

TIC Primer for TU Teachers

Introduction

Trout In the Classroom is a cold-water environmental education program where students raise trout from the egg stage to fry over a period of 6-7 months. It is a cooperative effort of the Virginia Department of Wildlife Resources (DWR) and Trout Unlimited. DWR provides trout eggs, food, and the regulatory framework that allows teachers to raise wildlife (trout) in the classroom and release them into the wild. Trout Unlimited volunteers from chapters all over Virginia work with teachers to manage the program which includes purchasing and setting up equipment, obtaining the eggs from DWR, providing expertise on raising trout and troubleshooting issues, and assisting with the release of fish. This TIC Primer is for schools in the State of Virginia.

Timeline

September – Set up tanks and make sure everything is working

Late Sept. - Early October – Eggs delivered to schools

Mid to late October – Eggs hatch

Early November – Baby fish start to swim and feeding begins

November – April/May – Feed fish and maintain tank

April/May – Release fish in DWR approved streams

TIC Basics

The main difference between raising trout and raising tropical fish is the addition of a chilling unit which keeps the water cool and comfortable for trout. Trout tanks are maintained in the mid-50's. Water temperatures over 70 are fatal to trout.

The standard aquarium is 55 gallons which is a common tank size available from any pet store. Tanks in the 40–60-gallon range will also suffice.

Just like a tropical fish aquarium, the trout tank will have a filter system to keep the water clean and an air stone and pump to provide oxygen.

Most tanks use enough gravel to cover the bottom.

The cost of all the equipment to raise trout is over \$1,000, with the bulk of the cost going to the chilling unit.

Equipment

New schools interested in joining the TIC Program will have two options for equipment. The first option is to purchase all of the equipment through grants or other school funds. TU chapter coordinators can direct schools to suppliers of the appropriate equipment. While much of the equipment can be purchased at local pet stores, there are a few companies that provide TIC kits and ship all over the country. Chillers are usually not available to purchase locally and must be ordered. They are the primary expense for TIC as they run in the \$700-800 range and up.

The second option is to get on a waiting list to see if a chilling unit becomes available. There are some chapters that have purchased that are in use. If a school drops out of the program and that chapter owns the chiller, it can be moved to a new school. The school must still purchase all the other equipment.

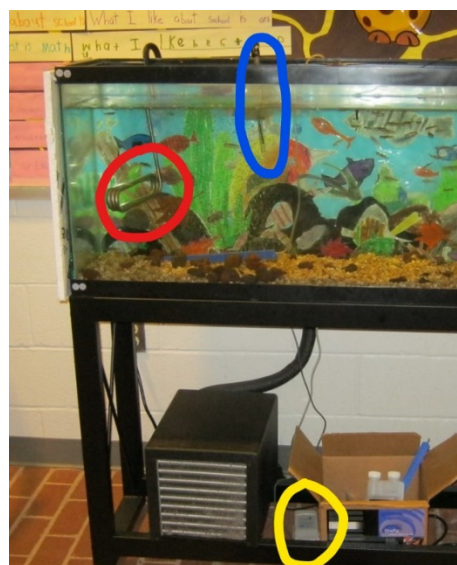
Aquariums

The standard aquarium for TIC is a 50-55 gallon tank which is a common size available from most pet stores. They can be purchased separately or as part of kit that may contain the aquarium, a top that may have contain lights, gravel, a filter, and maybe an air stone and pump.

Chillers

There are two basic styles of chillers. One style is the drop-in chiller which means the unit has a metal coil attached to the chiller and it hangs over (drops in) the side of the tank. The coil cools the water while the filter system and air stone provide water movement. The chiller is plugged into a control unit that plugs into the wall. The control unit has a temperature probe that goes in the tank. There are several drop-in style chillers made by Tradewind Chillers in use.

The picture to the right shows the chiller under the tank. The little gray box next to it (yellow circle) is the control unit. There is a temperature probe (blue circle) attached to the control unit. The metal coil (red circle) is attached to the chiller and cools the water.



