# Mission golden-eyed tree frog *Trachycephalus resinifictrix*

Figure 1. *T. resinifictrix* (BT)

## Introduction

### *Description*

*Trachycephalus resinifictrix* (formerly in the genus *Phrynohyas*), commonly referred to as the Mission golden-eyed tree frog or the Amazonian milk frog, is a large, strikingly coloured hylid (Fig. 1). The dorsal surface is a light greenish-grey with dark grey or brown bands and spots. Some specimens may also have rust coloured markings. Patterning is generally darker in juveniles, and fades with age. Each toe terminates in a large disc. Females grow up to 100 mm SVL (snout vent length), while males reach up to 65mm.

### *Distribution*

*T. resinifictrix* is widely distributed in South America, occurring in Bolivia, Brazil, Columbia, Ecuador, French Guiana, Peru, Suriname and Venezuela. It is found from 0 – 450 m asl (IUCN *et al.*, 2006).

### *Conservation Status and Threats*

*Trachycephalus resinifictrix* is listed as Least Concern on the IUCN Red List due to its extensive distribution, presumed large population size, and because it is not likely to be declining rapidly enough to meet the criteria for a more threatened category (IUCN, 2007). Its range encompasses a number of protected areas (IUCN *et al*., 2006).

While this species is not currently threatened overall, local populations are adversely affected by habitat destruction and disturbance as a result of logging and expanding human settlements and agriculture (IUCN *et al*., 2006).

### *Habitat and Ecology*

This species is arboreal, and inhabits the canopy of primary tropical rainforest. It is one of relatively few amphibian species that breeds in water-filled tree holes, and so is able to complete its life-cycle entirely in the canopy. *T. resinifictrix* exhibits strong site fidelity and males are territorial. They consume a variety of invertebrates and small vertebrates.

### *Sexing Individuals*

The adult males of the species are smaller and have nuptial pads on the inside of the thumbs, these are more obvious in the breeding season. Males also have visible lateral vocal sacs, and call loudly.

### *Reproduction and Larval Development*

Males call from tree holes to attract females, usually between August and April (the wet season). Tree holes used by *T. resinifictrix* are large (depth = 15 – 90 cm, water volume = 2.8 - 90 l), are between 2 and 32 m above ground level, and exhibit pH values of approximately 6.0 - 7.0 and dissolved oxygen contents of between 0.2 and 3.9 mg / l (Schiesari *et al*., 2003). Males will compete aggressively for suitable tree holes, through both specific vocalisations and physical interactions (Schiesari *et al*., 2003). Amplexus is axillary. Once in amplexus, the female raises her cloaca slightly above the water level and deposits between several hundred and several thousand eggs (measuring approximately 1.6 mm in diameter each) as a surface film (Jungfer & Proy, 1998; Schiesari *et al*., 2003).

Free-swimming larvae hatch out of the eggs within 48 hours. They are generalists and are predominantly macrophageous, basing their diet on detritus and fertilized eggs of younger cohorts (oophagy appears to be opportunistic in this species, and not an example of parental care via the periodic deposition of eggs specifically as a food source for tadpoles). Larval density can be high, up to 16 tadpoles / litre (Schiesari *et al*., 2003). Time to metamorphosis has not been documented for tadpoles in the wild.

### *Longevity and Age at Sexual Maturity*

Lifespan and age at sexual maturity in the wild have not been reported. The maximum lifespan in captivity is also unknown; to date captive individuals have been recorded to live six to eight years. Sexual maturity can be reached in one year and eight months in captivity.

## Captive Management

***Introduction***
This species has been established in captivity for ten years, and is now quite common in the pet trade. Durrell obtained captive-bred individuals of this species in late 2004.

***Identifying Individuals***
Individuals have unique patterns, and can thus be identified using photographs of these natural markings. As patterns can change over time, new ID photographs should be taken once a year.

