

# 2010 Annual Report

## Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 11



Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program

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## EXECUTIVE SUMMARY

The Missouri Department of Conservation completed its fifth year of the Pallid Sturgeon Population Assessment Program at the end of the 2010 sampling season. All standard sampling was successfully completed in the required bends for otter trawls and trammel nets ( $N = 7$  bends), but sustained low water levels above the Johnson County Weir prevented us from completing standard sampling with gill nets in one bend and trotlines in two bends during the 2010 sturgeon and fish community seasons.

Seven hatchery-stocked pallid sturgeon were captured in segment 11 during the 2010 sampling season. We have captured a total of twelve hatchery-stocked pallid sturgeon in the Kansas River since 2007 (four were captured in 2009 and one was captured in 2007). These are the first recorded captures of pallid sturgeon in the Kansas River since 1952 (Horner et al. 2010; Niswonger et al. 2008; The University of Kansas Natural History Museum). The pallid sturgeon captured in 2010 ranged in length from 568 to 796 mm. These fish were all captured below the Johnson County Weir, from river miles 13.6 to 14.7. The pallid sturgeon that was 796 mm was captured directly below the Johnson County Weir (Weir) and was void of any previous markings for identification. This pallid sturgeon was a potential broodfish until genetic analyses identified it as hatchery origin. The seven pallid sturgeon captured during the 2010 sampling season were from 2002 and 2003 year classes. The average stocking length of the 2002 year class fish was 284 mm and the 2003 year class fish was 232 mm. The average recapture lengths of the 2002 and 2003 year class fish were 669 and 688 mm, respectively. The 2002 and 2003 year class fish had statistically similar average condition factors ( $0.795 \pm 0.081$  (2SE) and  $0.809 \pm 0.099$  (2SE), respectively) at the time of capture.

In standard random sampling, 983 shovelnose sturgeon (fork length 25 – 728 mm) were captured in segment 11 in gill nets ( $N = 442$ ), trotlines ( $N = 413$ ), one inch trammel nets ( $N = 35$ ), and otter trawls ( $N = 93$ ). More shovelnose sturgeon were captured below the Weir using all gears. Twenty three young-of-year sturgeon ( $< 170$  mm) have been captured in the Kansas River since sampling began. These range in size from 22 – 169 mm, and all but five have been captured above the Weir. Though some of these fish are too small to determine species by external characteristics alone, they are most likely shovelnose sturgeon due to the higher number of shovelnose sturgeon compared to pallid sturgeon in the Kansas River.

Shoal chub (N = 6) and sicklefin chub (N=1) were the only *Macrhybopsis* spp. captured in segment 11. Overall CPUE for shoal chub showed a decrease for the first time in three years. Sicklefin chub were captured for only the third season in 2010 in the Kansas River. Sicklefin chub had similar CPUE's in all three years with 0.023 fish/ 100 m trawling in 2006, 0.016 fish/ 100 m trawling in 2008, and 0.012 fish/ 100 m trawling in 2010. No sturgeon chub have been captured in segment 11. Sand shiner CPUE in mini-fyke nets has been decreasing every year since 2006. Four *Hybognathus* spp. were captured in 2010 and consisted of 3 plains minnows and 1 western silvery minnow. Catches of *Hybognathus* spp. in 2007 and 2008 were comprised of plains minnows, while brassy minnows were sampled in 2009. Standard gears captured 22 blue sucker in segment 11. Most blue sucker in 2010 were sampled above the Weir. Sauger were captured in gill nets (N = 2) and mini-fyke nets (N = 1) and ranged in size from 232 to 477 mm.

Overall, 4,173 fish representing 56 species were captured with all standard gear deployments in segment 11 during the 2010 sampling season. This is more fish than was captured in 2006, 2007 or 2008 (N = 2,000, 3,254 and 3,944, respectively), but fewer fish than was captured in 2009 (N = 5,023). Higher fish catches in 2009 and 2010 were primarily due to the initiation of standard gear deployments in the unchannelized section above the Johnson County Weir (river mile 21.1 – 52.1), which occurred in 2009.

# TABLE OF CONTENTS

Introduction .....	1
Study Area .....	4
Methods .....	6
Sample site selection and description .....	8
Sampling gear .....	10
Data Collection and Analysis .....	12
Results	
Effort .....	16
Pallid sturgeon .....	18
Shovelnose X Pallid Sturgeon Hybrids .....	36
Targeted Native River Species	
Shovelnose sturgeon .....	37
Sturgeon chub .....	51
Sicklefin chub .....	52
Shoal chub .....	55
Sand shiner .....	58
<i>Hybognathus</i> spp .....	61
Blue sucker .....	64
Sauger .....	70
Kansas River Fish Community .....	76
Discussion .....	78
Acknowledgments .....	81
References .....	82
Appendices .....	86

## LIST OF TABLES

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 11, the Kansas River, during the sturgeon season and fish community season in 2010. N-E indicates the habitat is non-existent in the segment.

.....17

### **Pallid sturgeon**

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2010. Means (minimum and maximum) are presented. ....20

Table 3. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2010 from Segment 11, the Kansas River. Relative condition factor was calculated using the equation in Shuman et al. (2011). ....24

Table 4. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....29

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....30

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....31

Table 7. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....32

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....33

### **Shovelnose sturgeon**

Table 9. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....43

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....44

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....45

Table 12. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....46

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. ....47

**Blue sucker**

Table 14. Total number of blue sucker captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. .  
.....68

**Sauger**

Table 15. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010.  
.....74

## LIST OF FIGURES

Figure 1. Map of Segment 11, the Kansas River, with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from the mouth (River Mile 0.0) to the Bowersock Dam (River Mile 52.1). .....15

### **Pallid sturgeon**

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 11, the Kansas River, during 2010. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples. ....19

Figure 3. Incremental relative stock density (RSD) for all pallid sturgeon captured with all gear by length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006). ....25

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).  
.....26

Figure 5. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic verification. ....28

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using one inch trammel nets in Segment 11, the Kansas River, from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic verification. ....OMITTED

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 11, the Kansas River, from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic verification. ....OMITTED

Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. Pallid sturgeon of unknown origin are awaiting genetic verification. ....34

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 11, the Kansas River,

from 2006-2010. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples. ....35

**Shovelnose sturgeon**

Figure 10. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2010. ....39

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using one inch trammel nets in Segment 11, the Kansas River, from 2006-2010. ....40

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....41

Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....48

Figure 14. Incremental relative stock density (RSD) for all shovelnose sturgeon captured with all gear by length category from 2006 to 2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998). ....49

Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998). ....50

**Sturgeon chub**

Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....OMITTED

Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....OMITTED

**Sicklefin chub**

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....52

Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....53

**Shoal chub**

Figure 20. Mean annual catch per unit effort (+/- 2 SE) of shoal chub using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....55

Figure 21. Length frequency of shoal chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....56

**Sand shiner**

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2010. ....59

Figure 23. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....60

***Hybognathus* spp.**

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2010. ....62

Figure 25. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 1, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....63

**Blue sucker**

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of blue suckers using gill nets in Segment 11, the Kansas River, from 2006-2010. ....65

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using one inch trammel nets in Segment 11, the Kansas River, from 2006-2010. ....66

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....67

Figure 29. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....69

**Sauger**

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sauger using gill nets and in Segment 11, the Kansas River, from 2006-2010. ....71

Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sauger using one inch trammel nets in Segment 11, the Kansas River, from 2006-2010. ....72

Figure 32. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 11, the Kansas River, from 2006-2010. ....73

Figure 33. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. ....75

## LIST OF APPENDICES

Appendix A. Phylogenetic list of Missouri River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. ....	86
Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long term pallid sturgeon and associated fish community sampling program. ....	92
Appendix C. List of standard and wild gears, their corresponding codes in the database, seasons deployed, years used, and catch-per-unit-effort units for collection of Missouri River fishes for the long-term pallid sturgeon and associated fish community sampling program. ....	93
Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area in the Missouri River Basin. ....	94
Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 11, the Kansas River (RPMA 4). ....	95
Appendix F. Total catch, overall mean catch per unit effort, and mean CPUE by mesohabitat within a macrohabitat for all species caught during sturgeon season and fish community season combined in Segment 11, the Kansas River, during 2010. ....	96
Appendix F1. Gill Net: .....	97
Appendix F2. 1.0” Trammel Net: .....	98
Appendix F3. Otter Trawl: .....	99
Appendix F4. Mini-fyke Net: .....	101
Appendix F5. Trotline: .....	104
Appendix G. Hatchery names, locations, and abbreviations. ....	105
Appendix H. Alphabetic list of Missouri River fishes with total number caught by gear type for the sturgeon season and the fish community season during 2010 for Segment 11, the Kansas River. ....	106
Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 11, the Kansas River, comparing bend selection between years from 2006-2010. ....	109

## Introduction

Pallid sturgeon (*Scaphirhynchus albus*) are native throughout the Yellowstone River, Missouri River, middle and lower Mississippi River, and the Atchafalaya River. Population levels of this species have declined over the past century; these declines have been attributed to anthropogenic influences including habitat loss, blocked migration routes, altered hydrograph, and water temperature regime (USFWS 1993). As a result, this species was listed under the Endangered Species Act in 1990. The USFWS issued The Pallid Sturgeon Recovery Plan in 1993, and drafted an updated version in 2009 (USFWS 1993 and 2009). The latter document identifies four priority pallid sturgeon management units. These management units are broken down into the Great Plains (GPMU; the Missouri River above Fort Peck Dam to Fort Randall Dam and a portion of the Yellowstone River), Central Lowlands (CLMU; Missouri River from Fort Randall Dam to the mouth of the Grand River), Interior Highlands (IHMU; the lower Missouri River and Middle Mississippi River to the mouth of the Ohio River) and the Coastal Plain (CPMU; the Mississippi River from the mouth of the Ohio River to the Gulf of Mexico, including a portion of the Atchafalaya River). Further, this document provides an outline that proposes to: 1) protect and restore pallid sturgeon populations, individuals, and their habitats; 2) conduct research on the genetic makeup and monitor pallid sturgeon populations; 3) develop and implement a pallid sturgeon captive propagation program, and; 4) coordinate and implement conservation and recovery of sturgeon species.

In 2000, the U. S. Fish and Wildlife Service (USFWS) issued the U. S. Army Corps of Engineers (USACE) the Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System (Bi-Op; USFWS 2000). This document recommended the flow regime of the Missouri River mimic a more natural hydrograph, an increase in propagation and population augmentation efforts, and the development of a pallid sturgeon population assessment program (PSPAP). As the federal agency responsible for water management in the Missouri and Kansas River systems, the USACE has an obligation under the Endangered Species Act to conserve the pallid sturgeon. To comply with the Bi-Op, the USACE has proposed to operate Gavins Point Dam in a manner to

create a more natural hydrograph, funded hatchery improvements and expansions, and facilitated the development of the Pallid Sturgeon Population Assessment Team (Team).

Implementation of the PSPAP began in 2001 when the USFWS-Columbia Fish and Wildlife Conservation Office (USFWS-Columbia) began sampling under PSPAP guidelines and Nebraska Game and Parks Commission (NGPC) conducted an evaluation of benthic trawls. The USACE hired a fishery biologist to coordinate the PSPAP in 2002 and the USFWS-Columbia and NGPC continued sampling in segments 9, 13, and 14 in the lower Missouri River. Standardized sampling above Gavins Point Dam (segments 5 and 6) occurred for the first time in 2003 by the USFWS-Great Plains Fish and Wildlife Management Assistance Office. During 2004, monitoring continued in segments 5, 6, 8, 9, 13, and 14 and an independent science review was conducted (SEI 2004) to determine the ability of the PSPAP to address its objectives. Beginning with the 2005 fish community season, the Team added the USFWS-Missouri River Fish and Wildlife Management Assistance Office (segment 4), the South Dakota Department of Game Fish and Parks (segment 7), and the Missouri Department of Conservation (segment 10) field crews that completed implementation of the PSPAP from segments 4 through 14. In 2006, the Team added the Montana Department of Fish, Wildlife, and Parks field crew and the Missouri Department of Conservation began sampling segment 11 (the Kansas River) to complete implementation of the PSPAP in segments 1 through 14.

The Pallid Sturgeon Recovery Plan lists propagation as an objective. Pallid sturgeon propagation began in 1992 when Blind Pony State Fish Hatchery in Missouri successfully spawned the first pallid sturgeon in captivity. The initial stocking of pallid sturgeon in 1994 consisted of about 6,500 two- year-old fish that were stocked into the CLMU and IHMU (Krentz et al. 2005). Subsequent stockings in 1997, 1998, and 2001 - 2010 have resulted in approximately 1,422,955 pallid sturgeon being stocked into the Missouri, Mississippi, and Yellowstone rivers (Wilson and Krentz 2010). Most pallid sturgeon were stocked as fingerlings (age-0), advanced fingerlings, and yearlings (age-1), though some fish ages two to five were released as well. Most (90%) pallid sturgeon have been stocked into the GPMU, while 8% have been stocked into the CLMU and IHMU (Wilson and Krentz 2010). The only pallid sturgeon stocking to occur in a tributary was in 1997 in the Platte River, Nebraska. There have been no stockings into the Kansas River thus far.

Since 1992, over 118,703 pallid sturgeon have been stocked into the CLMU and IHMU. Of that total, 10,922 were stocked into the area between Fort Randall Dam and the headwaters of Lewis and Clark Lake. The total number of pallid sturgeon stocked per year has ranged from about 4,000 (2006 year class) fish to over 40,000 (2004 year class) fish. Most of these fish were stocked as either yearlings or fingerlings. In 2008, pallid sturgeon spawned from broodstock captured in the CLMU were stocked back into the CLMU for the first time. Prior to this, fish stocked into the lower management unit originated from the GPMU. The only exception to this is the 1992 year class that came from the Middle Mississippi River which is part of the IHMU. In both 2009 and 2010 broodstock pallid sturgeon collected from the CLMU were spawned at Blind Pony State Fish Hatchery, Gavins Point National Fish Hatchery, and Neosho National Fish Hatchery and progeny were stocked back into the river, either as yearlings or fingerlings.

**The objectives of the PSPAP are as follows:**

- 1) Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
- 2) Document annual results and long term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
- 3) Document population structure and dynamics of pallid sturgeon in the Missouri River System.
- 4) Evaluate annual results and long term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
- 5) Document annual results and long term trends of habitat usage of the native target species by season and life stage.
- 6) Document annual results and long term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

## Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 through 4 lie in the GPMU and include the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 through 10 lie in CLMU and includes downstream of Fort Randall dam to the mouth of the Grand River. Segments 5 and 6 consist of 55 river miles from Fort Randall Dam, South Dakota downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only segment below Gavins Point Dam that is unchannelized. Segments 8 - 14 include the entire channelized portion (750 miles) of the Missouri River that extends from Lower Ponca Bend to the confluence with the Mississippi River. The lower Kansas River, from Lawrence, Kansas to the mouth (52 miles), was given its own segment designation (segment 11) because this tributary was addressed by the 2000 Bi-Op as a moderate priority management area for pallid sturgeon. Also, the USACE is responsible for water management on the Kansas River. Segments 1 through 4 and 5 through 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by several impoundment and tailwater areas interspersed by a meandering, often braided, channel that lacks navigation structures and deep pools. Segments 5 through 7 of the lower sampling universe are influenced by reservoirs and are unchannelized. Segments 8 through 10 and 13 through 14 are channelized, have revetted banks, deep scour pools and sand bars that are associated with a variety of navigation structures. Segment 11, the Kansas River, is both channelized and unchannelized, the separation occurring at the Johnson County Weir (Weir). This document reports activities during the 2010 sampling season specific to segment 11.

The Kansas River has been divided into 22 bends from RM 0 upstream to RM 52.1. This area has also been divided into two stretches: 1) the stretch of the River from its confluence to the Weir where depth and flow is more consistent allowing us to fish all gears (RM 0 – 14.7), and 2) the stretch of the River from the Weir to Bowersock Dam (RM 14.7 to RM 52.1), which is

characterized by a braided system with no defined channel. Our bends are randomly selected out of these two groups. In the lower sample area, three bends out of five were randomly selected to be sampled. In the upper sample area, four bends out of 17 were randomly selected to be sampled.

The Kansas River below the Weir is channelized through the industrial area of Kansas City to the confluence, though no channel is maintained for navigation traffic. River banks are lined with revetment along the outside and inside bends of the River. Structures in this segment are few, but include very small wing dikes in some areas. There are various large boulder areas, refuse concrete slabs, junk cars, degraded areas with undercut banks, natural islands, and side chute habitats. The River is relatively shallow, but is accessible with a jet-propelled motor most of the sample year. The lower sample area is treated as other segments in the channelized Missouri River, with the same gears and habitat coding used.

In the upper sampling area, the River is mostly unchannelized. The five mile area just upstream of the Weir is mostly pooled, still water and the portion of the River above the pooled area consists of a few (10 – 15) randomly placed dikes and banks are revetted in areas. Otherwise, most of this area is braided, characterized by a shallow and shifting channel. In this area we are able to deploy most of our standard gears (gill net, trotlines, otter trawls, and mini-fyke nets). In addition to these, push trawls are also deployed as a standard gear in the unchannelized portion.

## Methods

All sampling was conducted in accordance with the guidelines established by the Pallid Sturgeon Assessment Team as outlined in the Pallid Sturgeon Population Assessment Program and Missouri River Standard Operating Procedures for Sampling and Data Collection (Welker and Drobish 2010 and Drobish 2008). Data collected by each PSPAP field office were entered via double-blind entry into a single database housed and managed by the Missouri Department of Conservation. Data were subsequently distributed to each participating office according to reporting responsibilities: segments 1 through 3 - Montana Fish, Wildlife and Parks (Fort Peck, MT); segment 4 – USFWS (Bismark, ND); segments 5 and 6 – USFWS (Pierre, SD); segment 7 - South Dakota Department of Game, Fish, and Parks (Yankton, SD); segments 8 and 9 - Nebraska Game and Parks Commission (Lincoln, NE); Segments 10 and 11 - Missouri Department of Conservation (Chillicothe, MO); segments 13 and 14 – USFWS (Columbia, MO).

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 2 November 2009 [when water temperatures dropped below 12.8°C (55°F)] and continued through 30 June 2010. The fish community season began 01 July 2010 and continued through 18 October 2010. Data from 2005 to 2009 are also included in this report for annual comparisons. During these seasons, standard gear types included gill nets, trotlines, 16-foot otter trawls, and mini-fyke nets (Appendix C). Gill nets were used during sturgeon season from 11 November 2009 through 22 March 2010. Gill net season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts began 25 February 2010 and continued until water temperatures reached 12.8°C (55°F). Otter trawl efforts began 19 May 2010 and went through 3 June. Trammel nets were not a standard gear during sturgeon season.

Fish community season began 01 July 2010 and continued through 18 October 2010. Standard gears during the fish community season included one inch trammel nets, 16-foot otter trawls and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season with efforts made to spatially and temporally distribute sampling across the seven randomly selected bends within the segment.

In addition to pallid sturgeon, the Team identified eight fishes from the associated fish community that were of particular interest due to their ecology (e.g., surrogate species to pallid

sturgeon, obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, shoal chub *M. hyostoma*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when feasible and measured in millimeters (mm) to total length (TL), except sturgeon that were measured to fork length (FL) and paddlefish *Polyodon spathula* that were measured from eye to fork length. Pallid, shovelnose, and lake sturgeon, blue suckers, and sauger were weighed to the nearest gram (g).

When a pallid sturgeon was encountered, meristic and morphometric measurements were recorded to determine the character index (CI) score for each fish (Sheehan et al. 1999). Measurements required to calculate CI score included: head length, interrostral length, length of each barbel, mouth to inner barbel length, and mouth width. The length from the fish’s snout to the anterior midline of the mouth was also recorded. Meristics included number of dorsal and anal fin rays, including rudimentary rays. Ranges of CI scores for pallid sturgeon, shovelnose X pallid sturgeon hybrids, and shovelnose sturgeon have been defined as -1.48 to -0.09, -0.45 to 0.51, and 0.37 to 1.33, respectively. In general, CI scores were only calculated for suspected wild pallid sturgeon or hybrid individuals.

In addition to meristics and morphometric measurements, all pallid sturgeon were to be examined for elastomer (color, orientation, and side of fish), coded wire (CWT), and passive integrated transponder (PIT) tags. If no PIT tag was present, a PIT tag was implanted in the base of the dorsal fin and a 1 cm<sup>2</sup> piece of tissue was removed from the trailing edge of the caudal fin for genetic analysis. Before each pallid sturgeon was released, voucher pictures were taken from a lateral and ventral view of the fish with a summary of capture information (e.g., PIT tag number, location, date, CI score, etc.).

## Sampling Description and Site Selection

### *Site Description*

Sampling sites were described using a three-tiered (macro-, meso-, and microhabitat) classification system based on the Missouri River Benthic Fish Study (Berry and Young 2001). Within this habitat designation system, by definition each river bend contained the following three continuous macrohabitats: main channel crossover (CHXO), inside bend (ISB), and outside bend (OSB). The channel crossover was the area where the thalweg crossed from one concave side of the river to the other. The inside bend was the convex side of the river and the outside bend was the concave side of the river.

Classifications for discrete macrohabitats that may not be present in every bend included: braided channel (BRAD), tributary confluence (CONF), dendritic channel (DEND), deranged channel (DRNG), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), non-connected secondary channel (SCN), large tributary mouth (TRML) and small tributary mouth (TRMS). Braided channels were areas with multiple channels and an unidentifiable main channel. Tributary confluences were areas where tributaries influenced physical features (e.g., temperature, turbidity, sand bars, etc.) of the Kansas River for up to one bend in length downstream from the tributary mouth. Dendritic and deranged channels were transitions from a meandering channel to a tree-like pattern of multiple channels and vice versa, respectively. Large, connected secondary channels carried less water than the main channel, were open on both ends, and had flowing water with depths greater than 1.2 m. Small, connected secondary channels were defined the same as SCCL, but water depths did not exceed 1.2 m. Non-connected secondary channels were channels that were blocked on one end. Large tributary mouths were areas within tributaries, with an annual discharge that exceeded  $20 \text{ m}^3/\text{s}$  and extended 300 m upstream from the confluence with the main river. Small tributary mouths were areas within 300 m of the confluence with the main river, were greater than 6 m in width, and had an annual discharge less than  $20 \text{ m}^3/\text{s}$ .

Mesohabitats within each macrohabitat included: sand bar (BARS), main channel border (CHNB), island tip (ITIP), pool (POOL), and thalweg (TLWG). Sand bars were defined as areas less than 1.2 m deep at the aquatic-terrestrial interface. Channel border habitats extend from the 1.2 m depth contour to the edge or toe of the thalweg. Island tips were areas immediately downstream from islands where water depths were greater than 1.2 m. Pools were areas

immediately downstream from obstructions (rock dikes, sand bars, and bridge pilings) where there was a scour greater than 1.2 m in depth, regardless of water velocity. The thalweg was defined as the area between the channel borders that conveyed the majority of the flow.

Microhabitats were identified using a six digit numeric code. The first three digits described the general habitat structure (e.g., kicker dike, wing dike, sand bar, etc.) with which the gear deployment was associated. The last three digits described the exact location of the gear in relation to this structure (e.g., wing-dike pool, open water inside eddy, sand bar crown, etc.). For complete definitions of each microhabitat type see Welker and Drobish (2010).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 - 4, 5 - 7, and 8 - 14) in which each gear type could be deployed (Drobish 2008). For segment 11, standard macrohabitats sets for standard gears (gill nets, one inch trammel nets, otter trawls, and mini fyke nets) included: CHXO, CONF, ISB, OSB, SCCL, SCCS, and TRMS. Within these macrohabitats, CHNB, POOL, ITIP, and BARS mesohabitats were standard.

### *Site Selection*

During 2010, 25% of bends from each segment were randomly selected to be sampled within each sampling season. Segment 11 has a total of 22 named river bends, five in the lower sampling stretch and 17 in the upper sampling stretch. Three bends in the lower sampling area and four bends in the upper sampling area were randomly selected to be sampled during each sampling season (Appendix I).

Within each randomly selected river bend in segment 11, sampling locations were chosen based on the availability of standard habitats for each gear type. A minimum of 20 subsamples of 100 ft gill nets and 8 subsamples of trotlines and otter trawls were deployed in each bend during sturgeon season. During fish community season, a minimum of eight subsamples of trammel nets, otter trawls, mini-fyke nets, and push trawls (in the upper sampling reach only) were deployed in each bend. A minimum of two subsamples were collected in each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if six subsamples were conducted in the inside bend, and the inside bend portion of the bend was three miles in length, the gear would be deployed every half-mile. For most gear types, at least two

subsamples were conducted in the channel crossover and the inside and outside bends were equally sampled.

## **Sampling Gear**

### *Gill nets*

Gill nets were standard during sturgeon season while water temperatures were under 12.8°C. They were primarily set parallel with flow downstream from structures (rock dikes, bridge pilings, etc) or along the channel border (channel sand bars). They were anchored from the upstream end. Nets were anchored on the downstream end as well to ensure complete extension during the sampling period. A line and buoy were attached to the downstream end to mark the net and for retrieval. The standard gill nets were 30.5 m (100 ft.) in length, 2.4 m (8 ft) deep, constructed from multifilament nylon mesh and contained four 7.6 m (25 ft) panels. Panels 1 through 4 had a mesh size of 38.1 mm (1.5 in), 50.8 mm (2 in), 76.2 mm (3.0 in), and 101.6 mm (4.0 in), respectively. Panels repeat (5 - 8) in double length nets with 38.1 mm, 50.8 mm, 76.2 mm, and 101.6 mm mesh sizes in panels 5, 6, 7, and 8, respectively. All nets had a 13 mm braided polyfoam-core float line with a 7.1 mm diameter, 22.7 kg lead line.

Standard effort was calculated with a 30.5 m (100 ft) net (100 ft of gill net = 1 net night). Sets made with 61 m (200 ft) nets counted as double effort (2 net nights). The first panel (1, 4, or 8) deployed out of the boat for a set site was selected randomly and recorded. Gill nets were set overnight for a maximum of 24 hours.

### *Trammel nets*

Trammel nets were standard during fish community season, and were only deployed in the three bends below the Weir. They were deployed off the bow of the boat by throwing a buoy attached to a 10 m rope and motoring in reverse perpendicular to the flow. A second buoy and rope on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. Trammel nets (i.e., one inch trammel nets) were 38.1 m (125 ft) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in) bar mesh (#139 twine) that was 2.4 m deep (8 ft) and the outer wall was 203 mm (8 in.) bar

mesh (#9 twine) that was 1.8 m (6 ft) in depth. All nets had a 13 mm braided polyfoam-core float line with a 7.1 mm diameter, 22.7 kg lead line.

#### *Otter trawls*

Otter trawls were a standard gear during sturgeon and fish community seasons. They were deployed from the stern of a custom-designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and rope were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and on channel sand bars. The towing rope consisted of 13 mm low stretch nylon line with a 13.7 m bridle. Standard trawl subsamples ranged from a minimum distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom designed skate balloon with a 4.9 m (16 ft) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.).

#### *Mini-fyke nets*

Mini-fyke nets were a standard gear during fish community season. They were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. The lead length was adjusted so the top of the cab would be at or above the water surface to minimize turtle mortalities. In areas with moderate flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the frame to prevent the net from overturning. The perpendicular distance measured from the midpoint of the frame to the bank was recorded. Nets were generally set in the afternoon and left overnight for a maximum soak time of 24 hours. Mini-fyke nets were constructed from 3 mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the frame. The cab of the net was constructed with two 0.6 m steel hoops, with a single, 51 mm throat. The lead was 4.5 m in length and 0.6 m in height. .

#### *Trotlines*

Trotlines were adopted as a standard gear beginning in the 2010 sample season. They were set in each of our randomly selected bends once during the sample season, with a standard of 325 hooks per bend. Trotlines were set parallel with flow downstream from structures (rock

dikes) or along the channel border. Trotlines were anchored on the upstream and downstream ends. The main line was 62.48 m (205 ft) long and made from #8 (3.75 mm) solid braid nylon rope. Sash weights (1.36 – 1.81 kg) were attached along the mainline at 21 m intervals to ensure gear remained on the river bottom. Forty hooks (3/0 Eagle Claw Circle Sea attached to 45.72 cm long droppers) were clipped on each line at 1.5 m intervals while deploying gear from bow of boat.

## **Data Collection and Analysis**

### *Associated Environmental Data*

For every subsample, water depth (m) and temperature (°C) were recorded. Additional habitat data (water velocity and turbidity measurements) were collected for a minimum of 25% of subsamples within each mesohabitat within each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in segment 11, habitat data were generally collected for one subsample in the channel crossover and two to four subsamples for the inside bend, and one subsample in the outside bend. In addition to the collection of habitat data for randomly selected subsamples, these data were also collected for all subsamples that captured a pallid sturgeon. These habitat data collections were recorded as non-random and were not included toward the 25% minimum of subsamples in that bend.

Habitat parameters collected included turbidity and water velocity. Turbidity was determined using a Hach 2100 P Turbidimeter and reported as nephelometric turbidity units (NTUs). Surface water velocity was estimated visually for every subsample by categorizing flow in meters per second (m/s) as: 0 = cannot determine, 1 = eddy or circular flow, 2 = 0.0-0.3 m/s, 3 = 0.3 - 0.6 m/s, 4 = 0.6 - 0.9 m/s, and 5 = >0.9 m/s. When habitat parameters were collected the actual water velocity was recorded using a Marsh McBirney Flo-Mate Model 2000 and recorded in m/s. When sampling with gill nets, trammel nets, trotlines, and otter trawls, water velocity measurements were taken at the bottom, 80%, and 20% of the water column. With mini-fyke nets, this parameter was recorded at the bottom and 60% of the water column.

All habitat parameters were collected at the midpoint of the sample, except depth which was collected at the start point, midpoint, and end point for gill nets, trammel nets, trotlines, and otter trawls. For example, if an otter trawl was hauled 300 m, habitat data were collected 150 m downstream from the starting point (the approximate midpoint of the tow); for a 61 m (200 ft.) gill net set, habitat data were collected at the midpoint (at 30.5 m or 100 ft) of the net. With mini-fyke nets, all habitat parameters were measured at the point where the lead connected to the cab of the net.

### *Genetic Verification*

All pallid sturgeon captured that did not appear to be previously marked were considered to be unknown fish pending genetic verification. Tissue samples collected at time of capture were subsequently sent to the USFWS Northeast Fishery Center to genetically determine the origin of the fish (i.e., hatchery-stocked or wild).

### *Relative Condition*

The condition of recaptured pallid sturgeon was determined using the relative condition factor (Anderson and Neumann 1996). Relative condition ( $K_n$ ) was calculated as:

$$K_n = W/W'$$

where  $W$  was the observed weight and  $W'$  was the length-specific weight derived from the FL-weight equation from Shuman et al. (2011).

### *Relative Weight*

Relative weight of shovelnose sturgeon was calculated using the formula:

$$W_r = 100*(W/W_s)$$

where  $W$  is weight of the individual and  $W_s$  is the length-specific standard weight value for the species. Quist et al. (1998) provided a relative weight equation:

$$\log_{10}W = -6.287 + 3.330 \log_{10}FL$$

for shovelnose sturgeon throughout its range to calculate relative weight.

### *Relative Stock Densities*

Relative stock densities were calculated for pallid and shovelnose sturgeon captured during the 2010 season. Relative stock density was calculated as:

$$\text{RSD} = \text{number of fish in a length-class} / \text{number of fish} \geq \text{minimum stock length} \cdot 100$$
(Anderson and Neumann 1996). Minimum length specifications for pallid sturgeon were: stock = 330 mm; quality = 630 mm; preferred = 840 mm; memorable = 1,040 mm; trophy = 1,270 mm as reported by Shuman et al. (2006). For shovelnose sturgeon, minimum length specifications were: stock = 250 mm; quality = 380 mm; preferred = 510 mm; memorable = 640 mm; trophy = 810 mm as reported by Quist et al. (1998). In addition to these categories, two sub-stock length ranges for each species were defined by the PSPAP. Sub-stock categories were subdivided into 0 to 199 mm and 200 to 329 mm for pallid sturgeon and 0 to 149 mm and 150 to 249 mm for shovelnose sturgeon.

### *Analyses*

All analyses were conducted on data collected from randomly selected bends with standard gear types set within standard habitats for each respective gear. Mean catch-per-unit-effort (CPUE) was for each species within a bend sampled. Then, a grand mean from all bends was derived to get an overall average CPUE for each fish species. CPUE for one inch trammel nets and otter trawls were reported as the number of fish/100 m drifted or trawled, respectively. Gill nets and mini-fyke nets reported CPUE as the number of fish/net night. CPUE for trotlines were recorded as number of fish/ 20 hook-nights.

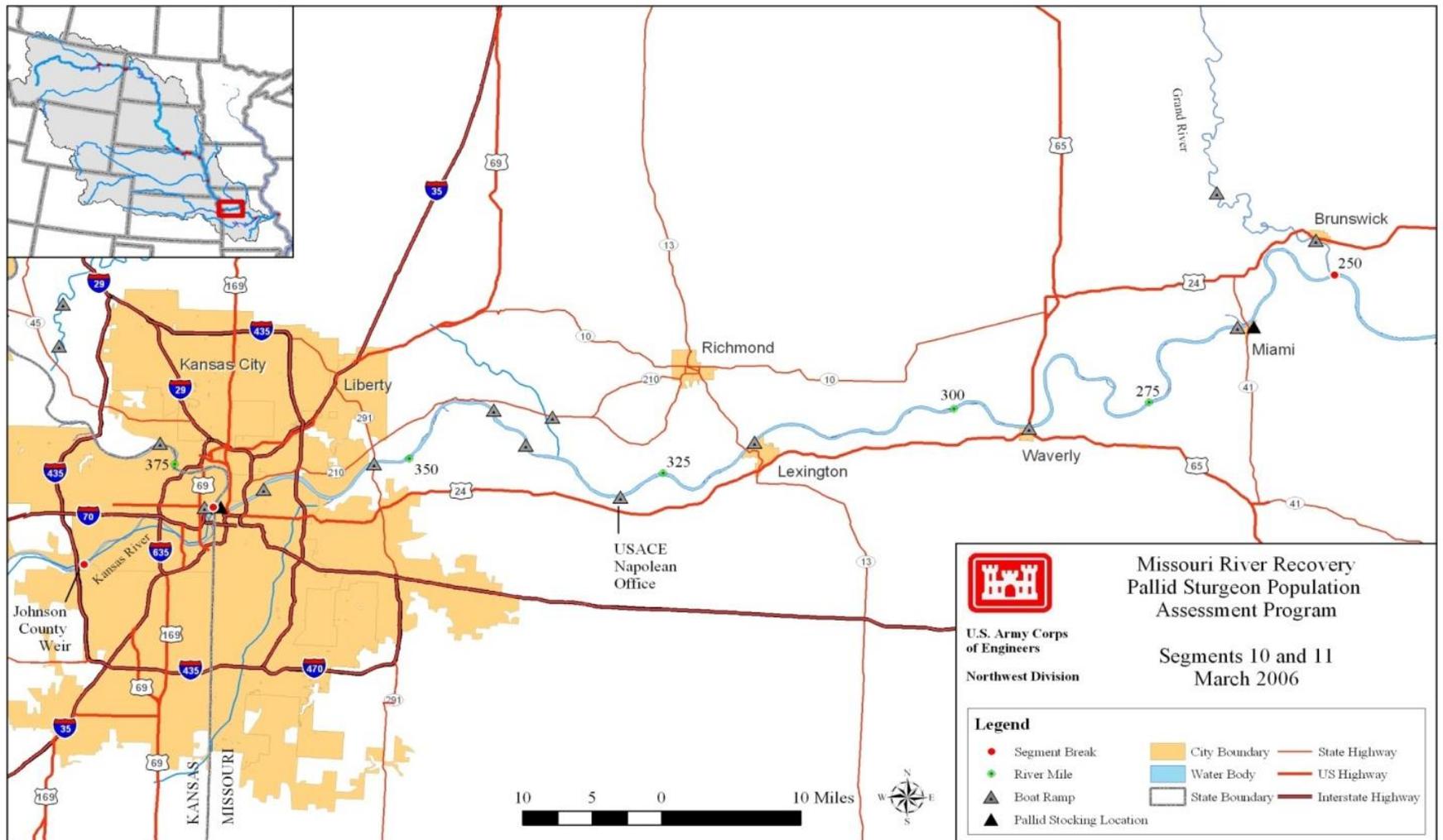


Figure 1. Map of Segment 11, the Kansas River, with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from the mouth (River Mile 0.0) to Bowersock Dam (River Mile 52.1).

## Results

### Effort

#### *Gill nets*

In segment 11 during the 2010 sturgeon season, gill nets were used as standard gear in CHXO, ISB, SCCL, and OSB macrohabitats and CHNB and POOL mesohabitats (Table 1). Six bends were sampled with gill nets for a total of 120 net nights.

#### *Trammel nets*

In segment 11, during the 2010 fish community season, trammel nets were used as standard gear in CHXO, OSB, SCCL, and ISB macrohabitats and CHNB mesohabitats (Table 1). Three bends were sampled for a total of 1,894 m drifted.

#### *Otter trawls*

In segment 11, during the 2010 sturgeon and fish community seasons, otter trawls were used as standard gear in BRAD, CHXO, ISB, OSB, and SCCL macrohabitats and CHNB and ITIP mesohabitats (Table 1). During 2010 sturgeon season, seven bends were sampled for a total of 4,766 m trawled. During fish community season, seven bends were sampled for a total of 5,212 m trawled.

#### *Mini-fyke nets*

In segment 11 during the 2010 fish community season, mini-fyke nets were set as a standard gear in BRAD, CHXO, ISB, OSB, SCCL, SCCS, SCN, and TRMS macrohabitats and BARS mesohabitats (Table 1). Mini-fyke nets were deployed in seven bends for a total of 60 net nights.

#### *Trotlines*

In segment 11, trotlines were deployed in CHXO, ISB, SCCL, SCCS macrohabitats and OSB and CHNB, POOL, ITIP, and BARS mesohabitats. During 2010 season, five bends were sampled for a total of 1,600 hook nights.

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 11, the Kansas River, during the sturgeon season and fish community season in 2010. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deployment-ments	Macrohabitat <sup>a</sup>												
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
Gill Net	6	10	0	18	0	N-E	N-E	19	22	1	0	0	N-E	0	0
Otter Trawl	7	8	9	9	0	N-E	N-E	20	16	2	0	0	N-E	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	3	8.00	0	6	0	N-E	N-E	8	8	2	0	0	N-E	0	0
Mini-Fyke Net	7	8.14	4	10	0	N-E	N-E	14	10	8	4	2	N-E	5	0
Otter Trawl	7	8.00	8	10	0	N-E	N-E	19	10	9	0	0	N-E	0	0
<b>Both Seasons</b>															
Trotline	5	8.00	0	7	0	N-E	N-E	13	13	6	1	0	N-E	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## **Pallid Sturgeon**

A total of seven pallid sturgeon was captured in the Kansas River in sample year 2010. In standard, random sampling, only two pallid sturgeon were captured on trotlines. The other five captures were from trotlines set in non-random bends during efforts to collect broodstock for propagation. The pallid sturgeon ranged in length from 568 to 796 mm.

All fish were of hatchery origin, and were captured below the Johnson County Weir, from river miles 13.6 to 14.7 (Figure 2). The pallid sturgeon that was 796 mm was captured directly below the Johnson County Weir and was void of any previous markings for identification. This pallid sturgeon was a potential broodfish until genetic analyses identified it as hatchery origin. Fish were from 2002 and 2003 year classes (Table 3). Average stocking length of the 2002 year class fish was 284 mm and 2003 year class fish was 232 mm. Average recapture lengths of the 2002 and 2003 year class fish were 669 and 688 mm, respectively. The 2002 and 2003 year class fish had statistically similar average condition factors ( $0.795 \pm 0.081$  (2SE) and  $0.809 \pm 0.099$  (2SE), respectively) at the time of capture (Table 3).

The stocking location was known for two of the 2002 year class fish and one of the 2003 year class fish captured in the Kansas River during 2010. These fish were stocked into the Missouri River at three different locations: Bellevue, NE (RM 601.4), Leavenworth, KS (RM 397.0), and Boonville, MO (RM 195.1). These fish traveled between 43.02 and 248.1 river miles from the time they were released into the Missouri River to the time of their capture in the Kansas River. These fish were at-large for nearly six to seven years.

Our field station has captured twelve pallid sturgeon in the Kansas River since we began sampling in 2006. These captures mark the first time pallid sturgeon have been captured in the Kansas River since 1952 (The University of Kansas Natural History Museum website). In that year, five pallid sturgeon were caught just downstream of Bowersock Dam in Lawrence, Kansas; however, there have not been any pallid sturgeon captures above the Johnson County Weir since its completed construction in 1967.

### Segment 11 - Pallid Sturgeon Captures by River Mile

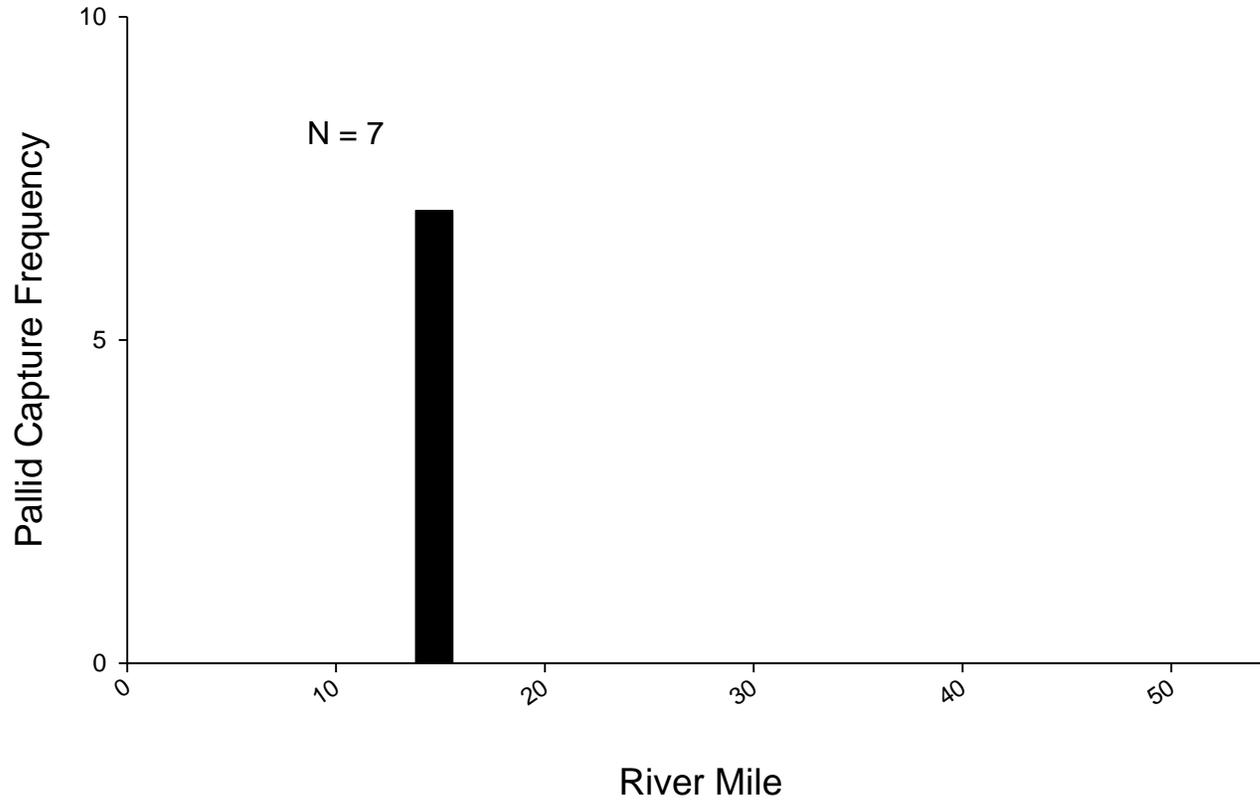


Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 11, the Kansas River, during 2010. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2010. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
BRAD	BARS	0.7 (0.2-1.5)		0.17(0.17-0.17)		30.7 (30.0-31.2)		152 (152-152)		
	CHNB	2.5 (1.4-4.2)		0.87(0.63-1.11)		21.3 (15.5-28.9)		465 (118-1026)		
	DTWT									
	ITIP	2.7 (2.2-3.2)		0.60(0.60-0.60)		28.7 (28.5-28.9)		131 (131-131)		
	POOL									
	TLWG									
CHXO	BARS	0.7 (0.2-3.1)		0.12(0.01-0.39)		23.0 (12.4-29.3)		315 (117-455)		
	CHNB	3.0 (1.2-6.2)		0.50(0.02-0.99)		16.7 (1.9-29.1)		242 (30-937)		
	DTWT									
	ITIP	4.4 (4.4-4.4)		0.36 (0.36-0.36)		23.3 (23.3-23.3)		483 (483-483)		
	POOL	3.1 (1.6-4.6)		0.23 (0.11-0.40)		10.6 (1.9-13.8)		221 (40-396)		
	TLWG									
ISB	BARS	0.9 (0.2-2.2)		0.33 (0.01-1.00)		25.3 (8.5-31.5)		266 (114-512)		5
	CHNB	3.0 (1.2-6.8)	2.9 (2.4-3.3)	0.55 (0.06-1.00)	0.51 (0.30-0.68)	18.4 (1.9-29.5)	16.2 (13.4-17.6)	274 (30-1062)	360 (166-710)	
	DTWT									
	ITIP									
	POOL	4.0 (2.0-6.5)		0.41 (0.32-0.57)		8.5 (5.8-10.2)		471 (117-824)		
	TLWG									

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	TLWG									
OSB	BARS	0.7 (0.2-1.2)		0.24 (0.01-0.62)		24.2 (12.4-29.4)		307 (135-778)		
	CHNB	3.1 (1.0-7.0)		0.44 (0.01-1.01)		17.0 (1.9-29.5)		256 (28-739)		
	DTWT									
	ITIP									
	POOL	3.6 (1.2-6.8)	3.5 (3.5-3.5)	0.29 (0.02-0.58)	0.11 (0.11-0.11)	10.0 (1.9-18.0)	13.4 (13.4-13.4)	187 (27-407)	407 (407-407)	1
	TLWG									
SCCL	BARS	0.6 (0.3-1.7)		0.16 (0.03-0.66)		26.5 (24.5-30.5)		286 (110-587)		
	CHNB	3.4 (1.5-5.2)		0.42 (0.02-0.80)		22.8 (8.8-29.3)		261 (20-843)		
	DTWT									
	ITIP	3.3 (1.4-5.7)		0.43 (0.13-0.78)		22.7 (16.9-29.1)		284 (29-738)		
	POOL	3.5 (3.5-3.5)		0.36 (0.36-0.36)		13.4 (13.4-13.4)		501 (501-501)		
	TLWG									
SCCS	BARS	0.7 (0.3-1.1)		0.38 (0.03-0.68)		27.0 (8.5-32.7)		321 (166-729)		
	CHNB									
	DTWT									
	ITIP	0.9 (0.9-0.9)				25.3 (25.3-25.3)				
	POOL									

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	TLWG									
SCN	BARS	0.6 (0.4-0.7)		0.05 (0.05-0.05)		29.7 (29.6-29.8)		128 (128-128)		
	CHNB									
	DTWT									
	ITIP									
	POOL									
	TLWG									
TRMS	BARS	0.4 (0.3-0.6)		0.01 (0.01-0.02)		27.7 (24.5-32.5)		158 (110-213)		
	CHNB									
	DTWT									
	ITIP									
	POOL									
	TLWG									
WILD	BARS									
	CHNB									
	DTWT	4.6 (3.7-5.5)	5.5 (5.5-5.5)	0.03 (0.03-0.03)	0.03 (0.03-0.03)	17.6 (17.6-17.6)	17.6 (17.6-17.6)	164 (164-164)	164 (164-164)	1
	ITIP									
	POOL	5.0 (3.9-6.1)				17.6 (17.6-17.6)				

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
TLWG										

Table 3. Mean fork length, weight, relative condition factor ( $K_n$ ) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2010 from Segment 11, the Kansas River. Standard error rates (2SE) for each mean are presented in the bottom row for each year class. Relative condition factor was calculated using the equation in Shuman et al. (2011).

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	$K_n$	Length (mm)	Weight (g)	$K_n$	Length (mm/d)	Weight (g/d)
1997									
1999									
2001									
2002	4	284	67.0	1.526	669	1065.0	0.795	0.151	0.220
		77			111	489.5	0.081	0.028	
2003	3	232			688	1133.0	0.809	0.207	
					46	121.8	0.099		
2004									
2005									
2006									
2007									
2008									
2009									
2010									

## Segment 11 - Pallid Sturgeon

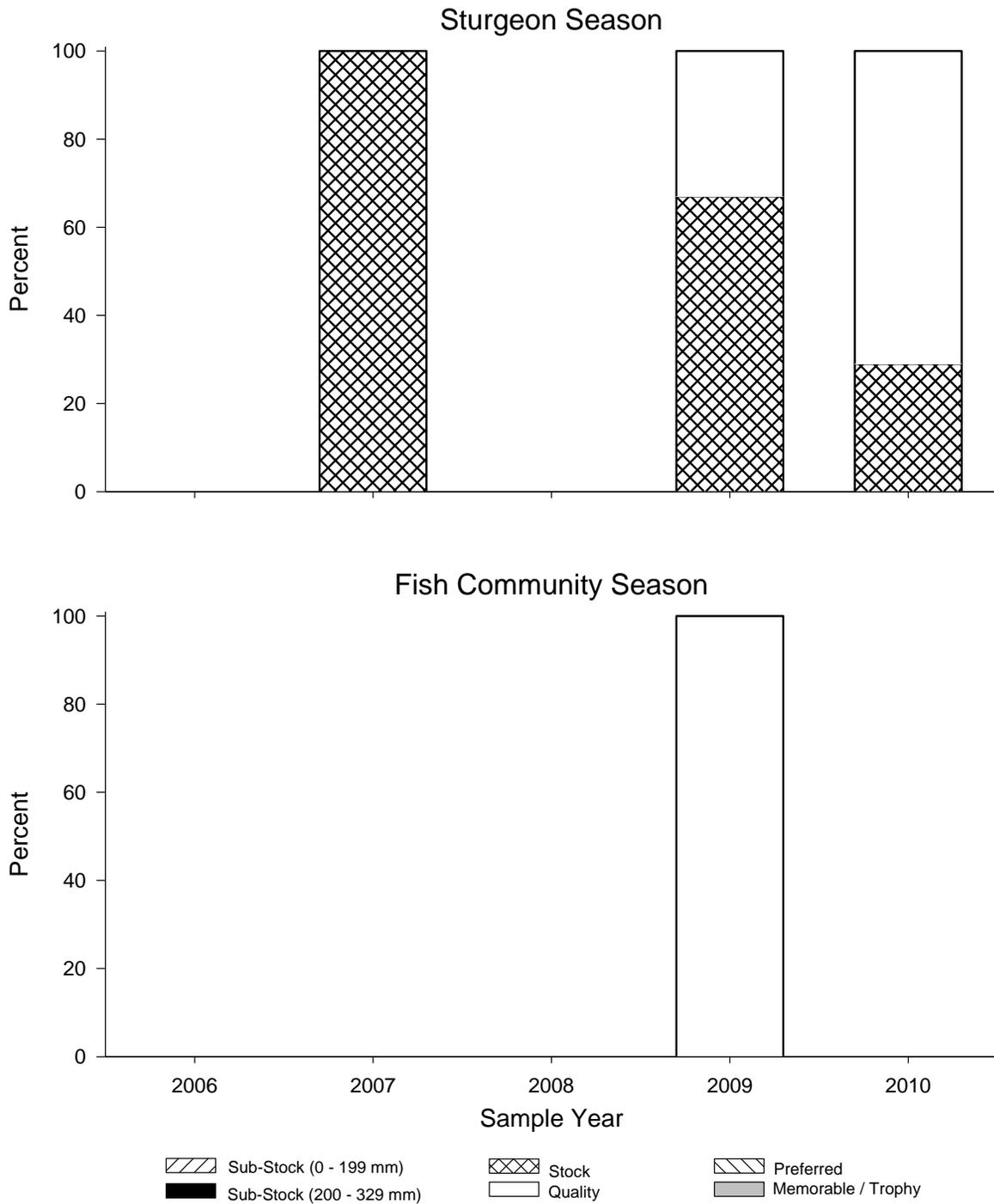


Figure 3. Incremental relative stock density (RSD) for all pallid sturgeon captured with all gear by length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006).

### Segment 11 - Pallid Sturgeon

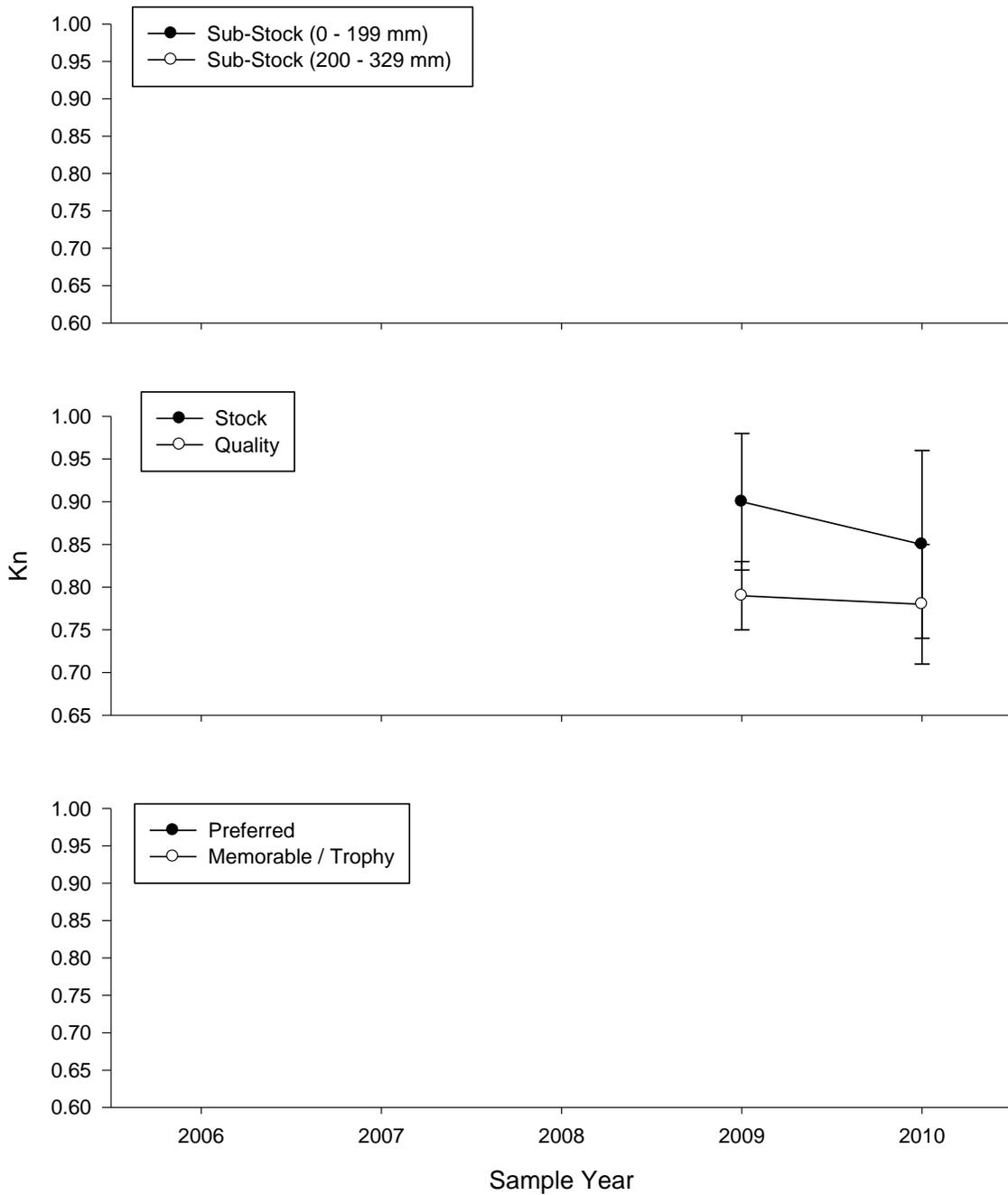


Figure 4. Relative condition factor ( $K_n$ ) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

### ***Year comparisons, Gear evaluation and Habitat associations***

Six of the seven pallid sturgeon captured in sampling year 2010 were from inside bend and outside bend macrohabitats (Table 2). The largest pallid sturgeon captured in the Kansas River was from dam tailwaters mesohabitat associated with the Johnson County Weir. Average depth at capture ranged from 2.4 to 4.3 m, with an average of 3.0 m. Temperature ranged from 13.4 to 17.6 °C. Turbidity for the captures ranged from 164 to 710 NTUs.

All seven pallids were captured using trotlines with 3/0 circle hooks. Two were captured during standard, random sampling (with standard number of hooks and randomly selected bends and subsamples), and the other five were captured during out targeted broodstock collection efforts. Prior to 2010, our field station had only captured five pallid sturgeon in the Kansas River in four years of sampling.

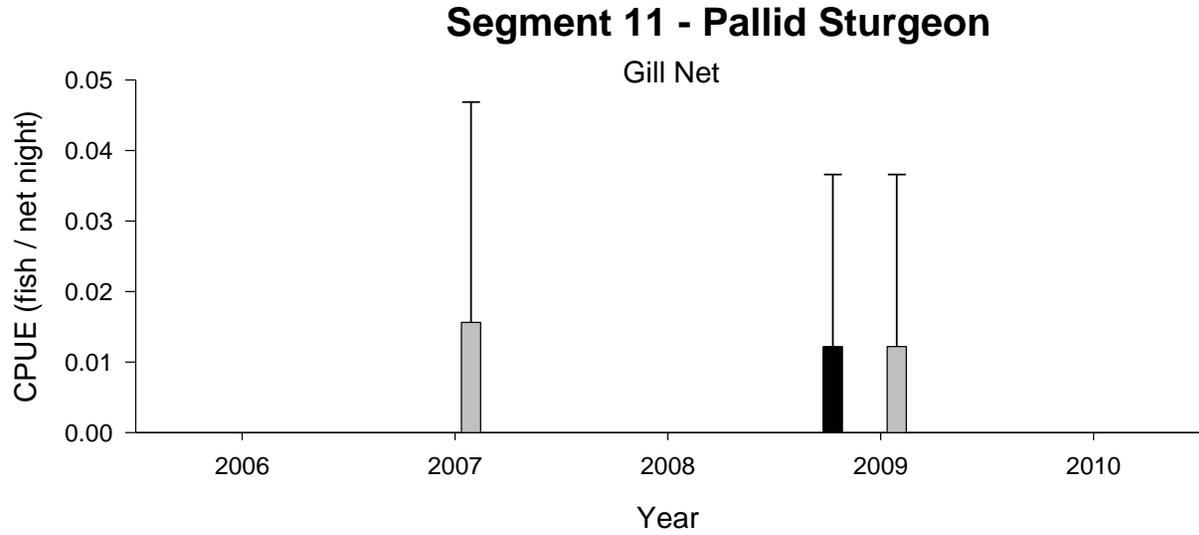


Figure 5. Mean annual catch per unit effort ( $\pm 2$  SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic verification.

Table 4. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	18	0	N-E	N-E	20	20	18	18	0	N-E	0	0

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	18	0	N-E	N-E	20	20	18	18	0	N-E	0	0

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	1	0	0	0	N-E	N-E	0	100	0	0	0	N-E	0	0
		0	18	0	N-E	N-E	20	20	18	18	0	N-E	0	0

Table 7. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	1	0	0	0	N-E	N-E	100	0	0	0	0	N-E	0	0
		0	18	0	N-E	N-E	20	20	18	18	0	N-E	0	0

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	2	0	0	0	N-E	N-E	50	50	0	0	0	N-E	0	0
		0	18	0	N-E	N-E	20	20	18	18	0	N-E	0	0

## Segment 11 - Pallid Sturgeon

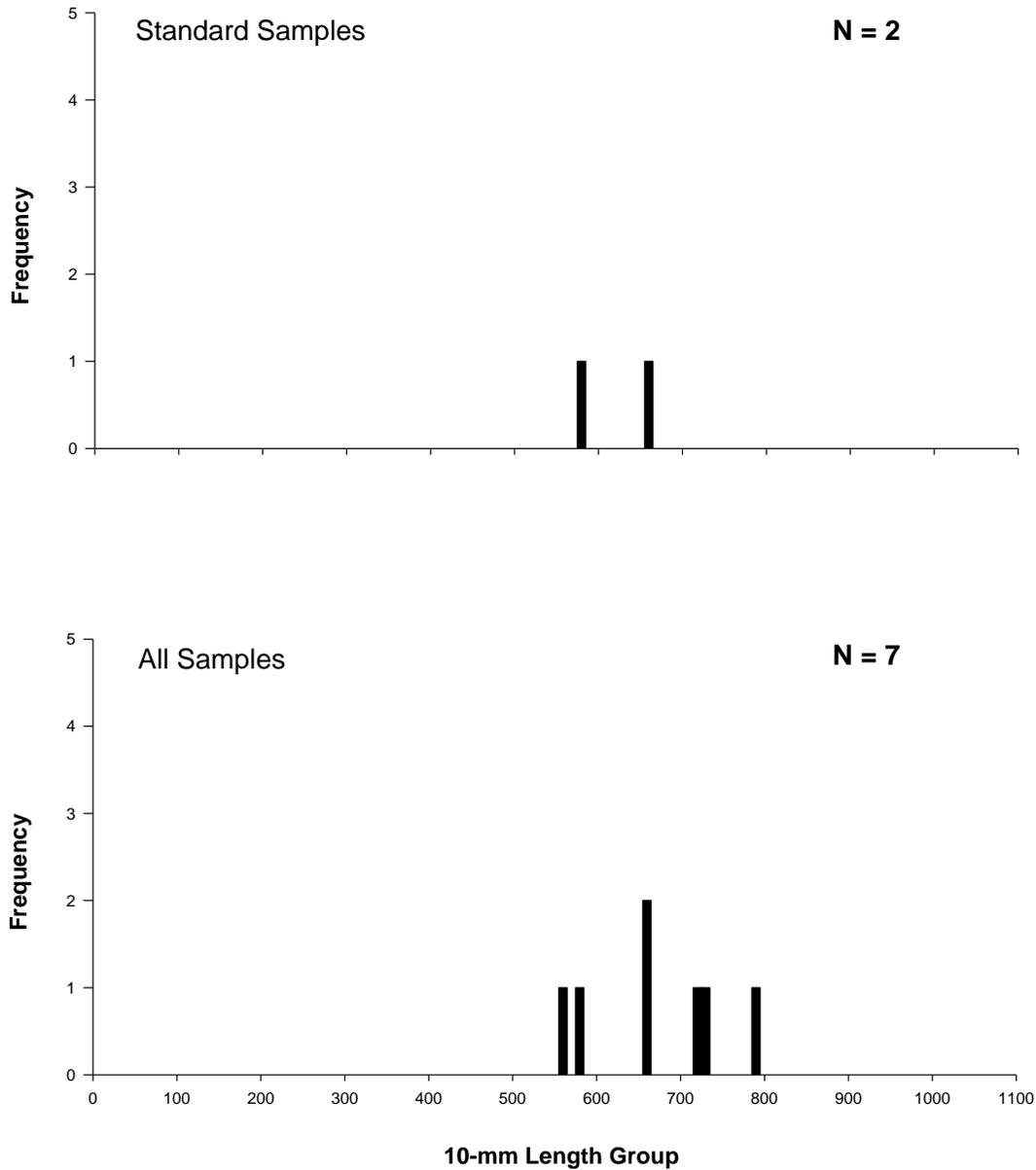


Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. Pallid sturgeon of unknown origin are awaiting genetic verification.

## Segment 11 - Annual Pallid Sturgeon Capture History

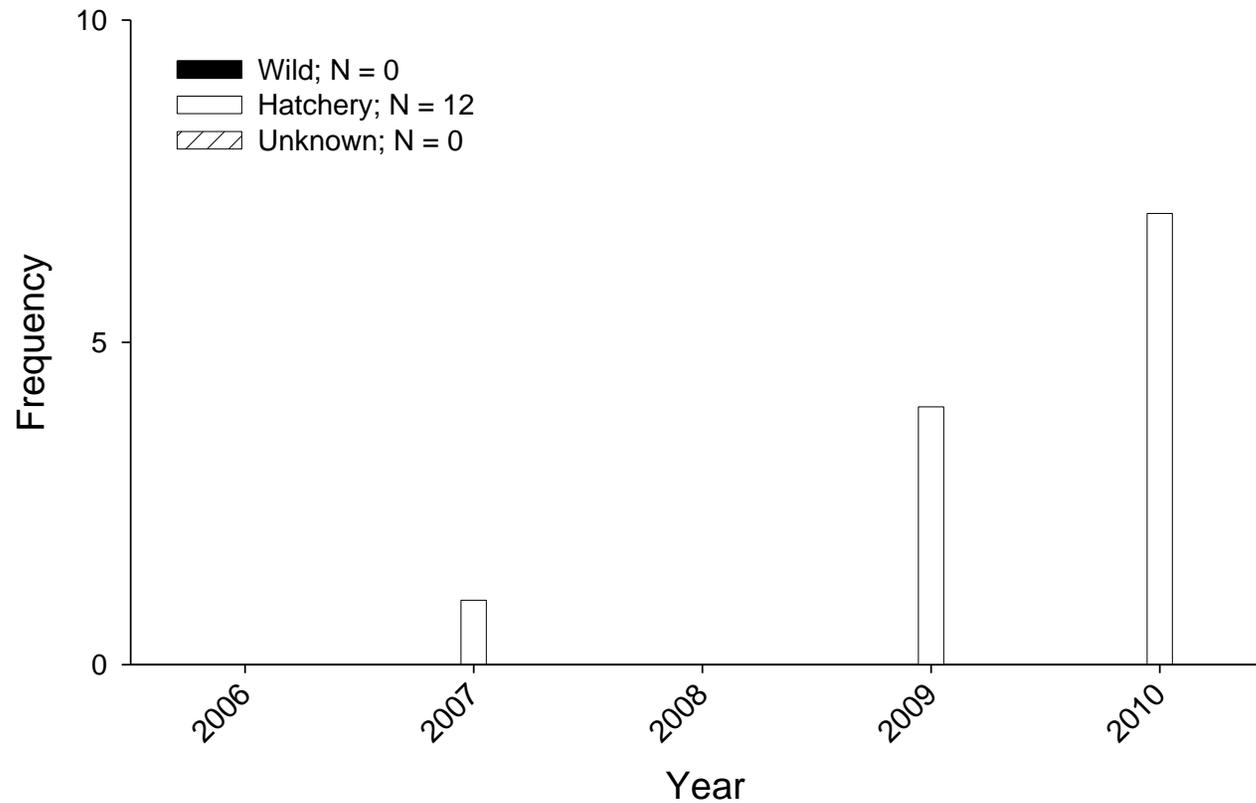


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 11, the Kansas River, from 2006-2010. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples.

## **Shovelnose X Pallid Sturgeon Hybrids**

A total of four shovelnose X pallid sturgeon hybrids (hybrids) was captured in the Kansas River in sample year 2010. All hybrid sturgeon were captured in standard, random sampling. Two hybrid sturgeon were captured by otter trawl and were 566 mm and 625 mm in length. The other two hybrid sturgeon were 629 mm and 677 mm in length and were captured by trotline and trammel net, respectively. All fish were void of previous markings for identification, and were identified as hybrids through genetic analysis. Sampling year 2010 marks the first time any shovelnose X pallid sturgeon hybrids have been captured above the Johnson County Weir.

### ***Year Comparisons, Gear Evaluations, and Habitat Associations***

The two hybrid sturgeon captured below the Johnson County Weir were at river mile 4.0 and 13.3 in outside bend and channel-crossover macrohabitat, respectively. The other two hybrid sturgeon were captured above the Johnson County Weir at river miles 32.3 and 44.9 in braided and outside bend macrohabitat, respectively.

Two of the hybrid sturgeon were captured by our field station in sampling year 2010 by otter trawl, one was captured by trotline, and one was captured by trammel net. Prior to 2010, our field station had captured five hybrid sturgeon in the Kansas River by gill net.

## Targeted Native River Species

### Shovelnose Sturgeon

A total of 983 shovelnose sturgeon was captured with standard gears in eight bends in segment 11 during the 2010 season (Figure 13). This was the first year trotlines was a standard gear and was the primary reason the 2010 season was the largest catch of shovelnose sturgeon in segment 11 over all the years of sampling. Fork lengths ranged from 25 to 728 mm, which is similar to previous years. Gill nets captured the most shovelnose sturgeon (N = 442), followed by trotlines (N = 413), otter trawls (N = 93) and trammel nets (N = 35).

Quality size class fish (> 380 mm) continue to be the most frequently captured size in standard gill nets. Catch per unit effort increased in 2010 (3.641 fish/net night) but had been decreasing every year since 2006 (Figure 10). Gill nets have only captured smaller size classes in 2007 and 2010. Sub-stock size (150 – 249 mm) and stock size (250 – 379 mm) were captured at low rates (0.008 and 0.033 fish/net night, respectively in 2010).

Otter trawls captured a large size range of shovelnose sturgeon in segment 11 (60 – 694 mm), but captured more from quality and above size classes. The sub-stock class has increased CPUE during both seasons (Figure 12). Sub-stock (0 – 149 mm) CPUE for both seasons was higher in 2010 (0.098 fish/ 100m) than in any other year. Genetic samples were collected from the smaller sturgeon (<170 mm) to accurately identify the species.

Trammel nets had the highest CPUE for quality (>380 mm) size class fish, but was lower than in 2009 (Figure 11). Trammel net CPUE was lower for all size classes in 2010. Over both seasons, CPUE was highest for the largest size classes during fish community season in 2006 (5.165 fish/ 100 m) and lowest during sturgeon season 2008 (0.889 fish/ 100 m). Over both seasons and all size classes, CPUE was highest in 2006.

Trotlines captured a total of 549 shovelnose sturgeon (standard and wild gears) in the Kansas River, which is the second-highest catch for all gears used. The fish were all stock size and above (291 – 728 mm). Quality size class CPUE was 4.66 fish/ 20 hooks and stock size CPUE was 0.075 fish/ 20 hooks.

Push trawls captured two shovelnose sturgeon from the quality size class and two sub-stock size (0 – 149 mm) unidentified sturgeon above the Weir. Overall catch, including all effort in segment 11 resulted in a total of 1,123 shovelnose sturgeon (Figure 13). Ten sturgeon were

unidentified as to species and are pending genetic verification, but due to the high proportion of sturgeon identified as shovelnose sturgeon they are included here.

Over all years and seasons, the preferred size class (510 – 639 mm) was the most frequently captured size class of shovelnose sturgeon in the Kansas River, averaging 69% of the catch (Figure 14). Sub-stock size class fish were only collected in 2007, 2009, and 2010 (Figure 15). The sub-stock size class in 2009 had the highest average relative weight (101.6) and in 2007 the lowest average relative weight (45.6). The average relative weight across all years was inversely related to size (stock = 90.7, quality = 89.5, preferred = 85.6 and memorable = 80.4). The stock size class and above show a slight downward trend in relative weights across the years.

## Segment 11 - Shovelnose Sturgeon

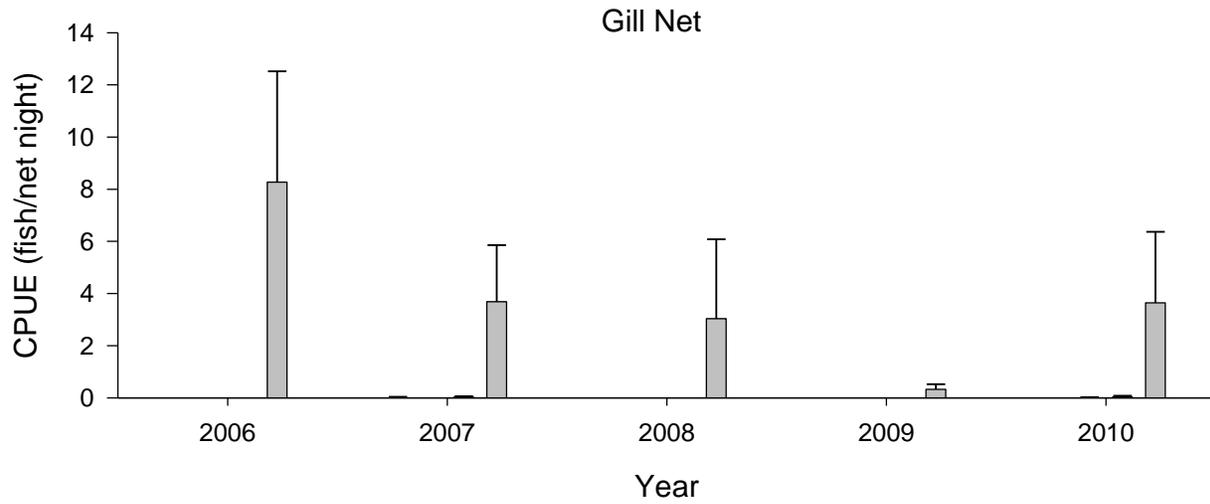


Figure 10. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using gill nets in Segment 11, the Kansas River from 2006-2010.

## Segment 11 - Shovelnose Sturgeon

1.0" Trammel Nets

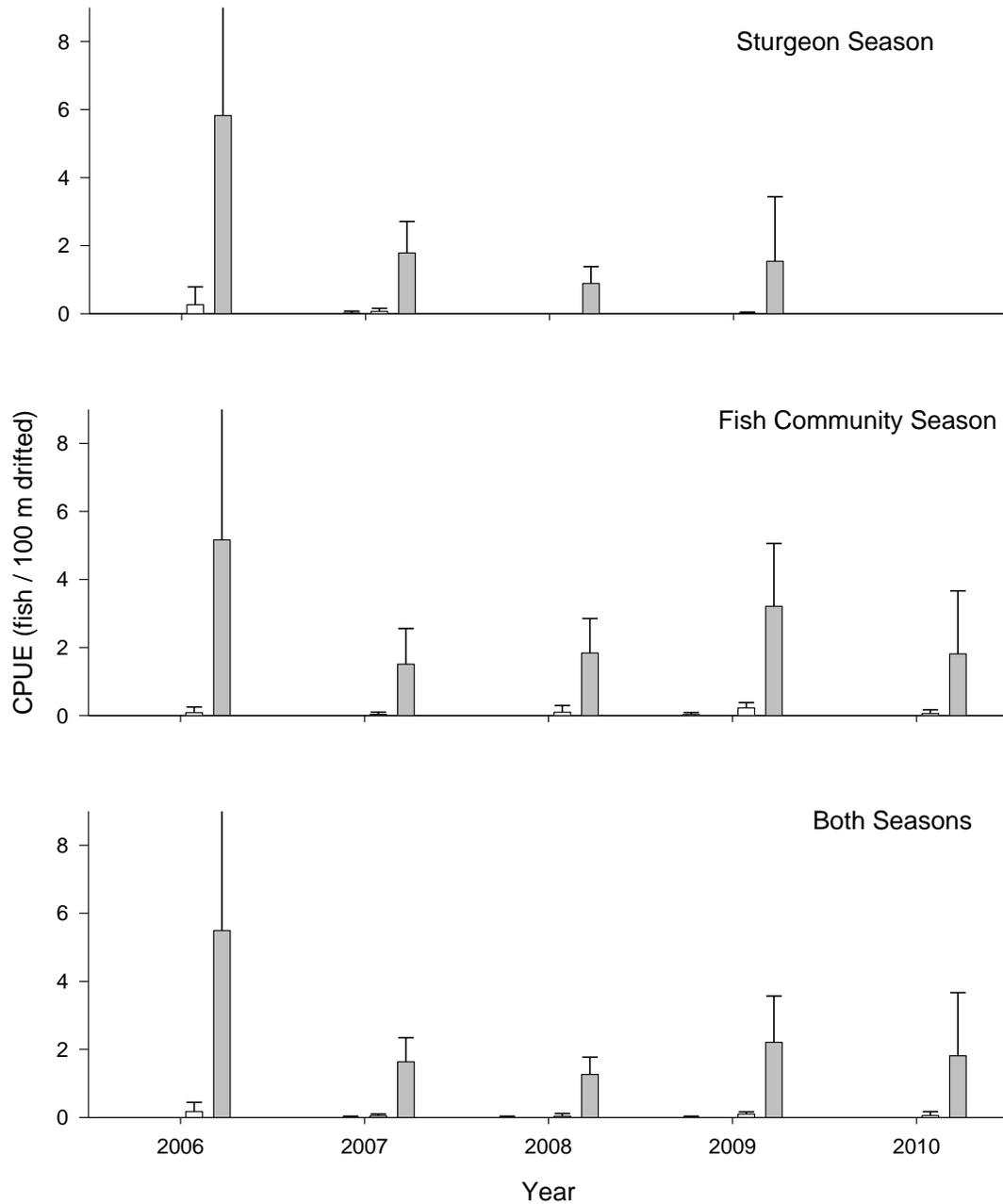


Figure 11. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size ( $> 380$  mm; gray bars) shovelnose sturgeon using one inch trammel nets in Segment 11, the Kansas River, from 2006-2010.

## Segment 11 - Shovelnose Sturgeon

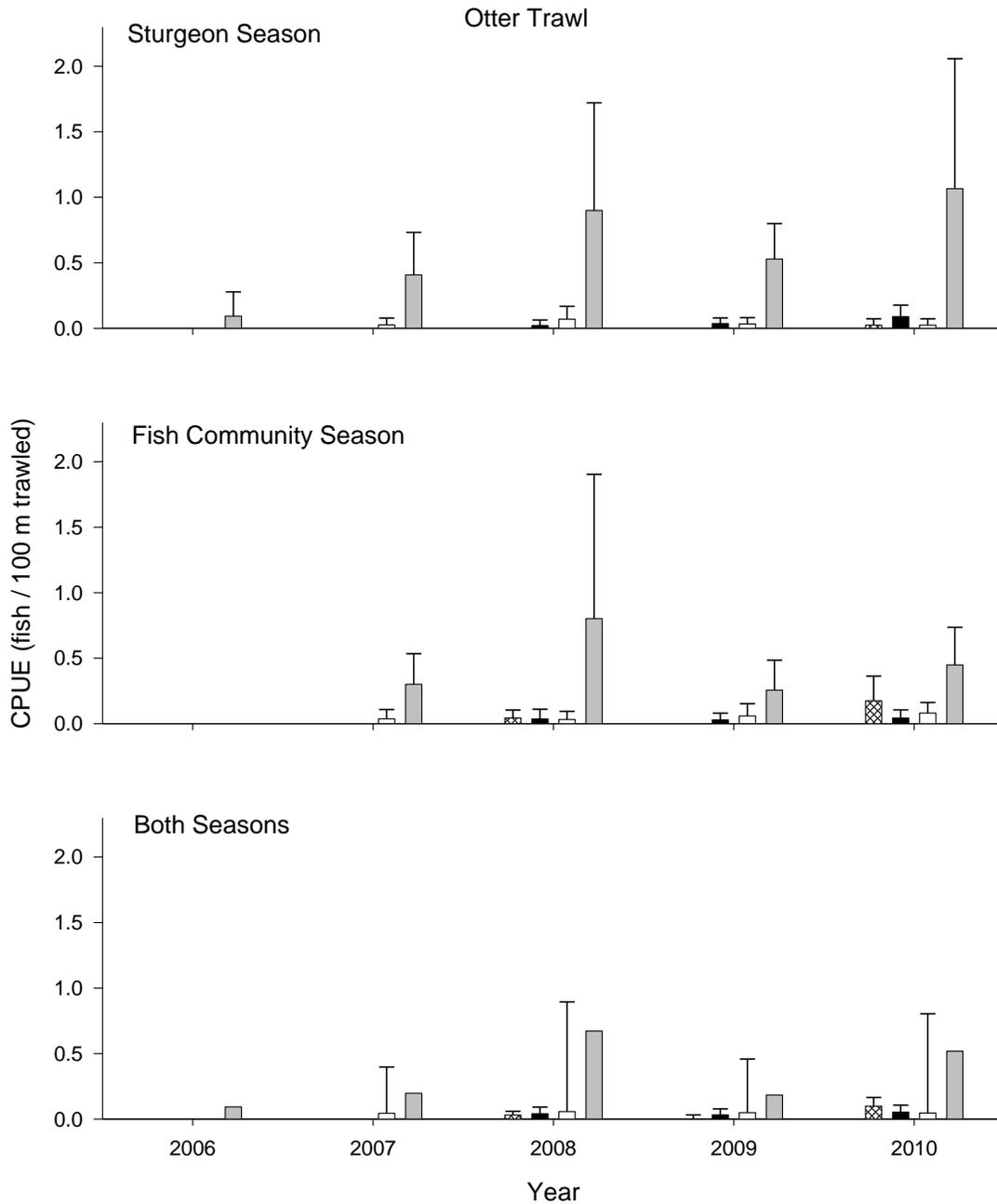


Figure 12. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 11, the Kansas River, from 2006-2010.

### ***Habitat Use***

Habitat classifications used by the PSPAP in the other segments of the Missouri River are not always applicable for use in the Kansas River. The major habitat difference in our sample area of the Kansas River is the designation of above and below the Johnson County Weir (Weir). The difference lies in the channelization of the river that occurs below the Weir versus the more natural, braided channel above the Weir.

Sixteen sub-stock stock size shovelnose sturgeon were captured during 2010 (Table 9 and 10). Thirteen were captured above the Weir in inside bend (2), braided (7), large connected side channels (3), and channel crossover (1) macrohabitats. Three were captured below the Weir in channel crossover, inside bend, and outside bend macrohabitats. Ten stock size fish were captured (Table 11). Stock size class fish were captured in large connected side channels and channel crossover macrohabitats below the Weir, and in inside bend, braided, and channel crossover macrohabitats above the Weir. Quality size and above fish were captured in the highest numbers (N = 951; Table 12). They were captured in the same habitats both above and below the Weir (channel crossover, inside bend, and outside bend). They were also captured in large connected side channel macrohabitats below the Weir, and two other macrohabitats above the Weir (braided and small connected side channel). Most sturgeon were captured in channel border mesohabitats, but most of the effort was expended there due to that being the only mesohabitat in which trammel nets and otter trawls are deployed.

Table 9. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	1	0	0	0	N-E	N-E	0	100	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	8	50	13	0	N-E	N-E	0	0	38	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotlines	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	1	0	0	0	N-E	N-E	100	0	0	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	4	50	25	0	N-E	N-E	25	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	2	50	0	0	N-E	N-E	50	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotlines	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	4	0	50	0	N-E	N-E	0	0	50	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	1	0	0	0	N-E	N-E	100	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	1	0	100	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	4	50	50	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotlines	6	0	17	0	N-E	N-E	50	17	16	0	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

Table 12. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	437	0	16	0	N-E	N-E	15	58	11	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	52	38	23	0	N-E	N-E	13	19	6	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	34	0	9	0	N-E	N-E	62	29	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	21	29	38	0	N-E	N-E	10	5	19	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotlines	407	0	19	0	N-E	N-E	33	38	8	2	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	442	0	17	0	N-E	N-E	15	57	12	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	58	38	22	0	N-E	N-E	16	19	5	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	35	0	11	0	N-E	N-E	60	29	0	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	35	37	31	0	N-E	N-E	9	3	20	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotlines	413	0	19	0	N-E	N-E	33	38	8	2	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

## Segment 11 - Shovelnose Sturgeon

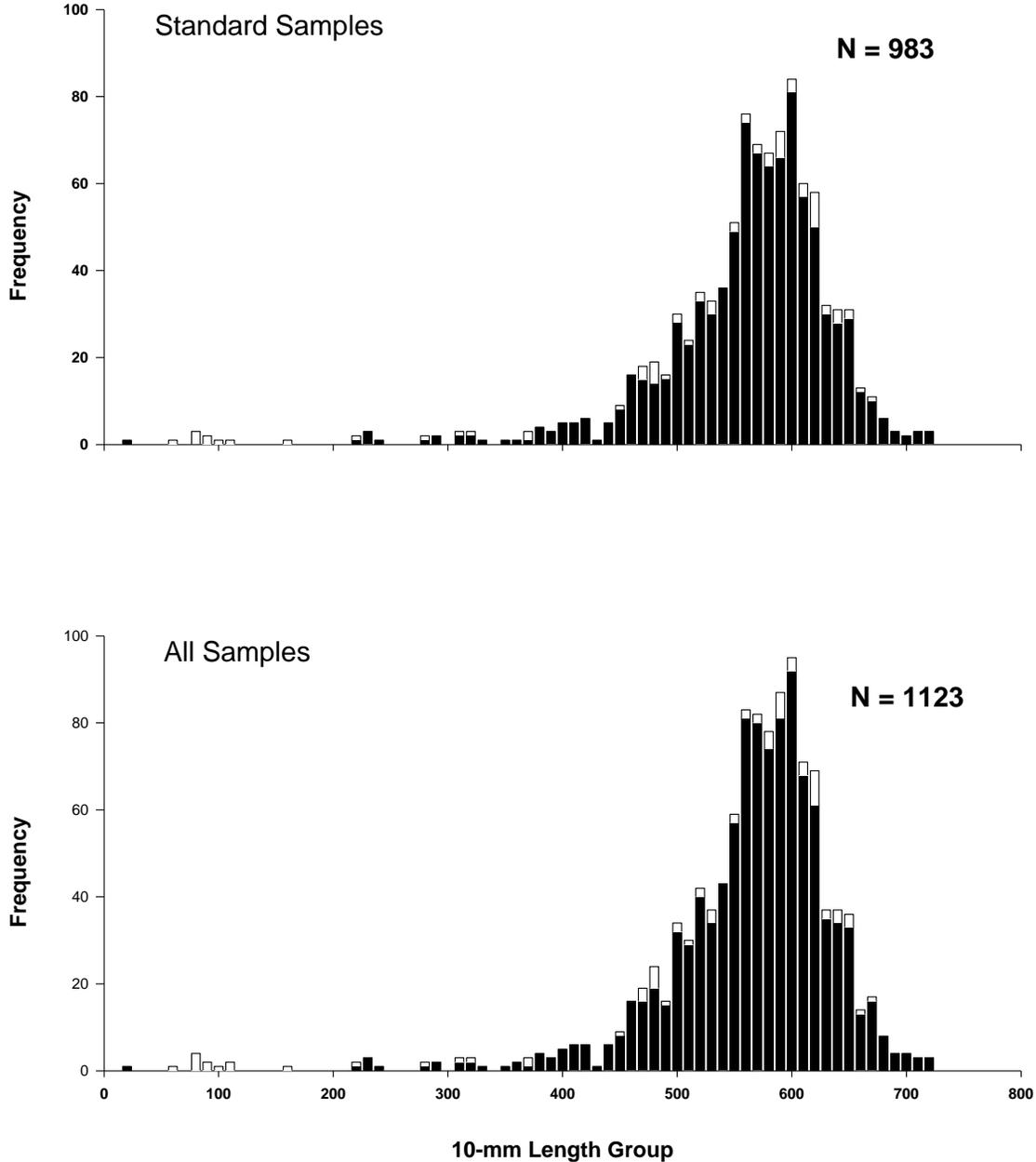
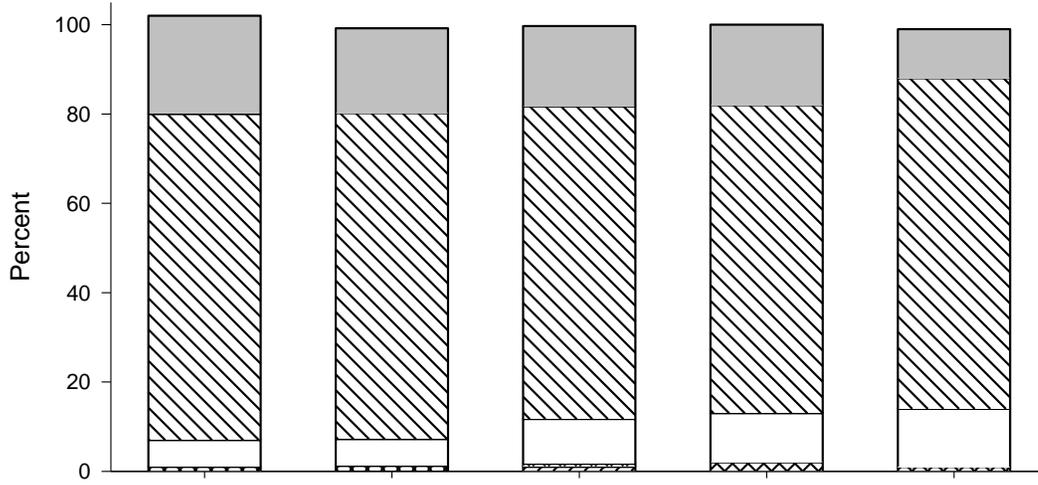
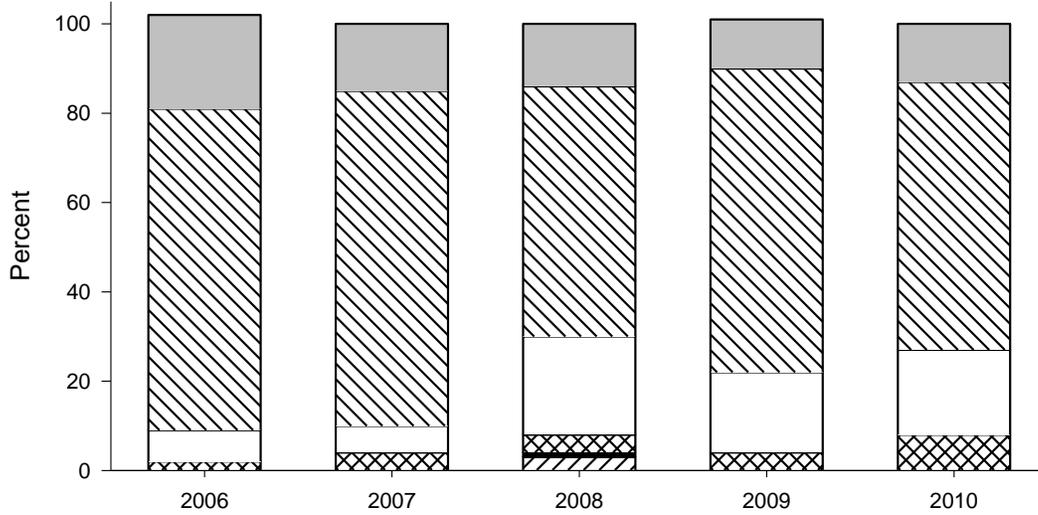


Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

### Segment 11 - Shovelnose Sturgeon Sturgeon Season



### Fish Community Season



Sub-Stock (0 - 149 mm)    
  Stock    
  Preferred  
 Sub-Stock (150 - 249 mm)    
  Quality    
  Memorable / Trophy

Figure 14. Incremental relative stock density (RSD) for all shovelnose sturgeon captured with all gear by length category from 2006 to 2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998).

## Segment 11 - Shovelnose Sturgeon

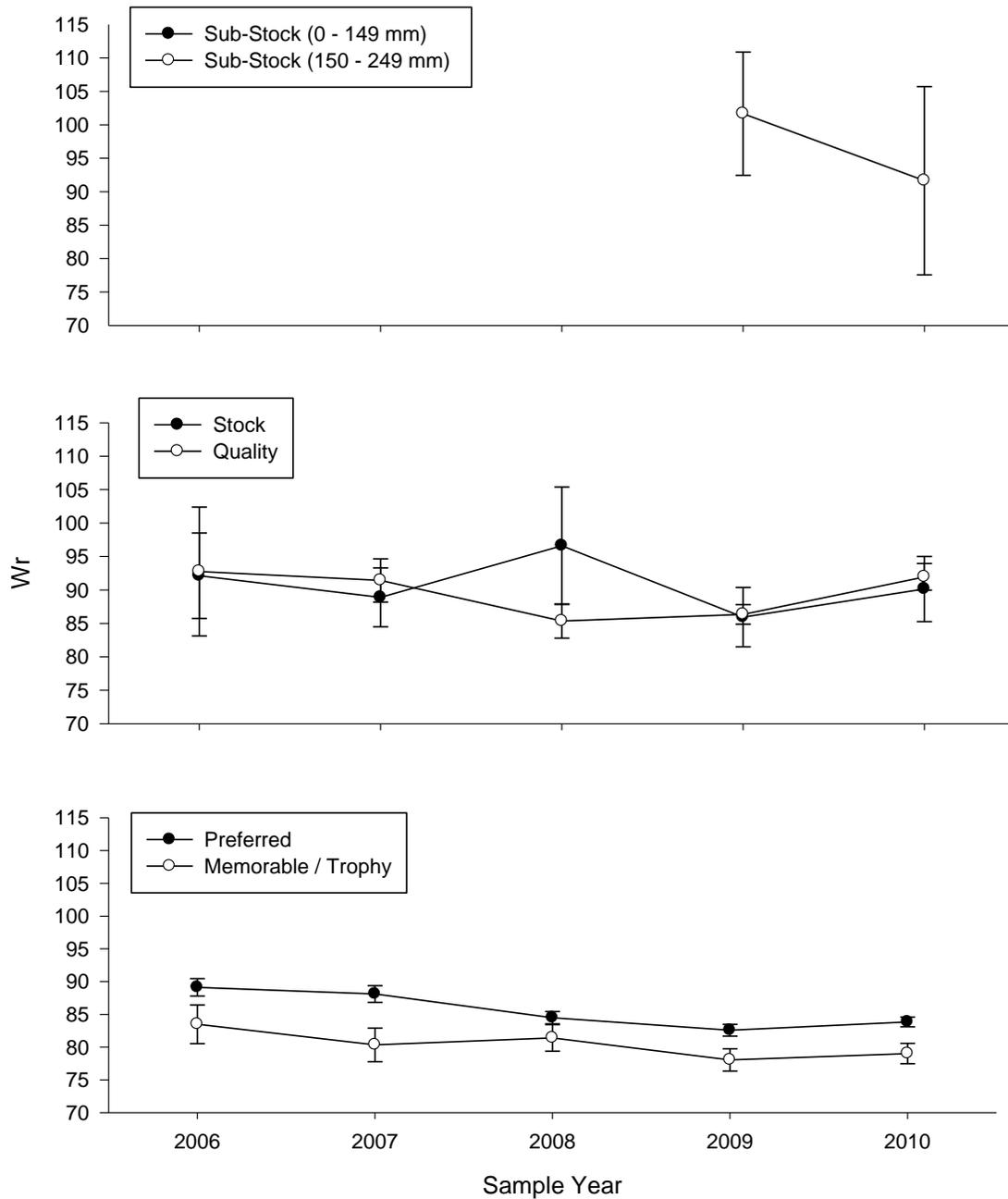


Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998).

## **Sturgeon Chub**

No sturgeon chub were captured in segment 11 during the sample years 2006 - 2010, therefore figures 16 and 17 have been omitted.

