

# RESOURCES

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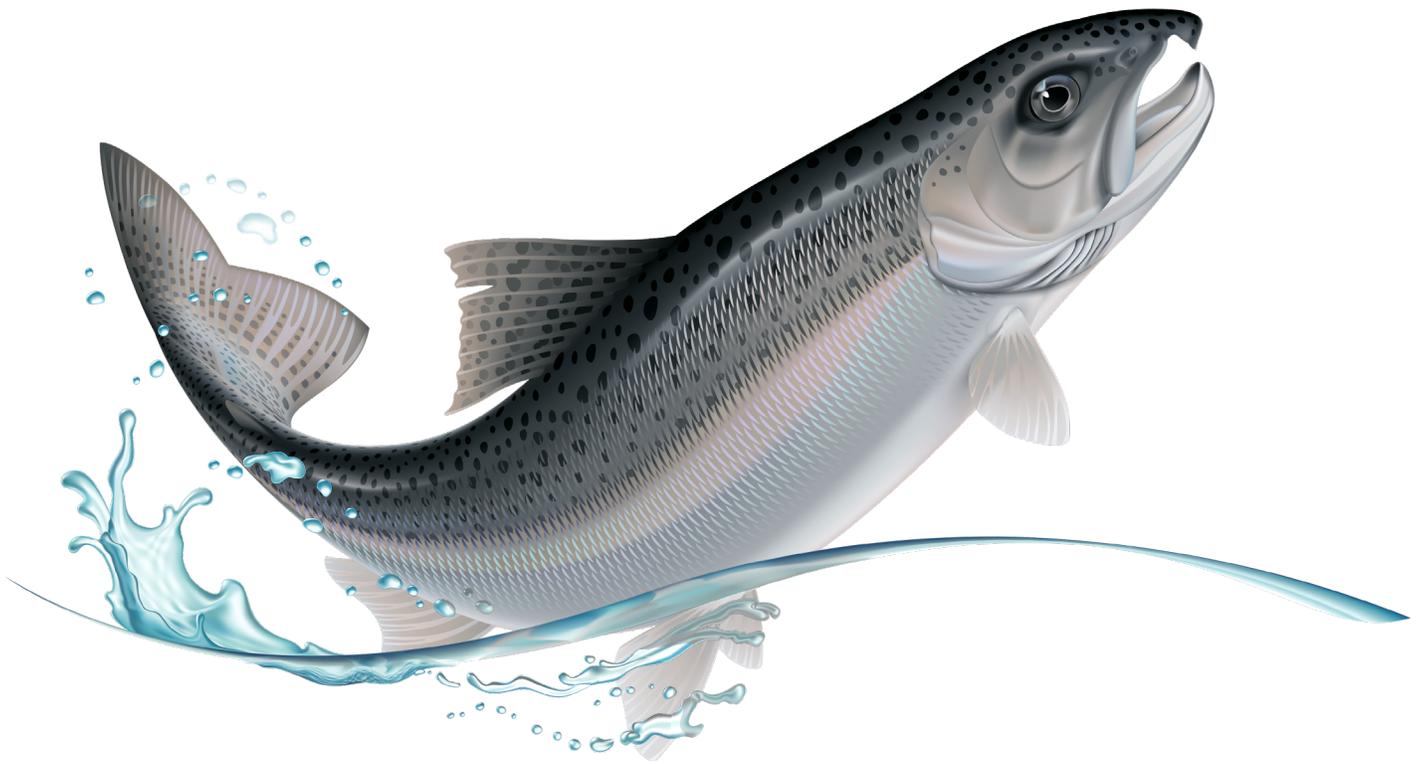
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# SALMON IN THE CLASSROOM

## Aquarium Maintenance Manual

Instructions for Aquarium Preparation,  
Maintenance, and Troubleshooting  
During the Egg to Fry Lifecycle  
(REV September 2018)



For further information and instruction

**Clear Creek Task Force**

360.434.7665

[Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org)

The Salmon in the Classroom Program was started by the Central Kitsap Kiwanis Club in 1988. It is now a partnership with the Clear Creek Task Force, Silverdale Kiwanis Club, Clean Water Kitsap, Kitsap Public Utility District, United Van Lines, Suquamish Tribe, Air Management Solutions and over 30 local classrooms with the shared goal of enhancing the salmon population in Clear Creek and educating students on the importance of ecosystems.

# Salmon in the Classroom Aquarium Maintenance Manual

REV September 2018

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The following information will provide users sufficient details to ensure they can provide a functional and safe environment for salmon eggs and the resulting evolution into fry prior to release into Clear Creek, the approved salmon stream.

The aquariums were built by the Kiwanis Club of Central Kitsap three decades ago. They were built from old refrigerator parts. There are three important things to keep in mind: 1) Never turn it on its side; 2) low refrigerant is the most common reason for temperature fluctuations; 3) dust accumulation on the mechanical parts underneath is the second most common reason for temperature fluctuations.

## Section 1. Inspection, Cleaning and Operational Check

**Very Important! Complete by Halloween**

**NOTE:** *Minor parts and labor are donated by Air Management Solutions in Bremerton. Repair requests need to be completed before the winter weather sets in. Air Management Solutions naturally gives priority to their paying customers.*

### Materials and Equipment – Aquarium Inspection and Cleaning

- Flashlight
- Paint brush for dusting
- Vacuum with wand and brush fitting
- White vinegar
- Sponge or rags
- Towels for wiping up spills and drying the aquarium and parts for maintenance
- Egg tray (provided)
- 1/3 of a bucket of ¾" to 2" clean rocks (think redd)
- Two 5 gallon white buckets
- Siphon or small bucket
- Electrical Tape



Siphon Hose



Egg Tray on its side

## 1. Inspecting and Cleaning the Aquarium and Equipment

**NOTE:** Disconnect the aquarium from power source before cleaning. The aquarium should never be run dry.

### 1. Aquarium

- a. Inspect the inside of the aquarium for cracks and fungus. If there are cracks, remove debris with a whisk broom or a cloth and patch with a marine sealant that is safe for aquariums. This can be purchased at pet stores. Contact the Clear Creek Task Force for further information, [info@clearcreektrail.org](mailto:info@clearcreektrail.org), 360 434 7665.
- b. Wipe the inside of the aquarium with a mild white vinegar and water solution to remove any fungus. Do not use detergent (residual soap deposits cling and raise the phosphate level of the water). Remove any debris from the interior.
- c. Using the paint brush, dust off the motor and other parts in the bottom back of the aquarium cabinet to remove dust. You may also use a vacuum wand with a brush attachment to gently remove dust.

**NOTE:** Most tanks are 25+ years old, do not be too vigorous with the cleaning.

2. **Thermostat:** The thermostat controls the temperature of the water. It is located in the bottom back of the aquarium cabinet. Note where the setting is at in case you may have to change the setting. A picture on your phone is best.
3. **Copper Cooling Tube:** Copper is deadly to salmon. Check for exposed copper on the cooling tube inside on the back wall of the aquarium. Use a small mirror to see between the aquarium wall and the pipe. Cover exposed areas with electrical tape, covering the pipe in one long, continuous, overlapping wrap.

### 4. Accessories

**NOTE:** If you have issues with any of the accessories listed below or need assistance, contact the Clear Creek Task Force, 360 434 7665 or [info@ClearCreekTrail.org](mailto:info@ClearCreekTrail.org).

- a. **Electrical Cord:** Check the electrical cord for any damage. To repair, contact the Clear Creek Task Force.
- b. **Airstone:** This provides a source of dissolved oxygen in the form of tiny air bubbles. The 10" airstone is connected to the air pump (small aqua or black box next to the thermostat underneath on the left). If the airstone is damaged, you are responsible for replacing it, available at a pet store for about \$6. Sometimes, it comes from the store damaged—be certain it is in one piece when you purchase it.
- c. **Air Tubing:** This connects to the air stone and air pump. If there is mold present inside the tube, replace the tubing; available at a pet store or home improvement center. After the fry are released, hang the tube to dry so mold does not develop.



Airstone

- d. **Thermometer:** Aquarium thermometers come with a suction cup so that the temperature can be easily monitored. Check that the thermometer is in working order by noting air temperature and then holding it in your hand. If needed, replacements can be purchased at a pet store.
- e. **Siphon Hose:** A great tool to use when changing the water. A small mesh screen rubberbanded to the end in the tank keeps fish from getting sucked into the bucket. Hang to dry after each use. Contact the Clear Creek Task Force if you need a screen.
- f. **Buckets:** You should have two white five (5) gallon buckets. They should be clean and only used for Salmon in the Classroom. These will be used to change the water. Use a mild vinegar solution to clean them. Do NOT use detergent (phosphates).

**NOTE:** *It's easier to see the salmon fry in a white bucket.*

- g. **Egg Tray:** Check that the custom made egg tray is free of rust and the screen is intact.
- h. **Rocks:** Clean rocks as necessary to ensure no mold is present. Do this by lightly agitating them in a water and vinegar solution, rinse and dry.

