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A TRAP FOR USE ON TIDAL WEIRS AND STREAMS[1]

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ABSTRACT: Over 100,000 ha of Louisiana coastal marsh have been semi-impounded by weir construction. This paper describes a trap designed specifically for use at weirs to study certain aspects of the juvenile life history of aquatic species. The trap could be modified easily for use in other situations.

As used in this paper, weirs are low dams placed across tidal channels for several purposes, but especially to encourage the growth of aquatic vegtation through partial stabilization of water levels (Chabreck and Hoffpauir 1965). The weir crest is about 15 cm lower than the surface of the soil supporting rooted emergent vegetation. Since tidal flow occurs over a weir whenever water level exceeds crest level, the marsh behind them has been termed "semi-impounded" (Herke 1971). A conservative estimate of the area of Louisiana coastal marsh semi-impounded by weirs in 1966 was 100,000 ha (Herke 1968) and weir construction has continued in the ensuing decade. Because of the magnitude of the area affected, study of the effect of weirs on the nursery role of the marsh has become increasingly important.

Traps are one of the better gear types for use in studying certain aspects of the juvenile life history of aquatic species in the marsh (e.g. migrational movements, biomass production, etc.). This paper describes a trap specifically designed for use at a weir, although it could be modified readily for use elsewhere.

Many authors have used traps in studying fishes (Shetter 1938, Carbine and Shetter 1943, Wolf 1951, Whalls et al. 1955, Kahl 1963, Higer and Kolipinski 1967, Hall 1972, and Kushlan 1972, 1974). However, only a few authors have used traps in the estuarine environment. Hellier (1958) used a drop trap on a bay bottom. Simmons and Hoese (1959), Copeland (1965), and King (1971) used traps in tidal passes. Arnoldi et al. (1974) used a system in a semi-impounded marsh consisting of traps for incoming and outgoing organisms on opposite sides of a bayou, with a diagonal deflecting screen connecting the traps. Numerous breakdowns occurred with this system because of (1) inundation, (2) clogging and subsequent washout, (3) scouring under the deflecting screen, and (4) physical destruction by blue crabs *(Callinectes sapidus)*. We reasoned (correctly) that the first three problems would be greatly alleviated if the trap system were installed at the weir. Therefore, prior to initi-

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ation of the next project on the same study area, we designed and fabricated a trap (Fig. 1) for installation at a weir about 50 m Gulfward of the trap system used by Arnoldi et al. (1974).

To prevent undue strain on the weir, the trap was suspended by cables from a frame attached to the four support pilings. Leverage produced on the cables from a 2-m diameter wheel and axle raised the trap.

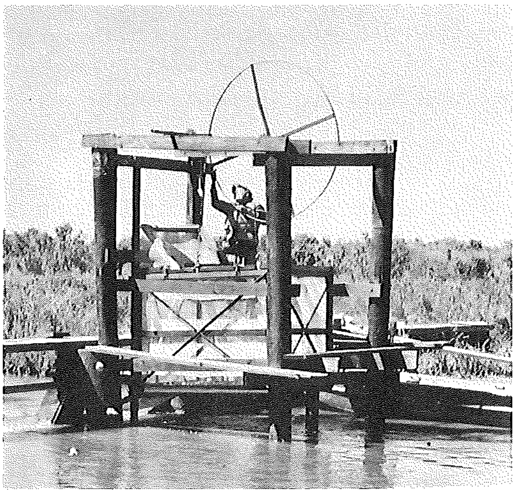

Fig. 1. Lowering the trap to take a sample.

Only the main features of the trap are diagrammed in Figure 2. It was in the shape of a rectangular box 1.8 x 1.2 x 1.2 m. The edges were of 5-cm angle iron with the "concave" side facing inward. Nails were driven through holes bored in the angle iron to fasten chemically treated wood into all concave edges. Chemically treated wood was also fastened around the box, midway between the top and bottom (A, no angle iron here); this divided each wall into upper and lower halves so that only half of the nest on a wall had to be replaced when a hole developed. Plastic coated 6-mm mesh hardware cloth was fastened to the inside edges of the wood with nails and laths.

The diagonal cross braces on the ends and sides were of 2.5-cm angle iron. A similar cross brace on the bottom supported the 2-cm (¾-inch) plywood floor.

Most organisms were caught when the current was flowing into the trap mouth (B). The mouth ended in a horizontal slit, at the narrow end, which extended across the width of the trap resulting in an opening about 1.1 m wide and 5 cm high. This allowed organisms entrance to the trap but made exit unlikely. The slit width was adjustable; too narrow a slit caused the mouth to become plugged. We found it necessary to set the slit wide enough to pass the largest crabs.

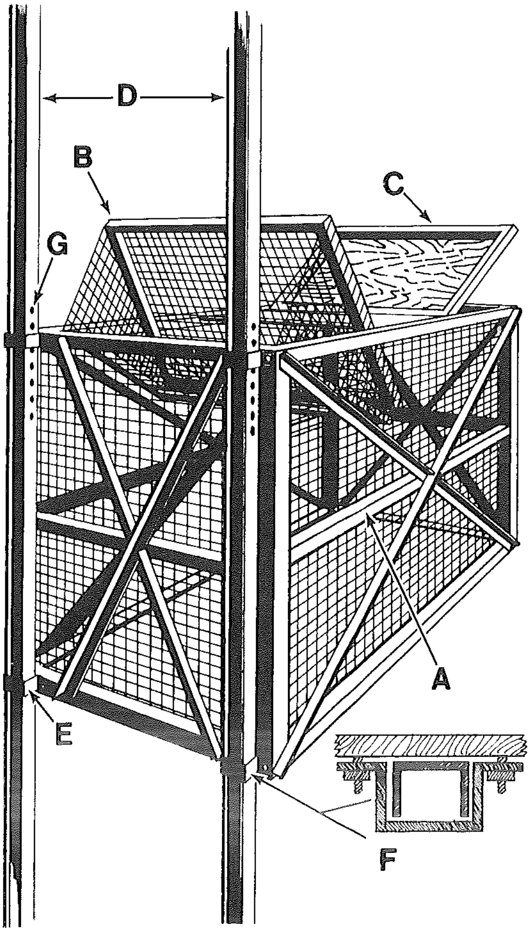

Fig. 2. Oblique perspective diagram of main trap features.

