

Kevin Amboe photo



POWER HEAD

# Manual

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Fisheries and Oceans  
Canada

Pêches et Océans  
Canada

## Welcome to Salmonids in the Classroom

Fisheries and Oceans Canada is pleased to support salmon incubation in your school. Raising salmon in the classroom is an opportunity to teach students to understand, respect and protect freshwater, estuarine and marine ecosystems, and to recognize how all humans are linked to these complex environments.

## The Aquarium Environment

As much as possible we want the tank to represent a stream environment. The equipment is designed to create the habitat that salmon need. When students are aware of these needs, maintaining the tank becomes more meaningful.

### Learning Resources

Salmonids in the Classroom resources (Primary and Intermediate) are required for the program.

Download at [www.streamtosea.ca](http://www.streamtosea.ca)

#### SALMON HABITAT

- 1 Cold water between 5°C to 10°C . . . . . refrigerator and insulation
- 2 Oxygenated water . . . . . fluval filter which aerates
- 3 Clean water . . . . . filter inserts which clean
- 4 De-chlorinated water . . . . . aquaplus chlorine remover
- 5 Darkness for eggs and alevins . . . . . covering of insulation and lid

#### AQUARIUM PROVIDES



### Equipment List

#### Set-up provided by DFO

- Aquarium 20 gallon
- Insulation and cover
- Fluval with filter inserts
- Aquarium gravel
- Gravel cleaner
- Thermometer
- Dip Net
- Aquaplus chlorine remover
- Cycle nitrifiers
- Ammonia remover

#### Provided by your School

- Refrigerator
- pH and Ammonia test kits
- 5 gallon bucket for water changes and fry release

#### Consumables replaced annually by your school

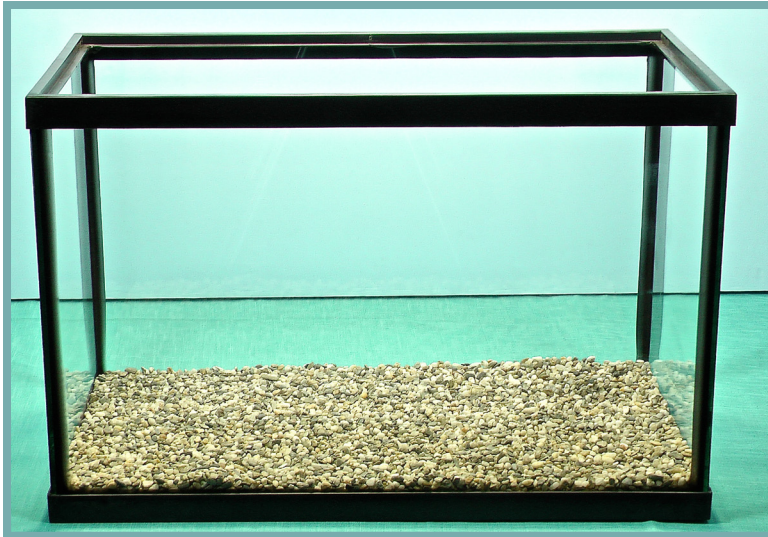
- Filter inserts
- Aquarium gravel
- Chlorine remover

### Calendar/Time Line

- September . . . . . Applications sent to new participants as requested.
- Oct-Nov . . . . . Eggs from spawners are fertilized and reared at hatchery.
- November. . . . . Training workshops for salmon educators.
- December. . . . . Set-up tanks, prepare for egg delivery.
- January. . . . . Eyed-egg delivery to most classrooms.
- February. . . . . Eggs hatch to alevin stage.
- March. . . . . Swim-up fry stage; feeding and cleaning
- March-April. . . . . Fry released to local streams.

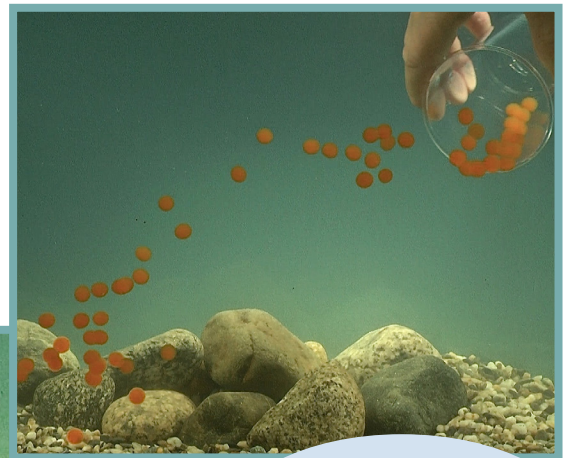
## A. Set-Up with gravel

Set-up tank 10 days before eggs arrive to condition the water and ensure all equipment is working.



### 1 Gravel

Dust-free epoxy-coated gravel is recommended  
For 20 gallon tanks use 5kg  
For 33 gallon tanks use 10kg  
Spread evenly over the bottom of the tank.



Demonstration of eyed eggs deposited in front of the redd.



