TROUT IN THE

Classroom

HOW TO RAISE TROUT IN THE CLASSROOM

Condensed Edition

Originally produced by

With changes made by the Champlain Valley Trout Unlimited TIC Team

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Chapter 1 Overview

Trout in the Classroom
Trout in the Classroom (TIC) is an environmental education program in which students raise brook trout from eggs before releasing them in a state-approved stream. Trout in the Classroom began approximately 30 years ago, and each year thousands of classrooms across the country host active TIC projects. These programs typically result from unique local collaborations among teachers, volunteers, outdoor-oriented organizations, and government agencies.

Grade Levels
The optimal grade level is grade 3 - 6. TIC works best when it is taught "across the curriculum," that is, when teachers use TIC to foster learning in virtually all subject areas, certainly in science, mathematics, language arts, social studies, and fine art. VINS is well positioned to support teachers in implementing TIC and incorporating it into existing curriculum.

How it Works

What You Need

1. A classroom tank (55-gallon is recommended), chiller, filter, aerator, water test kits, and bacterial additives (together these cost approximately $1,200)
2. One or more committed teachers (given the expense and the learning that it takes to initiate the program, we don't encourage schools to apply for TIC unless they intend to offer the program repeatedly)
3. A supportive principal, including, after the first year, willing to allocate an annual supplies budget of approximately $100
4. LEARNING! New teachers are encouraged to attend a free daylong training workshop on an early November Saturday. Teachers are also expected to read/study this Quick Start Guide and have awareness of the 90+-page VTTIC Manual. This Web site and its frequent blog posts are intended to be further sources of support. As challenges arise–and they will!–teachers will need to do additional research, consult with others, and engage in problem-solving with colleagues and volunteers.

The Students' Role
Ideally, TIC students have a large role in—indeed, take responsibility for—tank maintenance. Experience has shown that, once trained, students as young as third graders can accurately, reliably, and conscientiously perform all water chemistry tests as well as necessary water changes. Adult supervision is, of course, desirable.

Trout Unlimited's Role
Nationally, Trout Unlimited provides extensive technical and curricular resources through the TIC Web site (www.troutintheclassroom.org) and an invaluable list of state coordinators. In Vermont, members of TU's five chapters serve as volunteers to their respective region's TIC programs. VINS is the lead facilitator for TIC in Vermont, and organizes a workshop each fall for teachers and volunteers that is also available for ongoing support and consultation.

The Role of Volunteers

Although some teachers prefer to "go it alone," all programs, especially new programs, TIC coordinators and support team members are always available to help with basic tank set-up and maintenance, participate in field trips, and collaborate with teachers in addressing water chemistry challenges. They are often willing to teach lessons on stream insects and topics such as trout anatomy, habitat, and life cycle. Some even augment the standard TIC program with fly-casting instruction or fly tying classes.

The Role of VT Fish & Wildlife

VT Fish & Wildlife provides trout eggs, offers hatchery tours, helps to determine appropriate stocking/release locations for the fish, and provides field presentations by Fish Biologists and Habitat Biologists.

Project Timeline

- Spring before the year of initiation, investigate what's involved, decide whether you want to do the program, look into possible funding sources, begin curriculum planning
- If at all possible, funds should also be secured by the end of September
- Early October, order equipment and supplies
- Early November, TIC workshop
- Early January, eggs are delivered
- Early January, get eggs
- From mid-May to mid-June, Release Day! (weather and water level permitting)
- Mid-June, clean everything and pack it away for next year

Other

The following URL provides access to the detailed TIC Project Manual, Filter and Chiller manuals, educational resources and he TIC Blog: https://vinsweb.org/trout-in-the-classroom

CVTU Contact Information

Here are the names of and contact information for the TIC volunteers.

Mark Manley, CVTU TIC Coordinator, markmanley36@gmail.com
Bob Wible, rwible1@msn.com
Richard Giard, rich.giard@gmail.com
Chuck Goller, maxvert@comcast.net
Frank Hagerty, hagertys@gmail.com
Rick Shappy, rshappy@gmat.net
Nicky Paquette, npaquett345@gmail.com
Rob Brown, rob.brown51@gmail.com

Chapter 2 Equipment for Trout in the Classroom

EQUIPMENT OWNERSHIP

Schools that purchase equipment with their funds own that equipment. When equipment is purchased by or through CVTU or one of its chapters, CVTU or the chapter retains control of TIC equipment and will reassign it should a school decide to discontinue the program. Schools are responsible for the maintenance, repair, and replacement of their equipment. Schools must also budget an annual amount, currently approximately $200, for the purchase of replacement supplies.

The first items listed can be purchased online or over the phone from ThatPetPlace (contact information below). The recommended source for the aquarium chiller is TradeWind Chillers. Their contact information is provided as well. The 55-gallon tank can be purchased at a substantial discount several times a year at PETCO. The final items (Rows 39 through 45) can be obtained from a local hardware or home improvement store.

Table 1 - Start Up Kit

TROUT IN THE CLASSROOM VTTIC START UP KIT for 2022-2023			
ITEMS TO BE PURCHASED FROM THATPETPLACE			
ITEM NUMBER	**DESCRIPTION**	**QTY**	**EXTENDED COST**
205754	Whisper 60 Aquarium Air Pump (Tetra)	1	$18.36
212520	10" Aqua Mist Add-a-Stone (Penn Plax)	1	$5.84
212445	Flexible Airline Tubing 8' length (Penn Plax)	1	$2.30
204235	Lee's Check Valve (Lee's)	1	$3.32
204233	Net Breeder (Lee's) **$7.83/ea.**	2	$15.66
209362	Battery Operated Digital Thermometer (ESU)	1	$8.97
212526	8" Net w/ Long Handle (16" length handle)	1	$6.49
268724	Shallow Creek Pebbles 5 lb. (2 bags=10 lbs. Total) **$6.31/ea.**	2	$12.62
216507	API 5-in-1 Aquarium Test Strips (25 count) **$10.06/ea.**	2	$20.12
216502	API Ammonia Test Strips (25 count) **$13.62/ea.**	2	$27.24
243555	Nite-Out II 16oz. (Eco Labs)	1	$13.84
215378	Aqua Clear 110 Filter (Hagen)	1	$84.50
253080	Lees Squeeze Bulb Ultra Gravel Vac.with on/off Valve	1	$25.33
214299	NovAqua Plus Water Conditioner 16 oz. (Kordon/Novalek)	1	$8.67
196393	Chemi-Pure 5 oz. Filter Media (carbon) (Boyd) **$6.65/ea.**	2	$13.30
274819	Dr. Tims - Ammonium Chloride Solution - 2 oz	1	$3.97
	SUB TOTAL (MERCHANDISE ONLY) **DISCOUNTED PRICING**		**$270.53**
	SHIPPING		**$15.99**
	TOTAL		**$286.52**
			NO ADDITIONAL PROMOS
	ADD THE FOLLOWING ITEM TO YOUR KIT "OPTIONAL"		
279881	**Aqueon Submersible Glass Heater -200W-Up to 75 Gal**	1	**$28.54**
	CONTACT: STEPHANIE WELSH		
	717-345-4671 or swelsh@thatpetplace.com		
ADDITIONAL SUPPLIES NEEDED (purchased locally)			
	55-gallon tank (At PETCO's periodic sales)	1	$74.99
	Five-gallon pails with lids	2	$14.96
	1"X4'X8' sheet of foam insulation (Home Depot #320821, price 10/7/19: $15.48)	2	$30.96
	Turkey baster	1	$7.99
	Clear tape	1	$6.49
	Roll duct tape	1	$8.99
	SUBTOTAL		**$144.38**
	GRAND TOTAL WITHOUT CHILLER		**$459.44**
ALL VTTIC PROGRAMS NEED A CHILLER CAPABLE OF COOLING 55 GALLONS OF WATER. ORDINARILY, WE HAVE RECOMMENDED THOSE BE PURCHASED FROM TRADE WIND CHILLERS. BECAUSE OF SUPPLY-CHAIN CHALLENGES, HOWEVER, IT MAY BE NECESSARY TO SEEK OTHER SUPPLIERS. IN ADDITION TO TRADE WIND, WE HAVE PROVIDED INFORMATION REGARDING THE GLACIER BRAND CHILLER. FINALLY, TROUT UNLIMITED TIC COORDINATORS OCCASIONALLY HAVE USED CHILLERS TO DEPLOY. YOU MAY EXPERIENCE LONG DELIVERY DELAYS.			
CHILLER FROM TRADE WIND			
	Trade Winds DI-25 1/4 hp chiller	1	**$625.00**
	SUB TOTAL (MERCHANDISE ONLY)		**$625.00**
	SHIPPING CHARGE		**$68.00**
	TRADE WINDS SUBTOTAL		**$693.00**
	Contact Hal Collier (760-233-8888 or twchillers@sbcglobal.net)		
CHILLER FROM GLACIER CORPORATION			
	Approximate cost		**$1,100**
	Contact 714-557-2826		

