

Simulating a New Hampshire River Ecosystem

A Resource Guide

Caitlin Julian



By Caitlin Julian, Souhegan High School Senior Project (2001)

Revised by Judy Tumosa, NHF&G Watershed Specialist (2009, 2015)

With assistance from:

- ❖ Dr. Joel Bader, former NHF&G Fish Pathologist
- ❖ Angela Gospodarek, former Raymond Middle School
- ❖ Gabe Gries, former NHF&G Fisheries Biologist

Aquatic Resources Education (ARE) Program

- ❖ Federally Funded
- ❖ State Match = Teachers and Volunteers who provide Watershed Education in the classrooms
- ❖ Watershed Education Program (WEP)
- ❖ Watershed Ecology Institute (WEI)
- ❖ Let's Go Fishing (LGF)



Who Sponsors Simulating a NH River Ecosystem Program?

- ❖ NH Fish and Game
 - ✓ Fisheries Division
 - ✓ Watershed Education Program



Why create a river ecosystem in the classroom?

- ❖ To learn more about our warm water fish species ecology and management in NH
- ❖ To learn how fish species interact & behave with their surrounding environment
- ❖ To learn how fish species interact & behave with each other

What is a warm water fish?

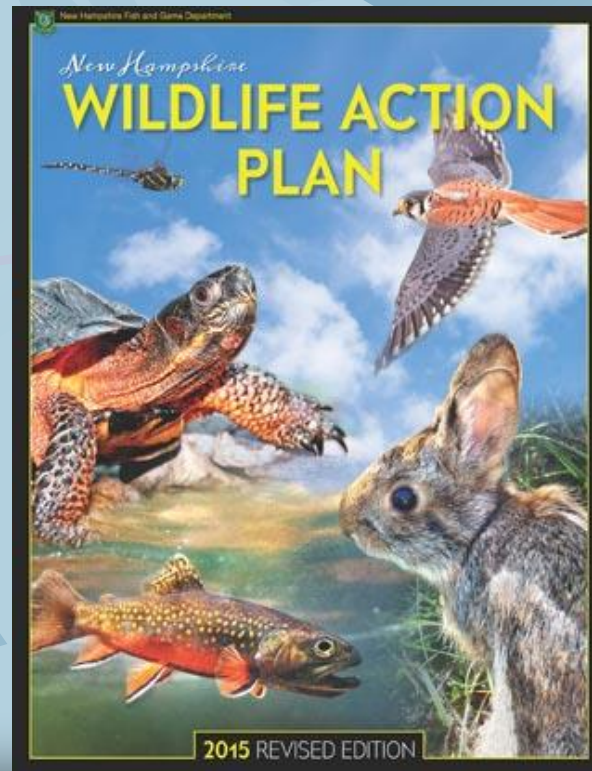


Why manage warm water species?



Warm water rivers and streams and lakes and ponds are Habitats of Concern in the NH Wildlife Action Plan (pollution and invasive species)

<https://www.wildlife.state.nh.us/wildlife/wap.html>





- ❖ Natural reproduction typically able to replenish populations
 - ✓ no warm water fish stocked vs many trout stocked
- ❖ Spawning habitat generally intact
- ❖ Wise management still important

How objectives are met

- ❖ Boat electrofishing + angler surveys
- ❖ Age and growth studies
- ❖ Warm water database
- ❖ Habitat restoration/improvement
- ❖ Bass tournaments: permitting, data collection and data analysis
- ❖ Special studies: Bass tagging on Winni



All Program Logistics can be found in the [Teacher's Resource Guide](#)



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A RESOURCE GUIDE
CAITLIN JULIAN

Sign Up and Get Trained



Scientific License Application to Keep Warm Water Fish in the Classroom

Note: Only warm water fish species and minnows may be kept (no salmon or trout).

