

2007 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 9



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

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EXECUTIVE SUMMARY

The Nebraska Game and Parks Commission (NGPC) in cooperation with the U.S. Army Corps of Engineers began sampling Segment 9 in 2003. Segment 9 begins at the confluence of the Platte and Missouri Rivers (River Mile (R.M.) 595.0) at Plattsmouth, NE and continues down stream to the confluence of the Kansas and Missouri Rivers (R.M. 367.5) at Kansas City, MO. NGPC and the Missouri Department of Conservation (MDC) divided the sampling responsibilities for this segment.

The sturgeon season started on 16 October 2006 when water temperatures fell below 12.7°C and continued until 30 June 2007. During the sturgeon season, a total of 741 samples were completed using gill nets, otter trawls, and 1.0” trammel nets. The fish community season started 1 July 2007 and continued until 26 October 2007 when water temperature fell below 12.7°C. During the fish community season, a total of 683 samples were completed using otter trawls, 1.0” trammel nets, and mini-fyke nets.

A total of 32 pallid sturgeon *Scaphirynchus albus* were captured during the 2007 sampling season. Twenty-five were recaptured hatchery reared pallid sturgeon and the remaining seven were confirmed wild via genetics analysis. Since the project started, hatchery reared pallid sturgeon had had an 86% retention rate of PIT tags and represent seven year classes (1997, 1999, 2001, 2002, 2003, 2004 and 2005) that have been stocked into RPMA #4. The only year classes that have been stocked but not sampled are 1992, 2006, and 2007. Standardized gears (gill nets (N = 13), 1.0” trammel nets (N = 9) and otter trawls (N = 2)) collected twenty-four of the thirty-two pallid sturgeon during 2007. The remaining eight pallid sturgeon were collected using an experimental 25 ft. otter trawl and trotlines. Mini-fyke nets did not collect any pallid sturgeon. No young-of-the-year pallid sturgeon were collect with any gear during 2007.

Mean relative condition of hatchery reared pallid sturgeon was 1.29 at time of stocking but had declined to 0.80 by the time the fish had been recaptured. Mean growth per day of stocked fish was 0.18 mm. Pallid sturgeon captures were distributed along the entire length of Segment 9. Ten recaptures came from Upper Plattsmouth Bend (R.M. 595.0) and five from Indian Cave Bend (R.M. 517.6). Upper Plattsmouth Bend is a historic “hot spot” because of the confluence of the Platte and Missouri Rivers. The actual confluence of the Platte and Missouri River produced four pallid sturgeon compared to two on the inside bend macrohabitat and two

on the outside bend macrohabitat in the main channel. Most pallid sturgeon (N = 16) were captured on the inside bend macrohabitat with nine in the channel border mesohabitat and six from pools. The ratio of pallid sturgeon to shovelnose sturgeon in Segment 9 during 2007 was 1:128 compared to 1:113 in 2006, 1:261 in 2005, 1:279 in 2004 and 1:1,076 in 2003. The decrease in this ratio can be attributed to the increased number of hatchery reared pallid sturgeon recaptured.

A total of 28,824 fish were captured in Segment 9 of the Missouri River using standard gears. These gears collected 70 species with emerald shiners (18.9%, N = 5,471), red shiners (17.5%, N = 5,049) and shovelnose sturgeon (14.3%, N = 4,090) making up over 50% of the total catch. The Pallid Sturgeon Assessment Team identified eight native species to serve as target species to measure changes in the overall fish community. These target species include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, speckled chub *Macrhybopsis aestivalis*, sturgeon chub *Macrhybopsis gelida*, sickfin chub *Macrhybopsis meeki*, sand shiners *Notropis stramineus*, *Hybognathus* species (western silvery minnow *H. argyritis*, brassy minnow *H. hankinsoni* and plains minnow *H. placitus*), blue sucker *Cycleptus elongatus* and sauger *Sander canadense*. A total of 4,090 shovelnose sturgeon were sampled during 2007 with 3,875 captured with standard gears and 215 with non-standard gears. Standard gears during 2007 included: gill nets (N = 2,035), 1.0" trammel nets (N = 1,259), and otter trawls (N = 581). Non-standard or wild gear included: trot lines (N = 98), 2.5" monofilament gill nets (N = 94), 25 ft. otter trawl (N = 20), push trawls (N = 2), and set lines (N = 1). Otter trawling collected 33 of 34 sturgeon chubs, all sicklefin chubs and 235 of 256 speckled chubs throughout both seasons. Mini-fyke nets remain the most effective method to collect sand shiners, collecting over 98% of the total catch. A total of 382 *Hybognathus* species were captured in 2007 and mini-fyke nets collected all but two. Overall catch for *Hybognathus* species increased during 2007 (N = 382) compared to 2006 (N = 59). A total of 634 blue suckers were collected during 2007 with 1.0" trammel nets being the most effective sampling method, collecting over 67%. Overall, fewer sauger were collected during the 2007 (N = 69) compared to 2006 (N = 137), most while winter gill netting.

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Introduction

The pallid sturgeon *Scaphirynchus albus* is native to the Missouri and Mississippi River systems, has evolved with and adapted to large river conditions. Due to population declines, pallid sturgeon were federally listed as endangered in 1990. Modification of the pallid sturgeon's habitat by human activities has blocked fish movement, destroyed or altered spawning areas, reduced food sources or ability to obtain food, altered water temperature, reduced turbidity, and changed the hydrograph (USFWS 1993). In response to obvious declines in population and lack of recruitment, the United States Fish and Wildlife Service developed the Biological Opinion on the Operation of the Missouri River Main System Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op) in 2000. This report made recommendations to the U.S. Army Corp of Engineers (USACE) to modify flows of the Missouri River to a more natural regime, to increase pallid sturgeon propagation and augmentation efforts, and to assist and provide funding for a basin-wide pallid sturgeon assessment. In response to the Bi-Op, the USACE formed the Pallid Sturgeon Population Assessment Team with representatives from federal and state agencies and universities. The team developed standard operating procedures (SOP) for long-term pallid sturgeon and associated fish community assessment for the Missouri River. This included creating standard habitat definitions, selecting and describing standard sampling gears thought to be suitable for use in the Missouri River, creating sampling protocols for sampling fish and habitat parameters and developing standard data sheets and reporting procedures.

The 2007 sampling season extended from the 16 October 2006 through the 26 October 2007 and was divided into two seasons: The sturgeon season and the fish community season. The reason for a split in seasons was that during the sturgeon season, the capture of sturgeon was more efficient due to increased sturgeon movement and the ability to use gill nets, an effective gear for sampling sturgeon when water temperatures permit. The sturgeon season was defined as the period when water temperatures fell below 12.7° C (55° F) in the fall, until 30 June. While water temperatures were below 12.7° C, experimental gill nets were used, and above this temperature, two additional gears were fished: 1.0" trammel nets and otter

trawls. Sampling was conducted on the bend level with all bends being randomly selected and a minimum of eight sub-samples per bend.

The fish community season began 1 July and continued until water temperatures dropped below 12.7° C in the fall. Three gear types were used during the fish community season: 1.0” trammel nets, otter trawls, and mini-fyke nets. Sampling was conducted on the bend level and bends were selected at random with a minimum of eight sub-samples per bend. The fish community season is the best time to identify natural reproduction of pallid sturgeon and other native target species. Because sturgeon are less active and gill nets can not be used because of temperature restrictions, efforts focus on sampling the associated fish community, including chubs and minnows, which are more readily sampled during this time. The Pallid Sturgeon Assessment Team selected 8 target species that represent the native warm water benthic fish community (Appendix A). The eight target species are: shovelnose sturgeon *S. platyrhynchus*, speckled chub *Macrhybopsis aestivalis*, sturgeon chub *M. gelida*, sicklefin chub *M. meeki*, sand shiner *Notropis stramineus*, *Hybognathus* species (western silvery minnow *H. argyritis*, brassy minnow *H. hankinsoni* and plains minnow *H. placitus*), blue sucker *Cycleptus elongatus*, and sauger *Sander canadense*. During the fish community season, these native species along with pallid sturgeon are targeted.

The objectives and measurable hypotheses for the Pallid Sturgeon Population Assessment Team are as follows:

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

- 1.1. H₀: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.
H_a: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.
- 1.2. H₀: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages remain constant over time
H_a: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages increase or decrease over time.
- 1.3. H₀: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.

H_a: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.

- 1.4 H₀: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time
H_a: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages increases or decreases over time.

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

- 2.1 H₀: Stocked and wild pallid sturgeon use the same habitat during all life stages annually.
H_a: Stocked and wild pallid sturgeon do not use the same habitat during all life stages annually.
- 2.2 H₀: Stocked and wild pallid sturgeon use the same habitat during all life stages over the long term.
H_a: Stocked and wild pallid sturgeon do not use the same habitat during all life stages over the long term.

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

- 3.1 H₀: The population structure of stocked and wild pallid sturgeon remains constant over time.
H_a: The population structure of stocked and wild pallid sturgeon changes over time.
- 3.2 H₀: The population dynamics of stocked and wild pallid sturgeon remain constant over time.
H_a: The population dynamics of stocked and wild pallid sturgeon change over time.

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

- 4.1 H₀: Annual trends in native target species abundance are stable throughout the year.
H_a: Annual trends in native target species abundance increase or decrease throughout the year.
- 4.2 H₀: Annual trends in native target species geographic distribution remains stable throughout the year.
H_a: Annual trends in native target species geographic distribution increases or decreases throughout the year.
- 4.3 H₀: Long-term trends in native target species population abundance are stable over time.

H_a: Long-term trends in native target species population abundance increases or decreases over time.

- 4.4 H₀: Long-term trends in the native target species geographic distribution remain constant over time.
H_a: Long-term trends in the native target species geographic distribution increases or decreases over time.

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

- 5.1 H₀: Native target species use the same habitat during all life stages annually.
H_a: Native target species do not use the same habitat during all life stages annually.
- 5.2 H₀: Native target species use the same habitat during all life stages over the long term.
H_a: Native target species do not use the same habitat during all life stages over the long term.

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.

- 6.1 H₀: Annual trends in non-target species abundance are stable throughout the year.
H_a: Annual trends in non-target species abundance are increasing or decreasing throughout the year.
- 6.2 H₀: Annual trends in non-target species geographic distribution remains stable throughout the year.
H_a: Annual trends in non-target species geographic distribution increases or decreases throughout the year.
- 6.3 H₀: Long-term trends in non-target species population abundance are stable over time.
H_a: Long-term trends in non-target species population abundance increases or decreases over time.
- 6.4 H₀: Long-term trends in the non-target species geographic distribution remain constant over time.
H_a: Long term trends in the non-target species geographic distribution increases or decreases over time.

Study Area

The project area includes the Missouri River from Fort Peck Dam (RiverMile (R.M.) 1771.5) to the confluence of the Missouri and Mississippi Rivers (R.M. 0.0) and the lower reach of the Kansas River from the Johnson County Weir (R.M. 15.4) to the confluence with the Missouri River (R.M. 0.0). The Biological Opinion divided the Missouri River into river and reservoir reaches and categorized each reach as a high, moderate or low priority management area. The areas which were given high priority designation in the Bi-Op for the pallid sturgeon include Segment Area 2 (Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota), Area 8 (Fort Randall Dam, South Dakota to the Mouth of the Niobrara River, Nebraska), and Areas 10 through 15 (Gavins Point Dam, Nebraska/South Dakota to the mouth of the Missouri River at St. Louis, MO).

The Pallid Sturgeon Population Assessment Team identified 14 river segments within these reaches based on changes in physical attributes such as degrading or aggrading stream bed, flow fluctuation, natural hydrograph, stream gradient, geology, water temperature, turbidity, substrate, discrete habitat changes (tributary or tributary influence) and modifications (presence of restoration projects) (Drobish, editor 2008). There are also several areas being sampled that were not designated as high priority areas in the Bi-Op. These are being sampled because of known pallid sturgeon use and include the Kansas River from Johnson County Weir to the mouth and Bi-Op Segment Area 9 (Niobrara River, Nebraska to the headwaters of Lewis and Clark Lake Nebraska/South Dakota).

The Nebraska Game and Parks Commission and Missouri Department of Conservation Pallid Sturgeon Population Assessment crews sampled Segment 9, R.M. 595.0 from the confluence of the Platte and Missouri Rivers at Plattsmouth, Nebraska, downstream to R.M. 367.5 to the mouth of the Kansas River (R.M. 367.5) at Kansas City, Missouri (Figure 1a).

Methods

Sampling was conducted in accordance with the current Standard Operating Procedures (Drobish, editor 2008) established by a panel of representatives from various state and federal agencies involved with pallid recovery on the Missouri River. Descriptions of these procedures are reported in the appropriate sections.

Sampling Site Selection and Habitat Description

Segment 9 is the longest segment (227.5 miles) in the project and consists of 80 bends (Figure 1a). Twenty-two bends were randomly selected to be sampled for sturgeon and fish community seasons. NGPC was responsible for the sampling effort on 12 bends while MDC sampled the remaining 10 bends.

The Pallid Sturgeon Assessment Team developed a standard set of habitat classifications for the Missouri River (Appendix B) to describe areas of sampling effort. These classifications are broken down in to three distinct levels with macrohabitats at the top. Each river bend contains three continuous macrohabitats: main channel outside bend (OSB), main channel inside bend (ISB) and main channel cross over (CHXO). Additional discrete macrohabitats have been identified that may not be present in every bend. These include: large tributary mouth (TRML), small tributary mouth (TRMS), tributary confluence (CONF), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), tributary (TRIB) and non-connected secondary channel (SCN). Mesohabitats have been established and defined to further classify areas within macrohabitats. Mesohabitat classifications include: bars (BARS), pools (POOL), channel borders (CHNB), thalweg (TLWG) and island tips (ITIP). Bars are sandbars or shallow bankline habitat at the area of terrestrial/aquatic interface, where water depth is less than 1.2 m deep. Pools are areas immediately downstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole greater than 1.2 m deep. Channel borders lie along a bankline or sandbar area between the thalweg and the 1.2 m depth interval. Thalweg is the main channel between the channel borders and is the area of maximum depth. Island tips are the areas immediately downstream of a bar or island where two channels converge and water depth is greater than 1.2 m.

Sampling Gear

Sampling gear and methods were developed by the Pallid Sturgeon Assessment Team and described in Missouri River Standard Operating Procedures for Sampling and Data Collection, (Drobish, editor 2008). Standard gear types and methods used are as follows.

Gill Net

The standard gill net was a four panel experimental gill net 30.5 m (100 ft.) long with a height of 2.4 m (8 ft.). The standard gill net had four 7.6 m (25 ft.) panels consisting of

38.1 mm (1.5") (Panel 1), 50.8 mm (2.0") (Panel 2), 76.2 mm (3.0") (Panel 3), and 101.6 mm (4.0") (Panel 4) multifilament bar mesh. Twine size was #104 for the 38.1 mm and 50.8 mm panels and #139 for the 76.2 mm and 101.6 mm panels. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg/183 m). A double length gill net (61 m or 200 ft.) could be used and consisted of two standard gill nets attached together but counted as twice the effort. Panel numbering continued for 61 m nets, so the second 38.1 mm mesh was panel 5, the second 50.8 mm mesh was panel 6, the second 76.3 mm mesh was panel 7 and the second 101.6 mm mesh was panel 8. The first panel set (38.1 mm (Panel 1) or 101.6 mm mesh (Panel 4 or 8)) was selected randomly and recorded. Gill net samples were overnight sets with a maximum set time of 24 hours.

16 ft. Otter Trawl

The standard otter trawl had a width of 4.9 m (16 ft.), height of 0.9 m (3 ft.), and length of 7.6 m (25 ft.). The trawl had a 6.35 mm (1/4") inner bar mesh and a 19 mm (0.75") outer bar mesh, with a cod-end opening of 406.4 mm (16"). Trawl doors made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") by 381 mm (15"), were used to keep the trawl deployed on the river bottom. Otter trawls were fished downstream with the length of the trawl dependent upon the size of the macrohabitat and mesohabitat being sampled. Otter trawl samples covered a minimum of 75 m (246 ft.) and a maximum of 300 m (984 ft.).

1.0" Trammel Net

The standard 1.0" trammel net had a length of 38.1 m (125 ft.), with an inner mesh 2.4 m (8 ft.) deep and two outer walls 1.8 m (6 ft.) deep. The inner mesh was composed of #139 multifilament twine with a bar mesh size of 25.4 mm (1.0"). The outer walls were #9 multifilament twine with a bar mesh size of 203.2 mm (8.0"). The float line was a 12.7 mm (1/2") foam core and the lead line was 22.7 kg (50 lb.). Trammel nets were drifted a minimum of 75 m and a maximum of 300 m.

Mini-Fyke Net

The standard mini-fyke net had two rectangular frames (1.2 m (4.0 ft.) by 0.6 m (2.0 ft.)) and two hoops (0.6 m (2.0 ft.)) made of oil tempered spring steel. A 4.5 m (15 ft.) by 0.6 m (2.0 ft.) lead was connected to the second rectangular frame. The mini-fyke net had 3 mm (1/8") ace mesh with a 29.5 kg (65lb.) lead core line. Mini-fyke net samples were overnight sets with a maximum set time of 24 hours.

2.5" Monofilament Gill Net

The non-standard or wild 2.5" monofilament gill net was 61 m (200 ft.) long with a height of 2.4 m (8 ft.) and was constructed of 2.5" #208 monofilament nylon netting. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg/183 m). Gill net samples were overnight sets with a maximum set time of 20 hours. This net was used during the 2007 sampling season in an attempt to collect pallid sturgeon broodstock.

3.25" Monofilament Gill Net

The non-standard or wild 3.25" monofilament gill net was 61 m (200 ft.) long with a height of 3.0 m (10 ft.) and was constructed of 3.25" #208 monofilament nylon netting. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg/183 m). Gill net samples were overnight sets with a maximum set time of 20 hours. This net was used during the 2007 sampling season in an attempt to collect pallid sturgeon broodstock.

25 ft. Otter Trawl

The non-standard or wild 25 ft. trawl had a width of 7.6 m (25 ft.), height of 0.9 m (3 ft.), and length of 7.6 m (25 ft.). The trawl was constructed of 1.5" #9 HDPE sapphire bar mesh. Trawl doors made from 19.1 mm (3/4") marine plywood, measuring 1066 mm (42") by 533 mm (21"), were used to keep the trawl deployed on the river bottom. Otter trawls were fished downstream with the length of the trawl dependent upon the size of the macrohabitat and mesohabitat being sampled. Otter trawl samples covered a minimum of 75 m (246 ft.) and a maximum of 300 m (984 ft.).

Trot Line

The non-standard or wild trot line had a 32 m (105 ft.) main line with 15 3/0 O'Shaughnessy hooks per line baited with night crawlers. Hooks were tied to leaders with a minimum of 304 mm (12") and maximum of 608 mm (24") of line. Each leader was fastened to the main line using trot line snaps. Hooks were spaced a minimum of 1.5 m (5 ft.) and a maximum of 3.0 m (10 ft.). Trot lines were deployed in all habitat types and CPUE is reported as fish/hook night.

Push Trawl

The non-standard or wild push trawl was an envelope shaped net that was pushed along the bottom straining fish from shallow water habitats. The net was fished from the front of a powered boat while being pushed downstream. The push trawl had a width on 2.4 m (8 ft.), height on 0.61 m (24") and length of 1.8 m (6 ft.). The trawl was composed entirely of a 4 mm (3/16") bar mesh. Trawl doors were used to keep the trawl deployed on the river bottom and were made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") by 381 mm (15"). These nets were used during the 2007 fish community season in an attempt to collect additional young-of-the-year *Scaphirhynchus* species.

Data Collection and Analysis

Fish Data Collection

When a pallid sturgeon was sampled, the fish was measured to the nearest millimeter and weighed to the nearest gram, morphometric measurements were recorded along with pictures, habitat parameters and all tagging information. If the pallid sturgeon had not been previously PIT tagged, a PIT tag was placed in accordance with the protocols. Other target species were measured to the nearest millimeter and weighed to the nearest gram. All non-target species collected were measured to nearest millimeter and released. An exception to this was during the community sampling season, when mini-fyke netting samples could be preserved in 10% formalin and brought back to the lab for identification. Mini-fyke net samples were identified to species, stored in 70% alcohol and labeled by species by sample.

Associated Environmental Data

Habitat samples were collected at every pallid sturgeon capture site and were collected at 25% of the remaining sampling sites by macrohabitat and mesohabitat. The predetermined parameters for habitat sampling were GPS coordinates (latitude and longitude in decimal degrees), water depth (m), water velocity ((mps) at bottom, 0.2, and 0.8 of water column), water temperature (°C), turbidity (NTU) and a sediment profile (based on percent of gravel, sand and silt).

Genetic Validation

Collection methods, including the handling of pallid sturgeon, conformed with methods described in Biological Procedures and Protocol for Collecting, Tagging, Sampling,

Holding, Culture, Transporting, and Data Recording for Researchers and Managers Handling Pallid Sturgeon (U.S Fish and Wildlife Service, 2008). Fin clips for DNA analysis were taken from any pallid sturgeon that was not tagged when captured and all suspected hybrids and sent to Abernathy Fish Technology Center for validation.

Analyses

All datasheets were checked and submitted to the Missouri Department of Conservation. Data was processed and analyzed using Microsoft Access and SAS statistical software (SAS Institute, Version 9.1). Figures were generated via SigmaPlot.

Catch per Unit Effort

All fish collections are reported as catch per unit effort (CPUE) with the associated standard error. Catch per unit effort for gill nets is reported as the number of fish per 100 feet of gill net per net night. Catch per unit effort for otter trawls are reported as number of fish per 100 linear meters trawled. Catch per unit effort for 1.0” trammel nets is reported as number of fish per 100 meters drifted. Catch per unit effort for mini-fyke nets are reported as number of fish per net night. Catch per unit effort was calculated for each subsample instead of overall catch per overall effort in order to get a measure of variance. These individual CPUEs are then averaged to get a total CPUE for an individual gear, bend or segment.

Mean annual CPUE data were checked for normality (PROC UNIVARIATE) using SAS (SAS Institute, Version 9.1). All data that did not follow a normal distribution were log10 transformed. Normality assumptions were still not met. Therefore, to compare mean annual CPUE’s between years, non-parametric statistical analysis were completed. PROC GENMOD used a TYPE3 POISSON distribution to test for an overall difference amongst all years. For the model, PROC GENMOD reports the source data (i.e. year), the degrees of freedom associated with the source, an F value statistic with associated p-value and a chi-squared statistic with associated p-value for testing the significance of the source to the model. When overall CPUE data were significantly different, the PROC GENMOD ESTIMATE statement compared individual years. This determined which years were statistically different by comparing one years data versus a different years data. For the model, PROC GENMOD reports a label for the data (i.e. 2003 VS 2004), the estimated value, the standard error of the estimated value, upper and lower confidence limits and a chi-squared statistic with associated p-value for testing the significance of the model. Finally,

CPUE by year was tested used PROC GENMOD to determine if there was a significant trend in the data. For the model, PROC GENMOD reports the source data (i.e. year), the degrees of freedom associated with the source and a chi-squared statistic with associated p-value for testing the significance of the source to the model. Significance was determined at $\alpha = 0.05$ for all tests.

To determine if fish were being caught in proportion to the amount of effort being expended in each habitat, a chi-squared analysis was performed using SAS (SAS Institute, Version 9.1).

Character Index

Pallid sturgeon, shovelnose sturgeon and hybrids can be distinguished using meristic and morphometric characteristics (Sheehan, 1999). Sheehan et al. (1999) developed the character index (CI) using two meristics (dorsal and anal fin ray counts) and five morphometric ratios. This equation categorized *Scaphirhynchus* specimens into three categories. Character index values for pallid sturgeon range from -1.48 to -0.09, hybrid sturgeon from -0.45 to 0.51 and shovelnose sturgeon from 0.37 to 1.33.

Relative Condition

The relative condition of recaptured hatchery reared pallid sturgeon was calculated using the formula:

$$K_n = (W / W');$$

where W is weight of the individual and W' is the length-specific mean weight predicted by the weight-length equation calculated for that population. Keenlyne and Evanson (1993) provided a weight-length regression:

$$\log_{10}W = -6.378 + 3.357 \log_{10}L \quad (r^2 = 0.9740);$$

for pallid sturgeon throughout its range which was used to calculate a relative condition factor.

Relative Weight

The 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

Length frequency indexes can be used to indicate changes in a population structure. Length categories were based on the percentage of the largest known pallid sturgeon are as followed (Gablehouse 1984): sub-stock fork length < 330 mm (20%), stock fork length = 330 – 629 mm (20 – 36%), quality fork length = 630 – 839 mm (36 - 45%), preferred fork length = 840 – 1039 mm (45 – 59%), memorable fork length = 1040 – 1269 mm (59 – 74%) and trophy fork length > 1270 mm (> 74%). Length categories based on the percentage of the largest known shovelnose sturgeon are as follows: sub-stock fork length < 250 mm (20%), stock fork length = 250 – 379 mm (20 – 36%), quality fork length = 380 – 509 mm (36 - 45%), preferred fork length = 510 – 639 mm (45 – 59%), memorable fork length = 640 – 809 mm (59 – 74%) and trophy fork length > 810 mm (> 74%). Proportional Stock Density (PSD) is proportion of fish of quality size in a stock. Relative Stock Density (RSD) is the proportion of fish of a size group in a stock. Length frequency distributions for each species for each season were compared with a Kolmogorov-Smirnov test (SAS Institute, Version 9.1).

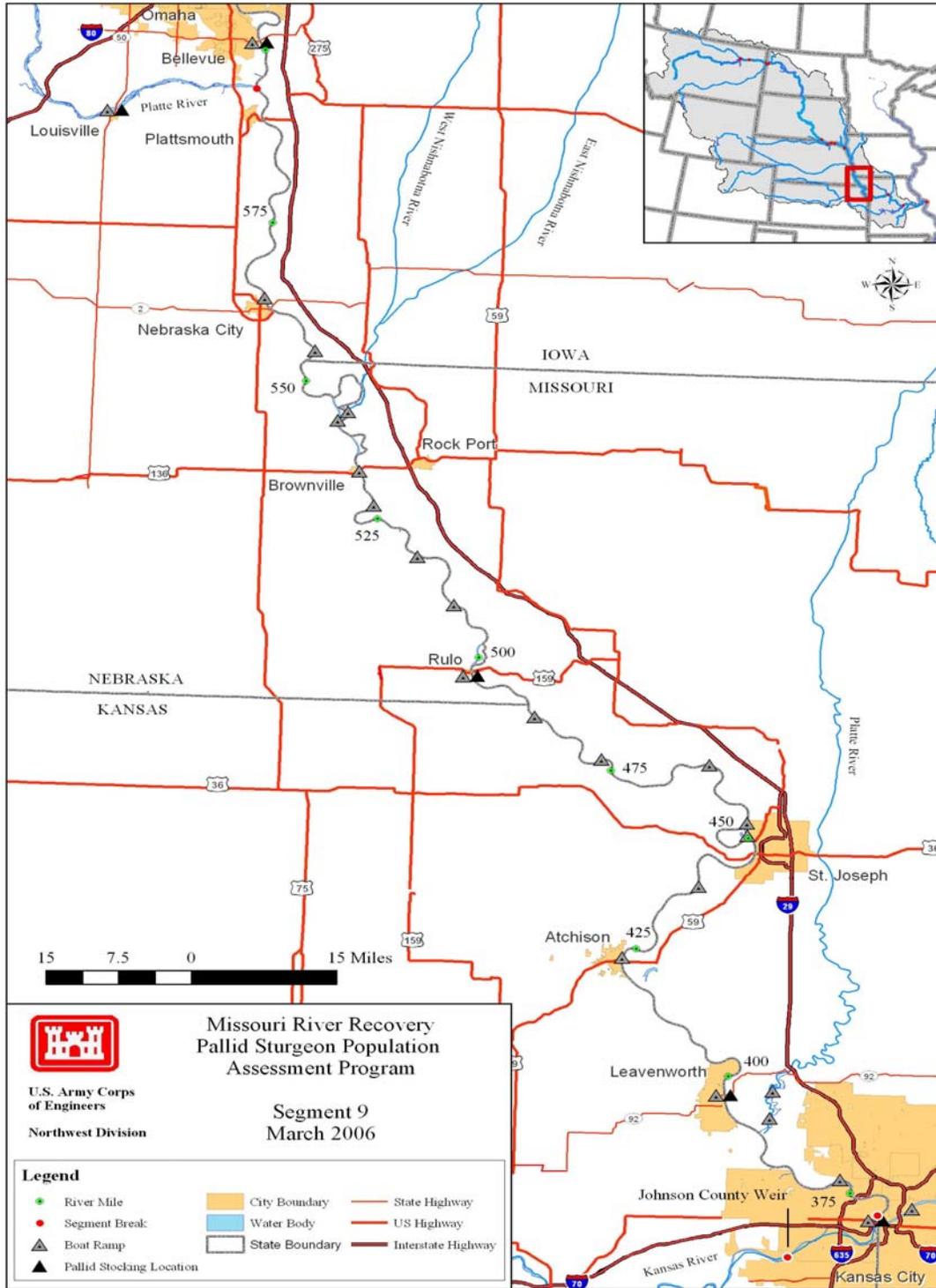


Figure 1a. Map of Segment 9 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 9 encompasses the Missouri River from the Platte River (River Mile 595.0) to the Kansas River (River Mile 367.5).

