Designation: D4132 – 82 (Reapproved 2012)

Standard Practice for Sampling Phytoplankton with Conical Tow Nets[1]

This standard is issued under the fixed designation D4132; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the procedures for obtaining qualitative samples of a phytoplankton community by use of conical tow nets. Nets will not retain all phytoplankton taxa; for example, nannoplankton and ultraplankton generally will pass through a net.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Summary of Practice

2.1 The net is attached to a tow line and towed at the surface or at a greater depth using a cable depressor. After a specified distance or period of time, the net is retrieved and the captured phytoplankton are removed from the net. The phytoplankton may be preserved as dictated by the objective of the study.

3. Significance and Use

3.1 The *advantages* of conical tow nets are as follows:

3.1.1 They are relatively inexpensive, easy to construct, and highly versatile in a variety of surface waters.

3.1.2 They can be used from a small powered boat with a minimum of auxiliary equipment.

3.1.3 They provide a simple means by which to collect qualitative samples of macro- and micro-plankton.

3.1.4 They can be adapted with a flowmeter to collect semiquantitative samples of macro- and micro-plankton.

3.2 The *disadvantages* of conical tow nets are as follows:

3.2.1 They are effective only where drawn through a stratum of water having considerable thickness. They are not suitable for collecting samples from a small or restricted region.

3.2.2 They are not suitable for collections in very shallow water.

3.2.3 They collect only qualitative samples, or semiquantitative samples when used with a flowmeter.

3.2.4 Clogging of the net by extraneous materials, such as floating vascular plants or debris can cause erroneous results.

3.2.5 If discrete depths are sampled using a horizontal tow, the sample can be contaminated with organisms from other depths during the deployment and retrieval of the samples.

3.3 There are several *special considerations* that shall be observed when using conical tow nets. They are as follows:

3.3.1 The conical net samplers are designed to be towed at speeds less than 3 knots; however, greater speeds have been used for the larger nets with a concomitant increase in capture.

3.3.2 Although there is a tendency to use the smallest mesh size available, there is the liability of small mesh sizes reducing the collection efficiency and increasing equipment failure through tearing.

3.3.3 If discrete depth samples are required, an opening and closing net device should be installed on the sampler.

3.3.4 The nets should be washed frequently and inspected for pin-size holes, tears, net deterioration, and other anomalies.

3.3.5 Following use, wet nets should be suspended full length in air and in subdued light and allowed to dry.

4. Procedure

4.1 According to Heron,[2] the material used in sampling nets should have the following properties: "The meshes should be square and the mesh aperture uniform. The material of the strands should be stiff enough to resist bending or stretching, but flexible enough to allow self-cleaning action. The nature of the weave should prevent the meshes from distorting diagonally. The porosity should not change when the net is immersed in water. The gauze should resist clogging and allow complete removal of material after use. The material of the strand should not abrade easily. It should resist degradation by sunlight and by chemicals used in cleaning."

4.2 For many years, the standard mesh opening used in phytoplankton net was the standard silk size No. 25 having an aperture of 64 μm. Depending upon the study objective, a larger mesh opening (for example, 80 μm) can be used. A mesh opening smaller than 64 μm can be used, but it is doubtful whether the additional cost and slower operation are justified.

[1] This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.24 on Water Microbiology.

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[2] Heron, A. C., "Plankton Gauze," *In: UNESCO, Zooplankton Sampling*, UNESCO Press, Paris, France, 1968, pp. 19–25.

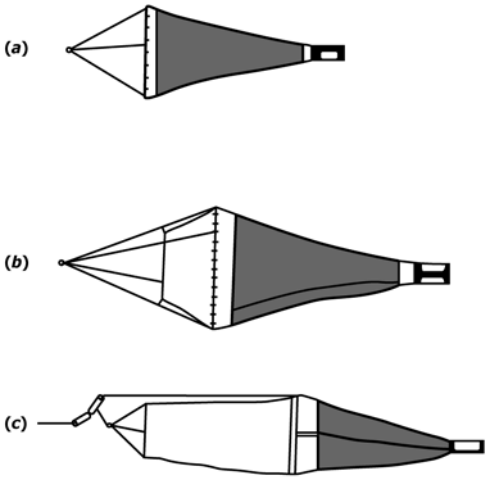

FIG. 1 Plankton Nets (*a*) Conical Tow Net (*b*) Wisconsin Net Sampler (*c*) Birge Closing Net Sampler (Illustration by J. W. Steiner and W. G. Hester, U.S. Geological Survey, Doraville, GA)

4.3 A conical tow net (Fig. 1a) typically is composed of a single hoop, a towing bridle, a cone-shaped net, and a collecting container. The size of the net can vary considerably; however, the mouth diameter to length ratio should be greater than 1:5 to ensure a high filtration efficiency. The net generally is attached to a tow line and towed at the surface or at a greater depth using a cable depressor. The precise depth of towing is difficult to determine because a slight change in the movement of a boat will cause the depth of the net to vary. Under steady forward movement, the depth (D) of tow can be determined as follows:

$$D = L \cos a \quad (1)$$

where:

L = length of the tow line from the surface of the water to the sampler, and
$\cos a$ = cosine of the cable angle.

The duration of tow should be determined experimentally, and will be dependent upon the density of phytoplankton, depth of tow, size of net, and speed of forward movement.

4.4 Conical tow nets are of several, but similar, designs. The simple tow net sampler described above contains a single hoop. A Wisconsin net sampler (Fig. 1b) consists of three major parts: an upper section in the form of a short inverted truncated cone consisting of light-weight canvas or sailcloth, a middle section in the form of an elongated cone and consisting of the filtration material, and a detachable plankton bucket. A hoop is located at the mouth of the net and another at the junction of the canvas and filtration material. The latter hoop is the larger of the two. The Wisconsin net sampler generally is used for making vertical tows, whereas the simple tow net sampler is used for making horizontal tows.

4.5 A Birge closing net sampler (Fig. 1c) is constructed so that it can be lowered into the water to a selected position, made to function from that point by drawing it through the water, closed by means of a messenger at the conclusion of the haul, and the catch brought to the surface without further additions to the sample.[3] It is used for both vertical and horizontal towing. The sampler consists of two truncated cones connected at their bases. The inlet cone is made of light-weight canvas or sailcloth. The other cone consists of the filtration material. A plankton bucket is affixed at the narrow end of the filtering cone. The sampler contains two hoops situated similar to those of the Wisconsin net sampler. The towing bridle consists of three cords that are equidistantly placed and extending from the mouth hoop. The main draw line is attached to a brass ring at the bottom of the canvas sleeve. At the other end is located the tripping mechanism.

[3] Welch, P. S., Limnological Methods, McGraw-Hill Book Co., New York, NY, 1948, 381 pp.