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An Annotated Atlas of the Freshwater Fishes of North Carolina

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Abstract

North Carolina's first state-specific checklist of freshwater fish species was published in 1709 by John Lawson. Subsequent species lists with descriptions included: Brickell (1737), Cope (1870a), Jordan (1889a), Jordan and Evermann (1896-1900), Smith (1907), Jordan et al. (1930), Fowler (1945), Louder (1962), Ratledge et al. (1966), Menhinick et al. (1974). In 1991, Menhinick published "*The Freshwater Fishes of North Carolina*", which is still widely in use because a comprehensive update has not been produced since its publication. The increase in the availability of historical records in globally accessible databases and the surge of collections post-1991 made by federal and state resource agencies, and academic and museum researchers, allowed for the creation of an update of North Carolina's freshwater fish species in an annotated atlas. Herein we discuss the distribution of the 257 currently described and undescribed freshwater fish species within North Carolina. Annotations for each species include a distributional map with type locality noted where appropriate, remarks concerning questionable records and misidentifications, extirpations, introductions and interbasin transfers, and imperilment status.

Keywords

North Carolina, Freshwater Fishes, Atlas, Distribution, Indigenous, Nonindigenous

Cover Page Footnote

The authors are greatly indebted to all of the fish enthusiasts around the globe, including state and federal agency personnel, museum curators, collection managers, technicians, interns, and volunteers, that have collected, databased, geo-referenced, curated, and photographed North Carolina freshwater fishes and kindly shared their data. Without this tremendous amount of data, we would not have been able to put this publication together. The authors are also greatly indebted to Zion Creech (formally NCSM) and Scott A. Smith (NCDMF) for guidance and assistance with ArcGIS. Lastly, we would like to thank Dr. Steven Powers (Roanoke College), Editor, and two anonymous reviewers for their constructive criticisms, comments, and suggestions that greatly improved our manuscript.

Introduction

The rich history of the study of fishes in North Carolina dates all the way back to 1682 when Thomas Ash wrote a general description of the fish fauna of "Carolina", which referred to all of the coastal lands between Florida and Virginia. The first state-specific checklist was provided by Lawson in 1709 (pages 152-160), and it was received in such high regard that it was later plagiarized extensively by Brickell (1737). Since 1870, checklists and publications detailing the fishes of the region have appeared regularly beginning with Cope (1870a) and continuing with Jordan (1889a), Jordan and Evermann (1896-1900), Smith (1907), Jordan et al. (1930), Fowler (1945), Louder (1962), and Ratledge et al. (1966). In 1974, Menhinick, Burton, and Bailey published an annotated checklist, which relied heavily upon Randall (1957), the North Carolina Wildlife Resources Commission's (NCWRC) 1960s stream survey data (Starnes and Hogue 2011), and Joseph R. Bailey's (Duke University) unpublished survey data from 1947 and 1949 of the Savannah, Hiwassee, Little Tennessee, Pigeon, French Broad, Nolichucky, Watauga, New, and Yadkin river basins. In 1991, Edward F. Menhinick published "*The Freshwater Fishes of North Carolina"* using datasets from NCWRC and Bailey, distributional maps from Lee et al. (1980), his 1974 checklist, unpublished manuscripts archived at North Carolina Museum of Natural Sciences (NCSM), and his and other researchers' personal collections. Although the distributional maps and some of the taxonomic nomenclature are now out-of-date, the book is still widely in use. More recent field guides, including identifying characteristics, illustrations, photographs, and distributional maps, include Page and Burr (1991, 2011) and Rohde et al. (1994).

Since the publication of Menhinick (1991), the availability of new collections and historical data in readily available electronic databases has greatly increased. Therefore, the timing seemed right to produce an updated annotated atlas of the state's indigenous and nonindigenous freshwater fish fauna.

Methods

Following Lee et al. (1980) and Rohde et al. (1994) species that are included in this Atlas are: a) species that spend all their life in fresh water; b) those that move into salt water after beginning life in fresh water (anadromous fishes); c) those that move into fresh water after beginning life in salt water (catadromous fishes); and d) those that are primarily found in salt or brackish waters but are frequently found in fresh water, typically to find food. Species that were excluded were: a) estuarine and marine waifs and migrants; and b) nonindigenous species that have not been documented to have established and reproducing populations in the state. This includes species such as Bighead Carp, *Hypophthalmichthys nobilis***,** Tench, *Tinca tinca*, Pacu (Characidae), Snakehead, *Channa* spp., Florida Gar, *Lepisosteus platyrhincus*, Oscar, *Astronotus ocellatus*, and Clown Knifefish, *Chitala ornata*, etc. (U.S. Geological Survey Nonindigenous Aquatic Species database, nas.er.usgs.gov; USGS. 2019).

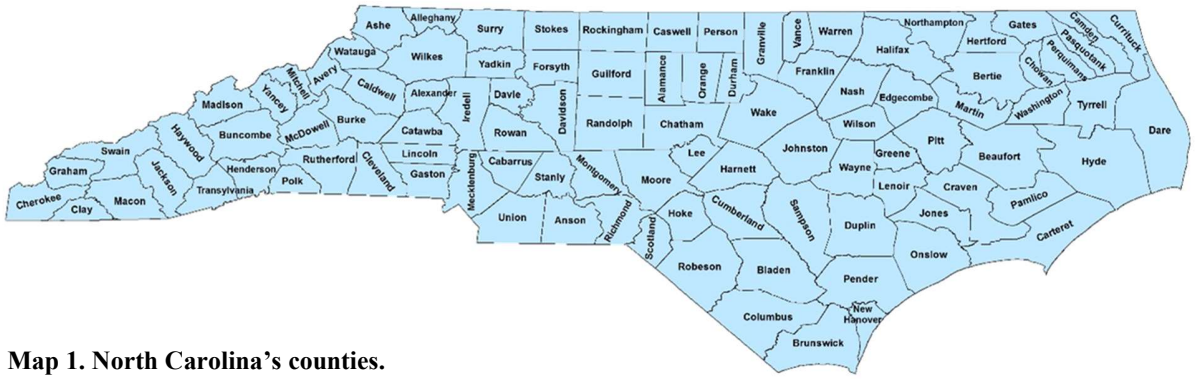
The species annotations contain scientific name, author(s), year of description, common name, river basin(s) in which species is found, indigenous determination, and State/Federal listing status. Throughout the text, excluding tables, map captions, and annotations headings, the common name is followed by the scientific name. Thereafter, only the common name is written, provided that the scientific name has been used previously in the text. The level of imperilment applies only

to indigenous species. For the 34 species scientifically described from North Carolina, the type locality, collector, author(s), and location of type material are also given. Phylogenetic order and family, scientific names, and common names follow the California Academy of Sciences' Catalog of Fishes Online Database (www.calacademy.org/scientists/projects/catalog-of-fishes; Fricke et al. 2020) and Page et al. (2013). Nomenclatural differences between these references and Menhinick (1991) are provided at the end of each annotation where applicable. All native minnows, shiners, and chubs, formerly classified in the family Cyprinidae, are now classified in the family Leuciscidae, a former subfamily of cyprinid fishes (Tan and Armbruster 2018). In addition, the nonindigenous Grass Carp, *Ctenopharyngodon idella,* is now classified in the family Xenocyprididae (Tan and Armbruster 2018). For undescribed species, vernacular names are used strictly for convenience and may or may not be the accepted common name once the species is scientifically described.

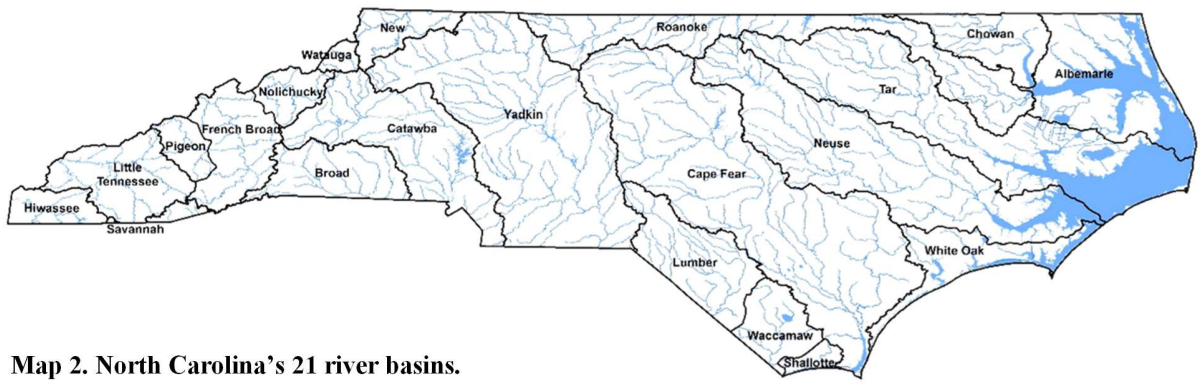
The designation of indigenous vs. nonindigenous is as follows. An indigenous (native) species, as defined by Fuller et al. (1999), occurs or is found naturally in a particular area or ecosystem and historically occurred in a geographic range previous to the arrival of the first European settlers. A nonindigenous species is an individual, group, or population of a species that is introduced into an area or ecosystem outside its historical or native geographic range. The term includes both foreign (i.e., exotic) and transplanted species and is used synonymously with alien, introduced, and nonnative (Fuller et al. 1999). Introductions may occur legally, i.e., sanctioned or conducted by federal or state resource agencies, or illegally by intentional or unintentional bait-bucket dumping by fishermen or by deliberately stocking fish without the necessary permit from resource agencies (Fuller et al. 1999; nas.er.usgs.gov; USGS 2019). Such illegal introductions are often referred to as cryptic introductions because they are apparently undocumented introductions of a species to a drainage in which it is not believed to be native (Jenkins 1987; Jenkins and Burkhead 1994; Tracy et al. 2011; Tracy et al. 2013). These types of introductions are often documented serendipitously through basinwide surveys or collections.

Nonindigenous species determinations followed historical literature (e.g., Cope 1870a, Jordan 1889a, Jordan 1889b, Smith 1907), more recent literature (e.g., Hocutt et al. (1986), Menhinick (1991), Jenkins and Burkhead (1994), Fuller et al. (1999), Rohde et al. (2009), USGS (2019)), and recent collection records. Using historical data, supplemented with recent records and literature, we were able to revise some of the prior held beliefs of the classification of species as indigenous vs. nonindigenous. For example, nonindigenous introductions in the Nolichucky, French Broad, and Pigeon basins were determined from historical and recent records for several species including Bluehead Chub, *Nocomis leptocephalus*, Flat Bullhead, *Ameiurus platycephalus*, and Chain Pickerel, *Esox niger* (Tracy 2008a). Similarly, Tracy et al. (2013) showed that Northern Hog Sucker, *Hypentelium nigricans*, and Striped Jumprock, *Moxostoma rupiscartes*, in the Yadkin basin were both nonindigenous species, which had been thought to be indigenous by many including Menhinick (1991), Jenkins and Burkhead (1994), and Fuller et al. (1999). In 2018, Tracy also used historical records detailing the absence of species to demonstrate that the following additional seven species in the Yadkin basin were the result of nonindigenous introductions: Central Stoneroller, *Campostoma anomalum*, Mountain Redbelly Dace, *Chrosomus oreas*, Red Shiner, *Cyprinella lutrensis*, Warpaint Shiner, *Luxilus coccogenis*, Rosefin Shiner, *Lythrurus ardens*, Comely Shiner, *Notropis amoenus*, and Swallowtail Shiner, *N. procne*.

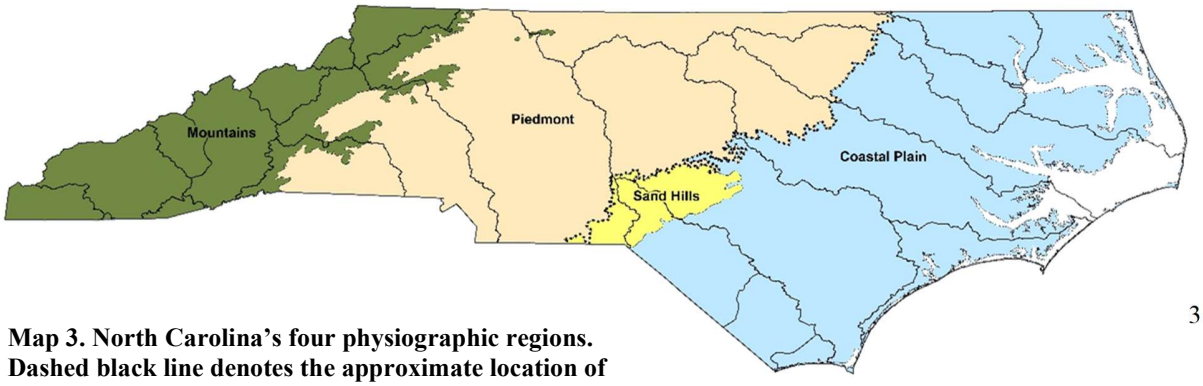
River basin designations for the 21 basins within North Carolina's 100 counties and four physiographic regions (Maps 1-3; Table 1) generally follow those of NCWRC's 1960s surveys (Starnes and Hogue 2011) and Menhinick (1991), with the exceptions of using the Nolichucky River basin instead of the Toe River basin and the inclusion of the Pamlico Sound within the Neuse and Tar River basins. Three extremely small river basins, the Ocoee, Tallulah, and Lynches are combined with the Hiwassee, Savannah, and Yadkin river basins, respectively. Even though the Pee Dee River originates at the confluence of the Yadkin and the Uwharrie rivers, for simplicity the entire basin is referred to as the Yadkin basin.



Map 1. North Carolina's counties.



Map 2. North Carolina's 21 river basins.



Map 3. North Carolina's four physiographic regions. Dashed black line denotes the approximate location of the Fall Zone.

Table 1. North Carolina's 21 river basins and their major tributaries from the Mountains eastward towards the Coastal Plain.

River Basin	Major Tributaries
Hiwassee	Hiwassee, Valley, and Nottely rivers
Little Tennessee	Little Tennessee, Cullasaja, Nantahala, Tuckasegee, Oconaluftee, and Cheoah rivers
Savannah	Chattooga, Toxaway, Horsepasture, Thompson, and Whitewater rivers
Pigeon	Pigeon River and Cataloochee Creek
French Broad	French Broad, Davidson, Mills, Little, Swannanoa, and Ivy rivers and Big Laurel and Spring creeks
Nolichucky	Nolichucky, North Toe, South Toe, and Cane rivers
Watauga	Watauga and Elk rivers
New	New, South Fork, North Fork, and Little rivers
Yadkin	Yadkin, Reddies, Roaring, Mitchell, Fisher, Ararat, South Yadkin, Uwharrie, Pee Dee, Rocky, and Little rivers
Catawba	Catawba, Linville, Johns, Henry Fork, and South Fork Catawba rivers
Broad	Green, First Broad, Second Broad, and North Pacolet rivers
Roanoke	Roanoke, Dan, Little Dan, Smith, Mayo, and Hyco rivers
Tar	Tar, Pamlico, and Pungo rivers and Fishing Creek
Neuse	Eno, Little, and Trent rivers and Contentnea Creek
Cape Fear	Haw, Deep, Rocky, Little, South, Black, and Northeast Cape Fear rivers
Lumber	Lumber River and Drowning and Naked creeks
Waccamaw	Lake Waccamaw, Juniper Creek, and Waccamaw River
Shallotte	Shallotte, Lockwood Folly, and Calabash rivers
White Oak	White Oak, New, and Newport rivers
Chowan	Chowan, Meherrin, Wiccacon, and Cashie rivers
Albemarle	Pasquotank, Perquimans, North, Little, Yeopim, Scuppernong, and Alligator rivers

Distributional data totaling 276,139 records (see *Data Availability*) were compiled from accessible material found at the institutions listed in Table 2. Museum data were accessed through the FishNet2 Portal (www.fishnet2.net, 2018-2020) or through direct contact with museum staff. Data from non-vouchered material were obtained from the North Carolina Division of Water Resources (NCDWR) (1990-2016 data), the North Carolina Wildlife Resources Commission (NCWRC) (via the Portal Access to Wildlife Systems (www.ncpaws.org)), the Tennessee Valley Authority (TVA) (D. Mathews, pers. comm.), and the North Carolina Division of Marine Fisheries (NCDMF) (Programs Nos. 100, 115, 123, 127, 146, 150, and 915). Compiling the distributional dataset included removing hybrids and records only identified to genus, records with indeterminate locality data, and offshore marine localities. Questionable identifications, potential new distributional records, and outlier records were requested from the institutions and agencies (Table 2) for re-identification, verification, or correction.

Species distributional maps were produced using ArcGIS Version 10.5, projection GCS_WGS_1984, and WGS 84 datum. Red dots indicate species localities based upon the dataset discussed above. When a species was known to occur within a basin, but material was not present, the occurrence was designated with a gray diamond in the approximate middle of the basin. Coordinates for type localities containing specific locality information were added by the authors and these localities are plotted as yellow stars. Several species may be under-represented in the dataset due to various reasons including their large size, which increases the time and cost of preservation and archival, and their status as imperiled species. All of the fish species included in this Atlas, except for Lake Sturgeon, *Acipenser fulvescens*, Paddlefish, *Polyodon spathula*, Black Buffalo, *Ictiobus niger*, Alabama Bass, *Micropterus henshalli*, and Blueside Darter, *Etheostoma*

jessiae, are documented by voucher specimens in ichthyological research collections and are thus verifiable.

Table 2. List of museums and agencies that provided distributional data.

Museum/Agency	Acronym	Contact
Academy of Natural Sciences of Drexel University	ANSP	Mariangeles Arce H., Mark H. Sabaj
American Museum of Natural History	AMNH	Barbara Brown
Auburn University Museum	AUM	David Werneke
California Academy of Sciences	CAS	David Catania
Cornell University Museum of Vertebrates	CUMV	Charles M. Dardia
Field Museum of Chicago	FMNH	Caleb McMahan
Florida Museum of Natural History	UF	Lawrence Page, Robert Robins
Harvard Museum of Comparative Zoology	MCZ	Andrew Williston
Illinois Natural History Survey	INHS	Christopher A. Taylor, Rachel Vinsel
National Museum of Natural History	USNM	Jeffrey M. Clayton
North Carolina Division of Parks & Recreation	NCDP&R	Ed Corey
North Carolina Division of Marine Fisheries	NCDMF	George Joyner, Fred C. Rohde (retired), Scott A. Smith
North Carolina Division of Water Resources	NCDWR	Bryn H. Tracy (retired)
North Carolina Museum of Natural Sciences	NCSM	Gabriela M. Hogue
North Carolina Wildlife Resources Commission	NCWRC	Doug Besler, Tyler Black (formerly), Kevin Dockendorf, Luke Etchison, Todd Ewing, Michael Fisk, Kevin Hining (formerly), Kin Hodges, Brena Jones, Scott Loftis, Clint Morgeson (formerly), Corey Oakley, Dylan Owensby, Katherine Potoka, Jacob Rash, Kyle Rachels, Benjamin Ricks, Kelsey Roberts, Kirk Rundle, Thomas Russ, Chris Wood
Ohio State University Museum	OSUM	Marc R. Kibbey
Roanoke College Ichthyological Collection	RCIC	Robert E. Jenkins (retired), Steven Powers
Royal Ontario Museum	ROM	Erling Holm
Tennessee Valley Authority	TVA	David C. Mathews
Tulane University	TU	Justin G. Mann
University of Alabama Ichthyological Collection	UAIC	Philip Harris, M. Worth Pugh
University of Kansas	KU	Leo Smith
University of Michigan Museum of Zoology	UMMZ	Douglas Nelson (emeritus), Randy Singer
University of North Carolina at Wilmington	UNCW	Thomas Lankford
University of Tennessee	UT	Jennifer Parris Brummett, Benjamin P. Keck
Virginia Institute of Marine Sciences	VIMS	Sarah K. Huber
Yale Peabody Museum of Ichthyology	YPM	Thomas Near

Results

There are 257 described and undescribed species of freshwater fish in North Carolina, in accordance with species that were included in this Atlas (see *Introduction*, Table 3). In addition to Cope's 1869 collections, which are further discussed within the annotations, the following are the oldest known vouchered specimens from North Carolina:

- 1853 – Salem Creek, Forsyth County, collected by J.T. Linebach and students at Salem Academy
    - USNM 12 Bluehead Chub, *Nocomis leptocephalus*
    - USNM 26 Rosyside Dace, *Clinostomus funduloides*
- 1854 – near Summerville, Harnett County, collected by J. C. McNair
    - USNM 1463 Yellow Bullhead, *Ameiurus natalis*
    - USNM 8376 Lake Chubsucker, *Erimyzon sucetta*
- 1869–1872 – Fort Macon, Carteret County, collected by Drs. Elliot Coues and Henry C. Yarrow (noted U.S. Army Surgeons, ornithologists, and naturalists)
    - ANSP 1188 Atlantic Menhaden, *Brevoortia tyrannus*
    - ANSP 7357 and ANSP 9800 Mummichog, *Fundulus heteroclitus*
    - ANSP 9782 Striped Mullet, *Mugil cephalus*
    - ANSP 9799 Sheepshead Minnow, *Cyprinodon variegatus*

The two most speciose families are Leuciscidae (68 species) and Percidae (40 species) and 16 families only have one species found in North Carolina. The three most speciose river basins, which also happen to be some of our largest basins, are the Cape Fear (125 species), Roanoke (121 species), and Yadkin (116 species). The three least diverse river basins, all small headwater basins, are the Watauga (30 species), Savannah (37 species), and New (56 species).

In addition to the 257 species, there are also many marine species that occasionally stray into North Carolina's fresh waters (NCSM and NCDMF unpublished data, Table 4). Further information on these species can be found in FAO (2002), Kells and Carpenter (2011), and Ray and Robins (2016).

Table 3. Phylogenetic listing of the freshwater fishes in North Carolina by river basin.

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Petromyzontidae																						
Ichthyomyzon bdellium		I			I	I																3
Ichthyomyzon greeleyi	I	I			I	I																4
Lampetra aepyptera													I	I								2
Lethenteron appendix					I																	1
Petromyzon marinus											I	I	I	I	I	I	I		I			8
Acipenseridae																						
Acipenser brevirostrum											I	I				I	I					4
Acipenser fulvescens					I																	1
Acipenser oxyrinchus											I	I	I	I	I	I	I	I				8
Polyodontidae																						
Polyodon spathula					E																	1
Lepisosteidae																						
Lepisosteus osseus	I	I			I					I	I	I	I	I	I	I	I	I	I	I	I	15
Amiidae																						
Amia calva										I	I	I	I	I	I	I	I	I		I	I	11
Hiodontidae																						
Hiodon tergisus					I																	1
Anguillidae																						
Anguilla rostrata										I	I	I	I	I	I	I	I	I	I	I	I	12
Engraulidae																						
Anchoa mitchilli												I	I	I	I	I	I	I	I			8
Clupeidae																						
Alosa aestivalis	IB	IB	IB						IB	IB	IB	I	I	I	I	I	I	I	I			14
Alosa mediocris												I	I	I	I	I	I	I				7
Alosa pseudoharengus										IB		I	I	I	I	I	I	I	I			9
Alosa sapidissima									I		I	I	I	I	I	I	I	I	I	I		11
Brevoortia tyrannus												I	I	I	I	I	I	I	I			8
Dorosoma cepedianum	I	I		I	I	I			I	I	I	I	I	I	I	I	I	I	I	I	I	18
Dorosoma petenense	NI	NI			NI				NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI			14

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated

	Mountain								Piedmont							Coastal						
Family, Scientific Name	**Hiwassee**	**Little Tennessee**	**Savannah**	**Pigeon**	**French Broad**	**Nolichucky**	**Watauga**	**New**	**Broad**	**Catawba**	**Yadkin**	**Cape Fear**	**Neuse**	**Tar**	**Roanoke**	**Chowan**	**Albemarle Sound Rivers**	**White Oak**	**Shallotte**	**Waccamaw**	**Lumber**	**Total Basin No. of Occurrences**
Cyprinidae																						
Carassius auratus	NI	NI		NI	NI				NI	NI	NI	NI	NI	NI	NI	NI		NI			NI	14
Cyprinus carpio	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	21
Xenocyprididae																						
Ctenopharyngodon idella			NI	NI	NI			NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	17
Leuciscidae																						
Campostoma anomalum	I	I	I	I	I	I	I	I	I	I	NI				I							12
Chrosomus oreas		IB					IB	IB		IB	IB	IB	I	I	I							9
Clinostomus funduloides		IB			IB	IB	IB	I	I	I	I	I	I	I	I							12
Clinostomus sp. "Hiwassee" Dace	I																					1
Clinostomus sp. "Smoky" Dace		I																				1
Cyprinella analostana											I	I	I	I	I	I	I					7
Cyprinella chloristia									I	I	IB											3
Cyprinella galactura	I	I	I	I	I	I	I	IB		I												9
Cyprinella labrosa									I	I	I											3
Cyprinella lutrensis											NI	NI			NI							3
Cyprinella monacha		I			E																	2
Cyprinella nivea			I						I	I	I	I										5
Cyprinella pyrrhomelas									I	I	I											3
Cyprinella spiloptera	E			I	I	I		I														5
Cyprinella zanema									I	I												2
Cyprinella sp. "Thinlip" Chub											I	I									I	3
Erimystax insignis	I				I	I																3
Exoglossum laurae								I														1
Exoglossum maxillingua															I							1
Hybognathus regius									I	I	I	I	I	I	I	I	I			E		10
Hybopsis amblops	I			I	I	I																4
Hybopsis hypsinotus								IB	I	I	I											4
Hybopsis rubrifrons			I																			1
Luxilus albeolus								I				I	I	I	I	I						6
Luxilus cerasinus												IB			I	I						3
Luxilus chrysocephalus	I			I	I	I																4

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																						
	Mountain								Piedmont							Coastal						
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Luxilus coccogenis	I	I	I	I	I	I	I	IB	IB	I/IB	IB											11
Lythrurus ardens											IB	IB			I							3
Lythrurus matutinus													I	I								2
Nocomis leptocephalus		IB	I		IB	IB		I	I	I	I	I	I	I	I	I					IB	14
Nocomis micropogon	I	I	I	I	I	I	I			I												8
Nocomis platyrhynchus								I														1
Nocomis raneyi													I	I	I	I						4
Notemigonus crysoleucas	IB	IB	I	IB	IB	IB	IB	IB	I	I	I	I	I	I	I	I	I	I	I	I	I	21
Notropis alborus										IB	I	I			I							4
Notropis altipinnis										I	I	I	I	I	I	I		I				8
Notropis amoenus											IB	I	I	I	I	I	I	I				8
Notropis bifrenatus													I			I						2
Notropis chalybaeus												I	I	I	I	I	I	I	I	I	I	10
Notropis chiliticus								IB		IB	I	IB			I						IB	6
Notropis chlorocephalus										I												1
Notropis cummingsae										I	I	I	I	I				I	I	I	I	9
Notropis hudsonius									I	I	I	I	I	I	I	I	I					9
Notropis leuciodus	I	I	I	I	I	I	I	IB		I												9
Notropis lutipinnis		IB	I																			2
Notropis maculatus											I	I								I	I	4
Notropis mekistocholas												I										1
Notropis micropteryx	I	I		I	I	I																5
Notropis petersoni										I	I	I						I	I	I	I	7
Notropis photogenis	I	I		I	I	I		I														6
Notropis procne									IB	I	IB	I	I	I	I	I	I					9
Notropis rubricroceus		IB	IB	I	I	I		IB	IB	I												8
Notropis scabriceps								I														1
Notropis scepticus									I	I	I	I										4
Notropis spectrunculus	I	I	I	I	I	I			IB	I												8
Notropis telescopus	I	I		I	I	I				I												6
Notropis volucellus		IB			I	I		I					I	I	I							7
Notropis sp. "Kanawha" Rosyface Shiner								I														1

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Notropis sp. "Piedmont" Shiner									I													1
Phenacobius crassilabrum		I			I	I																3
Phenacobius teretulus								I														1
Pimephales notatus	I				I	I		I														4
Pimephales promelas	NI	NI		NI	NI	NI		NI	NI	NI	NI	NI	NI	NI	NI							13
Rhinichthys atratulus															I							1
Rhinichthys cataractae	I	I	I	I	I	I	I	I		I												9
Rhinichthys obtusus	I	I	I	I	I	I	I	I	I	I	I											11
Semotilus atromaculatus	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I						16
Semotilus lumbee											I	I									I	3
Catostomidae																						
Carpiodes carpio					I	I																2
Carpiodes cyprinus				I	I	I									I							4
Carpiodes sp. "Atlantic" Highfin Carpsucker										I	I	I										3
Carpiodes sp. "Carolina" Quillback									I	I	I											3
Catostomus commersonii	I	I	I	I	I	I	I	I	I	I	I	IB	IB	I	I							15
Erimyzon oblongus					IB					I	I	I	I	I	I	I	I	I	I	I	I	13
Erimyzon sucetta											I	I	I	I	I	I	I	I	I	I	I	11
Hypentelium nigricans	I	I	I	I	I	I	I	I	IB	IB	IB		I	I	I							14
Hypentelium roanokense											IB				I							2
Ictiobus bubalus					I	I				IB	IB											4
Ictiobus cyprinellus										NI	NI											2
Ictiobus niger					I																	1
Minytrema melanops											I	I						I	I	I	I	6
Moxostoma anisurum	I	I			I	I																4
Moxostoma ariommum															I							1
Moxostoma breviceps	I	I		I	I	I																5
Moxostoma carinatum	I	I		I	I																	4
Moxostoma cervinum													I	I	I							3
Moxostoma collapsum									I	I	I	I	I	I	I	I						8
Moxostoma duquesnei	I	I		I	I	I	I		I													7

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																						
	Mountain								Piedmont							Coastal						
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Moxostoma erythrurum	I	I		I	I	I									I							6
Moxostoma macrolepidotum										I	I	I	I	I	I	I	I					8
Moxostoma pappillosum									I	I	I	I	I	I	I	I						8
Moxostoma robustum										E	I											2
Moxostoma rupiscartes			I						I	I	IB											4
Moxostoma sp. "Brassy" Jumprock									I	I	I	I										4
Moxostoma sp. "Carolina" Redhorse											I	I										2
Moxostoma sp. "Sicklefin" Redhorse	I	I																				2
Thoburnia hamiltoni															I							1
Cobitidae																						
Misgurnus anguillicaudatus												NI										1
Ictaluridae																						
Ameiurus brunneus	IB	IB	I		IB				I	I	I	I	I		IB						I	11
Ameiurus catus				IB	IB			IB	I	I	I	I	I	I	I	I	I	I	I	I	I	16
Ameiurus melas										NI	NI				NI							3
Ameiurus natalis	IB									I	I	I	I	I	I	I	I	I	I	I	I	13
Ameiurus nebulosus	I	I		I	I		IB	IB	I	I	I	I	I	I	I	I	I	I		I	I	18
Ameiurus platycephalus	IB	IB		IB	IB	IB	IB		I	I	I	I	I	I	I	I			I	I	I	17
Ictalurus furcatus										NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	12
Ictalurus punctatus	I	I		I	I	I		I	IB	IB	IB	IB	IB	IB	IB	IB	IB			IB	IB	17
Noturus eleutherus					I																	1
Noturus flavus		I			I	I																3
Noturus furiosus													I	I								2
Noturus gilberti															I							1
Noturus gyrinus											I	I	I	I	I	I	I	I	I	I	I	11
Noturus insignis			I				IB	IB	I	I	I	I	I	I	I	I	I	I	I	I	I	16
Noturus sp. "Cape Fear Broadtail" Madtom												I										1
Noturus sp. “Lake Waccamaw Broadtail” Madtom																				I		1
Noturus sp. "Pee Dee Broadtail" Madtom																				I	I	2
Pylodictis olivaris	I	I		I	I	I		I	IB	IB	IB	IB	IB	IB	IB			IB		IB	IB	16

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Loricariidae																						
Pterygoplichthys pardalis					NI																	1
Esocidae																						
Esox americanus										I	I	I	I	I	I	I	I	I	I	I	I	12
Esox masquinongy	I	I			I	I		IB	IB													6
Esox niger					IB						I	I	I	I	I	I	I	I	I	I	I	12
Umbridae																						
Umbra pygmaea											I	I	I	I	I	I	I	I	I	I	I	11
Salmonidae																						
Oncorhynchus mykiss	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI				NI							12
Oncorhynchus nerka		NI																				1
Salmo trutta	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI				NI							12
Salvelinus fontinalis	I	I	I	I	I	I	I	I	IB	I	I				IB							12
Aphredoderidae																						
Aphredoderus sayanus										I	I	I	I	I	I	I	I	I	I	I	I	12
Amblyopsidae																						
Chologaster cornuta												I	I	I	I	I	I	I	I	I	I	10
Mugilidae																						
Dajaus monticola																	I	I	I			3
Mugil cephalus											I	I	I	I	I	I	I	I	I			9
Atherinopsidae																						
Labidesthes sicculus					I																	1
Labidesthes vanhyningi											I	I								I	I	4
Menidia beryllina										IB		I	I	I	I	I	I	I	I			9
Menidia extensa																				I		1
Belonidae																						
Strongylura marina											I	I	I	I	I	I	I	I	I			9
Fundulidae																						
Fundulus chrysotus																				I		1
Fundulus confluentus												I	I	I			I	I				5
Fundulus diaphanus												I	I	I	I	I	I					6
Fundulus heteroclitus												I	I	I		I	I	I	I	IB		8

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Fundulus lineolatus											I	I	I	I	I	I	I	I	I	I	I	11
Fundulus rathbuni										IB	I	I	I		I							5
Fundulus waccamensis																				I		1
Fundulus sp. "Lake Phelps" Killifish																	I					1
Lucania goodei												NI										1
Lucania parva												I	I	I		I	I	I	I			7
Poeciliidae																						
Gambusia affinis	I	I			I																	3
Gambusia holbrooki					IB				I	I	I	I	I	I	I	I	I	I	I	I	I	14
Heterandria formosa												I								I		2
Poecilia latipinna												I						I	I			3
Cyprinodontidae																						
Cyprinodon variegatus												I	I	I		I	I	I	I			7
Gasterosteidae																						
Apeltes quadracus													I				I					2
Cottidae																						
Cottus bairdii	I	I	I	I	I	I	I	I	IB													9
Cottus caeruleomentum															I							1
Cottus carolinae				I	I																	2
Moronidae																						
Morone americana									IB	IB	I	I	I	I	I	I	I	I		I		11
Morone chrysops	NI	NI			NI				NI	NI	NI	NI	NI		NI							9
Morone saxatilis										IB	I	I	I	I	I	I	I	I	I	I	I	12
Centrarchidae																						
Acantharchus pomotis											I	I	I	I	I	I	I	I	I	I	I	11
Ambloplites cavifrons											IB	IB	I	I	I							5
Ambloplites rupestris	I	I	IB	I	I	I	I	IB	IB	IB	IB				IB							12
Centrarchus macropterus											I	I	I	I	I	I	I	I	I	I	I	11
Enneacanthus chaetodon											I	I	I		I	I			I	I	I	8
Enneacanthus gloriosus											I	I	I	I	I	I	I	I	I	I	I	11
Enneacanthus obesus												I	I	I	I	I	I	I	I	I	I	10
Lepomis auritus	IB	IB	I	IB	IB	IB	IB	IB	I	I	I	I	I	I	I	I	I	I	I	I	I	21

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Lepomis cyanellus	NI	NI		NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI					16
Lepomis gibbosus		IB			IB	IB		IB	I	I	I	I	I	I	I	I	I	I	I	I	I	17
Lepomis gulosus	IB	IB		IB	IB				I	I	I	I	I	I	I	I	I	I	I	I	I	17
Lepomis macrochirus	I	I	I	I	I	I	I	IB	I	I	I	I	IB	IB	IB	IB	IB	I	I	I	I	21
Lepomis marginatus											I	I	I	I				I	I	I	I	8
Lepomis microlophus	NI	NI			NI			NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	17
Lepomis punctatus											I	I							I	I	I	5
Micropterus coosae	NI																					1
Micropterus dolomieu	I	I	IB	I	I	I	I	IB	IB	IB	IB				IB							12
Micropterus henshalli	NI									NI												2
Micropterus punctulatus	I	I			I	I			IB	IB	IB	IB			IB					IB	IB	11
Micropterus salmoides	I	I	I	I	I	I	I	IB	I	I	I	I	I	I	I	I	I	I	I	I	I	21
Micropterus sp. "Bartram's" Bass			I						IB													2
Pomoxis annularis	I	I		I	I				IB	IB	IB	IB	IB	IB	IB	IB	IB			IB		14
Pomoxis nigromaculatus	I	I		I	I			IB	I	I	I	I	I	I	I	I	I	I	I	I	I	18
Percidae																						
Etheostoma acuticeps						I																1
Etheostoma blennioides	I		I	I	I	I		I														6
Etheostoma brevispinum									I	I	I											3
Etheostoma chlorobranchium		I		I	I	I	I															5
Etheostoma collis										I	I	I	I	I	I							6
Etheostoma flabellare				I	I			I			I	I	I	I	I							8
Etheostoma fusiforme				IB	IB					I	I	I	I	I	I	I	I	I	I	I	I	14
Etheostoma gutselli		I		I																		2
Etheostoma inscriptum			I																			1
Etheostoma jessiae					E																	1
Etheostoma kanawhae								I														1
Etheostoma mariae																					I	1
Etheostoma nigrum													I	I	I							3
Etheostoma olmstedi								IB	I	I	I	I	I	I	I	I	I	I	I	I	I	14
Etheostoma perlongum																				I		1
Etheostoma podostemone															I							1

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated																							
	Mountain								Piedmont							Coastal							
Family, Scientific Name	Hiwassee	Little Tennessee	Savannah	Pigeon	French Broad	Nolichucky	Watauga	New	Broad	Catawba	Yadkin	Cape Fear	Neuse	Tar	Roanoke	Chowan	Albemarle Sound Rivers	White Oak	Shallotte	Waccamaw	Lumber	Total Basin No. of Occurrences
Etheostoma rufilineatum	I	IB		I	I																	4
Etheostoma serrifer											I	I	I	I	I	I	I	I	I	I	I	11
Etheostoma simoterum					I	I																2
Etheostoma swannanoa				I	I	I																3
Etheostoma thalassinum									I	I												2
Etheostoma vitreum													I	I	I	I						4
Etheostoma vulneratum		I			E																	2
Etheostoma zonale	I	I		I	I	I																5
Perca flavescens	IB	IB	IB	IB	IB			IB	I	I	I	I	I	I	I	I	I	I		I	I	18
Percina aurantiaca	I	I		I	I	I	I															6
Percina burtoni					E	I																2
Percina caprodes				I	I			I														3
Percina crassa									I	I	I	I									I	5
Percina evides	I	I		I	I	I																5
Percina gymnocephala								I														1
Percina nevisense													I	I	I	I						4
Percina oxyrhynchus								I														1
Percina rex															I							1
Percina roanoka													I	I	I	I						4
Percina squamata	I	I		I	I	I																5
Percina westfalli			I																			1
Percina williamsi					E																	1
Sander canadensis	I			I	I					IB												4
Sander vitreus	I	I		I	I				IB	IB	IB		E		I	I	I					11
Sciaenidae																						
Aplodinotus grunniens					I										IB							2
Leiostomus xanthurus												I	I	I		I	I	I	I			7
Elassomatidae																						
Elassoma boehlkei																				I		1
Elassoma evergladei												I							I	I	I	4
Elassoma zonatum												I	I	I	I		I		I	I	I	8

Table 3. (continued).

I = Indigenous (native) IB = Indigenous but not in this basin NI = NonIndigenous (introduced) E = Extirpated

	Mountain								Piedmont							Coastal						
Family, Scientific Name	**Hiwassee**	**Little Tennessee**	**Savannah**	**Pigeon**	**French Broad**	**Nolichucky**	**Watauga**	**New**	**Broad**	**Catawba**	**Yadkin**	**Cape Fear**	**Neuse**	**Tar**	**Roanoke**	**Chowan**	**Albemarle Sound Rivers**	**White Oak**	**Shallotte**	**Waccamaw**	**Lumber**	**Total Basin No. of Occurrences**
Cichlidae																						
Coptodon zillii												NI			NI							2
Oreochromis aureus					NI					NI					NI							3
Eleotridae																						
Dormitator maculatus												I	I	I				I				4
Eleotris amblyopsis												I					I	I				3
Gobiidae																						
Awaous banana												NI						NI				2
Ctenogobius shufeldti												I	I				I	I	I			5
Evorthodus lyricus												I	I				I	I				4
Paralichthyidae																						
Paralichthys lethostigma												I	I	I	I	I	I	I	I			8
Archiridae																						
Trinectes maculatus											I	I	I	I	I	I	I	I	I		I	10

Total Number of Species	**70**	**75**	**37**	**63**	**102**	**64**	**30**	**56**	**70**	**99***	**116**	**125**	**109**	**100**	**121**	**85**	**78**	**73**	**64**	**66**	**63**
No. of Indigenous Species (= I + E)	51	50	28	49	76	53	19	28	42	65	82	101	95	88	96	75	69	65	59	57	53
No. of Nonindigenous Species (IB + NI)	19	25	9	14	26	11	11	28	28	35	34	24	14	12	25	10	9	8	5	9	10

**Luxilus coccogenis* is indigenous (I) in the Linville River watershed, but nonindigenous (IB) in other parts of the Catawba basin.

Table 4. Marine species that may be periodically encountered in coastal fresh waters.

Scientific Name	Common Name
Dasyatis sabina	Atlantic Stingray
Megalops atlanticus	Tarpon
Myrophis punctatus	Speckled Worm Eel
Mugil curema	White Mullet
Menidia menidia	Atlantic Silverside
Fundulus majalis	Striped Killifish
Centropomus undecimalis	Common Snook
Pomatomus saltatrix	Bluefish
Caranx latus	Horse-eye Jack
Lutjanus griseus	Gray Snapper
Diapterus auratus	Irish Pompano
Eucinostomus argenteus	Spotfin Mojarra
Eucinostomus harengulus	Tidewater Mojarra
Archosargus probatocephalus	Sheepshead
Lagodon rhomboides	Pinfish
Bairdiella chrysoura	Silver Perch
Micropogonias undulatus	Atlantic Croaker
Sciaenops ocellatus	Red Drum
Gobionellus oceanicus	Highfin Goby
Gobiosoma bosc	Naked Goby
Citharichthys spilopterus	Bay Whiff
Etropus crossotus	Fringed Flounder
Paralichthys dentatus	Summer Flounder

Of the 242 described species of freshwater fish in North Carolina, 45 (18.5%) were described by E. D. Cope between 1865 and 1871. Thirty-six species were described from North Carolina and 15 of these were described by Cope in 1870 (Table 5, Cope 1870a, 1870b). The first species described from North Carolina was *Clinostomus carolinus* (Girard 1856, page 212). However, because this species was later synonymized with Rosyside Dace by Lachner and Deubler (1960) this makes the Bluehead Chub (Girard 1856, p 213) the first species to be described from North Carolina that has not been synonymized with any other species (Tracy 2013). The most recently described species from North Carolina was Carolina Pygmy Sunfish, *Elassoma boehlkei*, described by Rohde and Arndt (1987).

Table 5. Species described from North Carolina and their verbatim type localities.

Scientific Name, Author, Year	Verbatim Type Locality	County	Date	Collector(s)	No. Specimens	Catalog Number	Type
Cyprinella labrosa (Cope) 1870	clear and rapid creeks, which flow into waters of the upper Catawba River in Macdowell and Burke counties, N. Ca.	McDowell, Burke	Fall 1869	E.D. Cope	Unspecified	ANSP 2045	Lectotype
Cyprinella nivea (Cope) 1870	the upper waters of the Catawba River, North Carolina	Unknown	Fall 1869	E.D. Cope	Common	ANSP 2930	Lectotype
Cyprinella pyrrhomelas (Cope) 1870	tributaries of the upper Catawba River, North Carolina	Unknown	Fall 1869	E.D. Cope	Abundant	ANSP 2631	Lectotype
Hybopsis hypsinotus (Cope) 1870	creeks heading the Catawba R., in Macdowell Co., N. Ca., or tributary to the Yadkin River in Roane Co., in the same State	McDowell, Roane (Davidson)	Fall 1869	E.D. Cope	Common	ANSP 2005	Lectotype
Lythrurus matutinus (Cope) 1870	Neuse River, in Wake County, North Carolina	Wake	Fall 1869	E.D. Cope	Unspecified	ANSP 2844	Syntypes
Nocomis leptocephalus (Girard) 1856	Salem, N.C.	Forsyth	1853	J.T. Lineback & students	5	USNM 12	Syntypes
Notropis alborus Hubbs & Raney 1947	Brush Creek, a tributary of Deep River, 5 miles west of Siler City, Randolph County, North Carolina	Randolph	06 March 1940	E.C. Raney & E.A. Lachner	20	UMMZ 138489	Holotype
Notropis altipinnis (Cope) 1870	from the Yadkin River, Roane County, North Carolina	Roane (Davidson)	Fall 1869	E.D. Cope	Unspecified	ANSP 2846	Lectotype
Notropis chiliticus (Cope) 1870	common in the tributaries to the Yadkin River, in Roane County, North Carolina	Roane (Davidson)	Fall 1869	E.D. Cope	Common	ANSP 4378	Lectotype
Notropis chlorocephalus (Cope) 1870	abundant in the clears waters which it inhabits, viz: the tributaries of the Catawba River	Unknown	Fall 1869	E.D. Cope	Abundant	ANSP 2755	Lectotype
Notropis cummingsae Myers 1925	upper Burnt Mill Creek, Wilmington, North Carolina, directly under the wooden railroad bridge, the other just below	New Hanover	19 May 1924	G.S. Meyers	Two large schools	AMNH 8391	Holotype
Notropis mekistocholas Snelson 1971	Cape Fear (Deep) dr., N.C., Chatham Co., Rocky R., N.C. Hwy. 902 bridge, 7.0 air miles SW center Pittsboro	Chatham	02 June 1968	F.S. Snelson & W.M. Palmer	37	USNM 205299	Holotype
Notropis petersoni Fowler 1942	Crane Creek on U.S. #1 below bridge, Moore County, North Carolina	Moore	23 August 1940	G.A. Coventry, C.B. Peterson, & F.A. Ulmer, Jr.	Unspecified	ANSP 69967	Holotype
Semotilus lumbee Snelson & Suttkus 1978	Pee-dee (Lumber) drainage; North Carolina, Moore County, trib. of Aberdeen Creek at culvert on U.S. Hwy #1, 0.5 airmi SW jct Hwys #1 and #15 in center of Aberdeen	Moore	08 May 1975	W.M. Palmer, A.L. Braswell, & J.E. Cooper	11	TU 101095	Holotype
Moxostoma collapsum (Cope) 1870	Neuse, Yadkin, and Catawba Rivers, in North Carolina, the Clinch River in Tennessee, and I have a specimen from the Wabash River, in Indiana, and three others without locality, but probably from the Western States or Great Lakes	Unknown	Fall 1869	E.D. Cope	Unspecified	ANSP 6949	Lectotype
Moxostoma pappillosum (Cope) 1870	Catawba and Yadkin Rivers in North Carolina	Unknown	Fall 1869	E.D. Cope	Quite abundant	ANSP 6921, 6926	Syntypes

Table 5. (continued).

Scientific Name, Author, Year	Verbatim Type Locality	County	Date	Collector(s)	No. Specimens	Catalog Number	Type
Moxostoma robustum (Cope) 1870	inhabiting the Yadkin	Unknown	Fall 1869	E.D. Cope	Unknown	None designated	
Moxostoma rupiscartes Jordan & Jenkins 1889	Catawba River near Marion, N. C., at the upper ford, 3 miles northwest of Marion, about a mile below the mouth of Buck's Creek	McDowell	22 August 1888	D.S. Jordan, O.P. Jenkins, & S.E. Meek	Abundant	USNM 39927	Lectotype
Noturus furiosus Jordan & Meek 1889	Neuse River at Millburnie, near Raleigh	Wake	27 August 1888	O.P. Jenkins, & S.E. Meek	15	USNM 39932	Lectotype
Menidia extensa Hubbs and Raney, 1946	north shore of Lake Waccamaw, North Carolina	Columbus	30 March 1941	E.C. Raney, E.A. Lachner, & R.A. Pfeiffer	536	UMMZ 135845	Holotype
Fundulus rathbuni Jordan & Meek 1889	Reedy Fork of Haw River at Fulk's Mill, 11 miles north-northeast of Greensborough; South Buffalo Creek about 5 miles southeast of Greensborough; Little Allemance Creek, about 9 miles southeast of Greensborough; and from a small very clear brook or spring-run, without name, one mile south of Fulk's Mill	Guilford	25 August 1888	D.S. Jordan, O.P. Jenkins, & S.E. Meek	Numerous	USNM 39860	Holotype
Fundulus waccamensis Hubbs & Raney 1946	north shore of Lake Waccamaw, Columbus County, North Carolina	Columbus	30 March 1941	E.C. Raney, E.A. Lachner, & R.A. Pfeiffer	260	UMMZ 138473	Holotype
Etheostoma brevispinum (Coker) 1926	swift waters of a small, rocky stream (Paddys Creek) just above the head of Paddys Creek Lake, part of the artificial Lake James system in Burke County, N.C.	Burke	August 1926	R.E. Coker	3	USNM 87411	Holotype
Etheostoma chlorobranchium Zorach 1972	N.C., Macon Co., Cullasaja R. 10-13 km SE Franklin on Rt. 64, collected in a 3 km stretch of river	Macon	29 March 1957	H.E. Winn & C.F. Powers	12	USNM 205650	Holotype
Etheostoma gutselli (Hildebrand) 1932	Tuckaseegee River, Ela, North Carolina	Swain	26, 29 August 1930	J.S. Gutsell	3	USNM 92402	Holotype
Etheostoma kanawhae (Raney) 1941	North Fork of the New River at Crumpler, Ashe County, North Carolina	Ashe	1 April 1940	E.C. Raney, E.A. Lachner, & L.J. Kezer	21	UMMZ 131837	Holotype
Etheostoma mariae (Fowler) 1947	Tributary outlet of Watson's Lake near Southern Pines, in eastern Moore County, North Carolina	Moore	12 October 1946	H.W. Fowler	3	ANSP 71731	Holotype
Etheostoma perlongum (Hubbs & Raney) 1946	north shore of Lake Waccamaw, North Carolina	Columbus	30 March 1941	E.C. Raney, E.A. Lachner, & R.A. Pfeiffer	17	UMMZ 138475	Holotype
Etheostoma rufilineatum (Cope) 1870	Warm Springs Creek, which flows into the French Broad River, in Madison co., N. Ca.	Madison	Fall 1869	E.D. Cope	8	ANSP 13791	Lectotype
Etheostoma serrifer (Hubbs & Cannon) 1935	Buffalo Creek, Wendell, Wake County, North Carolina	Wake	19 November 1925	C.S. Brimley & J.A. Harris	1	UMMZ 107053	Holotype
Etheostoma vitreum (Cope) 1870	Walnut Creek, a tributary of the Neuse River, in Wake co., N. Carolina	Wake	Fall 1869	E.D. Cope	1	Unknown	

Table 5. (continued).

Scientific Name, Author, Year	Verbatim Type Locality	County	Date	Collector(s)	No. Specimens	Catalog Number	Type
Etheostoma vulneratum (Cope) 1870	Warm Springs Creek, a tributary of the French Broad River, Madison co., N. Carolina	Madison	Fall 1869	E.D. Cope	1	ANSP 13798	Holotype
Percina burtoni Fowler 1945	Swannanoa River near Oteen, Buncombe County, N.C.	Buncombe	21 August 1934	E.M. Burton	1	ANSP 70701	Holotype
Percina gymnocephala Beckham 1980	South Fork New River at eastern crossing of co. rd. 1181, 7.0 airmi. SE of West Jefferson, Ashe Co., North Carolina	Ashe	22 September 1977	E.C. Beckham & E.B. Beckham	311	TU 106911	Holotype
Percina nevisense (Cope) 1870	boisterous waters at the falls of the Neuse River, 8 miles east of Raleigh, North Carolina	Wake	Fall 1869	E.D. Cope	1	Unknown	
Elassoma boehlkei Rohde & Arndt 1987	Waccamaw River Drainage, North Carolina, Brunswick County, Juniper Creek at State Route 1340 bri'ge, 1.6 km E Makatoka and 17.8 km NW Supply	Brunswick	13 March 1983	F.C. Rohde	26	ANSP 158481	Holotype

Species Described or Elevated Since Menhinick (1991)
Since the publication of Menhinick (1991), two species, whose ranges include North Carolina, have been formally described: Blue Ridge Sculpin, *Cottus caeruleomentum* (Kinziger et al. 2000) found in the upper Roanoke basin in Stokes County and Sickle Darter, *Percina williamsi* (Page and Near 2007) found in the French Broad basin in Buncombe County. Species that have been re-elevated since Menhinick (1991) include: Pinewoods Shiner, *Lythrurus matutinus* (Dimmick et al. 1996), Highland Shiner, *Notropis micropteryx* (Wood et al. 2002), Notchlip Redhorse, *Moxostoma collapsum* (Nelson et al. 2004), Smallmouth Redhorse, *Moxostoma breviceps* (Nelson et al. 2004), Southern Brook Silverside, *Labidesthes vanhyningi* (Werneke and Armbruster 2015), Carolina Fantail Darter, *Etheostoma brevispinum* (Blanton and Schuster 2008), Tuckasegee Darter, *E. gutselli* (Piller and Bart 2017), Westfall's Darter, *Percina westfalli* (Near et al. 2011; Hayes and Piller 2018), and Chainback Darter, *P. nevisense* (Goodin et al. 1998).

Undescribed Species
There are 15 undescribed species found in North Carolina (Table 3). Several of the undescribed species are endemic to North Carolina and eight are listed as imperiled species: *Clinostomus* sp. "Smoky" Dace, *Cyprinella* sp. "Thinlip" Chub, *Carpioides* sp. "Atlantic" Highfin Carpsucker, *Moxostoma* sp. "Carolina" Redhorse, *Moxostoma* sp. "Sicklefin" Redhorse, *Noturus* sp. "Lake Waccamaw Broadtail" Madtom, *Noturus* sp. "Pee Dee River Broadtail" Madtom, and *Noturus* sp. "Cape Fear River Broadtail" Madtom. (NCNHP 2018; NCWRC 2017).

Indigenous Species
There are 236 indigenous species found in North Carolina (Table 3). Forty-eight of them are restricted to just one river basin in North Carolina (Table 3), with the French Broad containing the most (n=11). Thus far, no indigenous species are restricted to only the Pigeon, Watauga, Yadkin, Shallotte, White Oak, Neuse, Tar, or Chowan basins. The Shallotte and Albemarle Sound basins have the most pristine fauna of any of the basins, with approximately 92% and 89% respectively, of their faunas comprising indigenous species (Figure 1). By contrast, the fauna of the New basin is equally split between indigenous and nonindigenous species (Figure 1).

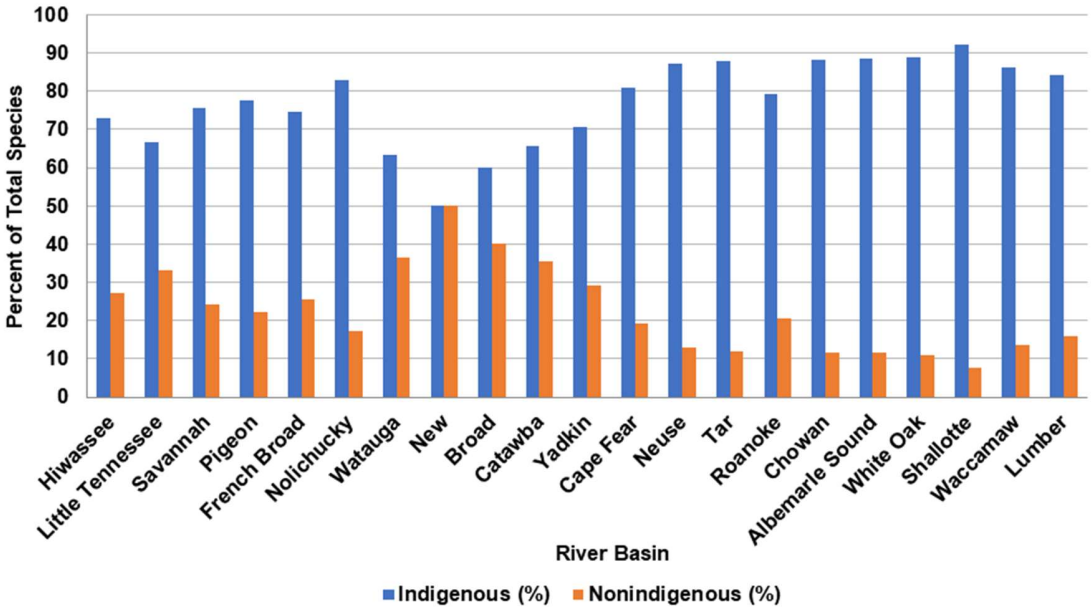


Figure 1. Indigenous and nonindigenous species as a percentage of the total number of species found within each river basin.

Nonindigenous Species

Twenty-three of the 257 species are nonindigenous to North Carolina (Table 3). Fifteen of the species are indigenous elsewhere in the United States. The other eight species are indigenous outside of North America (e.g., Goldfish, *Carassius auratus*, Grass Carp, Common Carp, *Cyprinus carpio,* Oriental Weatherfish, *Misgurnus anguillicaudatus*, Amazon Sailfin Catfish, *Pterygoplichthys pardalis,* Brown Trout, *Salmo trutta,* Redbelly Tilapia*, Coptodon zilli,* and Blue Tilapia, *Oreochromis aureus*). The two most widely distributed of these 22 nonindigenous species are Common Carp, found in every basin, and Grass Carp, found in 17 basins.

The high prevalence of nonindigenous species in some basins (e.g., New basin) and not in others (e.g., Shallotte and Albemarle basins) may be related to several factors that promote introductions: the presence of large impoundments, the proximity to anglers and to urban areas, and the proximity to adjacent drainages. Species are also introduced because of the desire for new commercial or sport fishes. Brightly colored species and species associated with colonial nesters have increased chances of being seined, used for bait, and then released at the end of the day. Species are also introduced via the aquaculture and aquarium trade and through cultural religious practices (Jenkins and Burkhead 1994; Kerr et al. 2005; Rahel 2007; Tracy et al. 2013; Tracy 2019).

Indigenous Introductions

Sixty-two species indigenous to North Carolina have been introduced into basins outside of their historical drainages (Table 3), thereby, establishing interbasin transfers. Leuciscidae and Centrarchidae have the highest number of interbasin transfers (18 and 10, respectively) stemming from the fact that many are bait-bucket species and game fishes. Channel Catfish, *Ictalurus punctatus*, and White Crappie, *Pomoxis annularis*, two game species, have been introduced into more basins (n=11 and 10, respectively) than any other species. As illustrated in Figure 2, the New

basin has more indigenous introductions than any other basin (n=21), with the Catawba and Yadkin close behind. Thus far, no indigenous species have been introduced into the Shallotte.

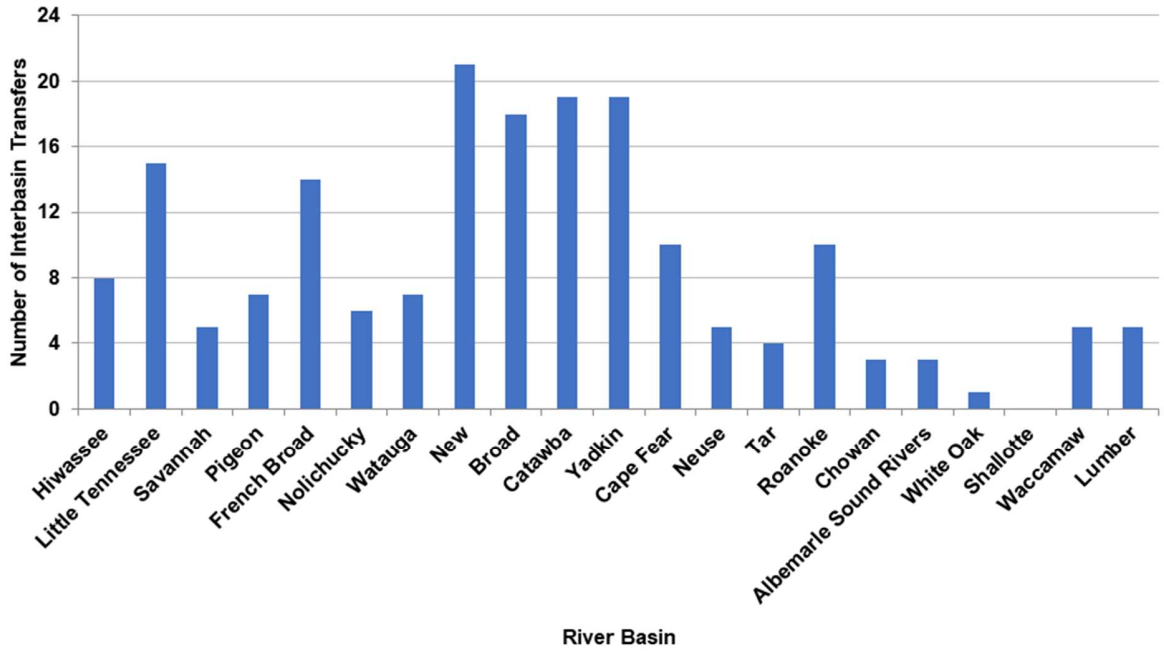


Figure 2. Number of interbasin indigenous transfers within each river basin.

Indigenous and Nonindigenous Species Introductions Occurring in North Carolina since Menhinick (1991)

Approximately 20% (54 species) of North Carolina's indigenous and nonindigenous fauna have been introduced into other North Carolina river basins since the *Freshwater Fishes of North Carolina* was published in 1991 (Table 6). Approximately one-half of these introductions involved game and sportfish (Ictaluridae, Salmonidae, Centrarchidae, Moronidae, Freshwater Drum, *Aplodinotus grunniens*, Yellow Perch, *Perca flavescens*, and Chain Pickerel) and about one-third of these introductions involved bait or forage fish (Clupeidae and Leuciscidae). The two most-widely introduced species were Fathead Minnow, *Pimephales promelas*, and Blue Catfish, *Ictalurus furcatus*, found in nine additional basins each since Menhinick (1991). The New and French Broad basins had the most introductions – 9 and 8 species, respectively.

Table 6. Species that have been introduced into other North Carolina river basins since Menhinick (1991) was published. *Nonindigenous.

Family, Scientific Name	Basins
Clupeidae	
Alosa aestivalis	Hiwassee, Little Tennessee, Savannah, Catawba
Alosa pseudoharengus	Catawba
*Dorosoma petenense**	Shallotte, White Oak, Tar, Chowan, Albemarle Sound Rivers
Cyprinidae	
*Carassius auratus**	Cape Fear
Xenocyprididae	
*Ctenopharyngodon idella**	Pigeon
Leuciscidae	
Chrosomus oreas	Little Tennessee, Watauga, Catawba, Cape Fear
Clinostomus funduloides	Little Tennessee, French Broad
Cyprinella chloristia	Yadkin
Cyprinella galactura	New
*Cyprinella lutrensis**	Cape Fear
Hybopsis hypsinotus	New
Luxilus coccogenis	Yadkin
Lythrurus ardens	Yadkin
Nocomis leptocephalus	French Broad, Nolichucky
Notemigonus crysoleucas	Nolichucky
*Pimephales promelas**	Hiwassee, Little Tennessee, Pigeon, Nolichucky, Broad, Yadkin, Cape Fear, New, Tar
Catostomidae	
Catostomus commersonii	Cape Fear, Neuse
Erimyzon oblongus	French Broad
Hypentelium roanokense	Yadkin
Cobitidae	
*Misgurnus anguillicaudatus**	Cape Fear
Ictaluridae	
Ameiurus brunneus	Hiwassee, Little Tennessee, French Broad
Ameiurus catus	New
Ameiurus natalis	Hiwassee
Ameiurus nebulosus	Hiwassee, Watauga, New
Ameiurus platycephalus	French Broad, Pigeon, Watauga
*Ictalurus furcatus**	Lumber, Waccamaw, Shallotte, White Oak, Neuse, Tar, Roanoke, Chowan, Albemarle Sound
Ictalurus punctatus	Lumber, Waccamaw
Noturus insignis	New
Pylodictis olivaris	Lumber, Waccamaw, White Oak, Neuse, Tar, Roanoke, Broad
Loricariidae	
*Pterygoplichthys pardalis**	French Broad
Esocidae	
Esox niger	French Broad

Table 6. (continued).

Family, Scientific Name	Basins
Salmonidae	
*Salmo trutta**	Roanoke
Salvelinus fontinalis	Roanoke
Atherinopsidae	
Menidia beryllina	Catawba
Fundulidae	
Fundulus heteroclitus	Waccamaw
Moronidae	
Morone americana	Broad
*Morone chrysops**	Neuse
Centrarchidae	
Ambloplites cavifrons	Yadkin
Ambloplites rupestris	Roanoke
*Lepomis cyanellus**	French Broad, Nolichucky, Watauga, New, Broad, Chowan, Albemarle Sound Rivers
Lepomis gulosus	Pigeon
*Lepomis microlophus**	New, Broad, Chowan, Albemarle Sound
Micropterus coosae	Hiwassee
*Micropterus henshalli**	Hiwassee, Catawba
Micropterus punctulatus	Broad, Roanoke, Lumber, Waccamaw
Micropterus sp. "Bartram's" Bass	Broad
Pomoxis annularis	Waccamaw, Chowan, Albemarle Sound Rivers
Pomoxis nigromaculatus	New
Percidae	
Etheostoma fusiforme	French Broad
Etheostoma rufilineatum	Little Tennessee
Perca flavescens	French Broad, New, Savannah
Sciaenidae	
Aplodinotus grunniens	Roanoke
Cichlidae	
*Oreochromis aureus**	Catawba
Gobiidae	
*Awaous banana**	Cape Fear, White Oak

Imperiled Species

Almost 30% (78 species) of North Carolina's freshwater fish fauna are Federally or State listed as either Endangered, Threatened, Special Concern, or Significantly Rare (North Carolina Administrative Code (NCAC) 2017; NCNHP 2018; NCWRC 2017; Table 7). The French Broad basin has the greatest number and percentage of imperiled species (27 and 27%, respectively) (Figure 3). There are no imperiled species in the Watauga basin.

Table 7. NCAC (2017), NCNHP (2018), and NCWRC (2017) listings of imperiled species in North Carolina. *Federally endangered. **Federally threatened.

Endangered	
*Acipenser brevirostrum**	*Noturus flavus*
*Acipenser oxyrinchus**	*Thoburnia hamiltoni*
Polyodon spathula	*Noturus gilberti*
Notropis bifrenatus	*Percina burtoni*
*Notropis mekistocholas**	*Percina oxyrhynchus*
Moxostoma robustum	*Percina rex**
Threatened	
Lampetra aepyptera	*Noturus furiosus*
*Cyprinella monacha***	*Menidia extensa***
Hybopsis rubrifrons	*Etheostoma acuticeps*
Notropis volucellus	*Etheostoma inscriptum*
Moxostoma ariommum	*Percina caprodes*
Moxostoma sp. "Carolina" Redhorse	*Etheostoma perlongum*
Moxostoma sp. "Sicklefin" Redhorse	*Elassoma boehlkei*
Special Concern	
Ichthyomyzon bdellium	*Noturus* sp. "Lake Waccamaw Broadtail" Madtom
Lethenteron appendix	*Noturus* sp. "Pee Dee Broadtail" Madtom
Acipenser fulvescens	*Fundulus waccamensis*
Hiodon tergisus	*Lucania goodei*
Clinostomus sp. "Hiwassee" Dace	*Heterandria formosa*
Clinostomus sp. "Smoky" Dace	*Cottus caeruleomentum*
Cyprinella sp. "Thinlip" Chub	*Cottus carolinae*
Exoglossum maxillingua	*Etheostoma collis*
Luxilus chrysocephalus	*Etheostoma jessiae*
Notropis lutipinnis	*Etheostoma mariae*
Phenacobius teretulus	*Etheostoma simoterum*
Semotilus lumbee	*Etheostoma vulneratum*
Carpiodes carpio	*Percina squamata*
Carpiodes sp. "Atlantic" Highfin Carpsucker	*Percina westfalli*
Noturus eleutherus	*Percina williamsi*
Noturus sp. "Cape Fear Broadtail" Madtom	*Aplodinotus grunniens*
Significantly Rare	
Erimystax insignis	*Fundulus* sp. "Lake Phelps" Killifish
Exoglossum laurae	*Ambloplites cavifrons*
Notropis chalybaeus	*Enneacanthus chaetodon*
Notropis micropteryx	*Enneacanthus obesus*
Notropis sp. "Kanawha" Rosyface Shiner	*Micropterus* sp. "Bartram's" Bass
Carpiodes cyprinus	*Etheostoma kanawhae*
Carpiodes sp. "Carolina" Quillback	*Etheostoma podostemone*
Ictiobus bubalus	*Etheostoma thalassinum*
Ictiobus niger	*Percina gymnocephala*
Moxostoma breviceps	*Sander canadensis*

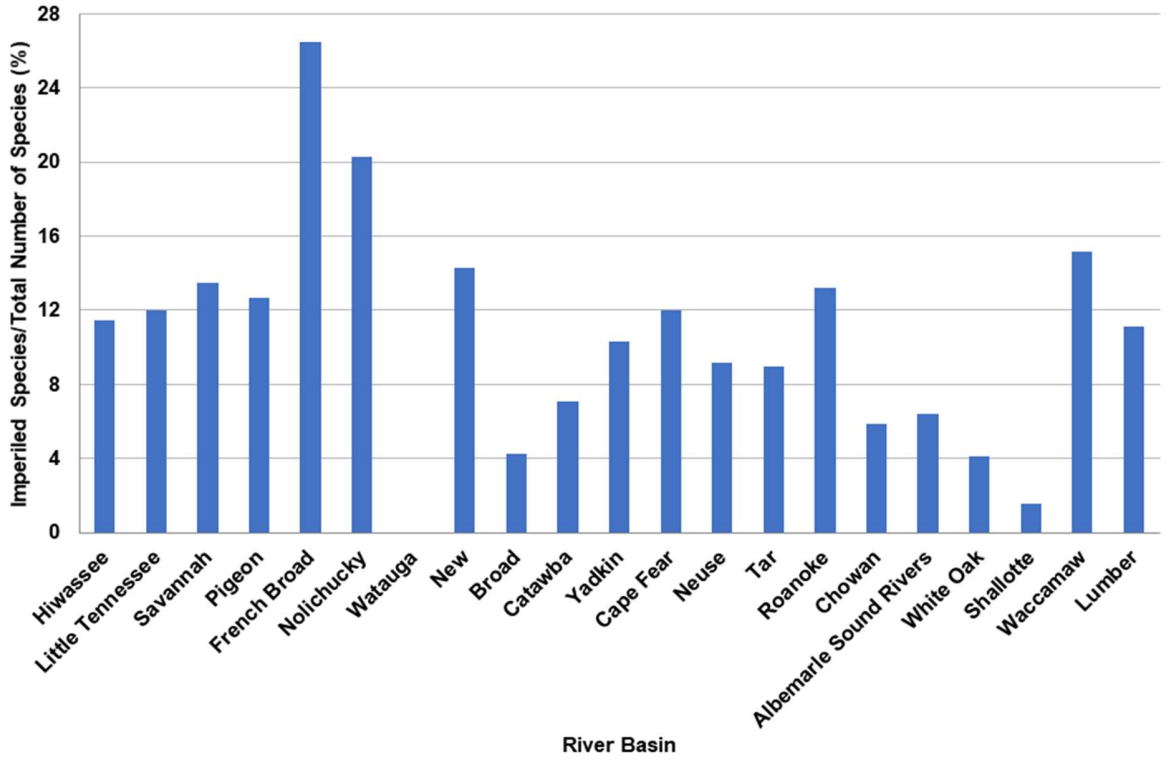


Figure 3. Imperiled species as a percentage of the total number of species within each river basin.

Extirpated Species

Three species have long been considered extirpated from North Carolina's waters and all were originally found in the French Broad River or its tributaries: Paddlefish, Blueside Darter, and Sickle Darter (Table 3) (Burr 1997a; Etnier 1997a; Etnier 1997b; Rohde et al. 1998). Paddlefish was first and only reported from the French Broad River at Asheville (Cope 1870a). Blueside Darter was last collected in 1950 by J. R. Bailey and crew from the Mills River, a tributary to the French Broad River. The sole specimen of Sickle Darter from North Carolina was collected by Edward C. Raney, Ernest A. Lachner, and James Kezer in April 1940 and has not been seen since. Six species, previously thought of as being extirpated from North Carolina, have recently been discovered or have been reintroduced: Lake Sturgeon (reintroduced), Bridle Shiner, *Notropis bifrenatus*, Rustyside Sucker, *Thoburnia hamiltoni*, Mountain Madtom, *Noturus eleutherus*, Banded Sculpin, *Cottus carolinae*, and Snubnose Darter, *Etheostoma simoterum* (Table 3). However, there are also several species, which may be perilously close to extirpation because their presence has not been documented for many years (e.g., "Atlantic" Highfin Carpsucker (1997)) or because their populations have declined precipitously (e.g., Carolina Madtom, *Noturus furiosus*).

Distribution of Species

The most widely distributed species, found in all 21 river basins, are: Common Carp, Golden Shiner, *Notemigonus crysoleucas*, Redbreast Sunfish, *Lepomis auritus*, Bluegill, *L. macrochirus*, and Largemouth Bass, *Micropterus salmoides* (Table 3). Conversely, there are 44 species, which are found in only one basin (Table 3) of which 13 species are Leuciscidae and 12 are Percidae. Thirty-four of these restricted-distribution species are also listed as imperiled (Table 7). No species are restricted solely to the Pigeon, Watauga, Yadkin, Shallotte, White Oak, Neuse, Tar, or Chowan

basins. There are more species restricted to the French Broad (n=11) than any other basin (Table 3).

Species Reintroduced, Rediscovered, or Discovered for the First Time in North Carolina Since Menhinick (1991)

Seventeen species have been either reintroduced, rediscovered, or discovered for the first time in North Carolina since Menhinick (1991): Lake Sturgeon (French Broad), Bridle Shiner (Neuse and Chowan), Black Buffalo (French Broad), Robust Redhorse, *Moxostoma robustum* (Yadkin), "Carolina" Redhorse (Yadkin and Cape Fear), "Sicklefin" Redhorse (Hiwassee and Little Tennessee), Mountain Madtom (French Broad), Golden Topminnow, *Fundulus chrysotus* (Waccamaw), Western Mosquitofish, *Gambusia affinis* (Hiwassee and Little Tennessee), Brook Silverside, *Labidesthes sicculus* (French Broad), Southern Brook Silverside (Yadkin, Lumber, Waccamaw, and Cape Fear), Banded Sculpin (Pigeon and French Broad), Redeye Bass, *Micropterus coosae* (Hiwassee), Alabama Bass (Hiwassee and Catawba), *Micropterus* sp. "Bartram's" Bass, (Savannah and Broad), Snubnose Darter (French Broad), Roanoke Logperch, *Percina rex* (Roanoke), and Westfall's Darter *(*Savannah).

Reintroductions and translocations of species into their native ranges as a result of improved water quality, implementation of instream flows, and passage above hydroelectric projects have taken place on several rivers. For example, Bigeye Chub, *Hybopsis amblops*, Striped Shiner, *Luxilus chrysocephalus*, Tennessee Shiner, *Notropis leuciodus*, Highland Shiner, Silver Shiner, *N. photogenis*, Saffron Shiner, *N. rubricroceus*, Mirror Shiner, *N. spectrunculus,* Telescope Shiner, *N. telescopus*, Smallmouth Redhorse, River Redhorse, *M. carinatum,* Golden Redhorse, *M. erythrurum*, Fantail Darter, *Etheostoma flabellare*, Swannanoa Darter, *E. swannanoa,* Banded Darter, *E. zonale,* and Gilt Darter, *Percina evides*, were reintroduced into the Pigeon basin during 2000-2010s following a long history of degraded water quality, which has recently greatly improved (S. J. Fraley, formerly NCWRC and Joyce Coombs, retired, UT-Knoxville, pers. comm. and B. H. Tracy, pers. obs.). Another project, also resulting from improved water quality in the Pigeon basin, was conducted within the Richland Creek watershed from 2010-2014, which re-introduced 10 species: Warpaint Shiner, River Chub, *Nocomis micropogon*, Saffron Shiner, Mirror Shiner, Tennessee Shiner, Rock Bass, *Ambloplites rupestris*, Mottled Sculpin, *Cottus bairdii,* Greenfin Darter, *Etheostoma chlorobranchium*, Tuckasegee Darter, and Fantail Darter (Tracy 2014b). In the Cheoah River (Little Tennessee basin) Spotfin Chub, *Cyprinella monacha,* Mottled Sculpin, Wounded Darter, *Etheostoma vulneratum,* Gilt Darter, and Blotchside Logperch, *Percina burtoni*, have been reintroduced into the historically dewatered section of the Cheoah River as a result of implementation of Federal Energy Regulatory Commission's mandated instream flows downstream from Santeetlah Lake (L. Etchison, NCWRC, pers. comm.). In the Roanoke basin American Eel, *Anguilla rostrata*, are being relocated from the Roanoke River to upstream of the Roanoke Rapids Dam and Gaston Dam as a result of Federal Energy Regulatory Commission's relicensing of the Dominion Energy hydroelectric facilities at Roanoke Rapids (F. C. Rohde, pers. obs.). In the Cape Fear basin, populations of the Cape Fear Shiner, *Notropis mekistocholas*, were relocated/augmented from the Deep River to the lower Rocky River from 2013-2016. With the removal of the Hoosier Dam, fish now have unrestricted access throughout much of the middle and lower reaches of the Rocky River. Future augmentation plans will focus on historical localities in the Haw and upper Cape Fear rivers (B. Jones, NCWRC, pers. comm.).

Species Inter- and Intra-Basin Range Expansions and Contractions

Comparing the species range maps in Menhinick (1991) with those produced for this Atlas, 103 species (approximately 40% of the known fauna) have expanded or extended their inter- or intrabasin ranges (Table 8), either naturally, through introductions, through more focused surveys, using more effective collection techniques (i.e. boat and backpack electrofishing), or through the discovery of recently databased specimens in museums (Frey 2009). Species whose ranges seemed to have contracted during this 29-year period include Ironcolor Shiner, *Notropis chalybaeus*, "Atlantic" Highfin Carpsucker, Carolina Madtom, "Cape Fear Broadtail" Madtom, and Blackbanded Sunfish, *Enneacanthus chaetodon.*

Table 8. Species that have expanded their ranges in North Carolina since Menhinick (1991).

