Eastern Brook Trout in the Classroom
Teacher’s Manual

Developed by
NH Fish and Game Watershed Education Program and
New Hampshire Trout Unlimited
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ACKNOWLEDGEMENTS

The Eastern Brook Trout in the Classroom Teacher’s Manual is provided to you because of the efforts of dedicated Trout Unlimited volunteers Mark Seymour (Great Bay Chapter) and George Embley (Basil Woods Jr. Chapter) who have spent many hours assisting in this effort. Without the time, expertise, and resources that these two gentlemen provide, the Trout in the Classroom program would not run as well as it does. Our thanks to both of them.

Our thanks also to the following teachers who volunteered their time and teaching experience to make this a more useful and effective manual and who have offered many examples of curricula and classroom advice to make Trout in the Classroom a much better program.

- Alex Hicks, Science & Technology Teacher @ Shaker Road School in Concord
- Mary Jolles, Principal @ Colebrook Elementary School
- Elaine Marhefka, on leave from Garrison Elementary School in Dover
- Judy Ross, Science Curriculum Coordinator @ Lebanon School District

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What is Trout in the Classroom? (TIC)

Program Goals:
Trout in the Classroom (TIC) is an environmental education program in which students in grades k-12:
• raise trout from eggs to fry.
• monitor tank water quality.
• engage in stream habitat study.
• learn to appreciate water resources.
• begin to foster a conservation ethic.
• grow to understand ecosystems.

TIC is a unique way to teach the relevance of watersheds. Trout are indicator species; their abundance directly reflects the quality of the water in which they live. In the TIC program, students grow to care about their trout and then the habitat in which trout live. As the program progresses, students learn to see connections between the trout, water resources, the environment, and themselves.

During the year each teacher tailors the program to fit his or her curricular needs. Therefore, each program is unique. TIC has interdisciplinary applications in science, social studies, mathematics, language arts, fine arts, and physical education. Most programs end the year by releasing their trout in a state-approved stream near the school or within a nearby watershed.

Case Studies:
In New Hampshire, many schools at all grade levels, participate in the TIC program.
• In Dover, the elementary, middle, and high schools all participate in raising trout eggs and then release them into the Cocheco River. All three schools have studied the water quality and macroinvertebrate populations of the river. The Children’s Museum of New Hampshire has also added the TIC program to their educational outreach to the public about the Cocheco River watershed, the “Cochecosystem”. This program includes a dynamic partnership with the Great Bay chapter of Trout Unlimited who provide chillers and liaison duties with the schools. The year culminates with a River Day in May when the fingerlings are stocked and the community is invited to see what the students have done.

• In Lebanon, the fourth grades from two schools work together to study the watershed of Great Brook and determine if the water quality is good enough to release the trout they raise in the classroom. The schools visit the brook before release day to test water quality and macroinvertebrate populations and also study the riparian habitat. The year culminates with a Watershed Congress which is an aquatic field day designed to offer the students more opportunities to learn about their watershed from various natural resource professionals. The students also provide management suggestions to improve Great Brook habitat to the local government officials on the conservation commission and planning board.
In Colebrook, two different grades raise Eastern brook trout. The focus in the fourth grade is on brook trout being the New Hampshire state fish and an example of a living thing's place in the ecosystem of a stream or river. The life cycle is also studied. Seventh grade is much more in-depth, with discussions of water quality, temperature variations and their effects on the development of fish, how brook trout are related to other trout, adaptations they have developed in order to survive in their habitat, limiting factors, evaluation of different habitats for suitability for brook trout, and threats to their survival.

**Learning Objectives:**
Students will be able to:
- Understand the life cycle of the Eastern brook trout
- Understand the habitat needs for the Eastern brook trout
- Understand the need to maintain a healthy watershed
- Use Science Processing Skills as outlined in the NH Science Curriculum Frameworks (See “Watershed Education Program Connection to the NH Science Curriculum Frameworks”, page 22)
- Be responsible stewards of their local water resources

**TIC Curriculum Expectations:**
The TIC program is part of the Watershed Education Program (see WEP flyer on NH Fish & Game website). Teachers are encouraged to incorporate as much of WEP into their TIC program as possible by having the students:
- Visit their local river or stream to collect water samples, describe the site characteristics, and collect macro-invertebrates to define the level of water quality in their river.
- Explore their watershed through the use of Geographic Information Systems or GIS to facilitate discussion about how human activities may impact the watershed and therefore the river.
- Survey the aquatic resources at the river by performing habitat assessments, and collecting, identifying and measuring fish with NHF&G staff. Some fish may be kept in a tank in the classroom for behavioral studies and observation. Salmonid eggs may also be provided to be raised in the classroom and released in an appropriate river.
- Use all of the information they have collected to identify and share with the community possible management strategies and projects to maintain and improve the water quality in their watershed and in their river.

Teachers can find the Trout Unlimited “Trout in the Classroom” curriculum at [www.troutintheclassroom.org](http://www.troutintheclassroom.org).

For other curricula and support materials, see “Eastern Brook Trout Habitat and Curriculum Information”, page 20.

