Habitat use and activity with new records of the agile snouted tree frog (*Scinax agilis*) on the north coast of Bahia, Brazil.

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ABSTRACT - The agile snouted tree frog *Scinax agilis* (Anura, Hylidae) is one of the *restinga* frog species, with reported distribution in the Espírito Santo, Alagoas, Sergipe and Bahia states, especially in sand dune habitats, known locally as restinga. On the north coast of Bahia, north-eastern Brazil, it is known, according to literature, only from the cities Camaçari and Mata de Sao Joao. In this study we fill the geographic distribution gap in the region including presence in six new localities and cities. We also report findings on diurnal and nocturnal activity patterns and the use of microhabitats at the different vegetation type habitats. We found *S. agilis* in dry forest, scrub and beach vegetation and also at the temporary or permanently flooded river plains. Most records (52.2 %) were on river plains during daytime surveys mainly from 1200 to 1800 hours. Bromeliads were the most frequently used microhabitat (45.4%) followed by aquatic plants. The agile snouted tree frog association with flooded river plains and associated plant communities reinforces the urgent need for conservation measures to preserve the *restinga* remnants in the region.

INTRODUCTION

The agile snouted tree frogs are typically small sand dune habitat frogs. Snouted tree frogs of the Genus *Scinax* is formed of 111 species, distributed through Mexico, South America and the Caribbean (Duellman & Wiens, 1992; Frost, 2013). In Brazil 90 *Scinax* species are known, and they occur at all the country's eco-regions (Segalla et al., 2012). The agile snouted tree frog (*Scinax agilis* Cruz & Peixoto, 1983) is included in the *Scinax catharinae* (Faivovich et al., 2005) group and its type locality is Ibiriba (19° 14' S; 39° 55' W) at the city of Linhares, on the south-eastern state of Espírito Santo. Its distribution was recently expanded to the states of Bahia (Peixoto, 2003), Alagoas (Toledo, 2005) and Sergipe (Passos et al., 2012), but remains with major distributional gaps.

The agile snouted tree frog (Fig. 1) is typically found on the coastal sand dune ecosystem, locally known as "restinga". It is found either at open areas as well as inside forests and dense scrub, and usually on bromeliads (Cruz & Peixoto, 1983; Toledo, 2005; Juncá, 2006). The species is listed as Least Concern at the IUCN Red List assessment, mainly as a result of its distribution extension. This assumes there is a large population, however its main ecosystem and associated habitats are under severe threats, via deforestation (Peixoto & Pimenta, 2004), which may cause some concern. At this study we present new distribution localities and cities at one of the most representative *restinga* system along the species distribution, and also look at the habitat use and activity of a few subpopulations on the north coast of the state of Bahia, Brazil.

Figure 1: Adult agile snouted tree frog (*Scinax agilis*) from Busca Vida, city of Camaçari. Adults averaged SVL = 130 mm

MATERIALS AND METHODS

The study took place from June 2010 until August 2013. We sampled the intended sites every two months on a regular basis. Six localities on the north coast of Bahia were sampled: Busca Vida (-12.863831, -38.262675) a locality in the city of Camaçari; Imbassaí (-12.483250, -37.958667) in the city of Mata de São João; Massarandupió (-12.315722, -37.832139), in the city of Entre Rios; Baixio (-12.105083, -37.697639), in the city Esplanada; Barra de Itariri (-11.950278, -37.611917), in the city Conde; and Costa Azul (-11.664167, -37.483611) in the city Jandaíra (Fig. 2); the entire coast line encompasses an extension of about 220 km.

At each of these sample units, four vegetation type habitats were thoroughly surveyed: beach vegetation; flooded river plain; scrub vegetation; and sand dune dry forest. The four habitat types were surveyed simultaneously, when surveyors applied a visual search survey at a 500 m belt transect. The survey seasons covered all daylight periods and seasons all along the three years. A day cycle started at 6 am for the first survey and ended at the last, or sixth survey of the same year at 6 pm (six cycles per year). During the third and last year, night surveys were also applied following the same procedures, from 7 pm to 9 pm. The overall survey effort covered 1,728 hours. We sampled specimens for taxonomic confirmation and reference, under the national environmental licensing program authorization MMA-ICMBIO / SISBIO nº 23355-2. Sampled specimens were deposited at the Herpetological Reference Collection at the Centre for Ecology and Conservation of Animals (CHECOA) at the Universidade Católica do Salvador. We also collected distributional data from literature for comparison purposes.

