Topminnow (Family Fundulidae) Diversity in North Carolina

The Topminnow Family in North Carolina is a small family of 11 scientifically described and 1 undescribed species (Table 1) occurring primarily within the eastern Coastal Plain and within the estuarine marshes along the Atlantic Coast (Menhinick 1991; Tracy et al. 2020). Often referred to as killifishes, top minnows, or mud-minnows, each species has an American Fisheries Society-accepted common name (Page et al. 2013) and a scientific (Latin) name (Table 1; Appendix 1).

Table 1. Species of topminnows found in North Carolina. Common name enclosed within tick marks (‘) is a scientifically undescribed species.

Scientific Name/ American Fisheries Society Accepted Common Name	Scientific Name/ American Fisheries Society Accepted Common Name
Golden Topminnow, *Fundulus chrysotus*	Striped Killifish, *Fundulus majalis*
Marsh Killifish, *Fundulus confluentus*	Speckled Killifish, *Fundulus rathbuni*
Banded Killifish, *Fundulus diaphanus*	Waccamaw Killifish, *Fundulus waccamensis*
Mummichog, *Fundulus heteroclitus*	*Fundulus* sp. “Lake Phelps” Killifish
Lined Topminnow, *Fundulus lineolatus*	Bluefin Killifish, *Lucania goodei*
Spotfin Killifish, *Fundulus luciae*	Rainwater Killifish, *Lucania parva*

Topminnows range in size from the diminutive *Lucania* at 50 mm (about 2 inches) to the 200 mm (7.8 inches) Striped Killifish. Because of their abundance and the ease by which they can be collected, they are often sold and used as bait fish along the Coast. As previously stated, most species are found in the eastern part of the state, although one species, Speckled Killifish, is found in the central Piedmont. There are no species in our river basins west of the Appalachian Mountains.

Most of our species inhabit a variety of coastal aquatic environments (Table 2) and have a wide-ranging tolerance to salinities. Speckled Killifish, Waccamaw Killifish, and *Fundulus* sp. “Lake Phelps” Killifish are known to inhabit only freshwater environments.

The Waccamaw basin is home to two of our three species found in only one river basin – Golden Topminnow and Waccamaw Killifish; the other species, Bluefin Killifish is found only in the Cape Fear basin. The Golden Topminnow is a recent, naturally-occurring migrant from South Carolina; it was unknown to occur in North Carolina until 2007 when it was first discovered in Marlowe Branch in Columbus County. The Bluefin Killifish is our state’s only nonindigenous (non-native or introduced) topminnow. Speckled Killifish is suspected of being introduced in the Catawba basin and questionably *Fundulus* sp. “Lake Phelps” Killifish or perhaps Banded Killifish has been discovered in Shearon Harris Lake in southern Wake County, Cape Fear basin (Tracy et al. 2020).

The Lined Topminnow is our most widely distributed species being found in 11 basins. The Cape Fear basin contains the most species, seven; whereas the Catawba and Lumber basins each have only one species (Tracy et al. 2020, NCFIshes.com).

Two species were scientifically described for the first time from North Carolina. Waccamaw Killifish described in 1946 from Lake Waccamaw in Columbus County (Hubbs and Raney 1946) and Speckled Killifish described in 1889 from several localities in the Haw River watershed in Guilford County (Jordan 1889).

Because of their limited distributions and anthropogenic impacts upon their habitats, three species are listed as imperiled - *Fundulus* sp. “Lake Phelps” Killifish, which is Significantly Rare; Waccamaw Killifish which is Special Concern; and Bluefin Killifish which is Special Concern (Krabbenhoft et al. 2009; NCAC 2017; NCNHP 2020; NCWRC 2017).

Table 2. Physiographic regions and habitats in which to find North Carolina's Killifish. Adapted from Hardy (1980), Lee (1980), Shute et al. 1983, Rohde (2009), and Kells and Carpenter (2011).