Family, Scientific Name			
Petromyzontidae	*Notropis maculatus*	*Pylodictis olivaris*	*Lepomis microlophus*
Ichthyomyzon bdellium	*Notropis mekistocholas*	**Esocidae**	*Lepomis punctatus*
Lampetra aepyptera	*Notropis petersoni*	*Esox niger*	*Micropterus dolomieu*
Petromyzon marinus	*Notropis procne*	**Mugilidae**	*Micropterus henshalli*
Clupeidae	*Notropis rubricroceus*	*Dajaus monticola*	*Micropterus punctulatus*
Alosa aestivalis	*Notropis telescopus*	**Atherinopsidae**	*Micropterus* sp. "Bartram's" Bass
Alosa pseudoharengus	*Notropis volucellus*	*Labidesthes sicculus*	*Pomoxis annularis*
Dorosoma petenense	*Pimephales notatus*	*Labidesthes vanhyningi*	*Pomoxis nigromaculatus*
Cyprinidae	*Pimephales promelas*	**Fundulidae**	**Percidae**
Carassius auratus	*Semotilus atromaculatus*	*Fundulus chrysotus*	*Etheostoma flabellare*
Xenocyprididae	**Catostomidae**	*Fundulus heteroclitus*	*Etheostoma fusiforme*
Ctenopharyngodon idella	*Carpiodes cyprinus*	*Fundulus lineolatus*	*Etheostoma rufilineatum*
Leuciscidae	*Catostomus commersonii*	*Fundulus rathbuni*	*Etheostoma simoterum*
Campostoma anomalum	*Erimyzon oblongus*	*Fundulus* sp. "Lake Phelps" Killifish	*Perca flavescens*
Chrosomus oreas	*Hypentelium nigricans*	**Poeciliidae**	*Percina caprodes*
Cyprinella galactura	*H. roanokense*	*Gambusia affinis*	*Percina rex*
Cyprinella lutrensis	*Ictiobus bubalus*	*Heterandria formosa*	*Percina roanoka*
Cyprinella spiloptera	*Ictiobus niger*	**Gasterosteidae**	*Percina squamata*
Clinostomus funduloides	*Minytrema melanops*	*Apeltes quadracus*	*Percina westfalli*
Exoglossum maxillingua	*Moxostoma anisurum*	**Cottidae**	*Sander vitreus*
Hybopsis hypsinotus	*Moxostoma collapsum*	*Cottus carolinae*	**Sciaenidae**
Luxilus cerasinus	*Moxostoma duquesnei*	**Moronidae**	*Aplodinotus grunniens*
Luxilus chrysocephalus	*Moxostoma rupiscartes*	*Morone americana*	**Eleotridae**
Luxilus coccogenis	**Ictaluridae**	*Morone chrysops*	*Eleotris amblyopsis*
Lythrurus ardens	*Ameiurus brunneus*	**Centrarchidae**	**Elassomatidae**
Nocomis leptocephalus	*Ameiurus catus*	*Ambloplites cavifrons*	*Elassoma zonatum*
Nocomis micropogon	*Ameiurus nebulosus*	*Ambloplites rupestris*	**Cichlidae**
Notropis altipinnis	*Ameiurus platycephalus*	*Enneacanthus chaetodon*	*Oreochromis aureus*
Notropis amoenus	*Ictalurus furcatus*	*Lepomis cyanellus*	
Notropis bifrenatus	*Ictalurus punctatus*	*Lepomis gibbosus*	
Notropis chiliticus	*Noturus eleutherus*	*Lepomis gulosus*	
Notropis lutipinnis	*Noturus insignis*	*Lepomis marginatus*	

Geographically and Hydrologically Endemic Species

In this publication, indigenous endemic species can be further characterized as being a geographic endemic or hydrologic endemic. Geographically as an indigenous species occurring solely in North Carolina or occurring in North Carolina and one other adjacent state. Hydrologically as an indigenous species restricted to one drainage (basin). According to these definitions, there are 37 geographic endemic species (Table 9) of which 22 are listed as imperiled (Table 7). The Roanoke basin has the greatest number of geographic endemic species (13). There are no geographic endemic species found in the French Broad, Nolichucky, Watauga, Savannah, Shallotte, and White Oak basins. The families containing the highest number of geographic endemic species are Leuciscidae (11) and Percidae (10).

In the case of hydrological endemism, there are 18 species (Table 9), plus Golden Topminnow, which occurs only in the Waccamaw basin in North Carolina and in multiple states. Eleven of these hydrologic endemic species are also listed as imperiled (Table 9). The families containing the highest number of hydrologic endemic species are Leuciscidae, Ictaluridae, and Percidae with four species each. There are four species found only in one North Carolina river basin and nowhere else in the world: Cape Fear Shiner, “Lake Waccamaw Broadtail” Madtom, “Cape Fear River Broadtail” Madtom, and *Fundulus* sp. “Lake Phelps” Killifish. Each of these species is listed as imperiled.

Table 9. North Carolina’s geographically and hydrologically endemic species. *Hydrologic endemics.

Family, Scientific Name	
Leuciscidae	**Atherinopsidae**
Clinostomus sp. "Hiwassee" Dace*	*Menidia extensa**
Cyprinella pyrrhomelas	**Fundulidae**
Cyprinella zanema	*Fundulus rathbuni*
Cyprinella sp. "Thinlip" Chub	*Fundulus waccamensis**
Luxilus cerasinus	*Fundulus* sp. "Lake Phelps" Killifish*
Lythrurus matutinus	**Centrarchidae**
Nocomis raneyi	*Ambloplites cavifrons*
*Notropis chlorocephalus**	**Percidae**
*Notropis mekistocholas**	*Etheostoma brevispinum*
Notropis sp. "Piedmont" Shiner*	*Etheostoma gutselli*
Semotilus lumbee	*Etheostoma kanawhae**
Catostomidae	*Etheostoma mariae**
Hypentelium roanokense	*Etheostoma perlongum**
*Moxostoma ariommum**	*Etheostoma podostemone**
Moxostoma cervinum	*Etheostoma thalassinum*
Moxostoma sp. "Carolina" Redhorse	*Percina nevisense*
*Thoburnia hamiltoni**	*Percina rex**
Ictaluridae	*Percina roanoka*
Noturus furiosus	**Elassomatidae**
*Noturus gilberti**	*Elassoma boehlkei**
Noturus sp. "Cape Fear Broadtail" Madtom*	
Noturus sp. "Lake Waccamaw Broadtail" Madtom	
Noturus sp. "Pee Dee Broadtail" Madtom*	

Annotations

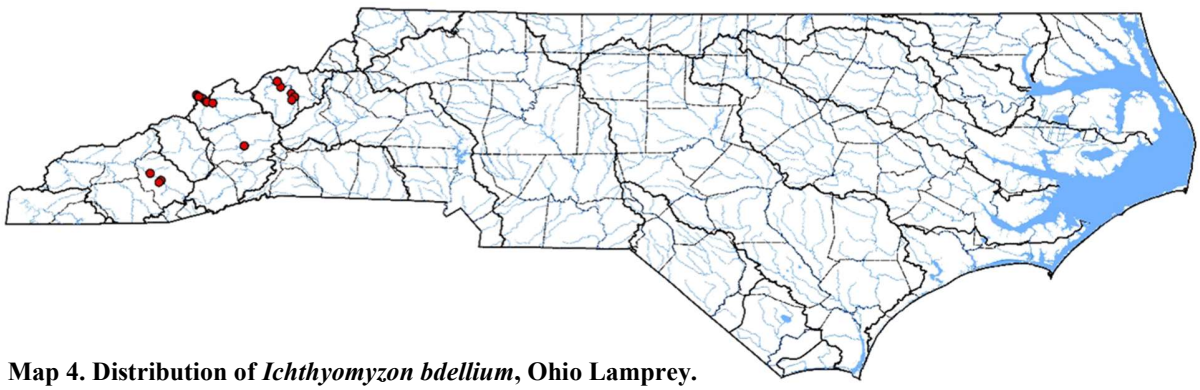
Petromyzontidae - Lampreys

***Ichthyomyzon bdellium* (Jordan, 1855). Ohio Lamprey.**

Ohio Lamprey is at the southeastern limit of its range in North Carolina (Rohde and Lanteigne-Courchene 1980a; Renaud 2011). Ohio Lamprey was first vouchered from the state in 1994 from Spring Creek, a tributary to the French Broad River, at Hot Springs, Madison County (Rohde et al. 1998). Since 1994, specimens have been vouchered at museums from larger creeks and rivers in the Nolichucky basin (1997-two locations on the North Toe River, Yancey County; 1997 and 2012-Pigeonroost Creek, Mitchell County; 2007-South Toe River, Yancey County); in the French Broad basin (1997-Swannanoa River, Buncombe County; between 2001 and 2016-regularly found at several localities on the French Broad and Ivy rivers and Spring and Big Laurel creeks, Madison County); and in the Little Tennessee basin in Jackson County (2009-Cullowhee Creek, a tributary to the Tuckasegee River; 2018-from mainstem of the Tuckasegee River) (Map 4).

Remarks: Where their distributions are sympatric, adult Ohio Lamprey may be easily separated from adult Mountain Brook Lamprey, *Ichthyomyzon greeleyi*. However, the ammocoetes (larvae) cannot be easily separated, contrary to Lanteigne (1988) and Renaud (2011) (Jenkins and Burkhead 1994; B. H. Tracy, pers. obs.). Hubbs and Trautman (1937) commented on three ammocoetes, initially identified as Ohio Lamprey, collected by James S. Gutsell in August 1930 from the Tuckasegee River near Cullowhee (Jackson County, Little Tennessee basin, USNM 92527) (Hildebrand 1932) as "*possibly not of this species.*" If the specimens were Ohio Lamprey, then they represent the first collection from North Carolina and the only known collection of Ohio Lamprey from this basin, until recently. If they were instead Mountain Brook Lamprey, they would represent the first collection in North Carolina of this more widely distributed species.

Status: State Special Concern.

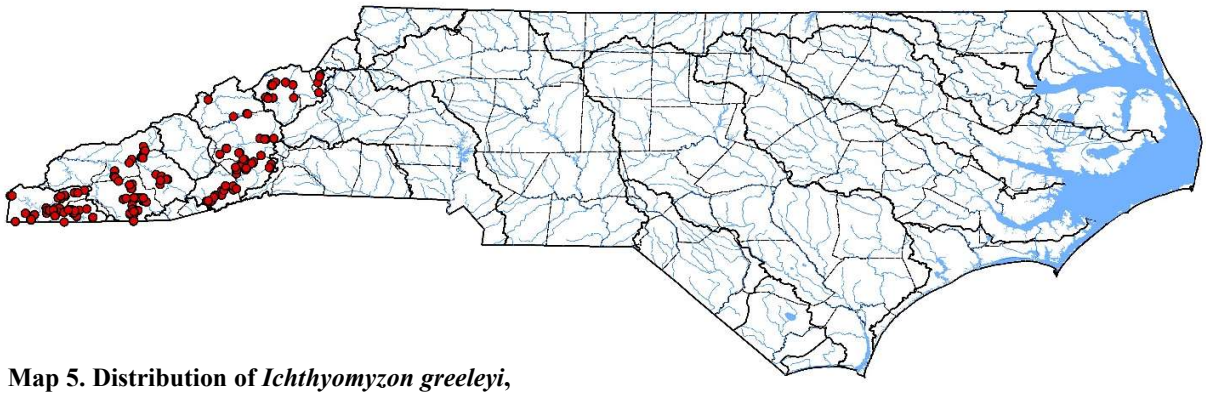


Map 4. Distribution of *Ichthyomyzon bdellium*, Ohio Lamprey.

***Ichthyomyzon greeleyi* Hubbs and Trautman, 1937. Mountain Brook Lamprey.**

Mountain Brook Lamprey is at the southeastern limit of its range in North Carolina (Rohde and Lanteigne-Courchene 1980b; Renaud 2011). Mountain Brook Lamprey occurs throughout the Nolichucky, French Broad, Little Tennessee, and Hiwassee basins; it is absent from the New, Watauga, and Pigeon basins (Map 5).

Remarks: See Ohio Lamprey for discussion of sympatric distribution. The first North Carolina record of Mountain Brook Lamprey was from the Oconaluftee River, Little Tennessee basin in 1937 (UMMZ 129556), when it was described as *Ichthyomyzon hubbsi* (Raney 1952).



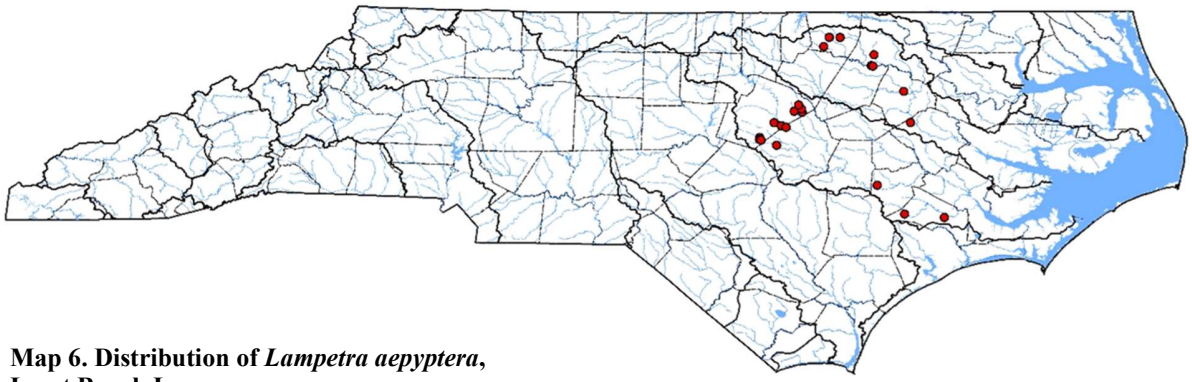
Map 5. Distribution of *Ichthyomyzon greeleyi*, Mountain Brook Lamprey.

***Lampetra aepyptera* (Abbott, 1860). Least Brook Lamprey.**

Least Brook Lamprey was first collected in North Carolina in 1940 (CUMV 8529, Raney 1941a). It is known from the Neuse and Tar basins (Map 6), where it is at the eastern edge of its range (Rohde and Jenkins 1980; Renaud 2011).

Remarks: There are two specimens (NCSM 63920, RGA-95-23) supposedly from the Dan River (Roanoke basin), but the field notes from Rudolf G. Arndt make no mention of lampreys being collected and there are no records of this species in the Roanoke basin in Virginia (Jenkins and Burkhead 1994). Therefore, this record is questionable, and the locale is not mapped nor tabulated in Table 3.

Status: State Threatened.



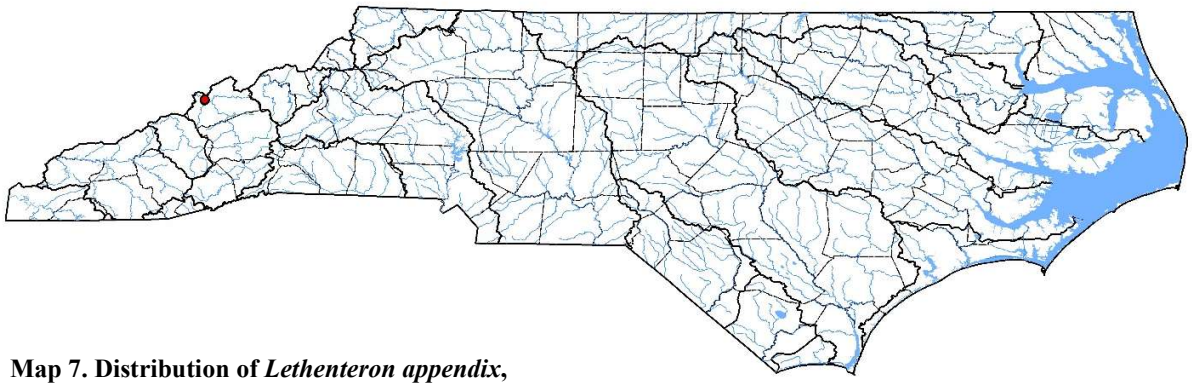
Map 6. Distribution of *Lampetra aepyptera*, Least Brook Lamprey.

***Lethenteron appendix* (DeKay, 1842). American Brook Lamprey.**

American Brook Lamprey is restricted to Spring Creek (French Broad basin) (Map 7), which is currently the southeastern limit of its range (Rohde 1980a; Rohde et al. 1998; Renaud 2011; Tracy 2014a).

Remarks: In August 1977, the first three specimens of this species were collected in the French Broad River at the mouth of Spring Creek in Hot Springs, Madison County (NCSM 7783). Since then it has only been collected in Spring Creek in 1980 (n=29), 1983 (n=3), 1994 (n=1), 1995 (n=3), 2001 (n=2), and 2009 (n=3) (NCSM data). Listed in Menhinick (1991) as *Lampetra appendix*.

Status: State Special Concern.

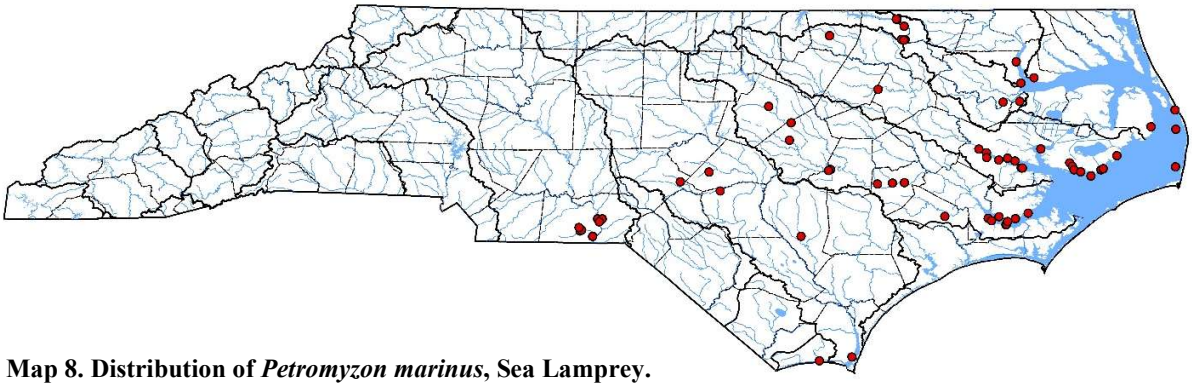


Map 7. Distribution of *Lethenteron appendix*, American Brook Lamprey.

***Petromyzon marinus* Linnaeus, 1758. Sea Lamprey.**

Sea Lamprey, an anadromous species, is widely distributed in the eastern part of the state and has been documented from the Albemarle, Chowan, Roanoke, Tar, Neuse, Cape Fear, Shallotte, and Yadkin basins, as well as, in the Atlantic Ocean (Rohde 1980b) (Map 8).

Remarks: Cope (1870a) reported *Petromyzon* from the Catawba basin, possibly as far upstream as at Morganton (Burke County), but there are no verifiable specimens to substantiate his claim. Nine Sea Lamprey specimens found in the NCSM collection were attached to either American Shad or Hickory Shad. A Hickory Shad caught by a fisherman on 26 February 2019 from the Cashie River at Windsor (Bertie County, Chowan basin) also hosted a juvenile Sea Lamprey (Wilson Laney, retired, and Jean Richter, U.S. Fish & Wildlife Service (USFWS, pers. comm.).



Map 8. Distribution of *Petromyzon marinus*, Sea Lamprey.

Acipenseridae - Sturgeons

***Acipenser brevirostrum* Lesueur, 1818. Shortnose Sturgeon.**

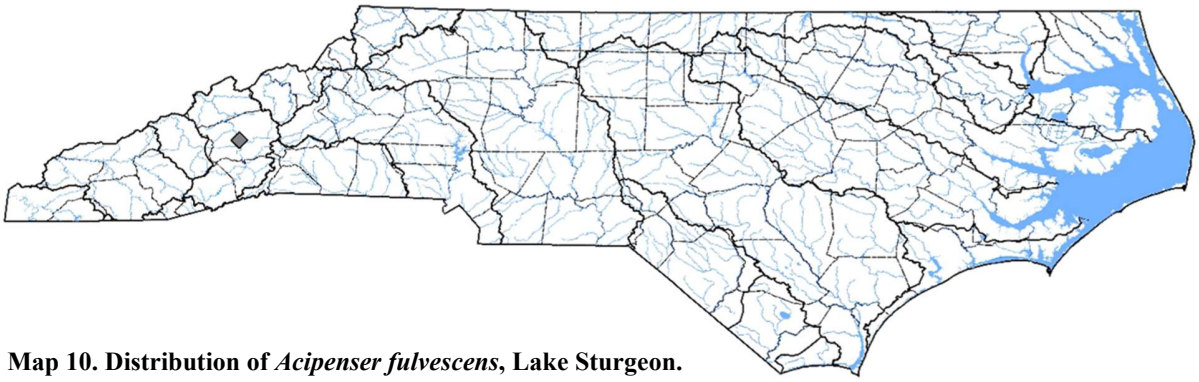
Shortnose Sturgeon, an anadromous species, has been widely reported from North Carolina (Gruchy and Parker 1980a). Unfortunately, most historical records (e.g., Menhinick 1991) cannot be validated and Ross et al. (1988) determined that the records were doubtful. For more than 100 years, the only valid historical record (USNM 64330) was caught in Salmon Creek, Bertie County (Chowan basin) in 1881 (Vladykov and Greeley 1963) (Map 9).

Remarks: In 1985 a gravid female was caught in the Pee Dee River (Yadkin basin) downstream from the US 74 bridge (Ross et al. 1988) and discovered mounted at a bait shop adjacent to the Pee Dee River (NCSM 13789). None have since been detected in the North Carolina portion of

the Pee Dee River, but the South Carolina Department of Natural Resources (SCDNR) tracked several in 2002-03 to within 5.6 kilometers of the state line (William Post, SCDNR, pers. comm.). What was thought to be the first verifiable record from the Cape Fear River was caught by a commercial fisherman in 1987 (NCSM 13827), but a specimen mis-identified as an Atlantic Sturgeon, *Acipenser oxyrinchus*, and later verified to be a Shortnose Sturgeon, had been captured in a gill net in the lower Cape Fear River in 1978 (NCSM 28520). Other records include an adult captured in Albemarle Sound in 1998 (NCSM 27062), and another near the mouth of the Chowan River, downstream from Salmon Creek in 2016 (Michael Loeffler, NCDMF, pers. comm.).
Status: Federally Endangered.

Map 9. Distribution of *Acipenser brevirostrum*, Shortnose Sturgeon.

***Acipenser fulvescens* Rafinesque, 1817. Lake Sturgeon.**
Until recently, Lake Sturgeon was considered extirpated from the state (NCNHP 2018) where the species is at the southeastern edge of its range (Gruchy and Parker 1980b). Since 2015, more than 24,000 young juvenile Lake Sturgeon have been released into the French Broad River upstream of Hot Springs as part of a re-introduction effort in the Tennessee River drainage (Lucas Etchison, NCWRC, pers. comm.; Leventhal 2019) (Map 10).
Remarks: The first possible record of this species in North Carolina was published in the Asheville Daily Gazette (Anon 1901). The newspaper reported: "*Some years ago, a 60 pound (27.2 kilogram) sturgeon was caught in a trap in the French Broad River a few miles below Asheville and when brought to town by the astonished captor proved no less an astonishment to the inhabitants.*" The second record of Lake Sturgeon was also from the French Broad River in 1945 (Brimley 1946; Menhinick 1986; Menhinick 1997). However, the eight specimens, all caught by a fisherman, were not vouchered and C.S. Brimley never saw the specimens. Brimley (1946) even speculated that it was possible that the specimens were Shovelnose Sturgeon, *Scaphirhynchus platorynchus,* on account of the flattened snout, which was how the fish was described to him. Historically, the Shovelnose Sturgeon was also found in the upper Tennessee River drainage (Lee 1980a; Etnier and Starnes 1993).
Status: State Special Concern.



Map 10. Distribution of *Acipenser fulvescens*, Lake Sturgeon.

***Acipenser oxyrinchus* Mitchill, 1815. Atlantic Sturgeon.**

Atlantic Sturgeon, an anadromous species, is found in all the major rivers from the Chowan to the Yadkin basin, except in the Lumber, Waccamaw, and Shallotte basins. It is also found in the sounds and Atlantic Ocean (Gruchy and Parker 1980c; Tracy 2014a) (Map 11).

Remarks: There is an anecdotal record from 1882 of the capture of a 201 kilogram specimen from the Haw River, Chatham County (Cape Fear basin). It is possible that Atlantic Sturgeon historically may also have migrated and spawned up into the Fall Zone in the Cape Fear, Catawba, and Broad basins. In the Roanoke basin, there are recent records from the Roanoke River as far upstream as Weldon, in the Chowan basin beyond NC 11 in Potecasi Creek, in the Tar basin from the Tar River near Tarboro, and in the Neuse basin from the Neuse River at Goldsboro and Smithfield (B. Ricks, NCWRC, pers. comm.). At least two large Atlantic Sturgeon were caught in the North Carolina portion of the Pee Dee River (Yadkin) in the early 1950s and a large adult, perhaps a fall spawning migrant, was detected at Blewett Falls Dam near Rockingham in mid-September 2018 by SCDNR (William Post, SCDNR, pers. comm.). Listed in Menhinick (1991) as *Acipenser oxyrhynchus*.

Status: Federally Endangered.

Map 11. Distribution of *Acipenser oxyrinchus*, Atlantic Sturgeon.

Polyodontidae - Paddlefishes

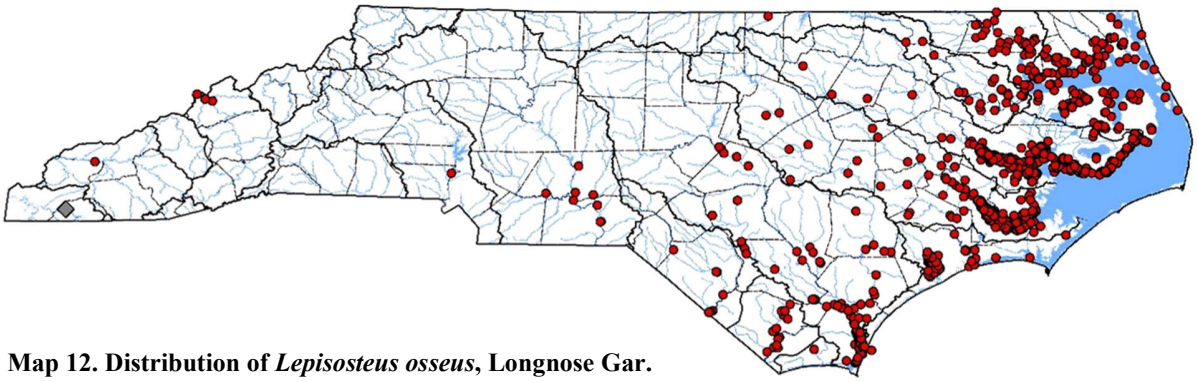
***Polyodon spathula* (Walbaum, 1792). Paddlefish.**

Paddlefish is known anecdotally and historically only from the French Broad River (Cope 1870a).

Remarks: Paddlefish is now presumed to be extirpated from North Carolina (Rohde et al. 1998). Smith (1907) writes "*The claim of this species to a place in the North Carolina fauna rests on*

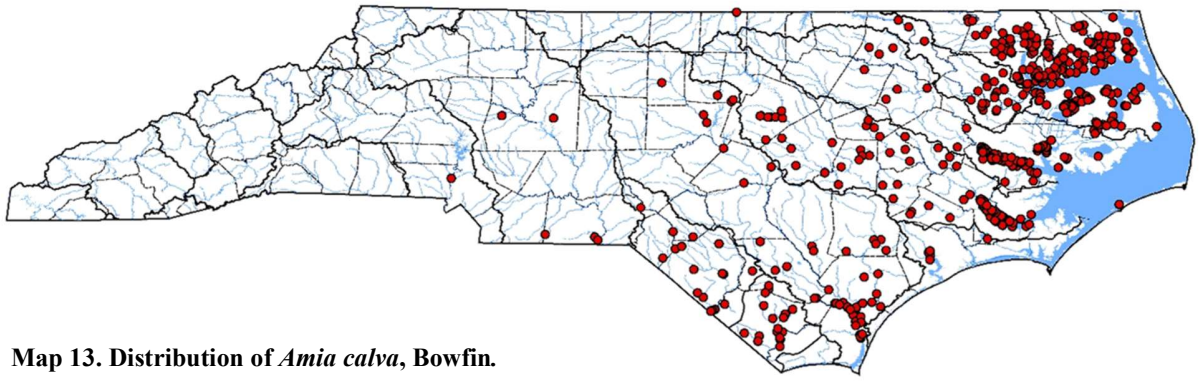
Professor Cope's statement that it ascends the French Broad River to near Asheville." One anecdotal report, attributed to a fisherman, claimed to have caught one on 10 October 1983, but the catch was not verified (Gengerke 1986). North Carolina is on the eastern edge of the Paddlefish's range (Burr 1980), and it would have been rare in the state if it ever occurred.
Status: State Endangered.

Lepisosteidae - Gars
***Lepisosteus osseus* (Linnaeus, 1758). Longnose Gar.**
Longnose Gar is widely distributed in large creeks, rivers, reservoirs, and sounds, primarily in the Coastal Plain, from the Albemarle to the Catawba basins. It is also present in the French Broad, Little Tennessee, and Hiwassee basins (Wiley 1980a) (Map 12).



Map 12. Distribution of *Lepisosteus osseus*, Longnose Gar.

Amiidae – Bowfins
***Amia calva* Linnaeus, 1766. Bowfin.**
Bowfin is widely distributed throughout the Coastal Plain from the Albemarle to the Yadkin basins and in Piedmont rivers and reservoirs in the Roanoke, Tar, Neuse, Cape Fear, Yadkin, and Catawba basins (Burgess and Gilbert 1980) (Map 13).



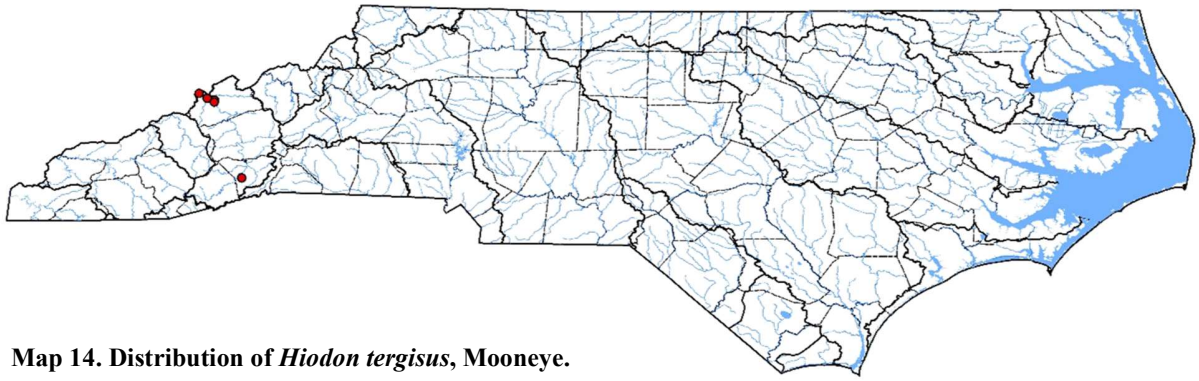
Map 13. Distribution of *Amia calva*, Bowfin.

Hiodontidae - Mooneyes

***Hiodon tergisus* Lesueur, 1818. Mooneye.**

Mooneye is at the eastern edge of its range in North Carolina (Gilbert 1980a). It is known only from the mainstem of the French Broad River where it was first collected in 1902 at Bowman's Bluff, Henderson County (USNM 50561; Smith 1907). Since then, it has only been found much further downstream in the French Broad River near Hot Springs in Madison County (Map 14).

Status: State Special Concern.



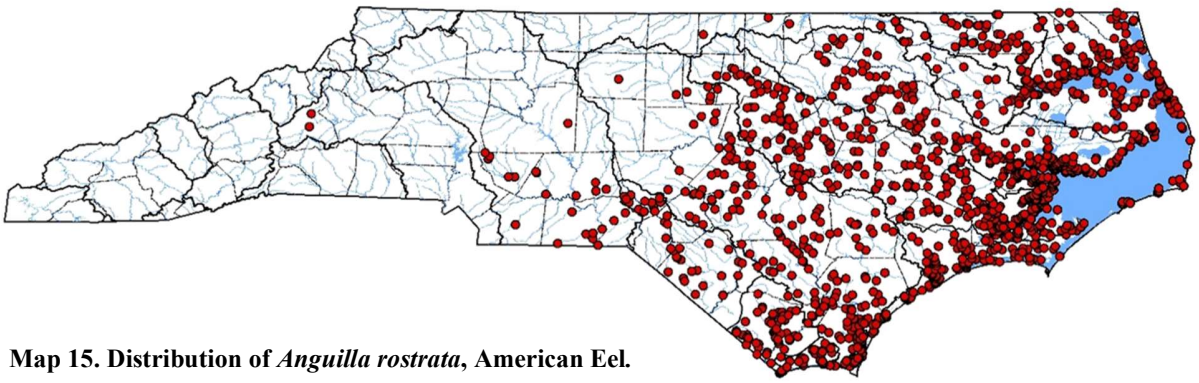
Map 14. Distribution of *Hiodon tergisus*, Mooneye.

Anguillidae - Freshwater Eels

***Anguilla rostrata* (Lesueur, 1817). American Eel.**

American Eel, a catadromous species, is abundant and widespread in the eastern half of North Carolina and is found in all the river basins from the Albemarle to the Catawba. While mostly distributed throughout the Coastal Plain, there are a number of records in the Piedmont from the Roanoke, Tar, Neuse, Cape Fear, and Yadkin basins and an anecdotal record as far upstream as Elk Creek in the Eastern Blue Ridge Foothills of the Yadkin basin (Bailey 1949) (Map 15).

Remarks: There is a disjunct record from Armstrong Creek in the upper Catawba basin from 1952, but its locality has been questioned (NCSM 41909, Specimen Remarks). In 1888, the species was documented in the Catawba River as far upstream as Marion by Jordan (1889a, CAS-SU 1285). Cope (1870a) also reported American Eel from the Catawba basin, possibly as far upstream as Morganton (Burke County), but there are no verifiable specimens to substantiate his claim. There is also a record of a single American Eel from the North Toe River near Toecane, Mitchell County (Nolichucky basin), collected by Tennessee Valley Authority (TVA) staff on 17 August 1999. This appears to have been a one-time occurrence of a bait-bucket introduction (D. Mathews, TVA, pers. comm.) and is not mapped or tabulated in Table 3.



Map 15. Distribution of *Anguilla rostrata*, American Eel.

Engraulidae - Anchovies

Anchoa mitchilli (Valenciennes, 1848). Bay Anchovy.

Bay Anchovy is a seasonal inhabitant in all coastal river basins as far upstream as near Lock and Dam No. 1 and Castle Hayne (Cape Fear basin), Jacksonville (White Oak basin), New Bern (Neuse basin), Williamston (Roanoke basin), and Cannon Ferry (Chowan basin) (Map 16).

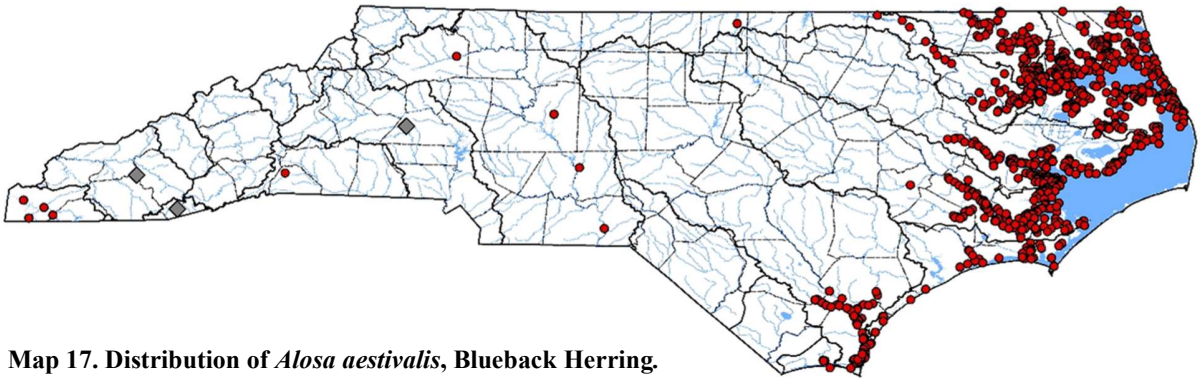
Map 16. Distribution of *Anchoa mitchilli*, Bay Anchovy.

Clupeidae - Herrings

Alosa aestivalis (Mitchill, 1814). Blueback Herring.

Blueback Herring is indigenous in the Atlantic Coast basins from the Albemarle to the Shallotte. It has not been found in the Waccamaw or Lumber basins. Landlocked populations, introduced as forage fish (Fuller et al. 2016), exist in reservoirs in the Roanoke, Yadkin, Catawba, Broad, Savannah, Little Tennessee, and Hiwassee basins (Map 17).

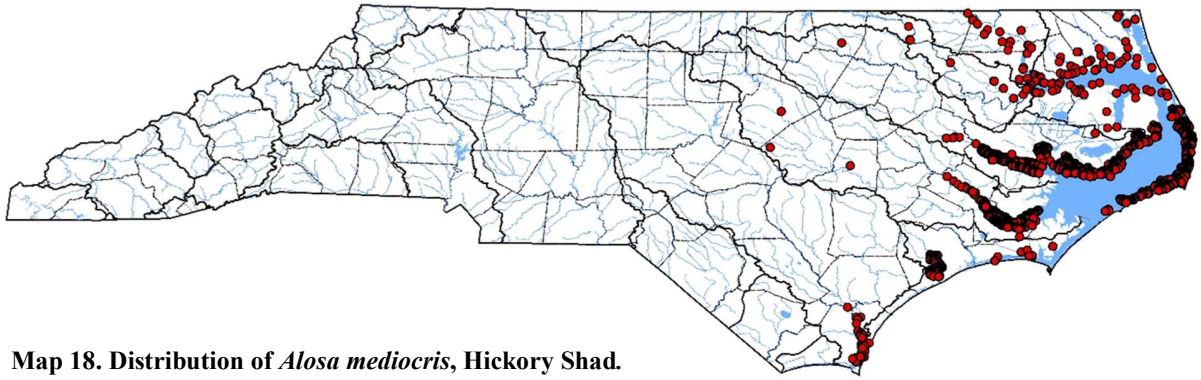
Remarks: Hasselman et al. (2014) showed that landlocked populations of Blueback Herring and Alewife, *Alosa pseudoharengus*, produced a hybrid swarm in John H. Kerr Reservoir (Roanoke River) since the two populations were isolated from their downstream riverine purebred populations by the construction of the dam in 1953. This has resulted in total hybridization between the two species in the reservoir. Evans et al. (2018) detected hybrids downstream of the reservoir, but could not prove that hybrids were escaping from the reservoir and moving downstream to the lower Roanoke River, that hybridization could be occurring naturally in the Roanoke River, or that hatcheries might unintentionally be stocking hybrids if broodfish were not identified correctly at the species level and subsequently spawned in a hatchery. Similar hybrid swarms may be expected to occur in the Catawba Chain-of-Lakes reservoirs where both introduced species are sympatric.



Map 17. Distribution of *Alosa aestivalis*, Blueback Herring.

***Alosa mediocris* (Mitchill, 1814). Hickory Shad.**

Hickory Shad has been documented from the Albemarle, Chowan, Roanoke, Tar, Neuse, White Oak, and Cape Fear basins. In the Yadkin basin, Hickory Shad are found near Cheraw, South Carolina, downstream of the North Carolina state line (Rohde et al. 2009; Justin Dycus, Duke Energy, pers. comm.). In the Neuse, the species has been documented as far upstream as Milburnie, near Raleigh (NCSM 59969) (Map 18).

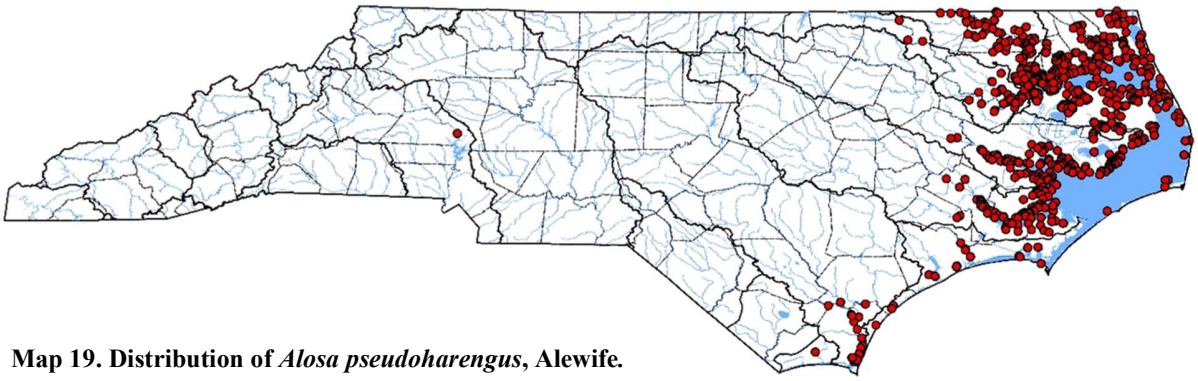


Map 18. Distribution of *Alosa mediocris*, Hickory Shad.

***Alosa pseudoharengus* (Wilson, 1811). Alewife.**

Alewife is at the southeastern limit of its range in North Carolina (Burgess 1980a). While it has been reported from all the Atlantic Coast basins from the Albemarle to the Shallotte, it is uncommon outside the Albemarle, Chowan, and Roanoke basins. Most records, especially those south of the Neuse basin, are pre-1980. The furthest points upstream that Alewife have been found are as follows: Pasquotank River (Albemarle basin) at South Mills; Meherrin River (Chowan basin)-NC 35, and Chowan River at Wyanoke; Tar River past Grimesland; Neuse River at Fort Barnwell; and Northeast Cape Fear River (Cape Fear basin) at Smith Creek (Map 19).

Remarks: Alewife was introduced as forage fish in Lake Norman (Catawba basin), presumably by fishermen, and was first detected there in 1999 (FERC 2009). In March 2020, Alewife was documented in the Neuse basin as far upstream as Contentnea Creek, near Stantonsburg, Wilson County (B. Ricks, NCWRC, pers. comm.). See Blueback Herring for discussion on hybridization with Alewife.

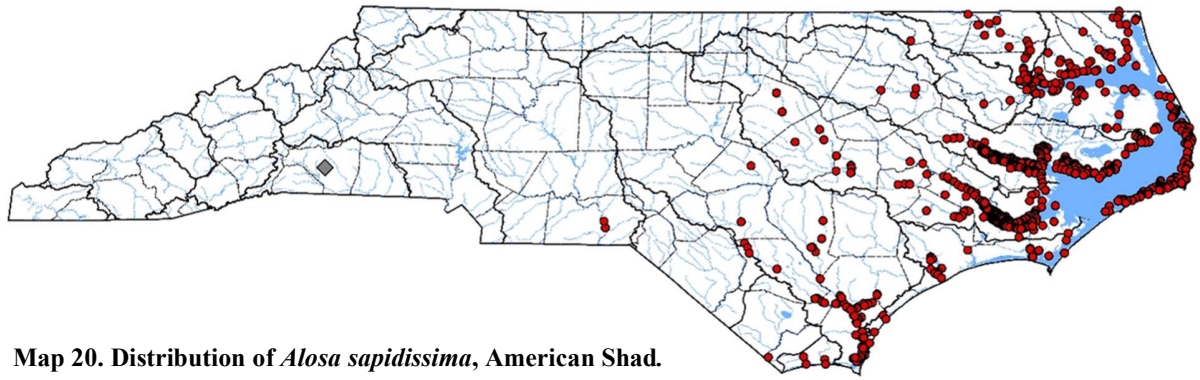


Map 19. Distribution of *Alosa pseudoharengus*, Alewife.

***Alosa sapidissima* (Wilson, 1811). American Shad.**

American Shad is present in all the Atlantic Coast basins from the Albemarle to the Yadkin but is not found in the Lumber basin. They are often found as far upstream as the first dams at the Fall Zone (Map 20). For example, it is present in the Pee Dee River upstream to Blewett Falls Dam (Yadkin) and in the Neuse River at the base of Falls Dam (Neuse).

Remarks: As part of the Federal Energy Regulatory Commission's relicensing of the Duke Energy hydroelectric facility at the Blewett Falls Dam, American Shad were to be moved above that dam beginning in 2018 (Michael Abney, Duke Energy, pers. comm.). Coxe (1884) and Stevenson (1899) noted runs of shad in the Broad River up to the confluence with the Green River (Polk-Rutherford counties) and up to Hickory Nut Gap (Henderson-Rutherford counties). However, shad have not been observed in the Broad basin in North Carolina since at least 1914, when the Parr Shoals Dam was built on the Broad River above Columbia, South Carolina. Concerning the historical occurrence of American Shad in the Waccamaw River, Stevenson (1899) remarked: "… *and a few are sometimes taken even beyond the North Carolina line, over 100 miles from Georgetown by the river course*." In April 2018, the first Alosine, an American Shad, was collected in more than 50 years from the Waccamaw River, approximately 2.7 kilometers upstream of the South Carolina line (K. Rachels, NCWRC, pers. comm.).

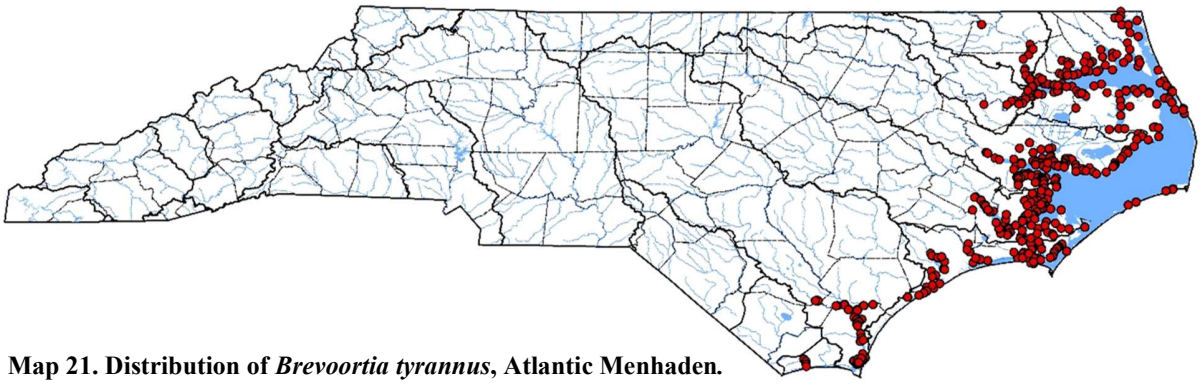


Map 20. Distribution of *Alosa sapidissima*, American Shad.

***Brevoortia tyrannus* (Latrobe, 1802). Atlantic Menhaden.**

Atlantic Menhaden is a seasonal inhabitant that is found in all of the Atlantic Coast basins as far upstream as near Lock and Dam No. 1 and Castle Hayne (Cape Fear basin), near Jacksonville

(White Oak basin), past New Bern (Neuse basin), Williamston (Roanoke basin), and near Murfreesboro (Chowan basin) (Map 21).

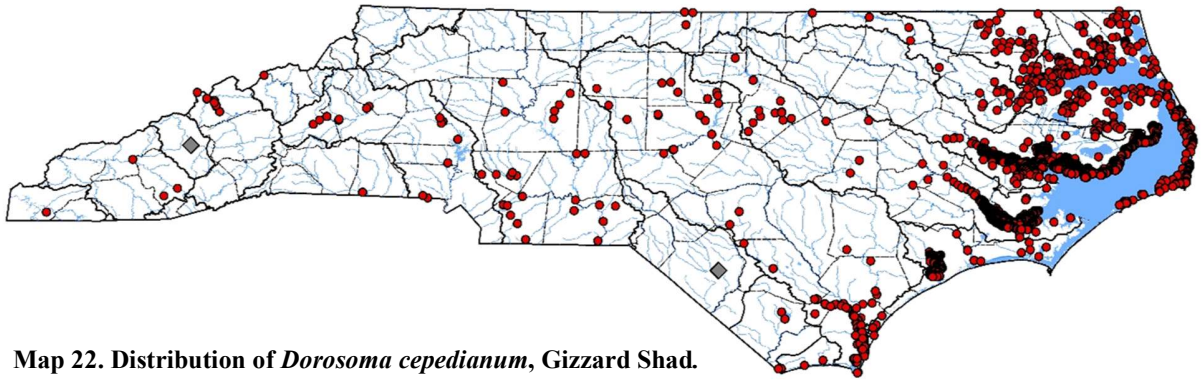


Map 21. Distribution of *Brevoortia tyrannus*, Atlantic Menhaden.

***Dorosoma cepedianum* (Lesueur, 1818). Gizzard Shad.**

Gizzard Shad is present in all basins except the Savannah, Watauga, and New (Map 22).

Remarks: Etnier and Starnes (1993) presumed that the indigenous range included all eastern and central drainages in North America, except those in New England and southern Florida. However, there is now some evidence that Gizzard Shad was introduced into the Blue Ridge region of the upper Tennessee River drainage (Hiwassee, Little Tennessee, Pigeon, French Broad, and Nolichucky basins) based upon the lack of records reported from eastern Tennessee by Evermann (1918) (Fuller et al. 2019; Matthew Neilson, U.S. Geological Survey, pers. comm.).

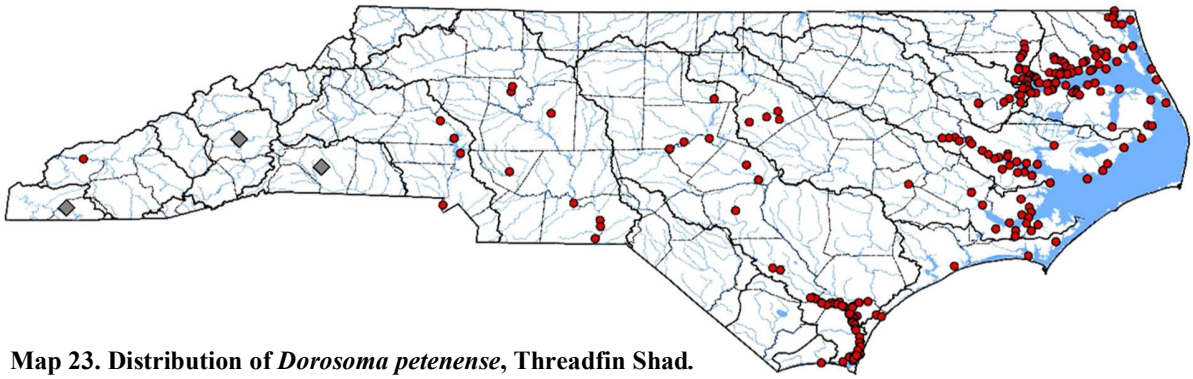


Map 22. Distribution of *Dorosoma cepedianum*, Gizzard Shad.

***Dorosoma petenense* (Günther, 1867). Threadfin Shad.**

Threadfin Shad, a nonindigenous species, has been widely stocked as forage fish in reservoirs and has escaped into downstream rivers and streams (Fuller and Neilson 2020). It is also found in coastal streams from the Albemarle to the Shallotte basins. It has also been found in the Hiwassee, French Broad, and Broad basins. It has yet to be introduced into the Savannah, Pigeon, Nolichucky, Watauga, New, Lumber, and Waccamaw basins (Map 23). Its indigenous range is from the lower Mississippi River basin, Gulf slope, and peninsular Florida south to Guatemala and Belize (Rohde et al. 2009).

Remarks: The earliest records at NCSM are from the Cape Fear River in 1951. The earliest record of it being stocked into reservoirs is from 1957 in Kerr Reservoir (Roanoke basin) (NCWRC 1961).



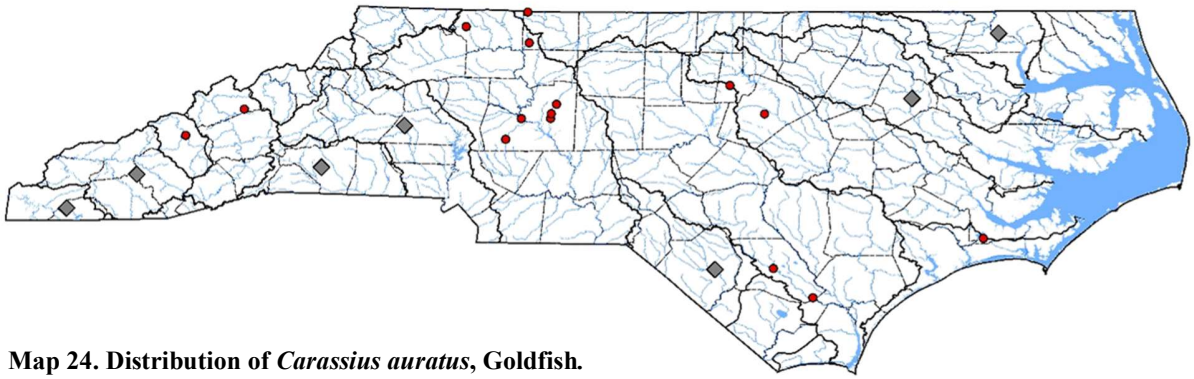
Map 23. Distribution of *Dorosoma petenense*, Threadfin Shad.

Cyprinidae – Barbs and Carps

***Carassius auratus* (Linnaeus, 1758). Goldfish.**

Goldfish, a nonindigenous species, has been documented in 14 of the 21 river basins from the Coastal Plain to the Blue Ridge (Menhinick 1991) (Map 24).

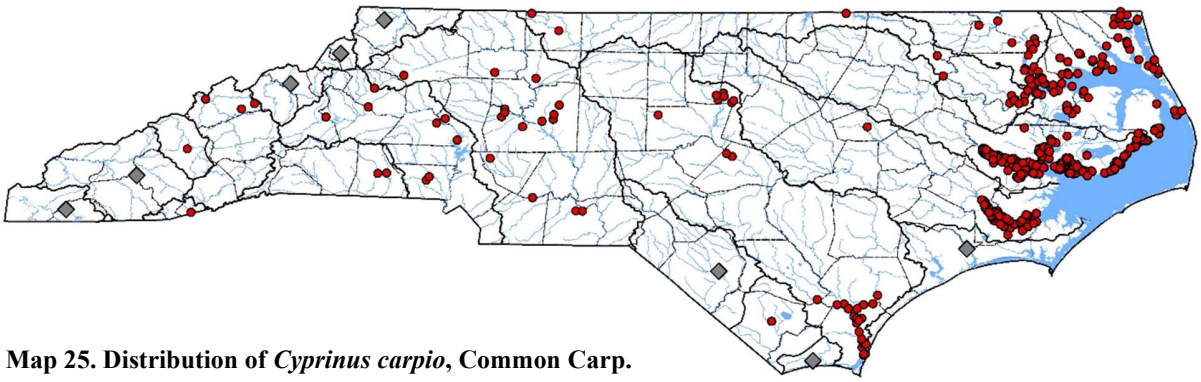
Remarks: It is unknown if the records mapped represent persistent and reproducing populations or if they are remnants of one-time bait bucket releases. However, an established and reproducing population is known from the Abbotts Creek arm of High Rock Reservoir (Davidson County, Yadkin basin). The earliest vouchered specimen is from Wake County in 1925 (NCSM 462).



Map 24. Distribution of *Carassius auratus*, Goldfish.

***Cyprinus carpio* Linnaeus, 1758. Common Carp.**

Common Carp, a nonindigenous species, has been documented in all the basins in the state (Map 25) and was first introduced into the state in 1879 (Smith 1907).

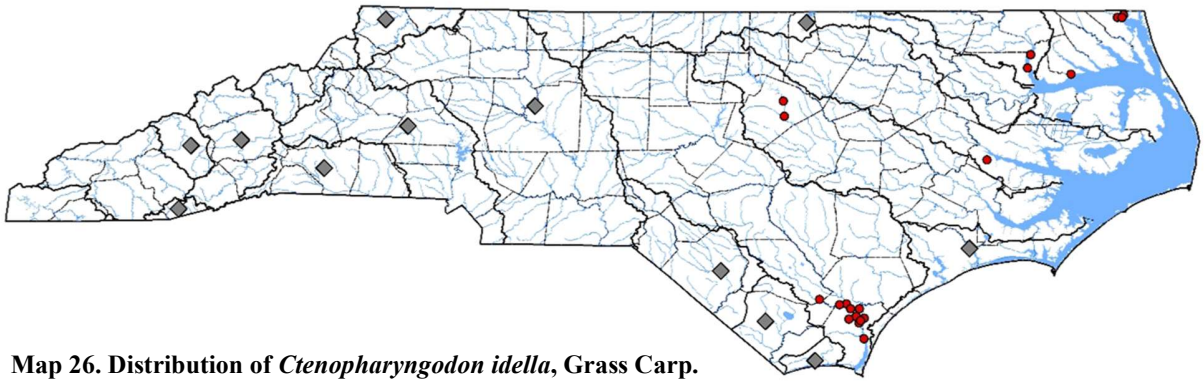


Map 25. Distribution of *Cyprinus carpio*, Common Carp.

Xenocyprididae – Asian Carps

***Ctenopharyngodon idella* (Valenciennes, 1844). Grass Carp.**

Grass Carp, a nonindigenous species, has been widely stocked, presumably as triploid individuals, to control nuisance aquatic vegetation in all but the Hiwassee, Little Tennessee, Nolichucky, and Watauga basins (Menhinick 1991) (Map 26). The earliest date of its introduction into North Carolina is unknown, but it was reported in the state as early as 1978 (Guillory and Gasaway 1978).



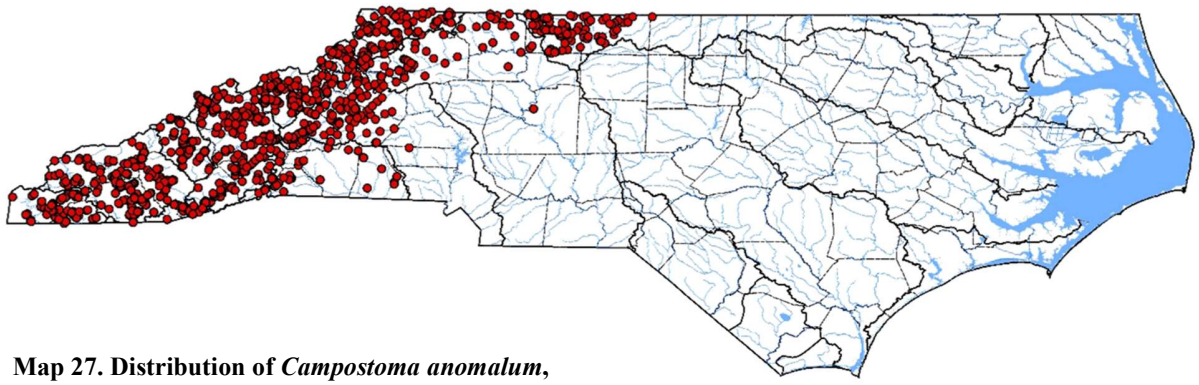
Map 26. Distribution of *Ctenopharyngodon idella*, Grass Carp.

Leuciscidae - Minnows

***Campostoma anomalum* (Rafinesque, 1820). Central Stoneroller.**

Central Stoneroller is indigenous and widespread throughout the Mountain basins from the Hiwassee to the Catawba. It is also indigenous to the Dan River system in the Roanoke basin. It was introduced into the Yadkin basin, probably multiple times, between 1960 (earliest vouchered specimen) to 2016 (Tracy 2018). Currently, there are 118 known collections from that basin (Tracy 2018) (Map 27).

Remarks: Evermann (1916) reported Central Stoneroller in the Lumber basin but those specimens cannot be found. One specimen, also from the Lumber basin, was collected in 1964 from Watson Lake at Southern Pines, Moore County (UF 146896). If valid, these records are unusual and may represent a locality error or a bait bucket introduction. These two records are not mapped or tabulated in Table 3. There could be as many as three species of *Campostoma* in North Carolina (Blum et al. 2008).

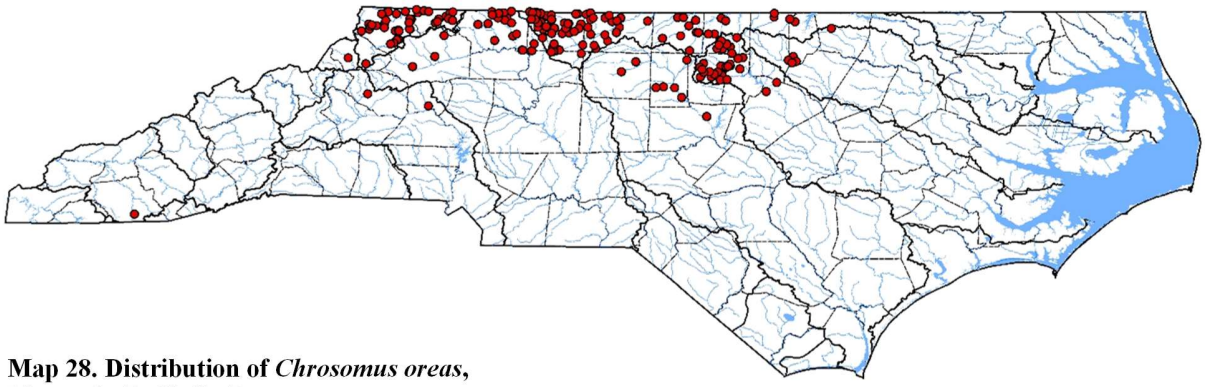


Map 27. Distribution of *Campostoma anomalum*, Central Stoneroller.

***Chrosomus oreas* Cope, 1868. Mountain Redbelly Dace.**

Mountain Redbelly Dace, found only in North Carolina and Virginia (Jenkins and Burkhead 1994), is indigenous to the Roanoke, Tar, and Neuse basins. It has been introduced into the Little Tennessee, Watauga, New, Catawba, Yadkin (Tracy 2018), and Cape Fear basins (earliest vouchered specimens from 2009, 2004, 1963, 1999, 1962, and 1992, respectively) (Map 28).

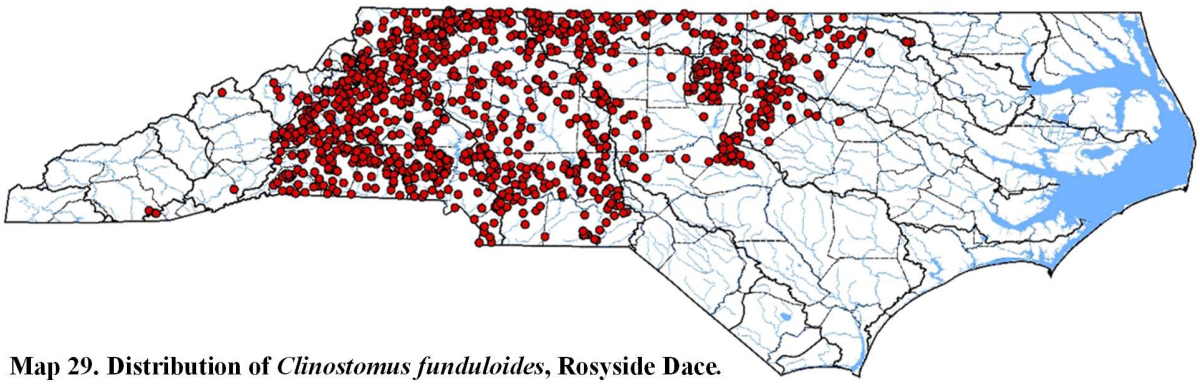
Remarks: Listed in Menhinick (1991) as *Phoxinus oreas.*



Map 28. Distribution of *Chrosomus oreas*, Mountain Redbelly Dace.

***Clinostomus funduloides* Girard, 1856. Rosyside Dace.**

Rosyside Dace is widely distributed from the Piedmont to the Mountains where it is indigenous to the New and to seven of the Atlantic slope basins. It has been introduced into the Little Tennessee, French Broad, Nolichucky, and Watauga basins (earliest vouchered specimens from 1999, 2003, 1968, and 1949, respectively) (Map 29). In 2019 and 2020 additional nonindigenous populations were discovered in the French Broad basin in the lower Davidson River, streams in Brevard (Transylvania County), and in the upper Swannanoa River watershed (Buncombe County) (D. Owensby, NCWRC, pers. comm.).



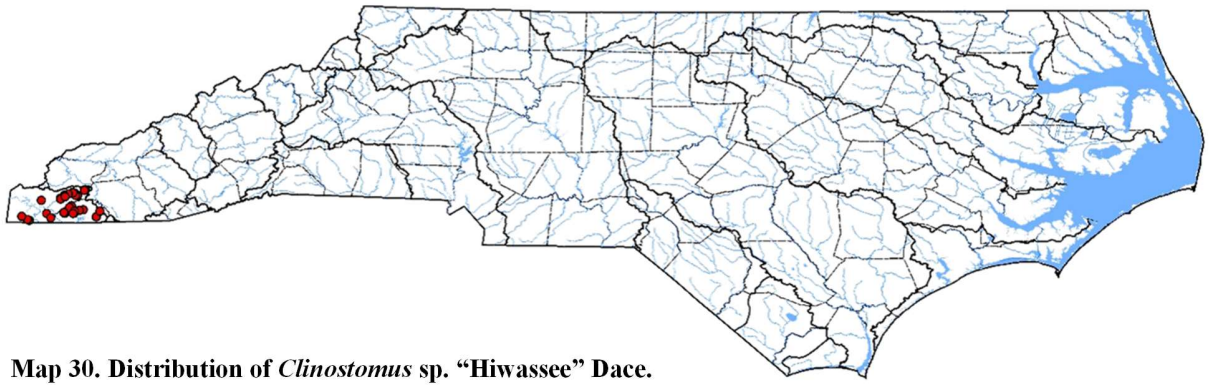
Map 29. Distribution of *Clinostomus funduloides*, Rosyside Dace.

***Clinostomus* sp. "Hiwassee" Dace.**

"Hiwassee" Dace, an undescribed species, is only found in small streams in the Hiwassee basin in North Carolina and Georgia (Map 30).

Remarks: Initially this species was considered to be an intergrade between *Clinostomus funduloides estor* and the undescribed "Smoky" Dace (Kyle Piller, Southeast Louisiana University, pers. comm.). However, recent work indicates that "Smoky" and "Hiwassee" dace are genetically distinct from one another (Weyand and Piller 2017; Weyand and Piller 2020). This undescribed species keys out as *Clinostomus funduloides* in Menhinick (1991).

Status: State Special Concern.



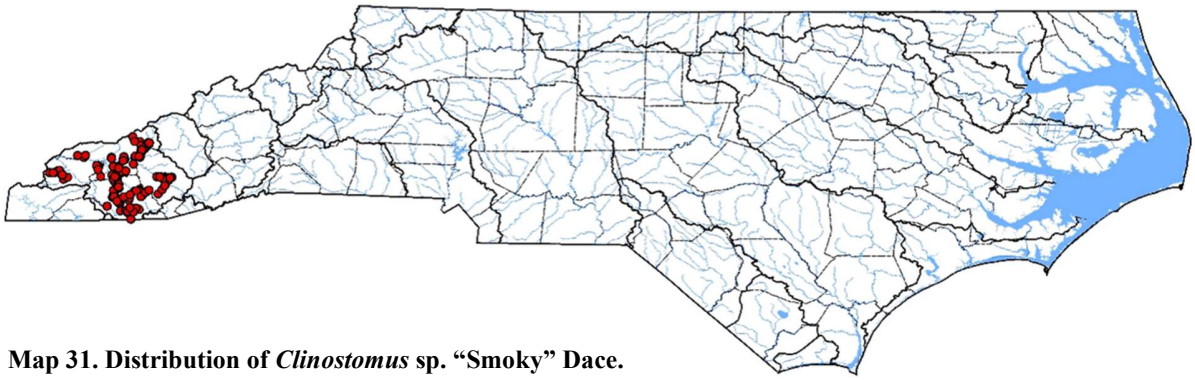
Map 30. Distribution of *Clinostomus* sp. "Hiwassee" Dace.

***Clinostomus* sp. "Smoky" Dace.**

"Smoky" Dace, an undescribed species, is only found in small streams in the Little Tennessee basin in North Carolina and Tennessee (Weyand and Piller 2017; Weyand and Piller 2020) (Map 31).

Remarks: This undescribed species keys out as *Clinostomus funduloides* in Menhinick (1991).

Status: State Special Concern.

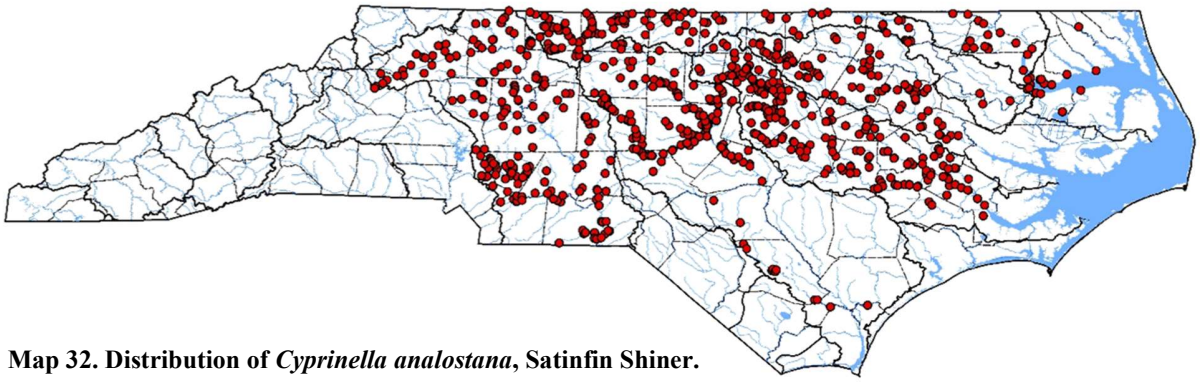


Map 31. Distribution of *Clinostomus* sp. "Smoky" Dace.

***Cyprinella analostana* Girard, 1859. Satinfin Shiner.**

Satinfin Shiner is widely distributed from the Yadkin basin eastward to the Albemarle basin (Map 32). This species is at the southern limit of its range in North Carolina and South Carolina (Gilbert and Burgess 1980a; Rohde et al. 2009).

Remarks: Records from the Albemarle basin in Menhinick (1991) could not be verified, but data provided by the NCDMF shows the species at widely separated locales in the basin. This species keys out as *Notropis analostanus* in Menhinick (1991).

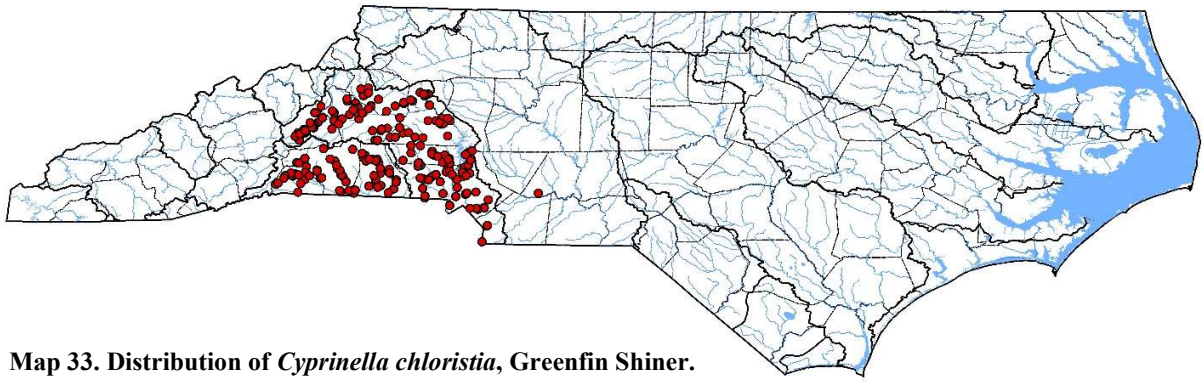


Map 32. Distribution of *Cyprinella analostana*, Satinfin Shiner.

***Cyprinella chloristia* (Jordan and Brayton, 1878). Greenfin Shiner.**

Greenfin Shiner, closely related to Satinfin Shiner, *C. analostana*, is indigenous in the Broad and Catawba basins (Map 33) and is found only in North Carolina and South Carolina (Gilbert and Burgess 1980b; Rohde et al. 2009). There is one isolated record from the Yadkin basin (NCSM 34708).

Remarks: This species keys out as *Notropis chloristius* in Menhinick (1991).

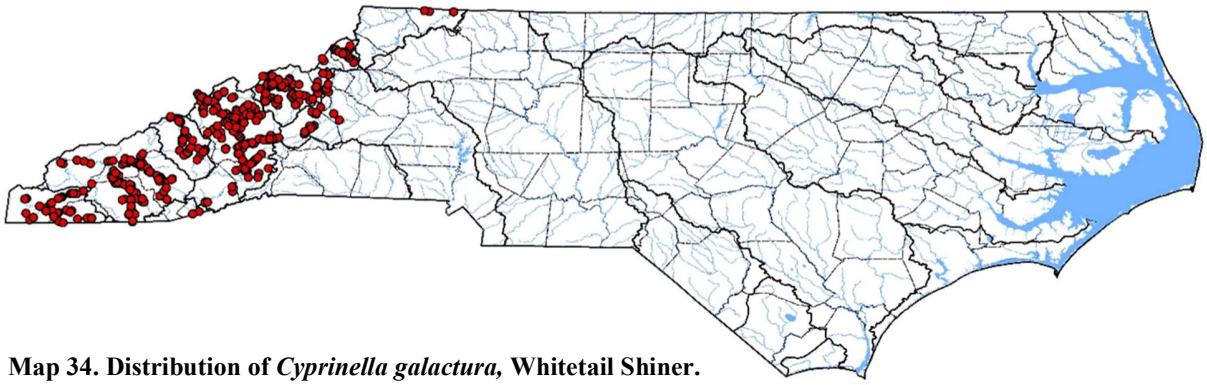


Map 33. Distribution of *Cyprinella chloristia*, Greenfin Shiner.

***Cyprinella galactura* (Cope, 1868). Whitetail Shiner.**

Whitetail Shiner is widely distributed in all the basins that flow into the Tennessee River and the Savannah basin. It is also considered to be indigenous in the upper Catawba basin through stream capture of the Linville River (Weaver 1897; Ross 1971; Scott 2014). It has been introduced into the New basin (earliest vouchered specimens from 1968) (Map 34).

Remarks: One lot of four specimens at ANSP (ANSP 3218) is reportedly from the Catawba River, although Cope (1870a, pages 459 and 494) states that: "*It does not occur east of the Alleghenies*." There are two records from Polk and Henderson counties upstream from Lake Adger plotted in Menhinick (1991), but these records cannot be verified. This species keys out as *Notropis galacturus* in Menhinick (1991).

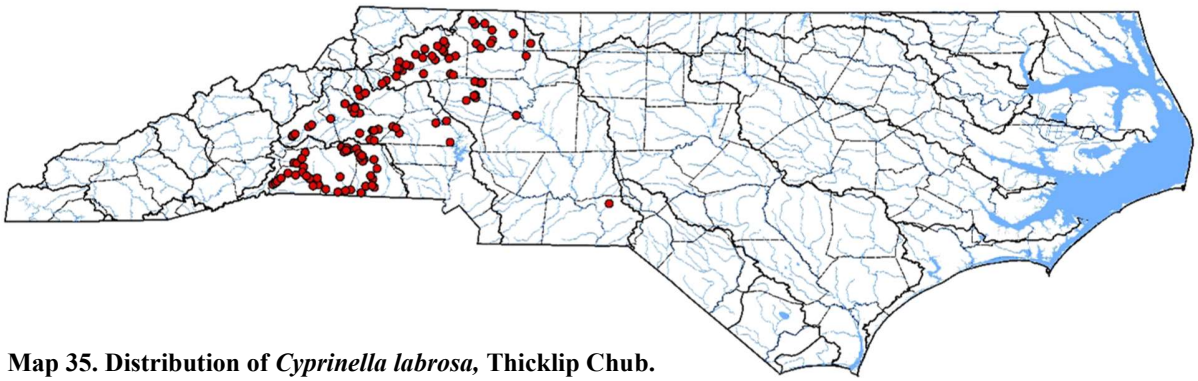


Map 34. Distribution of *Cyprinella galactura,* Whitetail Shiner.

***Cyprinella labrosa* (Cope, 1870). Thicklip Chub.**

Thicklip Chub is widely distributed in the Broad and upper Catawba and Yadkin basins with one outlier in a tributary of the lower Pee Dee River (Yadkin basin; NCSM 88758) (Map 35). It is found only in North Carolina, South Carolina, and Virginia (Jenkins and Lachner 1980a; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: A waif individual was collected in 1967 from Big Mountain Creek, a tributary to the Pee Dee River (Richmond County, Yadkin Basin, NCSM 88758). No additional specimens have been collected from the middle or lower part of the basin. Thicklip Chub was described as *Ceratichthys labrosus* (Cope 1870a; Table 5). This species keys out as *Hybopsis labrosa* in Menhinick (1991).

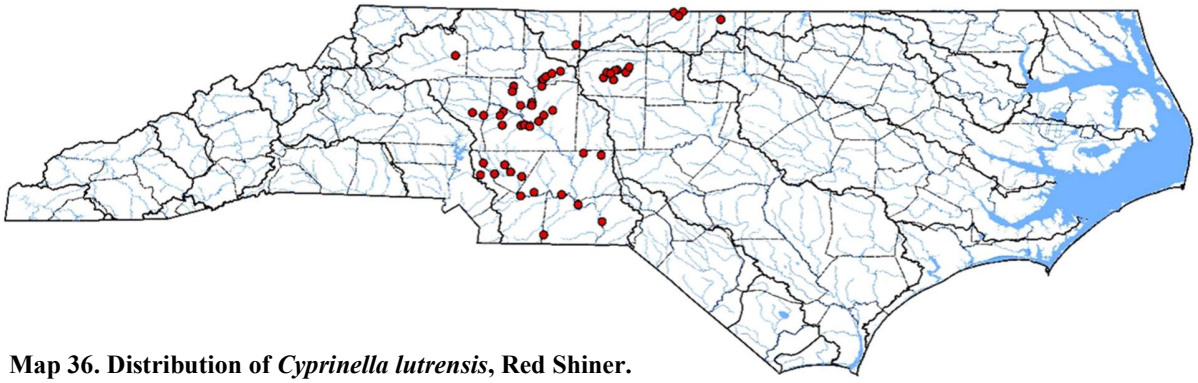


Map 35. Distribution of *Cyprinella labrosa,* Thicklip Chub.

***Cyprinella lutrensis* (Baird and Girard, 1853). Red Shiner.**

Red Shiner, a nonindigenous species, was first discovered in North Carolina in 1974 in Abbotts Creek (Davidson County, Yadkin basin) (Tracy 2018). Its distribution now includes more than 40 localities in the Yadkin basin and a few localities in the Dan River (Roanoke basin) and Haw River systems (Cape Fear basin) (Map 36).

Remarks: This species keys out as *Notropis lutrensis* in Menhinick (1991).



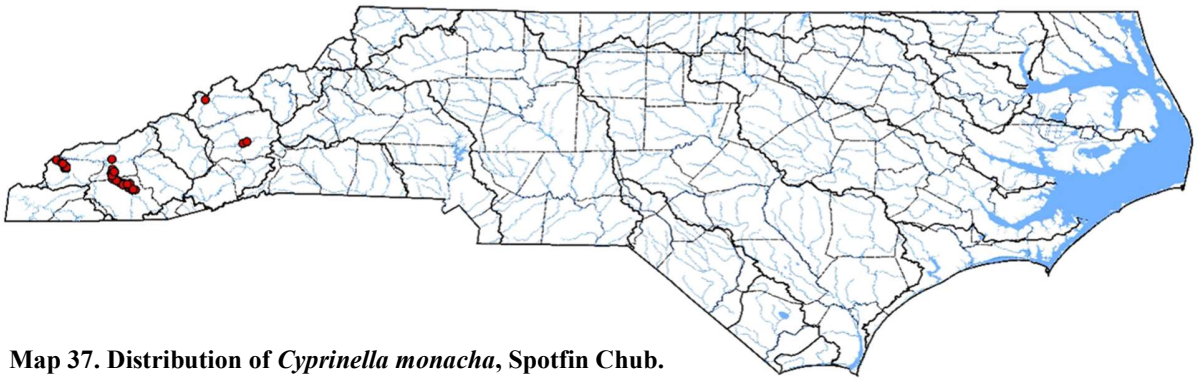
Map 36. Distribution of *Cyprinella lutrensis*, Red Shiner.

***Cyprinella monacha* (Cope, 1868). Spotfin Chub.**

Spotfin Chub, until recently, only occurred in North Carolina in the Little Tennessee River and the lower reaches of some of its tributaries upstream from Fontana Dam. Since 2007, it has been reintroduced into the historically dewatered section of the Cheoah River (Little Tennessee basin) between Santeetlah Lake and Calderwood Reservoir (Doll et al. 2020) (Map 37). It is extirpated from the Tuckasegee River (Little Tennessee basin, last collected in 1940 from a tributary) and the Swannanoa River and Spring Creek (French Broad basin, last collected in 1888) (Jenkins and Burkhead 1984; Rohde et al. 1998; Winston 1998).

Remarks: This species keys out as *Hybopsis monacha* in Menhinick (1991) and is listed as *Erimonax monachus* in Page et al. (2013).

Status: Federally Threatened.

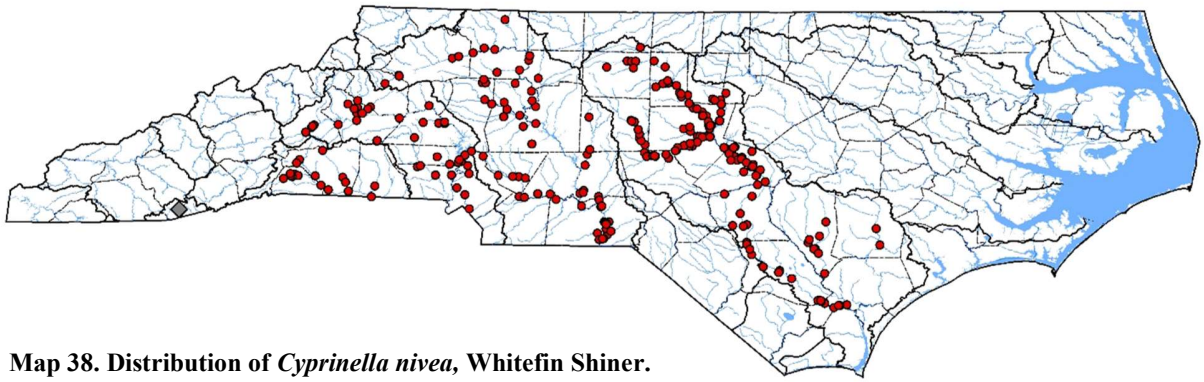


Map 37. Distribution of *Cyprinella monacha*, Spotfin Chub.

