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Update of Distribution of the Chestnut Lamprey in Arkansas

Cover Page Footnote

The field research was conducted under Arkansas Game and Fish Commission Scientific Collection Permit #051420151, issued to Jeremiah Salinger. This research would not have been possible without the assistance of our field technicians, Joshua Lukac and Taylor Mackey, as well as Justin Stroman and the many other members of the Arkansas Game and Fish Commission's Fisheries Division, past and present, who have put forth the time and effort to make this research possible. Jim Wise of the Arkansas Department of Environmental Quality and Ben Thesing of the Arkansas Highway and Transportation Department generously allowed us access to several chestnut lamprey records heretofore unavailable to us. Justin Mann of the Tulane University Biodiversity Research Institute was instrumental in aiding us in accessing specimens previously inaccessible. We are also grateful for the help of Henry Robison and Thomas Buchanan in our coordination of collections. Gratitude is also due to Jennifer Bouldin and Jerry Farris for loaning us equipment used during the field season, as well as to Tracy Klotz and Casey Cox for their invaluable boat maintenance advice. Shannon Smith and Douglas Zentner assisted in the creation of Figure 1. Lastly, we are grateful to the faculty and staff, particularly Jesse Filbrun and Pablo Bacon, of the L.A. Logan Biological Field Station, Southern Arkansas University, for housing the field crew during part of its field season. The views and opinions expressed herein are those of the authors and do not necessarily reflect the views or policies of the Arkansas Game and Fish Commission.

Update of Distribution of the Chestnut Lamprey (*Ichthyomyzon castaneus*) in Arkansas

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Running Title: Update of Distribution of the Chestnut Lamprey in Arkansas

Abstract

Most lamprey species other than sea lampreys have been poorly studied in North America. The chestnut lamprey, *Ichthyomyzon castaneus*, has a distribution within the Mississippi River and Hudson Bay drainage systems, and the Great Lakes. Since the text *Fishes of Arkansas* was published in 1988, few papers have been published to update the statewide distribution of this lamprey. We incorporated our electrofishing sampling results with gray and published literature to describe the distribution of this species in the drainage basins of the State of Arkansas. Reported are records of 250 chestnut lamprey specimens, over a 90-year period, from 47 different waterbodies in the state.

Introduction

Most lamprey species, other than the sea lamprey *Petromyzon marinus* L., have been poorly studied in North America. Rather than being directly studied, lamprey distributions are often identified as part of broader qualitative fish surveys. This information is particularly important, as a majority of lamprey species are imperiled in some fashion (Renaud 1997; Kiabi *et al.* 1999; Mateus *et al.* 2012), and lampreys may also be valuable bioindicators (Lyons *et al.* 1998; Soto-Galera *et al.* 1998; Newall *et al.* 1999).

The chestnut lamprey, *Ichthyomyzon castaneus* Girard, is an obligate blood-feeding parasitic freshwater lamprey (Renaud 2011). Their distribution primarily lies within the Mississippi River drainage system ranging from southern Canada to the Gulf of Mexico (Renaud 1997). The chestnut lamprey is considered to be threatened in portions of its range, but is largely unstudied in these areas (Kansas and Saskatchewan, Mesa and Copeland 2009; Iowa, Flammang and Olson 2010; Nebraska, Steffensen 2015). Since the text *Fishes of Arkansas* was published in 1988 (Robison and Buchanan 1988), few papers have been published

updating the distribution of this lamprey in Arkansas. One notable exception was an update on chestnut lamprey collections by Robison *et al.* (2006).

Our goal was to identify the distribution of this species in the context of published historic and gray literature, and provide a summary of the available distribution records for this species. Further, we studied by way of electrofishing, the distribution of the chestnut lamprey in streams where this species was previously documented. We summarize those records by drainage basin within the State of Arkansas.

