Salmon in the Schools-Seattle 2023-2024 Teacher Handbook

Welcome aboard Seattle Salmon in the Schools (SIS-SEATTLE)! Whether this is your first year or your fifteenth as a salmon teacher or tank volunteer, this handbook is your go-to resource for the entire experience.

The salmon-rearing opportunities that SIS-SEATTLE makes possible help students in public and private schools throughout Seattle develop stewardship and environmental literacy. We provide expertise and resources for teachers to create hands-on learning experiences and for volunteers to help maintain healthy tanks (see *sisseattle.org/*). We also ensure that schools have Washington Department of Fish and Wildlife (WDFW) permits to get salmon eggs and to release fry into state waters.

TOPIC ..... PAGE

APPENDICES

CONTACTS

LEADERSHIP TEAM

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PARTICIPATING HATCHERIES

Issaquah Salmon Hatchery: 125 W Sunset Way, Issaquah (425-391-9094)
Soos Creek Hatchery: 13030 Auburn-Black Diamond Road, Auburn (253-931-3950)
Grovers Creek Hatchery: 23175 Indianola Road NE, Poulsbo (360-598-3142)

PARTICIPATING WATERSHEDS GROUPS

Fauntleroy: *fauntleroywatershed.org*
Piper's: *carkeekwatershed.org*
Thornton: *thornton-creek-alliance.org*

If you know of another school that might like to participate in this program, refer the teacher or principal to the "Interested?" tab at *sisseattle.org* to submit an interest form. Schools seeking to join the program must contact us by APRIL 15 for the following school year.

Thanks to the Washington Department of Fish and Wildlife, Seattle Public Utilities, Islandwood, the Fauntleroy Watershed Council, the Carkeek Watershed Community Action Project, and staff at participating hatcheries for expertise in developing this handbook. Also thanks to Jefté Sanchez, Tom Trulin, and the West Seattle Blog *for cover photos.* ***Your feedback is welcome!! Please contact us through sisseattle.org.***

FINANCIAL ASSISTANCE

SIS-SEATTLE is maintained through volunteer effort, in-kind support, and funding from Seattle Public Utilities and private donations. Depending on available funds, we assist with expenses as follows:

Equipment and Repairs	0%-40% FRL students	41%- 100% FRL students
Basic set-up (tank, chiller, stand, filter unit, etc.)	Sliding scale	
Chiller repairs	Sliding scale	
Maintenance and supplies	Paid by school	No charge

Transportation subsidies for release field trips are offered according to free or reduce lunch percentage. Your area coordinator can tell you what to expect.

KEYS TO SUCCESS

Welcome to the exciting adventure of raising salmon! Pacific salmon are key to healthy rivers and forests in the Pacific Northwest, and the salmon you and your students will rear are part of the big picture of salmon recovery and watershed stewardship.

If this is your first year as an SIS-SEATTLE teacher, here are the most important keys to your success:

- ★ **ENLIST HELP:** We STRONGLY advise that you enlist a **tank volunteer** or two to help throughout your salmon project, from tank preparation through release. These volunteers can do water changes, help students monitor tank conditions, and generally give a hand so that you can teach, manage this project, *and* keep pace in your classroom. Find a sample volunteer recruitment flyer in Appendix G. If you have difficulty recruiting a volunteer, contact your area coordinator for ideas or referrals.
- ★ **PARTICIPATE IN OUR WORKSHOP:** You and your tank volunteer(s) will learn how to set up and maintain your tank and how to incorporate salmon study into multiple curriculum units.
- ★ **READ THIS HANDBOOK!!** It will answer most of your questions. Share it with your tank angel and keep a copy close to your tank.
- ★ **GET TO KNOW YOUR AREA COORDINATOR:** Meet in person if you can, before you set up your tank or start planning your salmon unit.
- ★ **CALL FOR HELP IMMEDIATELY:** Ask for technical support if you suspect something is wrong with your equipment, if water-quality takes a nosedive, or if fish seem in distress. We are here to support you!
- ★ **GET YOUR WHOLE SCHOOL INVOLVED:** Plan to engage not only your students but also the principal; science, art, and math specialists; custodial staff; other teachers; and parents. Your mentor can share ideas and we know what other salmon teachers have reported as effective.

BE SURE TO LET YOUR AREA COORDINATOR KNOW
IF SOMEONE NEW TAKES OVER AS LEAD SALMON TEACHER AT YOUR SCHOOL.

REARING TIMELINE

Following is the approximate timeline if you are rearing coho or chum salmon. If you are rearing chinook, those eggs will arrive about two months earlier, for spring release.

	Sept	Oct	Nov	Dec	Jan		Feb	Mar	Apr	May
Recruit tank volunteer(s). Take spawning fieldtrip. Schedule presentations.										
Participate in SIS workshop.										
Set up tank.										
Prepare students.										
Get eggs. Begin observing changes.										
Watch eggs hatch.										
Feed fry.										
Monitor water quality.										
Schedule release.										
Release fry; observe habitat.										
File report. Sign up for next year.										

EQUIPMENT & SUPPLIES

You will find everything except chillers at your local aquarium or pet shop. Full set-ups range from $1,200 to $2,000. Yearly maintenance and replacement costs for consumables will be less than $75. Wand chiller repairs average $300 per occurrence, so we are shifting away from them to in-line pump systems. SIS-SEATTLE may be able to help with equipment and supply expenses; talk with your area coordinator. The diagrams that follow show typical setups for a 55-gallon tank on a stand, with wand and inline chillers.

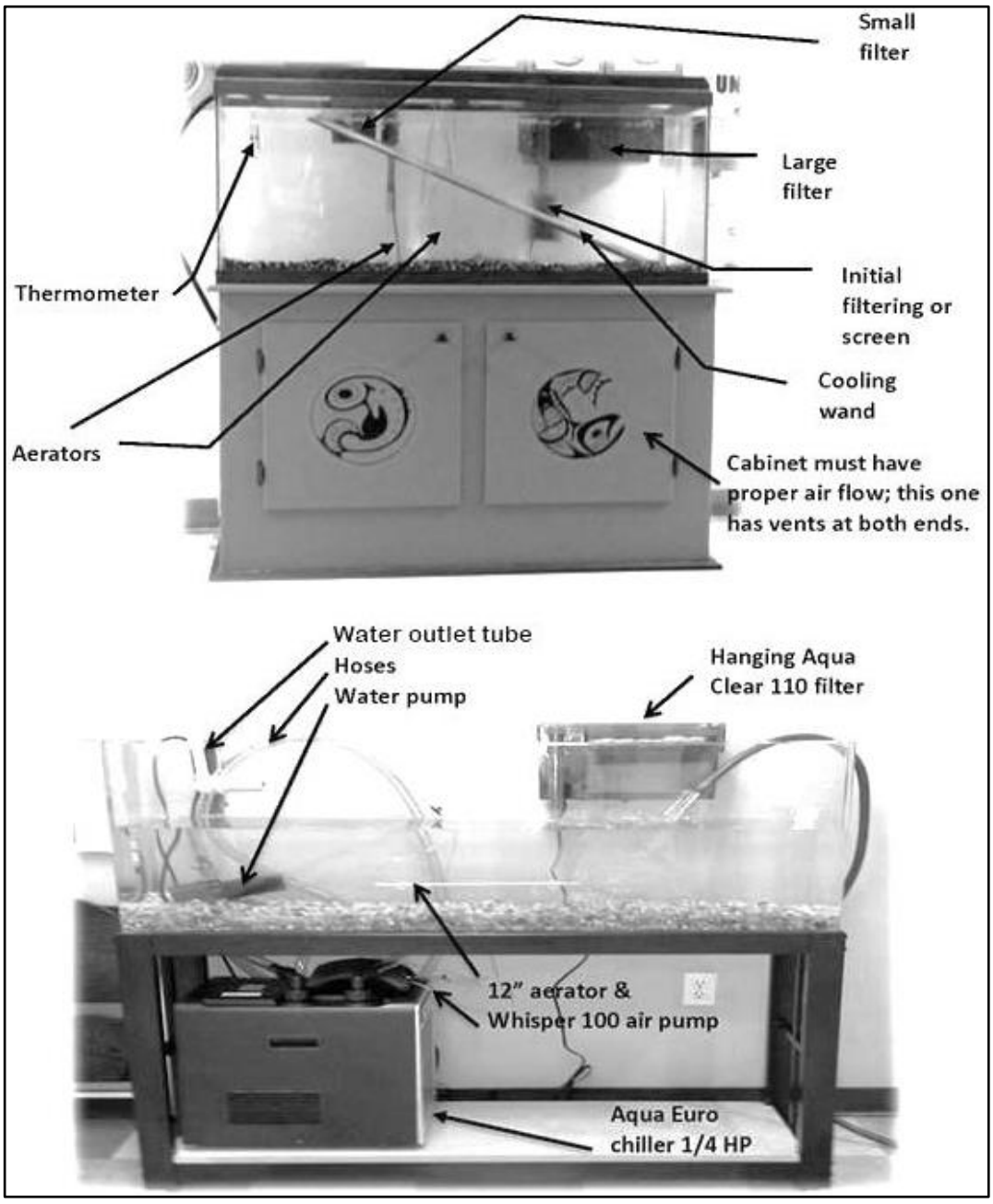
EQUIPMENT

For details about brands and costs, visit *sisseattle.org/Set-up costs 2023/* and click on "List."