Table 2 – Vermont TIC Replacement Supplies

	TROUT IN THE CLASSROOM for 2022-2023		
	VT REFILL KIT# 2A		
ITEM NUMBER	**DESCRIPTION**	**QTY**	**EXTENDED COST**
216507	API 5-in-1 Aquarium Test Strips (25 count) **$10.06/ea.**	**2**	$20.12
216502	API Ammonia Test Strips (25 count) **$13.62/ea.**	**2**	$27.24
204235	Lee's Check Valve (Lee's)	**1**	$3.32
212520	10" Aqua Mist Add-a-Stone (Penn Plax)	**1**	$5.84
243555	Nite-Out II 16oz. (Eco Labs)	**1**	$13.84
214299	NovAqua Plus Water Conditioner 16 oz. (Kordon/Novalek)	**1**	$8.67
196393	Chemi-Pure 5 oz. Filter Media (carbon) (Boyd) **$6.65/ea.**	**2**	$13.30
274819	Dr. Tims - Ammonium Chloride Solution - 2 oz	**1**	$3.97
	SUBTOTAL **DISCOUNTED PRICING**		**$96.30**
	SHIPPING		**$10.99**
	TOTAL		**$107.29**
			NO ADDITIONAL PROMOS
	ADD THE FOLLOWING ITEM TO YOUR KIT "OPTIONAL"		
279881	**AQUEON SUBMERSIBLE GLASS HEATER – 200W-Up to 75 Gal.**	**1**	**$28.54**
	CONTACT: STEPHANIE WELSH		
	717-345-4671, or swelsh@thatpetplace.com		

For information about ordering from ThatPetPlace.com contact:

Stephanie Welsh
Senior Business Account Representative
ThatFishPlace/ThatPetPlace
237 Centerville Road
Lancaster, PA 17603
Phone: 717-299-5691, x1288
Local Fax: 800-786-3829
Direct Fax: 717-381-2266
e-mail: stephanie.welsh@thatpetplace.com

The CVTU program uses the DI-25 ¼ HP TradeWind drop-in chiller. To order the chiller contact:

TradeWinds Chillers
510 Corporate Drive, Suite F
Escondido, CA. 92029
760-233-8888
Hal Collier; President

Chapter 3 System Setup

For new set up click on the following link for step-by-step instructions: Tank Assembly Tutorial – Vermont Trout Unlimited Council

Helpful Tank Set Up Tips:

Clean Tank -Tanks removed from storage should be rinsed and wiped out with a diluted bleach or vinegar solution. Rinse with fresh water and dry with paper towels. This helps remove contaminants or infective agents.

Wash Gravel - Wash/rinse new gravel in a 5-gallon bucket using tap water. If this gravel was used the previous year it should have been cleaned in a diluted bleach solution when the system was placed in storage. Rinse it in tap water.

Spread the gravel evenly on the tank bottom but leave 1/4 of the bottom gravel-free to better see the accumulation of fish and food waste. Only about 1/2 inch of gravel is needed. The gravel provides about 20% of the tank's bio-filtering.

If you are reusing last year's set up:

Filter System - Make sure the foam block and BioMax has been thoroughly cleaned with vinegar/water solution and rinsed well. The foam block will require many cycles of soaking in cleaner and rinsing to remove all black material.

Check and clean the screen on the bottom of the intake tube and replace if necessary. Cover filter intake tube with mesh or nylon screening with 16 holes per inch to protect alevin and brook trout fry from being sucked into the filter.

Chiller - Clean intake (metal) grill with stiff paint or tooth brush to remove dirt and dust (check every 2 months). Be careful to avoid cutting yourself on the sharp metal fins. If dirt builds up, the compressor will overheat due to lack of air circulation, and the chiller will be damaged and may stop working.

Keep the controller unit out of sight of students. There is always a temptation to "play" with devices such as this. Changing any of the settings can lead to catastrophic loss of fish.

If your chiller stops working try turning it off for about five minutes and then turn it back on. You can also try going through the start-up sequence for the control unit. TIC volunteers may have a spare chiller. Notify them immediately of the problem and put the frozen bottles of water in the tank to help maintain the correct temperature.

Siphon Cleaning Tube Modification - To allow the siphon cleaning tube to reach the bottom of the tank without having to get your hands into 52 degree temperature water attach a 24"—36" section of flat molding, dowel, or yardstick to the plastic tube as shown. For most tanks a 26" extension is sufficient. If your tank is deeper, use a longer length. Use zip ties that are at least 11" in length to secure the molding. This technique also makes it a lot easier for students to maneuver the siphon tube when cleaning the tank bottom and gravel.

Chapter 4 Development Stages of Trout

A. EMBRYO STAGE

1. Fertilized trout eggs have black eyes and a central line that show healthy development. All the eggs will hatch over a 5-7 day period from the time the first one hatches. Hatching usually starts within a week of egg arrival.
2. The outer shell of the eggs must remain translucent. Uniform cloudiness can be okay. Some eggs will not hatch properly. Any fully opaque eggs or those with white or opaque spots will not develop and should be removed when seen (inspect them twice a day if possible). A turkey baster works well for that task. The white spots are a fungus that spreads very rapidly. Be sure to check the breeder basket before leaving school on Friday or the last day of the school week.
3. The leftover shells float to the top of the tank or the breeder box. Use the small aquarium net or turkey baster to remove them. Fish enzymes will break down any remaining shells and create foam. This is normal. Scrubbing the sides of the tank will loosen the foam. During this phase, a jelly-like fungal growth may appear. Check for it around the inside tank surfaces. Also check for fungal growth on the surfaces of the breeder box. If you find any, wipe or scrape the surfaces with a clean sponge or brush to loosen and send this growth through the tank filtration system.

B. ALEVIN STAGE (from hatching to 4-8 weeks, depending on water temperature)

1. When the embryos hatch, they have large yolk sacs that serve as their food source.
2. Look for any odd-looking trout (two-headed, three-headed, unusual heart development, etc. These odd trout usually don't survive and illustrate the principle of survival of the fittest.
3. Alevin can survive in a Petri dish for short periods and can be observed closely under a microscope or by using a hand lens.
4. Tank maintenance is simpler when the alevin are in the breeder box. Actually, **the longer the alevin can stay in the breeder basket, the longer these hatchlings have time to learn to swim to the surface to feed.**

C. SWIM-UP STAGE (AKA "First Feed") (4-6 weeks)

The timing of "first-feed" is critical in young trout. Every year the single greatest cause of trout mortality occurs when teachers and their students "miss" the swim-up stage. The signs of swim-up are subtle, and especially teachers new to raising trout may have difficulty noticing them. A further problem is that the swim-up period doesn't last long, perhaps only three or four days; and, if you don't know when this is going to take place or happen to be away from your tank when it does, you can miss it entirely.

Initially, alevin will "swim up" to inflate their air bladders—independent of the need for food. It is important to delay first-feed until the majority of fish have only a small slit of yolk visible. Research indicates that fish still have considerable yolk reserves when only a slit is present. Feeding too early is not advantageous to the fish and only creates a fouled tank environment. If you are in doubt, place a small number of fry in a clear glass beaker/jar to examine the ventral surface (belly) from below. Refer to Appendix G for photographs.

Here's a link to a YouTube video about the swim-up stage that may also be helpful: https://www.youtube.com/watch?v=0VfuBYoeb8g.

1. CVTU will provide a swim-up projection and guidance upon egg delivery so as to avoid having it occur over a weekend, school holiday or vacation. There is also a spreadsheet available at https://docs.google.com/spreadsheets/d/1OOLgzxFywgqeOuWvZikCpimgx_ncDLY8lrHp-pfeqeI/edit?gid=388097950#gid=388097950 . Open this file and read and follow the "Instructions" for Method 1.

