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# Size Structure, Age, Growth and Spawning Periodicity of Silver Carp *Hypophthalmichthys molitrix* in Kentucky Lake, Kentucky

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# Size Structure, Age, Growth & Spawning Periodicity of Silver Carp *Hypophthalmichthys molitrix* in Kentucky Lake, Kentucky

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## Introduction

- Silver Carp are an aquatic invasive species of concern that have successfully expanded throughout much of the Mississippi River Basin.
- By 2004, Silver Carp were reported in Kentucky Lake, the largest reservoir east of the Mississippi River (Fig 1).
- Nothing is known about the population demographics of Silver Carp in Kentucky Lake.
- Population demographics information is necessary to monitor the population and develop effective management strategies.

## Objectives

- Characterize population demographics of Silver Carp in Kentucky Lake including: size structure, age and growth.
- Determine how often Silver Carp spawn in Kentucky Lake.

## Study Area

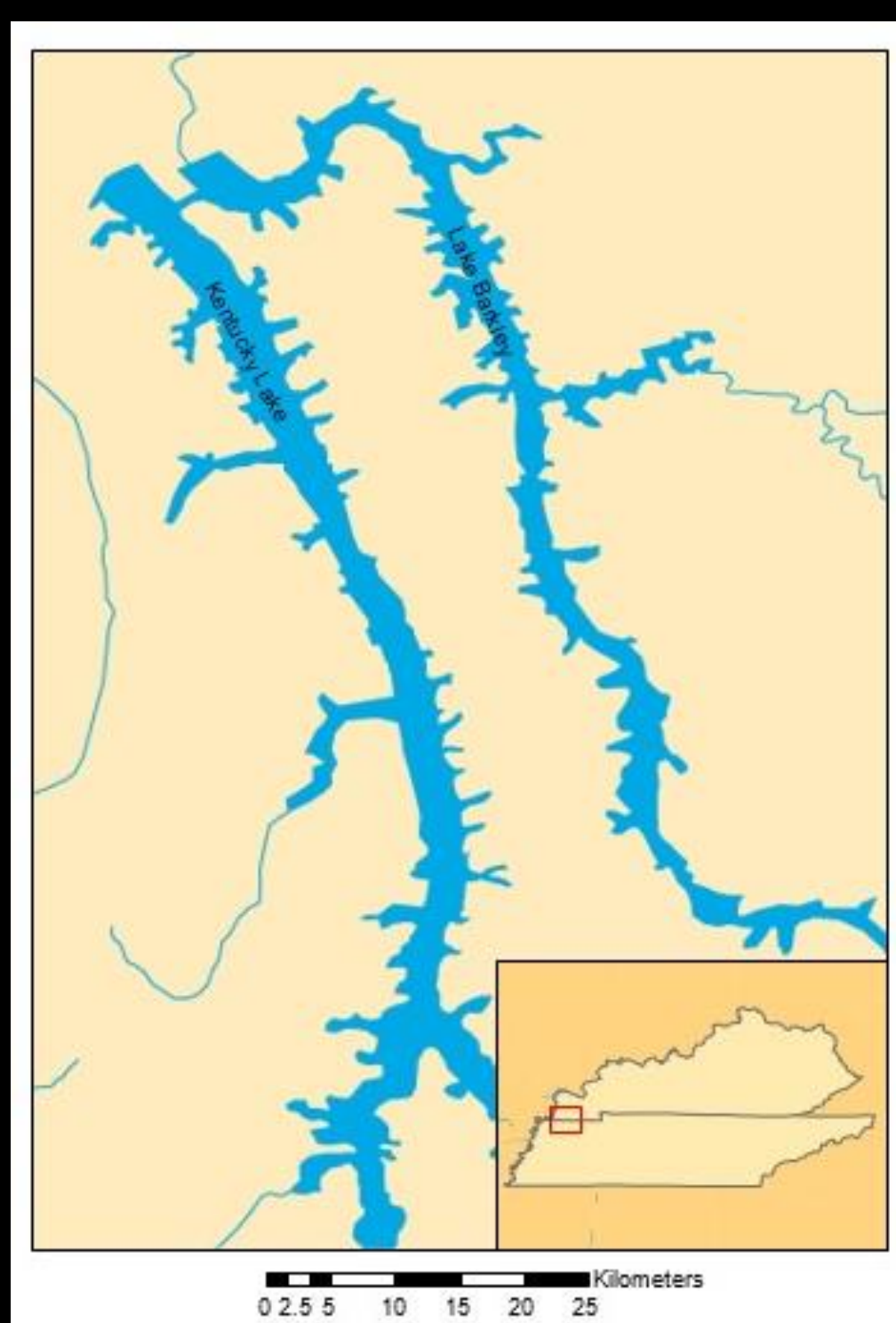


Fig 1. Map of Kentucky Lake with Lake Barkley shown for reference. Inset shows location of Kentucky Lake relative to Kentucky and Tennessee. Map created by Dalton Lebeda.

## Methods

- Silver Carp were captured using gill nets, boat electrofishing and commercial fishermen.
- Total length (nearest mm), body weight (nearest 0.01 kg) and sex were recorded for all Silver Carp.

