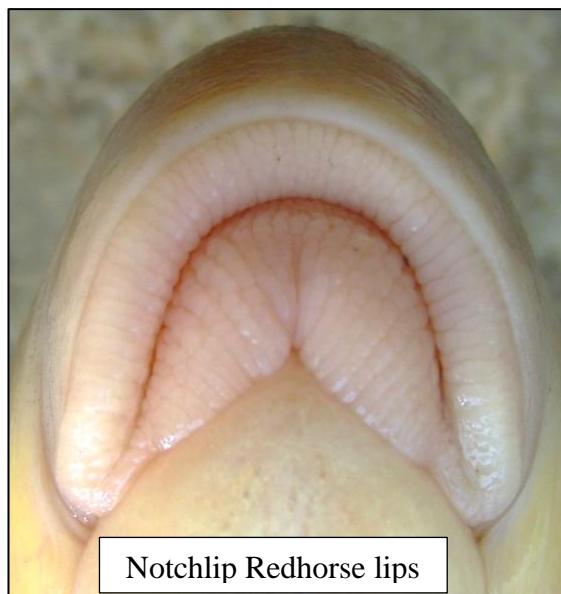


**Identifying North Carolina’s Suckers May Not Be as Hard as You Might Think
By Bryn H. Tracy, Scott A. Smith, and Fred (Fritz) C. Rohde**

The correct identification of suckers (Family Catostomidae) may be intimidating to those students or citizens just beginning to study our extremely diverse and colorful freshwater fish fauna. With some practice and with a keen eye to details, one can master this skill, although it might take a while and require handling a lot of fish. Key characteristics for identification include the shape and texture of the lips (Hogue and Tracy 2014), lateral line scale counts, dorsal fin rays counts, and pharyngeal teeth structure (please refer to Identification Key to the Species of Suckers (Family Catostomidae) in North Carolina).

There are 29 species of suckers including 5 undescribed species in North Carolina (Table 1; Tracy et al. 2020). [Please note: Tracy et al. (2020) may be downloaded for free at: <https://trace.tennessee.edu/sfcproceedings/vol1/iss60/1.>]



You might have heard fishermen calling them Mulletts, Redhorses, Hoovers, Creek Trout, Razor Back, or many more colloquial names. But each species has its own scientific (Latin) name, which coincidentally actually means something (Table 2), and an American Fisheries Society-accepted common name (Table 1). They are found throughout North Carolina in streams, big rivers and reservoirs from Cherokee County in the Mountains to Dare County along the Albemarle Sound. Every county has at least one species (Tracy et al. 2020), but Stokes County takes the prize for having the most – 11 species! They are Northern Hog Sucker, Roanoke Hog Sucker, Notchlip Redhorse, Golden Redhorse, V-lip Redhorse, Bigeye Jumprock, Blacktip Jumprock, “Brassy” Jumprock, White Sucker, Rustyside Sucker, and Quillback (Beane 2017; Hogue and Tracy 2014).

Table 1. Species of suckers found in North Carolina. Common names enclosed within tick marks (“”) are scientifically undescribed species.

Scientific Name/ American Fisheries Society Accepted Common Name	Scientific Name/ American Fisheries Society Accepted Common Name
<i>Carpiodes carpio</i> , River Carpsucker	<i>Moxostoma breviceps</i> , Smallmouth Redhorse
<i>Carpiodes cyprinus</i> , Quillback	<i>Moxostoma carinatum</i> , River Redhorse
<i>Carpiodes</i> sp. "Atlantic" Highfin Carpsucker	<i>Moxostoma cervinum</i> , Blacktip Jumprock
<i>Carpiodes</i> sp. "Carolina" Quillback	<i>Moxostoma collapsum</i> , Notchlip Redhorse
<i>Catostomus commersonii</i> , White Sucker	<i>Moxostoma duquesnei</i> , Black Redhorse
<i>Erimyzon oblongus</i> , Eastern Creek Chubsucker	<i>Moxostoma erythrurum</i> , Golden Redhorse
<i>Erimyzon sucetta</i> , Lake Chubsucker	<i>Moxostoma macrolepidotum</i> , Shorthead Redhorse
<i>Hypentelium nigricans</i> , Northern Hog Sucker	<i>Moxostoma pappilosum</i> , V-lip Redhorse
<i>Hypentelium roanokense</i> , Roanoke Hog Sucker	<i>Moxostoma robustum</i> , Robust Redhorse
<i>Ictiobus bubalus</i> , Smallmouth Buffalo	<i>Moxostoma rupiscartes</i> , Striped Jumprock
<i>Ictiobus cyprinellus</i> , Bigmouth Buffalo	<i>Moxostoma</i> sp. "Brassy" Jumprock
<i>Ictiobus niger</i> , Black Buffalo	<i>Moxostoma</i> sp. "Carolina" Redhorse
<i>Minytrema melanops</i> , Spotted Sucker	<i>Moxostoma</i> sp. "Sicklefin" Redhorse
<i>Moxostoma anisurum</i> , Silver Redhorse	<i>Thoburnia hamiltoni</i>
<i>Moxostoma ariommum</i> , Bigeye Jumprock	

Table 2. The meanings of the scientific names of suckers (Family Catostomidae) found in North Carolina. Adopted from the ETYFish Project by Christopher Scharpf and Kenneth J. Lazara, accessed September 30, 2020, <http://www.etyfish.org/>.

Carpiodes Rafinesque 1820: *oides*, having the form of: carp, *Cyprinus carpio*
C. carpio (Rafinesque 1820): from the Old French *carpe*, carp, referring to resemblance to *Cyprinus carpio*
C. cyprinus cyprinus (Lesueur 1817): Latinization of Greek *kyprinos*, carp, referring to resemblance to *Cyprinus carpio*
C. velifer (Rafinesque 1820): *velum*, sail; *fero*, to bear, referring to tall dorsal fin

Catostomus Lesueur 1817: tautonymous with *Cyprinus catostomus*
C. commersonii (Lacepède 1803): in honor of French naturalist Philibert Commerçon (also spelled Commerson, 1727-1773), whose collections were studied by Lacepède

Erimyzon Jordan 1876 *eri-*, very; *myzon*, sucker, a “free translation” of the vernacular name chubsucker
E. oblongus (Mitchill 1814): oblong, referring to more elongate shape compared to *E. sucetta*
E. sucetta sucetta (Lacepède 1803): Latinization of the French *sucet*, meaning sucker

Hypentelium Rafinesque 1818: *hypo-*, below; *pente*, five, referring to “lower jaw shorter with five lobes” (a character that does not fit the genus):
H. nigricans (Lesueur 1817): blackish, probably referring to dark saddles
H. roanokense Raney & Lachner 1947: *ensis*, suffix denoting place: Roanoke River drainage, Virginia and North Carolina, USA, where it is endemic

Ictiobus Rafinesque 1820: *ichthyo*, fish; *bous*, ox or cow, referring to humpbacked nape
I. bubalus (Rafinesque 1818): Greek for buffalo, referring to humpbacked nape
I. cyprinellus (Valenciennes 1844): diminutive of *cyprinus*, carp, referring to resemblance to *Cyprinus carpio*
I. niger (Rafinesque 1819): black, referring to blackish fins

Minytrema Jordan 1878: *mini-*, reduced; *trema*, aperture, referring to its lateral line, absent in juveniles and incomplete (consisting of only four unpored scales): in adults
M. melanops (Rafinesque 1820): *melanos*, black; *ops*, appearance, referring to large, square blackish spot at base of each scale, which combine to form more or less conspicuous stripes along the sides