## **Sicklefin Chub**

Sicklefin chub were only sampled in Segment 11 during the 2006, 2008, and 2010 sampling years. There were two sicklefin chub captured in segment 11 during sample year 2008. Sicklefin chub were captured in mini-fyke (56 mm) and otter trawl (33 mm) during the 2008 fish community season (Figure 18). Both sicklefin chub were captured in the inside bend, one in bars habitat and the other in channel border habitat. In sample years 2006 and 2010, single individuals (26 mm and 71 mm total length, respectively) were captured in otter trawls during sturgeon season (Figure 18). All were captured below the Johnson County Weir.

## Segment 11 - Sicklefin Chub

Otter Trawl

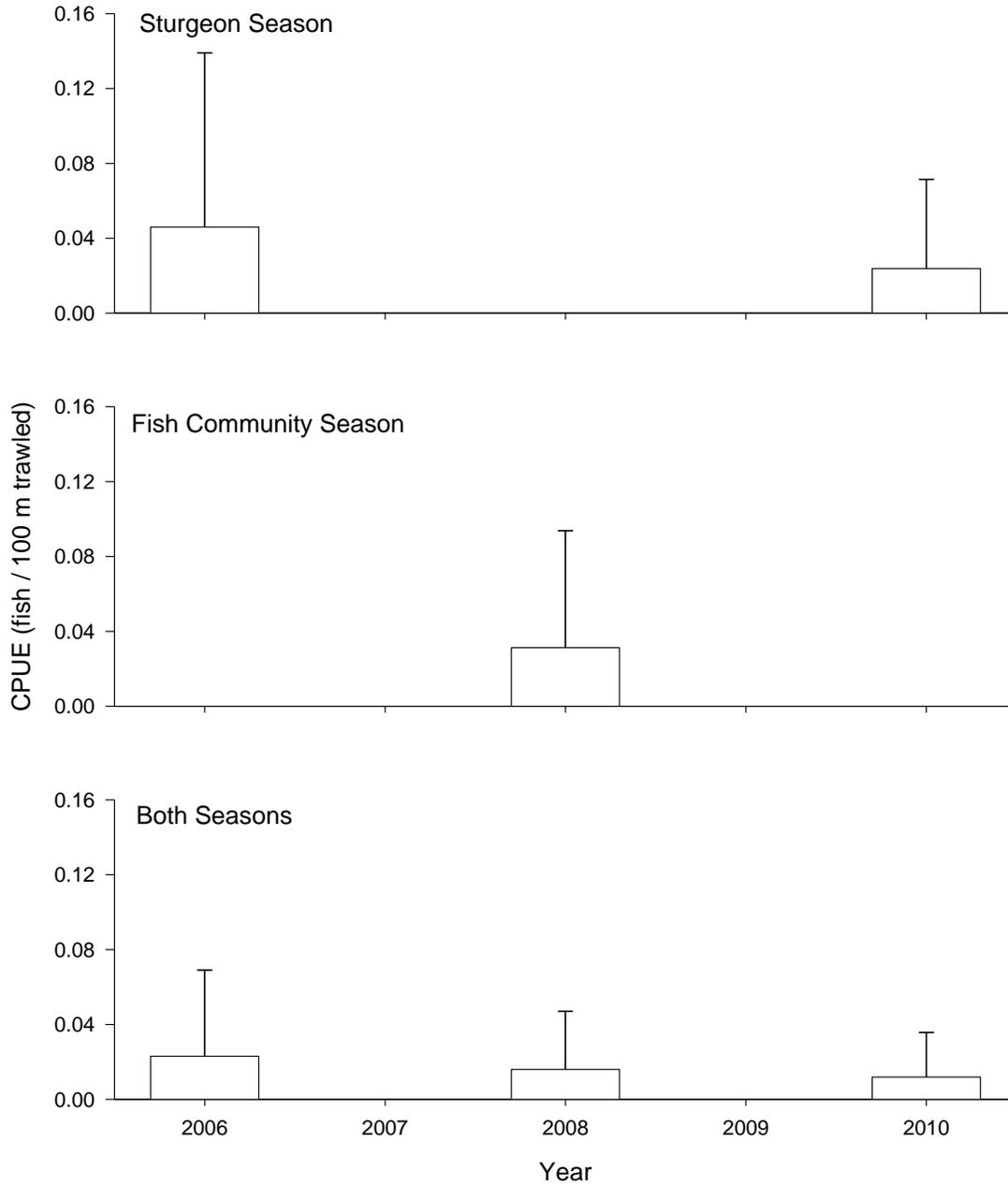


Figure 18. Mean annual catch per unit effort ( $\pm 2$  SE) of sicklefin chub using otter trawls in Segment 11, the Kansas River, from 2006-2010.

## Segment 11 - Sicklefin Chub

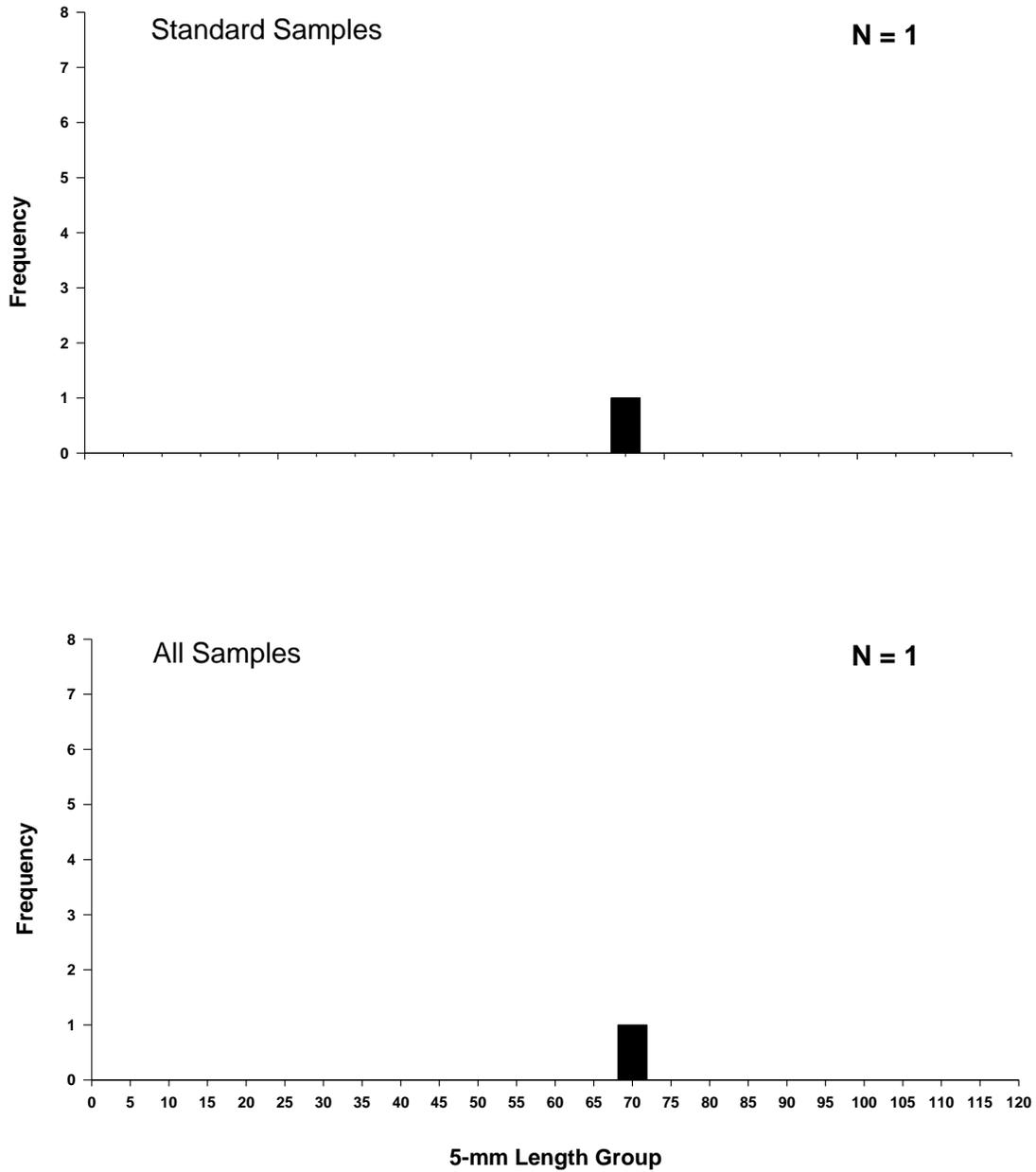


Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

## **Shoal Chub**

Shoal chub were sampled for the fourth straight year in sample year 2010. Total numbers of shoal chub collected decreased during 2010 in segment 11 with only 6 shoal chub collected in standard samples. Overall CPUE decreased as well (Figure 20). Fish were captured in both sturgeon (N = 5) and fish community seasons (N = 1). All were captured below the Johnson County Weir.

Fish lengths during the 2010 sampling season ranged from 27 – 61 mm. A majority of fish sampled were in the 40 mm size class (Figure 21). Lengths were similar to the previous sampling year (37 to 60 mm).

## Segment 11 - Shoal Chub

Otter Trawl

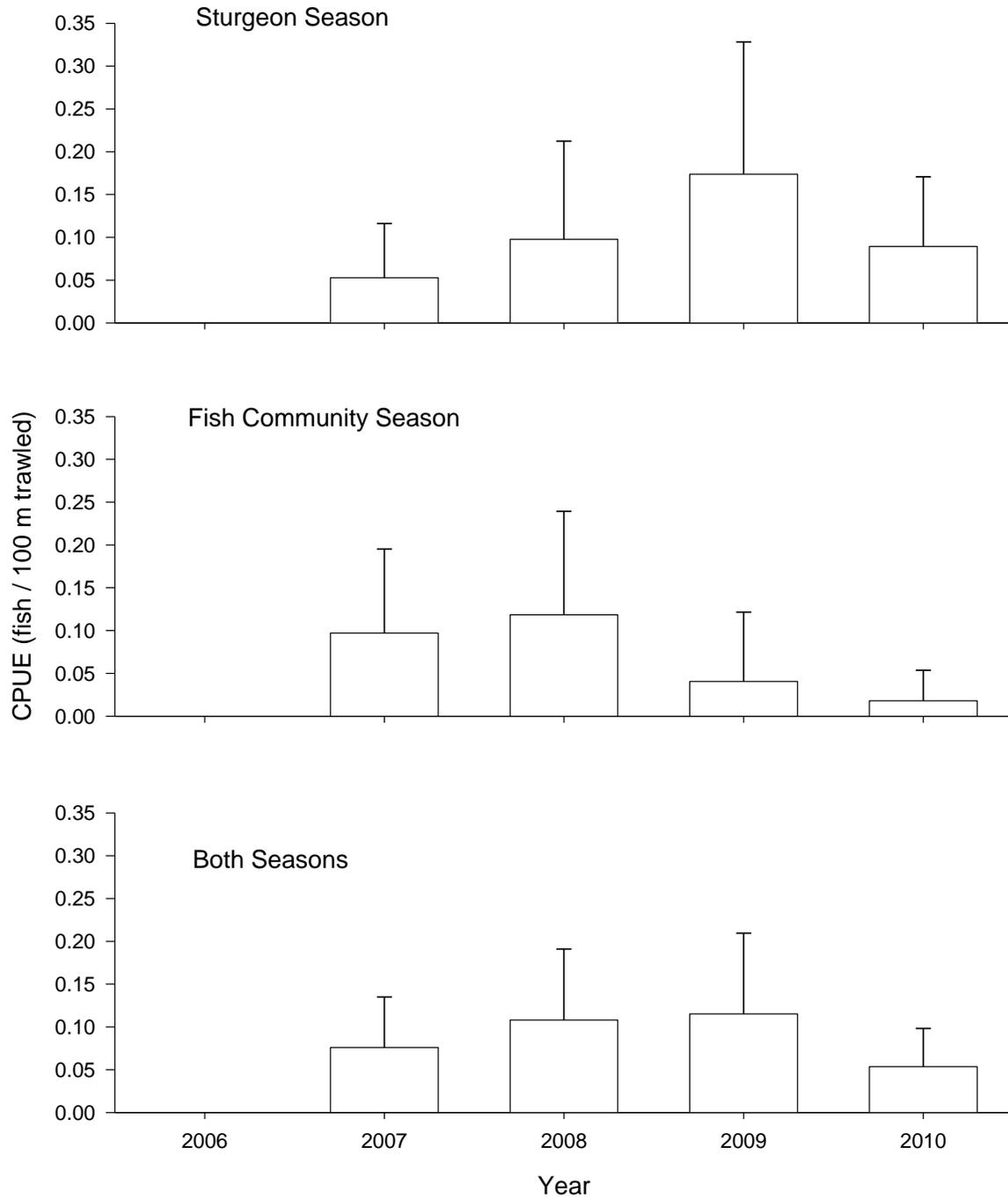


Figure 20. Mean annual catch per unit effort ( $\pm 2$  SE) of Shoal chub using otter trawls in Segment 11, the Kansas River, from 2006-2010.

## Segment 11 - Shoal Chub

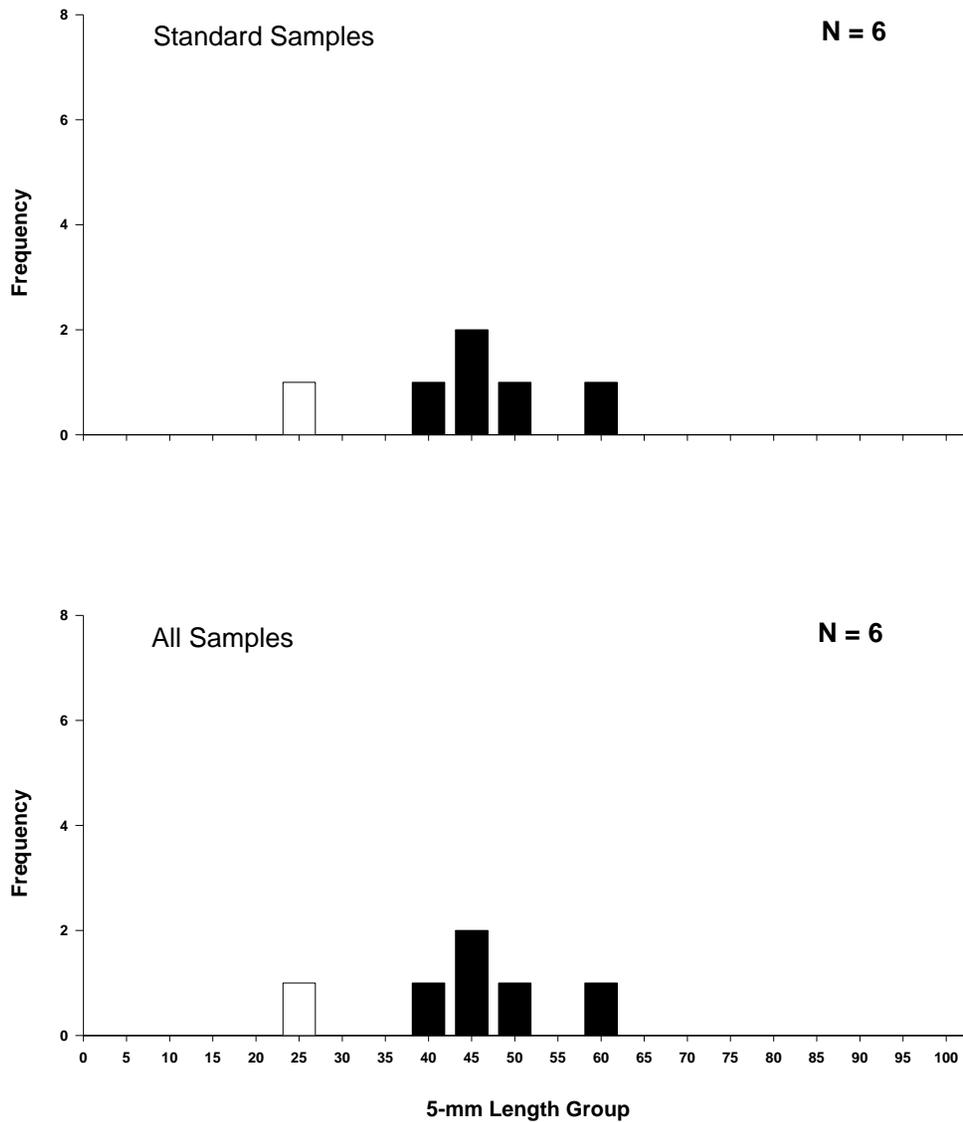


Figure 21. Length frequency of shoal chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

## **Sand Shiner**

A total of 57 sand shiners was captured with standard gears in segment 11 during the 2010 sampling season. This is down from the previous year (N = 91) and has been declining since 2007. Mini-fyke nets were the most effective standard gear at capturing sand shiners (N = 52), while five fish were sampled in otter trawls (OT16) and an additional 10 fish sampled in push trawls (POT02). Mini-fyke net CPUE for sand shiner was 0.9123 fish/net night during the 2010 sampling season. This is lower than in previous years and is also in decline since 2006 (Figure 22).

Like the previous year, only one individual sand shiner was captured below the Johnson County Weir. Fish lengths ranged from 30 – 62 mm with most in the 40 mm size class (Figure 23) and are similar to previous years' catches.

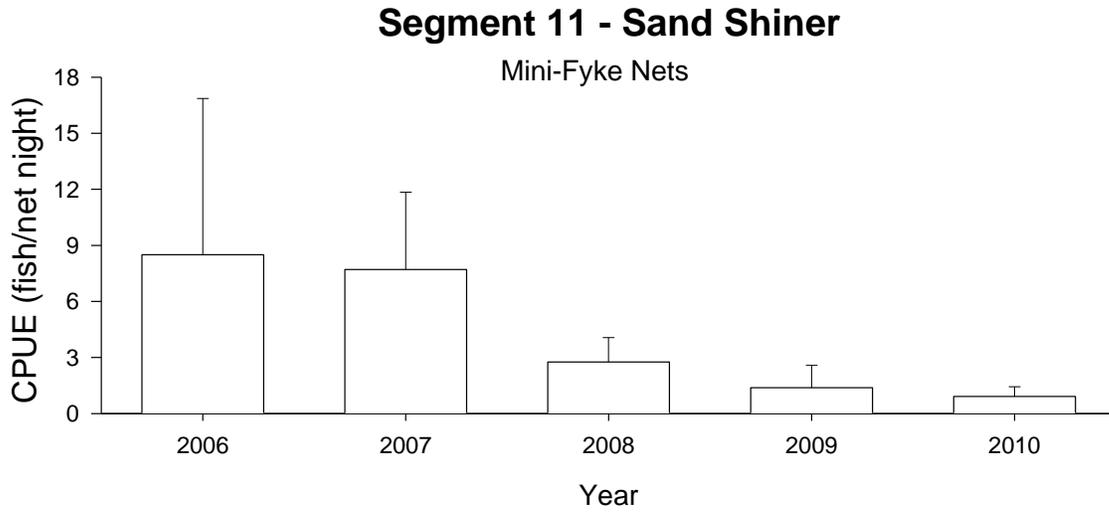


Figure 22. Mean annual catch per unit effort ( $\pm 2$  SE) of sand shiner with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2010.

## Segment 11 - Sand Shiner

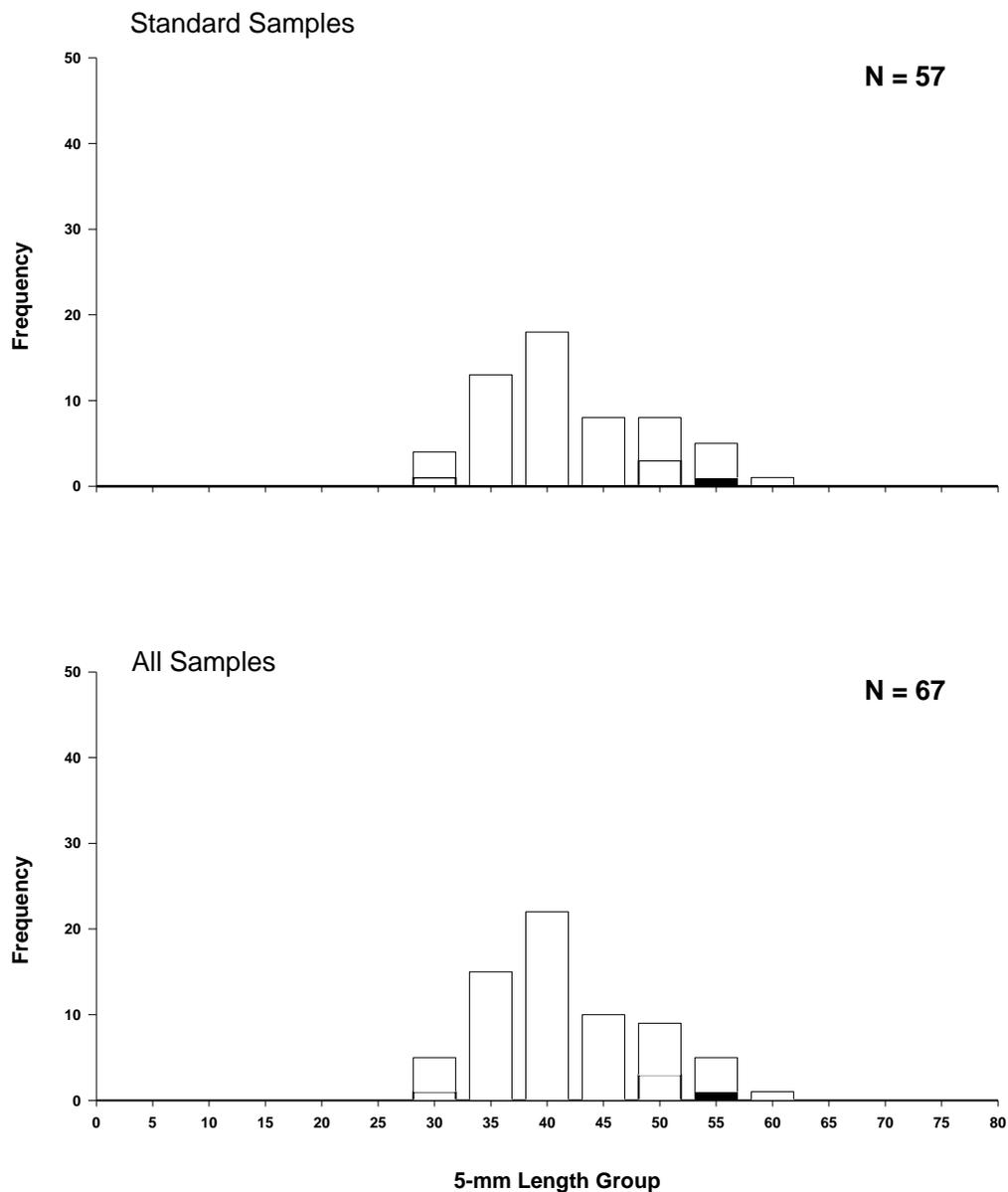


Figure 23. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

### ***Hybognathus* spp.**

There were only four *Hybognathus* spp. captured in segment 11 during 2010 with two captured in 2009, 15 captured in 2008 and four in 2007. One western silvery minnow was sampled in 2010 with the rest being plains minnows. Brassy minnows were captured in 2009, while 2007 and 2008 catches were comprised of plains minnows. Plains minnows were captured in mini-fyke nets in 2010 with the lone western silvery minnow captured in an otter trawl. Mini-fyke net CPUE was 0.053 fish/net night during the 2010 sampling season, which is slightly higher than the 2009 sampling season but still lower than in previous years (Figure 24).

Plains minnows captured in segment 11 during the 2010 sampling season were 44 mm and 58 mm in length and 34 mm for the single western silvery minnow. All *Hybognathus* spp. were sampled below the Johnson County Weir. In previous years, only one *Hybognathus* spp. was sampled above the Weir.

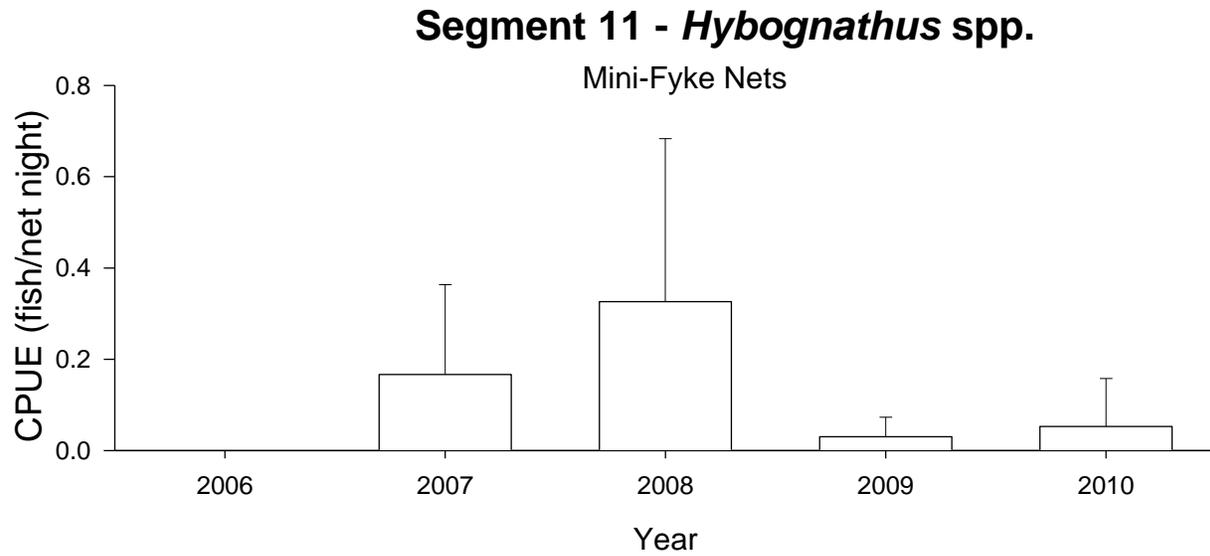


Figure 24. Mean annual catch per unit effort ( $\pm 2$  SE) of *Hybognathus* spp. with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2010.

## Segment 11 - *Hybognathus* spp.

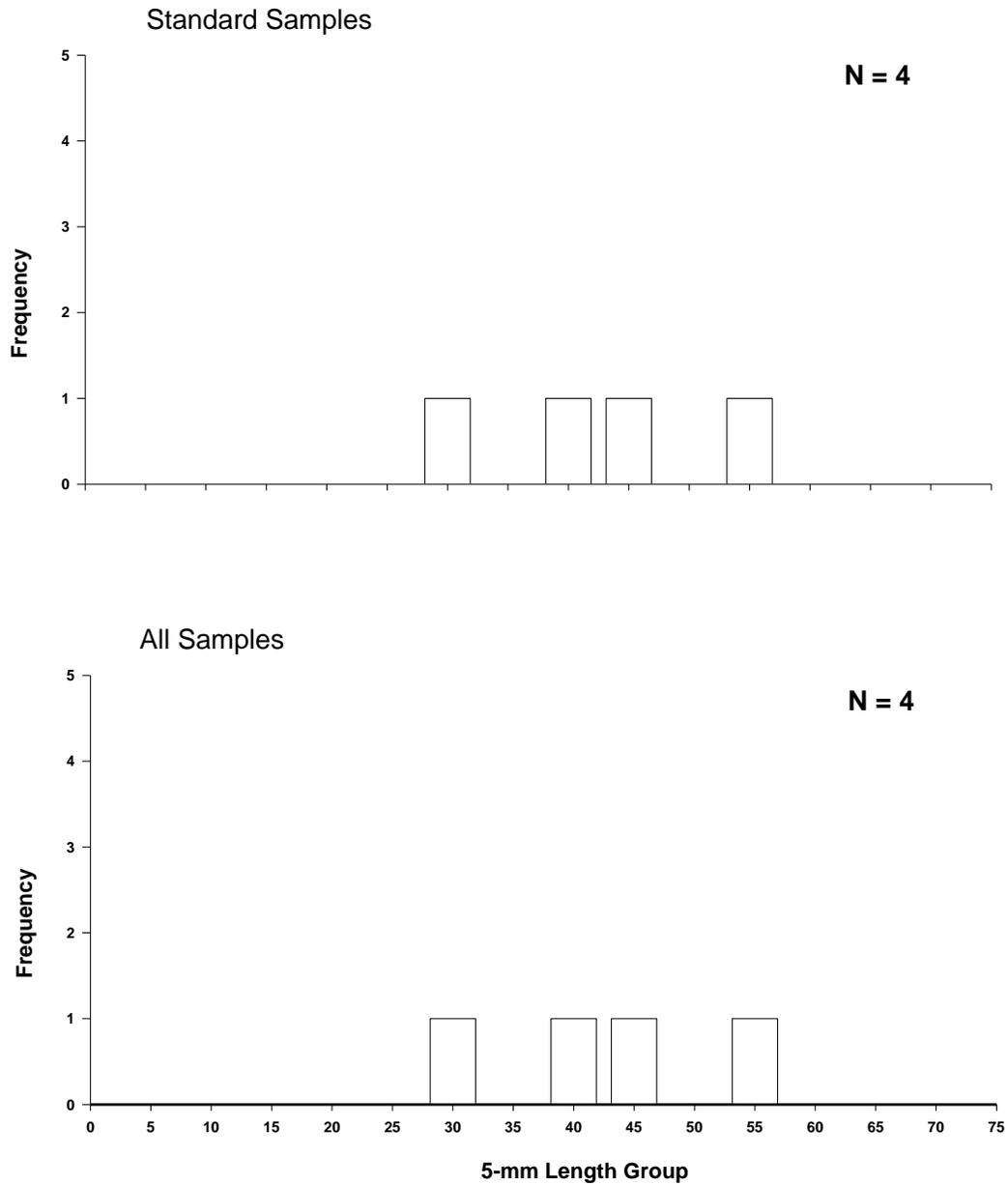


Figure 25. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

## **Blue Sucker**

A total of 22 blue sucker was captured with standard gears in segment 11 during the 2010 sampling season. This is up from 2009 (N=14) and 2008 (N = 17). Three additional fish were sampled using wild gears (push trawls and trotlines). Gill nets were the most effective gear for sampling blue sucker in segment 11 in 2010, with overall CPUE for trammel nets continuing to decline for the third straight year (Figure 27). Otter trawls captured five fish which equals their catch from 2009 (Figure 26 and Figure 28).

Total lengths ranged from 233 to 799 mm for fish captured with standard gears and 634 to 716 mm for fish captured in wild gears (Figure 29). These smaller fish have not been captured previously. Blue suckers were captured primarily in channel crossovers, inside bend, outside bend, side channel connected large, and braided macrohabitats (Table 14). Blue sucker were found both below and above the Johnson County Weir.

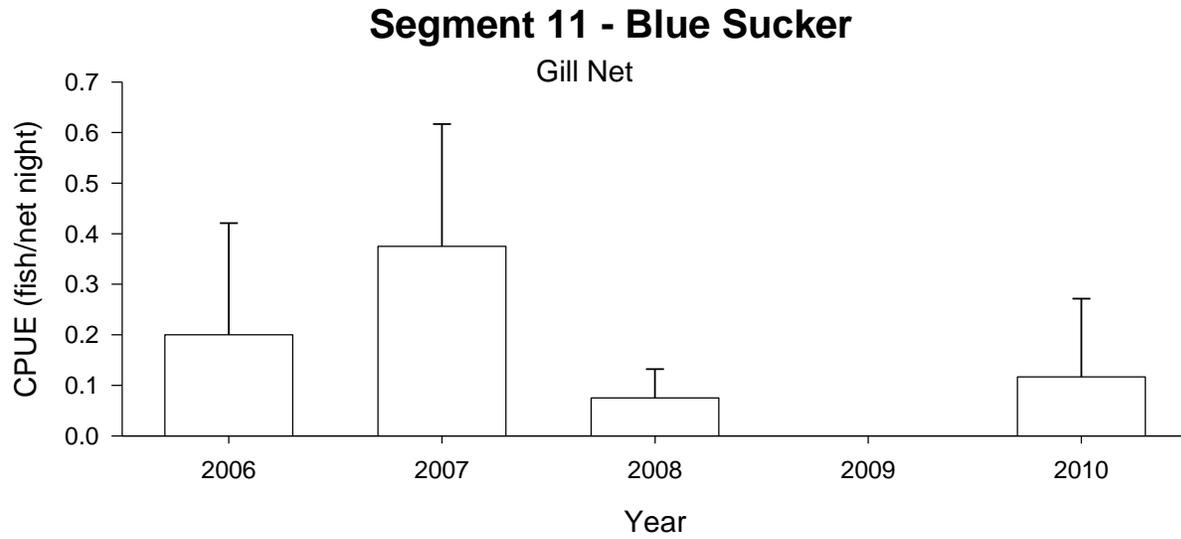


Figure 26. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using gill nets in Segment 11, the Kansas River, from 2006-2010.

## Segment 11 - Blue Sucker

1.0" Trammel Nets

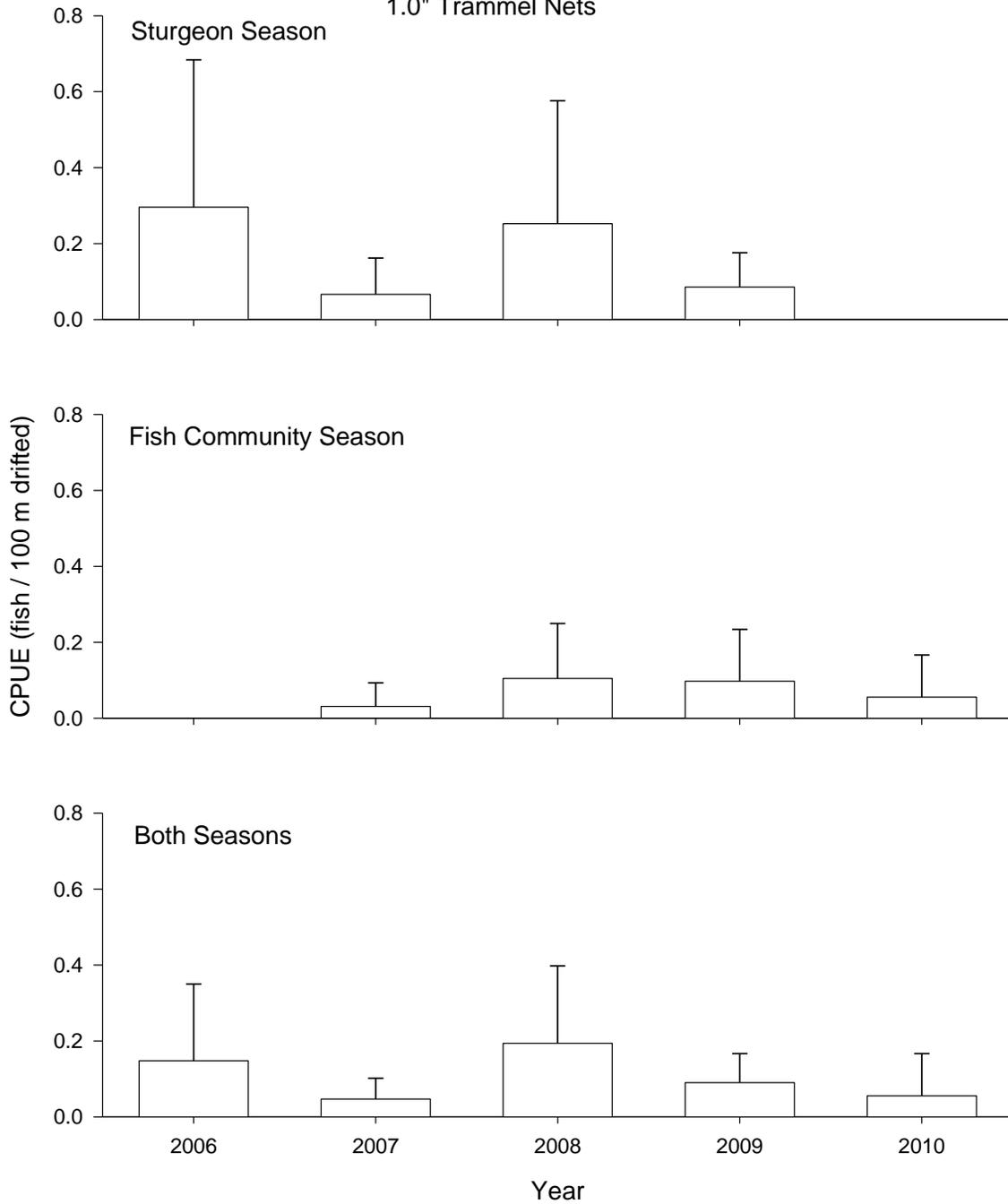


Figure 27. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using 1.0" trammel nets in Segment 11, the Kansas River, from 2006-2010.

### Segment 11 - Blue Suckers

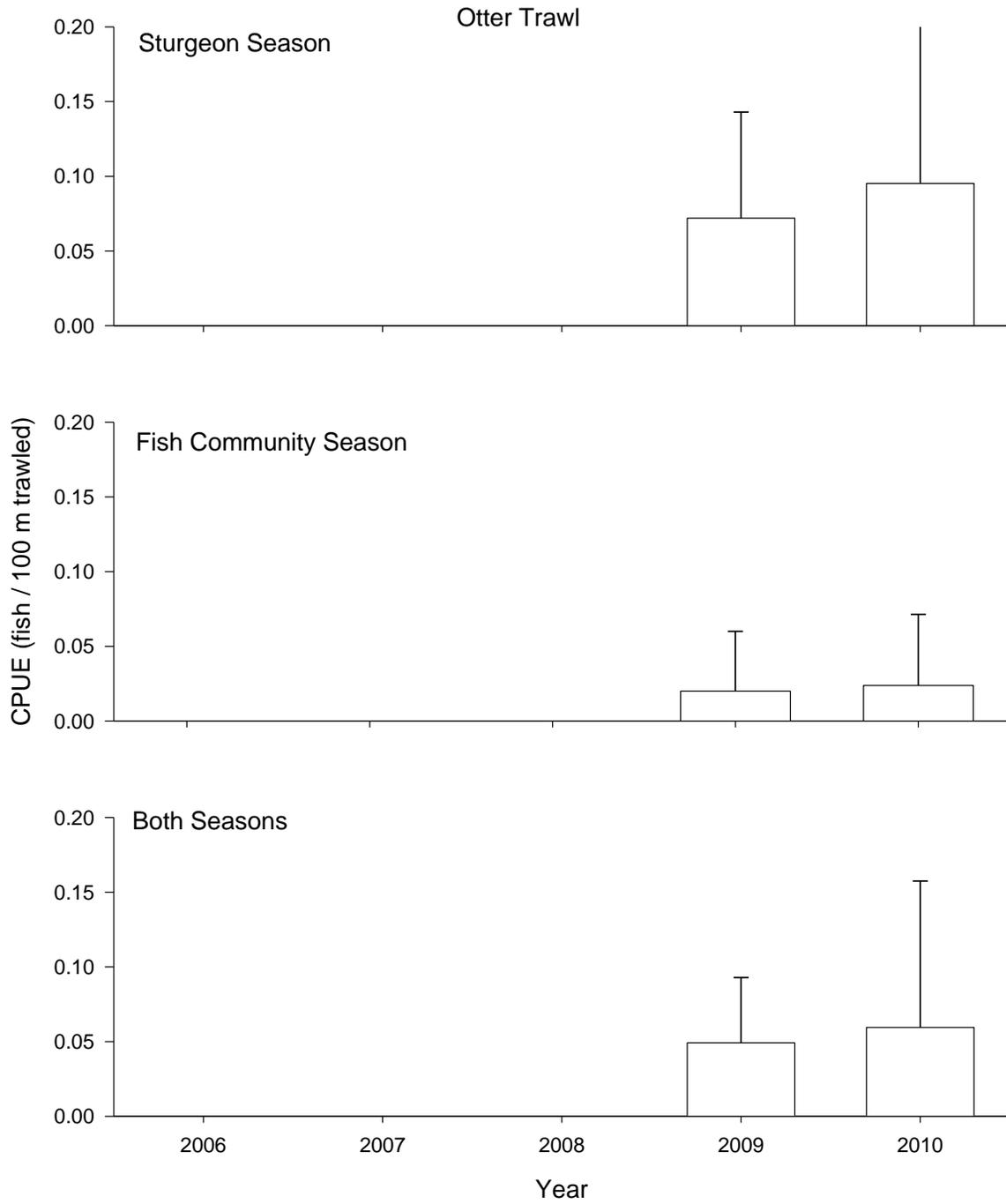


Figure 28. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using otter trawls in Segment 11, the Kansas River, from 2006-2010.

Table 14. Total number of blue sucker captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	14	0	21	0	N-E	N-E	0	64	14	0	0	N-E	0	0
		0	30	0	N-E	N-E	32	37	2	0	0	N-E	0	0
Otter Trawl	4	0	0	0	N-E	N-E	100	0	0	0	0	N-E	0	0
		14	19	0	N-E	N-E	36	28	3	0	0	N-E	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	1	0	0	0	N-E	N-E	0	0	100	0	0	N-E	0	0
		0	25	0	N-E	N-E	35	32	8	0	0	N-E	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		7	18	0	N-E	N-E	25	18	14	7	4	N-E	9	0
Otter Trawl	1	100	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		12	19	0	N-E	N-E	37	17	15	0	0	N-E	0	0
<b>Both Seasons</b>														
Trotline	2	0	0	0	N-E	N-E	0	50	50	0	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

## Segment 11 - Blue Sucker

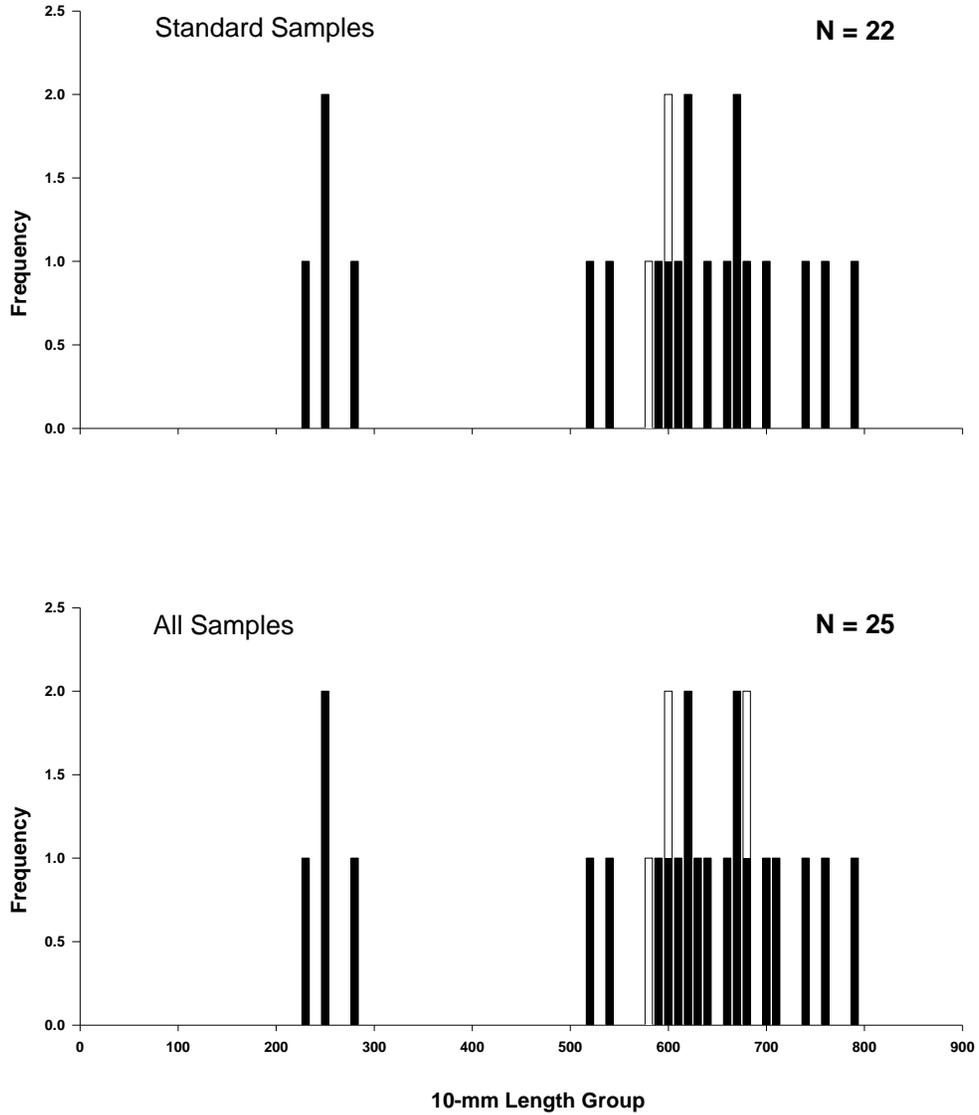


Figure 29. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

## **Sauger**

Only three sauger were captured in segment 11 during the 2010 sampling season. This is a decrease from 2009 where a total of 19 sauger was captured and no sauger were captured during the 2008 sampling year. Three sauger were captured in segment 11 during the 2007 sampling season, which is equal to catch in 2006. Two sauger were captured in gill nets with the other captured in a mini-fyke net.

Sauger captured during the sturgeon season were 458 and 477 mm in length, while the lone individual sampled during the fish community season was 232 mm (Figure 33). Sauger were found in channel crossover and small tributary mouth macrohabitats (Table 15). One sauger was collected below the Johnson County Weir during the 2010 sampling season.

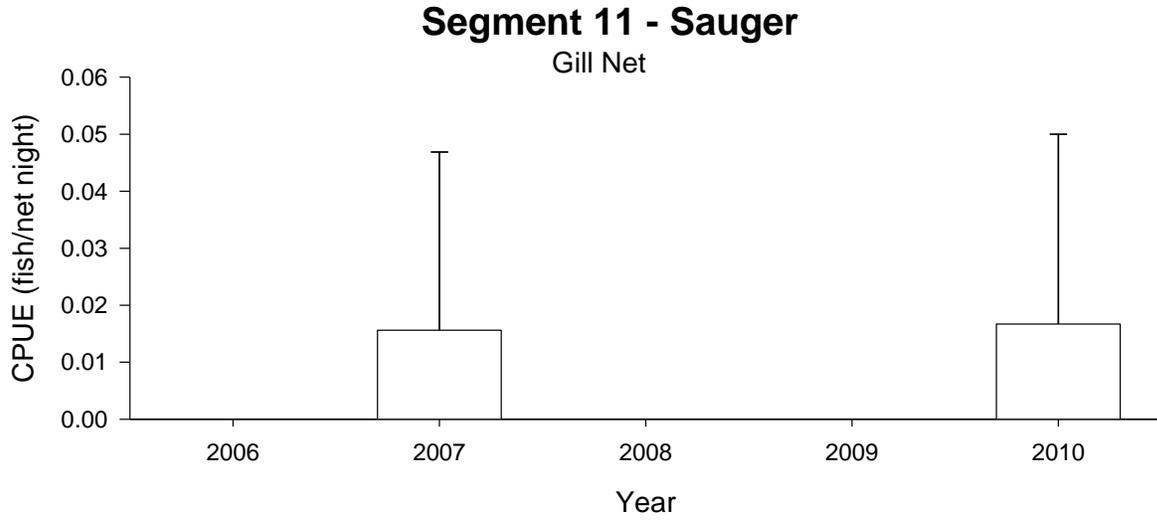


Figure 30. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using gill nets and in Segment 11, the Kansas River, from 2006-2010.

### Segment 11 - Sauger

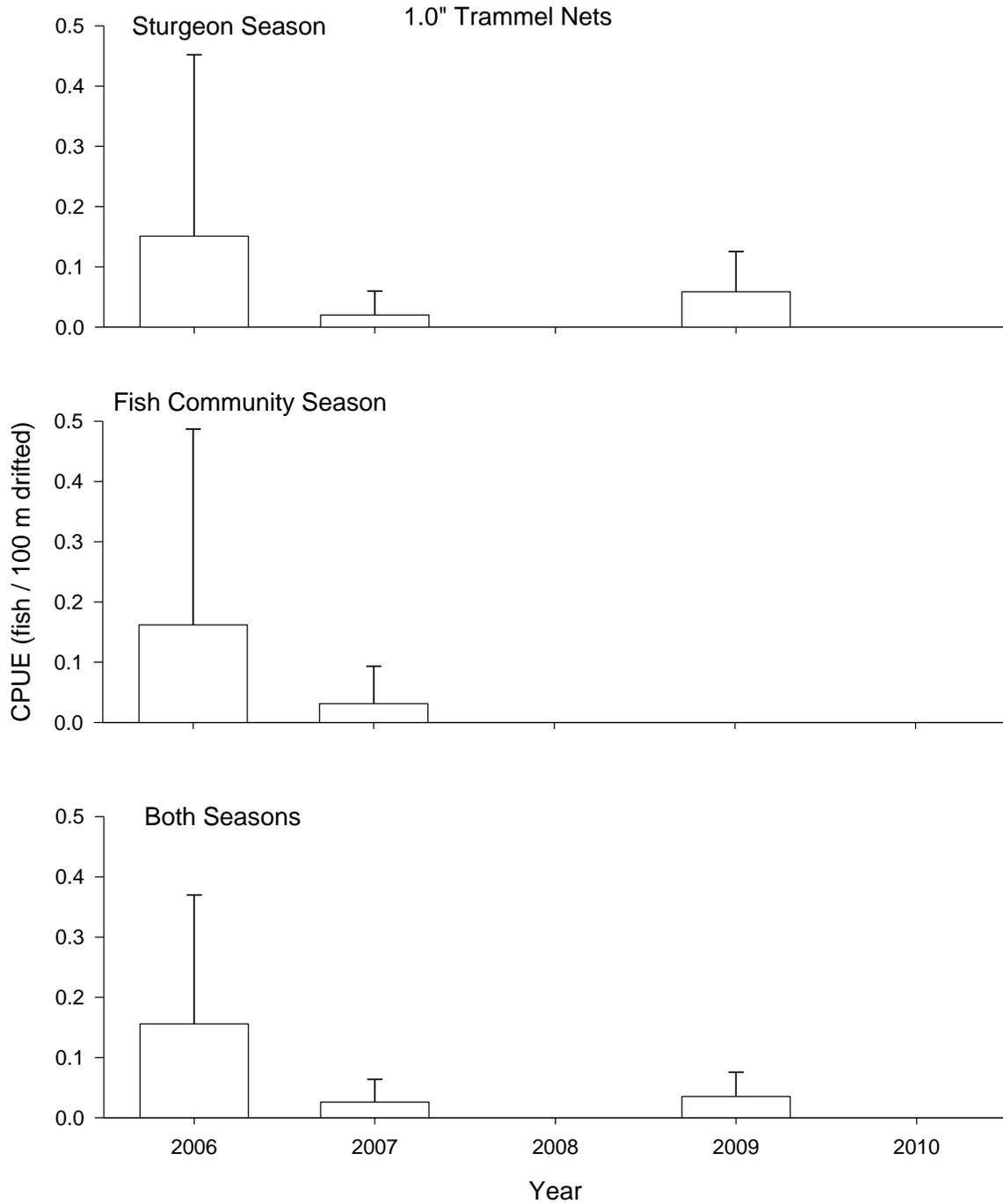


Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0" trammel nets in Segment 11, the Kansas River, from 2006-2010.

## Segment 11 - Sauger

Otter Trawl

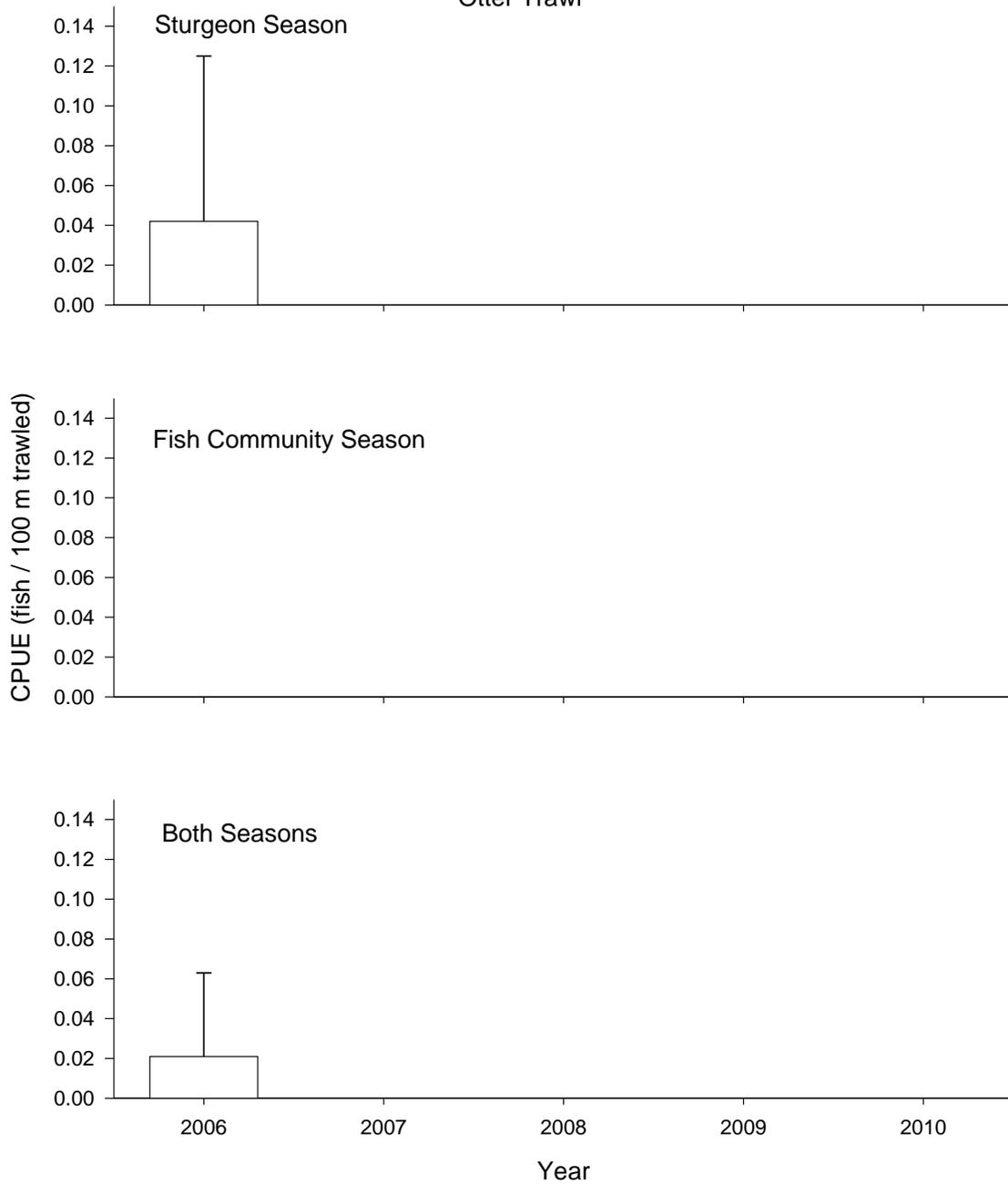


Figure 32. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using otter trawls in Segment 11, the Kansas River, from 2006-2010.

Table 15. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
<b>Sturgeon Season</b>														
Gill Net	2	0	100	0	0	0	0	0	0	0	0	0	0	0
		0	30	0	0	0	32	37	2	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		14	19	0	0	0	36	28	3	0	0	0	0	0
<b>Fish Community Season</b>														
1.0" Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	25	0	0	0	35	32	8	0	0	0	0	0
Mini-Fyke Net	1	0	0	0	0	0	0	0	0	0	0	0	100	0
		7	18	0	0	0	25	18	14	7	4	0	9	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		12	19	0	0	0	37	17	15	0	0	0	0	0
<b>Both Seasons</b>														
Trotline	0	0	0	0	N-E	N-E	0	0	0	0	0	N-E	0	0
		0	17	0	N-E	N-E	31	36	14	2	0	N-E	0	0

## Segment 11 - Sauger

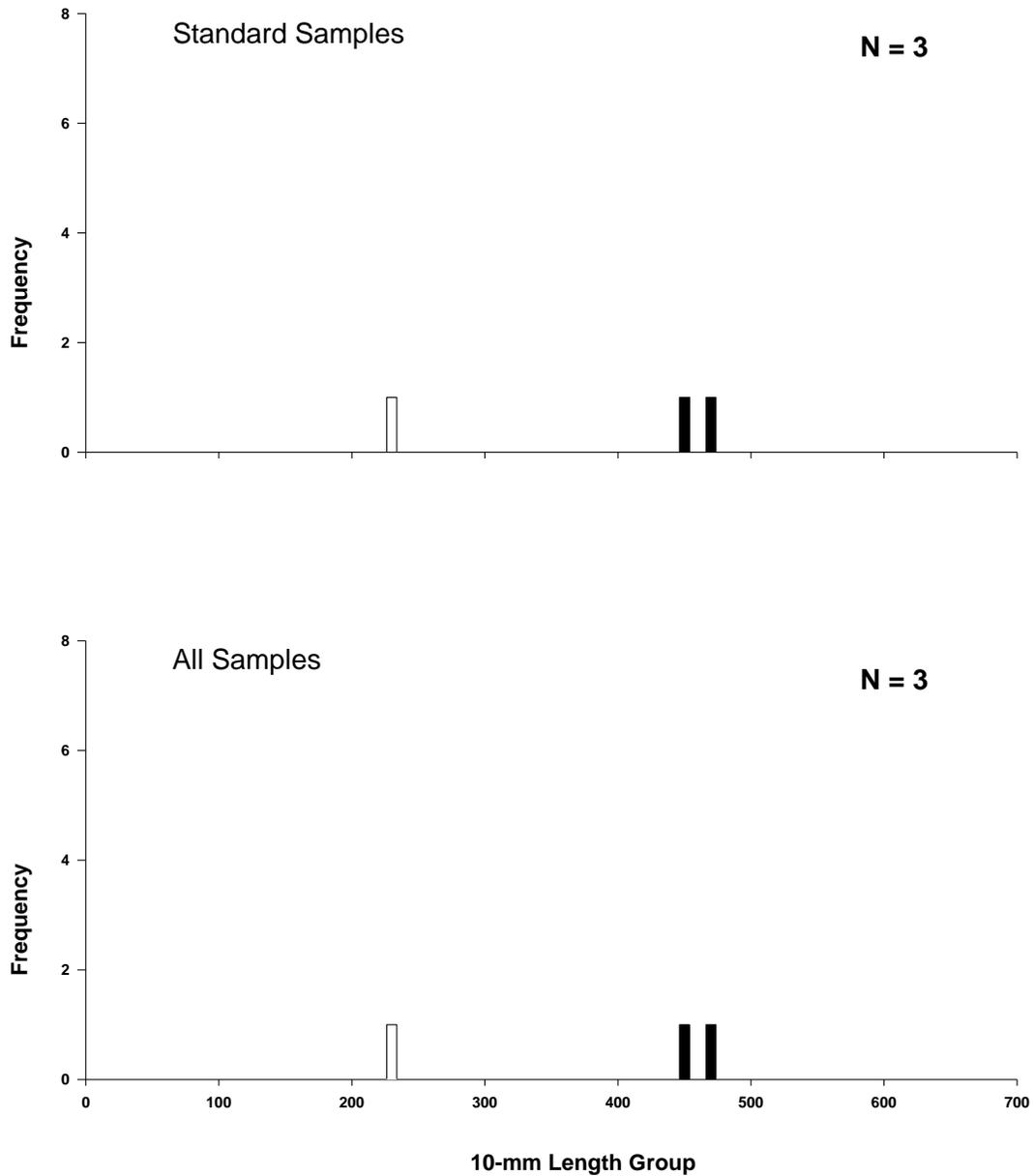


Figure 33. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

## Kansas River Fish Community

A total of 4,173 fish representing 56 species was captured with standard gears in segment 11 during the 2010 sampling season, which was more fish than 2007 and 2008 (N = 3,254 and 3,944, respectively), but fewer fish than 2009 (N = 5,023). The increase in the number of fish captured in 2009 and 2010 was primarily due to the initiation of standard deployments in the unchannelized section (RM 21 - 52). Sixteen (N = 9 in 2007, 7 in 2008, and 15 in 2009) non-target species were represented by at least 50 individuals with non-target species comprising 75% of the total catch during the 2010 sampling year, which is a decrease from the last four years of sampling (90% in 2009, 86% in 2008, 76% in 2007 and 82% in 2006). This decrease in the proportion of non-target species was primarily due to trotlines becoming standardized and the high catch rate of shovelnose sturgeon on trotlines. Catch from bars mesohabitats accounted for 60% (65%, 79%, 60% and 54% in 2009, 2008, 2007 and 2006, respectively) of the total catch. Thirty percent of fish were captured in the channel border. Very few fish were captured from pool areas (< 1%).

Gill nets captured 20 species (13 in both 2006 and 2008, 20 in 2007, and 14 in 2009), with shovelnose sturgeon as the only species represented by more than 50 individuals (Appendix F1). Gill nets captured the most shovelnose sturgeon (N = 442) compared to other standard gears. Gill nets captured the largest specimens of blue catfish (443 – 794 mm) and goldeye (298 – 380 mm) compared to other standard gears. Gill net CPUE's for blue catfish and goldeye were 0.050 and 0.183 fish/net night, respectively. Notable captures in gill nets include quillback and shorthead redhorse.

One-inch trammel nets captured 12 species of fish. Besides shovelnose sturgeon (CPUE = 1.867 fish/ 100 m drifted), silver carp (CPUE = 1.722 fish/100 m) were captured most efficiently with oneinch trammel nets (Appendix F2). Channel catfish (271 mm; CPUE = 0.056 fish/100 m) and blue catfish (276 – 310 mm; CPUE = 0.111 fish/100 m) were captured in low numbers (N = 1 and 2, respectively).

Otter trawls captured 22 species (15 in 2007, 20 in 2006, 18 in 2008, and 15 in 2009) including two non-target species with more than 50 individuals (Appendix F4). Blue and channel catfish (CPUE = 1.596 and 1.884 fish/100 m, respectively) were most effectively captured with otter trawls. Notable captures in otter trawls were stonecat (N = 8) and one western silvery minnow at 34 mm in length.

Mini-fyke nets captured 45 species of fish (21 in 2006, 30 in 2007, 35 in 2008, and 45 in 2009), including ten species represented by at least 50 individuals (Appendix F6). Mini-fyke nets were the most effective gear to sample the following non-target Kansas River species (CPUE = number of fish/net night): gizzard shad = 8.596, freshwater drum = 7.982, channel catfish = 3.368, bluegill = 2.632, white bass = 2.561, red shiner = 1.947, bullhead minnow = 1.842, ermerald shiner = 1.719, and common carp = 1.649. Average CPUE's decreased slightly from previous years captures of non-target species.

## Discussion

Two hatchery-stocked pallid sturgeon were captured in segment 11 with trotlines during standard sampling. An additional five pallid sturgeon were captured with trotlines during our targeted broodstock collection efforts. These pallid sturgeon, with the addition of four hatchery-stocked pallid sturgeon captured in 2009 and one hatchery-stocked pallid sturgeon captured in 2007, are the first to be captured in the Kansas River since 1952 (Horner et al. 2010; Niswonger et al. 2008; The University of Kansas Natural History Museum). These captures occurred below the Johnson County Weir (Weir), and are a result of the pallid sturgeon propagation program that began in 1992, and has resulted in a stocking event into the Missouri River every year since 2001. There has not yet been a wild pallid sturgeon capture below the Weir or any pallid sturgeon captured above the Weir, in the unchannelized portion of the Kansas River. There are likely to be more pallid sturgeon captured in the Kansas River as more are stocked.

Pallid sturgeon are documented to use other tributaries, including the Yellowstone, Platte, and Atchafayla rivers (USFWS 2000). Bramblett and White (2001) observed pallid sturgeon in the Yellowstone River exhibiting spawning behavior. This study also showed a preference to sandy substrate. The closest resemblance to the Yellowstone River that occurs in the Kansas River is in the unchannelized section above the Weir. If pallid sturgeon have been extirpated from this section of the river, it is possible that mature hatchery-stocked pallid sturgeon from the Missouri may make it above the Weir to spawn.

Trotlines were standardized during the 2010 sampling season. During the 2010 standard, random sampling season the overall CPUE of pallid sturgeon on trotlines (0.025 fish/ 20 hooks) was slightly higher than in gill nets (0.00 fish/ net night). Trotlines used in the Missouri River have captured a larger number of pallid sturgeon than other gears used (Niswonger et al. 2011).

The majority of shovelnose sturgeon sampled in the Kansas River each year were preferred size class and above ( $\geq 510$  mm) fish. A total of 983 shovelnose sturgeon was captured with standard gears in eight bends in segment 11 during the 2010 season and is the largest catch of shovelnose sturgeon over all the years of sampling there. Young-of-year (YOY) sturgeon were classified as *Scaphirhynchus* spp. under 170 mm (Steffensen and Hamel 2008). These fish were assumed to be shovelnose sturgeon due to the much larger numbers of shovelnose sturgeon compared to pallid sturgeon found in the Kansas River, and the fact that no wild pallid sturgeon have been captured in the River since 1952. There have been 23 YOY sturgeon captured in the Kansas River since sampling began. The first YOY sturgeon captured were in 2008, when eight

were captured with push trawls (N = 5) and otter trawls (N = 3; 22 – 154 mm). Since 2008, three YOY sturgeon were detected in all sampling in 2009 and twelve YOY sturgeon were detected in all sampling in 2010. In total, only five of these fish were sampled below the Johnson County Weir. The first year that we sampled extensively above the Weir using push trawls was 2008. A total of 3,047 meters was push trawled above the Weir in 2008 which captured five YOY sturgeon. However, more than double that amount of effort was trawled in 2009 (6,267 m), yet only two YOY were captured. During the 2010 sampling season 2,626 m were push trawled, and two YOY were sampled above the Weir. During the past two years there have been spring and summer high water events in the Midwest. These increased flows may potentially increase successful recruitment of *Scaphirhynchus* spp. in the Kansas River.

A large part of our sampling (nearly 50% in 2010) in segment 11 occurs below the Johnson County Weir (RM 0 – 14.7) where the Kansas River flows through a highly industrialized portion of the Kansas City metropolitan area. High concentrations of nitrogen and phosphorus have been documented in water quality studies on the Kansas River (Rasmussen et al. 2005) and poor water quality associated with urban environments (Herman et al. 2008) may be the cause of low numbers or absence of many native benthic fishes.

Shoal chub is the only *Macrhybopsis* species to have been captured both below and above the Weir. Shoal chub catch decreased in 2010 with only six fish being sampled, down from 2009 (N = 16), but similar to 2008 (N = 9) and 2007 (N = 6). Sicklefin chub have only been captured within one to two river miles upstream from the confluence of the Kansas River and only in 2006, 2008, and 2010. No sturgeon chub have been captured in five years of sampling in segment 11. Total numbers of sand shiner captured in segment 11 has been decreasing since 2007. Like the previous year, only one individual sand shiner was captured below the Johnson County Weir. Four *Hybognathus* spp. were captured in 2010 compared to 2 in 2009, 15 in 2008, and 4 in 2007. Both individuals in 2009 were brassy minnows, while 2007, 2008 and 2010 catches were comprised primarily of plains minnows and one western silvery minnow. Currently only one *Hybognathus* spp. has been sampled above the Weir.

A total of 22 blue sucker was captured with standard gears in segment 11 during the 2010 sampling season which is slightly higher than the previous two years. A study conducted on the Kansas River from 2005 to 2006 found no blue sucker below the Weir, but an abundance in the upper portions of the river (Eitzman et al. 2007). Our field office has captured 37 blue sucker above the Weir and 53 below using all gears since sampling started. Only large blue sucker (581

– 838 mm) were sampled in the first three years of our study with three YOY fish (32 to 37 mm) sampled above the Weir in 2009 using a push trawl. In 2010 smaller blue sucker were sampled with total lengths ranging from 233 to 799 mm for fish captured with standard gears. The lack of small (i.e., juvenile) blue sucker has been noted in the main stem Missouri River as well by LaBay et al. (2008), and may be the result of sampling bias. Blue sucker may prefer tributaries like the Kansas and Grand rivers and upper reaches of larger rivers for their spawning and rearing areas (Vokoun et al. 2003). Others have suggested that low catch rates of small blue sucker may be related, in part, to high growth rates of age-0 and age-1 blue sucker (Oldenburg et al. 2010).

Only three large sauger (232 – 477 mm) were captured in segment 11 during the 2010 sampling season. This is a decrease from 2009 where a total of 19 sauger was captured. One sauger was collected below the Johnson County Weir during the 2010 sampling season. The 2009 sampling season continues to be the only year YOY sauger were sampled, when 16 were collected ranging in length from 40 to 67 mm. All these fish were captured in one day near the mouth of the Kansas River. These are by far the smallest sauger captured in the Kansas River. There have only been five sauger under 100 mm captured in segment 10 of the Missouri River within PSPAP sampling, and four of these were also captured during 2009 (Horner et al. 2010).

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Appendix A. Phylogenetic list of Missouri River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5<sup>th</sup> edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
<b>Petromyzontidae – lampreys</b>		
<i>Ichthyomyzon castaneus</i>	Chestnut lamprey	CNLP
<i>Ichthyomyzon fossor</i>	Northern brook lamprey	NBLP
<i>Ichthyomyzon unicuspis</i>	Silver lamprey	SVLP
<i>Ichthyomyzon gagei</i>	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
CLASS OSTEICHTHYES – BONY FISHES		
ORDER ACIPENSERIFORMES		
<b>Acipenseridae – sturgeons</b>		
<i>Acipenser fulvescens</i>	Lake sturgeon	LKSG
<i>Scaphirhynchus</i> spp.	Unidentified Scaphirhynchus	USG
<b><i>Scaphirhynchus albus</i></b>	<b>Pallid sturgeon</b>	<b>PDSG*</b>
<b><i>Scaphirhynchus platyrhynchus</i></b>	<b>Shovelnose sturgeon</b>	<b>SNSG*</b>
<i>S. albus</i> X <i>S. platyrhynchus</i>	Pallid-shovelnose hybrid	SNPD
<b>Polyodontidae – paddlefishes</b>		
<i>Polyodon spathula</i>	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
<b>Lepisosteidae – gars</b>		
<i>Lepisosteus oculatus</i>	Spotted gar	STGR
<i>Lepisosteus osseus</i>	Longnose gar	LNGR
<i>Lepisosteus platostomus</i>	Shortnose gar	SNGR
ORDER AMMIFORMES		
<b>Amiidae – bowfins</b>		
<i>Amia calva</i>	Bowfin	BWFN
ORDER OSTEOGLOSSIFORMES		
<b>Hiodontidae – mooneyes</b>		
<i>Hiodon alosoides</i>	Goldeye	GDEY
<i>Hiodon tergisus</i>	Mooneye	MNEY
ORDER ANGUILLIFORMES		
<b>Anguillidae – freshwater eels</b>		
<i>Anguilla rostrata</i>	American eel	AMEL
ORDER CLUPEIFORMES		
<b>Clupeidae – herrings</b>		
<i>Alosa alabame</i>	Alabama shad	ALSD
<i>Alosa chrysochloris</i>	Skipjack herring	SJHR
<i>Alosa pseudoharengus</i>	Alewife	ALWF
<i>Dorosoma cepedianum</i>	Gizzard shad	GZSD
<i>Dorosoma petenense</i>	Threadfin shad	TFSD

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>D. cepedianum</i> X <i>D. petenense</i>	Gizzard-threadfin shad hybrid	GSTS
<b>ORDER CYPRINIFORMES</b>		
<b>Cyprinidae – carps and minnows</b>		
<i>Campostoma anomalum</i>	Central stoneroller	CLSR
<i>Campostoma oligolepis</i>	Largescale stoneroller	LSSR
<i>Carassius auratus</i>	Goldfish	GDFH
<i>Carassius auratus</i> X <i>Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<b><i>Hybognathus argyritis</i></b>	<b>Western silvery minnow</b>	<b>WSMN*</b>
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<b><i>Hybognathus placitus</i></b>	<b>Plains minnow</b>	<b>PNMW*</b>
<i>Hybognathus</i> spp.	Unidentified <i>Hybognathus</i>	HBNS
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<b><i>Macrhybopsis aestivalis</i></b>	<b>Shoal chub</b>	<b>SKCB*</b>
<b><i>Macrhybopsis gelida</i></b>	<b>Sturgeon chub</b>	<b>SGCB*</b>
<b><i>Macrhybopsis meeki</i></b>	<b>Sicklefin chub</b>	<b>SFCB*</b>
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. aestivalis</i> X <i>M. gelida</i>	Shoal-Sturgeon chub hybrid	SPST
<i>M. gelida</i> X <i>M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennioides</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis buchanaui</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greeniei</i>	Wedgespot shiner	WSSN
<b>Cyprinidae – carps and minnows</b>		
<i>Notropis heterolepis</i>	Blacknose shiner	BNSN
<i>Notropis hudsonius</i>	Spottail shiner	STSN
<i>Notropis nubilus</i>	Ozark minnow	OZMW
<i>Notropis rubellus</i>	Rosyface shiner	RYSN
<i>Notropis shumardi</i>	Silverband shiner	SBSN
<i>Notropis stilbius</i>	Silverstripe shiner	SSPS
<b><i>Notropis stramineus</i></b>	<b>Sand shiner</b>	<b>SNSN*</b>
<i>Notropis topeka</i>	Topeka shiner	TPSN
<i>Notropis volucellus</i>	Mimic shiner	MMSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Notropis wickliffi</i>	Channel shiner	CNSN
<i>Notropis</i> spp.	Unidentified shiner	UNO
<i>Opsopoeodus emiliae</i>	Pugnose minnow	PNMW
<i>Phenacobius mirabilis</i>	Suckermouth minnow	SMMW
<i>Phoxinus eos</i>	Northern redbelly dace	NRBD
<i>Phoxinus erythrogaster</i>	Southern redbelly dace	SRBD
<i>Phoxinus neogaeus</i>	Finescale dace	FSDC
<i>Pimephales notatus</i>	Bluntnose minnow	BNMW
<i>Pimephales promelas</i>	Fathead minnow	FHMW
<i>Pimephales vigilax</i>	Bullhead minnow	BHMW
<i>Platygobio gracilis</i>	Flathead chub	FHCB
<i>P. gracilis</i> X <i>M. meeki</i>	Flathead-sicklefin chub hybrid	FCSC
<i>Rhinichthys atratulus</i>	Blacknose dace	BNDC
<i>Rhinichthys cataractae</i>	Longnose dace	LNDC
<i>Richardsonius balteatus</i>	Redside shiner	RDSS
<i>Scardinius erythrophthalmus</i>	Rudd	RUDD
<i>Semotilus atromaculatus</i>	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
	<b>Catostomidae - suckers</b>	
<i>Carpiodes carpio</i>	River carpsucker	RVCS
<i>Carpiodes cyprinus</i>	Quillback	QLBK
<i>Carpiodes velifer</i>	Highfin carpsucker	HFCS
<i>Carpiodes</i> spp.	Unidentified Carpiodes	UCS
<i>Catostomus catostomus</i>	Longnose sucker	LNSK
<i>Catostomus commersonii</i>	White sucker	WTSK
<i>Catostomus platyrhynchus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<b><i>Cycleptus elongatus</i></b>	<b>Blue sucker</b>	<b>BUSK*</b>
<i>Hypentelium nigricans</i>	Northern hog sucker	NHSK
<i>Ictiobus bubalus</i>	Smallmouth buffalo	SMBF
<i>Ictiobus cyprinellus</i>	Bigmouth buffalo	BMBF
<i>Ictiobus niger</i>	Black buffalo	BKBF
<i>Ictiobus</i> spp.	Unidentified buffalo	UBF
<i>Minytrema melanops</i>	Spotted sucker	SPSK
<i>Moxostoma anisurum</i>	Silver redhorse	SVRH
<i>Moxostoma carinatum</i>	River redhorse	RVRH
<i>Moxostoma duquesnei</i>	Black redhorse	BKRH
<i>Moxostoma erythrurum</i>	Golden redhorse	GDRH
<i>Moxostoma macrolepidotum</i>	Shorthead redhorse	SHRH
<i>Moxostoma</i> spp.	Unidentified redhorse	URH
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
	<b>ORDER SILURIFORMES</b>	
	<b>Ictaluridae – bullhead catfishes</b>	
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurus nebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnus</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
<b>ORDER SALMONIFORMES</b>		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarkii</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonneville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL
<b>ORDER PERCOPSIFORMES</b>		
<b>Percopsidae – trout-perches</b>		
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
<b>ORDER GADIFORMES</b>		
<b>Gadidae - cods</b>		
<i>Lota lota</i>	Burbot	BRBT
<b>ORDER ATHERINIFORMES</b>		
<b>Cyprinodontidae - killifishes</b>		
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus diaphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	<b>Poeciliidae - livebearers</b>	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	<b>Atherinidae - silversides</b>	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	<b>Gasterosteidae - sticklebacks</b>	
<i>Culaea inconstans</i>	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	<b>Cottidae - sculpins</b>	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	<b>Moronidae – temperate basses</b>	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	<b>Centrarchidae - sunfishes</b>	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis megalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG
	<b>Centrarchidae - sunfishes</b>	
<i>L. cyanellus X L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus X L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctulatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis X P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified Centrarchidae	UCN
	<b>Percidae - perches</b>	
<i>Ammocrypta asprella</i>	Crystal darter	CLDR

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orange throated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caprodes</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculata</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER*</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
	<b>Sciaenidae - drums</b>	
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
	<b>NON-TAXONOMIC CATEGORIES</b>	
	Age-0/Young-of-year fish	YOYF
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF
	<b>Turtles</b>	
<i>Chelydra serpentina</i>	Common Snapping Turtle	SNPT
<i>Chrysemys picta bellii</i>	Western Painted Turtle	PATT
<i>Emydoidea blandingii</i>	Blanding's Turtle	BLDT
<i>Graptemys pseudogeographica</i>	False Map Turtle	FSMT
<i>Trachemys scripta</i>	Red-Eared Slider Turtle	REST
<i>Apalone mutica</i>	Smooth Softshell Turtle	SMST
<i>Apalone spinifera</i>	Spiny Softshell Turtle	SYST
<i>Terrapene ornata ornata</i>	Ornate Box Turtle	ORBT
<i>Sternotherus odoratus</i>	Stinkpot Turtle	SPOT
<i>Graptemys geographica</i>	Map Turtle	MAPT
<i>Graptemys kohnii</i>	Mississippi Map Turtle	MRMT
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	OUMT
<i>Pseudemys concinna metterii</i>	Missouri River Cooter Turtle	MRCT
<i>Terrapene carolina triunguis</i>	Three-toed Box Turtle	TTBT

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendritic	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m <sup>3</sup> /s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m <sup>3</sup> /s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes in Segment 11 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for Segment 11.

<b>Gear</b>	<b>Code</b>	<b>Type</b>	<b>Season</b>	<b>Years</b>	<b>CPUE units</b>
Gill Net – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	Fish / net night
Trammel Net – 1.0”inner mesh	TN	Standard	Both Seasons	2003 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2003 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2003 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Hoop Net – 4 ft.	HN	Standard	Both Seasons	2003 - 2004	Fish / net night
Trammel Net – 2.5” inner mesh	TN25	Standard	Sturgeon	2005 – 2006	Fish / 100 m drift
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 – 2005	Fish / 100 m <sup>2</sup>
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m <sup>2</sup>
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m <sup>2</sup>
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m <sup>2</sup>
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m <sup>2</sup>
Bag seine – rectangular method pulled downstream	BSRD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m <sup>2</sup>
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2006	Fish / 100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trotline	TL	Standard	Both Seasons	2010	Fish / 20 hook nights

Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area (RPMA) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	R.M.
MT	GPMU	Forsyth	FOR	Yellowstone	253.2
MT	GPMU	Cartersville	CAR	Yellowstone	235.3
MT	GPMU	Miles City	MIC	Yellowstone	181.8
MT	GPMU	Fallon	FAL	Yellowstone	124.0
MT	GPMU	Intake	INT	Yellowstone	70.0
MT	GPMU	Sidney	SID	Yellowstone	31.0
MT	GPMU	Big Sky Bend	BSB	Yellowstone	17.0
ND	GPMU	Fairview	FRV	Yellowstone	9.0
MT	GPMU	Milk River	MLK	Milk	11.5
MT	GPMU	Mouth of Milk	MOM	Missouri	1761.5
MT	GPMU	Grand Champs	GRC	Missouri	1741.0
MT	GPMU	Wolf Point	WFP	Missouri	1701.5
MT	GPMU	Poplar	POP	Missouri	1649.5
MT	GPMU	Brockton	BRK	Missouri	1678.0
MT	GPMU	Culbertson	CBS	Missouri	1621.0
MT	GPMU	Nohly Bridge	NOB	Missouri	1590.0
ND	GPMU	Confluence	CON	Missouri	1581.5
SD/NE	CLMU	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	CLMU	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	CLMU	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	CLMU	Running Water	RNW	Missouri	840.1
SD/NE	CLMU	James River Conf		Missouri	800.1
SD/NE	CLMU	St. Helena	STH	Missouri	799.0
SD/NE	CLMU	Mullberry Bend	MUL	Missouri	775.0
NE/IA	CLMU	Ponca State Park	PSP	Missouri	753.0
SD/NE/IA	CLMU	Big Sioux River Conf		Missouri	734.0
NE/IA	CLMU	Sioux City	SIO	Missouri	732.6
NE/IA	CLMU	Sloan	SLN	Missouri	709.0
NE/IA	CLMU	Decatur	DCT	Missouri	691.0
NE/IA	CLMU	Wilson Island		Missouri	641.0
NE/IA	CLMU	Boyer Chute	BYC	Missouri	637.4
NE/IA	CLMU	Bellevue	BEL	Missouri	601.4
NE/IA	CLMU	Platte River Conf		Missouri	595.0
NE	CLMU	Platte River	PLR	Platte	5.0
NE/IA	CLMU	Rulo	RLO	Missouri	497.9
NE/MO	CLMU	Paynes Landing	PAY	Missouri	477.1
KS/MO	CLMU	Worthwine Chute		Missouri	458.5
KS/MO	CLMU	Kenmoor Bend	KEN	Missouri	438.1
KS/MO	CLMU	Atchison		Missouri	421.9
KS/MO	CLMU	Leavenworth	LVW	Missouri	397.0
MO/KS	CLMU	Parkville	PKV	Missouri	377.5
MO/KS	CLMU	Kansas River	KSR	Missouri	367.5
MO	CLMU	Liberty		Missouri	351.2
MO	CLMU	Kansas City	KAC	Missouri	342.0
MO	CLMU	Cooley Lake	COO	Missouri	339.5
MO	CLMU	Camden Bend	CAM	Missouri	327.0
MO	CLMU	Lexington		Missouri	312.2
MO	CLMU	Waverly	WAV	Missouri	299.0
MO	CLMU	Cranberry Chute	CBC	Missouri	282.3
MO	CLMU	Miami	MIA	Missouri	262.8
MO	CLMU	Grand River	GDR	Missouri	250.0
MO	CLMU	Boonville	BOO	Missouri	195.1
MO	CLMU	Overton	OVT	Missouri	185.1

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MO	CLMU	Hartsburg	HAR	Missouri	160.0
MO	CLMU	Jefferson City	JEF	Missouri	143.9
MO	CLMU	Mokane	MOK	Missouri	124.7
MO	CLMU	Hermann	HER	Missouri	97.6
MO	CLMU	Washington	WAS	Missouri	68.5
MO	CLMU	St. Charles	STC	Missouri	28.5

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Appendix E. There have not been any juvenile or adult pallid sturgeon stockings in Segment 11, the Kansas River.

<b>Year</b>	<b>Stocking Site</b>	<b>Number Stocked</b>	<b>Year Class</b>	<b>Stock Date</b>	<b>Age at Stocking<sup>a</sup></b>	<b>Primary Mark</b>	<b>Secondary Mark</b>
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## **Appendix F**

Total catch, overall mean catch per unit effort ( $\pm 2$  SE), and mean CPUE by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 11, the Kansas River, during 2010. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when  $N < 2$ .

Appendix F1. Gill net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD		CHXO		CONF	ISB		OSB		SCCL			SCN		
			CHNB	POOL	CHNB	POOL	CHNB	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	CHNB	POOL	
BLCF	6	0.05			0	0		0.059	0	0	0.222						
		0.057			0	0		0.081	0	0	0.338						
BMBF	1	0.008			0	0		0	0	0.038	0						
		0.017			0	0		0	0	0.077	0						
<b>BUSK</b>	<b>14</b>	<b>0.117</b>			<b>0.094</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0.5</b>			<b>1</b>			
		<b>0.155</b>			<b>0.101</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>						
CARP	2	0.017			0	0		0	0	0	0.111						
		0.023			0	0		0	0	0	0.147						
CNCF	5	0.042			0	0.5		0.029	0	0.077	0						
		0.049			0	1		0.059	0	0.154	0						
FHCF	1	0.008			0	0		0.029	0	0	0						
		0.017			0	0		0.059	0	0	0						
FWDM	1	0.008			0	0		0.029	0	0	0						
		0.017			0	0		0.059	0	0	0						
GDEY	22	0.183			0	0		0	0	0.423	0.611						
		0.246			0	0		0	0	0.846	1.103						
GSCP	3	0.025			0	0		0	0	0.077	0.056						
		0.037			0	0		0	0	0.154	0.111						
GZSD	1	0.008			0	0		0.029	0	0	0						
		0.017			0	0		0.059	0	0	0						
LNGR	34	0.283			0.094	0		0.059	0	0.846	0.278			1			
		0.314			0.136	0		0.081	0	1.375	0.556						
QLBK	5	0.042			0	0		0	0	0.192	0						
		0.068			0	0		0	0	0.311	0						
RVCS	7	0.058			0.063	0.25		0.029	0	0.077	0.056						
		0.054			0.125	0.5		0.059	0	0.154	0.111						
SBWB	1	0.008			0	0		0	0	0.038	0						
		0.017			0	0		0	0	0.077	0						
<b>SGER</b>	<b>2</b>	<b>0.017</b>			<b>0.063</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>			
		<b>0.033</b>			<b>0.125</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>			
SHRH	1	0.008			0	0		0	0	0.038	0						
		0.017			0	0		0	0	0.077	0						
SMBF	17	0.142			0.094	0		0	0	0.231	0.389			0.5			
		0.133			0.188	0		0	0	0.462	0.465						
SNGR	7	0.058			0.031	0		0	0	0.154	0			1			
		0.076			0.063	0		0	0	0.308	0						
<b>SNSG</b>	<b>442</b>	<b>3.683</b>			<b>2.281</b>	<b>0.25</b>		<b>1.706</b>	<b>1.75</b>	<b>1.808</b>	<b>11.389</b>			<b>25.5</b>			
		<b>2.73</b>			<b>2.806</b>	<b>0.5</b>		<b>1.088</b>	<b>2.5</b>	<b>1.18</b>	<b>16.326</b>						
SVCP	1	0.008			0	0		0	0	0.038	0						
		0.017			0	0		0	0	0.077	0						

Appendix F2. 1.0” trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL		SCCS	TRMS	WILD
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	DTWT
BLCF	2	0.111		0		0	0.333	0	0			
		0.222		0		0	0.667					
<b>BUSK</b>	<b>1</b>	<b>0.056</b>		<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>1.333</b>			
		<b>0.111</b>		<b>0</b>		<b>0</b>	<b>0</b>					
CNCF	1	0.056		0		0	0	0	1.333			
		0.111		0		0	0					
FWDM	1	0.053		0		0	0.16	0	0			
		0.107		0		0	0.321					
GZSD	2	0.111		0		0	0.333	0	0			
		0.222		0		0	0.667					
LNGR	3	0.167		0		0.167	0.333	0	0			
		0.184		0		0.333	0.436					
RVCS	1	0.056		0		0	0.167	0	0			
		0.111		0		0	0.333					
SMBF	2	0.11		0		0	0.329	0	0			
		0.152		0		0	0.431					
SNGR	3	0.167		0.444		0	0	1.333	0			
		0.244		0.889		0	0					
SNPD	1	0.053		0		0	0.16	0	0			
		0.107		0		0	0.321					
<b>SNSG</b>	<b>35</b>	<b>1.867</b>		<b>0.846</b>		<b>3.357</b>	<b>1.609</b>	<b>0</b>	<b>0</b>			
		<b>1.846</b>		<b>0.541</b>		<b>4.798</b>	<b>2.856</b>					
SVCP	31	1.722		0		0	4.833	2.667	0			
		3.22		0		0	9.667					

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD		CHXO		CONF	ISB	OSB	SCCL		SCCS	TRMS	WILD
			CHNB	ITIP	CHNB	ITIP	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	DTWT
BHCP	10	0.084	0	0	0.138	0		0.047	0.162	0.13	0			
		0.072	0	0	0.192			0.072	0.253	0.26	0			
BHMW	1	0.006	0	0	0.04	0		0	0	0	0			
		0.013	0	0	0.079			0	0	0	0			
BLCF	197	1.596	0	0	4.527	0		0.391	1.622	2.918	4.857			
		1.103	0	0	5.531			0.341	1.825	5.404	8.848			
<b>BUSK</b>	<b>5</b>	<b>0.06</b>	<b>0.089</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0.137</b>	<b>0</b>	<b>0</b>	<b>0</b>			
		<b>0.098</b>	<b>0.178</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0.274</b>	<b>0</b>	<b>0</b>	<b>0</b>			
CARP	2	0.012	0	0	0	0		0.011	0	0	0.238			
		0.019	0	0	0			0.022	0	0	0.476			
CNCF	212	1.884	2.667	0	2.569	1.333		0.909	1.707	4.442	3.143			
		0.699	3.012	0	2.146			0.528	1.28	3.859	4.081			
FHCF	8	0.074	0.089	0	0	0		0.026	0.16	0.26	0			
		0.061	0.178	0	0			0.051	0.185	0.519	0			
FWDM	34	0.342	0	0	0.284	0		0.03	0.524	0.26	4.143			
		0.318	0	0	0.396			0.06	0.717	0.519	7.073			
GSCP	3	0.025	0	0	0.101	0		0	0.037	0	0			
		0.029	0	0	0.141			0	0.073	0	0			
GZSD	2	0.022	0	0	0	0		0.064	0	0	0			
		0.032	0	0	0			0.09	0	0	0			
RVCS	1	0.012	0	0	0	0		0	0.051	0	0			
		0.024	0	0	0			0	0.103	0	0			
<b>SFCB</b>	<b>1</b>	<b>0.012</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0.034</b>	<b>0</b>	<b>0</b>	<b>0</b>			
		<b>0.024</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0.068</b>	<b>0</b>	<b>0</b>	<b>0</b>			
<b>SKCB</b>	<b>6</b>	<b>0.054</b>	<b>0</b>	<b>0</b>	<b>0.111</b>	<b>0</b>		<b>0.034</b>	<b>0.103</b>	<b>0</b>	<b>0</b>			
		<b>0.045</b>	<b>0</b>	<b>0</b>	<b>0.152</b>			<b>0.05</b>	<b>0.142</b>	<b>0</b>	<b>0</b>			
SMBF	2	0.024	0	0	0	0		0	0	0.381	0			
		0.034	0	0	0			0	0	0.492	0			
SNGR	1	0.012	0	0	0	0		0	0	0	0.333			
		0.024	0	0	0			0	0	0	0.667			
SNPD	2	0.024	0.089	0	0	0		0	0.051	0	0			
		0.034	0.178	0	0			0	0.103	0	0			
<b>SNSG</b>	<b>85</b>	<b>0.882</b>	<b>2.358</b>	<b>2.667</b>	<b>1.106</b>	<b>5.333</b>		<b>0.293</b>	<b>0.493</b>	<b>0.762</b>	<b>0.81</b>			
		<b>0.545</b>	<b>3.719</b>	<b>2.667</b>	<b>0.88</b>			<b>0.256</b>	<b>0.327</b>	<b>1.143</b>	<b>0.963</b>			
<b>SNSN</b>	<b>5</b>	<b>0.06</b>	<b>0.356</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0.034</b>	<b>0</b>	<b>0</b>	<b>0</b>			
		<b>0.071</b>	<b>0.485</b>	<b>0</b>	<b>0</b>			<b>0.068</b>	<b>0</b>	<b>0</b>	<b>0</b>			
STCT	8	0.085	0	0	0	0		0	0.244	0.32	0.238			
		0.083	0	0	0			0	0.326	0.424	0.476			
SVCB	8	0.069	0	0	0.056	0		0.069	0.154	0	0			
		0.065	0	0	0.111			0.097	0.226	0	0			
SVCP	6	0.05	0	0	0.162	0		0	0	0.381	0			
		0.062	0	0	0.248			0	0	0.762	0			
UIC	1	0.009	0	0	0	0		0	0	0	0.238			
		0.017	0	0	0			0	0	0	0.476			
USG	8	0.092	0.157	1.333	0	0		0	0.051	0.571	0			
		0.097	0.314	2.667	0			0	0.103	1.143	0			

Species	Total Catch	Overall CPUE	BRAD		CHXO		CONF	ISB	OSB	SCCL		SCCS	TRMS	WILD
			CHNB	ITIP	CHNB	ITIP	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	DTWT
<b>WSMW</b>	<b>1</b>	<b>0.008</b>	<b>0</b>	<b>0</b>	<b>0.051</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			
		<b>0.016</b>	<b>0</b>	<b>0</b>	<b>0.101</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			

Appendix F4. Mini-fyke net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
BHCP	15	0.263	0	0		0.214	1	0	0	0	0.4
		0.334	0	0		0.429	1.789	0	0	0	0.49
BHMW	105	1.842	0.75	2.9		1.571	1.9	1.25	1.25	6	1
		0.709	0.957	2.2		1.634	1.724	0.982	2.5	4	0.632
BKBH	1	0.018	0	0		0	0.1	0	0	0	0
		0.035	0	0		0	0.2	0	0	0	0
BKCP	1	0.018	0	0		0.071	0	0	0	0	0
		0.035	0	0		0.143	0	0	0	0	0
BKSS	2	0.035	0	0.1		0	0	0	0	0	0.2
		0.049	0	0.2		0	0	0	0	0	0.4
BLCF	2	0.035	0	0		0.071	0	0	0.25	0	0
		0.049	0	0		0.143	0	0	0.5	0	0
BLGL	150	2.632	0	2.9		1.5	2.1	1.875	8.5	2	5.2
		1.005	0	1.896		1.043	0.867	2.119	8.544	2	5.455
BNMW	5	0.088	0	0.3		0	0.1	0	0	0.5	0
		0.115	0	0.6		0	0.2	0	0	1	0
CARP	94	1.649	0.25	0.3		0.571	4	0.75	1	0	6.4
		1.153	0.5	0.306		0.345	3.54	0.732	1.414	0	10.327
CLSR	1	0.018	0	0		0.071	0	0	0	0	0
		0.035	0	0		0.143	0	0	0	0	0
CNCF	192	3.368	1.750	8.1		1.786	2.8	3.375	3.25	1.5	1.6
		1.909	1.258	10.243		0.987	1.628	1.887	5.188	3	1.356
ERSN	98	1.719	0	2.2		1.429	2.7	3.5	0	0	0.2
		1.167	0	2.491		1.788	3.267	5.868	0	0	0.4
FHCF	14	0.246	0.5	0.3		0.286	0.2	0	0.5	0.5	0
		0.153	0.577	0.6		0.251	0.267	0	1	1	0
FWDM	455	7.982	0.5	13.6		5	7.3	5.125	3.25	1.5	23.4
		3.81	0.577	8.247		3.374	5.086	4.199	5.252	3	36.114
GDSN	1	0.018	0	0		0	0.1	0	0	0	0
		0.035	0	0		0	0.2	0	0	0	0
GNSF	21	0.368	0.25	0.6		0.071	0.4	0.25	1	0	0.6
		0.258	0.5	0.854		0.143	0.8	0.327	2	0	0.8
GSCP	12	0.211	0	0		0.143	0.6	0	0	0	0.8
		0.148	0	0		0.194	0.442	0	0	0	1.166
GZSD	490	8.596	2.25	7		4.071	13.8	12.75	0.5	2	21.6
		4.633	2.217	5.424		3.448	19.955	16.176	1	4	15.5
HFCS	1	0.018	0	0		0	0.1	0	0	0	0
		0.035	0	0		0	0.2	0	0	0	0
LESF	1	0.018	0	0		0.071	0	0	0	0	0
		0.035	0	0		0.143	0	0	0	0	0
LMBS	4	0.07	0	0		0	0.1	0	0.5	0	0.2
		0.085	0	0		0	0.2	0	1	0	0.4
LNGR	34	0.596	0.25	0.8		0.5	0.8	0.625	0.5	0.5	0.4
		0.269	0.5	0.833		0.457	0.98	0.648	0.577	1	0.49
MQTF	4	0.07	0	0.1		0	0.1	0	0	0	0.4
		0.068	0	0.2		0	0.2	0	0	0	0.49

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
OSSF	6	0.105	0	0.1		0.071	0.1	0.25	0	0	0.2
		0.082	0	0.2		0.143	0.2	0.327	0	0	0.4
<b>PNMW</b>	<b>3</b>	<b>0.053</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>0.3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		<b>0.105</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>0.6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
QLBK	2	0.035	0	0.1		0.071	0	0	0	0	0
		0.049	0	0.2		0.143	0	0	0	0	0
RDSN	111	1.947	3	2		1.929	3.1	0.75	3	0.5	0.4
		0.784	2.944	1.764		2.016	2.375	0.824	2.708	1	0.49
RVCS	44	0.772	0.25	0.8		0.286	1.3	0	0	1.5	3
		0.577	0.5	0.833		0.388	1.492	0	0	1	5.514
RVSN	2	0.035	0	0.1		0	0.1	0	0	0	0
		0.049	0	0.2		0	0.2	0	0	0	0
SDBS	1	0.018	0	0		0	0	0	0	0	0.2
		0.035	0	0		0	0	0	0	0	0.4
<b>SGER</b>	<b>1</b>	<b>0.018</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.2</b>
		<b>0.035</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.4</b>
SHRH	1	0.018	0	0		0	0	0	0	0	0.2
		0.035	0	0		0	0	0	0	0	0.4
SJHR	1	0.018	0	0		0	0.1	0	0	0	0
		0.035	0	0		0	0.2	0	0	0	0
SMBF	8	0.14	0.25	0.1		0.071	0.5	0	0	0	0
		0.154	0.5	0.2		0.143	0.803	0	0	0	0
SMMW	2	0.035	0.25	0.1		0	0	0	0	0	0
		0.049	0.5	0.2		0	0	0	0	0	0
SNGR	42	0.737	0.25	0.4		0.5	0.5	0.375	0.25	0	4.2
		0.494	0.5	0.442		0.545	0.803	0.526	0.5	0	4.261
<b>SNSN</b>	<b>52</b>	<b>0.912</b>	<b>2.75</b>	<b>0.2</b>		<b>0.929</b>	<b>1</b>	<b>0.625</b>	<b>2.5</b>	<b>0</b>	<b>0.2</b>
		<b>0.526</b>	<b>3.594</b>	<b>0.267</b>		<b>1.138</b>	<b>1.578</b>	<b>1.25</b>	<b>1.732</b>	<b>0</b>	<b>0.4</b>
STBS	1	0.018	0	0.1		0	0	0	0	0	0
		0.035	0	0.2		0	0	0	0	0	0
SVCB	35	0.614	0	1		0.286	1.50	0.75	0	0	0
		0.55	0	1.193		0.327	2.785	0.982	0	0	0
SVCP	37	0.649	0	0.3		0.429	2	0.125	0	0	1.4
		0.494	0	0.427		0.718	2.329	0.25	0	0	1.744
UBF	2	0.035	0	0		0	0	0.25	0	0	0
		0.07	0	0		0	0	0.5	0	0	0
UBH	2	0.035	0	0		0.143	0	0	0	0	0
		0.07	0	0		0.286	0	0	0	0	0
UCN	10	0.175	0	0		0.714	0	0	0	0	0
		0.351	0	0		1.429	0	0	0	0	0
UCY	2	0.035	0	0		0.143	0	0	0	0	0
		0.07	0	0		0.286	0	0	0	0	0
ULP	92	1.614	1	1.6		2.714	2.2	0.375	1.5	0.5	0.4
		1.107	1.414	3.2		2.58	3.975	0.75	3	1	0.8
WTBS	146	2.561	0.25	2.1		0.429	5.9	1.25	0	0.5	9.6
		1.843	0.5	2.01		0.455	6.335	1.239	0	1	15.422
WTCP	77	1.351	0.25	1.6		1.571	1.5	0.875	0.25	0	3
		0.648	0.5	1.611		1.162	1.274	1.221	0.5	0	5.02
WTSK	1	0.018	0	0		0	0	0	0	0	0.2

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
		0.035	0	0		0	0	0	0	0	0.4
YLBH	22	0.386	0.5	0		0.714	0.5	0	0.25	0	0.8
		0.312	0.577	0		0.971	0.803	0	0.5	0	1.6
YWBS	1	0.018	0	0		0	0	0	0	0	0.2
		0.035	0	0		0	0	0	0	0	0.4

Appendix F5. Trotline: overall season and segment summary. Lists CPUE (fish/20 hook nights) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD		CHXO			ISB			OSB			SCCL			SCCS	SCN	TRMS
			CHNB	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	CHNB	ITIP	POOL	BARS	CHNB	CHNB	
BLCF	3	0.038 0.042		0	0	0	0	0	0	0	0	0	0.333	0.250	0	0			
<b>BUSK</b>	<b>2</b>	<b>0.025</b> <b>0.035</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.050</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.500</b>	<b>0</b>			
CARP	6	0.075 0.067		0	0.100	0	0	0.046	0	0.100	0	0	0	0	0	1.000			
CNCF	3	0.038 0.042		0	0	0	0	0	0	0	0.333	0	0.333	0	0.250	0	0		
FHCF	7	0.088 0.071		0	0.200	0	0	0.046	0	0.050	0.333	0	0.250	0	0.500	0			
FWDM	13	0.163 0.104		0.500	0.100	0.500	0	0	0	0.150	0.167	0.167	0.500	1.500	0				
<b>PDSG</b>	<b>2</b>	<b>0.025</b> <b>0.035</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.046</b>	<b>0</b>	<b>0</b>	<b>0.167</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			
SMBF	45	0.475 0.202		0.500	0.100	0.500	0	0.455	0	0.500	0.167	0.500	0.500	1.000	3.500				
SNPD	1	0.013		0.500	0	0	0	0	0	0	0	0	0	0	0				
<b>SNSG</b>	<b>413</b>	<b>4.738</b> <b>1.501</b>		<b>8.500</b>	<b>3.300</b>	<b>14.500</b>	<b>5.000</b>	<b>5.500</b>	<b>2.500</b>	<b>4.400</b>	<b>7.167</b>	<b>2.000</b>	<b>1.000</b>	<b>4.500</b>	<b>4.000</b>				
STCT	1	0.013		0	0	0	0	0	0	0	0.167	0	0	0	0				
											0	0.333	0	0					

Appendix G. Hatchery names, locations and abbreviations.

