EQUIPMENT FOR HOLDING AND RELEASING PENAEID SHRIMP DURING MARKING EXPERIMENTS [1]

Personnel of the National Marine Fisheries Service Biological Laboratory at Galveston, Texas, have conducted numerous mark-recapture experiments to obtain information on the movement, growth, and mortality of penaeid shrimp. These experiments were carried out under a variety of conditions at sea and in coastal bays. Several types of specialized equipment were developed to overcome problems of holding, handling, and releasing shrimp during the marking phase of these experiments. Some of this equipment has been described previously by Costello (1964). Holding tanks, a cooling unit, and two devices used to transport shrimp to the sea floor are described here.

Holding Facilities

A number of factors were considered in the design of tanks for holding shrimp. Construction materials had to be relatively light in weight, require little maintenance, and be nontoxic to shrimp. Provisions also were needed to permit rapid water exchange, minimize water turbulence within tanks, and control water temperature. The tank design in Figure 1 meets these needs and has proved successful for both sea- and land-based operations. It is constructed of light gray fiberglass with wood reinforcement and weighs about 114 kg (250 lb.). Advantages of the light color are that it reflects heat and makes shrimp easily visible in the tank. To permit rapid drainage or water exchange, a polyvinyl chloride (PVC) pipe, 7.6 cm (3 inches) in diameter, is molded into each end of the tank near the bottom. Filter screens, used to prevent loss of shrimp in outflowing water, have a large surface area to minimize clogging. A one-quarter section of PVC pipe, 7.6 cm (3 inches) in diameter, is molded to the top of the tank at each end as a splash rail to reduce spillage.

Five sets of guides in the tank support baffles that reduce water turbulence at sea and are used to separate groups of shrimp in a tank (Fig. 1). The baffles have a frame of aluminum flashing covered with sheets of patterned aluminum 0.063 cm (0.025 inch) thick.

During field use, a series of two to four tanks are linked to provide either recirculating water or continually flowing new water. The pump used depends on the volume of water required. Normally, we use a cast-iron pump powered by a 0.5-hp electric motor (110-220 v) that discharged 114 to 132 liters (30 to 35 gal) per min. As the water is discharged into the tanks, it passes through siphon filler-drain nozzles (Costello, 1964) which draw air into the circulation system and aerate the water. The aeration unit (Fig. 2), made of 1.9-cm (0.75-inch) pipe, may be attached temporarily at any convenient place on the tank. The amount of air that enters the water is regulated by valves in each air line.

Because it is difficult to keep shrimp alive when water temperatures exceed about 27° C (80° F), cooling units are used to lower and maintain temperatures in holding tanks. A cooling unit of our own design is shown in Figures 3 and 4. The casing consists of a PVC pipe, 25.4 cm (10 inches) inside diameter, 45.7 cm (18 inches) long, and 0.9 cm (0.37 inch), thick, and top and bottom pieces of PVC flat stock, 30.5 by 30.5 by 1.3 cm (12 by 12 inches by 0.5 inch) with circular grooves 0.6 cm (0.25 inch) deep. O-ring gaskets that fit the grooves prevent leakage of water. The refrigerant coil is made from 0.9-cm (0.37-inch) diameter stainless steel tubing, 9 m (30 ft) long. A thermostat sensor receptacle, inserted through the top