Methods

We used historical records of gray literature from the Arkansas Game and Fish Commission (B. Wagner), the Arkansas Department of Environmental Quality (ADEQ; J. Wise), and the Arkansas Highway and Transportation Department (AHTD; B. Thesing) in addition to published literature (Robison *et al.* 2006; Tumblison and Robison 2010; Connior *et al.* 2011) and the online database FishNet2. We tabulated those records on the basis of major drainage systems from north to south, including the St. Francis, White, Arkansas, Ouachita, and Red river drainages, as well as the Mississippi River itself. When discrepancies existed between information provided in Robison and Buchanan (1988) and information we had available in archived databases, we chose to not include records from the text. Nonetheless, we refer to discrepancies between archived data and Robison and Buchanan (1988). It must be noted that Robison and Buchanan (1988) do not include number of individuals collected, but rather had a focus on sites of collection. Lastly, we looked at archived records in a historical context (before or after 2000) to try to identify current distribution trends.

In an effort to collect chestnut lampreys, or identify fish hosts parasitized by chestnut lampreys, electrofishing by boat for the present study was

conducted from mid-July to mid-November 2015 in 12 streams in Arkansas, USA (29 river km total; Table 1). This included 11 streams previously reporting the presence of this species, as well as 1 adjoining stream (Spring River) suspected of containing this species. Criteria used for the selection of rivers sampled included the absence of the silver lamprey *I. unicuspis* Hubbs and Trautman (documented in the upper White River drainage of northwest Arkansas, confluence of the White River with the Black River in Jackson and Independence counties, and the lower White River; Robison *et al.* 2011), existing historical records of chestnut lampreys, and boat access. Up to ten 250 m reaches on each river were selected for sampling, with at least one km separating sampling sites. Reaches were excluded from sampling consideration if they were inaccessible or too shallow for sampling. In addition to identifying chestnut lampreys, we evaluated their presence by examining potential host species for evidence of lamprey lesions and scars. We assumed based upon the lack of historic silver lamprey records that lamprey parasitism was due to the chestnut lamprey. This assumption may prove incorrect, yet additional specimens of silver lampreys have not been documented since the 2005 collections and re-identification of specimens collected in 1972 and 1998 reported by Robison *et al.* (2011).

Parasitic lampreys have been reported in the federal Norfolk National Fish Hatchery by U.S. Fish and Wildlife Service personnel. In an effort to determine the presence of chestnut lampreys and/or parasitism by lampreys, rainbow trout *Oncorhynchus mykiss* Walbaum were examined at the hatchery over a three-month period from the end of January to mid-April 2013.

Results and Discussion

Red River Drainage

The Red River drainage includes the Cossatot/Little Cossatot, Sulphur and Bayou Dorcheat rivers. There were 3 collection dates since 2000 of Chestnut Lampreys (n = 4) within this drainage, and no prior collection dates (Figure 1). One of the sub-watersheds, the Bayou Dorcheat, empties into the Red River below Shreveport, LA, whereas the Little Cossatot and the Sulphur have more proximal connections to the Red River. Additional records are found upstream and downstream of Lake Millwood in Robison and Buchanan (1988; n = 6), yet we were not able to find those records. Therefore, they were not included in the Figure 1 results. Despite intensive electrofishing efforts in the Sulphur River (2.5 river km), we did not

Table 1. Streams electrofished in 2015 and outcomes for the collection of Chestnut Lampreys. Rainbow Trout from Norfolk National Fish Hatchery (NFH) were studied for parasitism by lampreys in 2013.

| Drainage Basin Stream | River km Sampled | Number Collected | Parasitized Fishes |
|----------------------------|---------------------|---------------------|-----------------------|
| Red River Drainage | | | |
| Sulphur R. | 2.5 | 0 | 0 |
| Ouachita River Drainage | | | |
| Little Missouri R. | 1.5 | 0 | 1 |
| Ouachita R. | 2.5 | 0 | 1 |
| Arkansas River Drainage | | | |
| Cadron Cr. | 2.5 | 0 | 1 |
| Fourche LaFave R. | 2.5 | 0 | 0 |
| Petit Jean R. | 2.5 | 0 | 0 |
| White River Drainage | | | |
| Black R. | 2.5 | 3 | 3 |
| Current R. | 2.5 | 2 | 1 |
| Little Red R. | 2.5 | 0 | 0 |
| Norfolk NFH | N/A | 0 | 83 |
| Spring R. | 2.5 | 3 | 3 |
| Strawberry R. | 2.5 | 0 | 1 |
| St. Francis River Drainage | | | |
| St. Francis R. | 2.5 | 0 | 0 |

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find any evidence of this species directly or indirectly (parasitized hosts) (Table 1).

