

## Activity 11: Creek Monitoring

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Coho salmon smolt from the Shasta River, northern California. Photo by Lisa Thompson

### **Overview**

Participants perform a variety of assessments of the local creek to determine whether it is a suitable habitat for salmon and steelhead.

### **Background Information**

Working closely with the salmon and steelhead resource professional, participants monitor several different aspects of the creek to determine its suitability for salmon and steelhead. In general, a healthy salmon and steelhead habitat contains areas with riffles (shallow areas where water flows rapidly over gravel or rocks) and pools. It has different sizes of rocks and plenty of overhead cover from trees and plants. It also has cool, clear, running water that is free of pollution. For more information about these habitat needs, see the [Background Information in the Unit Overview](#) and [Fish Habitat in Freshwater Streams](#).

Depending on the water quality test kit you use, participants can test for the following:

- **Temperature** is a measure of the warmth or coolness of the water, and an important habitat factor for salmon and steelhead. The optimum temperature depends on the species and the life stage. In general, however, if the water temperature is higher than 64° F (18° C), salmon and steelhead may become sluggish and more susceptible to disease and predators. While temperatures in the 74°-78° F (23°-26° C) range may be lethal, salmon and steelhead in California can sometimes tolerate these higher temperatures for short periods of time. In California, the temperature of a creek or stream can vary tremendously at different times of the day or in different locations along the stream. If the temperature in one place is too warm, salmon and steelhead will seek out a different location with cooler water.

Agriculture, reservoirs, industrial discharges of heated water, and the plant cover over the creek can all affect water temperature.

- **Turbidity** is a measure of water clarity. Salmon and steelhead require clear (non-turbid) water. Turbid water contains suspended matter such as clay, silt, chemicals, or microscopic organisms and can be caused by soil erosion, high levels of algae, or

disturbances of the creek bottom.

- **Dissolved Oxygen (DO)** tells how much oxygen is dissolved in the water. Salmon and steelhead require water with high dissolved oxygen levels. As DO actually decreases overnight, the best measurements are taken in the pre-dawn hours or with a logging DO meter (see [Advance Preparation](#)).
- **pH** is a measure of how acidic or basic the water is and ranges from 0 (very acidic) to 14 (very basic). Natural water usually has a pH between 6.5 and 8.0. Industrial waste and agricultural runoff can affect pH. Fish usually cannot withstand pH values lower than 4.0 to 5.0. Values this low are rare in California (low pH is more of a problem in the Northeast, due to acid rain).
- **Nutrients (including phosphate and nitrate)** in the creek, like nutrients in a garden, are essential for growth. They become a problem when their concentration levels are too high. Excess nutrients in the water can cause excess plant growth (especially algae). When these excess plants die and decompose, they can cause dissolved oxygen levels in the water to drop. Common sources of excess nutrients are soil erosion and water runoff carrying fertilizers from farms, lawns, and golf courses. Other sources include sewage and storm drain discharge, and industrial discharge.

(Note: Water quality test kits do not all measure for the same nutrients. Ask your salmon and steelhead resource professional for a suitable range for the particular nutrient parameters included in your kit.)

- **Coliform Bacteria** are normal bacteria that live in the digestive tract and feces of humans, other mammals, and birds. While not harmful themselves, their presence in water indicates sewage or fecal contamination. When coliform bacteria levels are high (greater than 200 colonies per ml), salmon and steelhead are more susceptible to disease. At these levels, people may also be exposed to diseases like dysentery, typhoid fever, hepatitis, and ear infections.

## Objectives

Participants will: (1) conduct a number of assessments of the local creek, and (2) based on the data and what they know about salmon and steelhead habitat requirements, evaluate whether the creek is a suitable habitat.

## Time

Setting the Stage: 30 minutes

Activity: At least three group sessions, with additional time for on-going monitoring

## Materials

- KWLR chart (started in [Activity 1: Getting to Know Salmon and Steelhead](#))
- Team portfolios, with completed work from:
  - [Activity 4: Community Survey](#) - survey results