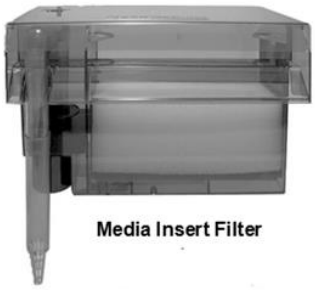
- 50 - 55 gallon glass or acrylic **aquarium**.
- A table or **stand** that can hold a weight of 650 pounds, allows ample air flow around the chiller.
- A refrigeration unit, also called a "**chiller**" (NOT found at aquarium or pet shops) sized for at least a 100-gallon tank.
  - Inline chillers require an in-tank water pump, hoses, and clamps. **Make sure you have them.**
  - Wand chillers still exist in some schools but we no longer recommend them as in-line chillers are more reliable and efficient.
- A **filtration** system, hanging or canister type, capable of filtering a 100-gallon tank. Options include AquaClear 110; Penn Plax Cascade canister 1000; Fluval 407 canister; Marineland Emperor Pro 450.
- An **air pump system** for ≥ 60 gallons with two hose ports, two check valves, and an 8 ft. air hose.
- A **5" fish net** with long handle.
- An aquarium **thermometer** (preferably with suction cups).

- **Gravel vacuum** OR **a 5 ft. clear siphon hose** for cleaning the tank and replacing water.
- Nearby **potable water supply** and an **RV water hose** if possible.
- A dedicated **power outlet** and a **power surge strip** with 5 ports.
- A battery-operated **air pump/aerator** for your fry release (area coordinators may have loaners).
- Two new 5-gallon **buckets** to use for tank water exchanges and transporting fry.
- *Extra **intake sponges** for pumps and filter intakes.
- *Turkey baster or tongs for removing dead eggs or debris.
- *A plastic two-quart water pitcher to aid in exchanging water.
- *An **aquarium scrubber pad** (appropriate for glass or acrylic tank).
- Cotton towels for water spills.

*Optional



FILTER TYPES



Media Insert Filter

Bio-Wheel Filter

Media Cartridge Filter

Canister Filter

Under Gravel Filter
not recommended

CHILLER TYPES

INLINE

WAND

SUPPLIES - CONSUMABLES

- 10 lbs. of clean, natural-colored **aquarium gravel** and 12 or more fist-sized **river rocks** to provide places for alevin to hide. Change out gravel every three years or more frequently if pH is difficult to maintain.
- API's ***Freshwater Master Test Kit*** for monitoring water chemistry; check expiration dates annually. Test strips are unreliable; don't waste your money.
- **Tap-water conditioner** (such as *AquaSafe, Stress Coat, Nite-Out II, or Prime*) to help keep tank balanced and remove chlorine and metals
- Enough **filter media and other filter supplies (**depending on the type of filtration system you have) to be able to change out once a month. Make sure you have sponge or other screen material on the intake tube to prevent fish from being sucked into the filter basket**.**
- *A **mineral block** to maintain proper pH and water hardness
- ***Flake-style fish food** (such as *Tetra-Min Tropical Flake, Omega One Freshwater Flake,* or *Sera Vipan*) from an aquarium store as a step-up food. All these brands are about 45% protein and 6-10% fat. First meals will be from food provided by the hatchery with your eggs
- ***Frozen/freeze-dried bloodworms** as a step-up food (enough for 2-3 weeks prior to release)

*Optional

TANK SET-UP

ALL ABOUT PREPARING YOUR TANK

Set up your tank **at least four weeks** prior to when you will receive eggs (chinook in mid October; coho and chum the first week of January) will enable you to work out any kinks in the system before baby salmon are at risk - to check equipment, get the water to the proper temperature, and begin establishing the biological filter (see note on p. 10. Once you confirm that all systems are working, you may turn off everything except the air pump and filter system. Turn on your chiller **2-3 days before eggs go in**.

Follow these steps to get your tank ready for eggs:

TANK STAND: Position your stand in a hallway or other common space where you, your students, and your tank volunteer have ready access.

TANK: Rinse the tank in water only (no soap or chemicals), gently scrub with baking soda or a strong salt solution, and rinse again thoroughly. (You may have done this step in the spring.)

GRAVEL AND ROCKS: Use approx. 10-15 lbs. of rinsed, natural pebble-sized gravel for at least half the tank (never colored gravel, dirty gravel, or very old gravel). Use fist-sized rocks and cobbles for the other half. Rinse gravel/rocks well in water to remove dust and algae. Gently spread gravel to at least an inch deep.

TEMPERATURE: Install a suction-cup thermometer inside the tank as a backup to the readout on your chiller and so students can gain experience using a thermometer to monitor temperature.

WATER: Fill the tank with cold tap water. To avoid unwanted chemicals, do not use an old garden hose, a metal bucket, or a bucket that has ever contained a cleaning product or other chemicals. (A white RV hose for potable water is OK.) Fill to at least 3 inches from the top and use a Sharpie or weather-proofing tape to mark the fill line. Be sure you fill high enough for your type of filter to work. We strongly recommend the use of water conditioners to remove the toxicity of heavy metals and chlorine whenever you add water. **Letting water sit to off gas does not remove heavy metals.**

CHILLER: Blow or vacuum all the dust off condenser fins, screens, and motors. **Failure to remove dust may cause your chiller to overheat, resulting in costly repairs.** See the following cleaning instructions.

➔ **IMPORTANT:** After moving any chiller into place, always allow it to sit for a minimum of 30 minutes before powering up so internal fluids can resettle.

If you have an inline chiller: Place your chiller in a ventilated place away any heat source and make sure that the front and rear of the chiller have at least 1-foot clearance for air flow. It must have adequate air flow to function correctly. Do not place your chiller inside a fully enclosed tank stand!

Pre-rinse used hoses with hot water to remove any build-up. Clean the intake foam screen on your pump with water and reinstall. **You will need to clean this intake pump sponge weekly** (see p. 10).

If you have a wand chiller: Insert the silver portion of the wand along the inside back of the tank and rest the tip on a fist-sized rock. Keep the copper connection piece out of the water as leaching copper will kill your fish. Insert the small, gray-wired temperature sensor into the tank until it reaches the bottom. Secure this wire to the tank with weather-proofing tape. Set the thermostat to 48° F, with a 2° differential (the range the thermostat will use to turn refrigeration on and off; see Appendix E)

➔ **NOTE: If ice forms on the chilling wand**, check that the thermostat wire is in the water! Increase circulation around the wand by moving filter/circulation systems closer to it.

Attaching chiller hoses:

1. Dry measure lengths of hose before cutting anything; the inflow hose will be longer than the outflow.
2. Attach the outflow hose to the chiller fitting and clamp it (softening with hot water helps hoses fit easier).
3. Attach the outflow diverter on the other end and hang the clamped hose over the back of the tank.
4. Connect the intake hose to the water pump (this pump will be in the bottom of the tank). Leave enough hose to be able to pull pump out of the water to service it.
5. Connect the other end to the chiller fitting, using a hose clamp. Put the water pump in the bottom of the tank.
6. Plug in just the water pump and check all fittings for leaks. Run the pump for a few minutes.
7. Plug in the chiller and set the digital reading to 48 degrees.

Call your coordinator or use the internet to learn more about your chiller.

➔ **NOTE:** Always turn off power to your chiller and filters before doing water changes.

AIR: At a minimum, have a 60-gallon air pump with two hose ports. Install check valves on pump side of hosing to prevent back-flow. Install air stones on the tank ends of the hoses and n place them near the chiller wand or the bottom of the tank. Use a rock or gravel to keep them on the bottom of the tank.

WATER FILTER: Install either hang-on-the-back or external canister filter systems. At a minimum, your bio-filtration system needs to be capable of filtering a 100-gallon tank. You may use one or two filter systems. Wrap netting over the filter intake or attach a foam rubber "fish sponge" to prevent alevin from being sucked in. Always start the new season with fresh filter materials. Remove plastic packaging, always rinse new filter materials thoroughly, and read manufacturer recommendations online. Before plugging in, prime the filter by pouring tank water into it until it starts to flow back into the tank. Canister filters have a priming button that you push.

AIR SPONGE FILTERS: This type of filter will optimize surface area for beneficial bacteria in your tank and help retain good bacteria when changing out other filter media. Install inexpensive coarse sponge filters on filter intakes and air hoses.

POWER-UP: Check to make sure everything is working properly. Tap water may take **48 hours** to cool to 48 degrees. "Cycling" an aquarium to build up nitrifying bacteria on gravel/rocks and filters takes four to six weeks. **Recheck everything after two days; if your tank is not at/near 48 degrees, call your area coordinator.** If everything is working property, you may turn off the chiller until three days before your eggs arrive. Leave the air pump and water filter on to keep water circulating.

ABOUT BIOLOGICAL FILTRATION (NITROGEN CYCLE)

A biological filter is often referred to as a population of beneficial bacteria that eat waste products in the aquarium, thus helping to maintain a healthy water chemistry. Some bacteria produce waste products (such as ammonia) that can be very harmful. Others consume ammonia and give off nitrite, which can also be very harmful. Still others consume nitrite and produce nitrate, which is much less harmful. You don't want any measurable amount of ammonia or nitrite in your tank.

A well-established biological filter keeps tank chemistry under control, and this is why you're asked to establish a functional biological cycle **before** putting eggs in your tank. (Find more detail at *fishlab.com/biological-filtration/,)* By assembling your tank and filling it with water, you will be starting your biological filtration (bio filter) system.

Simply stated, filtration is accomplished **biologically** , **mechanically** , and **chemically** , which is done with a combination of media. Many cartridges or inserts that hang on the back of the tank offer some combination of mechanical (sponges) and chemical (charcoal) filtration. The bio filtering (growth of beneficial bacteria) happens within the sponges and on other surfaces within the tank over time.

BIO FILTERING: Ceramic balls, bio balls, or ceramic rings improve tank chemistry by increasing the surface area on which beneficial bacteria can grow. Once established and cared for according to product directions, they can be used over many seasons. Ceramic rings are typically integrated into stand-alone or external in-line filter systems, although can be incorporated into just about any system.

