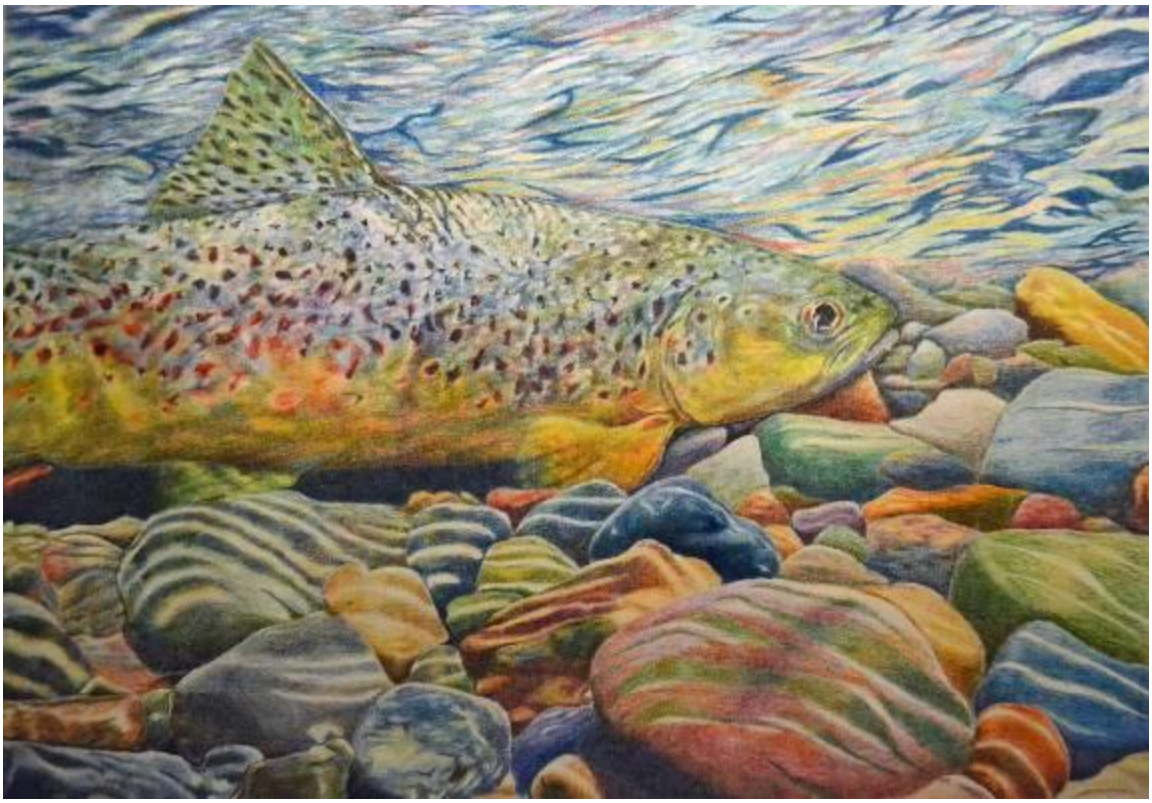
2013 Edition (09/12/2013)

TROUT IN THE CLASSROOM



At the Estuary

Connecting Ohio Students with Their Watersheds

Artwork by William Kennedy, TIC Student at Benjamin Logan High School, Bellefontaine, OH © 2013

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1. INTRODUCTION

The Trout in the Classroom (TIC) Program is a tremendous opportunity for students to witness the growth of trout from egg stage to the fingerling stage (2-4 in.) during the school year. The exciting climax is the release of the baby trout into a state designated lake or stream, each one to face the hazards and challenges of life in the wild. But from an educational standpoint, the TIC Program is much more than that! As an environmental education program it offers opportunities to teach the needs of aquatic organisms for quality habitat. Water quality is integral to the rearing of trout and daily testing of the water is necessary to control the cycling of nitrogenous wastes. Other sciences are closely related to the TIC Program. The biology of embryology, growth and development; the biochemistry of the nitrogen cycle are all teaching opportunities associated with TIC.

It is common knowledge that Ohio is 500 miles south and west of "real" trout water. Except for a small pocket of native and genetically distinct brook trout stranded by the last glacial retreat in the north-east corner of the State, trout, as far as we know, are not native to Ohio. The teaching moment in this truth is that humans must grow, and care for the brown trout that we grow and place in cold water streams, such as the Mad and Clear Fork Rivers, or the rainbow trout that we stock in a number of lakes or the anadromous steelhead trout (a stain of rainbow trout) that run from Lake Erie to its tributaries each spring and fall. This requires clean water and proper habitat and food; all of which are closely monitored in the TIC aquarium. In this Anthropocene Era, we humans must take responsibility for the maintenance and restoration of our environment.

The TIC Program in Ohio is promoted and supported by the State chapters of Trout Unlimited, the Ohio State Council of Trout Unlimited and is supported and sponsored in part by the Ohio Department of Natural Resources (ODNR). Trout eggs and fingerlings are counted and sent by the ODNR Supervisor at the State Hatchery in London Ohio, an ODNR Officer will be present at the Release Day for each school, and ODNR's Aquatic Education division has provided funding for many TIC units throughout the State. ODNR Officers also meet with the TIC classrooms to describe Ohio's efforts at providing trout to the State waters and encouraging outdoor education.

Trout Unlimited, through its State Council and its several chapters also provides funding for TIC units throughout Ohio and provides help in the day to day operation and maintenance of the aquariums The motto of TIC is "Connecting students with their watershed." Trout Unlimited sees TIC not only as an excellent environmental education tool, but as a means of building a sense of environmental responsibility into the next generation of caretakers of our streams and lakes.

We recognize that rearing trout is not easy. We stand ready to help teachers provide this excellent environmental teaching opportunity to their students and we hope this manual will aid in your success with the TIC Program.

Donald H. Dean, Ph.D.
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Trout Unlimited Ohio Council
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2. PERMISSION TO RAISE AND RELEASE TROUT

As mentioned above, TIC operates under the guidance and support of the Ohio Department of Natural Resources. Indeed, only through the permission of ODNR may we release trout into the public waters of Ohio. Therefore it is necessary to *request permission* to receive trout eggs and release. The contact person is given below. This step should be taken before the aquarium is set up and must be done each year.

Marty Lundquist
Acting Fish Management Supervisor
Wildlife Division One Office
Fish Management Supervisor
Ohio Department of Natural Resources
1500 Dublin Rd.
Columbus, OH 43215; Phone: 614-644-3925.

3. TIC EQUIPMENT

Table A below contains a list of equipment needed to set up and maintain the TIC program. In Ohio, the necessary initial first year equipment will be provided to the school, with the expectation that the teacher or school attempt to refund the Ohio State Council of Trout Unlimited with replacement equipment by applying for a grant (e.g., though NEA or Ohio Environmental Education Fund). In this way Ohio TU can continue to provide TIC to schools throughout the State.

The home improvement store items are relatively cheap: surge protector, $12.00; Styrofoam board, $6.00, buckets around $5.00 each; and the other items combined around $7.00, for a total of $40.00 or less.

TABLE A: EQUIPMENT LIST

Item	First Year Set-Up	Annual Replacement
Items from local aquarium supply store		
Fluval 305 or 405 Filter	X	
Replacement filter media*		X
Whisper #40 Air Pump	X	
Battery Operated Digital Thermometer	X	
16-oz. bottle of MicrobeLift	X	X

Water Chemical Testing Kit (see Sect. 8)	X	X
20ft. ½" internal diameter (I.D.) tubing	X	
Tap Water Conditioner	X	X
¼" check valve	X	X
6" Aquarium Net	X	
Foam Pre-filter	X	X
12" Air Stone	X	
10ft. ¼" airline tubing	X	
1 Tube of Aquarium Sealant	X	
Large aquarium gravel vacuum siphon tube (Hydroclean)	X	X
2 bags of gravel "river jewels"	X	
3 Piece Brush Set (to clean tank sides)	(Optional)	(Optional)
Breeder Boxes (Hatching Baskets)	X	
55 Gallon Tank	X	
Stand for Aquarium (or make your own)	X	
Other Source Items		
55-Gallon Tank Stand	X	
TradeWinds DI-25 ¼ HP drop-in chiller**	X	
Home Improvement Store		
Foam Board (Styrofoam) Insulation	X	
5-Outlet Surge Protector	X	
Stainless Steel Hose Clamps for Tubing	X	
2 one- or two-liter bottles	X	
Turkey Baster	X	
3 five-gallon buckets with lids***	X	
Large insulated ice chest****	X	
Battery Air Pumps ****	X	
Dr. Tim's One and Only (or MicroLift) Biofilter	X	X

* Biomax, Marineland White Diamond Crystals, and ChemiPure Charcoal.

** Order direct from TradeWinds (760-233-8888), twchillers@sbcglobal.net.
Price to Ohio Trout in the Classroom (TIC) schools $570 + ~ $45 shipping.

