

## Reproduction in the tree frog *Tachycnemis seychellensis*

Justin Gerlach & Ron Gerlach  
PO Box 207, Victoria, Mahé, SEYCHELLES  
*jstgerlach@aol.com*

**Abstract:** Captive breeding of the Seychelles tree frog *Tachycnemis seychellensis* (Hyperoliidae) is reported. The tadpoles of this species are described and compared to those of the only other Seychelles frog to have free-living tadpoles, the Mascarene frog *Ptychadena mascariensis* (Ranidae). Eggs may be laid more than once a year in clumps above water. Embryonic development and hatching occurs out of water, and the fully developed tadpoles fall into the water below the egg mass. The time from hatching to metamorphosis is 45-141 days with a bimodal distribution of metamorphosis dates. Tadpoles feed on detritus. One male started calling at 450 days from metamorphosis (485 days from hatching) having reached 44mm SVL.

**Key words:** Seychelles, Hyperoliidae

The hyperoliid Seychelles tree frog *Tachycnemis seychellensis* (Duméril & Bibrion, 1841) is widely distributed on the Seychelles islands of Mahé, Silhouette, Praslin and La Digue. It is currently classified as Least Concern by the IUCN Red List. Its distribution is reasonably well known but there is little information on the ecology of the species. Some studies of behaviour and diet in anthropophilic situations have been published (Rocamora 2003; Gerlach & Rocamora 2004) as has a brief account of general ecology (Nussbaum 1984). Knowledge of reproductive biology is restricted to descriptions of tadpoles (Boulenger 1882; Drewes 1984; McDairmid & Altig 1999), reports of eggs being laid adjacent to streams where flood-waters may transfer the tadpoles into the water (Nussbaum 1984) and a report of frogs laying 100-500 eggs on aquatic vegetation in standing water or the bottom of pools (Henkel & Schmidt 2000). However, the details of this last account are not known.

In 2008 a pair of tree frogs were collected at La Passe on Silhouette island and maintained in captivity. The female laid eggs on two occasions; both clutches hatched and were successfully reared. This captive breeding is reported here and a description of the tadpoles presented. In addition, for comparative purposes a description is given of the tadpoles of the Mascarene frog *Ptychadena mascariensis*, the only other Seychelles frog with free-living tadpoles.

### Captive maintenance of Seychelles tree frogs

Two adult frogs were kept, a female caught on 2<sup>nd</sup> July 2008 and a male on 31<sup>st</sup> October 2008. Both were from the La Passe population on Silhouette island. The adults were kept in a glass vivarium measuring (in cm) 60x30 x 40h, with a wooden lid (Fig. 1). The vivarium was filled with water to a depth of 2cm and in this were placed 2 sprouting coconuts. These provided hiding and climbing places for the frogs while the water provided constant moisture. No artificial heating or lighting were provided,

ambient conditions were a temperature range of 22-32°C and humidity levels of 75-95%. Humidity within the vivarium was not recorded but was probably constantly above 85%. Frogs were fed with burrowing cockroaches (*Pycnoscelus surinamensis*) 3 cockroaches each on most days.

On hatching tadpoles were transferred to a large, shallow aquarium measuring (in cm) 50x100 x 25h. This was filled with 1.5cm of washed sand and 10cm of water. The aquarium was placed at an angle to provide shallow and deep water. Stones were placed in the centre to allow froglets to climb out of the water on metamorphosis. The aquarium was covered with a mosquito mesh screen allowing free-flow of air but preventing escape. Some filamentous algae and dead leaves of *Calophyllum inophyllum* were placed in the water as a possible food source. The algae were never eaten but the leaves were grazed as they blackened and decomposed. Tadpoles were periodically provided with commercial terrapin food pellets (various brands) which were consumed.

On metamorphosis (when they emerged from the water) froglets were transferred to small vivaria (30x20 x 25h) with solid lids. These contained flower pots of soil and plants, standing in 1.5cm of water. Froglets were fed on small insects, mainly *Drosophila* fruit flies. When they reached 20mm snout-vent length (SVL) they were fed small cockroaches under 5mm long.

