Field Sampling of Strawberry Creek

Things To Do Before Lab

Read this lab guide BEFORE coming to lab to familiarize yourself with the all of the instructions listed below. **Bring a copy of this guide with you to lab.**

Lab Goals:

The goal of this lab is to introduce you to the following concepts:

- field sampling methodology for an aquatic habitat
- abiotic and biotic factors influencing the distribution and abundance of aquatic organisms
- the effect of municipal freshwater input on the health of an urban creek
- importance of long-term data sets to understand seasonal and annual variability in the distribution and abundance of organisms
- communication of your results

Introduction

Patterns of organismal ecology/relationships are reflected in their distribution and abundance. Many factors influence where and when you can find a particular species. Can you name three of these off the top of your head? You may have thought about the day's weather, the climate, the presence or absence of food, predators, or shelter. Ecological studies consider the influence of biotic (biological) and abiotic (physical) parameters that determine the distribution and abundance of organisms.

This week's lab involves the investigation of Strawberry Creek and its associated organisms. Many of you encounter this freshwater habitat on a daily basis, but it's more than water passing beneath a bridge you cross to get to class. This liquid treasure was a key factor when the founders of the University of California were selecting a site for the campus. Today Strawberry Creek is seen as an impacted system, threatened by many anthropogenic inputs and interventions.

If you were asked to name the number one threat to aquatic life in Strawberry Creek, what would you say? According to campus Environmental Health and Safety experts, the answer is not pesticides, oil pollution, or erosion. Surprisingly, it's an excess of potable water discharges into the creek. Breaks in city, campus, and private water pipes discharge chlorinated municipal water that enters the creek, and the chloramines it contains kill more life than all other impacts.

Chloramines

Why are chloramines a problem for aquatic organisms? In 1998, the water supplier for campus and much of the East Bay, East Bay Municipal Utility District (EBMUD), switched from using chlorine to chloramine as a disinfectant in an effort to reduce the potential for the formation of cancer-causing trihalomethanes (THM) during treatment of raw feed water to produce drinking water.

While the effort was successful in lowering the THM concentration in our drinking water, it introduced a more toxic (to fish mainly) form of chlorine into the environment. Before the switch, chlorine impacts to creeks were much lower because of the faster dissipation and off-gassing rates of chlorine in comparison to chloramine. The effects of the chloramine were often devastating. For example, in 2003, a water main break at Lawrence Berkeley National Laboratories introduced a high flow of chloramines and wiped out all the fish in the North Fork of Strawberry Creek.

In addition to water main breaks, runoff from daily irrigation and washing uses of treated drinking water also makes its way into urban creeks and streams. The chlorine concentrations vary with factors such as distance to catch basins, type of surface the runoff is flowing over, and temperature. Irrigation runoff from UC Berkeley's landscaping may also contribute to negative impacts on aquatic biota within Strawberry Creek.

Assignment

You will be able to use a variety of sampling gear to characterize Strawberry Creek and its water quality. Your lab section will be divided into groups to assess the abiotic and biotic components of portions of this aquatic habitat. As a group, you should determine which tasks will be necessary, who will carry them out and when, how the group will adjust the apportionment of tasks as the project develops, and how the group will communicate about your progress with your instructor.

Other than tromping through the creek itself, you will have the freedom to design your non-invasive sampling protocol. The following equipment will be available: GPS units, meter tapes, quadrats, meter sticks, binoculars, Pasco Xplorer GLX datalogger (for pH, temperature, conductivity, dissolved oxygen), flow meters, colorimeters, etc. Colorimeters are used to measure the amount of chloramines in water. You may sample various points along both forks and the main stem of Strawberry Creek as well as the outfall structures that drain and discharge the various sub-drainages and irrigation zones on campus property.

Identify and record riparian plants, aquatic macroinvertebrates, and fishes using printed picture keys, computer guides (calphotos.berkeley.edu/, creeks.berkeley.edu/content/strawberry-creek, etc.), and mobile device applications (iNaturalist, etc.).

The questions that you're attempting to answer should guide the design of your sampling regime. For instance, if you're curious about the effects of rapid, transient inputs, then you may want to capture hourly variability; if you want to know about more extended trends, you might want to standardize your data collection to smooth over the variability on that time scale. If you suspect that some sources of chloramines are localized, then you may want to focus your sampling directly above and below those points. If you want to learn about ways that some environmental variables interact with one another, then strategically capturing contrasting values will let you make comparisons.

We suggest that you start designing your study with observations and at least one pilot run, collecting preliminary data that will give you some information about what's feasible, significant, and interesting. The pilot run will also help you make decisions about the type and quantity of evidence that will help support the claims that you'll make.

Report

Effective science communication often involves creative approaches that may integrate science and art. You will be asked to submit a 3-5 minute video of your activities and findings (including ideas, questions, sampling protocols, observations, results, patterns, and insights). We are not looking for a dry recitation of your data! Think about what makes storytelling different from narrative, explanation, and description. What do successful YouTube videos do to grab the viewer's attention? Think about your audience. Some video creation guidelines are below. You will be graded on content, so don't feel that your submission has to have a professional level of polish.

