

## **2006 Annual Report**

### **Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 8**



**Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program  
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**March 2006**

## EXECUTIVE SUMMARY

The Nebraska Game and Parks Commission (NGPC) in cooperation with the U.S. Army Corps of Engineers (USACE) began sampling segment 8 in 2005. Segment 8 begins at Lower Ponca Bend (River mile (R.M.) 753.0), where river channelization begins, and continues down to the mouth of the Platte River (R.M. 595.0). Sampling continued in 2006 with the sturgeon season, which began 26 October after water temperatures dropped below 12.7°C, and ran until 21 November, when ice inhibited boat navigation. Sampling resumed in early March after ice flows subsided and continued until 30 June. During the sturgeon season, a total of 690 samples were completed using gill nets, otter trawls, 1.0" and 2.5" trammel nets. The fish community season ran from 1 July through mid-October (> 12.7°C). During the fish community season, 650 samples were completed using otter trawls, 1.0" trammel nets, and mini-fyke nets.

A total of 17 pallid sturgeon *Scaphirhynchus albus* were captured during the 2006 sampling season. Hatchery reared pallid sturgeon recaptures accounted for 12 fish, while the remaining 5 are awaiting genetic verification and, therefore, are classified as unknown origin. Throughout 2005 and 2006, 5 of 27 hatchery reared pallid sturgeon were thought to have shed their PIT tags (Barada and Steffensen 2006). This results in 81% pit tag retention in segment 8. Recaptured hatchery reared pallid sturgeon represented five year classes (1997, 1999, 2001, 2002 and 2004) that have been stocked into RPMA #4. Representatives from the 2003 year class are the only group that has not been sampled. Relative condition (Kn) of recaptured hatchery reared pallid sturgeon was calculated in 2006. Hatchery reared pallid sturgeon that were stocked into segment 8 had a mean Kn of 1.09. When these fish were recaptured, the mean Kn had dropped to 0.84. Stocked pallid sturgeon grew on an average of 0.16 mm/day.

During 2006 pallid sturgeon were only collected with standardized gears, which was similar to 2005. Eight pallid sturgeon were captured in gill nets, otter trawls captured five fish, 1.0" trammel nets captured three fish, and 2.5" trammel nets captured one. Mini-fyke nets were the only standard gear that did not collect any pallid sturgeon. No young-of-the-year pallid sturgeon were collected with any gear during 2006.

Pallid sturgeon were sampled throughout the length of segment 8. Sampling in Omadi Bend (R.M. 722.0) resulted in the most pallid sturgeon (N = 4), and Upper Little Sioux Reach Bend (R.M. 676.7) and Manawa Bend (R.M. 608.8) both yielded three pallid sturgeon. No other

single bend yielded more than two pallids. Most pallid sturgeon (N = 12) were captured in channel border mesohabitats within the inside bend macrohabitat. Two pallid sturgeon were caught in inside bend pools and three pallids in channel cross-over pools.

The Pallid Sturgeon Assessment Team identified eight target species to serve as surrogate species to detect changes to the overall fish community. These target species include: shovelnose sturgeon *Scaphirhynchus platorynchus*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *Macrhybopsis meeki*, speckled chub *Macrhybopsis aestivalis*, 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 canadensis*. A total of 1,514 shovelnose sturgeon were captured in 2006: 888 with gill nets, 306 with 1.0" trammel nets, 278 with otter trawls, and 42 with 2.5" trammel nets. Gill nets were the most productive gear for collecting shovelnose (59%), followed by 1.0" trammel nets (20%). For all gears combined, the ratio of pallid sturgeon to shovelnose sturgeon was 1:89. Otter trawls were most productive in collecting *Macrhybopsis* spp. All sturgeon chubs (N = 5), sicklefin chubs (N = 6), and speckled chubs (N = 102) were collected by otter trawls throughout both seasons. Mini-fyke nets were the most productive method to sample sand shiners, collecting 99 % of the 881 individuals. There were 26 *Hybognathus* species captured in mini-fyke nets in 2006. No other gear was successful at collecting any *Hybognathus* species. A total of 981 blue suckers were captured in 2006, with gill nets and 1.0" trammel nets comprising 39% and 35% of the catch, respectively. Finally, there were 100 sauger captured in 2006, with otter trawls and gill nets catching the most fish (N = 38 and 36, respectively). A total of 40,694 fish representing 58 species were captured during 2006 in segment 8.