*** Needed for water changes, storing de-chlorinated water.

**** Needed to transport fingerlings to release site.

3. SYSTEM SET-UP

A. PREPARING THE TANK

1. **Position the tank** on Styrofoam board, cut to fit the bottom of the tank with about ½" overhang on all sides. This will help insulate the tank and discourage water from dripping onto the floor from the outside of the tank.
2. **Place the tank** on a stable lab-type counter, bench, concrete blocks or stand capable of supporting a total of 500 pounds (the tank, 55 gallons of water, and gravel). The best location is close to an electrical outlet and a sink to make filling and draining the tank easier. Select the location for the tank carefully because once it is filled with water, it won't be moveable.
3. **Lighting Conditions for the tank.** The tank should be away from direct sunlight. Sunlight will raise the water temperature in the tank and promote the growth of algae. This will put a greater strain on the chiller and require additional tank cleaning time. Furthermore, newly hatched trout prefer relative darkness for the first four weeks or so as they do in nature where they seek to hide in the darkness provided by stream structures. To provide this dark environment, cover all four sides of the tank with Styrofoam board cut to fit and attached with duct tape. The top of the tank also should be covered with Styrofoam with cut-outs for filter hoses and the chiller line. A removable window can be cut out of the front board and hinged with duct tape for viewing. The Styrofoam will not only provide the desired darkness but also insulate the tank, thus requiring less operating time for the chiller and prolonging its life. Alternatively, a piece of black paper or black cloth can be used to cover the front glass of the tank. **Avoid positioning the tank under fluorescent light. Do not use aquarium lights.**

4. **Install the Under Gravel Filter**

B. GRAVEL

Ideally one should use rocks and gravel from the river where the trout will be released, but the right size gravel matters. Doug Sweet, Supervisor of the ODNR London Hatchery has these thoughts on gravel size: ideally, gravel should be between an average of 1/8 inch and 3/16 inch particle size. Gravel too small (like course sand) tends to compact tightly and water does not flow through it well. Dead spots of anaerobic bacteria develop in compacted small gravel which leads to hydrogen sulfide production which could kill fish. Gravel too large allows food particles to quickly sink out of sight of the fish between the large spaces between the gravel. Here the food rots and molds, causing a heterotrophic bacteria bloom, and ammonia and water quality problems. Furthermore, it seems that the nitrifying bacteria are more efficient on the ideal sized gravel mentioned above, probably due to more surface area for given volume of gravel, and adequate flow rates through the gravel with water being brought into close proximity to the bacteria.

For a commercial gravel, two 5-lb bags of **pre-cleaned** gravel (e.g., "River Jewels", sold at most aquarium stores) sufficient to cover the bottom of the tank to a depth of ½ to 1 inch. Gravel makes an excellent "home" for the bacteria which are necessary to convert ammonia into harmless compounds. The large surface area provided by the gravel allows ample area for the bacteria to grow.

Gravel other than "River Jewels" must be cleaned before being placed in the tank (unless it comes from the river where the fingerlings will be released). To clean, place the gravel in a holding container where it can be hosed down until the water runs clear of dirt and dust. A bucket or a colander is used for this purpose. After getting the gravel as clean as possible by hosing, place it evenly across the bottom of the tank. The gravel will probably still need further cleaning. Gently cover the gravel with several inches of tap water. If the water still looks stained, and it probably will, siphon out the water and replace it with fresh water. Do this until you feel you have removed as much residual dirt as you can. It may not be possible to siphon out all the dirt but the main filter should take care of what's left when it gets turned on.

C. CHILLER

A chiller is needed to keep the tank's water temperature at about 52°F (11°C). The TIC program strongly recommends the TradeWinds DI-25 drop-in chiller. It can be ordered directly from:
TradeWinds
Phone: 760-233-8888
e-mail: twchillers@sbcglobal.net

TIC's preference for the TradeWinds drop-in chiller is based on:

1. satisfactory experience; made in the USA by someone we can talk to on the phone.
2. convenience (less maintenance, no water pump needed);
3. lower price than most other chillers; and

4. a 5-year warranty.

The chiller should be placed where it can be easily accessed for maintenance and temperature adjustments, i.e., next to, and at the same height as or under the tank.

D. AIR PUMP AND WATER FILTER CONNECTIONS

1. **Place the air pump** behind the tank.
2. **Cut the tubing** from the air pump and insert the check valve. Make sure the check valve faces the proper direction to prevent water from returning to the air pump in case of a power outage.
3. **Place the air stones** in the tank. The air stones are very fragile and should be carefully removed from its package.
4. **Run the tubing** from check valve to the air stone. Greasing the tubing with vaseline or saliva will make installation easier.
5. **Place the gravel in the tank** covering the Under Gravel Filter.
6. **Fill the tank** with water from the river or tributary where the trout will be released, if possible. Otherwise use tap water that is treated to get rid of chlorine. (**Note:** Please remember that the water needs to be totally chlorine-free by the time eggs are put in the tank.)
7. **Wait 10 minutes** to saturate the air stone and provide an even air flow.
8. **Plug in the air pump** and check to see that air is flowing evenly through the stone.
9. **Install the Fluval Water Filter**, following installation instructions on the CD.
10. **Double check the Fluval Water Filter** to make sure the housing does not leak.
11. **Fix a fine mesh cloth or bag over the intake tube** of the water filter. Fasten tightly to the tube with a plastic or twist tie to keep fry from being sucked into the filter. A cut-down Bio Max media bag works well.

E. BREEDER BOX/HATCHING BASKET

The breeder box is designed to protect very young fish from harm. The plastic frame should be secure and free of sharp edges or scrap plastic. The net, which should be free of holes or damage, is supposed to be placed loosely around the outside of the plastic frame to protect the fish from damage by the sharp edges of the frame or from getting stuck between the frame and netting. To avoid this problem entirely, the net can be placed inside the frame and secured at each corner with needle and thread, aquarium sealant, or twist ties. It is recommended to have the net on the inside of the frame. Several breeder boxes will avoid crowding the eggs and alevin.

YOUR SYSTEM IS NOW OPERATIONAL!

F. BY EARLY NOVEMBER

1. **Set up tank and breeder box** as described above. (Do **NOT** install Breeder Box yet.)
2. **Turn on the filter, chiller and air pump**.
4. **Set the chiller** to cool the tank water to 52°F (11°C) with a 2^0F differential. **NOTE:** Never run a drop-in chiller unless the chiller coil is completely submerged.
5. **Test the setup** to make sure all the equipment is functioning properly.
3. **After a test period of two or three days, disconnect the chiller. Continue running the filter and air pump.** During this time, the filter can be run at a lower flow rate by adjusting the flow control valve. Be sure to set the filter for maximum flow when you start feeding the hatchlings.

4. PREPARING FOR YOUR EGGS OR FINGERLINGS

Fertilized trout eggs will be delivered to schools about the end of November. If fingerlings are requested instead of eggs, they will be shipped the first week in January. Exact dates are variable since the State Hatchery orders eggs from other locations and their exact delivery date is never certain.

A. BEFORE DELIVERY (MID NOVEMBER)

1. **Turn on the chiller,** setting the temperature to register around 52°F (11°C).
2. **Test the water** for pH, ammonia, nitrites and nitrates. Adjust pH 7-8, depending on the pH of the water you will release in: see Section 8. **Water Testing Procedures.**
3. **Add additional Dr. Tim's One and Only to tank** in accordance with directions on its container.
4. **At least two days before the eggs arrive, wash and thoroughly rinse a container to hold the eggs** during the tempering process. Use dechlorinated water from the tank. The container can be a china or glass bowl, a margarine tub or any similar chlorine-free container that has been well-cleaned.
5. **Let container air dry** to make sure all residual chlorine has fully leached out of container before egg delivery.
6. **Using dechlorinated tank water, prepare two or three trays of ice cubes** for possible use in tempering eggs and keep in a freezer. Be sure that the ice trays have zero trace chlorine. **Note on dechlorination:** Chlorine should leach out of the tank and buckets within 72 hours. The use of tap water conditioner can reduce that time to minutes.

B. ONE DAY BEFORE EGG DELIVERY

1. **Using the digital thermometer, check to see that the water temperature registers 55°F (11°C)**.
2. **Check the breeder box** in the tank. Make sure that water flowing from the filter will not disturb the resting eggs. If necessary, redirect the outflow from the filter.
3. **Place the air stone** near but not underneath the breeder basket.

5. TRANSITIONING THE EGGS TO THE TANK: TEMPERING

The eggs will arrive in a Zip-Lock bag with cold water of variable temperature in an ice chest The eggs will need to be tempered: that is, the water temperature in the bag has to be gradually raised to within 2-3°F (1-2°C) of the temperature of the water in the tank.

1. **Gently move the eggs** with some of their water from the carrying container to the tempering container.
2. **Measure the temperature** of the water containing the eggs with a standard thermometer.
3. **Using the prepared ice cubes of de-chlorinated tank water, chill an appropriate quantity of clean de-chlorinated tank water** so that it reaches the temperature measured in step 2. Add this water to the tempering container to submerge all the eggs.
4. **Gradually add tank water to the egg container** over a 60 to 90-minute period until the temperature of the water in the tempering container and in the tank is the same.
5. **Using a stirrer which has been cleaned and rinsed in dechlorinated tank water, NOT TAP WATER, gently stir the eggs** from time to time to increase oxygen supply to tempering water. **Do not stir the eggs roughly** during tempering. Egg movement at that time can weaken their outer shells. This can create weak spots or broken areas. These spots are vulnerable to fungal infection.
6. **When the tank and egg container temperatures are the same, place the eggs carefully in the breeder box.**
7. **The outer shells of the eggs must remain translucent.** Uniform cloudiness can be okay; it might be just the trout development. P**ick out any eggs with white spots**. A turkey baster will work well for this. An egg with any opaque spots (or a fully opaque egg) will not develop.. The white spots are a fungus that spreads REALLY fast. Pick out spotted eggs twice a day, if possible. The breeder box should be checked the last thing on Friday afternoon.

6. HATCHLING STAGES

A. HATCHING

This starts the alevin stage when trout absorb their yolk sacs.

