Potential to Improve Growth of Bluegills Using Supplemental Feeding

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Abstract: Bluegills are a popular sport fish in many parts of the United States, but some populations demonstrate a reduced size structure. Numerous attempts have been made by natural resource agencies to improve bluegill size structure through management manipulations, but these attempts have had variable success. Supplemental feeding has been used to improve growth of bluegills in small impoundments. In May 2019, large bluegills were observed in a hatchery pond at the United States Fish and Wildlife Service, Tishomingo National Fish Hatchery. These bluegills may have benefited from pelletized feed that was applied to the pond to provide additional forage for brood stock alligator gar and largemouth bass. The goal of this study is to evaluate the potential for supplemental feeding to improve growth of bluegills in Oklahoma. Bluegill growth, in both length and weight metrics, was superior to growth of bluegills from five quality populations in Oklahoma. These results suggest that supplemental feeding can result in growth of bluegills to large sizes, but further research is needed to determine if supplemental feeding can produce similar growth affects in larger, natural environments.

Introduction

Bluegill *Lepomis macrochirus* is a ubiquitous sunfish species (Centrarchidae) found in most aquatic systems across the United States. In many parts of the country, bluegill populations create some of the most popular recreational fisheries (U.S. Fish and Wildlife Service and Bureau of the Census 2011). However, some bluegill populations can demonstrate reduced size structure (Drake et al. 1997). Causes of stunted bluegill growth include overharvest (Coble 1988, Drake et al. 1997, Rypel 2015), male social dynamics (Drake et al. 1997, Jennings et al. 1997, Aday et al. 2006, Peterson et al. 2010), insufficient predator populations (Guy and Willis 1990), and prey resource availability (Berger 1982, Aday et al. 2006).

Bluegill populations with reduced size structure (many fish < 152 mm TL) are undesirable to recreational anglers, as they are considered too small to harvest (Paukert et al. 2002). Fisheries management efforts to create quality bluegill populations or reclaim stunted populations have typically relied on predator introductions to control numbers and recruitment of small bluegills (Otis et al. 1998, Schneider and Lockwood 2002) and harvest regulations (bag or length limits; Ott et al. 2001, Paukert et al. 2002, Sammons et al. 2006, Rypel 2015). However, attempts to create high quality sunfish angling opportunities through these management manipulations have produced variable results (Beard et al. 1997, Sammons et al. 2006).

Supplemental feeding has been used successfully to improve growth of bluegills in small impoundments (Berger 1982, Woodard et al. 2013, Henderson et al. 2019). In spring 2019, Oklahoma Department of Wildlife Conservation

(ODWC) personnel observed large bluegills in a hatchery pond at the United States Fish and Wildlife Service (USFWS) Tishomingo National Fish Hatchery (TNFH) while collecting alligator gar brood stock. Bluegill growth may have benefited from pelletized food that was applied to the pond, therefore growth of bluegills collected from the hatchery pond will be described. Further, growth of these bluegills will be compared to bluegill growth from five high quality sunfish populations in Oklahoma (Porta 2019). This case study will evaluate the potential for supplemental feeding to improve growth of bluegills in Oklahoma.

Methods

Bluegill were raised in a 0.4 ha earthen pond at TNFH, Tishomingo, Oklahoma. The intended purpose of this pond was to hold adult alligator gar *Atractosteus spatula* that are used for annual hatchery production. Besides bluegill and alligator gar, the predominant fish species in the pond included largemouth bass *Micropterus salmoides* and redear sunfish *Lepomis microlophus*. Bluegills were stocked into the hatchery pond to provide forage for the largemouth bass, and largemouth bass served as forage for alligator gar. Additionally, alligator gar and largemouth bass were provided 2.72 kg of commercial fish feed (6.4 mm pellets) twice weekly (equivalent to 1.93 kg ha/day; R. Simmons, USFWS, personal communication).

Bluegills were collected from the hatchery pond using a bag seine (12.2 m L x 1.8 m H with 6 mm mesh) in May 2019. Bluegills were collected from five Oklahoma small impoundments (Elmer Lake, New Spiro Lake, Pawhuska Lake, Sparks Lake, and Stilwell City Lake) during April-May 2019 using boat electrofishing to sample the entire perimeter of each lake. Once captured, bluegills were measured for total length (TL; mm). We attempted to collect a sample of ten fish per 10 mm length group for age and growth purposes, to ensure that all size and age classes were represented in the sample. All fish collected for age assessment purposes were kept on ice until they were returned to the ODWC Oklahoma Fishery Research Laboratory, Norman, Oklahoma.

In the laboratory, each fish was measured for TL and weight (g), sex identified, and sagittal otoliths were removed for age estimation. Otoliths were prepared for age estimation using methods similar to Maceina (1988). Otoliths were viewed in random order by two independent readers and an age estimate was assigned to each fish (Hoff et al. 1997). When there was a disagreement on an estimated age, a concert reading was conducted by both readers and a final age estimate was determined.

The length frequency was graphed to visualize the size structure of hatchery pond bluegills. Mean length and standard deviation of bluegill in each age class was calculated. Growth of bluegills from the hatchery was described using von Bertalanffy growth models. Growth of bluegills from the TNFH pond was plotted against growth curves from the five quality sunfish populations (Porta 2019) to compare growth patterns.

