

Distribution of the Frog *Mannophryne trinitatis* (Anura – Dendrobatidae) in Trinidad, West Indies

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ABSTRACT

Mannophryne trinitatis populations are found throughout most of Trinidad's Northern Range. The only previously reported *M. trinitatis* population found elsewhere other than the Northern Range is at Mount Tamana (Kenny 1969). We report here three new *M. trinitatis* localities in the central region; at Mount Harris (10 km northeast from Mount Tamana), and in the vicinities of Pepper Village and Gran Couva (16 and 20 km southwest from Mount Tamana respectively). No *M. trinitatis* have been found in the Southern Range. On several occasions, tadpoles were found in still pools distant from streams, made from plant material (phytotelmata).

INTRODUCTION

Mannophryne trinitatis (Garman) (see Murphy, 1997 for naming history of this species) is a small (25-28 mm snout-vent length), dark coloured diurnal and terrestrial dendrobatid frog that inhabits the humid coastal mountain forests of Northern Venezuela and the Northern and Central Ranges of Trinidad, West Indies. These frogs are found in Trinidad from sea level to the highest elevations (Kenny 1969) in and around rocky streams. The mostly slow-running clear-water streams that they inhabit are generally quite narrow and shallow; deeper pools within the streams are used for deposition and growth of tadpoles.

Kenny (1969) stated that *M. trinitatis* is present throughout the Northern Range, but did not list localities. He noted that deforestation of the southern slopes west of St. Joseph had restricted the species to "isolated pockets". Murphy (1997) listed previously published localities in the Northern Range (all on the southern slopes, other than Toco) and also noted localities he had checked himself. The Northern Range is an extension of Venezuela's Paria Peninsula, where *M. trinitatis* is also found (Murphy 1997 and personal observations) and consists of a series of ridges running northwest-southeast, up to 16 km wide and 88 km long. Most of the range lies between 150-456 m in elevation, although isolated peaks reach greater altitudes. The ridges are split by a large number of steep valleys and streams, descending on the southern side to Trinidad's central plain, but on the north side reaching the sea (Murphy 1997).

The only *M. trinitatis* locality recorded outside the Northern Range by Kenny (1969) and Murphy (1997) is Tamana Cave, located in Mount Tamana, the highest hill of the Central Range. The Central Range has an average elevation of 60 to 300 m with Tamana Cave at 240 m. The Central Range is separated from the Northern Range by about 20 km of relatively flat low elevation terrain (Fig. 1).

M. trinitatis distribution

M. trinitatis is found throughout most of Trinidad's Northern Range. This range was once an extension of the Venezuelan mountain range currently known as the Paria Peninsula. The Northern Range consists of a series of ridges running northwest-southeast, up to 16 km wide and 88 km long. Most of the range lies between 150-456 m in elevation although peaks reach greater altitudes (Murphy 1997). The ridges are split by a large number of steep valleys and streams where *M. trinitatis* is found.

The Central Range is 60 km long, 5-8 km wide and is orientated northeast to southwest. The Central Range is lower than the

Northern Range, with an average elevation between 60 and 300 m (Murphy 1997). The only previously recorded population of *M. trinitatis* in the Central Range is found in a cave system at an altitude of 240 m. This cave, Tamana Cave, is in the highest hill of the Central Range, Mount Tamana (Kenny 1979), and is separated from the Northern Range by 20 km of relatively flat low elevation terrain (See Fig. 1).

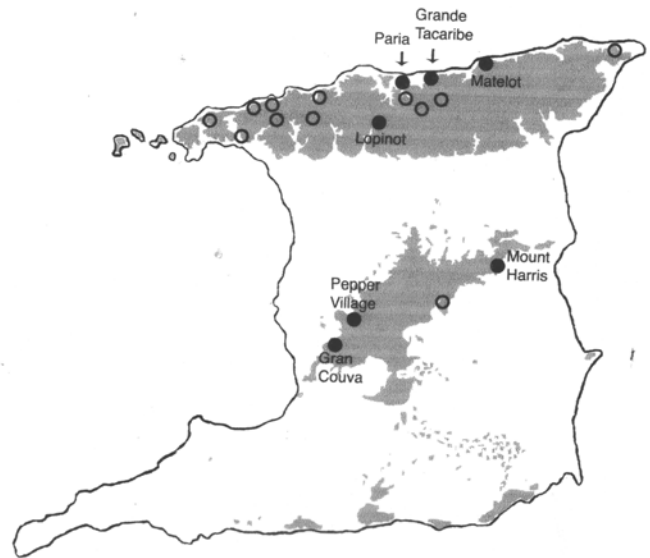


Fig. 1. Distribution of *Mannophryne trinitatis* populations in Trinidad. (Shaded areas: hill and mountain ranges; open circles: previously described populations; black circles: new populations).

The aim of the survey reported here was to check previously reported localities and to search for and establish whether any other populations of *M. trinitatis* exist within Trinidad's Central Range, and to understand the distribution and habitat requirements of this species within Trinidad.

