Predators of White Perch at Branched Oak and Pawnee Reservoirs

Final Report

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Authors:

Nathan J.C. Gosch
Nebraska Cooperative Fish and Wildlife Research Unit
School of Natural Resources
University of Nebraska-Lincoln

Kevin L. Pope
USGS-Nebraska Cooperative Fish and Wildlife Research Unit
School of Natural Resources
University of Nebraska-Lincoln

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Study Objective

The purpose of this project is to quantify food habits of largemouth bass, white crappie, black crappie, channel catfish, flathead catfish, hybrid striped bass, white bass, sauger and walleye to determine which fishes are predators of white perch.

Introduction

Though nonnative to Nebraska, the Nebraska Game and Parks Commission (NGPC) stocked white perch, *Morone americana* (Gmelin), in several Nebraska Sandhills' lakes in 1964 (Hergenrader and Bliss 1971). The NGPC thought that this species might flourish in the highly alkaline Sandhills' lakes (McCarraher 1971). However, white perch were also inadvertently stocked into Wagon Train Reservoir in southeastern Nebraska in 1964 with largemouth bass (*Micropterus salmoides*) fry (Hergenrader and Bliss 1971). This species then spread to Salt Creek, the Platte River and the Missouri River (Bliss and Schainost 1974). White perch have established self-sustaining populations in Branched Oak and Pawnee reservoirs.

In freshwater systems, white perch tend to overpopulate and stunt (Scott and Crossman 1973). The current Branched Oak Lake white perch population is stunted (i.e., high density of slow growing individuals with a reduced size at maturity and reduced maximum size), whereas the Pawnee population is not stunted. An ability to reproduce during their first year of life and withstand a wide range of environmental conditions allows quick establishment of this species and potential domination of fish communities (Ballinger and Peters 1978; Hodkin 2001). For example, white perch will consume fish eggs of other species, such as walleye (*Sander vitreus*) and white bass (*Morone chrysops*), which could negatively affect recruitment (e.g., result in missing or weak year classes) of these species (Schaeffer and Margraf 1987; Hodkin 2001). Furthermore, white perch may also negatively affect fishes that feed on invertebrates (e.g., bluegill and crappie) through competition for food (Ballinger and Peters 1978). Mansueti (1961) suggested that white perch have the potential to reduce the abundance of invertebrates and alter the composition of the invertebrate community. This effect on the invertebrate community could also affect piscivorous fishes that rely on invertebrates during early life history (e.g., walleye). In Branched Oak Lake, walleye have not had a strong year class since 1992, despite annual stockings of fingerlings by NGPC (Jackson 1999). Similarly, white perch may have caused the decline in walleye abundance in the Bay of Quinte (Hurley and Christie 1977).

Declining sportfish populations in Branched Oak and Pawnee reservoirs have lead to drastic suggestions such as complete and partial chemical renovations to control or eradicate white perch populations (Vrtiska et al. 2001). However, chemical renovation is expensive, difficult to successfully complete and frequently has social and political ramifications. All alternatives to chemical renovation should be investigated before taking such extreme measures. Therefore, the primary purpose of this study is to document food habits of potential white perch predators in Branched Oak and Pawnee

reservoirs to investigate predation as a potential mechanism for biological control of white perch.

Methods

Food habits of potential white perch predators (largemouth bass, white crappie, black crappie, channel catfish, flathead catfish, hybrid striped bass, white bass, sauger and walleye) and white perch are being investigated during the ice-free period (approximately March through November) of 2007 in Branched Oak and Pawnee reservoirs. Fishes were captured with a boat-mounted electrofisher (pulsed DC). Each reservoir was sampled weekly from one hour before to two hours after sunrise and from sunset to three hours after sunset. Target sample size was up to 25 stock-length (Gabelhouse 1984; Quinn 1991). Captured individuals were weighed to the nearest 1 g and measured (standard and total length) to the nearest 1 mm.

Stomach contents of captured stock-length predator fishes were removed using non-lethal pulsed gastric lavage (Light et al. 1983). After the stomach was flushed with water, an appropriately-sized clear plastic tube was inserted into the digestive tract and used as a gastroscope to ensure that all stomach contents had been removed. Stomach contents were preserved in a 10% buffered-formalin solution. Fish were released after stomach contents are removed.

