



A new and threatened species of *Scinax* (Anura: Hylidae) from Queimada Grande Island, southeastern Brazil

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Abstract

We describe a new species of hylid frog, *Scinax peixotoi*, from Queimada Grande Island, southeastern Brazil. The new species belongs to the *Scinax perpusillus* species group, in which all known forms inhabit bromeliads, and is diagnosed by the following set of characters: moderate-size (males 18.8–20.7 mm SVL, females 22.4–25.1 mm SVL); canthus rostralis distinct; dorsal skin slightly rugose; and a distinct advertisement call with relatively low dominant frequency. The new species is known from a single population on Queimada Grande, an island of 43 ha, approximately 33 km distant from the coast of São Paulo State, where it inhabits scattered patches of bromeliads. The highly specialized and patchy habitat of *S. peixotoi*, associated with its small range size, make this species highly susceptible to stochastic or anthropogenic habitat disturbances, which could lead it to extinction.

Key words: Atlantic forest; new species; *Scinax*; Southeastern Brazil; Habitat specialization; Conservation

Introduction

The treefrog genus *Scinax* Wagler, 1830 contains 89 recognized species (Frost 2006) that in the part were arranged into seven species groups: *S. catharinae*, *S. perpusillus*, *S. rizibilis*, *S. rostratus*, *S. ruber*, *S. staufferi*, and *S. x-signatus* (Duellman and Wiens, 1992). More recently, the *S. rizibilis* and *S. x-signatus* species groups were considered synonyms of the *S. catharinae* and *S. ruber* groups, respectively (Pombal et al. 1995 a, b). In a cladistic analysis of the genus *Scinax*, Faivovich (2002) recognized only three species groups: *S. catharinae*, *S. ruber*, and *S. perpusillus*. Peixoto (1987) was the first to propose the *Scinax perpusillus* group, characterized by small species that breed exclusively in bromeliads, rosette-like plants capable of storing water in their leaf axils.

Seven species are currently recognized in the *Scinax perpusillus* group: *Scinax alcatraz* (Lutz, 1973); *S. atratus* Peixoto, 1988; *S. arduous* Peixoto, 2002; *S. littoreus* Peixoto, 1988; *S. melloi* Peixoto, 1988; *S. perpusillus* (Lutz and Lutz, 1939); and *S. v-signatus* (Lutz, 1968). All known forms of the *perpusillus* species group are found exclusively in terrestrial and arboreal bromeliads (e. g., Peixoto, 1987; Oliveira and Navas, 2004), and the entire clade is endemic to the Atlantic Forest of southeastern Brazil.

Lutz (1973) mentioned a distinct form of *Scinax perpusillus* from Queimada Grande Island in her catalogue of Brazilian hylids, but did not describe it formally. Likewise, Peixoto (1986), in his PhD thesis, recognized the population of Queimada Grande as a potentially new species based on poorly preserved specimens deposited in Museu de Zoologia, Universidade de São Paulo, but did not describe it formally.

Here, we describe the population related to *Scinax perpusillus* from Queimada Grande Island as a new species based on recently collected material and preserved specimens from Museu de Zoologia, Universidade de São Paulo. We also compare the advertisement call of the new species to its mainland congeners and discuss its conservation status.

Material and Methods

All specimens examined are deposited in the following collections: CFBH (Célio F. B. Haddad collection, Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro, SP, Brasil), EI (Eugênio Izecksohn collection, Departamento de Biologia Animal, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, Seropédica, RJ, Brasil), MZUSP (Museu de Zoologia, Universidade de São Paulo, São Paulo, SP, Brasil), ZUEC (Museu de História Natural, Universidade Estadual de Campinas, Campinas, SP, Brasil), ZUFRJ (Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brasil), WCAB (Werner C. A. Bokermann collection at the Museu de Zoologia, Universidade de São Paulo, São Paulo, SP, Brasil) and MNRJ (Museu Nacional, Universidade Federal do Rio de Janeiro, RJ, Brasil).