Moxostoma Rafinesque 1820: *moxo*, probably a variant spelling of *myzo*, to suck; *stoma*, mouth, referring to “fleshy, thick, or lobed sucking lips”
M. anisurum (Rafinesque 1820): *anisos*, unequal; *oura*, tailed, referring to upper lobe of tail being narrower and longer than lower (which it is not):
M. ariommum Robins & Raney 1956: *ari-*, a strengthening prefix; *omma*, eye, referring to its large eyes
M. breviceps (Cope 1870): *brevis*, short; *ceps*, head, referring to small head and mouth
M. carinatum (Cope 1870): keeled, referring to low ridges on roof of skull
M. cervinum (Cope 1868): of deer, referring to tawny or fawn-like coloration of lateral stripe on *Thoburnia rhothoeca*, which Cope confused with this species
M. collapsum (Cope 1870): flattened sidewise, referring to compressed body
M. duquesnei (Lesueur 1817): of Fort Duquesne (now Pittsburgh, Pennsylvania, USA) on Ohio River, type locality
M. erythrurum (Rafinesque 1818): *erythros*, red; *oura*, tailed, which accurately describes color of lower fins in some adults but not the yellowish tail
M. macrolepidotum (Lesueur 1817): *macro-*, long; *lepida*, scale, probably referring to how dark scale bases make scales appear larger than they are
M. papillosum (Cope 1870): referring to papillose (pimplelike): surface of lips
M. robustum (Cope 1870): full-bodied, referring to large size
M. rupiscartes Jordan & Jenkins 1889: Latin transcription of vernacular name, jumprock: *rupis*, rock; *skarthmos*, jumper, inspired by *Rupiscartes* Swainson 1839 for a genus of blenniids (= *Alticus*): that “jump on rocks, like a lizard,” probably referring to the proclivity of some specimens to jump or break surface of water while spawning

Thoburnia Jordan & Snyder 1917: *ia*, belonging to: Wilbur Wilson Thoburn (1859-1899) , who described *T. rhothoeca* and taught bionomics (ecology): at Stanford University (where Jordan was president):
T. hamiltoni Raney & Lachner 1946: in honor of the authors’ friend and teacher William J. Hamilton, Jr. (1902-1990), Cornell University vertebrate zoologist, “whose stimulating suggestions and assistance over a period of ten years have been invaluable”

Three species are found in only one river basin: Rustyside Sucker and Bigeye Jumprock, which are found only in the upper Roanoke basin and Black Buffalo found only in the lower French Broad basin (Figure 1; Table 3). White Sucker is our most widely distributed species; it is found in 15 of our 21 basins but absent from waters east of Interstate 95 in the Chowan, Albemarle Sound, White Oak, Shallotte, Waccamaw, and Lumber basins (Table 3; Tracy et al. 2020).

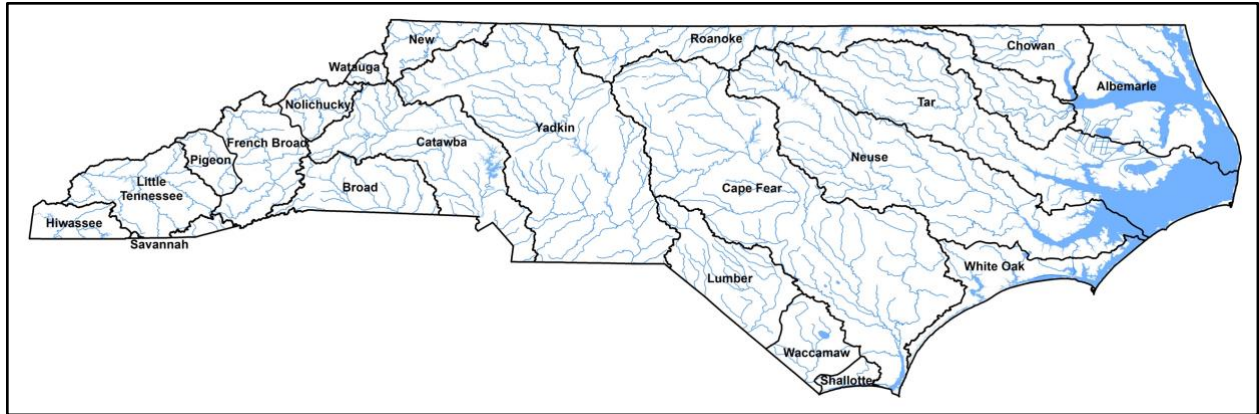


Figure 1. North Carolina’s 21 river basins. Map originally appeared in Tracy et al. (2020).

More species of suckers, 17, are found in the Yadkin basin than in any of the other 20 basins (Table 3). Those 17 species include 4 species that have been introduced from other basins in North Carolina - Northern Hog Sucker, Roanoke Hog Sucker, Smallmouth Buffalo and Striped Jumprock, and 1 species introduced from outside the state, Bigmouth Buffalo. Our least speciose basin is the New basin where only Northern Hog Sucker and White Sucker are found (Table 3).

Twelve species are considered imperiled in North Carolina: 1) State Endangered – Robust Redhorse and Rustyside Sucker; 2) State Threatened – Bigeye Jumprock, *Moxostoma* sp. “Sicklefin” Redhorse and *Moxostoma* sp. “Carolina” Redhorse; 3) State Special Concern – River Carpsucker and *Carpiodes* sp. “Atlantic Highfin” Carpsucker; and 4) Significantly Rare – Quillback, *Carpiodes* sp. “Carolina” Quillback, Smallmouth Buffalo, Black Buffalo, and Smallmouth Redhorse (NCAC 2017; NCNHP 2018; NCWRC 2017).



Notchlip Redhorse



Sicklefin Redhorse

So, don’t shy away from learning more about this fascinating family of freshwater fishes. If you have troubles with your identifications, just send us (<https://ncfishes.com/contact/>) an e-mail and include as many quality digital photographs as you can along with all the pertinent locality descriptors so that we will know from where the fish came.

Table 3. Species of suckers found in North Carolina listed by river basin in which they occur ^{1,2}. Common names enclosed within tick marks (“”) are scientifically undescribed species. Table originally appeared in Tracy et al. (2020).

Scientific Name	Mountain								Piedmont						Coastal					Total No. of Basin Occurrences		
	HIW	LTN	Sav	PIG	FRB	NOL	WAT	NEW	BRD	CTB	YAD	CPF	NEU	TAR	ROA	CHO	ALB	WOK	SHL		WAC	LBR
<i>Carpiodes carpio</i>																						2
<i>Carpiodes cyprinus</i>																						4
<i>Carpiodes</i> sp. "Atlantic" Highfin Carpsucker																						3
<i>Carpiodes</i> sp. "Carolina" Quillback																						3
<i>Catostomus commersonii</i>												IB	IB									15
<i>Erimyzon oblongus</i>					IB																	13
<i>Erimyzon sucetta</i>																						11
<i>Hypentelium nigricans</i>									IB	IB	IB											14
<i>Hypentelium roanokense</i>											IB											2
<i>Ictiobus bubalus</i>										IB	IB											4
<i>Ictiobus cyprinellus</i>										NI	NI											2
<i>Ictiobus niger</i>																						1
<i>Minytrema melanops</i>																						6
<i>Moxostoma anisurum</i>																						4
<i>Moxostoma ariommum</i>																						1
<i>Moxostoma breviceps</i>																						5
<i>Moxostoma carinatum</i>																						4
<i>Moxostoma cervinum</i>																						3
<i>Moxostoma collapsum</i>																						8
<i>Moxostoma duquesnei</i>																						7
<i>Moxostoma erythrurum</i>																						6
<i>Moxostoma macrolepidotum</i>																						8
<i>Moxostoma pappillosum</i>																						8
<i>Moxostoma robustum</i>										E												2
<i>Moxostoma rupiscartes</i>											IB											4
<i>Moxostoma</i> sp. "Brassy" Jumprock																						4
<i>Moxostoma</i> sp. "Carolina" Redhorse																						2
<i>Moxostoma</i> sp. "Sicklefin" Redhorse																						2
<i>Thoburnia hamiltoni</i>																						1
Total Number of Species	8	8	3	7	12	9	3	2	8	13	17	10	8	8	13	5	3	3	3	3	3	
No. of Indigenous Species (= I + E)	8	8	3	7	11	9	3	2	7	10	12	9	7	8	13	5	3	3	3	3	3	
No. of Nonindigenous Species (IB + NI)	0	0	0	0	1	0	0	0	1	3	5	1	1	0	0	0	0	0	0	0	0	

¹ I = Indigenous (native), IB = Indigenous but not in this basin, NI = NonIndigenous (introduced), E = Extirpated.

