TROUT IN THE CLASSROOM

HOW TO RAISE TROUT IN MARYLAND CLASSROOMS
Fifth Edition

Produced by
Trout Unlimited Mid-Atlantic Council

Edited by Chuck Dinkel

DEDICATION

This manual is dedicated to Jim Greene and Ros Bass.
As a member of Potomac-Patuxent Chapter of Trout Unlimited (PPCTU) in 2004 Jim's vision and leadership resulted in three schools in Montgomery County becoming the first in the state to participate in Trout in the Classroom (TIC). From this small beginning, the program has expanded to over 90 schools and environmental centers state –wide, today encompassing 12 counties and the District of Columbia. Since its inception Jim has tirelessly shepherded and guided its growth and direction. Serving as a role model for protecting our water shed and streams Jim has influenced thousands of students to become more enlightened stewards of the environment. Jim continues to work and excel at assisting volunteers fulfill TIC's mission. In 2013, at TU's annual meeting, Jim was the recipient of the prestigious TU Youth Education Leadership Award in recognition of his TIC accomplishments.

Over the years Ros has guided the writing and production of this manual. It is she who asks the questions that insightfully ensures the accuracy, conciseness and readability of the document. If there is anything in the manual that Ros does not understand completely odds are teachers will also struggle with it. If the writing passes the "Ros Test" it's ready for the printer. In addition, her grant writing skills were instrumental to the early success and growth of the Maryland TIC program.

Everyone who has participated in or supported TIC in a volunteer role owes a debt of gratitude to these two hardworking and conscientious individuals.

INTRODUCTION

This is the fifth edition of ***How to Raise Trout in Maryland and D.C. Classrooms.*** It updates previous versions by incorporating the additional knowledge gained from experience and new technology during the past two years.

A new chapter (Chapter 1) has been added to this edition of the manual. For the first time, the principles, policies and practices of the Mid-Atlantic Trout in the Classroom (MATIC) program have been conceptualized and articulated to share with the teachers implementing this program. We are grateful for the efforts and dedication of the family of MATIC teachers in realizing those objectives. They teach our young people to be mindful of cold water conservation and so implement the MATIC mission!

Also a new concept has been added to this manual. It is the principle of moving from a management support program model to a teacher reliant model. We feel that teachers who have been in the MATIC program for two years or more are now ready to undertake some of the tasks which have hitherto been provided by MATIC management, particularly in areas which are short of volunteers.

To facilitate the set-up of the tank and equipment Appendix E has also been added. It includes photographs and descriptive text that teachers and volunteers can use to step through this process.

This teacher's manual is intended to facilitate the work of those fine teachers as well as volunteers. We hope you find it useful.

TABLE OF CONTENTS

Table of Contents

Chapter 1 Principles, Policies and Practices

I. BACKGROUND

The Mid-Atlantic Trout in the Classroom (MATIC) program is a voluntary effort started and originally supported by the Potomac-Patuxent Chapter of Trout Unlimited (PPTU). It is part of a loose and growing national network of over 4,500 TIC programs in more than 20 states. About 40% of these TIC programs are associated with Trout Unlimited (TU). TIC began around 40 years ago in California. It expanded to other states and was introduced into New York City in 1995, where it later caught the attention of Potomac-Patuxent Trout Unlimited here in Maryland.

The MATIC program started in 2003 with 3 elementary schools in Montgomery County and has expanded to a combination of 95 elementary, middle and high schools, two colleges and 4 outdoor education centers in 10 Maryland Counties, Baltimore and the District of Columbia. Partly due to MATIC's statewide expansion, the Mid-Atlantic Council of Trout Unlimited, made up of TU chapters throughout Maryland and The District of Columbia took on stewardship of the program in 2012. This growth in MATIC has been accompanied by the development of principles, policies and practices which help to provide uniform guidance to this expanding program.

MATIC's long range vision includes helping to implement the state's education requirement for environmental literacy. Through the MATIC, teachers will promote a durable conservation ethic among their students on whom the future of our water and other natural resources depends.

THE MATIC MISSION is to introduce students to cold water conservation as the first step in becoming future protectors of and advocates for clean and healthy streams, lakes and rivers.
MATIC is essentially a cold water conservation program taught to students in a classroom. The students are provided with fertilized rainbow trout eggs which they raise in a 55-gallon tank, in water kept at optimum conditions for the eggs to hatch and grow rapidly to fingerling size. The MATIC program concludes with a release of these fish into an approved designated stream.

Here, the connection is made between the tank water which has been carefully controlled with respect to temperature, chemical balance and cleanliness and the stream receiving the trout. The students see that they have created in the classroom a microcosm of what prevails in nature.

II. PRINCIPLES

1. The MATIC program is teacher driven. Teachers, rather than school administrators, initiate applications to join the MATIC family.
2. Teachers are responsible for implementing MATIC's mission of introducing students to cold water conservation.
3. Schools own the equipment required to successfully raise the trout if it has been purchased with their funds.

4. Schools provide financial and administrative support to the program.
5. Under teacher supervision, students are responsible for carrying out all MATIC trout raising activities.
6. The release event as a yearly field trip during school hours is an integral part of the MATIC program.
7. MATIC management will facilitate the MATIC program with technical, training, advisory and other types of support.
8. Volunteers have an essential role in helping implement MATIC. Because of its mission, MATIC needs to partner with like-minded organizations that promote conservation in order to implement and enrich its program to the students.

III. POLICIES ON:

1. ADMISSION TO THE PROGRAM

Teacher initiated applications will get priority consideration for admission to the MATIC. Experience has shown that MATIC school performance and teacher commitment are better when teachers, rather than school administrators, initiate application for admission to the program. Also, fish survival rates are better. MATIC is designed for fourth grade and above. This factor is taken into consideration when determining admission to the program.

2. TEACHER TRAINING

All first year teachers must attend a free one day special session where they receive MATIC orientation, training and resource materials.

3. PROGRAM MODEL

The rapidly increasing number of schools has outstripped the capacity of MATIC management to support them. For that reason, MATIC is changing from a ***management support*** model to a ***self-reliant teacher*** model in counties where support volunteers are insufficient to provide the high level of support hitherto provided. Teachers with more than two years of MATIC experience will now be fully responsible for recruiting guest speakers and planning, organizing and conducting their own release programs in accordance with guidelines in Chapter 9 of the teacher's manual. However they will continue to receive help in emergencies and for other needs when available.

For the first two years of their participation in MATIC, each teacher will receive priority technical support and access to emergency equipment from the program's volunteer network. MATIC also will continue to promote a system by which new TIC teachers can contact designated, experienced ones for ways for help in resolving tank care problems.

4. EQUIPMENT OWNERSHIP

MATIC schools will procure the equipment and supplies listed in Chapter 2 of the teacher's manual. Schools are responsible for the maintenance, repair and replacement of their equipment. It is particularly important for schools to use the chillers and filters specified in the equipment list because MATIC management tries to keep several spare units and parts on hand for emergency use. Loaned units must be maintained to the same standard as original equipment and returned to MATIC management when asked

to do so. Equipment provided by the DNR under their Aquatic Resource Education Grant program belongs to that agency and must be returned if a school decides to no longer participate in TIC.

5. RELEASE EVENT

A yearly event to release the trout grown in the classroom is a critical part of every MATIC program. The release event provides closure to the annual school MATIC effort and illustrates the relationship between the tank and the stream. Just as the water in the tank needs to be kept clean, chemically balanced and free of pollution so should our streams, lakes and rivers. The teacher and principal of each participating facility sign a letter of intent guaranteeing the school will carry out a planned release program following the guidelines in Chapter 9 of the teacher's manual.