## 2. Operational Check

To be **completed by HALLOWEEN** to allow time for any needed repairs. Repairs during the winter weather and holiday seasons are challenging for Air Management Solutions.

### Materials and Equipment - Aquarium Operational Check

- Aquarium
  - Airstone, air pump and tubing
  - Thermostat set to the proper temperature (45° – 47° F)
  - Thermometer with suction cup
  - Compressor (motor) connected to the cooling tube
  - Two 5-gallon white buckets for water
1. Attach one end of the tubing to the airstone. The other end is attached to the air pump. Place the airstone directly underneath the cooling tube. This aerates the water (salmon need dissolved oxygen) and the rising bubbles inhibit ice forming on the cooling tube.
  2. Add water (does not need to be off gassed) to cover the cooling tube, which will cool the water to the desired temperature.
  3. Check for leaks around aquarium window. If leaking, contact the Clear Creek Task Force, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).



Airstone in tank

**NOTE:** *Condensation on the window is normal.*

4. Plug the power cord into a 120V AC outlet. The motor should start running immediately. If not, contact the Clear Creek Task Force, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).
5. Check that bubbles are coming out across the entire length of the airstone. If not, check that the tubing is connected properly and the airstone is not clogged. If still not working, replace airstone.
6. Check the thermostat setting (45° – 47°F). The thermostat is a silver box with a dial, located in the back on the bottom left. Put the lid on the tank. Within 5 minutes the cooling tube will begin to work. If not, contact the Clear Creek Task Force, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).
7. Once the water is at the desired temperature (45°- 47° F), the compressor will cycle on and off as needed to maintain the set temperature. Compare thermometer and thermostat settings for future reference.
8. Your aquarium is functioning normally when:
  - a. The water has reached the proper temperature (45° – 47° F) and can maintain this temperature for at least 4 hours
  - b. The compressor cycles on and off after reaching the proper temperature
  - c. The airstone is working properly directly underneath the cooling tube.
9. Disconnect the power cord and empty the tank. Hang the tubing to dry. Report the results of the Operational Check to the Clear Creek Task Force, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).
10. If any of these parts is not functioning normally (see #8 above):
  - a. Check the Troubleshooting Guide, Section 4 of this manual.
  - b. If following the Troubleshooting Guide does not fix the problem, unplug the power cord and contact the Clear Creek Task Force, 360 434 7665, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org) for assistance and/or repair.

## Section 2. Aquarium Readiness!

(Complete at least 1 week before egg pick up)

### 1. Egg Tray

Needed to hold the salmon eggs until all the eggs hatch.

- a. Remove the airstone and thermometer to a safe place
- b. Set the egg tray in the aquarium with the mesh side up.
- c. Place rocks on the wooden base of the egg tray to hold it in place.
- d. If you need a new one, contact the Clear Creek Task Force, 360 434 7665 or [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).

### 2. Rocks for the Redd

- a. GENTLY place cleaned rocks to cover 1/2 of the bottom of the aquarium

- b. Just dumping the rocks in could chip or crack the sealant on the inside of the aquarium.

### 3. Adding Water

HELPFUL HINT: If this is done 2 or more days ahead of egg delivery, no need to off gas. (See Section 3.3d)

- a. Fill the tank to one inch (1") above the cooling tube. This will likely take 2 – 3 buckets of water—possibly more since full buckets are difficult to lift.

### 4. Power On

- a. Place the airstone directly underneath the cooling tube.
- b. Attach the thermometer to the window so it's visible to the students.
- c. Plug in the power cord. The system should start up immediately.
- d. With the airstone directly under the cooling tube, check that the bubbles are coming out across the entire 10" length. This aerates the water (salmon need dissolved oxygen) and prevents ice build-up on the cooling tube.
- e. Monitor the thermometer to confirm it's working and the cooling tube is working. Before introducing salmon eggs, the water temperature needs to be between 45°-47°F. It will likely take that much water 1 to 2 days to reach the proper temperature depending on the room temperature.

### 5. Covering the Window and Top

Salmon eggs are light sensitive, so cover the window with dark paper. You can cut out a flap in the front piece of paper so your students can check on egg development. A styrofoam or cardboard top is also needed to regulate the temperature.

### 6. Validation of Proper Set Up

- a. Run the aquarium for at least one week before eggs are due to arrive.
- b. Check water temperature often. It should be between 45°-47°F.
- c. Check that the air stone bubbles continuously across the entire length.
- d. If experiencing any problems with the above, refer to the Troubleshooting Guide in Section 4 of this manual.
- e. If the problem is salmon life threatening or persistent, contact the Clear Creek Task Force immediately, 360 434 7665 or [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org).



Aquarium with cover

## Section 3. Egg Pickup and Placement; Raising Salmon

### 1. Egg pickup

- a. The 100 salmon eggs and fish food for each aquarium are donated by the Suquamish Tribe. Pickup dates are determined by weather but it usually occurs in early January. The tribe holds the permit for disbursing the chum eggs, which are best suited for Clear Creek.
- b. Pick up eggs and food from Grover's Creek Fish Hatchery, 23175 Indianola Road NE, Poulsbo, WA. Hours are 8:00 am until 4 pm.
- c. You are responsible for arranging the pickup. Pickup times are scheduled with hatchery staff and volunteers. Dates will be provided by email.
- d. Central Kitsap School District teachers MAY have the option of picking up at the Science Kit Center. Check with your district Science Curriculum Specialist.
- e. When you receive the eggs, they will be in a small cup with a damp paper towel. The eggs should be placed in the classroom aquarium within an hour of pickup from the hatchery.
- f. You will also receive a small bag of food. **DO NOT USE THE FOOD UNTIL YOUR SALMON BECOME FRY.** See Section 3.5 for more information. Clearly label and store the food in a cool place.

### 2. Placing the Eggs in the Egg Tray

- a. **Gently** place the eggs on the mesh of the egg tray. They should be orange similar to the picture on the right.
- b. Gently spread the eggs out.
- c. Remove any dead eggs. These are eggs with an opaque white appearance as opposed to red-orange and "eyed" eggs. A turkey baster works well for this.



Healthy Salmon Eggs

### 3. Changing the Water

Changing the water is necessary because these tanks do not have a filtering system. In a healthy stream, water would wash over the redd to clean it. In your aquarium, change the water based on the stage of your salmon:

- a. Eggs: Water change is not necessary
- b. Hatching: Change the water daily and remove egg cases after hatching has begun. If egg cases are left in the water, it would change the chemical balance of the water and become a detriment to the salmon.
- c. Alevin: Change the water every other day.
- d. Fry: Change the water every other day.

**NOTE:** *Water does not need to be changed on weekends unless the period between changes will exceed 3 days. If so, make arrangements to change the water at least every 3 days.*

Water should be changed as follows:

- a. Fill one bucket at least 24 hours before placing the water in the aquarium. Do not cover. This allows any chlorine in the water to evaporate (off gas).
- b. Remove about five gallons (one bucket full) of water from the aquarium using the siphon tube or a small container. The used water can be used for plants – they will love the natural fertilizer!
- c. Immediately fill the tank with the off gassed, cooled water being careful not to disturb the salmon. You can use the siphon hose to transfer the water from the bucket to the tank. Fill so the cooling tube is covered. The cooling tube **MUST** be under water.
- d. Fill the bucket with tap water and store outside to off gas and reach optimal temperature (45° – 47° F) for the next water change.
- e. Hang the siphon hose to dry.

**HELPFUL HINT:** Setting the bucket of water outside to off gas obtains the proper temperature more efficiently.

**NOTE:** *The clean water should be stored in a protected, cool area. If the water becomes contaminated, DO NOT USE. Instead, discard it, refill the bucket with clean water, and store it for 24 hours before placing it in the aquarium.*

#### 4. Egg Hatch

- a. Eggs will usually hatch in about 10 days and the immature fish (alevin or sac fry salmon) will swim down into the rocks.
- b. Remove egg cases and dead eggs regularly. A turkey baster works well for this.
- c. Once all the eggs have hatched, egg cases and a few more dead eggs may be left in the tray. Carefully remove the tray and discard the dead eggs and cases.
- d. The tray should be rinsed, dried and stored for use next year.



Alevin or Sac Fry Salmon

**NOTE:** *While the eggs are hatching, it is important to change the water daily (except for weekends) as the water will froth due to an enzyme released by the hatching eggs.*

#### 5. Feeding the Fish

- a. The fish will feed from their own egg sack for approximately one to two weeks. When the egg sacks are exhausted, the fish will begin to swim freely. **Start feeding when ALL THE FISH START TO FREE SWIM.**

**PLEASE NOTE:** Very little food is needed. Food that sinks to the bottom of the tank will not be eaten by the fish. Food on the bottom of the tank means cleaning by changing the water more often.

