

Population Trends and a Distributional Record of Selected Fish Species from the Illinois River

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ABSTRACT

Illinois has a rich history of knowledge regarding the status and distribution of native and non-native fish species throughout the state. In addition, ongoing collections and publications continue to update this knowledge base. However, recent collections in the lower Illinois River show the need for an update of current knowledge for two species, Shoal Chub *Macrhybopsis hyostoma* and Channel Shiner *Notropis wickliffi*, and a verified distributional record of Banded Darter *Etheostoma zonale*.

INTRODUCTION

Over 30 years have passed since the last thorough review of the status and distribution of fishes in Illinois by Smith (1979). In those 30+ years, a number of peer reviewed publications and internal reports have updated the status and distribution of Illinois fishes (e.g. Burr et al. 1988; Burr et al. 1996; Page and Retzer, 2002; Tiemann et al. 2004; Metzke et al. 2012; Sherwood and Wylie, 2015). Despite this accumulated information, population trend and distributional knowledge gaps still exist for many species, including three species recently collected from the La Grange Reach of the lower Illinois River: Shoal Chub *Macrhybopsis hyostoma*, Channel Shiner *Notropis wickliffi*, and Banded Darter *Etheostoma zonale*. Data presented here includes an update of population trends for Shoal Chub and Channel Shiner and a verified distributional record of Banded Darter for the La Grange Reach of the lower Illinois River.

The Shoal Chub is listed as Speckled Chub *Macrhybopsis aestivalis* in Smith (1979) and by current Illinois Natural History Survey (INHS) distribution maps and reports (Metzke et al. 2012, INHS Fish Collection). However, the Shoal Chub was elevated to full species from the Speckled Chub species-complex by Eisenhour (1999), Underwood et al. (2003), and Eisenhour et al. (2004). The Shoal Chub is a small, slender minnow with small eyes and a long, horizontal, bluntly rounded snout (Smith, 1979; Robison and Buchanan, 1988; Pflieger, 1997; Eisenhour, 2004). Shoal Chubs are benthic species preferring sand or gravel substrates with moderate to fast water velocity (Smith, 1979; Robinson and Buchanan, 1988; Pflieger, 1997). This minnow occurs in large and moderate-sized rivers, as

well as streams and can tolerate moderately clear to highly turbid waters (Smith, 1979; Robison and Buchanan, 1988; Pflieger, 1997).

Records of Shoal Chub from the lower Illinois River include collections post-1950 at or near the mouths of the Mackinaw, Spoon, and Sangamon Rivers with 4 additional collection locations on the Alton Reach of the Illinois River (Smith, 1979). Smith (1979) stated the minnow occurs in the lower half of the Illinois River and "is never common and is a rather insignificant fish in the major rivers." Similarly, current INHS data identify Shoal Chub collections pre-1976 from near the mouths of the Mackinaw, Spoon, and Sangamon rivers as well as 5 collections in the Alton Reach (INHS Fish Collection). Metzke et al. (2012) listed the Shoal Chub as rare and declining in the Illinois.

The Channel Shiner is a small-bodied minnow with large eyes, a broad, rounded snout, and a small oblique mouth lacking barbels. The Channel Shiner is also taxonomically and phenotypically very similar to Mimic Shiner *N. volucellus* (Mettee et al. 1996; Hrabik, 1996; Eisenhour, 1997; Pflieger, 1997). Channel Shiners can be found over silt, sand, or gravel substrates with little to no flow (Hrabik, 1996; Mettee et al. 1996; Pflieger, 1997). The species is generally found in main channel habitats of large rivers including the Mississippi, Missouri, Tennessee, Ohio, and Wabash Rivers (Smith, 1979; Trautman, 1981; Mettee et al. 1996; Eisenhour, 1997; Pflieger, 1997) and also seems to be tolerant of high turbidities (Hrabik, 1996).