In the laboratory, all stomach contents were identified to the lowest desired taxon using dichotomous keys provided by Thorp and Covich (1991) and grouped by taxa. Stomach contents were measured volumetrically using water displacement in graduated cylinders. Prey fishes removed from stomachs were measured for standard length (mm) and body depth (mm) when possible. We used foraging success (FS) to quantitatively describe fish diets. The FS is the volume of a particular prey item (ml) divided by the predator's mass (kg). Minimum sample size for FS assessment was 10 individuals of a particular species containing at least one item in their stomach. A Kruskal-Wallis non-parametric ANOVA was used to detect significant differences among predators and Dunn's multiple comparison procedure was used for all pairwise comparisons. A Kolmogorov-Smirnov test was used to detect differences between foraging success distributions on white perch and gizzard shad for each predator in Branched Oak Lake.

Results

During 2006, foraging success was different for predators in both Branched Oak and Pawnee reservoirs (Figure 1). In Branched Oak Lake, largemouth bass foraging success on white perch was greater than all other predators (Table 1). Similarly, walleye foraging success on white perch was greater than all other predators, except largemouth bass and flathead catfish (Table 1). In Pawnee Lake, walleye foraging success on white perch was greater than all other predators, except sauger (Table 2). Similarly, largemouth bass and sauger foraging successes were greater than all other predators, except walleye (Table 2). Thus, largemouth bass and *Sander* species were the most efficient white perch predators on a per-kg basis in Branched Oak and Pawnee reservoirs during 2006.

During 2007, foraging success was significantly different for predators in both Branched Oak and Pawnee reservoirs (Figure 2). In Branched Oak Lake, walleye foraging success on white perch was significantly greater (~ three times) than any other predator (Table 3). Flathead catfish foraging success was significantly lesser than any other predator (Table 3). In Pawnee Lake, walleye and sauger foraging success on white perch was significantly greater than all other predators (Table 4). Similar to Branched Oak Lake, flathead catfish foraging success on white perch was the least for all predators, although not statistically lesser than white bass (Table 4). Thus, *Sander* species were the most efficient white perch predators on a per-kg basis in Branched Oak and Pawnee reservoirs during 2007.

In Branched Oak Lake, foraging success cumulative frequency distributions on white perch compared to gizzard shad were different for largemouth bass, white crappie, flathead catfish, hybrid striped bass and walleye, but not for black crappie and channel catfish (Figure 3). Largemouth bass, flathead catfish, and walleye had more individuals with relatively high foraging success values on white perch than gizzard shad. Conversely, white crappie and hybrid striped bass had more individuals with relatively high foraging success values on gizzard shad than white perch. Thus, largemouth bass, flathead catfish and walleye consumed greater amounts of white perch than gizzard shad on a per-kg basis.

Deviations from Proposal

No significant deviation occurred from the proposal during 2007.

Program Plan

N.J.C. Gosch successfully defended his thesis (attached) for this project on May 15, 2008 and graduated on August 16, 2008. Results of this project were presented at several professional conferences including the Midwest Fish and Wildlife Conference, Nebraska Chapter of the American Fisheries Society Annual Meeting and the Midwest American Fisheries Society Student Colloquium. The final stage of this project is the publication of research findings in peer-reviewed journals. We submitted one manuscript for publication to Fisheries Management and Ecology and plan to submit three to four additional manuscripts to journals such as Ecology of Freshwater Fish, Great Plains Research and North American Journal of Fisheries Management. All peer-reviewed publications resulting from this research project will be submitted to the Nebraska Game and Parks Commission upon completion.

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	LMB	WHC	BLC	CHC	FHC	HSB	WAE
LMB							
WHC	*						
BLC	*	—					
CHC	*	—	*				
FHC	*	*	*	*			
HSB	*	*	—	*	*		
WAE	*	*	*	*	—	*	

Table 2. Pairwise comparisons for foraging success on white perch between predators (LMB = largemouth bass, CHC = channel catfish, FHC = flathead catfish, WHB = white bass, SAU = sauger, WAE = walleye) using Dunn's multiple comparison procedure in Pawnee Lake, Nebraska during 2006. An "*" indicates statistically significant comparisons ($\alpha = 0.05$) and "—" indicates non-significant comparisons.

