A SYSTEM FOR COLLECTING LARGE NUMBERS OF LIVE POSTLARVAL PENAEID SHRIMP[1]

Acquiring large numbers of small marine organisms for experimental or commercial purposes is often hampered by inefficient methods. Means for concentrating organisms and separating desired species from the rest of the catch can be particularly troublesome problems.

For commercial shrimp culture and related research, a system is needed whereby large numbers of postlarval shrimp can be efficiently caught, separated, and held alive in a healthy condition. The shrimp of greatest interest for pond culture include the tropical and subtropical species whose habit of entering estuaries during larval stages and remaining there for several weeks makes them accessible in large numbers to various collecting methods. Two general methods are presently employed to collect shrimp for culture. Postlarvae are impounded in the Orient by manipulating tidal flow with sluice gates built into the dikes of ponds (Walford, 1958). This method, however, also impounds undesirable species that enter with the small shrimp. Fishermen of the Philippine Islands catch shrimp larvae by immersing bundles of grass at the edges of mangrove thickets and periodically removing the attached postlarvae with a dip net, or by dipping a triangular net into the water (Caces-Borja and Rasalan, 1968). These methods are time-consuming, and the number of postlarvae caught varies greatly among localities; often catches are too small to provide stock for a successful crop.

The objective of this study was to develop more efficient methods for collecting and separating large numbers of postlarval brown shrimp, *Penaeus aztecus*. Postlarvae of this species immigrate through tidal passes on flood tides from February through September along the Texas coast with peak abundance occurring during late winter and early spring (Baxter and Renfro, 1966). The postlarvae occur in great numbers near the surface, especially in the more shallow areas (Duronslet, Lyon, and Marullo, in press) and are about 11 mm in total length and 1 mm in diameter at immigration.

Description of Equipment

The collecting system, designed for use on a 13-m vessel, is shown in Figures 1 and 2. The telescoping outriggers consist of a pipe frame attached to the vessel and pipe extensions which slide inside the frame. The frame itself was constructed from two pieces of 76-mm (outside diameter) galvanized pipe bolted side-by-side to the top of the cabin. The extensions were 51-mm (outside diameter) galvanized pipe. Holes were drilled in the pipes so that each could be extended 2.4 m and secured with a steel pin.

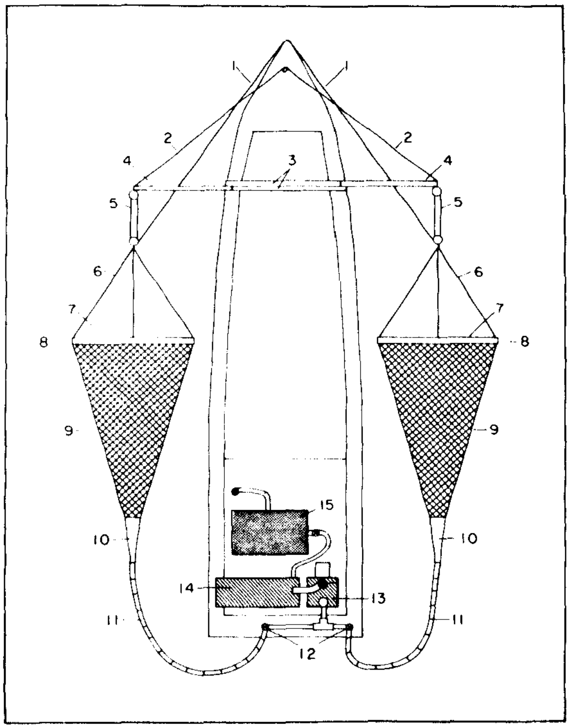

FIGURE 1.—Schematic drawing of collecting system: 1 - bow bridles; 2 - staywires; 3 - outrigger frame; 4 - outrigger; 5 - double block; 6 - net bridle; 7 - trash screen; 8 - net frame; 9 - net; 10 - funnel; 11 - suction hose; 12 - screw valve; 13 - pump; 14 - sorting box; 15 - holding tank.

