HANDY UNDERWAY PLANKTON CATCHERS

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There have been developed several underway plankton samplers,[1–11] some of them being very excellent and applicable to simultaneous serial tow at different depths, and others being capable of use for continuous recording of plankton distribution. Notwithstanding, at present, such simple apparatuses as those presented here are felt to be conveniently useful for researchers and fishermen who desire to take plankton sample from their boat while underway by handling manually with ease.

The present samplers are originally designed to use for sampling the plankton of surface water, but the deep tow, if desired, may be possible by installation of diving plane such as that equipped on the Hardy Plankton Indicator[3] or by use of Reed & Stewart's mahogany depressor[12] or Isaac's bronze depressor.[7] In the deep tow, however, the depressing force produced by such devices results in so great cable tension, that a robust cable and powerful winch may be necessary in towing and retrieving the samplers.

Although comprehensive test tows with the present underway catchers have not yet been performed, and, therefore, statistical analysis of the method can not be presented, the possibility of catching of the surface plankton while underway was revealed by the results of a few experiments.

Underway Plankton Catcher Model 1

(figs. 1A, 2A)

The apparatus consists of a narrow brass cylinder, 53 cm in length and 5 cm in diameter, which bears four posterior fins, and tapering head-piece made of solid brass metal, 15 cm in length, which is screwed into the cylinder. A narrow net, made of fine Japanese bolting silk, XX 13, 129 meshes a linear inch, with about 0.0053 mm^2 of mesh aperture, is inserted inside. Two holes, each having 14 mm diameter, are pierced on the two opposite sides of the head-piece, and they are united to one hole, 20 mm in diameter, which opens toward the inside of the cylinder. The ratio of sectional area of the united hole (3.14 cm^2) to the total area of the gauze is about 1 : 114, and to the total area of the mesh apertures of the gauze it measures about 1 : 16.

Barnes[13] experimented with the Hardy Plankton Indicator, finding that the machine, of which the ratio of mouth opening to area of filtering gauze (not the area of total mesh apertures) is 1 : 6, catches the sample at a speed of 8 knots more efficiently than the machine, of which the ratio is 1 : 4, but that the same amount of catch is obtained whether the ratio is 1 : 6 or 1 : 30; that is the ratio 1 : 6 is

sufficient for filtering the theoretical quantity of water.

Total weight of the apparatus assembled is 4 kg. While underway water flows into the two holes on the head-piece and is introduced into the net, outflowing from the terminal opening of the cylinder. The plankton sample retained in the net is removed by releasing the cork of the terminal bucket of the net, leaving the assemblage of the apparatus just as it is unless the meshes of the net clog with the retained matter.

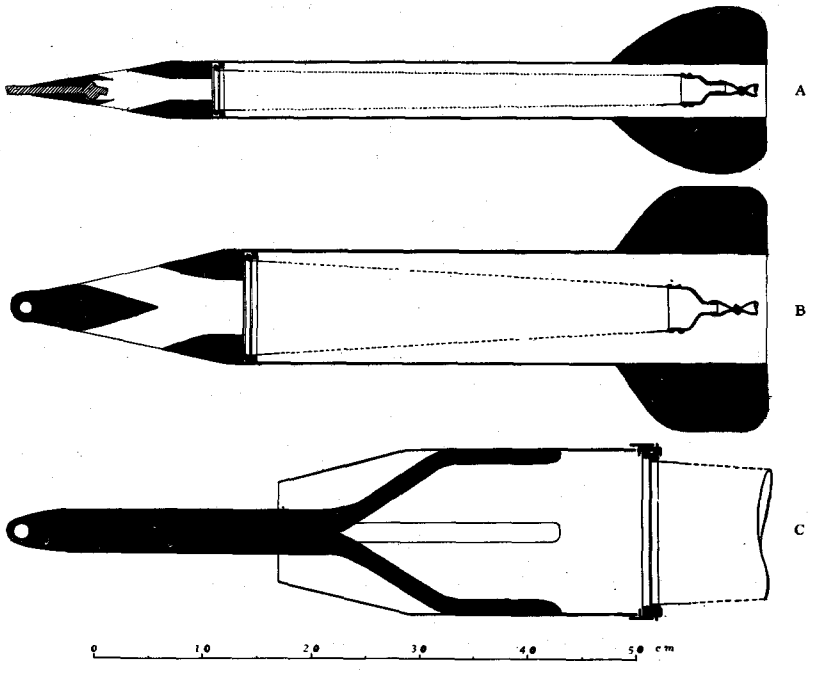

Fig. 1. Sectional view of underway plankton catcher, model 1 (A), model 2 (B) and underway fish-larva catcher (C)

Since the warp (using cotton log line) is introduced from a narrow hole, 8 mm in diameter, at the top of the tapering head-piece, there is least fluid resistance, the cable tension being only about 2 kg at 8.5 knots and about 8 kg at the speeds up to 14.7 knots.

