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**“Ghost Sightings” Made by Ichthyologists Past: Longear Sunfish,  
*Lepomis megalotis*, in North Carolina**

Bryn H. Tracy<sup>1,\*</sup>, Fred C. Rohde<sup>2</sup>, and Gabriela M. Hogue<sup>3</sup>

**Abstract** - *Lepomis megalotis* (Longear Sunfish) was first reported from North Carolina by Edward Drinker Cope in 1870, but its whereabouts in the state have been a mystery for almost 150 years. Published literature perpetuated the occurrence of Longear Sunfish and, eventually in 1986, its extirpation. Vouchered specimens from Cope’s 1870 publication are not available, but specimens collected later (1930s to 1990s) and purported to be Longear Sunfish, are available at various museums. Here we reidentified all known vouchered specimens of Longear Sunfish from North Carolina as either *L. auritus* (Redbreast Sunfish), *L. cyanellus* (Green Sunfish), *L. gibbosus* (Pumpkinseed), *L. marginatus* (Dollar Sunfish), *Lepomis* hybrids, or *Enneacanthus gloriosus* (Bluespotted Sunfish). Our findings indicate that there is no supportive evidence that Longear Sunfish, historically or more recently, ever occurred in North Carolina. This investigation of the true status and distribution of the Longear Sunfish in North Carolina underscores the importance of vouchered material in museum collections and globally accessible specimen data. Without these resources, we cannot discover the true distribution of species and therefore effectively list and allocate funds for their restoration and conservation.

### Introduction

For 150 years, *Lepomis megalotis* (Rafinesque) (Longear Sunfish) has been reported to have occurred in North Carolina. In June 1870, Edward Drinker Cope, reading before the American Philosophical Society, reported on its occurrence in western North Carolina. Later that year, he published his findings on Longear Sunfish from the upper waters of the French Broad River (Cope 1870). Within the same publication, he also reported on finding Longear Sunfish in Tennessee, but called them *L. nitidus* Kirtland, a synonym of *L. megalotis*. He remarked that the species was common in Coal Creek, TN, but not seen in North Carolina (Cope 1870). Ten specimens from Coal Creek are vouchered at Drexel University’s Philadelphia Academy of Natural Sciences (ANSP 12959) and were determined to be Longear Sunfish by H.W. Fowler. Unfortunately, vouchered specimens of Longear Sunfish from the North Carolina portion of his survey were not retained or cannot be located.

This contradiction within Cope’s 1870 publication leads us to question his identification of Longear Sunfish in North Carolina. What species was Cope finding and have other reports of this species (Bauer 1980; Evermann and Cox 1896; Fowler 1936, 1945; Menhinick 1986, 1991, 1997; NatureServe 2018;

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NCNHP 2018; Smith 1907) been accurate or “ghost sightings” due to the fact that Longear Sunfish have been considered extirpated from North Carolina since 1986 (Menhinick 1986)? This could be a case of mistaken identity, like that of *Percina sciera* (Swain) (Dusky Darter), which lasted almost 45 years based on 2 misidentified specimens; this species has been considered extirpated from North Carolina since 2008 (NCNHP 2008, Tracy and Starnes 2011). Using vouchered specimens, we will attempt to resolve the true distribution of Longear Sunfish in North Carolina and expand upon the historical “ghost sightings”. Finally, this study will clearly show the importance of vouchering specimens, which allows for their future examination when questions arise.

### Methods

We obtained data for historical records of vouchered material of Longear Sunfish from North Carolina via the FishNet2 Portal (<http://www.fishnet2.net/>), through direct contact with museum staff (see Acknowledgments), or through historical literature (e.g., Fowler 1936, 1945). We produced species distributional maps using ArcGIS Version 10.5, projection GCS\_WGS\_1984, and WGS84 datum. We discovered vouchered specimens at ANSP, Florida Museum of Natural History, Illinois Natural History Survey (INHS), Ohio State University Museum (OSUM), Smithsonian National Museum of Natural History (USNM), and the University of Michigan Museum of Zoology (UMMZ). We requested loans of 135 vouchered specimens and performed verification of the identities of each (Supplemental Table 1, available online at <http://www.eaglehill.us/SENAonline/suppl-files/s19-2-S2559-Tracy-s1>, and for BioOne subscribers, at <https://dx.doi.org/10.1656/S2559.s1>).