1. The eggs will not all hatch at exactly the same time but over a 2-3 day period from the first egg hatches. Hatching usually starts within ten days of egg arrival.
2. Some eggs will not hatch properly and should be picked out after a couple of days.
3. Any leftover eggs must be removed or at least isolated. These eggs are not likely to hatch.
4. The leftover shells float to the top of the tank or the breeder box. Fish enzymes will break down these shells and create foam. This is normal. Scrubbing the sides of the tank will loosen this foam.
5. During this phase, a jelly-like fungal growth may appear. Check for this around the inside tank surfaces. Also check for this growth on the surfaces of the breeder box. If you find this, wipe or scrape these surfaces with a sponge or brush. Loosening this growth will send it through the filtration system.
   Note: The longer the hatchlings can stay in the breeder basket, the better

B. REMAINDER OF ALEVIN (SAC-FRY) STAGE (1-3 weeks)

1. The length of time at this stage depends upon the water temperature. If the water temperature is permitted to rise, fry develop faster.
2. A digital thermometer is the most reliable method of checking the in-tank temperature since chiller consoles are notoriously inaccurate. Check the water temperature daily.
3. Look for any odd looking trout (two-headed, three-headed, unusual heart development, etc.). These odd trout don't usually survive. They illustrate the principle of survival of the fittest.
4. Alevins can survive in a Petri dish for short periods and can be observed closely under a microscope or using a hand lens.
5. Do not feed in the alevin stage. It can deform and kill the fish.

C. SWIM-UP STAGE

1. As yolk sacs disappear, some trout will start swimming to the top of the breeder box.

2. **Wait until all of the alevin have lost their yolk sacs before feeding (or move those precocious fish to another breeder box.** Spread a minuscule amount of the tiniest (ground) food size near any swimming trout. Turn off the filter system for a few minutes when you are feeding the trout for the first couple of times. Not having a strong current will make the food more visible and the trout will more likely begin to feed. **MAKE SURE YOU TURN THE FILTER BACK ON WHEN YOU FINISH FEEDING.**
3. Once all hatchlings are swimming up and have been eating, **unhook the breeder box** and lower it gently to the bottom of the tank.
4. Strong adventurous fish will swim out. The more timid weaker fish will hide for a few more days until they are stronger.
5. **You should continue to add *MicrobeLift, Dr. Tim's One and Only*** or **API *Quick Start*** to your tank as often as once a week according to directions on the bottle.

Note: The longer the hatchlings stay in the breeder basket, the better

D. FRY STAGE (4-8 weeks)

1. Some trout never learn to feed and will die. These non-feeding fish are called "pinheads" (big heads, little bodies). These trout should be removed and euthanized (e.g., freezing), as they will not develop.
2. Most TIC classrooms see a mortality spike with the pinheads. It is **very normal**.

E. FINGERLING/PARR STAGE (the rest of the time until release)

See Appendix A for pictures of the developmental stages of the trout. See section 8 for Water Testing and section 9 for Feeding.

1. Look for parr marks (vertical stripes) on the trout.
2. Cannibalism can and does occur. The big fish do eat the little fish. If cannibalism becomes an issue, feed more often to assuage hunger. Large cannibalistic fish can be separated in the breeder basket if necessary.

7. CARING FOR THE TANK

A. INTRODUCTION

The most important job after the hatchlings are in place is to keep the tank system clean and the bacteria colonies growing and happy. Specifically, keep the tank sides and bottom clean and the tank water changed regularly using high quality stream water, well water, aged tap water or tap water treated with a dechlorinating conditioner. Also, before working in the tank, hands must be washed, thoroughly rinsed of contaminants (such as soap and lotion). This will ensure a much higher trout survival rate.

B. TANK CLEANING

This section applies mainly to tank maintenance AFTER the fish leave the breeder box.

1. Remove any slime and dirt from the sides of the tank **WEEKLY** with a hand mitt, long-handled brush, or other suitable implement.
2. Prompt removal of dead fish is also required. Some fish may start to get lethargic, or have problems swimming. Eventually, they simply float around the tank. These fish are sick, and they will never get better. One dead fish body, if left too long, can spread disease to other fish, damaging the whole population.
3. Cleaning also includes examining the filter intake and removing tank debris, as well as any dead or trapped fingerlings found there.
4. Gravel in the tank is cleaned by moving the siphon through the gravel, sucking up water and dirt trapped in and below the gravel. If tank cleaning is scheduled twice a week (e.g., Tuesday and Friday), the siphon is used to clean half the gravel in the tank, removing about 5 gallons of tank water at each cleaning. This water is emptied into a bucket used for that purpose.
5. Occasionally, fingerlings can get sucked up along with dirt from the gravel. Just net them and return the runaways to the tank. They may look dispirited or even comatose, but the odds are that they will survive.
6. Check chiller cooling fins for lint and dust. If necessary, clean with a small vacuum cleaner, dusting cloth, or soft bristle plastic dust brush.

C. WATER CHANGING

Particularly during the earliest stages of trout development, daily water testing is your best guide as to how much water to change and when to do so. High ammonia and nitrite levels are the best indicators of the need for a water change.

1. Water changing should be done at least twice a week. A total of 10 gallons of water should be exchanged weekly. As explained above, this can be done most efficiently in combination with gravel cleaning. An easy alternative method of water removal is to use a clean gallon jug (milk or other) with the top cut off. Dipping the jug in the tank (while not scooping up fish) is an easy way to reduce tank water.
2. Fill a clean 5-gallon plastic bucket with dechlorinated water **chilled to the temperature of the tank water** and equal to the amount of water removed from the tank. Slowly add this water to the tank, trying not to create a disturbance. This procedure, when done twice a week, achieves the weekly routine water change that works so well in helping to keep trout mortality low.
3. Immediately change 10 gallons of water any time the fish appear to behave strangely or start dying in large numbers. Most likely this is the result of an ammonia spike.
4. Always keep 10 gallons of clean dechlorinated water on hand for regular and emergency water changes. Tap water can be dechlorinated by "aging": that is, leaving it in a bucket for at least two days to allow the chlorine to evaporate out of solution. Alternatively, a "tap water conditioner" can be used for rapid dechlorination. Well or spring water does not need to be aged.

5. Always keep two or more 1- or 2-liter bottles of dechlorinated water in the freezer to use for maintaining the tank water at 52°F (11°C) in the event of a power failure or other temperature spike. The exterior of these bottles must be cleaned and then rinsed with dechlorinated water before freezing since they will be used to chill dechlorinated water needed for water exchanges or to float in the tank.

D. FILTER CLEANING

It is normally not necessary to clean the filter or change its media during the school year. Should the water flow become seriously restricted, open the filter and remove all debris, mainly from the foam insert. Then refill and seal the filter, reattach the inlet tubing, prime the pump and reattach the power cord. If you change the filter media, change only one section at a time, thereby permitting bacteria from the remaining section to colonize the new media.

Note: Detailed instructions on how to disassemble and reassemble the filter are on both the illustrated instruction sheet and the CD accompanying the filter. When reassembling the filter after cleaning apply a thin layer of Vaseline or plumber's grease to the rubber gasket on the filter cover.

8. WATER TESTING

A. INTRODUCTION

A water testing kit, included in the first year set-up, has the equipment you need to test for ammonia, nitrite, nitrate, and pH. There are several good manufactures of chemical testing kits (e.g., Aquatic Pharmaceuticals, Tetra, Hach, etc.); follow the directions on the kit box. The two most essential tests are for pH and ammonia. However, testing for all four is a good practice since nitrites are toxic to fish and high nitrate levels can also negatively affect the health of the fish. Testing for dissolved oxygen is useful but optional. It is advisable to keep a daily log of test results which can also serve as "real" data for students to graph. **See Appendix B for a sample Tank Inspection Record.**

Note on Test Kit Shelf Life: There is a lot number on each of the small bottles of test solutions in the kits. The last 4 digits of that number indicate the month and year of manufacture. It is permissible to use the test solutions for three years after the manufacturing date before opening a new test kit. So be sure to check the lot number on the bottles in your test kit.

B. TEST FOR pH (Follow Directions on kit box)

A pH level of 7.0 to 8.5 is recommended (the ideal is the pH of the water where the trout will be released)

Water in most of Ohio tends toward the slightly alkaline (around pH 8.0), which has not caused a problem with our trout. Of greater concern is rapid and significant changes in pH. Remember a pH change of 1.0 is a 10-fold change in H+ concentration. If the water becomes too acidic (pH level below 6.5), the following procedure is recommended:

1. For a 55-gallon tank, divide ½ cup of rinsed coral chips (found in most pet stores) into 3 equal portions.
2. Spread one portion of the chips in the tank every 4-5 days during the next two weeks.
3. If at the end of the third week, the pH is still lower than required, repeat this procedure with another ½ cup of rinsed coral chips.

Following this procedure will usually raise and maintain a pH of about 7.0 in the tank water. **DO NOT TRY TO CHANGE THE pH LEVEL OF THE TANK MORE THAN 0.1 OR 0.2 IN A DAY. NOTE**: Products such as pH Up and pH Down are also available at aquarium stores to maintain constant pH levels and are easier to use but more expensive than coral chips.

C. TEST FOR AMMONIA (Follow Instructions on the Test Kit Bottle)

An ammonia level of 0 ppm is recommended.

A major water change will be needed if the ammonia load becomes consistently too high for the biological filtration to handle (*i.e.* a level of 0.5 ppm or higher). This usually occurs when the fish are over-fed or there are too many fish in the tank. If the problem occurs frequently, some fish may need to be removed to reduce the daily level of ammonia or the number of water changes may need to be increased to 3 or 4 a week.

D. TEST FOR NITRITE (Follow Instructions on the Test Kit Bottle)

A nitrite level of 0 ppm is recommended.

