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Amphibians and Reptiles of Taim, a Brazilian Ramsar Site: Current Knowledge and a Possible Case of Local Extinction

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Abstract.—**The Taim Ecological Station (ESEC Taim) encompasses Brazilian wetlands and has been recognized since 2006 for its unique, worldwide importance by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) under the Ramsar Convention on wetlands. Despite the importance of this region, however, its herpetofauna is relatively unknown with no updates since a preliminary species list was compiled in the 1980s. Here, we present an updated list of the amphibian and reptile species in ESEC Taim, critically review the previously available list, and suggest two possible local extinction events since the 1980s. We based the update on field sampling carried out between 2009 and 2018 complemented with the compilation of specimens from scientific collections obtained over decades of sampling. We recorded 47 species, including 18 amphibians and 29 reptiles. Among the amphibians, 17 species are anurans and one is a caecilian. The reptiles include two amphisbaenians, 18 snakes, four lizards, four tortoises, and one caiman. The families Hylidae and Leptodactylidae were the most well represented amphibians (75% of the total number of species), whereas over half (53%) of the reptile species were in the family Dipsadidae. This list includes eight new snake species for ESEC Taim, as well as taxonomic updates and corrections regarding the identification of some species included on previous lists. We also propose the exclusion of two amphibian species previously included in the list from the 1980s. This work is of particular conservation importance both because of the uniqueness of this wetland area and because it is an example of a conservation area lacking a surrounding buffer zones.**

Key Words.—Anura; Chelonia; Crocodilia; Gymnophiona; Squamata; subtropical; wetlands

Introduction

Non-avian reptiles and amphibians play major, complex roles in ecosystem functioning, acting as prey and predators of many organisms (Huckembeck et al. 2014; Whiles et al. 2006). Herpetological inventories are a basic step to understanding these dynamics and many other ecological interactions among species/guilds across space and time. As just one example among others, the description of the trophic web of a threatened lizard based on stable isotopes revealed a link between coastal sand-dune habitats and freshwater wetlands in southern Brazil (Martins et al. 2021). This information is valuable for ecosystem management.

Unfortunately, there is still a lack of basic information regarding the faunal composition of many habitats that are conservation priorities and one example of this is the Taim Ecological Station (ESEC Taim). This site was decreed as a federal conservation unit in southern Brazil in the 1980s (Decree nº 92.963, 21/06/1986). Taim is recognized worldwide as a priority area for the conservation of freshwater wetlands and is listed under the Ramsar Convention site by the United Nations Educational, Scientific and Cultural Organization (UNESCO; https://rsis.ramsar.org/ris/2298) but has been never comprehensively evaluated to determine its herpetofauna composition.

Some research has attempted to document the biodiversity of Taim. A preliminary species list for Taim was published in the 1980s (Gayer et al. 1988; Gomes and Krause 1982); however, because it was intended as a pioneer study, the list is incomplete. In recent decades,

many herpetological studies have been performed at Taim, but all of them focused on particular taxonomic groups (e.g., lizards, snakes, and frogs). Although none of these studies attempted a global evaluation of the herpetological communities, some of the samplings at Taim led to specimen collection. These specimens were deposited in different herpetological museums and provide a valuable addition to knowledge of the species in the region (dos Santos et al. 2020; Dalmonlin et al. 2021).

An additional reason that updated information on the herpetofauna of Taim is needed is to reinforce the role of this protected area as a wildlife refuge for many species (Fernandes et al. 2017; Pereira et al. 2019), and to help initiatives to combat threats as roadkill, alien species, and light pollution (Dias et al. 2019; Quintela et al. 2019). Taim is located within a matrix of private properties formed by flooded grasslands with different levels of conservation (Da Costa and Sato 2019). Grasslands that suffer less human interference are used as pastures for livestock, although most of the surrounding area has been converted to irrigated rice plantations. Therefore, functional buffer areas beyond the polygon that define the limits of ESEC Taim are practically nonexistent, and the surrounding agricultural areas influence water quality and the water cycle (Motta Marques and Villanueva 2001).

Because there have been no comprehensive studies of the herpetofauna of ESEC Taim since the preliminary inventories in the 1980s, we set out to revise and update these lists. This is a first step critical in updating management plans and efforts to preserve this valuable wetland. Additionally, this wetland may provide opportunities for future studies that give insights into the best approaches to managing threats to critical conservation areas that lack buffer zones. It is well know that the Taim has a high degree of physical connections with surrounding areas (Kurtz et al. 2003; Da Costa et al. 2019), which are driven by the flat terrain that resembles a single habitat during the peak of flooding season. It is evident that Taim offers a habitat for a wide range of species, but they are not restricted to the limits of Taim conservation unit. Therefore, we believe that our findings will be useful as guidelines for future discussions about management needs for the entire region.