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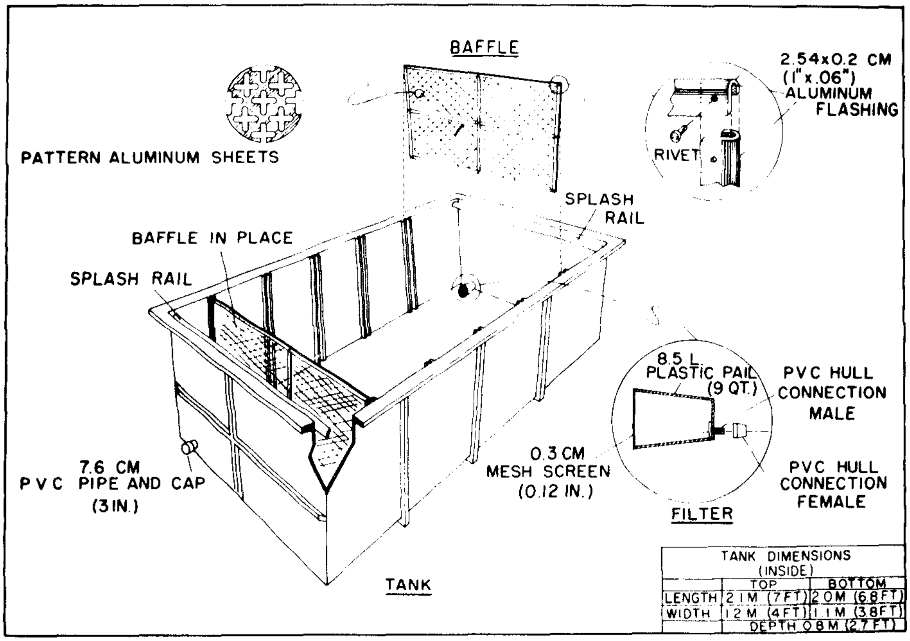

FIGURE 1.—The holding tank, baffles, and filters used in shrimp marking experiments.

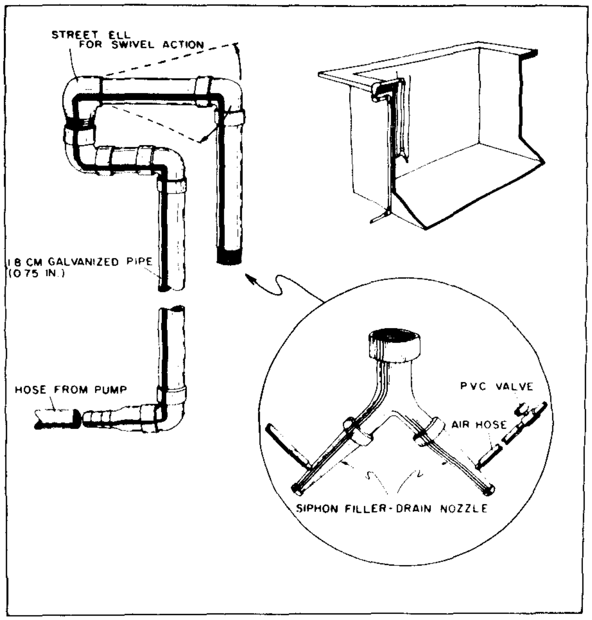

FIGURE 2.—Aeration unit and siphon filler-drain nozzle through which water enters tank.

plate of the cooling tank, consists of a piece of 0.6-cm (0.3-inch) diameter stainless steel tubing, 20.3 cm (8 inches) long, and is sealed at one end. The top of the chilling tank is reinforced by a 30.5 by 30.5 cm (12 by 12 inches) frame made from angle aluminum stock 3.8 by 3.8 by 0.6 cm (1.5 by 1.5 inches by 0.25 inch).

Two experiments were completed to determine the cooling capability of the unit. Water was recirculated through the chilling unit at rates of 114 to 132 liters (30 to 35 gal) per min, and thermographs recorded water and air temperatures (Fig. 5). The temperature attained after 24 hr was about 15.6° C (60° F) and was lower than that required for shrimp-marking procedures. Field observations have indicated that water temperatures can be maintained within 2° C (4° F) of desired levels, irrespective of fluctuations in air temperatures.

A table top with plastic pans 33.0 cm (13 inches) long, 38.1 cm (15 inches) wide, and 13.97 cm (5.5 inches) deep equipped for continuous water circulation (Fig. 6) slides over the lip of the holding tank and extends about 5 cm (2 inches) beyond the ends of the tank. When in

