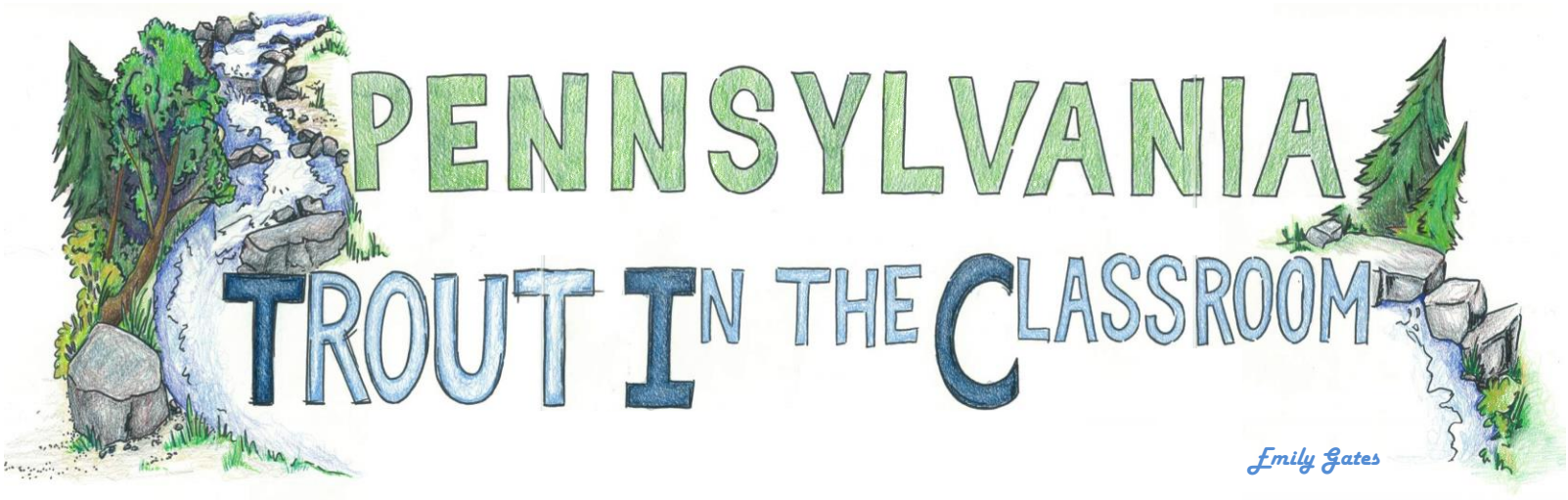

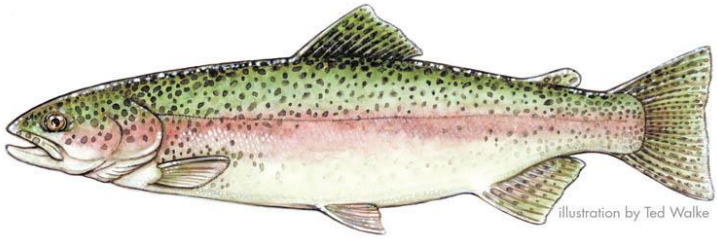

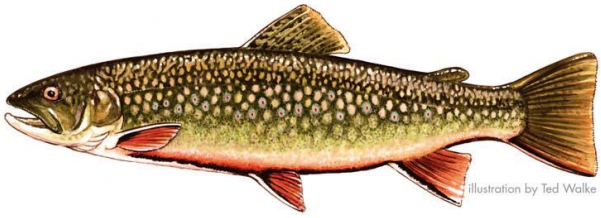

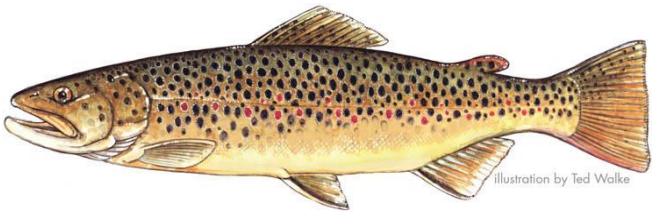

Aquarium Resource Guide

Updated March 2020

Overview

Pennsylvania Trout in the Classroom (PATIC) is an interdisciplinary program that focuses on connecting students with Pennsylvania's coldwater resources. The program offers students and teachers the opportunity to observe the lifecycle of trout firsthand while raising them in the classroom from eggs to fingerlings. The PATIC program offers educational connections not only related to the trout life cycle, but also a wealth of additional topics related to PA's Coldwater resources. These topics include, but are not limited to:

- Aquatic Ecology
- Management Practices concerning Conservation and Preservation
- Current and Historical Ecological Threats
- Enhancement Opportunities and Strategies
- Recreational Opportunities

Each PATIC aquarium is unique in that each teacher tailors the program to fit their needs. The program has applications covering environment and ecology, science, mathematics, social studies, language and fine arts, and physical education.

PATIC Story –

STATEWIDE
Prior to and through 2007, PATIC was an informal program, depending on individual teachers and program partners (e.g. sportsmen groups, local Trout Unlimited chapters). At that time, there were approximately 20-40 teachers implementing TIC on their own. Trout eggs were obtained from local hatcheries either state/private. At that time, formal TIC registration, end of year reports, teacher/program partner workshops, designated release sites for the trout, curriculum connections and a TIC network for teachers/partners did not exist.

Beginning in 2008, PA Fish and Boat Commission (PFBC) partnered with PA Council of Trout Unlimited (PATU) to coordinate and implement TIC statewide. In January of 2008, PFBC hired a Trout In the Classroom Coordinator to coordinate, implement and manage the TIC program statewide. Working directly with TIC teachers, program partners and PA Council of Trout Unlimited's Program Director. Through this unique partnership each organization provides the following key resources to make TIC possible statewide.

- PFBC provides:
  - A TIC Coordinator to coordinate TIC efforts with PATU statewide.
    - Through this position and staff support from several PFBC bureaus, PFBC manages, maintains and provides:
      - Trout eggs, trout food and shipments of the trout eggs and food at no cost to teachers/program partners
      - TIC classroom registrations, end of year reports
      - Designation of agent letters ensuring trout are released into "Stocked Trout Waterways"

- Coordination, training, troubleshooting/curriculum assistance and support for TIC teachers
- Content to PATU staff to upload on PATIC webpage.

- PA Trout Unlimited provides:
  - Coordination, assistance and support for TIC program partners
  - PATIC webpage using content from PFBC and PATU staff
  - PATIC grant program for current TIC participants
  - PATIC t-shirt program to support the TIC grant program
  - Assistance at TIC trainings and egg/food packing days

VITAL LOCAL SUPPORT

In addition to the statewide support from PFBC and PATU, vital, on-the-ground, TIC implementation relies upon dedicated teachers who choose to bring the program into their classrooms and their, equally dedicated, program partners (*e.g. TU, Conservancies, Conservation Districts, Sportsmen Associations, Watershed Associations, private organizations etc*). These partners provide assistance with aquarium set-up, troubleshooting, release days/other field experiences, connections to local watershed impacts/projects and in some cases assistance with funding.

THEN AND NOW

Since 2008, the PATIC program has grown from 90 participants to over 400.The program continues to grow organically due to dedicated teachers and local program partners.

TROUT USED FOR PATIC

PFBC provides Rainbow Trout to all registered TIC participants. Below is a short story of types of trout provided historically to PATIC participants, the story the decision in 2019 to switch from Brook Trout to Rainbow Trout in an effort conserve and protect PA's native Brook Trout populations.

In the beginning, PATIC participants would go to a local hatchery and choose the type of trout eggs they wanted to raise in their classrooms. In 2008, with the program gaining more popularity and interest, PFBC began providing trout eggs from one state hatchery to streamline the PATIC program's source of eggs, shipment process, fish health and direct where the trout were allowed to be released (e.g. Stocked Trout Waters). The trout of choice, in 2008, was the Brook Trout.

Over the next few years, PFBC continued to provide Brook Trout (*Salvelinus fontinalis*) as the "TIC Trout"; however, in 2016-2019 biologists began to receive increased angler reports of gill lice being found on Brook Trout, not only in stocked waters, but also in native trout waters. This type of gill lice is "host specific" to the Char family, as a result, PFBC made a proactive decision to decrease Brook Trout stockings statewide.

This approach is part of an ongoing management strategy to minimize conflicts between hatchery Brook Trout and PA's Native Brook Trout populations. Implementation of this approach began within the PFBC hatchery system, then rolled out to PFBC's Cooperative Nursery Program and is now keying into the TIC program.

Acknowledgments

Pennsylvania Trout In the Classroom program is provided to teachers through a partnership between Pennsylvania Trout Unlimited and Pennsylvania Fish and Boat Commission.

The PATIC 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, hatchery managers and members of Pennsylvania Trout Unlimited also provided key information for this resource guide. The guide is subject to change as the Pennsylvania Trout In the Classroom program continues to grow, new technologies and techniques become available.

Our gratitude goes to the dedicated Pennsylvania teachers and volunteers who are implementing TIC across the state and who continue to share their knowledge and expertise.

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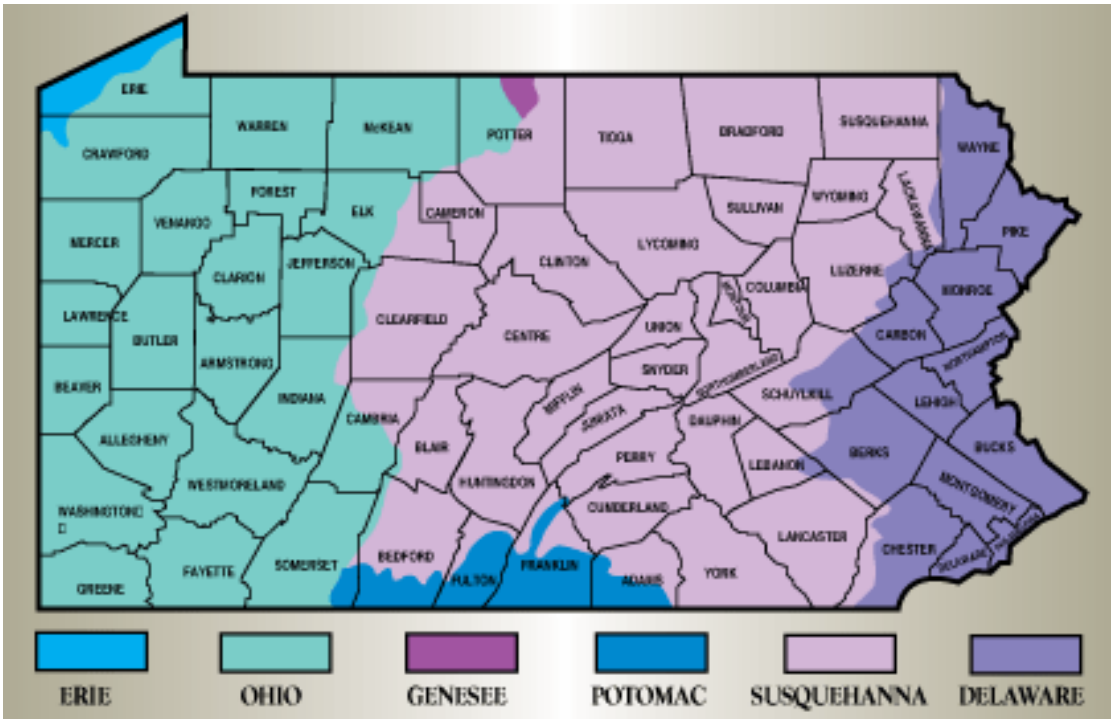
Chapter 1:

Introduction to PA Watersheds



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What is a watershed?

A. Watersheds

Definition:
A watershed is an area or ridge of land that separates waters flowing to different rivers, basins, or seas. Watersheds can best be described using an imaginary line, when rain falls on either side of that line the water drains to a different body of water. This imaginary line is known as a watershed divide.

Pennsylvania recognizes 6 major watersheds that each have a different river basin (listed in the table below). Smaller watersheds are comprised within each major watershed however, these smaller watersheds all drain to the river basin within the major watershed. Pennsylvania's major watersheds are named after the corresponding river basin.

Watersheds serve an important function when it comes to the management of Pennsylvania's aquatic resources. Conservation planning almost always begins with delineating the watershed before any action takes place. Having a firm understanding of the watershed you are conducting your PATIC program within provides a great foundation for you to begin planning your lessons. Pennsylvania is fortunate to have vast water resource comprised of more than 86,000 miles of streams and rivers, along with 4,000 inland lakes and ponds covering 160,000 acres, plus 470,000 acres of Lake Erie.