Materials and Methods

Study site.—We conducted sampling in ESEC Taim, which is located on the coastal plain of the state of Rio Grande do Sul in the municipalities of Rio Grande and Santa Vitória do Palmar (32°20'S and 33°00' S, 52°20'W and 52°45' W; Fig. 1). ESEC Taim is the second-largest protected area in the Pampa biome, covering approximately 32,797 ha. Taim is formed by coastal habitats, such as sand dunes, freshwater wetlands, *restingas*, grasslands, and subtropical forest-like habitats, which increase the expected species richness. Also, Taim is inserted into a matrix of private properties formed by flooded fields with different levels of conservation, some of which have been formed by pastures and agricultural areas. The climate of the region is classified as super-humid mesothermal, with average annual maximum temperatures of 23.3° C and average minimum of 12.7° C (Vieira 1983). Rainfall is evenly distributed throughout the year with an annual average of 1,252 mm (Vieira 1983), which, in association with the flat relief, favors the non-seasonal formation of temporary water bodies.

Field sampling.—We concentrated sampling in the habitats with the largest areas in ESEC Taim. These habitats are highly distinctive (e.g., fields, wetlands, dunes, and dense forest). The sampling effort overall was nonrandom as we wished to obtain as many observations as possible and worked with collaborators who were able to make observations in the area during the study period using the same sampling methods.

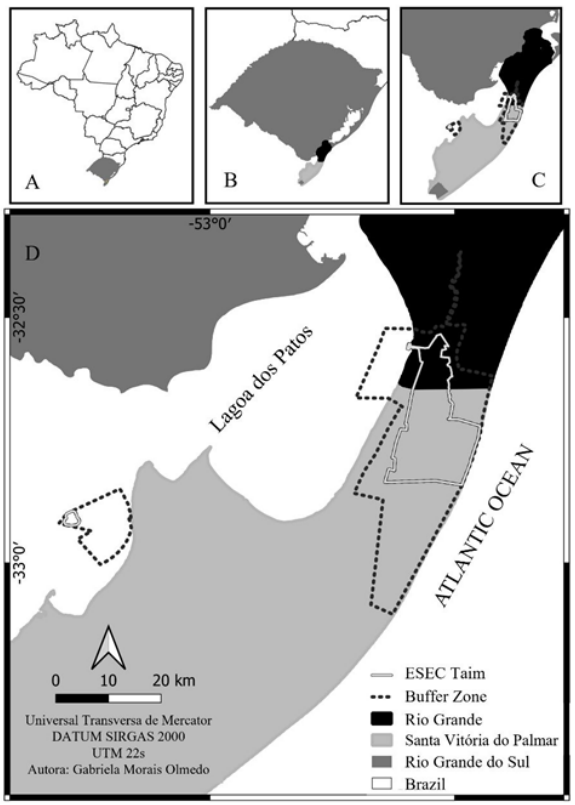

Figure 1. Study area in Brazil (A) highlighting the state of Rio Grande do Sul, (B) Rio Grande do Sul highlighting Rio Grande and Santa Vitória do Palmar, and (C) and (D) highlighting the limits of ESEC Taim and Buffer Zone.

Although this maximized sampling effort, it precludes statistical comparisons or estimates of exact number of person-hours of sampling per habitat type. We did, however, standardize the search schedule to 4 d/mo from 2012 to 2016.

We used three complementary methods to detect amphibians and reptiles: (1) nocturnal visual searches; (2) call surveys; and (3) pitfall trap captures (Heyer et al. 1994). Between 2008 and 2011, we only used visual search and calling surveys and sampled only in the warmest period of the year (August to March) on an irregular schedule. For each set of 4-d field surveys, an average of three researchers spent 4 h per night conducting visual search and calling surveys and we evaluated all Taim habitats (fields, wetlands, dunes, dense forest). We combined visual search with calling surveys between 2000 and 2330 in amphibian breeding sites (pools and ponds).

Between 2011 and 2013, we started sampling by pitfall trap in addition to continuing all previous methods. We used 104 pitfall buckets distributed across grasslands, wetlands, dunes, and dense forests. We kept the buckets in operation for four consecutive days and then closed them to prevent accidental catches. We reopened them at bi-weekly intervals. The buckets had a volume of 110 L, sufficient to capture the largest snakes recorded in the region. We installed pitfall traps in 40-m-long lines with four buried buckets following the description of Cechin and Martins (2000) and Oliveira (2011). In each row, we separated the buckets by 13.3 m and connected them with a mosquito net (60 cm tall) that was used as a guide fence. We buried the guide fence 10 cm into the ground to prevent individuals from crossing it (Cechin and Martins 2000).