When your eggs are delivered, the person making the delivery will tell you what the DI is as of that date. This number should be entered into the cell in Column D, "CUMULATIVE DI TO DATE," that corresponds with the date when you receive your eggs. On the day after your eggs were delivered, enter the tank's temperature in Column B, "TEMP F," in the row corresponding to the date. Then continue to enter temperature data for **every** day, including weekends and school holidays. No one expects you to go to school on the weekends to check the temperature. Simply **estimate** what it was. For example, if the tank was 46° when you left on Friday and is 44° when you come in on Monday, assume that the tank was at 45° both weekend days. Once the Cumulative Di reaches 85, remove the top and front covering during the day to expose the alevin to light. Now's the time to start paying close attention. Based on past data, we can expect approximately half the alevin to be swimming up when the DI is between 85 and 93.

1. to help you either predict or control when swim-up occurs
2. As yolk sacs disappear, some trout will start swimming to the top of the tank. The following is advice provided by the Albert Powell Hatchery manager: "It's my experience that small percentages of fish will begin to swim up continuously over a period of 3-5 days. I begin to supplement feeding when approximately 25% are up and gradually increase feed amount as the percentage increases. When you begin feeding, only spread a minuscule amount of the food near any swimming trout."
3. When you're beginning to suspect that the alevin may be ready to swim up, raise the water temperature to 52 to 55 degrees and expose the tank to light for at least half an hour a couple of times a day. See if this stimulates their swim-up behavior.
4. Once all fry are feeding eagerly, **keep them in the breeder basket for at least two more weeks.**
5. Two or three weeks after all the fry have been feeding, reposition the basket so that one side is under the surface of the water. This will allow the more adventurous fry to swim out into the main tank.
6. After the vast majority of fish have left the comforts of the breeder basket, you may unhook the basket and lower it gently to the bottom of the tank.
7. Continue to add Nite-Out II to your tank as often as once a week according to directions in Appendix E.
5. Once all the fish have left the breeder basket, you can remove it from the tank. At this time, you can also remove the front foam insulation during the school day.

D. FRY STAGE (6-8 weeks)

Some trout never learn to feed and will die. These non-feeding fish are called "pinheads" (big heads, skinny bodies). These trout should be removed. They will not develop. Most TIC classrooms see a mortality spike due to pinheads. It is quite normal.

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

1. When a fry grows to 2 inches it becomes a fingerling. Larger fingerlings will develop dark vertical stripes known as parr marks that serve as camouflage. At this stage they are called parr.
2. Cannibalism can and does occur. The big fish will eat smaller fish. If cannibalism becomes an issue, feed more often to assuage hunger. Large predatory fish can be separated and given "time out" by placing them back in the breeder basket. See Appendix B for pictures of the developmental stages of trout.
3.

Chapter 5 Caring for the Tank

A. TANK CLEANING

This section applies mainly to tank maintenance **after** the fish leave the breeder basket**.** The most important job after the hatchlings are in place is to keep the tank system clean and the bacteria colonies growing and happy.

1. Whenever possible, do your tank work without putting your hands or those of students into the water.
2. If you need to put hands in the tank, wash hands in **de-chlorinated** water—trout are extremely sensitive to chlorine—to remove all contaminants (such as soap and lotion) and dry them thoroughly. Proper hand care when working in the tank will ensure a higher trout survival rate.
3. Remove dead and sick-looking fish from the tank immediately. Some fish may start to get lethargic or have problems swimming. Eventually, they simply float around the tank or sink to the bottom, die, and decay. Even one dead fish, if left too long, can spread disease and endanger the whole population
4. The gravel should be cleaned twice a week (e.g., Tuesday and Friday). Clean half of the gravel each of these days. During one cleaning, use the siphon to suck up fish waste and dirt from the non-gravel portion of the bottom of the tank and half of the graveled part of the tank. (See Chapter 3.B for gravel distribution in the tank.) Gravel is cleaned by moving the siphon through and under the gravel, sucking up water and fish waste trapped in and below the gravel. Use one of the 5-gallon buckets to collect the wastewater. Clean the remaining portion of the gravel in the tank during the next semi-weekly cleaning.
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. Only remove as much water as needed to clean the gravel and replace that water with water that has been treated with NovAqua Plus water conditioner. (See Appendix E for instructions.) As the fish grow, it may be necessary to increase the frequency of weekly gravel cleanings. Even though about 80% of biological activity takes place in the filter, gravel in the tank serves as part of the tank's biological filter.
7. Weekly remove the slime and dirt that accumulate on the sides of the tank, using a hand mitt, a long handled brush, or some other suitable implement. As the trout increase in size, bi-weekly cleaning of this sort may be required.
8. Weekly examine the filter intake and remove tank debris, as well as any dead or trapped fingerlings found there.

B. MAINTAINING CHEMICAL BALANCE IN THE TANK

Eighty percent or more of the biological activity of the trout tank takes place in the filter. The goal of the pre-cycling process was to "seed" the filter with bacteria that play three different roles (decomposition, nitrification, and denitrification) in maintaining a healthy water chemistry balance for trout. If this is accomplished the need for water changes is minimized. See Appendix E for proper use of additives.

High ammonia and nitrite levels indicate a lack of adequate biological nitrification. Nitrification is the biological oxidation of ammonia or ammonium to nitrite followed by the oxidation of the nitrite to nitrate. Check KH and add baking soda if required. Add 20 ml of Nite-Out II **to the filter** to increase ammonia removal. Nitrite and Nitrate are the byproducts of nitrification. Water changes are an additional method of correcting ammonia problems.

Be aware, however, that some short-term spiking of ammonia, nitrite, and nitrate readings is normal. Don't over-react and increase the size and frequency of water changes **unless an ammonia spike is accompanied by signs of fish distress**. High ammonia and nitrite levels prevent fish from absorbing oxygen through their gills, at which time the gills darken and may take on a brown color. Fish will be seen at the surface gasping for air or swimming erratically. This is the time to take remedial action by adding 20 ml of Nite-Out II and performing a water change.

The ammonia drives the nitrification process of the Nite-Out II bacteria. Because our tanks typically contain more fish than is recommended for a 55-gallon tank, some removal of fish and food waste by vacuuming the tank bottom may still be required.

At the early stages of development, only 2-3 gallon water changes may be necessary. As your fish grow, and food portions increase you may need to change about 5 gallons of tank water at a time. **The bacteria in your tank should provide the first line of defense against changes in your tank that affect water chemistry balance. Water changes are secondary to biological activity**. Allowing the bacteria to do their job will reduce your need for water changes. The log of daily water testing and the overall health of the trout will also help you determine how much water to change and when to do so.

Note: The ammonia test produces a value that consists of ammonia plus ammonium. The former is un-ionized (NH_3) the latter is ionized (NH_4^+). Ammonia is hazardous to fish and plants; ammonium is not. The test reading is a measure of the sum of both. However, it does not indicate the percent distribution of each component. Therefore, if the test yields an elevated ammonia reading but the fish show no sign of distress, it is very likely ammonium is the larger component of the reading. At lower temperatures (52^0-54^0F.) and pH between 7.0 – 7.8 the ammonium value predominates. Unless the fish show signs of distress, there is no need to panic if ammonia readings seem on the high side. At pH readings above 7.8, ammonia toxicity increases**.**

How temperature and pH affect ammonia

Ammonia varies in toxicity at different pH and temperature of the water. For example, ammonia (NH3) continually changes to ammonium (NH4+) and vice versa, with the relative concentrations of each depending on the water's temperature and pH. At higher temperatures and higher pH, more of the nitrogen is in the toxic ammonia form than at lower pH.

At what point should you get concerned about ammonia levels becoming a threat to your fish given that ammonia is constantly being produced? The answer to this question will depend on the temperature and pH of your tank water, how many fish are in your tank, and how much uneaten fish food remains in the system.

This chart identifies the level of ammonia you can tolerate in your fish tank before it affects the fish. You will notice that at very warm water temperatures a small amount of ammonia can be

toxic to your fish. At the opposite end of the spectrum in very cold water, the opposite is true. Fish can tolerate higher levels of ammonia the cooler the water. This is also true for dissolved oxygen. Cold water can store more dissolved oxygen than the same volume of warm water. The good news is that the water temperatures and pH levels at which our trout are raised tend to reduce the effect of harmful ammonia. If you encounter an ammonia spike that is causing fish mortality you may try lowering the water temperature 2-4 degrees to see if the fish start to recover. (Example: 10° C = 50° F. At pH of 7.6, the ammonia test reading would have to exceed 2.8 ppm (interpolate between 3.2 ppm and 2.4 ppm) before it became significant.)

