First description of the female Magnificent Broodfrog (*Pseudophryne covacevichae*), in North Queensland

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Abstract

The Magnificent Broodfrog (*Pseudophryne covacevichae*) is a cryptic species living in remote areas of North Queensland, Australia. Critical natural history information, like detailed distribution, habitat preference, breeding biology and genetics are lacking. As an example of limited information on the species, there have been no records of a female Magnificent Broodfrog. This note documents what is believed to be the first records and descriptions of the female Magnificent Broodfrog.

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The Magnificent Broodfrog (*Pseudophryne covacevichae*) is a small myobatrachid frog, a semi-terrestrial breeder, with a snout to vent length of 25–30 mm (Clulow & Swan 2018). The species relies on a particular combination of habitat, preferring rhyolitic or granitic soils above 700 m asl (author observation), in open eucalypt forest or the bordering wet sclerophyll woodland (McDonald 2002). Individuals occupy small, ephemeral drainage lines or seepages within these landscapes, typically on first order streams (McDonald 2002).

The species was first discovered at Millstream National Park, near Ravenshoe in the late 1980s and was subsequently described in 1994 (Ingram & Corben 1994). For two decades, there were only a small number of known populations across a 25 km × 10 km expanse, in the Atherton Tablelands region (McDonald 2002). In 2013, the species was found to inhabit the Paluma Range, extending the distribution by 160 km south east (Zozaya & Hoskin 2015). At present, they are known from an approximate 50 km × 10 km expanse in the north (Ravenshoe–Herberton) and 14 km × 5 km expanse in the south (Paluma Range) (Fig. 1). Due to their isolated and fragmented distribution, the species is classified as Vulnerable under both the Queensland *Nature Conservation Act 1994* (NCA) and the Federal *Environment Protection and Biodiversity Act 1999* (EPBC) and Endangered by the International Union for Conservation of Nature.

During the breeding season (September to May) males vocalise to establish a territory and encourage a female to mate, and they build a nest on land in moist soil or leaf litter beside the drainage line or within seeps (McDonald 2002). Females deposit their eggs into the nests, with clutches of 6–82 eggs observed, often in varying stages of development (McDonald 2002). When the nests are flooded, the tadpoles emerge and are washed into the adjacent pools to complete their aquatic metamorphosis (McDonald 2002).

Given that the Magnificent Broodfrog is small, terrestrial and resides in thick grass or leaf litter, elements of their life history have been difficult to observe and remain relatively unknown. This is particularly evident, as to date there have been no recorded observations of a female. As there is little information available on the species, inferences can only be drawn from others within the genus.

