Designation: E 1201 – 87 (Reapproved 2004)

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

This standard is issued under the fixed designation E 1201; 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 procedure for obtaining qualitative samples of a zooplankton community by use of conical tow nets. Nets will collect most zooplankton, but some forms will avoid nets.

1.2 *This standard does not purport to address all of the safety problems, 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 desired depth, using a cable depressor if necessary. After a specified distance or period of time, the net is retrieved and the captured zooplankton are removed from the net. The zooplankton may be preserved as dictated by the objective of the study.

3. Significance and Use

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

3.1.1 They are relatively inexpensive and highly versatile in a variety of inland, estuarine, coastal, and marine waters.

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

3.1.3 They can be used to collect qualitative samples and semiquantitative samples when fitted with a flowmeter and even better samples when fitted with a companion meter on the outside of the hoop to monitor filtering efficiency.

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

3.2.1 When equipped with a flowmeter they require frequent maintenance including calibration and, in some types, lubrication.

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

3.2.3 They are not suitable for collecting in very shallow water.

3.2.4 They are clogged by grass beds, coelenterates, and filamentous algae.

3.2.5 When used with a flowmeter, they collect only qualitative samples, or semiquantitative samples.

3.2.6 When sampling discrete depths using a horizontal tow, the sample can be contaminated from other depths during the deployment and retrieval of the samples if opening and closing devices are not used.

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

3.3.1 Conical tow net samplers are designed to be towed at speeds less than three knots; however, greater speeds have been used for the larger nets with a concomitant increase in capture.[2]

3.3.2 A conical tow net 0.5 m in diameter or larger shall be used to reduce avoidance by organisms.[2]

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

3.3.4 Nets should be allowed to dry while suspended full length in air and in subdued light prior to storage.

3.3.5 Lower catches per sample may result when collections are made during the day. These are particularly noted in the larger zooplanktons.

4. Procedure

4.1 The conical net samplers are designed to be towed at speeds of approximately three knots. However, greater speeds of up to five knots have been used with a concomitant increase in organisms captured per unit volume of water filter.[3]

4.2 Select the bridle arrangement carefully. The most common arrangement is a three-point attached bridle resulting in considerable net avoidance.[4] An attachment procedure resulting in no obstruction of the mouth is preferred and can be accomplished by using a simple gimbaled hoop arrangement, with a depressor at the bottom of the tow line.

4.3 Proper placement of the flowmeter within the conical net mouth is crucial for sample quantification. In order to

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[1] This practice is under the jurisdiction of ASTM Committee E47 on Biological Effects and Environmental Fate and is the direct responsibility of Subcommittee E47.01 on Aquatic Assessment and Toxicology.

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[2] Schwoerbel, J., Methods of Hydrobiology (Freshwater Biology), Pergamon Press, New York, NY, 1968, p. 200.

[3] Clutter, R. I., and Anraku, M., "Avoidance of Samplers," *UNESCO Monograph on Oceanographic Methodology*, No. 2, 1968, pp. 57–76.

[4] UNESCO, "Zooplankton Sampling," *Monographs on Oceanographic Methodology*, Unipub, Inc., New York, NY, 1968, p. 174.

TABLE 1 Size of Common Zooplankton[A]

Species	Fresh		Marine	
	Habitat	Size Range	Habitat	Size Range
Protozoans (single cells)		6 to 1,000 µ		−2.0 mm
Ciliophora (ciliated single cells)	few fresh	22 to 600 µ		
Coelenterata	few fresh (Hydras)	<20 mm		
Ctenophora				10 to 121 mm
Platyhelminthes (flatworms)		1 to 30 mm	inland waters	0.5 to 40 mm
Nemertea (Proboscus worms)		<20 mm	great variation	5 mm to 6.5 m
Nematoda (Round worms)		<2.3 mm		7 mm
Nematomorpha (horsehair worms)	pools, slow brooks	10 to 70 cm		
Gastrotricha	most fresh (shallow)	70 µ–615 µ		
Rotifera	90 percent fresh	80 µ–1,500 µ		
Bryozoa (moss animals)	some fresh; statoblasts	0.4 to >1.0 mm	most species encrusting statoblasts	
Chaetognatha (arrowworms)			high salinity	up to 40 mm
Annelida (segmented worms)				
Oligochaeta	most fresh	0.5 to 5 mm	very few	
Polychaeta	few fresh		most spp. small except *Nereis*	up to 50 cm
Hirundinea	most fresh (standing waters)	adults 5 mm to 45.7 cm	few marine	
Arthropoda				
Crustacea				
Branchlopoda	most fresh	3 mm to 30 mm	some marine	10 mm
Cladocerans	most fresh (lenthic waters)	up to 3 mm; 0.2 to 18.0 mm 0.6, 0.3, 0.4 mm; 1.7, 1.0, 0.9 mm	few marine most estuarine/marine in top of bottom sediment	
Ostracoda				
Copepoda				
Calenoida		nauplius—<4.0 mm		0.5 to 10.0 mm
Cyclopoida		nauplius—<3.0 mm		<0.5 to 1.0 mm
Harpacticoid		nauplius—1.0 mm		<0.5 to 1.0 m
Ectoparasites	some fresh	5 to 25 mm	some estuarine	5.5 to 25 mm
Cirripedia			estuarine/marine:nauplii	
Mysidacea	few in cold lakes	8 to 30 mm		
Amphipoda	some fresh	5 to 25 mm		5 to 30 mm
Decapoda	some associated with debris	15 to 200 mm		2.0 mm to 20 to 40 cm
Insecta (aquatic)	most fresh			
Mollusca				
Gastropoda		adults <2 to 70 mm		8 to 80 mm trochophore
Pelecypoda	some fresh	adults 2 to 250 mm	most have free swimming larvae	
Echinodermata				
Fish eggs/larvae	eggs 0.75 to 3 mm larvae 1.5 mm	400 µ to 505 µ		

[A] Sage, L. E., "*Zooplankton*," In: *Methods for the Assessment and Prediction of Mineral Mining Impacts on Aquatic Communities: A Review and Analysis*, Fish Wildlife Service/Office of Biological Services, Vol 78/No. 30, April 1978, pp 55–65.

obtain an average velocity of water within the net, place the meter at a point one-third of the diameter of the mouth of the net.

4.4 The type and mesh size of the netting used is very important because the most common type of net available is a simple, interlocking monofilament mesh. Although there is a tendency to adopt the smallest mesh size possible, there is a liability with small mesh sizes in reducing the collecting efficiency of the gear. In addition to the initial reduction in efficiency by the nature of the small mesh, the clogging rate of the gear is accelerated. A 103-µm net has been demonstrated to fall below 85 % efficiency within the first minute of towing.[4] Table 1 indicates the types of organisms present in the zooplankton from various habitats and the size range of each that is necessary for determining the mesh necessary to implement a sampling program.

4.5 The length of the net applied to these conical net frames is crucial. It is widely accepted that a mouth diameter to length ratio of 1:5 is used to increase filtration efficiency of the gear.

4.6 Collect the sample during the night, again to minimize avoidance of the larger adult forms.

4.7 Depending on the mesh net employed and the density of the zooplankton and detritus in a particular ecosystem, keep the length of tow to two minutes or less to avoid undue clogging which would result in drastically altered filtration efficiency adversely affecting the quantification of the sample.