plywood circle at the back of the trap and secure it with 8 mm staples. It is important to attach the back of the trap last because it facilitates sewing the screening and the staples can secure both the hardware cloth and the mesh to the back of the trap.

Finally, we coat the small opening of the funnel with two-part epoxy (we found Plasti-Dip to be much less durable than epoxy). We dip the end of the funnel multiple times to build a thick coat. This serves two purposes: it makes the funnel more durable by hardening and securing the window screening and it covers sharp ends from the cut window screening which could injure snakes or deter them from entering the trap.

The trap is pushed tight against the funnel and secured by attaching a rope to the plywood on each side of the funnel (through two drilled holes) and passing that rope around the back of the trap. Because the trap is made of screening and hardware cloth, a visual inspection of the trap is sufficient to detect the presence of animals. When animals are captured, we detach the retaining rope, pull the trap back and quickly surround the opening of the trap with a snake bag (we use a pillow case). We gently raise the back of the trap until the animals slide in the bag. To prevent bites when dealing with venomous snakes, one could empty the trap in a hard plastic bucket or a garbage can instead of a bag.

To prevent overheating, we ensure that animals have shade by covering one end of the trap with a tarp or plywood scraps. Only one end is covered, as covering the whole trap could impede airflow and also lead to overheating.

Our funnel trap was inspired by earlier versions that were made solely of window screening held with office staples (e.g., Enge 1997), but we found those too flimsy for our purpose. The addition of hardware cloth, epoxy, and plywood does not add much weight and retains the effectiveness of earlier designs, but renders the traps more durable (some of our traps have been in service for 10 years) and better able to handle numerous large snakes (Fig. 2). Although we designed those traps to be placed on perimeter fences, they are versatile and can be placed at the end of a drift fence with leads (Fig. 2) or can be modified easily into a two-ended funnel trap (by the addition of a second funnel) to be placed at the center of a fence. Compared to box designs, we believe our mesh design is advantageous because it is light and see-through, but we think it is also more effective because it allows airflow. Airflow is likely a cue animals use to find an escape hole along a fence. If one makes many traps, the cost will be < US $20 per trap because the materials can be purchased in large quantities (e.g., full plywood sheets, 30.5 m (100 feet) rolls of hardware cloth and window screening). In conclusion, the traps can be used to catch a variety of terrestrial herpetofauna in numerous environments.

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Using Deep-Water Crawfish Nets to Capture Aquatic Turtles

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The most primitive method used to capture turtles is by hand, and a variety of hand capture methods appear in the literature (Cagle 1950; Carpenter 1955; Marchand 1945). Non-baited traps, particularly basking traps of various forms, have also been used in many turtle studies (Cagle 1950; Lagler 1943; Petokas and Alexander 1979; Robinson and Murphy 1975). The most popular baited-trap method is the hoop net, originally described by Legler (1960), and later refined by others to suit their specific needs. Since Plummer (1979) reviewed collection methods for turtles, many individuals have improved earlier trap designs and developed innovative capture techniques (e.g. Kuchling 2003; Sharath and Hegde 2003). Here we describe a novel technique that uses baited deep-water crawfish nets to capture carnivorous or omnivorous turtles. We include some preliminary data using this technique and discuss the potential advantages and disadvantages of these nets over traditional hoop nets.

Two dozen custom-made deep-water crawfish nets were purchased for US $75/dozen from a private dealer in Chalmette, Louisiana. Deep-water crawfish nets were constructed from a 50.8 cm diameter stainless steel ring (4.8 mm diameter) to which 16 mm black-dipped mesh was attached loosely to form a pocket (Fig. 1). Three 30.5 cm ropes were attached to the steel ring at equal distances from each other and were tied together at the other end to form a knot. A 5.1 cm diameter, 1.9 cm thick cork was attached above the knot followed by another knot to keep this cork in place. When placed in water, the cork suspended the three ropes above the mesh and minimized interference caused by turtles attempting to feed. A larger, second cork (5.7 cm in diameter and 3.8 cm

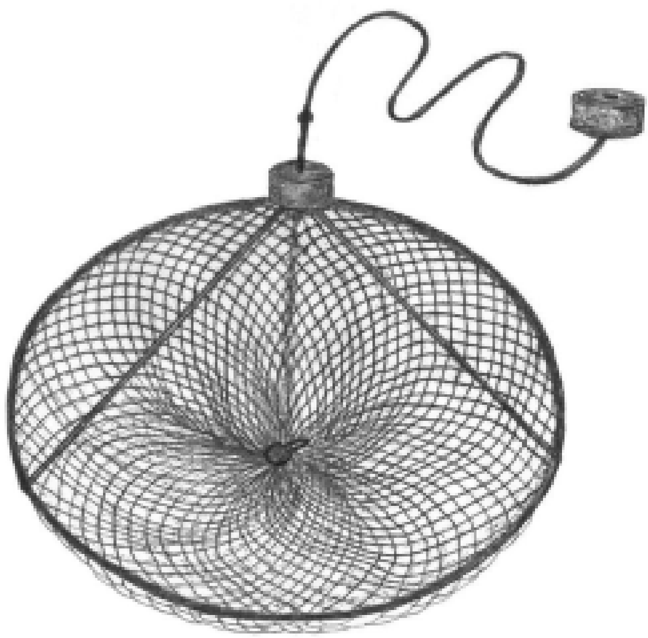

FIG. 1. Illustration of deep-water crawfish net.

