Water Quality Sampling, Link-Keno
Protocols for 2008

Contacts

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Field Supplies

- Van Dorn samplers (and grab sample containers if desired - see #3 in section on field sampling)
- churns
- peristaltic pump with clean tubing, 12V battery
- coolers and ice
- DI water
- IBW water if taking field blank
- field sheets and pencils/pens
- ziplocks with bottles, labels, preservatives, filter - for week and site
- DOC/TPCN bottles (brown glass 125 ml, 60 ml)
- BOD bottles, if needed
- bacteria tubes, if needed
- zooplankton net, rope, DI squirt bottle

Lab Supplies

- filtration apparatus, pump and tubing, metal forceps
- glass fiber filter, pre-baked, 25 mm
- 125 mL amber pre-baked glass bottles
- blank water (IBW)
- shipping sleeves for glass bottles
- aluminum foil squares
- whirlpak bags

Regular Field Sampling

1. Take samples according to weekly sampling schedule. Samples can be taken any day/time during the week, but samples should not be shipped Thursday or Friday. If samples are taken those days, keep chilled and ship the next week (Mon, Tues, or Wed). Before heading to field, check that supplies presorted into Ziploc bags match the sampling schedule for the current week.

2. Keep field notes on conditions, sample ID, time, date, and location of collection. Wear gloves to minimize contamination during sampling. Rinse equipment (including sampler, churn, tubing) 3x with unfiltered sample water.

3. First take “top” samples near mid-channel with Van Dorn sampler at 0.5 m depth. Alternatively, sample could be taken by reaching a gloved arm into river at a depth of 0.5 m and pulling a grab sample. The main point is to take sample at a noted, reproducible depth, and minimize human or boat petroleum contamination. Regular “top” samples are time coded as XX:X**1**.

Then take “bottom” samples near mid-channel with Van Dorn approx. 1 m above channel bottom. Note actual depth in field notes and on ASR form. These samples are processed the same as “top” samples, EXCEPT that the filtered sample should be taken directly from the Van Dorn (usually a tubing connection on the Van Dorn).

The reason for this is that when samples with low oxygen come into contact with air, the distribution of phosphorus (between dissolved and particulate) can change. We want to filter before these transformations happen. Other samples are measuring totals, so they are okay to take from the churn. If any iron precipitation occurs (rust colored) while churning the bottom samples, it is okay, but make note on field sheet. Bottom samples are time coded as XX:X**2**.

“Right bank” and “Left bank” samples will look for variability across the stream channel. At the site noted on schedule, take the “right bank” sample at 0.5 m depth, half way between mid-channel and the right bank (looking downstream). Similarly, take the “left bank” sample at 0.5 depth, half way between mid-channel and the left bank. Take YSI profiles at both locations. Right bank samples are time coded as XX:X**7** , and left bank samples as XX:X**8**.

4. Process sample with churn (except for “bottom” filtered sample, see above).

5. Unfiltered samples:
   a. Chlorophyll *a*.
      125 mL brown poly bottles, marked with “C”. Very light sensitive, so minimize exposure to light at sampling. Do not rinse bottle – magnesium carbonate preservative inside. Keep on ice at 4°C.
   b. CBOD.
      300 mL clear BOD bottle. Use unfiltered sample to rinse bottle. Fill as full as possible. Stopper with glass stopper, put on plastic cap. Keep in the dark, on ice at 4°C.
   c. Algae species.
      Tall brown poly bottles, marked with “P”. Do not rinse bottle - Lugol preservative inside. Samples are stable, refrigeration not necessary.
   d. Bacteria
      15 mL plastic tube with blue cap. Do not rinse tube – formalin preservative inside. Fill to 15 mL mark. Cap and keep on ice at 4°C.
   e. Organic carbon.
      Fill 4 to 6 125 mL or 60 mL amber glass pre-baked bottles (fewer if water has relatively high suspended material, more if water is very clear). Do not rinse bottles. These are processed in the lab for particulates and DOC. Keep on ice at 4°C.
   f. Total nutrients (aka “WCA”)
      125 mL plain poly bottle. Use unfiltered sample to rinse bottle. Acidify with sulfuric acid vial (1 mL of 4.5 N sulfuric acid) in the field. Remove sticker from acid vial and paste in field notes. Keep on ice at 4°C.

