



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
- Power Head with inserts
- Aquarium gravel
- Gravel cleaner
- Thermometer
- Dip Net
- Aquaplug 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.



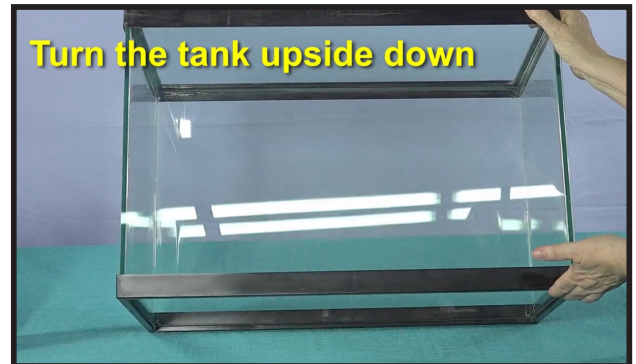
# Aquarium Set-Up

Set-up aquarium 10 days before eggs arrive to condition the water and ensure all equipment is working. Clean with vinegar/water before set-up.

## 1 Add Streambed Image

### You will need:

- streambed image
- glass dish
- scissors and tape
- mineral oil
- ruler or squeegee

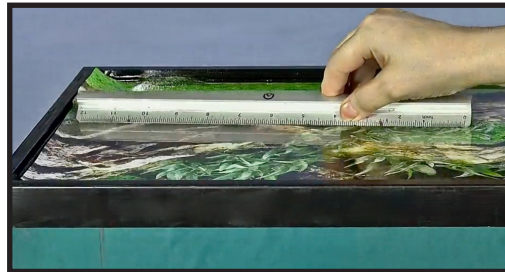


1. Cut the vinyl streambed image to fit **inside the rim** of the bottom of the tank.

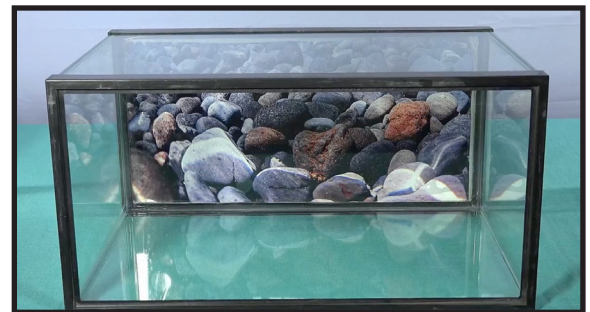


2. Add 1/4 cup of oil to bottom of tank and spread evenly. Use only **mineral or baby oil** as vegetable oils become rancid.

3. Place image of streambed face down on outside bottom of tank. **Remove air bubbles** with ruler or squeegee.



4. Wipe off excess oil and **tape** edges down. Image can remain on tank for several years without needing replacement.



5. Streambed image on outside bottom of tank.

## 2 Build Redd in Glass Dish

Use a 9 inch glass dish with high sides. Clean with boiling water or one part water to one part vinegar. Rinse well.

**Add no more than 1 cup of aquarium gravel in a thin layer.**

Use epoxy coated gravel and replace each year. If reusing epoxyed gravel it cannot be boiled or baked, only rinsed with vinegar.

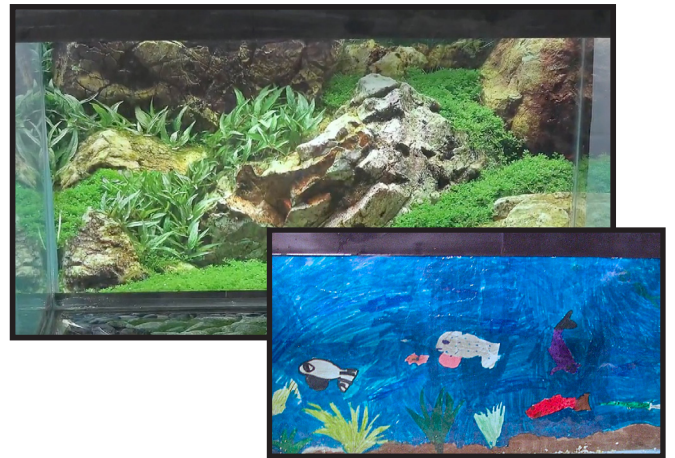
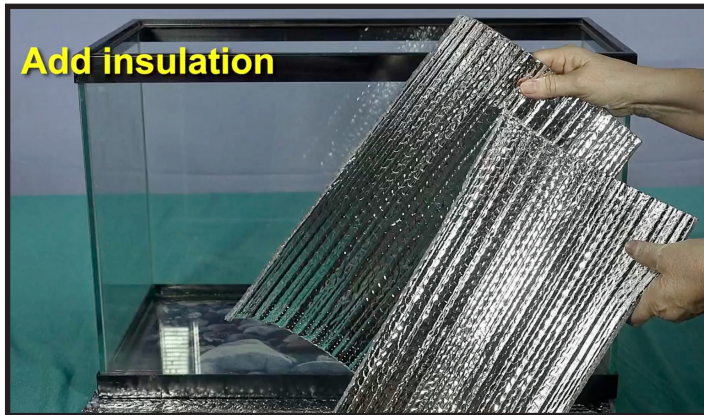


