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FINAL REPORT

FEDERAL AID GRANT NO. F-50-R-17
Fish Research for Oklahoma Waters

PROJECT NO. 28
Arkansas River Striped Bass Fishery Assessment

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

JANUARY 1, 2010 through DECEMBER 31, 2010

FINAL REPORT

State: Oklahoma Grant Number: F-50-R-17

Grant Title: Fish Research and Surveys for Oklahoma Lakes and Reservoirs

Project Number: 28

Project Title: Arkansas River Striped Bass Fishery Assessment.

Project Leader: Greg Summers

Contract Period: From: January 1, 2010 To: December 31, 2010

Project Objectives: 1.) To determine the size (total length) and age structure of the Arkansas River striped bass population at five points along the river system: Kaw Dam, Keystone Dam and Zink Dam, the lower Illinois River below Lake Tenkiller, and the Eufaula tailwaters below Eufaula Lake. 2.) To determine the size and number of striped bass harvested by anglers per trip in the five focus areas of the fishery.3). To use PIT tags to determine the interconnectivity of the Arkansas River striped bass population at five points along the river system: Kaw Dam, Keystone Dam and Zink Dam, the lower Illinois River below Lake Tenkiller, and the Eufaula tailwaters below Eufaula Lake

I. **Segment Objectives**: 2.) To use Passive Integrated Transponder (PIT) tags to determine the interconnectivity of the Arkansas River striped bass population at five points along the river system: Kaw Dam, Keystone Dam and Zink Dam, the lower Illinois River below Lake Tenkiller, and the Eufaula tailwaters below Eufaula Lake. 3.) To determine the size and number of striped bass harvested by anglers per trip in the five focus areas of the fishery.

II. Summary of Progress

A. Introduction

The Arkansas River system in Oklahoma supports one of the few inland populations of naturally reproducing striped bass (*Morone saxatilis*) in the southeastern United States (Dudley et al, 1977; Combs, 1980). Natural reproduction of striped bass occurs in several areas of the Arkansas River between Kay and Sequoyah Counties. Bohnsack (1990) and Shutters (1992) verified spawning sites above Keystone Reservoir, while other spawning locations are known immediately below Keystone dam and further downstream at Zink

dam (Brent Gordon, Oklahoma Department of Wildlife Conservation, personal communication). Oklahoma Department of Wildlife Conservation (ODWC) staff collected striped bass broodstock from the river to produce striped bass and hybrid striped bass for ODWC stocking programs throughout the state.

Recent proposals by Tulsa County, OK and legislative entities may threaten the striped bass fishery in the Arkansas River. The proposed Arkansas River Corridor (part of Tulsa County's Vision 2025 Plan) incorporates the establishment of numerous low-water dams throughout Tulsa County on a stretch of river from Keystone Dam to the Tulsa/Wagoner County line (68 km) for enhancing aesthetic quality and development opportunities. The proposed series of low-water dams along the Arkansas River in Tulsa County may impact movements and reproductive success of resident striped bass. Arkansas River striped bass implanted with ultrasonic transmitter tags below Keystone dam in 2006 and 2007 were observed to record any movements. Individual fish movements varied between movements of a large distance and remaining in or near the tagging locations for the duration of the transmitter life (Kuklinski and Groom, 2009). Other studies of striped bass in southeastern river systems have reported movement and migration patterns based on water temperature, flow regime, and spawning (Dudley et al, 1977; Combs, 1980; Moss, 1985; Bjorgo et al, 2000). For striped bass to successfully reproduce, a long reach of free-flowing river is needed for proper development of eggs and hatching of fry (Davin, 1999). The proposed impounding structures have the potential to negatively impact striped bass reproduction by impeding the long reaches of flow necessary for developing eggs to properly mature and hatch.

Anglers and angling groups have recently begun to voice concerns about the Arkansas River striped bass fishery. The Oklahoma Striped Bass Association (OSBA) angling group has submitted a formal petition to ODWC asking for striped bass regulation changes and a better understanding of the fishery to prevent over harvest of large individuals from the system. There is a perception among some anglers of this fishery that the Arkansas River has the potential to support "trophy" regulations, or restrictive harvest of large striped bass. ODWC data from this system is currently lacking. Intense sampling of this fishery will provide ODWC the data needed to make management and regulatory decisions, assess the size and age structure, and help determine if the proposed dams will have negative impacts.

