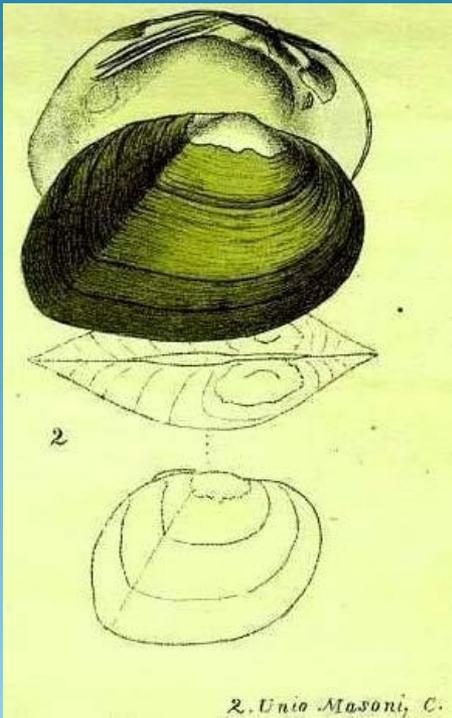




Atlantic Pigtoe

The Service is proposing to list the Atlantic pigtoe, a clam, freshwater mussel, as a threatened species and to designate Critical Habitat.



This presentation is a companion piece to these documents:

- Proposed Listing Rule
- Proposed Critical Habitat Designation
- Draft Economic Analysis for the Designation of Critical Habitat
- Special 4(d) Rule for the Atlantic pigtoe



Description

The shell of the Atlantic pigtoe is a chunky, roughly oval, like that of a pig's hoof/toe. The outer surface of the shell is yellow to dark brown and parchment-like, while the inner layer is iridescent blue to salmon, white, or orange. Although larger specimens exist, the Atlantic pigtoe rarely exceeds 2 inches in length.





Taxonomy: Atlantic Pigtoe

Kingdom: Animals

Phylum: Mollusca

Class: Bivalvia

Order: Unionoida

Family: Unionidae

Genus: *Fusconaia* (15 species)

Species: *Fusconaia masoni*



- Synonymous with *Lexingtonia subplana*
- Was once considered *Pleurobema masoni*
- Tetragenous nature of marsupial gills (females use all 4 demibranchs when fully gravid to brood glochidia). This trait places it in the *Fusconaia* genus.



Endangered Species Act (ESA) Listing

Endangered: any species which is in danger of extinction throughout all or a significant portion of its range

Threatened: any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

Listing decisions arrived at by careful analysis of these 5 factors:

- A. The present or threatened destruction, modification, or curtailment of the species' habitat or range
- B. Overutilization for commercial, recreational, scientific, or educational purposes
- C. Disease or predation
- D. The inadequacy of existing regulatory mechanisms
- E. Other natural or manmade factors affecting the species' survival.



Criteria for protection

A species is added to the list of threatened and endangered wildlife because of the following factors:

1. The present or threatened destruction, modification, or curtailment of its habitat or range.
2. Overutilization for commercial, recreational, scientific, or educational purposes.
3. Disease or predation.
4. The inadequacy of existing regulatory mechanisms.
5. Other natural manmade factors affecting its survival.



Shares habitat with other imperiled wildlife

Close to 62% of the areas proposed as critical habitat for the Atlantic pigtoe are occupied by other listed species with similar habitat needs.



James
Spiny mussel



Tar River
Spiny mussel



Dwarf
Wedgemussel



Yellow Lance



Roanoke Logperch



Atlantic Sturgeon

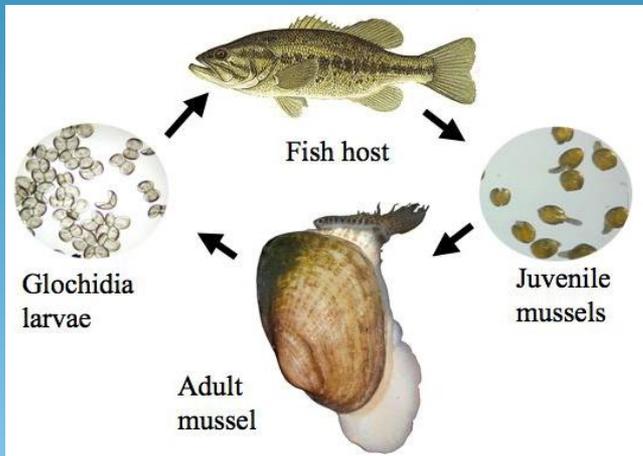


Shortnose Sturgeon



Freshwater Mussel life cycle depend on fish

Atlantic Pigtoe larvae need to infest the gills, heads, or fins of darter fish for about a month to develop.





Host fish- mobile nurseries

White Shiner
Satinfin Shiner
Bluehead Chub
Rosyside Dace
Pinewoods Shiner
Creek Chub
Rosefin Shiner
Swallowtail Shiner
Mountain Redbelly Dace



bluehead chub by L. Serrano



white shiner by L.Serrano



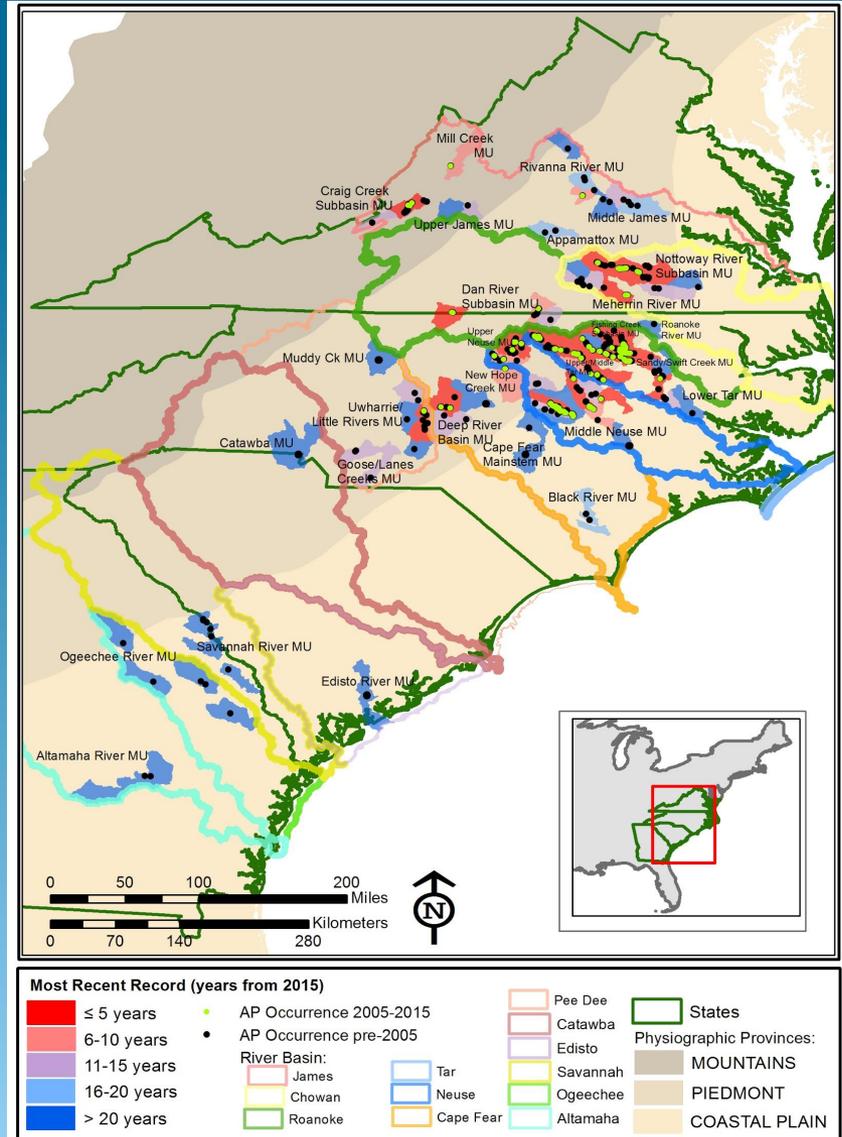
Rivers where it is found

Virginia and North Carolina

1. James
2. Chowan
3. Roanoke
4. Tar
5. Neuse
6. Cape Fear
7. Yadkin-Pee Dee

Presumed extirpated in South Carolina and Georgia:

1. Catawba
2. Edisto
3. Savannah
4. Ogeechee
5. Altamaha





Breeding, Feeding, Sheltering, and Dispersal Needs

Atlantic Pigtoe
Glochidia Tubes



- Clear flowing water
- Food- Phytoplankton
- Low turbidity
- Appropriate water chemistry
 - Low ammonia
 - High dissolved oxygen
 - neutral pH (6.5-7.5)
 - No salinity
- abundance of host fish (darters)
- Appropriate substrate
 - Silt-free
 - gravel
 - coarse stable sands



Preferred Habitat



Atlantic Pigtoes burrows in coarse sand and gravel, and rarely in silt. Historically, the best populations existed in small creeks to larger rivers with excellent water quality, where flows were sufficient to maintain clean, silt-free substrates.





What is a Population?