Using digital calipers, we took the following measurements to the nearest 0.01 mm from 20 specimens: snout-vent length (SVL), head length (HL), head width (HW), thigh length (THL), tibia length (TBL), foot length (FL), and hand length (HaL); we also measured eye diameter (ED), tympanum diameter (TD), interorbital distance (IOD), eye-nostril distance (END), and internostril distance (IND), using a stereomicroscope. All measurements follow Heyer et al. (1990), and Duellman et al. (1997). Webbing formula follows Savage and Heyer (1967) as modified by Myers and Duellman (1982). Description of the snout shape was based on Cei (1980). All specimens collected were anesthetized with 5% xylocaine, fixed in 10% formalin, and transferred to 70% ethanol for permanent storage. Drawings of the holotype were made using a Zeiss stereomicroscope with a drawing tube.

Vocalizations were recorded in the field with a Marantz PMD 222 tape recorder coupled to a Sennheiser ME 66 microphone. The spectrogram and waveform were analyzed using the software Raven 1.2.1 (Cornell Laboratory of Ornithology, Ithaca, USA), with fast Fourier transform (FFT) of 512 points.

Results

Scinax peixotoi sp. n.

Scinax perpusillus queimadensis Lutz, 1973 *Nomen Nudum*

Holotype. CFBH 9437 (Fig. 1), adult male, collected at Queimada Grande Island, Municipality of Itanhaém, São Paulo state, Brazil, on 20 January 2002, by C. A. Brasileiro, R. J. Sawaya, and O.V. Marques.

Paratopotypes. Collected with the holotype: CFBH 9440, adult female; CFBH 09438-09439, adult males; ZUEC 13240, adult male; ZUEC 13241, adult female; MNRJ 39757, adult male. Collected at Queimada Grande Island by A. R. Hoge and A. T. Leão on 22 June 1947: MZUSP 31283, 31286-31287, 31291, 31293-31297, 31299, adult males; MZUSP 312884-312885, 312888, adult females. Collected at Queimada Grande Island by R. J. Sawaya on 17 December 2004: MNRJ 39758 adult female.

Diagnosis. *Scinax peixotoi* is a moderate-sized species (males 18.8–20.7 mm SVL, females 22.4–25.1 mm SVL) relative to other species of the *Scinax perpusillus* group (Peixoto 1987, Duellman & Wiens 1992; Faivovich 2002). The species is characterized by (1) snout protruding in lateral view and subacuminate in dorsal view, (2) canthus rostralis distinct and well defined, (3) head slightly longer than wide, (4) loreal region

weakly concave, (5) protruding eyes, (6) internostrils distance similar to eye diameter, (7) tibia + thigh size same or greater than SVL; (8) vestigial webbing between toes I and II, II and III, (9) dorsal skin texture slightly rugose, and (10) in preservative, dorsum silvery-colored.



FIGURE 1. *Scinax peixotoi*, CFBH 9437 (holotype), adult male in life from Queimada Grande Island, Itanhaém, São Paulo, southeastern Brazil. SVL = 20.3 mm. Photo by O. A. V. Marques.

Comparison with other species. *Scinax peixotoi* differs from *S. alcatraz* by its smaller size (*S. alcatraz* males: 19.7–24.4 mm SVL; females 27.0–29.8 mm SVL), a wider head (SVL/HW *S. peixotoi* 2.7–3.2, *S. alcatraz* 2.6–2.9), loreal region more concave, canthus rostralis more evident, smaller and less pronounced eyes, larger distance between nostrils (IND/HW *S. peixotoi* 0.28–0.39; *S. alcatraz* 0.21–0.25), more rugose dorsal skin texture, and silvery and more ornamented dorsum. *Scinax peixotoi* differs from *S. arduous* by its more robust body shape, less protruding eye, more protruding snout, less wider head (SVL/HW males of *S. arduous* 2.9–3.4;), loreal region less concave; absence of tubercles on the loreal region, and less metallic dorsum color. *Scinax peixotoi* differs from *S. atratus* by its larger size (maximum SVL of males of *S. atratus* 19.2 mm, maximum SVL of females 20.0 mm; Peixoto, 1988), more robust body shape, more evident canthus rostralis, loreal region more concave, and tibia and thigh with the same size (tibia much larger than thigh in *S. atratus*);. *Scinax peixotoi* differs from *S. littoreus* by its more rugose dorsal skin texture, presence of supratympanic folder (absent in *S. littoreus*), protruding snout in lateral view (little truncate in *S. littoreus*), and silvery and more ornamented dorsal color pattern. *Scinax peixotoi* differs from *S. melloi* by its larger size (SVL of males *S. melloi*, 15.9–17.00 mm, N = 10), shorter head (SVL/HL *S. peixotoi* 2.3–2.6; *S. melloi* 2.5–2.8), larger distance between nostrils (IND/HW *S. peixotoi* 0.28–0.39; *S. melloi* 0.23–0.30), more rugose dorsal skin texture, less variable dorsal pattern, and less keratinized inner metacarpal tubercule. *Scinax peixotoi* differs from *S. perpusillus* by its more robust body shape, wider head (SVL/HW *S. perpusillus* 2.6–3.0; SVL/HW *S. peixotoi* 2.7–3.2), smaller eye diameter (DO/SVL *S. perpusillus* 0.12–0.14; *S. peixotoi* 0.09–0.12), more protruding snout, presence of supratympanic folder (absent in *S. perpusillus*), and distinct dorsal color pattern. *Scinax*