- b. For the 100 fish you have, a pinch of food, four times each day is about the right amount. Measure about 1/8 teaspoon of food in a container. Use a popsicle stick to sprinkle tiny amounts of food four times a day. Slow feeding will give small fish a chance to get their share.
- c. Feed only as much as your fish will eat in 1 minute. Avoid giving the fish more than they can eat as the uneaten food settles to the bottom of the aquarium. At each feeding observe the fish for 1 minute to see how much food settles to the bottom. Adjust feeding as necessary.
- d. Missing a few days over a weekend is okay but make arrangements for longer periods.

## 6. Transferring the Fish in Preparation for Release into the Stream

**PLEASE NOTE:** *The fish should not be removed from the aquarium until immediately prior to taking them to the release site. The water in the buckets will lose its dissolved oxygen in a couple of hours and the fish will die.*

Transfer the fry into a 5-gallon Transport Bucket half full of the aquarium water. Follow the steps below.

- a. Unplug the aquarium.
- b. With a fine screen secured around the siphon hose (a rubber band works well), siphon aquarium water to fill the Transport Bucket about half full.
- c. Carefully remove the rocks from the aquarium.
- d. Drain the remaining aquarium water until there is about 3" – 6" left.
- e. Put the bucket on a table or sturdy chair close to the aquarium.
- f. Using the small net, quickly transfer the fry into the Transport Bucket.



Waiting to be released

**NOTE:** *Do not cover the bucket during transport. This deprives the fry of oxygen. Do not use ice or an ice pack in the bucket while in transport as it can crush the fry. If desired, you can purchase a portable aerator available at pet stores.*

## 7. Releasing the fry into the stream at the field trip

- a. If your class attends one of the scheduled field trips, instructions for releasing will be provided by trained Salmon in the Classroom volunteers at the release site.
- b. **Salmon Release Tic Sheet:** For each fry that is released into Clear Creek, students should make a tick mark on a sheet. Teachers will turn this in to the Salmon in the Classroom Coordinators at the end of the field trip or by April 1<sup>st</sup>. These numbers are reported to the Washington Department of Fish and Wildlife so they can keep track of the number salmon that have been introduced into Clear Creek.



Releasing Salmon

## 8. Releasing the fry into the stream on your own

If your class cannot attend a scheduled field trip, you can release the salmon on your own into Clear Creek.

- a. Determine a date and time to release the salmon.
- b. Identify a location along Clear Creek to release your salmon. Contact the Clear Creek Task Force if you need more information.
- c. Have a dozen or so clear plastic cups, at least 6-8 ounces, two white 5-gallon buckets (the Transport Bucket and an empty bucket), the small net for use at the stream, and a clipboard, paper, and pen to mark each time a fry is released.
- d. Right before you leave the school, transfer the fish into the Transport Bucket (see Section 3.6).
- e. When you arrive at Clear Creek, fill the empty bucket with creek water.
- f. Partially fill each cup halfway with the creek water. Using the net, put 1-5 salmon fry into each cup, depending on the number of fry and students.



Salmon fry waiting for release

**NOTE:** *If cups are shallow or too full of water, salmon fry may jump out. You can also have students put their hand flat over the top of the cup to keep the fish from jumping out.*

- g. If your class made salmon release tools, have participating students first test the equipment with a cup of water only before introducing the salmon fry.
- h. Have the student move to the edge of the stream. Put the cup with the salmon fry in it into their tool. Put the cup in the water and slowly tilt it so the salmon can swim out into the stream.
- i. Without a salmon release tool, have your students move to the edge of the stream one at a time. If possible, have students hold the cup in the water and slowly tilt it so the fish can swim out into the stream.

**NOTE:** *Release salmon by putting the cup in the water and slowly tilting it so as not to shock the fish by just dropping them in the stream.*

- j. Watch as they swim away.
- k. Have students or an adult make a tick mark on the clipboard paper each time a fry is released.
- l. Repeat until all the fish have been released into the stream.

## 9. Reporting Requirements

**NOTE:** *The Salmon in the Classroom program is monitored by Washington Department of Fish and Wildlife. Data on how many fry are released and where they are released is valuable to this program.*

For each fry that is released into Clear Creek, students should make a tick mark on paper. Teachers will turn this in to the Salmon in the Classroom Coordinators at the end of the field trip. For those not attending the scheduled field trip, turn in these reports by April 1<sup>st</sup>. to the Clear Creek Task Force, P.O. Box 1188, Silverdale, 98383 or Info@ClearCreekTrail.org.

## 10. Cleaning the Aquarium and Equipment

- a. Return to Section 1 for a refresher on how to clean the equipment, then store for next year.
- b. If you use the aquarium as a storage bin, please take the time to protect the aquarium lining, air stone, cooling tube and thermometer by wrapping in bubble wrap or an old towel.
- c. If minor damage does occur, repair or replace the equipment using the information in this manual.
- d. If major damage occurs, contact the Clear Creek Task Force to determine if a service technician can solve the problem. Some repairs are provided free of charge by our partners at AMS in Bremerton. Please extend your heartfelt thanks for this invaluable service to the aged equipment.

## Section 4. Troubleshooting Guide

If you are having any problems with the aquarium, please review this Troubleshooting Guide first.

If you cannot solve the problem and need a service call, contact the Clear Creek Task Force for maintenance ([Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org) or 360 434 7665), please provide the contact name, school, tank number, contact e-mail, phone number, description of the problem, and the current aquarium temperature.

**Issue: Discolored tubing** or hose—looks moldy

- Replace the tubing or hose. Measure the length or take the moldy one to a pet store or home improvement store.

**Issue:** The paint on the insides of my aquarium is **cracked and/or peeling**.

- Remove dried paint with a vacuum
- Use marine salmon safe adhesive to patch the crack.
- Contact the Clear Creek Task Force for more information, [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org), 360 434 7665.

**Issue:** The **temperature is not holding** and the **cooling tube** is covered in frost.

- The cooling tube should always be submerged to operate sufficiently. Add enough off gassed water to cover the tube.

**Issue: Ice forming on cooling tube**

- Check to make sure that the airstone is positioned directly under the cooling tube. The air bubbles not only provide oxygen, but also circulate the water.
- Be certain the cooling tube is completely submerged.
- Check the water temperature. Adjust the thermostat as needed.
- If there is still no change, contact the Clear Creek Task Force, 360 434 7665 IMMEDIATELY.



Ice on Cooling Tube

**Issue:** Metal is **exposed on the copper** cooling tube

- The metal of the copper cooling tube should be covered to protect the salmon from exposure to copper, which is toxic to them. This should be done BEFORE FILLING THE AQUARIUM. See Section 1.1.3 for details.

- A quick fix is to cover the exposed metal with electrical tape. Unplug the unit and drop the water level to expose the tube. Dry off the tube so the tape will stick. When the tube is warmer and dry, wrap with electrical tape, overlapping as you go.
- When finished, add off gassed water to cover the cooling tube.

**Issue:** There is **condensation** on the window

- Because of the difference in room temperature and water temperature, condensation will form on the window. This is normal.

**Issue:** The **airstone** isn't working/no bubbles are coming from the airstone.

- Check that the air tubing is properly plugged in/seated at both ends.
- Check that the air pump is plugged in and functioning.
- Check that the tubing is not blocked and there are no kinks in the line. This can be easily accomplished with a wet finger held close to the tubing.
- If all of the above are functioning properly and air is still not coming from the airstone, purchase a 10" long air stone at a pet store for about \$6. Check to make certain the purchased airstone is intact. They break easily.
- If the new airstone still does not work, contact the Clear Creek Task Force, 360 434 7665 IMMEDIATELY.

**Issue:** The **airstone** is only producing a stream of bubbles on one end.

- Check to make sure the tubing is properly connected to the air stone and the airpump.
- Check that the tubing is not blocked and there are no kinks in the line. This can be easily accomplished with a wet finger held close to the tubing.
- If air is still not coming from the whole airstone, purchase a 10" air stone at a pet store for about \$6. Check to make certain the purchased airstone is intact. They break easily.
- If the new airstone still does not work, contact the Clear Creek Task Force, 360 434 7665 IMMEDIATELY.

**Issue:** The **temperature** is higher than the recommended range of 45° 47° F.

- Check to see if there is a buildup of dust on the compressor. If so, carefully dust off or vacuum.
- Monitor the compressor to see if it cycles on and off indicating it is functioning properly. If it's not cycling, contact the Clear Creek Task Force 360 434 7665 IMMEDIATELY.
- If the compressor cycles, the dust has been vacuumed, and the temperature is still too high, adjust the thermostat. Monitor the thermometer constantly to determine if this works. See "Adjusting the Thermostat" at the end of this Troubleshooting Guide.