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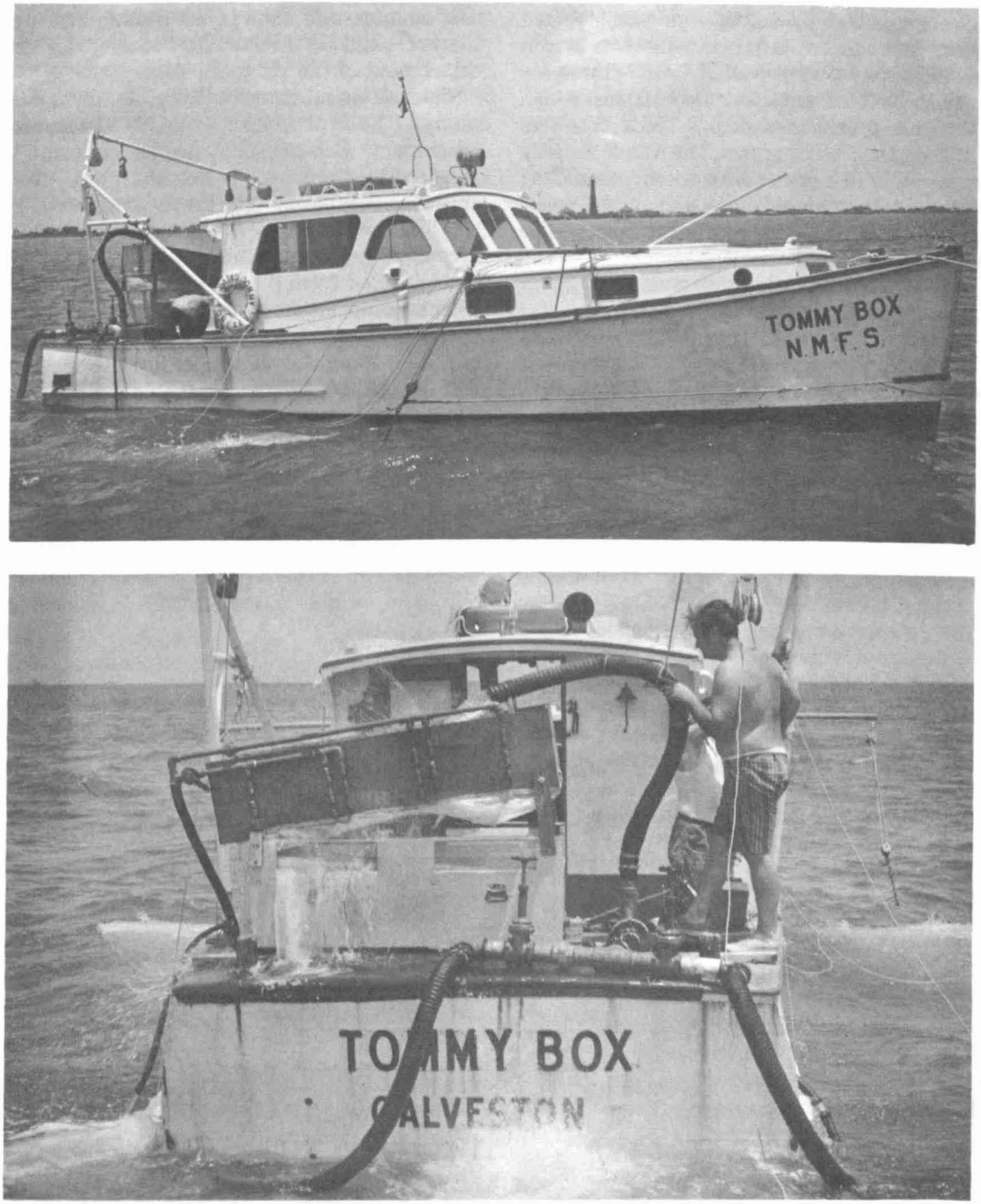

FIGURE 2.—Collecting system in operation on flood tide.

Net frames, 1.2 by 2.4 m, were constructed of 3-mm flat steel reinforced with 6-mm iron rods. Six U-bolts were welded to the frame for the attachment of stainless steel cables which bridled each frame to a double block bolted to the end of each outrigger. The trash screens were made of 6.4-cm square mesh galvanized hardware cloth soldered onto galvanized metal frames which were bolted to the net frame. The nets were fabricated from nylon netting (169 meshes per square inch) measuring 3.7 m in length and patterned so that the seams ran from the corners of the metal frame to the aluminum rings. The rings were attached with bayonet fittings to the collecting funnels. Both the mouth and tail of the nets were reinforced with cotton duck and fitted with brass grommets so that the nets could be laced on the frames and rings.

The collecting funnels were made with 3-mm flat stock aluminum and were 90 cm long (30 cm outside diameter at the mouth and 7.5 cm inside diameter at the tail). A 15-cm nipple was welded to the posterior end where the suction hose from the pump was attached, and a 10-cm flat band was welded to the mouth of the funnel. L-shaped slots were cut in the leading edge of the band. These slots were spaced so that countersunk bolts in the aluminum ring of the net could be inserted and rotated for quick attachment of the net to the funnel.

The self-priming, centrifugal, solids handling pump ("Crown" model PO3LB, Construction Machinery Company, Waterloo, Iowa[2]) was powered by the winch power shaft (Figure 3). In turn, the power shaft was controlled by a small hydraulic motor which allowed regulation of pumping speed. Water volume output could be controlled from 0 to 180 gal/min.