<b>Hatchery</b>	<b>State</b>	<b>Abbreviation</b>
Blind Pony State Fish Hatchery	MO	BYP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2010 for Segment 11, the Kansas River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season			Fish Community Season			Both Seasons
	1.0" Trammel Net	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trotline
BHCP		0.000	0.000	0.000	0.263	0.168	0.000
BHMW		0.000	0.000	0.000	1.842	0.013	0.000
BKBH		0.000	0.000	0.000	0.018	0.000	0.000
BKCP		0.000	0.000	0.000	0.018	0.000	0.000
BKSS		0.000	0.000	0.000	0.035	0.000	0.000
BLCF		0.050	0.000	0.111	0.035	3.192	0.038
BLGL		0.000	0.000	0.000	2.632	0.000	0.000
BMBF		0.008	0.000	0.000	0.000	0.000	0.000
BNMW		0.000	0.000	0.000	0.088	0.000	0.000
<b>BUSK</b>		<b>0.117</b>	<b>0.095</b>	<b>0.056</b>	<b>0.000</b>	<b>0.024</b>	<b>0.025</b>
CARP		0.017	0.000	0.000	1.649	0.025	0.075
CLSR		0.000	0.000	0.000	0.018	0.000	0.000
CNCF		0.042	1.328	0.056	3.368	2.440	0.038
ERSN		0.000	0.000	0.000	1.719	0.000	0.000
FHCF		0.008	0.018	0.000	0.246	0.130	0.088
FWDM		0.008	0.000	0.053	7.982	0.684	0.163
GDEY		0.183	0.000	0.000	0.000	0.000	0.000
GDSN		0.000	0.000	0.000	0.018	0.000	0.000
GNSF		0.000	0.000	0.000	0.368	0.000	0.000
GSCP		0.025	0.000	0.000	0.211	0.050	0.000
GZSD		0.008	0.000	0.111	8.596	0.045	0.000
HFCS		0.000	0.000	0.000	0.018	0.000	0.000
LESF		0.000	0.000	0.000	0.018	0.000	0.000
LMBS		0.000	0.000	0.000	0.070	0.000	0.000
LNGR		0.283	0.000	0.167	0.596	0.000	0.000
MQTF		0.000	0.000	0.000	0.070	0.000	0.000
NFSH		0.000	0.000	0.000	0.000	0.000	0.000

Species Code	Sturgeon Season			Fish Community Season			Both Seasons
	1.0" Trammel Net	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trotline
OSSF		0.000	0.000	0.000	0.105	0.000	0.000
<b>PDSG</b>		<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.025</b>
<b>PNMW</b>		<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.053</b>	<b>0.000</b>	<b>0.000</b>
QLBK		0.042	0.000	0.000	0.035	0.000	0.000
RDSN		0.000	0.000	0.000	1.947	0.000	0.000
RVCS		0.058	0.000	0.056	0.772	0.024	0.000
RVSN		0.000	0.000	0.000	0.035	0.000	0.000
SBWB		0.008	0.000	0.000	0.000	0.000	0.000
SDBS		0.000	0.000	0.000	0.018	0.000	0.000
<b>SFCB</b>		<b>0.000</b>	<b>0.024</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
<b>SGER</b>		<b>0.017</b>	<b>0.000</b>	<b>0.000</b>	<b>0.018</b>	<b>0.000</b>	<b>0.000</b>
SHRH		0.008	0.000	0.000	0.018	0.000	0.000
SJHR		0.000	0.000	0.000	0.018	0.000	0.000
<b>SKCB</b>		<b>0.000</b>	<b>0.089</b>	<b>0.000</b>	<b>0.000</b>	<b>0.018</b>	<b>0.000</b>
SMBF		0.142	0.000	0.110	0.140	0.048	0.475
SMMW		0.000	0.000	0.000	0.035	0.000	0.000
SNGR		0.058	0.000	0.167	0.737	0.024	0.000
SNPD		0.000	0.048	0.053	0.000	0.000	0.013
<b>SNSG</b>		<b>3.683</b>	<b>1.178</b>	<b>1.867</b>	<b>0.000</b>	<b>0.585</b>	<b>4.738</b>
<b>SNSN</b>		<b>0.000</b>	<b>0.119</b>	<b>0.000</b>	<b>0.912</b>	<b>0.000</b>	<b>0.000</b>
STBS		0.000	0.000	0.000	0.018	0.000	0.000
STCT		0.000	0.137	0.000	0.000	0.033	0.013
SVCB		0.000	0.137	0.000	0.614	0.000	0.000
SVCP		0.008	0.000	1.722	0.649	0.100	0.000
UBF		0.000	0.000	0.000	0.035	0.000	0.000
UBH		0.000	0.000	0.000	0.035	0.000	0.000
UCN		0.000	0.000	0.000	0.175	0.000	0.000
UCY		0.000	0.000	0.000	0.035	0.000	0.000
UIC		0.000	0.000	0.000	0.000	0.017	0.000
ULP		0.000	0.000	0.000	1.614	0.000	0.000
USG		0.000	0.024	0.000	0.000	0.161	0.000

Species Code	Sturgeon Season			Fish Community Season			Both Seasons
	1.0" Trammel Net	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trotline
<b>WSMW</b>		<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.016</b>	<b>0.000</b>
WTBS		0.000	0.000	0.000	2.561	0.000	0.000
WTCP		0.000	0.000	0.000	1.351	0.000	0.000
WTSK		0.000	0.000	0.000	0.018	0.000	0.000
YLBH		0.000	0.000	0.000	0.386	0.000	0.000
YWBS		0.000	0.000	0.000	0.018	0.000	0.000

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 11, the Kansas River, comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2006 - 2010.

Bend Number	Bend River Mile	Coordinates		2006	2007	2008	2009	2010
		Latitude	Longitude					
1	1.7	39.09375	-94.60988			ST, FC	ST, FC	
2	5.0	39.07892	-94.65139		ST, FC	ST, FC		ST, FC
3	9.0	39.09493	-94.70882	ST, FC			ST, FC	ST, FC
4	12.0	39.07377	-94.75377		ST, FC		ST, FC	
5	14.7	39.04654	-94.78568			ST,FC		ST, FC
6	21.0	39.04406	-94.88401		ST, FC	ST,FC	ST, FC	
7	22.5	39.02448	-94.89053				ST, FC	
8	23.9	39.00660	-94.89584			FC		
9	25.2	38.99133	-94.90937					ST, FC
10	26.8	38.99330	-94.91747					
11	29.1	38.98870	-94.94072				ST, FC	
12	31.6	39.99135	-94.97892					
13	33.2	39.00008	-95.00573					ST, FC
14	35.0	38.98853	-95.02351					
15	37.5	38.98052	-95.05407					
16	40.4	38.97048	-95.08091				ST, FC	
17	43.5	38.96646	-95.10712					
18	44.6	38.96856	-95.12116					
19	45.6	38.97063	-95.13836					ST, FC
20	46.8	38.97939	-95.15782				ST, FC	
21	47.8	38.97239	-95.16258					
22	52.1	38.97461	-95.23460			FC		ST, FC

## 2009 Annual Report

### Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 11, the Kansas River



Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program

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## EXECUTIVE SUMMARY

The Missouri Department of Conservation completed its fourth year of the Pallid Sturgeon Population Assessment Program at the end of the 2009 sampling season. All standard sampling was successfully completed in the required bends for gill netting (N = 4 bends) and otter trawls and trammel nets (N = 8 bends) during the 2009 sturgeon and fish community seasons.

Four hatchery stocked pallid sturgeon were captured in segment 11 during the 2009 sampling season. We have captured a total of five hatchery-stocked pallid sturgeon in the Kansas River since 2007 (one hatchery-stocked fish was captured in 2007). These are the first recorded captures of pallid sturgeon in the Kansas River since 1952 (US Fish and Wildlife Service 2000). Fish were captured in gill nets and trot lines, all downstream of the Johnson County Weir (weir). The pallid sturgeon were from the 2002, 2003, and 2005 year classes. These fish were stocked into the Missouri River at Boonville, MO, Parkville, MO, and Bellevue, NE. The fork length at capture for pallid sturgeon captured in the Kansas River during 2007 and 2009 range from 329 to 712 mm. All fish retained their PIT tags and elastomer marking received in the hatchery.

In standard random sampling, 371 shovelnose sturgeon (fork length 133 – 746 mm) were captured in segment 11 in gill nets (N = 101), 1 inch trammel nets (N = 213), and otter trawls (N = 57). More shovelnose sturgeon were captured below the weir, using gill nets and trammel nets, even though less effort was expended there than above the weir. Ten young-of-year sturgeon (<150 mm) have been captured in the Kansas River since sampling began (N = 7 and 3 in 2008 and 2009, respectively). These range in size from 22 – 133 mm, and all but one have been captured above the weir. Though some of these fish are too small to determine species by external characteristics alone, they are most likely shovelnose sturgeon due to the higher number of shovelnose sturgeon compared to pallid sturgeon in the Kansas River.

Shoal chub (N = 15 in standard otter trawl, N= 5 wild push trawl) was the only *Macrhybopsis* spp. captured in segment 11. Overall CPUE for shoal chub showed an increase for the third straight year. Sicklefin chub were captured in the Kansas River in 2006 and 2008, with similar CPUE in both years (0.023 and 0.016 fish/ 100 m). No sturgeon chub have been captured in segment 11. Sand shiner CPUE in mini-fyke nets has been decreasing every year since 2006. Two *Hybognathus* spp. were captured in 2009, both brassy minnows captured below

the weir. Catches of *Hybognathus* spp. in 2007 and 2008 were comprised of plains minnows. Trammel nets and otter trawls captured 14 blue suckers in segment 11. Wild push trawls captured three young-of-year blue suckers (32, 33, and 37 mm), all above the weir. Sauger were captured in trammel nets (N = 3) and mini-fyke nets (N = 16). These fish ranged in size from 40 to 447 mm, with young-of-year fish comprising 83% of the catch. No shovelnose sturgeon X pallid sturgeon hybrids were captured during the 2009 sampling season.

Overall, 5,023 fish representing 51 species were captured with all standard gear deployments in segment 11 during the 2009 sampling season. This is more fish than was captured in 2006, 2007 or 2008 (N = 2000, 3,254 and 3,944, respectively), primarily due to the initiation of standard gear deployments in the unchannelized section (river mile 21 – 52), which occurred in 2009.

# TABLE OF CONTENTS

Introduction .....	1
Study Area .....	4
Methods .....	6
Sample site selection and description .....	8
Sampling gear .....	10
Data Collection and Analysis .....	12
Results	
Pallid sturgeon .....	18
Shovelnose X Pallid Sturgeon Hybrids .....	35
Targeted Native River Species	
Shovelnose sturgeon .....	36
Sturgeon chub .....	50
Sicklefin chub .....	51
Shoal chub .....	54
Sand shiner .....	57
<i>Hybognathus</i> spp .....	60
Blue sucker .....	63
Sauger .....	69
Kansas River Fish Community .....	75
Discussion .....	76
Acknowledgments .....	79
References .....	80
Appendices .....	84

## LIST OF TABLES

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 11, the Kansas River, during the sturgeon season and fish community season in 2009. N-E indicates the habitat is non-existent in the segment. .... 17

### **Pallid sturgeon**

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2009. Means (minimum and maximum) are presented. .... 20

Table 3. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2009 from Segment 11, the Kansas River. Relative condition factor was calculated using the equation in Shuman et al. (In review). .... 23

Table 4. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 28

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 29

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 30

Table 7. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 31

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 32

### **Shovelnose sturgeon**

Table 9. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 42

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 43

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 44

Table 12. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 45

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 46

**Blue sucker**

Table 14. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 67

**Sauger**

Table 15. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. .... 73

## LIST OF FIGURES

Figure 1. Map of Segment 11 of the Kansas River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from the confluence with the Missouri River (River Mile 0) to Bowerstock Dam in Lawrence, KS (River Mile 52.1). ..... 15

### **Pallid sturgeon**

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 11, the Kansas River, during 2009. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples. .... 19

Figure 3. Proportion by length group for all pallid sturgeon captured with all gear by length category from 2006-2009 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006). ..... 24

Figure 4. Relative condition factor ( $K_n$ ) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2009 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (In review). ..... 25

Figure 5. Mean annual catch per unit effort ( $\pm 2$  SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2009. Pallid sturgeon of unknown origin are awaiting genetic verification. .... 27

Figure 6. Mean annual catch per unit effort ( $\pm 2$  SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0” trammel nets in Segment 11, the Kansas River, from 2006-2009. Pallid sturgeon of unknown origin are awaiting genetic verification..... OMITTED

Figure 7. Mean annual catch per unit effort ( $\pm 2$  SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 11, the Kansas River, from 2006-2009. Pallid sturgeon of unknown origin are awaiting genetic verification. .... OMITTED

Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 33

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 11, the Kansas River, from 2006-2009. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples. Pallid sturgeon of unknown origin are awaiting genetic verification. .... 34

**Shovelnose sturgeon**

Figure 10. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2009. .... 38

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 11, the Kansas River, from 2006-2009. .... 39

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 11, the Kansas River, from 2006-2009. .... 40

Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 47

Figure 14. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2009 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998). .... 48

Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2009 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998).....49

**Sturgeon chub**

Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 11, the Kansas River, from 2006-2009. ....OMITTED

Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. ....OMITTED

**Sicklefin chub**

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 11, the Kansas River, from 2006-2009. .... 52

Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 53

**Shoal chub**

Figure 20. Mean annual catch per unit effort (+/- 2 SE) of shoal chub using otter trawls in Segment 11, the Kansas River, from 2006-2009. .... 55

Figure 21. Length frequency of shoal chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 56

**Sand shiner**

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2009. .... 58

Figure 23. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 59

***Hybognathus* spp.**

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2009. .... 61

Figure 25. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 62

**Blue sucker**

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of blue suckers using gill nets in Segment 11, the Kansas River, from 2006-2009. .... 64

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0” trammel nets in Segment 11, the Kansas River, from 2006-2009. .... 65

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 11, the Kansas River, from 2006-2009. .... 66

Figure 29. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 68

### **Sauger**

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sauger using gill nets and in Segment 11, the Kansas River, from 2006-2009. .... 70

Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 11, the Kansas River, from 2006-2009. .... 71

Figure 32. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 11, the Kansas River, from 2006-2009. .... 72

Figure 33. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. .... 74

## LIST OF APPENDICES

Appendix A. Phylogenetic list of Kansas and Missouri river fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. ....	84
Appendix B. Definitions and codes used to classify standard Missouri River and Kansas River habitats in the long term pallid sturgeon and associated fish community sampling program. ....	90
Appendix C. List of standard and wild gears, their corresponding codes in the database, seasons deployed, years used, and catch-per-unit-effort units for collection of Missouri and Kansas river fishes for the long-term pallid sturgeon and associated fish community sampling program. ....	91
Appendix D. Stocking locations and codes for pallid sturgeon by Management Unit in the Missouri River Basin. ....	92
Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 11, the Kansas River. ....	93
Appendix F. Total catch, overall mean catch per unit effort, and mean CPUE by mesohabitat within a macrohabitat for all species caught during sturgeon season and fish community season combined in Segment 11, the Kansas River, during 2009. ....	94
Appendix F1. Gill Net: .....	95
Appendix F2. 1.0” Trammel Net: .....	96
Appendix F3. Otter Trawl: .....	97
Appendix F4. Mini-fyke Net: .....	98
Appendix G. Hatchery names, locations, and abbreviations. ....	101
Appendix H. Alphabetic list of Kansas River fishes with total number caught by gear type for the sturgeon season and the fish community season during 2009 for Segment 11, the Kansas River. ....	102
Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 11, the Kansas River, comparing bend selection between years from 2006-2009. ....	105

## Introduction

Pallid sturgeon (*Scaphirhynchus albus*) are native throughout the Yellowstone River, Missouri River, middle and lower Mississippi River, and the Atchafalaya River. Population levels of this species have declined over the past century; these declines have been attributed to anthropogenic influences including habitat loss, blocked migration routes, altered hydrograph, and water temperature regime (USFWS 1993). As a result, this species was listed under the Endangered Species Act in 1990. The USFWS issued a The Pallid Sturgeon Recovery Plan in 1993, and an updated version in 2009 (USFWS 1993 and USFWS 2009). This document identifies four priority pallid sturgeon management units. These management units are broken down into the Great Plains (GPMU; the Missouri River above Fort Peck Dam to Fort Randall Dam and a portion of the Yellowstone River), Central Lowlands (CLMU; Missouri River from Fort Randall Dam to the mouth of the Grand River), Interior Highlands (IHMU; the lower Missouri River and Middle Mississippi River to the mouth of the Ohio River) and the Coastal Plain (CPMU; the Mississippi River from the mouth of the Ohio River to the Gulf of Mexico, including a portion of the Atchafalaya River). Further, this document provides an outline that proposes to: 1) protect and restore pallid sturgeon populations, individuals, and their habitats; 2) conduct research on the genetic makeup and monitor pallid sturgeon populations; 3) develop and implement a pallid sturgeon captive propagation program, and; 4) coordinate and implement conservation and recovery of sturgeon species.

In 2000, the U. S. Fish and Wildlife Service (USFWS) issued the U. S. Army Corps of Engineers (USACE) the Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System (Bi-Op; USFWS 2000). This document recommended the flow regime of the Missouri River mimic a more natural hydrograph, an increase in propagation and population augmentation efforts, and the development of a pallid sturgeon population assessment program (PSPAP). As the federal agency responsible for water management in the Missouri and Kansas river systems, the USACE has an obligation under the Endangered Species Act to conserve the pallid sturgeon. To comply with the Bi-Op, the USACE has proposed to operate Gavins Point Dam in a manner to create a more natural hydrograph, funded hatchery improvements and expansions, and facilitated the development of the Pallid Sturgeon Population Assessment Team (Team).

Implementation of the PSPAP began in 2001 when the USFWS-Columbia Fishery Resource Office (USFWS-CFRO) began sampling under PSPAP guidelines and Nebraska Game and Parks Commission (NGPC) conducted an evaluation of benthic trawls. The USACE hired a fishery biologist to coordinate the PSPAP in 2002 and the USFWS-CFRO and NGPC continued sampling in segments 9, 13, and 14 in the lower Missouri River. Standardized sampling above Gavins Point Dam (segments 5 and 6) occurred for the first time in 2003 by the USFWS-Great Plains Fish and Wildlife Management Assistance Office. During 2004, monitoring continued in segments 5, 6, 8, 9, 13, and 14 and an independent science review was conducted (SEI 2004) to determine the ability of the PSPAP to address its objectives. Beginning with the 2005 fish community season, the Team added the USFWS-Missouri River Fish and Wildlife Management Assistance Office (segment 4), the South Dakota Department of Game Fish and Parks (segment 7), and the Missouri Department of Conservation (segment 10) field crews that completed implementation of the PSPAP from segments 4 through 14. In 2006, the Team added the Montana Department of Fish, Wildlife, and Parks field crew and the Missouri Department of Conservation began sampling segment 11 (the Kansas River) to complete implementation of the PSPAP in segments 1 through 14.

The Pallid Sturgeon Recovery Plan lists propagation as an objective. Pallid sturgeon propagation began in 1992 when Blind Pony State Fish Hatchery in Missouri successfully spawned the first pallid sturgeon in captivity. The initial stocking of pallid sturgeon in 1994 consisted of about 6,500 two- year-old fish that were stocked into the CLMU and IHMU (Krentz et al. 2005). Subsequent stockings in 1997, 1998, and 2001 - 2009 have resulted in approximately 1,376,961 pallid sturgeon being stocked into the Missouri, Mississippi, and Yellowstone rivers (Wilson and Krentz 2009). Most pallid sturgeon were stocked as fingerlings (age-0), advanced fingerlings, and yearlings (age-1), though some fish ages two to five were released as well. Most (92%) pallid sturgeon have been stocked into the GPMU, while 7% have been stocked into the CLMU and IHMU. The only pallid sturgeon stocking to occur in a tributary was in 1997 in the Platte River, Nebraska. There have been no stockings into the Kansas River thus far.

From 1994 to 2009, 99,907 pallid sturgeon have been stocked into the CLMU and IHMU. An additional 10,080 have been stocked into the area between Fort Randall Dam and the headwaters of Lewis and Clark Lake. The total number of pallid sturgeon stocked per year has

ranged from about 4,000 (2006 year class) fish to over 40,000 (2004 year class) fish. Most of these fish were stocked as either yearlings or fingerlings. In 2008, pallid sturgeon spawned from broodstock captured in the CLMU were stocked back into the CLMU for the first time. Prior to this, fish stocked into the lower management unit originated from the GPMU. The only exception to this is the 1992 year class that came from the Middle Mississippi River which is part of the IHMU. In 2009, broodstock fish were collected from both the CLMU and the IHMU. The CLMU fish were spawned, and a portion of these fish have been stocked, while the remaining fish are being held to be stocked as yearlings. IHMU fish were spawned in 2009, but are at Neosho National Fish Hatchery currently awaiting stocking.

**The objectives of the PSPAP are as follows:**

- 1) Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
- 2) Document annual results and long term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
- 3) Document population structure and dynamics of pallid sturgeon in the Missouri River System.
- 4) Evaluate annual results and long term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
- 5) Document annual results and long term trends of habitat usage of the native target species by season and life stage.
- 6) Document annual results and long term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

## Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 through 4 lie in the GPMU and include the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 through 10 lie in CLMU and includes downstream of Fort Randall dam to the mouth of the Grand River. Segments 5 and 6 consist of 55 river miles from Fort Randall Dam, South Dakota downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only segment below Gavins Point Dam that is unchannelized. Segments 8 - 14 include the entire channelized portion (750 miles) of the Missouri River that extends from Lower Ponca Bend to the confluence with the Mississippi River. The lower Kansas River, from Lawrence, Kansas to the mouth (52 miles), was given its own segment designation (segment 11) because this tributary was addressed by the 2000 Bi-Op as a moderate priority management area for pallid sturgeon. Also, the USACE is responsible for water management on the Kansas River. Segments 1 through 4 and 5 through 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by several impoundment and tailwater areas interspersed by a meandering, often braided, channel that lacks navigation structures and deep pools. Segments 5 through 7 of the lower sampling universe are influenced by reservoirs and are unchannelized. Segments 8 through 10 and 13 through 14 are channelized, have revetted banks, deep scour pools and sand bars that are associated with a variety navigation structures. Segment 11, the Kansas River, is both channelized and unchannelized, the separation occurring at the Johnson County Weir (weir). This document reports activities during the 2009 sampling season specific to segment 11.

The Kansas River has been divided into 22 bends from RM 0 upstream to RM 52.1. This area has been further divided into the area of the river where depth and flow is more consistent, allowing us to fish all gears (RM 0 – 21.1), which contains six bends. The other area (RM 21.0 to RM 52.1, Bowerstock Dam) is characterized by a braided system with no defined channel, and

is divided into 16 bends. Our bends are randomly selected out of these two groups. In each of the sample areas, four bends were randomly selected to be sampled each season.

The Kansas River below the weir is channelized through the industrial area of Kansas City to the mouth, though no channel is maintained for navigation traffic. River banks are lined with rip-rap along the outside and inside bends of the river. Structures in this segment are few, but include very small wing dikes in some areas. There are various large boulder areas, refuse concrete slabs, junk cars, degraded areas with undercut banks, natural islands, and side chute habitats. The river is relatively shallow, but is accessible with a jet-propelled motor most of the sample year. The lower sample area is treated as other segments in the channelized Missouri River, with the same gears and habitat coding used.

In the upper sampling area, the river is mostly unchannelized. The 4-5 mile area just upstream of the weir is mostly still water and pooled. The portion of the river above the pooled area consists of a few (10 – 15) randomly placed dikes and banks are revetted in areas. Otherwise, most of this area is braided, characterized by shallow and shifting channel. In this area we deploy gears which are not depth-specific (trot line) and gears suited for shallow water deployments (push trawl and mini-fyke nets).

## Methods

All sampling was conducted in accordance with the guidelines established by the Pallid Sturgeon Assessment Team as outlined in the Pallid Sturgeon Population Assessment Program and Missouri River Standard Operating Procedures for Sampling and Data Collection (Welker and Drobish 2009 and Drobish 2008). Data collected by each PSPAP field office were entered via double-blind entry into a single database housed and managed by the Missouri Department of Conservation. Data were subsequently distributed to each participating office according to reporting responsibilities: segments 1 through 3 - Montana Fish, Wildlife and Parks (Fort Peck, MT); segment 4 – USFWS (Bismark, ND); segments 5 and 6 – USFWS (Pierre, SD); segment 7 - South Dakota Department of Game, Fish, and Parks (Yankton, SD); segments 8 and 9 - Nebraska Game and Parks Commission (Lincoln, NE); Segments 10 and 11 - Missouri Department of Conservation (Chillicothe, MO); segments 13 and 14 – USFWS (Columbia, MO).

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 29 November 2008 [when water temperatures dropped below 12.8°C (55°F)] and continued through 30 June 2009. The fish community season began 01 July 2009 and continued through 12 October 2009. Data from 2005 to 2008 are also included in this report for annual comparisons. During these seasons, standard gear types included experimental gill nets, 1 inch trammel nets, 16-foot otter trawls, and mini-fyke nets (Appendix C). Gill nets were the only sampling gear used during the sturgeon season until 13 March 2009. The beginning of sturgeon season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts began 3 March 2009 and continued until water temperatures reached 12.8°C (55°F). Trammel netting began 21 April 2009 and trawl efforts began 4 May 2009. Both were conducted through 23 June.

Fish community season began 01 July 2009 and continued through 12 October 2009. Standard gears during the fish community season included 1 inch trammel nets, 16-foot otter trawls and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season with efforts made to spatially and temporally distribute sampling across the six randomly selected bends within the segment.

In addition to pallid sturgeon, the Team identified eight fishes from the associated fish community that were of particular interest due to their ecology (e.g., surrogate species to pallid

sturgeon, obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, shoal chub *M. hyostoma*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when feasible and measured in millimeters (mm) to total length (TL), except sturgeon that were measured to fork length (FL) and paddlefish *Polyodon spathula* that were measured from eye-fork length. Pallid, shovelnose, and lake sturgeon, blue suckers, and sauger were weighed to the nearest gram (g).

When a pallid sturgeon was encountered, meristic and morphometric measurements were recorded to determine the character index (CI) score for each fish (Sheehan et al. 1999). Measurements required to calculate CI score included: head length, interrostral length, length of each barbel, mouth to inner barbel length, and mouth width. The length from the fish’s snout to the anterior midline of the mouth was also recorded. Meristics included number of dorsal and anal fin rays, including rudimentary rays. Ranges of CI scores for pallid sturgeon, shovelnose X pallid sturgeon hybrids, and shovelnose sturgeon have been defined as -1.48 to -0.09, -0.45 to 0.51, and 0.37 to 1.33, respectively. In general, CI scores were only calculated for suspected wild pallid sturgeon or hybrid individuals.

In addition to meristics and morphometric measurements, all pallid sturgeon were to be examined for elastomer (color, orientation, and side of fish), coded wire (CWT), and passive integrated transponder (PIT) tags. If no PIT tag was present, a PIT tag was implanted in the base of the dorsal fin and a 1 cm<sup>2</sup> piece of tissue was removed from the trailing edge of the caudal fin for genetic analysis. Before each pallid sturgeon was released, voucher pictures were taken from a lateral and ventral view of the fish with a summary of capture information (e.g., PIT tag number, location, date, CI score, etc.).

## Sampling Description and Site Selection

### *Site description.*

Sampling sites were described using a three-tiered (macro-, meso-, and microhabitat) classification system based on the Missouri River Benthic Fish Study (Berry and Young 2001). Within this habitat designation system, by definition each river bend contained the following three continuous macrohabitats: main channel crossover (CHXO), inside bend (ISB), and outside bend (OSB). The channel crossover was the area where the thalweg crossed from one concave side of the river to the other. The inside bend was the convex side of the river and the outside bend was the concave side of the river.

Classifications for discrete macrohabitats that may not be present in every bend included: braided channel (BRAD), tributary confluence (CONF), dendritic channel (DEND), deranged channel (DRNG), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), non-connected secondary channel (SCN), large tributary mouth (TRML) and small tributary mouth (TRMS). Braided channels were areas with multiple channels and an unidentifiable main channel. Tributary confluences were areas where tributaries influenced physical features (e.g., temperature, turbidity, sand bars, etc.) of the Kansas River for up to one bend in length downstream from the tributary mouth. Dendritic and deranged channels were transitions from a meandering channel to a tree-like pattern of multiple channels and vice versa, respectively. Large, connected secondary channels carried less water than the main channel, were open on both ends, and had flowing water with depths greater than 1.2 m. Small, connected secondary channels were defined the same as SCCL, but water depths did not exceed 1.2 m. Non-connected secondary channels were channels that were blocked on one end. Large tributary mouths were areas within tributaries, with an annual discharge that exceeded  $20 \text{ m}^3/\text{s}$  and extended 300 m upstream from the confluence with the main river. Small tributary mouths were areas within 300 m of the confluence with the main river, were greater than 6 m in width, and had an annual discharge less than  $20 \text{ m}^3/\text{s}$ .

Mesohabitats within each macrohabitat included: sand bar (BARS), main channel border (CHNB), island tip (ITIP), pool (POOL), and thalweg (TLWG). Sand bars were defined as areas less than 1.2 m deep at the aquatic-terrestrial interface. Channel border habitats extend from the 1.2 m depth contour to the edge or toe of the thalweg. Island tips were areas immediately downstream from islands where water depths were greater than 1.2 m. Pools were areas

immediately downstream from obstructions (rock dikes, sand bars, and bridge pilings) where there was a scour greater than 1.2 m in depth, regardless of water velocity. The thalweg was defined as the area between the channel borders that conveyed the majority of the flow.

Microhabitats were identified using a six digit numeric code. The first three digits described the general habitat structure (e.g., kicker dike, wing dike, sand bar, etc.) with which the gear deployment was associated. The last three digits described the exact location of the gear in relation to this structure (e.g., wing-dike pool, open water inside eddy, sand bar crown, etc.). For complete definitions of each microhabitat type see Welker and Drobish (2009).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 - 4, 5 - 7, and 8 - 14) in which each gear type could be deployed (Drobish 2008). For segment 11, standard macrohabitats sets for standard gears (gill nets, one inch trammel nets, otter trawls, and mini fyke nets) included: CHXO, CONF, ISB, OSB, SCCL, SCCS, and TRMS. Within these macrohabitats, CHNB, POOL, and BARS mesohabitats were standard.

#### *Site selection*

During 2009, 25% of bends from each segment were randomly selected to be sampled within each sampling season. Segment 11 has a total of 22 named river bends, 6 in the lower sampling area and 16 in the upper sampling segment. Four bends in each sampling area (lower and upper) were randomly selected to be sampled during each sampling season (Appendix I).

Within each randomly selected river bend in segment 11, sampling locations were chosen based on the availability of standard habitats for each gear type. A minimum of twenty 100 ft gill nets and 8 subsamples of trammel nets and otter trawls were deployed in each bend during sturgeon season. During fish community season, a minimum of 8 subsamples of trammel nets, otter trawls, and mini-fyke nets were deployed in each bend. A minimum of two subsamples were collected in each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if six subsamples were conducted in the inside bend, and the inside bend portion of the bend was three miles in length, the gear would be deployed every half-mile. For most gear types, at least two subsamples were conducted in the channel crossover and the inside and outside bends were equally sampled (8 to 16 subsamples per bend depending upon bend length).

## Sampling Gear

### *Gill nets*

Standard gill nets were primarily set parallel with flow downstream from structures (rock dikes, bridge pilings, etc) or along the channel border (channel sand bars). Gill nets were anchored from the upstream end. Nets were anchored on the downstream end as well to ensure complete extension during the sampling period. A line and buoy were attached to the downstream end to mark the net and for retrieval. In segment 11 during the 2009 sturgeon season, gill nets were used as standard gear in CHXO, ISB, TRMS, SCCL, CONF and OSB macrohabitats and CHNB and POOL mesohabitats (Table 1). The standard gill nets were 30.5 m (100 ft.) in length, 2.4 m (8 ft) deep, constructed from multifilament nylon mesh and contained four 7.6 m (25 ft) panels. Panels 1 through 4 had a mesh size of 38.1 mm (1.5 in), 50.8 mm (2 in), 76.2 mm (3.0 in), and 101.6 mm (4.0 in), respectively. Panels repeat (5 - 8) in double length nets with 38.1 mm, 50.8 mm, 76.2 mm, and 101.6 mm mesh sizes in panels 5, 6, 7, and 8, respectively. All nets had a 13 mm braided polyfoam-core float line with a 7.1 mm diameter, 22.7 kg lead line.

Standard effort was calculated with a 30.5 m (100 ft) net (100 ft of gill net = 1 net night). Sets made with 61 m (200 ft) nets counted as double effort (2 net nights). The first panel (1, 4, or 8) deployed out of the boat for a set site was selected randomly and recorded. Gill nets were set overnight for a maximum of 24 hours. During the 2009 sampling season, 4 bends were sampled with gill nets for a total of 80 net nights.

### *Trammel nets*

Trammel nets were deployed off the bow of the boat by throwing a buoy attached to a 10 m rope and motoring in reverse perpendicular to the flow. A second buoy and rope on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. In segment 11, during the 2009 sturgeon and fish community seasons, trammel nets were used as standard gear in CHXO, OSB and ISB macrohabitats and CHNB mesohabitats (Table 1). Trammel nets (i.e., 1 inch trammel nets) were 38.1 m (125 ft) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in) bar mesh (#139 twine) that was 2.4 m deep (8 ft) and the outer wall was 203 mm (8 in.) bar mesh (#9

twine) that was 1.8 m (6 ft) in depth. All nets had a 13 mm braided polyfoam-core float line with a 7.1 mm diameter, 22.7 kg lead line. During sturgeon season, eight bends were sampled, for a total of 5,919 m drifted. During fish community season, five bends were sampled for a total of 3,593 m drifted.

#### *Otter trawls*

Otter trawls were deployed from the stern of a custom-designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and rope were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and on channel sand bars. The towing rope consisted of 13 mm low stretch nylon line with a 13.7 m bridle. In segment 11, during the 2009 sturgeon and fish community seasons, otter trawls were used as standard gear in CHXO, ISB, OSB, and SCCL macrohabitats and CHNB mesohabitats (Table 1). Standard trawl subsamples ranged from a minimum distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom designed skate balloon with a 4.9 m (16 ft) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.). During 2009 sturgeon season, eight bends were sampled for a total of 8,183 m trawled. During fish community season, six bends were sampled for a total of 5,250 m trawled.

#### *Mini-fyke nets*

Mini-fyke nets were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. The lead length was adjusted so the top of the cab would be at or above the water surface to minimize turtle mortalities. In areas with moderate flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the frame to prevent the net from overturning. The perpendicular distance measured from the midpoint of the frame to the bank was recorded. Nets were generally set in the afternoon and left overnight for a maximum soak time of 24 hours. In segment 11 during the 2009 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, SCCL, SCCS, and TRMS macrohabitats and BARS mesohabitats (Table 1). Mini-fyke nets were constructed from 3 mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the frame. The cab of the net was constructed with two 0.6 m steel hoops, with a single, 51 mm

throat. The lead was 4.5 m in length and 0.6 m in height. During the 2009 fish community season, mini-fyke nets were deployed in eight bends for a total of 66 net nights.

### *Trotlines*

Trotlines were an evaluation gear in 2009; therefore all crews on the Team were fishing this gear in a similar fashion in order to evaluate its usefulness to our objectives. Trotlines were set in each of our randomly selected bends in the lower sampling area (RM 0 – 21.1) once during the 2009 sample season, with a standard of 325 hooks per bend. Trotlines were set parallel with flow downstream from structures (rock dikes) or along the channel border (channel sand bars). Trotlines were anchored on the upstream and downstream ends. The main line was 205 ft long and made from #8 (31.75 mm) solid braid nylon rope or 6.35 mm, 30 lb lead core line. When nylon rope was used, sash weights (1.36 – 1.81 kg) were attached along the mainline at 21 m intervals to ensure gear remained on the river bottom. Hooks (3/0 Eagle Claw Circle Sea attached to 45.72 cm long droppers) were clipped on each line at 2.4 m intervals while deploying gear from bow of boat. Each trot line had 25 hooks. In segment 11, evaluation trotlines were deployed in CHXO, ISB, and OSB and CHNB, POOL, and BARS mesohabitats. During 2009 sturgeon season evaluation gear effort, two bends were sampled with 650 hook nights. During fish community season random effort, two bends were sampled with 648 hook nights.

## **Data Collection and Analysis**

### *Associated Environmental Data*

For every subsample, water depth (m) and temperature (°C) were recorded. Additional habitat data (water velocity and turbidity measurements) were collected for a minimum of 25% of subsamples within each mesohabitat within each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in segment 11, habitat data were generally collected for one subsample in the channel crossover and two to four subsamples for the inside bend, and one subsample in the outside bend. In addition to the collection of habitat data for randomly selected subsamples, these data were also collected

for all subsamples that captured a pallid sturgeon. These habitat data collections were recorded as non-random and were not included toward the 25% minimum of subsamples in that bend.

Habitat parameters collected included turbidity and water velocity. Turbidity was determined using a Hach 2100 P Turbidimeter and reported as nephelometric turbidity units (NTUs). Surface water velocity was estimated visually for every subsample by categorizing flow in meters per second (m/s) as: 0 = cannot determine, 1 = eddy or circular flow, 2 = 0.0-0.3 m/s, 3 = 0.3 - 0.6 m/s, 4 = 0.6 - 0.9 m/s, and 5 = >0.9 m/s. When habitat parameters were collected the actual water velocity was recorded using a Marsh McBirney Flo-Mate Model 2000 and recorded in m/s. When sampling with gill nets, trammel nets, trot lines, and otter trawls, water velocity measurements were taken at the bottom, 80%, and 20% of the water column. With mini-fyke nets, this parameter was recorded at the bottom and 60% of the water column.

All habitat parameters were collected at the midpoint of the sample, except depth which was collected at the start point, midpoint, and end point for gill nets, trammel nets, trot lines, and otter trawls. For example, if an otter trawl was hauled 300 m, habitat data were collected 150 m downstream from the starting point (the approximate midpoint of the tow); for a 61 m (200 ft.) gill net set, habitat data were collected at the midpoint (at 30.5 m or 100 ft) of the net. With mini-fyke nets, all habitat parameters were measured at the point where the lead connected to the cab of the net.

#### *Genetic Verification*

All pallid sturgeon captured that did not appear to be previously marked were considered to be unknown fish pending genetic verification. Tissue samples collected at time of capture were subsequently sent to the USFWS Northeast Fishery Center to genetically determine the origin of the fish (i.e., hatchery-stocked or wild).

#### *Relative Condition*

The condition of recaptured pallid sturgeon was determined using the relative condition factor (Anderson and Neumann 1996). Relative condition ( $K_n$ ) was calculated as:

$$K_n = W/W'$$

where  $W$  was the observed weight and  $W'$  was the length-specific weight derived from the FL-weight equation from Shuman et al. (in review).

### *Relative Weight*

Relative weight of shovelnose sturgeon was calculated using the formula:

$$W_r = 100 \cdot (W/W_s)$$

where  $W$  is weight of the individual and  $W_s$  is the length-specific standard weight value for the species. Quist et al. (1998) provided a relative weight equation:

$$\log_{10}W = -6.287 + 3.330 \log_{10}FL$$

for shovelnose sturgeon throughout its range to calculate relative weight.

### *Relative Stock Densities*

Relative stock densities were calculated for pallid and shovelnose sturgeon captured during the 2008 season. Relative stock density was calculated as:

$RSD = \text{number of fish in a length-class} / \text{number of fish} \geq \text{minimum stock length} \cdot 100$  (Anderson and Neumann 1996). Minimum length specifications for pallid sturgeon were: stock = 330 mm; quality = 630 mm; preferred = 840 mm; memorable = 1,040 mm; trophy = 1,270 mm as reported by Shuman et al. (2006). For shovelnose sturgeon, minimum length specifications were: stock = 250 mm; quality = 380 mm; preferred = 510 mm; memorable = 640 mm; trophy = 810 mm as reported by Quist et al. (1998). In addition to these categories, two sub-stock length ranges for each species were defined by the PSPAP. Sub-stock categories were subdivided into 0 to 199 mm and 200 to 329 mm for pallid sturgeon and 0 to 149 mm and 150 to 249 mm for shovelnose sturgeon.

### *Analyses*

All analyses were conducted on data collected from randomly selected bends with standard gear types set within standard habitats for each respective gear. Mean catch-per-unit-effort (CPUE) was for each species within a bend sampled. Then, a grand mean from all bends was derived to get an overall average CPUE for each fish species. CPUE for one inch trammel nets and otter trawls were reported as the number of fish/100 m drifted or trawled, respectively. Gill nets and mini-fyke nets reported CPUE as the number of fish/net night.

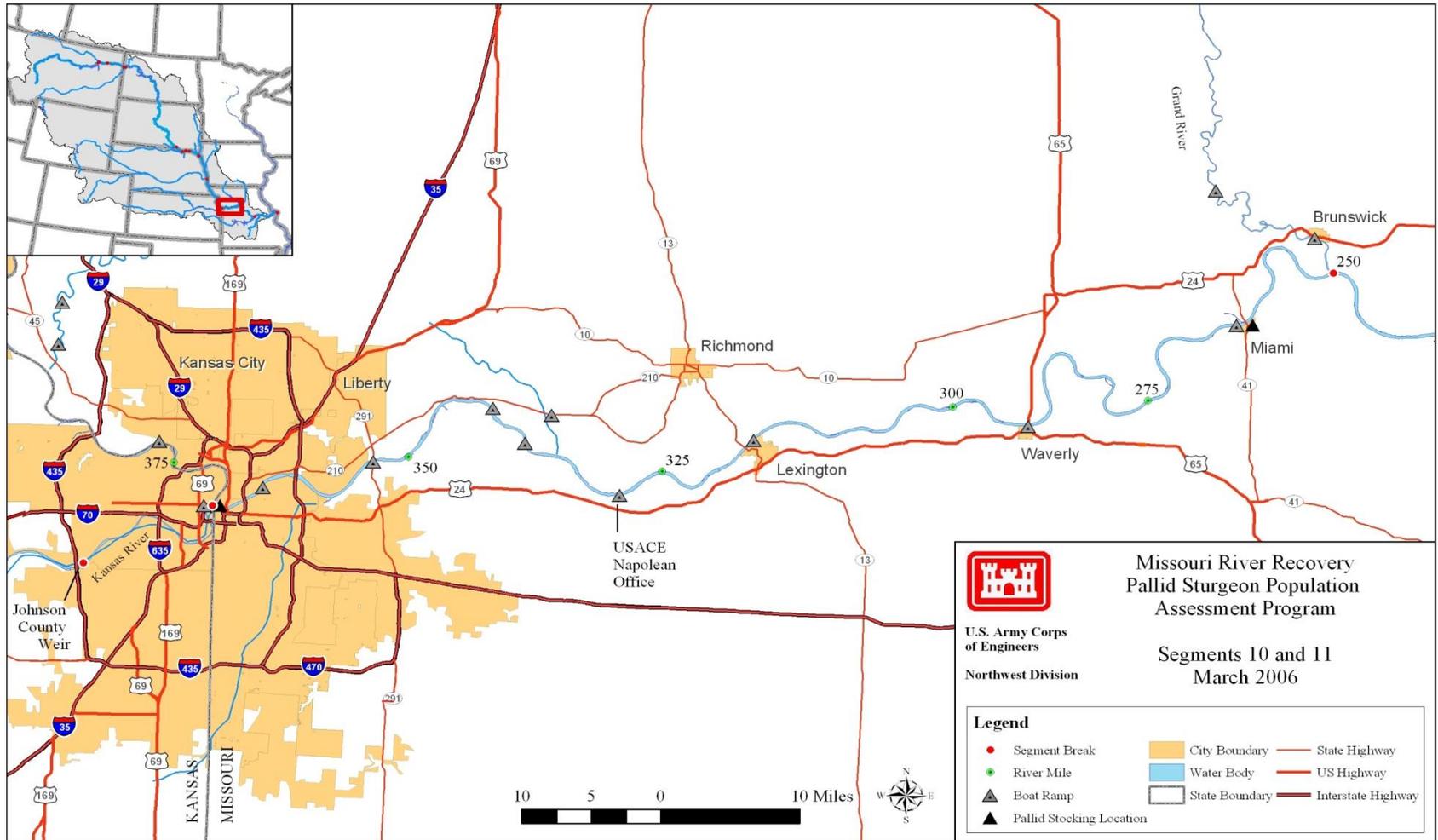


Figure 1. Map of Segment 11 of the Kansas River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from the mouth (River Mile 0.0) to the Bowerstock Dam (River Mile 52.1).

## Results

### Effort

#### *Gill nets*

In segment 11 during the 2009 sturgeon season, gill nets were used as standard gear in CHXO, ISB, TRMS, SCCL, CONF and OSB macrohabitats and CHNB and POOL mesohabitats (Table 1). During the 2009 sampling season, 4 bends were sampled with gill nets for a total of 80 net nights.

#### *Trammel nets*

In segment 11, during the 2009 sturgeon and fish community seasons, trammel nets were used as standard gear in CHXO, OSB and ISB macrohabitats and CHNB mesohabitats (Table 1). During sturgeon season, eight bends were sampled, for a total of 5,919 m drifted. During fish community season, five bends were sampled for a total of 3,593 m drifted.

#### *Otter trawls*

In segment 11, during the 2009 sturgeon and fish community seasons, otter trawls were used as standard gear in CHXO, ISB, OSB, and SCCL macrohabitats and CHNB mesohabitats (Table 1). During 2009 sturgeon season, eight bends were sampled for a total of 8,183 m trawled. During fish community season, six bends were sampled for a total of 5,250 m trawled.

#### *Mini-fyke nets*

In segment 11 during the 2009 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, SCCL, SCCS, and TRMS macrohabitats and BARS mesohabitats (Table 1). During the 2009 fish community season, mini-fyke nets were deployed in eight bends for a total of 66 net nights.

#### *Trotlines*

In segment 11, evaluation trotlines were deployed in CHXO, ISB, and OSB and CHNB, POOL, and BARS mesohabitats. During 2009 sturgeon season evaluation gear effort, two bends were sampled with 650 hook nights. During fish community season evaluation gear effort, two bends were sampled with 648 hook nights.

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 11 on the Kansas River during the sturgeon season and fish community season in 2009. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deployments	Macrohabitat <sup>a</sup>													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>																
1.0" Trammel Net	8	7.75	0	12	0	N-E	N-E	34	16	0	0	0	0	0	0	0
Gill Net	4	10.25	0	9	1	N-E	N-E	16	12	2	0	0	0	0	1	0
Otter Trawl	8	8.00	0	17	0	N-E	N-E	31	13	3	0	0	0	0	0	0
<b>Fish Community Season</b>																
1.0" Trammel Net	5	8.20	0	9	0	N-E	N-E	16	16	0	0	0	0	0	0	0
Mini-Fyke Net	8	8.25	0	17	0	N-E	N-E	26	13	2	4	0	0	0	4	0
Otter Trawl	6	8.33	0	11	0	N-E	N-E	18	16	5	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## **Pallid Sturgeon**

A total of four pallid sturgeon was captured in the Kansas River in sample year 2009. In standard, random sampling, only one pallid sturgeon was captured. The other three captures were from trot lines set overnight. All fish were of hatchery origin, and were captured below the Johnson County Weir, from river miles 5.8 to 14.3 (Figure 2).

The pallid sturgeon ranged in length from 585 to 712 mm. Fish were from 2002 and 2003 year classes (Table 3). The two 2002 year class fish captured were stocked at 293 and 306 mm, while both 2003 year class fish captured were stocked at 256 and 260 mm. At the time of capture, the 2002 year class fish were 601 and 712 mm, and the 2003 year class fish were 585 and 666 mm in length. The 2002 year class had a slightly higher average condition factor (1.072) than the 2003 year class fish (0.987) at the time of capture.

Both fish from the 2002 year class captured in the Kansas River during 2009 were stocked into the Missouri River at Boonville, MO (RM 195.1). The two pallid sturgeon captured from the 2003 year class were stocked into the Missouri river at Boonville and Bellevue, NE (RM 601.4). These fish traveled between 192 and 229 river miles from the time they were released into the Missouri River to the time of their capture in the Kansas River. These fish were at-large from 4.5 years to nearly six years.

Our field station has only captured five pallid sturgeon in the Kansas River since we began sampling in 2006. These captures mark the first time pallid sturgeon have been captured in the Kansas River since 1952 (The University of Kansas Natural History Museum website). In that year, five pallid sturgeon were caught just downstream of Bowerstock Dam in Lawrence, Kansas.

## Segment 11 - Pallid Sturgeon Captures by River Mile

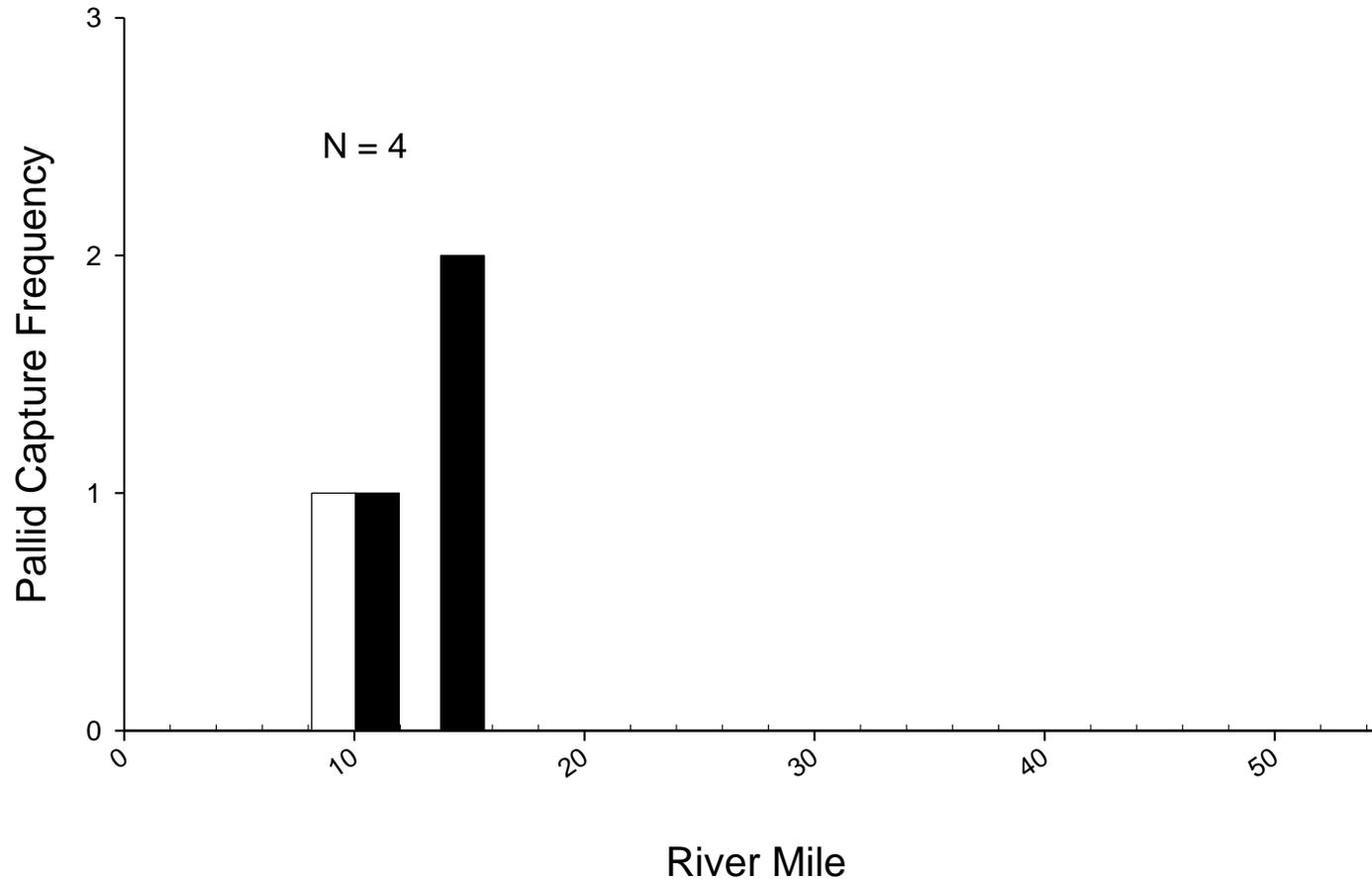


Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 11, the Kansas River, during 2009. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2009. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught								
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch									
CHXO	BARS	0.6 (0.3-1.2)		0.27 (0.00-0.78)		23.5 (9.8-30.4)		447 (43-1760)										
	CHNB	2.7 (1.0-6.2)		0.46 (0.09-0.96)		19.2 (3.3-29.4)		319 (34-1830)										
	DTWT																	
	ITIP																	
	POOL	2.8 (1.9-3.6)		0.32 (0.27-0.37)		9.9(9.8-10.0)		675 (59-1290)										
	TLWG																	
CONF	BARS																	
	CHNB	2.4 (2.4-2.4)		0.09 (0.09-0.09)		12.7 (12.7-12.7)		34 (34-34)										
	DTWT																	
	ITIP																	
	POOL																	
	TLWG																	
ISB	BARS	0.7 (0.2-1.6)		0.36 (0.01-0.86)		23.3 (10.0-30.2)		492 (46-1656)		2								
	CHNB	2.3 (0.9-5.4)		1.6 (1.3-1.8)		0.52 (0.07-0.99)		0.67 (0.63-0.70)			20.7 (3.3-29.8)		15.2 (15.2-15.2)		451 (24-2007)		61 (60-61)	
	DTWT																	
	ITIP																	
	POOL	2.7 (1.2-4.7)		0.35 (0.02-1.05)		9.8 (3.3-16.8)		172 (28-655)										

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	TLWG									
OSB	BARS	0.6 (0.3-1.5)		0.24 (0.00-0.70)		23.9 (17.8-30.5)		352 (55-1015)		
	CHNB	2.9 (1.0-6.1)		0.42 (0.14-0.86)		20.8 (8.1-30.2)		348 (38-1886)		
	DTWT									
	ITIP									
	POOL	3.3 (1.0-5.2)	3.6 (2.7-4.5)	0.27 (0.01-0.72)	0.44 (0.37-0.50)	11.0 (3.3-16.8)	9.7 (9.4-10.0)	218 (37-925)	139 (63-214)	2
	TLWG									
SCCL	BARS	0.9 (0.4-1.5)		0.13 (0.01-0.32)		23.4 (18.7-27.0)		507 (85-757)		
	CHNB	2.0 (1.2-3.7)		0.37 (0.22-0.53)		22.5 (10.7-27.0)		623 (410-844)		
	DTWT									
	ITIP									
	POOL									
	TLWG									
SCCS	BARS	0.6 (0.3-1.0)		0.32 (0.00-0.58)		23.9 (17.6-29.7)		201 (67-657)		
	CHNB									
	DTWT									
	ITIP	4.0 (4.0-4.0)				15.2 (15.2-15.2)				
	POOL									
	TLWG									

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
SCN	BARS	0.4 (0.4-0.4)				27.0 (27.0-27.0)				
	CHNB									
	DTWT									
	ITIP									
	POOL									
	TLWG									
TRMS	BARS	0.5 (0.4-0.5)		0.01 (0.00-0.02)		27.2 (25.0-29.4)		30 (24-35)		
	CHNB	1.5 (1.5-1.5)		0.71 (0.71-0.71)		10.7 (10.7-10.7)		422 (422-422)		
	DTWT									
	ITIP									
	POOL									
	TLWG									

Table 3. Mean fork length, weight, relative condition factor ( $K_n$ ) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2009 from Segment 11, the Kansas River. Relative condition factor was calculated using the equation in Shuman et al. (In review).

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	$K_n$	Length (mm)	Weight (g)	$K_n$	Length (mm/d)	Weight (g/d)
2002	2	300	83.0	1.098	657	1054.5	1.072	0.173	0.378
		13			111	431.0	0.132	0.039	
2003	2	258	60.0	1.186	626	831.0	0.987	0.212	0.442
		4	10.0	0.140	81	266.0	0.087	0.004	0.063

### Segment 11 - Pallid Sturgeon

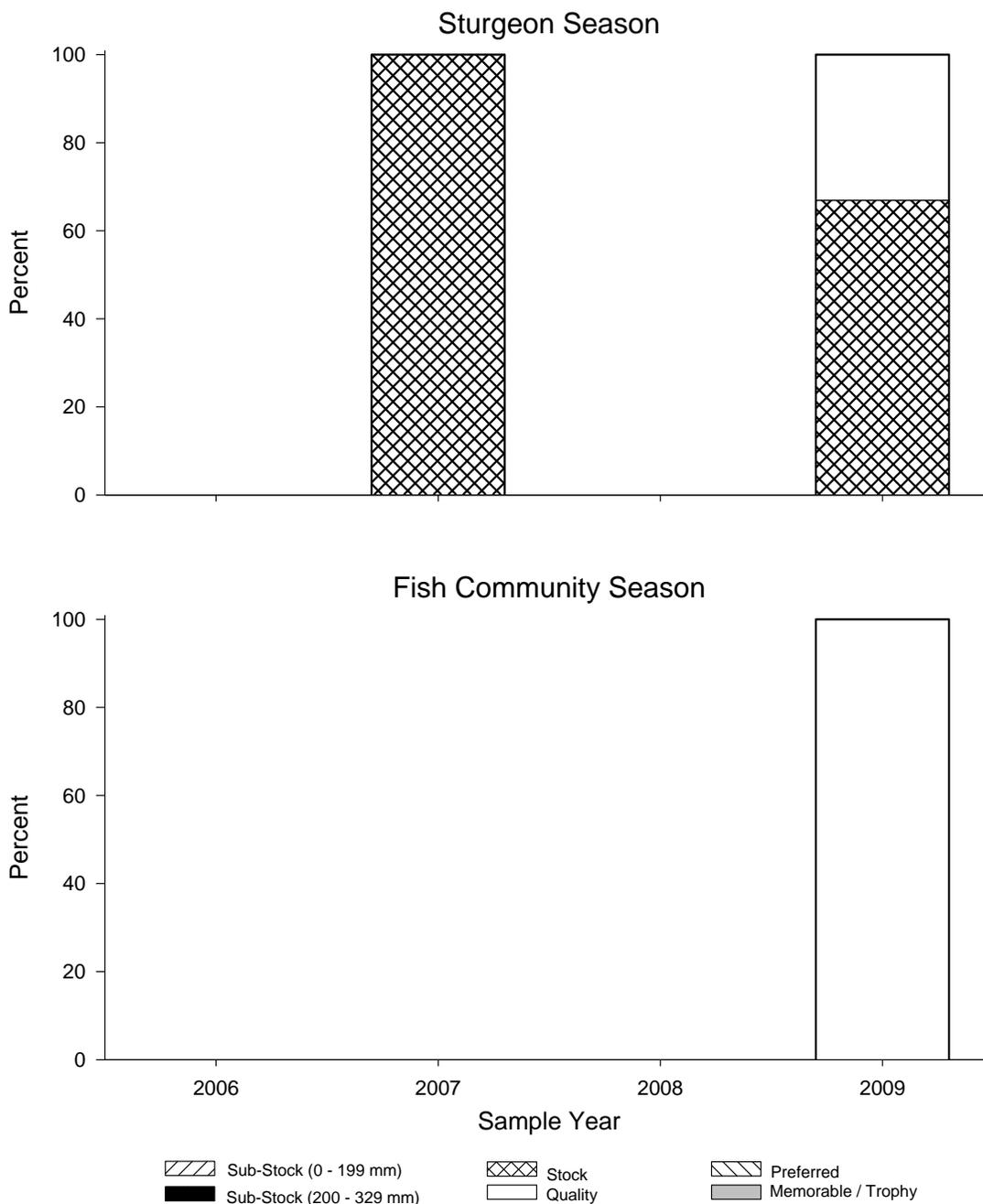


Figure 3. Proportion by length group for all pallid sturgeon captured with all gear by length category from 2006-2009 in Segment 11, the Kansas River. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Length categories determined using the methods proposed by Shuman et al. (2006).

## Segment 11 - Pallid Sturgeon

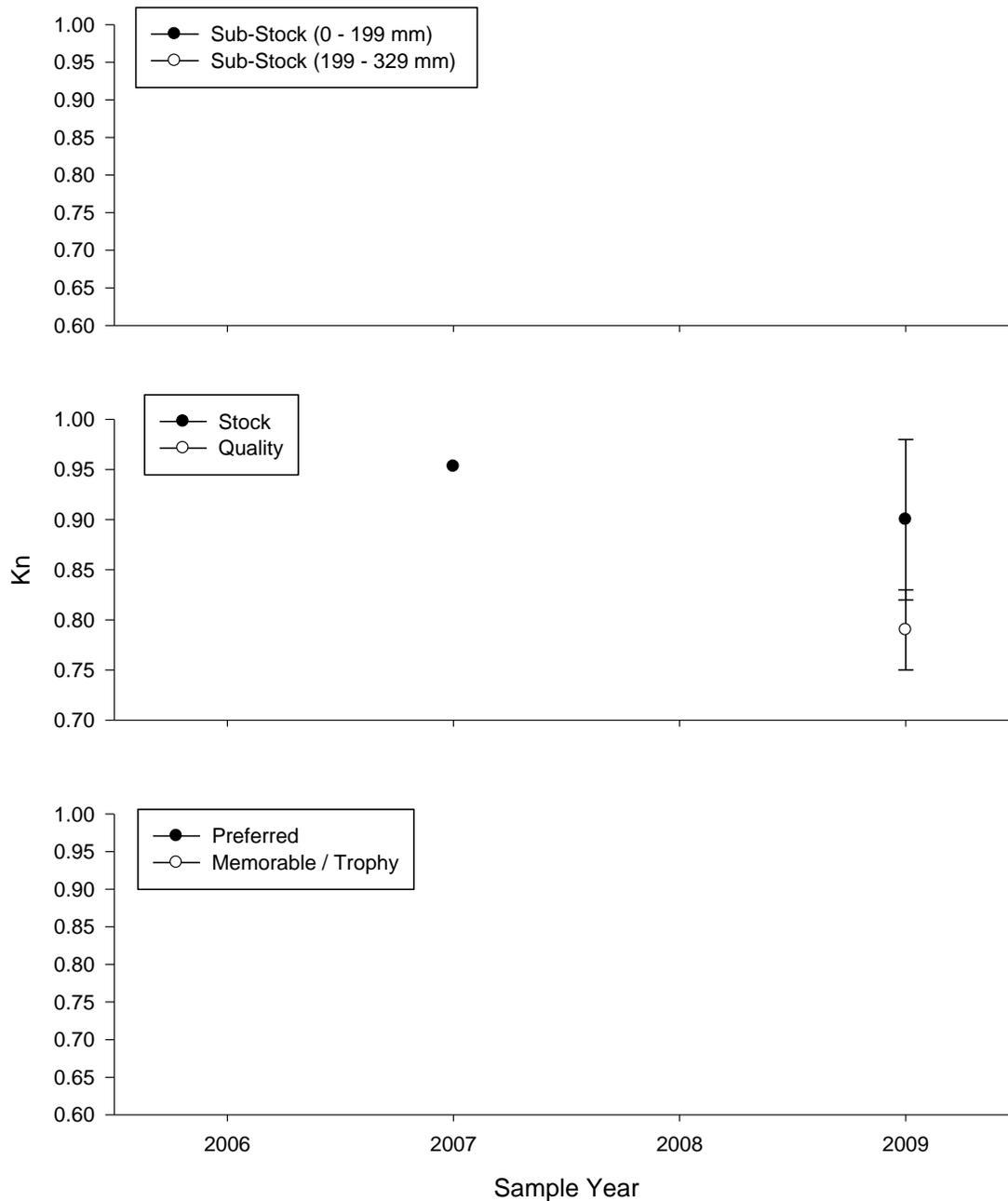


Figure 4. Relative condition factor ( $K_n$ ) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2009 in Segment 11, the Kansas River. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (In review).

### ***Year Comparisons, Gear Evaluations, and Habitat Associations***

The pallid sturgeon were captured from inside bend and outside bend mesohabitats (Table 2). Average depth at capture ranged from 1.2 to 4.5 m, with an average of 2.42 m. Temperature ranged from 10 to 15.2 °C. Turbidity for the captures was 60, 61, 63, and 214 NTUs.

One of the pallid sturgeon was captured in gill nets (CPUE 0.012 fish/ net night; Figure 5). In 2007, our field station captured a hatchery-stocked pallid sturgeon in the Kansas River in a gill net (CPUE 0.016 fish/ net night).

The other three pallids were captured using trot lines. Two were captured with 3/0 O'Shaughnessy hooks and one with 3/0 circle hooks. One was captured during experimental trot line sampling (with standard number of hooks and randomly selected bends and subsamples). Pallid sturgeon CPUE captured in experimental trot lines was 0.015 fish/ 20 hooks.

Only one stock size fish was captured in standard sampling (Tables 4 – 8). The fish was captured in a gill net from an outside bend mesohabitat (Table 6).

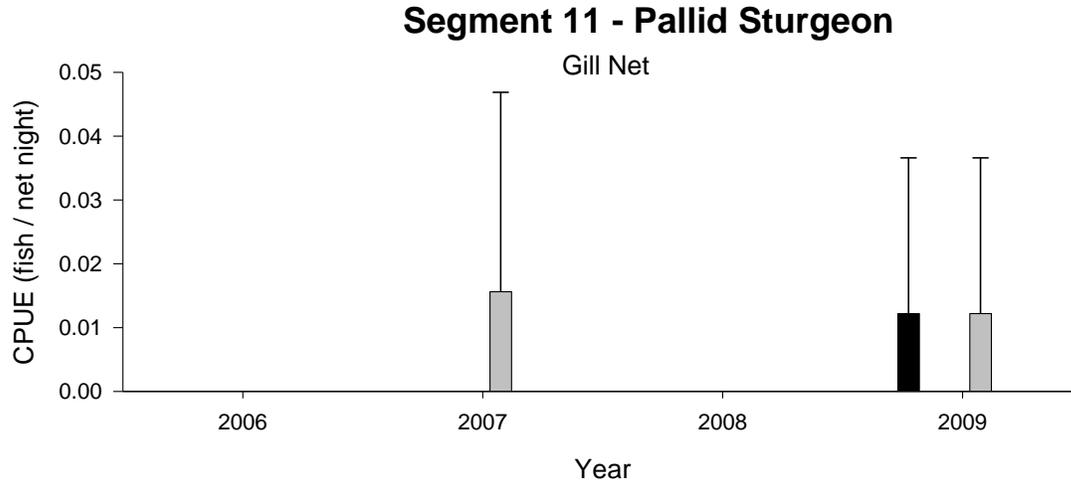


Figure 5. Mean annual catch per unit effort ( $\pm 2$  SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2009. Pallid sturgeon of unknown origin are awaiting genetic verification.

Table 4. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
			17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	1	0	0	0	N-E	N-E	0	100	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 7. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	1	0	0	0	N-E	N-E	0	100	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

## Segment 11 - Pallid Sturgeon

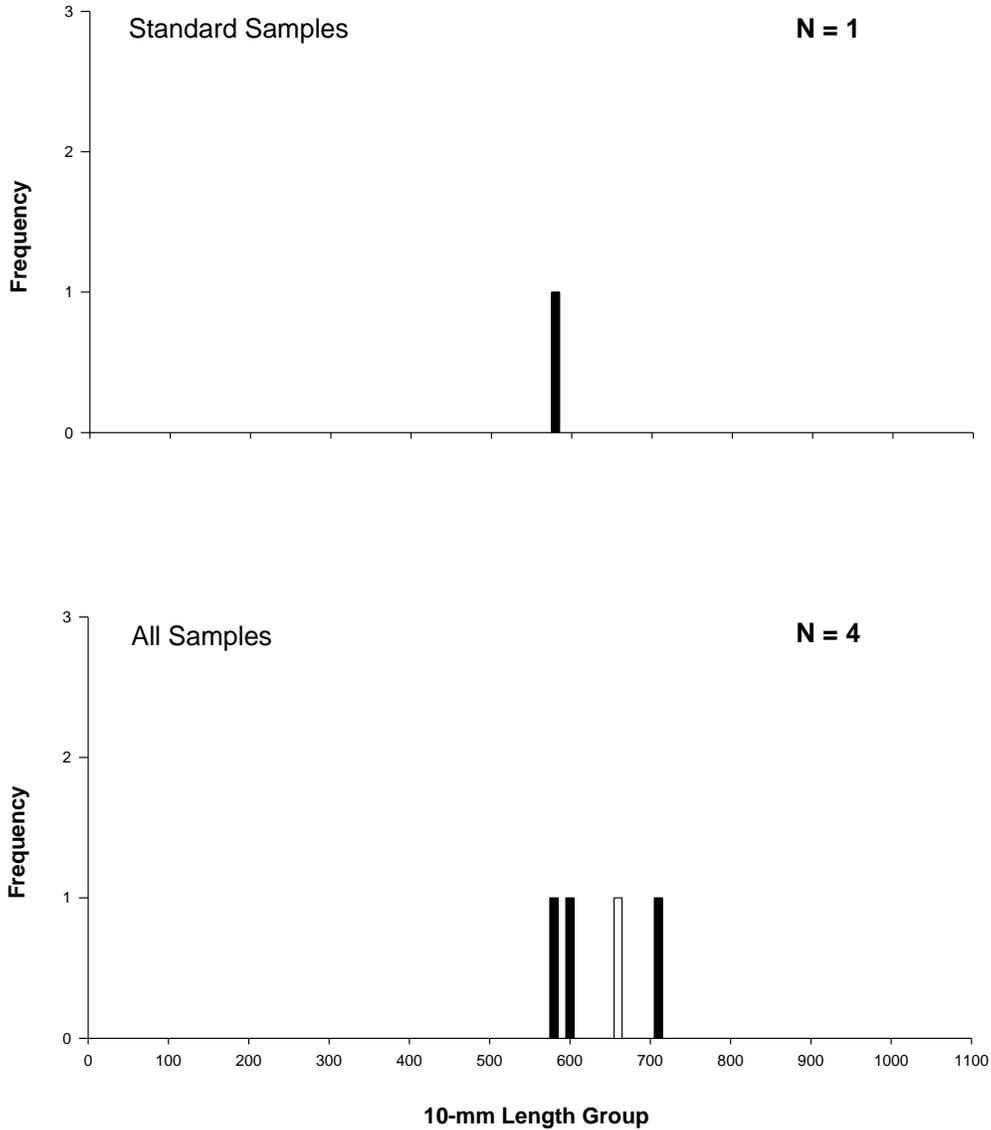


Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009. Pallid sturgeon of unknown origin are awaiting genetic verification.

## Segment 11 - Annual Pallid Sturgeon Capture History

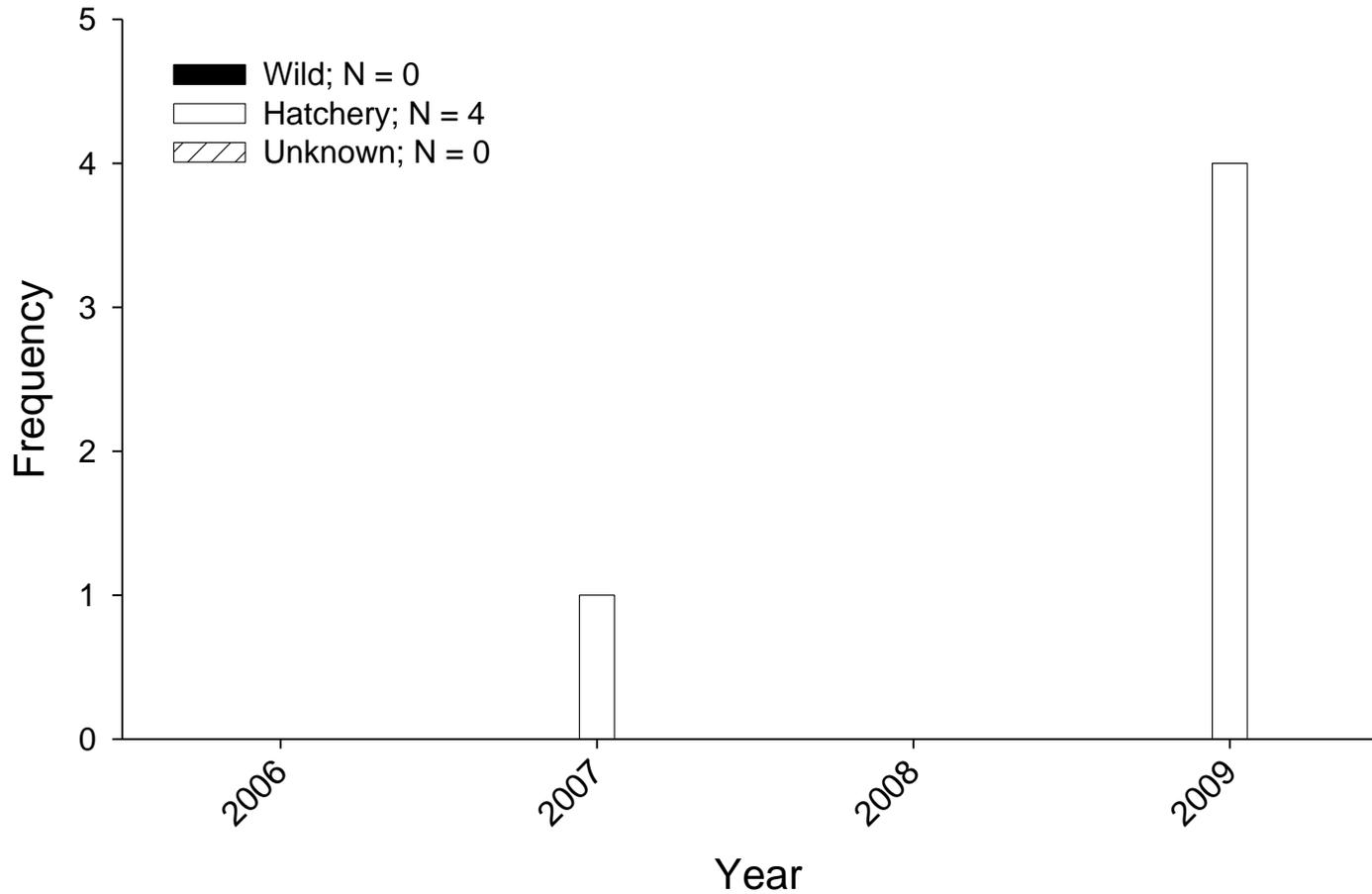


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 11, the Kansas River, from 2006-2009. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples.

## **Shovelnose X Pallid Sturgeon Hybrids**

There were no shovelnose X pallid Sturgeon hybrid fish captured in the Kansas River during 2009.

## Targeted Native River Species

### Shovelnose Sturgeon

A total of 371 shovelnose sturgeon was captured with standard gears in seven bends in segment 11 during the 2009 season (Figure 13). This is less than the total catch of shovelnose sturgeon in 2007 (N = 532) and 2008 (N = 385) but more than captured in 2006 (N = 253). Fork lengths ranged from 133 to 746 mm, a similar range to 2006 (275 – 726 mm), 2007 (201 – 764 mm), and 2008 (100 – 750 mm). Trammel nets captured the most shovelnose sturgeon (N = 213), followed by gill nets (N = 101) and otter trawls (N = 57).

Quality size class fish (> 380 mm) were the most frequently captured size in standard gill nets. However, CPUE has decreased every year since 2006 (8.273, 3.687, and 3.036 fish/ net night in 2006, 2007, and 2008, respectively; Figure 10), the most dramatic decrease occurring in 2009 (CPUE = 0.325 fish/ net night). Gill nets have only captured smaller size classes in 2007, when sub-stock size and stock size were captured at a low rate (CPUE 0.012 and 0.025 fish/ net night).

Trammel nets captured a large size range of shovelnose sturgeon (133 – 746 mm), and had highest catch rates over all years for the quality and above size classes (Figure 11). Over both seasons, CPUE was highest for the largest size classes during fish community season in 2006 (5.165 fish/ 100 m) and lowest during sturgeon season 2008 (0.889 fish/ 100 m). Over both seasons and all size classes, CPUE was highest in 2006, and decreased in 2007 through 2009.

Otter trawls also captured a large range of shovelnose sturgeon in segment 11 (200 – 693 mm) but captured more from quality and above size classes (Figure 12). Catch rates over both seasons do not seem to show a trend for quality and above size classes. In 2008, only smaller sub-stock size class (<150 mm) fish were captured (N = 2, 110 and 114 mm). Genetic samples were collected from the smaller sturgeon to accurately identify the species.

Trot lines captured a total of 197 shovelnose sturgeon in the Kansas River, which is the second-highest catch for all gears used. The CPUE of shovelnose in random trot line subsamples over all seasons (3.036 fish/ 20 hooks) was second only to overall quality and above size class trammel net catch (5.165 fish/ 100 m). The fish were all stock size and above (298 – 709 mm).

Push trawls captured 12 shovelnose sturgeon from sub-stock size to the memorable size class (177 – 653 mm). Overall catch with all effort in segment 11 resulted in a total of 637

shovelnose sturgeon (Figure 13). Push trawls were used above the weir in the Kansas River in 2009 and captured eight shovelnose sturgeon (177 – 653 mm) and one unknown sturgeon species (55 mm). A fin clip was taken on the unknown sturgeon so species could be genetically determined.

Over all years and seasons, the preferred size class (510 – 639 mm) was the most frequently captured size class of shovelnose sturgeon in the Kansas River, averaging 69% of the catch (Figure 14). Sub-stock size class fish were only collected in 2007 and 2009 (Figure 15). The 2009 sub-stock size class had the highest average relative weight (101.6). The average relative weight across all years was inversely related to size (stock = 90.8, quality = 88.9, preferred = 86 and memorable = 80.8). The stock size class and above show a slight downward trend in relative weights across the years.

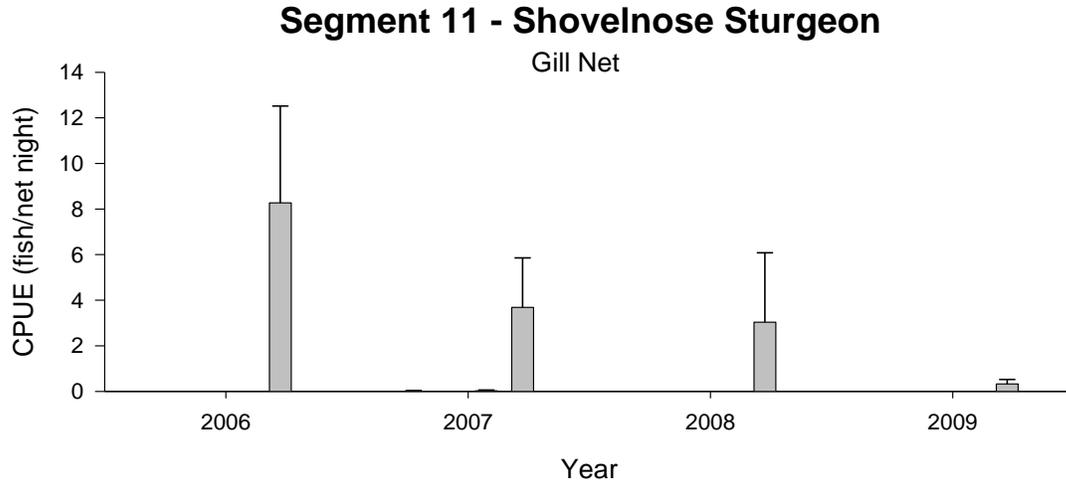


Figure 10. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size ( $> 380$  mm; gray bars) shovelnose sturgeon using gill nets in Segment 11, the Kansas River, from 2006-2009.

## Segment 11 - Shovelnose Sturgeon

1.0" Trammel Nets

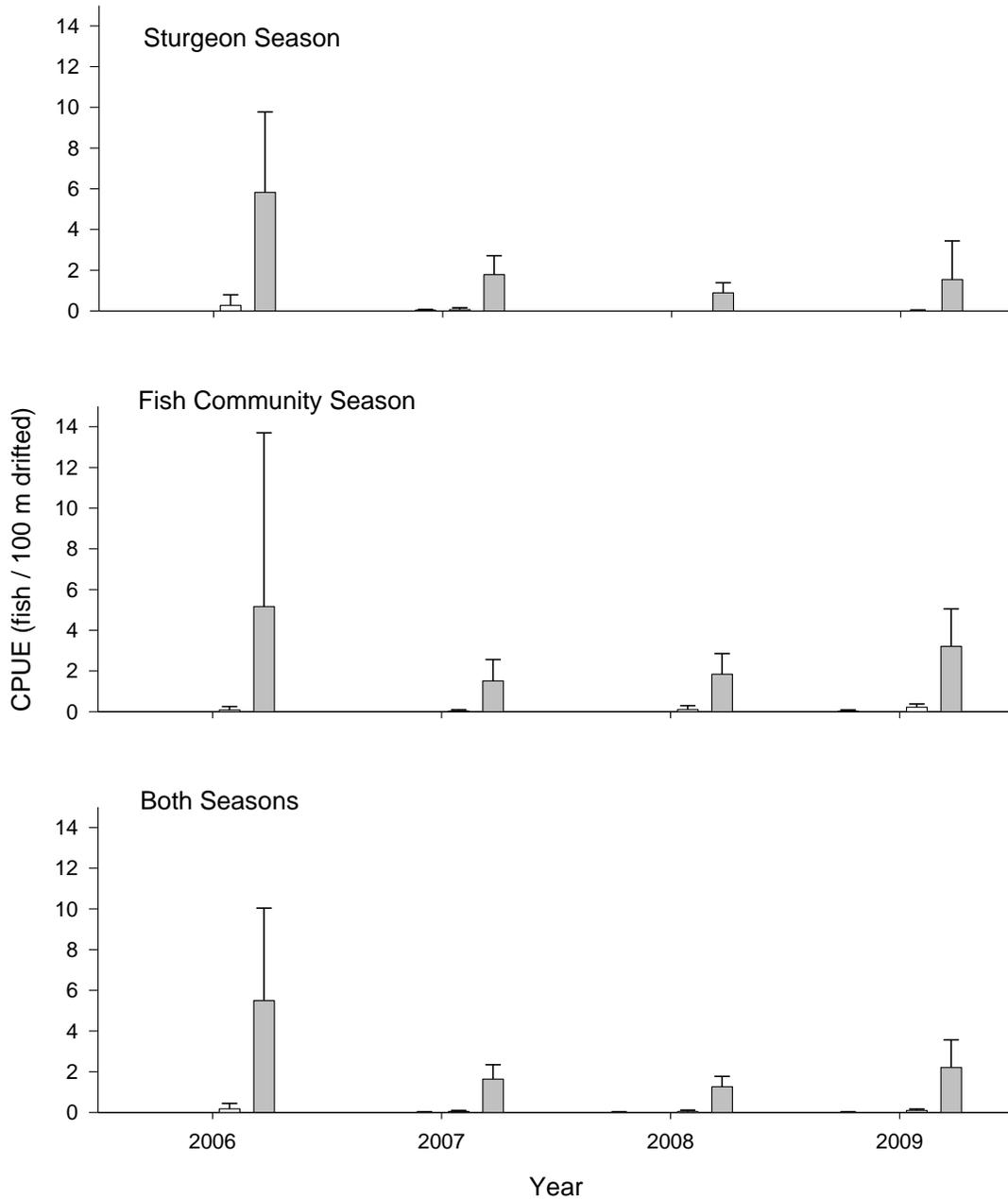


Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0" trammel nets in Segment 11, the Kansas River, from 2006-2009.

## Segment 11 - Shovelnose Sturgeon

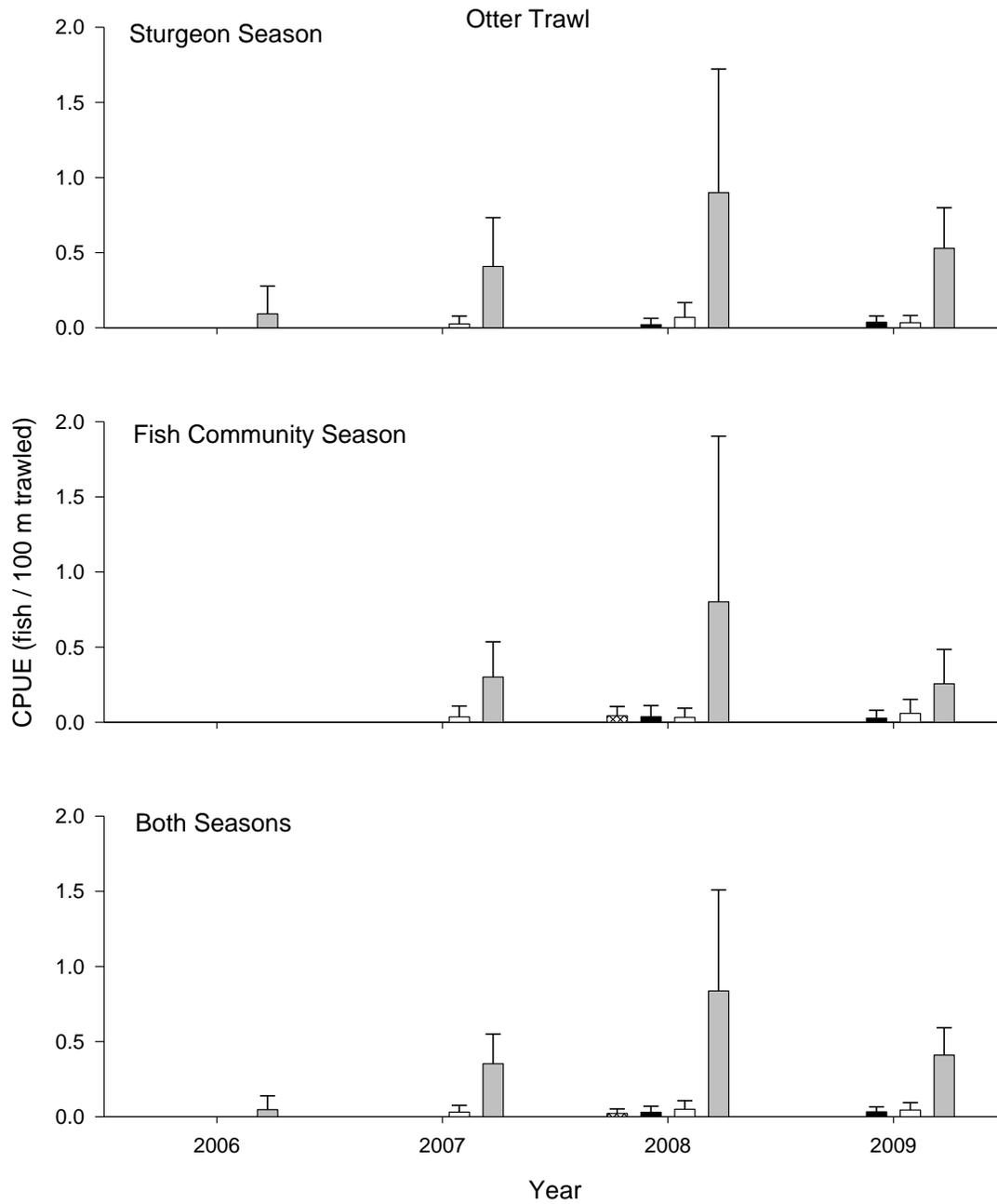


Figure 12. Mean annual catch per unit effort ( $\pm$  2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 11 of the Kansas River from 2006-2009.