- If there is still no change, unplug the unit and plug in the air pump only. Add ice in a gallon size ziplock bag to the aquarium to reduce the temperature and keep the fish cool until help arrives.
- Contact the Clear Creek Task Force, 360 434 7665, IMMEDIATELY for repair and an emergency cooling system until the repair can be made.

**Issue:** The **temperature is lower** than the recommended 45° – 47° F

- Adjust the thermostat. See “Adjusting the Thermostat” at the end of this Troubleshooting Guide.
- This lower temperature will not harm the salmon but will slow their development and the fry may not be fully developed in time for the scheduled field trip.
- If the thermostat does not adjust the temperature, contact the Clear Creek Task Force, 360-434-7665 IMMEDIATELY.



Dusty compressor! Needs to be vacuumed.

**Issue: Compressor runs all the time** or is louder than usual

- Check to make sure the compressor is free of dust. Vacuum gently or brush off to remove dust.
- Check the thermostat setting. (45° - 47° F) and compare with the thermometer.
- This is usually an indication that the unit needs service NOW. Unplug the unit and plug in the air pump only. Add ice in a Ziplock bag and call or text the Clear Creek Task Force, 360 434 7665 IMMEDIATELY.

**Issue:** A lot of the **eggs have turned white**.

- An opaque white egg indicates the egg is dead. Remove from the tank as soon as possible. A turkey baster works well for this.
- Check for proper temperature (45° – 47° F).
- Make sure the airstone is functioning properly.

**Issue:** There are lots of **particles floating** around in the water

- Remove egg cases, any dead (white) eggs, alevin or fry. These can spread fungus and disease if left in the water.
- Change the water as required. See Section 3.3.

**Issue: Foam** is forming on the top of the aquarium.

- Change the water immediately. Replace at least one 5-gallon bucket with each water change.
- Remove dead eggs, alevin, or fry as soon as possible. Using a turkey baster works well.
- If these are not causing the problem, replace 5 gallons of off gassed water twice in one day. Spread this out over time — possibly one 5-gallon bucket in the

morning and one in the afternoon to avoid stressing your fish. Plan ahead. Make sure the water is off gassed and the proper temperature.

**Issue: The power has gone out**

- Your salmon should be ok for about an hour.
- If you've started feeding your salmon, avoid feeding until the power is back on.
- If there is a storm predicted that could knock out power, change the water just before the storm.
- If the power outage lasts more than an hour:
  - Put ice in a gallon-size Ziploc bag and add that to the tank. Replace as needed.
  - You can GENTLY move the water around in the tank with a net periodically to simulate circulation.
  - For longer outages or if your school loses power regularly, consider getting a battery-operated aerator. You can also use this in the bucket when transferring your fish for release.

**Issue: Our field trip is in less than 5 days and our salmon are still alevin.**

- Colder temperatures slow the development of salmon. If your water temperature is lower than the recommended 45° – 47° F, try increasing your tank temperature by 1° each day.
- Be very careful—large temperature changes and too warm water (55°F) can be lethal to salmon.

**Issue: The rocks that were in my tank are no longer there.**

- Replace the rocks with ¾" to 1 ½" rock—about 1/3 of a bucket. Agitate the rocks in a vinegar solution, rinse, and dry them before putting them in the aquarium.

**Issue: Adjusting the thermostat to reach the ideal temperature for salmon eggs (44° - 46°F)**

- First and foremost, please make certain all mechanical parts under the tank are free from dust, then begin troubleshooting.
- In the back of the cabinet on bottom left, there is a silver box with a dial. This is your thermostat. It controls the compressor that controls the temperature of the water. Water temperature in the mid-40s is best for raising salmon eggs to fry.
- Make a note of where the dial is currently set and the tank's water temperature. A picture on your phone is the best method to see where the dial is set.
- If the tank temperature needs to be colder (mid-40s), turn the dial clockwise a few marks. Listen and record if and how often the compressor cycles on. Monitor the temperature and compressor cycles for at least an hour; record the results before making more adjustments.

**Note:** warmer temperatures will result in the salmon developing faster than in colder temperatures.

- If the tank temperature needs to be warmer (mid-40s), turn the dial counterclockwise a few marks. Listen and record if and when the compressor cycles on. Monitor the temperature and compressor for at least an hour; record the results before making more adjustments.
- When the compressor shuts off for a period of time, that means the tank has reached the temperature the dial is set at. Make a mark of the temperature on the thermostat for future reference.
- These tanks were built with refrigerator parts by the Silverdale Kiwanis Club. They are at least 30 years old. Over the years, the refrigerant will need to be refilled to operate properly. If the temperature will not stabilize in the mid-forties, this could be the problem.
- If the compressor does cycle on and off, but the temperature does not change, it may need to have the refrigerant refilled. Please be certain that the mechanical parts are dusted off before the technician arrives. Their time and expertise is donated.
- If the compressor does not cycle on and off at all, unplug and call or text the Clear Creek Task Force IMMEDIATELY, 360 434 7665.

If after following the Troubleshooting Guide you cannot solve the problem, contact the Clear Creek Task Force for repair and/or maintenance ([Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org) or 360 434 7665). The following information will be needed: contact name, school name and address, hours/days available, contact e-mail, phone number, tank number, description of the problem, how long it's been a problem, and the current aquarium temperature. [Info@ClearCreekTrail.org](mailto:Info@ClearCreekTrail.org) or 360-434-7665.

## Project Timeline

Timeline for Teachers - Salmon in the Classroom												
REV August 2018												
Task	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	August
Determine with teaching partner(s) if you are participating in Salmon in the Classroom this school year	•											
Complete registration when link emailed		•										
Inventory supplies for the aquarium		•										
Attend Aquarium Training (tentative)		•	•									
Inspect Aquarium		•										
Clean Aquarium		•										
Complete an Operational Check of the Aquarium		•										
Set up Aquarium at least 1 week before egg pickup				•	•							
Add water at least 1 week before egg pickup				•	•							
Pick up eyed salmon eggs					•							
Salmon Lessons		•	•	•	•	•	•					
Raise salmon					•	•	•					
Monitor aquarium					•	•	•					
Change water and maintain aquarium					•	•	•					
Respond to field trip registration					•							
Make field trip arrangements (transportation, permission slips, etc.)						•						
Release salmon at field trip or on own							•					
Clean and dry aquarium and equipment							•	•				
Store aquarium and supplies safely	•	•						•	•	•	•	•
Report # of salmon released							•	•				

For further information and instruction

**Clear Creek Task Force**

360.434.7665

[info@clearcreektrail.org](mailto:info@clearcreektrail.org)

The Salmon in the Classroom Program was started by the Central Kitsap Kiwanis Club in 1988. It is now a partnership with the Clear Creek Task Force, Silverdale Kiwanis Club, Clean Water Kitsap, Kitsap Public Utility District, United Van Lines, Suquamish Tribe, Air Management Solutions and over 30 local classrooms with the shared goal of enhancing the salmon population in Clear Creek and educating students on the importance of ecosystems.



## Resources - Field Trip Opportunities and Websites

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### Field Trip Opportunities

There are several local opportunities for fall field trips to see salmon returning to local streams.

**Grovers Creek Fish Hatchery:** Located in Indianola and run by the Squamish Tribe, tours are offered in the fall while salmon are returning to spawn,

<https://suquamish.nsn.us/home/departments/fisheries/finfish/salmon-enhancement/>

**Kitsap Salmon Tours:** Limited school field trips to several Kitsap locations to view adult salmon returning to spawn are available through the Kitsap Salmon Tours planning group. Visit the website [www.kitsapsalmon tours.org](http://www.kitsapsalmon tours.org) to inquire about availability.

**Quilcene National Fish Hatchery:** Run by the US Fish and Wildlife Service, the Quilcene National Fish Hatchery offers educational programming and tours of the hatchery,

<https://www.fws.gov/quilcenenfh/Outside.cfm>.

### Websites

Highlighted here are some websites that provide great resources for teachers and students studying salmon and our environment.

**Clear Creek Trail:** Located in Silverdale, the trail is more than just for walking. Citizen science and volunteer opportunities are also available, <https://www.clearcreektrail.org/>.

**Great Peninsula Conservancy:** A local organization working to protect land and water through land conservation, stewardship, and education. Volunteer opportunities available, <https://greatpeninsula.org/>.

**Hood Canal Bridge Ecosystem Impact Assessment:** Long Live the Kings, the Hood Canal Coordinating Council, tribes and state and federal agencies are working to address high steelhead deaths at the Hood Canal Floating Bridge that could also be impacting salmon. This website provides a summary of the program including a 13-minute video explaining the data collected. This resource can provide teachers with background information to share with elementary students at their level, <https://lltk.org/project/hood-canal-bridge/>.

**Hood Canal Salmon Enhancement Group:** Local research and restoration projects related to salmon and habitat. Volunteer opportunities also available,

<https://www.eopugetsound.org/magazine>.



