Invasion of Non-native Flathead Catfish and Decline of the Carolina Madtom

Pylodictis olivaris and Notorus furiosus

Tom Fox and Tyler Black

Background: Carolina Madtom (*Noturus furiosus*)

- Southeastern United States harbors one of the most diverse temperate fish assemblages in the world
- State Threatened; Federal Species of Concern
- Currently under 12-month review by USFWS
- Endemic to Tar and Neuse River basins
- Historic range included all major and many minor tributaries to the Tar and Neuse River basins

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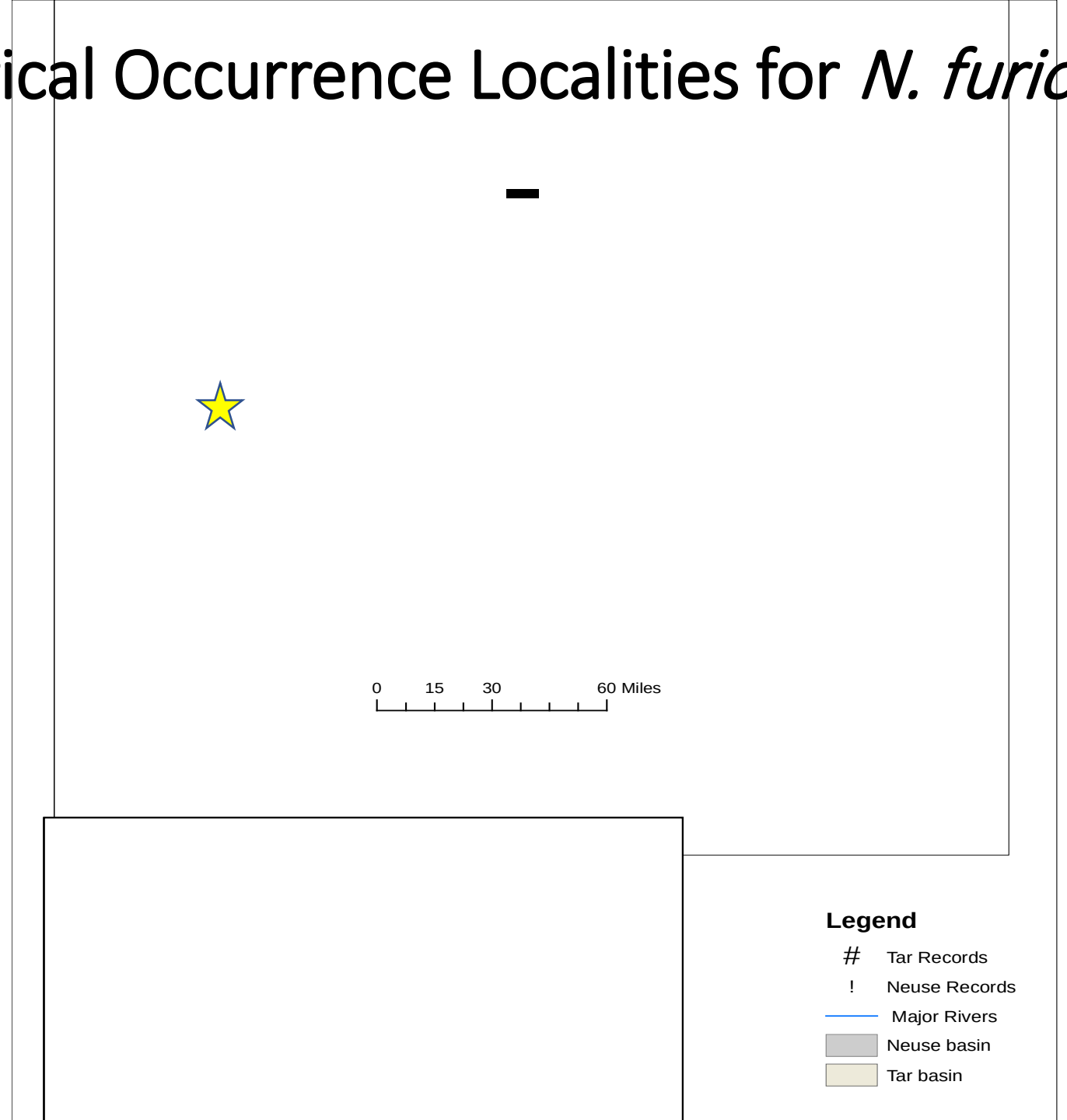
Historical Occurrence Localities for *N. furiosus*



Background: Carolina Madtom (*Noturus furiosus*)

- Adults 36-84 mm, up to 130 mm
- Medium to large streams with moderate flow
- Nocturnal benthic foragers
- Diets: primarily immature aquatic insects (elmid larvae, simullid larvae, ephemeropteran nymphs, trichopteral larvae, chironomid larvae, odonate nymphs)
- Spawn in cavities, males guard nest (May-July)
- Seek cover under cobble, boulder, woody debris, leaf packs, mussel shells, and cans/bottles