Total Ammonia Nitrogen (TAN) - ppm
Use this table to find out when ammonia levels will start to become toxic to your fish

Temp (°C)	pH										
	6.0	6.4	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4
4	200	67	29	18	11	7.1	4.4	2.8	1.8	1.1	0.68
8	100	50	20	13	8.0	5.1	3.2	2.0	1.3	0.83	0.5
12	100	40	14	9.5	5.9	3.7	2.4	1.5	0.95	.61	0.36
16	67	29	11	6.9	4.4	2.7	1.8	1.1	0.71	0.45	0.27
20	50	20	8.0	5.1	3.2	2.1	1.3	0.83	0.53	0.34	0.21
24	40	15	6.1	3.9	2.4	1.5	0.98	0.63	0.4	0.26	0.16
28	29	12	4.7	2.9	1.8	1.2	0.75	0.48	0.31	0.2	0.12
32	22	8.7	3.5	2.2	1.4	0.89	0.57	0.37	0.24	0.16	0.1

1. Water changes should be performed as needed. The best way to remove water from the tank is by siphoning because this also removes excess waste. In an emergency, an alternative to siphoning is to use a clean gallon jug to scoop water out of the tank. Remember, the jug and the hands of those dipping the jug should be clean and chlorine-free.
2. Fill a clean 5-gallon plastic bucket with tap water equal to half the amount of water to be removed from the tank. Add the appropriate amount of NovAqua Plus water conditioner to de-chlorinate (and remove harmful heavy metals from) the water being added. Then add the remaining half of the water being removed. One ml. treats 2 gallons of water. Slowly add the de-chlorinated water to the tank. When done twice a week, this procedure achieves a weekly routine water change that helps keep trout mortality low.
3. If the fish appear stressed or start dying in large numbers, it is possible your tank is experiencing an ammonia spike due to a lack of adequate nitrification. Check the ammonia level. If high, assure KH levels are correct, and then add 20 ml Nite-Out II to increase biological ammonia removal. Contact your TIC volunteer for assistance. Correcting the problem may require a large water change, but it is best to proceed with this only after receiving advice.

4. Always keep two or more 1- or 2-liter bottles of de-chlorinated water in the freezer to maintain the tank water at 52° F in case of a temperature spike caused by a chiller or power failure. The outer surface of these bottles must be cleaned and then rinsed with de-chlorinated water before freezing.
5. When convenient or necessary, water changing may be combined with tank cleaning. As fish grow and feed rates are increased ammonia production is also increased. Since the nitrification process is critical to fish survival always control essential KH levels and add Nite-Out II when ammonia levels increase.

C. CHILLER MAINTENANCE

Once a month, check the chiller intake cooling fins for lint and dust. If necessary, dislodge the dust with a stiff paint brush or tooth brush and use a small hand vacuum to collect the dust. A build-up of dust can cause the compressor to overheat and fail.

D. CHECK LIST

Daily

1. Check tank temperature. A temperature increase might indicate a chiller problem.
2. Once your fish are feeding, feed the trout (see Chapter 8 for feeding guidelines).
3. Remove dead fish or debris from the tank.
4. Update data records based on recent water testing and observational reports.
5. Ensure that (a) water is flowing from the filter, (b) no fry are caught at the intake points, and (c) the air stone is working properly.
6. Check the filter and the air pump hose connections to ensure there are no leaks.

Two or three times a week

1. Test water chemistry (pH, ammonia, nitrites, and nitrates) and record the readings on a Log Sheet (see Tank Inspection Record, Appendix C). Daily testing encourages participation by more students and is optimal from the standpoint of trout health. (In the early stages of the TIC process, especially before your fish have begun to feed, water chemistry *should* be stable. If that's the case, you can, if you want, reduce the frequency of your water testing regimen.)
2. Clean/siphon gravel as instructed above. Persistently high ammonia or nitrite levels may indicate the need for more frequent or more thorough gravel cleaning.

Weekly

1. Conduct the KH test and record the readings in the log. If KH has dropped to 100 or below, use baking soda to raise it. (See Appendix F for instructions on how to use baking soda to correct low KH.)

F. REPAIR AND REPLACEMENT OF TIC EQUIPMENT

Regardless of how obtained, each school is responsible for the care, maintenance and replacement of its TIC equipment.

Although the reliability of chillers is high, eventually failures may occur. CVTUwill try to provide a spare unit within 24 hours of a notice of failure if one is available. If the broken unit is no longer under warranty, two options exist. (1) Replace with a new chiller. (2) Refurbish the unit. After consulting the manufacturer, CVTU will recommend whether the unit should be discarded or refurbished. Refurbishing costs vary with the condition of the unit. To refurbish a unit that is out of warranty, the school pays for shipping both ways. CVTU may offer to take over and pay for refurbishing the broken chiller to use as a spare.

Very few failures have been experienced with fish tanks if carefully maintained, handled, and stored. It is difficult to repair a leaking tank so it is best to replace the tank with a new one.

Chapter 6 Water Testing

INTRODUCTION

Maintaining safe water chemistry levels is critical for trout health. Because we recommend that students do all or most of the water testing and maintain data records, water testing also becomes a great learning opportunity as it takes students inside the exciting world of the chemistry that is so important to the wellbeing of our fish.

TIC teachers and their students have to be concerned about six chemical compounds: carbonate hardness (KH), general hardness (GH), pH, ammonia, nitrite, and nitrate.

ABOUT THE COMPOUNDS WE TEST FOR

<u>pH and Carbonate Hardness (KH)</u>

1. pH is a number reflecting to what extent water in the tank is acidic, alkaline, or neutral. A pH level of 7.0 to 7.6 is desirable. Trout will survive outside this pH range, but high pH increases ammonia toxicity. A lower pH will also cause a slowing down of bacteria reproduction. Below a pH value of 5.5, nitrification ceases. Do not use solutions or additives that are sold to raise or lower pH without consulting a TIC volunteer. These additives mask problems and often result in pH fluctuations that cause fish stress or even mortality.
2. KH or carbonate hardness (sometimes called *alkalinity*) is a measure of carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-) ion concentrations dissolved in the water. KH levels determine the capacity known as *buffering* to keep the pH stable. KH is essential to the nitrification process. The process requires 7.1 pounds of KH alkalinity for every pound of ammonia removed. If adequate KH is not present, the nitrification process will stop due to the loss of all bacteria and cannot be restarted. KH minerals are present in municipal, well, and bottled spring water. The level of carbonate hardness in tap and bottled water depends on the source of the water and the treatment processes it has undergone. Tank water with a low KH level (50 ppm or less) tends to be acidic and can cause rapid pH shifts if not monitored carefully. **An initial KH reading of 150 and a maintenance reading of 100 is recommended.**

<u>Ammonia, Nitrite, and Nitrate</u>

To different degrees, excessively high levels of these three compounds are dangerous for trout. Ammonia and nitrite are, without question, the most dangerous. High nitrate levels are not desirable, but fish can often survive them.