**TIC requires:**
- An aquarium set up to provide cold, clean, fresh water. (See “Trout in the Classroom Equipment List”) page 8.
- A state-approved source of eggs. (NHF&G hatcheries)
• Registration for the program by the schools (See “Trout in the Classroom Registration Form for NH”) page 30.
• Permit to raise trout eggs in the school (provided by NHF&G)
• Training for the teachers and volunteers (See Sample Orientation Agenda (page 17) and “Trout in the Classroom Volunteer Job Description”) page 7.
• A year-long commitment to care for and release the trout.
• A teacher evaluation of the program at the end of the year (See “Trout in the Classroom Evaluation Form for NH”) page 31

See “Trout in the Classroom Timeline” on page 5 for month by month timing of the steps.

**TIC partners:**
The Watershed Education Specialist Judy Tumosa at NH Fish & Game (NHF&G) provides oversight and resources to support the state TIC programs. NH F&G keeps track of teachers, schools, and other organizations that participate and provides eggs and permits for release into local streams. NH F&G also provides training and environmental education resources, and helps to connect teachers with New Hampshire Trout Unlimited (NHTU), local chapters of Trout Unlimited (TU), and other organizations that support TIC.

The NHF&G state hatcheries provide the trout eggs and technical assistance to the schools to help them successfully raise the trout eggs. They also, by appointment, can provide hatchery tours. The fisheries division and biologists provide the permits to raise the trout eggs and advice about acceptable stocking sites.

New Hampshire Trout Unlimited and its associated Chapters are important partners in the state TIC program. The state TU Council, TU chapters, and other partners can sponsor one or more schools by providing funding, equipment, technical support, classroom guest speakers, and guidance during field work. Members of TU can help classes by sharing their expertise in conservation, stream restoration, fly-tying, trout biology, invertebrate identification, and outdoor sports activities.

The Eastern Brook Trout Joint Venture (EBTJV) is a recognized Fish Habitat Partnership operating under the National Fish Habitat Action Plan. The EBTJV coordinates efforts that build private and public partnerships to improve brook trout habitat. The long-term goals of the EBTJV are to implement a comprehensive conservation strategy to improve aquatic habitat, raise public awareness, and prioritize the use of federal, state and local funds for brook trout conservation. TIC assists in this public awareness with the students and with the public.

For specific contact information see page 29: “Trout in the Classroom Contact Information.”
TROUT IN THE CLASSROOM TIMELINE

- August/September:
  NHF&G sends out introduction letter and **Trout in the School Registration Form** to the schools to sign up for the program. All schools need a permit to raise and release the eggs and fish so they must go through me to get their eggs. Schools should be arranging to get their equipment.

  **TU can help with school contacts of interested schools.**
  **TU can help with equipment needs.**

- September/October:
  NHF&G processes registration forms and sends them onto the fisheries biologists for approval of the stocking sites, egg numbers, and permit information.

- November:
  NHF&G and partners train new teachers and liaisons in salmonid life history, restoration program, tank set up and care, and fisheries activities. Typically lasts 4-6 hours, can be moved around the state and can include a tour of a hatchery.

  **TU can be school liaisons to help with tank questions and stocking field trips.**
  **TU can help with training locations and curriculum.**

- December/January:
  NHF&G sends out permits for the schools.
  NHF&G coordinates with the hatcheries to get the eggs to the schools. Schools should set up their tanks at least a week ahead of time to make sure the chillers will work.

  **TU can help with egg delivery from the hatcheries to the schools.**
  **TU can help with tank questions.**

- January – April:
  Schools are raising their eggs and doing watershed and fish culture activities such as testing their local river and visiting their local hatchery. Schools track the development of salmon/trout using the Developmental Index (DI).

  **TU can help with tank questions and DI calculations.**

- May:
  We stock our fish!! and fill out **Trout in the School Evaluation form.**
  **TU can help with stocking field trips.**
Dear teachers and students:

It is time again to register for the Eastern Brook Trout Egg in the Classroom program for the upcoming school year! The New Hampshire Fish and Game Department is excited to bring this annual program to schools throughout the state. We have experienced schools returning to the program and invite new schools to sign up. Our state hatcheries are committed to providing the fish eggs and excellent fish culture advice. Our partners with Trout Unlimited will help advertise and coordinate the school registrations, will assist with equipment needs, and will be active liaisons with their local schools.

The first step to participate is to fill out the mandatory Trout registration form for whichever species you choose, and return it to Judy Tumosa at the New Hampshire Fish and Game Department by **September 30th**. The registration form provides information about your school and serves as your request to obtain a New Hampshire state permit to raise and release the trout. **Be specific** about the location of your release site so the department biologists can be sure that you are in acceptable salmonid waters; for example “in the Oh My Gosh stream on River Street by the railroad bridge”.

Supplies for the program include: a chiller (estimated cost $700.00), and a tank set up consisting of a 20 or 30 gallon fish tank, water filter, air stone and pump, gravel or plastic matting, tank insulation, thermometer, turkey baster, and duct tape (estimated cost $125.00). The chiller is needed to keep the eggs cold enough to survive and hatch on schedule. There are some available for schools to borrow and your local Trout Unlimited chapter, PTO’s, or community service groups may be able to help you obtain one.

New teachers will be required and experienced teachers are encouraged to attend a training session in early November. The session covers salmonid ecology, tank care, water quality assessments of your local river, fish hatchery function and purpose, and science curriculum framework connections. The eggs are available for the classroom in mid-January.

Contact Judy Tumosa with questions at judy.l.tumosa@wildlife.nh.gov or #271-0456, and if interested, please fill out and return the forms by **September 30th**! Looking forward to a “fin” year!