Species	Physiographic Region	Habitats
Golden Topminnow	Southeastern Coastal Plain	Open, sunlit, quiet, slow, shallow, warm, heavily vegetated waters of marshes, swamps, lake shores, sloughs, drainage ditches, borrow pits, and creek waters; also occurring in slightly to moderately saline waters
Marsh Killifish	Eastern Coastal Plain	Freshwater rivers and streams and brackish water tidal streams, coastal bays, marshes, channels, and over seagrass flats
Banded Killifish	Primarily northeastern Coastal Plain	Calm, slow, and clear water of rivers and creeks, but also occurring from, small inland streams to wide tidal rivers with low salinity, usually over a bottom of open sand
Mummichog	Eastern Coastal Plain	Tidal marshes, creeks, and ditches over mud flats and in or near vegetation, but also often occurring in fresh water
Lined Topminnow	Sand Hills, Coastal Plain	Freshwater, soft-water, dystrophic, acidic, clear or tannin-stained quiet portions of streams, sloughs, drainage ditches, borrow pits, and ponds, especially near submerged or emergent vegetation
Spotfin Killifish	Southeastern Coastal Plain	Estuarine, typically in intertidal salt marshes
Striped Killifish	Eastern Coastal Plain	Preferring high salinities in inlets, bays, estuaries, marshes, and also along beaches
Speckled Killifish	Central Piedmont	Freshwater, common in pools and runs of streams, usually over mud or sand bottoms
Waccamaw Killifish	Coastal Plain – Lake Waccamaw	Freshwater, occurring in large schools in shallow water along the sandy to muddy shoreline, often associated with submerged or emergent vegetation
Fundulus sp. "Lake Phelps" Killifish	Coastal Plain – Lake Phelps	Freshwater, occurring in large schools in shallow water along the sandy to muddy shoreline, often associated with submerged or emergent vegetation
Bluefin Killifish	Wilmington, New Hanover County	Freshwater, only occurring in the lake and outfall
Rainwater Killifish	Eastern Coastal Plain	Saltwater environments, but also occurring in some freshwater habitats; usually associated with dense vegetation

Key characteristics for their proper identification include the positioning of the dorsal fin relative to the snout and caudal fin, origin of the dorsal fin relative to the origin of the anal fin; color patterns; number of dorsal fin rays; number of gill rakers, and lateral scale count. However, several species can co-occur within the same habitats at the same time, rendering field identifications a challenge.

Identification Key to the Species of Topminnows (Family Fundulidae) in North Carolina

1a. Dorsal fin origin closer to preopercle than to caudal fin base (Figure 1) 2

1b. Dorsal fin origin closer to caudal fin base than to preopercle (Figure 1) 3

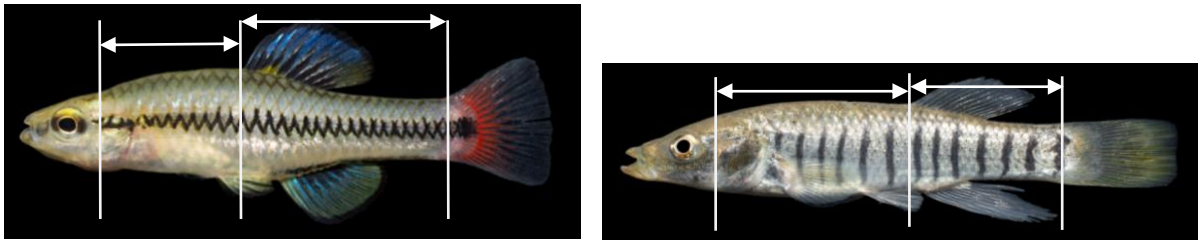

Figure 1. Left – Dorsal fin closer to preopercle than to caudal fin base; Right – Dorsal fin closer to caudal fin base than to preopercle.

2a. Lateral stripe black, extending from snout to caudal fin spot (Figure 2). Dorsal fin rays 8-11. Restricted to Burnt Mill Creek and an impoundment of the creek at Anne McCrary Park in Wilmington, New Hanover County .....Bluefin Killifish, *Lucania goodei*

2b. Lateral stripe inconspicuous; caudal fin spot absent (Figure 3). Dorsal fin rays 11 or 12. Not restricted as above ..... Rainwater Killifish, *Lucania parva*

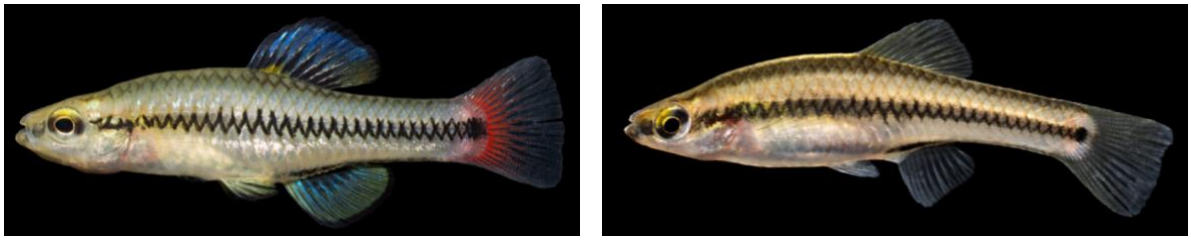

Figure 2. Bluefin Killifish.

