A NEW MULTIPLE-PLATE SAMPLER FOR COLLECTING MACROINVERTEBRATES OF THE STREAM BIOCIES

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ABSTRACT.—The construction and use of a new sampling device which can be used to analyze quantitatively faunal populations of swift water areas of streams is described.

The ever increasing aesthetical and recreational demands on our freshwater streams today and the pollution problem make obvious the need of reclaiming polluted streams and increasing the beauty and productiveness of non-polluted streams.

A knowledge of the kinds and numbers of macroinvertebrates which inhabit a stream is important as they are vitally related—as food chain organisms—to its production of fishes. The absence, sparsity or abundance of these animals may also be used as indicators of the physical as well as the chemical quality of a stream. Results of comparative productiveness studies, determination of degree of pollution and potential productiveness of various streams or different stretches of the same stream can be used to program and institute stream improvements. Because much data for comparisons is needed, we must have a better method than the classical ones used for sampling invertebrates of stream communities. These older, conventional sampling methods—as the Peterson dredge and Surber sampler—are toilsome and seem to be inadequate for studies in deeper swift waters, on rocky bottoms, and in stream areas where fallen logs, limbs and brush are lodged.

This need of a more effective and efficient sampling method for analyzing benthic macroinvertebrates of riffle stream areas challenged the authors to devise a new sampler. The new sampler is an outgrowth of the multiple-plate samplers used by Hester and Dendy, which they employed in studies of benthic macroinvertebrates in ponds (Hester and Dendy, 1962). Where rigidity to withstand current is not essential in ponds, they used a nylon cord hanging from a branch of a tree to suspend the sampler units on the bottom. When they used their samplers in streams, each was fastened to a vertical wire that extended from a heavy weight on the bottom to an overhanging tree. At a distance from the weight, the wire was wrapped around the neck of the assemblage bolt to maintain the sampler at a selected depth. Their procedure necessitated an advantageously located tree with a limb overhanging the sampling site for the suspension wire attaching to the sampler, and even though the samplers were attached by the wire, they would sway and vibrate unnaturally in the current when used in swift water of riffles. Also the samplers were disturbed many times by curious bypassers who saw the exposed wires. The overall accuracy of sampling results obtained using this arrangement is doubtful. Some modifications of the multiple-plate sampling methods of Hester and Dendy, mainly the attachment of a contrivance to stabilize the samplers in swift waters and a different method—in lieu of their

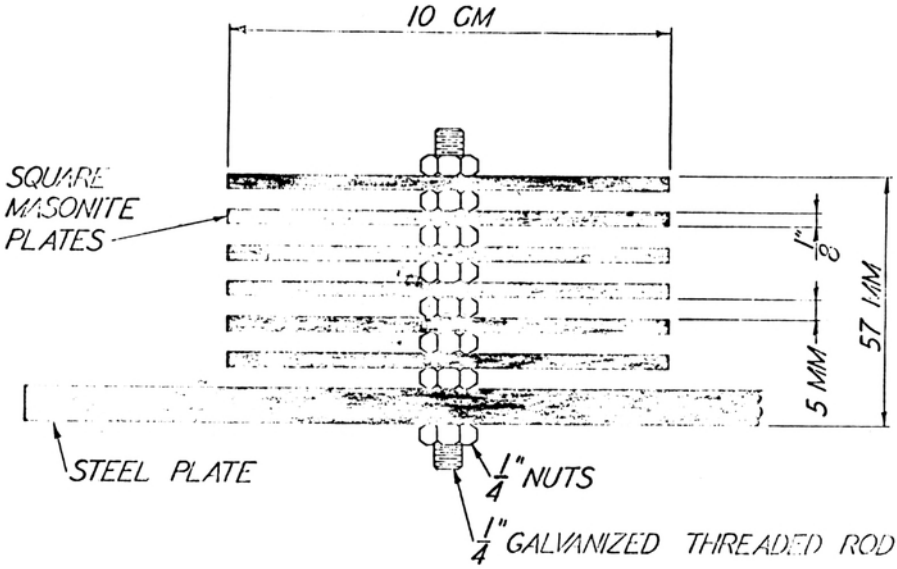

FIGURE 1.—Diagram showing side view of a riffle multipleplate sampler attached to basal steel plate. Size measurements of structural parts which are standard commercial products have been purposely labeled in inches rather than converting them to the metric system.