Originally described by Trautman in 1931 as a sub-species of Mimic Shiner *Notropis volucellus*, the Channel Shiner was first el-

evated to species in 1976 and subsequently reaffirmed by several authors as a full species in the 1980's and 1990's (Hrabik, 1996 and references therein). However, there is ongoing debate about the identification and distribution of Channel Shiner and similar species. A literature review by Hrabik (1996) discusses the taxonomic status of the Channel Shiner at length, and it is not the purpose of the authors to enter this long-standing debate. For the purpose of this paper, we recognize the viewpoint summarized by Hrabik (1996): "*N. wickliffi* warrants full species rank and that intergrades may occur where they are sympatric" [with *N. volucellus*].

Channel Shiner is not mentioned by Smith (1979) and the similar Mimic Shiner is "not known from the Illinois River." Current INHS records show Channel Shiner collections at one location in the Starved Rock Reach on the upper Illinois River, one location in the Alton Reach, and none on the La Grange Reach (INHS Fish Collection). Current INHS records of the similar Mimic Shiner show collections in only the Dresden Reach of the upper Illinois River (INHS Fish Collection).

Banded Darter are a moderately slender darter with a broadly connected gill cover, premaxillary frenum connecting snout to the upper lip, and complete lateral line (Smith, 1979; Robinson and Buchanan, 1988; Pflieger, 1997). The darter has 6 or 7 dark saddles across the back (Robinson and Buchanan 1988; Pflieger, 1997); however other descriptions of coloration patterns vary by author (Smith, 1979; Robinson and Buchanan, 1988; Mettee et al 1996; Pflieger, 1997). Banded Darters occur in riffles or pools with swift current over gravel or other rocky substrates often covered with algae

or aquatic vegetation (Smith, 1979; Robinson and Buchanan, 1988; Pflieger, 1997). They are known to occur in creeks, small to medium sized streams, and smaller rivers (Smith, 1979; Robinson and Buchanan, 1988; and Pflieger, 1997).

Banded Darter was discussed by Smith (1979) but was not shown to occur in the lower Illinois River. Records exist for Banded Darters in the Mackinaw River both pre-1908 and post-1950, in tributaries of the Sangamon River post-1950, and in the upper Sangamon River pre-1908 (Smith, 1979). Current INHS records show no Banded Darter in the lower Illinois River, however, records show multiple collections on several tributaries of the Sangamon River, the upper Sangamon River, the Mackinaw River, and Quiver Creek (INHS Fish Collection).

STUDY AREA

The Illinois River (Figure 1), formed by the confluence of the Des Plaines and Kankakee Rivers, is a 439 km tributary of the Mississippi River, draining 44% of the largely agricultural central portion of Illinois (De-long, 2005). The 125-km La Grange Reach of the Illinois River is located between the La Grange Lock and Dam at river km (RKM) 129 and Peoria Lock and Dam at RKM 254. This section of the river is characterized by a wide floodplain surrounding a mosaic of main and side channel habitats as well as permanently connected and semi-connected floodplain habitats (McClelland et al. 2012). The La Grange Reach also receives input from three major tributaries: the Mackinaw, Spoon, and Sangamon Rivers.

METHODS

The Long Term Resource Monitoring (LTRM) element of the U.S. Army Corps of Engineers' Upper Mississippi River Restoration (UMRR) Program conducts annual, standardized fish community monitoring (1993-present) along five reaches of the Upper Mississippi River System and the La Grange Reach of the Illinois River (Ratcliff et al. 2014). Fish community monitoring uses a stratified random sampling (SRS) design in order to encompass major habitat strata using a multi-gear approach to better represent the overall fish community based on species-habitat relationships (Ickes et al. 2014; Ratcliff et al. 2014). SRS sampling on

the La Grange Reach is supplemented by fixed site sampling at the Peoria Lock and Dam tailwater zone (TWZ, located immediately downstream of the lock and dam) (RKM 254) and in Bath Chute, a side channel at RKM 182. Additional details of the LTRM protocols can be found in Ratcliff et al. (2014).