“Populations” refer to the river basins within the historical range of each species

Atlantic Pigtoe has
12 historical
populations

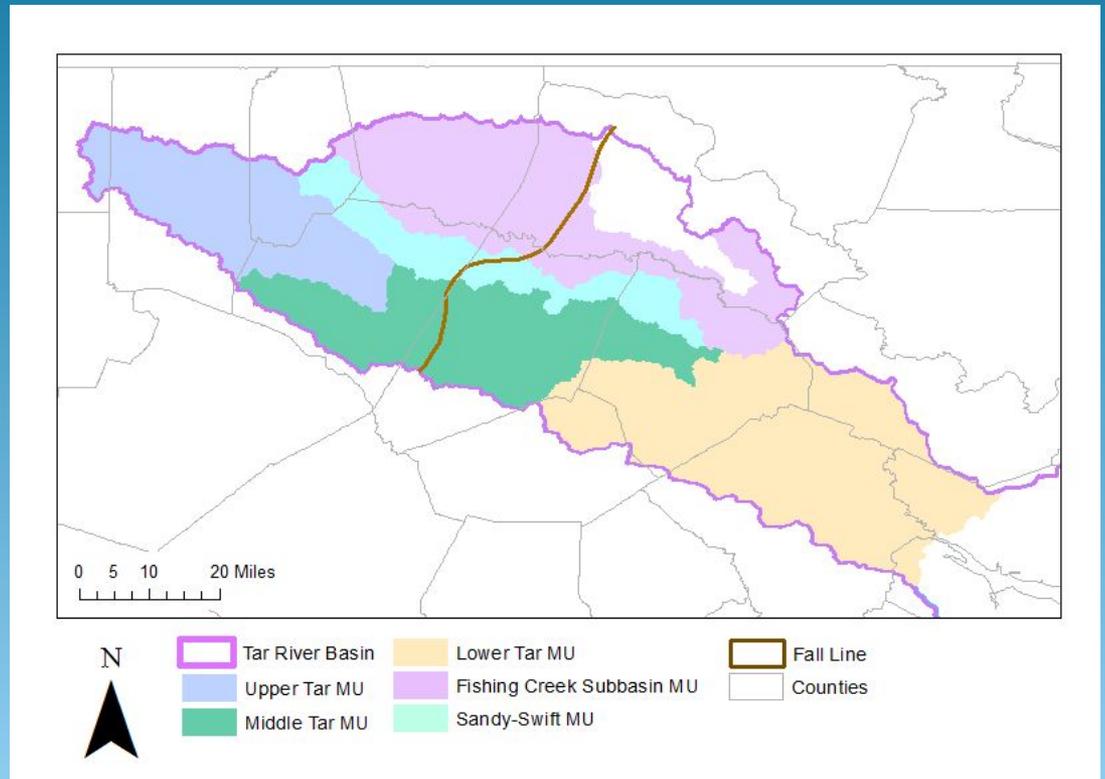




Defining Management Units

“MUs” (Management Units) are the smaller geographically-defined contiguous watersheds that encompass

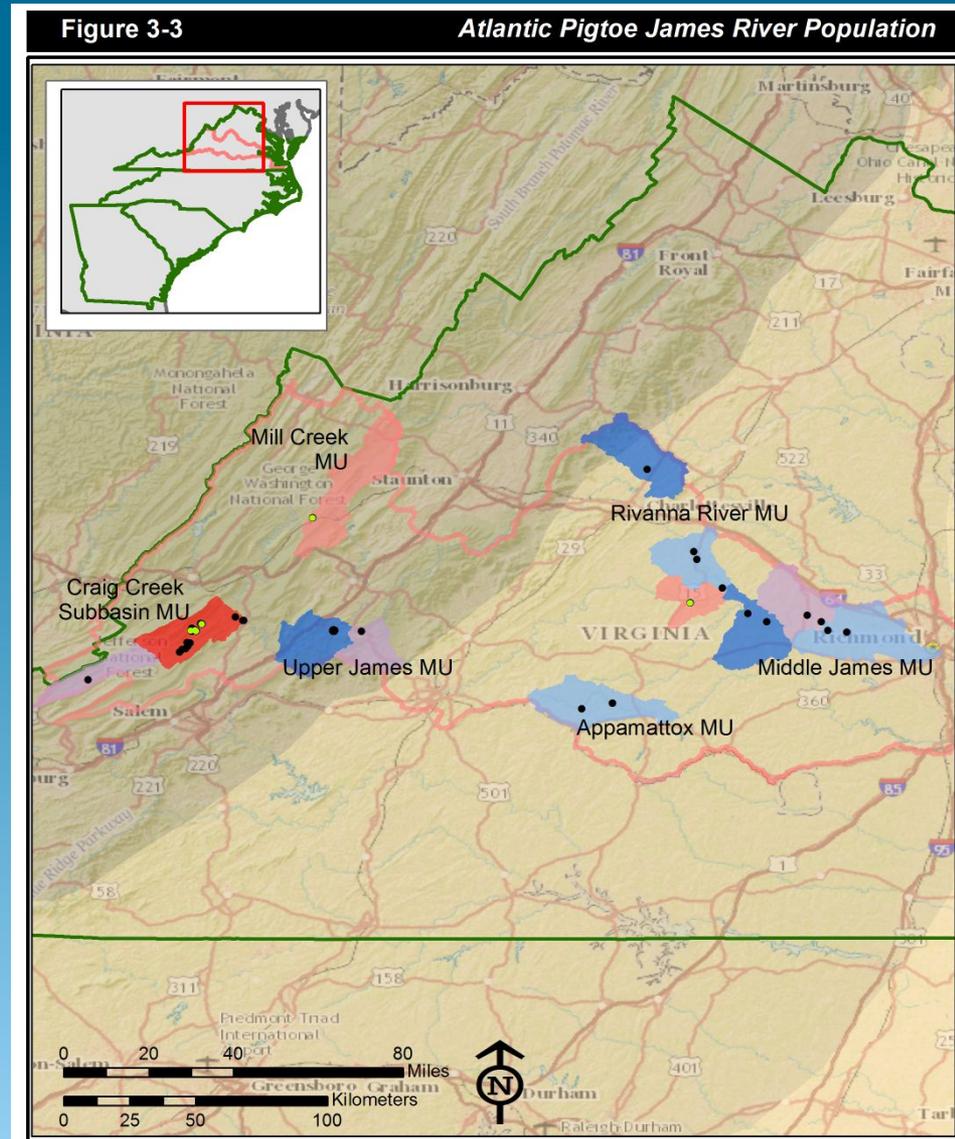
historically or currently documented occupied habitat





AP: James population

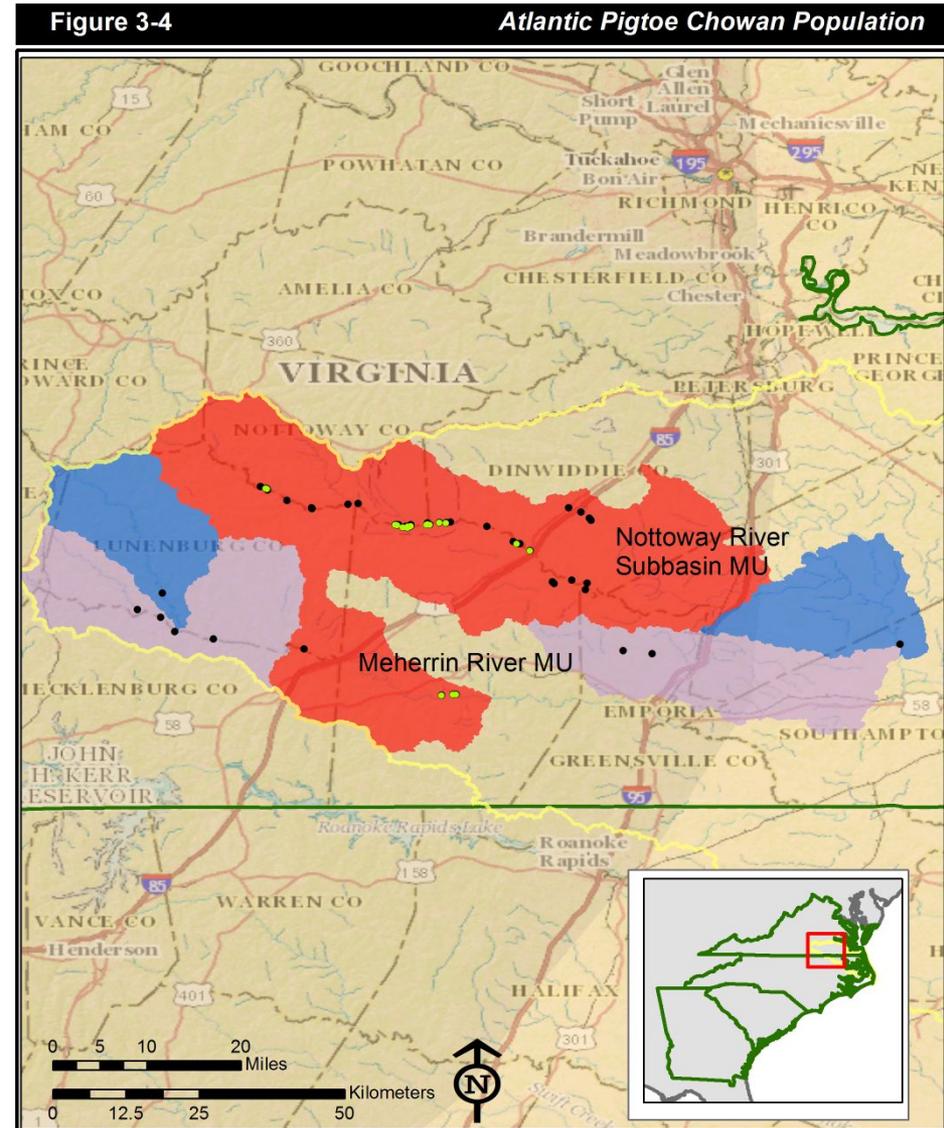
- 6 Management Units (MU)
- “Rare” but consistently found in most surveys except Craig Creek subbasin (50+)
- Rivanna MU former stronghold, but AP has not been seen in this MU for 18 years despite much effort
- Major stressors: sediment & pollutants





AP: Chowan Population

- 2 MUs
- Once common (50+) in Nottoway, but species has not been seen since 2012 (shell)
- Increased frequency of low flow events have affected habitat in Nottoway





