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# Research Note



## Sampling Procedure for Lake or Stream Surface Water Chemistry

**Robert Musselman**

### Introduction

Surface waters collected in the field for chemical analyses are easily contaminated. This research note presents a step-by-step detailed description of how to avoid sample contamination when field collecting, processing, and transporting surface water samples for laboratory analysis.

### Locate Sample Collection Site

Choose a sampling spot with fast-moving water, at least 15-20 cm (6-8 inches) deep if possible, and where you can reach it from a solid place on the stream bank (rocky, not soft/spongy spot) or from a large rock. Streams are always sampled upstream from any bridge, culvert, flume, or other artificial structure. Lakes are sampled at their

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outlet unless the chemistry of the lake profile is needed. Approach the sampling location from downstream if possible. If collections are repeated over time, check the previous collection field notes for exact sampling location and collect from the same sampling site. A GPS identification of the location is helpful.

## **Take Water Temperature**

Place thermometer in the water near the sampling point, preferably downstream. Avoid disturbing the bottom at the sample site. Allow the thermometer to equilibrate (reach stream temperature and stop changing) and record the temperature. It may take a couple of minutes to equilibrate. Digital thermometers equilibrate faster and are easier to determine when they have reached water temperature.

## **Label Bottle Correctly**

Sample bottles should be brown 250 ml (about 1 cup volume) high-density polyethylene (HDPE) or low-density polyethylene (LDPE) plastic unless otherwise instructed. Before immersion of the sample bottle, use a black permanent marker to write on the dry bottle the sample location (geographic area name and stream or lake name), date and year, time of day (indicate daylight or standard time as MDT or MST), water temperature (add °F or °C), and sampler's first and last name.

## **Avoid Contaminating Bottle**

After the bottle is labeled, put on the gloves (latex or nitrile, and powder-free) and rinse the capped bottle and the gloves downstream to remove any possible contaminants. Be careful not to touch your face, the ground, or anything except the bottle after the gloves and bottle are rinsed. Fingers contain contaminants such as nitrates. Insect repellents, sunscreen, and cigarette smoke are particularly troublesome as contaminants. Do not touch anything except the sample bottle once the gloves are on. Avoid glove and sample contact with the ground or with human skin or clothing, and avoid breathing directly in/on the bottle or cap during sample collection.

## Prepare Bottle for Sampling

First rinse the inside of the bottle, the inside of the cap, and the rim with the deionized water (DIW) that comes in the bottle. To rinse, remove the cap with index finger and thumb, palm facing up (Figures 1-2). If the cap is not held correctly when removed (Figures 3-4) there is an increased possibility of pouring water over your hand and into the bottle when rinsing (Figure 5). Once the cap is removed, turn your palm down to face the cap up (Figure 6), fill the inside of the cap with water (Figure 7), and empty it over the rim and threads of the bottle (Figure 8), being careful not to pour water over your finger and/or thumb or back into bottle (point mouth of bottle down, not up). Do about six cap and rim rinses then completely empty the bottle of any remaining DIW. Pour discard downstream or off-stream on land away from the sampling site. After the final rinse, place cap back on  $\frac{1}{4}$  turn, hold cap on with index finger of the hand holding the bottle. Now the sample rinses can be collected.



**Figures 1 and 2.** Correct way to remove cap for rinsing, palm facing away from bottle.



Figures 3 and 4. Wrong way to remove cap for rinsing, palm facing the bottle.



Figure 5. Wrong way to hold cap for rinsing, palm up facing bottle.



**Figure 6.** Correct way to hold cap for rinsing, palm away from bottle.



**Figure 7.** Rinse cap with fingers and palm out of the way.



**Figure 8.** Rinse rim with water in cap, fingers and palm out of the way and bottle opening down.

## Rinse Bottle with Sample Water

Return to your sampling point and reach as far into stream as possible. Hold the cap on the bottle with your index finger (Figure 9). Immerse the bottle completely 10 cm (4 inches) deep, or half way to bottom if the stream is shallow (write the depth the sample was collected on the field notes after the sample is collected and secured). If stream is too shallow to immerse the bottle fully, collect as much as possible, being very careful not to touch the bottom where sediments can be disturbed and make sure no surface film flows into the bottle. A syringe (appropriately rinsed three times) may be used to fill the bottle if necessary, but it is best to collect the sample directly into the bottle if possible. If a syringe is used, be sure to document this in the field notes.

Place the bottle flat on its side under water pointing the mouth of the immersed bottle upstream. Remove the index finger holding the cap from upstream once your other thumb and index finger of your other hand grips the cap. Remove the cap with the index finger and thumb

of your hand not holding the bottle, with your palm placed under or over the bottle to make sure it is not upstream (Figure 10). Be very careful that any water entering bottle does not touch your fingers/gloves by making sure your hands and fingers are not upstream of the bottle when the cap is removed (Figure 11). Remove the cap enough to let water enter the bottle. Fill the bottle about half full. It is not necessary to fill the bottle for rinses. Place cap back on loosely ( $\frac{1}{4}$  turn) under water, holding cap on with index finger of the hand holding the bottle. Always remove and replace the cap under water.