An ammonia level below 1 ppm is recommended. Ammonia levels in an aquarium are controlled biologically by nitrifying microorganisms. pH and KH levels are critical to the nitrification process, and to ammonia toxicity. Correct KH levels at the first sign of ammonia increase, adjust pH, and add Nite-out II (nitrifying microorganisms) to deal with ammonia issues. **Water changes should be considered a secondary method of correcting ammonia problems.**

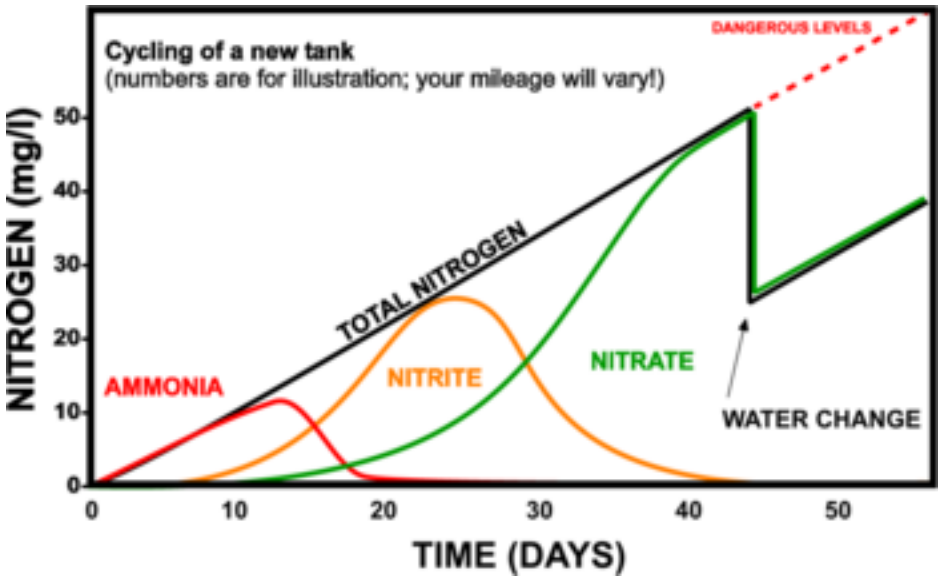
THE NITROGEN CYCLE

If you have engaged in the pre-cycling process, your tank will have fully gone through the nitrogen cycle before you got your eggs. Otherwise, changes in the water chemistry of your tank should conform to the classic nitrogen cycle described below. (Unfortunately, experience has taught us that not all tanks follow the classic patterns.)

The classic nitrogen cycle looks like this:

- Readings for ammonia, nitrite, and nitrate are all at zero when you add eggs to the tank. They stay low for a period after your eggs have hatched. (Pre-cycled tanks will typically have somewhat elevated nitrate levels when the eggs arrive.)
- In tanks that have not been pre-cycled, when fish start feeding and producing waste, ammonia rises, but nitrite and nitrate stay low.
- Eventually nitrite begins to rise and, with that, ammonia starts to drop.
- Then nitrate begins to rise, and gradually nitrite goes down. At this point, it is said that your tank "has cycled." That's an important milestone. From that point forward, it should be possible to control nitrate levels through periodic partial water changes. (In pre-cycled tanks, nitrate should be the only compound that needs to be managed; ammonia and nitrite should remain at or near zero.)

Here's what the "classic" nitrogen cycle looks like.



If your tank has cycled in this way either before you get your eggs or after, you and your students should celebrate! If your water chemistry doesn't follow the hoped for pattern—as many tanks won't—don't despair. Every year lots of tanks follow other patterns and nonetheless have successful TIC seasons.

DIRECTIONS FOR USING TEST STRIP KITS

1. Two test strip kits are required. One kit is the API 5-in-1 Aquarium Test Strips and tests for acidity (pH), nitrites (NO2), nitrates (NO3), carbonate hardness (KH) and general hardness (GH). The other kit is the API Ammonia Test Strips and tests for ammonia (NH3/NH4).

2. Rather than having students test water in the tank, **have them use the turkey baster to fill a clean beaker** or other clean container with tank water and use this to perform the water tests. This keeps their hands out of the water and prevents residual solutions from getting into the tank.
3. Keep a daily log of test results. This information can help identify causes of fish mortality and also serves as "real" data for students to graph. (And will benefit future TIC practitioners when you submit your data to the state coordinator, who will aggregate them in the spring and study the statewide data for patterns that might reveal ways to improve practice.) The spreadsheet for TIC record keeping can be found in Appendix C.
4. Caution must be taken when handling these kits to keep any moisture from contaminating the unused strips. Make sure fingers and hands are completely dry before opening the kit tubes holding the test strips.
5. Test water three times a week during the pre-cycling process. Then, from the time the eggs arrive until fry start to feed, perform one test a week from each kit. From the start of feeding until release day, perform two tests from each kit every week. However, there may be times when water quality or fish health issues indicate more frequent testing of some of these parameters. For example, if ammonia levels increase, check KH levels at once as KH is essential to the nitrification process. **Don't forget to chart all your readings**.

Testing Procedures

A. API 5-in-1 Aquarium Test Strips (pH, Nitrite, Nitrate, KH, and GH

1. Using the baster, remove some water from the tank and put it into a clean beaker.
2. With dry fingers, open cap of test strip container tube and remove one strip. Close cap tightly.
3. Find color comparison chart on side of container tube.
4. Dip strip into the beaker of tank water.
5. Swirl two times.
6. Remove and hold level with pads facing up.
7. DO NOT SHAKE WATER OFF!
8. Hold strip as indicated on tube side, so alignment of strip pads to comparison chart is correct.
9. Compare to color chart.
10. Immediately read KH and GH.
11. Wait 30 seconds and then read pH, Nitrite, and Nitrate.
12. Document results.
13. Discard test strip.

B. Ammonia Test Strips

1. With dry fingers, open cap of test strip container and remove one strip. Close cap tightly.
2. Find color comparison chart on side of container tube.
3. Dip strip into the beaker of tank water for 5 seconds.
4. Remove and hold strip level with pads up for 60 seconds.
5. DO NOT SHAKE WATER OFF!
6. Hold strip as indicated on tube side, so alignment of strip pads to comparison chart is correct.
7. Compare to color chart.
8. Document results.
9. Discard test strip.

Chapter 7 Feeding the Trout Routinely and During Vacations

A. INTRODUCTION

The routine feeding guidelines below are based on an estimate of 125-145 fish per tank and the kind of measuring spoons used in cooking**.** Measurement is always a level amount, the excess in the spoon removed by running a straight edge across the top of the spoon. Please feed only the amount of food that the trout will consume in five minutes. For the first couple of days, feed once a day. After that, follow the guidelines in **B**. below. Effective 2015 only size 0 food is provided by the hatchery. This midsize food is appropriate for all size fish until they are released. Store food in a cool, dry location. **DO NOT REFRIGERATE**

B. ROUTINE FEEDING GUIDELINES (See FIRST FEED Guidance Chapter 5, Section C and Appendix G BEFORE feeding fish!)

Begin feeding when eggs sacs are absorbed and the alevin begin to swim to the top of the breeder basket. At this stage, it is best to keep the fish in the breeder basket rather than give them access to the entire tank.

Age/Size of Fish	**Amount/Size of Food**
From week 1 to week 3	pinch of size 0 food
From 3 weeks to 1 inch long	¼ + ⅛ tsp. size 0 food
From 1 inch to 1.5 inches long	¾ teaspoon of size 0 food

From 1.5 inches to 2 inches long	1½ tsp. of size 0 food
From 2 inches plus long	2¼ tsp. of size 0 food

1. Feeding Quantities. At each age/size of the trout, the amount of food provided per day should start with the amount shown in table above and gradually be increased so that the size of the trout and the amount of food called for in the table reach the next stage at about the same time. For example, midway between the 1 inch stage and the 1½ inch stage you can be feeding a total of ½ teaspoon per tank daily, i.e., ¼ tsp. in the morning and ¼ tsp. in the afternoon. Since these measurements are not the product of hard science, you always need to factor in common sense. Use your best judgment based on the number, age, and size of the fish in your tank and any water quality issues you may be experiencing.

2. Feeding Frequency. The trout can be fed up to five times a day by dividing the recommended total daily amount by the number of feedings you plan to administer 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. It is important to **remove all food that is uneaten after five minutes** (scoop out with your net or suck out with the baster). During the first few weeks, be vigilant to the possibility of ammonia spikes from over-feeding. If water tests and fish health indicate excess ammonia, add more Nite-Out II or increase the number of water changes. Reduce the amount of food until tank conditions stabilize.

C. FEEDING GUIDELINES DURING VACATIONS

Ideally, during vacation periods, someone should check 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 enlisting 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 for them to record when and how much the fish have been fed. The importance of not overfeeding the trout should be made clear to everyone feeding the fish during vacation periods. If fish are fed during mid-length or long vacation periods, water changes and gravel cleaning to remove fish waste may also be required. Persons providing assistance should be instructed how to perform these procedures per instructions in Chapter 6.

1. Short Vacations (3- or 4-day weekends)

On the day before a short vacation, feed less; change water as necessary. Three days without additional food is not a threat to fish health.

