

SALMON IN THE CLASSROOM

Aquarium Care and Maintenance Guide



U.S. Fish and Wildlife Service
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Salmon in the Classroom Aquarium Care and Maintenance Guide

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Contact Information

If you are interested in received information on raising Salmon in your classroom, please submit your requests to https://bit.ly/SiC_TankRequest

Responsibilities and Expectations

U.S. Fish and Wildlife Service

FWS contact for Salmon in the Classroom 2022-2023

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1. Providing the aquarium tank, chiller, and associated start-up equipment (on a loan basis). In most cases, the Service will provide all the necessary aquarium components. If certain components are unavailable, then reach out to your FWS contact about other sources of funding.
2. Aquarium Setup and Disassembly. Your FWS contact for Salmon in the Classroom is available to set up and disassemble the aquarium for you.
3. Replacing aquarium components. This only applies to equipment that is loaned to you by the Service.
4. Providing guidance and advice about maintenance. Your FWS contact will explain these tasks to you before or at the time of tank assembly.
5. Delivering live salmon eggs to aquariums and picking up the hatched fry for release.
6. Coordinating all permits and fish release information related to U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife and/or Oregon Department of Fish and Wildlife.

Instructors

1. Ensuring there is adequate space for the tank and components. The tank should sit on a level surface in a quiet corner without direct sunlight with room for students to view the aquarium. There should be room next to the tank for the chiller. The area should also have a ground fault current interrupt (GFCI) outlet for plugging in the tank components. The outlet should be in a space where the cords do not pose a trip hazard.
2. Receiving salmon eggs from the hatchery. Your USFWS contact will arrange to bring the eggs to your classroom. This time can be used to discuss with the students what they are receiving and give them an opportunity to ask questions.
3. Maintaining the aquarium. Tasks designated as “Essential” are required to be completed by all instructors that host tanks. See the section on “Aquarium Maintenance” for instructions on completing these tasks and how often they should be done. Tasks designated as “Assigned” will vary by school, tank location and the availability of FWS personnel. Your FWS contact will discuss which of these tasks you should be doing.
4. Informing volunteers, students, colleagues, and anyone else that may interact with the tank about the importance of not unplugging anything.
5. Recognizing that the equipment provided by the Service is on loan to the school. Unless authorized in advance, the aquarium needs to be used for fish rearing and environmental learning through the entire use period

6. Emailing the Temperature Unit Data Sheets, and Tank Log Data Sheet (if applicable) to your FWS contact at the conclusion of the program.

Aquarium Supplies and Assembly

The aquarium will be set up and running at least one week before the eggs are delivered. This ensures that all the parts are working, the temperature is regulated correctly, and the water quality is adequate.

Supplies

Below is a list of equipment the Service uses for its Salmon in the Classroom aquariums. Other than the chiller, this equipment can be purchased locally at various pet or department stores.

- 1/6 HP Aquarium Chiller (and water pump depending on the type of chiller used)
- 20-gallon aquarium (24in. x 12in. x 16in.)
- In-tank filter (suitable for use in a tank up to 40 gallons)
- Filter cartridges
- Air pump (suitable for use in a 20-gallon tank)
- Clear air line tubing (8 feet)
- Air pump check valve
- Air stone
- Algae scrapper
- 25-pound bag of large gravel (natural colors)
- Small net
- Turkey baster (to remove dead eggs/fish)
- Tank vacuum siphon
- Aquarium thermometer
- Tap water conditioner
- 5-gallon bucket (to transport fry)
- 2.5 – 5 gallon jug (for storing water to top off the aquarium)
- Water quality test kit (pH, ammonia, nitrite and nitrate)

Assembly

If you choose to set the aquarium up yourself, follow the instructions below.