Sincerely,

*Judy Tumosa*
Watershed Education Specialist
Trout in the Classroom Volunteer Job Description

A successful Trout in the Classroom program needs volunteers who are willing to give their time to be a resource for the teachers and their students. Volunteer interest, encouragement, and experience with trout and cold water conservation mean a lot to teachers and kids involved in the program.

See “Trout in the Classroom Timeline” for details throughout the school year.

1. Assist teachers with obtaining chiller and tank.
2. Assist teachers with chiller and tank set up.
3. Recruit new schools into the program.
4. Attend and participate in the training offered to the new teachers by NH Fish & Game watershed education staff.
5. Contact teachers to make sure tank set up is complete before arrival of the eggs.
6. Pick up eggs from the hatchery and deliver eggs to the schools. Make sure you get the hatchery water temperature and the developmental index from the hatchery staff and share that with the teachers. Successfully transport the eggs into the tank and be prepared to talk with students about the program.
7. Check in with the school on a regular basis to address questions, concerns, problems, and successes. Check on hatchling status, water quality, tank care, need for food, any other problem.
8. Be available in person if possible in case of emergencies.
9. Update NHF&G staff about progress.
10. Relay teacher requests for guest speakers.
11. Participate in spring events centered around release days, congresses, river field days.
12. Help teachers clean and store equipment at the end of the school year.
13. Track and record time spent on the program for the ARE federal grant match.
14. Suggest program improvements, training needs, and curriculum changes.
Trout in the Classroom Equipment List

Equipment everyone will need:

Chiller to keep the tank temperature at 38 degrees F +/-.
Suggested unit: Glacier Corporation Chiller
1/6 Horsepower Immersed Coil Type (Cooling coil is placed in water). No tubing or pump needed for the chiller.

Tank
20 gallon is acceptable if releasing the fish after they absorb the yolk sac with no feeding
30 gallon or larger is recommended if feeding the fingerlings and growing to a larger size before releasing

Filter: Recommended Fluval canister filter and filter media appropriate for the size of the tank you are using.
Follow the advice of your supplier for a heavy load. The filter media you choose should be able to handle a high quantity of waste and should support a large colony of beneficial nitrifying bacteria.

Table, counter, or stand strong enough to support the tank and water.

Insulation for the tank (foam board from a home store, bubble wrap, or the like) to stabilize the tank temperature and reduce wear on the chiller.
Be sure to make a cover for the tank top to shade out UV light and cut a window in the front so students can see the eggs as they develop.

Gravel (pea size) from the pet store or rocks (pea to ping pong size) from the river to provide a substrate.
The gravel (not pink) will make it easier to see the eggs, the rocks will provide a natural substrate. Some prefer to have a bare bottomed tank or prefer to use plastic netting to support the eggs.
Thoroughly rinse the gravel and clean the rocks.

Air Pump & Airstone to maintain oxygen levels.

Thermometer to measure water temperature and track development of the eggs.

Nets to capture fish in the tank when taking to the river to stock.

Net Breeder (optional) to allow students to view some eggs up close without disturbing them all.

Freshwater Testing Kit to track oxygen, pH, and ammonia and nitrite levels.
Turkey Baster to remove dead eggs and extra food/waste from the tank

Siphon Gravel Cleaner to clean the bottom of fish waste and unused food.
Optional Equipment as needed:
Buckets (2 or more), to age water before putting in the tank
Battery-operated aerator, to give the trout oxygen during transportation (available at pet stores)
Ammonia removal compound, for use in ammonia emergencies (available at pet stores)
Tap-water-safe compound, for use in emergency water changes (available at pet stores)
Clean ice packs, for use in transportation and/or chiller emergencies

Equipment Replaced Yearly:
Filter pads or cartridges—some parts of the filter can just be rinsed, scrubbed, and dried, but consumable components such as charcoal filters should be replaced.
Airstone and check valve--these two pieces can degrade or get gummed up with waste.
Water Quality Test Kit--at the end of one school year, you may have used up most of the reagents and other testing materials.
Aquarium compounds you are using to boost the bacterial population and manage water chemistry.
As a participant in the Trout in the Classroom program (TIC), starting during the 20XX-20XX School year, this Agreement is entered into by and between NAME OF SCHOOL OR PROGRAM AND The New Hampshire Trout Unlimited Council. This Agreement memorializes the transfer of equipment from The New Hampshire Trout Unlimited Council to the designated school or program for the purposes of participating in Trout in the Classroom (TIC), a program designed to advance TU’s Coldwater conservation objectives. The New Hampshire Trout Unlimited Council is pleased to provide the following equipment for the use by NAME OF SCHOOL OR PROGRAM, under the following conditions:

**EQUIPMENT LIST**

This is necessary equipment for participation in TIC. The equipment is for the use of NAME OF SCHOOL OR PROGRAM, for the sole purpose of participating in TIC.

NAME OF SCHOOL OR PROGRAM acknowledges receipt of this equipment. By accepting and using this equipment for the stated purposes, NAME OF SCHOOL OR PROGRAM assumes all liabilities and responsibility for its use, and agrees to indemnify and hold harmless TU from any claims of any nature whatsoever arising from the use and/or misuse of the equipment, including attorney’s fees and costs.

