# New distribution of the Panama Humming Frog (*Elachistocleis panamensis),* in the Azuero region, Panama

## Nueva distribución de la rana termitera (*Elachistocleis panamensis*), en la región de Azuero, Panamá

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## Abstract

The research focused on the study of the frog belonging to the Microhylidae family, distributed in South and Central America. In November 2021, two observations were made in Pedasí, Los Santos province, within the Azuero Dry Arc, where an individual was collected that was later identified as *Elachistocleis panamensis*. This record expands the known distribution range of the species, locating it approximately 90 km by land southwest of its last known position. The importance of these findings is highlighted to better understand the biogeography of the species, since it is found in a tropical dry forest on the coast of the Pacific Ocean, a habitat not previously reported for this species in Central America.
**Keywords**
Dry Forest, fossorial, limit, locality, microhylid

## Resumen

La investigación se centró en el estudio de la rana perteneciente a la familia Microhylidae, distribuida en América del Sur y Central. En noviembre de 2021 se realizaron dos observaciones en Pedasí, provincia de Los Santos, dentro del Arco Seco de Azuero, donde se colectó un individuo que posteriormente fue identificado como *Elachistocleis panamensis.* Este registro amplía el rango de distribución conocido de la especie,

ubicándola aproximadamente a 90 km por tierra al suroeste de su última posición conocida. Se destaca la importancia de estos hallazgos para comprender mejor la biogeografía de la especie, ya que se encuentra en un bosque seco tropical en la costa del Océano Pacífico, un hábitat no reportado previamente para esta especie en Centroamérica.

**Palabras clave**
Bosque seco, fosorio, frontera, límite, localidad, microhílido

## Introduction

The Microhylidae family have morphological adaptations that allow them to dig and move on the ground, such as a robust bone structure in the forelimbs (Keeffe & Blackburn, 2020) with marked seasonality and observable after intense rains (Cuentas et al., 2002; Acosta-Galvis, 2012). They are known to be voracious predators of ants and termites and are preyed upon by osprey spiders (Vera-Candioti, 2006; Pinto & Costa-Campos, 2017; Salcedo-Rivera et al., 2018).

The genus *Elachistocleis* is distributed in Panama and Colombia southward, east of the Andes, to southern Paraguay, southeastern Bolivia, central Argentina, central and southeastern Brazil and Uruguay; Trinidad; west of the Andes in Azuay Province, Ecuador (Frost, 2024). *Elachistocleis panamensis* can be found in humid tropical forests, dry forests, and open areas such as pastures and croplands, up to an elevation of 600 meters above sea level. In Panama this species is distributed across provinces of Darién, Colón, Panamá, Coclé, and Panamá Oeste (Nelson, 1972; IUCN, 2018).

## Materials and Methods

Two observations were made on November 19, 2021 in Pedasí, Los Santos Province, in the region known as the Dry Arc on a casual visit to two streams (7.6362524 N, 80.1550822 W and 7.6090771 N, 80.0923336 W), separated by 6 kilometers from each other (figure 1).

A single individual was collected in a plastic bag and then transported to the Serpentario Maravillas Tropicales from El Valle de Antón, Coclé province, where it was preserved.

For the identification of the species, the sample was sent to the Biologist Ángel Sosa-Bartuano, later deposited in the Zoological Collection of the Gorgas Memorial Institute and

located within the collection of Dr. Eustorgio Méndez where the collection number COZEM-ANF 0711/ MG 098 was assigned (figure 2c-d). The species is identified by a dorsal coloration of olive brown or light cinnamon with a large blackish spot on the back, dark sides of the body and a creamy, dirty belly. It lacks an eardrum and has a small, triangular head, demarcated by a transverse fold in the occipital region, just behind the eyes. It has cylindrical fingers, with unexpanded, non-webbed ends, and has smooth dorsal skin.

## Preparation of input environmental data

The input data required by the Maxent program are a set of bioclimatic variables, which are necessary to determine the geographic distribution of the species. To do this, these variables were downloaded from the WorldClim website (www.worldclim.org) corresponding to the period 1970-2000, version 2.1; these variables are a set of climatic layers on a global scale, with a 30-second resolution in tif format (Hijmans et al., 2005).The bioclimatic covers are made up of 19 biologically significant variables that affect the distribution of the species, these are:

