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Reprinted from LIMNOLOGY AND OCEANOGRAPHY
Vol. 6, No. 2, April, 1961
pp. 230–233

AN ENLARGED CLARKE-BUMPUS PLANKTON SAMPLER

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An Enlarged Clarke–Bumpus Plankton Sampler[1]

The plankton sampler described by Clarke and Bumpus (1950), and improved by Paquette and Frolander (1957), is of limited use in oceanic areas of low plankton abundance. In such regions, relatively large volumes of water must be strained to increase the probability of catching a representative sample. To overcome this difficulty a similar instrument of approximately twice the diameter of the original model was designed. This quadruples the amount of water strained per unit time but changes as little as possible the well-proven operating principles of the earlier instruments.

The new design essentially involves only a change in scale, although modifications from the original form were required to avoid the use of castings, and to maintain ruggedness and stiffness without the accumulation of excess weight. The resulting instrument is illustrated in Figure 1.

The tubular body is made from a 5-in. length of seamless brass tubing 10 in. in inside diameter, with a ⅛-in. wall thickness. As in the earlier instrument, the body is supported within the frame at its forward end by a pair of axles, with the axis of rotation passing through the center of a half-circular ring on the gate. As before, this half-ring engages an L-shaped release lug on the index shaft, which in turn controls the two motions of opening and closing of the gate. The planing vanes, which give the body a horizontal aspect during operation, are of 1⁄16-in. stainless steel sheet, 8 in. long by 5 in. wide and extend 5 in. aft of the body tube. They are given a tilt of 15° with respect to the longitudinal axis, and a dihedral angle of 10°.

The frame is fabricated from ¼- × 2-in. brass flat bar held together with ¼-20 stainless steel socket-head cap screws. Reinforcement is provided at corners and other points by silver-soldered ⅜- × ½-in. brass blocks tapped for cap screws. The junctions of the upper and lower angular

[1] Contribution No. 244 from the Department of Oceanography, University of Washington. This research was supported in part by funds of the Inter-American Tropical Tuna Commission, and in part by the Office of Naval Research under Contract Nonr-477(10) with the University of Washington.

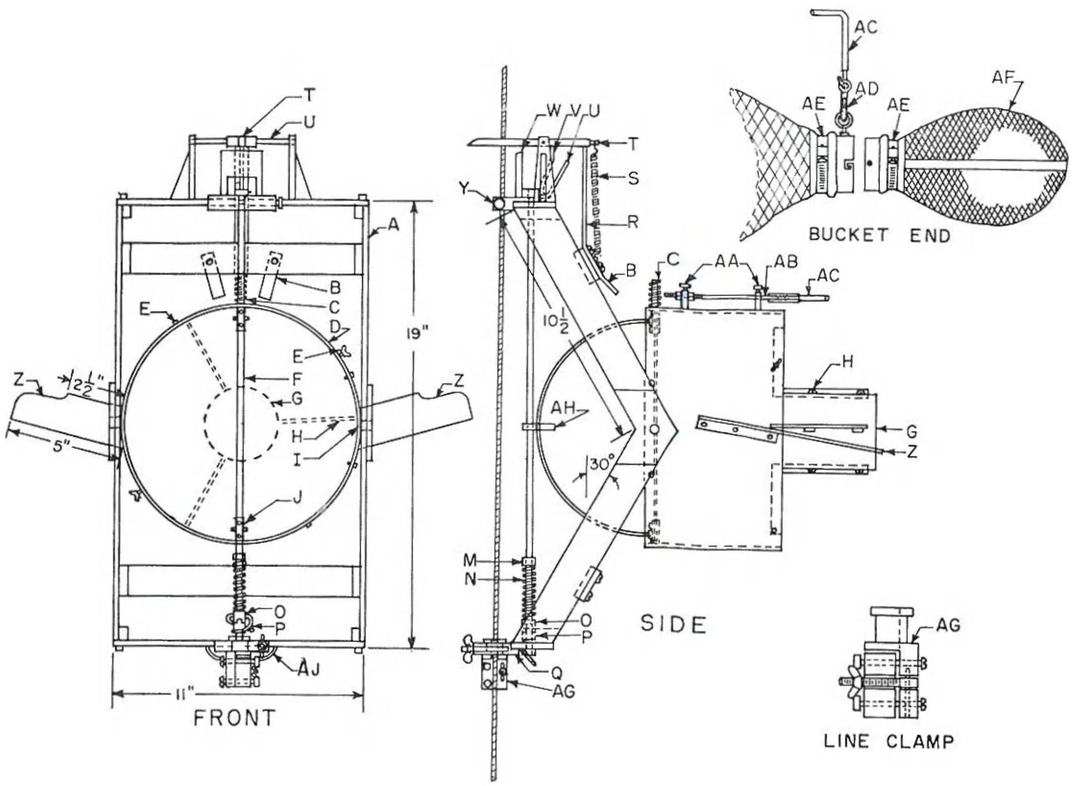

FIG. 1. Enlarged Clarke–Bumpus plankton sampler and improved line clamp. See Parts List below.

