PROCEDURE IN TAKING STREAM BOTTOM SAMPLES WITH THE STREAM SQUARE FOOT BOTTOM SAMPLER

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ABSTRACT

A detailed description of the procedure used in taking stream bottom samples follows a description of the stream square foot bottom sampler, which, although pictured in a publication by the author in 1937, was not described in detail in any publication.

One of the principal problems in retrieving bottom animals from samples is getting them quickly from the gravel without damaging them. Large stones in the sample area are removed first and placed in a pail half-filled with water. The contents of the net are also emptied carefully into the same pail. Upon reaching the shore, the pail is filled with water. After washing and removal of the large stones which are placed where animals crawling from hiding places on them can be retrieved, a series of decantations are made into a U. S. Series No. 30 soil sieve 8 inches in diameter and 2 inches deep held in water above the screen surface. After this decantation process, the gravel and sand are placed in a white enamel photographic tray from which any molluscs present are removed. The few bottom animals that escape the decantation process are retrieved at this time. Animals and debris retained by the sieve are concentrated by a swirling action of the sieve and placed in pint jars.

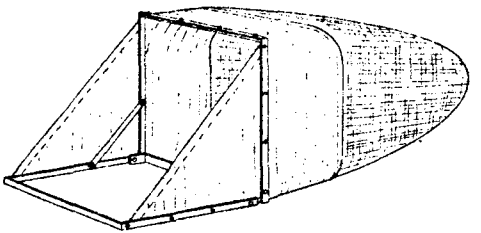
In the laboratory, the samples (after washing to remove formalin) are placed in large white trays, the bottoms of which have been divided into approximately 50 x 30 m.m. rectangles with a diamond point glass-marking pencil. The surface scratches are filled with India ink. Black, hard-rubber trays are used for the retrieval of animals in samples containing small oligochaete worms.

Petri dishes about 100 m.m. in diameter are used for the systematic placement of bottom organisms within concentric circles spaced about 12 m.m. apart. The contents of the petri dishes are examined on the raised stage of a binocular microscope.

INTRODUCTION

It has been suggested to the writer that he prepare a detailed account of the procedure used in collecting stream square foot bottom samples. This will follow a detailed description of the sampler itself, which I find at this late date has never been published, although a detailed description of it was prepared for the Department of Commerce, Bureau of Fisheries as Memorandum I-22 (Surber, 1934). A figure of the stream square foot bottom sampler appeared in Volume 66, p. 195, of the Transactions of the American Fisheries Society (Surber, 1937), but except for the net, construction details were omitted. The net now used by the writer has the same pattern as the original, but nylon netting (actually curtain material of 26-28 meshes to the inch) is now used instead of 23 mesh OOO XXX extra double heavy bolting silk. The nylon material is much more durable. One supplier of the sampler is furnishing nets that taper off to a cone, whereas a widely rounded net furnishing the maximum of straining surface is needed.

The stream bottom sampler is widely used in river pollution surveys, and it is in this area of use that procedural difficulties arose which required the particular techniques which will be described in this paper.



Sampler as it appears when assembled.

METAL FRAME STREAM BOTTOM SAMPLER

U.S. Bureau of Fisheries

Figure #1

DESCRIPTION OF THE SAMPLER

The stream bottom sampler (Surber Sampler) is designed for quantitative collections in stream bottoms, particularly riffle areas where there is appreciable current which sweeps the organisms into the net when gravel and stones within the sampling area are turned over.

This bottom sampler[1] consists of two brass frames one foot square hinged together (see Figure 1), one of which is provided with a net while the other merely overlies the area of riffle to be sampled.