### Age

- The left pectoral fin ray was removed for age analysis.
- Fin rays were dried, then three 700 μm sections were obtained from each fin ray using a low-speed diamond blade saw.
- Sections were immersed in water in a dark cap and placed under a dissecting microscope. Annuli were illuminated using reflected light. Two readers independently aged sections from each fin ray. Ages were compared; if ages differed, a consensus age was reached.
- Only adult fish were aged. Young of the year otoliths are being processed for daily growth rings.

### Growth

- An attempt to model growth using a von Bertalanffy curve was unsuccessful due to the lack of size variability across ages (Fig 5).

### Spawning Periodicity

- Gonads were removed and weighed (nearest g).
- Gonadosomatic index (GSI) was calculated using the equation below:

$$GSI = 100 \times \frac{\text{gonad weight}}{\text{body weight}}$$

## Results

- Of 292 Silver Carp collected, 95% were between 750-950 mm (Fig 3).
- Of 101 Silver Carp aged, 87% were ages 3 or 4 (Fig 4).
- Silver Carp in Kentucky Lake appear to be approaching maximum length based on the lack of variability in size between ages 3 and 9 (Fig 5).
- Mean GSI for Silver Carp did not yield definitive spawning times (Fig 6).
- Male and female mean GSI peaked in April and declined by June (Fig 6).
- Male mean GSI peaked again in October and declined by November, however, no matching trend in mean GSI was apparent for females (Fig 6).

