SOME PRACTICAL METHODS FOR SAMPLING LAKES IN WINTER

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In most winter limnological field research, it is desirable to minimize interference with natural lake processes. It is almost impossible to work on an ice-covered lake without more or less seriously modifying the snow and ice. As each cover component (snow, white ice and black ice) has quite distinct ecological and other environmental effects, changes in the proportions of each can have direct and indirect effects on the lake system (see, for example, Adams, 1980, 1981). Small changes in snowcover, for example, can produce differences in the type and amount of ice present as the winter proceeds. This affects the entire lake ecosystem and thus is important not only for those studying the winter cover, but also for those interested in winter and spring limnology.

This paper is intended to make researchers more conscious of implications of advertent and inadvertent modification of a winter lake cover by providing some practical suggestions for reducing impact. The examples cited are not intended to be comprehensive but rather to be thought provoking.

In many situations, a passive research system (see Figure 1) can be utilized to reduce impact on the lake. Equipment and procedures used in such situations need not be complex or expensive. Actual approaches used will vary with the objectives of the research program.

Atmospheric inputs can be sampled before they enter the lake system. Precipitation inputs can easily be sampled with snow gauges, wet and dry bulk collectors or other bulk collectors, (see, for example, Wolfe, 1979; Goodison, et. al., 1981; Kingsbury, 1983). Data can often be recorded on land or by telemetry. Where stations are installed on the lake, regular routes, ideally parallel to the prevailing wind, should be used to minimize disturbance. Researchers may prefer infrequent measurement of the stratigraphy of snow and ice in the cover as their main source on atmospheric inputs (see, for example, Adams English and Lasenby, 1978; Adams and Lasenby, 1982), or they may use accumulation gauges which require infrequent servicing.

The measurement and sampling of the lake cover itself is important to researchers since the cover acts as a seal between the atmosphere and the water body, as a barrier to light, and as an integral part of the lake's hydrologic system. Many winter studies indicate that it is not desirable to drill holes in the ice cover of snow covered lakes. Such drilling promotes slushing which dramatically changes the existing snowcover and the nature and rate of subsequent ice growth. As Figure 1 and its caption indicates, the ice and snow cover of a lake can be effectively monitored without frequent drilling.

Winter sampling of the lake water column and sediment can also be accomplished without flooding the lake snow cover. A collared barrel (Figure 1) provides access to the lake (see Wolfe, 1979; Kingsbury, 1983) while containing water from one drill hole. Two barrels, within close proximity of each other, connected by above and below surface pulley systems, allow sampling of the water column and the surface simultaneously (Adams, W.A. and Flavelle, 1977; Adams, W.A., 1978; Adams and Roulet, 1983). A variety of water properties, such as temperature, can, of course, be monitored quite easily via cable set permanently below the ice with recording equipment on or off the lake. Modifications of devices can add to their usefulness reducing the need for other equipment.