***Cyprinella nivea* (Cope, 1870). Whitefin Shiner.**

Whitefin Shiner is indigenous to the Savannah, Broad, Catawba, Yadkin, and Cape Fear basins (Map 38) and is found only in North Carolina, South Carolina, and Georgia (Gilbert and Burgess 1980c; Rohde et al. 2009).

Remarks: Four lots from the Neuse basin plotted by Menhinick (1991) and one lot, not plotted, from the Tar basin are in error. Specimens collected and vouchered in 1888 by O. P. Jenkins and S. E. Meek (Jordan 1889a, CAS-SU 1306, CAS-SU 4083, UMMZ 246738, UMMZ 247313), in 1890 by C. S. Brimley and H. H. Brimley (Evermann and Cox 1896, USNM 125164), and in 1949 by J.R. Bailey and A.T. Davison (NCSM 97019) were reexamined and reidentified as Satinfin Shiner (7 of 16 specimens from UMMZ 247313 as Eastern Silvery Minnow, *Hybognathus regius*). In fact, Gibbs (1963, pages 521 and 522) concluded that Jordan (1889a, pages 125 and 129) and others (e.g., Evermann and Cox 1896, pages 305, 308, and 309) mistook *Cyprinella analostana* for *C. nivea*. There is no vouchered evidence that the distribution of Whitefin Shiner included the Tar or Neuse basins. Whitefin Shiner was described as *Hybopsis niveus* (Cope 1870a; Table 5). This species keys out as *Notropis niveus* in Menhinick (1991).

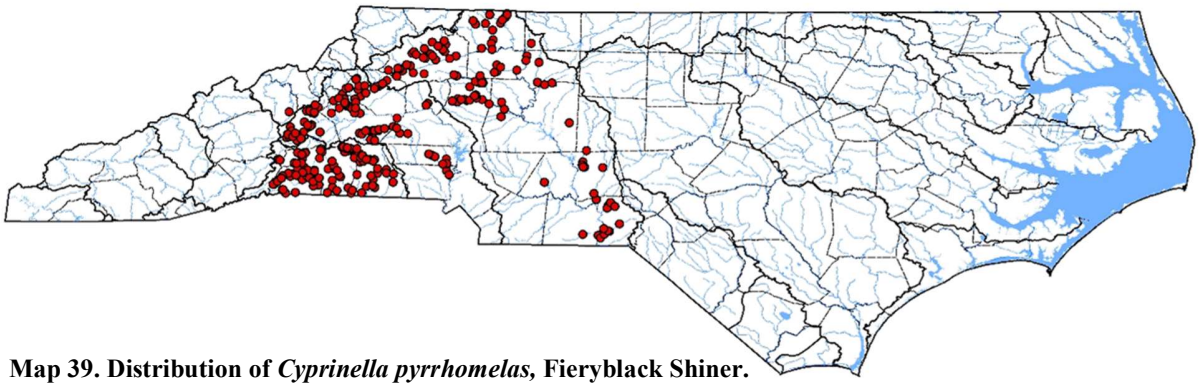


Map 38. Distribution of *Cyprinella nivea,* Whitefin Shiner.

***Cyprinella pyrrhomelas* (Cope, 1870). Fieryblack Shiner.**

Fieryblack Shiner is endemic to North Carolina and South Carolina. and is found in the Broad, Catawba, and Yadkin basins (Gilbert 1980b; Rohde et al. 2009) (Map 39). Speculation exists that there is significant isolation among the various basins (Gibbs 1955; Raley and Kennedy 2009).

Remarks: Fieryblack Shiner was described as *Photogenis pyrrhomelas* (Cope 1870a; Table 5). This species keys out as *Notropis pyrrhomelas* in Menhinick (1991).



Map 39. Distribution of *Cyprinella pyrrhomelas,* Fieryblack Shiner.

***Cyprinella spiloptera* (Cope, 1867). Spotfin Shiner.**

Spotfin Shiner occurs in the Mountain basins from the Hiwassee to the New, excluding the Little Tennessee and Watauga (Map 40).

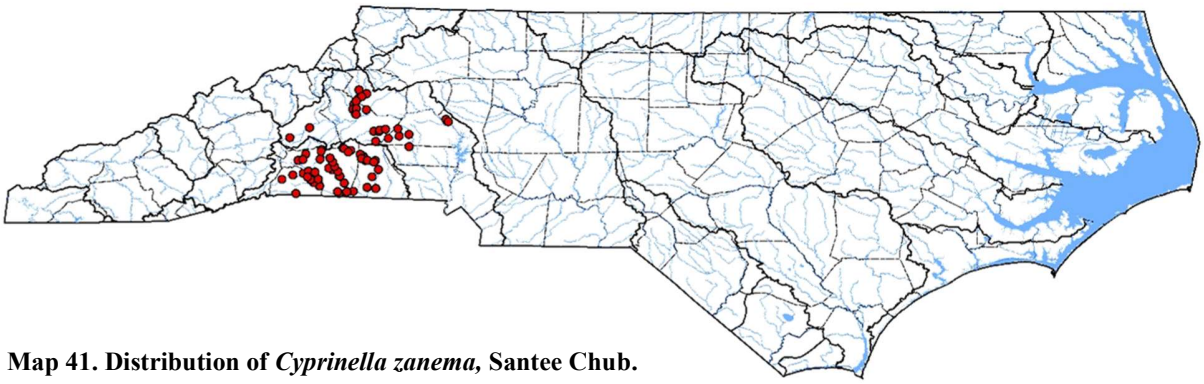
Remarks: There is a valid record of one specimen (CUMV 25194) collected in 1939 from Shooting Creek, Clay County, Hiwassee basin incorrectly plotted by Menhinick (1991) in Cherokee County.; No other specimens have been collected from this basin where it is now considered extirpated. The record from Macon County in the Little Tennessee basin (Menhinick 1991) is also mis-plotted and considered invalid because it was based upon a locale mapped in Gilbert and Burgess (1980d), which cannot be substantiated by a vouchered record. Additionally, Menhinick also later questioned the validity of the record (Menhinick undated and unpublished photocopy "*Addenda to the Freshwater Fishes of North Carolina*", circa mid-1990s). This species keys out as *Notropis spilopterus* in Menhinick (1991).

Map 40. Distribution of *Cyprinella spiloptera*, Spotfin Shiner.

***Cyprinella zanema* (Jordan and Brayton, 1878). Santee Chub.**

Santee Chub is endemic to the Broad and Catawba basins in North Carolina (Map 41) and South Carolina (Jenkins and Lachner 1980b; Rohde et al. 2009).

Remarks: This species keys as *Hybopsis zanema* in Menhinick (1991).



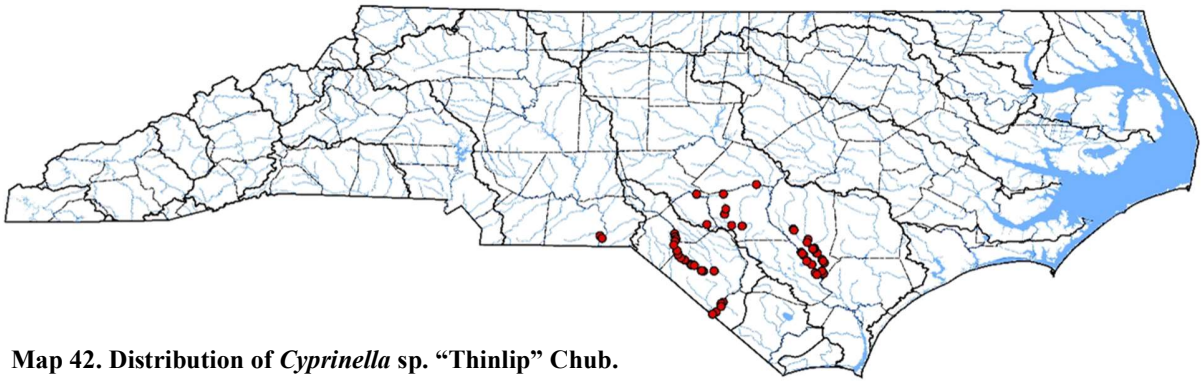
Map 41. Distribution of *Cyprinella zanema,* Santee Chub.

***Cyprinella* sp. "Thinlip" Chub.**

"Thinlip' Chub, an undescribed species, is closely related to Thicklip and Santee chubs, and is endemic to North Carolina and South Carolina. It is found in the upper Coastal Plain streams of the Cape Fear basin (Little River in Cumberland, Hoke, and Moore counties; Rockfish Creek in Hoke County; and the South and Black rivers in Bladen and Sampson counties), the Lumber basin from near Wagram downstream to near Fair Bluff, and the Pee Dee River below Blewett Falls Reservoir (Menhinick 1991) (Map 42).

Remarks: The earliest known vouchered specimens were collected in 1962 from two sites on Rockfish Creek, a tributary to the Cape Fear River, in Cumberland County as part of NCWRC's statewide survey of fishes (NCSM 5512 and NCSM 55864; Starnes and Hogue 2011). Two unvouchered specimens were apparently collected in 1961 and reported as Thicklip Chub from the Lumber River at Fair Bluff in Columbus County (Starnes and Hogue 2011; Tracy 2014a). This undescribed species keys out as *Hybopsis zanema* in Menhinick (1991).

Status: State Special Concern.



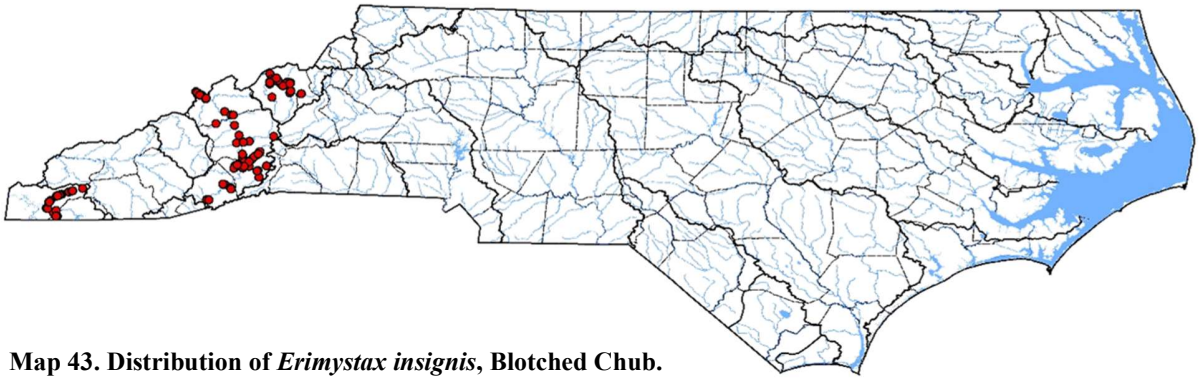
Map 42. Distribution of *Cyprinella* sp. "Thinlip" Chub.

***Erimystax insignis* (Hubbs and Crowe, 1956). Blotched Chub.**

Blotched Chub is only known in North Carolina from the Hiwassee (Valley River), French Broad (from Rosman to near Hot Springs), and Nolichucky (Nolichucky, Cane, and North Toe rivers) basins (Map 43).

Remarks: This species keys out as *Hybopsis insignis* in Menhinick (1991).

Status: State Significantly Rare.



Map 43. Distribution of *Erimystax insignis*, Blotched Chub.

***Exoglossum laurae* (Hubbs, 1931). Tonguetied Minnow.**

Tonguetied Minnow in North Carolina is endemic to North Carolina and is found throughout the New basin and is found throughout that basin (Map 44). It is at the southern limit of its range in North Carolina (Jenkins et al. 1980b).

Status: State Significantly Rare.

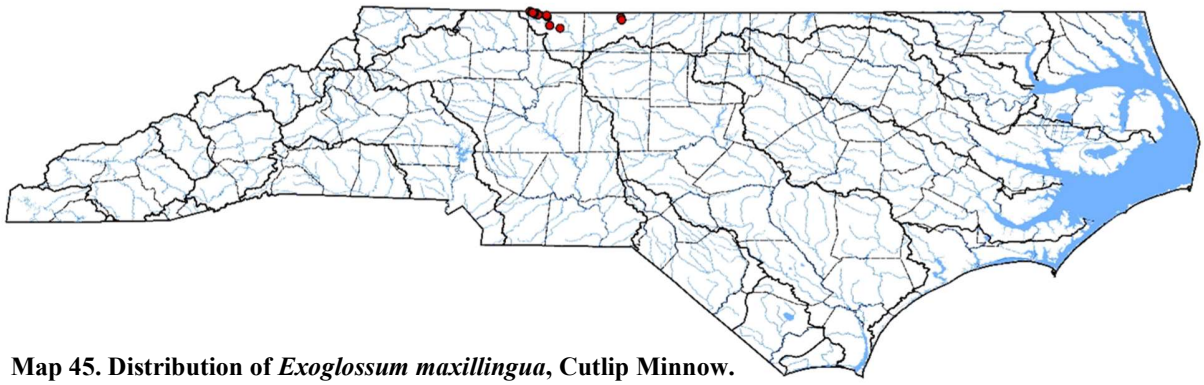
Map 44. Distribution of *Exoglossum laurae,* Tonguetied Minnow.

***Exoglossum maxillingua* (Lesueur, 1817). Cutlip Minnow.**

Cutlip Minnow, although widely distributed in eastern North America, is at the southern limit of its range in North Carolina (Gilbert and Lee 1980). It is only found in the Dan River and two of its tributaries (Archies and Elk creeks, Stokes County), and in the lower Smith River in Rockingham County (Roanoke basin) (Map 45).

Remarks: Listed in Menhinick (1991) as Cutlips Minnow.

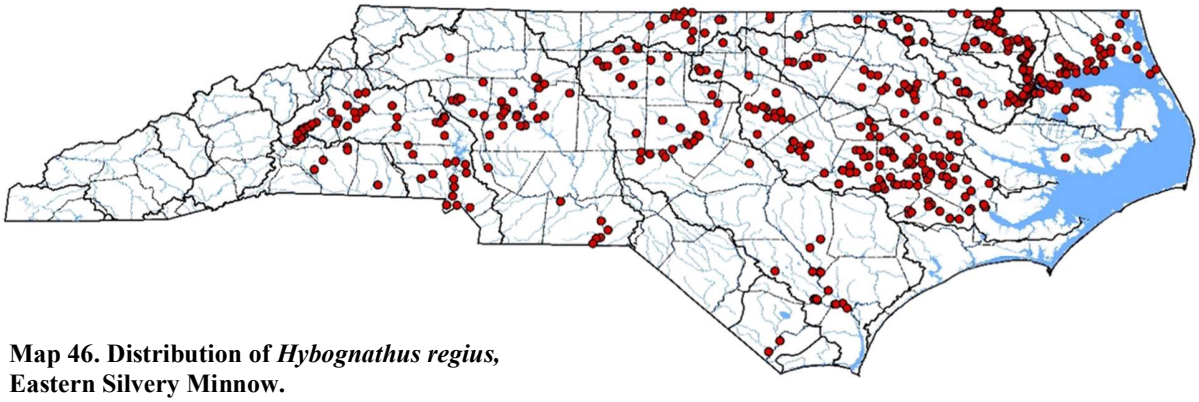
Status: State Special Concern.



Map 45. Distribution of *Exoglossum maxillingua*, Cutlip Minnow.

***Hybognathus regius* Girard, 1856. Eastern Silvery Minnow.**

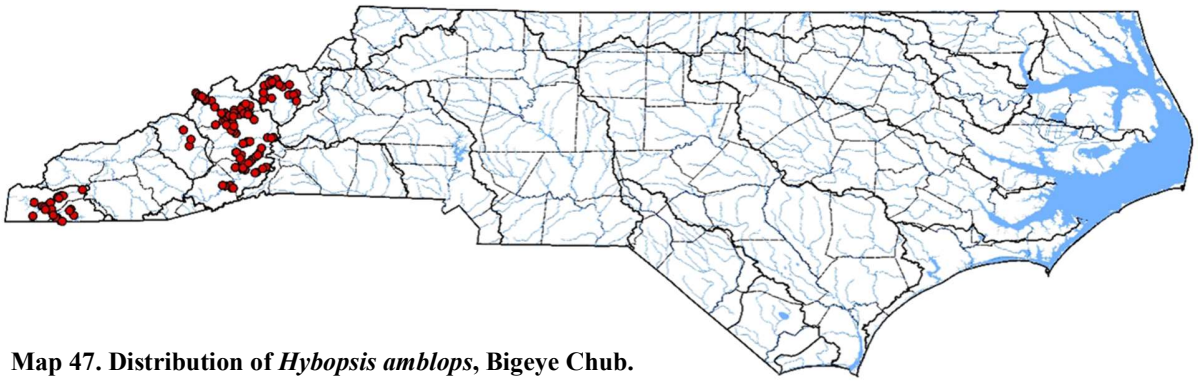
Eastern Silvery Minnow is widely distributed in the Atlantic slope from the Albemarle to the Catawba basins, but is absent in the Lumber, Shallotte, and White Oak basins (Map 46). There are two vouchered records (UNCW 79-241-19 and 79-243-11) of seven specimens from the Waccamaw River collected in 1979 (Shute et al. 1981), but the species has not been collected since then and is considered extirpated from the North Carolina portion of that basin.



Map 46. Distribution of *Hybognathus regius*, Eastern Silvery Minnow.

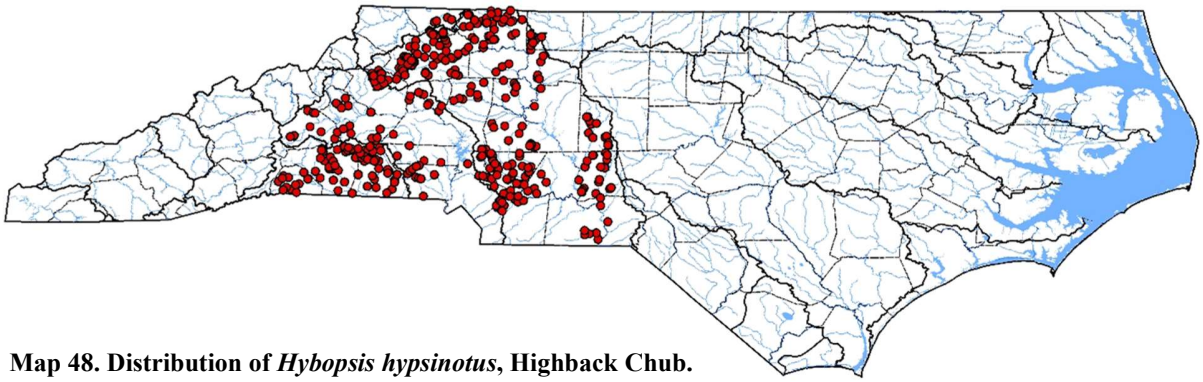
***Hybopsis amblops* (Rafinesque, 1820). Bigeye Chub.**

Bigeye Chub is common in the French Broad and Nolichucky basins, uncommon in the Hiwassee basin, and rare in the Pigeon basin (Map 47).



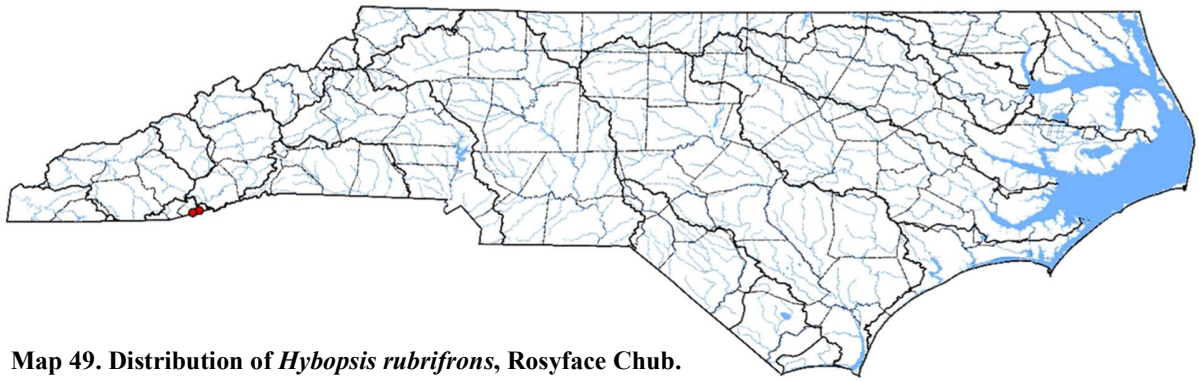
Map 47. Distribution of *Hybopsis amblops*, Bigeye Chub.

***Hybopsis hypsinotus* (Cope, 1870). Highback Chub.**
Highback Chub is indigenous to the Broad, Catawba, and Yadkin basins (Map 48) and found only in Virginia, North Carolina, and South Carolina (Jenkins and Lachner 1980c; Jenkins and Burkhead 1994; Rohde et al. 2009). It was discovered in four streams in 2008 in the New basin.
Remarks: Highback Chub was described as *Ceratichthys hypsinotus* (Cope 1870a; Table 5). The tributary in the Yadkin basin of the type locality was not specified, but it was most likely Gobble Creek, which is south of US 64 at the Koontz Plantation in Davidson County (which at that time of Cope, was a part of Roane (Rowan) County) (R. E. Jenkins, retired, Roanoke College, pers. comm.; B. H. Tracy, pers. obs.). The species was no longer extant at this locality in October 2009 (B. H. Tracy, unpublished data).



Map 48. Distribution of *Hybopsis hypsinotus*, Highback Chub.

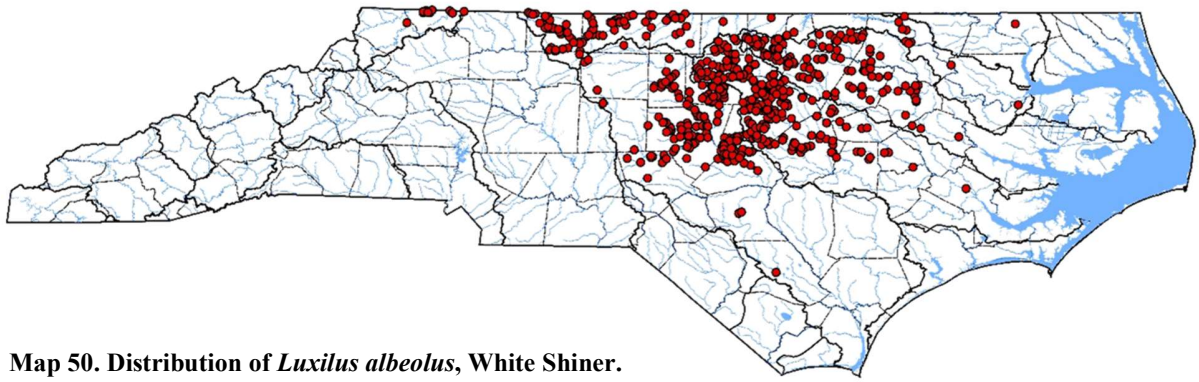
***Hybopsis rubrifrons* (Jordan, 1877). Rosyface Chub.**
Rosyface Chub in North Carolina is only known from a few records from the lower stretches of the Horsepasture and Toxaway rivers in the headwaters of the Savannah basin (Map 49). It occurs more widely in the Piedmont portion of the Savannah River to the Altamaha River in Georgia (Clemmer 1980; Rohde et al. 2009).
Status: State Threatened.



Map 49. Distribution of *Hybopsis rubrifrons*, Rosyface Chub.

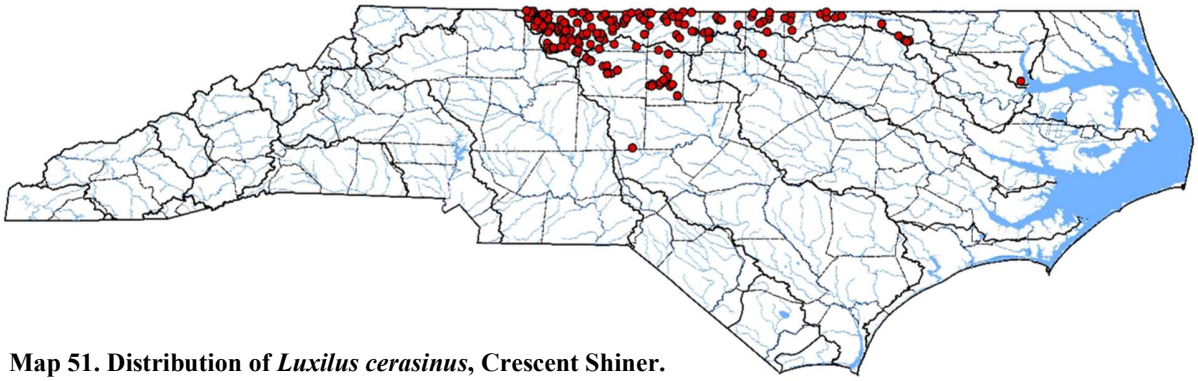
***Luxilus albeolus* (Jordan, 1889). White Shiner.**
White Shiner is widely distributed and common in the Piedmont and upper Coastal Plain of the Cape Fear, Neuse, Tar, and Roanoke basins (Map 50). It is also present in the New basin and there is one record from Beaverpond Creek, a tributary to the Meherrin River (Chowan basin), which

was collected in 1962 (NCSM 53649). White Shiner is also localized in the lower Cape Fear basin. This species is also found in West Virginia and Virginia (Gilbert 1980c).
Remarks: This species keys out as *Notropis albeolus* in Menhinick (1991).



Map 50. Distribution of *Luxilus albeolus*, White Shiner.

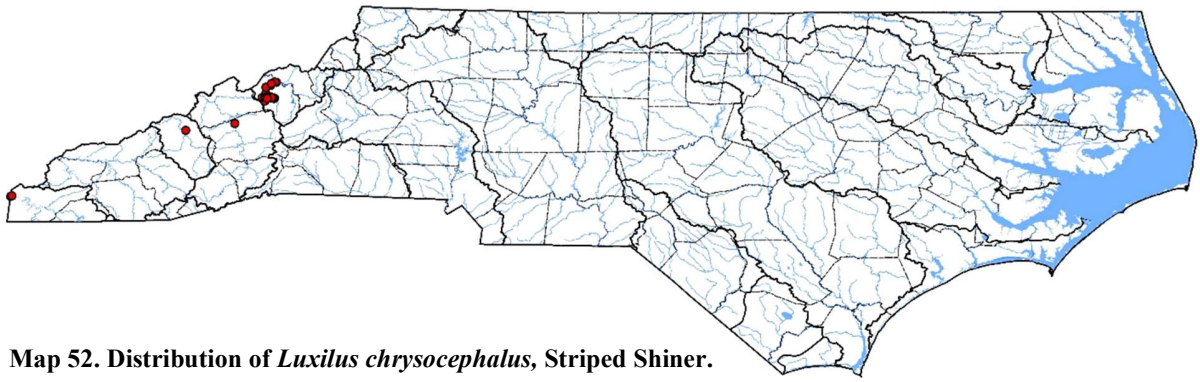
***Luxilus cerasinus* (Cope, 1868). Crescent Shiner.**
Crescent Shiner is indigenous to the Roanoke basin in Virginia and North Carolina where it widely occurs (Gilbert 1980d; Jenkins and Burkhead 1994). There is one record from Salmon Creek, a tributary to the Chowan River, collected in 1944 (NCSM 86517). It is introduced in the upper Cape Fear basin, primarily in the Haw River system (earliest vouchered specimen from 1955), but there is also one record from the Deep River system (2001, NCSM 30554) (Map 51).
Remarks: The Neuse basin record plotted by Menhinick (1991) is invalid because it was mapped in error based upon a misinterpretation of the locale shown in Gilbert (1964, 1980d). This species keys out as *Notropis cerasinus* in Menhinick (1991).



Map 51. Distribution of *Luxilus cerasinus*, Crescent Shiner.

***Luxilus chrysocephalus* Rafinesque, 1820. Striped Shiner.**
Striped Shiner is known principally in North Carolina from the Nolichucky basin, primarily in the Cane River watershed (Rohde et al. 1998) (Map 52). There is one non-vouchered TVA record from the Hiwassee River collected in 2006 (D. Mathews, TVA, pers. comm.) and two non-vouchered NCWRC records from Schuler Creek, downstream from Apalachia Lake, collected in 2010 and 2019 (L. Etchison and D. Owensby, NCWRC, pers. comm.). There is also one record from the French Broad basin collected in 1997, which we consider valid and not introduced (NCSM 34051).

Remarks: Cope (1870a, p. 459 and 494) reported *Hypsilepis cornutus* var. *fontinalis* (a synonym of *Luxilus chrysocephalus* (Gilbert 1964)) from an unspecified locality in the French Broad basin, but there are no vouchered records to substantiate his claim. There are several unverifiable records from the Little Tennessee basin that are presumably introductions, if valid. This species keys out as *Notropis chrysocephalus* in Menhinick (1991).
Status: State Special Concern.

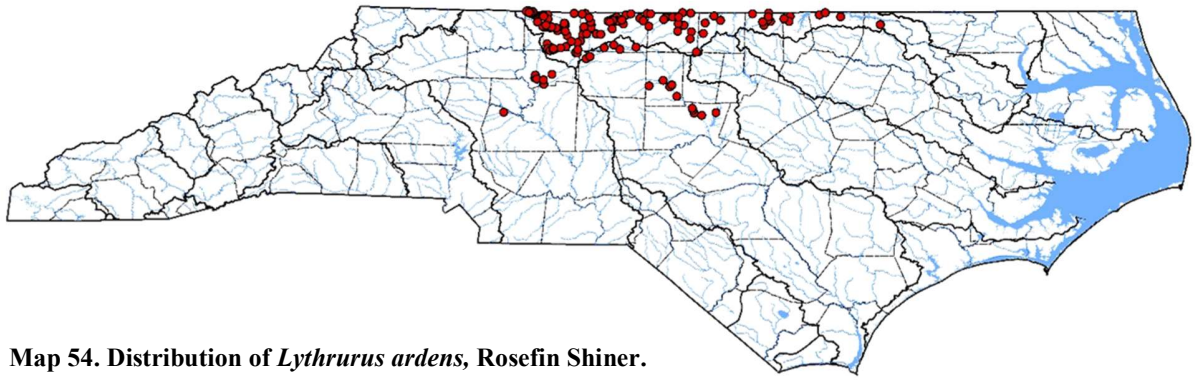


Map 52. Distribution of *Luxilus chrysocephalus*, Striped Shiner.

***Luxilus coccogenis* (Cope, 1868). Warpaint Shiner.**
Warpaint Shiner is indigenous in all the Mountain basins from the Watauga to the Hiwassee and Savannah (Map 53). The species has been introduced into the New (first documented in 1941), Broad (in 1964; and Ramsey 1965), Catawba (in 1954; and Ramsey 1965), and Yadkin (in 1988) basins (Tracy 2018).
Remarks: In the Linville River system (Catawba basin, first documented in 1941), the Warpaint Shiner is considered indigenous through stream capture (Weaver 1897; Ross 1971; Scott 2014). This species keys out as *Notropis coccogenis* in Menhinick (1991).

Map 53. Distribution of *Luxilus coccogenis*, Warpaint Shiner.

***Lythrurus ardens* (Cope, 1868). Rosefin Shiner.**
Rosefin Shiner, indigenous in the Roanoke basin (Dimmick et al. 1996), has been introduced into two other basins (Map 54). It was first documented in the Haw River system (Cape Fear basin) in 1949 (NCSM 99630) and in the Yadkin basin in 2001(NCSM 34862 and NCSM 34866) (Tracy 2018).
Remarks: This species keys out as *Notropis ardens* in Menhinick (1991).

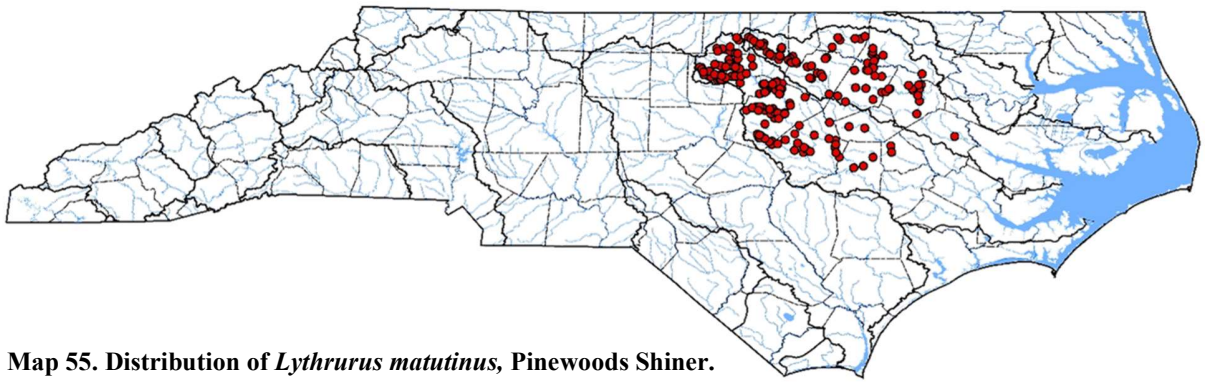


Map 54. Distribution of *Lythrurus ardens,* Rosefin Shiner.

***Lythrurus matutinus* (Cope, 1870). Pinewoods Shiner.**

Pinewoods Shiner is found only in North Carolina and is endemic to the Neuse and Tar basins (Dimmick et al. 1996) (Map 55).

Remarks: Pinewoods Shiner was described as *Alburnellus matutinus* (Cope 1870a; Table 5). This species keys out as *Notropis ardens* in Menhinick (1991).



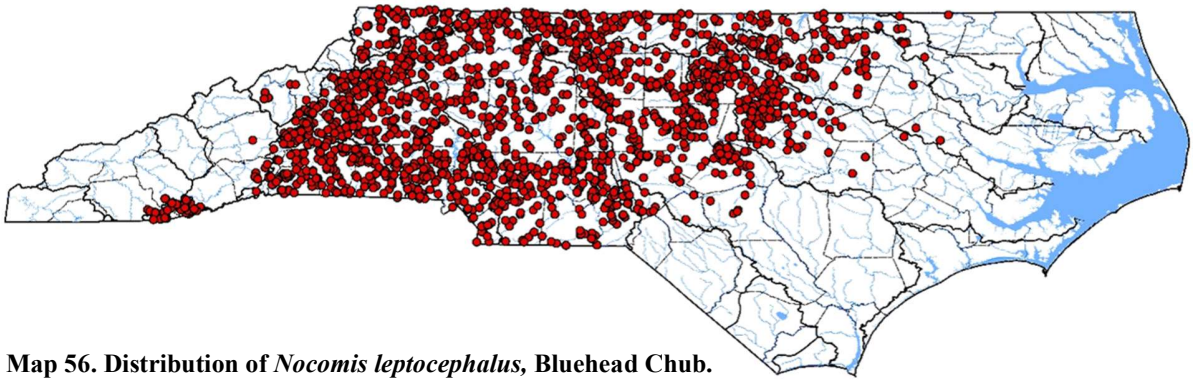
Map 55. Distribution of *Lythrurus matutinus,* Pinewoods Shiner.

***Nocomis leptocephalus* (Girard, 1856). Bluehead Chub.**

Bluehead Chub, one of the most abundant and widespread species in North Carolina, is indigenous to the New, Savannah, Broad, Catawba, Yadkin, Roanoke, Cape Fear, Neuse, Tar, and Chowan basins. It has been introduced into the Little Tennessee (Johnston et al. 1995, Ramsey 1965), French Broad, and Nolichucky basins (earliest vouchered specimens from 1962, 1997, and 1980, respectively (Tracy 2008a) (Map 56).

Remarks: Evermann (1916) reported this species as being common in the upper Lumber, but there are no vouchered specimens to support his claim. During NCWRC state-wide basins survey in the 1960s, no Bluehead Chub were encountered in the Lumber basin (Starnes and Hogue 2011). We presume populations in the Sand Hills region of that basin are the result of an introduction(s). Bluehead Chub was described as *Ceratichthys leptocephalus* by Charles Girard (1856; Table 5). The type locality was not specified but was most likely Salem Creek (then known as Middle Creek or Watch Creek) in Salem, Forsyth County. The species was extant at Salem Creek near Salem Academy in July 2009 (NCSM 59202, B. H. Tracy, unpublished data). There are two recognized subspecies in North Carolina: *N. leptocephalus interocularis* in the Savannah (Lachner and Wiley 1971) and *N. leptocephalus leptocephalus* (Girard 1856) in the other basins where the species

occurs (Nagle and Simons 2012). Nagle and Simons (2012) also recommended that existing subspecies be recognized as species and that in North Carolina there could be three species: *N. interocularis* in the Savannah basin, *N. leptocephalus* in the Pee Dee (including the Yadkin), Catawba, Santee (including the Broad), and Cape Fear basins, and an undescribed form of *Nocomis*, *Nocomis* sp. cf. *leptocephalus*, in the Roanoke, New, and Neuse basins.

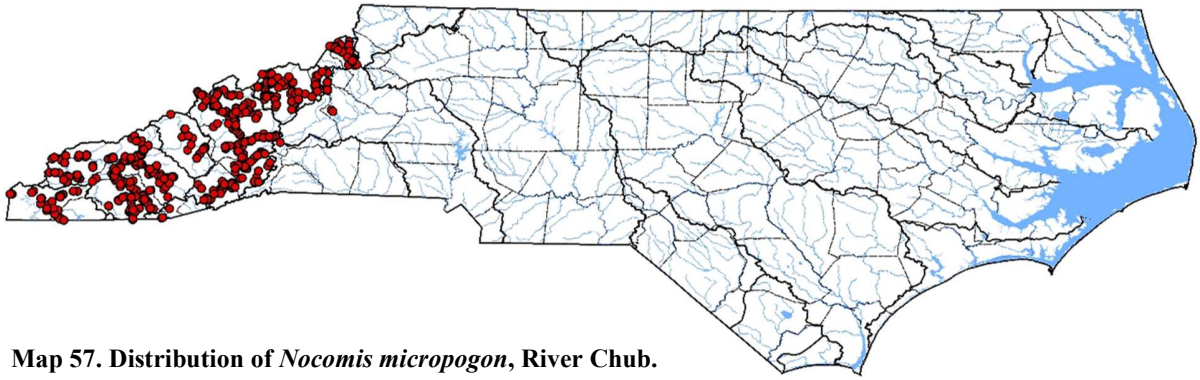


Map 56. Distribution of *Nocomis leptocephalus,* Bluehead Chub.

***Nocomis micropogon* (Cope, 1865). River Chub.**

River Chub is indigenous to all basins that drain into the Tennessee River. River Chub is also indigenous in the upper Linville River (Catawba basin) via stream capture, and possibly the Savannah, although the earliest records from the North Carolina portion of the Savannah date only to 2010 (Map 57).

Remarks: River Chub has been reported from several localities within the New basin, but their identities were based only upon field identifications (L. Etchison, NCWRC, pers. comm.). These unverifiable records are not mapped (Map 57).

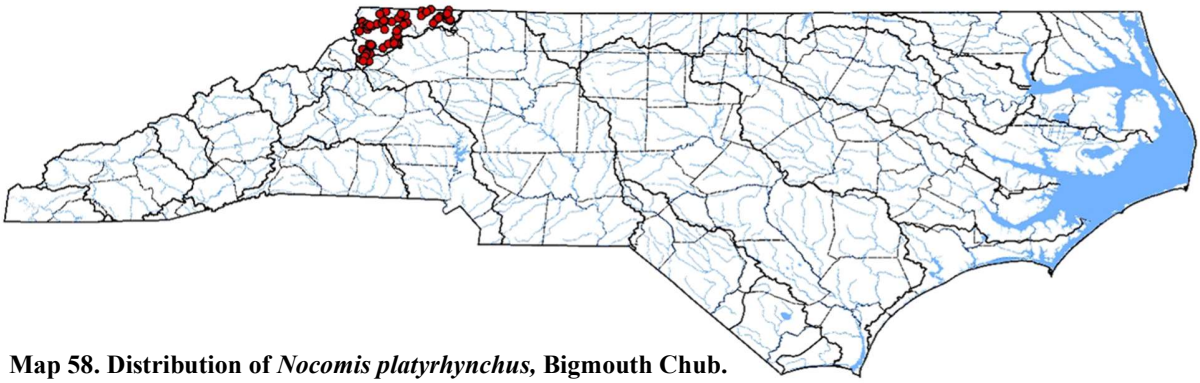


Map 57. Distribution of *Nocomis micropogon*, River Chub.

***Nocomis platyrhynchus* Lachner and Jenkins, 1971. Bigmouth Chub.**

Bigmouth Chub is endemic to the New basin (Map 58), where it is at the southern limit of its range (Jenkins and Lachner 1980d; Jenkins and Burkhead 1994).

Remarks: Nagle and Simons (2012) presented preliminary evidence that Bigmouth Chub should be subsumed into River Chub, a position also supported by R. E. Jenkins (retired, Roanoke College, pers. comm.).

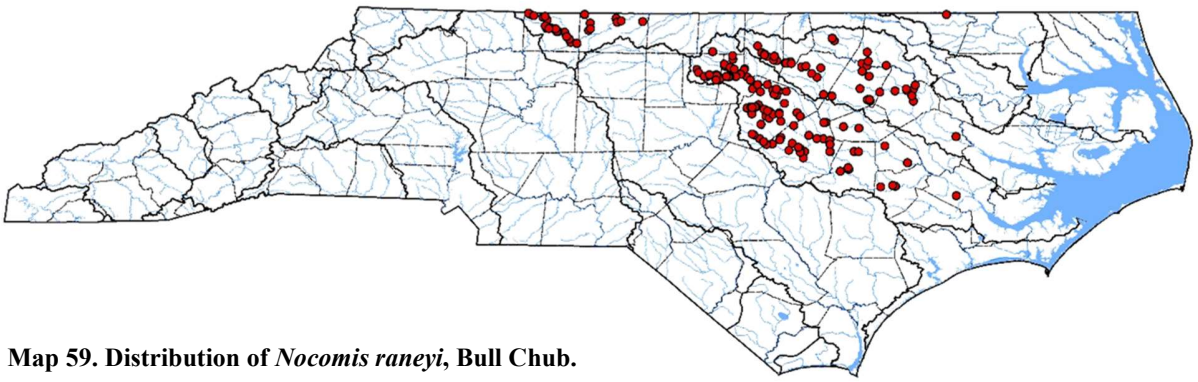


Map 58. Distribution of *Nocomis platyrhynchus,* Bigmouth Chub.

***Nocomis raneyi* Lachner and Jenkins, 1971. Bull Chub.**

Bull Chub is indigenous to the Roanoke, Neuse, and Tar basins (Map 59). It is also found in Atlantic slope streams in Virginia from the James basin southward (Jenkins and Lachner 1980e; Jenkins and Burkhead 1994).

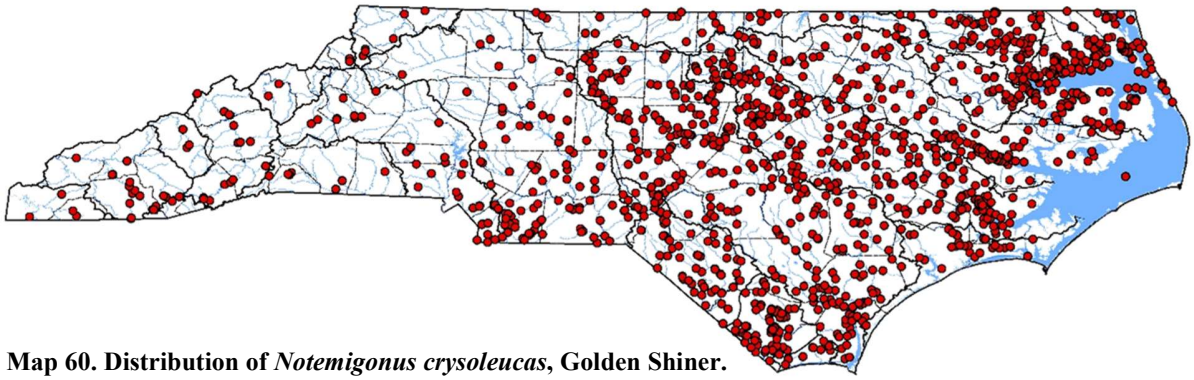
Remarks: The record plotted in Menhinick (1991) from the Cape Fear basin is in error (UF 178130, reidentified as Bluehead Chub). There is one unverified record, collected by NCWRC from the Meherrin River (Chowan basin) in August 2013 (NCWRC database, T. Black, formerly NCWRC, pers. comm.).



Map 59. Distribution of *Nocomis raneyi*, Bull Chub.

***Notemigonus crysoleucas* (Mitchill, 1814). Golden Shiner.**

Golden Shiner is indigenous to all Atlantic slope basins and has been introduced as a bait and forage fish into each of the river basins west of the Mountains (Map 60). The earliest vouchered specimens from the Hiwassee, Little Tennessee, Pigeon, French Broad, Nolichucky, Watauga, and New basins are 1980, 1955, 1998, 1962, 1994, 1949, and 1949, respectively.

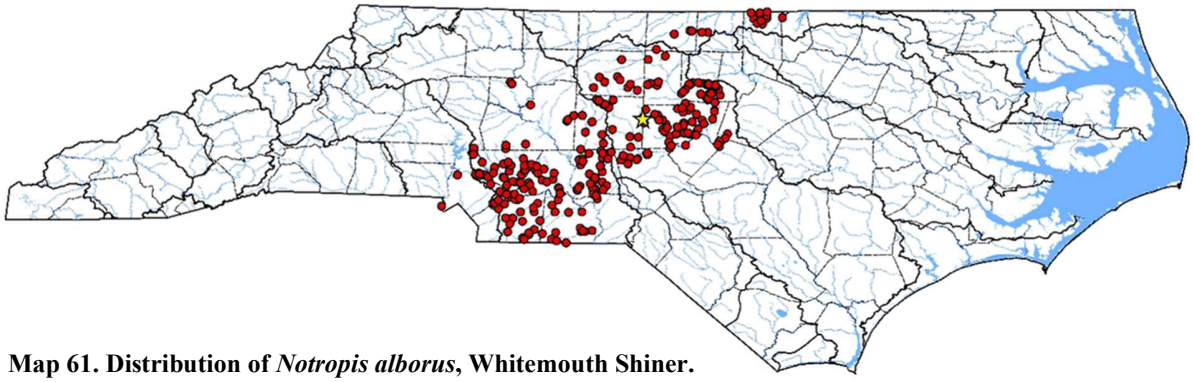


Map 60. Distribution of *Notemigonus crysoleucas*, Golden Shiner.

***Notropis alborus* Hubbs and Raney, 1947. Whitemouth Shiner.**

Whitemouth Shiner is restricted to the Piedmont portion of the Roanoke, Cape Fear, and Yadkin basins (Map 61) and is found only in Virginia, North Carolina, and South Carolina (Gilbert 1980e; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: There are two lots at NCSM from 1966 and 1967 from the Catawba basin in Mecklenburg County (Long Creek, NCSM 97448, n=5) and a backwater cove of Lake Wylie (NCSM 97449, n=1) plotted in Menhinick (1991). These two lots represent either an unsuccessful introduction or incorrect locality information, because no additional specimens of Whitemouth Shiner have ever been collected or reported from the Catawba basin in Mecklenburg County (Cloutman and Olmsted 1978; Caroline Burgett, Mecklenburg County Water Quality Program, pers. comm.). Whitemouth Shiner was described by Carl L. Hubbs and E. C. Raney (Hubbs and Raney 1947; Table 5). The species was extant at its type locality in March 2009 (NCSM 59132, B. H. Tracy, unpublished data). Whitemouth Shiner may easily be confused with other sympatric species of *Notropis* with black lateral lines and 7 or 8 anal rays, such as Cape Fear Shiner, Spottail Shiner, *N. hudsonius*, Swallowtail Shiner, and Coastal Shiner, *N. petersoni*.

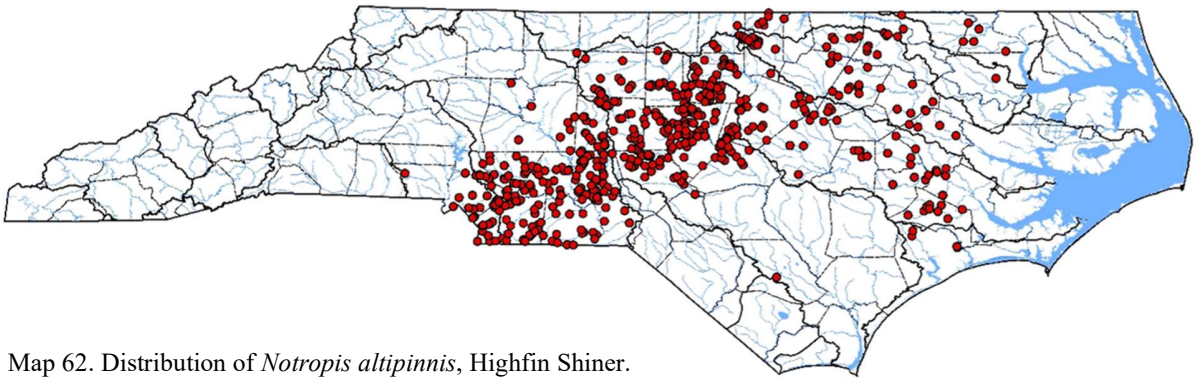


Map 61. Distribution of *Notropis alborus*, Whitemouth Shiner. Star indicates type locality.

***Notropis altipinnis* (Cope, 1870). Highfin Shiner.**

Highfin Shiner is widespread across the Piedmont from the Catawba to the Roanoke basins and in the lower Coastal Plain in the Neuse, Tar, and Chowan basins (Map 62). It is localized in the lower Cape Fear basin. Highfin Shiner is found only in Virginia, North Carolina, and South Carolina (Gilbert and Burgess 1980e; Rohde et al. 2009).

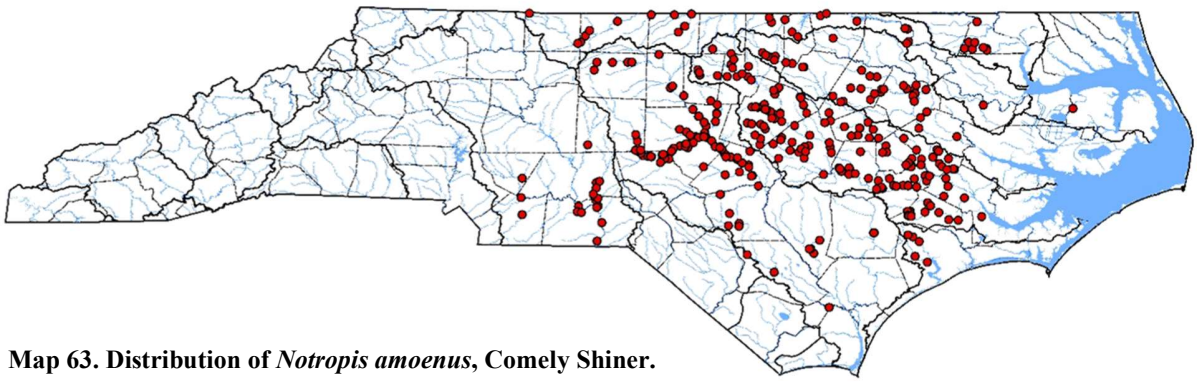
Remarks: Recently, two localized populations were discovered in the White Oak basin (Grants Creek, a tributary to the White Oak River and Mill Swamp a tributary to the New River) after two lots at NCSM (NCSM 10899 and NCSM 58300) and one lot at UAIC (UAIC 01459.11) were reexamined. Highfin Shiner was described as *Alburnellus altipinnis* (Cope 1870a; Table 5). The type locality was not specified, but most likely would have been the Yadkin River south of US 64 at the Koontz Plantation in Davidson County (which at that time of Cope was a part of Roane (Rowan) County) (R. E. Jenkins, retired, Roanoke College, pers. comm.; B. H. Tracy, pers. obs.). The species was no longer extant at this locality in October 2009 (B. H. Tracy, unpublished data). Highfin Shiner is often confused with Dusky Shiner, *Notropis cummingsae*, where their distributions are sympatric.



Map 62. Distribution of *Notropis altipinnis*, Highfin Shiner.

***Notropis amoenus* (Abbott, 1874). Comely Shiner.**

Comely Shiner is found in Piedmont and Coastal Plain streams of the Roanoke, Chowan, Albemarle (NCSM 12597, collected in 1964), Tar, Neuse, White Oak, and Cape Fear basins (Map 63). It has been introduced into the lower Yadkin basin in North Carolina and the Pee Dee basin in South Carolina (Tracy 2018). Comely Shiner is at the southern limit of its range in North Carolina (Snelson and Gilbert 1980).

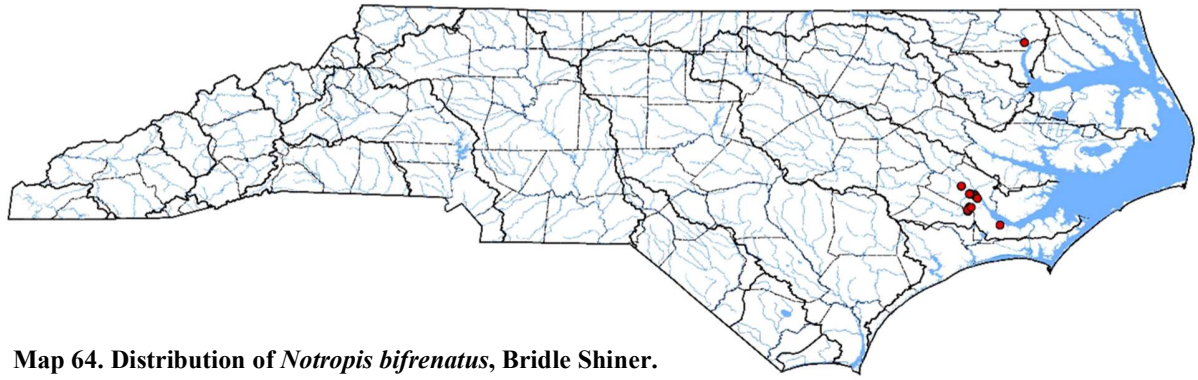


Map 63. Distribution of *Notropis amoenus*, Comely Shiner.

***Notropis bifrenatus* (Cope, 1869). Bridle Shiner.**

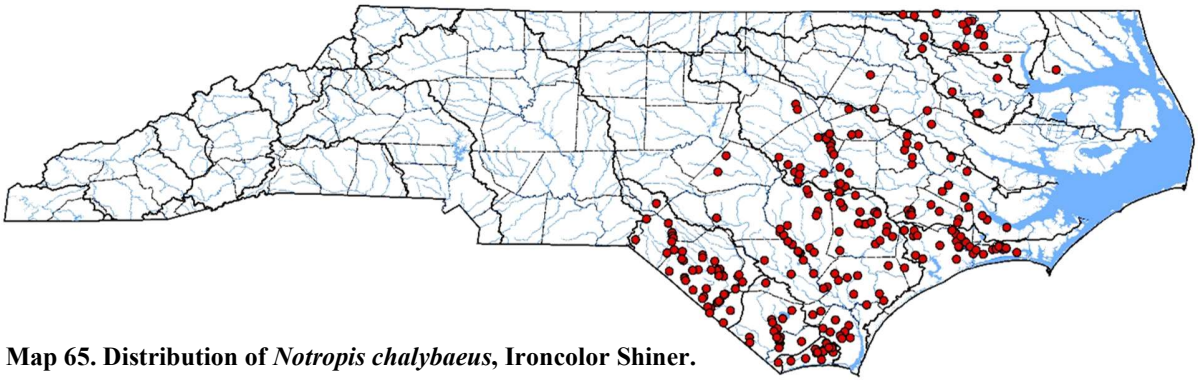
Bridle Shiner has been considered extirpated from North Carolina since the 1960s. However, it was rediscovered in 2000 from Bachelor Creek (Neuse basin) and in 2012 from Deep Swamp

Branch (Chowan basin) (Map 64). This species is at the southern limit of its range in North Carolina and South Carolina (Gilbert 1980f; Rohde et al. 2009).
Remarks: Its presence in North Carolina was first noted in July 1960 and then not again until July 2000 in Craven County. Three additional localities in the Neuse basin were found in 2014, Rocky Run and Neuse River, Craven County and Trent River and Island Creek, Jones County. A separate population was discovered in May 2012 in Deep Swamp Branch (Hertford County, Chowan basin).
Status: State Endangered.



Map 64. Distribution of *Notropis bifrenatus*, Bridle Shiner.

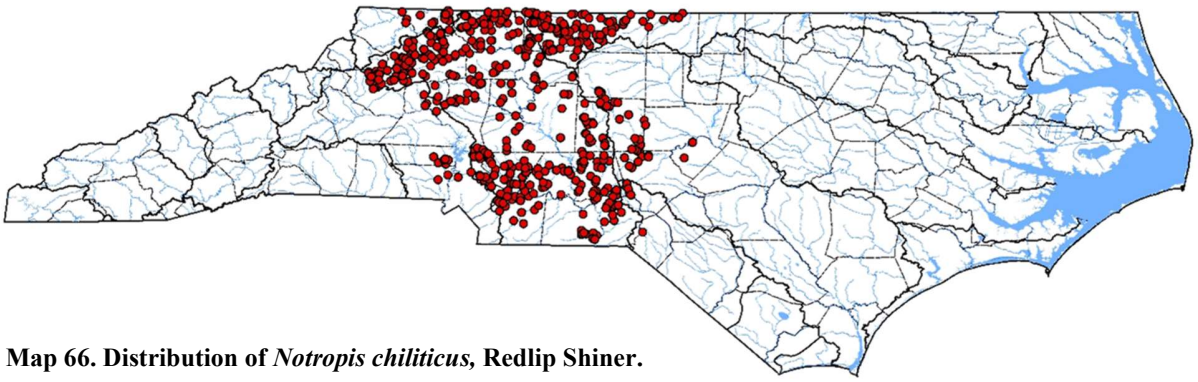
***Notropis chalybaeus* (Cope, 1867). Ironcolor Shiner.**
Ironcolor Shiner is found in every river basin within the Coastal Plain from the Virginia state line to the South Carolina border (Map 65).
Remarks: Surveys conducted in the southeastern basins by NCWRC staff between 2010 and 2016 showed that the number of Ironcolor Shiners encountered and the number of sites at which they were present seemed to be much lower and fewer than during the NCWRC surveys conducted in the 1960s (B. Jones, NCWRC, pers. comm.). A similar decline in relative abundance has also been observed in the Shallotte basin (F. C. Rohde, pers. obs.).
Status: State Significantly Rare.



Map 65. Distribution of *Notropis chalybaeus*, Ironcolor Shiner.

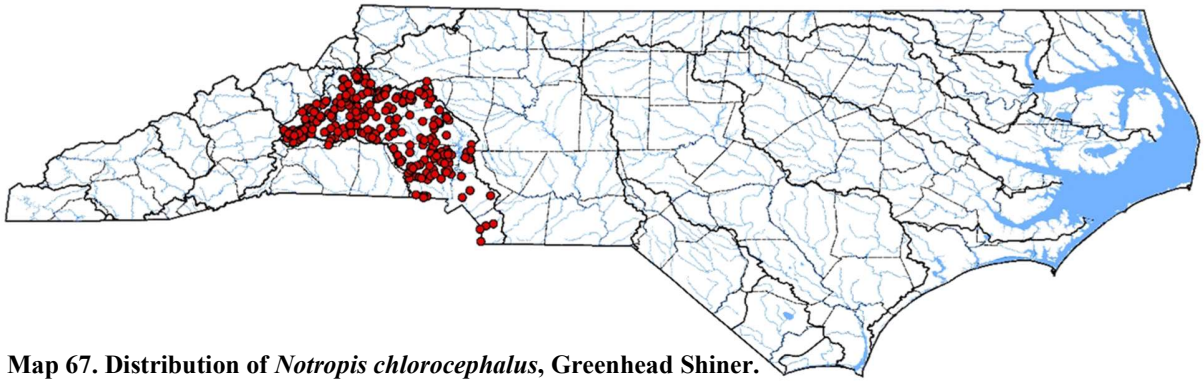
***Notropis chiliticus* (Cope, 1870). Redlip Shiner.**
Redlip Shiner is indigenous to the Piedmont portion of the Roanoke and Yadkin basins with introduced populations in the New, Cape Fear, Catawba, and Lumber basins (earliest vouchered specimens from 1963, 1984, 1948, and 1967, respectively) (Map 66). It is found only in Virginia,

North Carolina, and South Carolina (Gilbert and Burgess 1980f; Jenkins and Burkhead 1994; Rohde et al. 2009).
Remarks: Redlip Shiner was described as *Hybopsis chiliticus* (Cope 1870a; Table 5). The type locality was not specified, but was most likely Gobble Creek, which is south of US 64 at the Koontz Plantation in Davidson County (which at that time of Cope, was a part of Roane (Rowan) County) (R. E. Jenkins, retired, Roanoke College, pers. comm.; B. H. Tracy, pers. obs.). The species was extant in Gobble Creek in October 2009 (NCSM 59372, B. H. Tracy, unpublished data).



Map 66. Distribution of *Notropis chiliticus,* Redlip Shiner.

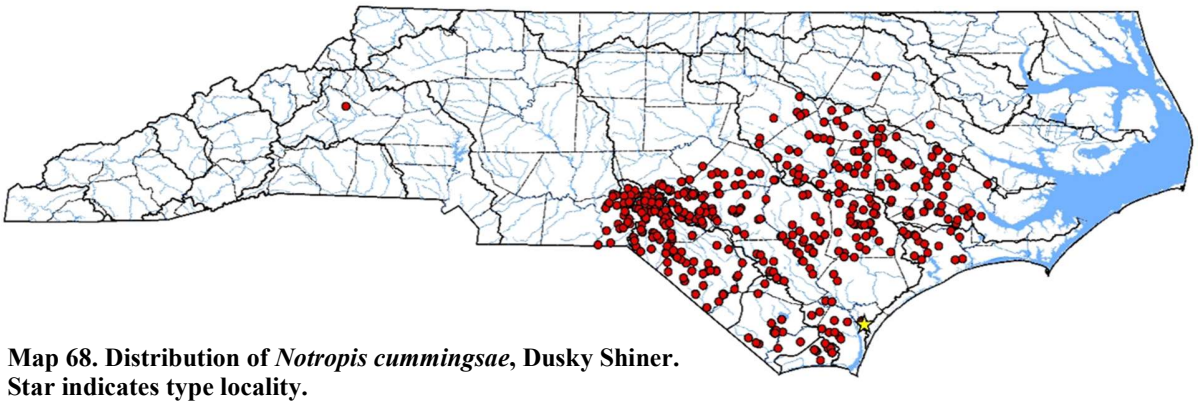
***Notropis chlorocephalus* (Cope, 1870). Greenhead Shiner.**
Greenhead Shiner is endemic to the Catawba basin in North Carolina and South Carolina (Gilbert and Burgess 1980g; Rohde et al. 2009) (Map 67).
Remarks: Greenhead Shiner was described as *Hybopsis chlorocephalus* (Cope 1870a; Table 5).



Map 67. Distribution of *Notropis chlorocephalus*, Greenhead Shiner.

***Notropis cummingsae* Myers, 1925. Dusky Shiner.**
Dusky Shiner, primarily a Sand Hills and Coastal Plain species, is found from the lower Tar basin southwest to the lower Yadkin basin (Map 68). The species is at the northern limit of its range in North Carolina (Gilbert and Burgess 1980h).
Remarks: A disjunct and possibly extirpated Piedmont population was discovered in Burke County (Catawba basin) in 1946 and given the name *N. cummingsae collis* (Hubbs and Raney 1951; Tracy and Starnes 2013). Records plotted in Menhinick (1991) from Mecklenburg and Union counties (Catawba basin) were reidentified as Highfin Shiner. Dusky Shiner was described as *Notropis cummingsi* (Myers 1925; Table 5). The species was no longer extant at its type locality in March

2009 (B. H. Tracy, unpublished data). Dusky Shiner is often confused with Highfin Shiner where their distributions are sympatric.

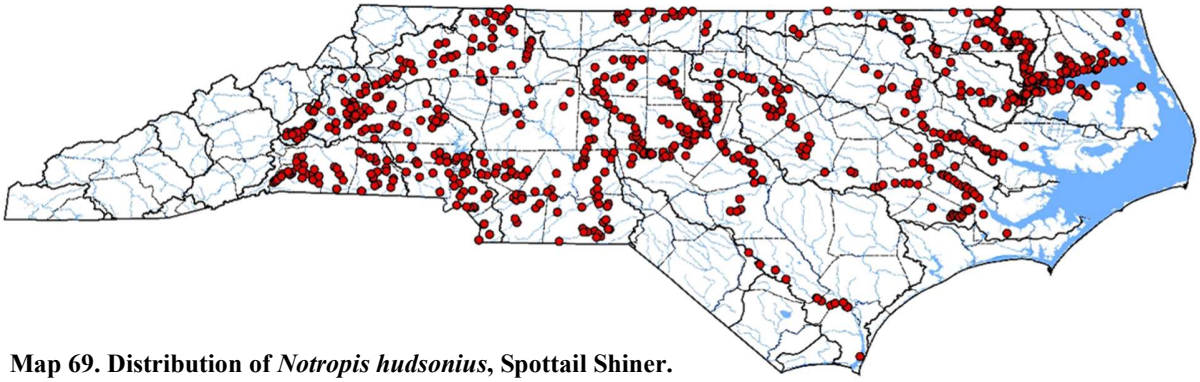


Map 68. Distribution of *Notropis cummingsae*, Dusky Shiner. Star indicates type locality.

***Notropis hudsonius* (Clinton, 1824). Spottail Shiner.**

Spottail Shiner is found in all Atlantic slope basins, except for the White Oak, Shallotte, Waccamaw, Lumber, and Savannah (Map 69).

Remarks: Records plotted in Menhinick (1991) for the Lumber, Waccamaw, and Shallotte are in error (Starnes and Hogue 2011). Young Spottail Shiner may easily be confused with other sympatric species of *Notropis* with black lateral lines and 7 or 8 anal rays, such as Cape Fear Shiner, Whitemouth Shiner, Swallowtail Shiner, and Coastal Shiner.

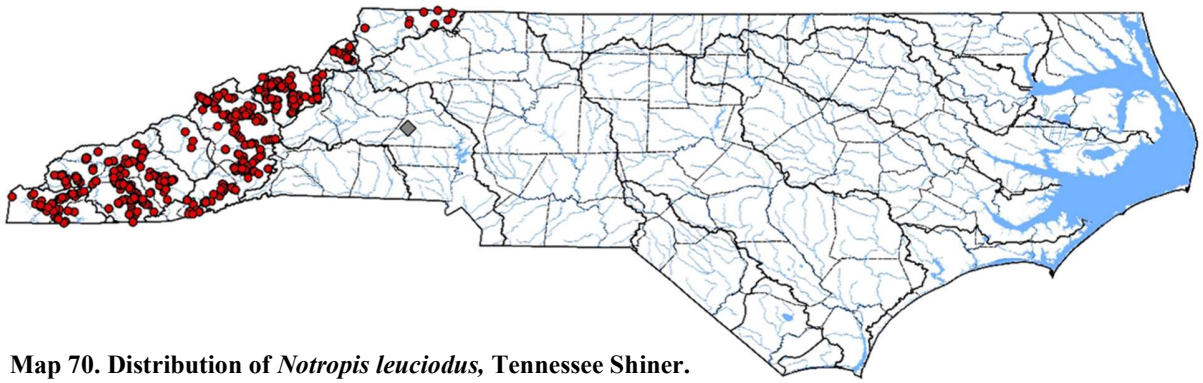


Map 69. Distribution of *Notropis hudsonius*, Spottail Shiner.

***Notropis leuciodus* (Cope, 1868). Tennessee Shiner.**

Tennessee Shiner is indigenous to the Savannah and all basins west of the Mountains, except for the New basin, where it has been introduced (earliest vouchered specimens from 1963) (Map 70).

Remarks: The population in the Linville River (Catawba basin) is considered indigenous via stream capture (Weaver 1897; Ross 1971; Scott 2014).



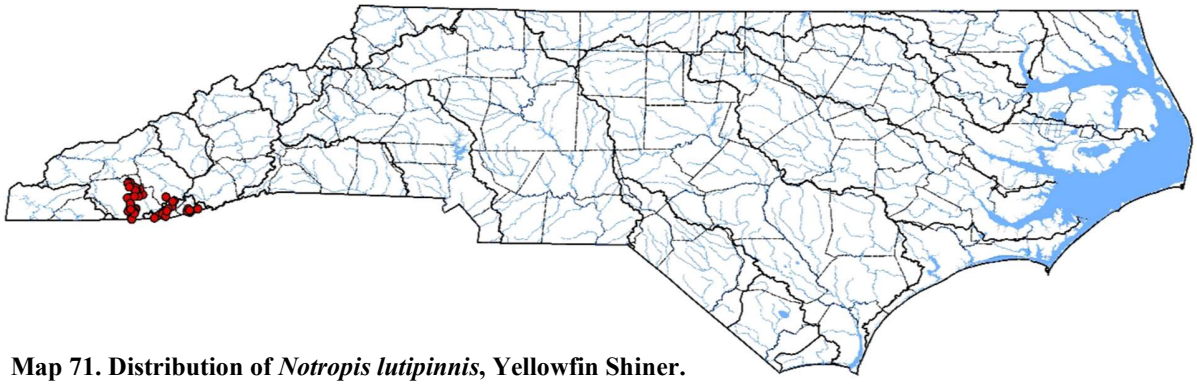
Map 70. Distribution of *Notropis leuciodus,* Tennessee Shiner.

***Notropis lutipinnis* (Jordan and Brayton, 1878). Yellowfin Shiner.**

Yellowfin Shiner, indigenous in the Savannah basin, is now found in many tributaries of the Little Tennessee River upstream and downstream from Porters Dam in Macon County (Map 71). This species is at the northern limit of its range in North Carolina (Gilbert and Burgess 1980i).

Remarks: We consider Yellowfin Shiner as introduced in the Little Tennessee basin. Scott et al. (2009) were unable to clearly resolve the Yellowfin Shiner's complex distributional history (i.e. vouchered specimens (1989) versus published records of (Ramsey (1965), Johnston et al (1995)) and could not reject the possibility that the species is indigenous to the Little Tennessee basin.

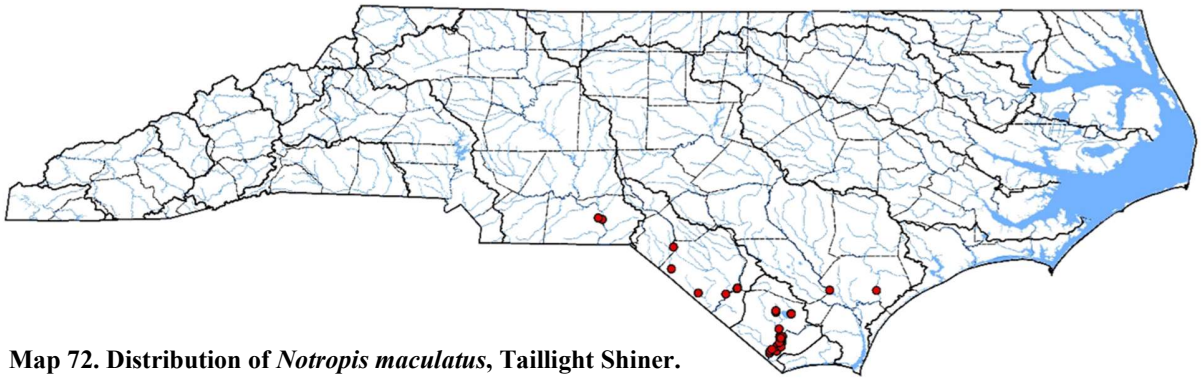
Status: State Special Concern.



Map 71. Distribution of *Notropis lutipinnis*, Yellowfin Shiner.

***Notropis maculatus* (Hay, 1881). Taillight Shiner.**

Taillight Shiner is a lower Coastal Plain species found in the Yadkin, Lumber, Waccamaw, and Cape Fear (Northeast Cape Fear and Black rivers) basins (Map 72) where it is at the northern limit of its range. (Gilbert 1980g).



Map 72. Distribution of *Notropis maculatus*, Taillight Shiner.

***Notropis mekistocholas* Snelson, 1971. Cape Fear Shiner.**

Cape Fear Shiner is endemic to a small number of creeks and rivers in the Piedmont region of the Cape Fear basin in Chatham, Lee, Harnett, Moore, and Randolph counties (Snelson 1971; Snelson 1980a; Pottern 2009) (Map 73).

Remarks: Cape Fear Shiner was described by Franklin F. Snelson, Jr. (Snelson 1971; Table 5). The species was no longer extant at its type locality in July 2009 (B. H. Tracy, unpublished data). Cape Fear Shiner may easily be confused with other sympatric species of *Notropis* with black lateral lines and 7 or 8 anal rays, such as Spottail Shiner, Whitemouth Shiner, Swallowtail Shiner, and Coastal Shiner.

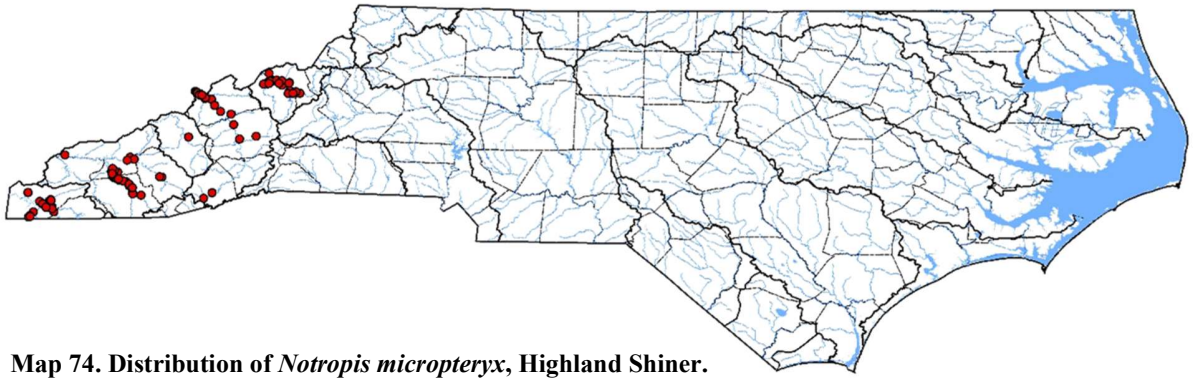
Status: Federally Endangered.

Map 73. Distribution of *Notropis mekistocholas*, Cape Fear Shiner. Star indicates type locality.

***Notropis micropteryx* (Cope, 1868). Highland Shiner.**

Highland Shiner is widely distributed throughout the Nolichucky, French Broad, Little Tennessee, and Hiwassee basins (Wood et al. 2002) (Map 74).

Remarks: This species keys out as *Notropis rubellus* in Menhinick (1991).

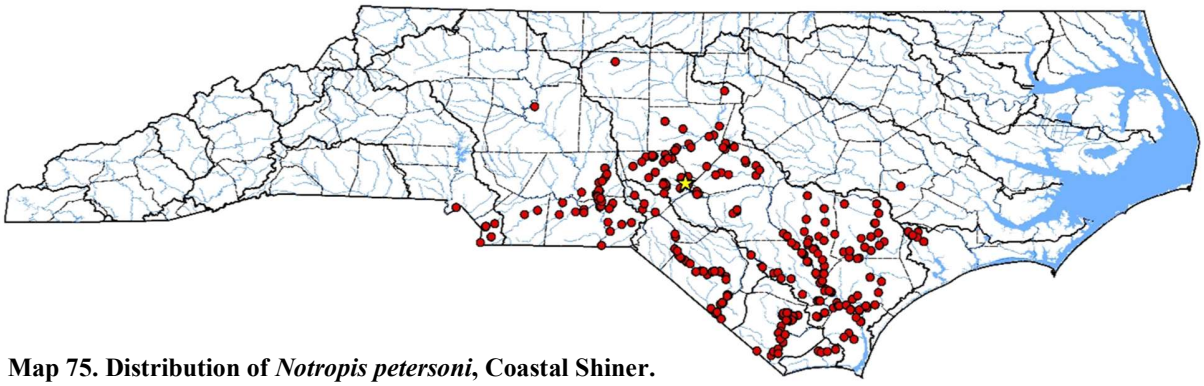


Map 74. Distribution of *Notropis micropteryx*, Highland Shiner.

***Notropis petersoni* Fowler, 1942. Coastal Shiner.**

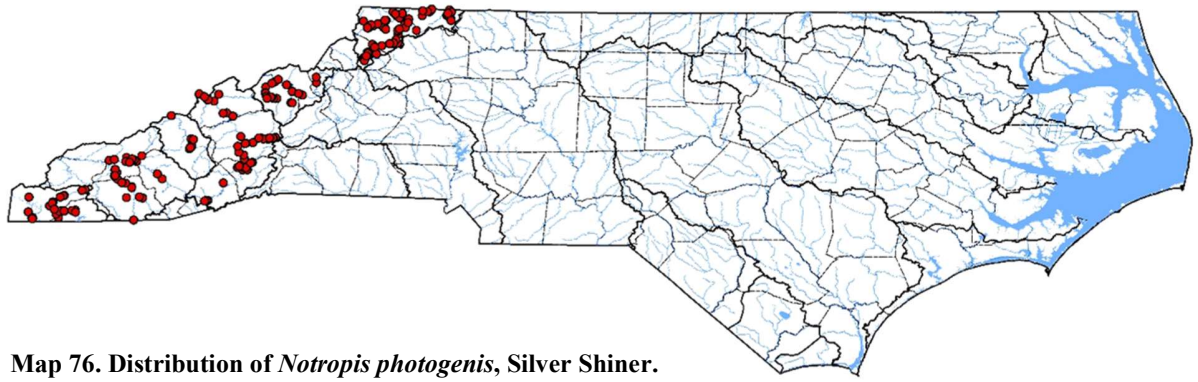
Coastal Shiner is found from the White Oak basin southwestward. It is also found in the lower Catawba and Yadkin basins with a disjunct record from 1961 from Guilford County (NCSM 56144, Cape Fear basin) and a record from 1869 collected by E. D. Cope from Davidson County (ANSP 2031, Yadkin basin) (Map 75). It is at the northern limit of its range in North Carolina (Swift 1980).

Remarks: Coastal Shiner has never been collected again in the middle Yadkin basin since 1869. There is an anomalous record of a specimen collected in 1963 from Falling Creek, Lenoir County, in the Neuse basin (NCSM 22635) (Map 75). The validity of the locality has been questioned in the remarks for that lot: "*NCSM collection data suggests no previous records of Notropis petersoni in Neuse Basin and a field data transposition might be suspected. Original identification was N. altipinnis but Joseph R. Bailey did not list this species in original field notes (nor other that might be referable to this species); appears to be fairly typical N. petersoni (2-4, 4-2 teeth, scaleless breast, pigmentation etc.) except snout blunter than average - Wayne C. Starnes, 27 June 2006*." The record is mapped, but the species is not considered introduced or indigenous in the Neuse basin (Table 3) because no additional specimens have ever been collected from this basin. Coastal Shiner was described by Henry W. Fowler (Fowler 1942; Table 5). The species was extant at its type locality in May 2009 (NCSM 59165, B. H. Tracy, unpublished data). Coastal Shiner may easily be confused with other sympatric species of *Notropis* with black lateral lines and 7 or 8 anal rays, such as Cape Fear Shiner, Whitemouth Shiner, Spottail Shiner, and Swallowtail Shiner where their distributions are sympatric.