² River basin abbreviations are: HIW = Hiwassee, LTN = Little Tennessee, SAV = Savannah, PIG = Pigeon, FRB = French BROAD, NOL = Nolichucky, WAT = Watauga, NEW = New, BRD = Broad, CTB = Catawba, YAD = Yadkin, CPF = Cape Fear, NEU = NEUSE, TAR = Tar, ROA = Roanoke, CHO = Chowan, ALB = Albemarle Sound, WOK = White Oak, CHL = Shallotte, WAC = Waccamaw, and LBR = Lumber.

An Identification Key to the Species of Suckers (Family Catostomidae) in North Carolina

(Please refer to NCFishes.com for pictures and identifying characteristics for all species and a distributional map for each species is available at: [NC Freshwater Fishes](#))

(Appreciation is extended to Dr. Wayne C. Starnes for his constructive review of this Identification Key)

- 1a. Dorsal fin base short (Figure 1); 10-18 dorsal fin rays; dorsal fin margin not strongly falcate; anterior dorsal rays not greatly elongated2
- 1b. Dorsal fin base long (Figure 1); 22-30 dorsal fin rays; dorsal fin margin strongly falcate; anterior dorsal rays greatly elongated 23

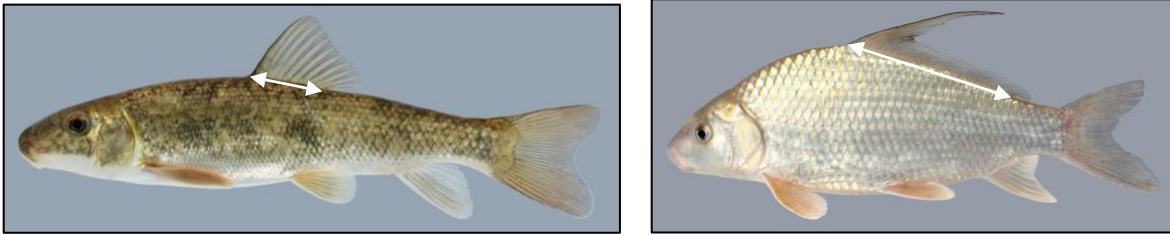


Figure 1. Left – Short dorsal fin base; Right – Elongated dorsal fin base.

- 2a. Lateral line absent or virtually so3
- 2b. Lateral line complete and visible5
- 3a. In adult each scale with a dark spot at the base, forming longitudinal stripes (Figure 2). Range restricted to the middle and lower Yadkin and Cape Fear and the Lumber, Waccamaw, Shallotte, and White Oak basinsSpotted Sucker, *Minytrema melanops*
- 3b. Side with single wide dark stripe in young (Figure 2), occasionally blotches in adult4

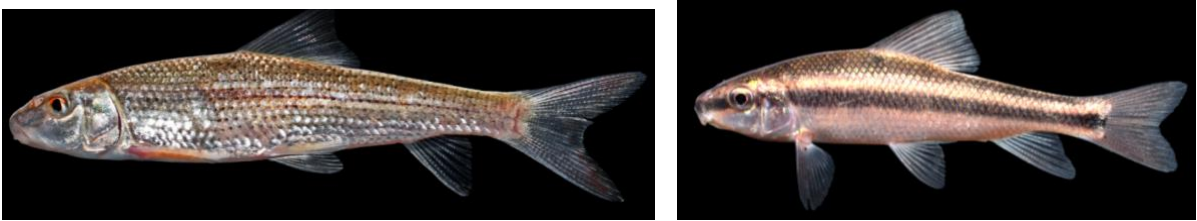


Figure 2. Left - Spotted Sucker; Right – Juvenile *Erimyzon* sp. Chubsucker

- 4a. Mid-lateral scales usually 34-38. Anterior tip of upper lip generally near the level of the lower rim of the eye (Figures 3 and 4). In mature specimens, eye larger, snout shorter; eye diameter going 1.5-1.8 times in snout length. Configuration of body in cross section – more laterally compressed, deeper bodied; maximum body width ~1.8-2.2 times in maximum depth. Found in all Atlantic slope basins, except for the Savannah, Broad, and Catawba basins .. Lake Chubsucker, *Erimyzon sucetta*
- 4b. Mid-lateral scales usually 40-46. Anterior tip of upper lip generally well below level of lower rim of the eye (Figures 3 and 4). In mature specimens, eye smaller, snout longer; eye diameter going 2.1-2.6 times in snout length. Configuration of body in cross section – less compressed, somewhat more cylindrical; maximum body width ~ 1.4-1.7 times in maximum depth. Found in all Atlantic slope basins, except for the Savannah and Broad basins..... Eastern Creek Chubsucker, *Erimyzon oblongus*

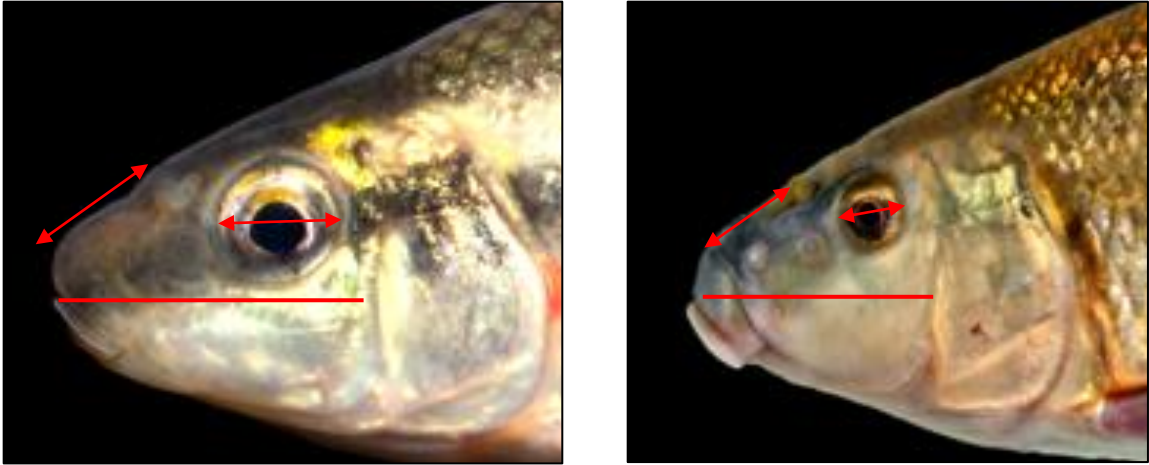


Figure 3. Left – Lake Chubsucker with anterior tip of upper lip generally near the level of the lower rim of the larger eye in relation to snout length; Right – Eastern Creek Chubsucker with anterior tip of upper lip generally well below level of lower rim of the smaller eye in relation to snout length.

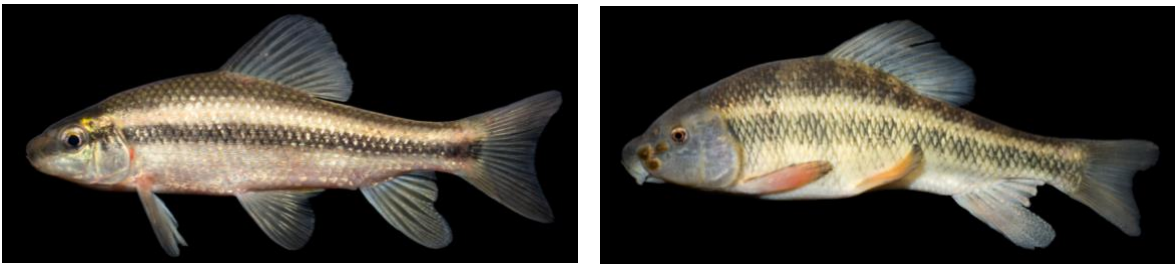


Figure 4. Left – Lake Chubsucker; Right – Tuberculate male Creek Chubsucker.

