


Fall 10-19-2022

Evaluating Gizzard Shad *Dorosoma cepedianum* populations in two Kentucky reservoirs recently invaded by Silver Carp *Hypophthalmichthys molitrix*

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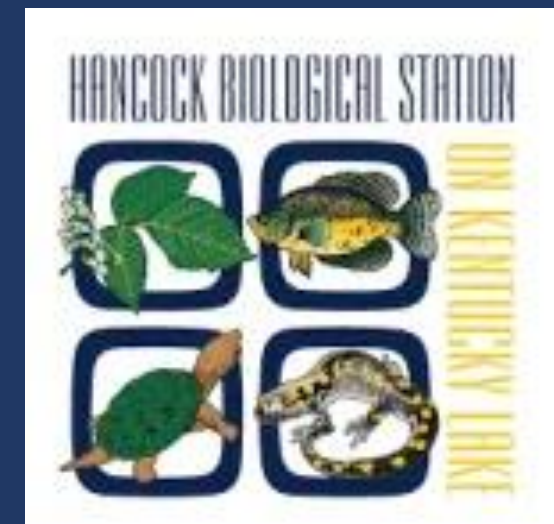
Klein, Nathan and Spier, Timothy, "Evaluating Gizzard Shad *Dorosoma cepedianum* populations in two Kentucky reservoirs recently invaded by Silver Carp *Hypophthalmichthys molitrix*" (2022). *Student Scholarship & Creative Works*. 17.
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Evaluating Gizzard Shad *Dorosoma cepedianum* Populations in two Kentucky Reservoirs Recently Invaded with Silver Carp *Hypophthalmichthys molitrix*

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INTRODUCTION

Gizzard Shad *Dorosoma cepedianum* are an ecologically important fish species found in many reservoirs throughout the southeastern United States [1,2]. Kentucky Lake and Lake Barkley are two reservoirs where Gizzard Shad and Silver Carp *Hypophthalmichthys molitrix* are present and possibly competing. The presence of Silver Carp has been shown to negatively effect Gizzard Shad in other waterbodies [3,4]. Previous research done at Murray State has shown evidence of competition between Silver Carp and Gizzard Shad in Kentucky Lake for a limited food resource [5], showing the possibility of Silver Carp influencing Gizzard Shad populations. However, the overall effect of the invasive Silver Carp on Gizzard Shad can not be fully quantified for these lakes due to limited baseline population data.

OBJECTIVES

- Describe size structure, condition, age, growth, mortality, and reproduction of Gizzard Shad populations in Kentucky Lake and Lake Barkley.

METHODS

- Gizzard Shad were collected every two weeks during nighttime shoreline electrofishing surveys during May 2021 - October 2021 and March 2022 - August 2022.
- Two cove and two main channel sites were sampled for 15 minutes every survey.
- Total length and weight was recorded for all Gizzard Shad. For mature Gizzard Shad, gonad weight and sex was also recorded.
- Sagittal otoliths were collected from five fish per 10mm length bin in October 2021 and April/May 2022.
- Gizzard Shad were aged by two independent readers using images of whole and sectioned otoliths [6].
- Age-length keys were used to assign ages to unaged fish from October 2021 and April/May 2022 samples [7,8]



Figure 1. Whole view of Gizzard Shad sagittal otolith (top) and cross section of Gizzard Shad sagittal otolith (bottom).

Table 1. Precision of two readers estimating the age of Gizzard Shad otoliths collected from Kentucky Lake and Lake Barkley during fall 2021 and spring 2022. ACV is the average coefficient of variation.

Fall 2021	Agreement	±1	±2	±3	ACV	SD	N
Kentucky Lake	92.9%	6.1%	1.0%	0.0%	1.6	6.0	98
Lake Barkley	90.7%	9.3%	0.0%	0.0%	1.5	5.4	108

Spring 2022	Agreement	±1	±2	±3	ACV	SD	N
Kentucky Lake	79.7%	19.5%	0.8%	0.0%	3.3	7.2	118
Lake Barkley	86.4%	12.7%	0.0%	0.8%	2.2	6.6	118

Results

- Kentucky Lake was sampled via electrofishing 25 times during 2021-2022. A total of 1,647 Gizzard Shad were captured, average CPUE was 66 fish/hour (SE = 13.8).
- Lake Barkley was sampled via electrofishing 19 times during 2021-2022. A total of 4,434 Gizzard Shad were collected, average CPUE was 233 fish/hour (SE = 56.4)