A plywood trap door (C) at the rear of the trap allowed removal of organisms with a dipnet, or one to get inside the trap and completely empty it after it had been raised above the water. The trap door was latched shut when submerged. Mesh covered the remainder of the top.

Two lenghts of channel iron (D) served as guides, and supports, for the trap. Shackles (E) were bolted to studs welded at each corner of the anterior end of the trap. These shackles surrounded the channel iron (as shown in top view, F) so that the trap was held in position by the channel irons, but the trap could still be raised and lowered. (Grease or hypoid oil on the channel iron facilitates this.) The shackles were made by cutting 5-cm sections from a larger piece of channel iron and welding a tab on both outside edges. Before we entered the raised trap, we inserted metal pins in the nearest hole (G) beneath each top shackle. Thus even if the support cables broke, the channel irons and shackles would hold the trap and its contents securely in position.

For trap installation, the pilings were first driven and the wooden supporting frame (Fig. 1) was fastened in place with large lag screws. Next the wheel and axle, and 6-mm (¼-inch) diameter stainless steel cables, were installed. Then the cables were fastened to clevises attached to tabs welded to either side of the trap at the balance point. The trap was allowed to hang from the cables while the lengths of channel iron (D) were bolted into place with the schackles (E). The lower ends of the channel iron were then pushed into the bayou bottom and the top ends were bolted to the wood frame at the top of the pilings. Finally, they were also bolted to another crosspiece about a meter lower so they would remain rigid. (This lower crosspiece must be high enough that the upper shackles do not reach it when the trap is fully raised.)

A funnel of about the same width as the trap was installed from the weir crest to the trap mouth. The funnel frame (Fig.3) also was covered with 6-mm mesh. The lower edge of the funnel mouth was hinged to the upstream edge of the weir crest so the funnel could be tilted out of the way when the trap was raised. Organisms entering the funnel mouth passed over the weir crest and out the smaller end of the funnel, which fit into the trap mouth.

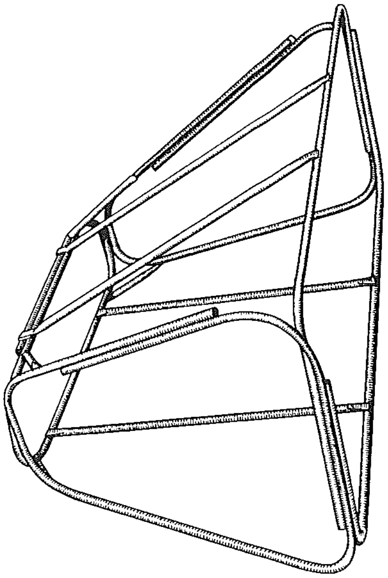

Fig. 3. Funnel frame without 6-mm mesh hardware cloth attached.

Blue crabs were troublesome even with this trap, although they did not tear it up as much as they would have nets. When crabs were "running" they filled the trap to a depth of about 60 cm in 24 hours. Even when less numerous they ate and mutilated large numbers of other organisms. Therefore, a divider of plywood and large-mesh welded wire was added. Slots were placed inside on each side of the trap, running from slightly posterior of the hinged edge of the trap door to near the front edge of the floor. The divider slid snugly in these slots and against the top and bottom of the trap so the larger crabs were retained above the divider and other organisms could seek refuge below it. This reduced, but did not eliminate the crab damages. If one were not interested in the crabs, it might be possible to devise an escape hatch for them alone.

Other improvements could also be made. Water flow at the weir creates considerable pressure, so a metal frame is necessary for strength and rigidity, but aluminum or some light alloy containing copper (for anti-fouling purposes) would reduce corrosion and the weight of the trap. The plastic-covered hardware cloth lasted for several months before physical damage by crabs, and corrosion, became serious. It was much more satisfactory than conventional galvanized hardware cloth coated with asphaltum. Even so, a stronger mesh impervious to crab attack would be preferable. Again, an alloy containing copper would be best if the mesh is small; for 12-mm (½-inch) and larger mesh, plastic-covered meshes readily available would probably be strong enough and present only minor fouling problems.

Fouling, which can occur rapidly, reduces water flow through the trap. This increases the probability that organisms will bypass around the trap, if possible. Even when the trap was in an unfouled condition, we believe there was some organism avoidance of the weir bay at which the trap was installed. Trap efficiency was increased by installing 6-mm mesh "flap screens" across the remaining bays. These opened on incoming tides, allowing organisms entrance to the study area; they closed on outgoing tides, denying most organisms passage over the weir except at the bay containing the trap.

The trap catches organisms moving in one direction only; this is both an advantage and a disavantage. One knows what direction the organisms were moving when caught (i.e. into the nursery or out of it). However, to catch those moving the other way requires the installation of a second trap facing in the opposite direction.

The trap has the advantage of being big enough to hold a 24-hour catch from a large area without suffocation occurring. Also it can be lifted completely out of the water for emptying and maintenance. It could probably be used in unweired streams by eliminating the present mouth, and putting a conventional V-shaped mouth with a vertical slit in the end next to the channel irons (D).

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