## *Habitat Use*

Habitat classifications used by the PSPAP in the other segments of the Missouri River are not always applicable for use in the Kansas River. The major habitat difference in our sample area of the Kansas River is the designation of above and below the Johnson County Weir (weir). The difference lies in the channelization of the river that occurs below the weir versus the more natural, braided channel above the weir.

When comparing catch of shovelnose sturgeon in gill nets above and below the weir, more shovelnose sturgeon were captured below the weir than what was expected based on effort ( $P = < 0.001$ ). Otter trawl catch showed no difference in catch above versus below the weir.

Five sub-stock stock size shovelnose sturgeon were captured during 2009 (Table 9 and 10). Three were captured above the weir, two in the inside bend and one in a large sidechannel macrohabitats. Two were captured below the weir in channel cross-over mesohabitats. Fourteen stock size fish were captured (Table 11). Stock size class fish were captured in inside bend, outside bend and channel cross-over macrohabitats below the weir, and in inside bend and large side-channel macrohabitats above the weir. Quality size and above fish were captured in the highest numbers ( $N = 352$ ; Table 12). They were captured in the same habitats both above and below the weir (channel cross-over, inside bend, outside bend, and large side channel). They were also captured in small tributary mouths below the weir. Most sturgeon were captured in channel border mesohabitats, but most of the effort was expended there due to that being the only mesohabitat in which trammel nets and otter trawls are deployed (Table 13).

Table 9. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	1	0	100	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	3	0	33	0	N-E	N-E	67	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	1	0	0	0	N-E	N-E	0	0	100	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	1	0	0	0	N-E	N-E	0	100	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	3	0	0	0	N-E	N-E	67	33	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	8	0	50	0	N-E	N-E	38	13	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	2	0	0	0	N-E	N-E	50	0	50	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 12. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	79	0	6	0	N-E	N-E	20	73	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	101	0	24	0	N-E	N-E	47	28	1	0	0	0	0	1	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	36	0	28	0	N-E	N-E	42	17	14	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	124	0	5	0	N-E	N-E	59	36	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	12	0	8	0	N-E	N-E	42	8	42	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	80	0	6	0	N-E	N-E	20	74	0	0	0	0	0	0	0
		0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	101	0	24	0	N-E	N-E	47	28	1	0	0	0	0	1	0
		0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	42	0	26	0	N-E	N-E	45	17	12	0	0	0	0	0	0
		0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	133	0	8	0	N-E	N-E	57	35	0	0	0	0	0	0	0
		0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	15	0	7	0	N-E	N-E	40	7	47	0	0	0	0	0	0
		0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

## Segment 11 - Shovelnose Sturgeon

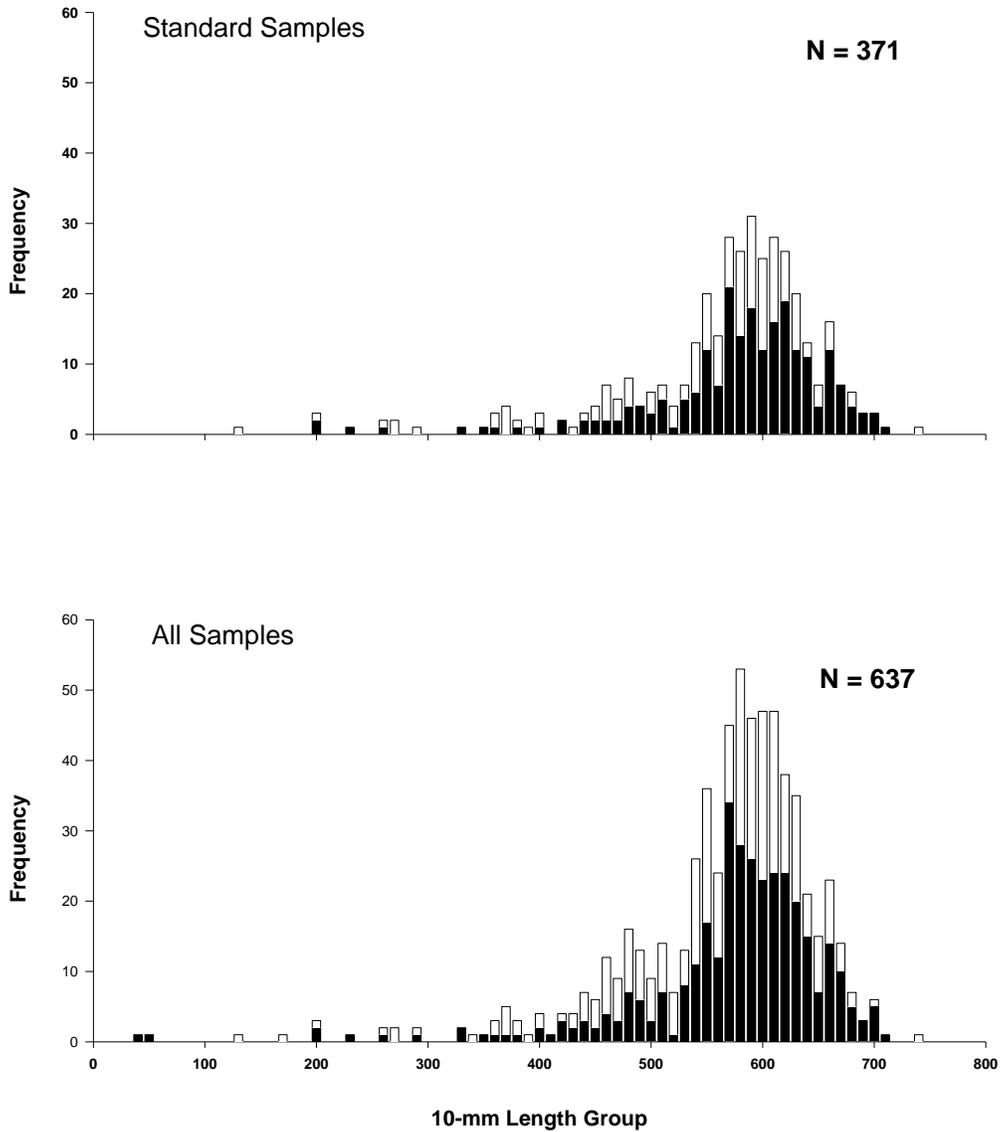
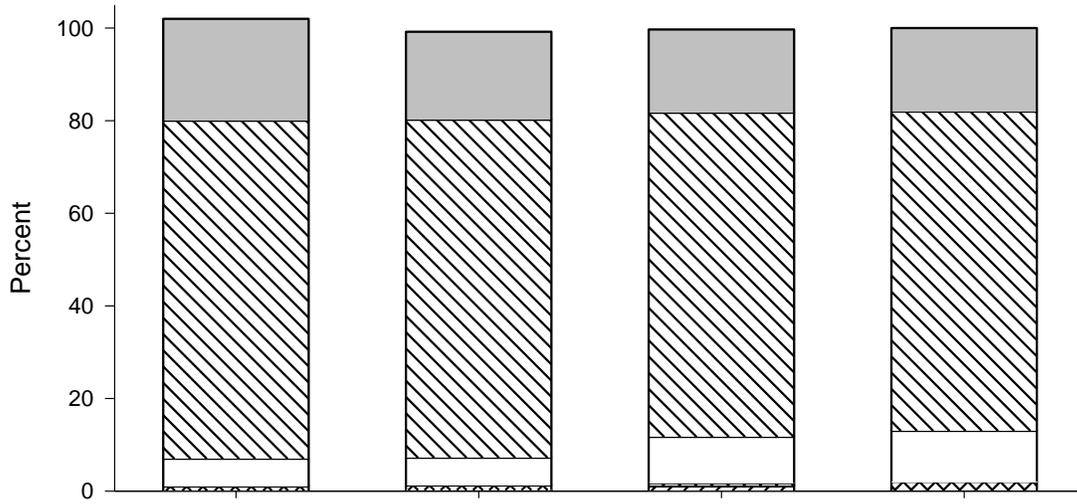
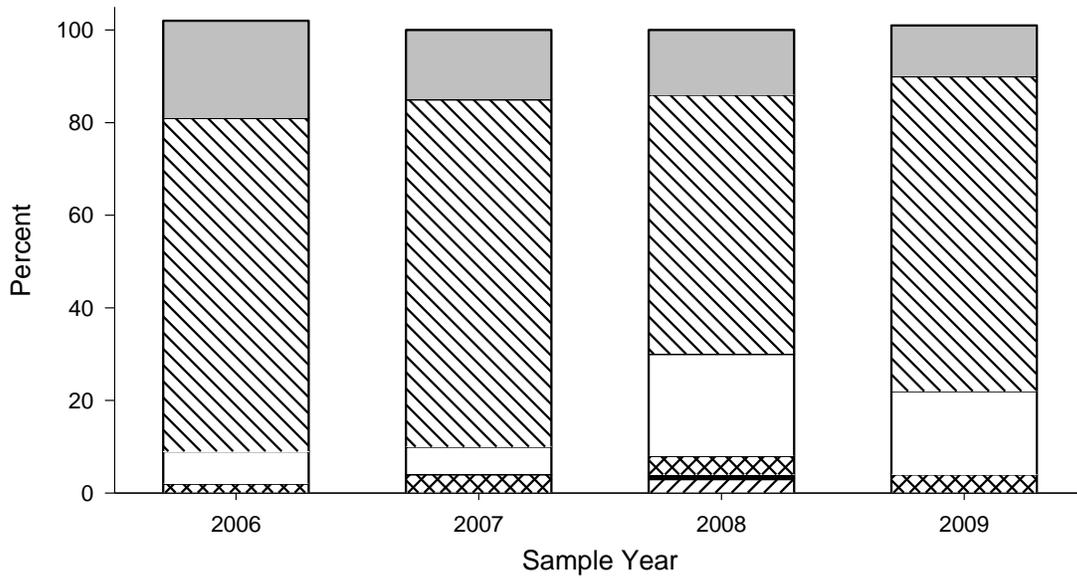


Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

### Segment 11 - Shovelnose Sturgeon Sturgeon Season



### Fish Community Season



Sub-Stock (0 - 149 mm)     
  Stock     
  Preferred  
 Sub-Stock (150 - 249 mm)     
  Quality     
  Memorable / Trophy

Figure 14. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2009 in Segment 11, in the Kansas River. Length categories determined using the methods proposed by Quist (1998).

### Segment 11 - Shovelnose Sturgeon

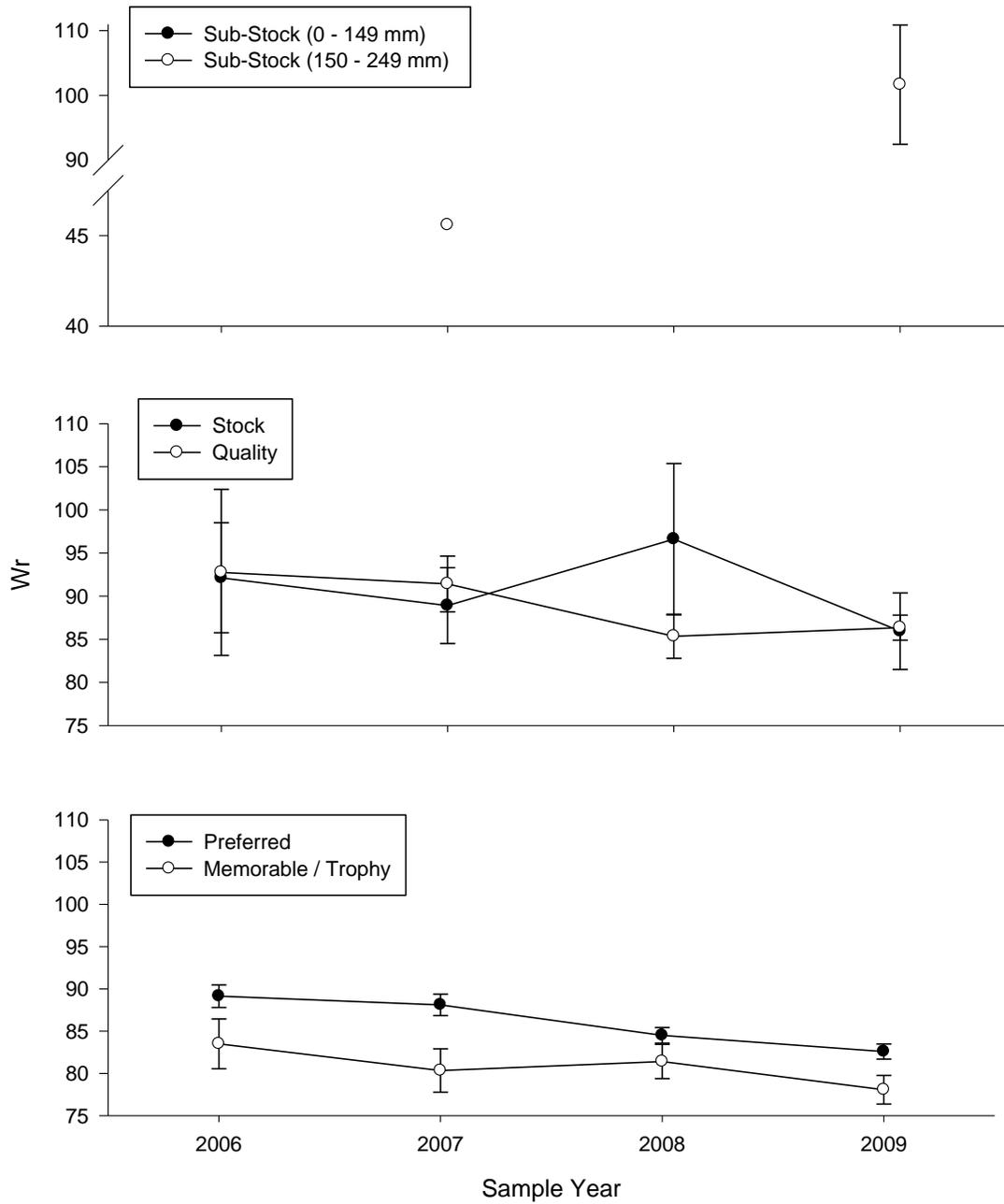


Figure 15. Relative weight ( $W_r$ ) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2009 in Segment 11, the Kansas River. Length categories determined using the methods proposed by Quist (1998).

## **Sturgeon Chub**

No sturgeon chub were captured in segment 11 during the sample years 2006 - 2009, therefore figures 16 and 17 have been omitted.

## **Sicklefin Chub**

Sicklefin chub were only sampled in segment 11 during the 2006 and 2008 sampling years. There were two sicklefin chub captured in segment 11 during sample year 2008. Sicklefin chub were captured in mini-fyke (56 mm) and otter trawl (33 mm) during the 2008 fish community season (Figure 18). Both sicklefin chub were captured in the inside bend, one in bars habitat and the other in channel border habitat. In sample year 2006, one (26 mm total length) was captured in an otter trawl during sturgeon season (Figure 18).

### Otter Trawl

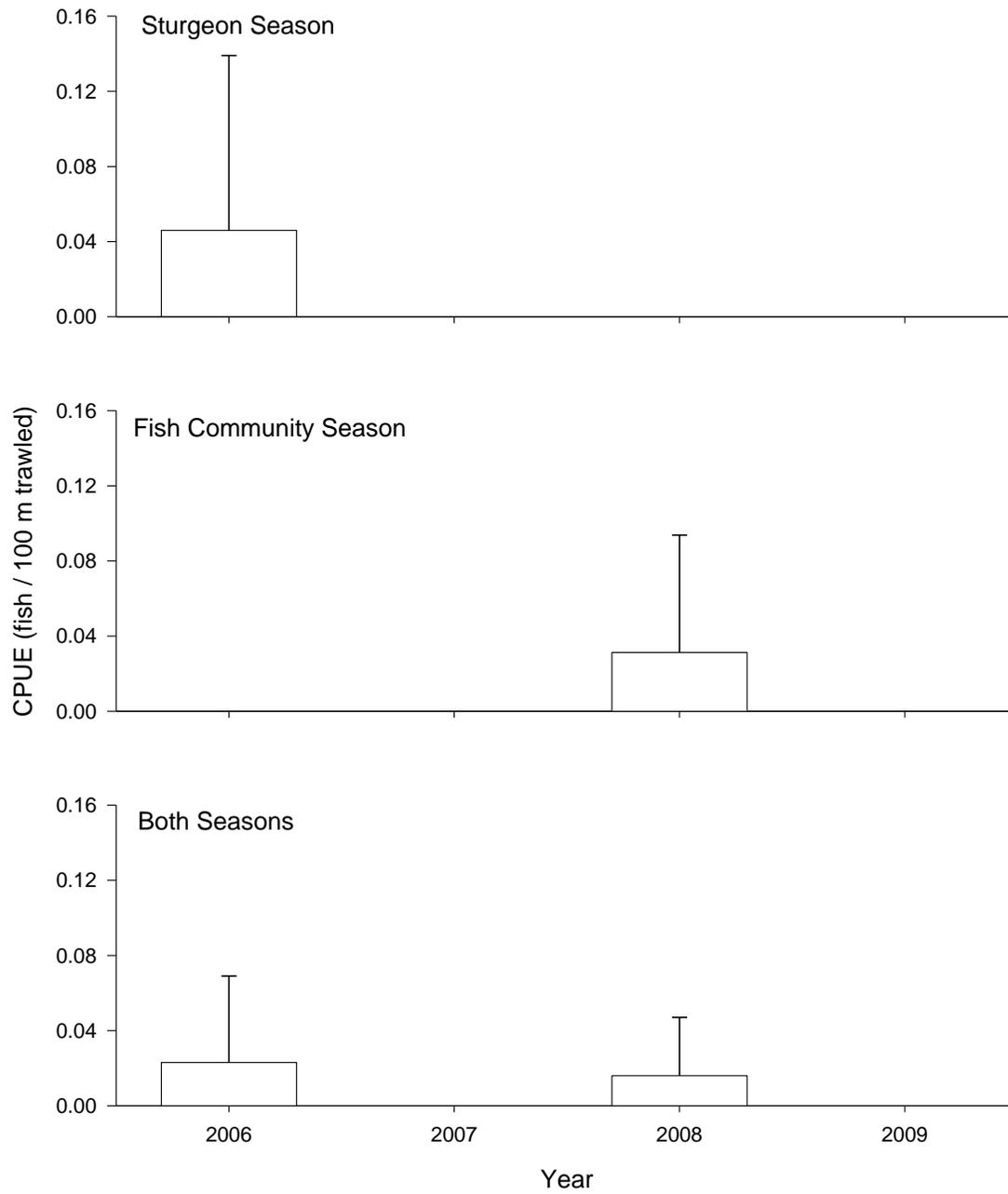


Figure 18. Mean annual catch per unit effort ( $\pm 2$  SE) of sicklefin chub using otter trawls in Segment 11, the Kansas River, from 2006-2009.

## Segment 11 - Sicklefin Chub

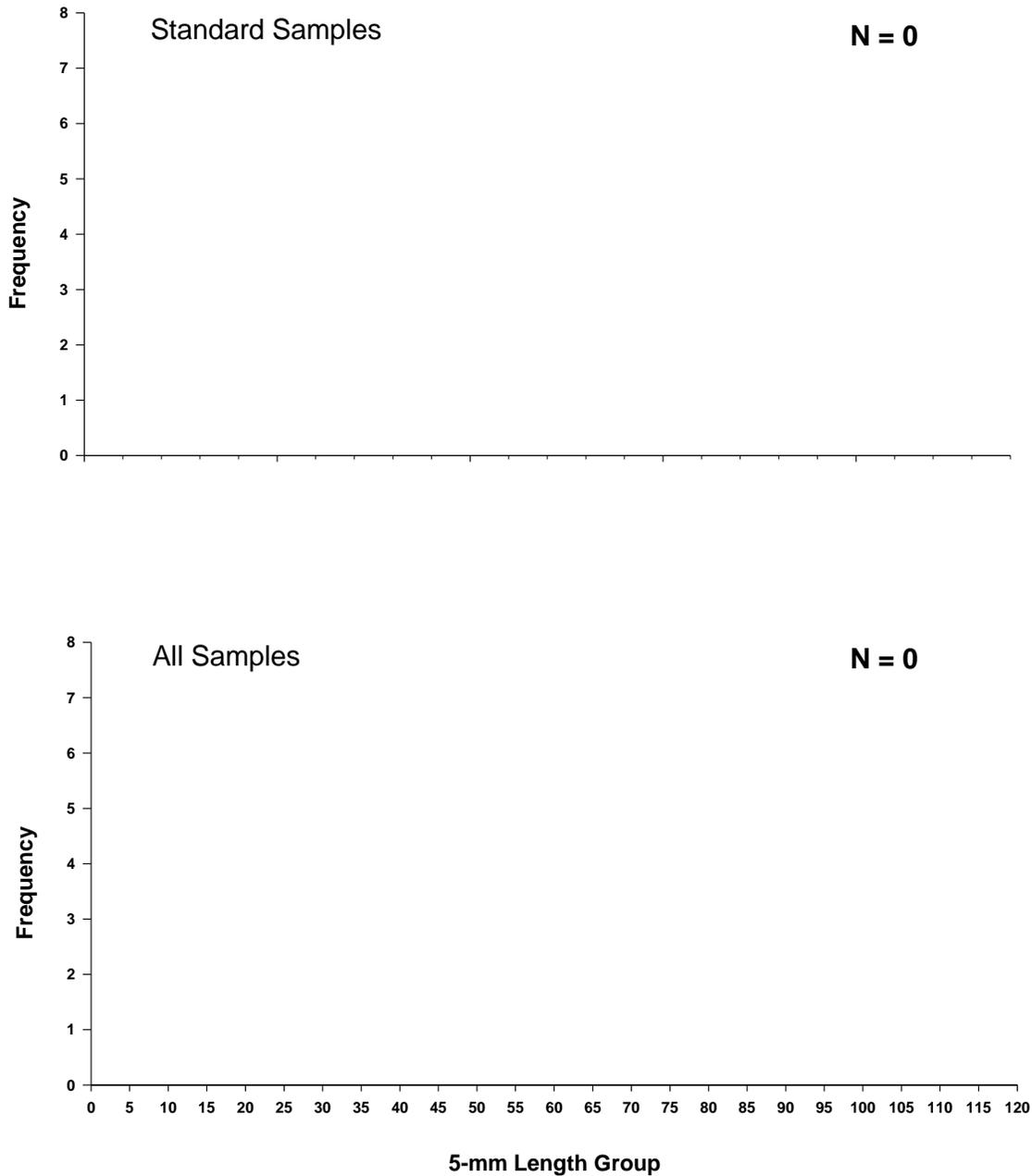


Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

## **Shoal Chub**

Shoal chub were collected for the third straight year in sample year 2009. Total numbers of shoal chub collected continued to increase in segment 11 with 15 shoal chub collected in standard samples and an additional 5 with wild gears. Overall CPUE showed an increase for the third straight year as well (Figure 20). However, CPUE during the fish community season (0.040 fish/100 m trawl) was lower than in previous years (Figure 20). Sample year 2008 was the second year shoal chub (N = 11) were captured in segment 11 (2007: N = 7). Fish were captured in both sturgeon (N = 5) and fish community seasons (N = 6). Most were captured below the Johnson County Weir (weir) with a few (N = 6) being captured above the weir.

Fish lengths during the 2009 sampling season ranged from 30 to 62 mm. A majority of fish sampled were in the 50 mm size class (Figure 21). Lengths were similar to previous sampling years (37 - 60 mm).

## Segment 11 - Shoal Chub

Otter Trawl

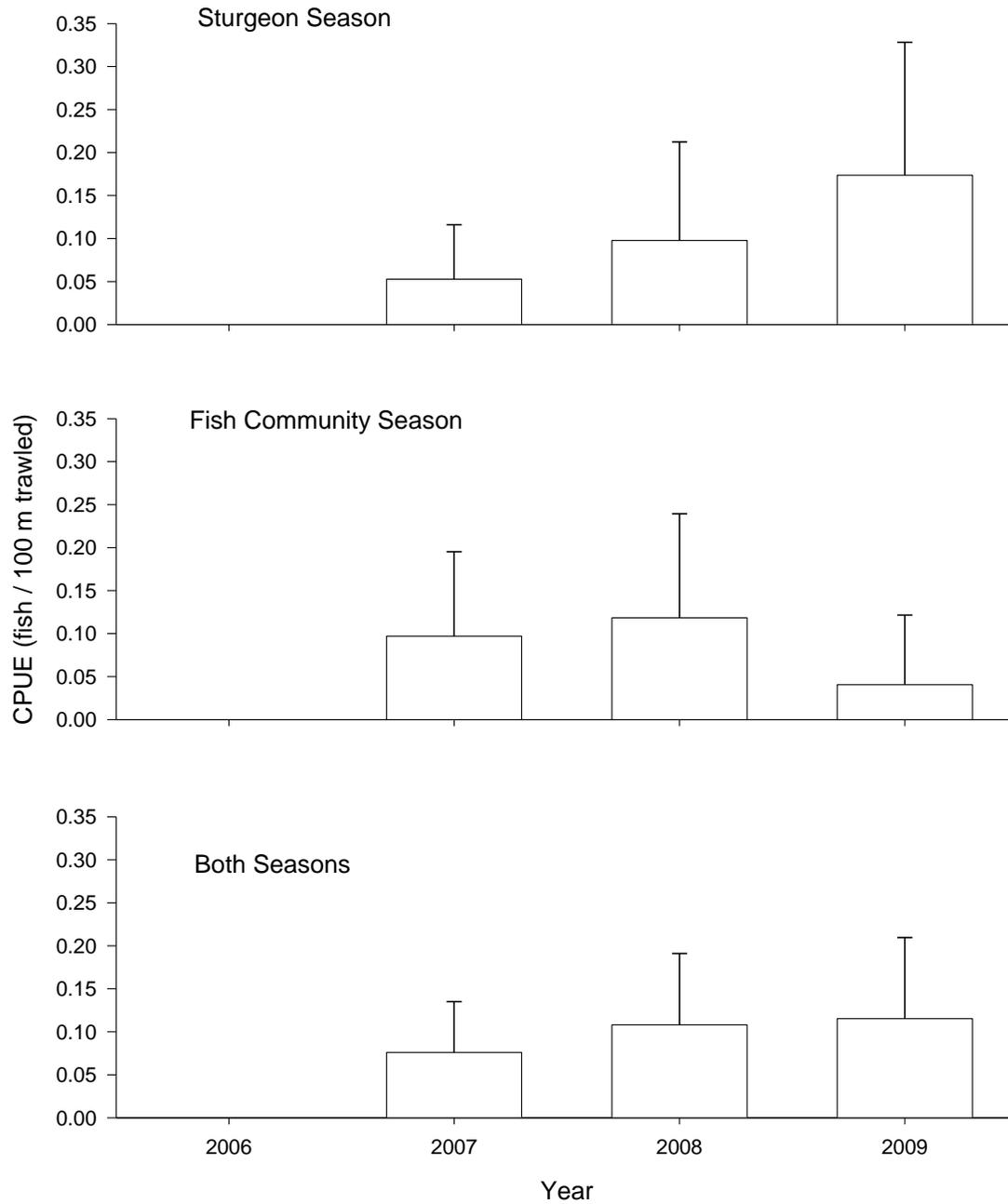


Figure 20. Mean annual catch per unit effort ( $\pm 2$  SE) of speckled chub using otter trawls in Segment 11, the Kansas River, from 2006-2009.

## Segment 11 - Shoal Chub

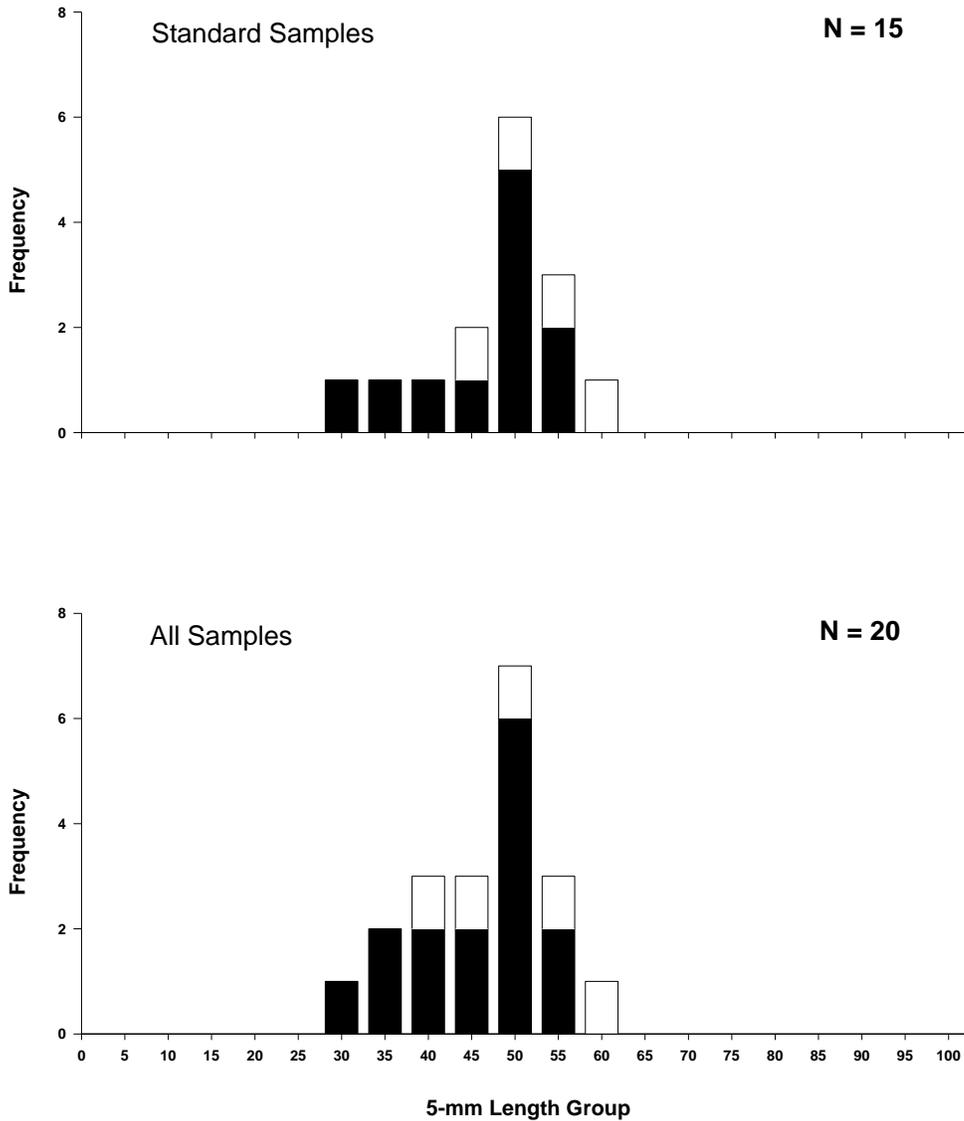


Figure 21. Length frequency of speckled chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

## **Sand Shiner**

A total of 91 sand shiners was captured with standard gears in segment 11 during the 2009 sampling season. This is down from the previous year (N = 129) and has been declining since 2007. Mini-fyke nets were the most effective standard gear at capturing sand shiners (N = 91) with an additional four fish being sampled in push trawls (POT02). Mini-fyke net CPUE for sand shiner was 1.378 fish/net night during the 2009 sampling season. This is lower than in previous years and is also in decline since 2006 (Figure 22).

Unlike the previous year, only one individual sand shiner was captured below the Johnson County Weir. Fish lengths ranged from 20 – 58 mm with most in the 40mm size class (Figure 23) and was similar to previous years' catch.

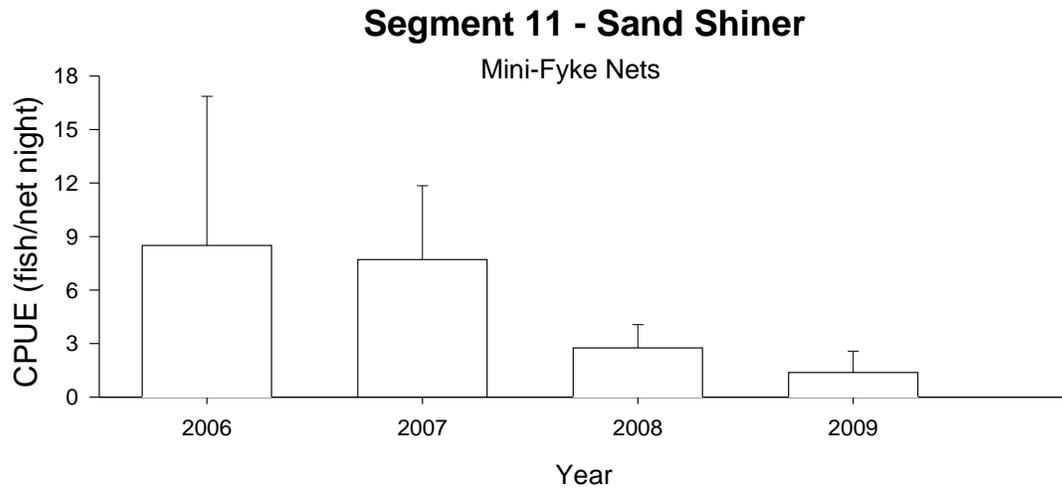


Figure 22. Mean annual catch per unit effort ( $\pm 2$  SE) of sand shiner with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2009.

## Segment 11 - Sand Shiner

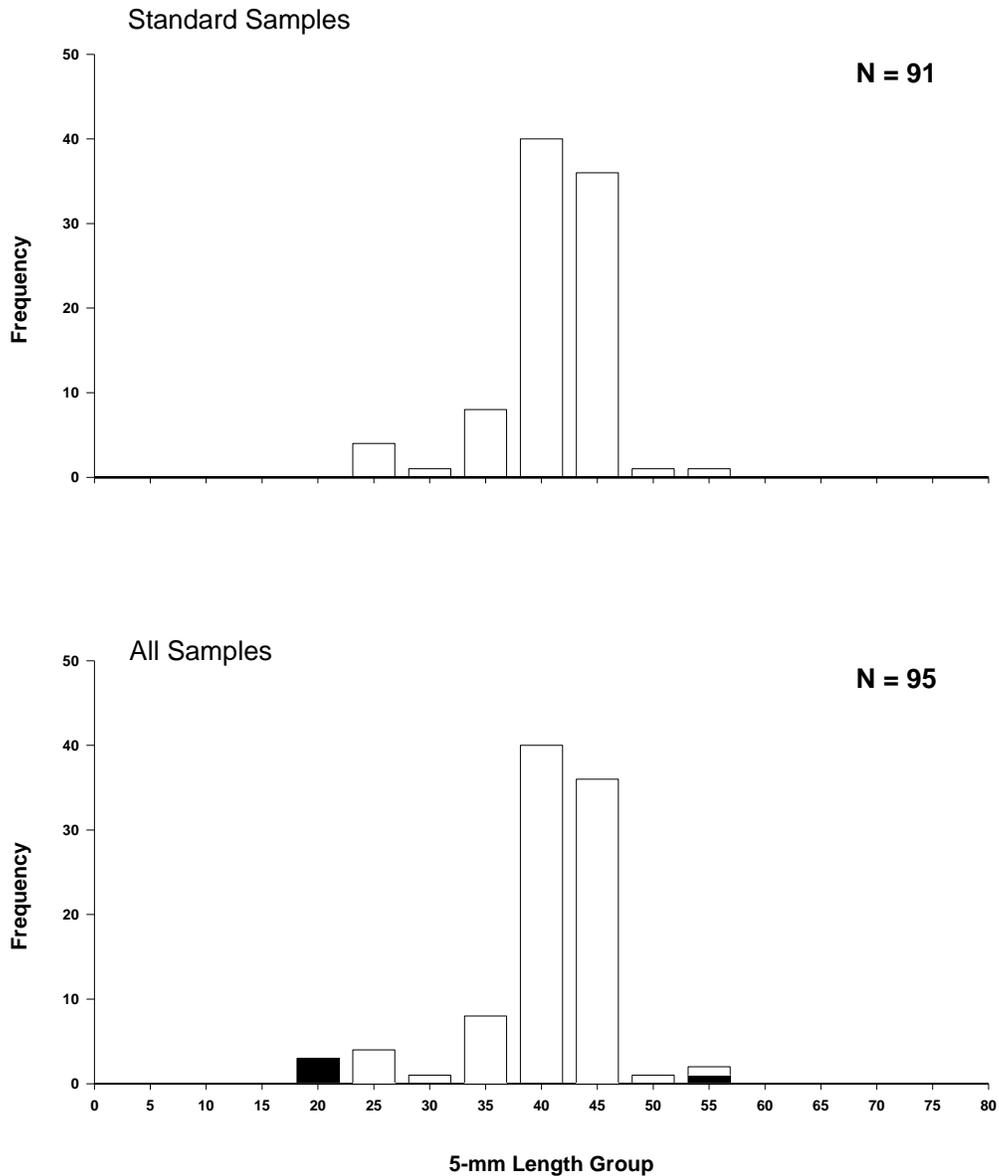


Figure 23. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

***Hybognathus* spp.**

There were only 2 *Hybognathus* spp. captured in segment 11 during 2009, with 15 captured in 2008 and four in 2007. Both individuals in 2009 were brassy minnows, while 2007 and 2008 catches were comprised of plains minnows. As in previous sampling years, all were captured in mini-fyke nets. Mini-fyke net CPUE was 0.030 fish/net night during the 2009 sampling season, which is the lowest since the 2007 sampling season (Figure 24).

Brassy minnows captured in segment 11 during the 2009 sampling season were 34 mm and 39 mm in length. Both individuals were sampled below the Johnson County Weir. In previous years, only one *Hybognathus* spp. was sampled above the weir.

### Segment 11 - *Hybognathus* spp.

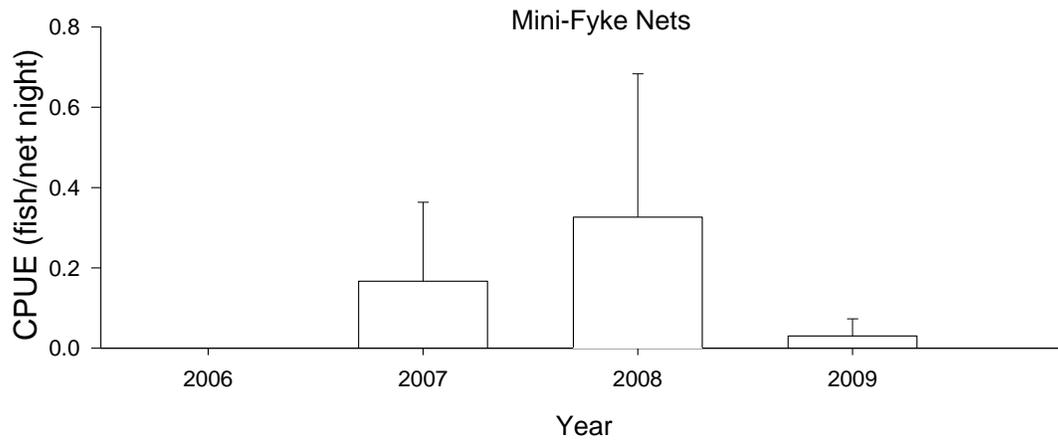


Figure 24. Mean annual catch per unit effort ( $\pm 2$  SE) of *Hybognathus* spp. with mini-fyke nets in Segment 11, the Kansas River, during fish community season 2006-2009.

### Segment 11 - *Hybognathus* spp.

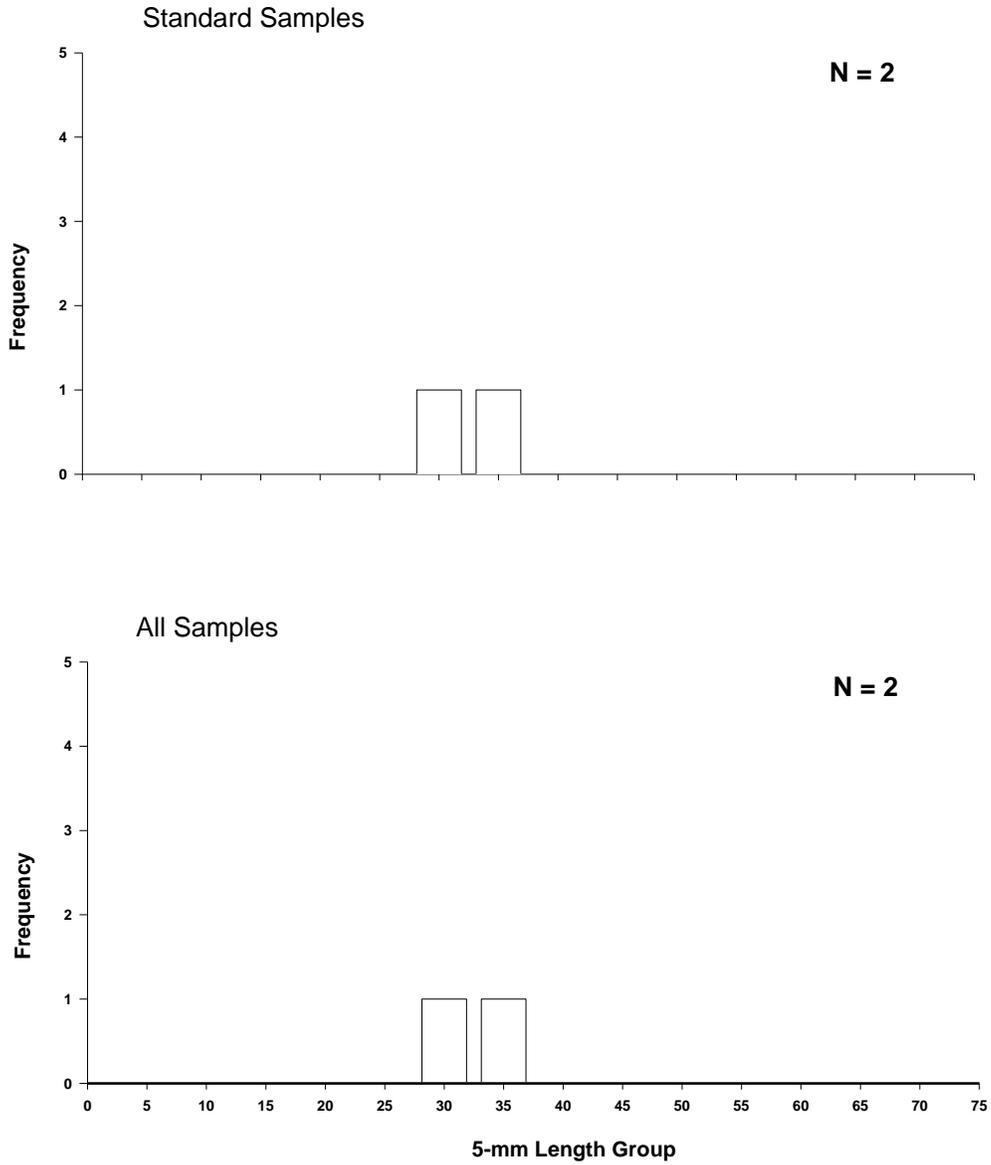


Figure 25. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

## **Blue Sucker**

A total of 14 blue suckers was captured in segment 11 during the 2009 sampling season. This is slightly down from 2008 (N = 17) and 2007 (N = 25). Four additional fish were sampled using push trawls, a wild gear (POT02), during the sturgeon season. Trammel nets continued to be the most effective gear for sampling blue sucker in segment 11, however, overall CPUE for trammel nets was lower than in 2008 (Figure 27). Gill nets did not capture blue sucker during the 2009 season, but for the first time five fish were captured using otter trawls (Figure 26 and Figure 28).

Total lengths ranged from 567 to 749 mm for fish captured with standard gears and 32 to 37 mm for fish captured in wild gears (Figure 29). These smaller fish have not been captured previously. Blue suckers were captured in channel crossovers, inside bend, and outside bend macrohabitats (Table 14). Blue sucker were found both below (N = 5) and above (N = 12) the Johnson County Weir.

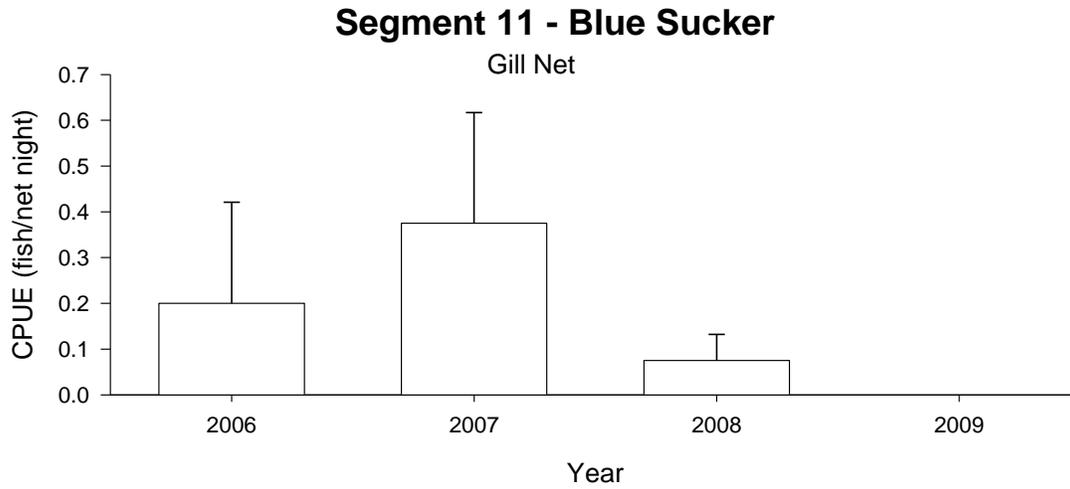


Figure 26. Mean annual catch per unit effort ( $\pm 2$  SE) of blue suckers using gill nets in Segment 11, the Kansas River, from 2006-2009.

### Segment 11 - Blue Sucker

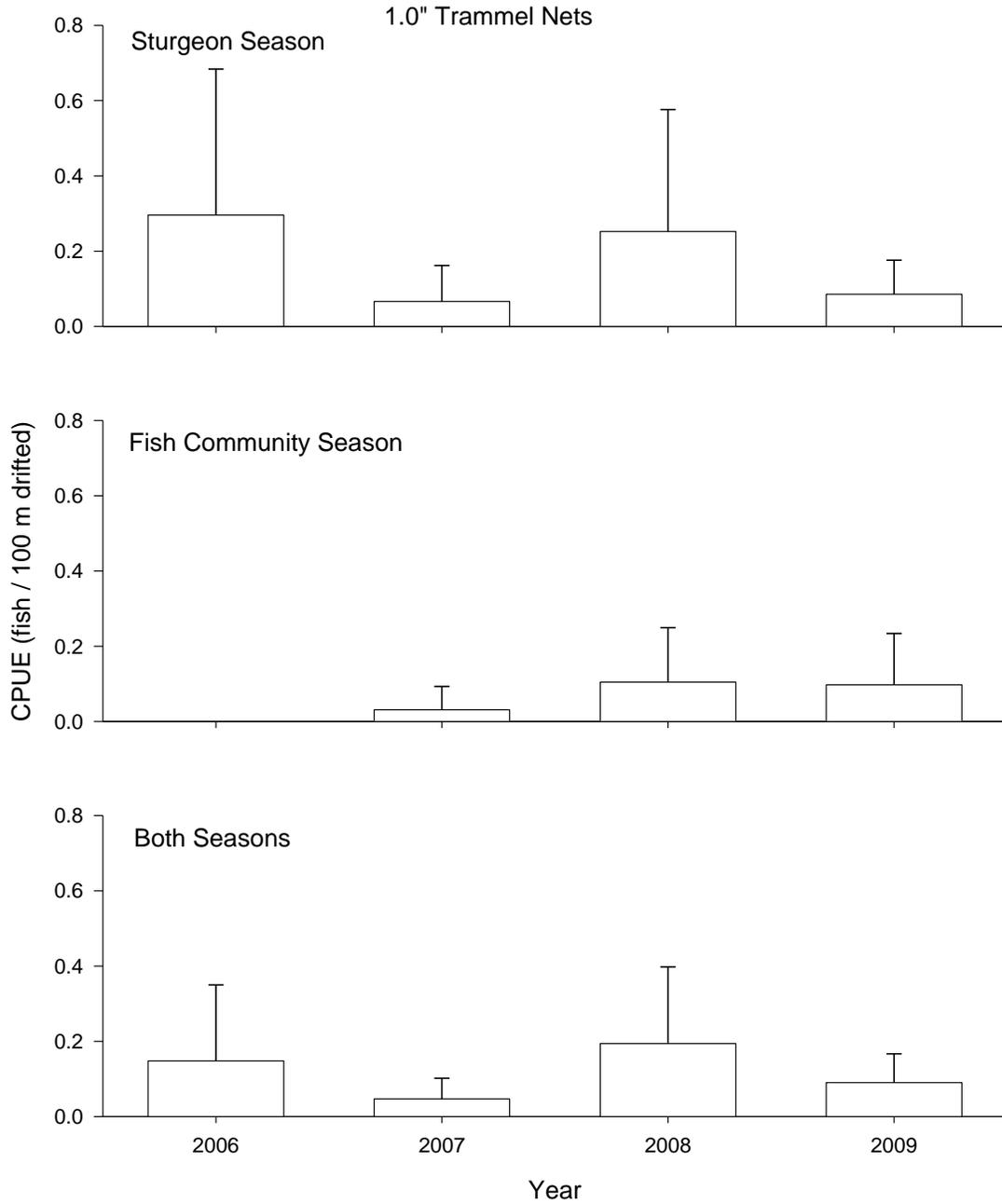


Figure 27. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using 1.0" trammel nets in Segment 11, the Kansas River from 2006-2009.

### Segment 11 - Blue Suckers

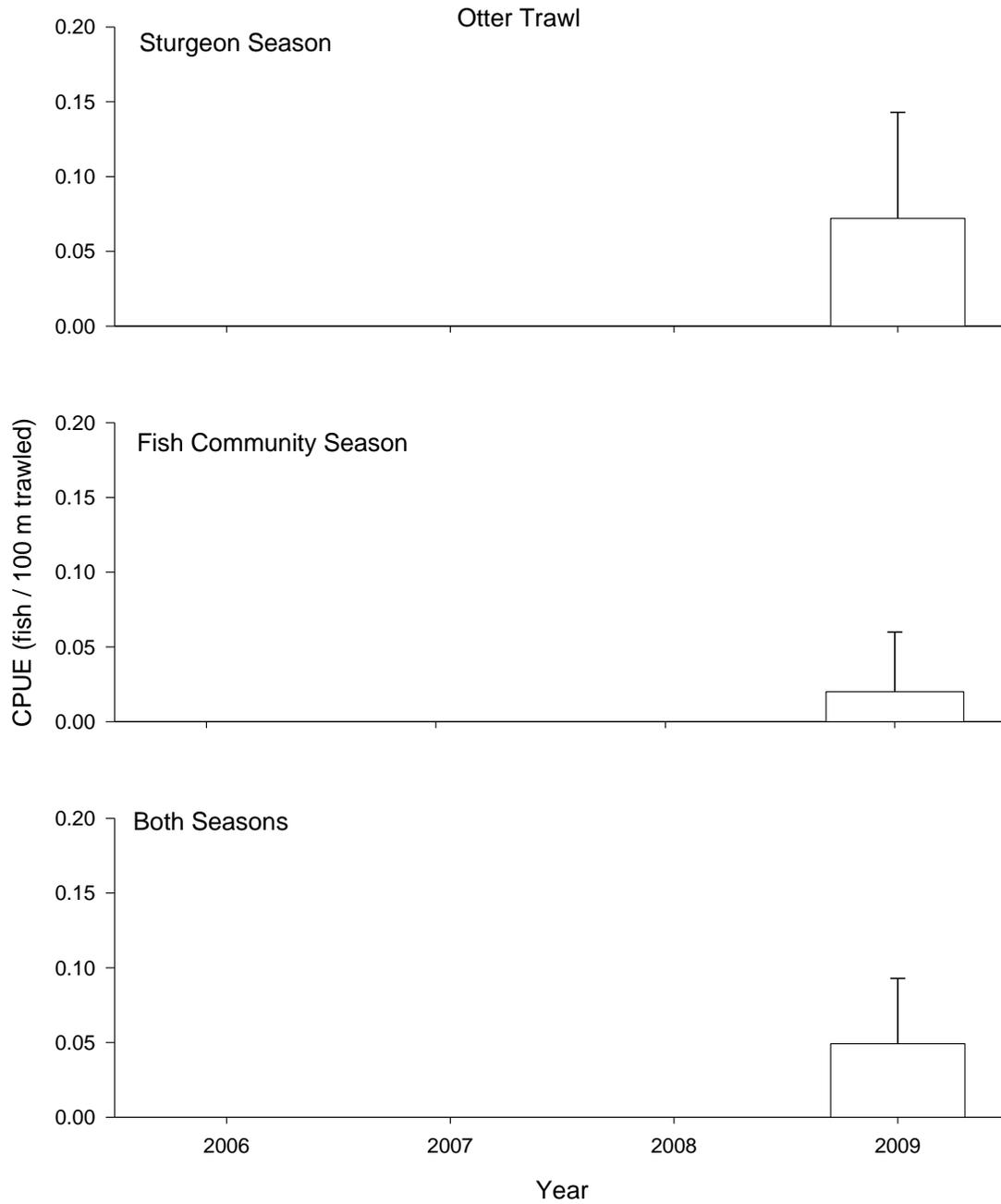


Figure 28. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using otter trawls in Segment 11, the Kansas River, from 2006-2009.

Table 14. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	5	0	0	0	N-E	N-E	40	60	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	4	0	50	0	N-E	N-E	25	25	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	4	0	0	0	N-E	N-E	50	50	0	0	0	0	0	0	0
	.	0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

## Segment 11 - Blue Sucker

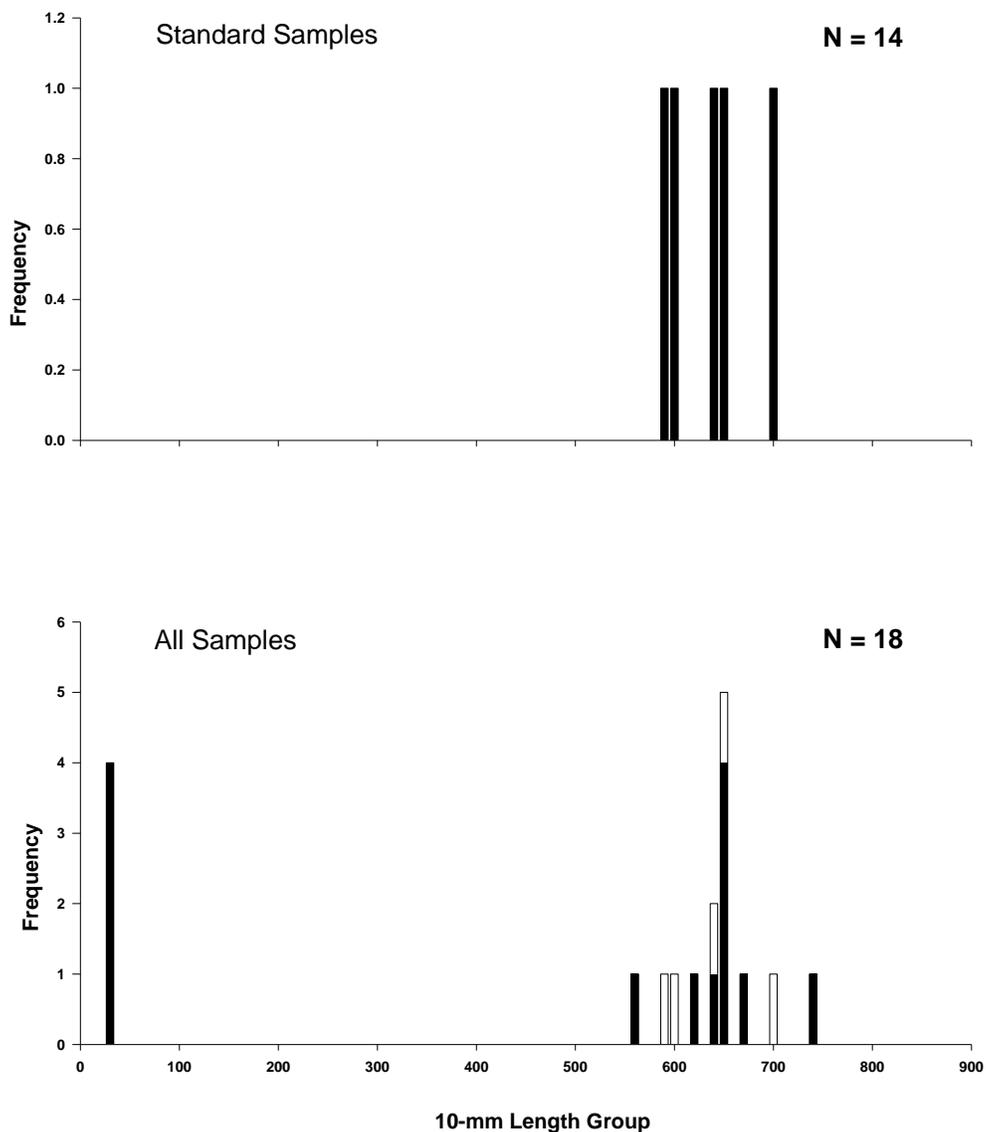


Figure 29. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

## Sauger

In segment 11 during the 2009 sampling season a total of 19 sauger was captured. A majority of the sauger (N = 16) were captured in mini-fyke nets during the fish community season. Only three sauger were captured in the sturgeon season using trammel nets. No sauger were captured during the 2008 sampling year. In past sampling seasons, there have been only six sauger captured in segment 11. Three sauger were captured in segment 11 during the 2007 sampling season, which is equal to catch in 2006. In previous years, sauger were captured in gill nets and trammel nets (Figure 30 and 31). Overall CPUE for trammel nets increased in 2009 from the previous two years (Figure 31).

Sauger captured during the sturgeon season ranged from 335 to 447 mm in length, while those sampled during the fish community season were small ranging from 40 to 67 mm (Figure 33). Sauger were found in channel crossover, inside bend, and outside bend habitats (Table 15.) All sauger were collected below the Johnson County Weir.

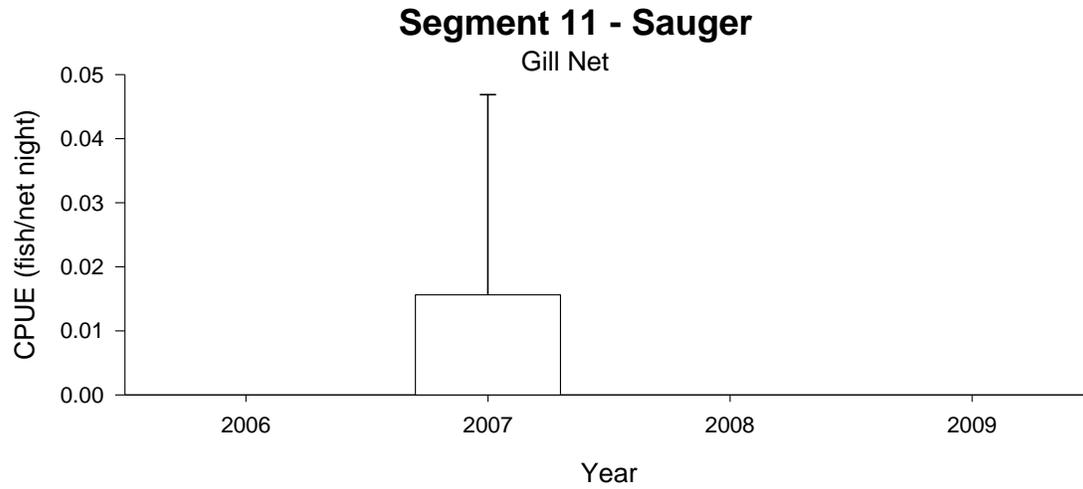


Figure 30. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using gill nets and in Segment 11, the Kansas River, from 2006-2009.

### Segment 11 - Sauger

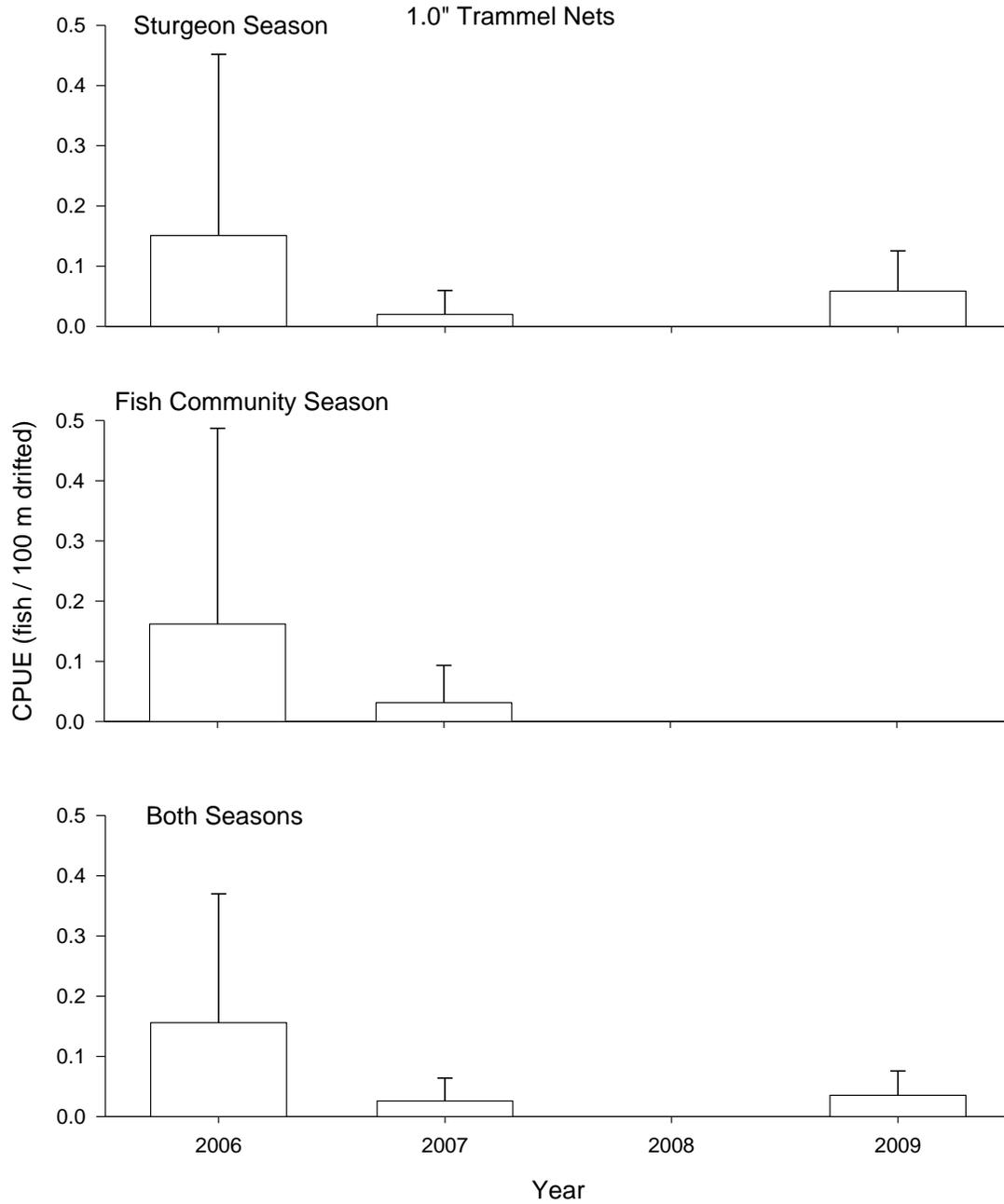


Figure 31. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using 1.0" trammel nets in Segment 11, the Kansas River, from 2006-2009.

### Segment 11 - Sauger

Otter Trawl

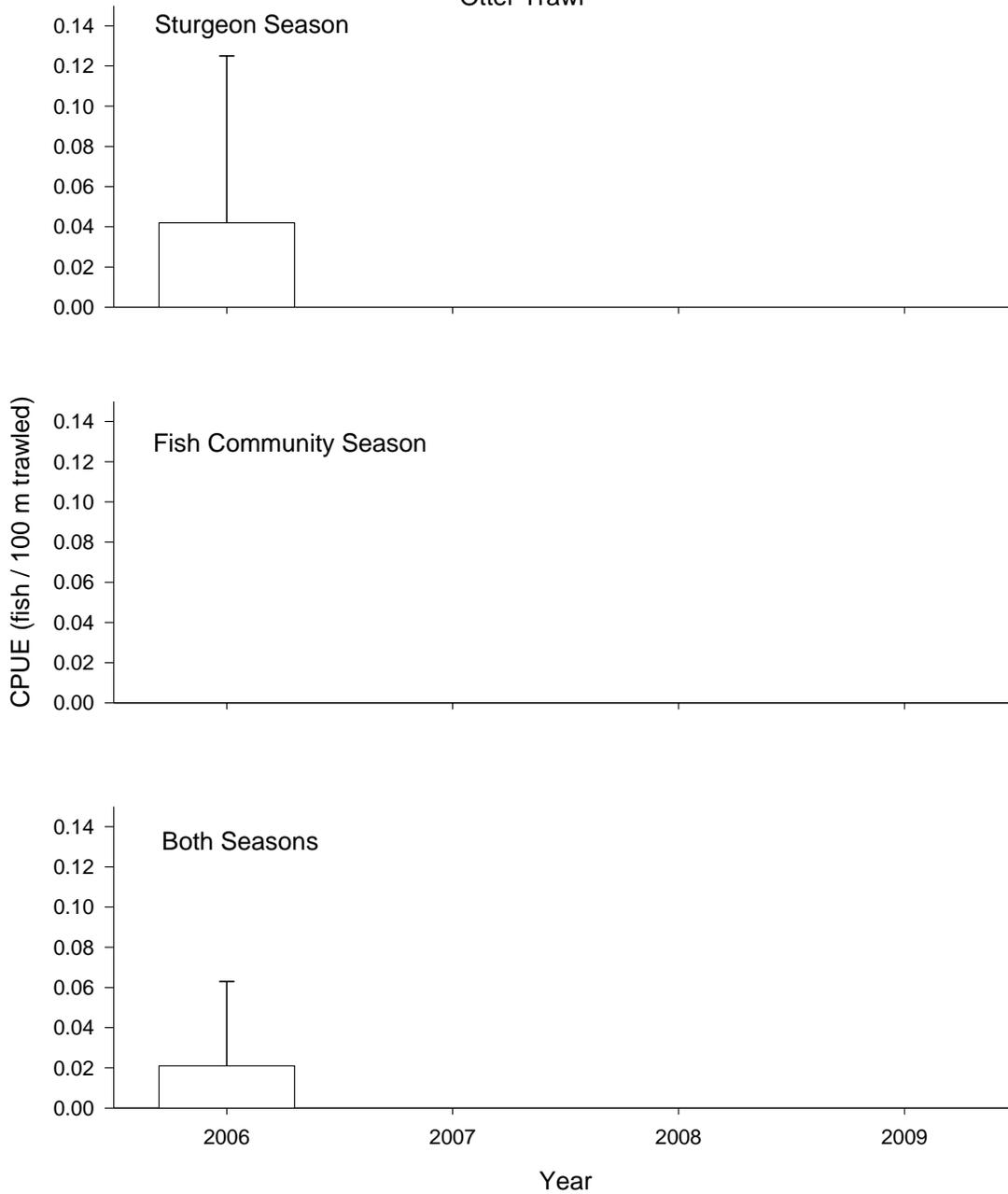


Figure 32. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using otter trawls in Segment 11, the Kansas River, from 2006-2009.

Table 15. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 11, the Kansas River, during 2009. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season</b>															
1.0" Trammel Net	3	0	33	0	N-E	N-E	33	33	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	56	27	0	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	23	3	N-E	N-E	40	30	3	0	0	0	0	3	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	46	23	5	0	0	0	0	0	0
<b>Fish Community Season</b>															
1.0" Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	23	0	N-E	N-E	39	38	0	0	0	0	0	0	0
Mini-Fyke Net	16	0	13	0	N-E	N-E	88	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	39	20	3	6	0	0	0	6	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	20	0	N-E	N-E	40	34	7	0	0	0	0	0	0

## Segment 11 - Sauger

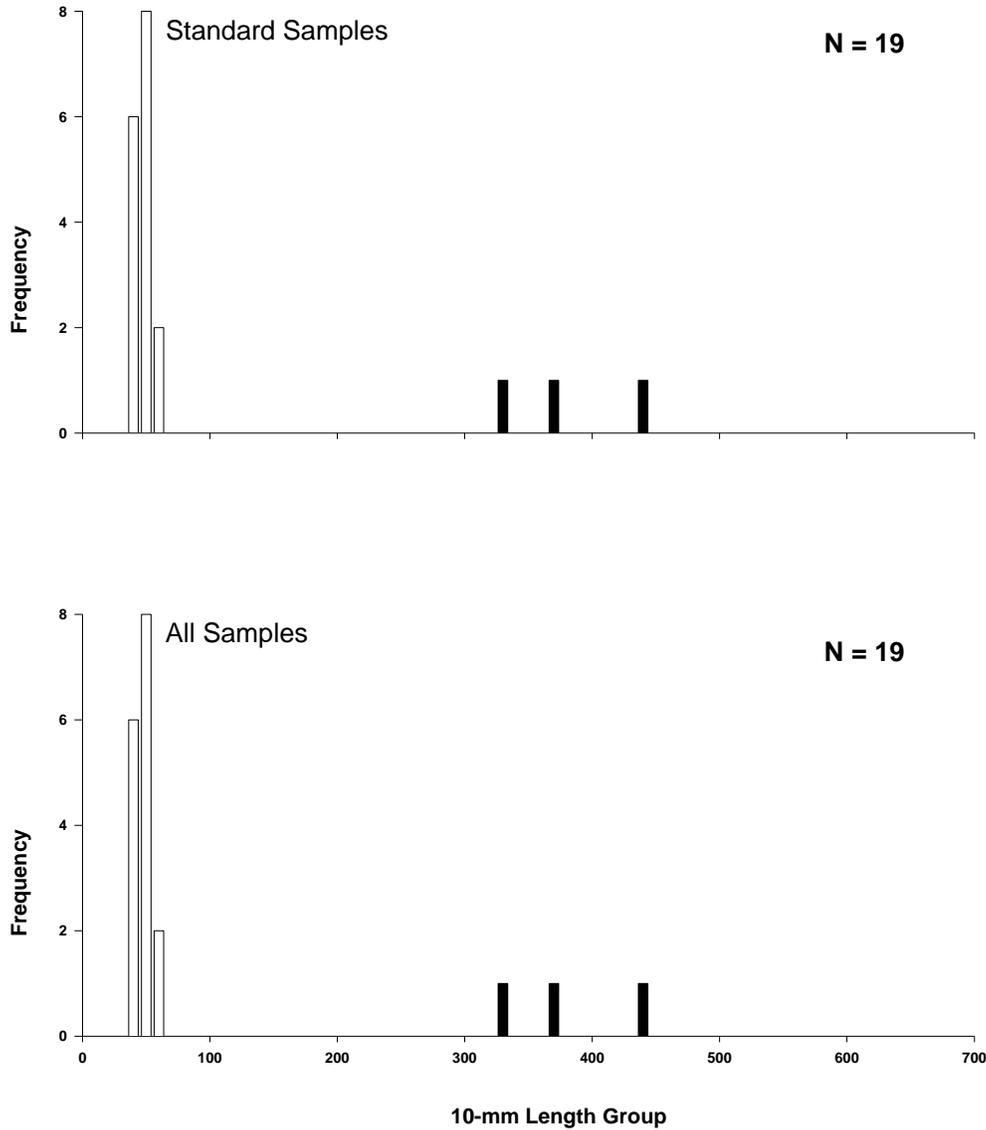


Figure 33. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 11, the Kansas River, during 2009. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2009.

## **Kansas River Fish Community**

A total of 5,023 fish representing 51 species was captured with standard gears in segment 11 during the 2009 season, which was more fish than 2007 and 2008 (N = 3,254 and 3,944 respectively). The increase of fish captured is primarily due to the initiation of standard deployments in the unchannelized section (RM 21 - 52). Fifteen (N = 9 in 2007 and N = 7 in 2008) non-target species were represented by at least 50 individuals with non-target species comprising 90% of the total catch during the 2009 sampling year, which is an increase from the last three years of sampling (86% in 2008, 76% in 2007 and 82% in 2006). Catch from bars mesohabitats accounted for 65% (79%, 60% and 54% in 2008, 2007 and 2006, respectively) of the total catch. Thirty three percent of fish were captured in the channel border. Very few fish were captured from pool areas (< 1%).

Gill nets captured 14 species (13 in both 2006 and 2008, 20 in 2007), with two species represented by more than 50 individuals (Appendix F1). Gill nets captured the largest specimens of blue catfish (372 – 757 mm) and river carpsuckers (260 – 568 mm) compared to other standard gears. CPUE's for blue catfish and river carpsuckers were 0.085 and 0.110 fish/net night, respectively. Notable captures in gill nets include quillback and shorthead redhorse.

One-inch trammel nets captured 14 species of fish. Besides shovelnose sturgeon (CPUE = 2.303 fish/ 100 m), smallmouth buffalo (CPUE = 0.195 fish/100 m drifted) was captured most efficiently with one-inch trammel nets (Appendix F2). Channel catfish (270 – 499 mm; CPUE = 0.045 fish/100 m) were captured in low numbers (N = 4).

Otter trawls captured 15 species (15 in 2007, 20 in 2006, and 18 in 2008) including four non-target species with more than 50 individuals (Appendix F4). Blue and channel catfish (CPUE = 4.25 and 2.53 fish/100 m, respectively) were most effectively captured with otter trawls. Notable captures in otter trawl were stonecat and a young-of-the-year paddlefish (N = 1 at 58 mm).

Mini-fyke nets captured 43 species of fish (21 in 2006, 30 in 2007, and 35 in 2008), including seven species represented by at least 50 individuals (Appendix F6). Mini-fyke nets were the most effective gear to sample the following non-target Kansas River species (CPUE = number of fish/net night): red shiner = 13.364, bullhead minnow = 6.727, bluegill = 4.136, channel catfish = 3.682, freshwater drum = 3.030, gizzard shad = 1.864, and largemouth bass = 1.576. CPUE's increased slightly from previous years captures of non-target species.

## Discussion

One hatchery-stocked pallid sturgeon was captured in segment 11 with standard gears during standard sampling. An additional three pallid sturgeon were captured with trot lines. These pallid sturgeon, with the addition of one hatchery-stocked pallid sturgeon captured in 2007 (Niswonger et al. 2008), are the first to be captured in the Kansas River since 1952 (The University of Kansas Natural History Museum). These captures occurred below the Johnson County Weir (weir), and are a result of the pallid sturgeon propagation program that began in 1992, and has resulted in a stocking event into the Missouri River every year since 2001. There has not yet been a wild pallid sturgeon capture below the weir or any pallid sturgeon captured above the weir, in the unchannelized portion of the Kansas River. There is likely to be more pallid sturgeon captured in the Kansas River as more are stocked.

Pallid sturgeon are documented to use other tributaries, including the Yellowstone, Platte, and Atchafalaya rivers (USFWS 2000). Bramblett and White (2001) observed pallid sturgeon in the Yellowstone River exhibiting spawning behavior. This study also showed a preference to sandy substrate. The closest resemblance to the Yellowstone River that occurs in the Kansas River is in the unchannelized section above the weir. If pallid sturgeon have been extirpated from this section of the river, it is possible that mature hatchery-stocked pallid sturgeon from the Missouri may make it above the weir to spawn.

CPUE of pallid sturgeon in trot lines (0.015 fish/ 20 hooks) was slightly higher than in gill nets (0.012 fish/ net night). Trot lines used in the Missouri River have captured a larger number of pallid sturgeon than other gears used (Horner et al. 2010). We anticipate that trot lines are the most likely gear to capture pallid sturgeon in the Kansas River, and we are going to be using them more in the future sampling seasons.

The majority of shovelnose sturgeon sampled in the Kansas River in 2006, 2007, 2008, and 2009 (94%, 96%, 85%, and 82% respectively) were preferred size class and above ( $\geq 510$  mm) fish. Young-of-year (YOY) sturgeon were classified as *Scaphirhynchus* spp under 170 mm (Steffensen and Hamel 2008). These fish were assumed to be shovelnose sturgeon due to the much larger numbers of shovelnose sturgeon compared to pallid sturgeon found in the Kansas River, and the fact that no wild pallid sturgeon have been captured in the river since 1952. There have been nine YOY sturgeon captured in the Kansas River since sampling began. The first YOY sturgeon captured were in 2008, when eight were captured with push trawls and otter

trawls (22 – 154 mm). Six of these fish were captured above the weir in the unchannelized section of the river, in the downstream vicinity of Bowerstock Dam (RM 47 - 52). Only one YOY sturgeon was detected in all sampling in 2009, a 113 mm fish collected near the mouth of the Kansas River. The first year that we sampled extensively above the weir using push trawls was 2008. A total of 3,047 meters was push trawled above the weir in 2008, however, more than double that amount of effort was trawled in 2009 (6,267 m), yet only one YOY was captured. During the past two years there have been spring and summer high water events in the Midwest. These increased flows may potentially increase successful recruitment of *Scaphirhynchus* spp. in the Kansas River.

The majority of sampling in segment 11 occurs below the Johnson County Weir (RM 0 – 14.7) where the Kansas River flows through a highly industrialized portion of the Kansas City metropolitan area. High concentrations of nitrogen and phosphorus have been documented in water quality studies on the Kansas River (Rasmussen et al. 2005) and poor water quality associated with urban environments (Herman et al. 2008) may be the cause of low numbers or absence of many native benthic fishes.

Shoal chub is the only *Macrhybopsis* species to have been captured both below and above the weir. Sicklefin chub have only been captured within one to two river miles upstream from the confluence of the Kansas River and only in 2006 and 2008. No sturgeon chub have been captured in four years of sampling in segment 11. Total numbers of sand shiner captured in segment 11 has been decreasing since 2007. Unlike the previous year, only one individual sand shiner was captured below the Johnson County Weir. There were only 2 *Hybognathus* spp. captured in segment 11 during 2009 with 15 captured in 2008 and 4 in 2007. Both individuals in 2009 were brassy minnows, while 2007 and 2008 catches were comprised of plains minnows. Both individuals were sampled below the Johnson County Weir. In previous years, only one *Hybognathus* spp. was sampled above the weir.

Blue sucker catch rates were lower in 2009 (N =14) than in 2008 (N = 17) and 2007 (N = 25) in segment 11. A study conducted on the Kansas River from 2005 to 2006 found no blue suckers below the weir, but an abundance in the upper portions of the river (Eitzman et al. 2007). Our field office has only captured 16 blue suckers above the weir, which is likely attributed to the few gear deployments in four years of sampling in that portion of the Kansas River. Only large blue suckers (581 – 838 mm) were sampled in the first three years of our study. However three YOY fish (32 to 37 mm) were sampled above the weir in 2009 using a push trawl. The lack

of small (i.e., juvenile) blue sucker has been noted in the mainstem Missouri River as well by LaBay et al. (2008), and may be the result of sampling bias. Blue suckers may prefer tributaries like the Kansas and Grand rivers and upper reaches of larger rivers for their spawning and rearing areas (Vokoun et al. 2003).

Sauger were captured in mini-fyke nets in segment 11 in 2009 for the first time since the project began (N = 16). The average mean length of a YOY sturgeon in this section of the Missouri River is 143 mm or less (Dattilo et al. 2008). All these fish were YOY fish, ranging in size from 40 to 67 mm, and were all captured in one day near the mouth of the Kansas River. These are by far the smallest sauger captured in the Kansas River; previously, the smallest captured was 278 mm. There has only been 5 sauger under 100 mm captured in segment 10 of the Missouri River within PSPAP sampling, and four of these were also captured during 2009 (Horner et al. 2010).

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Appendix A. Phylogenetic list of Missouri River and Kansas River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5<sup>th</sup> edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
<b>Petromyzontidae – lampreys</b>		
<i>Ichthyomyzon castaneus</i>	Chestnut lamprey	CNLP
<i>Ichthyomyzon fossor</i>	Northern brook lamprey	NBLP
<i>Ichthyomyzon unicuspis</i>	Silver lamprey	SVLP
<i>Ichthyomyzon gagei</i>	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
CLASS OSTEICHTHYES – BONY FISHES		
ORDER ACIPENSERIFORMES		
<b>Acipenseridae – sturgeons</b>		
<i>Acipenser fulvescens</i>	Lake sturgeon	LKSG
<i>Scaphirhynchus</i> spp.	Unidentified Scaphirhynchus	USG
<b><i>Scaphirhynchus albus</i></b>	<b>Pallid sturgeon</b>	<b>PDSG*</b>
<b><i>Scaphirhynchus platyrhynchus</i></b>	<b>Shovelnose sturgeon</b>	<b>SNSG*</b>
<i>S. albus</i> X <i>S. platyrhynchus</i>	Pallid-shovelnose hybrid	SNPD
<b>Polyodontidae – paddlefishes</b>		
<i>Polyodon spathula</i>	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
<b>Lepisosteidae – gars</b>		
<i>Lepisosteus oculatus</i>	Spotted gar	STGR
<i>Lepisosteus osseus</i>	Longnose gar	LNGR
<i>Lepisosteus platostomus</i>	Shortnose gar	SNGR
ORDER AMMIFORMES		
<b>Amiidae – bowfins</b>		
<i>Amia calva</i>	Bowfin	BWFN
ORDER OSTEOGLOSSIFORMES		
<b>Hiodontidae – mooneyes</b>		
<i>Hiodon alosoides</i>	Goldeye	GDEY
<i>Hiodon tergisus</i>	Mooneye	MNEY
ORDER ANGUILLIFORMES		
<b>Anguillidae – freshwater eels</b>		
<i>Anguilla rostrata</i>	American eel	AMEL
ORDER CLUPEIFORMES		
<b>Clupeidae – herrings</b>		
<i>Alosa alabame</i>	Alabama shad	ALSD
<i>Alosa chrysochloris</i>	Skipjack herring	SJHR
<i>Alosa pseudoharengus</i>	Alewife	ALWF
<i>Dorosoma cepedianum</i>	Gizzard shad	GZSD
<i>Dorosoma petenense</i>	Threadfin shad	TFSD

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>D. cepedianum</i> X <i>D. petenense</i>	Gizzard-threadfin shad hybrid	GSTS
<b>ORDER CYPRINIFORMES</b>		
<b>Cyprinidae – carps and minnows</b>		
<i>Campostoma anomalum</i>	Central stoneroller	CLSR
<i>Campostoma oligolepis</i>	Largescale stoneroller	LSSR
<i>Carassius auratus</i>	Goldfish	GDFH
<i>Carassius auratus</i> X <i>Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<b><i>Hybognathus argyritis</i></b>	<b>Western silvery minnow</b>	<b>WSMN*</b>
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<b><i>Hybognathus placitus</i></b>	<b>Plains minnow</b>	<b>PNMW*</b>
<i>Hybognathus</i> spp.	Unidentified <i>Hybognathus</i>	HBNS
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<b><i>Macrhybopsis hyostoma</i></b>	<b>Shoal chub</b>	<b>SKCB*</b>
<b><i>Macrhybopsis gelida</i></b>	<b>Sturgeon chub</b>	<b>SGCB*</b>
<b><i>Macrhybopsis meeki</i></b>	<b>Sicklefin chub</b>	<b>SFCB*</b>
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. hyostoma</i> X <i>M. gelida</i>	Shoal-Sturgeon chub hybrid	SPST
<i>M. gelida</i> X <i>M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennioides</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis buchani</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greeniei</i>	Wedgespot shiner	WSSN
<b>Cyprinidae – carps and minnows</b>		
<i>Notropis heterolepis</i>	Blacknose shiner	BNSN
<i>Notropis hudsonius</i>	Spottail shiner	STSN
<i>Notropis nubilus</i>	Ozark minnow	OZMW
<i>Notropis rubellus</i>	Rosyface shiner	RYSN
<i>Notropis shumardi</i>	Silverband shiner	SBSN
<i>Notropis stilbius</i>	Silverstripe shiner	SSPS
<b><i>Notropis stramineus</i></b>	<b>Sand shiner</b>	<b>SNSN*</b>
<i>Notropis topeka</i>	Topeka shiner	TPSN
<i>Notropis volucellus</i>	Mimic shiner	MMSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Notropis wickliffi</i>	Channel shiner	CNSN
<i>Notropis</i> spp.	Unidentified shiner	UNO
<i>Opsopoeodus emiliae</i>	Pugnose minnow	PNMW
<i>Phenacobius mirabilis</i>	Suckermouth minnow	SMMW
<i>Phoxinus eos</i>	Northern redbelly dace	NRBD
<i>Phoxinus erythrogaster</i>	Southern redbelly dace	SRBD
<i>Phoxinus neogaeus</i>	Finescale dace	FSDC
<i>Pimephales notatus</i>	Bluntnose minnow	BNMW
<i>Pimephales promelas</i>	Fathead minnow	FHMW
<i>Pimephales vigilax</i>	Bullhead minnow	BHMW
<i>Platygobio gracilis</i>	Flathead chub	FHCB
<i>P. gracilis</i> X <i>M. meeki</i>	Flathead-sicklefin chub hybrid	FCSC
<i>Rhinichthys atratulus</i>	Blacknose dace	BNDC
<i>Rhinichthys cataractae</i>	Longnose dace	LNDC
<i>Richardsonius balteatus</i>	Redside shiner	RDSS
<i>Scardinius erythrophthalmus</i>	Rudd	RUDD
<i>Semotilus atromaculatus</i>	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
	<b>Catostomidae - suckers</b>	
<i>Carpiodes carpio</i>	River carpsucker	RVCS
<i>Carpiodes cyprinus</i>	Quillback	QLBK
<i>Carpiodes velifer</i>	Highfin carpsucker	HFCS
<i>Carpiodes</i> spp.	Unidentified <i>Carpiodes</i>	UCS
<i>Catostomus catostomus</i>	Longnose sucker	LNSK
<i>Catostomus commersonii</i>	White sucker	WTSK
<i>Catostomus platyrhynchus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<b><i>Cycleptus elongatus</i></b>	<b>Blue sucker</b>	<b>BUSK*</b>
<i>Hypentelium nigricans</i>	Northern hog sucker	NHSK
<i>Ictiobus bubalus</i>	Smallmouth buffalo	SMBF
<i>Ictiobus cyprinellus</i>	Bigmouth buffalo	BMBF
<i>Ictiobus niger</i>	Black buffalo	BKBF
<i>Ictiobus</i> spp.	Unidentified buffalo	UBF
<i>Minytrema melanops</i>	Spotted sucker	SPSK
<i>Moxostoma anisurum</i>	Silver redhorse	SVRH
<i>Moxostoma carinatum</i>	River redhorse	RVRH
<i>Moxostoma duquesnei</i>	Black redhorse	BKRH
<i>Moxostoma erythrurum</i>	Golden redhorse	GDRH
<i>Moxostoma macrolepidotum</i>	Shorthead redhorse	SHRH
<i>Moxostoma</i> spp.	Unidentified redhorse	URH
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
	<b>ORDER SILURIFORMES</b>	
	<b>Ictaluridae – bullhead catfishes</b>	
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurus nebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnus</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
<b>ORDER SALMONIFORMES</b>		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarkii</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonneville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL
<b>ORDER PERCOPSIFORMES</b>		
<b>Percopsidae – trout-perches</b>		
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
<b>ORDER GADIFORMES</b>		
<b>Gadidae - cods</b>		
<i>Lota lota</i>	Burbot	BRBT
<b>ORDER ATHERINIFORMES</b>		
<b>Cyprinodontidae - killifishes</b>		
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus diaphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	<b>Poeciliidae - livebearers</b>	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	<b>Atherinidae - silversides</b>	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	<b>Gasterosteidae - sticklebacks</b>	
<i>Culaea inconstans</i>	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	<b>Cottidae - sculpins</b>	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	<b>Percichthyidae – temperate basses</b>	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	<b>Centrarchidae - sunfishes</b>	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis megalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG
	<b>Centrarchidae - sunfishes</b>	
<i>L. cyanellus X L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus X L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctulatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis X P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified Centrarchidae	UCN
	<b>Percidae - perches</b>	
<i>Ammocrypta asprella</i>	Crystal darter	CLDR

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orange throated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caprodes</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculata</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER*</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
	<b>Sciaenidae - drums</b>	
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
	<b>NON-TAXONOMIC CATEGORIES</b>	
	Age-0/Young-of-year fish	YOYF
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF
	<b>Turtles</b>	
<i>Chelydra serpentina</i>	Common Snapping Turtle	SNPT
<i>Chrysemys picta bellii</i>	Western Painted Turtle	PATT
<i>Emydoidea blandingii</i>	Blanding's Turtle	BLDT
<i>Graptemys pseudogeographica</i>	False Map Turtle	FSMT
<i>Trachemys scripta</i>	Red-Eared Slider Turtle	REST
<i>Apalone mutica</i>	Smooth Softshell Turtle	SMST
<i>Apalone spinifera</i>	Spiny Softshell Turtle	SYST
<i>Terrapene ornata ornata</i>	Ornate Box Turtle	ORBT
<i>Sternotherus odoratus</i>	Stinkpot Turtle	SPOT
<i>Graptemys geographica</i>	Map Turtle	MAPT
<i>Graptemys koharii</i>	Mississippi Map Turtle	MRMT
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	OUMT
<i>Pseudemys concinna metterii</i>	Missouri River Cooter Turtle	MRCT
<i>Terrapene carolina triunguis</i>	Three-toed Box Turtle	TTBT

Appendix B. Definitions and codes used to classify standard Missouri River and Kansas River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendritic	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m <sup>3</sup> /s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m <sup>3</sup> /s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri and Kansas river fishes in Segment 11 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for Segment 11.

<b>Gear</b>	<b>Code</b>	<b>Type</b>	<b>Season</b>	<b>Years</b>	<b>CPUE units</b>
Gill Net – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2006 - Present	Fish / net night
Gill Net – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2006 - Present	Fish / net night
Gill Net – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2006 - Present	Fish / net night
Gill Net – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2006 - Present	Fish / net night
Trammel Net – 1.0” inner mesh	TN	Standard	Both Seasons	2006 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2006 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2006 - Present	Fish / net night
Trammel Net – 2.5” inner mesh	TN25	Standard	Sturgeon	2006	Fish / 100 m drift
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2006	Fish / 100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trot Line	TL	Evaluation	Both Seasons	2009	Fish / hook night

Appendix D. Stocking locations and codes for pallid sturgeon by Management Unit (GPMU, CLMU, IHMU) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	R.M.
MT	GPMU	Forsyth	FOR	Yellowstone	253.2
MT	GPMU	Cartersville	CAR	Yellowstone	235.3
MT	GPMU	Miles City	MIC	Yellowstone	181.8
MT	GPMU	Fallon	FAL	Yellowstone	124.0
MT	GPMU	Intake	INT	Yellowstone	70.0
MT	GPMU	Sidney	SID	Yellowstone	31.0
MT	GPMU	Big Sky Bend	BSB	Yellowstone	17.0
ND	GPMU	Fairview	FRV	Yellowstone	9.0
MT	GPMU	Milk River	MLK	Milk	11.5
MT	GPMU	Mouth of Milk	MOM	Missouri	1761.5
MT	GPMU	Grand Champs	GRC	Missouri	1741.0
MT	GPMU	Wolf Point	WFP	Missouri	1701.5
MT	GPMU	Poplar	POP	Missouri	1649.5
MT	GPMU	Brockton	BRK	Missouri	1678.0
MT	GPMU	Culbertson	CBS	Missouri	1621.0
MT	GPMU	Nohly Bridge	NOB	Missouri	1590.0
ND	GPMU	Confluence	CON	Missouri	1581.5
SD/NE	CLMU	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	CLMU	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	CLMU	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	CLMU	Running Water	RNW	Missouri	840.1
SD/NE	CLMU	James River Conf		Missouri	800.1
SD/NE	CLMU	St. Helena	STH	Missouri	799.0
SD/NE	CLMU	Mullberry Bend	MUL	Missouri	775.0
NE/IA	CLMU	Ponca State Park	PSP	Missouri	753.0
SD/NE/IA	CLMU	Big Sioux River Conf.		Missouri	734.0
NE/IA	CLMU	Sioux City	SIO	Missouri	732.6
NE/IA	CLMU	Sloan	SLN	Missouri	708.6
NE/IA	CLMU	Decatur	DCT	Missouri	691.0
NE/IA	CLMU	Wilson Island		Missouri	641.0
NE/IA	CLMU	Boyer Chute	BYC	Missouri	637.4
NE/IA	CLMU	Bellevue	BEL	Missouri	601.4
NE/IA	CLMU	Platte River Conf.		Missouri	595.0
NE	CLMU	Platte River	PLR	Platte	5.0
NE/MO	CLMU	Rulo	RLO	Missouri	497.9
NE/MO	CLMU	Paynes Landing	PAY	Missouri	477.1
KS/MO	CLMU	Kenmoor Bend	KEN	Missouri	438.1
KS/MO	CLMU	Leavenworth	LVW	Missouri	397.0
MO/KS	CLMU	Parkville	PKV	Missouri	377.5
MO/KS	CLMU	Kansas River Conf.	KSR	Missouri	367.5
MO	CLMU	Kansas City	KAC	Missouri	342.0
MO	CLMU	Cooley Lake	COO	Missouri	339.5
MO	CLMU	Camden Bend	CAM	Missouri	327.0
MO	CLMU	Waverly	WAV	Missouri	299.0
MO	CLMU	Cranberry Chute	CBC	Missouri	282.3

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 11, the Kansas River.

<b>Year</b>	<b>Stocking Site</b>	<b>Number Stocked</b>	<b>Year Class</b>	<b>Stock Date</b>	<b>Age at Stocking<sup>a</sup></b>	<b>Primary Mark</b>	<b>Secondary Mark</b>
N/A							

## **Appendix F**

Total catch, overall mean catch per unit effort ( $\pm 2$  SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 11, the Kansas River, during 2009. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when  $N < 2$ .

