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ABSTRACT—The construction and use of a simple water sampler for winter limnological studies is described. Data presented indicate that water samples taken with this device and by a mechanical hand-operated suction pump over a wide range of temperatures do not differ significantly (P is less than 0.05, t-test) in the dissolved oxygen concentration determined by the Winkler titration. Certain distinct advantages of a static water sampler are discussed.

A research project on wild rice (*Zizania aquatica L.*) required that water samples from a pond and a lake be collected for analysis under extreme winter conditions. Included in the analyses was the Winkler determination for dissolved oxygen which requires that the sampling procedure does not itself introduce oxygen into the sample (American Public Health Association - A.P.H.A. - 1975). This water quality condition was used as an index of comparison to validate a simple sampler relative to a hand-operated suction pump the "Guzzler 400", manufactured by Dart Union Co., of Rhode Island. Until the surface waters froze, the hand operated "Guzzler" pump was adequate for this sampling program. During the deep winter, however, it was necessary to take samples through a 15 cm hole bored through ice up to 45 cm thickness at air temperatures as low as 23 degrees below zero cellsius. The limited size of the sampling apparatus also necessitated the elimination of any parts such as valves or gaskets which would freeze and allow the entrance of air bubbles or would cause the pump to become inoperable. In severe cold, (lower than minus 15 degrees C.) the pump would often freeze even while in use. In order to overcome these difficulties, the authors designed a water sampler that solved the freezing problem and also offered a number of additional davantages.

Other water samplers have been designed to solve particular problems (Abdullah, 1976; Patterson, et al., 1978), but these do not have the features incorporated in the "Static" sampler herein described, such as simplicity, durability, economy, and ease of transport to remote areas.

This sampler also eliminates the need for any pump mechanism. The sampling in this study was done in about 75 cm of water with the inlet of the sampler 15 cm from the pond bottom. Since the "Static" sampler allowed water to enter slowly, there was a minimum of disturbance of the bottom sediments. The "Guzzler" pump does have some backflush of water during the pumping operation, as do most hand-operated pumps, which caused mixing of the bottom sediments. No back-flush of water is associated with the "Static" sampler. Water samples can be obtained without disturbing the bottom sediments if this sampler is filled slowly. The rate of filling is controlled by restricting the flow of air from the outlet tube.

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Table 1. Comparison between two types of water samplers over a range of environmental temperatures.*

Sample Source	Water temp. (° C)	ppm O_2 Guzzler pump (mean ± S.D.)	ppm O_2 Static sampler (mean ± S.D.)
McCabe Lake	0.5	6.30 ± 0.283	6.30 ± 0.283
Carlson Pond	1.0	0.25 ± 0.283**	0.10 ± 0.000
Cold, aerated tap water	12.3	10.32 ± 0.021	10.28 ± 0.035
Water fern tank	17.0	3.86 ± 0.085	4.00 ± 0.141
Warm tap water	34.2	5.56 ± 0.035	5.75 ± 0.099

*based on 2 replications of 300-ml samples. Two 100-ml aliquots titrated for each.

**Guzzler pump froze during sampling and introduced air bubbles through gasket.

Construction of "Static" Water Sampler

This simple, but effective, water sampler can easily be constructed from these common materials:

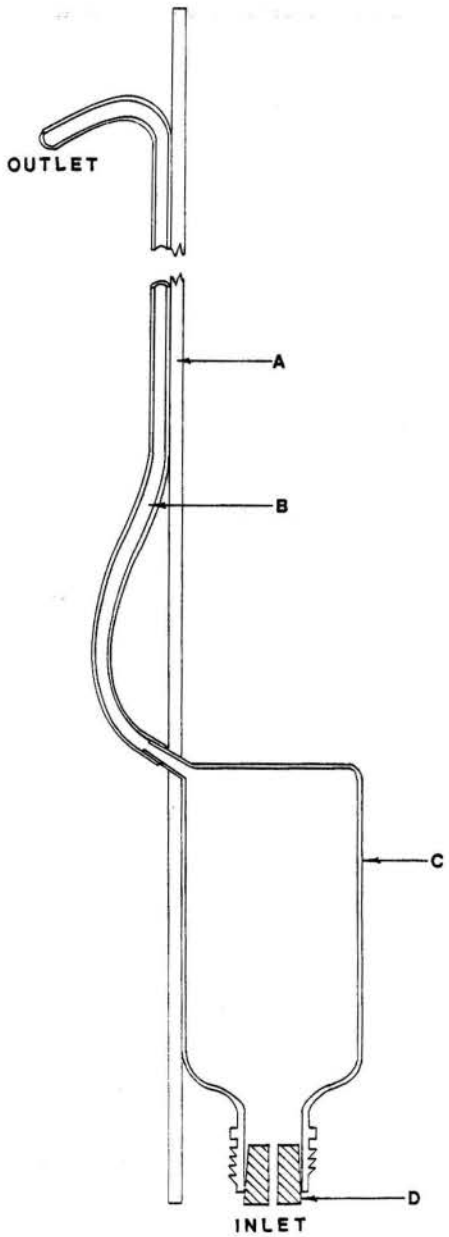
Round 500 ml polyethylene narrow-necked bottle
Tapered polyethylene nipple
Meter stick
Aquarium sealant
Latex tubing

A hole was cut in the bottom edge of a round 500 ml polyethylene narrow-necked bottle. A polyethylene tapered nipple was attached flush to the surface of the bottle by first fusing it to the bottle by melting with a hot scalpel and then coating the union with silicone rubber aquarium sealant. To further secure the nipple, it was inserted through a hole drilled in the meter stick. The bottle and tubing were taped to the meter stick with nylon fiber tape. (Fig. 1).

Use of the Sampler

The sampler is used in the following manner. The outlet tubing is pinched shut, and the inlet end of the bottle is immersed to the depth from which a sample is to be collected. The outlet tube is then released and water allowed to enter the bottle slowly. Water will fill the bottle and rise in the outlet tube until it reaches the outside water level, when the tube is again pinched and the apparatus is withdrawn from

Figure 1. Sectional view of water sampler. A-Meter stick, B-38" x ¼" latex tubing, C-500 ml polyethylene bottle, D-No. 4 rubber stopper with ¼" hole



the water. By inverting the apparatus, sample bottles can be slowly flushed and filled through the outlet tube.

The tube is then removed and the bottle stoppered. If the sample bottles are kept at sub-freezing temperatures for any length of time, they should be stored in an insulated container. It was found that placing glass-stoppered bottles in sponge rubber blocks provides considerable mechanical protection and insulation. The bottom of the bottles should be placed on silimar material to avoid freezing and breakage. Chemical reagents for the Winkler test or other analyses can be added to the bottles either in the field or in a shelter if it is available close by.

Comparison of the two sampling techniques

In order to compare the "Static" Sampler and the "Guzzler" pump, the authors drew water from two field sites under freezing conditions; water from a hot water tap; cold, aerated tap water and water taken from an aquatic fern tank in a greenhouse. Winkler dissolved oxygen determinations were made on these samples and the results are shown in Table 1. The data indicated no significant difference in more than (p 0.05, t-test) in oxygen concentration due to sampling technique. Disturbance of the bottom by the pump sampler resulted in turbid water samples and a reduction in dissolved oxygen concentration due to the oxygen demand of suspended material. No such disturbance occurred with the "Static" sampler. The authors found that this lack of turbulence when sampling near the sediments of frozen ponds and bogs yields more reliable measurements of dissolved oxygen concentration. The depth at which a sample is taken and ice thickness are quite easily measured with the "Static" sampler as presently designed.

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