***Housing***
These are large, mobile tree frogs, and as such require spacious enclosures with extensive branching. At Durrell, this species has been housed and bred in two different enclosures, each with five animals. The off-display enclosure was a converted plastic storage unit (Fig. 2) measuring 600 x 800 x 600 mm, with a wire mesh lid for ventilation. A 250 x 150 x 100 mm plastic dish was used as a water dish. No substrate was provided in this enclosure. For branching, bamboo lengths (30 mm diameter) were used, and 150 mm lengths of PVC pipe (70 mm diameter) were attached to these to provide refugia. Lengths of this PVC pipe were also cut in half longitudinally to create refugia that were placed on the bottom of the enclosure. Artificial plants were attached to the sides of the vivarium and branches to provide additional refugia.
This species was also housed in a mixed-species public exhibit (*T. resinifictrix* and *Dendrobates azureus*). The enclosure measured 2.0 x 1.0 m x 1.2 m, and the substrate was peat and leaf litter. Natural tree branches and plants (including large bromeliads) were provided, and artificial tree holes were created using sections of drainpipe blocked off at one end (Fig. 3).

***Temperature, Humidity and Lighting***
The off-display enclosure was housed in a room heated to between 23-27 $^{o}$C (night/day summer) and 20 and 25˚C (night/day winter). A Reptisun 5.0 strip light was used for lighting, and an 80 watt spotlight was provided to create basking spots. from 24 – 29$^{o}$C by day to 20$^{o}$C at night. Two 250 W metal halide lamps and two 220 W incandescent spotlights were provided above the enclosure.
All adult specimens were given monthly UVb boosts where the animals were exposed to a 300w OSRAM ultra vita lux spot for 20 minutes. To do this the frogs were put in a plastic box with a plastic mesh lid under the OSRAM bulb. The frogs were positioned so that the UVb reading inside the box measured 300 µW / sq. cm. The UVb reading was obtained by using a solarmeter 6.2 (Solatell Inc). The solarmeter was set up in exactly the same type of box the frogs received their UVb boosts in, the bottom of the box was removed to allow the sensor to sit on the level which would have been equivalent to the base of the box. This was important as it allowed the measurement of UVb the frogs would be exposed to through the mesh of the lid of their box. The box with the solarmeter was then held with the sensor directly below the strongest beam of light being ommited from the OSRAM bulb. The solarmeter and box was then moved away from the bulb until it gave the desired reading of 300 µW / sq. cm. It was at this distance below the light that the frogs were positioned for the UVb boost.
The enclosure was lightly misted with tap water on a daily basis, and humidity varied between 45 and 90%.

***Routine Husbandry***


Figure 2. One set up for housing *T. resinifictrix* (BT)

All animals were visually inspected every two days. In the off-display enclosure, the water dish was cleaned out and refilled, and faeces were removed daily. The enclosure and all furniture were thoroughly scrubbed (with a brush and hot water, no chemical cleaners or disinfectants were used) twice a week. In the public display, the artificial tree holes and bromeliads were topped up with fresh water every day, and were completely cleaned out and refilled with fresh water once a week. Faeces were removed daily, and the branching was replaced as necessary.

***Diet in captivity***
At Durrell *T. resinifictrix* were fed on live invertebrates, predominantly crickets (*Gryllus assimilis* and *Gryllus bimaculatus*). Cockroaches (*Blaberus craniifer*) and locusts (*Locusta migratoria*) were occasionally offered. Adults readily took food items offered to them on tongs, which allowed the control of individual food intake when keeping them in larger groups (otherwise particular individuals may mo-

nopolize the food). Juvenile animals were fed on live pin head crickets and *Drosophila hydei*. All food items were dusted with Nutrobal ® (vitamin and mineral supplement) immediately prior to being fed out.Adults were fed every three to six days (depending on season and condition), juveniles up to six weeks of age were fed daily.