In dealing with nitrite toxicity table salt (sodium chloride) can be added to the water to reduce nitrite toxicity. About one teaspoon per gallon of kosher or pure food grade salt a as temporary method to reduce deaths associated with high nitrite levels in the water.
It is also imperative to stress that ANY measurable ammonia levels and ANY measurable nitrite levels are toxic to the fish and need to be dealt with by all of the following

1. Water changes
2. Reduced feeding rate
3. Addition of more Microbe Lift, Quick Start or Dr. Tim's One and Only
4. Addition of salt if nitrite levels are stubbornly high

Nitrate levels are really non-toxic. However, high nitrate levels are affiliated with reduced growth rates of fish and eventually a decline in pH (more acidity). Therefore they should be removed and managed with water changes.

E. TEST FOR NITRATES (Follow Instructions on the Test Kit Bottle)

Beneficial bacteria convert toxic ammonia and nitrite into nitrate. A high nitrate level indicates a build-up of fish waste and organic compounds, resulting in poor water quality.

A nitrate level of 40 ppm or less is recommended.

F. TEST FOR DISSOLVED OXYGEN (DO)

A test kit for measuring the dissolved oxygen (DO) in the tank water is optional but recommended. The test kit can be obtained from *ThatPetPlace, Drs Foster and Smith* or your local aquarium or pet store. Following the instructions in the test kit, it is best to measure the DO at the bottom of the tank where a low level (less than 5 ppm) is a signal to search for the presence of dirt or a poorly functioning air stone or pump. A DO level of around 5ppm or less will not sustain trout life.

G. CHECK LIST

For your convenience, the following check list has been prepared to help organize the tank maintenance chores.

DAILY

1. Check tank temperature. A temperature increase might indicate a chiller problem.
2. Feed the trout (see Section 9 for feeding guidelines).
3. Remove dead fish or debris from the tank.
4. Test water for Ammonia, pH, nitrites and nitrates, and record the readings in a Log **(see Tank Inspection Record, Appendix B).** Do a 10-gallon water change if any reading deviates markedly from the recommended level. **As you do this, don't let the tank temperature fluctuate more than 5^0F(3^0C).**
   In an emergency, however, clean water is more important than temperature stability. Some schools have had success with testing twice or three times weekly instead of daily. However, daily testing encourages participation by more students and is optimal from the standpoint of trout health.
5. Ensure that water is flowing from the filter and that no fry are caught at the Intake points and that the air stone is still working properly.
6. Check all hose connections and tighten as necessary.

WEEKLY

1. Clean the gravel 2 or 3 times a week such that there is an exchange of 10 gallons of water per week (see section on water changing in Section 7).
2. Clean the sides of the tank with a mitt, brush or other suitable implement.
3. Examine chiller cooling fins for lint and dust. Clean, if needed, using a small vacuum cleaner, dusting cloth or soft bristle plastic dust brush.
4. Test for dissolved oxygen and record reading in the log (optional).

9. FEEDING THE TROUT: ROUTINELY AND DURING VACATIONS

A. INTRODUCTION

The rule of thumb for feeding the trout is to provide only as much food as can be completely consumed in 5 minutes and certainly within 10 minutes. Give only one pinch of food at any time, and remove all extra food particles. Overfeeding can pollute the tank and cause problematic ammonia levels. Continued leftovers mean that you are over-feeding your fish. It is better to have slightly hungry fish than to over-feed and have too much waste.

While fish are in the breeder box, do not feed. **Feeding guidelines for trout swimming outside the breeder box and a increasing levels of development until release are in Tables B and C below.**

B. MEASURING THE FEED

Table B indicates how much food is recommended daily per tank in measurements by medicine spoon and measuring spoon. These food amounts are based on an estimate of 135 fish (plus or minus 10 fish) in the tank. A medicine spoon can be purchased at a pharmacy or the drug section of some stores.

Alternatively, the amount of food recommended for the fish at each developmental stage can be measured by weight, *i.e.* ounces or grams, using a digital scale. The calculated weight of food is then marked off on a medicine spoon for daily use.

1. For fish leaving the breeder box and until 1 inch long (no more than 45 days), gradually increase the amount of #0 feed (finely ground with mortar and pestle) to 0.04 oz. per tank per day.
2. For trout 1 inch to 1-½ inches (less than another 60 days) switch to #1 feed and gradually increase daily feeding from 0.04 oz. to 0.12 oz. per tank.
3. For trout larger than 1-½ inches, switch to #2 feed and continue feeding at 0.12 oz. per tank per day until release.

Table C presents the recommended amount of food in ounces and grams for varying numbers of trout in the tank. This table is available for teachers who use a digital scale to weigh the food.

TIC FEEDING GUIDELINES
BY VOLUME

Table B (around 125 to 145 fish per tank)

Age and Size of Fish	Size of Food	Medicine Spoon Amount	Measuring Spoon Amount
First 3 weeks after alevin stage	Crumble Mix	1.5 ml. mark	1/3 of 1/4 teaspoon
3 weeks to 1 inch (2.5 cm.) long	Crumble Mix and then Size 0	2 ml. mark	3/8 teaspoon
1 to 1.5 inches (2.5 to 3.8 cm.) long	Size 1 and then Size 2	4 ml. mark	3/4 teaspoon
1.5 to 2 inches (3.8 to 5.7 cm.) long	Size 2	8 ml. mark	1-1/2 teaspoons
2 inches (5.7 cm.) and longer	Size 2	12 ml. mark	2-1/4 teaspoons

A standard medicine spoon can be obtained from a pharmacist who may even give it to you for nothing if you tell him/her why you want it. The measuring spoons are those used in cooking. Measurement in cooking spoons is always a level amount, the excess in the spoon removed by running a straight edge across the top of the spoon.

At each age/size of the trout, the amount of food provided per day should start with the amount shown in the table and be gradually increased so that the size of the trout and the amount of food called for in the table should reach the next stage at about the same time.

Since these measurements are not the product of hard science, you always need to factor in common sense and your best judgment based on the number and needs of the fish in your tank and any water quality issues you may be experiencing.

TIC FEEDING GUIDELINES
BY WEIGHT (grams and ounces)

Table C

Fish Size	50 fish total	100 fish total	200 fish total	Food size
Out of Hatch Box	0.09 g. 0.003 oz.	0.17 g. 0.006 oz.	0.34 g. 0.012 oz.	Powdered with mortar & pestle
Approx. 1 inch (2.5 cm.) long	0.34 g. 0.012 oz.	0.68 g. 0.024 oz.	1.36 g. 0.048 oz.	Small broken pieces
Approx. 1.5 inches (3.8 cm.) long	0.85 g. 0.03 oz.	1.70 g. 0.06 oz.	3.40 g. 0.12 oz.	Small broken pieces
Approx. 2.25 inches (5.7 cm.) long	2.73 g. 0.10 oz.	5.45 g. 0.19 oz.	10.9 g. 0.38 oz.	Smallest size fish food

C. FEEDING FREQUENCY

The trout can be fed 2 or 3 times a day, as desired, by dividing the recommended total daily amount into halves or thirds and feeding the portions as appropriate. The trout will seem "hungry" all the time. Remember that they are wild animals, and their instinct is to eat any food presented to them, no matter how often. During the first few weeks, be vigilant to the possibility of ammonia spikes from over-feeding. Water changes (removal of ammonia) are the only solution. **It is always good to "boost" your tank with *MicrobeLift* or *Dr. Tim's One and Only* as often as once a week in amounts suggested by instructions on the bottle.**

If ammonia levels can be kept satisfactorily low, an extra daily feeding can be done in the last two weeks before release, as long as the fish continue to consume the feed completely in less than five minutes. However, be particularly vigilant against ammonia spikes at this time.

Doug Sweet, the Supervisor at the ODNR London Hatchery, who has years of experience in rearing trout has this advice:

> The 1/40 rule should be mentioned. That is, the food particle size should be 1/40th the length of the trout being fed. Too large and the trout fry cannot eat it, too small and the particles will pass through the gill arches, irritate the gills, and cause bacterial gill disease.
> It may also be beneficial here to supply the fact that trout fry are fed typically around 4% of their body weight per day in dry feed. This can

range from about 2% to 6% depending on temperature and water conditions. The lighter (lesser) feeding if water quality (ammonia, nitrites) are an issue. A table including length and weight of trout fry should be furnished if teachers wanted to calculate and weigh out an approximate ration for their fish. This rate needs to be adjusted periodically, either weekly or bi-weekly as the fish grow. (See Table C)

D. GUIDELINES FOR FEEDING DURING VACATIONS

Ideally, during vacation periods, someone should check on the tank, conduct water changes and feed the trout on a regular basis. However, this is not always possible. The following guidelines have been designed for those times when daily feeding is not possible. **AN AUTOMATIC FEEDER IS NOT RECOMMENDED.** If you enlist the assistance of security and maintenance staff to feed the fish on weekends and holidays, it is advisable to place a feeding chart near the tank to record when and how much the fish have been fed. The importance of <u>not overfeeding</u> the trout should be made clear to everyone feeding the fish during vacation periods.

<u>SHORT VACATIONS</u> (3- or 4-day weekends)

On Friday, feed less; do a normal water change. The fish can survive for more than three days without any additional food.

<u>MID-LENGTH VACATIONS</u> (7 to 10 days)

1. Trout can survive even a 10-day vacation without food or water changes..
2. In the days leading up to the vacation, feed a little less so as to minimize ammonia buildup during the holiday.
3. Do a 10-gallon water change on the day you are leaving. If possible, do a 5-gallon change in the morning and another 5-gallon change in the afternoon.
4. Watch the water temperature as you do this. Don't let the tank water temperature fluctuate more than about 5^0F (3^0C) or so.

