Status of Invasive Carps in the Tennessee River and Cumberland River

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Tennessee Tech University

USGS
science for a changing world

TTU
Tennessee
Cooperative Fishery
Research Unit

U.S.
FISH & WILDLIFE
SERVICE
DEPARTMENT OF THE INTERIOR

TENNESSEE
WILDLIFE RESOURCES
AGENCY

Invasive carp?

- Four species – Black, Grass, Silver and Bighead carp
- From Asia in 1960-70s for water treatment
- Escaped
- By late 1990s self-supporting populations in the Mississippi River and tributaries.

Bigheaded carp (*Hypophthalmichthys spp.)*

Silver carp, *H. molitrix*

Bighead carp, *H. nobilis*

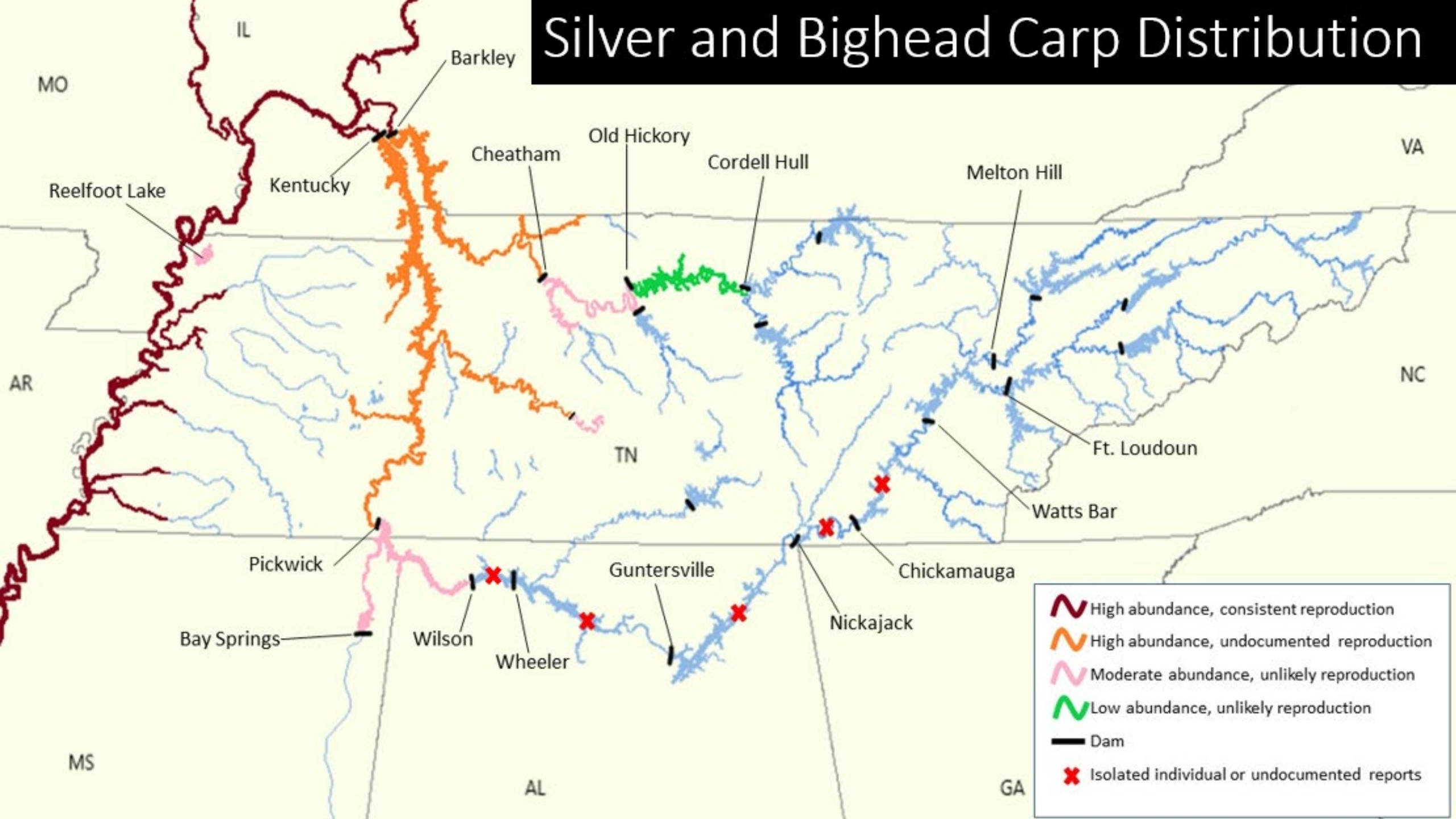
Bigheaded carp characteristics

- Pelagic nomads
- Highly fecund
- Highly mobile
- Filter feeders
- Jumpers
- Competitors
- Gear avoiders

Source: Asiancarp.us

Bighead Carp and Silver Carp: Characterization of Relative Abundance in the Upper Mississippi River and Ohio River

Silver and Bighead Carp Distribution

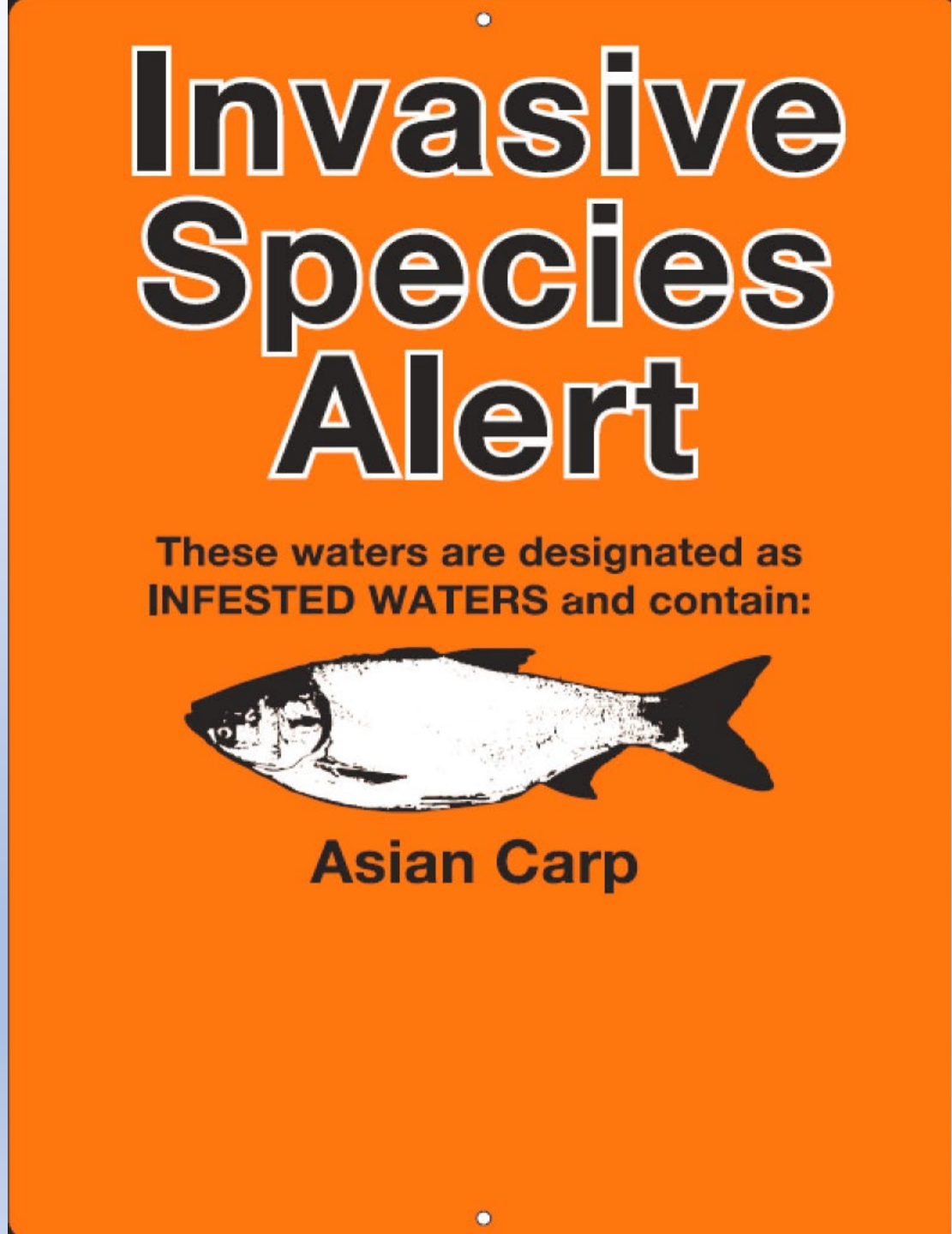


Carp Control Goals

- Stop carp population expansion
- Reduce the abundance of carp in populated waters