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2015/09/16





NEW & IMPROVED

Background: Carolina Madtom (*Noturus furiosus*)

- Jordon (1889): "numerous specimens taken" from Neuse River below Raleigh (type locality)
- NCWRC (1962,1964): " common in two drainages"
- Cooper and Braswell (1982): "….serious decline"
- Burr et al. (1989): "….decline and loss of habitat"
- Wood and Nichols (2011): "….declined and the remaining populations are in jeopardy"

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Wood and Nichols (2011): Methods

- Subset of 30 sites chosen from historical locations
- 60 total surveys
- Times snorkel searches
- All CMTs captured with aquarium net, weighed and measured
- Anal fin clips taken for inter/intra basin population genetics

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Wood and Nichols (2011): Results

<u>2007 Surveys</u>

CMT detected at **37%** of sites:

- **60%** of Tar basin sites (9/15):
  - -208 individuals
- **13%** of Neuse basin sites (2/15):
  - -35 individuals
- Detection probabilities = 1

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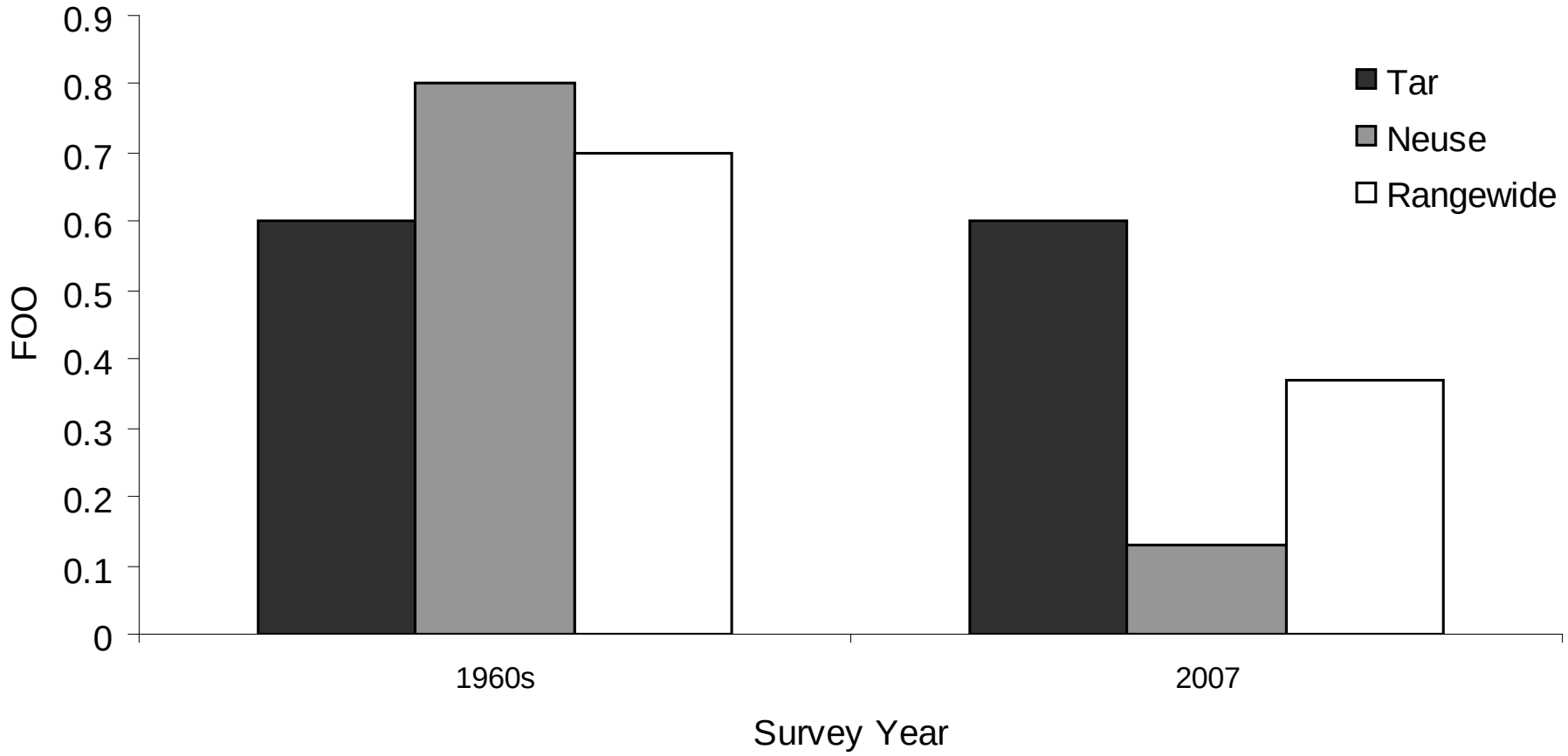
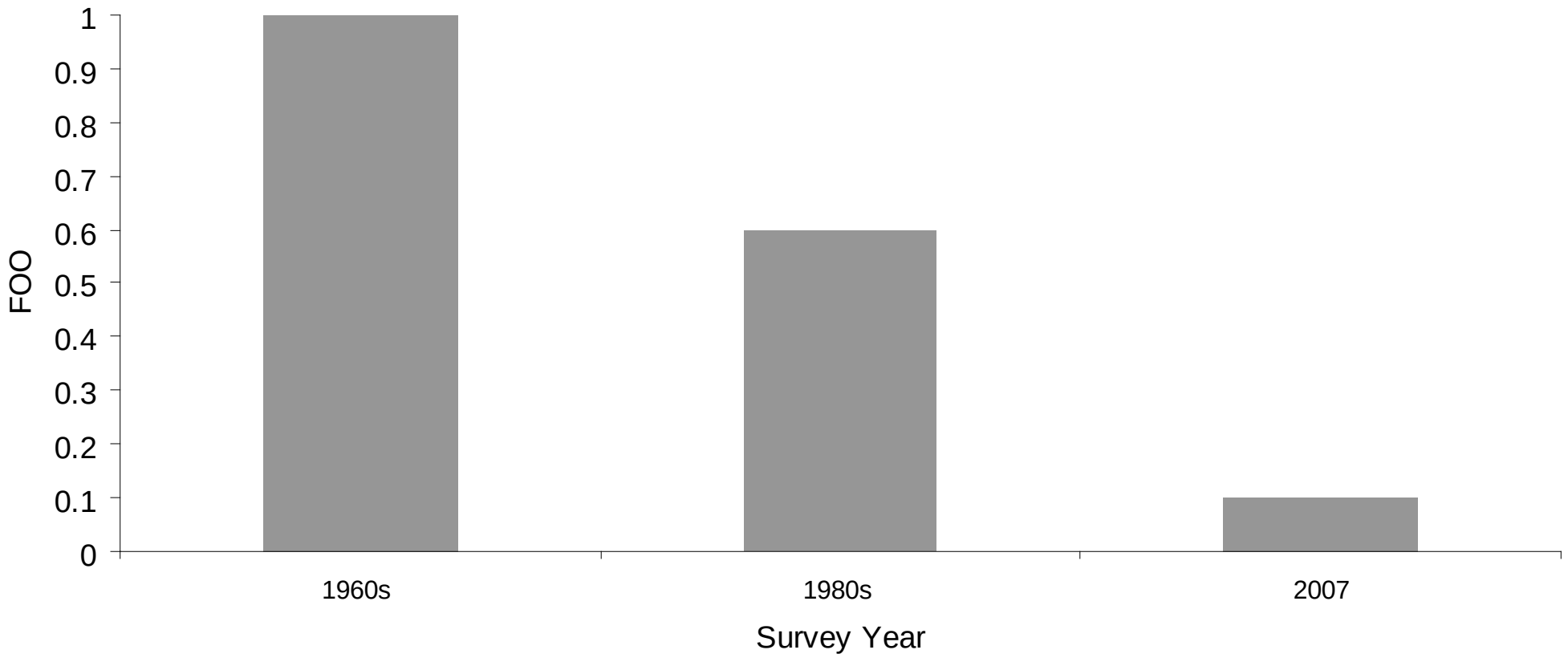
CMT Frequency of Occurrence (FOO)