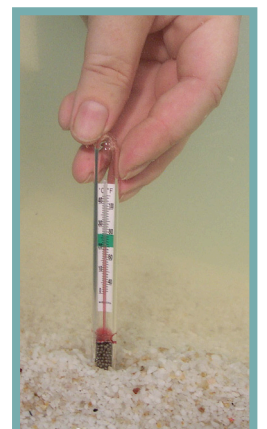
### 2 Redd

Collect 10-15 round rocks of 2 inch diameter.  
Avoid sharp edges and rust, iron, or metal in the rocks.  
Boil for 10 minutes, cool, and pile loosely in the center of the aquarium. Leave 4 inches of space between redd and front of the tank so the eggs can be observed.  
When the eggs hatch, alevins will hide by wedging between the rocks.

3

### Thermometer

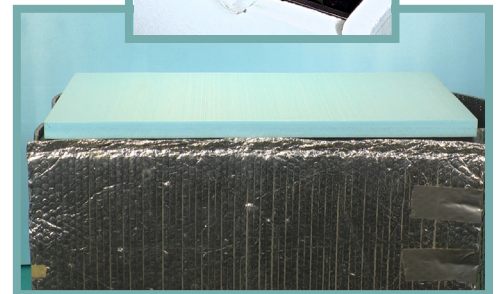
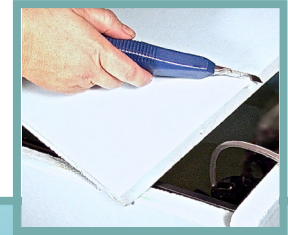
Place thermometer in gravel or on the inside of glass. Place near small opening in front cover to monitor daily. Optimal temperatures are 5° to 9°.





#### 4 Insulation

Styrofoam or insulation is wrapped tightly to all sides of the dry tank, then taped to sides of glass. Use one piece for under the tank. Sides, back and lid remain on the tank throughout the program. The front is removed at fry stage.



Custom cut the lid with openings for electric cords etc for a tight fit. This will prevent fry from jumping through cracks between lid and sides.



Limit the light at egg and alevin stages. A small door can be cut for individual peeking.



Hinge the front cover for class viewing of eggs and alevins. Suggested daily limit is three 10 minute sessions. The front is removed at the fry stage.

#### 5

### Background

Add a laminated background on the outside of tank between insulation and glass to minimize the shine of the insulation. Tanks will often have water on the outside of the glass from condensation. This is not an indication of leaking.



#### 6

### Water

Run cold tap **30 minutes** prior to filling tank to clear pipes of harmful metals such as copper and lead.



#### 7

### Aquaplus

Add to remove chlorine and prepare water. Follow directions on bottle for 20 or 33 gallon tank.

## B. Alternate Minimal Gravel Set-Up

Set-up tank 10 days before eggs arrive to condition the water and ensure all equipment is working.



### 1 Backdrop

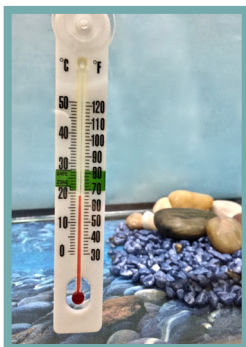
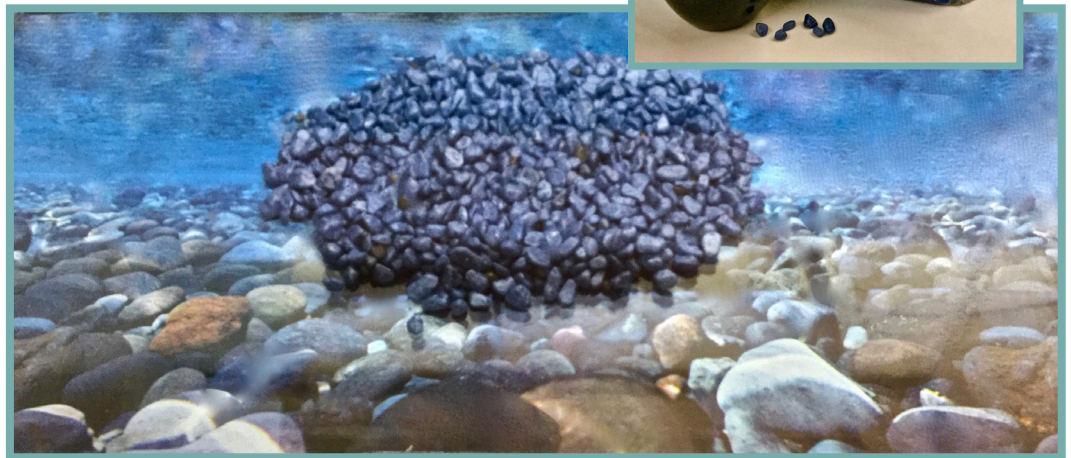
Tape a backdrop of river rock (or other similar image) to underside of tank.

Dust-free epoxy-coated aquarium gravel is recommended.



### 2 Gravel

Spread 1 kg (approx. 1 cup) in an 8" circle to cover glass in middle of tank. When fry are swimming remove all gravel and redd rocks.



### Thermometer

Place suction-cup thermometer on the inside glass near opening in insulation. Monitor daily. Optimal temperatures are 5°C to 9°C.