Pennsylvania Water Resources

Major Watersheds:	
1. Erie Watershed	511 square miles within Pennsylvania
2. Ohio Watershed	15,614 square miles within Pennsylvania
3. Genesee Watershed	94 square miles within Pennsylvania
4. Susquehanna Watershed	27,510 square miles within Pennsylvania
5. Potomac Watershed	1,584 square miles within Pennsylvania
6. Delaware Watershed	6,422 square miles within Pennsylvania
Miles of Rivers and Streams (approx.)	86,000 miles
Number of Lakes, Reservoirs and Ponds (approx.)	4,000
Estuaries, Harbors and Bays (Delaware and Presque Isle)	23 square miles
Freshwater Wetlands (approx.)	404,000 acres
Amount of Groundwater (approx.)	80 trillion gallons

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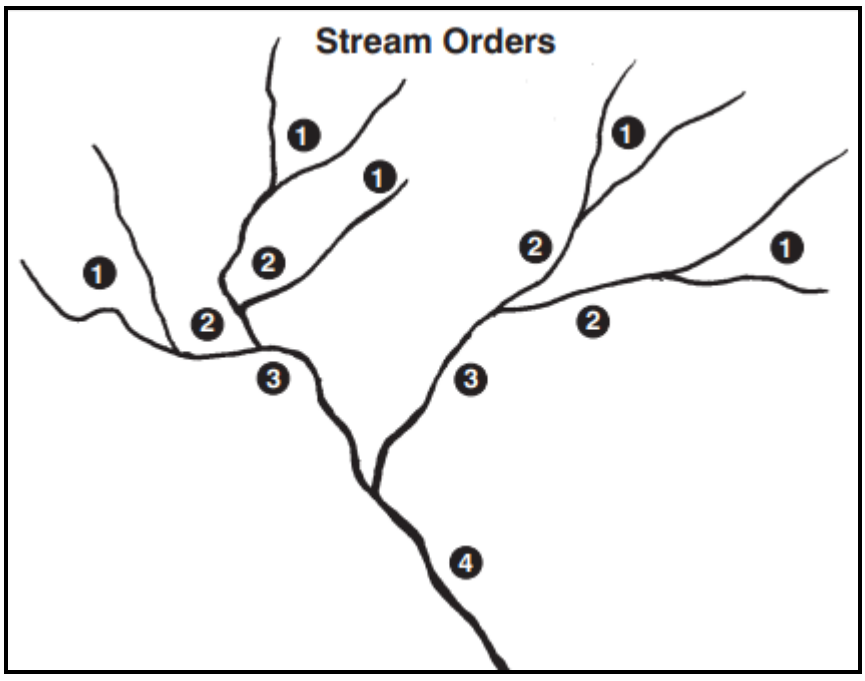
Stream Order

B. Stream Order

Definition:
A method used to categorize streams and rivers based on size and location within a watershed. Calculating stream order provides a rough indication of stream size and helps to compare one watershed to another.

A first order stream is defined as having no tributaries. A tributary is defined as a small stream that flows into a larger stream or river. A second order stream must have at least two first order streams flowing into it. A third order stream must have at least two second order streams flowing into it and so forth.

Categorizing moving waters into stream orders provides a foundation for "starting to think like a scientist." Many characteristics associated with streams can be inferred simply by knowing the stream order. The diagram below can help you to get started with properly calculating the order of the stream you might be studying (and eventually releasing into) with your PATIC program.



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River Continuum Concept

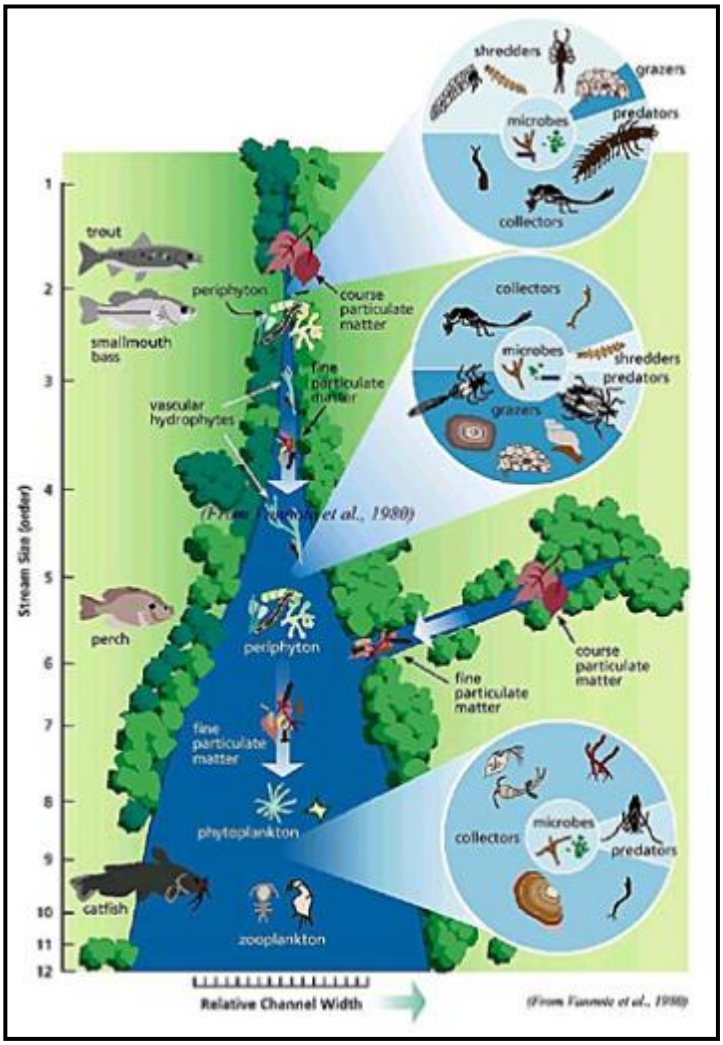
C. The River Continuum Concept (RCC)

Definition:
A hypothesis developed by Stroud Research Center scientist Robin Vannote and other Stroud staff that describes how streams and their watersheds work. Essentially, the concept predicts what the structure of the biological communities will be downstream based on what is influencing the system upstream. The concept emphasizes that just as a river or stream changes as it moves downstream through stream order, so do the biological and chemical processes.

The RCC provides a great way to tie in watersheds, stream order, biodiversity and energy flow through a system.

To learn more about the RCC and how you can incorporate it into your PATIC program lesson plan you can visit the following page:

https://stroudcenter.org/continuum/



Source: Stream Corridor Restoration: Principals, Processes and Practices, 10/98, By the Federal Interageny Stream Restoration Working Group (FISRWG)

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Chapter 2:

Salmonids in PA

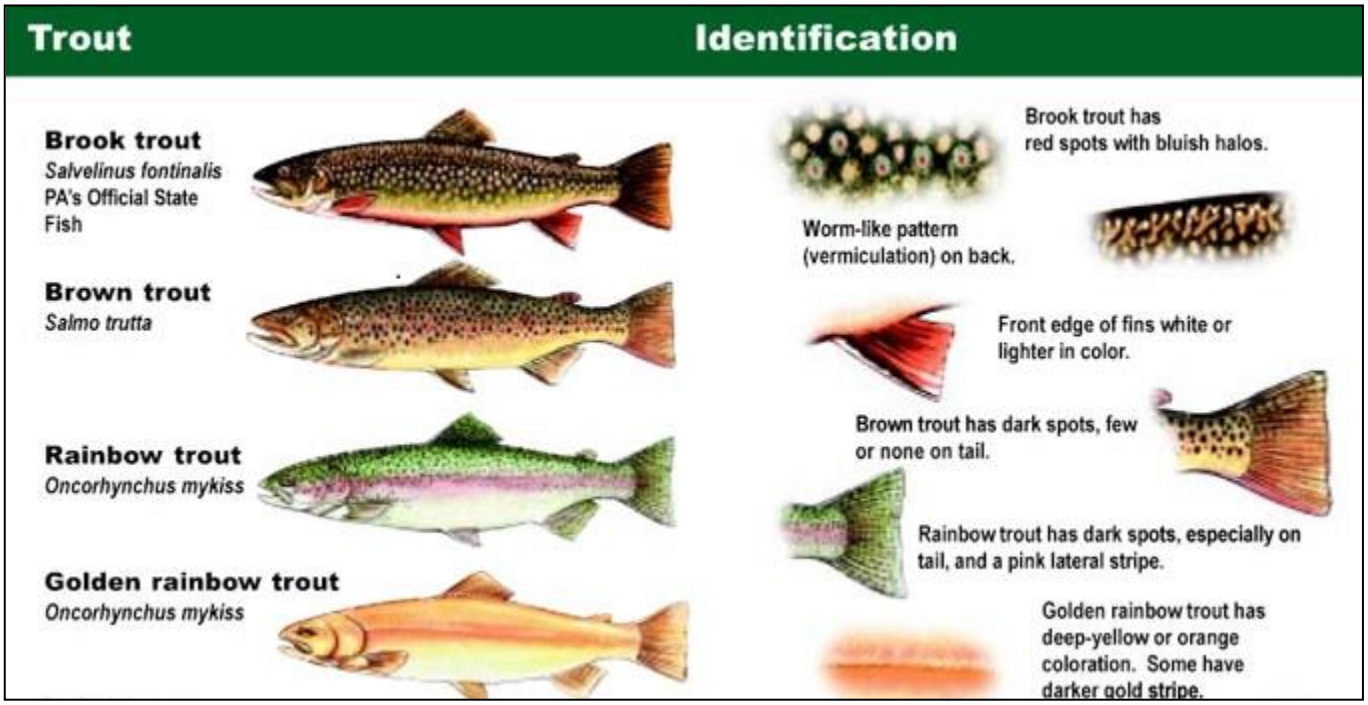

Illustration: Ted Walke

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Brook Trout (*Salvelinus fontinalis*)

As one of Pennsylvania's native Trout, this vibrant and stunning salmonid is labeled as our state fish. Brook Trout are also recognized by local names such as native trout, natives, brookie, and speckled trout, the scientific epithet *fontinalis* in fact means "living in springs." Brook Trout occur naturally in small, cold, clean streams. These fish can also adapt to ponds and lakes, as well as instream beaver ponds. Brook Trout are found in Pennsylvania as wild populations in the Ohio, Susquehanna, Genesee, Potomac and Delaware River watersheds. Naturally self-sustaining populations can still be found in limestone spring-fed streams and cold, mountain creeks that also have lots of mountain laurel, rhododendron, and hemlock to provide additional shade. Brook Trout are unique in that they can tolerate relatively acidic waters, but not temperatures much over 65 degrees Fahrenheit.

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. Eggs develop over winter and hatch in early spring.

Brook trout are members of the Char family and can be identified by the following characteristics:

Physical characteristics	
Body color	**Dark green, Worm-like pattern known as vermiculations on back.**
Sides	**Shade of light green/lavender tone with irregular marks. They also have scattered red dots surrounded by blue halos.**
Belly	**Pale yellow/orange with black streak down the middle.**
Fins	**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 less than 100-1,000 eggs, with only a small percentage (approximately 1-2%) surviving.	

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Brown Trout (*Salmo trutta*)

Not native to Pennsylvania, these fish are now naturalized and widespread here in the wild, even becoming the main trout species in streams previously dominated by Brook Trout. Brown Trout were introduced to the United States in the 1800s from various locations, including Scotland and Germany. Pennsylvania received its first Brown Trout in 1886. Brown Trout are closely related to Atlantic Salmon (*Salmo salar*).

Brown Trout spawn in the fall, a little later than Brook Trout, from October through mid-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 the following spring.

Brown Trout can be identified by the following characteristics:

Physical characteristics	
Body color	Brownish in overall tone.
Sides	The back and upper sides are dark-brown to gray-brown, with yellow-brown to silvery lower sides. Large, dark spots are outlined with pale halos on the sides, the back and dorsal fin, with reddish-orange or yellow spots scattered on the sides.
Belly	White and with a pale shading of yellow.
Fins	Clear, yellow-brown, and unmarked.
Size	
At maturity (two to three years of age), Brown Trout range from 5 inches to 18 inches long, depending on availability of food, shelter and water quality. A trophy Brown Trout can exceed 30 inches.	
# of eggs	
Adult females, depending on size, will lay anywhere from 4,000 – 12,000 eggs with only a small percentage (approximately 1-2%) surviving.	

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Rainbow Trout (*Oncorhynchus mykiss*)

A western North American species, native to the Pacific slope from California to Alaska. Rainbow Trout were introduced throughout the state in efforts to restore degraded trout fisheries. Today, as wild fish, Rainbows sustain reproducing populations in only a handful of fast-falling creeks scattered around the state. As stocked, hatchery-reared fish, Rainbow Trout occur in every major drainage throughout Pennsylvania.

Rainbow Trout are known as "spring spawners." They spawn in the spring, from mid-March through April. 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. Hatching will occur in late spring or early summer.

Rainbow Trout can be identified by the following characteristics:

Physical characteristics	
Body color	Silvery-Gray to Dark-Green
Sides	A pinkish or reddish lateral stripe, sometimes with lavendar or orange overtones, from the gill cover running the length of the fish to the tail. Dark spotting along back and sides.
Belly	White belly
Fins	The caudal fin (tail fin) and adipose fin have small dark spotting. The pectoral and pelvic fins are pinkish in color and lack spotting.
Size	
At maturity (two to three years of age), rainbow 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 less than 100-12,000 eggs, with only a small percentage (approximately 1-2%) surviving.	

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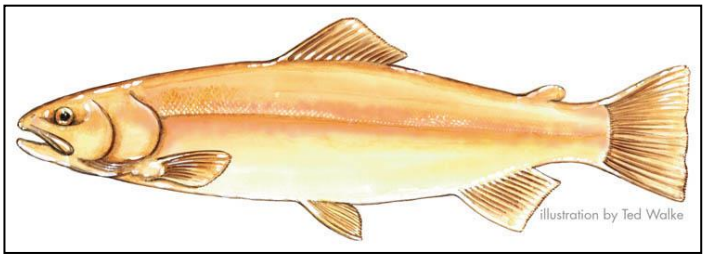
Golden Rainbow Trout (*Oncorhynchus mykiss*)



The Golden Rainbow Trout is a Rainbow Trout reared through artificial fish culture conditions and stocked as a novelty for angling sport. This strain of Rainbow Trout was originally found in the West Virginia hatchery system in 1954. Through selective breeding with regularly marked Rainbow Trout, an all-gold, Golden Rainbow Trout was developed. In 1963, this fish strain was popularized as the "West Virginia Centennial Golden Trout." Pennsylvania and other states hybridized the pure strain of West Virginia Golden Trout with normal Rainbows and produced Palomino Trout, which were true genetic Palominos. Palomino trout were first stocked in Pennsylvania in 1967. Although Palominos were stocked as both average-sized and large trout, today's Golden Rainbow is raised only to trophy size for anglers and stocked throughout the state.