A1 = Annual mean temperature
A2 = Mean diurnal range (Monthly mean (maximum temperature - minimum temperature))
A3 = Isothermality (A2/A7) (×100)
A4 = Seasonality of temperature (standard deviation ×100)
A5 = Maximum temperature of the warmest month
A6 = Minimum temperature of the coldest month
A7 = Annual temperature range (A5-A6)
A8 = Mean temperature of the wettest quarter
A9 = Mean temperature of the driest quarter
A10 = Mean temperature of the warmest quarter
A11 = Mean temperature of the coldest quarter
A12 = Annual precipitationSmart thermostats
A13 = Precipitation of the wettest month
A14 = Precipitation of the driest month
A15 = Seasonality of precipitation (coefficient of variation)
A16 = Precipitation of the wettest quarter
A17 = Precipitation of the driest quarter
A18 = Precipitation of the warmest quarter
A19 = Precipitation of the coldest quarter

For editing the environmental layers (Hijmans et al., 2005) and georeferenced frog observation records (GBIF, 2024), the QGis program, version 3.28.8, was used; this allowed the selected environmental layers to be cut and transformed, as well as the coordinates to obtain the same extension. Before executing the model, some adjustments were made prior to the process, the rest was left as default.

Maxent was used because it is a free program that estimates the probability of distribution of a species by finding the most dispersed or close to uniformity possible, but subject to a set of restrictions, based on the presence of the species, allowing its geographic distribution to be predicted (Phillips et al., 2006). In this sense, the objective of this note was to present the areas where the *E. panamensis* frog is potentially distributed, serving for future field evaluations that allow us to propose strategies that contribute to the conservation of the species.

## Results

The two individuals were identified as *Elachistocleis panamensis* (figure 1) which is 1 of the 3 species of this genus reported in Panama and our record places this species approximately 130 km southwest of its last known position.

A map was generated with the geographic coordinates (current and those compiled in this note) and the potential distribution areas of *E. panamensis,* with an AUC of 0.97. This high value indicates that it has a wide geographic distribution in relation to the area of the environmental data. The maximum achievable AUC is 1.

**Figure 1.** Panama Humming Frog (*E. panamensis*). A) Dorso-lateral view, B) Dorso-frontal view; living specimens photographed in situ; C) Dorsal view with museum number D) Dorsal view with museum code.

## Discussion

These records provide background to the biogeography of the species as it allows to expand the already established habitats where this frog can develop without problems with an added value since it is found within a tropical dry forest known mainly for its low annual rainfall. In addition to this, taking into account the distribution suggested by Jowers et al. (2021) this frog has traveled approximately 90 km in a straight line (figure 2).

The area with a high probability of favorable conditions for the *E. panamensis* frog is located mainly in central Panama; including the provinces of Colon and Panama City. In turn, favorable conditions (>60%) are observed in the southern region of the Azuero Peninsula in the provinces of Los Santos and Veraguas (figure 2).
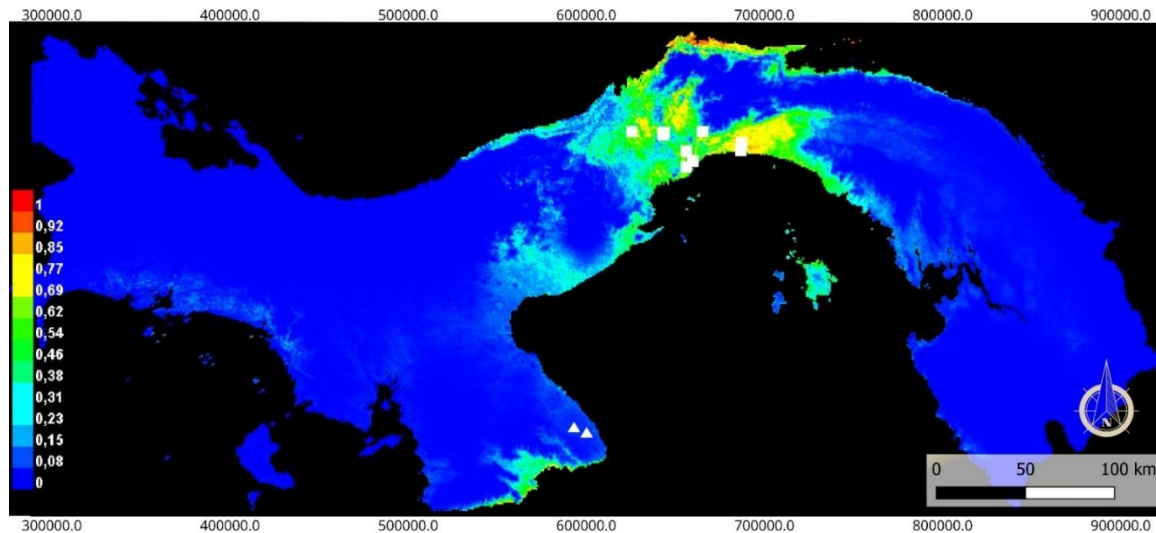
**Figure 2. Potential distribution map. White squares show where the species is present (Hijmans et al., 2005), while white triangles show the new extension proposed in this note. Red indicates a high predicted probability of favorable conditions; yellow and green represent typical conditions; and light and dark blue indicate a low probability of environmental conditions for the development of the species.**