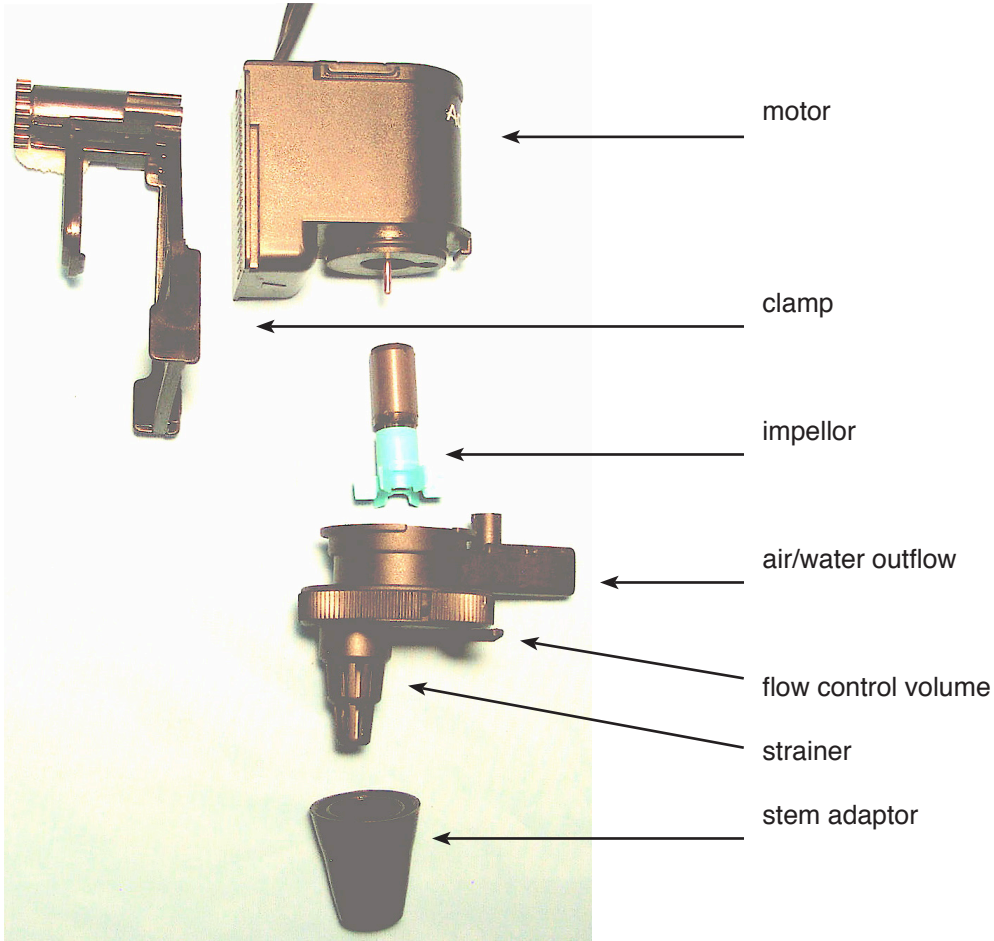


### 3 Redd

Collect 10-15 round rocks of 2 inch diameter. Avoid sharp edges and rust, iron, or metal in the rocks. Boil for 10 minutes, cool, and pile loosely on the gravel. Leave 2-3 inches of gravel in front for placing the eggs. When the eggs hatch, alevins will hide by wedging between the redd rocks.

**Follow previous instructions to add insulation and fill tank.**

# 1 Assemble powerhead



The powerhead pumps water and air through the tank. It sits tightly on the riser stem.

If not using undergravel plates and riser stems;

- cut a 1" slit in foam filter block and insert over end of intake. This prevents fry from being sucked into the power head. Clean foam block as necessary.

Add stem adaptor to powerhead if using riser tubes and undergravel filter plates.

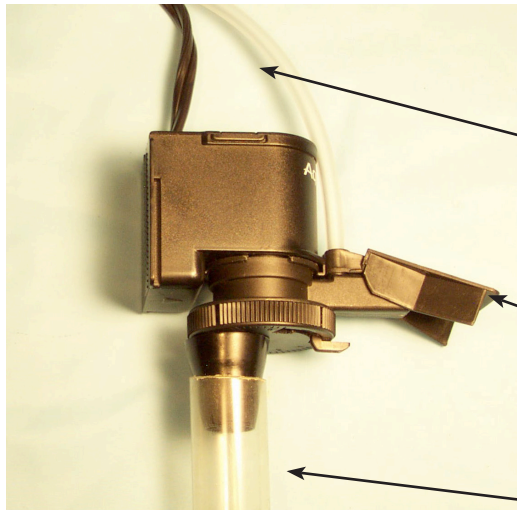
## 2 Make adjustments

Adjust the flow control volume to maximum.

Cut the riser stem so that powerhead sits below water line.  
Place clamp on side of tank and tighten the knob to secure.

Slide powerhead down into the clamp (it will sound like a zipper).  
Adjust height until sitting snugly on the riser stem.