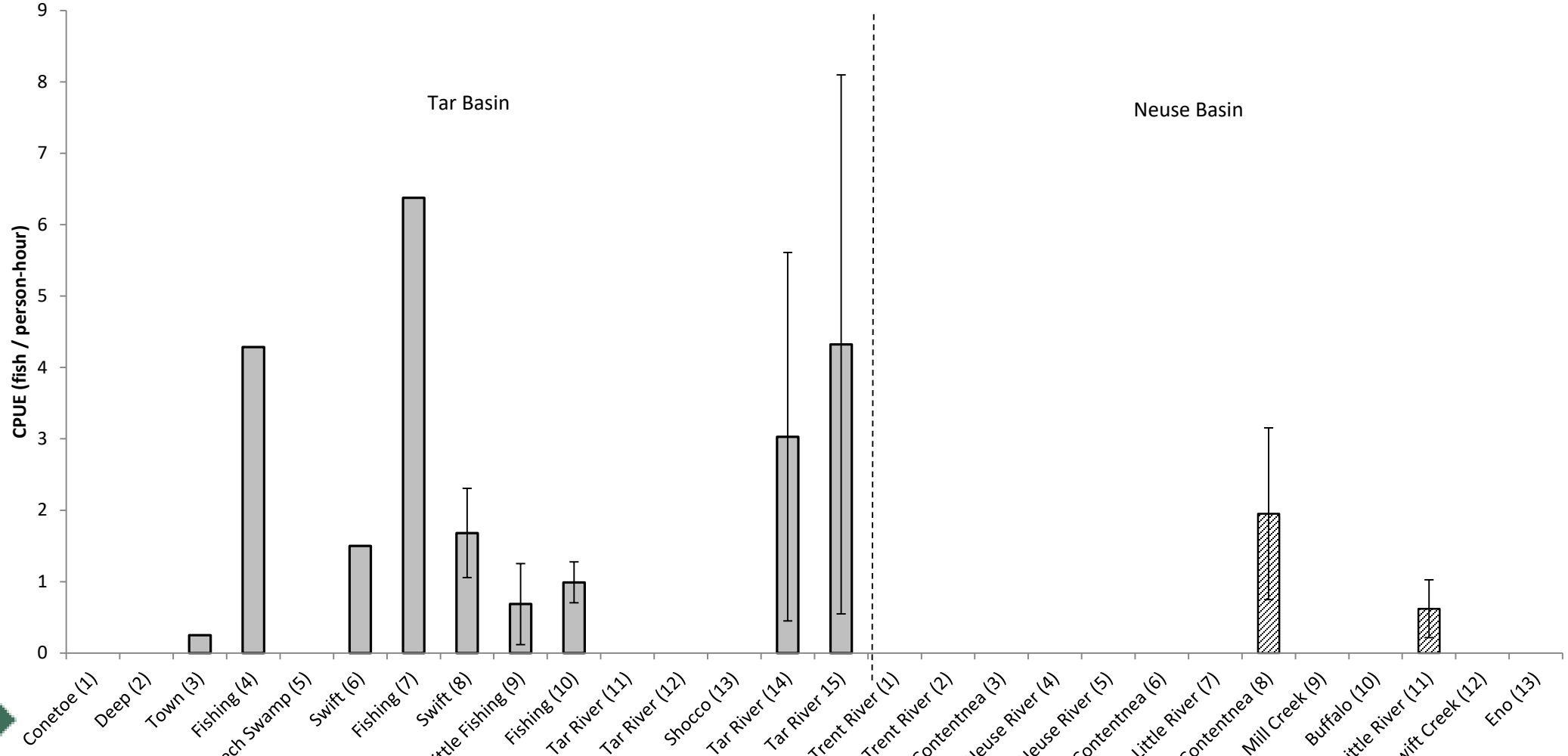
Wood and Nichols (2011)