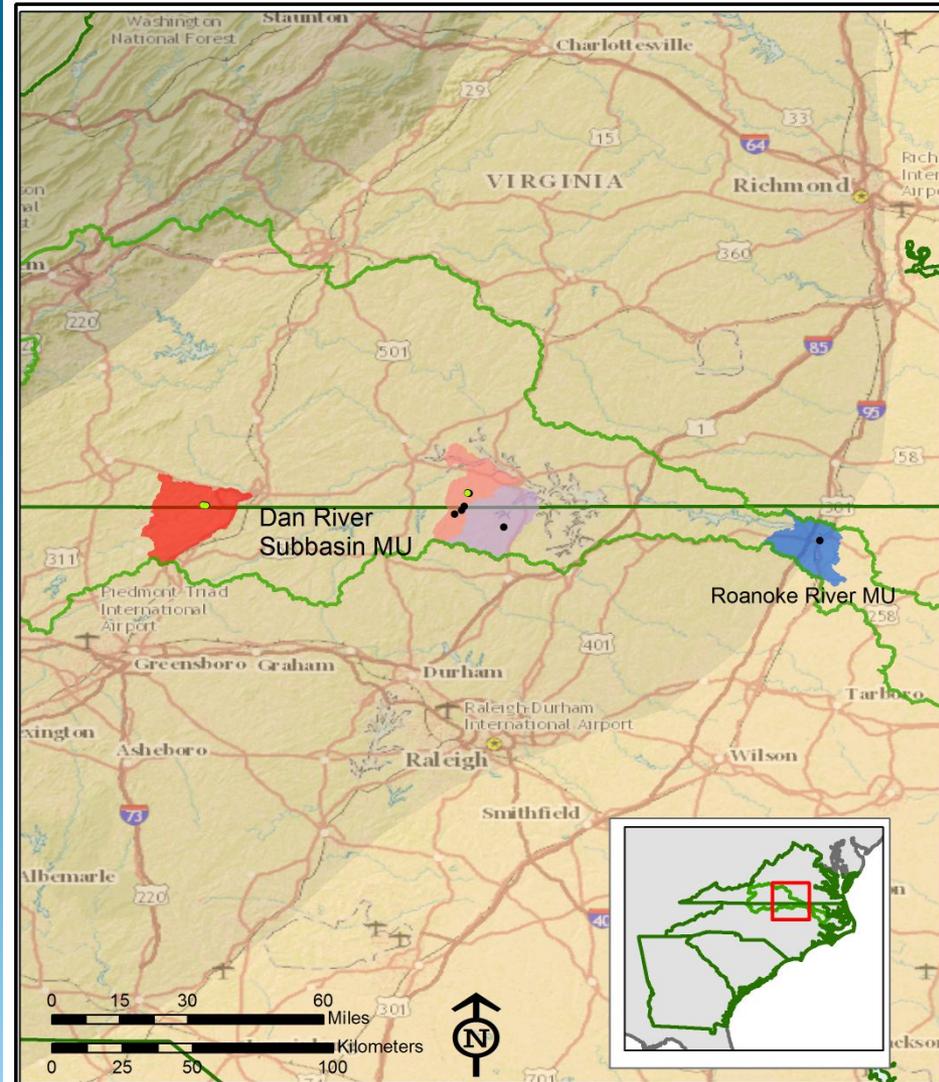
AP: Roanoke population

- Historical records in Roanoke River
- Extensive surveys of Dan River in 2014 found 1 small AP (has been known from other parts of basin)



Figure 3-5

Atlantic Pigtoe Roanoke Population



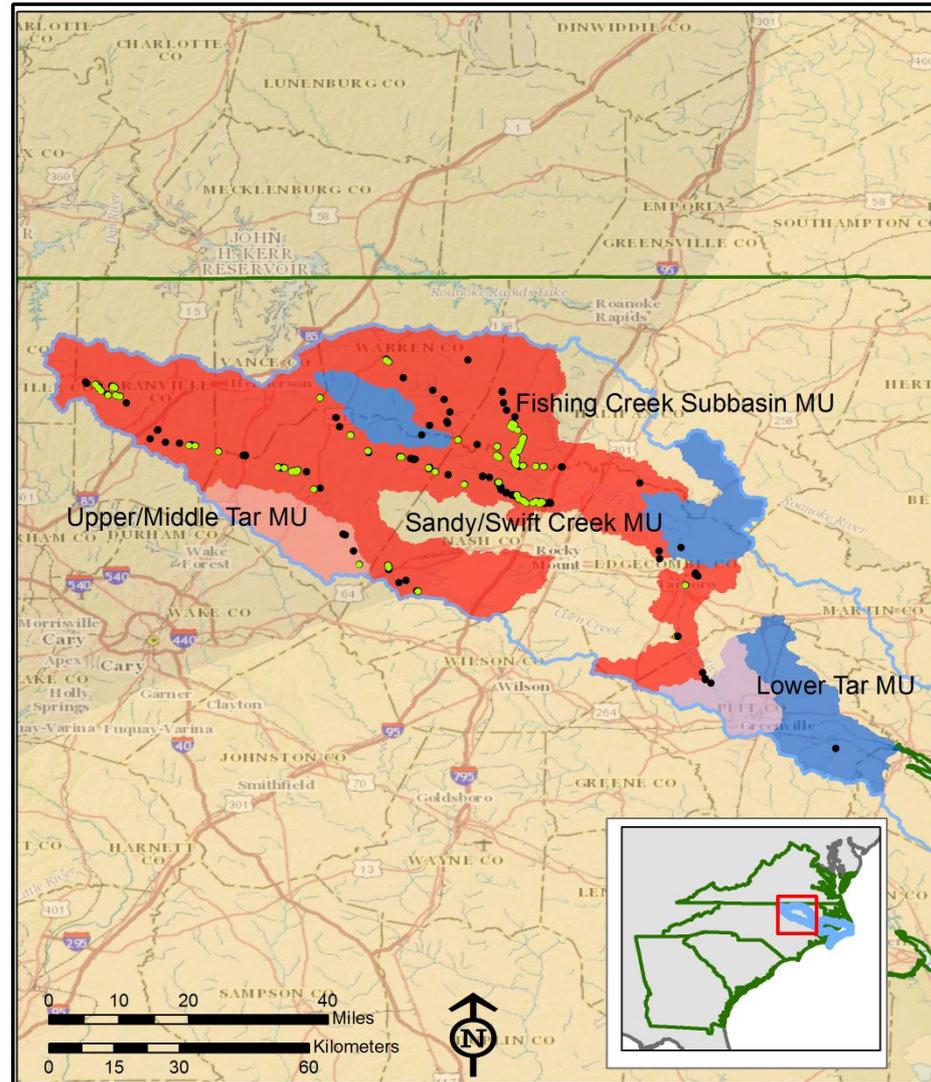


AP: Tar population

- 4 MUs
- First seen in 1974
- Recently seen in 2016
- Not many (<10) seen during surveys
- Best remaining areas are Fishing Creek Subbasin and Sandy-Swift

Figure 3-6

Atlantic Pigtoe Tar Population



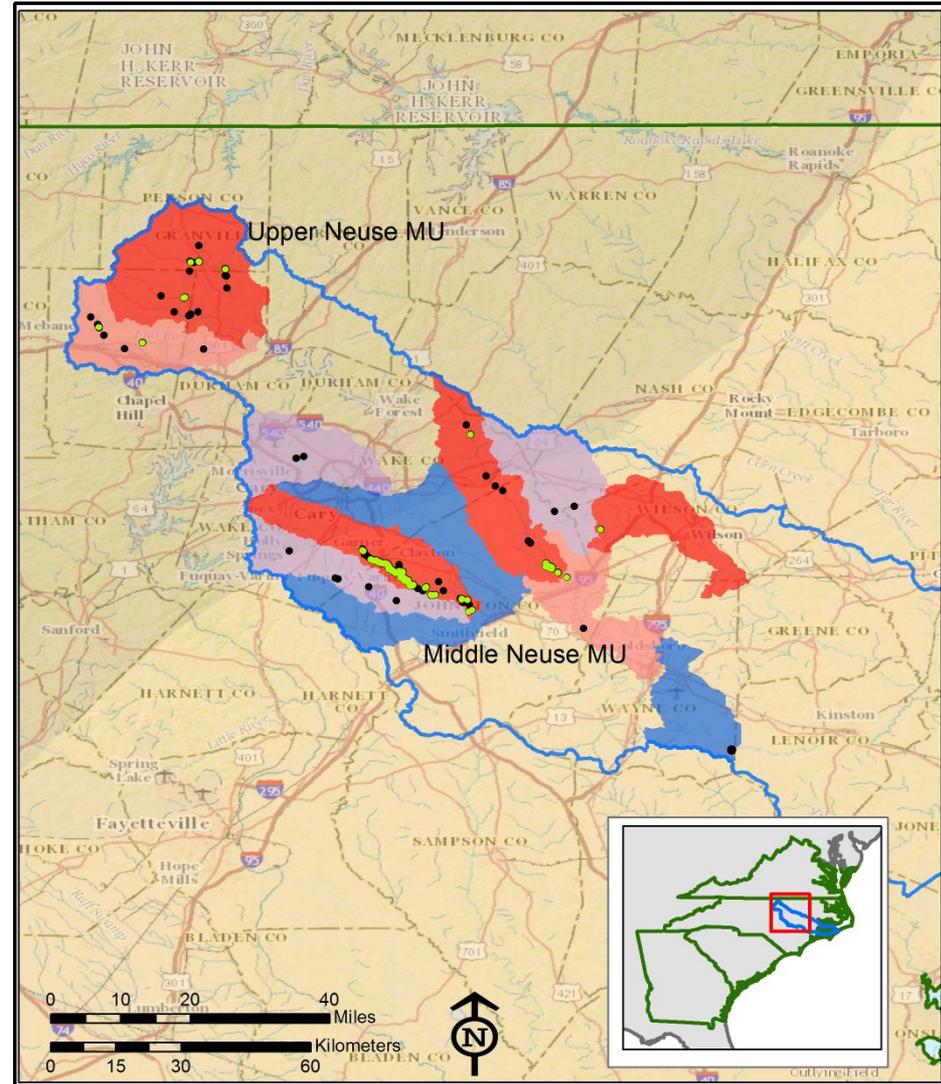


AP: Neuse Population

- First seen in 1983
- Historical surveys have documented many per survey (25+)
- Recent surveys have documented very low numbers (<5 or shell)/survey
- Extensive surveys in Swift Creek (2014-2016); 62 total observed
- Rapidly urbanizing watershed