<u>LONG VACATIONS</u> (11+ days)

1. Same preparation as for mid-length vacation.
2. Plan to have someone feed the fish halfway through the vacation, if possible, with the same amount of food provided the day just before the vacation.
3. Don't worry if no one can come to feed the fish. Trout can survive lean times.

10. RELEASING YOUR TROUT

A. INTRODUCTION

The most rewarding event of the TIC program year is the release of the fingerlings into local streams. This provides confirmation of success in maintaining a healthy environment for the trout and nurturing them well. It also can provide a direct connection between student caregivers, their fingerlings and their local watershed.

It is hard to determine the survival rates for released trout, but full grown fish have been recovered and genetically linked to trout raised in the classroom. However, in general, TIC is not a stocking program, but rather an educational program. The true value of raising and releasing trout lies in the process.

B. PREPARATIONS FOR RELEASING THE TROUT

The fingerlings need to be transferred from the tank (a 4" x 6" dip net is recommended) with some of the tank water into an aerated hard plastic cooler. Battery-operated aerators are available from Bass Pro, Cabelas and other large sporting goods stores. The cooler should be able to hold at least 10 gallons of water. When available, Trout Unlimited volunteers can help with this process. To keep the water in the cooler from warming during the trip to the stream, liter bottles of frozen dechlorinated water should be placed into the cooler with the fingerlings. This should keep the temperature in the cooler comfortable for the fingerlings for several hours. If time permits before releasing the trout, the fingerlings could be gradually acclimated by adding stream water to the cooler to reduce differences in temperature and chemistry between the water in the cooler and the stream water.

C. THE OPTIMAL RELEASE PROGRAM

The optimal release program includes the following broad areas:

1. a stream habitat study
2. a discussion of conservation issues
3. Trout Games
4. Trout Release
5. Trout Fishing Orientation

For convenience of presentation and organization for both teacher and student, particularly when several schools are participating in the same release date, it is useful to set up 5 stations, each focusing on a specific set of activities in the Optimum Release

Program. This is conceptualized as follows. (Asterisks [*] denote particularly high priority activities which should form the core of all release programs.)

Station 1 (Home Sweet Home) consists of:

* **1.** a blind comparison test of water quality in a sample of water from:
   a. the stream receiving the trout;
   b. tap water; and
   c. water from a nearby stream that does not harbor trout.
   The comparison should include tests for ammonia, nitrites, nitrates, pH, and dissolved oxygen. Teachers should record the number of students choosing each of the three options as part of a year-end program report to the TIC state coordinators.

2. measuring turbidity and the speed and volume of stream flow.

Station 2 (What's for Dinner?) consists of:

* **1.** a student survey and identification of macroinvertebrates in the stream

2. an examination of plants, insects and other critters found on or near the stream bank.

Station 3 consists of teachers'/students' choices of games relating to conservation such as Web of Life, Who's Your Daddy?, Macro Mayhem, Food Web Tag, etc.

Station 4 consists of a specialist-led discussion of conservation issues such as:

1. the factors affecting stream quality, e.g., impervious surfaces, erosion, storm drains, culverts, trash, and garbage

* **2.** the impact of people on trout.

Station 5 consists of:

1. Trout Unlimited volunteers demonstrating fly tying/casting, use of fishing gear

2. student participation in fly tying/casting practice

Although no specific Station has been designated for that activity, no Trout in the Classroom program is complete without the release of the trout. Please note that keeping count of the number of fingerlings released is a valuable part of this activity.

A naturalist-led stream walk could be both an enjoyable and instructive part of a release program. The appropriate county's Parks Department or Department of the Environment may have a naturalist on staff who could both conduct the talk (see Station 4 above) and lead such a walk if given sufficient advance notice of the opportunity to do so.

It also is recognized that time constraints may not permit the full range of activities listed in the Optimal Release Program and therefore priority should be given to the activities asterisked above.

D. EQUIPMENT NEEDED

1. For the stream habitat study:
   - **a.** a water testing kit
   - **b.** kick seine
   - **c.** hip boots
   - **d.** table and chair
   - **e.** white plastic sheet or cutting board for specimens
   - **f.** turkey baster to siphon up macroinvertebrates
   - **g.** clear bowls and specimen jars for samples
   - **h.** magnifying hand-held viewer box (Acorn Naturalists, T-2345 or equivalent), magnifying glasses, and measuring tape to set up stream flow measurements
2. For the angling demonstration:
   - **a.** rods and reels
   - **b.** lures, flies, and fly-tying equipment
3. For the trout release and count:
   - **a.** 12-oz. cups
   - **b.** 2 or 3 aquarium nets (6x4 inches)

E. SAMPLE AGENDA FOR TROUT RELEASE PROGRAM

9:15 AM - 9:45 AM:	Students arrive with fingerlings in coolers which bear school identification
9:45 AM - 10:00 AM:	Welcome and overview of day's activities
10:00 AM - 11:00 AM:	Two 25-minute sessions with 5 minutes between each
11:00 AM - 12:00 PM:	Trout releases, including time for acclimatization. This early time has been chosen to release the fingerlings into the stream in order to keep the fingerlings from becoming overstressed.
12:00 PM - 12:30 PM:	Lunch
12:30 PM - 2:00 PM:	Three 25-minute sessions with five minutes between each
2:00 PM - 2:15 PM:	Closing Ceremony including a report of the number of trout released by school; students/teachers depart
2:15 PM - 2:45 PM:	Clean up, volunteers depart

F. SAMPLE SCHEDULE FOR MULTIPLE SCHOOL PARTICIPATION IN A TROUT RELEASE PROGRAM

TIME	**Station 1:** Home Sweet Home	**Station 2:** What's for Dinner?	**Station 3:** Food Web Activity	**Station 4:** Conservation Discussion	**Station 5:** Fly tying/ casting
10:00 AM to 10:25 AM	Group A	Group B	Group C	Group D	Group E
10:30 AM to 10:55 AM	Group B	Group C	Group D	Group E	Group A
11:00 AM to 12:00 PM	**RELEASE TROUT**				
12:00 PM to 12:30 PM	**LUNCH**				
12:30 PM to 12:55 PM	Group C	Group D	Group E	Group A	Group B
1:00 PM to 1:25 PM	Group D	Group E	Group A	Group B	Group C
1:30 PM to 1:55 PM	Group E	Group A	Group B	Group C	Group D
2:00 PM to 2:15 PM	**CLOSING CEREMONY**				

11. END OF YEAR CLEAN-UP*

A. INTRODUCTION

At the end of the TIC season, it is important to clean your tank set-up to ensure success in the following year. Furthermore, if you take time to make sure that everything is clean, your equipment will last longer.

B. DIRECTIONS FOR FINAL CLEANING OF THE TANK

1. Turn off the electrical pumps, chillers, filters, etc. Empty the tank almost all the way, by your usual method. Many people like to use the gravel cleaner to do this work. Remove the gravel and finish emptying the tank.

2. Disconnect the tubing.

3. Using a solution of 1 part unscented Clorox to 100 parts water, wipe down the interior and exterior of the tank. A soft sponge (dedicated to this use only) can be used, scrubbing hard to remove scale and algae growth. Stubborn scale/algae can be scraped off by careful use of a straight-edged safety razor blade.

4. The same solution used above can now be used for cleaning out the tubing. Use long brushes which can be bought at any pet shop. (I use a bottle brush the diameter of the tubing and connect it to a piece of stiff wire so I can maneuver the brush thru the entire length of the tubing. It is a lot easier if you disconnect the tubing from the filter AquaStop valve and remove the intake tube and output nozzle)

5. Surface rinse the tank at least 5-times to remove chlorine and wipe dry with clean cloth, or let air-dry. [Surface rinse means pour water over the surface; it is not necessary to fill the aquarium for each rinse.]

6. Wash and dry the gravel by spreading it out on a cloth or towel and placing it in the sun or in a ventilated area. The gravel can also be sterilized using diluted (1/100) Clorox, but then it MUST be rinsed with tap water and completely dried.

7. Put the gravel inside the tank, cover the tank with a dust-proof cover, and store.

C. DIRECTIONS FOR FINAL CLEANING OF THE CHILLER

1. Drop-in Chiller (*TradeWind, Glacier*)

a. Using a bleach, as described above, and a dedicated sponge, wipe off the stainless steel Freon tubing. Rinse chlorox off of metal and aluminum parts immediately.

b. For hard-to-remove plaque, use a small plastic scrub brush. **Never use a wire brush on these tubes.**

c. Remove dust and lint from the fins of the coolant tubing (those black thin slats on the side of the chiller). Use a small vacuum cleaner, dusting cloth, or soft plastic bristle dust brush to do this. Your chiller will run more efficiently if you remove the lint and dust. (I use a stiff paint brush- an old one works well - and use it to loosen any dust on the fins. You can also use air in a can to blast the dust away after loosening it. This compressed air is often sold for cleaning electrical components such as computer keyboards)

D. DIRECTIONS FOR FINAL CLEANING OF THE FILTER (we use Fluval filters)

1. Take apart the filter and scrub the plastic parts clean with a 1:10 bleach solution or 1:5 vinegar solution as described above. (See above for directions for cleaning hoses/tubing)

2. Discard charcoal and White Diamond ammonia absorbent. Scrub the ceramic cylinders (we use BioMax) free of all debris. This year's foam filters may be used for the following year if they are thoroughly cleaned. Alternatively,they can be replace with 4 new foam filters.

