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FEEDING TIMES OF *AMPHIUMA TRIDACTYLUM* AT REELFOOT LAKE, TENNESSEE

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ABSTRACT—Feeding activity times were determined for *Amphiuma tridactylum* in a roadside slough adjacent to Reelfoot Lake in northwestern Tennessee. Twenty-nine *A. tridactylum* were captured using baited deep-water crawfish nets, with more than half of the captures being large adults. Despite the majority (82.4%) of trapping effort being concentrated in daytime hours, 82.7% of *A. tridactylum* captures were at night. Capture rates during nighttime hours were more than 25 times greater than daytime capture rates. Though nocturnal, the mid-day captures indicate that *A. tridactylum* may exit their burrows during the day. This study also provides an alternative trapping method for *Amphiuma*, in which feeding times can be accurately determined.

Amphiuma is a genus of large eel-like aquatic salamanders that can be found in nearly any lentic waters in their range, which extends from eastern Texas eastward along the coastal region of the Gulf of Mexico and up the Atlantic Coast to eastern Virginia (Conant and Collins, 1998). The three-toed amphiuma, *A. tridactylum*, can also be found in association with the Mississippi River floodplain to its northernmost populations in southeast Missouri and western Kentucky (Conant and Collins, 1998). Relative to most other North American salamanders, few ecological studies have been conducted on species of *Amphiuma*. Despite their large size, *Amphiuma* are difficult to observe because of their aquatic environment and elusive behavior. Most of the ecology of *A. tridactylum* is known from the works of Baker (1945, 1947) in Tennessee and Cagle (1948) in Louisiana. The majority of other studies on *A. tridactylum* have focused on reproduction (e.g. Baker, 1937; Baker et al., 1947; Sever et al., 1996; Fontenot, 1999), taxonomy and relationships among *Amphiuma* (e.g. Goin, 1938; Baker, 1947; Hill, 1954; Karlin and Means, 1994). *Amphiuma* populations can constitute a large percentage of the biomass in an aquatic ecosystem; therefore, acquiring basic life-history data and understanding their role in wetlands is important as their populations undoubtedly influence associated wetland species (Sorensen, 2004).

Amphiuma tridactylum is generally considered to be nocturnal, with a peak of activity in the hours leading to midnight (Cagle, 1948). During daytime hours *A. tridactylum* rest quietly in their burrows with head exposed, and will strike at passing prey (Cagle, 1948). Although *A. tridactylum* commonly feeds upon crawfish and earthworms, it is regarded as a generalist feeder, known to consume a wide variety of invertebrates as well as vertebrates and carrion (Chaney, 1951; Fontenot and Fontenot, 1989; Petranka, 1998). Small amounts of plant matter, although possibly incidental, have also been noted in the diet (Chaney, 1951).

Trapping methods for *Amphiuma* have included baited cylindrical funnel traps of various designs, gigging, crawfish funnel traps, seining, hook and line, electro-shocking, burrow excavation, artificial shelters, and hand collecting (Baker, 1945; Fontenot, 1999; Johnson and Barichivich, 2004; Sorensen, 2004; Wilson et al., 2005). Here we report feeding times and body sizes of a population of *A. tridactylum* captured using deep-water crawfish nets in a roadside slough at Reelfoot Lake in northwestern Tennessee.

MATERIALS AND METHODS

Study Area—Kiwanis Slough is a roadside linear water body near the southern boundary of Blue Basin of Reelfoot Lake (36°21.150′N, −89°24.920′W) in Lake County, Tennessee. The dominant submerged aquatic macrophyte was *Cabomba caroliniana* (Carolina fanwort). Floating vegetation included *Lemna minor* (lesser duckweed), *Spirodela polyrhiza* (greater duckweed), *Wolffia* sp. (water meal), *Azolla caroliniana* (eastern mosquito fern), *Limnobium spongia* (frog's bit), and *Hydrocotyle ranunculoides* (floating pennywort). The dominant species at the slough edges were *Zizaniopsis miliacea* (giant cutgrass) and *Taxodium distichum* (bald cypress).

