Hyalinobatrachium orientale (Tobago Glass Frog)

Family: Centrolenidae (Glass Frogs)
Order: Anura (Frogs and Toads)
Class: Amphibia (Amphibians)

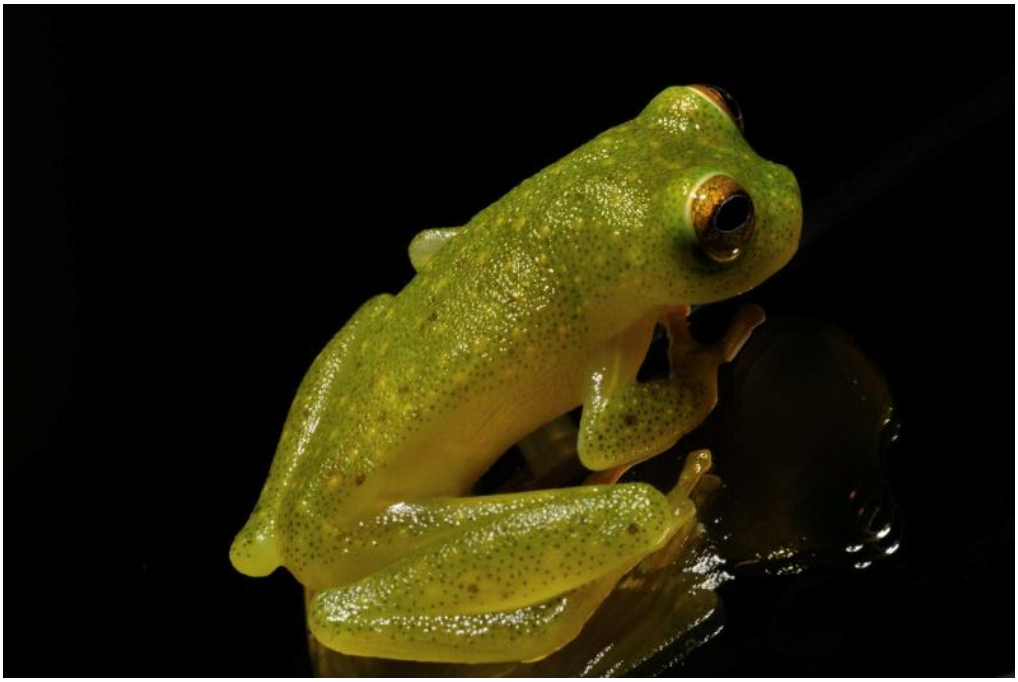

Fig. 1. Tobago glass frog, *Hyalinobatrachium orientale*.

[https://www.flickr.com/photos/67822445@N07/13550286223/, downloaded 24 January 2015]

TRAITS. *Hyalinobatrachium orientale* is also called the eastern glass frog; in Tobago there is a separate subspecies, named *Hyalinobatrachium orientale tobagoensis*. Glass frogs are given their name because the dorsal surface is pale green (Fig. 1) but the abdomen skin is transparent and the organs, for example the heart, are visible (Fig. 2). The dorsum (back) is smooth with many melanophores (black pigment cells) while the ventral skin is granular (Murphy, 1997). It is small; usually less than 30mm (males are 18-21 mm while females are 20-22mm); tip of the toes are T-shaped; fingers have reduced webbing; eyes are large with a gold iris; the head is round in dorsal view and truncated in lateral view (Murphy, 1997). Additionally, in this family of amphibians the eyes are directed forward in comparison with other amphibians whose eyes are directed to the sides.

DISTRIBUTION. There are 151 species of glass frogs but this one in particular resides in Tobago. The distribution is fragmented (IUCN, 2014). It is distributed among the Cordillera Oriental in Columbia, the mountains of northern Venezuela, Sierra de Lema in Guyana, and in north eastern Tobago (Fig. 3). In Tobago, it occurs along streams that cut the road leading to Bloody Bay from Roxborough approximately 3-5 km south of Bloody Bay. This species originated in Venezuela but it diverged about three million years ago (Murphy, 1997).

HABITAT AND ACTIVITY. These nocturnal and aboreal vertebrates live on leaves near streams, creeks or rivers. They are terrestrial and freshwater organisms. They choose leaves, usually *Heliconia,* with larger surface areas for oviposition sites. The male call is tonal and it lasts about 0.19-0.38 seconds. In 2011, it was observed that small crabs are found on these leaves and they were predators to the eggs hence the eggs were placed on the underside of the leaves as a response to crab predation since they cannot walk here (Murphy et al., 2011).

FOOD AND FEEDING. There is not a lot of information available about the feeding of this species in particular but another species in the Centrolenidae family, *Hyalinobatrachium fleischmanni,* which exist mostly in South American countries like Guyana and Suriname, feed on small arthropods (Guyer and Donnelly, 2005) and it is assumed that *H. orientale* do the same. The predators are bigger arthropods or ctenid spiders.