- 5a. Body scales becoming progressively smaller from the caudal peduncle to the head (Figure 5). Widespread but absent from waters east of Interstate 95 in the Chowan, Albemarle Sound, White Oak, Shallotte, Waccamaw, and Lumber basins White Sucker, *Catostomus commersonii*
- 5b. Body scales not becoming progressively smaller from the caudal peduncle to the head6



Figure 5. White Sucker.

- 6a. Head that is concave between the eyes7
- 6b. Head that is not concave between the eyes8

- 7a. Upper lip with smaller papillae and no plicae (Figure 6). Lateral line scales (minimum 44) 45-48 (maximum 50). Body form elongate. Dark and light horizontal stripes usually absent or faint (Figure 7). Range widespread (i.e., Hiwassee, Little Tennessee, Pigeon, French Broad, Nolichucky, Watauga, New, Savannah, Broad, Catawba, Yadkin, Roanoke, Neuse, and Tar basins).....
.....Northern Hog Sucker, *Hypentelium nigricans*
- 7b. Upper lip coarsely papillose on the outer border but plicate or subplicate on the inner edge (Figure 6). Lateral line scales (minimum 38) 40-43 (maximum 44). Body form stocky anteriorly. Dark and light horizontal stripes usually moderately developed (Figure 7). Range restricted to the Roanoke basin with an introduced population in the upper Ararat River watershed (Yadkin basin).....
.....Roanoke Hog Sucker, *Hypentelium roanokense*

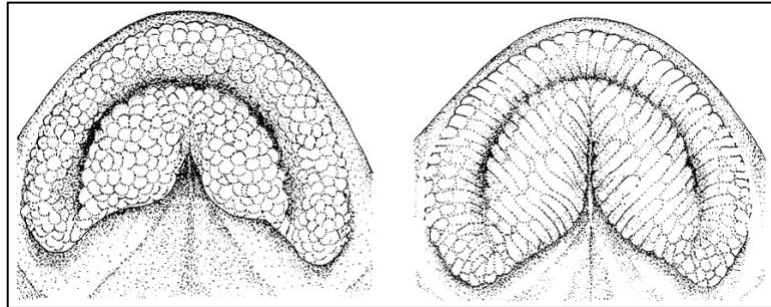


Figure 6. Left – Northern Hog Sucker with upper lip with smaller papillae and no plicae; Right – Roanoke Hog Sucker with upper lip coarsely papillose on the outer border, but plicate or subplicate on the inner edge.

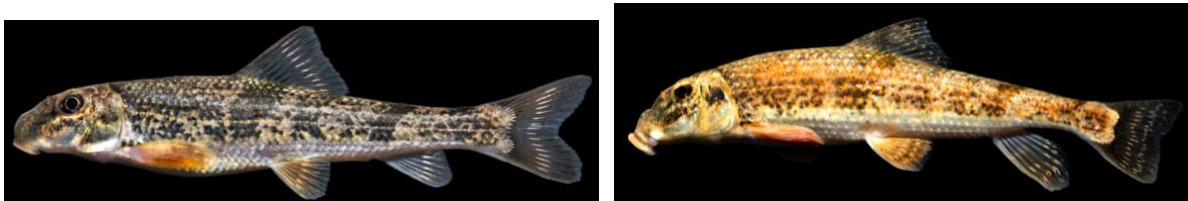


Figure 7. Left – Northern Hog Sucker; Right – Roanoke Hog Sucker.

- 8a. Circumpeduncle scales 16 (14-16) (Figure 8). Dorsal fin rays 10-12 (13)9
- 8b. Circumpeduncle scales 12 or 13 (Figure 8). Dorsal fin rays almost always 13 or more 13

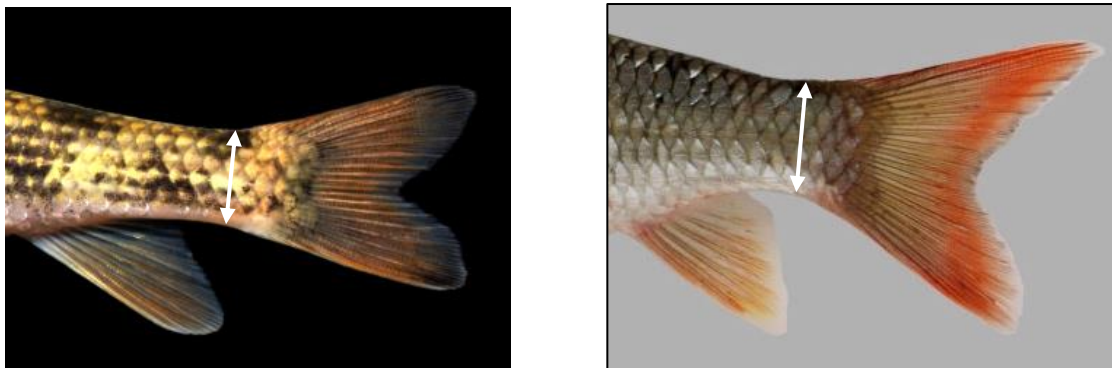


Figure 8. Left – Circumpeduncle scales 16 (encircling the caudal peduncle); Right – Circumpeduncle scales 12 or 13 (encircling the caudal peduncle).

- 9a. Posterior part of lower lip papillose, flared posteriorly to form a free flap (Figure 9). Inner surface of lips with firm, smooth rim, often separated from outer part of lips by a narrow groove. Range restricted to the upper Roanoke basin. 10
- 9b. Posterior part of lower lip plicate or semi-plicate, not flared posteriorly to form a free flap (Figure 9). Inner surface of lips without a firm, smooth rim. Range not restricted to the Roanoke basin 11

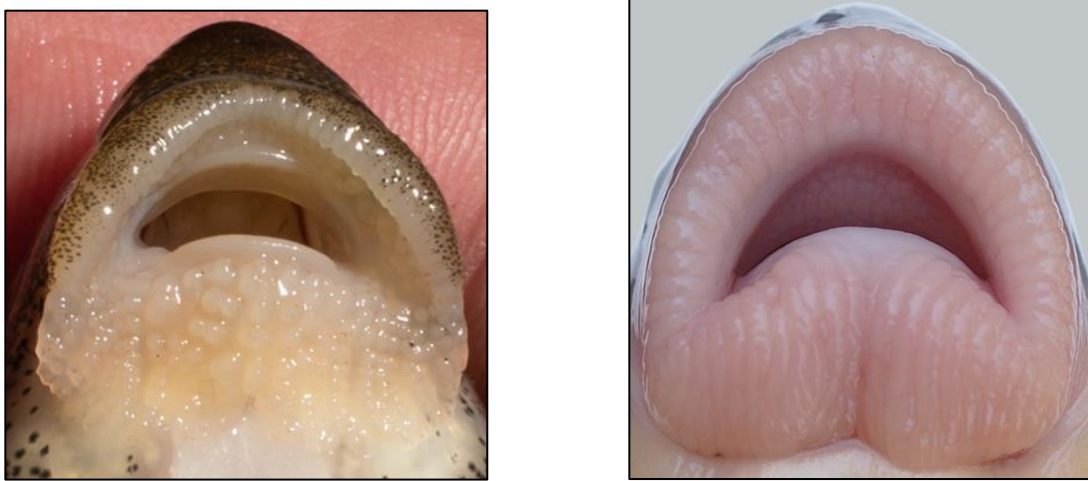


Figure 9. Left – Papillose lower lip; Right – Plicate lower lip.