6. NETWORKING

Early in the development of the program, it became clear that MATIC must network with other organizations to fulfill its mission and help schools enrich their TIC programs. MATIC has reached out to TU chapters for volunteers to: (a) deliver trout eggs and food to schools,(b) conduct macro-invertebrate and other stream studies and (c) teach casting and fly tying at releases. A contact list of potential volunteers may be found in Appendix G of the teacher's manual.

7. PROGRAM GROWTH

The MATIC program has expanded considerably faster than the required increase in volunteers to service it. To avoid mismatches between volunteers and the needs of the program, MATIC has adopted a policy of limiting the number of new schools, when necessary, to those for which adequate volunteer support is available. The decision on the number of new schools will be made yearly.

8. DISCONTINUATION FROM THE PROGRAM

A school, which fails to meet its commitment to the MATIC principles, policies or practices will be discontinued from the program but can apply for readmission after a two-year interval. Where in MATIC management's opinion, special circumstances exist, a school may be placed on a year's probation instead of being immediately discontinued.

IV. PRACTICES

A. STUDENT ROLE

It is desirable for as many students as possible carry out all trout-raising activities, including water quality testing and maintenance, trout feeding, tank maintenance and year-end equipment cleanup as specified in the teacher's manual. Students are expected to maintain an up-to-date record of conditions in the tank and fish health as specified in the teacher's manual. All of these activities should be done under teacher supervision. It is hoped that students taking an active role in the care of the fish and their environment are more likely to feel more caring and responsible for trout, not only in the tank but in nature.

B. TEACHER ROLE

The MATIC teacher

1. Takes the initiative to apply to join MATIC and implement the progra in that school.
2. Obtains MATIC start-up equipment and supplies as listed in the current TIC teacher's manual. A grant for the funds needed to obtain this equipment may be submitted to a funding agency. (see chapter 12 for a list of funding agencies)
3. Using the manual, will instruct and be responsible for supervising students in the protocols for proper tank, fertilized egg and fish care.
4. Plans, organizes and carries out an annual field trip during school hours to release the school's trout fingerlings into waters approved by the Maryland Department of Natural Resources (DNR). Those teachers with two or more years of experience will recruit the volunteers required for their planned release activities. MATIC will try to provide volunteers to help first and second year teachers implement their trout release events.
5. Will, assisted by students, clean up the tank and its accessories, chiller and filter for storage until the next school year as specified in Chapter 10 of the current teacher's manual.

C. MATIC MANAGEMENT ROLE

MATIC management will supply each participating TIC facility with free fertilized rainbow trout eggs and enough food to promote healthy trout growth while the hatchlings are in the school tanks.

MATIC management will obtain from DNR and distribute to each member school permits to raise trout in classrooms and to release them at DNR-approved sites. Teachers will propose specific release sites, preferably in consultation with MATIC management, no later than the date specified in the current TIC teacher's manual or other official MATIC communication. The teacher's manual contains a list of DNR-approved trout release sites. MATIC management will apply for stocking permits for all schools. If several schools apply for a permit to stock trout in the same location on the same day, the earliest applicant will get the applicable permit.

MATIC management is also responsible for developing, updating and distributing the teacher's manual and other printed and online materials. The manual is the key compilation of best practices and procedures for successful implementation of the MATIC program.

D. VOLUNTEER ROLE

Volunteers are an essential part of the MATIC family. They may come from both within and outside the ranks of TU members. They may deliver fertilized eggs, food and permits to MATIC schools and may help in other ways, including: (a) assisting teachers in organizing students at release events, (b) helping teachers resolve problems of tank management, and (c) speaking to students on topics such as the importance of the health of our streams, lakes, and rivers to our future; how streams provide the temperature, chemical balance and cleanliness the students maintain in the tank for trout survival, and other topics relevant to the program.

E. COMMUNITY ROLE

Parental or other volunteer involvement can facilitate the TIC experience by providing assistance with release programs, tank maintenance and such activities as feeding trout during prolonged school closings. While not mandatory, such help from the parent or neighborhood community can enrich the TIC experience.

Chapter 2 Equipment for Trout in the Classroom

Table A below contains the list of equipment required to set up and maintain the Mid-Atlantic Trout in the Classroom (MATIC) program. The first 17 items listed in Table A can be purchased online from ThatFishPlace; the next 4 items may be obtained from a home improvement store; and the remaining items can be obtained from other sources. The recommended source for the Aquarium Chiller is TradeWinds Chillers.

For information about ordering from THATFISHPLACE 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

Before omitting or substituting for any of the recommended items listed in Table A, please obtain the approval of your TIC Coordinator. This approval is required before Stephanie Welsh can make any changes to the recommended setup or the replacement kit list.

The MATIC program uses the DI-25 TradeWinds drop-in chiller. This chiller is designed for 100-125 gallon tanks, thus providing a desirable safety margin for the smaller sized tanks used by the MATIC program . TIC's preference for the TradeWinds drop-in chiller is based on:

- satisfactory experience;
- convenience (less maintenance, no water pump needed);
- a 5-year warranty; and.
- availability of spare units and parts
-

To order the chiller contact:

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

TradeWinds currently provides the DI-25 chiller to TIC for $570.00 + $45.00 shipping, a total price of $620. The unit is warranted for 5 years when used for TIC.

TABLE A: MATIC COMPLETE EQUIPMENT LIST

Item	First Year Set-Up	Annual Replacement
Items from ThatFishPlace.com		
Fluval 406 canister filter	X	
Fluval Biomax Media 17.63 oz[1]	X	X.
4 Chemi-Pure Charcoal 5-ounce containers.[7]	X	X
Whisper #40 Air Pump	X	
10-inch Aqua Mist Add-a-Stone	X	X
8 ft., 1/4-inch airline tubing	X	
Fusion Check Valve	X	X
Battery Operated Digital Thermometer	X	
Freshwater (FM) Master Testing Kit[2]	X	X
GH & KH Hardness Test Kit for fresh water[2]	X	X
Lee's Squeeze Bulb Ultra Gravel Vacuum	X	
NovAqua Plus Tap Water Conditioner	X	X
2 Microbe-Lift Special Blend 16 oz.	X	X
2 Nite-Out II 16oz.	X	X
8-inch Net w/16" Long Handle	X	
Shallow Creek Pebbles (2 bags =10 lbs)	X	
Breeder Box (Hatching Basket)	X	
Items from Home Improvement Store		
1 4'x8'x3/4" closed cell polyethylene insulation board	X	
5-Outlet Surge Protector	X	
2 5-gallon buckets with lids[3]	X	
1 Danco 1/2oz silicone grease	X	
Items from other Sources		
55-gallon tank and stand	X	
TradeWinds DL-25 1/4HP drop-in chiller	X	
2 one or two-liter bottles	X	
Plastic turkey baster	X	
2 1-gallon plastic milk jugs[4]	X	
Measuring spoon set with 1/4 tsp[5]	X	
Plastic eye dropper[6]	X	
8 oz box of baking soda	X	X
Cooler for transporting fingerlings (min. 10 gallons)[7]		
Aerator for Cooler (12 volt DC plug-in & battery)[7]		

- See Appendix A for lists of the set-up and replacement parts with their respective order numbers and cost figures. Refer to these tables to check receipt of orders and supplies and as a guide to reordering.

Footnotes for Table A

[1] The Biomax can last more than one year if thoroughly washed at the end of the year cleanup.

[2] The water test kits claim to have a shelf life of 3 years. However, if used regularly these kits will not last more than two years.

[3] The 5-gallon buckets are for water changes and transporting fish.

[4] Cut off top of jug, leaving handle intact and use to remove water from tank.

