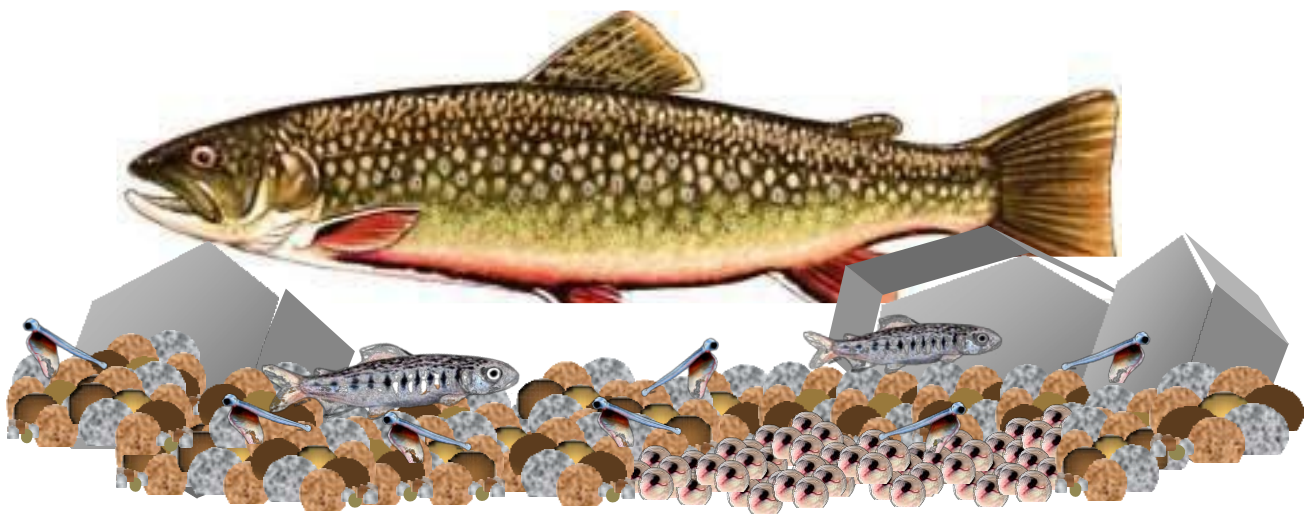


# North Carolina Trout in the Classroom



## Aquarium Resource Guide

Updated April 2012, November 2014, Pisgah Chapter TU



NC Chapters



## *Acknowledgments*

*North Carolina Trout In The Classroom Aquarium Resource Guide is provided to teachers by the Pennsylvania Fish and Boat Commission and through a partnership between Trout Unlimited, North Carolina Trout Unlimited Chapters, and North Carolina Wildlife Resources Commission.*

The Aquarium Resource Guide is a compilation of classroom incubator techniques and ideas shared among schools throughout the United States.

Portions of the following publications were adapted or directly referenced throughout this resource guide.

- New Jersey Department of Environmental Protection, Division of Fish & Wildlife And NJ Chapters of Trout Unlimited, 2005 ---**New Jersey Activity Guide and Reference for Teachers** (*Activity guide modified from New York State Trout in the Classroom*)
- Smith, Less; Nevada Department of Wildlife, fourth edition January 2006 --- **Nevada Department of Wildlife Trout In the Classroom Curriculum Resource Guide**
- Virginia Trout Unlimited, 2008 --- **Trout In the Classroom, “How to Raise Virginia trout”**
- Pennsylvania Fish and Boat Commission biologists and hatchery managers and members of Pennsylvania Trout Unlimited also provided key information for this resource guide.

The guide is subject to change as the North Carolina Trout In The Classroom program continues to grow.

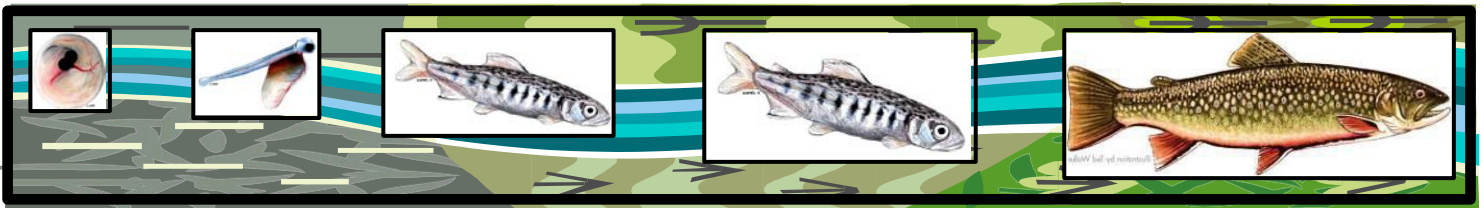
*North Carolina Trout in the Classroom gratitude goes to the Pennsylvania Trout in the Classroom teachers and volunteers who are implementing TIC across the state and who continue to share their knowledge and expertise.*

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# Chapter 1: The Life Cycle of Trout

## *Descriptions of Each Trout Stage*



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### A. Eyed Eggs

#### Definition:

Once eggs have been fertilized they are called “green eggs”, one of the most vulnerable life stages. As they develop, eyes become visible. They are still fragile at this stage, but are a bit more stable than green eggs.

*Note: This is the egg stage you will receive for your classroom.*

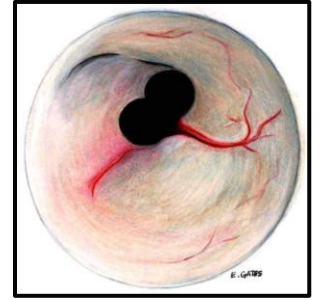
#### Description:

Between late September – early November, female brook trout select a location for their nest, called a “redd”. Streams with areas of clean gravel and steady water flow are ideal. Using her tail, she cleans a small area of gravel, while at the same time creating a spot for the eggs.

In their natural setting, a mature female brook trout (*spawning brook trout range between 5 – 10 inches in length with a 12 inch brook trout being a trophy*) lays anywhere from 20 - 400 eggs depending on size, health and water quality. Once a “redd” has been prepared, a male brook trout will fertilize the eggs as the female lays them in the redd. Once fertilized, the female covers the eggs with a thin layer of gravel using her tail and body. This layer of gravel protects the eggs from predators and sunlight.

As eggs develop they get oxygen from steady water flow and nutrition from the egg yolk. Temperatures must stay between 35 to 52-degree Fahrenheit. Typically, if everything is just right, brook trout eggs will hatch in early Spring (*late February to mid March*). Hatch dates depend heavily on the stream temperatures.

In nature 1-2% (10 to 20) of the 500-1000 eggs will survive to spawning age depending on the health of the watershed, food availability and stamina of the trout.



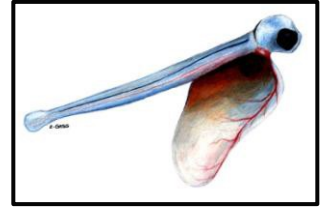
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## B. Alevins (*pronounced Al-a-vin*)

(also known as “sac fry”)

### Definition:

A newly hatched trout, still attached to and utilizing the yolk sac as food. This sac contains protein, carbohydrates, vitamins and minerals. The yolk sac serves as a “mini-lunch bag” that feeds the trout until it is completely absorbed. Once the yolk sac is absorbed, called the “button up” stage, trout emerge from the gravel and begin searching for food as a “swim-up fry”.



Alevins begin breathing through their gills when they hatch from the egg. The rate of respiration can be observed by watching the number of gill movements. As cold-blooded animals, their metabolic rate depends on the surrounding environment temperature. Temperature controls the rate of respiration. As a result, they breathe and grow slower in cold temperatures. Trout grow rapidly in warmer temperatures; however, their overall body growth is reduced because of inefficient digestion and respiration processes.

### Description:

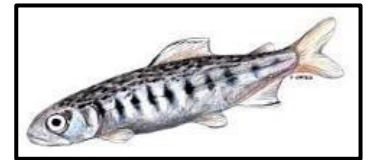
When eggs hatch, the alevins stay nestled at bottom of the stream. They will remain there until their yolk sac is fully absorbed. Their yolk sac shrinks as they begin to develop teeth, digestive system and a respiration system. It takes about a week or two for the yolk sac to be completely absorbed.

At this stage alevin are extremely fragile and susceptible to predators, siltation, pollution, floods or any disturbance in the water.

## C. Fry

### Definition:

*Swim-up Fry:* Trout who have fully consumed their yolk sacs. Once the yolk sac is consumed, trout will emerge from the gravel and begin to search for food.



I----1 inch or less ----I

*Fry/Parr:* A hatched trout, previously a swim-up fry, that is less than one inch in length and has learned to search for food and begin eating. At this stage, you will begin to see a series of dark vertical lines on their sides called parr marks.

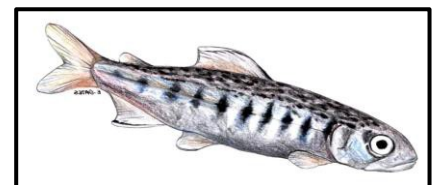
### Description:

When the alevins become swim-up fry, they must be fed immediately (Note: For feeding instructions refer to “Trout Care”). Some trout never learn to feed and will die. These non-feeding fish are called “pinheads” (*big heads, small bodies*) and should be removed as they will not develop. It is very normal to see a mortality spike with pinheads. After learning to feed, the fish are deemed “Fry.”

## D. Fingerling

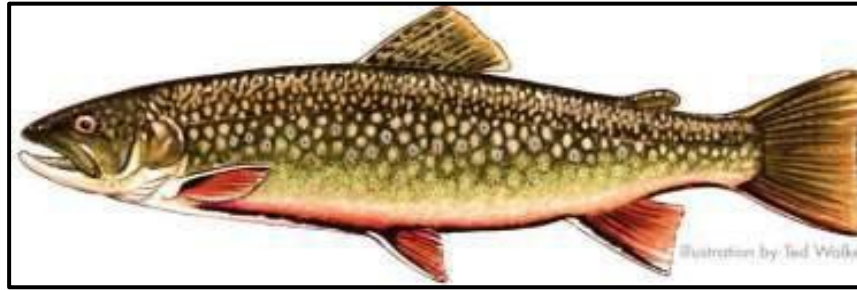
**Definition:** A young fish 1 to 3 inches in length.

**Description:** If you keep your aquarium clean and feed your fish the appropriate amount, they will become healthy fingerlings by Spring.



I-----1-3 inches -----I

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## E. Adult Brook Trout

### Definition:

Pennsylvania's *ONLY* native trout and labeled as our state fish. Brook trout are members of the Char family and can be identified by the following characteristics:

Physical characteristics	
<b>Body color</b>	Dark green
<b>Sides</b>	Shade of light green/lavender tone with irregular marks. They also have scattered red dots surrounded by blue halos.
<b>Belly</b>	Pale yellow/orange with black streak down the middle.
<b>Fins</b>	Pectoral, pelvic and anal fins are orange with white edge and black stripe.
Size	
At maturity (two to three years of age), wild brook trout range from 5 inches to 18 inches long, depending on availability of food, shelter and water quality.	
# of eggs	
Adult females, depending on size, will lay 500-1,200 eggs, with only a small percentage (approximately 1-2%) surviving.	

Brook trout live in small, coldwater streams within Pennsylvania and throughout the northeastern United States through the Great Lakes and south along the Appalachian Mountains to Georgia. They spawn in the fall, from mid-September to early November. The female digs a shallow gravel nest on the stream bottom called a "redd". A redd is located where there is good water flow to bring oxygen to the eggs. After spawning, the eggs receive an additional covering of gravel. Eggs develop over winter and hatch in early spring.

Trout Life Cycle Stages	Duration
Eggs (eyed)	5-15 days
Hatching/Alevin	2-3 days
Yolk sac absorbed/ Fry	1-2 weeks
Fry to Fingerling	3-4 weeks
Fingerling	4+ weeks
Release Date	Anytime between April and May

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# The Life Cycle of Trout



## SMART Angler's Notebook

by Carl Richardson

Illustrated by Ted Waite



### Seasons of a Trout

Natural reproduction occurs in many streams, including those stocked with hatchery fish. On most of these waters stream productivity, habitat and water quality limit reproduction and growth. Few wild fish reach adulthood in these waters,

so they are stocked with hatchery fish. There are a few streams where conditions are suitable for reproduction and growth. These waters are not stocked with hatchery trout.

#### SPRING

Developing eggs, still in redd, hatch anytime from February to March. Hatch date depends on stream temperature.

Fry, still living in bottom gravel, live off yolk sac. When this sac is used up, the fry emerge from the gravel. This usually happens in April through early May. Fry eat plankton, the microscopic animals in the stream. Fry are 1 1/2 inches long when they emerge.



After Hatching

Yolk Fry- 3/4 to 1 inch

#### SUMMER

To hide from predators, young trout spend time in shallow water hiding under and around rocks. They eat small insects and plankton. Depending on the stream, young trout may be three to four inches long by the end of the summer. In the wild, fewer than 10 percent of these fry survive the first year.

Three-year-old fish are getting ready to spawn for the first time. The eggs develop in the female and grow larger each day.

Fry with Parr Marks- 3 to 4 inches



Adult- 10 to 12 inches

#### WINTER

Fertilized eggs develop from the steady flow of water. Nutrition for the eggs comes from the egg yolk. Temperatures must stay within the 35-degree to 55-degree range for brook and brown trout eggs to hatch. Rainbow trout eggs don't survive when temperatures drop below 40 degrees.



Fertilized Egg- Eyed Stage

#### FALL

Females select a spot for the nest, called a redd. Gravel bottoms with a steady flow are ideal. Using her tail she clears a spot for the eggs. A three-year-old fish, about 10 to 12 inches long, will release 500 to 1000 eggs. Fertilized eggs, about 1/4-inch round, sink into the spaces between the gravel.

Fertilized Egg- 1/4 inch

CATCH US ON THE WEB: [www.fish.state.pa.us](http://www.fish.state.pa.us)



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# Wild Trout Life Cycle

From Nevada TIC Guide

## WILD TROUT LIFE CYCLE

**Spawning trout** lay eggs in redds in gravel stream bottoms. Trout often spawn several times in their lives.

**Eggs** develop in the gravel and hatch into alevins.

**Alevins** stay in the gravel. They get food from their yolk sacs and grow bigger.

After the yolk sac is used up, the tiny fish are **fry**. They swim out of the gravel to find food. They live in gentle water near the stream bank until they get bigger.

As the fry grow stronger, they take up positions in the main current of the stream. They eat insects and other small animals that live in, or fall into, the stream.

**Adults** often eat other fish, even smaller trout. Although they may live longer, trout usually do not grow as large as their salmon and steelhead relatives because they don't benefit from the ocean's abundant food supply.

Some trout live in lakes. They may live there all their lives, but often spawn in streams.

Adapted from original artwork by Gary Bloomfield, Salmon and Trout Go To School, An Instruction Manual For Hatching Salmon and Trout Eggs in Classroom Aquarium-Incubators by Diane Higgins, California Department of Fish and Game and American Fisheries Society, Humboldt Chapter, 1996.

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# Chapter 2: Trout Habitat and Needs



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# Trout Habitat Needs

Trout need a healthy habitat to survive, which includes: cold, clean, oxygenated water, food and shelter.