Data survey in scientific collections.—To complement the data we collected, we visited four scientific collections: (1) the Herpetological Collection of the Universidade Federal do Rio Grande (FURG); (2) the Herpetological Collections of the Natural Sciences Museum of the Secretaria Estadual do Meio Ambiente e Infraestrutura do Rio Grande do Sul (MCN): (3) the Herpetological Collection of the Universidade Federal do Rio Grande do Sul (UFRGS); and (4) the Herpetological Collection of the Universidade do Vale do Rio dos Sinos (UNISINOS). We reviewed species with only one collected specimen or with dubious identification. We also compiled data from the literature with preliminary herpetological inventories in the Estação Ecológica do Taim. We based common names on Frank and Ramus (1995) and Ananjeva et al. (1988), except for the name *escuerzo* given to the Ornate Horned Frog (*Ceratophys ornata*) by the local inhabitants in the municipalities of Santa Vitória do Palmar and Chuí.

Results

Based on our field work and analysis of museum specimens, we identified 47 species (Supplemental Information Table S1) including some of particular conservation importance. Our results suggest the local extinction of two species: *Ceratophrys ornata* and the Hensel's Dwarf Frog (*Physalaemus henselii*). Also, we added eight snakes and one amphibian to the previous species list presented by Gomes and Krause (1982) and Gayer et al. (1988). We identified 18 amphibians, including 17 anurans, and one caecilian (Fig. 2). We also documented 29 reptiles, including two amphisbaenians, four lizards, four chelonians, one crocodilian (Fig. 3) and 18 snakes (Fig. 4). The families with the largest number of species were Hylidae (n = 7) and Leptodactylidae (n = 7) for anurans and Dipsadidae (n = 15) for reptiles.

Discussion

Although Taim is recognized by the Ramsar Convention as a priority area for the conservation of freshwater wetlands, this conservation unit has never been comprehensively evaluated to determine its herpetofauna composition. We have obtained more data to provide better documentation of its herpetological diversity. This information provides a better understanding of ecological processes in a poorly studied Brazilian ecosystem, the subtropical wetland. Our survey adds new species to those previously documented at Taim (Gomes and Krause 1982; Gayer et al. 1988) and suggests the possible local extinction of two species: *Ceratophrys ornata* and *Physalaemus henselii*. We added eight snakes to the previous species list presented by Gomes and Krause (1982): Mussurana (*Boiruna maculata*), Jararaca (*Bothrops pubescens*), Two-Headed Cipo (*Chironius gouveia*), Fronted Ground Snake (*Lygophis flavifrenatus*), False Coral Snake (*Oxyrhopus rhombifer*), Brazilian Green Racer (*Philodryas aestiva*), Wide Ground Snake (*Psomophis obtusus*), and Red Bellied Grass Snake (*Taeniophallus poecilopogon*). We also added one amphibian to the previous list by Gayer et al. (1988), Two-colored Oval Frog (*Elachistocleis bicolor*).

We removed and adjusted several records from the previous species lists as follows. We corrected the South American Hognose Snake (*Xenodon histricus*) to *X. dorbignyi* (UFRGS; Di Bernardo et al. 2003). The report of Darwin's Ringed Worm Lizard (*Amphisbaena darwinii trachura*; Gomes and Krause 1982) may have been an identification error as the taxonomy of *A. darwinii* has been in flux and only *A. darwinii* has been reported since in the region (consistent with recent taxonomic reviews by Perez et al. 2012). Two subspecies of Wied's Keelback (*Helicops carinicaudus*)

Figure 2. Amphibians of the Taim Ecological Station: (A) juvenile Common Toad (*Rhinella arenarum*); (B) Dorbigny's Toad (*Rhinella dorbignyi*); (C) White-banded Treefrog (*Boana pulchella*); (D) Lesser Treefrog (*Dendropsophus minutus*); (E) Sanborn's Treefrog (*Dendropsophus sanborni*); (F) Lesser Swimming Frog (*Pseudis minuta*); (G) Treefrog (*Scinax granulatus*); (H) Striped Snouted Treefrog (*Scinax squalirostris*); (I) Dwarf Snouted Treefrog (*Scinax berthae*); (J) Dumeril's Striped Frog (*Leptodactylus gracilis*); (K) Oven Frog (*Leptodactylus latinasus*); (L) Butter Frog (*Leptodactylus* aff. *luctator*); (M) Weeping Frog (*Physalaemus biligonigerus*); (N) Graceful Dwarf Frog (*Physalaemus gracilis*); (O) Hensel's Swamp Frog (*Pseudopaludicola falcipes*); (P) Two-colored Oval Frog (*Elachistocleis bicolor*); (Q) Lesser Ground Frog (*Odontophrynus maisuma*); (R) Caecilian (*Chthonerpeton indistinctum*). (Photographed by Daniel Loebmann).