Do not plug in until water is covering the motor.  
Tape the plug and outlet to prevent accidental loss of power.



add airline

add diverter to  
direct air flow

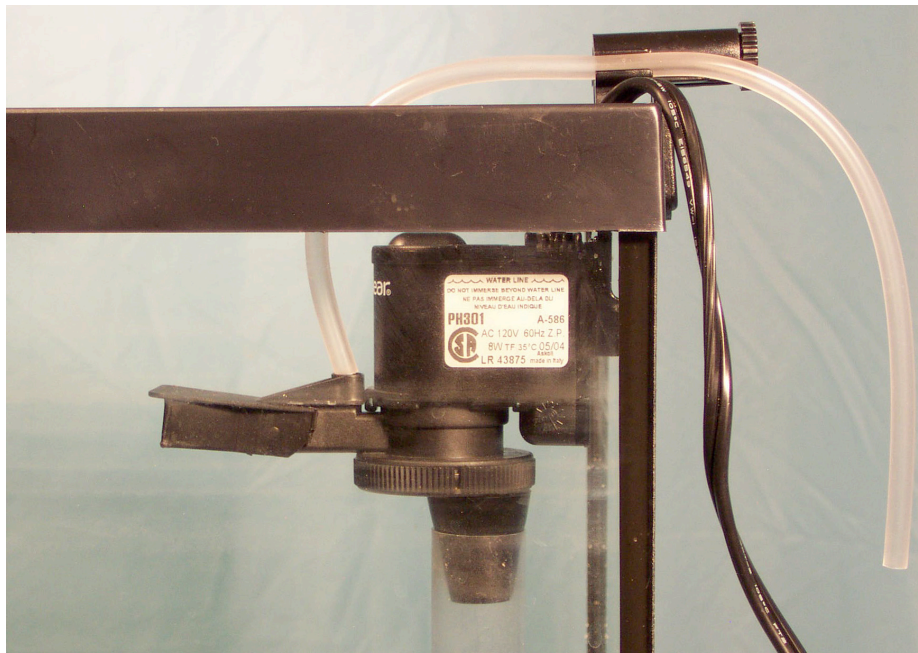
place on  
riser stem

### Maintenance

Always keep the powerhead immersed in water.

Once a year use a q-tip to clean the impellor and the shaft it sits in.

Check the strainer for debris if the air outflow decreases.



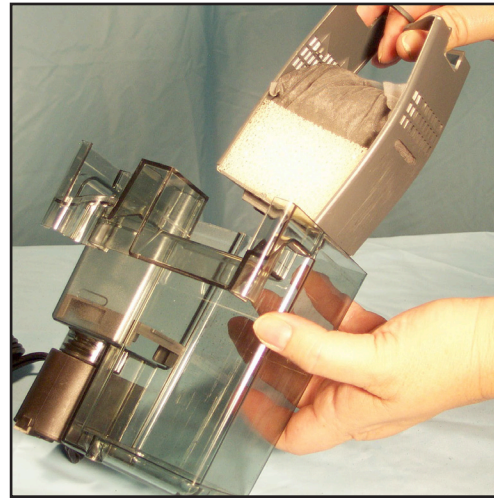
### 3 Assemble power filter

The power filter will help keep the tank water clean, but does not replace water changes. You will need two foam blocks and two mesh charcoal bags.

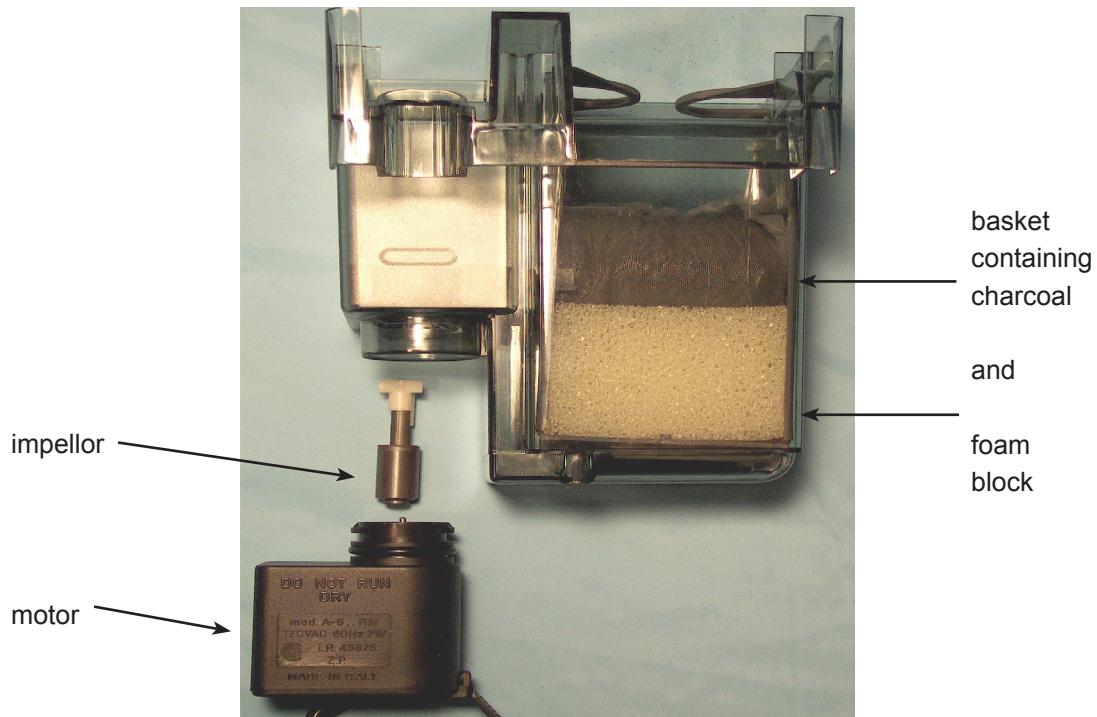


Rinse the foam block insert. Rinse the mesh bag of charcoal (remove plastic dust cover).