Results

Effort

Sampling efforts in Segment 9 is limited to a few macro and mesohabitats due to the simplification of the river due to channelization. Sampling was conducted primarily in bar, pool and channel border mesohabitats within inside bend and channel cross-over macrohabitats. The 100' and 200' standard gill nets have been used since this project started in March of 2003 and were only used during the sturgeon season due to temperature restrictions (Appendix C). Gill nets were set on the channel border and pool mesohabitats within the outside bend, inside bend, channel cross-over, secondary connected channel large and confluence macrohabitats (Tables 1 and 2). A total of 456 net nights of effort were expended with gill nets in Segment 9 during 2007.

The standard 16' otter trawl has been used since this project started in 2003 and was used during the sturgeon season and the fish community season (Appendix C). Otter trawls were used to sample the channel border mesohabitats within the inside bend, channel cross-over, tributary mouth large, outside bend, secondary connected channel large and confluence macrohabitats (Tables 1 and 2). A total of 415 otter trawl samples were collected in Segment 9 during 2007. Effort for the sturgeon season was the equivalent of 279.3 one hundred meter trawl deployments compared to 286.4 for the fish community season.

The standard 1.0" trammel nets have been used since this project started in 2003 and were used during the sturgeon season and the fish community season (Appendix C). One inch trammel nets were used to sample the channel border mesohabitats within the inside bend, channel cross-over, secondary connected channel large and confluence macrohabitats (Tables 1 and 2). A total of 625 one inch trammel net drifts were conducted in Segment 9 during 2007. Effort for the sturgeon season was the equivalent of 338.6 one hundred meter trammel net deployments compared to 307.6 for the fish community season.

The standard mini-fyke net has been used since this project started in 2003 and was used during the fish community season (Appendix C). Mini-fyke nets were used to sample the bar mesohabitats within the inside bend, channel cross-over, tributary mouth large, confluence and secondary connected channel large macrohabitats (Tables 1 and 2). A total of 156 mini-fyke sets were completed in Segment 9 during 2007 resulting in an effort of 156 net nights.

Table 1. Number of bends sampled, mean effort per bend (total number of deployments), and total effort by macrohabitat for Segment 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. 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	SCCS	SCCN	TRIB	TRML	TRMS
Fall through Spring - Sturgeon Season															
1 Inch Trammel Net	20	16.9 (304)	N-E	81.6	5.4	N-E	N-E	237.2		14.3		N-E			
Gill Net	23	19.8 (228)		100.0	6.0			328.0	14.0	8.0					
Otter Trawl	20	13.9 (209)		49.4	2.7			204.0	1.8	19.4				2.0	
Summer – Fish Community Season															
1 Inch Trammel Net	20	15.3 (321)	N-E	68.2	9.0	N-E	N-E	213.6		11.8		N-E		5.0	
Mini-Fyke Net	20	7.8 (156)		43.0				90.0	11.0	7.0				2.0	3.0
Otter Trawl	20	14.3 (206)		58.0	5.9			204.1		14.2				4.2	

Table 2. Number of bends sampled, mean effort per bend (total number of deployments), and total effort by mesohabitat for Segment 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	20	16.9 (304)		338.6	N-E	N-E		N-E
Gill Net	23	19.8 (228)		208.0			248.0	
Otter Trawl	20	13.9 (209)		279.5				
Summer – Fish Community Season								
1 Inch Trammel Net	20	15.3 (321)		307.6	N-E	N-E		N-E
Mini-Fyke Net	20	7.8 (156)	156.0					
Otter Trawl	20	14.3 (206)		286.4				

Pallid Sturgeon

A total of 32 pallid sturgeon were sampled during 2007 with 25 captured in standard gears and seven captured in a wild gear. Twenty-four fish were of known hatchery origin while eight were genetically determine wild origin. The sturgeon season was the most productive for pallid sturgeon captures with twenty-five fish sampled compared to seven during the fish community season.

Pallid sturgeon were captured throughout Segment 9 ranging from the confluence of the Platte and the Missouri Rivers (R.M. 595.0) downstream to Middle Iatan Bend (R.M. 410.0) (Figure 1b). Ten pallid sturgeon were sampled from Upper Plattsmouth Bend (R.M. 595.0) followed by three pallid sturgeon from Indian Cave Bend (R.M. 517.6) during the sturgeon and fish community seasons. Pallid sturgeon were collected from fifteen of the twenty-two randomly selected bends sampled.

Pallid sturgeon were captured from inside bend macrohabitats (N = 16) more frequently than any other macrohabitat sampled in Segment 9 in 2007 (Table 3). Pallid sturgeon were collected from channel border, pool, and thalweg mesohabitats. Channel borders accounted for twenty-one pallid sturgeon compared to nine collected in pools. The majority of pallid sturgeon were sampled in depths (69%), velocities (56%), temperatures (62%) and turbidities (71%) less than the average values for all gear deployments (Table 3). However, due to low catch rates, preferred habitat parameters can not be determined.

Five (1999, 2001, 2002, 2003 and 2005) of the eight year classes that have been stocked into the upper reach of RPMA # 4 were represented in the 2007 pallid sturgeon recaptures (Table 6). The 1992, 1997, 2005 and 2006 year classes were not collected. Relative condition factor (Kn) for all year classes of hatchery reared pallid sturgeon have declined since stocking. However, all recaptured pallid sturgeon appeared healthy. Daily growth rates ranged from 0.14 mm per day for the 1999 year class to 0.20 mm per day for the 2003 year class.

Incremental RSD was similar between the sturgeon and fish community seasons (Table 7). The majority (sturgeon season; RSD-S = 64 and fish community season; RSD-S = 71) of the pallid sturgeon collected were stock size. Only five pallid sturgeon were collected in the preferred length category during both seasons and no memorable or trophy fish were collected during 2007. Kn was very similar by length category and season.

Segment 9 - Pallid Sturgeon Captures by River Mile

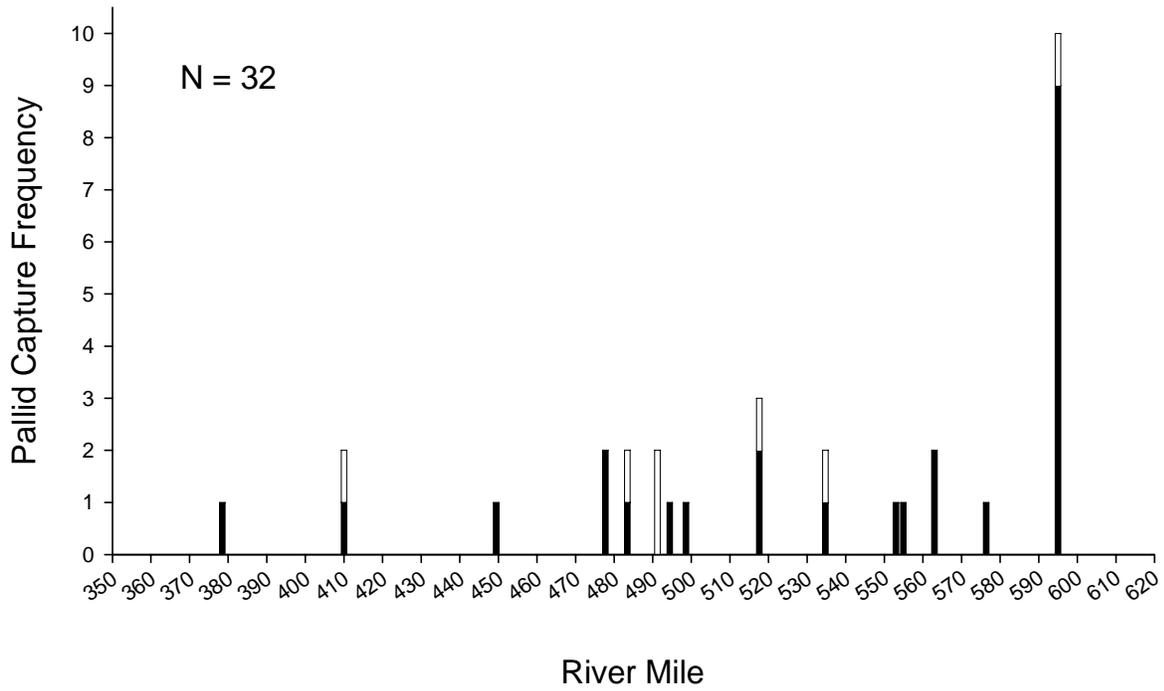


Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 9 of the Missouri River during 2007. Black bars represent pallid captures during Sturgeon Season and white bars during Fish Community Season. Figure includes all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2007. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity	Bottom Velocity	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
CHXO	BARS	0.6 (0.2-1.8)		0.06 (0.00-0.49)		25.0 (13.0-32.1)		75 (30-284)		
	CHNB	3.1 (0.4-7.7)	3.2 (1.9-4.5)	0.62 (0.00-2.70)	1.18 (0.60-2.70)	22.1 (2.6-29.5)	19.0 (12.5-27.1)	164 (18-623)	163 (50-315)	6
	POOL	3.0 (0.5-9.3)	2.0	0.38 (0.06-0.75)	0.34	9.1 (2.7-26.8)	4.0	158 (18-484)	20	1
CONF	BARS	0.6 (0.6-0.6)				27.2 (27.2-27.2)				
	CHNB	2.7 (1.2-4.7)	3.8 (3.3-4.4)	0.56 (0.14-1.13)	0.61 (0.35-0.80)	19.6 (6.8-27.7)	15.5 (13.0-19.7)	201 (30-738)	105 (80-148)	4
	POOL	3.4 (1.2-5.6)		0.12 (0.12-0.12)		10.7 (8.6-13.4)		22 (22-22)		
ISB	BARS	0.6 (0.1-1.8)		0.14 (0.01-0.66)		24.7 (13.0-30.6)		150 (39-1858)		
	CHNB	2.7 (0.2-8.6)	2.0 (1.1-3.1)	0.62 (0.05-1.47)	0.6 (0.21-0.78)	22.3 (2.9-30.6)	19.2 (9.7-28.1)	171 (18-1088)	76 (22-207)	9
	POOL	3.5 (1.0-8.3)	2.8 (2.1-3.7)	0.31 (0.02-1.12)	0.24 (0.04-0.58)	9.3 (2.8-13.4)	9.7 (3.9-12.5)	226 (17-1071)	117 (18-270)	7
OSB	BARS	0.6 (0.2-1.9)		0.09 (-0.01-0.30)		25.9 (20.4-31.0)		63 (39-103)		
	CHNB	2.8 (2.0-4.2)	3.7	0.14 (0.02-0.28)	0.28	9.1 (2.8-22.5)	2.8 (2.8-2.8)	121 (93-145)	145	1
	POOL	3.1 (1.8-4.4)		0.67 (0.37-0.97)		4.3 (3.6-5.0)		185 (138-232)		
	TLWG	4.3 (4.3-4.3)	4.3 (4.3-4.3)	1.06 (1.06-1.06)	1.06 (1.06-1.06)	25.8 (25.8-25.8)	25.8 (25.8-25.8)	105 (105-105)	105 (105-105)	2
SCCL	BARS	0.5 (0.2-1.0)		0.04 (0.02-0.06)		27.2 (23.8-28.5)		85 (67-118)		
	CHNB	1.9 (1.1-4.2)		0.75 (0.27-2.40)		22.8 (8.0-29.3)		211 (43-740)		
	POOL	2.0 (1.8-2.1)	1.8	0.09 (0.09-0.09)	0.09	9.9 (9.9-9.9)	9.9	346 (346-346)	346	1
TRML	BARS	0.4 (0.1-0.9)		0.13 (0.13-0.13)		25.2 (24.2-27.2)		122 (122-122)		
	CHNB	1.6 (1.2-3.0)	1.2	0.73 (0.14-1.06)	0.71	24.4 (13.8-27.3)	26.5	227 (96-771)	149	1
TRMS	BARS	0.4 (0.3-0.5)		0.01 (0.01-0.01)		30.1 (24.9-33.4)		114 (58-170)		

Table 6. Mean fork length, weight, relative condition factor (Kn) and growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from Segment 9 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
1999	2	434	357.5	1.09	676	1001.0	0.74	0.15	0.39
		67	365.0	0.64	116	546.0	0.01	0.11	0.56
2001	4	205			496	367.0	0.84	0.18	
		10			86	221.3	0.06	0.03	
2002	6	314			560	607.7	0.84	0.17	
		22			46	178.0	0.04	0.05	
2003	3	243	63.0	1.44	455	259.3	0.72	0.22	0.19
		12	32.1	0.54	23	108.1	0.21	0.02	0.09
2004	1				403	196.0	0.84		

Table 7. Incremental relative stock density (RSD)^a and relative condition factor (Kn) for all pallid sturgeon captured with all gear by a length category during 2007 in the Missouri River. Length categories^b determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)			
Sub-stock (200-329)			
Stock (330 – 629)	16	64	0.83 (0.07)
Quality (630 – 839)	5	20	0.82 (0.05)
Preferred (840- 1039)	4	16	0.82 (0.08)
Memorable (1,040 – 1,269)			
Trophy (> 1,270)			
Overall Kn			0.83 (0.04)
Fish Community Season			
Sub-stock (0-199)			
Sub-stock (200-329)			
Stock (330 – 629)	5	71	0.82 (0.02)
Quality (630 – 839)	1	14	0.75
Preferred (840- 1039)	1	14	0.67
Memorable (1,040 – 1,269)			
Trophy (> 1,270)			
Overall Kn			0.79 (0.05)

^a RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 100.

^b Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL (20 %), Stock (20 – 36 %), Quality (36 – 45 %), Preferred (45 – 59 %), Memorable (59 – 74 %), Trophy (>74 %).

Year comparisons, Gear evaluation and Habitat associations

A total of 32 pallid sturgeon were captured in 2007 including 25 with standard gears. Standard gears during 2007 included: gill nets (N = 14), 1.0" trammel nets (N = 9), and otter trawls (N = 2). Non-standard or wild gears during 2007 included: 25 ft. otter trawl (N = 2) and trot lines (N = 5). During the 2007 sturgeon season, hatchery reared pallid sturgeon were captured in all standard gears. Gill nets produced the highest CPUE (0.025 fish per net night), followed by 1.0" trammel nets (CPUE = 0.012 fish per 100 m drifted) and 16 ft. otter trawls (CPUE = 0.002 fish per 100 m trawled) (Figures 2 and 3). Catch rates of hatchery reared pallid sturgeon with gill nets were significantly higher during 2007 than 2006 ($\chi^2 = 9.71$, $P = 0.001$), 2005 ($\chi^2 = 10.64$, $P = 0.001$), 2004 ($\chi^2 = 15.27$, $P = < 0.001$), and 2003 ($\chi^2 = 12.22$, $P = < 0.001$). Two wild pallid sturgeon were collected during the sturgeon season with gill nets resulting in a CPUE of 0.007 fish per net night. Catch per unit effort for hatchery reared pallid sturgeon for otter trawls during the sturgeon season was significantly lower in 2007 compared to 2006 ($\chi^2 = 26.58$, $P = < 0.0001$) and 2005 ($\chi^2 = 5.47$, $P = 0.019$).

During the 2007, fish community season only seven pallid sturgeon were collected. Six were collected in 1.0" trammel nets, resulting in a CPUE of 0.007 fish per 100 m drifted for wild pallid sturgeon and 0.019 fish per 100 m drifted for hatchery reared pallid sturgeon (Figure 5).

No sub-stock (0-199 mm) or sub-stock (200-329 mm) pallid sturgeon were collected during the 2007 sampling season. Nineteen stock size (330-629 mm) pallid sturgeon were sampled during the 2007 sturgeon season (Tables 13 and 14). The majority (70%) of the stock size pallid sturgeon were collected on the inside bend with gill nets. However, 1.0" trammel nets in channel cross-over macrohabitats and otter trawls in confluence macrohabitats produced one hundred percent of the catch with a small amount of effort. Five quality and above size (> 630 mm) pallid sturgeon were sampled during 2007, with three being collected during the sturgeon sampling season (Tables 15 and 16). Four were sampled from inside bend macrohabitats and the other from a channel cross-over macrohabitat. Two fish were sampled in pool mesohabitats and three were sampled in channel border mesohabitats during 2007.

A total of 32 pallid sturgeon were measured during 2007, with 24 being sampled during the sturgeon season (Figure 8). The average fork length was 626 mm during the

sturgeon season compared to 574 mm for the fish community season. The length range for pallid sturgeon sampled during the sturgeon season was 372 to 1,023 mm compared to 403 to 849 mm for the fish community season.

Since this project began, 91 pallid sturgeon have been collected and the number collected has increased each year. During the 2003 sampling season three fish were collected (Wild = 2 and Hatchery = 1), in 2004 eleven fish were collected (Wild = 6 and Hatchery = 5), in 2005 fifteen fish were collected (Wild = 5 and Hatchery = 10), in 2006 31 fish were collected (Wild = 3, Hatchery = 23, and Unknowns = 5) and in 2007 32 fish were collected (Wild = 8 and Hatchery = 24) (Figure 9).

Segment 9 - Pallid Sturgeon / Sturgeon Season

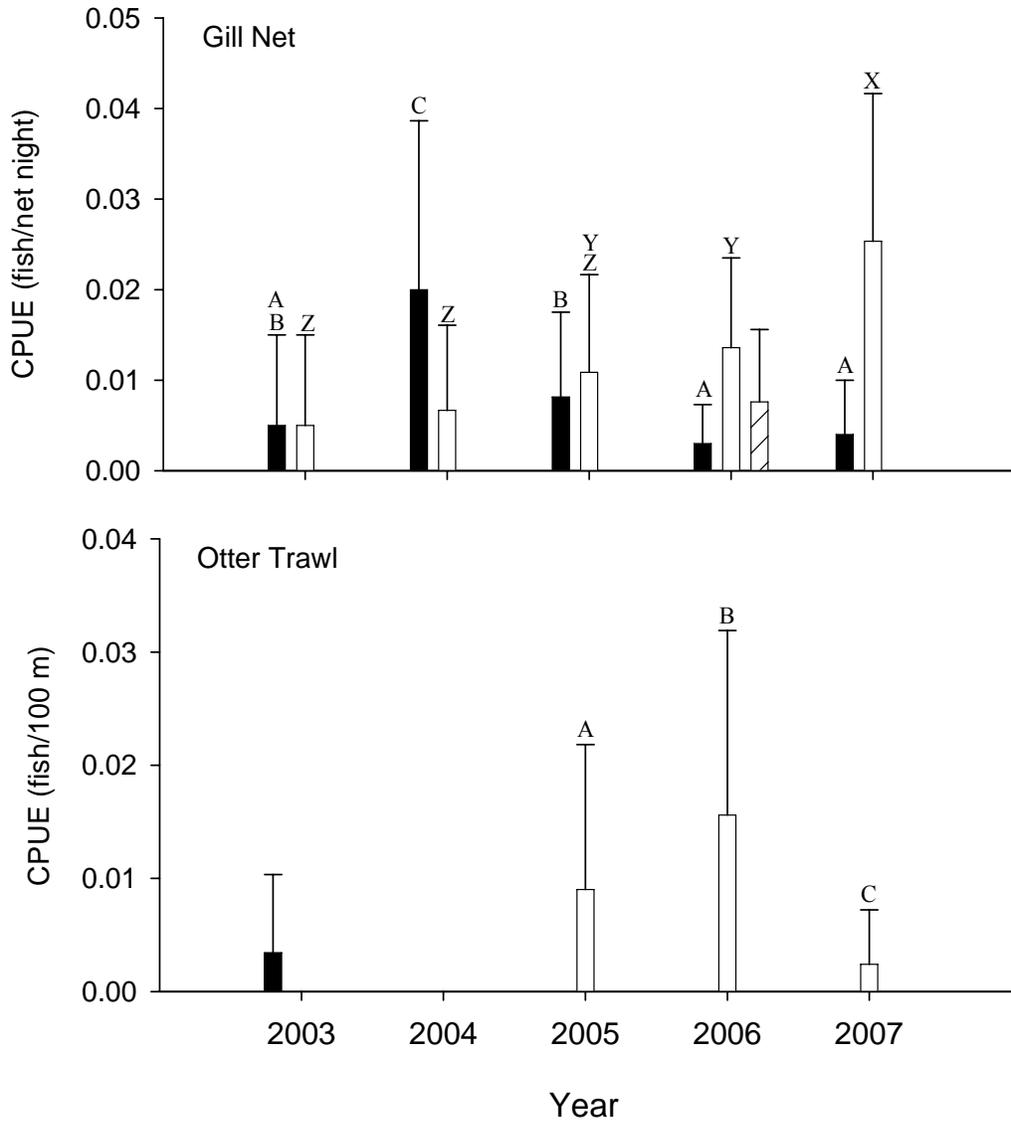


Figure 2. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification. Letters denote significant difference in mean CPUE between years.

Segment 9 - Pallid Sturgeon / Sturgeon Season

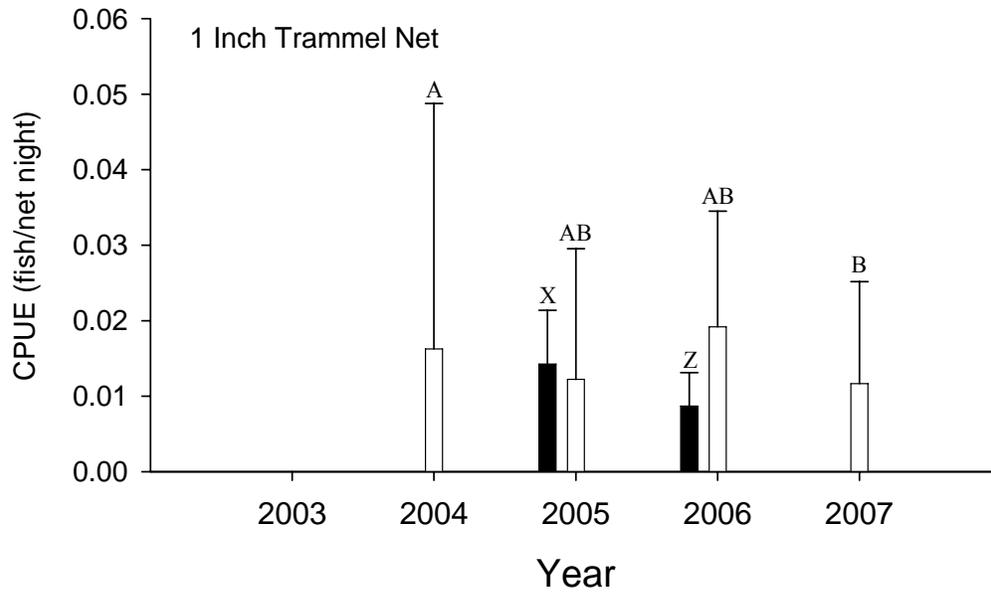


Figure 3. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets in segment 9 of the Missouri River during sturgeon season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification. Letters denote significant difference in mean CPUE between years.

Segment 9 - Pallid Sturgeon / Fish Community Season

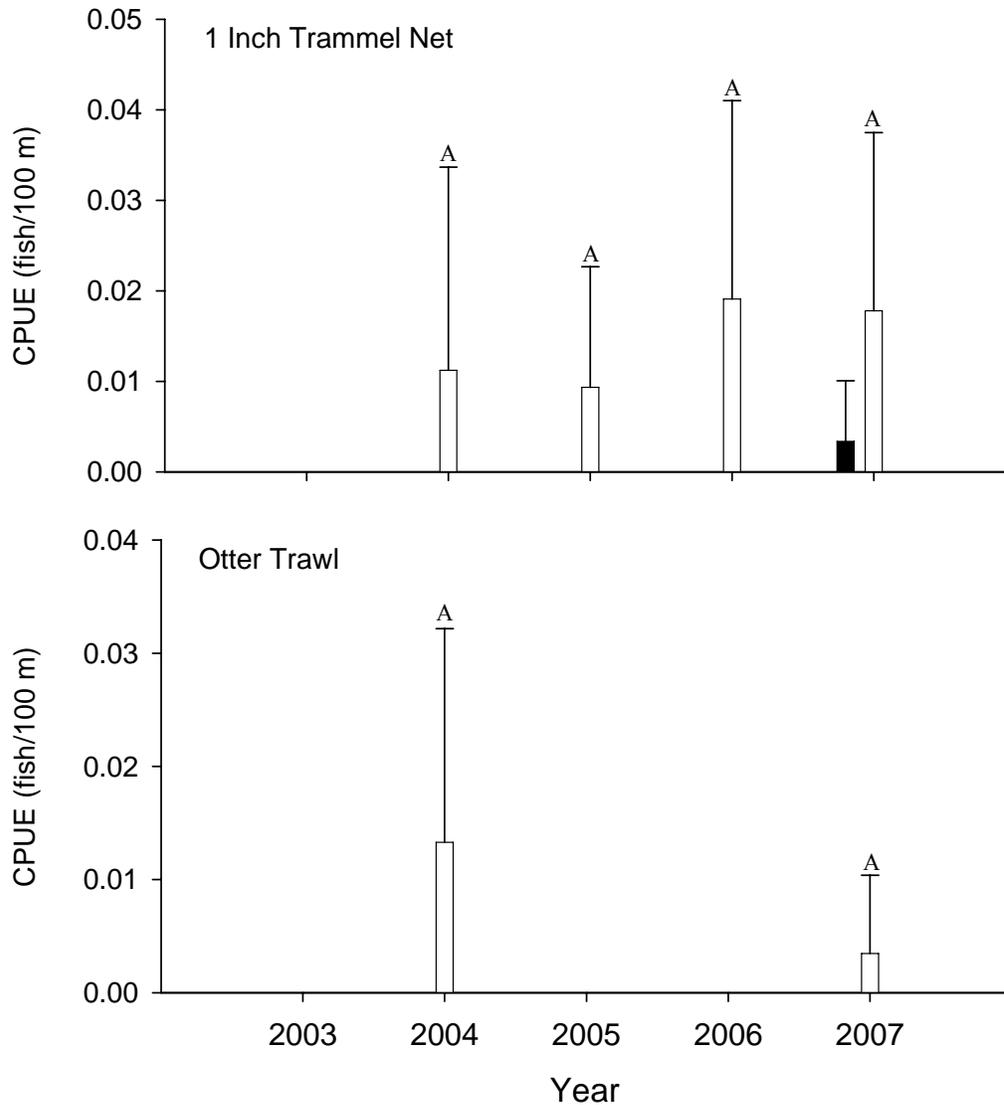


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification. Letters denote significant difference in mean CPUE between years.