If a chiller is included in the equipment provided, The New Hampshire Trout Unlimited Council retains full title and ownership. As long as NAME OF SCHOOL OR PROGRAM fully participates in TIC, the chiller will be for the sole use of NAME OF SCHOOL OR PROGRAM. NAME OF SCHOOL OR PROGRAM agrees to promptly notify TU if any repairs or replacements are necessary. Upon receipt of written notice, TU will consider the feasibility of making repairs and/or providing replacements in a timely manner.

In the event that participation in TIC is terminated or diminished, NAME OF SCHOOL OR PROGRAM shall notify The New Hampshire Trout Unlimited Council and shall return the loaned equipment to The New Hampshire Trout Unlimited Council.
In the event that the contact person (hereinafter designated) changes for either **NAME OS SCHOOL OR PROGRAM** or **The New Hampshire Trout Unlimited Council**, it is the responsibility of the outgoing contact to notify the other contact in writing of said change.

New Hampshire Trout Unlimited Council

The undersigned, as authorized representatives of the indicated entities, agree to the terms and conditions herein specified:

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<th>Trout Unlimited Chapter or Council</th>
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<td>Participating Teacher (or Principal)</td>
<td>Chapter TIC Coordinator (or President)</td>
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HOW THE CHILLER WORKS (Refer to Sketch)

An aquarium chiller operates on the same principles as a refrigerator or air conditioner. There is a temperature controller and temperature sensor on all chillers which allow you to set the optimum temperature for your water.

Chillers function using four main parts – a compressor, a condenser (or radiator), an evaporator or cooling coil, and an expansion valve. The operation uses compression and expansion of a refrigerant gas to transfer heat from a low temperature source (the aquarium water) to a higher temperature sink (room temperature air).

Referring to the above diagram, refrigeration gas, such as R134A, is mechanically compressed (A) to high pressure and high temperature and then run through a condenser (B). The condenser is a heat exchanger which removes heat from the hot compressed gas and allows it to condense into a liquid. The liquid refrigerant is then sent through an expansion valve (C), or capillary tube, where the pressure drops—which lowers the boiling point and makes it easy to evaporate. For a drop-in chiller, the refrigerant then goes through an evaporator coil (D) where it can absorb heat from the tank water. At atmospheric pressure, the boiling point of R134A is -15°F so the gas temperature will be well below that of aquarium water, allowing heat from the water to be transferred to the refrigerant. The loop is completed when the refrigerant goes back through the compressor (A) and into the condenser where the heat is transferred to the room air by pulling the air through the condenser (B) with a fan.
For a flow through chiller, the process is identical except that, instead of immersing the evaporator coil in the tank, the coil is inside a chamber which is internal to the chiller and through which aquarium water is pumped.

Two common problems can occur with chillers. Firstly, if the water in the tank is not agitated the drop-in evaporator coil can ice up – causing a significant reduction in the chilling effect. This can be avoided by placing a bubbler under the coil. Secondly, since the fan sucks air from the room in through the condenser (or radiator), dust and dirt come in with the air and can cover or clog the fins on the radiator. This reduces their ability to dissipate heat and the chiller’s efficiency can be severely compromised. To avoid this, the dust and dirt must be cleaned off periodically.
CHILLER MAINTENANCE:

The most important item in maintaining a chiller is to clean dust off of the radiator fins annually (There are also instructions for doing this on the national TIC site). Removing the cover to clean inside the chiller is not recommended. The thermocouple and wiring are attached to the cover and it would be too easy to damage stuff. Dirt collecting on the condensing coil is the primary problem because it can reduce efficiency. Most of this can be removed from the back of the chiller. A soft brush on a vacuum hose gets some dirt off but running a clean nylon paint brush over the fins and then vacuuming a second time is better. You can also blow a lot of the dirt out with an air compressor (I would still loosen the dirt on the fins with a brush).

When the aquarium is cleaned out with disinfectant at the end of the year, the chiller tubing that is immersed in the tank can also be wiped off. A rag or soft brush is sufficient. Never use anything metallic (e.g., scouring pad or brush with metal bristles) as this can damage the tubing.

A lot of schools put the equipment away at the end of the year. It seems like moving chillers is when they usually get damaged. For drop-in chillers, there have been cases where the foam covered flexible coolant lines have been damaged and required replacement. This kind of damage probably happens when the lines are overstressed by excessive flexing (or even using them as a handle!). If care is taken by not bending them into a new shape and keeping them under control so they don't flop around when being moved there shouldn't be a problem. There is also a bend in the stainless steel tubing that loops over the tank. It is possible for the tubing to eventually crack at this point if it is force fit over too great a width (say the tank plus an inch of insulation). If the chiller has been moved (or even if it hasn't), it should be checked to make sure it is operational once it is in place and before use. That way, if refrigerant charge has leaked out over the summer, or some other damage has occurred, there would still be time to repair or replace before the eggs arrive. You can check to see if it is cooling without immersing the coil in water but the unit should only be run briefly (less than a minute) if that is the case. During normal operation, temperature should be double checked with an independent measurement.

So, a "maintenance" checklist is pretty brief:

- At the end of the school year, clean dirt/dust off of condensing coil and, if possible, blow out unit with air compressor.
- As early as possible, but after unit is set up for the new school year, confirm that unit is operating properly.
- During operation, confirm that accuracy of thermostat with independent measurement (daily or at least weekly)
- If unit is moved, protect foam covered flexible coolant lines from excessive movement.
End of Year Cleanup

Guidance for end-of-year cleanup is on the TU National Website. It has been reproduced here for convenience.