2. Mid-length Vacations (7 to 10 days)

Trout can survive a 10-day vacation without food or water changes.

a. On the days leading up to the vacation, feed a little less to minimize ammonia buildup during the holiday.

b. If indicated, change as much as ten gallons of water on the day before leaving. For such a large water change, if possible do a 5-gallon change in the morning and another 5-gallon change in the afternoon. Watch the water temperature as you do this. If necessary, use your bottles of frozen de-chlorinated water to keep the tank temperature

below 57^0 F until the chiller cools the tank to its normal 52^0 F. **Also be sure to add Nite-Out II.**

3. Long Vacations (11+ days)

a. Same preparation as for a mid-length vacation. 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.

b. Bear in mind that feeding the fish will result in the need to remove fish waste by siphoning the gravel and replacing de-chlorinated water removed from the tank during that process.

c. Don't worry if no one can come to feed the fish. Trout can survive lean times. They are more at risk from poor water quality than starvation.

Chapter 8 Releasing the Trout

A. INTRODUCTION

The most rewarding event of the TIC year is the field trip to release the fingerlings into local streams. Placing these young trout into their natural environment confirms student success in creating a healthy and nurturing home for the fertilized eggs and hatchlings—a microcosm of the natural world.

It is hard to determine survival rates for released fingerlings but full-grown trout have been recovered and genetically linked to those raised in the classroom. However, VTTIC is not a stocking program; it is an **environmental education program** promoting cold-water conservation. The true value of VTTIC is that young people become aware of the importance of keeping our streams, rivers, and lakes as clean as they have kept the water in their classroom tanks.

B. PREPARATIONS FOR RELEASING THE TROUT (see Section **G, 1, a** for equipment needed for these activities)

1. Extra Feeding Before Release

If ammonia levels can be kept satisfactorily low, extra daily feeding can be done for the last two weeks before release, as long as the fish continue to consume the food completely in less than five minutes. However, be particularly vigilant against ammonia spikes at this time**. Add Nite-Out II to control ammonia if feed rates are increased**.

2. On Day of Release

a. Before transferring trout for transport to the release site, reduce the water in the tank by around 50% to make it easier to capture the fingerlings. Turn off air pump, chiller, and filter. Place some of that water into the 10 gallon (or larger) aerated hard plastic cooler to carry fingerlings to the release site.

b. Teachers and students should transfer the fingerlings into the cooler with an aquarium net. VTTIC volunteers may be able to help first- or second-year VTTIC teachers with such preparation activities.

c. If possible, try to keep the cooler well-oxygenated with a battery-operated aerator available from Bass Pro or other sporting goods stores.

d. Place bottles of frozen de-chlorinated water into the cooler with the fingerlings to keep the water in the cooler from warming up during the trip to the stream and until release.

e. If possible, the fingerlings should be gradually acclimated to the stream by adding stream water to the cooler. That would reduce the temperature and chemical differences between the water in the cooler and the stream.

C. AN EXAMPLE OF A GREAT RELEASE DAY PROGRAM

Your plans for Release Day should be based on several considerations:

- How much field work have your students been able to do over the year?
- How accessible is stream that will support brook trout?
- Can you arrange needed transportation?
- How many volunteers can you recruit?

In most cases, a great Release Day program includes activities like the following:

- A stream habitat study consisting of:
    a. Assessing water chemistry and the physical characteristics of the stream; and
    b. Collecting and identifying stream macro-invertebrates and other critters
- A discussion of conservation issues
- Trout Games
- Fly casting or fly tying experience
- Trout Release

To implement the above optimal release program, it is useful to set up 5 activity stations with a maximum of 12 students rotating through a station at any one time, plus a trout release station involving the entire student group. Capping the number of students at 12 for each activity station (except the trout release event) promotes full participation in the activity. Thus, the optimum number of students at a release program is 60 at any one time.

In the Optimal Release Program conceptualized below, asterisks [*] denote particularly high priority activities. They comprise the core of the release program.

D. THE STATIONS

Station 1 (Home Sweet Home) consists of:

*A blind comparison test of the water parameters in a sample of water from:

a. the stream receiving the trout;
b. water from the fingerling cooler; and
c. a nearby stream that is not approved for releasing the trout.

The water parameters should include a measurement of water temperature and tests for ammonia, nitrites and pH. A test for dissolved oxygen (DO) is optional. In addition, it would be valuable for the students to visually estimate the turbidity of the stream water and to measure stream speed.

(See section **G, 1, b** and **G, 1, c** for needed equipment.)

***Station 2** (What's for Dinner?) consists of a student survey of the macro-invertebrates in the stream and an examination of plants, insects and other critters found on or near the stream bank. (See section **G, 2** for needed equipment and **Appendix G** for potential sources of volunteer expertise to assist this activity.)

Station 3 Teacher-organized games relating to conservation such as Web of Life, Who's Your Daddy?, Macro Mayhem, Food Web Tag, Geo Caching, etc.

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

a. the factors affecting stream quality, e.g., impervious surfaces, erosion, storm drains, culverts,

trash, and garbage
b. the impact of people on trout.
c. how nature produces the effects of the chiller, aerator, and filter used in the tank.

A naturalist-led stream walk could be both an enjoyable and instructive part of a release program. State or local organizations or agencies may have a staff naturalist who could lead such a walk if given sufficient advance notice.

Station 5 Angling Demonstration**.** Volunteers demonstrate fly tying and casting; students try casting and fly tying. (See section **G, 3** for needed equipment.)

Station 6 Releasing trout into the stream by the students**.** This station is an integral part of the TIC program for two reasons. Releasing the fingerlings provides closure to the students and reinforces the link between conditions in the tank and in the natural world that the trout will inhabit. Also, at this station, the required count is made of the number of fingerlings released so that the Vermont Department of Fish and Wildlife can get an accurate tally of yearly TIC releases by stream. (See section **G, 4** for needed equipment.)

E. SAMPLE AGENDA FOR TROUT RELEASE PROGRAM

9:15 - 9:45 AM:	Students arrive with fingerlings in coolers bearing school identification
9:45 - 10:00 AM:	Welcome and overview of day's activities
10:00 - 11:00 AM:	Two 25-minute sessions with 5 minutes between each.
	11:00 - 12:00 PM: Trout releases. This release schedule includes time for acclimating the fingerlings to the stream water.
12:00 - 12:30 PM:	Lunch
12:30 - 2:00 PM:	Three 25-minute sessions with five minutes between each session.
2:00 - 2:15 PM:	Closing Ceremony including a report of the number of trout released by school; students and teachers clean up trash and depart
2:15 - 2:45 PM:	Volunteers complete clean up and 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 D	Group E	Group A
11:00 AM to 12:00 PM	**RELEASE OF 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**				

G. EQUIPMENT NEEDED

1. For arrival at stream and water testing:
   a. for arrival
      1. 2 or 3 aquarium nets (6x4 inches)
      2. 10-gallon cooler
      3. Battery-operated aerator
      4. Bottles of frozen de-chlorinated water
   b. water testing
      1. water testing kit.
      2. 3 clean jars for the water samples
      3. digital thermometer
   c. estimated stream flow
      1. watch with second hand
      2. floating bobber or ball to indicate distance traveled in elapsed time; measuring tape to establish stream flow distance.
2. For a study of animal and plant life in the stream;
   a. kick seine
   b. hip boots (optional)
   c. table and chair
   d. white plastic sheet or cutting board for specimens
   e. turkey baster to siphon up macro-invertebrates
   f. clear bowls and specimen jars for samples
   g. magnifying hand-held viewer box (Acorn Naturalists, T-2345 or equivalent), magnifying glasses. Laminated macro ID charts available from IWLA or other sources.
3. For the angling demonstration
   a, rods and reels
   b. lures, flies, and fly-tying equipment
4. For the trout release and count
   a. 12-oz. cups to carry fingerlings to stream
   b. Small net to capture fingerlings in cooler and place into cups

Chapter 9 End of Year Clean-Up

INTRODUCTION

It is important to clean the tank set-up at the end of each year to preserve the life of your equipment and prepare for a successful following year. The directions below lead you and your students carefully through all the steps needed for a successful end of year clean-up.

A. DIRECTIONS FOR FINAL CLEANING OF THE TANK

1. The air pump, chiller, and filter should have been turned off when the fish were removed for release. Empty the tank almost all the way by your usual method. Many people like to use the siphon to do this work. Remove the gravel; a plastic or rubber dust pan can be used to scoop the gravel into a bucket for cleaning. Finish emptying the tank.
2. Disconnect and remove the filter hoses (see D, 1. below) and air pump tubing from the tank.