1. Rinse the tank thoroughly using tap water. If you are using a second-hand tank or have had another species of fish in the tank, you may want to use a very mild chlorine solution, being careful to rinse thoroughly as the chlorine will kill the salmon. A scrub brush may also come in handy for hard-to-remove grime. If the aquarium is not being placed in front of a dark background, it is advisable to tape dark paper to the backside of the aquarium, as the fish will feel more at home.
2. Pour the gravel evenly over the bottom of the tank. You'll want to rinse the gravel with tap water to remove dust and other particulates.
3. Place the chiller next to the aquarium. Depending on the type of chiller you use, you'll need to refer to manufacturer's instructions for setup and operation. If the chiller has an air intake then take special care to make sure that it isn't blocked, this could cause the unit to overheat. Keep the area around the tank and chiller clear of papers or books.

4. Fill the aquarium with water. If using tap water, it is essential to have the tank sit for at least 5-7 days. You can also add the recommended amount of an additive to remove heavy metals and chlorine from the water.
5. Assemble the filter. The water will be pulled up through the tube that extends down into the aquarium, and water will cascade through the unit and out the top, back into the aquarium. Depending on the type of filter used, you'll need to refer to manufacturer's instructions for setup and operation, including how to correctly insert and change the filter cartridge, appropriate water levels and if the unit needs to be primed.
6. Place the thermometer in the tank
7. Attach the clear tubing to the aerator. Place the check valve about ½ way down the tube and the air stone at the end of the tube. Wrap the tube and air stone around/through the chiller coil to keep it down toward the bottom. You can bury the air stone in the gravel to keep it down.
8. Plug the chiller, filter and aerator into a power strip.
9. Turn on the outlet strip switch to start the aquarium.
10. The temperature on the chiller should be set around 49 ° F. Refer to the manufacturer's instructions for adjusting the chiller. It may take several hours for the water to reach the desired temperature.



The tank will be disassembled in the week after the fry have been released. You are welcome to disassemble the tank if you want it done sooner. If you chose to disassemble the tank, please remember to do the following:

- Drain the chiller (if you are using a recirculating chiller)
- Scrub off any algae from the side of the tank before emptying the water
- Throw away the filter cartridge and rinse out the filter
- Rinse off any components that have been submerged in the tank
- Store the tank and components in a climate-controlled environment until they are picked up

Maintenance

Before the eggs hatch, aquarium maintenance is minimal. During the early days of the project, the most important part of aquarium maintenance will be to remove dead eggs. Water changes are also minimal during this early time.

As the eggs begin to hatch, a chemical reaction causes the shells to disintegrate. A layer of foam or scum, which can be skimmed off using a dip net or a strainer lined with a coffee filter, may accumulate

at the top of the aquarium. The aquarium water may be cloudy for several days while the eggs are hatching.

After hatching, the alevin (as they are now called) spend several weeks feeding from a yolk sac (like a built in lunchbox). Until the time when the yolk sac is absorbed and you begin feeding (if feeding is needed) your fish (now called fry), there is little aquarium maintenance to be done.

If you begin to sense something is wrong with the aquarium or the eggs you should contact your FWS Salmon in the Classroom coordinator immediately. If you can, email or text pictures of the issue. Even if it turns out to be nothing, it's better to be ask than to let the problem get worse and potentially kill the eggs.

Essential

Removing dead fish or eggs

Dead eggs turn white and take on a cloudy appearance. Dead eggs and fish should be removed as soon as possible to avoid contaminating surrounding healthy eggs. The date and number of dead eggs (or fish) removed should be reported to your FWS contact. Do not wait to report, too many dead eggs (or fish) could indicate a bigger issue.

Topping off with water

Fill a 2.5-5 gallon jug with water and add the tap water conditioner per manufacturer's instructions. Let the water sit for 24 hours to release chlorine prior to adding to aquarium. Take note of where the water level is once the tank has been setup (use a sharpie to make a small mark on the outside of the tank). The water in the tank should be topped off when the water level begins to go more than a half inch below that mark. Alternatively, your Salmon in the Classroom coordinator will provide you will a jug of treated water that can be added directly to the tank. **Do not add untreated water to the tank.**

Scraping algae

Tanks that use water supplied by the hatchery may result in algae growing on the sides of the tank. Use the algae brush to scape the sides of the tank free of algae. The water may be cloudy afterwards but should clear up in 24 hours. Tanks that are cloudy after 24 hours should be reported to your FWS contact. Tanks that use tap water generally have little to no algae buildup. If you experience significant algae growth in a tank with tap water you should reach out to your FWS contact.