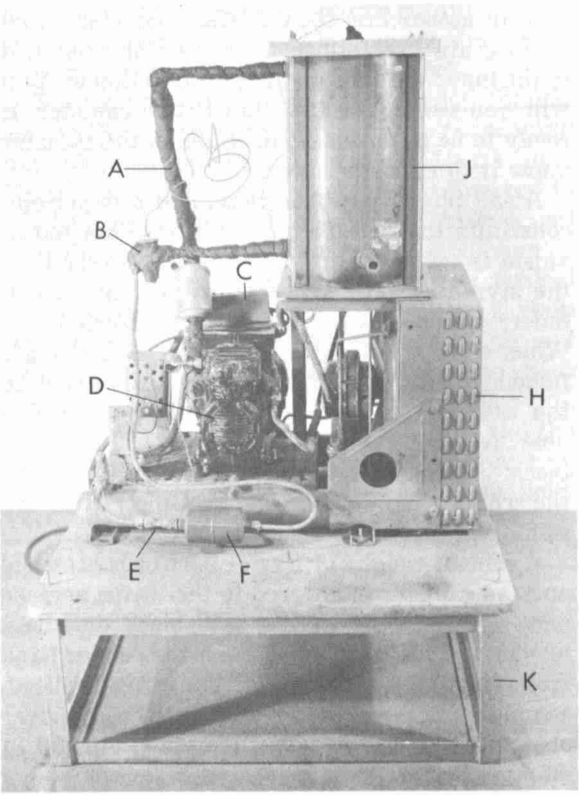

FIGURE 3.—One-hp single-phase compressor and condensing unit (12,000 BTU factory rated) attached to a PVC chilling tank and mounted on angle iron stand. A. vibration joint; B. expansion valve; C. thermostat control; D. compressor; E. sight glass; F. dryer; H. condensing unit; J. chilling tank; K. angle iron stand.

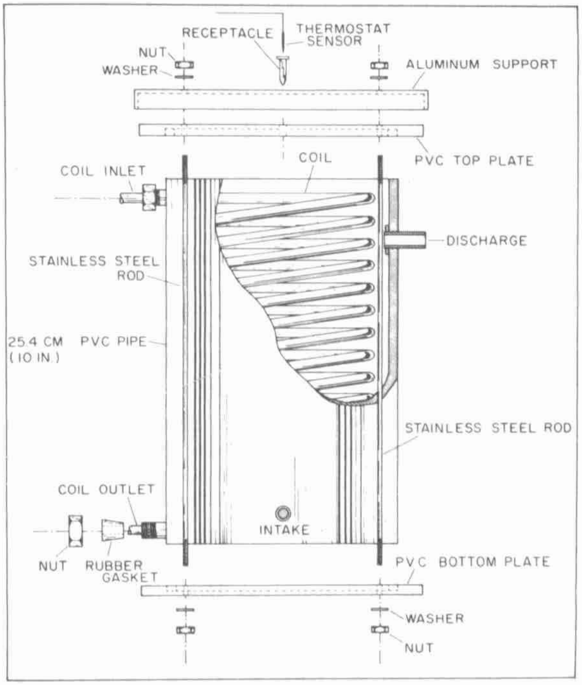

FIGURE 4.—Details of the chilling tank assembly.

place, the table top serves as a work area for staining and tagging shrimp which are held in the pans.

Equipment for Releasing Shrimp

Three types of release devices have been developed to protect shrimp from exposure to predation during their return to the sea floor. Costello (1964) described a release box that is lowered to the bottom with a winch and opened by

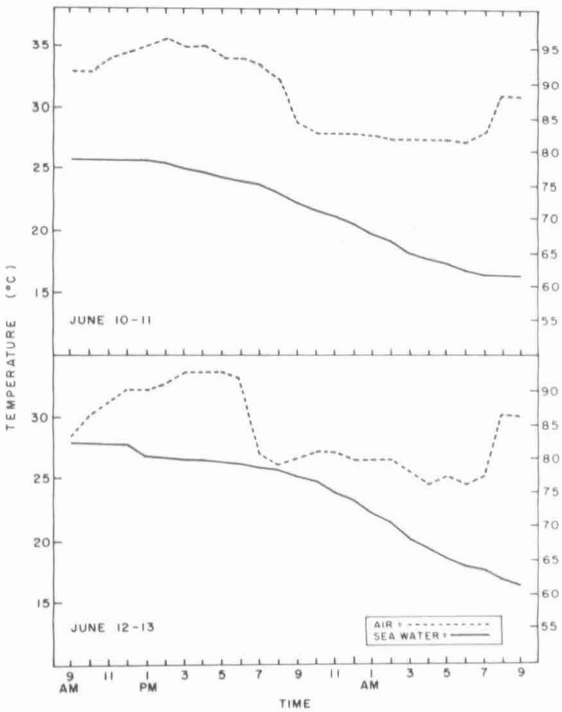

FIGURE 5.—Reduction of water temperatures in a 1,892-liter (500-gal) tank compared to surrounding air temperatures during trials with the chilling unit.