At the end of the TIC season, it is important to clean your aquarium set-up in order to ensure a successful next year. If you take a few minutes to make sure everything is clean, your equipment will have a much longer life. Here are a few pointers for cleaning the various components of your chilled aquarium set-up.

Aquarium Tank

1. Empty the tank almost all the way, by your usual method—many people like to use the electric pump to do this work. Then turn off the electrical pumps, chiller, filters, ect.
2. Finish emptying the tank, disconnect tubing.
3. Using a solution of 1 part Chlorine bleach (Clorox) and 10 parts water, wipe down the interior and exterior of the tank. A soft sponge (dedicated to this use only) can be used to scrub hard to remove scale and algae growth.
4. You can use the 1:10 bleach solution for cleaning out the tubing (clean tubes using long brushes you can buy at any pet shop).
5. Wipe dry with clean cloth, or let air-dry.
6. If you have any pebbles or gravel in the tank, they should removed, washed, and dried by laying out on a cloth or towel in the sun or a ventilated area. They can also be sterilized with the Clorox solution, but they also MUST be completely dried.

Aquarium Chiller: It is best not to move the chiller any more than necessary as it is delicate and can break.

Drop-in style chiller (Glacier) (See also separate guidance for maintenance of drop-in chillers)

Using bleach solution and a dedicated sponge, you can wipe off the stainless steel Freon tubing.

For hard-to-remove plaque, a small PLASTIC scrub brush can be used. NEVER USE A WIRE BRUSH ON THESE TUBES.

Remove dust and lint from the fins of the coolant tubing (those black thin metal slats on the side of the chiller). This can be accomplished using a small vacuum cleaner, dusting cloth or soft bristle plastic dust brush. Your chiller will run more efficiently if you clean the lint and dust from this side of it.

Flow-through style chiller (Arctica Titanium, Aquachill, Via Aqua, Polar Bear)

Rinse pre-filter sponge on pump thoroughly with water, and let air-dry.

Tip chiller and drain. Using pump or faucet hose, flush chiller with clean tap water in each outlet, to ensure any dirt is washed out of the cooling tank. Then tip further to ensure it is fully drained.

Remove dust and lint from all vents on the chiller, using a small vacuum cleaner, dusting cloth, or soft bristle plastic dust brush.
Filter

Take apart your filter and scrub out the plastic parts with you 1:10 bleach solution. Thoroughly rinse out all filter cartridges (filter sponges, charcoal, etc.) with regular water, and dry them in the sun or a well ventilated area. For most filters, it is suggested that you buy new filter cartridges for the following year. You can also use this year’s filters that you rinsed out. Thoroughly air-dry entire filter apparatus.
Eastern Brook Trout-In-The-Schools
Orientation Agenda (Sample)
@ The Children’s Museum of New Hampshire, Dover
November 3, 2010
3:30 to 6:30 pm

3:30 pm  Registration & Goodies & Materials Table
3:40 pm  Welcome & why are we here? Judy Tumosa NHF&G
3:45 pm  Eastern Brook Trout Ecology and Joint Venture
4:15 pm  Tank Set-up and Maintenance and Water Quality Challenges
4:45 pm  Break
4:55 pm  Teacher Successes and Horror Stories or what might occur in your tank - do not be afraid!!
5:05 pm  Fish Development:
       Developmental Index and/or Trout Temperature Units -
5:35 pm  Permits & Logistics of Picking Up Your Eggs
5:45 pm  Paperwork after the Fun is done
6:00 pm  Watershed study for your stocking river (WEP)
6:20 pm  Wrap up and Final Questions
6:30 pm  Migration Home…  

Location:  6 Washington Street
Dover, NH  03820
Directions to the museum:  www.childrens-museum.org.
## Eastern Brook Trout Developmental Index

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This chart goes from fertilization to swim-up.

- **cumulative % development**
  - weakly eyed 29%
  - shocking 38-42%
  - strongly eyed 47%
  - Hatched 73%
  - swim up 100%

Prepared by Jason Smith Powdermill
Hatchery 3/13/08
Date:

This is to certify that _________________________________ has successfully

completed the Trout in the Classroom ___ hour workshop held on ________________

at ____________________________________________________. This workshop will allow

him/her to raise Eastern Brook Trout eggs in the classroom.

Sincerely,

Judy Tumosa
Watershed Education Specialist
EASTERN BROOK TROUT HABITAT AND CURRICULUM INFORMATION


Colebrook Elementary School curriculum activities:
For copies, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

Lebanon Schools Watershed Congress and Great Brook Watershed Study:
For copy of CD, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

http://www.wildlife.state.nh.us/Fishing/fish_species_profiles.htm for fish species profiles.
http://www.wildlife.state.nh.us/Fishing/fisheries_management.htm for fisheries management plans for NH.

NHF&G “Eastern Brook Trout in the Classroom” DVD:
For copies, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

NHF&G “Fish for the Future A Hatchery Experience” curriculum
For copies, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

NHF&G Watershed Education Program (WEP) training and materials
For information, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

Trout in the Classroom (TIC) teacher resources:
www.troutintheclassroom.org
http://www.troutintheclassroom.org/teachers/lesson-plans
http://www.streamexplorers.org/members/stream-explorers-magazine

TIC National List Serve; teachers can all join to share successes, challenges, curriculum ideas:
For information, contact Judy Tumosa: judy.l.tumosa@wildlife.nh.gov

Wildlife Journal articles on brook trout:
Websites for information about agencies and organizations that contribute to the education, protection, management and restoration of salmonid species.