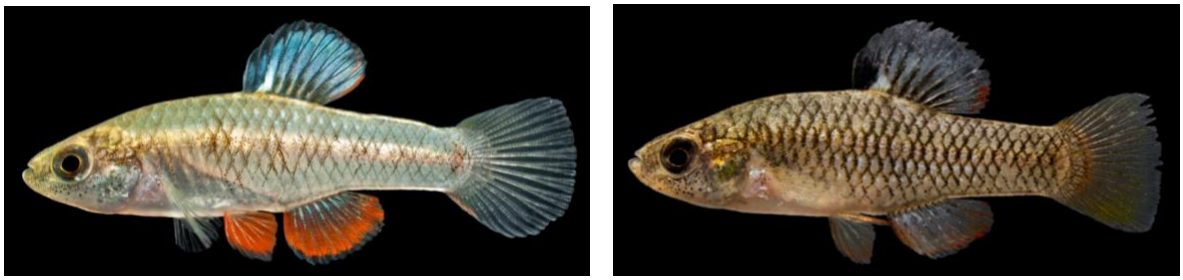

Figure 3. Rainwater Killifish.

3a. Dorsal fin rays 9 or fewer. Dorsal fin origin behind anal fin origin (Figure 4).....4

3b. Dorsal fin rays 10 or more. Dorsal fin origin in front of anal fin origin (Figure 4) 6

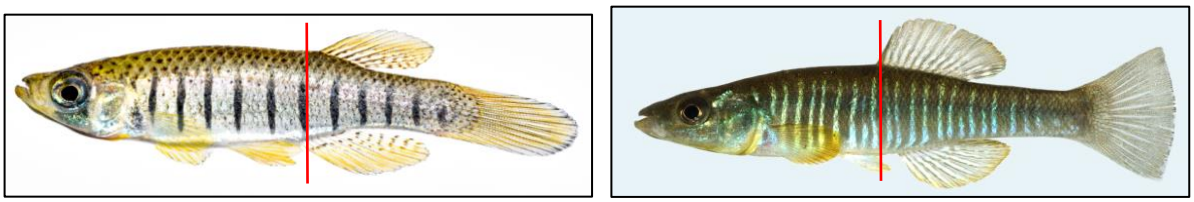

Figure 4. Red bars showing positioning of the dorsal fin relative to that of the anal fin. Left – Dorsal fin posterior to anal fin origin; Right – Dorsal fin anterior to anal fin origin.

4a. Predorsal median stripe distinct and dark (Figure 5). Male with 10-12 dark bars on the side and a black spot on the dorsal fin (Figure 5). Female more or less plain gray with no spot on the dorsal fin .....Spotfin Killifish, *Fundulus luciae*

4b. Predorsal stripe light or absent. No black spot on the dorsal fin.....5

Figure 5. Spotfin Killifish. Left – Male; Right – dorsal view with white arrowing pointing to the very thin black predorsal stripe.

5a. Dark blotch below eye. Female with 6-8 narrow longitudinal black stripes; male with 9-13 narrow dark bars on the side (Figure 6) .....Lined Topminnow, *Fundulus lineolatus*

5b. No dark blotch below eye; many small golden or pearly (in females and juvenile) to red (in males) spots on the side (Figure 7). Male can develop 10-12 broad, wavy indistinct vertical bars on the side. Range currently restricted to the Waccamaw basin..... Golden Topminnow, *Fundulus chrysotus*

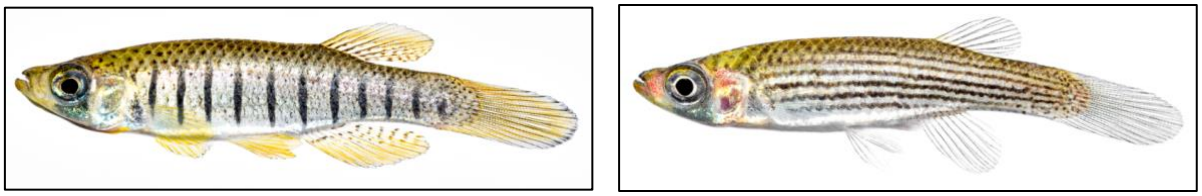

Figure 6. Lined Topminnow. Left – Female; Right – Male.