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 9 of the Missouri River during 2007. 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 7. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	3		100 25	2			69		4						
Gill Net	10	N-E	10 22	1	N-E	N-E	70 72	10 2	10 2		N-E				
Otter Trawl	1		100 18	2			72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net	4		22	3			75 70		4				25 2		
Mini-Fyke Net		N-E	28		N-E	N-E	58	7	4		N-E		1	2	
Otter Trawl	1		100 21	2			71		5				1		

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 9 of the Missouri River during 2007. 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 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	3		100 100	N-E	N-E		
Gill Net	10		30 47			70 53	
Otter Trawl	1		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	4		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl	1		100 100				

Table 15. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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 7. 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			
Sturgeon Season (Fall through Spring)																		
1 Inch Trammel Net		N-E	25	2	N-E	N-E	69		4		N-E							
Gill Net	3		33				67											
			22	1			72	2	2									
Otter Trawl			18	2			72	1	7				1					
Fish Community Season (Summer)																		
1 Inch Trammel Net	2	N-E	22	3	N-E	N-E	100		4		N-E		2					
Mini-Fyke Net			28				58	7	4					1	2			
Otter Trawl			21	2			71		5					1				

Table 16. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net			100	N-E	N-E		
Gill Net	3		33 47			66 53	
Otter Trawl			100				
Fish Community Season (Summer)							
1 Inch Trammel Net	2		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl			100				

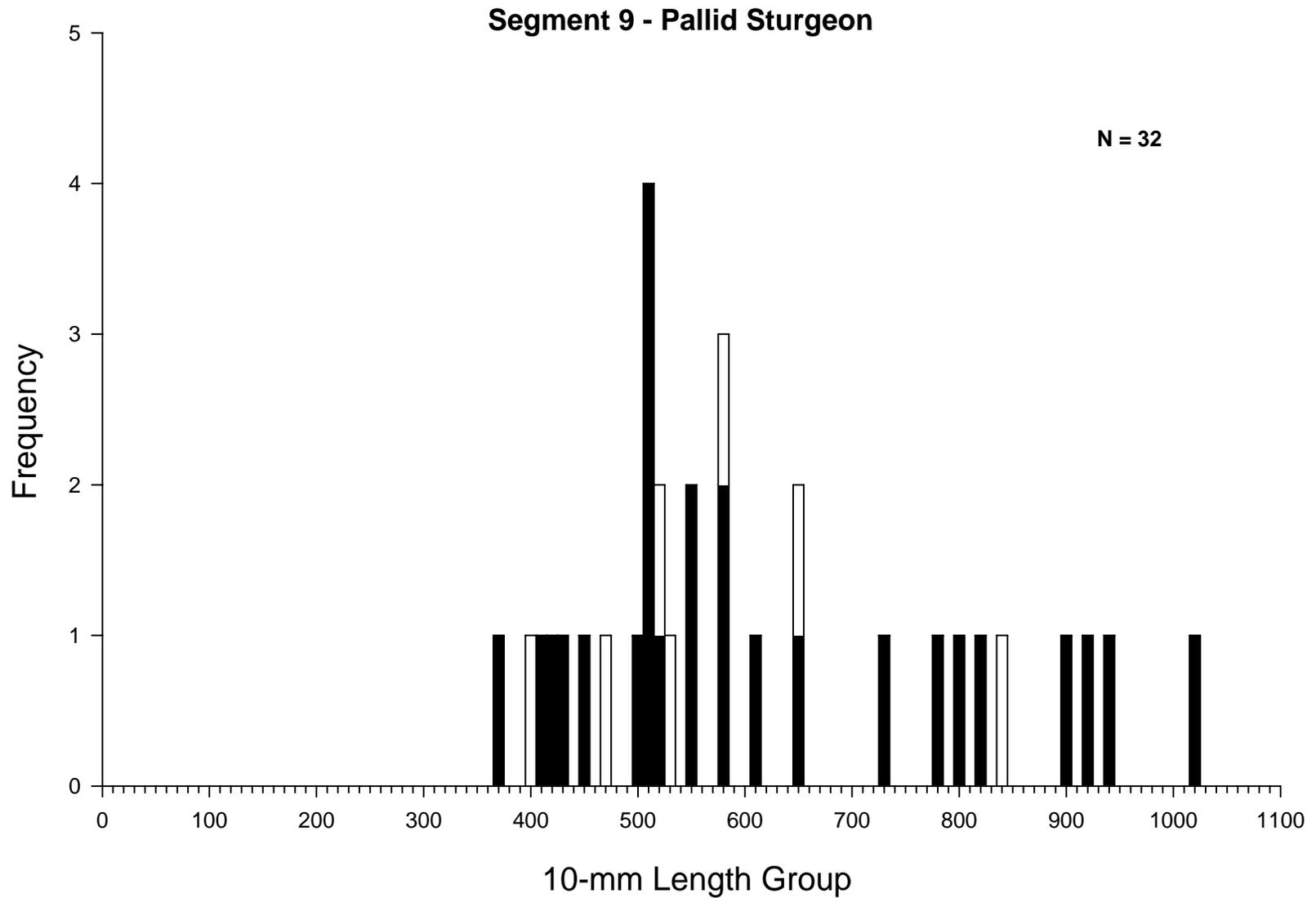


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2007 including non-random and wild samples.

Segment 9 - Annual Pallid Sturgeon Capture History

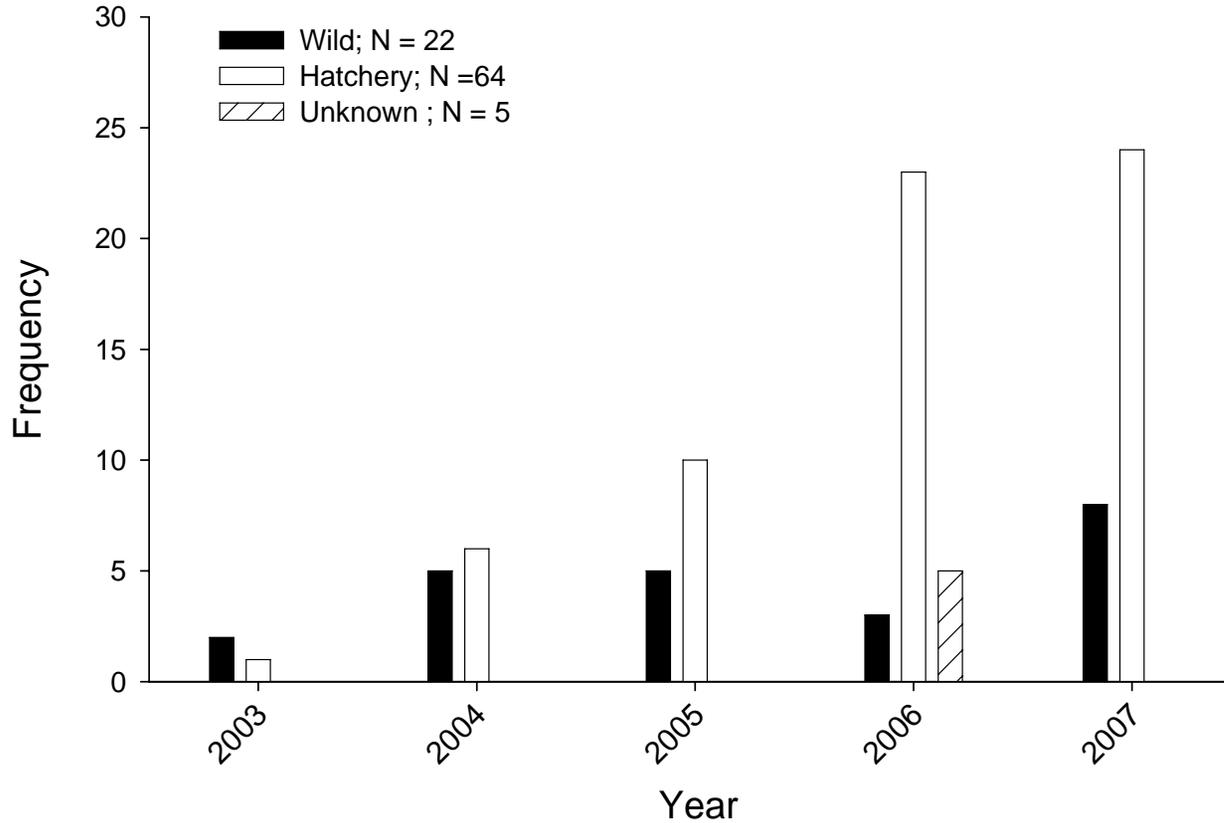


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 9 of the Missouri River from 2003-2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

A total of two hybrid sturgeon were collected during the 2007 sampling season and were determined hybrids using the Sheehan (1999) character index and/or genetic results. Both hybrids sturgeon were collected in the lower reach of Segment 9. This is a decrease from thirteen hybrid sturgeon in 2006 and three in 2005.

Targeted Native River Species

Shovelnose Sturgeon

A total of 4,090 shovelnose sturgeon were sampled during 2007 with 3,875 captured with standard gears. Standard gears during 2007 included: gill nets (N = 2,035), 1.0" trammel nets (N = 1,259), and otter trawls (N = 581). Non-standard or wild gear included: trot lines (N = 98), 2.5" monofilament gill nets (N = 94), 25 ft. otter trawl (N = 20), push trawls (N = 2), and set lines (N = 1). Numbers of sub-stock (0-149 (N = 3) and 150-249 mm (N = 25)) and stock (250-379 (N = 63)) sized shovelnose sturgeon was low for all gears during the sturgeon season. Gill nets remained the most effective gear during the sturgeon season (Figures 11 and 12). Catch per unit effort (4.6 fish per net night) for quality and above size (> 380 mm) shovelnose sturgeon for gill nets during the sturgeon season increased slightly compared to 2006 (3.4 fish per net night). Overall, gill netting CPUE's for quality and above size (> 380 mm) shovelnose sturgeon continue on a significant downward trend ($\chi^2 = 865.1$, $df = 1$, $P = < 0.001$). Otter trawling during the sturgeon season resulted in a significant increase in sub-stock (150-249 mm) and stock (250-379 mm) sized shovelnose sturgeon from 2003 to 2007 ($\chi^2 = 6.72$, $df = 1$, $P = 0.009$ and $\chi^2 = 8.63$, $df = 1$, $P = 0.003$, respectively). Catch per unit effort of stock (250-379 mm) sized shovelnose sturgeon with 1.0" trammel nets during the sturgeon season increased significantly from 2003 to 2007 ($\chi^2 = 10.04$, $df = 1$, $P = 0.001$) compared to quality and above (> 380 mm) size shovelnose sturgeon which decreased significantly ($\chi^2 = 13.9$, $df = 1$, $P = < 0.001$) (Figure 12).

One sub-stock (0-149 mm) and two sub-stock (149-249 mm) shovelnose sturgeon were collected during the fish community season while 1.0" trammel netting. Catch per unit effort for 1.0" trammel nets during the fish community season for stock (250-379 mm) and quality and above (> 380 mm) sized shovelnose sturgeon increased significantly from 2003 to 2007 ($\chi^2 = 7.46$, $df = 1$, $P = 0.006$ and $\chi^2 = 9.18$, $df = 1$, $P = 0.002$, respectively) (Figure 14). The number of sub-stock (0-149 mm (N = 25) and 150-249 mm (N = 13)) and stock sized (250-379 mm (N = 34)) shovelnose sturgeon collected while otter trawling increased when compared to 2005 and 2006. Overall, CPUE for all sizes of shovelnose sturgeon from otter trawls during the fish community season has remained similar through the first five years of this project, except for stock (250-379 mm) size fish which have had a significant upward trend ($\chi^2 = 16.9$, $df = 1$, $P = < 0.001$).

Segment 9 - Shovelnose Sturgeon / Sturgeon Season

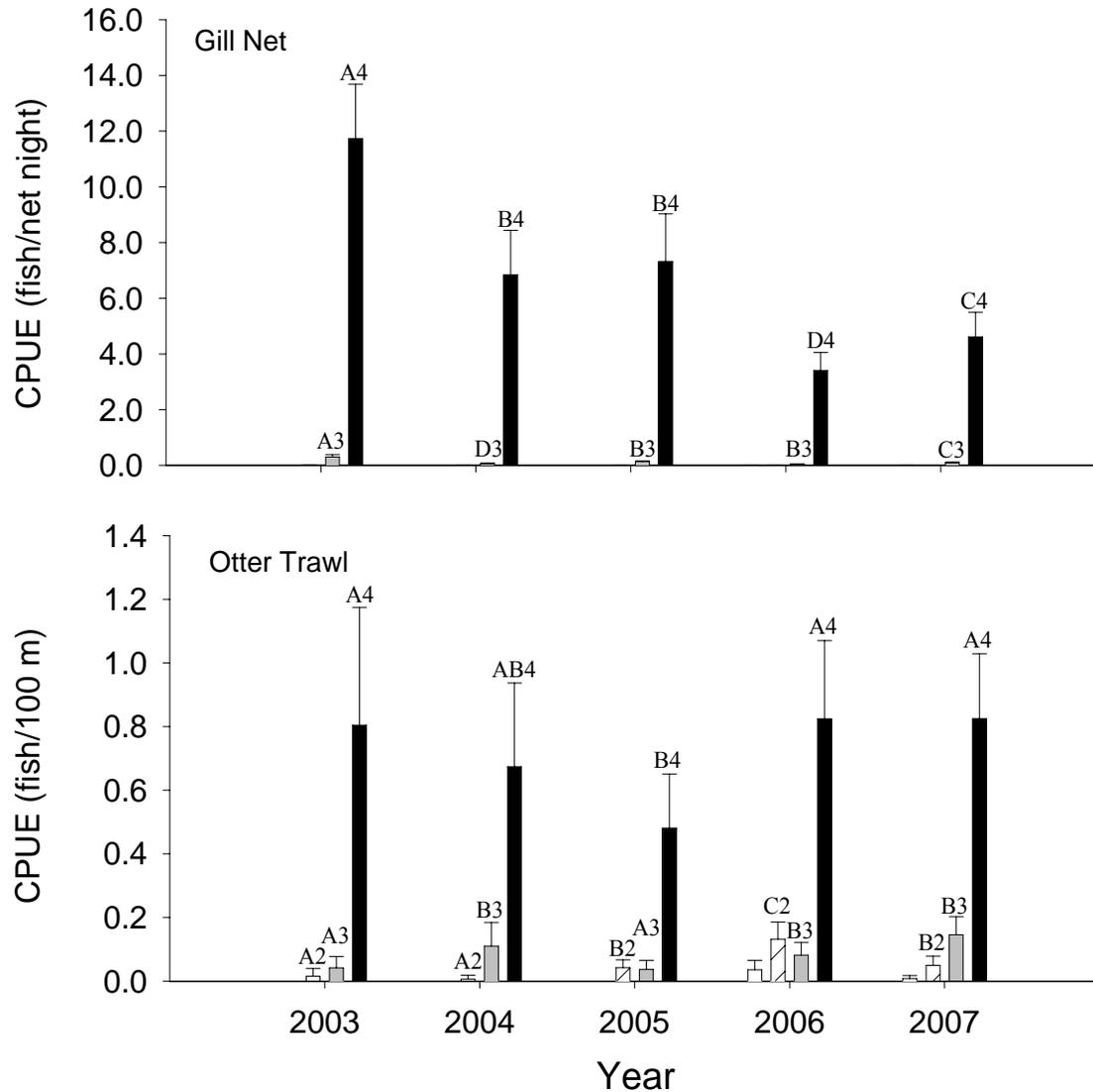


Figure 11. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Shovelnose Sturgeon / Sturgeon Season

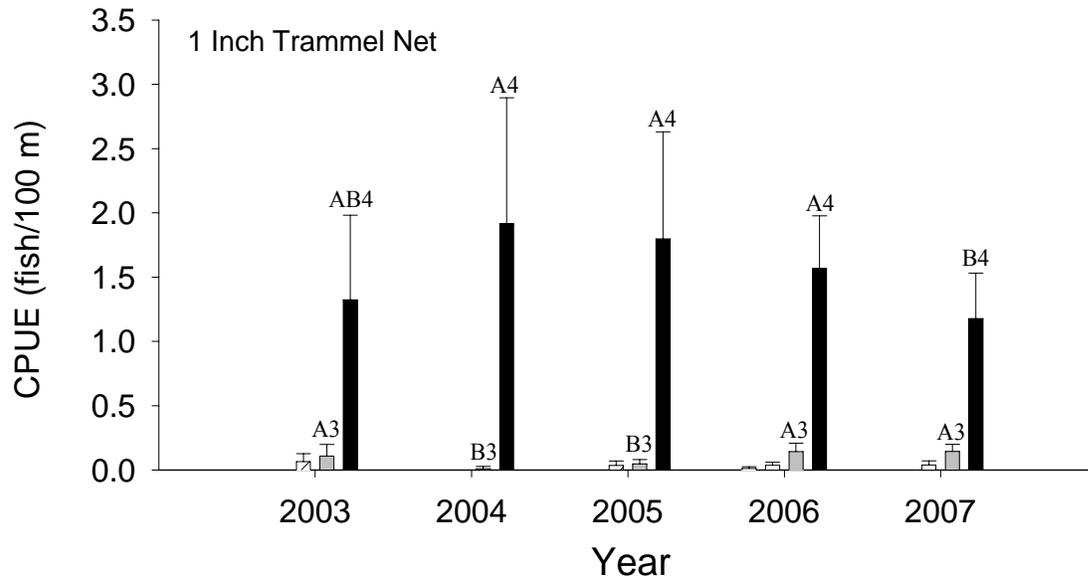


Figure 12. Mean annual catch-per-unit-effort (\pm 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Shovelnose Sturgeon / Fish Community Season

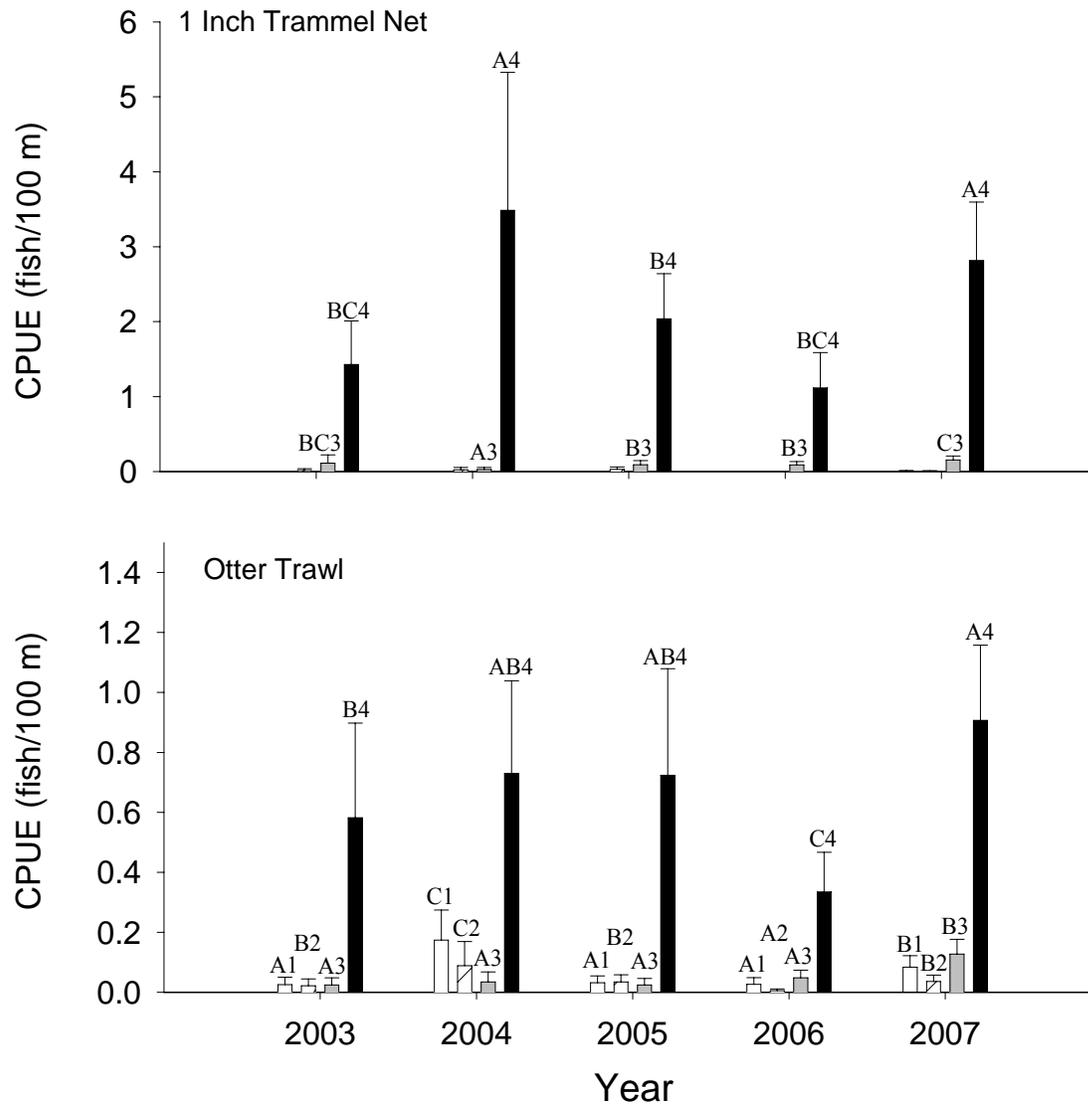


Figure 14. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Habitat Use

Thirty sub-stock (0-149 mm) shovelnose sturgeon were collected during the 2007 sampling season (Table 17). The majority (83%) of sub-stock (0–149 mm) shovelnose sturgeon were collected using the otter trawl, three during the sturgeon season and twenty-five during the fish community season. All sub-stock (0-149 mm) shovelnose sturgeon sampled were collected on the inside bend macrohabitats during both seasons. Channel borders were the only mesohabitat where sub-stock (0-149 mm) sized shovelnose sturgeon were collected (Table 18), except for one fish collected in a pool during winter gill netting.

Forty sub-stock (150-249 mm) shovelnose sturgeon were collected during the 2007 sampling season, with otter trawling (N = 27) being the most effective sampling method (Table 19). Otter trawling during the sturgeon season captured 15 sub-stock (150-249 mm) shovelnose sturgeon compared to 12 sampled during the fish community season. Sampling within the inside bend macrohabitats produced the highest catch rate for all gears during both seasons. Channel borders were the only mesohabitat where sub-stock (150-249 mm) shovelnose sturgeon were collected (Table 20).

One hundred ninety-seven stock size (250-379 mm) shovelnose sturgeon were sampled during 2007, 117 during the sturgeon season and 80 during the fish community season (Tables 21 and 22). The majority of stock size shovelnose sturgeon were collected from the inside bend macrohabitat and channel border mesohabitats during both seasons for all gears. Over 3,600 quality and above size (> 380 mm) shovelnose sturgeon were sampled during 2006 (Tables 23 and 24). Inside bend macrohabitats was the primary habitat sampled during both seasons. Comparison between proportion caught and effort shows no differences between macrohabitats for gears during both seasons, except for 1.0” trammel nets during the sturgeon season ($\chi^2 = 22.34$, $df = 3$, $P = < 0.0001$). Overall, more quality and above size shovelnose sturgeon were collected in the confluence and secondary connected channel large macrohabitats than proportion of effort expended. Channel border mesohabitat was the principle habitat sampled with 1.0” trammel nets and otter trawls gears during both seasons. Comparison between proportion caught and effort showed a significant difference between mesohabitats for gill nets during the sturgeon season ($\chi^2 = 12.65$, $df = 1$, $P = < 0.0004$).

A total of 4,090 shovelnose sturgeon were measured during 2007 (Figure 17). The average fork length was 537 mm during the sturgeon season compared to 504 mm for the fish community season. The length distributions for the two seasons were not significantly different

($D = 0.20$, $P = 0.167$). The length range for shovelnose sturgeon sampled during the sturgeon season was 23 to 794 mm compared to 28 to 743 mm for the fish community season.

The majority (65%) of shovelnose sturgeon collected with all gears fall into the RSD-P length category (Table 25). A higher percentage of RSD-S (7%) and RSD-Q (32%) shovelnose sturgeon were collected during the fish community season compared to the sturgeon season (RSD-S 4% and RSD-Q 22%) while more RSD-P shovelnose sturgeon were collected in the sturgeon season (sturgeon season 69% vs. fish community season 56%). The number of RSD memorable fish was the same for the sturgeon and fish community seasons and no trophy shovelnose sturgeon were collected during 2007.

