



Plankton Sampling and Microscopy

Grade Level: 6th-12th grade

Subject: Biology, Marine Science

Recommended length of time for unit: 90 minutes each

Overview: This plankton field sampling and microscopy will follow a virtual, classroom discussion about the role of phytoplankton, harmful algal bloom (HABs) genera, paralytic shellfish toxins, and the monitoring work done by the Sitka Tribe of Alaska Environmental Research Lab (STAERL). This lesson will be demonstrated in-person and in the field while wearing masks and maintaining a social distance of at least 6 feet. The students will each have their own field kit. They will also receive an folder with all of the protocols and activity instructions to help guide them through Clam Camp.

Students will conduct a 3-minute phytoplankton field sample collection, according to STAERL's procedures. They will learn how to record pertinent site information taken at the time of sampling. Following the plankton tow, the students will analyze their seawater samples using microscopy and identification guides. They will be asked to identify the phytoplankton genera, in particular the three harmful algal bloom genera most commonly found in Southeast Alaska.

Objectives/Goals:

- Students will use their own field kits to collect and record site data including seawater salinity, water temperature, air temperature, and tide level.
 - Students will conduct a 3-minute field plankton tow and collect phytoplankton species for microscopy.
 - Students will set up a microscope slide following standard STAERL lab protocols.
 - Students will use Foldscope microscopes to analyze a part of their phytoplankton samples and identify common Southeast Alaska phytoplankton genera, particularly the three common harmful algal bloom genera.
 - Maintain COVID safety procedures and social distancing while conducting outdoor, hands-on science education activities.
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Part One- Plankton Tow Field Sampling

Materials: Rite-in-the-Rain data sheet, pencil, Celsius thermometer, refractometer, disposable pipette, squirt bottle, 20 μm mesh plankton tow net, sample bottle with cap, labeling tape, permanent marker, tide chart, timer, field kit case.

COVID safety: If possible, each student should have their own field kit so they can maintain social-distancing and avoid touching the same surfaces (especially items that touch the face like the refractometer). If there are not enough resources for individual kits, student groups should take turns sampling to provide ample time between the groups for washing and disinfecting the equipment. Gloves and clear adhesive stickers (to put over on the eyepieces and change out between students) are additional recommended safety precautions.

The sample site should provide enough space for students to safely spread out (still masked) during the 3-minute plankton tow. A distance of at least 15 ft. for each is recommended. For larger groups, plan adult supervisor and student group shifts accordingly.

Data Recording: Students will record the sampling date, time, tide level, air temperature (in Celsius), water temperature (in Celsius), cloud coverage, wind intensity, and salinity. The field kit includes the supplies needed to record site data. Each student will use the tide chart in their own field kit to determine the tide level. Students should first record the air temperature by holding the thermometer in the open air, by the attached string. Once the air temperature has been determined and recorded, students will place the thermometer in the ocean and lower until the end of its string. After five minutes students will pull the thermometers out of the water and quickly read the temperature. Students will use their own observational skills to decide on the cloud coverage and wind intensity (none, low, high). The salinity will be read from the tow sample water later.

Rinse bottles: Next, students will take the sample bottle and fill it at least a third of the way full. They will shake and invert the bottle a couple of times and then pour the waste water out over the cap. With each rinse, students should move slightly upstream from where they poured out their waste water to collect new rinse water. This seawater rinsing action must be completed 3 times before bottles are used for sampling.

They need to also rinse the squirt bottle and its cap 3 times. With each squirt bottle rinse, the students should squeeze some water out of the spout. After the third rinse, the students will fill their squirt bottles to the maximum fill line and set it aside for later use.

They will then twist the sample bottle onto the plankton net's threaded cod-end. Students should be mindful of the screw-like threading and try to avoid twisting the bottle on sideways or stripped. Furthermore, they should keep the bottle cap somewhere safe and handy.

Plankton tow: Each plankton net with the attached bottle is dropped into the ocean then quickly yanked back up, in a scooping fashion, so that seawater is quickly driven into the net and bottle. Students hold the net and bottle out of the water and check that the bottle has been filled

without any air bubbles. Air bubbles will prevent the bottle from sinking properly. Next, students slowly lower the bottle and net vertically into the water. By lowering the net and bottle slowly, the students will avoid air bubbles so that it can sink. The students will continue letting out line until they get to the end of the string length or until the bottom of the bottle hits the seafloor. If the bottom of the bottle hits the seafloor, they should not let out any more line.

While the net hangs at this depth, the students should take out their timer and start it for three minutes. Immediately after they hit start on the timer, they should pull the net vertically upwards, but stop before breaching the surface. When the top of the net is just below the surface or just under the visible freshwater lens (if applicable to sample site), the student should begin walking their path with the net trailing slightly behind them. This is referred to as “walking the dog.” The students should maintain a casual, steady pace so that the net swims through the water and stays horizontal. For the entirety of the tow, the net and bottle must stay below the surface (and freshwater lens if applicable). As the students walk, they should also tighten and release the line so that their net follows a up and down, sine wave pattern. When the students need to turn around on their path, they should keep an eye on their net to ensure it stays submerged. Students can walk back and forth on their path as many times as it takes until the three minutes are over. When the three minutes have ended the net and bottle should be immediately pulled completely out of the water. Some students may continue past the three minutes, thinking they need to return to their starting point, but they should pull it out wherever they are.

Concentrating the sample: Now the students will use the squirt bottle to rinse the entire net: outside, inside, and the string. They must direct the water, algal matter, and debris into the bottle. After they have sprayed down the entire net, they are going to let go of the string and grasp the net with one hand at about a hands-length distance from the bottle, or at the lower one-third part of the net. With the other hand, they will grasp the bottle and gently but quickly tip the bottle so water pours into the section between their enclosed fist and the bottle. Some water will drain out of the mesh net. Water should not flow past their fist, it should stay in the divided portion of the net. They should continue this action until about one-third of the water sample has been poured out. Students must be careful not to lose more than 40% of their sample.

Students will go over that section of the net where water was poured out, between their fist and the bottle, with the squirt bottle once more. They need to direct any algal matter or debris that escaped the bottle during the concentrating pour back into the bottle. They should not reintroduce a lot of water, or that will reverse the concentrating, so make sure they just do a quick rinse. To finish, unscrew the bottle from the net’s cod end and replace the bottle cap.

Measuring salinity: The remaining required site datum is salinity. Students will need their seawater sample and refractometer kits to take a salinity measurement. The refractometer kit should include a disposable, plastic pipette. Once again, students should use the “rinse three times” rule for the pipette using the water from their seawater sample. Make sure they do not squirt the waste water back into the seawater sample; they need to squirt it outside of the bottle. After rinsing, students will fill their pipette with sample water and squeeze the entire pipette onto the blue prism or sample area of the refractometer. The prism area should be completely covered in water-- the more water the better. Then, using the eyepiece of the refractometer,

they direct it at a light source and read the measurement. Sometimes it takes a minute for the reading to stabilize. The numbers on the right side are for salinity, which is measured in parts per thousand (ppt). They should disregard the numbers on the left. The salinity level is read at the point where the lower blue area meets the white area.

Clean up: The disposable pipettes should be thrown out and not reused due to COVID virus safety standards. All field equipment needs to be rinsed with warm tap water. Do not use soap as it could contaminate or negatively affect the equipment.