peixotoi differs from *S. v-signatus* by its more rounded canthus rostralis, less wider (SVL/HW *S. v-signatus*: 3.3–3.9; SVL/HW *S. peixotoi* 2.7–3.2) and less long head (SVL/HL *S. v-signatus* 2.4–2.6; *S. peixotoi* 2.3–2.6); smaller eye diameter (DO/SVL *S. v-signatus* 0.11–0.14); tibia with the same size as the thigh (tibia larger than thigh in *S. v-signatus*); distinct dorsal color pattern, and no evident v-shaped dark mark on dorsum.

The advertisement calls of *Scinax peixotoi* (see below) differ from those of *S. arduous* and *S. perpusillus* recorded at their type-locality (Pombal & Bastos, 2002). The notes in the call of *S. peixotoi* are considerably shorter and exhibit a lower dominant frequency compared to those of *S. arduous* (mean note duration 25 ms; mean dominant frequency 4301 Hz). The notes of *S. peixotoi* are longer and have lower frequency compared to those of *S. perpusillus* (mean note duration 14 ms; mean dominant frequency 4913 Hz).

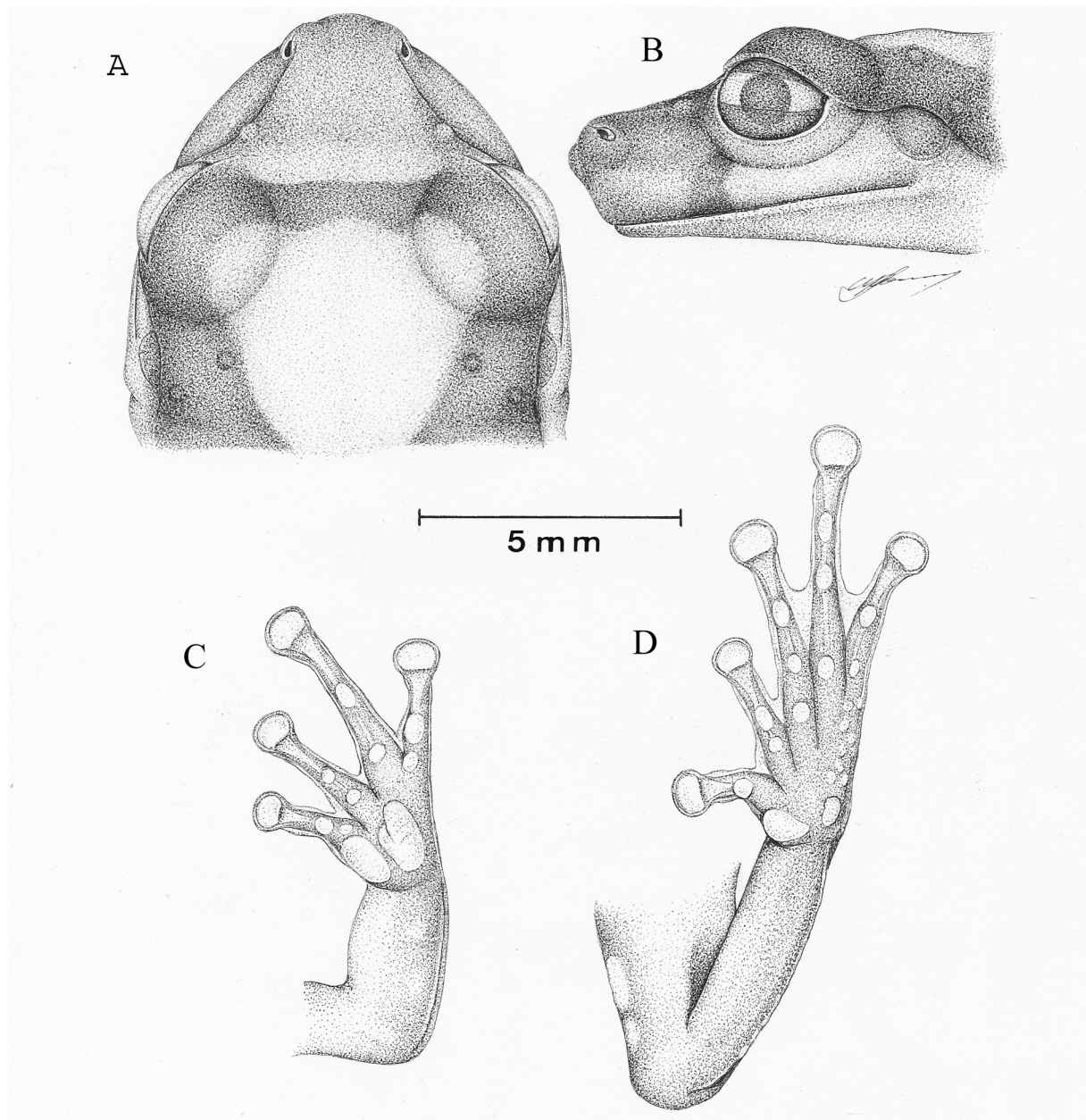


FIGURE 2. *Scinax peixotoi* CFBH 9437 (holotype). (A) Dorsal and (B) lateral views of head; ventral views of (C) left hand and (D) foot.

Description of holotype. Body robust (Fig. 1); head longer than wide; snout protruding in lateral view and subacuminate in dorsal view (Fig. 2A, B); nostrils rounded, canthus rostralis distinct, slightly rounded; loreal region weakly concave; eye protuberant; tympanum distinct, diameter about half of the eye diameter;