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 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net			25	2			69		4						
Gill Net	1	N-E	22	1	N-E	N-E	100 72	2	2		N-E				
Otter Trawl	3		18	2			100 72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net	1		22	3			100 70		4				2		
Mini-Fyke Net		N-E	28		N-E	N-E	58	7	4		N-E		1	2	
Otter Trawl	25		21	2			100 71		5				1		

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 9 of the Missouri River during 2007. 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					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net			100	N-E	N-E		
Gill Net	1		47			100 53	
Otter Trawl	3		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	1		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl	25		100 100				

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 9 of the Missouri River during 2007. 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			
Sturgeon Season (Fall through Spring)																		
1 Inch Trammel Net	11	N-E	25	2	N-E	N-E	91		9		N-E							
Gill Net			22	1			72	2	2									
Otter Trawl	15		13				87											
			18	2			72	1	7				1					
Fish Community Season (Summer)																		
1 Inch Trammel Net	2	N-E	22	3	N-E	N-E	100				N-E							
Mini-Fyke Net			28				58	7	4						2			
Otter Trawl	12		17				75		8									
			21	2			71		5				1					

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 9 of the Missouri River during 2007. 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net	11		100 100	N-E	N-E			
Gill Net			47				53	
Otter Trawl	15		100 100					
Fish Community Season (Summer)								
1 Inch Trammel Net	2		100 100	N-E	N-E			
Mini-Fyke Net		100						
Otter Trawl	12		100 100					

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 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	41	N-E	7 25	2	N-E	N-E	80 69		12 4		N-E		2		
Gill Net	35		9 22	1			86 72	3 2	3 2						
Otter Trawl	41		22 18	2			68 72		10 7					1	
Fish Community Season (Summer)															
1 Inch Trammel Net	46	N-E	15 22	4 3	N-E	N-E	81 70			4	N-E		2		
Mini-Fyke Net			28				58	7	4				1	2	
Otter Trawl	34		41 21	2			50 71		9 5				1		

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 9 of the Missouri River during 2007. 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					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	41		100 100	N-E	N-E		
Gill Net	35		14 47			86 53	
Otter Trawl	41		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	46		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl	34		100				

Table 23. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	337		13 25	13 2			55 69		18 4						
Gill Net	1999	N-E	22 22	1 1	N-E	N-E	74 72	2 2	1 2		N-E				
Otter Trawl	224		35 18	4 2			53 72		8 7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net	820		13 22	2 3			69 70		13 4				3 2		
Mini-Fyke Net		N-E	28		N-E	N-E	58	7	4		N-E		1	2	
Otter Trawl	227		31 21	1 2			60 71		7 5				1		

Table 24. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	337		100 100	N-E	N-E		
Gill Net	1999		23 47			77 53	
Otter Trawl	224		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	820		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl	227		100 100				

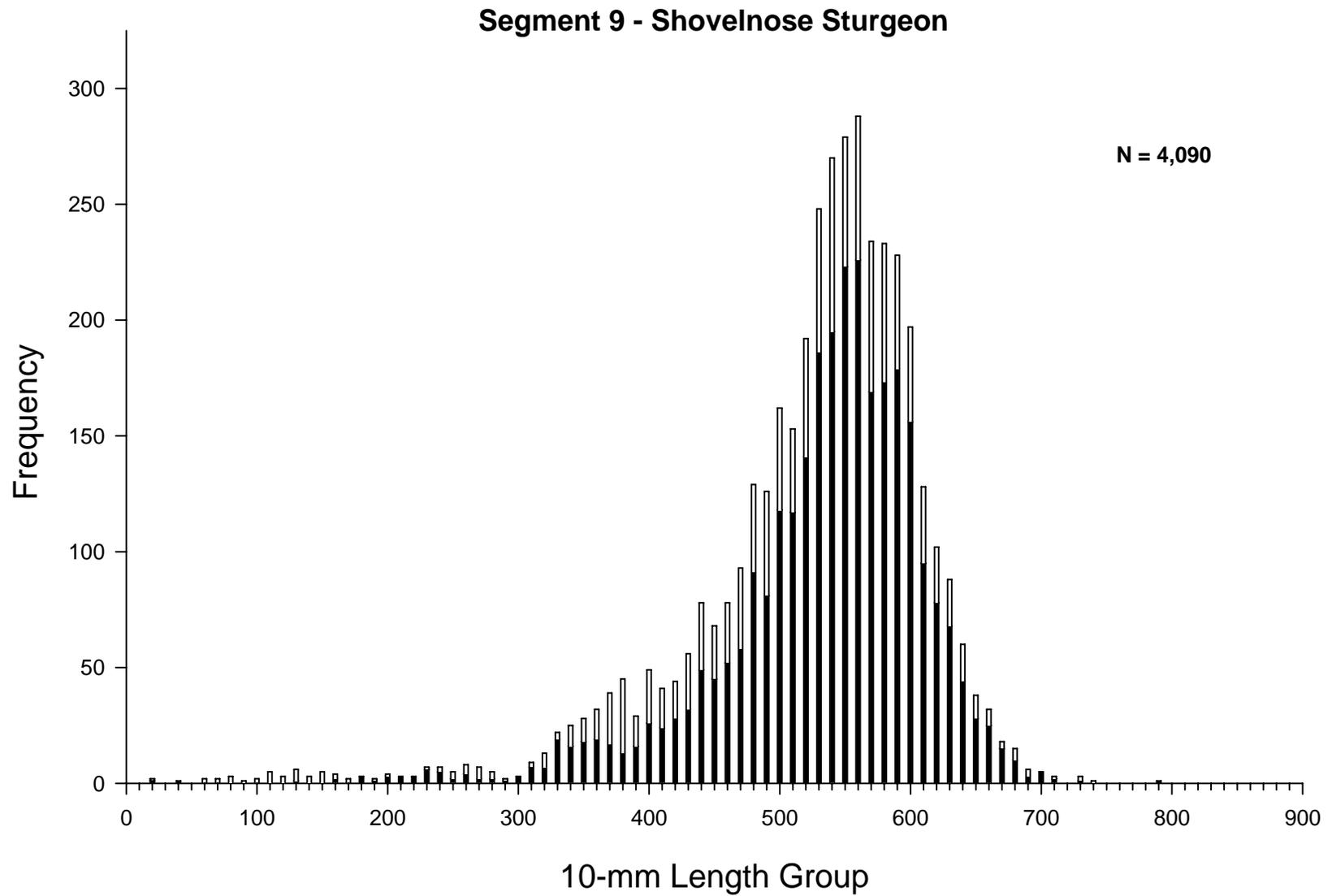


Table 25. Incremental relative stock density (RSD)^a and mean relative weight (Wr) by a length category for shovelnose sturgeon in Segment 9 of the Missouri River captured during 2007. Length categories^b determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	3		163.3
Sub-stock (150-249 mm)	26		101.2 (12.60)
Stock (250-379 mm)	117	4	84.76 (2.31)
Quality (380-509 mm)	600	22	89.20 (1.23)
Preferred (510-639 mm)	1843	69	85.83 (0.45)
Memorable (640-809 mm)	117	4	79.50 (1.98)
Trophy (> 810 mm)			
Overall Wr			86.41 (0.45)
Fish Community Season			
Sub-stock (0-149 mm)	26		143.9 (38.44)
Sub-stock (150-249 mm)	14		122.3 (29.29)
Stock (250-379 mm)	80	7	89.79 (5.03)
Quality (380-509 mm)	365	32	88.04 (1.53)
Preferred (510-639 mm)	634	56	83.50 (0.65)
Memorable (640-809 mm)	48	4	77.71 (2.41)
Trophy (> 810 mm)	0		
Overall Wr			86.12 (0.95)

^a RSD = (# of fish of a specified length class / # of fish \geq minimum stock length fish) * 100.

^b Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock (20 %), Stock (20 – 36 %), Quality (36 – 45 %), Preferred (45 – 59 %), Memorable (59 – 74 %), Trophy (>74 %).

Sturgeon Chub

A total of 37 sturgeon chubs were captured during 2007 with 34 captured in standard gears and 3 in wild gears. Standard gears during 2007 included: otter trawls (N = 33) and mini-fyke nets (N = 1). Wild gear during 2007 included: push trawls (N = 3). Catch per unit effort for otter trawling during 2007 (CPUE = 0.056 fish per 100 m trawled) was significantly lower than in 2005 (CPUE = 0.34 ($\chi^2 = 53.13$, $P = < 0.0001$)) but not significantly different than 2003, 2004 and 2006 (Figure 18). Sturgeon chubs from otter trawls had shown a significant increase during the fish community season from 2003-2006 ($\chi^2 = 29.96$, $P = < 0.0001$) (Figure 19). However, only 15 sturgeon chubs were collected during the 2007 fish community season with otter trawls resulting in significant decrease compared to 2006 ($\chi^2 = 4.40$, $P = < 0.036$). Only one sturgeon chub was collected with mini-fyke nets in 2007 (Figure 20).

All sturgeon chubs collected with otter trawls during the sturgeon season were sampled on the inside bends (56%) and channel cross-overs (44%) macrohabitats (Table 26) and were collected within the channel border mesohabitat (Table 27). Otter trawling during the fish community season showed similar results.

Eighteen sturgeon chubs were sampled during the sturgeon season and 19 were sampled during the fish community season with all gears (Figure 21). The average fork length was 68.5 mm during the sturgeon season and 45.9 mm during the fish community season. The length range for sturgeon chubs sampled during the sturgeon season was 36 to 87 mm compared to 20 to 87 mm during the fish community season.

Segment 9 - Sturgeon Chub / Sturgeon Season

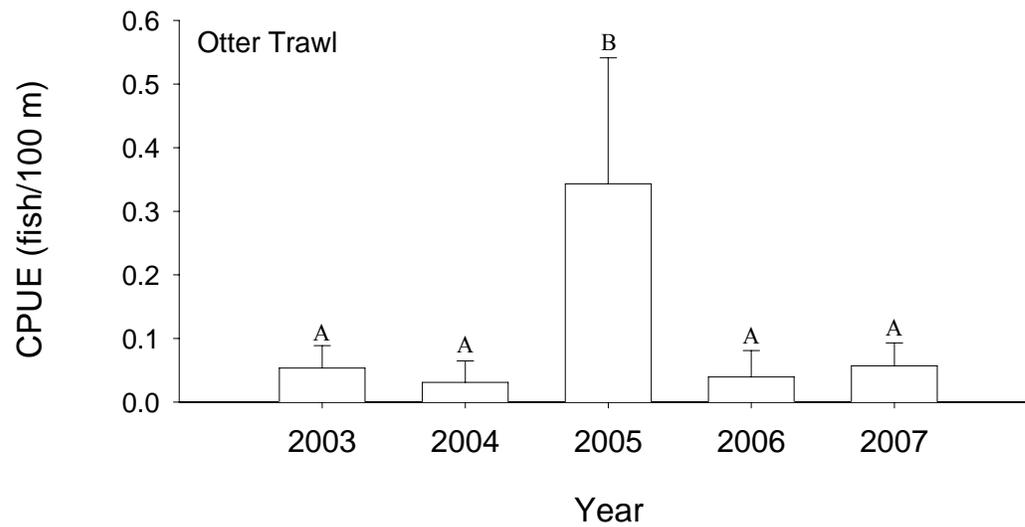


Figure 18. Mean annual catch-per-unit-effort (+/- 2 SE) of sturgeon chub using otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sturgeon Chub / Fish Community Season

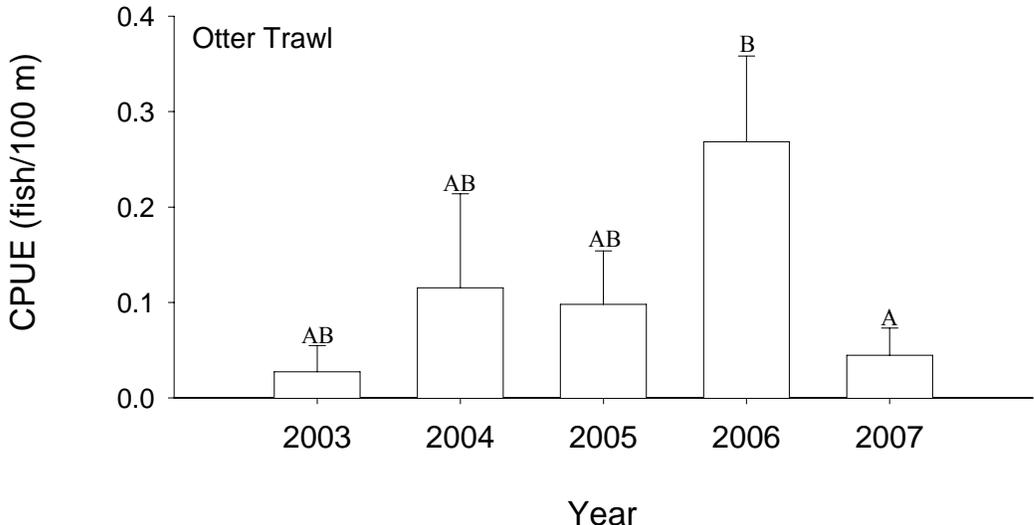


Figure 19. Mean annual catch-per-unit-effort (± 2 SE) of sturgeon chub using otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sturgeon Chub / Fish Community Season

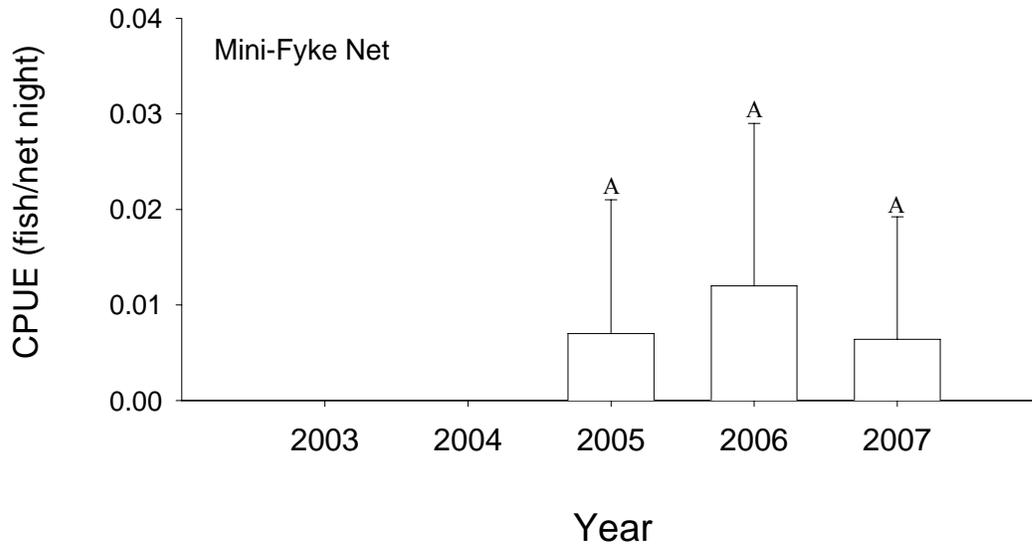


Figure 20. Mean annual catch-per-unit-effort (± 2 SE) of sturgeon chub using mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net			25	2			69		4						
Gill Net		N-E	22	1	N-E	N-E	72	2	2		N-E				
Otter Trawl	18		44				56								
			18	2			72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net			22	3			70		4				2		
Mini-Fyke Net	1	N-E	28		N-E	N-E	100				N-E				
							58	7	4				1	2	
Otter Trawl	15						87						13		
			21	2			71		5				1		

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net			100	N-E	N-E			
Gill Net			47				53	
Otter Trawl	18		100 100					
Fish Community Season (Summer)								
1 Inch Trammel Net			100	N-E	N-E			
Mini-Fyke Net	1	100 100						
Otter Trawl	15		100 100					

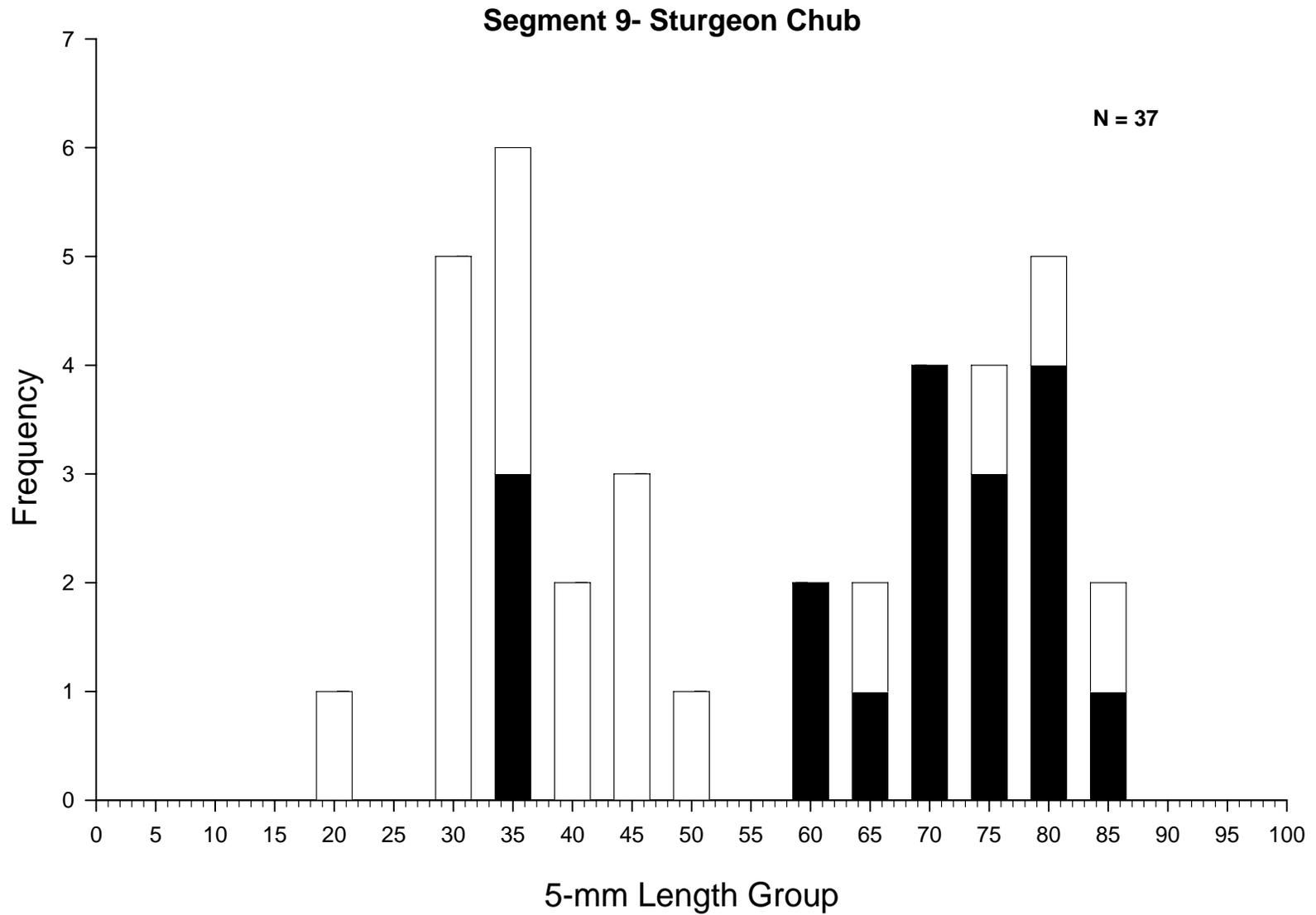


Figure 21. Length frequency of sturgeon chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Sicklefin Chub

A total of 19 sicklefin chubs were sampled during 2007 with 17 captured in standard gears and 2 in wild gears. Standard gears during 2007 included: otter trawls (N = 17). Wild gears during 2007 included: push trawls (N = 2). Catch per unit effort trends for otter trawling during the sturgeon season increased significantly from 2003-2006 ($\chi^2 = 40.73$, $P = < 0.0001$) (Figure 22). However, only 7 sicklefin chubs were collected during the 2007 sturgeon season with otter trawls resulting in a significant decrease in CPUE ($\chi^2 = 47.13$, $P = < 0.0001$). Twelve sicklefin chubs were collected during the 2007 fish community season. This was the lowest number collected since the project started (Figure 23). No sicklefin chubs were collected with mini-fyke nets in 2007 and only 4 in 2005 have ever been collected with this gear (Figure 24).

The only standard gear used to sample sicklefin chubs was the otter trawl. Seven fish were collected during the sturgeon season and ten fish were collected during the fish community season. Otter trawling during the sturgeon season showed a significant difference between percent caught and percent effort within macrohabitats ($\chi^2 = 33.55$, $df = 5$, $P = < 0.0001$). Conversely, no differences were observed during the fish community season ($\chi^2 = 8.56$, $df = 4$, $P = 0.070$) (Table 28). All sicklefin chubs were collected in channel border mesohabitats (Table 29).

A total of 19 sicklefin chubs were measured during 2007, with 12 being sampled in the fish community season (Figure 25). The average fork length was 83.5 mm during the sturgeon season and 63.1 mm during the fish community season. The length range for sturgeon chubs sampled during the sturgeon season was 39 to 100 mm compared to 29 to 107 mm during the fish community season.

Segment 9 - Sicklefin Chub / Sturgeon Season

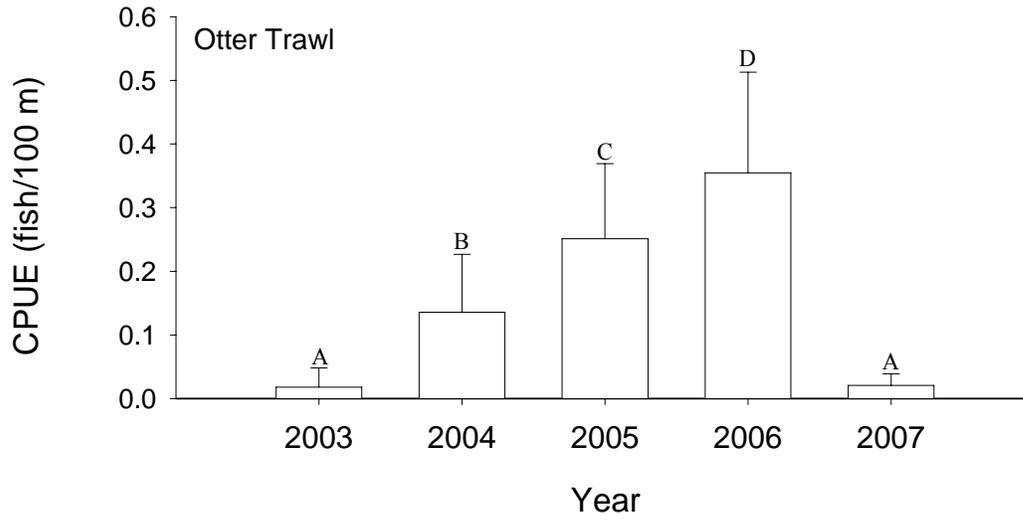


Figure 22. Mean annual catch-per-unit-effort (± 2 SE) of sicklefin chub using otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 Sicklefin Chub / Fish Community Season

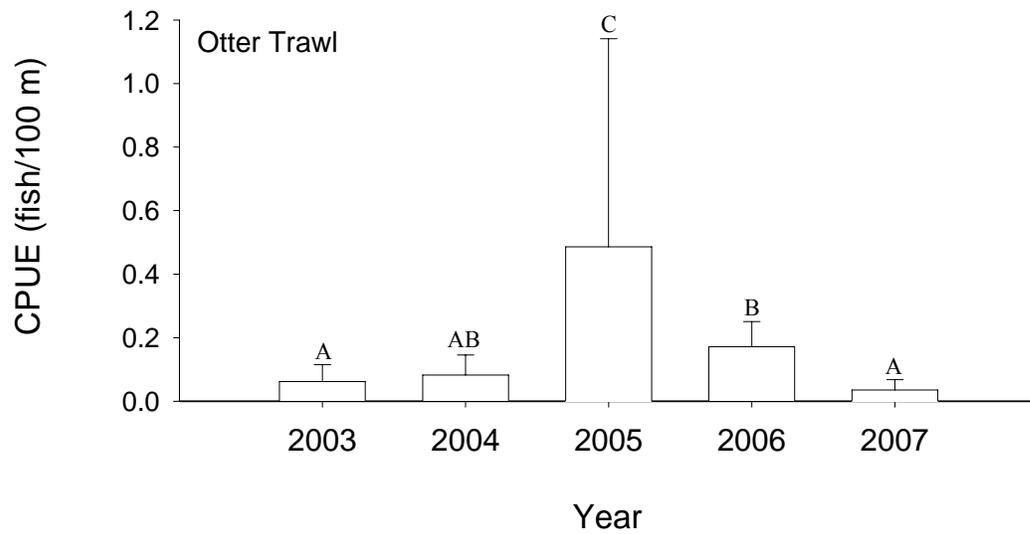


Figure 23. Mean annual catch-per-unit-effort (± 2 SE) of sicklefin chub using otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sicklefin Chub / Fish Community Season

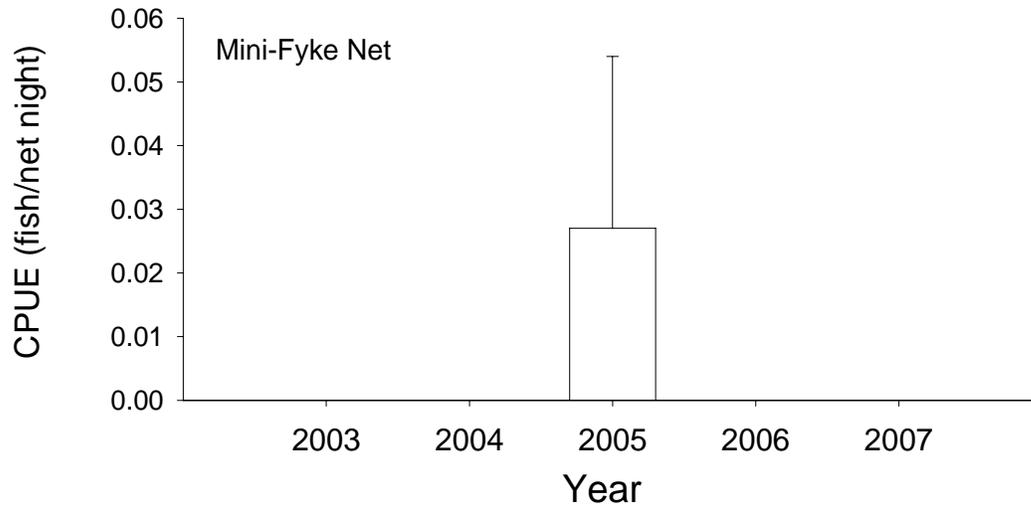


Figure 24. Mean annual catch-per-unit-effort (± 2 SE) of sicklefin chub using mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net			25	2			69		4						
Gill Net		N-E	22	1	N-E	N-E	72	2	2		N-E				
Otter Trawl	7		18	2			100 72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net			22	3			70		4				2		
Mini-Fyke Net		N-E	28		N-E	N-E	58	7	4		N-E		1	2	
Otter Trawl	10		20 21	2			80 71		5				1		

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net			100	N-E	N-E			
Gill Net			47				53	
Otter Trawl	7		100 100					
Fish Community Season (Summer)								
1 Inch Trammel Net			100	N-E	N-E			
Mini-Fyke Net		100						
Otter Trawl	10		100 100					

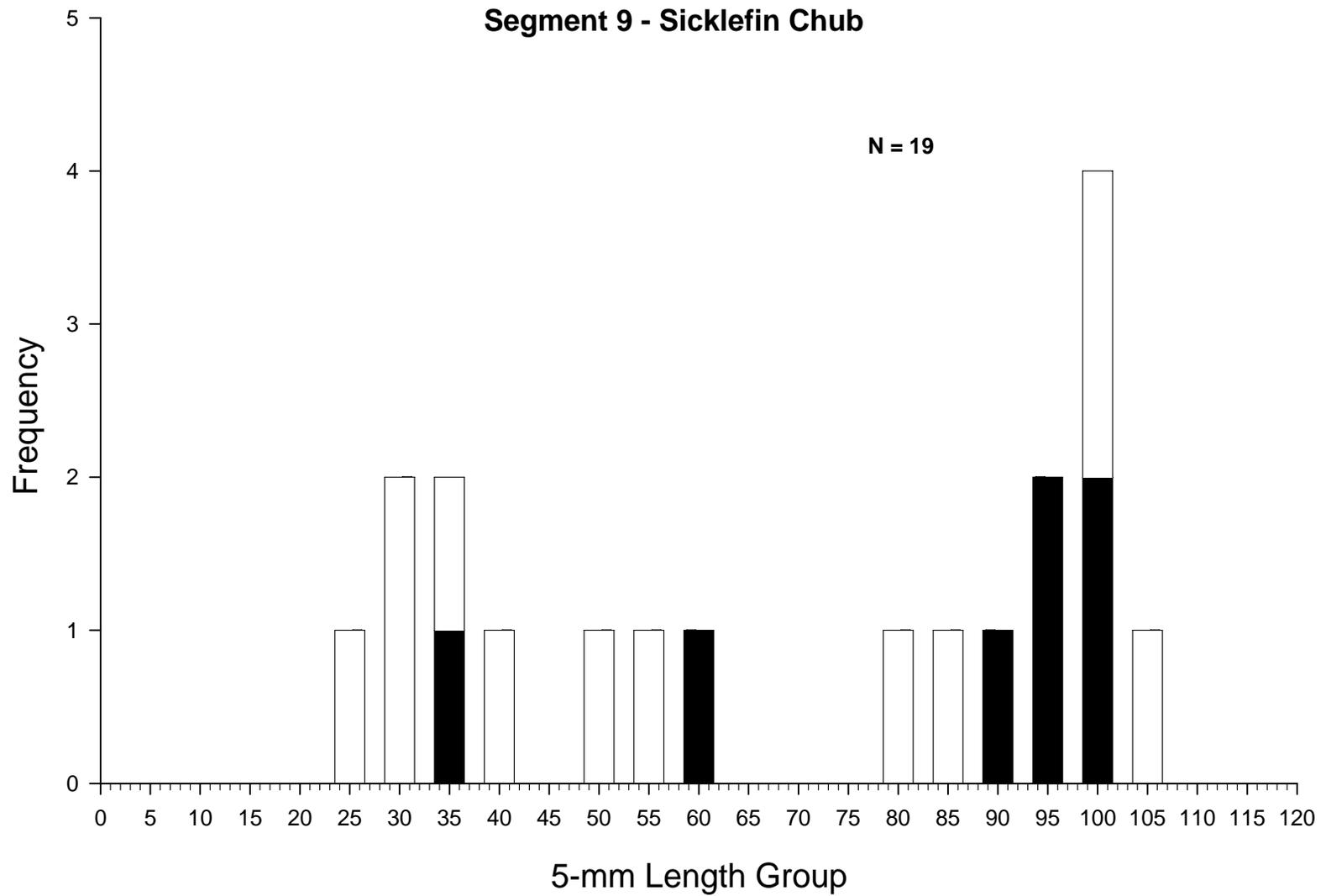


Figure 25. Length frequency of sicklefin chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Speckled Chub

A total of 346 speckled chubs were sampled during 2007 with 256 captured in standard gears and 90 in wild gears. Standard gears during 2007 included: otter trawls (N = 235) and mini-fyke nets (N = 21). Wild gears during 2007 included: push trawls (N = 90). Catch per unit effort for otter trawling during the sturgeon season in 2005 (CPUE = 0.953 fish per 100 m trawled) was significantly higher than in 2003 (CPUE = 0.317, $x^2 = 11.99$, $P = 0.0005$), 2006 (CPUE = 0.639, $x^2 = 4.27$, $P = 0.0388$), and 2007 (CPUE = 0.463, $x^2 = 11.92$, $P = 0.0006$) but similar to 2004 (CPUE = 0.675, $x^2 = 1.87$, $P = 0.171$) (Figure 26). Catch per unit effort for otter trawls during the fish community of speckled chubs continues on a significant downward trend ($x^2 = 9.93$, $df = 1$, $P = 0.001$) (Figure 27). Twenty-one speckled chubs were collected while mini-fyke netting, resulting in a CPUE of 0.014 fish per net night (Figure 28).

