

# Feasibility of Ageing and Application to Cyprinid Prey Species in the Upper Mississippi River

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## Introduction

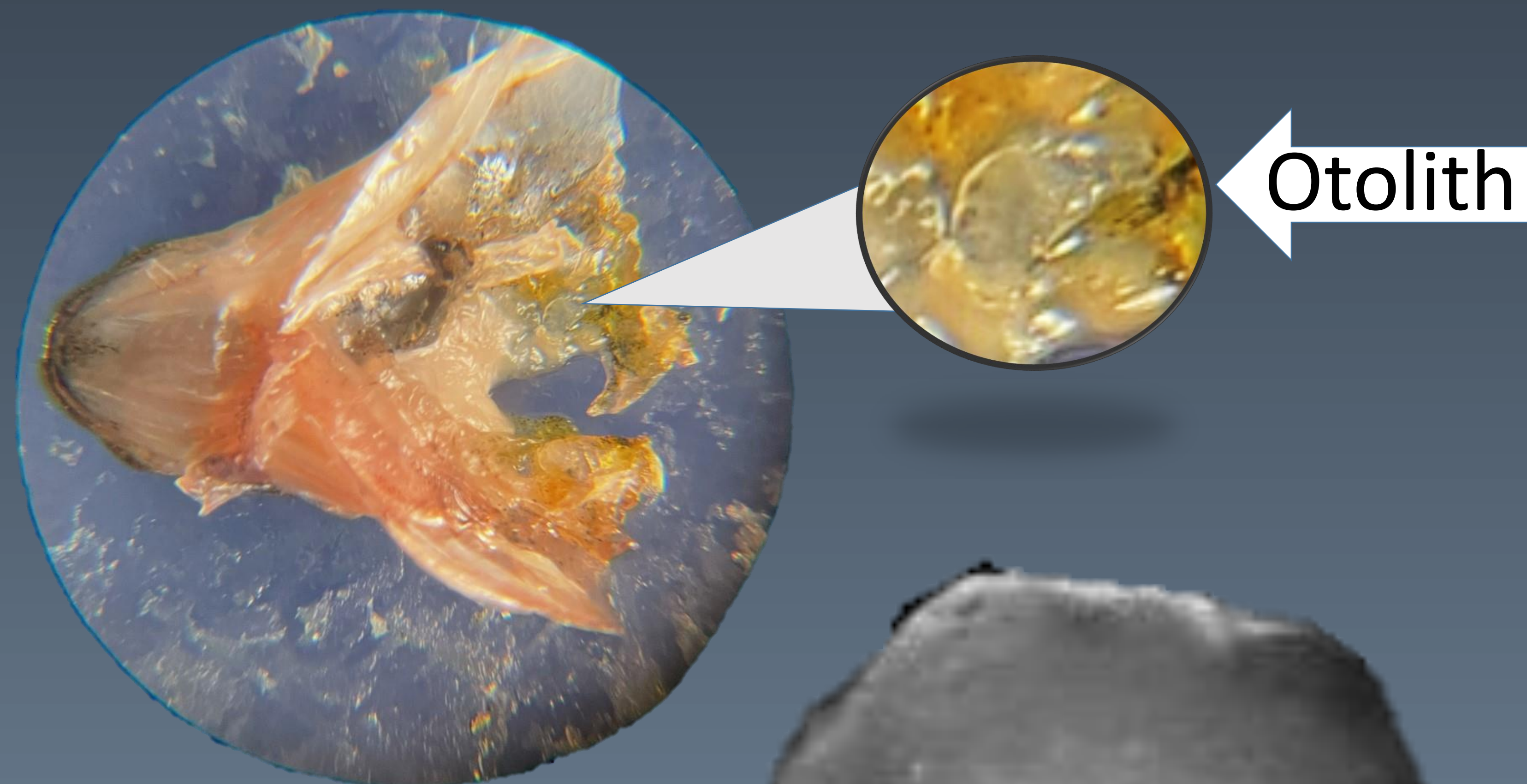
The family Cyprinidae (i.e., minnows and carps) is one of the most widely distributed fish taxa throughout the world. In North America, minnow species are important links to higher trophic levels in riverine ecosystems. Specifically, in the Mississippi River basin, minnow species represent an important forage species for various recreationally and commercially important species (e.g., Blue Catfish, Largemouth Bass). Minnow population dynamics (i.e., recruitment, growth, mortality) have the potential to influence higher trophic level fishes. Demographic trends can also elucidate changes to the environment. Given their life-history traits (e.g., relatively short-lived), minnows have the potential to rapidly reflect environmental perturbations. However, few studies have evaluated minnow age and growth. Further, even fewer studies have evaluated minnow age and growth using otoliths. Otoliths are widely regarded as the preferred ageing structure across teleost fishes (Phelps et al. 2017). As such, we evaluated the feasibility of extracting and ageing two minnow species commonly found throughout the Upper Mississippi River.