A fish marking technique utilizing Passive Integrated Transponder (PIT) tags consists of inserting a small encapsulated wire-wrapped antenna bound to an integrated circuit chip into target fish (Prentice et al 1990). The tag-implanted fish can then be recorded in future sampling by use of hand-held or remotely operated transmission antenna systems which emit an AC 400kHz frequency to excite the inert tag upon contact with the transmission antenna's magnetic field (Prentice et al 1990). The use of PIT tags would allow individual fish to be identified upon initial collection and again at any subsequent collection by study personnel.

B. Methods

Size and Age Structure

Striped bass were collected using boat-mounted electrofishing gear and angling at five target locations between 24 March and 14 September, 2009 (Figure 1). Each fish was measured for total length (mm) and weighed to the nearest 5-gram increment in the field. Specimens were then placed on ice and taken to the laboratory for further processing. Saggital otoliths were removed from all fish and each individual was dissected in order to use reproductive organs to verify the sex of each fish when possible. Otoliths were analyzed under a low power (2-3x magnification) microscope, and striped bass were aged based upon the number of annuli present on the otoliths.

PIT Tagging

ODWC personnel collected striped bass at all five points along the Arkansas River and tributaries using boat electrofishing. A minimum of eight hours of electrofishing was conducted at each of the five sites so long as weather and river flow did not prevent boat access. All striped bass collected were measured to the nearest millimeter, scanned for a PIT tag and if no tag was present, returned to the water with a PIT tag implanted in the left cheek musculature. PIT tags were implanted using a syringe with a 12 gauge needle and implantation was completed in a matter of seconds. All fish were held in a fresh-water flowing livewell for a maximum of 30 minutes prior to tagging.

Angler Interviews

ODWC personnel conducted interviews of striped bass anglers at each of the target locations where electrofishing sampling occurred (Figure 1). ODWC personnel identified themselves to anglers and asked anglers if they would be willing to participate in a short interview. Striped bass anglers were identified by asking if the angler(s) was fishing for striped bass. The angler(s) was included in the analysis if they answered yes to this question, or if they answered no but had a striped bass in possession. All data collected from the interviews are listed in Figure 3.

C. Results

Size and Age Structure

Combined electrofishing and rod and reel collection results by location were: Kaw tailwaters, 74 fish in seven sampling trips; Keystone tailwaters, 87 fish in nine sampling trips; Zink Dam tailwaters, 90 fish in three sampling trips; Eufaula tailwaters, 109 fish in 10 sampling trips; and Lower Illinois River, 245 fish provided by commercial guides throughout the sampling period. A total among all locations of 605 striped bass were included in the analysis.

Mean length at age was calculated by location for all samples (Table 1). Few individuals

less than age-3 were collected with the exception of the Eufaula tailwaters location (N=20, Table 1). Kaw tailwaters and Keystone tailwaters samples revealed a weak age-6 year class, however just downstream at the Zink Dam tailwaters a strong age-6 year class was present (Table 1). The majority of fish present among all locations were ages 4 and 5 (Table 1). Older striped bass were collected at several locations, the oldest fish from the Kaw tailwaters (985mm, age-13).

The growth curves among locations were similar with Eufaula tailwaters striped bass having the highest mean length at age, and Lower Illinois River striped bass having the lowest mean length at age (Figure 2.) Catch curves were calculated using the Fisheries Analysis and Simulation Tools (FAST©, Auburn University, 2000), and the estimated average annual mortality among all locations was 0.349.

