

## “Minnow” Species (Families Cyprinidae, Xenocyprididae, and Leuciscidae) Diversity in North Carolina

Next to our native darters (Family Percidae), our native species of minnows rival the brightly colored tropical fishes one would find in your local or big-box pet store, yet few people are aware of their existence. “Minnows” until recently were classified in the family Cyprinidae, along with Common Carp, Goldfish, and Grass Carp. Our indigenous (native) species, 68 species in total, are now classified in the family Leuciscidae, a former subfamily of cyprinid fishes (Tan and Armbruster 2018). The nonindigenous (nonnative or introduced) Grass Carp is now classified in the family Xenocyprididae (Tan and Armbruster 2018); and the nonindigenous Common Carp and Goldfish remain in the family Cyprinidae.

There are 71 species of “minnows” in North Carolina (Table 1), including 13 species found in only one river basin (Table 2), 3 species waiting to be scientifically described, and a few which may be re-named or split into additional species (Tracy et al. 2020). The family Leuciscidae is our most diverse family of North Carolina’s freshwater fish assemblage (Tracy et al. 2020).

**Table 1. “Minnow” species (Families Cyprinidae, Xenocyprididae, and Leuciscidae) found in North Carolina. Common names enclosed within tick marks (“”) are scientifically undescribed species.**

Family, Scientific Name, American Fisheries Society Accepted Common Name	Family, Scientific Name, American Fisheries Society Accepted Common Name
<b>Cyprinidae</b>	<b>Leuciscidae</b>
<i>Carassius auratus</i> - Goldfish	<i>Nocomis raneyi</i> - Bull Chub
<i>Cyprinus carpio</i> - Common Carp	<i>Notemigonus crysoleucas</i> - Golden Shiner
<b>Xenocyprididae</b>	<i>Notropis alborus</i> - Whitemouth Shiner
<i>Ctenopharyngodon idella</i> - Grass Carp	<i>Notropis altipinnis</i> - Highfin Shiner
<b>Leuciscidae</b>	<i>Notropis amoenus</i> - Comely Shiner
<i>Campostoma anomalum</i> - Central Stoneroller	<i>Notropis bifrenatus</i> - Bridle Shiner
<i>Chrosomus oreas</i> - Mountain Redbelly Dace	<i>Notropis chalybaeus</i> - Ironcolor Shiner
<i>Clinostomus funduloides</i> - Rosyside Dace	<i>Notropis chiliticus</i> - Redlip Shiner
<i>Clinostomus</i> sp. "Hiwassee" Dace	<i>Notropis chlorocephalus</i> - Greenhead Shiner
<i>Clinostomus</i> sp. "Smoky" Dace	<i>Notropis cummingsae</i> - Dusky Shiner
<i>Cyprinella analostana</i> - Satinfish Shiner	<i>Notropis hudsonius</i> - Spottail Shiner
<i>Cyprinella chloristia</i> - Greenfin Shiner	<i>Notropis leuciodus</i> - Tennessee Shiner
<i>Cyprinella galactura</i> - Whitetail Shiner	<i>Notropis lutipinnis</i> - Yellowfin Shiner
<i>Cyprinella labrosa</i> - Thicklip Chub	<i>Notropis maculatus</i> - Taillight Shiner
<i>Cyprinella lutrensis</i> - Red Shiner	<i>Notropis mekistocholas</i> - Cape Fear Shiner
<i>Cyprinella monacha</i> - Spottail Chub	<i>Notropis micropteryx</i> - Highland Shiner
<i>Cyprinella nivea</i> - Whitefin Shiner	<i>Notropis petersoni</i> - Coastal Shiner
<i>Cyprinella pyrrhomelas</i> - Fieryblack Shiner	<i>Notropis photogenis</i> - Silver Shiner
<i>Cyprinella spiloptera</i> - Spottail Shiner	<i>Notropis procne</i> - Swallowtail Shiner
<i>Cyprinella zanema</i> - Santee Chub	<i>Notropis rubricroceus</i> - Saffron Shiner
<i>Cyprinella</i> sp. "Thinlip" Chub	<i>Notropis scabriceps</i> - New River Shiner
<i>Erimystax insignis</i> - Blotched Chub	<i>Notropis szepticus</i> - Sandbar Shiner
<i>Exoglossum laurae</i> - Tonguetied Minnow	<i>Notropis spectrunculus</i> - Mirror Shiner
<i>Exoglossum maxillingua</i> - Cutlip Minnow	<i>Notropis telescopus</i> - Telescope Shiner
<i>Hybognathus regius</i> - Eastern Silvery Minnow	<i>Notropis volucellus</i> - Mimic Shiner
<i>Hybopsis amblops</i> - Bigeye Chub	<i>Notropis</i> sp. "Kanawha" Rosyface Shiner
<i>Hybopsis hypsinotus</i> - Highback Chub	<i>Notropis</i> sp. "Piedmont" Shiner
<i>Hybopsis rubrifrons</i> - Rosyface Chub	<i>Phenacobius crassilabrum</i> - Fatlip Minnow
<i>Luxilus albeolus</i> - White Shiner	<i>Phenacobius teretulus</i> - Kanawha Minnow
<i>Luxilus cerasinus</i> - Crescent Shiner	<i>Pimephales notatus</i> - Bluntnose Minnow
<i>Luxilus chrysocephalus</i> - Striped Shiner	<i>Pimephales promelas</i> - Fathead Minnow
<i>Luxilus coccogenis</i> - Warpaint Shiner	<i>Rhinichthys atratulus</i> - Eastern Blacknose Dace
<i>Lythrurus ardens</i> - Rosefin Shiner	<i>Rhinichthys cataractae</i> - Longnose Dace
<i>Lythrurus matutinus</i> - Pinewood Shiner	<i>Rhinichthys obtusus</i> - Western Blacknose Dace
<i>Nocomis leptocephalus</i> - Bluehead Chub	<i>Semotilus atromaculatus</i> - Creek Chub
<i>Nocomis micropogon</i> - River Chub	<i>Semotilus lumbee</i> - Sandhills Chub
<i>Nocomis platyrhynchus</i> - Bigmouth Chub	

**Table 2. “Minnow” species found in only one river basin in North Carolina.**

River Basin	Species
New	Bigmouth Chub, New River Shiner, Kanawha Minnow, <i>Notropis</i> sp. "Kanawha" Rosyface Shiner, Tonguetied Minnow
Little Tennessee	<i>Clinostomus</i> sp. "Smoky" Dace
Hiwassee	<i>Clinostomus</i> sp. "Hiwassee" Dace
Savannah	Rosyface Chub
Catawba	Greenhead Shiner
Broad	<i>Notropis</i> sp. "Piedmont" Shiner
Roanoke	Eastern Blacknose Dace, Cutlip Minnow
Cape Fear	Cape Fear Shiner

You might have heard people calling them Horny-Heads, Baltimore Minnows, Minnows, Knotty Heads, Horned Daces, Shad Roaches, Spawn Eaters, Minners, Crappie Minnows, or many other colloquial names. Each species has an American Fisheries Society-accepted common name (Page et al. 2013) and a scientific (Latin) name (Table 1; Appendix 1). Fourteen species of minnows were scientifically described from North Carolina (Table 3; Tracy et al 2020) of which eight species were describe by Edward Drinker Cope in 1870 (Cope 1870b).

**Table 3. Species of “minnows” scientifically described from North Carolina.**

Common Name	Scientific Name	Type Locality
Thicklip Chub	<i>Cyprinella labrosa</i> (Cope) 1870	Clear and rapid creeks, which flow into waters of the upper Catawba River, McDowell and Burke Cos.
Whitefin Shiner	<i>Cyprinella nivea</i> (Cope) 1870	The upper waters of the Catawba River
Fierlyblack Shiner	<i>Cyprinella pyrrhomelas</i> (Cope) 1870	Tributaries of the upper Catawba River
Highback Chub	<i>Hybopsis hypsinotus</i> (Cope) 1870	Creeks heading the Catawba River, McDowell Co., or tributary to the Yadkin River, Rowan Co.
Pinewoods Shiner	<i>Lythrurus matutinus</i> (Cope) 1870	Neuse River, Wake Co.
Bluehead Chub	<i>Nocomis leptcephalus</i> (Girard) 1856	Salem, Forsyth Co.
Whitemouth Shiner	<i>Notropis alborus</i> Hubbs & Raney 1947	Brush Creek, 5 miles west of Siler City, Randolph Co.
Highfin Shiner	<i>Notropis altipinnis</i> (Cope) 1870	Yadkin River, Rowan Co.
Redlip Shiner	<i>Notropis chiliticus</i> (Cope) 1870	Tributaries to the Yadkin River, Rowan Co.
Greenhead Shiner	<i>Notropis chlorocephalus</i> (Cope) 1870	Tributaries of the Catawba River
Dusky Shiner	<i>Notropis cummingsae</i> Myers 1925	Upper Burnt Mill Creek, underneath the wooden railroad bridge, New Hanover Co.
Cape Fear Shiner	<i>Notropis mekistocholas</i> Snelson 1971	Rocky River at NC 902, Chatham Co.
Coastal Shiner	<i>Notropis petersoni</i> Fowler 1942	Crane Creek below US 1 bridge, Moore Co.
Sandhills Chub	<i>Semotilus lumbee</i> Snelson & Suttkus 1978	Tributary of Aberdeen Creek at culvert on US 1, 0.5 airmile SW junction US 1 and US 15 in center of Aberdeen, Moore Co.

No species have been extirpated from our state, but three species have been extirpated from a portion of their native ranges. For example, Spotfin Chub is no longer found in the French Broad basin; Spotfin Shiner is now absent from the Hiwassee basin as is Eastern Silvery Minnow from the Waccamaw basin. And because many minnow species are endemic to specific basins, 18 species are considered imperiled in North Carolina (Table 5; NCAC 2017; NCWRC 2017; NCNHP 2020).