Many of the schools use the Aqua Euro chiller. They are referred to as in-line chillers. There are other makes of in-line chillers in use. They have a pump that sits in the tank and pushes water thru the chiller, creating quite a flow from the output hose. All controls are built in and operated through an LED panel on the front of the unit. The picture to the right shows the chiller on the floor to the right of the tank. One hose goes from the pump in the tank to the chiller, the other goes from the chiller back to the tank. The nozzles on the chiller are marked 'in' and "out". The pump does not have a power switch, it just starts running when plugged into the outlet. The chiller has a power switch on the lower right side.



Both types of chillers do a good job. A very important **recommendation** from the manufacturers is to **plug the chillers directly into the wall. Do not plug them into a power strip with other devices.** New chillers will have instructions for programming, schools that inherit used chillers will find them already programmed.

Filter Systems

Almost any type of appropriately sized filter system will work. It is recommended to purchase a filter sized for a 70 gallon or larger tank, but many tanks run fine on a filter sized for a 50-gallon tank. The simple filters that hang on the side of the tank are inexpensive and easy to use. There are filter systems made by Aqua Clear, Tetra, Marineland, and even generic store brands in use. The picture shows two different filters. On the left is an Aqua Clear 110 which many schools receive as part of a kit. It is oversized for what is needed but does a great job.





The filter on the right is a typical pet store filter that uses cartridges. At the beginning of each school year, teachers will receive a white foam block that is called the pre-filter (picture on left). It slides onto the tube that feeds water into the filter. While not absolutely necessary, the pre-filter helps with three functions. It keeps excess debris out of the main filter so we can go the whole year without having to change the cartridges in the filter. It also provides surface area for beneficial bacteria, and it keeps baby trout from being sucked into the filter as they learn to swim. Fish that die may get stuck to the pre-filter, but that were dead or dying before getting stuck

there.

Air stone

The air stone is the least expensive piece of equipment, but absolutely needed. Fish absorb oxygen through their gills, and the bubbles from the air stone provide it. Stones in the 6-10 inch range will work. Air stones get clogged up over time and occasionally break while being handled. They can be replaced for a few dollars at any pet store. The pumps that power the air stones are quite reliable and should last for years. If replacing the air stone does not provide bubbles, a new pump may be needed, again readily available.



Gravel

A layer of gravel on the bottom of the tank is attractive and helps with the nitrogen cycle. If gravel is needed when setting up a new tank, it can be purchased at any pet store. However, it can be cheaper to use pea gravel from a big box store. It just needs to be rinsed before using. An inch of gravel is all that is needed, just enough to cover the bottom.

Other equipment

Other equipment and tools used to maintain the tank will be handled separately in the appropriate sections.

Eggs

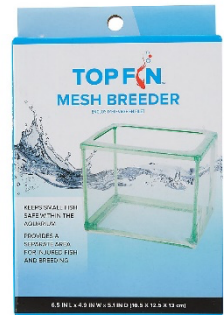
Trout eggs come from the Paint Bank Hatchery which is located about 4 hours from Warrenton. It is south of Covington. Eggs are usually ready in early October, the specific day is determined

by the hatchery. DWR personnel travel from Verona to Paint Bank and pick up eggs. They usually return to Verona by noon. Volunteers from chapters are waiting to pick up the eggs and bring them back for delivery to schools the following morning. Check with your individual chapter TIC coordinator for delivery times.

Teachers will be advised a few weeks in advance as to when eggs will be delivered. It is very important to remember that eggs are only produced once and there is only one egg delivery day. There is no second batch of eggs and no alternate delivery day.

Handling eggs

Eggs are packaged in cloth packets about the size of a book of matches. Each packet holds 200 or more eggs. In nature, female trout lay their eggs in gravel on the stream bottom. We recommend that teachers scatter the eggs in the gravel on the bottom of the tank. Many schools have egg baskets. Teachers can place a couple dozen eggs in the basket so students can observe the hatching process. Placing all the eggs in the basket increases the chance that dead or infertile eggs can get moldy and infect the healthy eggs. ‘Brood Baskets or Breeder Baskets’ are available at most pet stores and hang on the side of the tank for easy observation.



Eggs usually hatch within a week. The baby fish are referred to as alevin and they remain hidden in the gravel for about three weeks before they start to swim. Feeding does not start until the fish start to swim. Specific feeding directions are sent at the appropriate time. Feeding to much too soon is a common mistake that can have severe negative consequences.