Ouachita River Drainage

The Ouachita River drainage, including the Caddo, Little Missouri, Ouachita, and Saline rivers, has extensive records of chestnut lamprey collections (Figure 1). There were 37 specimens collected from the Caddo River in the past 45 years, with 10 of those collections occurring since the year 2000. This indicates the ongoing presence of this species. There are 13 records in the Little Missouri River and its tributaries, with only one individual collected since 2000. There

were 81 specimens collected from the Ouachita River and streams entering the river. Included in these collections were specimens from DeGray, Hamilton, and Webb lakes. Collections were regular throughout the archival records. Fewer individuals ($n = 6$) were collected from the Saline River, with most of those collections occurring over 30 years ago. In comparison Robison and Buchanan (1988) identified 5 collections from the Ouachita River, including Lake Ouachita, 4 records from the upper Caddo River, and 1 each from the Little Missouri River, the Antoine River, and the upper Saline River.

Despite our sampling efforts in both the Ouachita and Little Missouri rivers, no chestnut lampreys and only

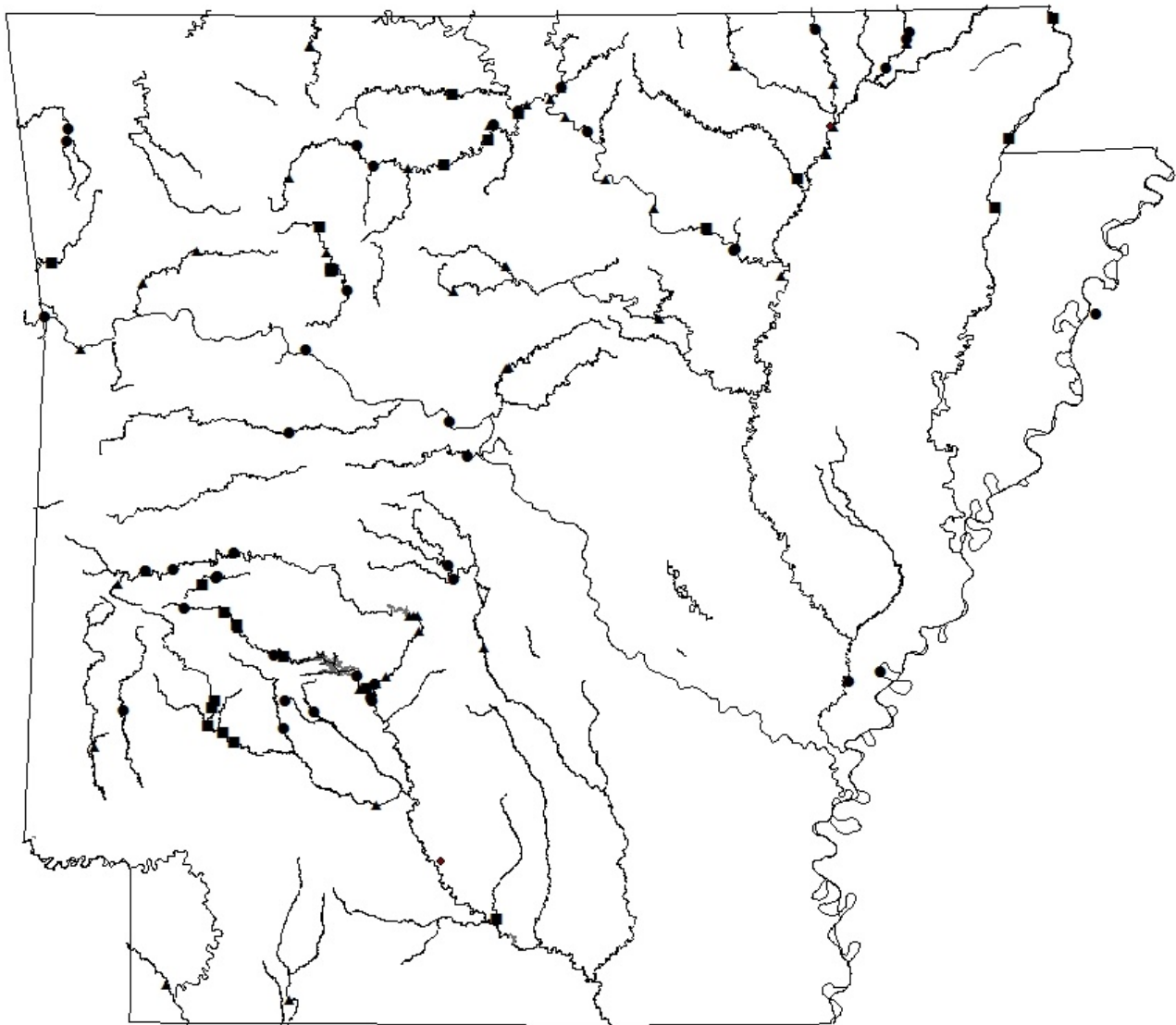


Figure 1. Chestnut lamprey distribution records in Arkansas, 1928-present. Legend: records from 1928-1986 are represented by a circle, records from 1987-2000 by a square, and records from 2000-present by a triangle. Records for which no date could be confirmed are represented by a diamond. See supplemental table (Appendix I) which contains all individual records at the journal website.

1 potential host (a river redhorse *Moxostoma carinatum* Cope) presumptively parasitized by a chestnut lamprey were collected in the Little Missouri River (Table 1).

Arkansas River Drainage

