

TABLE 1. Hibernation sites for adult North American treefrogs (*Hyla* and *Pseudacris*). In the “N” column, groups of individuals found together are separated by a comma.

Species	Locality	Month/ season	°C	N	Habitat	Reference
<i>H. andersonii</i>	Georgia	winter	—	1	under bark	Neill 1948. <i>Herpetologica</i> 4:107
<i>H. chrysoscelis</i>	Ohio	Dec	4	1, 1, 1, 1, 1	leaf litter at base of tree	Burkholder 1998. <i>Herpetol. Rev.</i> 29:231
<i>H. chrysoscelis</i>	Tennessee	Oct	15–30	1, 1, 1, 1	treehole	Ritke and Babb 1991. <i>Herpetol. Rev.</i> 22:5
<i>H. cinerea</i>	Louisiana	Dec	5	31	elevated wood pile	This study
<i>H. cinerea</i>	Illinois	Nov Feb Jan	20 — 16	2 1 1–5	cliff face crevices, under talus in holes	Garton and Brandon 1975. <i>Herpetologica</i> 31:150
<i>H. cinerea</i>	Georgia	winter	—	2–3	decaying tree under bark	Neill 1948, <i>op. cit.</i>
<i>H. femoralis</i>	Georgia	Dec	—	1	decaying log	Neill 1948, <i>op. cit.</i>
<i>H. gratiosa</i>	Florida	Dec	14	1	ground, under bark	Franz 2005. <i>Herpetol. Rev.</i> 36:434
<i>H. squirella</i>	Georgia	winter	—	1	decaying log	Neill 1948, <i>op. cit.</i>
<i>H. versicolor</i>	Louisiana	Jan	16	3, 4	treehole	Fontenot 2003. <i>Herpetol. Rev.</i> 34:358
<i>P. cadaverina</i>	California	fall–winter	4–19	40, each	rock crevices	Harris 1975. <i>Herpetologica</i> 31:236
<i>P. regilla</i>	California	Feb	9	1	under weeds, in water	Brattstrom and Warren 1953. <i>Copeia</i> 1955:181

5.3°C). The boards were among ~20 others in a pile stored ~1 m above the ground, under the west side a house that was elevated 4 m on pilings. Natural ground elevation was ~0.5 m, thus the frogs' refuge was ~1.5 m above sea level, in an area largely surrounded by brackish marsh and open waterways. The pile of boards had been in the weather for at least 6 months, and had warped to form ~1 cm crevices between them. The frogs were initially clustered next to each other in a roughly oval shape between the boards. Within three minutes of removing the board hiding them, all of the frogs had crawled slowly until each fell off the edge onto the ground, and continued to disperse into vegetation. The site was located at 30.303427°N, 90.330054°W, just south of the Joyce Wildlife Management area, ca. 8 air km E of the village of Manchac, Louisiana, USA.

Table 1 summarizes reported hibernation sites, most of which represent only one locality within each species' geographic range. Note that each account includes <5 individuals. Habitat descriptions in the Table 1 references suggest that many species move to different habitat for winter hibernation sites. Some of these sites were at higher elevation and may be above flood level, particularly in canyon habitat that may be prone to seasonal flooding. The present report is of a remote location in brackish marsh that potentially experiences flooding and increased salinity by wind-driven tides through Lake Pontchartrain. Variation in elevation in most of this marsh is less than 1m, such that sustained light east wind for 2–3 days would likely flood most of the area. Historical floods levels in the local area suggest that the frogs would have been above most flooding asso-

ciated with normal weather patterns, but not catastrophic floods like those produced by organized storms (i.e., tropical depressions, tropical storms, hurricanes), which do not normally occur there during winter. Thus, a potential explanation for the unusually large aggregation of frogs reported here is that suitable hibernation sites above flood level are rare in the area. Alternatively, and perhaps in addition, a frog aggregation may reduce evaporative water loss by reducing the amount of exposed body surface area.

**CLIFFORD L. FONTENOT, JR.**, Department of Biological Sciences, Southeastern Louisiana University, Hammond, Louisiana 70402, USA; e-mail: cfontenot@selu.edu.

**HYLA CINEREA (Green Treefrog). CANNIBALISM AND DEFENSIVE POSTURE.** Cannibalism among larval amphibians is not unusual (Pfennig et al. 1993. *Anim. Behav.* 46:87–94; Poelman and Dicke 2007. *Evol. Ecol.* 21[2]:215–227), and adults of large anuran species like Cane Toads (*Rhinella marina*) are also known to prey on smaller anuran species or smaller conspecifics (Pizzatto and Shine 2008. *Behav. Ecol. Sociobiol.* 63[1]:123–133). However, reports of adult treefrogs cannibalizing smaller conspecifics are rare (McCallum et al. 2001. *Herpetol. Rev.* 32[2]:99–100), and to my knowledge there has never been a report of a Green Treefrog consuming a smaller conspecific.

Here I report an incident of cannibalism of a recently metamorphosed *Hyla cinerea* (20.7 mm SVL) by an adult, male *H. cinerea* (41.6 mm SVL) (Fig. 1), which occurred on 23 June 2009 at a pond



FIG. 1. Adult male Green Tree Frog (*Hyla cinerea*) consuming a recently metamorphosed conspecific. Inset: Semicircular scars left on back of juvenile.

at Bowens Mill Fish Hatchery in Georgia, USA. I observed the frogs from when the male had apparently just captured the juvenile (only the juvenile's head was inside the male's mouth), until he had largely swallowed it (only one hind leg protruded out of the mouth). *Hyla cinerea* consume a variety of invertebrate prey, including insects and spiders of similar size to those of recently metamorphosed conspecifics. At the time the cannibalistic behavior occurred, recently metamorphosed frogs were relatively abundant at the site, and could thus provide a readily available food source for appropriately sized adults.