- 10a. Upper lip papillose (Figure 10). Eye and head large. Caudal base lacking two large pale areas (Figure 11). Range restricted to the upper Roanoke basin Bigeye Jumprock, *Moxostoma ariommum*
- 10b. Upper lip plicate (Figure 10). Eye and head small. Caudal base with two large pale areas (Figure 11). Range restricted to the upper Roanoke basin Rustyside Sucker, *Thoburnia hamiltoni*

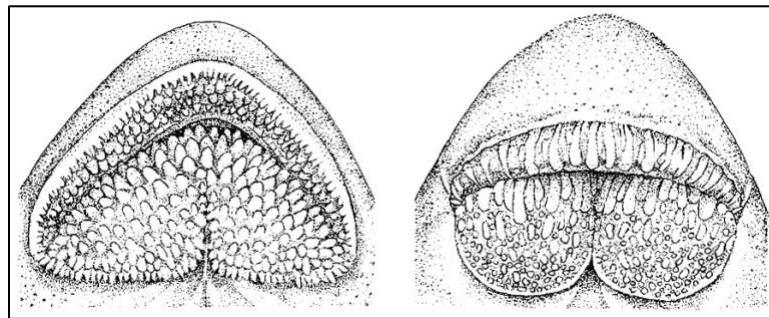


Figure 10. Left – Bigeye Jumprock with upper lip papillose; Right – Rustyside Sucker with upper lip plicate.

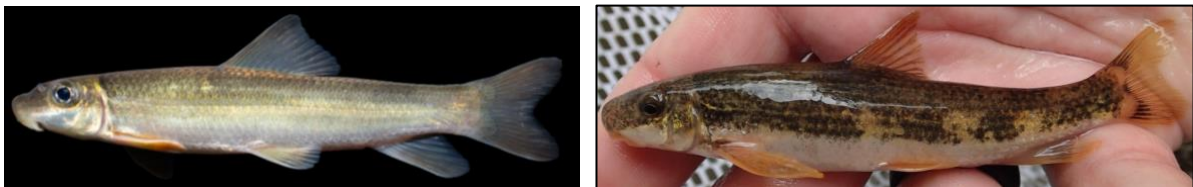


Figure 11. Left – Bigeye Jumprock; Right – Rustyside Sucker (photograph courtesy of Thomas Russ, North Carolina Wildlife Resources Commission).

- 11a. Dorsal and caudal fins with black tips (Figure 12). Range restricted to the Roanoke, Tar, and Neuse basins Blacktip Jumprock, *Moxostoma cervinum*
- 11b. Dorsal and caudal fins without black tips. Range does not include the Roanoke, Tar, or Neuse basins 12



Figure 12. Blacktip Jumprock. Right – Photograph courtesy of the North American Native Fishes Association.

- 12a. Body form stout. Head dorsum between eyes strongly convex, well elevated above the orbit. In juveniles and small adults, lateral body stripes below the lateral line – pale stripes wider than or equal in width to dark stripes (Figure 13). Lateral body blotches absent in medium juveniles and adults. Dorsal rays 12. Lower lip plicae with few or no deep transverse grooves. 28-34 gill rakers. Range restricted to the Broad, Catawba, Yadkin, and Cape Fear basins *Moxostoma* sp. “Brassy” Jumprock
- 12b. Body form elongate, cigar-shaped. Head dorsum between eyes flat or slightly convex, little or not at all elevated above orbit. In juveniles and small adults, lateral body stripes below the lateral line – pale stripes narrower in width than dark stripes (Figure 13). Lateral body blotches usually retained in juveniles and adults, often very blotchy and mottled. Dorsal rays usually 11. Lower lip plicae usually with numerous transverse grooves (subplicate). 23-26 gill rakers. Range restricted to the Catawba, Broad, and Savannah basins; introduced into the upper and middle Yadkin basin..... Striped Jumprock, *Moxostoma rupiscartes*

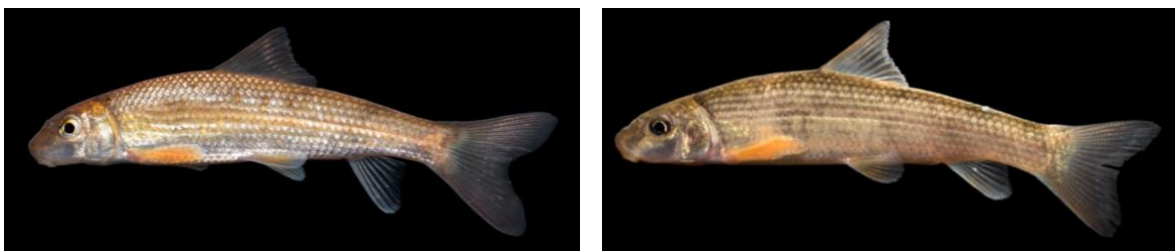


Figure 13. Left – *Moxostoma* sp. “Brassy” Jumprock with lateral body stripes below the lateral line – pale stripes wider than or equal in width to dark stripes; Right – Striped Jumprock with lateral body stripes below the lateral line – pale stripes narrower in width than dark stripes.

- 13a. Lips fully or nearly fully papillose or semi-papillose (Figure 14). V-lipped, halves of lower lip mostly unconnected medially. Posterior margin of lower lip medially forming a moderately or very acute angle..... 14
- 13b. Lips plicate or sometimes appearing corrugate (with shallow transverse creases) or upper lip plicate and lower lip subplicate. Full lipped, halves of lower lip mostly fully connected medially (Figure 14). Posterior margin of lower lip wholly forming slightly acute to very obtuse angle, or margin straight 16

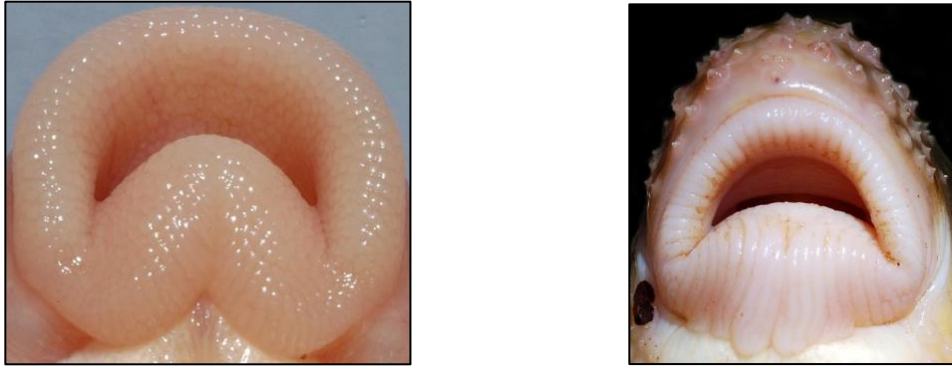


Figure 14. Left – Papillose lower lip; Right – Plicate lower lip.

- 14a. Lower lip papillose, papillae rounded at edges, regularly arranged, small, and mostly subequal or equal in size (Figure 15). Front of upper lip papillose in medium juveniles to adults. Lower lip with smoothly curved posterior margin, not abruptly thinned at a point distinctly anterior to its juncture with upper lip. Dorsal fin margin of large juveniles and adults almost always slightly to moderately falcate (Figure 16). Rather shallow form; profile elongate, little or not at all elevated towards dorsal fin. Scale bases dark. Most Atlantic slope river basins (i.e., Broad, Catawba, Yadkin, Cape Fear, Neuse, Tar, Roanoke, and Chowan basins) V-lip Redhorse, *Moxostoma pappillosum*
- 14b. Lower lip semi-papillose, its fine ridges (plicae) deeply, transversely, and somewhat irregularly dissected, resultant papillae-like subdivisions somewhat irregularly arranged and unequal in size (Figure 15). Front of upper lip smooth, lacking papillae. Lower lip abruptly thinned at a point distinctly anterior to its juncture with upper lip. Dorsal fin margin of large juveniles and adults convex, straight or slightly concave. Moderate or high-backed form. Scale bases pale 15

