STREAMLINE CHUB ERIMYSTAX DISSIMILIS AND TIPPECANOE DARTER NOTHONOTUS TIPPECANOE DISCOVERED IN ILLINOIS

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SPECIES ECOLOGY

North America boasts a diverse and unique array of fishes, with the majority comprised of two groups of species: minnows and darters. In fact, these two groups of fishes account for more than 450 species native to North America; over 300 of these species belonging to Leusicidae, the true minnows, and under 200 being species of darters within the family Percidae (Stout 2017; Page and Burr 2011; Schofield 2005). Additionally, many of these fishes are exposed to harsh environmental conditions resulting from human development, as it has become nearly impossible to locate a body of water anywhere in the world that has not experienced some form of anthropogenic disturbance, whether in the form of damming, pollution, channelization, or other impacts (Fisher et al. 2015). Due to numerous waters experiencing drastic ecological shifts caused by anthropogenic events, it is reasonable to expect that such an environment would elevate the risk of its inhabitants experiencing involuntary range shifts or complete extirpation. Conversely, if a water body experiences the removal of an anthropogenic disturbance, it stands to reason those impacted environmental conditions would improve, increasing the probability that a previously absent species may shift its range to encompass the rehabilitated habitat. The recent discovery of the Tippecanoe Darter Nothonotus tippecanoe (formerly Etheostoma tippecanoe; see Near et al. 2011), and the Streamline Chub Erimystax dissimilis for the first time in the state of Illinois exemplifies the benefit of removing an anthropogenic disturbance.

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Currently, Adam Jones is a graduate student at Eastern Illinois University, where he is nearing the completion of his thesis examining the impacts of low-head dam removal on the community and assemblage of stream fishes within the Vermilion and North Fork Vermilion rivers near Danville, Illinois. Adam grew up near St. Louis, Missouri, where he realized his passion for fisheries biology after years of avid angling and aspiring to learn as much as he could about the fishes he encountered. This passion later drove him to earn a BS in Wildlife Biology from Missouri State The Tippecanoe Darter is a small-bodied (TL <45 mm), benthic darter belonging to the family Percidae (Figure 1). The Tippecanoe Darter is known to occur within the Ohio River basin from Pennsylvania to Indiana and is known to also inhabit waters further south in the Cumberland River drainage located in Tennessee (Figure 2) (Kinziger et al. 2001; Page and Burr 2011; Honick et al. 2017). Additionally, the Tippecanoe Darter is often found in riffle-like habitats, specifically those consisting of moderate to high-flow rates and coarse substrates, such as cobble or gravel (Fisher 2008).

The Streamline Chub (Figure 3) is a larger-bodied minnow (TL<140 mm) belonging to the family Leuciscidae. Like the Tippecanoe Darter, this minnow occurs in the Ohio River ba-



Figure 1. Tippecanoe Darter *Nothonotus tippecanoe* collected from the Vermilion River during the sampling events on September 18, 2020.

University in 2019 and then continue to earn an MS in Biological Science from Eastern Illinois University.

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Figure 2. Extirpated, current, and expanded distributions of the Tippecanoe Darter in North America, illustrated by HUC 8 watersheds.

sin. However, the range of the two fishes within the basin differs slightly, as Streamline Chub populations encompass a range from western New York to northern Indiana and into northern Alabama (Figure 4) (Harris 1986; Strange and Burr 1997; Page and Burr 2011). Further, the Streamline Chub prefers deeper waters (>0.25 m) with high flow rates and large substrates, such as rocks or cobble (Rice and Zimmerman 2019), thus it is most often found within the runs of a river but will sometimes inhabit the shallower riffles as well.

DISCOVERY

The Tippecanoe Darter was the first of the two fish species to be newly discovered in Illinois and was found in the Vermilion River by Jarret Maurer, a micro-fisherperson from Indiana, on September 13, 2020. The fisherperson first alerted Indiana Department of Natural Resources (DNR) biologist Brant Fisher, who then alerted the Illinois DNR and Illinois Natural History Survey (INHS) to the possible discovery. Subsequently, just two days after initial discovery, Fisher returned to the site where the micro-fisherperson reported the occurrence and confirmed not only the presence of the Tippecanoe Darter at the site, but also the presence of additional individuals of the species. Once the discovery of the darter was confirmed, a sampling event was conducted on the Vermilion River September 18, 2020, ranging from Vermilion County, Indiana, to Vermilion County, Illinois, and into the North Fork, Middle Fork, and Salt Fork Vermilion



Figure 3. First Streamline Chub *Erimystax dissimilis* collected in Illinois, October 7, 2020.