We measured the slough to be 738 m in length, of which we sampled a 190 m section within the Kiwanis Park Day Use Area (Fig. 1). The sampled region had a mean width of 12.0 m (range 9.7–15.2) and a mean depth of 1.6 m (range 1.0–2.0) (Glorioso, 2006). Approximately 10 m separated the slough from adjacent State Highway 21, with a road embankment ca. 3 m higher than the slough water line. The slough is separated from the lake proper by ca. 100 m. Although not directly connected year-round, during periods of high water, the lake and slough are connected by a wooded wetland at the edge of the day use area (Fig. 1).

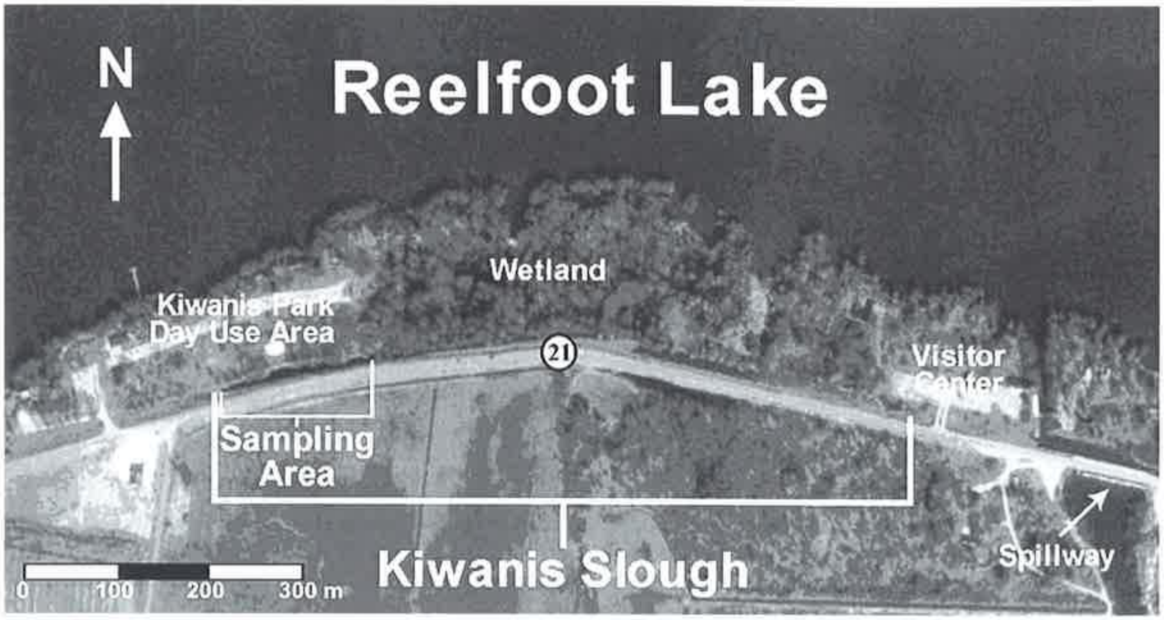

FIG. 1. Aerial view of Kiwanis Slough, Lake County, Tennessee. (United States Geological Survey, NAD 1983 / UTM Zone 16N).

Trapping—Deep-water crawfish nets were used from September 2004 to November 2005 in a study to capture turtles. It became apparent early that *A. tridactylum* were also feeding on the baited fresh chicken parts in the nets, and effort was made to capture these salamanders as well as the turtles. The deep-water crawfish nets were made of loosely attached 16 mm black-dipped mesh attached to a 50.8 cm diameter stainless steel ring. In the center of the mesh were strings for bait attachment, but standard shower curtain clips were used for bait attachment in this study. Three equidistant ropes on the steel ring come together at a knot, above which a small float is placed, and then another knot. From that knot a longer piece of rope extends nearly 100 cm to another knot, above which a larger float is placed, followed again by another knot. This larger float rests on the water surface or on vegetation at the shore, depending on water depth. A large hollow pole (ca. 200 cm) with two stainless steel rods extracts the net by the larger float from the water and over to the shore. For a more thorough description of this technique see Glorioso and Niemiller (2006).

We typically used 16 nets during a given sampling period, but as few as 10 and as many as 20 nets were used. We checked the nets every 20 min during the sampling period. Mean duration for a given sampling was 7 h (range 3–14). Trapping effort was highest in June and July 2005, and accounted for 45.2% of total effort, while August through November 2005 accounted for an additional 37.5% of the total effort. The remaining effort occurred on samplings prior to June 2005. The majority of trapping effort was concentrated in daytime hours with only 16.3% of the total effort between 2000 and 0600 h.

