on the right (Figs. 1c, 1d, and 2). From the author's experience, the apparatus is easily manipulated and facilitates rapid handling and photographing of specimens.

We have found this apparatus to be both durable and efficient, as it has been used to obtain over 500 photographs of specimens, with an approximate handling time of under 20 seconds for each specimen. Further, this platform is especially useful when photographing smaller species of larval anurans (e.g., *Bufo terrestris*, < 40 mm total length), or very small specimens at early developmental stages. Simple modifications such as adding an additional microscope slide to one side of the platform may be necessary in order to photograph very large specimens (e.g., *Rana catesbeiana*) or late developmental stages of large species.

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Baiting Differentially Influences Capture Rates of Large Aquatic Salamanders, *Siren* and *Amphiuma*

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Understanding the potential biases associated with a sampling method are necessary before undertaking a study of the ecology of any organism (Dodd 2003; Gunzburger 2007). Trapping is an effective way to determine whether a species is present in a certain habitat, and many forms of passive traps for aquatic salamanders have been developed, including minnow traps and other funnel traps, leaf litterbags, and box traps (Dodd 2003; Heyer et al. 1994). Baiting passive traps to attract organisms may increase the number of animals captured, but it may also introduce sampling bias to a study (Sorensen 2003). Baiting might attract more animals to an area than normally would be found there, which could lead to an overestimate of abundance. Another bias could be a potential change in behavior or survival of the target species due to predators that are also attracted to the bait. There also could be differences among target species in their food preferences and response to different types of bait.

The Greater Siren (*Siren lacertina*) and Two-toed Amphiuma (*Amphiuma means*) are large aquatic salamanders that are relatively poorly studied, perhaps because of their cryptic behavior and the perceived difficulty in sampling their habitats. These species co-occur throughout most of their geographic ranges in the Southeastern Coastal Plain of the United States (Petranka 1998), though inter-specific interactions may affect microhabitat occupancy (Snodgrass et al. 1999). Both salamanders are primarily nocturnal, with daylight activities restricted to either dense aquatic vegetation or hiding in burrows in the substrate (Duellman and Schwartz 1958; Freeman 1958; Knepton 1954). Limited data on their movement patterns suggest these salamanders have relatively small home ranges (Sorensen 2004) with occasional short dispersal across land during heavy rain or flooding (Aresco 2002; Carr 1940; Gibbons and Semlitsch 1991).

The diet of these salamanders may have significant influence on the effectiveness of baiting to attract these species to traps. Although there is considerable overlap in the diet of these species, diet studies suggest Amphiumas are more carnivorous than Sirens. This is supported by stable isotope analysis that placed Amphiumas at a higher trophic position than Sirens in a North Florida lake (Aresco and James 2005). Dietary analyses of Amphiumas, based on foraging habits or stomach contents, have shown they are entirely carnivorous, feeding on insects (both aquatic and terrestrial), many types of amphibians (including conspecifics), reptiles, fish, crayfish, mollusks, and spiders (Chaney 1951; Hamilton 1950; Hargitt 1892; Lee 1969; Machovina 1994). In contrast, plant material has often been found in dietary analyses of Sirens (Davis and Knapp 1953; Dunn 1924), although other studies have shown Sirens ingest invertebrates, especially mollusks, and fish along with vegetation (Burch and Wood 1955; Hanlin 1978; Moler 1994). *Siren lacertina* are able to effectively digest plant material, as the gastrointestinal structure of *S. lacertina* is similar to other vertebrates that use fermentative digestion (Pryor et al. 2006).

Differential movement patterns also may affect the capture of these salamanders, with more mobile species having a greater likelihood of encountering a passive trap than sedentary species. Unfortunately, there have been few studies examining movements of these species within habitats. A study conducted in Missouri of *Siren intermedia* noted most movements were > 10 m (75% of the population), with a mean home range of 94.8 m^2 (Frese et al. 2003). Another study found > 77% of the movements of *S. intermedia* in Texas were < 6 m (Gehlbach and Kennedy 1978).

The objective of this study was to evaluate the effect of baiting traps on capturing *Siren* spp. and *Amphiuma means*. A previous study (Sorensen 2004) found that baiting did not influence the capture rates of *Siren* spp. and *A. means* in crayfish traps, but that study may have been biased by the close proximity (one meter apart) of baited and unbaited traps. Chemical cues from the bait (canned sardines in oil) may have pervaded the entire trapping area (Sorensen 2004). The difference in trap spacing used for this study should eliminate the biases that may have been involved in the previous study.

Materials and Methods. —This study was conducted during two trapping intervals in June–July 2006 at Lake Suggs, a 34 ha dark-water lake at the Ordway Swisher Biological Station in Putnam County, Florida (USA). Our study used a blocked design, with four blocks of 10 traps for a total of 40 traps. Traps were deployed along a single transect with one trap every five meters (195 m long transect). The transect was set ca. 3–4 m from the shoreline in dense submergent aquatic vegetation (*Limnobium spongia, Pontedaria cordata*, and *Hydrocotyle* sp.). Two blocks (one half of the transect line) were baited in the first trapping interval (5—9 June 2006) and the other two blocks were baited in the second trapping interval (3—7 July 2006). The remaining two blocks in each trapping interval did not have bait added to them. Baiting an entire block of traps and separating each bock by 5 m allowed us to prevent contamination of unbaited traps by chemical cues from nearby baited traps. Because it is unlikely salamanders are distributed equally along the length of the transect, our design allowed us to evaluate separately the effect of baiting and block location on the number of animals captured.