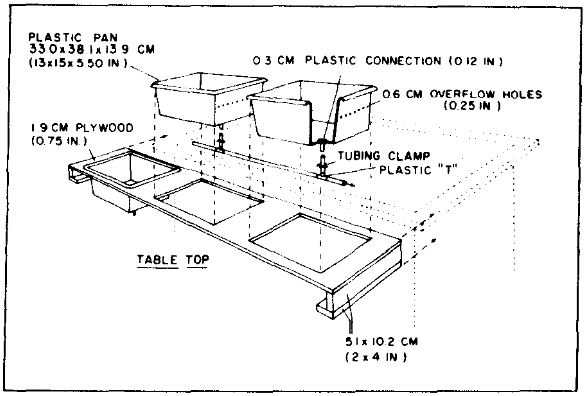

FIGURE 6.—Removable table top and holding pans equipped for continuous water circulation.

a messenger dropped down the cable. Use of this device is restricted to large vessels equipped with a winch, and requires that the vessel be stopped when shrimp are released. To circumvent these requirements, we designed an expendable release canister that can be put overboard while a vessel is underway and a release tube for use in shallow water.

The canister (Fig. 7) is constructed of high-impact styrene plastic formed into a hollow cylinder. Tabs on each of the styrene plastic end pieces have holes to accommodate retaining rods used in assembling the canister. Assembly and loading are accomplished in a cradle attached to the inner wall of a holding tank so that shrimp will remain submerged until the canister is ready to be put overboard. Slots in the canister allow it to fill with water.

A salt block, a rubber band, and a paper clip constitute the release mechanism. This mechanism is set by folding together the two ends of the styrene plastic sheet (thus forming a cylinder) and securing them with a rubber band. When ends A and B (see canister, Fig. 7) are folded, the paper clip is inside the canister with the attached rubber band inserted through a hole (end A) and a slot (end B). The salt block is then inserted in the loop formed by the rubber band, and the retaining rods are removed.

A cement weight (1.1 kg or 2.5 lb.) is attached and the canister is lowered to the water surface and released. When the salt block dissolves, tension in the canister wall pulls the rubber band from the slot (end B) and the canister disassembles, releasing the shrimp. Although never observed during the actual release of shrimp in offshore waters, this release devise was tested in shallow estuarine waters and in the laboratory. In all tests it performed as expected. The canister accommodates up to 100 shrimp that

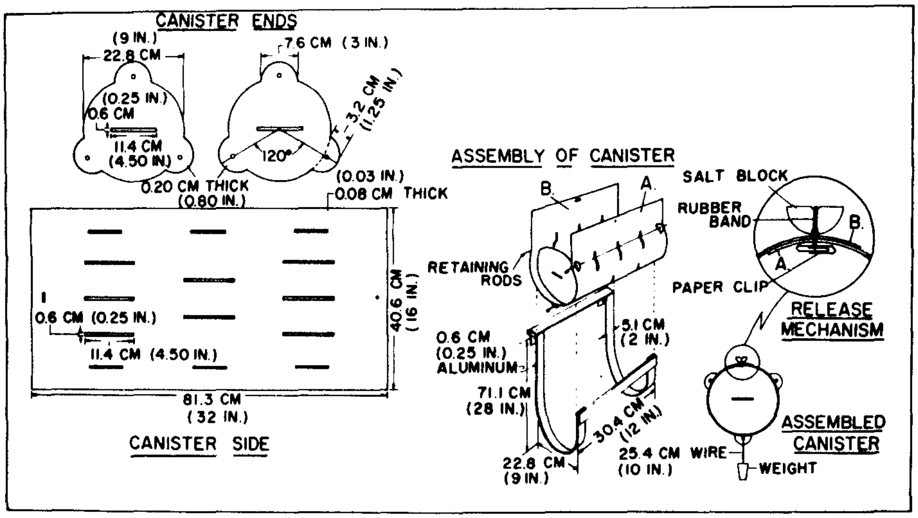

FIGURE 7.—Disposable release canister showing release mechanism, loading cradle, and method of assembly.

are released on the sea bottom within 5 to 15 min from the time the unit enters the water, depending on the size of the salt block.