Herein, LTRM data were summarized from day electrofishing (108 SRS samples and 12 fixed site samples collected per year) and mini fyke netting (72 SRS samples and 12 fixed site samples per year) in main channel, side channel, and backwater habitats, and trawling (12 fixed samples per year) at the Peoria TWZ only. Only LTRM data from 2010-2015 were used as no target spe-

cies were collected from 1993-2009. Sample efforts are defined as one 15 minute electrofishing run, one overnight, ~24 hour mini fyke net (3 mm mesh) set, and one 350 m trawl (4.8 m wide and 4.5 m long slingshot balloon trawl, 18 mm stretch mesh with a 1.8 m liner of 3 mm mesh covering the cod end) haul, respectively (see Ratcliff et al. (2014) for additional details of gear specifications). Annual effort (i.e. number of samples per year) has been consistent since 1993. Channel Shiner specimens were verified by R.A. Hrabik; Banded Darter specimens from 2013 were verified by R. A. Hrabik while 2015 specimens were verified by Dr. Phillip Willink and deposited in the INHS Fish Collection, Champaign.

RESULTS

Shoal Chub

LTRM collected its first Shoal Chub (n=1) in a trawl in 2010, and subsequently this species has constituted a significant proportion of the catch in all trawling collections. Total number of Shoal Chub sampled via trawling has increased from 1 to 151 individuals with catch-per-unit-effort (CPUE) of number of individuals per single sampling effort increasing from 0.08 to 12.6 Shoal Chubs per each 350 m trawling sample, 2010-2014, respectively (Table 1). Shoal Chub increased from 1.1% of total trawling catch in 2010 to a high of 45.8% in 2014 (Table 1). Beginning in 2011, Shoal Chub has been no less than the 3rd most abundant species in total trawling collections (Table 1). Shoal Chub were collected less frequently than Freshwater Drum *Aplodinotus grunniens* and Channel Catfish *Ictalurus punctatus* in 2011-2012 and 2015 trawling samples. They were more abundant than all other species combined (with the exception of Channel Catfish and Freshwater Drum) from 2012-2015. Trawling in the Peoria TWZ accounted for 97.7%

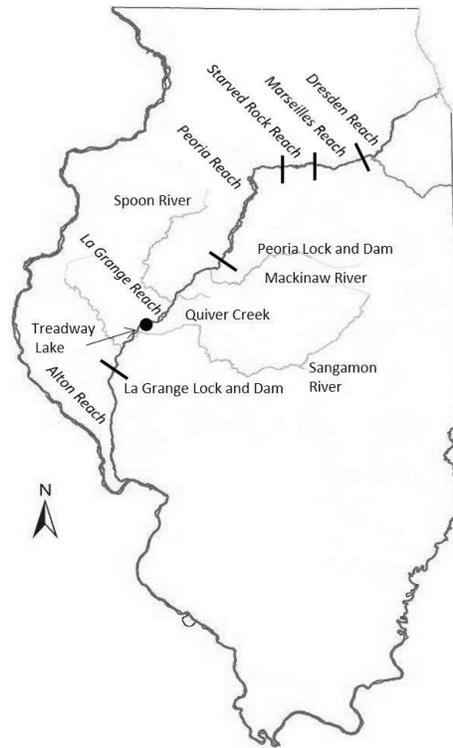


Figure 1. The Illinois River and major tributaries of the La Grange Reach.

Table 1. Total number of Shoal Chub caught by trawling at the Peoria Lock and Dam tailwater zones on the La Grange Reach of the Illinois River: total catch, catch per unit effort (CPUE), percent of total trawling catch, and rank of Shoal Chub catch in relation to total trawling catch.