Spawning in the wild is highly unlikely, because Golden Rainbows are highly visible in streams both to anglers and predators. Golden Rainbows and Palomino Rainbows grow larger and faster than regular Rainbows. They have "hybrid vigor," a trait often seen in crossbred plants and animals. Their food preferences are similar to those of other trout.

Golden Rainbows can be identified by the following characteristics:

Physical characteristics	
Body color	Bright Orange, No spotting
Sides	Pink or red tones on their cheeks and with the rainbow's reddish lateral stripe.
Belly	White belly
Fins	Pinkish lower fins, No spotting
Size	
At maturity (two to three years of age), rainbow 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 produce 100-12,000 eggs in the hatchery setting depending on size.	

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Chapter 3:

The Life Cycle of Trout

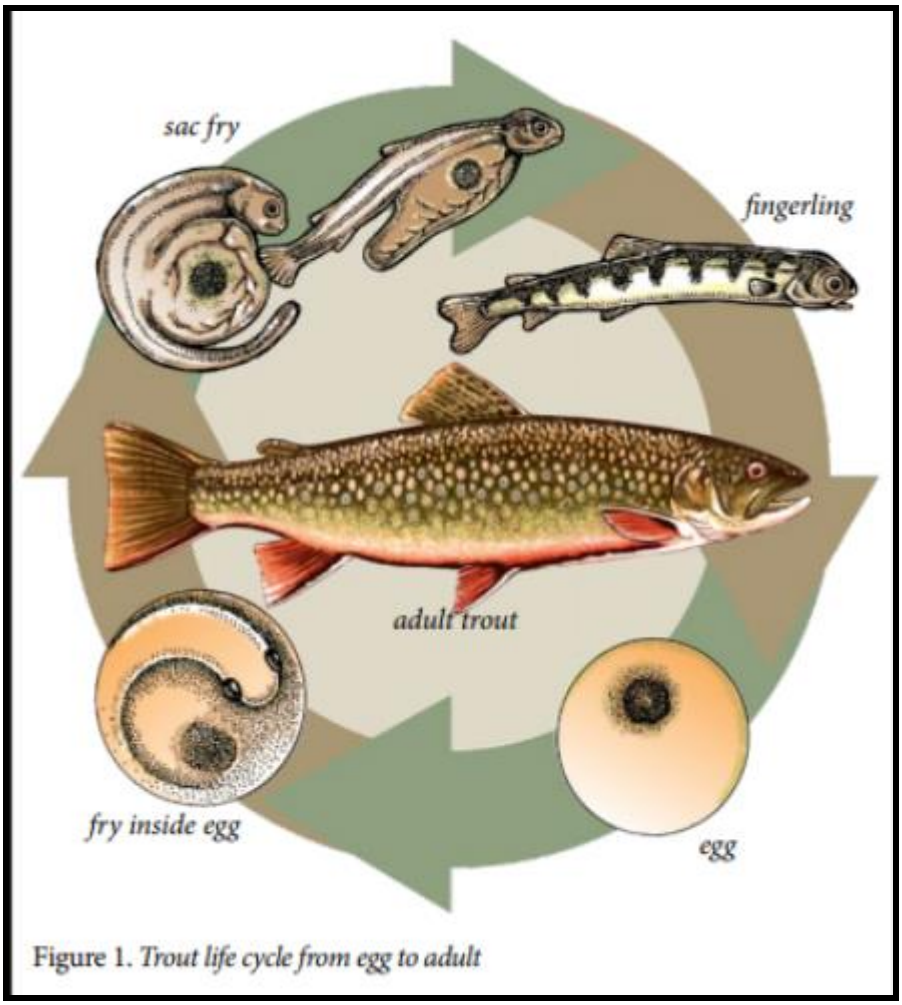

Figure 1. *Trout life cycle from egg to adult*

Illustration – Ted Walke

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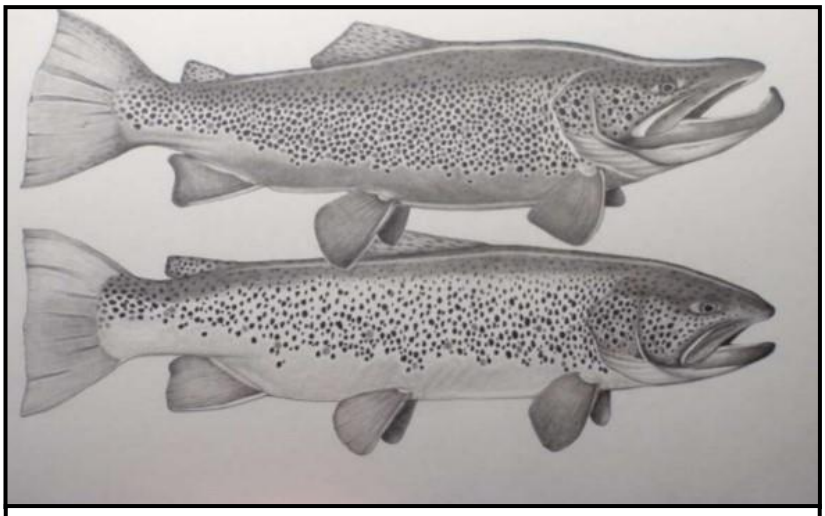
Life History of Salmonids in Pennsylvania



Comparison between physical characteristics that may be observed in spawning salmonids. The male (top fish) has developed a hooked lower jaw known as a kype. The female (bottom fish) has a more rounded snout. (Photo from PFBC presentation)

Fishes within the trout and salmon family (Salmonidae) live either in fresh water all their lives, or migrate to the sea and return to fresh water to spawn. Fishes that live primarily in a marine environment that migrate to a freshwater environment to spawn are known as anadromous species. Fishes that live primarily in a freshwater environment however, migrate to a marine environment to spawn are known as catadromous species. Trout and salmon spawn either in spring or fall, according to the species, over gravelly shoals, usually in small streams. During spawning, it is easiest to tell the difference between male and female salmonids based on physical characteristics that develop during this time. Older, larger males can develop a hooked lower jaw known as a kype. Conversely, female trout typically have a more rounded snout. The body shape of the male will also typically be laterally compressed compared to the female whom will characteristically have a more rounded body shape. During the spawning period, the males may also develop brighter coloration when compared to the females.

During spawning, the female digs a shallow dish nest in the gravel by lying on her side against the bottom and swimming forward energetically. Her body and fins flush out the stones. This nest created by the female is known as a redd. The eggs fall into the spaces between the now loose gravel within the redd, which allows for cold, clean oxygenated water to filter through. Redds may be covered slightly with more gravel by the female before she leaves which will help to protect the eggs from both predators and sunlight. Eggs hatch in 4 to 10 weeks, depending on water temperature. Young trout stay in the gravel until the yolk sac is absorbed. Then they move out into the stream. The presence of reproducing populations of trout has been used as an indicator of high-quality, well-oxygenated, unpolluted water. Natural reproduction of salmonids does occur throughout the state of Pennsylvania however, only in our highest quality streams.

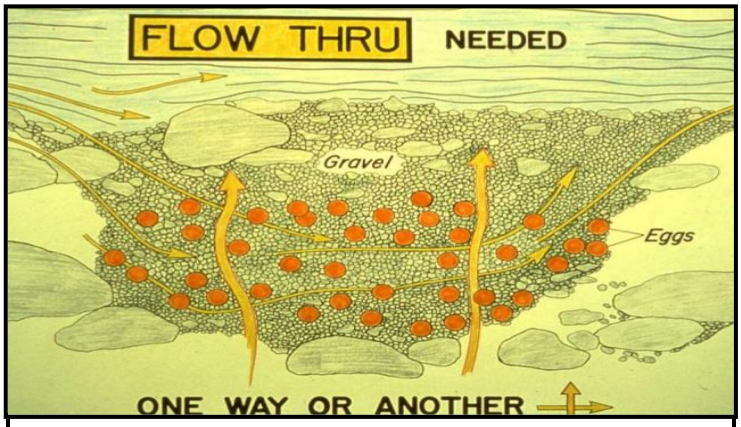


Diagram depicting how water flows through a redd to ensure the constant delivery of dissolved oxygen. (Photo from PFBC presentation)

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Stages of the Salmonid Life Cycle

A. Eyed Eggs

Definition:

Once eggs have been fertilized within the redd they are called "green eggs", one of the most vulnerable life stages of salmonids. As they develop, eyes will 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.

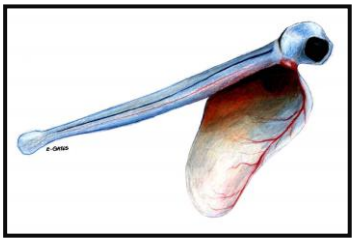
Description:

As eggs develop, they get oxygen from steady water flow and nutrition from the egg yolk. Water temperature is an important factor if the eggs are to remain viable. Different salmonids have varying temperature thresholds for the successful development of eggs.

In nature 1-2% (10 to 20) of the 100 -1000 eggs will survive to spawning age depending on the health of the watershed, food availability and stamina of the trout.

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".

Description:

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.

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.

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Stages of the Salmonid Life Cycle (Cont…)

C. Fry

1 Inch or Less

Definition:

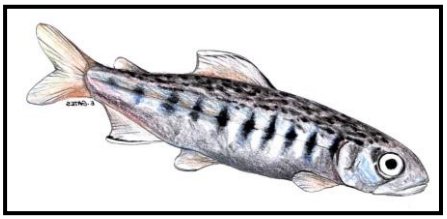
Swim-up Fry: Trout reach this stage once they have fully consumed their yolk sacs. Once the yolk sac is consumed, trout will emerge from the gravel and begin to search for food.

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



1 to 3 Inches

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. In the wild, fingerlings have strategies to avoid predators. Young trout spend time in shallow water, hiding under and around rocks as well as vegetation. They consume mainly small insects and plankton at this stage.

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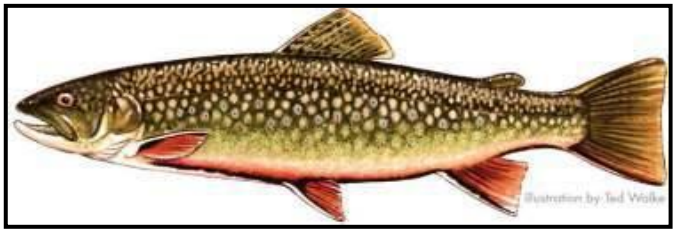
Stages of the Salmonid Life Cycle (Cont…)

E. Adult Trout



Definition:
Adult trout can range in size based both on species and the environment in which they live.

Description:
At this stage trout are ready to initiate the reproductive cycle. Age at first reproduction and time of year varies between species. Adult trout feed on aquatic and terrestrial macroinvertebrates, other fishes and even some small mammals.

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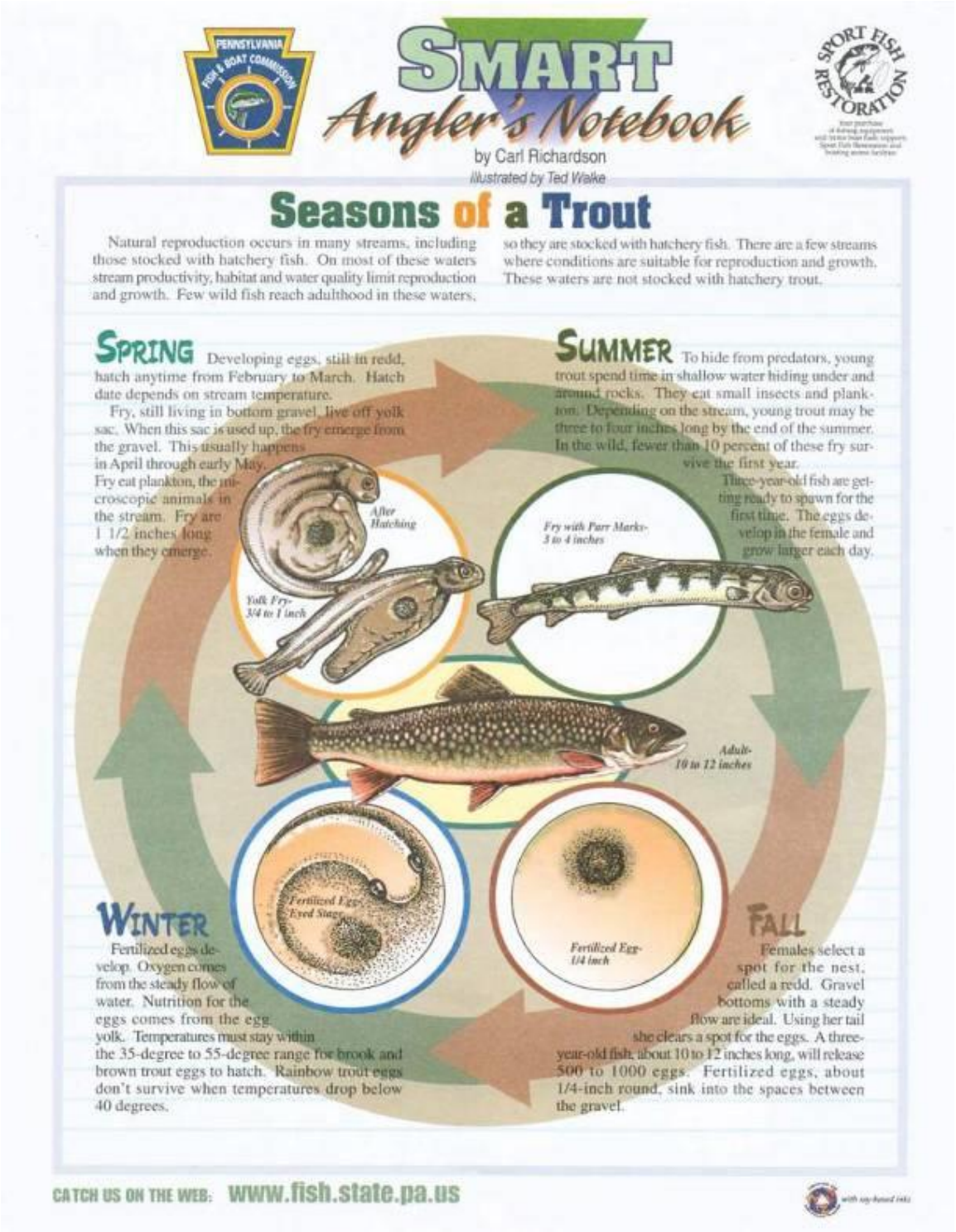
The Life Cycle of Trout