- [Activity 5: Salmon and Steelhead Creek Walk](#) - creek map and worksheet
- [Activity 7: Watershed Web Search](#) - pamphlets
- [Activity 8: Mapping Our Community](#) - community maps
- [Activity 9: Salmon and Steelhead Life Stories Web Search](#) - “Salmon and Steelhead Life Cycle” worksheet
- Copies of “Creek Monitoring” worksheet (see [Advance Preparation, step 4](#)), 1 per team
- Clipboards (or other hard writing surface), 1 per team\*
- Pencils for each team
- For Water Quality station: water-quality testing kit (see [Advance Preparation](#))\*
- For Riffles, Runs, and Pools station: yard or meter stick
- For Gravel station: tape measure\* and rulers
- For Water Speed station: tape measure\*, flags\* or other markers, small oranges or sticks, stopwatch with a seconds hand
- For Salmon and Steelhead Scan station: polarized glasses
- Flags\* or other markers for stations and boundaries
- Camera
- Chart paper (optional)
- Graph paper (optional)
- Writing paper for each person

\* = Included in Adopt-A-Watershed Kit

### **Advance Preparation**

1. Talk with your salmon and steelhead resource professional (see [Resource Professionals](#) under [Unit Overview: Tips for Managing the Unit](#)) about which monitoring activities will be suitable for your participants and your creek. Depending on your situation, you may plan to conduct one or all of the suggested assessments. Take into account:
  - What participants want to find out about the creek habitat (see [Setting the Stage](#), step 1)
  - Any safety concerns of participants working near or in the creek (see [Water Safety](#) under [Unit Overview: Tips for Managing the Unit](#))
  - How much time you have
  - What materials you have or can obtain
  - How many adults can assist in monitoring
  - Who else may be using the data collected
2. If possible, time this activity to coincide with the periods that salmon and/or steelhead might actually be in the creek either as young fry or as spawners. Consult your salmon and steelhead resource professional about the best timing, keeping in mind water safety as well (see [Water Safety](#) under [Unit Overview: Tips for Managing the Unit](#)).
3. Obtain a water-quality testing kit through purchase of the Adopt-A-Watershed kit for this unit (see the [Adopt-A-Watershed web catalog](#)), or through your salmon and steelhead resource professional, a local creek watcher’s organization (see [Resources: Resource](#)

[Agencies and Organizations](#)), or a science supply company (see [Resources: Science Supply Companies](#)).

Basic water quality testing kits will enable you to test for parameters such as temperature, turbidity, dissolved oxygen, pH, nutrients, and coliform bacteria (see [Background Information](#)). Read over the testing kit directions before doing the activity.

4. Print one copy of the “Creek Monitoring” worksheet, and insert under the Water Quality section the tests your group will be conducting. As there can be a wide variation in local conditions, ask your salmon and steelhead resource professional to confirm what results would be suitable for the salmon and/or steelhead in your area, and insert this information in the appropriate place on the worksheet. Make copies of the worksheet for each team.
5. Ask your salmon and steelhead professional to accompany your group on the field study trip and to help with the water quality testing and salmon scanning activities. Also ask him or her to meet with the group after the trip to discuss their results.
6. If possible, arrange with your salmon and steelhead resource professional for the use of a logging DO (dissolved oxygen) meter, which will give more accurate results than the DO test in your water quality kit. Have him or her obtain DO measurements at your creek site for participants to analyze. Also, ask whether he or she has any spare 24-hour temperature loggers to set up at the site (in air and in the water) for the duration of the unit. This data would help to give participants a sense of the daily and seasonal variations in temperature.
7. If possible, arrange for participants to monitor the creek on an on-going basis, as this will provide a more accurate picture of the creek habitat than monitoring just once. Consider your group schedule to determine when, how often, and over what time period participants will do the monitoring. Involve participants in the planning when practical.
8. Within the week before the assessment, make a quick trip to the site to check for unexpected hazards, such as high flows, changes in access trails, or pollution. If anything about the site appears unsafe, check with your resource professional about finding another site.
9. Gather the necessary materials for the creek assessments you plan to do.
10. If your participants are unable to monitor in the field, plan to use real-time Web-based data on stream flow, temperature, and dissolved oxygen to monitor creek conditions (see [Resources: Monitoring](#)).
11. Set the date and plan each field study trip (see [Planning Field Study Trips](#) under [Unit Overview: Tips for Managing the Unit](#)).