### Results

We verified the identification of 135 vouchered specimens obtained on loan; of these, we identified 65 as *L. auritus* (Redbreast Sunfish), 63 as *L. marginatus* (Dollar Sunfish), 1 as *L. gibbosus* (Pumpkinseed), 1 as *L. cyanellus* (Green Sunfish), 1 as *Lepomis* sp., 3 as *Lepomis* hybrids, and 1 as *Enneacanthus gloriosus* (Bluespotted Sunfish) (Table 1; Figs. 1, 2, 3A; Supplemental Table 1). None were determined to be Longear Sunfish.

Characteristics used to differentiate Longear Sunfish from Redbreast Sunfish include presence/absence of palatine teeth, length of gill rakers, length of maxilla, and lateral line scale counts (Table 2). Other characteristics used included the size and shape of the mouth and the color of the opercular flap. Figure 1 displays 4 of the character states, in order of importance from left to right and top to bottom, that differentiate Redbreast Sunfish from Longear Sunfish. Three character states (length of gill rakers, presence/absence of palatine teeth, and length of maxilla) clearly distinguished these specimens as Redbreast Sunfish, with the fourth character state (number of lateral line scales) showing slight overlap in 3 of the 65 specimens.

Characteristics used to differentiate Longear Sunfish from Dollar Sunfish include the number of cheek scale rows and the number of pectoral fin rays (Table 2).

Table 1. Museum and published records of misidentified *Lepomis megalotis* (Longear Sunfish) from North Carolina and our subsequent reidentifications (see also Supplemental Table 1).

Catalog number	No. of specimens	Reidentification	Waterbody	County	Basin	Collection date
— <sup>1</sup>	1	Presumed to be <i>Lepomis marginatus</i> ; see text for explanation	Walnut Creek	Wake	Neuse	07/08/1890
— <sup>2</sup>	8	Presumed to be <i>Lepomis auritus</i> ; see text for explanation	Neuse River	Wayne	Neuse	04/05–06/26/1953
ANSP 61185	1	<i>Lepomis auritus</i>	North Fork Swannanoa River	Buncombe	French Broad	08/21/1934
ANSP 61186	2	<i>Lepomis auritus</i>	Swannanoa River	Buncombe	French Broad	08/21/1934
ANSP 61203	1	<i>Lepomis auritus</i>	North Fork Swannanoa River	Buncombe	French Broad	08/21/1934
ANSP 73300	1	<i>Lepomis auritus</i>	East Clark Creek	Montgomery	Yadkin	08/27/1940
ANSP 73301	5	<i>Lepomis auritus</i>	Dutchmans Creek	Davie	Yadkin	08/30/1940
ANSP 86937	2	<i>Lepomis auritus</i>	Pisgah Forest Lake	Transylvania	French Broad	06/20/1941
ANSP 88602	65	1 <i>Enneacanthus gloriosus</i> ; 63 <i>Lepomis marginatus</i> ; 1 specimen missing	Swan Lake (Manly Pond)	Moore	Cape Fear	08/26/1940
ANSP 88605	1	<i>Lepomis gibbosus</i>	Moravian Creek	Wilkes	Yadkin	08/31/1940
ANSP 206911	69	68 specimens missing; remaining specimen in very poor condition identified as <i>Lepomis</i> sp.	Beaver Lake	Buncombe	French Broad	09/16/1936
INHS 27116	1	<i>Lepomis auritus</i>	Cane River	Yancey	Nolichucky	05/04/1979
OSUM 59649	48	<i>Lepomis auritus</i>	Pigeon River	Haywood	Pigeon	08/19/1980
UF 64883	1	<i>Lepomis auritus</i>	Little Tennessee River	Macon	Little Tennessee	04/19/1967
UMMZ 131443	3	<i>Lepomis auritus</i>	Richland Creek	Haywood	Pigeon	06/28/1940
UMMZ 131444	3	Hybrids - <i>Lepomis macrochirus</i> x <i>L. auritus</i>	Richland Creek	Haywood	Pigeon	06/28/1940
USNM 355843	1	<i>Lepomis cyanellus</i>	Neuse River	Wake	Neuse	09/11/1998

<sup>1</sup>Evermann and Cox (1896); specimen unavailable for study.  
<sup>2</sup>Walburg (1957); specimens unavailable for study.

