REMOVABLE HYDROFOILS WHICH PERMIT SURFACE AND BOTTOM SAMPLING WITH A SINGLE OTTER TRAWL

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ABSTRACT

A rapidly installable and removable hydrofoil permits a single otter trawl to be used for both surface and bottom sampling. The hydrofoil is airplane-wing shaped in cross section and is three feet long, ten inches wide with a two inch maximum thickness. It is mounted on a fifteen degree wedge and secured to the top edge of each otter board. Conversion of doors from one mode of sampling to the other can be done in about one minute.

As part of the Maryland anadromous fish studies,[1] young-of-the-year clupeids and other species were collected by otter trawling on the bottom and surface of the nursery area studied. The same net and doors were used for both surface and bottom sampling. This paper details the attachment of hydrofoils to the otter boards to permit the gear's use in surface collection. An alternative method has been derived by Trent (1967), however, he did not indicate whether the same boards could be used for both surface and bottom work.

Materials: The trawl employed was a 16-foot headrope, semi-balloon, modified shrimp (otter) trawl. The headrope carried four 1-½" x 2-½" ark floats as furnished; five additional floats were added to prevent sagging after experimentation. The dry weight of the net is 17 pounds.

Each mahogany otter board, shod with a steel runner, measured 24" x 12" x 1", and weighted 25-¾ pounds including its bridle chain and hydroplane.

The boat used for collection was a 16-foot Boston Whaler powered by a 40 horsepower Johnson outboard. The boat made three knots at full throttle while towing.

Construction of Hydrofoils: Each hydrofoil or plane was milled from a dressed plank measuring 2" x 10" x 3". It was shaped to approximate and airplane wing in cross section (See Figure 1). Tips of each plane were left square. A 15 degree wedge was attached to the bottom of each plane at its center. The apex of the wedge was flush with the trailing edge of the plane.

Holes were bored through the plane and wedge to accomodate 5/16" x 6" lag bolts. The holes were spaced approximately two inches apart, with the forward one about two inches behind the leading edge of the plane. (See Figure 1 for details)

Using the holes in the plane and wedge for guides. slightly smaller holes, snug for the bolts, were bored in the top edge of the otter boards.

The heads on the lag bolts were sawed off and the tops of the bolts threaded to receive butterfly or wing nuts. The after bolts, being inserted through the thinner, trailing wedge had to be threaded farther down the shaft than the forward bolts. When the wedge and plane are joined by nails, they can be put on or removed from the door as a unit. Butterfly nuts and washers hold the assembly firmly on the door.

Use of the planes for surface trawling: Time required to apply or remove planes and thus convert the trawl from one mode of sampling to the other is about one minute.

[1] PL 89-304-AFSC-1-1.