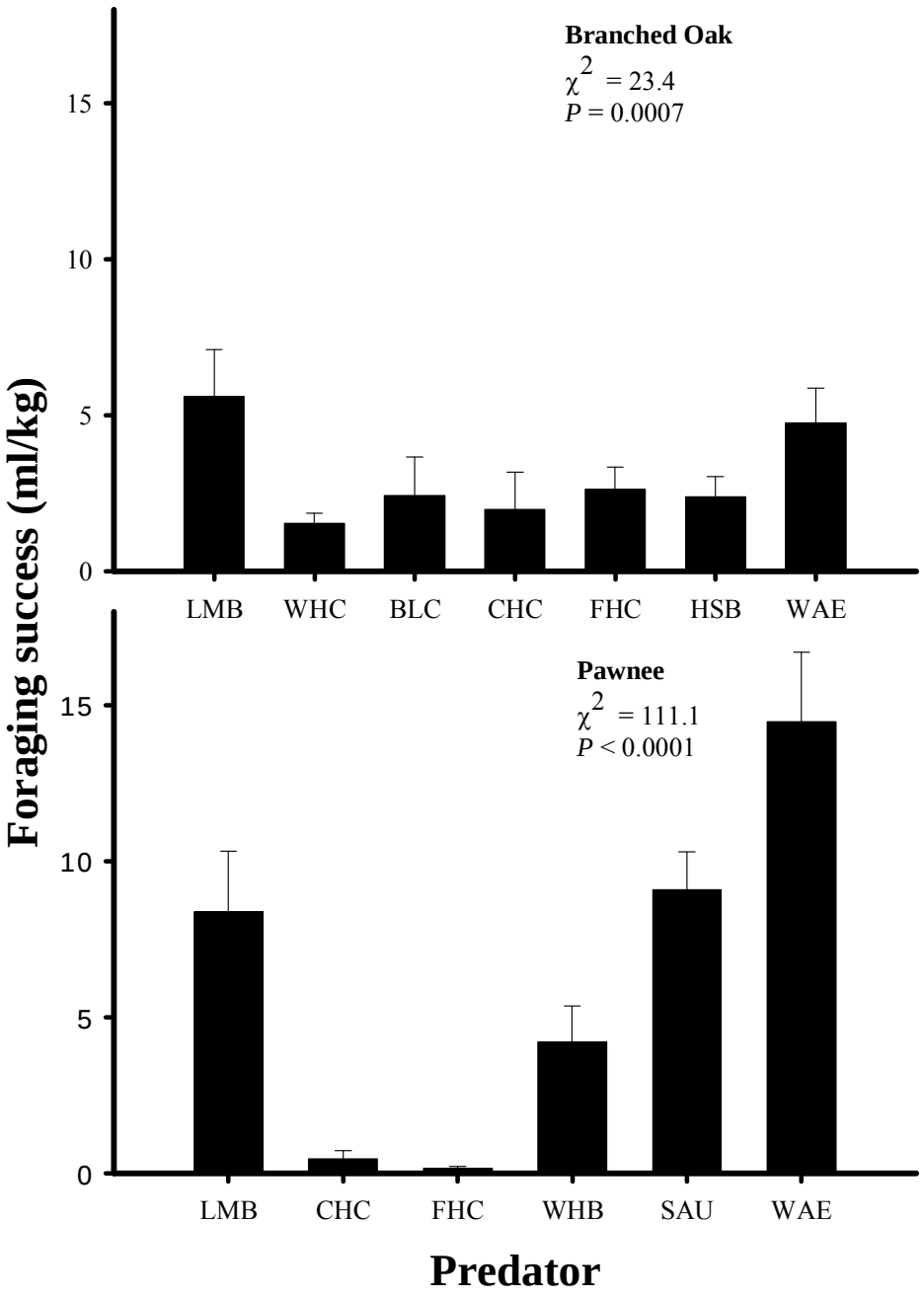
	LMB	CHC	FHC	WHB	SAU	WAE
LMB						
CHC	*					
FHC	*	*				
WHB	*	*	*			
SAU	*	*	*	*		
WAE	*	*	*	*	—	

Table 3: Pairwise comparisons for predator foraging success between species using Dunn's multiple comparison procedure in Branched Oak Lake, Nebraska during 2007. * indicates statistically significant comparisons ($\alpha = 0.05$) and — indicates non-significant comparisons (WHC = white crappie, FHC = flathead catfish, HSB = hybrid striped bass bass, WAE = walleye).