Figure 2 displays the 2 character states, in order of importance from left to right, that differentiate Dollar Sunfish from Longear Sunfish. One character state (number of cheek scale rows), clearly distinguished these specimens as Dollar Sunfish, with the second character state (number of pectoral fin rays) showing slight overlap in 13 of the 63 specimens.

One specimen (ANSP 88605) was identified as a Pumpkinseed by its pointed pectoral fins when spread open, medium-length gill rakers, and coloration, including black-spotted soft dorsal fin and body with dark spots in rows (Menhinick 1991). One specimen (USNM 355843) was identified as a Green Sunfish by its rounded pectoral fin when spread open, long gill rakers, large mouth with the maxilla reaching the pupil, and the absence of teeth on the tongue and pterygoids (Menhinick 1991). Of the 69 specimens reported in Fowler (1945) from Beaver

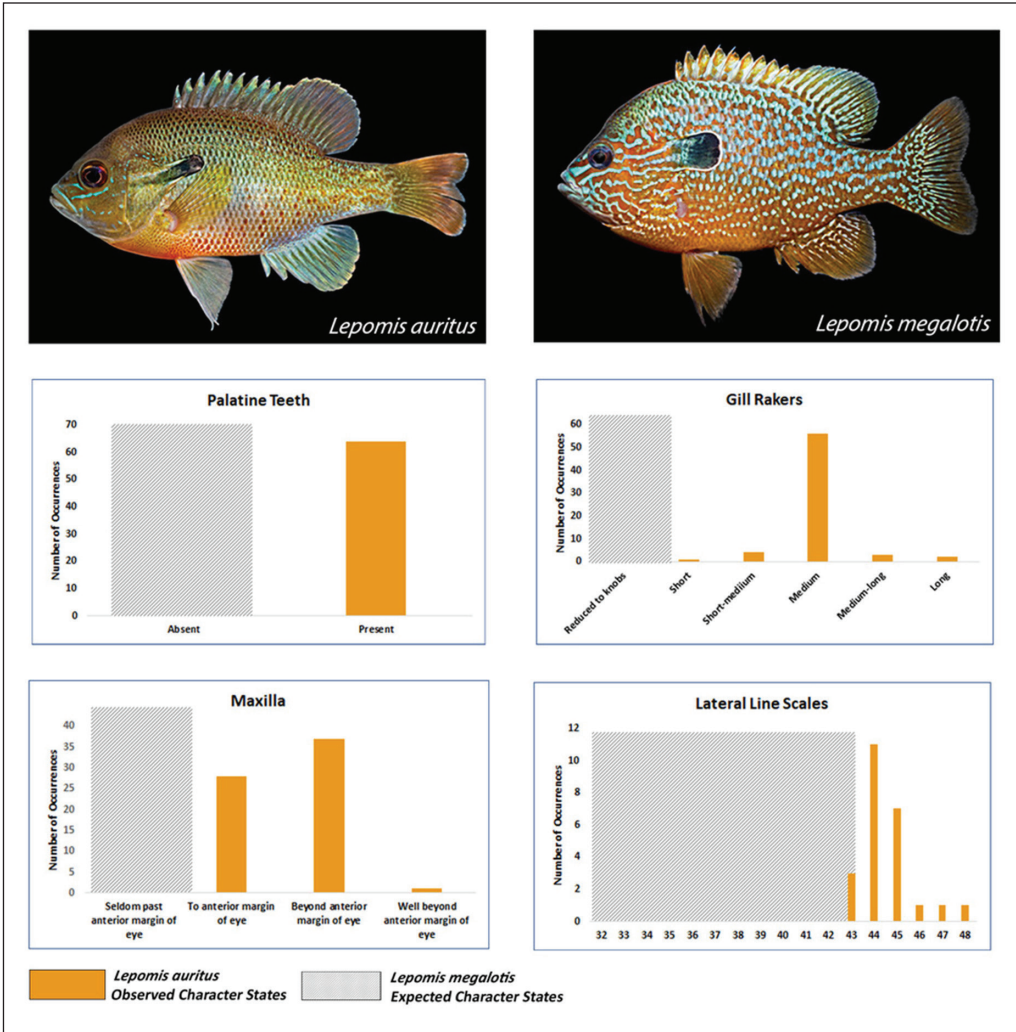


Figure 1. Characteristics used to differentiate specimens of *Lepomis auritus* (Redbreast Sunfish) from *L. megalotis* (Longear Sunfish).