<b>COLD WATER = temperature ~ 50°F</b>	
<b>Why?</b>	Trout need coldwater stream ecosystems that provide cold water (48 to 52 degrees Fahrenheit). Coldwater streams are a result of snow melt, rainfall, springs/groundwater and/or cold feeder streams. Vegetation along the stream bank provides shade, protection and assists in maintaining cool water temperatures.

<b>CLEAN WATER = no chlorination, no sedimentation, pH = 7, low levels of ammonia and nitrites</b>	
<b>Why?</b>	<p>A healthy coldwater stream ecosystem is cleaned by bacteria, scavengers and aquatic plants. It also provides ample amounts of water exchanges through rain, snowmelt and ground water. In addition, a natural stream’s carrying capacity for trout is not usually an issue because of flowing water and diverse holding areas for trout.</p> <p><u>Note:</u>  <i>An aquarium is a closed system, with no natural water exchanges and limited space for your trout population; as a result, ammonia, pH, nitrite/nitrate levels and carrying capacity can impact the health of your trout. You need to make sure your aquarium cycles and conduct water changes only when your parameters indicate that you need one.</i></p> <p><i>Keep a watchful eye on your aquarium trout population. In a 55 gallon aquarium the number of healthy trout that can be sustained is approximately 80-100 based on your trout size and water quality. If you have more than 120 trout in your aquarium, you may want to schedule an early release.</i></p> <p><i>Excess food will increase ammonia levels in your aquarium. Make sure people assisting you, students, or other helpers do not overfeed your trout.</i></p>

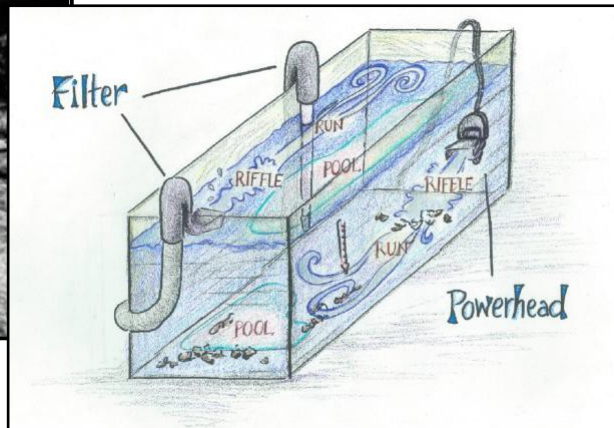
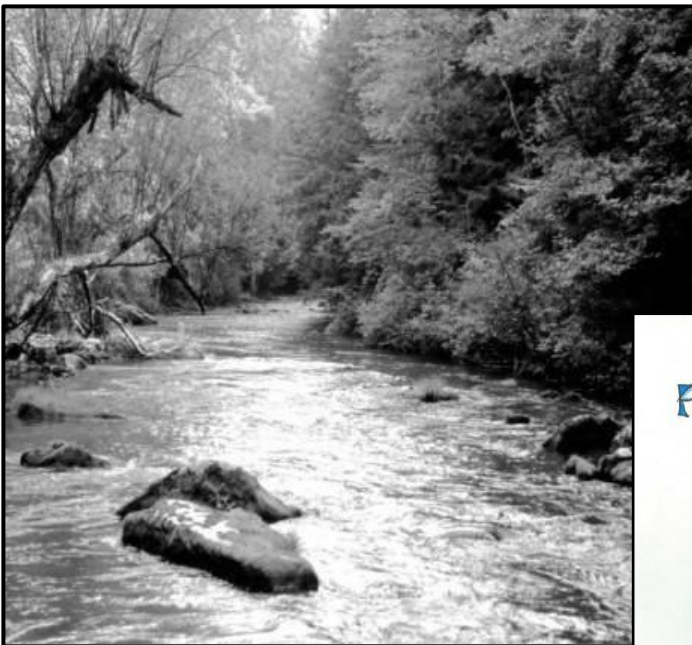
<b>OXYENATED WATER: High level of dissolved oxygen (DO) (above 7 ppm)</b>	
<b>Why?</b>	A healthy coldwater stream ecosystem is full of dissolved oxygen; 1) there is constant water flow over boulders, stones, wood debris (riffles, runs and pools), and 2) the water is cold – cold water holds more oxygen. <i>Using your airstone and keeping the water at 48-52 degrees Fahrenheit will maintain proper DO levels.</i>

<b>FOOD: Trout feed upon varieties of the following: macro-invertebrates, crustaceans, terrestrial insect life &amp; other fish (sometimes their own young)</b>	
<b>Why?</b>	Healthy trout habitats are diverse in their food sources enabling trout to be opportunistic.

<b>SHELTER: gravel, boulders/woody debris, shallow pools, stream bank vegetation</b>	
<b>Why?</b>	Trout need different types of shelter depending on t life cycle stage. The more shelter available and the more diverse it is, the greater potential of a healthy trout population. Clean gravel and shallow pools/riffles provide nesting opportunities for spawning trout and nurseries for young trout. Boulders, woody debris and stream bank vegetation provide areas for trout food sources and refuge for adult trout.

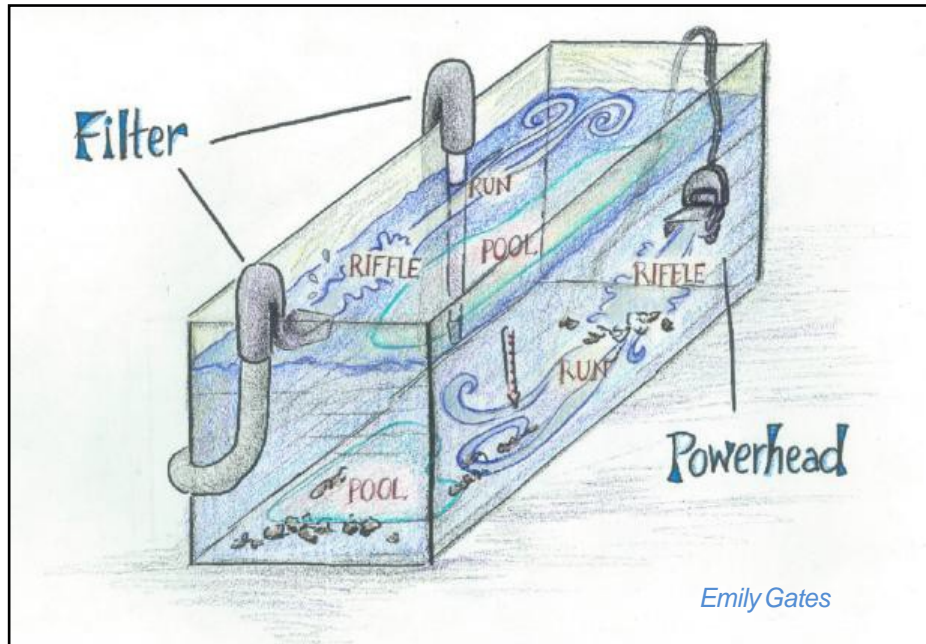
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# Chapter 3: “Making the Connection”



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## “Making the Connection”



*This diagram illustrates how your classroom “cold-water ecosystem” creates flow patterns similar to a natural stream setting for your trout.*



**Riffle:** A segment of stream where the water is shallow, less than 3 feet in depth, fast moving and rocky. The water here is more turbulent and helps add oxygen to the water. Riffles also contain an abundance of food ranging from algae to aquatic insects.



**Run:** Typically follows a riffle. Runs are a long, smooth flowing, fast segment of water. They are usually deeper than a riffle, ranging from 3 to 6 feet in depth, and have no white water.



**Pool:** A segment of water that is deep, slow moving and usually dark. Pools provide cover for adult trout both from their prey and predators. During a drought pools are usually the only part of a stream that still has water.

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# “Making the Connection”

## *Continued...*

### COLD WATER

<i>Aquarium</i>	<i>Natural Habitat</i>
The chiller maintains optimum water temperature for trout.	Shade trees, snowmelt and underground water sources (springs) help keep streams cool.

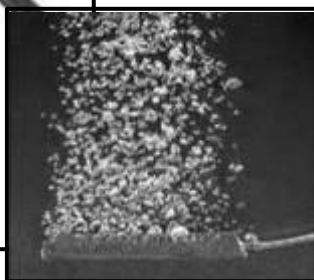


### OXYGENATED WATER

<i>Aquarium</i>	<i>Natural Habitat</i>
The air pump and air stone add oxygen to your water. The power head and the filter output add circulation to your aquarium.	Streams gather oxygen as they tumble over rocks and waterfalls. Aquatic plants also assist in the production of oxygen levels. Cold water also helps hold more oxygen.



*Whisper 20 Aquarium Air pump*



# “Making the Connection”

## *Continued...*

### CLEAN WATER

<i>Aquarium</i>	<i>Natural Habitat</i>
<p>The 405 Fluval Canister filter and a thin layer of gravel encourage the growth of microorganisms which turn harmful ammonia into somewhat harmless nitrates. The powerhead encourages good water circulation throughout your aquarium.</p>	<p>Clean water is stored and gradually released by a healthy watershed system. Also, bacteria and scavengers that eat decaying matter clean the water and plants absorb nitrates. Wetlands are some of nature’s best filters.</p>



*405 Fluval Canister Filter*



*Wetland*  
*(PFBC publication photo)*

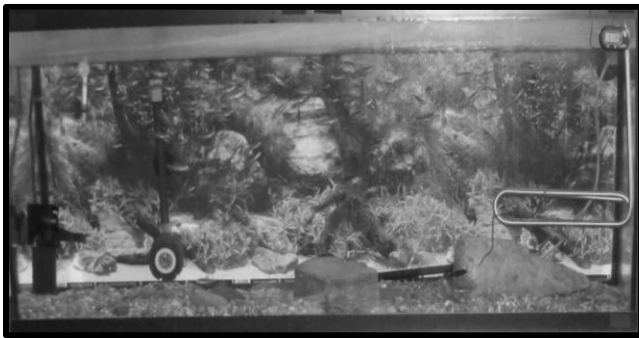
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# “Making the Connection”

## Continued...

### SHELTER

<i>Aquarium</i>	<i>Natural Habitat</i>
<p>Create a “redd”/depression in your <b>freshwater substrate (river jewels)</b>. This will simulate a natural redd and serve as their nursery until they hatch. You may also chose to make your own “hatching” basket using a metal letter box with holes or out of a plastic storage container as seen in this video:  <a href="http://www.youtube.com/watch?v=QiCBC2MYmi0">http://www.youtube.com/watch?v=QiCBC2MYmi0</a></p>	<p>The adult female brook trout will create a nest called a “redd” in the gravel to lay her eggs. The eggs are protected from light and have enough cold water, flow and oxygen to begin developing.</p>



*Brook trout redd*

### LIMITED LIGHT FOR EGG DEVELOPMENT

<i>Aquarium</i>	<i>Natural Habitat</i>
<p>The aquarium is positioned away from direct sunlight and enclosed in foam board insulation.</p>	<p>Eggs are protected from sunlight in the nest/redd created by the female brook trout.</p>

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# Chapter 4: Aquarium



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# Equipment Used

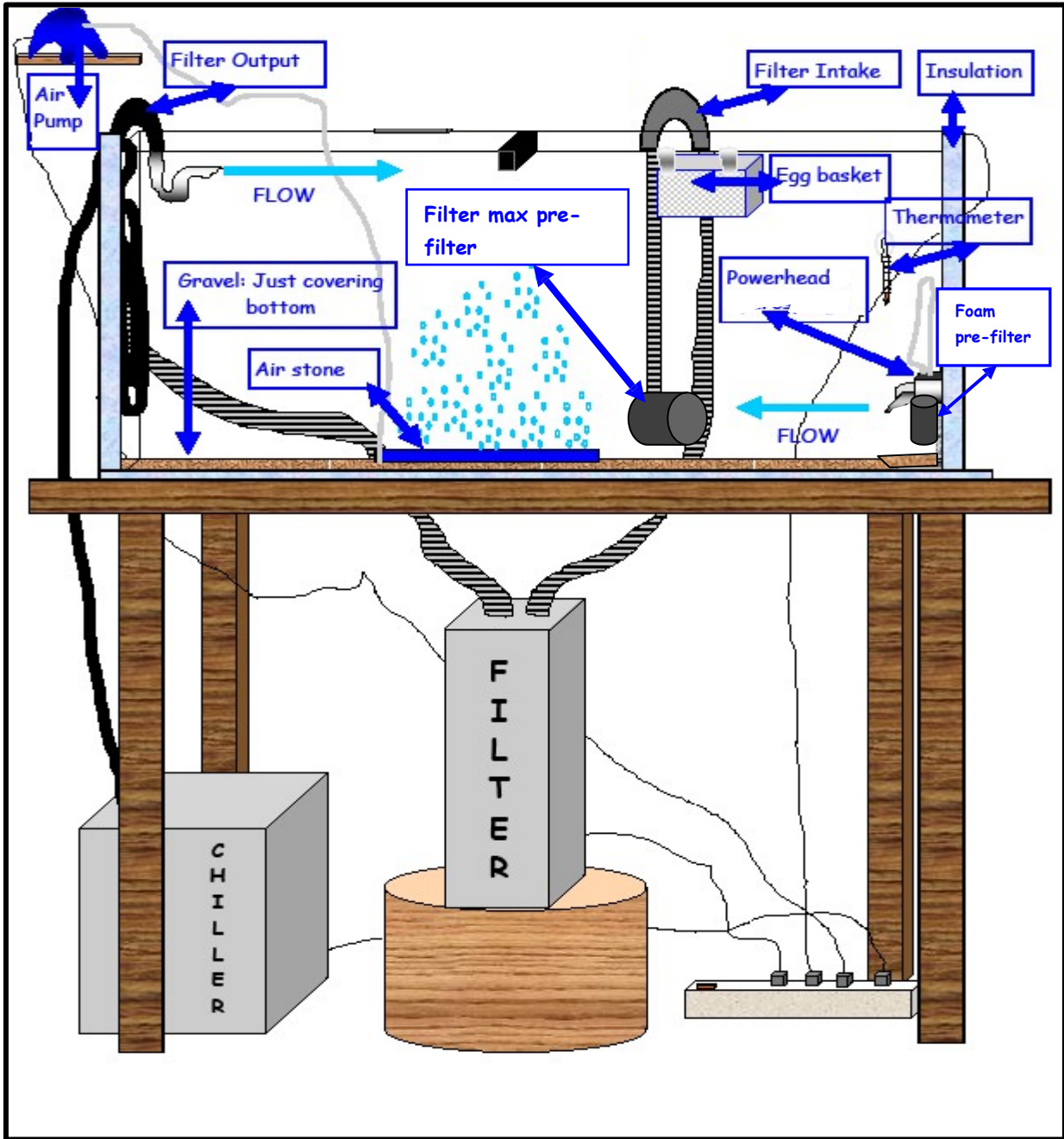
EQUIPMENT CAN BE PURCHASED AT A LOCAL BUSINESS OR <a href="http://www.thatpetplace.com/">http://www.thatpetplace.com/</a>	
<b>WATER QUALITY TESTING and CLEANUP</b>	
Freshwater Master Test Kit	Microbe Lift Special Blend and Microbe Lift NITE-OUT II
Siphon Kleen X-large	Turkey baster ( <i>for water quality testing &amp; egg removal</i> )
5 gallon buckets ( <i>for water changes</i> )	16 oz. Tap Water Conditioner ( <i>optional</i> )
<b>TEMPERATURE</b>	
Battery Operated Digital Thermometer	Floating Thermometer
Tradewinds Drop-in Chiller DI-25 (1/4 HP)	Foam board pieces for insulation: 2 @ 48 1/4" X21"; 2 @ 12 3/4" X 21"; 1 @ 12 3/4" X48 1/4"
<b>WATER FILTRATION and CIRCULATION</b>	
406 Fluval Canister Filter	Filter max pre filter (to place on your filter in-take)
Foam pre filter (for on your power head)	Aqua Clear 20 Power Head-Old 201
<b>OXYGEN</b>	
Whisper 20 Aquarium Air Pump	Airline tubing-25 feet
Check Valve-1 pack	Sandstone Airstone 12" x 3/4" x 3/4"
<b>TROUT HABITAT and FEEDING</b>	
55 gallon, glass aquarium (48 1/4" x 12 3/4" x 21")	Lid for 55 gallon aquarium ( <i>Plexi glass, glass, plastic, etc.</i> )
Freshwater Substrate Jewels-5 lb.	Net-4 in.
Measuring spoons (1/8 <sup>th</sup> , 1/4 <sup>th</sup> , 1/2 tsp)	
<b>GENERAL</b>	
Power strip, towels/rags	VELCRO fasteners of tape ( <i>for adhering foam to aquarium</i> )