Ensuring equipment is functioning

Tanks should be checked daily to ensure the chiller is plugged in, bubbles are streaming from the aerator and the filter is working properly.

Recording temperature units

Temperature units (TUs) are a measure of how warm or cold the water is over a 24-hour period. Degree days (or accumulated thermal units) are the sum of TUs over a period of time. Water temperature is critical for salmonids due to their metabolic rate being largely determined by the temperature of their environment. Eggs gain more degree days in warmer water than in colder water, leading to faster development. As such, eggs only hatch after a set number of degree days instead of a set number of days. Fish culturists use degree days to approximate the date when the eggs will hatch.

The table below shows the approximate number of degree days that are needed for each developmental stage for Fall Chinook Salmon.

Developmental Stage	Degree Days
Fertilization	0
Rapid Cell Division	10
Tiny embryo formed	100
Embryo grows larger	200
“Eyed” egg	500
Hatch	900
Emergence from gravel	1500

Your FWS contact can tell you the degree days for your eggs when they are delivered to your classroom. You may notice that not all the fish may hatch at 900 degree days. It’s normal for some to hatch sooner or later than the degree days provided in the table above.

Temperature units for the tank are calculated by taking the tank’s water temperature (in Fahrenheit) and subtracting it from 32°F (the temperature at which growth or development is effectively zero). For example, the temperature unit for eggs that are in a tank with a water temperature of 49°F is 17 TUs. If the water temperature the next day is 52°F, then the TU is 20 (52°F -32°F =20 TUs) and the degree days are 37 (17 TUs + 20 TUs).

Since the tank chiller is set to 49°F and the tank temperature remains relatively constant (+ or – 2 degrees), 17 TUs can be used for days when school is not in session (or when you forget to records the actual TU). This number can be added to the previous TU to get a new degree days estimate.

Use the “Temperature Unit Data Sheet” on page 11 to record the TUs and Degree Days for your eggs. **You will need to make copies of the blank data sheet to have enough room to record the daily data. The data sheets should be emailed to your FWS contact once the eggs hatch.**

Assigned

Feeding the fish

As the alevin absorb their yolk sacs, skin grows over the diminishing sacs, creating a “buttoning-up” effect depicted in Stages 1 thru 5 of the figure below. The time to begin feeding the fry is when most of the sac is absorbed but you can still see just a pinkish bubble or slit of yolk sac (Stage 5). As the sac is absorbed, the fish receive a diminishing amount of nourishment and begin to need supplemental feeding.



Remember:

- The majority of fish need to have absorbed their yolk sacs and be actively swimming around to start feeding. Do not start feeding if only a few fish are swimming and most are simply sitting on the bottom of the tank with yolk sacs remaining.
- Feeding too early may be fatal to the fish, as their digestive tracks may not be fully developed yet. Fry can survive for weeks without any long term affects. If you are releasing your salmon, you may not even need to feed depending on timing.
- Overfeeding can be a problem in classrooms. Too much food can cause the tank to cloud up and smell foul. Only a pinch of food should be given at first. You may work up to twice a day as the fry continue to develop.

To feed the fish:

1. Put a small pinch in the tank to see if the fish go after the food. It might take a few minutes for them to find it. The food will float on top for a bit. Watch the fish until the food starts to filter down through the water.
2. If the fish go after the food, give another pinch. If not DO NOT proceed to the next step. Instead, wait a week and repeat step 1.
3. Feed the fish a pinch in the morning and afternoon. On Fridays give them a bit more, and you don't have to worry about feeding over the weekends, unless you are at the school and want to feed them.