**Table 5. Imperiled “minnow” species in North Carolina (NCAC 2017, NCNHP 2020, and NCWRC 2017). \*Federally Endangered; \*\*Federally Threatened.**

Level of Imperilment	Species
Endangered	Bridle Shiner, Cape Fear Shiner*
Threatened	Spotfin Chub**, Rosyface Chub, Mimic Shiner
Special Concern	<i>Clinostomus</i> sp. "Hiwassee" Dace, <i>Clinostomus</i> sp. "Smoky" Dace, Cutlip Minnow, <i>Cyprinella</i> sp. "Thinlip" Chub, Striped Shiner, Yellowfin Shiner, Kanawha Minnow, Sandhills Chub
Significantly Rare	Blotched Chub, Tonguetied Minnow, Ironcolor Shiner, Highland Shiner, <i>Notropis</i> sp. "Kanawha" Rosyface Shiner

A few superlatives associated with our “minnow” fauna:

1. Two species are found in each of our 21 river basins -- Common Carp and Golden Shiner

2. Two species are found nowhere else in the World – Pinewoods Shiner, and Cape Fear Shiner
3. The smallest and largest native species -- Bridle Shiner (~50 mm Standard Length) and Ironcolor Shiner (~55 mm Standard Length) and Bull Chub (~270 mm Standard Length)
4. The prettiest species (in our opinion) – Mountain Redbelly Dace, Fieryblack Shiner, Warpaint Shiner, and Taillight Shiner
5. The most non-descript species (in our opinion) -- Eastern Silvery Minnow
6. Most unusual looking mouth and lips (in our opinion) – Cutlip Minnow, Tonguetied Minnow, Kanawha Minnow, and Fatlip Minnow
7. The rarest species – Bridle Shiner
8. The most geographically restricted species – Cape Fear Shiner, Tonguetied Minnow, Cutlip Minnow, Spotfin Chub, Rosyface Chub, Yellowfin Shiner, Bridle Shiner, Striped Shiner, Notropis sp. “Kanawha” Rosyface Shiner, Kanawha Minnow, New River Shiner, Bigmouth Chub, and Sandhills Chub
9. The most commonly encountered and abundant species -- Central Stoneroller (Mountains), Bluehead Chub (Piedmont), and Dusky Shiner, Highfin Shiner, and Swallowtail Shiner (Coastal Plain)

Indigenous vs. Nonindigenous Species (Table 4)

1. 3 species introduced into North Carolina from outside the U.S. – Common Carp, Grass Carp, and Goldfish
2. 2 species introduced into North Carolina from other states – Red Shiner and Fathead Minnow
3. 20 species that are indigenous to North Carolina have been introduced into other basins within North Carolina
4. These introductions are often the result of bait bucket dumping by fishermen, or for aquatic plant management (Grass Carp), or historically by the aquaculture trade (Common Carp)

**Table 4. “Minnow” species that have been introduced into North Carolina from outside the United States (\*), from outside North Carolina (\*\*), or which have been transferred from one river basin into a new river basins from within North Carolina.**

Family, Species	Family, Species
<b>Cyprinidae</b>	<b>Leuciscidae</b>
Goldfish*	Rosefin Shiner
Common Carp*	Bluehead Chub
<b>Xenocyprididae</b>	Golden Shiner
Grass Carp*	Whitemouth Shiner
<b>Leuciscidae</b>	Comely Shiner
Central Stoneroller	Redlip Shiner
Mountain Redbelly Dace	Tennessee Shiner
Rosyside Dace	Yellowfin Shiner
Greenfin Shiner	Swallowtail Shiner
Whitetail Shiner	Saffron Shiner
Red Shiner**	Mirror Shiner
Highback Chub	Mimic Shiner
Crescent Shiner	Fathead Minnow**
Warpaint Shiner	

In terms of species diversity:

1. The basin with the most number of species – Catawba with 27 indigenous and 7 nonindigenous species
2. The basin with the fewest number of species - Shallotte with 4 indigenous (Golden Shiner, Ironcolor Shiner, Dusky Shiner, and Coastal Shiner) and 2 nonindigenous (Grass Carp and Common Carp)
3. The basin with the most number of introduced species - Yadkin with 12 nonindigenous species - Goldfish, Common Carp, Grass Carp, Central Stoneroller, Mountain Redbelly Dace, Red Shiner, Greenfin Shiner, Warpaint Shiner, Rosefin Shiner, Comely Shiner, Swallowtail Shiner, and Fathead Minnow

4. The basins with least number of introduced species - Albemarle, Shallotte, and Waccamaw, each with two species (Common Carp and Grass Carp)

Key characteristics for their proper identification include the presence/absence of a frenum; lateral stripe width and length; lateral line scale count; the number of un-pored lateral line scales; the positioning and pigmentation of the dorsal fin, the anal ray count, presence of spines vs. rays, the position of the mouth, the pharyngeal teeth count, the presence/absence and length and shape of maxillary barbels, the overall color pattern; and the geographical distributions of the species. Many species can easily be told apart from one another. However, the identification of minnows with 7 or 8 anal rays and immature and female *Nocomis* spp., where species co-occur, can be very challenging.

**Identification Key to the Species of Barbs and Carps, Asian Carps, and Minnows (Families Cyprinidae, Leuciscidae, and Xenocyprididae) in North Carolina**

- 1a. Dorsal fin long with a stout, saw-toothed spine-like ray anteriorly, followed by 13 or more branched rays. Anal fin also preceded by a stout, spine-like ray.....Family Cyprinidae, 2
- 1b. Dorsal fin long without a stout, saw-toothed spine-like ray anteriorly, followed by 12 or fewer branched rays. Anal fin also without a stout, spine-like ray .....3
- 1a. One pair of fleshy barbels on each side located near the corner of the mouth on the upper jaw (Figure 1). Lateral line scale 35-39 .....Common Carp, *Cyprinus carpio*
- 2b. Barbels absent (Figure 2). Lateral line scales 28-32 ..... Goldfish, *Carassius auratus*



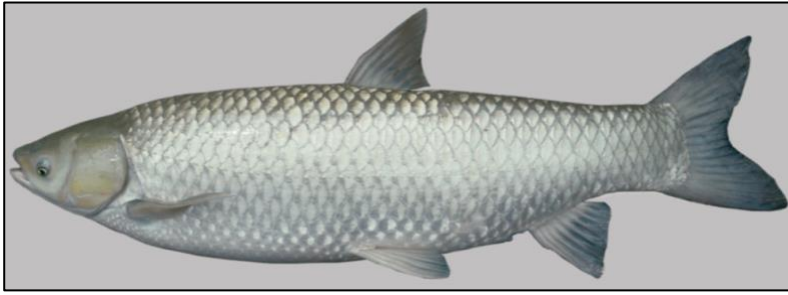
**Figure 1. Left – Yellow color morph of Common Carp; Right – Nishikigoi ornamental carp strain (popularly called “Koi”) Common Carp. Photograph of yellow Common Carp courtesy of J. Michael Swing; photograph of “Koi” courtesy of David Coughlan.**



**Figure 2. Pet shop Goldfish.**

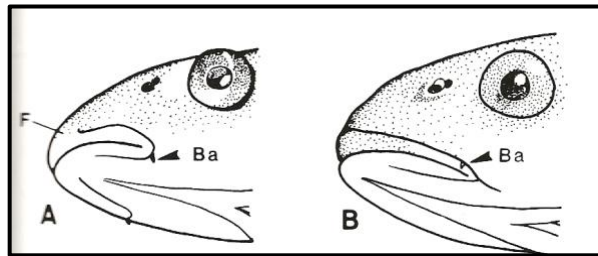
- 2a. Distance from anal fin origin to tip of snout 3 or more times as long as the distance from the anal fin origin to the caudal fin base (Figure 3). Pharyngeal teeth comb-like..... Family Xenocyprididae, Grass Carp, *Ctenopharyngodon idella*
- 3b. Distance from anal fin origin to tip of snout less than 3 times as long as the distance from the anal fin origin to the caudal fin base. Pharyngeal teeth not comb-like .....Family Leuciscidae, 4





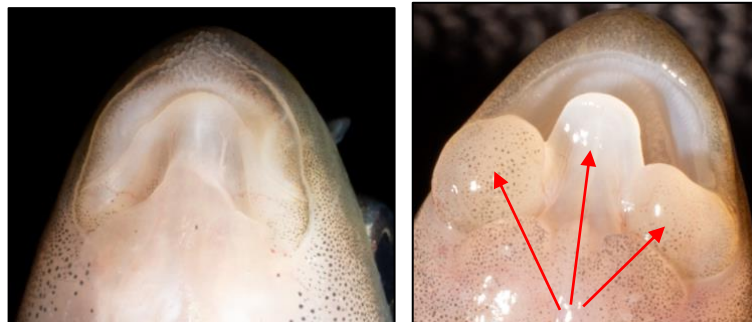
**Figure 3. Grass Carp**

- 3a. Frenum present; premaxillae nonprotractile, attached to the snout with skin (Figure 4).....5
- 4b. Frenum absent; premaxillae protractile, separated from the snout by a groove (Figure 4).....9



**Figure 4. Left (A) - frenum (F) and barbel (Ba) present; Right (B) frenum absent and barbel present (Ba).**

- 1a. Lower lip appears deformed and split; central part cartilaginous, sides lobes fleshy .....6
- 5b. Lower lip normal, central part not cartilaginous and stiff .....7
- 2a. Barbel present. Lower jaw tapers gradually anteriorly, not lobed, not producing a 3-lobed outline (Figure 5). Range restricted to the New basin (Figure 6) .....  
..... Tonguetied Minnow, *Exoglossum laurae*
- 6b. Barbel absent. Lower jaw lobes produce a 3-lobed outline anteriorly (Figure 5). Range restricted to the upper Roanoke basin (Figure 6) ..... Cutlip Minnow, *Exoglossum maxillingua*

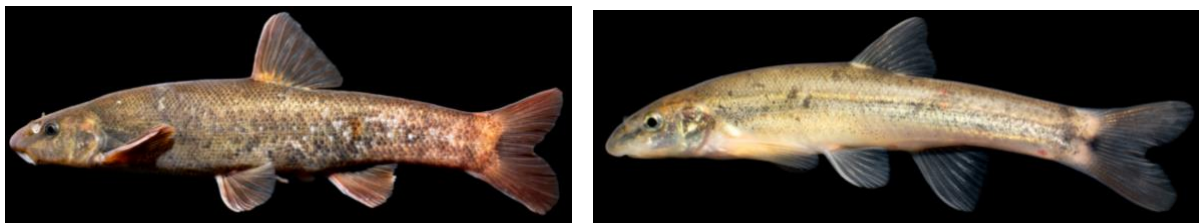


**Figure 5. Ventral view of the mouths of *Exoglossum*. Left – Tonguetied Minnow; Right – Cutlip Minnow with red arrows pointing to tri-lobed lower jaw.**



**Figure 6. Left – Tonguetied Minnow; Right – Cutlip Minnow.**

- 3a. Mouth very inferior, projecting well forward of the mouth. Distance from snout tip to anterior point of lower jaw about equal to or greater than the diameter of the eye (Figure 7)..... Longnose Dace, *Rhinichthys cataractae*
- 7b. Mouth terminal or subterminal. Snout projecting barely forward of the mouth. Distance from snout tip to anterior port of the lower jaw less than the diameter of the eye .....8

