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AN ADJUSTABLE MACROPLANKTON GEAR FOR SHALLOW WATER SAMPLING

Plankton gear are ideal for sampling fishes and crustaceans early in their life histories when they are perhaps more randomly distributed, and their densities more quantifiable than at any other life stage. The late Dr. Elbert H. Ahlstrom described the plankton net as a "simple and thorough" sampling device (Lasker 1984). The gear are used to estimate cohort size and potential recruits to adult fish populations, and are adaptable to a variety of field settings (Aron 1962, Dovel 1964, McGowan and Brown 1966, Tranter and Smith 1968, Hempel and Weikert 1972, Bagenal and Nellen 1980, and Snyder 1983).

Principal among the concerns of macroplanktologists have been: 1) net clogging before the sampling effort is completed; 2) net avoidance by larvae due to gear visibility or bridle deflection; 3) sufficient volume filtered to accommodate for sparseness and patchiness of the organisms; 4) adequate estimates of volume filtered; 5) sampling near the shoreline or structure; and 6) nets that open and close for sampling discrete depths. Unfortunately, gear modifications designed to accommodate those concerns often produce one or more of the following shortcomings: 1) small eggs and larvae are extruded through meshes coarser than 0.5 mm; 2) long nets with length to diameter ratios >5:1 are expensive and cumbersome to use and clean; 3) large nets (>1.0 m in diameter) or net series that open and close require either a large research vessel, or modifications which make the vessel less suitable for other collection activities; 4) stationary and passive gear are inefficient in slack currents; and 5) centrifugal pumps filter small volumes, or harvest from fairly localized regions and consequently yield inaccurate estimates of abundance and distribution.

In an effort to reduce some of the shortcomings of standard macroplankton gear, we designed an apparatus for sampling in a shallow tidal channel near Sabine Lake in southeast Texas.

MATERIALS AND METHODS

An inexpensive, removable frame was bolted to the gunwales near the bow of a shallow-draft vessel from which plankton nets were suspended (Fig. 1). Any aluminum welding shop should be able to construct the frame. Aluminum plates (13 mm thick) and pipes (up to 55 mm outside diameter with 5 mm walls) proved sufficiently sturdy for our 0.5-m nets fitted with 0.505-mm mesh, and should be able to withstand forces developed by nets up to 1.0 m in diameter. Angular bracing (6 mm thick) was used throughout the frame to reinforce aluminum welds. The net frames could be any size and adapted for any shallow-draft vessel, so long as hinges extend the net support plates outside the gunwales of the boat. We attached marine plywood (A, Fig. 1) inside the frame to provide

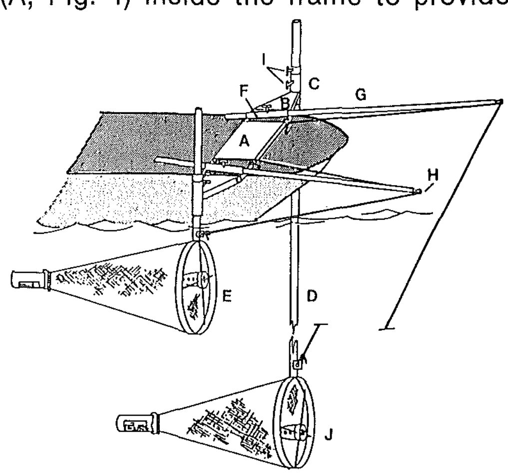

Figure 1. An adjustable shallow water sampling assembly for collecting macroplankton.

extra working surface area.

Triangular plates (B) were hinged to each end of the frame. A pipe sleeve (C) was welded vertically to the triangular plate. The pipe sleeve was 55.0 mm in diameter, with a wall thickness of 5.0 mm. Net poles (D) are 45 mm in diameter, with 3.0-mm wall thickness. They slide up and down and twist in the sleeves to provide for opening and closing net mouths for fishing specific depths. Net frames (E) are welded to the bottom of each pole. Plankton nets were tied to these frames. Horizontal pipe sleeves (F) mounted on the frame near the hinges guide support poles (G) that slide to the stern when the nets are not fishing. Ropes from the frame through the eyes (H) of the support poles were tied above the nets for reinforcement. Set screws or pins (I) hold the poles in position while sampling. Approximately 30 minutes were required to assemble the apparatus.

After zeroing the flowmeters (Fig. 1, J), net poles were submerged to appropriate depths and twisted so that the net mouth was open for sampling at the specified depth for the specified length of time. Support poles were extended forward until the ropes were taut. The boat was anchored in the current to fish passively, or moved $\cong$ 1.0m/sec upstream. After sampling, the net poles were twisted 90° to close the mouth of the net and pulled up and across the bow. The net mouth was then twisted facing upward with the net suspended over the water where it was washed using a bilge pump fitted with a garden hose and nozzle.

RESULTS

We collected over 1000 samples in a 30-m wide × 4-m deep tidal channel near Sabine Lake, Texas, from July 1984 through April 1986 (Hartman *et al.* 1987). Although we encountered no underwater obstruction, we cracked aluminum welds on two occasions when pushing the nets at speeds > 1.0 m/sec. After reinforcement with wedge-shaped braces welded to the vertical pipes and hinged plates, the gear proved sufficiently strong for simultaneously pushing two 0.5-m nets of 0.505-mm mesh at depths up to 4 m and speeds up to 1.3-m/sec.

With respect to the above-listed concerns of planktologists, we witnessed the following: 1) The length-to-diameter ratio of the nets was 3:1 and the 0.505 mm mesh clogged only when volumes filtered exceeded 150 m^3 or the water was particularly high in suspensoids. During calibration there was linearity of response in revolutions per tow length registered on the flowmeters at current speeds from 0.1 to 1.1 m/sec. 2) Densities of late larval stages and juveniles were greater at night than during the day, suggesting gear avoidance; however, fishes approaching the nektonic habit apparently avoided light and were captured near the bottom during the day (Hartman *et al.* 1987). 3) The sample volume filtered averaged 89 m^3; however, nets up to 1.0 m in diameter, or longer pushes, could have been made to increase sample volume. 4) Organisms could be simultaneously collected from two depths near the boat bow, thus avoiding the bow wake and prop wash. 5) Net poles and the vessel were easily maneuvered to avoid obstructions.

Another attribute was that the poles could be folded inboard when travelling between collecting stations, and stored in the boat when trailing to and from the laboratory.

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