An arc under the curve (AUC) of 0.98 was obtained; this high value indicates that it has a wide geographic distribution in relation to the area of the environmental data and that the model is appropriate to predict the presence of the species. The maximum achievable AUC is 1 (Cartaya et al., 2016). The training data and the test data are the same data set, the red curves (indicate the degree of adjustment of the sampling data) and the blue curves (model adjustment). This means that the model is appropriate to predict the presence of the species (figure 3A). In addition, the bioclimatic variable A6 (Minimum temperature of the coldest month) is the one that provides the most information, while the variable A13 (Precipitation of the wettest month) seems to have no relevant information (figure 3B).

On the IUCN Red List of Threatened Species, *E. panamensis* is classified as Least Concern (LC) due to its wide distribution, abundance and tolerance to habitat disturbance, in addition to not being on the list of threatened species of the Ministerio de Ambiente de Panamá (MiAmbiente, 2016).
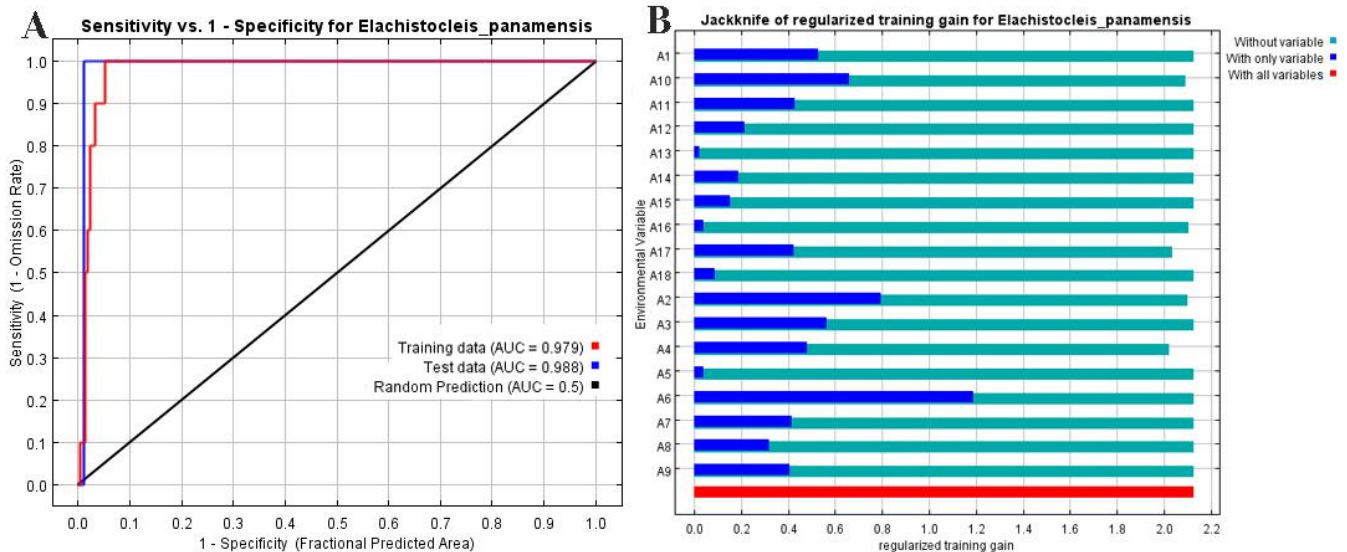
**Figure 3. A) In this image is the receiver operating characteristic (ROC) and the area under the curve (AUC); B) Jackknife results and the information provided by each bioclimatic variable.**

It is a terrestrial, insectivorous species with nocturnal habits and is usually found under logs or rocks in places with dense vegetation and in prayer within the forest (Köhler, 2011) in addition to being a specialist in eating termites and ants (Van Sluys et al., 2006; López et al., 2007), so the shelter and food needs are covered within this type of dry forest, typical of the Azuero region. This species was reported within a dry forest in South America in the Caribbean by (Blanco-Torres et al., 2021); but our note provides new information within a dry forest in Central America and the Pacific side.

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