Place the foam block in the bottom of the basket - avoid spaces on the sides of the basket. Lay mesh bag of charcoal on top.



Insert basket into power filter casing.



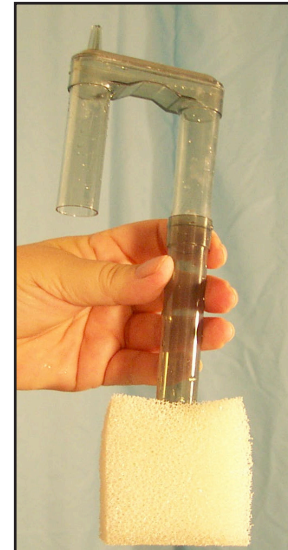




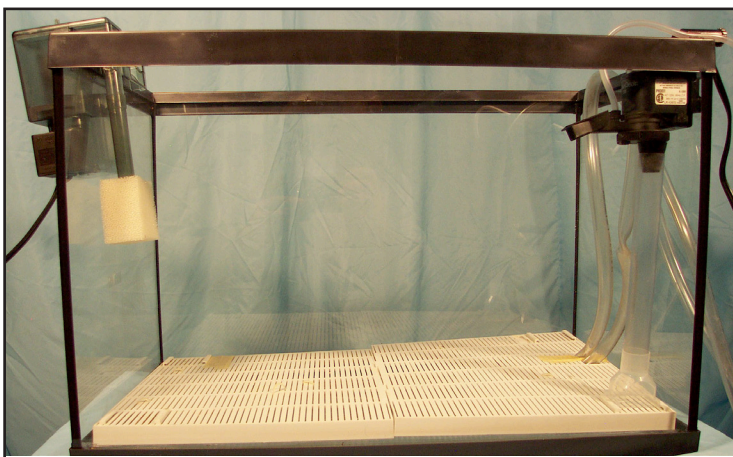
Assemble the intake stem.



Cut 1" slit in second foam block and insert over end of intake. This prevents fry from being sucked into filter. Clean foam block as necessary.



Hang the filter over the side of tank with intake stem on inside. The intake stem must be below water level.



Powerhead and powerfilter in place.

### Maintenance

Always keep the powerfilter case full of water.

Rinse the foam blocks in dechlorinated water when dirty.

Remove the foam block from the intake stem when the fry are larger.

Change the carbon insert when the fry begin feeding.

Once a year use a q-tip to clean the impellor and the shaft it sits in.

**TO AVOID ELECTRIC SHOCK** do not reach for the unit if it falls into the water. Unplug all outlets first.

# Life Stages in the Classroom

## Eyed-Eggs

Eyed eggs are sensitive to light and extreme changes in temperature. Limit observing (when the front insulation is removed) to three 10 minute sessions each day. Check your tank daily for egg health. You can expect 5 - 10% of the eggs to die. Dead eggs are milky-white and opaque. Remove immediately from the water as they spread fungus to live eggs. To remove dead eggs, wash hands and use dipnet or clean slotted spoon.

## Hatch

The eggs may hatch over a number of days. After hatch a white froth will appear on the water surface. This is normal and should be skimmed off with a dip net. Remove egg casings on the bottom on the tank with a dip net. Rinse filters to remove egg casings. Test for ammonia levels at this time. If above normal, change some tank water.

## Alevin

Alevins are sensitive to light and prefer the safety of the redd. Keep the tank covered and continue the guidelines of three 10 minute observations per day. Once the yolk sac is absorbed the alevin is 'buttoned-up' and will emerge from the redd.

## Swim-up Fry

Fry need to inflate their swim bladder at the surface of the water before they have buoyancy. They must struggle to the surface and gulp the air. This usually occurs at night. When the fry are swimming freely in the water they will rise to the surface looking for food.

## Release

Salmon species contain unique stocks that are attuned to their natal stream. All fry must be returned to an authorized stream under the direction of Fisheries and Oceans Canada. Keep records of the number of fry released (count at release site). This data is required for scientific purposes.

## Wrap-up

Your tank is lent "in trust" to raise salmon. Do not use for other purposes. Clean all equipment before storing in a safe place. Gravel may be reused after sterilization by boiling/baking. Purchase consumable supplies annually.