The pump intake pipe was attached to a 7.6-cm (outside diameter) PVC (polyvinyl chloride) tee. A reinforced rubber hose led from each side of the tee to the respective funnel, and a brass screw valve was incorporated in each hose so that we could pump from either or both nets.

The sorting box (Figures 3 and 4) was designed so that the smallest animals caught would be retained and the larger ones discarded. This was accomplished by pumping the catch from the nets onto three sets of sloping screens. A water-jet system was used to keep the animals

[2] Use of trade names in this publication does not imply endorsement of commercial products by the National Marine Fisheries Service.

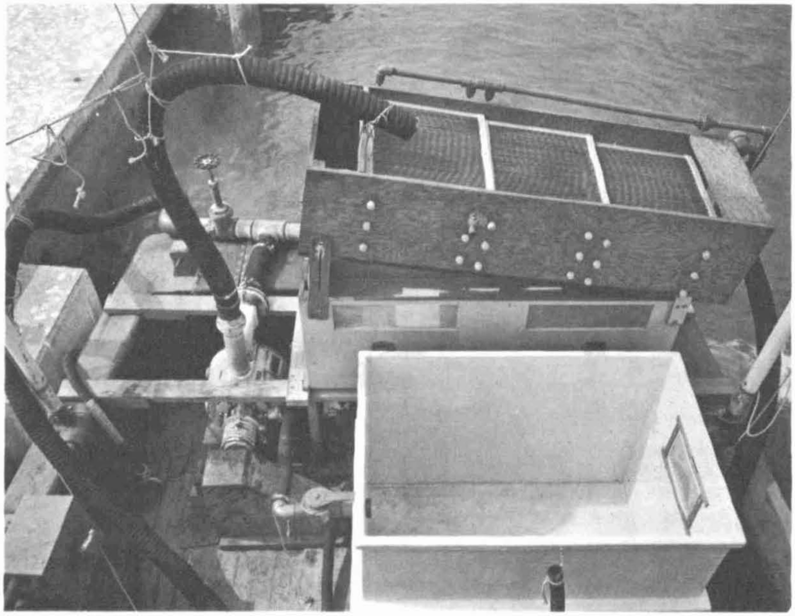

FIGURE 3.—Pump, sorting box, and holding tank.

separated and moving down the screens. The screen frame and the catch box located beneath the screens were made with 19-mm marine plywood. One end of the screen frame was hinged and could be set at the slope providing maximum sorting efficiency. To accommodate excess water, six overflow windows around the top edge of the catch box were screened with fine-mesh netting. The catch box drain emptied into a 145-gal fiber glass holding tank having screened overflow windows (Figure 3).

The 54- by 51-cm screens were constructed of brass welding rods and flat stock aluminum. The rods were cemented in place at both ends along the aluminum strips with liquid solder cement. Excess cement was ground off, and another aluminum strip was bolted to each end, thus sandwiching the brass rods between aluminum strips. Three layers of screens were installed in the frame with each layer having three screens fitted end-to-end so that the rods ran parallel with the long axis of the frame. The average openings between rods for the screen layers were 3, 2, and 1½ mm.

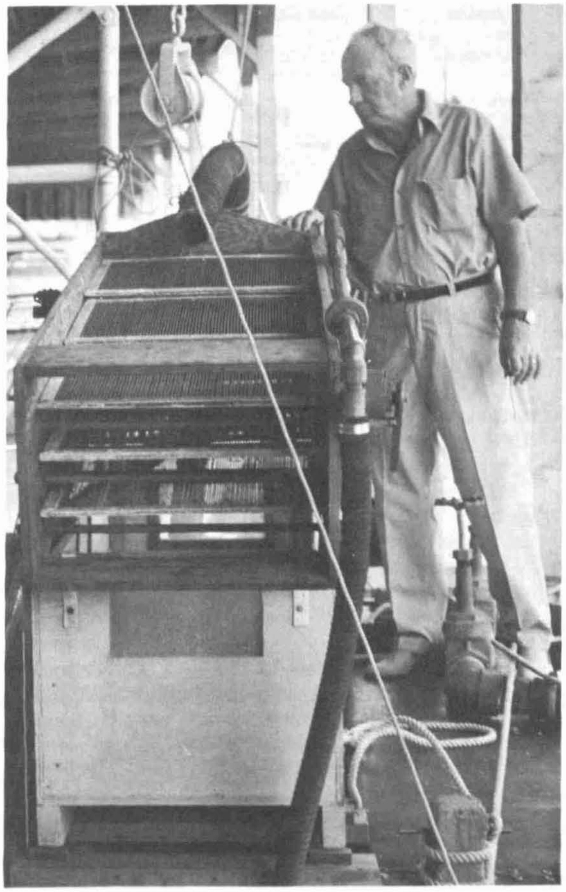

FIGURE 4.—End view of sorting box.