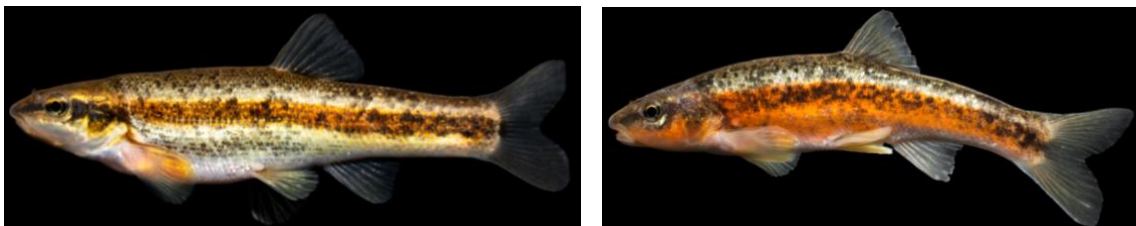


**Figure 7. Longnose Dace.**

- 4a. Lateral line scales (46)51-58 (63). Breeding males with a re-orange band that occurs adjacent to and above black lateral stripes (and some slightly below it) (Figure 8). Range currently restricted to the upper Dan River (Roanoke basin)..... Eastern Blacknose Dace, *Rhinichthys atratulus*
- 8b. Lateral line scales (56)57-64 (70). In breeding males the black lateral stripe is replaced by a red-orange band (Figure 9). Range not currently restricted to the upper Roanoke basin ..... Western Blacknose Dace, *Rhinichthys obtusus*



**Figure 8. Eastern Blacknose Dace. Left – Male; Right – Female. Photographs courtesy of Robert Criswell.**



**Figure 9. Western Blacknose Dace. Left – Male from the New basin; Right –Male from the Little Tennessee basin.**

- 5a. Lower jaw with a firm cartilaginous ridge (Figure 10).....Central Stoneroller, *Campostoma anomalum*
- 9b. Lower jaw lacking a firm cartilaginous ridge ..... 10



**Figure 10. Left - Ventral view of the mouth of Central Stoneroller with red arrow pointing to the cartilaginous ridge. Right – Central Stoneroller.**

- 6a. Barbel usually present (occasionally lacking in Highback Chub), located in groove above the maxilla at or slightly anterior to the posterior end of the maxilla ..... 11
- 10b. Barbel absent. If barbel is present, then dorsal fin membranes are profusely infused with pigment, either anteriorly, posteriorly, or across the base of the dorsal fin ..... 20
- 7a. Barbel flat and triangular, located in maxillary (upper jaw) groove anterior to end of the jaw ..... 12
- 11b. Barbel conical, located at posterior tip of the maxilla ..... 13
- 8a. Eight dorsal fin rays. Dark spot near dorsal fin origin (Figure 11). Lateral line scales 49-57. Widespread, not restricted to the Sand Hills ecoregion of the Cape Fear, Lumber, and Yadkin basins ..... Creek Chub, *Semotilus atromaculatus*
- 12b. Nine dorsal fin rays. No dark spot near dorsal fin origin (Figure 11). Lateral line scales 46-48. Restricted to the Sand Hills ecoregion of the Cape Fear, Lumber, and Yadkin basins ..... Sandhills Chub, *Semotilus lumbee*



**Figure 11. Left – Creek Chub with white arrow pointing to the dark spot near the dorsal fin origin; Right – Sandhills Chub.**

- 9a. Eye large and mouth small. Eye larger than or equal to upper jaw. Mouth distinctly subterminal to inferior, nearly horizontal ..... 14
- 13b. Eye small and mouth large. Eye smaller than upper jaw. Mouth subterminal, often oblique ..... 17

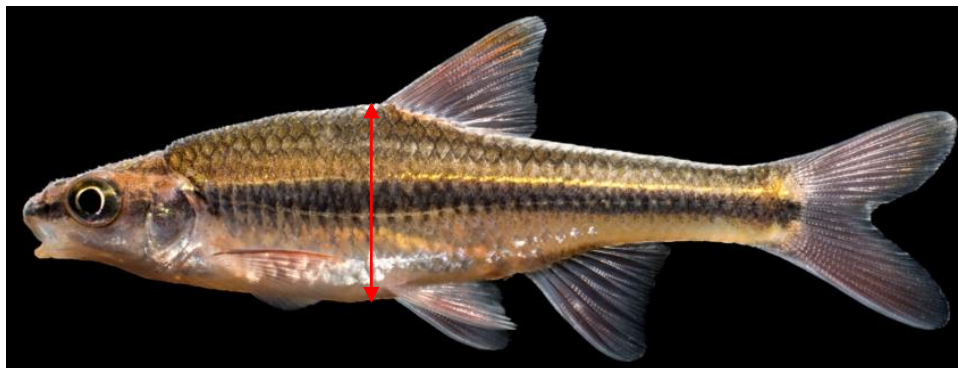


- 10a. Lateral blotches along the sides (Figure 12). Pharyngeal teeth 4-4.....  
 ..... Blotched Chub, *Erimystax insignis*
- 14b. No lateral blotches along the sides. Pharyngeal teeth 1,4-4,1 ..... 15



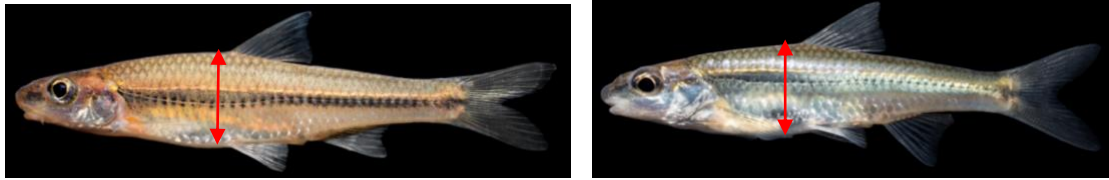
**Figure 12. Blotched Chub.**

- 11a. Breast well scaled. Body thick (Figure 13). Barbel sometimes absent. Predorsal scales 15-20. Restricted to the Broad, Catawba, and Yadkin basins; introduced into the Little River watershed in the New basin..... Highback Chub, *Hybopsis hysinotus*
- 15b. Breast naked or with embedded scales scaled. Body thin (Figure 14). Barbel sometimes absent in Bigeye Chub. Predorsal scales 12-15. Restricted to the Savannah and to the Nolichucky, French Broad, Pigeon, and Hiwassee basins ..... 16



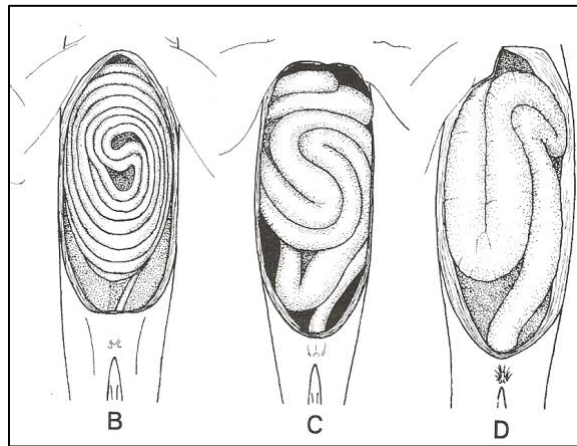
**Figure 13. Highback Chub with red arrows pointing to the relative thickness of the body.**

- 12a. Eye width 1.2 times into snout length. Barbel about one-half the length of the pupil. Restricted to the Savannah basin (Figure 14) ..... Rosyface Chub, *Hybopsis rubrifrons*
- 16b. Eye width equal to snout length. Barbel less than one-half the length of the pupil, often absent. Restricted to the Nolichucky, French Broad, Pigeon, and Hiwassee basins (Figure 14) .....  
 ..... Bigeye Chub, *Hybopsis amblops*



**Figure 14. Red arrows pointing to the relative thinness of the body. Left – Rosyface Chub; Right – Bigeye Chub.**

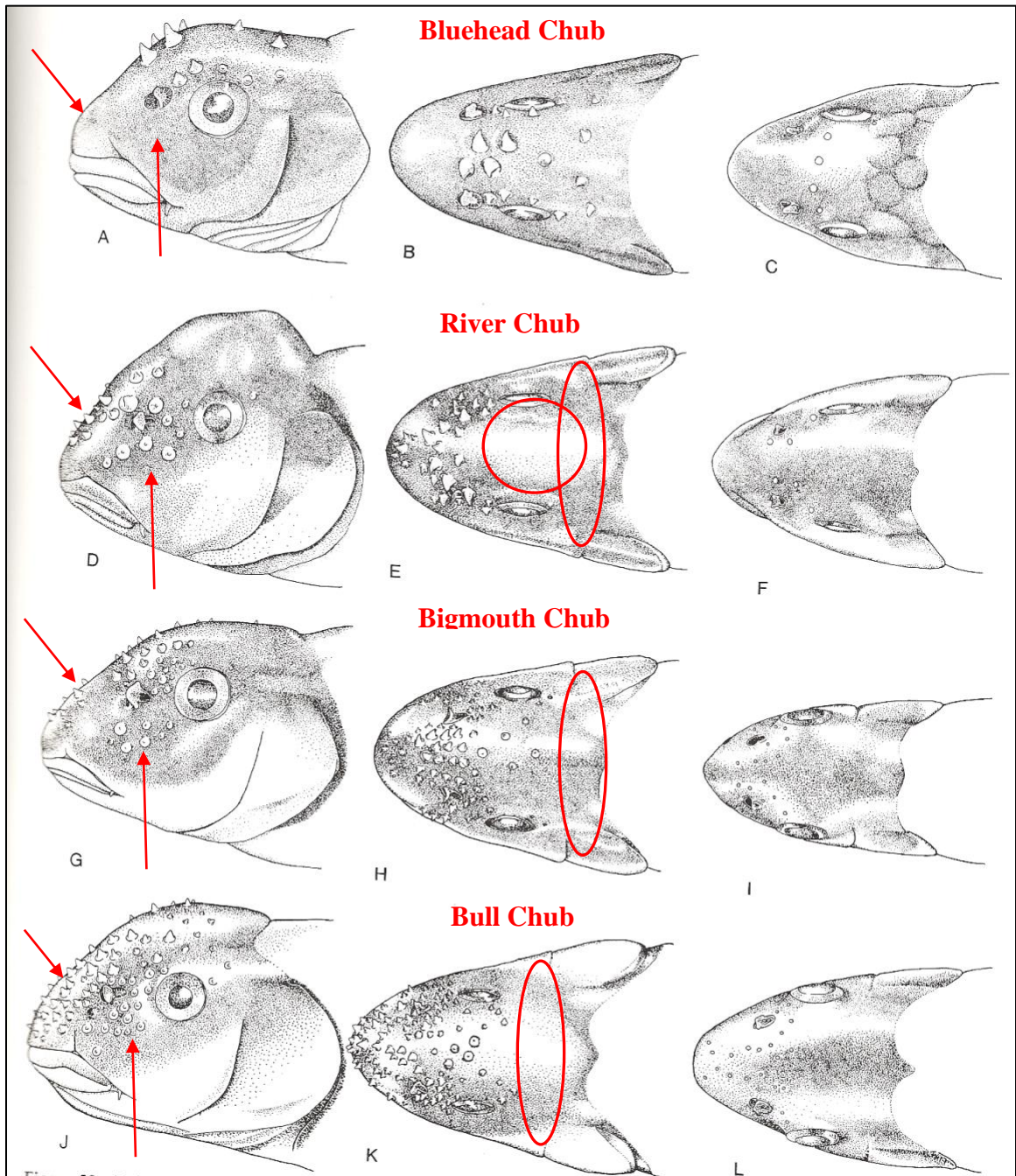
- 13a. Head tubercles or scars present in prenasal and subnasal areas in adult males (Figure 15). Upon dissection, intestine with a simple S-shaped configuration (Figure 16)..... 18
- 17b. Head tubercles or scars absent from prenasal and subnasal area in adult males (Figure 15). Upon dissection, intestine moderately whorled (Figure 16) (Figure 17).....  
 ..... Bluehead Chub, *Nocomis leptocephalus*