EQUIPMENT THAT MAY NEED REPLACED AT THE END OF THE YEAR		
406 filter motor seal ring	Freshwater Master Test Kit	Chemi-Pure Filter Media 5 oz.
Fluval BioMax Media-17.63 oz.	Special Blend (microbe lift & nite out II)	Sandstone Airstone 12" x 3/4" x 3/4"
Tubing air stone connection	Foam Block(Fluval 404 and 405;2pack)	Check Valve-1 pack

Companies that support TIC and are the main suppliers for the program (They can assist with specific equipment questions.)	
<b>That Fish Place, That Pet Place</b> Website: <a href="http://www.thatpetplace.com/">http://www.thatpetplace.com/</a> Contact: Stephanie Welsh Phone: 717-299-5691 ext. 1288 Email: <a href="mailto:Stephanie.welsh@thatpetplace.com">Stephanie.welsh@thatpetplace.com</a>	<b>Tradewind Chillers (2 year warranty)</b> Website: <a href="http://www.tradewindchillers.com/">http://www.tradewindchillers.com/</a> Contact: Hal Collier Phone: 760-233-8888 Email: <a href="mailto:twchillers@sbcglobal.net">twchillers@sbcglobal.net</a>

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# Aquarium Diagram



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# Step-by-Step Aquarium Set Up

**Set up your aquarium at least 3 - 4 weeks before receiving your eggs.** This will ensure that your equipment is in working order. If something is not working properly you have time to order replacement equipment.

**\*\*Use the DIAGRAM on the previous page as a visual guide when setting up your aquarium\*\***

Tools needed for aquarium set-up		
Screwdriver	Pair of scissors or utility knife	Pliers to tighten any connections
Two clean 5 gallon buckets to fill aquarium with water	Wash cloth to wipe down the aquarium inside and out	Towels to dry any spills
Bucket to soak and rinse gravel	5 gallon bucket to place your filter base into <i>(if your filter leaks the water will stay in the bucket)</i>	Velcro strips with sticky back to connect foam board to aquarium

## Aquarium location and preparation:

- a) Locate a suitable place in the classroom for the aquarium. Place it away from heat, excessive light, and lots of student activity. If next to a window, pull shade. Make sure aquarium is on a stable surface.
- b) Position aquarium on **insulation board** (cut to fit the bottom of the tank with 1/2" overhang on sides). Can be purchased at (*Lowes; Home Depot etc.*)
- c) Size, cut and place the remaining foam board on all sides of the aquarium. Use Velcro to attach foam to aquarium. This will help keep your water at the appropriate temperature.
  - i. After the trout hatch you can remove the front cover. **DO NOT** remove the sides or back, this will help continue keeping your water cold.
- d) If your trout become stressed place the front cover back on.
- e) Clean any dirt inside the aquarium with a wet paper towel. Do not use soap or any cleaning agent--the residue will stay in the aquarium and harm your trout.
- f) Locate an electrical outlet and plug in power strip. This should be right behind or underneath the aquarium. Turn off power strip.
 

*Note: Make sure you place a note above the outlet stating "DO NOT UNPLUG".*

## Gravel:

- a) Rinse gravel two or three times to remove dust. Then layer the bottom of the aquarium.
  - i. Gravel is important to your aquarium system. It encourages growth of good bacteria that assists with the nitrogen cycle.

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# Step-by-Step Aquarium Set Up

## *continued...*

### **Filter:**

- a) Assemble using the company directions. Place canister filter next to or underneath aquarium.
  - i. Place filter base in a 5 gallon bucket. This will prevent leaks if something goes wrong.
- b) Place filter outflow near the water surface and at opposite end of aquarium from the intake. The proper placement of the outflow will encourage good aeration at the water surface.
- c) Place the filter intake  $\frac{3}{4}$  way down the aquarium side or just a few inches from the bottom. This will ensure that toxic water accumulating at the bottom is taken out.
- d) Place filter max pre filter on filter intake. The pre filter will prevent your trout from being sucked up into the filter system.

### **Powerhead:** *(used for flow at the bottom of the aquarium)*

- a) Prepare the power head following company directions. On the opposite end of the aquarium from the filter output, place the powerhead  $\frac{3}{4}$  of the way down the side of the aquarium.

### **Create water circulation:**

- a) Make sure your filter output is at the opposite end of the aquarium of the power head. They will work together to create circulation on the surface (*filter output*) of your aquarium and near the bottom (*powerhead*).

### **Airstone and air pump:**

- a) Attach one end of the airline tubing to the airstone, and the other to the air pump. Place the air pump near the aquarium or above the aquarium about 6-12 inches.
- b) Place airstone in the aquarium, away from the filter intake tube, preferably in the center/back of the aquarium.
- c) Use a check valve to prevent backflow of water in the airstone tube. To do this, make a cut in the air tubing and use the check valve to connect the two pieces back together. Air should push the flap and compress the spring inside the valve. Then insert the airline tubing into the airstone.
- d) Before turning on your airstone, submerge it for at least 1-2 hours.

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# Step-by-Step Aquarium Set Up

## *continued...*

### **Chiller:**

- a) Set up your chiller and prep your chiller according to the directions.
- b) Place your chiller at the opposite end of your aquarium from the filter intake and power head.
- c) You may set up your chiller when you set up the rest of the aquarium 3-4 weeks before your eggs arrive.
- d) Once all of your equipment is ready to be turned on, turn on the chiller as well to see if it is working. Once you have determined that it works, turn it off until 1 week prior to egg arrival.
- e) 5 days before your eggs arrive turn on your chiller and set it to 65 degrees.
- f) Approximately 2 days before your eggs arrive decrease your chiller temperature to 48 –52 degrees

### **Adding water:**

- a) Fill aquarium about  $\frac{3}{4}$  full with tap water using any clean container or tubing.
  - i. Clean buckets are best for this purpose. Using a hose from the sink is not recommended unless you can ensure it is properly attached. Otherwise, use clean buckets to move the water from the tap to your aquarium.
  - ii. Chlorinated tap water can be used for the initial setup, as there will be no fish in the aquarium for a few weeks.
- b) Check to make sure all of the equipment is working appropriately. Then, finish filling the aquarium, but leave at least 2-3 inches to spare at the top.

### **Prime 405 Fluval Canister Filter:**

- a) Pump the silver key on top (marked “start”). Keep pumping the water through until you have filled all of the chambers, and have expelled all air. You’ll start to see water come out of the filter spout. *When turned on, the filter will make a “chugging” noise if not properly filled. Unplug immediately and continue to prime until the water has circulated through.*

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# Step-by-Step Aquarium Set Up

## *continued...*

### **Hatching basket:**

- a) Stretch the net over the outside of the plastic frame. Hang the basket on the aquarium wall by bending the metal clips. If you use a vibert box instead, it will be placed on the floor of your aquarium. Directions for making your own hatching basket are available in the “Extras” section.

**OR**

### **Create a redd (trout nest) in your aquarium:**

- a) Create your own “redd” at the bottom of your aquarium by making a small dome in your gravel and placing a few eggs.

### **Double check before turning on power:**

- a) Plug in all electric cords using the power strip, but keep the power OFF.
- b) Double check all connections and make sure everything is working.
- c) The output tube should be secure; a student can hold this tube in place.
- d) Turn on the power strip and check for any leaks in your equipment.
  - i. The bubbler should be creating a large volume of small bubbles.
  - ii. Place your hand in front of the power head to make sure there is good water flow.
  - iii. Make sure there is a good flow coming out of the filter output.
  - iv. Make sure your filter intake is taking in water by placing your hand in front of it.
- e) Make sure your chiller is working, and then unplug it. 2 days before eggs arrive turn chiller on and temperature to 50 –52 degrees.

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# TIC End of Year Clean Up

At the end of the TIC season, it is important to clean the aquarium set-up. Clean equipment lasts longer.

<b>AQUARIUM</b>	
1	Turn off equipment. Empty aquarium almost all the way using the siphon klean. Then remove gravel.
2	Finish emptying the aquarium and disconnect all tubing.
3	Use solution: 1 part chlorine bleach (Clorox-unscented) and 10 parts water, wipe down interior and exterior of aquarium. You can also use 1 part white vinegar to 5 part water solution. A soft sponge can be used to scrub hard to remove scale and algae growth. For stubborn scale/algae, use a safety razor.
4	Use the same solution to clean out the tubing (clean tubes using long brushes purchased at any pet shop.)
5	Rinse the aquarium to remove any chlorine/vinegar and wipe dry with clean cloth, or let air-dry
6	Gravel and any driftwood: rinse thoroughly and dry by laying out on a cloth or towel in the sun. Gravel can also be sterilized with the Clorox/vinegar solution, but <b>MUST</b> be rinsed thoroughly and completely dried. <b>DO NOT</b> use Clorox/vinegar solution on driftwood.
7	Place gravel and driftwood inside the aquarium and store it in a safe place. Cover the top with any dust-proof covering.
<b>CHILLER: Drop-in</b>	
1	Using bleach or vinegar solution and dedicated sponge, wipe off the stainless steel Freon tubing.
2	For difficult scale or build up, a small <b>PLASTIC</b> scrub brush can be used. <b>NEVER USE A WIRE BRUSH ON THESE TUBES.</b>
3	Remove dust and lint from the fins of the coolant tubing (the thin slats on the back of the chiller). This can be accomplished using a small vacuum cleaner, dusting cloth or soft bristle plastic dust brush. Your chiller will run more efficiently if you clean the lint and dust on a regular basis.
<b>405 FLUVAL CANISTER FILTER</b>	
1	Take apart your filter and scrub out the plastic parts with your 1:10 bleach solution or 1:5 vinegar solution.
2	Thoroughly rinse all filter media with regular water and dry them in the sun. Scrub ceramic cylinders until free of all debris. For most filters, it is suggested that you buy new filter cartridges.
3	When all components are dry, re-assemble the filter and store inside the aquarium.

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# Chapter 5: Trout Care

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# Trout Care

## *Egg preparation & placement*

### **Provide darkness**

Light can harm eggs. Keep light exposure to less than 15 minutes. Insulation placed around the aquarium will not only keep out light, but will also keep aquarium water cold.

### **When to take off front cover**

Once trout hatch, remove the front insulation cover. DO NOT remove all sides. There should still be insulation on both sides, back and bottom of your aquarium.

**\*\* BEFORE** your eggs arrive, if you choose not to place your eggs in the gravel you can make an egg basket by following this video created by West Virginia Fish and Game for their TIC program (<http://www.youtube.com/watch?v=QiCBC2MYmi0>). We do not recommend using the “store bought” egg basket because it does not provide enough room for eggs to spread out, causing healthy eggs to perish when they are in contact with dead eggs/fungus. **\*\***

### **Egg placement instructions**

#### **1. Temper eggs**

Gradually bring egg bag temperature, up or down, to match aquarium temperature

##### **How to temper**

- a. Thoroughly rinse hands. DO NOT use soap
- b. Remove egg bag from packaging.
- c. Acclimate egg bag in aquarium water for at least 3 hours
- d. After approximately 3 hours take the tape and rubber band off of the bag.

#### **2. Separate eggs**

Before placing eggs into the gravel and/or your homemade nest basket

(<http://www.youtube.com/watch?v=QiCBC2MYmi0>), separate the dead eggs from the live eggs.

##### **Tools needed:**

- 2 clear plastic cups/beakers (*1 for dead eggs; 1 for live eggs*)
- Separation tools: spoon/eye dropper/pipette. DO NOT use your fingers.

##### **How to separate:**

- Dead eggs appear white in color; live eggs appear orange in color and eyes are visible
- Place water into the container for live eggs.
- Use a recommended separation tool to separate eggs into designated containers.
- Count live and dead eggs while separating. These numbers are needed to complete the “egg conformation form”.

#### **3. Place eggs**

Gently place live eggs into gravel or homemade nest basket. Most teachers place the eggs near the front of the aquarium and toward the middle where they receive some water circulation, but not too much. Make sure the eggs are not stacked on top of one another.

#### **4. Return shipment box using the provided UPS label**

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# Trout Care

## *Basic daily care*

### Provide a “stress free” environment

- a) Locate aquarium in an area away from lots of student traffic
- b) Add StressZyme weekly, even if water quality levels are good.
- c) Keep all insulation on except the front and keep water temperature at or between 48 – 52F
- d) Monitor water parameters once every other day or at least twice a week. Change water only when parameters indicate a need. Refer to the “water quality” section of this guide for guidelines.
- e) DO NOT overfeed

### Daily check list

- a) Check aquarium temperatures; an increase in temperature might indicate a chiller problem
- b) Check equipment and make sure everything is working properly
- c) Once trout have hatched and are free-swimming, feed them according to guidelines provided.
- d) Check and remove dead fish or debris from aquarium. Note the number of dead eggs/trout. Keep track of trout behavior in “trout journals”
- e) Water changes – conduct depending upon your water quality parameters
- f) Food Storage – dry cool place. Some people keep it in the refrigerator.

### Weekly Check List

#### Weekly check list

- a) Monitor your water quality parameters approximately 2 times a week (e.g. Tuesday & Thursday).
- b) Check all hose connections and tighten if any are loose, check for leaks.
- c) Ensure chiller and filters are working properly.

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# Trout Care

## *Stressed trout*

### **If your trout seem sick or stressed:**

- Remove any trout that seem infected immediately. These trout if infected will spread bacterial infections quickly.
- Place the front cover back on the aquarium. Less interaction with humans will help decrease the stress. If your students still want to see their trout create viewing doors/windows that they can flip up.
- Don't feed them for at least a day or so
- Maintain COLD water temperatures (48-52 degrees Fahrenheit)
- Conduct a "Static Salt Bath" Directions are on the next page.
- Continue to add StressZyme weekly

### Fish can become stressed for a variety of reasons:

- a) Poor water quality
- b) Too much handling or exposure (*i.e. several feeding times, daily water monitoring, daily water changes or cleaning, constant student activity around aquarium*)
- c) Over crowding
- d) Temperature

### **Static salt bath will help stressed trout:**

Something as simple as a salt bath often eliminates infections and/or parasites in an aquarium.