Figure 3 Artificial tree hole for egg deposition (BT)

## Reproduction in Captivity

***Breeding Seasonality***

In captivity this species can breed year round. At Durrell, over a period of eighteen months, at least one egg clutch was produced by each group each month. However, it is probably advisable to provide the animals with an annual rest period, as continuous reproduction at Durrell over this period may have been responsible for the poor quality of the clutches that were produced in 2007. It should be noted that reproduction took place despite the occurrence of a 'winter' period (eggs were laid in water at 19˚C), so it may be necessary to physically separate males and females.

***Provision of Breeding Sites***

Despite breeding in tree holes well above ground level in the wild, in captivity they will readily breed in either plastic water dishes at ground level or artificial tree holes that are within 0.5 m of ground level (Fig. 3).

***Tadpole Husbandry and Development***

After hatching, tadpoles were transferred to a glass tank measuring 400 x 250 x 250 mm. At Durrell tap water was used to rear tadpoles, and oak leaves were added to soften the water. Partial (20 – 30%) water changes occurred two to three times per week. Air stream sponge filters were used for filtration, and were cleaned at each partial water change. The water was not heated and ranged in temperature from 23 – 26$^{o}$C.

Tadpoles were fed predominantly on a powdered tadpole food (components: ground tropical fish flake, grass pellet, trout pellets, tubifex, river shrimp, spirulina algae and cuttlefish bone), but were also opportunistically fed conspecific egg masses. They metamorphosed in approximately 75 days at the above-mentioned temperatures.

***Rearing Metamorphs***

Metamorphs were housed in small plastic containters (Pal Pens), 250 x 140 x 200 mm. Specimens were housed in groups of up to 12 (groups were divided amongst larger Pal Pens as individuals grew). Paper towel was used as a substrate and was kept permanently damp. This was replaced as necessary. It should be noted that moss does not appear to be a suitable substrate, as it can be ingested during feeding and caused cloacal prolapses. A water dish was provided. It is essential that the water dish is easy for the metamorphs to climb out of (a rock or small branch in the water dish facilitates access). At Durrell we provided branching for climbing and artificial plants for refugia. The metamorphs were raised at the same temperature as the adults (23 - 27˚C), were misted with room temperature tap water twice daily, and were provisioned with a Reptisun 5.0 strip light. UVB boosts were not administered to metamorphs. Metamorphs were fed daily until about six weeks of age with pin head crickets and (occasionally) *Drosophila.* All food items were dusted with Nutrobal ®. After 8 weeks, the interval was gradually increased to once every three days.

## Health

***Problems Encountered in Captivity***

This species appears susceptible to rostral abrasions, oedema and metabolic bone disease. The provision of adequate space is important in minimising / avoiding the occurrence of rostral lesions. A number of institutions have reported specimens developing metabolic bone disease (MBD); this problem can be resolved/avoided by providing the animals with UVB light and dietary supplements. One specimen at Durrell that presented with cardiac failure also exhibited MBD, cardiac failure may result from MBD, as hypocalcaemia can lead to the malfunction of the lymph hearts, generalised oedema and increased cardiac pressure that could, in turn, lead to cardiac dilatation. Another specimen presented with recurring cloacal prolapses and exhibited MBD, the prolapses may also have been caused by the underlying hypocalcaemia.

***Routine Veterinary Procedures At Durrell Wildlife Conservation Trust***

All imported specimens were treated for *Batrachochytrium dendrobatidis* by bathing them in Itroconazole solution (1 part Itroconazole : 99 parts water) for five minutes daily for 11 days. There was zero mortality of specimens undergoing this treatment.

Specimens were treated for parasites using Ivomectine. Specimens were bathed (10mg/litre) for one hour, once a week for three weeks. No mortality of, or adverse effects on, specimens undergoing this treatment were observed.

Specimens have also been given intra-muscular injections of antibiotics (*e.g.* Ceftazidime, 20 mg / kg).

Specimens have been x-rayed, scanned via ultrasound (probe: HST 10-5 MHz). and given barium contrasts when a problem with the digestive tract has been suspected.

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***Authorship***

*Benjamin Tapley & Kay Sara Bradfield*

***Photography***

*Benjamin Tapley*

***Date***

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