Results and Discussion

A total of 163 bluegills ranging 56-258 mm TL and weighing 2-470 g were collected from the TNFH pond (Figure 1). A total of 654 bluegills ranging 27-213 mm TL and weighing 0.1-246 g collected from five wild populations were used for comparison. Bluegills exposed to supplemental food in the TNFH pond attained a larger length (L_∞ = 349 mm TL) and weight (W_∞ = 406 g) than wild fish from five quality sunfish lakes (L_∞ = 179-227 mm TL, W_∞ = 118-216 g, Figure 2; Porta 2019). Differences in length and weight between bluegills from the TNFH pond and those from five quality bluegill populations in Oklahoma suggests that supplemental feeding can result in improved growth of bluegills in small aquatic systems, which has been observed in previous supplemental feeding evaluations (Berger 1982, Woodard et al. 2013, Henderson et al. 2019).

The intended purpose of applying supplemental feed to the TNFH pond was to provide additional forage for adult alligator gar

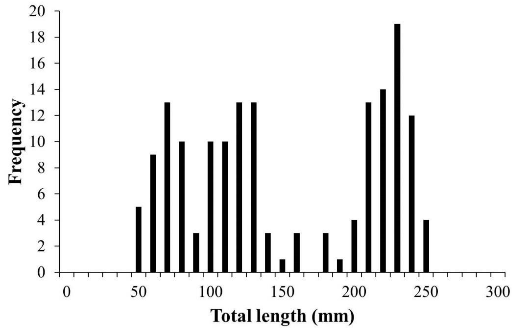

Figure 1. Length frequency diagram for bluegills collected from a pond at Tishomingo National Fish Hatchery during May 2019.

brood stock and largemouth bass (also serving as forage for the alligator gar) that were held in this pond. However, it appears that bluegills were able to take advantage of supplemental feeding, particularly when they reached 3 years old (Figures 2 and 3). Variability in length-at-age was greatest at age-3 (Figure 3), which likely resulted in the gap (140-200 mm) in the length frequency distribution. Presumably, this is when bluegill gape was large enough to begin consuming the large pellets (6.4 mm) that were applied to the pond, giving some age-3 fish a growth advantage. This suggests that earlier growth benefits of bluegills could occur if they were provided feed of a smaller pellet size. Bluegills were provided a smaller pellet size (3 mm) in previous supplemental feeding evaluations where positive growth was observed (Berger 1982, Woodard et al. 2013, Henderson et al. 2019).

Positive bluegill growth in this study was observed when applying a feeding rate of 1.93 kg/ha/day. Previous research suggests a feed rate of 2.7-11 kg/ha/day has a positive growth effect on bluegills (Woodard et al. 2013, Henderson et al. 2019). Although, Berger (1982) found that supplemental feeding at lower rates improved the sizes of bluegills in a Kansas reservoir (4.54 kg*6 feeders/30.4 ha = 0.89 kg/day maximum feeding rate). This study suggests that supplemental feeding can result in growth of bluegills to large sizes (> 250 mm TL; Figure 4). However, further research is necessary to determine whether supplemental feeding can result in similar growth effects of bluegills in larger, natural environments in Oklahoma.

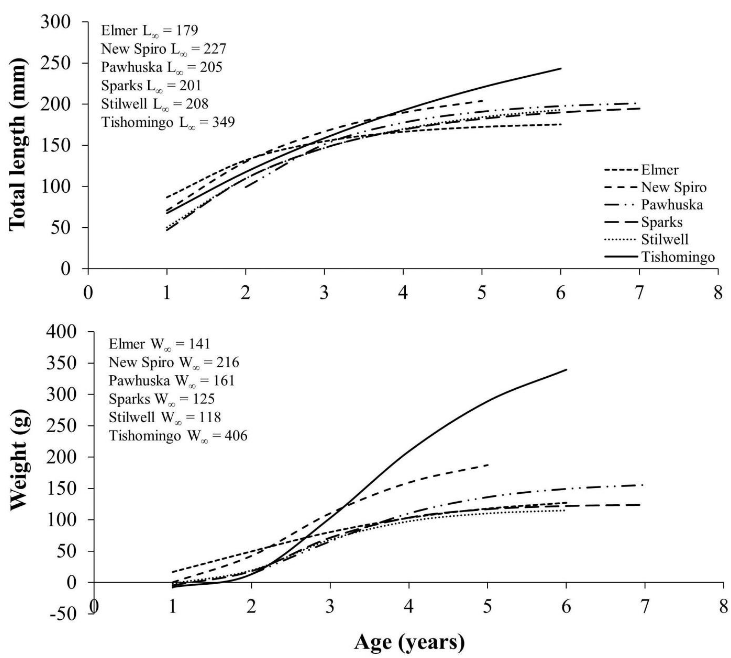

Figure 2. von Bertalanffy growth curves comparing growth of bluegills (by length [top] and weight [bottom] collected from a hatchery pond at Tishomingo National Fish Hatchery (TNFH) to growth of bluegills collected from five Oklahoma small impoundments (Porta 2019).

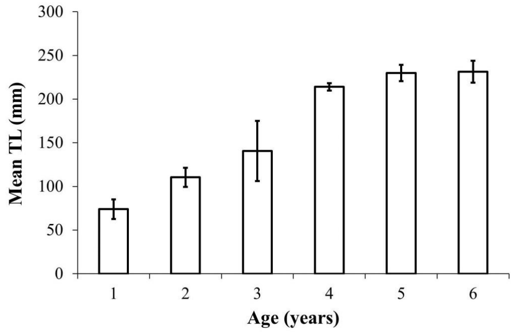

Figure 3. Mean length-at-age of bluegills collected from a pond at Tishomingo National Fish Hatchery during May 2019. Error bars represent the standard deviation of the mean.

Figure 4. Photograph comparing a bluegill captured from the pond at TNFH (246 mm TL, 364 g) to a typical quality-sized bluegill from the five small impoundments (180 mm TL, 110 g).

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