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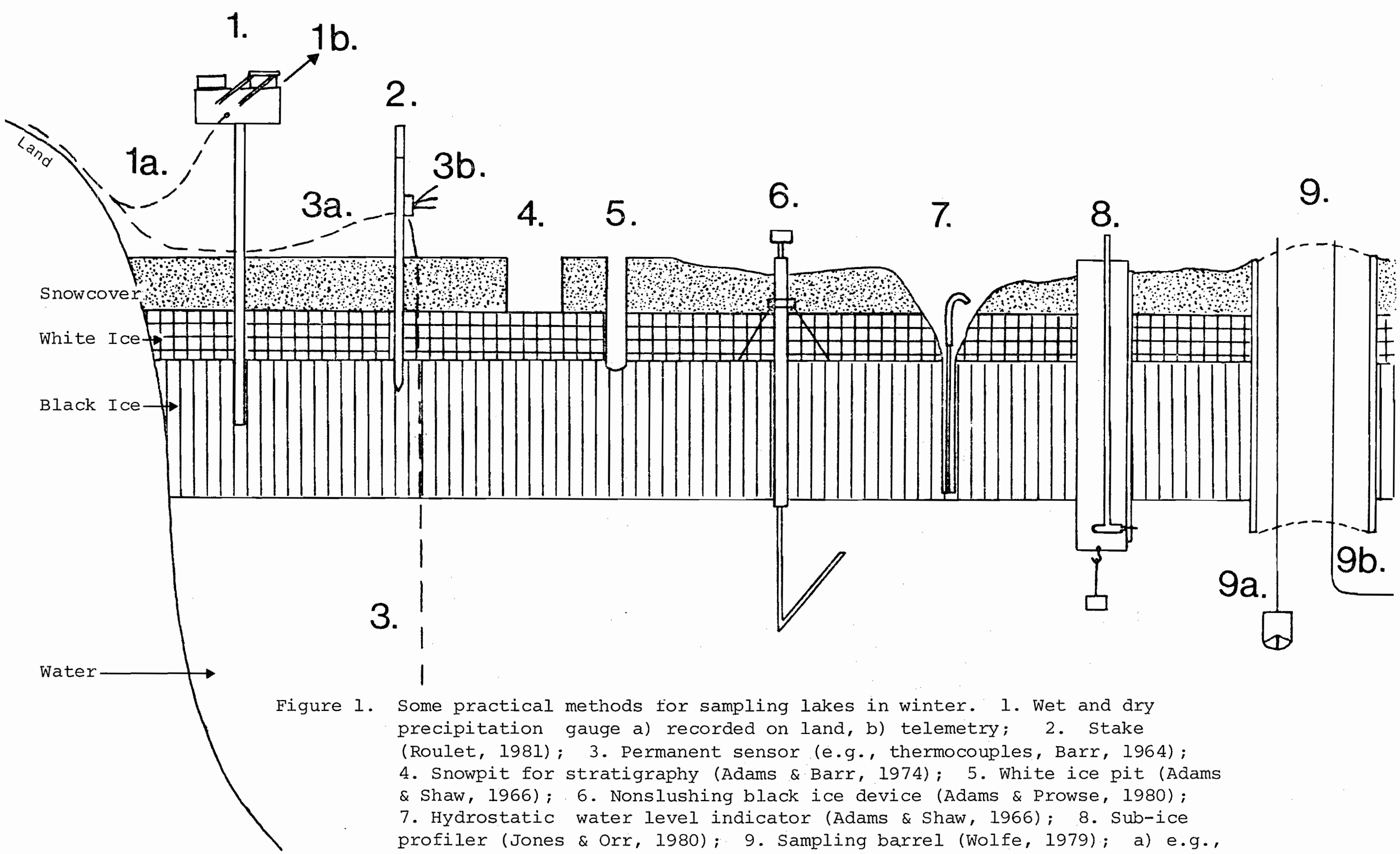

Figure 1. Some practical methods for sampling lakes in winter. 1. Wet and dry precipitation gauge a) recorded on land, b) telemetry; 2. Stake (Roulet, 1981); 3. Permanent sensor (e.g., thermocouples, Barr, 1964); 4. Snowpit for stratigraphy (Adams & Barr, 1974); 5. White ice pit (Adams & Shaw, 1966); 6. Nonslushing black ice device (Adams & Prowse, 1980); 7. Hydrostatic water level indicator (Adams & Shaw, 1966); 8. Sub-ice profiler (Jones & Orr, 1980); 9. Sampling barrel (Wolfe, 1979); a) e.g., water and sediments sampler here, an Ekman dredge, b) use of pulley between holes to perform sub-ice sampling (Adams, W.A. & Flavelle, 1977).

In order to reduce the potential for man-induced cover alterations during the sampling season, the placement of equipment just after lake freeze-up is desirable. The lake cover at this time has a negative hydrostatic water level and the ice cover is easily cut. One word of caution: the ice thickness should be at least 10 cm. thick and a floater coat or similar device should be worn at all times when out on the lake.

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