**Methow Beaver Project:** This project located in the Methow Valley of Washington State promotes beavers as a tool for stream restoration, <https://methowbeaverproject.org/beaver-solutions/education-programs/>.

**Puget Sound Institute:** This University of Washington resource provides analysis, research, and communication to inform and connect the science of ecosystem protection, <https://www.pugetsoundinstitute.org/> Resources include:

1. *Encyclopedia of Puget Sound:* The most current science on a variety of topics that can be searched by keyword, type or most recent, <https://www.eopugetsound.org/articles>.
2. *Salish Sea Currents:* This online magazine features stories about the science and research surrounding Puget Sound recovery. The latest stories are posted on the main page; click More Stories for links to previous stories, <https://www.eopugetsound.org/magazine> .

**Salmon Breeding Colors:** photographs of various salmon species and their spawning colors, <https://www.salmonography.com/Salmonid-Topic/Breeding-colors/>.

**Salmon Homecoming Alliance,** <https://salmonhomecoming.org/> : This Seattle nonprofit provides a variety of cultural and educational resources including:

1. *Virtual School Days:* a variety of videos celebrating the return of salmon and Coast Salish cultural activities, <https://salmonhomecoming.org/virtual-school-days/>.
2. *Salmon Homecoming Student Workbook:* at the bottom of the page, click on the link or icon to download the workbook, <https://salmonhomecoming.org/education/>.

**Survive the Sound:** This online interactive game from Long Live the Kings allows you and your students to pick a fish and follow it as it migrates through Puget Sound. Migration information is based on actual tracking data from previous years. The game begins in early May with registration opening sometime in April. <https://lltk.org/project/survive-the-sound/#:~:text=Survive%20the%20Sound%20is%20an%20interactive%20online%20game,of%20imperiled%20steelhead%20and%20the%20challenges%20they%20face>.



## Resources - Good Fit Books

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Several trade books support the learning targets of this investigation. Some may be available in your school's library or you can also access this extensive list developed by the Kitsap Regional Library, <https://www.krl.org/celebrate-salmon-returning-kitsap>. This KRL list includes children's books as well as a few adult books.

**Salmon Forest by Suzuki & Ellis:** One fall day, Kate goes with her father, a fish biologist, to the river where he works – a river in the Pacific rain forest – the “salmon forest,” as he calls it. Together they watch the sockeye salmon returning to the river to spawn, and witness a bear scooping up a salmon. Next, Kate and her dad run into a Native boy named Brett and his family fishing at a pool in the river. From her adventures, Kate discovers how the forest and the salmon need each other and why the forest is called the salmon forest. David Suzuki and Sarah Ellis's charming and informative text and Sheena Lott's watercolors magically evoke the spirit and mystery of the West Coast rain forest.

**Salmon by Ron Hirschi:** You're watching a stream, when all of a sudden, SPLASH! A fish jumps up out of the water and heads . . . upstream? Salmon are incredible fish that make a journey upstream each year to spawn, or reproduce. Found in the cold, dark waters of the northern Pacific Ocean coasts from California to Alaska and from Japan to Siberia, these fascinating creatures can grow to weigh as much as 100 pounds! With breathtaking photographs and fact-filled text, watch salmon grow from tiny eggs, to small fry, to jumping fish.



## Resources - Performance Task - Saving Our Salmon - Water Flow

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### Method

Teacher led

### Time Required

Part 1: 60-90 minutes

Part 2: 70 minutes

### Materials

Copies from provided blackline masters of:

- Performance Task - Saving Our Salmon - Water Flow

### Background Information

This is the second of two ELA Performance Tasks included in this curriculum. A pdf of this task is included in the Blackline Masters. These are a good fit for supporting the CCSS ELA skills students need to access the science concepts worked with in Salmon in the Classroom. They can be used to provide additional research while learning about salmon or after investigations as a way to continue to develop your students' conceptual understanding of the concepts addressed.

These performance tasks use environmental problems or issues as the context while students apply English language arts (ELA) skills of reading, writing and researching to complete the work. Performance tasks are tailored to assist educators in integrating locally relevant, complex texts with the Next Generation Science Standards (NGSS) and Common Core while providing frameworks for constructing meaningful field experiences for students.

These performance tasks are included with permission from Pacific Education Institute (PEI) based in Olympia, Washington. PEI has other performance tasks available for download at <https://pacificeducationinstitute.org/download-performance-task/g35/?pid=g35&newsigup=y>.

### Procedures

- Follow the procedures in the Performance Task



## Resources: Salmon Field Guide, Kitsap Edition

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Completed in 2016, this comprehensive guide provides information on the salmon life cycle, habitat, and biology as well as cultural connections and some Puget Sound history.

The guide can be accessed in a variety of ways:

- If you have a salmon tank in your school, there should be a copy of the Salmon Field Guide, Kitsap Edition, with the tank.
- Copies of the Salmon Field Guide, Kitsap Edition, are available for teachers by contacting Kitsap 1, [help@kitsap1.com](mailto:help@kitsap1.com), 360-337-5777. One copy per teacher.
- A class set of the Salmon Field Guides, Kitsap Edition, is available for check out by contacting Kitsap 1, [help@kitsap1.com](mailto:help@kitsap1.com), 360-337-5777.
- The Salmon Field Guide, Kitsap Edition and several posters from the Guide are also available online. Although the Guide is copyrighted, the posters listed can be printed and reproduced for educational purposes.

**NOTE:** *Some of these posters are already included in the blackline masters section of this curriculum.*

- Salmon Field Guide, Kitsap Edition Flipbook, <http://online.anyflip.com/nhxs/vhmm/mobile/index.html#p=1>
- Salmon Life Cycle, [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Salmonid\\_Life\\_Cycle.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Salmonid_Life_Cycle.pdf)
- Salmon Mortality Pyramid [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Salmon\\_Mortality\\_Pyramid.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Salmon_Mortality_Pyramid.pdf)
- Salmon in Kitsap Streams [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Salmon\\_in\\_KC\\_Streams.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Salmon_in_KC_Streams.pdf)
- Salmon Identification Poster (11 x 17) [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Salmon\\_ID\\_Poster.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Salmon_ID_Poster.pdf)
- The Big Three (stream bugs) [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Salmon\\_ID\\_Poster.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Salmon_ID_Poster.pdf)
- Stream Habitat [https://www.kitsapgov.com/pw/Documents/Kitsap\\_Salmon\\_Guide\\_Stream\\_Habitat.pdf](https://www.kitsapgov.com/pw/Documents/Kitsap_Salmon_Guide_Stream_Habitat.pdf)





## Resources - Videos

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### Kitsap Salmon Tours

Kitsap Salmon Tours are coordinated by many local organizations. Over the years, various videos relating to salmon have been produced that may be a great addition to instruction about salmon. Many of these videos are also available on the Kitsap Salmon Tours website, [www.kitsapsalmon tours.org](http://www.kitsapsalmon tours.org).

- **Kitsap Salmon Tours Playlist, 2020.** Kitsap County Public Works has a Kitsap Salmon Tours You Tube playlist includes videos about the salmon life cycle, salmon and beaver dams, and several short videos showing specific salmon behaviors in local streams. <https://www.youtube.com/playlist?list=PLQJx9SwwfqRoY0SVNpsiyzfTnLN4eg5LX>
- **Kitsap Salmon Tours Webinar Series, 2020.** A series of recorded webinars from WSU Extension Kitsap and Washington Sea Grant.
  - *Intro to Salmon and Their Life Cycle.* Learn about salmon, their amazing migratory journey and their anatomy that helps them through their migration. Includes a salmon dissection. [https://www.youtube.com/watch?v=KbTFn8A4\\_1M&feature=emb\\_title](https://www.youtube.com/watch?v=KbTFn8A4_1M&feature=emb_title)
  - *Water Quality and Salmon.* Learn about research being conducted about salmon pre-spawn mortality in Puget Sound streams and rivers as well as how the Kitsap Conservation District supports local water quality. [https://www.youtube.com/watch?v=6LKOMVm6yh0&feature=emb\\_title](https://www.youtube.com/watch?v=6LKOMVm6yh0&feature=emb_title)
  - *Climate Threats, Cultural, Humans and Economic Aspects.* Learn how salmon are affected by climate threats and humans impacts, as well as the local work being done in Kitsap County to improve salmon habitat. <https://www.youtube.com/watch?v=7Xb7JSp5TRI&t=8s>
- **Kitsap Salmon Report, 2020.** Kitsap Regional Library Youth Librarians teamed with the Clear Creek Trail, sharing what salmon need to survive. [https://www.youtube.com/watch?v=F2rORLOShEgU&feature=emb\\_title](https://www.youtube.com/watch?v=F2rORLOShEgU&feature=emb_title)
- **Great Peninsula Conservancy, Grovers Creek Black Bear and Chinook salmon, 2020.** Watch as a bear and her cubs get lunch at a local creek in Kitsap County. <https://vimeo.com/98827663>
- **Salmon and Beaver Dams, Kitsap Salmon Tours 2019.** This 360° video from Olympic College Film School shows how salmon navigate beaver dams. Be sure to use your mouse to move around and look wherever you and your students want to! <https://www.youtube.com/watch?v=lve-QiJyQ5U&feature=youtu.be>
- **Kitsap Salmon Tours 2018.** Kitsap Salmon Tours and salmon viewing. <https://www.youtube.com/watch?v=-8C-6ShWraw>



### Local Videos

Several local groups and agencies have salmon-related videos available on You Tube.