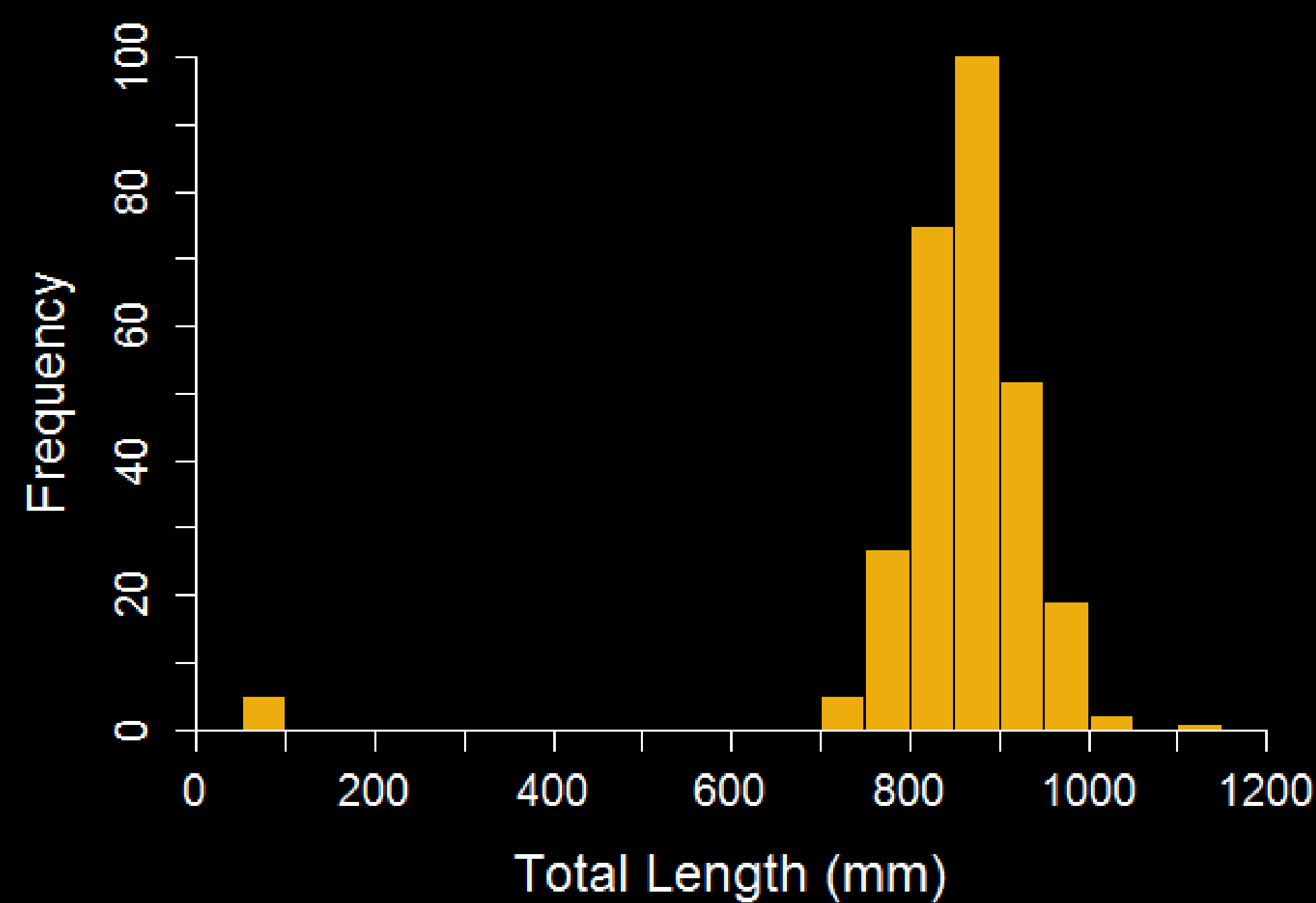


Fig 3. Length frequency distribution of sampled Silver Carp in Kentucky Lake.



Fig 4. Age frequency distribution of aged Silver Carp in Kentucky Lake.