Eastern Brook Trout initiative: http://www.easternbrooktrout.org

New Hampshire Fish and Game Department: www.wildlife.state.nh.us

Trout Unlimited: National website http://www.tu.org; NH websites: http://www.nhtROUT.org

Activities: Fly Fishing In Schools: www.flyfishinginschools.org
Science Process Skills, 5-8

S:SPS1:6:1.1 Make observations and record measurements using a variety of tools and instruments.

S:SPS1:6:1.2 Plan observations based on a given purpose.

S:SPS1:6:1.3 Identify and investigate similarities and differences among observations and sets of observations.

S:SPS1:6:1.4 Use appropriate units and precision of metric measurement when recording data.

S:SPS1:6:1.5 Use a classification key, such as a dichotomous key, to identify and distinguish among members of a group or set.

S:SPS1:6:1.8 Ask questions about relationships between and among observations.

S:SPS1:6:3.1 Carry out simple student or teacher-developed procedures or experiments.

S:SPS1:6:3.2 Use appropriate tools to collect and record data.

S:SPS1:6:3.3 Follow the teacher’s instructions in performing experiments, following all appropriate safety rules and procedures.

S:SPS1:6:4.1 Use appropriate tools to organize, represent, analyze and explain data.

S:SPS1:6:4.2 Make and record observations using a pre-determined format.

S:SPS1:6:4.3 Compare and display data in a variety of student or computer generated formats (such as diagrams, flow charts, tables, bar graphs, line graphs, scatter plots, and histograms).

S:SPS1:6:4.4 Identify patterns and relationships in data and formulate basic explanations.

S:SPS1:6:4.5 Draw appropriate conclusions based on data collected.

S:SPS3:6:1.1 Work effectively within a cooperative group setting, accepting and executing assigned roles and responsibilities.

S:SPS3:6:1.2 Work collectively within a group toward a common goal.

S:SPS3:6:1.3 Demonstrate respect of one another’s abilities and contributions to the group.
S:SPS3:6:2.1 Develop, focus and explain questions about the environment and do environmental investigations.

S:SPS3:6:2.2 Design environmental investigations to answer particular questions.

S:SPS3:6:2.3 Explore evidence that human-caused changes have consequences for the immediate environment as well as for other places and future times.

S:SPS3:6:2.4 Explore how humans shape and control the environment while creating knowledge and developing new technologies.

S:SPS3:6:2.5 Investigate environmental and resource management issues at scales that range from local to national to global.

S:SPS1:8:1.1 Use appropriate tools to accurately collect and record both qualitative and quantitative data gathered through observations (e.g., temperature probes, electronic balances, spring scales, microscopes, stop watches).

S:SPS1:8:1.2 Determine the degree of accuracy that can be obtained using a given instrument.

S:SPS1:8:1.3 Investigate similarities and differences noted when making observations.

S:SPS1:8:1.4 Construct and use a dichotomous key to classify a given set of objects or organisms.

S:SPS1:8:1.7 Ask questions about relationships between and among observable variables.

S:SPS1:8:2.1 Identify the manipulated, responding and controlled variables in an experiment.

S:SPS1:8:3.1 Use appropriate laboratory techniques to carry out student- or teacher-developed procedures or experiments.

S:SPS1:8:3.2 Use appropriate tools to gather data as part of an investigation (e.g., ruler, meter stick, thermometer, spring scale, graduated cylinder, calipers, balance, probes, microscopes).

S:SPS1:8:3.3 Follow the teacher’s instructions in performing experiments, following all appropriate safety rules and procedures.

S:SPS1:8:4.1 Use appropriate tools (including computer hardware and software) to collect, organize, represent, analyze and explain data.

S:SPS3:8:1.1 Work effectively within a cooperative group setting, accepting and executing assigned roles and responsibilities.

S:SPS3:8:1.2 Work collectively within a group toward a common goal.

S:SPS3:8:1.3 Demonstrate respect of one another’s abilities and contributions to the group.

S:SPS3:8:1.4 Demonstrate an understanding of the ethics involved in scientific inquiry.
S:SPS:8:2.2 Judge the weaknesses and strengths of the information they are using.

S:SPS:8:2.3 Explore the uses and limitations of models.

S:SPS:8:2.4 Synthesize observations and findings into coherent explanations about natural resources and the environment.

SPS4– Science Skills for Information, Communication and Media Literacy
(Except on how much the project encourages community outreach, this Framework could be covered as well.)

**Science Process Skills, 9-12**

S:SPS:11:1.1 Ask questions about relationships among variables that can be observed directly as well as those that cannot.

S:SPS:11:1.2 Use complex classification criteria and keys to identify items/organisms.

S:SPS:11:1.3 Evaluate complex methods of classification for a specific purpose.

S:SPS:11:3.1 Select and use apparatus and material safely.

S:SPS:11:3.2 Use instruments effectively and accurately for collecting data.

S:SPS:11:3.3 Compile and organize data, using appropriate units.