### **Instructions:**

1. Make sure you remove dead or infected trout ASAP.
2. Make a "static salt bath treatment": This salt bath will help get rid of the bacterial problem and is used as an osmoregulatory (osmosis balancing of your trout) aid to relieve stress. This is a very simple process.

### **Static Salt Bath recipe:**

- a) For your water change:
  - i. In your 5 gallon bucket, mix 4 lbs of salt with 5 gallons of your aged water. Water softener salt works best, it can be purchased in 25 lb or 40 lb bags at WalMart.
- b) Then add the dissolved salt and water solution to your aquarium as you would with a regular water change.
- c) Allow this to stay in the aquarium for approximately 65 hours.
- d) Depending on your results, do another REGULAR water change.
- e) If your trout have not improved make sure you have marked down any changes and perform another water change using the salt bath solution.

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# Trout Care

<p><b>Mortality</b></p>	<p>In nature a female brook trout, depending on size (<i>spawning brook trout range between 5 – 8 inches in length with a 12 inch brook trout being a trophy</i>) will lay approximately 500-1,000 eggs. Out of these eggs, only about 1 – 2% (10 to 20 trout) will survive to spawning age depending on the health of the watershed, food availability, and stamina of the trout.</p> <ul style="list-style-type: none"> <li>a) In general, a brook trout 5-8 inches long could be anywhere from 2-5years old. The age of a brook trout depends on several variables including type of stream, health and available food sources.</li> <li>b) Trout mortality is a natural cycle within all watersheds, including your “mini-coldwater ecosystem”. When you receive 200-300 eggs, ultimately you will end up with an ending number of 25-75 to release.</li> <li>c) Do not be alarmed when picking out dead trout. TIC focuses on cold water education and brook trout natural heritage, not the number OR size of trout released.</li> </ul>
<p><b>Expected mortality</b> (during the TIC school year)</p>	<p>Three periods during the TIC school year when you will experience trout mortality are:</p> <ul style="list-style-type: none"> <li>1. Just after hatching (sac fry/alevin stage) <b>WHEN: mid/late November – early December</b></li> <li>2. During the “swim-up stage”; when your trout are learning to feed. Some trout never learn to feed and will die as a result. <b>WHEN: mid December – early January</b></li> <li>3. During the aquarium cycling process, stage 2 (nitrite spikes) <b>WHEN: early/mid January – early February</b></li> </ul>
<p><b>Remove dead eggs</b></p>	<p>Fungus that forms on dead eggs can harm healthy eggs; therefore, careful removal of these dead eggs must occur immediately. Live or viable eggs appear pink to orange. Dead eggs appear white or milky in color. Check the aquarium regularly, at least twice every day. Use an eye dropper/pipette to remove dead eggs.</p>
<p><b>Hatching</b></p>	<p>The embryo produces an enzyme which dissolves the egg shell. You may notice a white foam on the surface of the water during hatching time. This is normal and will not harm the trout.</p> <p>Just after hatching, eggshells must be removed to prevent fungus. When the eggs hatch expect a spike in ammonia levels.</p>
<p><b>Alevin/sac fry</b></p>	<p>Little care is required at this stage. Check for dead fish and remove them immediately. The tiny alevin will remain in the gravel and avoid light. Keep the incubator in darkness. Do not feed the alevin until they come to the surface searching for food.</p> <p>As soon as you see them swimming to the surface, begin feeding with a very small pinch of size 0 food, making sure no food is left. Remember extra food = extra waste and potential ammonia spikes.</p>

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# Trout Care

## *Feeding guidelines*

Below is a chart showing approximate dates and amounts of food to feed your trout. By following these guidelines you should not run out of food. TIC staff developed these feeding guidelines based on experience with trout in the office (TIO). Trout raised in the office using these guidelines still measured 2-3.5 inches on release day 2012.

**REMEMBER:** The TIC program is not about who can grow the largest trout or the most trout.

<b>PA TIC BROOK TROUT FEEDING GUIDELINES</b>					
<i>These guidelines are for 100-150 trout.</i>					
<i>(If you have less or more trout you will need to adjust accordingly &amp; feed only what your trout will eat within the first 30 seconds of feeding time.)</i>					
<b>Trout size</b>	<b>Approx. date</b>	<b>Size food</b>	<b>Teaspoons/feeding</b>	<b>Times</b>	<b>Total tsp/week</b>
<b>Out of hatch box</b>	Late November	<b>0</b>	1/16	1/day	5/16tsp
	Early January	<b>0</b>	1/8	2/week	1/4tsp
<b>1/2- 1"</b>	Mid January to late January	<b>1</b>	1/4	2/week	1/2 tsp
	Early February to mid March	<b>1</b>	1/4	2/week	1/2tsp
<b>1 1/2"-3"</b>	Mid March to late May	<b>2</b>	1/2	2/week	1tsp

**SUGGESTIONS FOR FEEDING:**

When trout begin to “swim-up” from the gravel or the bottom of the breeder basket, they are ready to feed. **Do not feed them when they are eggs or sac fry.**

**Remember:** The swim-up stage is when the trout have completely absorbed their yolk sac and begin searching for food. This typically happens approximately 28 days after they hatch; however, this time frame depends on water temperatures (e.g. Cold water results in slower hatch rates).

Trout should be given **SMALL** amounts of food once a day in the beginning and once a day twice a week beginning in early January. The trout will seem “hungry” all the time; remember, they are opportunistic feeders and their instinct is to eat as often as possible.

The chart above is a guide on how much you should be feeding your trout. When switching food size, mix 50% of the smaller size with 50% of the larger size. This will allow smaller trout to continue to feed while your larger trout will feed on larger size.

**OVERFEEDING:**

What happens if I overfeed?

1. Ammonia and/or nitrite spikes
2. Trout mortality
3. Run out of food before release day
4. Decrease in pH

One way to remedy overfeeding consequences is to remove excess food 20 minutes after feeding using a turkey baster. If you have to remove food, you should decrease the amount you are feeding.

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# Trout Care

## *Vacation/holiday preparation*

Your trout will survive over a 2-4 day weekend without any food, but during vacations it is best for someone to check on the aquarium to make sure the equipment is working.

### **Prepping for short vacations** (3 or 4 day weekends)

- Feed less on Friday; however, make sure you remove any excess food from the bottom of the aquarium using a turkey baster to collect food you can see off of the bottom and a net to collect excess food on the surface. This will help decrease the potential of an ammonia spike while you are gone. If you are concerned you may want to skip feeding all together.
- Depending on your water quality parameters, you may want to conduct a small water change (5-7 gallons). If your water parameters are fine DO NOT conduct a water change.

### **Prepping for mid-length vacations** (7-10 days)

- Trout are wild animals that can survive leaner times; however, you should feed at least twice during a long vacation to discourage cannibalism. It is natural to experience some cannibalism, which could lead into a carrying capacity lesson or survival of the fittest lesson.
- Continue with the normal feeding cycle in the days leading up to vacation.
- Depending on your water quality parameters you may need to conduct a small water change. Again, if your parameters are reading fine do not worry about changing the water.

### **Prepping for LONG vacation** (11+ days)

- Same preparation as above.
- Plan to come in at least twice, if possible, leaving only 3-4 days between visits.
- If you can't come in, don't worry. Remember, trout are wild animals that can survive the lean times. Don't be surprised if you do end up with some cannibalism.

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# Trout Care

## *Release day*

Your hard work has paid off and your release day has arrived. This day can be delightful for herons, kingfishers and fish in the stream. To keep predation to a minimum, place your fingerlings into calm water with available cover from predators.

**Your trout should be released into the waterway you have listed on your Designation of Agent letter. This is the only stream you have state permission to release your trout into.**

<b>Materials needed:</b>	
✓	Sturdy cooler, tupperware or bucket with a loose-fitting lid
✓	Ice made with dechlorinated water -- or -- ice in a Ziploc bag or 2-liter bottle with labels removed
✓	Battery-powered air stone/ bait aerator
✓	Release containers (a cup per student, smaller buckets
✓	Boots and weather appropriate clothing for your students
✓	Towels for drying student hands
✓	Optional: Stream study equipment if you would like the students to conduct a stream study/water monitoring tests to determine the health of the stream they are releasing their trout into

<b>Travel preparation:</b>	
1.	Fill cooler or bucket half full with water from aquarium (be sure you can lift the cooler). The reason for filling only half way is that air introduction into the water is more important than the depth of the water. The slight jostling of the water in the bucket/cooler will keep adding oxygen to the water
2.	Add StressZyme to the transport containers. This will aid in decreasing trout stress level while traveling.
3.	Transfer trout fingerlings to cooler or bucket using a small net; <b>MAKE SURE</b> you have plenty of buckets and/or coolers available for the number of trout you will be releasing.
4.	<b>DO NOT</b> overcrowd your buckets/coolers. ( <i>i.e. do not put more than 50 trout per 5 gallon bucket</i> )
5.	Add ice baggies to water -- but monitor the temperature, taking care to keep it as consistent as possible
6.	Insert and start air stone or bait aerator.
7.	Place lid over bucket or on cooler, to keep trout from jumping out, but tight enough to pink your aerator tube.

<b>Release site instructions:</b>	
a.	Once you have arrived at the stream, slowly acclimate your fingerlings to their new environment;
b.	Monitoring the temperature of your cooler or bucket, slowly add water from their new stream, one or two cupfuls at a time every 10 minutes. The slow addition of water will gently change the temperature and water chemistry of your transport system;
c.	Don't allow the water temperature to change more than a few degrees every 10 minutes;
d.	Once the bucket/cooler temperature is within one or two degrees of the stream/aquarium temperature, remove the fingerlings to their release container (cup/small bucket);
e.	To release the trout, lower their container into the stream and gently tip it to let them out.

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# Chapter 6: How to maintain a healthy coldwater ecosystem in-class:

- **Nitrogen cycle** (*aquarium cycling*)
- **Water quality parameters**
- **Water changes**

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# Nitrogen Cycle *(aquarium cycling)*

Every aquarium goes through a process of establishing beneficial bacterial colonies known as the “Nitrogen Cycle” or aquarium cycling. The nitrogen cycle converts trout waste and uneaten food to safe by-products. Water quality fluctuations are a direct result of this cycle.

**Definition:**

The biological process that converts ammonia and nitrite (*toxic to fish*) into relatively harmless nitrogen compounds (*nitrates*).

**Nitrogen cycle (aquarium cycle) stages, what to expect:**

NOTE: To assist with aquarium cycling, add StressZyme once week throughout the school year to ensure good bacteria colonies flourish in your mini “coldwater ecosystem”. Your filter should be OFF before you add StressZyme. Leave it OFF for at least two hours. Then turn it back ON.

**When does it begin:**

The aquarium cycle will not begin until your trout hatch from their eggs and begin to excrete waste.

<b>Stage 1 (ammonia spike)</b>	
When	Late November – early/mid December; When trout begin to excrete waste ( <i>sac fry and/or swim-up fry stage</i> )
Trout mortality/stress	Yes. You will experience trout mortality/stress during this stage not only because of the ammonia spikes, but also because trout that do not learn to feed will also be dying off.
What happens	Ammonia levels increase and will stay elevated for 2 weeks until stage 2 begins.
Explanation	The cycle begins when your fish begin to excrete waste in your aquarium system. All waste and uneaten/decaying food breaks down to form ionized/unionized ammonia. The freshwater master test kits ammonia test gives a combined reading of Ammonium (NH <sub>4</sub> ) and Ammonia (NH <sub>3</sub> ).
<b>Stage 2 (Ammonia decreases and nitrites spike)</b>	
When	Late December – early/mid January
Trout mortality/stress	Yes. This is the stage when there will be another trout “die off” because of the nitrite spikes.
What happens	Ammonia levels should begin to decrease and nitrite levels will begin to increase. Nitrites will remain high for at least 2 weeks.
Explanation	Bacteria called “nitrosomonas” grow to sufficient quantities in the filter and then convert the ammonia to toxic nitrite. IF your monitoring results show high nitrite levels the “nitrobacters” are still trying to get established in the aquarium.
<b>Stage 3 (nitrite decreases and nitrate spikes)</b>	
When	January – early February (usually about 5-8 weeks after your trout hatched)
Trout mortality/stress	Very few if any. There is usually no die off at this time because the toxic nitrite is begin converted to less toxic nitrates
What happens	Nitrite levels begin to decrease and nitrate levels (not toxic) begin to increase.
Explanation	Nitrobacters convert the toxic nitrites to less toxic nitrates. Once your aquarium reaches this point it is said to have “cycled”.

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# Nitrogen Cycle

## *How it works in your aquarium*

**Make sure you add StressZyme at least once a week according to directions throughout the school year.**

**What NOT to do during the nitrogen cycle:**

- Do not change your aquarium water too often. Changing your aquarium water too often will delay your aquarium cycling process and STRESS your trout. Only change water if your parameters (i.e. ammonia and nitrites) are off the charts. Your aquarium needs to go through the initial ammonia and nitrite spike in order to cycle through completely.
- Don't change filter media in the beginning – beneficial bacteria are growing there. Remember they are needed to convert ammonia to nitrites and then nitrites to nitrates.
- Don't overfeed– when in doubt underfeed your trout.
- Remember that anything going into the aquarium will produce waste one way or another.

If your nitrite and nitrate levels are good, continue to observe the trout and record any abnormalities (e.g. consistent swimming on their sides, swimming in circles, not eating for several days).

***Weekly or once every other day water testing, not overfeeding your trout and conducting water changes based on your water quality test results, will keep your aquarium healthy!***

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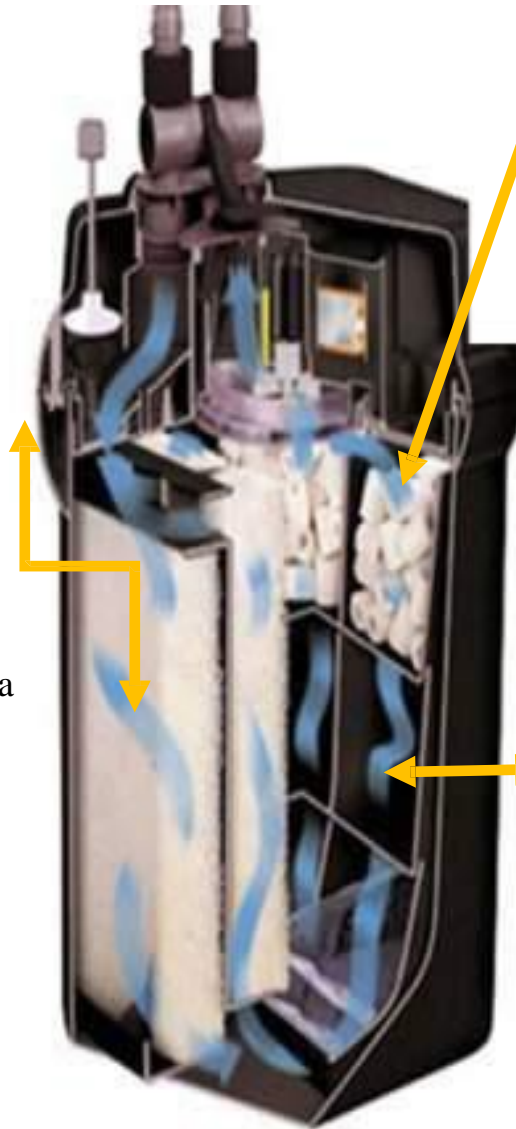
# Nitrogen Cycle

## *Filter components that aid in the nitrogen cycle*

### *405 Fluval Canister Filter*

#### **Foam Insert:**

Inserts that capture large particles for effective mechanical filtration. It helps reduce ammonia and nitrites by providing a large surface area for bacteria growth.