were previously recognized, and the Water Snake (*H. c. infrataeniatus*) was later elevated to the species level (Deiques and Cechin 1991). We identified the species present in ESEC Taim as *H. infrataeniatus*. Although different forms of Military Ground Snake (*Liophis miliaris*) were recognized at the time of publication of the 1982 list by Gomes and Krause (misspelled as *Liophis militaris* in the publication; Gans 1964), Dixon (1983) later recognized that some of these were subspecies. The populations present in ESEC Taim correspond to *L. m. semiaureus*, which was later elevated to the species level by Giraudo et al. (2006). The Green Tegu (*Teius*

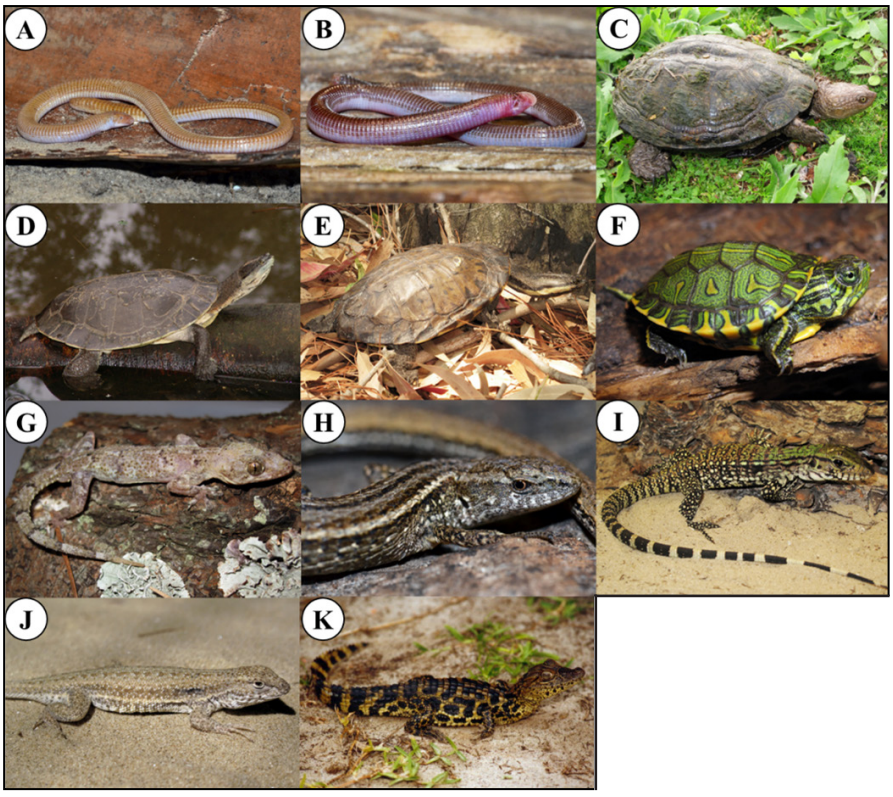

Figure 3. Reptiles of the Amphisbaenia, Chelonia, Lacertilia and Crocodylia groups of the Taim Ecological Station: (A) Darwin's Ringed Worm Lizard (*Amphisbaena darwinii*); (B) King's Worm Lizard (*Amphisbaena kingii*); (C) Black Spine-necked Swamp Turtle (*Acanthochelys spixii*); (D) Hilaire's Toadhead Turtle (*Phrynops hilarii*); (E) South-American Snake-headed Turtle (*Hydromedusa tectifera*); (F) juvenile Black-bellied Slider (*Trachemys dorbigni*); (G) House Gecko (*Hemidactylus mabouia*); (H) Long-tailed Little Lizard (*Cercosaura schreibersii*); (I) Argentine Giant Tegu (*Salvator merianae*); (J) Skull Tree Iguana (*Liolaemus occipitalis*); (K) Broad-snouted Caiman (*Caiman latirostris*). (Photographed by Daniel Loebmann).

teyou) was split after the publication of the list of Gomes and Krause (1982), and the populations present in ESEC Taim correspond to *Teius oculatus* (Cei 1993; Cei and Lescure 1985). More information on taxonomic changes is available in the Supplemental Information file.

Of the reptiles documented, Skull Tree Iguana (*Liolaemus occipitalis*) is of particular conservation importance as it is considered a threatened species, classified as vulnerable at the regional, national and global levels. *Liolaemus occipitalis* is an endemic species in the coastal dune region of southern Brazil and Uruguay (Peters and Donoso-Barros 1970; De Lema 1994; Verrastro et al. 2006), and the main identified threat to its survival is the loss of dune habitats, mainly due to residential and commercial development (Di-Bernardo et al. 2000; Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio 2018). In ESEC Taim, this dune system is associated with a set of temporary lagoons, and studies carried out in similar habitats have demonstrated that aquatic productivity is crucial for sustaining populations of terrestrial consumers (Martins et al. 2021). Thus, although there is no modification of these environments in ESEC Taim, the impacts related to the use of water for agro-industry farming (mainly rice production) may indirectly harm the populations of *L. occipitalis* inside the conservation unit.