Date: _____ School Year: _____

Teacher Name: _____

Teacher Email: _____

School Name: _____

School Address: _____

School Telephone Number: _____

Date of Collection: _____

Collection sites, Please Put Specific Name of River or Pond: _____

Method of Collection: _____

Subpermittees i.e. Other Teachers or Adults Assisting with collection of fish (if any): _____

_____ Will attend training "Simulating a New Hampshire River Ecosystem"

_____ Has attended training "Simulating a New Hampshire River Ecosystem"

Return to: **Judy Tumosa, Watershed Education Specialist**
New Hampshire Fish and Game Department
11 Hazen Drive, Concord, NH 03301
(603)271-0456 • FAX (603)271-0465
judy.l.tumosa@wildlife.nh.gov

Sample Simulating a NH River Ecosystem Agenda

Registration and Welcome

What is a warm water fish? "New Hampshire Fish" Power point
Activity: Am I warm or cold? Photos and "Freshwater Fishes of NH"

Why do fish live where they live?
Activity: Does your fish live there? Bathymetric map of local pond

What is in our watershed and why do we care?
Activity: GIS map exercise and watershed review

Break

How do we set up a river ecosystem tank in the classroom?
"Simulating a NH River Ecosystem" Power point

WQ and macro testing for habitat quality; ArcGIS fisheries data sets

What challenges do warm water fish face in the winter? Limiting season
Activity: "Fishy Deep Freeze" in Below Zero

Questions and wrap up

Contact:

Judy Tumosa, NHF&G Watershed Education Specialist
Phone: (603)271-0456
judy.l.tumosa@wildlife.nh.gov

How do you set up a tank?



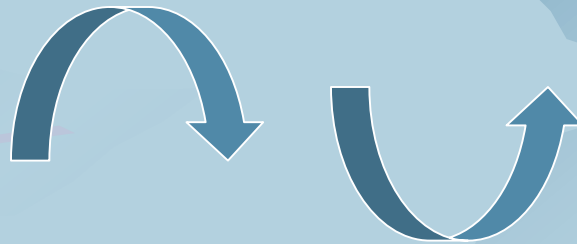
Lotic or flowing environment for fluvial dependent species

