*	—	LC	—
<i>Lachesis muta</i> (Linnaeus, 1766)	—	LC	EN



least twice, and was introduced into a number of different countries of the New World (Rocha & Bergallo, 2011). These geckos live in urban areas and other disturbed habitats in Brazil, and the ongoing deforestation occurring in many areas should facilitate further invasions into previously unoccupied areas (Oliveira et al., 2016). As a result, the area occupied by *H. mabouia* is known to have been expanding progressively into many areas of natural vegetation in Brazil, over the past 80 years, in particular in open, savanna-like habitats (Rocha & Bergallo, 2011).

Finally, the South American rattlesnake, *Crotalus durissus terrificus*, occurs naturally in open areas from the states of Rio Grande do Sul to Mato Grosso do Sul and Minas Gerais, Rondônia, Amazonas, and Pará (Campbell & Lamar, 2004). The first record of *C. durissus terrificus* in the Rio de Janeiro Atlantic Forest was in Itatiaia National Park (Barth, 1957; Bastos et al., 2005). Since then, the occurrence of this snake in the state has become common and its range has been gradually expanding, usually associated with the suppression of native vegetation (Bastos et al., 2005). At least two snake species (*Bothrops neuwiedi* and *Chironius quadricarinatus*) are restricted to putative natural open formations in the municipality of Campos do Goytacazes, in the northeastern extreme of the state of Rio de Janeiro. Both species may represent naturally disjunct populations separated from their core distribution in the Cerrado by the expansion of climatic conditions favorable for forest-dwelling species during the Last Glacial Maximum (e.g., Leite et al., 2016).

The records of *Iguana iguana* in the state of Rio de Janeiro are from the municipality of Cabo Frio in 1951 (MNRJ 12929-30) and there is no current record of the occurrence of this species in the state. The occurrence of *I. iguana* in RJ is also based on the existence of historical records of the species from the forests of Rio de Janeiro. In the book "*Animalia Brasiliensia Lacertae*", Spix (1825) described the occurrence of *Iguana lophyroides* (a junior synonym of *I. iguana* – Peters & Donoso-Barros, 1970) in Rio de Janeiro, reporting that it was commonly found on branches in the forests of Rio de Janeiro, "*Habitat non rara supra ramos in sylvis Rio de Janeiro*" (Spix, 1825). Therefore, we consider that these records suggest the natural occurrence of *Iguana iguana* in the state of Rio de Janeiro, which represents the southernmost limit of the original distribution of the species.

Twenty-one species from the present list (nearly 14% of all records) are considered under some degree of threat, either regionally (Rocha et al., 2000), nationally (ICMBio, 2018) or even at global level (IUCN, 2019). These include 15 species listed in Rio de Janeiro (Rocha et al., 2000), 11 in Brazil (ICMBio, 2018), and nine worldwide (IUCN, 2019). Five of these species are Testudines, of which four are marine turtles, which are broadly distributed across the world's oceans (IUCN, 2019). Despite the wide distribution of species, several factors are related to the decline in marine turtle populations, for example, the harvesting of adults and eggs (Jackson et al., 2001). Brazil has taken considerable steps toward the conservation of marine turtles, in particular, the protection of nesting

sites, which is potentially the most important conservation strategy at a local scale.

The broad-snouted caiman, *Caiman latirostris*, is the only crocodylian species found in Rio de Janeiro state, and is included as "Endangered" in the state's red list (Rocha et al., 2000). The populations of *C. latirostris* living in the municipality of Rio de Janeiro are of particular concern, given the ongoing urban expansion of Barra da Tijuca that have taken place of their natural habitat, such as lakes that nowadays are reduced to canals with polluted water. The broad-snouted caiman was naturally abundant in the coastal region of RJ, but its populations have been declining considerably mainly due to this strong anthropic pressure (Rocha et al., 2000). There is still a large shortage of studies that assess the relation between the reduction of available natural habitats over the population structures in the state of Rio de Janeiro.

