Pigeon River Recovery Project: Bringing Back Aquatic Diversity

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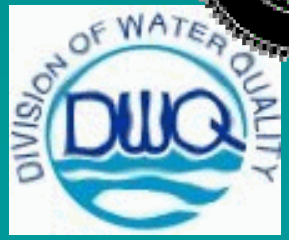
Pigeon River @ Browns Bridge

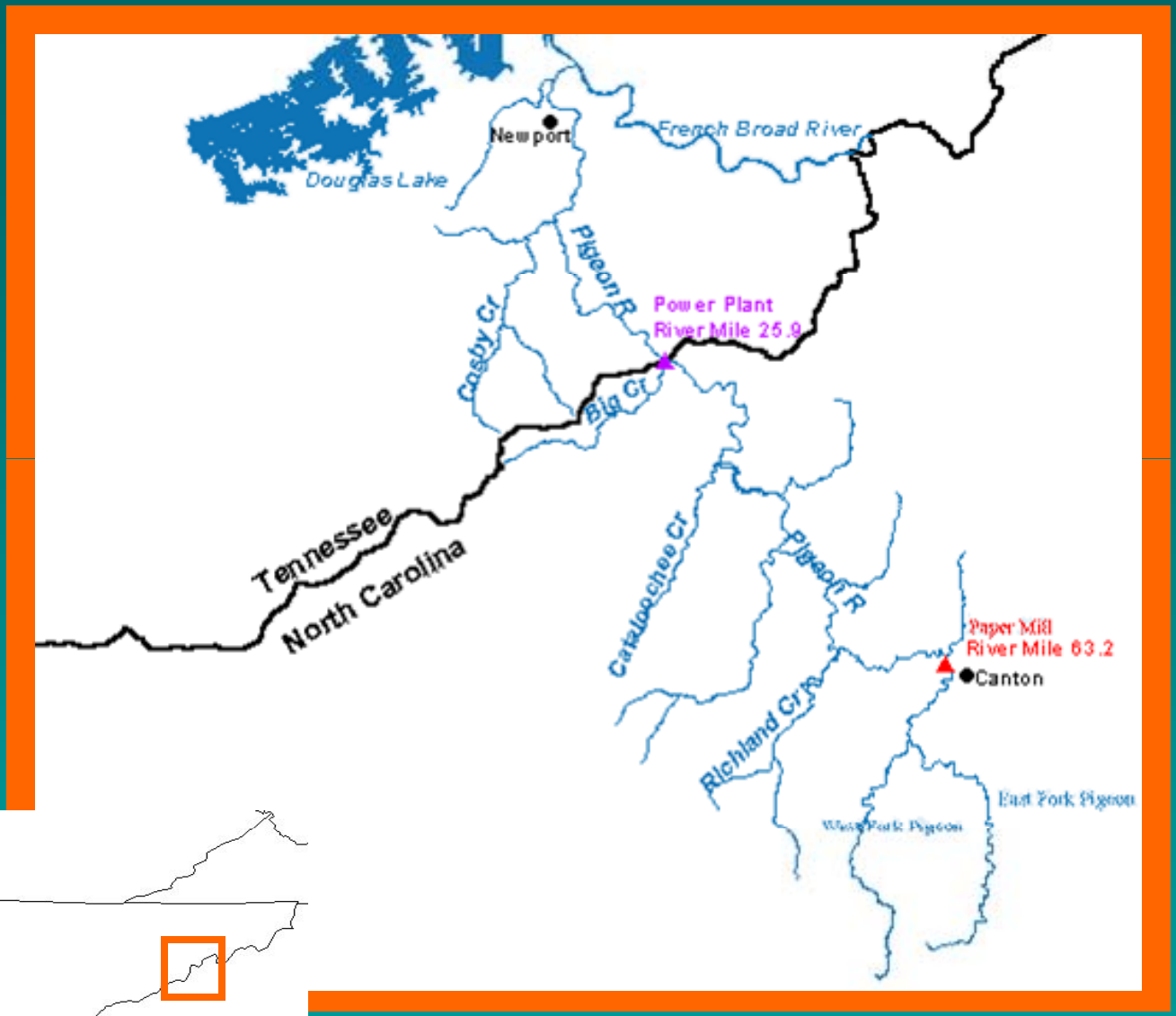
Pigeon River Recovery Project

A consortium of federal and state agencies, private organizations and industry in a collaborative effort to improve an aquatic ecosystem.