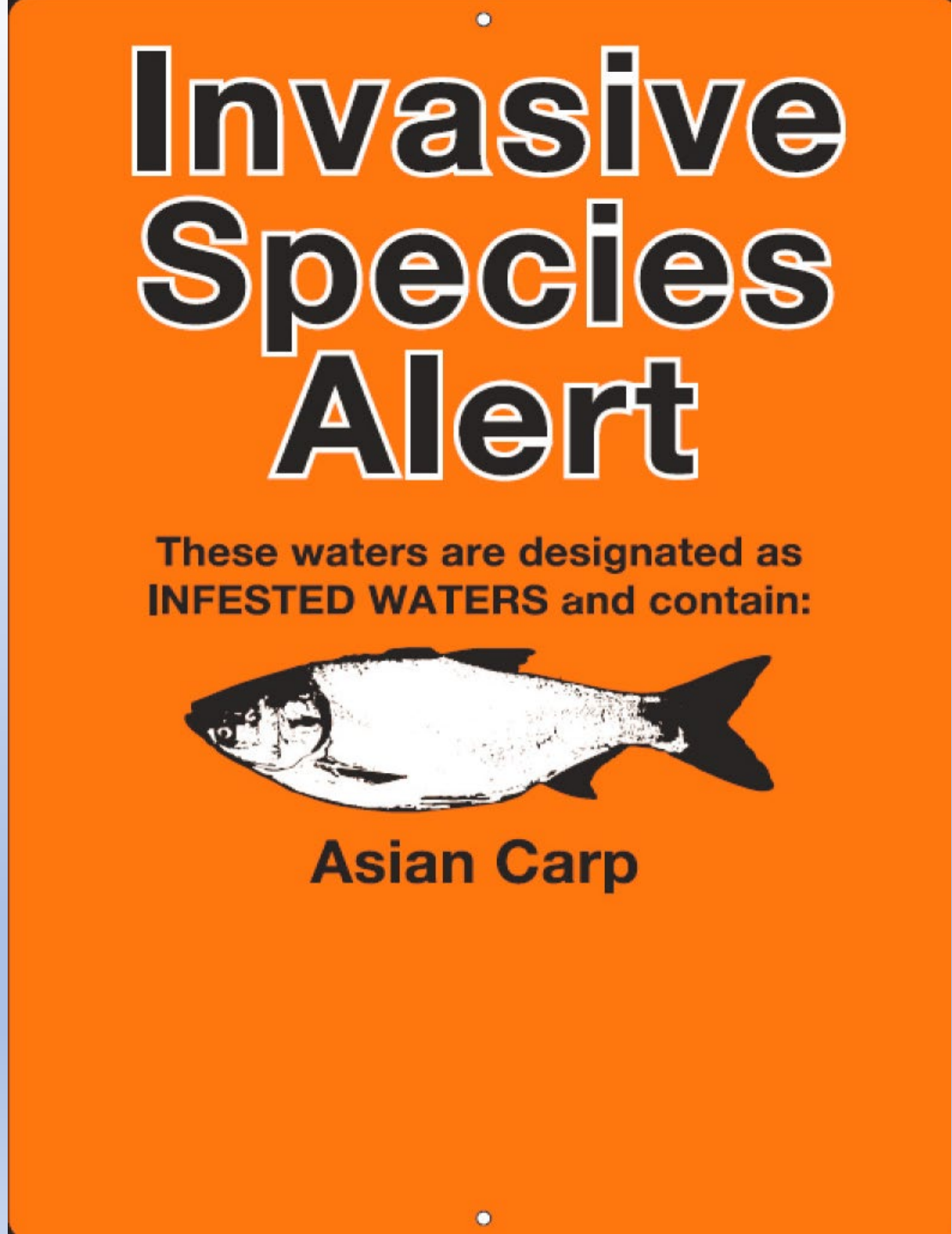
Strategies

- Prohibit movement by people

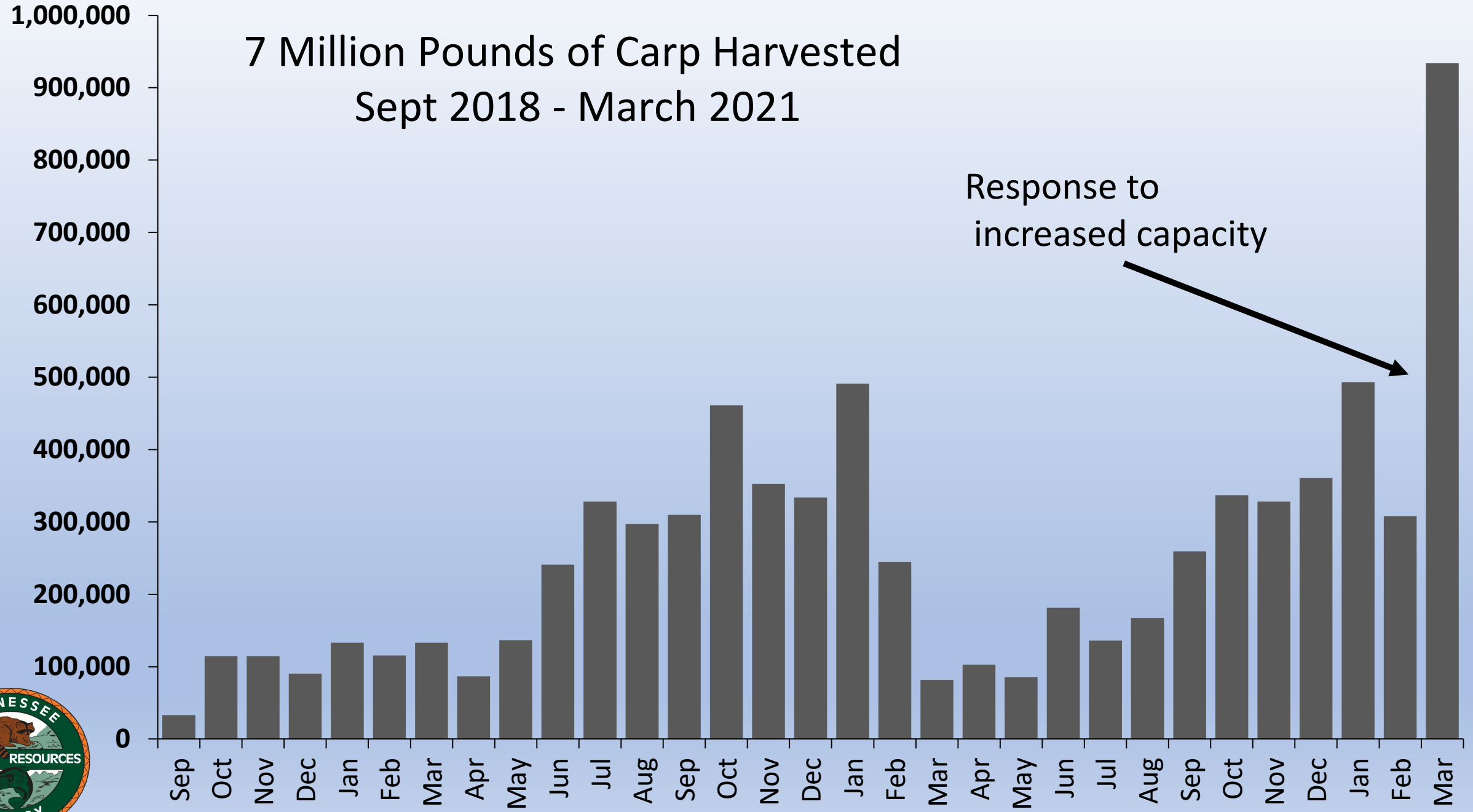


Strategies

- Prohibit movement by people
- Strategically remove carp



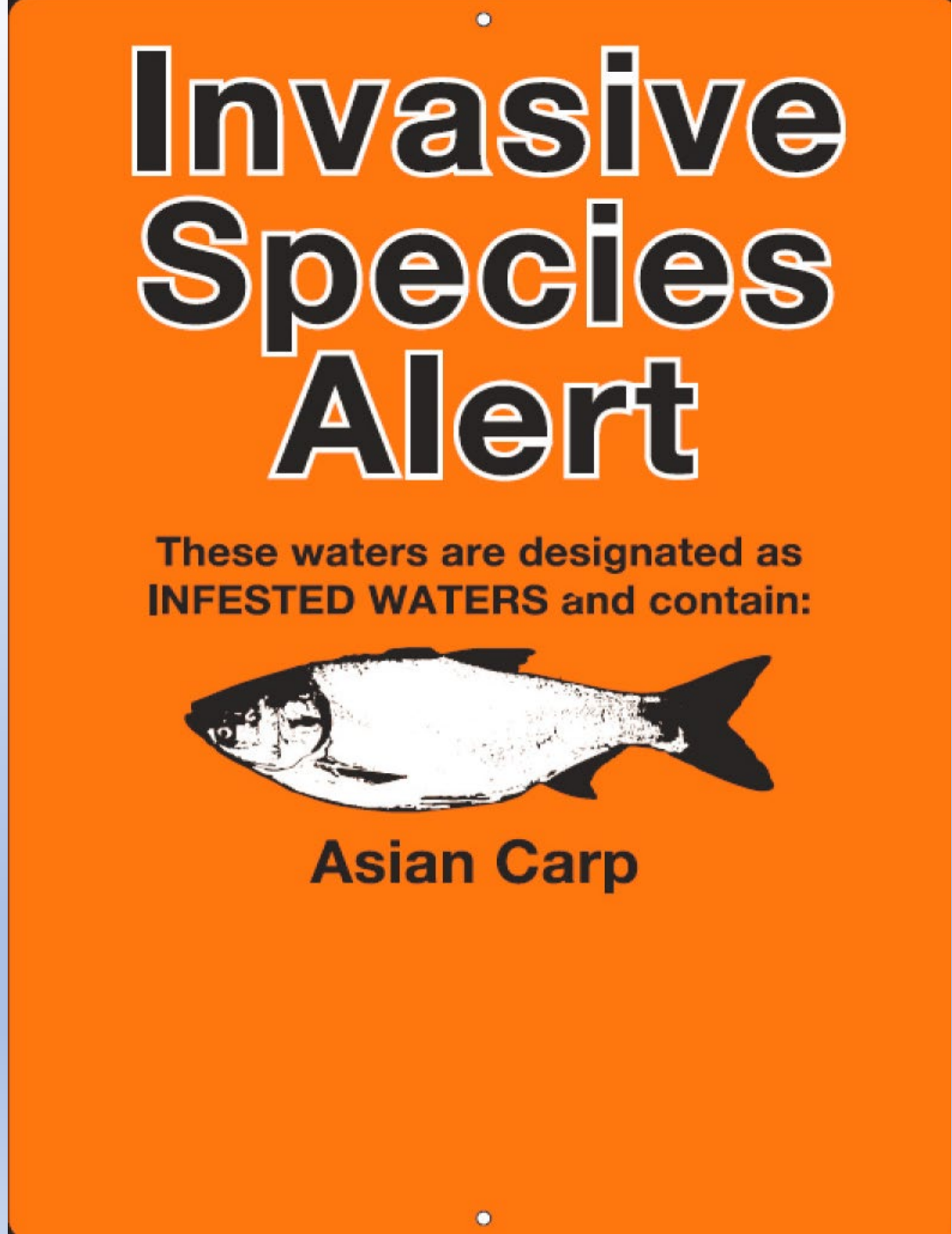
7 Million Pounds of Carp Harvested
Sept 2018 - March 2021