SPONGES: Good bacteria live on the surface areas provided by sponges, so do not scrub them clean. When cleaning, it is best to use a bucket of tank water and squeeze them clean. With proper care, they can be effective for many years or until they start to disintegrate. At the start of the rearing season just rinse off the largest particulates, and rinse them again if the filter appears to have reduced flow. Rinse again a final time when you take down your equipment at the end of the season. This advice applies to air-driven sponge filters, intake pre-filters, and any other sponge filters within canister systems.

CHARCOAL: It can be used temporarily to reduce a toxin that somehow gets spilled into your tank but best if removed within 4-6 weeks. Left too long, it no longer removes contaminants and may even release the contaminants it's been holding.

Because your system is starting anew, we recommend kick starting the growth of beneficial bacteria by adding water from an existing tank, which will introduce live inoculant. If you don't have access to that, you can add a product such as Microbe-Lift *Nite-Out*, API *Quick Start*, or *Fritz Zyme 7* to your tank. It is also good to use a dose of one of these products after water or filter changes.

Be sure your system is operational at least 4 weeks ahead of receiving salmon eggs. Do water-quality testing up to the time you get your eggs so that you avoid having to make extreme adjustments after eggs are in the tank. Because the nitrogen cycle will start faster in warm water, set up your tank, confirm that the chiller works, then turn off the chiller (not the pump) to let the system operate at room temperature until a week before you put in your eggs.

TANK MAINTENANCE & EMERGENCY PROCEDURES

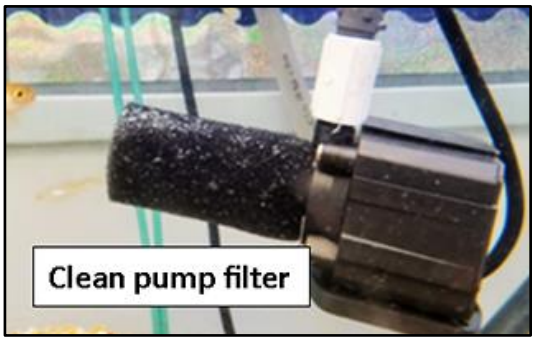
You can sometimes solve both mechanical and water-quality issues on your own with a little investigation and troubleshooting. The important thing is to keep up with maintenance and catch problems early. If you have a concern, check the applicable section below to try to solve the problem yourself. If you conclude that you need help, call or email your area coordinator. Don't wait until the end of the day! If you end up needing a chiller repair, SIS-SEATTLE can provide a loaner. Most schools will need to budget for their own chiller repairs, which can run as much as $500.

CHILLER

A malfunctioning chiller is the most common mechanical problem. Check water temperature daily as your fish can die in as little as 24 hours in water that a sick chiller cannot keep cold enough.

If the temperature rises into the danger zone (above 55° F):

In-line chiller: If you see no digital display, the fuse may have popped; **call your area coordinator for a spare.** Also check that your **pump filter is clean**, else adequate flow will not get through.



Wand chiller: Make sure the power is on and the temperature sensor is in the water, not on the floor! Try unplugging and restarting the chiller to see if it resets itself and resumes cooling. Take the wand out of the water; if the chiller is working properly, the entire wand should start to develop a layer of frost.

If your chiller still isn't doing the job:

1. Call your area coordinator immediately to receive a loaner.
2. Add ice packs or contained ice (frozen in a capped plastic jug) to the tank.

➔ **NOTE:** Commercial ice or ice made from city water has chlorine in it, so put it in a large zippered bag and add a few drops of dechlorinator in case any leaks into your tank.

3. Continue monitoring the temperature keep under 55° F if possible.

Even if your chiller is working fine, freeze dechlorinated water in clean milk jugs or other containers to use in your aquarium, if needed. Leave room at the top so freezing doesn't split the plastic jug. Mark container "for salmon use only."

WATER FILTER

Filtration is an essential part of fish rearing. An aquarium filter keeps water healthy for the fish, helps keep the tank looking nice, and can simplify maintenance. The best aquarium filters process three types of waste: biological, dissolved, and solid. Proper balance is needed to limit spikes in ammonia and nitrite.

Porous stones media: Biological waste includes all unwanted contaminants, such as ammonia and nitrate, that must be biologically processed rather than filtered. Biological media in the form of porous stones remove this type of waste by providing surface area for beneficial nitrifying bacteria to grow. These stones can be used again and again for several years.

Chemical- removal media: Organic waste compounds, decaying tissue, and tap water contaminates can dissolve in aquarium water and cause odor and discoloration. Chemical-removal media can be charcoal or ammonia-reducing. Change these media monthly. (*Prime* and *Amquel* chemically bind ammonia, leaving it available for the bacteria to consume; *Ammo Chips* and *Zeolite* do not.)

Sponge or pad media: Mechanical filtration removes waste particles or floating debris (fish food and waste). A coarse sponge can be used for several years if properly rinsed.

A new filtration system will not have the nitrifying bacteria necessary for bio-filtration and establishing them can take four to six weeks. You can accelerate this process by adding *Nite-Out, Quick Start*, *SafeStart*, or *RediStart* to your tank. The live bacteria will start working immediately to provide a safe and healthy environment for your fish without the long wait. You can also use one of these products after water or filter changes.

FILTER MAINTENANCE

Filters that hang on the back of your tank will require more frequent maintenance than canister filters.

- Avoid cleaning your entire biological filter at the same time. If you have several filter components, alternate cleaning/changing them. Also, do not clean your biological filter with tap water because the chlorine in it can kill your valuable beneficial bacteria.
- Once per week or if you experience reduced water flow through your filter, rinse the filter material in a bucket of <u>tank</u> water to remove slime and waste products, then reinstall. Check the sponge or screen on the uptake tube at the same time to see what may have sucked into the filter.
- Change out filters as recommended by the manufacturer; if you no longer have the information that came with your filter, search online for it.
- Follow the manufacturer's recommendations for cleaning interior pump parts. YouTube is also great.
- Charcoal media can lose effectiveness in as little as 30 days and need to be replaced to control odor and water clouding.
- Mix your media with ammonia or nitrite-reducing material to help with chemical spikes.

IN THE EVENT OF PUMP FAILURE

Although rare, the pump on your water filter may fail. Almost always, failure happens when the impeller that draws water into the pump has gotten damaged and become roughened. You can pull it out to clean it or you may be able to purchase just the impeller for your filter. <u>If you need to order a part, ask your area coordinator if a loaner filter is available.</u>

Maintaining water circulation is essential! Without proper circulation, the bottom of the tank will be depleted of oxygen and your eggs or fish could die. Use a portable aerator to create mini-currents that will mix oxygen-rich water from the top of the tank with oxygen-poor water near the bottom.

EMERGENCY PROCEDURES

Emergencies can result from chiller failure, electric power failure, or failure of other parts of your aquarium system. Temperature, aeration, and filters must be checked daily for proper operation. To guarantee that action will be taken before your fish are compromised, multiple people must be aware of the steps to take in the event of any failure.

ALWAYS HAVE BACKUP PERSONNEL KNOWLEDGEABLE ABOUT EMERGENCY PROCEDURES.

CHILLER FAILURE: Have or get a bag of ice to keep tank water cool. Put the ice in a bag so that chlorinated water does not enter the tank. See "Chiller" on p. 10. Once ice is in the tank, **call your area coordinator immediately to receive a loaner chiller.**

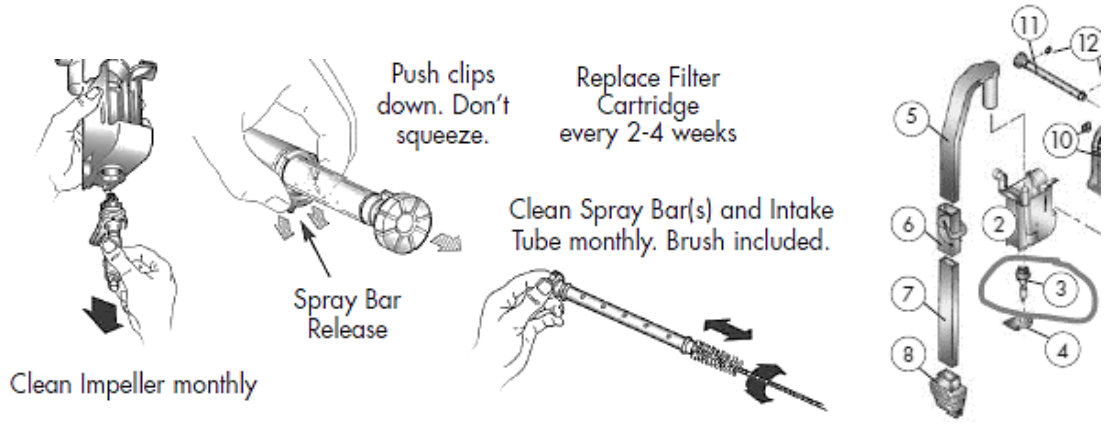
POWER OUTAGE: You need to maintain aeration quickly, in addition to maintaining cold water. The most inexpensive way is to have a portable battery-operated aerator available (you'll need one on release day as well). A portable aerator is very much a temporary fix because it will not put out much air. If you do not have an aerator that turns on when the power fails, have an emergency aerator with instructions by the tank.

Shopping for a portable aerator: You'll find a variety on the market but be sure to purchase one that will handle a 55-gallon tank and has good reviews. Some battery-operated aerators have a sensor that turns on when the power goes off. The Penn Plax Silent Air B11 Air Pump is an example (approx. $26); however, it is sized for 29 gallons so two would be needed.