Lake, 68 specimens are missing. The remaining specimen (ANSP 206911) was in very poor condition and could only be identified as *Lepomis* sp., but we detected the presence of palatine teeth and noted the medium length of the gill rakers, which

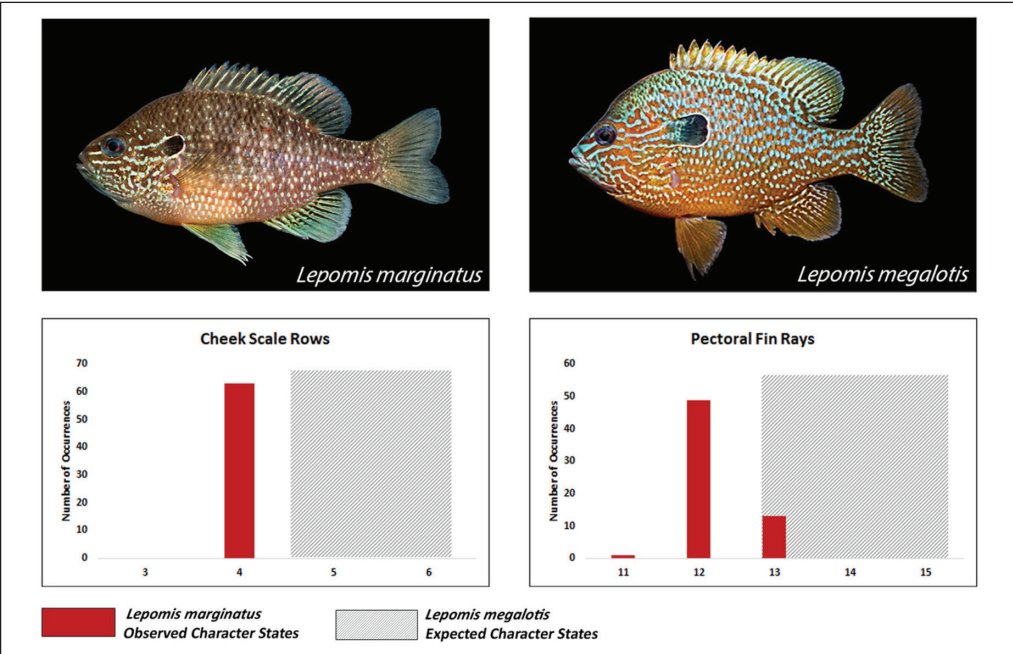


Figure 2. Characteristics used to differentiate specimens of *Lepomis marginatus* (Dollar Sunfish) from *L. megalotis* (Longear Sunfish).

Table 2. Characteristics separating *Lepomis megalotis* (Longear Sunfish) from *L. auritus*\* (Redbreast Sunfish) and *L. marginatus*\*\* (Dollar Sunfish) (adapted from Etnier and Starnes 1993, Jenkins and Burkhead 1994, Menhinick 1991).

Character	<i>Lepomis megalotis</i>	<i>Lepomis auritus</i>	<i>Lepomis marginatus</i>
Palatine teeth*	Absent	Present	Absent
Gill rakers*	Reduced to knobs	Long, 2–10 times longer than wide	Reduced to knobs
Maxilla*	Seldom extending past anterior rim of eye	Extending well-past anterior rim of eye in larger specimens	Seldom extending past anterior rim of eye
Lateral line scales*	Usually 32–43	Usually 43–50	Usually 34–41
Mouth*	Small; moderately to very oblique	Relatively large; moderately oblique	Small; moderately to very oblique
Opercular flap*	Pale margined, bordered with white or blue in life; no silver blotches	Dark to distal margin, not bordered with white or blue in life	Black portion of opercular lobe with silver blotches in adult
Cheek scale rows**	5–6		3–4
Pectoral fin rays**	Usually 14 (13–15)		Usually 12 (11–13)

are not characteristics of Longear Sunfish. Three specimens (UMMZ 131444) were requested on loan because they had been initially identified as *Lepomis macrochirus* Rafinesque (Bluegill) x *L. megalotis megalotis* hybrids. However, all 3 specimens were subsequently identified as Redbreast Sunfish by Reeve M. Bailey on 5 August 1948 (from the field data sheet files of Joseph R. Bailey, Duke University, archived at North Carolina Museum of Natural Sciences). We reidentified these specimens once again as hybrids but as hybrids of Bluegill x Redbreast Sunfish because of the following characteristics: very long gill rakers, palatine teeth present, long and pointed pectoral fins, and a small, oblique mouth (Menhinick 1991). Lastly, 1 specimen (part of ANSP 88602) was identified as a Bluespotted Sunfish by its rounded