The release tube (Fig. 8), intended for use in shallow water, consists of two telescoping aluminum pipes, each about 3 m (10 ft) long. To release shrimp, the outer pipe is lowered to the bottom and shrimp are poured from a pail into the funnel. After each pail of shrimp is poured into the unit, the apparatus is flushed with several pails of water to insure that shrimp do not remain in the tube. The pouring and flushing of one pail of shrimp usually take about 1 min.

The new equipment described herein and the improved techniques for staining and tagging described by Neal (1969) enabled us to hold, mark, and release large numbers of shrimp. We can now process between 1,500 and 3,000 shrimp per day, depending on the type of mark used.

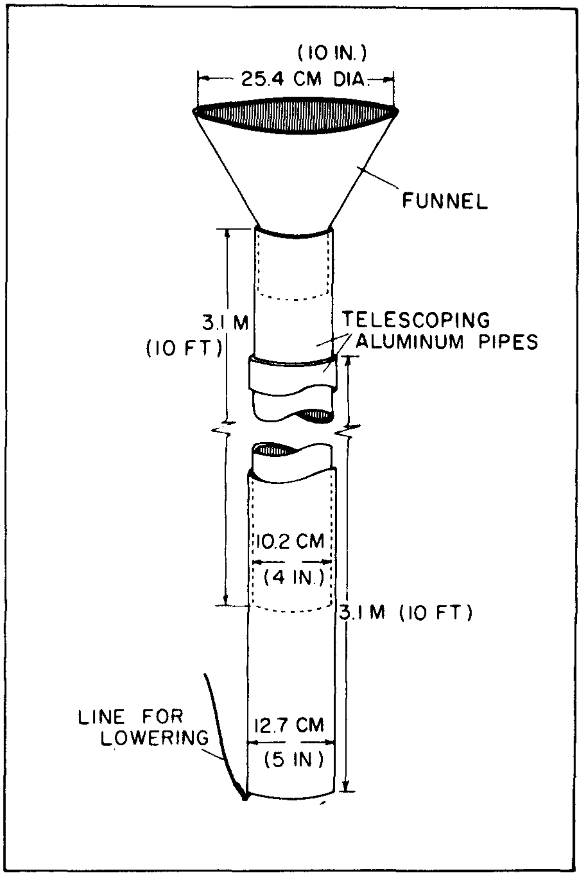

FIGURE 8.—Release tube used to place marked shrimp on the bottom.

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AN ADULT BLUEFIN TUNA, *Thunnus thynnus*, FROM A FLORIDA WEST COAST URBAN WATERWAY[1]

The bluefin tuna, *Thunnus thynnus* (Linnaeus), is a wide-ranging pelagic species occurring in most tropical and temperate seas (Gibbs and Collette, 1966: 119). In the Gulf of Mexico exploratory and commercial catches have been limited to the northern, western, and central parts, from waters beyond the continental shelf. The collection of a large adult from the Florida west coast represents a new record for the Florida shelf.

The specimen, a female, was captured by local fishermen with harpoons in a waterway at Hudson, Fla., (lat 28°21′24″ N, long 82°42′42″ W) on 10 May 1970. It weighed 239 kg (525 lb.), was 244 cm (96 inches) in fork length and 168 cm (66 inches) in girth, and appeared to be in healthy but lean condition, characteristic of post-spawning fish in May on the Bahama Banks (Rivas, 1955: 139).

Histological examination of gonadal tissue sectioned at 6 μ and stained with Harris hematoxylin and Eosin Y showed early and late atretic

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