The frame of the sampler is constructed entirely of brass as follows: Two pieces 1/8 x 1/2 x 37 inches are bent to form three sides of the square frame (Figure 1-"A") which overlies the square foot of stream bottom and (Figure 1-"B") the frame to which the net is attached and which is held at right angles (vertically) to the stream bed. Frame "A" is hinged to a third piece "C" which is made of slightly wider material 1/8 x 3/4 x 14 inches. "B" is soldered to this 14 inch piece "C" which is bent in one inch on both ends at right angles and set inside of "B" to complete the square of 12 x 12 inches. Two brass screws 3/16 x 1/4 inch hold B and A together and provide the hinges. These screws are set rigidly in piece A (the free end of piece A being outside the ears of C), but allow piece A to swing freely on them. Two braces are provided (Figure 1-"D") which give the frame rigidity when it is opened. These braces also keep the net wings from buckling in the face of the current. These pieces "D" are of 3/32 x 1/2 x 6 inch brass. The ends of the braces are attached to piece A by 3/16 x 3/8 inch brass screws set in frame A. The upper ends are notched to fit over 3/16 x 3/8 inch screws set in frame B at the proper points (or square). A handle for holding the frame in place in the stream bed was made by soldering one half of a 1/4 inch "T" to the center of the 3/32 x 1/2 x 12 inch piece that clamps the net to the top of frame B. The handle is screwed into the "T". A number of different types of handles have been used in the sampler, although the sampler has in most cases been used without a handle. The original handle supplied was in two pieces of 3/4 x 12 inch brass pipe joined by a 3/4 inch coupling. Another one piece handle was made by inserting a short piece of 3/4 inch brass pipe (threaded on one end) into a 6 inch length of broom handle. The net and wings are attached to the frame by six 3/32 x 1/2 x 12 inch brass pieces which overlie the material and are attached to the frame with 1/8 x 1/4 inch round-headed brass screws or 8/32 x 3/8 inch round-headed machine bolts with hexagonal nuts. Net replacements can be made by removing these plates.

The net is cut 27 inches deep and is made of 26-28 mesh nylon curtain material (or 23 mesh No. OOO XXX extra as in the original nets). The shape of the pattern of the net is shown roughly in Figure 1. Canvas is used in the first 11.5 inches of its length to increase its durability. This section of the net is that part which receives the greatest wear. Dr. B. R. Allanson[2] (personal communication) uses canvas only in the bottom of the net to increase the straining area.

The net is joined by a 5/16 inch French seam. The bag is hemmed with a double fold of 3/4 inches. Extra strength is needed because it underlies the brass plates which hold the net in place. The top of the bag is cut on the fold of the material.

A double fold of 3/4 inch is used in the wings for the hem if the wings are made of nylon or silk-bolting cloth, instead of canvas. The greatest length of the wings (17 inches) is the diagonal or the side opposite the right angle. The 12 1/4 inch side is placed on frame A,

1 The original description which appeared in I-22 of the Department of Commerce, Bureau of Fisheries, Washington, D. C. is reproduced with the consent of the Department of the Interior, U. S. Fish and Wildlife Service. Bureau of Sport Fisheries and Wildlife.

2 Dr. B. R. Allanson, Department of Hydrobiology, National Institute for Water Research, Pretoria, South Africa.

while the 12 inch side adjoins frame B. All borders when made of nylon or silk have a 3/4 inch seam. The net and photographic tray used for sorting animals may be carried in a simple knapsack of canvas.

Procedure

Few stream bottoms lend themselves to the random placing of the sampler, but in turbid waters the square foot frame is placed where the downstream edge can be worked into the bottom materials. Gaps beneath this edge are filled with gravel or sand to prevent loss of animals when the larger stones in the center of the frame are lifted into the current that sweeps most of the animals into the net. The net handle or frame is held with the left hand as a right-handed person works the bottom with the right hand. The larger stones are not discarded after rubbing off snails, caddisfly larval cases, pupae cases, etc., but they are placed in a pail about half-filled with water from which they are later removed and placed on a flat, solid surface. Upon exposure to the air and possible drying, caddisfly and other larvae immediately crawl from their spun nets or cases, and mayfly nymphs reveal their presence by moving about.

The collector of the sample frequently encounters stones beneath the frame edge lying only partly inside the square foot. In this case, the net frame is tilted on the downstream edge enough to permit the turning over of the stone *in situ* and the rubbing of both surfaces. The stone is then pulled out of the frame and discarded into the stream. Where the bottom can be seen, care should be taken not to have the front of the frame part way over a large stone. Where this does occur the stone should not be lifted, but it can be rubbed to dislodge snails or caddisfly cases.

The gravel and stones are turned over down to a depth where algae are no longer present. They are lifted into the current within the frame's wings and discarded outside the frame. In this process, some of the gravel is swept into the net. The gravel and the net's contents are dumped without grinding action into the pail containing the large stones then taken ashore. The pail is nearly filled with water and the interior of the net is shaken vigorously in the water to remove as many caddisfly larvae and mayfly nymphs as possible. The net, now inside out, will have organisms still clinging to the meshes of the net, or to the canvas wings. These are removed with forceps and placed in 8-10 per cent formalin in a pint sample jar.

