



FIG. 1. Egg clutch of *Haddadus binotatus* with 14 eggs found in the Parque Nacional da Tijuca.

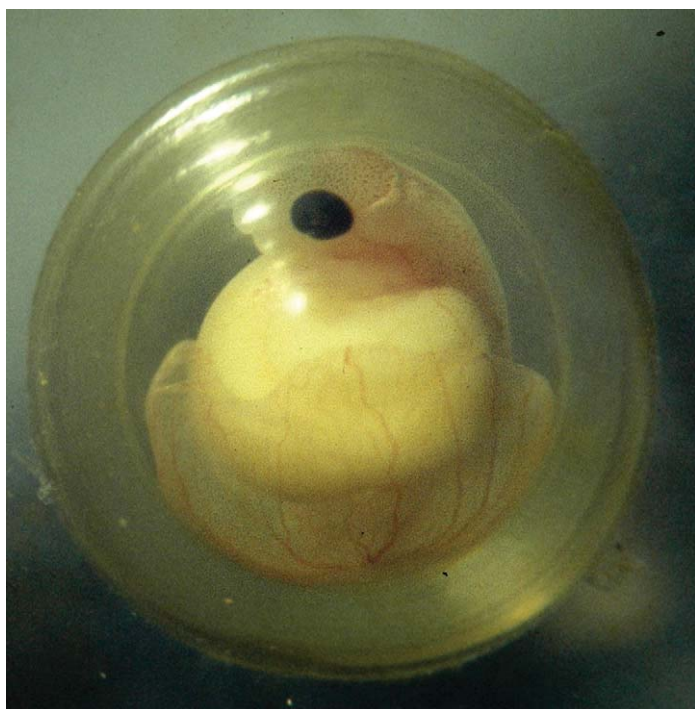


FIG. 2. Egg and embryo of *Haddadus binotatus* (about 10 mm).

and had a lot of yolk and a large, highly vascularized tail covering almost its entire body (Fig. 2). Near hatching, the characteristic egg tooth of the embryo could be observed. This tooth is keratinized and black in its distal portion as reported by Townsed and Stewart (1985 Copeia 1985:423–436) in *E. coqui* and *E. antillensis*, the egg tooth falling off shortly after hatching. The hatchling left the egg at ca. 9 mm SVL. The embryo tail of *Haddadus binotatus* covers almost its entire body, different from that of *Ischnocnema venancioi* (Izecksohn and Albuquerque 1972. Arq. Univ. Fed. Rur. Rio de Janeiro 2[1]:13–15), *I. guentheri* (Lynn and Lutz 1946. Bol. Mus. Nac. Zool. 71:1–46), *I. parva* (Lutz 1944. Bol. Mus. Nac. Zool.

15:1–30), and *E. coqui* (Townsed and Stewart 1985, *op. cit.*) which covers only part of the body. The tail is very vascularized, which suggests, as observed by Izecksohn and Albuquerque (1972, *op. cit.*), to be the main respiratory organ. Pombal (1999. Rev. Bras. Zool. 16[4]:967–979) observing the oviposition of *Brachycephalus ephippium*, showed that this species had parental care. The female rolled the eggs on the substrate to stick particles of substrate on its membrane to better camouflage them, to protect them from parasites, and to keep the embryos hydrated. It is possible that this behavior is the same in *H. binotatus* because the eggs were found covered by particles of substrate as observed by Pombal (1999, *op. cit.*). This is the first report of an egg clutch of *H. binotatus*.