Figure 3-7

Atlantic Pigtoe Neuse Population



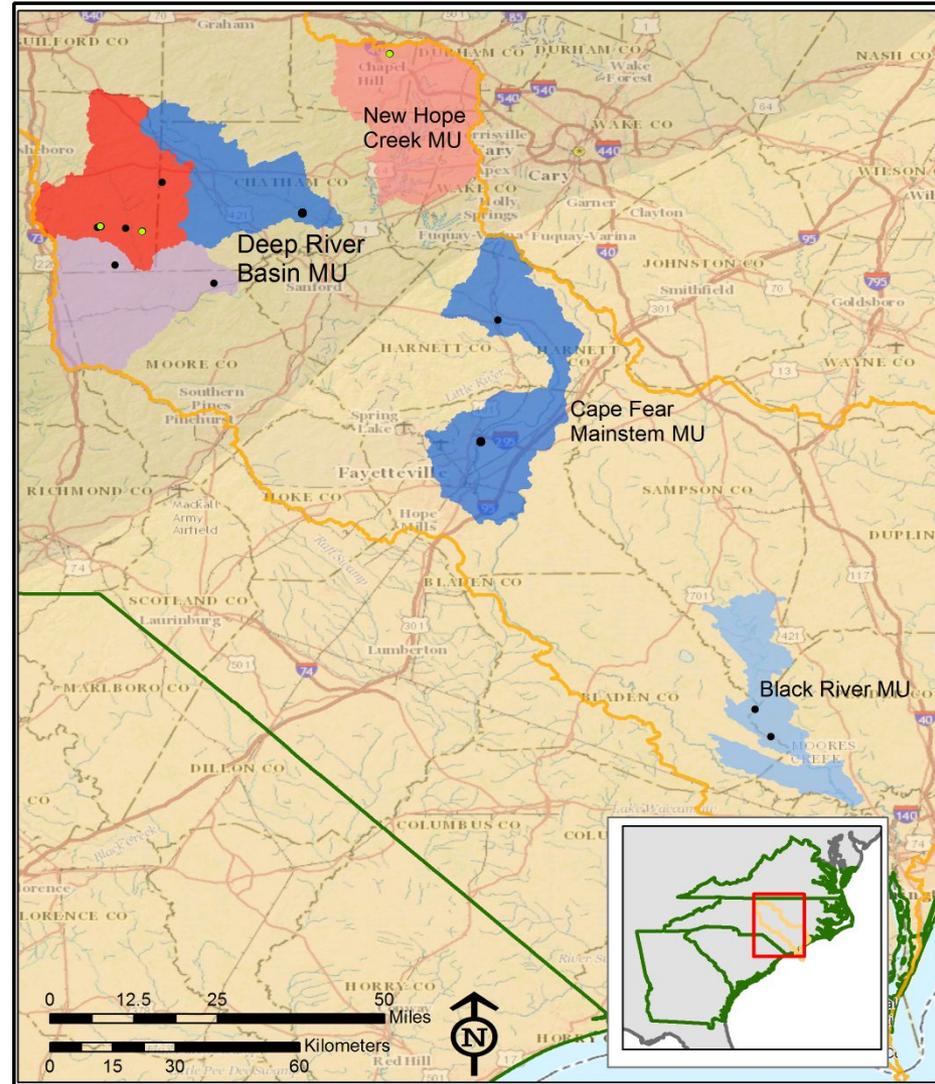


AP: Cape Fear population

- 4 MUs
- Surveys report low numbers (<5)
- Mark-recapture study in New Hope Creek MU from 2001-2006 found total of 9 over 14 intensive surveys

Figure 3-8

Atlantic Pigtoe Cape Fear Population



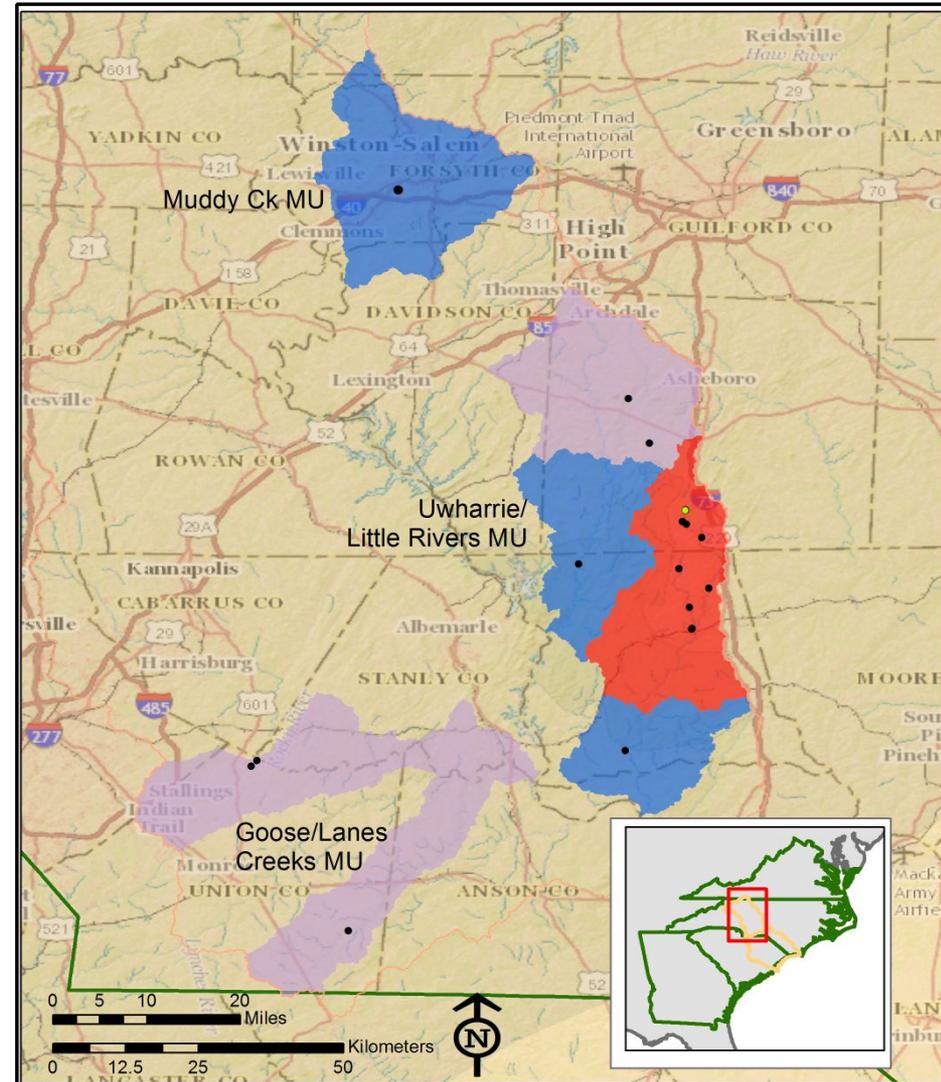


AP: Pee Dee population

- 3 MUs
- 1st seen in 1987
- Most surveys document one or two individuals
- Seen in Little River in 2010
- Goose/Lanes high urbanization threat

Figure 3-9

Atlantic Pigtoe Pee Dee Population



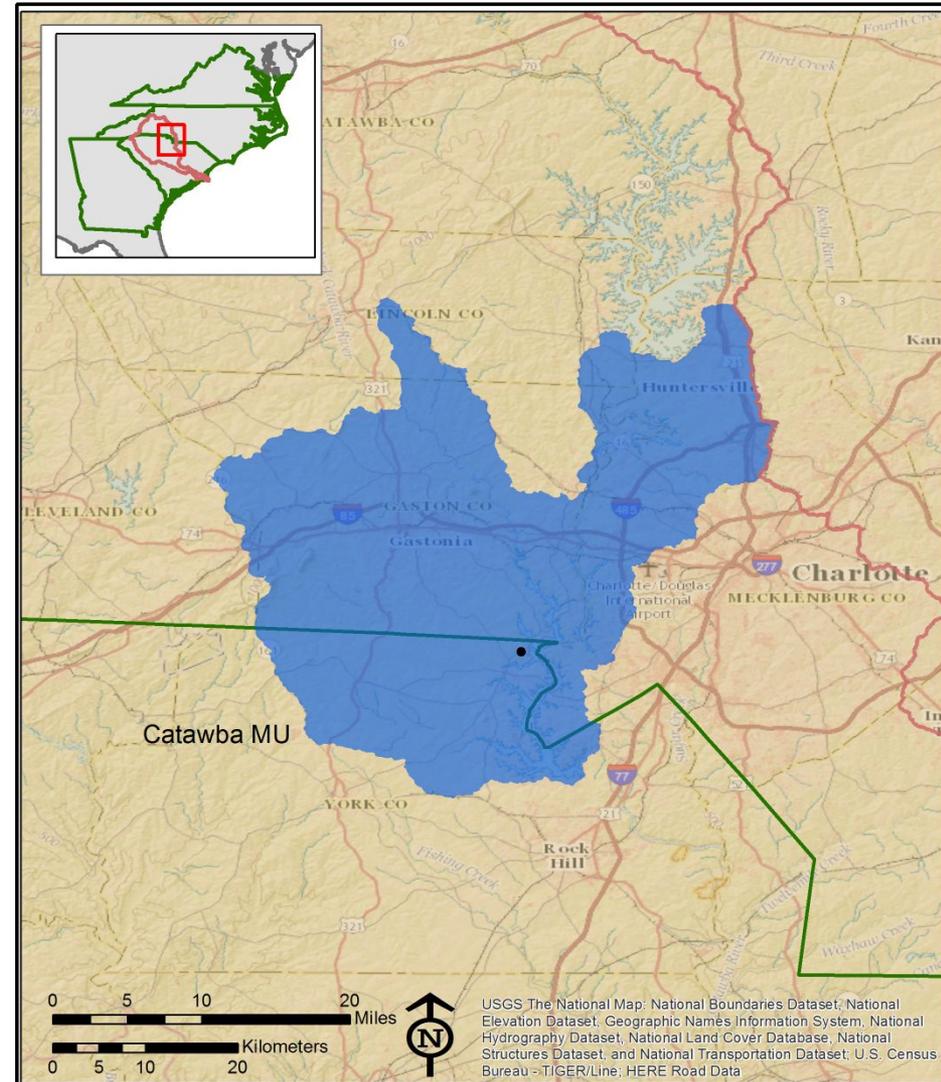


AP: Catawba Population

- Presumed extirpated
- Only one shell ever observed (in 1800s) despite recent survey efforts
- Very urbanized MU (Charlotte)