For each *A. tridactylum* capture, we measured snout-vent length (SVL), total length (TL), and pectoral girdle circumference (PGC) using a measuring tape (± 0.5 cm). We were unable to determine the sex of captures. Body mass was recorded using Pesola© spring scales of various sizes, and time of capture was recorded. Initially, we attempted toe clipping to identify individuals. However, this proved futile because of rapid toe regeneration, the presence of fused or deformed digits, or no limb at all on some captures. All statistical analyses were performed in the R statistical package (R Development Core Team, 2009).

RESULTS

Captures—Twenty-nine *A. tridactylum* captures were made at Kiwanis Slough using deep-water crawfish nets. The first capture occurred 23 May 2005, and the last 1 October 2005. Despite accounting for only 16.3% of the total effort (591 net hours), 24 of the 28 (85.7%) captures occurred between 2000 and 0600 h (Fig. 2). The exact time of capture was not recorded for the first individual captured 23 May 2005. However, we know the time of capture was between 0830 and 2000 h. With this addition, 24 of the 29 (82.7%) *A. tridactylum* were captured between dusk and sunrise, giving a rate of

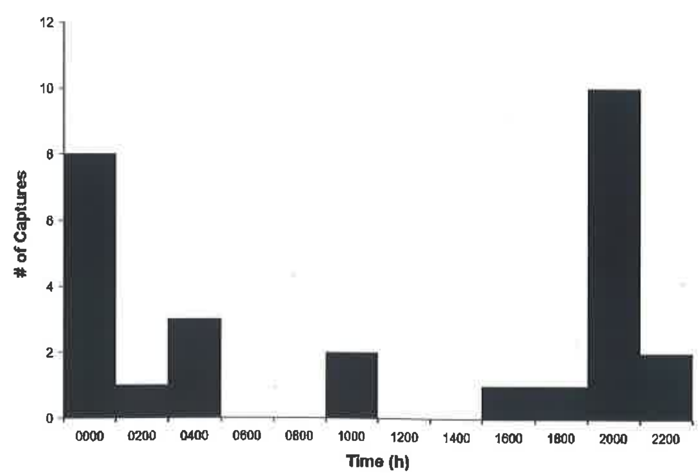

FIG. 2. Time of capture for *Amphiuma tridactylum* at Kiwanis Slough (n = 28).

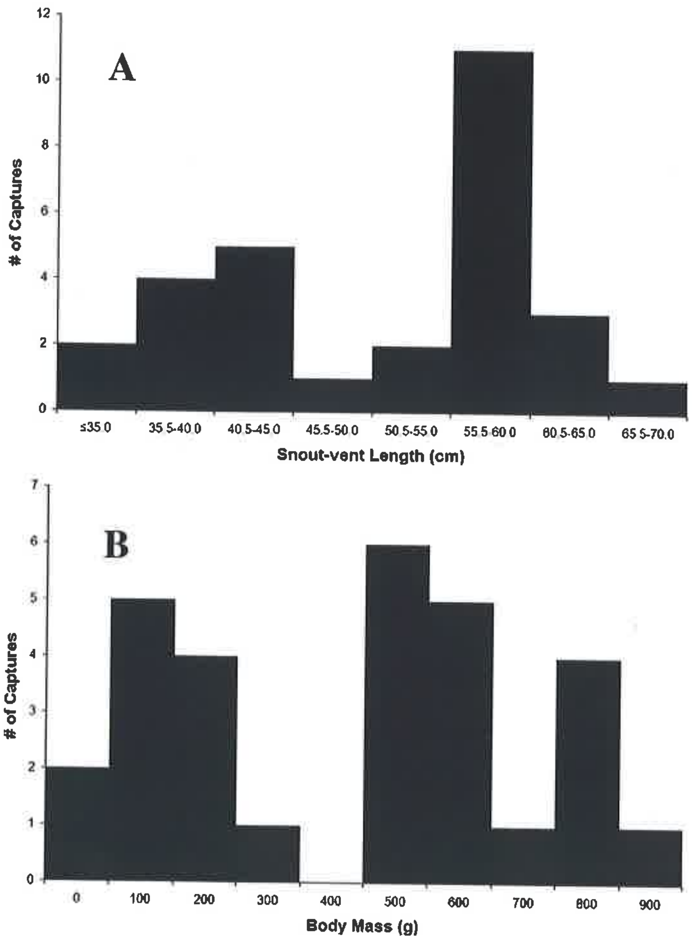

FIG. 3. Snout-vent length (A) and body mass (B) of *Amphiuma tridactylum* captured at Kiwanis Slough (n = 29).