6. Filtered samples:
   a. Set up capsule filter. Rinse filter with 500 ml of deionized water, 500 ml of sample water before collecting filtered sample. (These capsule filters can, in theory, also be used to collect DOC, but then they must be rinsed with 1000 ml of deionized water and 1000 ml of sample water. Since we are also collecting particulates, it is easier to collect DOC as part of that processing - that uses filters that have been pre-baked to remove any traces of carbon).

b. Dissolved nutrients (aka "FCC")
125 mL brown poly bottle. Filter through 0.45 μm capsule filter. Use filtered water to rinse container. Keep on ice at 4°C.

c. Alkalinity
Two 250-mL plain poly bottle. Bottles are acid-rinsed. Filter through 0.45 μm capsule filter. Use filtered water to rinse container. Keep on ice at 4°C.

d. Iron
250-mL plain poly bottle. Bottle is acid-rinsed. Filter through 0.45 μm capsule filter. Use filtered water to rinse container. Acidify with nitric acid vial. Keep on ice at 4°C.

7. Zooplankton
250 mL plain poly bottle. Do not rinse bottle, sample has isopropyl alcohol. See separate zooplankton protocol for details. Samples are stable, refrigeration not necessary.

Duplicates

Take duplicates for parameters and site as noted on the sampling schedule. Duplicates would always be taken as "top" samples (near-surface). Duplicates are time coded as XX:X**3**.

Blanks

1. Field blanks. Take field blanks according to sampling schedule. They can be taken at any site in the field – these labels have not been preprinted to allow that flexibility. Write USGS site ID on label for site where blank is actually taken. Field blanks are taken with Inorganic Blank Water (IBW). Run the blank water through all portions of the sampling equipment. Note IBW lot number and expiration date in notes. Field blanks would always be time coded as XX:X**4**. Per Kathleen Fitzgerald, USGS Office of Water Quality, USGS IBW has consistently low DOC (0.12 – 0.14 mg/L), and is suitable for all blanks for this project.

2. Source solution (lab) blanks. Take these blanks as noted in sampling schedule. In the lab, pour IBW directly into sample bottles noted in sampling plan. Note IBW lot number and expiration date in notes. Acidify sample for total nutrients with sulfuric acid vial. The Link River site ID will be assigned to all source solution blanks. Source solution blanks would always be time coded as XX:X**5**.

Spikes

Nutrient spike samples would be taken three times in the period between April and October 2008. The specific weeks when these are taken will be decided by Jason Cameron and the field crew. Spike samples are time coded as XX:X**6**.

Washing Procedures for Sampler, Churn and Tubing

Between sampling events, at a minimum, clean equipment including Van Dorn, churn and tubing with 3 good rinses with DI water. A Liquinox wash (very concentrated, just use a little) and tap water rinse prior to the DI rinses, would also be used to clean equipment after a day in the field. We will insure that these cleaning procedures are adequate by including a number of field blanks early into the sampling plan. These cleaning procedures may be modified.

Organic Carbon Processing

Overview: Unfiltered samples from the field are filtered and the particulate matter on 3 glass-fiber filters will be collected for analysis. Approximately 125-250 mL sample should be filtered through each filter, unless clogging is an issue. In any case, the exact volume filtered for each sample should be noted. One bottle of filtrate will be collected for DOC analysis. (Reference: USGS Field manual 5.2.2.C)