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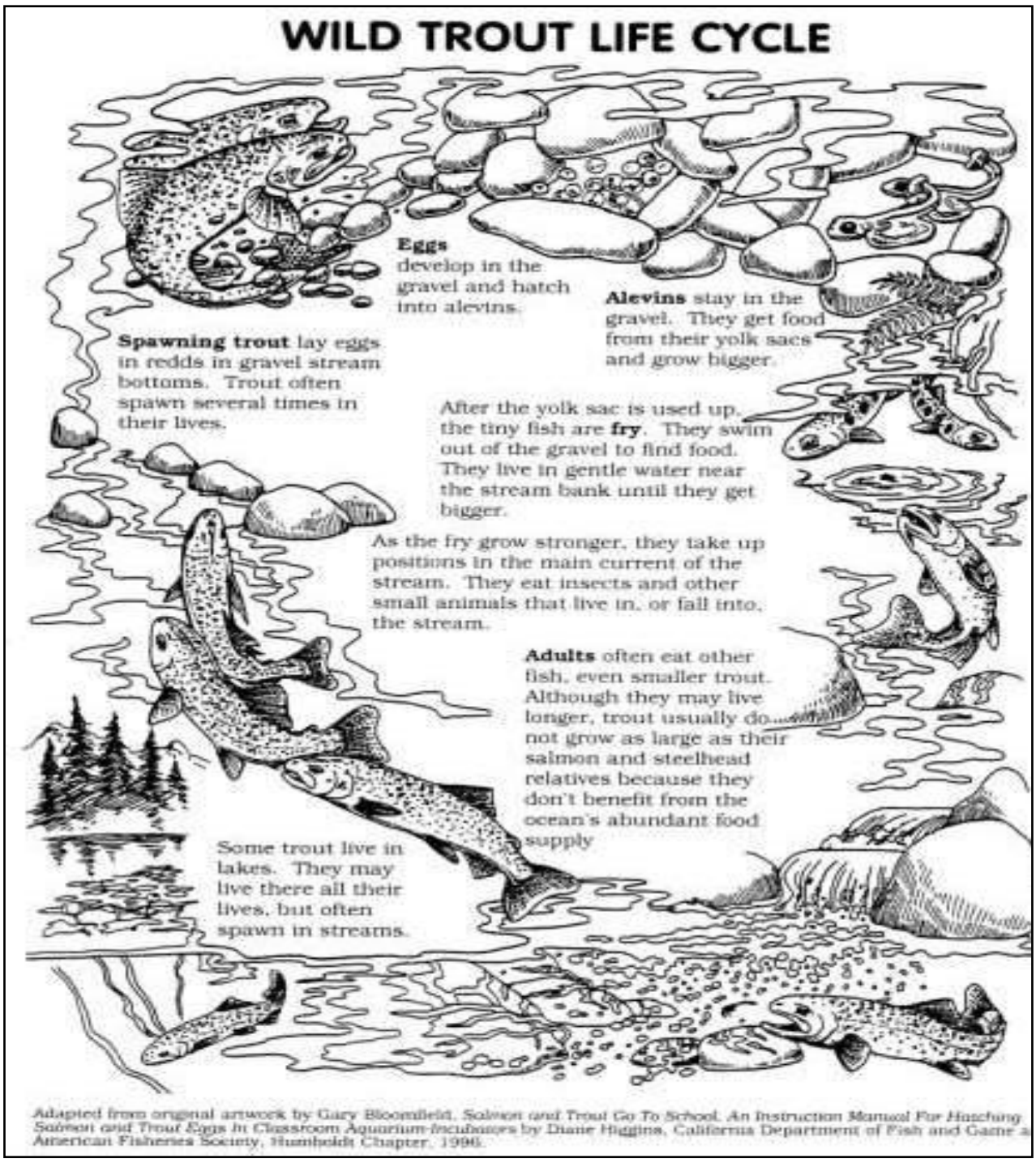
Wild Trout Life Cycle

From Nevada TIC Guide



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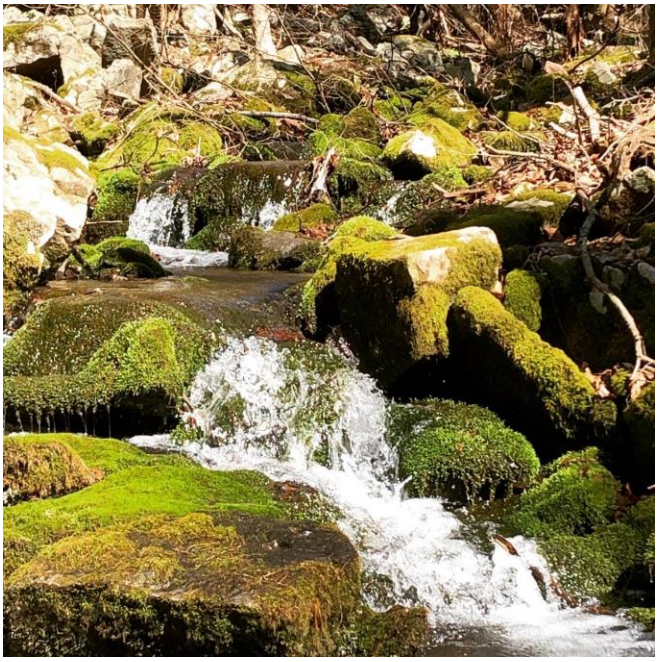
Chapter 4:

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.

COLD WATER = *temperature 52-56°F*	
Why?	Trout need coldwater stream ecosystems that provide cold water (52 to 56 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.

CLEAN WATER = *no chlorination, no sedimentation, pH = 7, low levels of ammonia and nitrites*	
Why?	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. *Note:* *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 has a proper nitrogen cycle and conduct water changes on a regular basis or as needed when your parameters indicate that you need one.* *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.* *Excess food will increase ammonia levels in your aquarium. Make sure people assisting you, students, or other helpers do not overfeed your trout.*

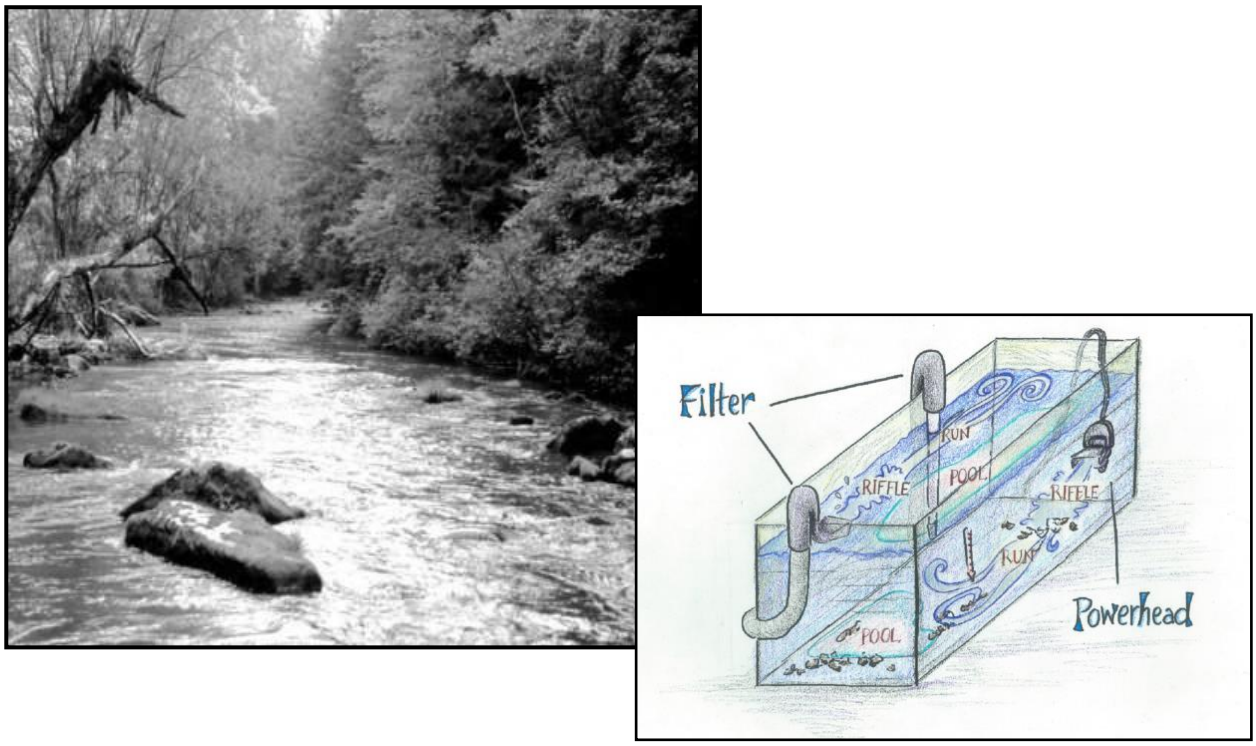
OXYENATED WATER: *High level of dissolved oxygen (DO) (above 7 ppm)*	
Why?	A healthy coldwater stream ecosystem is full of dissolved oxygen; 1) there is constant water flow over boulders, stones, wood debris (riffles, runs and pools), and 2) the water is cold – cold water holds more oxygen. *Using your airstone and keeping the water at 52-56 degrees Fahrenheit will maintain proper DO levels.*

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

SHELTER: *gravel, boulders/woody debris, shallow pools, stream bank vegetation*	
Why?	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.

Chapter 5:

"Making the Connection"



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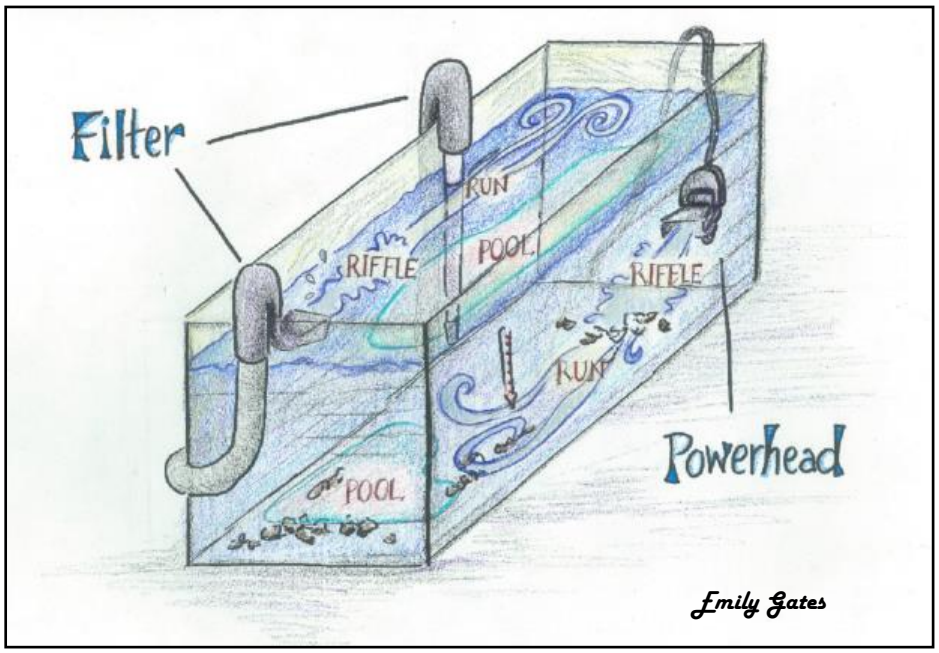
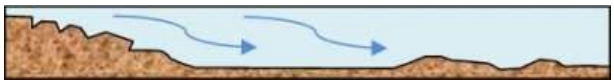
"Making the Connection"

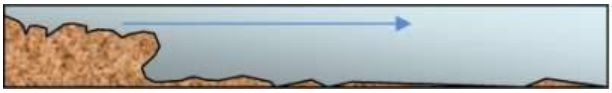


This diagram illustrates how your classroom "cold-water ecosystem" creates flow patterns similar to a natural stream setting for your trout.


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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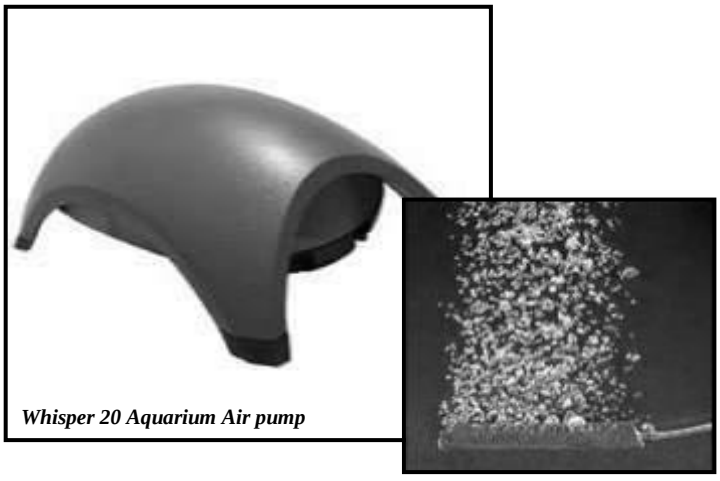
"Making the Connection"
Continued…

COLD WATER	
Aquarium	*Natural Habitat*
The chiller maintains optimum water temperature for trout.	Shade trees, snowmelt and underground water sources (springs) help keep streams cool.