PIT Tagging

A total of 339 striped bass ranging in length from 413 mm to 1181 mm (mean = 736.6 mm, SE = 7.2768) were implanted with PIT tags in 2010, of which ten individuals were recaptured. The lower Illinois River had the largest mean length of tagged (768.9 mm) while Keystone fish were the smallest tagged (mean = 663.2 mm, Table 3). To compare differences in mean lengths of tagged striped bass between tagging sites, data were tested using a nonparametric Kruskal-Wallis one way analysis of variance. Kaw tailwaters tagged striped bass were the least different form the other locations, while Keystone tailwaters tagged fish were only similar to fish from Zink. Stripers from the Lower Illinois River were only similar to Kaw fish (Table 3).

Of the ten recaptured striped bass, nine were recaptured in the same location as the initial tagging. One fish was implanted with a PIT tag below Eufaula Dam on April 9, 2010 and recaptured in the Lower Illinois River on July 22, 2010. This individual traveled at least 68 km from the tagging site within roughly 100 days, growing 15 mm in length. Mean recaptured striped bass growth was 0.278 mm per day or about 8.33 mm per month.

Angler Interviews

ODWC personnel conducted 141 angler interviews at four locations between 23 February and 17 August, 2009. No interviews were completed from the Zink Dam location. It should be noted that only anglers targeting striped bass or anglers with a striped bass in possession were included in interviews.

Striped bass anglers averaged 2.46 individuals/party, among all locations (N=347). These anglers harvested 493 striped bass (1.42 fish per angler per trip). Interviews revealed a striped bass release rate of 31% (222 of 715 fish caught). Of the 141 interviews, 43 (30%) noted that no striped bass were harvested and 98 (70%) harvested at least one fish.

The mean length of striped bass harvested by anglers among all locations was 624.4mm (24.6 inches, Table 2). Kaw tailwaters anglers harvested the largest fish ($\bar{x}$ =643.1mm,

25.3 inches), and Eufaula tailwaters anglers harvested the smallest ($\bar{x}$ =553.7mm, 21.8 inches) (Table 2).

The current harvest regulations for all locations allow the harvest of 15 striped bass per angler per day, with only five of those fish over 20 inches in length. The interview data showed that 70 of 493 (14%) striped bass harvested were less than 20 inches in length, and 58 of 493 (12%) fish were greater than 30 inches in length. The majority (365 of 493, 74%) of striped bass harvested by anglers were between 20 and 30 inches in length.

D. Conclusions/Recommendations

- Arkansas River system striped bass were fast-growing compared to ODWC age and growth data from Oklahoma reservoirs.
- A majority (74%) of fish seen in Arkansas River angler interviews were between 20 and 30 inches total length. This indicates that they are targeting larger fish, or that smaller striped bass are not as abundant.
- Based on the angler interview data in conjunction with size and age structure data, creel and length limit regulation changes may be needed on the Arkansas River system (five fish daily creel limit with a restriction of only one fish over 762 mm). However a better idea of exploitation is needed.
- Ongoing implantation of Arkansas River system striped bass with PIT tags to determine exploitation and the connectivity of the fishery is recommended.
- Ongoing angler interviews are recommended.

III. Significant Deviations: None

Prepared by: _____
Greg Summers

Date: 30 MAR 11

Approved by: _____

Fisheries Administration
Oklahoma Department of Wildlife Conservation

_____
John Stafford
Federal Aid Coordinator
Oklahoma Department of Wildlife Conservation

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Table 1. Mean length (mm) and sample size (N) of striped bass by age class for individuals collected at five points along the Arkansas River system, OK in 2009. Striped bass older than age-7 were not included because of low sample size.

Location	**Age-2**	**Age-3**	**Age-4**	**Age-5**	**Age-6**	**Age-7**
Kaw Tailwaters	**--- (0)**	**389.0 (1)**	**599.9 (32)**	**711.0 (30)**	**--- (0)**	**767.5 (6)**
Keystone Tailwaters	**--- (0)**	**563.4 (9)**	**596.5 (55)**	**658.4 (18)**	**685.0 (1)**	**792.3 (3)**

Zink Dam Tailwaters	**--- (0)**	**540.0 (4)**	**614.9 (15)**	**702.1 (23)**	**764.0 (26)**	**810.5 (16)**
Eufaula Tailwaters	**391.0 (20)**	**521.0 (41)**	**675.8 (11)**	**736.7 (7)**	**809.3 (3)**	**--- (0)**
Lower Illinois R.	**320.0 (1)**	**515.6 (27)**	**573.3 (108)**	**680.4 (73)**	**706.2 (16)**	**758.1 (11)**

Table 2. Striped bass angler harvest statistics from four interview locations along the Arkansas River system, OK in 2009.