Appendix F1. Gill net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRMS
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	CHNB
BHCP	1	0.012	0		0		0	0	0	0.071	0			0
		0.024	0				0	0	0	0.143	0			
BLCF	7	0.085	0.056		0		0	0.083	0.2	0.214	0			0
		0.092	0.111				0	0.167	0.4	0.429	0			
CARP	4	0.049	0		0		0	0.167	0.1	0.071	0			0
		0.058	0				0	0.333	0.2	0.143	0			
GDEY	10	0.122	0		0		0	0	0	0.714	0			0
		0.244	0				0	0	0	1.429	0			
LNGR	8	0.098	0		2		0.05	0.083	0.1	0	0			0.5
		0.106	0				0.1	0.167	0.2	0	0			
PDFH	1	0.012	0		0		0	0	0.1	0	0			0
		0.024	0				0	0	0.2	0	0			
<b>PDSG*</b>	<b>1</b>	<b>0.012</b>	<b>0</b>		<b>0</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0.071</b>	<b>0</b>			<b>0</b>
		<b>0.024</b>	<b>0</b>				<b>0</b>	<b>0</b>	<b>0</b>	<b>0.143</b>	<b>0</b>			
QLBK	1	0.012	0		0.5		0	0	0	0	0			0
		0.024	0				0	0	0	0	0			
RVCS	9	0.11	0		3		0.15	0	0	0	0			0
		0.154	0				0.213	0	0	0	0			
SHRH	1	0.012	0		0		0	0.083	0	0	0			0
		0.024	0				0	0.167	0	0	0			
SMBF	22	0.293	0.278		4.5		0.05	0.083	0.1	0.214	1			0
		0.27	0.556				0.1	0.167	0.2	0.429	2			
SNGR	3	0.037	0		1		0	0	0	0	0			0.5
		0.054	0				0	0	0	0	0			
<b>SNSG*</b>	<b>101</b>	<b>1.244</b>	<b>1.333</b>		<b>0</b>		<b>0.8</b>	<b>2.583</b>	<b>0.7</b>	<b>1.5</b>	<b>0.5</b>			<b>0.5</b>
		<b>0.811</b>	<b>2.088</b>				<b>0.763</b>	<b>4.385</b>	<b>0.98</b>	<b>1</b>	<b>1</b>			
SVCP	1	0.012	0		0		0	0.083	0	0	0			0
		0.024	0				0	0.167	0	0	0			

Appendix F2. 1.0” trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	1	0.011	0				0.024		0					
		0.023	0				0.047		0					
BLCF	3	0.034	0.063				0		0.069					
		0.04	0.127				0		0.098					
BMBF	1	0.013	0				0		0.042					
		0.026	0				0		0.083					
<b>BUSK*</b>	<b>9</b>	<b>0.09</b>	<b>0</b>				<b>0.082</b>		<b>0.163</b>					
		<b>0.077</b>	<b>0</b>				<b>0.098</b>		<b>0.193</b>					
CARP	2	0.02	0.063				0.015		0					
		0.03	0.127				0.031		0					
CNCF	4	0.045	0.125				0.04		0					
		0.045	0.173				0.057		0					
FHCF	1	0.013	0				0		0.042					
		0.026	0				0		0.083					
GDEY	4	0.05	0				0.104		0					
		0.061	0				0.125		0					
GSCP	1	0.013	0				0.026		0					
		0.026	0				0.053		0					
LNGR	4	0.052	0				0		0.167					
		0.104	0				0		0.333					
RVCS	9	0.113	0.254				0.099		0.042					
		0.12	0.508				0.117		0.083					
<b>SGER*</b>	<b>3</b>	<b>0.035</b>	<b>0.063</b>				<b>0.024</b>		<b>0.035</b>					
		<b>0.04</b>	<b>0.127</b>				<b>0.047</b>		<b>0.07</b>					
SMBF	19	0.195	0.063				0.18		0.304					
		0.116	0.127				0.173		0.244					
<b>SNSG*</b>	<b>212</b>	<b>2.303</b>	<b>0.835</b>				<b>1.968</b>		<b>3.789</b>					
		<b>1.365</b>	<b>0.513</b>				<b>1.456</b>		<b>3.729</b>					
USG	1	0.012	0.057				0		0					
		0.023	0.115				0		0					

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BLCF	537	4.248	4.529				4.264		5.122			0		
		1.821	3.999				2.905		3.526			0		
BLGL	1	0.008	0				0		0.031			0		
		0.016	0				0		0.063			0		
<b>BUSK*</b>	<b>5</b>	<b>0.049</b>	<b>0.086</b>				<b>0.038</b>		<b>0.046</b>			<b>0</b>		
		<b>0.044</b>	<b>0.119</b>				<b>0.054</b>		<b>0.092</b>			<b>0</b>		
CNCF	342	2.534	1.522				3.595		2.112		1.104			
		1.248	0.902				2.693		1.528		1.063			
FHCF	14	0.132	0.1				0.077		0.294			0		
		0.085	0.112				0.087		0.275			0		
FWDM	157	1.42	0.309				0.687		4.123			0		
		1.05	0.557				0.751		3.763			0		
GZSD	6	0.063	0.19				0		0.063			0		
		0.099	0.381				0		0.125			0		
LNGR	1	0.012	0				0.027		0			0		
		0.023	0				0.054		0			0		
PDFH	2	0.015	0				0.013		0.035			0		
		0.021	0				0.026		0.07			0		
RDSN	1	0.012	0				0.027		0			0		
		0.023	0				0.054		0			0		
RVCS	4	0.039	0.048				0.026		0.065			0		
		0.039	0.095				0.051		0.091			0		
<b>SKCB*</b>	<b>14</b>	<b>0.115</b>	<b>0.113</b>				<b>0.204</b>		<b>0</b>			<b>0</b>		
		<b>0.094</b>	<b>0.183</b>				<b>0.191</b>		<b>0</b>			<b>0</b>		
SMBF	2	0.017	0.035				0.02		0			0		
		0.024	0.071				0.04		0			0		
<b>SNSG*</b>	<b>57</b>	<b>0.486</b>	<b>0.412</b>				<b>0.466</b>		<b>0.229</b>		<b>1.799</b>			
		<b>0.193</b>	<b>0.308</b>				<b>0.309</b>		<b>0.201</b>		<b>1.234</b>			
STCT	15	0.111	0.351				0.058		0			0		
		0.1	0.38				0.067		0			0		
SVCB	9	0.07	0.058				0.129		0			0		
		0.059	0.081				0.129		0			0		
UCS	1	0.008	0.031				0		0			0		
		0.015	0.062				0		0			0		
UIC	135	1.272	2.432				1.347		0.379			0		
		1.018	3.066				1.564		0.495			0		

Appendix F4. Mini-fyke net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRMS
			BARS	POOL	CHNB	POOL	BARS	POOL	BARS	POOL	BARS	ITIP	BARS	BARS
BHMW	444	6.727	7.059				7.077		7.231				0.25	0.75
		2.537	4.921				4.301		4.724				0.5	0.957
BKCP	6	0.091	0.059				0.192		0				0	0
		0.083	0.118				0.193		0				0	0
BLGL	273	4.136	2.412				3.154		5.308				6	13
		1.384	1.151				1.842		1.992				10.033	13.292
BNBW	63	0.955	0.706				0.346		1.385				0	5.75
		0.76	0.681				0.292		1.981				0	10.178
<b>BSMW*</b>	<b>2</b>	<b>0.03</b>	<b>0</b>				<b>0.077</b>		<b>0</b>				<b>0</b>	<b>0</b>
		<b>0.043</b>	<b>0</b>				<b>0.107</b>		<b>0</b>				<b>0</b>	<b>0</b>
CARP	12	0.182	0.176				0.231		0.077				0	0.5
		0.114	0.191				0.202		0.154				0	1
CKCB	2	0.03	0				0.038		0				0.25	0
		0.043	0				0.077		0				0.5	0
CNCF	243	3.682	2.235				5.692		2.231				2.25	0.25
		2.009	2.453				4.645		1.435				2.63	0.5
ERSN	76	1.152	0.706				1.808		1				0	0
		0.619	0.723				1.403		0.716				0	0
FHCF	12	0.182	0				0.192		0.154				0.25	0
		0.136	0				0.249		0.208				0.5	0
FHMW	8	0.121	0.118				0.077		0.231				0	0
		0.081	0.161				0.107		0.243				0	0
FWDM	200	3.03	2.412				4.962		1.385				0.75	0
		1.383	2.156				2.959		1.424				1.5	0
GDSN	2	0.03	0				0		0.154				0	0
		0.061	0				0		0.308				0	0
GNSF	54	0.818	0.765				0.962		0.615				0.25	0.25
		0.34	0.471				0.632		0.735				0.5	0.5
GSBG	1	0.015	0.059				0		0				0	0
		0.03	0.118				0		0				0	0
GSCP	2	0.03	0				0.038		0.077				0	0
		0.043	0				0.077		0.154				0	0
GTSN	1	0.015	0				0.038		0				0	0
		0.03	0				0.077		0				0	0
GZSD	123	1.864	1.647				2.577		1.923				0.25	0.5
		1.224	1.552				2.781		1.914				0.5	1

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRMS
			BARS	POOL	CHNB	POOL	BARS	POOL	BARS	POOL	BARS	ITIP	BARS	BARS
JYDR	1	0.015	0				0		0.077		0		0	0
		0.03	0				0		0.154		0		0	0
LESF	2	0.03	0				0		0		0		0	0.5
		0.061	0				0		0		0		0	1
LGPH	1	0.015	0				0		0.077		0		0	0
		0.03	0				0		0.154		0		0	0
LMBS	104	1.576	2.176				2.154		0.231		0		0.25	1.75
		0.894	2.144				1.714		0.462		0		0.5	1.708
LNGR	26	0.394	0.471				0.5		0.154		0		0.25	0.5
		0.207	0.546				0.355		0.208		0		0.5	0.577
MMSN	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
MQTF	55	0.833	0.941				0.577		1.077		1		1	1
		0.336	0.737				0.446		0.919		2		0.816	2
OSSF	14	0.212	0.235				0.192		0.077		0		0	1
		0.118	0.273				0.158		0.154		0		0	0.816
QLBK	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
RDSN	882	13.364	11				14.538		18		35.5		1.25	1.75
		4.567	6.996				7.858		12.568		25		0.957	2.217
RESF	1	0.015	0				0		0		0		0	0.25
		0.03	0				0		0		0		0	0.5
RVCS	72	1.091	1				1.769		0.462		1.5		0	0
		0.785	1.414				1.734		0.487		1		0	0
SDMT	5	0.076	0.176				0.038		0		0		0	0.25
		0.079	0.256				0.077		0		0		0	0.5
<b>SGER*</b>	<b>16</b>	<b>0.242</b>	<b>0.118</b>				<b>0.538</b>		<b>0</b>		<b>0</b>		<b>0</b>	<b>0</b>
		<b>0.302</b>	<b>0.235</b>				<b>0.746</b>		<b>0</b>		<b>0</b>		<b>0</b>	<b>0</b>
SHRH	1	0.015	0				0		0.077		0		0	0
		0.03	0				0		0.154		0		0	0
<b>SKCB*</b>	<b>1</b>	<b>0.015</b>	<b>0</b>				<b>0.038</b>		<b>0</b>		<b>0</b>		<b>0</b>	<b>0</b>
		<b>0.03</b>	<b>0</b>				<b>0.077</b>		<b>0</b>		<b>0</b>		<b>0</b>	<b>0</b>
SMBF	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
SMMW	19	0.288	0.529				0.269		0.154		0		0	0.25
		0.232	0.644				0.393		0.208		0		0	0.5
SNGR	36	0.545	0.471				0.692		0.154		2		0	1
		0.217	0.303				0.412		0.208		2		0	1.155

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRMS
			BARS	POOL	CHNB	POOL	BARS	POOL	BARS	POOL	BARS	ITIP	BARS	BARS
<b>SNSN*</b>	<b>91</b>	<b>1.379</b>	<b>0.118</b>				<b>2.462</b>		<b>0.846</b>		<b>6</b>		<b>0.5</b>	<b>0</b>
		<b>1.196</b>	<b>0.161</b>				<b>2.874</b>		<b>1.278</b>		<b>4</b>		<b>1</b>	<b>0</b>
STCT	13	0.197	0				0.385		0.154		0		0	0.25
		0.225	0				0.544		0.308		0		0	0.5
SVCB	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
UBC	46	0.697	0				1.654		0.154		0.5		0	0
		0.79	0				1.966		0.208		1		0	0
UBF	26	0.394	0.471				0.577		0.231		0		0	0
		0.302	0.572				0.649		0.332		0		0	0
UCS	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
UCT	1	0.015	0				0.038		0		0		0	0
		0.03	0				0.077		0		0		0	0
UCY	31	0.47	0.059				0.038		2.231		0		0	0
		0.879	0.118				0.077		4.462		0		0	0
ULP	111	1.682	0.647				2.423		0.846		5.5		1.25	2.5
		1.337	0.593				3.235		1.082		5		2.5	3.697
UPP	11	0.167	0				0.192		0.385		0.5		0	0
		0.134	0				0.193		0.533		1		0	0
UST	2	0.03	0				0.077		0		0		0	0
		0.043	0				0.107		0		0		0	0
UTB	6	0.091	0.059				0.038		0.308		0		0	0
		0.083	0.118				0.077		0.35		0		0	0
WTBS	98	1.485	2.176				2.077		0.538		0		0	0
		0.998	2.409				1.905		0.923		0		0	0
WTCP	72	1.091	1.118				1.231		1		0		0.75	1.25
		0.467	0.906				0.917		0.847		0		1.5	0.957
YLBH	3	0.045	0.059				0.038		0		0		0	0.25
		0.052	0.118				0.077		0		0		0	0.5

Appendix G. Hatchery names, locations and abbreviations.

<b>Hatchery</b>	<b>State</b>	<b>Abbreviation</b>
Blind Pony State Fish Hatchery	MO	BYP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2009 for Segment 11, the Kansas River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri and Kansas river species.

Species Code	Sturgeon Season			Fish Community Season		
	Gill Net	Otter Trawl	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net
BHCP	0.012	0.000	0.019	0.000	0.000	0.000
BHMW	0.000	0.000	0.000	0.000	0.000	6.727
BKCP	0.000	0.000	0.000	0.000	0.000	0.091
BLCF	0.085	0.010	0.036	9.672	0.033	0.000
BLGL	0.000	0.000	0.000	0.018	0.000	4.136
BMBF	0.000	0.000	0.022	0.000	0.000	0.000
BNMW	0.000	0.000	0.000	0.000	0.000	0.955
<b>BSMW*</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.030</b>
<b>BUSK*</b>	<b>0.000</b>	<b>0.072</b>	<b>0.085</b>	<b>0.020</b>	<b>0.098</b>	<b>0.000</b>
CARP	0.049	0.000	0.034	0.000	0.000	0.182
CKCB	0.000	0.000	0.000	0.000	0.000	0.030
CNCF	0.000	1.077	0.035	4.399	0.060	3.682
ERSN	0.000	0.000	0.000	0.000	0.000	1.152
FHCF	0.000	0.076	0.000	0.205	0.033	0.182
FHMW	0.000	0.000	0.000	0.000	0.000	0.121
FWDM	0.000	0.471	0.000	2.635	0.000	3.030
GDEY	0.122	0.000	0.021	0.000	0.094	0.000
GDSN	0.000	0.000	0.000	0.000	0.000	0.030
GNSF	0.000	0.000	0.000	0.000	0.000	0.818
GSBG	0.000	0.000	0.000	0.000	0.000	0.015
GSCP	0.000	0.000	0.021	0.000	0.000	0.030
GTSN	0.000	0.000	0.000	0.000	0.000	0.015
GZSD	0.000	0.000	0.000	0.143	0.000	1.864
JYDR	0.000	0.000	0.000	0.000	0.000	0.015
LESF	0.000	0.000	0.000	0.000	0.000	0.030
LGPH	0.000	0.000	0.000	0.000	0.000	0.015
LKSG	0.000	0.000	0.000	0.000	0.000	0.000
LMBS	0.000	0.000	0.000	0.000	0.000	1.576

Species Code	Sturgeon Season			Fish Community Season		
	Gill Net	Otter Trawl	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net
LNGR	0.098	0.021	0.086	0.000	0.000	0.394
MMSN	0.000	0.000	0.000	0.000	0.000	0.015
MQTF	0.000	0.000	0.000	0.000	0.000	0.833
NFSH	0.000	0.000	0.000	0.000	0.000	0.000
OSSF	0.000	0.000	0.000	0.000	0.000	0.212
PDFH	0.012	0.026	0.000	0.000	0.000	0.000
<b>PDSG*</b>	<b>0.012</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>
QLBK	0.012	0.000	0.000	0.000	0.000	0.015
RDSN	0.000	0.021	0.000	0.000	0.000	13.364
RESF	0.000	0.000	0.000	0.000	0.000	0.015
RVCS	0.110	0.015	0.108	0.070	0.120	1.091
SDMT	0.000	0.000	0.000	0.000	0.000	0.076
<b>SGER*</b>	<b>0.000</b>	<b>0.000</b>	<b>0.059</b>	<b>0.000</b>	<b>0.000</b>	<b>0.242</b>
SHRH	0.012	0.000	0.000	0.000	0.000	0.015
<b>SKCB*</b>	<b>0.000</b>	<b>0.174</b>	<b>0.000</b>	<b>0.041</b>	<b>0.000</b>	<b>0.015</b>
SMBF	0.293	0.015	0.175	0.020	0.224	0.015
SMMW	0.000	0.000	0.000	0.000	0.000	0.288
SNGR	0.037	0.000	0.000	0.000	0.000	0.545
<b>SNSG*</b>	<b>1.244</b>	<b>0.598</b>	<b>1.558</b>	<b>0.342</b>	<b>3.430</b>	<b>0.000</b>
<b>SNSN*</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>1.379</b>
STCT	0.000	0.178	0.000	0.025	0.000	0.197
SVCB	0.000	0.072	0.000	0.067	0.000	0.015
SVCP	0.012	0.000	0.000	0.000	0.000	0.000
UBC	0.000	0.000	0.000	0.000	0.000	0.697
UBF	0.000	0.000	0.000	0.000	0.000	0.394
UCS	0.000	0.000	0.000	0.017	0.000	0.015
UCT	0.000	0.000	0.000	0.000	0.000	0.015
UCY	0.000	0.000	0.000	0.000	0.000	0.470
UIC	0.000	0.014	0.000	2.833	0.000	0.000
ULP	0.000	0.000	0.000	0.000	0.000	1.682
UPP	0.000	0.000	0.000	0.000	0.000	0.167
USG	0.000	0.000	0.000	0.000	0.029	0.000

Species Code	Sturgeon Season			Fish Community Season		
	Gill Net	Otter Trawl	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net
UST	0.000	0.000	0.000	0.000	0.000	0.030
UTB	0.000	0.000	0.000	0.000	0.000	0.091
WTBS	0.000	0.000	0.000	0.000	0.000	1.485
WTCP	0.000	0.000	0.000	0.000	0.000	1.091
YLBH	0.000	0.000	0.000	0.000	0.000	0.045

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 11, the Kansas River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2006 - 2009.

Bend Number	Bend River Mile	Coordinates		2006	2007	2008	2009
		Latitude	Longitude				
1	1.7	39.09375	-94.60988			ST, FCS	ST, FC
2	5.0	39.07892	-94.65139		ST, FCS	ST, FCS	
3	9.0	39.09493	-94.70882	ST, FCS			ST, FC
4	12.0	39.07377	-94.75377		ST, FCS		ST, FC
5	14.7	39.04654	-94.78568			ST,FCS	
6	21.0	39.04406	-94.88401		ST, FCS	ST,FCS	ST, FC
7	22.5	39.02448	-94.89053				ST, FC
8	23.9	39.00660	-94.89584			FC	
9	25.2	38.99133	-94.90937				
10	26.8	38.99330	-94.91747				
11	29.1	38.98870	-94.94072				ST, FC
12	31.6	39.99135	-94.97892				
13	33.2	39.00008	-95.00573				
14	35.0	38.98853	-95.02351				
15	37.5	38.98052	-95.05407				
16	40.4	38.97048	-95.08091				ST, FC
17	43.5	38.96646	-95.10712				
18	44.6	38.96856	-95.12116				
19	45.6	38.97063	-95.13836				
20	46.8	38.97939	-95.15782				ST, FC
21	47.8	38.97239	-95.16258				
22	52.1	38.97461	-95.23460			FC	

## 2008 Annual Report

### Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Kansas River: Segment 11



Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program  
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## EXECUTIVE SUMMARY

The Missouri Department of Conservation began its fourth year of the Pallid Sturgeon Population Assessment Program at the beginning of the 2008 sampling season. All standard sampling was successfully completed (except for 8 trammel net subsamples) in the required bends (N = 4) during the 2008 sturgeon and fish community seasons. No pallid sturgeon were captured in segment 11 during the 2008 sampling season.

Four hundred seventy four shovelnose sturgeon (fork length = 22 – 75 mm) were captured with gill nets (N = 252), 1-inch trammel nets (N = 72), and otter (N = 61) and push trawls (N = 10) and trotlines (N = 79) during the 2008 season. Most shovelnose sturgeon were captured in channel border meso habitats and were associated with open water bar areas and along bank lines.

Speckled (N = 17) and sicklefin chub (N = 2) were the only *Macrhybopsis* spp. captured in segment 11. Speckled chub were captured in otter trawls, mini-fyke nets, and push trawls. They were captured in channel crossover, inside and outside bend macrohabitats and channel border and bars mesohabitats. Sturgeon chub were captured in mini-fyke and otter trawl from the inside bend macrohabitat and bars and channel border mesohabitats. Sand shiner (N = 161) were captured with mini-fyke nets (N = 127), otter (N = 2) and push trawls (N = 32) with most fish captured on sand bar habitat and along the bank line using mini-fyke nets. Gill nets and trammel nets captured 17 blue suckers in channel border and pool mesohabitats. The only *Hybognathus* spp. to be captured this sample year was the plains minnow (N = 15). Plains minnow were captured in mini-fyke nets in shallow (< 1.2 m) water bar habitats. No sauger were captured in segment 11 2008 sampling season. No shovelnose X pallid sturgeon hybrids were captured during the 2008 sampling season. We captured 3,944 fish from all gear deployments representing 46 species in segment 11 during the 2008 sampling season.

# TABLE OF CONTENTS

Introduction .....	1
Study Area .....	4
Methods .....	6
Sample site selection and description .....	8
Sampling gear.....	10
Data Collection and Analysis.....	13
Results	
Pallid sturgeon .....	17
Shovelnose X Pallid Sturgeon Hybrids.....	28
Targeted Native River Species	
Shovelnose sturgeon .....	29
Sturgeon chub .....	46
Sicklefin chub .....	47
Speckled chub.....	54
Sand shiner .....	61
<i>Hybognathus</i> spp.....	68
Blue sucker .....	75
Sauger.....	83
Missouri River Fish Community .....	88
Discussion.....	89
Trotline .....	91
Acknowledgments.....	94
References .....	95

Appendices ..... 98

## LIST OF TABLES

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for segment 11, the Kansas River, during sturgeon season and fish community season in 2007-2008. .... 18

Table 2. Number of bends sampled, mean number of deployments, and total number of deployments by mesohabitat for segment 11, the Kansas River, during sturgeon season and fish community season in 2007-2008..... 19

### **Pallid sturgeon**

Table 3. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2007-2008. Means (minimum and maximum) are presented ..... 20

Table 6. Mean fork length, weight, relative condition factor (Kn), and absolute growth rates for all hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2008 from 11, the Kansas River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993)..... OMITTED

Table 7. Incremental relative stock density (RSD) for all pallid sturgeon captured with all gear by a length category during 2005-2008 in the Kansas River. Length categories<sup>b</sup> determined using the methods proposed by Shuman et al. (2006) ..... OMITTED

Table 9. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008..... OMITTED

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008. .... OMITTED

Table 11. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008. .... OMITTED

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008. .... OMITTED

Table 13. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008. .... OMITTED

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008. .... OMITTED

Table 15. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008..... OMITTED

Table 16. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... OMITTED

### **Shovelnose sturgeon**

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008..... 36

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... 37

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008..... 38

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... 39

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008. .... 40

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008. .... 41

Table 23. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in 11, the Kansas River, during 2007-2008. .... 42

Table 24. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... 43

Table 25. Incremental relative stock density (RSD) and mean relative weight ( $W_r$ ) by a length category for shovelnose sturgeon in segment 11, the Kansas River, captured during 2007-2008 .....45

### **Sturgeon chub**

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008..... OMITTED

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... OMITTED

### **Sicklefin chub**

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008..... 51

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008..... 52

### **Speckled chub**

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008..... 58

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008..... 59

**Sand shiner**

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008..... 65

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008..... 66

***Hybognathus* spp.**

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008..... 72

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008..... 73

**Blue sucker**

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2006-2008..... 80

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2006-2008..... 81

**Sauger**

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2007-2008.  
..... OMITTED

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2007-2008.  
..... OMITTED

Table 40. Summary of trotline information on pallid sturgeon (PDSG), shovelnose sturgeon (SNSG), and by-catch for each hook type/size in segment 11, the Kansas River the 2007-2008.  
..... OMITTED

## LIST OF FIGURES

Figure 1a. Map of segment 11, the Kansas River, with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from Edwardsville, KS (River Mile 21.1) to Kansas City, KS (River Mile 0.0) ..... 16

Figure 1b. Distribution of pallid sturgeon captures by river mile for 11, the Kansas River, during 2007-2008. Black bars represent pallid captures during sturgeon season and white bars during fish community season. Figure includes all pallid captures including non-random and wild samples. .... OMITTED

### **Pallid sturgeon**

Figure 2. Mean annual catch per unit effort ( $\pm$  2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008. Pallid sturgeon of unknown origin are awaiting genetic verification.. ..... 26

Figure 3. Mean annual catch per unit effort ( $\pm$  2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2007-2008. Pallid sturgeon of unknown origin are awaiting genetic verification ..... OMITTED

Figure 5. Mean annual catch per unit effort ( $\pm$  2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 11, the Kansas River, during fish community season 2007- 2008. Pallid sturgeon of unknown origin are awaiting genetic verification.. ..... OMITTED

Figure 7. Mean annual catch per unit effort ( $\pm$  2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using mini-fyke nets in segment 11, the Kansas River, during fish community season 2007-2008. Pallid sturgeon of unknown origin are awaiting genetic verification ..... OMITTED

Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008. .... OMITTED

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 11, the Kansas River, from 2006 to 2008. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples. .... 27

**Shovelnose sturgeon**

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq 380$  mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008. .... 31

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq 380$  mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2006-2008..... 32

Figure 14. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq 380$  mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 11, the Kansas River, during fish community season 2006-2008. .... 33

Figure 15. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq 380$  mm; black bars) shovelnose sturgeon using mini-fyke nets in segment 11, the Kansas River, during fish community season 2006-2008..... 34

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in s segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008. .... 44

**Sturgeon chub**

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008..... OMITTED

Figure 19. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in segment 11, the Kansas River, during fish community season 2005-2008.OMITTED

Figure 20. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

..... OMITTED

Figure 21. Length frequency of sturgeon chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... OMITTED

### **Sicklefin chub**

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 48

Figure 23. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in segment 11, the Kansas River, during fish community season 2006-2008..... 49

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2006-2008..... 50

Figure 25. Length frequency of sicklefin chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... 53

### **Speckled chub**

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of speckled chub using otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 55

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of speckled chub using otter trawls in segment 11, the Kansas River, during fish community season 2006 -2008..... 56

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of speckled chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2006 -2008..... 57

Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008 ..... 60

**Sand shiner**

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 62

Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with otter trawls in segment 11, the Kansas River, during fish community season 2006 -2008..... 63

Figure 32. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 11, the Kansas River, during fish community season 2006 -2008..... 64

Figure 33. Length frequency of sand shiner during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... 67

***Hybognathus* spp.**

Figure 34. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 69

Figure 35. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with otter trawls in segment 11, the Kansas River, during fish community season 2006-2008..... 70

Figure 36. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in segment 11, the Kansas River, during fish community season 2006-2008..... 71

Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... 74

**Blue sucker**

Figure 38. Mean annual catch per unit effort (+/- 2 SE) of blue sucker with gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 76

Figure 39. Mean annual catch per unit effort (+/- 2 SE) of blue sucker with 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2006-2008..... 77

Figure 41. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2006-2008. .... 78

Figure 42. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using mini-fyke nets in segment 11, the Kansas River, during fish community season 2006-2008..... 79

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... 82

### **Sauger**

Figure 45. Mean annual catch per unit effort (+/- 2 SE) of sauger using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2006-2008..... 84

Figure 46. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2006-2008..... 85

Figure 48. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2006-2008. .... 86

Figure 49. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in segment 11, the Kansas River, during fish community season 2006-2008..... 87

Figure 51. Length frequency of sauger during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2005 - 2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2008..... OMITTED

### **Trotlines**

Figure 52. Frequency of shovelnose sturgeon captured on trotlines for each hook type/size in segment 11, the Kansas River, by length categories. .... 93

## LIST OF APPENDICES

Appendix A. Phylogenetic list of Missouri and Kansas River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program..99 .....	
Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long term pallid sturgeon and associated fish community sampling program. ....	105
Appendix C. List of standard and wild gears, their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes for the long-term pallid sturgeon and associated fish community sampling program .....	108
Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area in the Missouri River Basin.....	109
Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 11, the Kansas River, (RPMA 4). ....	110
Appendix F. Total catch, overall mean catch per unit effort, and mean CPUE by mesohabitat within a macrohabitat for all species caught during sturgeon season and fish community season combined in segment 11, the Kansas River, during 2007-2008.....	11
Appendix F1. Gill Net: .....	112
Appendix F2. 1 Inch Trammel Net: .....	116
Appendix F4. Otter Trawl: .....	120
Appendix F6. Mini-fyke Net: .....	124
Appendix G. Hatchery names, locations, and abbreviations. ....	128
Appendix H. Alphabetic list of Missouri River fishes with total number caught by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2007-2008 for segment 11, of the Kansas River .....	129
Appendix I. Comprehensive list of bend numbers and locations for segment 11, the Kansas River, comparing bend selection between years from 2005-2008..... .....	136

## Introduction

Pallid sturgeon *Scaphirhynchus albus* are native throughout the Missouri River, parts of the Missouri River basin (including Kansas River), and the middle and lower Mississippi River. Population levels of this species have declined over the past century. Declines have been attributed to anthropogenic influences including habitat loss, blocked migration routes, altered hydrograph, and water temperature regime (USFWS 1993). As a result, this species was listed under the Endangered Species Act in 1990. The Pallid Sturgeon Recovery Plan (USFWS 1993) identified six priority pallid sturgeon recovery management areas (RPMAs), four of which lie within the Missouri River. Further, this document provided an outline that proposed to: 1) protect and restore pallid sturgeon populations, individuals, and their habitats; 2) conduct research necessary for survival and recovery of pallid sturgeon; 3) develop and implement a pallid sturgeon captive propagation program, and; 4) coordinate and implement conservation and recovery of sturgeon species.

In 2000, the U. S. Fish and Wildlife Service (USFWS) issued a Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op; USFWS 2000) to the U. S. Army Corps of Engineers (Corps). This document recommended: 1) the flow regime of the Missouri River mimic a more natural hydrograph, 2) an increase in propagation and population augmentation efforts, and 3) the development of a pallid sturgeon population assessment program (PSPAP). As the federal agency responsible for water management in the Missouri and Kansas River systems, the USACE has an obligation under the Endangered Species Act to conserve the pallid sturgeon. To comply with the Bi-Op, the Corps has proposed to operate Gavins Point Dam in a manner to create a more natural hydrograph, has funded PSPAP, hatchery improvements and expansions, and facilitated the development of the Pallid Sturgeon Population Assessment Team (Team).

The initial stocking of pallid sturgeon in 1994 consisted of about 6,500 fish from the 1992 year class that were stocked into RPMAs 4 (Missouri River below Gavins Point Dam) and 5 (middle Mississippi River; USFWS 2005). Subsequent stockings in 1997, 1998, and 2001 - 2008 in all six RPMAs have resulted in approximately 1,102,724 pallid

sturgeon being stocked into the Missouri, Mississippi, and Yellowstone Rivers (Wilson and Krentz 2009). The total number of pallid sturgeon stocked per year has increased from an average of about 4,000 fish per year prior to 2000 to an average of nearly 39,000 fish per year from 2001-2006. In 2007, a total of 577,936 pallid sturgeon from the 2006 and 2007 year class were stocked into the Yellowstone and Missouri Rivers, with most (529,152) of those stocked in RPMA 2. In 2008, fish were stocked in RPMA 1 (62,814), 2 (99,381), 3 (3,410) and 4 (5,987), for a total of 171,592 fish stocked. These fish were from both the 2007 and 2008 year classes. Most pallid sturgeon were stocked as fingerlings (age-0), advanced fingerlings, and yearlings (age-1), though some fish ages two to five were released as well. There have been no pallid sturgeon stocked in segment 11, the Kansas River.

Since 1994, there has been 81,757 fish stocked into RPMA 4 (Gavins Point Dam to the mouth of the Ohio River). Most of these fish were stocked as either yearlings or fingerlings. Two-thousand eight marked the first year that pallid sturgeon spawned from fish captured in the lower Missouri River were stocked back into the lower Missouri River. The fish stocked in 2008 came from both the 2007 and 2008 year classes spawned at Blind Pony State Fish Hatchery or Gavins Point National Fish Hatchery.

Implementation of the PSPAP began in 2001 when the USFWS-Columbia Fishery Resource Office (USFWS-CFRO) began monitoring under PSPAP guidelines and when Nebraska Game and Parks Commission (NGPC) conducted an evaluation of benthic trawls. The USACE hired a fisheries biologist to coordinate the PSPAP in 2002, while the USFWS-CFRO and NGPC continued monitoring in segments 9, 13, and 14 in the lower Missouri River. Standardized sampling above Gavins Point Dam (segments 5 and 6) occurred for the first time in 2003 by the USFWS-Great Plains Fish and Wildlife Management Assistance Office. During 2004, monitoring continued in segments 5, 6, 8, 9, 13, and 14, and an independent science review was conducted to determine the ability of the PSPAP to address its objectives. Beginning with the 2005 fish community season, the Team added USFWS-Missouri River Fish and Wildlife Management Assistance Office (segment 4), South Dakota Department of Game Fish and Parks (segment 7), and Missouri Department of Conservation (segment 10) field crews that completed implementation of the PSPAP from segments 4 through 14 on the Missouri River. In 2006, the Team added the Montana Department of Fish, Wildlife, and Parks field crew and the Missouri Department of Conservation began

sampling segment 11 (the Kansas River) to complete implementation of the PSPAP from segment 1 through 14.

**The objectives of the PSPAP are as follows:**

- 1) Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
- 2) Document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
- 3) Document population structure and dynamics of pallid sturgeon in the Missouri River System.
- 4) Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
- 5) Document annual results and long-term trends of habitat usage of the native target species by season and life stage.
- 6) Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than 50 individuals.

## Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 - 4 lie in RPMA 2 and includes the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 and 6, lie in RPMA 3 and consist of the 55 river miles from Fort Randall Dam, South Dakota, downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only non channelized segment below Gavins Point Dam. Segments 8 - 14 include the entire channelized portion (750 miles) of the Missouri River that extends from Lower Ponca Bend to the confluence with the Mississippi River. The Kansas River, from just above the Johnson County Weir (Kansas) to the mouth (20.0 miles), was given its own segment designation (segment 11) because this tributary was addressed by the 2000 Bi-Op as a moderate priority management area for pallid sturgeon. Also, the USACE is responsible for water management on the Kansas River. Segments 1 - 4 and 5 - 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by several impoundment and tailwater areas interdispersed by a meandering, often braided, channel that lacks navigation structures and deep pools. The lower sampling universe is channelized, has revetted banks, and deep scour pools and sand bars that are associated with a variety of navigation structures. Segments 5 - 7 of the lower sampling universe are influenced by reservoirs and are unchannelized. This document reports activities during the 2008 sampling season specific to segment 11.

Segment 11, the Kansas River, is a large tributary within RPMA 4 and is designated as the lower portion of the river, from Lawrence, KS (RM 40.0) to the mouth. However, the river from Lawrence to RM 21.0 is not consistently accessible by boat. Therefore, only the areas of the river that can be consistently sampled are randomly-selected from to be sampled yearly. This consists of six numbered river bends between RM 21.0, located 6.3 miles above the Johnson County Weir (weir), Kansas and the confluence of the Kansas River (RM 0).

River bends in this segment ranged from 1.7 to 6.3 miles in length with a mean bend length of 3.5 miles. Starting in the 2008 sample season, segments from 21.0 upstream to 52.1 were given bend designations. There are a total of 16 bends above the weir that are not consistently accessible by boat (segments RM 21.1 – 52.1). Of these 16 bends, four were randomly selected to be sampled each season (as water conditions allowed), to sample a greater area of the river. The Kansas River above the weir is unchannelized, and characterized by a braided system with no defined channel. There is a notable amount of sand dredging, but the river is mostly shallow (1 – 3 meters), restricting sampling to high flow ( $\geq 7500$  cfs) events. The Kansas River below the weir is channelized through the industrial area of Kansas City to the mouth, though no channel is maintained for navigation traffic. River banks are lined with rip-rap along the outside and inside bends of the river. Structures in this segment are few, but include very small wing dikes in some areas. There are various large boulder areas, refuse concrete slabs, junk cars, degraded areas with undercut banks, natural island, and side chute habitats. The river is relatively shallow, restricting sampling only at times following a rain event, or increased gage height when influenced by the mainstem Missouri while experiencing high flows ( $> 45,000$  cfs).

## Methods

All sampling was conducted in accordance with the guidelines established by the Pallid Sturgeon Assessment Team as outlined in the Pallid Sturgeon Population Assessment Program and Missouri River Standard Operating Procedures for Sampling and Data Collection (Drobish 2008a, b). Data collected by each PSPAP field office were entered via double-blind entry into a single database housed and managed by the Missouri Department of Conservation. Data were subsequently distributed to each participating office according to reporting responsibilities: segment 1 through 3 – Montana Fish, Wildlife and Parks-Fort Peck, MT; segment 4 – USFWS-Bismark, ND; segments 5 and 6 – USFWS-Pierre, SD; segment 7 – South Dakota Department of Game, Fish, and Parks-Yankton, SD; segments 8 and 9 – Nebraska Game and Parks Commission-Lincoln, NE; Segments 10 and 11 – Missouri Department of Conservation-Chillicothe, MO; segments 13 and 14 – USFWS-Columbia, MO.

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 27 November 2007 [(when water temperatures dropped below 12.8°C (55°F)] and continued through 30 June 2008. The fish community season began 01 July 2008 and continued through 15 October 2008. Data from 2005, 2006, and 2007 are also included in this report for annual comparisons. During these seasons, standard gear types included experimental gill nets, 1-inch trammel nets, 16-foot otter trawls, and mini-fyke nets (Appendix C). Gill nets were the only sampling gear used during the sturgeon season until 23 April 2008. The beginning of sturgeon season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts would have began 16 January and continued until water temperatures reached 12.8°C (55°F). Trammel netting began 23 April 2008 and trawl efforts began 15 May 2008 and were conducted through 30 June.

Fish community season began 01 July 2008 and continued through 15 October 2008. Although this season utilized gears that capture sturgeon species (i.e., 1-inch trammel nets and otter trawls), particularly small (i.e., juvenile or young) sturgeons, there was an additional emphasis placed on assessing the associated fish community. Standard gear types

during the fish community season included 1-inch trammel nets, 16-foot otter trawls and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season with efforts made to spatially and temporally distribute sampling across the six randomly selected bends within the segment. Wild gear types used during fish community season include trotlines and push trawls.

In addition to pallid sturgeon, the Team identified members of the associated fish community that were of particular interest due to their ecology (e.g., obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when feasible and measured in millimeters (mm) to total length (TL), except sturgeon that were measured to fork length (FL) and paddlefish *Polyodon spathula* that were measured from eye-fork length. Shovelnose sturgeon, blue suckers, and sauger were weighed to the nearest gram (g).

When a pallid sturgeon was encountered, meristic and morphometric measurements were recorded to determine the character index (CI) score for each fish (Sheehan et al. 1999). Measurements required to calculate CI-score included: head length, interrostral length, length of each barbel, mouth to inner barbel length, and mouth width (see Sheehan et al. (1999) for descriptions of each measurement). The length from the fish’s snout to the anterior midline of the mouth was also recorded. Meristics included number of dorsal and anal fin rays, including rudimentary rays. Ranges of CI-scores for pallid sturgeon, shovelnose X pallid sturgeon hybrids, and shovelnose sturgeon have been defined as -1.48 to -0.09, -0.45 to 0.51, and 0.37 to 1.33, respectively. In general, CI-scores were only calculated for suspected wild pallid sturgeon or hybrid individuals.

In addition to meristic and morphometric measurements, all pallid sturgeon were to be examined for elastomer (color, orientation, and side of fish), coded wire (CWT), and passive integrated transponder (PIT) tags. If no tags were present, a PIT tag was implanted in the base of the dorsal fin and a 1 cm<sup>2</sup> piece of tissue was removed from the trailing edge of the caudal fin for genetic analysis. Before each pallid sturgeon was released, voucher

pictures were taken from a lateral and ventral view of the fish with a summary of capture information (e.g., PIT tag number, location, date, CI score, etc.).

## **Sampling Site Selection and Description**

### *Site selection*

Beginning with the 2008 sampling season, 25% of bends from each segment were randomly selected to be sampled within each sampling season. Segment 11 has a total of six named river bends, and three of these were randomly selected to be sampled during each sampling season (Appendix I). Within each randomly selected river bend in segment 11, sampling locations were chosen based on the availability of standard habitats for each gear type. A minimum of 20 100ft gill nets and 8 subsamples of trammel nets and otter trawls were deployed in each bend during sturgeon season. During fish community season, a minimum of 8 subsamples of trammel nets, otter trawls, and mini-fyke nets were deployed in each bend. A minimum of two subsamples were collected in each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if six subsamples were conducted in the inside bend within the influence of wing dikes and there were 12 wing dikes, approximately every other wing dike would be sampled. For most gear types, at least two subsamples were conducted in the channel crossover and the inside and outside bends were equally sampled (8 to 16 subsamples per bend depending upon bend length).

### *Site description.*

Sampling sites were described using a three-tiered (macro-, meso-, and microhabitat) classification system based on the Missouri River Benthic Fish Study (Berry and Young 2001). Within this habitat designation system, by definition each river bend contained the following three continuous macrohabitats: main channel crossover (CHXO), inside bend (ISB), and outside bend (OSB). The channel crossover was the area where the thalweg crossed from one concave side of the river to the other. The inside bend was the convex side of the river and the outside bend was the concave side of the river.

Classifications for discrete macrohabitats that may not be present in every bend included: braided channel (BRAD), tributary confluence (CONF), dendritic channel (DEND), deranged channel (DRNG), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), non-connected secondary channel (SCN), large tributary mouth (TRML) and small tributary mouth (TRMS). Braided channels were areas with multiple channels and an unidentifiable main channel. Tributary confluences were areas where tributaries influenced physical features (e.g., temperature, turbidity, sand bars, etc.) of the Kansas River for up to one bend in length downstream from the tributary mouth. Dendritic and deranged channels were transitions from a meandering channel to a tree-like pattern of multiple channels and vice versa, respectively. Large, connected secondary channels carried less water than the main channel, were open on both ends, and had flowing water with depths greater than 1.2 m. Small, connected secondary channels were defined the same as SCCL, but water depths did not exceed 1.2 m. Non-connected secondary channels were channels that were blocked on one end. Large tributary mouths were areas within tributaries, with an annual discharge that exceeded  $20 \text{ m}^3/\text{s}$  and extended 300 m upstream from the confluence with the main river. Small tributary mouths were areas within 300 m of the confluence with the main river, were greater than 6 m in width, and had an annual discharge less than  $20 \text{ m}^3/\text{s}$ .

Mesohabitats within each macrohabitat included: sand bar (BARS), main channel border (CHNB), dam tailwater (DTWT), island tip (ITIP), pool (POOL), and thalweg (TLWG). Sand bars were defined as areas less than 1.2 m deep at the aquatic-terrestrial interface. Channel border habitats extend from the 1.2 m depth contour to the edge or toe of the thalweg. Island tips were areas immediately downstream from islands where water depths were greater than 1.2 m. Pools were areas immediately downstream from obstructions (rock dikes, sand bars, and bridge pilings) where there was a scour greater than 1.2 m in depth regardless of water velocity. The thalweg was defined as the area between the channel borders that conveyed the majority of the flow.

Microhabitats were identified using a six digit numeric code. The first three digits described the general habitat structure (e.g., kicker dike, wing dike, sand bar, etc.) with which the gear deployment was associated. The last three digits described the exact location

of the gear in relation to this structure (e.g., wing-dike pool, open water inside eddy, sand-bar crown, etc.). For complete definitions of each microhabitat type see Drobish (2008a,b).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 - 4, 5 - 7, and 8 - 14) in which each gear type could be deployed (Drobish 2007a). For segment 11, standard macrohabitats for 1 inch trammel nets included: CHXO, CONF, ISB, OSB, and SCCL. Within these macrohabitats, only CHNB and ITIP mesohabitats were standard. Otter trawls were standard in these same macro- and mesohabitats as well as in TRML macrohabitats. Standard macrohabitats for mini-fyke nets included: CHXO, CONF, ISB, OSB, SCCL, SCCS, SCN, TRML, and TRMS. The only standard mesohabitat for this gear type was BARS.

## **Sampling Gear**

### *Gill nets*

Standard gill nets were set primarily parallel with flow downstream from structures (rock dikes) and along the channel border (channel sand bars). Gill nets were anchored on the upstream and downstream end to ensure complete extension during the sampling period. A line and buoy were attached to both ends to mark the net and for retrieval. In segment 11 during the 2008 sturgeon season, gill nets were used as standard gear in CHXO, ISB, and OSB macrohabitats and CHNB and POOL mesohabitats. The standard gill nets were 30.5 m (100 ft.) in length, 2.4 m (8 ft.) deep, constructed from multifilament nylon mesh and contained four panels. Each panel was 7.6 m (25 ft.) with mesh size of 25.4 mm (1 in.) Panel 1 is 50.8 mm (2 in.) Panel 2, 76.2 mm (3.0 in.) Panel 3, and 101.6 mm (4.0 in.) Panel 4. Panels repeat (5 - 8) in double length nets with 38.1 mm, 50.8 mm, 76.2 mm, 101.6 mm mesh sizes in panels 5, 6, 7, and 8, respectively. All nets had a 13.0 mm braided polyfoam core float line and a 7.1 mm diameter, 22.7 kg lead line. Standard effort was calculated as a 30.5 m (100 ft.) net (1 net night). Sets made with 61 m (200 ft.) nets counted as double effort (2 net nights). The first panel (1, 4, or 8) deployed out of the boat for a set site was selected randomly and recorded. Gill nets were set overnight for a maximum of 24 hours. Four bends (three below the wier and one above) were sampled in Segment 11 in 2008 for a total of 80 net-nights.

### *Trammel Nets*

Trammel nets were deployed off the bow of the boat by throwing a buoy attached to a 10 m line and motoring in reverse perpendicular to the flow toward the bank. A second buoy and line on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. In segment 11 during the 2008 fish community and sturgeon seasons, trammel nets were used as standard gear in CHXO, ISB, and OSB macrohabitats and CHNB and ITIP mesohabitats. Trammel nets (i.e., 1 inch trammel nets) were 38.1 m (125 ft.) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in.) bar mesh (#139 twine) that was 2.4 m deep (8 ft) and the outer wall was 203.0 mm (8 in.) bar mesh (# 9 twine) that was 1.8 m (6 ft.) in depth. All nets had a 13.0 mm braided polyfoam core float line and a 7.1 mm diameter, 22.7 kg lead line. During sturgeon season 2008, four bends (three below the wier and one above) were sampled for a total of 4119 m drifted. During fish community season, three bends (all below the weir) were sampled for a total 2191 m drifted.

### *Otter Trawls*

Otter trawls were deployed from the stern of a custom designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and line were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and along channel sand bars. The towing warp consisted of 13 mm low stretch nylon line with a 13.7 m bridle. In segment 11, during the 2008 fish community and sturgeon seasons, otter trawls were used as standard gear in CHXO, ISB, OSB, and SCCL macrohabitats and CHNB and ITIP mesohabitats. Standard trawl hauls ranged from a minimum distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom designed skate balloon with a 4.9 m (16 ft.) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.). During the 2008 sturgeon season, four bends (three below the wier and one above) were

sampled with a total of 3929 m trawled. During fish community season, four bends (three below the wier and one above) were sampled with a total of 3753 m trawled.

### *Mini-fyke*

Mini-fyke nets were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. The lead length was adjusted so the top of the cab would rise above the water surface to minimize turtle mortalities. In areas with moderate flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the cab to prevent the net from overturning. The perpendicular distance measured from the midpoint of the cab to the bank was recorded. Nets were generally set in the afternoon and left overnight with a maximum soak time of 24 hours. In segment 11, during the 2008 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, and SCCS macrohabitats and BARS mesohabitats. Mini-fyke nets were constructed from 3 mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the cab. The body of the net was constructed with two 0.6 m steel hoops, with a single, 51 mm throat. The lead was 4.5 m in length and 0.6 m in height. A total of six bends were sampled (three below the weir and three above) for a total of 47 net/nights.

### *Push Trawl*

Push trawls (POT02) were used to sample water between 0.25m and 1.2 m from the bow of a jet boat while traveling in a downstream direction. They were deployed by mechanical means using forward facing outriggers of sufficient length to allow the net to fish ahead of the point where the boat breaks the water. Rope is subsequently released to accommodate for varying depths. Standard trawl hauls ranged from a minimum distance of 15 m to a maximum distance of 150 m. All push trawls were designed with a 2.4 m (8 ft.) headrope, 0.6 m mouth height, and an overall length of 1.8 m. Paired wooden doors were 762 mm (30 in.) x 381 mm (15 in.).

### *Trot lines*

Trot lines were a wild gear in 2008 used in segment 11. Trot lines were set parallel with flow downstream from structures (rock dikes) and along the channel border (channel sand bars).

Trot lines were anchored on the upstream and downstream ends. The main line was 205 ft long and made from #8 (1/4") solid braid nylon rope or 1/4" 30 lb lead core line. When nylon rope was used, sash weights (3-4 lbs) were attached along the mainline at 70 ft intervals to ensure gear remained on the river bottom. Hooks (attached to 18 in long droppers) were clipped on each line at 8 ft intervals while deploying gear from bow of boat. In an effort to determine the effectiveness of different hook types/ sizes at catching various size ranges of pallid sturgeon, four hook types were used. These included: size 3/0 Eagle Claw Circle Sea, 3/0 Eagle Claw O'Shaughnessy, 7/0 Eagle Claw O' Shaughnessy, and 7/0 Gamakatsu Octopus Circle hooks. For the most part, 12 lines were deployed per bend, with only one hook type per line. Therefore, a total of 75 of each hook type were typically deployed per bend. In segment 11, trot lines were deployed in CHXO, ISB, OSB, and TRMS macrohabitats and CHNB, POOL, and ITIP mesohabitats. Trot lines were deployed in two fashions: a) random effort: in randomly-selected bends and subsamples and b) targeted effort: bends and subsamples targeted for pallid sturgeon. During 2008 sturgeon season random effort, two bends were sampled with 599 hook/ nights. During sturgeon season targeted effort, 8 bends were sampled with 696 hook/ nights. There were no trot lines deployed in Segment 11 during fish community season.

## **Data Collection and Analysis**

### *Associated Environmental Data*

For every subsample, water depth (m) and temperature (°C) were recorded. Additional habitat data were collected for a minimum of 25% of subsamples within each mesohabitat in each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in segment 11, habitat data were generally collected for one subsample in the channel crossover and two to four subsamples for the outside and inside bend. In addition to the collection of habitat data for randomly selected subsamples, these data were also collected for all subsamples that captured a pallid sturgeon. These habitat data collections were recorded as non-random and were not included toward meeting the 25% minimum of subsamples in that bend.

Habitat parameters collected included turbidity, and velocity. Turbidity was determined using a Hach 2100 P Turbidimeter and recorded as nephelometric turbidity units (NTUs). Surface water velocity was estimated visually for every subsample by categorizing flow in meters per second (m/s) as: 0 = cannot determine, 1 = eddy or circular flow, 2 = 0.0-0.3 m/s, 3 = 0.3-0.6 m/s, 4 = 0.6-0.9 m/s, and 5 = >0.9 m/s. Actual water velocity was recorded using a Marsh McBirney Flo-Mate Model 2000 and record in m/s. Water velocity measurements were taken at the bottom, 80%, and 20% of the water column for gill nets, trammel nets, and otter trawls. This parameter was recorded at the bottom and 60% of the water column for mini-fyke nets.

All habitat parameters were collected at the midpoint of the sample, except depth which was collected at the start point, midpoint, and end point for gill nets, trammel nets, and otter trawls. For example, if an otter trawl was hauled 300 m, habitat data were collected 150 m downstream from the starting point (the approximate midpoint of the tow); for a 61 m (200 ft.) gill net set, habitat data were collected at the midpoint (at 30.5 m or 100 ft) of the net. All habitat parameters for mini-fyke nets were measured at the point where the lead connected to the cab of the net.

#### *Genetic Validation*

All pallid sturgeon captured that did not appear to be previously marked were considered to be unknown origin fish pending genetic verification. Tissue samples collected at time of capture were subsequently sent to the USFWS Abernathy Fish Technology Center, Washington, or the USFWS Northeast Fishery Center, Pennsylvania to genetically determine the origin of the fish (i.e., hatchery-stocked or wild).

#### *Relative Condition*

The condition of recaptured pallid sturgeon was determined using the relative condition factor (Anderson and Neumann 1996). Relative condition ( $K_n$ ) was calculated as:

$$K_n = W/W'$$

where  $W$  was the observed weight and  $W'$  was the length-specific weight derived from the FL-weight equation from Keenlyne and Evanson (1993).

### *Relative Weight*

Relative weight of shovelnose sturgeon was calculated using the formula:

$$W_r = 100 * (W/W_s)$$

where W is weight of the individual and W<sub>s</sub> is the length-specific standard weight value for the species. Quist et al. (1998) provided a relative weight equation for shovelnose sturgeon throughout its range to calculate relative weight.

$$\log_{10}W = -6.287 + 3.330 \log_{10}FL$$

### *Relative Stock Densities*

Relative stock densities were calculated for pallid and shovelnose sturgeon captured during the 2006 season. Relative stock density was calculated as:

RSD = number of fish in a length-class / number of fish  $\geq$  minimum stock length  $\cdot$  100 (Anderson and Neumann 1996). Minimum length specifications for pallid sturgeon were: stock = 330 mm; quality = 630 mm; preferred 840 mm; memorable 1,040 mm; trophy = 1,270 mm as reported by Shuman et al. (2006). For shovelnose sturgeon, minimum length specifications were: stock = 250 mm; quality = 380 mm; preferred = 510 mm; memorable = 640 mm; trophy = 810 mm as reported by Quist et al. (1998). In addition to these categories, two sub-stock length ranges for each species were defined by the PSPAP. Sub-stock categories were subdivided into 0 to 199 mm and 200 to 329 mm for pallid sturgeon and 0 to 149 mm and 150 to 249 mm for shovelnose sturgeon.

### *Analyses*

All analyses were conducted on data collected from randomly selected bends with standard gear types set within standard habitats for each respective gear. Mean catch-per-unit-effort (CPUE) was calculated for each species within a bend sampled. Then a grand mean from all bends was derived to get an overall average CPUE for each fish species. CPUE for 1-inch trammel nets and otter trawls was reported as the number of fish/100 m drifted or trawled, respectively. Gill nets and mini-fyke nets reported CPUE as the number of fish per net night.

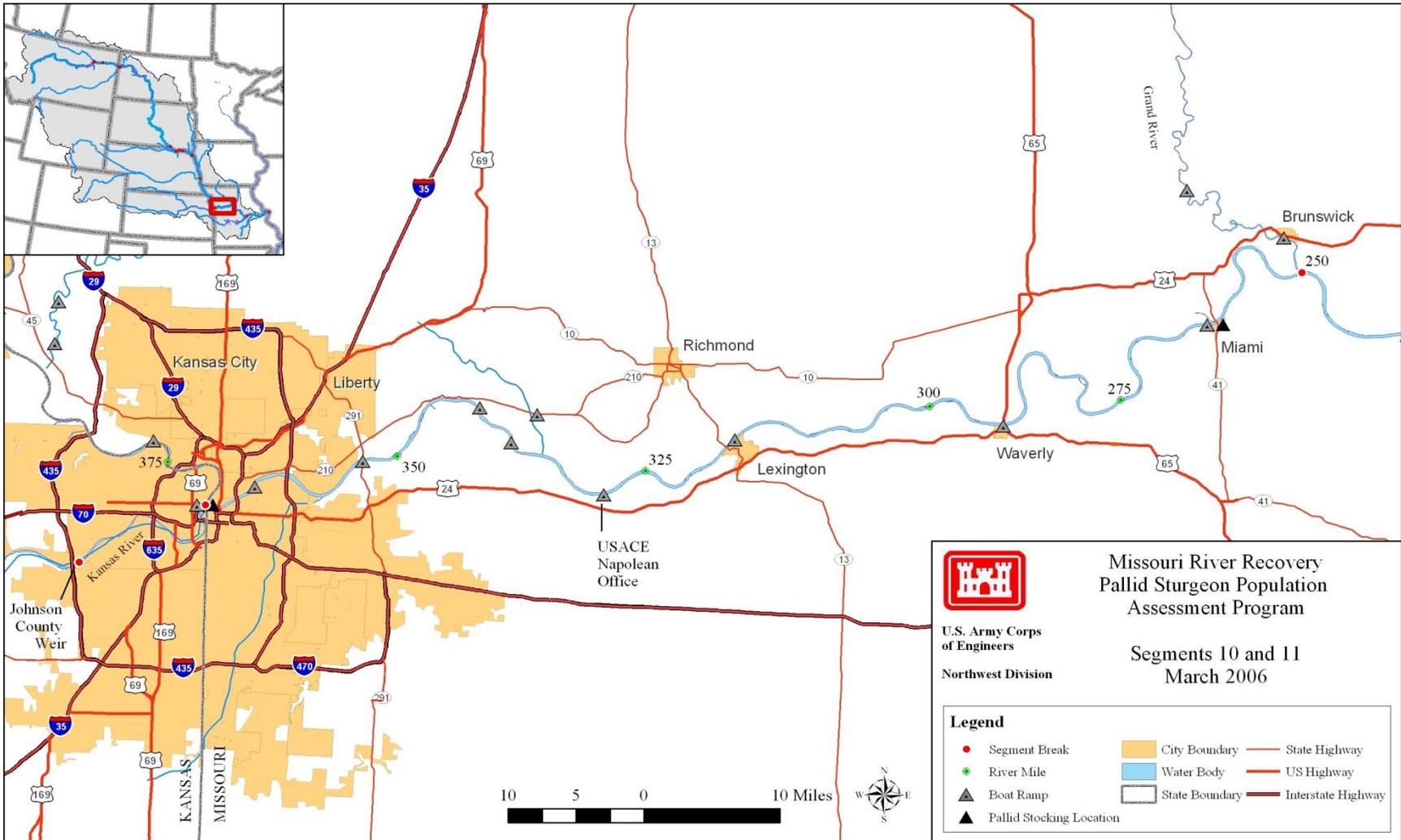


Figure 1a. Map of segment 11, the Kansas River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River from the bend above the Johnson County Weir (River Mile 21.0) to the mouth (River Mile 0.0)

## Results

### Pallid Sturgeon

*Objective 1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.*

*Objective 2. Document annual results and long-term trends of habitat usage of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.*

*Objective 3. Document population structure and dynamics of pallid sturgeon in the Missouri River System.*

No pallid sturgeon were captured in 2008. Two thousand-seven marked the first sampling season a pallid sturgeon was captured in segment 11 since 1952 (U.S. Fish and Wildlife Service 2000). The fish was spawned at Gavins Point National Fish Hatchery in 2005, and released at Parkville, MO (Missouri River mile 377.5) in August 2006. This fish was at large for seven months and traveled 10 miles downstream to the mouth of the Kansas River, then traveled 12 miles up the Kansas River.

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for segment 11 on the Kansas River during sturgeon season and fish community season in 2007-2008. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deployments	Macrohabitat <sup>a</sup>													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Fall through Spring - Sturgeon Season</b>																
1 Inch Trammel Net	4	9.25	N-E	7	N-E	N-E	N-E	15	15	0	0	N-E	N-E	N-E	N-E	N-E
Gill Net	4	10.00	N-E	8	N-E	N-E	N-E	17	15	0	0	N-E	N-E	N-E	N-E	N-E
Otter Trawl	4	8.00	N-E	6	N-E	N-E	N-E	14	12	0	0	N-E	N-E	N-E	N-E	N-E
<b>Summer – Fish Community Season</b>																
1 Inch Trammel Net	3	8.00	N-E	6	N-E	N-E	N-E	12	6	0	0	N-E	N-E	N-E	N-E	N-E
Mini-Fyke Net	6	7.67	N-E	11	N-E	N-E	N-E	20	13	0	2	N-E	N-E	N-E	N-E	N-E
Otter Trawl	4	8.00	N-E	6	N-E	N-E	N-E	16	9	1	0	N-E	N-E	N-E	N-E	N-E

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 2. Number of bends sampled, mean number of deployments, and total number of deployments by mesohabitat for segment 11 on the Kansas River during sturgeon season and fish community season in 2007-2008. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean deployments	Mesohabitat <sup>a</sup>					
			BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Fall through Spring – Sturgeon Season</b>								
1 Inch Trammel Net	4	9.25	0	35	N-E	2	0	N-E
Gill Net	4	10.00	0	35	N-E	0	5	N-E
Otter Trawl	4	8.00	0	30	N-E	2	0	N-E
<b>Summer – Fish Community Season</b>								
1 Inch Trammel Net	3	8.00	0	22	N-E	2	0	N-E
Mini-Fyke Net	6	7.67	45	1	N-E	0	0	N-E
Otter Trawl	4	8.00	0	32	N-E	0	0	N-E

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 3. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Kansas River during 2007-2008. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
BRAD	BARS									
	CHNB									
	DTWT									
	ITIP									
	POOL									
	TLWG									
CHXO	BARS	0.6 (0.3-1.4)		0.03 (0.01-0.07)		23.3 (16.2-29.6)		202 (82.0-452)		.
	CHNB	2.9 (1.2-6.0)		0.67 (0.23-1.21)		17.3 (4.2-29.0)		316 (32.0-994)		.
	DTWT									.
	ITIP	3.7 (1.9-6.0)		0.58 (0.56-0.60)		20.8 (4.5-26.5)		194 (161-232)		.
	POOL	5.2 (2.3-8.0)				16.5 (5.8-27.2)				.
CONF	TLWG									.
	BARS									.
	CHNB									.
	DTWT									.
	ITIP									.

Table 3 (continued).

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CONF	POOL									.
	TLWG									.
DEND	BARS									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
DRNG	BARS									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
ISB	BARS	0.7 (0.2-2.0)		0.02 (0.00-0.06)		25.0 (16.2-29.6)		209 (65.0-450)		.
	CHNB	3.2 (0.9-7.2)		0.58 (0.03-1.02)		18.4 (4.2-29.4)		465 (38.0-2820)		.
	DTWT									.
	ITIP									.
	POOL	2.8 (1.8-3.7)		0.45 (0.45-0.45)		14.4 (6.1-23.7)		35.0 (35.0-35.0)		.
	TLWG									.

Table 3 (continued).

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
OSB	BARS	0.7 (0.2-2.0)		0.02 (0.01-0.03)		23.3 (16.2-29.6)		279 (47.0-501)		.
	CHNB	3.3 (0.3-6.7)		0.38 (0.03-0.72)		17.5 (4.2-29.6)		287 (32.0-1542)		.
	DTWT									.
	ITIP									.
	POOL	4.4 (1.7-8.2)		0.19 (0.08-0.30)		16.8 (4.5-27.2)		211 (66.0-329)		.
	TLWG									.
SCCL	BARS	0.9 (0.9-0.9)				22.9 (22.9-22.9)				.
	CHNB	1.4 (0.8-1.9)				18.9 (17.9-19.8)				.
	DTWT									.
	ITIP	2.4 (1.0-3.7)				22.1 (17.6-25.8)				.
	POOL	2.5 (2.5-2.5)				23.7 (23.7-23.7)				.
	TLWG									.
SCCS	BARS	0.7 (0.2-1.0)		0.01 (0.01-0.01)		23.2 (18.2-25.8)		133 (133-133)		.

Table 3(continued).

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total fish caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
SCCS	CHNB	3.2 (2.2-4.1)				26.5 (25.8-27.2)				.
	DTWT									.
	ITIP	1.6 (1.6-1.6)				27.2 (27.2-27.2)				.
	POOL									.
	TLWG									.
SCN	BARS									.
	POOL									.
	CHNB									.
	TLWG									.
SCN	NULL	2.3 (2.3-2.3)				25.8 (25.8-25.8)				.
										.
TRIB	BARS									.
	POOL									.
	CHNB									.
	ITIP									.
	TLWG									.
TRML	ITIP									.
	BARS									.
	POOL									.
	CHNB									.

Table 3 (continued).

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total fish caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
TRML	TLWG									.
	ITIP									.
TRMS	BARS									.
	POOL									.
	CHNB	2.0 (2.0-2.0)		0.03 (0.03-0.03)		15.6 (15.6-15.6)		19.0 (19.0-19.0)		.
	TLWG									.
	ITIP									.
WILD	BARS									.
	POOL									.
	CHNB									.
	TLWG									.
	ITIP									.

*Year comparisons, Gear evaluation and Habitat associations*

No pallid sturgeon were captured during the 2008 sample year in segment 11, therefore Figures 1b, 3, 5, 7, 8 and Tables 6, 7, 9 – 16 were omitted.

In sample year 2007 (Figure 9), one pallid sturgeon was captured in the Kansas River in a gill net, resulting in a catch-per-unit-effort of 0.0156 fish/ net night (Figure 2). This net was set adjacent to an island within the channel cross-over. The net was set off an extension of the island located on the main-channel side of the river and deployed in a small slack-water area with a minimum amount of eddy flow.

## Segment 11 - Pallid Sturgeon / Sturgeon Season

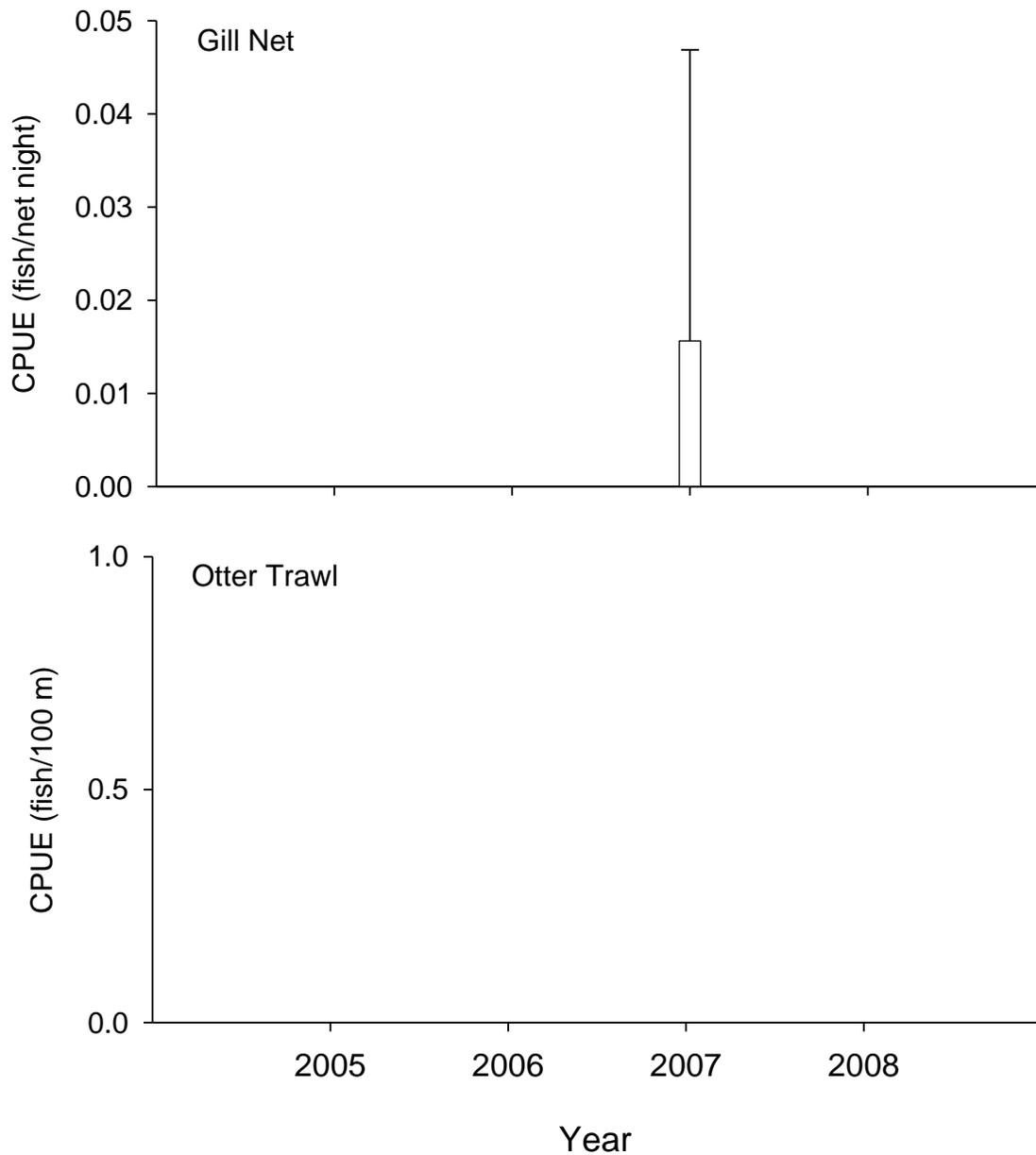


Figure 2. Mean annual catch per unit effort ( $\pm 2$  SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008. Pallid sturgeon of unknown origin are awaiting genetic verification.

## Segment 11 - Annual Pallid Sturgeon Capture History

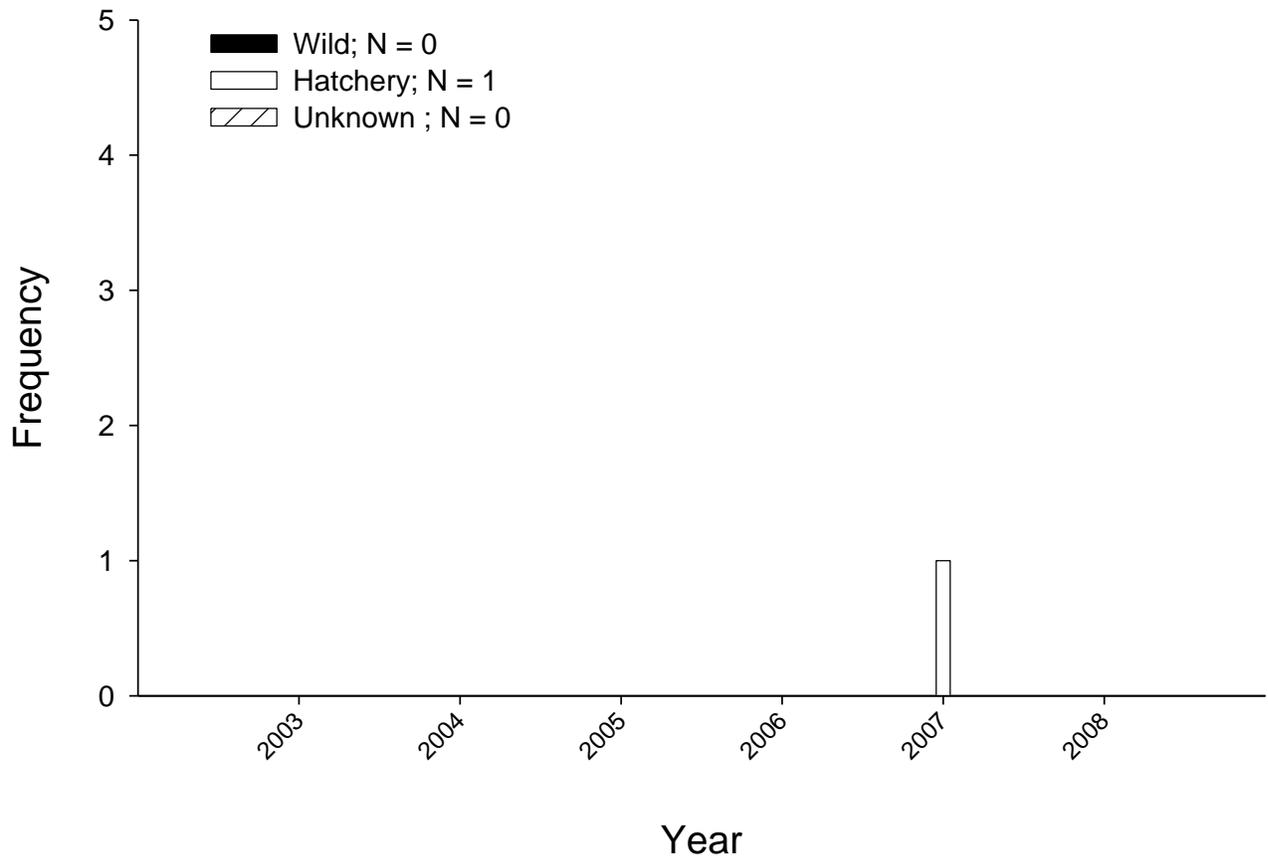


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 11, the Kansas River, from 2003 to 2008. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples.

## **Shovelnose X Pallid Sturgeon Hybrids**

No shovelnose X pallid sturgeon hybrids were captured during the 2008 sampling season. Two were captured during 2007 and the 2006 sampling season. In past seasons, all fish were captured with gill nets. Fork lengths were 625 and 640 mm. All fish displayed three strong characteristics of a hybrid sturgeon: a somewhat elongated snout, smaller inner barbles and patchey scales on the ventral side.

## Targeted Native River Species

*Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Kansas River System.*

*Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.*

### Shovelnose Sturgeon

A total of 385 shovelnose sturgeon were captured with standard gears in four bends sampled in segment 11 during the 2008 season (Figure 17). This is less than the total catch of shovelnose sturgeon in 2007 (N = 532) but more than captured in 2006 (N = 253). Fork lengths ranged from 100 to 750 mm, a similar range to 2007 (201 – 764 mm), but a much broader range of fish than was captured in 2006 (275 – 726 mm). Gill nets captured the most shovelnose sturgeon (N = 252) in 80 net-nights (Tables 1 and 2). This has been the most effective gear at capturing shovelnose sturgeon in 2006, 2007, and 2008 (CPUE = 7.7, 6.53, and 3.15 fish/net night, respectively; Figure 11). In Segment 11, all fish captured in gill nets (65% of ) fell in quality and above (>380 mm) size class.

Trammel nets were drifted a total of 6310 m during the sampling seasons in 2007, with an average of 1577 meters per bend. This standard gear captured a total of seventy-four shovelnose sturgeon during sturgeon (N = 41) and fish community (N = 33) seasons. In all years sampling, 2006 (275 – 726 m), 2007 (201 – 700 m), and 2008 (340 – 750) trammel nets have captured the second widest size-range of fish compared to gill nets and otter trawls but have captured fewer each season, each year (Figures 12 and 14). Total distance otter trawled in segment 11 during 2007 was 7682 m during sturgeon (3929 m) and fish community (3753 m) seasons. This resulted in the total catch of 61 shovelnose sturgeon, ranging in size from 306 to 685 mm, doubling catch from 2007 (N = 33) and increasing the size range (100 – 735 mm) to include smaller individuals in the sub-stock size class (N = 4). Genetic sample were collected from two of the smaller shovelnose to confirm species. Combining both seasons for 2008, otter trawls increased to an average of 0.953 fish/100 m trawled, a considerable increase from the average in 2006 (0.046 fish/100 m) and 2007 (0.384 fish/100 m) (Figures 11 and 14). Otter trawl was represented by three size classes of shovelnose, conversely, trammel nets and gillnets representation of different size classes decreased in 2008. Relative weight (Wr) of shovelnose sturgeon in segment 11 is inversely related to size, except where a very low sample size exists.

The average  $W_r$  in 2008 for both sturgeon and fish community is comparable to the results in 2006 and 2007.

## Segment 11 - Shovelnose Sturgeon / Sturgeon Season

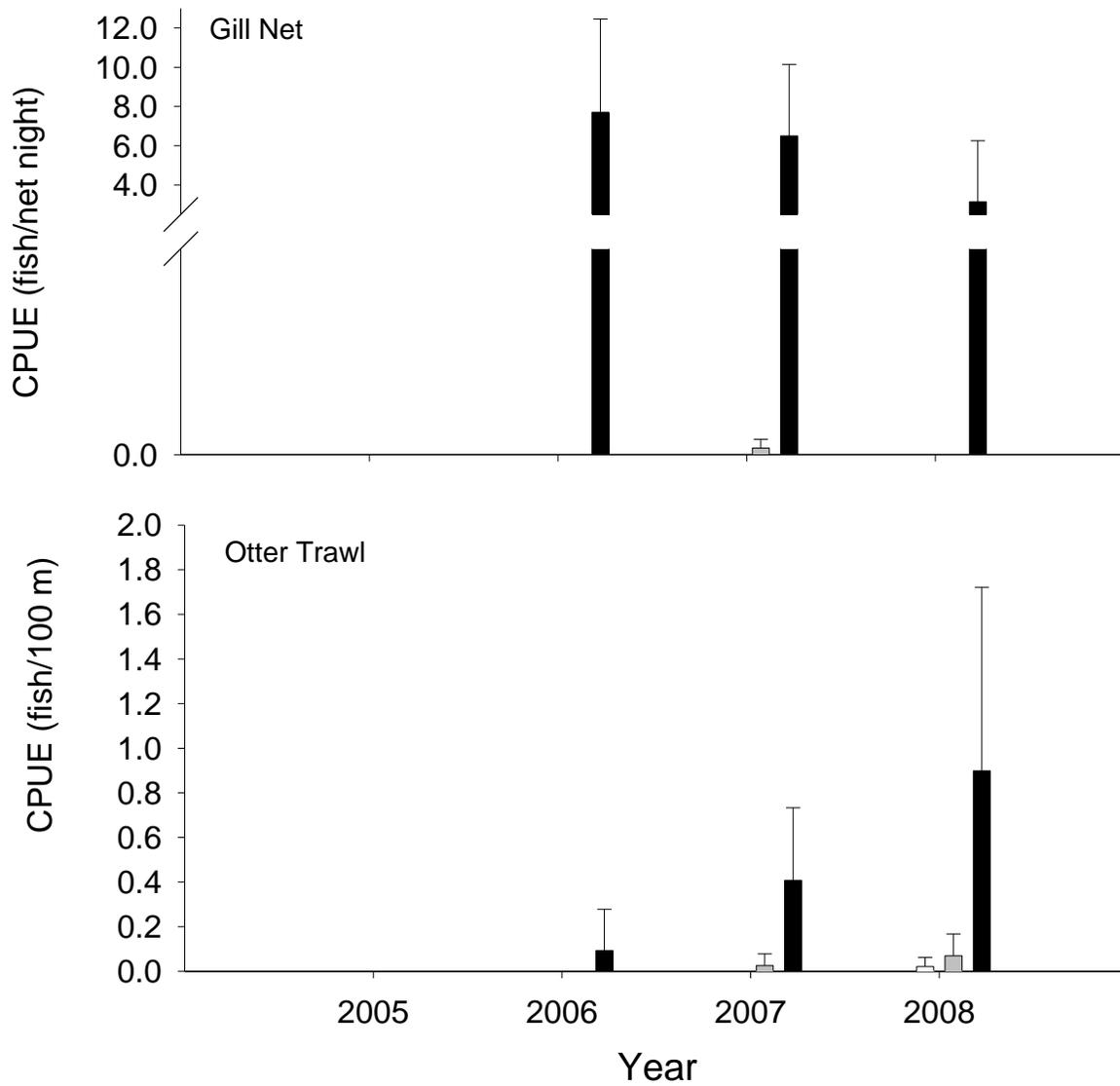


Figure 11. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Shovelnose Sturgeon / Sturgeon Season

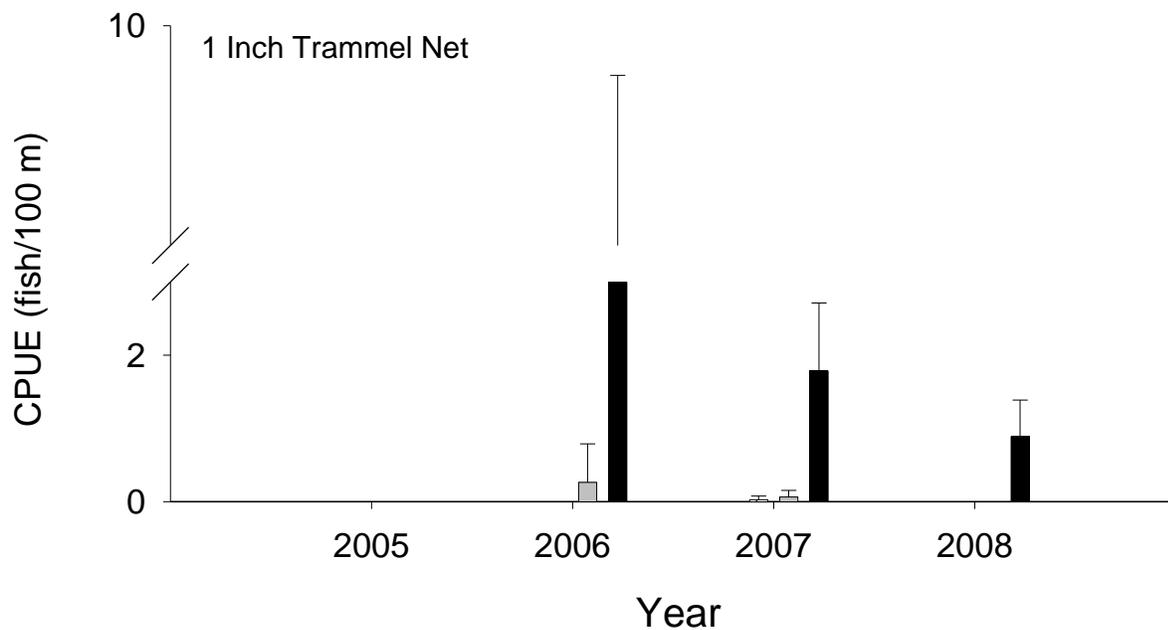


Figure 12. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Shovelnose Sturgeon / Fish Community Season

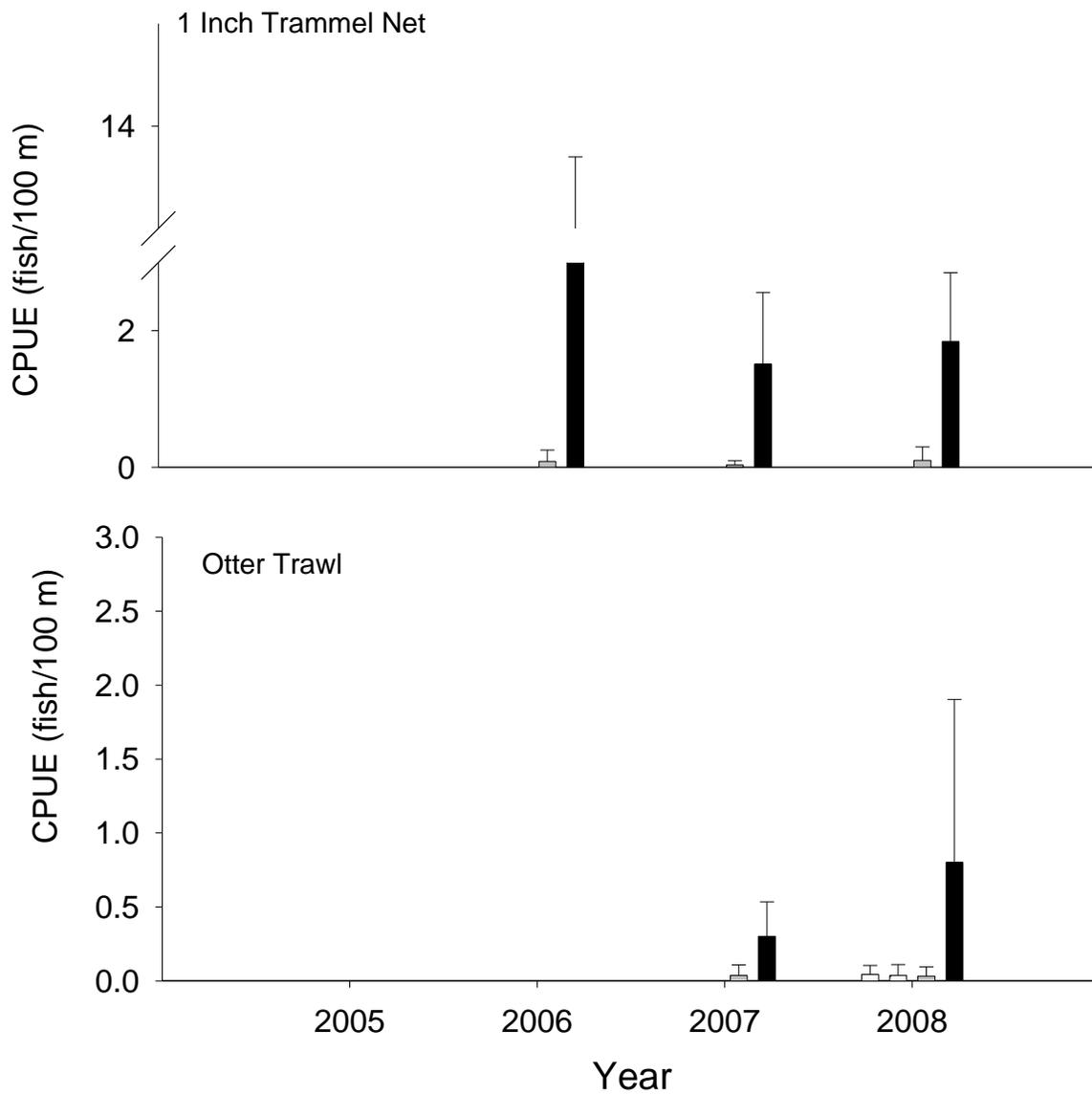


Figure 14. Mean annual catch per unit effort ( $\pm$  2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 11, the Kansas River, during fish community season 2005-2008.

## Segment 11 - Shovelnose Sturgeon / Fish Community Season

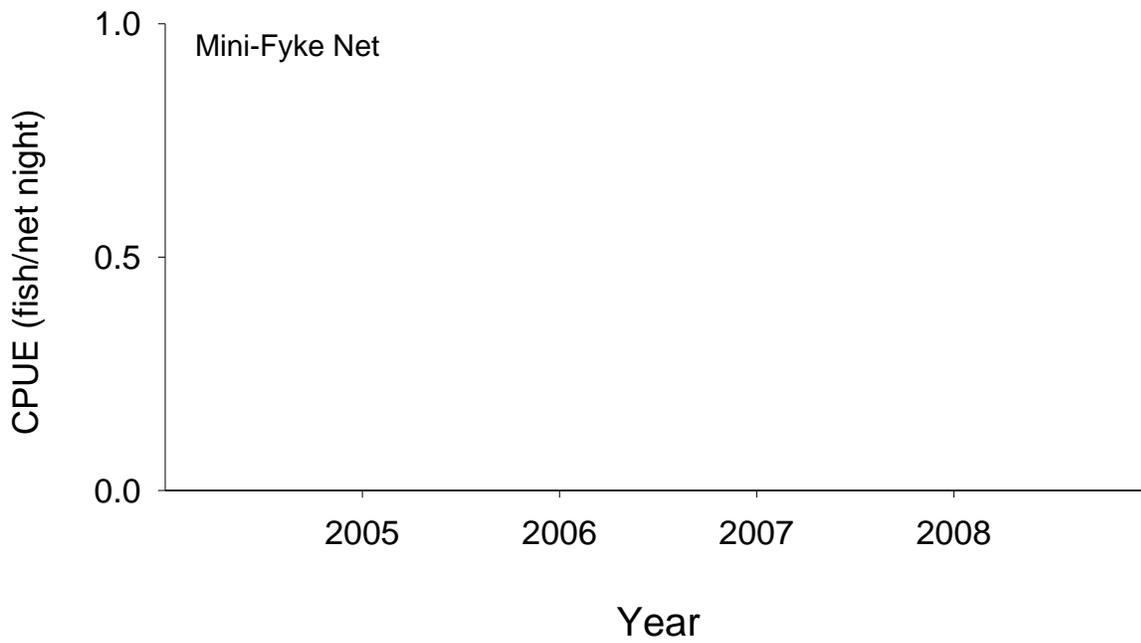


Figure 15. Mean annual catch per unit effort ( $\pm 2$  SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $> 380$  mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 11, the Kansas River, during fish community season 2005-2008.

### *Habitat Use*

In 2008, most shovelnose sturgeon were captured in outside bend macrohabitats (50%; Tables 17-24), an increase from 2007 (42%) the same as 2006 (50%). Inside bend and channel-cross over macrohabitats types accounted for thirty-one and ten percent of all shovelnose sturgeon captures. Approximately two percent were captured from side channels. In 2006, fifty percent of the shovelnose were captured in the channel-crossovers. Most shovelnose (50%) (83% in 2007) were captured in channel border mesohabitats in 2008. The remainder of shovelnose sturgeon were captured from pool (42%), island tip (6%), and bars (2%) mesohabitats. Thirty-five percent of shovelnose sturgeon were captured below a modified rock structure, thirty-one percent were captured in general open water (mid channel) habitat areas. Additional shovelnose were captured from bar, bankline, and pool areas (16, 12, and 6%, respectively). In 2007, seventy-seven percent of shovelnose sturgeon were captured along bankline microhabitats.

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	2	0	0	0	0	0	50	50	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	2	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	0	0	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	2	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	0	0	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	2	0	0	0	0	0	50	50	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	2	0	0	0	0	0	100	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	2	0	100	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	2	0	100	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	0	0	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 23. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	32	0	6	0	0	0	50	44	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	251	0	6	0	0	0	27	67	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	27	0	33	0	0	0	33	33	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	39	0	26	0	0	0	67	8	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	27	0	4	0	0	0	30	67	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 24. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	32	0	97	0	3	0	0
	.	0	(92)	0	(8)	0	0
Gill Net	251	0	38	0	0	62	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	27	0	67	0	33	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	39	0	85	0	15	0	0
	.	0	(93)	0	(7)	0	0
Mini-Fyke Net	0	0	0	0	0	0	0
	.	(98)	(2)	0	0	0	0
Otter Trawl	27	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - Shovelnose Sturgeon

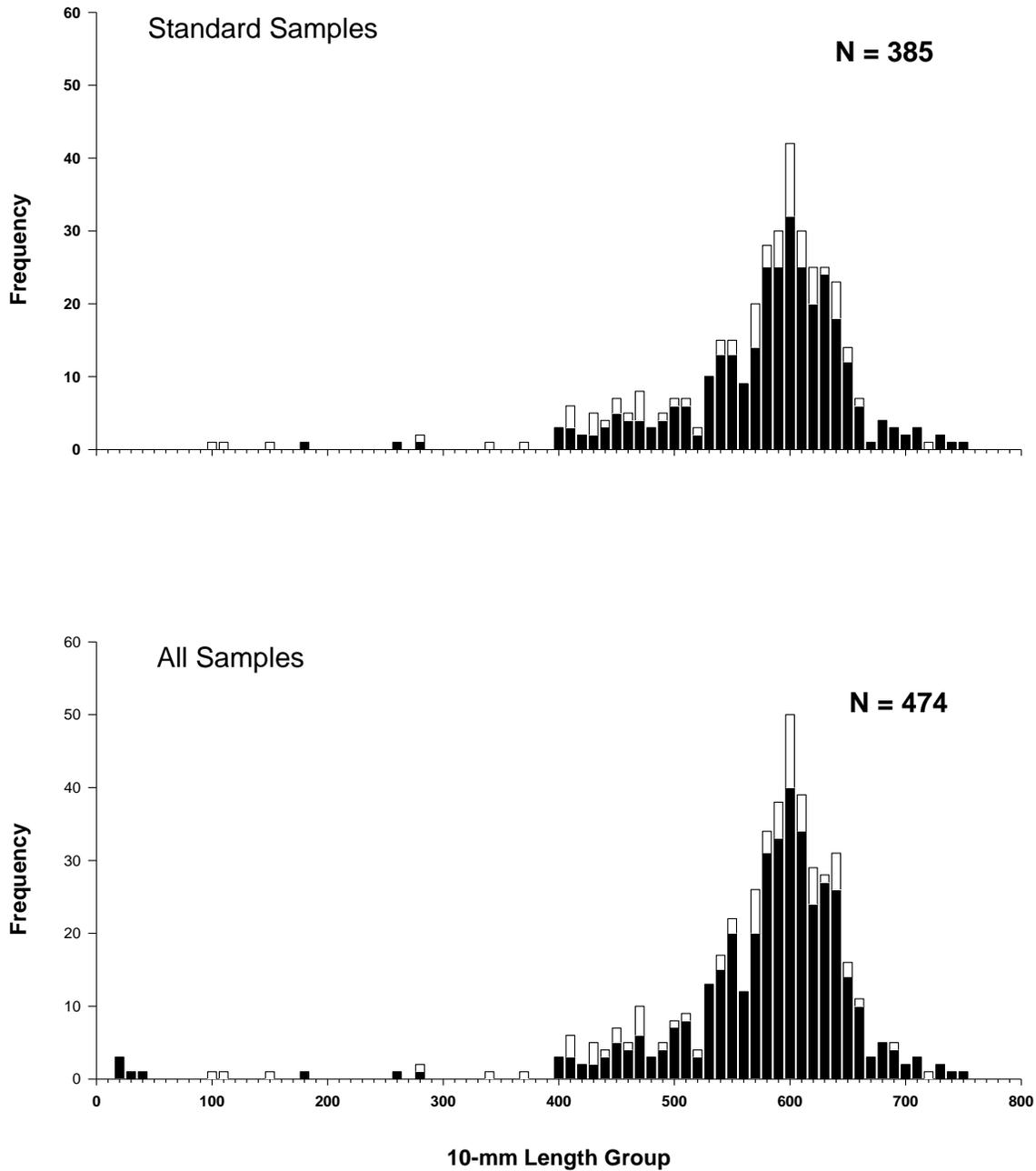


Figure 17. Length frequency of shovelnose sturgeon during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

Table 25. Incremental relative stock density (RSD)<sup>a</sup> and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 11 of the Kansas River captured during 2007-2008. Length categories<sup>b</sup> determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2 SE)
<b>Sturgeon Season</b>			
Sub-stock (0-149 mm)	0	.	0
Sub-stock (150-249 mm)	1	.	.
Stock	2	1	102.8 (7.709)
Quality	39	13	85.93 (3.023)
Preferred	218	70	85.60 (1.087)
Memorable	53	17	83.01 (2.645)
Trophy	0	.	0
Overall Wr	.	.	85.32 (0.975)
<b>Fish Community Season</b>			
Sub-stock (0-149 mm)	2	.	.
Sub-stock (150-249 mm)	1	.	.
Stock	3	4	92.49 (12.32)
Quality	16	23	85.33 (5.274)
Preferred	41	59	80.99 (2.425)
Memorable	9	13	77.74 (3.214)
Trophy	0	.	0
Overall Wr	.	.	82.07 (2.107)

<sup>a</sup> RSD = (# of fish of a specified length class / # of fish  $\geq$  minimum stock length fish) \* 100.