3. Using a solution of 1 tsp. unscented Clorox to 8 oz. water or a 2 oz. solution of white vinegar to 10 oz. water, wipe down the interior and exterior of the tank. Use a soft sponge (dedicated to this use only) and scrub hard to remove scale and algae growth. Scrape off stubborn scale/algae by careful use of a straight-edged safety razor blade.
4. Rinse the tank to remove any chlorine/vinegar and wipe dry with clean cloth or paper towels, or let air-dry.
5. Wash the gravel and dry it by spreading on a cloth or towel in the sun or a ventilated area. The gravel can also be sterilized using the Clorox or vinegar solution, but then it MUST be rinsed with tap water and completely dried.
6. Put the gravel inside the tank, cover the tank with a dust-proof cover, and store in a safe place.

B. DIRECTIONS FOR FINAL CLEANING OF <u>DROP-IN</u> CHILLERS

1. Using the bleach or vinegar solution described above and a dedicated sponge, wipe off the stainless steel chiller coil
2. For hard-to-remove plaque, use a small plastic scrub brush. Never use a wire brush on these tubes.
3. Remove dust and lint from the cooling fins on the intake side of the chiller unit. Loosen dirt with a stiff paint brush or tooth brush. Use a small portable vacuum cleaner to collect dust. The chiller will run more efficiently after removal of the lint and dust. This also protects the compressor from overheating. **NOTE:** Keep hands away from these fins, as they are sharp.

C. DIRECTIONS FOR FINAL CLEANING OF <u>FLOW-THROUGH</u> CHILLERS

The chiller has two main parts, the chiller unit (a cube about 22" on a side) and a pump or "power head," which normally sits on the floor of the tank and pumps water out of the tank, into and through the chiller, and back into the tank.

The cleaning process involves these steps (It's not as complicated as it looks):

1. Fill a five-gallon bucket with three or four gallons of water.
2. Add a quart of white vinegar to the water in the bucket.
3. Put the power head and the end of the outflow hose into the bucket.
4. Plug the power head in and run for about half an hour. This will push the vinegar-water mix through the chiller. You don't need to plug in and turn on the chiller.
5. After half an hour, unplug the power head and dispose of the vinegar-water.
6. Fill the bucket with three or four gallons of clean water.
7. Return the power head and the other end of the outflow hose to the bucket. Plug the power head back in.
8. Run for another 15" to flush out the vinegar-water residue.
9. Use an air compressor to force air through the chiller to remove the water that's still in there. You might want to do that in both directions, that is, pushing air through from the input side and then, after you've done that, pushing it in through from the output side.
10. If the tubes are grungy, it'd be good to force a rag at the end of a stiff wire through the tubing a few times (assuming that you don't have an appropriate-size brush). If the

interior of the tubing has a greenish tinge, this probably means algae has been growing in it. Then, it'd probably be best to clean the interior of the tubing twice, once with a dilute vinegar-water mixture and then with clean water.

D. DIRECTIONS FOR FINAL CLEANING OF THE AQUACLEAR FILTER

1. Unplug the power cord and remove top cover.
2. Remove BioMax, Chemi-Pure, and the foam block from the filter cavity. Discard spent Chemi-Pure. The foam block and the BioMax must be thoroughly rinsed in a bleach or vinegar cleaning solution (1 tsp. unscented Clorox to 8 oz. water or a 2 oz. solution of white vinegar to 10 oz. water) followed by a fresh water rinse. The foam block, specifically, will require many cycles of soaking in the cleaning solution and rinsing to remove all black material. (This effective cleaning will reduce transferring unwanted ammonia or nitrite generating materials to next year's tank.) Spread these materials on a towel and place in the sun or a well-ventilated area to dry.
3. Scrub the plastic parts clean, including the intake tube screen, with the bleach or vinegar cleaning solution described above.
4. Thoroughly air-dry entire filter apparatus.
5. When all components are dry, re-assemble the filter and store inside the tank. (Be careful NOT to misplace the filter "foot," the small plastic piece used to level the filter on the aquarium.)

E. DIRECTIONS FOR FINAL CLEANING OF THE FLUVAL FILTER

1. Remove the hoses (unscrew them from the connector), the intake strainer and the outflow nozzle. Clean these parts in the bleach/vinegar solution. A long-handled bottle brush will be needed to clean the hoses. Rinse all parts in fresh water.
2. The BioMax and pre-filter foam material can be discarded or used for two years, but both must be thoroughly rinsed in a bleach or vinegar solution followed by a fresh water rinse if you plan to reuse them. Spread these materials on a towel and place in the sun or a well-ventilated area to dry. Many teachers choose to discard the pre-filter foam, as this material tends to get slimy and smelly. All bags of Chemi-Pure should be discarded.
3. Scrub the plastic parts clean with the bleach or vinegar solution described above.
4. Thoroughly air-dry entire filter apparatus.
5. When all components are dry, re-assemble the filter and store inside the tank.

F. **DIGITAL THERMOMETER MAINTENANCE**

Turn off digital thermometer to conserve battery life. Remove the battery and check the battery contacts for corrosion. Place the battery and thermometer in a zip lock back for storage.

Chapter 10 FAQ

When should the trout be allowed out of the breeder basket?
It is generally agreed that trout should remain in the breeder basket as long as possible, even after some start to jump out on their own. As a general rule, the alevin should stay in the breeder box for between three and four weeks after hatching is complete. Once all the trout are able to swim freely and have been feeding actively for at least two weeks, 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 basket when it is time?
Gently remove the breeder basket from the sides of the tank and lower it slowly to the bottom. The trout can swim out from there. This allows some trout to remain protected in the breeder basket for a few more days. Tip the basket very gently to remove any lingering fish before removing it from the tank. Be sure that the filter intake is covered with a mesh bag to prevent small fish from getting suctioned into the unit.

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 in an emergency?
In an emergency, eggs can be preserved by placing the breeder box in a container of water from the tank and putting the container holding the eggs into a cooler containing de-chlorinated ice or one or more ice packs that have been washed in de-chlorinated water. Keep measuring the water temperature in the breeder box to determine the amount of ice or ice packs needed to keep the eggs around 50°F. **Do not add ice directly to the eggs.** Place the ice or ice packs around the outside of the container holding the breeder box. However, do not permit any ice or water from the melting ice to mix with water in the container holding the eggs. **Note:** Whole Foods sells ice cubes made from de-chlorinated spring water.

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 eggshells?
The discarded eggshells 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 if I find dead eggs or dead fish?
Remove dead eggs and dead fish as soon as possible using a turkey baster or siphon. Do so at least once a day, and even more often during critical periods or as needed. Remove fish waste and decaying waste matter (*e.g.* discarded food) when you clean the gravel per instructions in

Chapter 6. This process alone is very important in keeping the remaining fish alive. Poor cleaning is very often the root cause of excess 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 need to 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 eyed eggs, a high survival rate is expected because they come from the hatchery tempered and treated against fungus. The loss of most of your eyed eggs suggests a problem. In Vermont, the highest rates of mortality have occurred at or just after the swim-up stage, when fish that didn't learn to eat die as "pinheads." As the fish mature, survival rates improve. By the time fish have all learned to eat, death should be an uncommon event. Losing many free-swimming fish is, above all else, a sign that the tank environment is not healthy. As they grow, fish produce more waste, so diligent cleaning and water changes may be needed more often.

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. At this stage, young trout prefer dark corners. Putting some opaque material over the breeder box may help to reduce the amount of light these fish are exposed to. UV light can be harmful to eggs and alevin. Fish at the alevin stage do not need any food. When at the end of the alevin stage the fish begin to feed, start with small amounts. See Chapter 8 for guidelines on feeding the trout.

Trout are being sucked into the filter. How can I prevent this?
Place BioMax media bags or similar screening over the filter intake as recommended in Chapter 3.

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. Fish can handle small fluctuations of a few degrees, but sudden changes of almost any scale will be stressful. Rapid changes of 5^0 F 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?
See Emergency Instructions below.

Why are my fish or eggs dying at an abnormally high rate?
Poor water quality from insufficient cleaning or water changes is among the most serious threats to fish health. It is essential to perform de-chlorinated water changes according to the guidance in Chapter 6. Other causes of fish death might be sudden pH or temperature fluctuations, insufficient bacteria, lack of aeration, and chemical exposure. High ammonia, nitrite, or nitrate

concentrations can result in sudden fish death. Frequent water testing will show if the tank water is experiencing ammonia issues. Dealing with ammonia spikes is covered under the Water Quality section below.