Maintaining the tank through the year

Setting up the tank

Teachers in the TIC program will start receiving weekly emails with detailed instructions early in the school year. Following are some major topics that will be repeated in the weekly updates.

Most of the equipment and supplies are reusable. Teachers do need to replace the filter components and make sure they have tap water conditioner, beneficial bacteria, and water testing supplies.

The aquariums should be set up by mid-September to make sure the equipment is working and ready to receive the eggs. In selecting a location for the tank, it needs to be on a sturdy counter or aquarium stand that can handle the weight, preferably not next to a window. There should

be electric within reach for the chiller and accessories. Make sure the aquarium is a few inches out from the wall so there is room for the filter to hang on the back of the tank. The air pump can also go behind the tank.

If the aquarium has a cover with a light system built in, do not use the lights until the eggs have hatched and the fish start to swim. Once the fish are swimming, the lights can be used, but should be on a timer for 8-10 hours each day, or turned on and off every day.

The water in the aquarium should be treated with a tap water conditioner when the tank is filled. There are many brands of conditioner and they will all indicate on the label that they remove chlorine, chloramine, and toxic metals.

Handling the eggs

When the eggs arrive, they are in the 'eyed' stage which means the two small black dots in each egg are the eyes of the developing trout. The eggs will usually hatch in a few days to maybe as long as a week. A few eggs are sometimes damaged in handling, or infertile, and they will not hatch. These eggs are easy to identify as they turn white. The damaged eggs can get moldy and infect any eggs they are touching. If the eggs are scattered on the bottom of the tank, the eggs that mold are harmless as they are not in contact with healthy eggs. If some eggs are placed in a basket for observation, check them daily and remove any that turn white. A turkey baster is an excellent tool for removing the bad eggs or any fish that die during the hatching process.

Feeding

After hatching, the baby fish are in the alevin stage which lasts about three weeks. During this time, they pretty much just lie in the gravel and absorb their yolk sacs. After about two weeks, some may be observed wiggling and scooting along the bottom, but this is not swimming. Feeding does not start until fish start to swim up in the water column and remain there.

Teachers will be provided food at the time eggs are delivered. The food is the same as that used in the State fish hatcheries. Feeding too much too soon is a serious problem that is seen every year and can really affect the water quality. Refer to Appendix 1 at the end of this document for more detailed feeding instructions. Schools that run out of food can use fish flakes or mini granules from the pet store that are packaged for tropical fish or gold fish. The trout do not care and they do not read labels.

It is not uncommon to have some fish that never get the hang of feeding. They are referred to as pinheads, because they will have a large head and skinny body and will likely die. This is usually observed between Thanksgiving and Christmas and is normal.

Nitrogen Cycle and Water Changes

All fish tanks, including trout tanks, rely on beneficial bacteria to break down fish waste and uneaten food. The waste and uneaten food form ammonia which is toxic. One type of bacteria breaks down the ammonia into nitrite, which is also toxic. Another bacteria breaks down the nitrite to nitrate, which is only toxic at high levels.

There are many brands of beneficial bacteria available at any pet store with clearly marked labels. One capful of the bacteria can be added to the tank when the eggs arrive, and a capful every week for the following month. There is no need to add bacteria before the eggs arrive, as they need the eggs to hatch and waste to be produced so they have a food source and start to multiply.

Water testing is a good way to involve students and can be incorporated easily into math and science topics. Most schools use the API Master Kit which is readily available and lasts several years. It is normal to find spikes in ammonia followed by spikes in nitrite as the bacteria get established. This is not cause for concern and is covered in Notes on Ammonia Spikes in Appendix 2.

Nitrate is only slightly toxic but can build up over time. It is kept in check with regular water changes. For trout, the recommendation is to conduct one or two five gallon changes a week, starting in November after the fish are swimming. Instructions and video links will be sent at the appropriate time. Any water added back to the tank should be treated with the tap water conditioner.

Trout are very tolerant of a wide range of pH and this is seldom an issue. Most water systems in this part of Virginia provide water with a pH around 8. If the pH gets up to 8.4 or higher, the recommendation is to take a handful of dried oak leaves and crumble them and place in a mesh bag to float in the tank. A handful the size of a tennis should slowly bring the pH back down.