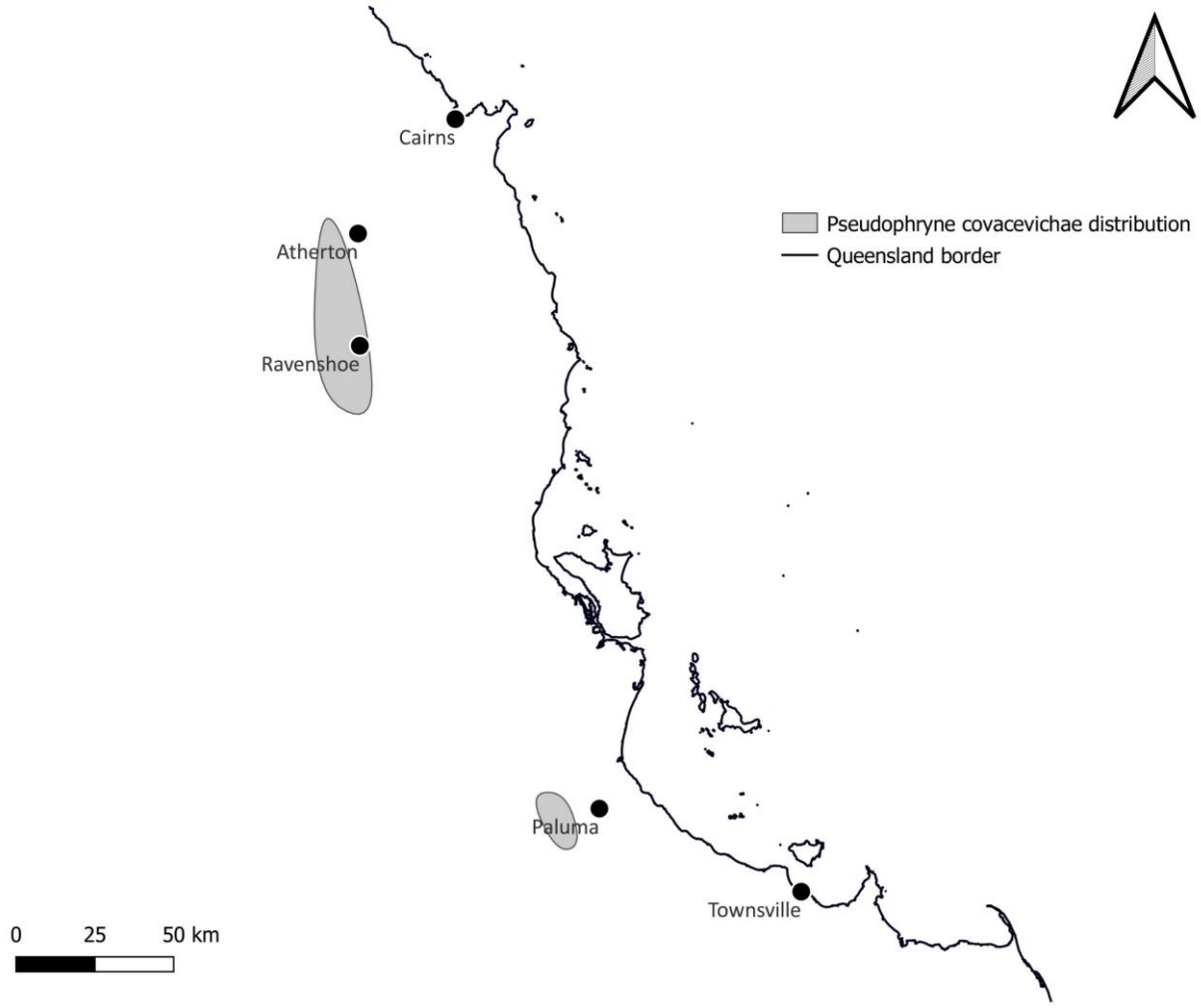

Figure 1. Current recognised distribution of the Magnificent Broodfrog (*Pseudophryne covacevichae*) in the Atherton Tablelands region and Paluma Range.

Female *Pseudophryne* are typically larger than males (Pengilley 1966; Woodruff 1976; White 1993; Byrne *et al.* 2021), and in some instances may vary in pattern and colour (Pengilley 1966; Anstis 2017). Research on the Brown Toadlet (*P. bibronii*), Dendy's Toadlet (*P. dendyi*) and Southern Toadlet (*P. semimarmorata*) demonstrate that males begin calling several weeks prior to females entering the breeding site, which is timed for when the ground has become sufficiently damp for egg-laying (Woodruff 1976; Mitchell 2001). Females migrate into the breeding area (Woodruff 1976; White 1993), during peaks of male calling activity (Byrne *et al.* 2021). Following mating, males typically remain close to the eggs and resume calling, while females either leave the breeding area or remain to mate again if they have not deposited all their eggs (Woodruff 1976). Egg-laying may continue for a period of four to seven weeks (Woodruff 1976).

It is unsurprising that female *Pseudophryne* are seldom encountered, as their presence at a site is not consistent. Some *Pseudophryne* species are more easily located by looking under woody debris and rocks (Stauber 2006; Heap *et al.* 2015), however, this is not possible for the Magnificent Broodfrog as they reside in dense vegetation that is not readily moveable (Fig. 2). Below details the first potential descriptions of the female Magnificent Broodfrog from observations made in 2022 and 2023.

Surveys to collect Magnificent Broodfrog genetic samples occurred during the North Queensland wet season, in February 2022 and again from November 2022 to March 2023. Surveys took place 30 to 40 minutes after sunset and ended by 23:00 each night. One or two observers approached a

Figure 2. Example of Magnificent Broodfrog (*Pseudophryne covacevichae*) habitat (at a drier site), taken in the Herberton region of North Queensland. Photo: Emily Rush.

calling male and narrowed in on its location before carefully moving vegetation to locate the individual. In total, approximately 150 Magnificent Broodfrogs were encountered during surveys. Of these, six were believed to be female. Five of these individuals were located either with a calling male, or on top of vegetation moving towards a calling male. Of significance, one of these individuals was located while searching for a male producing what is believed to be a courtship call. This female was observed to orientate towards the male making this short, high-pitched vocalisation (Groffen *et al.* unpublished data). A sixth individual was incidentally located, approximately three meters from the breeding area on a patch of bare ground, beside a cluster of termites.