Figure 3-10

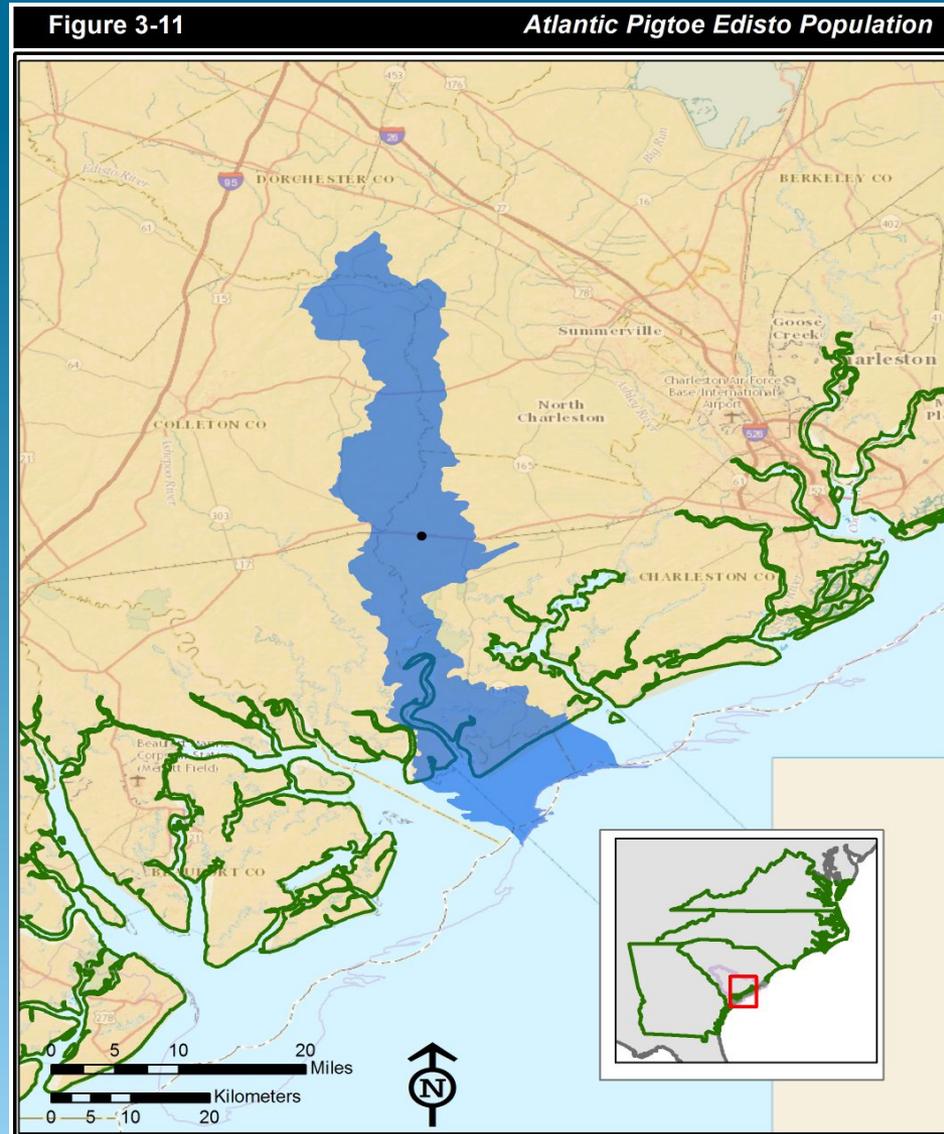
Atlantic Pigtoe Catawba Population





AP: Edisto population

- Recent discovery of old records in Swiss Museum
- Presumed extirpated Not found during recent surveys.



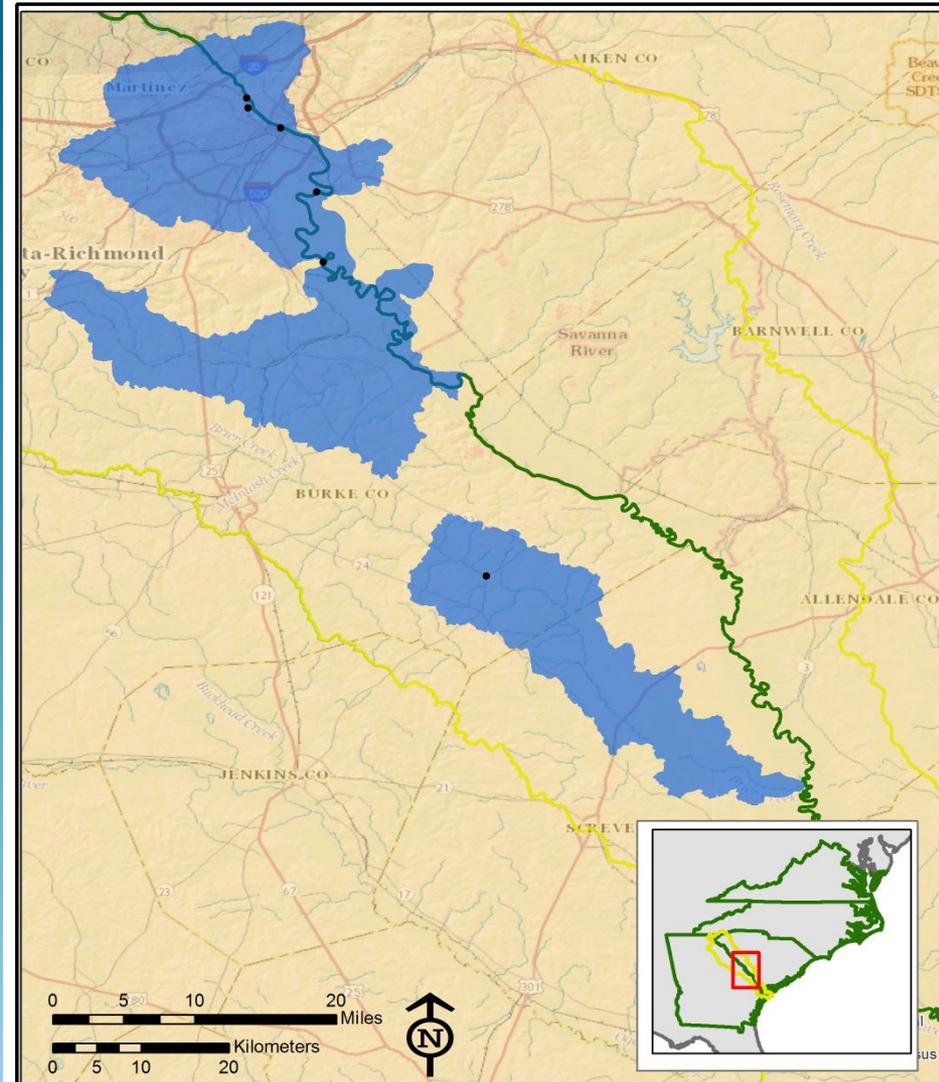


AP: Savannah population

- Type Specimen from Savannah River near Augusta
- Targeted dive surveys in 2006 did not find species
- Presumed extirpated

Figure 3-12

Atlantic Pigtoe Savannah Population



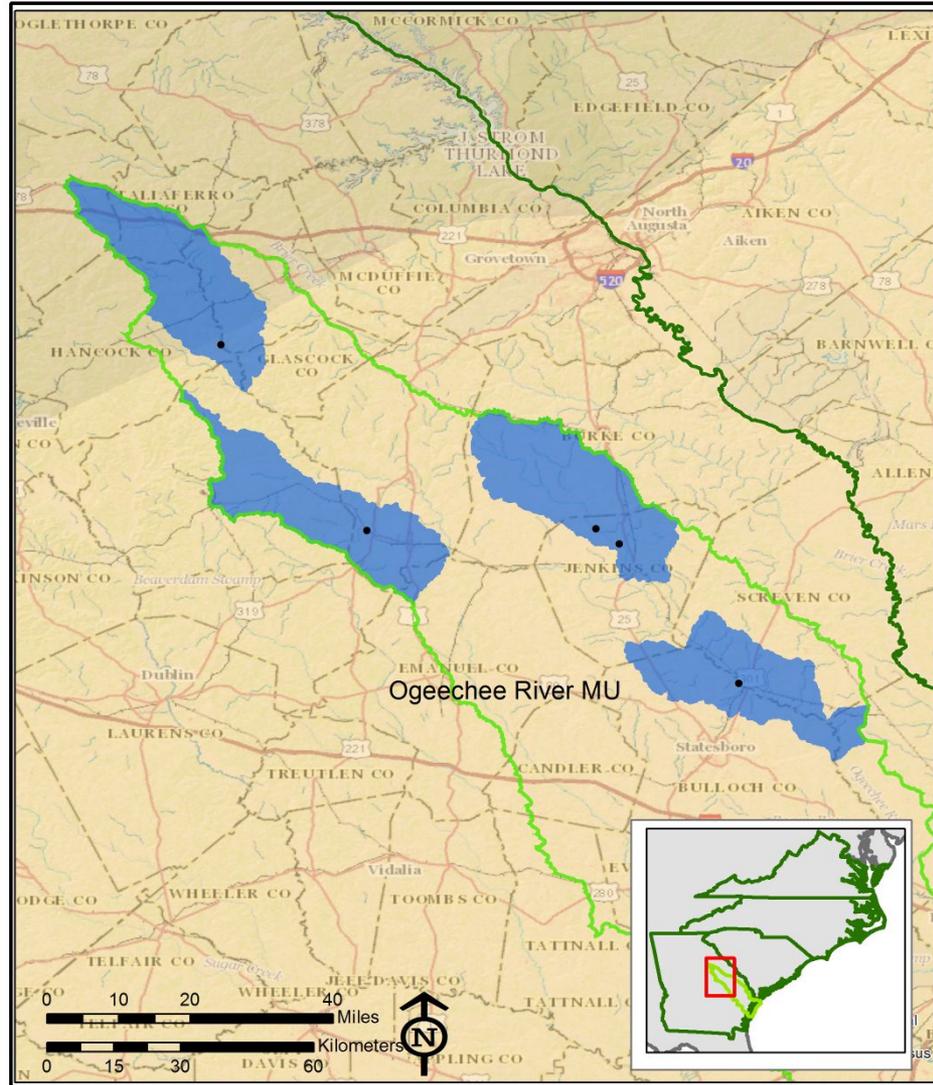


AP: Ogeechee population

- 1st observed in 1970s
- Several surveys in mid-2000s failed to document species
- Presumed extirpated