OXYGENATED WATER	
Aquarium	*Natural Habitat*
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	
Aquarium	*Natural Habitat*
The 407 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.	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.

407 Fluval Canister Filter (www.fluvalaquatics.com)

Wetland (PFBC Publication photo)

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"Making the Connection"

Continued…

SHELTER	
Aquarium	*Natural Habitat*
Create a "redd"/depression in your **freshwater substrate (river jewels).** 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: http://www.youtube.com/watch?v=QiCBC2MYmi0	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.

Brook trout redd

LIMITED LIGHT FOR EGG DEVELOPMENT	
Aquarium	*Natural Habitat*
The aquarium is positioned away from direct sunlight and enclosed in foam board insulation.	Eggs are protected from sunlight in the nest/redd created by the female brook trout.

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Chapter 6:

Aquarium

VIEW OF HOW YOUR AQUARIUM SHOULD LOOK ONCE SET-UP

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Equipment Used

WATER QUALITY TESTING and CLEANUP	
Freshwater Master Test Kit	Microbe Lift Special Blend and Microbe Lift NITE-OUT II
Lees Squeeze Bulb Ultra Gravel Vac with on/off valve	Turkey baster *(for water quality testing & egg removal)*
5-6 gallon buckets *(for water changes)*	16.9 oz. Seachem Prime Water Conditioner
25ft Python Water Change Kit (*for teachers with access to sink in classroom*)	Poly Bio Marine-Poly Filter 4”x8” Sheet
Green Killing Machine UV Sterilizer Kit	
TEMPERATURE	
Battery Operated DigitalThermometer	Floating Thermometer
Tradewinds Drop-in Chiller DI-25 (1/4 HP)	Foam board pieces for insulation: 2 @ 48 ¼” X21”; 2 @ 12 ¾” X 21”; 1 @ 12 ¾” X48 ¼”
WATER FILTRATION and CIRCULATION	
Fluval 407 Canister Filter	Filter max pre filter (Aquarium Tech) (to place on your filter in-take)
Foam pre filter (Marineland) (for power head)	Aqua Clear 20 Power Head-Old 201
Chemi-Pure 5oz	Seachem Tidal 75 matrix Bio Media
OXYGEN	
Whisper 60 Aquarium Air Pump	Flexible airline tubing-25 feet
Lee’s Check Valve-1 pack	10” Aqua Mist Add-a-stone
TROUT HABITAT and FEEDING	
55-gallon, glass aquarium *(48 ¼” x 12 ¾” x 21”)*	Lid for 55 gallon aquarium *(Plexi glass, glass, plastic, etc.)*
Shallow Creek Pebbles-5 lb.	8-inch net with long handle (16” handle length)
Measuring spoons (1/8th; 1/4th; ½ tsp)	
GENERAL	
Power strip, towels/rags	VELCRO fasteners of tape *(for adhering foam to aquarium)*

EQUIPEMTENT THAT MAY NEED REPLACED AT THE END OF THE YEAR (NOT ALL items need replaced, the foam blocks, Bio Media can be rinsed off and dried for the following year. Only replace items that you KNOW need replaced by their condition) *Reusable as condition or expiration allows		
Chemi-Pure Filter Media 5 oz	*Check Valve-1 pack	*Fluval Media (Foam Block).
Tubing air stone connection	*Fluval BioMax Media-17.63 oz.	*Special Blend (microbe lift & nite out II)
10” Aqua Mist Add-a-stone	*Fluval filter motor seal ring	*Freshwater Master Test Kit

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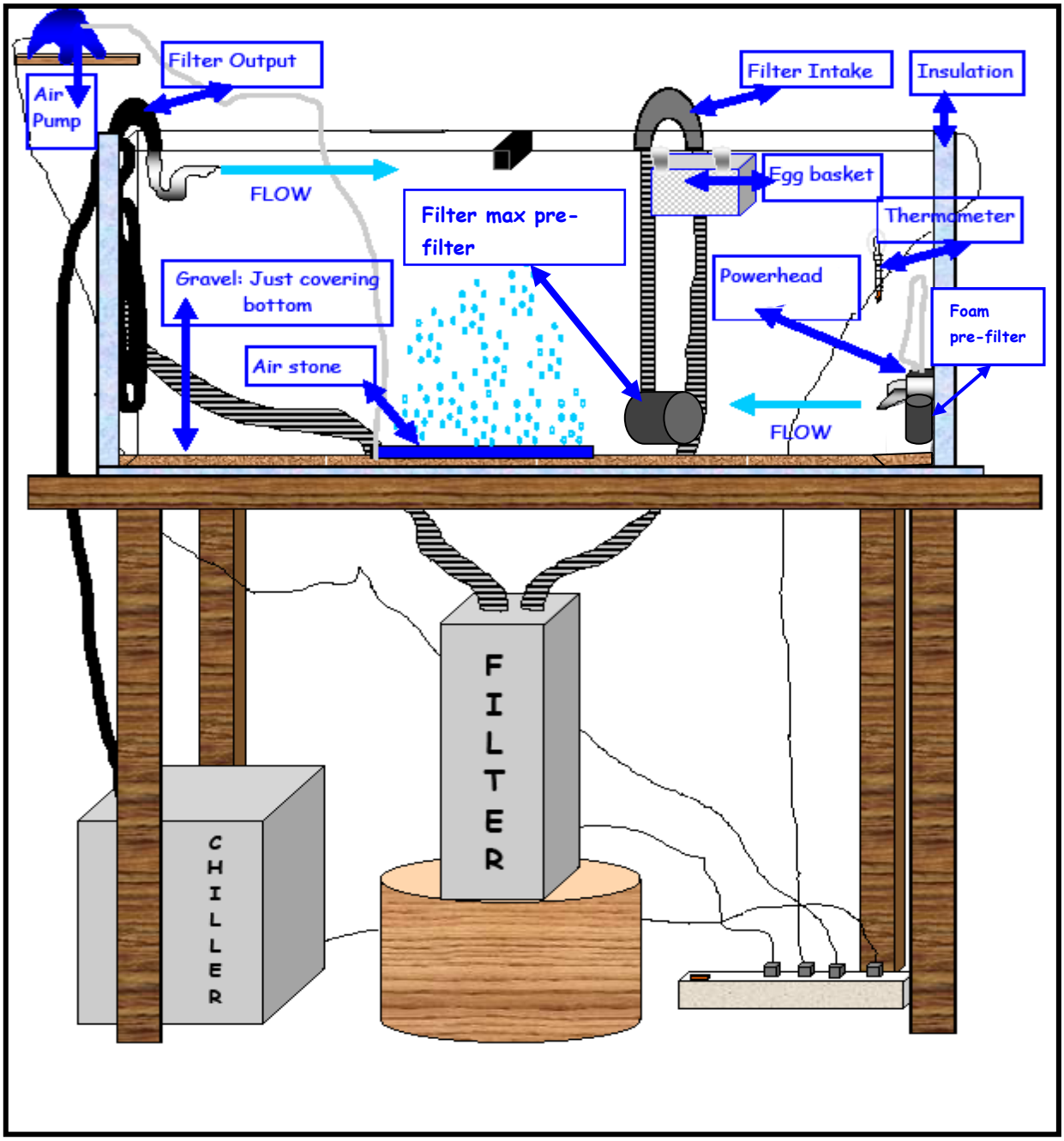
Contacts for Specific Equipment Questions

Companies that support TIC and are the main suppliers for the program (*They can assist with specific equipment questions.)*	
That Fish Place, That Pet Place **ORDER TIC Kit #2 (without chiller and has 406 Fluval Filter)** Website: http://www.thatpetplace.com/ Contact: Stephanie Welsh Phone: 717-299-5691 ext. 1288 Email: Stephanie.welsh@thatpetplace.com	**Tradewind Chillers** ***(2 year warranty)*** Website: http://www.tradewindchillers.com/ Contact: Hal Collier Phone: 760-233-8888 Email: twchillers@sbcglobal.net

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 *(if your filter leaks the water will stay in the bucket)*	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 level surface.

b) Position aquarium on top of your **insulation board** (cut to fit the bottom of the tank with ½"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 filter intake. Place outflow approximately 2-3inches above water level to encourage aeration at the surface.

c) Place the filter intake ¾ way down the aquarium side, 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 ¾ 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) If air pump is below water level, use a check valve to prevent backflow of water into the air stone and air pump. 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 air stone.

c) Place air stone in the aquarium, away from the filter intake tube, preferably in the center/back of the aquarium.

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 your aquarium is setup and 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 5 days 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 **54 F**

Adding water:

a) Fill aquarium about ¾ full with tap water using any clean container or tubing.
   i. Clean buckets are best for this purpose. Unless you have a sink nearby and can use a Python Water Changer to fill the tank. 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 407 Fluval Canister Filter:

a) Fill your canister up with water prior to putting on the lid. This will help jumpstart your filter priming time. Pump the silver key on top (marked "start"). Keep pumping the water through until you see water coming out of the filter outflow. *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.*

b) If you end up with air in the tubing, get two dixie cups and some helpers. One person will need to detach the pre filter at the intake and begin pouring water into the tube until water is overflowing from the tube. The other person should do the same with the outflow tubing. Once the tubes are completely filled with water, each person with a tube in hand must be ready to submerge the tubes at the same time into the water, while the third person plugs in the filter. This should take care of any air bubbles caught in the tubing.

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Pre-Cycling Your Aquarium Prior to Receiving Trout

Now that you have your aquarium set up it is recommended that you pre-cycle your aquarium prior to receiving eggs. Pre-cycling will help to establish healthy water chemistry and a bacterial community before introducing fish.

Ideally, you will want to complete these steps **4-6 weeks** before receiving eggs.

Here is how to get started:

1. Add the Seachem Prime water conditioner to your aquarium at the recommended dosage (per manufacturer instructions) for your aquarium capacity. (Ensures your water is dechlorinated)

2. Add the Microbe Lift Special Blend to your aquarium at the recommended dosage (per manufacturer instructions) for your aquarium capacity. (Promotes and jump starts bacterial growth)

3. Leave your chiller turned **off** at this time. Having the water at room temperature will better promote the growth of beneficial bacteria.
   Do Not add any other chemicals at this point

4. Add a pinch or two of food per day in order to initiate the Nitrogen cycle. This food will decay and produce ammonia for your system.

5. Now that you've begun your cycling process, you will want to test for the ammonia and nitrite levels regularly. The levels will be elevated for some time while the N cycle is establishing. **Do Not** do any water changes or add any additional chemicals while your tank is cycling.
   Typically you will begin to see an ammonia spike peak at 5-10 days. As ammonia is decomposed Nitrites will appear and at approximately 14-21 days they will peak. As Nitrites are decomposed Nitrate will appear, and at approximately 28 days, your ammonia and nitrite should be almost zero, pending how high your initial ammonia spike was. The length of the cycle will vary depending on the water temperature which is why room temperature is recommended to initially cycle the aquarium. A small amount of food may be added to keep the bacterial colonies sustained until your fish arrive. Ensure ammonia and nitrites stay at zero.

6. If ammonia and nitrite levels start to go above 5ppm, stop adding food and continue to monitor. After 2-4 weeks you should begin to see your levels move towards zero.

Pre-cycling your aquarium is a great option to reduce any mortality you may experience through the initial ammonia and nitrite spikes you would otherwise have after introducing fish to your system.

Aquarium Salt Treatment

Once you have your aquarium set-up and ready to receive eggs treating your tank with non-iodized salt otherwise known as aquarium salt as a general tonic is recommended and can never hurt! Benefits include the ease of stress, reducing osmotic pressure, inhibition of nitrite uptake, promoting the slime coat, and helping to heal wounds.

The trick is to add the salt directly to the tank at the recommended rate.

1. As a general rule you can add one tablespoon of salt/5 gallons of water.
   ***Do not add the salt to your aquarium all at once.**

Aquarium Capacity	Total Dose	Application Rate
35 gallon aquarium	7 tablespoons	2 tablespoons over 3 days with 1 on day 4
55 gallon aquarium	11 tablespoons	3 tablespoons over 3 days with 2 on day 4
75 gallon aquarium	15 tablespoons	3 tablespoons/day

2. Add the salt at the recommended application rate until the total dose is reached for your aquarium.

3. Once you complete this the treatment is finished and you **DO NOT** have to add it directly to the aquarium water again. Salt does not evaporate out of the water, If you top off your aquarium there is no need to add salt to that water, only when you remove water from your aquarium during water changes.

You will want to **add the salt** to the water you are using for your **water changes** at the same rate.

- **For example**, you will treat the salt like a water conditioner, if you are doing a 10 gallon water change add 2 tablespoons of salt to the water along with your water conditioner (if you use one).

- Add the salt and the conditioner every time you do a water change.