1. Place foil down to cover work space. Wear gloves. Put 25-mm pre-baked glass fiber filters onto filter apparatus with metal forceps. Put back together and finger tighten (not too tight) blue collar. Clamp to ringstand. Attach peristaltic pump tubing so that air pushes into apparatus. Tie a whirlpak bag to the other end of tubing, so particles don't get sucked in.
2. Rinse filter with about 10 mls of blank water (IBW). Push water through with pump, then rinse one more time.
3. Weigh an amber glass bottle that contains unfiltered sample collected in field. Shake bottle gently to suspend particulates and pour all into filtration apparatus.
4. Place a bottle for DOC collection underneath filtration apparatus. Can collect for DOC while filtering through any of the three filters. Collect DOC in a pre-baked 125 ml amber bottle. Do not rinse DOC bottle. Be careful to remove DOC sample bottle when doing any rinses with IBW, only collect sample. Ideally fill DOC bottle to shoulder, but bare minimum sample needed for DOC is 40 mls. *Do not add any preservatives to DOC sample.* Keep samples on ice at 4°C.
5. If particles stick to sides of filtration apparatus, can rinse with IBW, making sure to remove DOC bottle during these rinses. Also rinse initial sample bottle with IBW to get any remaining particles and pour into filtration apparatus. Weigh empty initial sample bottle bottle. To get volume filtered, subtract weight of full bottle from empty bottle. Assume 1 mL = 1 g. So, if weight difference was 100 g, the volume is 100 mL. Make a note on label how much sample was filtered through each filter.
6. When all sample is through filter, let air push through for a little while still. A drier filter is easier to handle.
7. Change filters after filtering one or two bottles. Want to have enough on filter so it is a light tan color, not so much that it is dark brown and caked. Need to send three separate filters to lab. Fold filter in half while still on filter holder, with suspended material on inside.
8. Place one used filter with metal forceps onto aluminum square that has been folded into thirds. Fold together aluminum pouch, and label with site id, date, time, filtered volume of sample, and lab code 2606/2607. Place pouches in a Whirlpak bag. Keep filters on ice at 4°C.
9. Clean carbon filtration apparatus. First with very dilute Liquinox, then 3 hot water rinses, 3 rinses with regular deionized water, 1 rinse with IBW. Let dry.

Shipping

1. Ship samples (all except zooplankton) FEDEX overnight priority. Take coolers and put double large plastic bag inside. Put plenty of ice inside of double bags. Put samples in a smaller ziplock bag also inside double bag. Put return shipping labels for coolers in whirlpak bag, and tape whirlpak on inside of cooler lid. Fill out ASRs (make sure time codes are correct, and sample depth is noted, if bottom sample). Fold up ASR(s) into whirlpak bag for cooler shipped to National Water Quality Lab. For DOC cooler: make sure glass bottles have protective shipping sleeves, pack tightly and keep upright.

Zooplankton samples don't need to be refrigerated, and shipping can wait until you have a few samples, if desired. Shipping addresses are as follows:

a. Ship total nutrients (125 mL plain poly, lab codes 2756, 2759), dissolved nutrients (125 mL brown poly, lab codes 3116, 3117, 1975, 3118), particulate carbon/nitrogen (glass-fiber filters, lab code 2606/2607), and iron (250 mL plain poly, lab code 645) to:

National Water Quality Lab
U.S. Geological Survey
Denver Federal Center
Bldg 95, Entrance E3
Denver, CO 80225-0046
(303-236-3707)

b. Ship DOC (125 mL amber glass) to:

Kenna Butler
U.S. Geological Survey
3215 Marine Street, Suite E-127
Boulder, CO 80303-1066
(303-541-3009)

c. Ship chlorophyll *a* (brown poly) and algal species (brown poly) samples to:

Jim Sweet
Aquatic Analysts
232 Acme Road
White Salmon, WA 98672
(509-493-8222)
(address updated 9/07)

d. Ship bacteria (15 ml tubes) to:

Julie Kirshtein
USGS, MS 430
12201 Sunrise Valley Dr.
Reston, VA 20192
(703-648-5493)

e. Ship zooplankton (250 ml poly) to:

Allan Hayes Vogel
ZP's Taxonomic Services
12527 Bridgeport Way SW
Lakewood, WA 98499
(360-593-7230)
(address updated 3/08)

f. BOD and alkalinity samples go to:

USGS Klamath Falls
2795 Anderson Ave., Suite 106
Klamath Falls, OR 97603
(541) 273-8689
ext 205
BOD analyst still to be determined as of 3/20/08