**Eyed Egg**




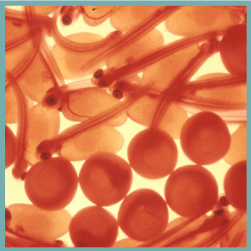



**Alevin**



**Fry**



# Maintenance Calendar

STAGE	TANK	WATER
<p><b>Eyed Egg</b></p> 	<p><b>Insulation</b></p> <ul style="list-style-type: none"> <li>• covers all sides and top</li> <li>• viewing limited to short periods</li> </ul> <p><b>Daily check</b></p> <ul style="list-style-type: none"> <li>• begin recording ATU's</li> <li>• remove dead eggs immediately</li> <li>• monitor air flow and water temperature</li> </ul>	<p><b>Before eggs arrive</b></p> <ul style="list-style-type: none"> <li>• age water 10 days in tank</li> <li>• check pH (6 - 7.5 range)</li> <li>• check ammonia if re-using gravel</li> </ul> <p><b>After eggs arrive</b></p> <ul style="list-style-type: none"> <li>• once a week check pH and ammonia levels</li> </ul>
<p><b>Hatch</b></p> 	<p><b>Insulation</b></p> <ul style="list-style-type: none"> <li>• covers all sides and top</li> <li>• viewing limited to short periods</li> </ul> <p><b>Cleaning</b></p> <ul style="list-style-type: none"> <li>• remove any white froth on the water surface with a dip net</li> <li>• remove egg casings with a dip net</li> </ul>	<p><b>Testing</b></p> <ul style="list-style-type: none"> <li>• once a week check pH and ammonia levels</li> <li>• change water if required</li> <li>• clean filters in treated water (dechlorinated)</li> </ul>
<p><b>Alevin</b></p> 	<p><b>Insulation</b></p> <ul style="list-style-type: none"> <li>• covers all sides and top</li> <li>• viewing limited to short periods</li> </ul> <p><b>Cleaning</b></p> <ul style="list-style-type: none"> <li>• remove any dead alevin</li> <li>• check water levels and add if needed</li> </ul>	<p><b>Testing</b></p> <ul style="list-style-type: none"> <li>• once a week check pH and ammonia levels</li> <li>• change water if required</li> <li>• rinse filters in treated water (dechlorinated)</li> </ul>
<p><b>Fry</b></p> 	<p><b>Insulation</b></p> <ul style="list-style-type: none"> <li>• front is removed completely</li> </ul> <p><b>Cleaning</b></p> <ul style="list-style-type: none"> <li>• remove redd and/or gravel</li> <li>• every week vacuum/remove 5 gal. add 5 gal. clean water, rinse filters</li> </ul> <p><b>Feeding</b></p> <ul style="list-style-type: none"> <li>• begin when fry swim-up</li> </ul>	<p><b>Testing</b></p> <ul style="list-style-type: none"> <li>• <b>every 2 days</b> check pH and ammonia levels</li> <li>• change water every week</li> </ul> <p><b>Additives</b></p> <ul style="list-style-type: none"> <li>• add Cycle during water changes</li> <li>• lay bag of Ammonia Remover on bottom of tank near filter intake</li> </ul>
<p><b>Release</b></p> 	<p><b>Cleaning</b></p> <p>Your tank is lent "in trust" to raise salmon only. Clean all equipment with vinegar before safely storing. Gravel may be reused after sterilization, (boiling) and stored dry.</p>	<p><b>Transport</b></p> <ul style="list-style-type: none"> <li>• remove 5 gallons of tank water to clean pail (with cover)</li> <li>• dipnet fry into pail for transport to authorized stream</li> <li>• count and record fry released</li> </ul>

# Catch the Hatch with ATU's

## Your students will be able to predict

- 1 When the eggs will hatch
- 2 When the fry will swim-up and look for food.

## How it works

- When eggs are laid they have **0 Thermal Units**.
  - The temperature of the water is measured (for example the average temperature might be 8°C).
  - The eggs **accumulate 8 Thermal Units** in one day (24 hours) .
  - During the next 24 hours the water may be 9°C.
  - The two days are added - and the eggs have now **accumulated 17 ATU's**.
  - During the next 24 hours the water may be 7°C. This is added to 17 and the eggs are now **24 ATU's**.
- Hatcheries continue to measure temperature **every day** to keep accurate record of the salmon's age.


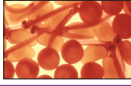

## We Calculate

### Accumulated Thermal Units (ATU's).

1 thermal unit = 1 degree Celsius.

ATU's = the degrees accumulated over one day.

## ATU's predict each stage of development

Stages of Development		Coho ATU	Chum ATU
	<b>Eyed eggs</b> ( <i>delivered to schools</i> )	220	325
	<b>Hatch</b> ( <i>eggs become alevin</i> )	400 - 500	475 - 525
	<b>Fry</b> ( <i>swim-up and look for food</i> )	700 - 800	900 - 1000

- When the eggs are delivered the ATU's on that day will be given to you.
- Prepare a chart to record this ATU. (Use a class chart or students may keep individual records).
- Measure your water temperature every day, enter it on the chart and record the ATU's.
- Estimate water temperatures for Saturday and Sunday then add these to your chart on Monday.

## Example ATU chart

Date	Today's Temp.	+ Yesterday's ATU	= Today's ATU
Jan 5	9 C	235	244
Jan 6	10 C	244	255

# Feeding Fry

## When to begin

Begin feeding when a quarter of the fry are swimming about in the middle of the tank.

## Changes to tank

### 1 Remove the redd (and 1kg gravel)

The fry no longer need their nest. The redd may hide dead eggs or alevins which will contaminate the water. If using the 'Minimal Gravel' set-up remove the all gravel as well.

### 2 Remove the front cover

Fry need light to see food. They will be shy at first, but will grow accustomed to the light and movement in the classroom. Keep sides covered and lid on tight or fry will jump from the water.

### 3 Turn off the lights at night

Fry need a cycle of light and dark, so turn off lights in the evening and weekends. The front cover may remain off during nights and weekends if the water temperature is remaining below 10C.

**Students love to feed their fry!**  
**Let everyone share this special time, but pre-measure the food and supervise.**



Use 1/16 tsp of fish food 4 times each day. Use the "Starter" for 10 days then switch to "Second Stage" food. You do not need to feed on weekends.