Location	Mean Length (mm) of Harvested Fish	Number of Fish Harvested	Number of Fish Released
Kaw Tailwaters	643.1	207	22
Keystone Tailwaters	594.4	62	14
Eufaula Tailwaters	553.7	23	7

Lower Illinois River	622.3	201	179
All Locations Combined	624.4	493	222

Table 3. Descriptive statistics for striped bass implanted with PIT tags from five locations along the Arkansas River system, OK in 2010. Different superscript letters signify significant difference (α=0.05) between means using Kruskal-Wallis one way analysis of variance.

Location	Mean Length (mm)	Number of Fish	Standard Error
Kaw Tailwaters	731.5^{A}	33	17.671
Keystone Tailwaters	663.2^{B}	33	7.774
Zink Tailwaters	676.6^{BC}	19	14.391

Eufaula Tailwaters	726.6[AC]	103	15.533
Lower Illinois River	768.9[AD]	151	10.890
All Locations Combined	736.6	339	7.277

Figure 1. Arkansas River system striped bass sample sites for 2009.

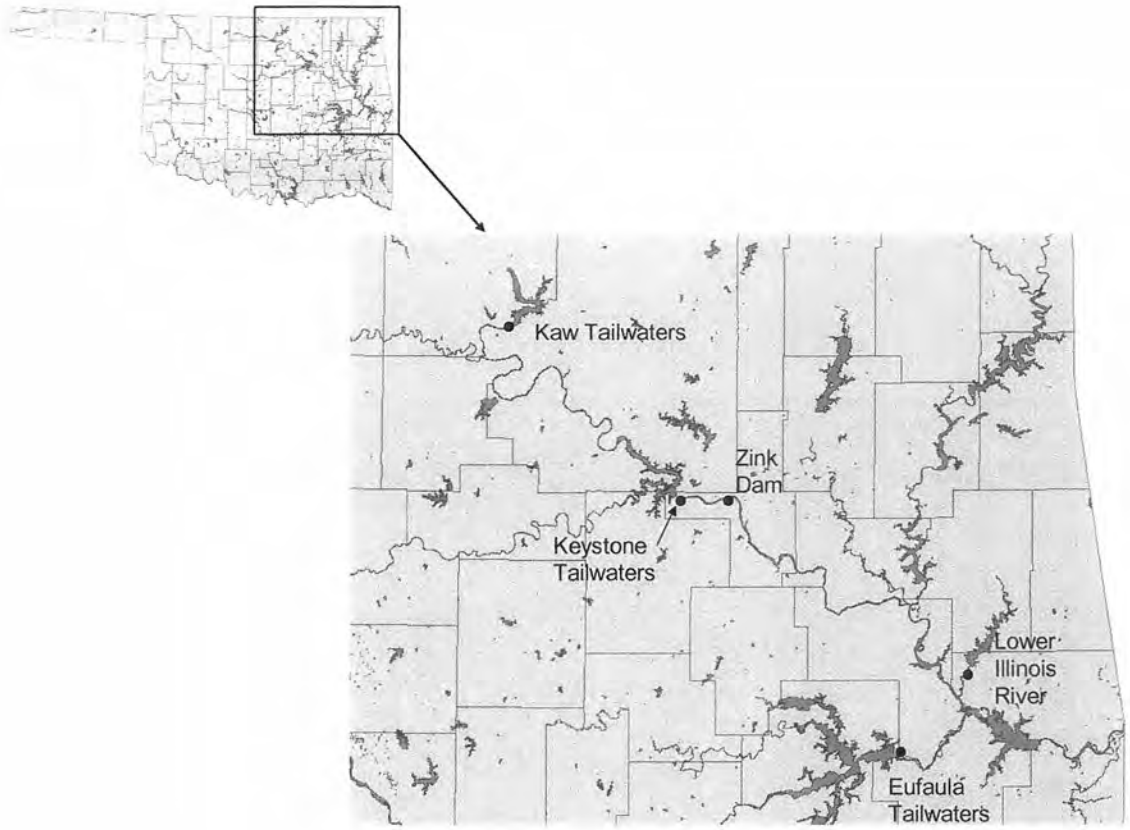

Figure 2. Mean length (mm) at age for Arkansas River system striped bass collected in 2009. Annual mortality estimates were calculated with FAST© software.