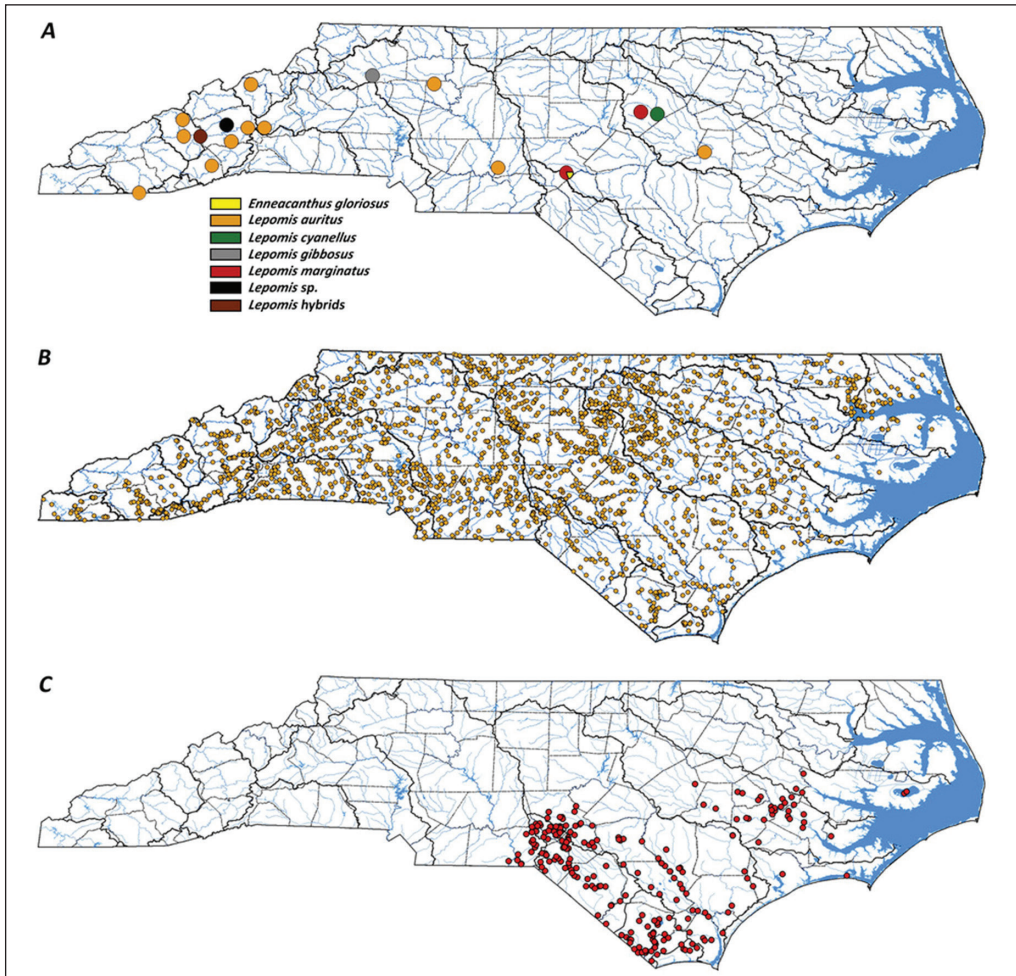


Figure 3. (A) Distribution of misidentified *Lepomis megalotis* (Longear Sunfish) based upon records listed in Table 2 and subsequent reidentifications (Supplemental Table 1). (B) Distribution of *L. auritus* (Redbreast Sunfish) in North Carolina. (C) Distribution of *L. marginatus* (Dollar Sunfish) in North Carolina. Distributions of Redbreast Sunfish and Dollar Sunfish are based on records from the FishNet2 Portal and the North Carolina Divisions of Water Resources and Marine Fisheries.

caudal fin, whereas all *Lepomis* species have a forked or emarginate caudal fin (Table 2, Supplemental Table 1; Menhinick 1991).