- **Kitsap Conservation District (KCD) videos.** KCD works cooperatively with private landowners to help preserve our natural resources.  
<https://www.youtube.com/user/KitsapCD/videos>
- **Steelhead Eggs Hatching, US Fish and Wildlife Service.** Steelhead are sea-run versions of rainbow trout and have a life cycle similar to salmon. This video from the Quilcene Hatchery shows eggs hatching to alevin.  
<https://www.youtube.com/watch?v=dnX4ZKvYTHs>
- **Coho Salmon and Copper:** researchers from WSU show how small amounts of dissolved copper in water (usually from copper brake pads) can deaden a salmon's sense of smell, which normally alerts the fish to the presence of predators. Review this video and the text below it before showing to students. Note that the top tank has no copper and the bottom tank has 10 micrograms/liter (10 parts/billion) of copper. The green dot at the top will change to red once copper has been introduced. Have your students observe what happens to the coho salmon fry. Which is more likely to get seen, and most likely eaten, by a predator? (HINT: the one that keeps moving).  
[https://www.youtube.com/watch?v=VkuwnYYEIIA&feature=emb\\_logo](https://www.youtube.com/watch?v=VkuwnYYEIIA&feature=emb_logo)
- **Bringing Clear Creek Back to Life, 2018.** Overview of how development in Silverdale impacted Clear Creek and recent projects completed to restore the creek and habitat. *NOTE: The Clear Creek Floodplain Project area is where students raising salmon as part of the Clear Creek Salmon in the Classroom program will release their salmon.*  
<https://www.youtube.com/watch?v=OAwakWFGcMs&list=PLQJx9SwwfqRph9MGU29BQPyXeLHvkWXbq&index=5>.
- **Manchester Stormwater Park, 2016.** This public park provides water quality treatment of stormwater for approximately 100 acres of the Manchester community, improving water quality for salmon and other aquatic life.  
<https://www.youtube.com/watch?v=k6CQbin4czU&list=PLQJx9SwwfqRph9MGU29BQPyXeLHvkWXbq&index=6>
- **Bucklin Hill Bridge Project, 2016.** The replacement of 2 six-foot culverts with a 240' bridge not only improved traffic in Silverdale, but it provided habitat improvement for the aquatic life living in Clear Creek.  
<https://www.youtube.com/watch?v=yboMhZShNus&list=PLQJx9SwwfqRph9MGU29BQPyXeLHvkWXbq&index=2>
- **Stillhope Productions.** John Williams is a local videographer. His short videos on nature and the environment are a great learning resource for you and your students.  
<https://vimeo.com/stillhope/videos/page:1/sort:date>. A few videos geared specifically for the younger age group include:



- **Is This Where Puget Sound Starts?**, 4 minutes. Ron Hirschi, local biologist and author, explores 2 creeks in Poulsbo. <https://vimeo.com/98827239>
- **Who Uses the Rain?**, 4 minutes. See how water flows from Klahowya Secondary school in Central Kitsap down to Chico Creek and how animals and runoff have an impact on the stream. <https://vimeo.com/98827663>
- **Who Swims in the Rain?**, 4 minutes. Students from Olalla Elementary School share ways to protect streams like Olalla Creek, <https://vimeo.com/98826947>.
- **The Hidden Treasures of Kitsap County, 2008.** Join Community Forester Jim Trainer to learn about trees of Kitsap County and their cultural and habitat importance. <https://www.bing.com/videos/search?q=jim+trainer+bremerton+video&docid=607998383985132390&mid=8CF35F011799237A664A8CF35F011799237A664A&view=detail&FORM=VIRE>

### Deep Look Series KQED and PBS

This series, created by KQED San Francisco and presented by PBS Digital Studios, has an amazing variety of short (3-5 minute) ultra-HD (4K) videos on a variety of natural and animal occurrences—but seen very closely. Here are a few that connect to salmon and streams:

- **There's Something Very Fishy About These Trees**  
<https://www.youtube.com/watch?v=rZWWh5acbE&feature=youtu.be>.  
Take a close look at how salmon impact the vegetation all around streams.
- **Sticky. Stretchy. Waterproof. The Amazing Underwater Tape of the Caddisfly**  
<https://www.youtube.com/watch?v=Z3BHzDHoYo&list=PLdKlciEDdCQDxBs0SZgTMqhszst1jqZhp&index=82&t=0s>.  
See how these bugs that salmon may eat build their homes.
- **Why Beavers are the Smartest Thing in Fur Pants**  
<https://www.youtube.com/watch?v=Zm6X77ShHa8>.  
Learn about beavers, their history, and how they support other wildlife.
- **This is Why Water Striders Make Terrible Lifeguards**, <https://www.youtube.com/watch?v=E2unnSK7WTE>.  
How do water striders walk on water and what do they eat? Also makes connections to properties of water like surface tension.
- **A Baby Dragonfly's Mouth Will Give You Nightmares**  
[https://www.youtube.com/watch?v=EHo\\_9wnnUTE](https://www.youtube.com/watch?v=EHo_9wnnUTE).  
Learn about the unique parts of a dragonfly nymph's mouth and watch it in action. (Another stream critter salmon may eat!)



## Resources - Vocabulary List

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These vocabulary words are important to understanding salmon. Those words with a \* can also be found on the Washington Comprehensive Assessment of Science vocabulary list.

The vocabulary words are listed in two ways:

1. Alphabetical
2. By topic relating to needs of salmon as well as field trip stations at the Clear Creek Salmon in the Classroom field trips.

### Alphabetical

- **acclimated:** get used to new conditions.
- **adipose fin:** small fin on back between dorsal and tail with no known function.
- **adult:** salmon living in the ocean waters for 1-7 years.
- **advantage\*:** a better chance or position.
- **alevin:** newly spawned salmon or trout that still have the yolk sac attached. Salmon is dependent on yolk sac for nutrition. Alevins are usually buried within the gravel of the stream bottom.
- **anadromous:** fish born in freshwater that spends most of its life in the sea/ocean and then returns to freshwater to spawn (e.g. salmon, sturgeon, smelt, shad, striped bass)
- **anal fin:** help fish to keep its balance and not tip.
- **aquarium:** a glass/plastic container (tank, bowl or the like) in which fish or other living aquatic animals or plants live or are kept.
- **behavior\*:** the typical actions of a person, animal, thing or group, either in general or in certain situations.
- **benthic:** relating to the bottom of a body of water or the organisms living there.
- **bioaccumulation:** process by which toxic chemicals, industrial waste, etc. gradually accumulate or build up in living tissue.
- **bioindicators of stream health:** macroinvertebrates living in a stream can provide information about the health of the stream (healthy vs. unhealthy).
- **biological monitoring:** continual examination of biological specimens taken from an environment (such as air, water, food) or from a body (such as blood, urine, body tissue) for identification of health risks or for course of therapy.
- **camouflage\*:** a way of hiding something by covering or coloring it so it looks like its surroundings.
- **caudal fin:** tail fin used for jumping and swimming.
- **cause\*:** something or someone that brings about a result of effect.
- **Celsius:** denoting a scale of temperature in which water freezes at 0 degrees.