Water-jet pipes were inserted through the walls of the screen frame 5 cm below each screen with two pipes per screen (Figure 3). The pipes were perforated with 2-mm holes spaced 25 mm apart to form the water jets. The force of the jets, which was supplied with water by a 25-mm gasoline-driven centrifugal pump, was controlled by a PVC ball valve on the discharge line of the pump.

Operation of System

After anchoring the vessel, the outriggers were extended, the suction hoses and cones put overboard, and the nets and frames were lowered into the water. A rope was then passed around the bow, and the ends were attached to the bridle of each net. When the nets were subsequently slacked back, the rope bridles became taut, and tidal flow forced the frames into the water (Figure 2). The solids-handling pump and the water-jet pump were then engaged and the jet heights adjusted. When the sorting box was full of water, the valve on the bottom was opened allowing the catch to flow into the holding tank.

Evaluation of System

The number of brown shrimp postlarvae caught per cruise was estimated by periodically taking 5-sec samples from the pump discharge. Twenty collection cruises were made on flood tides between March 17 and June 2, 1971 (Table 1). Numbers of postlarvae caught during individual cruises ranged from 0 to about 106,000, and the total estimated catch for all cruises was about 411,600. Mortalities associated with catching, pumping, and sorting brown shrimp postlarvae were less than 3%.

During evaluation of the system, large numbers of larval fishes and crustaceans other than postlarval brown shrimp were collected. The more common and readily recognizable forms are listed in Table 2. Mortalities related to capture of these larvae were estimated to be less than 10%, while mortalities for subadults and adults were less than 20%. Large specimens of Atlantic cutlassfish, sea catfish, Atlantic croaker, Gulf menhaden, and the blue crab were passed through the pump with little damage. The sorting box was effective in removing all animals and trash larger than 1.5 mm in diameter, or about 95% of the larval fishes caught. Postlarvae retained in the trash were less than 10% of the total number of postlarvae caught. Larval stages of the blue crab were not effectively separated, however, and were voracious feeders on postlarvae.

This system was efficient in capturing and sorting large numbers of postlarval shrimp and, by adjusting the widths of the sorting screens, can be used to catch and sort most small animals as they migrate through tidal passes. The pump and suction cone attachment on the tail of the nets provided a constant free flow of water which eliminated the problem of clogging or fouling as encountered with standard plankton nets. The system is not restricted to use on a boat and could be easily adapted for land-based operations from piers and platforms.

TABLE 1.—Estimated number of postlarval brown shrimp caught by date in the Bolivar Roads Tidal Pass, Galveston Bay, Tex., 1971.

Date		Fishing time (min)	Number of samples	Estimated total catch
March	17	167	8	14,400
	20	240	9	3,800
	21	50	5	3,000
	22	108	9	5,200
	23	80	6	800
	26	173	16	45,200
	27	345	16	46,200
	28	335	32	52,600
	30	465	49	65,100
	31	180	15	4,500
April	2	173	8	500
	3	150	15	5,100
	7	120	12	200
	13	155	17	9,100
	20	60	6	1,400
	21	135	13	0
	30	100	10	23,200
May	19	160	16	800
	20	220	21	106,000
June	2	90	9	24,500
Total		3,506	292	411,600

TABLE 2.—Fishes and crustaceans collected during evaluation of the system; A = abundant; O = occasional.

Scientific name	Common name	Juvenile	Adult
Anchoa mitchilli	Bay anchovy	A	O
Brevoortia patronus	Gulf menhaden	A	O
Callinectes danae	Gulf crab	O	O
Callinectes sapidus	Blue crab	A	O
Cynoscion arenarius	Sand seatrout	O	
Dysommia sp.	Eel	A	
Elops saurus	Ladyfish		A
Arius felis	Sea catfish	A	O
Gobiesox strumosus	Skilletfish		O
Hippocampus zosterae	Dwarf seahorse		O
Histrio histrio	Sargassumfish		O
Libinia emarginata	Spider crab	O	
Menticirrhus americanus	Southern kingfish	O	
Micropogon undulatus	Atlantic croaker	A	O
Monacanthus hispidus	Common filefish		A
Mugil cephalus	Striped mullet	A	
Ophidion welshi	Crested cusk-eel		O
Palemonetes sp.	Grass shrimp		A
Penaeus setiferus	White shrimp	A	A
Polydactylus octonemus	Atlantic threadfin		A
Porichthys porosissimus	Atlantic midshipman		O
Prionotus tribulus	Bighead searobin		O
Sergistid sp.		A	A
Sphoeroides nephelus	Southern puffer	O	O
Squilla sp.	Mantis shrimp	A	A
Syngnathus scovelli	Gulf pipefish	A	A
Synodus foetens	Inshore lizardfish	A	O
Trachypenaeus sp.	Brokenback shrimp	O	A
Trichiurus lepturus	Atlantic cutlassfish		A

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