Figure 3-13

Atlantic Pigtoe Ogeechee Population



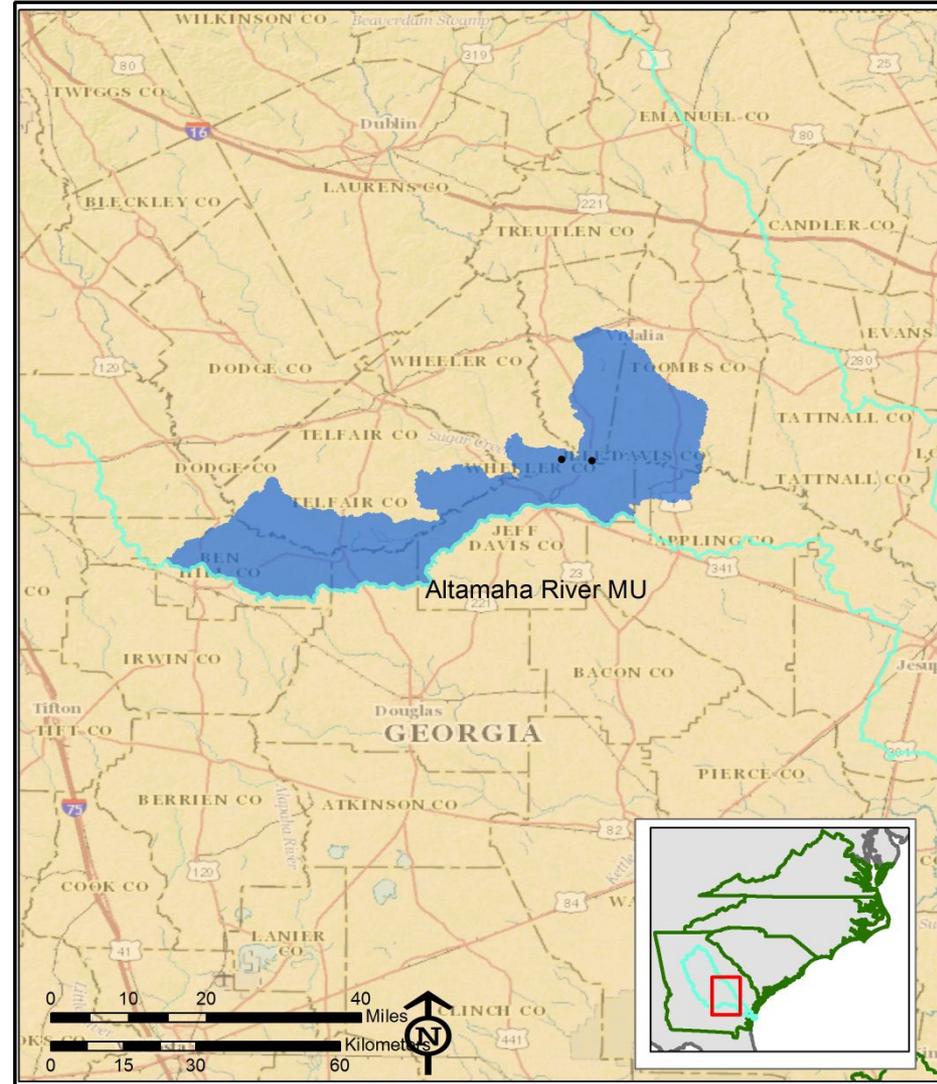


AP: Altamaha population

- Two shells from 1800s
- Presumed extirpated
- Numerous threats, including coal/nuclear power, municipal/industrial effluent, agricultural use

Figure 3-14

Atlantic Pigtoe Altamaha Population





Atlantic Pigtoe Current Condition



Abundance

The analysis of species' current condition revealed that Atlantic Pigtoe abundance and distribution has declined, with the species currently occupying approximately 40% of its historical range. Most of the remaining populations are small and fragmented, only occupying a fraction of reaches that were historically occupied. This decrease in abundance and distribution has resulted in largely isolated contemporary populations.



Population resiliency

- 7 (of 12) populations known to be extant
- Currently extirpated from 14 of the 28 Management Units
- Population status:
 - 1 high resiliency (Tar population)
 - 1 moderate resiliency (Neuse population)
 - 5 low resiliency (James, Chowan, Roanoke, Cape Fear, Pee Dee populations)

42% of the species' range eliminated.

Resiliency: The ability to withstand stochastic events such as:

- High flow events
- Droughts
- Pollution discharge failures
- Sediment pulses



Atlantic pigtoe redundancy

- Five of the 12 populations are presumed extirpated
- Two of the seven extant populations have only one MU currently occupied
- 50% of MUs are presumed extirpated
- Overall 60% reduction in redundancy across range (32 out of 81 HUCs currently occupied)

Redundancy describes the ability of the species to withstand catastrophic disturbance events.

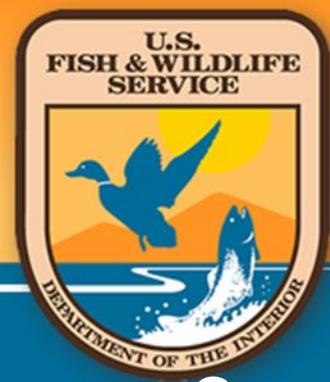


Atlantic pigtoe adaptability

Compared to historical distribution:

- 42% of river basin variability lost; most remaining populations are in low condition
- Low genetic representation (due to very low abundances) in remaining populations

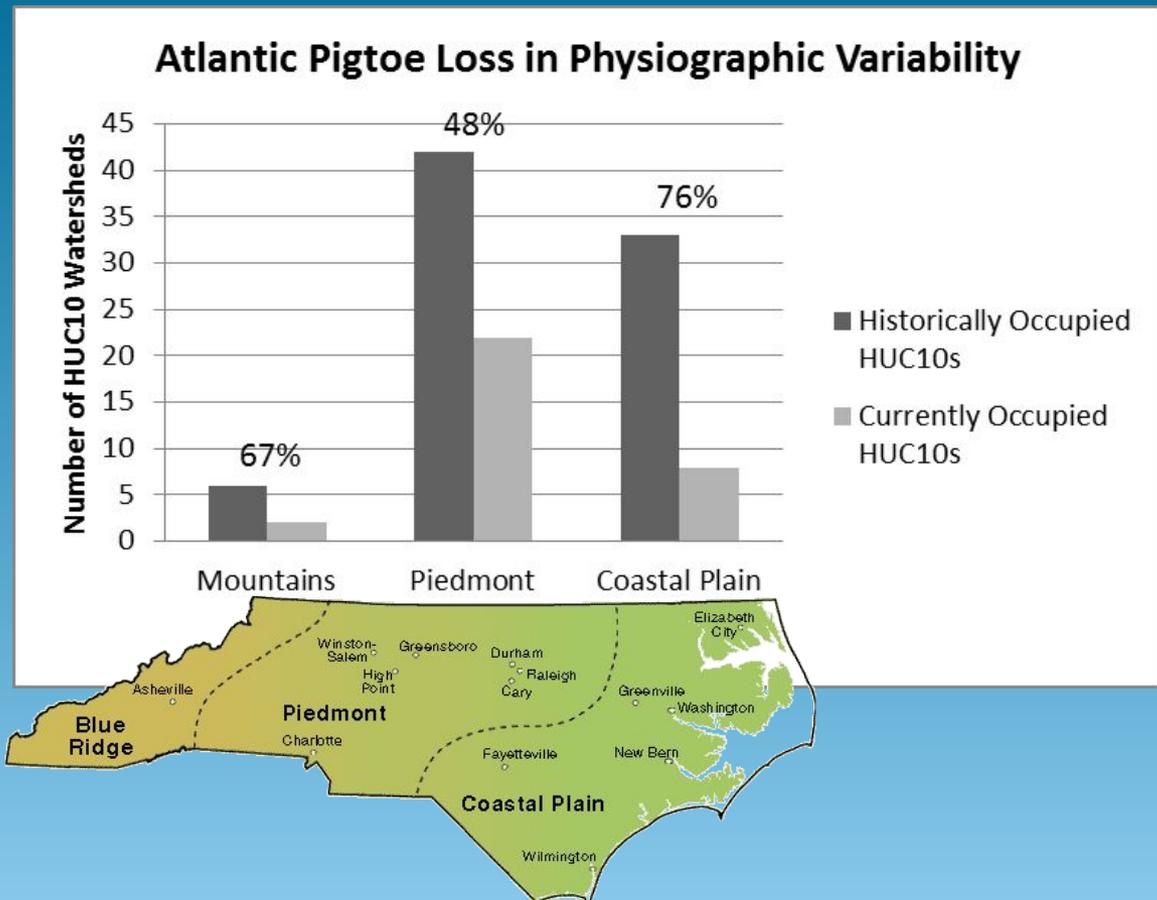
Representation characterizes a species' adaptive potential by assessing geographic, genetic, ecological, and niche variability.