[5] The measuring spoons are used to measure out fish food

[6] The plastic eyedropper is used to measure out small quantities of NovAqua Plus water Conditioner

[7] The cooler and aerator are used to transport fingerlings to the release site. For first and second year schools TIC volunteers will transport the fish. Teachers who have been in the TIC program for more than 2 years have the experience to transport their own fish.

Chapter 3 System Set-up

REFER TO APPENDIX E FOR DETAILED PICTURES OF SYSTEM SET-UP

A. PREPARING THE TANK

Place the tank on a stable lab-type counter, bench, 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 it easier to fill and drain the tank. Select the location for the tank carefully because once it is filled with water, it won't be moveable.

1. Under the tank place a closed-cell polyethylene insulation board cut to fit the bottom of the tank with about ½" overhang on all sides. This will help insulate the tank and prevent water from dripping onto the floor from the outside of the tank.

2. 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 strain on the chiller and require additional tank cleaning time. Newly hatched trout prefer relative darkness, hiding from predators in the cover provided by stream structures. To provide this dark environment, use Velcro or duct tape to attach a polyethylene insulation board which has been cut to fit the top, back and sides of the tank .The top of the tank should also have cut-outs for filter hoses and the chiller line. In addition to providing the desired darkness, the polyethylene boards will also insulate the tank, thus reducing chiller operating time and prolonging its life. Cover the front of the tank with opaque material to protect the hatchlings during their first six weeks of development (one week hatching, 3 weeks absorbing the egg sac, and 2 additional weeks in breeder basket while they learn to swim up and feed). This opaque cover should be removable for viewing and performing tank maintenance. **Avoid positioning the tank under fluorescent light. Do not use aquarium lights.**

B. GRAVEL

1. The items from ThatFishPlace for the first year set-up include 2 bags of gravel ("Shallow Creek Pebbles"). The gravel provides a large surface area on which bacteria can grow and provides about 20% of the tanks bio-filtering. Only about 1/2 inch of gravel is needed

2. Gravel should be rinsed before being placed in the tank. A bucket or a colander is useful for this purpose. After getting the gravel as clean as possible, distribute it evenly across three-quarters of the bottom of the tank, leaving about one-quarter of the tank bottom completely clear of gravel. The gravel-free area permits seeing when the build-up of trout and food waste has reached the point when it has become necessary to siphon the tank bottom.

C. CHILLER SET-UP

Save the chiller shipping carton; it will be needed if the unit needs to be returned to the manufacturer. Send the TIC coordinator an email with the name of the school, purchase date of the chiller and its serial number (located on the instruction sheet). The chiller is needed to keep the tank's water temperature at about 52-54°F. To promote uniform water temperature in the tank, the following tank configuration is suggested:

1. Place the chiller housing on the left side of the tank. On the left side of the tank also install and submerge the chiller coil**. Never run the chiller unless the coil is fully submerged.**
2. Make sure that nothing obstructs air from entering and exiting the chiller housing. Do not place the housing in an enclosed area under a tank stand. Lack of fresh air will cause the unit to overheat and malfunction
3. Install the temperature sensor that is attached to the chiller on the right side of the tank. Chillers manufactured prior to 2014 have a plastic tube into which the temperature sensor is inserted and sealed with black cork sealant. A suction cup holds the tube in place. Beginning in 2014 the temperature sensor is sealed with a waterproof marine-grade shrink tubing eliminating the need for a plastic tube.
4. As instructed in the Filter section below, position the filter intake tube on the back left side of the tank and install the outflow tube on the back right side of the tank. Position the outflow tube to direct water toward the chiller coil to prevent it from icing up.
5. The configuration above, with the coil and temperature sensor at opposite ends of the tank, promotes uniform water temperature throughout the tank.
6. Periodically, check the cooling fins of the chiller for dust. Make sure the unit is positioned so that you can see and remove any dust that accumulates on the chiller fins.
7. Follow the manufacturer's instructions for programming the chiller's controller unit. It must be set for degrees F (Fahrenheit**)** and in the Cooling mode. Set the chiller for temperature differential of 2^{o}F.
8. Firmly connect the controller to the chiller unit. A loose connection will cause the chiller to run continually. If possible, don't plug the chiller, a power strip or any other electrical component into a Ground Fault Interrupter (GFI) circuit which needs to be reset following a power outage. Loss of power over a weekend or holiday will result in fish kills unless the GFI circuit is reset.

D. AIR PUMP CONNECTION

1. Place the air pump behind the tank.
2. Place the air stone on the bottom of the tank toward the back. Since the air stone is quite fragile, be careful and handle it with care when you unpack it. Do not place it under the breeder basket or the intake to the filter.
3. Measure the tubing and cut a length that reaches from the air pump to the air stone. Cut the tubing near the 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. (The OUT side faces the air pump; the IN side faces the air stone). The arrow on the Fusion check valve should point in the direction of the air stone.
4. Connect the tubing from the air pump to the check valve and then to the air stone. Greasing the fittings on the air pump and check valve with Vaseline or saliva will make it easier to install the tubing.
5. Fill the tank with tap water. **Treat the water with NovAquaPlus at this time to remove chlorine and heavy metals.**
6. Wait 10 minutes before plugging in the air pump to saturate the air stone and provide an even air flow. Gravel placed around the frame of the air stone will help keep it in place.

E. THE FLUVAL WATER FILTER

1.Install the Fluval water filter following instructions supplied with the unit. However, when filling the media baskets please follow the instructions provided in section 5 below.
2.Position the filter's intake tube on the back left side of the tank and the outflow tube on the back right side of the tank for reasons stated above (see items 4 and 5 in section entitled CHILLER SET-UP).
3.Check the housing and make sure it does not leak.

4.Cover the mouth of the intake tube with porous material (**available from TIC volunteers**) to keep fry from being sucked into the filter. A piece of plastic screening, fastened tightly to the tube with a plastic tie, will also work. **Do not use fine-mesh material, such as cheesecloth or nylon stocking; they can block the water flow through the filter. See Page 82**.

5 The Fluval 406 filter canister has two sections. In a new model 406 filter the smaller section, a screen frame, has four pieces of rectangular foam that function as a pre-filter. The larger section has four 2-compartment media baskets that fit on top of one another. The lowest 2-compartment media baskets are pre-loaded with two black foam blocks and a thin white polishing pad that removes the micro-particulate. The upper two compartments are pre-loaded with charcoal. Beneath these is a compartment containing Bio-Max. Discard the black foam blocks, but retain the polishing cloth, the charcoal bags and the BioMax. The BioMax will be used to help fill the compartments in media baskets 3 and 4. The charcoal bags can be set aside for emergency use when Chemi-Pure charcoal is unavailable. The following instructions apply to every filter that has four media baskets

a. For clarity, number the media baskets 1, 2, 3 and 4, with 4 being the bottom basket. Wash the Bio-Max and use it to fill the two compartments in media baskets 3 and 4. A new filter has enough Bio-Max to fill media basket 4. The Start-Up kit includes the Bio-Max needed to fill media basket 3.
b. Following the instructions on the jars of Chemi-Pure charcoal, wash the charcoal bags to remove the dust and other very small particles. Load the two compartments in media baskets 1 and 2 with the washed bags of Chemi-Pure charcoal. **If you have a brand new 406 filter install the white polishing pads in media baskets 2 underneath the Chemi-Pure.**
c. If you are using an older model filter that has 3 media baskets, place Bio-Max in basket 3. Basket 2 will have one compartment with Bio-Max and one with Chemi-Pure. Basket 1 will contain 2 bags of Chemi-Pure.

F. BREEDER BOX/HATCHING BASKET

1.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 should be free of holes or damage. To protect hatchlings from getting caught between the netting and frame, place the net **inside** the frame and secure it at each corner with needle and thread, twist ties or aquarium sealant.