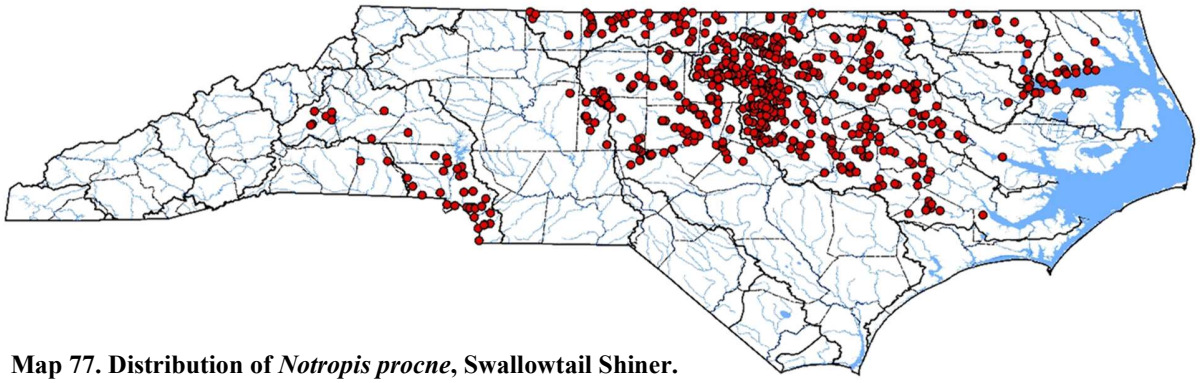
Map 75. Distribution of *Notropis petersoni*, Coastal Shiner. Star indicates type locality.

***Notropis photogenis* (Cope, 1865). Silver Shiner.**
Silver Shiner is indigenous and widely distributed in all basins west of the Mountains, except the Watauga basin (Map 76). The species is at its southern limit of its range in North Carolina and extreme northern Georgia (Rabun County) (Gilbert 1980h).
Remarks: The record plotted for the Watauga basin by Menhinick (1991) was based upon six incorrectly identified specimens of Tennessee Shiner (NCSM 3253; Starnes and Hogue 2011).



Map 76. Distribution of *Notropis photogenis*, Silver Shiner.

***Notropis procne* (Cope, 1865). Swallowtail Shiner.**
Swallowtail Shiner is indigenous to the Catawba, upper Cape Fear, Neuse, Tar, Roanoke, Chowan, and Albemarle basins and has been introduced into the Yadkin (Tracy 2018) and Broad basins (Map 77).
Remarks: Evermann (1916) recorded Swallowtail Shiner in the Lumber basin, but that record cannot be verified and is the only record of the species in the basin. The distribution of Swallowtail Shiner is enigmatic with its indigenous occurrences north and east of the Cape Fear, an introduced population in the Yadkin basin, indigenous populations in the Catawba basin, and an introduced population in the Broad basin (Map 77). The population(s) in the lower Catawba appear different from their eastern counterparts, resembling Sand Shiner, *Notropis stramineus,* in terms of overall body color and physical appearance (B. H. Tracy, pers. obs.). Raney (1947) recognized two subspecies of Swallowtail Shiner, but the validity of the subspecies designations was dismissed by Snelson (1971) and Jenkins and Sorensen (1980). Rohde et al. (2009) acknowledged the results of some preliminary genetic work from different drainages, but the results were never published, and the subject continues to require further study (F. C. Rohde, pers. comm.). Swallowtail Shiner may easily be confused with other sympatric species of *Notropis* with black lateral lines and 7 or 8 anal rays, such as Cape Fear Shiner, Whitemouth Shiner, Spottail Shiner, and Coastal Shiner where their distributions are sympatric.

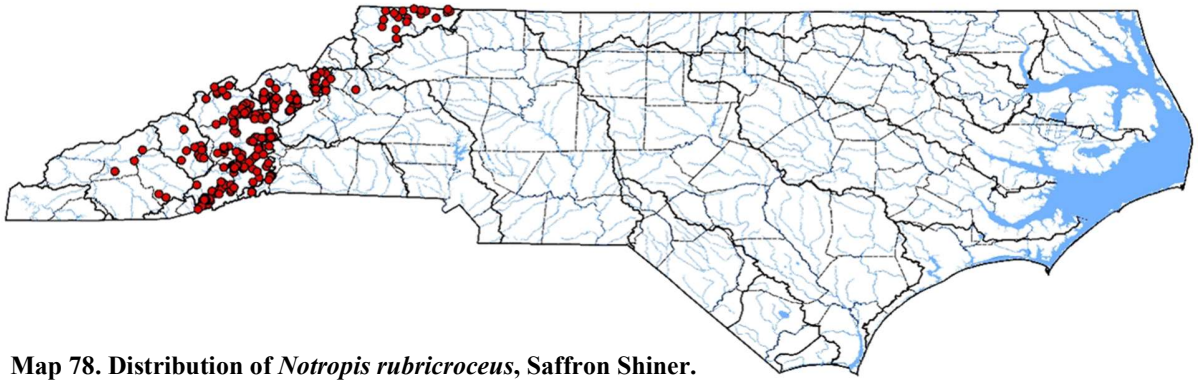


Map 77. Distribution of *Notropis procne*, Swallowtail Shiner.

***Notropis rubricroceus* (Cope, 1868). Saffron Shiner.**

Saffron Shiner is indigenous to the Pigeon, French Broad, Nolichucky, and Catawba basins. It has been introduced in the Broad, Savannah, Little Tennessee, and New basins with the earliest vouchered specimens from those basins from 1962, 1962, 1936, and 1974, respectively (Johnston et al. 1995; Ramsey 1965; Map 78). It is found only in Virginia, Tennessee, North Carolina, and South Carolina (Gilbert 1980i; Etnier and Starnes 1993; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: The population occurring in the Linville River (Catawba basin) is considered indigenous via stream capture (Weaver 1897; Ross 1971; Scott 2014).



Map 78. Distribution of *Notropis rubricroceus*, Saffron Shiner.

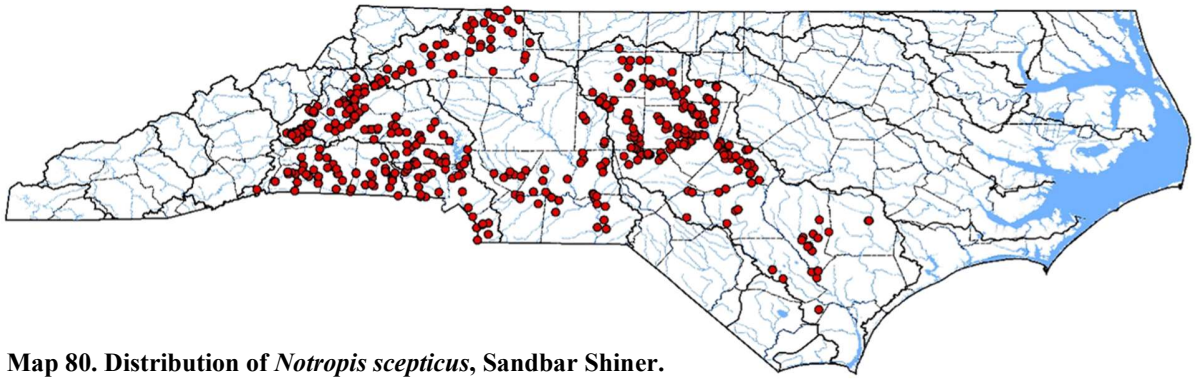
***Notropis scabriceps* (Cope, 1868). New River Shiner.**

New River Shiner is endemic to and found throughout the New basin where it is at the southern limit of its range (Jenkins 1980a; Jenkins and Burkhead 1994) (Map 79).

Map 79. Distribution of *Notropis scabriceps*, New River Shiner.

***Notropis scepticus* (Jordan and Gilbert, 1883). Sandbar Shiner.**

Sandbar Shiner is widely distributed from the Broad to the Cape Fear basins but is absent from the southeast and northeast corners of the state and from the Roanoke basin (Map 80). It is only found in North Carolina, South Carolina, and Georgia (Harrell and Cloutman 1978; Cloutman 1980; Rohde et al. 2009).

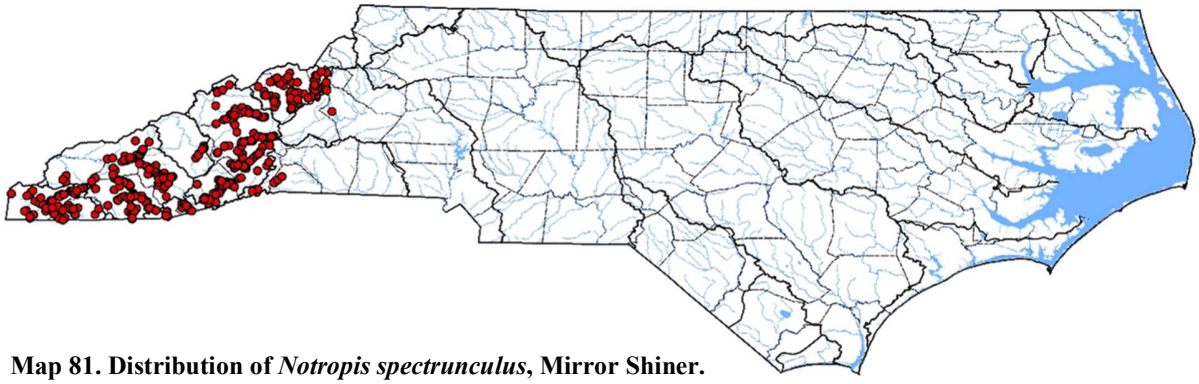


Map 80. Distribution of *Notropis scepticus*, Sandbar Shiner.

***Notropis spectrunculus* (Cope, 1868). Mirror Shiner.**

Mirror Shiner is indigenous and widely distributed in all river basins west of the Mountains and south of the Watauga basin (Map 81).

Remarks: Populations of this species in the Catawba (Linville River) and Savannah basins are considered indigenous via stream capture (Weaver 1897; Ross 1971; Scott 2014). The distribution of Mirror Shiner in the upper Broad basin (Polk and Henderson counties) is the same as that of Saffron Shiner and Mottled Sculpin. There are only eight vouchered lots (5 at NCSM, 2 at UAIC, and 1 at UT) with the earliest vouchered specimens from 1999 and one unvouchered record from the NCWRC's 1960s state-wide basin survey (Starnes and Hogue 2011). Based upon this evidence, we consider the upper Broad populations introduced, although Ramsey (1965) considered them, along with the Savannah River population, to be "derived" populations.

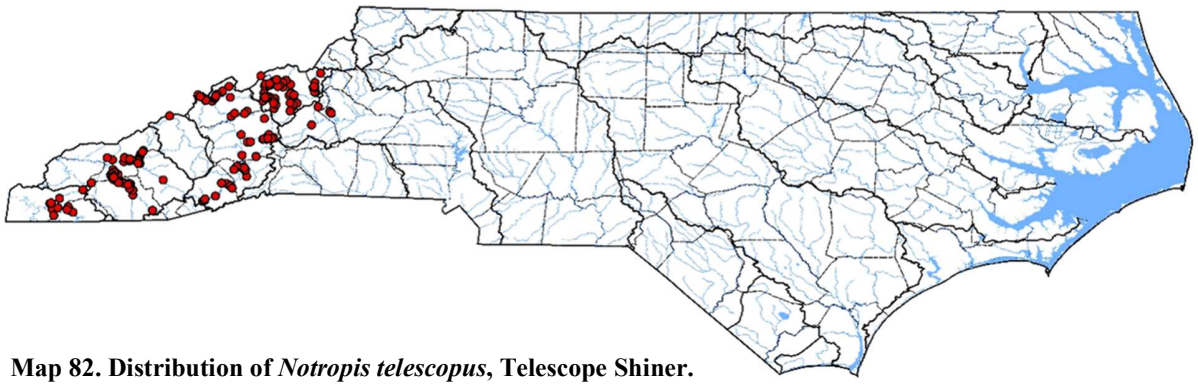


Map 81. Distribution of *Notropis spectrunculus*, Mirror Shiner.

***Notropis telescopus* (Cope, 1868). Telescope Shiner.**

Telescope Shiner is indigenous to all river basins west of the Mountains and south of the Watauga basin, except for the Savannah basin (Map 82).

Remarks: The population in the Catawba basin (Linville River) is considered indigenous via stream capture (Weaver 1897; Ross 1971; Scott 2014). However, other records plotted in Menhinick (1991) from the upper Catawba are based upon misidentifications of Sandbar Shiner, Redlip Shiner, and Warpaint Shiner.

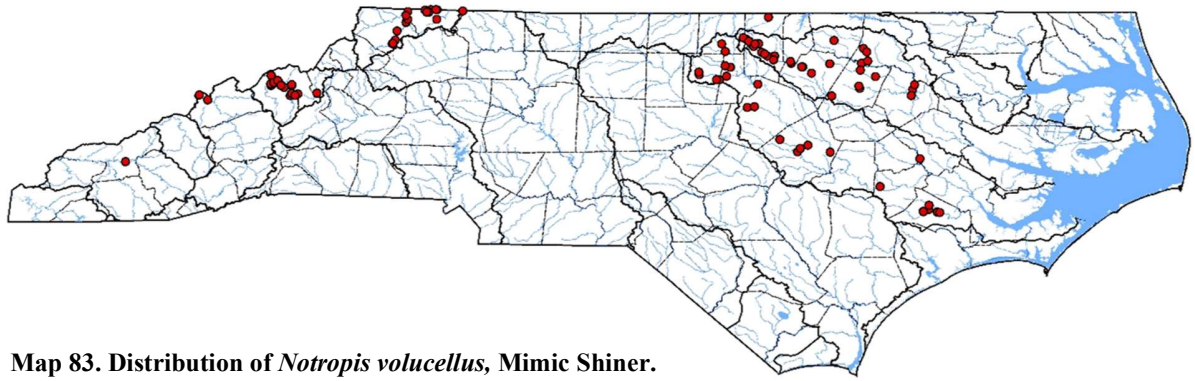


Map 82. Distribution of *Notropis telescopus*, Telescope Shiner.

***Notropis volucellus* (Cope, 1865). Mimic Shiner.**

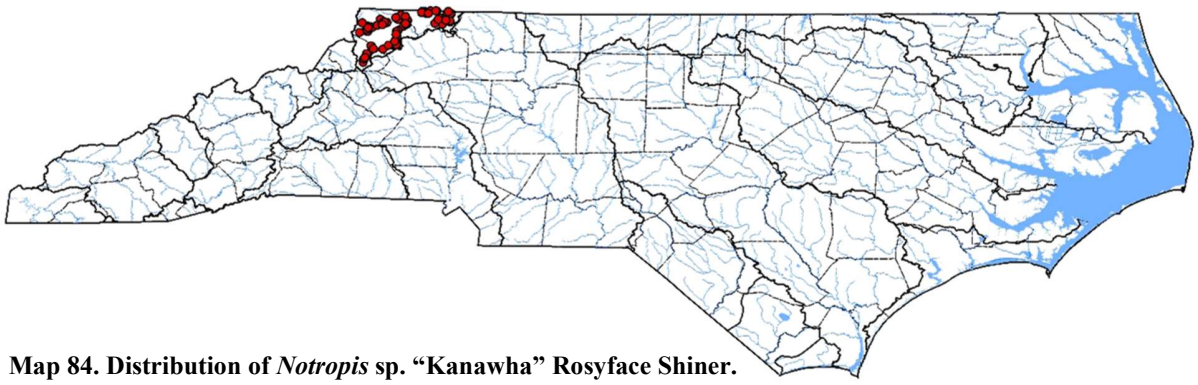
Mimic Shiner is found in the Roanoke (possibly extirpated), Neuse, Tar, New, French Broad and Nolichucky basins. Its distribution forms at least three disjunct populations in North Carolina (Map 83).

Remarks: There is one record of a single specimen from the Little Tennessee basin (UT 44.1944, verified by Bruce Bauer) that had been collected in 1979. It is the only known record from the basin. There is one lot at UMMZ (UMMZ 177032) collected in 1963 from Little Grass Creek (Roanoke basin) in Granville County. This lot, representing the only known record from the basin, was verified in May 2013 by W. C. Starnes and B. H. Tracy. An examination of Smith's field notes (archived at AMNH), did not disprove that the collection was not made from Little Grassy Creek (Tracy 2014a). There appears to be undescribed biodiversity within this species (Jeremy Wright, New York State Museum, pers. comm.). Mimic Shiner may be confused with other co-occurring *Notropis* species such as Whitemouth Shiner, Bridle Shiner, Ironcolor Shiner, Spottail Shiner, Swallowtail Shiner, and New River Shiner.
Status: State Threatened.



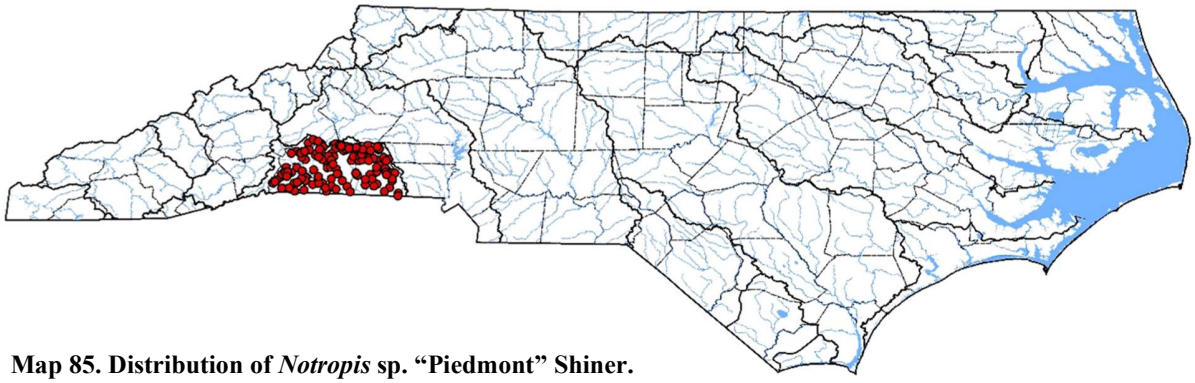
Map 83. Distribution of *Notropis volucellus,* Mimic Shiner.

***Notropis* sp. "Kanawha" Rosyface Shiner.**
"Kanawha" Rosyface Shiner, an undescribed species, is endemic to the New basin (Wood et al. 2002) (Map 84).
Remarks: This undescribed species keys out as *Notropis rubellus* in Menhinick (1991).
Status: Significantly Rare.



Map 84. Distribution of *Notropis* sp. "Kanawha" Rosyface Shiner.

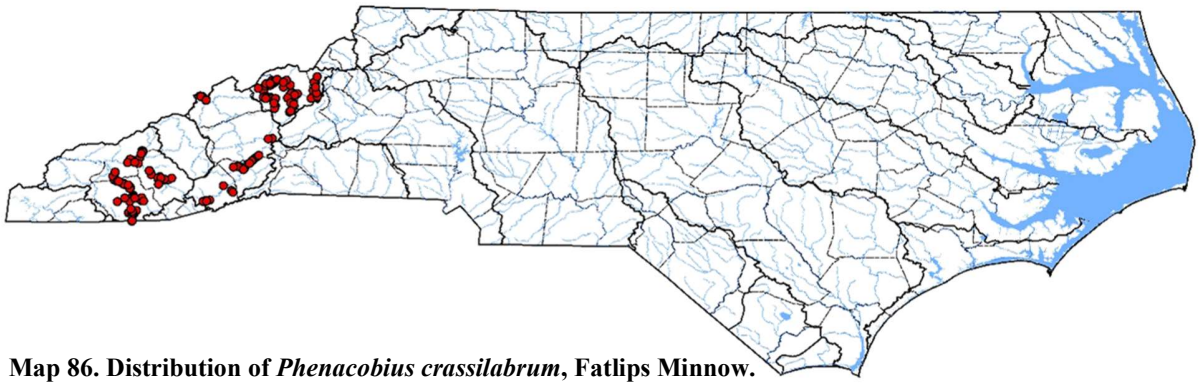
***Notropis* sp. "Piedmont" Shiner.**
"Piedmont" Shiner, an undescribed species, is endemic to and found throughout the Broad basin in North Carolina and South Carolina (Map 85).
Remarks: This undescribed species keys out as *Notropis lutipinnis* in Menhinick (1991).



Map 85. Distribution of *Notropis* sp. "Piedmont" Shiner.

***Phenacobius crassilabrum* Minckley and Craddock, 1962. Fatlips Minnow.**

Fatlips Minnow is widely distributed from the Nolichucky basin to the Little Tennessee basin, but is absent from the Pigeon (Map 86). It is found only in southwestern Virginia, eastern Tennessee, western North Carolina, and extreme northern Georgia (Rabun County) (Jenkins 1980b; Etnier and Starnes 1993; Jenkins and Burkhead 1994).

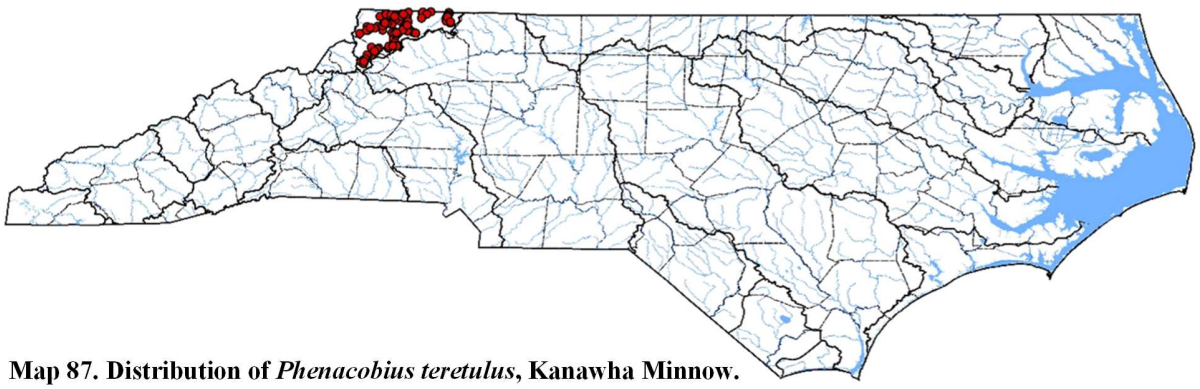


Map 86. Distribution of *Phenacobius crassilabrum*, Fatlips Minnow.

***Phenacobius teretulus* Cope, 1867. Kanawha Minnow.**

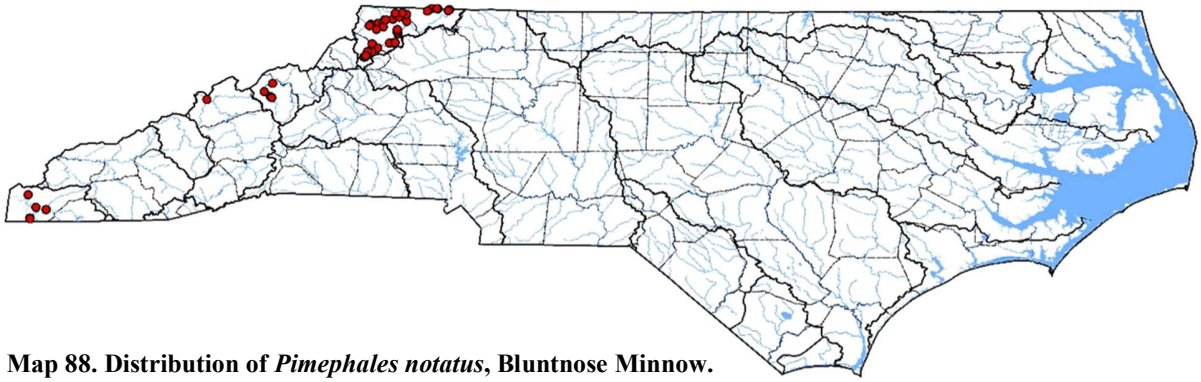
Kanawha Minnow is endemic to the New basin (Map 87), where it is at the southern limit of its range (Jenkins 1980c; Jenkins and Burkhead 1994).

Status: State Special Concern.



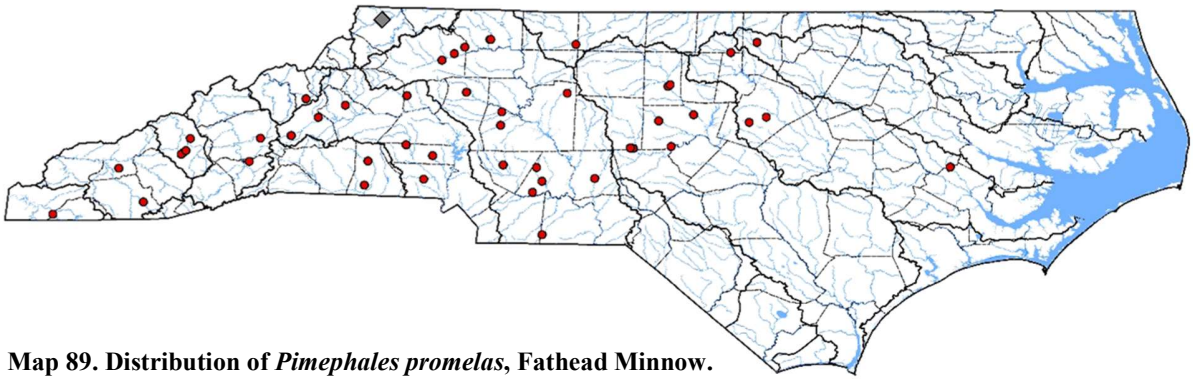
Map 87. Distribution of *Phenacobius teretulus*, Kanawha Minnow.

***Pimephales notatus* (Rafinesque, 1820). Bluntnose Minnow.**
Bluntnose Minnow has widely disjunct populations in the New, Nolichucky, lower French Broad, and Hiwassee basins (Map 88).
Remarks: An unverifiable record from the Watauga basin was plotted in Menhinick (1991).



Map 88. Distribution of *Pimephales notatus*, Bluntnose Minnow.

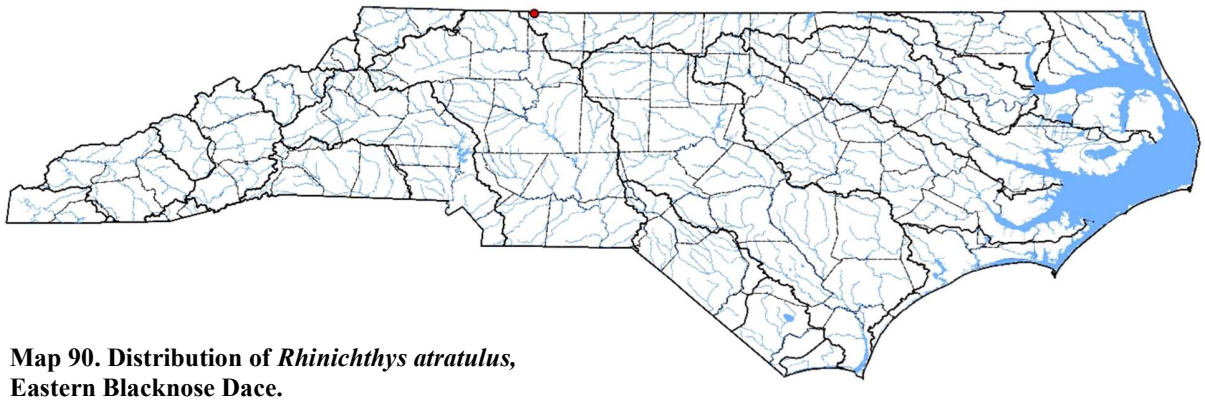
***Pimephales promelas* Rafinesque, 1820. Fathead Minnow.**
Fathead Minnow, a nonindigenous species, has been introduced as bait fish in many of the basins across North Carolina (Map 89).
Remarks: It is unknown if the records mapped represent persistent and reproducing populations, or if they are remnants of one-time bait bucket releases, or if the collector only vouchered one specimen per lot (61 of the 80 vouchered lots consisted of only one specimen each).There is one lot of nine specimens collected in November 1975 from the Watauga River (Watauga County, Watauga basin). The lot (TU 96318) was recently confirmed as Fathead Minnow by J. Mann (Tulane University, pers. comm.). It is the only known record from the basin and was most likely a bait-bucket introduction. Therefore, it is not mapped in Map 89 or tabulated in Table 3. The first vouchered specimen from North Carolina was from 1964 (NCSM 53864).



Map 89. Distribution of *Pimephales promelas*, Fathead Minnow.

***Rhinichthys atratulus* (Hermann, 1804). Eastern Blacknose Dace.**
Eastern Blacknose Dace are only known from the Roanoke basin (upper Dan River system) in Stokes County (Map 90).
Remarks: Eastern Blacknose Dace is found in Atlantic slope streams from Nova Scotia southward to the Roanoke basin in Virginia and in southeastern tributaries of Lake Ontario (Kraczkowski and

Chernoff 2014). However, collections from the Stewarts Creek watershed in Surry County (Pauls, Rutledge, and Stewarts creeks within the Ararat River subsystem) in 2009 appeared to include both Eastern Blacknose Dace and Western Blacknose Dace, *Rhinichthys obtusus*, or hybrids of the two species based upon nuptial coloration (R. E. Jenkins, retired, Roanoke College, and W. C. Starnes, retired, NCSM, pers. comm.).



Map 90. Distribution of *Rhinichthys atratulus*, Eastern Blacknose Dace.

***Rhinichthys cataractae* (Valenciennes, 1842). Longnose Dace.**

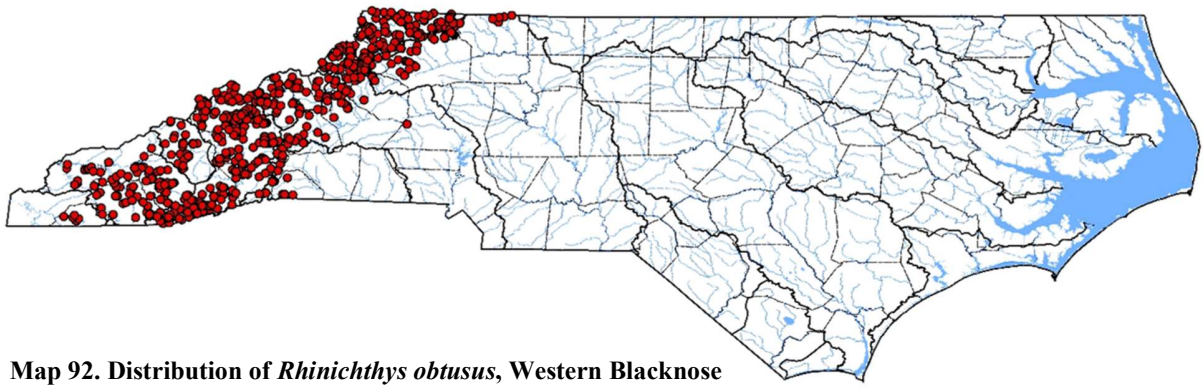
Longnose Dace is found in all basins west of the Mountains and in Savannah and Catawba Atlantic slope basins (Map 91). It is at the southern limits of its range on the Atlantic slope in North Carolina, South Carolina, and Georgia (Gilbert and Shute 1980a; Rohde et al. 2009).

Map 91. Distribution of *Rhinichthys cataractae*, Longnose Dace.

***Rhinichthys obtusus* Agassiz, 1854. Western Blacknose Dace.**

Western Blacknose Dace is found in all basins west of the Mountains, the Savannah, and in the upper reaches of the Yadkin, Catawba, and Broad basins (Map 92).

Remarks: This species keys out as *Rhinichthys atratulus* in Menhinick (1991).

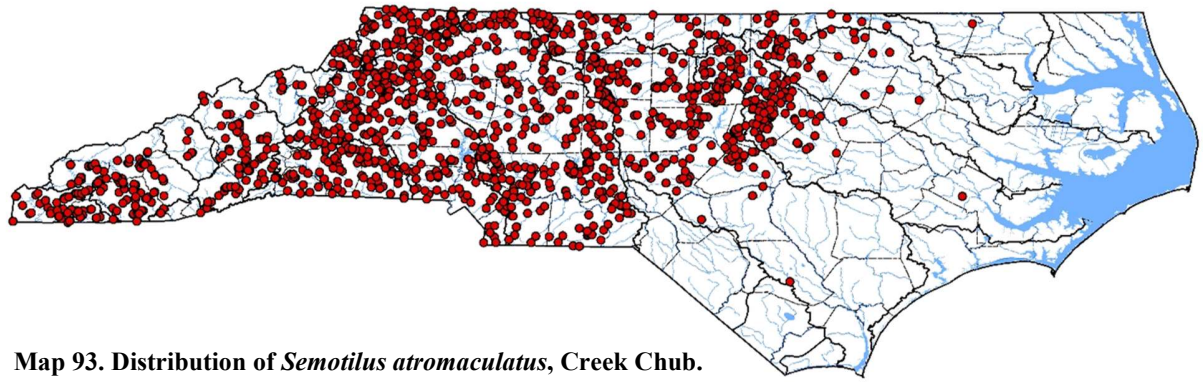


Map 92. Distribution of *Rhinichthys obtusus*, Western Blacknose

***Semotilus atromaculatus* (Mitchill, 1818). Creek Chub.**

Creek Chub is primarily a Piedmont and Mountain species that is found in all basins, except for the Lumber, Waccamaw, Shallotte, White Oak, and Albemarle (Map 93).

Remarks: There are two geographically separate clades of Creek Chub in North Carolina, which may warrant individual species recognition (Schönhuth et al. 2018). Although Creek Chub is considered indigenous to the Watauga basin, no mention of its occurrence in the basin was noted by Starnes and Hogue (2011) based upon the NCWRC's 1960s survey of the basin. The first specimens from that basin were not collected until 1980 (Bonner 1983).



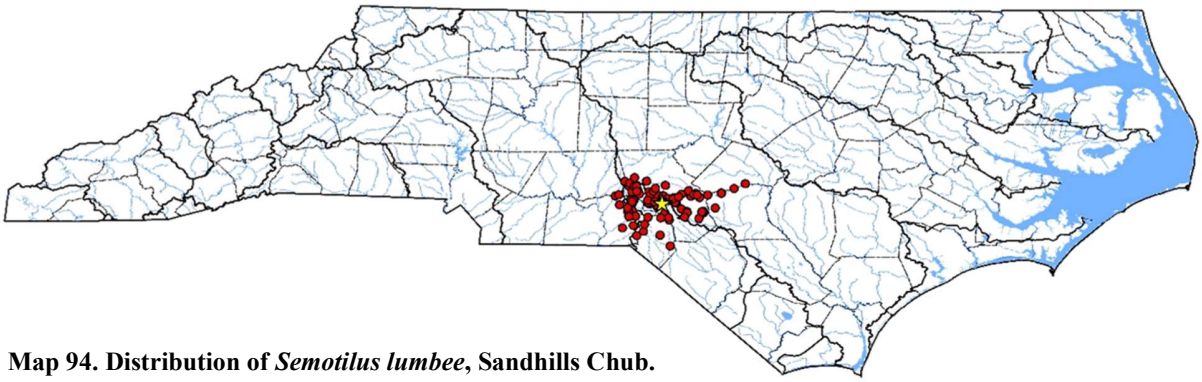
Map 93. Distribution of *Semotilus atromaculatus*, Creek Chub.

***Semotilus lumbee* Snelson and Suttkus, 1978. Sandhills Chub.**

Sandhills Chub is endemic to the Sand Hills in North Carolina and South Carolina (Snelson and Suttkus 1978; Snelson 1980b; Rohde et al. 2009) where it is found in the lower Yadkin, middle Cape Fear, and upper Lumber basins (Map 94).

Remarks: Sandhills Chub was described by Franklin F. Snelson and Royal D. Suttkus (Snelson and Suttkus 1978; Table 5). The species was extant at its type locality in May 2009 (NCSM 59176, B. H. Tracy, unpublished data).

Status: State Special Concern.



Map 94. Distribution of *Semotilus lumbee*, Sandhills Chub. Star indicates type locality.

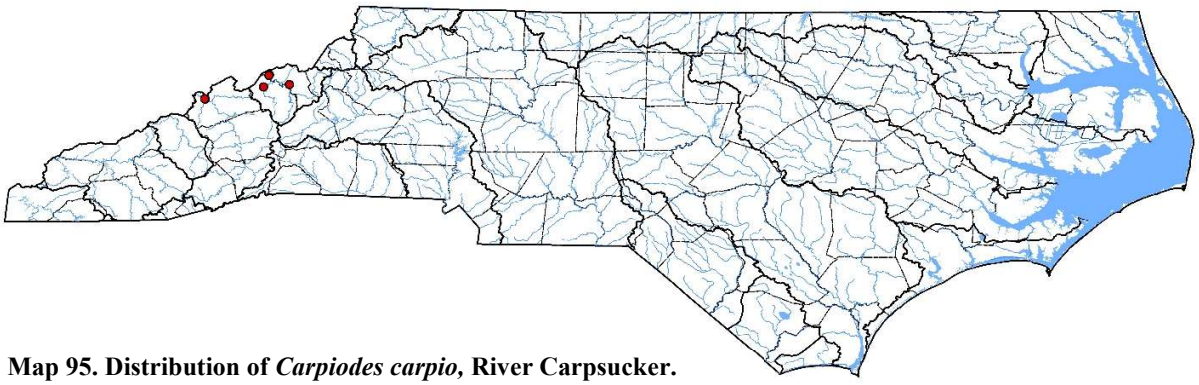
Catostomidae - Suckers

***Carpiodes carpio* (Rafinesque, 1820). River Carpsucker.**

River Carpsucker is known only from the French Broad basin (mainstem French Broad River, Madison County) and from the Nolichucky basin (Cane River, Yancey County and North Toe and Nolichucky rivers, Mitchell County) where it is at the eastern edge of its range (Lee and Platania 1980) (Map 95).

Remarks: This species and Quillback, *Carpiodes cyprinus*, were probably encountered by E. D. Cope from the French Broad and other tributaries of the Tennessee in 1869, but Cope remarked that those specimens were lost (Cope 1870a, p. 479).

Status: State Special Concern.



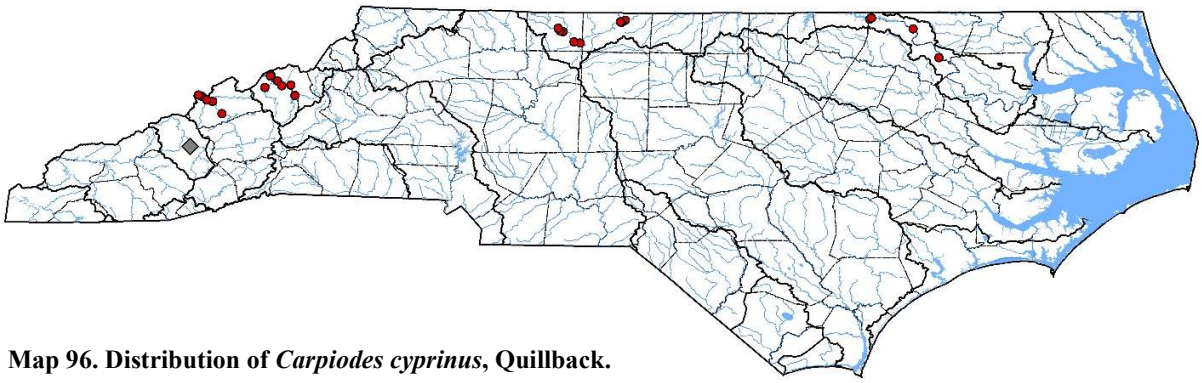
Map 95. Distribution of *Carpiodes carpio,* River Carpsucker.

***Carpiodes cyprinus* (Lesueur, 1817). Quillback.**

Quillback is known only from the mainstem rivers of the lower French Broad, Pigeon, Nolichucky, and Roanoke basins (Map 96).

Remarks: An unverifiable and most likely erroneous record from the Neuse was plotted by Menhinick (1991). Quillback was recently discovered by Virginia Department of Game and Inland Fisheries staff in the New basin in Virginia where it was collected from Claytor Lake in Pulaski County and in the mainstem of the New River at Foster Falls in Wythe County (Hilling et al. 2018). Its occurrence in the North Carolina portion of the river may be expected in the future.

Status: State Significantly Rare.



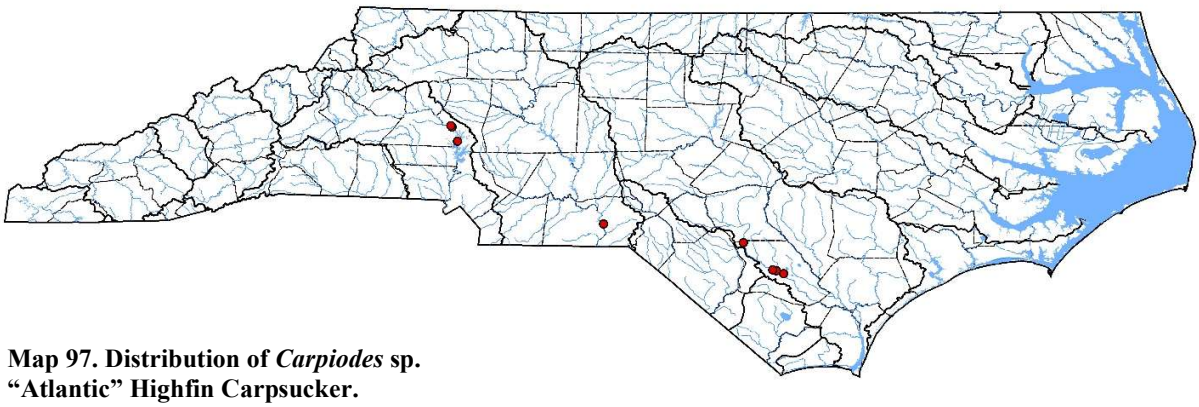
Map 96. Distribution of *Carpiodes cyprinus*, Quillback.

Carpiodes sp. "Atlantic" Highfin Carpsucker.

"Atlantic" Highfin Carpsucker, an undescribed species, is restricted to the Piedmont and Coastal Plain of North Carolina, South Carolina, and Georgia (Rohde et al. 2009; Tracy 2014a). The only known North Carolina populations are from the Catawba River Chain-of-Lakes (Catawba basin), the Pee Dee River below Blewett Falls Dam (Yadkin basin), and the Cape Fear River between Lock and Dam No. 3 and Sugarloaf Landing (Cape Fear basin) (Bailey et al. 1977; Menhinick 1991) (Map 97).

Remarks: There is one lot at CUMV (CUMV 34979) of a single specimen of *Carpiodes* sp. collected from an unspecified locality on the Cape Fear River in 1955. It is possible that the specimen may be an "Atlantic" Highfin Carpsucker, but the lot has not been reexamined and therefore this record has not been mapped. In the Yadkin, the species was reported from Blewett Falls Lake in 1986 and in the river downstream from the Blewett Falls Dam in Chesterfield County, SC in May 1977 (Progress Energy 2006). Only a single specimen, collected on 20 June 1956 from the Pee Dee River (Yadkin basin) in North Carolina is vouchered (NCSM 31697), despite intensive sampling of that river in recent years. Three, supposedly unvouchered lots, were mapped from the Catawba River, Chain-of Lakes (Menhinick 1991). These lots were recently discovered at NCSM (NCSM 89390, NCSM 89393, and NCSM 89470) and reverified as "Atlantic" Highfin Carpsucker. In addition, the species very likely formerly occupied the Broad basin in North Carolina based upon extant populations in South Carolina (Rohde et al. 2009). Messer (1966) reported catching two Highfin Carpsucker, weighing 9.7 kilograms (21.3 pounds) total, in trammel nets in 1965 from the upper reaches of Apalachia Lake in Cherokee County (Hiwassee basin). Bailey et al. (1977) reported them as River Carpsucker, but they might also have been large *Ictiobus;* the specimens were not vouchered, and their true identity will never be known. No additional specimens have been collected since then from the lake. This species is possibly extirpated from North Carolina because the last reported collections are from 1997 (NCSM 33838). This undescribed species keys out as *Carpiodes velifer* in Menhinick (1991).

Status: State Special Concern.



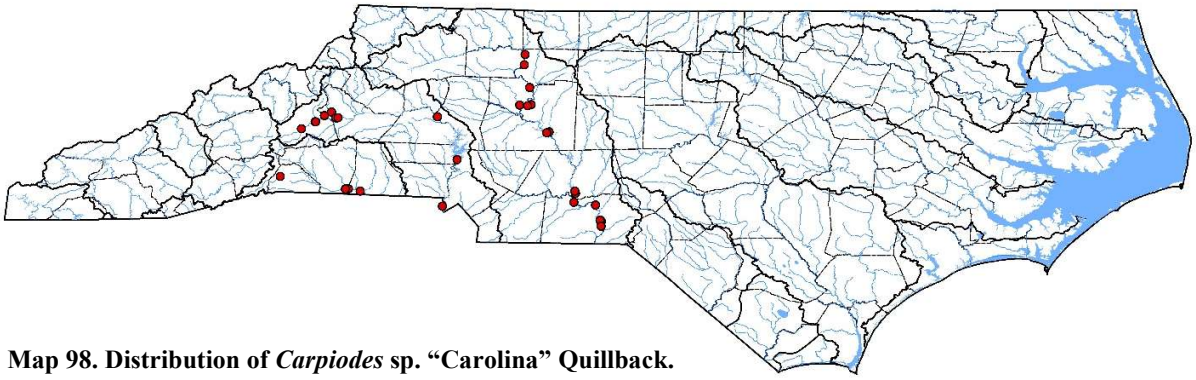
Map 97. Distribution of *Carpiodes* sp. "Atlantic" Highfin Carpsucker.

***Carpiodes* sp. "Carolina" Quillback.**

"Carolina" Quillback, an undescribed species, is found in the large rivers and reservoirs of the Broad, Catawba, and Yadkin basins (Map 98).

Remarks: This undescribed species keys out as *Carpiodes cyprinus* in Menhinick (1991).

Status: State Significantly Rare.

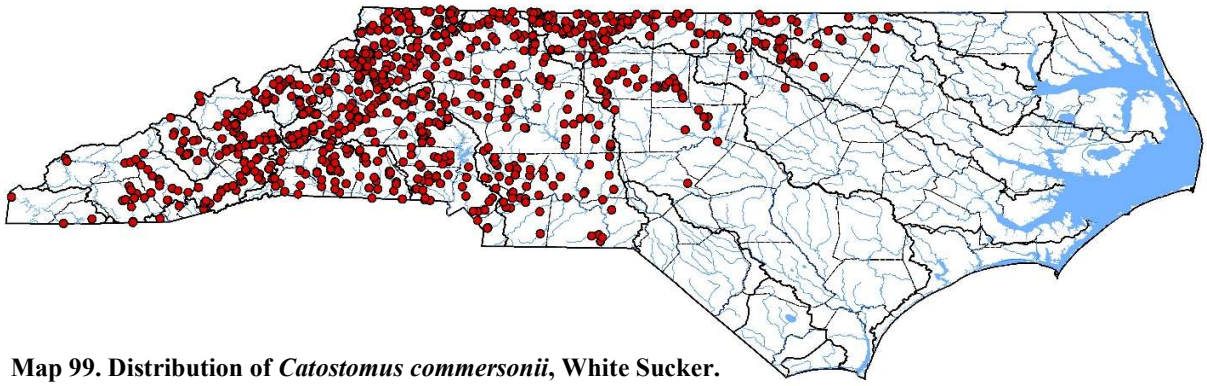


Map 98. Distribution of *Carpiodes* sp. "Carolina" Quillback.

***Catostomus commersonii* (Lacepéde, 1803). White Sucker.**

White Sucker is a Piedmont and Mountain species that is not found downstream from the Fall Zone in any of the Coastal Plain basins or the Sand Hills (Map 99).

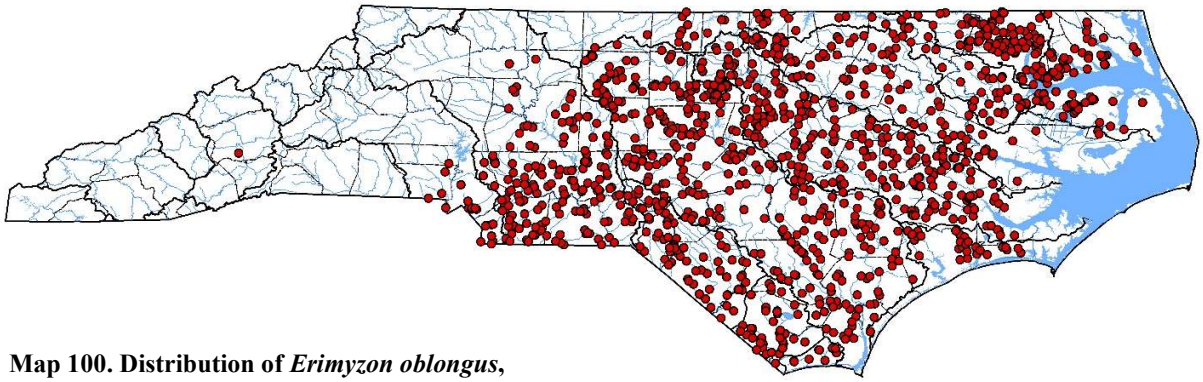
Remarks: One specimen (USNM 351924) was reported from Wayne County (Neuse basin), but the specimen was subsequently discarded due to an irretrievably degraded condition, thus the record is suspect. White Sucker is introduced in the upper Piedmont of the Cape Fear (earliest vouchered specimens in 1947) and Neuse basins (earliest vouchered specimens in 1963 - these specimens cannot be located at AMNH (R. E. Jenkins, retired, Roanoke College, pers. comm.)). Cope (1870a) reported White Sucker (as *Catostomus teres*) from the Neuse basin, but there are no verifiable specimens to substantiate his claim. Fowler (1945) verified a single specimen at NCSM collected by C. S. Brimley from Raleigh, but the specimen cannot be located and therefore, this record is also unverifiable. It is believed to be indigenous in the Tar (Menhinick 1991), although the earliest vouchered specimens were not until 1956. Its reported occurrence in the Lumber by Evermann (1916), and mapped by Menhinick (1991), cannot be verified and is the sole record of this species in this basin. Listed in Menhinick (1991) as *Catostomus commersoni.*



Map 99. Distribution of *Catostomus commersonii*, White Sucker.

***Erimyzon oblongus* (Mitchill, 1814). Eastern Creek Chubsucker.**

Eastern Creek Chubsucker is a lower Piedmont and Coastal Plain species that is found in all Atlantic slope basins, except for the Savannah and Broad. It is introduced in the French Broad basin (Buncombe County; earliest vouchered specimen from 1975) (Tracy 2008a) (Map 100).

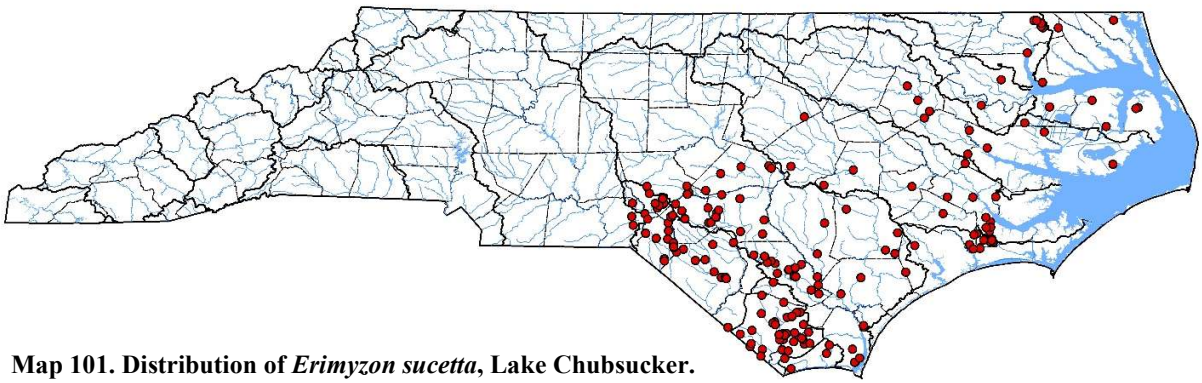


Map 100. Distribution of *Erimyzon oblongus*, Eastern Creek Chubsucker.

***Erimyzon sucetta* (Lacepéde 1803). Lake Chubsucker.**

Lake Chubsucker is a lower Coastal Plain species that is found in all Atlantic slope basins, except for the Savannah, Broad, and Catawba basins (Map 101). It is at the northern limit of its range in Atlantic slope streams in Virginia and North Carolina (Orth 2020; Wall and Gilbert 1980).

Remarks: This species is easily confused with Eastern Creek Chubsucker and was not clearly separated from the other chubsuckers until studied by Hubbs (1930) (Rohde et al. 2009). Many records most likely represent misidentifications.

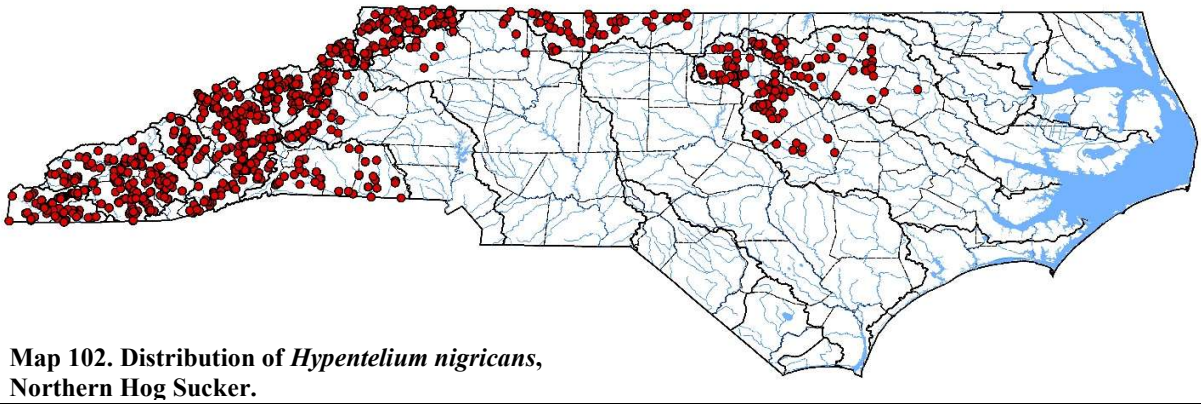


Map 101. Distribution of *Erimyzon sucetta*, Lake Chubsucker.

***Hypentelium nigricans* (Lesueur, 1817). Northern Hog Sucker.**

Northern Hog Sucker is found in all basins west of the Mountains and in the Savannah, upper Roanoke, Tar, and Neuse basins. It is absent from the Cape Fear basin and all waterways of the Coastal Plain (Map 102).

Remarks: Northern Hog Sucker has been introduced into the upper Yadkin basin and reported as early as 1961 but the earliest vouchered specimens are from1996 (Tracy et al. 2011; Tracy et al. 2013). It has also been introduced into scattered localities in the Broad basin (earliest vouchered specimens from 1964) and in headwaters of the Catawba basin (earliest vouchered specimens from 1922).

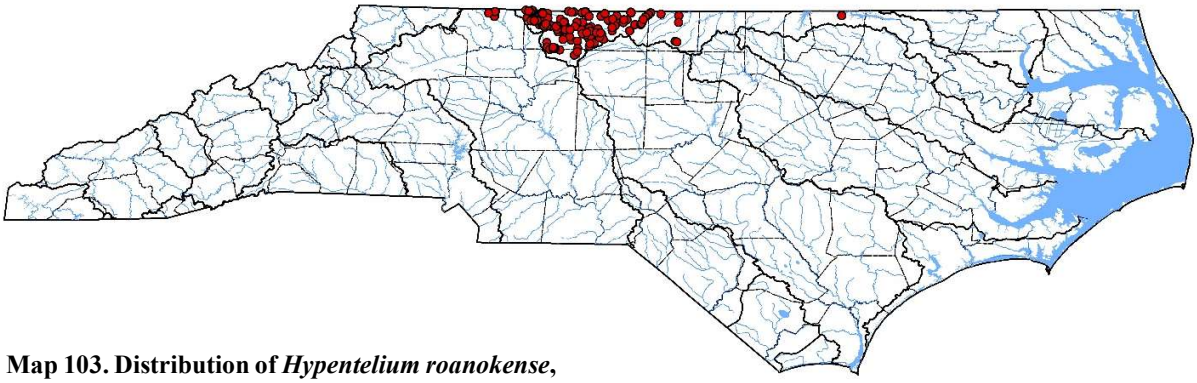


Map 102. Distribution of *Hypentelium nigricans*, Northern Hog Sucker.

***Hypentelium roanokense* Raney and Lachner, 1947. Roanoke Hog Sucker.**

Roanoke Hog Sucker is endemic to the upper and middle Roanoke basin including the Dan River system in North Carolina and Virginia (Jenkins 1980d; Jenkins and Burkhead 1994) (Map 103).

Remarks: Roanoke Hog Sucker is now found in the upper Yadkin basin (upper Ararat River system, upper Stewarts Creek watershed in Stokes County) as a result of cryptic introductions (Tracy et al. 2011; Tracy et al. 2013). It was first detected in the Yadkin basin in 2009 in Pauls Creek (Tracy et al. 2011; Tracy et al. 2013).



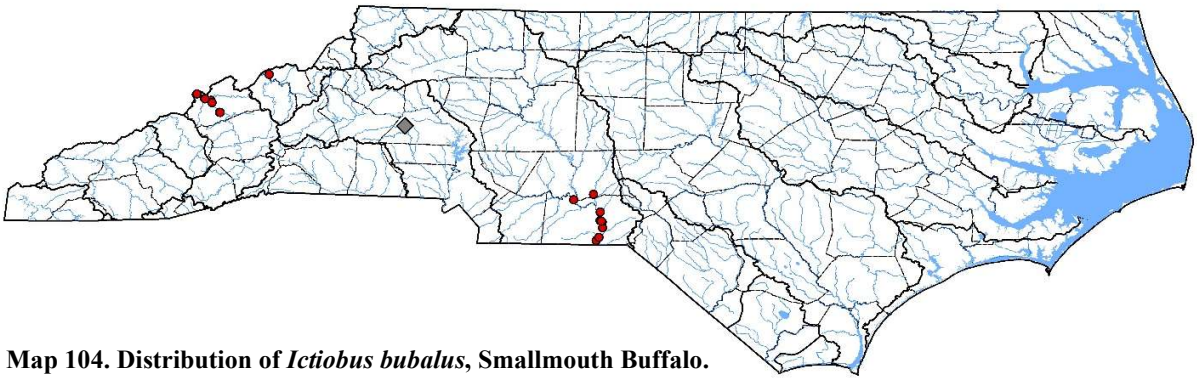
Map 103. Distribution of *Hypentelium roanokense*, Roanoke Hog Sucker.

***Ictiobus bubalus* (Rafinesque, 1818). Smallmouth Buffalo.**

Smallmouth Buffalo is indigenous to the lower French Broad and Nolichucky basins and has been stocked into the large rivers and reservoirs of the Catawba and Yadkin basins (Map 104).

Remarks: Some of the earliest reports of Smallmouth Buffalo in Lake Wylie and the Yadkin Chain-of-Lakes (Yadkin) are from 1956-1958 (NCWRC 1961). However, in 1919, 475 fingerlings, yearlings, and/or adults of *Ictiobus* sp. were stocked into Badin and Blewett Falls lakes (Yadkin basin), Buckhorn Pond (an impoundment upstream of Buckhorn Dam on the Cape Fear (Cape Fear basin)), Milburnie Pond (an impoundment upstream of Milburnie Dam on the Neuse River (Neuse basin)), and the Catawba River near Rock Hill, SC (Catawba basin) (Leach 1921). It is unknown whether the populations currently within the Catawba and Yadkin Chain-of-Lakes originated from this initial stocking attempt. An unverifiable and most likely erroneous record from Falls Reservoir (Neuse basin) was plotted by Menhinick (1991). In 2015, Smallmouth Buffalo were discovered by SCDNR staff in the South Carolina portion of the Waccamaw River, approximately 18 kilometers from the North Carolina-South Carolina state line (C. Morgeson, formerly NCWRC, pers. comm.). Its occurrence in the North Carolina portion of the Waccamaw River may be expected in the future.

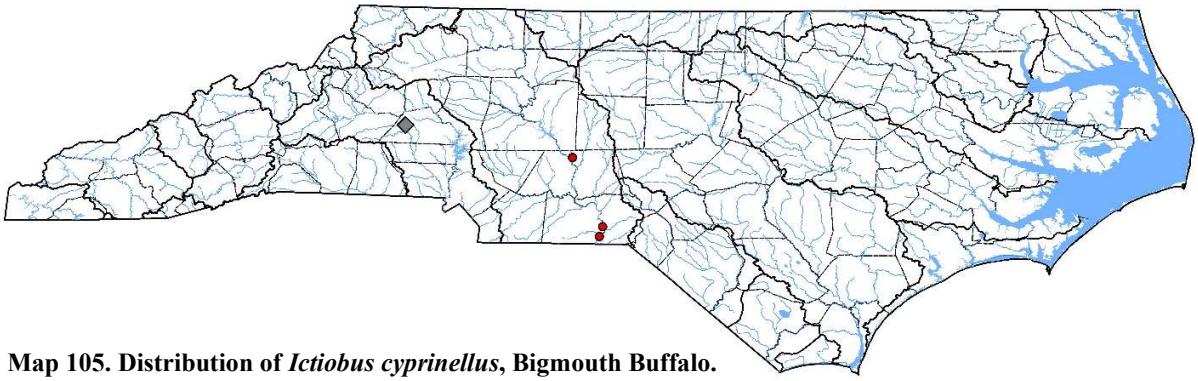
Status: State Significantly Rare.



Map 104. Distribution of *Ictiobus bubalus*, Smallmouth Buffalo.

***Ictiobus cyprinellus* (Valenciennes, 1844). Bigmouth Buffalo.**

Bigmouth Buffalo, a nonindigenous species, has been introduced into the large rivers and reservoirs in the lower Catawba and Yadkin basins (Map 105), where it is now at the eastern limit of its range (Lee and Shute 1980).



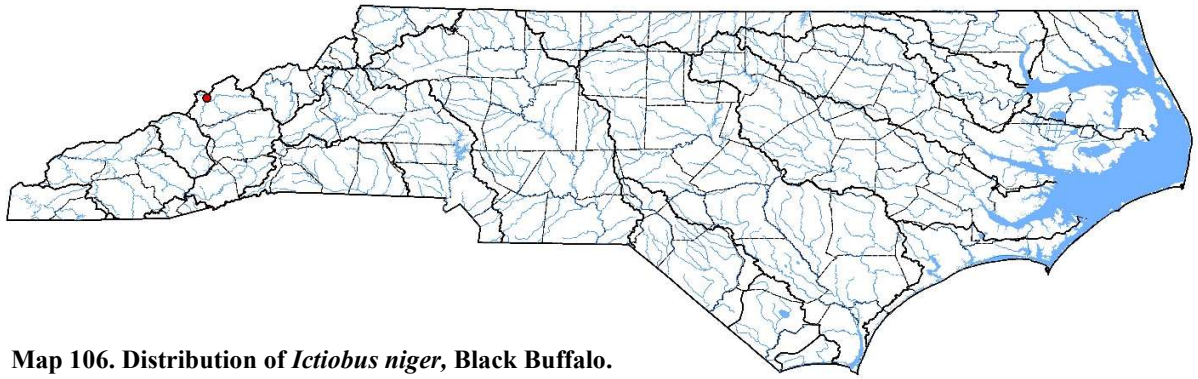
Map 105. Distribution of *Ictiobus cyprinellus*, Bigmouth Buffalo.

***Ictiobus niger* (Rafinesque, 1819). Black Buffalo.**

Black Buffalo has only been found in the lower French Broad basin in Madison County where it is at the eastern edge of its range (Shute 1980a) (Map 106).

Remarks: Previously unknown from North Carolina (Menhinick et al. 1974; Shute 1980a), Black Buffalo was still included in a dichotomous key to the species of *Ictiobus* and a distribution map with two nearby locations in Tennessee was shown in Menhinick (1991). The first and only specimens from North Carolina were not collected until August 21, 2001 when eight were netted by TVA staff from the French Broad River at Hot Springs (Charles Saylor, retired, and D. Mathews, TVA, pers. comm.).

Status: State Significantly Rare.



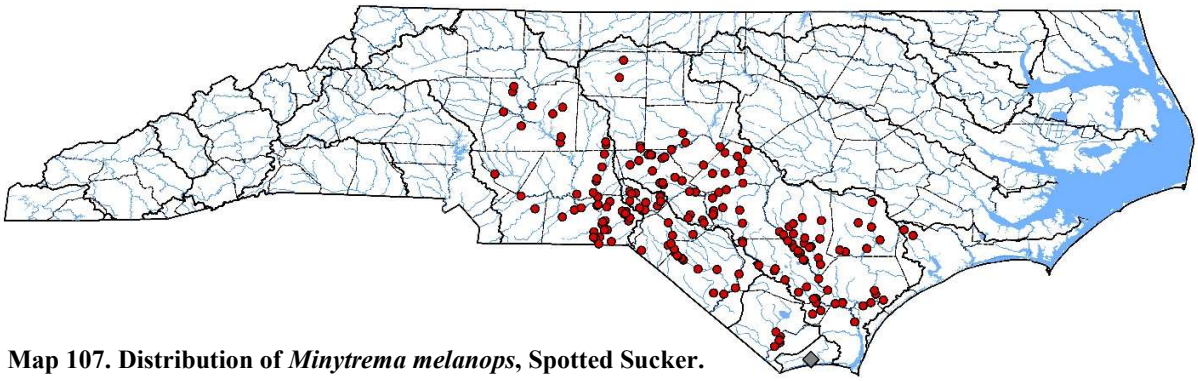
Map 106. Distribution of *Ictiobus niger,* Black Buffalo.

***Minytrema melanops* (Rafinesque, 1820). Spotted Sucker.**

Spotted Sucker is known from the middle and lower Yadkin and Cape Fear basins, and the Lumber, Waccamaw, Shallotte, and White Oak basins. In North Carolina, it is at the northern limit of its range along the Atlantic slope (Gilbert and Burgess 1980j) (Map 107).

Remarks: There are two lots, one specimen each, collected in 1888 by Jordan et al. (1889a) from South Buffalo Creek and Reedy Fork (Guilford County, Haw River system of the Cape Fear basin) that are vouchered at USNM (USNM 40620) and UMMZ (UMMZ 192102). These two lots represent the furthest upstream localities in the Cape Fear basin. The species may have been more widely distributed in the upper Cape Fear basin prior to mill dam and reservoir constructions in the 1900s and prior to widespread water pollution from textile mills downstream from Greensboro. All subsequent records of Spotted Sucker in the Cape Fear basin have been downstream from

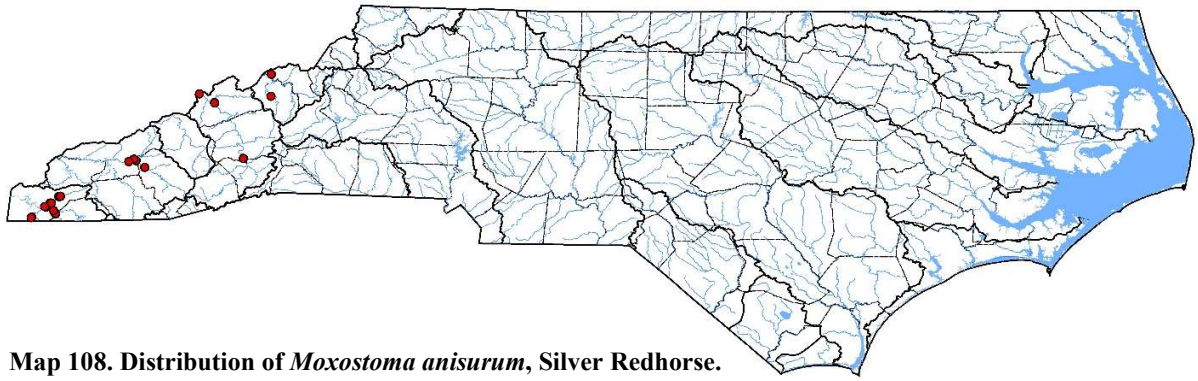
Jordan Reservoir. The historical record plotted by Menhinick (1991) from the Neuse River at Kinston (the only record from this basin) was based upon four specimens collected by J. W. Milner in 1875 and deposited at USNM (Smith 1907). However, these specimens cannot be found and thus, the record is unverifiable.



Map 107. Distribution of *Minytrema melanops*, Spotted Sucker.

***Moxostoma anisurum* (Rafinesque, 1820). Silver Redhorse.**

Silver Redhorse is found in all basins west of the Mountains, except for the Pigeon, Watauga, and New (Map 108). It is at the southeastern limit of its range in North Carolina, Tennessee, and Alabama (Jenkins 1980e).

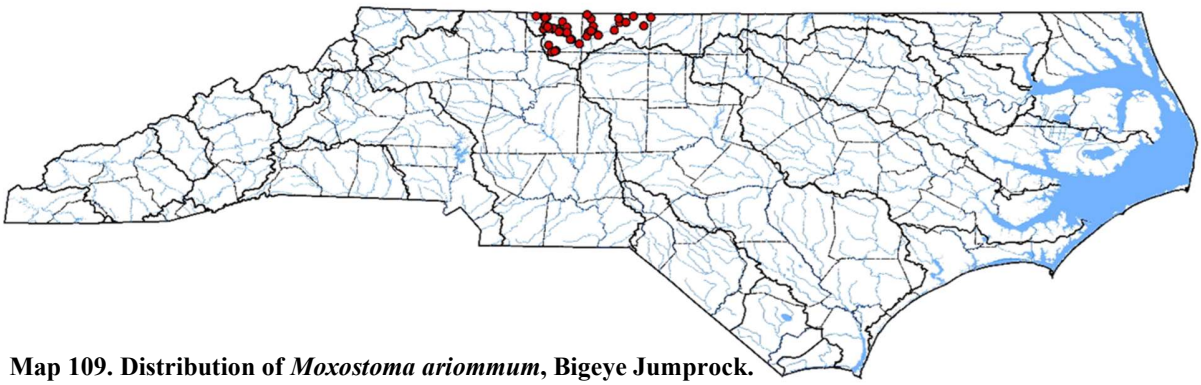


Map 108. Distribution of *Moxostoma anisurum*, Silver Redhorse.

***Moxostoma ariommum* Robins and Raney, 1956. Bigeye Jumprock.**

Bigeye Jumprock is endemic to the Roanoke basin in Virginia and North Carolina (Jenkins and Lahrmann 1980; Jenkins and Burkhead 1994) and is found in Forsyth, Stokes, and Rockingham counties (Map 109).

Status: State Threatened.



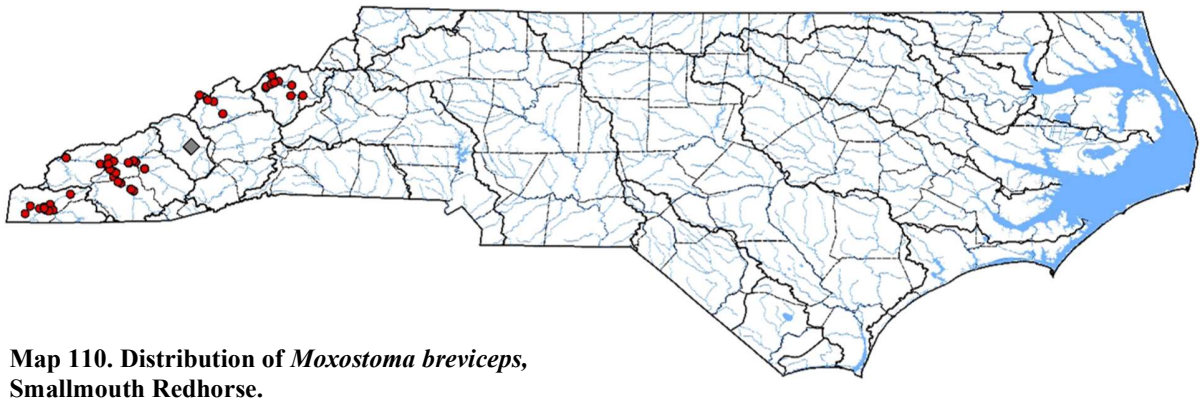
Map 109. Distribution of *Moxostoma ariommum*, Bigeye Jumprock.

***Moxostoma breviceps* (Cope, 1870). Smallmouth Redhorse.**

Smallmouth Redhorse is found in all basins west of the Mountains, except for the Watauga and New (Map 110).

Remarks: This species keys out as *Moxostoma macrolepidotum* in Menhinick (1991).

Status: State Significantly Rare.

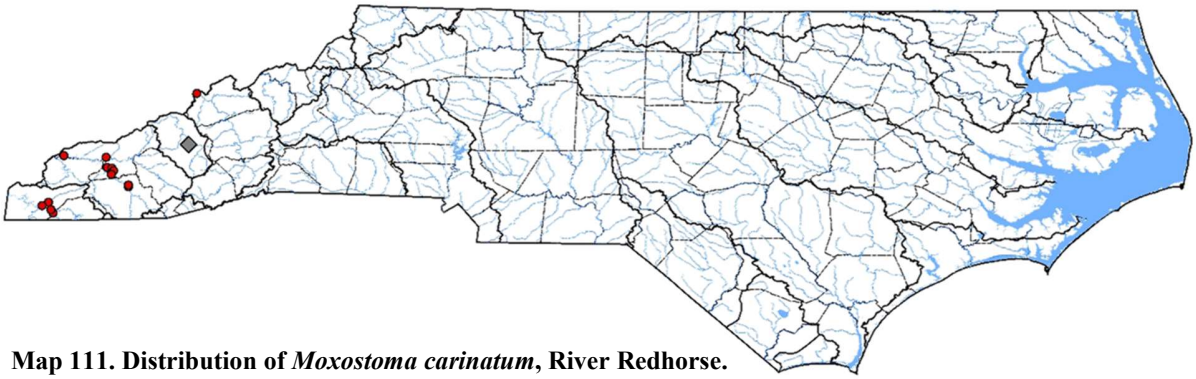


Map 110. Distribution of *Moxostoma breviceps*, Smallmouth Redhorse.

***Moxostoma carinatum* (Cope, 1870). River Redhorse.**

River Redhorse, a big river species, is found in the Hiwassee, Little Tennessee, and French Broad basins (Map 111).

Remarks: River Redhorse is being reintroduced back into the Pigeon basin (L. Etchison, NCWRC, pers. comm.).

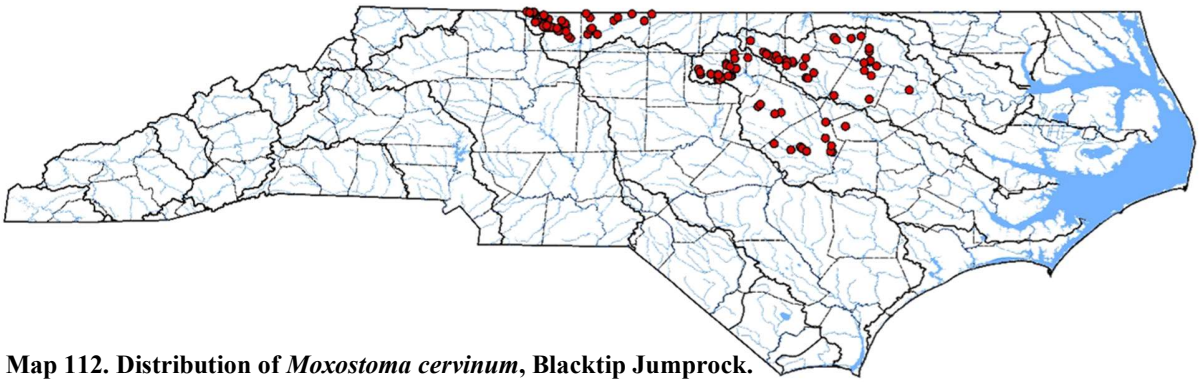


Map 111. Distribution of *Moxostoma carinatum*, River Redhorse.

***Moxostoma cervinum* (Cope, 1868). Blacktip Jumprock.**

Blacktip Jumprock is found only in Virginia and North Carolina (Jenkins 1980f; Jenkins and Burkhead 1994). In North Carolina it is endemic to the Piedmont region of the Dan River system (Roanoke basin) and in the Piedmont and near the Fall Zone of the Tar and Neuse basins (Map 112).

Remarks: Listed in Menhinick (1991) as Black Jumprock.



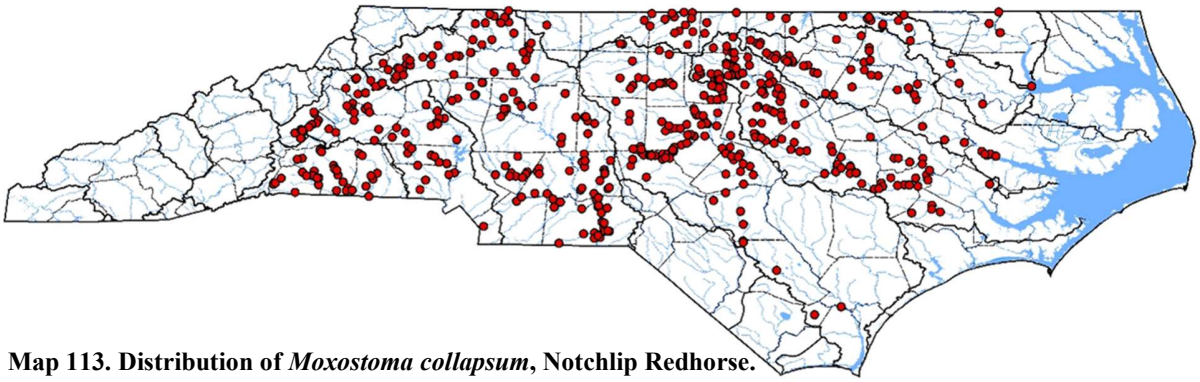
Map 112. Distribution of *Moxostoma cervinum*, Blacktip Jumprock.

***Moxostoma collapsum* (Cope, 1870). Notchlip Redhorse.**

Notchlip Redhorse is found in Atlantic slope streams from Georgia to Virginia (Jenkins 1980f; Jenkins and Burkhead 1994; Rohde et al. 2009). In North Carolina, this species is found in all Atlantic slope basins, except the Savannah and the Sand Hills and Coastal Plain basins (Lumber, Waccamaw, Shallotte, White Oak, and Albemarle) (Map 113).

Remarks: Notchlip Redhorse was recently discovered in the New basin in Virginia where it was collected by Virginia Department of Game and Inland Fisheries staff from Claytor Lake in Pulaski County and in the mainstem of the New River at Foster Falls in Wythe County (Hilling et al. 2018). Its occurrence in the North Carolina portion of the New River may be expected in the future. This species was described as *Ptychostomus collapsus* (Cope 1870a; Table 5). Cope (1870a) reported that in the Yadkin and Catawba rivers it was immensely numerous and was caught in weir traps in the spring and autumn in quantities. It is likely that the specimens from the Yadkin River were procured from the Indian fishing weir just upstream from the mouth of Gobble Creek on the Koontz Plantation, south of US 64 in Davidson County (R. E. Jenkins, retired, Roanoke College, pers.

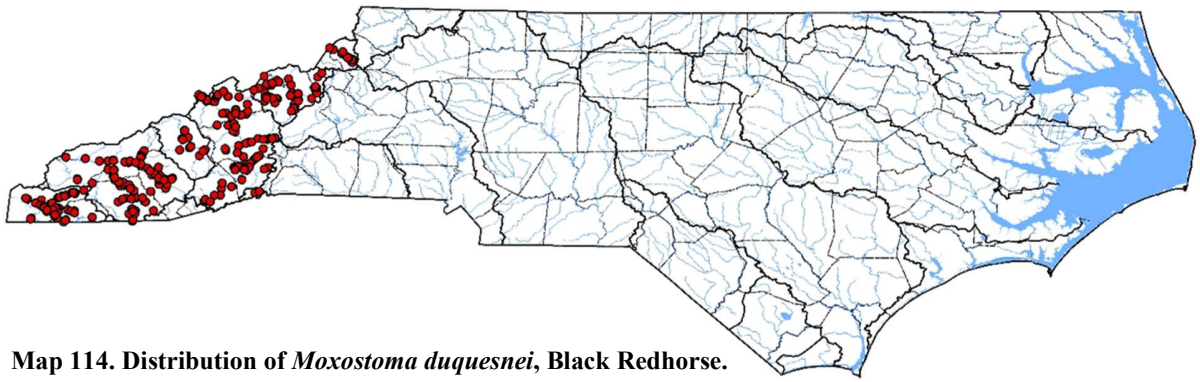
comm.; B. H. Tracy, pers. obs.). This species keys out as *Moxostoma anisurum* in Menhinick (1991).



Map 113. Distribution of *Moxostoma collapsum*, Notchlip Redhorse.

***Moxostoma duquesnei* (Lesueur, 1817). Black Redhorse.**

Black Redhorse is found in all basins west of the Mountains, except for the New (Map 114). There are two records from the Green River (Henderson County, Broad basin) collected in 1980 and 2015 (NCSM 9916 and NCSM 82010).

