A Simple Technique for Trapping *Siren lacertina*, *Amphiuma means*, and Other Aquatic Vertebrates

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ABSTRACT

We describe a commercially-available funnel trap for sampling aquatic vertebrates. The traps can be used in heavily vegetated wetlands and can be set in water up to 60 cm deep without concern for drowning the animals. They were especially useful for capturing the aquatic salamanders *Siren lacertina* and *Amphiuma means*, which have been difficult to capture with traditional sampling methods. They also were effective for sampling small fishes, particularly centrarchids, and larval anurans. In total, 14 species of amphibians, nine species of aquatic reptiles, and at least 32 fish species were captured. The trap we describe differs significantly from traditional funnel traps (e.g., minnow traps) and holds great promise for studies of small, aquatic vertebrates, in particular *Siren* and *Amphiuma* species.

INTRODUCTION

Greater siren (*Siren lacertina*, Linnaeus) and two-toed amphiuma (*Amphiuma means*, Garden) are large, fully aquatic salamanders that occur in a variety of shallow-water habitats throughout much of the Southeastern Coastal Plain (Petranka 1998). Although studies have revealed their importance as predators and competitors in some aquatic systems (Fauth and Resetarits 1991, Resetarits and Fauth 1998, Fauth 1999a, Snodgrass et al. 1999), much is unknown about their life history. Their conservation status is uncertain due to lack of systematic population surveys (Petranka 1998). Both species prefer thickly-vegetated habitats and are difficult to collect. Standard methods such as dip-netting, seining, and Goin dredges (Goin 1942) are ineffective in such habitats. We describe a simple and effective method for capturing *Siren lacertina*, *Amphiuma means*, and numerous other aquatic vertebrates.

METHODS AND MATERIALS

Trap description

The traps were commercially[a] produced to catch crayfish. Each trap consists of: 1) the trap body, 2) three funnels, and 3) a neck with a lid at the top (Fig. 1). The body and funnels are made of 2.5 cm black plastic-coated hexagonal mesh. The neck and lid consist of plastic-coated rectangular wire mesh (2.5 X 1.25 cm). The trap body is pyramid-shaped with a flat back and bottom and a rounded front. The three funnel openings are 18 cm deep, and the opening of each is approx. 4.5 cm wide at its smallest diameter. The largest diameter of each funnel is approx. 20 cm, and each funnel faces upward at an angle of approx. 45 °. The cylindrical neck extends 12.5 cm above the top of the trap body. The lid is held closed with elastic rope and a plastic hook. Although the traps are relatively light weight (1.65 kg), they are bulky and not collapsible.

[a] Lee Fisher International, 3922 W. Osborne Ave., PO Box 15695, Tampa, FL 33684

Because of mortality and injury to trapped animals during initial trials with standard traps, we had the manufacturer customize the traps by lining them with plastic mesh (Vexar™). The size of the mesh in the Vexar™ liner was 5 mm. Modified traps lined with Vexar™ cost $37.50 each. Standard (i.e., no Vexar™ liner) traps as described above cost $20.00 each.

Study sites

We used these funnel traps in a variety of wetlands at several locations, including: 1) Katharine Ordway Preserve (KOP), north-central Florida; 2) Okefenokee National Wildlife Refuge (ONWR), southeastern Georgia; and 3) St. Marks National Wildlife Refuge (SNWR), Florida panhandle. We also used Vexar™-lined funnel traps to sample amphibians and reptiles at other locations in Florida and loaned traps to several colleagues, who used them to sample aquatic herpetofauna and fishes.

Trap deployment

We deployed traps near the shorelines of wetlands in small clearings made in floating and emergent vegetation or in open, shallow water. Traps were set flush with the bottom in water deep enough to cover the funnels (approx. 20 cm). Plastic cable ties were attached to each trap neck, and the ties were slid over a piece of PVC pipe (3/4 in., schedule 40) that was inserted into the substrate. The PVC pipes allowed us to relocate traps easily and to secure the traps in place. The neck of each trap extended at least 5-10 cm above the water to allow trapped animals access to air. Traps remained deployed continuously during the sampling periods; traps were not baited and were checked daily.