Thirty-four chestnut lampreys have been documented from the Arkansas River drainage, encompassing eight streams (Figure 1). Specimens were first collected from this drainage in 1937. Sub-watersheds of the Arkansas River where chestnut lamprey were observed include the Illinois (n = 3), Mulberry (n = 2) and Petit Jean (n = 2) rivers, in addition to Big Piney (n = 5), Cadron (n = 2), Garrison (n = 1), and Lee (n = 1) creeks. Nonetheless, only 9 individuals have been collected from the Arkansas River and tributaries since 2000. During our 2015 sampling, no individuals were collected from the 3 streams sampled, but 1 potential host (a spotted bass *Micropterus punctulatus* Rafinesque) was collected from Cadron Creek (Table 1). In contrast, Robison and Buchanan (1988) had 5 records from the Arkansas River, 1 from the Illinois River, 1 from Lee Creek, and 1 from the Petit Jean River.

White River Drainage

Chestnut Lampreys in the White River drainage have been identified in several of tributaries, including the Black (n = 4), Buffalo (n = 13), Current (n = 5), Eleven Point (n = 2), Fourche (n = 2), Little Red (n = 10), Spring (n = 2), Strawberry (n = 1), and White (n = 16) rivers (Figure 1). Specimens were first collected from this drainage in 1928, representing the first documented collection of the species in Arkansas. Nine of the specimens collected from the Little Red River were from streams feeding Greers Ferry Lake, with 1 record in a downstream creek; each was collected over the past 2 decades. All of the Spring River collections were from our 2015 survey (Table 1). Creeks directly feeding the White River that have chestnut lamprey records include Crooked Creek and Long Creek (Figure 1). A single record exists for the species from an unnamed pit lake on the White River National Wildlife Refuge in Phillips County. Within this drainage collections of Chestnut Lampreys have been regular and ongoing.