RESULTS

We recorded 1,163 adult *S. agilis* at the six localities (Fig. 2). The animals were found inhabiting the four different habitat types at the restinga ecosystem: temporary and permanently flooded river plains (n=608), dry forest (n=446), scrub vegetation (n=69) and beach vegetation (n=40).

The agile snouted tree frog also used differently the available microhabitats. We detected the frogs on bromeliads (n=529), on macrophyte vegetation (n=300), scrub vegetation (n=128), leaf litter (n=86), suspended branches (n=68), moving in temporary ponds (n=32) and on bare sand soil (n=20). We also recorded cases of communal microhabitat use. We found animals sharing the same bromeliads. Over 15 individuals used the same plant at the locality of Costa Azul and over 17 at the locality of Busca Vida.

Animals were mostly found active during daytime. Over 62 % of the sightings and records were made between 12:00 and 6 pm, and 32% from 6 am to noon. During night surveys only 5.4 % records were observed at the same sites. Although the beach habitat type showed very low frog frequency, most of the sightings occurred at the night surveys, with 72.5 %. The scrub vegetation on the other side had 52.1 % of the records from 2 pm to 6 pm, most then, during the day (Fig. 3).

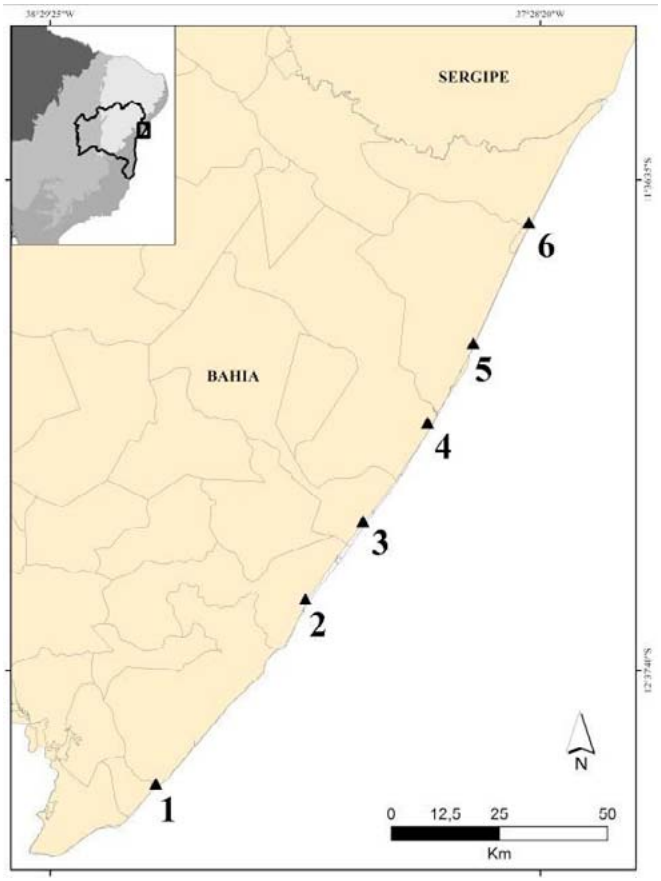

Figure 2: *S. agilis* geographic distribution new records on the north coast of Bahia. 1) Busca Vida; 2) Imbassaí; 3) Massarandupió; 4) Baixio; 5) Barra de Itariri; 6) Costa Azul.

All six localities represent new records for the species on the north coast of Bahia: Busca Vida, Imbassaí, Massarandupió, Baixio, Barra de Itariri and Costa Azul. Together they include another six municipalities into the species distribution, all of them on the coast, and filling a 212 kilometers distributional gap, from Praia do Forte, Mata de São João, Bahia (Juncá, 2006) to Areia Branca, Sergipe (Passos et al., 2012) (Table 1).

DISCUSSION

The activity patterns of *S. agilis* showed that the species is rather more active during the day. However it is more commonly found at sites where humidity and shade is higher. It was particularly found at the temporary or permanent flooded river plains. The soil humidity and type seems to be the major factors shaping the frogs' communities' structures (Bastazini et al., 2007), which was also observed at the studied localities. Barreto et al. (2012) found a similar result for the marsh frog (*Pseudopaludicola* sp. (*aff. falcipes*)) at the same localities, and they also