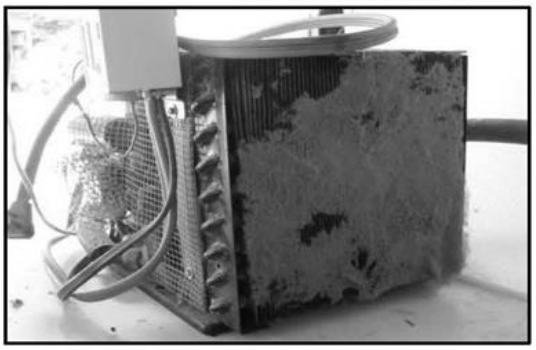
A better choice would be Penn-Plax Air Pod Aquarium Air Pump for Power Outage (Model:APB1) that incorporates automatic battery backup for up to 55 gallons (approx. $35). It has enough battery power for 150 hours. It would be your primary aerator as it is not portable.

Use a backup battery: Backup batteries used for computers could certainly be used to power your aerator and filter. They would be too expensive to power your pump and chiller and might not work. One such unit is the APC UPS Battery Backup Surge Protector, 425VA Backup Battery Power Supply, BE425M (approx. $55). It would keep the aerator and filter running for over 24 hours.

FOR OPTIMUM POWER FILTER PERFORMANCE



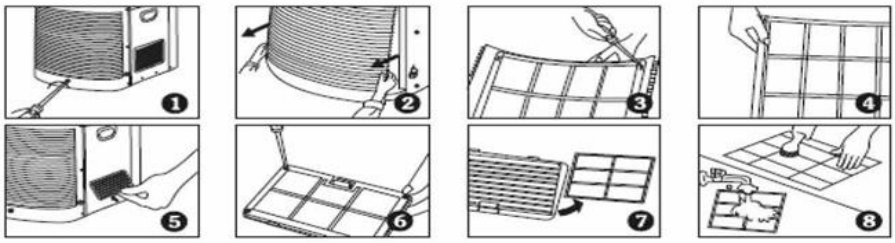
Marineland example



A good way to avoid refrigeration problems is to keep the condenser (the motor, filters, etc.) free of dust and have plenty of air circulation around it. Giving it a thorough cleaning with pressurized gas once or twice a year will go a long way toward keeping it good working order. This photo shows a very dirty chiller condenser. ☹

How To Clean the AquaEuro 1/4 HP Chiller's Filters

1. Loosen front cover screw and turn counter-clockwise (Fig. 1).
2. Gently pull out front hood cover (Fig. 2).
3. Loosen filter screws and remove filter (Figs. 3-4).
4. Lift and remove side draft hood (Fig. 5).
5. Loosen screw of side draft hood and remove the filter (Figs. 6-7).
6. Remove dust with brush or vacuum cleaner or rinse filter well with water and completely dry it before reinstalling (Fig. 8).
7. Reinstall all parts by counter steps.



CHANGING WATER

- Eyed-egg stage -replace 5-10 gallons 1/wkly. Remove dead/white eggs daily.
- Hatching and alevin stage - replace 10 gallons 2/wkly and remove the foam from egg casings so protein doesn't build up.
- As fry begin to feed -replace 10 gallons 3/wkly. Test water quality once or twice a week to guide your actions. Remove dead fish daily. Keep count of losses to help you become aware of water-quality problems and to know how many fry your students may release.

CLEANING

Once you begin feeding your fry; yucky bacteria, ("gunk," "water bunnies") will grow in the tank. They aren't the problem directly, but they prompt changes in acidity (pH), ammonia, and nitrite that can kill your fish. They also make your tank smell terrible. If you don't test water quality, you may not know you have a problem until your fish begin to die.

If you must vacuum the tank more than once a week, reduce the amount of food you are giving until water chemistry is balanced again.

How often your tank needs cleaning depends on the number and size of fish, their food, how well your filtration system works, and the tank's chemical balance. To avoid sucking up hidden alevin, vacuum gravel only after all your fish are swimmers.

CLEANING THE TANK

Tools needed: 2 buckets, 5-foot hose, sponge, aquarium vacuum, and small pitcher

Turn off power to filter when water level causes it to gurgle. To restart after cleaning, use a cup to refill the filter chamber with tank water until it overflows back into the tank.

1. Once a week, use a gravel vacuum to pick up uneaten food, egg casings, or other large debris and to tumble debris out of the gravel. A loose mesh or netting attached to the end of the gravel vacuum will help keep fry from being sucked in as you clean. Section your tank into thirds or fourths and clean only one section of gravel at a time, all the way to the bottom. Vacuum a different section next time. Watch your bucket so it doesn't overflow onto the floor. This process can remove 10-15 gallons of water.
2. The more algae growing on the walls of your tank, the more problems you will have with keeping pH within range, plus it clouds the view. Scrape the glass with a tank scrubber or a clean sponge. Note: If your tank is acrylic, make sure your scraper is safe for plastic.
3. Remove any dead eggs (will be a white/yellow-ish color) and/or dead fish daily.
4. Avoid replacing more than one quarter of the water at a time so that you don't stress the fish or upset the chemical balance. If you have a chemical imbalance and need to replace more water, try changing out several gallons over the course of a day instead of all at once.
5. **Always add cold, dechlorinated water** (see Step 6). NEVER USE WARM OR HOT WATER as sudden temperature changes will stress or kill your fish. Although cold tap water won't be 48 degrees, it will be close enough for the amount of water you will be changing.
6. Add an amount of dechlorinator proportionate to the amount of new water (per instructions on bottle) **BEFORE** adding the new water to the tank. **Do not forget this step** as chlorinated water will kill your eggs or fish.

MONITORING WATER QUALITY

In a chemically balanced tank, beneficial bacteria and proper filtration help break down ammonia and nitrite naturally and reduce the need to clean. The simplest way to know if you have a balanced tank is to **test water quality at least once a week**. We don't recommend using test strips as they can give readings that don't provide an appropriate level of accuracy

Your fish will have adequate **dissolved oxygen** if your aerator is working properly and if you maintain the water **temperature** between **46° F and 52° F**. Consequently, your monitoring of water quality will focus on different parameters.

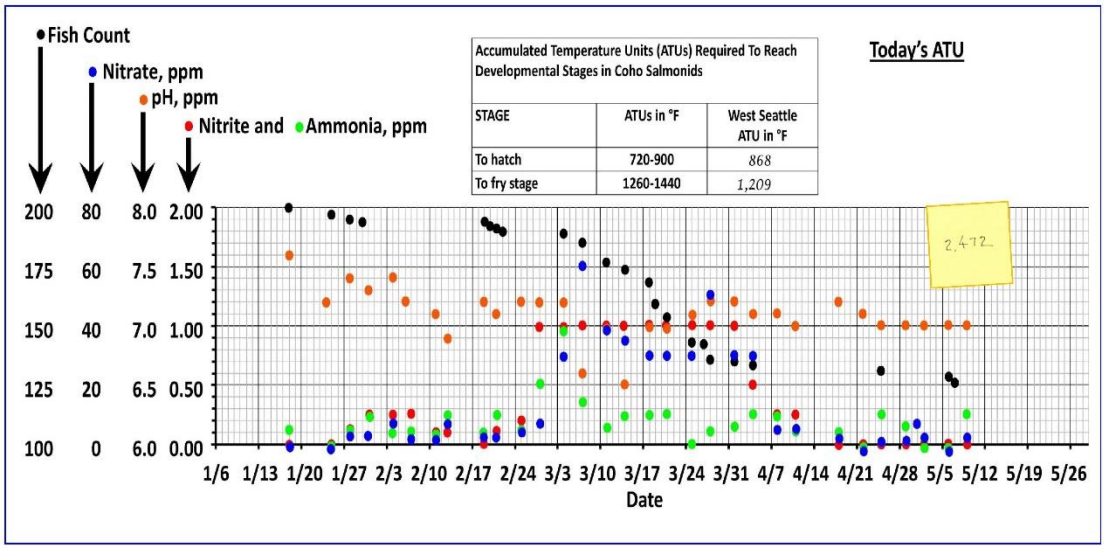
Before your eggs arrive, begin **weekly water testing** for ammonia, nitrite, and nitrate to be sure your tank's nitrogen cycle is established (see page 9). *Freshwater* master test kits purchased at an aquarium shop are easy to use and provide a learning experience for students. Here's what to look for when shopping and an example of what's inside.

Test your source water to see how its chemistry may affect test results from the water in your tank. **If you get a high reading from your source water,** retest to be sure of the result before adding chemicals that may not be needed.

If you get a high reading from tank water, re-test before taking corrective action. If the reading remains high, the best and fastest solution is to change out 15 gallons of water and add a double dose of *Prime*. Wait 24 hours, then change out another 15 gallons and test again.

Keep a chart by the tank to monitor for changes (see Appendix H). Students should update this chart each time they test the water. The following example of a comprehensive chart uses colored dots to show multiple parameters.

TRACKING TANK CHEMISTRY: An Example



pH (acidity) - Goal: between 7.0 and 7.6. Pay close attention if it gets too extreme; a pH below 6.0 can inhibit the establishment of a strong colony of beneficial bacteria.
You will mostly be using the regular pH test to get your readings. If your water tests at 7.6, use the high-pH test as it will determine how toxic your ammonia reading may be. If you cannot keep pH within this range, consult your local aquarium shop about stabilization products; use them very sparingly and according to directions. Do not change the pH more than 0.2 points within a 24-hour period.

Although you can purchase a pH-raising product (to make the water more basic), it is just baking soda. If the pH is 7.0 or lower, dissolve a half teaspoon of baking soda in 1/2 cup of warm water (for a 55-gallon tank) and add it to the tank. Swish your arm through the tank to mix well.
Your pH level greatly effects the toxicity of your ammonia readings. When you have test results of lower pH and higher ammonia; toxicity will be less.