## Reproduction

Amplexus was observed on 29-30<sup>th</sup> November and most of the first half of December 2008. Oviposition was not observed and tadpoles were first seen on 9<sup>th</sup> August 2009. By this time they measured an average of 10.2mm total length (body length 3-4mm). A second clutch of eggs was found in October 2009. 148 eggs were laid on a coconut 2cm above the water-line.

## Tadpole descriptions – all measurements given in mm.

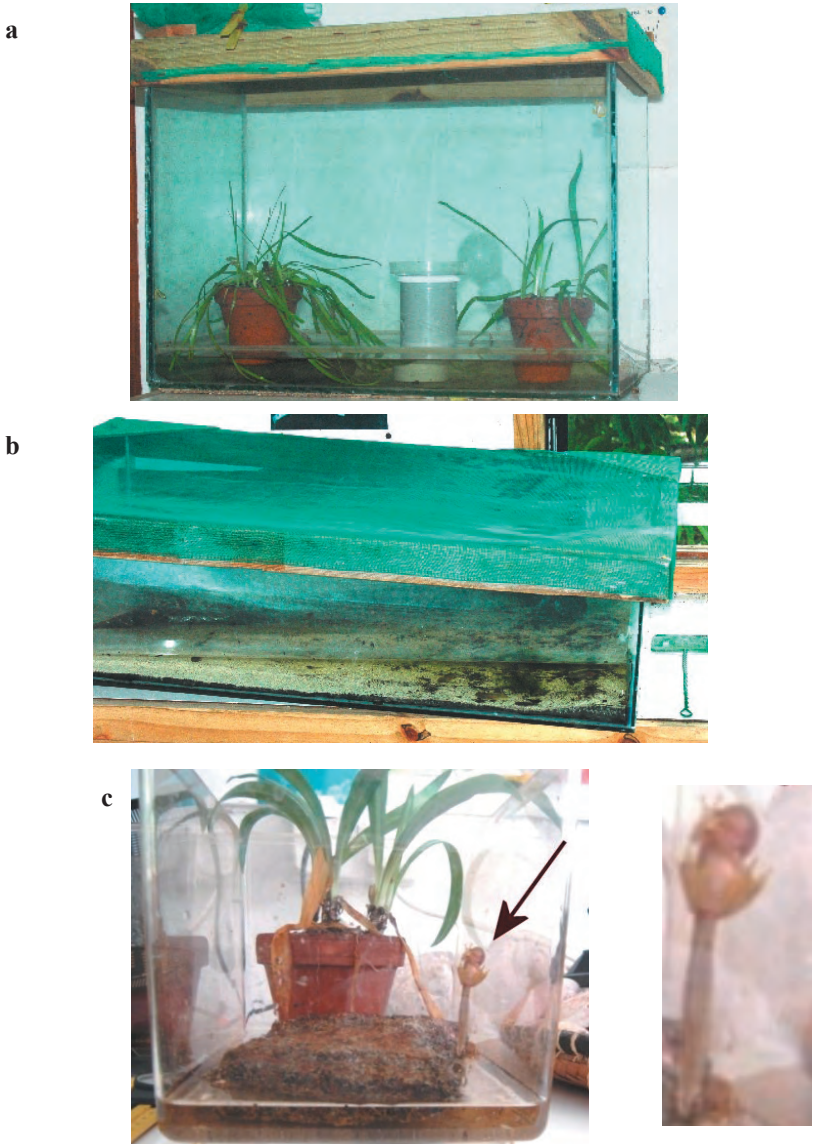
### *Ptychadena mascariensis* tadpoles (Fig. 2).

Source: Mascarene frog tadpoles were collected from the Grande Riviere at La Passe, Silhouette on 9<sup>th</sup> July 2008.