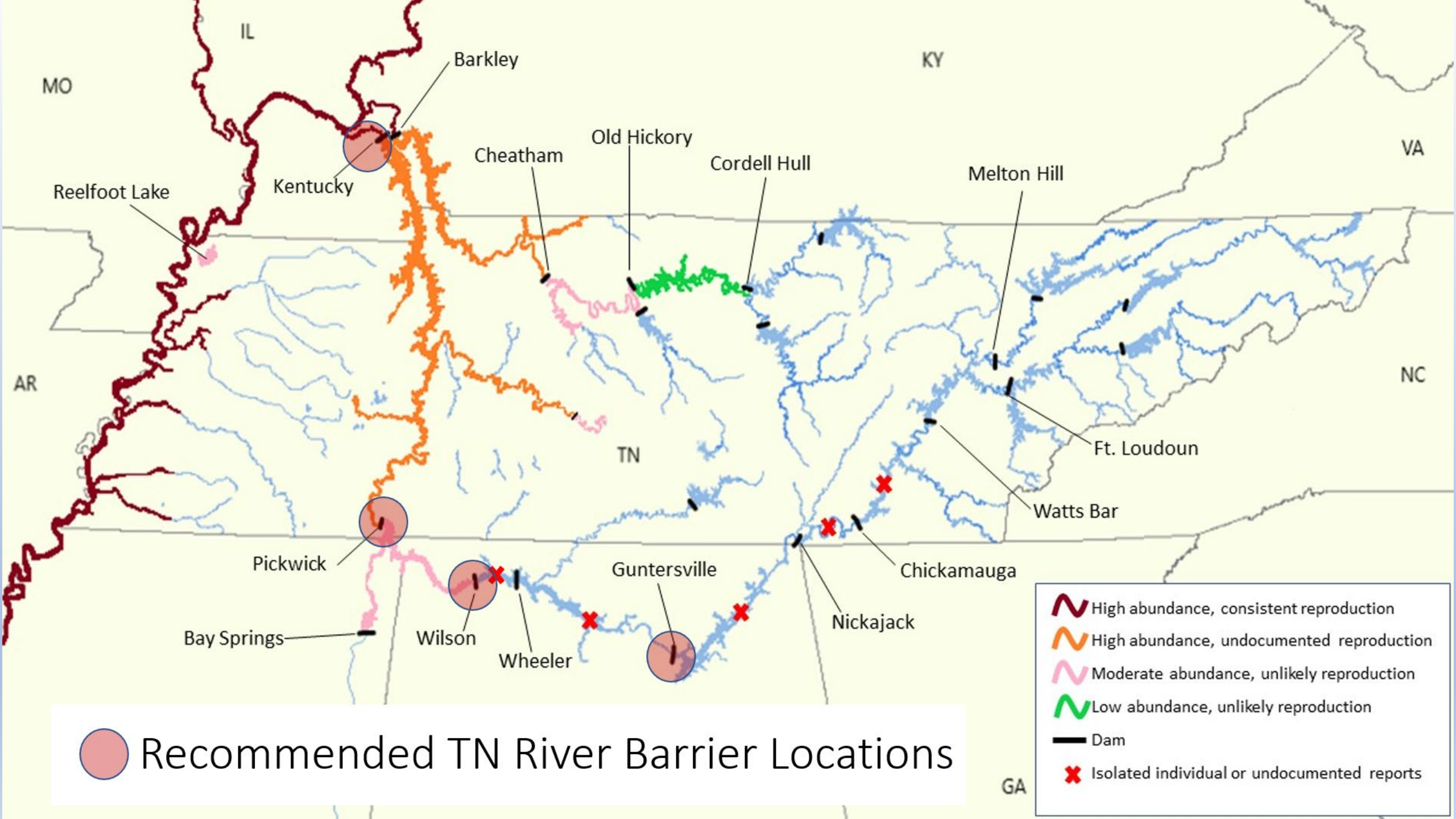


TENNESSEE WILDLIFE RESOURCES AGENCY

Strategies

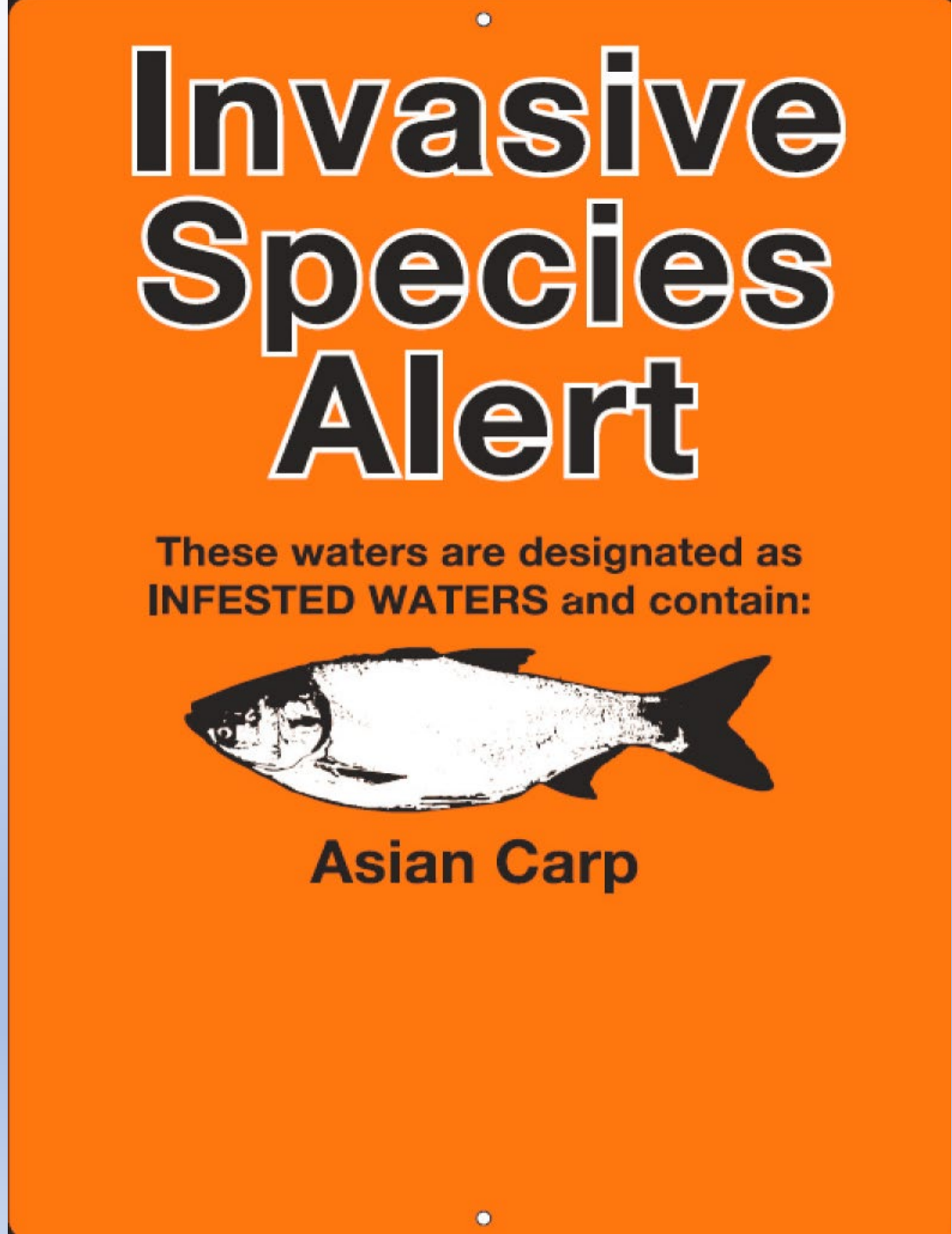
- Prohibit movement by people
- Strategically remove carp
- Install barriers to stop/reduce movement upstream




IL
MO
KY
VA
NC
AR
TN
GA
Barkley
Kentucky
Reelfoot Lake
Cheatham
Old Hickory
Cordell Hull
Melton Hill
Ft. Loudoun
Watts Bar
Chickamauga
Nickajack
Guntersville
Wheeler
Wilson
Bay Springs
Pickwick
High abundance, consistent reproduction
High abundance, undocumented reproduction
Moderate abundance, unlikely reproduction
Low abundance, unlikely reproduction
Dam
Isolated individual or undocumented reports
Recommended TN River Barrier Locations