### Discussion

Based on our reidentifications of the 135 vouchered specimens, we did not find any Longear Sunfish in North Carolina (Fig. 3A). These findings support the portion of Cope (1870:453) that stated that Longear Sunfish were “not seen in North Carolina”. Due to the lack of vouchered specimens from Cope’s 1869 survey, we cannot resolve the contradiction in his publication (Cope 1870). Unfortunately, this record began the history of “ghost sightings” of this species and its perpetuation in the literature. Freshwater ichthyological surveys within the state continued with Jordan (1889), but neither he nor his staff encountered Longear Sunfish. However, “ghost sightings” of the species resumed with Evermann and Cox (1896). They identified a single specimen from Walnut Creek in the Neuse River basin, but the whereabouts of that specimen remain unknown. Curiously, Evermann and Cox (1896) failed to include that specimen of Longear Sunfish in their list of species from the Neuse River basin. Smith (1907) commented that Longear Sunfish, while not common in North Carolina, could occur based on Cope (1870) and Evermann and Cox (1896). Fowler (1936, 1945) identified 6 lots vouchered at ANSP as Longear Sunfish, which we have reidentified as other species (Table 1). Extensive state-wide surveys were conducted in the 1960s by the North Carolina Wildlife Resources Commission, but no Longear Sunfish were found (Ratlidge et al. 1966, Starnes and Hogue 2011). Menhinick et al. (1974) speculated that Longear Sunfish may have been introduced into the state but its whereabouts could not be verified. Menhinick (1986) regarded Longear Sunfish as extirpated, and he plotted 3 records in *The Freshwater Fishes of North Carolina* (Menhinick 1991). Menhinick (1997) reversed the species’ non-native to native status based on Richland Creek records (UMMZ 131443 and UMMZ 131444; Table 1). North Carolina’s Natural Heritage Program (NCNHP 2018) and NatureServe (NatureServe 2018) continued to reiterate the species’ extirpation from the state. Fuller and Canister (2019) noted a single record from the upper Tennessee River basin based solely upon Menhinick (1991) and records from the Neuse River basin based upon the presumed misidentified record from Walnut Creek (Evermann and Cox 1896) and the misidentified specimen from the Neuse River (USNM 355843).

If Cope’s “ghost sighting” in 1869 was not actually a “ghost sighting” but a true occurrence of Longear Sunfish, then its extirpation would have had to occur between 1869 and Jordan’s 1888 survey. A possible, but highly unlikely, cause for the extirpation of this species may have been from interspecific competition with the Redbreast Sunfish. In Tennessee, Longear Sunfish is widely distributed except in the highest portions of the Blue Ridge, but it is much less common in the upper Tennessee drainage where it is broadly sympatric with, and possibly being supplanted by, the ecologically similar Redbreast Sunfish (Etnier and Starnes 1993). Etnier and Starnes (1993) also believed that Longear Sunfish appear to be disappearing or declining in eastern Tennessee, and circumstantial evidence



suggests that direct competition with Redbreast Sunfish is involved. Although Redbreast Sunfish has been introduced into North Carolina's western basins, the earliest records of this species from the French Broad River basin are from 1913 (American Museum of Natural History, AMNH 5023). The absence of Redbreast Sunfish in the basin in surveys prior to that date indicates at the very least it was not likely to be present in numbers high enough to exert strong competitive pressure, a presumption that negates the possibility of interspecific competition as a cause for the Longear Sunfish's extirpation.

Excluding Cope (1870), there are 2 published reports (Evermann and Cox 1896, Walburg 1957) from which the specimens are missing. We believe the specimens from Walnut Creek were most likely Dollar Sunfish (as listed in Fowler 1945). Those from the mainstem of the Neuse River were most likely Redbreast Sunfish based on the known distribution of Redbreast Sunfish (Fig. 3B) and point of collection (Table 1). In North Carolina, Redbreast Sunfish is one of the most widely distributed and commonly caught fish and is found in all 21 river basins (Fig. 3B). The Dollar Sunfish is found primarily in the Sand Hills of the Lumber and Cape Fear basins, in the lower Yadkin, and the Coastal Plain regions of the Lumber, Waccamaw, lower Cape Fear, and White Oak basins, with widely scattered occurrences in the lower Neuse and Tar basins in North Carolina (Fig. 3C; B.H. Tracy, F.C. Rohde, and G.M. Hogue, unpubl. data). The Longear Sunfish's native range includes portions of the Great Lakes–St. Lawrence and Mississippi drainages and the Gulf slope from northern Illinois, Indiana, and Ohio to southern Texas and along the Gulf Coast to the Florida Panhandle (Bauer 1980, Fuller and Canister 2019, Jenkins and Burkhead 1994). The species has been introduced along the Atlantic slope from central Florida to New Hampshire, in the upper Midwest, and as far west as New Mexico (Fuller and Canister 2019).