Description: Type IV, exotrophic, lentic and benthic tadpoles. Total length 43.2, body length (15.2) 37% of total length; body shape oval, body length 188% of body height (8.0), and body width (10.2) 127% of body height, without constrictions between head and trunk; snout pointed in dorsal and lateral profile; eyes relatively large, dorsolaterally placed; eye diameter 26% of body width at eye level, and 393% of interorbital distance, interorbital distance (4.3) 7% of body width at eye level. Nostrils subcircular, dorsal, slightly elevated, closer to tip of snout than to eye, rostronasal distance 65% of orbitonasal distance; internarial distance (1.4) 7% of interorbital distance. Spiracle sinistral, spiracular tube and opening ventral. Vent tube length 23% of body length; vent opening medial. Tail length 63% of total length, tail height at the base of the tail (5.2) 69% of body height; dorsal and ventral fins well developed, with slightly curved margins; maximum tail height approximately at one third to middle of length, 110% of body height; tail axis straight and tip of tail rounded pointed. Caudal musculature height at base of the tail 59% of body height, caudal musculature width at the base of the tail

64% of body width; myotomes clearly visible.

Oral disc sub-terminal, not visible dorsally; oral disc width 1.4, disc small, about 21% of maximum body width; disc pointed anteriorly; a row of lower marginal papillae and an additional lateral row; no mental gap and rostral gap narrow; intramarginal papillae absent; tooth row formula: 1/2. Beak pointed, serrated



**Fig. 1.** Captive rearing system. a) Breeding vivarium, b) Tadpole aquarium, c) Juvenile vivarium, arrow shows metamorph with tail, and shown right

Dorsum and lateral body sides grey, mottled brown; ventral region grey, peribranchial zone paler than abdominal region, abdomen with guanophores; fins transparent with mottled pigmentation; caudal musculature darker with melanophores arranged more densely on fins.

Metamorph: dorsum and lateral body sides ochre with irregular darker patches, a medial dorsal green line developing at metamorphosis; dark pigmentation around nostril; ventral region pale grey, peribranchial zone paler white, abdomen with guanophores; fins transparent with sparse melanophores.

*Tachycnemis seychellensis* tadpoles (Fig. 2).

Source: tadpoles at various stages of development collected from Grande Riviere, La Passe, Silhouette on 14<sup>th</sup> July 2008 and captive bred in July and October 2009.