**Figure 16. Examples of intestinal coiling in Eastern Silvery Minnow (B), Bluehead Chub (C), and Bull Chub (D).**



**Figure 17. Bluehead Chub with red arrows pointing to tubercle scars atop the head, absent from the nasal and subnasal areas, and maxillary barbel.**



**Figure 15. Left – Tuberculation in *Nocomis*. Left and center column – nuptial crested males. Right column – juveniles. Red arrows pointing to prenasal and subnasal areas. Red circle and ovals showing an absence of tubercles in the interorbital and occipital areas.**

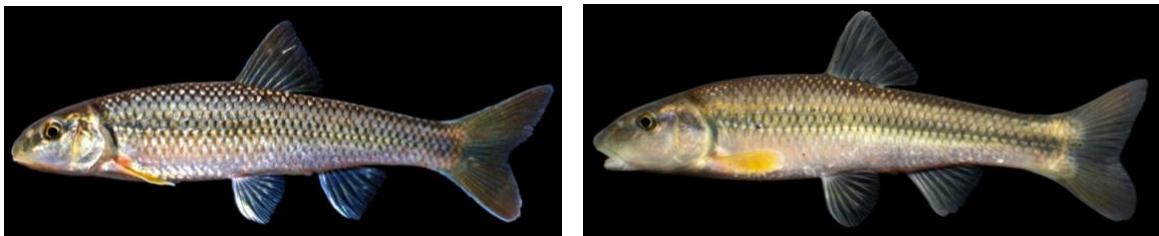
- 14a. Tubercles usually fewer than 60 on head, do not extend into interorbital area (Figure 15). Predorsal circumferential scales usually 30-33 (Figure 18) .....River Chub, *Nocomis micropogon*
- 18b. Tubercles 60-200 on head in specimens longer than 100 mm, extending into interorbital area (Figure 15). Predorsal circumferential scales usually 32-36..... 19





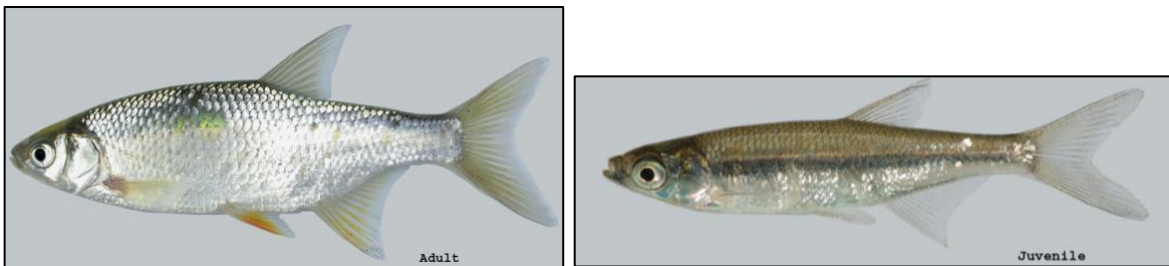
**Figure 18. River Chub with red arrows pointing to the tubercle scars absent from atop the head, but present in the nasal and subnasal areas.**

- 15a. Range restricted to the Neuse, Tar, and Roanoke basins (Figure 19) .....Bull Chub, *Nocomis biguttatus*
- 19b. Range restricted to the New basin (Figure 19) ..... Bigmouth Chub, *Nocomis biguttatus*



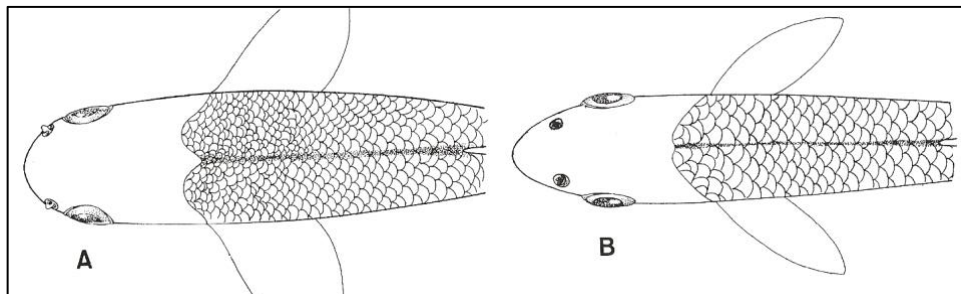
**Figure 19. Left – Bull Chub; Right – Bigmouth Chub.**

- 16a. Midline of belly between pelvic fins and anal fin with a nonscaled ridge (keel). Anal fin falcate with 12 or more rays. Lateral line strongly curved downward. Black lateral stripe on young (Figure 20) .  
.....Golden Shiner, *Notemigonus crysoleucas*
- 20b. Midline of belly between pelvic fins and anal fin without a nonscaled ridge (keel). Anal fin not falcate with 11 or fewer rays. Lateral line not strongly curved downward..... 21



**Figure 20. Golden Shiner. Left – Adult; Right – Juvenile.**

- 17a. Predorsal scales smaller than lateral scales, appear crowded behind the head. (Figure 21). First dorsal fin ray in adult short and stout, separated from first principal ray by a membrane ..... 22
- 21b. Predorsal scales nearly same size as lateral scales, not crowded (Figure 21). First dorsal fin ray in adult slender, not separated from first principal ray by a membrane ..... 23



**Figure 21. Predorsal squamation. Left (A) – Scales small and crowded anteriorly; Right (B) – typical scale pattern.**

- 18a. Lateral line complete. Basicaudal spot distinct. Mouth inferior, almost horizontal (Figure 22), Restricted to the New, Nolichucky, French Broad, and Hiwassee basins ..... Bluntnose Minnow, *Pimephales notatus*
- 22b. Lateral line usually incomplete. Basicaudal spot indistinct or absent. Mouth nearly terminal, oblique (Figure 22). Nonindigenous, introduced as a bait fish, wide-spread ..... Fathead Minnow, *Pimephales promelas*



**Figure 22. Left – Bluntnose Minnow; Right – Fathead Minnow. Photograph of Fathead Minnow courtesy of the North American Native Fishes Association.**

- 19a. Lateral line short or absent. Scales small and thin, difficult to observe. Lateral line scales 70-90 (Figure 23) ..... Mountain Redbelly Dace, *Chrosomus oreas*
- 23b. Lateral line usually complete. Scales clearly visible. Lateral line scales less than 70 ..... 24



**Figure 23. Mountain Redbelly Dace.**

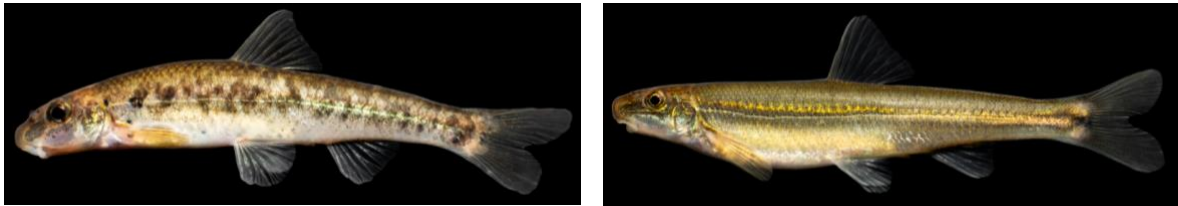


- 20a. Lips papillose, sucker-like; lower lip forms a fleshy lobe (Figure 24). Mouth inferior ..... 25
- 24b. Lips not papillose. Mouth seldom inferior ..... 26



**Figure 24. Fatlips Minnow with red arrows pointing to the inferior mouth with papillose lips.**

- 21a. Lateral line scales 44-49. Basicaudal spot usually absent (Figure 25). Restricted to the New Basin .....Kanawha Minnow, *Phenacobius teretulus*
- 25b. Lateral line scales 52-58. Basicaudal spot distinct to faint (Figure 25). Restricted to the Nolichucky, French Broad, and Little Tennessee basins ..... Fatlips Minnow, *Phenacobius crassilabrum*



**Figure 25. Left – Kanawha Minnow; Right – Fatlips Minnow.**

- 22a. Mouth large, upper jaw extends beyond front of pupil. Mouth usually slightly superior, oblique. Chin elongate, lower jaws converge inwardly when viewed from below ..... 27
- 26b. Mouth small, upper jaw seldom reaches to pupil. Mouth usually terminal or subterminal; angle variable. Chin wide, lower jaws do not converge inwardly when viewed from below..... 28
- 23a. Restricted to the Hiwassee basin (Figure 26) .....*Clinostomus* sp. “Hiwassee” Dace
- 27b. Restricted to the Little Tennessee basin (Figure 26) .....*Clinostomus* sp. “Smoky” Dace
- 27c. Widely distributed from the Piedmont to the New and to seven of the Atlantic slope basins; introduced into the Little Tennessee, French Broad, Nolichucky, and Watauga basins (Figure 26) .  
..... Rosyside Dace, *Clinostomus funduloides*