- ❖ Construct a Water Circulation System for “natural” current like a river

Ponded environment for macrohabitat generalist species

- ❖ Design the tank like a pond - Water Circulation System not needed

Building a Water Circulation System

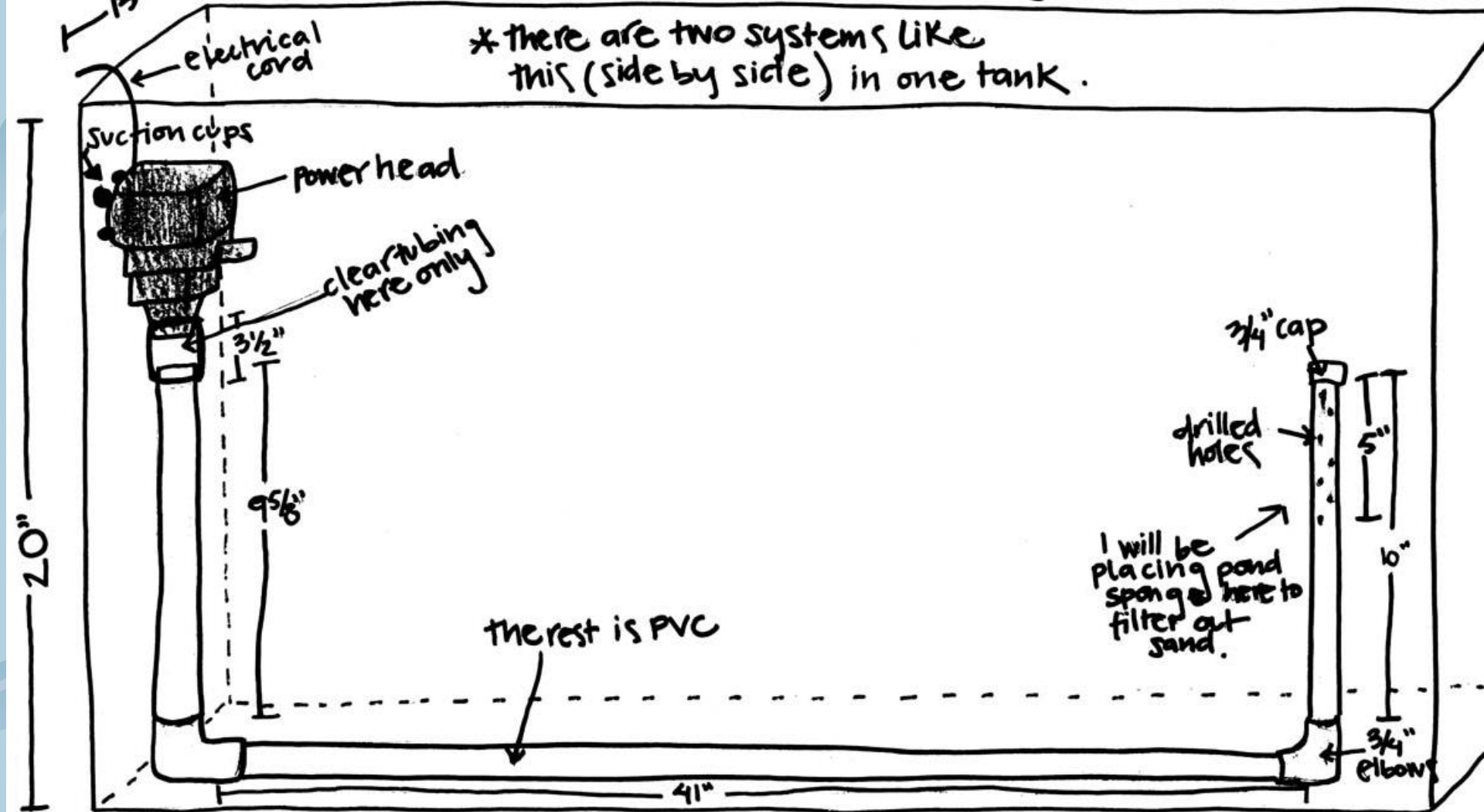


I used ...