We also noted the possible extinction of *Ceratophrys ornata*, listed as an endangered species. This species was last collected in ESEC Taim in the 1980s (Gayer et al. 1988); however, there are reports of individuals from the early 1990s, and oral records suggest that previously it was common to find this species (Andreas Kindel, pers. comm). A retired ESEC Taim employee, Laudelino de Quadros Ribeiro, contributed to the capture of specimens mentioned in Gayer et al. (1988) and contributed to these oral reports. Unfortunately, the specimens reported from the 1990s were not deposited in any collections. In addition, there have been no records of the species over the last 15 y despite a series of infrastructure projects nearby that required extensive surveying and continuous monitoring of fauna. This reinforces the belief that the species is locally extinct, although the reasons for this loss are unclear. Currently, there are initiatives to rediscover *C. ornata* through citizen science approaches (Deutsch et al. 2018).

Another important absence from the sampling was *Physalaemus henselii,* recorded in ESEC Taim by Gayer et al. (1988). This is a species with a wide distribution in

Figure 4. Snakes of the Taim Ecological Station. (A) Two-headed Sipo (*Chironius gouveai*); (B) Mussurana (*Boiruna maculata*); (C) Jaeger's Ground Snake (*Erythrolamprus jaegeri*); (D) Grass Snake (*Erythrolamprus poecilogyrus*); (E) Water Snake (*Erythrolamprus semiaureus*); (F) Water Snake (*Helicops infrataeniatus*); (G) Striped Snake (*Lygophis anomalus*); (H) Fronted Ground Snake (*Lygophis flavifrenatus*); (I) False Coral Snake (*Oxyrhopus rhombifer*); (J) Brazilian Green Racer (*Philodryas aestiva*); (K) Patagonia Green Racer (*Philodryas patagoniensis*); (L) Dumeril's Diadem Snake (*Phalotris lemniscatus*); (M) Wide Ground Snake (*Psomophis obtusus*); (N) Red Belly Grass Snake (*Taeniophallus poecilopogon*); (O) False Lancehead Snake (*Dryophylax hypoconia*); (P) South American Hognose Snake (*Xenodon dorbignyi*); (Q) Urutu (*Bothrops alternatus*); (R) Pampa's Jararaca (*Bothrops pubescens*). (Photographs A and L by Daniel Loebmann. Other photographs by Márcio Borges-Martins).

Rio Grande do Sul (Braun and Braun 1980) and is very common and relatively abundant in the places where it occurs, even in human-disturbed habitats (Patrick Colombo, pers. Comm.). Additionally, this species is easy to detect in field surveys. In Uruguay, in several areas with the same habitat physiognomies as the ESEC Taim and with decades of collection efforts, the species has not been found (Kolenc et al. 2009).

We also found no evidence for the caecilian *Siphonops annulatus* in Gayer et al. (1988). Ihering (1911) mentioned its occurrence in the municipality of Pelotas, Rio Grande do Sul (approximately 100 km

north of Taim), based on only one specimen, but only tentatively classified it as belonging to the species *S. annulatus*. In the list of amphibians of Rio Grande do Sul (Braun and Braun 1980) and in the last compilation of the Brazilian records of this species (Maciel et al. 2013), the record of Pelotas is kept (Braun and Braun 1980). Neither of these two works mentions the tentative assignment of the species by Ihering (1911), however, and the lack of vouchered material from ESEC Taim. Based on these uncertainties, we consider that *S. annulatus* does not occur in ESEC Taim and possibly also not in Pelotas. The identifications by Gayer et al. (1988) and Ihering (1911) may refer to the caecilian *Chthonerpeton indistinctum*, a common species with recent records in the southern municipalities of the state (Quintela et al. 2011).