CMT FOO at Occurrence Sites from 1960's



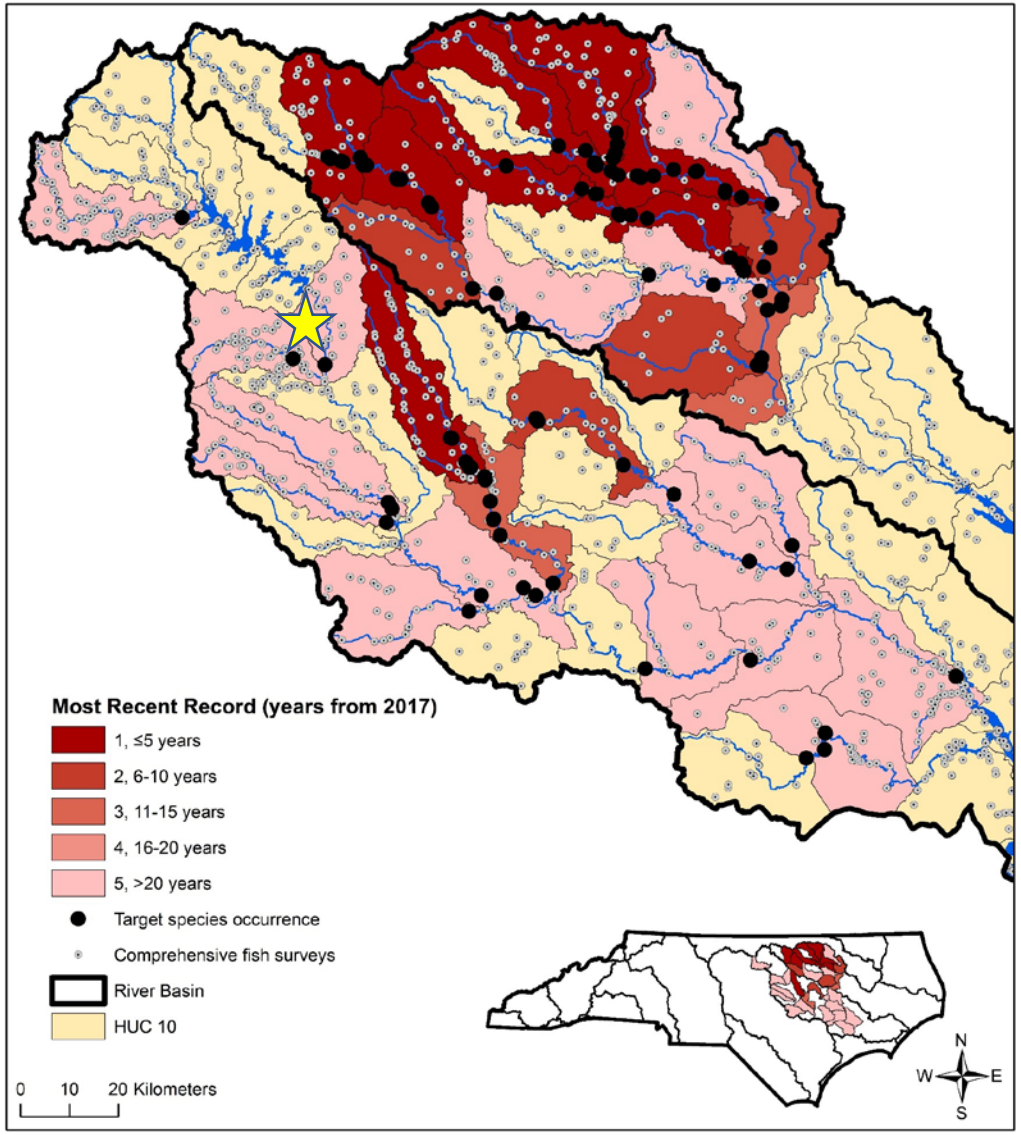
Wood and Nichols (2011)