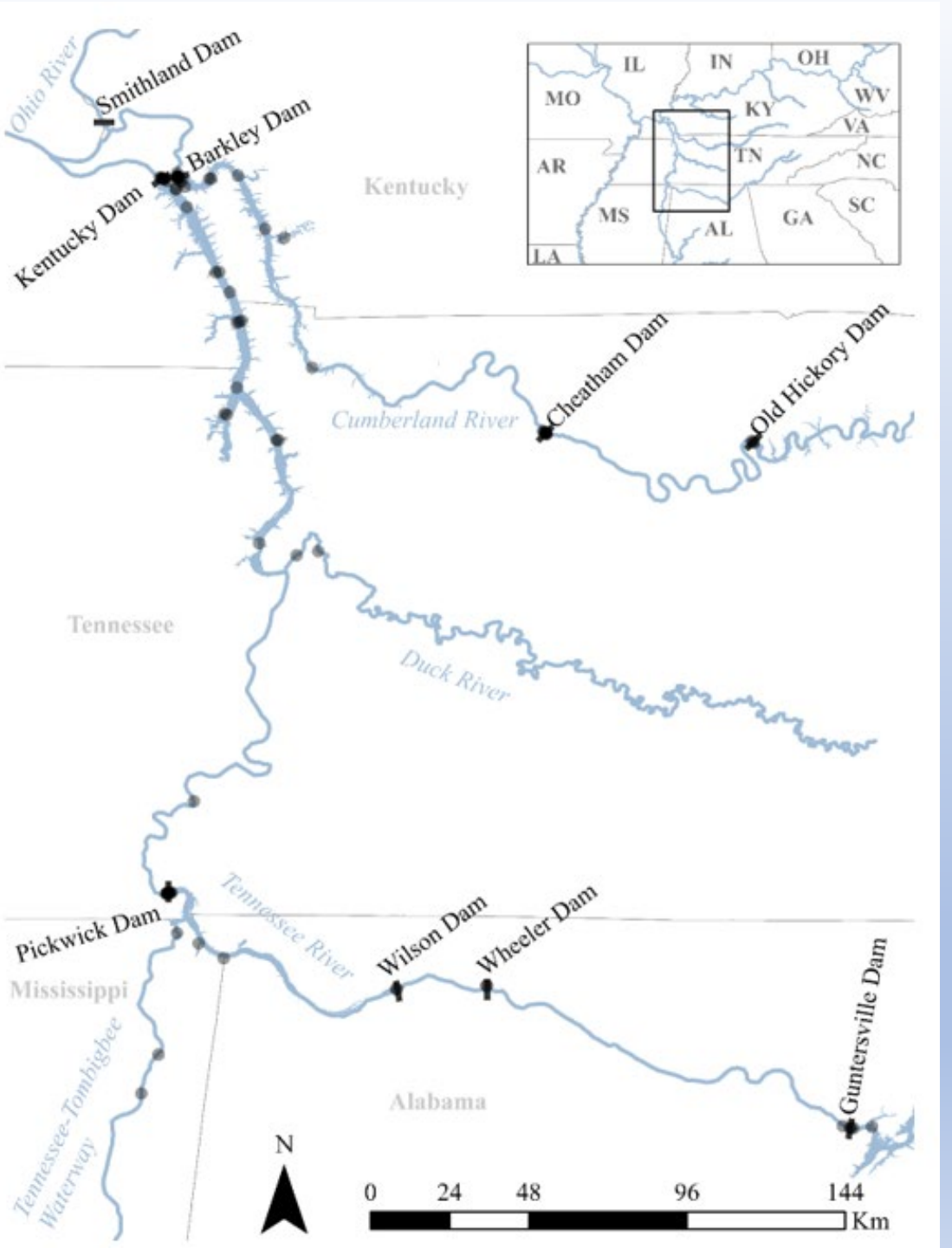
Strategies

- Prohibit movement by people
- Strategically remove carp
- Install barriers to stop/reduce movement upstream
- Monitor abundance and movements



Tracking Movement – Sonic tagging carp

- TN, TTU, KY, MS, USFWS, USGS
- Hundreds of carp tagged


Ohio River
Smithland Dam
Barkley Dam
Kentucky Dam
Kentucky
Cumberland River
Cheatham Dam
Old Hickory Dam
Tennessee
Duck River
Tennessee River
Pickwick Dam
Wilson Dam
Wheeler Dam
Guntersville Dam
Mississippi
Alabama
Tennessee-Tombigbee Waterway
N
0 24 48 96 144
Km
IL IN OH
MO KY WV
VA
AR TN NC
MS AL GA SC
LA

Importance of Monitoring and Research

What is the status of carp populations?