Although the green pit viper, *Bothrops bilineatus bilineatus*, is listed as "Least Concern" (LC) in national red list (ICMBio, 2018), it is considered to be Probably Extinct (Pex) in the state of Rio de Janeiro (Table 1). *Bothrops b. bilineatus* has not been reliably documented in the state since 1963, when a specimen was collected in the suburb of Recreio dos Bandeirantes, in the municipality of Rio de Janeiro (Rocha et al., 2000). A second viperid, the bushmaster, *Lachesis muta*, is also listed as LC in Brazil, but is considered "Endangered" (EN) in Rio de Janeiro (Rocha et al., 2000). *Lachesis muta* is the largest venomous snake in the New World, and is the world's longest viperid (Campbell & Lamar, 2004). This forest-dwelling pit viper is known to be particularly sensitive to anthropogenic impacts, and it is thus restricted to areas in which forest remnants are relatively well preserved (Campbell & Lamar, 2004). The most recent specimen from Rio de Janeiro (voucher specimen IVB1) was collected in 1986 in the municipality of Santa Maria Madalena, in the north of the state. A photographic record of the species was obtained in 2004 in the União Biological Reserve (Fig. 2K), although the animal was left in the wild (Marcos Felipe R. Pinto, pers. comm). In general, records of this species in southeastern Brazil have become increasingly rare over the past four decades, probably due to the loss and fragmentation of habitats. In addition to the species listed as threatened in the state (Rocha et al., 2000), it is important to consider species that have not been recorded in herpetological collections for some time, such as *Clelia plumbea*, which has been collected only rarely in recent decades in the state. This highlights the need for a detailed review of the list of endangered species of Rio de Janeiro state.

Reptile species are threatened worldwide for several reasons as, for example, habitat loss or climate change. Global warming is provoking species extinction on a major scale, and lizard populations are currently being extirpated from all the continents on which reptiles are found (Sinervo et al., 2010; Diele-Viegas et al., 2020). Rising environmental temperatures lead to a reduction in the thermal niche, by reducing the number of hours a day that a species can remain active without overheating (Sinervo et al., 2010; Diele-Viegas et al., 2019). The combined ef-

fects of habitat loss and global warming, together with species endemism, contribute to a preoccupying scenario for these species, and may greatly increase the risk of extinction, especially for the species that are already endangered. This scenario is worrying for lepidosaurian species around the world (Diele-Viegas *et al.*, 2020) and this reinforces the need for the development of adequate policies for the protection and conservation of reptile species, most of which are under considerable threat, and are likely to suffer extinction, on some scale, in the near future (Sinervo *et al.*, 2010). These conservation initiatives are needed urgently in species-rich regions such as Rio de Janeiro state. One complementary strategy is the reintroduction of species, as in the case of *Liolaemus lutzae*, following a systematic program of habitat recovery, which allowed the species to return to its area of origin (Rocha *et al.*, 2009c). Special care is also required for the endemic and threatened lizard *Glaucomastix littorallis*, which is now restricted to only four isolated areas of restinga, one of the most impacted and endangered ecosystems in Brazil.

As the most recent evaluation of the conservation status of the reptiles of Rio de Janeiro was published two decades ago (Rocha *et al.*, 2000), the findings of the present study reinforce the need for a revision of the listing. Clearly, new inventories are also still needed, in particular in the north of the state, and the results of this research will also be important for the development of effective public conservation policies. Taxonomic studies are also needed to clarify unresolved issues in specific reptile groups, in order to best elucidate their phylogenetic relationships. A better understanding of the distribution patterns of the reptile species found in the state of Rio de Janeiro and their association with habitat loss and knowledge gaps on the ecology of the state's fauna will contribute to the management of protected areas and the creation of new conservation units in the state.

### Authors' Contributions Statement

JCFO, RCG and PP identified the species in herpetological collections and wrote the manuscript. All the authors actively participated in the results, discussion, reviewed and approved the final version of the paper.

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