- **characteristic\***: having to do with a typical or special quality of a person, animal, group or thing.
- **chemical monitoring**: checking certain characteristics of water (dissolved oxygen, temperature, pH, etc.) using chemical tests.
- **confluence**: a place where two (2) rivers or streams join to become one (1).
- **culvert**: a tunnel (usually a pipe) carrying a stream or open drain under a roadway or railway.
- **cumulative**: increasing or growing by accumulation or successive additions.
- **deposition**: geological process in which sediments, soil, and rocks are added to a landform or land mass through forces of erosion.
- **disadvantage\***: a condition or situation that makes it more difficult to succeed.
- **dissolved oxygen**: tiny bubbles of oxygen in a gas form mixed in the water, and available for aquatic organisms to use.
- **diversity**: showing a lot of variety.
- **dorsal fin**: keeps the fish upright and controls direction.
- **egg**: fully ripe released egg in freshwater (Roe are the internal egg masses in the ovaries of a female fish.)
- **environment\***: all things together that surround animals and humans in the natural world, including the air, the water, and the soil.
- **environmental stressor**: something in the environment that can negatively impact an organism (e.g. pollution, extra sediment from erosion, urban and agriculture runoff, sewage, clearing land, alien/non-native species, channelization, temperature change).
- **erosion\***: the process by which water, ice, wind, and gravity moves fragments of rock and soil.
- **estuary**: the area where the fresh water from a river or stream meets the salt water of a sea. Estuaries experience tidal flows, so the water is a changing mixture of salt and fresh water.
- **evidence\***: something that gives proof or reason to believe.
- **Fahrenheit**: denoting a scale of temperature in which water freezes at 32 degrees.
- **fertilizer**: a chemical or natural substance added to soil to help plants grow.
- **fins**: exterior parts of a fish's body used to move it through the water.
- **flood plain**: flat land bordering a river that is naturally subject to flooding.
- **food chain**: linear network of links of organisms in an ecosystem in which each link feeds on the one before it and then is fed upon by the one after it. The first link is a **producer** (plant) and the rest are **consumers** (animals/organisms that feed on other animals/organisms). The food chain is a diagram showing how food energy is moved/transferred from one organism to another.
- **food web**: intertwining network of different food chains that show feeding relationships by which energy and nutrients are passed/transferred from one organism to another.



- **forage**: to search for food.
- **fry**: young salmon who have absorbed the yolk sac and have emerged from the gravel nest (redd). Salmon emerge in the spring when water temperatures reach about 50F and begin feeding on invertebrates.
- **function\***: the purpose or role that an object or a person fulfills or is suited for.
- **gills**: respiratory organ found in many aquatic organisms that filters oxygen from the water.
- **graph\***: a diagram that shows a relationship between two or more changing things by lines, bars, dots, or portions of a circle.
- **groundwater\***: water held underground in soil or pores and crevasses in rock. It completely fills the air spaces between rock and soil particles.
- **habitat\***: the natural home or environment where an animal, plant, or other organism lives.
- **hatchery**: a place where people raise and hatch eggs of fish, chickens, etc. under artificial conditions to raise young.
- **impact\***: a strong and powerful effect.
- **impervious surface**: a surface that does not allow/permit liquid (e.g. water) to pass through or be absorbed which leads to runoff.
- **insensitive or not sensitive**: organisms that can live and thrive in high levels of pollution or environmental stressors.
- **interaction\***: the action or influence of people, groups, or things on another.
- **invasive plants**: not a native to a location and usually tends to spread to cause damage to the environment, human economy, or human health.
- **invertebrate**: organism or animal with no backbone.
- **investigation\***: to study by close examination and structured inquiry.
- **large woody debris**: trees, logs, root wads, and large tree branches that fall into streams and interact with the water, sediment, and organisms in a channel of water.
- **larvae**: immature phase of complete metamorphosis for a bug's life cycle. Larva generally do not look like the adult. Maggot is a term used for larva of some flies.
- **lateral line**: a sensory organ along the side of the fish used to detect motion and vibration.
- **life cycle\***: the sequence of changes a living thing goes through as it grows and develops.
- **macro**: able to see with the naked eye.
- **macroinvertebrate**: organism that lives underwater in the streams and rivers that lacks a backbone, and can be seen by the naked eye (e.g. insects, worms, crustaceans, mollusks, etc. Also, aquatic critters such as mayflies, stoneflies, caddisflies, dragonflies, rat-tailed maggots, scuds, snails, leeches.).
- **marine\***: relating to the sea or ocean.
- **meandering**: a winding stream, path, or course (not straight).



- **migration:** seasonal movement of animals from one region to another. Migration is usually a result of changing temperatures, food supply, or amount of daylight. Salmon migrate from freshwater to salt water and then later from salt water to fresh water to spawn.
- **milt:** a milk-colored substance the male releases into a red to fertilize the female's eggs.
- **nares:** fish nostrils used for smelling, but not breathing.
- **native plants:** plants that occur naturally in a particular region or ecosystem.
- **nymph:** immature phase of incomplete metamorphosis for a bug's life cycle. Nymphs generally resemble the adult but are smaller and do not have wings.
- **observation\*:** the act or an instance of perceiving the environment through one of the senses; a comment or remark.
- **offspring\*:** the child or young of a particular human, animal, or plant.
- **parr marks:** dark vertical marks on the sides of young salmon that help them hide.
- **parts per million (ppm):** usually describes the concentration of something in water or soil with how many parts out of a million. 1ppm=1mg of something per liter of water OR 1mg of something per kilogram of soil.
- **pectoral and pelvic fins:** used for turning, backing up, stopping, and balancing.
- **pervious or permeable surfaces:** allow water to percolate into the soil to filter out pollutants and recharge the water table (groundwater).
- **pesticides:** a chemical used to kill harmful animals or plants. Pesticides include fungicides, herbicides, insecticides, and rodenticides.
- **pH:** measure of hydrogen ion concentration or the acidity or alkalinity of a solution on a scale from 0 to 14. Less than 7 is acidic, more than 7 is alkaline, and 7 is neutral.
- **pollution\*:** the presence of a substance or thing that has harmful or poisonous effects on the environment.
- **redd:** gravel nest made by the spawning female with her tail in a freshwater stream.
- **riffle:** a rocky, shallow part of a stream with rough water.
- **riparian zone or habitat:** area bordering a river or other bodies of water that include floodplains and water-loving plants.
- **runoff\*:** the draining away of water and the substances carried in it from the surface of an area or land. Also see Stormwater runoff.
- **salmonid:** any elongated, bony fish of the family Salmonidae such as salmon and trout.
- **scales:** small, hard plates that cover the body for protection.
- **Scientific diagram:** a simple, clear representation that explains the parts or operation of something, a scientific process, an experiment, or equipment.
- **sediment\*:** small, solid particles of material from rock or organisms which are moved by water or wind resulting in erosion and deposition.



- **sense receptor\***: a part of the body that takes in information and sends it to the brain.
- **sensitive**: organisms that are easily impacted/changed by environmental stressors which may cause infertility or death.
- **slime**: a clear, slippery substance that covers a salmon's body and protects it.
- **smolt**: silvery-colored young, juvenile salmon migrating from freshwater to saltwater so their internal organs can change and adapt from fresh to salt water.
- **spawning**: when a fish releases or deposits eggs or milt. The female digs a red in the stream bottom and deposits her eggs; the male then covers the eggs with milt to fertilize them.
- **species\***: a group of living things that can mate with one another but not with those of other groups.
- **stormwater runoff**: the water and substances carried from the surface after a storm event. Also see Runoff.
- **structure\***: a thing made up of several parts joined together in a certain way.
- **survive\***: to continue to live despite serious threat to one's life.
- **temperature\***: the measure of warmth or coldness of an object or substance with reference to some standard value or scale.
- **trait\***: a characteristic or quality that makes a person or animal different from others.
- **turbidity**: a measure of how clear the water is.
- **water or hydrologic cycle**: the continuous movement of water on, above, and below the surface of the earth through evaporation, condensation, precipitation, and transpiration; the natural sequence through which water passes into the atmosphere as water vapor, precipitates to earth as a liquid or solid form, and ultimately returns to the atmosphere through evaporation.
- **water quality**: describes the condition of water with respects to its chemical, physical, and biological characteristics.
- **watershed**: area of land that drains water and everything in the water into the same body of water (creek, river, lake, bay, etc.).
- **wetland\***: areas that are saturated by surface or groundwater much of the year; where water covers the soil or is present either at or near the surface of the soil all year or varying periods of time during the year. Wetlands contain plants and soils that have adapted to wet or soggy conditions. Examples of wetlands are estuaries, marshes, swamps, bogs.
- **zooplankton**: tiny animals that salmon feed on during the ocean stage of life.



## Sorted by Field Trip Station - Clear Creek Salmon in the Classroom

### Stream Bugs

- ***benthic***: relating to the bottom of a body of water or the organisms living there.
- ***bioindicators of stream health***: macroinvertebrates living in a stream can provide information about the health of the stream (healthy vs. unhealthy).
- ***biological monitoring***: continual examination of biological specimens taken from an environment (such as air, water, food) or from a body (such as blood, urine, body tissue) for identification of health risks or for course of therapy.
- ***chemical monitoring***: checking certain characteristics of water (dissolved oxygen, temperature, pH, etc.) using chemical tests.
- ***diversity***: showing a lot of variety.
- ***environmental stressor***: something in the environment that can negatively impact an organism (e.g. pollution, extra sediment from erosion, urban and agriculture runoff, sewage, clearing land, alien/non-native species, channelization, temperature change).
- ***insensitive or not sensitive***: organisms that can live and thrive in high levels of pollution or environmental stressors.
- ***invertebrate***: organism or animal with no backbone.
- ***larvae***: immature phase of complete metamorphosis for a bug's life cycle. Larva generally do not look like the adult. Maggot is a term used for larva of some flies.
- ***macro***: able to see with the naked eye.
- ***macroinvertebrate***: organism that lives underwater in the streams and rivers that lacks a backbone, and can be seen by the naked eye (e.g. insects, worms, crustaceans, mollusks, etc. Also, aquatic critters such as mayflies, stoneflies, caddisflies, dragonflies, rat-tailed maggots, scuds, snails, leeches.).
- ***nymph***: immature phase of incomplete metamorphosis for a bug's life cycle. Nymphs generally resemble the adult but are smaller and do not have wings.
- ***pesticides***: a chemical used to kill harmful animals or plants. Pesticides include fungicides, herbicides, insecticides, and rodenticides.
- ***pollution\****: the presence of a substance or thing that has harmful or poisonous effects on the environment.
- ***riffle***: a rocky, shallow part of a stream with rough water.
- ***runoff\****: the draining away of water and the substances carried in it from the surface of an area or land. Also see Stormwater runoff.
- ***sensitive***: organisms that are easily impacted/changed by environmental stressors which may cause infertility or death.
- ***scientific diagram***: a simple, clear representation that explains the parts or operation of something, a scientific process, an experiment, or equipment.
- ***stormwater runoff***: the water and substances carried from the surface after a storm event. Also see Runoff.