12. Plan how to manage the creek assessments. You might have teams rotate to different stations set up along the creek site, with at least one adult at each station.
  - Parent volunteers can easily manage the Riffles, Runs, and Pools; Overhead Cover; Stream Velocity; Gravel Size; and Salmon and Steelhead Scan stations.
  - You or the salmon and steelhead resource professional (if available) should plan on managing the Water Quality station. Depending on the water quality parameters you will be testing, you may need to double the time (and number of participants) at this station.
  - Salmon and steelhead are easily spooked by noise and other disturbances. They will then hide under cover or move to another part of the stream. Either plan to do the Salmon and Steelhead Scan together as soon as you arrive at the field study site, or place the Salmon and Steelhead Scan station well upstream of the other stations to minimize disturbance.
  - Decide where to put each of the other stations along the creek site. The Water Quality station should be upstream of all stations except the Salmon and Steelhead Scan station.
  
13. On the day of the field study trip:
  - Go over the station directions with parent volunteers to make sure they understand their task.
  - Ask the salmon and steelhead resource professional (if available) to point out salmon and/or steelhead so that parent volunteers can help participants find them for the Salmon and Steelhead Scan station.

### **Setting the Stage**

1. Have participants look at the KWLR chart and identify questions they still have about the salmon and/or steelhead in your watershed. For example, participants may still have unanswered questions such as, “Is our creek a healthy habitat for salmon and steelhead?” or “Why don’t salmon and/or steelhead live in our creek any more?” Explain that they will have an opportunity to monitor the creek for a variety of different conditions, and ask them to point out which of their questions could be answered through this activity.
2. Ask participants what conditions salmon and steelhead need for a suitable creek habitat. Have them look at the KWLR chart and their completed “Salmon and Steelhead Life Cycle” worksheets to help them recall specific conditions. List these conditions on the board.
3. For each condition listed in step 2, ask participants for their ideas about how they could tell whether that condition is present in the local creek. For example, how would they know whether the water is free of pollution? You might have them look at their worksheets and maps from [Activity 5: Salmon and Steelhead Creek Walk](#) for ideas.

4. Hand out copies of the “Creek Monitoring” worksheet and read over it together. Point out that the assessments measure the various conditions that salmon and steelhead need in their creek habitat, and will help participants to determine the suitability of the local creek as salmon and steelhead habitat. Ask, “Which assessments will help to answer the questions we have (from step 1)?”
5. Explain the procedure for each of the creek assessments that participants will be doing (the assessments will depend on their questions from step 1 and on suggestions from your salmon and steelhead resource professional (see [Advance Preparation](#), step 1).
6. Do a practice run of the water quality tests the group will be doing.
7. Review your behavioral expectations for the creek monitoring and explain any logistical details (see [Planning Field Study Trips](#) under [Unit Overview: Tips for Managing the Unit](#)).
8. Answer any questions participants may have about the assessment or the field study trip.

### **Conducting the Activity**

1. At the field study site, point out or mark the overall boundaries. Mark a spot for each of the assessment stations.
2. Ask the group, “What safety concerns might there be here? What potential hazards do we need to look out for? What areas appear to be fragile (such as stream banks or certain plants)? How can we avoid damaging the habitat?” Review behavior expectations. Make sure that adult chaperones know what you want them to do with participants.
3. Have each team start at one of the stations. (If you will be doubling up at the Water Quality station, have two teams start there.) Give participants about 10-15 minutes at each station before giving the signal to rotate.
4. After participants have completed all the stations, gather the group together to share their findings. For each assessment (temperature, dissolved oxygen, stream velocity, and so on), discuss:
  - What were our results for this assessment?
  - Why might different teams have gotten different results?
  - Do you notice anything in the immediate area that might affect the results? (For example, turbidity, which is an indication of erosion, may be affected by the lack of vegetation along the creek.)
  - (If salmon or steelhead were present) What were the salmon or steelhead doing? How did they seem to be using different parts of the habitat?
5. Back in the classroom or meeting room, use chart paper (or the board) and help participants make a group compilation of the results. Have participants compute the

range, mean, median, and mode of the data for each assessment.