Some species have been recorded in nearby locations but were not found within the limits of the station. These included the lizards Paraguay Mabuya (*Aspronema dorsivittatum*), Striped Worm Lizard (*Ophiodes enso*), and *O*. aff. *striatus*, also called Striped Worm Lizard (Quintela et al. 2006), the snakes Boulenger's Tree Snake (*Dipsas ventrimaculatus*), Culebra (*Paraphimophis rusticus*), Lichtenstein's Green Racer (*Philodryas olfersii*), Pampas Snake (*Tomodon dorsatus*; Quintela et al. 2011), and the anurans Common Bullfrog (*Lithobates catesbeianus*; Xavier and Volcan 2006), Redbelly Toad (*Melanophryniscus dorsalis*; Quintela et al. 2007), Montevideo Redbelly Toad (*Melanophryniscus montevidensis*; Tedros et al. 2001), Rio Grande Dwarf Frog (*Physalaemus riograndensis*; this work), and Lesser Snouted Treefrog (*Scinax nasicus*; Dalmolin et al. 2017). These species were recorded just under 100 km from the station, including habitats that are continuous with ESEC Taim, such as temporary wetlands, sand dunes, and *restinga*, among others. Therefore, many of these species have potential occurrence in ESEC Taim. In addition, many species with cryptozoic habits, such as Paraguay Mabuya (*Aspronema dorsivittatum*) and *Ophiodes* sp. aff. *striatus* and *O. enso* are difficult to detect and may be recorded during future fieldwork.

ESEC Taim is recognized as an important wetland and conservation priority. In developing conservation efforts, it will be important to understand more thoroughly how this area compares with nearby wetlands. Although we did not assess relative species abundance, our experience in the area suggests that ESEC Taim has a high abundance of a relatively small number of species. This pattern appears to be common in wetlands of the region (dos Santos et al. 2012; Oliveira et al. 2013; Ximenez and Tozetti 2015). There is a need for more documentation and monitoring of herpetofauna of the region, which may also provide insights relevant to other conservation areas lacking buffer zones. For example, there is a need to examine anthropogenic effects such as agricultural activities carried out at the vicinity of the Taim (Josende et al. 2015) and to conduct an adequate assessment of these impacts in the proposal and delimitation process of the ESEC Taim Buffer Zone.

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Literature Cited

Ananjeva, N.B., L.J. Borkin, I.S. Darevsky, and N.L. Orlov. 1988. Dictionary of Amphibians and Reptiles in Five Languages. Russky Yazyk Publishers, Moscow, Russia.

Braun, P.C., and C.A.S. Braun. 1980. Lista prévia dos anfíbios do Estado do Rio Grande do Sul. Iheringia, Série Zoológica 56:121–146.

Cechin, S.Z., and M. Martins. 2000. Eficiência de armadilhas de queda (pitfall traps) em amostragens de anfíbios e répteis no Brasil. Revista Brasileira de Zoologia 17:729–740.

Cei, J.M. 1993. Reptiles del noroeste, nordeste y este de la Argentina. Museo Regionale di Scienze Naturali, Monografie 14:1–949.

Cei, J.M., and J. Lescure. 1985. Identité de *Lacerta palluma* Molina, 1782, et revalidation de *Centrura flagellifer* Bell, 1843 (Reptilia, Sauria). Bulletin Muséum National d'Histoire Naturelle (Paris), Series 7(4), section A 2:451–459.

Da Costa, M. S., and S. E. Sato. 2019. Análise multitemporal através de imagens landsat no entorno da ESEC Taim (RS/Brasil). 13º ENANPEGE. A geografia brasileira na ciência-mundo: produção, circulação e apropriação do conhecimento. São Paulo, 2019.

Dalmolin, D.A., V. Mathies Filho, and A.M. Tozetti. 2021. Anuran assemblage changes along small-scale phytophysiognomies in natural Brazilian grasslands. Iheringia Série Zoologia 111: e2021017. https://doi.org/10.1590/1678-4766e2021017.

Dalmolin, D.A., F.O. Rosa, M.D. Freire, L.F.M. Fonte, I.F. Machado, C.N. Paula, D. Loebmann, and E. Périco. 2017. Primeiro registro da perereca-de-banheiro *Scinax nasicus* (Cope, 1862) na costa do Brasil e novos registros para o estado do Rio Grande do Sul. Brazilian Journal of Biology 77:659–661.

De Lema, T. 1994. Lista comentada dos répteis ocorrentes no Rio Grande do Sul, Brasil. Comunicação do Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Série Zoologia 7:41–150.

Deiques, C.H., and S.T.Z. Cechin. 1991. O status de *Helicops carinicaudus* (Wied 1825) (Serpentes: Colubridae). Acta Biologica Leopoldensia 12:313–326.

Deutsch, C., L.F.M. Fonte, R. Maneyro, A. Kindel, N.D. Vargas, M.D. Freire, and G. Agostini. 2018. In Search of the Giant of the Pampas: Gathering Conservation Efforts in Argentina, Brazil and Uruguay. FrogLog 26:44–46.

Dias, K.S., E.S. Dosso, A.S. Hall, A.P. Schuch, and A.M. Tozetti. 2019. Ecological light pollution affects anuran calling season, daily calling period, and sensitivity to light in natural Brazilian wetlands. Science of Nature 106(7–8):46. https://doi.org/10.1007/s00114-019-1640-y.