The majority of speckled chubs (235 of 256) sampled with standard gears were collected while otter trawling with 128 captured during the sturgeon season and 107 captured during the fish community season (Table 30). Otter trawling during both seasons showed no differences between percent caught and percent effort within macrohabitats (sturgeon season: $x^2 = 6.43$, $df = 4$, $P = 0.168$, fish community season: $x^2 = 7.45$, $df = 4$, $P = 0.113$). Channel border mesohabitats are the only habitat where otter trawls are deployed and therefore the only location where speckled chubs were collected (Table 31).

A total of 346 speckled chubs were measured during 2007, with 218 sampled during the fish community season (Figure 29). The average fork length was 52.3 mm during the sturgeon season and 39.4 mm during the fish community season. The length frequency distributions between the two seasons were not significantly different ($D = 0.31$, $P = 0.701$). The length range for speckled chubs sampled during the sturgeon season was 37 to 75 mm compared to 15 to 76 mm during the fish community season.

Segment 9 - Speckled Chub / Sturgeon Season

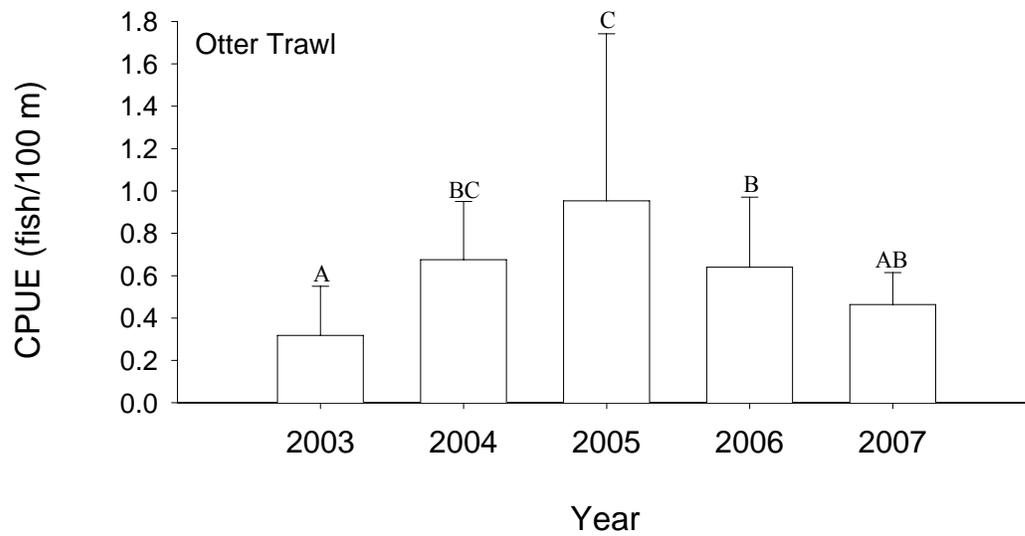


Figure 26. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub using otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Speckled Chub / Fish Community Season

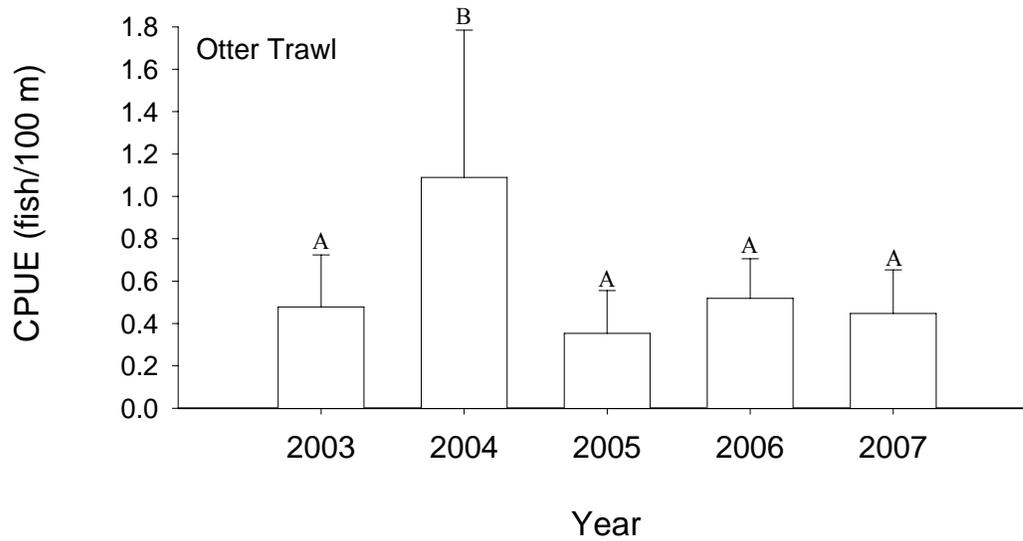


Figure 27. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Speckled Chub / Fish Community Season

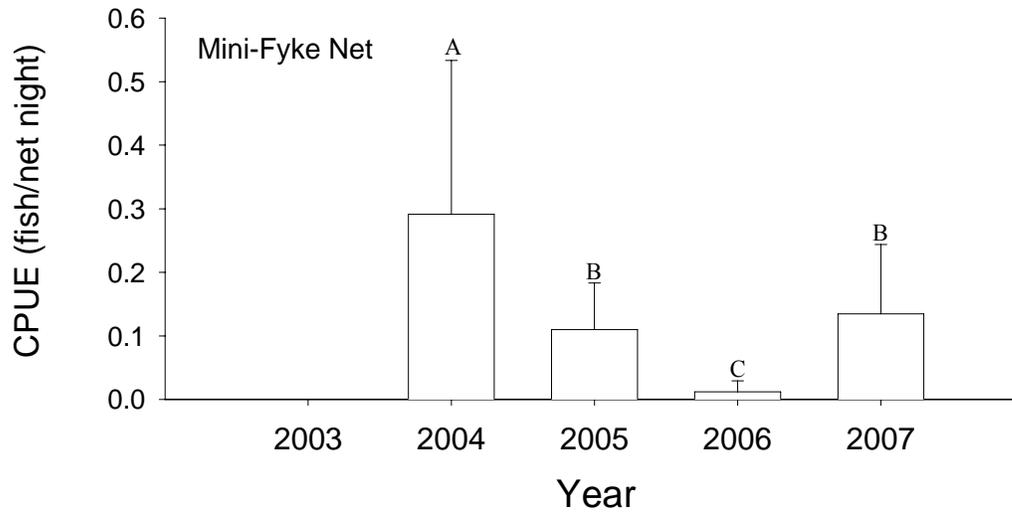


Figure 28. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub using mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net			25	2			69		4						
Gill Net		N-E	22	1	N-E	N-E	72	2	2		N-E				
Otter Trawl	128		27				62		11						
			18	2			72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net			22	3			70		4				2		
Mini-Fyke Net	21	N-E	24		N-E	N-E	67		10		N-E				
			28				58	7	4				1	2	
Otter Trawl	107		20				79						1		
			21	2			71		5				1		

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net			100	N-E	N-E			
Gill Net			47				53	
Otter Trawl	128		100 100					
Fish Community Season (Summer)								
1 Inch Trammel Net			100	N-E	N-E			
Mini-Fyke Net	21	100 100						
Otter Trawl	107		100 100					

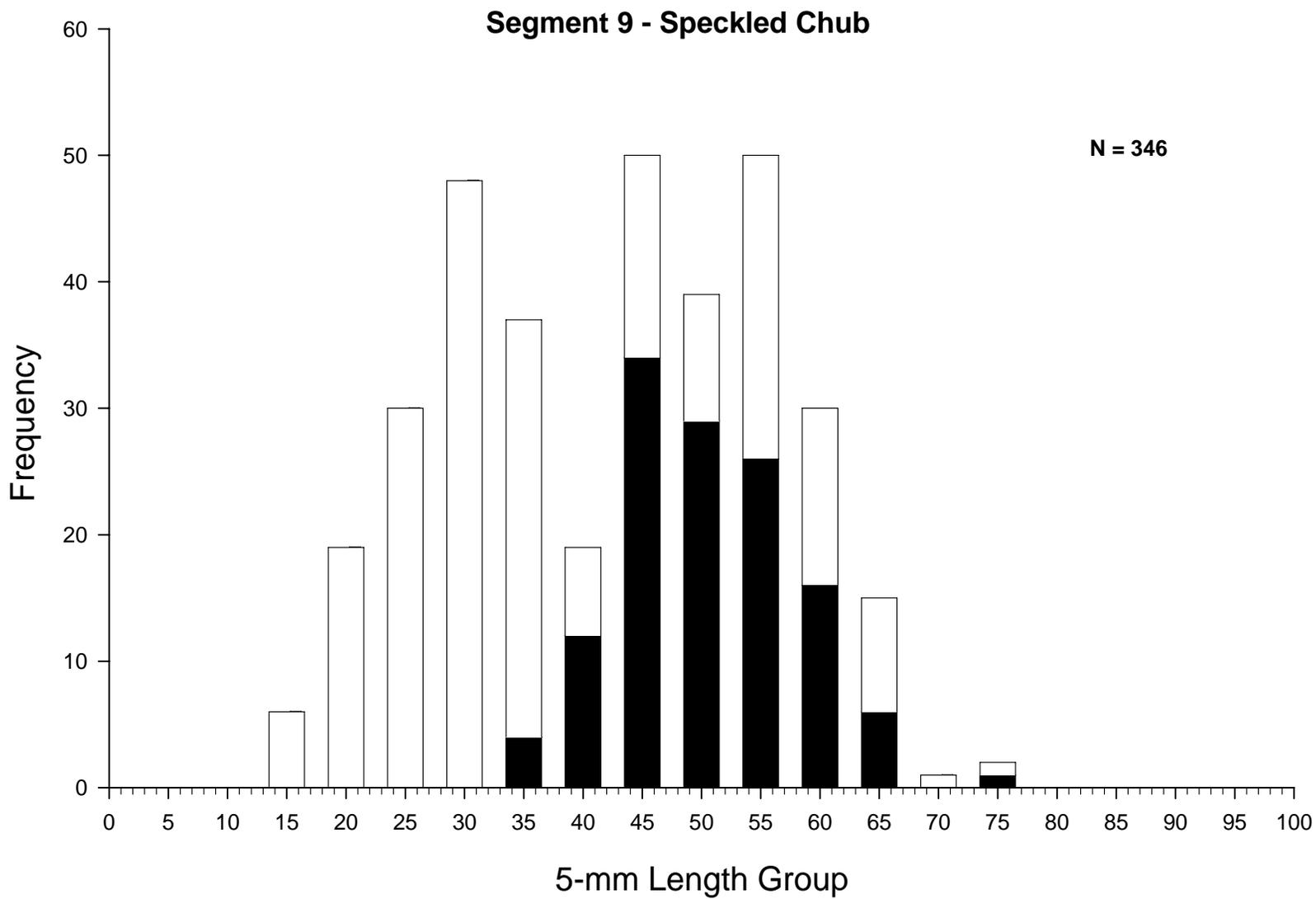


Figure 29. Length frequency of speckled chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Sand Shiner

A total of 253 sand shiners were sampled during 2007 with 230 captured in standard gears. Standard gears during 2007 included: mini-fyke nets (N = 226) and otter trawls (N = 4). Wild gears during 2006 included: push trawls (N = 23). Otter trawls remain an ineffective gear for sampling sand shiners. Only one sand shiner was collected during the sturgeon season and three during the fish community season, resulting in a catch per unit effort of 0.003 and 0.009 fish per 100 m trawled, respectively (Figures 30 and 31). Only 226 sand shiners were collected with mini-fyke nets during the 2007 fish community season compared to 1,336 during 2006. But mini-fyke net catch per unit effort has increased significantly from 2003 ($\chi^2 = 344.78$, $P = < 0.0001$).

The majority of sand shiners collected while mini-fyke netting during the fish community season were sampled on the inside bend macrohabitats (52%), followed by channel cross-over macrohabitats (43%) (Table 32). Mini-fyke nets during the fish community season showed a significant difference between percent caught and percent effort within macrohabitats ($\chi^2 = 31.88$, $df = 5$, $P = < 0.0001$). All sand shiners collected while otter trawling during both seasons were collected on channel border mesohabitats and from bar mesohabitats for mini-fyke nets (Table 33).

A total of 206 sand shiners were measured during 2007, 205 during the fish community season (Figure 33). The average fork length was 38.3 mm during the fish community season. The length range for sand shiners sampled during the fish community season was 21 to 61 mm.

Segment 9 - Sand Shiner / Sturgeon Season

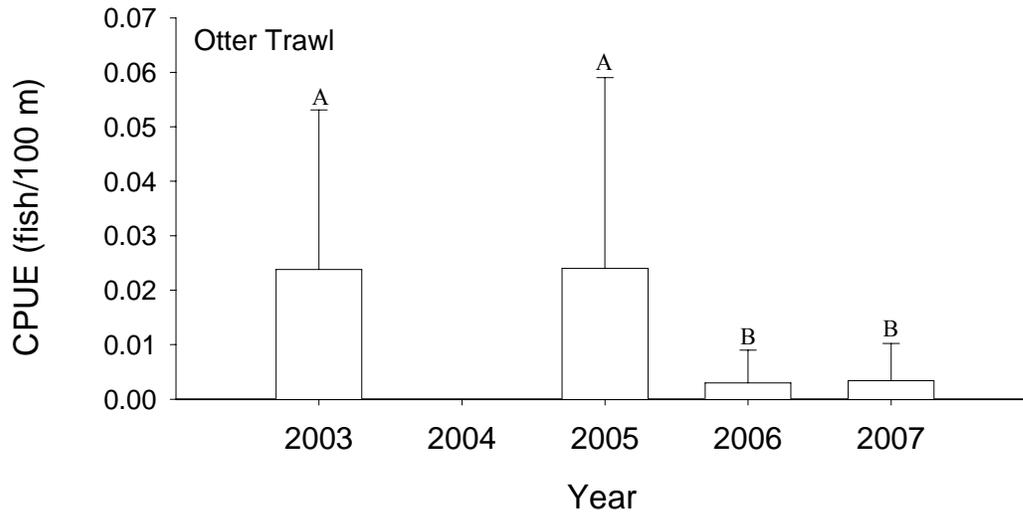


Figure 30. Mean annual catch-per-unit-effort (+/- 2 SE) of sand shiner with otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sand Shiner / Fish Community Season

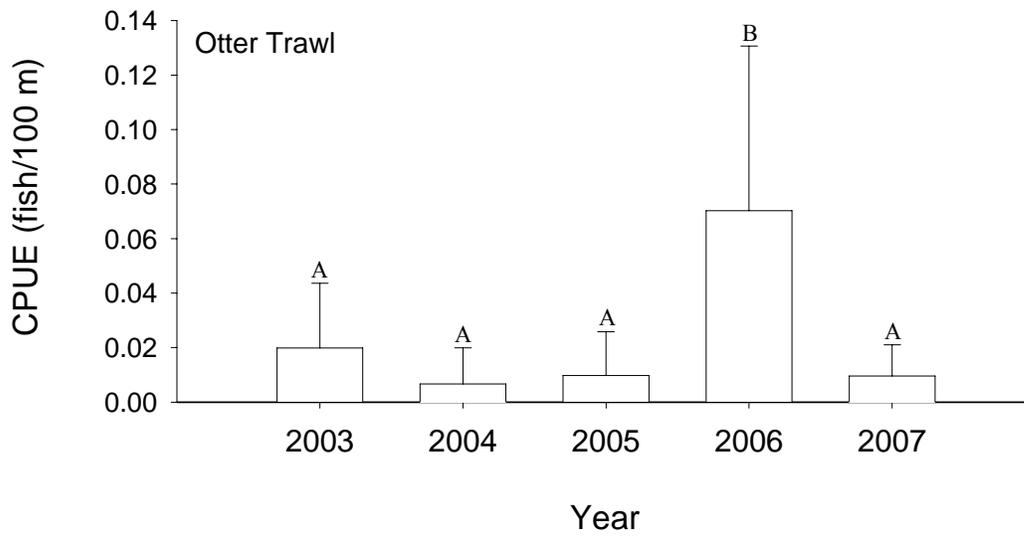


Figure 31. Mean annual catch-per-unit-effort (± 2 SE) of sand shiner with otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sand Shiner / Fish Community Season

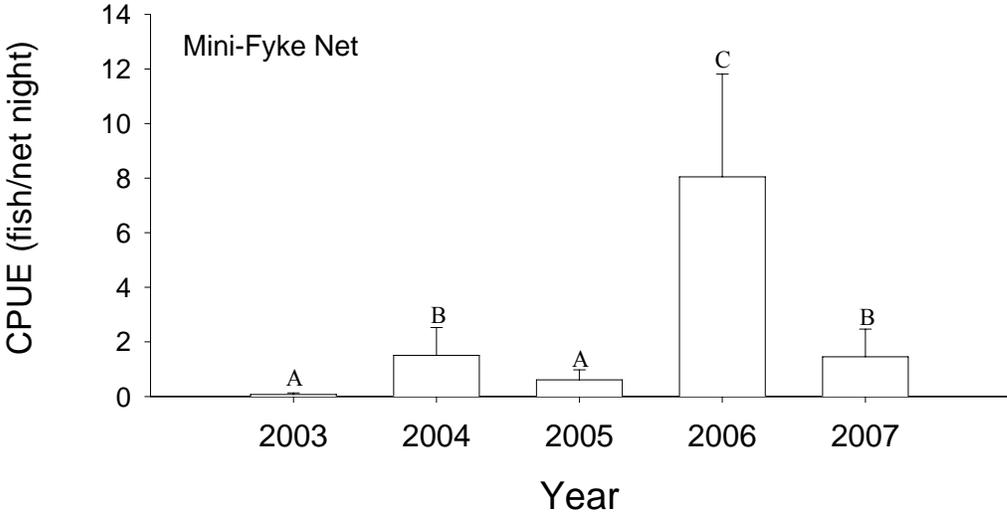


Figure 32. Mean annual catch-per-unit-effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net			25	2			69		4						
Gill Net		N-E	22	1	N-E	N-E	72	2	2		N-E				
Otter Trawl	1		18	2			72	1	7	100			1		
Fish Community Season (Summer)															
1 Inch Trammel Net			22	3			70		4				2		
Mini-Fyke Net	226	N-E	43		N-E	N-E	52	1	3		N-E				
			28				58	7	4				1	2	
Otter Trawl	3		33				33						33		
			21	2			71		5				1		

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net			100	N-E	N-E			
Gill Net			47				53	
Otter Trawl	1		100 100					
Fish Community Season (Summer)								
1 Inch Trammel Net			100	N-E	N-E			
Mini-Fyke Net	226	100 100						
Otter Trawl	3		100 100					

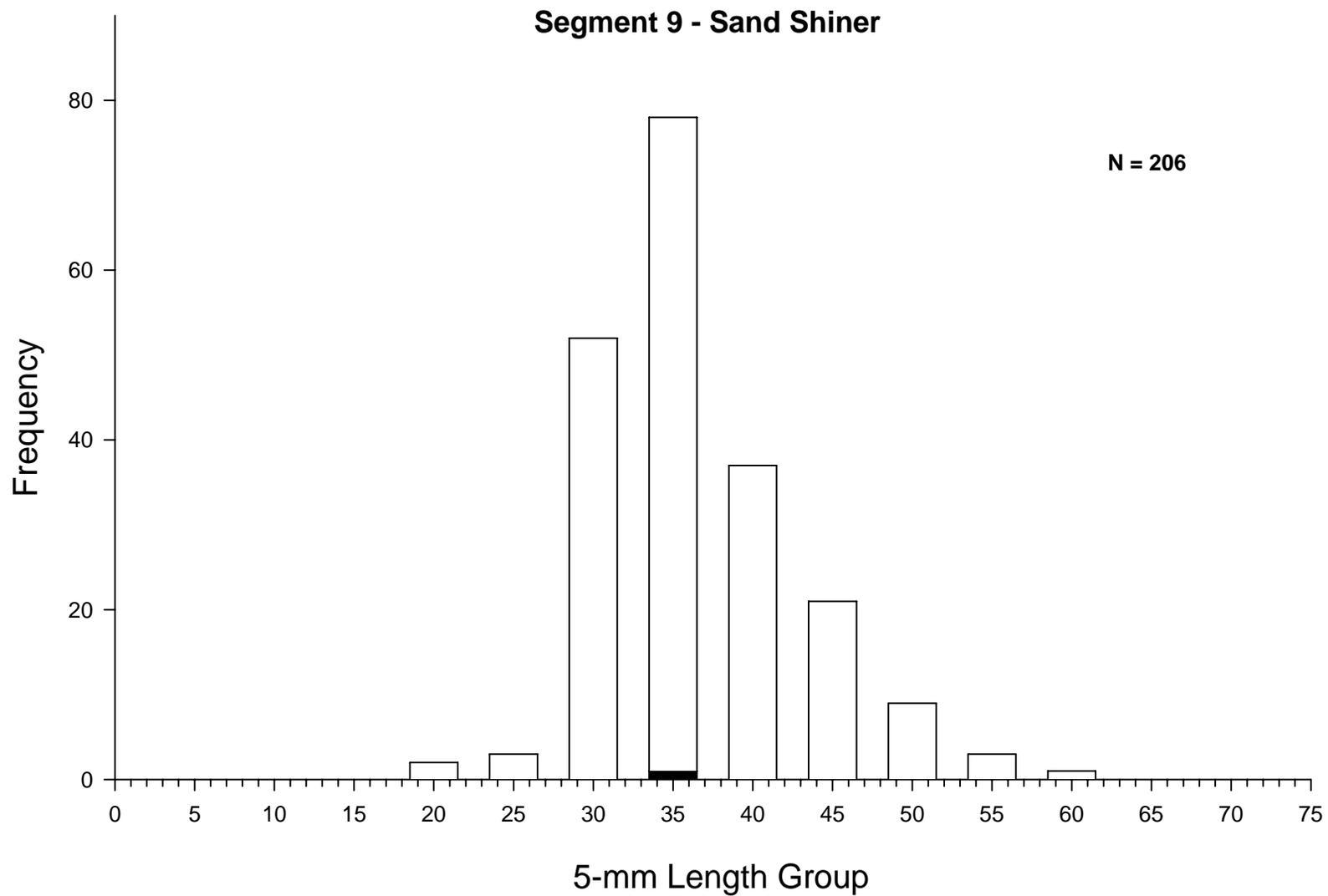


Figure 33. Length frequency of sand shiner during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

***Hybognathus* spp.**

A total of 386 *Hybognathus* species were sampled during 2007 in standard gears. Standard gears during 2007 included: mini-fyke nets (N = 364) and otter trawls (N = 2). Otter trawling remained an ineffective gear for sampling *Hybognathus* species (Figure 35). Three hundred eight-two *Hybognathus* species were collected while mini-fyke netting, resulting in a CPUE of 2.44 fish per net night (Figure 36). Catch per unit effort has significantly increased when compared to 2003 ($\chi^2 = 177.28$, $P = < 0.0001$).

The majority of *Hybognathus* species (99%) were collected during the fish community season while mini-fyke nettings (N = 382). During the fish community season, 36% of the *Hybognathus* species were caught on channel cross-over macrohabitats while only 28% of the efforts was expended in this macrohabitat. *Hybognathus* species were sampled in macrohabitats in similar abundance as effort expended ($\chi^2 = 20.38$, $df = 5$, $P = 0.001$). All *Hybognathus* species were caught from bar mesohabitats during the fish community season for mini-fyke nets (Table 35).

A total of 256 *Hybognathus* species were measured during the 2007 fish community season (Figure 37). The average fork length was 39.9 mm. The length range for *Hybognathus* species was 22 to 77 mm.