Ammonia - Goal 0; keep it less than 0.25 ppm.
Ammonia results when not enough beneficial bacteria are present to break down egg casings, fish waste, and uneaten food. It isn't as toxic in acidic water (pH below 7.0) but becomes very harmful (corroding gill and fin tissue) when pH approaches 8.0. To be safe, keep pH below 7.6 **and** ammonia below 0.25 ppm. These articles explain the relationship of temperature, pH, ammonium, and ammonia:

- *aquaworldaquarium.com/articles/Ammonia.html*
- *myaquariumclub.com/the-effects-of-ph-on-ammonia-nitrite-and-the-nitrogen-cycle-21226.html*

PERCENTAGE UN-IONIZED AMMONIA IN AQUEOUS SOLUTION BY PH VALUE AND TEMPERATURE

pH	Temperature (C)					
	4	6	8	10	12	14
7.0	0.11	0.13	0.16	0.18	0.22	0.25
7.2	0.18	0.21	0.25	0.29	0.34	0.40
7.4	0.29	0.34	0.40	0.46	0.54	0.63
7.6	0.45	0.53	0.63	0.73	0.86	1.00
7.8	0.72	0.84	0.99	1.16	1.35	1.57
8.0	1.13	1.33	1.56	1.82	2.12	2.47
8.2	1.79	2.10	2.45	2.86	3.32	3.85

Follow these steps to bring down ammonia:

1. Stop feeding and do a one-third water change (half in the morning and half in the afternoon). Check your filter, clean it of any decaying material, and retest.
2. The next day, retest both ammonia and pH. Make sure pH is 7.6 or below. If necessary, do another one-third water change (see p. 14) and retest.
3. Add beneficial bacteria to your tank (*Stability, Quick Start*) to help re-establish bacteria colonies.
4. If high ammonia persists, add an ammonia-absorbing resin to your tank or filter system. Your local aquarium shop can sell you one of several effective products. Leave these products in for only a couple of weeks; if they get saturated with ammonia, it could be released back into the tank.

Nitrite - **Goal 0; pay close attention if it gets up to 0.5 ppm.**
Nitrite results when other beneficial bacteria break down ammonia. It harms fish by inhibiting the uptake of oxygen and the release of carbon dioxide. Fish thus weakened are susceptible to infection.

1. Re-establish biological filtration by following the instructions about ammonia. Add beneficial bacteria and be patient; they will solve an ammonia problem faster than they will solve a nitrite problem.
2. If nitrite tests high (0.5 to 1 ppm), do partial water changes more frequently, even daily.
3. If neither technique works, find out what is interfering with production of beneficial bacteria. The culprit could be colored gravel, volcanic rocks, toxic build-up, or inadequate cleaning after the tank was used for turtles or reptiles. Or the culprit might be changing filter materials too often or changing both filter pads at the same time; you need to leave a little “gunk” behind.
4. If high nitrite persists, add a nitrite-absorbing resin or aquarium salt to your tank. Your local aquarium shop can sell you one of several effective products.

Nitrate - Goal 10-40 ppm; keep it below 40 ppm.
Nitrate is the final product of the nitrification process in the nitrogen cycle. Bacteria break down organic material to release ammonia; ammonia breaks down to form nitrite and nitrite oxidizes into nitrate. Nitrate is the form of nitrogen that is readily taken up be plants and released as a gas. It can be harmful to fish if persistently high (30-60 ppm or more). The nitrification requires a good amount of oxygen, which is one reason to have plenty of oxygen bubbling in your tank. If nitrate exceeds 40 ppm, follow these steps:

1. Be sure you are following water-change guidelines because the rate of changes in water chemistry varies with each stage of fish development (see p. 13).
2. Test water quality at least once a week to guide your actions.
3. Alternate changing or cleaning your filter systems; don't do them all at once.
4. If values remain above 40 ppm, change a larger volume of water and do not clean filter systems.

EGG PICK-UP/DELIVERY

Pick-up/delivery of eyed coho and chum eggs happens in early January, just after winter break. If you are expecting chinook eggs, they will be ready late October/early November. The hatchery determines the date of pick-up/distribution by the developmental stage of the eggs. Eyed eggs have a small window during which they are stable for transport.

Each school will receive 100 - 230 eggs, a small amount of starter food for the fry, and (depending on the hatchery), a small container of iodine to disinfect the eggs before putting them in your tank. **Your tank MUST be ready and your teacher agreement (Appendix B) must be signed or no eggs!** You'll also find the agreement at *sisseattle.org/wp-content/uploads/SIS-Teacher-Agreement-16-17.pdf*.

Your area coordinator will notify you of dates and times for delivery or pick up of eggs at a central distribution point. If you are to pick up your eggs and find you cannot do so, ask your tank volunteer, a parent, or a colleague to go in your stead because getting eggs when they are ready is critical.

TRANSPORTING: Bring a clean, small cooler with an ice pack to put your eggs in. Provide some sort of buffer (newspaper, towel) so your eggs don't rest directly on the ice. **Plan to take your eggs right back to school** (no stopping for coffee along the way!) as they will be very sensitive to movement and temperature.

DISINFECTING: Before putting them in your tank, disinfect them as follows (if that is your hatchery's recommendation):

1. Put pre-measured iodine (provided by the hatchery) in **1 gallon of tank water** in a clean bucket or other container. Never use a container that has been exposed to soap, detergent, or other chemicals.
2. Pour eggs from the hatchery cup into a strainer, colander, or large aquarium net.
3. Set the strainer in the bucket of iodine water and leave it there for **10 minutes, making sure all eggs are covered by the liquid.**
4. Lift out the strainer and catch any drips on the rim of the bucket (iodine will stain clothing or carpets).
5. Sprinkle eggs from the strainer into the front area of the tank.
6. **Dispose of iodine in a sink.**
7. Replace **dechlorinated** water in your tank to the fill line.

PREDICTING HATCH: Our ATU lesson plan guides students in predicting hatching and developmental stages. Find it at *sisseattle.org/wp-content/uploads/Predicting-Salmon-Hatch-1.pdf*. Eggs generally hatch during their second week in the tank but may hatch earlier or later depending on their development at the time they left the hatchery. Ask your students to record hatch observations on their Salmon Tank Monitoring Record chart (p. 33). During the hatch, egg casings will appear as foam on top of the water.

ALEVIN STAGE: If you haven't already, begin weekly water testing. Use testing values to determine if water changes are needed. Check daily for dead eggs and alevin and record any on your monitoring chart. Also start checking your chiller and filler screens for gunk build-up.

The alevin stage is fun for students and, apparently, for alevin. Watch as they bounce on their big bellies and bury their heads in the gravel. Then during the first month you may notice that they have all disappeared! Don't be alarmed; they are under the gravel and will emerge when they are ready, just as they would in the wild. Be sure check your filters for any that went astray!

➔ **NOTE:** Don't disturb your gravel or rocks while cleaning as eggs and alevin are very fragile! Don't start vacuuming the gravel until all fry are able to swim out of the way.

FEEDING YOUR FRY

Do not feed your fish until they have all mostly absorbed their yolk sacs ("buttoned up"). You should not see even a little pink line.

Helpful Hint: Put one to three fish in a clear plastic cup so you can look under them to view their bellies.

This is the "suture line," where the salmon's yolk sac used to be. **It needs to be almost completely gone ("buttoned up") before you start feeding.** These chinook were first fed about a week **AFTER** this photo was taken. Your fish will look very skinny at this point, but they are OK!

IMPORTANT NOTES ABOUT FEEDING

Salmon feed at the top and bottom of the tank and feed better with some daylight on the tank.

- The bigger your fish are when released, the better their chance of survival in the wild. That said, however, try to feed them just to capacity as overfeeding is one way to cause ammonia to spike. Slowly feed only as much as your fish will eat in one to two minutes.
- At each feeding, observe the fish for 5 minutes. If you find uneaten food on the bottom of the tank, feed more slowly next time. If your fish still don't eat it all, reduce the amount.
- Warn students and the building staff about the perils of giving the fish "just a little more." Avoid temptation by keeping your fish food out of sight.
- Your fish will survive over a weekend (even a 3-day weekend) without food; simply feed end of day on Friday and start of day on Monday. For longer periods, **arrange for someone to feed your fish or consider buying an auto feeder.**

WEEK 1 - TEASE FEEDING: Wait until nearly all your alevin are free-swimming fry before "tease feeding" so they will learn to eat. Sprinkle a finger pinch of hatchery food on the water a few times a day. **The fish may spit it out but, after a week, they will begin to eat normally.**

WEEKS 2 - 3: Use a 1/4 teaspoon measuring spoon to dip out hatchery food and gently sprinkle the food over the surface of the water. Slow feeding will give small fish a chance to get their share and prevent food from going straight to the bottom. **Increase the amount each week as you see that they are consuming all the food.** Ideally, you should feed 2-3 times a day.

An important function of feeding at this stage is to nurture the biological filter so that it will be ready to handle the waste as they eat and create waste. **Test water weekly and increase water changes from now until release.** Consider adding some live beneficial bacteria regularly to your tank to avoid spikes in ammonia or nitrite.

Show students how to use the monitoring chart to record feeding sessions and, until a pattern is established, note in the "Comments" column how much food they dispensed. This record is your check that the fish were fed properly.

WEEKS 4 THROUGH 7: If you wish, switch from hatchery food to a flake food twice daily. Because flakes settle slowly, your fish will have a good chance to nibble all this food. A pet or aquarium store will have what you need. **Test water chemistry weekly**.

WEEK 8 to RELEASE: If filtration is working well and you have no problems with ammonia or nitrite, you may switch to feeding frozen bloodworms when the fish are vigorously free-swimming (not resting at all on the bottom). Test water twice weekly for spikes in ammonia and nitrite as bloodworms contain extra

protein. To enable students to compare feeding behavior, try using a small amount of hatchery food up to five times daily and supplement with bloodworms once a day. The fish should really attack the more natural food (bloodworms). Use an auto feeder if you find feeding this often isn't manageable.