3/4" in diameter PVC piping

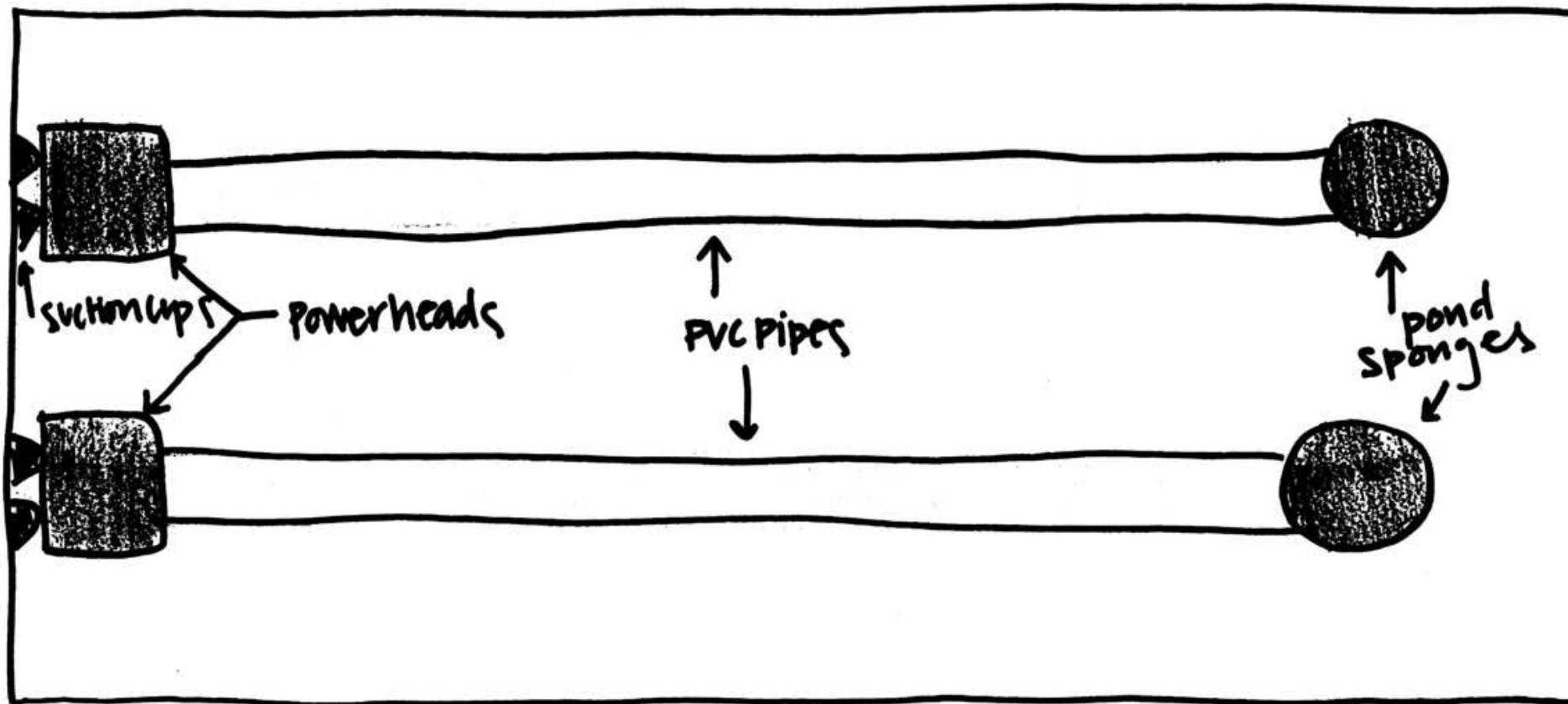
1" in diameter clear flexible tubing

* there are two systems like this (side by side) in one tank.



- SIDE VIEW -

48"



48"