#### **BioMax:**

Ceramic rings that have a complex pore system where beneficial bacteria can thrive. It helps reduce ammonia and nitrite. Also, the rings allow for ideal water movement, which ensures optimal contact time for biological filtration.

#### **Fluval Carbon:**

A premium, low-ash carbon that improves water clarity and color, while also removing odors. It provides a great amount of surface area for absorption of impurities.

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# Nitrogen Cycle

## Diagram

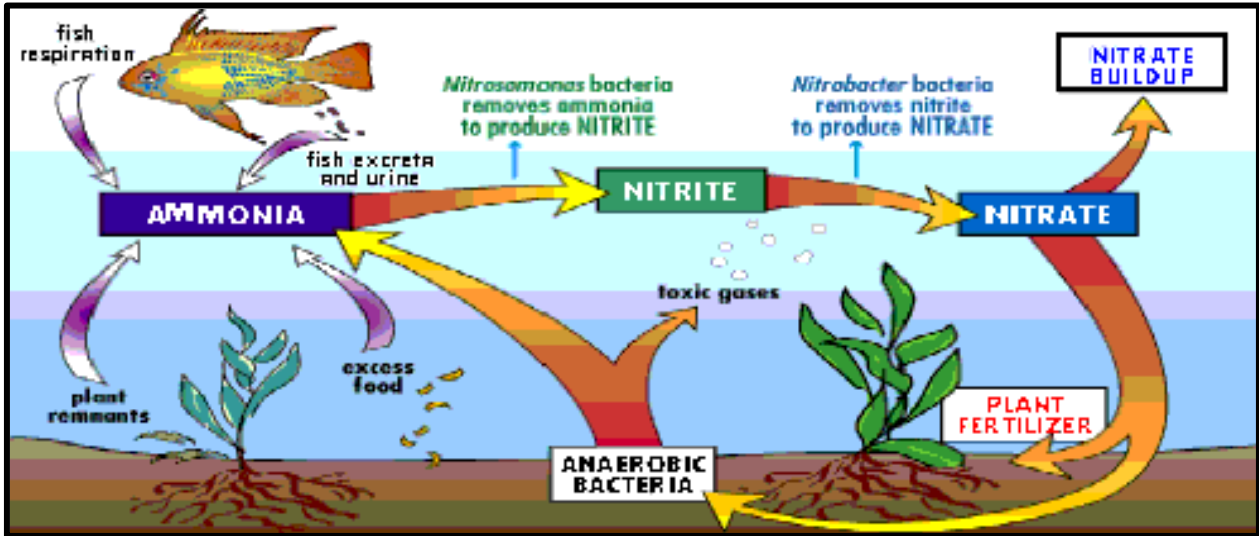


Diagram found at: *Puffer Net*. N.p., n.d. Web. 23 June 2010  
<http://puffernet.tripod.com/nitrogencycle.html>.

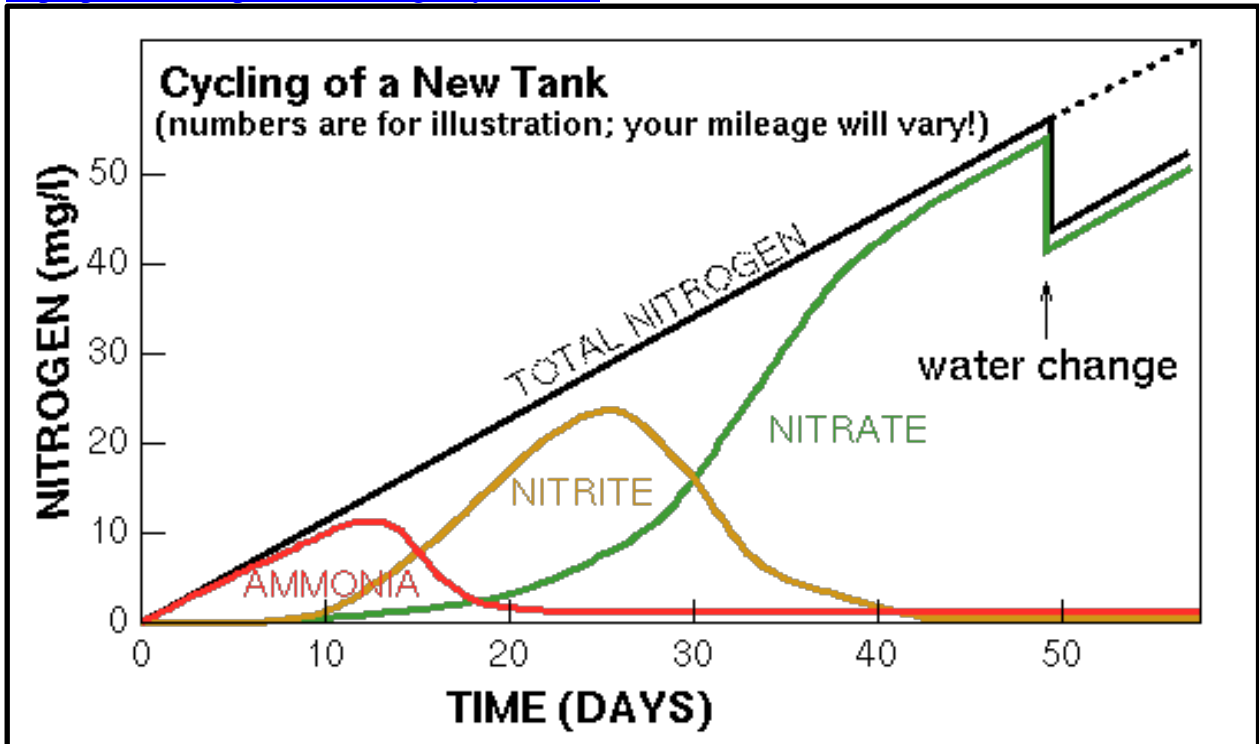


Diagram found at: Narten, Thomas. *Beginning Fishkeeping*. N.p., n.d. Web. 23 June 2010.  
<http://faq.thekrib.com/begin-cycling.html#cycle>  
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# Water Quality Parameters

## (Overview)

Parameters to be monitored	Optional parameters you may test	Parameters to check with water authority <i>** Both parameters, <u>in any concentration</u>, are LETHAL.</i>
Nitrites & Nitrates	Dissolved oxygen	Chlorine (Lethal in any concentration)
Temperature	Total dissolved solids	Chloramines
pH	Alkalinity	
Ammonia		

Consistent monitoring, *at least 2-3 times a week*, provides you with a picture of what is “normal” for your aquarium. If your trout are thriving within the parameters of your aquarium DO NOT change your parameters based on other TIC classrooms. What is “normal” for their aquarium may not be best for your trout.

When to monitor		
<b>Once every other day or once every two days</b>		
Reason for less monitoring	Less interaction = less stress on trout	Prolongs the life of your test chemicals
	Decrease worries for teachers and students while the aquarium goes through the cycling process	

Variables that impact aquarium water parameters	
Aquarium location	Hallways/unmonitored classroom = sabotage; trout stress from constant crowds
	Close to window with direct sunlight = increased temperatures & chiller use; algal growth
	Close to heaters = fluctuating temperatures
Water source	Water from springs, creeks, public will all have different parameter results
Type of substrate	Pebbles, rock, wood will all impact water parameters depending on the type
Overfeeding	Too much food increases organic matter decay = increased ammonia & nitrites
Dead eggs/fingerlings	Increase levels of decaying organic matter = increased ammonia & nitrites
Rinsing hands	NOT rinsing hands before working with aquarium introduces soaps; oils; contaminants to aquarium

**Safety note:** Material Safety Data Sheets (MSDS) for the Freshwater Master Test Kit is on the PA TIC website.

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# Water Quality parameters

## (Nitrites and Nitrates)

(Information on nitrites and nitrates were collected from: Sharpe, Shirlye. *Nitrogen Cycle*. N.p., n.d. Web. 22 June 2010. <<http://freshaquarium.about.com/od/watercare/a/nitrates.htm>>.)

About nitrite (NO <sub>2</sub> <sup>-</sup> ) and nitrate (NO <sub>3</sub> <sup>-</sup> ):	
<b>What are they</b>	Inorganic ions that occur naturally and are part of the nitrogen cycle Metabolic products of microbial digestion in soil or water that decomposes wastes containing organic nitrogen. This process produces ammonia which is then oxidized into nitrites and then nitrates.
<b>Wastes that contain organic nitrogen</b>	Animal feces      Decaying plants; animals; food

**Nitrites:**

<b>How do they form</b>	When ammonium ions (NH <sub>4</sub> <sup>+</sup> ) mix with water the beneficial bacteria ( <i>nitrosomonas</i> ) can then convert ammonia to nitrite (NO <sub>2</sub> <sup>-</sup> ).
<b>Nitrites are toxic to trout</b>	Increased levels of nitrites causes stress on trout. Stress leads to respiratory hardship and a weakened immune system, which makes the trout more susceptible to disease, bacterial infections and death.
<b>Prevention</b>	You need to test for nitrites each time you monitor your aquarium (2-3 times a week)

**High nitrite issues: (nitrite poisoning)**

<b>Symptoms</b>	Lethargy & congregating near the water surface
	Light tan to brown gills
	Tan to brown looking blood ( <i>in this case your trout would appear pale in color</i> )
<b>Remedies</b>	Dose your aquarium with StressZyme ( <i>make sure you are doing this weekly</i> )
	Small water change (5-10 gallons)
	Do not feed your trout for a day or two
	Slowly decrease your water temperature (48-50 F)
	Conduct a static salt bath. This will “de-stress” your trout and help fight off infections

**Acceptable levels of nitrites (as experienced by the TIC staff with Trout In the Office (TIO))**

Nitrates present in aquarium (10ppm-40ppm)	0 – 2 ppm nitrites is O.K.
Nitrates NOT present in your aquarium	0 - .25 ppm nitrites is O.K. ;any higher will stress trout
<b>A cycled aquarium should have little to no nitrite readings (0-.5).</b>	

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# Water Quality parameters

## (Nitrites and Nitrates)

*Continued...*

**Nitrates:**

<b>How do they form</b>	When nitrite (NO <sub>2</sub> <sup>-</sup> ) mixes with water the beneficial bacteria ( <i>nitrobacters</i> ) will convert nitrite ( <i>toxic</i> ) to nitrate (NO <sub>3</sub> <sup>-</sup> ) ( <i>harmless when at low levels 10ppm – 40ppm</i> )
<b>Nitrates are seemingly harmless</b>	Nitrate can and is usually present in aquarium to a certain extent.
	At levels below 80ppm it is harmless; however, readings at/over 80ppm will begin to stress your trout.
	Nitrate readings at/over 80ppm is an indication that there are too many fish and/or waste in your aquarium.
<b>Prevention</b>	You need to test for nitrites each time you monitor your aquarium (2-3 times a week)

**High nitrate issues:**

<b>Symptoms</b>	Diseased, unhealthy fish
	Algae growth: Nitrates promote growth of algae which creates cloudy water. The algae growth will eventually increase your amounts of ammonia and nitrites.
<b>Remedies</b>	Change out 5-10 gallons of water
	Add bio enhancer product (Microbe lift; StressZyme) weekly
	Increase aeration at the surface of your aquarium water by dropping the water level just below the filter output

**Acceptable levels of nitrate** (*as experienced by the TIC staff with Trout In the Office (TIO)*)

<b>5 – 40 ppm</b>	Nitrate at these levels will not stress your trout
<b>What to do if they are higher than 40ppm</b>	Small water change (5 -10 gallons)
	Make sure you add StressZyme after your water change according to the directions

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# Water Quality Parameters

## (Chlorine and Chloramines)

Many water companies have switched from chlorine to chloramines to treat water.

<b>Concern</b>	Chlorine and chloramines are both lethal to trout.
	Unlike chlorine, chloramines cannot be removed by allowing your water to sit for 48 hrs
<b>What to do</b>	BEFORE using public water for your aquarium, contact your local water authority to see what they treat their water with
	Depending on what they treat the water with will determine what you need to do.

### Chlorine

Chlorine is typically what most water authorities treat their water with to rid public water sources of harmful bacteria.

#### **How to remove chlorine from your water:**

<b>1.</b>	Fill up two 5 gallon buckets. DO NOT use gallon jugs, they do not provide enough surface area of water for proper chlorine dissipation.
<b>2.</b>	Allow the buckets to sit for at least 48 hours before placing them into your aquarium
<b>3.</b>	While your buckets are sitting, you should also occasionally stir the water to help dissipate the chlorine more rapidly
** Always have at least 2 chlorine free buckets available for water changes**	

#### **Other options:**

<b>You can also use commercial dechlorinators such as:</b>	
Prime	AmQuel
AP Tap water conditioner	Aquasafe Plus

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# Water Quality Parameters

## (Chlorine and Chloramines)

*Continued...*

**Chloramines** *(content below was modified from: Sioux Falls Water Purification Plant fact sheet)*

Chloramines are another type of disinfectant used by water authorities to kill harmful bacteria in water. They are a combination of chlorine and ammonia. Chloramines are safe for humans and other animals because when water containing chloramines are swallowed they are neutralized by the digestive system before reaching the blood stream.

<b>Concern</b>	Chloramines are lethal to trout. They, unlike humans and other animals, do not just swallow water they breathe it; therefore, the chloramines enter directly into their blood stream, making it difficult for their blood to carry oxygen.
	Cannot be removed by allowing your water to sit out for 48 hours
<b>What to do</b>	BEFORE using public water for your aquarium, contact your local water authority to see what they treat their water with
	Depending on what they treat the water with will determine what you need to do.

**How to remove chloramines:**

*(Information collected from: Gadd, Chuck. "Chlorine and Chloramines." Chuck Gadd's Planted Aquaria Pages. Ed. Chuck Gadd. N.P, n.d Web 10 June 2010. [http://www.csd.net/~cgadd/aqua/art\\_chlorine.htm](http://www.csd.net/~cgadd/aqua/art_chlorine.htm))*

<b>1.</b>	Use a commercial dechlorinator that specifically states that it also removes ammonia
<b>Products that remove chloramines and ammonia:</b>	
Seachem Prime	Tetra "AquaSafe NH/CL Formula"
Jungle's "ACE"	Kordon's "AmQuel"
Kent's "Professional Ammonia Detox"	
<b>If the label doesn't specifically mention that it neutralizes ammonia, then don't depend on it to safely treat water containing chloramines.</b>	

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# Water Quality Parameters

## (Temperature and pH)

### Temperature

<b>Ideal temperature range for trout</b>	48-52 °F
<b>What does temperature affect</b>	Ammonia and oxygen concentration
	Trout metabolism
	Sudden increase or decrease will stress trout in any life stage
<b>Prevention</b>	When doing a water change, make sure the new water is within 1-2 degrees Fahrenheit of water in the aquarium.
	Use a standard aquarium and digital thermometer to monitor temperature.