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**HYLARANA LEPTOGLOSSA** (Long-tongued Frog). **DEFENSIVE BEHAVIOR.** *Hylarana leptoglossa* is an aquatic frog, inhabiting subtropical lowland forests and forming breeding aggregations on the edges of permanent, macrophyte-dominated

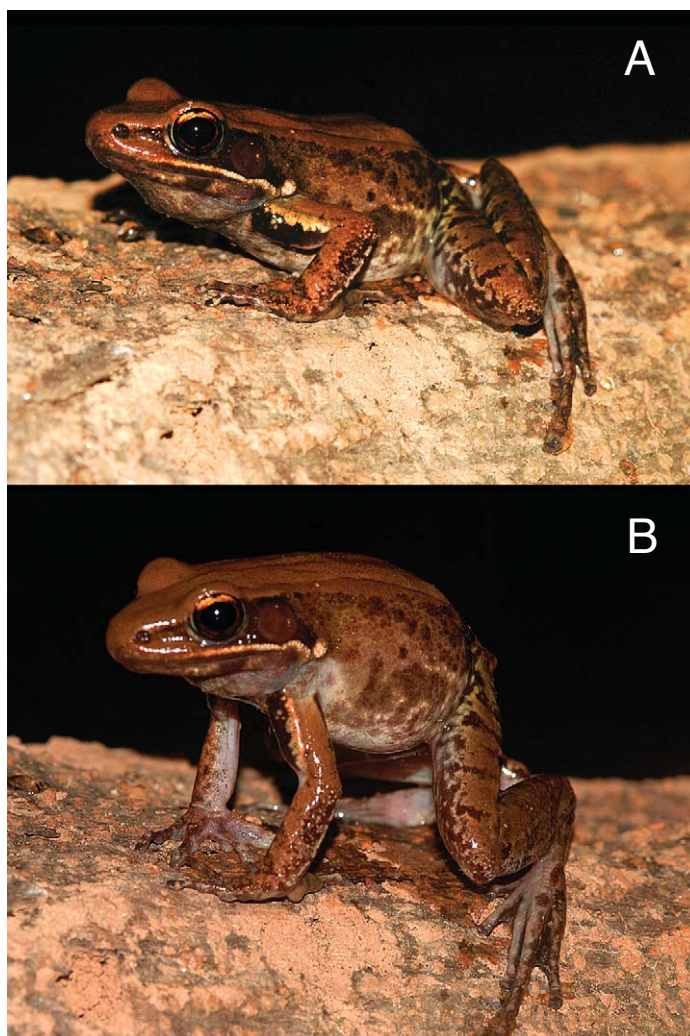


FIG. 1A. *Hylarana leptoglossa* in typical resting position. 1B. *Hylarana leptoglossa* in defensive posture.

COLOR REPRODUCTION SUPPORTED BY THE THOMAS BEAUVAIS FUND



waterbodies during the early monsoons (between the months of March to May). An adult male (Museum of Arya Vidyapeeth College, AVC 0943; SVL 60.5 mm) collected from near Lailad village (25.9320278°N, 91.7756944°E; 225 m elev.), Nongkhylllem Wildlife Sanctuary, East Khasi Hills, Meghalaya State, northeast India on 25 March 2009 displayed the following behavior as a response to handling during a photography session: all four limbs were planted on the substratum, while the body was greatly elevated, till the forelimbs were nearly vertical to the ground with the knee raised, the body raised > 50% depth of body (Figs. 1A–B). It maintained the position for ca. 10 secs each time.

Defensive postures are familiar methods of defense in anuran amphibians (review in Dodd 1976. *Smithson. Herpetol. Inf. Serv.* [37]:1–10), and were previously unreported in this species. The described posture results in elevated body position, presumably confusing potential predators. Another behavioral defense mechanism noticed was puffing of the body and of the gular region, although no glandular secretions or odor were detected.

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**LITHOBATES AREOLATUS CIRCULOSUS** (Northern Crawfish Frog). **PREDATION.** The Eastern Hog-Nosed Snake, *Heterodon platyrhinos*, is generally considered to be specialized for eating toads (Bufonidae); it has been suggested that their enlarged posterior maxillary teeth assist in holding and deflating these prey (Edgren 1955. *Herpetologica* 11:105–17; Minton 2001. *Amphibians and Reptiles of Indiana*. Indiana Academy of Science. Indianapolis, Indiana. 404 pp.). However, *H. platyrhinos* is also known to consume other anuran species including several species of ranids (Edgren 1955, *op. cit.*; Platt 1960. *Univ. Kansas Pub. Mus. Nat. Hist.* 18:253–420). Here, we report predation by *H. platyrhinos* on *Lithobates areolatus circulosus*. To our knowledge, this is the first documentation of this snake species preying upon this frog species, which is in decline across portions of its northern range, including Indiana (Parris and Redmer 2005. *In* Lannoo [ed.] *Amphibian Declines: Conservation Status of United States Species*, pp. 526–528. Univ. Calif. Press, Berkeley, California).