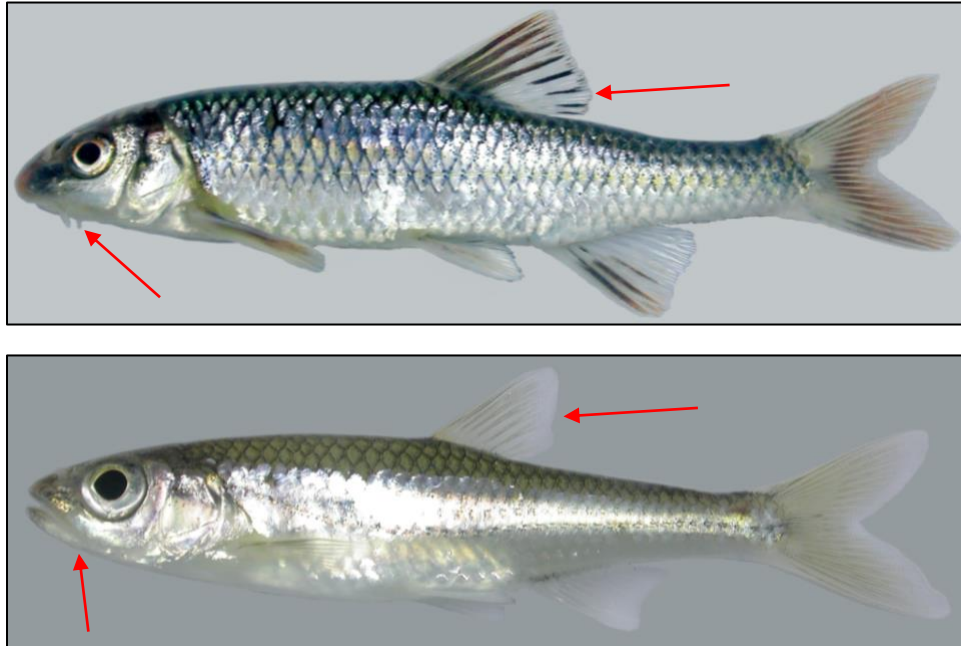
**Figure 26. Top – *Clinostomus* sp. “Hiwassee” Dace; Middle – *Clinostomus* sp. “Smoky” Dace, and Bottom – Rosyside Dace.**

- 24a. Mouth small, crescent shaped. Small groove along anteroventral edge of lachrymal extends markedly dorsad from groove that separates side of snout from upper lip. Sides with silvery or dusky lateral stripe (Figure 27). Upon dissection, intestine long and strongly coiled (Figure 16) ..... Eastern Silvery Minnow, *Hybognathus regius*
- 28b. Mouth usually large, except in Cape Fear Shiner. Upon dissection, intestine short and not long or strongly coiled, except in Cape Fear Shiner ..... 29



**Figure 27. Eastern Silvery Minnow with red arrows pointing to the small mouth and lachrymal groove.**

- 25a. Dorsal fin interradi al membranes profusely infused with black pigment, either anteriorly, posteriorly, or across the base of the dorsal fin (Figure 28). Maxillary barbel present or absent (Figure 28). Anterolateral scales with a diamond-shaped pattern, in distinct diagonal rows ..... 30
- 29. Dorsal fin interradi al membranes not profusely infused with black pigment, either anteriorly, posteriorly, or across the base of the dorsal fin (Figure 28). Maxillary barbel absent (Figure 28). Anterolateral scales not usually with a diamond-shaped pattern, seldom in distinct diagonal rows .. ..... 40



**Figure 28. Top – Red arrows pointing to dorsal fin membranes with black pigment and maxillary barbel; Bottom – Red arrows pointing to dorsal fin membranes without black pigment and maxillary barbel absent.**

- 26a. Maxillary barbel present ..... 31
- 30b. Maxillary barbel absent ..... 34
- 27a. Maxillary barbel small. Currently restricted to the Little Tennessee basin (Figure 29).....  
.....Spotfin Chub, *Cyprinella monacha*
- 31b. Maxillary barbel not small. Restricted to the Broad, Catawba, Yadkin, Lumber, or Cape Fear basins ..... 32



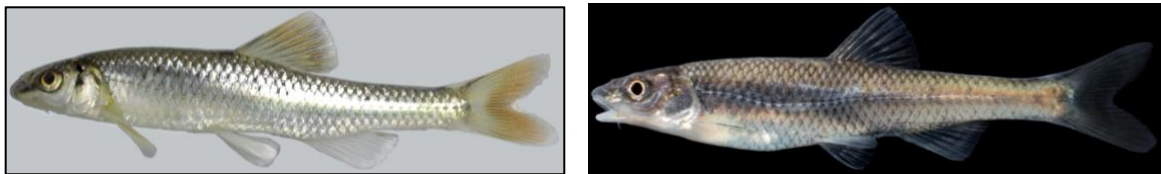
**Figure 29. Spotfin Chub. Photograph courtesy of the North Carolina Wildlife Resources Commission**

- 28a. Dorsal fin origin approximately over origin of pelvic fin (Figure 30). Anal fin slightly pointed; margin nearly straight. Small, dark blotches and cross hatching on back and side. Body deep, depth going 4.3-4.8 times into Standard Length..... Thicklip Chub, *Cyprinella labrosa*
- 32b. Dorsal fin origin 2 or 3 scales behind origin of pelvic fin (Figure 30). Anal fin not pointed; margin nearly rounded. No dark blotches and cross hatching on back and side. Body slender, depth going 5.0-5.7 times into Standard Length..... 33



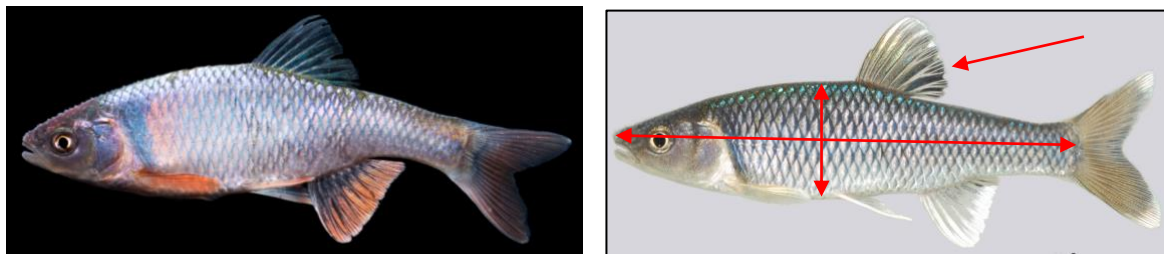
**Figure 30. Left - Thicklip Chub showing dorsal fin origin approximately over origin of pelvic fin; Right – Santee Chub showing dorsal fin origin 2 or 3 scales behind origin of pelvic fin.**

- 29a. Barbel long, going 1.2-1.5 times into pupil width. Upper lip broad, length going less than 2 times into pupil width. 16-18 predorsal scales. Restricted to the Broad and Catawba basins (Figure 31) ..... Santee Chub, *Cyprinella zanema*
- 33b. Barbel short, going 2.0-2.2 times into pupil width. Upper lip thin, length going more than 2 times into pupil width. 19-22 predorsal scales. Restricted to the lower Yadkin, Lumber, and Cape Fear basins (Figure 31)..... *Cyprinella* sp. "Thinlip" Chub



**Figure 31. Left - Santee Chub; Right – Thinlip Chub.**

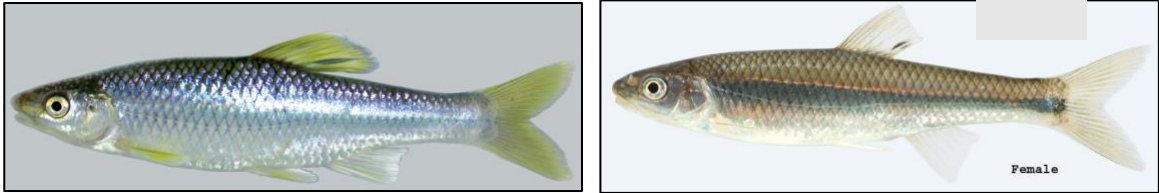
- 30a. Entire dorsal fin evenly pigmented. Body deep in adults, depth going less than 3.6 times in Standard Length (Figure 32).....Red Shiner, *Cyprinella lutrensis*
- 34b. Dorsal fin pigmentation restricted to or concentrated in last 2 or 3 interradial membranes. Body slender, depth going usually more than 3.6 times in Standard Length (Figure 32)..... 35



**Figure 32. Left – Red Shiner; Right – Satinfish Shiner with red arrows pointing to the dorsal fin pigmentation concentrated in last 3 interradial membranes and slender body depth going more than 3.6 times in Standard Length.**

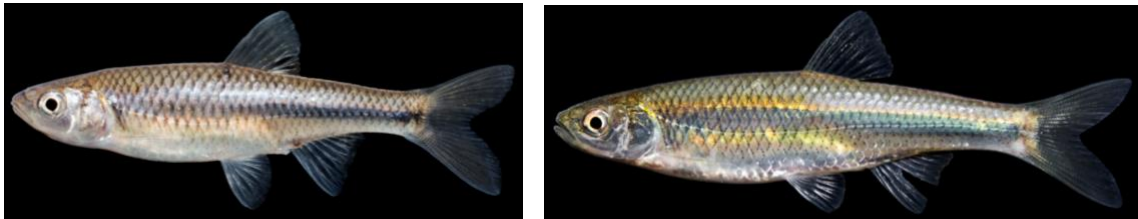


- 31a. Anal fin rays modally 8, rarely 9 ..... 36
- 35b. Anal fin rays modally 9-11 ..... 38
- 32a. Predorsal circumferential scales above lateral line 15 (13-15). Lateral line scales 37-40. Lateral stripe black, distinct anterior to dorsal fin origin. Mouth inferior, snout extends beyond upper lip a distance equal to width of upper lip (Figure 33) ..... Whitefin Shiner, *Cyprinella nivea*
- 36b. Predorsal circumferential scales above lateral line 11-13. Lateral line scales 35-38 (Spotfin Shiner) or 32-35 (Greenfin Shiner). Lateral stripe not distinct anterior of dorsal fin origin. Mouth usually subterminal, slightly oblique ..... 37



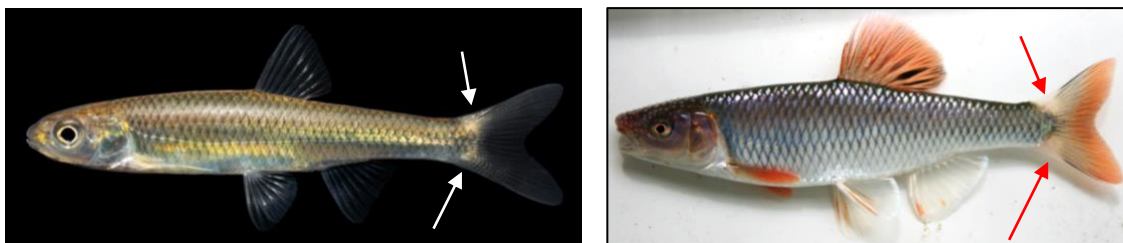
**Figure 33. Left – Male Whitefin Shiner; Right – Female Whitefin Shiner showing lateral stripe extending past the dorsal fin origin.**