2. The breeder box should be installed one day before the eggs arrive. It should be placed in the right front corner of the tank, away from the filter outflow tube.

G. DIGITAL THERMOMETER

Before installing the digital thermometer, remove the protective film that keeps the battery from making contact with the thermometer terminals. Turn unit ON and check operation. Turn unit OFF and remove battery to extend its life during storage.

YOUR SYSTEM IS NOW OPERATIONAL!

H. REMINDER

Set up tank and breeder box as described above at least 10 days before the scheduled egg delivery date, but do **not** install Breeder Box.

1. Fill the tank with tap water. **Treat the water with NovAquaPlus at this time to remove chlorine and heavy metals.**
2. Turn on the filter, chiller and air pump.
3. Set the chiller to cool the tank water to 52° - 54° with a 2° F differential.

4. Test the setup to make sure all the equipment is functioning properly.
5. 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, but NEVER at less than 1/2 maximum flow.

Chapter 4 Preparing and Transitioning Eggs

Fertilized rainbow trout eggs, food, and the aquaculture permit will be delivered to all schools during January. The actual date depends on when the hatchery receives its egg delivery.

A. FIVE DAYS BEFORE EGG DELIVERY

1. Turn on the chiller, setting the temperature to register around 52°F.
2. Test the water for pH, ammonia, nitrites, nitrates, carbonate alkalinity (KH) and general hardness (GH). The pH of the tank should be stable within a range of 7.0 - 7.6 for optimum biology.
3. Refer to Chapter 7 for guidance regarding KH and GH and to Appendix F for instructions for using baking soda to correct low KH readings.

B.**ONE DAY BEFORE EGG DELIVERY**

1.Using the digital thermometer, check to see that the water temperature registers 52^0 - 54^0 F.
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.

C.EGG DELIVERY PROTOCOL

1 The tempered eggs should arrive in a jar of hatchery water at a temperature approximately the same as your tank (52^0 F). The eggs will be transported from the state hatchery in coolers with de-chlorinated ice to keep the temperature as stable as possible around 52^0 – 54^0 F
2. Measure the temperature of the water in the jar(s) with the eggs. If this reading is no more than 5 degrees lower or 3 degrees higher than the tank temperature, gently pour the eggs into the breeder basket. If the water temperature reading is outside the acceptable range, raise or lower the temperature in the jar to be within range before placing the eggs in the breeder basket. Use the turkey baster to draw up tank water to raise or lower the temperature of the water in the jar.
3. Be sure the filter is operating at its highest flow rate.
4. Add both Special Blend and Nite-Out II **to the tank and to the filter** after the eggs are in the basket. See appendix F for directions for adding bacterial solutions to the tank. (**the filter represents 80% of the system's biological oxidation processes**)

Chapter 5 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 2-3 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 or twice a day when possible. A turkey baster works well for that task. The white spots are a fungus that spreads **really** fast. 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 sponge or brush to loosen and send this growth through the tank filtration system.

B. ALEVIN (SAC-FRY) STAGE (from hatching to 4 weeks)

1. When the embryos hatch, they have large yolk-sacs which 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 illustrates 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. ALEVIN (SWIM-UP) STAGE (Also Known As First Feed) (4-6 weeks)

Timing of "first-feed" is critical in young trout. 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 (>50%) 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 H for photographs***

1. 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 approximately25% 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.

2. When all hatchlings are swimming up and eating, unhook the breeder box and lower it gently to the bottom of the tank. **It is highly recommended that that alevin remain in the breeder basket for at least 7-10 days after they are all feeding. It is much easier to clean and siphon the tank when they are contained.**

3. Strong adventurous fish will swim out. The more timid weaker fish will hide for a few more days until they are stronger.

4. Continue to add Special Blend and Nite-Out II to your tank as often as once a week according to directions in Appendix F

5. Once the fish have left the breeder basket you can remove the front cover of the tank. See Chapter 3 A.3

D. FRY STAGE (6-8 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, they will not develop. Most TIC classrooms see a mortality spike with the pinheads. It is quite normal.

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

1. When a fry grows to 2 to 5 inches it becomes a fingerling. Larger fingerlings will develop large dark vertical stripes known as parr marks which 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 in the breeder basket. See Appendix B for pictures of the developmental stages of trout

Chapter 6 Caring for the Tank

A. TANK CLEANING

This section applies mainly to tank maintenance **after** the fish leave the breeder box**.** 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. Before working in the tank, hands must be washed in de-chlorinated water to remove all contaminants (such as soap and lotion) and thoroughly dried because trout are extremely sensitive to chlorine. Proper hand care when working in the tank will ensure a higher trout survival rate.

2. 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

3. 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 3B. 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.

4. Only remove as much water as needed to clean the gravel and replace that water with de-chlorinated water. See Appendix F for instructions regarding the use of NovAqua Plus water conditioner. 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. The gravel should be cleaned periodically to remove excess fish and food waste.

5. 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.

6. Weekly, examine the filter intake and remove tank debris, as well as any dead or trapped fingerlings found there.

7. 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.

B. MAINTAINING CHEMICAL BALANCE IN THE TANK

80% or more of the biological activity of the trout tank takes place in the filter. The goal is 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 F 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 30 ml of Nite-Out ll to the filter to increase ammonia removal. Nitrite and Nitrate are the byproducts of nitrification. Water changes are a secondary aid to correcting ammonia problems

Be aware, however, that during the nitrogen cycle 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.

Special Blend contains bacteria functioning as decomposers. In our tanks they convert fish waste and uneaten food to ammonia. 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 w
ater at a time. **The bacteria in your tank should provide the first line of defense against changes in your tank that effect 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 Effect 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 2.8ppm (interpolate between 3.2ppm and 2.4ppm) 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. An easy alternative to siphoning water out of the tank 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 chlorine-free.

2. Fill a clean 5-gallon plastic bucket with tap water equal to the 1/2 the amount of water removed from the tank. Add the appropriate amount of NovAqua Plus water conditioner to de-chlorinate **all** the tap water being added Then add the remaining 1/2 of the water removed. 1 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 ll 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 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. tank 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 ll when ammonia levels increase.

C. FILTER CLEANING

The biological filter performs 80% of the biological processes for organic waste removal, ammonia removal termed nitrification, and also nitrate reduction via a process called denitrification. It is not normally necessary to clean the filter or change its media during the school year. Should the water flow become seriously restricted, the following steps will guide you in opening the filter and cleaning or replacing media.

1. Make certain the filter is unplugged and the flow control lever on the AquaStop valve is in the fully closed position (all the way up) before removing the valve or opening the filter. This seals off the input and output hose connections to maintain the vacuum necessary to restart the filter without priming. Also see Appendix E

2. Unplug the filter
3.Lift the locking lever to release the AquaStop valve. It is NOT necessary to remove the hoses.
4. Release the lift-lock clamps. Push down on the clamps to lift the cover off the canister.
5. Carry the canister to a sink and drain out the water.
6. Rinse the 4 sections of foam in the pre-filter section with de-chlorinated water.
7. Rinse no more than two baskets containing Bio-Max.
8. As needed replace two bags of Chemi-Pure. Never replace all biological media at one time as valuable colonies of bacteria will be lost. **Add Special Blend and Nite-Out ll directly to the filter to help restore adequate biological processes**
9. Reassemble unit. Do NOT refill with water.
10. Replace the cover and re-clamp.
11. Re-insert AquaStop valve and lock it in place.
12. Open the flow control valve to maximum flow position. The canister should begin filling with water. If the system has lost its vacuum, it will be necessary to use the instant-prime lever to fill the canister.
13. When the canister is full, plug in the unit. **Do NOT run the filter if the canister in not full.**

D. 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 over heat and fail.

E. CHECK LIST.

DAILY

1. Check tank temperature. A temperature increase might indicate a chiller problem.
2. Feed the trout (see Chapter 8 for feeding guidelines).
3. Remove dead fish or debris from the tank.
4. Test water chemistry (ammonia, pH, 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.
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 still working properly.