6. If you have received DO or 24-hour temperature data from your salmon and steelhead resource professional (see [Advance Preparation](#)), share that data with the group and have participants make a graph of the data over time.
7. Participants should look at the results of each assessment and determine whether that condition meets the needs of salmon and steelhead, or whether the data is inconclusive. Make sure participants understand that their results represent just one point in time along one section of the creek. While the data can help identify possible problems, participants cannot definitively determine the overall health of the watershed based on these results alone.
8. For any results that do not fall within the suitable ranges, have teams look at the data they have compiled from previous activities for clues as to the causes. They might find clues in their:
  - Survey results (from [Activity 4: Community Survey](#))
  - Creek maps (from this activity and [Activity 5: Salmon and Steelhead Creek Walk](#))
  - Pamphlets (from [Activity 7: Watershed Web Search](#))
  - Community maps (from [Activity 8: Mapping Our Community](#))
  - “Salmon and Steelhead Life Cycle” worksheets (from [Activity 9: Salmon and Steelhead Life Stories](#))
9. Invite your salmon and steelhead resource professional to meet with the group to view their results, and to provide a big picture or long-term view of your local creek or watershed conditions affecting salmon and/or steelhead.
10. Discuss:
  - How well does our watershed seem to support salmon and/or steelhead? What factors influence its ability to support salmon and/or steelhead?
  - What does the presence or absence of salmon or steelhead tell us about the quality of the water in the creek, the condition of the watershed, or other factors of the watershed?
  - In what ways could our creek or watershed be restored as a habitat for salmon and/or steelhead?
  - Healthy streams are important for salmon and steelhead, and they are also important for people. Is there anything we learned about the creek that could affect people?
  - How else do salmon and steelhead and people affect each other?
11. Explain to participants that in the next activity ([Activity 12: Salmon and Steelhead Restoration Project](#)), they will use what they have learned to plan and carry out a restoration project.

12. If you planned to conduct long-term monitoring of the creek (see [Advance Preparation](#)), revisit the creek to repeat the assessments. Help participants make graphs and charts showing the data they collect over time. Have participants look for patterns in the data. Does their assessment of the creek as a suitable salmon and steelhead habitat change over time?

## Wrap-Up

1. Have participants look at the KWLR chart again. Add their ideas to the “L” sheet (What We Have Learned) and “W” sheet (What We Wonder). Discuss:
  - What have we learned as a result of this activity?
  - Did we find the answers to our questions about salmon and/or steelhead in our creek (from [Setting the Stage](#), step 1)?
  - If not, what else might we do to answer these questions?
  - Do you have any new questions about salmon and steelhead?
2. Have participants write their responses to the following questions:
  - Is our creek a suitable habitat for salmon and steelhead? What facts and observations support your view?
  - In what ways do people affect whether the creek is suitable for salmon and steelhead? What facts and observations support your view?
  - What could people in our community do to restore salmon and steelhead habitat?
3. Direct participants to place their responses to the questions and their completed worksheets into their team portfolios.

## Enrichment

- An amazingly accurate indicator of a creek’s water quality is the number and kinds of insect larvae, snails, worms, and other invertebrates living there. Some of these invertebrates are quite sensitive to pollution and will only be found in very clean water, while others can tolerate poorer water quality. Surveying the macroinvertebrates (those that can be seen with the naked eye) in your creek is a fascinating activity to do with participants. It does require walking in the creek with a kick net and some familiarity with the organisms. Ask your salmon and steelhead resource professional about whether this assessment would be suitable for your creek situation. Take into consideration participant safety (see [Water Safety](#) under [Unit Overview: Tips for Managing the Unit](#) and whether walking in the creek could harm salmon or steelhead, or their habitat. For information see Habitat Monitoring under [Resources: Monitoring](#)).
- For an assessment of the size of gravel and rocks in a creek bed, help participants sample and measure rocks in the creek itself. As in the activity, at marked intervals participants reach down into the water and, without looking, pick up the first rock their finger touches at the end of their boot. For this, you will need to stretch a measuring tape or string across

the creek. Make sure that the creek level is safe and that participants walking across the creek will not harm salmon or steelhead, or their habitat (see [Water Safety](#) under [Unit Overview: Tips for Managing the Unit](#)). For detailed directions on doing a pebble count, see [Field Procedures: Pebble Count](#).

- Check the [California Department of Fish and Game Threatened and Endangered Species web site](#) for listed species in California. Have participants choose one of the species to research, answering questions such as:
  - How has the population of this species changed over time?
  - What habitats does this species depend on?
  - What are threats to this species?
  - What are people doing to increase this species in California?

Names: \_\_\_\_\_

Date: \_\_\_\_\_

## Creek Monitoring

### Water Quality

Salmon and steelhead need water that is cool, clear, oxygenated, and free of pollution. Use a water quality testing kit to measure the following parameters. Follow the directions provided on the testing kit. Mark on your map where the water was collected.