CMT Catch Per Unit Effort



Wood and Nichols (2011)

Occurrences by HUC 10 Watershed of the Carolina Madtom (*Noturus furiosus*) and Survey Locations



Map created by: Tyler Black, Ph.D., 9/5/2017
Data sources: NC Wildlife Resources Commission and NC Museum of Natural Sciences

Wood and Nichols (2011):

"The population in Contentnea Creek may be the last viable population in the Neuse River basin….The Carolina madtom was not discovered in the lower stretches of Contentnea Creek below Wiggins Mill Pond, suggesting that this population is very localized and at a high risk of extirpation"

Causes for CMT Declines:

- A plethora of anthropogenic impacts due to human population growth in the Neuse River Basin.
- Habitat degradation, municipal and industrial pollution, turbidity, habitat fragmentation, sedimentation, development
- Range expansion of the invasive Flathead Catfish (*Pylodictis olivaris*)

Background: Flathead Catfish (*Pylodictis olivaris*)

- Second largest ictalurid in North America
- Length: regularly >1 m
- Weight: regularly >50 kg
- Age: can be over 28 years
- Native to the Southern Great Lakes and the Mississippi, Mobile, and Rio Grande River drainages
- Documented in NC from Tar, Neuse, Cape Fear, Yadkin-Pee Dee, White Oak, Catawba, Roanoke, and Lumber River basins