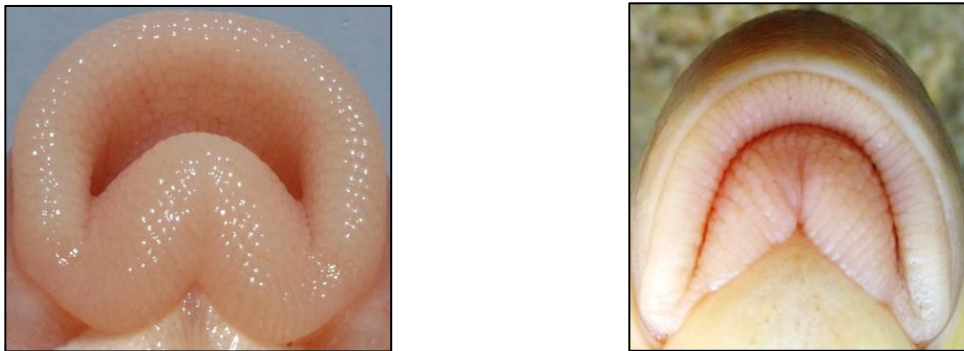


Figure 15. Left – V-lip Redhorse lower lip with smoothly curved posterior margin, not abruptly thinned at a point distinctly anterior to its juncture with upper lip; Right – Notchlip Redhorse lower lip that is abruptly thinned at a point distinctly anterior to its juncture with upper lip.



Figure 16. V-lip Redhorse.

- 15a. Body elevated; body depth at dorsal fin origin (minimum 27) 28-32 (maximum 34)% standard length. Dorsal fin margin usually slightly convex in adults (Figure 17). Restricted to river basins west of the Appalachian Mountains (i.e., Nolichucky, French Broad, Little Tennessee, and Hiwassee basins)..... Silver Redhorse, *Moxostoma anisurum*
- 15b. Body form moderate; body depth at dorsal fin origin (minimum 23) 24-28 (maximum 30)% standard length. Dorsal fin margin slightly concave or straight in adults (Figure 17). Found across most Atlantic slope basins (i.e., Broad, Catawba, Yadkin, Cape Fear, Neuse, Tar, Roanoke, and Chowan basins)..... Notchlip Redhorse, *Moxostoma collapsum*



Figure 17. Left – Silver Redhorse (photograph courtesy of the North American Native Fishes Association); Right – Notchlip Redhorse.

- 16a. Dorsal fin very falcate (Figure 18), the anterior tip when appressed exceeding the posterior tip, usually markedly. Pharyngeal arch stout; lower teeth slightly molariform, 8-9 teeth on lower half of tooth row. Lower lip usually subplicate, posterior margin truncate or nearly so. Range restricted to the Little Tennessee and Hiwassee basins *Moxostoma* sp. “Sicklefin” Redhorse
- 16b. Dorsal fin margin straight to moderately falcate (rarely very falcate in adult Smallmouth Redhorse) (Figure 18) 17



Figure 18. Left – *Moxostoma* sp. “Sicklefin” Redhorse with dorsal fin margin strongly falcate; Right – *Moxostoma* sp. “Carolina” Redhorse with moderately straight dorsal fin. *Moxostoma* sp. “Sicklefin” Redhorse photograph courtesy of Luke Etchison, North Carolina Wildlife Resources Commission.

- 17a. Pharyngeal arch stout; lower teeth large, molariform, 6-9 teeth on lower half of tooth row. Lips plicate. Head medium or large. Caudal and dorsal fins bright red in life. [Note: The only other redhorse with bright red dorsal and caudal fins are the Shorthead Redhorse and Smallmouth Redhorse, which have a tiny mouth with the posterior border of the lower lip straight, a moderately falcate dorsal fin, and a very slab-sided rather than cylindrical body cross-section.] Snout of breeding males with obvious, medium-sized nuptial tubercles..... 18
- 17b. Pharyngeal arch light; lower teeth thin, comb-like; 12-30 teeth on lower half of tooth row. Caudal and dorsal fins not bright red in life, except in occasional young. Snout of breeding males with or without medium-sized breeding tubercles. Head medium or small 19

- 18a. Body laterally with dark-and-pale scale pattern and uniformly shaded or gradually changing shade from shoulder to tail and back to flank; stripes and irregular dusky patches absent. Upper body dominantly brassy, coppery, or olive (Figure 19). Pelvic rays usually 9-9. Males with few or no nuptial tubercles on opercle. Restricted to river basins southwest of the Appalachian Mountains (i.e., French Broad, Pigeon, Little Tennessee, and Hiwassee basins).....
 River Redhorse, *Moxostoma carinatum*
- 18b. Body laterally with dark-and-pale scale pattern non-uniform from shoulder to tail and (or) back to flank, having stripes and/or irregular dusky patches (Figure 19). Upper body dominantly golden brown in life. Pelvic fin rays 10-10 or 10-9. Males with many nuptial tubercles on opercle. Restricted to the Catawba (extirpated) and lower Yadkin (Pee Dee) basins.....
 Robust Redhorse, *Moxostoma robustum*



Figure 19. Left – River Redhorse; Right – Robust Redhorse. River Redhorse photograph courtesy of Luke Etchison, North Carolina Wildlife Resources Commission.

- 19a. Lower lip subplicate laterally, laterally and posteriorly, or entirely; plicae deeply transected into small to large, oval elements (Figure 20). Head small and short 20
- 19b. Lower lip plicate, plicae undissected or with shallow creases (corrugate) (Figure 20). Head not small or short..... 21



Figure 20. Left – Lower lip subplicate laterally and posteriorly; Right – Lower lip plicate, plicae undissected.

- 20a. Pelvic fin rays modally 10-10. Dorsal fin rays modally 12. Restricted to river basins west of the Appalachian Mountains (i.e., Nolichucky, French Broad, Pigeon, Little Tennessee, and Hiwassee basins) (Figure 21)..... Smallmouth Redhorse, *Moxostoma breviceps*
- 20b. Pelvic fin rays modally 9-9. Dorsal fin rays modally 13. Found across most Atlantic slope basins (i.e., Catawba, Yadkin, Cape Fear, Neuse, Tar, Roanoke, Chowan, and Albemarle basins) (Figure 21) Shorthead Redhorse, *Moxostoma macrolepidotum*

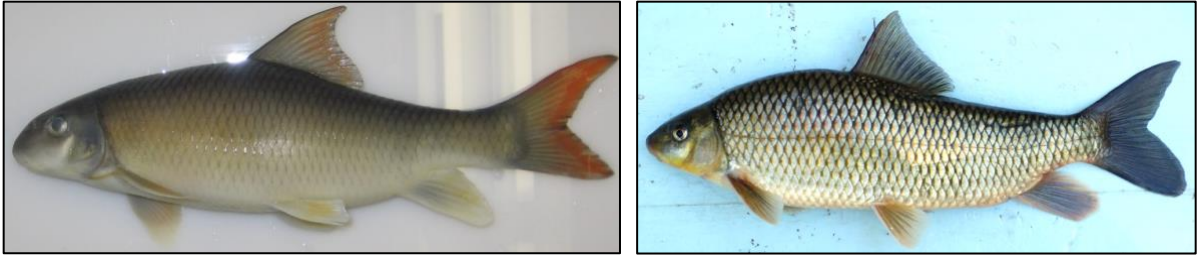


Figure 21. Left – Smallmouth Redhorse; Right – Shorthead Redhorse.

- 21a. Lateral line scales (minimum 43) 44-48 (maximum 51). Breast usually with a small scaleless area anteromedially, anteromedialmost breast scales much smaller than anterior belly scales. Embedded breast scales. Snout of breeding males with minute or no nuptial tubercles; without medium to large breeding tubercles on snout (Figure 22). Pelvic fin rays modally 10-10 (but modally 9-9 in the Blue Ridge of Tennessee River drainage). Angle of posterior edge of lower lip (95) 120-160 (175)°. Widespread in all basins west of the Appalachian Mountains (i.e., Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, and Hiwassee basins), except for the New basin; two records from the upper Green River in the Broad basin Black Redhorse, *Moxostoma duquesnei*
- 21b. Lateral line scales (minimum 37) 39-43 (maximum 45). Breast usually fully scaled (exposed), anteromedial breast scales slightly to moderately smaller than anterior belly scales. Snout of breeding males with obvious, medium to large--sized nuptial tubercles (Figure 22). Pelvic fin rays modally 9-9. Angle of posterior edge of lower lip 90-130 (155)° 22



Figure 22. Left – Black Redhorse without medium to large nuptial tubercles on snout; Right – *Moxostoma* sp. “Carolina” Redhorse with obvious, medium to large--sized nuptial tubercles on snout.