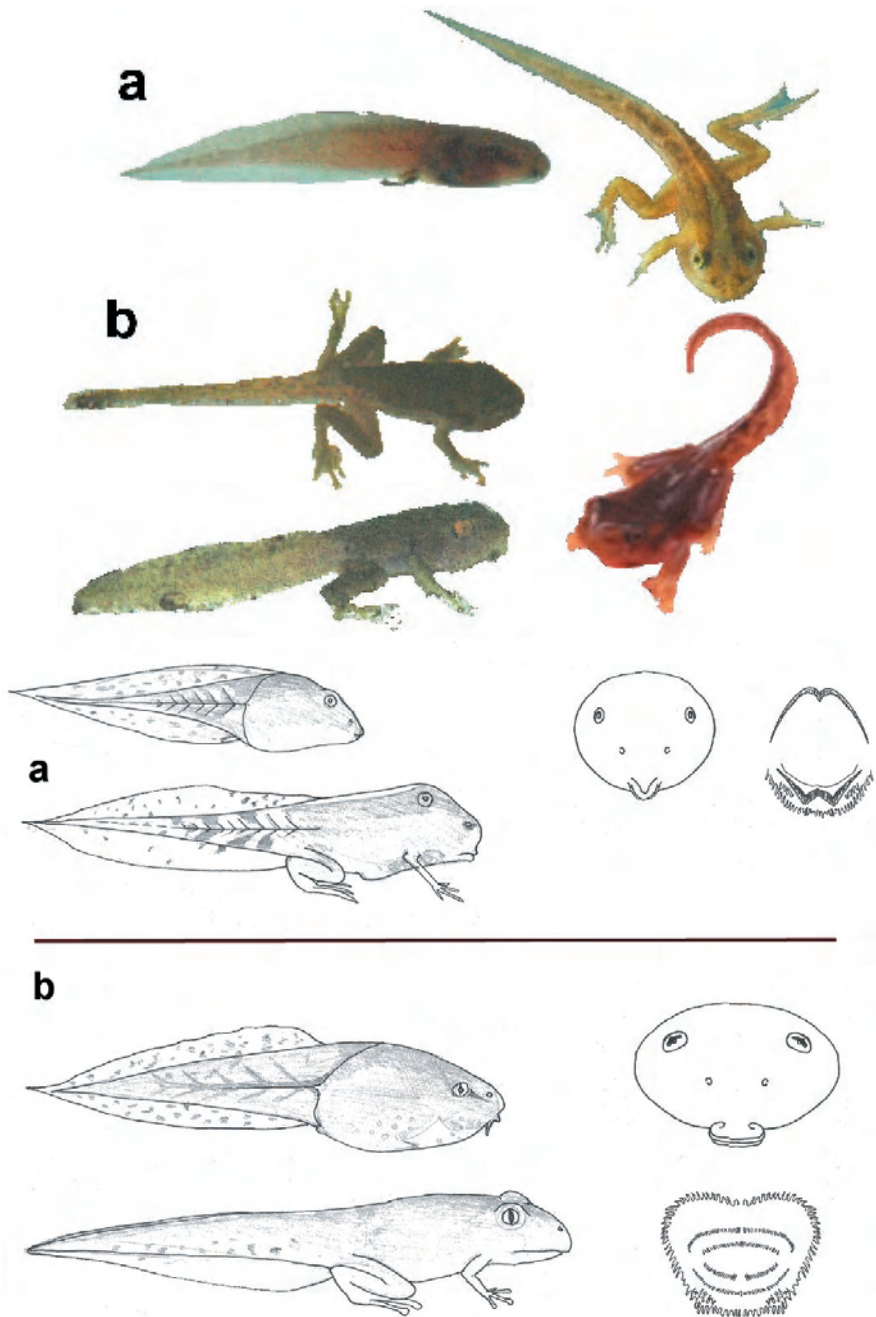
Description: Type IV, exotrophic, lentic and benthic tadpoles. Total length 36.5-44, body length (11.9) 32% of total length; body shape depressed oval, body length 210% of body height (5.9), and body width (7.9) 123% of body height, without constrictions between head and trunk; snout broad, rounded in dorsal and lateral profile; eyes relatively large, dorsolaterally placed; eye diameter 17% of body width at eye level, and 12% of interorbital distance, interorbital distance 72% of body width at eye level; rostro-orbital distance 34% of body length. Nostrils subcircular, dorsal, not elevated, closer to tip of snout than to eye, rostronasal distance 45% of orbitonasal distance; internarial distance 50% of interorbital distance. Spiracle sinistral, spiracular tube and opening ventral. Vent tube length 19% of body length; vent opening dextral. Tail length 68% of total length, tail height at the base of the tail (6.1) 92% of body height; dorsal and ventral fins well developed, with slightly curved margins, dorsal fin originates distal to body, edge waved; maximum tail height approximately 25% of distance from body, 120% of maximum body height; tail axis straight and tip of tail slightly pointed. Caudal musculature height at the base of the tail 72% of body height, caudal musculature width at the base of the tail 40% of body width; myotomes clearly visible.

Oral disc sub-terminal, not visible dorsally; moderately wide, about 25% of maximum body width; disc without angular constrictions; a row of well developed marginal papillae in anterior, posterior and lateral regions; no mental gap present (cited as wide in McDairmid & Altig 1999), narrow rostral gap less than 10% of oral disc width; intramarginal papillae present ventrally; tooth row formula 2/2(1). Upper jaw wide, serrated; lower jaw moderately wide, V-shaped.

Dorsum and lateral body sides uniformly dark reddish brown; a dark line between eye and nostril; ventral region grey, peribranchial zone paler than abdominal region, abdomen with guanophores; fins transparent with dense mottled pigmentation; caudal musculature dark.

Metamorph: dorsum and lateral body sides uniformly dark brownish green; tail mottled with pale areas. Pale stripe from nostril to eye. Ventral region pale yellowish; toes elongate with distinct toe pads, yellow.