During the process of being preyed on, the juvenile struggled and showed defensive posturing which included spreading and locking of arms and legs. Although these defensive postures did not deter further ingestion, they seemed to interfere with the predator's ability to swallow its prey. It took the male more than 15 minutes to proceed beyond the outstretched arms of the juvenile, and another 15 min to swallow it to the point where only one leg protruded from its mouth. After more than 30 min of observation I captured the male to document its size, at which point he regurgitated its prey. Without this intervention, it is certain the juvenile would have been fully consumed. The juvenile was still alive, but showed a series of semicircular scars across its back (Fig. 1-inset). Both frogs were released at the site of capture immediately after size measurements were taken.

**GERLINDE HÖBEL**, University of Wisconsin-Milwaukee, Department of Biological Sciences, Lapham Hall, Milwaukee, Wisconsin 53201, USA; e-mail: hoebel@uwm.edu.

**Hyla intermedia (Italian Treefrog). CANNIBALISM.** Cannibalism often occurs in crowded conditions where resources are limited (Crump 1983. *Amer. Nat.* 121[2]:281–289) and the predator benefits from a gain in nutrients, a reduction in competition for food, and consequently increased fitness. Amphibians breeding in ephemeral pools are especially likely to experience crowding and food limitation as the pond dries, leading to intraspecific predation (Crump 1983, *op. cit.*; Crump 1990. *Copeia* 1990:560–564; Jordan et al. 2004. *Western N. Amer. Nat.* 64[3]:403–405). As a temporary pond dries, larvae are subject to intensifying pressure for oxygen, food, space, and there is also a build-up of waste products, which can lead to intra-larval competition and inhibition of growth of some larvae (Kovaks and Sas 2009. *North-West. J. Zool.* 5[1]:206–208). In such

pond drying situations, larger larvae may prey on smaller conspecifics (Kovaks and Sas 2009, *op. cit.*).

We observed the larvae of the prolonged breeding anuran, *Hyla intermedia*, in an ephemeral pool formed by rainwater collecting in the tire tracks of agricultural vehicles. The pool was located near San Ruffino Lake, Le Marche, Italy (43.0011°N, 13.3844°C). Observations at the breeding pool were made daily from 16 May to 13 June 2010 but the time of day at which observations were made varied. Two cohorts of larvae hatched in the pool during the study period. Spawn was laid on 17 May and 24 May. The first cohort hatched on 24 May and the second on 30 May. This indicates a developmental time to hatching of 7 and 5 days, with the increased developmental time of the second cohort probably reflecting the increasing temperature of the pool. This agrees with the observations of Sayim and Kaya (2008. *Biologia* 63[4]:588–593) who observed hatching after 5 or 6 days in the laboratory at 20°C in the closely related species *Hyla arborea*. The different cohorts were easily distinguished by their size and developmental stage. Early developmental stages were determined by comparing to those shown in Sayim and Kaya (2008, *op. cit.*).

The pond dried steadily over the course of the study and by 13 June there was <1 cm of water left and between 12 June and 13 June the younger larvae were no longer visible in the pool. There are several possible reasons for this. Small larvae may have burrowed into the mud at the bottom of the pool, but this is unlikely due to the probable low O<sub>2</sub> levels as the pond dried. Alternatively, larvae may have died due to a build-up of waste products, low O<sub>2</sub> levels, or lack of food. However no remains were seen and we think that this would have been unlikely to affect all larvae simultaneously.

The most likely explanation is that the smaller larvae were consumed by their larger conspecifics as an response to the drying up of a small, ephemeral pool, a condition in which cannibalism is likely to be common (Hoff et al. 1999. *In* R. W. McDiarmid and R. Altig [eds.], *Tadpoles. The Biology of Anuran Larvae*, pp. 215–239. Univ. Chicago Press, Chicago, Illinois). Unfortunately, we were not able to compare the responses of larvae in a non-ephemeral pool. To our knowledge this is the first time that cannibalism has been reported in *Hyla intermedia* tadpoles.

**RACHEL GRANT**, Department of Life Sciences, The Open University, Milton Keynes, MK7 6BJ, United Kingdom (e-mail: Rachelanegrant@gmail.com); **TIM HALLIDAY**, 21 Farndon Road, Oxford, OX2 6RT, United Kingdom.

**Hypsiboas raniceps (Chaco Treefrog). PREDATION.** Anurans are potential prey to all classes of vertebrates, many invertebrates, and even carnivorous plants (Andrade-de-Figueiredo et al. 2010. *Herpetol. Notes* 3:053–054; Ghizoni-Jr et al. 2000. *Melopsittacus* 3[3]:137–139; Morais et al. 2010. *Herpetol. Rev.* 41[3]:336; Pombal 2007. *Rev. Bras. Zool.* 24[3]:841–843). Studies on the predation of amphibians are sparse and are based mostly on fortuitous observations. This is due to the difficulty of observation and quantification of predation events, but it has been estimated that such events occur frequently (Pombal 2007, *op. cit.*).

*Hypsiboas raniceps* is a medium-sized hyliid commonly found in Brazilian Cerrado, Atlantic Rainforest, and Caatinga biomes (Arzaga 1999. *Ver. Bras. Zool.* 16[3]:851–864; Guimarães et al. 2003. *Iheringia* 93[2]:149–158). They occur in Amazonian Colombia, Venezuela (Amazonas), French Guiana, eastern Brazil, Paraguay, northern Argentina, and eastern Bolivia (Frost 2010. *Amphibian Species of the World: an Online Reference. Version 5.4* [8 April 2010]. Electronic database accessible at <http://research.amnh.org/vz/herpetology/amphibia/>. American Museum of Natural History, New York. Accessed 14 Sept 2010).