<sup>b</sup> Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock FL < 250 mm (20 %), Stock FL = 250-379 mm (20 – 36 %), Quality FL = 380 – 509 mm (36 – 45 %), Preferred FL = 510 - 639 mm (45 – 59 %), Memorable FL = 640 – 809 mm (59 – 74 %), Trophy FL > 810 mm (>74 %).

## **Sturgeon Chub**

No sturgeon chub were captured in Segment 11 during the sample years 2005 - 2008, therefore Figures 18 to 21 and Tables 26 to 27 have been omitted.

## **Sicklefin Chub**

There were two sicklefin chub captured in segment 11 during sample year 2008 (Figures 23 and 24). Sickelfin chub were captured in mini-fyke (56 mm) and otter trawl (33 mm) during the 2008 fish community season (Figure 25). No sicklefin chub were captured in 2007. In sample year 2006, one (26 mm total length) was captured in otter trawl during fish community season (Figure 22). Each sicklefin chub was captured in the inside bend, one in bars habitat and the other in channel border habitat (Tables 28 and 29).

## Segment 11 - Sicklefin Chub / Sturgeon Season

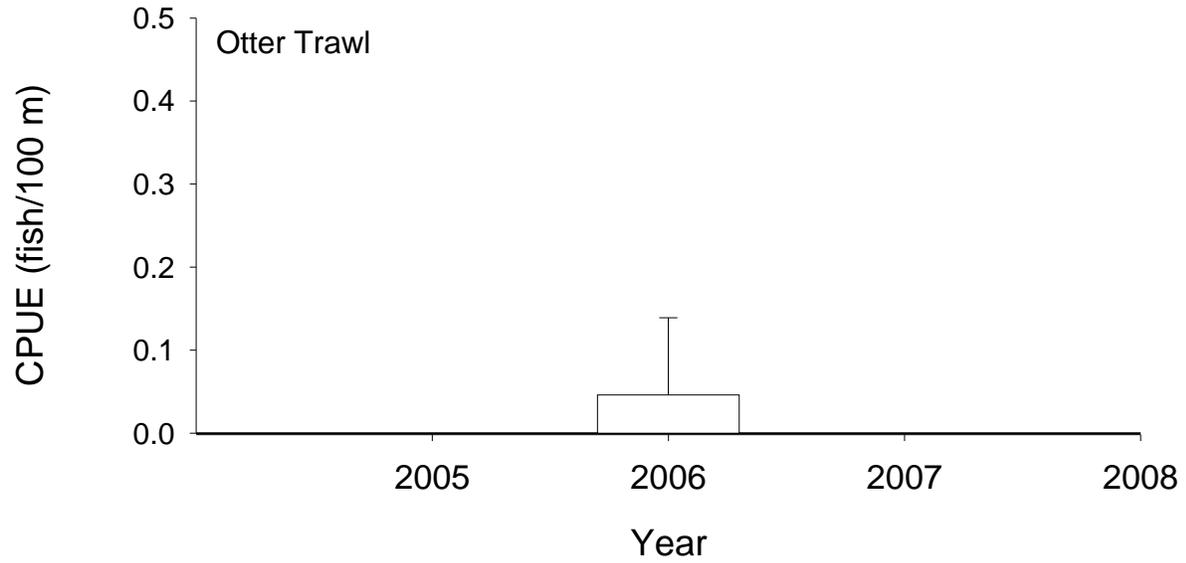


Figure 22. Mean annual catch per unit effort ( $\pm 2$  SE) of sicklefin chub using otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Sicklefin Chub / Fish Community Season

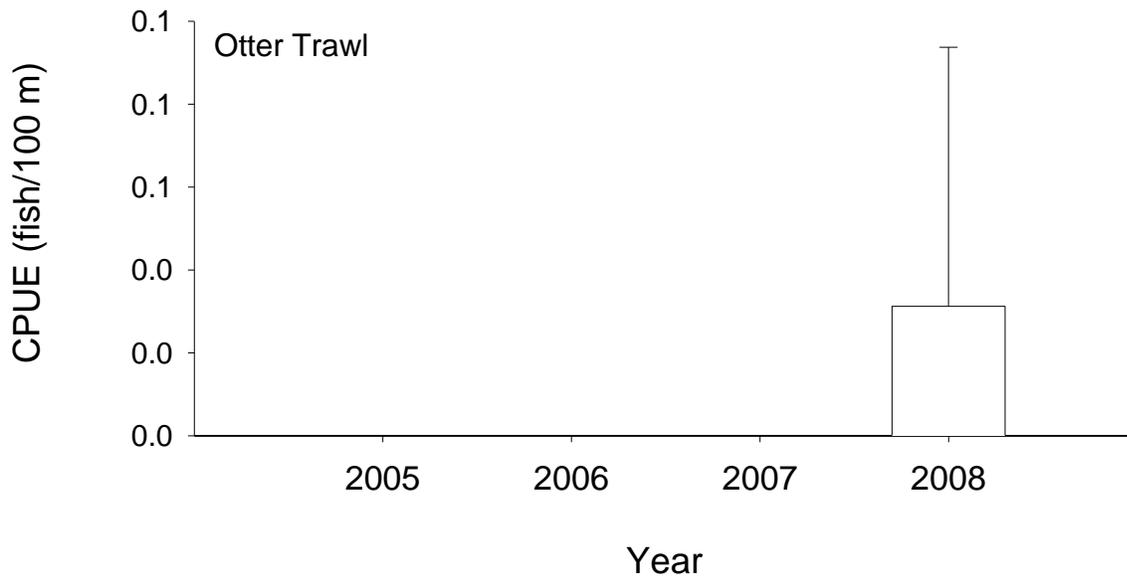


Figure 23. Mean annual catch per unit effort ( $\pm 2$  SE) of sicklefin chub using otter trawls in segment 11, the Kansas River, during fish community season 2005-2008.

# Segment 11 - Sicklefin Chub / Fish Community Season

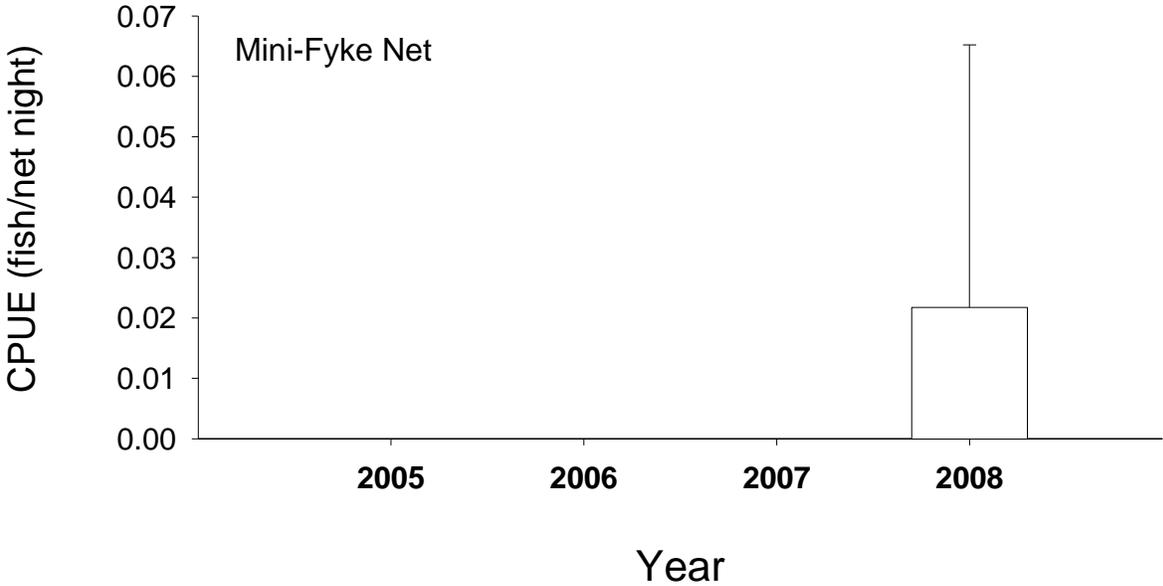


Figure 24. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	1	100	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - Sicklefin Chub

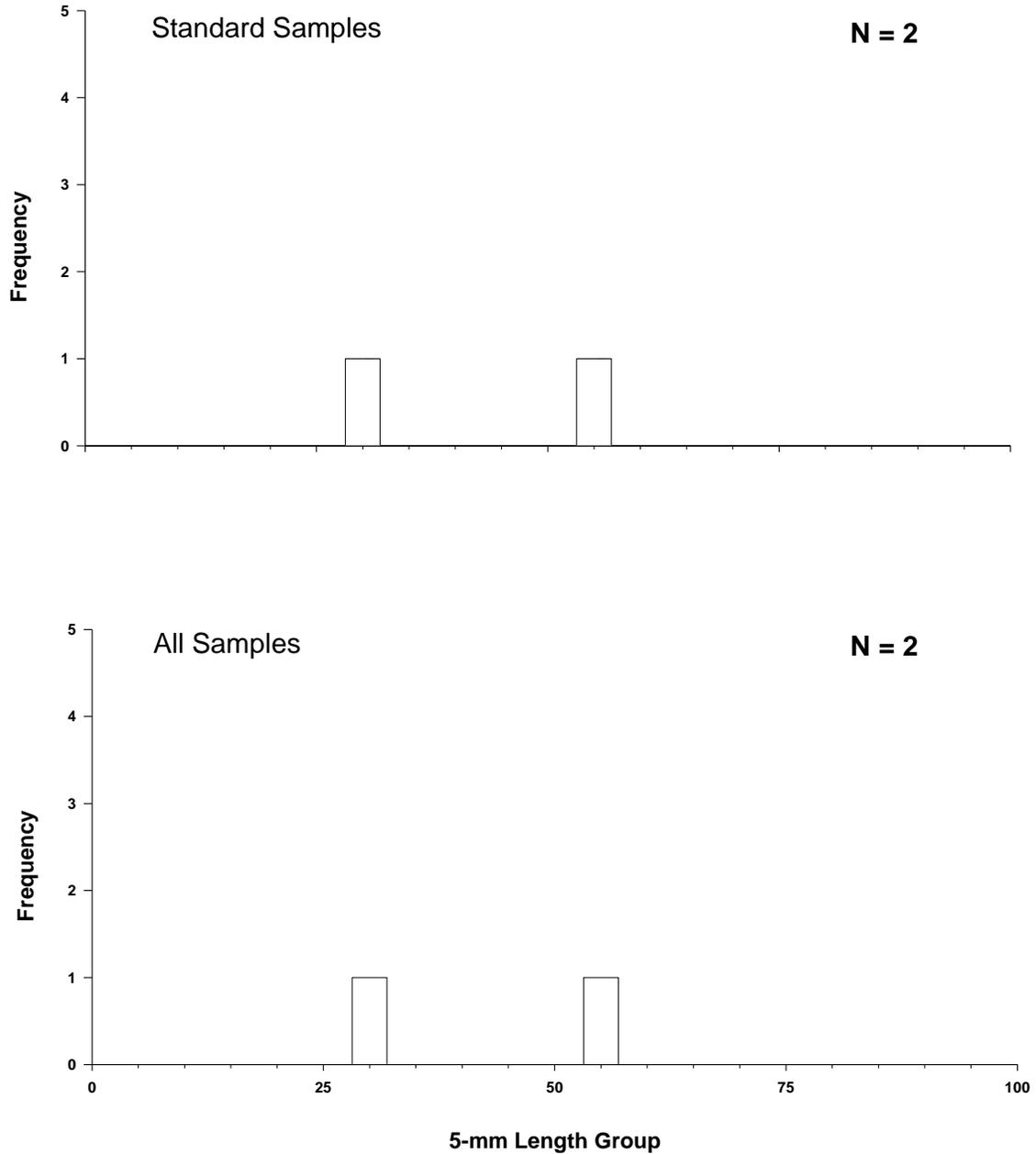


Figure 25. Length frequency of sicklefin chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

## **Speckled Chub**

Sample year 2008 was the second year speckled chub (N = 11) were captured in segment 11 (2007 N = 7). Fish were captured in both sturgeon (N = 5) and fish community seasons (N = 6). All were captured below the Johnson County Weir except for one individual captured in a mini-fyke net (0.022 fish/net night) in an additional bend above the Weir (Figure 28). Otter trawl was the only gear to catch this species in regular random standard samples. Overall CPUE was higher in 2008 (0.108 fish/100 m trawles) than 2007 (0.076 fish/100 m trawled) Figures 26 and 27). Size of fish ranged from 37 to 60 mm (Figure 29). Speckled chub were captured in the inside and outside bend (Table 30) channel border habitat, while the remaining one fish was from bars mesohabitats (Table 31). Five additional speckled chubs were captured with a wild gear (POT02)

## Segment 11 - Speckled Chub / Sturgeon Season

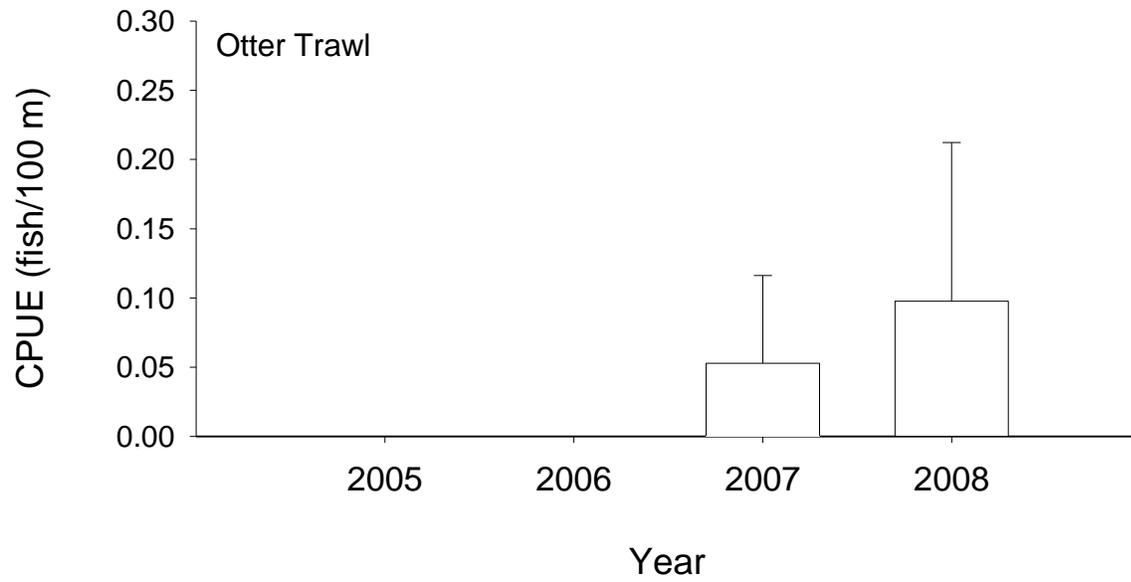


Figure 26. Mean annual catch per unit effort ( $\pm 2$  SE) of speckled chub using otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Speckled Chub / Fish Community Season

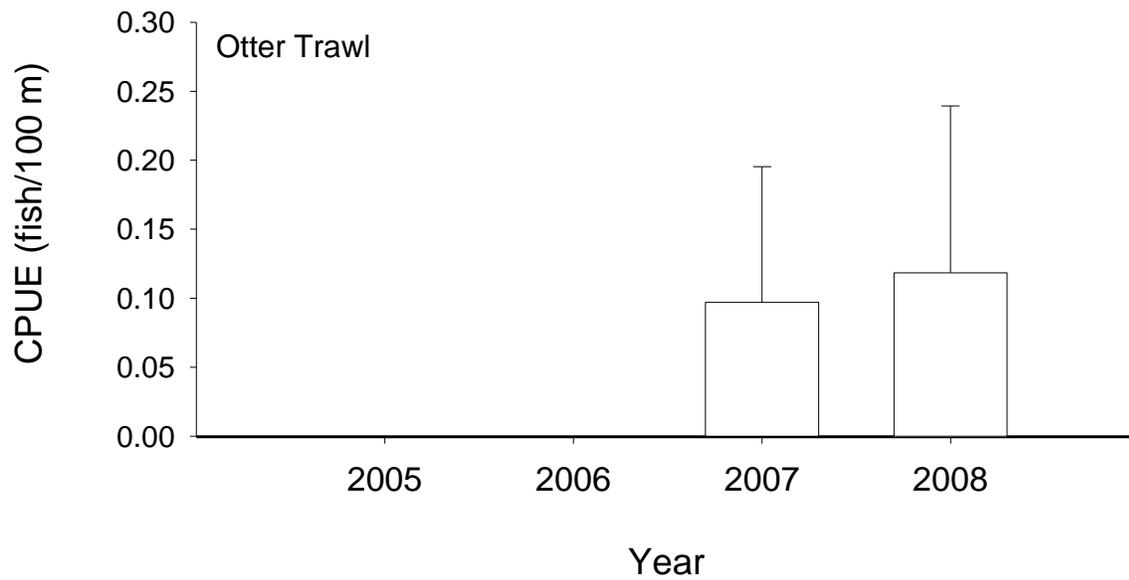


Figure 27. Mean annual catch per unit effort ( $\pm 2$  SE) of speckled chub in segment 11, the Kansas River, during fish community season 2005-2008.

# Segment 11 - Speckled Chub / Fish Community Season

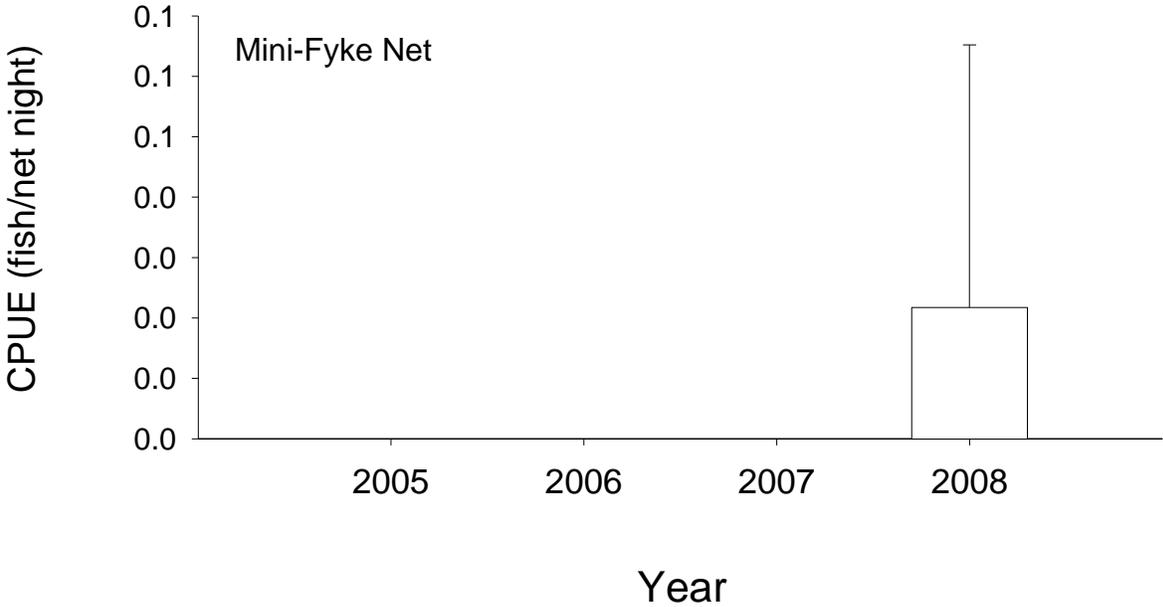


Figure 28. Mean annual catch per unit effort ( $\pm 2$  SE) of speckled chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	5	0	0	0	0	0	80	20	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	5	0	0	0	0	0	80	20	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	5	0	100	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	1	100	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	5	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - Speckled Chub

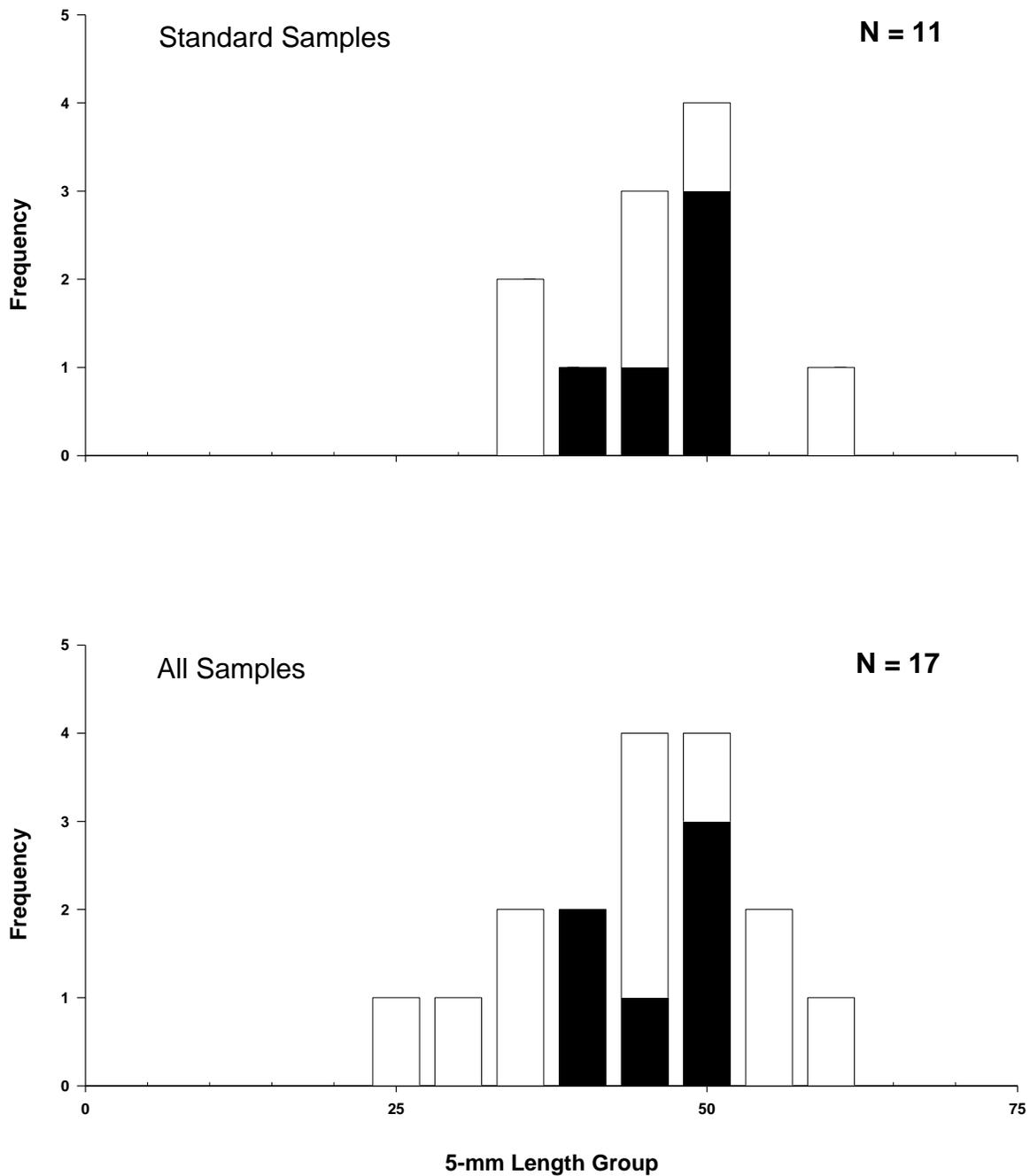


Figure 29. Length frequency of speckled chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

## Sand Shiner

A total of 129 sand shiners were captured with standard gears in segment 11 during the 2008 sampling season, making them the second most frequently-captured target species. They were present in all bends sampled, above and below the Johnson County Weir. This is a reduction in catch from 2007 (N = 191). Mini-fyke nets were the most effective standard gear at capturing sand shiners. Sand shiners were captured at a rate of 2.761 fish/net night (N = 127), considerably less than 2007 (7.7083 fish/ net night; N = 185) and 2006 (8.5 fish/net night) (Figure 32). Otter trawls captured two sand shiners, one in each season, with an overall average of 0.031 fish/100 m trawled, which is a decrease from 2007 (0.068 fish/100 m) and 2006 (0.588 fish/100 m) Figures 30 and 31.

Total fish lengths during sturgeon season and fish community season ranged from 41 – 55 and 30 – 56 mm, respectively (Figure 33). The sand shiners were found throughout the river in channel cross-over, inside bend, outside bend, and small side channels (Table 32). Most sand shiners were found in shallow (< 1.2 m) water bar habitats except for the two captured in otter trawl which were captured in the channel border (Table 33). An additional thirty-one sand shiners were captured in a wild gear (POT02). Size ranged from 24 – 60 mm.

## Segment 11 - Sand Shiner / Sturgeon Season

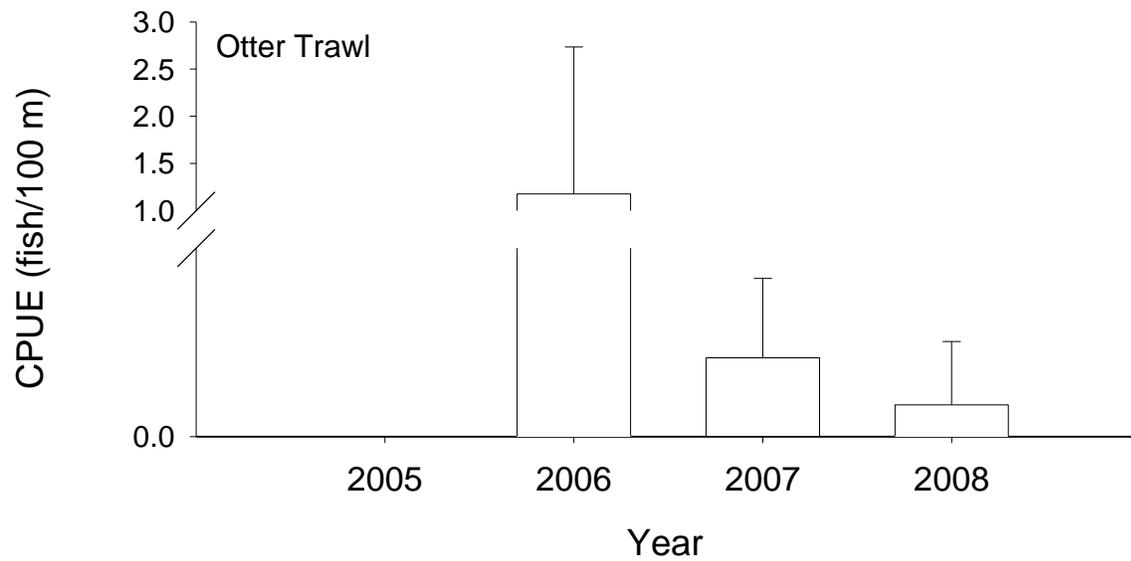


Figure 30. Mean annual catch per unit effort ( $\pm 2$  SE) of sand shiner with otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Sand Shiner / Fish Community Season

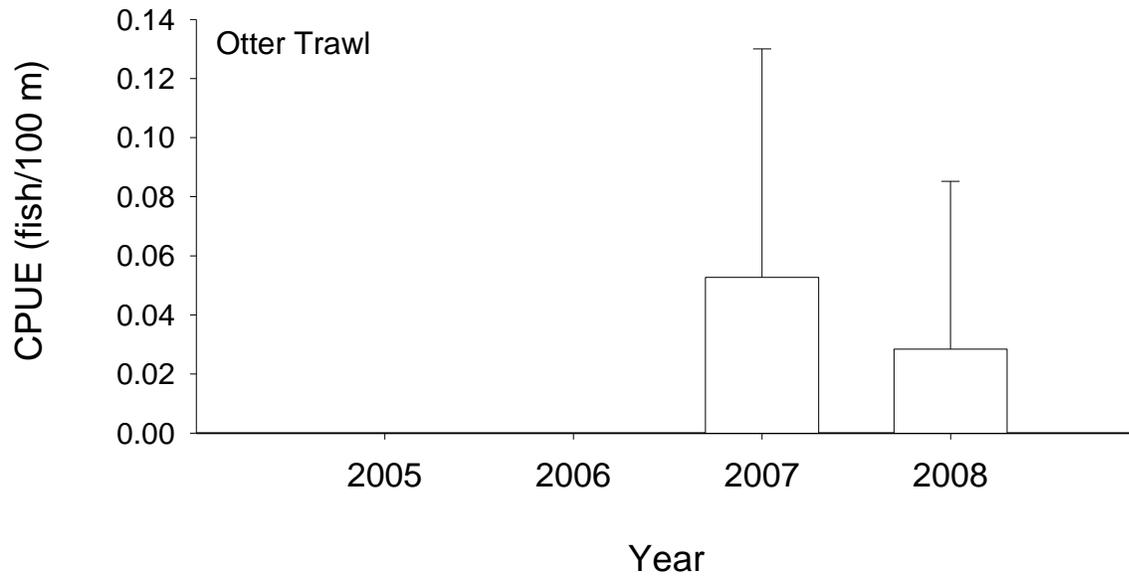


Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with otter trawls in segment 11, the Kansas River, during fish community season 2005-2008.

# Segment 11 - Sand Shiner / Fish Community Season

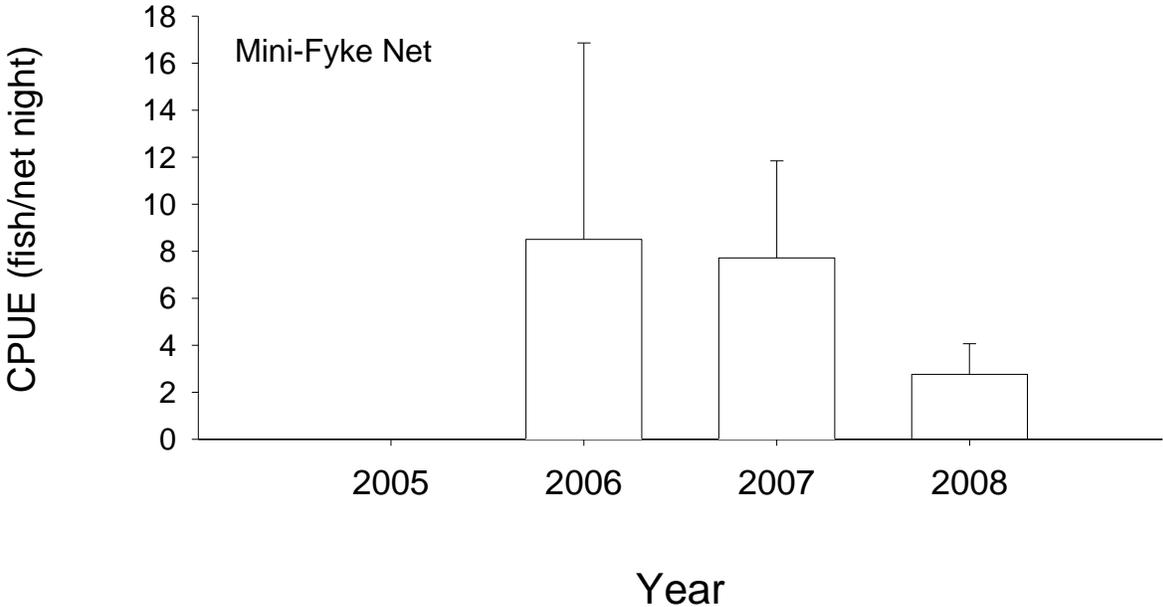


Figure 32. Mean annual catch per unit effort ( $\pm 2$  SE) of sand shiner with mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	1	0	100	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	127	0	27	0	0	0	53	17	0	3	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	127	(98)	(2)	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - Sand Shiner

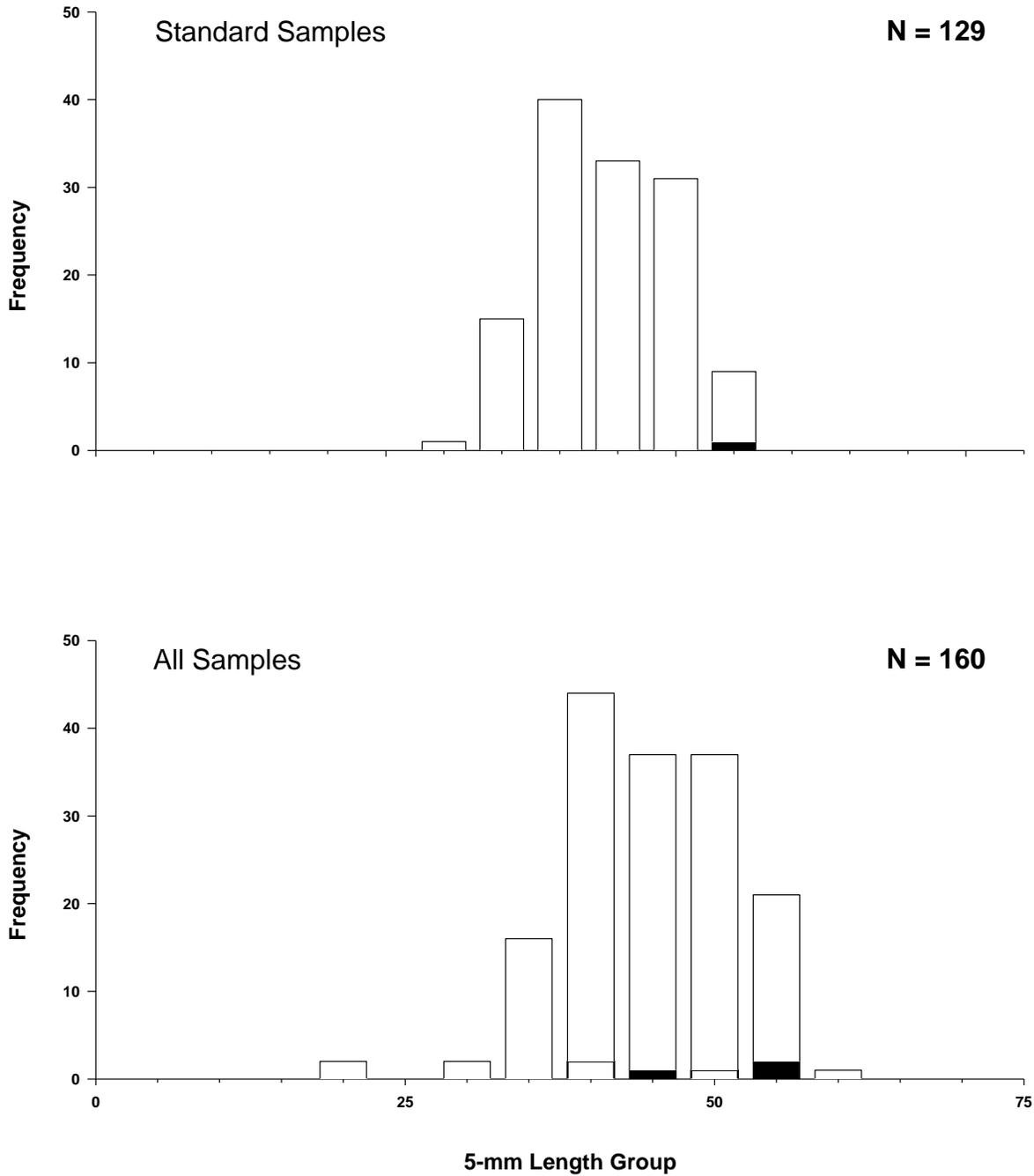


Figure 33. Length frequency of sand shiner during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

***Hybognathus* spp.**

There was a total of fifteen *Hybognathus* spp. captured in segment 11 during 2008, while only four were captured in 2007 and none in 2006. Species include the plains minnow (N = 15) captured in mini-fyke nets, with a CPUE of 0.326 fish/net night which is an increase from 2007 (0.1667 fish/net night) (Figure 36). Lengths ranged from 25 – 49 mm, similar to 2007 (35 – 54 mm) (Figure 37). Nine fish were captured in the channel cross-over, five were captured in the inside bend, and one was captured in a small side channel (Figure 34). All sand shiners were captured in shallow (< 1.2 m) water bar habitats (Figure 35).

## Segment 11 - *Hybognathus* spp. / Sturgeon Season

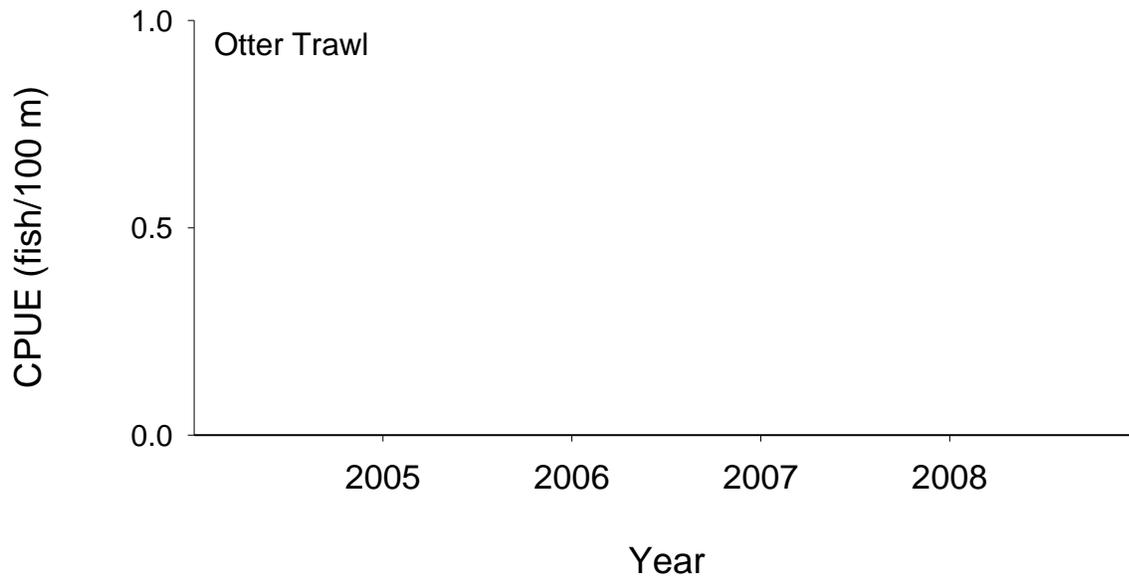


Figure 34. Mean annual catch per unit effort ( $\pm 2$  SE) of *Hybognathus* spp. with otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - *Hybognathus* spp. / Fish Community Season

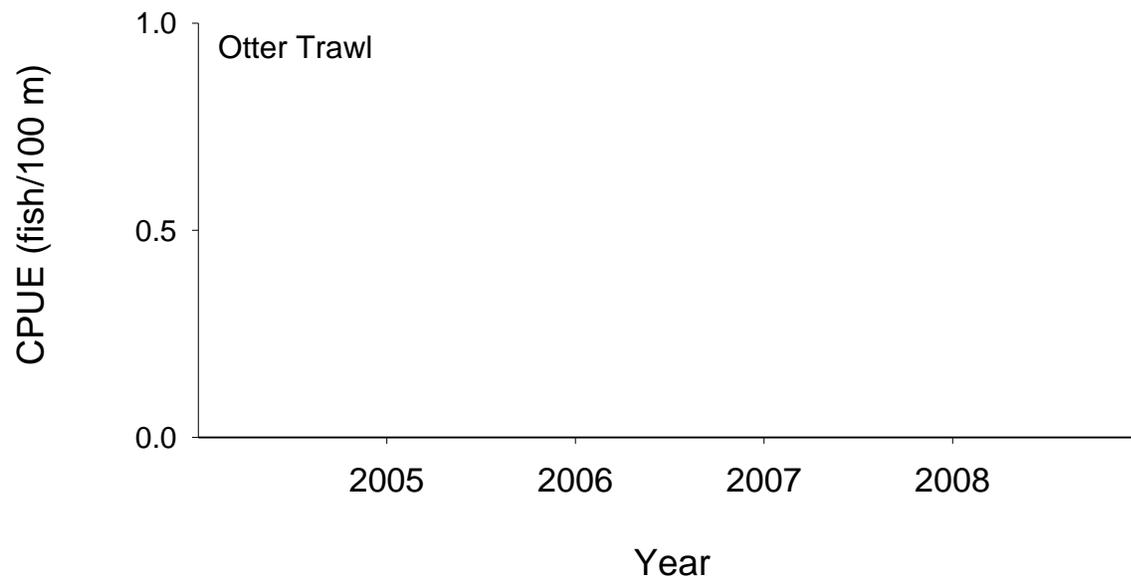


Figure 35. Mean annual catch per unit effort ( $\pm 2$  SE) of *Hybognathus* spp. with otter trawls in segment 11, the Kansas River, during fish community season 2005-2008.

## Segment 11 - *Hybognathus* spp. / Fish Community Season

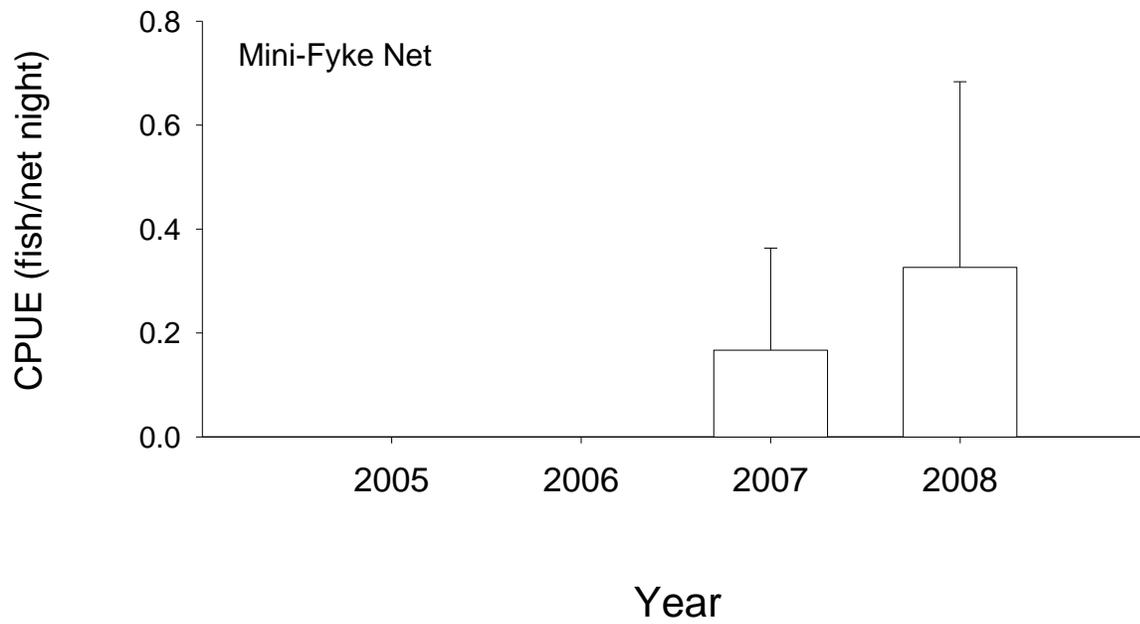


Figure 36. Mean annual catch per unit effort ( $\pm 2SE$ ) of *Hybognathus* spp. with mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammel Net	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke	15	0	60	0	0	0	0	33	0	7	0	0	0	0	0
Net	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	0	0	0	0	0	0	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	0	0	0	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	15	100	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - *Hybognathus* spp.

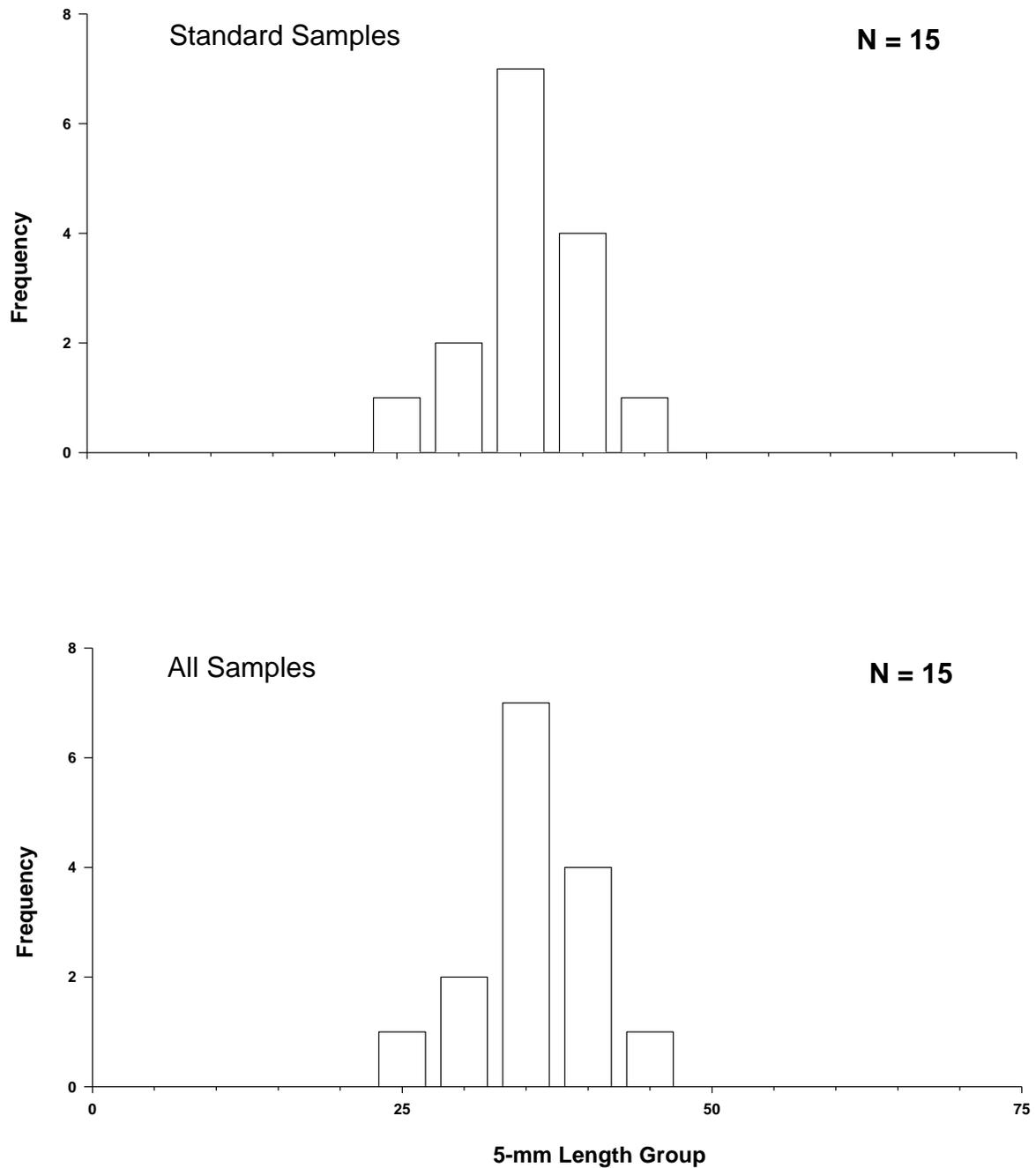


Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

## **Blue Sucker**

A total of 17 blue suckers were captured in segment 11 during 2008 sampling season, a decrease in catch from 2007 (N = 25) but an increase from 2006 (N = 6). Fish were most effectively captured in trammel nets at an average of 0.194 fish/100 m drifted (N = 11; Figures 39 and 41). Gill net captured six blue suckers at a rate of 0.075 fish/net night (Figure 38). More were captured in sturgeon season (N = 15) than in fish community season. Total lengths ranged 595 – 838 mm, a broader size range from 2007 (610 – 732 mm; Figure 44) and 2006 (581 – 697 mm). Blue suckers were captured in channel cross-overs, inside bends, and outside bends macrohabitats (Table 36). All blue sucker were captured in the channel border mesohabitat (Table 37).

## Segment 11 - Blue Sucker / Sturgeon Season

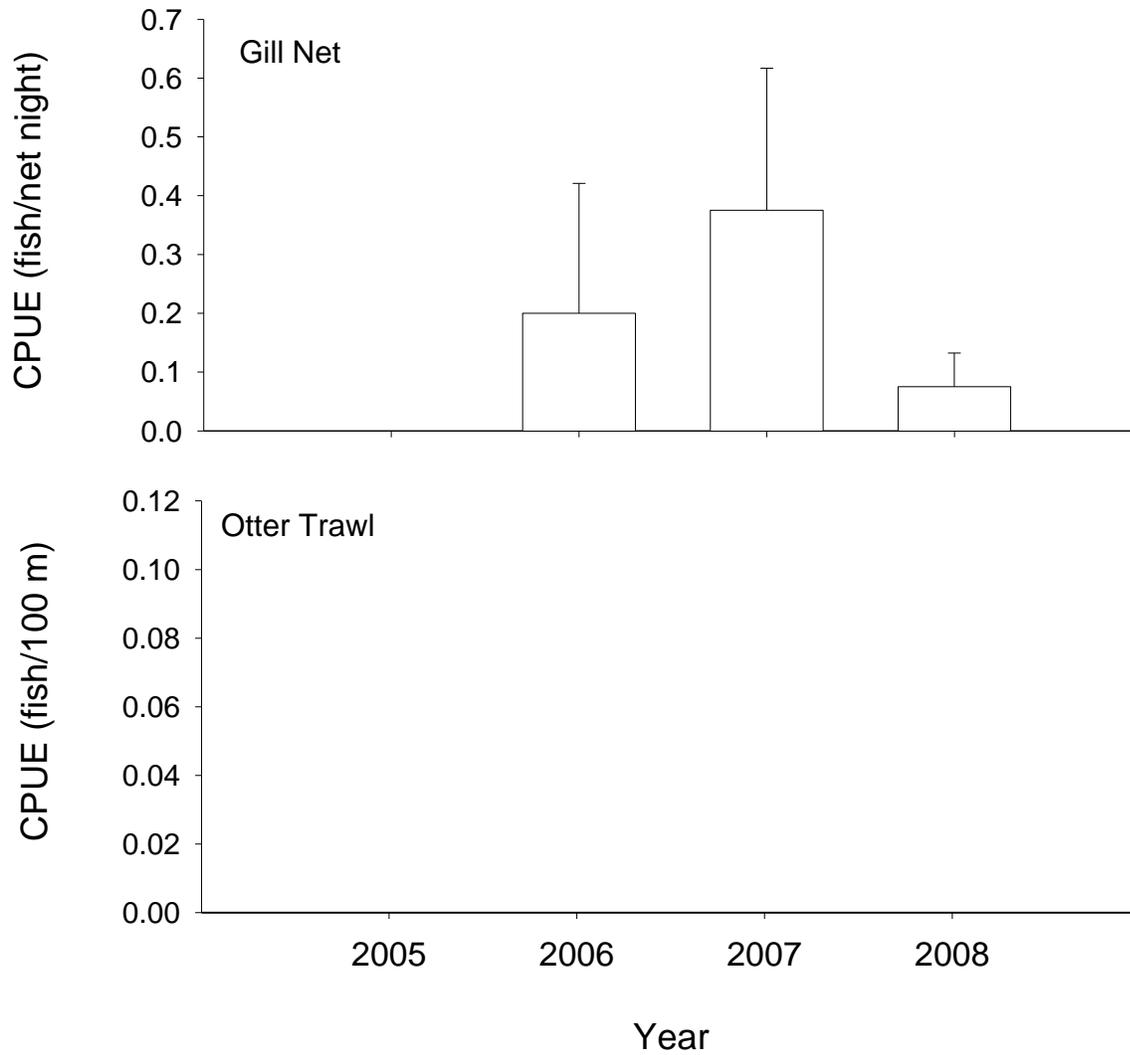


Figure 38. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker with gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Blue Sucker / Sturgeon Season

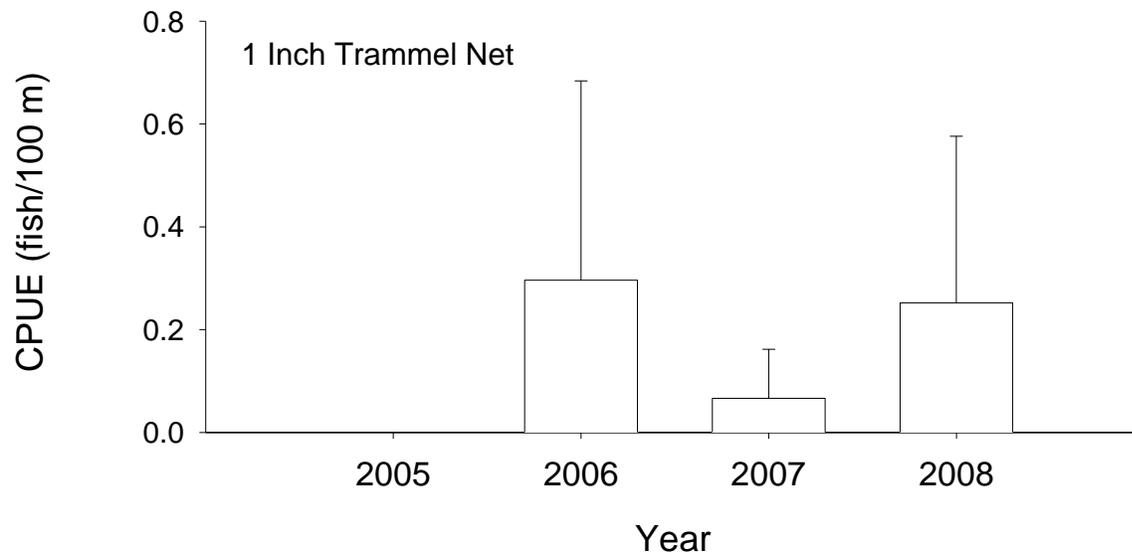


Figure 39. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker with 1 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Blue Sucker / Fish Community Season

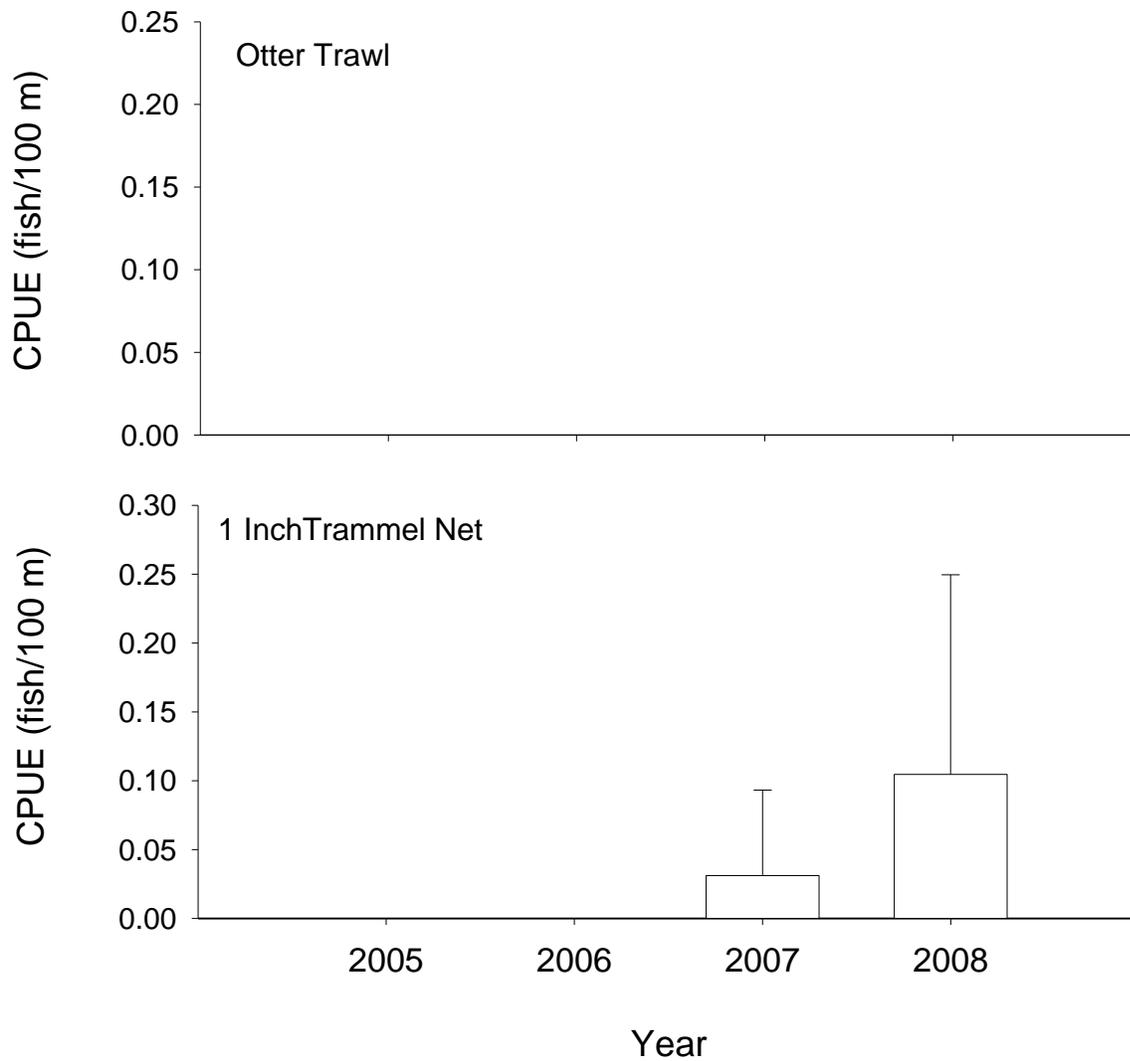


Figure 41. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005-2008.

## Segment 11 - Blue Sucker / Fish Community Season

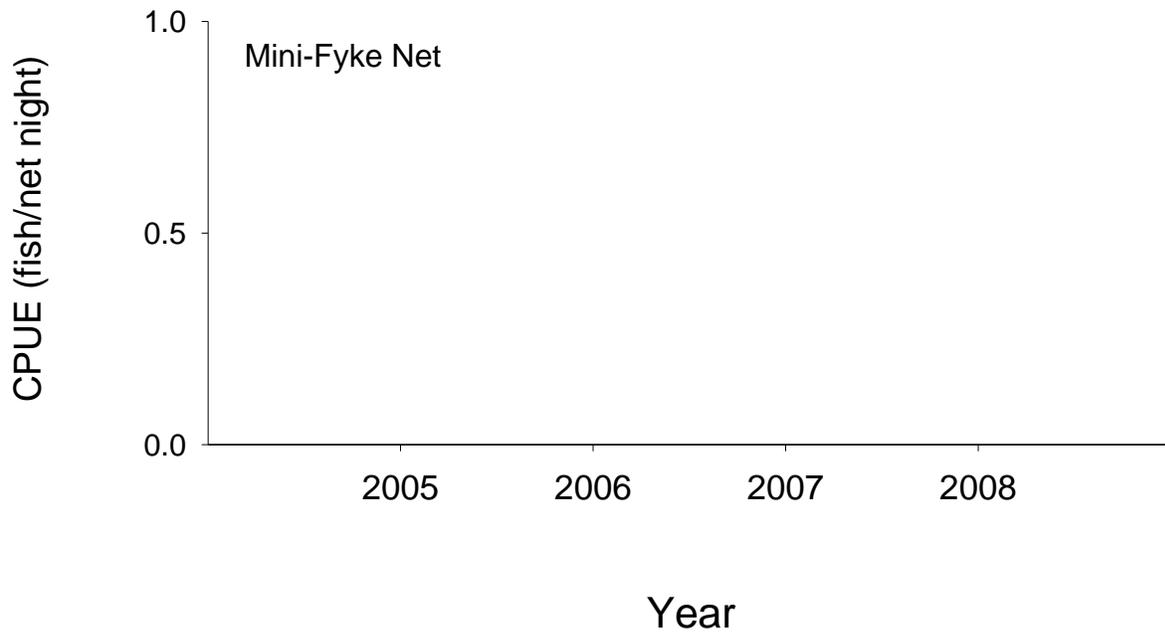


Figure 42. Mean annual catch per unit effort ( $\pm 2$  SE) of blue sucker using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat <sup>a</sup>													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	9	0	11	0	0	0	67	22	0	0	0	0	0	0	0
	.	0	(22)	0	0	0	(43)	(35)	0	0	0	0	0	0	0
Gill Net	6	0	17	0	0	0	17	67	0	0	0	0	0	0	0
	.	0	(20)	0	0	0	(43)	(38)	0	0	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(48)	(35)	0	0	0	0	0	0	0
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	2	0	0	0	0	0	50	50	0	0	0	0	0	0	0
	.	0	(25)	0	0	0	(53)	(22)	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(24)	0	0	0	(43)	(28)	0	(4)	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	(17)	0	0	0	(52)	(29)	(2)	0	0	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11 of the Kansas River during 2007-2008. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat <sup>a</sup>					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch	9	0	100	0	0	0	0
Trammel Net	.	0	(92)	0	(8)	0	0
Gill Net	6	0	50	0	0	50	0
	.	0	(88)	0	0	(13)	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(96)	0	(4)	0	0
<b>Fish Community Season (Summer)</b>							
1 Inch	2	0	100	0	0	0	0
Trammel Net	.	0	(93)	0	(7)	0	0
Mini-Fyke	0	0	0	0	0	0	0
Net	.	(98)	(2)	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	(100)	0	0	0	0

<sup>a</sup> Habitat abbreviations and definitions presented in Appendix B.

## Segment 11 - Blue Sucker

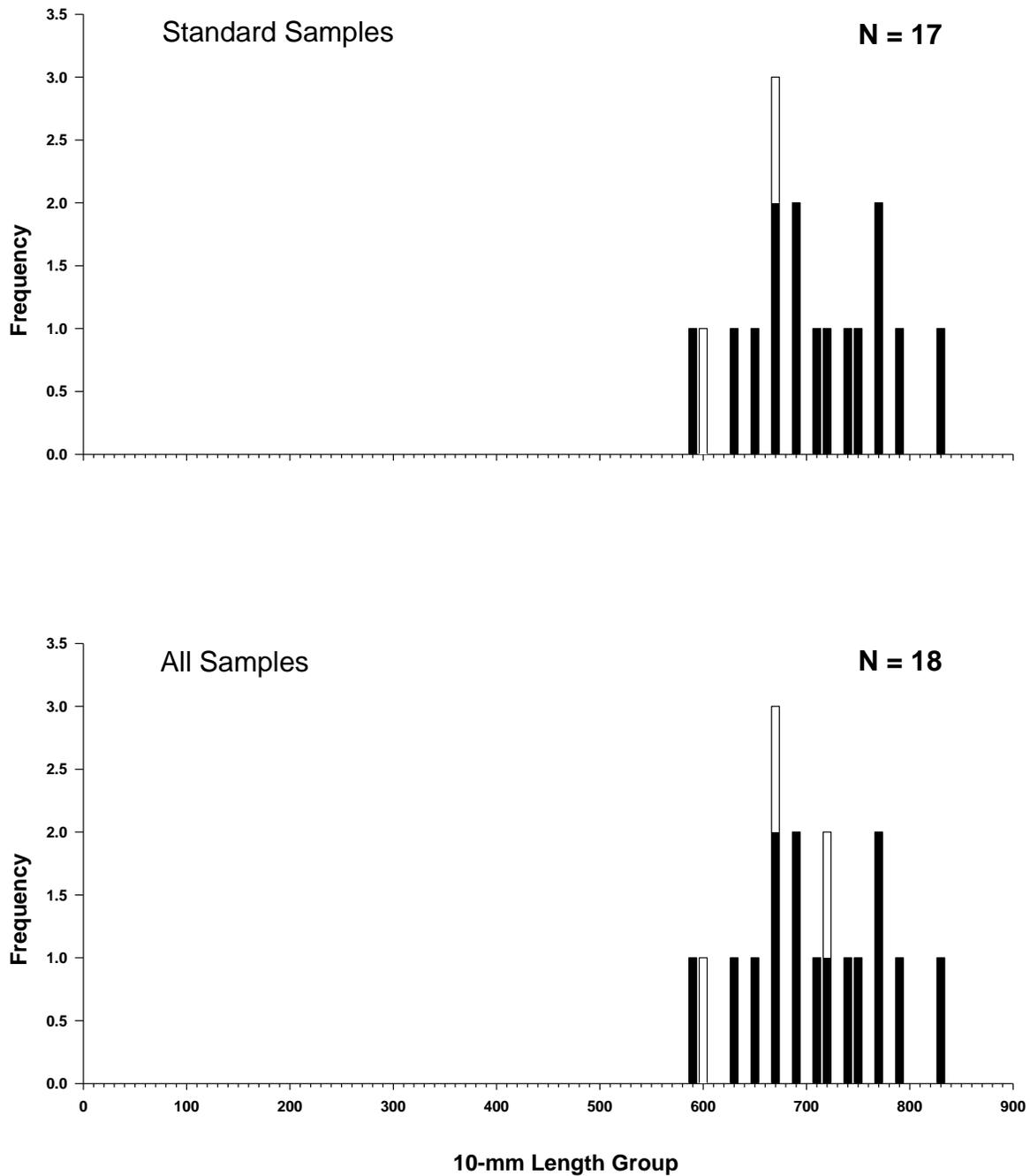


Figure 44. Length frequency of blue sucker during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 11, the Kansas River, during 2007-2008. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2007-2008.

## **Sauger**

No sauger were captured during the 2008 sampling year . Figure 51 and tables 38 and 39 are omitted due to no captures. In past sampling seasons, there have been only 6 sauger captured in segment 11. Three sauger were captured in segment 11 during the 2007 sampling season, which is equal to catch in 2006. In previous years, sauger were captured in gill nets and trammel nets (Figure 45, 46, and 48).

## Segment 11 - Sauger / Sturgeon Season

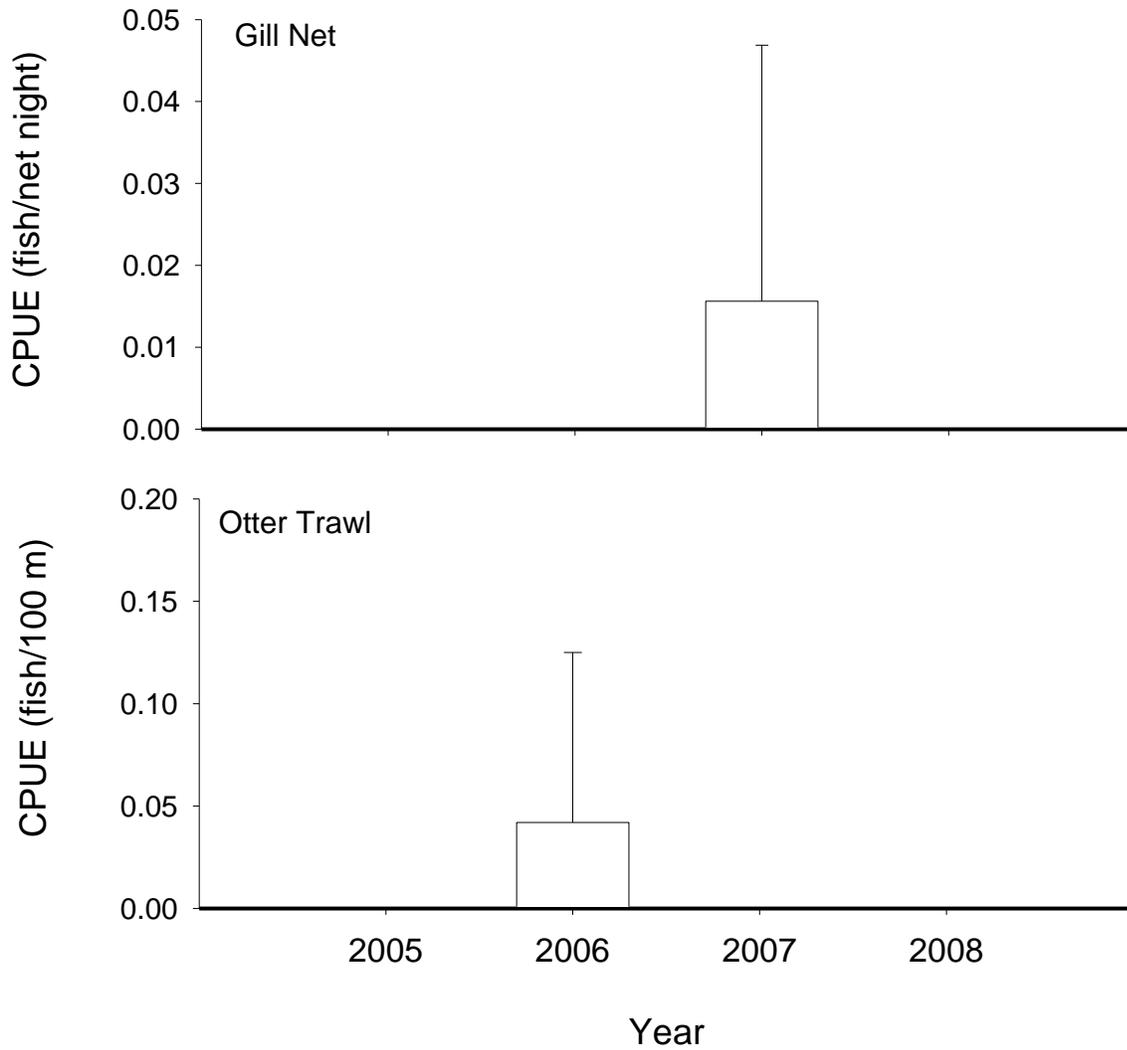


Figure 45. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Sauger / Sturgeon Season

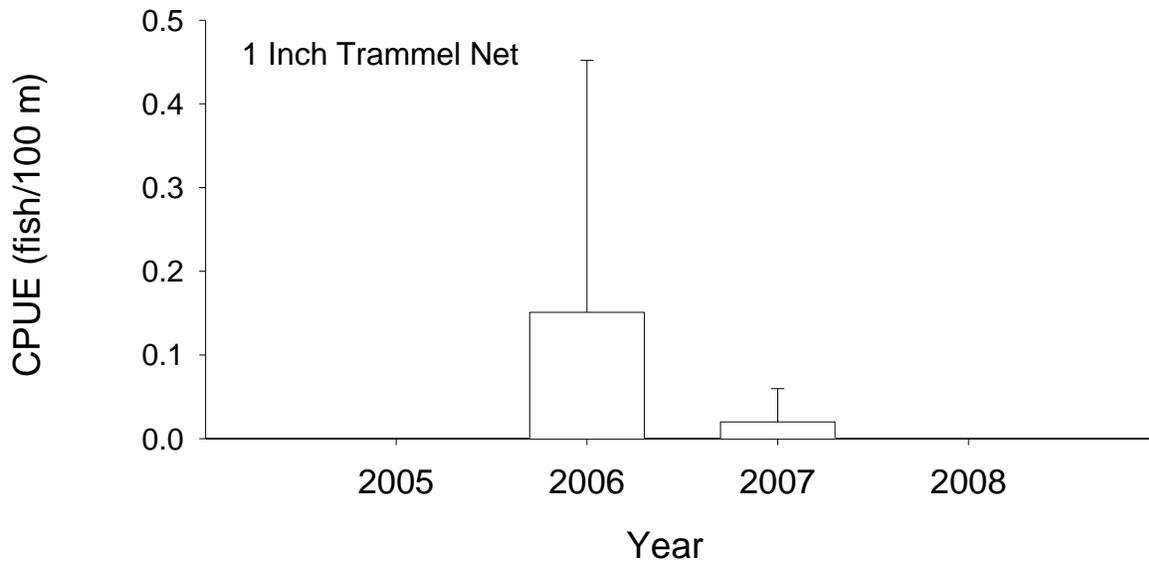


Figure 46. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005-2008.

## Segment 11 - Sauger / Fish Community Season

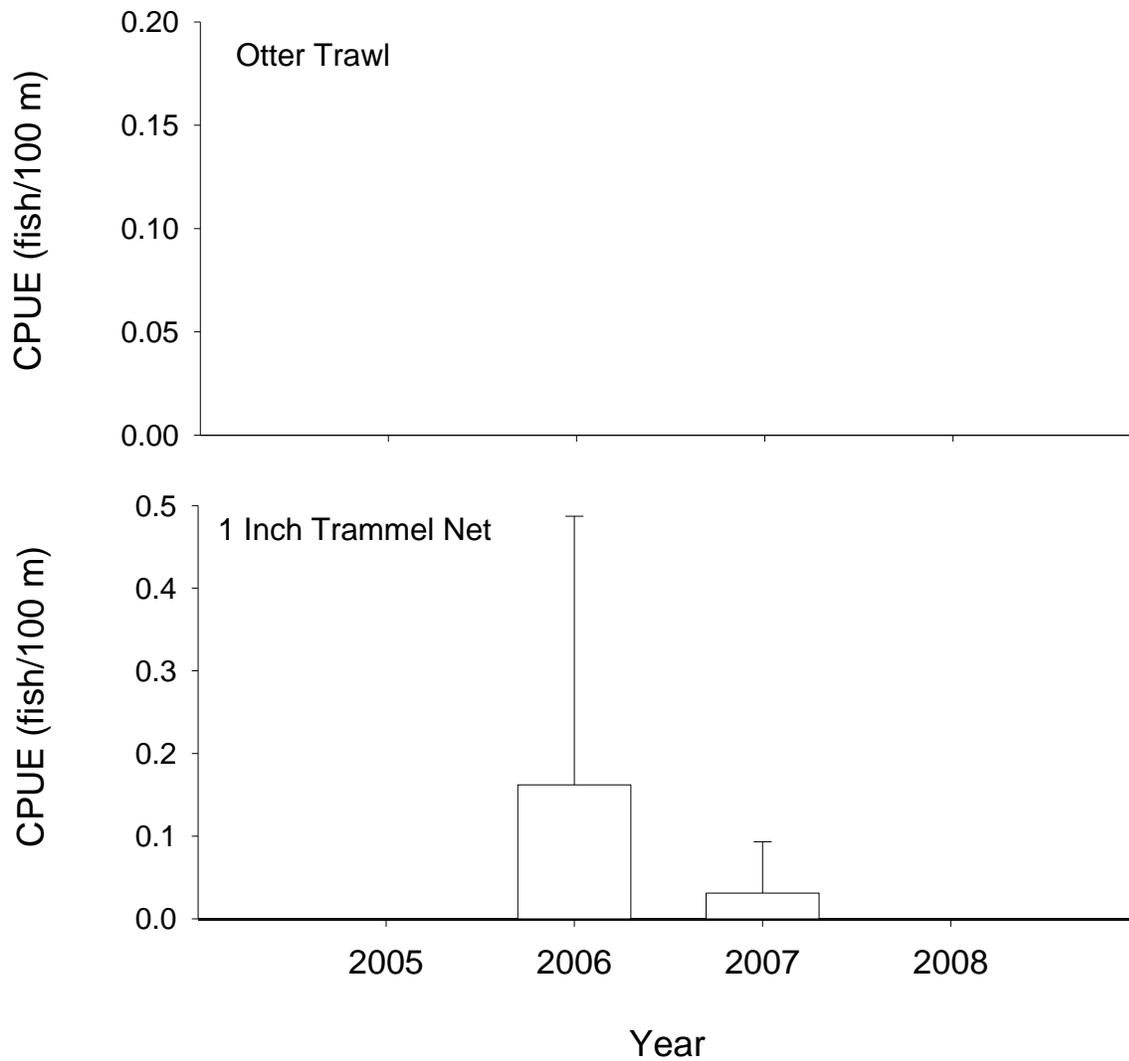


Figure 48. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005-2008.

## Segment 11 - Sauger / Fish Community Season

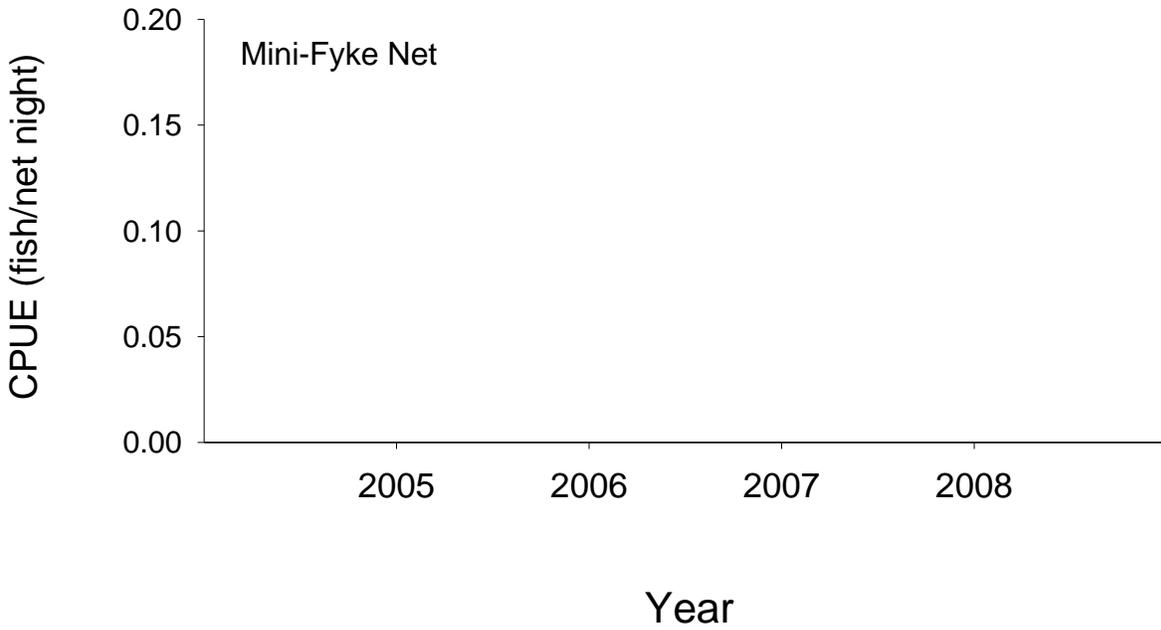


Figure 49. Mean annual catch per unit effort ( $\pm 2$  SE) of sauger using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2008.

## Kansas River Fish Community

**Objective 6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Kansas River system, where sample size is greater than fifty individuals.**

A total of 3,944 fish representing 46 species was captured with standard gears in Segment 11 during the 2008 season, similar to 2007 (N = 3254). Seven (nine in 2007) non-target species were represented by at least 50 individuals with non-target species comprising 86% of the total catch, which is an increase from 76% in 2007 and 82% in 2006. Catch from bars mesohabitats accounted for 79% (60% and 54% in 2007 and 2006, respectively) of the total catch. Channel border and pool mesohabitats produced 20% (33 in 2007, 44% in 2006) and less than 1 % (2% in 2007 and 2.5% in 2006), respectively in 2008. Less than one percent of fish was captured from island tip areas. Gears deployed in bars mesohabitats captured more species (35%) than those deployed in channel border mesohabitats (28%) but more were captured in 2007 (30 and 32% respectively) and 2006 (21 and 25 %, respectively) in channel borders.

Gill nets captured 13 species (20 and 13 in 2007 and 2006, respectively) in 80 net nights with two of those represented by more than 50 individuals (Appendix F1). Gill nets captured the largest specimens of gizzard shad (183 – 406 mm) and blue catfish (400 – 851 mm) with CPUE's = 0.113 and 0.05 fish/net night, respectively. Notable captures in gill nets are shorthead redhorse and walleye. One-inch trammel nets captured 10 species with two species represented by at least 50 fish. (Appendix F2). Larger individuals of channel catfish (515 – 615 mm) and gizzard shad (188 – 194 mm) (CPUE = 0.041 and 0.043 fish/100 m, respectively) were captured with one-inch trammel nets. Otter trawls captured 18 species (20 and 15 species in 2007 and 2006) including four non-target species with more than 50 individuals (Appendix F4). Blue and channel catfish (CPUE = 3.50 and 2.72 fish/100 m, respectively) were most effectively captured with otter trawls. Notable captures in otter trawl were slough darter and stone cat.. Mini-fyke nets captured 35 (30 and 21 species in 2007 and 2006) in 47 net nights, including seven species represented by at least 50 individuals (Appendix F6). Mini-fyke nets were the most effective gear to sample the following non-target Kansas River species (CPUE = number of fish/net night): gizzard shad = 28.78, red shiner = 12.21, freshwater drum = 4.33, channel catfish = 2.76, bullhead minnow = 1.11, bluntnose minnow = 1.80, and silver chub = 1.02. Catch more than doubled in 2006 than in 2007.

## Discussion

No pallid sturgeon were captured in segment 11 during the 2008 sample year. The majority of shovelnose sturgeon sampled in the Kansas River in 2006, 2007, and 2008 (94, 96, and 68%, respectively) are preferred size class and above ( $\geq 510$  mm). This remains a higher proportion of this larger size classes of shovelnose sturgeon found in the Missouri River in the segments 9 and 10 at the mouth of the Kansas River. An increase (100 – 750) in the size range of shovelnose sturgeon was detected in sample year 2008 to further include the lower length category of sub-stock sized fish. The two previous years of sampling of sub-stock size fish include 275 - 726 mm in 2006 and 201 – 764 mm in 2007. The past two years there have been significant spring and summer high water events in the Midwest. These increased flows may potentially increase successful recruitment of *Scaphirhynchus* spp. in the Missouri and Kansas Rivers. Niswonger et al 2008 noted that increased flows in 2007 on the mainstem Missouri may positively influence recruitment of riverine species, especially *Scaphirhynchus* spp.

The majority of sampling in segment 11 occurs below the Johnson County Weir. This section of the Kansas River (RM 0 – 14.7) flows through a highly industrialized portion of the Kansas City metropolitan area. Water quality studies on the Kansas River have shown poor conditions, specifically related to high concentrations of nitrogen and phosphorus (Rasmussen et al. 2005). A number of benthic fishes have low numbers or are not present (based on PSPAP standard sampling in past years in other segments) within the the lower Kansas River, especially *Macrhybopsis* spp. Very few have been captured in the Kansas River since sampling began in 2006. (2006, N = 7; 2007, N = 8; 2008, N = 13). This may be attributed to the poor water quality associated with urban environments (Herman et al. 2008). Speckled chub have been captured below and above the weir. Sickie fin chubs have only been captured within 1 to 2 RM upstream the confluence of the Kansas River. No sturgeon chubs have been captured in three years of sampling in segment 11. Blue sucker catch rates were low in 2008 (N = 17) as in 2006 (N = 6) when compared to sample year 2007 (N = 25) in segment 11. A study conducted on the Kansas River from 2005 to 2006 found no blue suckers below the weir and an abundance in the upper portions of the river (Eitzman et al. 2007). Only three blue suckers have been captured above the weir, which is likely attributed to the few gear deployments in only three years of sampling in that portion of the Kansas River. Only large fish were sampled in the three years of our study (581 – 838 mm). The lack of small (i.e., juvenile) blue sucker has been noted in the mainstem Missouri River as well by LaBay et al. (2008), and may be the result of gear bias. Additionally, sand shiners catch has decreased as well

in segment 11 the past three sample years. Captures have steadily declined each season for each gear type

## Trotline

The Pallid Sturgeon Population Assessment Program (PSPAP) began implementing the trotline as a trial gear at all field stations during the 2008 season. Since the onset, efforts have been made to standardize protocols and equipment to establish uniformity in hopes to implement the trotline as a standard/evaluation gear for the PSPAP. In order to properly evaluate trotline capture of pallid sturgeon, we felt an evaluation of hook type/size was needed. A literature review and personal communication resulted in no published or unpublished studies for a trotline hook evaluation for pallid sturgeon.

The information collected from this study will provide an understanding of the size range of pallid sturgeon captured. These data will be helpful for broodstock collection (pallid sturgeon > 750mm), with our goal to find the most effective hook type while keeping by-catch to a minimum.

At the beginning of 2008 the trotline was implemented as a wild/evaluation gear. Data collection for this study ended at the conclusion of the 2008 season. Only data from randomly selected trotline deployments and bends were utilized for this study. Trotline specifications were based on protocol from the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection: Volume 1.3 (Drobish 2008). CPUE (Fish/hook night) was calculated by the number of fish divided by the number of hooks retrieved.

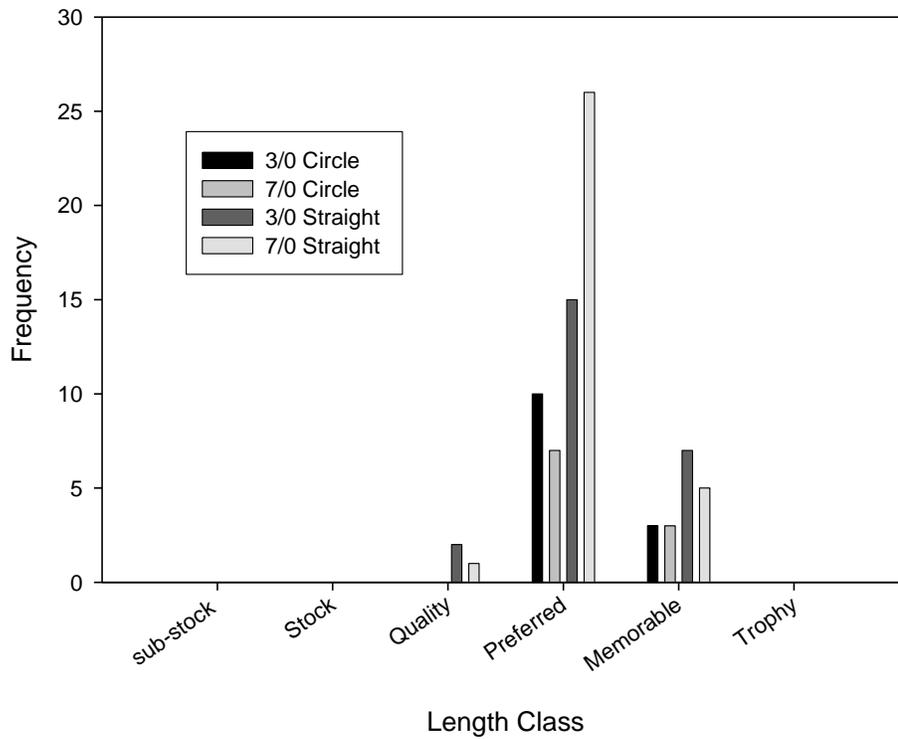
For this analysis the following hook types/sizes were used based on similarity in size, style, and prior use for capturing pallid sturgeon: 3/0 Eagle Claw Circle Sea, 7/0 Gamakatsu Octopus Circle, 3/0 Eagle Claw O'Shaughnessy, and 7/0 Eagle Claw O'Shaughnessy. All hooks were baited with earthworms.

During this study zero pallid sturgeon, 52 shovelnose sturgeon, and 24 non-sturgeon species were captured with 798 hook nights within Segment 11. The highest catch rates for shovelnose sturgeon were achieved with the straight 7/0 hooks. Circle 7/0 hooks captured the largest shovelnose sturgeon on average and straight 7/0 had the lowest by-catch CPUE (Table 40). There were more preferred sized shovelnose sturgeon captured than any other length category with trotlines in segment 11 (Figure 50).

**Table 40.** Summary of trotline information on pallid sturgeon (PDSG), shovelnose sturgeon (SNSG), and by-catch for each hook type/size in segment 11, the Kansas River during 2007-2008. (Catch per unit of effort, CPUE = fish/hook night).

<b>Hook Type/Size</b>	<b># Hooks</b>	<b># PDSG</b>	<b># SNSG</b>	<b># By-catch</b>	<b>SNSG CPUE</b>	<b><i>By-catch</i> CPUE</b>	<b><i>SNSG Avg FL</i></b>
<b>Circle 3/0</b>	<b>150</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>0.013</b>	<b>0.027</b>	<b>598</b>
<b>Circle 7/0</b>	<b>150</b>	<b>0</b>	<b>2</b>	<b>10</b>	<b>0.013</b>	<b>0.067</b>	<b>609</b>
<b>Straight 3/0</b>	<b>224</b>	<b>0</b>	<b>17</b>	<b>6</b>	<b>0.08</b>	<b>0.027</b>	<b>601</b>
<b>Straight 7/0</b>	<b>274</b>	<b>0</b>	<b>31</b>	<b>4</b>	<b>0.113</b>	<b>0.015</b>	<b>595</b>
<b>Total</b>	<b>798</b>	<b>0</b>	<b>52</b>	<b>24</b>	<b>0.07</b>	<b>0.03</b>	<b>600</b>

## Segment 11 - Shovelnose Sturgeon Size Classes Captured with Trotlines



**Figure 52. Frequency of shovelnose sturgeon captured on trotlines for each hook type/size in segment 11, the Kansas River, by length categories in 2007-2008. Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock FL < 250 mm (20 %), Stock FL = 250-379 mm (20 - 36 %), Quality FL = 380 - 509 mm (36 - 45 %), Preferred FL = 510 - 639 mm (45 - 59 %), Memorable FL = 640 - 809 mm (59 - 74 %), Trophy FL > 810 mm (>74 %).**

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## **APPENDICES**

Appendix A. Phylogenetic list of Missouri and Kansas River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5<sup>th</sup> edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
<b>Petromyzontidae – lampreys</b>		
<i>Ichthyomyzon castaneus</i>	Chestnut lamprey	CNLP
<i>Ichthyomyzon fossor</i>	Northern brook lamprey	NBLP
<i>Ichthyomyzon unicuspis</i>	Silver lamprey	SVLP
<i>Ichthyomyzon gagei</i>	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
CLASS OSTEICHTHYES – BONY FISHES		
ORDER ACIPENSERIFORMES		
<b>Acipenseridae – sturgeons</b>		
<i>Acipenser fulvescens</i>	Lake sturgeon	LKSG
<i>Scaphirhynchus</i> spp.	Unidentified Scaphirhynchus	USG
<b><i>Scaphirhynchus albus</i></b>	<b>Pallid sturgeon</b>	<b>PDSG*</b>
<b><i>Scaphirhynchus platyrhynchus</i></b>	<b>Shovelnose sturgeon</b>	<b>SNSG*</b>
<i>S. albus</i> X <i>S. platyrhynchus</i>	Pallid-shovelnose hybrid	SNPD
<b>Polyodontidae – paddlefishes</b>		
<i>Polyodon spathula</i>	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
<b>Lepisosteidae – gars</b>		
<i>Lepisosteus oculatus</i>	Spotted gar	STGR
<i>Lepisosteus osseus</i>	Longnose gar	LNGR
<i>Lepisosteus platostomus</i>	Shortnose gar	SNGR
ORDER AMMIFORMES		
<b>Amiidae – bowfins</b>		
<i>Amia calva</i>	Bowfin	BWFN
ORDER OSTEOGLOSSIFORMES		
<b>Hiodontidae – mooneyes</b>		
<i>Hiodon alosoides</i>	Goldeye	GDEY
<i>Hiodon tergisus</i>	Mooneye	MNEY
ORDER ANGUILLIFORMES		
<b>Anguillidae – freshwater eels</b>		
<i>Anguilla rostrata</i>	American eel	AMEL

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>ORDER CLUPEIFORMES</b>		
<b>Clupeidae – herrings</b>		
<i>Alosa alabame</i>	Alabama shad	ALSD
<i>Alosa chrysochloris</i>	Skipjack herring	SJHR
<i>Alosa pseudoharengus</i>	Alewife	ALWF
<i>Dorosoma cepedianum</i>	Gizzard shad	GZSD
<i>Dorosoma petenense</i>	Threadfin shad	TFSD
<i>D. cepedianum</i> X <i>D. petenense</i>	Gizzard-threadfin shad hybrid	GSTS
<b>ORDER CYPRINIFORMES</b>		
<b>Cyprinidae – carps and minnows</b>		
<i>Campostoma anomalum</i>	Central stoneroller	CLSR
<i>Campostoma oligolepis</i>	Largescale stoneroller	LSSR
<i>Carassus auratus</i>	Goldfish	GDFH
<i>Carassus auratus</i> X <i>Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<b><i>Hybognathus argyritis</i></b>	<b>Western slivery minnow</b>	<b>WSMN*</b>
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<b><i>Hybognathus placitus</i></b>	<b>Plains minnow</b>	<b>PNMW*</b>
<b><i>Hybognathus</i> spp.</b>	<b>Unidentified Hybognathus</b>	<b>HBNS*</b>
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<b><i>Macrhybopsis aestivalis</i></b>	<b>Speckled chub</b>	<b>SKCB*</b>
<b><i>Macrhybopsis gelida</i></b>	<b>Sturgeon chub</b>	<b>SGCB*</b>
<b><i>Macrhybopsis meeki</i></b>	<b>Sicklefin chub</b>	<b>SFCB*</b>
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. aestivalis</i> X <i>M. gelida</i>	Speckled-Sturgeon chub hybrid	SPST
<i>M. gelida</i> X <i>M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennioides</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis burchanani</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greeniei</i>	Wedgespot shiner	WSSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Cyprinidae – carps and minnows</b>		
<i>Notropis heterolepsis</i>	Blacknose shiner	BNSN
<i>Notropis hudsonius</i>	Spottail shiner	STSN
<i>Notropis nubilus</i>	Ozark minnow	OZMW
<i>Notropis rubellus</i>	Rosyface shiner	RYSN
<i>Notropis shumardi</i>	Silverband shiner	SBSN
<i>Notropis stilbius</i>	Silverstripe shiner	SSPS
<b><i>Notropis stramineus</i></b>	<b>Sand shiner</b>	<b>SNSN*</b>
<i>Notropis topeka</i>	Topeka shiner	TPSN
<i>Notropis volucellus</i>	Mimic shiner	MMSN
<i>Notropis wickliffi</i>	Channel shiner	CNSN
<i>Notropis</i> spp.	Unidentified shiner	UNO
<i>Opsopoeodus emiliae</i>	Pugnose minnow	PNMW
<i>Phenacobius mirabilis</i>	Suckermouth minnow	SMMW
<i>Phoxinus eos</i>	Northern redbelly dace	NRBD
<i>Phoxinus erythrogaster</i>	Southern redbelly dace	SRBD
<i>Phoxinus neogaeus</i>	Finescale dace	FSDC
<i>Pimephales notatus</i>	Bluntnose minnow	BNMW
<i>Pimephales promelas</i>	Fathead minnow	FHMW
<i>Pimephales vigilas</i>	Bullhead minnow	BHMW
<i>Platygobio gracilis</i>	Flathead chub	FHCB
<i>P. gracilis</i> X <i>M. meeki</i>	Flathead-sicklefin chub hybrid	FCSC
<i>Rhinichthys atratulus</i>	Blacknose dace	BNDC
<i>Rhinichthys cataractae</i>	Longnose dace	LNDC
<i>Richardsonius balteatus</i>	Redside shiner	RDSS
<i>Scardinius erythrophthalmus</i>	Rudd	RUDD
<i>Semotilus atromaculatus</i>	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
<b>Catostomidae - suckers</b>		
<i>Carpionodes carpio</i>	River carpsucker	RVCS
<i>Carpionodes cyprinus</i>	Quillback	QLBK
<i>Carpionodes velifer</i>	Highfin carpsucker	HFCS
<i>Carpionodes</i> spp.	Unidentified <i>Carpionodes</i>	UCS
<i>Catostomus catostomus</i>	Longnose sucker	LNSK
<i>Catostomus commersoni</i>	White sucker	WTSK
<i>Catostomus platyrhincus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<b><i>Cycleptus elongates</i></b>	<b>Blue sucker</b>	<b>BUSK*</b>
<i>Hypentelium nigricans</i>	Northern hog sucker	NHSK
<i>Ictiobus bubalus</i>	Smallmouth buffalo	SMBF
<i>Ictiobus cyprinellus</i>	Bigmouth buffalo	BMBF
<i>Ictiobus niger</i>	Black buffalo	BKBF
<i>Ictiobus</i> spp.	Unidentified buffalo	UBF
<i>Minytrema melanops</i>	Spotted sucker	SPSK
<i>Moxostoma anisurum</i>	Silver redhorse	SVRH
<i>Moxostoma carinatum</i>	River redhorse	RVRH
<i>Moxostoma duquesnei</i>	Black redhorse	BKRH
<i>Moxostoma erythrurum</i>	Golden redhorse	GDRH
<i>Moxostoma macrolepidotum</i>	Shorthead redhorse	SHRH
<i>Moxostoma</i> spp.	Unidentified redhorse	URH

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
<b>ORDER SILURIFORMES</b>		
<b>Ictaluridae – bullhead catfishes</b>		
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurusnebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnes</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
<b>ORDER SALMONIFORMES</b>		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarki</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonniville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL

Appendix A. (continued).