All six of these individuals were noticeably paler in overall appearance than the typical colouration seen in males, in particular the orange colouration on their arms and legs was markedly reduced (Figs 3, 4). With so few individuals it is not possible to determine whether there is sexual dimorphism in their size. These observations occurred in February 2022, January and March 2023, in the Paluma Range.

These descriptions are in line with those of other female *Pseudophryne* species (Pengilley 1966; Woodruff 1976; White 1993; Byrne *et al.* 2021). Having been predominately located with calling males, it is most likely these individuals can be ascribed to female, as *Pseudophryne* males are highly territorial and unlikely to be interacting with other males at a nest site (White 1993; Byrne 2008; Heap *et al.* 2012).

Understanding details of the Magnificent Broodfrog's ecology, including the activity and movement of females, is critical in ensuring they can be effectively conserved. For instance, knowledge of their movement may aid in better outcomes for the species in the face of new land clearing activities, as the required buffer around breeding and non-breeding habitat is currently unknown. Additional research is required to understand how females use the environment, but these descriptions may aid in improving the identification of females at a location. Future research is required to clarify the species' geographic distribution, breeding biology, population genetics and threatening processes, which will allow for accurate reassessments of their conservation status.

Figure 3. A male Magnificent Broodfrog (*Pseudophryne covacevichae*) (left), located with a potential female (right), found together while the male was calling. Photo: Patrick Webster.

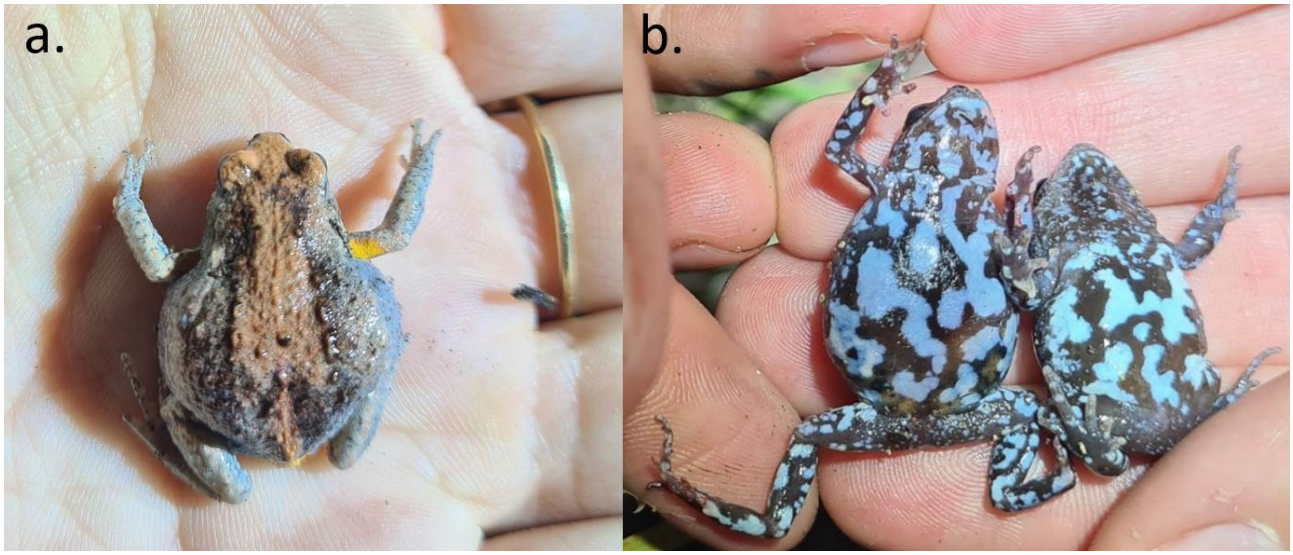

Figure 4. a. Potential female Magnificent Broodfrog (*Pseudophryne covacevichae*) located adjacent to the breeding area; b. the same female (left) with a male (right) for comparison. Photos: Emily Rush.

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