PINHEADS: These fish have difficulty learning to eat, most often because feeding began too early. They hang out on the bottom and may starve. Some may not even absorb all their yolk sac. If you have buttoned-up fish that "fail to thrive," try transferring them to a small, aerated container where they don't need to compete with more aggressive feeders, then try hand feeding them hatchery food or bloodworms with an eyedropper or pipette. Fish require several weeks to starve, so keep trying. In fact, a fish that is not eager to rise to the top of the water may survive better in a natural environment.

SALMON RELEASE & REPORTING

Releasing your fish is often the highlight of the experience of raising salmon! In the spring, your area coordinator will email you to coordinate your release event. We encourage you to include students and/or families in the release. Chum fry get released at Carkeek Park and coho fry get released into Fauntleroy Creek or Lake Washington. **You must release at the location specified on your state permit.** (See Appendices C and D for details about releasing in Carkeek Park and Lake Washington.)

SEATTLE RELEASE SITES

Visit your release site in advance if possible! You don't want to release into an algae bloom or have a park closure putting a kink in your plans.

Volunteers will assist with releases in Fauntleroy Creek and habitat exploration in Fauntleroy Park. For releases elsewhere, contact your area coordinator to ask if an SIS-SEATTLE representative could be available to assist with your release and habitat exploration. If not, see *sisseattle.org/learning/* for self-guided exploration options during your release field trip.

Your release site should have the following characteristics:

- Release location complies with permit.
- Water is cool and flowing (aerated) with pools for fry to rest.
- Habitat includes vegetation, woody debris, and/or rocks to provide shelter from predators.
- Students can safely reach the water.
- Your class (or each group you schedule) will have enough space to gather and not trample habitat.

WHY NO RELEASES IN THORNTON, LONGFELLOW, TAYLOR, OR MAPES CREEK at BE'ER SHEVA PARK
Schools are not permitted to release their fry into Thornton Creek in north Seattle, Longfellow Creek in West Seattle, Taylor Creek in south Seattle, and Mapes/Be'er Sheva in southeast Seattle.

As part of an effort to evaluate the performance of urban-creek restoration, Seattle Public Utilities (SPU), with the Washington Department of Fish and Wildlife and NOAA Northwest Fisheries Science Center, has been monitoring smolt out-migration to see if adult salmon and trout entering these creeks produce any viable offspring (Thornton, Longfellow, and Taylor) or if salmon fry are using the delta and lower channel (Taylor, Mapes). The number of natural smolts out-migrating from and fry using these creeks is very small (averaging <10 fish per day during May), and school salmon releases can easily mask and confound results.

SPU has also been working with the US Fish and Wildlife Service to monitor the abundance and distribution of fry in Thornton and Taylor creeks; released fish could confound these results. Improvements are being designed for Taylor Creek so that it can provide habitat for fry out-migrating from the Cedar River.

EQUIPMENT NEEDED

- 1 or 2 clean 5-gallon buckets with handles and lids, preferably light colored so everyone can see the fish
- White non-fragranced plastic garbage-can liners (optional)
- Battery-operated portable aerator so that fry get plenty of oxygen during transport; available in local pet stores or online (less than $20)
- Extra batteries for the aerator
- 2-3 small aquarium fish nets
- Several small, clear plastic cups

TRANSFERRING FRY FOR TRANSPORT

This process could take 30-60 minutes, depending on experience. **If your water is dirty** and hard to see through, consider a water change the day before release. It is heartbreaking to find extra fry in the tank when you go to clean it.

1. Try to **catch fish as close to departure time as possible** so that the water in their bucket doesn't get too warm. You may use an ice pack to keep the water cool but take it out of the bucket before transport as items can crush your fry in transit.
2. Use the same **clean bucket** you have used for water changes. (Some teachers line the bucket with a white non-fragranced plastic garbage bag - white, so you can see the fish.)
3. Fill your bucket at least **half full of water from the tank** (no more because water will slosh out). If you have more than 150 fry, use two buckets, each with an aerator.
4. Put the bucket on a table or sturdy chair close to the tank so that you can quickly release the fry from your net into the bucket.
5. Attach a portable aerator to the rim of each bucket to keep the water in this temporary home oxygenated until your fry are released. Make sure the aerator has an air stone on the end of the hose and that it sinks to the bottom of the bucket.
6. **Turn off all tank equipment except the tank aerator. Remove any large rocks and most of the water** to a level of about 6 inches so that catching the fry is easier. Don't worry about counting fish at this point as counting is easier as they are released.
7. Using a large, long-handled net, gently catch the fry and put them in the bucket. If you have particularly feisty fry, you may need to drain even more water from your tank to get the last few. Station a helper with another net on the opposite side of the tank to gently herd fish your way. **Be sure to check the corners of the tank and under large rocks for stragglers.**
8. If you are using a bucket liner, loosely secure it around the aerator tube. If you are using a bucket lid, cut a finger-size hole in it, put the aerator tube through it, making sure the air stone is under water, and tape the aerator to the lid.

➔ **NOTE:** ***Never cover your bucket tightly with a solid lid or plastic!*** Beware, though: If water can slosh out, so can your fry!!

And again, ***never have anything in your bucket except your fish, a small air stone, and the aerator hose.***

RELEASING YOUR FRY

If possible, release as soon as you arrive on site. If you are to have a program first, place small zippered bags of ice in your bucket to keep fry chilled and put the bucket in the shade. Recheck that your portable aerator working to keep fish oxygenated. Assign someone to watch the bucket during the program.

1. Carry the bucket close to the water's edge. Add some lake water to your bucket. Have students line up or form small release groups.
2. Optional: Explain to your students that the fry doesn't like sudden changes in their water. Direct them to bring a 3-4 cups of water from the creek/lake and pour it into the release bucket to mix with the aquarium water so the fish can begin to get used to the water in which they will be living.
3. Have an adult ready to tally the fish as they are released. Either the adult that is dipping fry or the student that is releasing may call out the number of fish. Clear cups are great for accurate counting. Note: This count is a check against the mortality count that students did while fish were in your tank.
4. Position an adult at the water's edge to steady students as they kneel and stand back up.
5. When all students are ready to release, explain the procedure by saying
   - "When you get a fish or two, immediately put one hand over the top of your cup so that the fish can´t jump out, then count the fish and tell the counter how many you have.
   - "Walk carefully to the water and kneel down.
   - "Take time to observe the camouflage markings on your fish. Salmon fry are easy to see when they are in a cup, but their markings will make them nearly invisible in their new home." "Look at them from above; look at them from below. Is there a difference?" "How do the colors help them?
   - "Hold the cup at the surface of the water and gently tip it to let the fish swim out. Never pour them from high above the water; high diving will stun or kill them!"

After all fry are released, pour the water remaining in the bucket into nearby grass or brush. Collect your equipment and, if you had a bucket liner, use that bag for any litter students find in the area.

FILING YOUR RELEASE REPORT

After your release, you must report how many fish you released, when, and where. **Filing this report is very important and MUST be done to ensure that your school may participate in the program next year.** Click on *sisseattle.org/release-form* to access the form. Fill it out AFTER you have released so that we have an accurate count of fish to report to the state.

BEWARE OF HIGHLY INVASIVE MUD SNAILS

New Zealand mud snails (*Potamopyrgus antipodarum*) are tiny freshwater invaders known to be in Thornton Creek, several tributaries to Lake Washington, and the lake shoreline itself. These non-natives have no natural predators, parasites, or diseases so they can multiply very quickly and cause a serious economic and ecological problem for the Puget Sound region.

Adult mud snails are similar in length to a grain of rice, with a pointy tip; coloring can range from gray to dark brown. For more about them, visit *kingcounty.gov* and search for mud snails.

If you enter the water or adjacent damp areas during a release in an infested location, clean your boots thoroughly (bring a brush for this purpose) and check carefully afterwards to be sure snails haven't hitched a ride. If you go to more than one release spot, change damp or muddy clothing and gear between each. At home, dry your clothing and gear in a dryer on high heat for at least 2 hours or air dry them for at least 48 hours.

END-OF-YEAR TANK CARE

Soon after your salmon release, t**ake photos of your set-up**; you'll be glad you did when set-up time comes around next fall! **Turn off power to all equipment** and have towels and buckets at hand before you start to clean.

WATER: Dip or siphon out all the water into buckets. Wait until the very end of your cleaning process to clean gravel/rocks and the tank as you will need those buckets.

CHILLER: End-of-year care depends on which type you have.

Inline chiller (JBJ 1/10 hp Arctica Chiller or Aqua Euro ¼ hp Max-chill Titanium)

1. Lift out the chiller pump, untwist it from the hose, and remove the pump and cord. Rinse in hot water.
2. Put the end of your tank hoses into a bucket before removing them from the chiller (lots of water in hoses).
3. Untwist chiller fittings from hoses, being gentle with plastic fittings.
4. Take hoses to a large sink and thoroughly rinse hoses in hot water, remove fittings (you may have to cut hose). You may use a round 1/2" brush attached to a 16-gauge wire to push/pull though hoses. Your hoses will still have coloring when clean. If they are hard, consider replacing them.

5. Empty remaining water in chiller (gently turn over).
6. Thoroughly rinse pump filter.
7. Remove any dust from chiller screens (may require a screwdriver).**FILTER:** End-of-year care of your filter depends on which type you have.

Wand chiller

Remove the wand from your tank, being careful not to bend the soft copper piece. Blow out any dust that has accumulated around the fan or on condenser fins. Carefully store, keeping the tubing straight.

FILTERS

Canister filter (Penn Plax Cascade 1000 or 1200 OR Fluval 306 or 406)

1. Turn off hose valves at canister. Detach plastic pieces from hoses inside tank. Carefully lift out hoses and put into a bucket, then open valves to drain a little water before opening the top of the canister. Take canister to a large sink to finish draining.
2. **Keep all coarse sponges and ceramic cubes**. Dispose of any used carbon/zeolite packs and white fiber media as **you will need new supplies for next fall**.
3. Use a brush to thoroughly clean all filter pieces with warm, clean water, removing any tubing and impellers to clean.