S:SPS:11:4.1 Compile and display data, evidence and information by hand and computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.

S:SPS:11:1.1 Collaborate with existing research efforts.

S:SPS:11:2.1 Develop, modify, clarify and explain questions that guide environmental investigations of various types.

S:SPS:11:2.2 Design investigations to answer particular questions about the environment.

S:SPS:11:2.3 Locate and collect reliable information for environmental investigations of many types.

S:SPS:11:2.4 Apply basic logic and reasoning skills to evaluate completeness and reliability in a variety of information sources.

S:SPS:11:2.5 Organize and display information in ways appropriate to different types of environmental investigations and purposes.

S:SPS:11:2.6 Create, use and evaluate models to understand environmental phenomena.

S:SPS:11:2.7 Use evidence and logic in developing proposed explanations that address their initial questions and hypotheses.

S:SPS:11:2.8 Analyze global, social, cultural, political, economic and environmental linkages.
S:SPS3:11:3.1 Analyze environmental issues such as water quality, air quality, hazardous waste, and depletion of natural resources.

S:SPS3:11:3.2 Evaluate status of a local community system (transportation, water, communication, food resources or electrical) in partnership with local officials.

S:SPS3:11:3.3 Analyze technical writing, graphs, charts, and diagrams.

S:SPS1:12:4.1 Interpret patterns and trends in data, and infer or calculate linear and non-linear relationships among variables.

S:SPS1:12:4.2 Compare theoretical and empirical values and account for discrepancies.

S:SPS1:12:4.3 Evaluate the relevance, reliability and adequacy of data and data collection methods.

SPS4– Science Skills for Information, Communication and Media Literacy
(Depending on how much the project encourages community outreach, this Framework could be covered as well.)

Earth Science, 5-8

S:ESS1:6:2.1 Differentiate between renewable and non-renewable resources.

S:ESS1:6:2.2 Describe and define the different landforms on the Earth’s surface, such as coastlines, rivers, mountains, deltas, canyons, etc.

S:ESS1:6:2.3 Identify and distinguish between various landforms using a map and/or digital images.

S:ESS1:6:7.2 Explain that water quality has a direct effect on Earth’s life forms.

S:ESS1:8:7.1 Describe how water flows into and through a watershed, falling on the land, collecting in rivers and lakes, soil, and porous layers of rock, until much of it flows back into the ocean.

S:ESS1:8:7.2 Identify the physical and chemical properties that make water an essential component of the Earth’s system.

S:ESS4:8:2.1 Calculate temperature in degrees Celsius.

S:ESS4:8:2.2 Perform calculations using metric measurements.

S:ESS4:8:3.4 Identify the potential impact of converting forested land to uses such as farms, homes, factories, or tourist attractions.

Earth Science, 9-12

S:ESS1:11:7.1 Explain that water quality can be affected positively or negatively by outside sources
S:ESS4:12:3.3 Research and evaluate a current environmental issue within the State of New Hampshire, such as a dispute regarding the conversion of a natural environment to human use; and construct a defense that supports environmental protection.

Life Science, 5-8

S:LS2:6:1.1 Identify and describe the factors that influence the number and kinds of organisms an ecosystem can support, including the resources that are available, the differences in temperature, the composition of the soil, any disease, the threat of predators, and competition from other organisms.

S:LS2:6:3.1 Define a population as all individuals of a species that exist together at a given place and time; and explain that all populations living together in a community, along with the physical factors with which they interact, compose an ecosystem.

S:LS2:6:3.2 Using food webs, identify and describe the ways in which organisms interact and depend on one another in an ecosystem.

S:LS3:6:1.1 Provide examples of how all organisms, including humans, impact their environment; and explain how some changes can be detrimental to other organisms.

S:LS3:6:1.2 Explain how changes in environmental conditions can affect the survival of individual organisms and the entire species.

S:LS1:8:2.5 Using data and observations about the biodiversity of an ecosystem, make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem.

S:LS2:8:1.1 Explain how changes in environmental conditions can affect the survival of individual organisms and an entire species.

S:LS2:8:1.2 Explain that in all environments, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter, and that in any particular environment the growth and survival of organisms depend on the physical conditions.

S:LS2:8:1.3 Using data and observations, predict outcomes when abiotic/biotic factors are changed in an ecosystem.

S:LS3:8:1.1 Describe the type of impact certain environmental changes, including deforestation, invasive species, increased erosion, and pollution containing toxic substances, could have on local environments.

S:LS3:8:3.2 Recognize that in any given environment the growth and survival of organisms depend on the physical conditions that exist; and explain that in all environments, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter.

S:LS4:8:1.2 Explain that organism’s behavioral response is a reaction to internal or and environmental stimuli, and that these responses may be determined by heredity or from past experience.
Life Science, 9-12

S:LS1:11:1.1 Describe how organisms are classified into a hierarchy of groups and subgroups, which are based on similarities that reflect their evolutionary relationships.

S:LS1:11:1.3 Identify plants and animals according to binomial nomenclature.

S:LS2:11:1.3 Identify the factors in an ecosystem that can affect its carrying capacity.

S:LS3:11:1.1 Identify ways humans can impact and alter the stability of ecosystems, such as habitat destruction, pollution, and consumption of resources; and describe the potentially irreversible effects these changes can cause.

S:LS3:11:1.2 Identify ways of detecting, and limiting or reversing environmental damage.