It is well to have help in holding the pail while the sample is being taken. The net, after careful removal of gravel, should be "picked" as soon as possible, or while the sieving of the contents of the bucket is taking place.

Removal of the large stones placed in the pail half-filled with water during the sampling is the next step. These stones receive a second washing before being placed on a solid surface for further observation and collection of any organisms crawling from spun nets, cases, or crevises in the stones.

The water over the remaining gravel and stones within the pail is swirled, and the overlying water containing most of the organisms are retrieved by decantation into a 8 x 2.5 inch U. S. Series No. 30 soil sieve held in the water to a depth of about a half inch over the screen surface. The decantation process can be repeated several times, keeping in mind that the gravel should not be permitted to move about and grind up the organisms present.

The gravel and sand contents of the decanted pail are dumped, sometimes in portions, into a white photographic tray where further decantation can be carried out if necessary. After decantation into the sieve is completed, the collected organisms and debris are placed in the collection jar after the contents of the sieve are brought to one side and concentrated by a swirling movement of the screen.

The gravel remaining in the photographic tray is then inspected for molluscs and other organisms.

During the collection of bottom samples it is safest (because of broken bottles) and more comfortable, summer and winter, to collect bottom samples wearing shoulder-length rubber or neoprene covered cloth gloves.[3]

The white enameled photographic tray carried into the field measures about 14 1/4 x 10 1/2 x 2 1/8 inches. In pollution surveys particularly, no attempt should be made to count the organisms in the field, but they should be placed in the sample jar as soon as possible. The writer has collected samples containing as many as 8,000 *Tendipes decorus* (midgefly larvae) in a single square foot. In other samples, the small oligochaete *Aulophorus* has been collected in large numbers without knowing that they were present until examination was begun in the laboratory.

In work on samples in the laboratory, it is desirable to have two photographic trays—one white and one black. They can be made of plastic, hard rubber, or enameled metal. The large white plastic tray now used measures 17.5 x 14.5 x 2.5 inches. The black tray is better for enumerating oligochaetes when they are numerous in the sample.

For convenience in enumerating organisms, the bottoms of the trays are divided into rectangles about 50 x 30 millimeters with a diamond point glass-marking pencil. In the white trays, India ink can be used in the pencil scratches to line the edges of the rectangles. In the black tray, a white wax pencil has been used to edge the rectangles.

Before examining the samples in the laboratory, the contents of the sample jar are emptied into a No. 30 sieve standing in a photographic tray of water. Tap water is then distributed over the sample to remove the formalin before all or portions of the sample are distributed in a second photographic tray for counting or for the removal of all organisms present.

The use of a Dazor Floating Magnifier lamp with a 5-inch diameter lens (3x) is very helpful in locating bottom organisms. Bottom animals are placed in concentric circles in Petri dishes 100 x 15 m.m. or larger. The concentric rings may be etched in the bottom with a diamond point pencil. They are spaced about 14 m.m. apart.

The bottom animals are sorted within these concentric rings according to genera or species during the picking process, then placed on the raised stage of a binocular microscope for identification and enumeration. Molluscs are placed in a dish for separate weighing. While in the Petri dishes, the organisms are kept moist by placing them in a minimum of water or preservative (8-10 per cent formalin). The Petri dish covers are useful in keeping the organisms moist over night.

Both molluscan and non-molluscan invertebrate animals present are dried for one minute on a good grade of blotting paper and weighed separately to determine the number of grams of animals present. Tweezers with curved tips are best for concentrating the animals. Excess water from the concentrated samples are removed by decantation and the use of a dropper prior to placing on blotting paper.

Six dram homeopathic vials (with No. 5 corks) are large enough to accommodate most of the samples of bottom animals. They can be kept for years in 8-10 per cent formalin, but collections for taxonomic work should be preserved in alcohol.

REFERENCES

Surber, Eugene W., 1934. A quantitative net for collecting bottom animals in streams. Department of Commerce, Bureau of Fisheries, Washington, D. C. I-22, 4 pages.

Surber, E. W., 1937. Rainbow trout and bottom fauna production in one mile of stream. Trans. Amer. Fish. Soc. 66 (1936): 193-202.

3 Schaefer Rubber Co., 306 Main Street, Cincinnati, Ohio, No. 9430 shoulder length gloves.