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

1. Remove healthy fish first and put them into a bucket filled with de-chlorinated water and 1 or 2 bottles of frozen de-chlorinated water prepared for emergencies.
2. Put a battery-operated aerator or tank air stone into the bucket.
3. Turn off the chiller and the filter.
4. Remove as much water from the tank as possible (at least 80%).
5. Leave filter intake covered.
6. Clean tank sides by scrubbing with a clean sponge and siphon the gravel. Remove as much fish and food waste as possible.
7. Refill tank, remembering to treat the water with NovAqua Plus
8. Turn the chiller back on.
9. Cool the water to 52^0-54^0 F. with de-chlorinated ice or leak proof freeze packs externally washed with de-chlorinated water.
10. Drain the filter and clean the foam pre-filter material. Do not replace more than half of the Bio-Max or Chemi-Pure media, which is part of the tank's biological filter
11. Turn the filter back on.
12. As soon as possible, add Nite-Out II in accordance with instructions for its use. See Appendix E.
13. Put fish back in tank.

I ran out of food. What do I do?

Contact a TIC volunteer or Coordinator

<u>CHILLER</u>

What do I do if my chiller stops working?

Try to maintain water temperature by putting one or two of the previously prepared bottles of de-chlorinated frozen water in the tank. Contact your VTTIC coordinator. Continue adding plastic containers of frozen de-chlorinated water to maintain the tank water temperature at about 52^0 until a replacement chiller arrives.

Obtaining an Emergency Replacement Chiller

A spare chiller and controller may be available for emergency use. Please get in touch with your local CVTU coordinator or support member to arrange for its delivery and installation.

WATER QUALITY

Do I need to age tank water before first filling the system?
No. The tank should be filled with tap water treated with NovAqua Plus, which will remove chlorine and heavy metals.

My tap water is discolored. Is this ok?
All water will have some color. Most often the water may be colored a faint green or white. Tap water that is not acceptable appears very cloudy or has a strong chemical smell. If this is the case, an alternate source of water should be obtained.

Cloudy tank water
Cloudy tank 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 (fish and food waste) by siphoning the bottom of the tank.
3. Make sure the filter is functioning properly and that water is flowing through it.
4. Clean filter components, if needed, with de-chlorinated water but do not use soap or chemical cleaners.
5. Keep reducing the amount of food until fish consume all they are given within 5 minutes. Excess food should be removed and discarded.

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. A general rule of thumb is to change about 10 gallons of tank water every week (20% of the volume of the tank), using water de-chlorinated with NovAqua Plus. A gravel vacuum/siphon 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. However, as stated in Chapter 6, it is best to use chemical tests and the overall health of the fish to determine the size and frequency of water changes.

Should students wash hands before touching tank water?
When working in or around the tank, students must wash their hands, preferably with de-chlorinated water, and carefully rinse off contaminants such as soap and lotions because trout are extremely sensitive to chlorine and other impurities. They should also dry their hands thoroughly.

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 chemical imbalances in the tank is to clean the tank regularly and change the water. All debris such as food, waste, and dead fish should be removed **as soon as possible**. There is no substitute for regular cleaning and water changes. See Chapter 7 for a description of the nitrogen cycle and Chapter 6 for guidance on cleaning the tank and changing the water.

Can I use AmQuel Plus or ammonia removal grains to prevent ammonia spikes?
They may be used only in a dire emergency and 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). Please consult your TIC volunteer or coordinator before adding any other media to the tank or filter. If water tests indicate that ammonia levels are excessive and fish are exhibiting signs of ammonia stress a large water change is recommended. This is generally necessary only in extreme cases.

POWER FAILURE

What happens if there is a power failure? How much time do I have?
It is important for the fish to have as stable a water temperature as possible as well as proper filtration and aeration. Short downtimes of an hour or two probably will not harm the fish or change tank temperatures or other parameters significantly. However, loss of power over a weekend or even worse, over 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 tools for tank installation are: a utility knife to trim the polyethylene foam insulation board if not already provided by CVTU, scissors, a marking pen, and two clean five-gallon buckets to assist in filling the tank and for water changes. Rinse the buckets first and then do not use them for anything other than tank water

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°FLimiting water changes to 5 gallons at any one time will help tank temperature stability, because using un-chilled water in a water change will increase the water temperature in the tank.

Why is aerating the tank water necessary?
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, providing oxygen for the trout to absorb through their gills. Because of this, the filter and air stone are both important. That is why the filter intake and the surface of the air stones should all be clean and free of debris. Positioning the outflow of the filter above the water surface will also increase dissolved oxygen.

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 intake. Also avoid placing the air stone where bubbles can accumulate under the breeder basket and raise it out of the water.

My tank is coated with a green slime. What is this? What should I do?
Green films or slime probably indicates the presence of algae. This will not necessarily hurt your trout and some teachers leave it growing. However, to remove it from your tank, please see Chapter 6, Section B5 for instructions. To prevent further growth of algae, limit the amount of light entering the tank (See Chapter 3, section A, 3 for instructions on providing proper lighting for the trout.) Excess accumulation of nutrients in the tank will also cause algae growth. Periodic cleaning of the tank and the gravel will help remove algae.

Should I get a lid for my tank?
Cover the tank top with foam insulation material to prevent objects from falling in and trout from jumping out. Foam insulation drawings are found at the link in Chapter 3.

Why does my tank need insulation?
Insulation provides a darker, more stable environment for the fish. It will also reduce the amount of work needed to maintain the water temperature, save electricity, and limit the amount of time the chiller will need to run (See Chapter 3, Section A, 3)

What kind of insulation can I use?
Use one-inch thick solid core polyethylene foam to cover the top, bottom, back, front, and both ends.

I am using the same tank system I had last year. What do I need to do to make it ready this year?
Assuming that end-of-year cleanup procedures were followed (See Chapter 9), start the school year by cleaning all parts of the tank system with warm water. Do not use soap on any part of the tank. Rinse thoroughly and allow time for the parts to dry completely. Also replace the air stone and the disposable filter media.

INSTRUCTIONS FOR EMERGENCIES

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. This is a requirement for trout survival. The chiller is located _____. (fill in the correct location).

2. Instructions for keeping the trout alive under emergency conditions. The trout need cold water to survive. An emergency condition is usually a temperature spike, i.e., tank temperature has risen to 60° or more, generally caused by a power outage or, less often, a chiller failure. A massive and sudden ammonia spike can cause a major fish die-off very quickly even if all the equipment is properly operational. Rarely does a major problem arise from an aerator or filter breakdown.

a. **What to do if the chiller stops working**:

Unplug the chiller, wait five minutes, then re-plug and restart the chiller. If the problem is a power outage, a tripped circuit breaker, or some other system failure, unplugging the chiller won't help. In any case, lower the temperature of the tank water by placing two or three previously prepared one- or two-liter plastic bottles of frozen de-chlorinated water into the tank

The plastic bottles are located :_____.

With a net, located _____, remove all dead fish and uneaten food from the tank. If more than six fish are dead, do a 5-gallon water change. Two 5-gallon buckets and a siphon, located_____ are available for a water change. Siphon off 5 gallons of tank water into an empty bucket and discard. Fill a 5-gallon bucket with tap water. Treat it with NovAqua Plus according to directions on the bottle and slowly empty the un-chlorinated water into the tank.

b. **What to do if the aerator stops working**: If the pump is still working, unplug it from the outlet. Disconnect the tubing at the outflow. Blow into the tubing to see whether the airflow is restricted. If it is, disconnect the air stone and blow through the tubing again to determine whether the problem is with the air stone or the tubing. If the tubing is blocked, the problem is probably dirt in the check valve. The best solution is to keep a spare check valve handy attached to replacement tubing to connect to the air stone. Replacing the old check valve and old tubing with the spare check valve and tubing assembly makes for an easy and inexpensive solution.

c. **What to do if the pump is not working**: Disconnect the pump, wait ten minutes for it to cool or reset, and plug it in again. If the pump still doesn't work, replace it as soon as possible.

d. **What to do if all the equipment is working and more than 6 fish are dead**:

Remove dead fish and follow the procedure in 2a above to remove and replace two 5-gallon buckets of water.

Whenever a sudden fish die-off of more than 10 fish takes place, please consult CVTU TIC Coordinator and support persons on the contact list below.

3. CONTACT INFORMATION FOR HELP IN EMERGENCIES

a. Name

Land Line

Cell Phone

b. Name

Land Line

Cell Phone