For the redd, collect 5 or 6 round rocks of 2 inch diameter. Avoid sharp edges, rust, iron, or metal in the rocks. Boil for 10 minutes and cool before adding to glass dish.



### 3 Backdrop

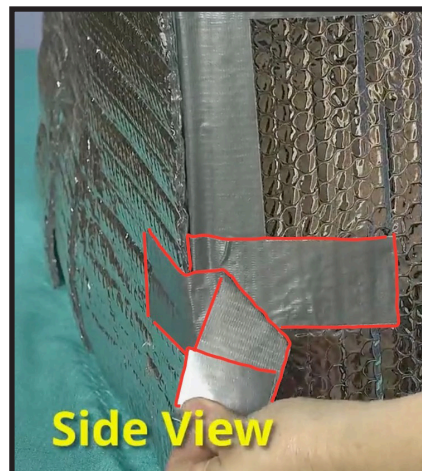
Add a laminated backdrop on the outside of the tank *between the* insulation and glass to minimize glare from the foil insulation. Have students create a stream scene backdrop or purchase from an aquarium shop.



### 4 Wrap Insulation

Add foil insulation (before water is added) and wrap tightly on all sides of the dry tank, then tape to sides. Use one piece for each side and one under the bottom. The sides, back and lid remain on the tank throughout the program. The front is removed at fry stage.

Hinge the front cover to easily open to view eggs and alevins. At this stage limit the light to three 10 minute sessions. At the fry stage remove front cover so fry become accustomed to day and night.

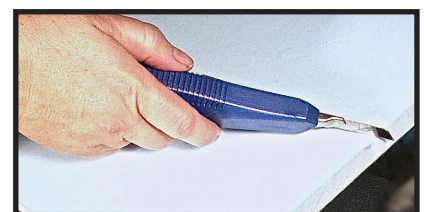


Cut a small door flap on the front cover for more frequent viewing by students.



### 5 Styrofoam Lid

Add a styrofoam lid. For a tight fit, custom cut the lid with openings for electric cords and the refrigerator coil. This will prevent fry from escaping through spaces between the lid and sides.





## 6 Fill Tank

Run cold tap **30 minutes** prior to filling tank to clear pipes of harmful metals such as copper and lead. This is a 20 gallon aquarium.



## 7 Remove Chlorine

Add AquaPlus to remove chlorine and prepare water. Follow the directions on bottle; for 20 gallons use 10 ml.

## 8 Thermometer

Add for daily recording of water temperature.

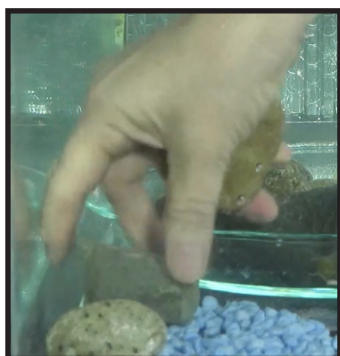


## 9 Glass Dish with Gravel and Redd

After filling tank with water carefully lower glass dish with gravel and redd into tank.

When delivered, the eggs are added to the front of the pie plate.

In two months, at the fry stage - remove glass dish, gravel and redd.