weak supratympanic fold from tympanic region to shoulder; discrete subgular vocal sac; tongue round and large; vomerine teeth in two arc shape series; medium-sized, elliptical choannae. Arms slender; forearms slightly robust, outer metacarpal tubercle large and bifid, inner metacarpal tubercle elliptic; subarticular tubercles rounded, single; fingers without webbing; finger lengths $IV < I < II < III$ (Fig. 2 C). Legs robust; tibia longer than thigh; feet with an elliptical inner metatarsal tubercle; round outer metatarsal tubercle; subarticular tubercles rounded, single, toe lengths $I < II < V < III < IV$ (Fig. 2 D); foot webbing formula $I-2^{+}II\ 2^{+}-3^{+}III\ 1^{+}-2IV\ 2-1^{+}V$. Dorsal and ventral skin texture rugose.

Color in preservative of the holotype. Dorsum light silvery with a dark brown lateral stripe; tibia and thigh with dark brown transverse stripes; throat with black spots; venter white; undersurfaces of throat, arms, hands, fingers, thighs, tibiae, feet, and toes, white with dark spots.

Color in life of the holotype. Dorsum brownish; a dark brown line on the canthus rostralis, upper eyelids, and supratympanic fold; interorbital dark brown line; upper surface of thigh and tibia distinct with dark transverse stripes; hidden portion of shanks with irregular yellow flash color spots. Iris golden with a horizontal black bar.

Measurements of the holotype (mm). SVL 20.3, HL 8.2, HW 6.8, ED 2.3, TD 1.1, IOD 2.3, END 2.4, IND 2.2, THL 9.4, TBL 10.4, FL 7.7, HL 5.5.