### Temperature issues:

<b>Symptoms</b>	Below 38°F will suppress fish appetites and slows digest processes.
	Above 68°F = partial digestion of food and holds less dissolved oxygen. Trout will gasp for oxygen at water surface and crowd near the filter outflow and/or chiller coil.
<b>Remedies</b>	Adjust temperatures accordingly using the chiller unit and thermometer.
<b>Mortalities</b>	Cold water (below 40°F) leads to starvation.
	Warm water (above 68°F) die from lack of oxygen and stress.

### pH

pH is an indicator of water acidity or alkalinity. pH values range from 1 to 14. A pH of 7 is neutral.

<b>Ideal pH range for trout</b>	6 – 8.2
<b>What does temperature affect</b>	A sudden increase or decrease will cause severe stress or death of trout.
<b>Prevention</b>	Monitor your parameters at least 2-3 times per week
	Don't increase or decrease pH if it doesn't match other TIC aquariums.

### pH issues:

<b>Symptoms</b>	Sever cases trout will become excited, jumping out of water, racing back and forth.
	Mild cases your fish may become sluggish and stay near the surface of the water.
<b>Remedies</b>	Conduct partial water change. Know the source water pH and aquarium pH. They should be within +0.5 standard pH units to safely exchange the water.
	Use store purchased reagent: pH “downer” or pH “upper”; purchase at local pet store
<b>Mortalities</b>	Death may occur immediately or shortly after a rapid change in pH

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# Water Quality parameters

## *(Dissolved Oxygen)*

### Dissolved Oxygen

Dissolved oxygen (DO) is defined as the amount of oxygen, measured in parts per million (ppm), that will dissolve in water at a given temperature. Trout are active and consume a lot of oxygen from the water.

<b>Ideal dissolved oxygen levels</b>	10-12 ppm
	8ppm is the absolute minimum for developing eggs and alevins
	5ppm is the absolute minimum for fry
	The colder your water the MORE dissolved oxygen you will have

### Low dissolved oxygen issues:

<b>Symptoms</b> <i>(usually occurs at DO levels less than 6ppm)</i>	Trout reduce eating; crowd incoming water flow; swim near the surface with gaped mouths; display rapid gill cover movement
<b>Remedies</b>	Add aeration (additional airstones) and lower water level so that your filter outflow creates a mini waterfall.
	Check your water temperature: decrease slowly if needed
	Stop feeding for a day or two
	Decrease fish density if low dissolved oxygen levels persist
<b>Mortalities</b>	Death will accelerate quickly until the issue is resolved

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# Water Quality parameters

## (Ammonia)

### Ammonia

<b>How do they form</b>	As alevins and fry develop and grow while excreting waste, both ammonium ions (NH <sub>4</sub> ) and ammonia (NH <sub>3</sub> ) are produced.
<b>Two chemical forms of ammonia</b>	
Ammonia	Favors high pH levels and high temperatures: toxic to trout
Ammonium	Favors low pH levels: not toxic to trout
<i>** your freshwater master test kit measure both ammonia and ammonium at the same time**</i>	
<b>Ammonia concern</b>	Highly toxic to trout High levels cause gill damage, anemia and death
<b>Prevention</b>	Do NOT overfeed. Main cause of ammonia increases Maintain cool water temperatures

### Ammonia issues:

<b>Symptoms</b>	Respiratory stress
	Trout exposed to high ammonia levels over time will exhibit eroded fin edges and thickened mucus covered gill filaments
<b>Remedies</b>	
Immediate	Conduct small (5-10 gallon) water changes. When doing this use your siphon clean and take water from the bottom of your aquarium. That is where ammonia will settle most.
	Turn off filter and add StressZyme. Leave filter off for at least 2 hours before turning it back on. This gives time for StressZyme to work.
	Do not feed your trout for a day or two
Daily	Feed smaller amounts of food
	Use a turkey baster to take out excess food 15-20 minutes after trout feed. This will prevent excess water changes and targets areas where food tends to accumulate.
Long term	Do NOT conduct too many water changes. Too many water changes = aquarium not cycling
	Ensure that your good bacteria populations are healthy by continuing to add StressZyme weekly.
<b>Mortalities</b>	The toxicity of ammonia increases with higher pH levels and water temperatures

### Acceptable ammonia levels for brook trout:

Nitrates present in aquarium (10ppm-40ppm)	0 -1 ppm ammonia is O.K.
Nitrates NOT present in your aquarium	0 - .25 ammonia is O.K. ; any higher will stress trout
<b>A cycled aquarium should have little to no ammonia readings.</b>	

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# Water changes

Keeping the aquarium clean (*i.e. free of extra food and other decaying matter*) and bacterial colonies healthy are two important jobs for all TIC aquariums.

Monitoring your water quality on a weekly basis and knowing what is “normal” for your aquarium is key to understanding your TIC aquarium and whether or not it needs a water change. What is “normal” or suitable for your aquarium may not be for another TIC classroom aquarium.

**When to conduct water changes:**

<b>Do NOT conduct water changes</b>	When your trout are still eggs; Most water changes are not needed until after the trout begin to produce increased levels of waste.
	When water quality parameters are at a healthy level for <u>your trout and your aquarium.</u>
<b>DO conduct water changes</b>	If your water quality parameters are abnormal according to your “normal” aquarium readings ( <i>Refer to the “water quality parameter” section of guide</i> )
	If you fear other contaminants were placed into the aquarium
<b>Generally water changes do not begin or are not necessary until about 2-3 weeks after you begin feeding them</b>	

<b>Too many water changes</b>	Aquarium never cycles. ( <i>Review “nitrogen cycle” section of guide</i> )
	If the aquarium never cycles you may have a trout die off later in the year.

**How to keep aquarium water healthy:**

<b>1.</b>	Monitor all parameters every two or three days. At least twice a week.
<b>2.</b>	Remove dead fish. One dead fish can/will spread disease. ( <i>You can use a turkey baster to remove small fish and the siphon clean vacuum when they are 1” or more</i> )
<b>3.</b>	Do NOT overfeed
<b>4.</b>	Using a turkey baster remove excess food after feeding your trout

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# Water changes

## *Continued...*

### **Conducting water changes:**

#### **1. Water changes need to be done with fresh, dechlorinated, clean water**

- a) You should always have at least two 5 gallon buckets of “aged”/dechlorinated water ready at ALL times
  - i. How to “age” water = fill two 5 gallon buckets of water and allow them to sit out for at least 48 hours. Stir the water occasionally to help dissipate the chlorine
  - ii. In addition to “aging” your tap water, you may also use a dechlorination agent. This item can be purchased at a local pet store.

#### **3. Clean the sides of the aquarium using only a sponge (NO SOAP)**

#### **4. Prime and use the Siphon Kleen aquarium vacuum according to the instructions**

- a) Use a 5 gallon buck to catch the waste water. This will help catch any trout that get sucked into the vacuum.
- b) When using the aquarium vacuum, move it up and down when cleaning the gravel so that it rolls/spins around in the vacuum. This will allow you to clean the gravel more thoroughly.
- c) Make sure you start cleaning in the areas where you typically feed the trout, then move on to other areas.
- d) Work quickly as the vacuuming process does stress the trout.
- e) Make sure you don’t take too much water out at a time. It is easy to lose track when cleaning.

#### **6. As you clean the aquarium using the gravel cleaner; you will remove about 5 gallons of water.**

- a) When you are done cleaning the gravel, add new water up to the level it was before cleaning.
- b) If you change more than 13 gallons of water make sure the new water is the same temperature as the aquarium water. If it is not you run the risk of “shocking” your trout.
- c) Plan ahead, if you plan on changing out 13 or more gallons you should refrigerate or store your dechlorinated water outside if it is cold enough before adding it to your aquarium.
- d) Add the water slowly, trying not to create a major disturbance to your trout

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# Chapter 7: Record Keeping

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# Record Keeping

## **Before the eggs arrive:**

1. Instruct students on how to conduct a daily inspection of the aquarium;
2. Show them how to make sure the equipment is working properly and how to read and record the temperature;
3. It is best if you organize biologist teams and assign times for each to monitor and record the aquarium information;
4. Explain that when the eggs arrive, they will also be checking for egg mortality;
5. Assign three students to conduct the inspection twice daily for a week;
6. At the end of the week rotate out one student and put a new student in. This way, after the first week, you will always have two students with experience in conducting the inspection.

*Have students inspect the aquarium early in the morning and at the end of the day and record their findings on the daily inspection record and on the progress chart.*

*Record keeping is an essential part of the program. Records can identify potential problems and can be used to reference experiences from past years. Students should record everything that is done or observed.*

For example:

- Dates
- Name of individual(s) conducting the tests and feeding the trout
- Time trout were fed to avoid overfeeding
- Feeding amount
- Temperatures
- Egg/alevin/fry numbers
- Problems and solutions
- Water quality testing results
- Mortality
- Observations: hatching, predation, etc.

You can use the following daily inspection record and progress reports that follow or have students create recording sheets of their own. In addition, progress reports can be posted on the Trout in the Classroom yahoo forum. [\(back to table of contents\)](#)

# Monitoring Records

**DAILY INSPECTION RECORD**

Week of: \_\_\_\_\_

Inspectors' Names: \_

	CHECK THE FOLLOWING				RECORD DATA:				
	Chiller is plugged in	Air pump is plugged in	Water is clear	Water level is correct	Temperature (F)	pH	Ammonia (mg/L)	# of eggs/trout removed	Initials
Monday									
Wednesday									
Friday									

**At the end of the week, you must calculate the following:**

Average temperature: \_\_\_\_\_

Average pH: \_\_\_\_\_

Average ammonia: \_\_\_\_\_

Total mortality (# of eggs/trout removed): \_\_\_\_\_

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# Monitoring Records

## Report of Operations

Teacher \_\_\_\_\_ School: \_\_\_\_\_  
 Species: \_\_\_\_\_ Phone #: \_\_\_\_\_  
 # of Eggs Received: \_\_\_\_\_ Grades: \_\_\_\_\_

Date	Mortality		Water				Comments
	Egg	Fry	Temp	pH	Ammonia	Water Changed	

Total Egg Mortality: \_\_\_\_\_ Number Fry Released: \_\_\_\_\_  
 Total Fry Mortality: \_\_\_\_\_ Release Site/Stream: \_\_\_\_\_

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# Monitoring Records

## Equipment Inspection Record

Date: \_\_\_\_\_  
 Temperature: \_\_\_\_\_  
 Chiller unit plugged in \_\_\_\_\_  
 Powerhead plugged in \_\_\_\_\_  
 Air Pump plugged in \_\_\_\_\_  
 Powerhead and Air Pump operating properly \_\_\_\_\_  
     Water at correct level \_\_\_\_\_  
     Even flow \_\_\_\_\_  
     Bubbles evident \_\_\_\_\_  
 Water \_\_\_\_\_  
     Clean \_\_\_\_\_  
     pH within acceptable range \_\_\_\_\_  
 Mortalities removed and recorded \_\_\_\_\_  
 Comments: \_\_\_\_\_

Inspector's Signature \_\_\_\_\_

## Equipment Inspection Record

Date: \_\_\_\_\_  
 Temperature: \_\_\_\_\_  
 Chiller unit plugged in \_\_\_\_\_  
 Powerhead plugged in \_\_\_\_\_  
 Air Pump plugged in \_\_\_\_\_  
 Powerhead and Air Pump operating properly \_\_\_\_\_  
     Water at correct level \_\_\_\_\_  
     Even flow \_\_\_\_\_  
     Bubbles evident \_\_\_\_\_  
 Water \_\_\_\_\_  
     Clean \_\_\_\_\_  
     pH within acceptable range \_\_\_\_\_  
 Mortalities removed and recorded \_\_\_\_\_  
 Comments: \_\_\_\_\_

Inspector's Signature \_\_\_\_\_

## Equipment Inspection Record

Date: \_\_\_\_\_  
 Temperature: \_\_\_\_\_  
 Chiller unit plugged in \_\_\_\_\_  
 Powerhead plugged in \_\_\_\_\_  
 Air Pump plugged in \_\_\_\_\_  
 Powerhead and Air Pump operating properly \_\_\_\_\_  
     Water at correct level \_\_\_\_\_  
     Even flow \_\_\_\_\_  
     Bubbles evident \_\_\_\_\_  
 Water \_\_\_\_\_  
     Clean \_\_\_\_\_  
     pH within acceptable range \_\_\_\_\_  
 Mortalities removed and recorded \_\_\_\_\_  
 Comments: \_\_\_\_\_

Inspector's Signature \_\_\_\_\_

## Equipment Inspection Record

Date: \_\_\_\_\_  
 Temperature: \_\_\_\_\_  
 Chiller unit plugged in \_\_\_\_\_  
 Powerhead plugged in \_\_\_\_\_  
 Air Pump plugged in \_\_\_\_\_  
 Powerhead and Air Pump operating properly \_\_\_\_\_  
     Water at correct level \_\_\_\_\_  
     Even flow \_\_\_\_\_  
     Bubbles evident \_\_\_\_\_  
 Water \_\_\_\_\_  
     Clean \_\_\_\_\_  
     pH within acceptable range \_\_\_\_\_  
 Mortalities removed and recorded \_\_\_\_\_  
 Comments: \_\_\_\_\_

Inspector's Signature \_\_\_\_\_

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# Chapter 8: Aquatic Invasive Species (AIS)

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# Aquatic Invasive Species (AIS)

## What are AIS?

Information on AIS was collected from:

Sea Grant and Penn State University Erie. *Aquatic Invasive Species of Pennsylvania*. Ed. Sara Grise. Sea Grant and Penn State University, June. Web. 19 June 2010. <<http://www.pserie.psu.edu/seagrant/ais/index.htm>>.

AIS are species, including its seeds, eggs, spores, or other biological material, capable of propagating in an area other than their origination. They are anticipated to be the leading cause of biodiversity loss in the Great Lakes in the 21<sup>st</sup> century and of extinctions in North American freshwater ecosystems. Once established in a body of water AIS are very difficult to eradicate and are easily spread to uninfested waterways through recreational boating, bait introductions, and aquaculture.

**\*\* REMEMBER:** Some species are native only to their watershed and should not be introduced to an adjacent watershed even if they are a few miles apart.

Aquatic Invasive Species	
<ul style="list-style-type: none"> <li>• Prey on native species</li> </ul>	<ul style="list-style-type: none"> <li>• Compete with native species</li> </ul>
<ul style="list-style-type: none"> <li>• Alter ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>• Spread disease</li> </ul>
<ul style="list-style-type: none"> <li>• Cause economic damage</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

As interesting and exciting these “new” additions to your aquariums may be for your students, you must approach the idea with extreme caution. Placing these creatures and plants into your classroom aquarium may not have an immediate impact on your aquarium ecosystem; however, they could have a drastic impact within the watershed you release your trout into.