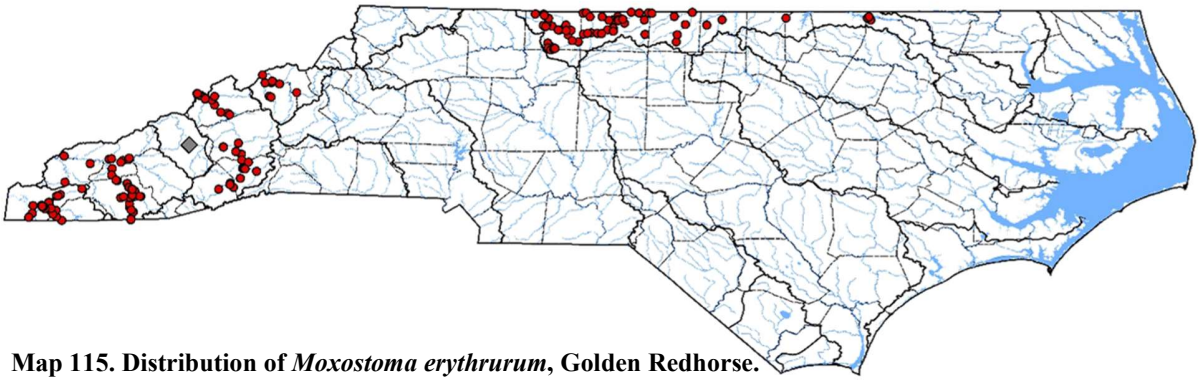


Map 114. Distribution of *Moxostoma duquesnei*, Black Redhorse.

***Moxostoma erythrurum* (Rafinesque, 1818). Golden Redhorse.**

Golden Redhorse is found in all basins west of the Mountains, except for the Watauga and New (Map 115). In the Roanoke basin, the species is at the southeastern limit of its range along the Atlantic slope (Jenkins 1980g; Jenkins and Burkhead 1994).

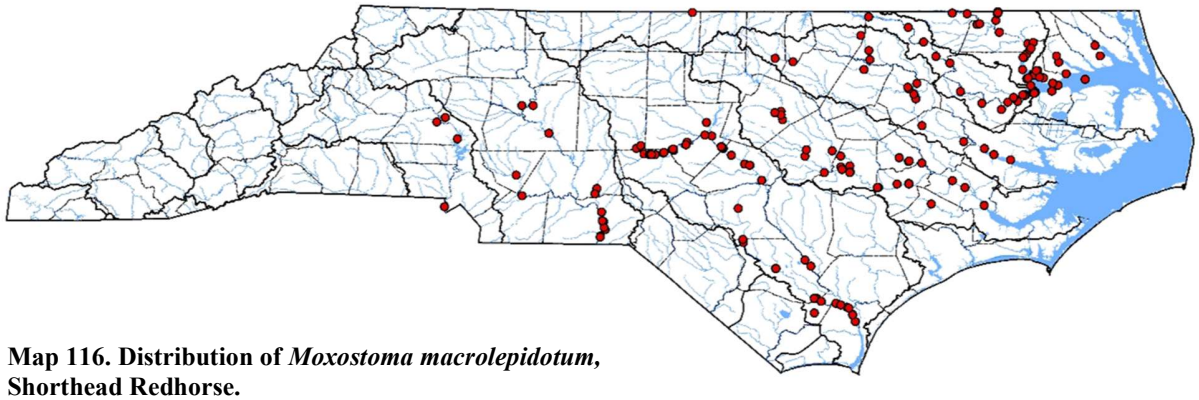
Remarks: A specimen collected by E. D. Cope (ANSP 6848), originally identified as *Ptychostomus lachrymalis* (Cope 1870a), was reidentified as Golden Redhorse by R. E. Jenkins in 1981. Jordan and Evermann (1896-1900) listed the locality as being: "*Neuse River, at Newbern, N.C.*", but the original description in Cope (1870a) does not provide any locality information. It does state: *"One like it is sold in the market of the city of Newbern, N.C.*", which could have created the confusion. Therefore, there is no evidence that Golden Redhorse ever occurred in the Neuse River. Jordan and Evermann (1896-1900) synonymized *P. lachrymalis* with *M. macrolepidotum*.



Map 115. Distribution of *Moxostoma erythrurum*, Golden Redhorse.

***Moxostoma macrolepidotum* (Lesueur, 1817). Shorthead Redhorse.**

Shorthead Redhorse is found in several Atlantic slope basins, except for the Savannah, Broad, Lumber, Waccamaw, Shallotte, and White Oak (Map 116).

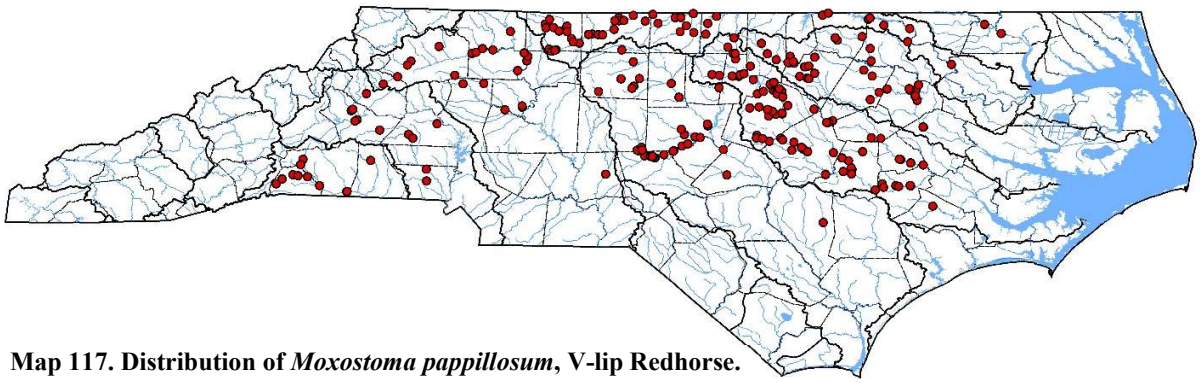


Map 116. Distribution of *Moxostoma macrolepidotum*, Shorthead Redhorse.

***Moxostoma pappillosum* (Cope, 1870). V-lip Redhorse.**

V-lip Redhorse is found in all Atlantic slope basins, except for the Savannah, Lumber, Waccamaw, Shallotte, White Oak, and Albemarle (Map 117). It is only found in Virginia, North Carolina, and South Carolina (Jenkins 1980h; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: V-lip Redhorse was described as *Ptychostomus pappillosus* (Cope 1870a; Table 5). The type locality was not specified, but the species was described as "*quite abundant in the Catawba and Yadkin Rivers in North Carolina*" (Cope 1870b). It is likely that the specimens from the Yadkin River were procured from the Indian fishing weir just upstream from the mouth of Gobble Creek on the Koontz Plantation, south of US 64 in Davidson County (R. E. Jenkins, retired, Roanoke College, pers. comm.; B. H. Tracy, pers. obs.). Listed in Menhinick (1991) as Suckermouth Redhorse.



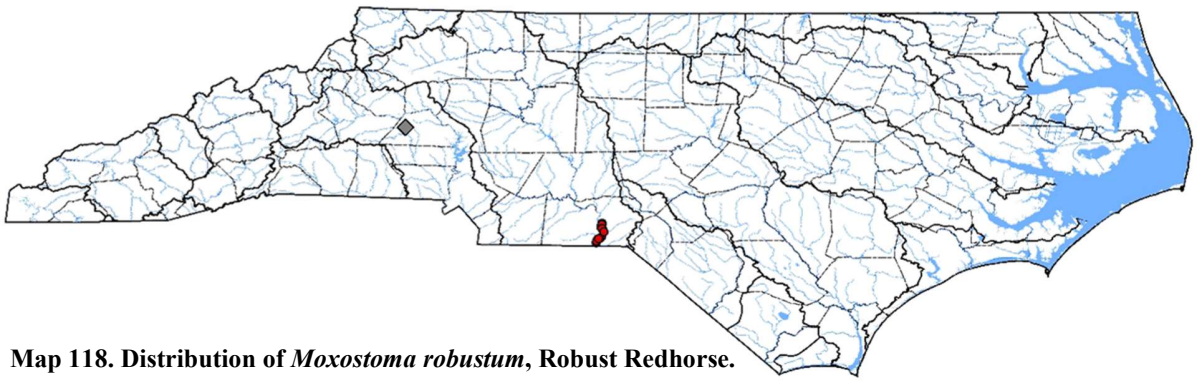
Map 117. Distribution of *Moxostoma pappillosum*, V-lip Redhorse.

***Moxostoma robustum* (Cope, 1870). Robust Redhorse.**

Robust Redhorse, a big river species, is now only found only in the lower Yadkin (Pee Dee River) downstream from Blewett Falls Dam (Map 118). It was originally found in the Catawba basin at Morganton in Burke County, and in the Yadkin basin upstream into the South Yadkin River system (Hunting Creek) in Davie and Rowan counties and in the Yadkin River near Donnaha in Forsyth and Yadkin counties (Jenkins and Freeman 1997a; R. E. Jenkins, retired, Roanoke College, pers. comm.; http://www.robustredhorse.com/h/rangemaps.html).

Remarks: A program, led by the NCWRC and the SCDNR, began in the 2010s to augment the population in the lower Yadkin basin (i.e., the Pee Dee River) with hatchery-reared fingerlings (B. Jones, NCWRC, pers. comm.). Robust Redhorse was described as *Ptychostomus robustus* (Cope 1870a; Table 5). It is likely that the specimens from the Yadkin River were procured from the Indian fishing weir just upstream from the mouth of Gobble Creek on the Koontz Plantation, south of US 64 in Davidson County (R. E. Jenkins, retired, Roanoke College, pers. comm.; B. H. Tracy, pers. obs.). An anecdotal account of a very large redhorse sucker caught on a trotline in 1968 from the lower Rocky River, a tributary to the Pee Dee River, along the Stanly-Union county line, was judged to be a Robust Redhorse (R. E. Jenkins, retired, Roanoke College, pers. comm.). Fowler (1913) designated two specimens as cotypes (ANSP 6958 and ANSP 6959) but questioned that designation and where the specimens had been collected. Robins and Raney (1956) designated ANSP 6958 as a lectotype and ANSP 6959 as a paralectotype. Both specimens have since been reidentified as Shorthead Redhorse by R. E. Jenkins. Therefore, there is no Holotype specimen. In older literature (e.g., Menhinick et al. 1974; Jenkins 1980i) Robust Redhorse was frequently listed as Smallfin Redhorse and confounded with the undescribed *Moxostoma* sp. "Brassy" Jumprock. This species keys out as *Moxostoma carinatum* in Menhinick (1991).

Status: State Endangered.

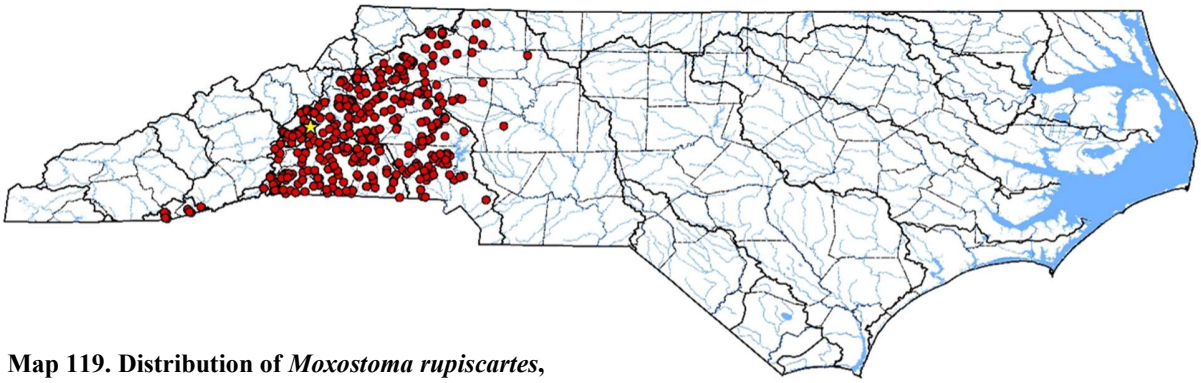


Map 118. Distribution of *Moxostoma robustum*, Robust Redhorse.

***Moxostoma rupiscartes* Jordan and Jenkins, 1889. Striped Jumprock.**

Striped Jumprock is indigenous and widespread in Piedmont and Mountain streams in the Savannah, Broad, and Catawba basins. This species has been widely introduced into the upper Yadkin and South Yadkin River systems (earliest vouchered specimens from 1960; Tracy et al. 2013) (Map 119). It is found only in Atlantic slope basins in North Carolina, South Carolina, and Georgia (Jenkins 1980j; Rohde et al. 2009).

Remarks: Striped Jumprock was described by David S. Jordan and Oliver P. Jenkins (Jordan 1889b; Table 5). The species continued to occupy its type locality in July 2010 (NCSM 62148, B. H. Tracy, unpublished data).

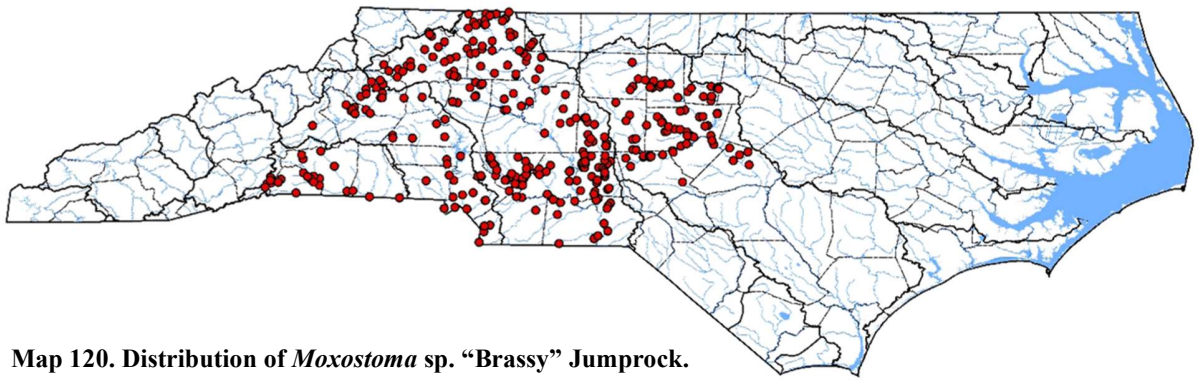


Map 119. Distribution of *Moxostoma rupiscartes*, Striped Jumprock. Star indicates type locality.

***Moxostoma* sp. "Brassy" Jumprock.**

"Brassy" Jumprock, an undescribed species, is found in many Atlantic slope Piedmont streams from the Cape Fear westward to the Broad basin (Map 120). It is not found in the Roanoke, Neuse, or the Tar basins. "Brassy Jumprock" is found from Virginia to Georgia (Jenkins 1980i; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: The record plotted for the Neuse basin (southeastern Wake County) by Menhinick (1991) is unverifiable. In older literature (e.g., Robins and Raney 1956; Menhinick et al. 1974; Jenkins 1980i) "Brassy" Jumprock was frequently listed as Smallfin Redhorse and confounded with Robust Redhorse. This undescribed species keys out as *Moxostoma robustum* in Menhinick (1991) and was described in part by Robins and Raney (1956).



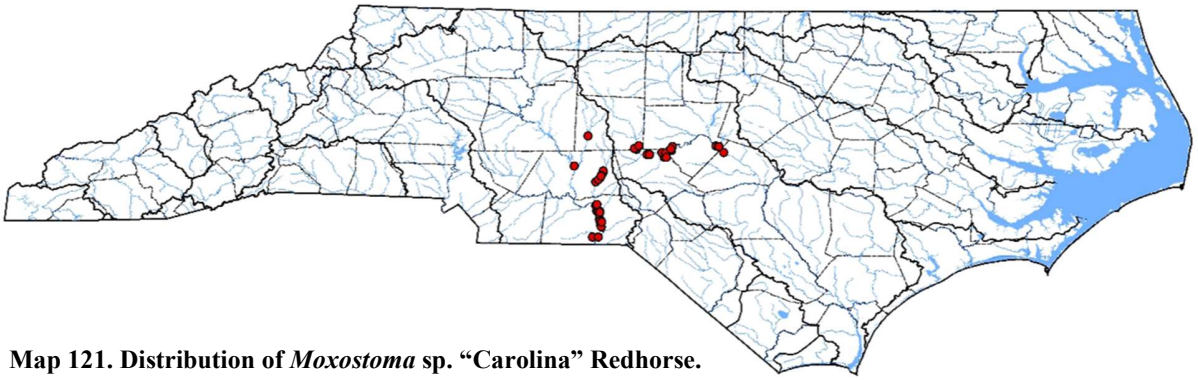
Map 120. Distribution of *Moxostoma* sp. "Brassy" Jumprock.

***Moxostoma* sp. "Carolina" Redhorse.**

"Carolina" Redhorse, recognized as an undescribed species in 1995, is found only in the middle portion of the Cape Fear basin (including the Deep River) and in the Yadkin basin (the lower Uwharrie, Little, and Pee Dee rivers) in North Carolina and South Carolina (Starnes 2004; Starnes et al. 2005; Rohde et al. 2009; Jenkins 2011) (Map 121).

Remarks: This undescribed species keys out as *Moxostoma erythrurum i*n Menhinick (1991).

Status: State Threatened.



Map 121. Distribution of *Moxostoma* sp. "Carolina" Redhorse.

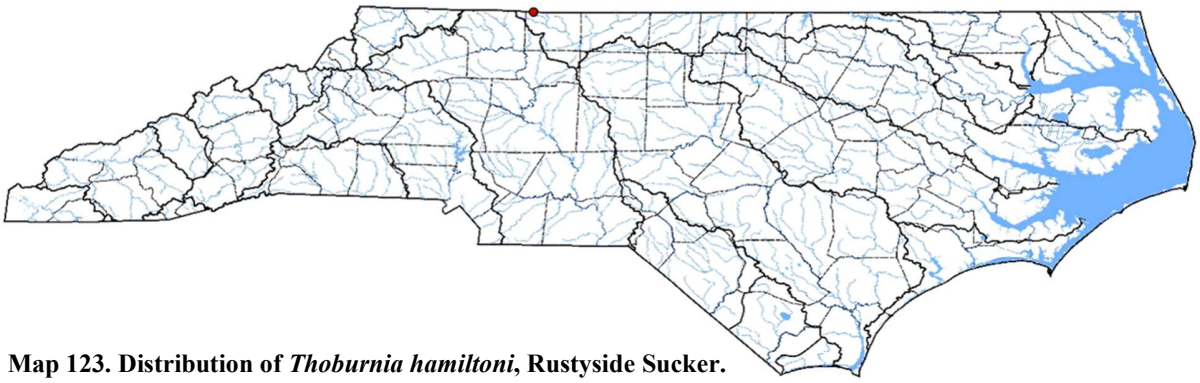
***Moxostoma* sp. "Sicklefin" Redhorse.**

"Sicklefin" Redhorse, recognized as an undescribed species in 1992, is found only in the Hiwassee and Little Tennessee basins in Georgia, North Carolina, and Tennessee (Jenkins and Freeman 1997b; Jenkins 1999) (Map 122).

Remarks: Since 2007, the Eastern Band of the Cherokee Indians has been reintroducing fingerling "Sicklefin" Redhorse into the Oconaluftee River watershed upstream from the dam at Ela (Little Tennessee basin) (Davis et al. 2020; L. Etchison, NCWRC, pers. comm.). In April 2020, the NCWRC formalized plans for a stocking proposal to restore viable populations of Sicklefin Redhorse to its historical range in the Hiwassee and Little Tennessee River basins in North Carolina. In the Little Tennessee basin there are five targeted watersheds: Cheoah River, Oconaluftee River, upper Tuckasegee River, upper Little Tennessee River, and Nantahala River. In the Hiwassee River basin there are two targeted watersheds: Nottely River and upper Hiwassee River (L. Etchison and T. Ewing, NCWRC, pers. comm.). This undescribed species keys out as *Moxostoma carinatum* in Menhinick (1991).
Status: State Threatened.

Map 122. Distribution of *Moxostoma* sp. "Sicklefin" Redhorse

***Thoburnia hamiltoni* Raney and Lachner, 1946. Rustyside Sucker.**
Rustyside Sucker is endemic to the Dan River system of the Roanoke basin in Virginia and North Carolina (Jenkins 1980k; Jenkins and Burkhead 1994). In North Carolina it has only been found in the Little Dan River (Stokes County) (Map 123).
Remarks: In July 2015 and June 2019, single specimens of Rustyside Sucker were netted, photographed, and released by NCWRC staff from the Little Dan River (T. Russ, NCWRC, pers. comm.). Prior detection had been in 1992. The occurrence of this species in North Carolina is based upon only seven specimens found during four different collecting events. Listed in Menhinick (1991) as *Moxostoma hamiltoni.*
Status: State Endangered.



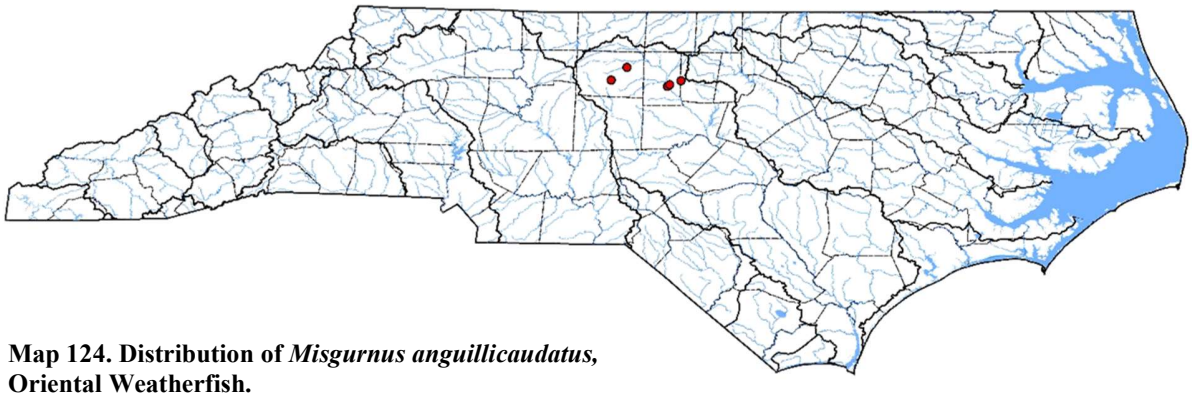
Map 123. Distribution of *Thoburnia hamiltoni*, Rustyside Sucker.

Cobitidae - Loaches

***Misgurnus anguillicaudatus* (Cantor, 1842). Oriental Weatherfish.**

Oriental Weatherfish, a nonindigenous species, was known from only three vouchered collections made in 2009 from the Haw River system of the Cape Fear basin (Varnals and Haw creeks in south-central Alamance County and South Buffalo Creek in central Guilford County; Tracy and Schneider (2009)) (Map 124). A collection was also reported from a wetland in northwest Alamance County in 2010, but the specimen was not retained.

Remarks: It was unknown if the Oriental Weatherfish persists in the Cape Fear basin because surveys conducted in 2013 failed to find additional specimens (B. H. Tracy, pers. obs.). However, in 2016 another specimen was collected from an unnamed tributary to Haw Creek in Orange County (B. Jones, NCWRC, pers. comm.). In 2018, eight additional specimens were collected from North Buffalo Creek upstream from its confluence with South Buffalo Creek in east-central Guilford County (Jeffrey DeBerardinis, NCDWR, pers. comm.). Thus, it now seems that Oriental Weatherfish might be persistent and more widespread in the upper Haw River system than previously thought.



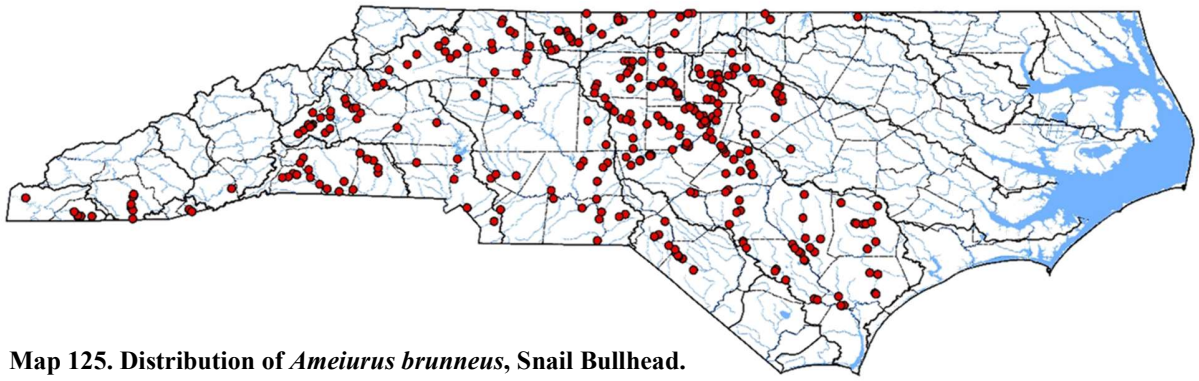
Map 124. Distribution of *Misgurnus anguillicaudatus*, Oriental Weatherfish.

Ictaluridae - North American Catfishes

***Ameiurus brunneus* Jordan, 1877. Snail Bullhead.**

Snail Bullhead is indigenous in all Atlantic slope basins from the Savannah to the Neuse basin, except for the Roanoke where it is introduced (Burkhead et al. 1980). It is also introduced into the Little Tennessee and Hiwassee basins with the earliest vouchered specimens from 1944 and 1993, respectively. There is one record of one specimen from the French Broad (UT 48.971, Little River at Cascade Lake Road, Transylvania County, 13 August 1997) (Map 125).

Remarks: Records plotted from Washington and Hyde counties by Menhinick (1991) are unverifiable. Snail Bullhead is often confused with Flat Bullhead. This species keys out as *Ictalurus brunneus* in Menhinick (1991).

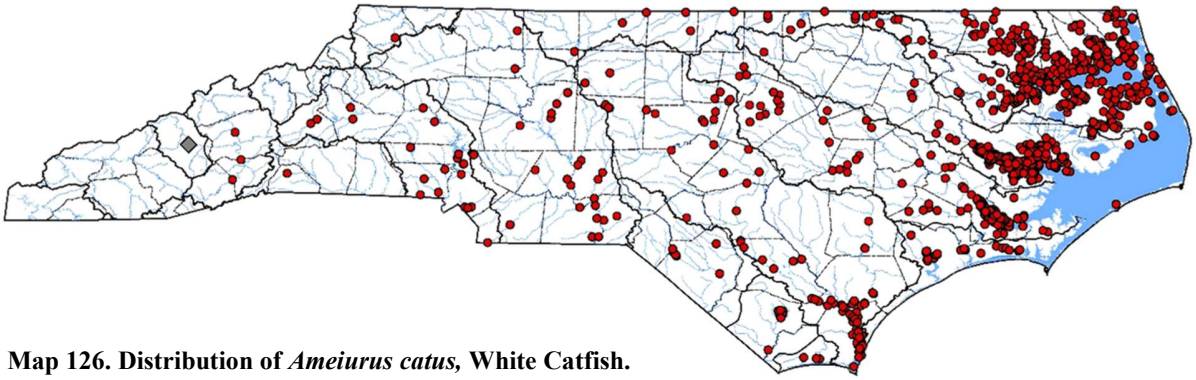


Map 125. Distribution of *Ameiurus brunneus*, Snail Bullhead.

***Ameiurus catus* (Linnaeus, 1758). White Catfish.**

White Catfish is indigenous to all Atlantic slope basins, except the Savannah. It has been introduced into the New, French Broad, and Pigeon basins (earliest vouchered specimens from the French Broad and New basins are 1977 and 2013, respectively) (Map 126).

Remarks: The record from Chatuge Lake (Clay County, Hiwassee basin) in Menhinick (1991) is unverifiable. This species keys out as *Ictalurus catus* in Menhinick (1991).

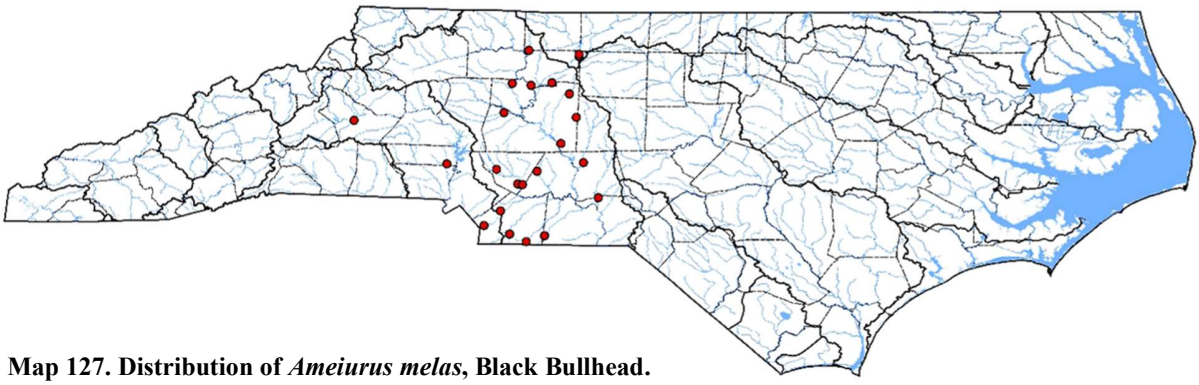


Map 126. Distribution of *Ameiurus catus,* White Catfish.

***Ameiurus melas* (Rafinesque, 1820). Black Bullhead.**

Although Black Bullhead is indigenous to the Mississippi River and Ohio River drainages (Glodek 1980a), there are no records of its occurrence in any North Carolina basins west of the Mountains. It is introduced in the Catawba, Yadkin, and Roanoke basins (Burkhead et al. 1980) (Map 127).

Remarks: The earliest vouchered specimens from the Yadkin basin are from 1936 and from the Catawba basin in 1961. The only verifiable records from the Roanoke basin are from Belews Lake (Forsyth and Stokes counties). Three other localities from that basin mapped by Menhinick (1991) are unverifiable. This species keys out as *Ictalurus melas* in Menhinick (1991).

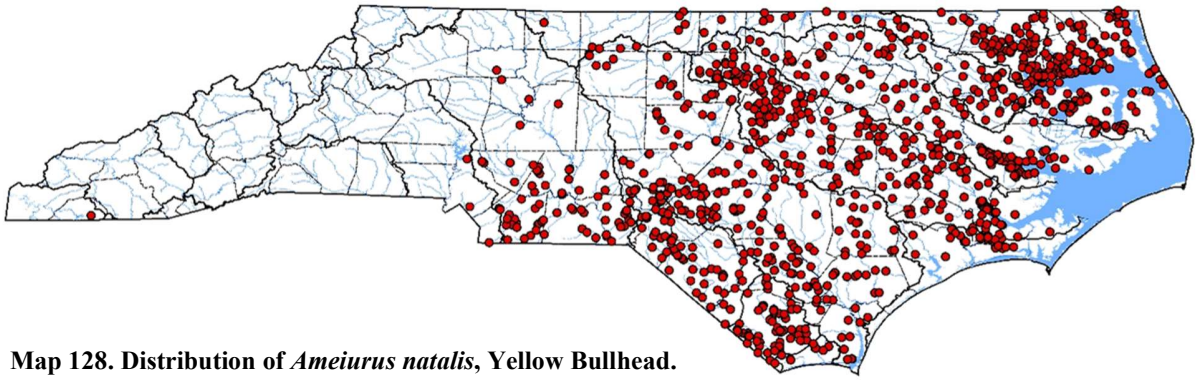


Map 127. Distribution of *Ameiurus melas*, Black Bullhead.

***Ameiurus natalis* (Lesueur, 1819). Yellow Bullhead.**

Yellow Bullhead is found in the lower Piedmont and across the Coastal Plain from the Catawba basin to the Coast. It is introduced in the Hiwassee basin (earliest vouchered specimens from 2004) (Map 128).

Remarks: For an in-depth essay on the etymological meaning of "*natalis*", see Scharpf (2020b). This species keys out as *Ictalurus natalis* in Menhinick (1991).

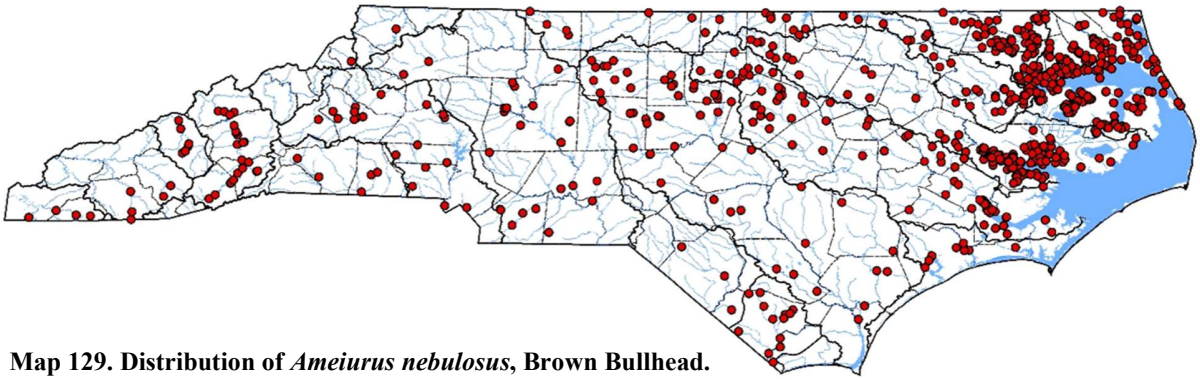


Map 128. Distribution of *Ameiurus natalis*, Yellow Bullhead.

***Ameiurus nebulosus* (Lesueur, 1819). Brown Bullhead.**

Brown Bullhead is indigenous to North Carolina, except for the New and the Watauga basins where it has been introduced based upon recent vouchered records from those two basins from 2008-2014 and 1984, respectively. There are no records of its occurrence in the Nolichucky, Savannah, or Shallotte basins (Map 129).

Remarks: This species keys out as *Ictalurus nebulosus* in Menhinick (1991).

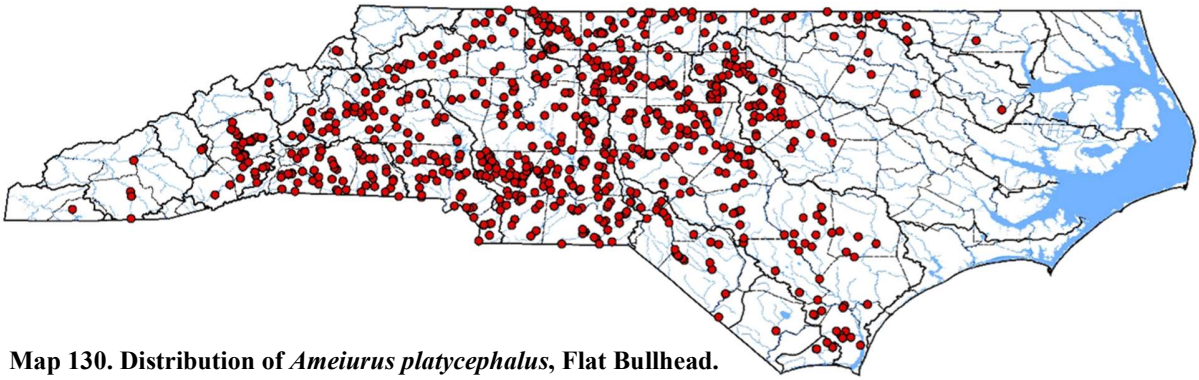


Map 129. Distribution of *Ameiurus nebulosus*, Brown Bullhead.

***Ameiurus platycephalus* (Girard, 1859). Flat Bullhead.**

Flat Bullhead is indigenous to most Atlantic slope basins (Gilbert and Burgess 1980k), but there are no records from the Savannah, White Oak, or Albemarle basins. It is introduced into all the basins west of the Mountains, except for the New (Tracy 2008a) (Map 130).

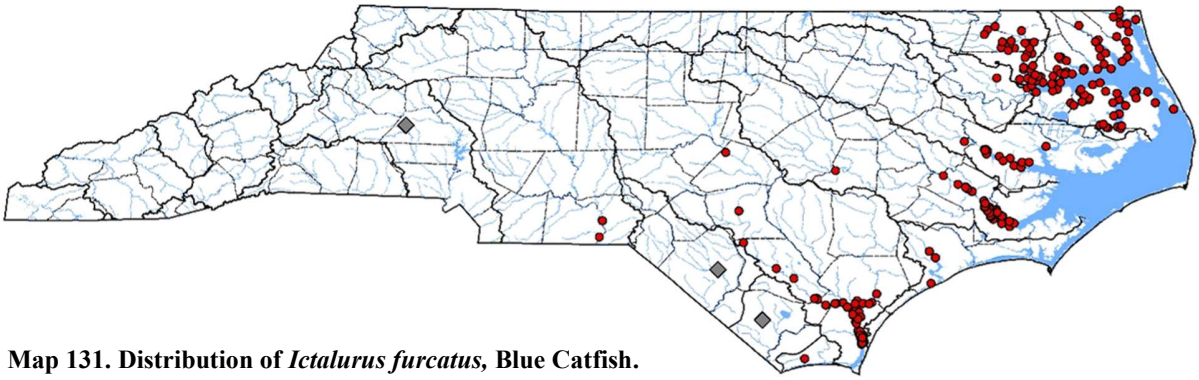
Remarks: The earliest vouchered specimens from the Hiwassee, Little Tennessee, Pigeon, French Broad, Nolichucky and Watauga basins are 1993, 1999, 2007, 1977, 1996, and 2012, respectively). It is often confused with Snail Bullhead. This species keys out as *Ictalurus platycephalus* in Menhinick (1991).



Map 130. Distribution of *Ameiurus platycephalus*, Flat Bullhead.

***Ictalurus furcatus* (Lesueur, 1840). Blue Catfish.**

Blue Catfish, a nonindigenous species, was introduced into North Carolina by NCWRC via reservoir stockings in the Catawba and Yadkin basins in the mid-1960s and stocking of fingerlings in the Cape Fear and Neuse rivers in 1966. Blue Catfish was first detected in Lake James (Catawba basin) in 1999 (D. Besler, NCWRC, pers. comm.). The species has since spread into the Lumber, Waccamaw, Shallotte, White Oak, Tar, Roanoke, Chowan, and Albemarle basins (K. Dockendorf, NCWRC pers. comm.; Borawa 1982; Fisk et al. 2018; NCWRC 2019) (Map 131). This species is indigenous to the Mississippi River and Ohio River drainages (Glodek 1980b), but there are no records of any occurrences in North Carolina basins west of the Mountains.

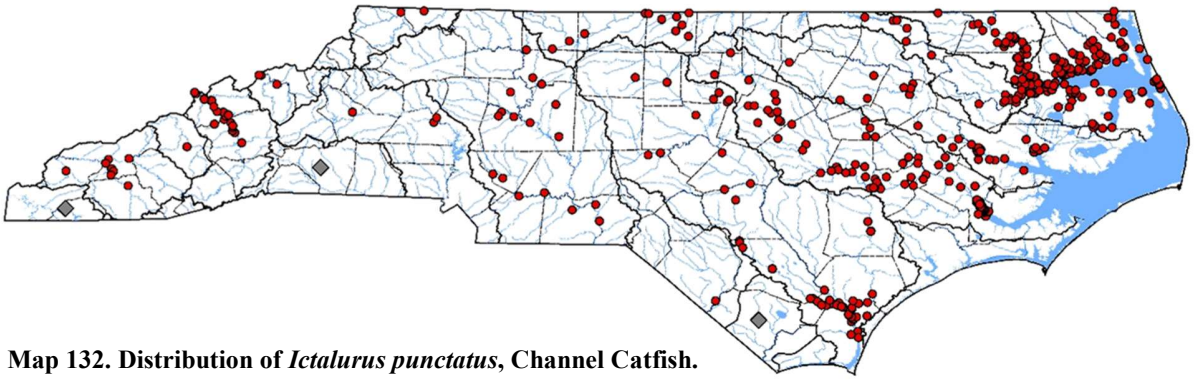


Map 131. Distribution of *Ictalurus furcatus,* Blue Catfish.

***Ictalurus punctatus* (Rafinesque, 1818). Channel Catfish.**

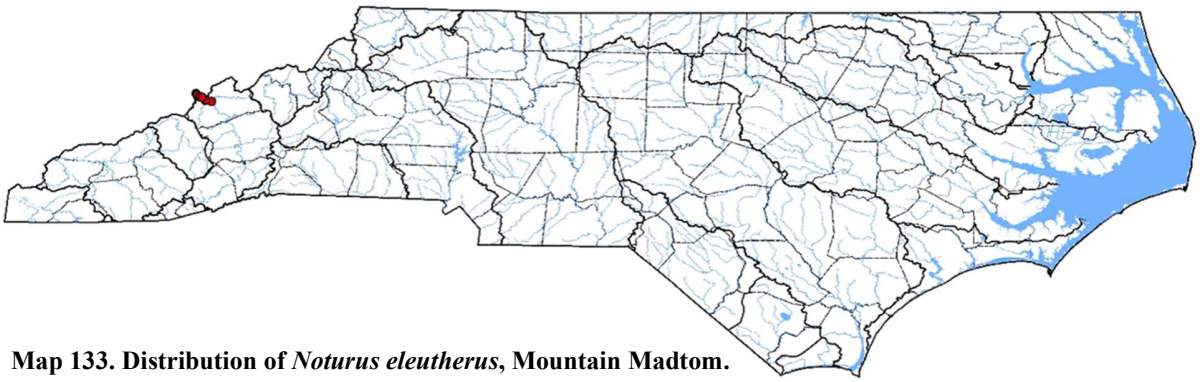
Channel Catfish is indigenous to the Mississippi River and Ohio River drainages (Glodek 1980c) and has been introduced into many Atlantic slope basins (Jenkins and Burkhead 1994; Fisk et. al 2018). However, there are no vouchered specimens or records of its occurrence in the Watauga, Savannah, Shallotte, or White Oak basins (Map 132). Menhinick (1991) shows records from the Hiwassee and Broad basins. Fisk et al. (2018) recently reported its occurrence in the Waccamaw basin.

Remarks: This species was likely stocked in the late 1800s in North Carolina, but exact stocking locations are unknown (NCWRC 2019). An examination of J. R. Bailey's original field notes (Field No. B49-1, dated July 19-20, 1949 and archived at NCSM) from a site on the New River in Alleghany County revealed that local inhabitants called the indigenous Flathead Catfish, *Pylodictis olivaris,* "*Yellow Cat*" and remarked that "*Blue Cats taken rarely now, but more commonly 20 years ago*". Burkhead et al. (1980) noted that non-spotted Channel Catfish have often been misidentified as Blue Catfish and dismissed all reports of Blue Catfish occurring in the New River. For the next 70 years or so, Channel Catfish, regionally called Blue Cats, were unknown by researchers and conservation managers from the North Carolina portion of the New River. However, in 2013 six specimens were caught at the same locality as Bailey's 1949 site (Farmers Fish Camp Road), and one specimen was caught in 2018 at the confluence of the North Fork and South Fork New rivers in Ashe County (K. Hodges, NCWRC and K. Hining, formerly NCWRC, pers. comm.).



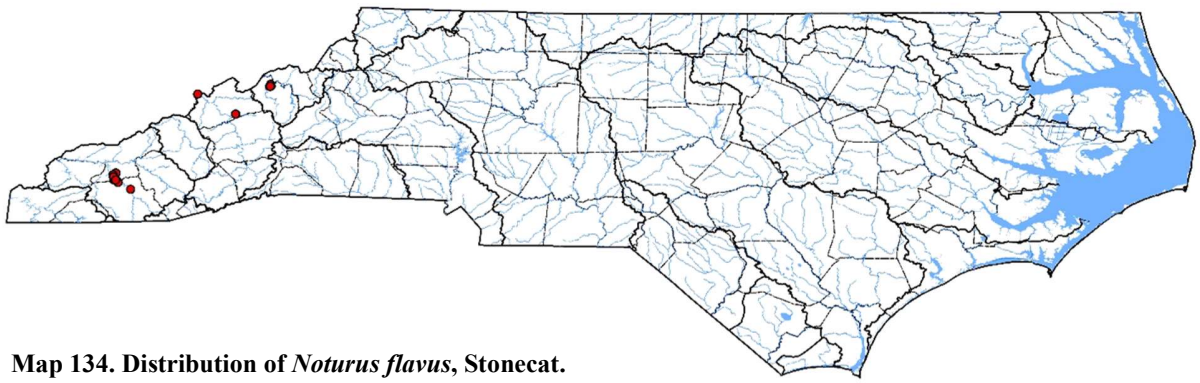
Map 132. Distribution of *Ictalurus punctatus*, Channel Catfish.

***Noturus eleutherus* Jordan, 1877. Mountain Madtom.**
Mountain Madtom, prior to 2007, was only known in North Carolina from a single record of one young specimen from Spring Creek, Madison County, collected in 1888 (Jordan 1889a) and since then was believed to be extirpated (Menhinick 1986; Burr 1997b; Rohde et al. 1998).
Remarks: In 2007, another single individual was collected by NCWRC staff (S. J. Fraley, Paul E. Pittman, T. Russ, J. Cal Younce, and David L. Yow) from the French Broad River at Hot Springs (Madison County) and vouchered (NCSM 52482). Since 2007, it has been repeatedly collected and commonly found in Spring Creek and the mainstem of the lower French Broad River downstream from Hot Springs to the Tennessee state line (Tracy 2014a) (Map 133). In June 2020, three individuals were observed under multiple boulders in Big Laurel Creek, just upstream from its confluence with the French Broad River (L. Etchison, NCWRC, pers. comm.).
Status: State Special Concern.



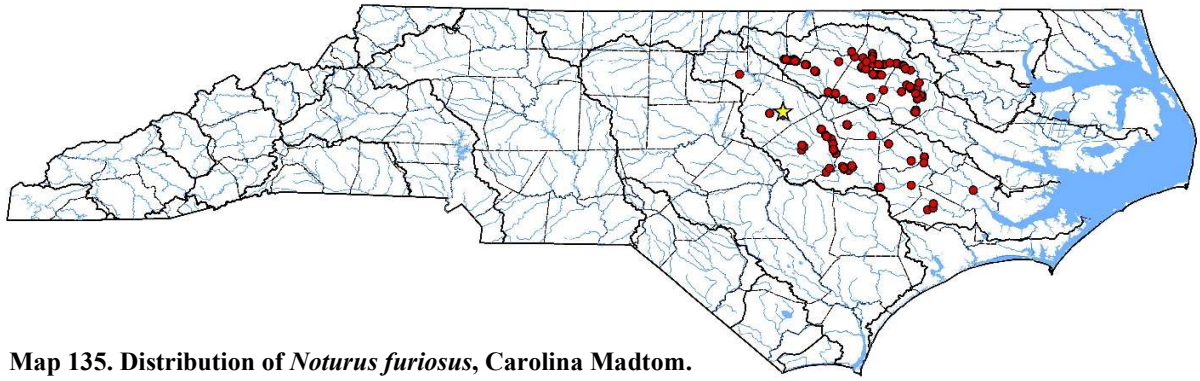
Map 133. Distribution of *Noturus eleutherus*, Mountain Madtom.

***Noturus flavus* Rafinesque, 1818. Stonecat.**
Stonecat is known from the Cane River (Nolichucky basin), French Broad River and Ivy Creek (French Broad basin), and the Little Tennessee River downstream from Porters Dam (Little Tennessee basin) (Rohde et al. 1998; L. Etchison and D. Owensby, NCWRC, pers. comm.) (Map 134).
Status: State Endangered.



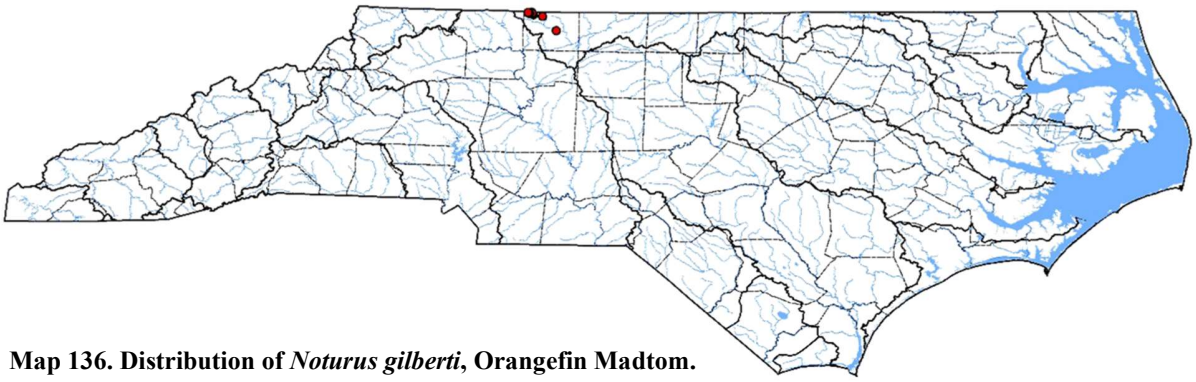
Map 134. Distribution of *Noturus flavus*, Stonecat.

***Noturus furiosus* Jordan and Meek, 1889. Carolina Madtom.**
Carolina Madtom is endemic to the Tar and Neuse basins (Taylor 1969; Rohde 1980c; Burr et al. 1989) (Map 135).
Remarks: A historical population in the Trent River might already be extirpated and all other Neuse basin populations may be perilously close to being extirpated (Wood and Nichols 2011; Cope 2018; M. Fisk, NCWRC, pers. comm.). Carolina Madtom faces a variety of threats from declines in water quality, loss of stream flow, riparian and instream fragmentation, deterioration of instream habitats, and expansion of the invasive predator Flathead Catfish. These threats are expected to be exacerbated by urbanization and climate change (USFWS 2018). Carolina Madtom was described by David S. Jordan and Seth E. Meek (Jordan 1889b; Table 5). The species was no longer extant at its type locality in August 2009 and September 2010 (B. H. Tracy, unpublished data).
Status: State Threatened. In May 2019, the USFWS proposed to list Carolina Madtom as an Endangered Species under the Endangered Species Act (Federal Register/Vol. 84, No. 99/Wednesday, May 22, 2019/Proposed Rules).



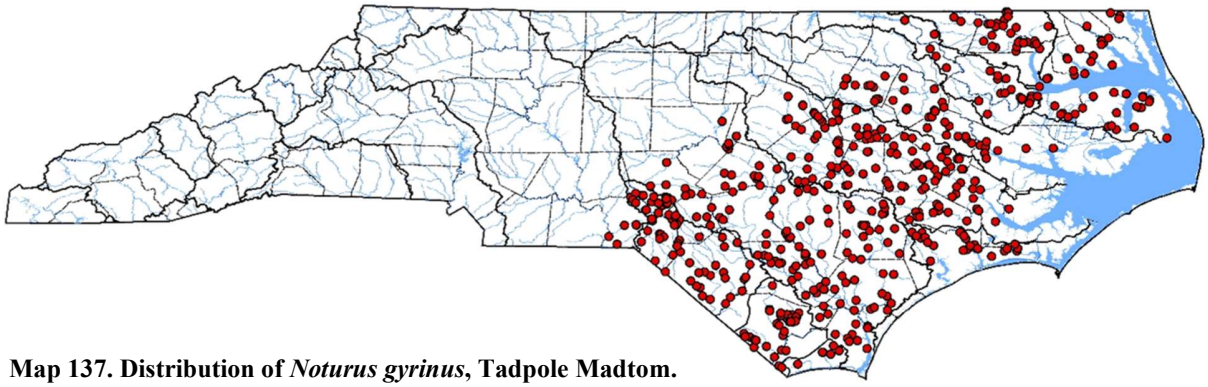
Map 135. Distribution of *Noturus furiosus*, Carolina Madtom. Star indicates type locality.

***Noturus gilberti* Jordan and Evermann. 1889. Orangefin Madtom.**
Orangefin Madtom is known only from the Dan River and Little Dan River in Stokes County (Map 136). It is endemic to the upper James River in Virginia and to the Roanoke basin in Virginia and North Carolina (Taylor 1969; Jenkins 1980l; Jenkins and Burkhead 1994).
Status: State Endangered



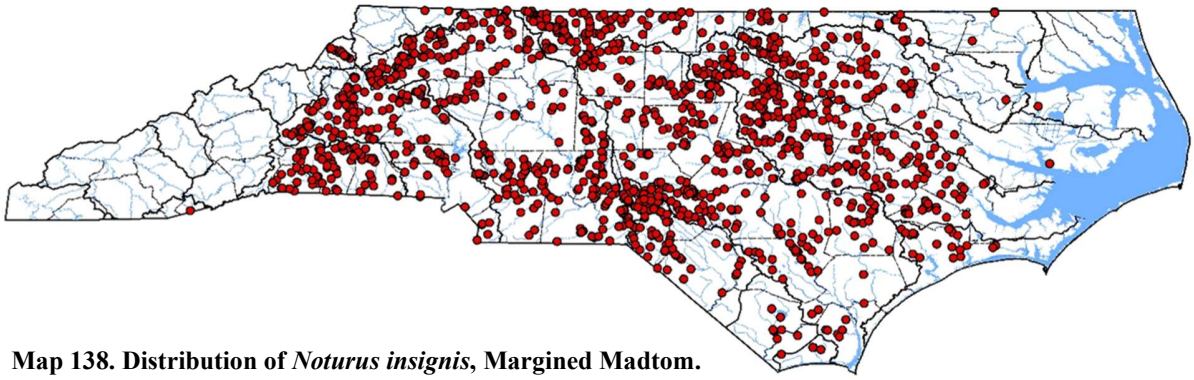
Map 136. Distribution of *Noturus gilberti*, Orangefin Madtom.

***Noturus gyrinus* (Mitchill, 1817). Tadpole Madtom.**
Tadpole Madtom is indigenous to the Sand Hills and Coastal Plain regions where it is found in every basin from the Virginia border to the South Carolina state line, including the southeastern corner of Richmond County (Yadkin basin). Scattered populations also exist in the lower Piedmont of the Cape Fear and Neuse basins (Map 137).



Map 137. Distribution of *Noturus gyrinus*, Tadpole Madtom.

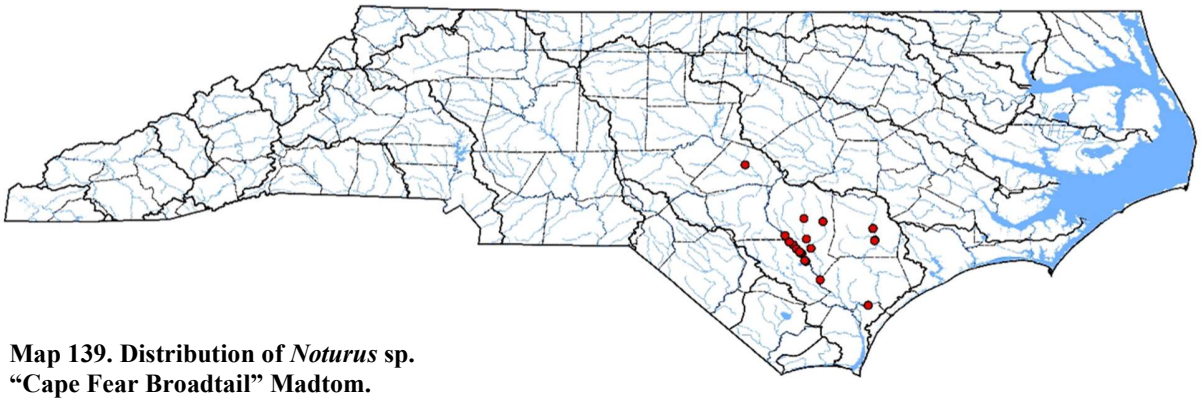
***Noturus insignis* (Richardson, 1836). Margined Madtom.**
Margined Madtom is found in all Atlantic slope basins from the Mountains to the Coast. It is introduced in the Watauga and New basins (earliest vouchered specimens from 1949 in both basins) (Map 138).
Remarks: It is considered indigenous in the Savannah basin even though it was not shown in Menhinick (1991) or listed in Starnes and Hogue (2011). Even though it is widespread in the basin in South Carolina, it was not collected from North Carolina's portion of the basin until 2000-2001.



Map 138. Distribution of *Noturus insignis*, Margined Madtom.

***Noturus* sp. "Cape Fear Broadtail" Madtom.**
"Cape Fear Broadtail" Madtom, an undescribed species, is endemic to the Cape Fear basin where it has been found in low numbers in the Cape Fear, Northeast Cape Fear, Black, and South rivers and Great Coharie and Six Runs creeks (Map 139).
Remarks: While it was first collected at five localities in the Cape Fear basin by NCWRC staff in 1962, it was not recognized as a different species until 1970 (Jenkins and Palmer 1978). It has not been collected since 2001 and may be extirpated from the basin. It is closely related to Margined

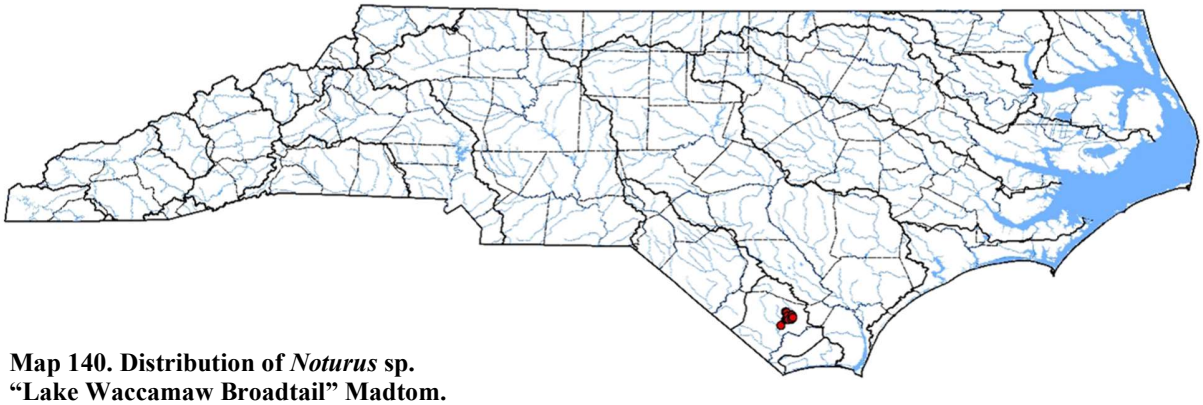
Madtom, *Noturus insignis*, and the other two undescribed *Noturus* species (Bennetts et al. 1999). This undescribed species keys out as *Noturus* n. sp. in Menhinick (1991).
Status: State Special Concern.



Map 139. Distribution of *Noturus* sp. "Cape Fear Broadtail" Madtom.

***Noturus* sp. "Lake Waccamaw Broadtail" Madtom.**

"Lake Waccamaw Broadtail" Madtom, an undescribed species, is endemic to and known only from Lake Waccamaw and the Waccamaw River (Waccamaw basin) immediately below the dam (Map 140). It was first collected in 1978 by David Lindquist (UNC-Wilmington) and assistants.
Remarks: Up until 2019, despite numerous visits to the lake by F. C. Rohde and NCWRC aquatic nongame biologists, "Lake Waccamaw Broadtail" Madtom had not been seen since 2002. However, in October 2019, Derek Crane and Coastal Carolina University students caught, photographed, and released two specimens of "Lake Waccamaw Broadtail" Madtom – the first specimens in 17 years (Derek Crane, Coastal Carolina University, pers. comm.; verification by F. C. Rohde). It is closely related to Margined Madtom and the other two undescribed *Noturus* species (Bennetts et al. 1999). This undescribed species keys out as *Noturus* n. sp. in Menhinick (1991).
Status: State Special Concern.

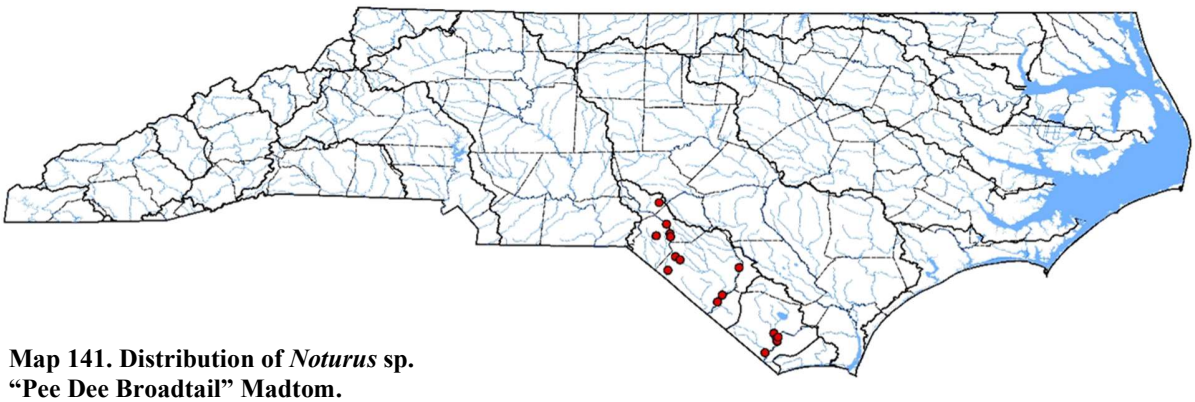


Map 140. Distribution of *Noturus* sp. "Lake Waccamaw Broadtail" Madtom.

***Noturus* sp. "Pee Dee Broadtail" Madtom.**

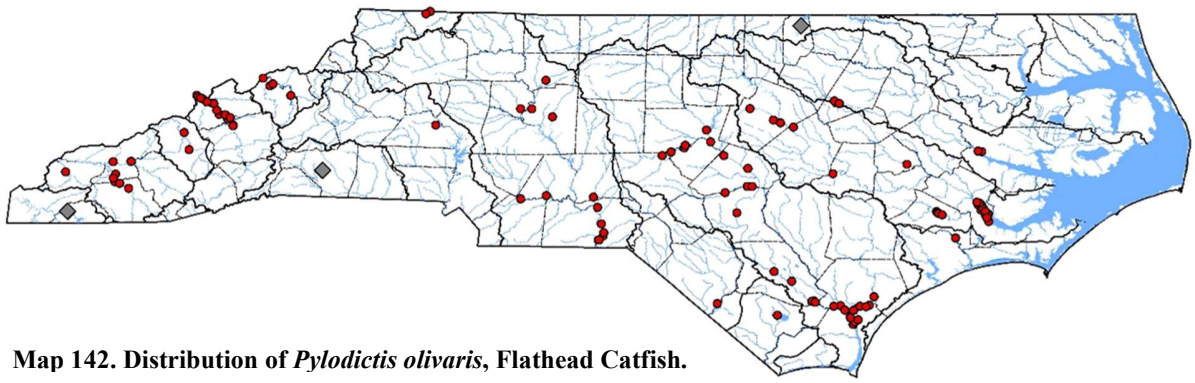
"Pee Dee Broadtail" Madtom, an undescribed species, has been collected in small numbers from the Lumber River (Lumber basin) and its tributaries and from the Waccamaw River (Waccamaw

basin) in North Carolina (Map 141) and from the Lynches, Little Pee Dee, and Pee Dee rivers (Yadkin basin) in South Carolina.
Remarks: While it was first collected from the Lumber River by NCWRC staff in 1960, it was not recognized as a different species until 1967 (Jenkins and Palmer 1978). It is closely related to Margined Madtom and the other two undescribed *Noturus* species (Bennetts et al. 1999). This undescribed species keys out as *Noturus* n. sp. in Menhinick (1991).
Status: State Special Concern.



Map 141. Distribution of *Noturus* sp. "Pee Dee Broadtail" Madtom.

***Pylodictis olivaris* (Rafinesque, 1818). Flathead Catfish.**
Flathead Catfish was intentionally stocked by NCWRC in 1965 in the Yadkin (Lake Lee), Catawba (Lake Norman), and Cape Fear (Lake Rim and Northeast Cape Fear River) basins. It has recently been found in Moss Lake, an impoundment of Buffalo Creek and a tributary of the Broad River, but not in the river proper (Broad basin) (T. Russ and C. Wood, NCWRC, pers. comm.) (Map 142). Flathead Catfish has yet to be found in the Savannah, Shallotte, Chowan, and Albemarle basins. It has also not been found in the Watauga basin even though the species is indigenous to the Mississippi River and Ohio River drainages.
Remarks: In 1966 stockings continued in Lake Norman and in the Cape Fear River proper (K. Dockendorf and K. Rachels, NCWRC, pers. comm.; Guier et al. (1981)). Stockings by NCWRC continued in the Yadkin basin throughout the 1960s (NCWRC 2019) and through unauthorized releases by individuals into most rivers on the Atlantic slope (Fisk et al. 2018). Flathead Catfish was first detected in Lake James (Catawba basin) in 1998 (D. Besler, NCWRC, pers. comm.).



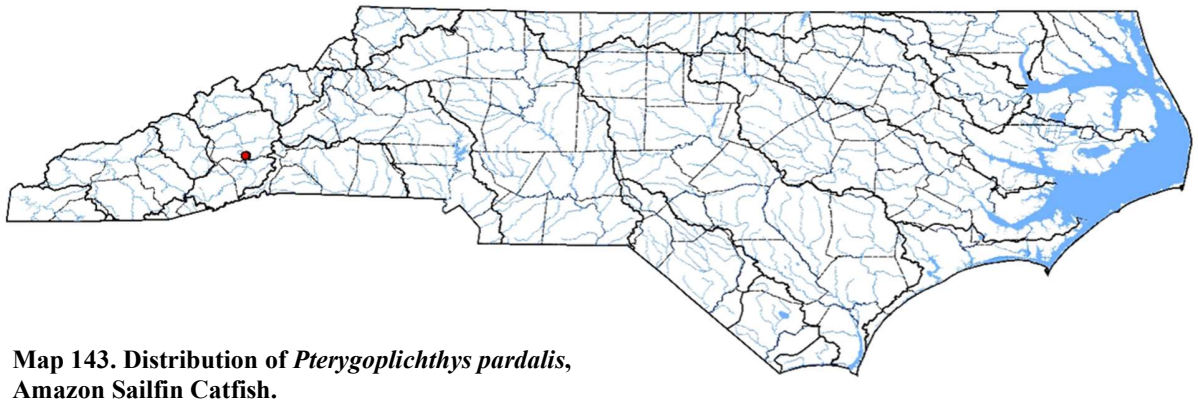
Map 142. Distribution of *Pylodictis olivaris*, Flathead Catfish.

Loricariidae - Suckermouth Armored Catfishes

***Pterygoplichthys pardalis* (Castelnau, 1855). Amazon Sailfin Catfish.**

Amazon Sailfin Catfish, a nonindigenous species, was first detected in Lake Julian in the French Broad basin in 1997 (R. Garrett, Duke Energy, pers. comm.) (Map 143).

Remarks: This species is not expected to survive in Lake Julian because the thermal discharge from the coal-fired and gas-fired power plant ceased in February 2020 (Reid Garrett, Duke Energy, pers. comm.). There is one lot of a single specimen at NCSM (NCSM 98152) from the Black River in Harnett County (Cape Fear basin) collected in 1977. However, no additional specimens have been collected from that basin since, and the illegal introduction, most likely from an aquarium disposal, is considered to have been unsuccessful. The record is not mapped or tabulated in Table 3.



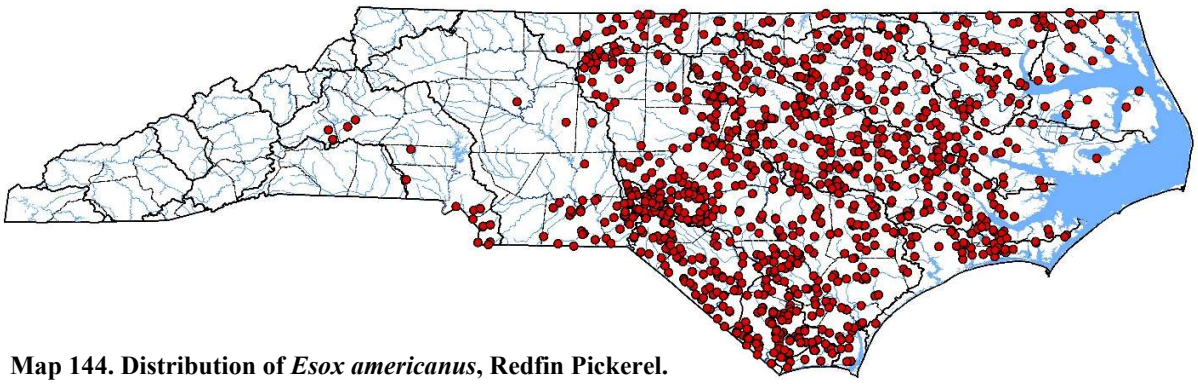
Map 143. Distribution of *Pterygoplichthys pardalis*, Amazon Sailfin Catfish.

Esocidae - Pikes

***Esox americanus* Gmelin, 1789. Redfin Pickerel.**

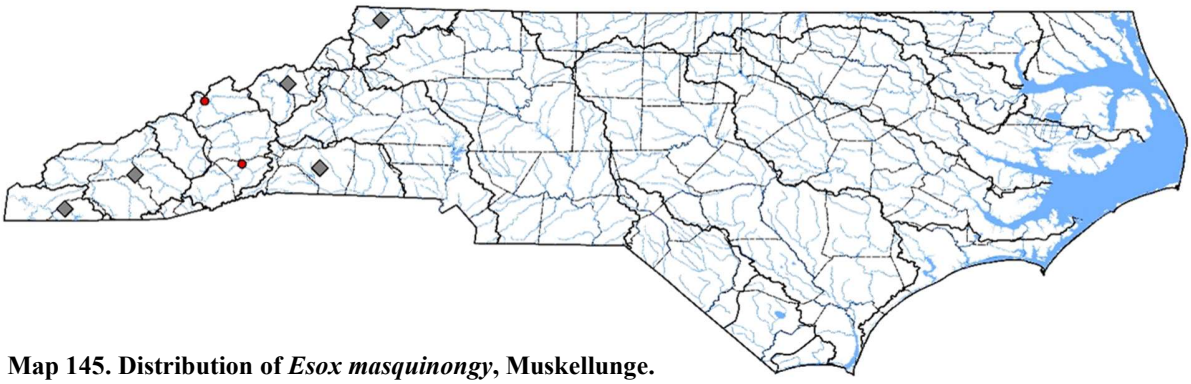
Redfin Pickerel is found in Piedmont, Sand Hills, and Coastal Plain streams in all Atlantic slope basins, except for the Savannah and Broad (Map 144).

Remarks: Historical records plotted by Menhinick (1991) from the middle and upper Yadkin were based upon unverified records mapped in Crossman (1962, 1966, 1980a). The valid subspecies in North Carolina is *Esox americanus americanus* (McCormick et al. 2020).



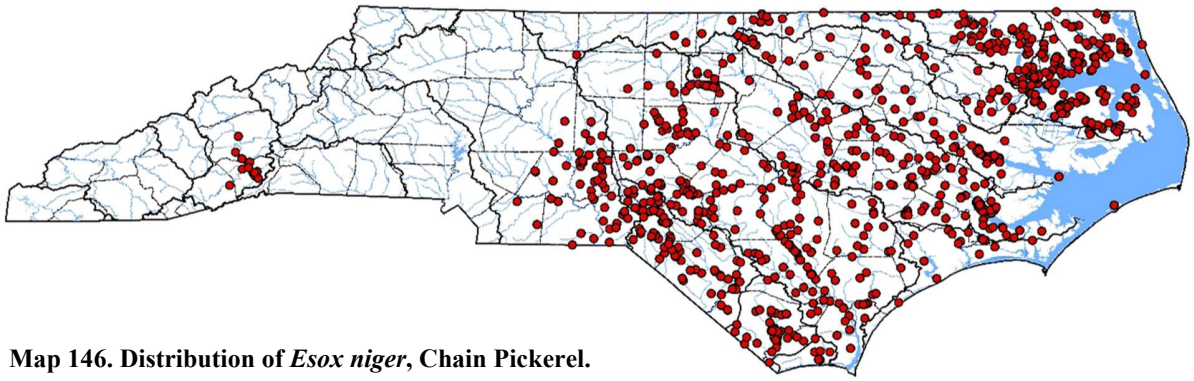
Map 144. Distribution of *Esox americanus*, Redfin Pickerel.

***Esox masquinongy* Mitchill, 1824. Muskellunge.**
Muskellunge is indigenous in the Hiwassee, Little Tennessee, French Broad, and Nolichucky basins. It has been stocked as a sportfish in the New and Broad basins. The species is at the southern limit of its range in North Carolina (Crossman 1980b) (Map 145).
Remarks: A record from Walters Lake (Pigeon basin), mapped in Menhinick (1991), is unverifiable. For a discussion on the authorship of the species, see Scharpf (2020a).



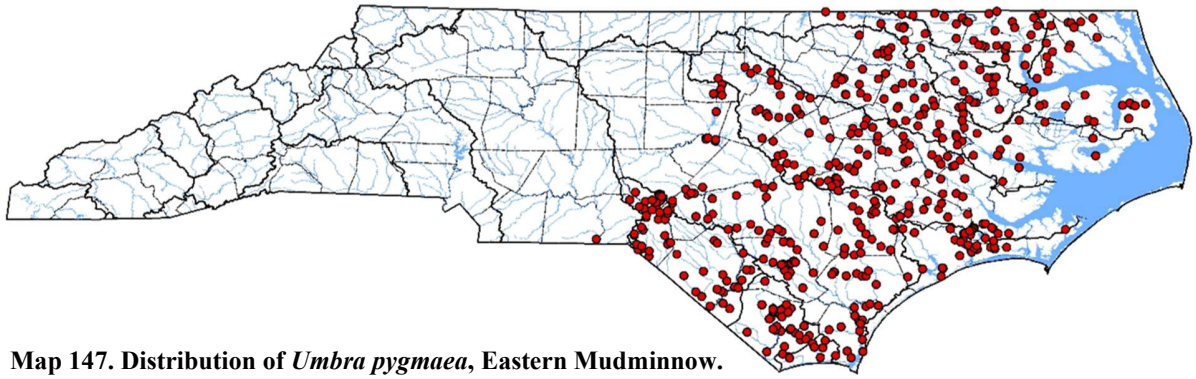
Map 145. Distribution of *Esox masquinongy*, Muskellunge.

***Esox niger* Lesueur, 1818. Chain Pickerel.**
Chain Pickerel is found in Piedmont, Sand Hills, and Coastal Plain streams in all Atlantic slope basins, except for the Savannah, Broad, and Catawba. It is introduced in the French Broad basin, including the mainstem of the river and many of its tributaries from the Davidson River downstream to river kilometer 232 (earliest vouchered specimens from 1991; Tracy 2008a) (Map 146).
Remarks: Cope (1870a) reported Chain Pickerel (as *E. affinis*) from the Catawba basin, but there are no verifiable specimens to substantiate his claim.



Map 146. Distribution of *Esox niger*, Chain Pickerel.

Umbridae - Mudminnows
***Umbra pygmaea* (DeKay, 1842). Eastern Mudminnow.**
Eastern Mudminnow is primarily found in Atlantic slope Coastal Plain basins from the Virginia border to the South Carolina state line, including the southeast corner of Anson County (Yadkin basin) (Map 147).

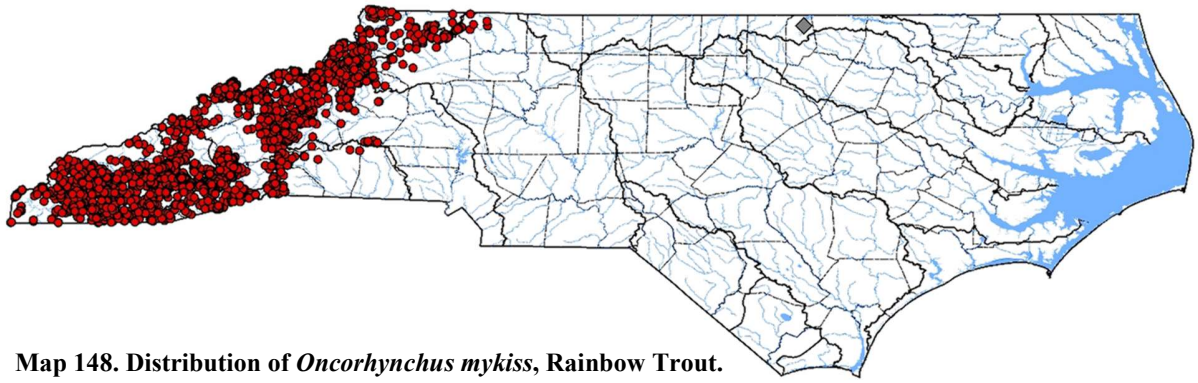


Map 147. Distribution of *Umbra pygmaea*, Eastern Mudminnow.

Salmonidae - Trouts and Salmons

***Oncorhynchus mykiss* (Walbaum, 1792). Rainbow Trout.**

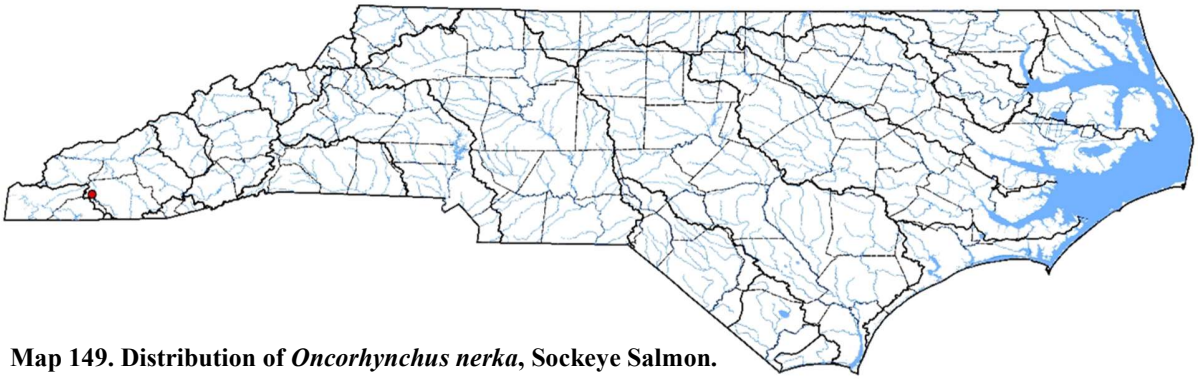
Rainbow Trout, a nonindigenous species, was first stocked as a sportfish in the late 1870s-early 1880s in the French Broad basin (French Broad River), Catawba basin (Linville, Johns, and Catawba rivers), Broad basin (Broad and Green rivers), Yadkin basin (Yadkin River), Pigeon basin (Pigeon River), and Roanoke basin (Town Creek and Dan River) (Worth 1879; Smith 1907). Today, Rainbow Trout are found throughout all Mountain basins and in the montane reaches of Atlantic slope basins, including the Roanoke, Yadkin, Catawba, Broad, and Savannah (Map 148). Remarks: There is an extremely aberrant lot of a single specimen from Pettiford Creek in Carteret County (NCSM 50095) collected in 1992. This fish is about 420 mm total length with a severely eroded dorsal fin, which may indicate that this was a hatchery raised fish that was illegally released and ultimately caught. The record is not plotted. This species keys out as *Salmo gairdneri* in Menhinick (1991).



Map 148. Distribution of *Oncorhynchus mykiss*, Rainbow Trout.

***Oncorhynchus nerka* (Walbaum, 1792). Sockeye Salmon.**

Sockeye Salmon, a nonindigenous species, was stocked in 1959 and the 1960s as a forage fish for Rainbow Trout and as a sportfish in the Nantahala Reservoir (Little Tennessee basin) where it persists today (NCWRC 1961; L. Etchison, NCWRC, pers. comm.) (Map 149).

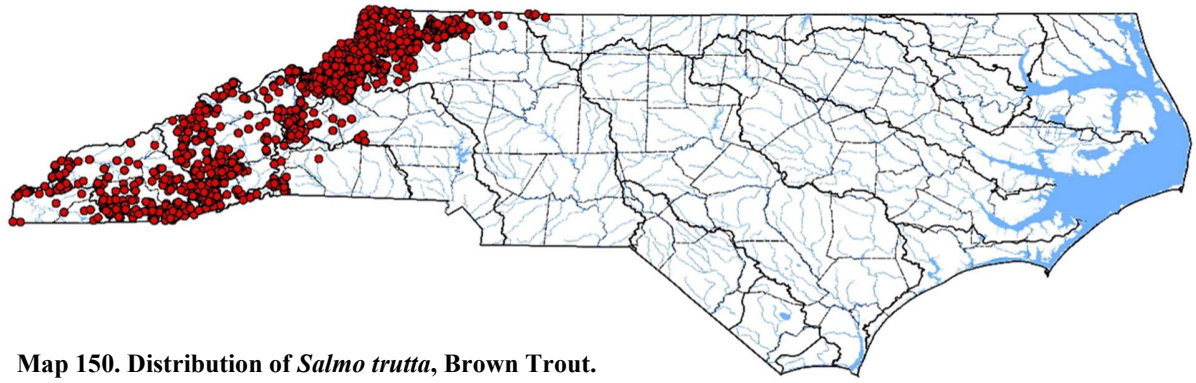


Map 149. Distribution of *Oncorhynchus nerka*, Sockeye Salmon.