6. Check the filter and the air pump hose connections to ensure there are no leaks.

TWICE WEEKLY

Clean gravel in the tank as instructed above.

WEEKLY

1. Clean the sides of the tank with a mitt, brush or other suitable implement.
2. Conduct the KH and GH tests and record the readings in the log.

F. REPAIR AND REPLACEMENT OF TIC EQUIPMENT

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

1. **Chillers.** TradeWind chillers have a 5-year warranty. The invoice for each school's chiller should be kept in the school's MATIC file in order to determine whether the unit is still under warranty in the event of failure. Save the original box in case the unit needs to be returned to the manufacturer. Send a TIC coordinator an email with the serial number of the unit. It is located on the unit's instruction sheet The cost of warranty repair is the cost of shipping the unit to the manufacturer (about $70).

Although the reliability of chillers is high, eventually failures will occur. MATIC will try to provide a spare unit within 24 hours of a notice of failure. If the broken unit is no longer under warranty, two options exist. (1) Replace with a new chiller. MATIC should be notified of this intent. (2) Refurbish the unit. After consulting the manufacturer, MATIC will recommend whether the unit should be scrapped or refurbished. Refurbishing cost varies with the condition of the unit and has ranged between $100-$150 plus shipping. To refurbish a non-warranted unit, the school pays for shipping both ways. Total repair cost including shipping both ways would be about $300. If a school decides to replace its unit, MATIC may offer to take over and pay for refurbishing the broken chiller to use as a spare. Currently, a new unit costs $620. Some schools have applied for a DNR ARE grant to replace their chillers.

When a school receives its new/refurbished chiller, the loaned spare unit should be returned to MATIC.

2. Filters. Fluval 406 filters have a 3-year warranty. Their cost is approximately $180. If properly maintained, filters also have a low failure rate. These units have very few moving parts. However, the impeller blades/fins and the shafts sometimes break. Some volunteers carry spare impellers in their kits. These parts are also available locally from pet supply stores. The major cost item is the motor head which is a sealed unit and can't be repaired. If this occurs and the unit is no longer under warranty, check with MATIC to decide whether to replace the entire filter or just the motor head. MATIC will try to provide you with a spare filter while the broken unit is repaired or a new unit ordered.

3. Tanks.

Very few failures have been experienced with fish tanks if carefully maintained, handled and stored. It is difficult to repair a leaking tank. It is best to replace the tank with a new one. Cost is about $125. Check with MATIC to see if any spare tanks are available. Some schools are able to obtain a tank from the PTA or parents.

Grant money is sometimes available to replace equipment. However, if you wait until a failure occurs it is possible that your grant application would not be acted upon until the next donor funding cycle. Also donors might give higher priority to a grant request from a new MATIC school than for replacement of existing equipment

Chapter 7 Water Testing

A. SAFETY PRACTICES

1. Teachers and volunteers should read the Instructions as well as the Safety Data Sheet (SDS) for solutions used in each test. (The seven tests Maryland TIC schools have been using--pH, high range pH, ammonia, nitrite, nitrate, KH, and GH—can be found here: http://www.apifishcare.com/aquarium/water-testing/test-kits.)
2. Those using *solution-based* test kits (not test strip kits) should always wear rubber/latex gloves and goggles.
3. Students performing tests should be supervised by a knowledgeable adult.
4. Students below the middle grades should not perform KH or GH tests using the solution-based test system.
5. All involved in water testing should exercise caution and diligence. Water testing chemicals need to be handled and disposed of properly.

B. INTRODUCTION

1. The two water testing kits included in the first year set-up have chemical solutions to test for pH, ammonia, nitrite, nitrate, carbonate alkalinity (KH) and general hardness (GH). Tests for ammonia and pH should be conducted daily; nitrite and nitrate tests should be conducted 3 times a week; and KH and GH tests should be conducted weekly. Testing for dissolved oxygen (DO) is useful, but optional. 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.
2. Rather than having students fill tests tubes directly from the tank, have them draw up a beaker of tank water and use this to fill the test tubes. This keeps their hands out of the water and prevents residual solutions from getting into the tank. Make sure test tubes and caps are rinsed in tap water after use.
3. Laminate the water test instructions. These sheets will get wet.
4. Keep a daily log of test results. This information can help identify causes of fish mortality and also serve as "real" data for students to graph. See Appendix C for sample tank inspection records.
5. Check **s**helf Life of test solutions: 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. The water test kits claim a 3-year shelf life. However, if used regularly these kits will not last more than 2 years. Be sure to check the lot number on the bottles in your test kit to know when to re-order.
6. Test Off-Color/Green Water: Algae will sometimes discolor tank water. This does not affect fish health, but will alter the water chemistry test results because the off-color water makes it more difficult to determine colors observed on the color chart.

To correct for this do the following: Draw up and cap a test tube of tank water. Call this test tube 1. Run each water chemistry test using the following instructions: Call the colored water that results from the test, test tube 2. Hold test tube 1 over the color bar for the test you are conducting. The colors seen through the water in test tube 1 become your new "color standard". Compare the color solution in test tube 2 against the new color standard. Record the numeric value that best corresponds to where the colors seen through test tube 1 and the color of the solution in test tube 2 appear closest in color.

C. TEST FOR pH

1. Put 5ml of the tank water to be tested into a clean test tube. The test tube in your testing kit has a line at 5ml.
2. Add 3 drops from the pH Solution bottle.
3. Cap the test tube with a clean stopper and invert it several times to mix the solution.
4. Holding the test tube against a white background, match the color of the solution against the pH chart provided. Record the test results in your Log.

A pH level of 7.0 to 7.6 is desirable. Trout will survive outside this pH range, however, **high pH increases ammonia toxicity.** A lower pH will 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.

D. TEST FOR AMMONIA

1. Put 5ml of the tank water to be tested into a clean test tube. The test tube in your testing kit has a line at 5ml.
2. Add 8 drops from the Ammonia Test Solution Bottle #1.
3. Add 8 drops from the Ammonia Test Solution Bottle #2.
4. Cap the test tube with a clean stopper and shake it vigorously for **5** seconds.
5. Wait 5 minutes for color to change. Precise timing is important. Variation can affect the color and accuracy of the results. Holding the test tube against a white background, match the color of the solution against the chart provided. Read and record the test results in your Log.

An ammonia level below 1 ppm is recommended. See the Note with specific information regarding the ammonia test in Chapter 5 Section C, "Water Changing" 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.

As fish grow and food rates are increased biological conversion of waste matter to ammonia takes place and results in a dramatic increases in ammonia. The nitrification process via nitrifying bacteria must equal the ammonia loading. Add Nite-Out II to the tank water and directly to the filter to biologically reduce ammonia levels. Water changes may also be needed if the ammonia load becomes consistently too high for the biological filtration to handle, i.e., a level of 2 ppm (not including the ammonium component) or higher. This usually occurs when fish are overfed 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.

E. TEST FOR NITRITE

1. Put 5 ml of the tank water to be tested in a clean test tube. The test tube in your testing kit has a line at 5ml.

2. Add 5 drops from the Nitrite Test Solution Bottle #1.

3.Cap the test tube with a clean stopper and shake it vigorously for 5 seconds. This step is essential. Do not hold finger over open end of test tube as that can affect accuracy of results.
4.Wait 5 minutes for the color to change. Precise timing is important. Variation can affect the color and accuracy of the results.
5.Holding the test tube against a white background, match the color of the solution against the chart provided.
6.Read and record the test results in your Log.
7.A nitrite level below 1.0 ppm is recommended.