Hang-on -the-back filter (Aqua Clear, Marineland, Emperor, or Tetra)

1. Remove any carbon or zeolite packs and throw away. **You will need new supplies for next fall.**
2. Rinse bio-wheels in warm water and air dry. Rinse sponge; replace only if torn.
3. Carefully lift out the filter as it will be full of water. Drain and rinse thoroughly with warm water and clean the impeller.
4. Rinse sponge filter thoroughly and air dry. It will last for many years if rinsed regularly.

TANK

1. Remove any rocks or gravel and rinse with clean water (no soap or chemicals). Fill a bucket halfway will gravel and swish with hands under running water. Continue until all is clean, then air dry in buckets.
2. If the tank is crusty, gently scrub with a micro-fiber towel using baking soda or a strong salt solution, then rinse thoroughly and air dry.

FINALLY

- Organize your equipment and inventory your supplies to know what you will need for next fall. Buy them now, if possible. Plan to change out gravel/rocks every three years (more frequently if pH has been difficult to maintain).
- Clearly mark your equipment "SIS-SEATTLE" and add your phone/email contacts to keep it safe from possible inadvertent disposal while in storage.

If the staff at your school decides not to participate next year, let us know. If your school does not participate two years in a row, we will drop it from our database and pick up the equipment to pass along to another school, unless other arrangements are made.

APPENDIX A: EDUCATION OPPORTUNITIES

The activities and lesson plans on our website foster learning related to salmon biology, habitat, stewardship, and importance to Pacific Northwest culture and commerce. Most of them now support Next Generation Science Standards and/or Common Core. Because of the pandemic, field-trip opportunities are in flux.

SPAWNING FIELD TRIPS

Fall Salmon Program: Seattle Public Utilities offers a FREE naturalist-led program in the fall at Carkeek Park, that will prepare your students for rearing salmon. It will introduce them to basic salmon biology and ecological concepts during a hands-on and interactive outdoor program. Space is limited and scheduled on a first-come first-serve basis. Contact *celinas@islandwood.org* to schedule.

The Carkeek Watershed Community Action Project offers tours and classes about returning salmon in the fall. In the spring, students have the opportunity to feed thousands of chum fry in imprint ponds. Both fall and spring programming may be customized in content and length. Email David Koon at *salmonprograms@carkeekwatershed.org* for details.

Salmon Seeson: Prepare your students for rearing salmon by seeing spawners during this most exciting phase of the salmon life cycle. Find details about opportunities in and near Seattle at *experience.arcgis.com/experience/779f2239705a42fba71f198d958da479/?data_id=dataSource_2-Salmon_viewing_sites_8034%3A7*.

ISLANDWOOD FIELD STUDY

In partnership with Seattle Public Utilities, Islandwood will offer a Next Generation Science Standards-aligned field study for Seattle 5th-grade students starting spring 2023. It is designed to enhance and localize the Amplify Ecosystems Restoration unit taught in Seattle Public Schools. Find details at *islandwood.org/education-programs/*.

FRIENDS OF THE ISSAQUAH HATCHERY (FISH)

FISH offers guided tours of the hatchery and a changing menu of other learning opportunities. To inquire, email *education@issaquahfish.org* or call 425-392-1118 and visit *issaquahfish.org*.

SALMON DISSECTIONS

Offered when spawner carcasses are plentiful, dissections are an engaging way to acquaint upper-elementary and older students with salmon anatomy and how a body's major systems work together. Check with your area coordinator about availability. A fee may apply.

CEDAR RIVER WATERSHED EDUCATION CENTER

This regional facility above the shores of Rattlesnake Lake in the Cascade foothills is a gateway to the watershed that provides drinking water for 70% of people living in the greater Seattle area. Visit *seattle.gov/utilities/protecting-our-environment/our-water-sources/cedar-river-watershed/education-center* for details about current learning opportunities.

SEATTLE AQUARIUM

The aquarium offers both in-person and distance learning, plus a program that provides free admission for schools serving low-income and immigrant families. Find details at *seattleaquarium.org/*.

APPENDIX B: PARTICIPATION AGREEMENT

Salmon in the Schools-Seattle is a coalition of educators, agencies, and advocates working together to support the Salmon in the Schools program in Seattle. This agreement itemizes SIS-SEATTLE responsibilities and those of participating schools.

SALMON IN THE SCHOOLS - SEATTLE SHALL

- Coordinate permits and release reporting with the Washington Department of Fish and Wildlife.
- Advise the school about what equipment and supplies to procure for initial setup or for replacement.
- Assist the school in acquiring the necessary equipment (by request and if possible).
- Provide resources and/or training to support assembly of the aquarium and associated equipment.
- Organize delivery or pick-up schedule for eggs (as shown on permit).
- Provide a loaner chiller on a first-come, first-served basis if the school's chiller must be repaired and recommend a repair source. The loaner will be available only until the school's chiller is repaired and returned.
- Assist with equipment repair costs (if funding is available and based on documented school need).
- Provide curriculum materials, technical support, and advice through fry release.

PARTICIPATING SCHOOLS SHALL

Tank and Fish Care

- Maintain the tank, chiller, and other equipment per recommendations*.
- Monitor water chemistry per recommendations*.
- Feed the fish per instructions*.
- Fund equipment, supply, and food costs to the best of your school's ability.
- Replace filter components and other consumables as needed and per instructions*.
- Release salmon fry at your designated release site in the appropriate watershed.
- Complete and submit all reporting and other requests for information.
- Keep equipment where it has been installed, ideally in a location that the whole school can access regularly unless a move has been approved by the area coordinator.
- Inform school personnel about the importance of leaving the tank undisturbed and request help in feeding the fish over breaks, as necessary.
- Do not use the tank to hold any other species as doing so may endanger the health of the fish and is in violation of your permit.
- Perform end-of-season equipment care per recommendations*.

Classroom Learning

Classroom learning about salmon may take any form that a teacher finds effective, both in providing special salmon lessons and/or incorporating salmon into other activities that address state learning standards. SIS-SEATTLE requires every participating teacher to, at a minimum

- orient students to the importance of salmon in the Pacific Northwest and the water quality, habitat, and other challenges they face.
- involve students in observing eggs, alevin, and fry in their tank, documenting their observations, and caring for their fish.
- engage students in researching interesting facts about salmon and sharing what they learned with others at school.
- include students in the salmon release and take them on other field trips as possible to learn about salmon habitat and connect what they experience with personal stewardship.

Project Wrap-Up and Reporting

- Release fry where specified in the permit and report date and fry count to SIS-Seattle.
- Summarize classroom learning activities and objectives addressed.
- Inform SIS-SEATTLE if you no longer wish to participate, are changing schools, or are passing the tank along to another teacher in your current school.

Hold-Harmless Agreement

The school named below and its lead salmon teacher shall hold Salmon in the Schools-Seattle and Seattle Public Utilities harmless from personal injury or property damage associated with having a salmon aquarium and related equipment at either the school or an offsite location during any closure of the school building.

The lead teacher and any volunteer assisting that teacher shall make every effort to ensure that equipment is safely placed, and electrical connections are safely made. Should an equipment malfunction occur that the teacher or volunteer cannot resolve, the teacher shall contact Salmon in the Schools-Seattle technician Dan Hannafious immediately for repair or replacement (*danh@islandwood.org;* 206-713-7704).

By signing this agreement, you agree to adhere to all points above to the best of your ability.

The principal and the lead salmon teacher must sign this contract. Keep one copy with the tank, file one copy with the principal, and send the original signed copy to SIS-SEATTLE.

_____

School Name Office Phone

_____

Principal Signature Printed Name Date

_____

Teacher Signature Printed Name Date

APPENDIX C: CHUM FOR RELEASE IN CARKEEK PARK

Here is advice unique to rearing chum fry for release into the Piper's Creek system in northwest Seattle's Carkeek Park:

BACKGROUND

Piper's Creek and its tributary, Venema Creek, in Carkeek Park supported wild coho and chum salmon runs until the 1930's when increased urban development in the watershed led to their extinctions. In 1980, the Carkeek Watershed Community Action Project (CWCAP) began salmon recovery efforts and still coordinates them today. Your chum salmon eggs are provided through a partnership between CWCAP and the Suquamish Tribe's Grover's Creek Hatchery in Kitsap County. Grover's Creek is the nearest hatchery source for eggs and therefore the closest possible genetic match to the original salmon in the Piper's Creek system.

Chum salmon were selected as the target species for restoration efforts in Carkeek because they have a shorter creek residency as compared to other species. Soon after emerging from the gravel, chum fry move quickly out of the flashy urban creek system and into the more stable environment of the estuarine waters of Puget Sound. Because chum released directly into the creek system as fry would not remain there long enough to enable them to find their way back as spawners, they must imprint to the creek water. Accordingly, CWCAP volunteers operate and maintain the Les Malmgren Imprint Pond, where school fry are imprinted a minimum of two weeks, then released into Venema Creek in the evening before a morning high tide to facilitate their migration from the creek system to the Sound.

RELEASING YOUR FRY

If you are rearing chum, your permit requires that you release them into the imprint pond in Carkeek Park, rather than directly into a creek. Watch for an email with details on scheduling your release. The Les Malmgren Imprint Pond is used for multiple releases so the dates for imprinting school fry are limited and must be adhered to.