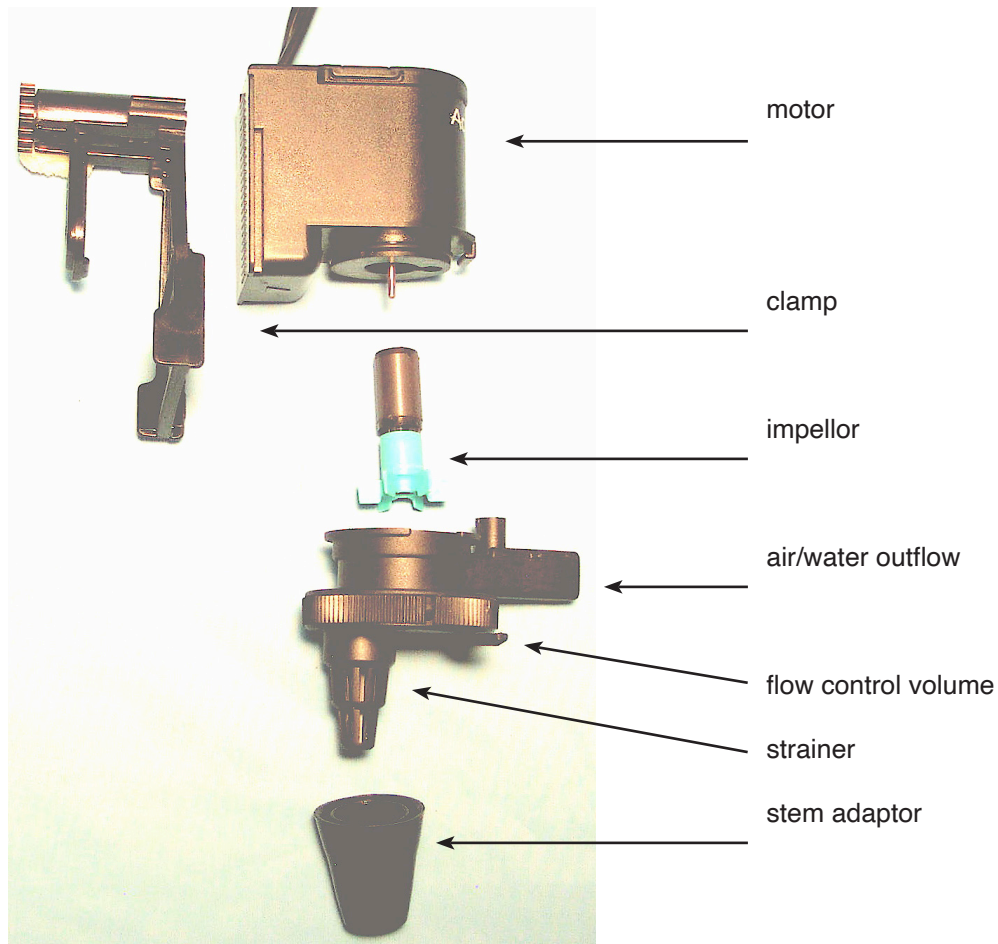


## 11 If Alevin Escape

Some alevin may leave the glass dish. The flat surface of the tank is uncomfortable for alevin. **If this happens** build a small redd with a little gravel and 2 - 3 rocks in a corner. They will find their way to the redd.



# 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.



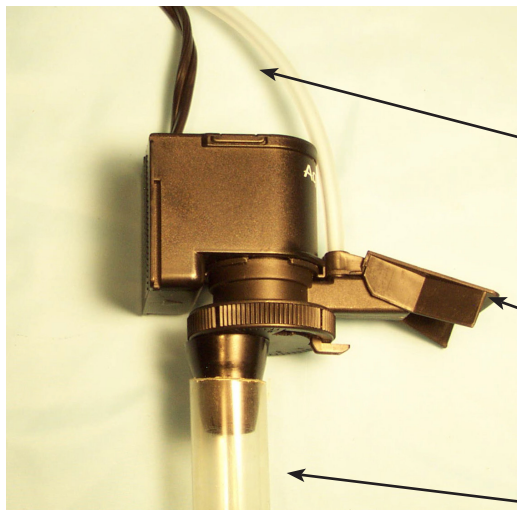
## 2 Make adjustments

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.



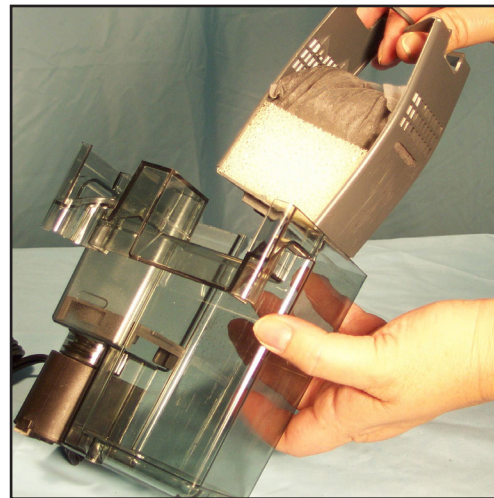
### 3 Assemble power filter

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.