Hamel, M.J., and K.D. Steffensen. 2007. 2006 Annual Report, Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River: Segment 8. Nebraska Game and Parks Commission, Lincoln, Nebraska.

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## Introduction

The pallid sturgeon *Scaphirynchus albus* is native to the Missouri and Mississippi River systems and has evolved 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 2006 sampling season extended from the fall of 2005 through the fall of 2006 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 fall 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, three additional gears were fished: 1.0" trammel nets, 2.5"

trammel nets, and otter trawls. Sampling was on the bend level with all bends being randomly selected.

The fish community season began 1 July and continued until water temperatures dropped below 12.7° C. Three gear types were used during the fish community season: 1.0' trammel nets, otter trawls, and mini-fyke nets. Sampling was on the bend level with all bends being randomly selected. 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 *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Stizostedion canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *Macrhybopsis meeki*, speckled chub *Macrhybopsis aestivalis*, *Hybognathus* species (western silvery minnow *H. argyritis*, brassy minnow *H. hankinsoni*, and plains minnow *H. placitus*) and sand shiner *Notropis stramineus*. During the fish community season, these native species including 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. H<sub>0</sub>: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.  
H<sub>a</sub>: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.
- 1.2. H<sub>0</sub>: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages remain constant over time  
H<sub>a</sub>: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages increase or decrease over time.
- 1.3. H<sub>0</sub>: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.

H<sub>a</sub>: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.

- 1.4 H<sub>0</sub>: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time.  
H<sub>a</sub>: 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 H<sub>0</sub>: Stocked and wild pallid sturgeon use the same habitat during all life stages annually.  
H<sub>a</sub>: Stocked and wild pallid sturgeon do not use the same habitat during all life stages annually.
- 2.2 H<sub>0</sub>: Stocked and wild pallid sturgeon use the same habitat during all life stages over the long term.  
H<sub>a</sub>: 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 H<sub>0</sub>: The population structure of stocked and wild pallid sturgeon remains constant over time.  
H<sub>a</sub>: The population structure of stocked and wild pallid sturgeon changes over time.
- 3.2 H<sub>0</sub>: The population dynamics of stocked and wild pallid sturgeon remain constant over time.  
H<sub>a</sub>: 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 H<sub>0</sub>: Annual trends in native target species abundance are stable throughout the year.  
H<sub>a</sub>: Annual trends in native target species abundance increase or decrease throughout the year.
- 4.2 H<sub>0</sub>: Annual trends in native target species geographic distribution remains stable throughout the year.  
H<sub>a</sub>: Annual trends in native target species geographic distribution increases or decreases throughout the year.
- 4.3 H<sub>0</sub>: Long-term trends in native target species population abundance are stable over time.

H<sub>a</sub>: Long-term trends in native target species population abundance increases or decreases over time.

- 4.4 H<sub>0</sub>: Long-term trends in the native target species geographic distribution remain constant over time.  
H<sub>a</sub>: 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 H<sub>0</sub>: Native target species use the same habitat during all life stages annually.  
H<sub>a</sub>: Native target species do not use the same habitat during all life stages annually.
- 5.2 H<sub>0</sub>: Native target species use the same habitat during all life stages over the long term.  
H<sub>a</sub>: 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 H<sub>0</sub>: Annual trends in non-target species abundance are stable throughout the year.  
H<sub>a</sub>: Annual trends in non-target species abundance are increasing or decreasing throughout the year.
- 6.2 H<sub>0</sub>: Annual trends in non-target species geographic distribution remains stable throughout the year.  
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- 6.3 H<sub>0</sub>: Long-term trends in non-target species population abundance are stable over time.  
H<sub>a</sub>: Long-term trends in non-target species population abundance increases or decreases over time.
- 6.4 H<sub>0</sub>: Long-term trends in the non-target species geographic distribution remain constant over time.  
H<sub>a</sub>: 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 (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 these areas as high, moderate or low priority management areas. The areas which were given high priority designation by 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 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 2006). There are also several areas 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).