	WHC	FHC	HSB	WAE
WHC				
FHC	*			
HSB	*	*		
WAE	*	*	*	

Table 4: Pairwise comparisons for predator foraging success between species using Dunn's multiple comparison procedure in Pawnee Lake, Nebraska during 2007. * indicates statistically significant comparisons ($\alpha = 0.05$) and — indicates non-significant comparisons (FHC = flathead catfish, WHB = white bass, SAU = sauger, WAE = walleye).

	FHC	WHB	SAU	WAE
FHC				
WHB	—			
SAU	*	*		
WAE	*	*	—	



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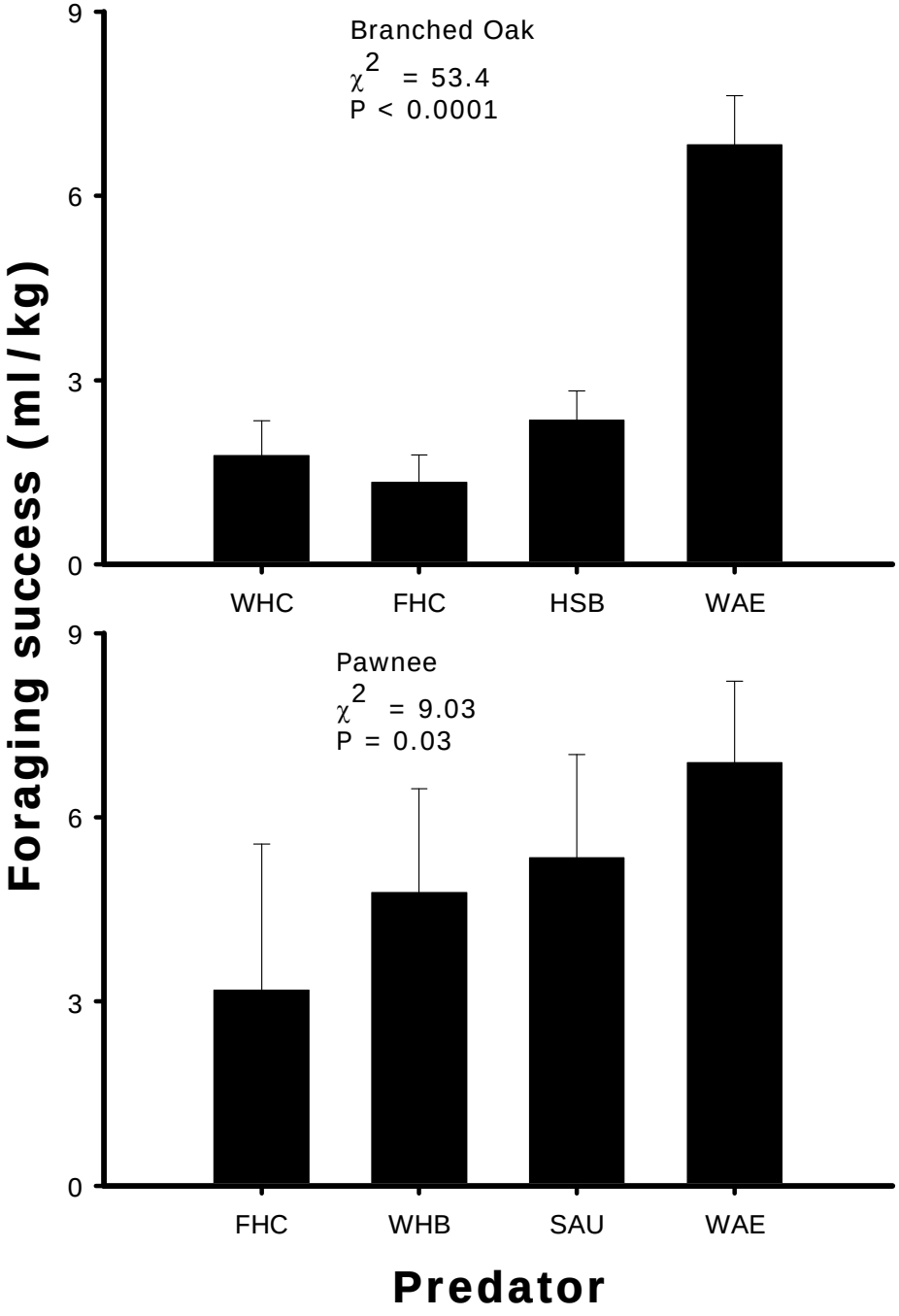