Are removing enough fish?

How/when are fish using locks?

What barrier types are most effective?

How are other species affected?

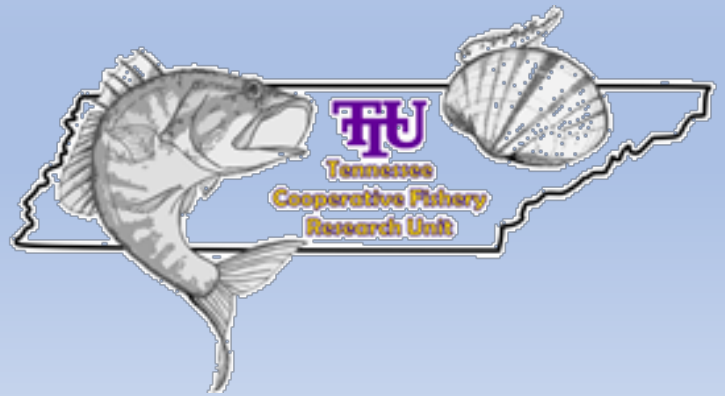
Implications of Silver Carp Invasion on the Food Web of a Freshwater Mussel Biodiversity Hotspot in Tennessee

Mark Rogers - USGS TN Coop Unit

Justin Murdock – Tenn Tech University

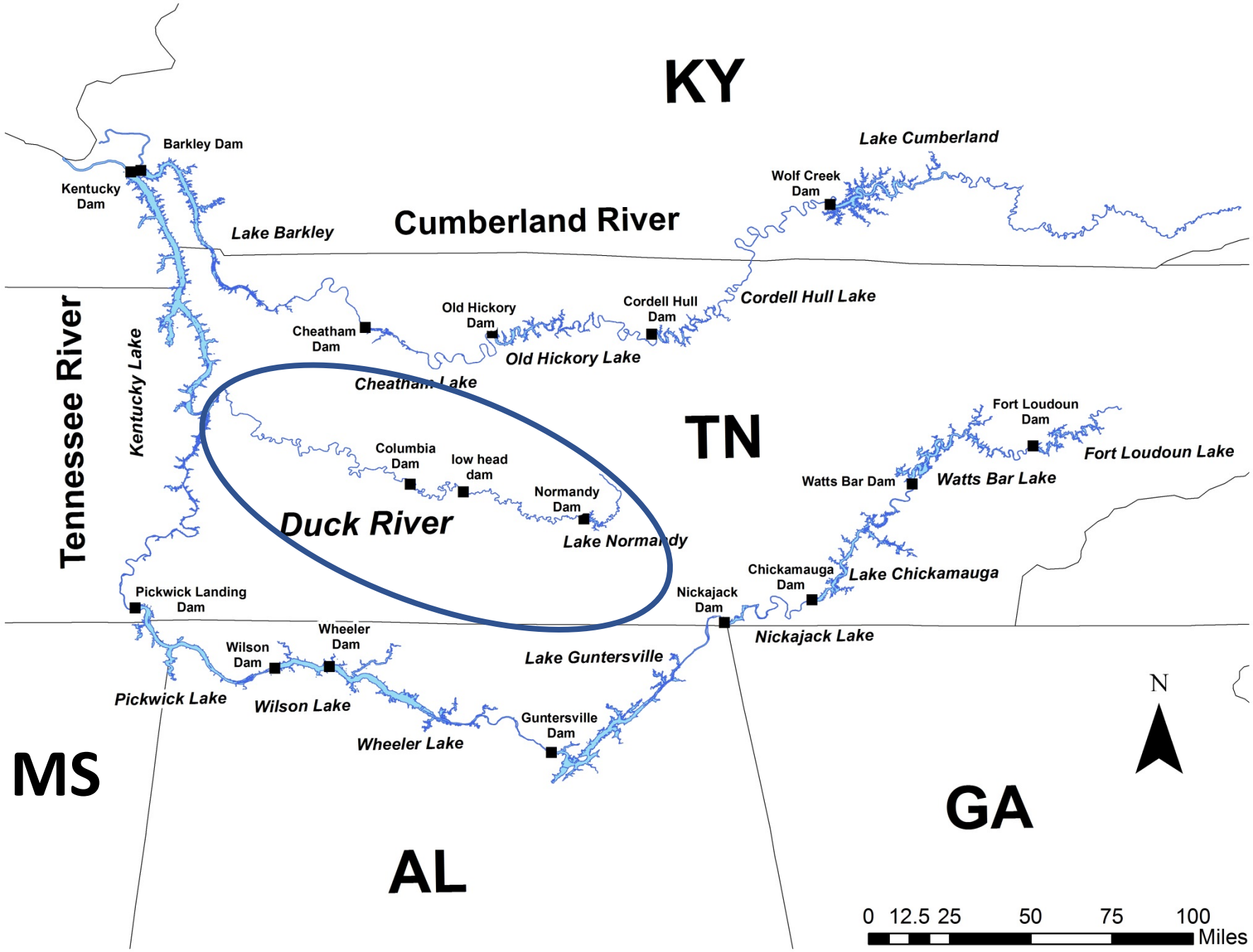
Don Hubbs - TWRA

USGS science for a changing world



Tennessee TECH

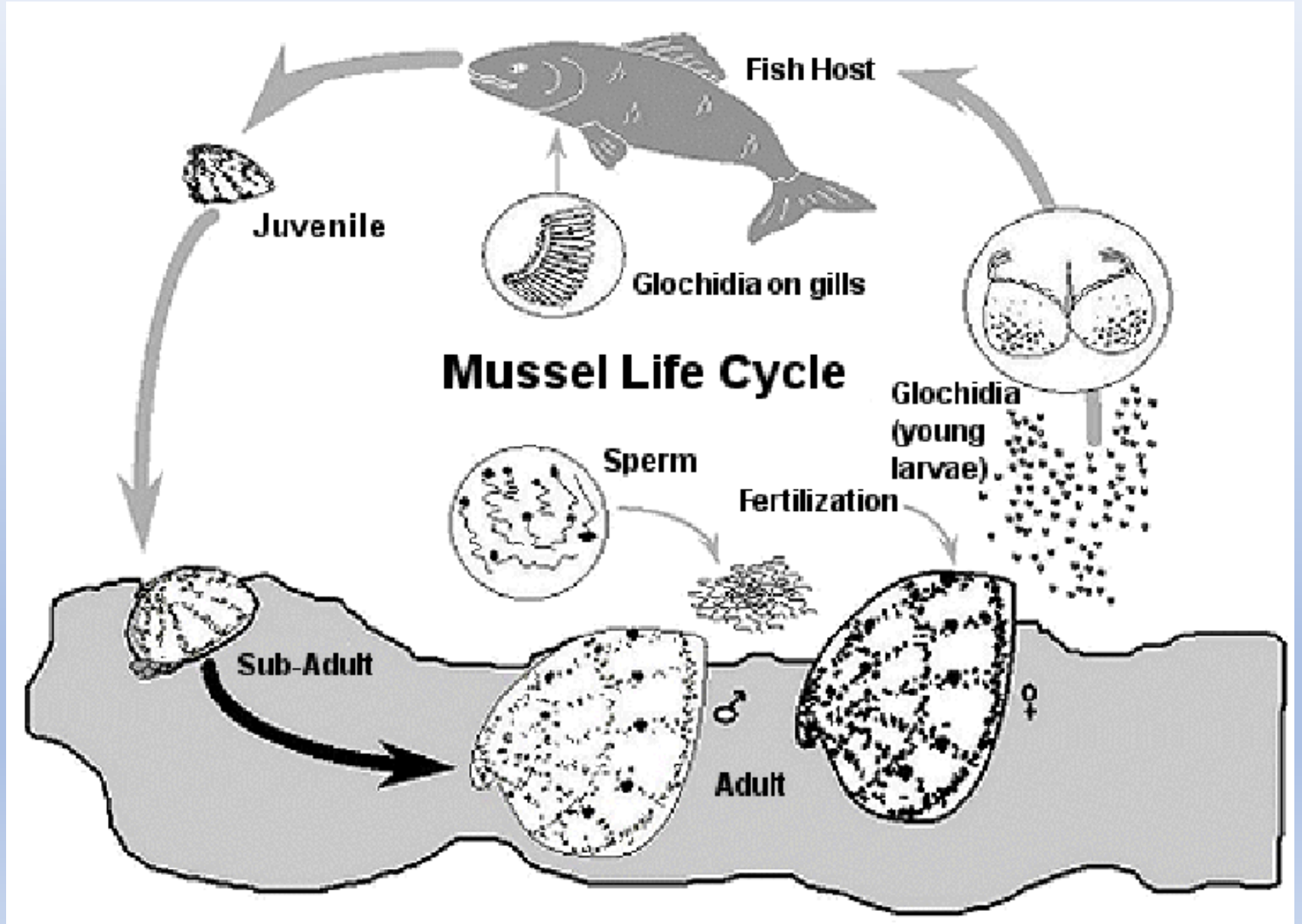
TENNESSEE WILDLIFE RESOURCES AGENCY


KY
Barkley Dam
Kentucky Dam
Lake Barkley
Cumberland River
Lake Cumberland
Wolf Creek Dam
Cordell Hull Dam
Cordell Hull Lake
Old Hickory Dam
Cheatham Dam
Old Hickory Lake
Cheatham Lake
Tennessee River
Kentucky Lake
TN
Fort Loudoun Dam
Fort Loudoun Lake
Watts Bar Dam
Watts Bar Lake
Columbia Dam
low head dam
Normandy Dam
Duck River
Lake Normandy
Chickamauga Dam
Lake Chickamauga