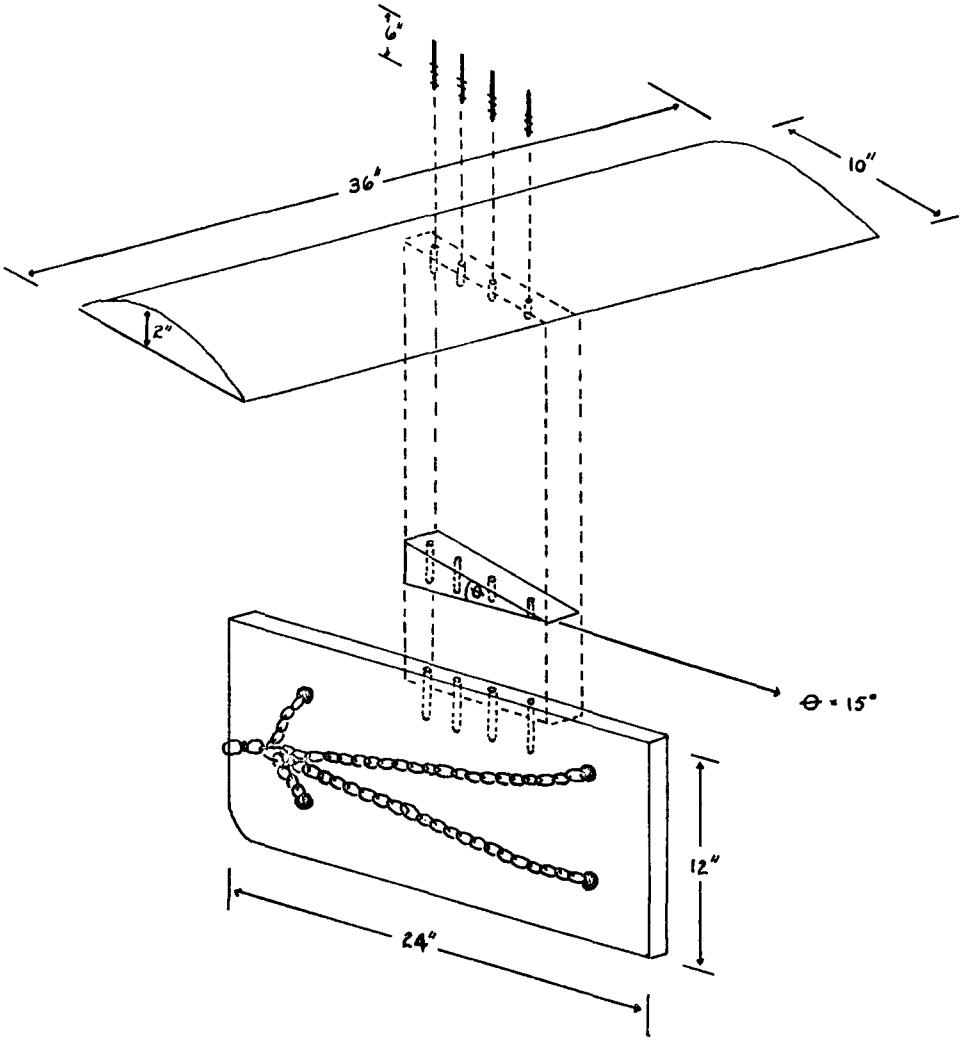

FIG. I EXPLODED VIEW OF TRAWL DOOR AND HYDROFOIL

When trawling on the surface, the 100-foot towing warp was paid out to its full extent. This was done in an attempt to minimize the boat-induced disturbance of the fish at the time when they were over taken by the trawl. It is unknown whether more or less fish would be taken were the net farther back, or were it towed from two boats utilizing a double warp rig. Some workers have utilized a double warp (Massman, Ladd and McCutcheon, 1952).

The full duration of a given surface pull cannot be made with the warp fully paid out. Before the end of a transect is neared the net must be started in, since, if forward motion is lost, the net sinks to the bottom. If brought in on the bottom, the surface sample becomes contaminated with a catch made on the bottom rendering vertical distribution estimates invalid.

Consequently, the last part of a pull is made nearer the boat which may reduce the catch. This problem might be obviated by the use of a high speed winch which would keep the gear on the surface during retrieval. Working with the present arrangement, the uptake winch was stated at the seventh minute of a ten minute pull. Using a 100-foot warp, the net was brought close enough to the boat by the tenth minute so that it remained on the surface long enough to be retrieved without its sinking after the boat lost way.

Results: The surface trawling rig described was used in a nursery area at the head of Chesapeake Bay which varied from six to twelve feet in depth. Turbidities averaged 20.9 ppm. Of 134 pulls furing 1968, 50.7% were made on the surface. For the species *Alosa aestivalis, A. pseudoharengus,* and *A. sapidissima* the relative numbers caught in this manner were 52.1%, 18.2%, and 45.4% respectively. The alewife catch was significantly lower at the 5% level than expected. It is thought that all three species are negatively phototropic. Possibly the alewife is more so than the other two.

Even in the shallow water sampled, it was evident that surface trawling collected only species present in the upper layers. For *Roccus americanus, R. saxatilis, Ictalurus nebulosus, I. punctatus, Anguilla rostrata, Trinectes maculatus,* and *Etheostoma nigrum* percentages of each species caught by surface trawling were 0.6, 5.9, 2.0, 3.4, 3.9, 2.1, and 1.9 respectively.

The catch of the bay anchovy, *Anchoa mitchilli*, suggests that the surface trawl may not be effective for this species. While the catches by day and night were divided exactly according to expended effort, implying no effects of light upon the species behavior, surface trawling (50.7% of trawling effort) produced only 26.4% of the species catch. However, daylight may enable the anchovy to avoid the net at the surface to some extent. Fishing effort equaling 29.8% was expended on surface daytime trawls, producing 10.4% of the anchovy catch; 20.9% of the effort, extended on surface night trawls, netted 16.0% of the anchovies.

Summary. A rapidly installable and removable hydrofoil permits a single otter trawl to be used as both surface and bottom sampling gear. This is of considerable value when sampling is done from a small boat where space is limited. The complete operation of conversion can be done in one minute. The surface fishing trawl is very selective for species inhabiting the upper layers of water and can facilitate work on diurnal migration and vertical distribution. Where specimens are available, the gear appears to capture in proportion to fishing effort expended, indicating that it is efficient.

LITERATURE CITED

Massman, W. H., E. C. Ladd, and H. N. McCutcheon, 1952. A surface trawl for sampling young fishes in tidal rivers. Trans. North American Wildlife Conf. 17: 386-392.

Trent, W. Lee, 1967. Attachment of hydrofoils to otter boards for taking surface samples of juvenile fish and shrimp. Ches. Sci. 8 (21: 130-133.