By an experiment made off Nagasaki in November, 1952, at night, about 9 cc (in settled volume) of diatoms, 47 small copepods and 5 other animals were sampled by a 15 minute tow at 10 knots.

Underway Plankton Catcher Model 2

(figs. 1B, 2B)

This apparatus is in general similar in construction to the catcher, model 1, but of larger dimensions. The cylinder is 50 cm in length and 10 cm in diameter, and

the head-piece is 20 cm in length. The holes on the two opposite sides of the head-piece are 36 mm in diameter, these being united to a hole, 50 mm in diameter (19.6 cm^2 of sectional area). Inserted net is made of coarse Japanese bolting silk, GG 32, *i. e.*, 31 meshes a linear inch, with about 0.285 mm^2 of mesh aperture, or made of GG 56, *i. e.*, 54.5 meshes a linear inch, with about 0.096 mm^2 of mesh aperture. The ratio of the sectional area of the hole to the total area of the gauze is 1 : 37, and to the total area of the mesh apertures of the gauze is about 1 : 16. (The same ratio in both kinds of gauze). The assembled apparatus weighs 8.4 kg.

The flow-meter, which rotates corresponding to the inflow of the water, may readily be attached behind the apparatus, though it is not installed at present. It has been developed in Japan by Mr. Zinziro Nakai of the Tokai Regional Fisheries Research Laboratory, under the same principle as the Atlas Current Meter.[1]

The warp is shackled at the top of the head-piece. Test tows showed that the cable tension was about 10 kg at 8.5 knots and about 18 kg at 14.7 knots, respectively.

The present catcher is designed to use for retaining the comparatively large agile plankton animals which may possibly be caught by high speed tow. It was surprising that by test tows a considerable number of such agile animals as euphausiids and large copepods were captured in good condition. For examples, 140 euphausiids, 440 large *Calanus*, 13 *Themisto*, 22 *Sagitta* and 3 *Aglantha* were captured by a 30 minute tow at 8.5 knots at night in April, 1954, eastern outside of the Tsugaru Strait and 320 euphausiids, 40500 large *Calanus*, 9220 small calanoids, 510 *Themisto* and 1080 *Sagitta* by a 37 minute tow at 8 knots at night in June, 1954, in the Ishikari Bay.

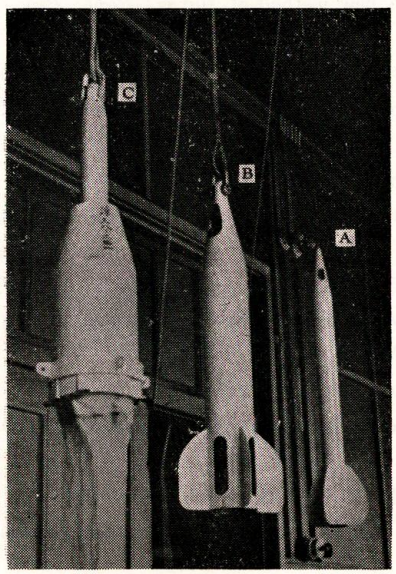

Fig. 2.
A: Underway plankton catcher, model 1
B: Underway plankton catcher, model 2
C: Underway fish-larva catcher

Underway Fish-Larva Catcher

(figs. 1C, 2C)

This apparatus is differently constructed from the above two. It consists of an iron fore-piece and conical net behind. The fore-piece is itself a cylinder, 23 cm in length and 15 cm in diameter, and tapering collar, 12 cm in length, anteriorly. From the inside of the cylindrical part of the fore-piece an iron rod, 5 cm in diameter, is stretched out until it extends 25 cm beyond the edge of the tapering collar. The warp is shackled at the anterior end of this iron rod. As the diameter of the edge of the collar is 9 cm, there remains a circular opening which allows the water to

enter, the area of the opening corresponding to 42 cm.^{2} The net attached behind the fore-piece is about 1 m long, and made of stramin or coarse bolting silk. The ratio of the area of the anterior circular opening to the total area of the net is about 1:45.

Total weight of the apparatus is 9 kg, and the cable tension when towed at a speed of 8.5 knots measures about 20 kg.

In a test tow at night western outside of the Tsugaru Strait in May, 1953, although the fish larvae were not found in collection in this time, 8 euphausiids, 9100 large *Calanus*, 19 *Euchaeta*, 15750 *Metridia*, 240 *Themisto*, 2 brachyuran larvae and 118 *Sagitta* were obtained by a 50 minute tow at 8.5 knots.

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