***Salmo trutta* Linnaeus, 1758. Brown Trout.**

Brown Trout, a nonindigenous species, was widely stocked as a sportfish and is now found throughout all Mountain basins and in the montane reaches of Atlantic slope basins, including the Roanoke, Yadkin, Catawba, Broad, and Savannah (Map 150).

Remarks: The exact locations of the introduction of Brown Trout into North Carolina's waters are unknown. Although Brown Trout were not mentioned by Worth (1897) or Smith (1907), MacCrimmon and Marshall (1968) and MacCrimmon et al. (1970) give the year of introduction as 1887. Brown Trout was first imported to the United States in 1883 from Germany and stocked in Michigan by the U.S. Fish Commission (Fuller et al. 1999).

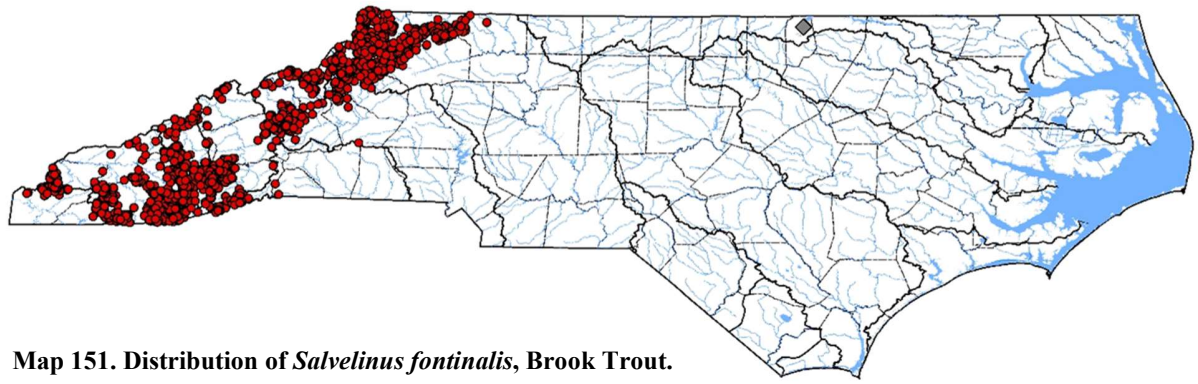


Map 150. Distribution of *Salmo trutta*, Brown Trout.

***Salvelinus fontinalis* (Mitchill, 1814). Brook Trout.**

Brook Trout, North Carolina's only indigenous species of trout, is found in all Mountain basins and in the headwater montane streams of the Savannah, Yadkin, and Catawba. It has been stocked into the Broad and Roanoke basins (Map 151).

Remarks: Although the exact years of its initial introductions into the Broad and Roanoke basins are unknown (J. Rash, NCWRC, pers. comm.), Smith (1907) stated: "*The natural distribution of the fish in North Carolina is the headwaters of the Catawba and French Broad Rivers, although it has been introduced into various other waters, and is now quite generally found in the mountainous sections.*"



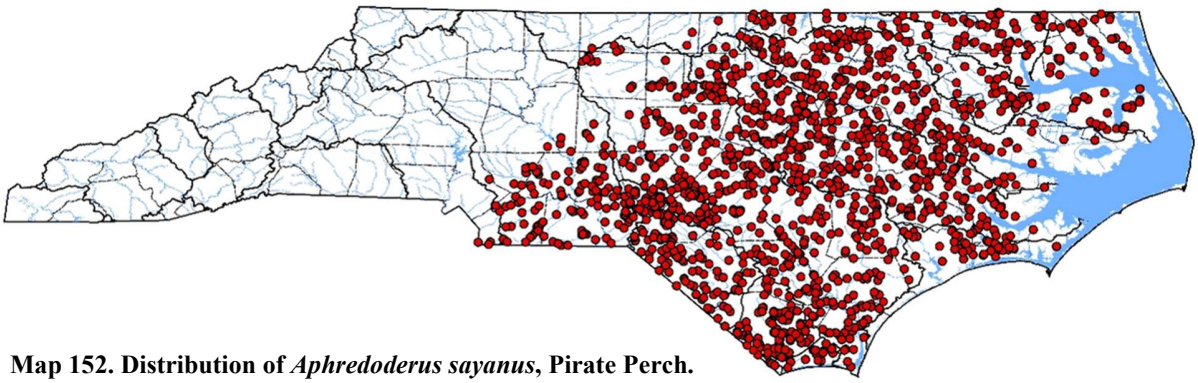
Map 151. Distribution of *Salvelinus fontinalis*, Brook Trout.

Aphredoderidae - Pirate Perches

***Aphredoderus sayanus* (Gilliams, 1824). Pirate Perch.**

Pirate Perch is a lower Piedmont and Coastal Plain species that is found in all Atlantic slope basins in North Carolina, except for the Savannah and Broad (Map 152). Its distribution along the Atlantic Slope extends from New York to central Florida (Lee 1980b; Boltz and Stauffer 1993).

Remarks: A valid subspecies in North Carolina is *Aphredoderus sayanus sayanus* (Burr and Warren 2020).

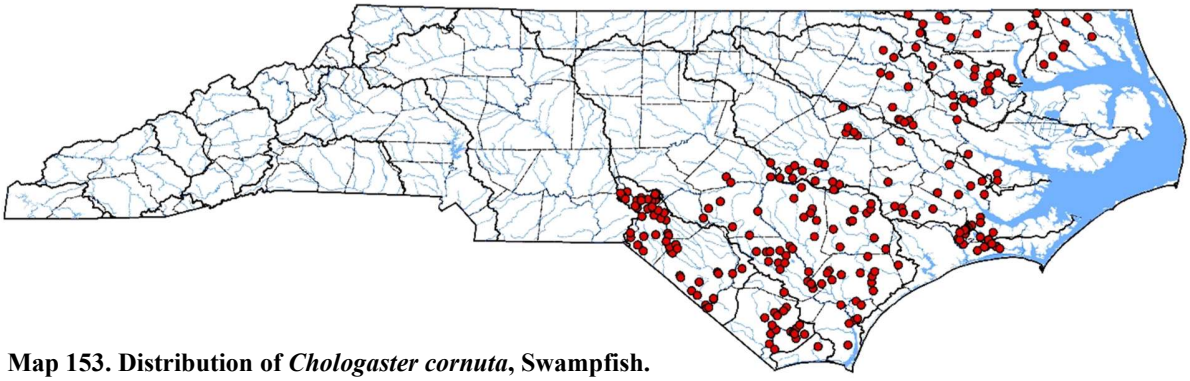


Map 152. Distribution of *Aphredoderus sayanus*, Pirate Perch.

Amblyopsidae - Cavefishes

***Chologaster cornuta* Agassiz, 1853. Swampfish.**

Swampfish is a Coastal Plain species that is widely distributed in every river basin from the Virginia border to the South Carolina state line (Map 153). Its distribution along the Atlantic Slope extends from southeastern Virginia to east-central Georgia (Cooper and Rohde 1980).

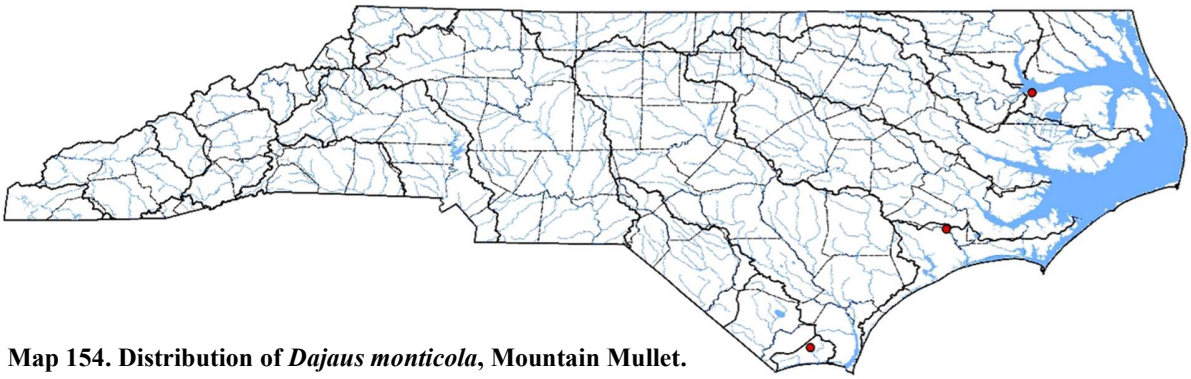


Map 153. Distribution of *Chologaster cornuta*, Swampfish.

Mugilidae - Mullets

***Dajaus monticola* (Bancroft, 1836). Mountain Mullet.**

Mountain Mullet, an amphidromous species, is known from one specimen each from the Shallotte (NCSM 46114, Royal Oak Swamp, 1975 (Rohde (1976)), the Albemarle (YPM ICH 019743, Albemarle Beach, 1938), and White Oak (NCSM 76605, White Oak River, 2013) basins (Map 154). It is at the northern limit of its range in North Carolina (Rohde 1980d) and is a seasonal inhabitant of fresh water. It may, however, be more common in U.S. waters than is generally thought since it is difficult to capture with most collecting gear (Pezold and Edwards 1983).

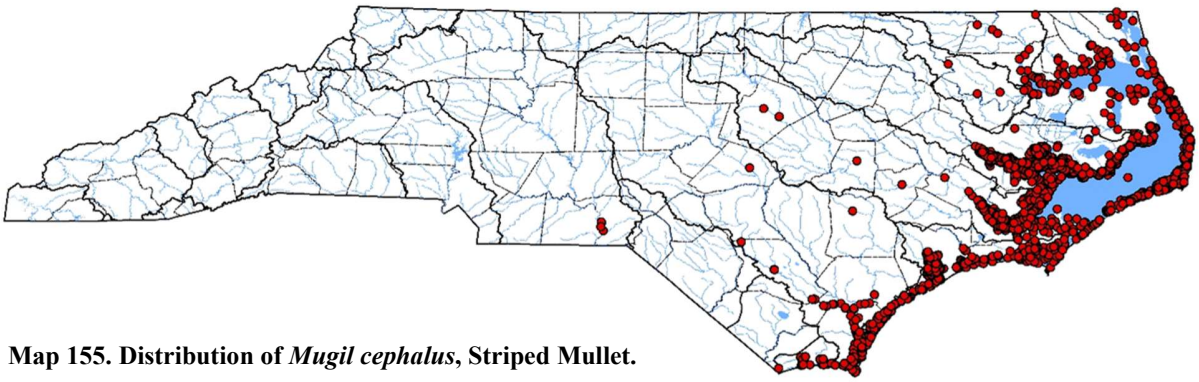


Map 154. Distribution of *Dajaus monticola*, Mountain Mullet.

***Mugil cephalus*, Linnaeus 1758. Striped Mullet.**

Striped Mullet is a seasonal inhabitant in all Coastal Plain river basins as far upstream as near the Fall Zone near Rockingham (Yadkin basin), Lillington on the mainstem Cape Fear River (Cape Fear basin), and at Raleigh (Neuse basin). It has also been found upstream near Jacksonville (White Oak basin), near Washington (Tar basin), upstream of Lewiston (Roanoke basin), near Murfreesboro on the Meherrin River (Chowan basin), and to Corapeake in a tributary to the Perquimans River (Albemarle basin) (Map 155).

Remarks: In the Pee Dee River (Yadkin basin) downstream from the Blewett Falls Dam, there seem to be at least three size (age) classes of this catadromous species (W. C. Starnes, retired, NCSM, pers. obs. and pers. comm.).



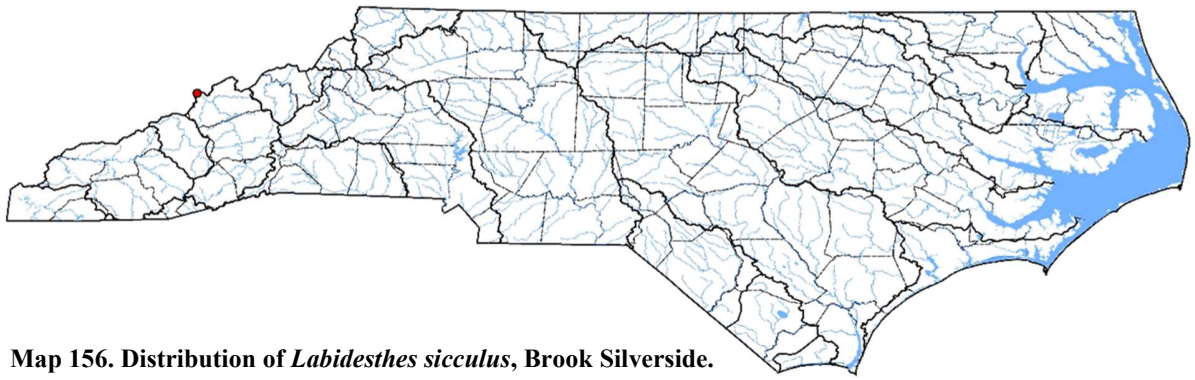
Map 155. Distribution of *Mugil cephalus*, Striped Mullet.

Atherinopsidae - New World Silversides

***Labidesthes sicculus* (Cope, 1865). Brook Silverside.**

Brook Silverside, a recent migrant from Tennessee, was first discovered in North Carolina in 2012 by NCWRC staff in the mainstem of the lower French Broad River in Madison County (NCSM 73181), which is its only known occurrence in the state (Map 156). Its indigenous range extends from the upper Mississippi River to the Gulf of Mexico, including the Great Lakes-St. Lawrence River, Tennessee River, and Ohio River drainages (Werneke and Armbruster 2015).

Remarks: Previously unknown from North Carolina (Menhinick 1974; Lee 1980d), Brook Silverside was still included in a dichotomous key to the species of silversides and a distribution map with a distant location in Tennessee downstream from Fontana Lake was shown in Menhinick (1991).

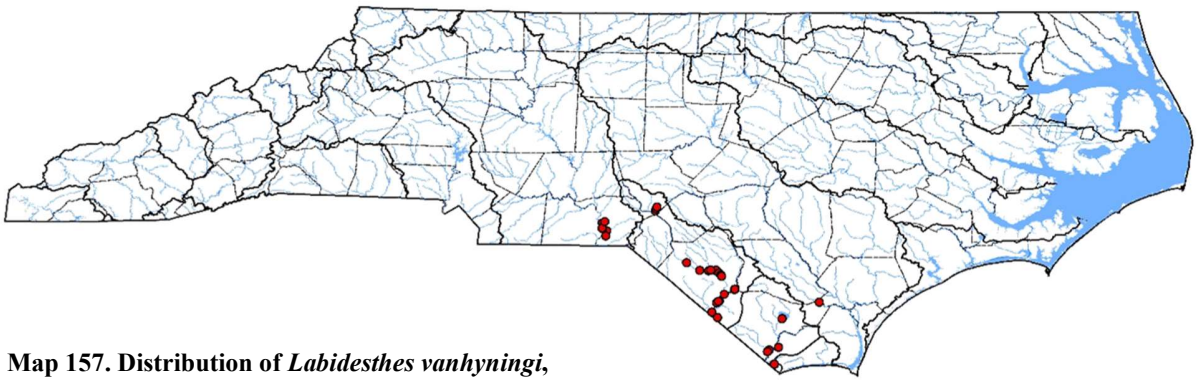


Map 156. Distribution of *Labidesthes sicculus*, Brook Silverside.

***Labidesthes vanhyningi* Bean and Reid, 1930. Southern Brook Silverside.**

Southern Brook Silverside, a recent migrant from South Carolina, was first discovered in North Carolina in 1995 in the Waccamaw River (Moser et al. 1998). Since 1995, Southern Brook Silverside has naturally dispersed into Lake Waccamaw, the Waccamaw River, and throughout the Lumber, lower Yadkin, and lower Cape Fear basins (Map 157), where it is now at the northern limit of its range along the Atlantic slope in North Carolina (Werneke and Armbruster 2015).

Remarks: This species keys out as *Labidesthes sicculus* in Menhinick (1991).

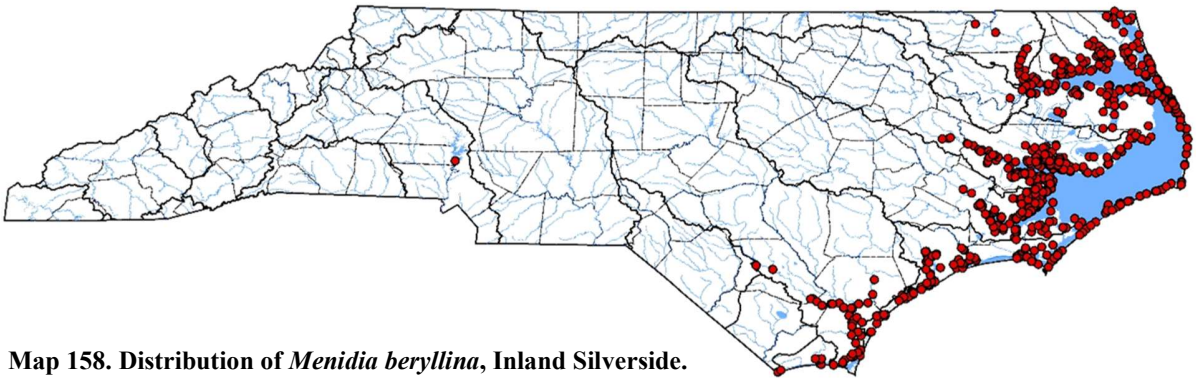


Map 157. Distribution of *Labidesthes vanhyningi*, Southern Brook Silverside.

***Menidia beryllina* (Cope, 1867). Inland Silverside.**

Inland Silverside is found in all Coastal Plain river basins from the Virginia border to the Shallotte basin. It has been found as far upstream as near Elizabethtown (Cape Fear basin), near Greenville (Tar basin), and near Murfreesboro on the Meherrin River (Chowan basin) (Map 158).

Remarks: Inland Silverside was discovered in Lake Norman (Catawba basin) in June 2016 at the McGuire Nuclear Plant intake structure where more than 600 specimens were collected during entrainment studies (Thomas Thompson, retired, Duke Energy, pers. comm.).



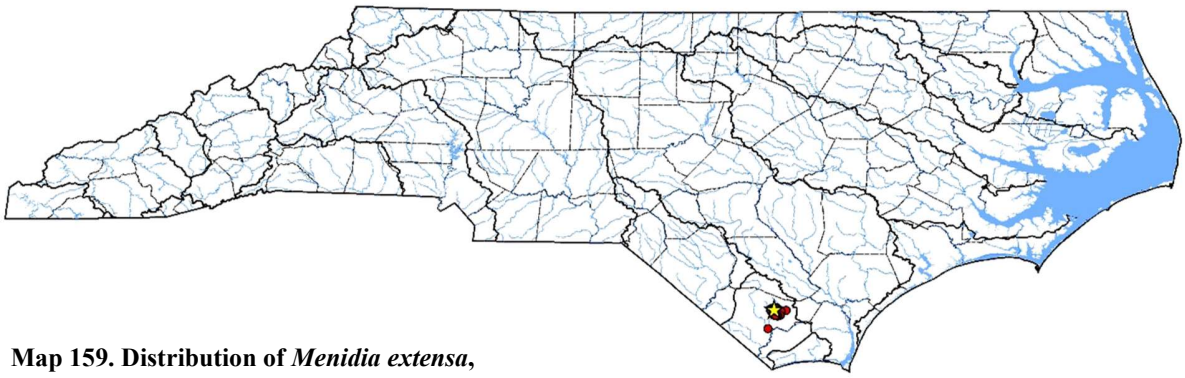
Map 158. Distribution of *Menidia beryllina*, Inland Silverside.

***Menidia extensa* Hubbs and Raney, 1946. Waccamaw Silverside.**

Waccamaw Silverside is endemic to Lake Waccamaw, Waccamaw basin (Shute 1980a; Krabbenhoft et al. 2005) (Map 159).

Remarks: Waccamaw Silverside was described by C. L. Hubbs and E. C. Raney (Hubbs and Raney 1946; Table 5). The species continued to occupy its type locality in March 2009 (NCSM 56311, B. H. Tracy, unpublished data).

Status: Federally Threatened.



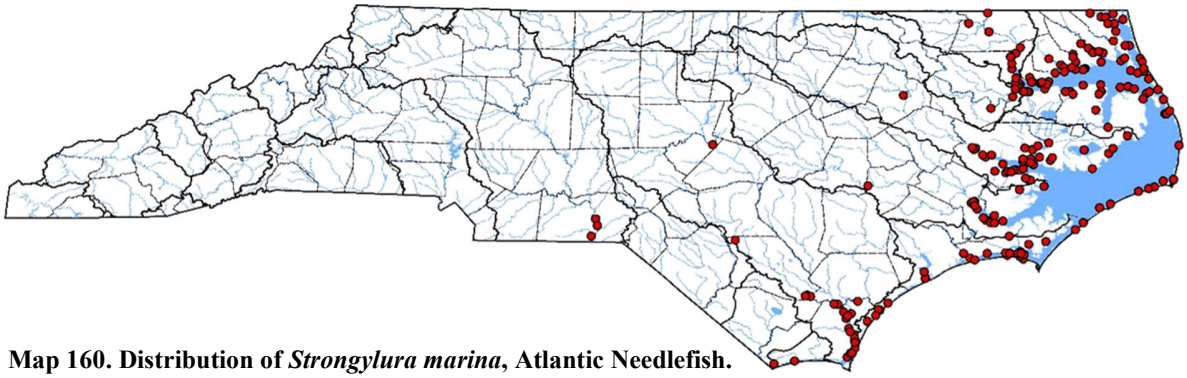
Map 159. Distribution of *Menidia extensa*, Waccamaw Silverside. Star indicates type locality.

Belonidae - Needlefishes

***Strongylura marina* (Walbaum, 1792). Atlantic Needlefish.**

Atlantic Needlefish is found seasonally in most Coastal Plain river basins as far upstream as Blewett Falls Dam (Yadkin basin), at Buckhorn Dam (Cape Fear basin), near La Grange (Neuse basin), near Tarboro (Tar basin), near Murfreesboro on the Meherrin River (Chowan basin), and also in the White Oak and the Albemarle basins. It has not been reported from the Waccamaw or Lumber basins (Map 160).

Remarks: Atlantic Needlefish commonly enters fresh water to spawn as far upstream as the Fall Zone (Burgess 1980b; Rohde et al. 2009).



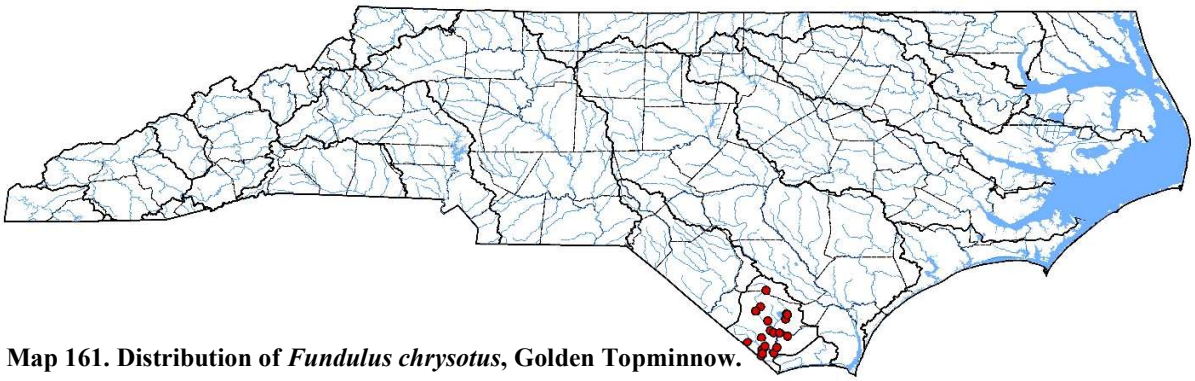
Map 160. Distribution of *Strongylura marina*, Atlantic Needlefish.

Fundulidae - Topminnows

***Fundulus chrysotus* (Günther, 1866). Golden Topminnow.**

Golden Topminnow is restricted to Columbus County (Waccamaw basin) (Map 161), where it is at the northern limit of its range (Shute 1980b; Rohde et al. 2009).

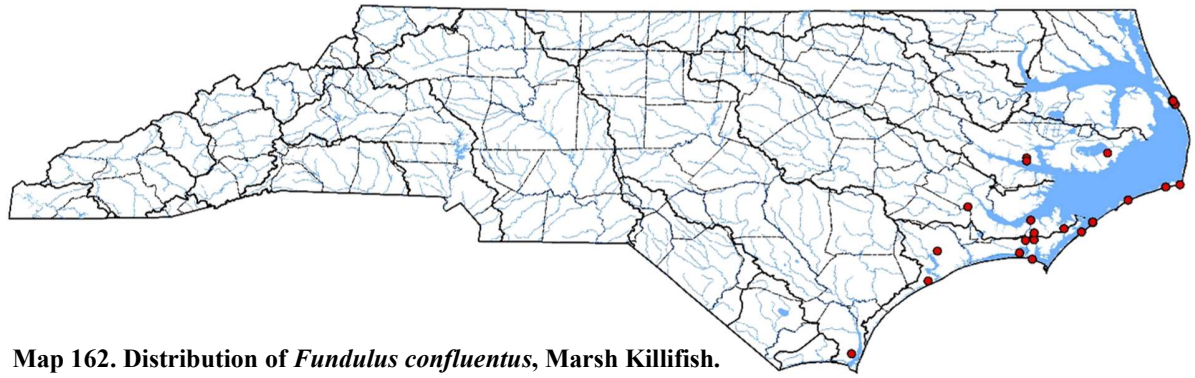
Remarks: A recent migrant from South Carolina, Golden Topminnow was first recorded in North Carolina in 2007 from Marlowe Branch in Columbus County.



Map 161. Distribution of *Fundulus chrysotus*, Golden Topminnow.

***Fundulus confluentus* Goode and Bean, 1879. Marsh Killifish.**

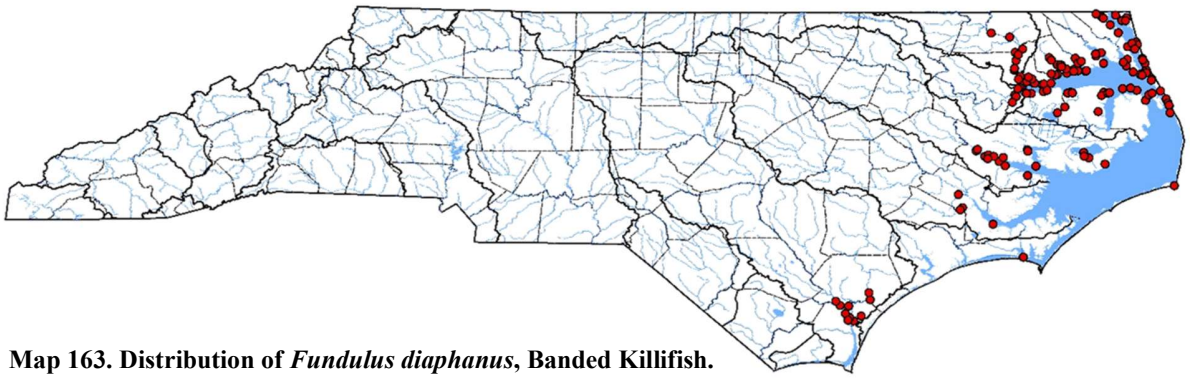
Marsh Killifish is known from a few scattered localities in estuarine and fresh waters from the Albemarle south to the Cape Fear basin (Map 162). Its indigenous range extends from southeastern Virginia to Texas (Hardy 1980).



Map 162. Distribution of *Fundulus confluentus*, Marsh Killifish.

***Fundulus diaphanus* (Lesueur, 1817). Banded Killifish.**

Banded Killifish is found along the coast in the Cape Fear, White Oak, Neuse, Tar, Roanoke, Chowan, and Albemarle basins, where it is near the southern limit of its range (Gilbert and Shute 1980b). In the Chowan basin, it has been found as far upstream as near Winton. In the Cape Fear basin, it has been found in the Northeast Cape Fear River as far upstream as near Rocky Point and near the mouth of the Black River (Map 163).

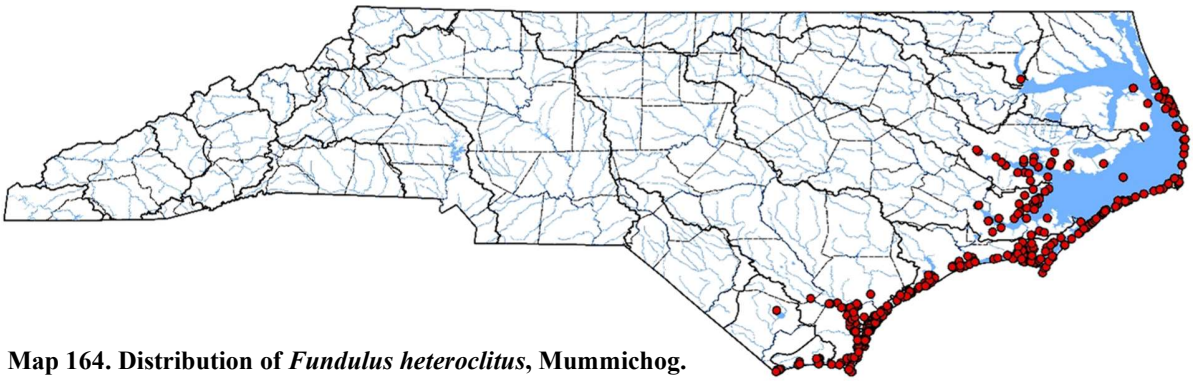


Map 163. Distribution of *Fundulus diaphanus*, Banded Killifish.

***Fundulus heteroclitus* (Linnaeus, 1766). Mummichog.**

Mummichog is found along the coast from the Albemarle to the Shallotte basins, except for the Roanoke basin (Map 164).

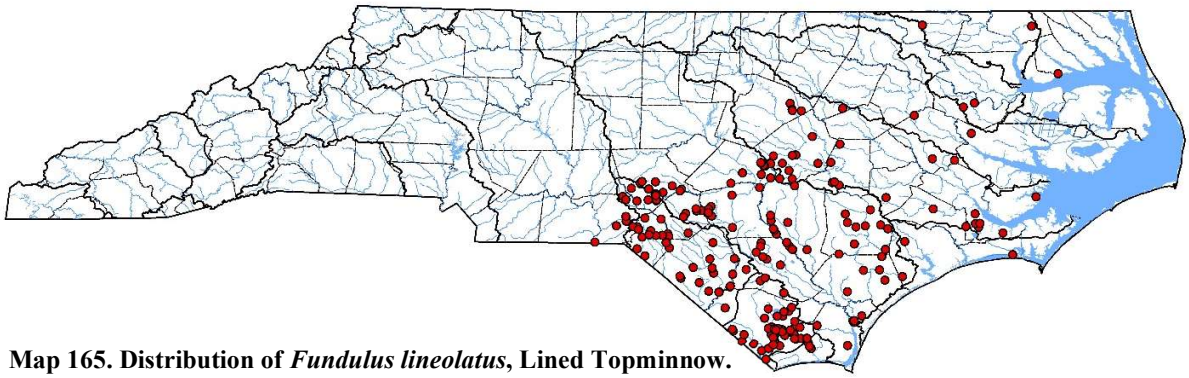
Remarks: In March 2020, F. C. Rohde collected Mummichog for the first time from the Waccamaw basin (Lake Waccamaw, Columbus County). It is unknown if this indigenous species introduction represents a reproducing and persistent population.



Map 164. Distribution of *Fundulus heteroclitus*, Mummichog.

***Fundulus lineolatus* (Agassiz, 1854). Lined Topminnow.**

Lined Topminnow is a Coastal Plain species that is found in every river basin from the Virginia border to the South Carolina state line (Map 165). It is near the northern limit of its range in North Carolina (Wiley 1980b).

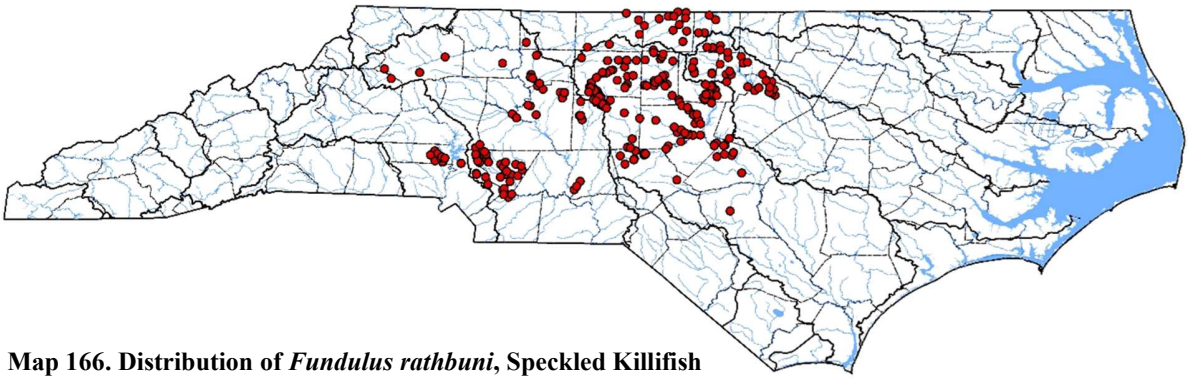


Map 165. Distribution of *Fundulus lineolatus*, Lined Topminnow.

***Fundulus rathbuni* Jordan and Meek, 1889. Speckled Killifish.**

Speckled Killifish is endemic to Virginia and North Carolina from across the Piedmont in the Roanoke basin to the lower Catawba basin (Lee 1980c; Jenkins and Burkhead 1994) (Map 166).

Remarks: Based on its indigenous distribution and occupied instream habitats in other basins, it appears that the localities clustered in eastern Lincoln County (Map 166) (Menhinick 1991, 2010) possibly constitute an introduction because suitable habitats throughout the middle and lower Catawba basin are not occupied by Speckled Killifish. It was described by David S. Jordan and Seth E. Meek 1889b; Table 5). The species was extant at Big Alamance Creek in July 2009 (NCSM 59197, B. H. Tracy, unpublished data).



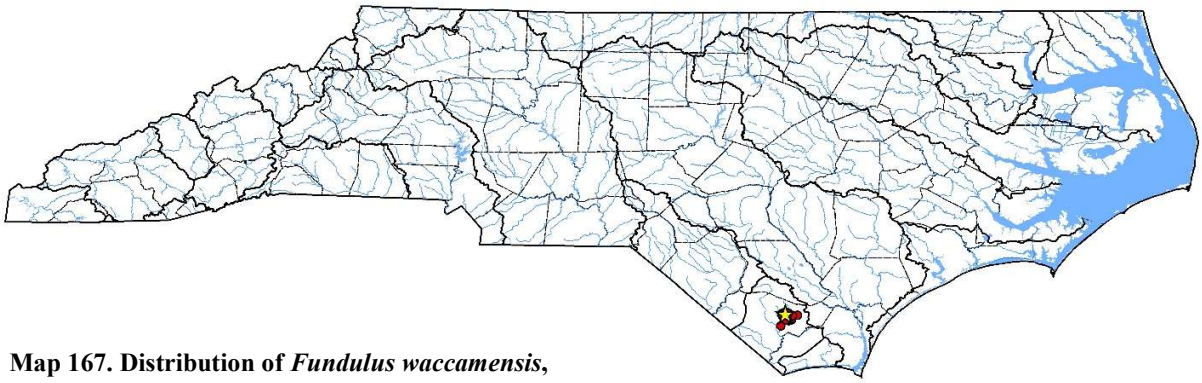
Map 166. Distribution of *Fundulus rathbuni*, Speckled Killifish

***Fundulus waccamensis* Hubbs and Raney, 1946. Waccamaw Killifish.**

Waccamaw Killifish is endemic to Lake Waccamaw and its adjacent canals (Waccamaw basin; Shute 1980b; Shute et al. 1981; Shute 1997; Krabbenhoft et al. 2009; Tracy 2014a) (Map 167).

Remarks: Waccamaw Killifish and *Fundulus* sp. "Lake Phelps" Killifish were formerly considered a single species (Bailey et al. 1977; Shute 1980b; Menhinick 1991), with the Lake Phelps population possibly introduced from Lake Waccamaw (Wiley and Mayden 1985; Wiley 1986). Subsequent unpublished genetic and morphometric analyses by Grady, Krabbenhoft, Quattro, and Rohde suggest that these two killifishes evolved independently from isolated populations of Banded Killifish. In Lake Waccamaw, it is the only killifish normally present, but in the adjacent canals it occurs with Lined Killifish and the recently expanding Golden Topminnow. Waccamaw Killifish was described by C. L. Hubbs and E. C. Raney (Hubbs and Raney 1946; Table 5). The

species was extant at its type locality in March 2009 (NCSM 56312, B. H. Tracy, unpublished data).
Status: State Special Concern.



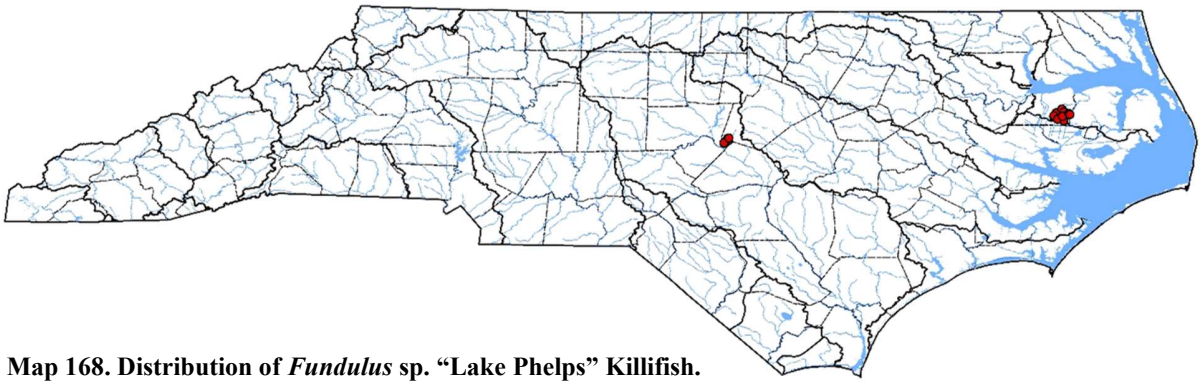
Map 167. Distribution of *Fundulus waccamensis*, Waccamaw Killifish. Star indicates type locality.

***Fundulus* sp. "Lake Phelps" Killifish.**
"Lake Phelps" Killifish is an undescribed species of killifish and is endemic to Lake Phelps, Albemarle basin (Map 168).
Remarks: "Lake Phelps" Killifish is the only known killifish present in the lake (Tracy 2014a). The similar Banded Killifish occurs mainly in tidal waters and has not been reported in the lake but occurs in the nearby Scuppernong River (Albemarle basin).

"Lake Phelps" Killifish and Waccamaw Killifish were formerly considered a single species (Bailey et al. 1977; Shute 1980b; Menhinick 1991), with the Lake Phelps population possibly introduced from Lake Waccamaw (Wiley and Mayden 1985; Wiley 1986). In 1980, David G. Lindquist (UNC-Wilmington) and students, J. R. Shute and P. W. Shute may have been the first to realize that, contrary to the beliefs of Bailey, the species of *Fundulus* inhabiting Lake Phelps was morphologically different from Waccamaw Killifish (letter from D. G. Lindquist to J. R. Bailey, dated 21 April 1980; from the correspondence files of E. F. Menhinick (UNC-Charlotte) archived at NCSM). Separately, Lindquist and Menhinick conducted comparative external morphometric studies of *Fundulus* from the two lakes in the early 1980s but neither published their results. Shute et al. (1981) stated: "*Specimens in Lake Phelps examined by us* [J. R. Shute, P. W. Shute, and D. G. Lindquist] *and E. F. Menhinick (pers. comm.) were found to differ slightly from F. waccamensis in respect to head length, interorbital width, and caudal peduncle length.*" Subsequent morphometric analyses by Krabbenhoft (2006) suggested these two allopatric killifishes independently evolved more elongate morphologies in their respective lakes from isolated populations of Banded Killifish. Analysis of mitochondrial sequence data suggests that this population has independently derived from local stream populations of Banded Killifish and is thus neither a relictual population of Waccamaw Killifish, or the result of bait-bucket introduction (Krabbenhoft 2006; Joe Quattro, University of South Carolina, pers. comm.).The alpha-level systematics of "Lake Phelps" Killifish continues to require further study (Krabbenhoft 2006).

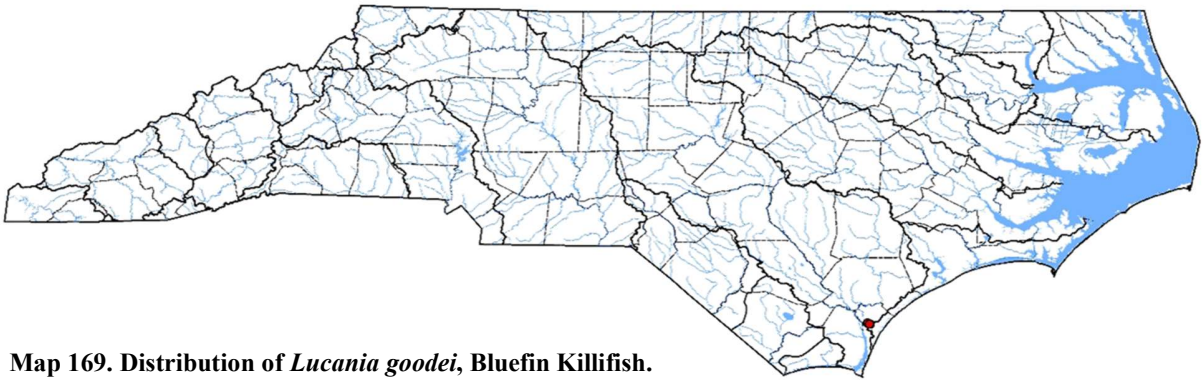
An analogous situation may occur in Shearon Harris Reservoir in Chatham/Wake counties (Cape Fear basin), where *Fundulus* specimens, bearing high scale counts and other traits similar

to Waccamaw Killifish and "Lake Phelps" Killifish, have been captured on several occasions between 2006 and 2018 (Map 168). Because that reservoir is relatively new (circa 1981), and very geographically remote from either of those lakes, these specimens may represent an introduction from one of those localities or possibly an introduction of Banded Killifish that has very rapidly assumed traits associated with a lacustrine environment. This undescribed species keys out as *Fundulus waccamensis* in Menhinick (1991).
Status: State Significantly Rare.



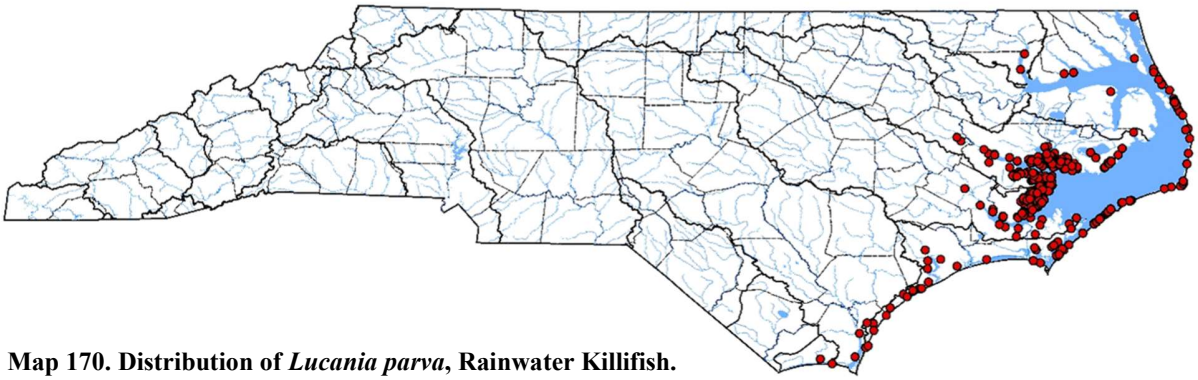
Map 168. Distribution of *Fundulus* sp. "Lake Phelps" Killifish.

***Lucania goodei* Jordan, 1880. Bluefin Killifish.**
Bluefin Killifish, a nonindigenous species, is restricted to Burnt Mill Creek and an impoundment of the creek at Anne McCrary Park in Wilmington, New Hanover County (Cape Fear basin) (Map 169), where it is at the northern limit of its range (Gilbert and Burgess 1980l).
Remarks: Persistent populations in North Carolina and South Carolina (near Charleston, Conway, and Pawley's Island), are presumed to have resulted from nonindigenous introductions (Rohde et al. 2009; F. C. Rohde, pers. obs.). The earliest vouchered specimens are from 1977.
Status: Despite being nonindigenous in North Carolina, it continues to be given State Special Concern species status (NCAC 2017; NCNHP 2018; NCWRC 2017).



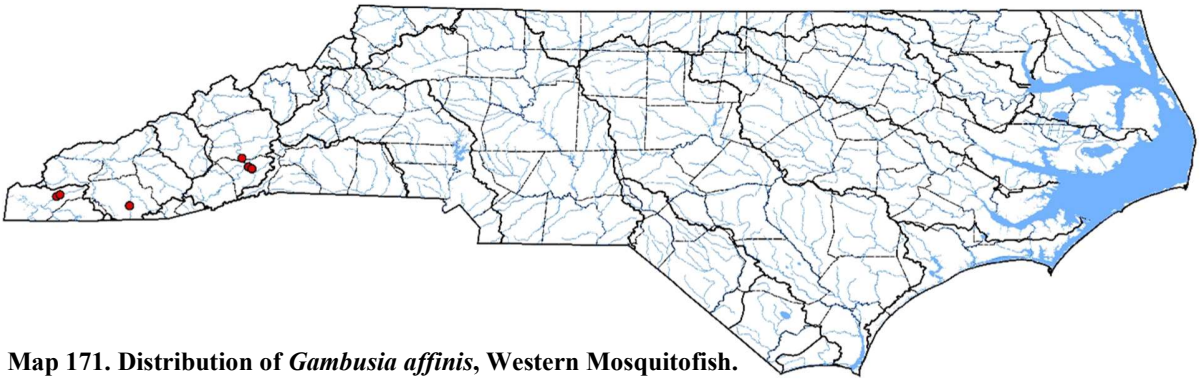
Map 169. Distribution of *Lucania goodei*, Bluefin Killifish.

***Lucania parva* (Baird, 1855). Rainwater Killifish.**
Rainwater Killifish is found along the Coastal Plain from the Shallotte to the Albemarle basins and as far inland as Pitt County (Tar basin) but has not been found in the Roanoke basin (Map 170).



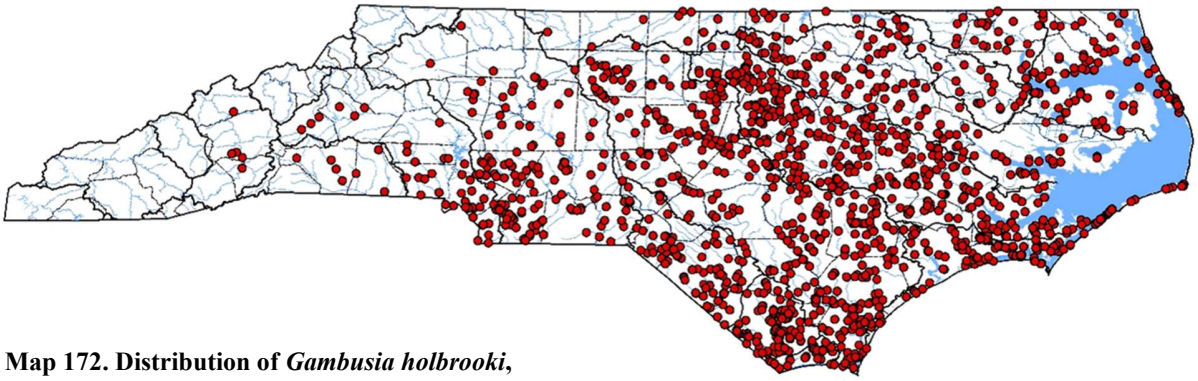
Map 170. Distribution of *Lucania parva*, Rainwater Killifish.

Poeciliidae - Livebearers
***Gambusia affinis* (Baird and Girard, 1853). Western Mosquitofish.**
Western Mosquitofish is indigenous to the Tennessee River drainage but in North Carolina was known only from two vouchered records from the Valley River (NCSM 31237 and NCSM 46115, Cherokee County, Hiwassee basin) and one vouchered record from Mud Creek, a tributary of the French Broad in Henderson County (UMMZ 156141, collected in 1947). Unvouchered records from 2012 obtained from TVA have been reported from the French Broad River (Buncombe County). In October 2018, the first record and vouchered specimen of Western Mosquitofish from the Little Tennessee basin was collected by NCWRC staff from Bates Branch (Macon County, NCSM 99811) (Map 171).
Remarks: Mosquitofish, *Gambusia* spp., have been recorded from the upper Little Tennessee River watershed (Macon County) since the late 1990s, but were not identified to species nor vouchered. The specimens, found near aquatic plant nursery ponds, were presumed to be Eastern Mosquitofish, *Gambusia holbrooki*, because the plants and other nonindigenous species were imported from Florida (William McLarney, Little Tennessee Land Trust, pers. comm.). These specimens, along with others recorded from Macon County, may or may not have been Western Mosquitofish.



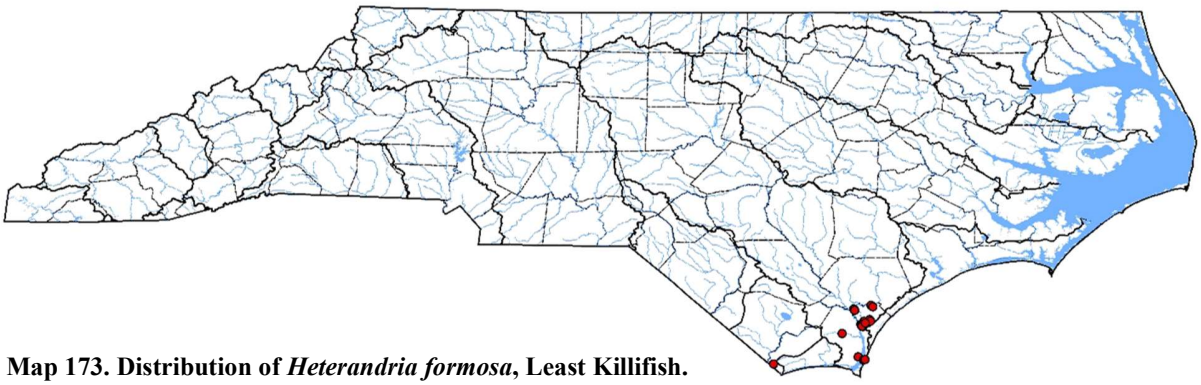
Map 171. Distribution of *Gambusia affinis*, Western Mosquitofish.

***Gambusia holbrooki* Girard, 1859. Eastern Mosquitofish.**
Eastern Mosquitofish is indigenous to and found across all Atlantic slope basins, except for the Savannah where it has yet to be found. It has been introduced into the French Broad basin with the earliest vouchered specimens from 1965 (Map 172).
Remarks: See Western Mosquitofish for discussion on ambiguity of distribution based on unvouchered collections.



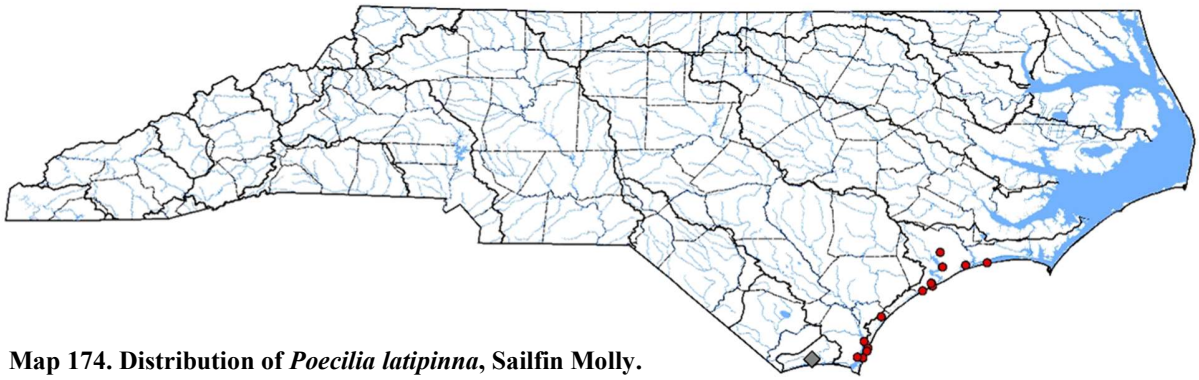
Map 172. Distribution of *Gambusia holbrooki*, Eastern Mosquitofish.

***Heterandria formosa* Agassiz, 1855. Least Killifish.**
Least Killifish is restricted to the Waccamaw and lower Cape Fear basins in Pender, New Hanover, and Brunswick counties (Map 173), where it is at the northern limit of its range (Martin 1980; Nelson and Burge 2014).
Status: State Special Concern.



Map 173. Distribution of *Heterandria formosa*, Least Killifish.

***Poecilia latipinna* (Lesueur, 1821). Sailfin Molly.**
Sailfin Molly is found along the Coastal Plain from the Shallotte (Menhinick 1991) to the White Oak (White Oak River and Emerald Island off Bogue Sound) basins where it is at the northern limit of its range (Burgess 1980c) (Map 174).

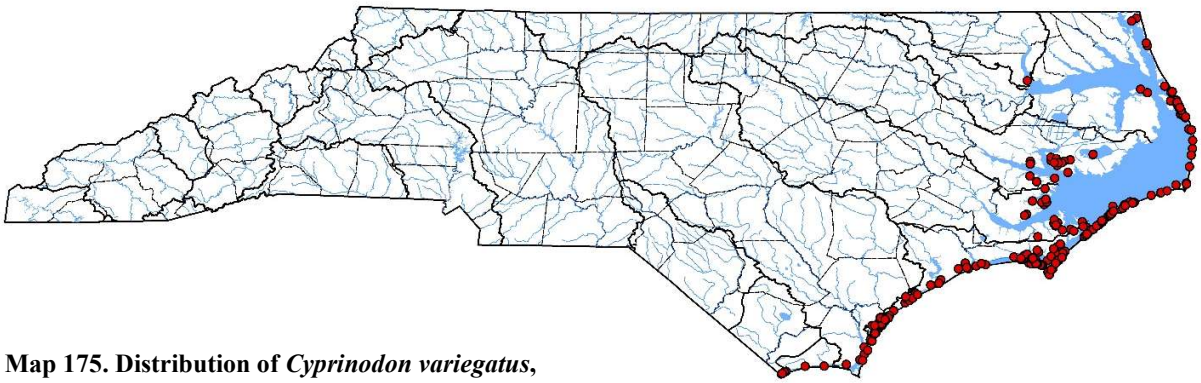


Map 174. Distribution of *Poecilia latipinna*, Sailfin Molly.

Cyprinodontidae - Pupfishes

***Cyprinodon variegatus* Lacepéde, 1803. Sheepshead Minnow.**

Sheepshead Minnow is found along the coast from the Shallotte to the Albemarle basins, except for the Roanoke basin (Map 175).

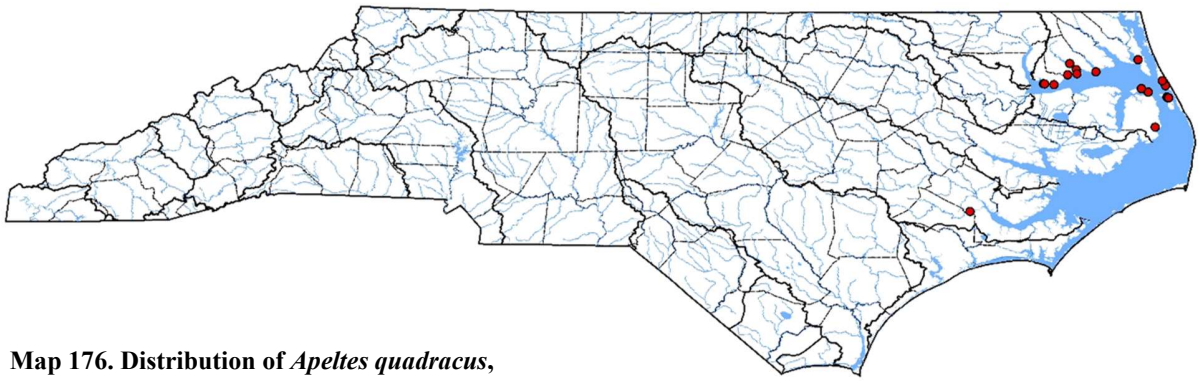


Map 175. Distribution of *Cyprinodon variegatus*, Sheepshead Minnow.

Gasterosteidae - Sticklebacks

***Apeltes quadracus* (Mitchill, 1815). Fourspine Stickleback.**

Fourspine Stickleback, until recently, was known only from three records from the Albemarle basin (NCSM 15595, UF 30593, and UF 30670) and one from the Neuse basin (NCSM 74386; Rohde et al. 1979). Based upon NCDMF data, Fourspine Stickleback is now commonly collected along the shoreline of Albemarle Sound and behind the Outer Banks in Dare County (Map 176). It is at the southern limit of its range in North Carolina (Burgess and Lee 1980).



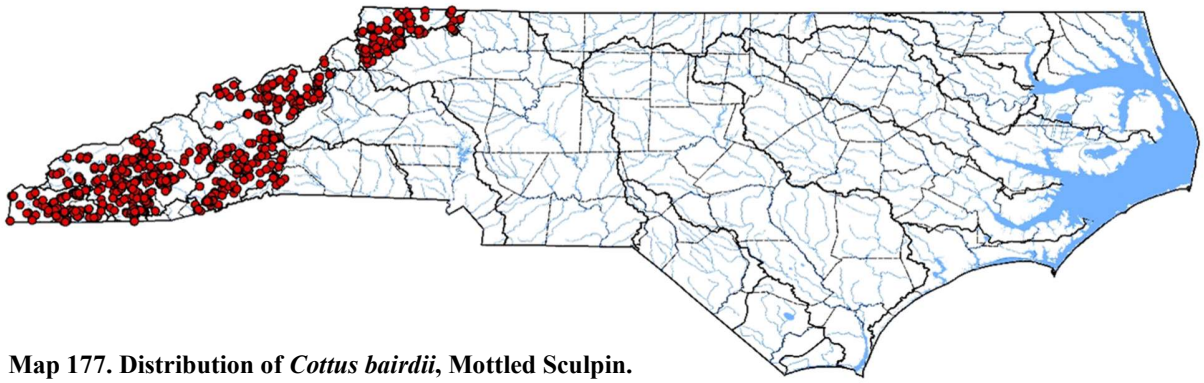
Map 176. Distribution of *Apeltes quadracus*, Fourspine Stickleback.

Cottidae - Sculpins

***Cottus bairdii* Girard, 1850. Mottled Sculpin.**

Mottled Sculpin is indigenous to the Mississippi River and Ohio River drainages and the Savannah basin. It is introduced in the upper Broad basin in Polk, Henderson, and Buncombe counties (earliest vouchered specimens from 1962). In the Watauga basin, it appears to be solely restricted to the Elk River watershed (D. Mathews, TVA and D. Owensby, NCWRC, pers. comm.) (Map 177).

Remarks: The distribution of Mottled Sculpin in the upper Broad basin (restricted primarily to the Hungry River and upper Broad River watersheds in Henderson and Buncombe counties) is similar to that of Saffron Shiner and Mirror Shiner. It is believed that distribution resulted from bait bucket introductions because Mottled Sculpin is not found in similar stream habitats in Rutherford and McDowell counties within the basin. The taxonomic status of this species in North Carolina has been unsettled for a long time (e.g., Jenkins and Burkhead 1994) and some researchers and museums record the species as *Cottus bairdii* complex or *Cottus* sp. (G. M. Hogue, pers. obs.).



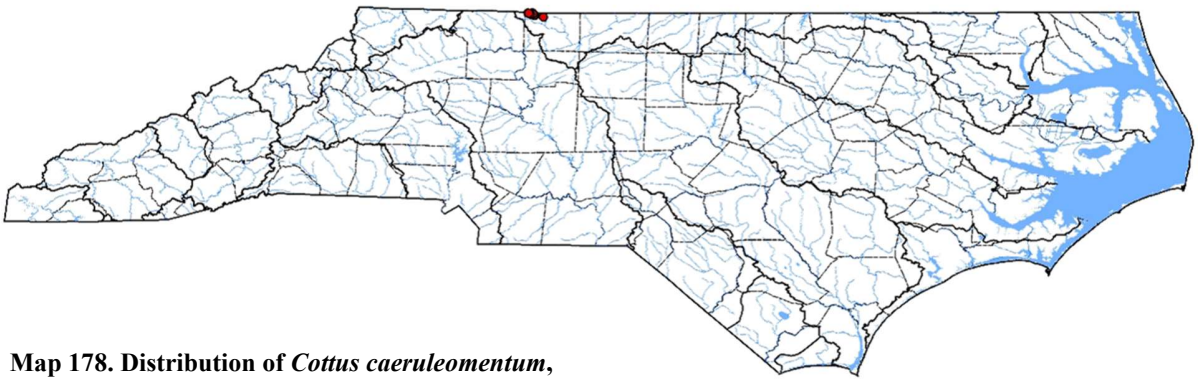
Map 177. Distribution of *Cottus bairdii*, Mottled Sculpin.

***Cottus caeruleomentum* Kinziger, Raesly, and Neely, 2000. Blue Ridge Sculpin.**

Blue Ridge Sculpin is restricted to the Little Dan River and the mainstem of the Dan River upstream from the Little Dan River to the North Carolina-Virginia state line in Stokes County (Roanoke basin) (Kinziger et al. 2000) (Map 178).

Remarks: This species keys out as *Cottus bairdii* in Menhinick (1991).

Status: State Special Concern.



Map 178. Distribution of *Cottus caeruleomentum*, Blue Ridge Sculpin.

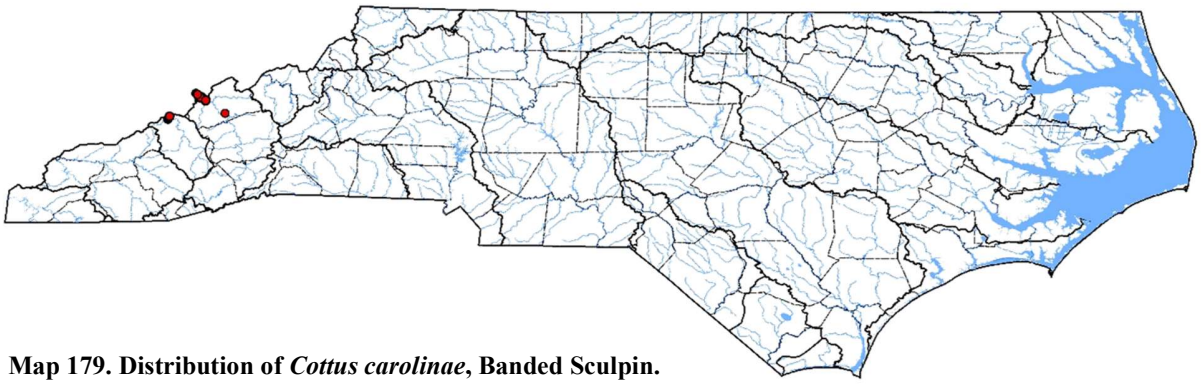
***Cottus carolinae* (Gill, 1861). Banded Sculpin.**

Banded Sculpin is known historically from records from the French Broad basin in Madison County (Cope 1870a; Robins 1954). Currently, Banded Sculpin is found only in the lower French Broad River and Shut-in Creek near Hot Springs, and French Broad River at Marshall (AMNH 3612) (Madison County, French Broad basin) and from the Pigeon River downstream from Walters Lake and in Big Creek (Haywood County, Pigeon basin) (Tracy 2014a) (Map 179).

Remarks: Specimens collected by E. D. Cope in 1869 from the French Broad River and vouchered at ANSP (ANSP 11838) bear Cope's original label: *"French Broad River, N.C"*. However, another internal label states: *"Cottus carolinae, confirmed by D. A. Neely, 2006, from North Carolina: Henderson Co.: French Broad River: E. D. Cope*" (M. H. Sabaj, ANSP, pers. comm.). There is a single specimen of Banded Sculpin collected by Cope from the French Broad River and vouchered at USNM (USNM 14985), but no date of collection or precise locality information are known. This lot also bears an original label from Cope stating the same information as ANSP 11838. The specimen vouchered at USNM is likely a specimen that was either gifted or exchanged out of the ANSP lot (ANSP 11838), a common practice among museums. Since 1875, the specimen (USNM 14985) has been identified as Mottled Sculpin by C. L. Hubbs (date unknown), as Banded Sculpin by C. R. Robins in 1953 and by W. C. Starnes in 2009. Cope (1870a) stated the species was abundant in the French Broad River, Madison County, but nowhere did he mention the species as occurring upstream of Hot Springs (Henderson County), even though he collected in Henderson County in 1869. Despite extensive sampling being conducted in the French Broad basin since 1869, there is no evidence that Banded Sculpin was ever found far upstream from Hot Springs. All of this information led W. C. Starnes and B. H. Tracy in 2009 to conclude that a mislabeling error (addition of "Henderson County") had possibly occurred, creating the misleading distributional picture. Other records from Big Laurel and Spring creeks in Madison County in Menhinick (1986), Menhinick (1991), Etnier (1997c), and Rohde et al. (1998) were attributed to Robins (1954), thus continuing to perpetuate the error.

A collection in 1987 of Mottled Sculpin by Duke Energy staff from the bypass reach near Big Creek was reported in Starnes and Hogue (2011). However, upon reexamination, the specimens were reidentified as Banded Sculpin. Another eight specimens collected by Duke Energy staff from Big Creek in 1989 were also reidentified as Banded Sculpin. In 1994, Menhinick collected 10 specimens of Banded Sculpin from Shut-in Creek near Hot Springs (Rohde et al. 1998). In 2018, a lot was discovered at UMMZ (UMMZ 131277) collected on 21 June 1940 by C. L. Hubbs and family and Willis King from Big Creek near the Tennessee state line (Pigeon basin).

In 2009, a reexamination of two specimens vouchered as part of NCWRC's 1963 survey of the Pigeon River and tributaries confirmed the presence of this species in Big Creek in Haywood County (Starnes and Hogue 2011). In that same year, Starnes and Tracy collected Banded Sculpin from Shut-in Creek and the French Broad River near the mouth of Shut-in Creek downstream from Hot Springs. Unbeknownst to them, biologists with TVA had previously collected a total of 27 specimens from a site further upstream on Shut-in Creek in 1999, 2004, and 2009 (S. J. Fraley, formerly with NCWRC, pers. comm.). In 2009 and 2010, Banded Sculpin were once again collected from Big Creek, just upstream from its confluence with the Pigeon River, and from the Pigeon River just upstream of Duke Energy's powerhouse in the bypass reach. Records from the Nolichucky and Watauga basins (Lee 1980i) cannot be verified.
Status: State Significantly Rare.

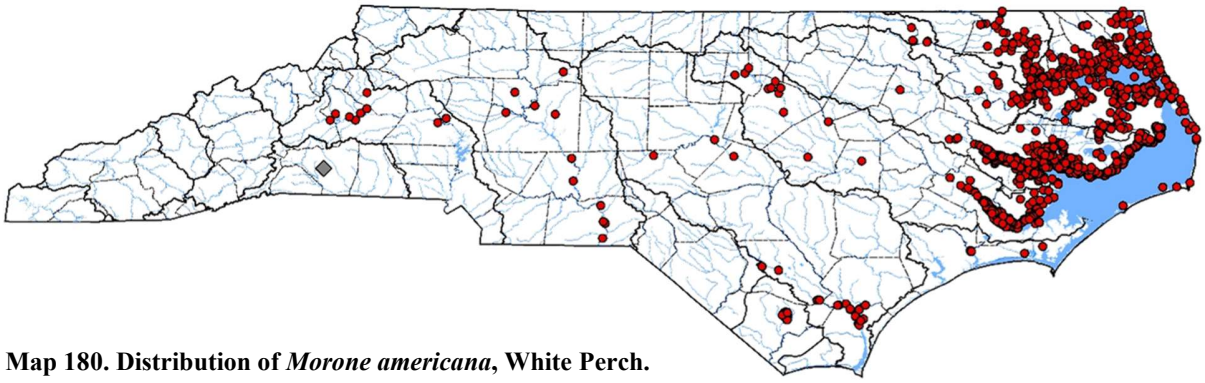


Map 179. Distribution of *Cottus carolinae*, Banded Sculpin.

Moronidae - Temperate Basses

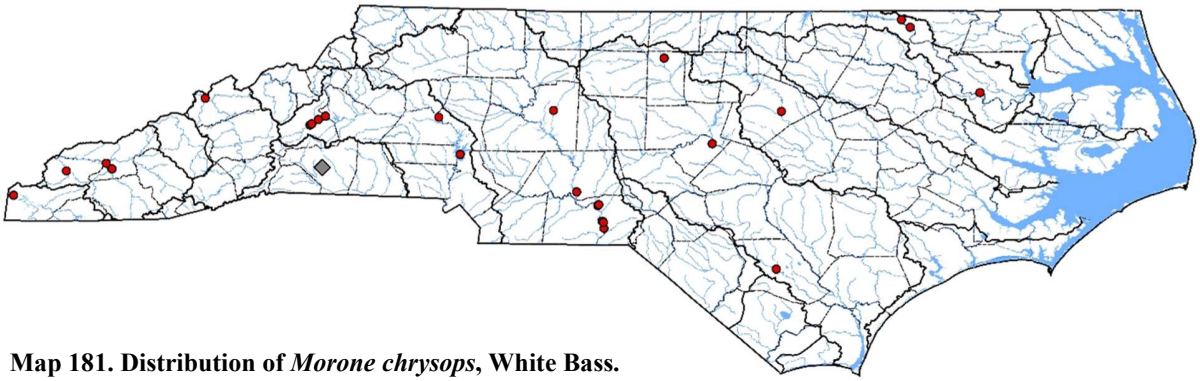
***Morone americana* (Gmelin, 1789). White Perch.**

White Perch is found from the Broad northeastward to the Albemarle basin, but is unknown from the Lumber and Shallotte basins (Map 180).
Remarks: Populations of White Perch in reservoirs and rivers upstream from the Fall Zone are considered unauthorized bait-bucket introductions by anglers, whereas downstream Coastal Plain populations are considered indigenous. White Perch in the Catawba basin were first reported from Lake James in 2008, Lake Hickory in 2004, Lookout Shoals Reservoir in 2004; Lake Norman in 1998; Mountain Island Reservoir in 2002, and Lake Wylie in 2001 (David Coughlan, retired Duke Energy, pers. comm.; J. Rash, NCWRC, pers. comm.).



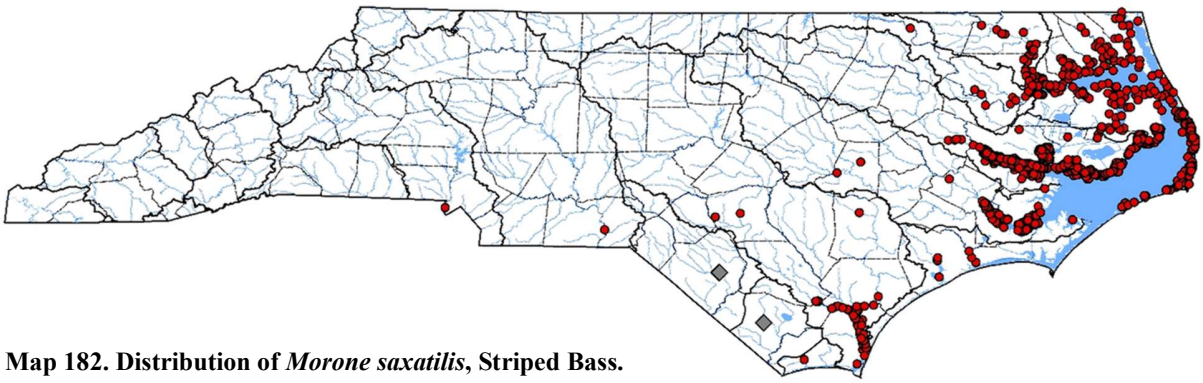
Map 180. Distribution of *Morone americana*, White Perch.

***Morone chrysops* (Rafinesque, 1820). White Bass.**
White Bass, a nonindigenous species, was stocked as a sportfish and today is found across the state in larger rivers and reservoirs from the Hiwassee to the Roanoke basin (Map 181).
Remarks: The earliest reports of White Bass are from Fontana Reservoir (Little Tennessee basin), the Catawba Chain-of-Lakes (Catawba basin), and the Yadkin Chain-of-Lakes (Yadkin basin) from the early 1950s (NCWRC 1961).



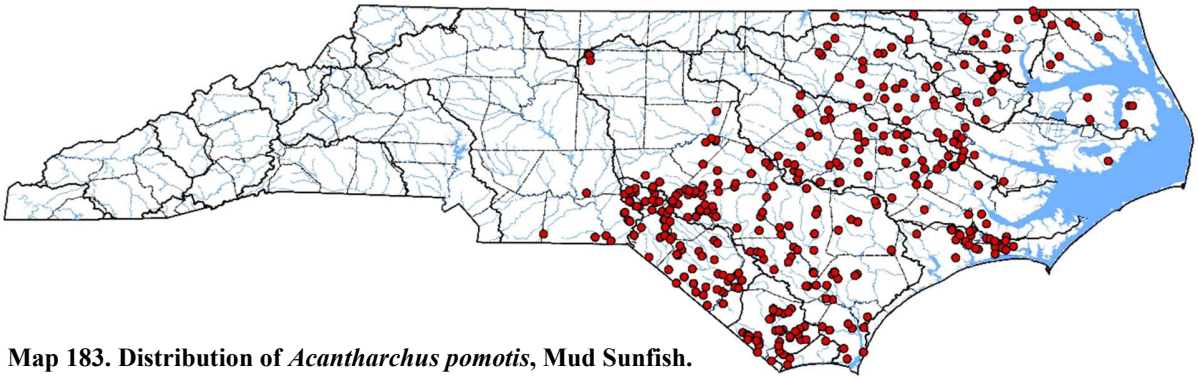
Map 181. Distribution of *Morone chrysops*, White Bass.

***Morone saxatilis* (Walbaum, 1792). Striped Bass.**
Striped Bass is found in all basins from the Catawba, where it has been introduced, east to the Atlantic Ocean (Map 182). Menhinick (1991) also mapped one locale each in the Lumber and Waccamaw basins.
Remarks: Striped Bass has been stocked as a sportfish in many of the larger reservoirs in the Catawba, Yadkin, Cape Fear, and Roanoke basins (Menhinick et al. 1974).



Map 182. Distribution of *Morone saxatilis*, Striped Bass.

Centrarchidae - Sunfishes
***Acantharchus pomotis* (Baird, 1855). Mud Sunfish.**
Mud Sunfish is found primarily in Coastal Plain and Sand Hills streams in all Atlantic slope basins from the lower Yadkin to the Albemarle. A disjunct population is known from the upper Piedmont in Reedy Fork Creek and the upper Haw River in Guilford County (Cape Fear basin) (Map 183).



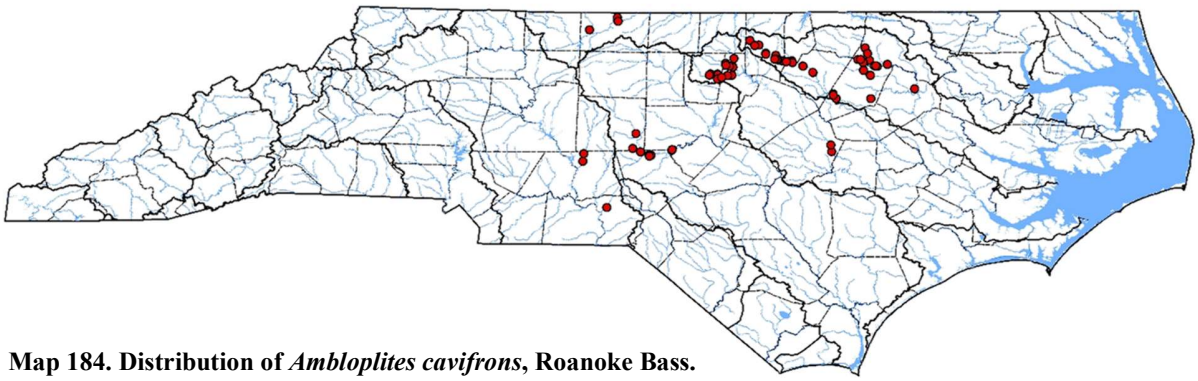
Map 183. Distribution of *Acantharchus pomotis*, Mud Sunfish.

***Ambloplites cavifrons* Cope, 1868. Roanoke Bass.**

Roanoke Bass is endemic to the Neuse, Tar, and Roanoke basins in North Carolina and Virginia and to the Chowan basin in Virginia (Cashner and Jenkins 1980; Cashner and Jenkins 1982; Jenkins and Burkhead 1994) (Map 184).

Remarks: Roanoke Bass were stocked by the NCWRC as a new game species or as refugial populations in the Deep River (1976, Cape Fear basin, C. Oakley, NCRWC, pers. comm.), and Uwharrie River and Mountain Creek (dates unknown, Yadkin basin). Five hundred Roanoke Bass were stocked by the NCWRC in the Valley River (Cherokee County, Hiwassee basin) in the 1970s, which turned out to be an unsuccessful introduction (map files of E. F. Menhinick (UNC-Charlotte) archived at NCSM). Smith (1907) reported a specimen collected in 1892 from near Raleigh (Wake County, Neuse basin) and at the State Museum, but the whereabouts of that specimen are unknown.

Status: State Significantly Rare.



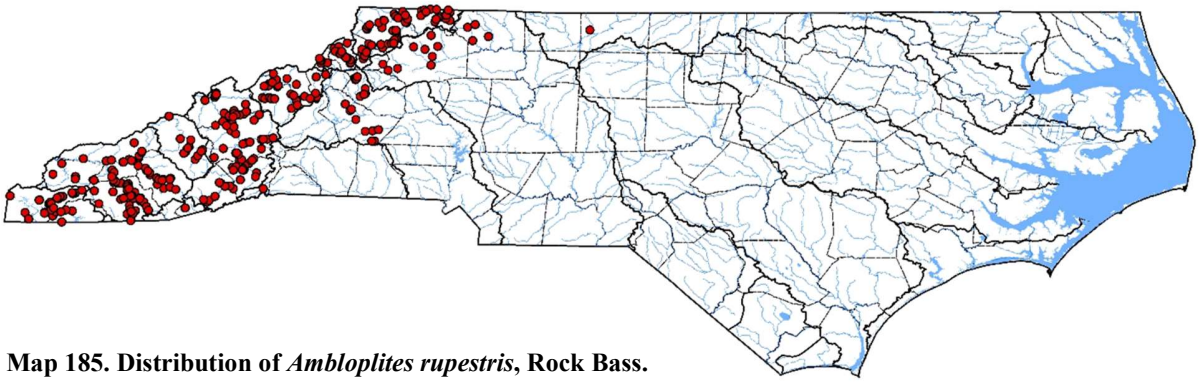
Map 184. Distribution of *Ambloplites cavifrons*, Roanoke Bass.

***Ambloplites rupestris* (Rafinesque, 1817). Rock Bass.**

Rock Bass is indigenous to and found in all Mountain river basins, except for the New where it is introduced (Cashner and Jenkins 1982). It is also introduced into montane and upper Piedmont basins along the Atlantic slope in the Savannah, Broad, Catawba, Yadkin, and Roanoke basins with the earliest vouchered specimens from 1981, 1962, 1956, 1961, and 2008, respectively (Map 185).