F. TEST FOR NITRATES

1. Put 5ml of the tank water to be tested into a clean test tube. The test tube in your testing kit has a line at 5ml.
2**.** Add 10 drops of Nitrate Test Solution Bottle #1 to the tube, holding the bottle upside down to make sure drops are the same size.
3. Cap the test tube with a clean stopper and tip it upside down several times to mix the solution.

4**.** Vigorously shake the Nitrate Test Solution Bottle #2 for at least 30 seconds. This step is extremely important to ensure accuracy of test results.
5. Add 10 drops of Nitrate Test Solution Bottle #2 to the test tube, holding the bottle completely upside down to make sure drops are the same size.
6**.** Cap the test tube with a clean stopper and shake it vigorously for 1 minute. This step is extremely important to ensure accuracy of test results.
7. Wait 5 minutes for the color to develop.
8**.** Hold the test tube against a white background and match the color of the solution to the colors on the Nitrate Color Chart. The closest match indicates the ppm of nitrate in the water sample. Read and record the test result in your Log.

Beneficial bacteria convert toxic ammonia and nitrite into nitrate. A nitrate level of 40 ppm or less is recommended. Special Blend will reduce nitrate via denitrification if added at the recommended rate.

G. TEST FOR DISSOLVED OXYGEN (DO)

Testing for DO is optional. A test kit for measuring dissolved oxygen (DO) in the tank water is available from ThatFishPlace. Follow the instructions in the test kit and measure the DO at the bottom of the tank. A DO level of 5ppm or less will not sustain trout life and is a signal to search for the presence of dirt or a poorly functioning air stone or pump.

H. WATER HARDNESS
Three aspects of water chemistry can affect the tank and the hatchlings. These are pH, KH and GH. pH is a number reflecting whether and to what extent water in the tank is acidic, alkaline or neutral. KH or Carbonate Hardness (sometimes also 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. GH or General Hardness is a measurement

of the concentration of dissolved calcium and magnesium ions in the water. Testing procedures for pH appear earlier in this chapter. Those for KH and GH appear below. 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. GH can be monitored for stability but left alone unless there's a sudden and major change in the GH level or accompanied by an otherwise inexplicable effect on hatchling health. If needed, GH can best be altered by addition of distilled or other softer water to dilute calcium and magnesium ion levels in the tank. Hard water (200 ppm) is high in calcium and magnesium, while soft water (50 to 100 ppm) is low in these minerals**.** A GH level between 100-150 ppm is recommended.

TEST FOR KH (CARBONATE ALKALINITY HARDNESS)

IMPORTANT: The KH TEST solution causes burns. In case of contact with eyes or skin, flush with water for 15 minutes and seek medical attention immediately.

1. Anyone conducting KH tests should wear impermeable gloves
2. **At the elementary school level, teachers should conduct this test.**
3. At the middle school level, teachers should carefully monitor the students conducting this test.
4. Read the instructions in the testing kit thoroughly before testing for KH.
5**. Do not allow test solutions to get into the aquarium.**
6. To remove the childproof safety cap, push red tab left with thumb while unscrewing the cap with your free hand.
7. Rinse a clean test tube with tank water. Fill the test tube with 5ml of aquarium water (to the line on the test tube).
8. Holding the bottle of Carbonate Hardness Test Solution upside down in a completely vertical position, add a drop of the solution into the test tube of tank water.
9. Cap the test tube with a clean stopper and invert the solution several times. Note the color of the solution. The solution may turn blue. The test is completed when the water in the test tube, after having been shaken, turns from blue to yellow. If you have difficulty discerning the color after the first drop of test solution is added, remove the cap from the test tube and while holding it over a white background, look down through the tube. If the solution does not look yellow continue with step 10.
10. Following the above protocol, continue to add one drop at a time holding the test solution in a completely vertical position. After each drop, cap the test tube, invert it several times and note the color of the solution.

NOTE: Keep count of the number of drops you have had to use to turn the solution yellow.

11**.** To calculate the parts per million (ppm) of Carbonate Hardness, multiply the number of drops needed to turn the test solution a bright yellow by 17.9**.** A KH level between 100-150 ppm is recommended. See Appendix F for instructions for the use of baking soda to correct low KH levels. A level of 100/150ppm essential at all times to assure nitrification

TEST FOR GH (GENERAL HARDNESS)

NOTE: GH Test solution contains Triethanolamine**.**

1. **At the elementary school level the teacher should conduct the test.**
2. At the middle school level, the teacher should carefully supervise the student conducting the test.
3. Read the instructions in the testing kit thoroughly before testing for GH. Do not allow Test Solutions to get into the aquarium.
4. To remove childproof safety cap: With one hand, push red tab left with thumb while unscrewing cap with free hand.
5. Rinse a clean test tube with water to be tested. Fill the test tube with 5 ml of aquarium water (to the line on the test tube).
6. Add General Hardness Test Solution, one drop at a time, holding dropper bottle upside down in a completely vertical position to assure uniformity of drops. After first drop is added, solution will turn orange. Cap the test tube with a clean stopper and invert several times after each drop. Keep count of the drops being added. Do not hold finger over open end of the tube, as this may affect the test results.
7. The test is completed when the water in the test tube, after having been shaken, turns from orange to green. If you have difficulty discerning the color after the first drop of test solution is added, remove the cap from the test tube and while holding it over a white background, look down through the tube.
8. The General Hardness (GH) value is determined by the number of drops of the reagent that must be added to turn the water in the test tube green multiplied by 17.9 ppm. Each drop is equal to 17.9 ppm GH.

Chapter 8 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 H ***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

After 3 weeks you can consider releasing the fish to the main tank but it is preferable to keep them in the basket for up to five seeks to promote complete food uptake by even the weaker hatchlings.

From 3 weeks to 1 inch long	1/4+1/8 tsp. size 0 food
From 1 inch to 1.5 inches long	3/4 teaspoon of size 0 food
From 1.5 inches to 2 inches long	1+1/2 tsp of size 0 food
From 2 inches plus long	2+1/4 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 1inch stage and the 1.5 inch stage you can be feeding a total of 1/2 teaspoon per tank daily i.e. 1/4 tsp. in the morning and 1/4 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 2 or even 3 times a day 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. If water tests and fish health indicate excess ammonia, add more Special Blend or NiteOut 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 Special Blend and 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 9 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, MATIC is not a stocking program; it is an environmental education program promoting cold-water conservation. The true value of MATIC 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 NiteOut II and Special Blend 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 the10 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. MATIC volunteers may be able to help first or second-year MATIC 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 large 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. THE OPTIMAL RELEASE PROGRAM

The optimal release program includes the following activities:

1. A stream habitat study consisting of:
    a. water chemistry and physical characteristics of the stream; and
    b. stream macro-invertebrates and other critters; plant life
2. A discussion of conservation issues
3. Trout Games.

4. Trout Release
5. Fishing Orientation

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, I, 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. The local county Parks Department or Department of the Environment may have a staff naturalist who could lead such a walk if given sufficient advance notice. (See **appendix G** for sources of speakers.)

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 Maryland Department

of Natural Resources 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**.** 2or 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 10 End of Year Clean-up

A. INTRODUCTION

It is important to clean your 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.

B. 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.

C. DIRECTIONS FOR FINAL CLEANING OF THE CHILLER

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.