PRRP Members:



Pigeon River



Point Source:

The Situation

- **The paper mill began operations in 1908. Its toxic effluent extirpated all snails & mussels, & most fish species.**

- **Paper mill effluents included:**

  Coffee colored tannins and lignins, toxics such as dioxin

The Issue –Water Quality

First Step

- **Modernization of mill processes drastically reduced waste effluent**

- **This led to a return of many fish species to the Pigeon; *however*, 24 non-game species were still missing**

Pigeon River 2000:
Missing Fish Species?

bluebreast darter
tangerine darter
river darter
stripetail darter
blotchside logperch

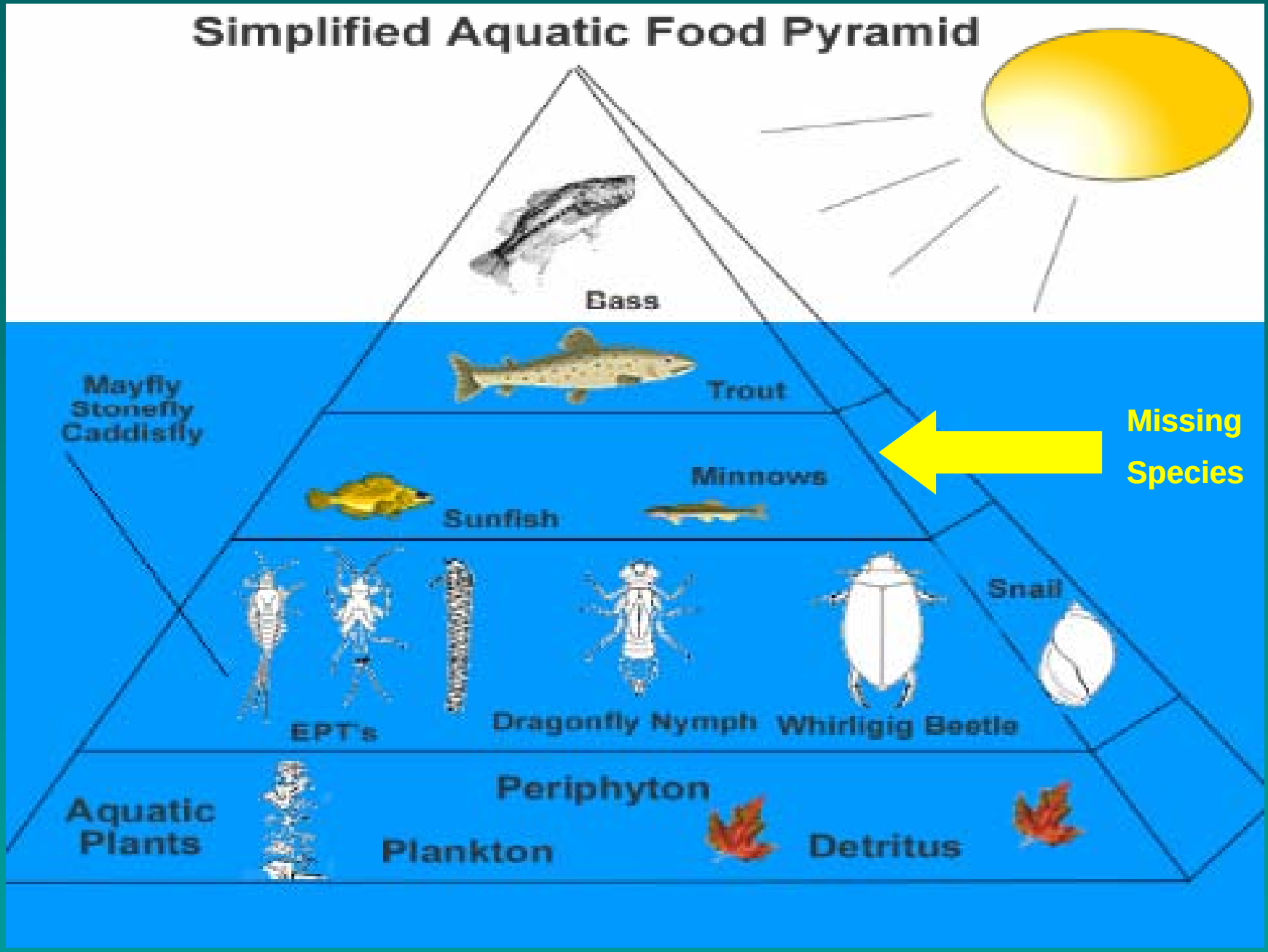
warpaint shiner
mirror shiner
stargazing minnow
bullhead minnow
spotfin chub