	2010	2011	2012	2013	2014	2015
Total catch	1	17	43	63	151	113
CPUE	.08	1.4	3.6	5.3	12.6	9.4
% of total	1.1	8.2	9.3	30.9	45.8	11.1
Rank of catch	5th	3rd	3rd	1st	1st	3rd

(388 of 397) of total Shoal Chub collected while the other nine specimens were captured using mini fyke nets. Shoal Chub collected using mini fykes occurred at the Peoria TWZ (n=2), main channel border sites near RKM 251 (n=1) and 199 (n=1), Bath Chute side channel near RKM 182 (n=1), and at Snicarte Slough, a backwater complex near RKM 170 (n=4). No Shoal Chub have been collected in the 720 electrofishing surveys completed since 2010

Our collections of Shoal Chub constitute a significant change in the knowledge of populations within the lower Illinois River. This species is no longer an insignificant portion of trawling collections from the La Grange Reach. Mini fyke collections indicate they are present throughout nearly the entire reach and in all habitat strata. Additionally, although reproduction has not been directly verified, 40 Shoal Chub <30 mm in total length (35 via trawling and 5 via mini fyke netting) have been sampled to date, indicating probable reproduction of the species within the La Grange Reach.

Channel Shiner

LTRM first collected Channel Shiners (n=8) in a single mini fyke net at the Peoria TWZ in 2012. Collections of Channel Shiners have verified 61 in 2013, 14 in 2014, and 58 in 2015. Channel Shiners still represented <1% of the total catch of small-bodied cyprinid shiners (Emerald and Red Shiners, *Notropis atherinoides* and *Cyprinella lutrensis*, composed 96.0% (\pm 0.9%) of the total small-bodied cyprinids collected). Channel Shiner collections occurred throughout the entire La Grange Reach (RKM 134.3-253.9) and in all habitat strata sampled: side channels (n=7; 2012-2015), backwaters (n=44; 2012-2015), main channel borders (n=50; 2012-2015) and the Peoria TWZ (n=41; 2012-2015). These additional collections of Channel Shiners suggest that while the species is not common, they are now present throughout the La Grange Reach in all major habitat strata over four continuous years of sampling.

Banded Darter

We collected the first Banded Darters in the La Grange Reach (n=2) on 5 August 2013 in a single day electrofishing sample in Treadway Lake, RKM 150.5, in Cass County IL. (latitude 40°4'22.47 longitude

90°23'15.32). Treadway Lake is a connected backwater complex immediately upstream of the mouth of the Sangamon River. These collections represent a new and verified distributional record in the La Grange Reach and the lower Illinois River. An additional specimen was collected (n=1) on 12 August 2015 in a single trawling sample at the Peoria TWZ, RKM 253.9, in Tazewell County, IL (latitude 40°37'53.48, longitude 89° 37'35.38).

DISCUSSION

Data presented here suggest that the current knowledge base of Shoal Chub and Channel Shiner be reassessed in light of increasing number of catches since initial appearance in collections and their presence in all major habitat strata of the La Grange Reach. Additionally, Banded Darters have now been documented for the first time in the La Grange Reach of the lower Illinois River. These collections demonstrate the need and value of continued research and monitoring given changes in abundance and distribution of each species throughout a long-term period of standardized fish assemblage monitoring.

Concerning Shoal Chub habitat requirements, the macro-habitat at the Peoria TWZ is similar to that described in the literature, as water velocities have averaged 0.37 m/s (\pm 0.20) from 1997-2015 over a sandy substrate. While the vast majority of Shoal Chubs have been sampled via trawling in the Peoria TWZ, they have also been collected downstream in mini fyke nets in multiple habitats, suggesting they probably occur throughout much of the La Grange Reach. However, because trawling appears to be the most effective sampling gear and is only performed at the Peoria TWZ, LTRM methods probably underestimate the abundance of Shoal Chub throughout the rest of the La Grange Reach. The collection of multiple (n=40) Shoal Chub less than 30 mm in total length also may indicate reproduction within the La Grange Reach, as individuals this small are unlikely to travel upstream in the Illinois River from existing populations in Pool 26 of the Mississippi River. Additionally, Shoal Chub rarely live beyond 1.5 years (Smith, 1979; Robison and Buchanan, 1988; Pflieger, 1997), and the increase in numbers caught from 2010-2015 provides additional support of a self-

sustaining, reproducing population rather than a population maintained by consistent emigration from Pool 26.