- 22a. Supratemporal canal usually interrupted medially. Dorsal fin rays 14 or 15. Pectoral fin rays 10-10. Lateral line scales 43 or 44. Range confined to the middle Cape Fear and lower Yadkin basins (Figure 23)..... *Moxostoma* sp. “Carolina” Redhorse
- 22b. Supratemporal canal not usually interrupted medially. Dorsal fin rays 12 or 13. Pectoral fin rays 10-9 or 9-10, but usually 9-9. Lateral line scales usually less than 42. Range confined to the Roanoke and all basins west of the Appalachian Mountains (i.e., Nolichucky, French Broad, Pigeon, Little Tennessee, and Hiwassee), except for the Watauga and New basins (Figure 23) Golden Redhorse, *Moxostoma erythrum*



Figure 23. Left – *Moxostoma* sp. “Carolina” Redhorse; Right – Golden Redhorse (photograph courtesy of the North American Native Fishes Association).

- 23a. Subopercle asymmetrical (triangular) (Figure 24). Pelvic and anal fins seldom pigmented. Anal fin rays 7, rarely 8 24
- 23b. Subopercle symmetrical (rounded) (Figure 24). Pelvic and anal fins with melanophores. Anal fin rays 8-11 27

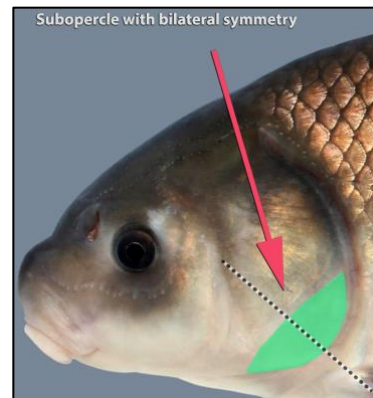
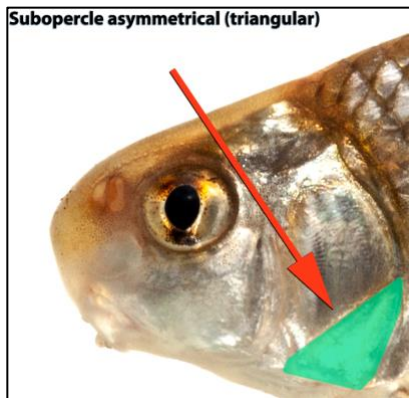


Figure 24. Left – Arrow pointing to the green shaded-in triangular subopercle; Right – arrow pointing to the green shaded-in rounded subopercle.

- 24a. Nipple-like projection present on tip of lower lip (Figure 25). Mouth extends posteriorly to or below the eye (Figure 26). Lateral line scales 36 or fewer (33-37). Dorsal fin rays usually 27 or fewer .. 25
- 24b. Nipple-like projection absent from tip of lower lip (Figure 25). Mouth does not extend posteriorly to or below the eye (Figure 26). Lateral line scales 37 or more (36-40). Dorsal fin rays usually 28 or more 26

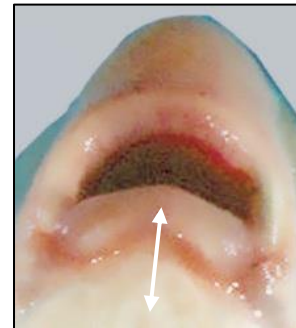
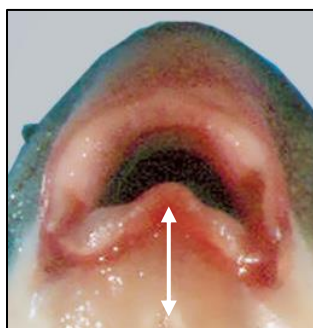


Figure 25. Left – White arrow pointing to the tip of lower lip with a nipple-like projection; Right – White arrow pointing to the tip of the lower without a nipple-like projection.

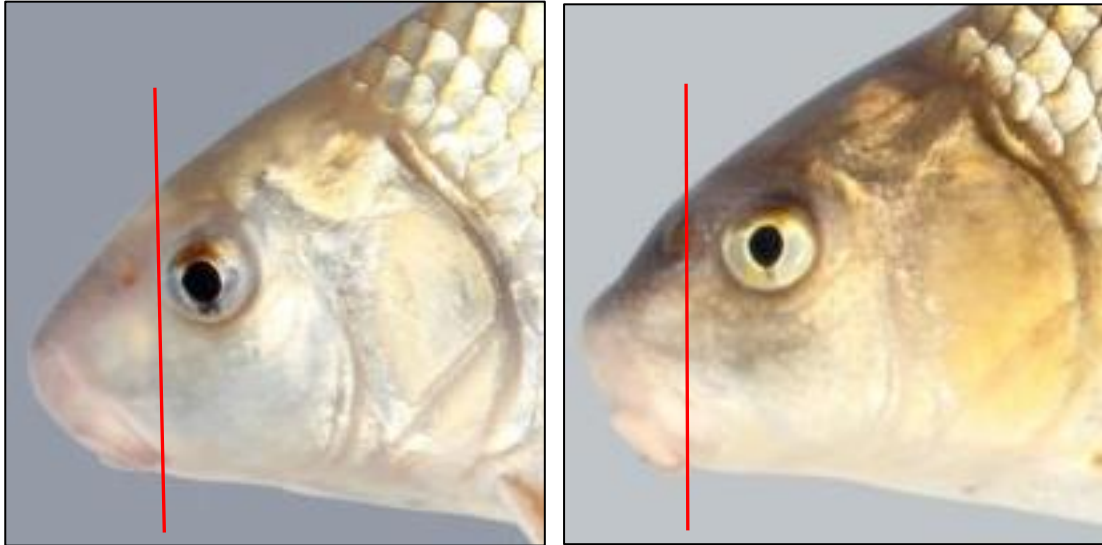


Figure 26. Left – Mouth extending to or below the eye; Right – mouth not extending below eye.

- 25a. Snout of adults blunt and rounded (Figure 27). Breeding tubercles large, larger on snout and top of head than on operculum. Tubercles on most of body scales. Range restricted to the Catawba, Yadkin (Pee Dee), and Cape Fear basins *Carpiodes* sp. “Atlantic Highfin” Carpsucker
- 25b. Snout angular (Figure 27). Breeding tubercles small, smaller on snout and top of head than on operculum. Tubercles absent from most of body. Range restricted to French Broad and Nolichucky basins River Carpsucker, *Carpiodes carpio*



Figure 27. Left – *Carpiodes* sp. “Atlantic Highfin” Carpsucker with snout blunt and rounded; Right – River Carpsucker with snout angular (photograph courtesy of the North American Native Fishes Association).

- 26a. Range restricted to the Roanoke, French Broad, and Pigeon basins (Figure 28) Quillback, *Carpiodes cyprinus*
- 26b. Range restricted to the Broad, Catawba, and Yadkin basins (Figure 28) *Carpiodes* sp. “Carolina” Quillback



Figure 28. Left – Quillback (photograph courtesy of the North American Native Fishes Association); Right – *Carpiodes* sp. “Carolina” Quillback.