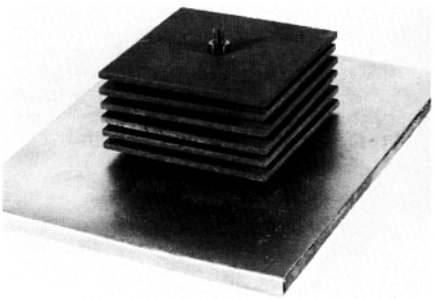

FIGURE 2.—Photograph of assembled riffle multple-plate sampler, showing sampler unit with attached basal steel anchor plate.

use of plastic bags—for retrieving the samplers from the water were, therefore, made. The new sampler has been named a "riffle multiple-plate sampler."

The newly devised sampler consists of one-eighth inch thick tempered hardboard (Masonite) which was cut into 10 cm square plates. A nine thirty-second inch hole was drilled in the center of each plate. Six of these plates were placed on a one-fourth inch galvanized threaded rod. The plates were separated by hexangular nuts, which were 5 mm thick. Thus, the plates were spaced 5 mm apart, an ample space for macroinvertebrates to move freely between the plates, and still offer them a protected microhabitat from larger predators. The total area per sampler unit, consisting of the six plates, was 1200 square cm. Each sampler assemblage was attached by the threaded rod and a nut to a heavy basal steel plate, 9 x 7½ x 5/8 inches, which weighed 7 pounds and 12 ounces (Figs. 1 and 2). This size basal plate was adequate to hold the samplers stationary in swift water. The dimensions and weight of the steel plate is, however, abritrary. The plate, of course, must be heavy enough to hold the sampler unit stable in swift water. By coating the steel plates and the nuts with Fiberglas, rusting was prevented.

During sampling studies, to prevent the loss of any of the organisms attached to the sampler units, each was removed from the water by using a 3-pound coffee can. The sampler was approached from downstream and the

open end of the coffee can was placed over the sampler unit tightly down onto the steel plate. The steel plate with attached sampler unit, and coffee can with water were then inverted. The steel plate was removed from the sampler unit at the collecting site. The coffee can with contained sampler and water was covered with a plastic lid and brought back to the laboratory. These procedures insured a capture of all attached organisms. At the laboratory, the sampler plates were disassembled in some water in a white porcelain pan, and while observing through binocular microscope, the invertebrates attached to the plates and those dislodged in the pan were removed by hand picking and counted. The remaining water in each coffee can was strained through a pair of brass testing sieves. The first sieve had a mesh size of one mm, while the second had a mesh size of 500 microns. Any invertebrate that did not pass through the smaller sieve was considered a macroinvertebrate in the studies. This procedure enabled collection and counting of fauna which had become detached during handling and transporting.

The new riffle multiple-plate sampler eliminates former disadvantages by the attachment of the heavy steel basal plate to the sampler unit for anchorage. There is no need of a tree for its attachment; it is completely stabilized in the swift water of the riffle, eliminating swaying and vibration; and it is not easily discovered by bypassers, because the entire sampling unit is submerged. Further, the sample plates can be easily removed from the water by the use of a 3-pound coffee can—rather than having to manipulate a plastic bag—to enclose them in the swift water. The new samplers can be used to qualitatively and quantitatively study microinvertebrates as well as macroinvertebrates. They are economical, simple to construct, convenient to transport, and easy to place and retrieve from the stream.

Obvious shortcomings of the riffle samplers are that some time must elapse before an accurate sample can be taken, unlike when using the Peterson dredge or Surber sampler, and that the artificial substrate collects only non-burrowing invertebrates.

The samplers have been used with much success at Northern Illinois University in the study of stream ecology: 1) to compare, qualitatively and quantitatively, benthic macroinvertebrate populations of riffles of various streams of northern Illinois, 2) to show population fluctuations of macroinvertebrates of riffle areas during a 12 month period, 3) to determine intimate, microhabitat preference of macroinvertebrates of the riffle by altering the surface texture of the plates, and 4) to compare the macroinvertebrate populations of the riffle stream areas and the sand-bottomed areas. In the latter study we used the sampler plates as simulated substrate objects in the riffle and sand-bottomed areas. A comparison of the populations collected in the two different areas gave us, therefore, the productive potentialities of a stream when substrate objects as those found in the riffle area are also placed in the sand-bottomed area. The results were conclusive. They showed—that if artificial placement of stream improvement objects as rocks, concrete slabs, logs and timbers in sand-bottomed areas—productiveness of a stream may be more than doubled and maintained more uniform and stable throughout the entire year.

Literature Cited

Hester, F. Eugene, and J. S. Dendy. 1962. A Multiple-Plate sampler for Aquatic Macroinvertebrates. Trans. Am. Fish. Soc. 91(4): 420-421.

Manuscript received October 24, 1968.