In our 2015 survey, the 8 specimens we collected were from tributaries feeding the lower White River: the Black (n = 3), Current (n = 2), and Spring (n = 3) rivers (Table 1). Further, we collected parasitized fishes from the Black River (n = 3), Current River (n = 1), Spring

River (n = 3), Little Red River (n = 1), and Strawberry River (n = 1). These fishes included a spotted bass and 2 common carp *Cyprinus carpio* Linnaeus from the Black River, a single common carp from the Current River, 3 common carp from the Spring River, 1 spotted sucker *Minytrema melanops* Rafinesque, and 1 common carp from the Strawberry River. Two chestnut lampreys were also collected from the federal Norfolk National Fish Hatchery in the summer and fall of 2012 by United States Fish and Wildlife Service personnel. Subsequent work by Salinger (2016) in this hatchery found 83 cases of rainbow trout parasitized by lampreys believed to be chestnut lampreys. Our sampling did not include the upper and lower White River in an effort to avoid the capture of silver lampreys or fishes parasitized by silver lampreys.

Robison and Buchanan (1988) reported that specimens were collected from the lower White River (n = 3), the middle section of the White River (n = 8), the South Fork of the Little Red River above Greers Ferry Reservoir (n = 1), the Little Red River below Greers Ferry Reservoir (n = 1), the and 1 record each from the Norfolk River, the Buffalo River, the Spring River, the Eleven Point River, and Crooked Creek.

St. Francis River Drainage

Three individuals have been collected from the St. Francis River, with each specimen collected during the years of 1987-1988 (Figure 1). No collection records were identified within the St. Francis River in Robison and Buchanan (1988). Despite sampling of 2.5 river km, no specimens or evidence of lamprey parasitism on other species was identified (Table 1).

Mississippi River

There have been 2 collections of Chestnut Lampreys (n = 3) from the Mississippi River. One collection record comes from an apparently unnamed oxbow lake in southern Phillips County, whereas the other was collected in the main stem of the river in southern Mississippi County. Both records date to the early to mid-1980s, and no other collection records have been documented since. This lack of records is in spite of the fact that the US Army Corps of Engineers has extensively sampled the Mississippi River in Arkansas for the past two decades, and large host fishes are abundant within the river (T. Buchanan, *pers. comm.*).

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Conclusions

The distribution of chestnut lampreys occurs throughout much of the state, although few individuals have been collected in the Mississippi River or the Red River or the St. Francis River drainages. Recent electrofishing results with a goal of specifically targeting chestnut lampreys showed a low frequency of individuals with all individuals collected in the White River drainage. Further, few parasitized individuals were collected in other drainages.

Acknowledgments

The field research was conducted under Arkansas Game and Fish Commission Scientific Collection Permit #051420151, issued to Jeremiah Salinger. This research would not have been possible without the assistance of our field technicians, Joshua Lukac and Taylor Mackey, as well as Justin Stroman and the many other members of the Arkansas Game and Fish Commission's Fisheries Division, past and present, who have put forth the time and effort to make this research possible. Jim Wise of the Arkansas Department of Environmental Quality and Ben Thesing of the Arkansas Highway and Transportation Department generously allowed us access to several chestnut lamprey records heretofore unavailable to us. Justin Mann of the Tulane University Biodiversity Research Institute was instrumental in aiding us in accessing specimens previously inaccessible. We are also grateful for the help of Henry Robison and Thomas Buchanan in our coordination of collections. Gratitude is also due to Jennifer Bouldin and Jerry Farris for loaning us equipment used during the field season, as well as to Tracy Klotz and Casey Cox for their invaluable boat maintenance advice. Shannon Smith and Douglas Zentner assisted in the creation of Figure 1. Lastly, we are grateful to the faculty and staff, particularly Jesse Filbrun and Pablo Bacon, of the L.A. Logan Biological Field Station, Southern Arkansas University, for housing the field crew during part of its field season. The views and opinions expressed herein are those of the authors and do not necessarily reflect the views or policies of the Arkansas Game and Fish Commission.

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