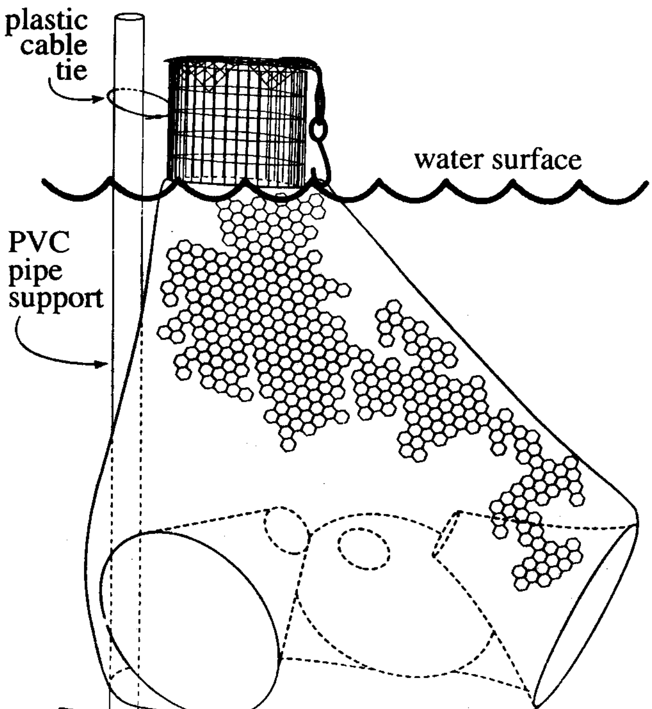

Figure 1. Schematic of deployed aquatic funnel trap. A standard, non-Vexar™-lined trap is illustrated here.

At KOP we used only unlined (i.e., no Vexar™ lining) funnel traps to sample the margins of four lakes where sirens were known to occur (Franz 1995). We set traps during three periods in 2000 for a total of 119 trap-nights.

At ONWR we used Vexar™-lined funnel traps, plastic minnow-traps (4 cm wide funnel mouths and 7 mm maximum mesh size), wire-screen funnel traps (90 cm long with two 25 cm wide funnel mouths per trap), and dip nets (53.3 cm X 45.7 cm bow with 3.5 mm mesh) to sample for aquatic amphibians in forested wetlands, wet prairies, isolated ponds, lakes, and along the edges of canals. We deployed traps and dip-netted at numerous sites during monthly sampling periods from April 2001 through October 2001. Total sampling effort was 52.5 hours for dip nets, 386 trap-nights for Vexar™-lined funnel traps, 590 trap-nights for minnow traps, and 266 traps-nights for wire-screen funnel traps.

At SNWR we used Vexar™-lined funnel traps to sample lakes, isolated ponds, wet prairies, and impoundments from June 2002 to September 2003. We had a total of 735 trap-nights at SMNWR during this period.

RESULTS and DISCUSSION

At KOP we had 35 captures of *S. lacertina* in unlined funnel traps. We also captured three species of turtles, one species of snake, an alligator, and six species of fish (Table 1). Overall trap success (no. captures / no. trap-nights) for *S. lacertina* was 0.29 for all lakes combined. The mesh size of the unlined traps may have biased our captures toward larger individuals. Although we did not measure or mark any of the sirens we caught, we estimate that all were longer than 40 cm total length. Additionally, the size of the mesh was responsible for the death of one animal that caught its head in the wire of the trap body, and three animals injured their gills and limbs while trying to escape.

At ONWR we had 32 captures of *A. means* and four captures of *S. lacertina*. Thirty of the *A. means* captures were in Vexar™-lined funnel traps and two in wire-screen funnel traps. Trap success for *A. means* for the entire trapping period was 0.08. One *Siren* capture was in a Vexar™-lined funnel trap, one in a wire-screen funnel trap, and two were with dip nets. We also captured fish, larval and adult amphibians, and reptiles (Table 1). One *A. means* was found dead in a Vexar™-lined funnel trap.

At SNWR we captured four *A. means*, 19 *S. lacertina*, and one *Siren intermedia* in Vexar™-lined funnel traps. The *A. means* and the *S. intermedia* were captured in five different isolated, ephemeral ponds. The *S. lacertina* were captured during December 2002 (60 trap-nights) and September 2003 (30 trap-nights) in a small, permanent lake. Trap success during December 2002 was 0.10 and 0.43 during September 2003. There was no mortality of trapped salamanders. We also captured several species of larval and adult frogs, mole salamander larvae (*Ambystoma talpoideum*), central newt larvae (*Notophthalmus viridescens*), and numerous species of fish (Table 1).