Segment 9 - *Hybognathus* spp. / Fish Community Season

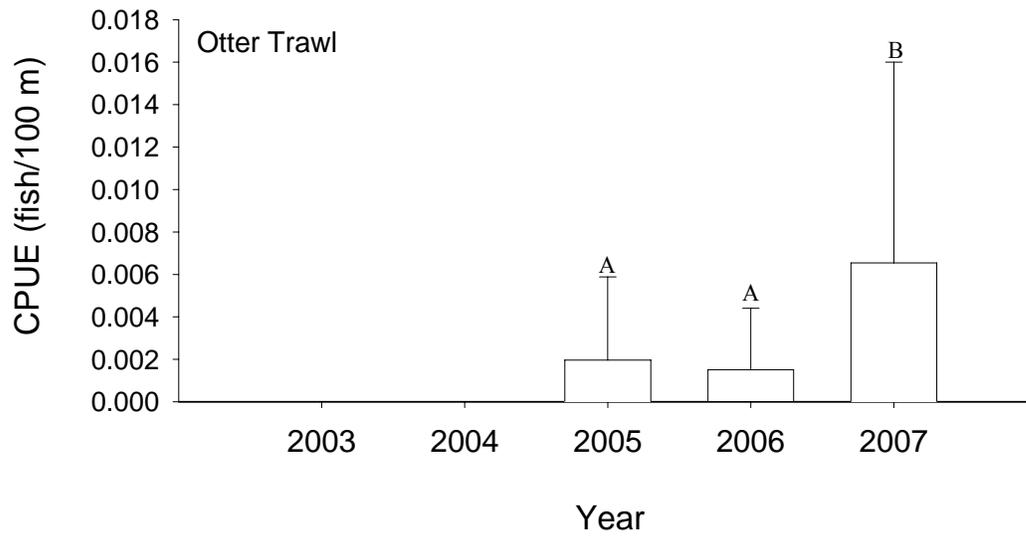


Figure 35. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with otter trawls in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - *Hybognathus* spp. / Fish Community Season

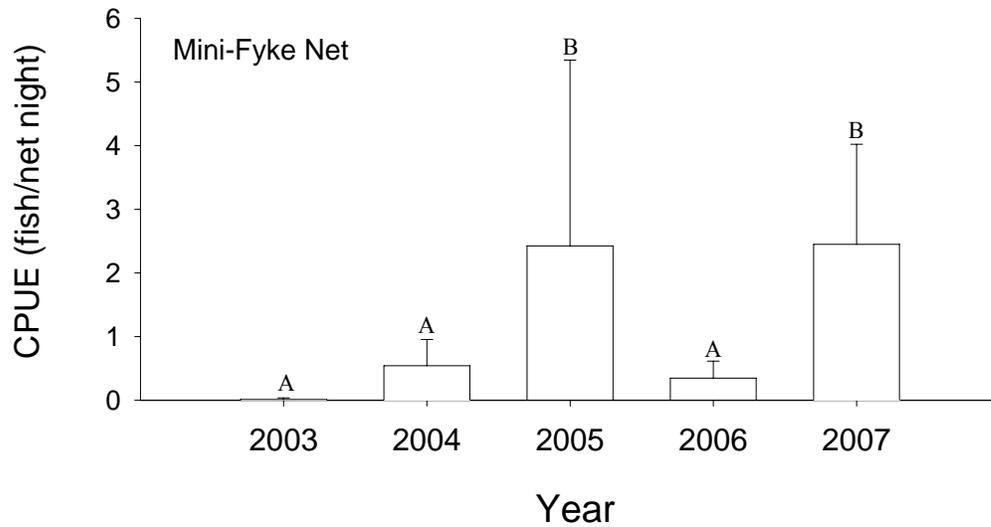


Figure 36. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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			
Sturgeon Season (Fall through Spring)																		
1 Inch Trammel Net		N-E	25	2	N-E	N-E	69		4		N-E							
Gill Net			22	1			72	2	2									
Otter Trawl			18	2			72	1	7						1			
Fish Community Season (Summer)																		
1 Inch Trammel Net		N-E	22	3	N-E	N-E	70		4		N-E		2					
Mini-Fyke Net	382		36				61	2							1			
			28				58	7	4						1	2		
Otter Trawl	2		50				50											
			21	2			71		5				1					

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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						
		BAR	CHNB	DTWT	ITIP	POOL	TLWG	
Sturgeon Season (Fall through Spring)								
1 Inch Trammel Net			100	N-E	N-E			
Gill Net			47				53	
Otter Trawl			100					
Fish Community Season (Summer)								
1 Inch Trammel Net			100	N-E	N-E			
Mini-Fyke Net	382	100 100						
Otter Trawl	2		100 100					

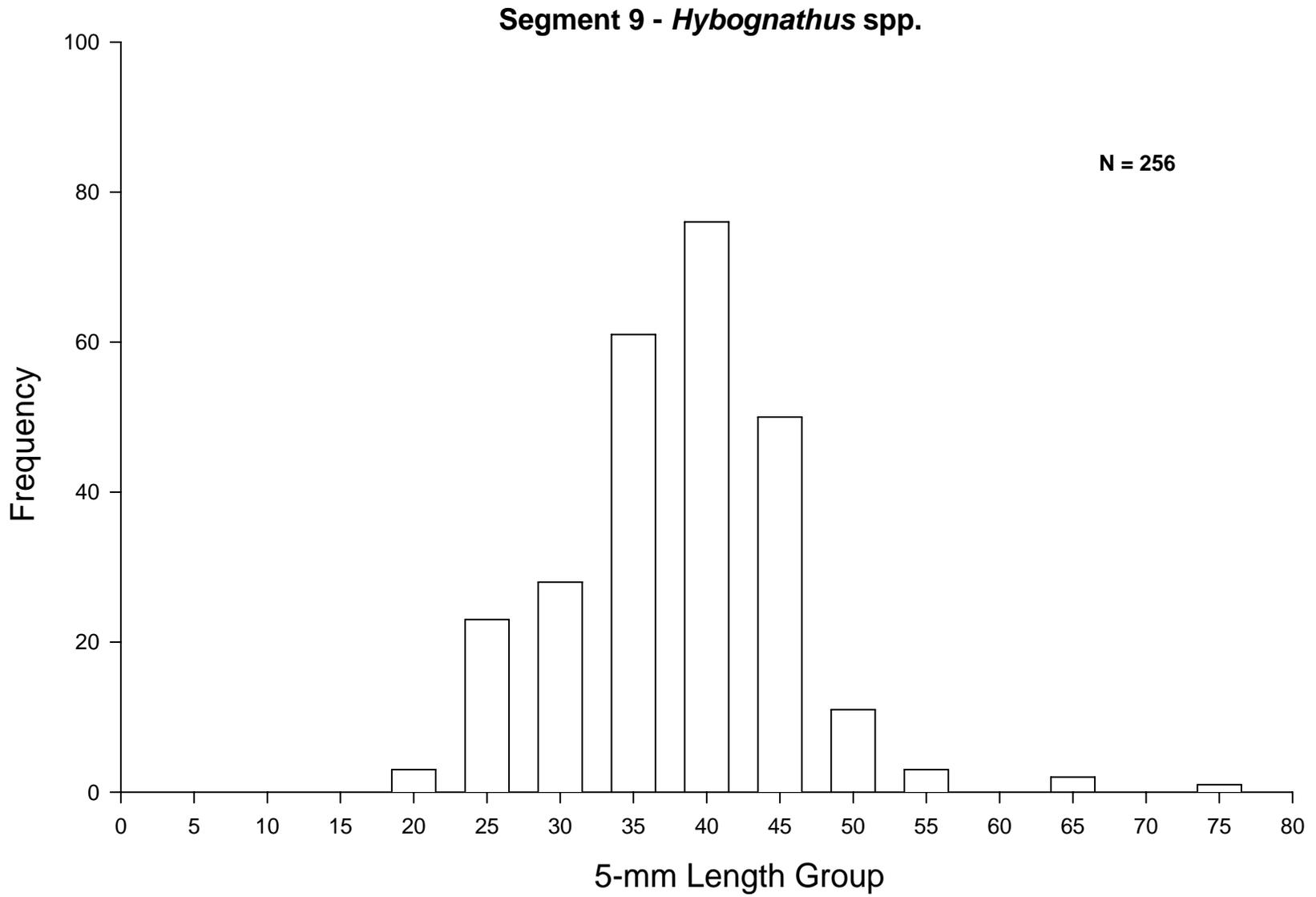


Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Blue Sucker

A total of 634 blue suckers were sampled during 2007 with 589 captured in standard gears. Standard gears during 2007 included: 1.0" trammel nets (N = 429), gill nets (N = 96) and otter trawls (N = 64). During the sturgeon season, CPUE was highest for 1.0" trammel nets (0.36 fish per 100 m drifted) followed by gill nets (0.22 fish per net night) (Figures 38 and 39). Catch per unit effort for gill netting during the sturgeon season is significantly different between all years, except for 2003 versus 2006 ($\chi^2 = 0.00$, $P = 0.956$) and 2007 ($\chi^2 = 3.51$, $P = 0.061$). Catch rates from 1.0" trammel nets during the sturgeon season continue to increase significantly ($\chi^2 = 10.31$, $df = 1$, $P = 0.001$) while otter trawls display no difference in mean annual catch rates ($\chi^2 = 0.21$, $df = 1$, $P = 0.649$). Catch per unit effort trends for otter trawling during the fish community season increased significantly from 2003 to 2006 ($\chi^2 = 11.38$, $P = 0.0007$) (Figure 41). However, CPUE during the 2007 fish community season declined significantly compared to 2006 ($\chi^2 = 11.57$, $P = 0.0007$). Catch per unit effort for 1.0" trammel during 2007 was significantly higher than 2005 ($\chi^2 = 9.78$, $P = 0.0018$) and 2006 ($\chi^2 = 7.20$, $P = 0.0073$).

Inside bend macrohabitats were the primary habitats sampled during both seasons and as expected, blue suckers were most frequently sampled from inside bend macrohabitats (Table 36). One inch trammel nets ($\chi^2 = 9.19$, $df = 3$, $P = 0.026$) and gill nets ($\chi^2 = 9.74$, $df = 4$, $P = 0.045$) during the sturgeon season and otter trawls ($\chi^2 = 23.89$, $df = 4$, $P = < 0.001$) during the fish community season displayed a significant difference between number of fish caught and amount of effort within macrohabitats. All blue suckers were sampled on channel border mesohabitats during both seasons with active gears (Table 37). In mesohabitats there was a significant difference between proportion of fish caught and effort expended within mesohabitats ($\chi^2 = 13.82$, $df = 1$, $P = 0.0002$).

A total of 634 blue suckers were measured during 2007, with 267 being sampled during the sturgeon season (Figure 44). The average fork length was 654.3 mm during the sturgeon season compared to 657.4 mm for the fish community season. The length frequency distributions between the two seasons were significantly different ($D = 0.29$, $P = 0.044$). The length range for blue suckers sampled during the sturgeon season was 223 to 814 mm compared to 224 to 860 mm for the fish community season.

Segment 9 - Blue Sucker / Sturgeon Season

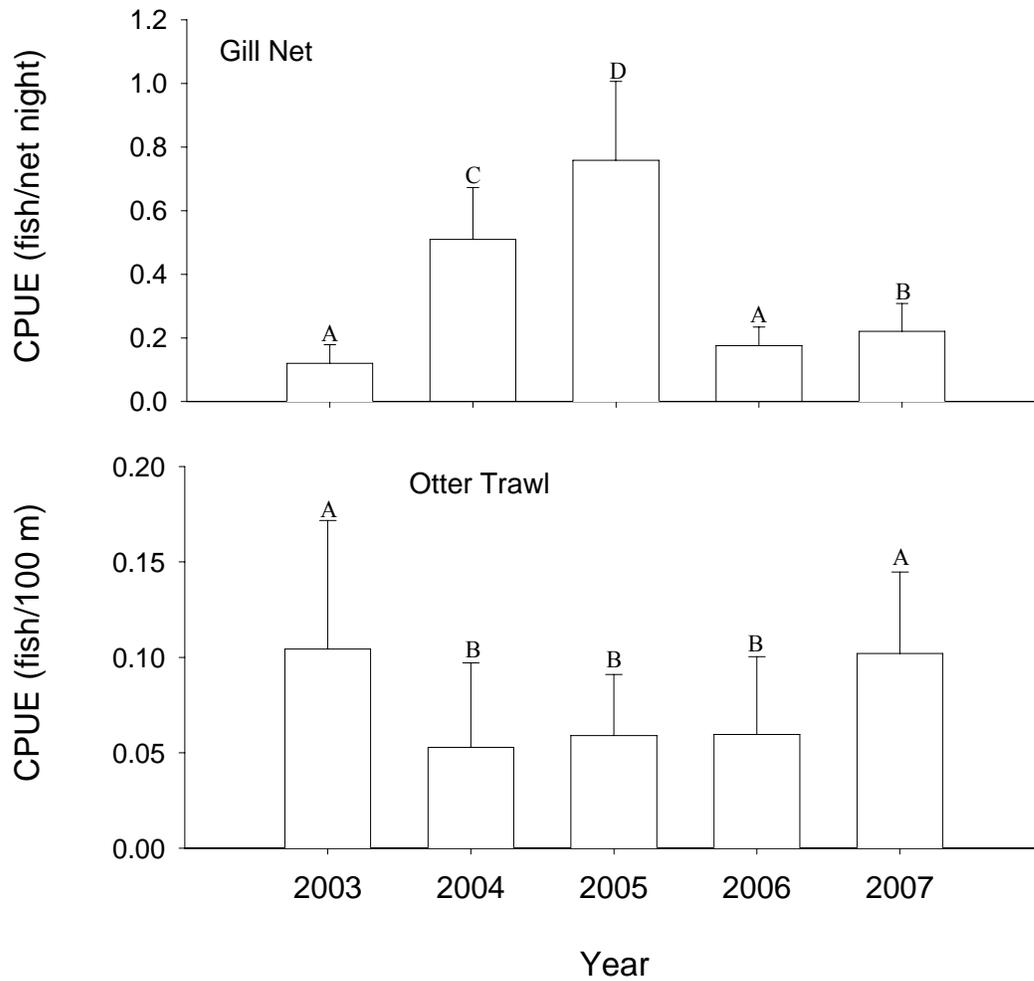


Figure 38. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers with gill nets and otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Blue Sucker / Sturgeon Season

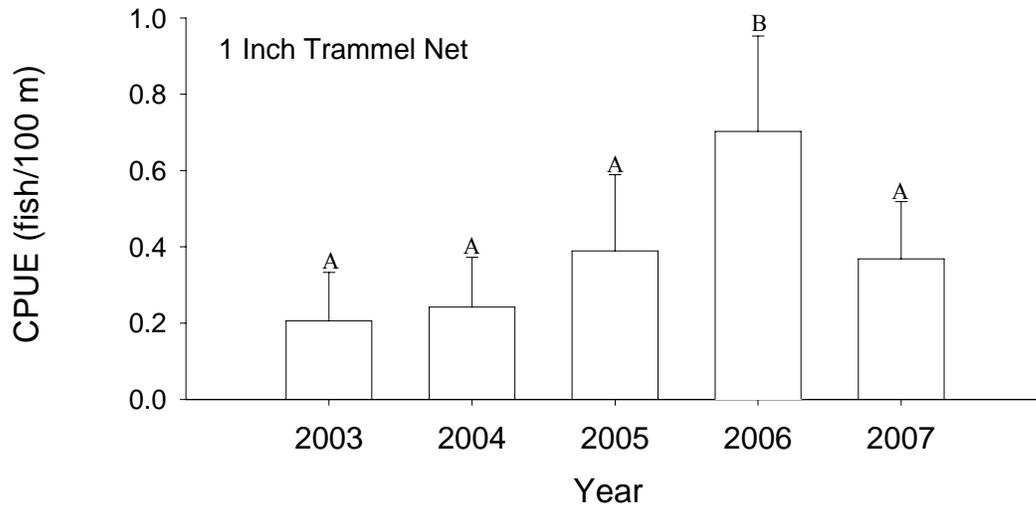


Figure 39. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers with 1 inch trammel nets in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Blue Sucker / Fish Community Season

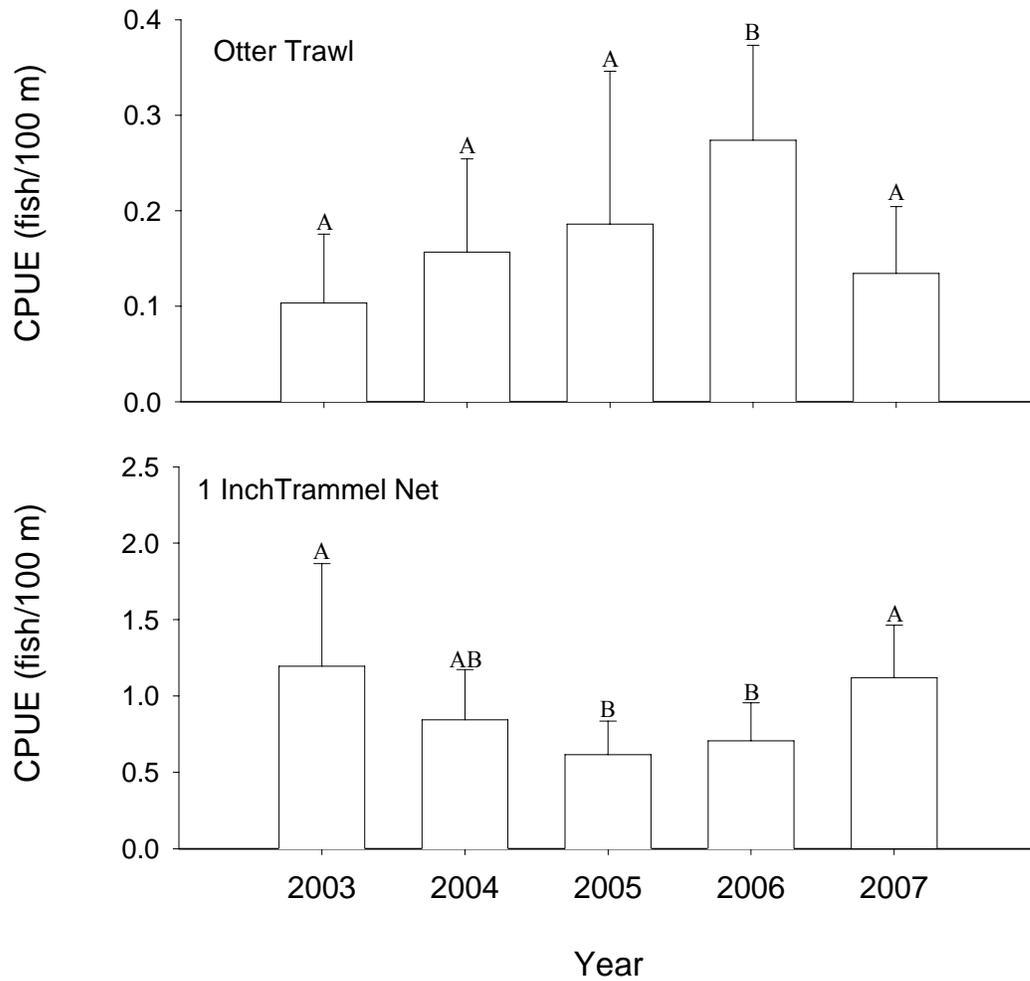


Figure 41. Mean annual catch-per-unit-effort (+/- 2 SE) of blue suckers using otter trawls and 1 inch trammel nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	99		9 25	2 2			85 69		4 4						
Gill Net	96	N-E	11 22	3 1	N-E	N-E	85 72	2		2		N-E			
Otter Trawl	28		21 18				68 72			11 7			1		
Fish Community Season (Summer)															
1 Inch Trammel Net	330		21 22				76 70		1 4				2 2		
Mini-Fyke Net		N-E	28		N-E	N-E	58	7	4			N-E	1	2	
Otter Trawl	36		3 21	11 2			75 71		3 5				6 1		

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	99		100 100	N-E	N-E		
Gill Net	96		22 47			78 53	
Otter Trawl	28		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	330		100 100	N-E	N-E		
Mini-Fyke Net		100					
Otter Trawl	36		100 100				

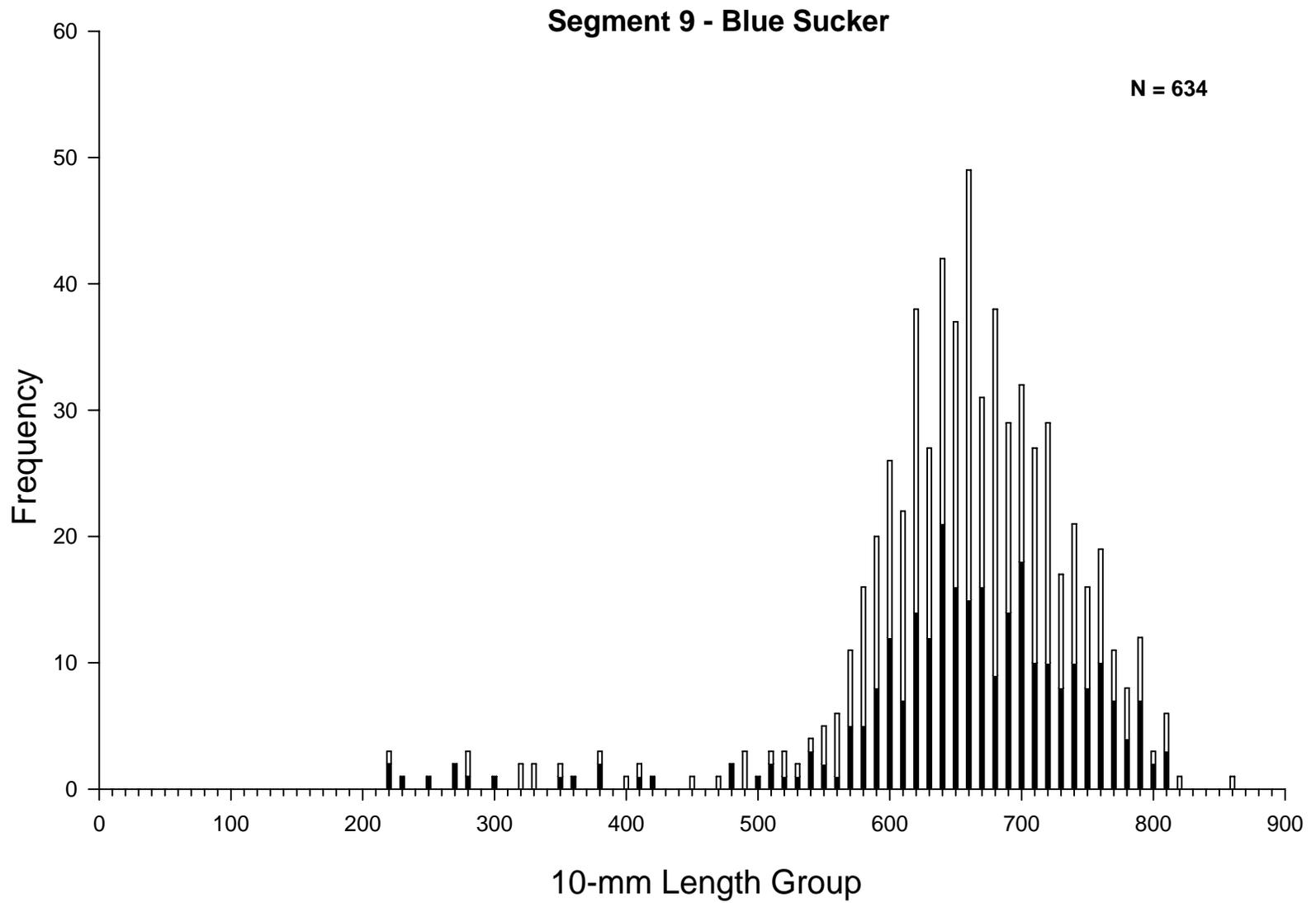


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Sauger

A total of 69 sauger were sampled during 2007 in standard gears. Standard gears during 2007 included: gill nets (N = 46), 1.0" trammel nets (N = 15), otter trawls (N = 7) and mini-fyke nets (N = 1). Catch per unit effort for gill nets during the sturgeon season significantly increased from 2003 to 2004 ($\chi^2 = 10.84$, $P = 0.001$) but has remained similar from 2004 to 2007 (Figure 45). CPUE of sauger from otter trawling was significantly higher during the 2006 sturgeon season than 2005 ($\chi^2 = 40.90$, $P = < 0.0001$) and 2007 seasons ($\chi^2 = 47.54$, $P = < 0.0001$) and no sauger were collected during 2003 and 2004. Catch rates for sauger in 1.0" trammel nets during the sturgeon season vary significantly between years with no overall trend (Figure 46).

Mean annual CPUE for 1.0" trammel nets ($\chi^2 = 6.23$, $df = 1$, $P = 0.012$) and otter trawls ($\chi^2 = 9.82$, $df = 1$, $P = 0.0017$) during the 2007 fish community season was significantly higher than in previous years (Figure 48). Mini-fyke net CPUE of sauger decreased from 0.07 fish per net night in 2006 to 0.006 in 2007 2006 (Figure 49).

Sauger were most frequently sampled during the sturgeon and fish community seasons from inside bend macrohabitats; except for mini-fyke nets, when a single fish was collected from the channel cross-over macrohabitat (Table 38). There was no significant difference while gill netting during the sturgeon season between number of fish caught and amount of effort expended within macrohabitats ($\chi^2 = 5.99$, $df = 4$, $P = 0.199$). However, there was a significant difference when comparing the mesohabitats ($\chi^2 = 11.55$, $df = 1$, $P = 0.0007$) where seventy-six percent of sauger were sampled in pool mesohabitats with only 53% of effort being expended (Table 39). Conversely, only 24% were sampled in channel border mesohabitat where we expended 47% of the effort. As a result of where the gears are deployed, all sauger were collected from channel border mesohabitats with 1.0" trammel nets and otter trawls and bar mesohabitats while using mini-fyke nets.

A total of 69 sauger were measured during 2007, with 50 being sampled during the sturgeon season (Figure 51). The average fork length was 418.0 mm during the sturgeon season compared to 376.0 mm for the fish community season. The length range for sauger sampled during the sturgeon season was 337 to 208 mm compared to 284 to 520 mm for the fish community season.