D. DIRECTIONS FOR FINAL CLEANING OF THE FILTER

1. With the filter flow control valve in the OFF position remove the AquaStop valve from the filter cover and carry it and the hoses to a sink. 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. Open the filter canister and remove the media baskets and screen frame holding the pre-filter foam. If the top of the canister is difficult to remove after the clamps are released, insert a stiff wide-blade putty knife or similar implement between the top and the canister and gently pry it open. DO NOT use a screwdriver. Take care not to damage the plastic surfaces.

3. 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.
4. Scrub the plastic parts clean with the bleach or vinegar solution described above.
5. Open the impeller well cover and gently remove the impeller and ceramic shaft. Flush out the impeller well with water. A small bottle brush such as used to clean test tubes is helpful. Rinse the impeller and shaft. Lubricate the ceramic shaft with a light coating of silicon grease and reinstall the impeller and shaft in the impeller well. Make certain the shaft is seated in the rubber bushing in the bottom of the well. Clean the impeller wel cover and reinstall. It must be properly fitted over the impeller and shaft.
6. Remove the large O-ring that seals the top of the filter to the canister. Rinse it to remove dirt and check it for nicks and other damage. Before reinstalling it, lubricate it with silicone grease. Do not use a petroleum base grease on the O-ring.
7. Thoroughly air-dry entire filter apparatus.
8. Lubricate the primer shaft with silicon grease
9. When all components are dry, re-assemble the filter and store inside the tank.

E. 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 11 Potential MATIC Funding Sources

MARYLAND DEPARTMENT OF NATURAL RESOURCES: AQUATIC RESOURCES EDUCATION GRANTS

Maryland's Aquatic Resources Education (ARE) Grants Program assists public and private schools (pre-K-12) and environmental education centers that are part of the public school system by providing funding for aquatic-based projects. Schools can apply for up to $2,000 per school year for student-driven projects that benefit Maryland's aquatic resources.
http://www.dnr.maryland.gov/education/are/aregrants.asp

CHESAPEAKE BAY TRUST MINI-GRANTS

The Chesapeake Bay Trust Mini-Grant Program awards up to $5,000 to support activities at schools and non-profit organizations that help promote awareness of and participation in the restoration and protection of the Chesapeake Bay and its tributary rivers and streams. The Mini-Grant Program is supported by a partnership with the National Oceanic and Atmospheric Association Bay Watershed Education and Training Program
http://www.cbtrust.org/site/c.miJPKXPCJnH/b.5457547/k.28ED/Mini_Grant.htm

BEST BUY SUPPORT FOR INTERACTIVE TECHNOLOGY

The Best Buy (http://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 dead lines; 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.
http://www.BestBuy.com

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.
http://captainplanetfoundation.org

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 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.
http://www.kinf.org/

MELINDA GRAY ARDIA ENVIRONMENTAL FOUNDATION

The Foundation seeks to facilitate the development and implementation of holistic environmental curricula that incorporate basic ecological principles and field environmental activities within a primary or secondary school setting. Accordingly, the Foundation is interested in contributing to the development, implementation and/or field testing of curricula that are consistent with the mission of the Foundation.
http://www.mgaef.org/index.htm

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.
www.toolboxforeducation.com

PHYSH ED GRANTS -- FUTURE FISHERMAN FOUNDATION

Through their partnership with the Recreational Boating and Fishing Foundation, the Future Fisherman Foundation has developed the Physh Ed grants initiative which offers grants in the amount of $2,500 to certified teachers in public, private or charter schools. They offer grants, training, and other services to help prepare teachers to launch fishing and boating programs in schools across the country. TIC fits in their initiative if it is part of a cross-curricular program.
http://www.futurefisherman.org

STATE FARM ENVIRONMENTAL PROJECT GRANTS

Each year, the State Farm Youth Advisory Board (YAB) awards $5 million for large-scale, student-driven service-learning projects that address pressing social issues, including environmental responsibility. In 2010, the YAB directed $1.6 million of those funds to environmental innovation projects, including the testing of waterways near Woodstock, Georgia; the recycling of rainwater in Pomona, Kansas; and the development of an environmental

Investigation Field trips will help provide assistance, resources, equipment, field trip funds, and mini-grants to students and teachers as they carry out environmental service-learning projects in their neighborhoods. The field trips will give students the opportunity to have out-of-classroom experiences that relate to investigating community issues and provide students with the skills of planning and presenting a project, and writing grants for what they want to do.

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.
www.corporate.target.com

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. www.toshiba.com/taf/612.jsp

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.
www.nsta.org/tapestry

NOAA GRANTS

http://www.oesd.noaa.gov/grants/

ALLSTATE FOUNDATION GRANTS

https://www.allstatefoundation.org/foundation_agency_owner.html

The Allstate Foundation offers several grant programs to support charitable organizations where Allstate agency owners and employees volunteer.

ALLSTATE FOUNDATION YOUTH EMPOWERMENT GRANTS

https://www.allstatefoundation.org/youth_empowerment_overview.html

Allstate believes it's important to invest today in the next generation of change-makers who can play an active role in shaping our collective tomorrow. The Allstate Foundation invests in select nonprofit organizations to help young people build the life skills they need to succeed in school, the workplace and as leaders for the next century.

FIRST ENERGYACCEPTING APPLICATIONS FOR STEM BASED CLASSROOM PROJECTS

FirstEnergy proudly supports classroom projects and teacher professional-development initiatives focused on science, technology, engineering, and mathematics. To that end, the company is accepting applications for its STEM grants program.

Grants of up to $1,000 will be awarded in support of creative classroom projects related to one or more of the STEM disciplines. Since the launch of the program during the 1986-87 school year, more than one thousand educators and leaders of youth groups have received classroom grants.

Educators (pre-K through 12) and youth group leaders are encouraged to apply if their school or group is located in communities served by FirstEnergy's electric operating companies (Ohio Edison, the Illuminating Company, Toledo Edison, Penn Power, Metropolitan Edison, Penelec, Jersey Central Power & Light, West Penn Power, Mon Power, and Potomac Edison), or in a community where the company has a facility.

See the FirstEnergy website for complete program guidelines and application instructions.

Applications for the 2016-2017 school year are now available. Applications must be submitted by September 23, 2016 for consideration during the 2016-2017 school year.
Link to Complete RFP

THE KARMA FOR CARA FOUNDATION

The **Karma for Cara Foundation** is a nonprofit founded by 21-year-old Cara Becker and her family while Cara was undergoing treatment for leukemia at the Johns Hopkins Kimmel Cancer Center. Cara and her two brothers began volunteering at a young age as part of their family's commitment to community service, and at the Kimmel Center they saw a tremendous need to help support other patients and their families who were also challenged by cancer. Tragically, Cara passed away four months after her diagnosis, but her wish to help others through K4C lives on with the support of an ever-growing circle of family and friends.
To date, the foundation has awarded forty grants totaling $27,286 and has engaged hundreds of volunteers in more than a thousand hours of community service.
As part of an effort to promote and support youth voluntarism, k4C started a microgrant program in the fall of 2014 to encourage kids 18 and under to apply for funds between $250 and $1,000 to complete service projects in their communities. Examples of fundable projects include but are not limited to turning a vacant lot into a community garden, rebuilding a school playground, or helping senior citizens get their homes ready for winter.
Application deadlines are seasonal (July 1, October 1, January 1, and April 1), and decisions will be made within a month of each deadline.
For complete program guidelines, profiles of featured projects, and application instructions, see the Karma for Cara Foundation website.
Link to Complete RFP

Chapter 12 FAQ

EGGS AND HATCHING

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. As a general rule, the alevin should stay in the breeder box for approximately two weeks after hatching is complete. 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. See **First Feed** guidance in the Appendix

How do I let the trout out of the breeder box when it is time?
Gently remove the breeder box 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 box 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 unchlorinated ice or one or more ice packs which 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 egg shells?
The discarded egg shells should be removed if possible using the turkey baster. They will decompose naturally in time. If they appear to be hosting fungal growth, dispose of them immediately. Eggs that turn opaque white, or take on a fuzzy appearance should be removed.