3. Thoroughly air-dry entire filter apparatus.

4. When all components are dry, re-assemble the filter and store inside the tank.

*modified from Chuck Dingle, Maryland Chapter of TU

12. WHAT SHOULD I DO IF…?

EGGS AND HATCHING

How should I assemble the breeder box (hatching basket)?
The breeder box is designed to protect eggs and very young fish from physical harm. The plastic frame should be secure and free of sharp edges or scrap plastic. The net should be free of holes or damage. The manufacturer designed the net to be placed around the outside of the plastic frame. However, a safer environment for the eggs and hatchlings is achieved by placing the net inside the breeder box and securing it at each corner with needle and thread, aquarium sealant, or twist ties. The net can be loose, but should not float up as this could let the eggs fall out of the breeder box.

When should the trout be allowed out of the breeder box?
It is generally agreed that trout should remain in the breeder box as long as possible, even after some start to jump out on their own. Once all the trout are able to swim freely and have been feeding actively for a week or two, they are likely to be strong enough to navigate the currents of the tank and can be released into the tank.

How do I let the trout out of the breeder box when it is time?
The breeder box may be gently removed from the sides of the tank and lowered slowly to the bottom. The trout can swim out from there. This allows some trout to remain protected in the breeder box for a few more days. Tip the basket very gently to remove any lingering fish before removing it from the tank. Placing a Bio-Max media filter bag on the filter and chiller intakes will ensure that small fish are not suctioned into these units.

Some of my hatched fish are not eating. Some of my fish are deformed. Is this normal?
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. 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 tank environment.

What do I do with my eggs or fish in an emergency?
In an emergency, eggs can be preserved by placing the breeder box in a container of de-chlorinated water and putting the container holding the eggs into a cooler containing one or more ice packs. Use a thermometer to carefully manage the amount of ice or ice packs needed to keep the eggs around 50°F (10°C). **Do not add ice directly to the eggs.** Place the ice around the outside of the egg container. Ice water may be dirty and the rapid melting from immersion would cause sudden temperature changes that might do the eggs more harm than good.

With fish, particularly large fish, the only option in an emergency is to add previously prepared plastic bottles of frozen water which have been externally washed with de-chlorinated tank water. Do not fill these plastic containers to the top with water before freezing since water expands in the frozen state and will push off the top of the container as it freezes. Alternative strategies include the use of clean ice packs or sealed plastic bags of regular ice. It is possible to regulate temperature by adding or taking away ice in this way. Do not add tap water ice cubes directly to the tank. This ice probably has chlorine in it, which can harm the fish. Tank-water ice cubes can be prepared and stored for these emergencies. If the tank itself is not useable, a clean 5-gallon bucket can hold fish in an emergency.

Can I keep eggs or fish in a household refrigerator?
No. Refrigerators are not an acceptable substitute for the tank environment. Because most refrigerators operate between 35^0F and 40^0F, they are far colder than the tank.

My eggs have hatched. What should I do with the egg shells?
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, remove them.

What do I do with dead eggs or dead fish?
Remove dead eggs, dead fish, and decaying waste matter (*e.g.*discarded food) as soon as possible with a turkey baster or suction hose. Do so at least once a day, and even more often during critical periods or as needed. This process alone is very important in keeping the remaining fish alive. Poor cleaning is very often the root cause of excessive fish death.

Why are so many of my eggs or fish dying?
Death is a natural part of fish development. Everyone should expect to lose eggs and fish. The exact survival rate is highly variable and based on many factors. A sudden spike in mortality can indicate a tank problem. It is also worth noting that there are two naturally high-mortality periods: first during the egg stage and then again when the trout first learn to feed. Some fish never learn to feed and simply starve.

What is a normal death rate?
Death rates are different from one stage to the next. With green eggs, a large percentage is expected to die. With eyed eggs (as you will receive them), a higher survival rate is expected. The loss of most of your eyed eggs does suggest a problem. As the fish hatch, and age further, survival rates should improve. By the time fish are free swimming and have learned to eat, death should be an uncommon event. Losing many free swimming fish, above all else, is a sign that the tank environment is not healthy. As they grow, fish produce more waste, so cleaning and water changes may be needed more often.

FISH

My alevin are very active and are pushing other fish into the corners of the basket. What does this behavior suggest? Should I be feeding them more?

This is normal activity. In this stage, young trout prefer dark corners. It may help to put some screen material over the breeder box to reduce the amount of light these fish are exposed to. UV light can be harmful to eggs and alevin. Fish at this age do not need food at all. When beginning to feed, after the alevin stage, start with small amounts as recommended in Section 9.

Trout are being sucked into the filter. How can I prevent this?
Use BioMax media bags over filter intake.

How sensitive are the fish to temperature changes?
For best results, the tank water temperature for trout should be maintained as close as possible to 52°F (11°C). Fish can handle small fluctuations of one or two degrees, but sudden changes of almost any scale will be stressful. Rapid changes of 5^0F (3^0C) or more are a serious threat to trout survival.

What should I do if all the fish are lethargic, unmoving at the bottom of the tank, gasping for oxygen at the top of the tank, or don't respond to food?
Do a 20% (10-gallon) water change.

Why are my fish or eggs dying at an abnormally high rate?
Poor water quality, as a result of insufficient cleaning or water changes, is among the most serious threats to fish health. It is essential that water changes of 10% per week for alevin and 20% per week for older and bigger trout be maintained, using de-chlorinated tap or well water. Other causes of fish death might be sudden pH or temperature fluctuations, lack of aeration, and chemical exposure. High ammonia concentrations can result in sudden fish death. Daily water testing will show if the tank water is experiencing continuing high ammonia concentrations. Dealing with ammonia spikes is covered under the Water Quality section below.

Most of my fish died in the first month. Is this common?
Massive fish death is commonly found in the first month. Eggs and young fish are easily stressed, putting them at greater risk of death due to fungus, changes in water quality or large swings in water temperature. It is useful to practice water changes and tank cleaning before the fish arrive and to continue this process regularly while caring for the fish.

What if I come in and many of the trout have died?

1. Remove healthy fish first and put them into into a bucket filled with the de-chlorinated water and 1 or 2 frozen bottles of ice you have prepared for emergencies.
2. Put a battery-operated aerator or tank's air stone in the bucket.
3. Add *Microbelift* to the bucket, following package instructions.
4. Turn off the chiller.
5. Remove as much water from the tank as possible (80%).
6. Leave pump and filter intake covered.
7. Clean tank with clean scrub sponge and gravel cleaner. Remove as much crud as possible.
8. Refill tank with any water available. If the available water is chlorinated, *e.g.,* tap water, use a de-chlorinating agent.
9. Turn the chiller back on.
10. Cool the water with prepared de-chlorinated ice or freeze packs externally washed with de-chlorinated water.
11. Drain the filter, clean the filter media, and replace at least one charcoal filter.
12. Add *MicrobeLift* as soon as possible.
13. Put fish back in tank.
14. The next day, add more *MicrobeLift*.

CHILLER

Does it matter where I put the chiller?
Yes. The best place to put a **drop-in chiller** is next to and level with the tank to ensure that the chiller coil can be completely submerged.

What if the chiller runs continuously?
If the chiller runs continuously, contact your TIC coordinator, as it may need more refrigerant or, in the case of a drop-in chiller, check whether dust or dirt is restricting action of the cooling fins.

What do I do if my chiller stops working?
Try to maintain water temperature by putting one or two of the previously prepared jugs of frozen water in the tank. Replace as necessary until a replacement chiller arrives.

Obtaining an Emergency Replacement Chiller
The State TIC Coordinator has a spare chiller for emergency use. Please phone Don Dean (614-260-5174) to arrange for its delivery and installation.

WATER QUALITY

Do I need to age tank water before first filling the system?
Yes, but the break-in period will age the water before fish are introduced. All other water must be aged, dechlorinated or water from the stream or lake where the fish will be released.

My tap water is discolored. Is this ok?
All water will have some color, most often a faint green or clear. Tap water that is not acceptable might appear very cloudy or may have a strong chemical smell. If this is the case, an alternate source of water should be considered.

The water in my tank is cloudy. What should I do?
Cloudy water probably indicates too much decaying matter. This may be from dead fish, leftover food, or a filtration problem. The best way to handle this problem is to:

1. **Conduct regular water changes.**
2. **Clean the tank** of all solid material.
3. **Make sure the filter is functioning** properly and that water is flowing through it.
4. **Clean filter components,** if needed, with aged or well water but do not use soap or any chemical cleaners.
5. **Replace carbon filter packs annually.**
6. **Keep reducing the amount of food** until fish consume all they are given within 10 minutes. Excess food should be removed and discarded.

How do I know if my water is safe for trout?
Most well water is acceptable for use in the tank. Tap water must be de-chlorinated to become safe for trout. This can be done by letting the tap water stand in the tank or bucket for at least 48 hours. This permits the chlorine to vaporize out of solution before use in the tank. This is called "aging" the water. Alternatively, a "tap water conditioner" can be used for rapid de-chlorination.

How should I conduct water changes? What is the right amount of water to change?
Water changes are an important part of tank maintenance to provide a healthy environment for the trout. It is best to change about 10 gallons of tank water every week, using well water or tap water that has been de-chlorinated by "aging" or by the use of a tap water conditioner. A gravel vacuum is an efficient way to clean the tank and remove water at the same time. Twice-a-week cleaning, i.e., removing 5 gallons of tank water each time, will keep the tank clean as well as generate a weekly 10-gallon water change.

Should students wash hands *before* touching tank water?

Before working in or around the tank, students' hands must be washed, thoroughly rinsed of contaminants such as soap and lotions and thoroughly dried because trout are extremely sensitive to chlorine.