Teachers are advised not to scour the internet and look at sites that recommend large water changes any time an ammonia or nitrite spike is observed. A large water change early in the year can inhibit development of the nitrogen cycle. It can also stress the fish if a large volume of room temperature water is added to the tank.

Maintaining Chillers

Once the chillers are up and running, there are only a few things to check on periodically.

With the **Tradewind** Chillers, about the only maintenance issue is keeping dust off the grills. Some schools have them in locations where dust is an issue while others rarely collect any. The picture shows an extreme case. A dust cloth or wisk broom will clean it easily.



The **Aqua Euro** chillers have a few issues that can arise. Because they have the pump and hoses, they require a little more effort to set up and there are more potential issues. Every hose connection is a potential leak. Most leaks are minor and occur at the base of the nozzles which can be tightened by hand. Some alleged leaks turn out to be condensation dripping down the hoses onto the unit. Maintenance involves a few tasks that ensure water and air are circulating properly. The unit has a fuse which will blow if it overheats.

The front of the chiller serves as a lint screen, similar to a clothes dryer. The front panel can be removed by loosening the screw at the bottom middle. The screen is held in by four small screws. Once removed, the lint can be removed by hand or under a faucet. There are also small panels on each side that just pop out for cleaning. We have had chillers blow their fuse because the front panel was completely choked with lint and dust causing the unit to overheat. In most cases, cleaning the filter once at the start or end of the year will suffice.



The pump in the tank has a filter that needs periodic attention. It is supposed to be cylindrical in shape. As it clogs with debris it constricts and takes on a coke bottle shape. It just slides off (unplug pump) and can be



squeezed out in water that was removed during cleaning, or in aged tap water. Cleaning it under running water will kill beneficial bacteria. The picture shows an extremely dirty filter. We have had a chiller blow its fuse because the dirty filter virtually stopped water flow causing



the unit to overheat. We have also had a chiller blow its fuse because the tubing had a kink. If the fuse does blow, the lights on the panel go out and the chiller quits. The fuse is a 125volt 10amp fuse that is located next to the power switch on the right side.

The pumps are Mag-Pumps and last for years. They should not be run while dry. They should be unplugged while cleaning the filter. If they are left running while the filter is removed, they can suck up sand or gravel which will be fatal to the unit.

The **vinyl tubing** on the Aqua Euro chillers should last for years. It will get algae growth inside the tube. It is pretty easy to clean, but getting the tubing off the nozzles can be a challenge. They can be cleaned at the end of the year with a brush made for tube cleaning. The picture shows a brush with a coat hanger used as extension. Tubing may have to be soaked for awhile if it was allowed to dry before cleaning.



Filter systems

Filter systems are also pretty reliable and usually last the whole year if the cartridges etc. are changed at the beginning of the year. If they die, it is usually because the impeller has burned out. The impeller is basically a small magnetic motor with plastic blades that push the water through the filter. For most filters, it costs just as much to replace the impeller as it does to replace the filter, so teachers should purchase whatever filter of the appropriate size is on sale at the local pet store. The tank can go a day or two without the filter running.

Several schools have the Aqua Clear 110 filter. It is oversized since it is intended for a 100 gallon tank. It does a great job, and they can be repaired more cost effectively if the impeller burns out. Impellers can easily be found on Amazon by searching for 'Aqua Clear 110 impeller'.

Most filters need to be filled with water before turning on. Some filters (Aqua Clear 110) also have a leveling device on the back which can be adjusted so the filter is level. A filter that tilts backwards may have a weak flow or stop running. The leveling device, which is a small plastic lever, often falls out and gets lost. A small wad of crumpled up paper can be wedged between the filter and tank to level it. Some filters may stop running if there is a short power outage and they just need a glass full of water added to them to get them flowing again.

Releasing fish

Fish can be released anytime in the March-May timeframe, it is up to the teachers. A list of approved streams will be provided. Releasing wildlife back into nature is regulated by the Division of Wildlife Resources. All teachers must report where they release their fish and the approximate number. This information is shared with the State Fish Biologists.