	Your Reading	Suitable Range for Local Salmon/Steelhead
Temperature:	_____	_____
Turbidity:	_____	0-10 NTU
pH:	_____	6.5-8.5
Dissolved Oxygen (DO):	_____	6 parts per million or more
Coliform Bacteria:	_____	0-200 colonies per ml
Other tests:		
_____	_____	_____
_____	_____	_____
_____	_____	_____

### Riffles, Runs, and Pools

A healthy salmon stream has riffles, runs, and pools.

- A riffle is a shallow area of a stream where water flows rapidly over a rocky or gravelly streambed. It shows up as ripples on the water surface. Riffles oxygenate the water (put oxygen into it), are good bug habitats, and are where salmon and steelhead make their redds, or nests.
- A run is an area of the stream where the water is traveling pretty fast, but doesn't show ripples.
- A pool is a deep area of a stream where the water flows very slowly. Salmon and steelhead hang out in pools because it is deeper and safer here than in open areas of the creek. The deeper water provides cover from predators such as birds.

1. Count the number of riffles, runs, and pools you see along this section of the creek:

Riffles \_\_\_\_\_ Runs \_\_\_\_\_ Pools \_\_\_\_\_

2. Add the riffles, runs, and pools to your creek map.

3. If you can do it safely, measure the width and the depth of one of the pools:

Width \_\_\_\_\_ Depth \_\_\_\_\_

4. Are the pools related to any other features in the stream, such as waterfalls, boulders, or logs? What do you think would happen to the pools if there were no logs or boulders in the creek?

### Cover

Tree branches hanging over the creek provide shade, which helps to keep the water cool for salmon. The roots of trees and shrubs also stabilize the banks of the creek so that silt does not clog the creek bed. Logs and large branches in the water give salmon and steelhead places to hide.

1. Count the number of trees along this stretch of the creek: \_\_\_\_\_
2. Looking straight up, estimate the percentage of the sky over the creek that is covered by trees and shrubs: \_\_\_ 100% \_\_\_ 75% \_\_\_ 50% \_\_\_ 25% \_\_\_ 0%
3. Show the overhead cover on your creek map. Also show on your map any logs or large branches in the creek.

### Gravel

A healthy salmon and steelhead creek bed consists of three sizes of rocks:

- Gravel (2 cm to 64 cm – from pea size to lemon size) is used for spawning nests.
- Cobble (64 cm to 256 cm – from lemon size to basketball size) stabilizes the creek bed.
- Boulders (larger than 256 cm – basketball size and up) are used by salmon and steelhead for shelter.

Other streambed materials are bedrock and fine sediment. Bedrock is solid ground that does not wash away; while fine sediment – sand, very small rocks, clay, or dirt – easily washes downstream.

1. Find an area along the creek where there is a stretch of rock or gravel. Lay the measuring tape along its length. One participant stands at each foot mark (or 30 cm mark) on the tape so that the toe of his or her shoe is even with the mark. Without looking, reach down and touch the rock or stone that is at the end of the shoe. Pick it up and measure it with a ruler. Record below.
2. Repeat this process until your team has measured a sample at each mark along the tape. Record where the rock is from (like “2-foot mark”) and its size. Then, classify each rock as gravel, cobble, or boulder.

Where from: _____	Size of rock: _____	Type of rock: _____
Where from: _____	Size of rock: _____	Type of rock: _____
Where from: _____	Size of rock: _____	Type of rock: _____
Where from: _____	Size of rock: _____	Type of rock: _____
Where from: _____	Size of rock: _____	Type of rock: _____

3. Looking at the creek, can you see areas in it with gravel, cobble, and boulders? Mark these areas on your map.

**Stream Velocity**

The stream velocity is how fast the water is going. Salmon and steelhead prefer water that is moving, but not moving too fast (usually less than 4 feet per second or 1.2 meters per second). If the water is moving faster than they like, the fish will stay behind rocks and logs, or near the bottom or banks, then dart out briefly into faster water to chase prey.

1. Place a flag or marker on the edge of the creek near a run (see Riffles, Runs, and Pools above). Using a tape measure, measure out 10 yards (or meters) along the edge of the creek. Keep the tape measure as straight as possible and parallel to the creek direction. Place a flag or marker at the 10-yard (or meter) mark.
1. To measure stream velocity, drop an orange or stick in the water at the first marker and time with a stopwatch how long it takes to reach the second marker.