POPULATION ECOLOGY. Glass frogs are solitary and the males are territorial. According to the IUCN (2014), it is a common species across its range but the distribution is fragmented. Lehtinen and Georgiadis (2012) reported that the distribution is more widespread in Tobago because they were heard calling from numerous streams along the island's Main Ridge. The IUCN (2014) reports that its Extent of Occurrence is less than 20000 km^2 in Venezuela and Tobago.

REPRODUCTION. Around July, the males have calling sounds which they use when they are ready to mate. One male opens the sequence with a low voice and a single, high pitched 'peep' until the others form a chorus and join (Murphy, 1997). The territorial males defend their calling sites on the leaves as can be seen in Fig. 4. Generally in the Centrolenidae family, when males attract females and she approaches him, he climbs onto her back in an amplexus position and he remains there until she lays her eggs. The females of *Hyalinobatrachium orientale* lay her eggs on the underside of leaves that overhang the water so that when the eggs hatch, the tadpoles which are transparent and bright green in colour fall into the water where they burrow into the substrate. Before hatching, there is egg attendance which is carried out by the males who fertilize these eggs. In *H. fleischmanni,* the females lay 18-30 eggs and after hatching, the tadpoles that drop into the water develop into froglets (AmphibiaWeb, 2011).

BEHAVIOUR. Fig. 5 shows a male on top of an egg mass which is thought to prevent desiccation and provides antifungal and antibacterial protection (Murphy et al., 2011). Three different males were observed on 25 June 2010 in the evening. They were found on *Heliconia* leaves about 1-3m above a stream in the Tobago Forest Reserve. Two males each attended a single mass of eggs and were directly on top of it. One male attended approximately six masses simultaneously but the developmental stages differed concluding that the masses were from different females. These males continued to call as they attended the eggs to attract more females to deposit more eggs. The following morning, the eggs were checked and the males were not there which led to the conclusion that egg attendance is nocturnal (Lehtinen and Georgiadis, 2012). In 2011, egg clutches were tampered with and they immediately hatched. The tadpoles propelled themselves 40cm in distance which showed that that was a response to threats from predators. Lehtinen et al. (2014) recorded three male removal experiments which were done twice in the rainy season and the other in the dry season. In the dry season, mortality is due to desiccation of the clutches hence egg attendance is increased during this season. In the wet season it was due to arthropod predation. Where males were removed from the clutches, there was reduced survivorship therefore it is assumed that the males prevent parasite infection and

predation of the egg masses and they also provide moisture for the eggs. In another species found in Costa Rica, *Hyalinobatrachium valerioi*, the males attend the egg clutches 24 hours a day and they have more successful mating on nights with more rainfall (Vochenhuber et al., 2008).

APPLIED ECOLOGY. Although there are no known threats to the species in Tobago, this glass frog which is listed as Vulnerable (VU) in 'The IUCN Red List of Threatened Species' is being protected in the rainforests where they are known to be found for example the Little Tobago Wildlife Sanctuary. However in Venezuela, the areas where they are found are being deforested due to human settlement and environmental explosion therefore the population trend is decreasing.