Decreased representation throughout NC regions

Compared to historical distribution:

- Limited variability in Mountains, Piedmont, and Coastal Plain





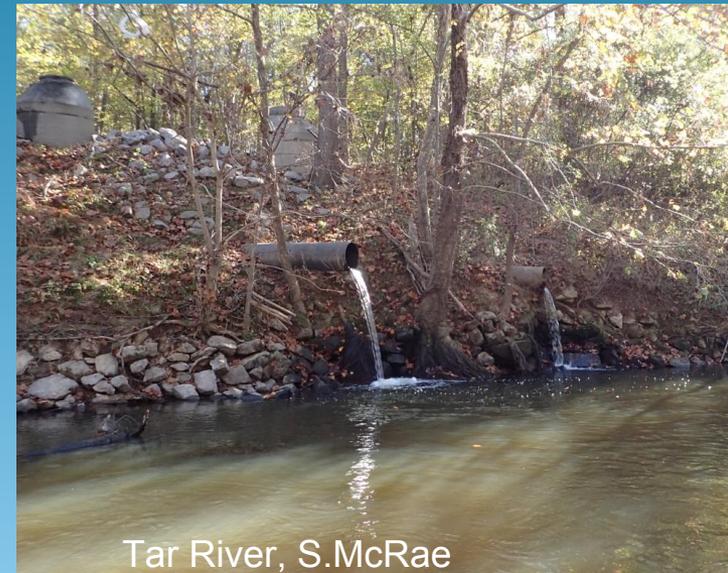
Stressors/ Threats



Basin-Wide Issues for Aquatic species

The present or threatened destruction, modification, or curtailment of its habitat or range

- Dams/impoundments
- Industrial and municipal pollution events
- Non-point source pollution :
 - sediments
 - fertilizers
 - herbicides
 - pesticides
 - animal wastes
 - septic tank and gray water leakage
- construction,
- silviculture,
- contaminated runoff from urban areas





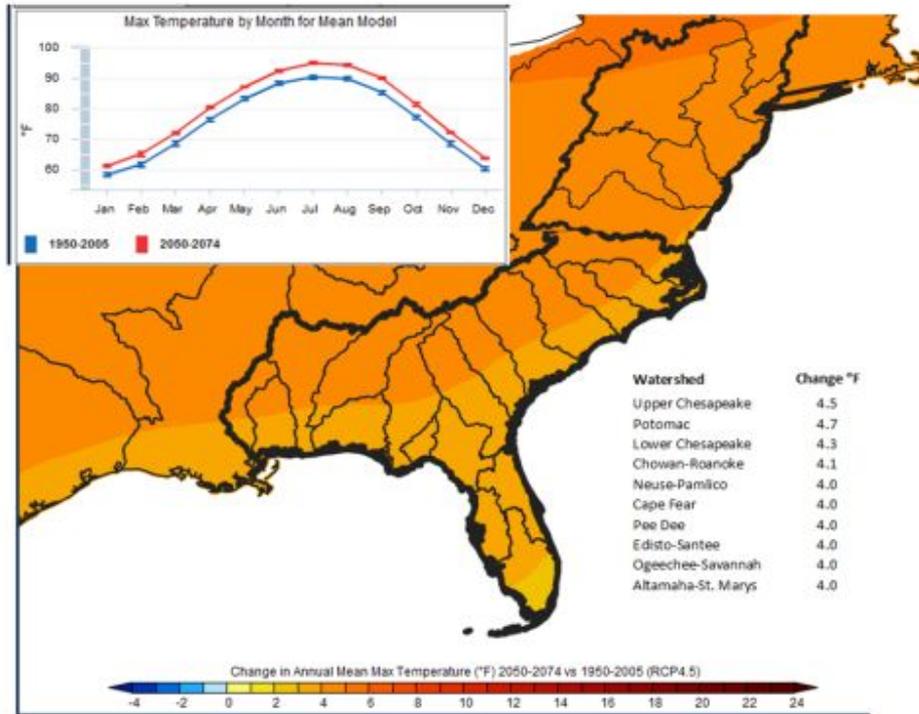
Development

- Impervious surface runoff
 - pulses of lots of water, causes erosion
 - pollutants washed into streams
 - elevated temperatures
- Clearing of riparian areas
- Road development
- Utility corridors
- Discharges
- Impacts affect species' needs





Climate Change



- More frequent drought
- More extreme heat (resulting in increases in air and water temperatures)
- Increased heavy precipitation events (e.g., flooding)
- More intense storms (e.g., frequency of major hurricanes increases)
- NC SWAP has Climate Change as a LOW threat





Agricultural Practices

- Non-point Discharge
- Nutrient Pollution
 - CAFOs
- Pumping for Irrigation
- Agriculture Exemptions from Permit Requirements





Forest Conversion & Management Practices

- Most states have FPGs or BMP Guidelines in place, often with high compliance rates (85%+)
- Despite Industry advances in Management, forest conversion and small-scale silvicultural practices are an impact on the landscape
- SMZs/Buffers are often too narrow (200+ ft guidance in NC)
- Clear-cuts near streams do occur, resulting in sedimentation, temperature changes
- Monoculture plantings – reduced food variety; changes in hydrology dynamics (hardwoods vs pine)
- Most forestry activities are exempt from permitting requirements; consultation rarely occurs
- Probability-Impact considerations





Dams & Barriers

- Instream habitat change: upstream inundation; downstream flow fluctuation
- Habitat fragmentation
- Genetic isolation
- Some benefits to dams:
 - Retention of fine sediments & toxicants
 - Impediments to spread of invasive species
 - Attenuation of floods
 - Leaky dams provide flow during low-flow times



Invasive Species



- *Hydrilla verticillata*
- Asian clam (*Corbicula fluminea*)
- Beavers



Regulatory Mechanisms

- State Endangered Species Laws
 - Protect species from take, transport, export, sale
 - no mechanisms for recovery, consultation, or critical habitat designation
 - NC requires conservation plans to be developed
 - In NC, protection of a listed species cannot “limit the rights of a landholder in the management of his lands for agriculture, forestry, development, or any other lawful purpose.”



Regulatory Mechanisms

- State and Federal Stream Protections
 - Buffers: Most states require them, but most are less than 50 feet and allow variances; NC has guidance for 200+ feet, but not implemented
 - CWA 401/404 permits – intended to prevent degradation of water quality; many exemptions and very little deference to listed species





Regulatory Mechanisms

- State and Federal Water Quality Programs
 - Freshwater mussels are more susceptible to many pollutants than organisms used to derive existing protections
 - Water Quality criteria development usually does not incorporate data for freshwater mussels
 - Freshwater mussels are sensitive to many pollutants for which water quality criteria do not exist



Conservation Management

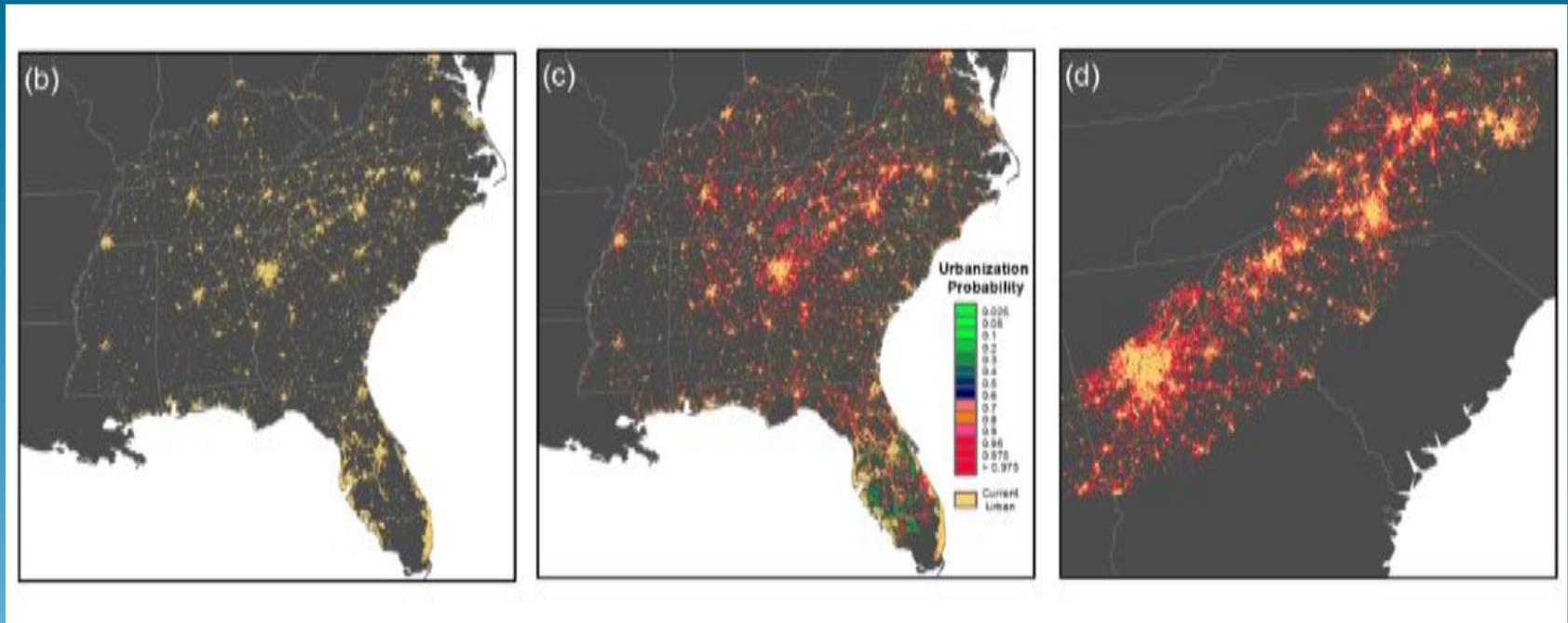
- Habitat Management
 - NRCS buffers
 - Land Trust priority acquisitions in NC
- Captive Propagation & Augmentation/
Reintroduction Programs
- Habitat/Species Restoration
opportunities:
 - Rappahannock, Nottoway,
Rocky/Deep, Uwharrie/Little





Urbanization into the Future

SLEUTH (Slope, Land use, Excluded area, Urban area, Transportation, Hillside area) model



Terando, A.J., J. Costanza, C. Belyea, R.R. Dunn, A. McKerrow, and J.A. Collazo. 2014. The Southern Megalopolis: Using the Past to Predict the Future of Urban Sprawl in the Southeast U.S. PLoS ONE 9(7): e102261. doi:10.1371/journal.pone.0102261