## Methods

Bullhead Minnow (BHMW) and Emerald Shiner (ERSN) were collected via mini-fyke nets and daytime electrofishing respectively (Ratcliff et al. 2014). Sampling was conducted by the United States Army Corps of Engineers' Long-Term Resource Monitoring (LTRM) element across six field stations in the Upper Mississippi and Illinois rivers (Ratcliff et al. 2014). All collected fishes were transferred to Missouri State University for further processing. Otoliths were removed using a dissecting microscope. Lapilliar otoliths (i.e., the biggest visible structure, double check that this is correct) were removed for age estimation.

## Results



Age 3 Emerald Shiner from Field Station 6 (La Grange, IL)

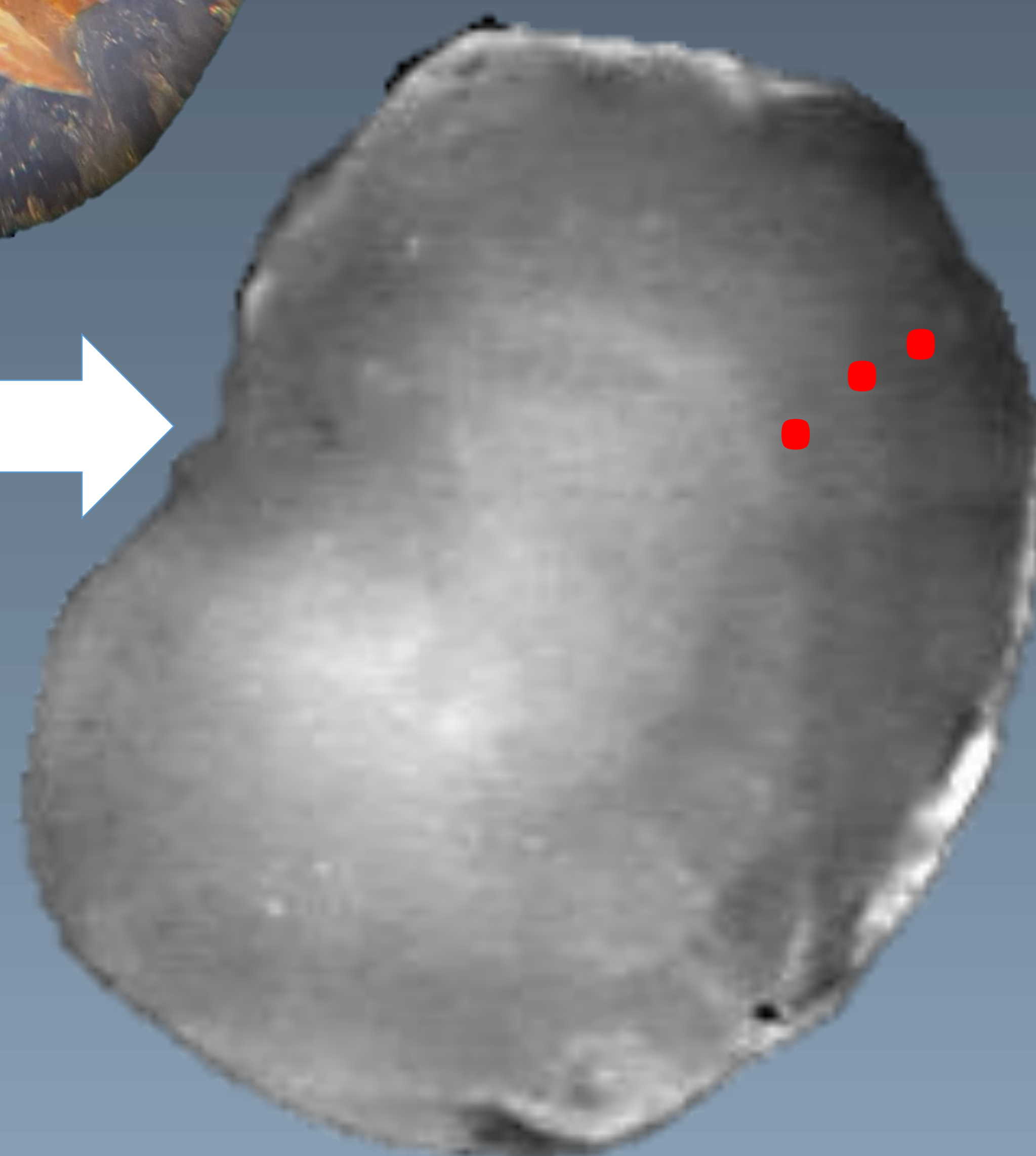
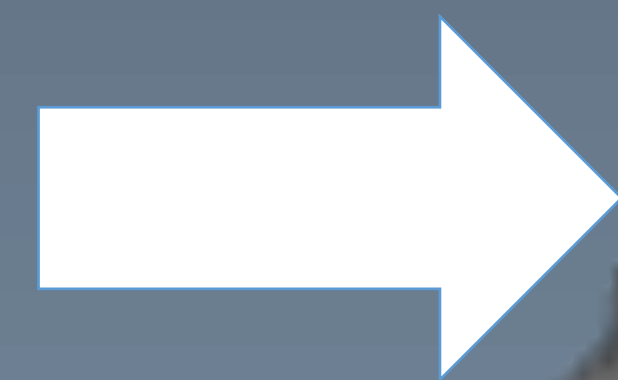