PARTS LIST

A Frame; B Stop; C Gate Spring; D Body; E Bayonet pin (2 long, with wing nut; 2 short); F Half-ring; G Flow Meter; H Flow Meter support (3); I Main axle; J Gate axle (2); K Gate release lug; L Index shaft; M Dog-clutch thrust collar; N Dog-clutch thrust spring; O Dog-clutch, upper member and helical messenger-release fingers; P Dog-clutch lower member; Q Line-clamp bushing; R Release-fork stop; S Release-fork spring; T Release-fork; U Index assembly, center pin; V Index assembly actuating pin; W Anvil; X Index assembly, detent pin collar; Y Upper line-attachment assembly; Z Vane (2); AA Boom support posts; AB Boom socket; AC Boom; AD Harness snap; AE Hose clamps; AF Sample sack; AG Line clamp; AH Release lug; AJ Guard

sections of the frame are strengthened by silver-soldered V-shaped pieces.

The release mechanism (including the fork-support, fork mechanism, fork restraining spring, index mechanism, dog-clutch, helical messenger-release fingers, and the corresponding slots in the bottom plate) is identical with that described by Paquette and Frolander (1957). Changes in construction lie only in the use of ¼-in. stainless steel rod for the index shaft and in the use of an enlarged release lug.

The gate is made of ⅛-in. sheet brass, the axle of ¼-in. brass rod, and the gate spring of 24 turns of 0.056-in. inconel wound on a 5/16-in. mandrel. The half-ring is made of 3/16-in. phosphor bronze spring wire. The guard, AJ, which prevents messenger lanyards from hanging up on the line clamp, is made from 3/16-in. rod.

An innovation is the installation of a Tsurumi T. S. plankton-net flow meter[2] instead of the original built-in propeller. The meter is adapted to the after end of the body by means of three L-shaped brass

[2] Tsurumi Seiki Kosakusho Company, Ltd. 1506 Tsurumi-cho, Tsurumi-ku, Yokohama, Japan.

arms, which are slotted into the after edge of the cylinder and silver-soldered. These arms bear holes to match the supporting eyes on the flow meter. The meter is fastened to the arms by means of machine screws. The Tsurumi meter has several advantages over the propeller–odometer combination. Besides being inexpensive, it has a completely flooded gear-driven dial register and so avoids the friction and corrosion problems associated with odometers. It has automatic stops which are an advantage in preventing propeller movement in the wind or during reverse motions.

The nets are 42 in. long and have been manufactured by the Puget Sound Workshop.[3] They are fastened to light, grooved, metal rings by means of stainless-steel hose clamps that have been lengthened by cutting and inserting an additional strip of metal. The rings fasten to the after end of the main body by means of four bayonet catches, two of which are secured by captured ¼-20 wing nuts.

As in the original instrument, the cod-end is supported by a metal boom, which prevents the net from wrapping around the supporting wire. This boom has been made of ¼-in. stainless steel rod, jointed just aft of the main body and about half way along its length. The coupling sleeves are made in such a way that ⅜-in. (or more) of unthreaded rod is supported inside the coupling to prevent breakage by concentration of stress at the thread. A ¼-in. rod has been found a little limber, and it would be well to consider making at least the butt section of somewhat larger rod or tubing. The end of the boom carries a harness snap, which connects into a wire loop on the bayonet coupling of the cod-end.

The cod-end has been modified from the conventional steel bucket. It consists of a small mesh sack joined to the trailing end of the net by means of a pair of grooved bayonet rings. The body of the net and the cod-end are fastened to the female and male partners of the pair of rings by means of lengthened hose clamps applied over the grooves. This design has these advantages: the sack is easier to attach and remove, it is less subject to damage than the metal bucket, and it is cheaper.

The sampler is fastened to the wire in the conventional way, using a spring-loaded retainer pin at the top of the instrument, and a cylindrical clamp, about which the sampler rotates, at the bottom. The retainer pin has a short, threaded portion to lock it in place.

The line clamp at the bottom of the instrument also has been improved and is illustrated in Figure 1. The principal difficulty with the old design was that it would fit only one size of wire rope. Further, the cylindrical portion serving as a bearing for the rotation of the sampler, expanded with an increase of wire size, and a slight change in actual wire diameter occasionally resulted in jamming. The new clamp has a cylindrical section independent of the clamping section. The wire passes through a ¼-in. round-bottomed slot in the cylindrical section and then is clamped between two flat surfaces, whose separation may be adapted to various wire sizes by adjustment of the two knurled screws. Difficult to see in the drawing is the fact that the upper knurled screw engages a slot rather than a hole in the movable plate. Release of the clamp involves loosening the wing nut and swinging away the clamping screw, after which the movable plate may be pivoted on the lower screw to release the clamp from the wire.

The sampler has been tested over a period of about a year, during which over 150 samples have been taken. In only 6 cases did the gate mechanism fail to operate. For the most part, these failures were attributed to the messengers not sliding down the wire; this in turn was due to the presence of burrs or jellies on the wire. The sampler can be tripped at wire angles from 0 to 75°. When towed at speeds of two to three knots for about 30 min. the sampler strains approximately 80–100 m^3 of water. These operating conditions have been found to yield samples that are reasonably representative, yet in most in-

[3] 3311-110th Ave. S. E., Bellevue, Washington.

stances small enough to be counted without entailing extensive periods of time.

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