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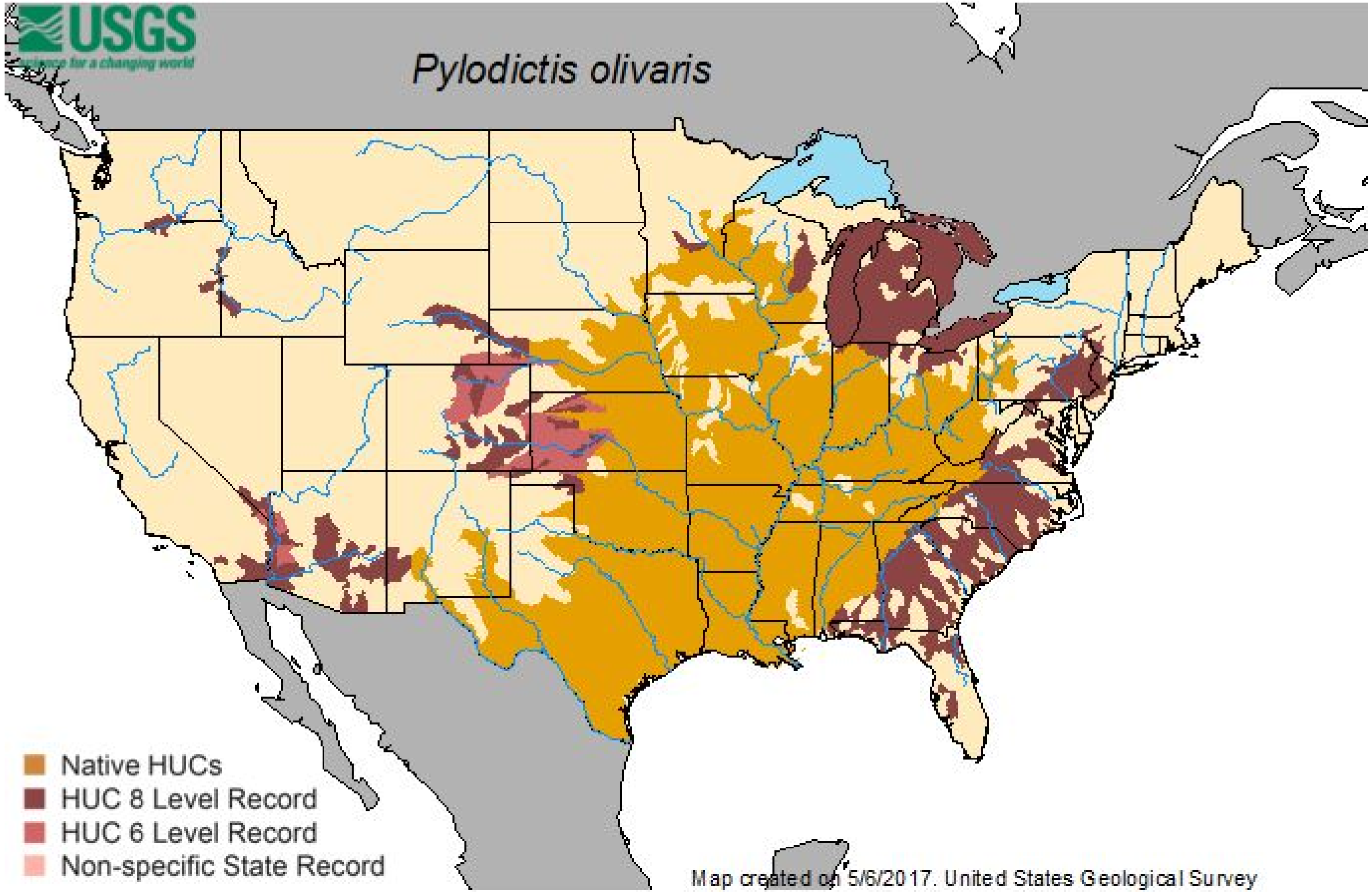

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Background: Flathead Catfish (*Pylodictis olivaris*)

- Primarily nocturnal
- Opportunistic feeders
- Prefer large woody debris, coarse substrate and riprap habitats

Diet: (Baumann and Kwak 2011, Pine et al. 2005)

<300 mm = invertivores: **aquatic insects** (Anisoptera, Baetidae, Trichoptera) and **crayfish**

>300 mm = obligate carnivores: **live fish** (Catostomidae, Centrarchidae, Clupeidae, Cyprinidae, Ictaluridae, Percidae, Soleidae)

- Display a positive selectivity for benthic fish in piedmont and coastal regions (Pine et al. 2005)

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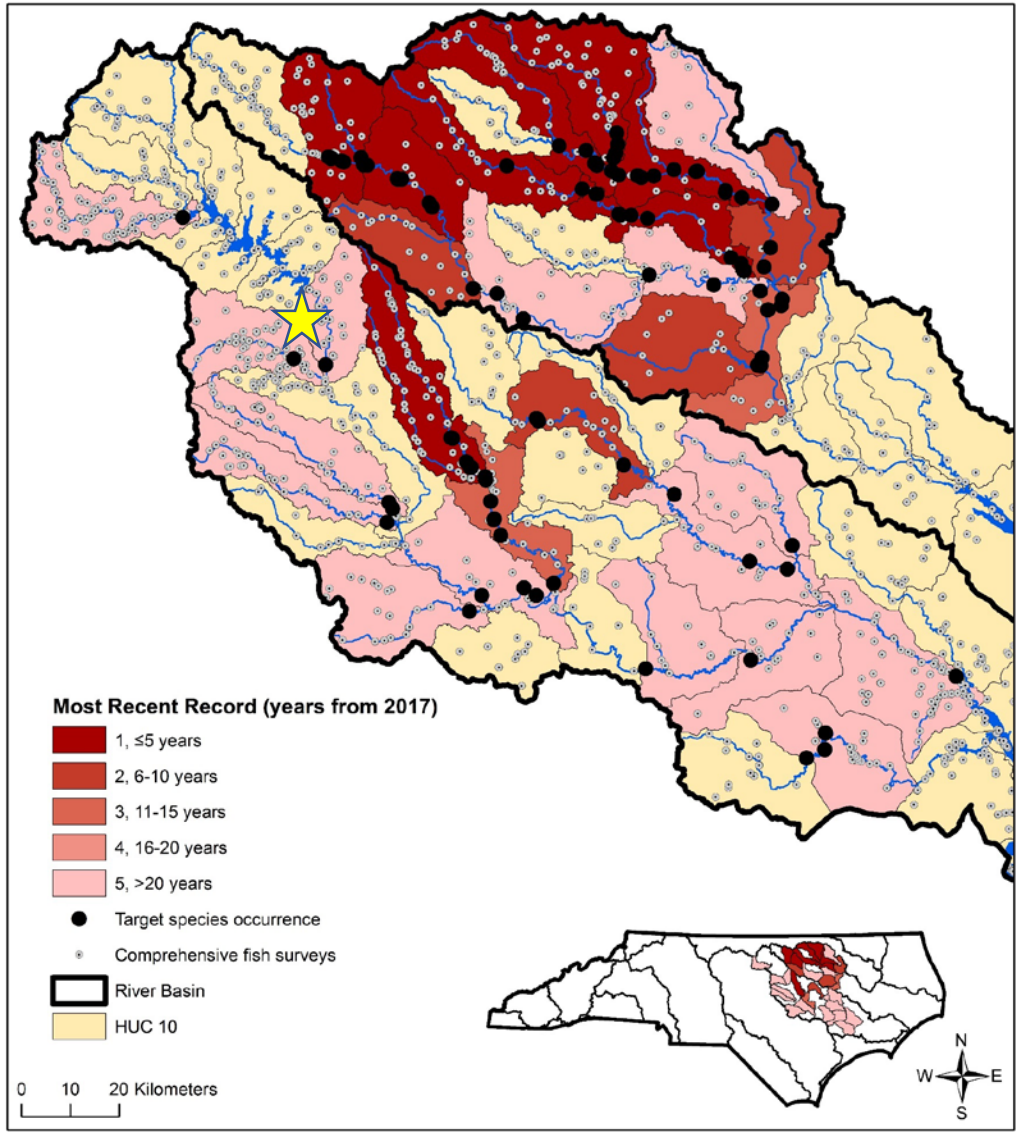