## Rinse Bottle Three Times, Then Collect the Sample

Remove the immersed and capped bottle from the stream and shake. It is okay if some water leaks out rinsing the rim during shaking. Rinse procedure is the same as described for DIW. Rinse the cap and rim



**Figure 9.** Hold cap on with your index finger to place bottle under water between rinses.



**Figure 10.** Correct way to remove cap under water with palm under the bottle, hand not upstream.



**Figure 11.** Wrong way to remove cap under water with hand upstream.

about six times, being careful that rinse water does not touch your gloves. Rinsing must be conducted downstream of the sample site. The bottle opening needs to be pointed down during rinses to avoid rinse water flowing back into the bottle. This is easier if the bottle is only filled (or dumped) to half full for rim/cap rinses. After the six separate cap/rim rinses, pour out any remaining rinse water downstream of the sample point. Do not touch bottle mouth or inside of cap.

Collect stream water three separate times to do three complete bottle/cap/rim rinses. If you lose count, collect and rinse again. Collect the final sample on the fourth immersion. Use the same procedure as before but fill the bottle completely. Tip the bottle mouth up to remove all air bubbles before capping. If necessary, squeeze the bottle slightly as the cap is tightened so no air remains in bottle. Be especially careful not to contaminate the sample with surface film or bottom sediment. If this happens, discard the sample and start your three rinses over. Place cap on and tighten under water. Remove from water and make sure that the cap is tight. If the stream is too shallow to immerse bottle fully when tipped up for filling, collect as much as possible, being very careful not to touch the surface or bottom. Note depth on field notes.

## **Stream Position to Take Water Sample**

Depending on whether you are on the right side or left side of the stream facing upstream, and whether you are holding the bottle in your right hand or left hand, always be careful that your hand holding the bottle and your palm and fingers of the other hand tightening and loosening the cap is not upstream of the bottle opening.

Left side of stream, facing upstream: Hold the bottle with your right hand, cap pointing upstream. Remove cap with the index finger and thumb of your left hand with your palm placed under the bottle (palm and other fingers should not be upstream).

Right side of stream, facing upstream: Hold the bottle with your left hand, cap pointing upstream. Remove cap with the index finger and thumb of your right hand with your palm placed under the bottle (palm and other fingers should not be upstream).

## Seal and Store Bottle for Transport

Once the final sample is collected, seal the sample bottle immediately in a zipper lock bag, place it in a cooler, and keep cold with frozen ice-packs or snow (place snow in double zipper lock bags). Do not place snow or ice in the same bag as the sample. Do not expose sample bottles to the sun.

## Complete Miscellaneous Post-Sampling Tasks

After the sample is secured in the cooler, remove the gloves, rinse in stream, and place in a zipper lock bag. Before leaving the field site, make sure the field data sheet is completed. Note any unusual conditions such as wind or rain. Measure the air temperature (thermometer must be shaded) and record. When you return from the field, rinse the gloves (with DIW if available) and dry them out.

## Shipping Instructions

Samples are filtered in the lab. Keep samples cool while transporting. Ship them overnight to the lab in a picnic cooler with frozen icepacks. The lab is not open weekends or holidays so do not ship the samples unless they can arrive at the lab Monday through Friday workdays. If you need to store the samples before shipping, keep them refrigerated at 39-40°F (4° C) but do not freeze. Ship them using afternoon pickup for next day arrival. Hand delivery to the lab is preferred, or arrange for a contact to pick up the samples.

## Duplicate and Blank Samples

Collect a duplicate sample if instructed. Generally, every 10<sup>th</sup> – 15<sup>th</sup> sample collected is replicated (duplicated). Sample sites chosen for duplicate sampling are selected at random among streams or lakes sampled. If a duplicate is required for your site, repeat the same procedures as with the normal stream samples. The duplicate is the second of the two samples collected. Write “DUPL” on the sample bottle before the sample is collected. Duplicates document repeatability of individual sample collections and reproducibility of laboratory results.

Take a field blank sample bottle to the field if instructed. The field blank (FB) remains unopened. Write sample study area, stream or lake name, date and year, sampler's name, and "FB" on the bottle. Field blanks are necessary to quantify chemicals from non-sample sources such as water bottles, DIW, filter paper, and handling procedures. The FB bottle is never opened in the field. However, the extra FB bottle can be used for the sample bottle in an emergency if the sample bottle or its cap is lost or contaminated. The FB is not as vital to collect as the sample.

## Acknowledgments

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## Information Sources for Surface Water Sampling

Information on the U.S. Forest Service Air Program Laboratory is available from a link at the U.S. Forest Service Air Resource Management website: [www.fs.fed.us/air](http://www.fs.fed.us/air). Click on "Air Program Laboratory" at the Air Program website. Information on where to obtain water bottles, where to ship samples, and blank field forms is available [here](#).

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