- 27a. Tip of upper lip nearly level with lower margin of eye (Figure 29). Mouth oblique, large. Lips nearly smooth. Introduced in the Catawba and Yadkin basins Bigmouth Buffalo, *Ictiobus cyprinellus*
- 27b. Tip of upper lip far below eye, midway between lower margin of eye and bottom of head (Figure 29). Mouth nearly horizontal; small. Lips plicate 28

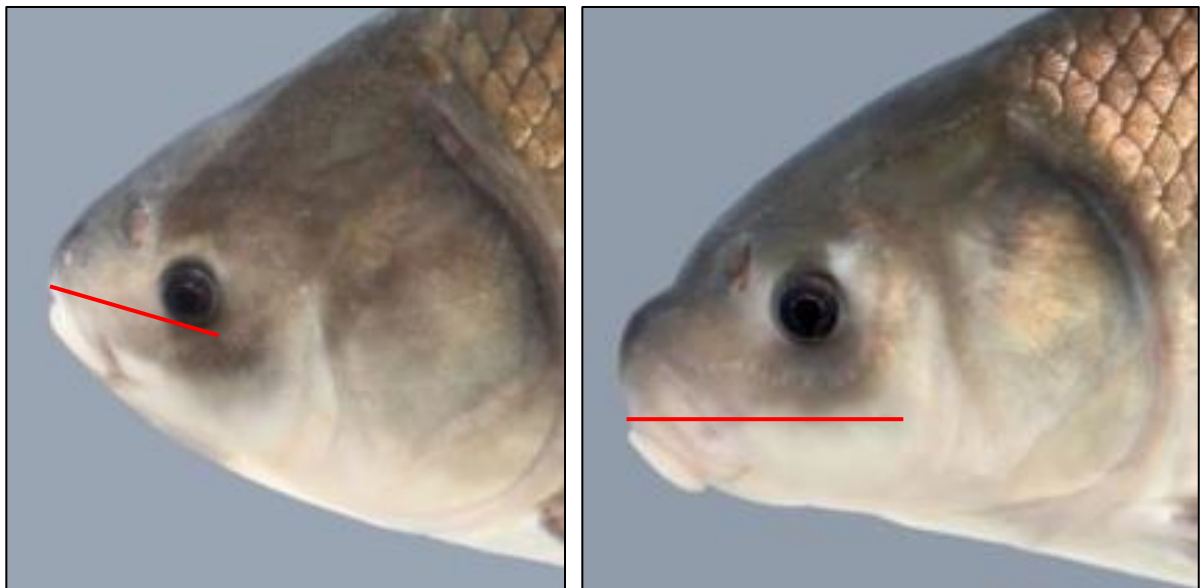


Figure 29. Left – Bigmouth Buffalo with tip of upper lip nearly level with lower margin of eye; Right – with tip of upper lip far below eye, midway between lower margin of eye and bottom of head. (Photographs courtesy of the North American Native Fishes Association.)

- 28a. Body deep and compressed, body depth, even in juveniles, usually less than 2.7 times in standard length (Figure 30). Eye diameter greater than distance from fleshy posterior tip of maxilla to fleshy anterior tip of lower jaw (may not be true in extremely large fish). Back sharply ridged anterior to dorsal fin. Found in the Yadkin, Catawba, Nolichucky, and French Broad basins Smallmouth Buffalo, *Ictiobus bubalus*
- 28b. Body depth usually more than 2.9 times in standard length (Figure 30). Eye diameter equal to or less than distance from fleshy posterior tip of maxilla to fleshy anterior tip of lower jaw in adults. Back rounded anterior to dorsal fin. Range restricted to the lower French Broad basin Black Buffalo, *Ictiobus niger*

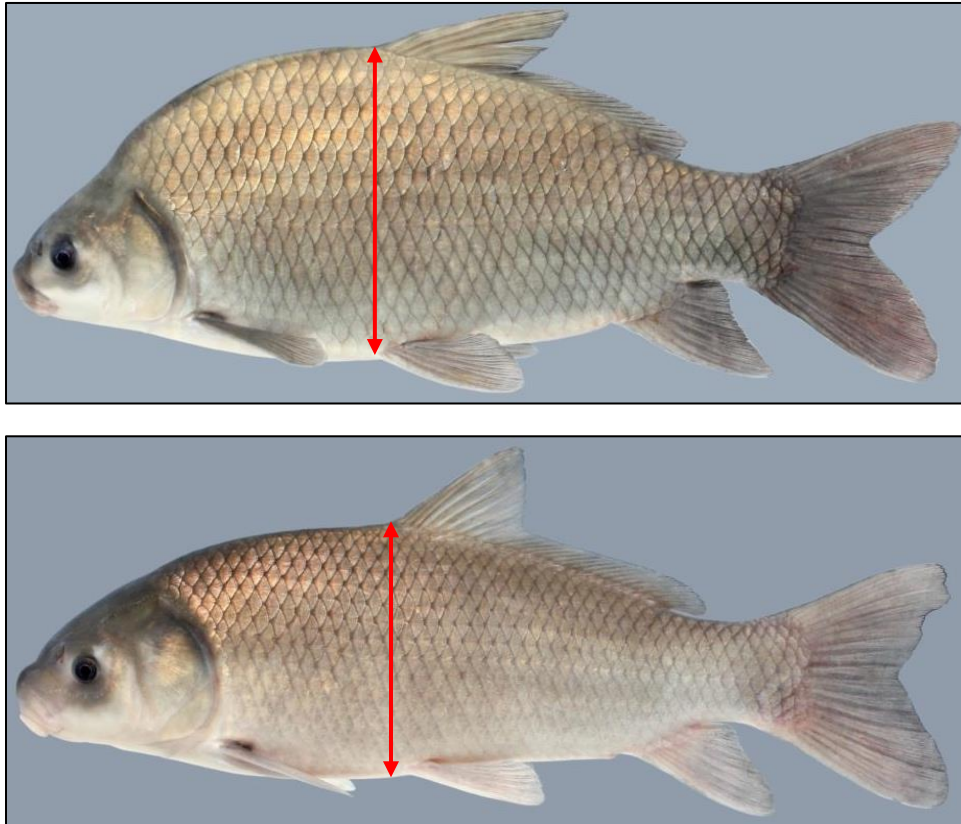


Figure 30. Top – Smallmouth Buffalo, body deep and compressed; Bottom –Black Buffalo, body depth not deep or compressed. (Photographs courtesy of the North American Native Fishes Association.)

Glossary

(Adapted from Jenkins and Burkhead (1994))

Anteromedially – towards the anterior middle region of the breast (as used in the diagnostic key) between the pectoral fins.

Circumpeduncle Scale Count – A count of the number of scales encircling the caudal peduncle

Corrugate – Appearing as wrinkled or folded

Embedded Scales – Scales that are not obvious owing to deep embedment in or full covering by skin

Falcate – Fins with a markedly concave or sickle-shaped distal margin

Gill Rakers – Projections along the anterior edge of the gill arch

Maxilla – Bone in the upper jaw that lies immediately above (or behind) and parallel to the premaxilla (the most anterior bones in the upper jaw)

Melanophore – A cell bearing melanin (a dark pigment which produces shades of gray to black depending upon the concentration)

Molariform – Molarlike; relatively large teeth with flattened or broadly rounded crowns

Papillose – Bearing papillae (small rounded fleshy protuberances, knob-like or elongate)

Pharyngeal Arch – The bony modified last (posterior) gill arch; term applied when this arch bears definitive teeth as in suckers

Pharyngeal Teeth – Teeth on the pharyngeal arch

Plicate (Plicae) – Having parallel ridges and grooves, appearing pleated or folded

Predorsal Circumferential Scale Count – A count of the number of scales obliquely encircling the body anterior to the dorsal fin

Subopercle – A bone of the gill cover that is below the opercle bone (the largest bone of the gill cover)

Supratemporal canal - That portion of the lateral line system that connects the lateral canals of the two sides by crossing the top of the head at the occiput or behind that point; a lateral line canal extending across the occiput of a fish's head, often incomplete (Accessed at <https://www.fishbase.in/glossary/Glossary.php?q=supratemporal+canal>, December 06, 2020).

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(Identification key adapted from these references)

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