Di-Bernardo, M., M. Borges-Martins, and R.B. Oliveira. 2003. Répteis. Pp. 165–188 *In* Livro vermelho da fauna ameaçada de extinção no Rio Grande do Sul. Fontana C.S., G.A. Bencke, and R. Reis (Eds.). Edipucrs, Porto Alegre, Brasil.

Di-Bernardo, M., M.B. Martins, and R.B. Oliveira. 2000. *Liolaemus occipitalis*. The IUCN Red List of Threatened Species 2000. International Union for Conservation of Nature. https://www.iucnredlist.org.

Dixon, J.R. 1983. Taxonomic status of the South American snakes *Liophis miliaris*, *L. amazonicus*, *L. chrysostomus*, *L. mossoroensis* and *L. purpurans* (Colubridae: Serpentes). Copeia 1983:791–802.

dos Santos, M.B., B. Madalozzo, A.M. Tozetti, L. Loebens, and S.Z. Cechin. 2020. Climatic dependence in the daily and seasonal calling activity of anurans from coastal wetlands of southernmost. Brazil Journal of Natural History 54:31–32.

dos Santos, M.B., M.C.L.M. de Oliveira, and A.M. Tozetti. 2012. Diversity and habitat use by snakes and lizards in coastal environments of southernmost Brazil. Biota Neotropica 12:78–87.

Frank, N., and E. Ramus. 1995. Complete Guide to Scientific and Common Names of Amphibians and Reptiles of the World. N.G. Publishing Inc., Pottsville, Pennsylvania, USA.

Fernandes, G.W., M.M. Vale, G.E Overbeck, M.M. Bustamante, C.E. Grelle, H.G. Bergallo, W.E. Magnunsson, A. Akama, S.S. Alves, A. Amorim, et al. 2017. Dismantling Brazil's science threatens global biodiversity heritage. Perspectives in Ecology and Conservation 15:239–243.

Gans, C. 1964. A redescription of, and geographic variation in, *Liophis miliaris* Linné, the Common Water Snake of southeastern South America. American Museum Novitates 2178:1–58.

Gayer, S.M.P., L. Krause, and N. Gomes. 1988. Lista preliminar dos anfíbios da Estação ecológica do Taim, Rio Grande do Sul, Brasil. Revista Brasileira de Zoologia 5:419–425.

Giraudo, A.R., V. Arzamendia, and P. Cacciali. 2006. Geographic variation and taxonomic status of the southernmost populations of *Liophis miliaris* (Linnaeus, 1758) (Serpentes: Colubridae). Herpetological Journal 16:213–220.

Gomes, N., and L. Krause. 1982. Lista preliminar de répteis da estação ecológica do Taim, Rio Grande do Sul. Revista Brasileira de Zoologia 1:71–77.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.-A. C. Hayek, and M.S. Foster (Eds.). 1994. Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians. Smithsonian Institution Press, Washington, D.C. USA.

Huckembeck, S., D. Loebmann, E.F. Albertoni, S.M. Hefler, M.C.L.M. Oliveira, and A.M. Garcia. 2014. Feeding ecology and basal food sources that sustain the Paradoxal Frog *Pseudis minuta*: a multiple approach combining stomach content, prey availability, and stable isotopes. Hydrobiologia 740:253–264.

Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio). 2018. Livro Vermelho da Fauna Brasileira Ameaçada de Extinção. Volume I. ICMBio/Ministério do Meio Ambiente (MMA), Brasilia, D.F., Brasil.

Ihering, H. 1911. Revista do Museu Paulista. Volume 8. Museu Paulista, São Paulo, Brasil.

Josende, M.E., A.M. Tozetti, M.T. Alalan, V.M. Filho, S.D.S. Ximenez, and S.E. Martins. 2015. Genotoxic evaluation in two amphibian species from Brazilian subtropical wetlands. Ecological Indicators 49:83–87.

Kolenc, F., C. Borteiro, D. Baldo, D.P. Ferraro, and C. Prigioni. 2009. The tadpoles and advertisement calls of *Pleurodema bibroni* Tschudi and *Pleurodema kriegi* (Müller), with notes on their geographic distribution and conservation status (Amphibia, Anura, Leiuperidae). Zootaxa 1969:1–35.

Kurtz, F.C., J.S.M.D. Rocha, S.M.D.J. Kurtz, A.D. Robaina, S.M. Garcia, A.H.D.O. Santos, P.R.J. Dill, P.R.V. Ataides, and F. Bolzan. 2003. Zoneamento ambiental dos banhados da estação ecológica do Taim, RS. Ciência Rural 33:77–83.