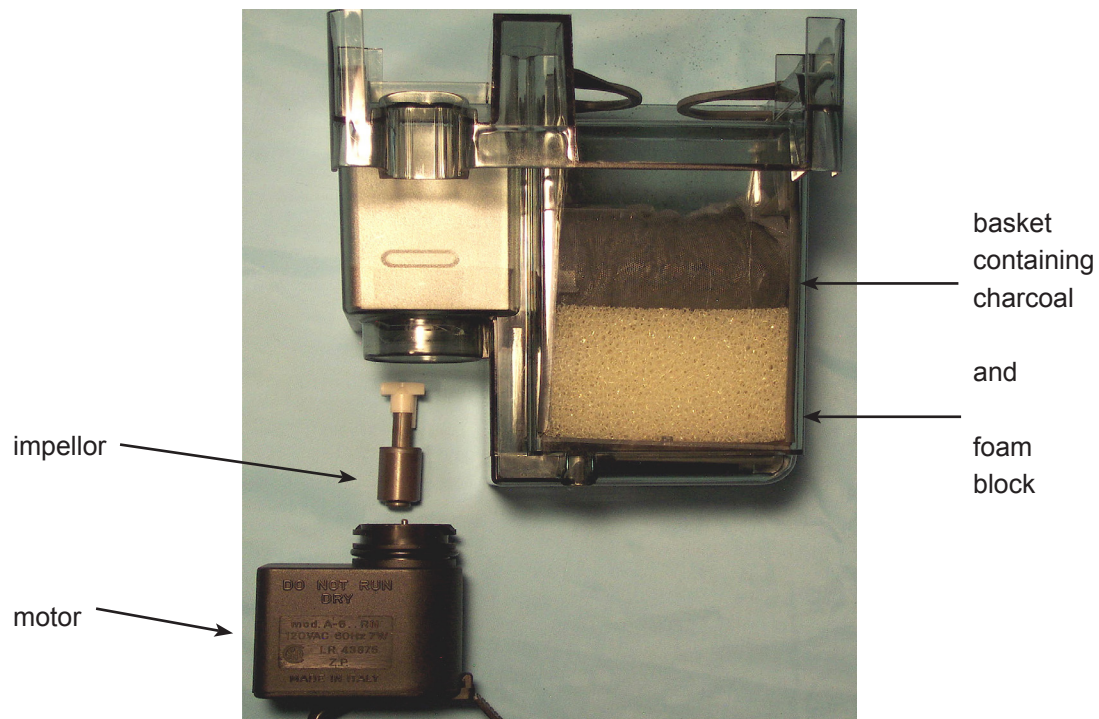


Rinse the foam block insert. Rinse the mesh bag of charcoal (remove plastic dust cover).

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.



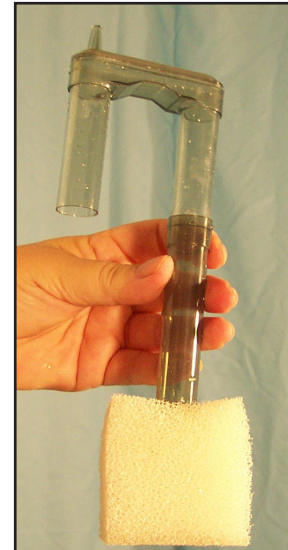




Assemble the intake stem.



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.

### 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.



Powerhead and powerfilter in place.

# 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**


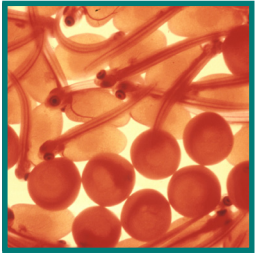





**Fry**





# Maintenance Calendar

STAGE	TANK	WATER
<b>Eyed Egg</b> 	<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>
<b>Hatch</b> 	<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>
<b>Alevin</b> 	<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>
<b>Fry</b> 	<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 glass dish, redd and gravel</li> <li>midweek 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 Wednesday</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>
<b>Release</b> 	<p><b>Cleaning</b></p> <p>Your tank is lent "in trust" to raise salmon only. Clean all equipment with 1 part water to 1 part vinegar before safely storing.</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.