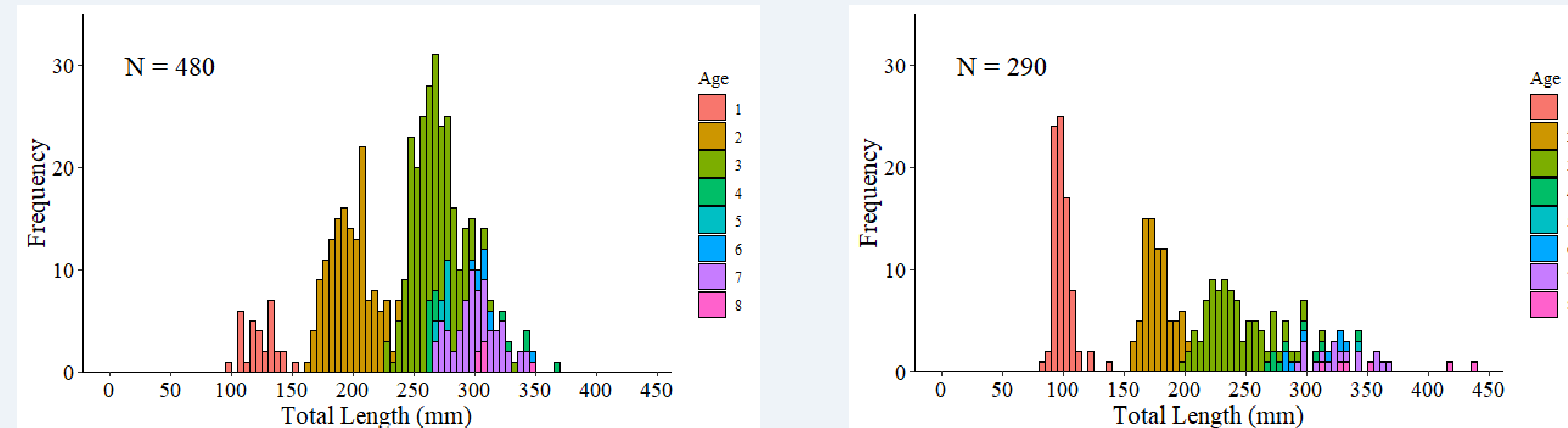


Figure 2. Length-Age frequency histograms of Gizzard Shad captured by shoreline electrofishing during Spring 2022. Kentucky Lake (left) and Lake Barkley (right).

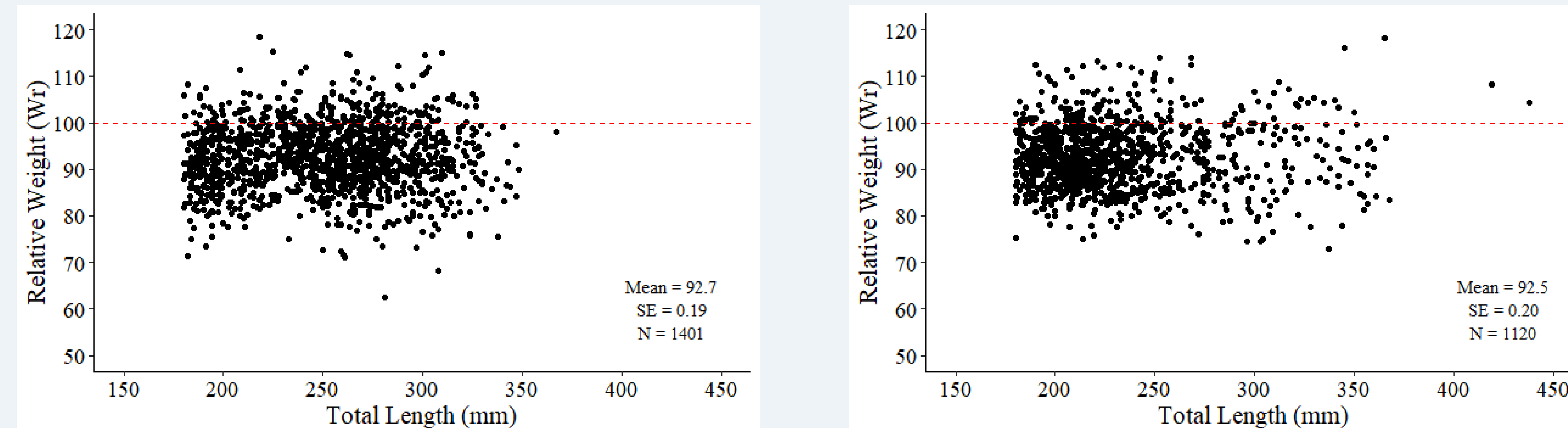


Figure 3. Scatterplot of relative weight and total length (mm) of Gizzard Shad in Kentucky Lake (left) and Lake Barkley (right). Dashed red line represents a relative weight of 100.