You will also enter your observations into a comprehensive database that will serve as a long-term resource for use by scientists and campus administrators wishing to make changes to infrastructure and to protect the creek. For your observations to be useful for others, they will have to contain standard information to make comparisons and connections possible. The table below includes the necessary information.

Table for Recording Field Data:

Date
Time of Day
Person Sampling
Person Recording Notes

<u>Location</u>
Description of Location (e.g., Cross-Campus Culvert 12 meters upstream from Wickson Auto Bridge)
GPS Coordinates
Side of Creek Bank (left or right when looking downstream)

<u>Weather</u>
General Description (Cloudy, Partly Cloudy, Sunny)
% Cloud Cover
Air Temperature
Wind Speed and Direction

<u>Water Characteristics</u>
Depth of Water
Temperature of Water
Water Clarity
Water Flow Rate
Location of Water Sample (depth in meters)

<u>Sampling Equipment</u>
Type of Equipment (e.g., Hach DR 900 Colorimeter, Pasco Xplorer GLX, etc.)
Serial Number of Equipment Used (for repeatability and accuracy checks)
Parameter Tested (pH, Conductivity, Temperature, Dissolved Oxygen, Chlorine, etc.)
Value of Parameter
Etc.

Biota

Species Observed (e.g., *Procambarus clarkii* – red swamp crayfish; Red dragonfly with wings spread out; Blue damselfly with wings swept back; Water striders glide along the surface of the water; Water boatmen are beetle-shaped and swim through the water column; California roach minnow (*Lavinia symmetricus* [http://calfish.ucdavis.edu/species/?uid=18&ds=241]; Coastal threespine stickleback (*Gasterosteus aculeatus aculeatus*) [http://calfish.ucdavis.edu/species/?uid=40&ds=698]; etc.)

Total Number of Species Observed

Density (no. per m2)

Location in Habitat

Interacting with Other Species

Other Notes

Chloramine Sampling Protocol

[Additional revisions have not been added here yet.]
Important notes:

- Always dry the outside of the vial before placing it in the colorimeter
- The diamond painted on the vial should always face the screen of the colorimeter
- Always cover the vial with the instrument cap before reading

To calibrate the colorimeter (***<u>**DO THIS FIRST**</u>***):

1. Place a "blank" vial (filled with 5mL DI water) in the colorimeter
2. Place the instrument cap over the vial
3. Press "zero" (the "up" arrow button)

To test a sample:

1. Rinse a vial 3 times with DI water (Put the cap on the vial and shake with each rinse)
2. Rinse the vial 3 times with water from your sample (Again, put the cap on the vial and shake with each rinse)
3. Fill the vial with about 5mL of water from your sample
4. Add the powder from one "Chlorine total – DPD" packet to the vial
5. Put the cap on the vial and shake for 20 seconds
6. Dry the outside of the vial and place it in the colorimeter.
7. On the colorimeter, press "Options" □ "Start Timer" □ "Timer 1: 03:00"
8. Wait for 3 minutes until timer finishes.
9. Place the instrument cap over the vial and press "read"
10. Record the result

YouTube Vlog-Style Video Creation Guide (originally created by Mike Gil, SciAll.org)

I. Record your video:

- ***The most important tip: PRACTICE!!*** I don't mean practice what you want to say, I mean practice actually talking to a recording video camera, and then watching these recordings over and over to get comfortable on camera. Some of you will be more naturals at this than me, but it took me 5-10 takes in the beginning to not feel like I seemed fake. I still struggle with bringing my full personality out on video, but, hey, it's a work in progress!
- Fortunately, there are a few different recording styles available, and some really help with mistakes you'll make while speaking to your camera. Here are some general categories:
    - 'Quick-cut' style: rapid cuts, basically removing even normal pauses among speaking points. This style is really fun to create, and it lends itself to witty, humorous, candid content (it's also super conducive to easily fixing many mistakes, and because of this, it's great for capturing natural, improvised humor). I tend to use this style when I tell short stories about misadventures doing research, or when I want to present an idea or advice in a humorous way;
        - e.g., https://youtu.be/iQyCvxGy_MU
        - Or see how the pros do it: https://www.youtube.com/watch?v=7jjege3W92E
        - With this approach, I think it helps to move around a bit in the camera's field of view (i.e., the camera remains fixed, but between cuts, you may scoot more to the left, right, center, etc. -- see my clip above, as an example). The more diverse the visual content, the more you'll keep the viewers' attention.
    - 'Long-cut' style: very few (or no) cuts, resulting in a seamless conversation. These are more challenging to shoot but require little to no post-processing, so it's a trade-off as far as the time commitment. I find this type to be especially useful when conveying a more serious message, or when you want to give a longer impassioned take on something;
        - e.g., https://www.youtube.com/watch?v=3VfWsdWZuNE
    - 'Narrated footage': great for telling the story behind clip montages of doing research. You can record these easily by just speaking to your computer while watching the video you want to narrate in real time (short tutorial on how to do this is below);
        - E.g., https://www.youtube.com/watch?v=ywob1eXwJC4
        - E.g., https://www.youtube.com/watch?v=KwKRifEm9Fw
    - Wacky/silly/ridiculous ideas (don't forget to have fun and be creative with video ideas!)
        - E.g., https://www.youtube.com/watch?v=TNfFV7Qogkg
- Tips:
    - Make sure you have a lot of room on your phone or camera for multiple takes. I've made the mistake of finding a great, remote beach in Thailand to record some videos, only to discover that I'd run out of room in <1 minute! Brutal.
    - When easily accessible, cool, scenic settings, especially when they have relevance to the video, are great.
    - On the other hand, if you want to include a lot of 'over the shoulder' visuals (which can really help keep viewers' attention, and are easy to edit in— see below), it seems better to choose a more plain background (for example).
    - Use a camera stand (don't try holding the camera, as shakiness will cause your viewers to hurl):
        - There are many options, but I prefer the versatility of the one below, which you can order from Amazon (this one's great, because you can be sitting on a beach or some other flat place, and you can set the camera at eyelevel).
        - Note: you (and everyone you know ;) can designate SCIALL ORG INC as your charity of choice for Amazon Smile. Then, when you shop on smile.amazon.com (same as amazon.com), a small percentage of your purchases will be donated to SciAll.org, fueling our campaign!:
        - https://smile.amazon.com/MAONO-Integrated-Silicone-Bluetooth-Portable/dp/B01M4J3S66/ref=sr_1_3?ie=UTF8&qid=1538859227&sr=8-3&keywords=maono%2Bselfie%2Bstick&th=1