Variation in the type series. In preservative, coloration of dorsum varies from light gray to dark gray. Interorbital bar and dorsal bars sometimes not evident in dark gray individuals. Females larger than males. Adhesive disks more developed in females. Females lack vocal sac and vocal slits. Measurements of 15 males and five females are presented in Table 1.

TABLE 1. Measurements (in mm) of males and females of the type series of *Scinax peixotoi*. Snout-vent length (SVL), head length (HL), head width (HW), tympanum diameter (TD), eye diameter (ED), interorbital distance (IOD), eye-nos-tril distance (END), internostril distance (IND), thigh length (THL), tibia length (TBL), foot length (FL), and hand length (HaL).

	Males (N = 15)			Females (N = 5)		
	\bar{x}	SD	Range	\bar{x}	SD	Range
SVL	19.8	0.8	18.8–20.7	24.1	1.1	22.4–25.1
HL	8.1	0.3	7.7–8.8	9.6	0.4	9.1–10.2
HW	6.8	0.4	6.2–7.3	8.3	0.3	8.1–8.7
TD	1.2	0.1	1.0–1.5	1.3	0.1	1.2–1.5
ED	2.2	0.1	2.0–2.4	2.5	0.3	2.0–2.8
IOD	2.3	0.2	1.9–2.6	3.4	0.1	3.5–4.6
END	2.5	0.1	2.4–2.8	3.2	0.2	2.8–3.4
IND	2.2	0.4	2.0–3.2	2.4	0.1	2.3–2.6
THL	9.0	0.7	8.2–9.9	11.6	0.3	11.3–11.8
TBL	10.7	0.4	9.9–11.1	12.8	0.4	12.4–13.5
FL	7.5	0.6	6.0–8.4	9.5	0.4	8.9–9.6
HaL	5.3	0.3	4.9–6.0	6.5	0.2	6.2–6.7

Vocalizations. Calls of two males of *Scinax peixotoi* were recorded on the night of 17 January 2002 just after a storm, at the same locality the holotype was captured. Thirty calls of those two males were analyzed. Air temperature during recordings was 23 °C. Each call is composed by 3–5 notes ($\bar{x} = 3.9 \pm 0.7$ notes, N = 20 calls), with duration of 9–28 ms ($\bar{x} = 17 \pm 7$ ms; N = 15 notes). Notes consisted of 4–9 pulses ($\bar{x} = 6.2 \pm 1.4$ pulses, N = 30 notes) with duration range of 1–3 ms ($\bar{x} = 1.6 \pm 0.6$ ms, N = 55 pulses). Call duration ranged

from 146 to 232 ms ($\bar{x} = 185.0 \pm 23.8$ ms, $N = 30$ calls) and the interval between notes varied from 438 to 2400 ms ($\bar{x} = 996 \pm 232$ ms, $N = 30$). The dominant frequency was 3777 ± 208 Hz (3617–3963 Hz, $N = 25$ calls).