The streams on the approved list are usually streams that are already stocked with trout for public fishing. A few streams may currently have no trout, but the TIC fish are released in hopes of establishing a population. Most of the approved streams are in or close to the mountains and remain cool throughout the summer. Students should be aware that most of the streams or ponds in their local neighborhoods are too warm for trout to survive. Additionally, TIC fish are not stocked in most of the streams in Shenandoah National Park or the National Forests that contain native brook trout. The Fish Biologists do not want the genetics of hatchery fish to mix with wild fish.

The easiest way to transport trout is to use the five-gallon bucket used for water changes. Fill it about half way with water from the aquarium, making sure someone can still lift and carry the bucket. A regular cooler will also work with 3-4 inches of water. It is much easier to catch the fish in the aquarium with a 5-6 inch net than a 2-3 inch net. If the trip to the release site is over half an hour, a battery-operated aerator is recommended. They are available at Walmart or any sporting goods store since many fishermen use them in live bait buckets. A frozen bottle of water or bag of ice cubes will keep the water cool during the trip.



Upon arrival at the release site, it is recommended to add small amounts of stream water to the bucket over 10-15 minutes to acclimate the fish to their new environment. Most teachers bring their net and some small cups so students can release individual fish. The bucket can also be tilted slowly to allow the fish to swim out on their own.

Appendix 1 - Feeding

The daily feeding guidelines below are based on an ***estimate of 125-145 fish per tank*** and the **kind of measuring spoons used for 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. Preferably feed twice daily: half in the morning and half in the afternoon.

At each age/size of the trout, the amount of food provided per day should start with the amount shown in the table below and gradually increased so that the size of the trout and the amount of food called for in the table reach the next stage at about the same time. For example, midway between the 1" stage and the 1.5" stage you can be feeding a total of 1/2 teaspoon per tank daily i.e. ¼ tsp in the morning and ¼ tsp in the afternoon

Since these measurements are not the product of hard science, you always need to factor in common sense and 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.

B. FEEDING GUIDELINES

Begin feeding when eggs sacs are absorbed and the alevin begin to swim up in the water column.

<u>Age/Size of Fish</u>	<u>Amount/Size of Food</u>
From week 1 to week 3	pinch of smallest size of food
From 3 weeks to 1" long	1/4+1/8 tsp smallest food size
From 1" to 1.5" long	3/4 teaspoon of mixture *
From 1.5" to 2" long	1+1/2 tsp
From 2" long	2+1/4 tsp

*Start mixing in the larger size food at this stage

Holidays

Fish can go the weekend and even the 5 day Thanksgiving break with no issues. There are several options for the Christmas break, which can be as long as two weeks. If there is access to the school and you can drop by a few times, that is ideal. Leaving food for maintenance staff can work, but takes planning, which usually means to hide the food except for daily doses kept in individually marked dixie cups. Automatic feeders are also an option, but take practice in setting up and calibrating. Practice with them on a desk top for few days before using them on the tank. Overfeeding is a common issue with automatic feeders.

Appendix 2 – Ammonia/Nitrite Spikes

High ammonia and nitrite levels can be indicators of the need for a water change, but remember that during the nitrogen cycle some 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 increasing the amount of water removed.

Note: The API test (this is the water testing kit most teachers use) for ammonia produces a value that consists of ammonia plus ammonium. Ammonia is hazardous to fish and plants; ammonium is not. The API reading is a measure of the sum of both. The API test, however, does not indicate the percent distribution of each component. Therefore, if the test yields an elevated ammonia reading and the fish show no sign of distress, it is very likely ammonium is the larger component of the reading. This is GOOD news. Thus, unless the fish show signs of distress, there is no need to panic if ammonia readings seem on the high side.

The Maryland guide suggests trying to keep the Nitrite and Ammonia levels under 1ppm, while the New Jersey guides says Ammonia levels (as determined with the API kit) as high as 4ppm are generally harmless. The Maryland guide also suggests keeping Nitrate under 40 ppm.

The bottom line again is that unless fish are showing signs of distress or dying in unusually high numbers, large water changes should be avoided. The main purpose of testing water is to involve students, not cause panic.