Map created by: Tyler Black, Ph.D., 9/5/2017
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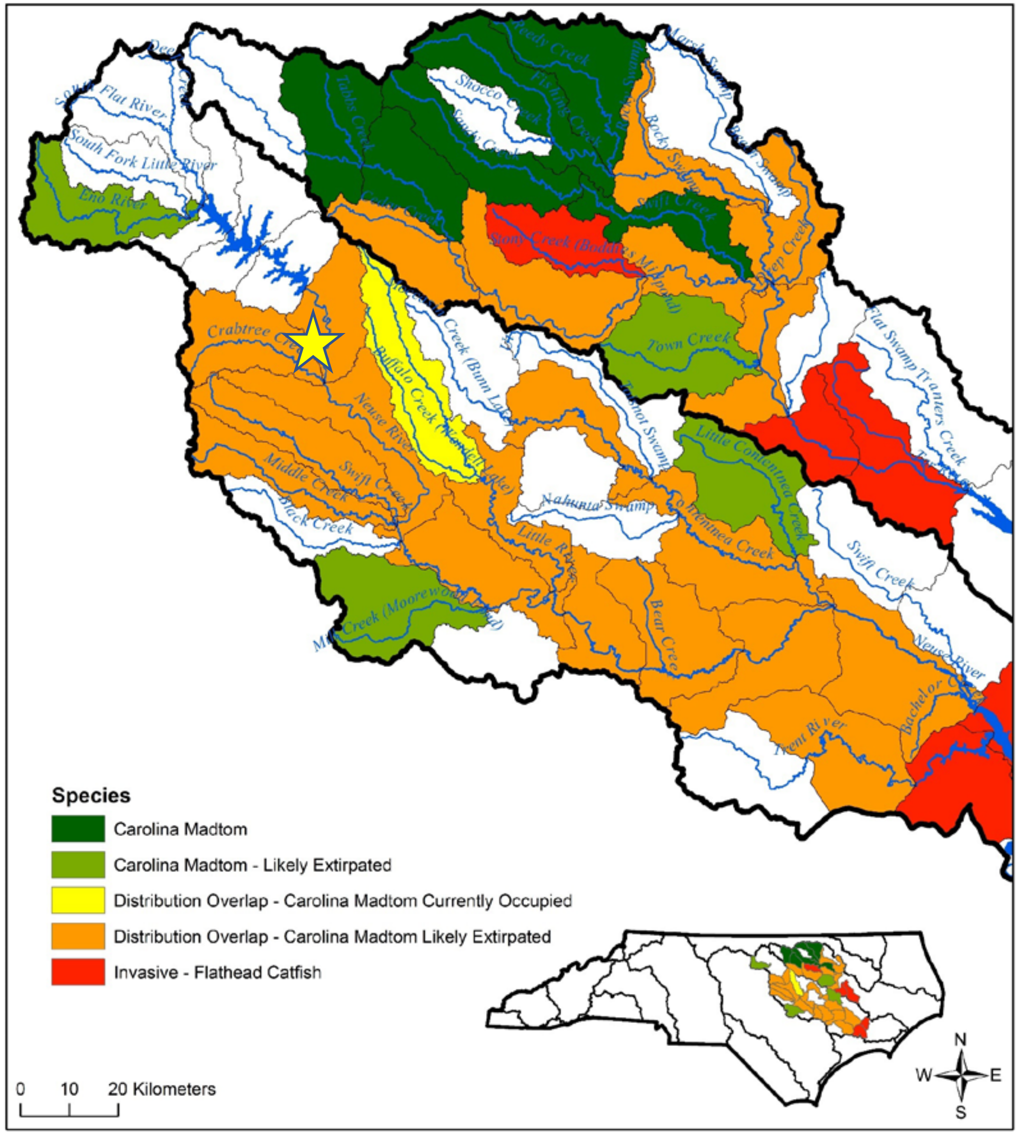
Carolina Madtom (*Noturus furiosus*) and Invasive Flathead Catfish (*Pylodictis olivaris*) Distribution Overlap