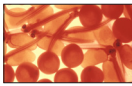

## We Calculate

### 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> (delivered to schools)	220	325
	<b>Hatch</b> (eggs become alevin)	400 - 500	475 - 525
	<b>Fry</b> (swim-up and look for food)	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. Fesces 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.

**Ammonia Remover 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.

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

### How it works

Cycle **DOES NOT REMOVE CHLORINE**. It 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.

## 1 Run replacement water

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

## 2 Turn off filters / remove pie plate

If left on the motor will burn out. Remove pie plate with gravel and redd.



## 3 Remove 5 gallons

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



## 4 Rinse filters in removed water

The used water has no chlorine and will not harm the beneficial bacteria 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 new water back to the tank without first removing the chlorine. To remove stir Aquasafe into the bucket.



## 8 Refill tank

Use ice-cream pail to scoop water from 5 gallon bucket back into the tank. Check that water is at correct level for filters.

## 9 Turn on filters

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

## Change water on Wednesday!

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

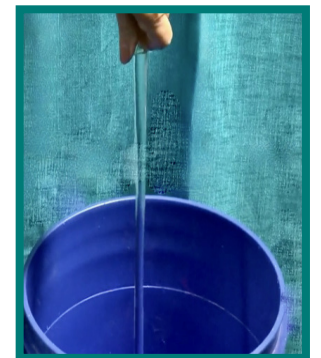
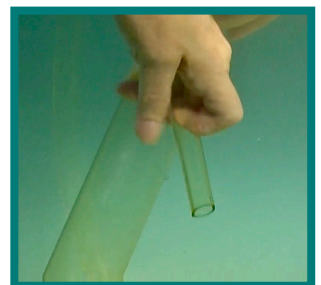
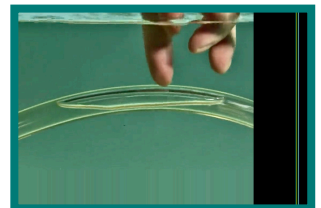
### You will need:

- water which has run 30 min.
- 5 gallon bucket & ice cream pail
- gravel cleaner / siphon
- AquaSafe chlorine remover

### To change the water:

- Immerse gravel cleaner in tank and fill with water - there should not be any air bubbles in the tubing as these prevent suction.
- Cover the end of small tubing with thumb to block water. While covering the end remove the small tube from tank and lower into 5 gallon bucket. Keep the large end of gravel cleaner in the tank under the water. The bucket must be lower than the tank to start siphoning out water.
- Remove your thumb from end of small tubing and water will begin siphoning into the bucket, (if not, check for air bubbles).
- Move the large tube of the gravel cleaner across the bottom of the tank to suction out uneaten food and waste from the fry.

## HOW TO Remove Tank Water With Gravel Cleaner



*Do not feed fry 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.

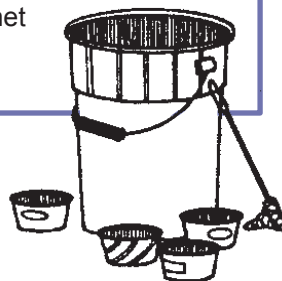
## Transfer fry from tank

- 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



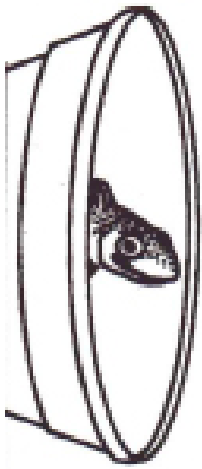
## How to release

- 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

*You Will Need a  
Small Container  
or cup (500 ml)*

**STEP 1** Obtain a cup with water and a fry from your teacher.

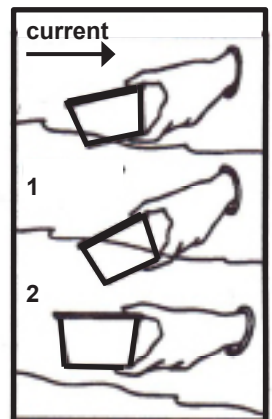
**STEP 2** Gently carry your cup and fry to the stream.

**STEP 3** Look for a place that is safe for your fry.

- Walk lightly so the streambank is not disturbed.
- Stay on the bank, do not go into the water.

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

1. Gently lower the edge of the cup into the stream and let a little water in.
2. Lift the cup out of the water.  
Wait a minute while your fry is getting used to the stream water.



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

3. Don't rush your fry - let them decide.
4. If the fry is not leaving - pull the cup downstream, away from the fry to let the fry swim away.