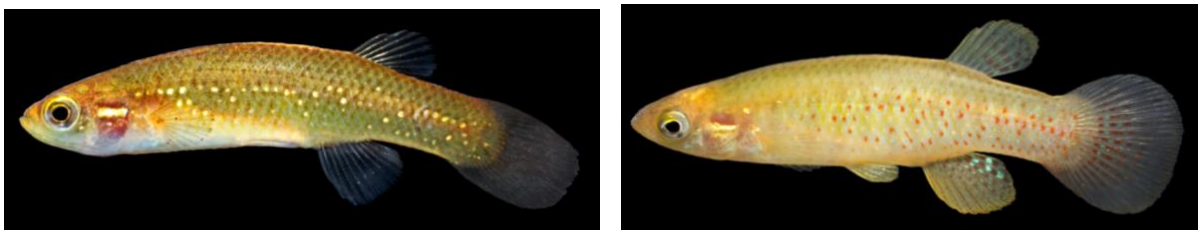

Figure 7. Golden Topminnow. Left – Female; Right – Male.

6a. Bars or distinct stripes present in one or both sexes. Dorsal fin origin usually in front of anal fin origin. Range confined to the Coastal Plain and Coast 7

6b. Sides of adults with no bars (Figure 8). Dorsal fin origin over or slightly behind anal fin origin. Female with irregular black spots on sides and head; males plain on sides, head spotted. Range generally restricted to the Piedmont ..... Speckled Killifish, *Fundulus rathbuni*

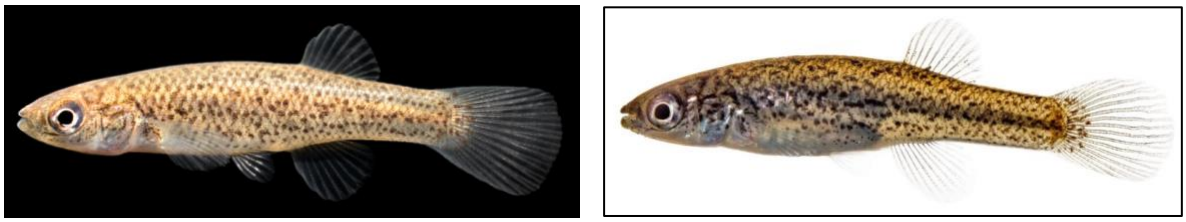

Figure 8. Speckled Killifish.

7a. Caudal fin truncate or emarginate. Dorsal fin with no black spot. Female with about 12-16 narrow dark bars; males with 15-20 dark bars, usually wider than light interspaces. Lateral scales 37-64. Gill rakers 4 or 5 8

7b. Caudal fin rounded. Bars, if present, fewer than 15 (but up to 18 in females Marsh Killifish). One sex often with a black spot at the posterior of the dorsal fin. Lateral scales 30-36 (29-39). Gill rakers 5-10 10

8a. Lateral scales 36-39 (34-46). Depth of caudal peduncle going 2.0-2.8 times in the length of the caudal peduncle (Figure 9) .....Banded Killifish, *Fundulus diaphanus*

8b. Lateral scales 52-58 (50-64). Depth of caudal peduncle going 2.8-3.5 times in length of caudal peduncle 9

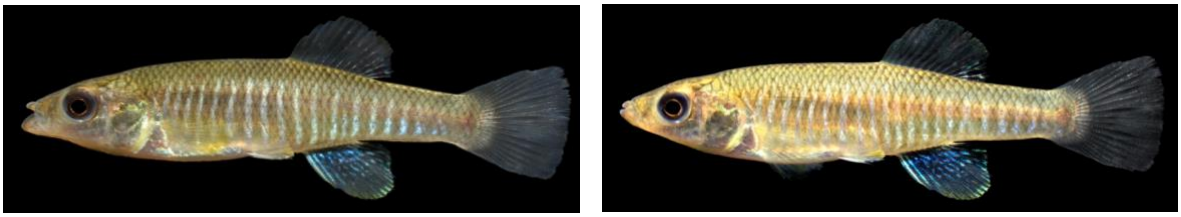

Figure 9. Banded Killifish

9a. Restricted to Lake Waccamaw and adjacent canals, Columbus County (Figure 10)..... .....Waccamaw Killifish, *Fundulus waccamensis*