## Concern

Over the past few years TIC teachers have asked about placing plants, mussels (bivalves) and/or snails into their aquariums. Our number 1 concern is the introduction or spread of Aquatic Invasive Species (AIS) to the waterways in which you release trout.

Many state agencies and organizations including, Pennsylvania Council of Trout Unlimited and Pennsylvania Fish and Boat Commission currently implement practices to decrease impacts of AIS; therefore, we are recommending that TIC participants take the same precautions.

TIC participants need to be aware and cautious of the impacts your aquarium could have on the local watersheds. We recommend that if you choose to have freshwater mussels or snails in your classroom that you do so in a SEPARATE aquarium and DO NOT release them back into waterways.

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# Aquatic Invasive Species (AIS)

## Continued...

**Remember**, as teachers and program partners we need to set an example for our students and help prevent the spread of invasive species. This is another great teaching opportunity on protection of our coldwater resources.

### **Reasons for concern**

1. The plants, snails or mussels you choose to place in your aquarium, without any research, could be AIS. Even if you do not release them into your chosen waterway with your trout, you may still impact your release stream. Some AIS have unique ways of reproducing and/or dispersing seeds that you may not be aware of; therefore, you may be adding to their spread throughout the state.

#### EXAMPLE:

If you have mussels (bivalves) in your aquarium they may reproduce and potentially utilize your trout as “hosts” for their young; as a result, you may impact the waterway you are releasing your trout into.

#### HOW?

(Information collected from: Storer, T.I. 1951. *General Zoology*, 2nd edition. McGraw-Hill Book Company, Inc., New York)

Fresh water mussels (bivalves) are very unique because they reproduce by utilizing fish as a host for their young. The female mussel spews embryos called glochidia into the gills of the “host” fish. The glochidia have hookless forms that clamp to the gill filaments of the fish. After the mussel develops 10-70 days, the connection weakens, the young opens and closes its valves, extends its foot, and escapes to the bottom to become free-living.

2. Some plants reproduce through even the smallest amount of vegetation.

#### EXAMPLE:

The aquatic plant Hydrilla was imported to the United States as an aquarium plant. It can reproduce primarily vegetatively; even the smallest living plant fragment can float downstream and form a new plant.

**\*\* The ONE aquatic plant that is NATIVE to Pennsylvania and safe to place into your aquariums is:**

1. Watercress

For more information on invasive plant facts go to <http://www.invasivespeciesinfo.gov/aquatics/main.shtml>

**Before placing plants or other animals into your aquarium you should conduct research using the following websites and contact us (814)359-5127.**

**For more on Pennsylvania Aquatic Invasive Species visit Sea Grant’s website:**  
<http://seagrant.psu.edu/publications/ais.htm>

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# Chapter 9: Troubleshooting

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# Troubleshooting

## (Equipment)

Airline tubing	
<b>Question</b>	<b>The tubing is very hard to fit over the plastic aquarium parts, what should I do?</b>
Answer	If tubing does not fit over parts, it might help to dip the end of the tub in very hot water. This will momentarily soften the plastic allowing you to slide the tubing over the part. Also, tubing can be carefully stretched by heating the ends, and then inserting a rigid object like a pair of scissors into the end. Tight tubing will fit, but it might require time and patience.
Airstone	
<b>Question</b>	<b>Where do I position the air stone?</b>
Answer	The air stone aeration system produces large volume of bubbles. These bubbles can interfere with the filter operation by filling the motor with air and causing it to “air lock” and fail. For this reason, there should be at least 4 inches between the air stone and the filter.
Aquarium lid	
<b>Question</b>	<b>Should I get a lid for my aquarium?</b>
Answer	Yes, it is better to cover the aquarium with some material which can prevent objects from falling in and provide the reduced light levels that fish prefer. Foam, screen, and plastic have all been used as lid materials with success. Purchased lids for the aquarium can also work.
Chiller	
<b>Question</b>	<b>What should I do if my chiller dies?</b>
Answer	<ul style="list-style-type: none"> <li>• Make sure all of your insulation is still in place. If your front insulation has been removed you must place it back on temporarily to keep your water cold.</li> <li>• You should always have at least 4 frozen gallons of water on hand. Make sure all labels and glue are removed and the top is secure. In an emergency, float the jugs in the aquarium to maintain the temperature. Replace/rotate as necessary.</li> <li>• Contact the chiller company to replace your broken chiller. If you have a Tradewind chiller it should be under warranty.</li> </ul>

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# Troubleshooting

*(Equipment continued...)*

Filter	
<b>Question</b>	<b>Trout are being sucked into the filter, how can I prevent this?</b>
Answer	Place a filter max pre-filter sponge on the intake of your filter system. You can also use stockings; however, they need cleaned regularly. The filter max pre-filter also provides good surface area for good bacteria.
<b>Question</b>	<b>What is Chemi-pure used for?</b>
Answer	<p>It is a replacement for the charcoal in the Fluval filter. You should change the carbon packets around late January – early February. As your fish grow, ammonia and/or nitrite levels may increase, these packets help alleviate these issues.</p> <p>Do not remove the carbon from the mesh bag. Place each carbon packets in the filter media trays. Don't change all media baskets at once. Do one level at a time over a period of a few weeks.</p>
Lights for the aquarium	
<b>Question</b>	<b>Is this something you recommend? Is there a type of light that you suggest we purchase?</b>
Answer	Lights are not necessary. They are not needed at all during the egg or sac fry stages; however, if you wish to have a light you can use a traditional aquarium light bar. Make sure the light has an aquarium grade bulb. NO LEDs.
Insulation	
<b>Question</b>	<b>Does my aquarium need insulation?</b>
Answer	Insulation provides a dark, more stable environment for classroom trout. Insulation also reduces the amount of energy needed to maintain water temperature, ultimately prolonging the live of the chiller.
<b>Question</b>	<b>What kind of insulation can I use?</b>
Answer	Foam board, two layers of bubble wrap and shipping material; cardboard. The most popular is foam board. It can be purchased at any hardware store. ALL sides of the aquarium should be covered (BOTTOM, SIDES AND TOP)

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# Troubleshooting

## (Equipment continued...)

Net breeder	
<b>Question</b>	<b>Can I make my own net breeder?</b>
Answer	Yes, many TIC participants have developed their own net breeders, aquarium set-ups. For examples please visit the “Extras” portion of the aquarium resource guide.
<b>Question</b>	<b>Do I have to weigh down my breeder basket?</b>
Answer	If the net is attached on the outside of the box, you should not have had a problem. Some teachers install the net on the inside – and in that case, you need to place a marble or something to keep the net from floating
Other equipment	
<b>Question</b>	<b>Besides the equipment on our list, what other items can be placed in our aquariums?</b>
Answer	Driftwood that has been thoroughly rinsed; additional airstone and pump; additional filter; aquaponics/hydroponics
Powerhead	
<b>Question</b>	<b>How do I set-up the Aqua 20 Powerhead?</b>
Answer	Anchor the powerhead to the side of the aquarium, $\frac{3}{4}$ way to the bottom of the aquarium. YES, the powerhead can be submerged.
Power failure	
<b>Question</b>	<b>What happens if there is a power failure? How much time do I have?</b>
Answer	<p>Brook trout, although stressed, they can survive in temperatures up to 60-62 degrees Fahrenheit.</p> <ul style="list-style-type: none"> <li>• Make sure all of your insulation is still in place. If your front insulation has been removed you must place it back on temporarily to keep your water cold.</li> <li>• You should always have at least 4 frozen gallons of water on hand. Make sure all labels and glue are removed and the top is secure. In an emergency, float the jugs in the aquarium to maintain the temperature. Replace/rotate as necessary.</li> </ul>

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# Troubleshooting

## (Water)

Ammonia spikes	
Question	What do I do in a case where I have ammonia spikes?
Answer	Refer to the “nitrogen cycle” and “ammonia” section of this resource guide. Directions are found there.
Aquarium cycling	
Question	Our aquarium is still not cycled, what can we do?
Answer	<p>New York classrooms tested <b>Microbe Lift Special Blend</b> and <b>Microbe Lift Nite-Out II</b> last year. These products have live nitrifying bacteria which help cycle aquariums. Test results came back with positive experiences in New York and mixed experiences in Connecticut. Pennsylvania teachers that used it had good feedback during the 2010-2011 school year.</p> <p><b>Benefits:</b> Live nitrifying bacteria (not spores); establish nitrogen cycle down to 50 degrees F (<i>growth slows in lower temperatures</i>); the two products used together can instantly cycle aquariums and keep them in balance.</p> <p><b>Drawback:</b> smell (only for a short period of time)</p> <p>Many teachers have had success using StressZyme or BioZyme, but others have not.</p>
Black film	
Question	<b>What is the black film on the sides of my aquarium?</b>
Answer	The black film is probably charcoal dust. Be sure to thoroughly wash all the charcoal dust out of the filter charcoal bags before putting them in your filter.
Cloudy water	
Question	<b>What is the main reason for cloudy water?</b>
Answer	Indicates excess of decaying matter. This could be from dead fish, excess food, or a filtration problem. Conduct a small water change while also vacuuming the bottom of the aquarium. Make sure your filter is working properly. Clean filter components if needed, with aged water. Do not use soap or any chemicals to clean filter parts. Decrease the amount of food fed.

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# Troubleshooting

## (Water...)

<b>Goldfish for aquarium cycling</b>	
Question	<b>Do I need goldfish to start my nitrogen cycle? If I start late, should I use more goldfish?</b>
Answer	You should not use any type of other fish begin your aquarium cycle. The aquarium cycle will begin after your trout hatch and begin to produce waste. Adding StressZyme weekly will help your process.
<b>Green slime</b>	
Question	<b>My aquarium is coated with a green slime. What is this? What should I do?</b>
Answer	Green film or slime indicates algal growth. This will not harm trout. Some teachers let it alone. It can be removed using a SOAP FREE sponge or similar tool. To prevent further growth limit light entering the aquarium. Foam insulation may prevent this from happening.
<b>Nitrites and Nitrates</b>	
Question	<b>What do I do in a case where I have nitrite spikes?</b>
Answer	Refer to the “nitrogen cycle” and “ammonia” section of this resource guide. Directions are found there.
<b>pH</b>	
Question	<b>How do you lower/raise the pH of your water?</b>
Answer	<p>Brook trout can live in a pH as low as 6.0 and up to 8.2; however, these levels are extreme. Do not be concerned with constantly adjusting pH. As long as your trout are happy, leave it alone. If the trout are acting stressed (i.e. swimming strangely, darting back &amp; forth or acting lethargic) follow these instructions:</p> <p><b>Lowering pH</b> (<i>please be cautious when using any “home” remedies</i>)</p> <ul style="list-style-type: none"> <li>• Add a piece of natural drift wood</li> <li>• Us pH “downer” (most recommended source to lower pH)</li> </ul> <p><b>Raising pH</b> (<i>please be cautious when using any “home” remedies</i>)</p> <ul style="list-style-type: none"> <li>• Add pH “upper”</li> </ul>

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# Troubleshooting

(*Water...*)

<b>Washing hands</b>	
Question	<b>Should students wash hands <i>before</i> touching aquarium water?</b>
Answer	<p>Students should rinse their hands thoroughly before working in or around the aquarium <b>WITHOUT SOAP</b>. Simply use warm tap water to rinse hands and nothing else. You would also do this when rinsing nets, buckets and wiping down the inside of the aquarium.</p> <p><i>Moisturizers, skin care products and natural oils may harm your trout.</i></p>

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# Troubleshooting

## *(Trout)*

Brook trout	
Question	Why are brook trout so delicate; why do we use brook trout?
Answer	<p>PA TIC provides Brook Trout because it relates directly to PA’s coldwater streams and connects students to Pennsylvania’s natural history. The Brook Trout is PA’s “State Fish” and is our <u>only</u> native trout. Their eggs are much smaller and tend to be more fragile; however, TIC is not a stocking program.</p> <p>Emphasis should be placed on the fact that Brook Trout are sensitive to pollution and other watershed impacts. If Brook Trout are not present in streams where they were historically there is a reason, have the students investigate why they no longer populate certain streams. TIC is an educational program for students to learn about coldwater conservation and the importance of clean water for everyone. What impacts our watersheds ultimately impacts our communities.</p>

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# Troubleshooting

## (Trout continued...)

<b>Bloated bellies</b>	
<b>Question</b>	<b>Our trout have bloated bellies and we have already lost a few, what is going on and what do we do?</b>
Answer	<p>Make sure they are not FULL of food first. If their bellies are not enlarged because of feeding, they may have a systemic bacterial infection. Bacteria are always present whether in an aquarium or stream. When trout are stressed bacteria take over, very similar to our typical cold. If not caught and treated it spreads throughout the trout population.</p> <p><b>What to do:</b></p> <ol style="list-style-type: none"> <li>1. Decrease stress levels on trout by:                             <ol style="list-style-type: none"> <li>a) Place the front insulation cover back on your aquarium</li> <li>b) Take them off of food for a day or two</li> <li>c) Decrease the water temperature SLOWLY</li> <li>d) Conduct a STATIC SALT BATH:</li> </ol> </li> </ol> <p style="margin-left: 40px;"><u>Instructions:</u></p> <ol style="list-style-type: none"> <li>1. Make sure you remove dead trout ASAP. Any fungus growing on dead fish will spread to other trout in the aquarium.</li> <li>2. Make a “static salt bath treatment”: SEE “trout care: stressed trout” section for recipe. The salt bath helps get rid of bacterial issues and is used as an osmoregulatory (osmosis balancing of your trout) aid to relieve stress.</li> </ol> <p><b>Potential causes for infection:</b></p> <ol style="list-style-type: none"> <li>a) If there is damage to skin caused by handling, abrasions, or chemical damage (<i>i.e. high ammonia levels, nitrite levels or considerable changes in pH</i>)</li> <li>b) Stress. When normal defenses are down because of stress fish will become infected. (<i>This is similar to when we catch a cold or other diseases if we are “run-down”.</i>)</li> </ol>
<b>Fish can become stressed for a variety of reasons</b>	
1) Poor water quality; over crowding	2) Temperature;
3) Too much handling ( <i>i.e. several feeding times, daily water monitoring, cleaning &amp; changes, constant student activity around aquarium</i> );	4) If bacterial colonies increase substantially as a result of increased levels of decomposing matter. This is what is typically occurring when the disease begins to spread and infects all trout.