APPENDIX D: COHO FOR RELEASE IN LAKE WASHINGTON

RELEASING YOUR FRY

You may request that a representative from SIS-SEATTLE help with your salmon release into Lake Washington. Contact your area coordinator if you want assistance. Also read recommendations in the "Salmon Release" section of this handbook. An educational scavenger hunt is available at some locations. **Contact Celina Steiger at *celinas@islandwood.org* to schedule and to inquire about getting a transportation subsidy for your field trip.**

TOXIC ALGAE BLOOMS

Check for toxic algae blooms near your preferred release site (*nwtoxicalgae.org*) and always have an alternate site in mind in case of a bloom. Cyanobacteria (or blue-green algae) can produce toxins at levels that are harmful to humans, pets, domestic animals, and wildlife. High biomass blooms, whether of toxic or nontoxic species, can accumulate as thick scums and mats, which decompose causing excessive oxygen consumption (hypoxia). Most cyanobacterial blooms occur during warm months (summer and early fall). Just avoid them.

RELEASE LOCATIONS NORTH OF THE SHIP CANAL

Matthews Beach (release at the beach north of the creek)
Magnuson Park (release at the beach in the north end)

RELEASE LOCATIONS SOUTH OF THE SHIP CANAL

Madrona Park (beach)
Seward Park (beach)
Pritchard Beach (beach)

INVASIVE ALERT

See information on p. 20 about highly invasive New Zealand mud snails that could be present at your Lake Washington release site.

Setting Temperature on Johnson-Controls A419

Read these instructions thoroughly if you have this thermostat and need to change the temperature setting.

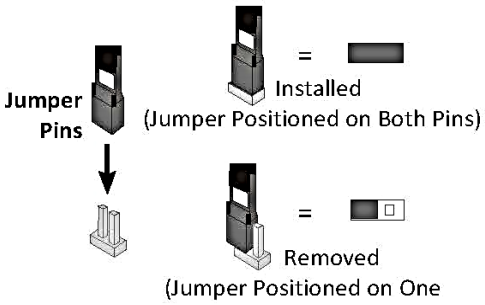
Positioning the Jumpers

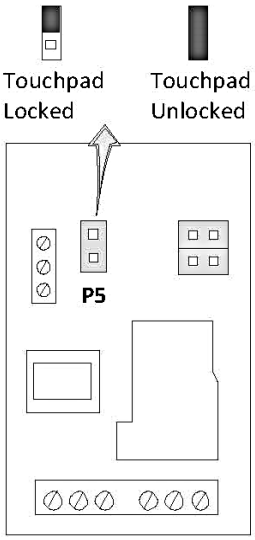
The P5 Jumper Pin Block has a single set of jumper pins and is used to lock or unlock the touchpad.

To position a jumper in the "Installed" position, place the jumper on both pins. To position a jumper in the "Removed" position, place the jumper on only one pin. (Save the jumper in case you need it later.)

Position the jumpers as follows. Refer to drawings at right.

1. Verify that all power to the control is disconnected.
2. Remove the cover by loosening the four screws.
3. Position the jumpers to set Cooling/Heating, Setpoint, and Touchpad Lock functions.
4. Replace the cover and fasten in place with the four screws.
5. Restore power to the control.





Setting the Setpoint

To view and adjust the temperature setpoint, follow these steps:

1. Press and hold the **MENU** button until the display changes to flashing **SP**. This will take about 2

2. Press the **MENU** button again. The current setpoint is displayed.

3. Press the **Up** or **Down** button to adjust the setpoint

4. Press the **MENU** button to save. The display then returns to the sensor temperature.

Notes: If no entries are made for 30 seconds while programming is in progress, the control reverts to the normal temperature display.

If the **MENU** button is not pressed after changing the setpoint value, the new value is not saved and the control reverts to the previously saved setpoint value.

Any **saved** control setting values will remain in the control's memory during power interruptions.

APPENDIX F: WEB RESOURCES

CURRICULUM RESOURCES AND REARING TIPS

Salmon in the Schools-Seattle
sisseattle.org/

Columbia Springs (Vancouver, WA)
columbiasprings.org/salmon-in-the-classroom/sitc-teacher-resources/ Comprehensive learning resources, including materials for download

Alaska Department of Fish and Game - Salmon in the Classroom
adfg.alaska.gov/index.cfm?adfg=educators.salmonclassroom
A wide variety of resources

Trout Unlimited - Trout in the Classroom
troutintheclassroom.org/
Lots of resources to connect students with their watershed

Franklin Conservation District, 53 videos
franklincd.org/salmon-in-the-classroom

MAINTENANCE REFERENCES

Salmon in the Schools-Seattle YouTube Channel
youtube.com/channel/UC085cm7lRydop6gqbgnsV3Q
Salmon rearing live video, maintenance, set-ups

Filters
Fluval 306 and 406: *usa.hagen.com/File/b3378f42-51ae-42e9-8c10-44fdc858d921*
Penn Plax Cascade: *youtube.com/watch?v=H1Qlh5Mh8Nc*
Marineland/Penguin: *marineland.com/customer-service/product-manuals.aspx*
Hagen/Aqua Clear: *usa.hagen.com/usefultools/instructionmanuals*

Gravel Vacuum
Aqueon siphon: *youtube.com/watch?v=D6Re04cYJcY*
Python Water changer: *youtube.com/watch?v=d6OoPn0HAAI*

Chillers
Choosing/installing: *youtube.com/watch?v=uNNPegVpYYI*
Aqua Euro manual: *aquaeurousa.com/image/Chiller%20Manual%20for%20.25HP%20and%20.50HP.pdf*
Arctica: *marineandreef.com/v/vspfiles/pdf/DBE-200_manual.pdf*

SALMON TANK VOLUNTEERS

Our school is participating in the Salmon in the Schools program, which enables students to experience rearing Pacific salmon from eggs to fry, then release them into a nearby waterway. Students develop an understanding of salmon biology, habitat, stewardship, and their importance to regional culture and commerce.

Experience with an aquarium helpful but not necessary

Flexible schedule during school day or right after

High school service credit hours

<u>AS A TANK VOLUNTEER, YOU WOULD</u>

Help set up our salmon tank (3-4 hrs.; fall)

Attend a half-day training on the basics of maintaining a salmon tank (4 hrs.; fall)

Pick up our salmon eggs if not delivered to our school (1-2 hrs.; fall-winter)

Remove and replace tank water (1 hr. twice weekly; winter-spring)

<u>YOU MIGHT ALSO</u>

Help students observe, monitor, and maintain our tank (1-2 hrs./week; winter-spring)

Prepare our salmon for transport to the release site (1-2 hrs.; spring)

Help chaperone salmon-related field trips (3-4 hrs. 1-3 times; fall-spring)

This assignment requires passing a Washington state background check.

Contact _____ for more information.

STUDENT GUIDE TO CARING FOR SALMON

FEEDING YOUR FISH

- Tease feedings: Sprinkle a tiny amount of hatchery food on the water a few times a day. The fish may spit it out but after a few days, they will begin to eat normally.
- Routine feedings: Feed no more than your fish can eat in one minute. Salmon feed only as food is falling through the water; they won't touch it once it hits the bottom of the tank. If after 5 minutes you see food on the bottom, reduce the amount. Slow feeding will also ensure that smaller fish get their share. Start with 1/4 teaspoon of hatchery food; if they eat it all, slowly increase the amount.
- To cover for weekends, feed the last thing on Friday and the first thing on Monday. Your teacher will arrange with a custodian to cover for long school holidays.
- Enter the amount of food and time of feeding on the tank monitoring record.

MAINTAINING YOUR TANK

What To Do Every Day

- Check and record water temperature. It should stay between 46° and 50° F. If it's higher or lower, **tell your teacher right away**.
- Check for any trash that might be in the tank and remove it with a net.
- Check for any egg or fish that might have died (mortality). Dead eggs are white. Dead fish could be floaters on the surface or bodies caught at the filter. Remove them with a net and subtract them from the total count.
- Check that the filter system is running and make sure that the air system is bubbling.

What Water Testing To Do Once a Week (or more frequently if ammonia rises)

- Use the ammonia test kit to check how much ammonia is in the water.
- Use the nitrite test kit to check how much nitrite is in the water.
- Use the pH test kit to check chemical balance in the water.

If any test indicates that the water is not healthy, **tell your teacher right away**.

What To Do Once a Week After Alevin Develop Into Fry

- Rake a net across the gravel to check for any buildup of uneaten food or fish waste.
- Tell your teacher if you think the tank needs cleaning and follow these instructions:
  - Remove any large stones (put them back when you finish adding new water).
  - Vacuum the gravel, putting the old water into a bucket. You may have to turn the filter off during cleaning and prime it for ease in restarting. Dump the old water outside on grass if possible.
  - Working with an adult, fill the bucket with 3-4 gallons of tap water and treat it with a chlorine-removal chemical, as directed on the bottle. The bucket will be heavy so enlist an adult to help.
  - Replace the water you took out with water from the bucket until the tank is full again.
- Mop up any water spilled on the floor.

SALMON MONITORING TEAMS

GREEN TEAM	RED TEAM
Temperature Specialist:	**Temperature Specialist:**
Feeder:	**Feeder:**
Trash / Mortality / Systems Specialist:	**Trash / Mortality /Systems Specialist:**
Ammonia Tester:	**Ammonia Tester:**
Nitrite Tester:	**Nitrite Tester:**
pH Tester:	**pH Tester:**

Assign a cleaning team as needed.

SALMON TANK MONITORING RECORD

1. Make an X to show that feeding and trash/systems have been checked.
2. Track mortality (dead eggs or fish) and keep the total count of live eggs or fish up-to-date.
3. Test and enter your results for ammonia, nitrite, pH, nitrate (if done), temperature, and ATUs.
4. Comments include date of hatching, chemical additions, cleaning, etc.

POST NEAR FISH TANK

Date		Feeding	Trash/ Systems	Mortality	Count
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		
	PM	☐	☐		
	AM	☐	☐		

Ammonia	Nitrite	pH	Nitrate	Temp °F	ATU °F	Comment