In total, there is no compelling evidence that Longear Sunfish ever occurred in the state. A possible explanation for its absence may be due to physiographic factors and ecological breaks (Fuller and Canister 2019, Gilbert 1980, Jenkins and Burkhead 1994, Jenkins et al. 1972, Starnes and Etnier 1986). At the North Carolina–Tennessee state line, prior to the creation of mainstem impoundments on the Hiwassee, Little Tennessee, and Pigeon rivers, these rivers were high-gradient, traversing through gorges, much like the Watauga and Nolichucky rivers of today. Fuller and Canister (2019), communicating with Carter R. Gilbert (UF), asserted that the state line is characterized by sharp increases in stream gradient of the various tributaries, which is most pronounced in the Watauga basin and least pronounced in the French Broad River. There are many species found in eastern Tennessee, such as *Ichthyomyzon castaneus* Girard (Chestnut Lamprey), *Phenacobius uranops* Cope (Stargazing Minnow), *Cycleptus elongatus* (Lesueur) (Blue Sucker), *Noturus eleutherus* Jordan (Mountain Madtom), *Cottus carolinae* (Gill) (Banded Sculpin), and *Etheostoma simoterum* (Cope) (Tennessee Snubnose Darter), whose distributions do not extend into the Blue Ridge of North Carolina (Etnier and Starnes 1993, Menhinick 1991). Similarly, in Virginia, Longear Sunfish also avoids the higher-gradient streams of the Blue Ridge and Valley and Ridge provinces (Jenkins and

Burkhead 1994). Its true indigenous distribution lies westward from the Blue Ridge physiographic region of the Appalachian Mountains outside of North Carolina.

In conclusion, this study underscores the need for vouchered material and globally accessible specimen data. Without these resources, we would have been unable to unravel this basic zoogeographical question about the true distribution and status of Longear Sunfish in North Carolina. The availability of historical data and vouchered specimens also provides a more complete picture of the distribution of species, allowing us to properly allocate funds for their conservation and restoration.

### Acknowledgments

This investigation of a species' historical distribution would not have been possible without vouchered museum specimens and the global accessibility of museum collections data. We are extremely grateful to the following museums and their curatorial staff: Mariangeles Arce H. and Mark H. Sabaj (ANSP); Barbara Brown (AMNH); David Werneke, Auburn University Museum; David Catania, California Academy of Sciences; Charles M. Dardia, Cornell University Museum of Vertebrates; Caleb McMahan, Field Museum of Chicago; Lawrence Page and Robert Robins (UF); Andrew Williston, Harvard Museum of Comparative Zoology; Christopher A. Taylor and Rachel Vinsel (INHS); Jeffrey Clayton (USNM); North Carolina Museum of Natural Sciences; Marc Kibbey (OSUM); Robert E. Jenkins (retired) and Stephen Powers, Roanoke College Ichthyological Collection; Erling Holm, Royal Ontario Museum; Jeff Clayton, Kris Murphy, and Jeff Williams (USNM); Justin G. Mann, Tulane University; Philip Harris and M. Worth Pugh, University of Alabama Ichthyological Collection; W. Leo Smith, University of Kansas Biodiversity Institute & Natural History Museum; Douglas Nelson (UMMZ); Jennifer Parris Brummett and Benjamin Keck, University of Tennessee Etnier Ichthyological Collection; Sarah K. Huber, Virginia Institute of Marine Sciences; and Thomas Near, Yale Peabody Museum of Ichthyology. We also thank Scott A. Smith for the digital pictures and Mark H. Sabaj, Mariangeles Arce H., Marc Kibbey, Christopher Taylor, Lawrence Page, Robert Robins, Douglas Nelson, Jeff Williams, Jeff Clayton, and Kris Murphy for searching for and re-examining specimens, responding to our numerous information requests, and providing specimen loans.

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