## Salmon Release

- **acclimated:** get used to new conditions.
- **adipose fin:** small fin on back between dorsal and tail with no known function.
- **adult:** salmon living in the ocean waters for 1-7 years.
- **alevin:** newly spawned salmon or trout that still have the yolk sac attached. Salmon is dependent on yolk sac for nutrition. Alevins are usually buried within the gravel of the stream bottom.
- **anal fin:** help fish to keep its balance and not tip.
- **caudal fin:** tail fin used for jumping and swimming.
- **confluence:** a place where two (2) rivers or streams join to become one (1).
- **dorsal fin:** keeps the fish upright and controls direction.
- **egg:** fully ripe released egg in freshwater. (Roe are the internal egg masses in the ovaries of a female fish.)
- **fertilizer:** a chemical or natural substance added to soil to help plants grow.
- **fins:** exterior parts of a fish's body used to move it through the water.
- **forage:** to search for food.
- **fry:** young salmon who have absorbed the yolk sac and have emerged from the gravel nest (redd). Salmon emerge in the spring when water temperatures reach about 50F and begin feeding on invertebrates.
- **gills:** respiratory organ found in many aquatic organisms that filters oxygen from the water.
- **hatchery:** a place where people raise and hatch eggs of fish, chickens, etc. under artificial conditions to raise young.
- **lateral line:** a sensory organ along the side of the fish used to detect motion and vibration.
- **marine\*:** relating to the sea or ocean.
- **migration:** seasonal movement of animals from one region to another. Migration is usually a result of changing temperatures, food supply, or amount of daylight. Salmon migrate from freshwater to salt water and then later from salt water to fresh water to spawn.
- **milt:** a milk-colored substance the male releases into a red to fertilize the female's eggs.
- **nares:** fish nostrils used for smelling, but not breathing.
- **parr marks:** dark vertical marks on the sides of young salmon that help them hide.
- **pectoral and pelvic fins:** used for turning, backing up, stopping and balancing.
- **redd:** gravel nest made by the spawning female with her tail in a freshwater stream.
- **riffle:** a rocky, shallow part of a stream with rough water.
- **salmonid:** any elongated, bony fish of the family Salmonidae such as salmon and trout.



- **scales:** small, hard plates that cover the body for protection.
- **slime:** a clear, slippery substance that covers a salmon's body and protects it.
- **smolt:** silvery-colored young, juvenile salmon migrating from freshwater to saltwater so their internal organs can change and adapt from fresh to salt water.
- **spawning:** when a fish releases or deposits eggs or milt. The female digs a red in the stream bottom and deposits her eggs; the male then covers the eggs with milt to fertilize them.
- **zooplankton:** tiny animals that salmon feed on during the ocean stage of life.

## Water Quality

- **bioaccumulation:** process by which toxic chemicals, industrial waste, etc. gradually accumulate or build up in living tissue.
- **biological monitoring:** continual examination of biological specimens taken from an environment (such as air, water, food) or from a body (such as blood, urine, body tissue) for identification of health risks or for course of therapy.
- **Celsius:** denoting a scale of temperature in which water freezes at 0 degrees.
- **chemical monitoring:** checking certain characteristics of water (dissolved oxygen, temperature, pH, etc.) using chemical tests.
- **cumulative:** increasing or growing by accumulation or successive additions.
- **dissolved oxygen:** tiny bubbles of oxygen in a gas form mixed in the water, and available for aquatic organisms to use.
- **Fahrenheit:** denoting a scale of temperature in which water freezes at 32 degrees.
- **gills:** respiratory organ found in many aquatic organisms that filters oxygen from the water.
- **groundwater\*:** water held underground in soil or pores and crevasses in rock.
- **parts per million (ppm):** usually describes the concentration of something in water or soil with how many parts out of a million. 1ppm=1mg of something per liter of water OR 1mg of something per kilogram of soil.
- **pesticides:** a chemical used to kill harmful animals or plants. Pesticides include fungicides, herbicides, insecticides, and rodenticides.
- **pH:** measure of hydrogen ion concentration or the acidity or alkalinity of a solution on a scale from 0 to 14. Less than 7 is acidic, more than 7 is alkaline, and 7 is neutral.
- **pollution:** the presence of a substance or thing that has harmful or poisonous effects on the environment.
- **riffle:** a rocky, shallow part of a stream with rough water.
- **temperature\*:** the measure of warmth or coldness of an object or substance with reference to some standard value or scale.
- **turbidity:** a measure of how clear the water is.



- **water or hydrologic cycle:** the continuous movement of water on, above, and below the surface of the earth through evaporation, condensation, precipitation, and transpiration; the natural sequence through which water passes into the atmosphere as water vapor, precipitates to earth as a liquid or solid form, and ultimately returns to the atmosphere through evaporation.
- **water quality:** describes the condition of water with respects to its chemical, physical, and biological characteristics.

## Habitat

- **anadromous:** fish born in freshwater that spends most of its life in the sea/ocean and then returns to freshwater to spawn (e.g. salmon, sturgeon, smelt, shad, striped bass).
- **aquarium:** a glass/plastic container (tank, bowl or the like) in which fish or other living aquatic animals or plants live or are kept.
- **confluence:** a place where two (2) rivers or streams join to become one (1).
- **culvert:** a tunnel (usually a pipe) carrying a stream or open drain under a roadway or railway.
- **deposition:** geological process in which sediments, soil, and rocks are added to a landform or land mass through forces of erosion.
- **erosion\*:** the process by which water, ice, wind, and gravity moves fragments of rock and soil.
- **estuary:** the area where the fresh water from a river or stream meets the salt water of a sea. Estuaries experience tidal flows, so the water is a changing mixture of salt and fresh water.
- **flood plain:** flat land bordering a river that is naturally subject to flooding.
- **food chain:** linear network of links of organisms in an ecosystem in which each link feeds on the one before it and then is fed upon by the one after it. The first link is a **producer** (plant) and the rest are **consumers** (animals/organisms that feed on other animals/organisms). The food chain is a diagram showing how food energy is moved/transferred from one organism to another.
- **food web:** intertwining network of different food chains that show feeding relationships by which energy and nutrients are passed/transferred from one organism to another.
- **groundwater:** water below the Earth's surface that completely fills the air spaces between rock and soil particles.
- **habitat\*:** the natural home or environment where an animal, plant, or other organism lives.
- **impervious surface:** a surface that does not allow/permit liquid (e.g. water) to pass through or be absorbed which leads to runoff.



- **invasive plants:** not a native to a location and usually has a tendency to spread to cause damage to the environment, human economy, or human health.
- **large woody debris:** trees, logs, root wads, and large tree branches that fall into streams and interact with the water, sediment, and organisms in a channel of water.
- **meandering:** a winding stream, path, or course (not straight).
- **native plants:** plants that occur naturally in a particular region or ecosystem.
- **pervious or permeable surfaces:** allow water to percolate into the soil to filter out pollutants and recharge the water table (groundwater).
- **riffle:** a rocky, shallow part of a stream with rough water.
- **riparian zone or habitat:** area bordering a river or other bodies of water that include floodplains and water-loving plants.
- **sediment\*:** small, solid particles of material from rock or organisms which are moved by water or wind resulting in erosion and deposition.
- **watershed:** area of land that drains water and everything in the water into the same body of water (creek, river, lake, bay, etc.).
- **wetland\*:** areas that are saturated by surface or groundwater much of the year; where water covers the soil or is present either at or near the surface of the soil all year or varying periods of time during the year. Wetlands contain plants and soils that have adapted to wet or soggy conditions. Examples of wetlands are estuaries, marshes, swamps, bogs.

\*these words can be found on the Washington Comprehensive Assessment of Science vocabulary list.