northern studfish
American brook lamprey

gilt darter
olive darter
wounded darter
longhead darter
blueside darter

striped shiner
saffron shiner
mimic shiner
blotched chub
mountain madtom

mountain brook lamprey
mooneye

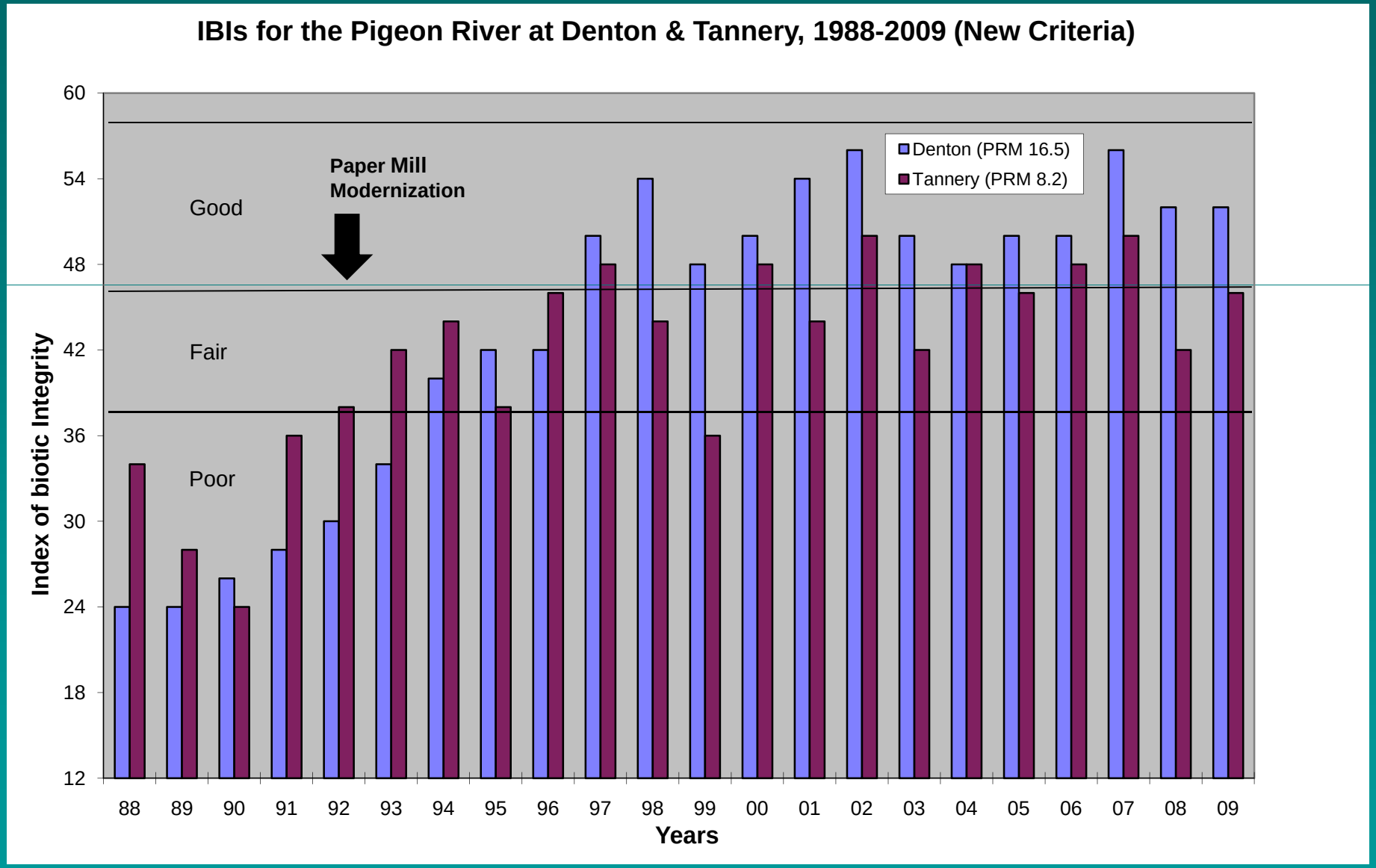

Simplified Aquatic Food Pyramid
Bass
Trout
Mayfly
Stonefly
Caddisfly
Missing
Species
Minnows
Sunfish
Snail
EPT's
Dragonfly Nymph
Whirligig Beetle
Periphyton
Aquatic
Plants
Plankton
Detritus

Pigeon River:
Other Species Missing?

- All native mollusks extirpated

- Approximately 40 mussel species & 10 snail species inhabited the Pigeon River

Biomonitoring 1988-2009



Testing the Waters:

- In 1996, common river snails were re-introduced in the TN segment to assess water quality
- Their survival and re-colonization led to the creation of the PRRP in 2001 in TN

Pink mass is snail eggs on discarded milk jug

PRRP Goal:

To help restore ecosystem health by increasing aquatic biodiversity through the establishment of viable, reproducing populations of native species.

Re-establishing Native Fish

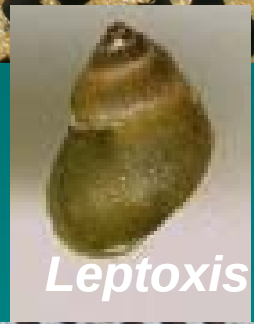
Criteria for selecting candidate species to be relocated to the Pigeon River included:

- **Historic range**
- **Available habitat**
- **Source of fish within the watershed**

Collecting bluebreast darters on the Nolichucky River

Candidates

For



Re-introduction

Gilt Darter

Nolichucky River Treasure

Bluebreast Darter

TDEC, TDOT, UTK, Americorps

Collecting Lampreys
Little River, TN

University of Tennessee

Collecting River Snails

Americorps volunteers

Methods

- Collection by seining or electrofishing from streams within the watershed
- Tagging with various colors of Visible Implant Fluorescent Elastomer (VIE)
- Monitoring: Snorkeling/seining surveys; annual Index of Biotic Integrity (IBI)

Survival/Reproduction

- Tagging with various colors of Visible Implant Fluorescent Elastomer (VIE)