thick) was positioned 91.4 cm above the smaller, first cork. The larger cork floated on the water surface and was used as a "catch" to extract the net from the water with a hollow aluminum pole (3.8 cm diameter, 195.6 cm long). Two stainless steel rods (6.4 mm in diameter) were attached on opposite sides of the same end of the aluminum pole (Fig. 2). The rods were 30.5 cm long, but extended only 15.2 cm beyond the pole. For added strength the remaining length of the rods was placed inside the aluminum pole and secured tightly by hammering flat the end of the pole. Both rods were slightly curved to prevent the large cork from falling off as the net is pulled from the water. The distance between the rods was 2.5 cm at the point they contacted the pole, but increased to 3.5 cm toward their end. The greater distance at the end of the rods facilitated grabbing the large cork, and as the net was pulled from the water, the cork slid down to the base of the rods where they contacted the pole. The point where the rods contacted the pole was the strongest part of the pole, and the strain of picking up nets rested on this position, not on the end or middle of the rods.

Each net was baited with chicken backs or leg quarter portions purchased from a local grocery. Each net was equipped with a center string for bait attachment, but to achieve longer bait life, a standard shower curtain clip was attached to the center of each net. The thickest part of the chicken back was pushed through the open clip, snaking the clip through the thin bone as many times as possible for a firm attachment, and then the clip was snapped close. Large turtles can remove poorly secured bait, and straighten clips while feeding; therefore, extra clips and replacement bait were required for an entire day of trapping.

Deep-water crawfish nets were set in waters ranging in depth from 15.2 cm to 121.9 cm. Spacing between nets was variable and depended primarily on depth and clarity of the water body. In murky, lentic waters (e.g., canals, ponds, sloughs, etc.) nets were positioned close together. In clear, lotic waters (e.g., rivers, streams, etc.) the distance between nets was increased. The nets rested flush with the substrate to reduce the chance of turtles, especially mud and musk turtles, from feeding beneath the net. To accomplish this, the aluminum pole was used to clear vegetation or debris from the water. After positioning the net, the larger cork was placed to one side of the net in a position to be easily grabbed with the rods of the aluminum pole. If the habitat allowed, the larger cork was placed out of the water on the bank or vegetation. Only in deep water was the larger cork ever directly above the net.

When using the pole to check nets, care was taken to minimize disturbance to the water surface, as this alarmed feeding turtles. To check nets, the larger cork was grasped between the rods, and then the cork was pulled straight up, and over to shore with one quick, fluid motion. Some turtles attempted to crawl or swim out of the net as it was picked up. Thus, checking nets was most efficiently accomplished with two individuals: one individual picked up the net and the second individual used a dipnet to catch any turtles that fell out of the net as it was being moved to land. Larger turtles (e.g., *Chelydra serpentina*) did not always completely enter the net while feeding. However, as the net was being lifted from the water, larger turtles often had their jaws firmly attached to the bait and could be lifted, albeit temporarily, from the water. If a second person was present with the dipnet ready, the turtle could be netted.

The frequency of checking nets depended on a variety of environmental variables, including habitat type, weather, water depth, water clarity and turtle behavior. Initially, nets should be set for at least fifteen minutes before checking to allow the scent of the bait to spread and attract turtles. However, because the scent was generally detected quickly in smaller lentic waters, nets needed to be checked every ten minutes. If feeding activity was low, more time between checking nets was required. In clear, lotic waters turtles could be observed feeding. Thus, to avoid disturbing feeding turtles,