9b. Restricted to Lake Phelps in Washington and Tyrell counties (Figure 11) ....*Fundulus* sp. "Lake Phelps" Killifish

Figure 10. Waccamaw Killifish.

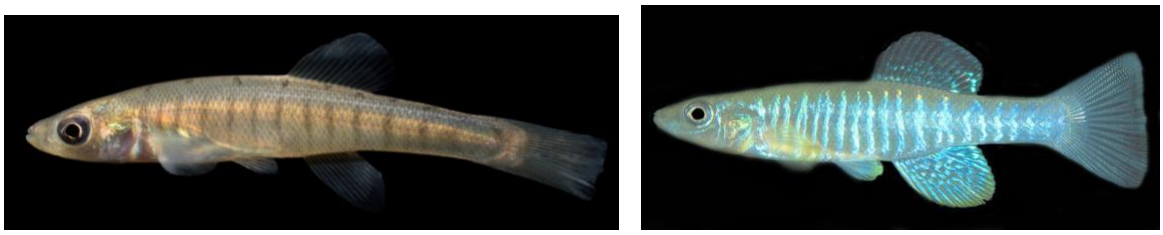

Figure 11. *Fundulus* sp. "Lake Phelps" Killifish

10a. Snout long, eye width going about 1.5 times into the snout length. Dorsal fin rays 14 or 15. Female with black stripes; male with black bars on the side and a dark spot in the dorsal fin (Figure 12). Caudal fin slightly rounded ..... Striped Killifish, *Fundulus majalis*

10b. Snout short, eye width going about one time into the snout length. Dorsal fin rays 10-12. Both sexes may have bars on the body. Caudal fin rounded 11

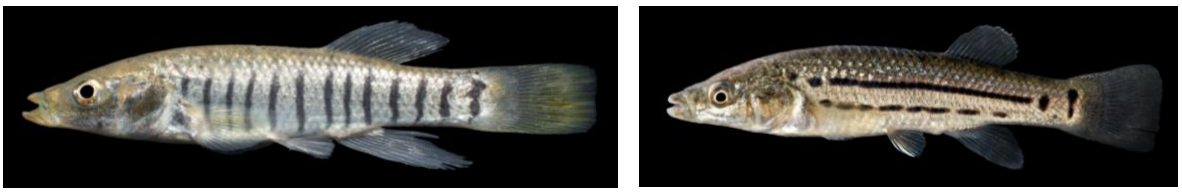

Figure 12. Striped Killifish. Left – Male; Right – Female.

11a. Gill rakers 5. Females with normal genital pouch, black spot on the posterior part of the dorsal fin; 14 narrow black bars on sides, and poorly defined longitudinal rows of black dots on the dorsum (Figure 13). Males with about 18 gray bars about same width as spaces and with a gold spot anterior to the dorsal fin and black spots on the dorsum (Figure 13) .....Marsh Killifish, *Fundulus confluentus*

11b. Gill rakers 9 or 10. Females with long genital pouch that extends to near tip of anal fin; no black dots on the dorsal fin; plain dorsal, anal, and caudal fins (Figure 14). Males with about 14 narrow white bars that fade anteriorly, blotch sometimes present on last rays of dorsal fin, and with black spot anterior to the dorsal fin (Figure 14). Dorsal, anal, and caudal fins of males often dark with light spots and light margin (Figure 14) ..... Mummichog, *Fundulus heteroclitus*

Figure 13. Marsh Killifish. Top Left – Male; Top Right – Female with white arrow pointing to the black spot on the posterior part of the dorsal fin; Bottom Center – Male with white arrow pointing to the gold spot anterior to the dorsal fin.

Figure 14. Mummichog. Top Left – Male; Top Right – Juvenile female. Bottom Center – White arrow pointing to the black spot anterior to the dorsal fin.