- 33a. Predorsal circumferential scales above lateral line 11, rarely 13. Lateral line scales 32-35. Range restricted to the Broad and Catawba basins (one record from the Yadkin basin) (Figure 34) ..... Greenfin Shiner, *Cyprinella chloristia*
- 37b. Predorsal circumferential scales above lateral line 13. Lateral line scales 35-38. Range restricted to the New, Nolichucky, French Broad, Pigeon, and Hiwassee basins (Figure 34) ..... Spotfin Shiner, *Cyprinella spiloptera*



**Figure 34. Left – Greenfin Shiner; Right – Spotfin Shiner.**

- 34a. Upper and lower portion of caudal fin base each with a distinct large pale patch (Figure 35). Predorsal stripe dark .....Whitetail Shiner, *Cyprinella galactura*
- 38b. Upper and lower portion of caudal fin base each without a distinct large pale patch. Predorsal stripe usually faint ..... 39



**Figure 35. Whitetail Shiner with white and red arrows pointing to the white patches on the upper and lower caudal fin base. Right – male in breeding colors.**

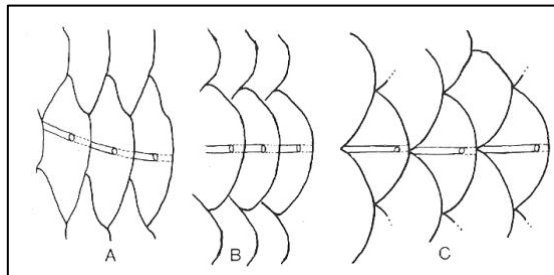


- 35a. Anal fin rays (9) 10 or 11. Caudal fin with black edge preceded by red in large males. No lightly pigmented area at the base of the caudal fin. Humeral bar black. Eye large (Figure 36).....  
 ..... Fieryblack Shiner, *Cyprinella pyrrhomelas*
- 39b. Anal fin rays modally 9. No pigment in caudal fin. Light basicaudal bar behind caudal spot. Humeral bar faint. Eye small (Figure 36)..... Satinfin Shiner, *Cyprinella analostana*



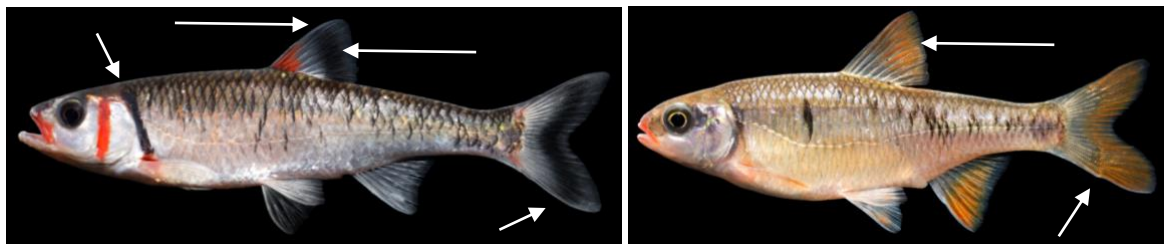
**Figure 36. Left – Fieryblack Shiner; Right – Satinfin Shiner.**

- 36a. Exposed portion (lunula) of anterior lateral line scales much more than 2 times as high as wide (Figure 37A). Anal fin rays modally 9..... 41
- 40b. Exposed portion of anterior lateral line scales 2 times or less as high as wide (except for Mimic Shiner which has modally 8 anal rays) (Figure 37B and 37C). Anal fin rays 7-12..... 44



**Figure 37. Height relative to width of exposed portion (lunula) of anterior lateral line scales. Left (A) – *Luxilus* species; Center (B) – Mimic Shiner, and Right (C) – typical of most *Notropis* species.**

- 37a. Mouth superior (often terminal or slightly subterminal in young). Caudal and often dorsal fins with light base and dark submarginal stripe. Humeral bar black, dark in young (Figure 38) .....  
 .....Warpaint Shiner, *Luxilus coccogenis*
- 41b. Mouth subterminal or terminal. Caudal and dorsal fins with no dark stripe. Humeral bar seldom black and distinct (Figure 38)..... 42



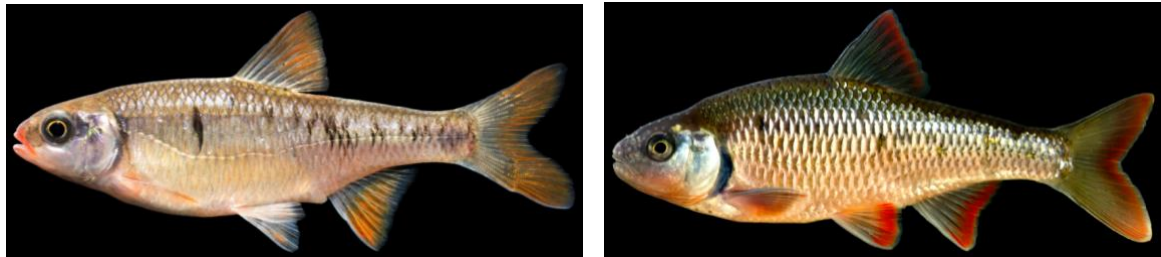
**Figure 38. Left - Warpaint Shiner with white arrows pointing to black humeral bar and caudal and dorsal fins with dark submarginal stripes; Right – Crescent Shiner showing white arrows pointing to caudal and dorsal fins lacking black stripes.**

- 38a. Predorsal scales 13-16; mid-row usually distinct and scales easily counted. 2 or 3 wavy dark horizontal lines running between dorsal fin insertion and lateral stripe (Figure 39). Restricted to Nolichucky, French Broad, Pigeon, and Hiwassee basins .. Striped Shiner, *Luxilus chrysocephalus*
- 42b. Predorsal scales 17-25; mid-row seldom straight, usually difficult to count. Range restricted to the New and Atlantic slope basins ..... 43



**Figure 39. Striped Shiner with white arrows pointing to the wavy dark horizontal lines running between dorsal fin insertion and lateral stripe.**

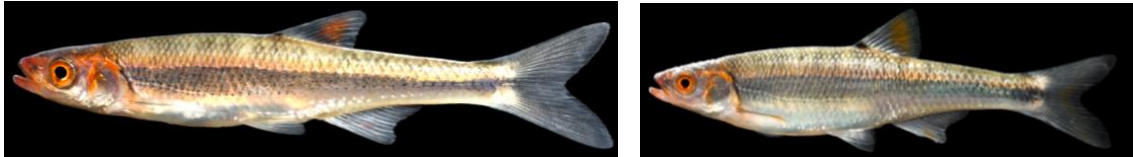
- 39a. Sides with irregularly blackened scales extending below lateral line (Figure 40). Scales near lateral line with dark pigment in center, margin clear. Opercle usually with no silvery patch. Appressed pectoral fin nearly reaches pelvic fin origin. Range restricted to Roanoke basin, introduced into the upper Haw River system in the Cape Fear basin ..... Crescent Shiner, *Luxilus cerasinus*
- 43b. Sides with no irregularly scattered dark scales (occasionally with irregular dark bars 2 or 3 scales deep) (Figure 40). Opercle usually with silvery patch in adults. Range restricted to the New, Roanoke, Chowan, Tar, Neuse, and Cape Fear basins ..... White Shiner, *Luxilus albeolus*



**Figure 40. Left – Crescent Shiner; Right – White Shiner.**

- 40a. Black spot on dorsal fin near origin. Anterodorsolateral scales distinctly smaller than postdorsal scales. Mouth terminal, oblique. Body very elongate. Dorsal fin origin moderately or much posterior to pelvic fin base. Anal rays usually 10 or 11. Breast usually naked ..... 45
- 44b. No black spot on dorsal fin near origin. Anterodorsolateral scales about the same size as the postdorsal scales ..... 46

- 41a. Vivid, blood-red chromatic colors restricted to upper head and median fins (Figure 41). Females in nuptial condition masculinized, with tubercle development on dorsum of head equal to that of males. Range restricted to the Tar and Neuse basins ..... Pinewoods Shiner, *Lythrurus matutinus*
- 45b. Less extensive development of red on fins (Figure 41). Females in nuptial condition not masculinized, with no or weakly developed tubercles on dorsum of head. Range restricted to the Roanoke River basin with introduced populations in the Cape Fear and Yadkin basins ..... Rosefin Shiner, *Lythrurus ardens*



**Figure 41. Left – Pinewoods Shiner; Right – Rosefin Shiner.**

- 42a. Anal fin rays usually 10-12 ..... 47
- 46b. Anal fin rays usually 7 or 8 ..... 54
- 43a. Lateral stripe dark, extends from dark caudal fin spot to around tip of snout and on the lips. Lateral line often incomplete, not set off by dark dashes. Anal fin base often dark ..... 48
- 47b. Lateral stripe if dark, not encircling the snout. Caudal fin spot seldom dark. Lateral line complete, often set off with black spots or dashes. Anal fin base pigment absent to faint ..... 49
- 44a. Dark lateral stripe extending anteriorly onto the opercle, confined to upper 60% of the opercle, ventral margin horizontal (Figure 42) Black lateral stripe above lateral line in region of pelvic fin. Light zone dorsal above dark lateral stripe usually continuous to head. Anal fin base generally not pigmented. Mouth strongly oblique. Pharyngeal teeth usually 2,4-4,2 ..... Highfin Shiner, *Notropis altipinnis*
- 48b. Anterior extension of the dark lateral stripe on opercle, covering most of the opercle, ventral margin sloping anteroventrally (Figure 42). Black lateral stripe extending 1 or 2 scale rows below the lateral line in region of pelvic fin. Light zone dorsal above dark lateral stripe usually slightly obscured anteriorly behind head by dark pigment edging scales. Anal fin base black, pigment extending to under caudal peduncle. Mouth less oblique. Pharyngeal teeth usually 1,4-4,1 ..... Dusky Shiner, *Notropis cummingsae*



**Figure 42. Left – Highfin Shiner; Right – Dusky Shiner.**

- 45a. Predorsal scales large, 13-16, mid-row straight and distinct. Predorsal circumferential scales above lateral line 10 or 11. Eye large, going 5.6-6.9 times in predorsal length. 2 dark lines on head between the eyes. Dorsolateral scales often with dark margin and a median row of dark dots. Dorsolateral scales form 2 or 3 horizontal stripes bordered with brown or black (Figure 43)..... Telescope Shiner, *Notropis telescopus*
- 49b. Predorsal scales small, 17-29 (15-29), mid-row seldom distinct anteriorly. Predorsal circumferential scales above lateral line 13-17. Eye small, going 6.9-8.4 times in predorsal length (large in Sandbar Shiner). Dorsolateral scales do not form distinct horizontal stripes..... 50