VIE Tagging

Using a 0.3 cc insulin syringe with an ultra-fine 29-gauge needle

Field Tagging

Minimize Stress - Handling & Temp

Flow-Through Live Well

Transport

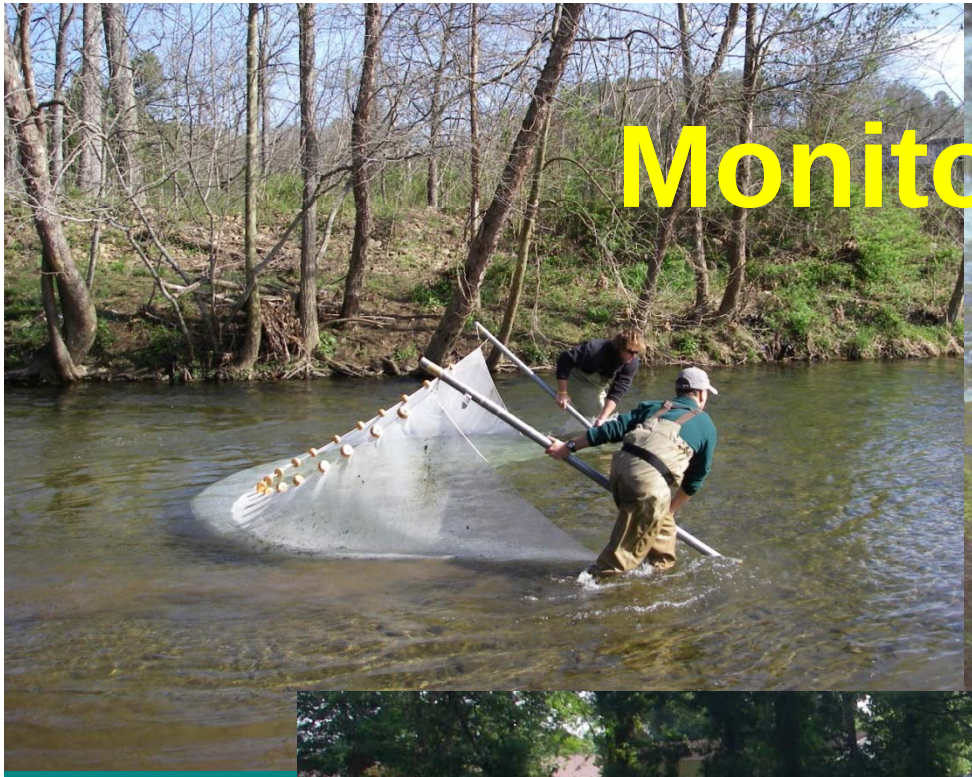
Acclimation Before Release

Acclimation and Release

NCWRC photos

Gilt darters released into the Pigeon River

Monitoring

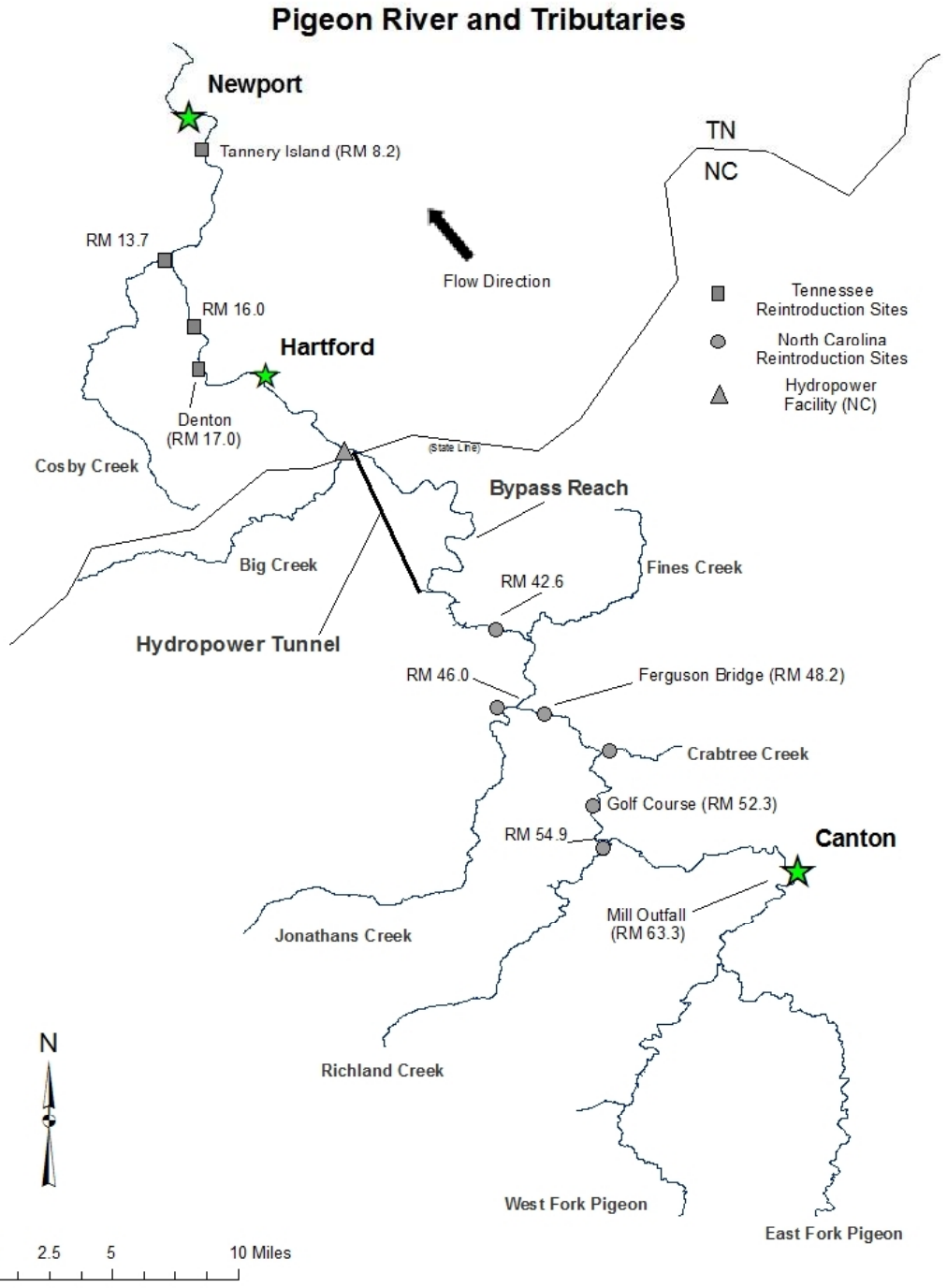


Survival, Reproduction, Propagation

- Survival of relocated fish & reproduction in TN led to expansion into NC in 2004
- Project made possible by support from UTK (2001-2010) and funding from BRPP (2003-2010)
- In 2004, CFI begins propagation of the tangerine darter


Tangerine Darter

Pigeon River



Disturbance….

Fish Barrier

Altered Flow

Pigeon River, TN:

Fish Species Still Missing?

bluebreast darter
tangerine darter
river darter
stripetail darter +
blotchside logperch

gilt darter +
olive darter
wounded darter
longhead darter
(blueside darter)

warpaint shiner
mirror shiner
(stargazing minnow)
bullhead minnow
spotfin chub

striped shiner
saffron shiner
mimic shiner
blotched chub
mountain madtom

northern studfish
(American brook lamprey)

mountain brook lamprey +
mooneye

+Denotes established population

2001, 2002, 2003, 2007, 2009

( ) Denotes suspended re-intro

Pigeon River, NC:
Fish Species Still Missing?

silver shiner +
(saffron shiner)
mirror shiner
telescope shiner+
Tennessee shiner
gilt darter
wounded darter
Swannanoa darter
tangerine darter
golden redhorse
river redhorse
mottled sculpin

New candidates:

bigeye chub
banded darter
Highland shiner

+Denotes established population

2004, 2005, 2007, 2009

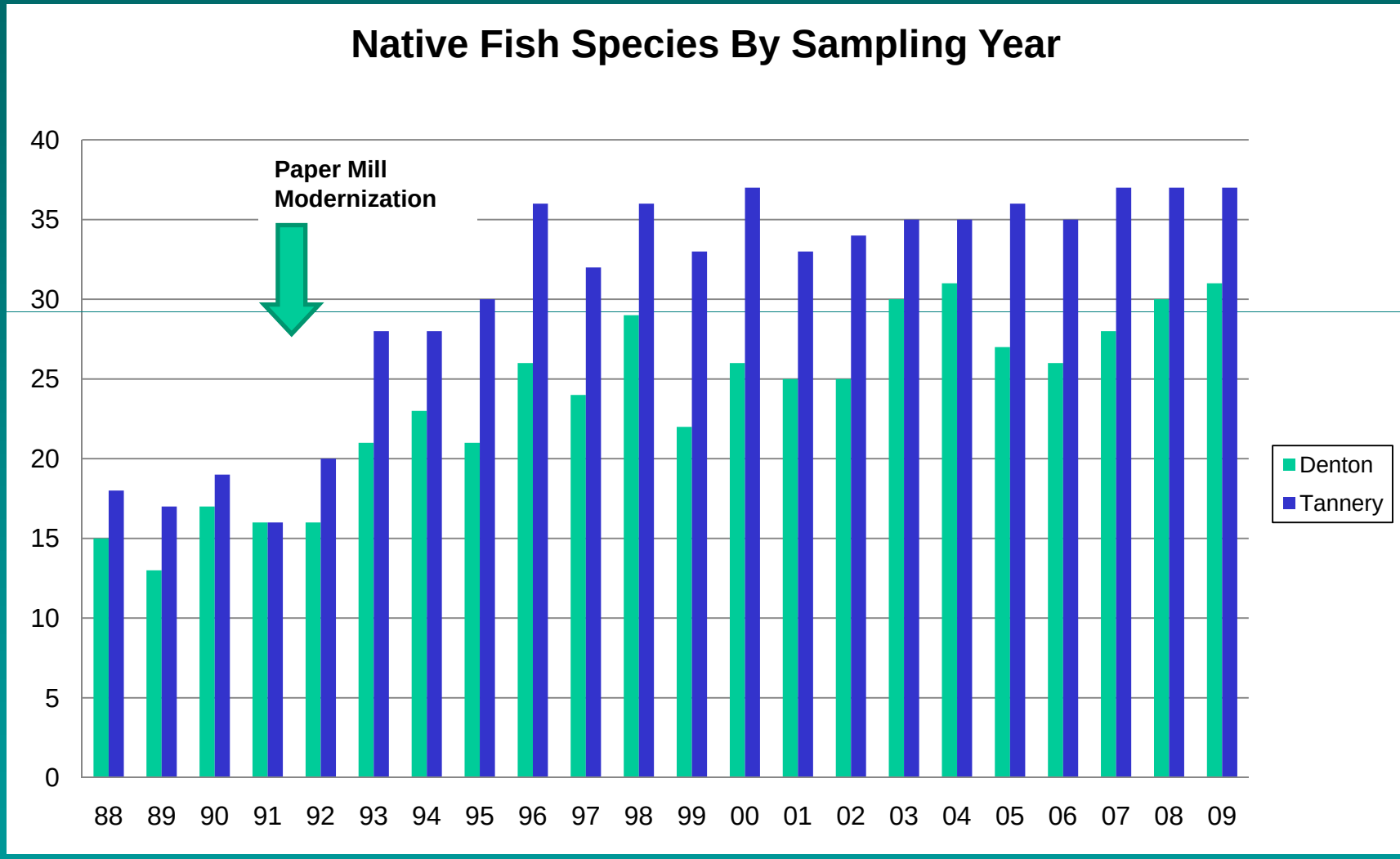
( ) Denotes suspended re-intro

PR Re-introduction Totals : as of April 2010

Year	Organism	Genera/Sp.	Individuals
1996-2010	Snail	6	215-220k
2000-2010	Mussel	9	145
2001-2010	Darter	5 spp.	5,861
2002-2010	Madtom	1 sp.	1,976
2002-2010	Minnow	8 spp.	17,107
2003-2010	Lamprey	2 spp.	1,697

Over 26,000 individual fish have been released into the Pigeon

Native Fish 1988-2009



TVA/TDEC Data

Project Milestones

- Five species of fish are re-colonizing the Pigeon River

- Evidence of reproduction in 4 more species of fish

- And…….

- **Multiple species of river snails are re-colonizing over 11 miles of the Pigeon**

Snail eggs on rock

REMAINING CONCERNS

Other aquatic life, other pollutants……

……Other Species

Salamander Surveys

Crayfish Surveys

….Other Pollution Sources

Pesticides

Tomato farm on Pigeon River, Cocke County, TN

….Construction

Sediment Pollution

….Urban Run-off

Oil, Chemicals

….Introduced Species

problems?