Figure 4. Extirpated, current and expanded distributions of the Streamline Chub in North America, illustrated by HUC 8 watersheds.

rivers. To maximize catch potential, site selection consisted exclusively of riffles, and sites were sampled with kick seines.

Shortly thereafter, on October 7, 2020, two fellow Eastern Illinois University graduate students and I (Adam Jones) collected a single Streamline Chub from the Vermilion River near Danville, Illinois. This specimen was collected using pulsed DC-boat electrofishing during a bi-annual sampling event for my thesis project analyzing the impacts of dam removal on fish communities. When we initially collected the specimen, we were able to deduce that it was in fact a species of chub but were unable identify the species in the field. Once back in the lab, we positively identified the specimen as a Streamline Chub. As this was the first recorded specimen collected in Illinois, we alerted Illinois DNR biologist Trent Thomas to the discovery. The news was then passed on to the INHS and Indiana DNR, leading to two subsequent sampling events on October 16 and November 4, 2020, in an attempt to collect additional Streamline Chub specimens. Both of these sampling events encompassed the same stretch of the Vermilion River as those in search of the Tippecanoe Darter but did not extend into the North Fork, Middle Fork, and Salt Fork Vermilion rivers. To maximize catch potential, pull seines were used in swift-flowing riffles and runs exclusively.

SAMPLING RESULTS AND CONCLUSIONS

During the initial sampling event for the Tippecanoe Darter, we sampled 11 sites along the Vermilion River in both Illinois and Indiana. Of these 11 sites, the Tippecanoe Darter was collected from nine sites. Further, the Tippecanoe Darter occurred from approximately 13 km downstream of the Indiana-Illinois state line to just upstream of Danville, Illinois, and within the lower North Fork Vermilion River (Figure 5).

The sampling events for the Streamline Chub focused only on seven sites, with a total of six chubs collected from three sites. Only a single specimen was collected from Indiana, occurring about 5 km downstream of the Indiana-Illinois state line, and the remaining five individuals were collected from Illinois, occurring as far upstream as Danville (Figure 6).

Given the findings of these sampling events, we must consider the potential drivers behind the expansion of the Stream-



Figure 5. Sites where *N. tippecanoe* was collected (black circles), and sites where they were not (grey circles). Map by B.E. Fisher.



Figure 6. Sites where *E. dissimilis* was collected (black circles) and sites where they were not (grey circles). Map by B.E. Fisher.

line Chub and the Tippecanoe Darter into the state of Illinois. Of the possible explanations, the existence of improved water conditions in the Vermilion River, is one of the most compelling. There is evidence of both species expanding their ranges previously within the Ohio River basin in response to enhanced water quality (Stauffer et al. 2016; Honick et al. 2017; Rice and Zimmerman 2019), providing support for this hypothesis. Additionally, several other fish species have also recently expanded their ranges throughout the Vermilion River, including the Bigeye Chub *Hybopsis amblops* and Eastern Sand Darter *Ammocrypta pellucida* (Sherwood and Wylie 2015; Tiemann et al. 2020; Tiemann et al. 2021).

This argument is compelling, especially considering the removal of the Danville Dam (Figure 7), a low-head dam that stood on the Vermilion River from 1920 until its removal in 2018 (IDNR 2018). The Danville Dam was removed to return the river to a more natural state and improve water quality issues that the dam had contributed to over its lifespan. This rationale for dam removal has gained popularity over the years and has resulted in both positive and negative trends in water quality (Bohrerova et al. 2017). However, there is one specific



Figure 7. Danville Dam removal site, located on the Vermilion River in Danville, Illinois. Pre-removal (top) and post-removal.

result of dam removal that is important in understanding these range expansions, which is sediment mobilization. After a dam is removed, it no longer restricts the flow of sediments, thus allowing sand and silt to move downstream and uncover larger, more coarse substrates that would potentially improve the desired habitat of species that are more siltation-intolerant, such as the Streamline Chub and the Tippecanoe Darter (Catalano et al. 2007; Becker 1983). Given this, it is reasonable to suggest that the range expansions of the Streamline Chub and the Tippecanoe Darter within the Vermilion River are likely responses to improved water quality and increased sediment mobility.

Prior to the discovery of the Streamline Chub and the Tippecanoe Darter in the Vermilion River, it was believed that Illinois harbored 192 native species of fishes (Burr and Page 2009; Tiemann and Sabaj 2012). However, with the discovery of these two species in Illinois, this number should be increased to at least 194. Due to their current narrow range and limited population size in Illinois, these species should both be given strong consideration for addition to Illinois' list of state endangered species.

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