What do I do with 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 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. As the eggs hatch, and the fish age, survival rates improve. By the time fish are free swimming and have 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 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. 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 this age do not need any food. When at the end of the alevin stage the fish begin to feed, start with small amounts. See in Chapter 8 for guidelines on feeding the trout.

Trout are being sucked into the filter. How can I prevent this?
Place coarse 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 one or two 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 dechlorinated 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. Daily 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 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 Special Blend and NiteOut II in accordance with instructions for its use. See Appendix F.
13. Put fish back in tank.

I ran out of food. What do I do?

Contact a TIC volunteer or Coordinator

CHILLER

Does it matter where I put the chiller?

Yes. The best place for a TradeWinds drop-in chiller is next to and level with the tank to ensure that the chiller coil can be completely submerged.

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 MATIC coordinator. Continue adding plastic containers of frozen de-clorinated water to maintain the tank water temperature at about 52^0 until a replacement chiller arrives.

Obtaining an Emergency Replacement Chiller

Several spare chillers and controllers are available for emergency use. Please get in touch with your local MATIC coordinator to arrange for its delivery and installation. If you don't have access to a local coordinator, please phone Alan Burrows (410) 730-3613, or Chuck Dinkel (301-401-5066)

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 NovAquaPlus 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 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, using water de-chlorinated with NovAqua Plus. 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. 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 and carefully rinse off contaminants such as soap and lotions because trout are extremely sensitive to chlorine and other impurities. Also they should 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 any 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 Appendix D 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 and proper filtration and oxygen. 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, scissors, a marking pen and two clean five-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 them 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.

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 hand-tightened in place in the proper position. No amount of force can replace good alignment.

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. Insulating the tank will help the chiller maintain a stable temperature. Positioning the chiller coil on the left side of the tank and the chiller's temperature sensor on the right side will provide better temperature distribution in the tank. Limiting 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 A3 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 jumping out. Purchased tank lids can also work, but these may not provide reduced light levels that fish prefer. It's also important not to use the lights sometimes pre-installed in a purchased lid. See Chapter 3, Section A.3 for instructions for making an insulated foam top.

Does My Tank Need Insulation?
Yes. 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 and all sides except the front of the tank. See Chapter 3, Section A3 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?
Assuming that end of year cleanup procedures were followed (See Chapter 10), 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

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-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 de-chlorinated water into the tank.

b. **What to do if the filter stops working**: Make certain the filter is unplugged and the flow control lever on the AquaStop valve is in the fully closed position before opening the filter. Remove the AquaStop valve and carry the canister to a sink for maintenance. Open the filter cover and remove all debris, mainly from the foam insert. ***Do Not replace more than 1/2 of the filter media. Doing so will remove your bacteria colony***. Refill the filter with un-chlorinated water or tank water when maintenance is completed. Re-clamp the top to the canister, attach the AquaStop valve, and plug in the power cord. Move the flow control lever to its maximum flow position. If you follow these steps in the above sequence, you will have no leaks from the filter and no priming of the filter will be needed when it starts back up.

c. 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 air flow 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 to the air stone with the spare check valve and tubing assembly makes for an easy and inexpensive solution.

d. 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.

e. **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.

f. Whenever a sudden fish die-off of more than 10 fish takes place, please consult 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 _____

Note: MATIC is developing a system to provide four levels of volunteer support to teachers. First-year TIC teachers should email or phone a "buddy" teacher if one has been designated. The next support tier for all teachers will be to contact a local MATIC volunteer. The next support level is the MATIC county coordinator, followed by the state TIC co-coordinators. At this writing, the system is not yet fully operational. County and state level support is available but the 'buddy' system for new teachers and the local MATIC volunteers tier are still in development. All teachers will receive timely information from county or state-level MATIC volunteers about whom in the support system to contact. Please feel free to contact your state co-coordinators for any questions about support options.

Appendix A Start-up and Replacement Equipment Lists

These two lists contain the item number, quantity and cost of each item in the start-up and replacement equipment and supplies kits furnished by ThatFishPlace. Prices are subject to change.

Table 1 - Maryland TIC Start Up Kit

ITEM #	DESCRIPTION		QTY	EXTENDED COST
256342	Fluval 406 Canister Filter (Hagen)		1	$180.36
205782	Whisper 40 Air Pump (Tetra)		1	$9.15
212520	10" Aqua Mist Add-a-Stone (Penn Plax)		1	$2.29
212445	8' Flexible Airline Tubing ST-8 (Penn Plax)		1	$0.81
240195	Fusion Check Valve 1pk. (JW Pet)		1	$1.19
204233	Net Breeder (Lee's)		1	$3.93
209362	Battery Operated Digital Thermometer (ESU)		1	$5.79
212526	8" Net w/ Long Handle (16" length handle)		1	$1.96
243424	Microbe-Lift Special Blend 16 oz. (Eco Labs)		2	$14.76
243555	Nite-Out II 16oz. (Eco Labs)		2	$24.74
214299	NovAqua Plus Water Conditioner 16 oz. (Novalek)		1	$5.84
199591	Freshwater Master Test Kit (Aq. Pharm.)		1	$15.62
253080	Lees Squeeze Bulb Ultra Gravel Vac. With on/off Valve		1	$12.02
268724	Shallow Creek Pebbles 5 lbs. (2 bags=10 lbs. total) **$3.29/ea**.		2	$6.58
199678	GH & KH Hardness Test Kit for FW (Aq. Pharm)		1	$4.48
196393	Chemi-Pure 5oz. Filter Media (Boyd)	**$3.76/ea**.	4	$15.04
214946	Fluval Biomax Media 17.63oz. (Hagen)		1	$7.79
	SUB TOTAL (MERCHANDISE ONLY)			**$312.35**
	SHIPPING CHARGES			**$8.99**
	TOTAL CHARGE			**$321.34**

Table 2 – Maryland TIC Replacement Kit

ITEM #	DESCRIPTION		QTY	EXTENDED COST
199591	Freshwater Master Test Kit (Aq. Pharm)		**1**	$15.62
243424	Microbe-Lift Special Blend 16 oz. (Eco Labs)		**2**	$14.76
243555	Nite-Out II 16oz. (Eco Labs)		**2**	$24.74
196393	Chemi-Pure 5 oz. (Boyd)	**$3.76/ea.**	**4**	$15.04
214299	NovAqua Plus Water Conditioner (Kordon/Novalek)		**1**	$5.84
212520	10" Aqua Mist Add-a-Stone (Penn Plax)		**1**	$2.29
240195	Fusion Check Valve 1pk. (JW Pet)		**1**	$1.19
199678	GH & KH Hardness Test Kit for FW (Aq. Pharm)		**1**	$4.48
214946	Fluval Biomax Media 17.63oz. (Hagen)	**$7.79/ea.**	**2**	$15.58
	SUB TOTAL FOR EVERYTHING LISTED ABOVE			**$99.54**
	SHIPPING CHARGES			**$8.99**
	TOTAL			**$108.53**
	IF YOU NEED THE FOAM BLOCKS FOR YOUR FLUVAL FILTER PLEASE ADD THE ITEM AND COST (LISTED BELOW) FOR YOUR PARTICULAR FILTER TO THE ABOVE SUB TOTAL.			
214590	Fluval Foam Block 2pk. For 304/305 (Hagen)	**$3.05/ea**	**2**	$6.10
214601	Fluval Foam Block 2pk. For 405/406 (Hagen)	**$3.60/ea**	**2**	$7.20

Appendix B 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.