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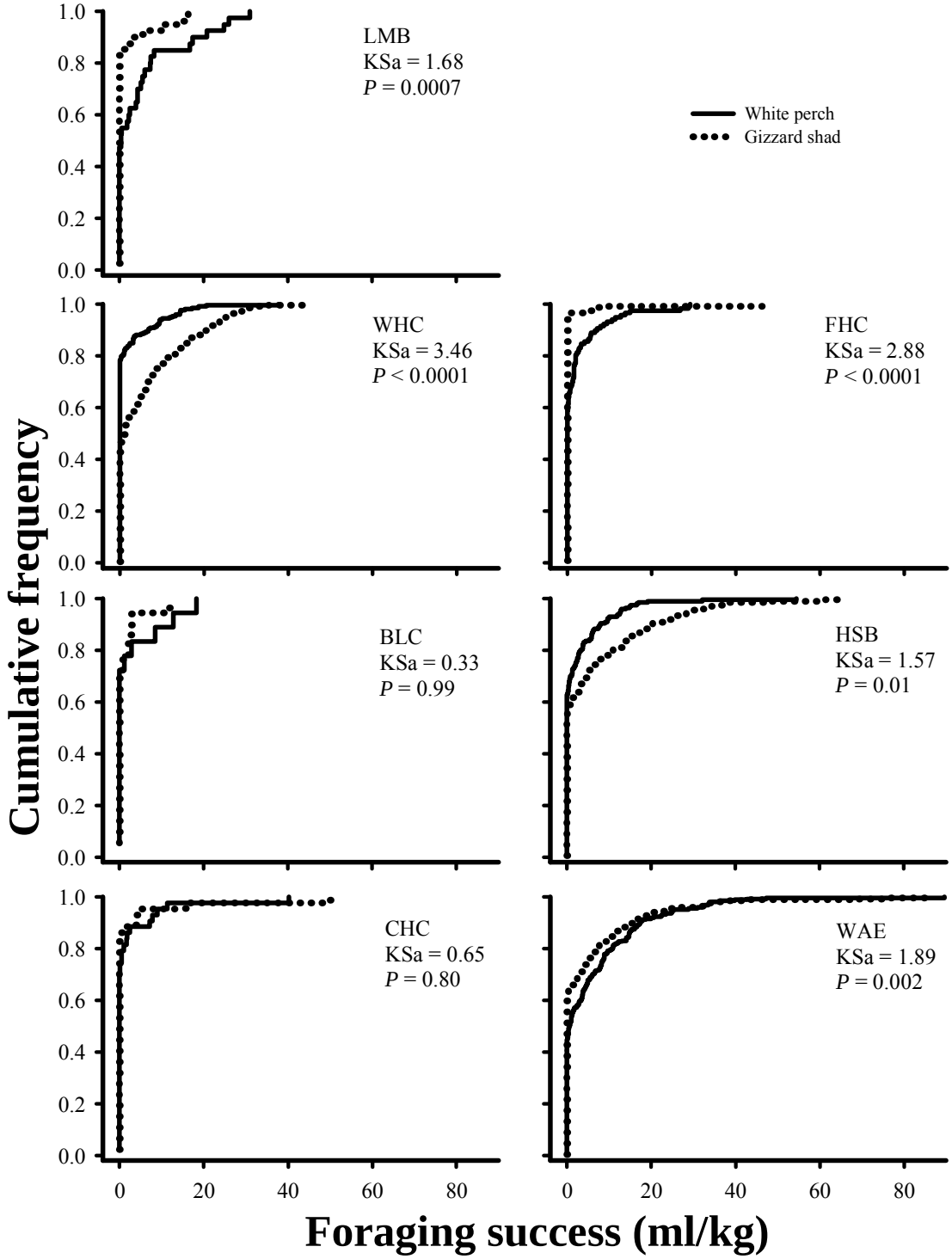

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