Remarks: There are two lots totaling five specimens at ANSP (ANSP 12824 and ANSP 13083) collected by E. D. Cope in 1869 with the localities listed as the Catawba River (Catawba basin)

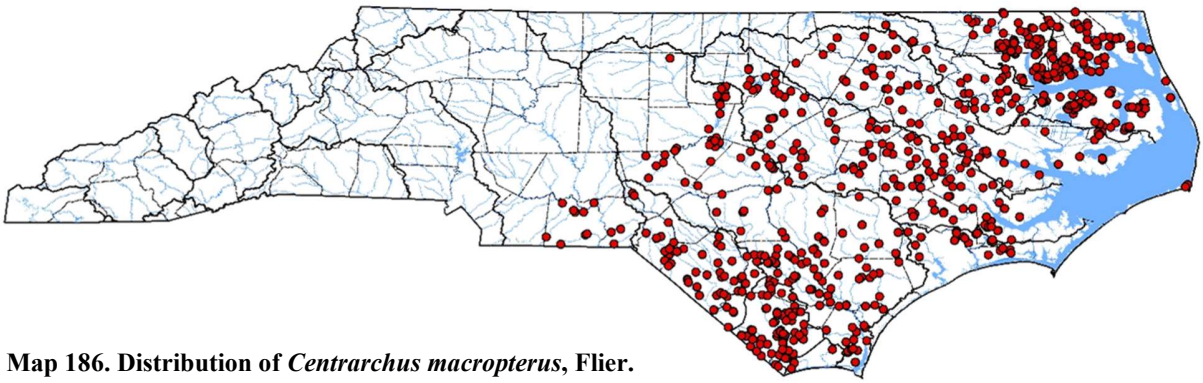
and tributary of the Yadkin River (Yadkin basin), respectively. However, Cope (1870a; pages 451, 494, and 495) does not mention Rock Bass being found east of the mountains and in fact, states: "*none found east of the Alleghenies*." These localities are undoubtedly in error and are not mapped. There is one specimen (UAIC 09518.08) collected from the Black River (Bladen County, Cape Fear basin) in 1986. This specimen, obviously an unsuccessful introduction, is also not mapped or tabulated in Table 3.



Map 185. Distribution of *Ambloplites rupestris*, Rock Bass.

***Centrarchus macropterus* (Lacepéde, 1801). Flier.**

Flier is found primarily in Coastal Plain and Sand Hills streams in all Atlantic slope basins from the lower Yadkin to the Albemarle. A disjunct population is known from the eastern Piedmont in Jordan Creek in Alamance County (Cape Fear basin) (Map 186).



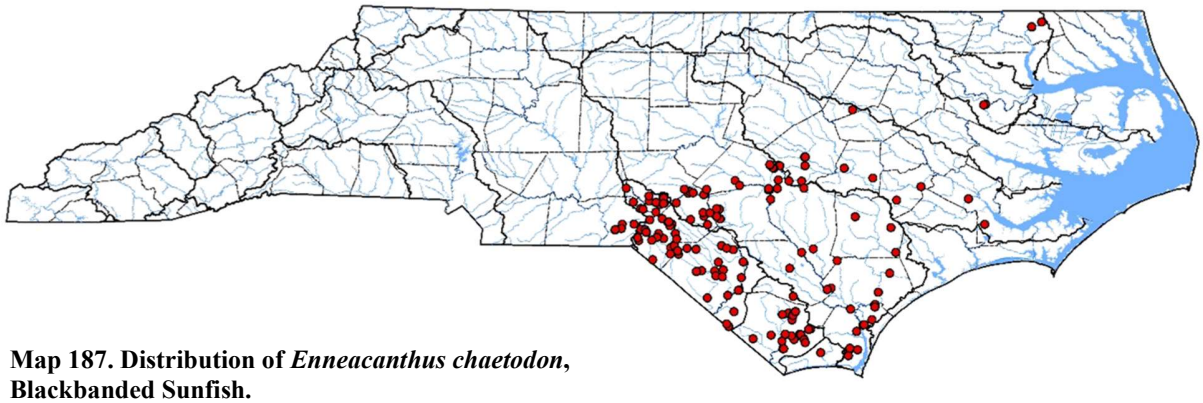
Map 186. Distribution of *Centrarchus macropterus*, Flier.

***Enneacanthus chaetodon* (Baird, 1855). Blackbanded Sunfish.**

Blackbanded Sunfish is found primarily in the Lumber, Waccamaw, and lower Cape Fear basins, with widely scattered occurrences in the lower Yadkin, Shallotte, Neuse, and Roanoke basins. It is also known from Merchant's Millpond and one of its tributaries (Duke Swamp) in Gates County, Chowan basin (M. Fisk, NCWRC and E. Corey NC State Parks, pers. comm.) (Map 187).

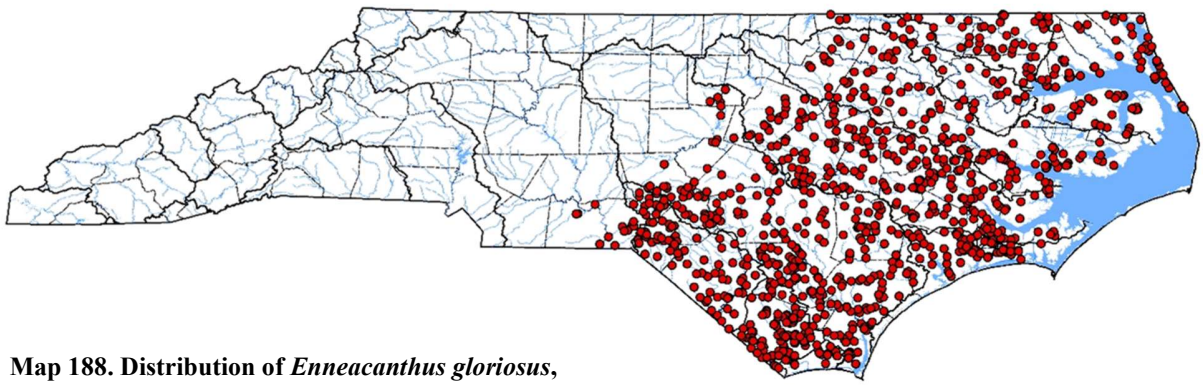
Remarks: Records plotted in Lee (1980e) and Menhinick (1991) from the White Oak (Jenkins et al. 1975), Albemarle (Baker and Smith 1965), and Chowan (Crowell 1966; Jenkins et al. 1975; Whitehurst 1981) basins are based upon unvouchered material, which cannot be verified The Tar basin record (Sapony Creek, Nash County, 01 June 1950), mapped in Menhinick (1991) and Lee (1980e), is based upon E. F. Menhinick's misinterpretation of J. R. Bailey's field notes (Jenkins et

al. 1975). An examination of Bailey's original field notes (archived at NCSM) does not show Blackbanded Sunfish in the list of species collected that day. Instead, the two vouchered specimens of *Enneacanthus* from that collection are Bluespotted Sunfish, *E. gloriosus,* (NCSM 57365) of which one had been listed on the field sheet as Banded Sunfish, *E. obesus*. Blackbanded Sunfish has not been recorded from the Roanoke basin since 1924.
Status: State Significantly Rare.



Map 187. Distribution of *Enneacanthus chaetodon*, Blackbanded Sunfish.

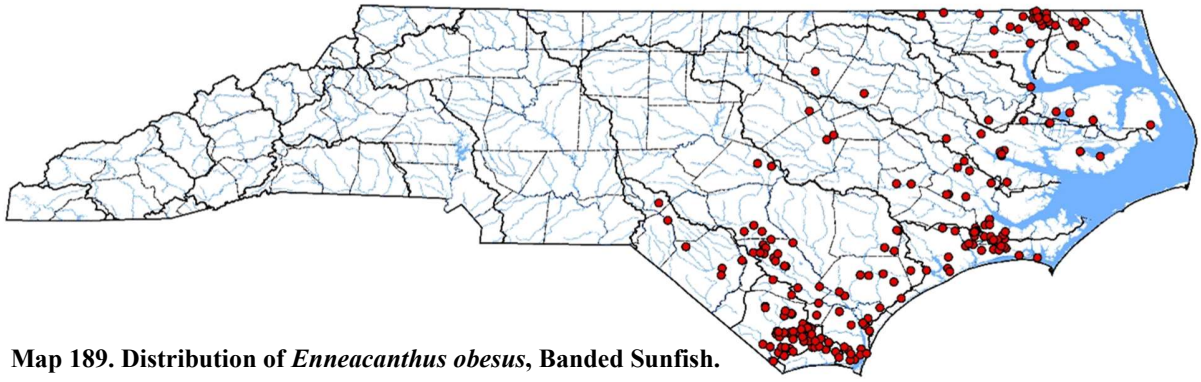
***Enneacanthus gloriosus* (Holbrook, 1855). Bluespotted Sunfish.**
Bluespotted Sunfish is a Coastal Plain and Sand Hills species that is found in every river basin from the Virginia border to the South Carolina state line with additional records along the Fall Zone (Map 188).
Remarks: There is a disjunct 1955 record of a single specimen (CUMV 34525) from the West Fork Deep River (Guilford County, Cape Fear basin). Females and immature individuals are readily confused with Banded Sunfish (Rohde et al. 2009) and many records most likely represent misidentifications.



Map 188. Distribution of *Enneacanthus gloriosus*, Bluespotted Sunfish.

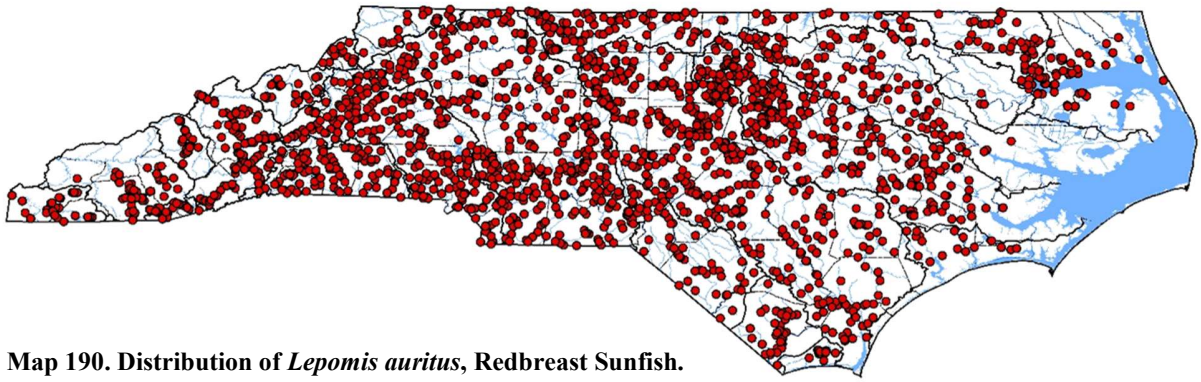
***Enneacanthus obesus* (Girard, 1854). Banded Sunfish.**
Banded Sunfish is a Coastal Plain species that is found in every river basin from the Virginia border to the South Carolina state line (Map 189).

Remarks: Banded Sunfish is easily confused with Bluespotted Sunfish and many records most likely represent misidentifications.
Status: State Significantly Rare.



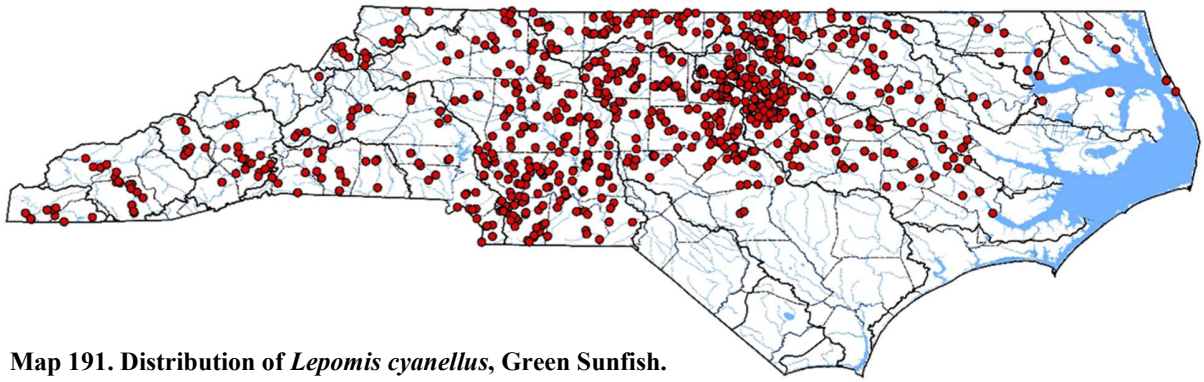
Map 189. Distribution of *Enneacanthus obesus*, Banded Sunfish.

***Lepomis auritus* (Linnaeus, 1758). Redbreast Sunfish.**
Redbreast Sunfish is found in every river basin in North Carolina. It is considered indigenous in the Piedmont, Sandhills, and Coastal regions, and introduced in the Mountain region (Map 190). The earliest vouchered specimens from the Hiwassee, Little Tennessee, Pigeon, French Broad, Nolichucky, Watauga, and New basins are from 1935, 1943, 1940, 1913, 1949, 1991, and 1942, respectively.



Map 190. Distribution of *Lepomis auritus*, Redbreast Sunfish.

***Lepomis cyanellus* Rafinesque, 1819. Green Sunfish.**
Green Sunfish, a nonindigenous species, was introduced as a sportfish and today is found throughout the state, except for the Savannah, Lumber, Waccamaw, Shallotte, and White Oak basins (Map 191). The earliest vouchered specimens from North Carolina are from 1937.

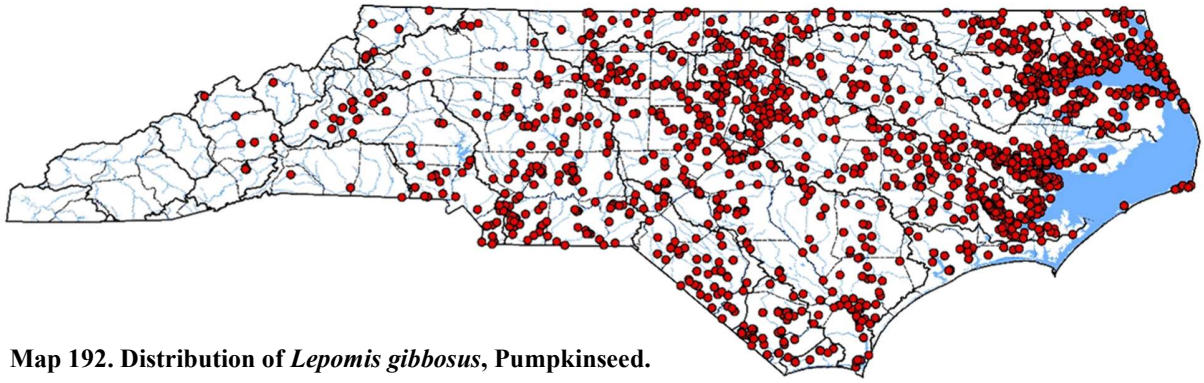


Map 191. Distribution of *Lepomis cyanellus*, Green Sunfish.

***Lepomis gibbosus* (Linnaeus, 1758). Pumpkinseed.**

Pumpkinseed is found in every river basin northeast of the Savannah and has been introduced into the New, Nolichucky, and French Broad basins with the earliest vouchered specimens from 1962, 1965, and 1936, respectively (Map 192).

Remarks: An unverifiable record from Norton Mill Creek (Jackson County, Savannah basin) was plotted in Menhinick (1991) and was most probably based upon a 1963 NCWRC record (Starnes and Hogue 2011). Menhinick (1991) also mapped an unvouchered record from the Little Tennessee basin (Thorpe (Glenville) Reservoir, Jackson County) based upon Messer (1966).

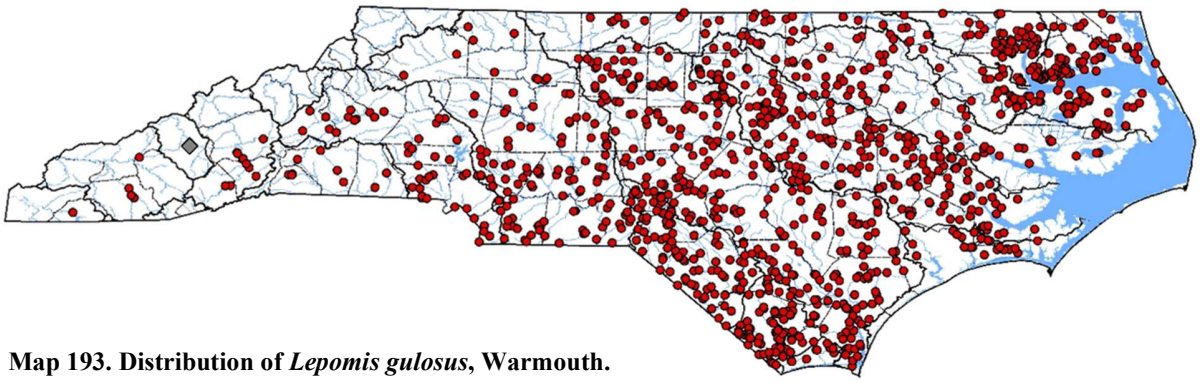


Map 192. Distribution of *Lepomis gibbosus*, Pumpkinseed.

***Lepomis gulosus* (Cuvier, 1829). Warmouth.**

Warmouth is found throughout the state, except for the New, Watauga, Nolichucky, and Savannah basins. It is introduced in the Hiwassee, Little Tennessee, Pigeon, and French Broad basins with the earliest vouchered specimens from the Hiwassee in 2003, from the Little Tennessee in 1930, and from the French Broad in 1943 (Map 193).

Remarks: An unverifiable record from Ashe County (New) was plotted in Menhinick (1991).

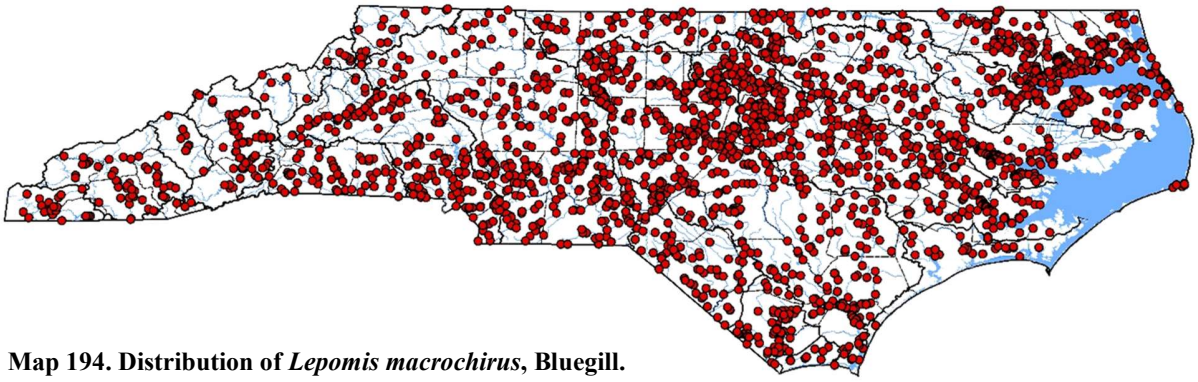


Map 193. Distribution of *Lepomis gulosus*, Warmouth.

***Lepomis macrochirus* Rafinesque, 1819. Bluegill.**

Bluegill, found in every river basin in North Carolina, has been widely introduced and is nonindigenous in the New, Roanoke, and all the drainages northeast of the Neuse, including the Neuse, based upon Jenkins and Burkhead (1994) and the absence of collection records in Cope (1870a), Evermann and Cox (1896), and Jordan (1888) (Map 194). The earliest vouchered specimens from the New, Neuse, Tar, Roanoke, Chowan, and Albemarle are from 1949, 1937, 1942, 1949, 1937, and 1956, respectively.

Remarks: However, the nonindigenous status of Bluegill in the basins listed above contradicts Smith (1907) who reported *Lepomis incisor* (Cuvier and Valenciennes), a synonym of *L. macrochirus*, as being common in the creeks near Edenton and in the Roanoke River at Weldon, common in Lake Mattamuskeet, and often sought by anglers in the Albemarle region. Its indigenous vs. nonindigenous status in these five Atlantic slope basins may never be known.



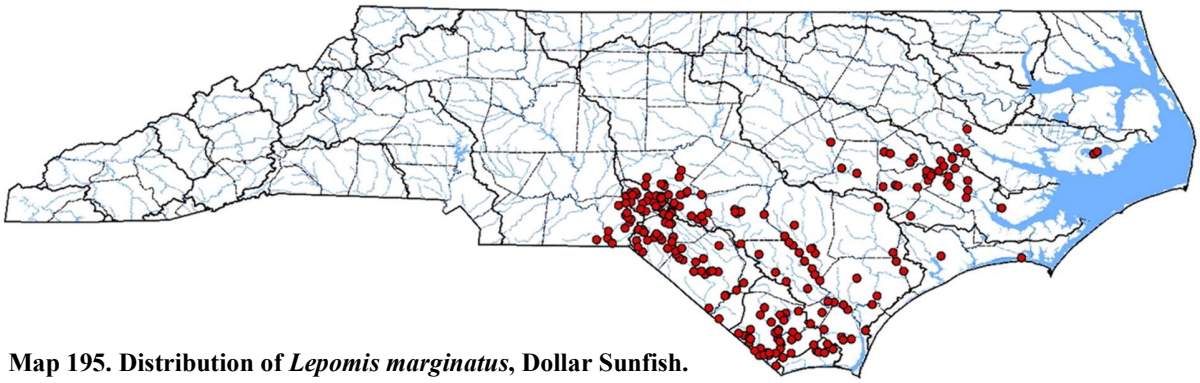
Map 194. Distribution of *Lepomis macrochirus*, Bluegill.

***Lepomis marginatus* (Holbrook, 1855). Dollar Sunfish.**

Dollar Sunfish is found primarily in the Sand Hills of the Lumber and Cape Fear basins, in the lower Yadkin, and the Coastal Plain regions of the Lumber, Waccamaw, lower Cape Fear, and White Oak basins, with widely scattered occurrences in the lower Neuse and Tar basins (Map 195). In North Carolina it is at its northern limit of its range along the Atlantic slope (Bauer 1980a).

Remarks: Unverifiable records are plotted in Menhinick (1991) from Gaston (based upon Randall (1957)), Mecklenburg (UNC-Charlotte collection), and Durham (Duke University collection) counties. A specimen of Longear Sunfish, *Lepomis megalotis*, from Walnut Creek in the upper

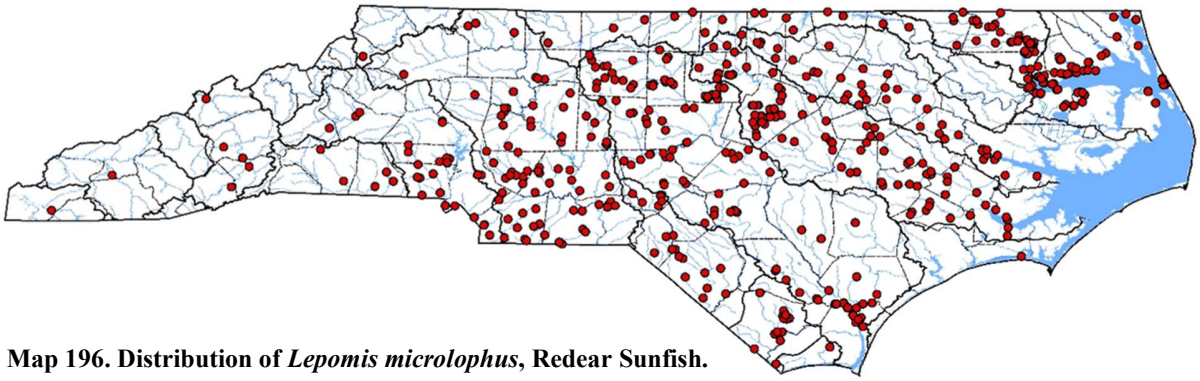
Neuse basin (Evermann and Cox 1896), although unavailable for reexamination, may have been Dollar Sunfish (Fowler 1945; see Annotation for Longear Sunfish).



Map 195. Distribution of *Lepomis marginatus*, Dollar Sunfish.

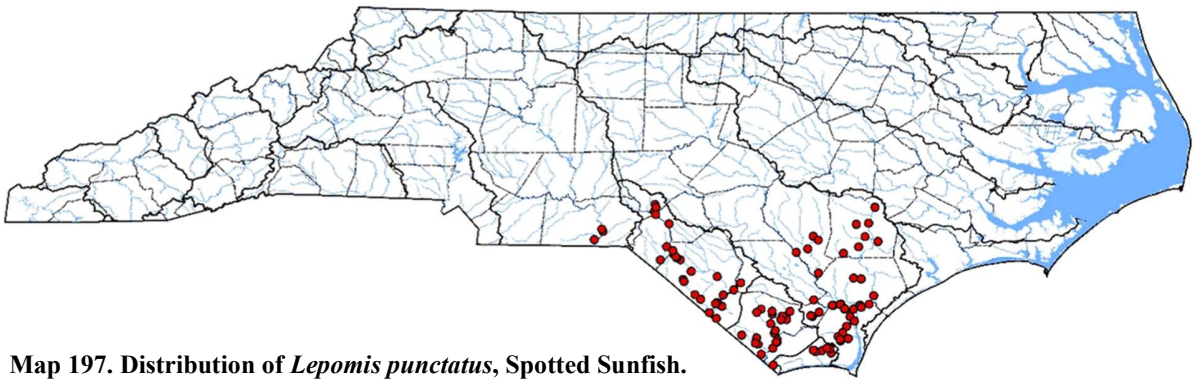
***Lepomis megalotis* (Rafinesque, 1820). Longear Sunfish.**
Remarks: Longear Sunfish was first reported from North Carolina in 1870 "*from the upper waters of the French broad*" (Cope 1870a). There was no supportive evidence that Longear Sunfish, historically or more recently, ever occurred in North Carolina (Tracy et al. 2018, 2020).

***Lepomis microlophus* (Günther, 1859). Redear Sunfish.**
Redear Sunfish, a nonindigenous species, is found throughout much of the state, except for the Watauga, Nolichucky, Pigeon, and Savannah basins (Map 196).
Remarks: The earliest stocking records in the Catawba Chain-of-Lakes (Catawba basin) and the Yadkin Chain-of-Lakes (Yadkin basin) are from the 1950s (NCWRC 1961). The earliest vouchered specimens are from 1942.



Map 196. Distribution of *Lepomis microlophus*, Redear Sunfish.

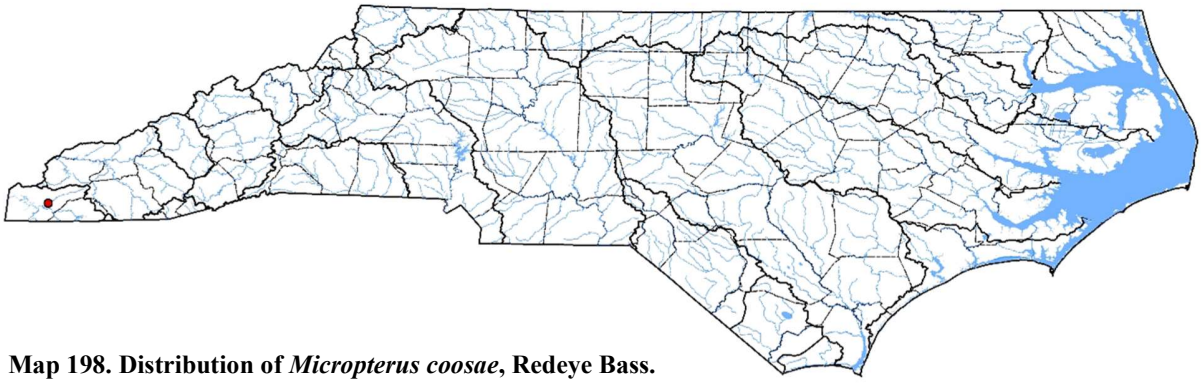
***Lepomis punctatus* (Valenciennes, 1831). Spotted Sunfish.**
Spotted Sunfish is confined to the southeastern corner of the state where it is found in the lower Yadkin, Lumber, Waccamaw, Shallotte, and Cape Fear basins. It is at the northern limit of its range along the Atlantic slope (Lee 1980f) (Map 197).



Map 197. Distribution of *Lepomis punctatus*, Spotted Sunfish.

***Micropterus* spp. – The Black Basses**
Black Basses are a group of well sought-after game fishes, which include 5 described and 1 undescribed species in North Carolina. They have been widely and legally stocked by resource agencies and in many instances, illegally by fishermen. As a result, the true historical distribution of this group of species is challenging to unravel. Compounding the problem is that, genetically, many of these fish are appearing to be hybrids and are rapidly dispersing into new watersheds. Currently, NCWRC is conducting a statewide investigation of the genetic composition of black bass populations from lakes, reservoirs, and rivers. This will allow them to assess the species compositions, including hybridization within North Carolina (K. Dockendorf and S. Loftis, NCWRC, pers. comm.). The following species annotations are based upon our current understanding of their distribution in North Carolina.

***Micropterus coosae* Hubbs and Bailey 1940. Redeye Bass.**
Redeye Bass, a nonindigenous species, is represented by one record of one young-of-year specimen from the Hiwassee basin (UT 90.2447, Valley River, river kilometer 6.4, just above Marble Creek, 01 July 1993) (Map 198). It was introduced into the Hiwassee drainage in Tennessee in the early 1940s (Etnier and Starnes 1993).
Remarks: Redeye Bass was originally described as indigenous to the Mobile basin above the Fall Zone and in the upper Chattahoochee, Altamaha, and Savannah river drainages in Alabama, Georgia, and South Carolina (Lee 1980g; Rohde et al. 2009; Baker et al. 2013; Leitner and Earley 2015; Taylor et al. 2019). The indigenous range of this species is now considered restricted to only the Coosa River of the Mobile basin (J. Leitner, retired, SCDNR, pers. comm.).

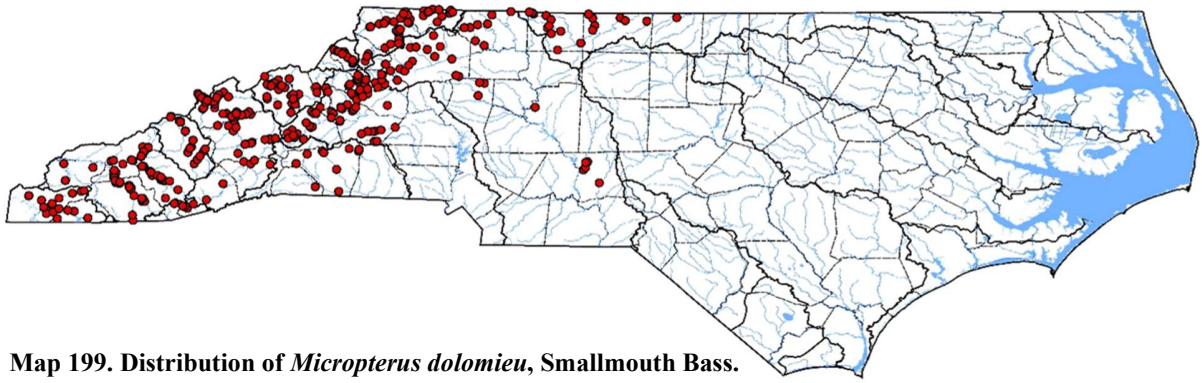


Map 198. Distribution of *Micropterus coosae*, Redeye Bass.

***Micropterus dolomieu* Lacepéde, 1802. Smallmouth Bass.**

Smallmouth Bass was originally restricted to the western river basins in North Carolina (Taylor et al. 2019). It has been widely introduced eastward into the Savannah, Broad, Catawba, New, Yadkin, and Roanoke basins with the earliest vouchered specimens from these basins from 1972, 1962, 1942, 1941, 1949, and 1943, respectively (Map 199).

Remarks: There is one record at NCSM (NCSM 17390; not mapped) from the Scuppernong River at Columbia, Tyrell County. The 365 mm standard length specimen, collected in May 1987, was most likely a waif from stockings in the Nottaway River in Virginia.

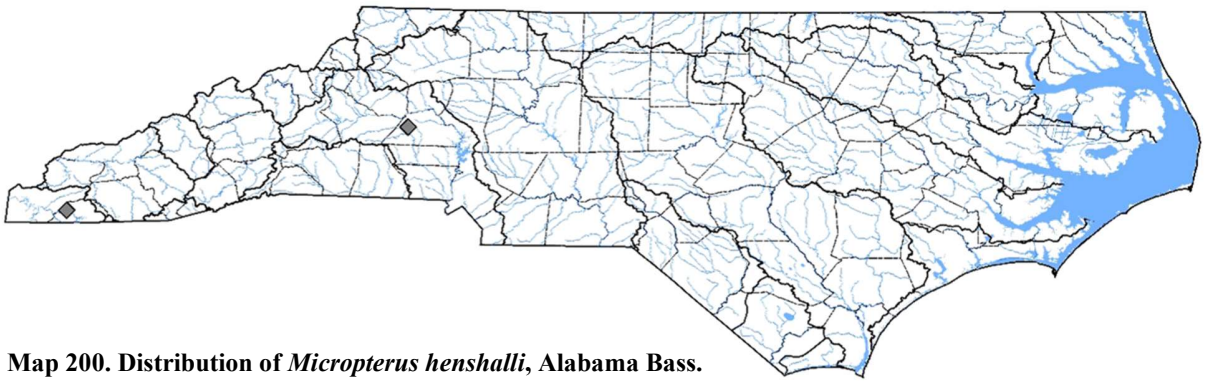


Map 199. Distribution of *Micropterus dolomieu*, Smallmouth Bass.

***Micropterus henshalli* (Hubbs and Bailey 1940). Alabama Bass.**

Alabama Bass, a nonindigenous species, was introduced into the Hiwassee (in the late 1970s in Lake Chatuge (Pierce and Van Den Avyle 1997; Rider and Maceina 2015) and Catawba (first discovered in 2000 in Lake Norman (Dorsey and Abney 2016; Godbout et al. 2009) basins (Map 200). It is indigenous to the Mobile River drainage in Mississippi, Alabama, and Georgia (Rider and Maceina 2015; Taylor et al. 2019).

Remarks: This species, and/or the similar looking Spotted Bass, *Micropterus punctulatus*, has also been reported from the Little Tennessee (Fontana Reservoir), Broad, Yadkin, Roanoke (Lake Gaston), Lumber, and Waccamaw basins and called Spotted Bass (www.bassmaster.com/conservation-news/alabama-bass-invasion). Currently, there are no vouchered specimens of Alabama Bass from North Carolina.

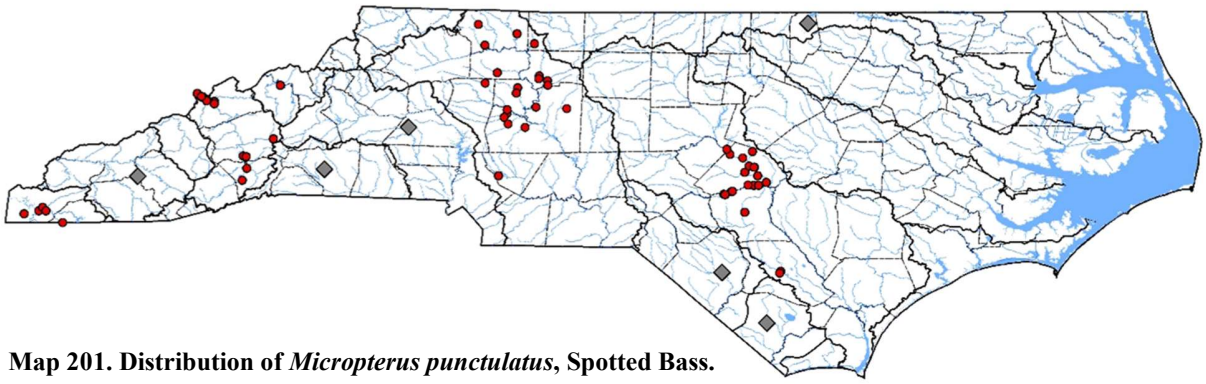


Map 200. Distribution of *Micropterus henshalli*, Alabama Bass.

***Micropterus punctulatus* (Rafinesque, 1819). Spotted Bass.**

Spotted Bass is indigenous in the Nolichucky, French Broad, Hiwassee, and Little Tennessee basins. It was introduced and has spread widely in the Yadkin, Catawba, and mid-lower Cape Fear basins with the earliest vouchered specimens from the Yadkin in 2003 and from Cape Fear basin in 1983. Spotted Bass was first detected in Lake James (Catawba basin) in 2000 (D. Besler, NCWRC, pers. comm.). It is also found in Belews Lake and has been reported, but not vouchered, from Hyco Lake and Lake Gaston (Roanoke basin), and the Lumber, Waccamaw, and Broad basins (Map 201). Spotted Bass was originally distributed within the Mississippi basin from southern Ohio and West Virginia to southwestern Kansas and south to the Gulf of Mexico and Gulf river drainages (Churchill and Bettoli 2015; Taylor et al. 2019).

Remarks: A sanctioned introduction in Belews Lake (Roanoke basin) circa 1970s was unsuccessful (D. Coughlan, retired, Duke Energy, pers. comm.). However, in 2011 a Spotted Bass was collected by Duke Energy staff for the first time since the 1970s from the upper, more riverine area of the reservoir. As of 2019, it is now ubiquitous, especially in the lower, deeper oligotrophic portion of the reservoir where it is commonly caught (R. Fawcett, formerly Duke Energy, and K. Hodges and K. Roberts, NCWRC, pers. comm.).



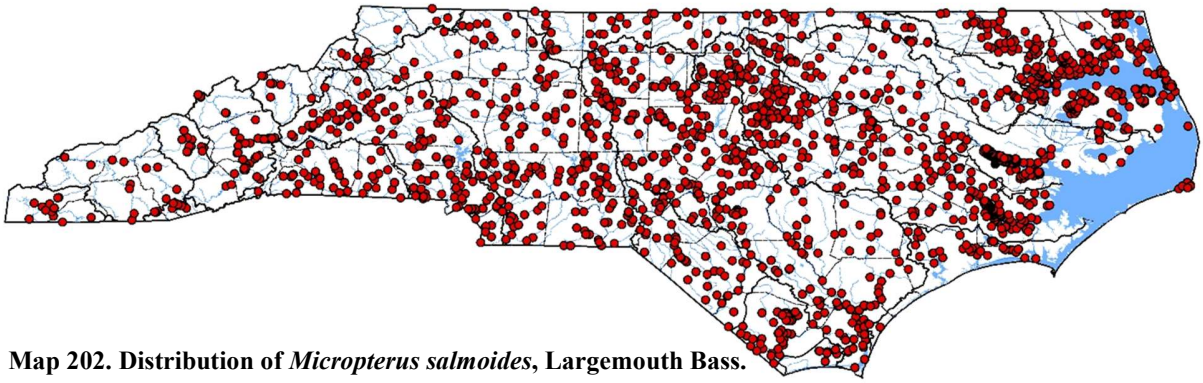
Map 201. Distribution of *Micropterus punctulatus*, Spotted Bass.

***Micropterus salmoides* (Lacepéde, 1802). Largemouth Bass.**

Largemouth Bass is indigenous to all basins, except the New basin where it has been introduced with the earliest vouchered specimens collected in 1941 (Map 202).

Remarks: A 1991-1992 study of biochemical genetics of Largemouth Bass in 18 reservoirs and rivers in North Carolina, from Lake James (Catawba Basin) eastward, determined that all

populations examined had a mixture of the alleles of Northern Largemouth Bass (*M. salmoides salmoides*) and Florida Largemouth Bass (*M. salmoides floridanus*), with some populations being almost pure Florida Largemouth Bass (Dunham and Robison 1992). Another study conducted in 1991 and 1992 using Largemouth Bass from Sutton Lake (Cape Fear basin) also determined their lineage to be predominantly the Florida subspecies (Wynne and Van Horn 1994). A much smaller study from Kerr Lake (Roanoke basin) and Lake Norman (Catawba basin) also characterized the bass as intergrades (Philipp et al. 1983). Kassler et al. (2002), Near et al. (2003), and Taylor et al. (2019) consider Florida Largemouth Bass, *M. floridanus*, to be a valid/provisional species found in peninsular Florida with intergrades between it and Largemouth Bass being found in the Florida Panhandle, Alabama, Georgia, and South Carolina, but not in North Carolina. However, intergrades north of Florida, including southeastern North Carolina, were noted by Bailey and Hubbs (1949).



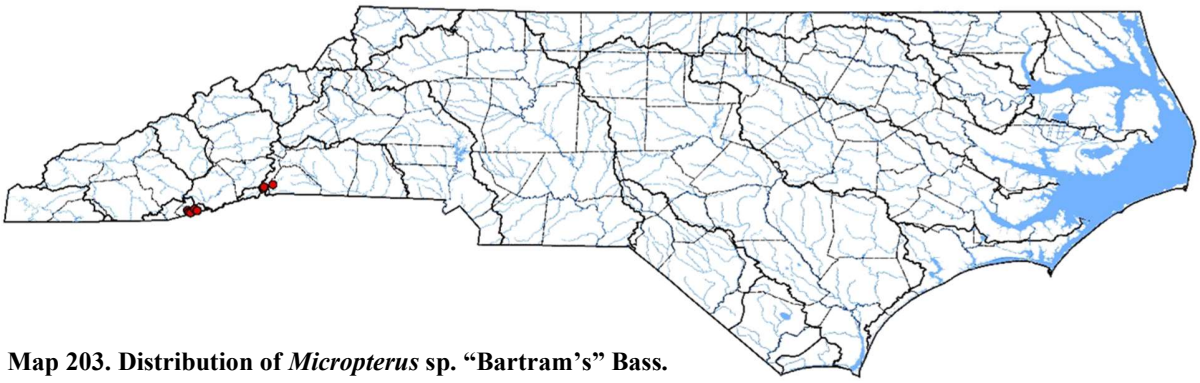
Map 202. Distribution of *Micropterus salmoides*, Largemouth Bass.

***Micropterus* sp. "Bartram's" Bass.**

Populations from the Savannah basin in Georgia and South Carolina, once considered Redeye Bass, represent an undescribed species, "Bartram's" Bass, *Micropterus* sp. cf. *cataractae* (Bagley et al. 2011; Baker et al. 2013; Freeman et al. 2015; Taylor et al. 2019; Jean Leitner, retired, SCDNR, pers. comm.). In North Carolina there are four records from the Toxaway River and Toxaway Creek and nine records from the Horsepasture River (Transylvania County, Savannah basin). There are four records from 2005-2017 from the Green River watershed in Henderson and Polk counties (Broad basin), presumably introduced (Map 203).

Remarks: The Linville River locality (Burke County, Catawba basin) mapped in Menhinick (1991) and tabulated in Johnston et al. (1995) is in error. It was either based upon a specimen at TU (TU 29827), which is a Smallmouth Bass or a data entry error. Hybrids of "Bartram's" Bass x Alabama Bass have recently been determined genetically from the Green River, Broad River basin (L. Etchison, S. Loftis, and T. Russ, NCWRC, pers. comm.). This undescribed species keys out as *Micropterus coosae* in Menhinick (1991).

Status: State Significantly Rare.

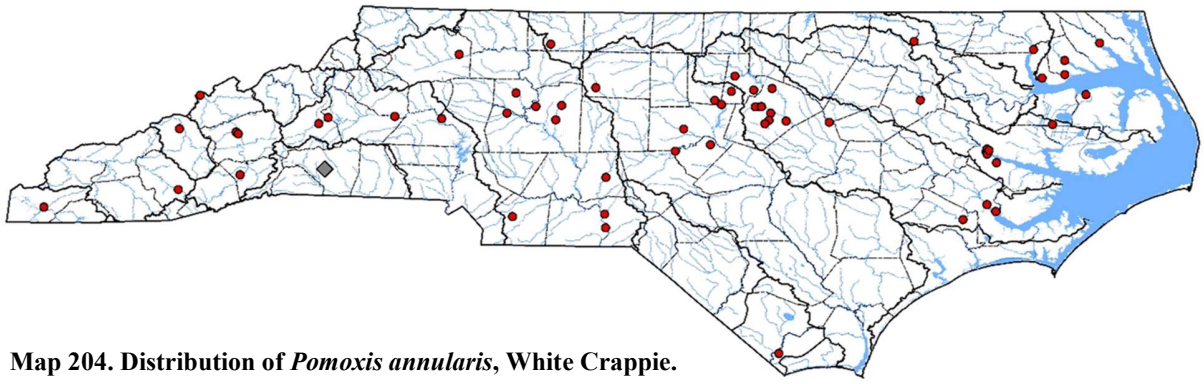


Map 203. Distribution of *Micropterus* sp. "Bartram's" Bass.

***Pomoxis annularis* Rafinesque, 1818. White Crappie.**

White Crappie is indigenous to the Hiwassee, Little Tennessee, Pigeon, and French Broad basins. It has been introduced into 10 of the Atlantic slope basins where it is widely scattered throughout, but is absent in the Lumber, Shallotte, and White Oak basins (Lee 1980h) (Map 204).

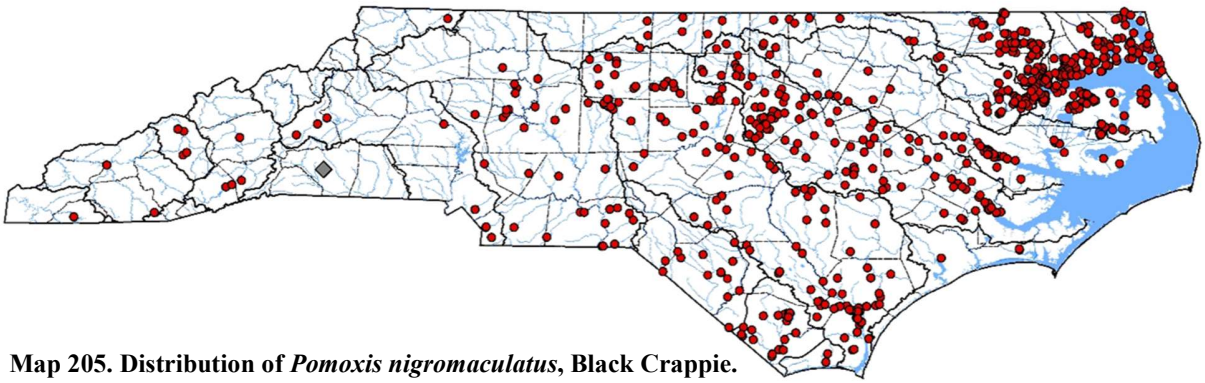
Remarks: The type locality of *Pomoxys protacanthus* Gill 1865, a synonym of *Pomoxis annularis*, is Tarboro, Edgecombe County, North Carolina (Tar basin, USNM 4565). This type locality is questionable and thus raises the possibility that this species is native to the Atlantic Slope (Gilbert 1998; Jordan and Evermann 1896). White Crappie was documented as occurring in the Roanoke River in Halifax County (Roanoke basin) as early as 1913 and 1914 (USNM 74825 and USNM 76382); in the mainstem of the Pee Dee River in Richmond County (Yadkin basin) as early as 1940 (ANSP 86498; Fowler 1945); in the Deep River in Guilford County (Cape Fear basin) as early as 1948 (CUMV 11645); and in the Catawba River upstream from Lake James as early as 1956 (USNM 237494). The earliest report of its presence in the state's lakes such as Lake Lure (Broad basin), the Catawba Chain-of-Lakes (Catawba basin), and the Yadkin Chain-of-Lakes (Yadkin basin) is from 1961 (NCWRC 1961).



Map 204. Distribution of *Pomoxis annularis*, White Crappie.

***Pomoxis nigromaculatus* (Lesueur, 1829). Black Crappie.**

Black Crappie is indigenous to most basins, but has not been found in the Nolichucky, Watauga, or Savannah. It has been introduced into the New with the first vouchered specimen being collected in 2008 (Map 205).

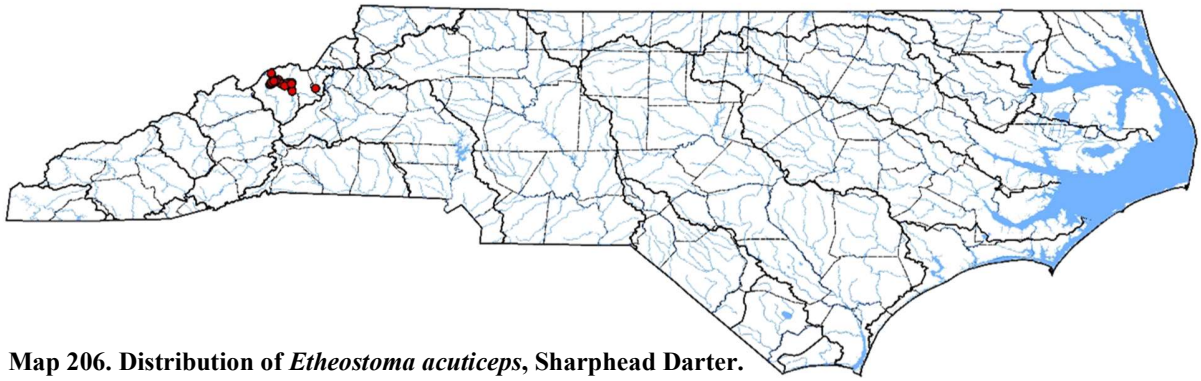


Map 205. Distribution of *Pomoxis nigromaculatus*, Black Crappie.

Percidae - Perches

***Etheostoma acuticeps* Bailey, 1959. Sharphead Darter.**

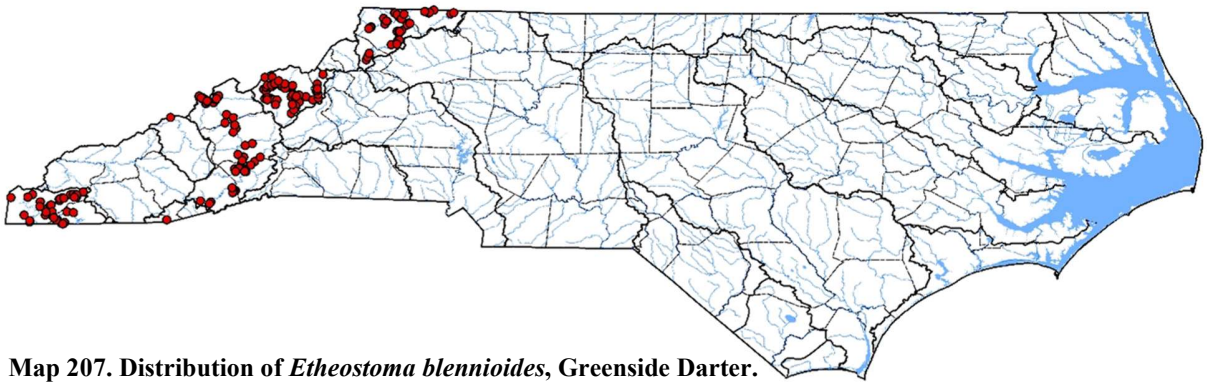
Sharphead Darter is restricted to the Cane and North Toe River systems in Mitchell and Yancey counties (Nolichucky basin) (Rohde and Arndt 1994) (Map 206). It is restricted to the South Fork Holston and Nolichucky basins of Tennessee, Virginia, and North Carolina (Etnier 1980a).
Status: State Threatened.



Map 206. Distribution of *Etheostoma acuticeps*, Sharphead Darter.

***Etheostoma blennioides* Rafinesque, 1819. Greenside Darter.**

Greenside Darter is widely distributed in the Savannah, Pigeon (downstream of the gorge, below Walters Lake), French Broad, Nolichucky, and New basins (Map 207).
Remarks: Near et al. (2011) recognized *Etheostoma blennioides newmanii* as a separate species, Highlands Greenside Darter, *E. newmanii* (Agassiz), which is found in the Nolichucky, French Broad, and lower Pigeon basins confining Greenside Darter solely to the New basin. Populations of uncertain taxonomic status (i.e., Highlands Greenside Darter or Tuckasegee Darter) are found in the Hiwassee basin (Piller and Bart 2017, Piller et al. 2008). Until resolved, these populations have been mapped as Greenside Darter (Map 207).

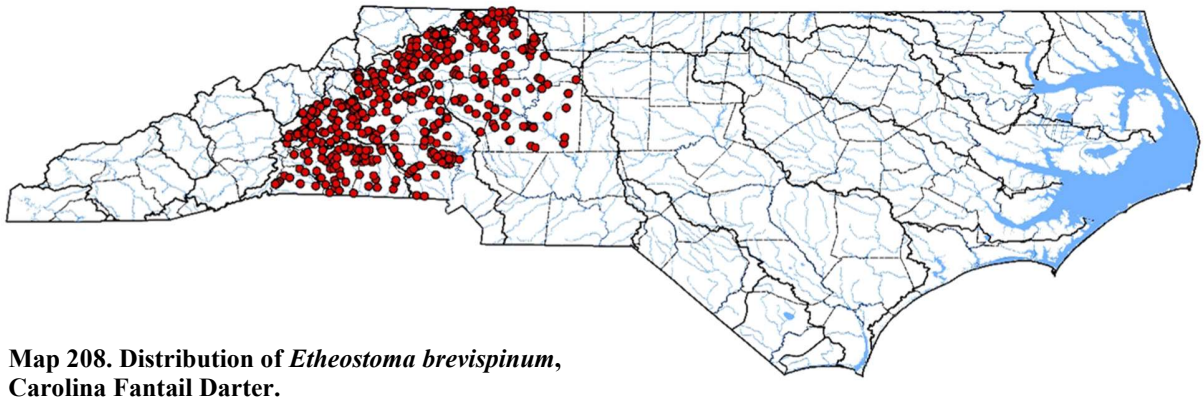


Map 207. Distribution of *Etheostoma blennioides*, Greenside Darter.

***Etheostoma brevispinum* (Coker, 1926). Carolina Fantail Darter.**

Carolina Fantail Darter is endemic and restricted to the Broad, Catawba, and Yadkin basins. In the Yadkin basin, it is found downstream to Rowan and Davidson counties and in the upper Savannah and Santee basins in South Carolina (Blanton and Schuster 2008) (Map 208).

Remarks: Carolina Fantail Darter was described as *Richiella brevispina* by Robert E. Coker (Coker 1926; Table 5). The species was extant in Paddy Creek when surveyed multiple times between 1997 and 2012 (NCSM 47282, Tracy 2008b, B. H. Tracy, unpublished data). This species keys out as *Etheostoma flabellare* in Menhinick (1991).

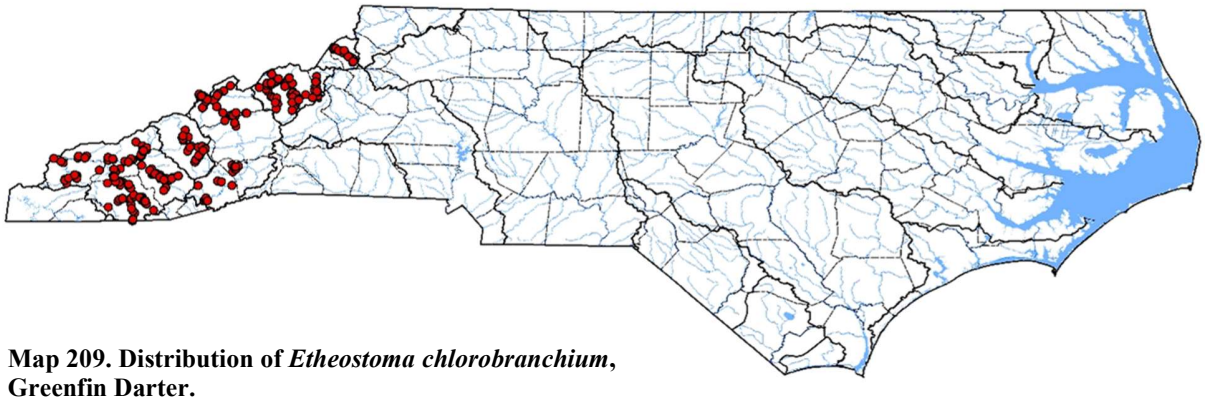


Map 208. Distribution of *Etheostoma brevispinum*, Carolina Fantail Darter.

***Etheostoma chlorobranchium* Zorach, 1972. Greenfin Darter.**

Greenfin Darter is found in each of the basins west of the mountains in North Carolina, except for the Savannah, Hiwassee and New (Page 1983) (Map 209).

Remarks: Greenfin Darter was described by Timothy Zorach (Zorach 1972; Table 5). The species was extant in the type locality reach of the Cullasaja River in April 2009 (NCSM 59164, B. H. Tracy, unpublished data).



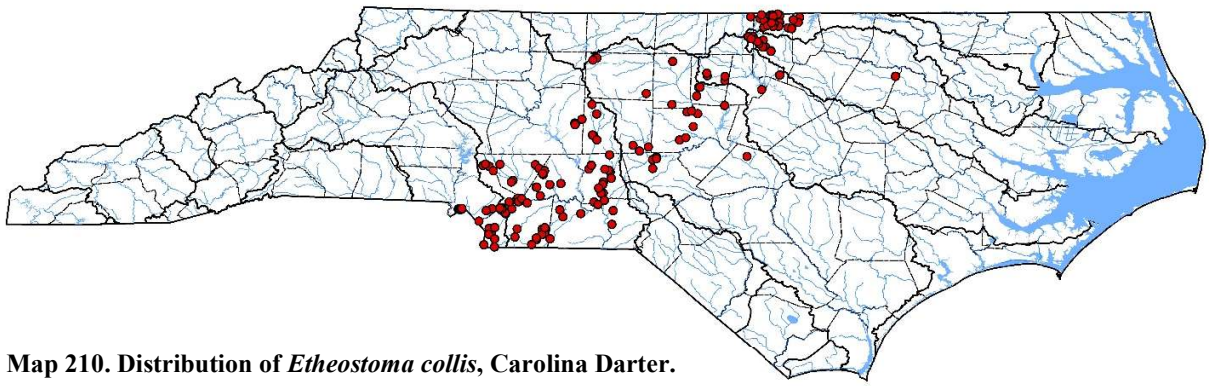
Map 209. Distribution of *Etheostoma chlorobranchium*, Greenfin Darter.

***Etheostoma collis* (Hubbs and Cannon, 1935). Carolina Darter.**

Carolina Darter is found in small streams across all Piedmont basins from the northeast to the southwest, except for the Broad (Map 210). It is found only in Virginia, North Carolina, and South Carolina (Hocutt 1980a; Jenkins and Burkhead 1994; Rohde et al. 2009).

Remarks: Genetic variation across the drainages as related to drainage-specific management strategies was studied by Oswald et al. (2009). Carolina Darter is often confused with Swamp Darter, *Etheostoma fusiforme*, where they are sympatric along the Fall Zone.

Status: State Special Concern.



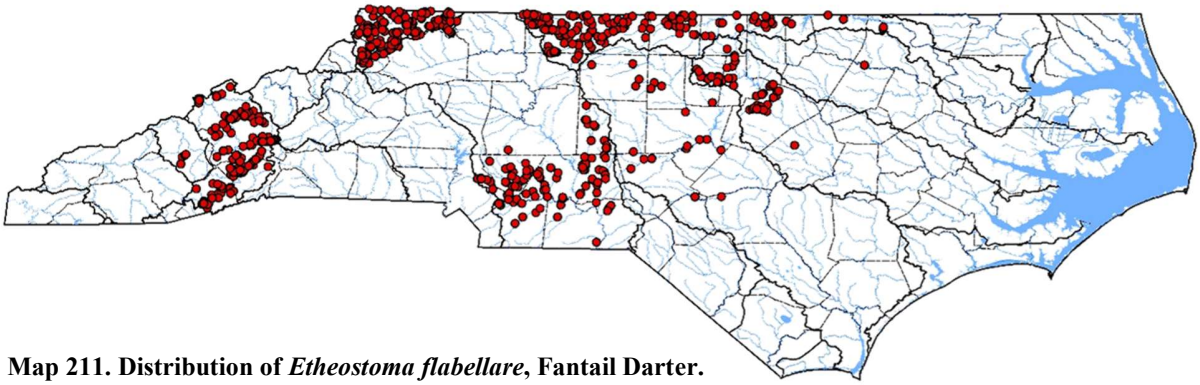
Map 210. Distribution of *Etheostoma collis*, Carolina Darter.

***Etheostoma flabellare* Rafinesque, 1819. Fantail Darter.**

Fantail Darter (and possibly several undescribed species) is found across the state in the Pigeon, French Broad, New, Roanoke, Cape Fear, and Neuse basins, and at one locality in the Tar basin. In the Yadkin basin, it is found downstream from Rowan and Davidson counties (Blanton and Schuster 2008) (Map 211). There is a disjunct and isolated population in the Fishing Creek watershed in the Tar basin (TU 71526; Branley Branson Museum of Zoology, Eastern Kentucky University, EKU 1641.03, Blanton (2001); Starnes and Hogue 2011).

Remarks: Interestingly in North Carolina Fantail Darter is absent from the Savannah, Hiwassee, Little Tennessee, Nolichucky, and Watauga basins. The taxonomic status of this species in North Carolina has been unsettled for a long time and there could be several undescribed species across the state (Blanton 2001; Blanton and Schuster 2008; Etnier and Starnes 1993; Page and Burr 2011). Near et al. (2011) recognized *E. flabellare humerale* as a separate species, *E. humerale* (Girard), which is found in the Atlantic slope drainages from the lower Susquehanna River to the Cape Fear

River (NatureServe 2020; Page and Burr 2011). Some researchers and museums record the species as *Etheostoma flabellare* complex or *Etheostoma* sp. (G. M. Hogue, pers. obs.).

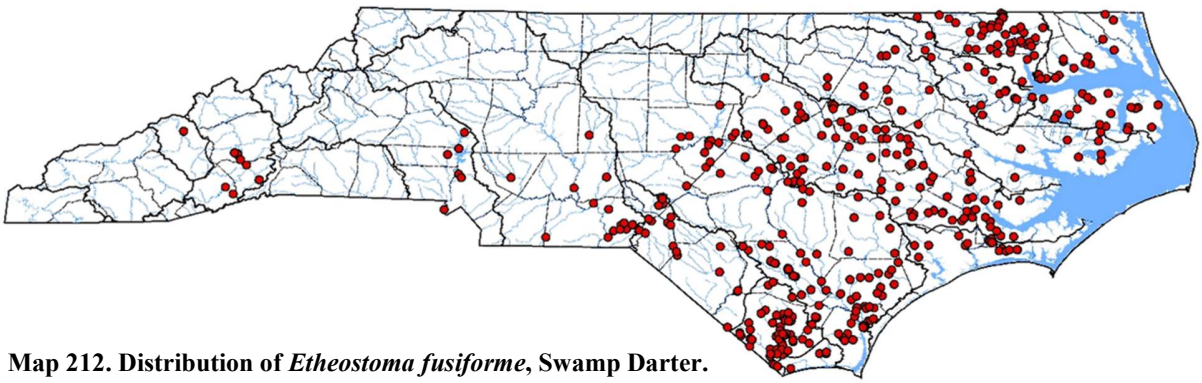


Map 211. Distribution of *Etheostoma flabellare*, Fantail Darter.

***Etheostoma fusiforme* (Girard, 1854). Swamp Darter.**

Swamp Darter is indigenous to all Atlantic slope basins, primarily east and downstream of the Fall Zone, but also extending into the Piedmont of the Catawba, Yadkin, Cape Fear, and Neuse basins. It has not been found in the Broad or Savannah basins (Map 212).

Remarks: *Etheostoma fusiforme barratti* (Holbrook) has been introduced into the Pigeon (earliest vouchered specimen from 2007) and French Broad (earliest vouchered specimens from 1943) basins (Bailey 1950; Collette 1962; Tracy 2008a). Near et al. (2011) consider this subspecies as a valid species – *E. barratti.* If it is accepted as a valid species, specimens from the Piedmont of the Catawba and Yadkin, and those of the Lumber, would need to be reidentified to determine their true identity as either *E. barratti* or *E. fusiforme*. Swamp Darter is often confused with Carolina Darter where they are sympatric along the Fall Zone.



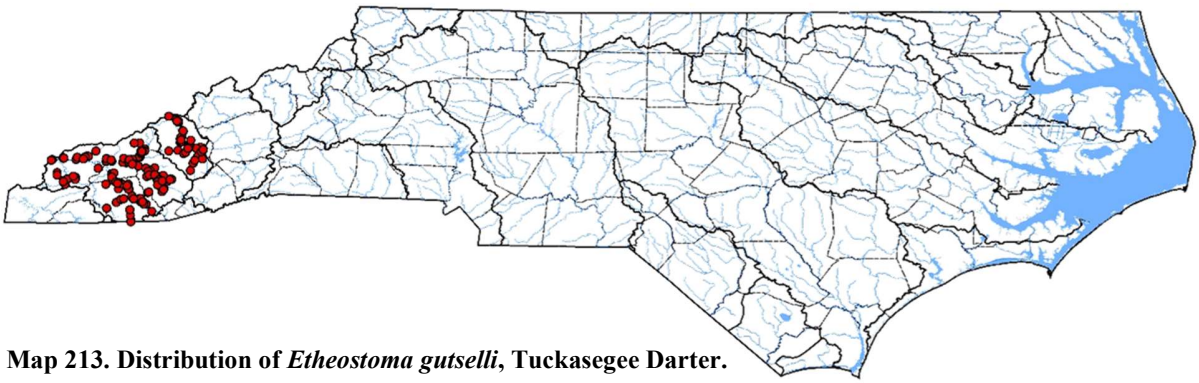
Map 212. Distribution of *Etheostoma fusiforme*, Swamp Darter.

***Etheostoma gutselli* (Hildebrand, 1932). Tuckasegee Darter.**

Tuckasegee Darter is endemic to the Little Tennessee and Pigeon basins, almost exclusively in North Carolina (Piller and Bart 2017) (Map 213).

Remarks: Tuckasegee Darter was described as *Poecilichthys gutselli* by Samuel F. Hildebrand (Hildebrand 1932; Table 5). The species was extant in the Tuckasegee River at Ela in August 2009 (NCSM 55450, B. H. Tracy, unpublished data). Populations of uncertain taxonomic status (i.e., Highlands Greenside Darter or Tuckasegee Darter) are found in the Hiwassee basin (Piller and

Bart 2017, Piller et al. 2008). Until resolved, these populations have been mapped as Greenside Darter (Map 207). This species keys out as *Etheostoma blennioides* in Menhinick (1991).

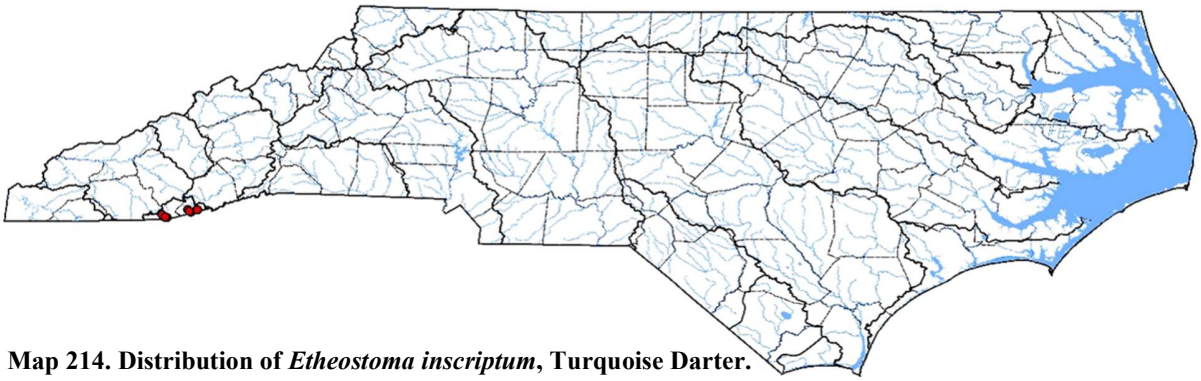


Map 213. Distribution of *Etheostoma gutselli*, Tuckasegee Darter.

***Etheostoma inscriptum* (Jordan and Brayton, 1878). Turquoise Darter.**

Turquoise Darter in North Carolina is restricted to the headwaters of the Savannah basin (i.e., the Chattooga, Horsepasture, and Toxaway rivers) where it is at the northern limit of its range (Starnes 1980b) (Map 214).

Status: State Threatened.



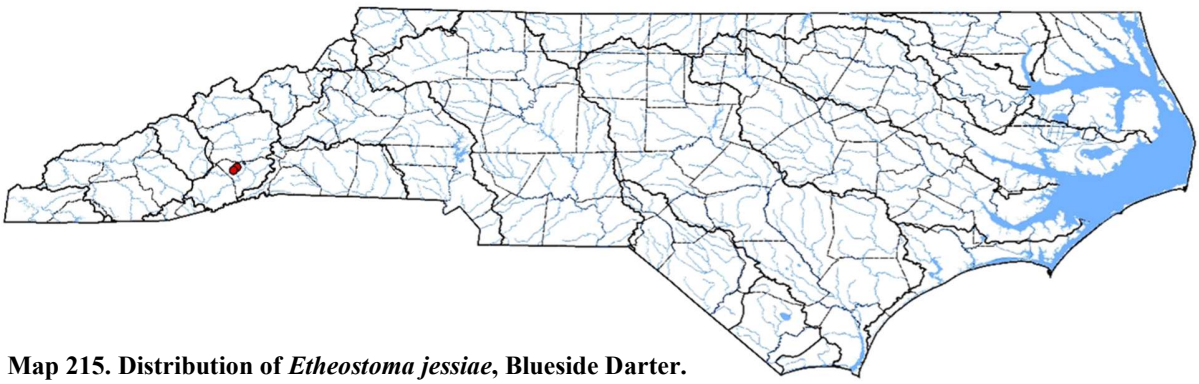
Map 214. Distribution of *Etheostoma inscriptum*, Turquoise Darter.

***Etheostoma jessiae* (Jordan and Brayton, 1878). Blueside Darter.**

Blueside Darter is known from just three single specimen collections made by J. R. Bailey, J.R. Charles, and C.C. Horn from the Mills and South Fork Mills rivers (Henderson County, French Broad basin) in 1949 and 1950 (Map 215).

Remarks: The three adult specimens were confirmed to be Blueside Darter by William M. Howell in 1973 and "*appear to be very typical specimens and conform well with those found in Little Pigeon River around Gatlinburg, Tennessee*" (letter from Howell to E. F. Menhinick, dated 27 August 1973, from the correspondence files of E.F. Menhinick (UNC-Charlotte) archived at NCSM). These three lots were originally in the Duke University collection and were gifted to the Samford University collection, and then transferred to the Auburn University Museum of Natural History. The lots cannot be located and are presumably lost (D. Werneke, Auburn University, pers. comm.). If the identifications were correct, the three lots represent the easternmost distribution of

the species (Howell 1980; Page 1983). Blueside Darter has long been considered extirpated from the state (Etnier 1997a).
Status: State Special Concern.



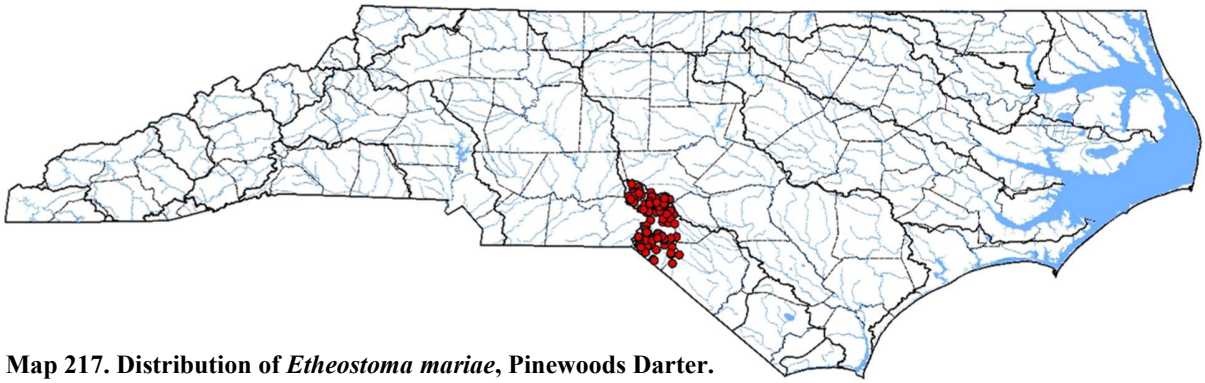
Map 215. Distribution of *Etheostoma jessiae*, Blueside Darter.

***Etheostoma kanawhae* (Raney, 1941). Kanawha Darter.**
Kanawha Darter is found throughout Watauga, Ashe, and Alleghany counties (Map 216). It is endemic to the New basin in Virginia and North Carolina (Hocutt et al. 1980; Jenkins and Burkhead 1994).
Remarks: Kanawha Darter was described as *Poecilichthys kanawhae* by E. C. Raney (Raney 1941b; Table 5). The species was extant at its type locality in October 2010 (NCSM 62249, B. H. Tracy, unpublished data).
Status: State Significantly Rare.

Map 216. Distribution of *Etheostoma kanawhae*, Kanawha Darter. Star indicates type locality.

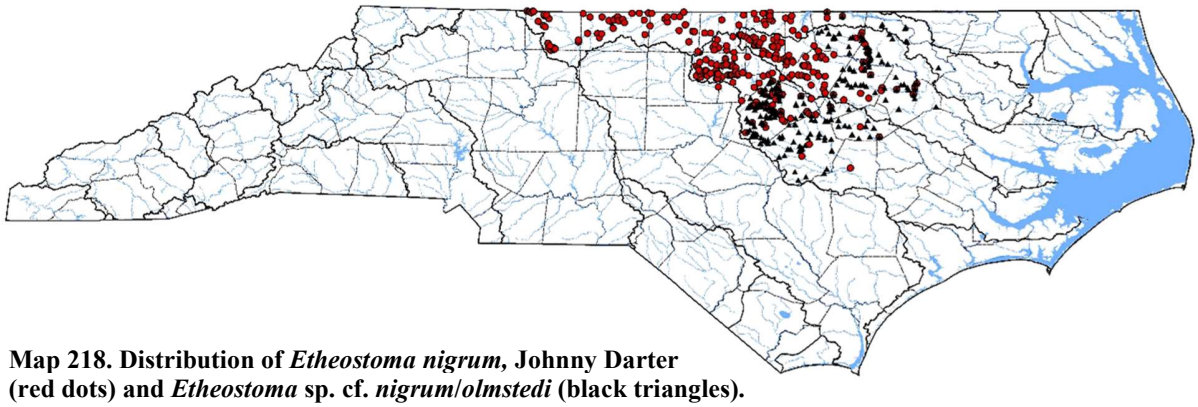
***Etheostoma mariae* (Fowler, 1947). Pinewoods Darter.**
Pinewoods Darter is endemic to the Sand Hills region of the Lumber basin (Rohde 1980e; Rohde and Ross 1987) (Map 217). There is one disjunct record from 1949 from Beaverdam Creek (Little Pee Dee River system (Yadkin basin), Marlboro County, SC (CUMV 29735)). It is considered extirpated from South Carolina (Rohde et al. 2009).
Remarks: An anomalous and suspect record from 1962 from McDuffie Creek (NCSM 53904, Hoke County, Cape Fear basin) is not mapped. Pinewoods Darter was described as *Belophlox mariae* by Henry W. Fowler (Fowler 1947; Table 5). The species was no longer extant at Aberdeen Creek in the vicinity of Watson Lake in May 2009 (B. H. Tracy, unpublished data). Genetic

variation across the Lumber and Little Pee Dee River systems as related to drainage-specific conservation management strategies was studied by Krabbenhoft et al. (2008).
Status: State Special Concern.

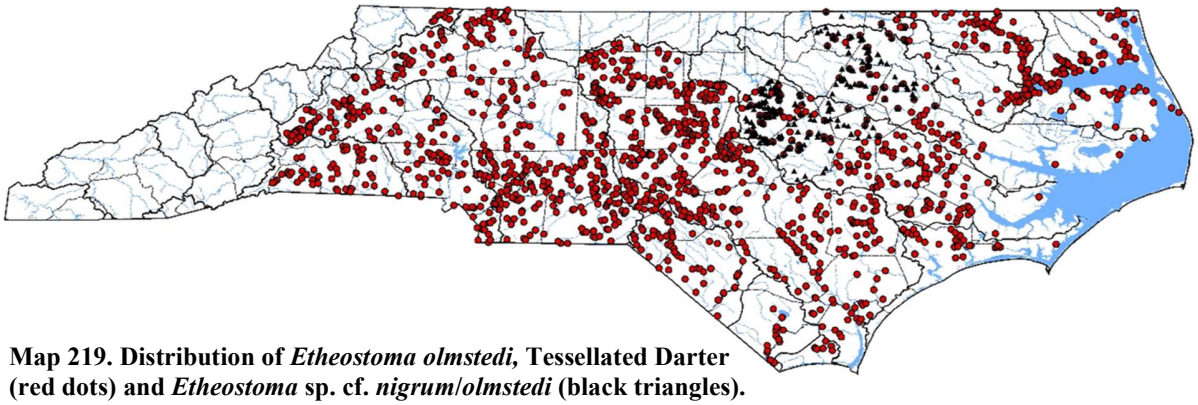


Map 217. Distribution of *Etheostoma mariae*, Pinewoods Darter.

***Etheostoma nigrum*, Rafinesque, 1820, Johnny Darter, and *Etheostoma olmstedi*, Storer, 1842, Tessellated Darter.**
The taxonomic status of these two species has been unsettled for a long time (e.g., Cole 1967). Johnny Darter in North Carolina is found primarily upstream from the Fall Zone in the Piedmont regions of the Roanoke, Tar, and Neuse basins (Menhinick 1991). It is at the southeastern limit of its range in Atlantic slope streams in North Carolina (Bruner 1980). Tessellated Darter in North Carolina is found in all river basins east of the Mountains with an introduced population in the New basin (Cole 1967; Lee and McAllister 1980; Menhinick 1991). As currently understood (Menhinick 1991), the two species are sympatric near the Fall Zone along the eastern Piedmont and western Coastal Plain in the Neuse, Tar, and Roanoke basins and are often referred to as *Etheostoma* spp., *Etheostoma nigrum* complex, *Etheostoma olmstedi* complex, or *Etheostoma* sp. cf. *nigrum*/*olmstedi* (Map 218; Map 219).



Map 218. Distribution of *Etheostoma nigrum*, Johnny Darter (red dots) and *Etheostoma* sp. cf. *nigrum*/*olmstedi* (black triangles).



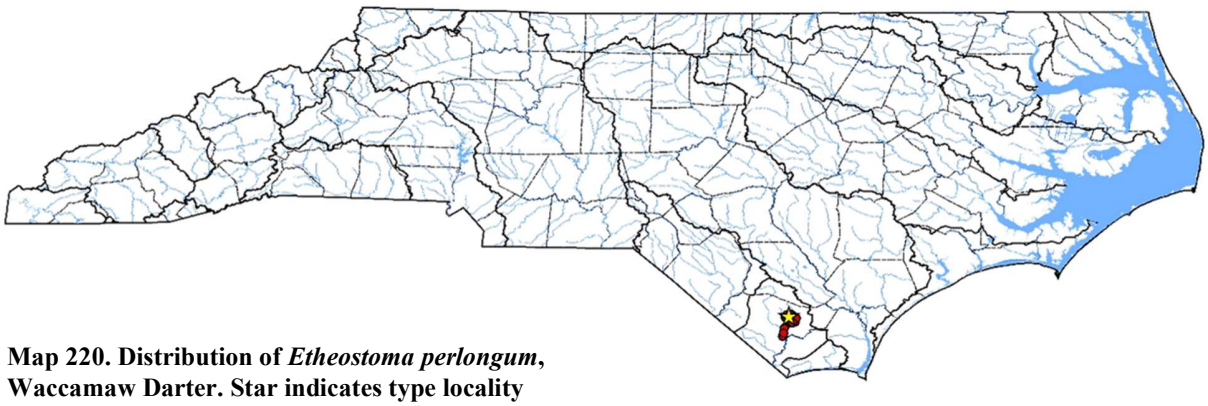
Map 219. Distribution of *Etheostoma olmstedi,* Tessellated Darter (red dots) and *Etheostoma* sp. cf. *nigrum*/*olmstedi* (black triangles).

***Etheostoma perlongum* (Hubbs and Raney, 1946). Waccamaw Darter.**

Waccamaw Darter is endemic to Lake Waccamaw (Shute 1980c; Krabbenhoft et al. 2006), although there are a few records from the Waccamaw River downstream from the lake (Waccamaw basin) (Map 220).