Checking the water chemistry

You will use the API Freshwater Master Test Kit to test the water chemistry and a digital thermometer to test the temperature. **The measurements should be taken weekly and recorded in the Tank Log on page 10. The data sheet should be sent to your FWS contact at the conclusion of the program.** Review the manual in the API Test Kit for chemical safety information about the test solutions provided in the kit.

The water chemistry tests are colorimetric. Ammonia, nitrate and nitrite all take 5 minutes to develop while pH is instant. It's recommended that you start with the nitrate test. While it's developing, move on to nitrite and ammonia. While those three tests are developing, you can use that time to check the pH.

Before you begin

1. Make sure you have all four test tubes and caps.
2. Use the dropper to add 1mL of tank water to each tube.
3. Cap the tube and shake vigorously.
4. Pour the water out into a waste container, or sink. Do not pour the water back into the tank.
5. Repeat steps 2-4 two more times.
6. Fill each tube with 5mL of tank water to be tested.

Nitrate

1. Vigorously shake the **Nitrate Test Solution #2** for at least 30 seconds. This step is extremely important to ensure accuracy of test results.
2. **Add 10 drops of Nitrate Test Solution #1** to 5mL tube of tank water. Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.

3. Cap tube and **invert several times** to mix solution.
4. **Add 10 drops of Nitrate Test Solution #2.** Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
5. **Cap tube and shake vigorously for 1 minutes.** This step is extremely important to ensure accuracy of test results.
6. Wait 5 minutes for color to develop.
7. Read the test result by comparing the color of the solution to the Nitrate Color Chart. The closest match indicates the ppm of nitrate in the water sample.

Nitrite

1. **Add 5 drops of Nitrite Test Solution** to 5mL tube of tank water. Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
2. Cap tube and **shake for 5 seconds.**
3. Wait 5 minutes for color to develop.
4. Read the test result by comparing the color of the solution to the Nitrite Color Chart. The closest match indicates the ppm of nitrite in the water sample.

Ammonia

1. **Add 8 drops of Ammonia Test Solution #1** to 5mL tube of tank water. Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
2. **Add 8 drops of Ammonia Test Solution #2.** Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
3. Cap tube and **shake for 5 seconds.**
4. Wait 5 minutes for color to develop.
5. Read the test result by comparing the color of the solution to the Ammonia Color Chart. The closest match indicates the ppm of ammonia in the water sample.

pH

The pH of the water usually varies between 7.4-8. For this reason, you will want to test the pH using the "High Range pH Test Solution". If the result looks like it can be less than 7.4, then repeat the test with the "pH Test Solution".

The pH range for the High Range pH Test Solution is 7.4 – 8.8. The pH range for the pH test solution is 6.0 – 7.6.

High Range pH Test Instructions

1. **Add 5 drops of High Range pH Test Solution** to 5mL tube of tank water. Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
2. Cap tube and **invert several times** to mix solution.
3. Read the test result by comparing the color of the solution to the High Range pH Color Chart. The closest match indicates the pH of the water sample.

pH Test Instructions

1. **Add 3 drops of pH Test Solution** to 5mL tube of tank water. Hold dropper bottle upside down in a completely vertical position to assure uniformity of drops.
2. Cap tube and **invert several times** to mix solution.

3. Read the test result by comparing the color of the solution to the pH Color Chart. The closest match indicates the pH of the water sample.

When you are finished

1. Pour water samples from test tubes in a waste container or sink. The chemicals are safe to dispose of down the drain.
2. Add a few mLs of tap water to each tube.
3. Cap the tube and shake vigorously
4. Pour water into waste container or sink
5. Repeat steps 2-4 two more times

Temperature

1. Turn on the digital thermometer. Be sure the reading is set to Fahrenheit.
2. Place the silver probe in the tank and allow the probe to equilibrate for at least 1 minute
3. Record the temperature displayed on the screen

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