Development: Development patterns shown in Figs 3-5. The smallest tadpole to develop legs had a snout-vent length of 12.0mm; the largest to start developing legs was 14.7mm. The smallest with all legs developed was 14.5mm; the normal range was



**Fig. 2.** Tadpole morphology of a) *Ptychadena mascariensis*, b) *Tachycnemis seychellensis*. Drawings on right show tadpole head in anterior view and mouthparts.

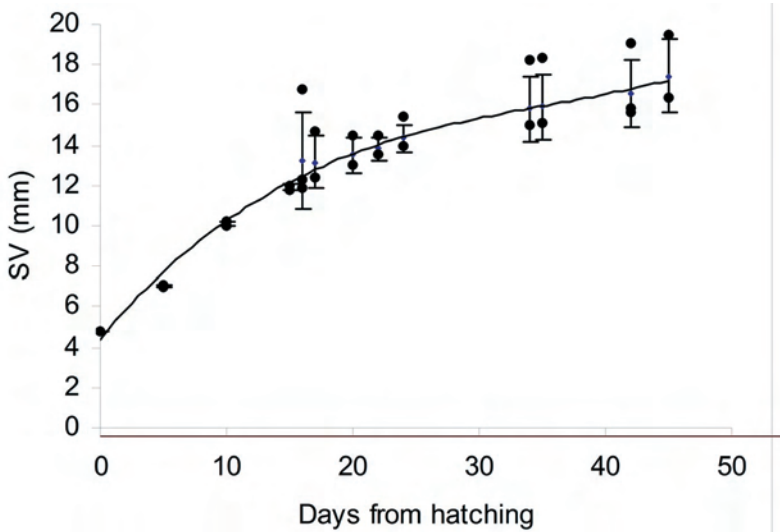


Fig. 3. Growth pattern of the five fastest developing tadpoles from hatching to metamorphosis.

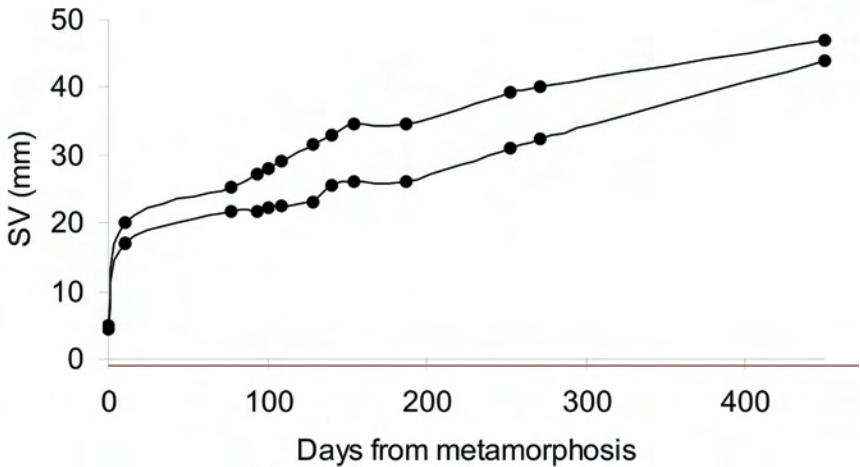


Fig. 4. Growth pattern of the first two tadpoles to reach metamorphosis.

15.6- 19.5mm. Metamorphs climbed up the sides of the glass aquarium or onto rocks within 12 hours of developing hind legs. Once at least 3cm above the water line they remained largely inactive until the tail had been resorbed (2-4 days).

## Discussion

*Tachycnemis seychellensis* tadpoles have been well described previously (Drewes 1984), and measurements were given by Boulenger (1882) who described an 18mm tadpole with at 44mm tail (probably transposed) and McDairmid & Altig (1999)

who gave a total length of 44mm. It appears that the latter two measurements refer to the same data, but the source of any of these specimens is not known. The present study supports previous descriptions with a body length of approximately 12mm and a total length of up to 44mm.