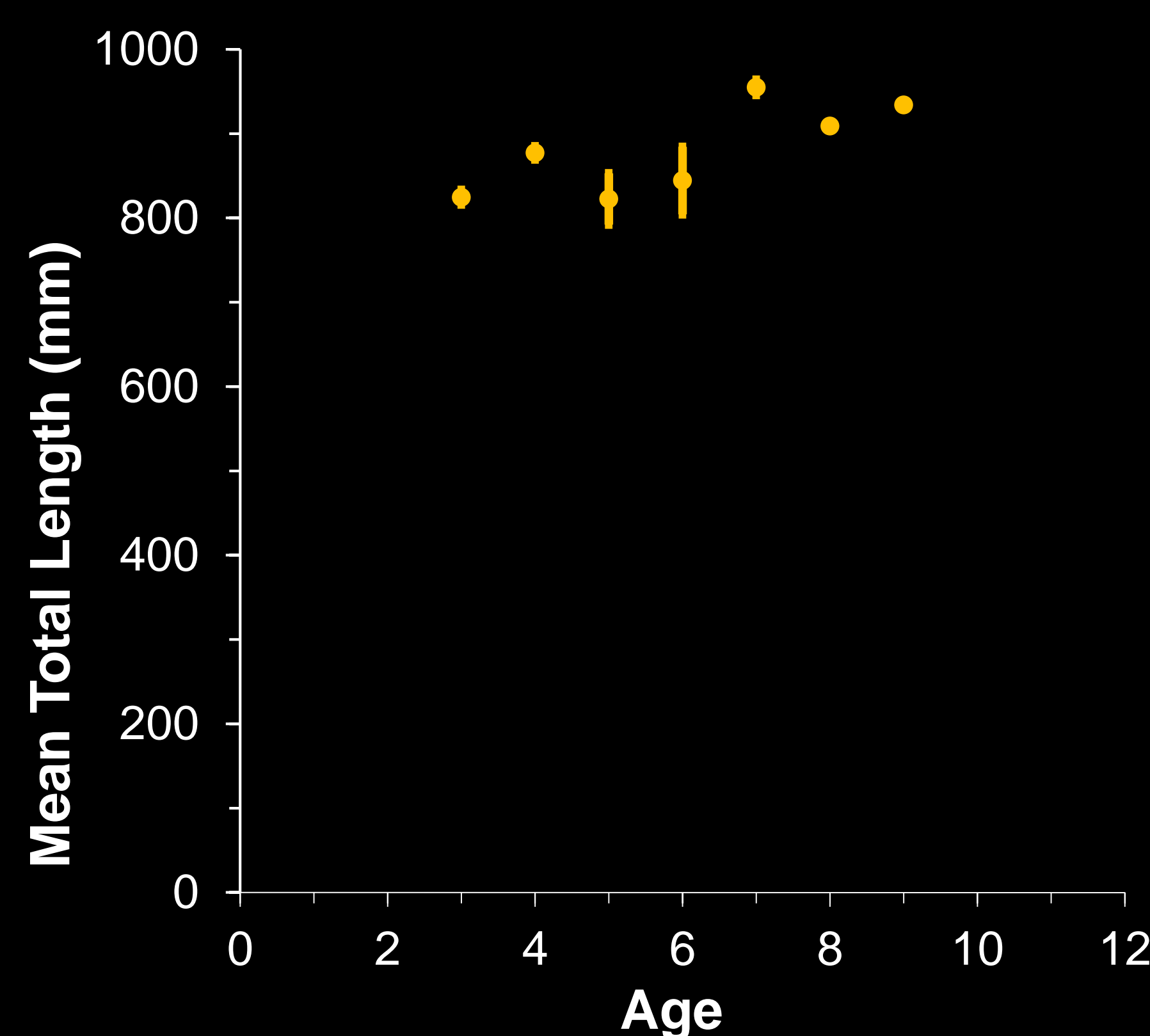


Fig 5. Mean total length (mm) by age for Silver Carp from Kentucky Lake. Error bars represent standard error of the mean. No standard error for 8 and 9 year old fish (n = 1).

