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SHORT COMMUNICATION

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Comparative precision of age estimates from two southern reservoir populations of paddlefish [*Polyodon spathula* (Walbaum, 1792)]

J. M. Long[1] | **A. A. Nealis**[2]

[1]U.S. Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, Department of Natural Resource Ecology and Management Oklahoma State University, Stillwater, OK, USA

[2]Oklahoma Department of Wildlife Conservation, Ponca City, OK, USA

Correspondence
James M. Long, US Geological Survey, Oklahoma Cooperative Fish and Wildlife Research Unit, Department of Natural Resource Ecology and Management, Oklahoma State University, Stillwater, OK, USA.
Email: longjm@okstate.edu

Summary

The aim of the study was to determine whether location and sex affected the age precision estimates between two southern, reservoir populations of paddlefish [*Polyodon spathula* (Walbaum, 1792)]. From 589 paddlefish collected in Grand Lake and Keystone Lake, Oklahoma in 2011, ages from dentaries were estimated using three independent readers and precision was compared with coefficient of variation between locations and sexes. Ages were more precisely estimated from Grand Lake and from females.

1 | INTRODUCTION

Paddlefish (*Polyodon spathula*) populations have been exploited throughout their range and typically exhibit irregular recruitment, making quality age estimates critical for management (LeBreton & Beamish, 2005). Estimating age of paddlefish with dentaries can be difficult (Jennings & Zigler, 2009), but few have attempted to quantify those difficulties (e.g., precision). In the Yellowstone River and Missouri River of Montana and North Dakota, estimates of precision (CV) depended on the location (Scarnecchia et al., 2006). Quantifying precision of age estimates from a southern latitude location would inform management across the range of the species. We sought to quantify precision of age estimates from two southern populations of self-sustaining paddlefish populations and to compare them between locations. Additionally, because growth rates can affect precision of age estimates (Hoxmeier, Aday, & Wahl, 2001) and female paddlefish grow faster than males (Jennings & Zigler, 2009; Leone, Stoeckel, & Quinn, 2012), we also sought to compare differences in precision between sexes.

2 | MATERIALS AND METHODS

2.1 | Study area

Paddlefish were collected for age estimation from Grand Lake and Keystone Lake in Oklahoma that contained self-sustaining and recreationally exploited populations. At Grand Lake, we obtained a convenience sample of 304 paddlefish brought by anglers to the Oklahoma Department of Wildlife Conservation's Paddlefish Research Center (PRC) from March through April 2011. At Keystone Lake, we used gill nets and actively collected 287 paddlefish from January through March 2011. For all fish collected, we measured size (eye-fork length [EFL; mm]), removed jawbones (dentaries) for age estimation, and examined gonads to determine sex (male, female).

2.2 | Age estimation and precision

Jawbones were cleaned and sectioned posterior to the point of greatest curvature to 0.635 mm thickness with a low-speed, diamond-edged saw (Scarnecchia, Stewart, & Power, 1996). Three readers of similar experience level independently estimated age of each fish, without knowledge of fish size or sex, by counting annuli along the mesial arm (Adams, 1942) under magnification. From these three independent estimates of age, we computed the coefficient of variation (CV;=(*SD*/mean)*100) (Chang, 1982) and tested for differences between lake, sex, and interaction using ANOVA (square-root + 1 transformed, Proc GLM, SAS v. 9.4).

3 | RESULTS

One fish from each lake could not be assigned to the sex, resulting in 144 females and 159 males from Grand Lake (ages 8–18 and

6–14, respectively), and 92 females and 194 males from Keystone Lake (ages 3–15 and 2–16, respectively) examined for age precision. Females grew faster than males at Grand Lake, reaching 1,000 mm EFL by age 9 compared to males, which reached 1,000 mm EFL by age 14. In Keystone Lake, males grew faster, reaching 1,000 mm EFL by age 6 compared to age 7 for females. Mean CV values from Grand Lake (6.47%) were statistically lower than for Keystone Lake (14.14%: $F_{1,585} = 98.17$, $p < .01$) as were CV values for females (8.27%) compared to males (11.47%: $F_{1,585} = 7.62$, $p < .01$). No significant interaction between lake and sex was evident (CV: $F_{1,585} = 0.01$, $p = .92$).

4 | DISCUSSION

Growth rates could be partially responsible for the results observed. Faster growth increases inter-annuli distances thereby increasing annuli discernibility (Hoxmeier et al., 2001), but this was evident only in our differences between sexes, not between locations.

Location-specific differences that might affect paddlefish age precision are speculative. According to the Lein and DeVries (1998) hypothesis, energy budgets in highly fluctuating environments are relatively unpredictable, affecting fish growth and thus, precision of age estimates. To test this hypothesis, one would need data from more than two systems in addition to concomitant paddlefish age estimates.

A better understanding of how location affects precision of paddlefish age estimates would improve management of individual stocks. From our study, sex and location both played a role and we speculate that location-specifics related to environmental stability may be a factor affecting reproducibility of age estimates for paddlefish.

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