Conservation partnerships

**NC STATE
UNIVERSITY**



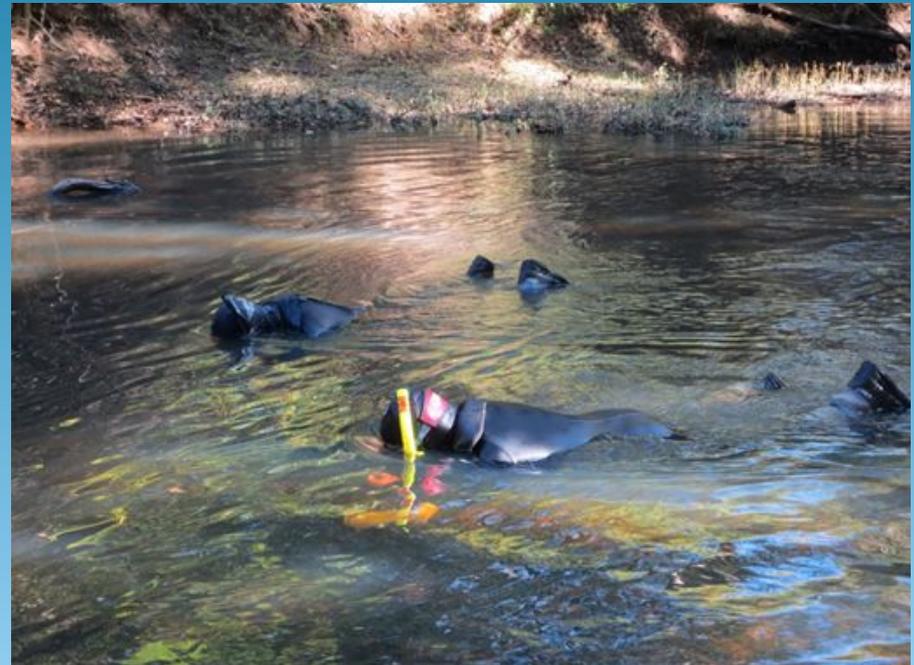


Conservation partnerships

Collaborate with state agencies to augment, monitoring, and enforce legal protections



State	Atlantic pigtoe status
VA	Threatened/Imperilled
NC	Endangered/Critically Imperilled
SC	Historical Habitat
GA	Endangered/Critically Imperilled





Conservation partnerships



Tar River Land Conservancy



Habitat Management

- Buffers
- Land Trust priority acquisitions in NC

– Restoration opportunities:

- Rappahannock
- Rocky/Deep
- Uwharrie/Little



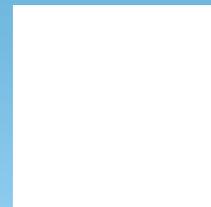
Conservation partnerships

Expanding Captive Propagation & Augmentation.

We are working with Wake County, NC Wildlife Resources Commission, and NC State University to establish an Eastern NC Freshwater Mussel Propagation Facility at the Historic Yates Mill County Park. The facility will be the second in the state, to complement the work done in western NC at the Marion Fish Hatchery, in McDowell County.

The Yates Mill Pond will be a reliable source of untreated, free-flowing water with the necessary algae and nutrients for the yellow lance and other mussels to thrive.

The Mill and the property surrounding it were purchased in 1963 by NC State University. An existing building on the property will be retrofitted to host the tanks and equipment upon availability of funds.



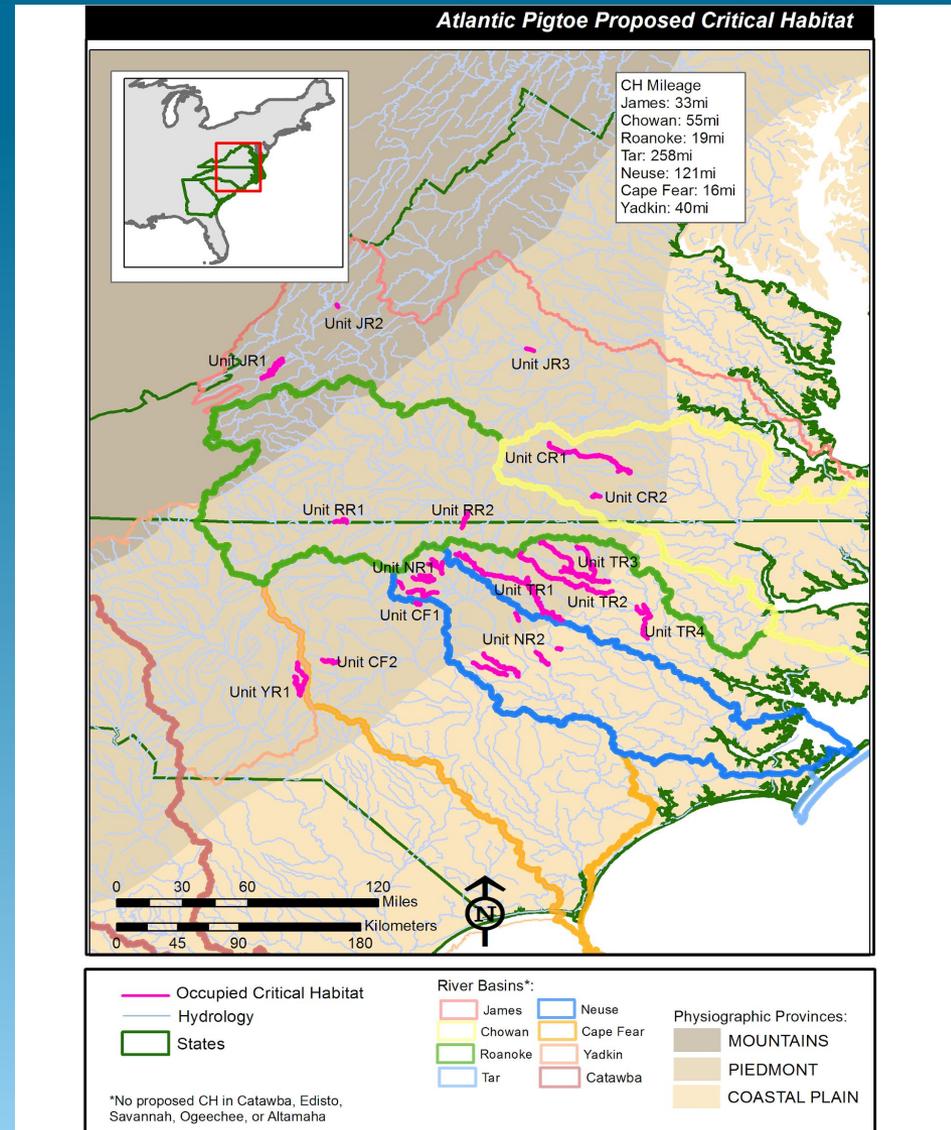


Critical Habitat



Proposed critical habitat map

- 542 river miles
- 16 Occupied units proposed within 7 river systems in NC and Virginia.
- Did not include historically occupied habitat in Georgia and SC.





What is Critical Habitat?

- When the Service proposes an animal or plant for listing as endangered or threatened under the ESA, we identify specific geographic areas called critical habitat that are essential to conserving those species.
- The Service determines critical habitat based on what an animal or plant needs to survive and reproduce by reviewing the best scientific information available
- Designating critical habitat informs landowners and the public which specific areas are important to a species' conservation and recovery.
- Identifying critical habitat raises awareness of the habitat needs of imperiled species and focuses efforts of our conservation partners.



Critical Habitat does not:

- Create a wildlife refuge, reserve, or park
- Affect private landowners that are not using federal money or do not require federal permits
- Create a new, independent review process
(potential impacts to critical habitat are reviewed at the same time as potential impacts to listed species)



Regulatory impact of a Critical Habitat designation

- Federal agencies are required to consult with the Service to ensure that their actions will not destroy or adversely modify critical habitat. Federal actions include activities that are funded or permitted by Federal agencies
- Federally listed species are protected by the Endangered Species Act regardless of whether or not they have designated critical habitat



Economic Analysis

Identifies and analyze the potential economic impacts (only incremental costs) associated with the designation of critical habitat for the yellow lance.

The incremental costs associated with critical habitat designation for the Atlantic pigtoe are estimated to be less than \$230,000 per year. These costs would be incurred only if projects or activities are proposed that have some **federal connection**, such as federal funding or federal permits.



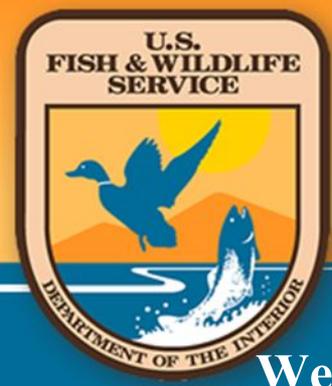
Example of actions with federal connection

- Federally funded roadway projects (FHWA)
- Wastewater permit application or renewal (EPA)
- CWA Water Quality Standards Review of new or revised standards (EPA)
- Projects impacting wetlands including dam maintenance (USACE)
- FEMA funded actions
- Incidental Take Permits under the ESA (FWS)
- Federal grants
- NRCS programs (USDA)



What happens next?

- Proposed listing and critical habitat designation, are expected to publish in *Federal Register* on 10-11-2018.
- Public notice will be posted in USA Today within 20 days after the comment period start.
- 60-day comment period ends on 12-10-2018.
- Public hearing (if requested).
- Final rule expected to publish in *Federal Register* in 2019.
- Develop an Atlantic Pigtoe Recovery Plan



Public Input

We encourage the public to review and comment these documents:

- Atlantic Pigtoe Proposed Listing Rule
- Proposed Critical Habitat Designation for the Atlantic Pigtoe
- Draft Economic Analysis for the Proposed Designation of Critical Habitat

Information needed for sound decisions:

- Basic biology (current vs. historical range, life cycle, genetic data, etc.).
- Habitat (areas used for breeding, food and shelter).
- Threats (related to the five factors)
- Conservation efforts
- Information on species viability
- Incremental costs associated with critical habitat designation