METHODS

The surveys were carried out in Trinidad during June to August (early in the rainy season) from 1996 to 2004 but most intensively 2002 to 2004. We searched at locations or sites where these frogs were likely to be found; near streams with surrounding dense vegetation, leaf litter or in muddy and humid valleys with thick vegetation cover. Three methods were used to survey the sites: (1) an auditory survey (males frequently call between 1600 and 1730 h,

or after rain), (2) tadpole sampling in pools and (3) looking for adult and juvenile frogs.

RESULTS

Northern Range

Some of the Northern Range *M. trinitatis* sites that we inspected have been well documented before; approaching and a few km beyond Maracas Bay (north coast road sites), Mount Saint Benedict and Lopinot (Downie *et al.* 2001; Cummins and Swan 1995). Other less well known populations were found at Blue Basin, Maracas Waterfall, El Tucuche, Simla, Paria, Matelot and Grande Tacaribe. Several other populations that we did not inspect have been reported previously in Arima Valley, Caura Valley, Maraval Valley, Morne Bleu Ridge, Toco, and St. Ann's Valley (Murphy 1997).

All Northern Range populations inspected showed similar ecological and environmental characteristics. All *M. trinitatis* sites were in valleys or mountain slopes with rocky streams flowing downhill for several kilometers. With the exception of Mount Saint Benedict, all sites were surrounded by dense vegetation and were difficult to access. On the southern side of the Northern Range, *M. trinitatis* sites were first found at moderately high altitudes; but on the northern side at the coast, *M. trinitatis* could be found at sea level, in and beside forest streams opening on to beaches.

Adult frogs were found in large numbers at Mount Saint Benedict, north coast road, and at El Tucuche and Matelot. These frogs could be seen all day and, unlike in other populations, the males called for most of the day.

As well as adult frogs, tadpoles were present in large numbers at Mount Saint Benedict and in the streams close to the north coast road west of Las Cuevas. Tadpoles at Mount Saint Benedict (more than 400 tadpoles, July-August) were only found in a predator-free pond (diameter; 1.30 m, depth; 20 cm): lack of tadpoles elsewhere was likely due to the large number of a tadpole predator, the fish *Rivulus hartii*, found in the stream and other ponds (Downie *et al.* 2001). Large numbers of tadpoles were seen in the stream pools close to the north coast road and Lopinot sites, where *R. hartii* was absent. *Rivulus hartii* was found in large numbers in El Tucuche, Blue Basin and in one Lopinot site, and no tadpoles were seen in the streams at these sites, presumably because of male selection of deposition sites lacking predators (Downie *et al.* 2001). However, tadpoles were found on the slopes of El Tucuche in water-filled tree-stump holes and seed pods. Few tadpoles were caught at Paria and no tadpoles were ever seen at Matelot and Grande Tacaribe possibly because of the presence of freshwater prawns of the genus *Macrobrachium* (Downie *et al.* 2001).

M. trinitatis were also heard calling at Maracas River, at Cerro del Aripo, Morne Bleu and Toco, but these sites were not inspected. We were unable to access possible Northern Range sites west of Blue Basin.

Eastern Central Range

Tamana Hill (Tamana Caves)

Tamana Cave is located in the northern face of Mount Tamana (lat. 61°12'W – long. 10°28'N) at 240 m. Between 1996 and 2001, tadpole and frog numbers fluctuated very markedly and we decided to assess the population more systematically in future years. Seven inspections of the site were carried out during the summer of 2002. Tadpoles were found at very high density in a small section of the stream (11 m) in almost complete darkness in 25 small rocky limestone pools (none exceeding 50 cm in diameter). This stream led to an open section of the cave, the chimney area (5.30 m x 7 m, 4 m high)

where the sunlight entered the cave and froglets were extremely abundant, possibly reaching several hundred individuals at a given time. In addition to normally coloured individuals we also found six albino froglets and eight albino tadpoles in the pools by the chimney area.

Adult frogs were rarely seen in the cave: occasionally some males with attached tadpoles could be seen near the cave stream but adults did not appear to inhabit the cave: they only entered through the chimney to deposit tadpoles in the cave ponds. These pools may be suitable for tadpole development for two reasons: (1) a downstream flow of bat guano effluent enriches the ponds with nutrients, and (2) the stream is free of the predators found in the Northern Range streams. Given that clutch size in this species is 10-12, the very large numbers of tadpoles represent the breeding activity of a large number of frogs.

During the summer of 2003 the cave was visited on three occasions. Only one male frog and 12 tadpoles were seen in the cave. In 2004 the cave was visited once. No adult frogs or tadpoles were found in the cave, merely one juvenile frog. In the summer of 2002, males were seen outside the chimney entrance to the cave and at the bottom of the north side of Mount Tamana where the stream exited the cave to a banana plantation. In 2003, many frogs were heard all around Mount Tamana; by the path that ascends to the cave entrance and by the banana plantation; at the bottom of the hill and 500 m down the path by a very small stream that runs through the banana and cocoa plantation. The unusually low numbers of tadpoles in the cave and the abundance of frogs outside the cave may be an indication that the population had changed breeding grounds. However, no tadpoles or suitable ponds were found in the vicinity of Mount Tamana to support this idea. However, in 2001 tadpoles were found in a water-filled tree root hole on the side of the hill.