Scientific name	Common name	Letter Code
	<b>ORDER PERCOPSIFORMES</b>	
	<b>Percopsidae – trout-perches</b>	
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
	<b>ORDER GADIFORMES</b>	
	<b>Gadidae - cods</b>	
<i>Lota lota</i>	Burbot	BRBT
	<b>ORDER ATHERINIFORMES</b>	
	<b>Cyprinodontidae - killifishes</b>	
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus daphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	<b>Poeciliidae - livebearers</b>	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	<b>Atherinidae - silversides</b>	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	<b>ORDER GASTEROSTEIFORMES</b>	
	<b>Gasterosteidae - sticklebacks</b>	
<i>Culea inconstans</i>	Brook stickleback	BKSB
	<b>ORDER SCORPAENIFORMES</b>	
	<b>Cottidae - sculpins</b>	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	<b>ORDER PERCIFORMES</b>	
	<b>Percichthyidae – temperate basses</b>	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	<b>Centrarchidae - sunfishes</b>	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis magalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Centrarchidae - sunfishes</b>		
<i>L. cyanellus</i> X <i>L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus</i> X <i>L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis</i> X <i>P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
<b>Percidae - perches</b>		
<i>Ammocrypta asprella</i>	Crystal darter	CLDR
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orangethroated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caproides</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculate</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER*</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
<b>Sciaenidae - drums</b>		
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
<b>NON-TAXONOMIC CATEGORIES</b>		
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCN
Tributary	Macro	Any river or stream flowing into the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m <sup>3</sup> /s, and the sample area extends 300 m into the tributary	TRML

Tributary small mouth

Macro

Mouth of entering tributary whose mean annual discharge is  $< 20 \text{ m}^3/\text{s}$ , mouth width is  $> 6 \text{ m}$  wide and the sample area extends 300 m into the tributary

TRMS

Appendix B. (continued).

Habitat	Scale	Definition	Code
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Dam Tailwaters	Meso	Immediate downstream of a dam	DTWT
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch per unit effort units for collection of Kansas River fishes in segment 11 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for segment 11.

Gear	Code	Type	Season	Years	CPUE units
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	fish/net night
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night
Push Trawl – 8 ft 4mm x 4mm	POT02	Wild	Fish Comm.	2006 - Present	fish/ m trawled
Trammel net – 1 inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Trot Line – Circle hooks*	TLC_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – Octopus hooks*	TLO_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – O’Shaughnessy hooks*	TLS_	Wild	Sturgeon	2007 - Present	fish/hook night
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2006 - Present	fish/100 m trawled

\*Code ends with line length in feet (1 = 105 ft, 2 = 205 ft, 3 = 305 ft, 4 = 405 ft). Hooks are placed between 5 and 10 feet apart.

Appendix D. Stocking locations and codes by Recovery Priority Management Area (RPMA) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Above Intake	AIN	Yellowstone	70 +
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KS/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 11 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking <sup>a</sup>	Primary Mark	Secondary Mark
2006	Parkville	174	2005	6/21/2006	Yearling	PIT Tag	Elasomer
2006	Parkville	402	2005	7/1/2006	Yearling	PIT Tag	Elasomer

<sup>a</sup>Age of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc...

\*\*There have been no pallid sturgeon stocked into segment 11; the closest stocking site Parkville, MO, located 10 river miles upstream from the confluence of the Kansas River.

## **Appendix F**

Total catch, overall mean catch per unit effort [ $\pm 2$  SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 11, of the Kansas River during 2007-2008. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when  $N < 2$ .

Appendix F1. Gill Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BESN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BHCP	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BHMW	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BKBH	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BKCP	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BKSS	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BLCF	4	0.05	0	0			0	0	0.154	0				
		[0.06]	[0]				[0]	[0]	[.175]	[0]				
BLGL	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BMBF	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
BNMW	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
<b>BUSK*</b>	<b>6</b>	<b>0.075</b>	<b>0</b>	<b>0.5</b>			<b>0.033</b>	<b>0</b>	<b>0.077</b>	<b>0.5</b>				
		<b>[0.057]</b>	<b>[0]</b>				<b>[0.067]</b>	<b>[0]</b>	<b>[0.104]</b>	<b>[0]</b>				
CARP	1	0.013	0.071	0			0	0	0	0				
		[0.025]	[0.143]				[0]	[0]	[0]	[0]				
CLSR	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
CNCF	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
CNLP	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
CNSN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
ERSN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
FHCF	1	0.013	0	0			0	0	0.038	0				
		[0.025]	[0]				[0]	[0]	[0.077]	[0]				
FHMW	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
FWDM	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
GDEY	14	0.175 [0.17]	0 [0]	0			0.267 [0.363]	0.25 [0.5]	0.038 [0.077]	1 [2]				
GDRH	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
GNSF	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
GSCP	3	0.038 [0.055]	0 [0]	0			0.067 [0.133]	0 [0]	0.038 [0.077]	0 [0]				
GZSD	9	0.113 [0.11]	0.143 [0.184]	0.5			0.167 [0.27]	0 [0]	0.038 [0.077]	0 [0]				
<b>HBNS*</b>	<b>0</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b>			<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>				
HFCS	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
LGPH	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
LKSG	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
LMBS	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
LNGR	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
MMSN	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
MNEY	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
MQTF	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
NFSH	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
OSSF	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				
PDFH	0	0 [0]	0 [0]	0			0 [0]	0 [0]	0 [0]	0 [0]				

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
<b>PDSG*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]				[0]	[0]	[0]	[0]				
<b>PNMW*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]				[0]	[0]	[0]	[0]				
QLBK	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
RDSN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
RVCS	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
RVSN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
SBSN	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
SBWB	1	0.013	0	0.5			0	0	0	0				
		[0.025]	[0]				[0]	[0]	[0]	[0]				
<b>SFCB*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]				[0]	[0]	[0]	[0]				
SGWE	1	0.013	0	0			0.033	0	0	0				
		[0.025]	[0]				[0.067]	[0]	[0]	[0]				
SHRH	1	0.013	0	0			0.033	0	0	0				
		[0.025]	[0]				[0.067]	[0]	[0]	[0]				
<b>SKCB*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]				[0]	[0]	[0]	[0]				
SLDR	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
SMBF	18	0.225	0.357	5			0.067	0	0.385	0				
		[0.168]	[0.421]				[0.133]	[0]	[0.426]	[0]				
SMMW	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
SNGR	0	0	0	0			0	0	0	0				
		[0]	[0]				[0]	[0]	[0]	[0]				
<b>SNSG*</b>	<b>252</b>	<b>3.15</b>	<b>1</b>	<b>0.5</b>			<b>1.5</b>	<b>6</b>	<b>1.423</b>	<b>32.75</b>				
		[3.116]	[0.845]				[1.37]	[1]	[1.436]	[58.5]				
<b>SNSN*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]				[0]	[0]	[0]	[0]				

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRM L
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLW G
STCT	0	0 [0]	0	0			0	0	0	0				
SVCB	0	0 [0]	0	0			0	0	0	0				
SVCP	0	0 [0]	0	0			0	0	0	0				
UCT	0	0 [0]	0	0			0	0	0	0				
UCY	0	0 [0]	0	0			0	0	0	0				
UIC	0	0 [0]	0	0			0	0	0	0				
ULP	0	0 [0]	0	0			0	0	0	0				
UTB	0	0 [0]	0	0			0	0	0	0				
WLYE	1	0.013 [.025]	0	0			0	0	0	0.25				[0.5]
WTBS	0	0 [0]	0	0			0	0	0	0				
WTCP	0	0 [0]	0	0			0	0	0	0				
YLBH	0	0 [0]	0	0			0	0	0	0				

Appendix F2. Trammel Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BESN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BHCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BHMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKBH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKSS	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BLCF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BLGL	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BMBF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BNMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>BUSK*</b>	<b>11</b>	<b>0.194</b>	<b>0.079</b>	<b>0</b>			<b>0.297</b>	<b>0</b>	<b>0.149</b>	<b>0</b>				
		<b>[0.204]</b>	<b>[0.159]</b>	<b>[0]</b>			<b>[0.431]</b>	<b>[0]</b>	<b>[0.207]</b>	<b>[0]</b>				
CARP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CLSR	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CNCF	2	0.041	0	0			0	0	0.119	0				
		<b>[0.082]</b>	[0]	[0]			[0]	[0]	<b>[0.238]</b>	[0]				
CNLP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CNSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
ERSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
FHCF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
FHMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				

Appendix F2. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
FWDM	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
GDEY	4	0.077	0	0			0.044	0	0.167	0				
		[0.075]	[0]	[0]			[0.087]	[0]	[0.184]	[0]				
GDRH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
GNSF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
GSCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
GZSD	3	0.043	0.171	0			0	0	0.052	0				
		[0.05]	[0.226]	[0]			[0]	[0]	[0.105]	[0]				
<b>HBNS*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		<b>[0]</b>	<b>[0]</b>	<b>[0]</b>			<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>				
HFCS	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
LGPH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
LKSG	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
LMBS	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
LNGR	1	0.017	0	0			0.038	0	0	0				
		[0.034]	[0]	[0]			[0.076]	[0]	[0]	[0]				
MMSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
MNEY	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
MQTF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
NFSH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
OSSF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
PDFH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				

Appendix F2. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
<b>PDSG*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>PNMW*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
QLBK	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
RDSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
RVCS	1	0.015	0	0			0.033	0	0	0				
		[0.029]	[0]	[0]			[0.066]	[0]	[0]	[0]				
RVSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SBSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SBWB	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>SFCB*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SGWE	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SHRH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>SKCB*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SLDR	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SMBF	18	0.282	0.263	0.154			0.178	0	0.448	0				
		[0.147]	[0.375]	[0.309]			[0.149]	[0]	[0.338]	[0]				
SMMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SNGR	1	0.017	0	0			0.038	0	0	0				
		[0.034]	[0]	[0]			[0.076]	[0]	[0]	[0]				
<b>SNSG*</b>	<b>74</b>	<b>1.312</b>	<b>0.517</b>	<b>2.154</b>			<b>1.741</b>	<b>0</b>	<b>0.941</b>	<b>0</b>				
		[0.543]	[0.656]	[3.908]			[0.928]	[0]	[0.68]	[0]				
<b>SNSN*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				

Appendix F2. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
STCT	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SVCB	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
SVCP	1	0.011	0	0			0	0	0.033	0				
		[0.022]	[0]	[0]			[0]	[0]	[0.065]	[0]				
UCT	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
UCY	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
UIC	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
ULP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
UTB	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
WLYE	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
WTBS	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
WTCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
YLBH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				

Appendix F4. Otter Trawl: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BESN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BHCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BHMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKBH	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKCP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BKSS	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BLCF	210	3.476	5.425	0			2.592	0	4.307	0				
		[2.225]	[8.115]	[0]			[2.368]	[0]	[4.551]	[0]				
BLGL	4	0.049	0	0			0.077	0	0.038	0				
		[0.049]	[0]	[0]			[0.089]	[0]	[0.076]	[0]				
BMBF	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
BNMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>BUSK*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CARP	2	0.026	0	0			0.019	0	0.053	0				
		[0.039]	[0]	[0]			[0.037]	[0]	[0.106]	[0]				
CLSR	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CNCF	219	2.726	4.464	2.542			2.758	0	2	0				
		[0.932]	[3.544]	[2.417]			[1.308]	[0]	[1.267]	[0]				
CNLP	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
CNSN	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
ERSN	3	0.032	0.118	0			0.029	0	0	0				
		[0.045]	[0.235]	[0]			[0.058]	[0]	[0]	[0]				
FHCF	9	0.148	0.059	0			0.1	0	0.28	0				
		[0.121]	[0.118]	[0]			[0.147]	[0]	[0.294]	[0]				
FHMW	0	0	0	0			0	0	0	0				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				

Appendix F4. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
FWDM	49	0.611 [0.661]	0.235 [0.471]	0 [0]			0.298 [0.38]	0 [0]	1.323 [1.921]	0 [0]		0		
GDEY	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
GDRH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
GNSF	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
GSCP	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
GZSD	1	0.016 [0.031]	0 [0]	0 [0]			0.033 [0.067]	0 [0]	0 [0]	0 [0]		0		
<b>HBNS*</b>	<b>0</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>			<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>		<b>0</b>		
HFCS	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
LGPH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
LKSG	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
LMBS	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
LNGR	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
MMSN	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
MNEY	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
MQTF	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
NFSH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
OSSF	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		
PDFH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]		0		

Appendix F4. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
<b>PDSG*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
<b>PNMW*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				
		[0]	[0]	[0]			[0]	[0]	[0]	[0]				
QLBK	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
RDSN	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
RVCS	4	0.062	0.118	0			0.033	0	0.085	0			0	
		[0.062]	[0.235]	[0]			[0.067]	[0]	[0.121]	[0]			0	
RVSN	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
SBSN	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
SBWB	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
<b>SFCB*</b>	<b>1</b>	<b>0.016</b>	<b>0</b>	<b>0</b>			<b>0.033</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0.031]	[0]	[0]			[0.067]	[0]	[0]	[0]			0	
SGWE	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
SHRH	0	0	0	0			0	0	0	0			<b>0</b>	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
<b>SKCB*</b>	<b>10</b>	<b>0.108</b>	<b>0</b>	<b>0</b>			<b>0.182</b>	<b>0</b>	<b>0.07</b>	<b>0</b>			<b>0</b>	
		[0.083]	[0]	[0]			[0.16]	[0]	[0.097]	[0]			0	
SLDR	1	0.016	0	0			0.033	0	0	0			0	
		[0.031]	[0]	[0]			[0.067]	[0]	[0]	[0]			0	
SMBF	2	0.022	0	0			0.017	0	0.043	0			0	
		[0.032]	[0]	[0]			[0.033]	[0]	[0.087]	[0]			0	
SMMW	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
SNGR	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]	[0]	[0]			0	
<b>SNSG*</b>	<b>61</b>	<b>0.951</b>	<b>0.059</b>	<b>6</b>			<b>0.62</b>	<b>0</b>	<b>1.413</b>	<b>0</b>			<b>0</b>	
		[0.705]	[0.118]	[12]			[0.515]	[0]	[1.699]	[0]			0	
<b>SNSN*</b>	<b>2</b>	<b>0.031</b>	<b>0.108</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0.043</b>	<b>0</b>			<b>0</b>	
		[0.044]	[0.215]	[0]			[0]	[0]	[0.087]	[0]			0	

Appendix F4. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	ITIP	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
STCT	13	0.177 [0.162]	0 [0]	0.625 [1.25]			0.039 [0.055]	0 [0]	0.362 [0.453]	0 [0]	1.333			
SVCB	10	0.152 [0.155]	0 [0]	0 [0]			0.302 [0.322]	0 [0]	0.032 [0.063]	0 [0]	0			
SVCP	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
UCT	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
UCY	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
UIC	58	0.9 [0.739]	1.412 [1.711]	0 [0]			0.239 [0.405]	0 [0]	1.73 [1.993]	0 [0]	0			
ULP	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
UTB	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
WLYE	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
WTBS	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
WTCP	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			
YLBH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0 [0]	0			

Appendix F6. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	BARS	CHNB	ITIP	BARS	TLWG
BESN	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
BHCP	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
BHMW	51	1.109	0	1.091			0	1.1	0	1.083			2	
		[0.47]	[0]	[1.025]			[0]	[0.753]		[0.903]			[2]	
BKBH	2	0.043	0	0.091			0	0	0	0.083			0	
		[0.061]	[0]	[0.182]			[0]	[0]		[0.167]			[0]	
BKCP	2	0.043	0	0			0	0	0	0.167			0	
		[0.061]	[0]	[0]			[0]	[0]		[0.225]			[0]	
BKSS	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
BLCF	4	0.087	0	0.182			0	0.1	0	0			0	
		[0.122]	[0]	[0.364]			[0]	[0.2]		[0]			[0]	
BLGL	32	0.696	0	1			0	0.5	0	0.917			0	
		[0.383]	[0]	[0.972]			[0]	[0.447]		[0.903]			[0]	
BMBF	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
BNMW	83	1.804	0	1.455			0	1.95	0	2.333			0	
		[1.211]	[0]	[1.385]			[0]	[2.498]		[1.729]			[0]	
<b>BUSK*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		<b>[0]</b>	<b>[0]</b>	<b>[0]</b>			<b>[0]</b>	<b>[0]</b>		<b>[0]</b>			<b>[0]</b>	
CARP	3	0.065	0	0.091			0	0.05	0	0.083			0	
		[0.074]	[0]	[0.182]			[0]	[0.1]		[0.167]			[0]	
CLSR	2	0.043	0	0			0	0.1	0	0			0	
		[0.087]	[0]	[0]			[0]	[0.2]	[0]	[0]			[0]	
CNCF	127	2.761	0	3.636			0	3.55	1	1.25			0	
		[1.491]	[0]	[2.883]			[0]	[2.922]		[1.158]			[0]	
CNLP	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
CNSN	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
ERSN	46	1	0	1.545			0	0.6	0	1.083			2	
		[0.486]	[0]	[1.124]			[0]	[0.671]		[0.999]			[2]	
FHCF	23	0.5	0	0.818			0	0.35	1	0.5			0	
		[0.387]	[0]	[1.002]			[0]	[0.508]		[0.835]			[0]	
FHMW	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	

Appendix F6. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	BARS	CHNB	ITIP	BARS	TLWG
FWDM	199	4.326 [2.255]	0 [0]	2.364 [2.519]			0 [0]	7.1 [4.656]	1 [1.893]	2.25			1.5 [3]	
GDEY	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
GDRH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
GNSF	2	0.043 [0.061]	0 [0]	0 [0]			0 [0]	0.1 [0.138]	0 [0]	0			0 [0]	
GSCP	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
GZSD	1324	28.783 30.645	0 [0]	17.182 [24.844]			0 [0]	5.85 [7.538]	3 [44.81]	28.583			336 [626]	
<b>HBNS*</b>	<b>0</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>			<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>			<b>0</b> <b>[0]</b>	
HFCS	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
LGPH	1	0.022 [0.043]	0 [0]	0.091 [0.182]			0 [0]	0 [0]	0 [0]	0			0 [0]	
LKSG	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
LMBS	1	0.022 [0.043]	0 [0]	0.091 [0.182]			0 [0]	0 [0]	0 [0]	0			0 [0]	
LNGR	8	0.174 [0.156]	0 [0]	0 [0]			0 [0]	0.3 [0.328]	0 [0.225]	0.167			0 [0]	
MMSN	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
MNEY	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
MQTF	31	0.674 [0.398]	0 [0]	0.545 [0.78]			0 [0]	0.55 [0.307]	1 [1.266]	1.083			0 [0]	
NFSH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	
OSSF	5	0.109 [0.112]	0 [0]	0 [0]			0 [0]	0.15 [0.219]	0 [0.225]	0.167			0 [0]	
PDFH	0	0 [0]	0 [0]	0 [0]			0 [0]	0 [0]	0 [0]	0			0 [0]	

Appendix F6. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	BARS	CHNB	ITIP	BARS	TLWG
<b>PDSG*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
<b>PNMW*</b>	<b>15</b>	<b>0.326</b>	<b>0</b>	<b>0.818</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0.417</b>			<b>0.5</b>	
		[0.357]	[0]	[1.17]			[0]	[0]		[0.833]			[1]	
QLBK	1	0.022	0	0.091			0	0	0	0			0	
		[0.043]	[0]	[0.182]			[0]	[0]		[0]			[0]	
RDSN	562	12.217	0	12.364			0	10	30	8.667			46	
		[4.679]	[0]	[7.882]			[0]	[5.179]		[8.781]			[58]	
RVCS	36	0.783	0	0.727			0	0.75	0	0.833			1.5	
		[0.469]	[0]	[1.268]			[0]	[0.694]		[0.81]			[1]	
RVSN	1	0.022	0	0			0	0.05	0	0			0	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	
SBSN	1	0.022	0	0			0	0	0	0.083			0	
		[0.043]	[0]	[0]			[0]	[0]		[0.167]			[0]	
SBWB	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
<b>SFCB*</b>	<b>1</b>	<b>0.022</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0.05</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	
SGWE	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
SHRH	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
<b>SKCB*</b>	<b>1</b>	<b>0.022</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0.05</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	
SLDR	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
SMBF	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
SMMW	3	0.065	0	0			0	0.15	0	0			0	
		[0.074]	[0]	[0]			[0]	[0.164]		[0]			[0]	
SNGR	22	0.478	0	0.182			0	0.75	0	0.167			1.5	
		[0.262]	[0]	[0.364]			[0]	[0.5]		[0.225]			[1]	
<b>SNSG*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>			<b>0</b>	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
<b>SNSN*</b>	<b>127</b>	<b>2.761</b>	<b>0</b>	<b>3.091</b>			<b>0</b>	<b>3.35</b>	<b>2</b>	<b>1.667</b>			<b>2</b>	
		[1.303]	[0]	[3.308]			[0]	[2.197]		[1.621]			[4]	

Appendix F6. (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	BARS	CHNB	ITIP	BARS	TLWG
STCT	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
SVCB	47	1.022	0	0.273			0	0.85	0	2.25			0	
		[0.88]	[0]	[0.545]			[0]	[1.126]		[2.721]			[0]	
SVCP	1	0.022	0	0			0	0.05	0	0			0	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	
UCT	5	0.109	0	0			0	0.15	0	0.167			0	
		[0.128]	[0]	[0]			[0]	[0.219]		[0.333]			[0]	
UCY	1	0.022	0	0			0	0	0	0			0.5	
		[0.043]	[0]	[0]			[0]	[0]		[0]			[1]	
UIC	1	0.022	0	0			0	0.05	0	0			0	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	
ULP	6	0.13	0	0.091			0	0.15	0	0.167			0	
		[0.1]	[0]	[0.182]			[0]	[0.164]		[0.225]			[0]	
UTB	42	0.913	0	0.545			0	0.85	1	1.083			2.5	
		[0.552]	[0]	[0.625]			[0]	[0.785]		[1.527]			[3]	
WLYE	0	0	0	0			0	0	0	0			0	
		[0]	[0]	[0]			[0]	[0]		[0]			[0]	
WTBS	5	0.109	0	0.091			0	0.1	0	0.167			0	
		[0.128]	[0]	[0.182]			[0]	[0.2]		[0.333]			[0]	
WTCP	32	0.696	0	0.364			0	0.4	2	0.333			7	
		[0.708]	[0]	[0.488]			[0]	[0.8]		[0.512]			[14]	
YLBH	1	0.022	0	0			0	0.05	0	0			0	
		[0.043]	[0]	[0]			[0]	[0.1]		[0]			[0]	

Appendix G. Hatchery names, locations, and abbreviations.

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<b>Hatchery</b>	<b>State</b>	<b>Abbreviation</b>
Blind Pony State Fish Hatchery	MO	BLP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

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Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2007-2008 for segment 11 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
ALSD							
ALWF							
AMEL							
AMGL							
BCCC							
BDDR							
BDKF							
BDSN							
BDSP							
BESN							
BHCP							
BHMW	0.000	0.000	0.000	0.000		0.000	1.109
BKBF							
BKBH	0.000	0.000	0.000	0.000		0.000	0.043
BKCP	0.000	0.000	0.000	0.000		0.000	0.043
BKRH							
BKSB							
BKSS							
BKTT							
BLCF	0.050	0.251	0.000	6.701		0.000	0.087
BLGL	0.000	0.097	0.000	0.000		0.000	0.696
BMBF							
BMSN							
BNDC							
BNMW	0.000	0.000	0.000	0.000		0.000	1.804
BNSN							
BNTT							
BPTM							
BRBT							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
BSDR							
BSMN							
BSTM							
BTDR							
<b>BUSK*</b>	<b>0.075</b>	<b>0.000</b>	<b>0.252</b>	<b>0.000</b>		<b>0.105</b>	<b>0.000</b>
BVSC							
BWFN							
CARP	0.013	0.052	0.000	0.000		0.000	0.065
CHSM							
CKCB							
CLDR							
CLSR	0.000	0.000	0.000	0.000		0.000	0.043
CMSN							
CNCF	0.000	2.202	0.068	3.250		0.000	2.761
CNLP							
CNSM							
CNSN							
CSCO							
CTTT							
ERSN	0.000	0.000	0.000	0.064		0.000	1.000
FCSC							
FHCB							
FHCF	0.013	0.076	0.000	0.220		0.000	0.500
FHMW							
FKMT							
FSDC							
FTDR							
FWDM	0.000	0.226	0.000	0.996		0.000	4.326
GDEY	0.175	0.000	0.060	0.000		0.102	0.000
GDFH							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
GDTT							
GFCC							
GLDR							
GDRH							
GDSN							
GN*?							
GNSF	0.000	0.000	0.000	0.000		0.000	0.043
GSBG							
GSCP	0.038	0.000	0.000	0.000		0.000	0.000
GSDR							
GSOS							
GSPK							
GSTS							
GTSN							
GVCB							
GZSD	0.113	0.000	0.071	0.031		0.000	28.783
<b>HBNS*</b>							
HFCS							
HHCB							
IODR							
JYDR							
LESF							
LGPH	0.000	0.000	0.000	0.000		0.000	0.022
LKCB							
LKSG							
LKTT							
LKWF							
LMBS	0.000	0.000	0.000	0.000		0.000	0.022
LNDC							
LNGR	0.000	0.000	0.028	0.000		0.000	0.174

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
LSSR							
LTDR							
LVLP							
MDSP							
MMSN							
MNEY							
MQTF	0.000	0.000	0.000	0.000		0.000	0.674
MSDR							
MSKG							
MTSK							
MTWF							
NBLP							
NFSH	0.000	0.000	0.000	0.000		0.000	0.000
NHSK							
NRBD							
NTPK							
NTSF							
OSSF	0.000	0.000	0.000	0.000		0.000	0.109
OTDR							
OZMW							
PDFH							
<b>PDSG*</b>							
PEMT							
PKLF							
PLDC							
<b>PNMW*</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>		<b>0.000</b>	<b>0.326</b>
PNSD							
PTMW							
QLBK	0.000	0.000	0.000	0.000		0.000	0.022

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
RBDR							
RBST							
RBTT							
RDSN	0.000	0.000	0.000	0.000		0.000	12.217
RDSS							
RKBS							
RRDR							
RUDD							
RVCS	0.000	0.021	0.024	0.103		0.000	0.783
RVRH							
RVSN	0.000	0.000	0.000	0.000		0.000	0.022
RYSN							
SBLR							
SBSN	0.000	0.000	0.000	0.000		0.000	0.022
SBWB	0.013	0.000	0.000	0.000		0.000	0.000
SCSC							
SDBS							
SDMT							
SESM							
<b>SFCB*</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.031</b>		<b>0.000</b>	<b>0.022</b>
SFSN							
<b>SGCB*</b>							
<b>SGER*</b>							
SGWE	0.013	0.000	0.000	0.000		0.000	0.000
SHDR							
SHRH	0.013	0.000	0.000	0.000		0.000	0.000
SJHR							
<b>SKCB*</b>	<b>0.000</b>	<b>0.098</b>	<b>0.000</b>	<b>0.118</b>		<b>0.000</b>	<b>0.022</b>
SLDR	0.000	0.000	0.000	0.031		0.000	0.000
SMBF	0.225	0.016	0.355	0.028		0.169	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
SMBS							
SMMW	0.000	0.000	0.000	0.000		0.000	0.065
SNGR	0.000	0.000	0.028	0.000		0.000	0.478
SNPD							
<b>SNSG*</b>	<b>3.150</b>	<b>0.989</b>	<b>0.907</b>	<b>0.913</b>		<b>1.937</b>	<b>0.000</b>
<b>SNSN*</b>	<b>0.000</b>	<b>0.034</b>	<b>0.000</b>	<b>0.028</b>		<b>0.000</b>	<b>2.761</b>
SPSK							
SPSN							
SPST							
SRBD							
SSPS							
STBS							
STCT	0.000	0.122	0.000	0.233		0.000	0.000
STGR							
STPD							
STSN							
SVCB	0.000	0.000	0.000	0.304		0.000	1.022
SVCP	0.000	0.000	0.019	0.000		0.000	0.022
SVLP							
SVMW							
SVRH							
TFSD							
TPMT							
TPSN							
TTPH							
UAC							
UBF							
UCF							
UCN							
UCS							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	Gill Net	Otter Trawl	1 Inch Trammel Net	Otter Trawl	Push Trawl	1 Inch Trammel Net	Mini-Fyke Net
UCT	0.000	0.000	0.000	0.000		0.000	0.109
UCY	0.000	0.000	0.000	0.000		0.000	0.022
UDR							
UET							
UHY							
UIC	0.000	0.000	0.000	1.800		0.000	0.022
ULP	0.000	0.000	0.000	0.000		0.000	0.130
ULY							
UNO							
UPC							
UPN							
URH							
USG							
UST							
UTB	0.000	0.000	0.000	0.000		0.000	0.913
WLYE	0.013	0.000	0.000	0.000		0.000	0.000
WRFS							
WRMH							
<b>WSMW*</b>							
WSSN							
WTBS	0.000	0.000	0.000	0.000		0.000	0.109
WTCP	0.000	0.000	0.000	0.000		0.000	0.696
WTPH							
WTSK							
YLBH	0.000	0.000	0.000	0.000		0.000	0.022
YWBS							
YWPH							

Appendix I. Comprehensive list of bend numbers and locations for segment 11 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2006-2008.

Bend Number	Bend River Mile	Coordinates*		2006	2007	2008	2009	2010
		Latitude	Longitude					
1	1.7	39.09375	-94.60988			ST, FCS		
2	5.0	39.07892	-94.65139		ST, FCS	ST, FCS		
3	9.0	39.09493	-94.70882	ST, FCS				
4	12.0	39.07377	-94.75377		ST, FCS			
5	14.7	39.04654	-94.78568			ST, FCS		
6	21.0	39.04406	-94.88401		ST, FCS	ST, FCS		
7	22.5	39.02448	-94.89053					
8	23.9	39.00660	-94.89584			FC		
9	25.2	38.99133	-94.90937					
10	26.8	38.99330	-94.91747					
11	29.1	38.98870	-94.94072					
12	31.6	39.99135	-94.97892					
13	33.2	39.00008	-95.00573					
14	35.0	38.98853	-95.02351					
15	37.5	38.98052	-95.05407					
16	40.4	38.97048	-95.08091					
17	43.5	38.96646	-95.10712					
18	44.6	38.96856	-95.12116					
19	45.6	38.97063	-95.13836					
20	46.8	38.97939	-95.15782					
21	47.8	38.97239	-95.16258					
22	52.1	38.97461	-95.23460			FC		

\* Coordinates represent the upper most point of the bend (i.e., the top of the bend going upstream).

## 2006 Annual Report

### Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Kansas River: Segment 11



Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program

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## EXECUTIVE SUMMARY

The Missouri Department of Conservation began its second year within the Pallid Sturgeon Population Assessment Program at the beginning of the 2006 sampling season. This is the first report for Segment 11, the Kansas River. Sampling was successfully completed in the required bend (N = 1) during the 2006 sturgeon and fish community seasons. No pallid sturgeon were captured in segment 11 during the 2006 sampling season. A total of 253 shovelnose sturgeon (fork length = 275 to 726-mm) was captured with gill nets (N = 154), 1-inch trammel nets (N = 97), and otter trawls (N = 2). Most shovelnose sturgeon were captured within the channel border and were associated with open water areas along bank lines. Two pallid sturgeon X shovelnose sturgeon hybrids were captured, but no morphometrics were recorded. Thus, character index values were not calculated. The two fish were deemed hybrids by physical characteristics (semi-scaled belly and position of inner barbels).

Sicklefin chubs (N = 1) were the only *Macrhybopsis* species captured with standard gear in segment 11. This chub was caught within channel border mesohabitats in the outside bend with an otter trawl. All sand shiners (N = 91) were captured with otter trawls and mini-fyke nets, with most fish captured on sand bars and along the bank line using mini-fyke nets. Gill nets and otter trawls captured six blue suckers in channel border mesohabitats. Two sauger were captured within the channel border along inside bends with 1-inch trammel nets, and one individual was collected with an otter trawl. A total of 2,000 fish representing 36 species was captured in Segment 11 during the 2006 sampling season. No *Hybognathus* spp. were captured in Segment 11.

# TABLE OF CONTENTS

Introduction.....	1
Study Area .....	4
Methods.....	6
Sample site selection and description.....	8
Sampling gear.....	10
Data Collection and Analysis.....	12
Results	
Pallid sturgeon .....	16
Shovelnose X Pallid Sturgeon Hybrids.....	23
Targeted Native River Species	
Shovelnose sturgeon .....	24
Sturgeon chub .....	41
Sicklefin chub .....	42
Speckled chub.....	49
Sand shiner .....	50
<i>Hybognathus</i> spp.....	57
Blue sucker .....	58
Sauger.....	66
Kansas River Fish Community.....	74
Discussion.....	75
Wild Gear.....	77
Acknowledgments.....	78
References .....	79
Appendices .....	81

## LIST OF TABLES

Table 1. Number of bends sampled, mean effort per bend, and total effort by macrohabitat for segment 11, the Kansas River, during fall through spring (sturgeon season) and summer (fish community season) in 2005 – 2006. .... 17

Table 2. Number of bends sampled, mean effort per bend, and total effort by mesohabitat for segment 11 on the Kansas River during fall through spring (sturgeon season) and summer (fish community season) in 2005 – 2006. .... 18

### **Pallid sturgeon**

Table 3. Pallid sturgeon (PDSG) capture summaries relative to habitat type and environmental variables of the Missouri River during 2004 - 2005. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment. .... 19

No pallid sturgeon were captured in segment 11 during the 2006 sampling season. Tables 4 through 16 were omitted from this report.

### **Shovelnose sturgeon**

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 31

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 32

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 33

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 34

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 35

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 36

Table 23. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 37

Table 24. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. .... 38

Table 25. Incremental relative stock density (RSD) and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 11, the Kansas River, captured during 2005 – 2006. ....40

### **Sturgeon chub**

There were no sturgeon chub captured in Segment 11 during the 2006 sampling season. Tables 26 and 27 were omitted from this report.

### **Sicklefin chub**

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 46

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 47

### **Speckled chub**

There were no sturgeon chub captured in Segment 11 during the 2006 sampling season. Tables 30 and 31 were omitted from this report.

### **Sand shiner**

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 54

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 55

***Hybognathus spp.***

There were no sturgeon chub captured in Segment 11 during the 2006 sampling season. Tables 34 and 35 were omitted from this report.

**Blue sucker**

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 63

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006..... 64

**Sauger**

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. ....71

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. ....72

## LIST OF FIGURES

Figure 1a. Map of segments 10 and 11, the Missouri and Kansas Rivers, with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 encompasses the Kansas River (River Mile 15.4) to the confluence (River Mile 0.0) ..... 15

### **Pallid sturgeon**

No pallid sturgeon were captured in Segment 11 during the 2006 sampling season. Figures 2 and 4-9 were omitted from this report.

### **Shovelnose sturgeon**

Figure 11. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq$  380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 25

Figure 12. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq$  380 mm; black bars) shovelnose sturgeon using 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 26

Figure 13. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon using beam trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 27

Figure 14. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq$  380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 28

Figure 15. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $\geq$  380 mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 29

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 – 2006. .... 39

**Sturgeon chub**

No sturgeon chub were captured in Segment 11 during the 2006 sampling season. Figures 18 through 21 were omitted from this report.

**Sicklefin chub**

Figure 22. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls and beam trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 43

Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls and beam trawls in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 44

Figure 24. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 45

Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 – 2006. .... 48

**Speckled chub**

There were no speckled chubs captured in Segment 11 during the 2006 sampling season. Figures 26 through 29 were omitted from this report.

**Sand shiner**

Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls and beam trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 51

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls and beam trawls in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 52

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 53

Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 – 2006. .... 56

***Hybognathus spp.***

There were no *Hybognathus spp.* captured in Segment 11 during the 2006 sampling season. Figures 34 through 37 were omitted from this report.

**Blue sucker**

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006..... 59

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005 – 2006.  
..... 60

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005 – 2006.  
..... 61

Figure 42. Mean annual catch-per-unit-effort (+/- 2SE) of blue suckers using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 62

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 – 2006. .... 65

**Sauger**

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 67

Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005 – 2006. .... 68

Figure 48. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005 – 2006.  
..... 69

Figure 49. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 – 2006. .... 70

Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 – 2006. .... 73

## LIST OF APPENDICES

Appendix A. Phylogenetic list of Missouri and Kansas River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. ....	82
Appendix B. Definitions and codes used to classify standard Missouri and Kansas River habitats in the long term pallid sturgeon and associated fish community sampling program.....	88
Appendix C. List of standard and wild gears, their corresponding codes in the database, seasons deployed, years used, and catch-per-unit-effort units for collection of Kansas River fishes for the long-term pallid sturgeon and associated fish community sampling program.....	89
Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area in the Missouri River Basin.....	90
Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 10 of the Missouri River (RPMA 4). ....	91
Appendix F. Total catch, overall mean catch per unit effort, and mean CPUE by mesohabitat within a macrohabitat for all species caught during sturgeon season and fish community season combined in segment 11, the Kansas River, during 2005 – 2006 .....	92
Appendix F1. Gill Net: .....	93
Appendix F2. 1 Inch Trammel Net: .....	94
Appendix F3. 2.5 Inch Trammel Net: .....	95
Appendix F4. Otter Trawl: .....	96
Appendix F6. Mini-fyke Net: .....	97
Appendix G. Hatchery names, locations, and abbreviations.....	99
Appendix H. Alphabetic list of Missouri and Kansas River fishes with total number caught by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2005 – 2006 for segment 11, the Kansas River .....	100
Appendix I. Comprehensive list of bend numbers and bend river miles for segment 11, the Kansas River, comparing bend selection between years from 2005 – 2006.....	107

## Introduction

Pallid sturgeon *Scaphirhynchus albus* are native throughout the Missouri River and to the middle and lower Mississippi River. Population levels of this species have declined over the past century, and declines have been attributed to anthropogenic influences including habitat loss, blocked migration routes, and an altered hydrograph and water temperature regime (USFWS 1993). As a result, this species was listed under the Endangered Species Act in 1990. The Pallid Sturgeon Recovery Plan (USFWS 1993) identified six priority pallid sturgeon recovery management areas (RPMAs), four of which lie within the Missouri River. Further, this document provided an outline that proposed to: 1) protect and restore pallid sturgeon populations, individuals, and their habitats; 2) conduct research necessary for survival and recovery of pallid sturgeon; 3) develop and implement a pallid sturgeon captive propagation program, and; 4) coordinate and implement conservation and recovery of sturgeon species.

In 2000, the U. S. Fish and Wildlife Service (USFWS) issued a Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op; USFWS 2000) to the U. S. Army Corps of Engineers (USACE). This document recommended: 1) that the flow regime of the Missouri River mimic a more natural hydrograph, 2) an increase in propagation and population augmentation efforts, and 3) the development of a pallid sturgeon population assessment program (PSPAP). As the federal entity responsible for water management within the Missouri and Kansas river systems, the USACE has an obligation under the Endangered Species Act to conserve the pallid sturgeon. To comply with the Bi-Op, the USACE has proposed to operate Gavins Point Dam in a manner to create a more natural hydrograph, has funded hatchery improvements and expansions, has funded the PSPAP, and facilitated the development of the Pallid Sturgeon Population Assessment Team (Team).

The initial stocking of pallid sturgeon in 1994 consisted of approximately 7,000 fish from the 1992 year class that were stocked into RPMAs 4 (Missouri River below Gavins Point Dam) and 5 (middle Mississippi River; USFWS 2005). Subsequent stockings in 1997,

1998, 2000, and 2002 through 2005 in all six RPMA's have resulted in nearly 172,000 pallid sturgeon being stocked into the Missouri and Mississippi River systems. In 2006, 3,654 yearlings were stocked in RPMA 4. The total number of pallid sturgeon stocked per year has increased from an average of about 4,000 fish per year prior to 2000 to an average of nearly 32,000 fish per year since that time (USFWS 2005). Most pallid sturgeon were stocked as yearling (i.e., age-1) fish, although some years age-0 and age-2 fish were released as well.

Implementation of the PSPAP began in 2001 when the USFWS-Columbia Fishery Resource Office (USFWS-CFRO) began monitoring under PSPAP guidelines and Nebraska Game and Parks Commission (NGPC) conducted an evaluation of benthic trawls. The USACE hired a fishery biologist to coordinate the PSPAP in 2002, and the USFWS-CFRO and NGPC continued monitoring in segments 9, 13, and 14 in the lower Missouri River. Standardized sampling above Gavins Point Dam (segments 5 and 6) occurred for the first time in 2003 by the USFWS-Great Plains Fish and Wildlife Management Assistance Office. During 2004, monitoring continued in segments 5, 6, 8, 9, 13, and 14, and an independent science review was conducted to determine the ability of the PSPAP to address its objectives. Beginning with the 2005 fish community season, the Team added USFWS-Missouri River Fish and Wildlife Management Assistance Office (Segment 4), South Dakota Department of Game Fish and Parks (Segment 7), and Missouri Department of Conservation (segments 10 and 11) field crews that completed implementation of the PSPAP from segments 4 through 14. In 2006, the Team added the Montana Department of Fish, Wildlife, and Parks field crew to complete implementation of the PSPAP from segment 1 through 14.

The objectives of the PSPAP are as follows: 1) document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System; 2) document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage; 3) document population structure and dynamics of pallid sturgeon in the Missouri River System; 4) evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system; 5) document annual results and long-term trends of habitat usage of the native target species by season and life stage; and 6) document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system,

where sample size is greater than fifty individuals. Results from the PSPAP will serve a valuable role in the collection and assembly of biological information to facilitate recovery of pallid sturgeon.

## Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 through 4 lie in RPMA 2 and includes the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 and 6, that lie in RPMA 3, consist of the 55 river miles from Fort Randall Dam, South Dakota, downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only segment below Gavins Point Dam that is not channelized. Segments 8 through 14 include the entire channelized portion (750 miles) of the Missouri River extending from Lower Ponca Bend to the confluence with the Mississippi River. The Kansas River, from the Johnson County Weir (Kansas) to the mouth (15.4 miles), was given its own segment designation (Segment 11) because this tributary was addressed by the 2000 Bi-Op as a high priority management area for pallid sturgeon. Segments 1 through 7 and 8 through 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by a meandering, often braided channel that lacks navigation structures and deep pools. The lower sampling universe is channelized, has revetted banks, and deep scour pools and sand bars associated with a variety navigation structures. This document reports activities during the 2006 sampling season specific to Segment 11.

Segment 11, the Kansas River, is a large tributary within RPMA 4 and consists of 5 numbered river bends of the lower Kansas River between the Johnson County Weir, Kansas (RM 15.4) and the confluence of the Kansas River (RM 0). River bends in this segment ranged from 1.1 to 4.0 miles in length with a mean bend length of 3.6 miles. The Kansas River is channelized from the Johnson County Weir through the industrial area of Kansas City to the mouth, but no channel is maintained for navigation traffic. River banks are lined with rip rap along the outside and inside bends of the river. Structures in this segment are

few but include very small wing dikes in some areas. There are various large boulder areas, refuse concrete slabs, and degraded areas with undercut banks. The river is relatively shallow, restricting sampling only at times following a rain event or when there is influence by the mainstem Missouri while experiencing high flows ( $> 45,000$  cfs). There are a few island areas, but these remain inaccessible due to shallow water.

## Methods

All sampling was conducted in accordance with guidelines established by the Pallid Sturgeon Assessment Team as outlined in the Pallid Sturgeon Population Assessment Program and Missouri River Standard Operating Procedures for Sampling and Data Collection (Drobish 2006a, b). Data collected by each PSPAP crew were entered via double-blind entry into a single database housed and managed by the Missouri Department of Conservation. Data were subsequently distributed to each participating office according to reporting responsibilities: segments 1 through 3 – Montana Fish, Wildlife and Parks-Fort Peck, MT; segment 4 – USFWS-Bismark, ND; segments 5 and 6 – USFWS-Pierre, SD; segment 7 – South Dakota Department of Game, Fish, and Parks-Yankton, SD; segments 8 and 9 – Nebraska Game and Parks Commission-Lincoln, NE; segments 10 and 11 – Missouri Department of Conservation-Chillicothe, MO; segments 13 and 14 – USFWS-Columbia, MO.

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 01 November 2005 or when water temperatures dropped below 12.8°C (55°F) and continued through 30 June 2006. The fish community season began 01 July 2006 and continued through 31 October 2006. The Missouri Department of Conservation sampled both seasons during 2006, thus, data from both sampling seasons are included in this report. During these seasons, standard gear types included experimental gill nets, 1-inch trammel nets, 2.5-inch trammel nets, 16-foot otter trawls, and mini-fyke nets (see Sampling Gear section for gear specifications). Gill nets were the only sampling gear that would have been used during the sturgeon season until 01 March 2005. The beginning of this season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts would have begun 16 January and continued until water temperatures reached 12.8°C (55°F). Trammel netting and trawl efforts began 01 March 2006 and continued through 30 June.

Fish community season began 01 July 2006 and continued through 31 October 2006. Although this season utilized gears that capture sturgeon species (i.e., 1-inch trammel nets and otter trawls), particularly small (i.e., young) sturgeons, there was an additional emphasis

placed on assessing the associated fish community. Standard gear types during the fish community season included 1-inch trammel nets, 16-foot otter trawls, and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season, with efforts made to spatially and temporally distribute sampling across the four randomly selected bends within the segment.

In addition to pallid sturgeon, the Team identified members of the associated fish community that were of particular interest due to their ecology (e.g., obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when practicable and measured for total length (TL) except sturgeon which were measured for fork length (FL) and paddlefish *Polyodon spathula* which were measured for eye-fork length. Shovelnose sturgeon, blue suckers, and sauger were weighed to the nearest 1 g and the remaining species of interest were weighed to the nearest 0.1 g.

If pallid sturgeon were captured, several meristic and morphometric measurements were to be recorded to determine the character index (CI) score for each fish (Sheehan et al. 1999). Measurements required to calculate CI-score include: head length, interrostral length, the length of each barbel, mouth to inner barbel length, and mouth width (see Sheehan et al. (1999) for descriptions of each measurement). The length from the fish’s snout to the anterior midline of the mouth was also to be recorded. Meristics include the number of dorsal and anal fin rays, including rudimentary rays. Ranges of CI-scores for pallid, shovelnose X pallid hybrids, and shovelnose have been defined as -1.48 to -0.09, -0.45 to 0.51, and 0.37 to 1.33, respectively. In general, CI-scores were to be only calculated for suspected wild pallid sturgeon or hybrid individuals.

In addition to meristic and morphometric measurements, all pallid sturgeon were to be examined for elastomer (color, orientation, and location on fish), coded wire (CWT), and passive integrated transponder (PIT) tags. If no tags were present, a PIT tag was to be implanted at the base of the dorsal fin and a 1-cm<sup>2</sup> piece of tissue was removed from the trailing edge of the caudal fin for genetic analysis. Before each pallid sturgeon was released,

voucher pictures were taken from a lateral and ventral view of the fish with a summary of capture information (e.g., PIT tag number, location, date, CI-score, etc.).

## **Sampling Site Selection and Description**

*Site selection.* – Beginning with the 2006 sampling season, bends within the channelized portion of the Missouri River (segments 8 through 14) were pooled to facilitate proportional representation of each segment due to large differences in segment length (113 to 228 river miles). Once all river bends were pooled, 72 river bends were randomly selected from segments 8 through 14 and evenly divided among the three agencies responsible for data collection in these segments (i.e., NGPC, MDC, and USFWS-CFRO). For the 2006 sampling season, the number of randomly selected bends for each segment of the lower sampling universe was: Segment 8 – 18 bends; Segment 9 – 21 bends; Segment 10 – four bends; Segment 11 – one bend, Segment 13 – 12 bends; Segment 14 – 16 bends. MDC and NGPC shared sampling responsibilities in Segment 9. An additional 18 bends (six per office) were randomly selected for extra gill netting effort in the channelized reach to increase sturgeon capture. The number of extra bends selected within each segment were as follows: Segment 8 – zero bends; Segment 9 – seven bends; Segment 10 – seven bends; Segment 11 – zero bends, Segment 13 – one bend; Segment 14 – three bends. MDC and NGPC conducted sampling in Segment 9, while MDC and USFWS-CFRO conducted sampling in segments 10 and 13.

Within the randomly selected river bend in Segment 11, sampling locations were selected based on the availability of standard habitats for each gear type. A minimum of two subsamples were collected within each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if four subsamples were conducted on the outside bend along the bankline and there was 3.0 miles in the bend, samples were spaced evenly throughout the bend alternating from inside bend to outside bend so there was no influence on the previous set. For most gear types, two to four subsamples were conducted in the channel crossover, three within the inside bend, and three in the outside bend (about eight subsamples per bend). If a specific macrohabitat (inside

bend) was scarce for gear deployment, the majority of samples were placed in other available macrohabitats (e.g., channel crossover or outside bend).

*Site description.* – Sampling sites were described using a three-tiered (macro-, meso-, and microhabitat) classification system that was based on the Missouri River Benthic Fish Study (Berry and Young 2001). Within this habitat designation system, by definition each river bend contained the following three continuous macrohabitats: main channel crossover (CHXO), inside bend (ISB), and outside bend (OSB). The channel crossover was the area where the thalweg crossed from one concave side of the river to the other. The inside bend was the convex side of the river and the outside bend was the concave side of the river. Classifications for discrete macrohabitats that may not be present in every bend included: braided channel (BRAD), tributary confluence (CONF), dendritic channel (DEND), deranged channel (DRNG), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), non-connected secondary channel (SCN), large tributary mouth (TRML) and small tributary mouth (TRMS). Braided channels were areas with multiple channels and an unidentifiable main channel. Tributary confluences were areas where tributaries influenced physical features (e.g., temperature, turbidity, sand bars, etc.) in the Missouri River for up to one bend in length downstream from the tributary mouth. Dendritic and deranged channels were transitions from a meandering channel to a tree-like pattern of multiple channels and vice versa, respectively. Large, connected secondary channels were channels that carried less water than the main channel, were open on both ends, and had flowing water with water depths greater than 1.2 m. Small, connected secondary channels were defined similarly to SCCL, but water depths did not exceed 1.2 meters. Non-connected secondary channels were channels that were blocked on one end. Large tributary mouths were areas within tributaries, with an annual discharge that exceeded 20 m<sup>3</sup>/s and extended 300-m upstream from the confluence with the main river. Small tributary mouths were areas within 300 m of the confluence with the main river, were greater than 6 m in width, and had an annual discharge less than 20 m<sup>3</sup>/s.

Mesohabitats within each macrohabitat included: sand bar (BARS), main channel border (CHNB), dam tailwater (DTWT), island tip (ITIP), pool (POOL), and thalweg (TLWG). Sand bars were defined as areas less than 1.2-m deep at the aquatic-terrestrial

interface. Channel border habitats extend from the 1.2-m depth contour to the edge of the thalweg. Island tips were areas immediately downstream from islands where water depths were greater than 1.2 meters. Pools were areas immediately downstream from obstructions where there was a scour greater than 1.2-m in depth regardless of water velocity. The thalweg was defined as the area between the channel borders.

Microhabitats were identified using a six-digit numeric code. The first three digits of this code described the general habitat structure (e.g., bankline, sand bar, etc.) with which the gear deployment was associated. The last three digits described the exact location of the gear in relation to this structure (e.g., wing-dike pool, sand-bar lip, etc.). For complete definitions of each microhabitat type see Drobish (2006b).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 through 4, 5 through 7, and 8 through 14) in which each gear type could be deployed (Drobish 2006a). For Segment 11, standard macrohabitats for 1-inch trammel nets included: CHXO, CONF, ISB, OSB, and SCCL. Within these macrohabitats, only CHNB and ITIP mesohabitats were standard. Otter trawls were standard in these same macro- and mesohabitats as well as in TRML macrohabitats. Standard macrohabitats for mini-fyke nets included: CHXO, CONF, ISB, OSB, SCCL, SCCS, SCN, TRML, and TRMS. The only standard mesohabitat for these gear types was BARS.

## **Sampling Gear**

Standard gill nets were set primarily parallel with flow downstream from structures (rock dikes) if available and along the channel border. Gill nets were also set perpendicular to the bank depending up flow in sampling areas. Gill nets were anchored to rock dikes from the upstream end. Nets were anchored on the downstream end as well to ensure complete extension during the sampling period. A line and buoy were attached to the downstream end to mark the net and for retrieval. In Segment 11 during the 2006 sturgeon season, gill nets were used as standard gear in CHXO, ISB, and OSB macrohabitats and CHNB and POOL mesohabitats. The standard gill nets were 30.5 m (100 ft.) in length, 2.4 m (8 ft.) deep, constructed from multifilament nylon mesh and contained four panels. Each panel was 7.6 m (25 ft.) with mesh size of 38.1 mm (1 in.) panel 1, 50.8mm (2 in.) panel 2, 76.2 mm (3.0 in.) panel 3, and 101.6 mm (4.0 in.) panel 4. Panels repeated (5 through 8) in double length nets

with 38.1 mm, 50.8 mm, 76.2 mm, 101.6 mm mesh sizes in panels 5, 6, 7, and 8, respectively. Standard single effort is calculated with a 30.5 m (100 ft.) net (1 net night). Sets were made with 61 m (200 ft.) nets and counted as double effort (2 net nights). The first panel (1, 4, or 8) deployed out of the boat for a set site was selected randomly and recorded. Gill nets were set overnight for a maximum of 24 hours. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line.

Trammel nets were deployed off the bow of the boat by throwing a buoy attached to a 10-m line and motoring in reverse perpendicular to the flow toward the bank. A second buoy and line on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. In Segment 11 during the 2006 fish community and sturgeon seasons, trammel nets were used as standard gear in CHXO, ISB, and OSB macrohabitats and CHNB mesohabitats. Trammel nets (i.e., 1-inch trammel nets) were 38.1 m (125 ft.) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in.) bar mesh (#139 twine) that was 2.4-m deep (8 ft) and the outer wall was 203-mm (8 in.) bar mesh (# 9 twine) and was 1.8 m (6 ft.) in depth. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line.

Otter trawls were deployed from the stern of a custom-designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and line were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and on channel sand bars. The towing warp consisted of 13-mm low-stretch nylon line with a 13.7-m bridle. In Segment 11 during the 2006 fish community and sturgeon seasons, otter trawls were used as standard gear in CHXO, ISB, and OSB macrohabitats and CHNB mesohabitats. Standard trawl hauls ranged from a minimum distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom-designed skate balloon otter trawl with a 4.9-m (16 ft.) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.).

Mini-fyke nets were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. In areas with moderate flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the cab to prevent the net from overturning. The perpendicular distance measured from the midpoint

of the cab to the bank was recorded. Nets were generally set in the afternoon and left overnight with a maximum soak time of 24 hours. In Segment 11 during the 2006 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, macrohabitats and BARS mesohabitats. Mini-fyke nets were constructed from 3-mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the cab. The body of the net was constructed with two 0.6 m steel hoops, with a single, 51-mm throat. The lead was 4.5-m in length and 0.6 m high.

## **Data Collection and Analysis**

### *Associated Environmental Data*

In addition to water depth and temperature that were recorded for every subsample, additional habitat data were collected for a minimum of 25% of subsamples within each mesohabitat within each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in Segment 11, habitat data were generally collected for one subsample in the channel crossover, one subsample in the inside bend and one in the outside bend. In addition to the collection of habitat data for randomly selected subsamples, these data were also to be collected for all subsamples that captured a pallid sturgeon. However habitat data from pallid sturgeon collections were to be recorded as non-random and were not included toward meeting the 25% minimum of subsamples in a bend.

Habitat parameters collected included turbidity, substrate, and velocity. Turbidity was determined using a Hach 2100 P Turbidimeter and reported as nephelometric turbidity units (NTUs). Substrate samples were collected using a Hesse sampler. The estimated percent composition of silt, sand, and gravel as well as the presence of cobble and organic matter (0 = none, 1 = incidental, 2 = dominant, 3 = ubiquitous) were recorded. Surface water velocity was estimated visually for every subsample by categorizing flow in meters per second (m/s) as: 0 = cannot determine, 1 = eddy or circular flow, 2 = 0.0-0.3 m/s, 3 = 0.3-0.6 m/s, 4 = 0.6-0.9 m/s, and 5 = >0.9 m/s. Water velocity was also recorded using a Marsh McBirney Flo-Mate Model 2000 and reported in m/s. Water velocity measurements were taken at the

bottom, and 80%, and 20% of the water column depth for gill nets, trammel nets, and otter trawls. This parameter was recorded at the bottom and 60% of the water column depth for mini-fyke nets.

All habitat parameters were collected at the midpoint of the sample, except depth which was collected at the start point, midpoint, and end point for gill nets, trammel nets, and otter trawls. For example, if an otter trawl was hauled 150 m, habitat data were collected 75 m downstream from the starting point at the approximate midpoint of where the net was drifted; from a 61 m (200 ft.) gill net set, habitat data were collected at the midpoint (at 30.5 m or 100 ft) of the net. All habitat parameters for mini-fyke nets were measured at the point where the lead connected to the cab of the net.

#### *Genetic Validation*

If pallid sturgeon were captured that did not appear to be previously marked, they were considered to be of unknown origin pending genetic verification. Tissue samples collected at time of capture were to be subsequently sent to the USFWS Abernathy Fish Technology Center, in Washington state to genetically determine the origin of the fish (i.e., hatchery-stocked or wild). No pallid sturgeon were captured in Segment 11 during the 2006 sampling season, thus, no genetic analyses were needed for this report.

#### *Relative Condition*

The condition of recaptured pallid sturgeon was determined using the relative condition factor (Anderson and Neumann 1996). Relative condition ( $K_n$ ) was calculated as:

$$K_n = W/W'$$

where  $W$  was the observed weight and  $W'$  was the length-specific weight derived from the FL-weight equation from Keenlyne and Evanson (1993). No pallid sturgeon were captured in Segment 11. Thus, comparisons of  $K_n$  were not made in Segment 11 during 2006.

#### *Relative Stock Densities*

Relative stock densities were calculated for shovelnose sturgeon captured during the 2006 season. Relative stock density was calculated as:

$$\text{RSD} = \text{number of fish} \geq \text{specified length} / \text{number of fish} \geq \text{minimum stock length} \cdot 100$$

(Anderson and Neumann 1996). For shovelnose sturgeon, minimum length specifications were: stock = 250 mm; quality = 380 mm; preferred = 510 mm; memorable = 640 mm; trophy = 810 mm as reported by Quist et al. (1998). In addition to these categories, two sub-stock length ranges for both pallid and shovelnose sturgeon were defined by the PSPAP. The two sub-stock categories selected for pallid sturgeon were 0 to 199 mm and 200 to 329 mm, while the two sub-stock categories for shovelnose sturgeon were 0 to 149 mm and 150 to 249 mm.

### *Analyses*

All analyses were conducted on data collected from the randomly selected bend with standard gear types set within standard habitats for each respective gear. Mean catch-per-unit-effort (CPUE) was calculated for each species within a bend sampled. Then a grand mean from all bends means was derived to get an overall average CPUE for each fish species. CPUE for 1-inch trammel nets and otter trawls was reported as the number of fish/100 m drifted or trawled, respectively. Gill nets and mini-fyke nets reported CPUE as the number of fish per net night.

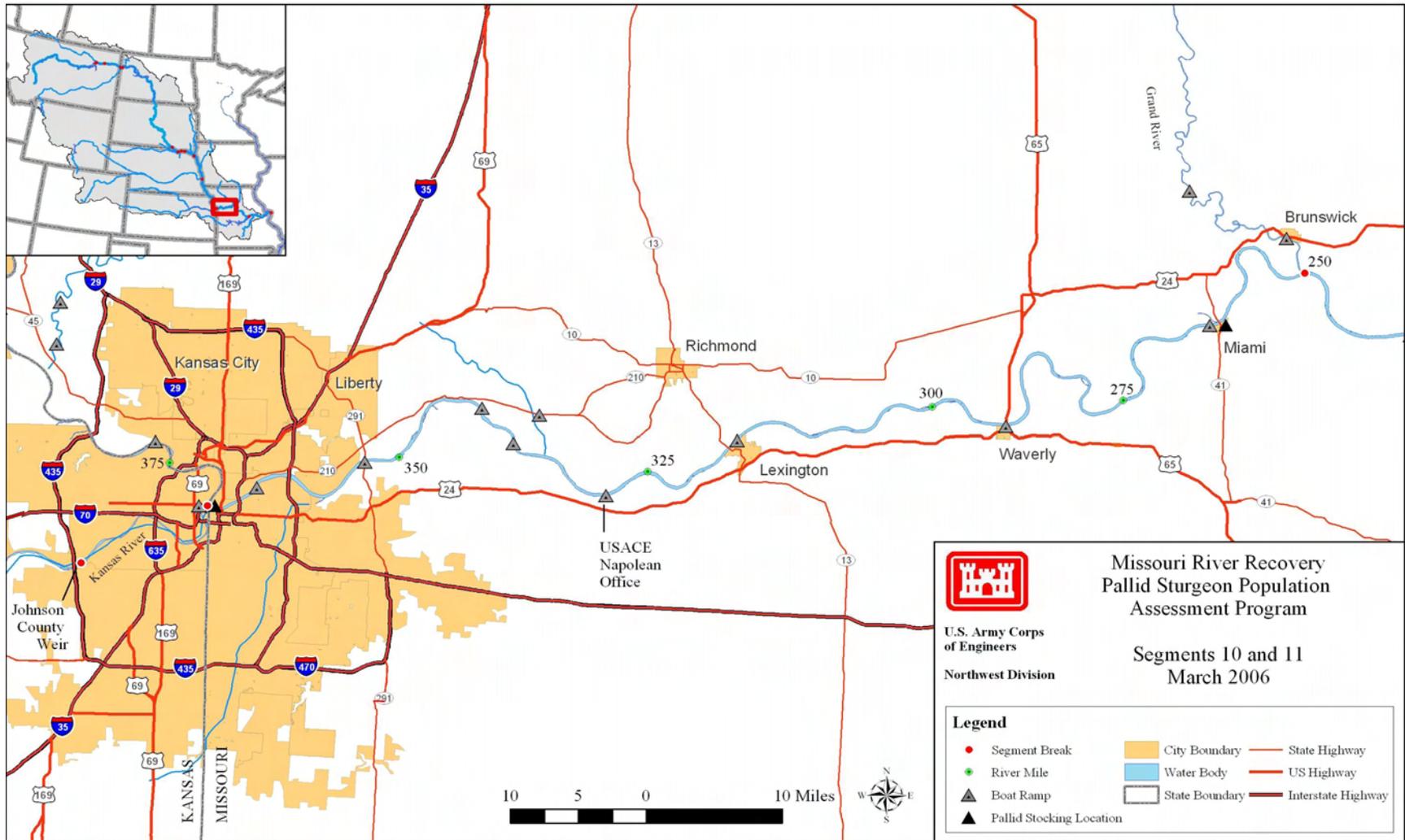


Figure 1a. Map of segment 10 and 11 of the Missouri and Kansas Rivers with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 11 on the Kansas River extends from the Johnson County Weir (River Mile 15.4) to the confluence (River Mile 0.0).

# Results

## Pallid Sturgeon

*Objective 1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.*

*Objective 2. Document annual results and long-term trends of habitat usage of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.*

*Objective 3. Document population structure and dynamics of pallid sturgeon in the Missouri River System.*

No pallid sturgeon ( $N = 0$ ) were captured in Segment 11 during the 2006 sampling season. Thus, Tables 3 through 16 and Figures 2 through 9 were omitted from this report.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for segment 11, the Kansas River, during fall through spring (sturgeon season) and summer (fish community season) in 2005 – 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCC S	SCCN	TRIB	TRML	TRMS	WILD
<b>Fall through Spring - Sturgeon Season</b>																
1 Inch Trammel Net	1	8 (8)		2 (2)				3 (3)	3 (3)							
2.5 Inch Trammel Net	1	8 (8)		2 (2)				3 (3)	3 (3)							
Beam Trawl																
Gill Net	1	10 (10)		4 (4)				1 (1)	5 (5)							
Otter Trawl	1	9 (8)		2 (2)				5 (5)	2 (1)							
<b>Summer – Fish Community Season</b>																
1 Inch Trammel Net	1	8 (8)		2 (2)				6 (6)								
Beam Trawl																
Mini-Fyke Net	1	8 (8)		2 (2)				4 (4)	2 (2)							
Otter Trawl	1	8 (8)		2 (2)				6 (6)								

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segment 11, the Kansas River, during fall through spring (sturgeon season) and summer (fish community season) in 2005 – 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat				
			BAR	POOL	CHNB	TLWG	ITIP
<b>Fall through Spring – Sturgeon Season</b>							
<b>1 Inch Trammel Net</b>	1	8 (8)			8 (8)		
<b>2.5 Inch Trammel Net</b>	1	8 (8)			8 (8)		
<b>Beam Trawl</b>							
<b>Gill Net</b>	1	10 (10)		1 (1)	9 (9)		
<b>Otter Trawl</b>	1	9 (8)			9 (8)		
<b>Summer – Fish Community Season</b>							
<b>1 Inch Trammel Net</b>	1	8 (8)			8 (8)		
<b>Beam Trawl</b>							
<b>Mini-Fyke Net</b>	1	8 (8)	8 (8)				
<b>Otter Trawl</b>	1	8 (8)			8 (8)		

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables in Segment 11, the Kansas River, during 2005-2006. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Macro -	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
BRAD	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
CHXO	BAR	0.04 (0.04-0.04)		0.01 (0.01-0.01)		22 (22-22)		46 (46-46)		0
	POOL									
	CHNB	1.9 (1.2-3.3)		0.22 (0.06-0.33)		22 (10.8-29.5)		57 (23-106)		0
	TLWG									
	ITIP									
CONF	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
DEND	BAR									
	POOL									
	CHNB									
	TLWG									

Table 3 (continued).

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
ISB	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
OSB	BAR	0.45 (0.4-0.5)		0.1 (0.1-0.1)		22 (22-22)		68 (68-68)		0
	POOL									
	CHNB	2.1 (1.2-6.1)		0.2 (0.03-0.35)		26.1 (10.8-29.5)		40 (20-75)		0
	TLWG									
	ITIP									
SCCL	BAR	0.4 (0.4-0.5)		0.01 (0.01-0.01)		22 (22-22)		54 (54-54)		0
	POOL	2.9 (2.9-2.9)				10.8 (10.8-10.8)		77 (77-77)		0
	CHNB	2.4 (1.2-3.5)		0.14 (0.02-0.23)		18.2 (10.8-27)		73 (60-93)		0
	TLWG									
	ITIP									
SCCS	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									

Table 3 (continued).

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
SCCN	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
TRIB	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
TRML	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
TRMS	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									

*Year comparisons, Gear evaluation and Habitat associations*

No comparisons, evaluations, nor habitat associations were made for Segment 11 due to no pallid sturgeon captures in this segment during 2006.

### **Shovelnose X Pallid Sturgeon Hybrids**

Two shovelnose X pallid sturgeon were captured in Segment 11 during the 2006 season. Both fish were captured in gill nets at RM 9.0. Their fork lengths were 524- and 580-mm. Both hybrid sturgeon were captured in the outside bend in POOL mesohabitats and were associated with small sand bar microhabitats in open water areas near the bank line

## Targeted Native River Species

*Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River System.*

*Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.*

### Shovelnose Sturgeon

#### *Year and gear comparisons*

A total of 253 shovelnose sturgeon [fork length (FL) = 275 to 726 mm] was captured with gill nets (N = 154), 1-inch trammel nets (N = 97), and otter trawls (N = 2; Figure 17). Gill nets were the most effective gear, followed by trammel nets and otter trawls (CPUE = 7.70 fish/net night, 5.50 fish/100 m, and 0.092 fish/100 m, respectively) during the 2006 sampling season. No shovelnose sturgeon were captured with 2.5-inch trammel nets.

One-inch trammel nets captured a wider size-range of shovelnose sturgeon (275- to 726-mm FL) than gill nets (481- to 713-mm FL; Tables 17 through 24). Otter trawls were not effective in capturing small shovelnose sturgeon (N= 2, 423 and 588-mm FL). Overall, GN were the most effective gear for sampling large shovelnose sturgeon (>380-mm FL; Figure 11). No shovelnose sturgeon less than stock size (250-mm FL) were captured, and 94% of shovelnose sturgeon captured were longer than 510-mm FL (Table 25).

## Segment 11 - Shovelnose Sturgeon / Sturgeon Season

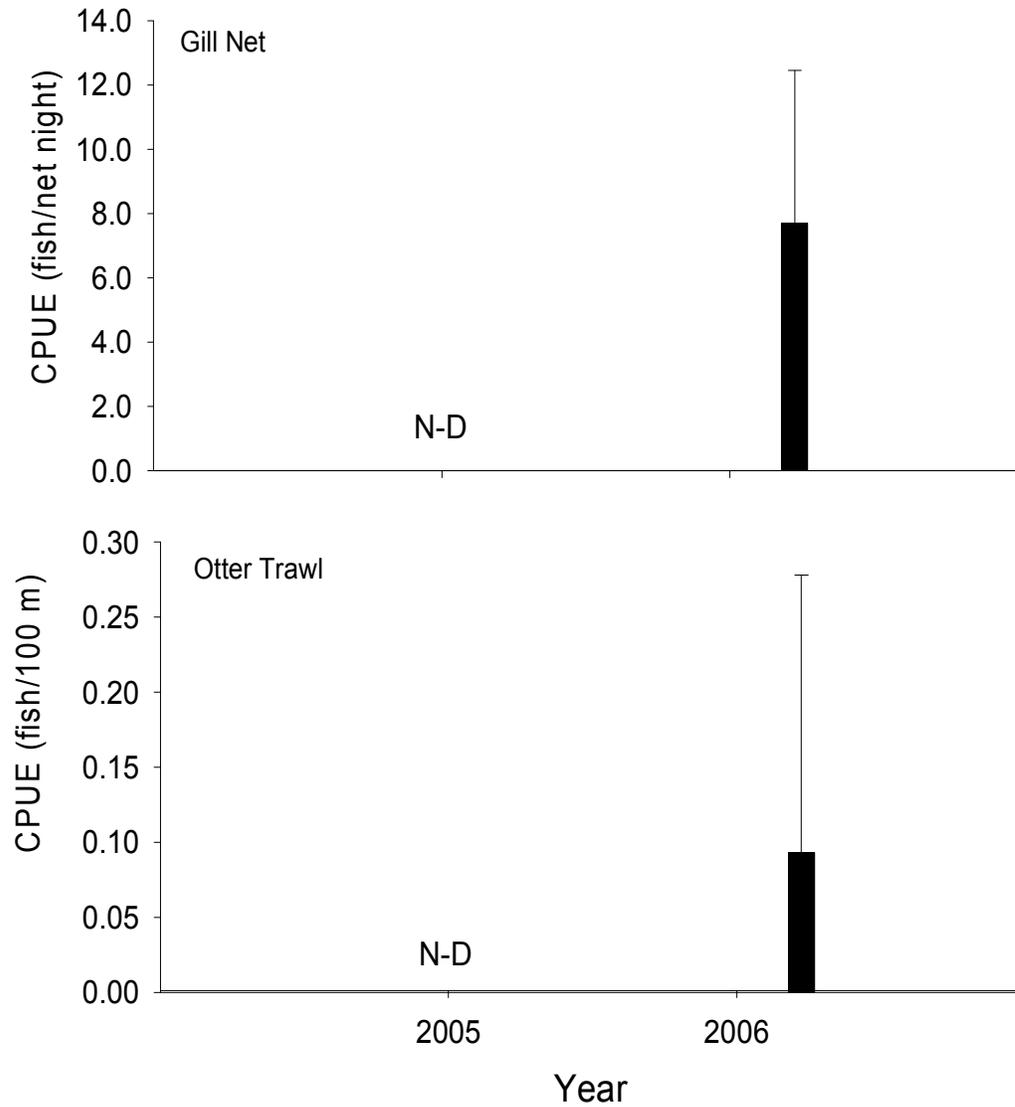


Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 11, the Kansas River during sturgeon season 2005 - 2006.

## Segment 11 - Shovelnose Sturgeon / Sturgeon Season

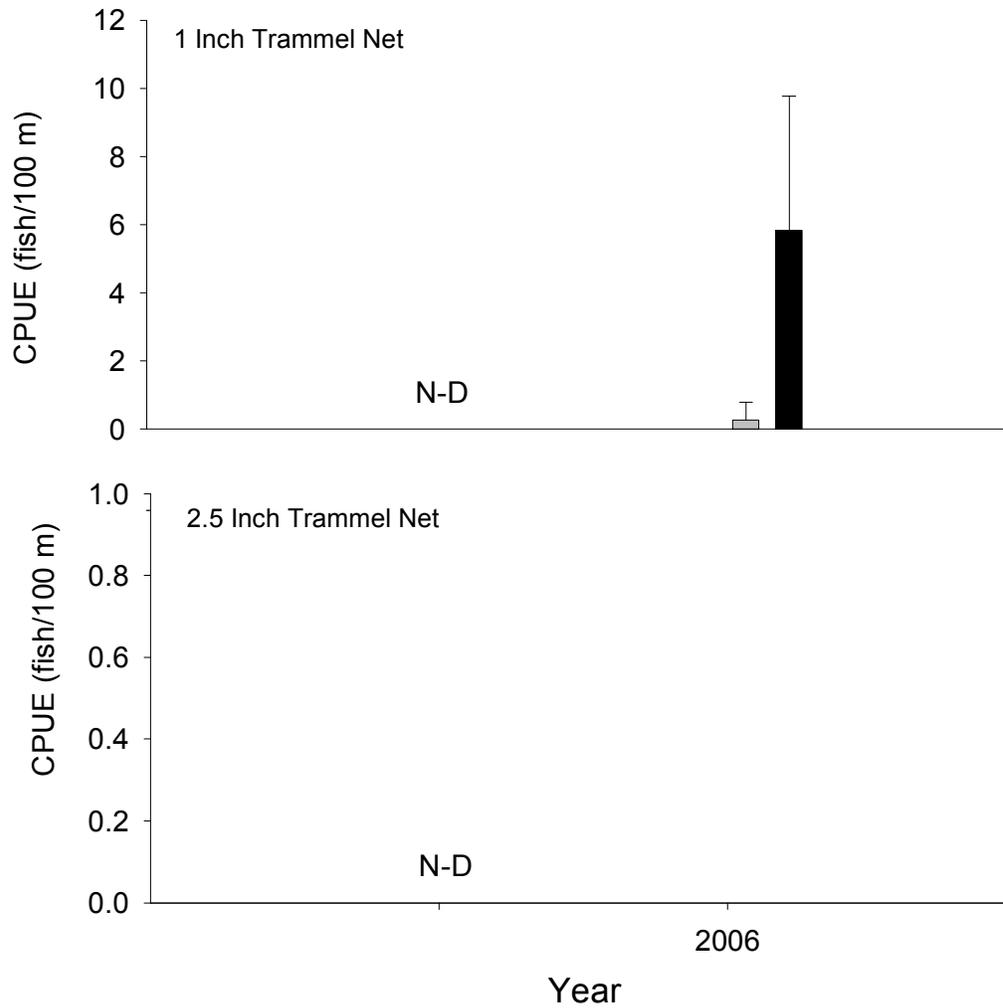


Figure 12. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 and 2.5 inch trammel nets in segment 9, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Shovelnose Sturgeon / Sturgeon Season



Figure 13. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon using beam trawls in segment 11, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Shovelnose Sturgeon / Fish Community Season

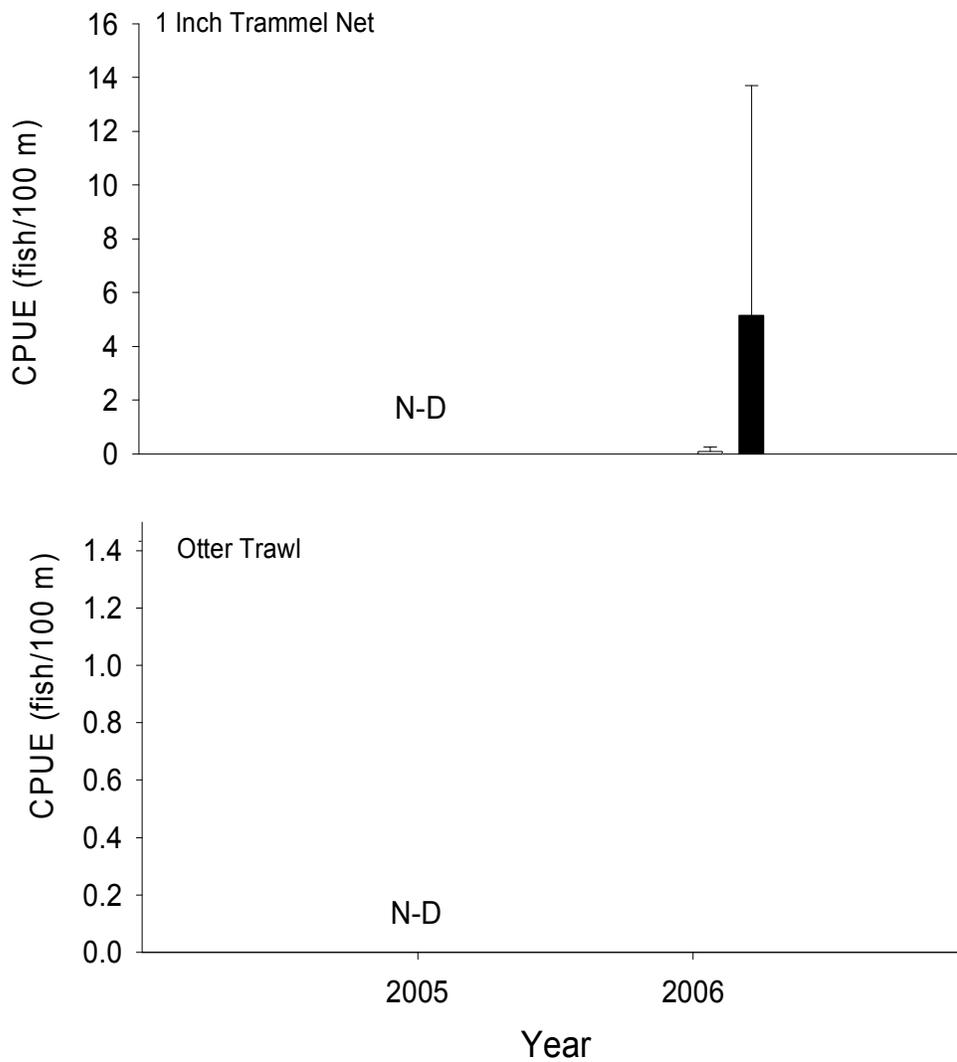


Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 11, the Kansas River, during fish community season 2005 - 2006.

## Segment 11 - Shovelnose Sturgeon / Fish Community Season

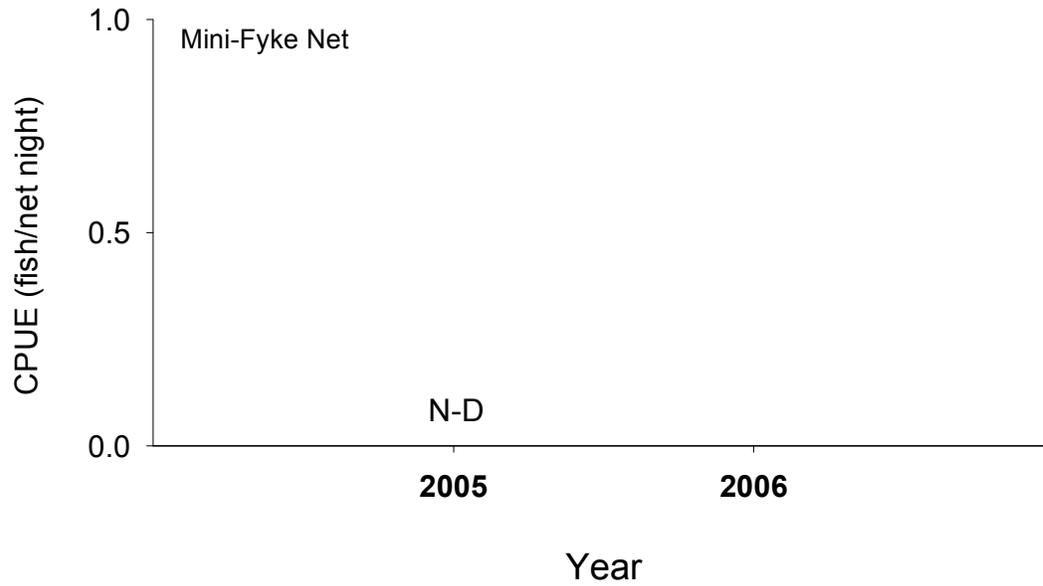


Figure 15. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 11, the Kansas River, during fish community season 2005 - 2006.

Shovelnose sturgeon were most frequently captured in gill nets, and were captured in proportion to the amount of effort expended in each macrohabitat (Figures 17 – 24). Shovelnose sturgeon were most frequently captured in gill nets set in outside bends (OSB), with channel cross-over (CHXO) capturing a similar amount (50 and 44%, respectively). A similar amount of effort was expended in those habitats (50 and 40%, respectively). Among trammel nets set during fish community (FC) season, most of the shovelnose sturgeon captured occurred in inside bend macrohabitats (ISB; 73%), though 78% of the FC trammel net effort was expended in ISB. During sturgeon season, trammel nets most frequently captured shovelnose sturgeon in outside bends (54%). Otter trawls only captured 2 shovelnose sturgeon, both in outside bend macrohabitats. Gill nets were the only gear that sampled both channel border (CHNB) and pool (POOL) mesohabitats. Only one-tenth of the gill net effort was in POOLs, but 29% of the shovelnose sturgeon were caught there. Ninety percent of the gill net effort was expended in channel borders, while this mesohabitat comprised 70% of the catch. Among trammel nets and otter trawls, all effort was expended in channel border (CNHB) mesohabitats. Therefore, all shovelnose sturgeon were captured in this habitat.

Most (61%) of the shovelnose sturgeon were caught with gill nets in microhabitats influenced by channel sand bars. One-inch trammel nets in bank line habitats captured 37% of the fish, while 1-inch trammel nets in habitats influenced by wing dikes caught 2% of the shovelnose sturgeon. All of the shovelnose sturgeon caught in wing dike and channel sand bar areas were caught in open water.

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0		0 (25)				0 (37)	0 (38)	0 0				0 0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0 0				0 0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0 0				0 0		
Otter Trawl	0		0 (26)				0 (58)	0 (16)	0 0				0 0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0		0 (22)				0 (78)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0 0					0 0	
Otter Trawl	0		0 (23)				0 (77)	0 0	0 0					0 0	

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	0		0 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0		0 (25)				0 (37)	0 (38)	0 0				0 0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0 0				0 0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0 0				0 0		
Otter Trawl	0		0 (26)				0 (58)	0 (16)	0 0				0 0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0		0 (22)				0 (78)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0 0					0 0	
Otter Trawl	0		0 (23)				0 (77)	0 0	0 0					0 0	

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	0		0 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	2		0 (25)				0 (37)	100 (38)	0				0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0				0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0				0		
Otter Trawl	0		0 (26)				0 (58)	0 (16)	0				0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	1		0 (22)				100 (78)	0	0					0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0					0	
Otter Trawl	0		0 (23)				0 (77)	0	0					0	

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	2		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	0		1 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	1	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Table 23. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	37		24 (25)				24 (37)	51 (38)	0 0				0 0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0 0				0 0		
Beam Trawl															
Gill Net	154		44 (40)				5 (10)	51 (50)	0 0				0 0		
Otter Trawl	2		0 (26)				0 (58)	100 (16)	0 0				0 0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	57		7 (22)				93 (78)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0 0					0 0	
Otter Trawl	0		0 (23)				0 (77)	0 0	0 0					0 0	

Table 24. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	37		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	154		71 (90)	0 0	29 (10)	
Otter Trawl	2		100 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	57	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

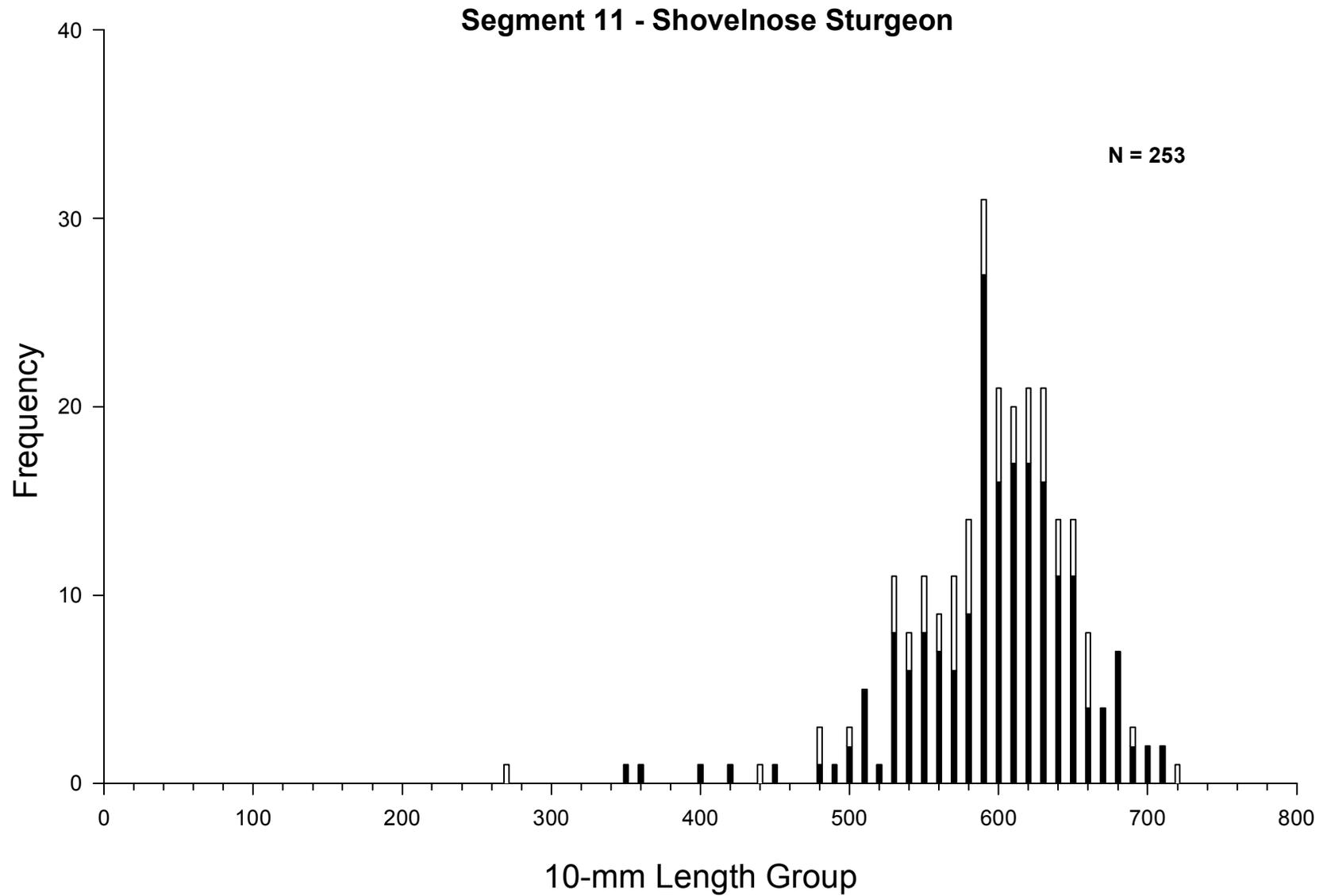


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 - 2006.

Table 25. Incremental relative stock density (RSD)<sup>a</sup> and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 11, the Kansas River, captured during 2005 – 2006. Length categories<sup>b</sup> determined using methods proposed by Quist (1998).

<b>Length category</b>	<b>N</b>	<b>RSD</b>	<b>Wr (+/- 2SE)</b>
<b>Sturgeon Season</b>			
Sub-stock (0-149 mm)	0		0
Sub-stock (150-249 mm)	0		0
Stock	2		95.159 (3.49)
Quality	7	350.00	99.03 (12.774)
Preferred	143	7150.00	89.513 (1.616)
Memorable	43	2150.00	85.059 (3.487)
Trophy			
Overall Wr	195		88.951 (1.522)
<b>Fish Community Season</b>			
Sub-stock (0-149 mm)	0		0
Sub-stock (150-249 mm)	0		0
Stock	1		86.074
Quality	4	400.00	81.787 (5.043)
Preferred	41	4100.00	87.806 (1.972)
Memorable	12	1200.00	77.995 (3.947)
Trophy			
Overall Wr	58		85.331 (1.947)

<sup>a</sup> RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) \* 100.

<sup>b</sup> Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock FL < 250 mm (20 %), Stock FL = 250-379 mm (20 – 36 %), Quality FL = 380 – 509 mm (36 – 45 %), Preferred FL = 510 - 639 mm (45 – 59 %), Memorable FL = 640 – 809 mm (59 – 74 %), Trophy FL > 810 mm (>74 %).

## **Sturgeon Chub**

There were no sturgeon chubs captured in Segment 11 during the 2006 sampling season.

## **Sicklefin Chub**

Sicklefin chubs were the least common *Macrhybopsis* species encountered ( $N = 1$ ) during the 2006 season. This individual was captured during the sturgeon season, and the total length from this individual was 26 mm. Mean CPUE for otter trawls was 0.633 fish/100 m and this was the only gear that captured sicklefin chubs (Figure 22). As a result, all sicklefin chubs were captured in a CHNB mesohabitat and a ISB macrohabitat because this was the only habitat sampled with otter trawls.

## Segment 11 - Sicklefin Chub / Sturgeon Season

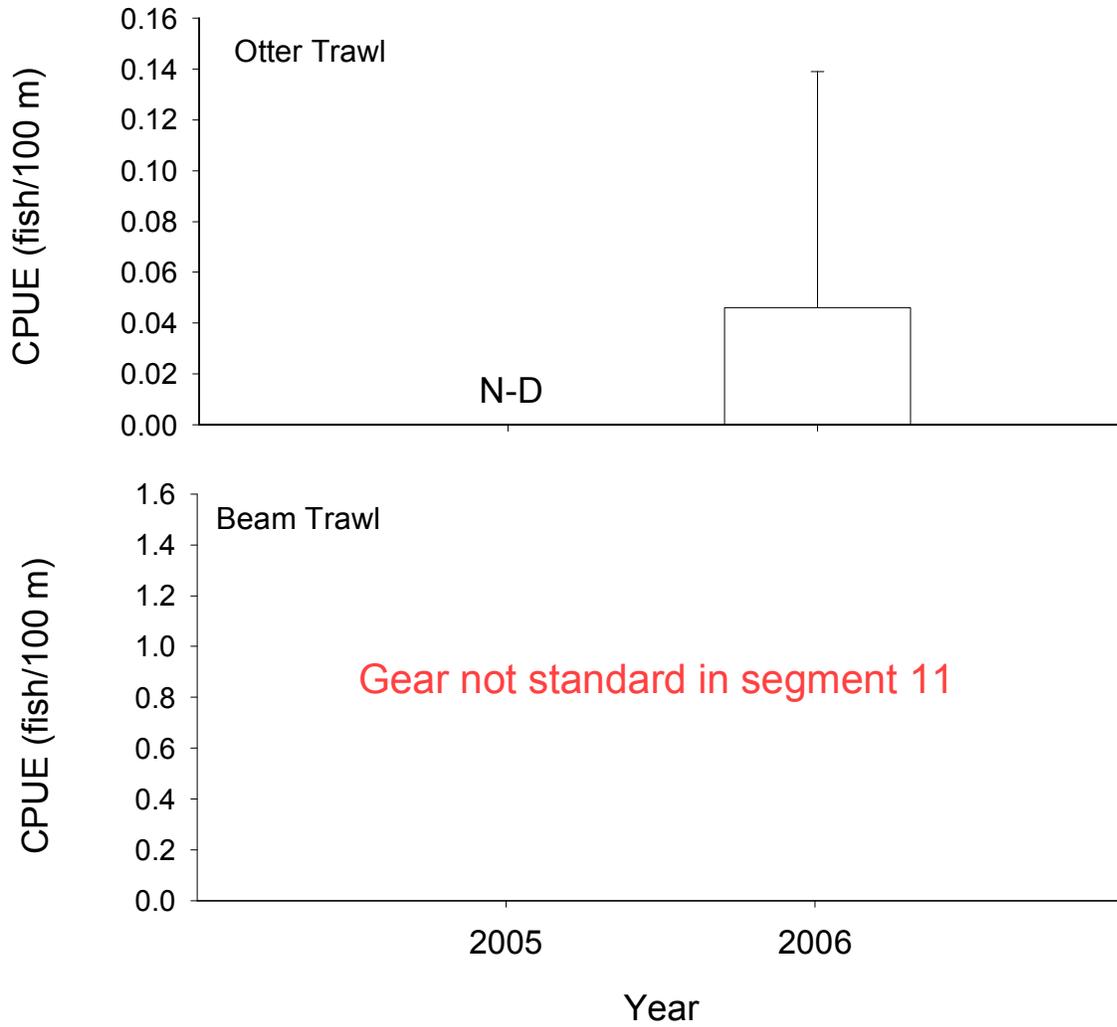


Figure 22. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sicklefin chub using otter trawls and beam trawls in segment 11, the Kansas River, during sturgeon season 2005-2006.