Table 1. Mean total length (mm), with standard errors in parentheses, at age for Bullhead Minnows and Emerald Shiners in the Upper Mississippi River.

Field Station	Fishcode	Age					
		0	1	2	3	4	5
Lake City, MN	BHMW	40 (n/a)	45 (0.61)	54.8 (0.78)	65.7 (2.40)	-	-
	ERSN	38.5 (1.19)	53.9 (1.11)	71 (0.70)	84 (0.96)	94 (0.38)	-
La Crosse, WI	BHMW	34.9 (0.80)	48 (n/a)	52.6 (1.63)	61.4 (1.63)	71.5 (2.5)	73 (1.15)
	ERSN	42 (n/a)	57 (0.89)	72.2 (0.68)	83 (0.68)	93 (1.16)	100 (n/a)
Bellevue, IA	BHMW	40 (n/a)	43.6 (1.69)	53.5 (1.78)	60.2 (1.47)	73.6 (2.08)	78.4 (0.68)
	ERSN	37.3 (1.29)	42.7 (1.02)	55.5 (1.19)	76.1 (1.68)	91 (3.09)	-
Alton, IL	BHMW	34.4 (0.56)	43.8 (0.85)	54.5 (0.87)	63 (n/a)	-	-
	ERSN	38.7 (0.88)	54 (1.62)	69.2 (0.99)	81.1 (2.07)	-	-
Cape Girardeau, MO	BHMW	35.2 (0.49)	44.7 (1.20)	54.3 (0.98)	-	-	71
	ERSN	37 (0.61)	53.9 (0.79)	66.2 (1.55)	-	-	-
La Grange, IL	BHMW	35.5 (0.66)	43.4 (0.63)	54.9 (0.83)	59.3 (2.20)	64 (n/a)	81.5 (2.5)
	ERSN	37.6 (0.85)	39.3 (1.33)	59 (1.25)	74.5 (1.19)	84.2 (2.60)	-

## Discussion

Otoliths sizes generally varies by fish body size. While otoliths are generally regarded as the preferred ageing structure, small-bodied fishes presents unique challenges (Phelps et al. 2017). Our study supports otolith use for ageing BHMW and ERSN in the Upper Mississippi River. Using a dissecting microscope, BHMW and ERSN lapillar otoliths can be removed and subsequently aged similar to other teleost fishes (e.g., Largemouth Bass) ageing procedures.

Otolith derived age assignments likely provide more accurate estimates compared to traditional length-based approaches. Age data can be used to quantify BMMW and ERSN population dynamics (i.e., recruitment, growth and mortality). Small-bodied fish species represent ecologically and biologically important species. Understanding population dynamics can provide insights into various abiotic and biotic factors influencing minnow populations. Further, given minnow life-history characteristics (e.g., relatively short regeneration time) these species could be used as a bio-indicator. Age data expands the use of fish to evaluate various environmental and anthropogenic influences on the ecosystem.

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