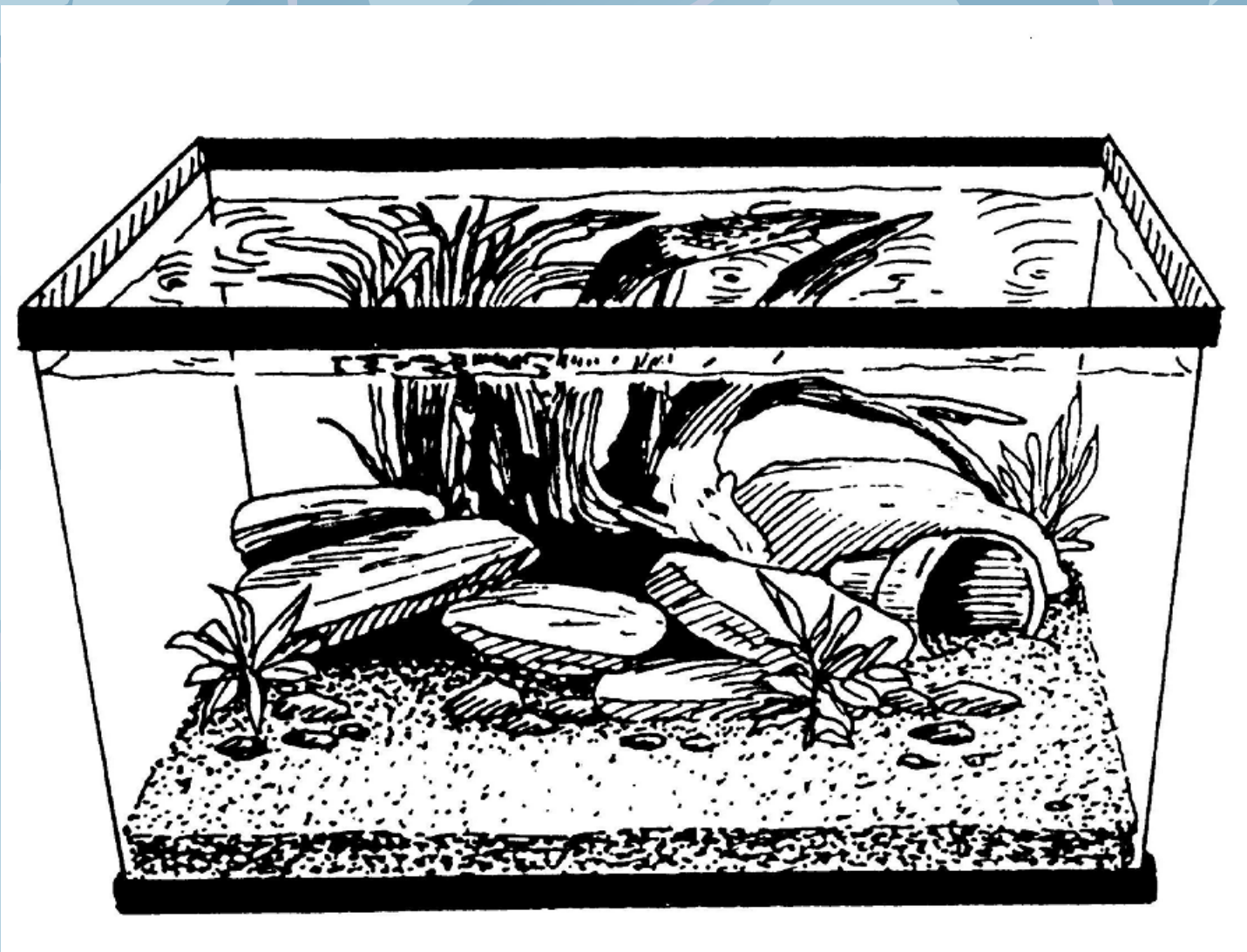
- TOP VIEW -

**Provide enough space – 50 gallons
minimum**



Provide “Natural” Substrate





Provide Cover



Native or fake plants



Provide Healthy Water

River water



Preparation

Set up your tank 6-10 days before fish arrive

Use the correct size filter for the tank



Now add the fish



Permits are provided by the NHFG Fisheries Division



New Hampshire Fish and Game Department

HEADQUARTERS: 11 Hazen Drive, Concord, NH 03301-6500
(603) 271-3421
FAX (603) 271-1438

www.WildNH.com
e-mail: info@wildlife.nh.gov
TDD Access: Relay NH 1-800-735-2964

SCIENTIFIC LICENSE #F2015-01

September 22, 2015

TO WHOM IT MAY CONCERN:

Under the authority contained in RSA 214:29, permission is hereby granted to Joe Teacher, Pillsbury Crest Elementary School, 193 Raisin Street, Wonderland, NH 03XXX, Tel. 603-555-5555 to collect various species of freshwater fish as part of an aquatic studies curriculum. Permission is also granted to transport captured specimens alive to Pillsbury Crest Elementary School to be kept in aquaria through the end of the school year.

Time of collection: September, October 2015

Collection sites: Lake Doughboy – south end near Pluto's Cove

Target species: Warmwater fish species and minnows. Not more than 10 individuals of each species. No collection of banded sunfish (*Enneacanthus obesus*) or bridle shiners (*Notropis bifrenatus*) is allowed.

Method of collection: Minnow traps, angling, seining

Final disposition of specimens collected: All fish will be returned to the water unharmed at the site of collection shortly after capture or after classroom studies are completed.

Subpermittees: Jeff Raspberry, Joan Strawberry

This permit, or a copy, shall be carried with the permittees while engaged in any activity allowed under this permit and shall be displayed to any New Hampshire Fish and Game Department Conservation Officer or employee upon request.

This permit shall expire at the end of the school year 2015-16, unless sooner revoked or rescinded.

Glenn Normandeau
Executive Director

GN/srd

cc: Law Enforcement Division
Inland Fisheries Division
Judy Tumosa

How to Collect

- ❖ Electrofishing
 - ✓ with NHF&G
- ❖ Netting
- ❖ Seining
- ❖ Angling
- ❖ Bait trap



Learn about NH fish species for your tank

In This Section

- ✦ Freshwater Fishing
- ✦ Saltwater Fishing
- ✦ Fish Fact Sheets
- ✦ Publications

Pumpkinseed (*Lepomis gibbosus*)

NH Conservation Status: Not listed

State Rank: Secure

Distribution: The pumpkinseed is native to the upper Mississippi, Great Lakes, and east coast drainages from New Brunswick south to South Carolina.

Description: Pumpkinseeds may be distinguished from other sunfish by a red spot on the rear margin of the operculum, just above the pectoral fin. The pectoral fins are long and pointed and the caudal fin is forked. Adult pumpkinseeds are often striking in color with a dark green back, rust colored spots, and a bright orange belly. There are bluish green streaks on the head radiating out from the mouth and eye.