## Feeding guidelines

### 1 Store food in the freezer until feeding

We are feeding a hatchery approved diet of complete nutrients. Keep it in a freezer until regular feeding begins and then store in a classroom cupboard away from the light.

### 2 Use 1/16 tsp of 'STARTER' to begin

Turn OFF filter. Gently sprinkle 1/16 tsp. food over the water to avoid startling the fry. If they do not rise to the surface for the food, try placing a pinch just under the water surface and then release to drift down through the tank. **Turn ON filter.**

### 3 For first 2 days feed every hour - then maintain a schedule of 4 times a day

If possible, familiarize the fry with the food by feeding every hour for the first 2 days. Then feed at least **4 times a day**. You do not need to feed on weekends.

### 4 Switch to "SECOND STAGE" food in the third week

After 10 days the fry will need larger food so begin using the "Second Stage" vial of food. Continue with 1/16 tsp of food 4 times a day.

## Can we feed to much?

Overfeeding is not a favour for your fry! They are cold blooded and eat infrequently in the wild. Feces and uneaten food in the tank will contaminate the water causing death. At the fry stage monitor the water every 2 days for changes in pH and ammonia levels. Water changes also become necessary at this stage in the salmon life cycle.

# Water Conditioners

## Ammonia Remover and Cycle

At the fry stage these conditioners will assist with water quality

### When?

Add ammonia remover and cycle to the tank water **when you have fry** approximately a week before feeding.



### Ammonia remover

- 1 Rinse the mesh bag to remove dust.
- 2 Place on bottom of tank beside the filter intake. This will distribute the remover throughout the water. This bag will help control ammonia levels for approximately one month.

***This does not replace the need for changing tank water - see "Water Change" guidelines.***

### How it works

Fluval ammonia remover is a natural ion-exchange media for freshwater use only. The Hagen Ammonia Test Kit A-7820 can be used with this product and will still give accurate readings of the ammonia levels in the water.

### Cycle

- 1 Shake well before using.
- 2 Add two capfuls to tank water.
- 3 How often? Weekly, after a water change.

***This does not replace the need for changing tank water - see "Water Change" guidelines.***

### How it works

Cycle is a natural source of nitrosome bacteria which inhabit and constantly multiply in an aquarium. Nitrosomes eliminate the ammonia by feeding on it. Ammonia is formed from fish urine and decaying food matter. Cycle is a dated product, always check expiry date.

# Water Tests

## Your Check List for Healthy Salmon

- Follow water test guidelines
- Follow Maintenance Calendar schedule
- Check everyday that equipment is working
- Record ATU's
- Make a check list (suggestions below)



### Ammonia Guidelines

STAGE	How often to test
Eyed egg	weekly
Hatch - alevin	weekly
Feeding - fry	every 2 days

### Ammonia is lethal

Food and feces in the tank will quickly convert to ammonia. Even a low level of ammonia is dangerous for fry, and if left too long is extremely difficult to remove.

Over time, ammonia converts to Nitrite which is very toxic and will quickly kill the salmon fry. Your ammonia test kits will not measure Nitrites, so test for ammonia frequently and take action when ammonia is present before it converts to Nitrites.

*Students involved in hands-on care of the fry develop empathy and a stronger stewardship ethic.*

### If ammonia is present

If a test result indicates ammonia is present ...

- 1 Change at least 1/4 of the water (5 gallons).
- 2 Measure ammonia levels again. If it is still present change more water and measure again. Removing 5 gallons of water only decreases ammonia by 25%. In persistent cases the water may need to be changed everyday until there is no ammonia present.

### pH Guidelines

- 1 pH should be between 6 and 7.5 (safe for salmon at these levels)
- 2 Check levels once a week
- 3 Use a broad range kit (4.5 - 9)
- 4 Find a baseline pH  
Check the tap water or other source for the tank.  
Use this to compare with the pH of your tank.

### If pH is outside the guidelines

Do not use buffers to raise or lower the tank pH. Use changes of water to maintain a steady pH.

### Tank Check List



- Date \_\_\_\_\_
- Water Temp. \_\_\_\_\_ ATU's \_\_\_\_\_
- pH \_\_\_\_\_ Ammonia \_\_\_\_\_
- Chiller is plugged in/temperature is displayed
  - Thermostat is in the water
  - Filter outflow is directed at refrigerator coils

# Water Changes

Change 5 gallons of tank water after one week of feeding. Continue once a week, or more if needed.

## Follow these 9 steps for safe water changes

### 1 Run replacement water

Water must run for 30 minutes to clear metals (copper and lead) and sediments.

### 2 Turn off filters /remove redds

If left on the motor will burn out. The rocks are not needed and may hide dead eggs.

### 3 Remove 5 gallons

Having a helper is necessary. Use gravel cleaner to siphon debris from the bottom of tank. Remove water to 5 gallon bucket, never directly to sink.

### 4 Rinse filters in this water

The used water is de-chlorinated and will not kill the beneficial bacteria that live in the filters.

### 5 Dispose of dirty water

If too heavy to lift, use a clean ice-cream pail to scoop water from the 5 gallon bucket.

### 6 Fill bucket with new water

Use replacement water which has ran 30 minutes.