The Vexar™-lined traps efficiently captured aquatic salamanders and a suite of other aquatic vertebrates. Aquatic vertebrates captured in Vexar™-lined funnel traps during our fieldwork at sites other than KOP, ONWR, and SMNWR, as well as species reported to us by colleagues to whom we loaned traps are listed in Table 1. Fourteen species of amphibians, nine species of aquatic reptiles, and at least 32 fish species were captured. Most frog species captured were represented by tadpoles, although adults and recently metamorphosed individuals were captured too. Although we frequently captured tadpoles, we usually did not capture large numbers (>5 per trap) of them. The traps were quite useful for sampling small fishes, especially those in the sunfish family Centrarchidae. The ability to simultaneous sample amphibians and fish is advantageous because it allows researchers to use presence of various fish species as covariates in statistical models of amphibian species occurrence and detection probabilities (e.g., MacKenzie et al. 2002 and 2003).

Table 1. Aquatic vertebrates captured with Vexar™-lined funnel traps at Katharine Ordway Preserve (KOP), Okefenofee National Wildlife Refuge (ONWR), St. Marks NWR (SNWR), and serveral other sites in north Florida.

Species captured	KOP	ONWR	SNWR	Other
Amphibians				
Mole salamander (*Ambystoma talpoideum*)			X	
Two-toed amphiuma (*Amphiuma means*)	X	X	X	X
Central newt (*Notophthalmus viridescens*)			X	X
Greater siren (*Siren lacertina*)	X	X	X	X
Lesser siren (*Siren intermedia*)			X	
Southern toad (*Bufo terrestris*)		X		
Southern cricket frog (Acris gryllus)		X		
Green treefrog (*Hyla cinerea*)		X		
Pine woods treefrog (*Hyla femoralis*)		X		
American bullfrog (*Rana catesbeiana*)			X	
Bronze frog (*Rana clamitans*)		X		
Pig frog (*Rana grylio*)		X	X	X
River frog (*Rana heckscheri*)		X	X	
Southern leopard frog (*Rana sphenocephala*)		X	X	
Reptiles				
Striped mud turtle (*Kinosternon baurii*)	X			X
Eastern mud turtle (*Kinosternon subrubrum*)	X		X	
Stinkpot (*Sternotherus odoratus*)	X			
Red-bellied mudsnake (*Farancia abacura*)		X		
Southern watersnake (*Nerodia fasciata*)		X		X
Florida green watersnake (*Nerodia floridana*)	X	X		X
Striped crayfish snake (*Regina alleni*)				X
Eastern ribbonsnake (*Thamnophis sauritus*)		X		
American alligator (*Alligator mississipiensis*)	X			
Fishes				
Bowfin (*Amia calva*)		X		
Pirate perch (*Aphredoderus sayanus*)		X	X	X
Lake chubsucker (*Erimyzon sucetta*)	X	X	X	X
Flier (*Centrarchus macropterus*)		X	X	
Blackbanded sunfish (*Enneacanthus chaetodon*)		X		
Bluespotted sunfish (*Enneacanthus gloriosus*)		X	X	X
Banded sunfish (*Enneacanthus obesus*)		X	X	X
Warmouth (*Lepomis gulosus*)	X	X	X	X
Bluegill (*Lepomis macrochirus*)	X		X	
Dollar sunfish (*Lepomis marginatus*)			X	X
Spotted sunfish (*Lepomis punctatus*)			X	
Largemouth bass (*Micropterus salmoides*)	X		X	
Black crappie (*Pomoxis nigromaculatus*)	X			
Mayan cichlid (*Cichlisoma urophthalmus*)				X
Flagfish (*Jordanella floridae*)				X
Pygmy sunfish (*Elassoma* sp.)[a]		X	X	
Redfin pickerel (*Esox americanus*)			X	
Chain pickerel (*Esox niger*)		X	X	
Golden topminnow (*Fundulus chrysotus*)		X	X	X
Russetfin topminnow (*Fundulus escambiae*)			X	
Seminole killifish (*Fundulus seminolis*)			X	
Lined topminnow (*Fundulus lineolatus*)			X	X
Pygmy killifish (*Leptolucania omata*)		X	X	
Bluefin killifish (*Lucania goodei*)				X
Yellow bullhead (*Ameiurus natalis*)	X			
Florida gar (*Lepisosteus platyrhincus*)			X	X
Swamp darter (*Etheostoma fusiforme*)		X	X	X
Blackbanded darter (*Percina nigrofasciata*)				X
Eastern mosquitofish (*Gambusia holbrooki*)		X	X	X
Least killifish (*Heterandria formosa*)			X	X
Sailfin molly (*Poecilia latipinna*)			X	
Eastern mudminnow (*Umbra pygmaea*)				X