0.0406 captures per net hour between 2000 and 0600 h and a rate of 0.0016 captures per net hour between 0600 and 2000 h. When examining all individual captures, simple linear regression showed no effect of capture time on SVL ($P = 0.29$, F = 1.18, df = 1, 26). However, when captures were grouped into daytime (n = 4) and nighttime (n = 24) captures, daytime captures (mean = 64.5 cm) had a significantly greater SVL than nighttime captures (mean = 53.3 cm; two-tailed P = 0.0018, t = 3.89, df = 26).

Size—Mean snout-vent length for all captures was 55.1 cm (SD = 10.6, range 26.0–70.0) and total length mean was 68.9 cm (SD = 12.9, range 46.0–87.5). More than half (51.7%) of all captures were ≥ 55.0 cm SVL, with few captures in the mid-range size classes (Fig. 3A). Mean pectoral girdle circumference was 9.7 cm (SD = 2.5, range 5.5–13.0) and mean body mass of all captures was 471 g (SD = 271.7, range 91–950). Body mass distribution illustrates again that few mid-range size classes were represented with 12 captures ≤ 400 g and the other 17 captures ≥ 500 g (Fig. 3B). Simple linear regression showed highly significant correlations among all measurements of body size (SVL, TL, PGC, and body mass; all $P <$ 0.001).

DISCUSSION

This study corroborates the nocturnal activity of *A. tridactylum* described by Cagle (1948) as feeding times were predominantly between dusk and sunrise. However, Cagle (1948:484) states that *A. tridactylum* emerge from their burrows "three or four hours after sunset" in search of food. In this study, on many sampling occasions, *A. tridactylum* feeding activity was observed right at dusk. Although Cagle (1948) states that an occasional individual may be seen active on dark days or after a rain, the *A. tridactylum* mid-day captures from this study occurred on clear sunny days when no precipitation fell. This merely may have been opportunistic feeding by *A. tridactylum* in nearby burrows. Although previously reported, this study reinforces that *A. tridactylum* will scavenge, as all captures were made with fresh chicken parts. *Amphiuma tridactylum* will also enter hoop nets baited with sardines, as five other captures were made using this technique in a related turtle project at Reelfoot Lake (B. M. Glorioso, unpub. data). Though a significant difference was found in body size between the daytime and nighttime grouped captures, small sample size (only 4 daytime captures) precludes any robust statement that larger individuals are more inclined to feed during the day.

Some individuals may have been captured more than once, but we suspected only three captures as recaptures. This was based both on missing digits (presumed to be our early attempts at uniquely marking individuals) and similar body size measurements of a prior capture associated with the suspected missing digits. The captures made at Kiwanis Slough showed a higher proportion of larger *A. tridactylum* than the New Orleans population (Cagle, 1948; Hill, 1954), whereas the body length sizes found in this study are similar to those found in the Reelfoot Lake population of Baker (1947). Trapping technique likely decreased our capture success of small *A. tridactylum* (< 30 cm SVL), as they were able to escape through the mesh of the deep-water crawfish net as it was lifted from the water.

Deep-water crawfish nets present a sufficient means to capture turtles (Glorioso and Niemiller, 2006) and *A. tridactylum*, particularly if the investigator is interested in knowing accurate times of feeding activity, albeit scavenging. However, we failed to capture an estimated three to four *A. tridactylum* suspected of feeding in the nets for every successful capture. Many times *A. tridactylum* were pulled from the water with their jaws still firmly attached to the bait, but dangling over the side of the net. The capture was only made if the salamander hung on until over shore or if an assistant was poised ready with a dipnet to capture them as they fell back towards the water after violently rolling and ripping off a piece of chicken. Simple captures occurred when the individual was coiled completely within the net while feeding. Despite our relatively low capture success of these elongate amphibians, we believe with a larger diameter net and smaller mesh, capture efficiency could be increased and all size classes could be captured with this technique in similar habitats.

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