Time to go 10 yards (or meters): \_\_\_\_\_  
 What is that in feet (or meters) per second? \_\_\_\_\_

2. Mark on your map where you measured the velocity.
3. Notice whether the velocity is the same all across the creek. Mark on your map places where it seems to be slower or faster than the area you measured.

**Salmon and Steelhead Scan**

Approach the creek very quietly and slowly from the downstream end of the site. Stay low so that it is harder for fish to see you. Since fish usually face upstream looking for food, they may not see you at first if you move from downstream to upstream. Using polarized sunglasses to help cut any glare (if you have them), look for salmon and/or steelhead in the water. If you don't have sunglasses, look for them in the shaded areas of the creek.

If you see any salmon or steelhead, describe what they look like and what they are doing.

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Names/ Nombres: \_\_\_\_\_

Date/ Fecha: \_\_\_\_\_

## **Creek Monitoring** ***Vigilando el Riachuelo***

### **Water Quality / Calidad del Agua**

Salmon and steelhead need water that is cool, clear, oxygenated, and free of pollution. Use a water quality testing kit to measure the following parameters. Follow the directions provided on the testing kit. Mark on your map where the water was collected.

*Salmón y trucha del mar (steelhead) necesitan agua fresca, clara, oxigenado, y libre de contaminación. Use un equipo de prueba de la calidad del agua para medirlos parámetros siguientes. Siga las direcciones indicadas en el equipo de prueba de la calidad del agua. Marque en su mapa donde recogió el agua.*

	Your Reading <i>Su medida</i>	Suitable Range for Local Salmon/Steelhead <i>Gama apropiada para Salmón y Trucha del mar locales</i>
Temperature / <i>Temperatura</i> : _____	_____	_____
Turbidity / <i>Turbiedad</i> : _____	_____	0-10 NTU
pH / <i>pH</i> : _____	_____	6.5-8.5
Dissolved Oxygen (DO) / <i>Oxígeno disuelto</i> : _____	_____	6 parts per million or more
Coliform Bacteria / <i>Bacterias del coliform</i> : _____	_____	0-200 colonies per mL
Other tests / <i>Otros análisis</i> : _____ _____ _____	_____ _____ _____	_____ _____ _____

### **Riffles, Runs, and Pools / Riffles, Fluyes, y Charcas**

A healthy salmon stream has riffles, runs, and pools.

*Un arroyo saludable para salmón tiene riffles, fluyes y charcas.*

- A riffle is a shallow area of a stream where water flows rapidly over a rocky or gravelly streambed. It shows up as ripples on the water surface. Riffles oxygenate the water (put oxygen into it), are good bug habitats, and are where salmon and steelhead make their redds, or nests.

*Un riffle es un área que no es profundo del arroyo donde el agua corre rápidamente sobre un fondo rocoso y con grava. Se muestra como ondulaciones en la superficie del agua. Riffles oxigenen el agua (le meten oxígeno), son buenos habitat para insectos, y son donde salmón y trucha del mar hacen sus jerarquías.*

- A run is an area of the stream where the water is traveling pretty fast, but doesn't show ripples.

*Un fluye es un área del arroyo donde el agua corre rápido, pero no tiene ondulaciones.*

- A pool is a deep area of a stream where the water flows very slowly. Salmon and steelhead hang out in pools because it is deeper and safer here than in open areas of the creek. The deeper water provides cover from predators such as birds.

*Una charca es un área profundo del arroyo donde el agua corre bien despacio. Salmón y trucha del mar se mantienen en las charcas porque es más seguro allí que en las áreas abiertas del riachuelo. La profundidad del agua les da cubierta de los depredadores como aves.*

1. Count the number of riffles, runs, and pools you see along this section of the creek:

*Cuente el número de riffles, fluyes, y charcas que ve a lo largo de esta sección de la riachuelo:*

Riffles/ Riffles \_\_\_\_\_ Runs/ Fluyes \_\_\_\_\_ Pools/ Charcas \_\_\_\_\_

2. Add the riffles, runs, and pools to your creek map

*Agregue los riffles, fluyes, y charcas a su mapa del riachuelo*

3. If you can do it safely, measure the width and the depth of one of the pools:

*Si puede cuidadosamente, mida la anchura y la profundidad de una de las charcas:*

Width/ Anchura \_\_\_\_\_ Depth/ Profundidad \_\_\_\_\_

4. Are the pools related to any other features in the stream, such as waterfalls, boulders, or logs? What do you think would happen to the pools if there were no boulders or logs in the creek?