Should students wash up *after* contact with tank water?
Yes. While tank water is not particularly hazardous to students, they should clean their hands with soap and warm water. Please do not use soap until all tank work is done.

What is an ammonia spike? What can I do about it?
An ammonia spike is one example of a chemical imbalance in the tank environment. These are serious threats to fish health. The tank filter and its bacterial population help reduce problems like this, but they cannot work alone. The best way to prevent any chemical imbalances in the tank is to regularly clean the tank and change the water. All debris such as food, waste, and dead fish should be removed as soon as possible. Water changes of 10 gallons per week are required and should not be skipped. There is no replacement for regular cleaning and water changes. See Appendix E for a description of the nitrogen cycle.

Can I use ammonia removal grains to prevent ammonia spikes?
They may be used only in a dire emergency if a large water change doesn't reduce the ammonia. These chemicals tie up the ammonia in the water, rendering it harmless to the fish. However, by tying up the ammonia, it deprives your biological filter (the "good" bacteria) of the food it needs to live and grow. So in the long run, while you have reduced your ammonia, you are killing off your long-term ammonia reducer (your biological filter).

POWER FAILURE

What happens if there is a power failure? How much time do I have?
It is important that the fish have as stable a water temperature as possible. Short downtimes of an hour or two probably will not harm the fish or change tank temperatures significantly. However, lost power over a weekend or worse still, a long vacation,will likely be fatal to the fish.

What should I do if the power must be turned off?
The custodians who are authorized to turn the power on and off should be informed that the trout system needs constant power. If constant power is not possible, see if you can cycle the power. This means running the chiller for two hours on, then two hours off. This is better than simply letting the tank sit all day without power. It is best to prevent any such problems and carefully maintain the tank environment. The priority in an emergency is getting the tank environment back to normal. No emergency procedure can replace the stability of a working tank.

TANK

What tools are needed for tank installation?
The only tools needed for tank installation are a screwdriver, a knife or pair of scissors, and pliers to tighten any connections if needed. You may also need 3 clean 5-gallon buckets to assist in filling the tank and for water changes. These can be purchased at any hardware store. Rinse the buckets first and then do not use these buckets for anything other than tank water.

How tight should plastic parts be?
Plastic parts need to be tightened by hand. They should be as tight as possible without risking damage.

The tubing is very hard to fit over the plastic tank parts. What should I do?
A small amount of Vaseline on the fitting may help. If tubing still doesn't fit over parts, it might help to dip the end of the tube 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. This applies pressure to the end and stretches it a small amount. Excessive force can break the tube end. Tight tubing generally will fit, but it might require some time and patience.

Is it safe to use metal tools on plastic parts?
The use of metal tools is OK when great care is taken. It is more important that parts be screwed in place in the proper position. No amount of force can replace good alignment.

What tool should I use to tighten the hose clamps?
Some hose clamps come with thumb screws that allow tightening without tools. Others only require a screw driver. Hose clamps should be tight, but should not be forced. Plastic parts could be broken with too much force.

How can I help keep a stable tank temperature?
It is important that the chiller always be on and set to the appropriate temperature of 52°F (11°C). The use of insulation will help the chiller maintain a stable temperature. When using **unchilled** de-chlorinated water in a 55-gallon tank, limit changes to 5 gallons at any one time, because unchilled water will increase the temperature in the tank.

Why is the air stone needed?
Aeration of the tank is an important part of simulating a stream environment. The stream environment is not only cold, but also constantly moving and constantly mixed with air. Because of this, it is important that filters, air stones, and the chiller pump all operate well. The pre-filters on the chiller pump, the intake on the tank filter, and the surface of the air stones should all be clean and free of debris.

Where do I position the air stone?
The air stone aeration system produces a 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.

My tank is coated with a green slime. What is this? What should I do?
Green films or slime may indicate the presence of algae. This will not necessarily hurt your trout and some teachers leave it growing. Many, however, choose to remove it, using an aquarium or other soap-free sponge or similar tool. To prevent further growth of algae, limit the amount of light entering the tank (See Section 3, section A.3 for instructions on providing a proper lighting environment for the trout).

Should I get a lid for my tank?
Yes, it is better to cover the tank with some material to prevent objects from falling in, trout jumping out and to provide the reduced light levels that fish prefer. (See Section 3, Section A.3 for instructions on preparing a lid for the tank.) Purchased tank lids can also work, but it is important not to use the light feature if provided in the purchased lid.

Does my tank need insulation?
Many tank systems have worked without insulation. However, insulation will provide a darker, more stable environment for the fish. Insulation will reduce the amount of work needed to maintain the water temperature, save electricity and limit the amount of time the chiller will be operational (See Section 3, Section A.3)

What kind of insulation can I use?
There are many materials which can help insulate the tank. The most popular is *Styrofoam*, available at any home repair/industrial hardware store. Two layers of bubble wrap also would make a good insulator. For best results, cover the bottom of the tank as well. Many other materials can work including plastic, wood, or cardboard (see Section 3 Section A.3 for recommended insulation).

I am using the same tank system I had last year. What do I need to do to make it ready this year?
At the beginning of each year, you should clean all parts of the tank system with warm water. Do not use soap on any part of the tank. You should also replace any disposable filter parts. (See Section 11, "End of Year Clean-Up", for more information.)

EMERGENCY INSTRUCTIONS

How can I inform custodians, or other teachers, about what to do if there is an emergency while I am away?
A written protocol for handling emergencies should be prepared by the teacher and discussed with the designated emergency back-up person(s) by the time the trout eggs have hatched. This document should include the following:

1. **Basic information about the tank set-up**
   - **a.** The tank needs a constant flow of electricity.
   - **b.** The chiller is a critical component of the tank set-up, because it keeps the temperature of the tank water at about 52°F (11°C). This is a requirement for trout survival. The chiller is located _____

2. **Instructions for keeping the trout alive under emergency conditions.** An emergency condition is either a chiller failure, i.e., tank temperature has risen to 60°F (15.5°C) or more, or a power outage.
   - **a.** The trout in this tank need cold water to survive. If possible, turn the electricity back on to restart the chiller.
   - **b.** To reduce the temperature of the water in the tank, place two or three previously prepared one-liter plastic bottles containing frozen tank water. These plastic bottles are located _____
   - **c.** With a net, located _____, remove all dead fish and uneaten food from the tank. If more than six fish are dead, do a 10-gallon water exchange.
   - **d.** Three 5-gallon buckets and a siphon, located _____, are needed for a water exchange. One bucket should be empty and the other two filled with either well water or prepared de-chlorinated tap water.
   - **e.** Siphon off two 5-gallon buckets of tank water into the empty bucket and discard the water.
   - **f.** Slowly empty one full bucket into the tank.
   - **g.** Repeat, using the other full bucket of de-chlorinated water.

3. **Contact information for help in emergencies:**

   a. Name _____

   Land Line _____

   Cell Phone _____

   b. Name _____

   Land Line _____

   Cell Phone _____

I ran out of food. What do I do?
Contact a TIC volunteer or Coordinator.

13. TEACHING AIDS

Here are some teaching aids that might help energize your students about TIC. While they are fun, they also help teach about trout.

A. TROUT COLORING FEATURES:

1. The lateral line is often marked by color.
2. Most trout have small spots.
3. Many trout never lose their parr marks—the dark, oval-shaped splotches along their bodies that can be a form of camouflage.
4. Coloring of a trout often matches their environment to some degree.
5. Males and females within a species can have different colors.
6. Colors can change over the lifetime of a trout, usually becoming more distinct and vivid as they age.
7. Trout colors become even more vivid at spawning time.

B. TROUT PICTURE RESOURCES

Behnke, Robert J. *Trout and Salmon of North America.* Illustrated by Joseph R. Tomelleri. New York: The Free Press, 2002.

Prosek, James. *Go Fish: A Fishing Journal.* New York: Stewart, Tabori & Chang, 2000.

_____. *Trout: An Illustrated History.* New York: Alfred A. Knopf, 1997.

_____. *Trout of the World.* New York: Stewart, Tabori & Chang, 2003.

James Prosek's website is www.troutsite.com.

14. POTENTIAL TIC FUNDING SOURCES

OHIO ENVIRONMENTAL EDUCATION FUND GRANTS
The OEEF provides grants at two levels. The Mini-Grant provides funds up to $5,000 for appropriate environmental education projects. Schools have used this source to purchase several TIC units as well as field trips and associated expenses related to TIC. See: http://www.epa.ohio.gov/oee/EnvironmentalEducation.aspx

OHIO DEPARTMENT OF NATURAL RESOURCES AQUATIC EDUCATION FUND.
The ODNR Division of Aquatic Education offers grants to single or multiple groups in a range of $2000-$10,000. http://www2.ohiodnr.gov/news/post/aquatic-education-grants-offered-to-increase-stewardship-and-fishing-participation

TOSHIBA AMERICA FOUNDATION GRANTS
Applications for grants under $5,000 are accepted year-round. Check the Web site for grades K-6 and 7-12 application rules. Deadline for grants over $5,000: February 1st or August 1st. The Toshiba America Foundation encourages teacher-led, K-12 classroom-based programs, projects, and activities that have the potential to improve classroom experiences in science, mathematics, and technology.

CAPTAIN PLANET FOUNDATION
The mission of the Captain Planet Foundation (CPF) is to support hands-on environmental projects for youth in grades K-12. Our objective is to encourage innovative activities that empower children around the world to work individually and collectively as environmental stewards. Through ongoing education, we believe that children can play a vital role in preserving our precious natural resources for future generations.