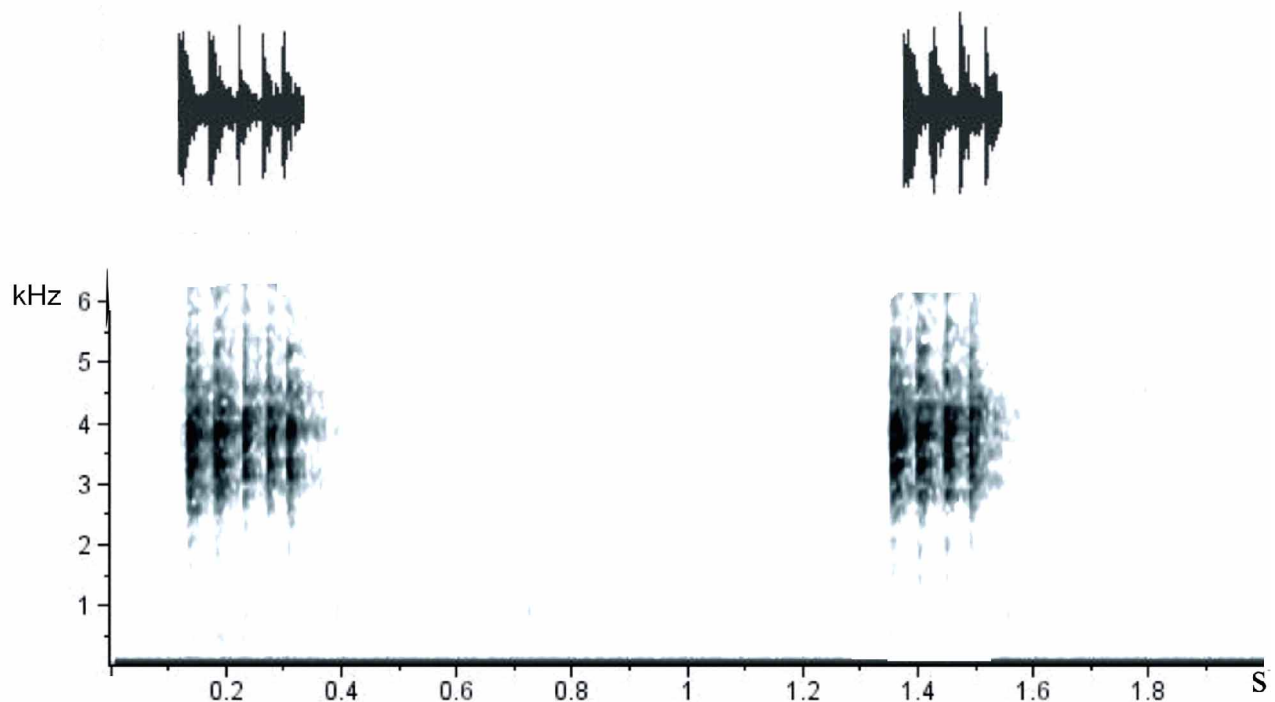


FIGURE 3. Waveform (upper) and spectrogram (lower) of two advertisement calls of *Scinax peixotoi* recorded at 21:30h at Queimada Grande Island, municipality of Itanhaém, São Paulo, Brazil. Air temperature = 23 °C.

Natural history. We visited Queimada Grande Island six times during the period of 2001–2005. Visits occurred in January, April, May, and December. We observed calling and reproductive behavior only in January 2002. Males called at night from the leaves of ground bromeliads (ca 40–60 cm in diameter) on a rock outcrop, frequently in a head-up vertical posture. Females were also found on bromeliad leaves. As observed in other species of the *S. perpusillus* species group (Oliveira and Navas, 2004), *S. peixotoi* tend to favor clustered bromeliads, as we never observed calling males in isolated plants throughout the island. All type specimens were collected at a single large patch of bromeliads at an altitude of ca. 50 m.

Distribution. *Scinax peixotoi* is known only from Queimada Grande Island (24°29'S; 46°41'W), a 43 ha island about 33 km from the coast of Itanhaém, in southern coast São Paulo state.

Etymology. The specific name honors Oswaldo L. Peixoto, the first herpetologist to recognize *S. peixotoi* as a distinct species, and for his contributions to our understanding of the *Scinax perpusillus* group.

Remarks

The evolutionary history and speciation of *S. peixotoi* probably is similar to that of the golden lancehead (*Bothrops insularis* Amaral, 1921), another endemic species of Queimada Grande Island (Marques et al., 2002a, b). The isolation of *S. perpusillus*-like ancestor in Queimada Grande Island may have occurred during one or more of the several oscillations of sea level during the Pleistocene (Martin et al., 1986), the last of which occurred about 11,000 years ago (Souza et al., 2005).

Most of the area of the Queimada Grande is still covered by native Atlantic forest, especially those parts located in the western slopes and on the mountaintops of the island. The forest on the eastern slope is much

shorter because of frequent exposure to strong winds carrying salt from the sea. Approximately one fifth of the area originally covered by forests is now covered by introduced grasses. Those areas were burned in the first half of the 20th century (Marques et al., 2002) and forest regeneration in these grassy areas is extremely slow, because they are primarily on the eastern slopes of the island.