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Author: Arianne Daniel

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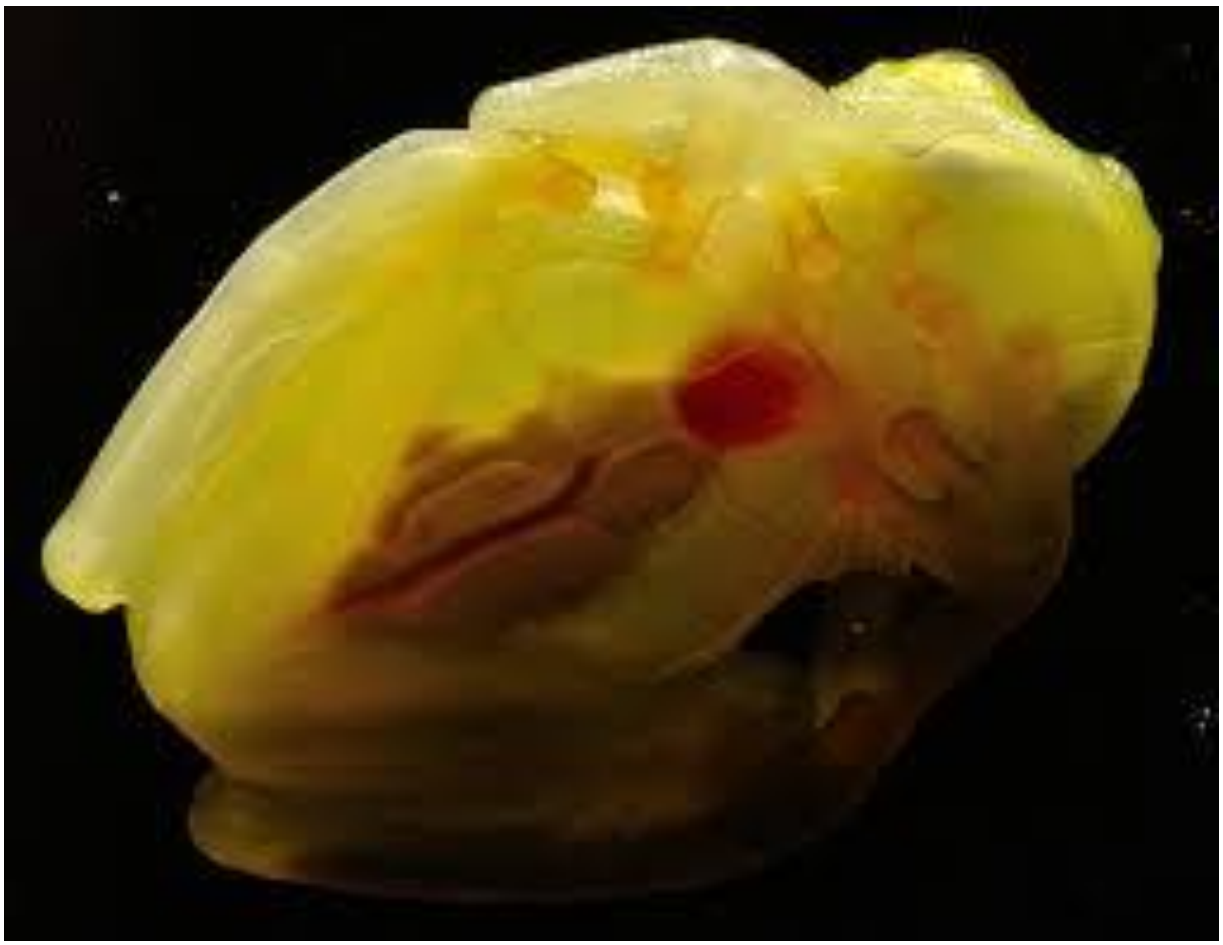

Fig. 2. Transparent ventral skin of a glass frog.

[https://www.flickr.com/photos/67822445@N07/13550389805/, downloaded 7 March 2015]

Fig. 3. Distribution of *Hyalinobatrachium orientale.*

[http://maps.iucnredlist.org/map.html?id=55025, downloaded 8 March 2015]

Fig. 4. Male glass frog calling from underside of leaf.

[Fig. 2 of Luhring and Ross (2012), downloaded 7 March 2015]

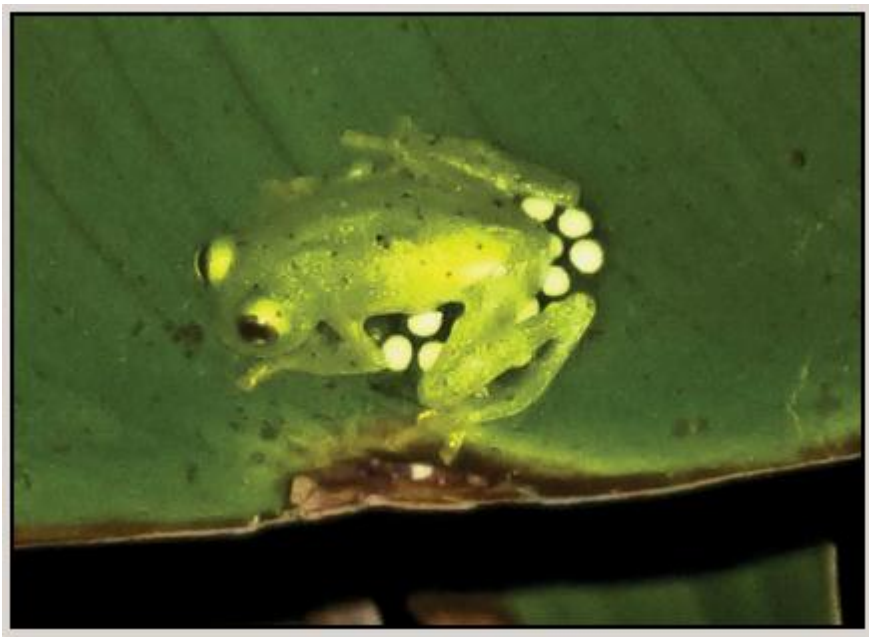

Fig. 5. Male glass frog covering an egg mass.

[Fig. 1 of Luhring and Ross (2012), downloaded 7 March 2015]