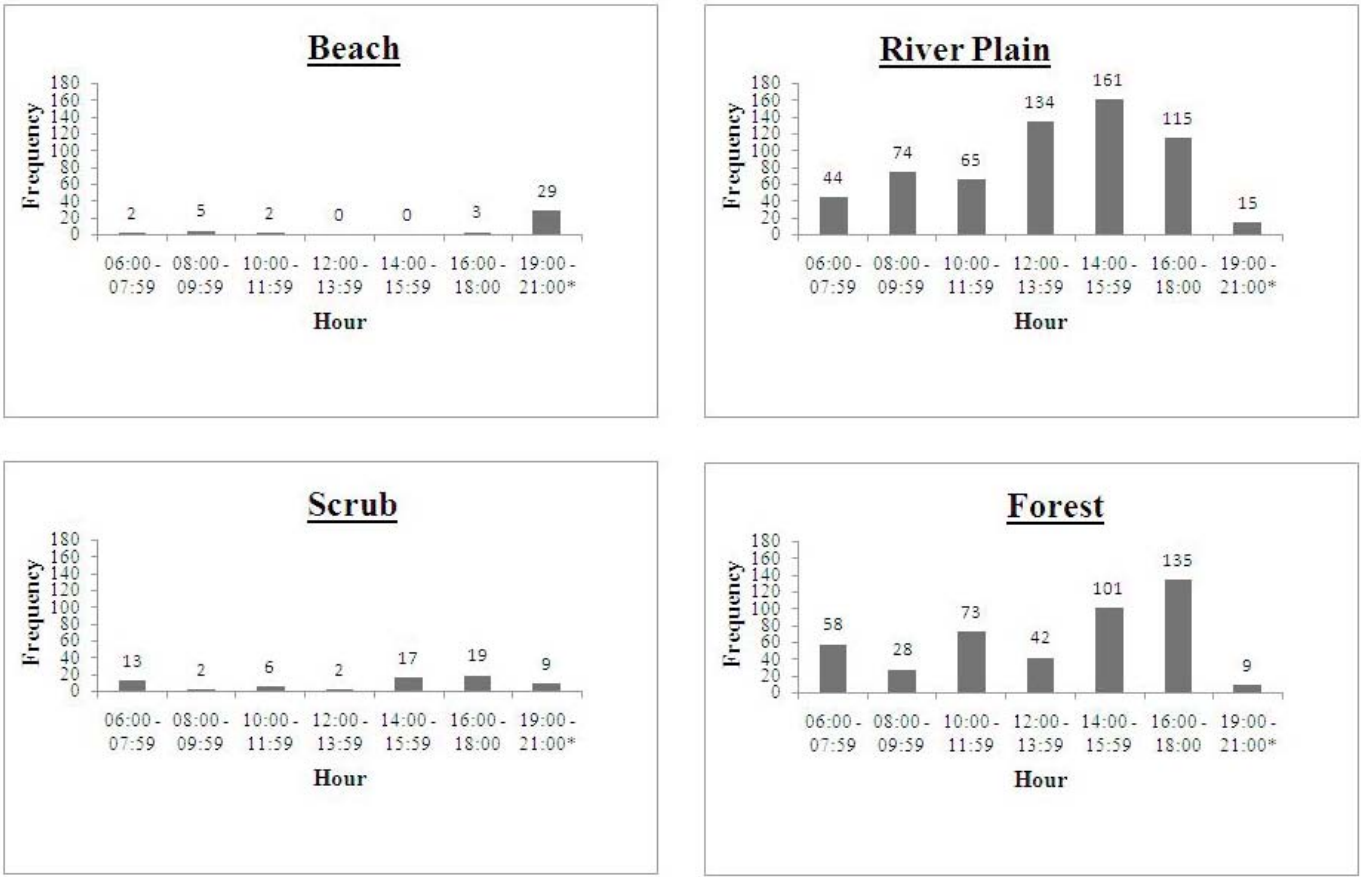

Figure 3: Number of recorded individuals at each time slot during the visual search surveys on the four different vegetation type habitats: beach, river plain, scrub, dry forest.

pointed out the flooded plains as a kind of nursery, where frogs tend to use during the breeding season, suggesting they are fundamental to retain those subpopulations. All of the aforementioned aspects reinforce the importance of maintaining the river plains and other water bodies aiming the *restinga* conservation.