**Figure 43. Telescope Shiner.**

- 46a. Eye large, going 5.8-6.8) times in predorsal length. Lateral line scales 34-36. Predorsal scale rows 14-16. Predorsal profile curves down above nostrils. Upper margin of lateral stripe higher anteriorly than posteriorly, curves down under dorsal fin (Figure 44) ..... Sandbar Shiner, *Notropis scepticus*
- 50b. Eye small, going 6.0-9.0 times in predorsal length. Lateral line scales 36-40. Predorsal scale rows 16-22. Predorsal profile does not curve abruptly down above nostrils. Upper margin of lateral stripe same height anteriorly as posteriorly, does not curve down under dorsal fin ..... 51



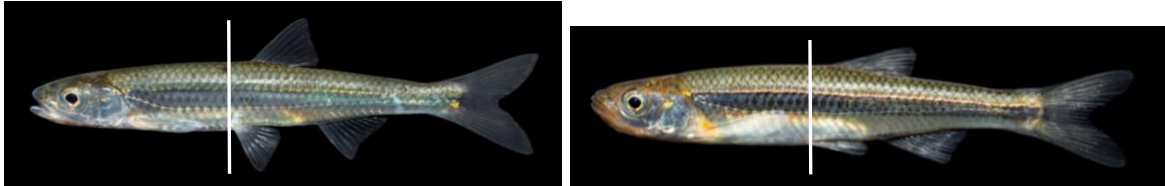
**Figure 44. Sandbar Shiner.**

- 47a. Predorsal circumferential scales above lateral line 15. Anal fin rays 11 (10-12). Predorsal profile straight in adults (Figure 45). Restricted to Atlantic slope basins..... Comely Shiner, *Notropis amoenus*
- 52b. Predorsal circumferential scales above lateral line 13 (11-13). Anal fin rays 10 (9-12). Predorsal profile slightly rounded in adults. Lateral line usually with dark dashes. Restricted to New and basins west of the Appalachian Mountains..... 52



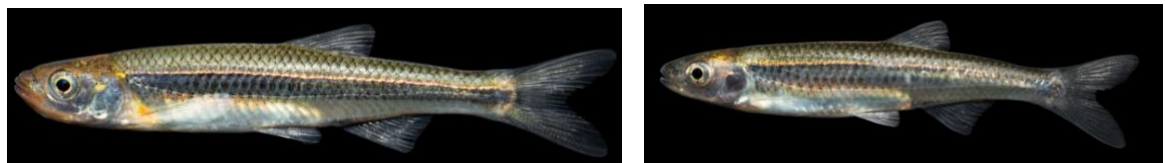
**Figure 45. Comely Shiner.**

- 48a. Middorsal line dark, distinct. Dorsal fin origin 1.5-2.5 scales behind pelvic fin origin (Figure 46). Dorsal fin not unusually far back on body, distance from dorsal fin origin to hypural plate greater than distance from dorsal fin origin to center of pupil. Pigment on sides extends below lateral line. Dark crescents often visible between nostrils. Middorsal line faint, diffuse. Pelvic fin rays 9 or 10 ...  
 ..... Silver Shiner, *Notropis photogenis*
- 52b. Middorsal line faint, diffuse. Dorsal fin origin 2.5-4.0 scales behind pelvic fin origin (Figure 46) Dorsal fin far back on body, distance from dorsal fin origin to hypural plate less than distance from dorsal fin origin to center of pupil. No pigment on sides below lateral line. No dark crescents visible between nostrils. Pelvic fin rays 8 ..... 53



**Figure 46. Left - Silver Shiner showing dorsal fin origin 1.5-2.5 scales behind pelvic fin origin; Right - *Notropis* sp. "Kanawha" Rosyface Shiner showing dorsal fin origin 2.5-4.0 scales behind pelvic fin origin.**

- 49a. Restricted to New basin (Figure 47) ..... *Notropis* sp. "Kanawha" Rosyface Shiner
- 53b. Restricted to Nolichucky, French Broad, Pigeon, Little Tennessee, and Hiwassee basins (Figure 47) ..... Highland Shiner, *Notropis micropteryx*



**Figure 47. Left – *Notropis* sp. "Kanawha" Rosyface Shiner; Right – Highland Shiner.**

- 50a. Anal fin rays modally 7 ..... 55
- 54b. Anal fin rays modally 8 ..... 58
- 51a. Snout almost equal to or longer than diameter of the eye. Mouth large extends backward almost even with front of eye (Figure 48). Anal and pelvic fin rays outline with black. Lateral stripe absent just behind eye (Figure 48). Body along anal fin base black, pigment extending to under caudal peduncle. Pre- and postdorsal midline stripe broad, pigment encircling dorsal fin. Triangular caudal spot. Pharyngeal teeth 2,4-4,2 ..... Coastal Shiner, *Notropis petersoni*
- 55b. Snout distinctly shorter than diameter of the eye. Anal and pelvic fin rays not outlined with black. Mouth variable, generally small. Body along anal fin base with little pigment (except in Swallowtail Shiner). Pre- and postdorsal midline stripe variable. Caudal spot variable. Pharyngeal teeth 4-4 ....  
 ..... 56



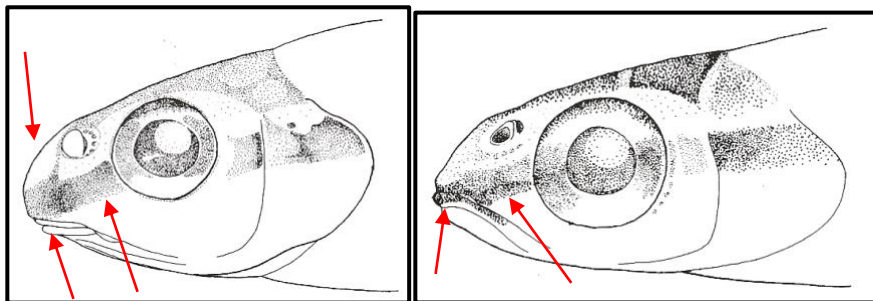


**Figure 48. Coastal Shiner - Left – close-up view of the length of the snout compared to the width of the eye and the large mouth extending backwards almost even with front of the eye; Right - Coastal Shiner.**

- 52a. Breast half scaled at most, often entirely naked. Pigmented predorsal stripe present. Anal fin base well pigmented, pigment extends along caudal peduncle. Smudge of dark pigment on body beneath origin of dorsal fin. Dark lateral stripe does not encircle snout (Figure 49). Light stripe absent on snout above dark stripe. Caudal fin spot usually not connected to lateral stripe. Males in breeding condition yellow or slightly brighter yellow (Figure 49) ..... Swallowtail Shiner, *Notropis procne*
- 56b. Breast usually half to fully scaled. Predorsal stripe absent. Anal fin base sometimes slightly pigmented. No dark smudge on body at origin of dorsal fin. Dark lateral stripe encircling the snout (Figure 50) ..... 57



**Figure 49. Swallowtail Shiner. Left – Red arrows pointing to the dark lateral stripe not encircling the snout and a pigmented snout.**



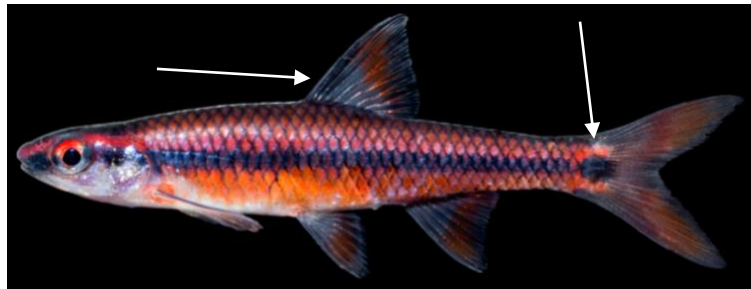
**Figure 50. Red arrows pointing to the dark lateral stripe encircling the snout. Left – Whitemouth Shiner with red arrows pointing to the dark lateral stripe encircling the snout, the white snout, and white lips; Right – Bridle Shiner with red arrows pointing to the dark lateral stripe encircling the snout and the pigmented upper lip.**

- 53a. Band of dark pigment encircling snout (Figure 50), about uniform in width or slightly narrowed at snout tip. Front of upper lip usually devoid of melanophores (black pigment cells). Mouth subterminal, horizontal. Red pigment in upper eye (Figure 51) .....Whitemouth Shiner, *Notropis alborus*
- 57b. Band of dark pigment encircling the snout, markedly constricted at snout tip (Figure 50). Front of upper lip liberally peppered with melanophores (Figure 50). Mouth terminal, oblique (Figures 50 and 51) ..... Bridle Shiner, *Notropis bifrenatus*



**Figure 51. Left – Whitemouth Shiner; Right – Bridle Shiner.**

- 54a. Lateral line incomplete. Caudal fin spot black, larger than pupil, surrounded by distinct light area (Figure 52). Lower lip with pigment. Large black blotch along front of dorsal fin ..... Taillight Shiner, *Notropis maculatus*
- 58b. Lateral line usually complete. Caudal fin spot, if present, no deeper than lateral stripe black..... 59



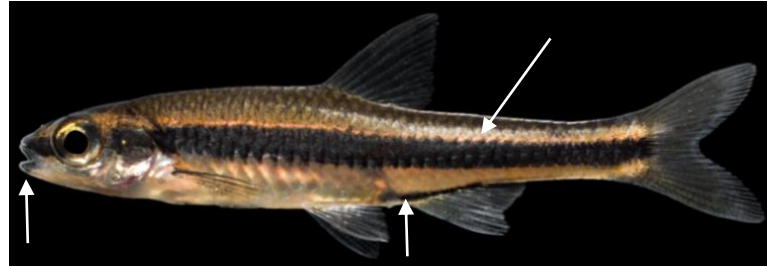
**Figure 52. Taillight Shiner with white arrows pointing to the large black blotch along front of dorsal fin and large black caudal fin spot.**

- 55a. Dorsal fin rounded. Caudal spot triangular, much darker than lateral stripe which is faint to absent. Body cylindrical. Predorsal scales crowded, thin, and embedded or absent. Head flat between the eyes (Figure 53) .....Mirror Shiner, *Notropis spectrunculus*
- 59b. Dorsal fin pointed. Predorsal scales not crowded, clearly visible. Head shape and caudal fin spot variable. Body compressed. Lateral stripe medium to well developed. Light streak usually present over dark lateral stripe..... 60