S:LS3:11:1.3 Analyze the aspects of environmental protection, such as ecosystem protection, habitat management, species conservation and environmental agencies and regulations; and evaluate and justify the need for public policy in guiding the use and management of the environment.
TROUT IN THE CLASSROOM CONTACT INFORMATION

Primary Contacts

George Embley, Basil Woods, Jr. Trout Unlimited chapter; Email: gembley@tds.net.

Mark Seymour, Great Bay Trout Unlimited chapter; Email: seymourwoodworking@ttlc.net

Judy Tumosa, New Hampshire Fish and Game Department, 11 Hazen Drive, Concord, NH 03301; Phone: 603-271-0456; Fax: 603-271-0465; Email: judy.l.tumosa@wildlife.nh.gov (State coordinator in NH)

Egg Pick Up

For appointment to pick up trout eggs and arrange NH Fish and Game hatchery tours for your classroom contact:

Wayne Paschall, Berlin Fish Hatchery
Off Route 110, Kilkenny Valley, White Mountain National Forest
York Pond Road, Berlin, N.H. 03570
603-449-3412
Educational exhibits for children and adults about raising fish.
Group hatchery tours by appointment. Open late May to mid-October.

Randy Ayers, New Hampton Fish Hatchery
Route 132, New Hampton 03256
603-744-3709
Group hatchery tours by appointment.

Tom Givetz, Powder Mill Hatchery
288 Merrymeeting Road, New Durham 03855
603-859-2041
Visitor's Center with information on fish and wildlife.
Group hatchery tours by appointment.

Fry Stocking

For questions about trout stocking dates and locations, contact Judy Tumosa, New Hampshire Fish and Game Department, for assistance with regional fisheries biologist’s input.
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NH Teachers Return Form to Judy Tumosa: NHFG, 11 Hazen Drive, Concord, NH 03301 Phone: 603-271-0456; FAX 271-0465 Email: judy.l.tumosa@wildlife.nh.gov
# Trout In The Classroom Evaluation Form for NH

**School Year Date:**

## School Information

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## Teacher

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<th>Field</th>
<th>Details</th>
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<td>Name</td>
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<td>Phone</td>
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<td>Email</td>
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Attended Orientation: Yes, No

## Classroom Liaison/Volunteer

<table>
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Attended Orientation: Yes, No

## Student/Curriculum Information

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
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<tbody>
<tr>
<td>Grade</td>
<td>No. Students</td>
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<tr>
<td>Subjects Covered</td>
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<tr>
<td>Primary Goal</td>
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## Raising/Releasing Information

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<th>Details</th>
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<tbody>
<tr>
<td>Release date</td>
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<tr>
<td># Eggs Received</td>
<td>50, 100, 150, 200 (circle)</td>
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<tr>
<td># Trout Stocked</td>
<td></td>
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</tbody>
</table>

Actual Release Site

NH Teachers Return Form to Judy Tumosa: NHFG, 11 Hazen Drive, Concord, NH 03301 Phone: 603-271-0456; FAX 271-0465 Email: judy.l.tumosa@wildlife.nh.gov
Describe how or attach evidence that you have completed the NH Trout in the Classroom teacher assignments:

Permits – Did you have a permit? Yes    No

**Protect Aquatic Habitat** – Demonstrate that your students can recognize healthy habitat, how to fix it if it isn’t, and how to keep it healthy if it is.

**Understanding Watersheds** – Show that your students understand that watershed health is dependent on land use and water quality.

**Community Involvement** – How did you grow community interest and involvement in natural resource stewardship?

Did you feel adequately trained?

Were any materials especially useful?

Was any technical support that you obtained adequate?

Was there a best or a worst thing about the training or the program in your classroom?

Do you want to participate in the NH Trout in the Classroom Program next year?  
Yes    No
Watershed Education Project Timesheet for Training

Name: ________________________________  School: ________________________________
(Please Print)

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Teacher Training</th>
<th>Travel Time</th>
<th>Total Time</th>
<th>Mileage</th>
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When completed, please FAX or mail to:
NH Fish and Game Department
Aquatic Resources Education Unit
11 Hazen Drive
Concord, NH 03301
(603) 271-3212 Phone
(603) 271-0465 Fax
aquatic-ed@wildlife.state.nh.us

** Please calculate time to nearest quarter hour

1.00 = 1 hour
0.75 = ¾ hour
0.50 = ½ hour
0.25 = ¼ hour

TOTAL

HOURS __________________

MILEAGE _____________

Educators Signature ____________________________

Aquatic Resource Educator NHF&G
# Watershed Education Project Timesheet for Class Time

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Class Time</th>
<th>Field Time</th>
<th>Prep Time</th>
<th>Travel Time</th>
<th>Total Time</th>
<th>Mileage</th>
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** TOTAL

HOURS____________

MILEAGE ____________

Teacher Signature

Principal or Science Department Chair
### Watershed Education Project Timesheet for Class Time

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<th>Location</th>
<th>Class Time</th>
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<th>Prep Time</th>
<th>Travel Time</th>
<th>Total Time</th>
<th>Mileage</th>
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<tbody>
<tr>
<td></td>
<td>WEP &amp; fisheries studies in Bath, NH</td>
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TOTAL  
HOURS___________  
MILEAGE___________

Volunteer Signature

Aquatic Resources Educator NHF&G