Nickajack Dam
Nickajack Lake
Pickwick Landing Dam
Wheeler Dam
Wilson Dam
Lake Guntersville
Pickwick Lake
Wilson Lake
Guntersville Dam
Wheeler Lake
MS
AL
GA
N
0 12.5 25 50 75 100
Miles

Duck River, tributary to TN River

- North America's richest river for diversity – Nature Conservancy
- One of 3 most diverse mussel hotspots – USGS
- 650 riverine fauna
- 151 fish species
- 60 mussel species
- 22 snail species
- Critical habitat for two endangered mussels
- SARP focal area

Host Fish Interactions

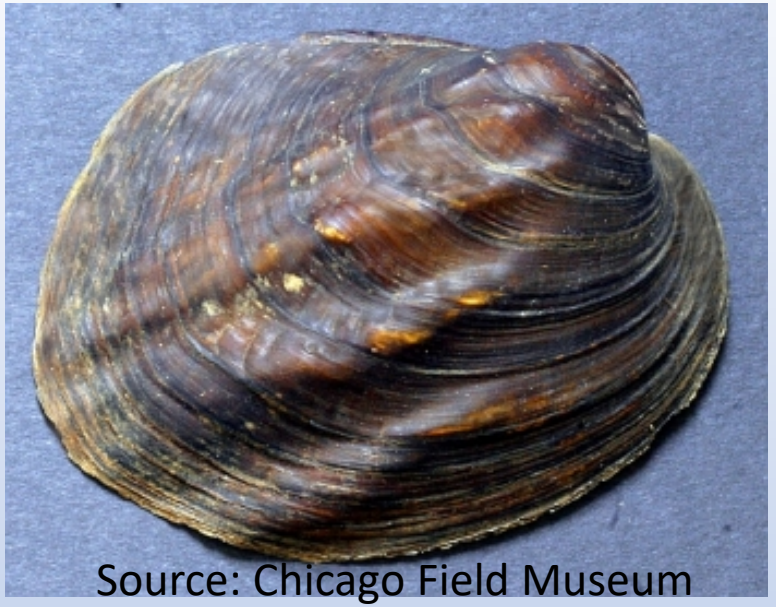


Objective

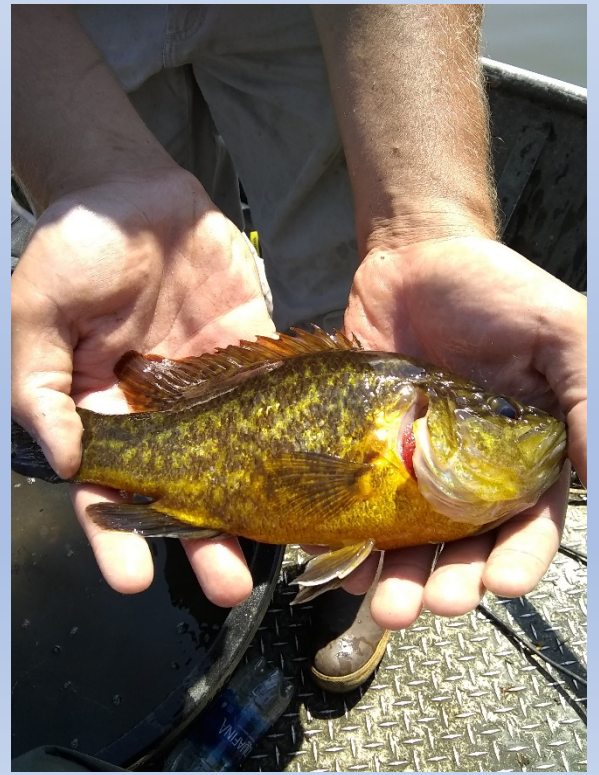
- Evaluate diet overlap between Silver Carp, Native mussels, and potential host fish
- Use eDNA techniques (QPCR) to confirm presence

Methods

- 2 sampling seasons
- Above and below dam
- 3 mussel species with differing hosts
- Breadth of potential host fish
- Energy resources
- Samples sent to University of Washington