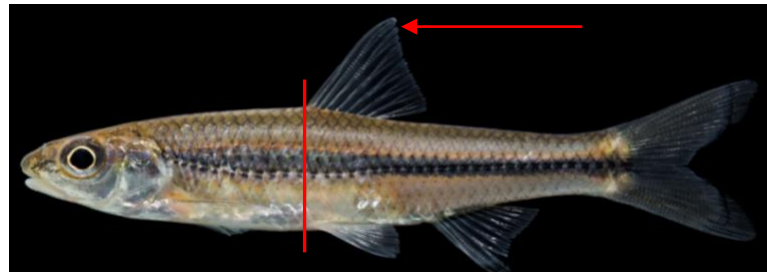
**Figure 53. Mirror Shiner with white arrows pointing to the flat head and triangular caudal fin spot.**

- 56a. Body along anal fin base black with pigment extending under caudal peduncle. Lateral stripe distinct and black. Mouth small, not reaching to front of eye. Roof of mouth black. Rays of anal and pelvic fins usually bordered with black (Figure 54) .....Ironcolor Shiner, *Notropis chalybaeus*
- 60b. Body along anal fin base with little or no pigment. Lateral stripe less distinct than above. Mouth size variable. Roof of mouth unpigmented. Anal fin rays not bordered with black ..... 61



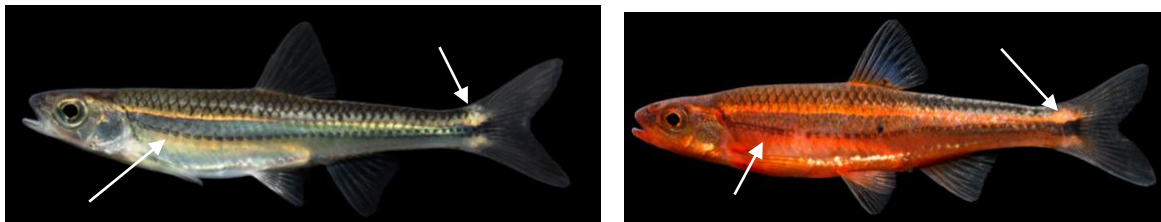
**Figure 54. Ironcolor Shiner with white arrows pointing to a small mouth, dark lateral stripe, and darkly pigmented anal fin base.**

- 57a. Dorsal fin pointed, first ray usually reaching 2 or 3 scales behind last ray. Dorsal fin origin over or anterior to pelvic fin origin. Mouth nearly horizontal (Figure 55)..... Spottail Shiner, *Notropis hudsonius*
- 61b. Dorsal fin not strongly pointed, first ray reaching 0 or 1 scales behind last ray. Dorsal fin origin behind pelvic fin origin. Mouth usually oblique ..... 62



**Figure 55. Spottail Shiner with red arrows pointing to the dorsal fin origin over the pelvic fin origin and to a pointed dorsal fin.**

- 58a. Lateral line bordered with dashes. Caudal fin spot rectangular. Light stripe present over lateral stripe posterior of dorsal fin origin (Figure 56)..... Tennessee Shiner, *Notropis leuciodus*
- 62b. Lateral line not bordered with dashes, except in New River Shiner. Light stripe usually absent over dark lateral stripe posterior of dorsal fin origin. Caudal fin spot, if present, round. .... 63



**Figure 56. Tennessee Shiner with white arrows pointing to the rectangular caudal fin spot and lateral line bordered with dashes. Right – male in breeding colors.**

- 59a. Body under posterior dorsal fin with a dark blotch. Pre-dorsolateral scales arranged in clearly defined diagonal rows. Eyes bulge out, directed upward more than usual (Figure 57). Restricted to the New basin..... New River Shiner, *Notropis scabriceps*
- 63b. Body under posterior dorsal fin with or without a dark blotch. Pre-dorsolateral scales not usually arranged in clearly defined diagonal rows. Eyes not bulging out, usually directed sideways. Not restricted to the New basin ..... 64



**Figure 57. New River Shiner.**

- 60a. Anterior lateral line scales elevated, exposed width going 2.1-2.9 times in height (best observed in the 3<sup>rd</sup>-7<sup>th</sup> scales from the head) (Figures 37 and 58). Extensive development of neuromasts on the anterior half of the head dorsum, snout, subnasal area, around the orbit, particularly on the cheek, and on the anterior portion of lateral line scales. Lateral stripe diffuse, not unusually black, not entering snout, dorsal margin of lateral stripe not serrate. Caudal fin spot faint to absent (Figure 58) ..... Mimic Shiner, *Notropis volucellus*
- 64b. Lateral line scales not elevated anteriorly, width going less than 2 times in the height (Figure 37). Lateral stripe usually black, stripe enters snout, dorsal margin often serrate. Caudal fin spot black, often joined to lateral stripe. .... 65



**Figure 58. Mimic Shiner with white arrows pointing to anterior lateral line scales which are elevated, the diffuse lateral line, and a caudal spot that is faint to absent.**

- 61a. Dorsal fin origin anterior or above pelvic fin origin (Figure 59). Distinct black lateral stripe extends from preorbital area to caudal fin spot. Mostly scaled anterior breast area. Lower lip usually lined with dark pigment (Figure 59). Males bright brassy yellow-gold (Figure 59). Restricted to the Cape Fear basin ..... Cape Fear Shiner, *Notropis mekistocholas*
- 65b. Dorsal fin origin posterior to pelvic fin origin. If present, distinct black lateral stripe not extending from preorbital area to caudal fin spot. Breast mostly naked. Lower lip not lined with dark pigment. Breeding males brightly colored with yellow, red, or white colored fins. Not restricted to the Cape Fear basin ..... 66





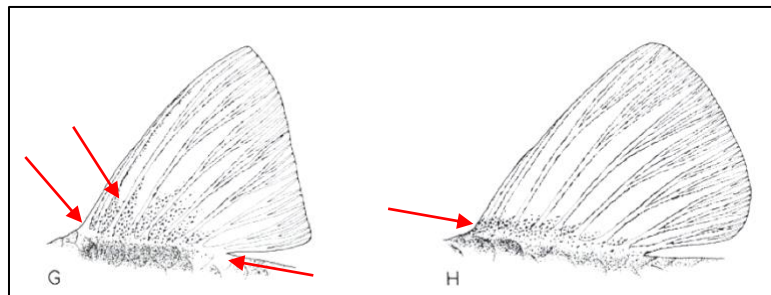
**Figure 59. Left - Cape Fear Shiner with white arrow pointing to the lower lip with dark pigment; Right – Cape Fear Shiner with white line showing dorsal fin anterior or above pelvic fin origin.**

62a. Humeral bar usually dark. Lateral stripe faint anteriorly, does not enter head (if entered into head, lateral stripe would pass above eye). Lateral line located 1 or 2 scales under top of diffuse lateral stripe in front of dorsal fin..... 67

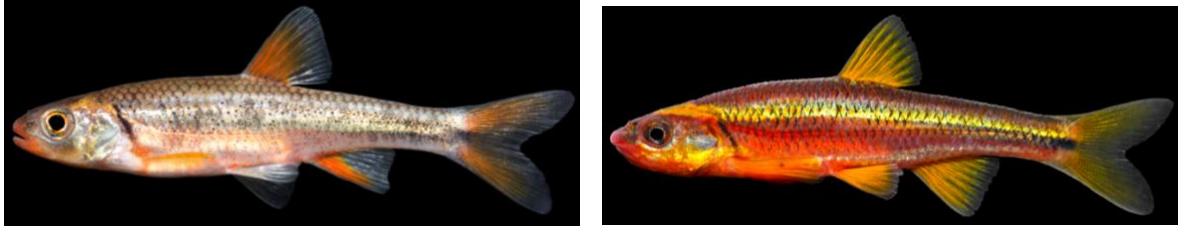
66b. Humeral bar faint. Lateral stripe dark anteriorly, passes uninterrupted from hypural plate onto opercle, crosses opercle level with eye, often passes through eye. Lateral line located in, or at lower edge of, lateral stripe in front of dorsal fin ..... 68

63a. Small pale spots at each end of dorsal fin with base of dorsal fin having melanophores covering one-fourth to one-third of the interradiial membranes (Figure 60). Ventral portion of the mid-lateral stripe fades anteriorly, especially along lateral line and beginning at posterior end of dorsal fin. Dark pigmented scales absent below lateral line. Scattered blotches present on sides of body (Figure 61) ..... Redlip Shiner, *Notropis chiliticus*

67b. No small pale spot at each end of dorsal fin base, with dorsal fin having melanophores covering only the interradiial membranes at its base (Figure 60). Mid-lateral stripe usually extending from head to tail. Scales having well-pigmented posterior margins extending 1 or 2 rows below lateral line in front of dorsal fin. Sides with no scattered dark blotches (Figure 61) ..... Saffron Shiner, *Notropis rubricroceus*



**Figure 60. Left (G) – Dorsal fin of Redlip Shiner with red arrows pointing to the pale spot at both ends of the dorsal fin and the melanophores on the interradiial membranes; Right (H) – Saffron Shiner with arrow pointing to the melanophores at the fin’s base.**



**Figure 61. Left - Redlip Shiner; Right – Saffron Shiner.**

- 64a. Lateral line occurs in bottom half of lateral stripe (including all pigmented areas) below dorsal fin origin (Figure 62). Pigment usually absent from 2<sup>nd</sup> scale row below lateral line anterior to dorsal fin. Lower margin of lateral stripe on the same level on opercle as on cheek. Pharyngeal teeth 2,4-4,2. Range restricted to the Savannah basin with introduced populations in the Little Tennessee basin ..... Yellowfin Shiner, *Notropis lutipinnis*
- 68b. Lateral line occurs in bottom half of lateral stripe (including all pigmented areas) below dorsal fin origin or in middle of lateral stripe (including all pigmented areas) below dorsal fin origin. Pigment present on 2<sup>nd</sup> scale row below lateral line anterior of dorsal fin or usually absent from 2<sup>nd</sup> scale row below lateral line anterior to dorsal fin. Lateral stripe lower on opercle than on cheek. Pharyngeal teeth 1,4-4,1, or 2,4-4,2, or 1,4-4,2, or 2,4-4,1. Range restricted to the Broad or Catawba basins ..... 69



**Figure 62. Yellowfin Shiner.**

- 65a. Pelvic, pectoral, and anal fins yellow to yellow + white, rarely red (Figure 63). Range restricted to the Broad basin ..... *Notropis* sp. “Piedmont” Shiner
- 69b. Pelvic, pectoral, and anal fins white (Figure 63). Range restricted to the Catawba basin ..... Greenhead Shiner, *Notropis chlorocephalus*



**Figure 63. Left – *Notropis* sp. “Piedmont” Shiner; Right – Greenhead Shiner.**