Species commonly confused with: [Redbreast sunfish](#), [bluntnose](#)

Habitat: Pumpkinseed sunfish, also known as common sunfish, are an adaptable species capable of living in both lacustrine and riverine habitats. They are usually found associated with aquatic vegetation along the shorelines of lakes and ponds. In rivers and streams pumpkinseeds usually inhabit backwaters and deeper pools with little current, although they may be found in faster moving water if there are slower flowing reaches nearby.

Life History: Pumpkinseed males excavate a circular nest in shallow water, often in groups or colonies. Females spawn with males in multiple nests where the eggs are aggressively defended by the males until they hatch. Pumpkinseeds feed on invertebrates attached to plants or on the bottom. Its jaws are adapted for crushing the shells of snails and other hard-shelled prey.

Origin: Native

Conservation/Management: Pumpkinseeds are widespread and abundant throughout the state. They are New Hampshire's most common native sunfish. Pumpkinseeds are a good tasting panfish. Easily caught in shallow water using small lures or live bait, they make a good introduction to fishing for young children.

Recommendations:

- Protecting natural vegetation along the shorelines of lakes and ponds is critical for maintaining healthy populations of pumpkinseeds and other warmwater fish species.



The orange spot on the operculum distinguishes the pumpkinseed from other sunfish, although the spot may not always be present on juvenile fish.



© Bob Michelson



© Bob Michelson

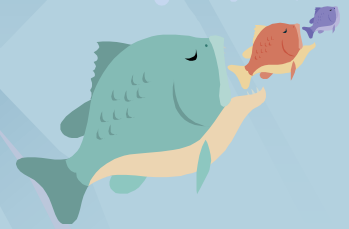
Examples of warm water species

Yellow are native, **white** are introduced

- ❖ Largemouth bass
- ❖ Smallmouth bass
- ❖ Walleye
- ❖ Northern Pike
- ❖ **Chain Pickerel**
- ❖ Black Crappie
- ❖ Bluegill
- ❖ Pumpkinseed
- ❖ **Yellow Perch**
- ❖ **Brown Bullhead (hornpout)**

What do you feed them?

- ❖ Goldfish (from the pet store)
 - ✓ Be aware wild fish will eat each other
- ❖ Macroinvertebrates
- ❖ Blood worms
- ❖ Worms
- ❖ Brine shrimp



How to Maintain the Tank

Aquarium Maintenance Guidelines

Activity	Daily	Weekly	Monthly
Visual check of fish for headcount, disease, swimming and breathing rates	✓		
Check color, smell and temperature of water		✓	
Visual check of equipment, air and water flow		✓	
Scrape algae growth on glass			✓
Check and prune plants			✓
Rake and siphon debris from gravel bottom			✓
Make a 25% water change (every 2 to 4 weeks)			✓
Change air and water filters			✓
Test water chemistry			✓

What do you do with your fish at the end of the year?

- ❖ If they are disease free, put them back where you collected them
- ❖ If they show signs of disease, dispose of them humanely

Complete Your Evaluation (Required by NHFG Executive Director)



Watershed Education Program Evaluation

School Year Date:

Teacher and School Information	
Teacher Name	
Teacher Email	
School Name	
Student/Curriculum Information	
Grade (s)	
Number of students	
Subjects Covered	
Primary Goal	

Connections to the NHF&G Watershed Education Program (WEP) objectives:

- 1) Protecting Aquatic Habitat** – How did your students learn to recognize healthy habitat, and how to maintain it or improve it as needed?

- 2) Understanding Watersheds** – How did your students learn to understand that watershed health is dependent on land use and water quality?

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

Did you collect water quality, macroinvertebrate or fisheries data within your watershed?

Did you contribute to/use the water quality, macroinvertebrate, and fisheries data posted on the ArcGIS online NHF&G watershed map?

Did you study warm water fish in a classroom tank (Simulating a NH River Ecosystem program)?

Did you feel adequately trained? If not, how can we improve?

Were the curriculum materials useful? If not, how can we improve?

Was there adequate technical support? If not, how can we improve?

Do you want to participate in the NH F&G Watershed Education Program next year (Simulating and NH River Ecosystem/Watershed Studies)?

Yes No

What additional training in aquatic topics would you like to see offered?

Any additional comments?