Segment 9- Sauger / Sturgeon Season

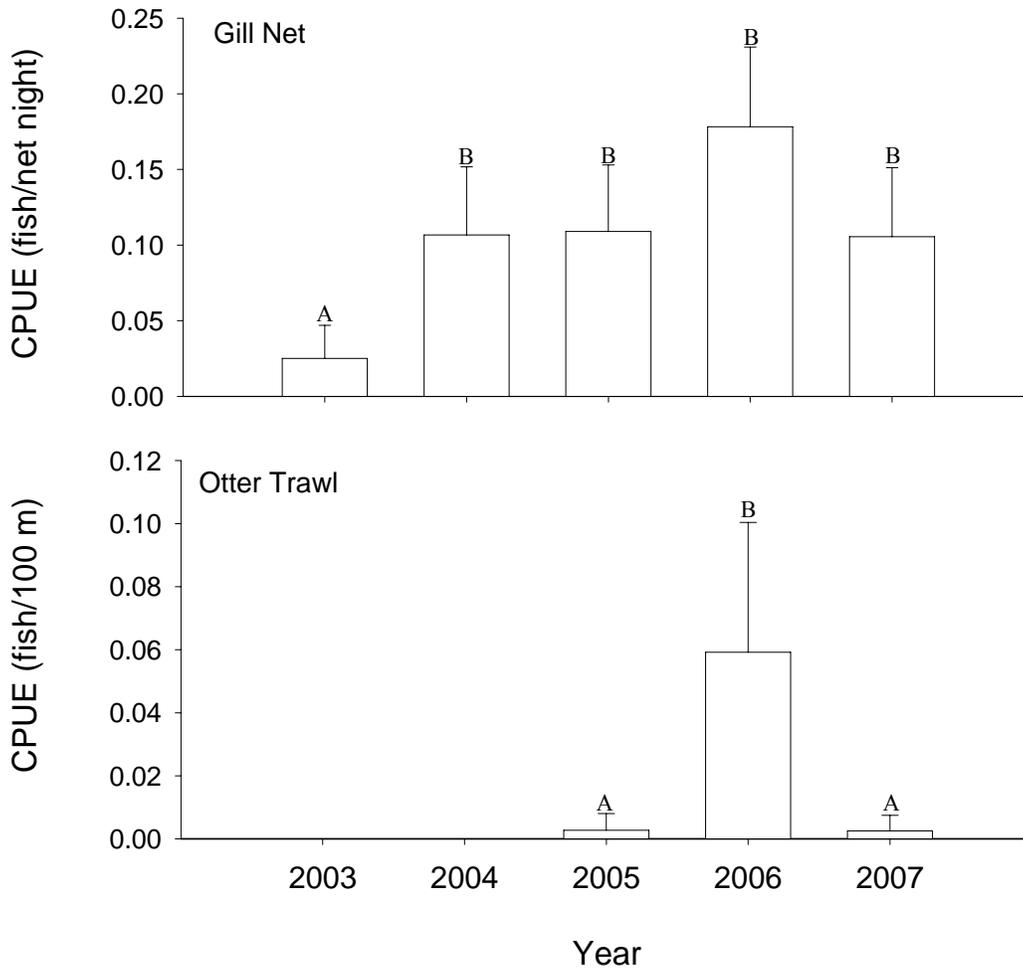


Figure 45. Mean annual catch-per-unit-effort (± 2 SE) of saugers using gill nets and otter trawls in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sauger / Sturgeon Season



Figure 46. Mean annual catch-per-unit-effort (± 2 SE) of saugers using 1 inch trammel nets in segment 9 of the Missouri River during sturgeon season 2003-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sauger / Fish Community Season

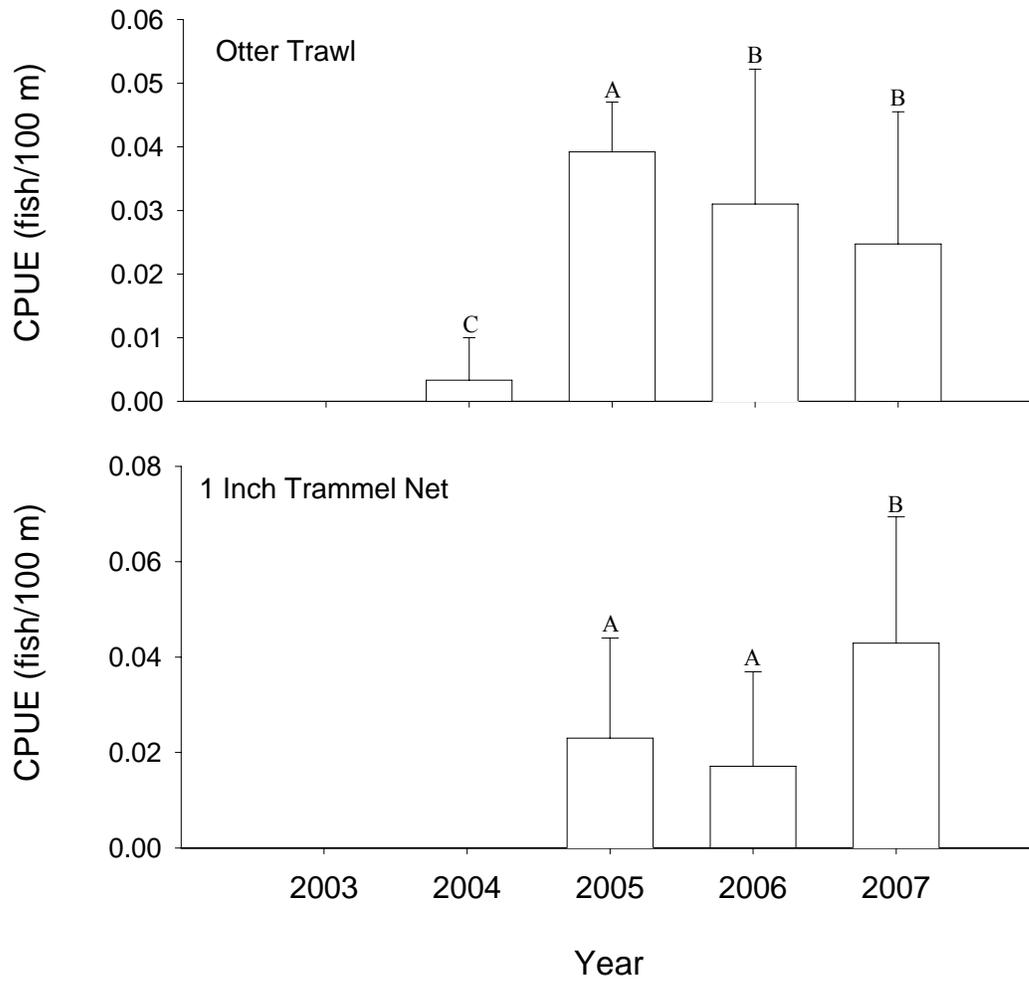


Figure 48. Mean annual catch-per-unit-effort (± 2 SE) of sauger using otter trawls and 1 inch trammel nets in segment 9 of the Missouri River during fish community season 2000-2007. Letters denote significant difference in mean CPUE between years.

Segment 9 - Sauger / Fish Community Season

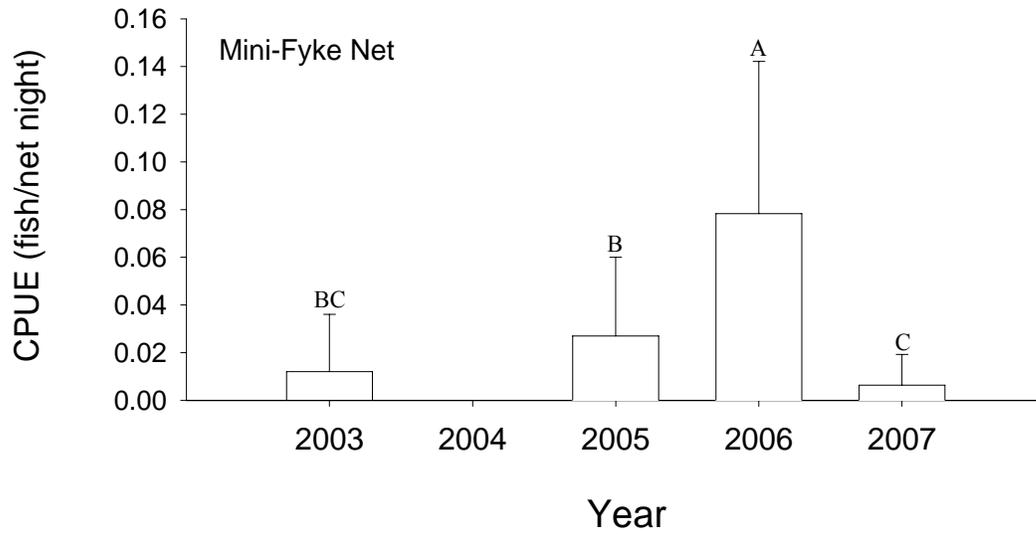


Figure 49. Mean annual catch-per-unit-effort (± 2 SE) of saugers using mini-fyke nets in segment 9 of the Missouri River during fish community season 2003-2007. Letters denote significant difference in mean CPUE between years.

Table 38. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 9 of the Missouri River during 2007. 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
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	3		25	2			67		33						
			69				69		4						
Gill Net	46	N-E	20	4	N-E	N-E	76				N-E				
			22	1			72	2	2						
Otter Trawl	1						100								
			18	2			72	1	7				1		
Fish Community Season (Summer)															
1 Inch Trammel Net	12		17				83								
			22	3			70		4				2		
Mini-Fyke Net	1	N-E	100		N-E	N-E					N-E				
			28				58	7	4				1	2	
Otter Trawl	6						100								
			21	2			71		5				1		

Table 39. Total number of sauger captured for each gear during each season and the proportion caught within each mesohabitat type in Segment 9 of the Missouri River during 2007. 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					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	3		100 100	N-E	N-E		
Gill Net	46		24 47			76 53	
Otter Trawl	1		100 100				
Fish Community Season (Summer)							
1 Inch Trammel Net	12		100 100	N-E	N-E		
Mini-Fyke Net	1	100 100					
Otter Trawl	6		100 100				

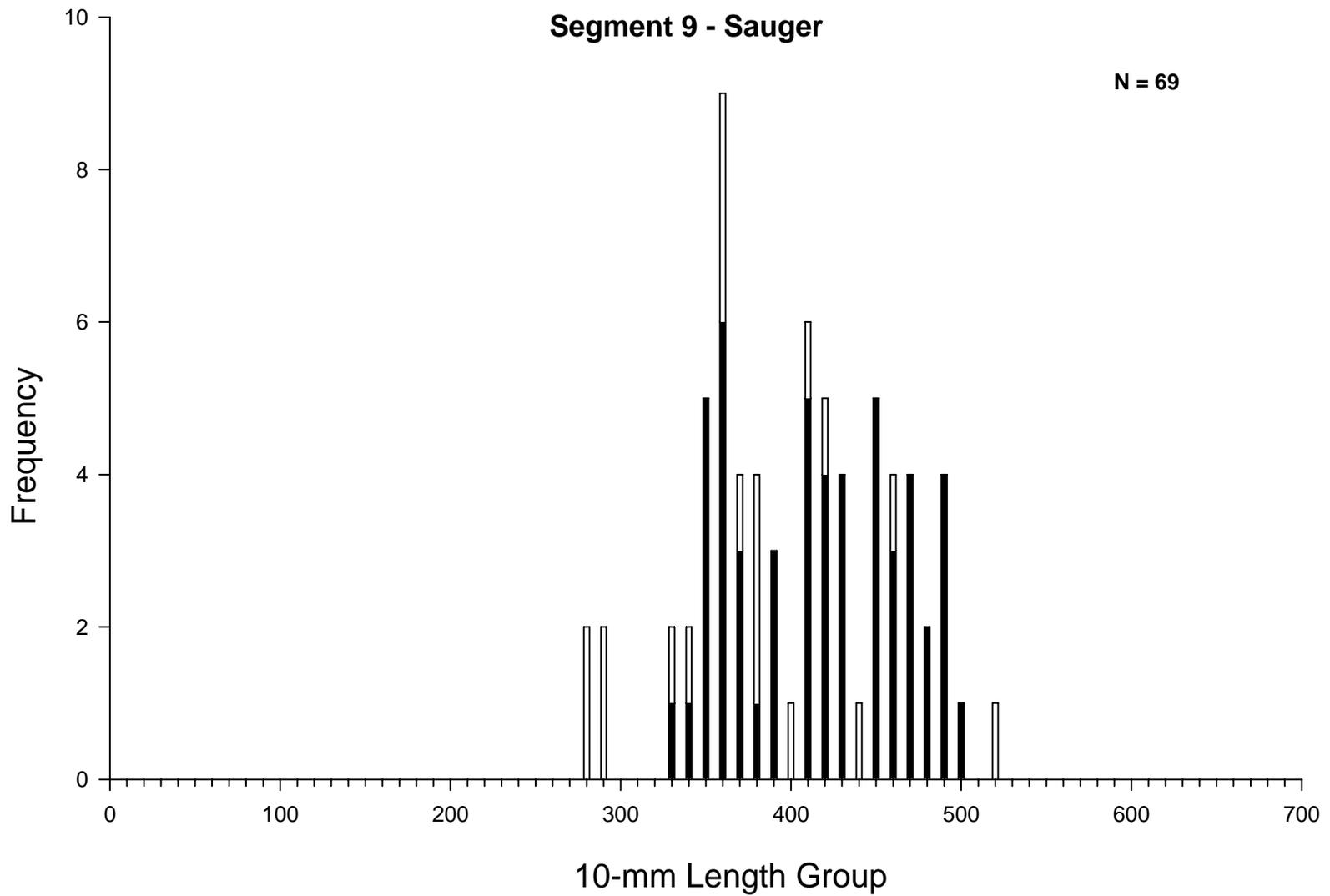


Figure 51. Length frequency of saugers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 9 of the Missouri River during 2007.

Missouri River Fish Community

A total of 28,824 fish were captured in Segment 9 of the Missouri River using standard gears. These gears collected 70 species with emerald shiners (18.9%, N = 5,471), red shiners (17.5%, N = 5,049) and shovelnose sturgeon (14.28%, N = 4,090) making up over 50% of the total catch. Target species account for 20.2% of the total catch, contributing in the follow order of relative abundance: shovelnose sturgeon (14.1%, N = 4,090), blue suckers (2.1%, N = 634), *Hybonathus* species (1.2%, N = 366), speckled chubs (1.2%, N = 346), sand shiners (0.9%, N = 253), sauger (0.2%, N = 69), sturgeon chubs (0.1%, N = 37), pallid sturgeon (0.1%, N = 32), and sicklefin chubs (< 0.1%, N = 19).

Gill nets remain the most productive gear for capturing large bodied fish. The 2007 effort decreased by 157 net nights and 480 less fish were collected, compared to 2006 (Steffensen and Hamel, 2007). The 2007 effort resulted in a total mean CPUE of 6.7 fish per net night (Appendix F1 and H). Shovelnose sturgeon were the most frequently captured species with gill nets in 2007 with a CPUE of 4.66 fish per net night, followed by goldeye (0.92 fish per net night). All other species were sampled at a frequency of less then 0.35 fish per net night.

During the 2007 sturgeon season, a total of 621 fish representing 22 species were captured in 33,850 meters of drifting 1.0" trammel nets (CPUE = 1.83 fish per 100 m drifted) compared to 1,442 fish representing 24 species were captured in 30,760 meters during the fish community season (CPUE = 4.68 fish per 100 m drifted). Shovelnose sturgeon were the most frequently captured species with a CPUE of 2.20 fish per 100 m drifted, followed by blue suckers (0.76 fish per 100 m drifted) (Appendix F2 and H). All other species were sampled at a frequency of less then 0.2 fish per 100 m drifted.

Otter trawls collect the widest size ranges of fish. During the 2007 sturgeon season, a total of 1,007 fish representing 26 species were captures in 27,930 meters of trawling (CPUE = 3.6 fish per 100 m trawled). Catch rates with otter trawls were much higher during the fish community season when a total of 4,838 fish representing 36 species were captured in 28,640 meters of trawling (CPUE = 16.8 fish per 100 m trawled). Channel catfish were the most frequently captured species with a CPUE of 2.78 fish per 100 m trawled, followed by freshwater drum (2.56 fish per 100 m trawled) and blue catfish (1.97 fish per 100 m trawled) (Appendix F4 and H). All other species were sampled at a frequency of less then 1.50 fish 100 m per trawled.

Mini-fyke nets remain the most productive gear to collect small bodied fishes and catch the greatest diversity of fish species. In 2007, a total of 17,828 fish representing 55 species were

captured in 156 net nights (CPUE = 114.28 fish per net night). Emerald shiners were the most frequently captured species with a CPUE of 32.99 fish per net night, followed by red shiners (31.72 fish per net night) and gizzard shad (10.29 fish per net night) (Appendix F6 and H).

The push trawl was implemented as an evaluation gear during the 2007 fish community season. A total of 3,004 fish representing 37 species were captured in 68 deployments covering 4,744 m (CPUE = 0.127 per 5 m trawled). Channel catfish were the most frequently captured species with a CPUE of 15.79 fish per 5 m trawled, followed by freshwater drum (15.19 fish per 5 m trawled) (Appendix F7 and H).

Discussion

Pallid Sturgeon

Thirty-two pallid sturgeon were collected during the 2007 sampling season in Segment 9 of the Missouri River (Figure 1b). Gill nets remain the most effective gear for capturing pallid sturgeon, collecting thirteen pallid sturgeon (11 hatchery reared and 2 unknowns) (Appendix F1). Pre-winter gill netting produced seven pallid sturgeon compared to six during post winter gill netting. One inch trammel nets and otter trawls which had been fairly ineffective during 2003, 2004, and 2005 sampling only 12 pallid sturgeon in over 200 kilometers of effort (Figures 2, 3 and 5). produced 15 pallid sturgeon during 2006 and 11 during 2007 (Figures 2, 3 and 5). Pallid sturgeon were captured in two continuous macrohabitats (inside bend and channel cross-over) with standard gears with the majority (N = 14) being collected on inside bends (Tables 13 and 15). Tributary confluence, secondary channel connected large and tributary mouth large were the only discrete macrohabitats were pallid sturgeon were collected (Tables 13 and 15). Pallid sturgeon were sampled in locations with a mean water depth of 2.5 m and an average bottom velocity of 0.539 mps (Table 3). Pallid sturgeon collected during winter gill netting were collected in deeper water and slower water velocities compared to 1.0" trammel nets and otter trawls (depth: 2.6 m vs. 2.4 m, water velocity: 0.30 mps vs. 0.81 mps).

Over 15,000 hatchery reared pallid sturgeon have been stocked in Segment 9 since 1997 (Appendix E). Hatchery reared pallid sturgeon stocked into Segment 9 are represented by the 1992, 1997, 2003, 2004 and 2005 year classes. During the 2007 sampling season, fish from five year classes were recaptured (1999, 2001, 2002, 2003, and 2004) (Table 6).

Shovelnose Sturgeon

Gill nets remained the most effective sampling method for shovelnose sturgeon, collecting almost 50% of all shovelnose sturgeon during 2007 (Table 17–24). Catch rates declined after 2003 when channel border mesohabitats were sampled along with pools. One inch trammel nets were the second most effective gear for sampling shovelnose sturgeon (N = 1,259), sampling over twice as many compared to otter trawling (N = 581) (Figures 11, 12 and 14). We have observed that drifting 1.0" trammel nets outside of wing dike tips produce lower catch rates and higher number of damaged or lost nets. A seventy-five meter drift between wing dikes is not always possible in this reach of the Missouri River due to wing dike spacing and placement.

***Macrophybopsis* species**

Otter trawling remained the most effective standard sampling method for all *Macrophybopsis* species. Otter trawling collected 33 of 34 sturgeon chubs, all sicklefin chubs and 235 of 256 speckled chubs during both seasons (Appendix F4). The use of an experimental push trawl designed to sample in areas where mini-fyke nets can not be set and areas where the standard otter trawl is ineffective due to shallow water proved ineffective at capturing these species. The experimental trawl collected 90 speckled chubs, 3 sturgeon chubs and 2 sicklefin chubs.

Sand Shiners

Mini-fyke nets are the most effective method to collect sand shiners, collecting over 98% of the total catch (Appendix F6). Overall catch rate for sand shiners increased each year from 2003 to 2006; however catch rates during 2007 declined sharply when compared to 2006 (Figures 30, 31 and 32). The experimental push trawl only collected 23 sand shiners compared to 226 with the standard mini-fyke net.

***Hybognathus* species**

Mini-fyke nets remain the most effective method for collecting *Hybognathus* species (Appendix F6). Overall catch for *Hybognathus* species increased during 2007 (N = 382) compared to 2006 (N = 59) and was similar to 2005 (N = 388). Catch rates during 2003 (N = 1,185 fish) was the highest observed since sampling began; however the majority of these fish were collected using a bag seine which was removed as a standard gear for the 2006 sampling season (Travnichek, unpublished data).

Blue Sucker

One inch trammel nets were the most effective sampling method for blue suckers, collecting over 67% of all blue suckers sampled during 2007 (Appendix F2). This was similar to 2006 when 1.0" trammel nets collected almost 50% of all blue suckers collected (Steffensen and Hamel, 2007); however during the 2004 and 2005 sampling season hoop nets and gill nets were the most effective gears, respectively (Steffensen and Barada, 2006 and Steffensen and Mestl, 2005). Overall catch for blue suckers increased during 2007 (N = 634) compared to previous years (2006, N = 617, 2005, N = 552, 2004, N = 474 and 2003, N = 240).

Sauger

No young-of-the-year sauger were collected during the 2007 sampling season (Figure 51). Overall, fewer sauger were collected during 2007 (N = 69) compared to 2006 (N = 137)

(Steffensen and Barada, 2006). Winter gill netting in wing dike pools remains the most productive method for collecting sauger (Figure 45 and Tables 38 and 39).

Trotlines

Trotlines were deployed after the conclusion of our winter gill netting efforts as a wild gear in an experiment to collect pallid sturgeon broodstock. A total 32 deployments were conducted during the week of April 16-19 resulting in 480 hook nights. All sampling was directed on Upper Plattsmouth Bend and the confluence of the Platte River with water temperatures from 12.1-16.5°C. A total of 109 fish were collected including 5 pallid sturgeon that were sent to Gavin Point National Fish Hatchery as potential broodstock. Shovelnose sturgeon (N = 98) were the most abundant species collected with a CPUE of 0.20 fish per hook night, followed by pallid sturgeon (N = 6, CPUE = 0.013 fish per hook night). Three channel catfish and two freshwater drum were also collected during this effort. Trotlines will continued to be evaluated during the 2008 sampling season.

Experimental 2.5" Monofilament Gill Net

An experimental 2.5" monofilament gill net design to collect broodstock pallid sturgeon and reduce the by-catch of smaller shovelnose sturgeon and other non-target species was deployed after the conclusion of our winter gill netting efforts. During this one day effort in Segment 9, a total of 150 fish representing 8 species were collected in 12 deployments (CPUE = 6.25 fish per net night). Shovelnose sturgeon were the most frequently captured species with a CPUE of 3.91 fish per net night, followed by blue suckers (CPUE = 1.58 fish per net night). Although no pallid sturgeon were collected with the experimental net in Segment 9, two lake sturgeon were collected. There was no evidence of a coded wire tag or PIT tag in either lake sturgeon.

Experimental 25 ft .Otter Trawl

An experimental 25 ft otter trawl designed by Mr. Greg Faulkner with Innovative Net System in Milton, LA was deployed to attempt to sample pallid sturgeon in areas where standard gears will not effectively sample. A total of 5 deployments and 4 additional passes were completed in the confluence of the Platte River and the revetment (OSB) immediately below the Platte River confluence. Two pallid sturgeon (one wild and one hatchery reared) was collected on the outside bend thalweg along with 19 shovelnose sturgeon. Depths ranged from 3.7 m to 5.2 with a bottom velocity of 1.06 mps. Even with this specially designed trawl, trawling along the outside bend revetment is potentially dangerous and not recommended without an experienced crew.

Miscellaneous Work

In addition to completing all required sampling, the Nebraska Game and Parks Commission Pallid Sturgeon Assessment (PSA) Crew participated in several side projects, conferences and crew training.

- January 18, 19, and 20 – Attended the Nebraska Chapter of the American Fisheries Society’s annual meeting in Council Bluffs, Iowa.
- March 6, 7, and 8 – Attended the Missouri River Natural Resource Conference / Biological Opinion Forum in Nebraska City.
- May 8 and 9 – Assisted in tagging and stocking pallid sturgeon at Gavins Point National Fish Hatchery.
- May 14, 15, and 16 – Attended the annual project training at the Desoto National Wildlife Refuge.
- June 7 – Assisted Matt Schwarz with the U.S. Fish and Wildlife Service (Grand Island Office) with collecting shovelnose sturgeon in Boyer Chute for a contaminants study.
- September 22 and 23 – Hosted Missouri River boat tours at the annual Ponca Outdoor Expo.
- October 7 -- Collected Asian carp genetic samples for a DNA study for Dr. Guoqing Lu at the University of Nebraska Omaha.
- October 15, 16, and 17 – Hosted the Nebraska Game and Parks Commission Fisheries Division Meeting at Aksarben Aquarium in Gretna, NE.
- October 18 – Assisted the Neosho National Fish Hatchery staff in stocking pallid sturgeon at Bellevue, NE.
- The PSA crew participated in the development and gear evaluation of an experimental push trawl. The push trawl was tested as an alternative gear to collect additional information on small bodied fishes, especially in habitats where mini-fyke nets are ineffective due to current or depth and areas where otter trawls are ineffective due to shallow water. The results of the evaluation of the experimental push trawl are pending.
- Assistance was provided to Ben Neely, a graduate student at the University of Nebraska in Lincoln. Mr. Neely is doing a telemetry study on blue suckers in the Missouri River. Fish were collected and implanted with telemetry tags for Mr. Neely’s graduate project.

Acknowledgments

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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, 5th edition. Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
Petromyzontidae – lampreys		
<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		
Acipenseridae – sturgeons		
<i>Acipenser fulvescens</i>	Lake sturgeon	LKSG
<i>Scaphirhynchus</i> spp.	Unidentified Scaphirhynchus	USG
<i>Scaphirhynchus albus</i>	Pallid sturgeon	PDSG*
<i>Scaphirhynchus platyrhynchus</i>	Shovelnose sturgeon	SNSG*
<i>S. albus</i> X <i>S. platyrhynchus</i>	Pallid-shovelnose hybrid	SNPD
Polyodontidae – paddlefishes		
<i>Polyodon spathula</i>	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
Lepisosteidae – gars		
<i>Lepisosteus oculatus</i>	Spotted gar	STGR
<i>Lepisosteus osseus</i>	Longnose gar	LNGR
<i>Lepisosteus platostomus</i>	Shortnose gar	SNGR
ORDER AMMIFORMES		
Amiidae – bowfins		
<i>Amia calva</i>	Bowfin	BWFN
ORDER OSTEOGLOSSIFORMES		
Hiodontidae – mooneyes		
<i>Hiodon alosoides</i>	Goldeye	GDEY
<i>Hiodon tergisus</i>	Mooneye	MNEY
ORDER ANGUILLIFORMES		
Anguillidae – freshwater eels		
<i>Anguilla rostrata</i>	American eel	AMEL

Appendix A. (continued).

Scientific name	Common name	Letter Code
ORDER CLUPEIFORMES		
Clupeidae – herrings		
<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
ORDER CYPRINIFORMES		
Cyprinidae – carps and minnows		
<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
<i>Hybognathus argyritis</i>	Western silvery minnow	WSMN*
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<i>Hybognathus placitus</i>	Plains minnow	PNMW*
<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
<i>Macrhybopsis aestivalis</i>	Speckled chub	SKCB*
<i>Macrhybopsis gelida</i>	Sturgeon chub	SGCB*
<i>Macrhybopsis meeki</i>	Sicklefin chub	SFCB*
<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 greeni</i>	Wedgespot shiner	WSSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
Cyprinidae – carps and minnows		
<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
<i>Notropis stramineus</i>	Sand shiner	SNSN*
<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
Catostomidae - suckers		
<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 commersoni</i>	White sucker	WTSK
<i>Catostomus platyrhynchus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<i>Cycleptus elongatus</i>	Blue sucker	BUSK*
<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
Catostomidae - suckers	Unidentified Catostomidae	UCT
ORDER SILURIFORMES		
Ictaluridae – bullhead catfishes		
<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
ORDER SALMONIFORMES		
Esocidae - pikes		
<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
Umbridae - mudminnows		
<i>Umbra limi</i>	Central mudminnow	MDMN
Osmeridae - smelts		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
Salmonidae - trouts		
<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
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
<i>Lota lota</i>	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
<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
	Poeciliidae - livebearers	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	Atherinidae - silversides	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	Gasterosteidae - sticklebacks	
<i>Culaea inconstans</i>	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	Cottidae - sculpins	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	Percichthyidae – temperate basses	
<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
	Centrarchidae - sunfishes	
<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
Centrarchidae - sunfishes		
<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 punctalatus</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
Percidae - perches		
<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
<i>Sander canadense</i>	Sauger	SGER*
<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
Sciaenidae - drums		
<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 ³ /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 ³ /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 9 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for Segment 9.