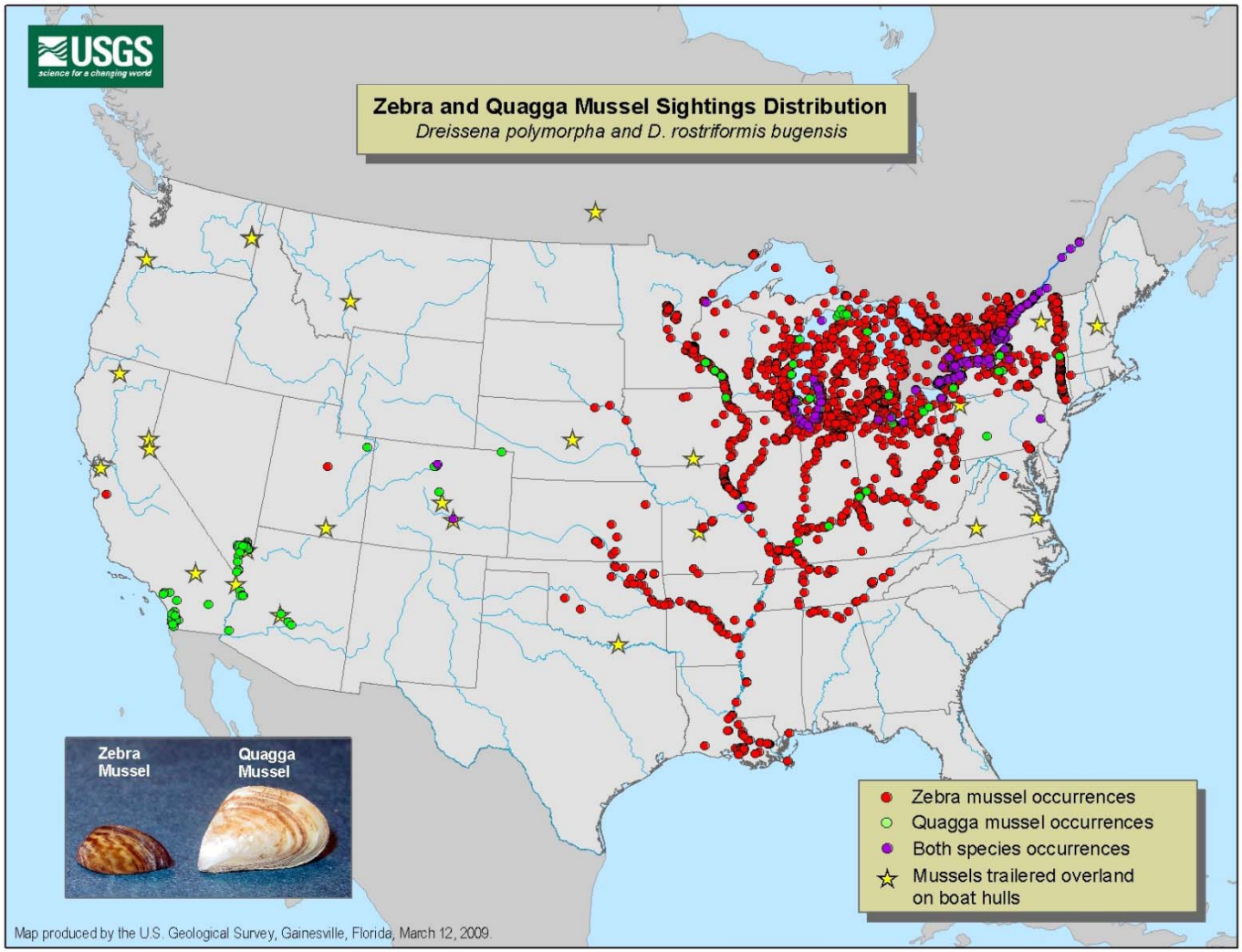
- Common carp
- Golden shiner
- Redbreast sunfish
- Striped bass
- Rainbow trout

Invasive Species

What harm can they do?

Silver Carp

Zebra and Quagga Mussels



TWO KEY COMPONENTS:

Physical restoration is complete, but what quality habitat, will the biota recolonize? And from where?

Keys to Success

Understand ecology/biology of ecosystem

- conduct seasonal inventories
- learn life histories of aquatic organisms

Maximize cooperative effort

- contact federal, state and local entities
- the more people involved, the better

Monitor for success

- a means to identify what works, what doesn't

Watershed Awareness

- know what's going on in your stream drainage

PRRP TEAM
(just a few of many)

Questions?

Dragonfly larvae = 1- 2 inches