Scinax peixotoi seems to be relatively rare at Queimada Grande Island. The bromeliads in which this species is found are patchily distributed. Therefore, the total distribution of the species is likely to be much smaller than the total island area. Species may be rare as a result of three different factors: local population density, geographical range, and variety of habitats occupied (Rabinowitz et al., 1986). *Scinax peixotoi* is a rare species due to a combination of all these three factors, which makes this species especially susceptible to stochastic or anthropogenic habitat disturbance. For instance, a widespread fire on the island could completely destroy the available habitat for this and other endemic species (Marques et al., 2002a, b). Critical priorities for conservation of *S. peixotoi* are to survey *S. peixotoi* aggregations throughout the island, estimate population size, and evaluate the quality and distribution of its habitat (bromeliad patches).

Queimada Grande Island is a federally protected area in the Brazilian conservation category “Área de Relevante Interesse Ecológico” (area of relevant ecological interest), with the objective of maintaining natural ecosystems of regional or local importance and regulating their use (Brasil, 2002). This category is equivalent to a Natural Monument (Category III) under the classification of protected area management categories by IUCN (1994). However, despite this legal protection, there are still habitat disturbances occurring in the island, such as removal of small patches of forest (Marques et al., 2002a). Additional enforcement of the conservation status of the Queimada Grande Island is needed to maintain the only known population of *S. peixotoi*. Based on the available information, *S. peixotoi* should be included in the category Critically Endangered of the IUCN Red List of Threatened Animals (IUCN, 2006; www.redlist.org)

Acknowledgments

We thank the Estação Ecológica de Tupiniquins, Instituto de Biociências of the Universidade de São Paulo, and Instituto de Biologia da Conservação for logistical support; Fapesp (00/12339-2, 01/13341-3), Fundação O Boticário para Proteção da Natureza (0294_19971; 613_20041), and Idea Wild for financial support, and Ibama for the permission to collect specimens (156/2004). O. V. Marques and K. R. Zamudio helped with field work. J. Somera made the line drawings. Hussam Zaher (MZUSP) Oswaldo L. Peixoto (EI-URRJ), and José P. Pombal Jr. (MNRJ) provided access to specimens of the *Scinax perpusillus* group under their care. I. Sazima, K. R. Zamudio, C. P. A. Prado and C. Barrio commented on earlier drafts of the manuscript. CAB and RJS thank Fapesp (03/06014-1 and 03/09568-8) for Post-doctoral fellowships and CFBH, MM, and RJS thank CNPq for research support.

References

- Brasil (2002). Sistema Nacional de Unidades de Conservação. Ministério do Meio Ambiente, Brasília.
- Cei, J.M. (1980). Amphibians of Argentina. Monit. Zool. Ital. (n.s.) Monogr. 2, 1–609.
- Duellman, W.E., & Wiens, J.J. (1992) The status of the hylids frog genus *Oloolygon* and the recognition of *Scinax* Wagler, 1830. Occasional Papers of the Museum of Natural History, University of Kansas, 151, 1–23.
- Duellman, W.E., I. De La Riva & Wild, F.R. (1997) Frogs of the *Hyla armata* and *Hyla pulchella* groups in the Andes of South America with definitions and analysis of phylogenetic relationships of Andean groups of *Hyla*. Scientific Papers, Natural History Museum of the University of Kansas, 3, 1–41.
- Faivovich, J. 2002. A cladistic analysis of *Scinax* (Anura:Hylidae). Cladistics 18, 367–393.
- Heyer, W.R., Rand, A.S., da Cruz C.A.G., Peixoto, O.L. & Nelson C.E. (1990) Frogs of Boracéia. Arquivos de Zoologia. S. Paulo, 31, 231–410.