Source: Chicago Field Museum



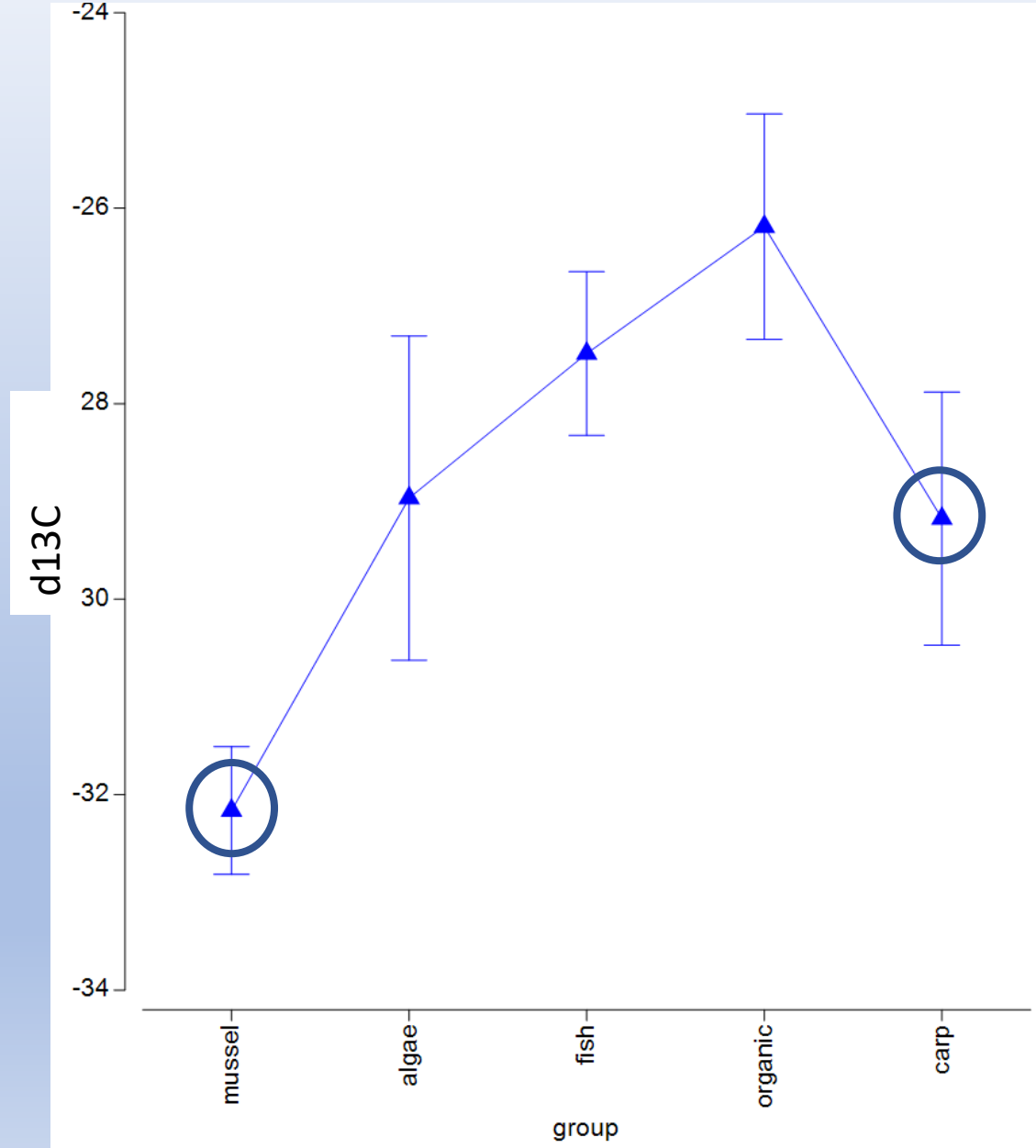
Methods

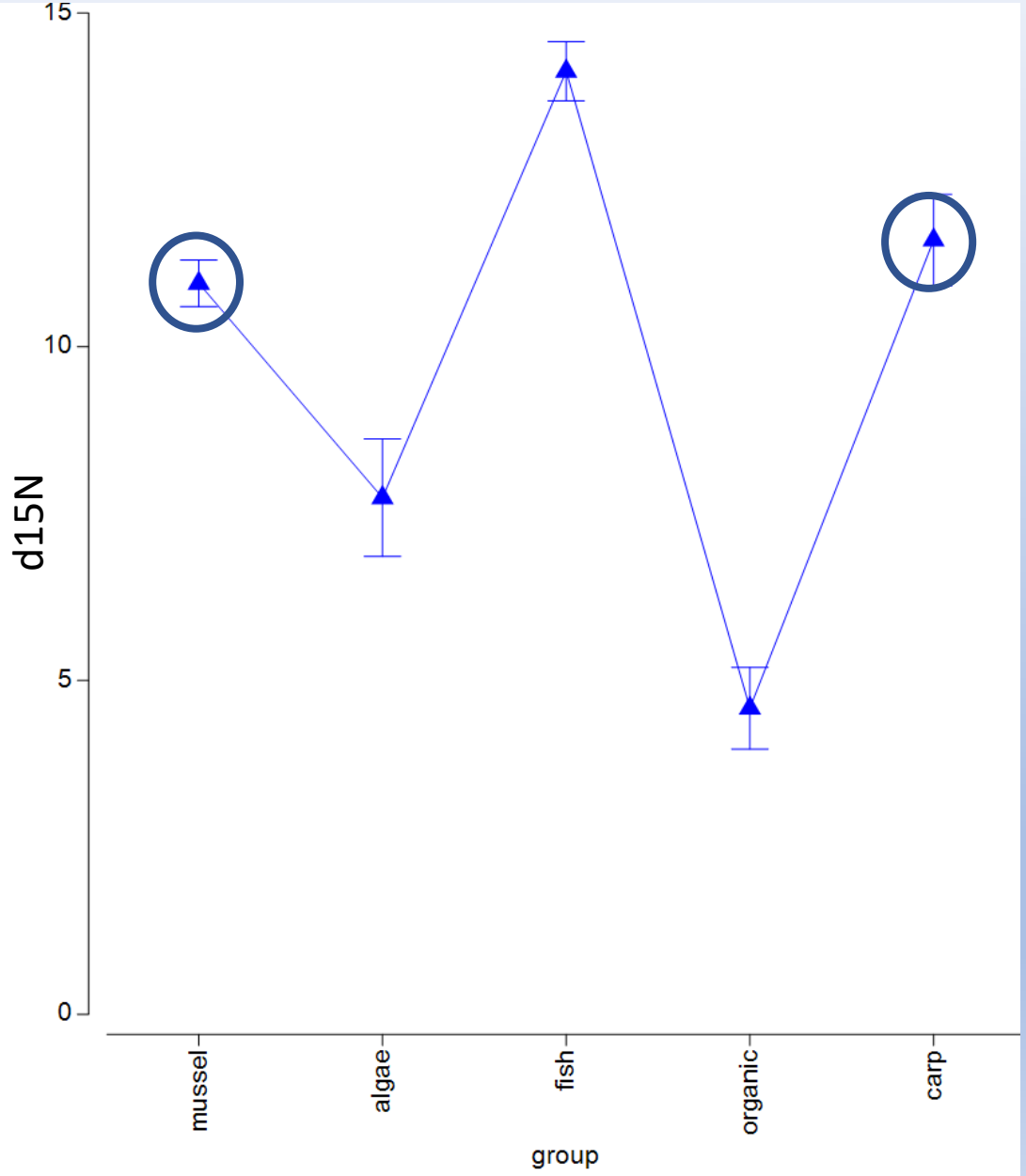
Algae	6
Biofilm	20
Carp	23
Catfish	25
Darter	15
Leaves	18
Mussel	184
Organic	46
Plants	25
Stick	12
Sunfish	102

Results

- Above and below dam differences were not evident
- Seasonality was not evident
- Carp are hard to catch, data were pooled across seasons

Results


-24
-26
28
30
-32
-34
d13C
mussel
algae
fish
organic
carp
group


15
10
5
0
d15N
mussel
algae
fish
organic
carp
group

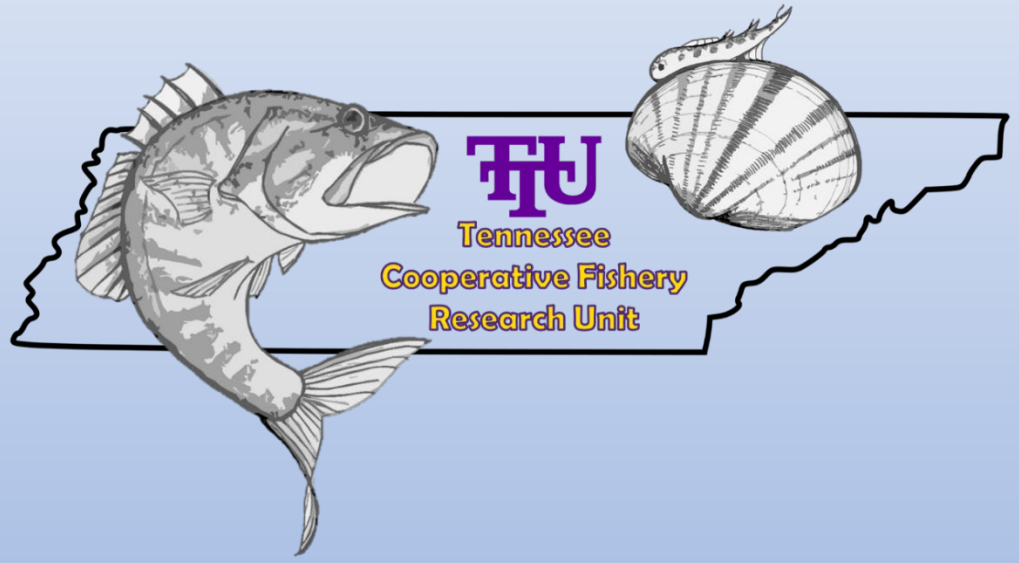
Take Homes

- Silver Carp and native feed at same trophic level
- Carbon signatures indicate different energy sources
- All three mussel species feed off same Carbon source
- eDNA results indicated Silver Carp had not gotten over the Columbia dam, yet…

The Heartbreaker

In September 2018 we got positive eDNA signals at two sites above the dam

Lower Food Web Selectivity by Bigheaded Carps in Southeastern Reservoirs



Ashley Padgett

Tennessee Cooperative Fishery Research Unit

Tennessee Technological University

Project Objectives

- Determine the seasonal availability of planktonic particles
- Determine the particle size/type selectivity of bigheaded carp and Gizzard Shad
- Evaluate dietary overlap between bigheaded carp and Gizzard Shad