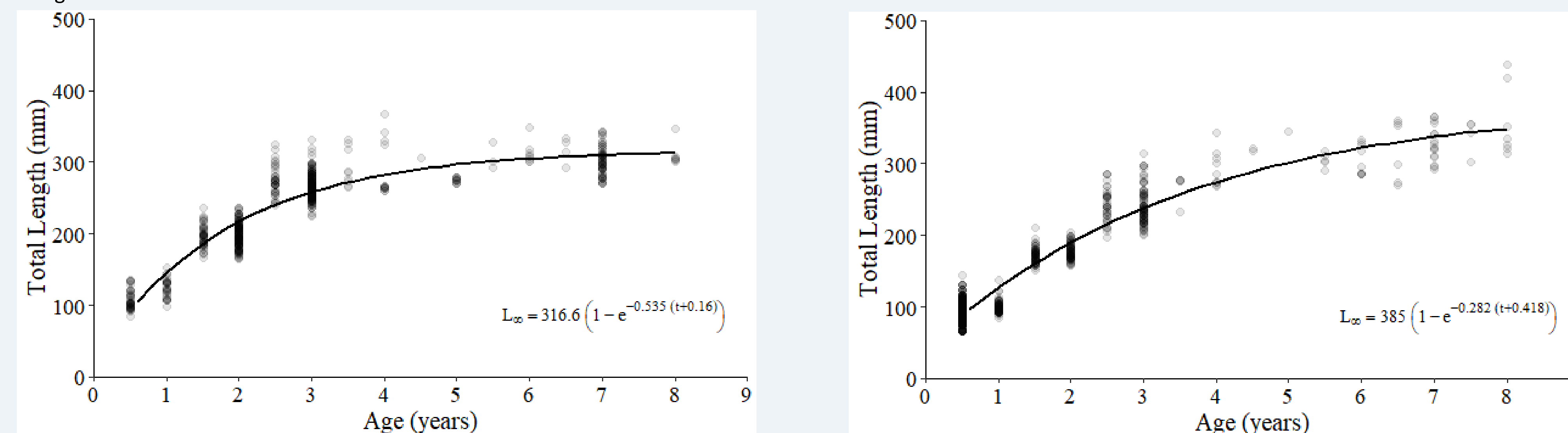


Figure 4. Von Bertalanffy growth curves calculated from otolith age estimates for Gizzard Shad collected from Kentucky Lake (left) and Lake Barkley (right) during Spring 2022 [7].

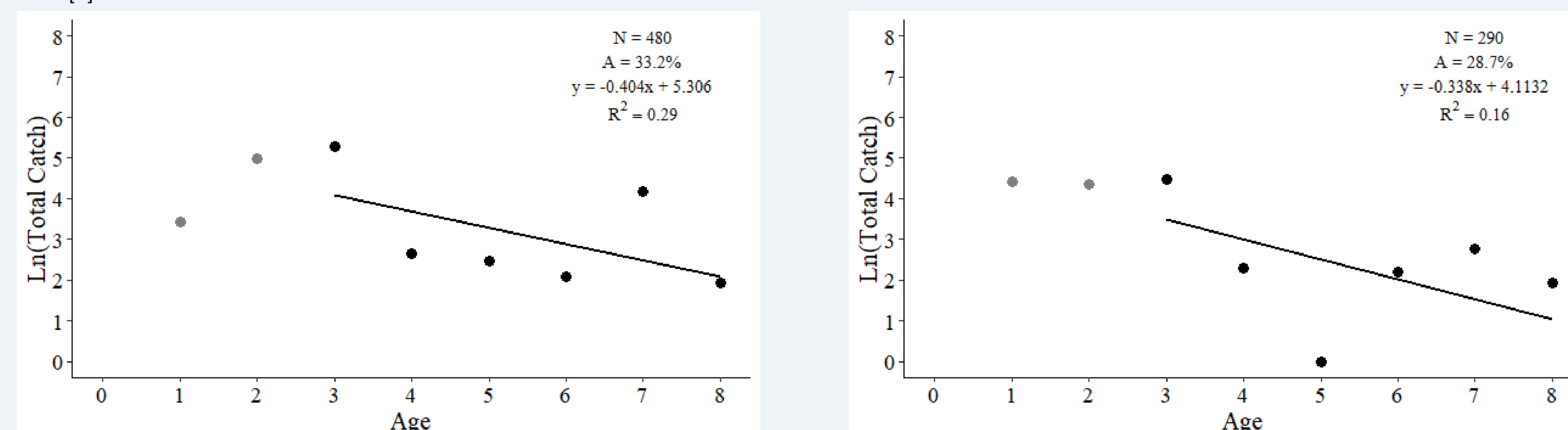


Figure 5. Weighted catch curve regressions for Gizzard Shad collected from Kentucky Lake (left) and Lake Barkley (right) during Spring 2022 [8]. A = annual mortality rate. Black points represent age classes which have fully recruited to the gear and thus were used in the calculations.

DISCUSSION

Results suggest that population characteristics of Gizzard Shad in Kentucky Lake and Lake Barkley are different despite the reservoirs' proximity to each other. Gizzard Shad in Lake Barkley are more abundant and have a lower mortality when compared to Kentucky Lake Gizzard Shad. Gizzard Shad have higher growth rates in Kentucky Lake but have a smaller maximum size. Gizzard Shad recruitment appears to be better in Lake Barkley than Kentucky Lake. Both populations of Gizzard Shad are in relatively good condition and exhibit similar average relative weights. However, the impact of Silver Carp on Gizzard Shad in these two reservoirs is still unknown, without comparable pre-carp data.



Figure 6. Gizzard Shad captured during electrofishing survey.

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ACKNOWLEDGEMENTS

I would like to thank my fellow graduate and undergraduate students who helped with sampling, Hancock Biological Station for use of equipment and space and U.S. Fish and Wildlife Service and SUPERB for the funding.