[a]Three similar-looking species (*Elassoma evergladei*, *E. okefenokee*, and *E. zonatum*) occur syntopically within the areas trapped.

We initially used unlined traps at KOP in an attempt to capture bottom-walking turtles (i.e., *Kinosternon baurii*, *K. subrubrum*, and *Sternotherus odoratus*). Although we captured turtles of both genera, the utility of the traps for capturing *Siren lacertina* became obvious. However, due to the relatively large mesh size of the unlined traps, three sirens were injured and one died. Several of the seven Florida green watersnakes (*Nerodia floridana*) we captured were injured too. Darby et al. (2001), who used these same unlined traps to capture Florida applesnails (*Pomacea paludosa*), also reported mortality of snakes (20% of snakes captured) as well as injuries to *A. means*. The higher mortality and morbidity observed by Darby et al. (2001) was likely due to their longer soak times (72 hr vs. 24 hr).

In addition to preventing injuries of trapped amphibians, the Vexar™ liner also increased our captures of small aquatic vertebrates. For example, during our initial trapping with unlined traps at KOP we did not capture any tadpoles, small fish, or small salamanders. At ONWR and SNWR, where we only used lined traps, tadpoles and small fish were captured frequently. We also captured small salamanders that would have escaped unlined traps.

Because of our initial success capturing *S. lacertina* at KOP, another trapping study was conducted at Lake Suggs (Sorensen 2003), which compared the effectiveness of Vexar™-lined funnel traps with plastic minnow-traps (4 cm wide funnels and 7 X 7 mm maximum mesh size). With more than 200 captures, and nearly equal numbers of *A. means* and *S. lacertina*, the Vexar™-lined crayfish traps were far superior to minnow traps; 95% of captures occurred in the Vexar™-lined funnel traps. Baiting with sardines had no affect on capture success, and there was no mortality of trapped salamanders or snakes in the Vexar™-lined traps.

Minnow traps, usually constructed of plastic, have been the tool of choice for recent ecological studies involving *S. lacertina*, *S. intermedia*, and *A. means*. (Fauth and Resetarits 1991, Resetarits and Fauth 1998, Fauth 1999a, b, Snodgrass et al. 1999, Eason and Fauth 2001). We have shown that Vexar™-lined traps are superior to plastic minnow traps at capturing *S. lacertina* and *A. means*, and that lined traps are also superior to wire-screen funnel traps. An additional advantage of these traps over commercial minnow traps is that they can be set in water up to 60 cm deep without concern for drowning animals. Therefore they can sample a larger area of wetlands than standard funnel traps, which need to be set in shallower water or equipped with floats (Casazza et al. 2000). When equipped with floats minnow traps do not sample bottom-dwelling fauna efficiently. However, when using traps in water near 60 cm deep, water levels must be monitored because rainfall can cause enough rise in water levels over a short period to completely submerge traps. This is especially important when trapping in streams and along river edges.

Aquatic funnel traps of varying design have proven useful for sampling aquatic amphibians and reptiles (Adams et al. 1997, Casazza et al. 2000, Fronzuto and Verrell 2000, Richter 1995, Shaffer et al. 1994). Funnel traps have numerous advantages over other methods of aquatic sampling, such as dip-netting (Adams et al. 1997), notably the ease of use in densely vegetated areas. The funnel trap we describe differs significantly from traditional traps (e.g., minnow traps) and was effective at detecting numerous species of aquatic vertebrates, especially cryptic salamanders of the genera *Siren* and *Amphiuma*. The Vexar™-lined funnel trap is more expensive than other commercial trap types, and it is not collapsible, which makes it inconvenient to transport. Nevertheless, the traps hold great potential for inventory and monitoring of aquatic vertebrates.

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