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# Troubleshooting

## *(Trout continued...)*

<b>Deformations and not eating</b>	
<b>Question</b>	<b>Some of my hatched trout are not eating - Some of my trout are deformed. Is this normal?</b>
Answer	Yes. During the growth process, some fish will die. Some fish may survive initially only to die later because they never begin to eat. Other fish will be deformed, and very often will also die as a result of this. This is a natural part of fish reproduction. It is not normal, however, for very many or most of the fish to die. If this is the case, there may be a problem with the aquarium environment.
<b>Egg shells</b>	
<b>Question</b>	<b>My fish have hatched, what should I do with the eggs?</b>
Answer	The discarded egg shells will decompose naturally in time. If they appear to be hosting fungal growth, they should be removed and disposed of. Just as with living eggs, they might turn opaque white, or may take on a fuzzy appearance. If this is the case, please remove them.
<b>Emergencies</b>	
<b>Question</b>	<b>What do I do with my eggs or fish in an emergency?</b>
Answer	<p><b>Eggs:</b></p> <ol style="list-style-type: none"> <li>1. Prepare a bucket of water using aquarium water or one of your aged buckets of water with StressZyme according to directions; small frozen water bottles and a bait aerator.</li> <li>2. Place your hatching basket of eggs into the bucket while you take care of the situation</li> <li>3. Take care not to place your eggs into the bucket of water until it is within 1-2 degrees of the aquarium water. Be sure to do the same when returning the eggs back to the aquarium.</li> </ol> <p><b>Fry/fingerlings:</b></p> <ol style="list-style-type: none"> <li>1. You should prepare a bucket the same way as you would do for an “egg emergency”.</li> <li>2. Be sure you always have plenty of frozen water containers on hand in case your chiller breaks.</li> <li>3. Never add regular tap water ice cubes directly to the aquarium. Chlorine is lethal to trout.</li> <li>4. Some teachers create ice cubes using their aquarium water; however, make sure they are labeled some way so that they are not used in drinks...</li> </ol>

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# Troubleshooting

## (Trout continued...)

Emergency Plan	
<b>Question</b>	<b>How can I inform custodians, or other teachers, about what to do if there is an emergency while I am away?</b>
<b>Answer</b>	<ul style="list-style-type: none"> <li>• Provide basic information about your aquarium requirements to all teachers and custodians.</li> <li>• Custodians should know that your aquarium always needs power.</li> <li>• Place a sheet of paper (in a visible location) that describes emergency procedures</li> <li>• Have plenty of frozen water containers. Place the location of these containers in the “emergency procedure form”</li> <li>• Emergency form example:  <b>Aquarium Emergency Procedure:</b>                      In the event of a power outage, leak, or refrigeration system failure, or any other aquairum problem, please contact me: _____                       Phone number: _____ If                      you cannot reach me, please try calling:                      Contact: _____ Phone                      number: _____                 </li> </ul> <p><b>In the event of a power outage:</b> The trout in this aquarium need cold water to survive, and the chiller next to/under the aquarium maintains the temperature. If possible, all aquarium equipment must be plugged in. If the electricity must be off for maintenance or construction please contact me as soon as possible. If I cannot be contacted, please place the frozen containers of ice, located _____, in the aquarium to help keep it cool. Even with the ice, the aquarium needs electricity as soon as possible.</p> <p><b>In the event of a serious leak:</b> A serious leak can be stopped by unplugging all quipment. Any leaking tubes should be placed in the aquarium or in a bucket. After the water is cleaned up, the leak source can be fixed. If there are more than 4 inches of water left in the aquarium, the fish can survive. Do not add water to the aquarium if this is the case. Lots of tap water, or water that is too warm, will kill trout. If there is very little water in the aquarium, add only enough water from the buckets below the aquarium to let the pump work again. If the leak is fixed, turn on all devices before you leave.</p>

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# Troubleshooting

## *(Trout continued...)*

<b>Hatching basket</b>	
<b>Question</b>	<b>When should we release the trout out of the hatching basket?</b>
Answer	Trout should remain in the basket as long as possible, even if some start to jump out on their own. Once the trout are able to swim freely and are strong enough to navigate the currents of the aquarium, you can release them. After the trout have been actively feeding for a week or two, they should be ready to venture out into the aquarium.
<b>Question</b>	<b>How do I let the trout out of the basket when it is time?</b>
Answer	Gently remove the basket from the sides of the aquarium and slowly lower it to the bottom of the aquarium. Let the trout swim out from here. Some trout to remain in the protection of the basket for a few days. Make sure the basket is empty before taking it out of the aquarium.
<b>Mixing species of trout</b>	
<b>Question</b>	<b>Can I mix species of trout?</b>
Answer	No, the different trout species may not be compatible. The risk of cannibalism among young fish (under ½ year of age) is greatly increased with species mixing.
<b>Mortality</b>	
<b>Question</b>	<b>I had a huge die-off, why?</b>
Answer	<p>Death is a natural part of fish development. In nature, female trout lay 500-1,200 eggs with only 1-2% surviving. You should expect to lose eggs and trout throughout the year. The exact survival rate is variable and based on many factors. A sudden spike in mortality may indicate aquarium water quality issues, bacterial infection or sabotage.</p> <p>There are two naturally high mortality periods:</p> <ol style="list-style-type: none"> <li>1. During the egg stage and hatching</li> <li>2. During the “button up” stage. This is when trout have absorbed their yolk sac and learn to feed. Some trout never learn to feed and simply die of starvation.</li> </ol> <p>Make sure you remove any eggs/fish that have died. These fish can spread bacterial infection if left unattended. If one or two trout seem to be acting strange or appear abnormal you should remove these fish, as they can spread infections they may have.</p>

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# Troubleshooting

## (Trout continued...)

Mortality continued	
<b>Question</b>	<b>What if I come in and many of the trout have died? What do I do?</b>
Answer	<ol style="list-style-type: none"> <li>1. Put a battery-operated aerator or aquarium air stone in a clean bucket.</li> <li>2. Add a few containers with frozen water.</li> <li>3. Add Stress Zyme to the bucket—follow package instructions.</li> <li>4. Place remaining trout into the water bucket with frozen water containers and aerator.</li> <li>5. Scrub down the sides of the aquarium using a clean sponge, NO SOAP.</li> <li>6. Use the siphon to clean gravel while you remove water from the aquarium (80% of water).</li> <li>7. Drain the filter, clean the filter media and replace at least one charcoal filter.</li> <li>8. Refill aquarium with aged water (if you have to use water that has not had time to age, use a de-chlorinating product).</li> <li>9. Provide time for chiller to cool water to a temperature within 1-2 degrees of bucket water.</li> <li>10. Add BioZyme, Stress Zyme, or Tap Safe, etc. if on hand, or as soon as possible.</li> <li>11. Place trout back into the aquarium</li> <li>12. The next day, add more Stress Zyme.</li> </ol>
<b>“Pop-eye”</b>	
<b>Question</b>	<b>I have a trout whose eyes are popping out and appears to have internal hemorrhaging.</b>
Answer	<p>Remove “infected” trout ASAP. These symptoms are not normal for trout. Bulging eyes are known as “Pop-eye”, which is not an actual disease, but rather a symptom of internal problems. Most often “pop-eye” is a result of too much handling or drastic water quality changes.</p> <p>Fluid accumulation behind the eyes could be a result of a few different issues:</p> <ol style="list-style-type: none"> <li>a) Systemic bacterial infection</li> <li>b) Internal disorders (tumors, gas bubble disease etc.)</li> <li>c) Water quality issues: Increased nitrogen levels cause gas bubble disease. Pop-eye occurs when nitrogen enters the trout blood stream. A clue = bubbles on the surface of water.</li> </ol> <p>Recommendations:</p> <ol style="list-style-type: none"> <li>1. Check water quality parameters (sample from near the bottom of the aquarium)</li> <li>2. Increase dissolved oxygen: arrange filter outtake so it creates a “mini waterfall”             <ol style="list-style-type: none"> <li>a) Aeration on water surface rids aquarium of toxic gases. It also eliminates the possibility of low D.O. levels being the culprit.</li> </ol> </li> <li>3. Conduct small water change (5-10 gallons)</li> </ol> <p><i>The information above was collected from: <a href="http://en.allexperts.com/q/Freshwater-Aquarium">http://en.allexperts.com/q/Freshwater-Aquarium</a> Also, check out this article that was a link on their website <a href="http://flippersandfins.net/pop-eye.htm">http://flippersandfins.net/pop-eye.htm</a></i></p>

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# Troubleshooting

## (Trout continued...)

Release stream and release site	
Question	When do I release my trout?
Answer	<p>Your trout release date is determined by the size of your trout, the average size of released fingerlings is 1 ½ to 2 ½ inches. It is also determined by the transportation funding you have and the availability of a substitute teacher (if you need one). Most TIC classrooms release their trout in March, April or May.</p>
Question	How do I plan a release/what should I do on my release day?
Answer	<p>All teachers plan their own release day, often with the help of their program partner. Ideas of activities to do on release day:</p> <ul style="list-style-type: none"> <li>a) Stream study</li> <li>b) Habitat study</li> <li>c) Tree planting</li> <li>d) Run stations (stream study; water quality station; forestry station; habitat station; watershed station; terrarium building; water cycle; amphibian/vernal pool station etc.)</li> </ul> <p>The release day is your opportunity to creatively incorporate hands-on, out of class education, public awareness of coldwater resources, community projects and a sense of interconnectedness within the community and its watersheds.</p> <p>Some teachers involve other agencies/organizations in their day:</p> <ul style="list-style-type: none"> <li>a) Universities</li> <li>b) Department of Conservation and Natural Resources (parks and forestry)</li> <li>c) Penn State Cooperative Extension</li> <li>d) Watershed Associations</li> <li>e) Trout Unlimited (casting/fishing/fly tying)</li> <li>f) Master gardener groups</li> </ul> <p>The list goes on and on. Sign up on the TIC yahoo group to discuss release days and much more on the forum.</p> <ol style="list-style-type: none"> <li>1. Go to <a href="http://www.yahoo.com">www.yahoo.com</a></li> <li>2. Once there, scroll down on the left side to “Yahoo groups”</li> <li>3. Click on “yahoo groups”</li> <li>4. On this page type in Trout In the Classroom in the provided box</li> <li>5. Once there click on join now (provide the necessary information)</li> </ol>

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# Troubleshooting

*(Trout continued...)*

Sac Fry/Aelvin	
Questions	<b>My sac-fry are lying on their side and not moving, are they dead?</b>
Answer	This is nothing to be concerned about. At this stage trout are relatively immobile/still. It will take approximately 28 days from their hatch date to fully consume their yolk sac and begin to search for food. Sac fry that have just hatched from the egg will be immobile; however, in a few days you will begin to see more activity.

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# Troubleshooting

## (Trout continued...)

White dots	
Question	<b>Our trout have small white dots on their belly. One individual speculated that it may be ich. Is that possible? If so, what do you recommend to treat it?</b>
Answer	<p>Based on your description it could be Ich.</p> <p><u>Here is some further information on Ich:</u></p> <p><b><i>What is Ich?</i></b></p> <p>Ich (ick) is the most common disease of freshwater and marine aquarium fish. Ich is a protozoan disease, often called 'white spot disease'. The scientific name for the disease is ichthyophthiriasis and the causing agent is Ichthyophthirius multifiliis. It is wide spread in freshwater fish, but is more common in aquarium fish, possibly because of closer contact and stress.</p> <p><b><i>Why fish get Ich?</i></b></p> <p>Ich is widespread. Many experts feel it is present in the environment of most aquariums. In fact, just about every aquarium fish will come in contact with ich at several times in its life. Because it is so widespread, most fish have developed a good immune response against the disease to allow them to fight it off before it ever causes symptoms. Captive fish that develop ich usually get the disease when they are stressed. Stress lowers immune responses and that is when ich will take over.</p> <p>The Ich parasite is dormant in the aquarium itself. Healthy fish can live with a balanced host-parasite relationship for a long time. The healthier the fish the more difficult it becomes for the parasite to re-produce, which in turn keeps their population under control. The unexpected appearance of Ich without new arrivals is usually caused by deteriorating water parameters which weaken the fish's immune system. Nevertheless the parasite has to be present in order for the disease to break out.</p> <p><b><i>Identifying Ich:</i></b></p> <p>Symptoms of Ich include the well know 'salt grain like' white spots. As the infection spreads other common symptoms are rubbing against decorations, breathing difficulties, loss of appetite and increased mucus layer (washed off slime coat), cloudy eyes, frayed fins, and abnormal swimming behavior. The disease may then cause respiratory distress, severe agitation, loss of appetite, and eventually death.</p> <p>(The majority of the above information was found on: <a href="http://www.algone.com/ich.php">http://www.algone.com/ich.php</a> ; <a href="http://peteducation.com/article.cfm?c=16+2160&amp;aid=2421">http://peteducation.com/article.cfm?c=16+2160&amp;aid=2421</a> )</p> <p><b><i>TREATMENT STATIC SALT BATH (whether Ich or stressed fish) Go to "Trout Care stressed trout section"</i></b></p>

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# Appendices

## Appendix 1

### Equipment Check List

- Table, counter, or stand** for the tank to hold at least 700 pounds.
- Tank** (30-55 gallons)
- Something to shade** the eggs and young alevins from UV light (cardboard, Styrofoam, or dark cloth).
- Insulation** for the tank (foam board from a home store, bubble wrap, or the like)--*this helps stabilize the tank temperature and reduces wear on the chiller.*
- Fluval 405 canister or Hagen AquaClear filter
- Filter media--appropriate for filter
- Pea-size Gravel
- Whisper 20 Air Pump
- Sandstone 12" Airstone
- 8' Flexible Airline Tubing
- Check Valve - 1 pk
- Net Breeder -- or homemade basket
- Battery Operated Digital Thermometer
- Floating Thermometer
- 4" Net
- Microbe Lift or other bacteria boost
- Siphon Gravel Cleaner
- 10'-15' Flexible Tubing 5/8" \*\*
- Zinc Plated Clip 1/2" 2 pk \*\*
- Freshwater Master Test Kit

### Chiller

A chiller is needed to keep the tank's water temperature at about 50° Fahrenheit. Most chillers are only designed to chill aquarium water to around 60°-70° Fahrenheit. Therefore, for our program, we purchase chillers that are rated for a larger size tank--for example, for a 55-gallon TIC tank, we provide at least 1/4 horsepower chillers which are technically designed for 100-125 gallon tanks.

Suggested models\*:

Trade Wind – Reliable and well priced.

Glacier —the original TIC chiller, a drop-in.

Model for your classroom depends on what is in inventory.

**\*Note:** *The chiller will determine which size pump you use. Each flow-through chiller requires a certain range of gallons or water per hour. Please ask your chiller source the recommended pump capacity and power for the chiller you chose.*

### **Other Equipment (as needed)**

- \_\_\_\_\_ Turkey baster to remove dead eggs and extra food/waste from the tank (some prefer pipette or bent paper clip)
- \_\_\_\_\_ Buckets (2 or more), to age water before putting in the tank
- \_\_\_\_\_ Battery-operated aerator, to give the trout oxygen during transportation (available at pet stores)
- \_\_\_\_\_ Long-handled scrub brush, to loosen grime and growth in tank
- \_\_\_\_\_ Ammonia removal compound, for use in ammonia emergencies (available at pet stores)
- \_\_\_\_\_ Tap-water-safe compound, for use in emergency water changes (available at pet stores)
- \_\_\_\_\_ Clean ice packs, for use in transportation and/or chiller emergencies

### **Equipment Replaced Yearly**

Each year, each set-up will need a few new items:

- \_\_\_\_\_ Filter pads or cartridges—*some parts of the filter can just be rinsed, scrubbed, and dried, but consumable components such as charcoal filters should be replaced.*
- \_\_\_\_\_ Airstone and check valve--*these two pieces can degrade or get gummed up with waste.*
- \_\_\_\_\_ Water Quality Test Kit--*at the end of one school year, you will have used up most of the reagents and other testing materials.*
- \_\_\_\_\_ Microbe Lift, TapSafe--*or whichever aquarium compounds you are using to boost the bacterial population and manage water chemistry.*