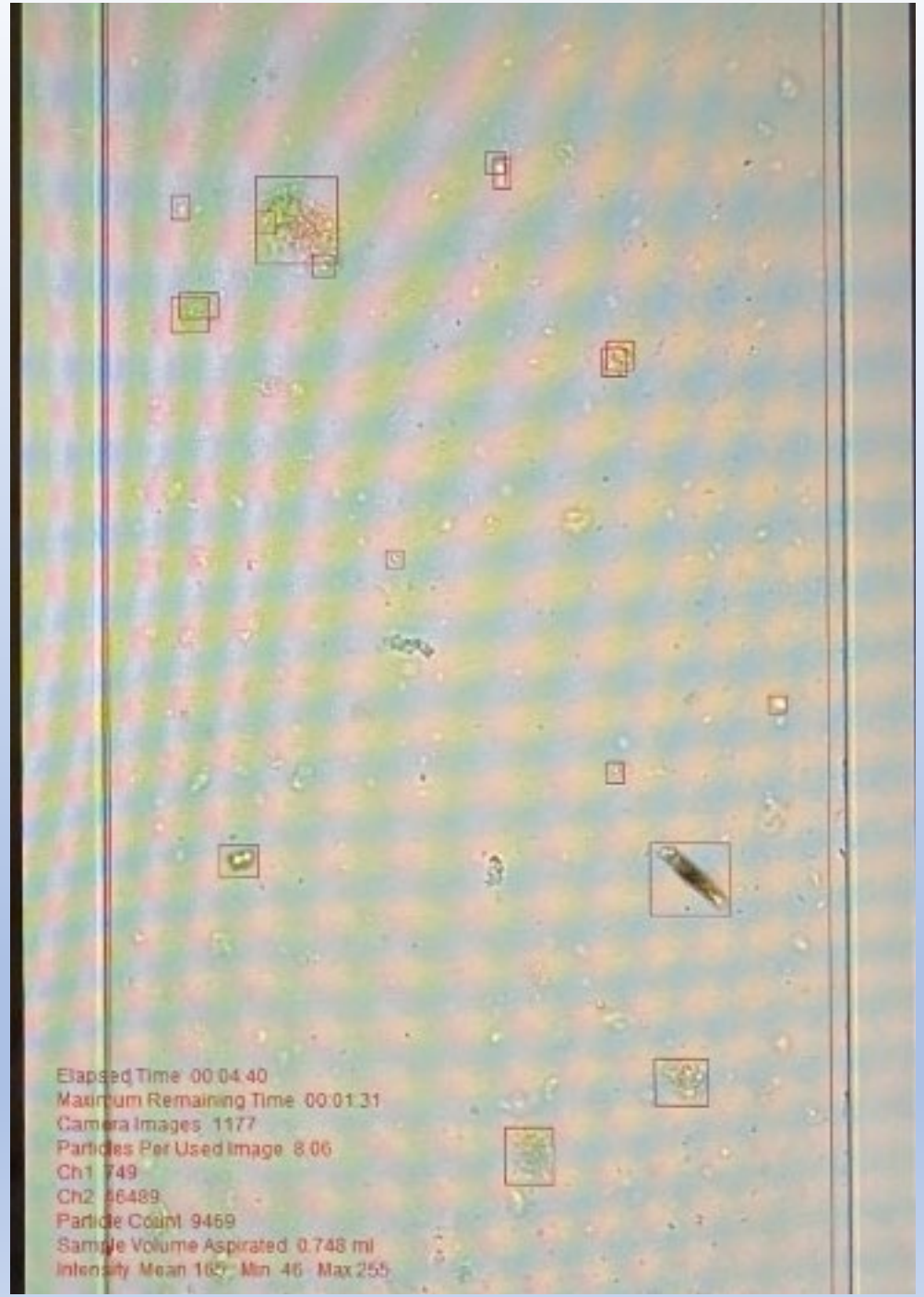
Field Methods

- Barkley and Kentucky reservoirs
- Gill raker removal and rinsing
- Integrated tube sampler

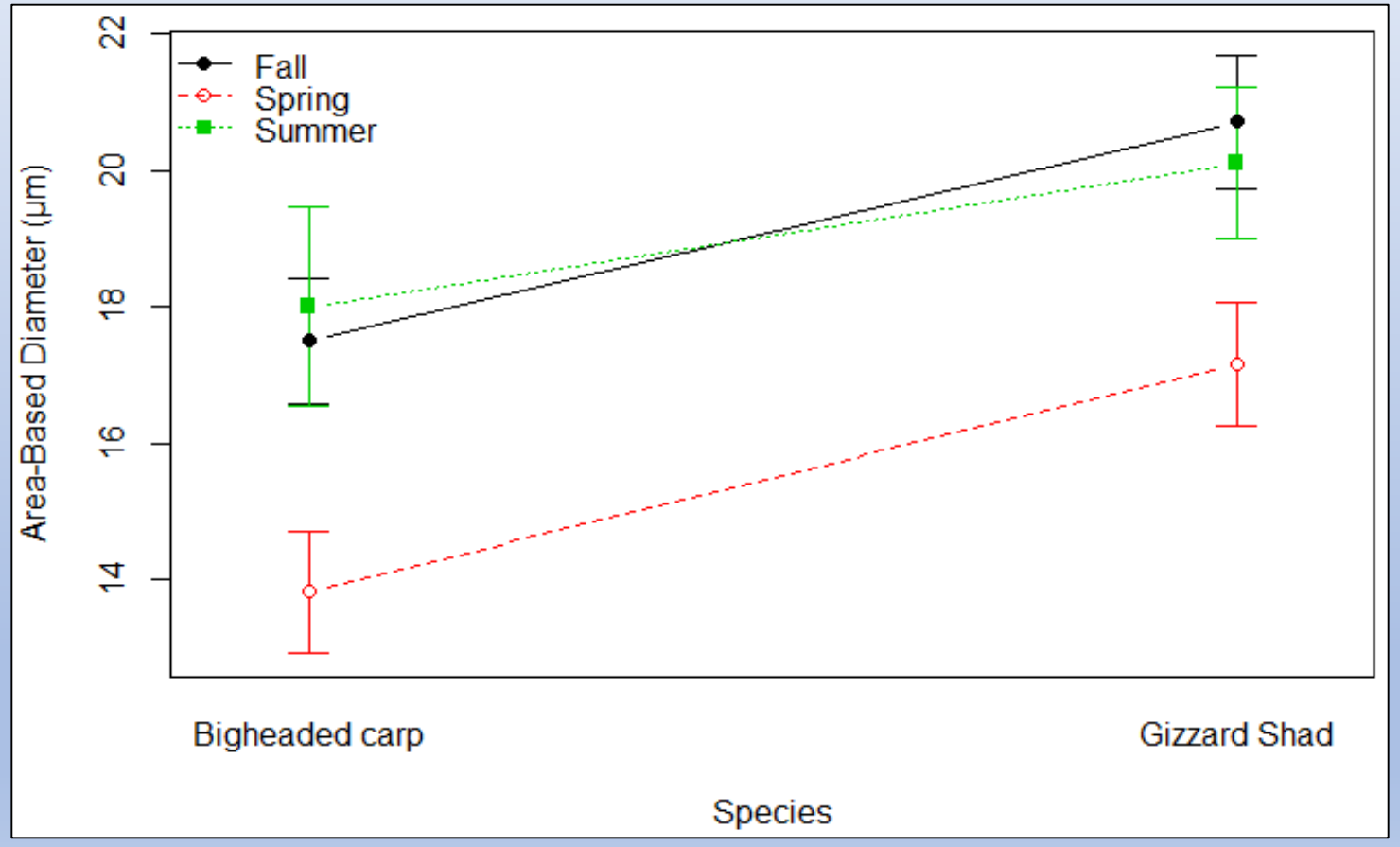
Bighead Carp Gill Raker

Lab Methods

- Flow Cam 8000
  - Sorts particles by size and type



Results


Fall
Spring
Summer
Area-Based Diameter (µm)
22
20
18
16
14
Bigheaded carp
Gizzard Shad
Species

Results

- Gizzard Shad selected for larger particles in every season
- Bigheaded carp exhibited larger size range of particle selection
- Bigheaded carp can filter larger particles

Implications

- Results inform effects on Gizzard Shad populations
  - Greatest differences in the spring may allow continuation of successful spawning
- Help develop an understanding of habitat selectivity by bigheaded carp in reservoirs of the Tennessee and Cumberland Rivers

Thank You!