*¿Están relacionadas las charcas con otras características del arroyo, como cascadas, cantos rodados, y registros? ¿Que piensa que les pasaría a las charcas si no hubieran cantos rodados y registros en el riachuelo?*

### **Cover / Cubierta**

Tree branches hanging over the creek provide shade, which helps to keep the water cool for salmon. The roots of trees and shrubs also stabilize the banks of the creek so that silt does not clog the creek bed. Logs and large branches in the water give salmon and steelhead places to hide.

*Ramas de los árboles que cuelgan sobre el riachuelo proporcionan sombra, que ayuda en mantener el agua fresca para el salmón. Las raíces de los árboles y los arbustos estabilizan los bancos del riachuelo para que el lodo no estorbe el fondo del riachuelo. Registros y ramas grandes en el agua les dan al salmón y trucha del mar lugares para esconderse.*

1. Count the number of trees along this stretch of the creek: \_\_\_\_\_

*Cuente el número de árboles que están a lo largo de esta sección del riachuelo*

2. Looking straight up, estimate the percentage of the sky over the creek that is covered by trees and shrubs: \_\_\_ 100% \_\_\_ 75% \_\_\_ 50% \_\_\_ 25% \_\_\_ 0%

*Mirando directamente arriba, calcule el porcentaje del cielo que está cubierto por los árboles y arbustos.*

3. Show the overhead cover on your creek map. Also show on your map any logs or large branches in the creek.

*Demuestre esa cubierta en su mapa del riachuelo. También demuestre en su mapa cualquier canto rodado y registro.*

### **Gravel / Grava**

A healthy salmon and steelhead creek bed consists of three sizes of rocks:

*Un fondo del riachuelo sano para salmón y trucha del mar contiene piedras de tres tamaños:*

- Gravel (2 cm to 64 cm – from pea size to lemon size) is used for spawning nests.  
*Grava (2 cm a 64 cm – del tamaño del chicharro al tamaño del limón) se usa para frezar jerarquías.*
- Cobble (64 cm to 256 cm – from lemon size to basketball size) stabilizes the creek bed.  
*Piedrin (64 cm a 256 cm – del tamaño del limón al tamaño del baloncesto) estabiliza el fondo del riachuelo.*
- Boulders (larger than 256 cm – basketball size and up) are used for shelter.  
*Cantos rodados (más grande que 256 cm – del tamaño del baloncesto al más grande) se usa para abrigarse.*

Other streambed materials are bedrock and fine sediment. Bedrock is solid ground that does not wash away; while fine sediment – sand, very small rocks, clay, or dirt – easily washes downstream.

*Otros materiales del fondo del arroyo son roca de fondo y sedimento. Roca de fondo es suelo sólido que no se erosione; pero el sedimento – arena, piedras chiquitas, arcilla, o tierra – se erosione a causa de la corriente.*

1. Find an area along the creek where there is a stretch of rock or gravel. Lay the measuring tape along its length. One participant stands at each foot mark (or 30 cm mark) on the tape so that the toe of his or her shoe is even with the mark. Without looking, reach down and touch the rock or stone that is at the end of the shoe. Pick it up and measure it with a ruler. Record below.

*Encuentre un área del riachuelo donde hay un parte de piedra o grava. Ponga la cinta métrica a lo largo del área. Un participante se para en la marca de 1 pie (o 30 cm) en la cinta para que su dedo este pleno con la marca. Sin mirar, estréchese para tocar la piedra que está en frente del zapato. Recójala y mídala con una regla. Apunte el dato en el lugar indicado.*

2. Repeat this process until your team has measured a sample at each mark along the tape. Record where the rock is from (like “2-foot mark”) and its size. Then, classify each rock as gravel, cobble, or boulder.