## Results (continued)

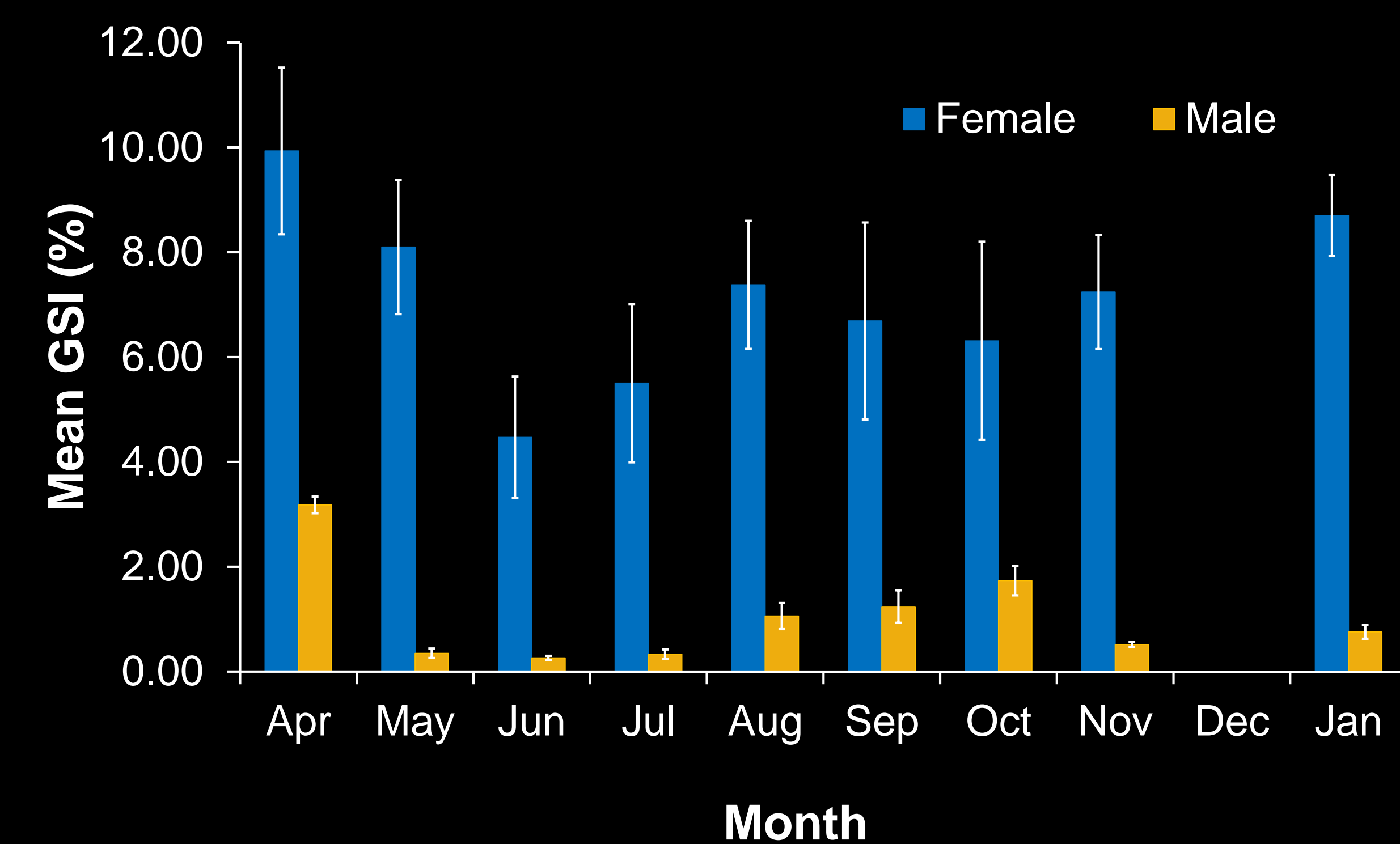


Fig 6. Mean GSI (%) for female and male Silver Carp from April 2015 to January 2016. Error bars represent standard error of the mean. No data were available for December 2015.

## Summary

- A large majority of the Silver Carp captured in Kentucky Lake were between 750 and 950 mm.
- Most of the Silver Carp aged were either 3 or 4 years old.
- The lack of variability across sizes and ages is likely because of a gear selectivity bias due to large mesh gill nets.
- Gill nets with 5.08 cm bar mesh and experimental gill nets measuring 2.54 to 8 cm bar mesh were fished a combined total of 324 hours and never caught Silver Carp.
- Based on male mean GSI, Silver Carp appear to spawn in the spring and may also spawn in the fall.

## Future Work

- We will continue to sample Silver Carp using a variety of methods in an attempt to collect a wide range of sizes and ages.
- We will attempt to model growth using a von Bertalanffy curve if we obtain smaller Silver Carp.
- We will continue to monitor GSI for Silver Carp to determine spawning periodicity in Kentucky Lake.
- We will also measure egg diameter using ovary samples from Silver Carp to help determine spawning periodicity.
- We will quantify fecundity using ovary samples from Silver Carp.

## Acknowledgements

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