Previous accounts of reproduction in the Seychelles tree frog have provided little background detail and it is difficult to determine what is taken from direct observation or extrapolated from other species. From the present observations reproduction in this species can be summarised. Eggs may be laid more than once a year and are laid in clumps of approximately 150 eggs above the water. In addition to eggs laid above water as observed here, Nussbaum (1984) described eggs being “occasionally placed on the ground in shallow depressions, in dry stream beds, or beside a flowing stream” and speculated that these eggs were laid in anticipation of flooding. Whether this is a deliberate strategy or the result of laying in inappropriate sites remains unknown and further field research is required to clarify this point. Henkel & Schmidt (2000) reported eggs laid in the water, which does not fit with the present observation of those of Nussbaum (1984). Embryonic development and hatching occurs out of water, and the fully developed tadpoles fall into the water below the egg mass.

Development of *Tachycnemis* tadpoles is extremely variable within clutches, time from hatching to metamorphosis varying from 45 to 141 days. In both clutches of eggs it appears that most tadpoles can be divided into fast or slow growing categories, with a clear bimodal distribution of metamorphosis dates. The second clutch developed more slowly and has a less pronounced bimodal distribution. This may be due to them being placed with the slow developing cohort of the first clutch, thus effectively subjecting this group to high levels of competition and slowing the early stages of development. The presence of two developmental strategies within egg clutches may

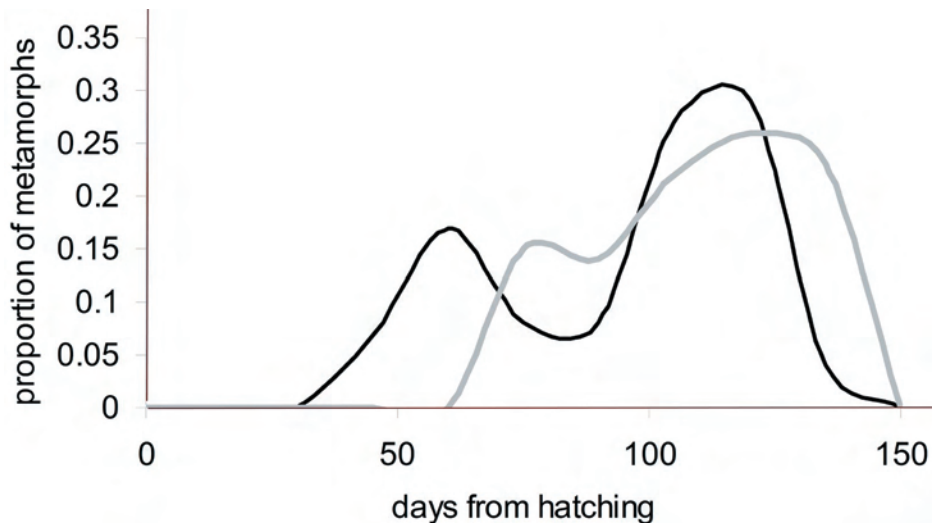


Fig. 5. Metamorphosis rates of the two captive-bred clutches of eggs. Black line – July clutch. Grey line – October clutch.

mean that most tadpoles spend an extended period of time feeding in water and reaching a maximum size for metamorphosis whilst others develop rapidly, ensuring that some metamorphs are produced even in ephemeral water bodies. No difference was observed between fast and slow developing tadpoles in size at metamorphosis. Tadpoles fed on detritus, especially old decaying leaves.

For the fastest growing individuals age to maturity (as indicated by male calling) was 450 days from metamorphosis (or 485 days from hatching). This was the earliest calling recorded and is not necessarily the same as true sexual maturity, but gives some indication of the development rate of the species. This calling male was 44mm SVL. This rate of development appears to be similar to many other tree frog species, although there are very few quantified studies. For example, the spotted tree frog *Litoria spenceri* is reported to mature at 3-4 years of age (NSWNP & WS 2001) whilst the Pacific tree frog *Pseudacris regilla* matures in 3-4 months (Jameson 1956).

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