- Salt is a great disease preventative as well as a general tonic and stress reducer. Salt can also be reduced to 1 tablespoon per 10 gallons if you want to save on supplies and all fish are healthy. You may also start out at a half dosage and keep that until/if you have any problems

Egg Nurseries for your Aquarium

Make your own hatching basket:

Making your own hatching basket can be a great project for you and/or your students in September. The benefits of making your own hatching basket are:

1. It is much larger than commercially purchased baskets, allowing more water flow and more room for your eggs.
2. Decreases crowding issues such as fungus spread and egg die offs

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. In the middle of the dome create an oval depression. Use a turkey baster to take your eggs from their original packaging and place them into the oval depression.

b) Be sure to spread your eggs out. If you need to, create an additional depression OR use a combination of a homemade hatching basket and the gravel redd.

Commercial hatching basket

a) If you decide to go with these, you should purchase at least 2 of them to spread your eggs out and avoid overcrowding.

b) 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.

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 **54 degrees**.

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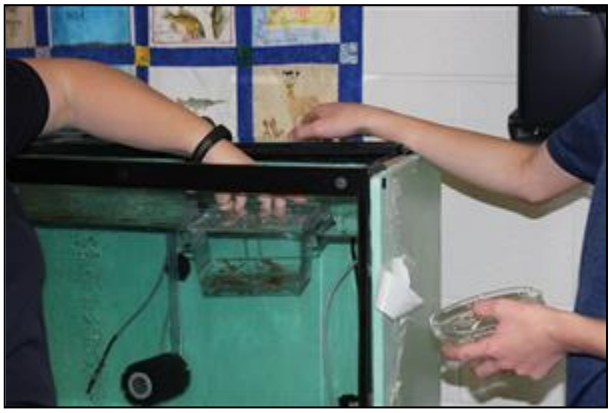
TIC End of Year Clean Up

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

AQUARIUM	
1	Turn off equipment. Empty aquarium almost all the way using the siphon kleen. 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, soak directly with vinegar, and 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 MUST be rinsed thoroughly and completely dried. DO NOT 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.
CHILLER: *Drop-in*	
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 PLASTIC scrub brush can be used. NEVER USE A WIRE BRUSH ON THESE TUBES.
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.
407 FLUVAL CANISTER FILTER	
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 pads, but coarse filter sponges and bio media can be used for several years.
3	When all components are dry, re-assemble the filter and store inside the aquarium.

Chapter 7:

Trout Care



Photos provided by TIC educator Stephanie Machmer

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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 using any of the egg basket designs found here: (http://patroutintheclassroom.org/Libraries/Resources/MAKE_YOUR_OWN_EGG_BASKET_3.sflb.ashx).

Egg placement instructions SEE VIDEO: https://www.youtube.com/watch?v=ycD_WJ7p0bU&feature=youtu.be
1. Remove egg bag from insulated box
Take off the duct tape and castrator bands
2. Separate eggs
Tools needed:
• 2 clear plastic cups/beakers (*1 cup for dead eggs; 1 cup filled half with aquarium water and half with water from egg bag 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 aquarium 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. Acclimate viable eggs
Gently place your "live egg" cup on the flat surface of your nesting basket or secure it to the inside of your aquarium so the cup doesn't spill, but is still in contact with the aquarium water. Allow your eggs to acclimate for at least 1 hour OR until the cup water temperature reads the same as the water temperature of the aquarium water. When temperature is the same in the cup you may add a small amount of water to adjust the eggs to the water parameters. You may add enough water until you have increased the total water volume by 100%, then your eggs should be ok to add to the aquarium.
4. Place your eggs into your homemade egg basket OR in the aquarium gravel
• Make sure you spread the eggs out in the egg basket OR in the gravel. This will increase survival rates. • If you have placed them in a homemade egg basket, near the surface of the water, make sure there is some circulation, but not so much that the eggs get pushed all together. • Adjust your filter output if the circulation on the surface pushes your eggs all together. You can angle the output, put it further under water etc.
5. Use the provided return UPS label and send the ice pack and egg box back to us.

Basic Daily Care

Provide a "stress free" environment

a) Monitor water parameters at least twice a week. Partial water changes are recommended (e.g. 1/month, 2/month) on a regular basis, pending your aquarium size, filtration and parameters when tested. Refer to the "water quality" section of this guide for guidelines.

b) Add your biological enhancer (e.g. Microbe Lift Special Blend or StressZyme) as per directions, and after every partial water change, even if water quality levels are good.

c) Locate aquarium in an area away from lots of student traffic

d) Keep all insulation on except the front and keep water temperature at or between 54-56F

e) DO NOT overfeed, Fingerlings should eat all food in less than 5 minutes. If any uneaten food remains, remove from aquarium to reduce the chance of an ammonia spike

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 in feeding guidelines.

d) Check and remove dead fish, old food 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.

Stressed/Sick Trout

If your trout seem sick or stressed:

- Remove any trout that seem infected immediately. These trout, if infected, will spread pathogens quickly to healthy fish.
- 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 (50-52 degrees Fahrenheit)
- Conduct a "Static Salt Bath" Directions are on the next page.
- Continue to add your biological enhancer as per directions (e.g. Microbe Lift Special Blend OR StressZyme)

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

Therapeutic salt treatments for aquarium, Dip treatment for a few sick/stressed current trout and for new trout you are introducing to your aquarium:
Something as simple as a salt bath often eliminates infections and/or parasites in an aquarium.

***Note – This treatment is separate from the salt treatment that is recommended for your aquarium water.**

Aquarium therapeutic 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.
3. Do not feed trout the day of treatment
4. Turn off any filtration, but continue to run your chiller and aeration.
5. Remove about 1 gallon of water from aquarium and place in a bucket with appropriate mixture of salt.
6. Mix it up and dump back into the aquarium.
7. After 30 minutes remove 10 gallons of water and replace with 5 gallons of aged water ready for your aquarium.
    - Be sure that your new water is suitable for the trout: Temperature and pH
8. Stagger water changes over the next 2 days.
    - 10 gallons immediately after treatment
    - 10 gallons the following day

Therapeutic aquarium recipe. What type and how much salt:

- Lbs of salt = (salt lbs/gal) X (gal of water)
- Lbs of salt = (0.0834 lbs/gal) X (53 gal)
- Lbs of salt = ***4.4202 lbs***

Therapeutic dip Treatment for current trout that are stressed and/or new trout coming in:

- Mix salt in a bucket with 2-3 gallons of aquarium water, replace water removed with freshwater into the aquarium, **NEVER** add the dip back into the aquarium
- Place aeration in the bucket
- Dip a net full of fish in the bucket until fish lose equilibrium (10-60 seconds)
- Return net full of fish back directly to your aquarium

Therapeutic dip treatment recipe: what type and how much:

- Replacement fish or current fish (if possible)
- 3% salt solution
- 1 bucket with 3% salt solution
- Bucket water and aquarium water must be close in temperature
- Refrigerate/chill if necessary

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Trout Care

Mortality	In nature a female trout, depending on size *(spawning trout range between 5 – 8 inches in length with a 12 inch brook trout being a trophy)* 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. 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. 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. 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.
Ich protocol	If your aquarium somehow gets ich and you lose your trout because you were unable to control the spread of ich: • You will need to dispose of your trout (compost or flush them) • Empty your aquarium and clean your aquarium using the end of year clean-up directions found in this manual. • Start with new gravel and water, and begin your cycling process again • Once you are all set-up contact PA Fish and Boat Commission's TIC coordinator to get more trout
Expected mortality *(during the TIC school year)*	Three periods during the TIC school year when you will experience trout mortality are: 1. Just after hatching (sac fry/alevin stage) ***WHEN: mid/late November – early December*** 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. ***WHEN: mid December – early January*** 3. During the aquarium cycling process, stage 2 (nitrite spikes) **WHEN: early/mid January – early February**
Remove dead eggs	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.
Hatching	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. Just after hatching, eggshells must be removed to prevent fungus. When the eggs hatch expect a spike in ammonia levels.
Alevin/sac fry	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. 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.

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Feeding Guidelines

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

PA TIC BROOK TROUT FEEDING GUIDELINES ***Guidelines are for 100-150 trout.*** *(Less or more trout = adjust accordingly & feed only what your trout will eat within the first 30 seconds)*				
Trout size	**Approx. date**	**Size food**	**Teaspoons/feeding**	**Times**
Swim-up fry *(no more yolk sac)*	Late November	**0**	1/16	3-4/day
	Early January	**0**	1/8	2-3/day
1/2- 1”	Mid January to late January	**1**	1/4	3-4/week
	Early February to mid March	**1**	1/4	3/week
1 ½”-3”	Mid March to late May	**2**	1/2	3/week

SUGGESTIONS FOR FEEDING:

Do not feed eggs or sac fry. Only feed swim-up trout.

Remember: Swim-up typically happens approximately 28 days after they hatch. ***Once your trout hatch out of their egg, slightly increase your water temperatures to 54-56 F.*** This will ensure an earlier yolk sac absorption date.

- Begin feeding AS SOON AS YOU SEE YOUR FIRST TROUT swimming up off the bottom of the basket or gravel, free of it’s yolk sac. **DON’T** wait for all of them to begin swimming around. Just feed a small amount to try and get the first trout to eat. Others will soon follow.
- Swim-up trout: **Feed small amounts regularly throughout the day** for the **first 3-4 weeks** to ensure their survival. This usually continues through Christmas break. If your trout have been eating regularly 2-3 weeks prior to Christmas break they will be able to survive 2-4 days over break without food. IF they swim-up late you will need to come in over Christmas break to feed your trout to be sure they survive through January.
- By mid January you can reduce feed to 1-2 times every other day. Less food = less clean-up and water quality issues. 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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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 in the morning Friday. Remove any excess food from the bottom of the aquarium using a turkey baster. Use a net to collect excess food on the surface. This will decrease potential ammonia spikes while you are gone. If you are concerned you may want to skip feeding all together.
- Conduct a partial water change (20-25%).

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. 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.
- Conduct a partial water change (20-25%) prior to leaving.

Prepping for LONG vacation (11+ days)

- Same preparation as above.
- Come in at least twice, if possible, leaving only 3-4 days between visits.

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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.

Materials needed:	
✓	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

Travel preparation:	
*	If possible check the temperature and parameters of the release stream, to make the transition easier on the fish, you may be able to adjust your chiller to match the stream temperature a few days prior to release.
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.	Transfer trout fingerlings to cooler or bucket using a small net; MAKE SURE you have plenty of buckets and/or coolers available for the number of trout you will be releasing.
3.	DO NOT overcrowd your buckets/coolers. *(i.e. do not put more that 50 trout per 5 gallon bucket*
4.	Add ice baggies to water -- but monitor the temperature, taking care to keep it as consistent as possible
5.	Insert and start air stone or bait aerator.
6.	Place lid over bucket or on cooler, to keep trout from jumping out, but tight enough to pink your aerator tube.

Release site instructions:	
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 5 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.

Chapter 8:

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 your biological enhancer according to directions (e.g. Microbe-Lift Special Blend. This will ensure good bacteria colonies flourish in your mini "coldwater ecosystem". Your UV should be OFF before you add the enhancer. Leave it OFF for at least two days to allow the new bacteria to colonize in the aquarium and filter. 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.

Stage 1 (ammonia spike) – Begin adding Microbe-Lift Nite-Out II according to directions	
When	Late November – early/mid December; When trout begin to excrete waste *(sac fry and/or swim-up fry stage)*
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 may 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 (NH4) and Ammonia (NH3).
Stage 2 (Ammonia decreases and nitrites spike)	
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.
Stage 3 (nitrite decreases and nitrate spikes)	
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 your biological enhancer (e.g. Microbe Lift Special Blend) when you first set-up your aquarium (directions for a "new" aquarium set-up). Once your aquarium has completed its nitrogen cycle (e.g. when nitrates become present), you no longer need to continue this process.

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 and fish healthy!

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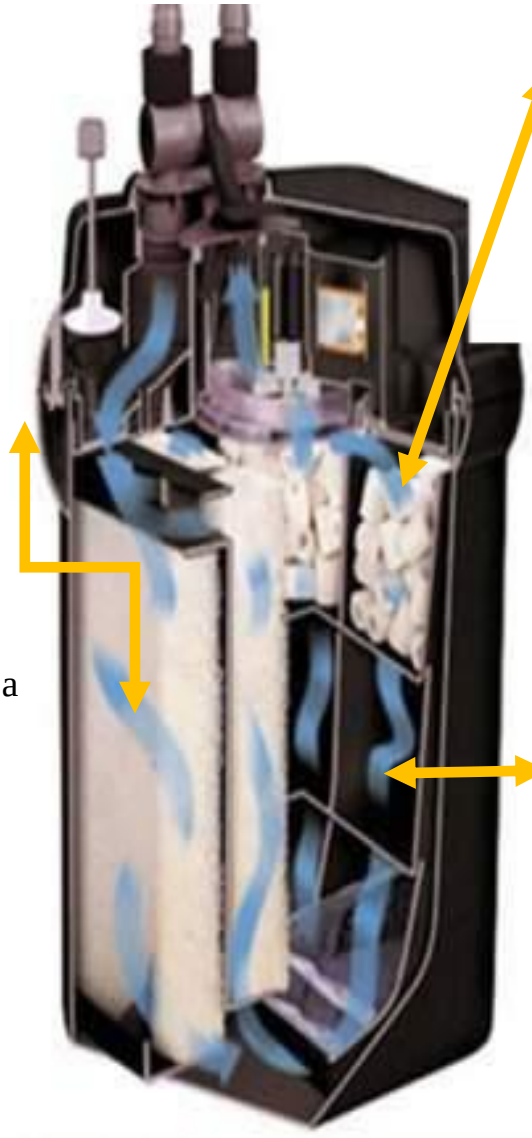
Nitrogen Cycle