## Segment 11 - Sicklefin Chub / Fish Community Season

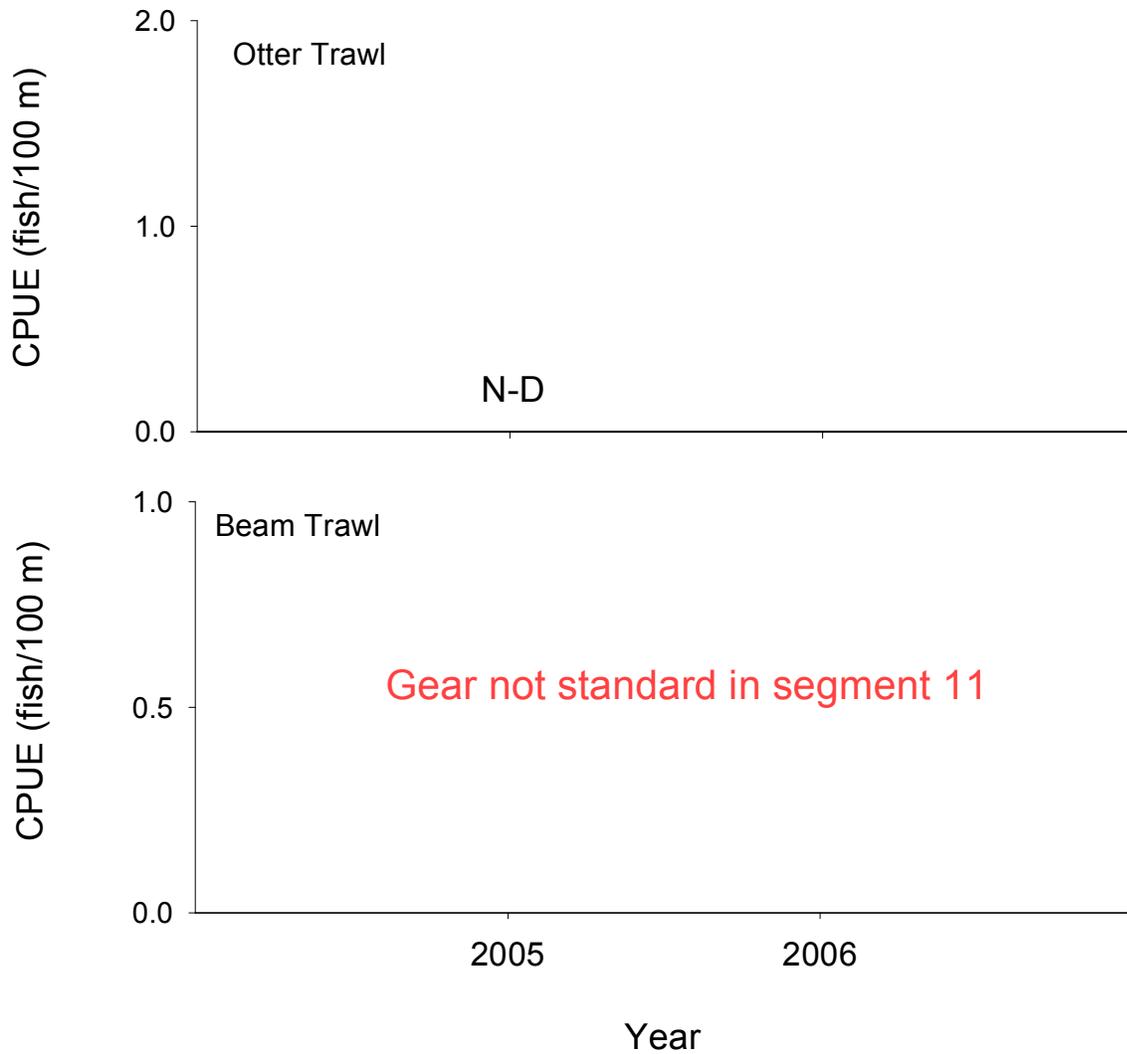


Figure 23. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sicklefin chub using otter trawls and beam trawls in segment 11, the Kansas River, during fish community season 2005-2006.

## Segment 11 - Sicklefin Chub / Fish Community Season

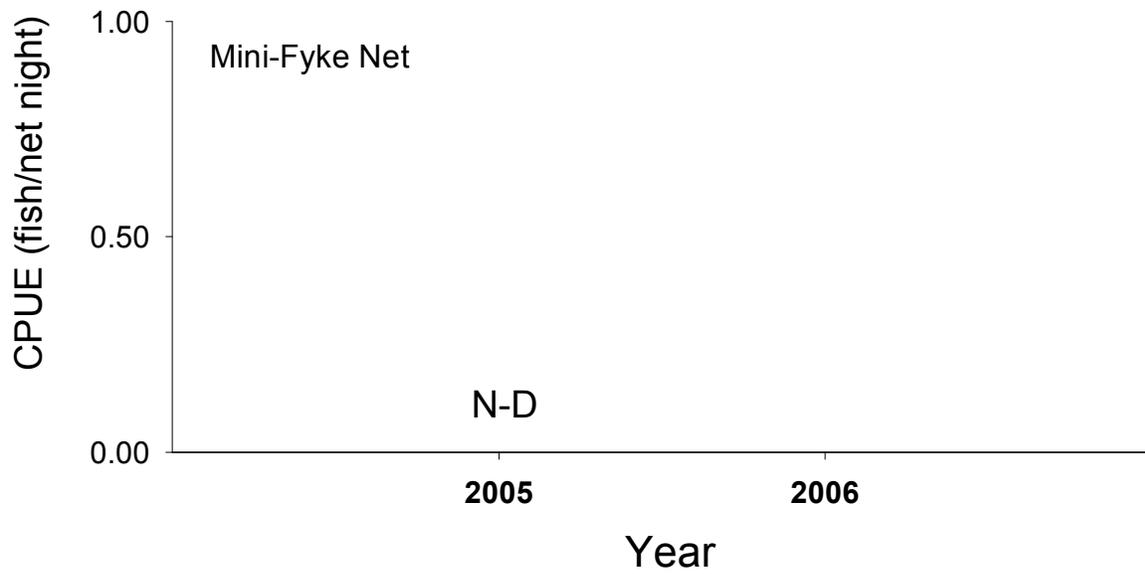


Figure 24. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sicklefin chub using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005-2006.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0		0 (25)				0 (37)	0 (38)	0				0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0				0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0				0		
Otter Trawl	1		0 (26)				0 (58)	100 (16)	0				0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0		0 (22)				0 (78)	0	0					0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0					0	
Otter Trawl	0		0 (23)				0 (77)	0	0					0	

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	1		100 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

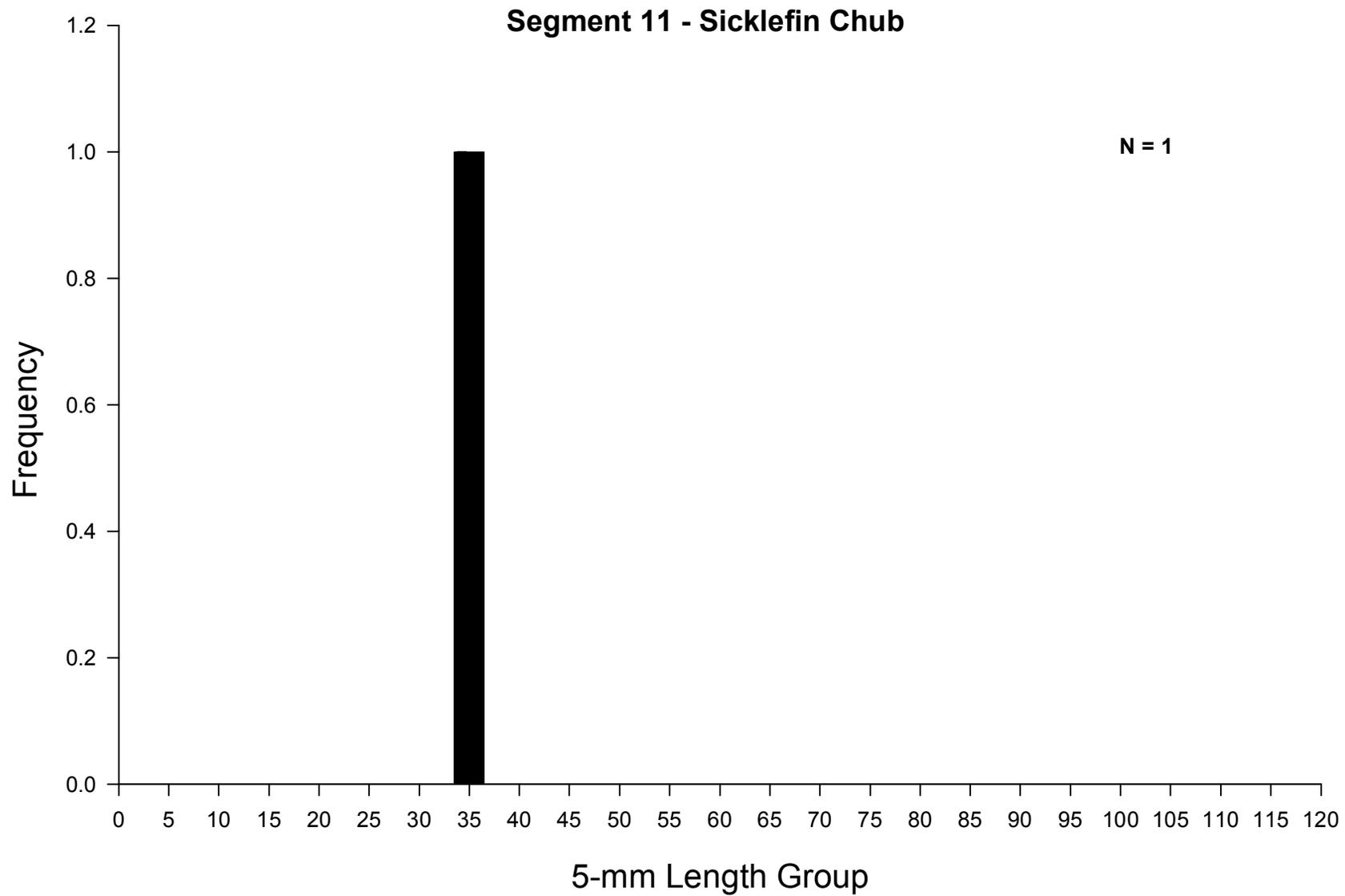


Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005- 2006.

## **Speckled Chub**

There were no speckled chubs captured in Segment 11 during the 2006 sampling season.

## **Sand Shiner**

Sand shiners (N = 95) were the second most-frequently captured target species. This species was captured using mini-fyke nets (N = 68) and otter trawls (N = 27). Mini-fyke nets were much more efficient at capturing sand shiners than otter trawls (CPUE = 8.5 fish/ net night and 1.176 fish/ 100 m, respectively; Figures 30 and 32). Total length of sand shiners ranged from 28 to 50 mm (mean = 37.6; Figure 33). Ninety-five percent of the catch in mini fyke nets were in inside bend macrohabitats, while only 63% of the effort was expended there (Table 32). Similarly, 41% of sand shiners captured with otter trawls were on the outside bend, while only 25% of the effort was expended there. All mini-fyke nets and otter trawl effort was in sand bar and channel border habitats, respectively; therefore, all sand shiners were captured in those respective habitats (Table 33). Forty-one percent of the sand shiners caught with otter trawls during sturgeon season were captured in microhabitats influenced by wing dikes, and the remaining 59% were caught along natural bank-lines. Within mini-fyke net catch, 54% of the catch was in microhabitats influenced by sand bars. Mini-fyke nets set in close proximity to bank lines accounted for 46% of the catch (97% of which were natural bank lines).

## Segment 11 - Sand Shiner / Sturgeon Season

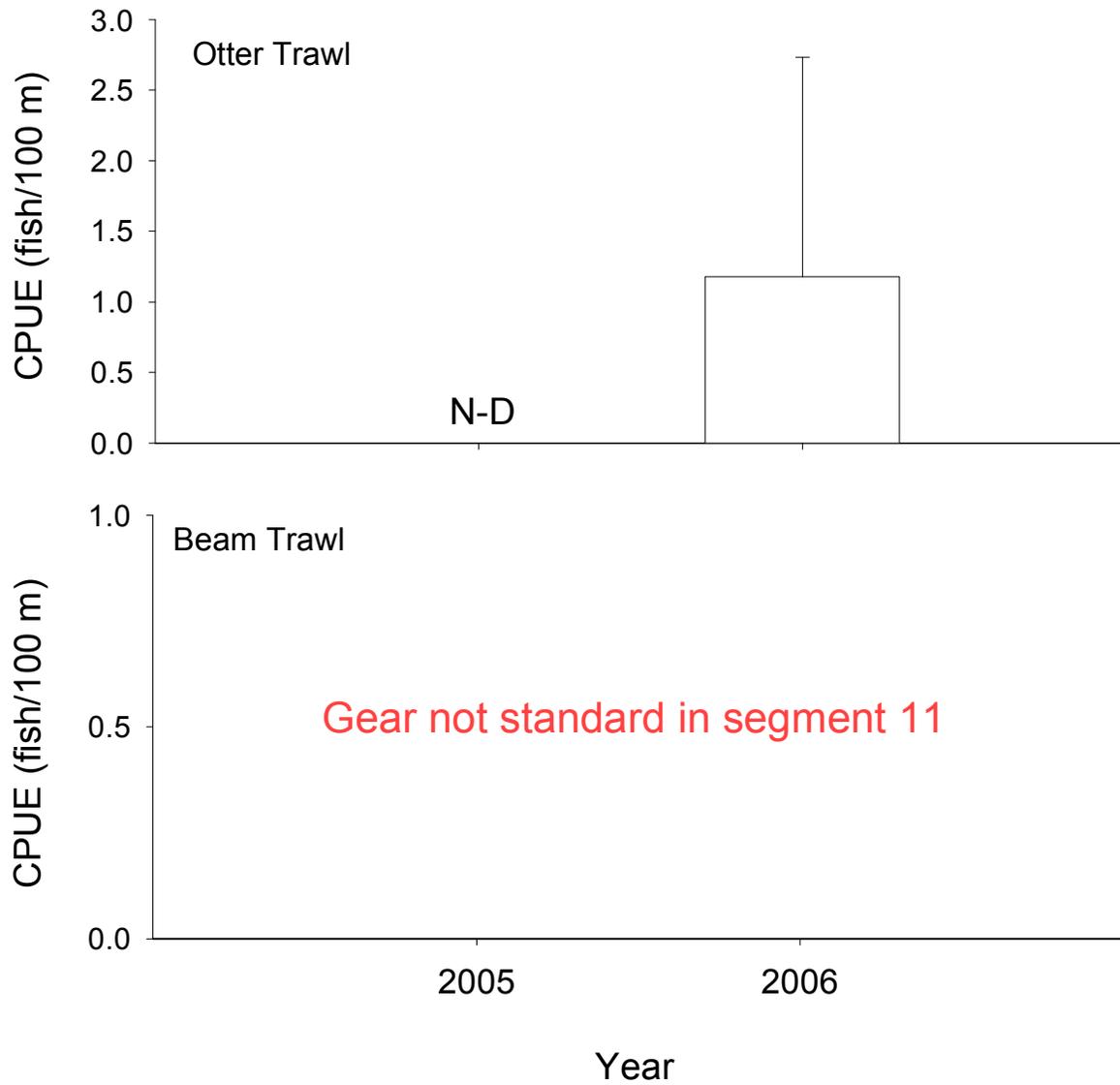


Figure 30. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sand shiner with otter trawls and beam trawls in segment 11, the Kansas River, during sturgeon season 2005 -2006.

## Segment 11 - Sand Shiner / Fish Community Season

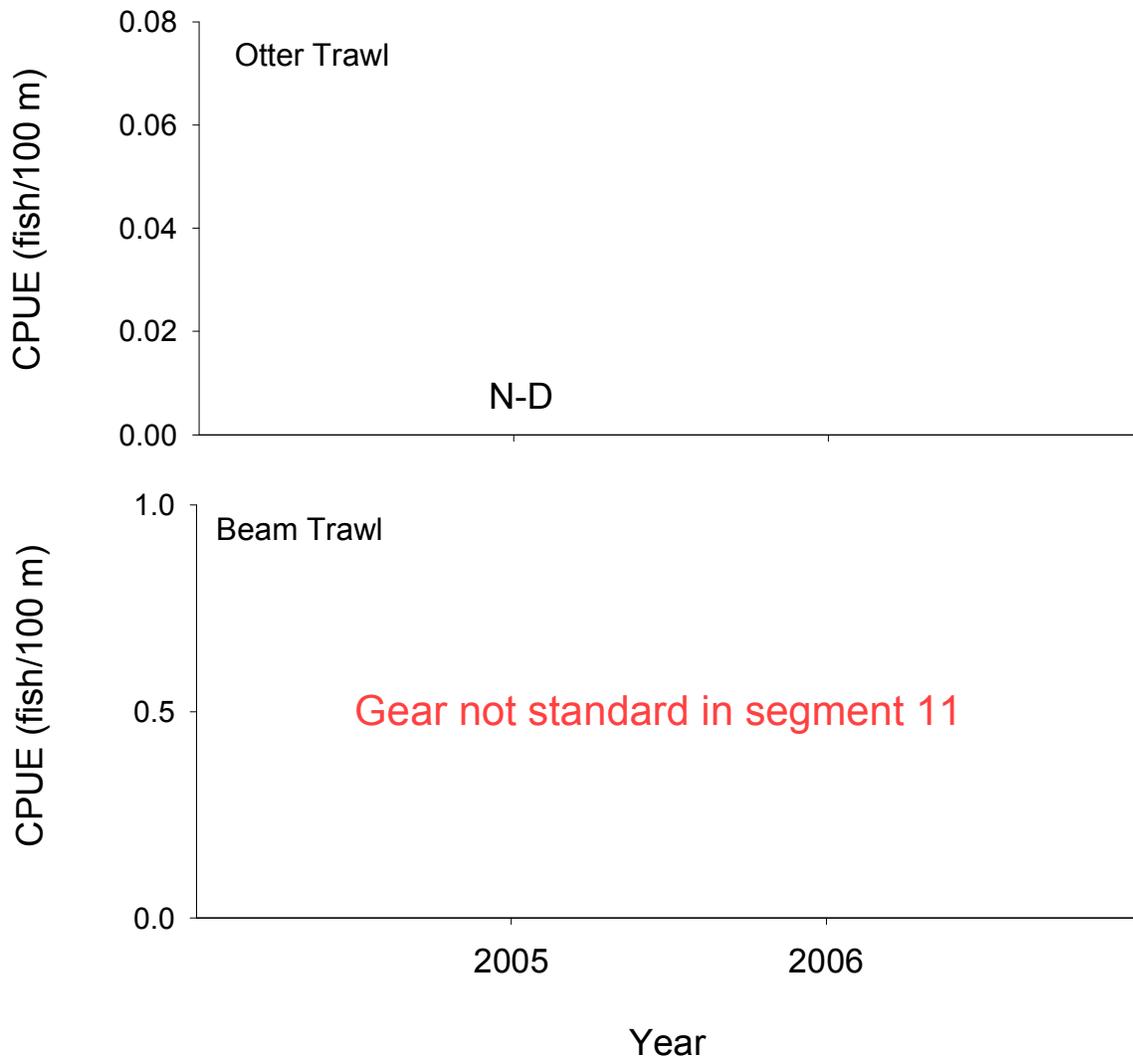


Figure 31. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sand shiner with otter trawls and beam trawls in segment 11, the Kansas River, during fish community season 2005 -2006.

## Segment 11 - Sand Shiner / Fish Community Season

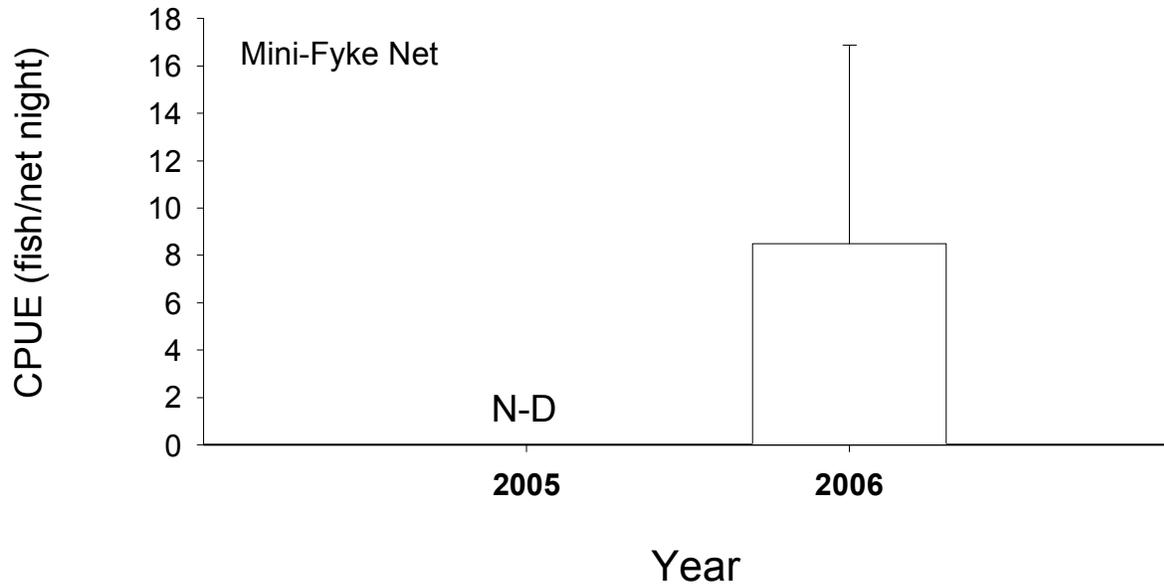


Figure 32. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sand shiner with mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 - 2006.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0		0 (25)				0 (37)	0 (38)	0				0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0				0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0				0		
Otter Trawl	27		0 (26)				59 (58)	41 (16)	0				0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0		0 (22)				0 (78)	0	0					0	
Beam Trawl															
Mini-Fyke Net	68		5 (25)				95 (50)	0 (25)	0					0	
Otter Trawl	0		0 (23)				0 (77)	0	0					0	

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	27		100 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	68	100 (100)	0 0			
Otter Trawl	0	0 0	8 (100)			

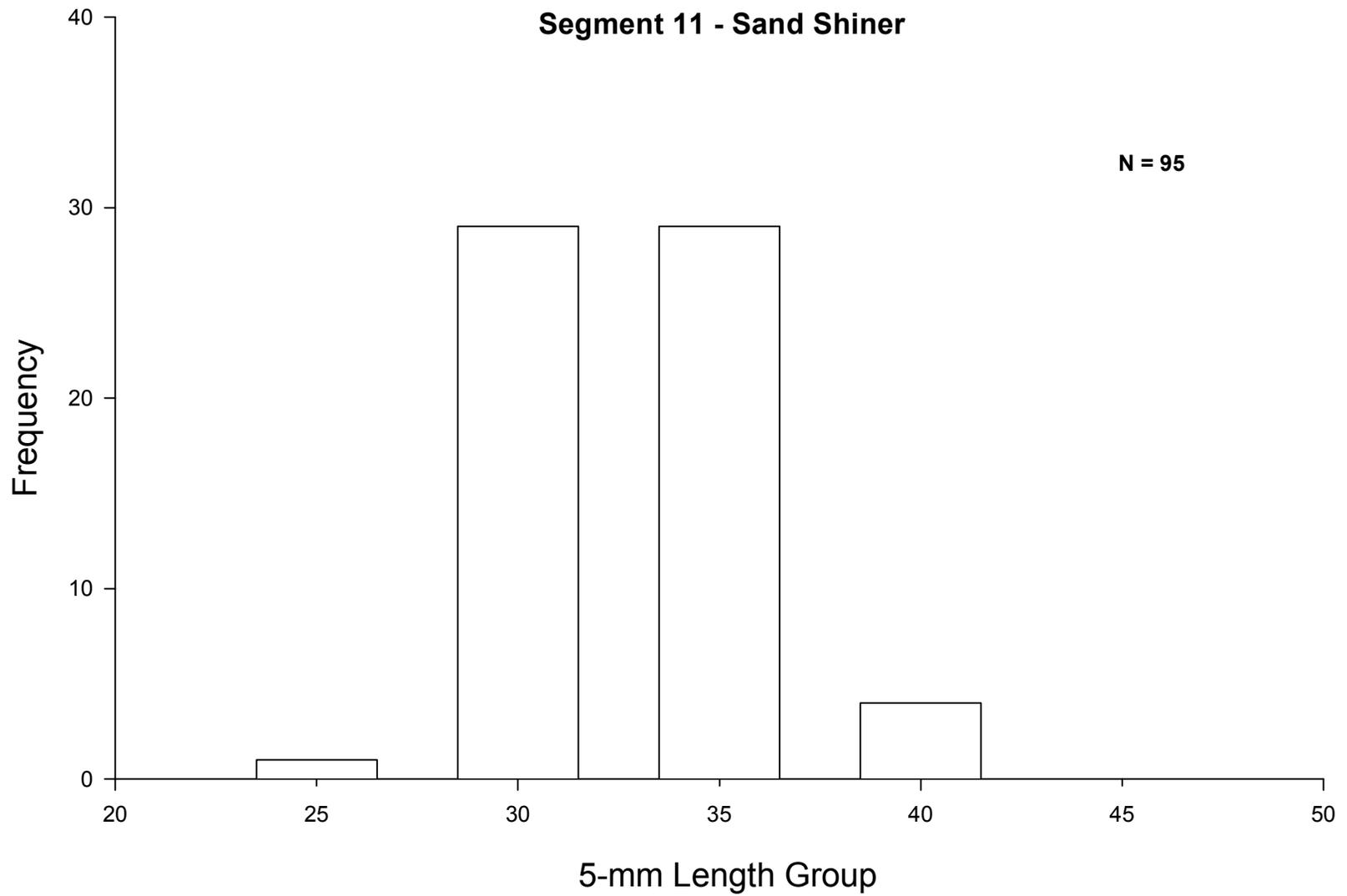


Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 - 2006.

***Hybognathus spp.***

No *Hybognathus sp.* were captured in Segment 11 during the 2006 sampling season.

## **Blue Sucker**

Six blue suckers were captured using gill nets ( $N = 4$ ; mean CPUE = 0.2 fish/ net night) and trammel nets ( $N = 2$ ; mean CPUE = 0.296 fish/100 m) during the 2006 season (Figure 38 and 39). Otter trawls and mini-fyke nets did not capture any blue suckers. Total length of blue suckers ranged from 581 to 697 mm (mean fork length = 689 mm; Figure 44). Blue suckers in gill nets were captured in channel cross-over, inside bend, and outside bend macrohabitats (50, 25, and 25%, respectively; Table 36). One of the blue suckers captured with a trammel net was in the channel cross-over, and the other was in the inside bend (Table 37). All blue suckers were captured in channel border mesohabitats. Those captured with gill nets were in open-water microhabitats influenced by channel sand bars. All blue suckers in trammel nets were caught in open water microhabitats in proximity to natural bank lines.

# Segment 11 - Blue Sucker / Sturgeon Season

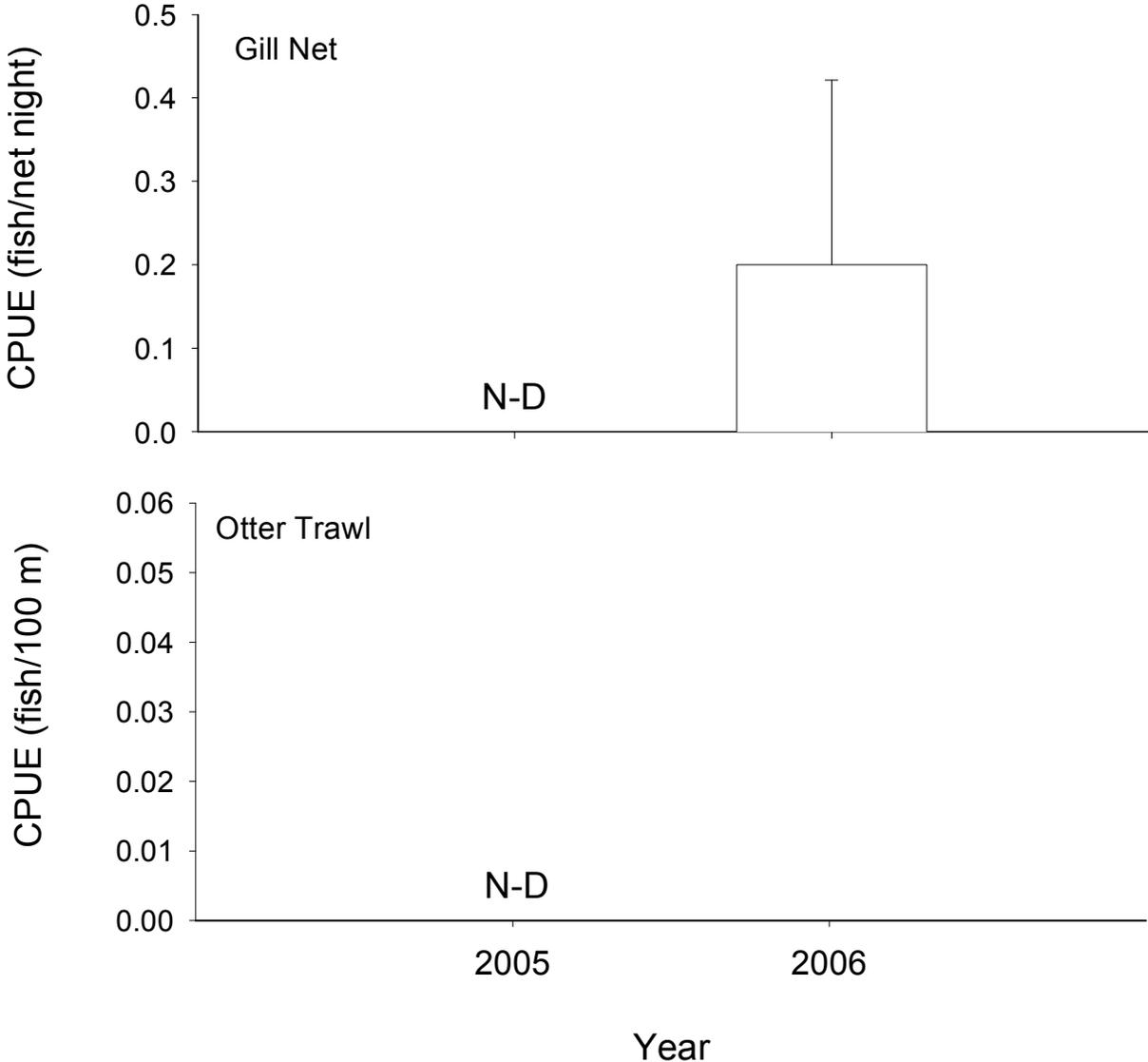


Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Blue Sucker / Sturgeon Season

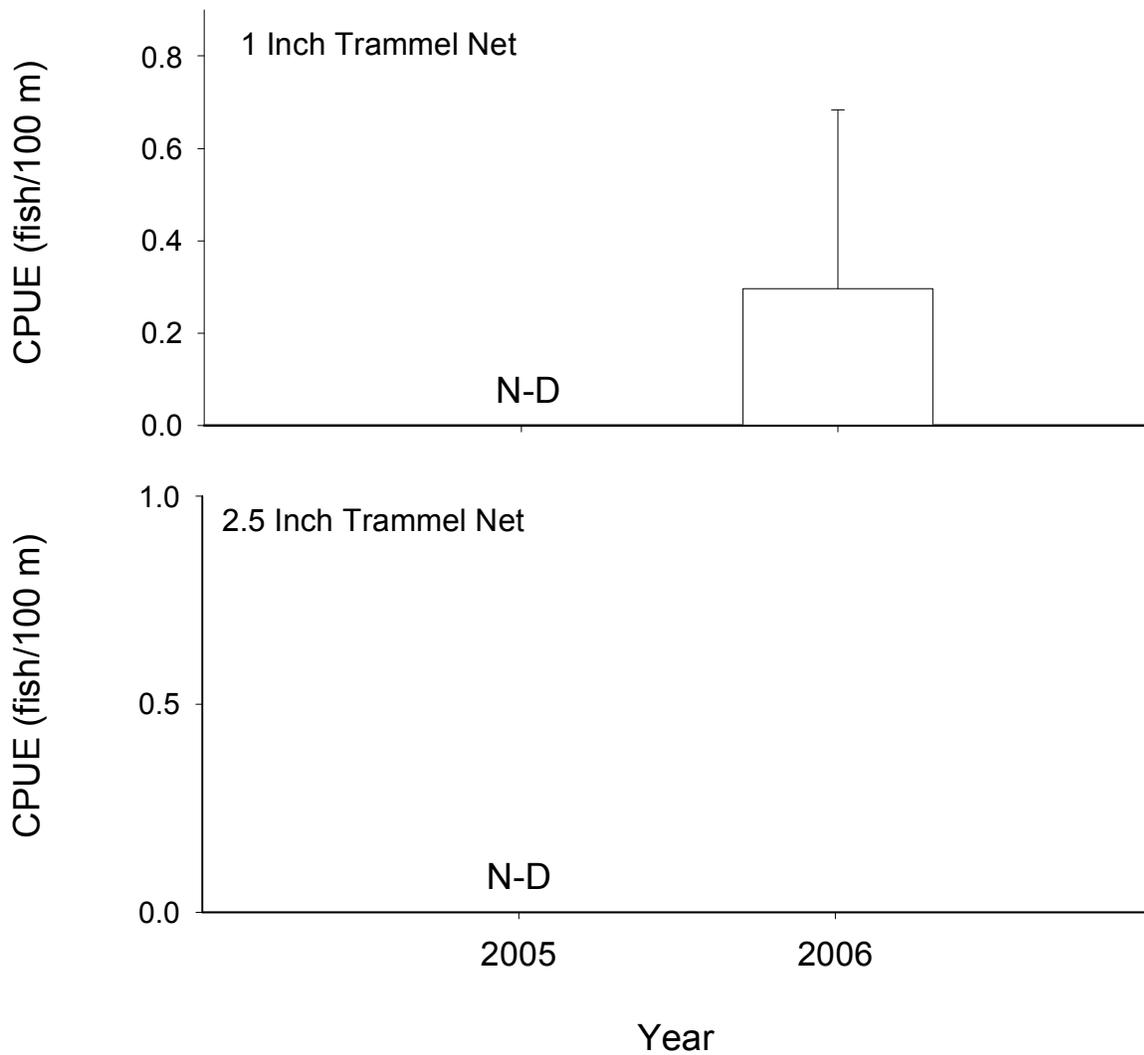


Figure 39. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker with 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Blue Sucker / Fish Community Season

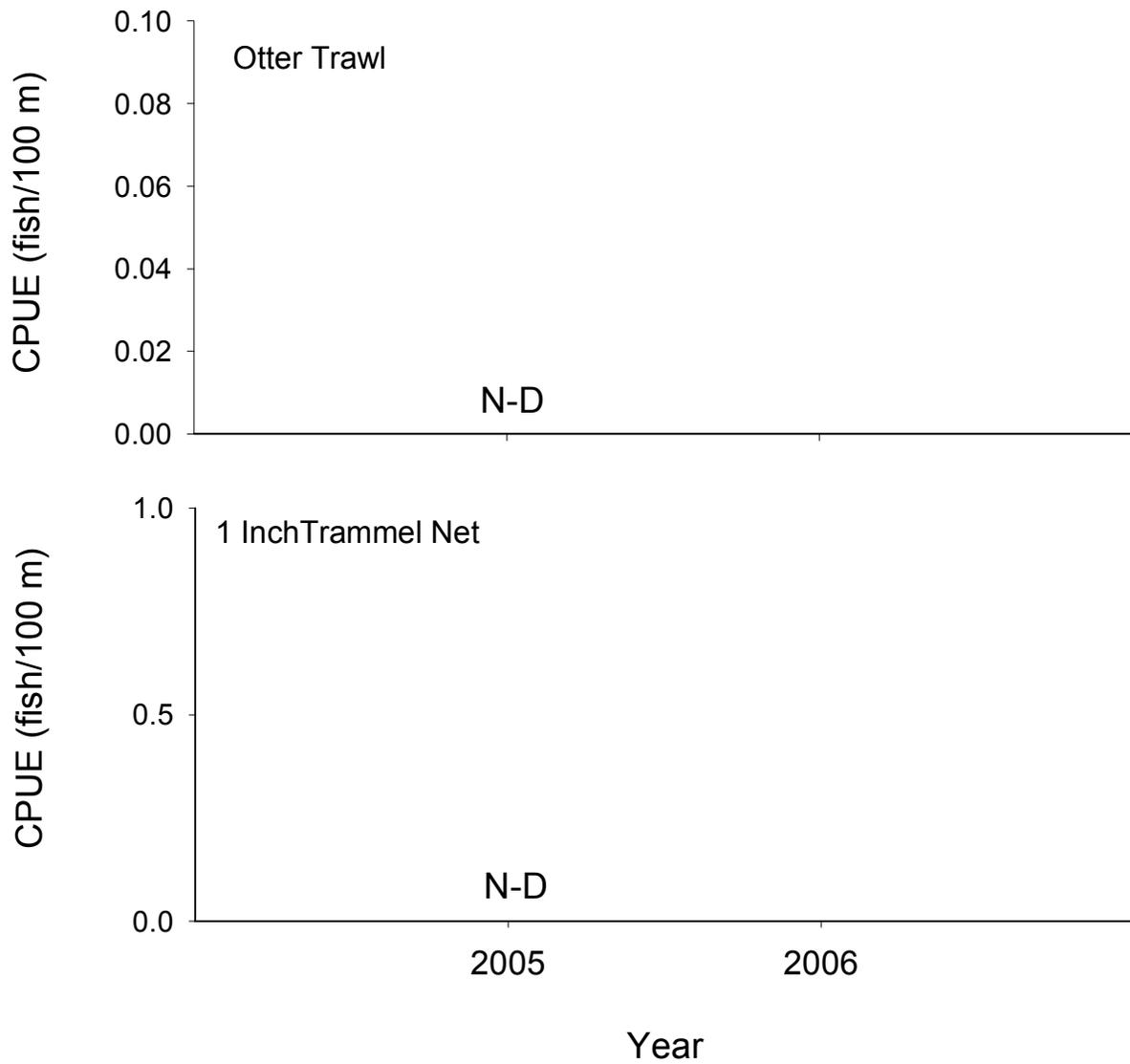


Figure 41. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker using otter trawl and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005 - 2006.

## Segment 11 - Blue Sucker / Fish Community Season

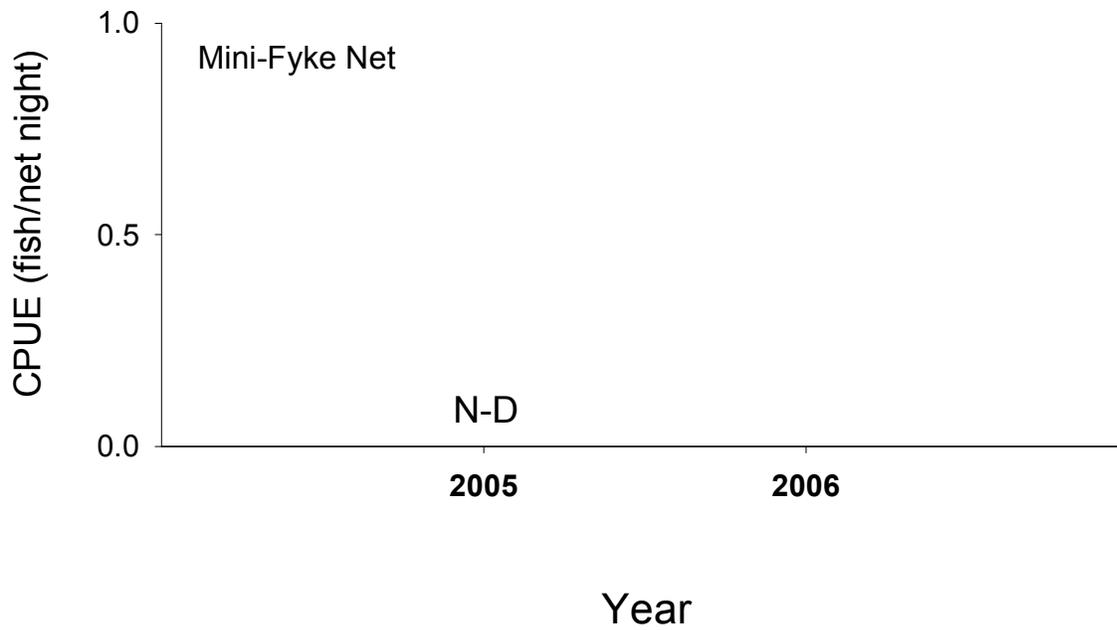


Figure 42. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue suckers using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 - 2006.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	2		50 (25)				50 (37)	0 (38)	0 0				0 0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0 0				0 0		
Beam Trawl															
Gill Net	4		50 (40)				25 (10)	25 (50)	0 0				0 0		
Otter Trawl	0		0 (26)				0 (58)	0 (16)	0 0				0 0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0		0 (22)				0 (78)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0 0					0 0	
Otter Trawl	0		0 (23)				0 (77)	0 0	0 0					0 0	

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	2		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	4		100 (90)	0 0	0 (10)	
Otter Trawl	0		0 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

### Segment 11 - Blue Sucker

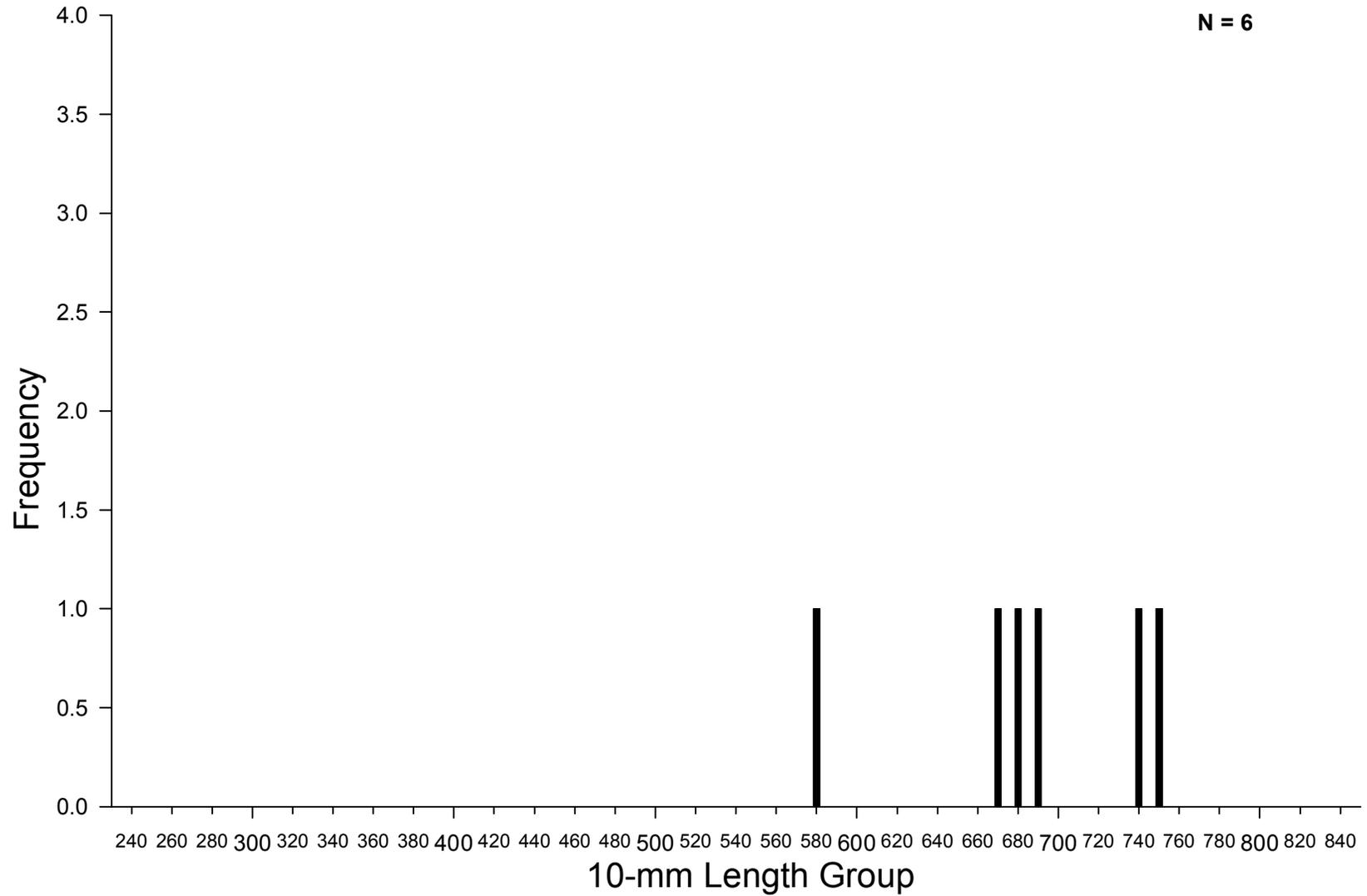


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005 - 2006.

## **Sauger**

Sauger were infrequently sampled ( $N = 3$ ) during the 2006 fish season. These fish were caught in trammel nets during sturgeon and fish community season (CPUE = 0.151 and 0.042 fish/ 100 m, respectively; Figure 46 and 48) and in otter trawls during sturgeon season (CPUE = 0.162 fish/ 100 m; Figures 46). Fork lengths for the fish were 361, 324, and 278 mm (Figure 51). All fish were captured in the inside bend macrohabitat and channel border mesohabitat (Tables 38 and 39).

## Segment 11 - Sauger / Sturgeon Season

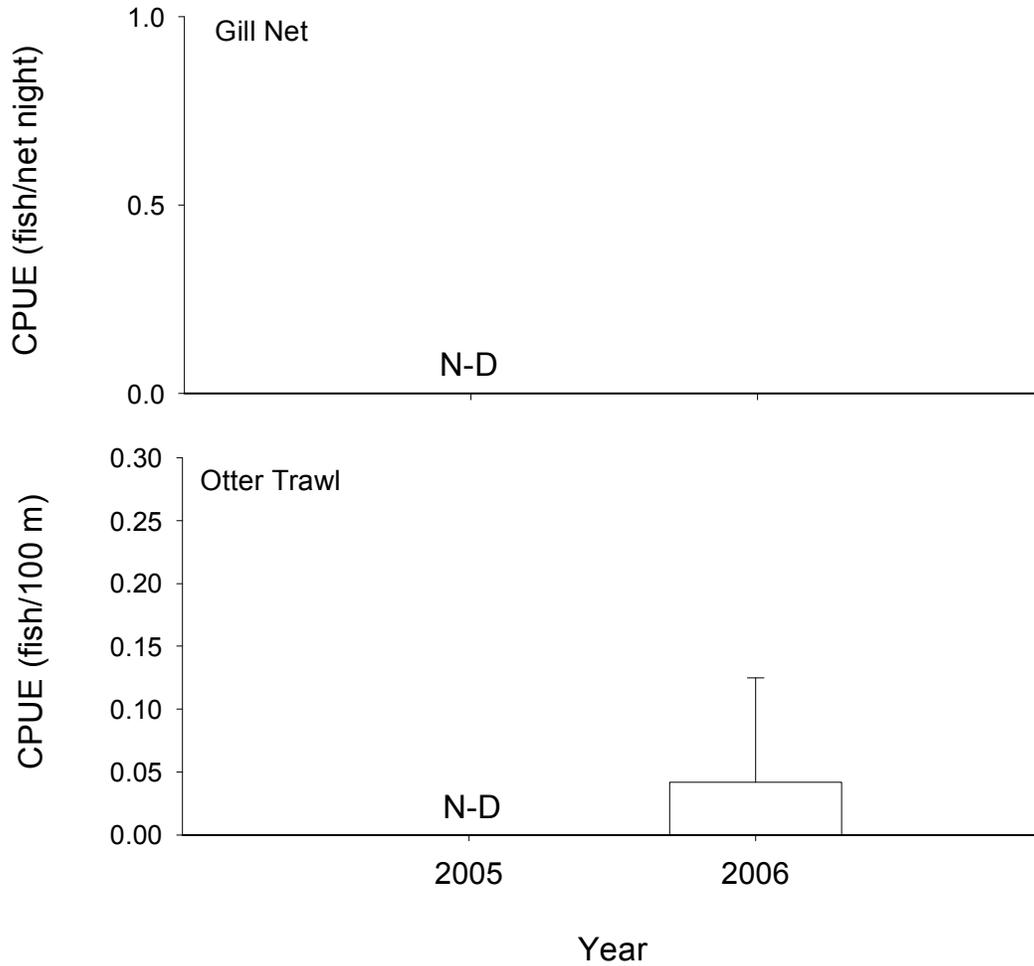


Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using gill nets and otter trawls in segment 11, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Sauger / Sturgeon Season

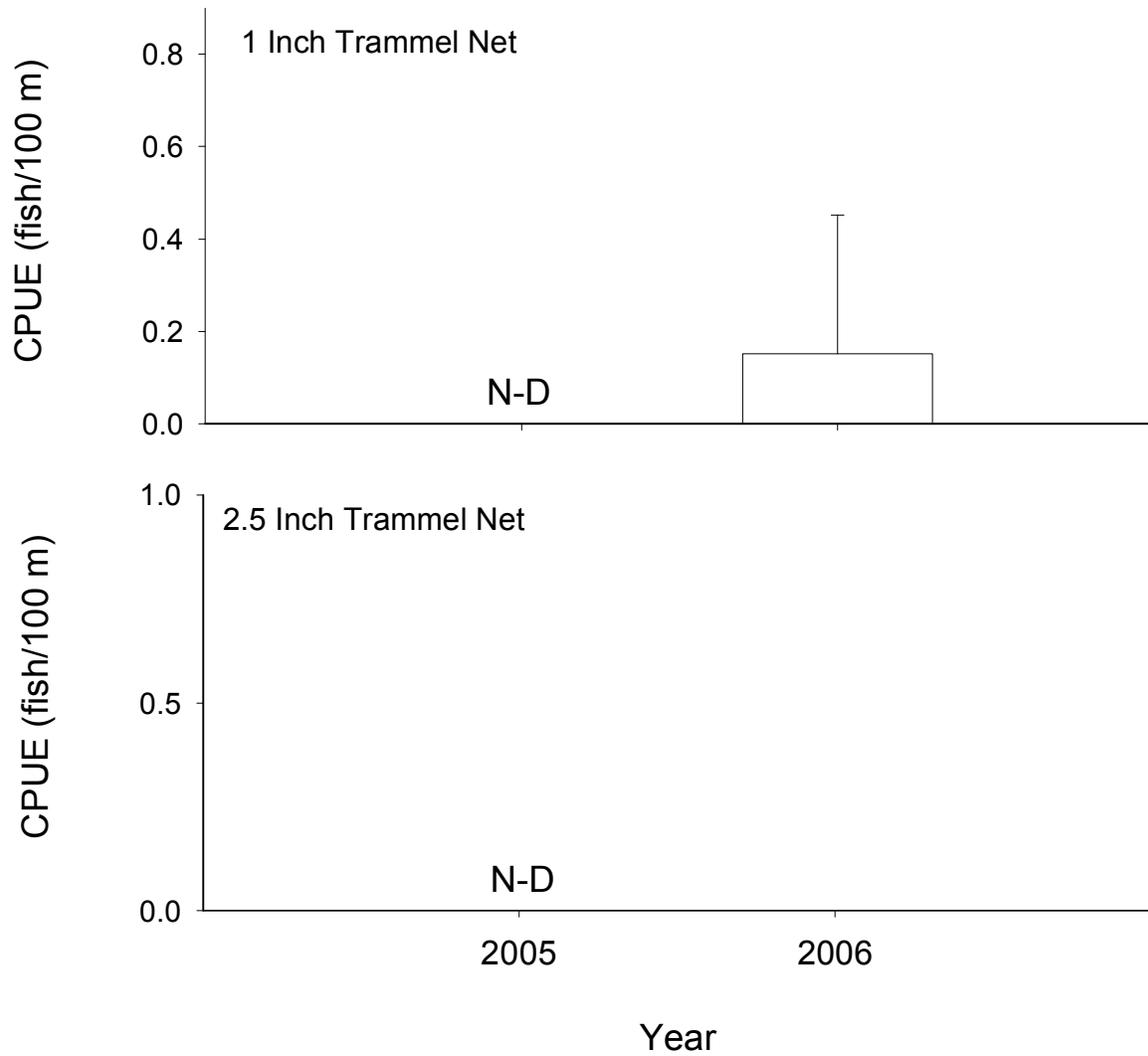


Figure 46. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger using 1 and 2.5 inch trammel nets in segment 11, the Kansas River, during sturgeon season 2005 - 2006.

## Segment 11 - Sauger / Fish Community Season

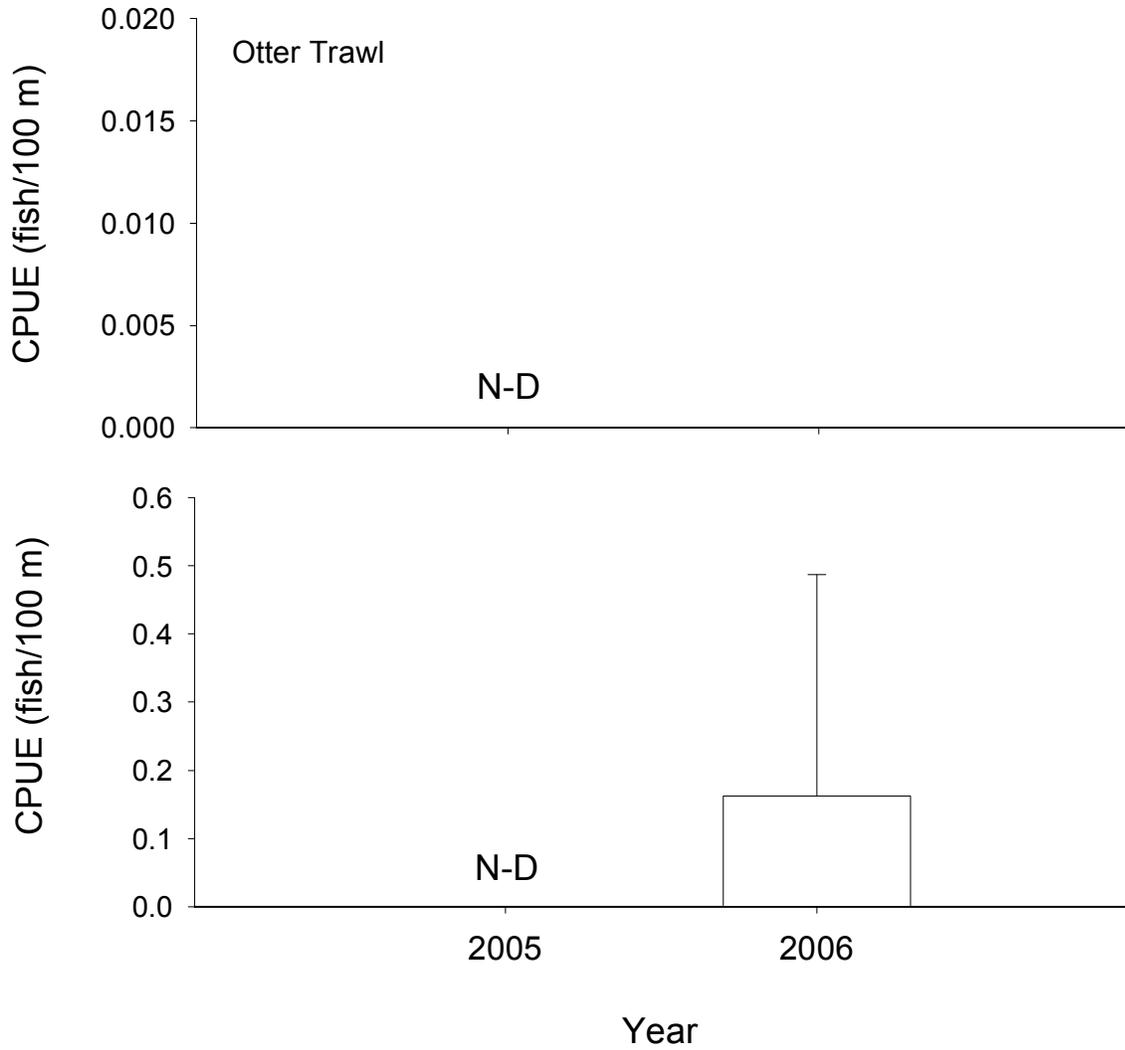


Figure 48. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sauger using otter trawls and 1 inch trammel nets in segment 11, the Kansas River, during fish community season 2005 - 2006.

## Segment 11 - Sauger / Fish Community Season

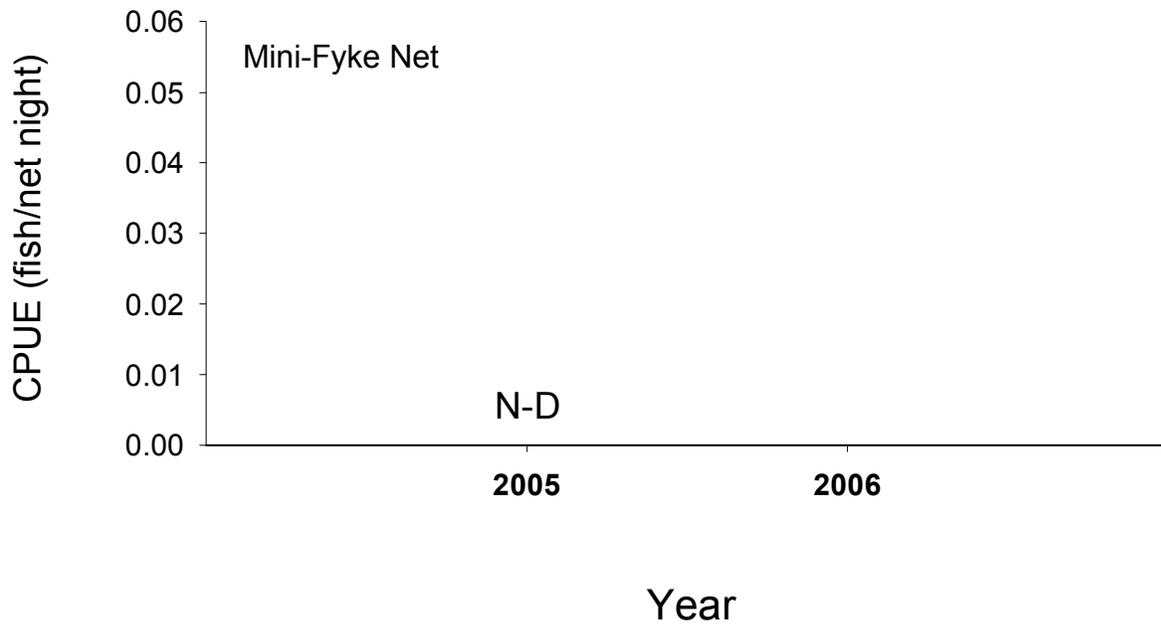


Figure 49. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger using mini-fyke nets in segment 11, the Kansas River, during fish community season 2005 - 2006.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	1		0 (25)				100 (37)	0 (38)	0				0		
2.5 Inch Trammel Net	0		0 (25)				0 (38)	0 (37)	0				0		
Beam Trawl															
Gill Net	0		0 (40)				0 (10)	0 (50)	0				0		
Otter Trawl	1		0 (26)				100 (58)	0 (16)	0				0		
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	1		0 (22)					0 (78)	0	0				0	
Beam Trawl															
Mini-Fyke Net	0		0 (25)				0 (50)	0 (25)	0					0	
Otter Trawl	0		0 (23)				0 (77)	0	0	0				0	

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 11, the Kansas River, during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1 Inch Trammel Net	1		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (90)	0 0	0 (10)	
Otter Trawl	1		100 (100)	0 0	0 0	
<b>Fish Community Season (Summer)</b>						
1 Inch Trammel Net	1	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

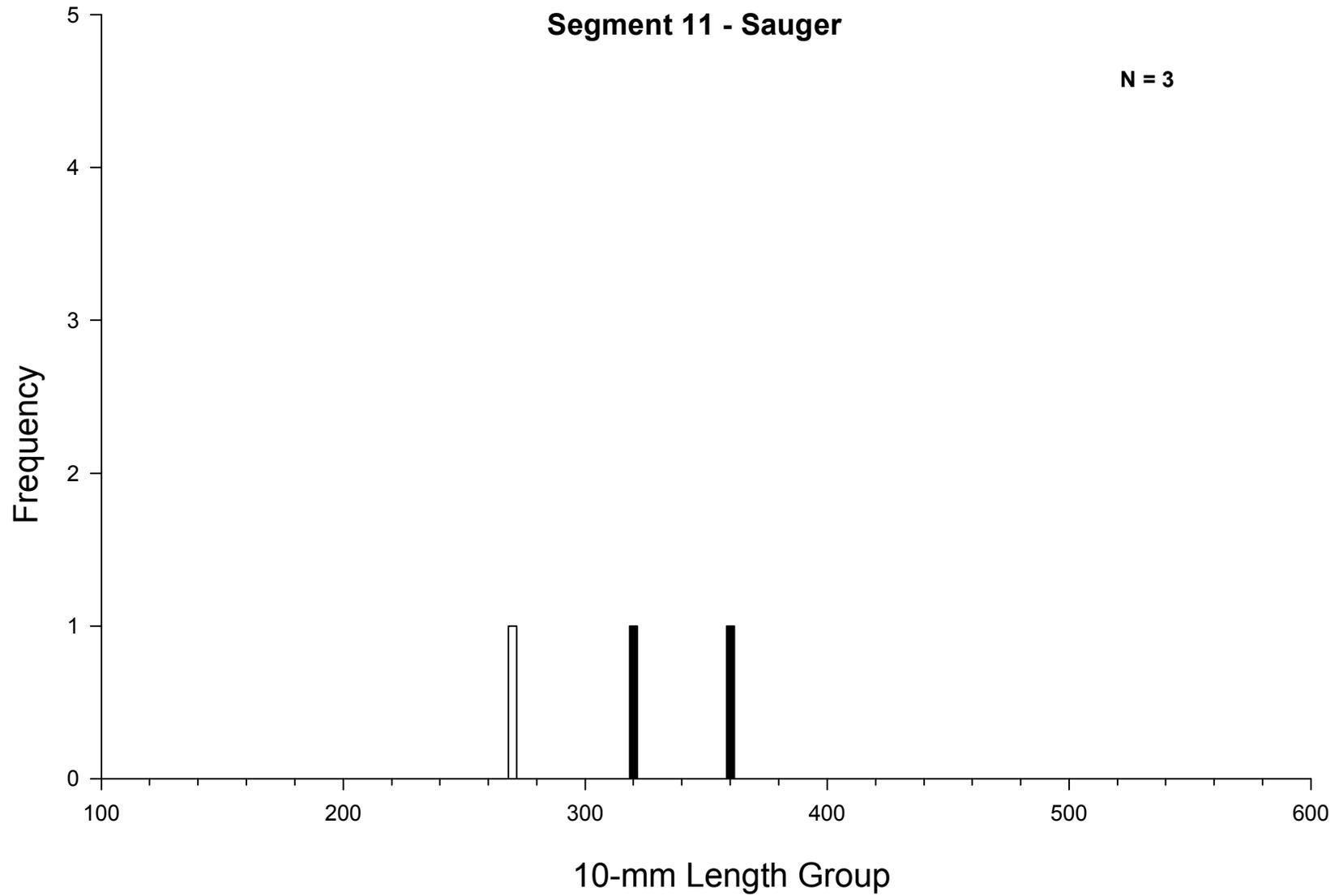


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 11, the Kansas River, during 2005-2006.

## **Kansas River Fish Community**

**Objective 6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.**

A total of 2,000 fish representing 36 species was captured in Segment 11 in all standard gear types during the 2006 season. Six non-target species were represented by at least 50 individuals with non-target species composing 82% of the total catch. Sampling gears deployed in BARS mesohabitats accounted for 54% of the total catch while CHNB and POOL mesohabitats produced 44 and 2.5%, respectively. Gears deployed in BARS mesohabitats captured fewer species (21) than those deployed in CHNB mesohabitats (25).

Gill nets captured 13 species in 20 net nights and only captured one non-target species with greater than 50 individuals (Appendix F1, river carpsucker, CPUE = 0.3 fish/net night). One-inch trammel nets captured 12 species in 865 meters drifted (Appendix F2). River carpsucker and channel catfish (both with CPUE = 0.2 fish/100 m) were the only non-target species captured by one-inch trammel nets with at least 50 individuals. The 2.5-inch trammel net had the lowest catch for all species but was the most efficient gear to capture river carpsuckers (Appendix F3, CPUE = 0.9 fish/100 m). A notable catch of one quillback sucker was captured with the 2.5-inch trammel net. Otter trawls captured 15 species including five non-target species with at least 50 individuals (Appendix F4). Channel catfish and bullhead minnows (CPUE = 10.1 and 7.9, respectively) were most effectively captured with otter trawls. Mini-fyke nets captured 21 species in eight net night, including six species represented by at least 50 individuals (Appendix F6). Mini-fyke nets were the most effective gear to sample the following four non-target Kansas River species (CPUE = number of fish/net night): red shiner = 61.7, bullhead minnow = 28.3, emerald shiner = 10.3, and bluegill = 8.1. No standardized sampling for the PSPAP was conducted in Segment 11 prior to 2006, and thus, no comparisons among years could be made.

## Discussion

Only one bend of Segment 11, the Kansas River, has been sampled by the Pallid Sturgeon Population Assessment Program (PSPAP). Because of this, no year-to-year comparisons can be made. However, some inferences from this preliminary year of data can be made. No pallid sturgeon were captured in Segment 11 during the 2006 fish community season. However, shovelnose sturgeon were the most frequently sampled target fish species (N = 253). Gill nets were the most efficient gear at capturing shovelnose sturgeon (N = 154, 7.70 fish/ net night), followed by 1-inch trammel nets (N = 97, 5.50 fish/ 100 m). Most shovelnose sturgeon were captured in microhabitats influenced by small channel sandbars (61%), while only 17% of the gear effort was expended there. This is largely due to the fact that most of the shovelnose sturgeon were caught in gill nets, and all the gill nets were set in sandbar habitats. Most of the catch on the Missouri River is in areas influenced by wing dikes. However, because there is no effort to maintain a navigable channel on the Kansas River, there are very few dikes. Therefore, channel sand bars may be important habitats for the shovelnose sturgeon in the Kansas River.

The shovelnose sturgeon catch was composed of mostly large fish. Fork lengths (FL) ranged from 275 to 726-mm. There were no shovelnose sturgeon less than stock size (<250-mm FL) and 94% of the catch was greater than 510-mm. This skewed length-frequency might be attributed to the fact that only one bend was sampled, therefore, gill nets were only deployed once, and trammel nets and otter trawls only twice. The study area and number of sampling events simply might have been too small to represent all fish sizes. More frequent and wide-spread sampling will be conducted in the future sampling seasons.

Sicklefin chubs were the only *Macrophybopsis* spp. captured in Segment 11 during the 2006 season. They were the least-frequently captured of all target species encountered (N = 1). The sicklefin chub was captured in an otter trawl, with a CPUE of 0.063 fish/100 m. The fish was captured in the channel border mesohabitat, and inside bend macrohabitat.

Sand shiners were the most frequently captured target species in Segment 11 during the 2006 season (N = 96). Sand shiners in Segment 11 during the 2006 season were captured in greater numbers in mini-fyke nets (CPUE = 8.5 fish/ net night) compared to otter trawls (CPUE = 1.176 fish/100 m). Perhaps this could be attributed to the difference in sampling gears; that is, mini-fyke nets are often deployed in shallow water habitats where sand shiners are more likely to be found (Pflieger 1997). More sand shiners were captured in one bend in Segment 11 than in

all four bends combined in segment 10 of the Missouri River (N = 54). The lengths of the sand shiners ranged from 28-50-mm FL, which is an average range for sand shiner lengths.

Blue sucker catch was low in segment 11 (N= 6). Trammel nets were slightly more efficient in catching blue suckers than gill nets (CPUE = 0.296 fish/ 100 m and 0.2 fish/ net night, respectively). In segment 10, more blue suckers were captured (N = 33) compared with other segments, and they were captured using four gears: gill nets, 2.5-inch trammel nets, 1-inch trammel nets, and otter trawls. The range of fork lengths for blue suckers was small (581-697-mm). The lack of small (i.e., young) blue suckers has also been noted for segments in the Missouri River (Doyle et al. 2005).

Only three sauger were collected in Segment 11 during the 2006 season. Two were collected during sturgeon season, and one during fish community season. Similarly, very few sauger were collected during the fish community season in Segment 10 during either 2005 or 2006 (N = 3 and 0, respectively). Historically, most sauger captured by the PSPAP have been caught during the sturgeon season in gill nets, however, all of the sturgeon caught in segment 11 were in 1-inch trammel nets and otter trawls.

## Wild Gear

There was one gear used during the 2006 sampling season that were not included in the standard, random sampling reported in this document (see Drobish 2006b for definitions). This gear was the 4 mm-mesh otter trawl (OT01) that was implemented in 2006 as an experimental, or “wild”, gear (Appendix C). This gear did not capture any pallid sturgeon, though it did capture 1,095 individual fish. Fifteen species were captured; of those two were target species. Only one species, the bullhead minnow, was represented by at least 50 individuals. In fact, the bullhead minnow (N = 984) made up 90% of the catch in the OT01 net in segment 11, the Kansas River. The otter trawl captured one target species, the speckled chub (N = 5), that the standard, random sampling gears did not (CPUE = 0.66 fish/ 100 m). The other target species captured in OT01, sauger, was only represented by one individual (CPUE = 0.114 fish/100 m).

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## **APPENDICES**

Appendix A. Phylogenetic list of Missouri River fishes with corresponding letter codes used in the long-term pallid sturgeon and associated fish community sampling program. The phylogeny follows that used by the American Fisheries Society, Common and Scientific Names of Fishes from the United States and Canada, 5<sup>th</sup> edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
<b>Petromyzontidae – lampreys</b>		
<i>Ichthyomyzon castaneus</i>	Chestnut lamprey	CNLP
<i>Ichthyomyzon fossor</i>	Northern brook lamprey	NBLP
<i>Ichthyomyzon unicuspis</i>	Silver lamprey	SVLP
<i>Ichthyomyzon gagei</i>	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLV
CLASS OSTEICHTHYES – BONY FISHES		
ORDER ACIPENSERIFORMES		
<b>Acipenseridae – sturgeons</b>		
<i>Acipenser fulvescens</i>	Lake sturgeon	LKSG
<i>Scaphirhynchus</i> spp.	Unidentified Scaphirhynchus	USG
<b><i>Scaphirhynchus albus</i></b>	<b>Pallid sturgeon</b>	<b>PDSG*</b>
<b><i>Scaphirhynchus platyrhynchus</i></b>	<b>Shovelnose sturgeon</b>	<b>SNSG*</b>
<i>S. albus</i> X <i>S. platyrhynchus</i>	Pallid-shovelnose hybrid	SNPD
<b>Polyodontidae – paddlefishes</b>		
<i>Polyodon spathula</i>	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
<b>Lepisosteidae – gars</b>		
<i>Lepisosteus oculatus</i>	Spotted gar	STGR
<i>Lepisosteus osseus</i>	Longnose gar	LNGR
<i>Lepisosteus platostomus</i>	Shortnose gar	SNGR
ORDER AMMIFORMES		
<b>Amiidae – bowfins</b>		
<i>Amia calva</i>	Bowfin	BWFN
ORDER OSTEGLLOSSIFORMES		
<b>Hiodontidae – mooneyes</b>		
<i>Hiodon alosoides</i>	Goldeye	GDEY
<i>Hiodon tergisus</i>	Mooneye	MNEY
ORDER ANGUILLIFORMES		
<b>Anguillidae – freshwater eels</b>		
<i>Anguilla rostrata</i>	American eel	AMEL

## Appendix A. (continued).

Scientific name	Common name	Letter Code
ORDER CLUPEIFORMES		
<b>Clupeidae – herrings</b>		
<i>Alosa alabame</i>	Alabama shad	ALSD
<i>Alosa chrysochloris</i>	Skipjack herring	SJHR
<i>Alosa pseudoharengus</i>	Alewife	ALWF
<i>Dorosoma cepedianum</i>	Gizzard shad	GZSD
<i>Dorosoma petenense</i>	Threadfin shad	TFSD
<i>D. cepedianum X D. petenense</i>	Gizzard-threadfin shad hybrid	GSTS
ORDER CYPRINIFORMES		
<b>Cyprinidae – carps and minnows</b>		
<i>Campostoma anomalum</i>	Central stoneroller	CLSR
<i>Campostoma oligolepis</i>	Largescale stoneroller	LSSR
<i>Carassius auratus</i>	Goldfish	GDFH
<i>Carassus auratus X Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<b><i>Hybognathus argyritis</i></b>	<b>Western silvery minnow</b>	<b>WSMN*</b>
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<b><i>Hybognathus placitus</i></b>	<b>Plains minnow</b>	<b>PNMW*</b>
<i>Hybognathus</i> spp.	Unidentified <i>Hybognathus</i>	HBNS*
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<b><i>Macrhybopsis aestivalis</i></b>	<b>Speckled chub</b>	<b>SKCB*</b>
<b><i>Macrhybopsis gelida</i></b>	<b>Sturgeon chub</b>	<b>SGCB*</b>
<b><i>Macrhybopsis meeki</i></b>	<b>Sicklefin chub</b>	<b>SFCB*</b>
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. aestivalis X M. gelida</i>	Speckled-Sturgeon chub hybrid	SPST
<i>M. gelida X M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennius</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis buchanani</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greenei</i>	Wedgespot shiner	WSSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Cyprinidae – carps and minnows</b>		
<i>Notropis heterolepsis</i>	Blacknose shiner	BNSN
<i>Notropis hudsonius</i>	Spottail shiner	STSN
<i>Notropis nubilus</i>	Ozark minnow	OZMW
<i>Notropis rubellus</i>	Rosyface shiner	RYSN
<i>Notropis shumardi</i>	Silverband shiner	SBSN
<i>Notropis stilbius</i>	Silverstripe shiner	SSPS
<b><i>Notropis stramineus</i></b>	<b>Sand shiner</b>	<b>SNSN*</b>
<i>Notropis topeka</i>	Topeka shiner	TPSN
<i>Notropis volucellus</i>	Mimic shiner	MMSN
<i>Notropis wickliffi</i>	Channel shiner	CNSN
<i>Notropis</i> spp.	Unidentified shiner	UNO
<i>Opsopoeodus emiliae</i>	Pugnose minnow	PNMW
<i>Phenacobius mirabilis</i>	Suckermouth minnow	SMMW
<i>Phoxinus eos</i>	Northern redbelly dace	NRBD
<i>Phoxinus erythrogaster</i>	Southern redbelly dace	SRBD
<i>Phoxinus neogaeus</i>	Finescale dace	FSDC
<i>Pimephales notatus</i>	Bluntnose minnow	BNMW
<i>Pimephales promelas</i>	Fathead minnow	FHMW
<i>Pimephales vigilax</i>	Bullhead minnow	BHMW
<i>Platygobio gracilis</i>	Flathead chub	FHCB
<i>P. gracilis</i> X <i>M. meeki</i>	Flathead-sicklefin chub hybrid	FCSC
<i>Rhinichthys atratulus</i>	Blacknose dace	BNDC
<i>Rhinichthys cataractae</i>	Longnose dace	LNDC
<i>Richardsonius balteatus</i>	Redside shiner	RDSS
<i>Scardinius erythrophthalmus</i>	Rudd	RUDD
<i>Semotilus atromaculatus</i>	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
<b>Catostomidae - suckers</b>		
<i>Carpionodes carpio</i>	River carpsucker	RVCS
<i>Carpionodes cyprinus</i>	Quillback	QLBK
<i>Carpionodes velifer</i>	Highfin carpsucker	HFCS
<i>Carpionodes</i> spp.	Unidentified <i>Carpionodes</i>	UCS
<i>Catostomus catostomus</i>	Longnose sucker	LNSK
<i>Catostomus commersoni</i>	White sucker	WTSK
<i>Catostomus platyrhynchus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<b><i>Cycleptus elongatus</i></b>	<b>Blue sucker</b>	<b>BUSK*</b>
<i>Hypentelium nigricans</i>	Northern hog sucker	NHSK
<i>Ictiobus bubalus</i>	Smallmouth buffalo	SMBF
<i>Ictiobus cyprinellus</i>	Bigmouth buffalo	BMBF
<i>Ictiobus niger</i>	Black buffalo	BKBF
<i>Ictiobus</i> spp.	Unidentified buffalo	UBF
<i>Minytrema melanops</i>	Spotted sucker	SPSK
<i>Moxostoma anisurum</i>	Silver redhorse	SVRH
<i>Moxostoma carinatum</i>	River redhorse	RVRH
<i>Moxostoma duquesnei</i>	Black redhorse	BKRH
<i>Moxostoma erythrurum</i>	Golden redhorse	GDRH
<i>Moxostoma macrolepidotum</i>	Shorthead redhorse	SHRH
<i>Moxostoma</i> spp.	Unidentified redhorse	URH

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
<b>ORDER SILURIFORMES</b>		
<b>Ictaluridae – bullhead catfishes</b>		
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurus nebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnus</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
<b>ORDER SALMONIFORMES</b>		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarki</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonneville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL

Appendix A. (continued).

Scientific name	Common name	Letter Code
	<b>ORDER PERCOPSIFORMES</b>	
	<b>Percopsidae – trout-perches</b>	
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
	<b>ORDER GADIFORMES</b>	
	<b>Gadidae - cods</b>	
<i>Lota lota</i>	Burbot	BRBT
	<b>ORDER ATHERINIFORMES</b>	
	<b>Cyprinodontidae - killifishes</b>	
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus diaphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	<b>Poeciliidae - livebearers</b>	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	<b>Atherinidae - silversides</b>	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	<b>ORDER GASTEROSTEIFORMES</b>	
	<b>Gasterosteidae - sticklebacks</b>	
<i>Culaea inconstans</i>	Brook stickleback	BKSB
	<b>ORDER SCORPAENIFORMES</b>	
	<b>Cottidae - sculpins</b>	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	<b>ORDER PERCIFORMES</b>	
	<b>Percichthyidae – temperate basses</b>	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	<b>Centrarchidae - sunfishes</b>	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis magalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Centrarchidae - sunfishes</b>		
<i>L. cyanellus</i> X <i>L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus</i> X <i>L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctulatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis</i> X <i>P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
<b>Percidae - perches</b>		
<i>Ammocrypta asprella</i>	Crystal darter	CLDR
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orangethroated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caprodes</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculata</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER*</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
<b>Sciaenidae - drums</b>		
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
NON-TAXONOMIC CATEGORIES		
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats.

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendritic	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m <sup>3</sup> /s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m <sup>3</sup> /s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 11 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for segment 11, the Kansas River.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	Standard	All	2006 - Present	fish/100 m drift
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2006 - Present	fish/100 m drift
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2006 - Present	fish/net night
Otter trawl – 16 ft head rope	OT16	Standard	All	2006 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2006 - Present	fish/100 m trawled
Mini-fyke net	MF	Standard	Fish Comm.	2006 - Present	fish/net night

Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area (RPMA) in the Missouri River Basin.

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Above Intake	AIN	Yellowstone	70 +
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KA/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 11, the Kansas River (RPMA 4).

No pallid fish have been stocked in segment 11, the Kansas River (stocking code NE/MO/KS).

## **Appendix F**

Total catch, overall mean catch per unit effort [ $\pm 2$  SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 11, the Kansas River, during 2005 – 2006. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when  $N < 2$ .

Appendix F1. Gill Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	1	0.05 [0.01]	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BLCF	3	0.15 [0.213]	0 [0]	0 [0]	0 [0]	0 [0]	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BMBF	1	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
<b>BUSK*</b>	<b>4</b>	<b>0.2</b> <b>[0.221]</b>	<b>0.25</b> <b>[0.5]</b>	<b>0</b> <b>[0]</b>	<b>0.5</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.125</b> <b>[0.25]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
CARP	3	0.15 [0.213]	0.25 [0.5]	0 [0]	0 [0]	0 [0]	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	2	0.1 [0.133]	0.25 [0.289]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GDEY	14	0.7 [0.733]	0.75 [1.5]	0 [0]	0 [0]	0 [0]	1 [1.155]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	15	0.75 [0.922]	0.75 [0.866]	0 [0]	0 [0]	0 [0]	1.125 [2.25]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
LNGR	16	0.8 [0.636]	0.75 [0.957]	0 [0]	0.5 [0]	0 [0]	1.125 [1.315]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	6	0.3 [0.306]	0.75 [0.5]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SMBF	11	0.55 [0.348]	0.375 [0.479]	0 [0]	1 [0]	0 [0]	0.5 [0.707]	1 [0]	0 [0]	0 [0]	0 [0]	0 [0]
<b>SNGR*</b>	<b>1</b>	<b>0.05</b> <b>[0.1]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.125</b> <b>[0.25]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
<b>SNSG*</b>	<b>154</b>	<b>7.7</b> <b>[4.754]</b>	<b>8.5</b> <b>[8.114]</b>	<b>0</b> <b>[0]</b>	<b>4</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>4.25</b> <b>[3.775]</b>	<b>22</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
WTBS	1	0.05 [0.1]	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F2. 1 Inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BLCF	1	0.042	0	0	0.074	0	0	0	0	0	0	0
		[0.083]	[0]	[0]	[0.148]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
<b>BUSK*</b>	<b>2</b>	<b>0.148</b>	<b>0.291</b>	<b>0</b>	<b>0.134</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		<b>[0.202]</b>	<b>[0.581]</b>	<b>[0]</b>	<b>[0.268]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>
CARP	0	0.042	0	0	0.074	0	0	0	0	0	0	0
		[0.083]	[0]	[0]	[0.148]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
CNCF	3	0.227	0.581	0	0.144	0	0	0	0	0	0	0
		[0.323]	[1.163]	[0]	[0.289]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
FWDM	2	0.114	0.291	0	0.074	0	0	0	0	0	0	0
		[0.163]	[0.581]	[0]	[0.148]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
LNGR	1	0.042	0	0	0.074	0	0	0	0	0	0	0
		[0.083]	[0]	[0]	[0.148]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
RVCS	3	0.234	0.329	0	0.27	0	0	0	0	0	0	0
		[0.252]	[0.658]	[0]	[0.357]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
<b>SGER*</b>	<b>2</b>	<b>0.156</b>	<b>0</b>	<b>0</b>	<b>0.278</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		<b>[0.214]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0.368]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>
SMBF	4	0.316	0	0	0	0	1.684	0	0	0	0	0
		[0.508]	[0]	[0]	[0]	[0]	[2.394]	[0]	[0]	[0]	[0]	[0]
SNGR	3	0.237	0	0	0.422	0	0	0	0	0	0	0
		[0.255]	[0]	[0]	[0.422]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
<b>SNSG*</b>	<b>97</b>	<b>5.664</b>	<b>4.078</b>	<b>0</b>	<b>5.384</b>	<b>0</b>	<b>8.622</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		<b>[4.613]</b>	<b>[2.979]</b>	<b>[0]</b>	<b>[7.833]</b>	<b>[0]</b>	<b>[8.526]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>	<b>[0]</b>
SVCP	1	0.081	0	0	0	0	0.433	0	0	0	0	0
		[0.162]	[0]	[0]	[0]	[0]	[0.866]	[0]	[0]	[0]	[0]	[0]

Appendix F3. 2.5 Inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	2	0.305 [0.61]	0 [0]	0 [0]	0 [0]	0 [0]	0.813 [1.626]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CARP	4	0.656 [0.707]	1.958 [1.417]	0 [0]	0 [0]	0 [0]	0.444 [0.889]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	1	0.167 [0.333]	0 [0]	0 [0]	0 [0]	0 [0]	0.444 [0.889]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GSCP	1	0.156 [0.312]	0 [0]	0 [0]	0.417 [0.833]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
QLBK	1	0.156 [0.312]	0 [0]	0 [0]	0.417 [0.833]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	6	0.99 [1.651]	3.958 [5.417]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SMBF	6	0.958 [0.919]	0.625 [1.25]	0 [0]	1.25 [2.5]	0 [0]	0.889 [0.889]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SVCP	1	0.167 [0.333]	0 [0]	0 [0]	0 [0]	0 [0]	0.444 [0.889]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F4. Otter Trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHMW	145	7.945 [7.495]	7.512 [12.291]	0 [0]	7.612 [10.245]	0 [0]	13.333 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BLCF	10	0.732 [0.606]	0.938 [1.875]	0 [0]	0.723 [0.625]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CNCF	293	10.153 [12.658]	9.233 [10.685]	0 [0]	11.31 [18.262]	0 [0]	1.111 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
ERSN	6	0.38 [0.503]	0.882 [1.765]	0 [0]	0.232 [0.403]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FHCF	1	0.021 [0.042]	0.083 [0.167]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	7	0.223 [0.188]	0.461 [0.571]	0 [0]	0.089 [0.127]	0 [0]	0.741 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	3	0.201 [0.217]	0 [0]	0 [0]	0.293 [0.303]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RDSN	3	0.069 [0.139]	0 [0]	0 [0]	0 [0]	0 [0]	1.111 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	27	1.145 [0.615]	0.588 [1.176]	0 [0]	1.149 [0.675]	0 [0]	3.333 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
<b>SFCB*</b>	<b>1</b>	<b>0.023</b> <b>[0.046]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.37</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
<b>SGER*</b>	<b>1</b>	<b>0.021</b> <b>[0.042]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.03</b> <b>[0.061]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
<b>SNSG</b>	<b>2</b>	<b>0.046</b> <b>[0.093]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.741</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
<b>SNSN*</b>	<b>27</b>	<b>0.588</b> <b>[0.811]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0.485</b> <b>[0.97]</b>	<b>0</b> <b>[0]</b>	<b>4.074</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>	<b>0</b> <b>[0]</b>
SVCB	8	0.263 [0.34]	0.683 [1.155]	0 [0]	0 [0]	0 [0]	1.481 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
UCY	7	0.162 [0.324]	0 [0]	0 [0]	0 [0]	0 [0]	2.593 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
WTPH	2	0.132 [0.181]	0 [0]	0 [0]	0.192 [0.258]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F6. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHMW	227	28.375 [17.175]	44 [78]	0 [0]	22.25 [11.471]	0 [0]	25 [8]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BKCP	1	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BLGL	65	8.125 [4.182]	3.5 [3]	0 [0]	6 [2.708]	0 [0]	17 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BNMW	12	1.5 [1.363]	0 [0]	0 [0]	1.75 [1.5]	0 [0]	2.5 [5]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CARP	2	0.25 [0.327]	0 [0]	0 [0]	0.25 [0.5]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CNCF	7	0.875 [0.59]	1 [2]	0 [0]	0.75 [0.957]	0 [0]	1 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
ERSN	83	10.375 [8.185]	15 [18]	0 [0]	11 [14.72]	0 [0]	4.5 [5]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FHCF	1	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FHMW	1	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	6	0.75 [0.5]	0 [0]	0 [0]	1 [0.816]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	1	0.125 [0.25]	0 [0]	0 [0]	0.25 [0.5]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
LMBS	1	0.125 [0.25]	0 [0]	0 [0]	0.25 [0.5]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
MQTF	14	1.75 [2.946]	0 [0]	0 [0]	0.5 [0.577]	0 [0]	6 [12]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
OSSF	9	1.125 [0.881]	1 [0]	0 [0]	0.5 [0.577]	0 [0]	2.5 [3]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RDSN	494	61.75 [52.767]	22 [44]	0 [0]	106 [86.121]	0 [0]	13 [2]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	9	1.125 [0.959]	0 [0]	0 [0]	2 [1.414]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVSN	31	3.875 [4.992]	0 [0]	0 [0]	7.5 [9]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SNGR	9	1.125	0.5	0	1.25	0	1.5	0	0	0	0	0
		[0.59]	[1]	[0]	[0.957]	[0]	[1]	[0]	[0]	[0]	[0]	[0]
<b>SNSN</b>	<b>68</b>	<b>8.5</b>	<b>1.5</b>	<b>0</b>	<b>16.25</b>	<b>0</b>						
		<b>[8.358]</b>	<b>[1]</b>	<b>[0]</b>	<b>[12.842]</b>	<b>[0]</b>						
UCN	11	1.375	0	0	0.5	0	4.5	0	0	0	0	0
		[2.234]	[0]	[0]	[1]	[0]	[9]	[0]	[0]	[0]	[0]	[0]
ULP	3	0.375	1.5	0	0	0	0	0	0	0	0	0
		[0.75]	[3]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
WTBS	2	0.25	0	0	0.5	0	0	0	0	0	0	0
		[0.5]	[0]	[0]	[1]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
WTCP	10	1.25	0.5	0	1.25	0	2	0	0	0	0	0
		[0.824]	[1]	[0]	[1.5]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
YOYF	1	1.25	0	0	0.25	0	0	0	0	0	0	0
		[0.25]	[0]	[0]	[0.5]	[0]	[0]	[0]	[0]	[0]	[0]	[0]

Appendix G. Hatchery names, locations, and abbreviations.

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<b>Hatchery</b>	<b>State</b>	<b>Abbreviation</b>
Blind Pony State Fish Hatchery	MO	BYP
Neosho National Fish Hatchery	MO	NEO
Gavins Point National Fish Hatchery	SD	GAV
Garrison Dam National Fish Hatchery	ND	GAR
Miles City State Fish Hatchery	MT	MCH
Blue Water State Fish Hatchery	MT	BLU
Bozeman Fish Technology Center	MT	BFT
Fort Peck State Fish Hatchery	MT	FPH

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Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2005 – 2006 for segment 11, the Kansas River,. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
ALSD							
ALWF							
AMEL							
AMGL							
BCCC							
BDDR							
BDKF							
BDSN							
BDSP							
BESN							
BHCP	0	0.305	0.05	0			
BHMW	0	0	0	2.245	0	28.375	13.645
BKBF							
BKBH							
BKCP					0	0.125	0
BKRH							
BKSB							
BKSS							
BKTT							
BLCF			0.15		0.083	0	1.463
BLGL					0	8.125	0
BMBF							
BMSN							
BNDC							
BNMW					0	1.5	0
BNSN							
BNTT							
BPTM							
BRBT							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
BSDR							
BSMN							
BSTM							
BTDR							
<b>BUSK*</b>	<b>0.296</b>	<b>0</b>	<b>0.2</b>	<b>0</b>			
BVSC							
BWFN							
CARP	0	0.656	0.15	0	0.083	0.25	0
CHSM							
CKCB							
CLDR							
CLSR							
CMSN							
CNCF	0.291	0	0	20.307	0.162	0.875	0
CNLP							
CNSM							
CNSN							
CSCO							
CTTT							
ERSN	0	0	0	0.042	0	10.375	0.719
FCSC							
FHCB							
FHCF	0	0	0	0.042	0	0.125	0
FHMW					0	0.125	0
FKMT							
FSDC							
FTDR							
FWDM	0.145	0.167	0.1	0.298	0.083	0.75	0.147
GDEY	0	0	0.7	0			
GDFH							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
GDTT							
GFCC							
GLDR							
GNSF							
GSBG							
GSCP	0	0.156	0	0			
GSDR							
GSOS							
GSPK							
GSTS							
GTSN							
GVCB							
GZSD	0	0	0.75	0	0	0.125	0.403
HBNS							
HFCS							
HHCB							
IODR							
JYDR							
LESF							
LGPH							
LKCB							
LKSG							
LKTT							
LKWF							
LMBS					0	0.125	0
LNDC							
LNDR	0	0	0.8	0	0.083	0	0
LNSK							
GDRH							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
GDSN							
LSSR							
LTDR							
LVLP							
MDSP							
MMSN							
MNEY							
MQTF					0	1.75	0
MSDR							
MSKG							
MTSK							
MTWF							
NBLP							
NHSK							
NRBD							
NTPK							
NTSF							
OSSF					0	1.125	0
OTDR							
OZMW							
PDFH							
<b>PDSG*</b>							
PEMT							
PKLF							
PLDC							
PNMW							
<b>PNMW*</b>							
PNSD							
PTMW							
QLBK	0	0.156	0	0			

## Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
RBDR							
RBST							
RBTT							
RDSN	0	0	0	0.139	0	61.75	0
RDSS							
RKBS							
RRDR							
RUDD							
RVCS	0.147	0.99	0.3	1.155	0.321	1.125	1.136
RVRH							
RVSN					0	3.875	0
RYSN							
SBLR							
SBSN							
SBWB							
SCSC							
SDBS							
SDMT							
SESM							
<b>SFCB*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.046</b>			
SFSN							
<b>SGCB*</b>							
<b>SGER*</b>	<b>0.151</b>	<b>0</b>	<b>0</b>	<b>0.042</b>	<b>0.162</b>	<b>0</b>	<b>0</b>
SGWE							
SHDR							
SHRH							
SJHR							
<b>SKCB*</b>							
SLDR							
SMBF	0.632	0.958	0.55	0			

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
SMBS							
SMMW							
SNGR	0	0	0.05	0	0.475	1.125	0
SNPD	0	0	0.1	0			
<b>SNSG*</b>	<b>6.089</b>	<b>0</b>	<b>7.7</b>	<b>0.093</b>	<b>5.24</b>	<b>0</b>	<b>0</b>
<b>SNSN*</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.176</b>	<b>0</b>	<b>8.5</b>	<b>0</b>
SPSK							
SPSN							
SPST							
SRBD							
SSPS							
STBS							
STCT							
STGR							
STPD							
STSN							
SVCB	0	0	0	0.527			
SVCP	0.162	0.167	0	0			
SVLP							
SVMW							
SVRH							
TFSD							
TPMT							
TPSN							
TTPH							
UAC							
UBF							
UCF							
UCN					0	1.375	0
UCS							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
UCT							
UCY	0	0	0	0.324			
UDR							
UET							
UHY							
ULP					0	0.375	0
ULY							
UNO							
UPC							
UPN							
URH							
USG							
UST							
WLEY							
WRFS							
WRMH							
<b>WSMN*</b>							
WSSN							
WTBS	0	0	0.05	0	0	0.25	0
WTCP					0	1.25	0
WTPH					0	0	0.264
WTSK							
YLBH							
YWBS							
YWPH					0	0.125	0

Appendix I. Comprehensive list of bend numbers and bend river miles for segment 11, the Kansas River, comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2003 – 2006.

<b>Bend Number</b>	<b>Bend River Mile</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>
1	1.1				
2	5.0				
3	9.0				ST, FCS
4	12.0				
5	15.4				