Mount Harris

Mount Harris (61°06'W – 10°30'N) is located 10 km northeast from Mount Tamana. Nine male frogs calling by a small stream were seen during three site inspections in 2003: this is the first time that *M. trinitatis* has been reported at this location. The site differed from the Northern Range sites in that it was formed primarily by broken forest, with hardly any low vegetation cover. Frogs were found at both sides of Cunapo Southern Road. At the top of the road (up a slight slope) the small stream was only a trickle, and at the other side of the road, down a slope, the stream increased in size and carried more water; the ground was covered in bamboo leaf litter and the ground was almost dry. The males were very elusive and difficult to catch. A batch of six tadpoles was found in a very small pool by the stream.

Western Central Range

Pepper Village

About 16 km southwest from Mount Tamana (61°21'W – 10°25'N), near Pepper Village, several males calling by a small stream were seen at both sides of Couva Main Road in 2003. The site above the road (up a small slope) was drier and covered in dry bamboo leaves. At the other side of the road (down a slope), access was difficult and the stream opened to several small effluents that flowed through very muddy terrain. The vegetation throughout was dense and led to a cultivated area several dozen meters down stream. Only two tadpoles were found in a small pond at the upper side of the road.

Gran Couva

Three kilometers southwest (61°22'W – 10°23'N) from Pepper Village (south from Gran Couva, Corosal Road) *M. trinitatis* were located in 2003 by a small stream that flowed through a very dry site with hardly any vegetation other than a few bamboo trees growing by the stream banks. For the first 50-70 m from the road the stream had few rocks and flowed slowly to a small descent with several dark rocks and stream pools. Adult males and females were found in larger numbers in this part of the stream. Fourteen tadpoles belonging to three different batches were found in three separate pools.

When disturbed, these frogs jumped into the pools and remained submerged for about a minute, swimming underwater to rock crevices within the ponds. This is the first time this behaviour has been observed for *M. trinitatis* in Trinidad. This escape response has only been observed before in some of the *M. trinitatis* Venezuelan coastal populations (Jowers, personal observation).

During a second visit in 2004 larger numbers of adults and tadpoles were found at this site.

Southern Range

Several sites and streams were surveyed at Moruga during a visit in 2003 (Lune Road and Moreau Road) and at Trinity Hills in 2004. Even though some sites seemed to be suitable for *M. trinitatis*, no frogs were found.

DISCUSSION

The results presented here add several points to previous reports on *M. trinitatis* in Trinidad.

First, *M. trinitatis* is more widely distributed in the central region than previously reported. It is not clear whether the populations at Mount Harris, Pepper Village and Gran Couva are recent expansions from the well-known population in Tamana Cave or whether previous workers have not searched for *M. trinitatis* in these areas. Since the habitat in these new localities is rather different from *M. trinitatis* habitat in the Northern Range, the latter explanation is possible. Genetic analysis should reveal how closely related the new populations are to the Tamana population.

Next, it is clear that the Tamana population is subject to dramatic fluctuations. Kenny (1969) reported tadpole densities of “several thousand per square meter” in the stream and as recently as 2002, we found high numbers. However, in the two years since, the population has drastically reduced. It is not clear what has caused

these fluctuations, but the degree of severity of the dry season in a limestone-based terrain may be a factor.

Finally, Kenny (1969) stated that “under natural conditions, tadpoles dwell always in running water”. However, Downie *et al.* (2001) found that tadpoles were rarely if ever found in streams containing predators, even when there were plentiful adult *M. trinitatis* close to the streams. They suspected that males carrying tadpoles migrated some distance in search of predator-free pools. Our findings here show that these pools can include phytotelmata i.e. not running water. Other dendrobatid species are obligate users of phytotelmata, such as bromeliad tanks, but in *M. trinitatis*, tadpole deposition in these pools seems to be opportunistic.

The apparent absence of *M. trinitatis* from the Southern Range is a puzzle. The habitat is very similar to the lower elevation hills of the Northern Range, where *M. trinitatis* is so common and widely distributed. It is possible that *M. trinitatis* is present, but not in large numbers and that previous searches including our own have been on unsuitably dry days. Neither Kenny (1969) nor Murphy (1997) report having searched the Trinity Hills, the most likely habitat, and our few visits have not coincided with the best weather for locating *M. trinitatis*. A genuine absence of this frog may reflect the pattern of its colonization of Trinidad, presumably from the Northern Range.

ACKNOWLEDGEMENTS

We wish to thank the Wildlife Section of the Trinidad and Tobago Government for permission to carry out this work. This study was carried out by several members of the University of Glasgow Trinidad Expeditions 2002 and 2003: many of these students contributed in this project; in particular, Ben Mitchell, Graham Stirling, Damian Tobin, Roisin Campbell-Palmer, Celia Langhorne, Jenny Miller and Vicky Ogilvy. This project was funded by the UK Natural Environmental Research Council (NERC).

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