Remarks: Waccamaw Darter was described as *Boleosoma perlongum* by C. L. Hubbs and E. C. Raney (Hubbs and Raney 1946; Table 5). The species was extant at its type locality in March 2009 (NCSM 56309, B. H. Tracy, unpublished data). Despite its designation as a morphological species, and its ecological and life history distinctiveness, recent mitochondrial DNA analysis did not support Waccamaw Darter as qualifying as a phylogenetic species (McCartney and Barreto 2010). However, until further studied, we continue to follow Menhinick (1991).

Status: State Threatened.

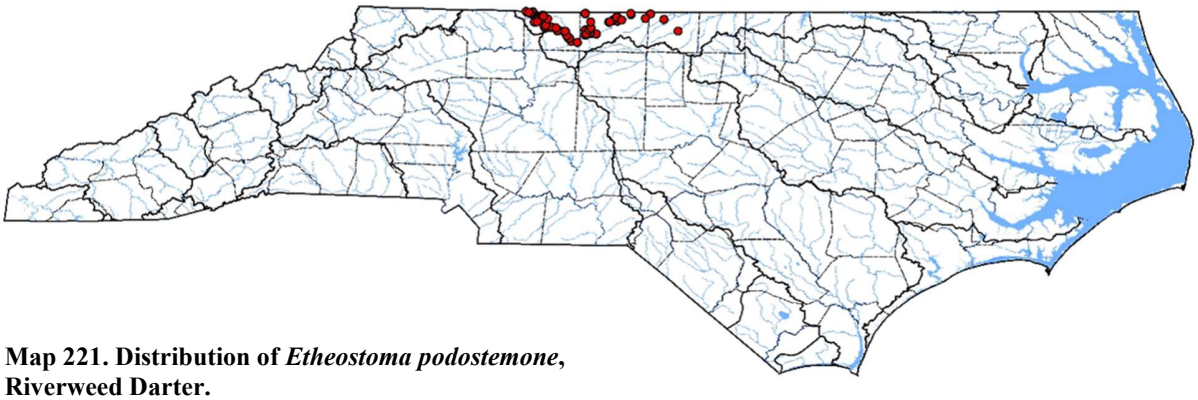


Map 220. Distribution of *Etheostoma perlongum*, Waccamaw Darter. Star indicates type locality

***Etheostoma podostemone* Jordan and Jenkins, 1889. Riverweed Darter.**

Riverweed Darter is endemic to the upper and middle Roanoke basin in Virginia and the more southern Dan River system in Virginia and North Carolina (Stokes, Rockingham, and Caswell counties) (Jenkins 1980m; Jenkins and Burkhead 1994; Tracy 2014a) (Map 221).

Status: State Significantly Rare.

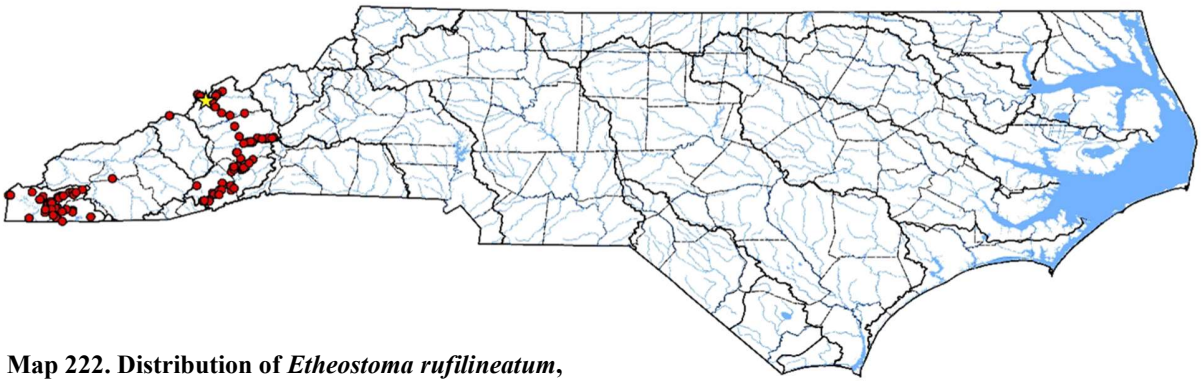


Map 221. Distribution of *Etheostoma podostemone*, Riverweed Darter.

***Etheostoma rufilineatum* (Cope, 1870). Redline Darter.**

Redline Darter is indigenous to the Hiwassee, Pigeon, and French Broad basins (Zorach 1970; Etnier 1980b) and introduced into the Little Tennessee basin (1980, Swain County, UF 132858), although no additional specimens have been collected from this basin since 1980 (Map 222).

Remarks: Unverifiable records from Graham and Macon counties were plotted in Menhinick (1991). Redline Darter was described as *Poecilichthys rufilineatus* (Cope 1870b; Table 5). The species was extant at its type locality in August 2009 (NCSM 55306, B. H. Tracy, unpublished data).

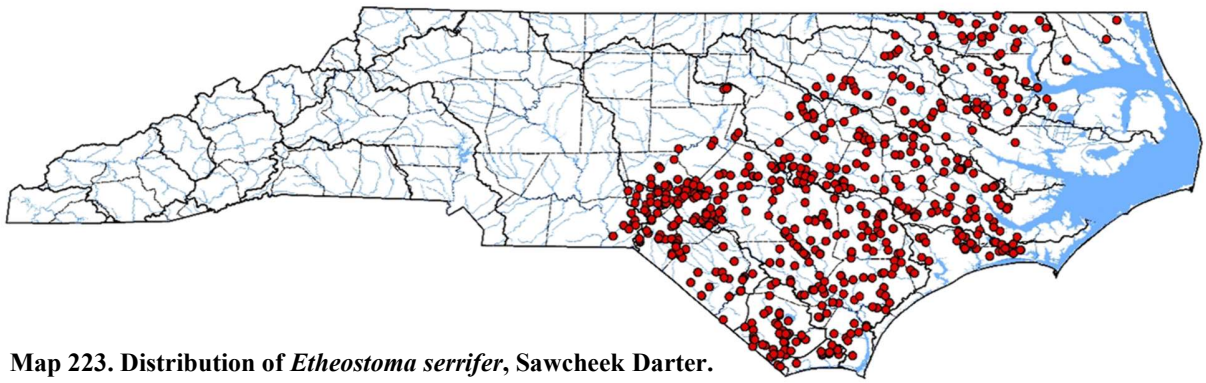


Map 222. Distribution of *Etheostoma rufilineatum*, Redline Darter. Star indicates type locality.

***Etheostoma serrifer* (Hubbs and Cannon, 1935). Sawcheek Darter.**

Sawcheek Darter is found in all Atlantic slope basins, including the Sand Hills Region, generally downstream from the Fall Zone and from the Virginia border to the South Carolina state line (Hocutt 1980b) (Map 223).

Remarks: Sawcheek Darter was described as *Hololepis serrifer* by C. L. Hubbs and Mott D. Cannon (Hubbs and Cannon 1935). The type locality tributary was not specified, but it was most likely Buffalo Creek at South Buffalo Street (B. H. Tracy, pers. obs.). The species was extant in Buffalo Creek in November 2010 (NCSM 62282, B. H. Tracy, unpublished data). Listed in Menhinick (1991) as *Etheostoma serriferum*.



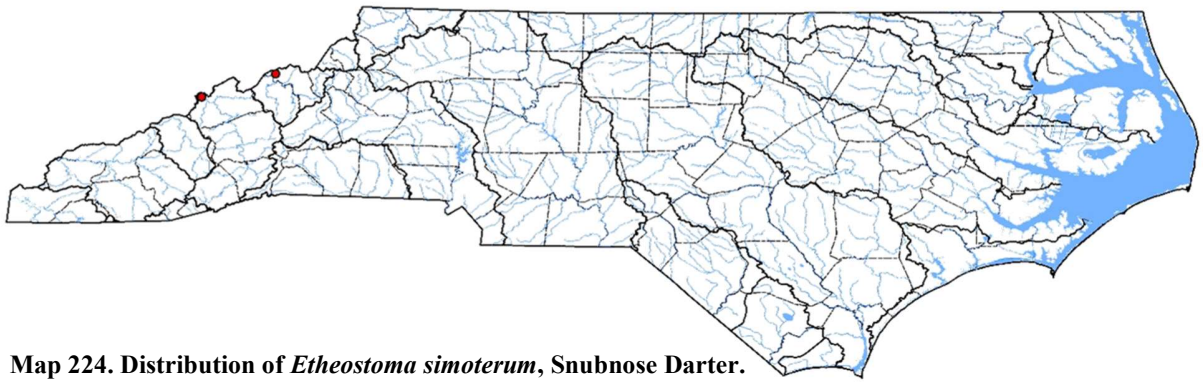
Map 223. Distribution of *Etheostoma serrifer*, Sawcheek Darter.

***Etheostoma simoterum* (Cope, 1868). Snubnose Darter.**

Snubnose Darter is known from North Carolina from two records from the French Broad River (French Broad basin). There is also a record, recently discovered in the backlog at NCSM, of 17 specimens collected in 1969 by Lora M. Outten (Mars Hill College) from Hughes Creek, a tributary to Hollow Poplar Creek and the Nolichucky River, Mitchell County (Nolichucky basin, NCSM 77814) (Map 224).

Remarks: One of the records in the French Broad basin is a specimen collected in 1869 (Cope 1870b) and, according to Smith (1907), was vouchered at USNM (USNM 14982). However, an online electronic search of the USNM collection failed to locate this specimen and, after a thorough search by USNM staff in November 2009, the specimen could not be found and was presumed lost. There are two unvouchered records from Spring and Laurel creeks in Madison County (French Broad basin) (Etnier 1980c; Menhinick 1986; Braswell 1997). In August 2009, W. C. Starnes and B. H. Tracy collected two specimens from Shut-in Creek in Madison County (French Broad basin) (NCSM 55217).

Status: State Special Concern.



Map 224. Distribution of *Etheostoma simoterum*, Snubnose Darter.

***Etheostoma swannanoa* Jordan and Evermann, 1889. Swannanoa Darter.**

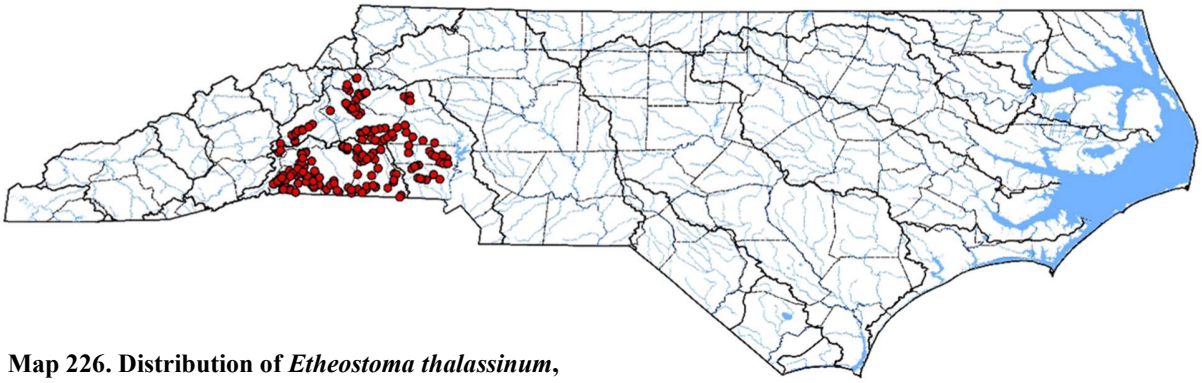
Swannanoa Darter is found only in the Nolichucky and French Broad basins but is being reintroduced into the Pigeon basin (Map 225). It is found only in Virginia, North Carolina, and Tennessee (Starnes 1980a; Etnier and Starnes 1993; Jenkins and Burkhead 1994).

Map 225. Distribution of *Etheostoma swannanoa*, Swannanoa Darter.

***Etheostoma thalassinum* (Jordan and Brayton, 1878). Seagreen Darter.**

Seagreen Darter is restricted to the Broad and Catawba basins (Map 226). It is endemic to the Santee drainage in North Carolina and South Carolina (Starnes 1980c; Rohde et al. 2009).

Status: Significantly Rare.

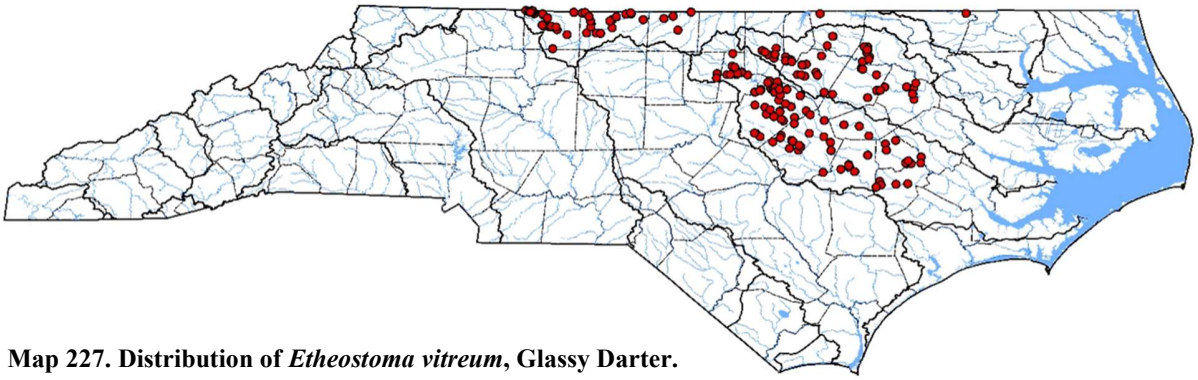


Map 226. Distribution of *Etheostoma thalassinum*, Seagreen Darter.

***Etheostoma vitreum* (Cope, 1870). Glassy Darter.**

Glassy Darter is found in Piedmont and Coastal Plain streams from the Chowan southwest to the Neuse basin (Map 227). It is at the southern limit of its range in North Carolina (Lee et al. 1980; Page 1983).

Remarks: This species was described as *Poecilichthys vitreus* (Cope 1870b; Table 5). The type locality, although not specified, was suspected to be at or near the South Street culverts in Raleigh [35.757900, -78.623321] (B. H. Tracy pers. obs.). A type specimen(s) was presumably deposited and curated at ANSP but it cannot be found (Collette and Knapp 1966). The species was no longer extant at its suspected type locality when surveyed multiple times between December 2008 and April 2015 (B. H. Tracy, unpublished data).



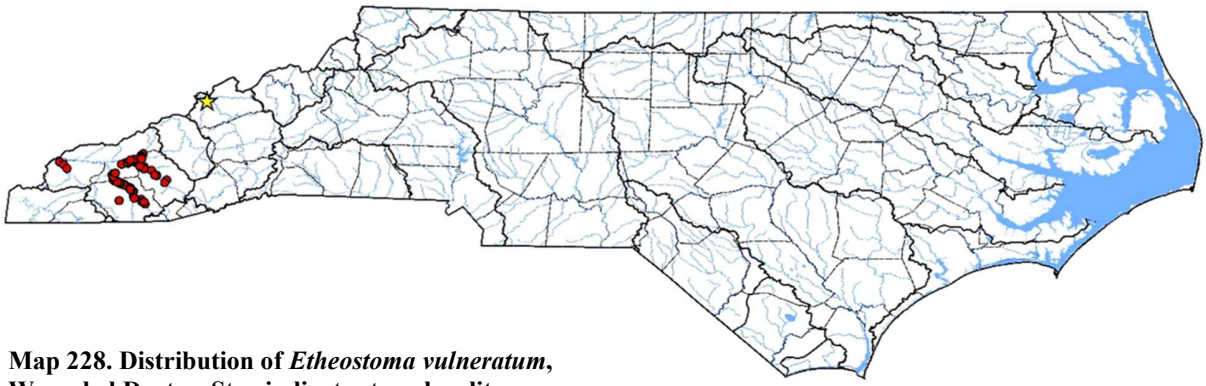
Map 227. Distribution of *Etheostoma vitreum*, Glassy Darter.

***Etheostoma vulneratum* (Cope, 1870). Wounded Darter.**

Wounded Darter is currently restricted to the Little Tennessee basin (Map 228). The species is limited to the upper Tennessee River system in Tennessee, North Carolina, and Virginia (Zorach and Raney 1967; Etnier and Williams 1989).

Remarks: Wounded Darter was described as *Poecilichthys vulneratus* (Cope 1870b; Table 5). The species has not been collected since 1869 from the French Broad basin in North Carolina and is considered extirpated from that basin.

Status: State Special Concern.



Map 228. Distribution of *Etheostoma vulneratum*, Wounded Darter. Star indicates type locality.

***Etheostoma zonale* (Cope, 1868). Banded Darter.**

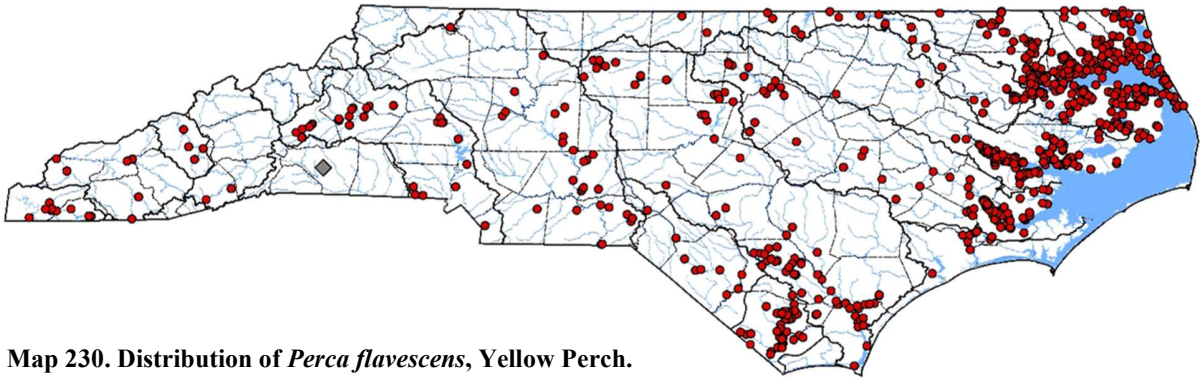
Banded Darter is found in all Mountain region basins southwest of the Watauga, excluding the Savannah (Denoncourt 1980a) (Map 229).

Map 229. Distribution of *Etheostoma zonale*, Banded Darter.

***Perca flavescens* (Mitchill, 1814). Yellow Perch.**

Yellow Perch is indigenous to all basins east of the Savannah, but it has yet to be found in the Shallotte. It has been introduced into most of the basins west of the mountain, except the Watauga and Nolichucky (Map 230).

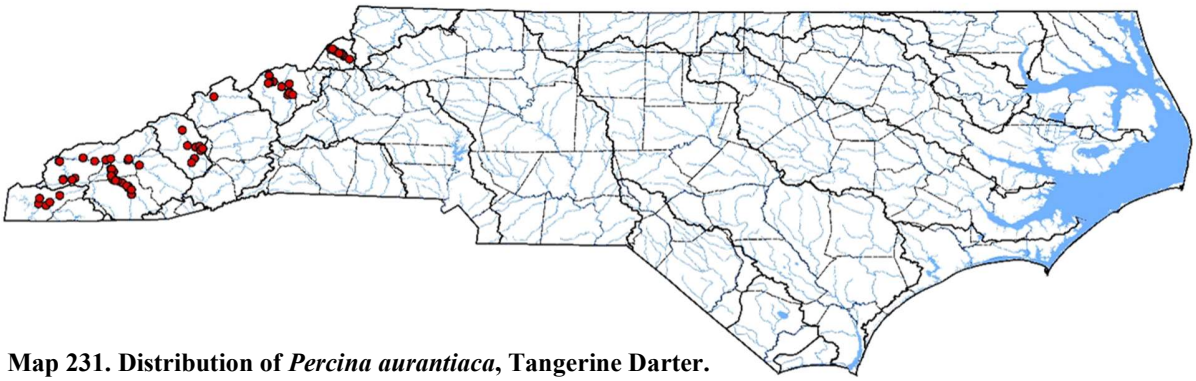
Remarks: Yellow Perch has been anecdotally reported from the Second Broad River near Cliffside (Broad basin). There is a record of one specimen collected in July 1949 from the New basin (Brush Creek, Alleghany County). To date, it is the only known record from that basin. The earliest vouchered specimens from the Hiwassee, Little Tennessee, Pigeon, and French Broad basins are from 1962, 1994, 1963, and 2007, respectively.



Map 230. Distribution of *Perca flavescens*, Yellow Perch.

***Percina aurantiaca* (Cope, 1868). Tangerine Darter.**

Tangerine Darter is indigenous to the Hiwassee, Little Tennessee, Pigeon, Nolichucky, and Watauga basins (Map 231).



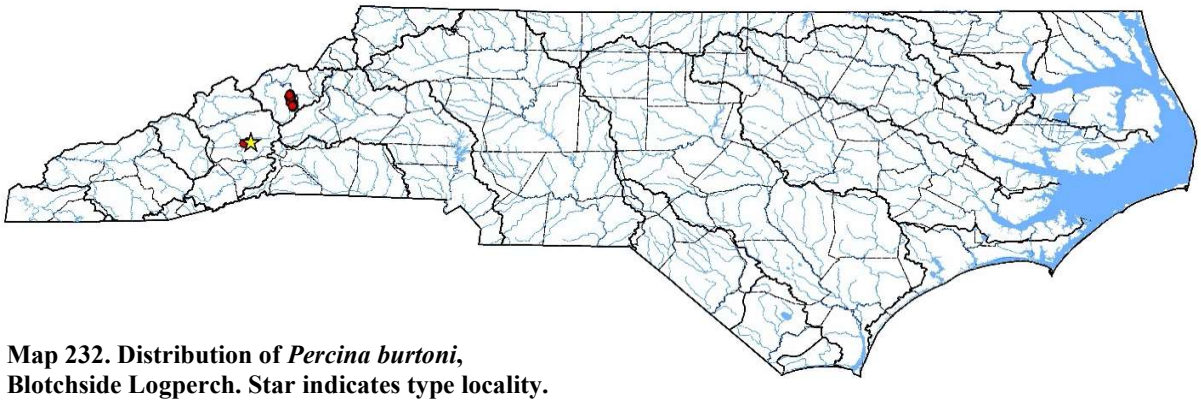
Map 231. Distribution of *Percina aurantiaca*, Tangerine Darter.

***Percina burtoni* Fowler, 1945. Blotchside Logperch.**

Blotchside Logperch is extirpated from the French Broad basin and is currently found only in the Nolichucky basin (Rohde et al. 1998) (Map 232).

Remarks: In August 2020, Blotchside Logperch were experimentally introduced into the Cheoah River, Little Tennessee River basin (L. Etchison, NCWRC pers. comm.). This new river basin locality is not plotted in Map 233 nor tabulated in any of the previous tables. Blotchside Logperch was described as *Percina caprodes burtoni* by Henry W. Fowler (Fowler 1945; Table 5). The species has never been collected again in the Swannanoa River since 1934 and was no longer extant at its type locality in August 2009 (B. H. Tracy, unpublished data).

Status: State Endangered.

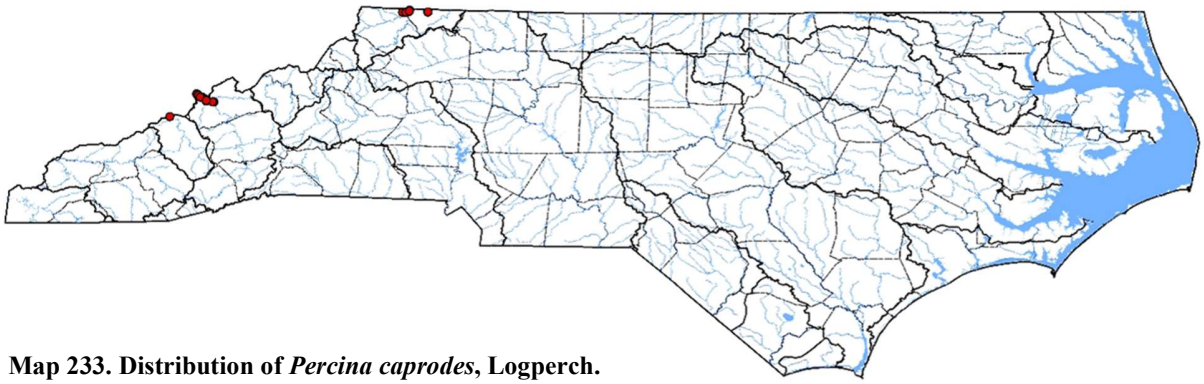


Map 232. Distribution of *Percina burtoni*, Blotchside Logperch. Star indicates type locality.

***Percina caprodes* (Rafinesque, 1818). Logperch.**

Logperch is found in the New basin (near the Virginia state line) and near the Tennessee state line both in the mainstems of the lower French Broad (French Broad basin) and lower Pigeon (Pigeon basin) rivers. In the French Broad basin, it is also found in the lower reaches of Big Laurel, Grass, and Springs creeks (Madison County) (Map 233).

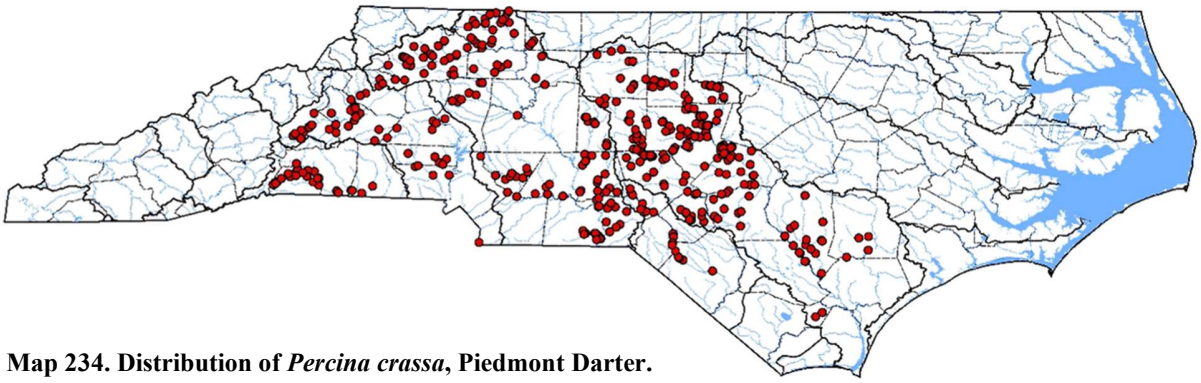
Status: State Threatened.



Map 233. Distribution of *Percina caprodes*, Logperch.

***Percina crassa* (Jordan and Brayton, 1878). Piedmont Darter.**

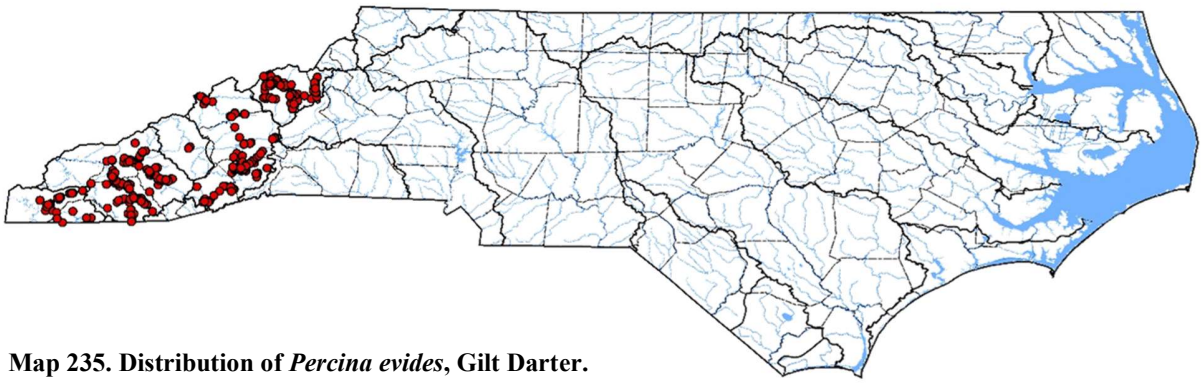
Piedmont Darter is found from the Broad basin east to the Cape Fear basin, excluding the Waccamaw and Shallotte basins (Map 234). It is only found in Virginia, North Carolina, and South Carolina (Mayden 1980a; Jenkins and Burkhead 1994; Rohde et al. 2009).



Map 234. Distribution of *Percina crassa*, Piedmont Darter.

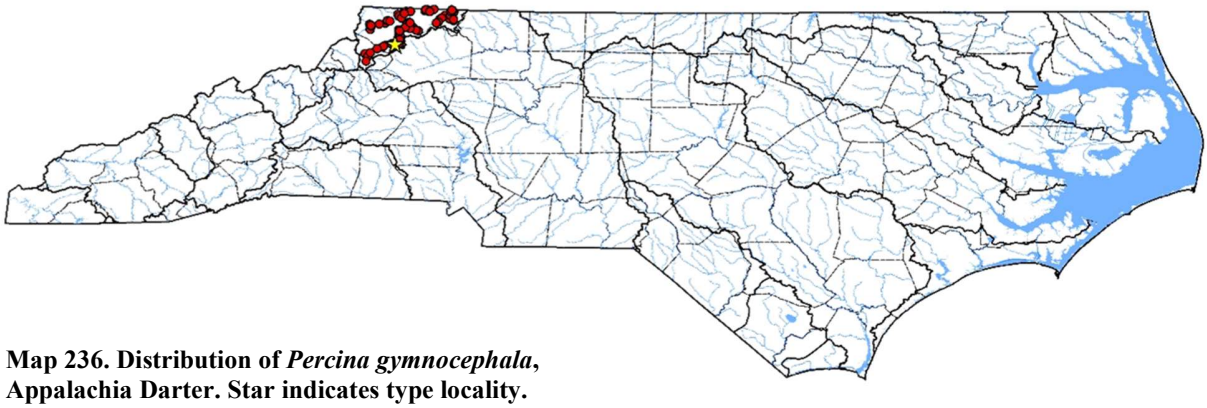
***Percina evides* (Jordan and Copeland, 1877). Gilt Darter.**

Gilt Darter is found in all the basins west of the mountains, except the New, Watauga, and Savannah (Denoncourt 1980b) (Map 235).



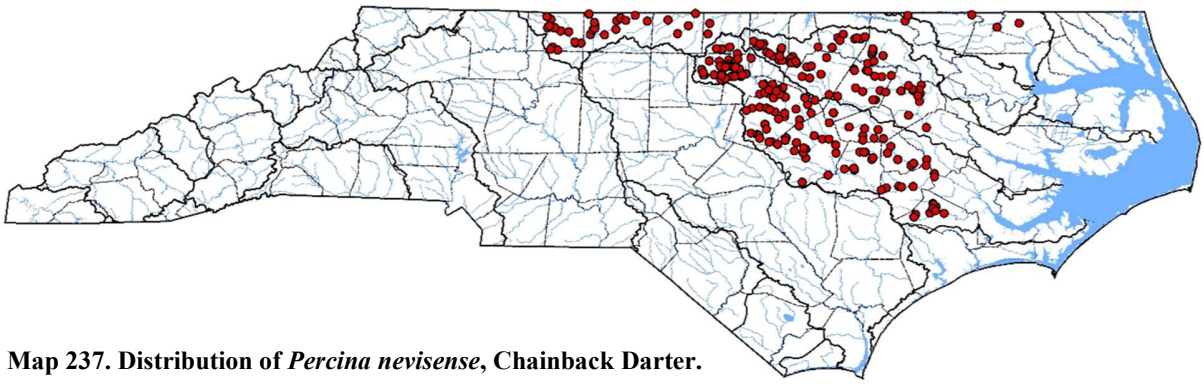
Map 235. Distribution of *Percina evides*, Gilt Darter.

***Percina gymnocephala* Beckham, 1980. Appalachia Darter.**
Appalachia Darter is endemic to the New basin (Beckham 1980a), where it is found throughout Watauga, Ashe, and Alleghany counties (Map 236), and where it is at the southern limit of its range (Beckham 1980b; Page 1983).
Remarks: Appalachia Darter was described by Eugene C. Beckham, III (Beckham 1980a; Table 5). The species was extant at its type locality in July 2009 (NCSM 59204, B. H. Tracy, unpublished data).
Status: State Significantly Rare.



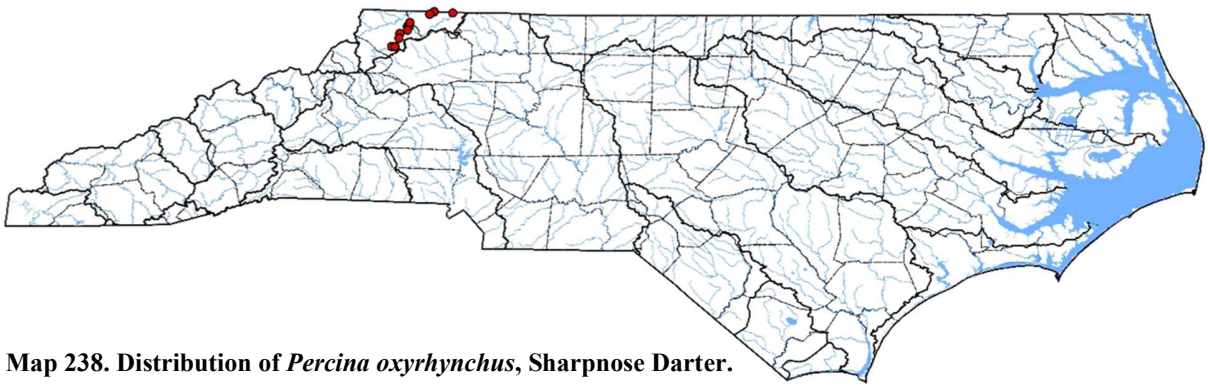
Map 236. Distribution of *Percina gymnocephala*, Appalachia Darter. Star indicates type locality.

***Percina nevisense* (Cope, 1870). Chainback Darter.**
Chainback Darter is found in the Roanoke, Chowan, Tar, and Neuse basins (Goodin et al. 1998) (Map 237). It is endemic to Virginia and North Carolina.
Remarks: This species was described as *Etheostoma nevisense* from "*boisterous and turbulent waters at the falls of the Neuse River, 8 miles east of Raleigh, North Carolina*" (Cope 1870b; Table 5). [Note: Cope's distance and direction are in error. Falls of the Neuse is approximately 12 miles north-northeast of Raleigh. Therefore, the type locality is not mapped. The Neuse River, at the now removed Milburnie Dam, is about 5.6 miles due east of Raleigh, but Cope did not mention visiting the river at this location.] A type specimen(s) was presumably deposited and curated at ANSP but it cannot be found (Collette and Knapp 1966). This species keys out as *Percina peltata* in Menhinick (1991).



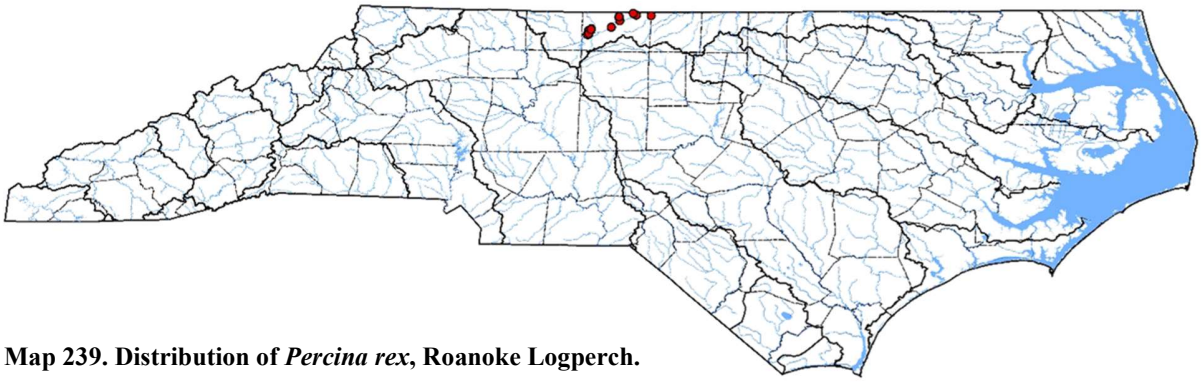
Map 237. Distribution of *Percina nevisense*, Chainback Darter.

***Percina oxyrhynchus* (Hubbs and Raney, 1939). Sharpnose Darter.**
Sharpnose Darter is known only from the New basin from the mainstem of the New River, South Fork New River, and the lower Little River in Ashe and Alleghany counties (Map 238), where it is at the southern limit of its range (Thompson 1980a; Page 1983; Menhinick 1991; Warren 1997; Tracy 2014a).
Remarks: Currently, only 18 specimens are known from North Carolina. Listed in Menhinick (1991) as *Percina oxyrhyncha*.
Status: State Endangered.



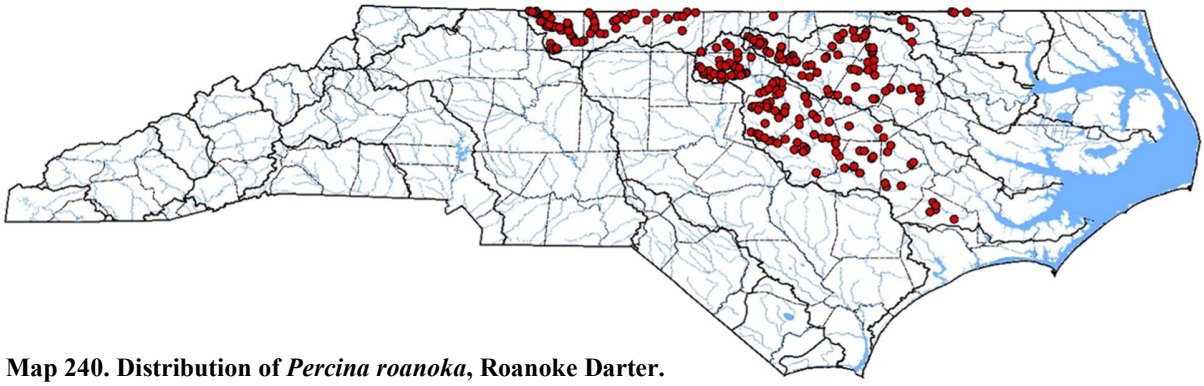
Map 238. Distribution of *Percina oxyrhynchus*, Sharpnose Darter.

***Percina rex* (Jordan and Evermann, 1889). Roanoke Logperch.**
Roanoke Logperch is restricted to the Roanoke basin, specifically the Dan River system including Wolf Island, Cascade, and Big Bear Island creeks and the Dan, Mayo, and Smith rivers in Rockingham County (Tracy 2014a) (Map 239).
Remarks: A dichotomous key to the species of *Percina* and a distribution map showing a locality nearby in Virginia were provided in Menhinick (1991), even though it was not listed as occurring in Menhinick et al. (1974) or by Jenkins et al. (1980a). This endemic species was not reported from the Dan River system in Virginia or North Carolina by Rohde et al. (2003). It was first discovered by Barry (Kim) Baker and David Coughlan (Duke Energy) from the Dan River downstream from its confluence with the Smith River near Eden (NCSM 46044; Roberts and Rosenberger 2008). Its recent occurrence in streams or recolonization of its historical range in the Dan River watershed in North Carolina may be the result of improved water quality and/or more targeted collections.
Status: Federally Endangered.



Map 239. Distribution of *Percina rex*, Roanoke Logperch.

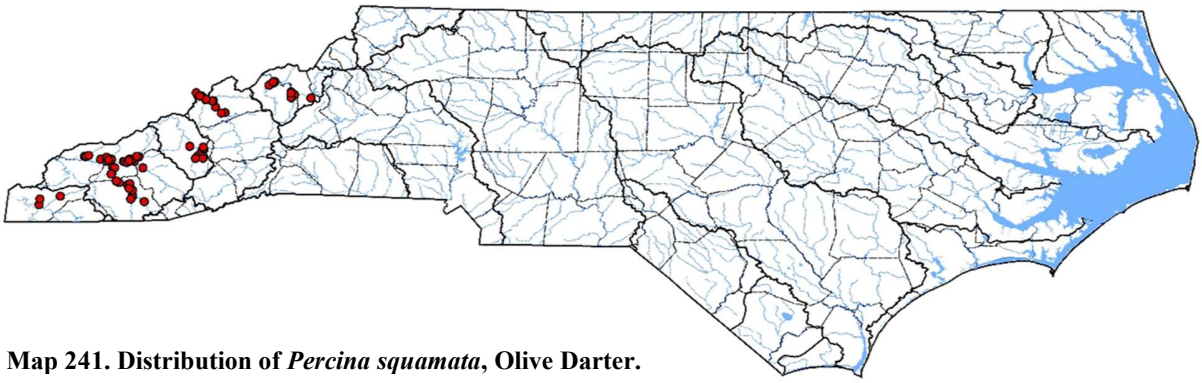
***Percina roanoka* (Jordan and Jenkins, 1889). Roanoke Darter.**
Roanoke Darter is found in the Piedmont region of the Roanoke, the Piedmont and Coastal Plain regions of the Neuse and Tar basins (Mayden 1980b), and was recently detected (2012 and 2013) in the Meherrin River (Chowan basin) (T. Black, formerly NCWRC, pers. comm.) (Map 240). It is endemic in Virginia and North Carolina and is introduced in the New basin downstream in Virginia and West Virginia.



Map 240. Distribution of *Percina roanoka*, Roanoke Darter.

***Percina sciera* (Swain, 1883). Dusky Darter.**
Remarks: The two occurrences of Dusky Darter in North Carolina were based upon the misidentifications of two specimens collected in 1966 (NCSM 5742) and 1969 (AUM 3442) from Spring Creek, Madison County, French Broad basin. The errors were not detected until 2011 at which time the NCSM specimen was reidentified correctly as Gilt Darter (Tracy and Starnes 2011). Prior to 2011, but unbeknownst to Tracy and Starnes (2011), the AUM specimen had already been reidentified correctly as Gilt Darter.
Status: Despite its nonoccurrence in North Carolina, it continues to be given State Endangered status (NCAC 2017; NCWRC 2017).

***Percina squamata* (Gilbert and Swain, 1887). Olive Darter.**
Olive Darter is found in all basins west of the mountains except the New, Watauga, and Savannah (Map 241). It is at the eastern limit of its range in North Carolina (Thompson 1980b).
Status: State Special Concern.



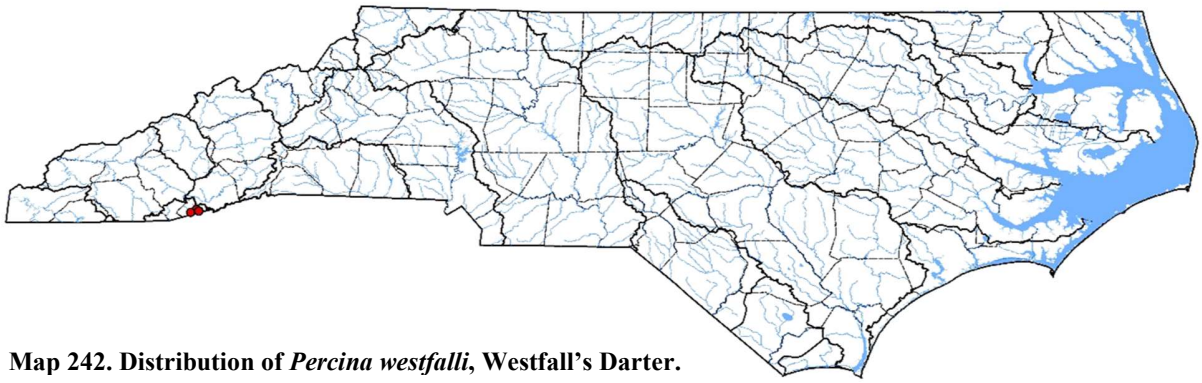
Map 241. Distribution of *Percina squamata*, Olive Darter.

***Percina westfalli* (Fowler 1942). Westfall's Darter.**

Westfalls' Darter is at the northernmost limit of its range in the headwaters of the Savannah basin in North Carolina (Burgess 1980d; Page 1983; Hayes and Piller 2018) (Map 242).

Remarks: Near et al. (2011) recognized *P. nigrofasciata westfalli* (Fowler) as a valid species, Westfall's Darter, based on a single genetic specimen from a tributary to the Savannah River (Hayes and Piller 2018). Previously unknown from North Carolina, Westfall's Darter was still included in a dichotomous key to the species of *Percina* and a distribution map showing a locality nearby in South Carolina in Menhinick (1991) because of its known occurrence in tributaries to the Savannah River just across the state line in South Carolina and Georgia (Crawford 1956; Burgess 1980d). The first specimen from North Carolina was collected by Hugh Barwick (Duke Energy) in September 1993 from the lower reaches of Toxaway Creek just before entering Lake Jocassee in Transylvania County (Duke Energy reference collection, Catalogue No. 2137) (David Coughlan, retired, Duke Energy, and Michael Abney, Duke Energy, pers. comm.). It has never been collected from the other major Savannah Basin tributaries in North Carolina (i.e., Chattooga, Whitewater, and Thompson rivers) (Tracy 2014a). This species keys out as *Percina nigrofasciata* in Menhinick (1991).

Status: State Special Concern.

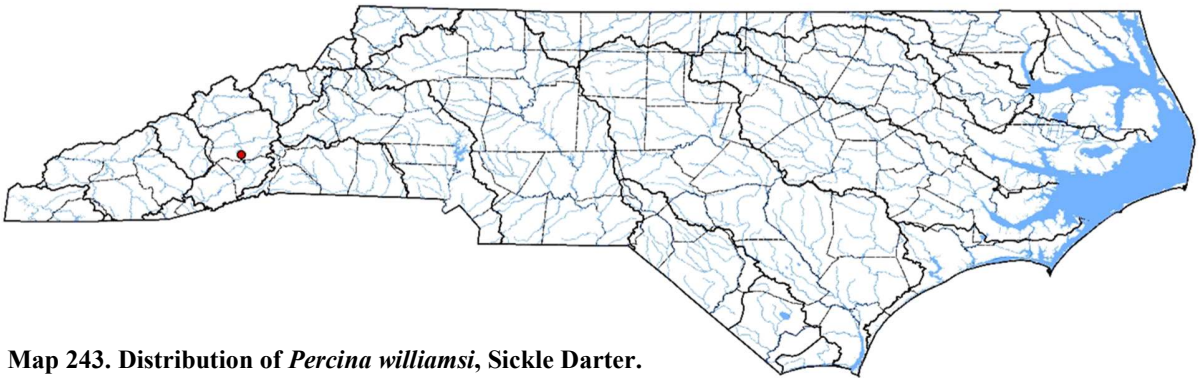


Map 242. Distribution of *Percina westfalli*, Westfall's Darter.

***Percina williamsi* Page and Near, 2007. Sickle Darter.**

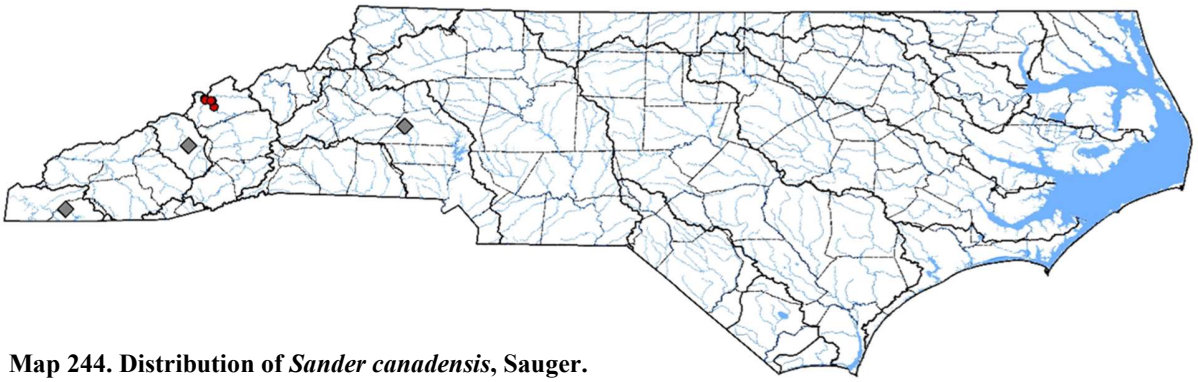
Sickle Darter is known only from a single specimen collected in April 1940 from the French Broad River (French Broad basin) near Skyland in Buncombe County (CUMV 10044; Page and Near 2007) (Map 243).

Remarks: Sickle Darter has long been considered extirpated from the state (Menhinick 1991; Etnier 1997b; Page and Near 2007). A Species Status Assessment was recently completed with the hope of reintroducing Sickle Darter back into the French Broad River basin (USFWS 2020). This species keys out as *Percina macrocephala* in Menhinick (1991), from which it was recently separated by Page and Near (2007).
Status: State Special Concern.



Map 243. Distribution of *Percina williamsi*, Sickle Darter.

***Sander canadensis* (Griffith and Smith, 1834). Sauger.**
Sauger is indigenous to the western Mountain basins but is known from only seven vouchered records collected from the lower French Broad basin (French Broad River, Big Laurel Creek, and Spring Creek) in Madison County (Map 244). Additional records from the lower Pigeon River (Pigeon), Hiwassee Lake (Hiwassee), and an introduced population (date unknown) in Lake Norman (Catawba basin) are plotted in Menhinick (1991).
Remarks: This species keys out as *Stizostedion canadense* in Menhinick (1991).

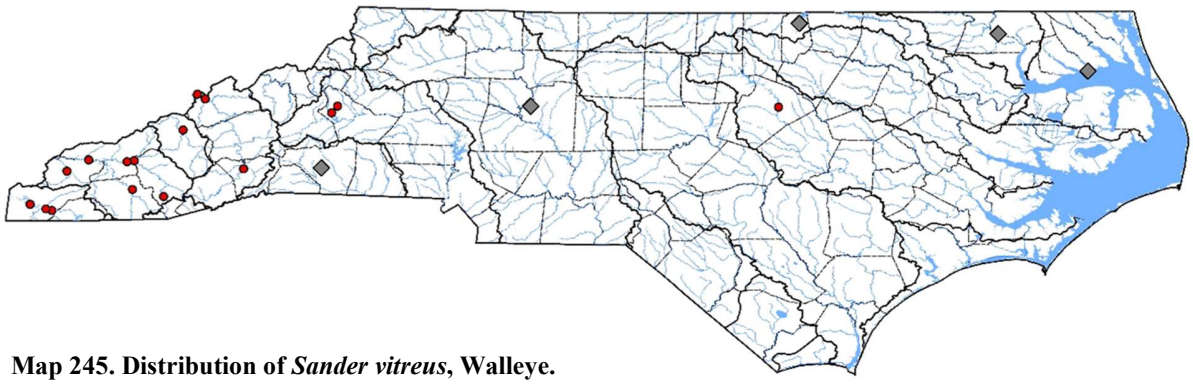


Map 244. Distribution of *Sander canadensis*, Sauger.

***Sander vitreus* (Mitchill, 1818). Walleye.**
Walleye is indigenous to the Hiwassee, Little Tennessee, Pigeon, French Broad, Roanoke, Chowan, and Albemarle basins. It has been introduced in the Broad, Catawba, and Yadkin basins and is considered extirpated from the Neuse basin (Map 245).
Remarks: Cope (1870a) remarked: "*A species of this genus occurs also in the Neuse*", but there are no vouchered specimens he collected or further details to lend validity to his claim. The only known record from the Neuse basin, from where it is now considered extirpated, can be found at

CAS (CAS-SU 3330, Neuse River at Milburnie, near Raleigh) collected in 1888 by Jenkins and Meek. Walleye is presumably indigenous in the lower Roanoke, Chowan, and Albemarle basins where local fishermen called Walleye "Salmon" (Smith 1907). In Bertie County, there is also a Salmon Creek, a tributary to the Chowan River, which shows up on historical maps as early as 1767, offering some credence to Walleye's indigenous status in these basins. However, Smith (1893) reported that Pasquotank River fishermen reported that Walleye: "*are said to have been known in the river only a few years.*" Jenkins and Burkhead (1994) questioned the indigenous status of the Walleye along the Atlantic slope by providing evidence that Walleye in the Chowan, Roanoke, and Albemarle basins were the result of stockings by state and federal agencies beginning in the 1870s. However, in 2001, bone fragments from Walleye were identified from an archaeological site on the Roanoke River that covered a 2600-year period (VanDerwarker 2001). Its indigenous vs. nonindigenous status in these three basins may never be known.

Unvouchered records have been reported from the Tuckasegee and Little Tennessee rivers (Little Tennessee basin, Jackson and Swain counties), from the Pigeon River (Pigeon basin), and from the French Broad River (French Broad basin, Madison County) (e.g., Cope 1870a; Menhinick 1991). The earliest stocking reports in the Catawba Chain-of-Lakes (Catawba basin) and the Yadkin Chain-of-Lakes (Yadkin basin) are from the early 1950s (NCWRC 1961). This species keys out as *Stizostedion vitreum* in Menhinick (1991).



Map 245. Distribution of *Sander vitreus*, Walleye.

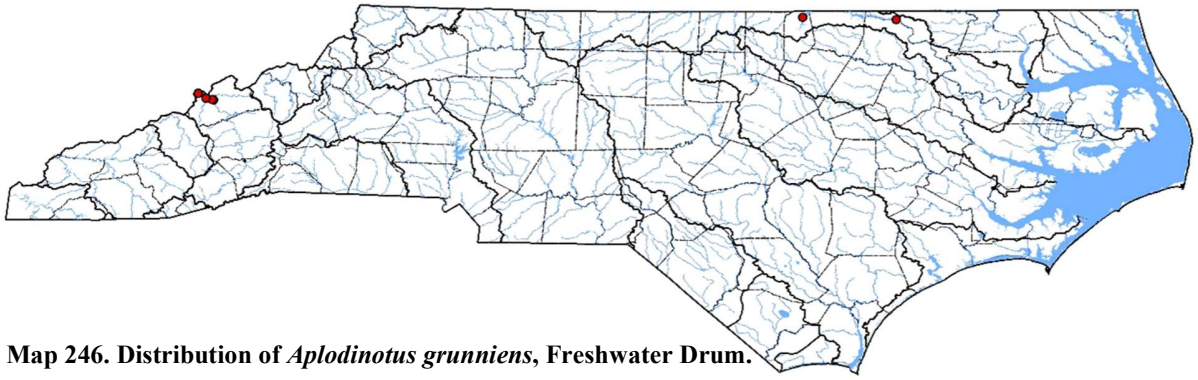
Sciaenidae - Drums and Croakers

***Aplodinotus grunniens* Rafinesque, 1819. Freshwater Drum.**

Freshwater Drum is indigenous to the western Mountain basins but is known from only six records from the lower French Broad basin (French Broad River, Big Laurel Creek, and Spring Creek) in Madison County (Map 246).

Remarks: Freshwater Drum was illegally introduced into John H. Kerr Reservoir (Roanoke basin). The exact year of the introduction is unknown but may have been in the 1980s or 1990s (K. Rundle, NCWRC and R. Graham, retired, Dominion Energy, pers. comm.). There are also anecdotal reports of Freshwater Drum from Lake Gaston and Roanoke Rapids Lake (K. Rundle, NCWRC pers. comm.). In March 2017 and April 2019 adult specimens were collected within the Roanoke Rapids Dam bypass reach (R. Graham, retired and P. Sturke, Dominion Energy, pers. comm.). More occurrences in the mainstem of the Roanoke River downstream from Roanoke Rapids Dam are expected into the future.

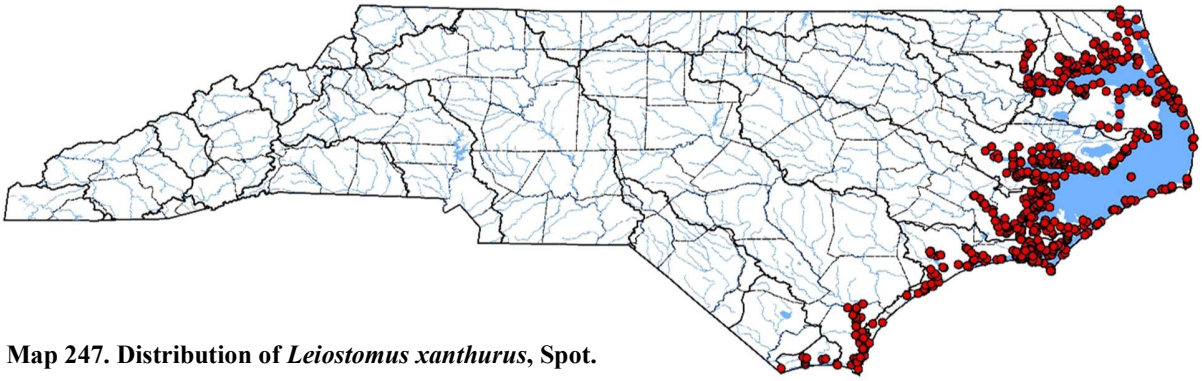
Status: Special Concern.



Map 246. Distribution of *Aplodinotus grunniens*, Freshwater Drum.

***Leiostomus xanthurus* Lacepéde, 1802. Spot.**

Spot, primarily a coastal estuarine species, is found as a seasonal inhabitant in freshwater habitats in almost all coastal river basins from the Shallotte to the Albemarle, except for the Roanoke (Map 247).



Map 247. Distribution of *Leiostomus xanthurus*, Spot.

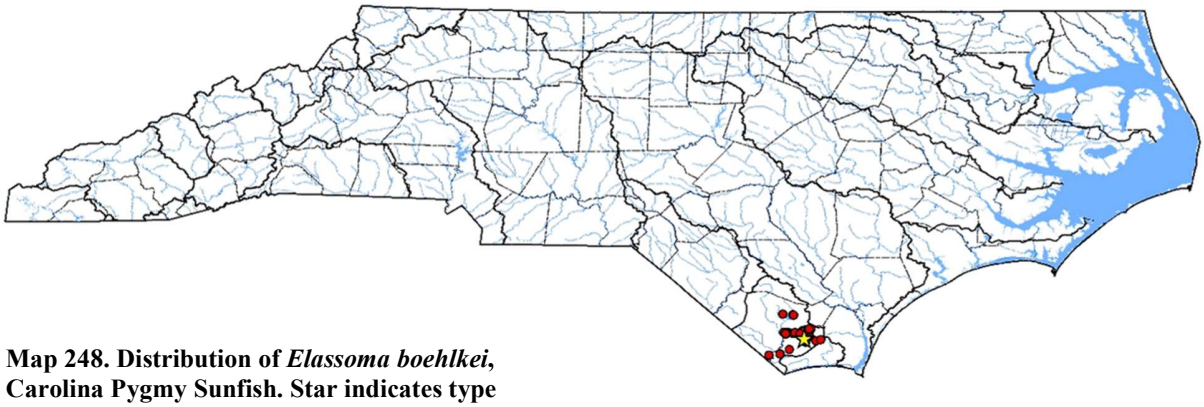
Elassomatidae - Pygmy Sunfishes

***Elassoma boehlkei* Rohde and Arndt, 1987. Carolina Pygmy Sunfish.**

Carolina Pygmy Sunfish, an endemic species, is restricted to the Waccamaw basin in Brunswick and Columbus counties (Map 248). It is found only in North Carolina and South Carolina (Jones and Ewing 2019; Quattro et al. 2001; Rohde et al. 2009; Sandel and Harris 2007).

Remarks: Carolina Pygmy Sunfish was described by F. C. Rohde and Rudolf G. Arndt (Rohde and Arndt 1987; Table 5). The species was extant at its type locality in March 2009 (NCSM 59163, B. H. Tracy, unpublished data).

Status: State Threatened.

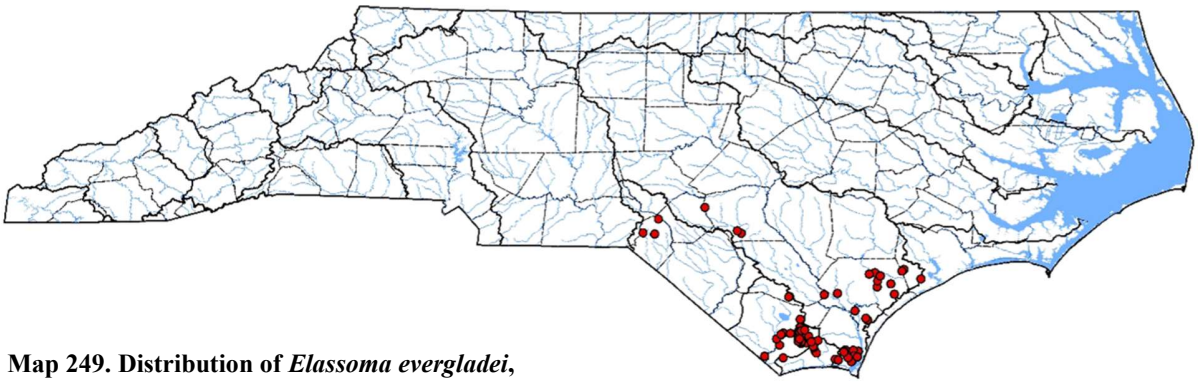


Map 248. Distribution of *Elassoma boehlkei*, Carolina Pygmy Sunfish. Star indicates type

***Elassoma evergladei* Jordan, 1884. Everglades Pygmy Sunfish.**

Everglades Pygmy Sunfish, as currently understood and following Menhinick (1991), is found in the southeastern corner of the state in the Lumber, Waccamaw, Shallotte, and Cape Fear basins (Map 249), where it is at the northern limit of its range (Böhlke and Rohde 1980a).

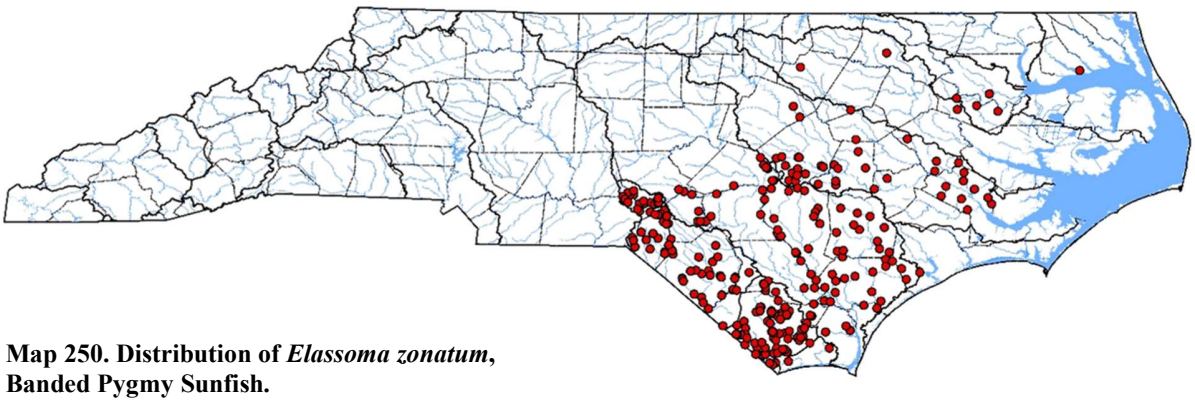
Remarks: The populations considered to be Everglades Pygmy Sunfish in North Carolina may represent an undescribed species (M. Sandel, University of West Alabama, pers. comm.).



Map 249. Distribution of *Elassoma evergladei*, Everglades Pygmy Sunfish.

***Elassoma zonatum* Jordan, 1877. Banded Pygmy Sunfish.**

Banded Pygmy Sunfish is found primarily in the Sand Hills and Coastal Plain from the Lumber northeastward to the Albemarle basin (NCSM 55026, collected 1964), where it is at the northern limit of its range (Böhlke and Rohde 1980b). It has not been recorded from the White Oak or Chowan basins (Map 250).



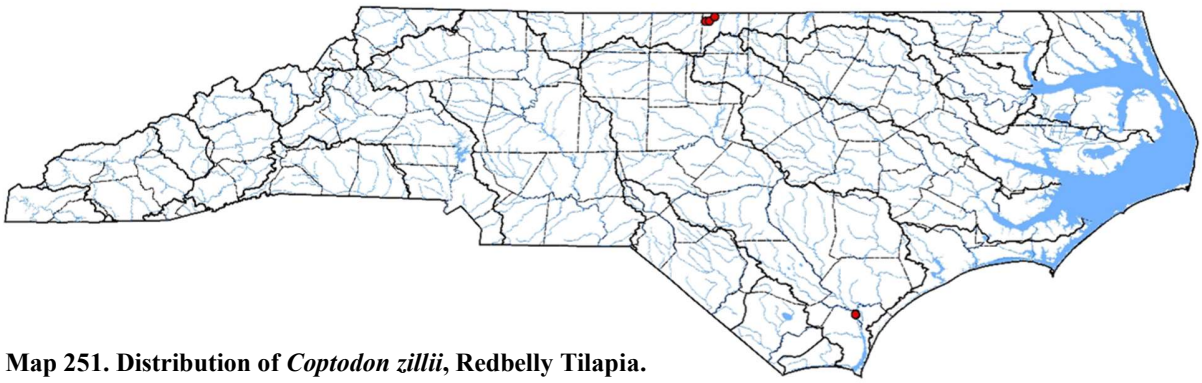
Map 250. Distribution of *Elassoma zonatum*, Banded Pygmy Sunfish.

Cichlidae - Cichlids

***Coptodon zillii* (Gervais, 1848). Redbelly Tilapia.**

Redbelly Tilapia, a nonindigenous species, was stocked in Sutton Lake (Cape Fear basin), in Duke Energy's Weatherspoon cooling pond (Lumber basin), and in PCS Phosphate Company's ponds (record not mapped; Tar basin) in attempts to manage aquatic macrophytes (Fuller et al. 1999). Redbelly Tilapia was also inadvertently introduced into Hyco Reservoir from an on-site aquacultural study during 1984 (Roanoke basin; Crutchfield 1995; Crutchfield et al. 1992) (Map 251).

Remarks: Except for Hyco Reservoir, it is very unlikely that reproducing populations continue to persist in the other three localities because of the species' intolerance to ambient low water temperatures during the winter. Its future persistence in Hyco Reservoir is dependent upon the continued discharge of the heated effluent from the power plant. This species keys out as *Tilapia zilli* in Menhinick (1991).



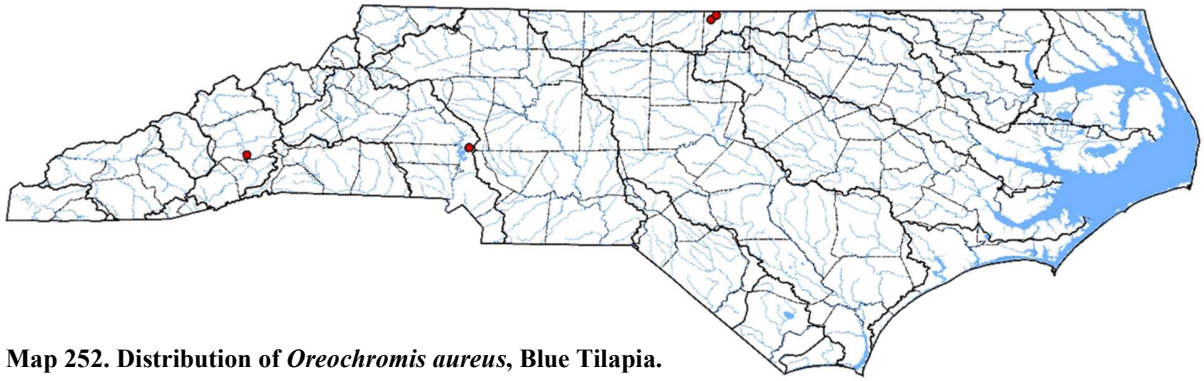
Map 251. Distribution of *Coptodon zillii*, Redbelly Tilapia.

***Oreochromis aureus* (Steindachner, 1864). Blue Tilapia.**

Blue Tilapia, a nonindigenous species, was stocked in 1965 as a forage fish and to control aquatic macrophytes in Lake Julian (French Broad basin; Fuller et al. (1999); Menhinick et al. (1974)). It was introduced into Lake Norman for unknown reasons (Catawba basin) and was inadvertently introduced into Hyco Reservoir from an on-site aquacultural study during 1984 (Crutchfield 1995) (Map 252).

Remarks: This species is not expected to survive in Lake Julian because the thermal discharge from the coal-fired and gas-fired power plant ceased in February 2020 (R. Garrett, Duke Energy,

pers. comm.). It is unknown if the record mapped for Lake Norman represents a persistent and reproducing population or if it was the remnant of a one-time bait bucket release. This species keys out as *Tilapia aurea* in Menhinick (1991).

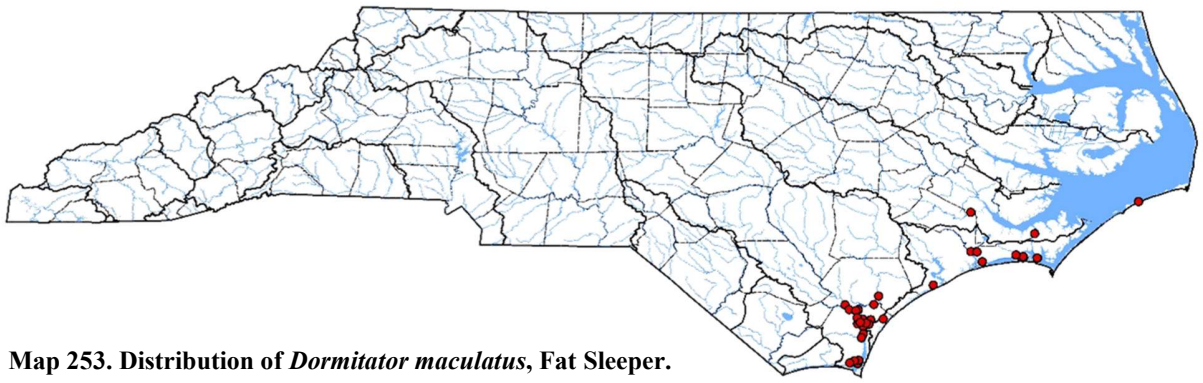


Map 252. Distribution of *Oreochromis aureus*, Blue Tilapia.

Eleotridae - Sleepers

***Dormitator maculatus* (Bloch, 1792). Fat Sleeper.**

Fat Sleeper appears restricted to shallow fresh and estuarine waters in North Carolina in the Cape Fear, White Oak, and Neuse basins (Ross and Rohde 2004). It has also been reported from Hyde County (Tar basin, AUM 45738) (Map 253). This species is widespread in freshwater and brackish coastal streams, ponds, and ditches along the Atlantic slope from New York to Florida and along the Gulf Coast (Lindquist 1980a).

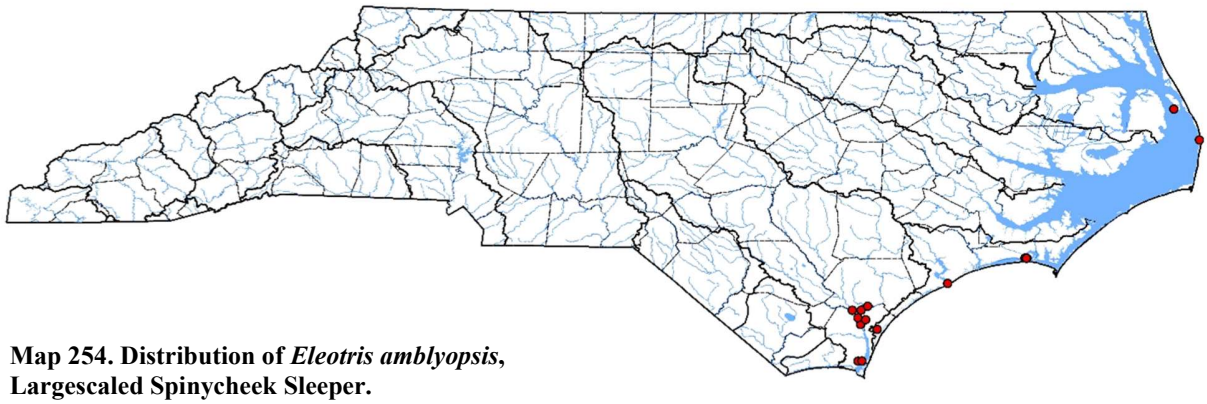


Map 253. Distribution of *Dormitator maculatus*, Fat Sleeper.

***Eleotris amblyopsis* (Cope, 1871). Largescaled Spinycheek Sleeper.**

Largescaled Spinycheek Sleeper is found in the Cape Fear, White Oak, and Albemarle basins (Ross and Rohde 2004) (Map 254). In North Carolina it prefers low-salinity upper estuaries but may invade fresh water (Ross et al. 1988). Its range extends from North Carolina south to Brazil and in the West Indies (Lindquist 1980b; Rohde et al. 2009).

Remarks: This species keys out as *Eleotris pisonis,* Spinycheek Sleeper in Menhinick (1991).



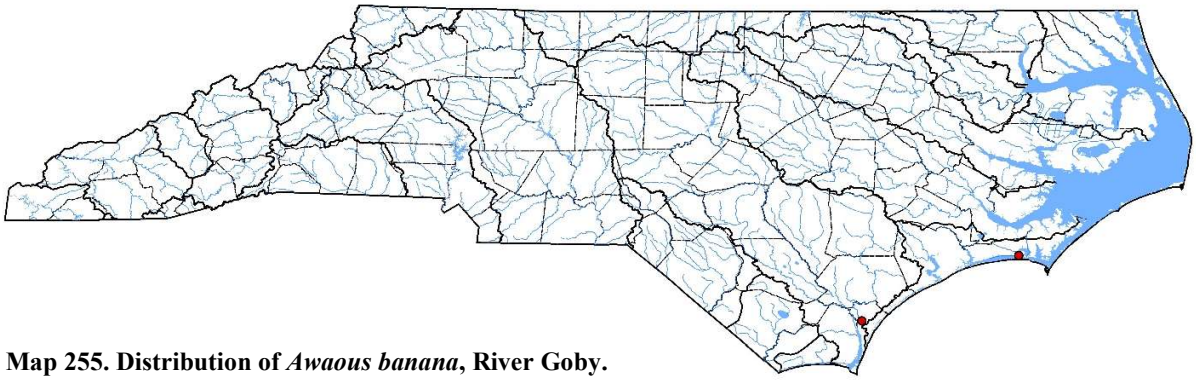
Map 254. Distribution of *Eleotris amblyopsis*, Largescaled Spinycheek Sleeper.

Gobiidae - Gobies

***Awaous banana* (Valenciennes, 1837). River Goby.**

River Goby was unknown from North Carolina until a single specimen was discovered in a fish kill in 1996 from Burnt Mill Creek in Wilmington (NCSM 30510; Cape Fear basin) (Map 255). It inhabits fresh to oligohaline streams and rivers from North Carolina to Venezuela (Ross and Rohde 2004).

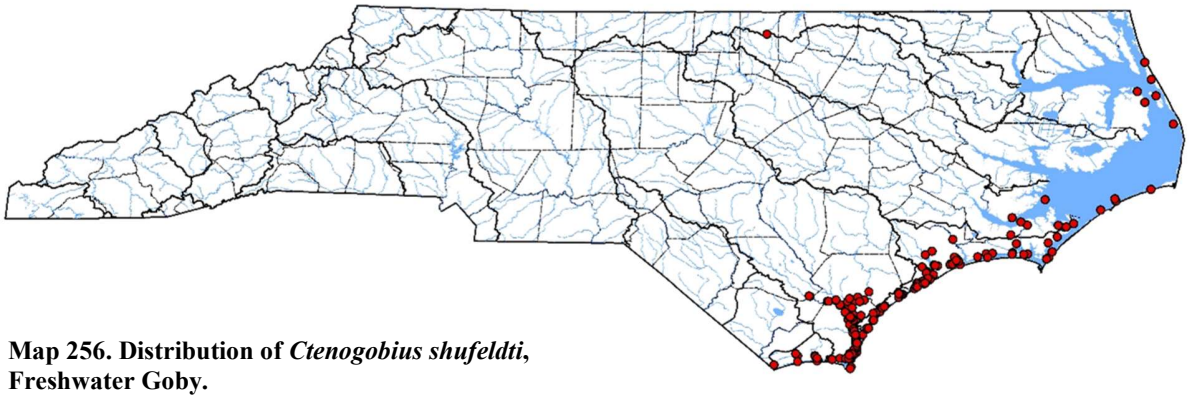
Remarks: In 2015, an apparently self-sustaining population was discovered in a stormwater retention pond in Morehead City in Carteret County (White Oak basin). This population has been present for at least four years, despite some mortalities from cold temperatures. River Goby was also found in 2017 in an unnamed creek near the Visitors Center in Morehead City. All three locations are near North Carolina's two shipping ports and this species may have been introduced from the release of ballast water.



Map 255. Distribution of *Awaous banana*, River Goby.

***Ctenogobius shufeldti* (Jordan and Eigenmann, 1887). Freshwater Goby.**

Freshwater Goby is known from the Shallotte to the Albemarle basins but is absent from the mainland side of Pamlico Sound in the Tar, Roanoke, and Chowan basins (Map 256). It is found in low to moderate salinity estuarine waters from the Albemarle Sound in North Carolina southward to east-central Florida and from northwestern Florida to Texas (Ross and Rohde 2004; Rohde et al. 2009).



Map 256. Distribution of *Ctenogobius shufeldti*, Freshwater Goby.

***Evorthodus lyricus* (Girard, 1858). Lyre Goby.**

Lyre Goby is found in the Cape Fear, White Oak, Neuse, and Albemarle basins (Ross et al. 1988; Ross and Rohde 2004) (Map 257). Its range extends from the Chesapeake Bay south to Brazil.

Map 257. Distribution of *Evorthodus lyricus*, Lyre Goby.

Paralichthyidae - Sand Flounders

***Paralichthys lethostigma* Jordan and Gilbert, 1884. Southern Flounder.**

Southern Flounder is found as a seasonal inhabitant in freshwater habitats along the coast from the Shallotte to the Albemarle basins (Map 258). It has been found in the Cape Fear River upstream near Lock and Dam No. 1 (Cape Fear basin), in the Neuse River as far upstream as at LaGrange (Neuse basin, NCSM 100001), in the Roanoke River as far upstream as at Weldon (Roanoke basin), and in the Chowan River as far upstream as at Arrowhead Beach (Chowan basin). Southern Flounder is at the northern limit of its range in North Carolina (Ross 1980).

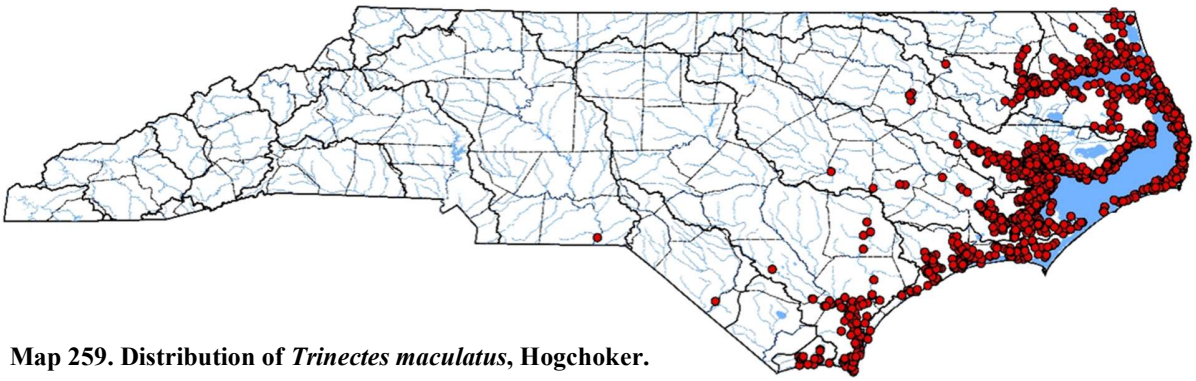
Map 258. Distribution of *Paralichthys lethostigma*, Southern Flounder.

Achiridae - American Soles

***Trinectes maculatus* (Bloch and Schneider, 1801). Hogchoker.**

Hogchoker is found in the lower Yadkin and Lumber basins and along the coast from the Shallotte and Cape Fear to the Albemarle basins, but not in the Waccamaw basin. It has been found upstream as far as Rockingham in the Yadkin basin, near Elizabethtown in the Cape Fear basin, near Raleigh in the Neuse basin (Evermann and Cox 1896), near Tarboro in the Tar basin, and near Scotland Neck in the Roanoke basin (Map 259).

Remarks: Hogchoker may seasonally ascend coastal rivers into fresh water as far upstream as the Fall Zone as a normal part of its life cycle (Burgess 1980e).



Map 259. Distribution of *Trinectes maculatus*, Hogchoker.

Data Availability

The distributional dataset that served as the basis for mapping species distributions is available on Zenodo (https://zenodo.org/badge/latestdoi/303499787).

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