### 7 Add Aquasafe to bucket

Never add water directly to the tank without first removing the chlorine. Stir the Aquasafe into the bucket - it acts immediately to remove chlorine.



### 8 Refill tank

Use ice-cream pail to scoop water from 5 gallon bucket. Avoid disturbing the gravel. Check that water is at correct level for filters.

### 9 Turn on filters

Ensure filter outflow is once again aimed at the refrigerator coils.

## Preparation

### You will need :

- water which has ran 30 minutes
- clean 5 gallon bucket
- clean ice cream pail
- AquaSafe chlorine remover
- Siphon/gravel cleaner



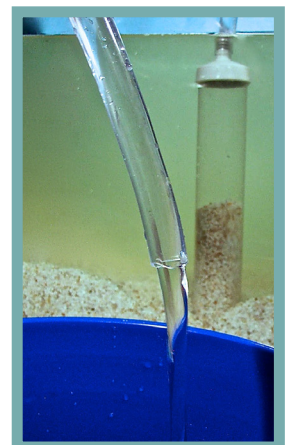
**Change water on Wednesday!**

*if a problem occurs it can be corrected the next day.*

## Tips on using a siphon

- Immerse siphon/gravel cleaner in tank and fill with water - there should not be any air bubbles in the tubing.
- Cover end of tubing with thumb to block water. Remove end of tubing from tank and lower into 5 gallon bucket, (to start siphon the bucket must be lower than the tank water).
- Remove your thumb and water will begin siphoning into the bucket, (if not, check for air bubbles in tube).
- Pump the siphon up and down on the gravel. The debris is light and will be siphoned out with the dirty water while the gravel will fall back into the tank.

**Do not feed fish after water changes. They will be stressed and will not eat.**





# Fry Release

## When to release

We recommend feeding fry for at least 2 - 3 weeks before releasing. The best release time for chum is April. Chum survive best when they can reach the ocean early. Coho may be kept a little longer but no later than mid-May. All fry survive best when the weather is warmer and aquatic insects have hatched in the stream.

## Before you go . . .

**Allow an hour+ to remove fry from tank. Discuss fry release methods and student streamside behavior.**



## Transport to site

Keep the lid on the bucket. Secure bucket during transport. Keep out of direct sunlight. Do not use ice blocks or floating coolers in the water bucket as these may crush the fry during transport.

## At the site

On arrival place bucket in shady spot. Slowly add a little creek water to the bucket. This will cool and aerate the water and begin acclimatizing the fry to the creek water.

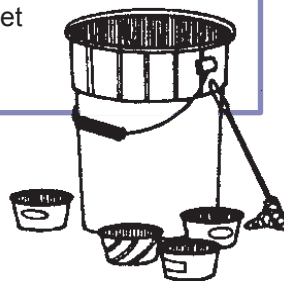
## Transfer fry from tank

- 1 Siphon 3/4 of tank water out and fill clean 5 gallon bucket. Leave at least 10 cm of air space at the top of the bucket to incorporate air into water.
- 2 Gently scoop out fry using a dipnet. Avoid contact with your hands by carefully pinching the bottom of the net. Turn the dip net upside down over the bucket of water so fry will fall into the water without being handled.
- 3 Count the fry as they are removed. Fisheries and Oceans requires this number for Fry Release Records.
- 4 If you are not leaving immediately, aerate the bucket with an airstone or frequently stir the surface of the water with a dipnet to incorporate air. Keep the bucket in a cool spot out of sunlight.

## Preparation

### You will need :

- clean 5 gallon bucket with lid (the bucket used for water changes)
- siphon (gravel cleaner)
- 500 ml containers for students to use
- dipnet



## How to release

- Release in small groups of 6 to 8 with an adult supervisor.
- Use clean, 500 ml containers.
- Half-fill each container with water from bucket.
- Dipnet a fry from the bucket into the container.
- Use *Student Handout* for detailed instructions.
- As needed, add more creek water to the 5 gallon bucket to keep water cool and aerated.

**Take only memories.  
Leave only soft  
footprints**

## Stream stewardship guidelines

- Many schools may use this site to release.
- Keep to existing trails to avoid trampling on streamside plants. This causes erosion which clouds the water and then fry will not see to catch food.
- Students should respect the natural site by not running, jumping, or screaming in an uncontrolled manner.
- Stay out of the water, which creates silt and crushes the aquatic insects which fry eat (not allowing boots will help this guideline).
- Please take all food and litter with you when you leave.



STUDENT HANDOUT:

# HOW TO RELEASE YOUR FRY

**MATERIALS:**

Small container (500 ml)

Fry with water

**PROCEDURE:**

**Step 1.** Obtain fry from supervisor.

**Step 2.** Gently carry your cup and fry to the creekside.

**Step 3.** Decide where to release your fry.

- Look for an area that is "safe" for the fry.
- Walk lightly so the bank is disturbed as little as possible.
- Walk in other people's footprints and try not to make new ones

**Step 4.** Hold the cup so the opening is facing upstream against the current.

- Gently lower the cup into the creek (just the lip).
- Allow a little creek water to enter your cup.
- Lift the cup up. Wait a minute.

**Step 5.** Slowly lower your cup into the creek and let your fry swim out.

- Don't rush your fry - let them decide.
- If they are reluctant - pull the cup downstream, away from the fry.