Return to Judy Tumosa: NH Fish & Game, 11 Hazen Drive, Concord, NH 03301
 Phone: 603-271-0456; FAX 271-0465 E-mail: judy.l.tumosa@wildlife.nh.gov

THANK YOU for your interest in watershed education and keeping the fish and wildlife of the state healthy!

Additional Curriculum Resources

- ❖ [Fish Poster ID – Minnows](#)
- ❖ [Fish Poster ID – Suckers](#)
- ❖ [Fish Species Abbreviations](#)
- ❖ [Freshwater Fish of NH ID Photos](#)
- ❖ [NH Fish Survey Story Map](#)

NGSS Connections

For high school:

<https://www.wildlife.state.nh.us/education/documents/hs-ngss-tank.pdf>

For middle school:

<https://www.wildlife.state.nh.us/education/documents/ms-ngss-tank.pdf>

Collect Data in Your Watershed

Water Quality Measurements: PH, Dissolved Oxygen, Temperature, Conductivity, Turbidity

- ❖ [Water quality sampling instructions](#)
- ❖ [Water quality data sheets](#)



Volunteer Biological Assessment Program (VBAP)

- ❖ Macroinvertebrate Sampling and Biotic Index Calculation based on Pollution Tolerance
- ❖ Stream Assessment



[VBAP Manual](#)

[VBAP Video](#)

Watershed Assessment Using ArcGIS Online (AGO)

Click on the WEP Watershed Map to see data collected, shared and analyzed by NHFG and teachers and students in watersheds all over the state.

The screenshot displays the ArcGIS Online interface for a map titled "A WEP Watershed Map". The map shows a green landscape with a yellow boundary representing a watershed. A popup window is open over a specific location, displaying the following data:

WQ_WEP: 03-HAR	
Latitude	43.22
Longitude	-71.74
Site	03-HAR
Stream	Hardy Springs Brook
Town	Hopkinton
Volunteer	NHWEI
pH	6.15
DO	15.10
Temp_C	21.50
Temp_F	70.70
Conductivi	0.00
Turbidity	1.37
VBAP	3.16
Zoom to	Get Directions

The interface includes a top navigation bar with "HOME", "NEW MAP", and the user name "Judy". Below the navigation bar are various tool icons such as "Details", "Add", "Basemap", "Share", "Directions", and a search bar labeled "Find address or place". The left sidebar contains the map title "A WEP Watershed Map", the creator information "Web Map by jtumosa_nhwep", the last modified date "September 6, 2013", and a "Make your own map" section with options to "Add to this map" or "Make a new map". The bottom of the page features the Esri logo and the text "POWERED BY esri".

Details

Add

Edit

Basemap

Save

Share

Print

Measure

Bookmarks

Find address or p



Finding the Fish

Finding the Fish

Web Map by
nhedgis2_administrator
Last Modified: December 21, 2012

☆☆☆☆☆ (0 ratings, 0
comments, 122 views)

[More Details...](#)**Make your own map**[Add to this map](#)[Make a new map](#)

NHF&G Fish Data: Unknown

Site_Name	27249
Year	2009
Date	20090526
Stream Name	Unknown
Latitude	43.76569
Longitude	-71.75217
Atlantic salmon	3
blacknose dace	27
burbot	1
creek chub	5
common shiner	17
common white sucker	5
brook trout	0
	-

[Zoom to](#) [Edit](#)

How Can I Help My Watershed?

- ❖ Support watershed education in your community
 - ✓ Help implement the Water Education Plan
 - ✓ Take part in watershed congresses
- ❖ Teach local students - what is a conservation commission?
- ❖ Sponsor citizen science & intern opportunities
 - ✓ Invasive species inventories
 - ✓ Natural resource inventory/EBT studies
 - ✓ Riparian buffer establishment/maintenance
- ❖ Support a watershed school
 - ✓ Be a liaison
 - ✓ Be a resource specialist to help with field days at the river
 - ✓ Provide resource studies and data

Citizen Science Definition

**From: Cornell Laboratory of Ornithology
Citizen Science Central**

*“Projects in which
volunteers partner
with scientists
to answer real world questions.”*

So if you are interested in a river ecosystem in your classroom:

Contact Watershed Education Specialist Judy Tumosa at NHF&G: Judy.1.tumosa@wildlife.nh.gov