- IUCN, (1994) Guidelines for protected area management categories. IUCN, Gland. Lutz, B. (1973). Brazilian species of *Hyla*. University of Texas Press, Austin & London.
- Marques, O.A.V., Martins, M. & Sazima, I. (2002a) A jararaca da Ilha da Queimada Grande. *Ciência Hoje*, 31, 56–59.
- Marques, O.A.V., M. Martins & Sazima I. (2002b) A new insular pitviper from Brazil, with comments on the evolutionary biology and conservation of the *Bothrops jararaca* group (Serpentes, Viperidae). *Herpetologica*, 58, 303–312.
- Martin, L., N.A. Mörner, J.M. Flexor & Suguio K. (1986) Fundamentos e reconstrução de antigos níveis marinhos do Quaternário. *Boletim do Instituto de Geociências, Publicação Especial*, 4, 1–161.
- Myers, C.W. & Duellmann E. (1982) A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from western Panama. *American Museum Novitates*, 2752, 1–32.
- Oliveira, F.B. & C.A. Navas (2004) Plant selection and seasonal patterns of vocal activity in two population of Bromeliogen treefrog *Scinax perpusillus* (Anura; Hylidae). *Journal of Herpetology*, 38(3), 331–339.
- Peixoto, O.L. (1986) Espécies bromelígenas do gênero *Oloolygon*; o grupo “*perpusilla*” (Amphibia. Anura, Hylidae). Tese de Doutorado, Inst. Biociências, Universidade de São Paulo, São Paulo, Brasil.
- Peixoto, O.L. (1987) Caracterização do grupo “*perpusillus*” e revalidação da posição taxonômica de *Oloolygon perpusilla perpusilla* e *Oloolygon perpusilla v-signata* (Amphibia, Anura, Hylidae). *Arquivos da Universidade Federal Rural do Rio de Janeiro, Itaguaí*, 10 (1/2), 37–49.
- Peixoto, O.L. (1988) Sobre o “status” taxonômico de *Hyla catharinae alcatraz* B. Lutz 1973, com a descrição de uma nova espécie para o grupo “*perpusilla*” (Amphibia, Anura, Hylidae). *Acta Biologica Leopoldesia*, 10, 253–267.
- Peixoto, O.L. (1988). Duas novas espécies de *Oloolygon* do Grupo “*perpusilla*” (Amphibia, Anura, Hylidae). *Arquivos da Universidade Federal Rural do Rio de Janeiro, Itaguaí*, 10, 27–37.
- Peixoto, O.L. (2002) Uma nova espécie de *Scinax* do grupo “*perpusillus*” para Santa Teresa, Estado do Espírito Santo, Brasil (Amphibia, Anura, Hylidae). *Boletim do Museu Biológico Mello Leitão (N. Sér.)*, 13, 7–15.
- Pombal, J.P. Jr. & Bastos R. P. (2003) Vocalizações de *Scinax perpusillus* (A. Lutz & B. Lutz) e *S. arduous* Peixoto (Anura, Hylidae), com comentários taxonômicos. *Revista Brasileira de Zoologia*, 20(4), 607–610.
- Rabinowitz, D., Cairns, S. & Dillon, T. (1986) Seven forms of rarity and their frequency in the flora of the British Isles. Pp. 182–204. *In*: Conservation biology, the science of scarcity and diversity, Soulé, M. E. (ed.). Sinauer, Sunderland, Mass.
- Savage, J.M. & W.R. Heyer. (1967) Variation and distribution in tree-frog genus *Phyllomedusa* in Costa Rica, Central America. *Beitr. Neotropical Fauna*, 5, 111–131
- Souza, C.R. de G., Suguio, K., Oliveira, A.M. dos S. & Oliveira, P.E. (2005) Quaternário do Brasil. Holos Editora. Ribeirão Preto, SP, Brazil.

Appendix 1: Additional specimens examined:

Scinax alcatraz (topotypes): CFBH 10457-10463; *Scinax arduous* (topotypes): EI (two individuals), MNRJ 34926-34930; *Scinax atratus*: (topotypes): WCAB 49641; *S. littoreous* (topotypes): EI 7570/71, MNRJ 32380-32382 (Arraial do Cabo, RJ); *Scinax melloi*: MZUSP 110639, 110648, 110664, 110666 (Teresópolis, RJ, Brazil), MZUSP 105826, 105829, 105835, 105846 (Serra dos Órgãos, RJ, Brazil), EI 6945, 6948; *Scinax perpusillus* (topotypes): CFBH 1465, WCAB 12859, MNRJ 40644-40659; *Scinax v-signatus* : MZUSP 105921, 105926, 105954, 105959, 76492 (Serra dos Órgãos, RJ, Brazil); MNRJ 43126-43130 (Teresópolis, RJ).