Filter components that aid in the nitrogen cycle

407 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

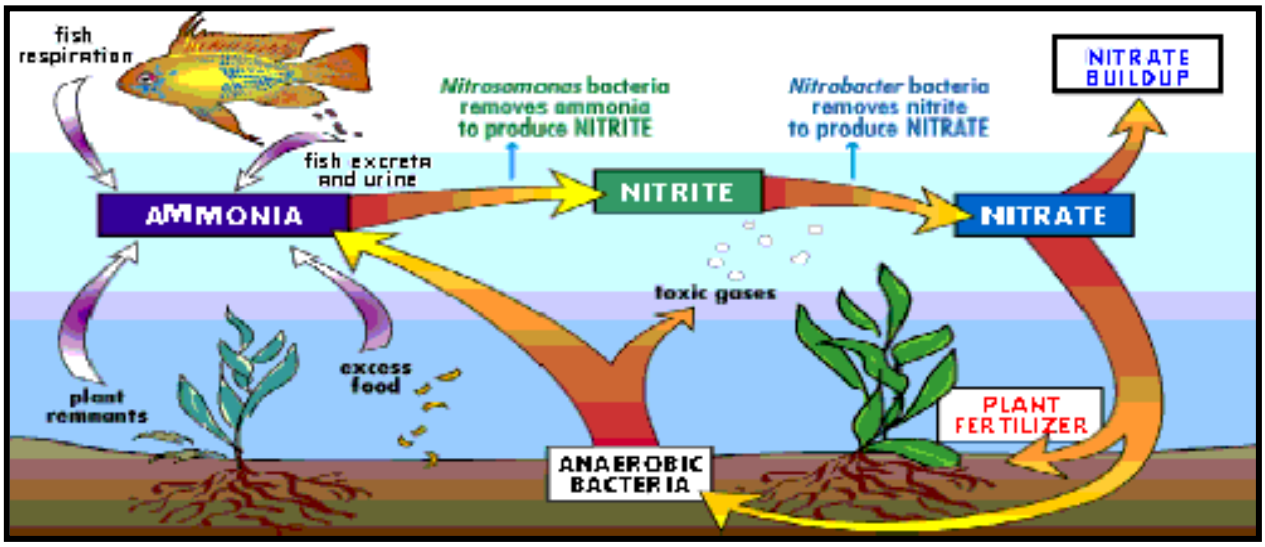

Diagram found at: *Puffer Net*. N.p., n.d. Web. 23 June 2010 http://puffernet.tripod.com/nitrogencycle.html .

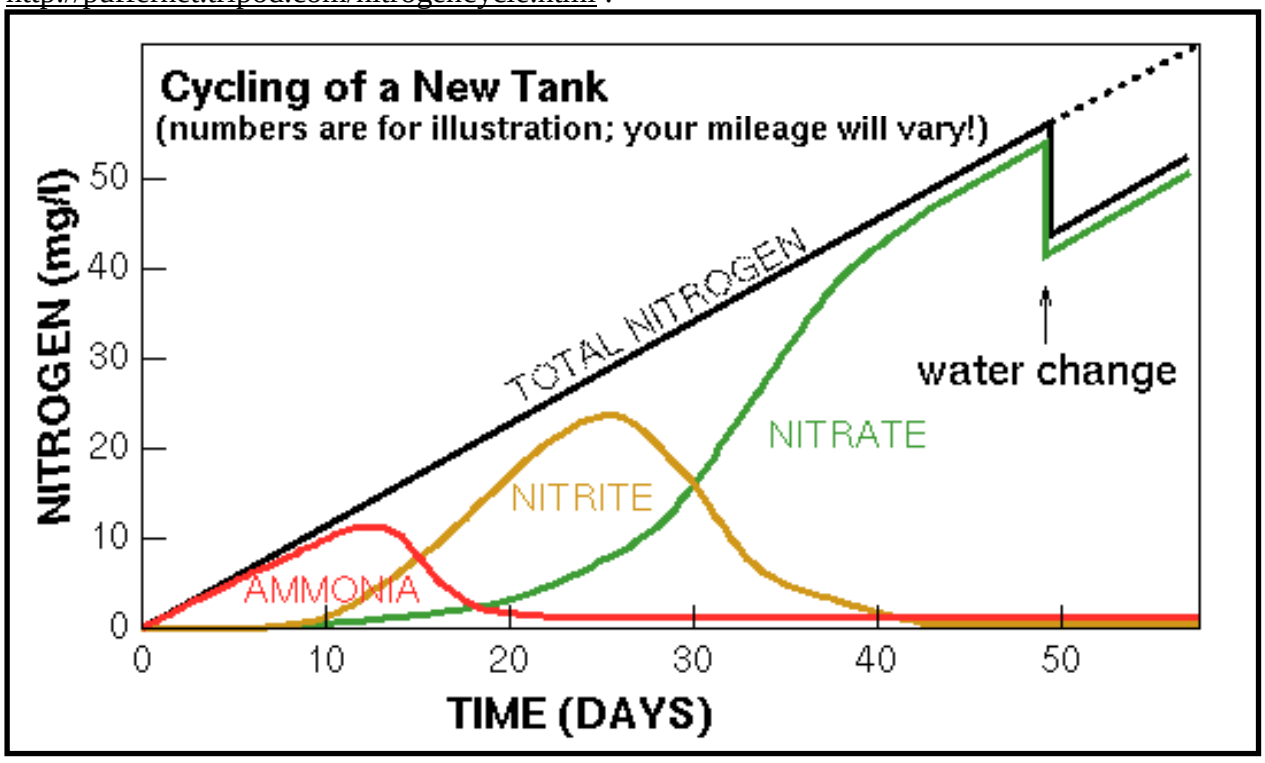

Diagram found at: Narten, Thomas. *Biginning Fishkeeping*. N.p., n.d. Web. 23 June 2010. http://faq.thekrib.com/begin-cycling.html#cycle

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Water Quality Parameters

(Overview)

Parameters to be monitored	**Optional parameters you may test**	**Parameters to check with water authority** *** Both parameters, in any concentration, are LETHAL.*
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. Your best friend regarding water parameters are to keep them stable. Regular water changes will keep the parameters stable with your source water. **DO NOT** try to adjust pH, hardness and alkalinity unless your release site is extremely different from your aquarium source water. The stability of your parameters is much more important than matching "normal" readings. Every aquarium is different, even in the same school.

When to monitor		
Once every other day or once every two days		
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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Ammonia

How do they form	As alevins and fry develop and grow while excreting waste, both ammonium ions (NH4) and ammonia (NH3) are produced.
Two chemical forms of ammonia	
Ammonia	Favors high pH levels and high temperatures: toxic to trout
Ammonium	Favors low pH levels: not toxic to trout
*** your freshwater master test kit measure both ammonia and ammonium at the same time***	
Ammonia concern	Highly toxic to trout
	High levels cause gill damage, anemia and death
Prevention	Do NOT overfeed. Main cause of ammonia increases
	Maintain cool water temperatures

Ammonia issues:

Symptoms	Respiratory stress
	Trout exposed to high ammonia levels over time will exhibit eroded fin edges and thickened mucus covered gill filaments
Remedies	
Immediate	Conduct small (10%) water changes. When doing this use your siphon clean and take water and any particulates (e.g. food/waste) from the bottom of your aquarium. That is where ammonia will settle most. If ammonia levels are higher than .5ppm may require a larger 20-25% water change and/or multiple days of water changes until level drops
	Continue to add your biological enhancer (e.g. Microbe Lift Special Blend or StressZyme). Prime will detoxify ammonia, water change still needed to remove.
	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 your biological enhancing product per its directions.
Mortalities	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
A cycled aquarium should have little to no ammonia readings.	

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Nitrites and Nitrates

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

About nitrite (NO_2^-) and nitrate (NO_3^-):		
What are they	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.	
Wastes that contain organic nitrogen	Animal feces	Decaying plants; animals; food

Nitrites:

How do they form	When ammonium ions (NH_4^+) mix with water the beneficial bacteria *(nitrosomonas)* can then convert ammonia to nitrite (NO_2^-).
Nitrites are toxic to trout	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.
Prevention	You need to test for nitrites each time you monitor your aquarium (2-3 times a week)

High nitrite issues: *(nitrite poisoning)*

Symptoms	Lethargy & congregating near the water surface
	Light tan to brown gills
	Tan to brown looking blood *(in this case your trout would appear pale in color)*
Remedies	Partial water change (25%)
	Dose your aquarium with Microbe Lift Nite Out II and continue to add your bacterial enhancer per its directions (e.g. Microbe Lift Special Blend or StessZyme)
	Do not feed your trout for a day or two
	Addition of salt to "de-stress" your trout and help fight off infections (Follow Aquarium Set Up, page 34) 1 tablespoon/5 gallons

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
A cycled aquarium should have little to no ammonia or nitrite readings (0-.5).	

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Nitrites and Nitrates Continued…

Nitrates:

How do they form	When nitrite (NO_2^-) mixes with water the beneficial bacteria *(nitrobacters)* will convert nitrite *(toxic)* to nitrate (NO_3^-) *(harmless when at low levels 10ppm – 40ppm)*
Nitrates are seemingly harmless	Nitrate can and is usually present in aquarium to a certain extent.
	At levels below 40ppm it is harmless; however, readings at/over 40ppm will begin to stress your trout.
	Nitrate readings at/over 40ppm is an indication that there are too many fish and/or waste in your aquarium.
Prevention	You need to test for nitrites each time you monitor your aquarium (2-3 times a week. Live plants will remove nitrates from water

High nitrate issues:

Symptoms	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.
Remedies	Partial water change (20-25%)
	Add bio enhancer product (Microbe lift Special Blend or 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))*

5 – 40 ppm	Nitrate at these levels will not stress your trout
What to do if they are higher than 40ppm	Partial water change (20-25%) Gravel vacuum waste from bottom, check filter foam and pad for buildup of waste and clean if necessary
	Make sure you add your biological enhancer (e.g. Microbe Lift Special Blend or StressZyme) after your water change according to the directions

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Chlorine and Chloramines

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

Concern	Chlorine and chloramines are both lethal to trout.
	Unlike chlorine, chloramines cannot be removed by allowing your water to sit for 48 hrs
What to do	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 type of water conditioner you should use.

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:

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

Other options:

You can also use commercial dechlorinators such as:	
Prime	AmQuel
API Tap water conditioner	Aquasafe Plus

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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.

Concern	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
What to do	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 type of water conditioner you should use.

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

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

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Temperature and pH

Temperature

Ideal temperature range for trout	52-56 °F
What does temperature affect	Ammonia and oxygen concentration
	Trout metabolism
	Sudden increase or decrease will stress trout in any life stage
Prevention	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:

Symptoms	Below 38ºF 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.
Remedies	Adjust temperatures accordingly using the chiller unit and thermometer.
Mortalities	Cold water (below 40ºF) 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.

Ideal pH range for trout	6 – 8.2
What does temperature affect	A sudden increase or decrease will cause severe stress or death of trout.
Prevention	Monitor your parameters at least 2-3 times per week
	Don't increase or decrease pH if it doesn't match other TIC aquariums. Should remain close to your source water you use for water changes.

pH issues:

Symptoms	Severe 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.
Remedies	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. If drastically different perform small (10%) water changes daily until it is close to source water.
	Use store purchased reagent: pH "downer" or pH "upper"; purchase at local pet store
Mortalities	Death may occur immediately or shortly after a rapid change in pH

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.

Ideal dissolved oxygen levels	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:

Symptoms *(usually occurs at DO levels less than 6ppm)*	Trout reduce eating; crowd incoming water flow; swim near the surface with gaped mouths; display rapid gill cover movement
Remedies	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
	Reduce or stop feeding for a day or two
	Decrease fish density if low dissolved oxygen levels persist
Mortalities	Death will accelerate quickly until the issue is resolved

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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. Developing a small water change schedule for your aquarium is a great way to keep your overall system healthy.

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:

Do NOT conduct water changes	When your trout are still eggs 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 your trout and your aquarium.
DO conduct water changes	If your water quality parameters are abnormal according to your "normal" aquarium readings *(Refer to the "water quality parameter" section of guide)*
	If you fear other contaminants were placed into the aquarium
Generally water changes do not begin or are not necessary until about 2-3 weeks after you begin feeding them. Small partial water changes are a great way to keep your parameters stable and provide fresh clean water to your fish. Large water changes are not recommended unless it is vital (nitrogenous compounds are extremely high) or small water changes do not fix the water quality problem. Develop a water change schedule to suit your aquarium as every aquarium is different. (e.g. 10% weekly, 10-20% biweekly, 20-25% monthly)	

Too many LARGE water changes	Too many large water changes (>50%) can throw off your Nitrogen Cycle.
	If the aquarium never cycles you may have a trout die off later in the year.

How to keep aquarium water healthy:

1.	Monitor all parameters every two or three days. At least twice a week.
2.	Remove dead fish. One dead fish can/will spread disease. *(You can use a turkey baster to remove small fish and the siphon clean vacuum when they are 1" or more)*
3.	Do NOT overfeed
4.	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, decholorintated, 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.

- If using aged water make sure the temperature is within a few degrees of aquarium, dechlorinated ice or frozen water bottles may be necessary to drop the bucket temperature.

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

4. Prime and use the Siphon Kleen or Python 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 25% of the 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 25% 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 9:

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.

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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: _____

	Mortality		Water				
Date	Egg	Fry	Temp	pH	Ammonia	Water Changed	Comments

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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Monitoring Records

Who is feeding?
Do Not Over Feed, It can **KILL** the fish.

Date	Time	Amount/Type of Feed	Name

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Chapter 10:

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 21st 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	
• Prey on native species	• Compete with native species
• Altar ecosystems	• Spread disease
• Cause economic damage	• Degrade natural aesthetics

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

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)

Freshwater 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.