On 14 May 2009 at 0750 h, an adult *H. platyrhinos* was observed at Hillenbrand State Fish and Wildlife Area in Greene County, Indiana (USA), regurgitating a recently consumed adult female *L. a. circulosus*. This frog was one of 19 implanted with transmitters (Model PD-2 Holohil Systems Ltd. [Carp, Ontario, Canada]) for a study of the movements and habitat use of this state endangered species. The snake (SVL 48.5 mm, TBL 62.1 mm, mass 130 g) was observed and captured near the frog's burrow. Upon being caught, the snake immediately performed a defensive display that included defecation and regurgitation; stomach contents included the frog implanted with the transmitter.

The *L. a. circulosus* (108 mm SVL) was first observed on 4 April

2009 in gravid condition (mass 134 g) while entering a semi-permanent breeding wetland. She left the wetland on 19 April 2009 after depositing her eggs (weight 90 g; Kinney, unpubl. data). After breeding, the frog traveled, over the course of 10 days, 730 m (straight line distance) NE to a burrow, which it inhabited for 14 days prior to being eaten. The regurgitated carcass was missing a portion of its head, suggesting the snake took the frog head on (and that there was resistance), a position consistent with occupancy of a burrow (JLH, pers. obs.), not an animal fleeing. The frog had been in the burrow the previous morning, and the carcass was fresh, suggesting that the frog had been eaten within the past 24 hours. Toads are uncommon at our study site. Only two *Anaxyrus fowleri* have been observed, another was heard calling (JLH; pers. obs.). None have been collected along 1100 m of drift fencing (184 buckets; four wetlands encircled; Kinney, unpubl. data). Low toad densities at our study site may result in *H. platyrhinos* predation on ranids.

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**LITHOBATES AREOLATUS CIRCULOSUS** (Northern Crawfish Frog). **BREEDING.** *Lithobates a. circulosus* is declining throughout parts of its range and listed as state endangered in Indiana (Parris and Redmer 2005. *In* Lannoo [ed.] *Amphibian Declines: Conservation Status of United States Species*, pp. 526–528. Univ. Calif. Press, Berkeley, California.). We have been studying the breeding biology of this species in an attempt to understand factors contributing to recent declines (Minton 2001. *Amphibians and Reptiles of Indiana*. Indiana Academy of Science. Indianapolis, Indiana. 404 pp.).

Here we report an instance of atypical, perhaps satellite-like, breeding in *L. a. circulosus*. On 1 May 2009 at 0803 h, one of us (VCK) found an amplexed pair (Fig. 1) in a drift fence pit fall trap located at our study site, Hillenbrand State Fish and Wildlife Area in Greene County, Indiana, USA. The female was gravid. Both animals were pit-tagged prior to their release—still in amplexus—in the wetland, and were individually weighed and measured after separating and upon exiting. The male was 86 mm SVL, 74 g; the female was 101 mm SVL, 96 g, and was spent. There were three unusual components to these field observations: 1) This pair arrived 25 days after the end of peak breeding at this wetland, which occurred from 2 April 2009 through 5 April 2009 (VCK, unpubl. data). This was 26 days later than the previous last female, 20 days later than the previous last male. 2) The pair was in amplexus when found. While males and females occasionally occurred in the same bucket over the course of the breeding season, at no other time were *L. a. circulosus* (97 breeding animals total observed at our drift fences encircling two wetlands) found in amplexus before entering breeding wetlands. 3) The animals left the pond separately, a week apart (the female on 6 May 2009, the male on 14 May 2009), and upon exiting were found at the same bucket on the opposite side of the wetland where they had entered.

Explosive breeding in temperate amphibians such as *L. a. circulosus* typically involves males arriving early (Smith et al.