We used modified crayfish traps (Lee Fisher International, Tampa, Florida) lined with 0.5 mm mesh which were attached to a PVC pipe anchored into the substrate (Johnson and Barichivich 2004). Traps were baited with canned sardines in olive oil; holes were punched in the can and the can was suspended inside the trap with a length of cord. Bait was not replaced daily, but rather one can of bait was left in each baited trap for the entire trap interval. Traps were set for four nights per interval (320 total trap-nights) and checked every morning.

We analyzed capture rates of each salamander species separately because we do not know the actual population size of either species nor the proportion that were captured in the traps, so we cannot evaluate the relative efficacy of the traps across species. Capture data could not be made normal with transformation, so we conducted Kruskal-Wallis one-way ANOVAs for each species with number captured as the dependent variable and presence of bait, sampling interval (June or July), and block as factors.

Results.—A total of 147 individuals (new captures and recaptures) were caught during the two sampling intervals, including 87 *Amphiuma means,* 56 *Siren lacertina*, 3 *S. intermedia*, and 1 small *Siren* sp. that escaped prior to identification. The number of new captures of unmarked individuals was 106, comprised of 52 *A. means*, 50 *S. lacertina*, 3 *S. intermedia,* and 1 unidentified *Siren* sp. Numbers of all *Siren* species were pooled for data analysis. The mean catch per unit effort (CPUE; captures/trap-night) for the two-month duration of this study was 0.27 *A. means*/trap-night and 0.18 *Siren* spp./trap-night. This CPUE was higher than the previous study (0.11 *A. means* /trap-night and 0.10 *Siren* spp./trap-night; Sorensen 2004).

Baited traps captured 72% (N = 106) of the animals whereas unbaited traps captured 28% (N = 41). Several individuals from the two-month sampling period were recaptured more than once, and multiple salamanders were captured in the same trap on several occasions. Multiple salamanders were captured in the same trap on 23 occasions during the two-month sampling period: 6 traps with multiple *A. means*, 3 traps with multiple *Siren* spp., and 14 traps with a combination of *A. means* and *Siren* spp. Sorenson (2003) reported multiple captures in the same trap on 7 occasions over a 12-month period. The results of the Kruskal-Wallis analyses showed that the effects of block and sampling interval were not significant for either species. Significantly more *Amphiuma* were caught in baited traps relative to unbaited traps (Mann-Whitney $U = 1492$, $p < 0.001$); there was no correlation of capture rates of *Siren* with baiting (Fig. 1).

Discussion.—Baiting of traps did not have the same effect on capture rates of these two species of salamanders. The dietary differences of these species accurately predict their response to bait: The carnivorous *Amphiuma means* is strongly attracted to bait, while the omnivorous *Siren* spp. were apparently not attracted to bait. Although not significant, both this study and Sorensen (2003) demonstrated a trend towards higher capture rates of *S. lacertina* in unbaited traps (Fig. 1).

The high capture rate of *A. means* could be due to the more predaceous behavior of *A. means* or other factors such as the ability of *A. means* to detect and locate bait. *A. means* can be caught on a trotline baited with dead crayfish (Chaney 1951), suggesting that chemoreception may play a role in locating prey by these salamanders. In contrast, a laboratory experiment suggested that chemical cues do not seem to play a role in prey location by *S. intermedia* (Sullivan et al. 2000).

Although we did not conduct comparisons across species, Willson et al. (2005) noted higher numbers of *Siren* spp. captures (N = 228) in commercial funnel traps compared with *A. means* (N = 14). Baiting was not part of their experiment, but the lack of bait within traps could explain the higher capture rates of *Siren* spp. over *A. means*. If baiting does attract *A. means,* then *Siren* spp. may be avoiding these traps because *S. lacertina* has been documented as a prey item in *A. means* stomach analyses (Machovina 1994).

Our study demonstrates that the decision of whether or not to use baited traps is likely to influence the outcome of trapping efforts for these species of aquatic salamanders. We suggest that researchers

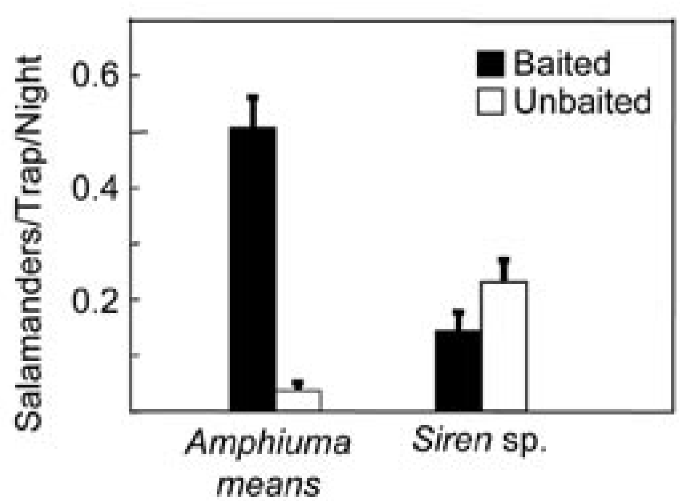

FIG. 1. Mean and standard error of catch per unit effort (number of captures/trap/night) of *Amphiuma means* and *Siren* sp. in 20 baited and 20 unbaited crayfish traps in two four-night sampling intervals.

conducting rapid assessment surveys for large aquatic salamanders, in which the response variable is detection or non-detection of a species, should use both baited and unbaited traps to increase the likelihood of trapping both *Siren* spp. and *Amphiuma* spp. if they are present. In contrast, if researchers are more interested in conducting long-term demographic studies, using unbaited traps may result in a more accurate and unbiased reflection of the relative abundance of the two species. We suggest researchers may minimize the likelihood of making critical errors in interpreting population data by conducting even a short-term series of trials designed to understand sampling biases prior to initiating longer-term studies.

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