Maciel, A.O., H.C. Costa, L. de Oliveira Drummond, J.O. Gomes, and A. D'Angiolella. 2013. Rediscovery of *Siphonops annulatus* (Mikan, 1820) (Amphibia: Gymnophiona: Siphonopidae) in the state of Pará, Brazil, with an updated geographic distribution map, and notes on size and variation. Check List 9:106–110.

Martins, L.S., L.E. Costa-Schmidt, A.M. Garcia, R.F. Bastos, M.M. Rebelato, and A.M. Tozetti. 2021. The contribution of aquatic plants to the trophic ecology of a sand dune lizard in southern Brazil. South American Journal of Herpetology 21:12–24

Motta Marques, D.D., and A.O.N. Villanueva. 2001. Regime hidrológico de banhados e sua conservação. Caderno de Pesquisa S*érie Biologia* 13:63–79.

Oliveira, M.C.L.M., M.B. dos Santos, D. Loebmann, A. Hartman, and A.M. Tozetti. 2013. Diversity and associations between coastal habitats and anurans in southernmost Brazil. Anais da Academia Brasileira de Ciências 85:575–583.

Oliveira, M.C.L.M. 2011. Diversidade e padrão de atividade de anfíbios anuros em ambientes úmidos costeiros no extremo sul Brasileiro. M.Sc. Thesis, Universidade Federal do Rio Grande (FURG), Rio Grande, Rio Grande do Sul, Brazil. 96 p.

Pereira, E.J.A.L., P.J.S Ferreira, L.C.S Ribeiro, T.S. Carvalho, and H.B.B. Pereira. 2019. Policy in Brazil (2016–2019) threaten conservation of the Amazon rainforest. Environmental Science & Policy 100:8–12.

Perez, R., S. Ribeiro, and M. Borges-Martins. 2012. Reappraisal of the taxonomic status of *Amphisbaena prunicolor* (Cope 1885) and *Amphisbaena albocingulata* Boettger 1885 (Amphisbaenia: Amphisbaenidae). Zootaxa 3550:1–25.

Peters, J.A., and R. Donoso-Barros. 1970. Catalogue of the Neotropical Squamata. Part II - Lizards and Amphisbaenians. Smithsonian Institution Press, Washington, D.C., U.S.A

Quintela, F.M., G.P. Lima, M.L. Silveira, P. Costa, A. Bianchini, D. Loebmann, and S.E. Martins. 2019. High arsenic and low lead concentrations in fish and reptiles from Taim wetlands, a Ramsar site in southern Brazil. Science of the Total Environment 660:1004–1014. http://doi.org/10.1016/j.scitotenv.2019.01.031.

Quintela, F.M., D. Loebmann, and N.M. Gianuca. 2006. Répteis continentais do município de Rio Grande, Rio Grande do Sul, Brasil. Biociências 14:180–188.

Quintela, F.M., I.G. Medvedovisky, C. Ibarra, L.F.M. Neves, and M.R.C. Figueiredo. 2011. Reptiles recorded in Marinheiros Island, Patos Lagoon estuary, southern Brazil. Herpetology Notes 4:57–62.

Quintela, F.M., I.G. Medvedovisky, L.F.D.M. Neves, D. Loebmann, and M.R.C. Figueiredo. 2007. Amphibia, Anura, Bufonidae, *Melanophryniscus dorsalis*: distribution extension in the state of Rio Grande do Sul, Brazil. Check List 3:100–103.

Tedros, M., F. Kolenc, and C. Borteiro. 2001. *Melanophryniscus montevidensis* (Philippi, 1902) (Anura: Bufonidae). Cuadernos de Herpetología 15:143–144.

Verrastro, L., M. Schossler, and C.M. Silva. 2006. *Liolaemus occipitalis*. Herpetological Review 37:495.

Vieira, E.F. 1983. Rio Grande: Geografia Física, Humana e Econômica. Sagra, Porto Alegre, Brasil.

Whiles, M.R., K.R. Lips, C.M. Pringle, S.S. Kilham, R.J. Bixby, R. Brenes, S. Connelly, J.C. Colon-Gaud, M. Hunte-Brown, A.D. Huryn, et al. 2006. The effects of amphibian population declines on the structure and function of Neotropical stream ecosystems. Frontiers in Ecology and the Environment 4:27–34.

Xavier, J.A.A., and M.V. Volcan. 2006. Scientific Note Registro da predação de girinos de rã touro (*Lithobates catesbeianus*) pelo biguá (*Phalacrocorax brasilianus*) no estuário da Laguna dos Patos, Rio Grande do Sul, Brasil. Pan-American Journal of Aquatic Sciences 1:267–270.

Ximenez, S., and A.M. Tozetti. 2015. Seasonality in anuran activity and calling season in a Brazilian subtemperate wetland. Zoological Studies 54, 47 (2015). https://doi.org/10.1186/s40555-015-0125-8.

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