*Repita este proceso hasta que su grupo ha medido cada marca a lo largo de la cinta. Apunte de donde viene la piedra (por ejemplo “a 2 pies”) y el tamaño. Entonces clasifique la piedra como grava, piedrin, o canto rodado.*

Where from/ *De donde viene*: \_\_\_\_\_ Size of rock/ *Tamaño de piedra*: \_\_\_\_\_  
Type of rock/ *Clase de piedra*: \_\_\_\_\_

Where from/ *De donde viene*: \_\_\_\_\_ Size of rock/ *Tamaño de piedra*: \_\_\_\_\_  
Type of rock/ *Clase de piedra*: \_\_\_\_\_

Where from/ *De donde viene*: \_\_\_\_\_ Size of rock/ *Tamaño de piedra*: \_\_\_\_\_  
Type of rock/ *Clase de piedra*: \_\_\_\_\_

Where from/ *De donde viene*: \_\_\_\_\_ Size of rock/ *Tamaño de piedra*: \_\_\_\_\_  
Type of rock/ *Clase de piedra*: \_\_\_\_\_

Where from/ *De donde viene*: \_\_\_\_\_ Size of rock/ *Tamaño de piedra*: \_\_\_\_\_  
Type of rock/ *Clase de piedra*: \_\_\_\_\_

3. Looking at the creek, can you see areas in it with gravel, cobble, and boulders? Mark these areas on your map.

*Mirando el riachuelo, puede ver áreas con grava, piedrin, y cantos rodados? Apunte estas áreas en su mapa.*

### **Stream Velocity / *Velocidad del Arroyo***

The stream velocity is how fast the water is going. Salmon and steelhead prefer water that is moving, but not moving too fast (usually less than 4 feet per second or 1.2 meters per second). If the water is moving faster than they like, the fish will stay behind rocks and logs, or near the bottom or banks, then dart out briefly into faster water to chase prey.

*La velocidad del arroyo es cómo rápidamente mueve el agua. Salmón y trucha del mar prefieren agua mueve, pero que no se mueve muy rápido (en general menos que 4 pies por segundo o 1.2 metros por segundo). Si el agua mueve más rápido que les gustan, el salmón y la trucha del mar se esconden detrás de piedras y registros, o en el fondo o bancos, y de allí saltan brevemente al agua de alta velocidad para seguir presa.*

1. Place a flag or marker on the edge of the creek near a run (see Riffles, Runs, and Pools above). Using a tape measure, measure out 10 yards (or meters) along the edge of the creek. Keep the tape measure as straight as possible and parallel to the creek direction. Place a flag or marker at the 10-yard (or meter) mark.

*Ponga una bandera o un marcador al borde del riachuelo o cerca de un fluye (revise Riffles, Fluyes, y Charcas). Use la cinta métrica, mida 10 yardas (o metros) al borde del riachuelo. Mantenga la cinta métrica lo más recto posible y paralelo al riachuelo. Ponga una bandera o un marcador en la medida de 10-yardas (o metros).*

2. To measure stream velocity, drop an orange or stick in the water at the first marker and time with a stopwatch how long it takes to reach the second marker.

*Para medir la velocidad del arroyo, meta una naranja o un palillo en el agua en el primer marcador y tome tiempo con un reloj cronómetro para ver cuánto tiempo se toma en llegar al segundo marcador.*

Time to go 10 yards (or meters) / *Tiempo para recorrer 10 yardas (o metros):* \_\_\_\_\_

What is that in feet (or meters) per second? / *Calcule esa respuesta en pies (o metros) por segundo:* \_\_\_\_\_

2. Mark on your map where you measured the velocity.

*Marque en su mapa donde tomó la velocidad.*

3. Notice whether the velocity is the same all across the creek. Mark on your map places where it seems to be slower or faster than the area you measured.

*Preste atención a la velocidad a lo largo del arroyo; ¿es igual por todo el arroyo? Apunte en su mapa los lugares donde la corriente se mueve más rápida o más lenta que el área usted midió.*

**Salmon and Steelhead Scan / *Búsqueda de Salmón y Trucha del mar***

Approach the creek very quietly and slowly from the downstream end of the site. Stay low so that it is harder for fish to see you. Since fish usually face upstream looking for food, they may not see you at first if you move from downstream to upstream. Using polarized sunglasses to help cut any glare (if you have them), look for salmon and/or steelhead in the water. If you don't have sunglasses, look for them in the shaded areas of the creek.

*Acerque al riachuelo contra de la corriente, de manera tranquila y cuidadosa. Agáchese para que los peces no le vean a usted. Los peces buscan comida contra la corriente así que pueden no verle al principio si usted se contra la corriente. Usando lentes del sol polarizados (si los tiene) para desviar el reflejo, busque salmón y trucha del mar en el agua. Si no tiene lentes del sol, búselos en las áreas del riachuelo con sombra.*

If you see any salmon or steelhead, describe what they look like and what they are doing.

*Si ve salmón o trucha del mar describa como parecen y que están haciendo.*

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