Map created by: Tyler Black, Ph.D., 10/2/2017
Data sources: NC Wildlife Resources Commission

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Interactions:

- Competition for food sources

  -aquatic insects= ephemeroptera, odonata, trichoptera

- Direct predation

  -madtoms, bullheads, channel catfish, other flatheads, darters

- Habitat competition

  -daytime cover, spawning cavities

Solutions?

- Removal

  -GA Satilla River – shifted size structure and younger reproduction

- Sterilization

  -triploid flatheads in lab setting at Auburn

- Genetic modification

  -CRISPR-Cas 9

- Regulations

  -manage for trophy catfish, no catch and release, prohibited fish list, commercial fishery

- **Monitoring**

  -establish a monitoring program to identify and track flathead distribution and population status

- **Education**

  -make information more accessible, consistent, and clearer to anglers and general public

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Research Needs:

- Monitor CMT populations every 2-5 years
- Determine the genetic diversity and number of genetically distinct populations throughout its range
- Develop captive propagation techniques to maximize yield and genetic diversity
- Develop microsatellite markers or similar genetic tagging techniques to determine hatchery contribution to wild stock
- Delineate the distribution of *P. olivaris* and monitor the invasion rate
- Develop techniques to reduce the rate of *P. olivaris* invasion and population size

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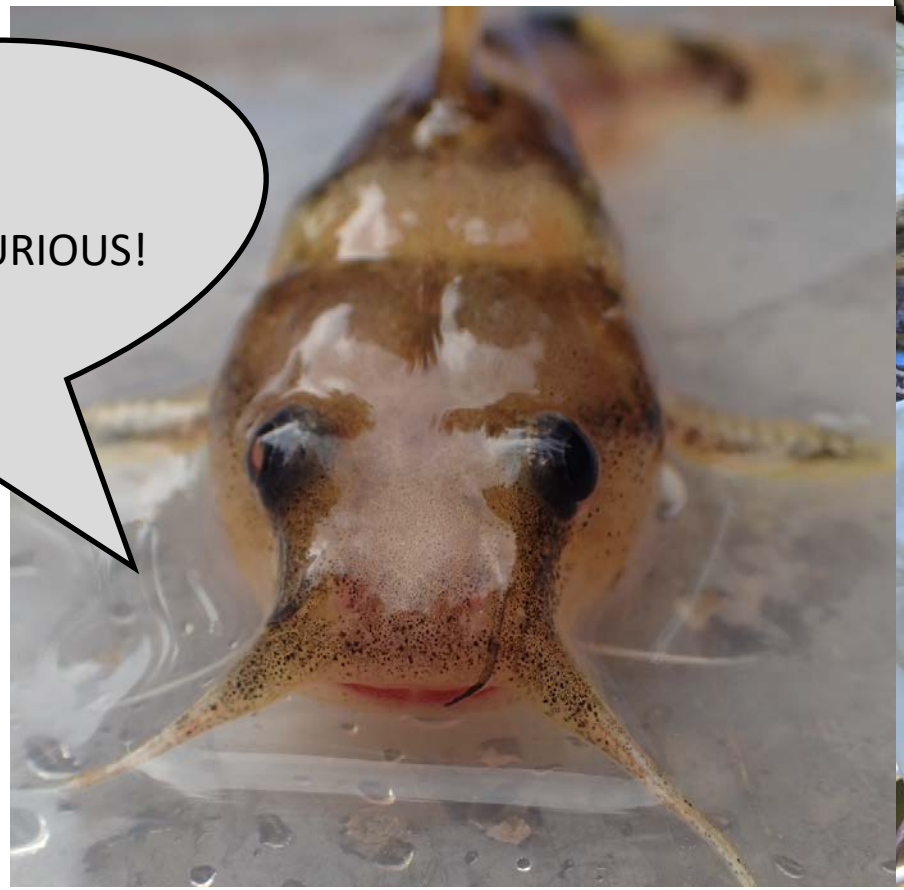
Questions?



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