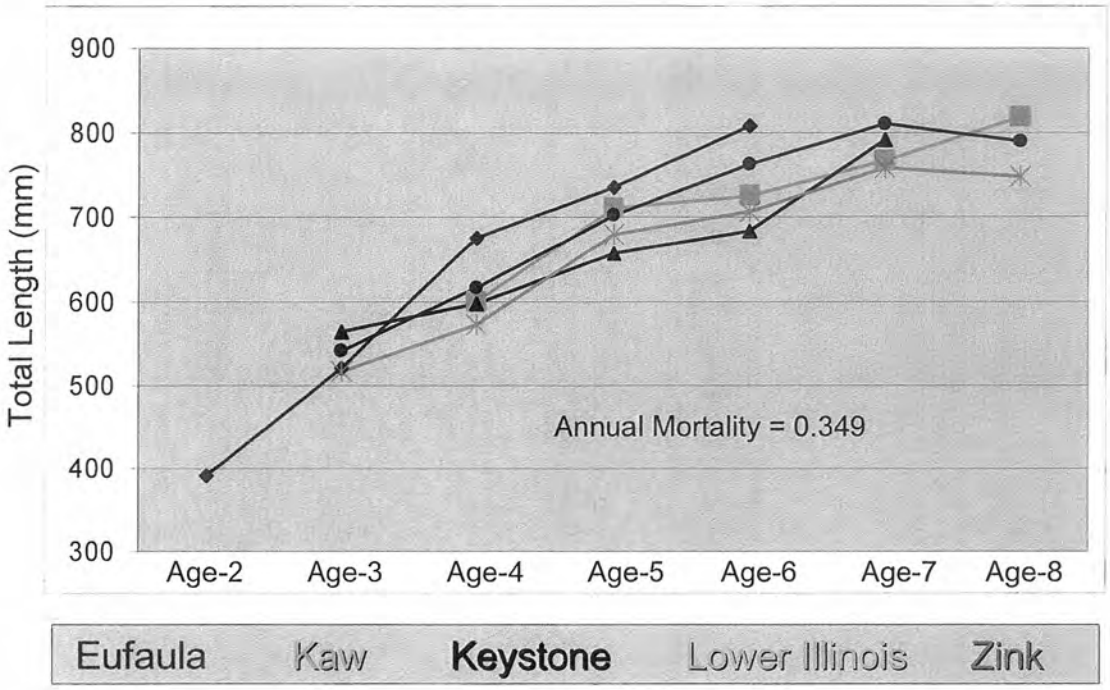

Figure 3. Creel interview data sheets used when interviewing striped bass anglers on the Arkansas River system in 2009.

STRIPED BASS CREEL INTERVIEW

DATE _____ LOCATION: Kaw__ Keystone__ Zink__ Eufaula__ Illinois__

ODWC Employee (names) _____

TARGETING STRIPED BASS YES____ NO____ ANGLER ZIP CODE(S)_____

NO. ANGLERS IN PARTY _____ BOAT _____ BANK _____

COMPLETED TRIP YES____ NO ____ NO. STRIPERS RELEASED_____

Striped Bass #	Length	Striped Bass #	Length	Striped Bass #	Length
1		15		29	
2		16		30	
3		17		31	
4		18		32	
5		19		33	
6		20		34	
7		21		35	
8		22		36	
9		23		37	
10		24		38	
11		25		39	
12		26		40	
13		27		41	
14		28		42	

One data sheet/party (unless caught more than 42 fish); One fish/number; Measure fish to nearest inch (total length-tip of nose to end of tail with forks squeezed together)

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