We found that *S. agilisis* a daytime forager, however it will have low levels of night activity in disturbed locations. When we compared the previous year's daytime and night activities we found that the amount of hours were notably higher during the day (n=140) in comparison to night foraging (n=62). It was possible to detect the agile snouted tree frog inhabiting seven different microhabitat types at the sampled *restinga* formations. According to Eterovick et al. (2010), the variety of habitat use by adult frogs may represent their response to several local selective pressures. These would be caused by other species, the environmental structure or even disturbance. Nevertheless the most important and far higher frequented microhabitat for the species were the bromeliads (45.5 %). These plants were mainly represented by the genus *Hohenbergia* spp. They are locally known as tank bromeliad as a result of their architecture promoting the maintenance of large amounts of water, even during dryer periods. These plants were very abundant at the study localities (Cogliatti-Carvalho et al., 2008). Along with scrub, herbaceous and macrophyte vegetation, and also suspended branches above water bodies these vegetation types formed 88.1 % of the entire microhabitats records. This possibly suggests a strong association of the agile snouted tree frog to plant community composition, and not just their abundance. However, bromeliads and macrophytes (especially the elongated ones) are commonly used for shaping gardens at hotels, resorts, golf courts and residential areas at the studied localities. All of these may shed light on understanding the reasons for the maintenance of some of the subpopulation, given the plants are frequently present in gardens, even in urbanized landscapes.

The alarming habitat loss in the region, especially when it comes to *restinga* habitats is a main and worrying threat to any amphibian population (Tinôco et al., 2008). When suppression comes into place, bromeliads, macrophytes and scrub are the main lost vegetation, even on law permanent protected zones and this may seriously affect the agile snouted tree frog on the north coast of Bahia. The new geographic distribution data for *S. agilis* confirms the species are endemic to *restinga* habitats. These new records add important information to its contiguous distribution on the coastal regions of the Brazilian states of Espírito Santo, Bahia, Sergipe e Alagoas. The presumed species endemism and severe habitat threats call attention to the need for conservation action to preserve these populations as well as other restinga restricted species.

LOCALITY	COORDINATES	VOUCHER	SOURCE
Lagoa Sete Pontas, Itapemirim – ES	-21.011111, -40.833889	MBML 4887	Specieslink
Restinga de Setiba, Guarapari – ES	-20.629339, -40.426642		Pombal et al., 2010
Ponta da Fruta, Vila Velha – ES	-20.519156, -40.373542	EI 7124-38	Peixoto & Gomes, 2007
Restinga de Camburí, Vitória – ES	-20.319444, -40.337778	MBML 4903	Specieslink
Reserva Florestal Vale do Rio Doce, Linhares – ES	-19.433889, -39.893311	EI 7155-56	Peixoto & Gomes, 2007
Ibiriba, Linhares – ES *	-19.233333, -39.916667		Cruz & Peixoto, 1983
São Mateus – ES	-18.716111, -39.858889	CFBH 1567	Specieslink
Parque Nacional de Itaúnas, Conceição da Barra – ES	-18.593333, -39.732222	CFBH 1938	Specieslink
Mucuri – BA	-18.081472, -39.926444		Peixoto et al., 2003
Trancoso – BA	-16.615278, -39.092331		Rocha et al., 2003; 2008
Belmonte – BA	-15.991944, -38.971667		Pombal et al., 2010
Arembepe, Camaçari – BA	-12.697500, -38.324167		Nunes et al., 2007
Busca Vida, Camaçari – BA ▲	-12.863831, -38.262675	CHECOA 2606	This work
Praia do Forte, Reserva Sapiranga, Mata de São João, – BA	-12.585278, -38.028333		Juncá, 2006
Praia do Forte, Fazenda Camurugipe, Mata de São João – BA	-12.575000, -38.056389		Juncá, 2006
Imbassaí, Reserva Imbassaí, Mata de São João – BA ▲	-12.483250, -37.958667	CHECOA 2820	This work
Massarandupió, Entre Rios – BA ▲	-12.315722, -37.832139	CHECOA 2510	This work
Baixio, Esplanada – BA ▲	-12.105083, -37.697639	CHECOA 3214	This work
Barra de Itariri, Fazenda Milagres, Conde – BA ▲	-11.950278, -37.611917	CHECOA 2548	This work
Costa Azul, Jandaíra – BA ▲	-11.664167, -37.483611	CHECOA 2937	This work
Areia Branca – SE	-10.977917, -37.048472	ZUEC 17842-44	Passos et al., 2011
Passo do Camarajibe – AL	-9.303889, -35.439444		Toledo, 2005

Table 1: Locality with geographic distribution records for the *S. agilis* in Brazil. * type locality of *S. agilis*. ▲ New records of *S. agilis* for the north coast of Bahia, Brazil.

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