1. 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 11:

Troubleshooting

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Troubleshooting

(Equipment)

Airline tubing	
Question	**The tubing is very hard to fit over the plastic aquarium parts, what should I do?**
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. Silicone airline tubing can also be used as it is a softer material and easier to use.
Airstone	
Question	**Where do I position the air stone?**
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	
Question	**Should I get a lid for my aquarium?**
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	
Question	**What should I do if my chiller dies?**
Answer	• 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. • 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. • Contact the chiller company to replace your broken chiller. If you have a Tradewind chiller it should be under warranty.

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Troubleshooting

(Equipment continued…)

Filter	
Question	**Trout are being sucked into the filter, how can I prevent this?**
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 beneficial bacteria.
Question	**What is Chemi-pure used for?**
Answer	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. 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.
Lights for the aquarium	
Question	**Is this something you recommend? Is there a type of light that you suggest we purchase?**
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.
Insulation	
Question	**Does my aquarium need insulation?**
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.
Question	**What kind of insulation can I use?**
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	
Question	**Can I make my own net breeder?**
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.
Question	**Do I have to weigh down my breeder basket?**
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	
Question	**Besides the equipment on our list, what other items can be placed in our aquariums?**
Answer	Driftwood that has been thoroughly rinsed, dried or baked; additional airstone and pump; additional filter; aquaponics/hydroponics
Powerhead	
Question	**How do I set-up the Aqua 20 Powerhead?**
Answer	Anchor the powerhead to the side of the aquarium, ¾ way to the bottom of the aquarium. YES, the powerhead can be submerged.
Power failure	
Question	**What happens if there is a power failure? How much time do I have?**
Answer	Brook trout, although stressed, they can survive in temperatures up to 60-62 degrees Fahrenheit. • 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. • 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. As long other parameters are in line and traffic is reduced a gradual temperature shift will not stress the fish. • I would suggest to have a battery powered air pump as a backup to provide aeration to the aquarium during the power outage

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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. When was your last partial water change, fish can always use some fresh water?
Aquarium cycling	
Question	Our aquarium is still not cycled, what can we do?
Answer	New York classrooms tested **Microbe Lift Special Blend** and **Microbe Lift Nite-Out II**. These products have live nitrifying bacteria which help cycle aquariums. Many Pennsylvania teachers have used both of these products and had great results. **Benefits:** Live nitrifying bacteria (not spores); establish nitrogen cycle down to 50 degrees F (*growth slows in lower temperatures*); the two products used together can instantly cycle aquariums and keep them in balance. **Drawback:** smell (only for a short period of time) Many teachers have had also had success using StressZyme or BioZyme, but others have not.
Black film	
Question	**What is the black film on the sides of my aquarium?**
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	**What is the main reason for cloudy water?**
Answer	This is most likely a result of a bacterial bloom associated with the beneficial bacteria. 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, a quick rinse of particulates on the bio media to limit the destruction of the beneficial bacteria. Do not use soap or any chemicals to clean filter parts. Decrease the amount of food fed.

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Troubleshooting

(Water…)

Goldfish for aquarium cycling	
Question	**Do I need goldfish to start my nitrogen cycle? If I start late, should I use more goldfish?**
Answer	You should not use any type of other fish begin your aquarium cycle. Adding your biological enhancer (e.g. Microbe Lift Special blend Or StressZyme) as per directions will help your process. The aquarium cycle will begin after your trout hatch and begin to produce waste. Room temperature water will speed the cycling process as bacteria will multiple faster at higher temperatures.
Green slime	
Question	**My aquarium is coated with a green slime. What is this? What should I do?**
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.
Nitrites and Nitrates	
Question	**What do I do in a case where I have nitrite spikes?**
Answer	Refer to the "nitrogen cycle" and "ammonia" section of this resource guide. Directions are found there. When was your last partial water change, fish can always use some fresh water?
pH	
Question	**How do you lower/raise the pH of your water?**
Answer	Brook trout can live in a pH as low as 6.0 and up to 8.2; however, these levels are extreme. If your trout are NOT showing signs of stress (i.e. swimming strangely, darting back & forth or acting lethargic), DO NOT adjust with pH levels. If you try to adjust pH levels using chemicals or other items, you might stress your fish even more. When concerns about pH arise, consider your water source; items in your aquarium and anything else that might be causing a change. Again, if the change is not drastic and constantly fluctuating, leave it alone. Regular water changes will keep the parameters stable with your source water. **DO NOT** try to adjust pH, hardness and alkalinity unless your release site is extremely different from your aquarium source water. The stability of your parameters is much more important than matching "normal" readings.

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Troubleshooting

(Water…)

Washing hands	
Question	**Should students wash hands *before* touching aquarium water?**
Answer	Students should rinse their hands thoroughly before working in or around the aquarium WHITHOUT SOAP. 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. *Moisturizers, skin care products and natural oils may harm your trout.*

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Troubleshooting

(Trout)

Sac Fry/Aelvin	
Questions	**My sac-fry are lying on their side and not moving, are they dead?**
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…)

<table>
<tr><th colspan="3">Bloated bellies</th></tr>
<tr><td>Question</td><td colspan="2">Our trout have bloated bellies and we have already lost a few, what is going on and what do we do?</td></tr>
<tr><td>Answer</td><td colspan="2">Make sure they are not FULL of food first. If it 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.
What to do:
1. Decrease stress levels on trout by:
a) Place the front insulation cover back on your aquarium
b) Take them off of food for a day or two
c) Decrease the water temperature SLOWLY
d) Add salt as general tonic to recommended dosage per page 34
e) Conduct a STATIC SALT BATH, per page 40

<u>Instructions:</u>
1. Make sure you remove dead trout ASAP. Any fungus growing on dead fish will spread to other trout in the aquarium.
2. Having a small amount of salt in the aquarium will reduce stress and allow the normal body function to fight off the infection, If severe follow step 2
3. 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.

Potential causes for infection:
a) If there is damage to skin caused by handling, abrasions, or chemical damage (i.e. high ammonia levels, nitrite levels or considerable changes in pH)
b) Stress. When normal defenses are down because of stress fish will become infected. (This is similar to when we catch a cold or other diseases if we are “run-down”.)</td></tr>
<tr><td></td><td colspan="2">Fish can become stressed for a variety of reasons</td></tr>
<tr><td></td><td>1)Poor water quality; over crowding</td><td>2)Temperature;</td></tr>
<tr><td></td><td>3)Too much handling (i.e. several feeding times, daily water monitoring, cleaning & changes, constant student activity around aquarium);</td><td>4) If bacterial colonies increase substantially as a result of increased levels of decomposing matter. This is typically occurring when the disease begins to spread and infects all trout.</td></tr>
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Troubleshooting

(Trout continued…)

Deformations and not eating	
Question	**Some of my hatched trout are not eating - Some of my trout are deformed. Is this normal?**
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.
Egg shells	
Question	**My fish have hatched, what should I do with the eggs?**
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.
Emergencies	
Question	**What do I do with my eggs or fish in an emergency?**
Answer	**Eggs:** 1. Prepare a bucket of water using aquarium water or one of your aged buckets of water, add in small frozen water bottles and a bait aerator. 2. Place your hatching basket of eggs into the bucket while you take care of the situation 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. **Fry/fingerlings:** 1. You should prepare a bucket the same way as you would do for an "egg emergency". 2. Be sure you always have plenty of frozen water containers on hand in case your chiller breaks. 3. Never add regular tap water ice cubes directly to the aquarium. Chlorine is lethal to trout. 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…

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Troubleshooting

(Trout continued…)

Emergency Plan	
Question	**How can I inform custodians, or other teachers, about what to do if there is an emergency while I am away?**
Answer	• Provide basic information about your aquarium requirements to all teachers and custodians. • Custodians should know that your aquarium always needs power. • Place a sheet of paper (in a visible location) that describes emergency procedures • Have plenty of frozen water containers. Place the location of these containers in the "emergency procedure form" • Emergency form example: **Aquarium Emergency Procedure:** 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:_____ **In the event of a power outage:** 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. **In the event of a serious leak:** 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.

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Troubleshooting

(Trout continued…)

Hatching basket	
Question	**When should we release the trout out of the hatching basket?**
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.
Question	**How do I let the trout out of the basket when it is time?**
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.
Mixing species of trout	
Question	**Can I mix species of trout?**
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.
Mortality	
Question	**I had a huge die-off, why?**
Answer	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. There are two naturally high mortality periods: 1. During the egg stage and hatching 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. 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.

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Troubleshooting

(Trout continued…)

Mortality continued	
Question	**What if I come in and many of the trout have died? What do I do?**
Answer	1. Put a battery-operated aerator or aquarium air stone in a clean bucket.
	2. Add a few containers with frozen water.
	3. Add Stress Zyme to the bucket—follow package instructions.
	4. Place remaining trout into the water bucket with frozen water containers and aerator.
	5. Perform water testing to determine the cause of the mortality
	6. Scrub down the sides of the aquarium using a clean sponge, NO SOAP.
	7. Use the siphon to clean gravel while you remove water from the aquarium (50% of water).
	8. Drain the filter, clean the filter media and replace at least one charcoal filter.
	9. Refill aquarium with aged water (if you have to use water that has not had time to age, use a de-chlorinating product).
	10. Provide time for chiller to cool water to a temperature within 1-2 degrees of bucket water.
	11. Add BioZyme, Stress Zyme, or Tap Safe, etc. if on hand, or as soon as possible.
	12. Place trout back into the aquarium
	13. The next day, add more Stress Zyme.
	14. Perform water testing to recheck levels, another partial water change may be needed if levels have not been corrected.
"Pop-eye"	
Question	**I have a trout whose eyes are popping out and appears to have internal hemorrhaging.**
Answer	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. Fluid accumulation behind the eyes could be a result of a few different issues: a) Systemic bacterial infection b) Internal disorders (tumors, gas bubble disease etc.) 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. Recommendations: 1. Check water quality parameters (sample from near the bottom of the aquarium) 2. Increase dissolved oxygen: arrange filter outtake so it creates a "mini waterfall" a) Aeration on water surface rids aquarium of toxic gases. It also eliminates the possibility of low D.O. levels being the culprit. 3. Conduct small water change (5-10 gallons) *The information above was collected from: http://en.allexperts.com/q/Freshwater-Aquarium Also, check out this article that was a link on their website http://flippersandfins.net/pop-eye.htm*

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Troubleshooting

(Trout continued…)

Release stream and release site	
Question	**When do I release my trout?**
Answer	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.
Question	**How do I plan a release/what should I do on my release day?**
Answer	All teachers plan their own release day, often with the help of their program partner. Ideas of activities to do on release day: a) Stream study b) Habitat study c) Tree planting d) Run stations (stream study; water quality station; forestry station; habitat station; watershed station; terrarium building; water cycle; amphibian/vernal pool station etc.) 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. Some teachers involve other agencies/organizations in their day: a) Universities b) Department of Conservation and Natural Resources (parks and forestry) c) Penn State Cooperative Extension d) Watershed Associations e) Trout Unlimited (casting/fishing/fly tying) f) Master gardener groups The list goes on and on. Sign up on the TIC yahoo group to discuss release days and much more on the forum. 1. Go to www.yahoo.com 2. Once there, scroll down on the left side to “Yahoo groups” 3. Click on “yahoo groups” 4. On this page type in Trout In the Classroom in the provided box 5. Once there click on join now (provide the necessary information)

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Troubleshooting

(Trout continued…)

White dots	
Question	**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?**
Answer	Based on your description it could be Ich. Here is some further information on Ich: ***What is Ich?*** Ich (ick) is the most common disease of freshwater 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. ***Why fish get Ich?*** 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. 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 arrival fish 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. ***Identifying Ich***: Symptoms of Ich include: 'salt grain like' white spots; rubbing against decorations; breathing difficulties; loss of appetite; increased mucus layer (washed off slime coat); cloudy eyes; frayed fins; and abnormal swimming behavior. The disease will eventually death. Facts from: http://www.algone.com/ich.php ; http://peteducation.com/article.cfm?c=16+2160&aid=2421) **What do I do if my trout have ich:** • You need to remove your trout. Conduct a therapeutic salt treatment should be conducted on stressed/ill trout **Go to "Trout Care stressed trout section"** • You should then drain your aquarium, clean all gravel, sponges including your filter sponges as you would at the end of the year. • Refill your aquarium with treated water or stream water. • Place your trout back into the aquarium

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Glossary

Adipose Fin – A rayless, fleshy fin situated posterior to the dorsal fin in some fishes.

Ammonia - Refers to two chemical compounds, free ammonia (NH3) and ammonium (NH4+) together. Ammonia is a food source for nitrifying bacteria and is toxic to fish, amphibians and invertebrates.

Anadromous – Fishes that primarily live in a marine environment however, migrate to a freshwater environment to spawn.

Catadromous - Fishes that primarily live in a freshwater environment however, migrate to a marine environment to spawn.

Nitrate – End product of the N cycle. A common waste product found in fish tanks. It comes from fish waste, old food and plants in the water. Less toxic to fishes.

Nitrite – Intermediate step of the N cycle. Toxic to fish, and is converted to nitrate by beneficial nitrifying bacteria.

River Basin – A land area that is made up of many watersheds that are all drained by a common river.

River Continuum Concept - Describes the entire river system as a continuously integrating series of physical gradients and associated biotic adjustments as the river flows from headwater to mouth.

Semelparous – Fishes that spawn once and die.

Stream Order - A method used to categorize streams and rivers based on size and location within a watershed.

Tetraploid – Having four sets of chromosomes.

Tributary - A small stream that flows into a larger stream or river

Vermicultions – Worm like patterning observed on the backs of Brook Trout.

Watershed Divide – An imaginary line separating different watersheds.

Watershed - An area or ridge of land that separates waters flowing to different rivers, basins, or seas.