- **Lighting**: This is an important one. If you shoot indoors, you'll need to be mindful of light, and you'll want to make sure that your face is well-illuminated, either from the natural light from a window (https://youtu.be/u7omfeOQUjo) or by making sure lamps are in front of you. You want to avoid shadows that darken your eyes/face (e.g., https://www.youtube.com/watch?v=hEo9HaEmaRs).
- Checklist
  - For now, we're aiming for no curse words. But, if they slip in there, we can bleep them :).
  - Avoid using trigger words that will turn off swaths of viewers. This can be tricky if speaking about unjustly politicized topics, like global climate change. But, we want to be unifiers, not polarizers, so tread lightly with these types of videos, and get others, in addition to an editor, to weigh in.
  - Each video needs to be reviewed by at least one other set of eyes. This will typically be the job of the Editor for your video.
- Don't be shy — just go for it!! You WILL get better at creating these videos, I promise (in my earliest videos, I was pretty uncomfortable and defaulted to a less-personal 'scripted' type approach, which I now avoid by taking a 'just be real' approach). Plus, you're already an amazing person, otherwise, I wouldn't have asked you to join! So, share that amazingness with the world, and help the public and future STEM leaders discover the amazingness of science in the process!. :D

II. Edit your video (don't be intimidated -- it's VERY easy!):

- Download Shotcut (free, cross-platform software for PC & Mac): https://shotcut.org/download/
- Beginner Tutorial: https://youtu.be/hlDG90sbhQY
  - I'd watch this while you're using Shotcut to edit
  - Useful hotkeys to note: 's' cuts a clip at the clicked location, and 'x' deletes a selected clip and automatically closes the gap that this deletion creates in the timeline
- Picture In Picture Tutorial (for adding images and videos over your shoulder while you're on camera): https://youtu.be/fL4yjMVZlfg
- Voiceover Tutorial for narrated videos (e.g., for narrating field footage): https://youtu.be/6C2WUsvWGdc
- Export settings (for when you're done editing and are ready to render the final product!):
  - Under the "Export" options, select: H.264 High Profile
  - Stick to the following default settings:
  - 1920 × 1080 pixels
  - 16 × 9 aspect ratio
  - frames/sec: 23.976024
  - Select the 'Codec' tab and raise quality from 60% to 80%
  - Select 'Export File' to save the rendered video in your desired directory
  - Give the video a name using your initials, underscore, then a description, underscore, and then the month and year. E.g.,: "MAG_few_hispanics_STEM_09_2018.mp4"

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Video Grading Rubric

1 point – Question. Did the group clearly state a question they were addressing by the choice of their sampling protocol? If not, did they describe their overall goal of characterizing Strawberry Creek?

1 point – Methods. Were the methods and equipment used sufficiently described so that someone else could replicate what was done? Were GPS samples, dates, and times recorded so that any data collected could be useful for incorporation into a long-term dataset? Were the samples taken properly?

1 point – Images/Video/Lists. Did the video include images of the habitat and any biota observed during the study? Was there an attempt made to try to describe the species seen? The identifications need not be perfect. If there were no recordings made of the biota, was there a list made of species observed?

1 point – Results. Were data collected for both abiotic and biotic parameters involving the creek? How were the data summarized and did it make sense?

1 point – Summary/Conclusion. Did the students draw any inferences based on the data and results they obtained? Did their conclusions follow the information they had without overstepping the data they had? Was the video interesting and a good overview of their project? Was there sufficient effort given to this report?