Since initial collection in 2012, Channel Shiner have appeared from the very southern reaches of the La Grange Reach up to and including the Peoria TWZ. This also includes multiple side channels and backwater complexes, demonstrating that they are occupying all major habitat strata available on the La Grange Reach. This observation supports the general conclusions of Trautman (1981), Mettee et al. (1996), Eisenhour (1997), and Pflieger (1997) that the species seems to be a habitat generalist. Potential sources of Channel Shiner, such as Pool 26 or the upper Illinois River, occur both above and below the La Grange Reach. However, similar to Shoal Chub, it is unlikely that catches are a result of consistent immigration from outside the La Grange Reach and more likely that a reproducing population now exists. More research is needed to identify the mechanisms driving their appearance and subsequent increase in abundance given that little is known about the life history of this species (Hrabik, 1996, Pflieger, 1997).

The increase in catch of Shoal Chub and Channel Shiner is not easily explained. The habitat at the Peoria TWZ has not undergone any significant change that would make it more conducive to Shoal Chub; however LTRM consistently trawled for 17 years prior to 2010 using the same methods without collecting a single individual. Similarly, LTRM consistently sampled with mini fyke nets (designed to sample small bodied cyprinid species) for 19 years without collecting a single Channel Shiner. The possibility does exist that the Shoal Chub and Channel Shiner have been present in the La Grange Reach all along and were consistently missed by standardized sampling. If this were true, it would indicate a substantial increase in populations of these two species as multiple collections from multiple sites and years have now been documented. However, because of the standardized multi-gear, multi-strata sampling protocol implemented by LTRM, we conclude that the catches represent legitimate initial collections of these species and subsequent changes in population (Ickes et al. 2014) and not an artifact of sampling bias or change in sampling (as no sampling

methodology changes have occurred). It is much more likely that natural or anthropogenic changes in the Illinois River system or its fish assemblage has led to the colonization and subsequent population increase of these two species and further research is needed to identify potential driving mechanisms.

One variation that could be driving changes observed is recent flooding on the Illinois River. Beginning in 2007, the lower Illinois River began receiving major, consistent flooding that potentially led to colonization of the La Grange Reach by both Shoal Chub and Channel Shiners from resident populations on Pool 26 of the Mississippi River. Channel shiners could have also potentially come from populations on the Upper Illinois River. Having potentially traveled up-river during flood events, it is possible that both species have established resident, reproducing populations possibly sustained by continued major flooding. However, as there are multiple stressors and influences on a system as dynamic as the Illinois River, identifying driving mechanisms remain difficult.

The limited collections of Banded Darter (n=3) are not enough to determine if this species is becoming established in the La Grange Reach or if these are merely isolated occurrences. It is important to note that the two individuals collected in 2013 were collected near the mouth of the Sangamon River following record spring flooding on the Illinois River. It is possible that these individuals came from known populations in the Sangamon River and its tributaries during this flooding and were subsequently sampled in Treadway Lake. In contrast, flooding would not explain the collection in the Peoria TWZ, which is 10 river miles upstream of the mouth of the Mackinaw River where Banded Darter are known to occur. Additional years of sampling are needed to determine future status of Banded Darter in the Illinois River.

Any potential changes to the Illinois River system or its fish community could be influenced by multiple stressors acting on the river itself and its tributaries including, but not limited to, increased occurrence of flooding, siltation, navigation, pollution, and invasive species. Additionally, other species new to LTRM collections (but not

new to the basin or the La Grange Reach) have been documented in recent years: Bluntnose Darter [2014 (n=2)], Lake Chubsucker [2015 (n=1)], and Pugnose Minnow [2014 (n=40); 2015 (n=15)]. These collections could be isolated incidences, not having enough years of collection or enough specimens to indicate a new, noteworthy population trend similar to Shoal Chub and Channel Shiner. However, if these species persist in LTRM collections, they could add to the evidence presented here that continues to document changes in fish population trends and community structure in the La Grange Reach. Additional monitoring and research is needed to document the future status of fish species in the La Grange Reach and potential mechanisms driving observed and future changes.

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