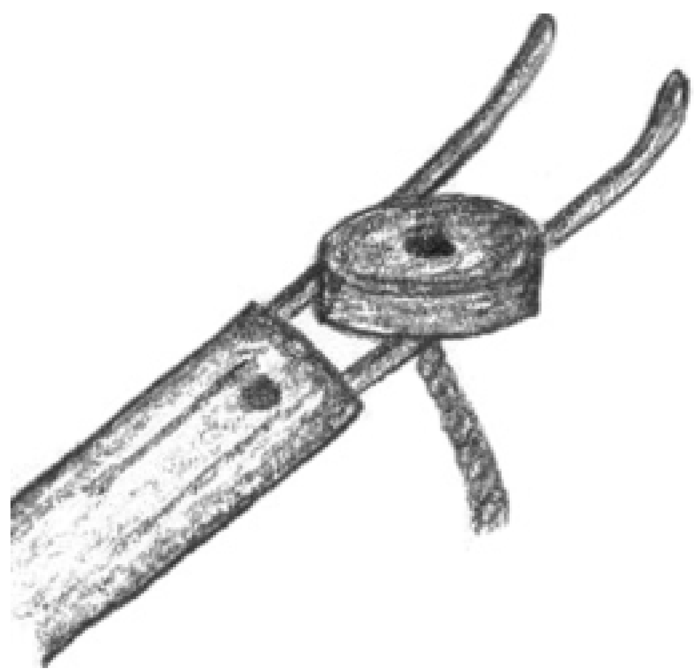

FIG. 2. Illustration of terminal end of aluminum pole showing position of steel rods used to extract deep-water crawfish nets from water via the large cork.

stealth was required in approaching and picking up the net. As turtles fed on the bait, oils and lipids rose and the presence of oil or small pieces of chicken fat at the water surface usually indicated feeding. Typically, the more oils at the surface, the larger the turtle (or more than one turtle) that was feeding. Also, larger turtles sometimes caused the larger cork at the surface to move while feeding in the net.

This technique has captured seven turtle species in several different aquatic habitats, including drainage canals in St. Bernard Parish, Louisiana (*Kinosternon subrubrum*, *Sternotherus odoratus* and *Trachemys scripta*), floodplain ponds and the main channel of the Stones River in Rutherford County, Tennessee (*S. odoratus*, *T. scripta*, *Apalone spinifera*, *C. serpentina,* and *Graptemys geographica*), and a roadside slough adjacent to Reelfoot Lake in Lake County, Tennessee (*K. subrubrum, S. odoratus*, *T. scripta*, *C. serpentina,* and *Chrysemys picta*). At the roadside slough (36°21.150'N, 89°24.920'W), 16 deep-water crawfish nets were used on 25 September 2004 for eight hours (0900–1700 h). All 16 nets were set from the shore in a straight (ca. 190 m) stretch of the slough. The total catch was 125 turtles with the following counts; 111 *S. odoratus*, 8 *C. picta*, 5 *T. scripta*, and 1 *C. serpentina*.

The largest turtle captured using this technique was a *C. serpentina* with a plastron length of 234 mm and a mass of 10.25 kg. This large turtle was captured with the aid of a dipnet, as it was not entirely within the net when it was pulled from the water. *Chelydra serpentina* exceeding 10 kg fed in the nets, but managed to escape during net retrieval. If the diameter of the ring for the nets were increased, this might increase chances of capturing these larger snapping turtles. *Trachemys scripta* ranging in size from 42 to 235 mm plastron length and 19.5 to 2575 g have been captured using deep-water crawfish nets. The smallest turtle captured was a hatchling *S. odoratus* with a plastron length of 16.6 mm having a mass of 3.2 g. Therefore, these nets are suitable for capturing nearly all size classes of carnivorous/omnivorous aquatic and semi-aquatic turtles. They are especially adept at capturing *S. odoratus*.

These nets have a number of advantages over traditional hoop nets: 1) With this active method of catching turtles exact times of feeding can be ascertained, which could not be done with any precision with hoop nets. 2) They are less expensive and less bulky than hoop nets. In general, two dozen deep-water crawfish nets takes up less space than a traditional hoop net. 3) Turtles can be captured in extremely shallow waters with these nets. 4) With hoop nets, there have been reports of turtle injury or mortality resulting from prolonged periods within the net (e.g., Barko et al. 2004; Dodd 1989). The likelihood of injury using deep-water crawfish nets is significantly reduced because turtles are not 'trapped', and nets are checked frequently. 5) Lastly, unlike hoop nets, there is little chance of theft or sabotage to deep-water crawfish nets that you are actively checking from the shore.

Hoop nets do have some advantages over deep-water crawfish nets. Because hoop nets only have to be baited, set and checked every so often, the time required to sample in this manner is significantly less than sampling using deep-water crawfish nets. The actual trapping of hoop nets is done passively as opposed to the active method of using deep-water crawfish nets where the investigator must be present. Hoop nets are advantageous in situations where trapping must be done from a boat. We suggest that deep-water crawfish nets will not work well in these situations because the surface disturbance created by a moving boat would scare feeding turtles out of the net before it could be checked. Also, hoop nets are useful in trapping turtles that feed at night. By comparison, deep-water crawfish nets are more difficult to use at night. However, we increased our trapping success at night by wearing headlamps and affixing reflective tape to the large cork and rods of the aluminum pole.

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