BEST BUY SUPPORT FOR INTERACTIVE TECHNOLOGY
The Best Buy (www.BestBuy.com) te@ch program recognizes creative uses of interactive technology in K-12 classrooms. The purpose of te@ch is to reward schools for successful interactive programs they have launched using available technology. This program has deadlines; check the website to find them. To apply, educators must first register as an applicant and identify a Best Buy store within a fifty-mile radius of the school.

TOYOTA TAPESTRY GRANTS FOR TEACHERS
Open to K-12 teachers of science residing in the United States, or U.S. territories or possessions. All middle and high school science teachers and elementary teachers who teach some science in the classroom are eligible. This program has deadlines; check the website to find them. Proposals must describe a project, including its potential impact on students, and a budget up to $10,000 (up to $2,500 for mini-grants). Environmental Education is one of their three target categories.

KIDS IN NEED TEACHER GRANTS
Kids In Need Teacher Grants provide K-12 educators with funding to provide innovative learning opportunities for their students. The SHOPA Kids In Need Foundation (KINF) helps to engage students in the learning process by supporting our most creative and important educational resource – our nation's teachers. Businesses work through KINF to sponsor classrooms.

OUTDOOR CLASSROOM GRANT PROGRAM
Lowe's Charitable and Educational Foundation, International Paper, and ***National Geographic Explorer!*** Magazine have teamed up to create an outdoor classroom grant program (TIC can be framed with stream study and release trips). The program focus is to engage students in hands-on natural science experiences and allow enrichment across the core curriculum. All K-12 public schools in the US are welcome to apply.

TARGET FIELD TRIP GRANTS
Education professionals who are employed by an accredited K-12 public, private, or charter school in the United States that maintain a 501(c)(3) or a 509(a)(1) tax-exempt status can apply for up to $1,000 for a class field trip. Educators, teachers, principals, paraprofessionals, or classified staff of these institutions must be willing and able to plan and execute a field trip that will provide a demonstrable learning experience for students. The Ohio Department of Natural Resources has also offered to support field trips. Contact Nick Jamison, Aquatic Education Coordinator at (614) 265-6310 for more information.

15. LOCAL TROUT UNLIMITED CHAPTERS – THE FIRST PLACE TO SEEK HELP

Chances are, your local chapter of Trout Unlimited was responsible for helping you get started in the Trout in the Classroom Program. They will be at your side all through the rearing process and at the release. Keep them posted on your progress or problems. They are there to help you.

Clearfork River Trout Unlimited,
Lowell (Skip) Nault, President
Email: bugmanosu@gmail.com
URL: http://www.cfrtu.org

Emerald Necklace Chapter of Trout Unlimited
Rich Bobby, President
Email: earthsong@sbcglobal.net>
URL: http://www.tu-clev.org

Madmen Chapter of Trout Unlimited
Mike Greenlee, President
Email: Mike Greenlee <mgreenlee56@gmail.com>
URL: http://tumadmen.org/

Western Reserve Chapter of Trout Unlimited
James Geary, President
Email: **jamesgeary7@yahoo.com**
URL: http://westernreservetu.com

16. NATIONAL TROUT UNLIMITED'S WEBPAGE FOR TIC – A WEALTH OF INFORMATION

Check out the National Trout Unlimited's webpage for Trout in the Classroom.
http://www.troutintheclassroom.org/
There is a wealth of information, including a thorough description of Trout in the Classroom, Teachers Lesson Plans, a Library of Resources, Web Resources, Links and FAQs

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The Ohio State Trout Unlimited Council has supplied financial support for Trout in the Classroom projects in several schools. Their support is keenly appreciated!

And a special thanks to two people who have had a huge impact on Trout and Teaching in Ohio. Perhaps no person in Ohio has done more to promote trout fishing and river restoration than **Tom Allen**. For more than 35 years he has worked on every aspect of river work for Trout Unlimited. Our special thanks and acknowledgement for his years of service! In the area of teaching, **Spencer Reames** of Benjamin Logan High School is an award winning science teacher, who, for more than 40 years has offered exceptional and tireless education in all areas from Molecular Biology to Outdoor Education. Spencer has made Trout in the Classroom a tremendous success and has influenced hundreds of students and teachers with his dedication, hard work and expansive knowledge. Our hats off to both of these gentlemen. **We dedicate this manual to them!**

Tom Allen (left) and Spencer Reames

APPENDIX A. STAGES OF TROUT GROWTH

EGG

Trout eggs have black eyes and a central line that show healthy development. Egg hatching depends on the water temperature. It should be 50 to 55 degrees F (10 to 12.5 degrees C).

ALEVIN (Al-a-vin)

Once hatched, the trout have a large yolk sac used as a food source. Can you see it in this picture? Each alevin slowly begins to develop adult trout characteristics. An alevin lives close to the gravel until it “buttons up”.

FRY

Buttoning-up occurs when alevin absorb the yolk sac and begin to feed on insects found in the water. Fry swim close to the water surface, allowing the swim bladder to fill with air and help the fry float through water.

FINGERLING AND PARR

When a fry grows to 2 to 5 inches (5 to 13 cm), it becomes a fingerling. These trout are being released at this stage into Great Seneca Creek in Germantown. When a trout develops large dark markings, it then becomes a Parr.

JUVENILE

In the natural habitat, a trout avoids predators, including wading birds and larger fish, by hiding in underwater roots and brush. As a juvenile, a trout resembles an adult but is not yet old or large enough to have babies (or spawn).

ADULT

In the adult stage, female and male Rainbow Trout spawn in autumn. Trout turn vibrant in color during spawning and then lay eggs in fish nests, or redds, in the gravel. The life cycle of the Rainbow Trout continues into the egg stage again.

APPENDIX B. TANK INSPECTION RECORD

Day of Week	**Temp.** 50-55°F (10-12.5°C)	**Mortality** Remove and count	**Water Condition** Clear? Correct Level?	**Equip-ment** Everything working?	**pH** 6.5 - 7.6	**Ammo-nia** < 0.5 ppm	**Dissolved Oxygen** 8 - 12 ppm	**Nitrates** < 40 ppm	**Nitrites** 0 ppm	**Initials of Inspectors**
Mon.			Clear ______ Level ______	Filter_______ Chiller______ Bubbler_____						
Tues.			Clear ______ Level ______	Filter_______ Chiller______ Bubbler_____						
Wed.			Clear ______ Level ______	Filter_______ Chiller______ Bubbler_____						
Thurs.			Clear ______ Level ______	Filter_______ Chiller______ Bubbler_____						
Fri.			Clear ______ Level ______	Filter_______ Chiller______ Bubbler_____						

APPENDIX C. THE NITROGEN CYCLE

(Modified document by Les Pearce of the Isle of Wight, United Kingdom)

When you first introduce fish to a new aquarium, the main problem is not the solid waste produced by the fish, it is the ammonia (NH_3) released into the water. This is very toxic to the fish. The first of our friendly bacteria to spring into action are the Nitrosomonas bacteria along with both Nitrospira and Nitrococcus bacteria and with Nitrobacters include other forms of Nitrococcus. These bacteria derive all the energy they need for growth and reproduction from converting ammonia into nitrites. They live in several places such as soil, sewage, fresh water, etc., and they thrive in places where there are high levels of nitrogen compounds. These bacteria need large amounts of energy to divide and multiply and, because of this, it takes a while for them to develop in the aquarium in such numbers as to be of use. It is, therefore, very important that you add a **biofilter**, which are the mixture of nitrifying bacteria, such as *Dr. Tim's One and Only* or *Micro Lift* and keep adding it until the ammonium levels remain low and stable.

Once your first fish are installed and begin to feed, they will produce toxic ammonia and carbon dioxide (CO_2) from their gills, and solid waste matter. Ammonia is also introduced into the aquarium by decaying matter such as solid fish waste, uneaten food, and dead plant matter. Nitrosomonas bacteria present in the water will begin to convert the ammonia into nitrites (NO_2) and, in doing this, will begin to multiply. As the numbers of Nitrosomonas and other nitrifying bacteria increase and the ammonia levels correspondingly decrease, nitrite levels in the water will rapidly start to increase.

Nitrite is almost as dangerous to fish as ammonia, and this is where the second batch of "friendly" bacteria come into action—the Nitrobacter. These microscopic rod-shaped bacteria begin to colonize the filter and feed on the nitrites (NO_2) produced by the Nitrosomonas bacteria. They convert them to nitrates (NO_3), which are far less harmful to fish and other animals. In doing this, they, too, begin to multiply their numbers until a balance is achieved.

The byproducts, then, of this cycle are the carbon dioxide exhaled by the fish and the nitrates produced by the bacteria. Both of these are used up to some degree by any aquatic plants present. The carbon dioxide is used up by the plants in the action of photosynthesis which produces oxygen back into the water, and the nitrates are consumed by the plants as fertilizer to aid their growth.

In an ideal world, there would be nothing further to say, but, because we have aquariums primarily to keep our fish, the stocking level of fish in relation to plants is almost always too high on the side of the fish. There is nothing wrong with this but it does mean that there will be more nitrates produced than the plants will need. Also, in some cases, people set up aquariums without plants or with plastic plants as decoration. This means that gradually, over a period of time, nitrates will build up in the aquarium to unacceptable levels. It is for this reason that we perform partial water changes on our aquariums at regular intervals.

As a final thought, when you clean out the filter in your tank to remove the solid wastes that build up and clog it, it is vital that you use water taken directly from the tank to do so. This is obviously best achieved at the same time as you do your partial water change, thus utilizing the old water taken from the tank to clean your filters out with. The reason for this is that the chlorine and chloramines in tap water you use to clean out your filter are deadly to the colonies of bacteria in the filter media.

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