



Tadpole Transport Behavior of the Philippine Small-disked Frog, *Limnonectes parvus* (Taylor 1920), from Western Mindanao, Philippines

Joe Merfurt N. Lama¹ and Tristan Luap P. Senarillos²

¹Department of Biological Sciences, Western Mindanao State University, Zamboanga City 7000, Philippines (jmlamanavarro@gmail.com [corresponding author])

²Philippine Eagle Foundation Inc, Philippine Eagle Center Malagos, Baguio District, Davao City 8000, Philippines (tristansenarillos18@gmail.com)

Parental care in amphibians is a broad topic of interest and has drawn much attention from biologists worldwide (Schulte et al. 2020). Most of these social traits are diverse, influenced by several ecological factors and life-history strategies, and play a vital role in the early stage of the development of tadpoles and the viability of the species (Vagi et al. 2019; Schulte et al. 2020). One unique form of parental care is larval transport and egg-guarding by males. Moving the eggs and larvae to different environments can help reduce developmental issues that may arise from poor oxygen or yolk layering. This behavior also creates a more favorable environment for the offspring, particularly in terrestrial environments. Additionally, this behavior helps prevent eggs from desiccation (Salthe and Mecham 1974; McDiarmid 1978). However, this parental investment by the breeding adults could result in smaller clutch sizes and delay subsequent reproduction until after eggs hatch (Vallejos et al. 2018).

Parental care is a well-known trait among anurans in the genus *Limnonectes* (Dicroglossidae) (Inger and Voris 1988; Vallejos et al. 2018). Most males in this genus are known to diligently safeguard eggs and tadpoles (Grant et al. 2006). For instance, the Rough Guardian Frog (*L. finchi*) in Borneo and the Smooth Guardian Frog (*L. palawanensis*) in Borneo and Palawan are known to carry tadpoles on their backs to nearby bodies of water, where they complete their development (IUCN SSC Amphibian Specialist Group 2018a, 2018b; Vallejos et al. 2018). In the Philippines, egg-guarding behavior and paternal investment have been described only for Woodworth’s Frog (*L. woodworthi*) in Mindoro (Binaday 2018) and the Leyte Wart Frog (*L. leytensis*) on Dinagat Islands (Maglangit et al. 2020). These observations suggest that parental attendance during embryonic development was performed primarily by males, similar to previously observed behavior in *L. finchi* and *L. palawanensis* (Inger and



Figure 1. *In-situ* tadpole-transportation on the back of a male Philippine Small-disked Frog (*Limnonectes parvus*). Photographs by J.M.N. Lama.

Voris 1988; Vallejos et al. 2018). However, only Salthe and Mecham (1974) mentioned the possibility of Philippine species of *Limnonectes* engaging in tadpole transport.

At 2035 h, during our rapid biological survey on 22 January 2020 at one of the Biodiversity Assessment Monitoring Sites (BAMS) in Pasonanca Natural Park (PaNP), Zamboanga City (7.0626 N, 122.0867 E; elev. 522 m asl), we stumbled across a single adult male *Limnonectes* within a minor tributary of the Misuloy River surrounded by a primary lowland dipterocarp forest. During approximately 18 minutes of observation, we noted that this individual carried seven tadpoles firmly attached to the posterior portion of its dorsum (Fig. 1). We identified this frog as a Philippine Small-disked Frog (*Limnonectes parvus*) based on its relatively small body size (SVL = 30 mm), presence of smooth dorsal skin, smooth supratympanic fold, length of finger 1 equal to finger 2, and presence of an inverted V-shaped mark in the scapular region (Siler et al. 2009).

Limnonectes parvus is an endemic dicroglossid frog patchily distributed on the islands of Basilan and Mindanao (Diesmos et al. 2015). On Mindanao, it has been recorded in the provinces of Zamboanga Del Norte and Misamis Occidental, with its northernmost distribution in Agusan Del Sur (Herr et al. 2021; Sanguila et al. 2016). However, this species may occur more widely outside of its known range, especially in areas between known sites (IUCN SSC Amphibian Specialist Group 2018c). It inhabits swamps, seeps, and wide, slow-moving streams in undisturbed lowland primary and secondary forests (Sanguila et al. 2016).

To our knowledge, this finding is the first documentation of tadpole-transport behavior in any Philippine species of *Limnonectes* and for *L. parvus*, confirming the presence of parenting behavior similar to that of congeners, which is often associated with a derived reproductive mode (Setiadi et al. 2011). Our single-event record for tadpoles transported by *L. parvus* is lower than the average number recorded for *L. palawanensis* (11, range 6–13) (Inger and Voris 1988; Vallejos et al. 2018) in Borneo and Palawan, and *L. finchi* (11, range 1–52 tadpoles) (Inger and Voris 1988) from Eastern Sabah. This record suggests that longer-duration natural history observations for *L. parvus* are warranted, particularly from other provinces where the species is known to occur.

In light of the global population decline of tropical amphibians due to diseases, habitat loss, and climate change (Alton and Franklin 2017), the preliminary observations on the reproductive behavior of poorly known endemic amphibian species like *L. parvus* is important information in understanding the species' natural history, which is currently lacking for many Philippine endemics (Brown et al. 2002). Reports on natural history are also important to address the persisting knowledge shortfalls and inform species conservation efforts (Teodoro et al. 2022). The data from thorough

field observations can also be applied to ex-situ amphibian conservation efforts by developing captive-care protocols for breeding endemic and threatened species (Gascon et al. 2007).

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