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
Trammel net – 1 inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night
Beam trawl	BT	Standard	All	2003 - 2004	fish/100 m trawled
Hoop net – 4 ft.	HN	Standard	All	2003 - 2004	fish/net night
Trammel net – 2.5 inch 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 ²
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	fish/100 m ²
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	fish/100 m ²
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	fish/100 m ²
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - 2005	fish/100 m ²
Bag seine – rectangular method pulled downstream	BSRD	Standard	Fish Comm.	2003 - 2005	fish/100 m ²
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

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	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
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	Grand Champs	GRC	Missouri	1741.0
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	Sloan	SLN	Missouri	709.0
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 9 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking^a	Primary Mark	Secondary Mark
1997	Platte River	402	1997	10/15/1997	Fingerling	Floy	CWT
1998	Two Rivers Rec. Area	84	1992	4/17/1998	6 yr Old	PIT Tag	CWT
1999	Two Rivers Rec. Area	15	1992	5/17/1999	7 yr Old	PIT Tag	CWT
2004	Leavenworth	38	2003	7/8/2004	Yearling	Elastomer	CWT
2004	Leavenworth	787	2003	7/8/2004	Yearling	PIT Tag	Elastomer
2004	Leavenworth	944	2003	7/30/2004	Yearling	PIT Tag	Elastomer
2004	Leavenworth	9170	2004	9/10/2004	Yearling	Elastomer	CWT
2004	Leavenworth	2864	2004	10/8/2004	Yearling	Elastomer	CWT
2006	Rulo	626	2005	5/5/2006	Yearling	PIT Tag	Elastomer
2006	Parkville	427	2005	8/31/2006	Yearling	PIT Tag	Elastomer

Appendix F

Total catch, overall mean catch per unit effort (± 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 9 of the Missouri River during 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 on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL
BHCP	3	0.007 0.008						0.019 0.021				
BLCF	38	0.087 0.041		0.034 0.048			0.013 0.018	0.21 0.102				
BMBF	1	0.002 0.005							0.167 0.333			
BUSK*	96	0.220 0.088	0.026 0.053	0.172 0.134	0.750 1.500	0.13 0.095	0.383 0.207					
CARP	23	0.053 0.025	0.079 0.086	0.052 0.058	0.750 0.500	0.026 0.025	0.062 0.048					
CNCF	58	0.133 0.083	0.053 0.072	0.017 0.034	0.250 0.500	0.026 0.031	0.309 0.216					
FHCF	7	0.016 0.020		0.069 0.138		0.013 0.018	0.006 0.012					
FSMT	1	0.002 0.005					0.006 0.012					
FWDM	18	0.041 0.040		0.017 0.034	0.250 0.500	0.006 0.013	0.093 0.104					
GDEY	403	0.924 0.336	0.421 0.788	1.103 0.716	15.000 19.000	0.214 0.134	1.407 0.557		0.250 0.500		0.250 0.500	
GSCP	4	0.009 0.011	0.053 0.105	0.017 0.034		0.006 0.013						
GZSD	16	0.037 0.033		0.052 0.076	0.250 0.500	0.039 0.078	0.037 0.042					
LNGR	145	0.333 0.277	0.053 0.072	0.052 0.076	1.750 1.500	0.019 0.022	0.642 0.693		3.500 7.000	0.750 1.500		0.500 1.000
PDFH	5	0.011 0.015		0.017 0.034			0.025 0.039					
PDSG*	13	0.032 0.019	0.026 0.053	0.017 0.034		0.019 0.022	0.043 0.04		0.167 0.333		0.250 0.500	
QLBK	1	0.002 0.005				0.006 0.013						
RVCS	30	0.069 0.038		0.086 0.087	0.500 1.000	0.026 0.052	0.117 0.079					

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL
RVRH	1	0.002					0.006					
		0.005					0.013					
SGER*	46	0.106	0.053	0.121	1.000		0.045	0.173				
		0.046	0.072	0.137			0.033	0.103				
SHRH	2	0.005	0.026					0.006				
		0.006	0.053					0.012				
SJHR	2	0.005					0.006	0.006				
		0.006					0.013	0.012				
SMBF	37	0.085	0.053	0.052			0.013	0.167	0.500			
		0.056	0.105	0.076			0.018	0.139	1.000			
SNGR	98	0.225		0.069	0.500	3.250	0.039	0.296	3.333	1.000		0.500
		0.157		0.065		2.500	0.044	0.335	5.696	2.000		1.000
SNSG*	2035	4.667	4.711	4.707	4.000	0.500	1.474	7.920	6.000	0.500	5.250	1.000
		0.898	3.375	2.305		1.000	0.487	1.787	11.504	1.000	4.500	
SVCP	2	0.005		0.017					0.167			
		0.006		0.034					0.333			
WTBS	2	0.005		0.017				0.006				
		0.006		0.034				0.012				

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	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
BHCP	3	0.005		0.103	0.005		
		0.006		0.206	0.007		
BLCF	15	0.023	0.024		0.025		
		0.014	0.029		0.017		
BMBF	3	0.005		0.067	0.006		
		0.009		0.134	0.012		
BUSK*	429	0.756	0.515	0.189	0.877	0.293	1.316
		0.194	0.327	0.379	0.256	0.249	1.519
CARP	13	0.023	0.025	0.056	0.019	0.030	0.149
		0.014	0.029	0.113	0.016	0.060	0.298
CNCF	73	0.130	0.158	0.151	0.119	0.159	
		0.040	0.105	0.211	0.044	0.184	
FHCF	5	0.008			0.012		
		0.008			0.012		
FWDM	6	0.011	0.014		0.011		
		0.009	0.020		0.011		
GDEY	69	0.119	0.112	0.111	0.119	0.202	
		0.035	0.071	0.222	0.043	0.174	
GSCP	14	0.022	0.033		0.020		
		0.013	0.030		0.016		
GZSD	6	0.011	0.008		0.006	0.060	0.188
		0.009	0.017		0.009	0.086	0.376
LNGR	14	0.025	0.042		0.016	0.086	
		0.017	0.052		0.015	0.120	
PDFH	1	0.002	0.008				
		0.004	0.016				
PDSG*	9	0.017	0.023		0.013		0.188
		0.013	0.027		0.014		0.376
QLBK	1	0.002	0.008				
		0.004	0.017				
RVCS	25	0.049	0.039		0.049	0.148	
		0.027	0.035		0.032	0.296	
SGER*	15	0.028	0.014		0.033	0.049	
		0.015	0.020		0.020	0.099	

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
SGWE	1	0.001			0.002		
		0.002			0.003		
SJHR	1	0.002	0.008				
		0.004	0.016				
SMBF	75	0.120	0.062	0.262	0.136	0.113	0.149
		0.034	0.043	0.243	0.045	0.161	0.298
SNGR	20	0.037	0.042		0.039		
		0.021	0.037		0.027		
SNPD	1	0.002			0.003		
		0.004			0.006		
SNSG*	1259	2.200	1.256	5.205	2.125	6.900	4.641
		0.459	0.523	4.674	0.576	2.987	8.85
SVCP	4	0.006	0.023		0.001		
		0.007	0.027		0.002		
WTSK	1	0.001			0.002		
		0.002			0.003		

Appendix F4. 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	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
BLCF	1029	1.974	2.820	0.190	1.796		1.561	0.532
		0.743	1.862	0.381	0.862		2.321	1.064
BLGL	2	0.003	0.011	0.048				
		0.005	0.021	0.095				
BMBF	4	0.009	0.034					0.133
		0.009	0.039					0.266
BUSK*	64	0.118	0.062	0.515	0.128		0.111	0.213
		0.041	0.053	1.030	0.050		0.104	0.426
CARP	28	0.053	0.080		0.036	0.476	0.158	
		0.024	0.069		0.020	0.952	0.207	
CNCF	1376	2.782	2.678	1.033	2.562	5.143	7.153	1.317
		0.736	1.048	1.473	0.713	4.952	10.345	1.086
ERSN	46	0.110	0.133		0.091		0.346	
		0.088	0.228		0.098		0.407	
FHCB	1	0.001			0.001			
		0.002			0.003			
FHCF	22	0.048	0.012	0.129	0.049	0.476	0.140	
		0.022	0.024	0.257	0.027	0.952	0.198	
FWDM	1109	2.560	4.633	0.353	2.020	5.143	1.329	0.106
		1.242	3.199	0.518	1.435	8.381	1.697	0.213
GDEY	2	0.005	0.009		0.003			
		0.006	0.019		0.007			
GSCP	1	0.002					0.042	
		0.004					0.085	
GZSD	10	0.020	0.027	0.082	0.017			
		0.015	0.031	0.163	0.019			
LNGR	1	0.001			0.002			
		0.003			0.004			
PDFH	21	0.039	0.012		0.053			
		0.037	0.025		0.053			
PDSG*	2	0.003	0.007	0.073				
		0.004	0.015	0.145				

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
PNMW*	2	0.003	0.009		0.002			
		0.005	0.017		0.004			
QLBK	2	0.002		0.048	0.001			
		0.002		0.095	0.003			
RBST	1	0.001			0.002			
		0.002			0.003			
RDSN	19	0.049	0.086	0.381	0.032			
		0.047	0.172	0.762	0.032			
RVCS	33	0.072	0.177		0.037	0.085	0.133	
		0.036	0.127		0.028	0.119	0.266	
RVSN	48	0.108	0.021	0.381	0.130	0.134		
		0.104	0.030	0.762	0.149	0.205		
SFCB*	17	0.028	0.027		0.032			
		0.019	0.055		0.020			
SFSN	1	0.002		0.129				
		0.004		0.257				
SGCB*	33	0.051	0.068		0.048		0.213	
		0.023	0.071		0.023		0.426	
SGER*	7	0.014			0.020			
		0.011			0.015			
SKCB*	235	0.457	0.470	0.048	0.470	0.461	0.106	
		0.128	0.217	0.095	0.166	0.564	0.213	
SMBF	596	1.371	0.426	0.082	1.826	0.140	0.399	
		2.475	0.542	0.163	3.581	0.188	0.798	
SMMW	1	0.001			0.001			
		0.002			0.002			
SNGR	4	0.010	0.014		0.010			
		0.010	0.027		0.012			
SNPD	1	0.001			0.002			
		0.002			0.003			
SNSG*	581	1.088	1.542	0.675	0.94	1.466	0.133	
		0.177	0.449	0.527	0.198	0.662	0.266	
SNSN*	4	0.006	0.009		0.002	0.036	0.106	
		0.007	0.017		0.005	0.072	0.213	
STCT	4	0.006			0.007	0.030		
		0.007			0.009	0.059		

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
SVCB	500	1.089	1.368	0.048	1.012		1.513	0.133
		0.657	1.775	0.095	0.729		2.245	0.266
UAC	2	0.004			0.006			
		0.006			0.009			
UCY	1	0.003			0.004			
		0.006			0.009			
UHY	7	0.016			0.023			
		0.029			0.042			
UIC	6	0.013			0.019			
		0.016			0.023			
WTBS	17	0.041	0.136		0.014			
		0.061	0.258		0.017			
YOYF	5	0.007			0.010			
		0.014			0.021			

Appendix F6. 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 BAR	ISB BAR	OSB BAR	SCCL BAR	TRML BAR	TRMS BAR
BGOS	1	0.006 0.013		0.011 0.022				
BHMW	5	0.032 0.042		0.055 0.073				
BKCP	16	0.103 0.058	0.209 0.170	0.077 0.056				
BKSS	2	0.013 0.018		0.022 0.031				
BLCF	1	0.006 0.013						0.333 0.667
BLGL	253	1.622 0.552	1.488 0.823	1.766 0.829	2.000 2.071	0.571 1.143	2.000 2.000	
BMBF	206	1.321 0.851	2.302 2.671	0.900 0.626	0.182 0.364	3.286 4.971		0.333 0.667
BNMW	3	0.019 0.022		0.011 0.022				
BSMW*	2	0.013 0.026	0.023 0.046	0.033 0.049				
CARP	71	0.455 0.206	0.465 0.307	0.466 0.314	0.273 0.545	0.286 0.369		1.333 1.333
CKCB	5	0.032 0.028		0.055 0.048				
CLSR	19	0.122 0.231	0.023 0.046	0.200 0.400				
CNCF	173	1.109 0.337	0.511 0.300	1.366 0.527	2.182 1.260		0.500 1.000	1.000
ERSN	5147	32.994 15.466	55.488 50.786	28.166 10.859	16.000 16.221	2.857 4.104		10.000 20.000
FHCB	1	0.006 0.013	0.023 0.046					
FHCF	6	0.038 0.031	0.023 0.046	0.033 0.038	0.091 0.182			0.333 0.667
FHMW	191	1.224 0.734	1.209 1.871	1.133 0.618	0.273 0.282	4.571 8.814		0.667 1.333

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	TRML	TRMS
			BAR	BAR	BAR	BAR	BAR	BAR
FWDM	1216	7.795	6.395	9.466	5.182	2.286		5.333
		4.994	3.400	8.493	3.301	1.784		2.906
GDEY	2	0.013	0.023	0.011				
		0.018	0.046	0.022				
GDSN	1	0.006	0.023					
		0.013	0.046					
GNSF	43	0.276	0.465	0.188	0.455	0.143		
		0.131	0.361	0.122	0.625	0.286		
GSCP	1	0.006						0.333
		0.013						0.667
GZSD	1606	10.295	11.767	11.344	0.545	10.000		1.000
		6.607	14.307	9.185	0.625	8.805		2.000
HBNS*	6	0.038	0.116	0.011				
		0.048	0.165	0.022				
LMBS	3	0.019	0.023		0.091	0.143		
		0.022	0.046		0.182	0.286		
LNGR	35	0.224	0.279	0.200	0.273	0.286		
		0.096	0.180	0.131	0.282	0.571		
MQTF	115	0.737	0.674	0.933	0.182			
		0.367	0.605	0.563	0.244			
OSSF	88	0.564	0.883	0.466	0.182	0.857		
		0.287	0.596	0.383	0.364	1.714		
PNMW*	364	2.333	3.023	2.455	0.727			1.667
		1.548	3.392	2.137	1.012			3.333
PTMW	1	0.006				0.143		
		0.013				0.286		
RDSN	4949	31.724	10.720	47.811	5.909	12.429	16.000	0.333
		26.739	8.962	45.948	4.402	13.128	18.000	0.667
RVCS	474	3.038	2.674	3.711	1.636			2.333
		1.698	2.448	2.690	1.579			1.333
RVSN	1146	7.346	4.395	9.200	5.000	5.286	18.000	0.333
		2.426	2.124	3.933	4.921	5.177	30.000	0.667
SFSN	151	0.968	0.442	1.444		0.286		
		1.107	0.748	1.883		0.571		
SGCB*	1	0.006		0.011				
		0.013		0.022				

Species	Total Catch	Overall CPUE	CHXO BAR	ISB BAR	OSB BAR	SCCL BAR	TRML BAR	TRMS BAR
SGER*	1	0.006	0.023					
		0.013	0.046					
SHRH	1	0.006		0.011				
		0.013		0.022				
SJHR	1	0.006	0.023					
		0.013	0.046					
SKCB*	21	0.135	0.116	0.155		0.286		
		0.109	0.136	0.172		0.571		
SMBF	494	3.167	6.348	1.777	0.545	7.857		
		1.595	4.993	1.114	1.091	8.263		
SMBS	1	0.006	0.023					
		0.013	0.046					
SMMW	5	0.032	0.046	0.022	0.091			
		0.028	0.065	0.031	0.182			
SNGR	100	0.641	1.023	0.444	0.727	0.571		1.333
		0.231	0.715	0.158	0.767	0.857		1.764
SNSN*	226	1.449	2.279	1.300	0.273	1.000	0.500	
		1.023	3.372	0.749	0.545	0.756	1.000	
SVCB	263	1.686	1.790	1.833	0.545	1.286	2.000	0.667
		0.670	1.779	0.785	0.563	1.429	2.000	0.667
UCN	5	0.032	0.023	0.044				
		0.034	0.046	0.054				
UCY	37	0.237	0.186	0.300	0.091			0.333
		0.171	0.284	0.261	0.182			0.667
UGR	1	0.006		0.011				
		0.013		0.022				
UHY	2	0.013		0.022				
		0.018		0.031				
ULP	1	0.006		0.011				
		0.013		0.022				
UTB	200	1.282	0.511	1.888	0.636			0.333
		0.915	0.558	1.553	0.619			0.667
WSMW*	10	0.064	0.023	0.100				
		0.072	0.046	0.122				
WTBS	134	0.859	1.046	0.855		1.714		
		0.334	0.831	0.382		2.170		

Species	Total Catch	Overall CPUE	<u>CHXO</u> BAR	<u>ISB</u> BAR	<u>OSB</u> BAR	<u>SCCL</u> BAR	<u>TRML</u> BAR	<u>TRMS</u> BAR
WTCP	17	0.109	0.163	0.100		0.143		
		0.062	0.147	0.077		0.286		
YOYF	4	0.026	0.023	0.033				
		0.040	0.046	0.067				

Appendix F7. Push Trawl: overall season and segment summary. Lists CPUE (fish/5 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB	SCCL		TRML	
			BAR	CHNB	BAR	CHNB	BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB
BKSS	7	0.152 0.214	0.830 1.34		2.128								
BLCF	25	0.324 0.338		0.703 1.405			0.144 0.203				3.055 4.059		
BLGL	3	0.057 0.066	0.133 0.265				0.105 0.148						
BMBF	43	1.148 1.215	3.878 5.813		6.383		0.061 0.121	0.193 0.265		0.303 0.606		34.375	
BUSK*	1	0.014 0.029									0.203 0.407		
CARP	3	0.055 0.065		0.304 0.608			0.044 0.088			0.253 0.506			
CNCF	721	15.792 8.930	8.401 13.949	1.651 2.158	6.383	1.351	35.808 22.974	4.452 2.550		5.478 6.866	6.823 6.171		
ERSN	278	4.907 3.927	8.484 8.398	0.731 1.020			1.946 2.090	1.790 3.402	17.776 28.962	28.710 56.859			
FHCF	3	0.061 0.071	0.167 0.334				0.044 0.089	0.106 0.212					
FHMW	1	0.018 0.036								0.303 0.606			
FWDM	695	15.198 12.634	43.932 75.053	3.452 4.111			5.307 4.683	19.024 18.929	0.240 0.481	42.913 58.826	2.899 2.865		
GDEY	1	0.019 0.039		0.234 0.468									
GZSD	46	1.104 0.932	3.551 4.965	0.238 0.476	2.128		0.803 1.230	0.083 0.167		1.818 3.636		9.375	
JYDR	1	0.013 0.026								0.225 0.449			
QLBK	3	0.088 0.149										6.250	1.220
RBST	1	0.039 0.078					0.111 0.222						
RDSN	81	2.040 1.696	0.488 0.538		25.532		1.613 3.226			11.094 11.670	0.341 0.443	34.375	1.220

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB	SCCL		TRML	
			BAR	CHNB	BAR	CHNB	BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB
RVCS	16	0.406	0.154	0.608			0.060	1.655					
		0.476	0.308	1.216			0.119	2.411					
RVSN	204	4.588	0.836	1.342	4.255	1.351	8.153			14.523			46.875
		5.13	1.672	0.723			13.786			20.105			
SFCB*	2	0.054					0.153						
		0.083					0.235						
SFSN	1	0.015									0.206		
		0.029									0.412		
SGCB*	3	0.096					0.273						
		0.112					0.311						
SHRH	1	0.026	0.167										
		0.051	0.334										
SJHR	40	0.733	0.918	0.484						9.394			
		1.129	1.5900	0.625						18.788			
SKCB*	90	2.385	1.295	0.472			5.181	0.174		4.625	0.203		
		1.841	2.121	0.610			4.811	0.347		8.699	0.407		
SMBF	216	5.184	22.83	1.742	21.277		2.824	0.086		2.364			12.500
		6348	40.885	3.484			4.399	0.171		2.473			
SNGR	2	0.034						0.118	0.240				
		0.050						0.236	0.481				
SNSG*	2	0.078					0.222						
		0.157					0.444						
SNSN*	23	0.534	0.836							6.906			
		0.794	1.672							12.585			
STCT	10	0.203					0.534				0.203		
		0.309					0.868				0.407		
SVCB	344	8.132	16.745	8.539	6.383		4.408	5.886		22.329	1.660		59.375
		4.617	25.688	12.108			2.727	5.266		18.368	2.826		
UCY	36	0.586		0.493			0.188	0.087		7.603	0.225		
		0.642		0.985			0.261	0.174		9.429	0.450		
UHY	27	0.593	0.154				1.480	0.250					
		0.901	0.308				2.532	0.500					
UNID	2	0.078	0.513										
		0.157	1.026										
UTB	19	0.510	1.077				0.311	1.250					
		0.440	2.154				0.451	1.292					
WTBS	52	1.274	4.231	2.456	4.255		0.548			0.303	0.225		12.500
		0.999	5.726	3.539			0.468			0.606	0.450		

Appendix G. Hatchery names, locations and abbreviations.

Hatchery	State	Abbreviation
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 sturgeon season (fall through spring) and fish community season (summer) during 2007 for Segment 9 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)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
BGOS					0.006		
BHCP	0.004	0.007		0.006			
BHMW					0.032		
BKCP					0.103		
BKSS					0.013		0.152
BLCF	0.025	0.087	0.034	0.021	0.006	3.951	0.324
BLGL					1.622	0.007	0.057
BMBF	0.009	0.002		0.002	1.321	0.019	1.148
BNMW					0.019		
BSMW*					0.013		
BUSK*	0.368	0.220	0.102	1.120		0.134	0.014
CARP	0.022	0.053	0.060	0.024	0.455	0.045	0.055
CKCB					0.032		
CLSR					0.122		
CNCF	0.087	0.133	1.010	0.170	1.109	4.579	15.792
ERSN			0.034		32.994	0.188	4.907
FHCB					0.006	0.002	
FHCF	0.012	0.016	0.030	0.005	0.038	0.065	0.061
FHMW					1.224		0.018
FSMT		0.002					
FWDM	0.020	0.041	0.380	0.003	7.795	4.778	15.198
GDEY	0.103	0.924		0.135	0.013	0.009	0.019
GDSN					0.006		
GNSF					0.276		

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
GSCP	0.018	0.009		0.025	0.006	0.004	
GZSD		0.037		0.021	10.295	0.039	1.104
HBNS*					0.038		
JYDR							0.013
LMBS					0.019		
LNGR	0.002	0.333		0.046	0.224	0.003	
MQTF					0.737		
NFSH							
OSSF					0.564		
PDFH		0.011	0.077	0.004			
PDSG*	0.012	0.032	0.002	0.021		0.003	
PNMW*					2.333	0.007	
PTMW					0.006		
QLBK		0.002		0.004		0.003	0.088
RBST			0.002				0.039
RDSN			0.018		31.724	0.079	2.040
RVCS	0.031	0.069	0.023	0.065	3.038	0.122	0.406
RVRH		0.002					
RVSN			0.016		7.346	0.201	4.588
SFCB*			0.021			0.036	0.054
SFSN					0.968	0.004	0.015
SGCB*			0.057		0.006	0.045	0.096
SGER*	0.013	0.106	0.002	0.043	0.006	0.025	
SGWE				0.002			
SHRH		0.005			0.006		0.026
SJHR		0.005		0.004	0.006		0.733
SKCB*			0.463		0.135	0.447	2.385
SMBF	0.074	0.085	0.019	0.162	3.167	2.749	5.184

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
SMBS					0.006		
SMMW					0.032	0.002	
SNGR	0.015	0.225		0.057	0.641	0.020	0.034
SNPD	0.004					0.002	
SNSG*	1.362	4.667	1.014	2.985		1.153	0.078
SNSN*			0.003		1.449	0.010	0.534
STCT			0.010			0.003	0.203
SVCB			0.296		1.686	1.894	8.132
SVCP	0.006	0.005		0.007			
UAC			0.008				
UCN					0.032		
UCY			0.006		0.237		0.586
UGR					0.006		
UHY					0.013	0.032	0.593
UIC						0.026	
ULP					0.006		
UNID							0.078
UNO							0.024
UTB					1.282		0.510
WSMW*					0.064		
WTBS		0.005	0.003		0.859	0.080	1.274
WTCP					0.109		
WTSK				0.002			
YOYF			0.014		0.026		

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 9 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2003 - 2007.

Bend Number	Bend River Mile	Coordinates		2003	2004	2005	2006	2007
		Latitude	Longitude					
1	595	41.04596	95.87038	ST,FCS	ST,FCS	ST,FCS	ST,FCS	ST,FCS
2	591.7	41.01768	95.86527	ST		ST,FCS		
3	589	40.98974	95.84554			ST		
4	586	40.95401	95.83642			ST	ST	
5	582.7	40.90883	95.82183	ST				
6	578.8	40.87309	95.83360	FCS		ST	ST,FCS	
7	576.4	40.84561	95.84148	FCS	FCS			ST,FCS
8	574.6	40.81763	95.84432		ST			
9	572.5	40.79142	95.83644					
10	569.8	40.76173	95.86485			ST	ST,FCS	ST
11	565	40.71079	95.86616			FCS	ST	
12	563	40.68817	95.84670			ST		ST,FCS
13	559.7	40.66492	95.80562				ST	
14	557	40.62983	95.77058	FCS	ST	ST		
15	554.9	40.61230	95.75513	ST,FCS	ST,FCS	ST	ST,FCS	ST,FCS
16	553	40.58536	95.76609		ST,FCS	ST		ST,FCS
17	550.4	40.56623	95.77157					
18	549.6	40.54287	95.76694		ST	ST		
19	546.2	40.52716	95.72691		ST			
20	544.7	40.51538	95.70737		ST			
21	543.3	40.50481	95.70015				ST,FCS	
22	542	40.48347	95.69619				ST	
23	539.8	40.45929	95.67607		FCS	ST		
24	536.9	40.42378	95.65873				ST,FCS	
25	534.7	40.39518	95.64858		ST		ST,FCS	ST,FCS
26	533.5	40.37602	95.64240		FCS	FCS	ST,FCS	
27	531.7	40.35646	95.63059			FCS		
28	529.0	40.32690	95.64390	ST		ST,FCS		
29	526.0	40.30977	95.63172		FCS	ST,FCS	ST,FCS	
30	523.9	40.30622	40.30622			FCS	ST,FCS	
31	522.4	40.29963	95.57262			ST, FCS		

Appendix I. (continued).

Bend Number	Bend River Mile	Coordinates		2003	2004	2005	2006	2007
		Latitude	Longitude					
32	520.5	40.27711	95.55355					
33	518.4	40.25645	95.53964					
34	517.6	40.25218	95.52956				ST,FCS	ST,FCS
35	516.0	40.24946	40.24946	ST	ST,FCS			
36	512.5	40.20930	95.47697	FCS		FCS		
37	508.4	40.16528	95.44889		ST			
38	506.9	40.14503	95.43385			FCS	ST,FCS	
39	504.5	40.13019	95.41132			ST,FCS	ST,FCS	
40	501.8	40.10075	95.40381	FCS				
41	500.3	40.08241	95.40826			FCS	ST,FCS	
42	498.6	40.07117	95.41262				ST,FCS	ST,FCS
43	494.4	40.02697	95.38339					ST
44	491.2	40.01311	95.31744	FCS		ST		ST,FCS
45	489.8	39.99532	95.30814					
46	486.0	39.96422	95.26478			FCS		
47	483.4	39.94461	95.22425	FCS				ST,FCS
48	480.9	39.91860	95.20439		ST			
49	477.7	39.90624	95.16293			ST	ST,FCS	ST,FCS
50	472.5	39.87057	95.10992	ST		FCS		
51	469.0	39.86515	95.03876		FCS	ST		
52	467.1	39.88269	95.02572			FCS		
53	463.0	39.90058	94.96650			ST		
54	458.8	39.86870	94.93686			FCS		
55	454.9	39.83489	94.89687	ST	ST			ST,FCS
56	451.7	39.80100	94.87923					
57	449.4	39.77142	94.86792		ST,FCS			ST
58	443.0	39.73635	94.93123		FCS			
59	438.1	39.71138	94.96909	ST		ST		ST,FCS
60	435.2	39.67664	95.00320			ST		
61	431.5	39.64265	95.04594					

Appendix I. (continued).

Bend Number	Bend River Mile	Coordinates		2003	2004	2005	2006	2007
		Latitude	Longitude					
62	429.1	39.61020	95.05000					ST,FCS
63	425.3	39.57937	95.08343	ST				
64	417.9	39.50804	95.06304					
65	415.8	39.48144	95.04884					
66	412.2	39.45012	95.00172				ST,FCS	
67	410.0	39.42979	94.97785					ST,FCS
68	408.4	39.41423	39.41423			ST		
69	407.0	39.40025	94.94655	FCS				
70	404.2	39.39213	94.90451			ST	ST,FCS	ST,FCS
71	400.3	39.36325	94.89580			FCS	ST,FCS	ST,FCS
72	398.9	39.34673	94.91022					ST,FCS
73	397.1	39.33020	94.90858			ST		
74	392.4	39.27450	94.85796		FCS		ST,FCS	
75	388.7	39.22989	94.83131				ST,FCS	
76	385.0	39.20786	94.79316	ST		FCS		ST,FCS
77	383.2	39.18734	94.76897				ST,FCS	
78	378.5	39.17989	94.69552				ST	ST,FCS
79	375.4	39.16736	94.66071					
80	371.9	39.15979	94.61535			FCS		