## **Methods**

Sampling was conducted in accordance with the current Standard Operating Procedures (Drobish, editor 2006) established by a panel of representatives from various State and Federal agencies involved with pallid sturgeon recovery on the Missouri River. Descriptions of these procedures are reported in the appropriate sections.

### **Sampling Site Selection and Habitat Description**

Nebraska Game and Parks Commission was contracted to monitor Segment 8 from Lower Ponca Bend (R.M. 753.0) downstream to the mouth of the Platte River (R.M. 595.0) Eighteen bends were randomly selected to be sampled for the sturgeon season and the fish community season.

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 into three distinct levels. 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 Long-term Pallid Sturgeon and Associated Fish Community Assessment for the Missouri River and Standardized Guidelines for Sampling and Data Collection, (Drobish 2006). 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 when needed to sample a particular location 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.

### ***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", # 9 sapphire twine outer bar mesh), with a cod-end opening of 406.4 mm (16"). Trawl doors are 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" 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.

### ***2.5" Trammel Net***

The 2.5" trammel net had a length of 38.1m (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 # 208 multifilament twine with a bar mesh size of 63.5 mm (2.5"). The outer walls were # 9 multifilament twine with a bar mesh size of 304.8 mm (12.0"). 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.

### ***1.0" Green Dyed Trammel Net***

The non-standard or wild 1.0" green dyed trammel net was constructed of the exact specifications of the standard 1.0" trammel net, except the netting was dyed green. This net was used during the 2006 sampling season to experiment if netting color affected the catch rates in different turbidity levels.

### ***4-mm Otter Trawl***

The non-standard or wild 4-mm otter trawl was constructed of the exact specifications of the standard otter trawl, except the netting was 4-mm anchovy mesh. These nets were used during the 2006 fish community season in an attempt to collect additional information about young-of-the-year *Scaphirhynchus* species.

## **Data Collection and Analysis**

### ***Fish Data Collection***

When a pallid sturgeon was sampled, 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 fish community sampling season, when mini-fyke net samples were preserved in 10% formalin and brought back to the lab for identification. Mini-fyke net samples were identified to species and stored in 70% alcohol.

### ***Associated Environmental Data***

Habitat samples were collected at the site of every pallid sturgeon capture and were randomly 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 (Krentz 2001). Fin clips for DNA analysis were taken from pallid sturgeon and suspected hybrids and sent to William Ardren at the Abernathy Fish Technology Center for validation.

### ***Analyses***

All datasheets were checked and submitted to Yan Hong and staff of the Missouri Department of Conservation. All data was processed and analyzed using Microsoft Access and SAS statistical software (SAS Institute, Version 9.1) and 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 per net-night. Catch per unit effort for otter trawls is reported as number of fish per 100 linear meters trawled. Catch per unit effort for 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 is 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. These data did not follow a normal distribution and were then log<sub>10</sub> transformed. Normality assumptions were still not met. Therefore, to compare mean annual CPUE between years, non-parametric statistical analysis were conducted. PROC GENMOD used a TYPE3 POISSON distribution to test for an overall difference amongst all years. For the model, PROC GENMOD prints 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, PROC GENMOD ESTIMATE statement compared individual years. This determined which years were statistically different by comparing one year's data versus a different year's data. For the model, PROC GENMOD prints a label for 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 using PROC GENMOD to determine if there was a significant linear regression. For the model, PROC GENMOD prints 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 proportionately to where sampling effort was being conducted in each habitat type, a chi-squared analysis was performed using SAS (SAS Institute, Version 9.1).

### ***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 ( $r^2 = 0.9740$ ) for pallid sturgeon throughout its range:

$$\log_{10}W = -6.378 + 3.357 \log_{10}L,$$

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 weight-length regression for shovelnose sturgeon throughout its range to calculate relative weight and was reported as:

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

### ***Relative Stock Densities***

Length frequency indices 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. In order to determine if gears were collecting a different size range of fish between seasons, length frequency distributions for each species were compared with a Kolmogorov-Smirnov test (SAS Institute, Version 9.1).

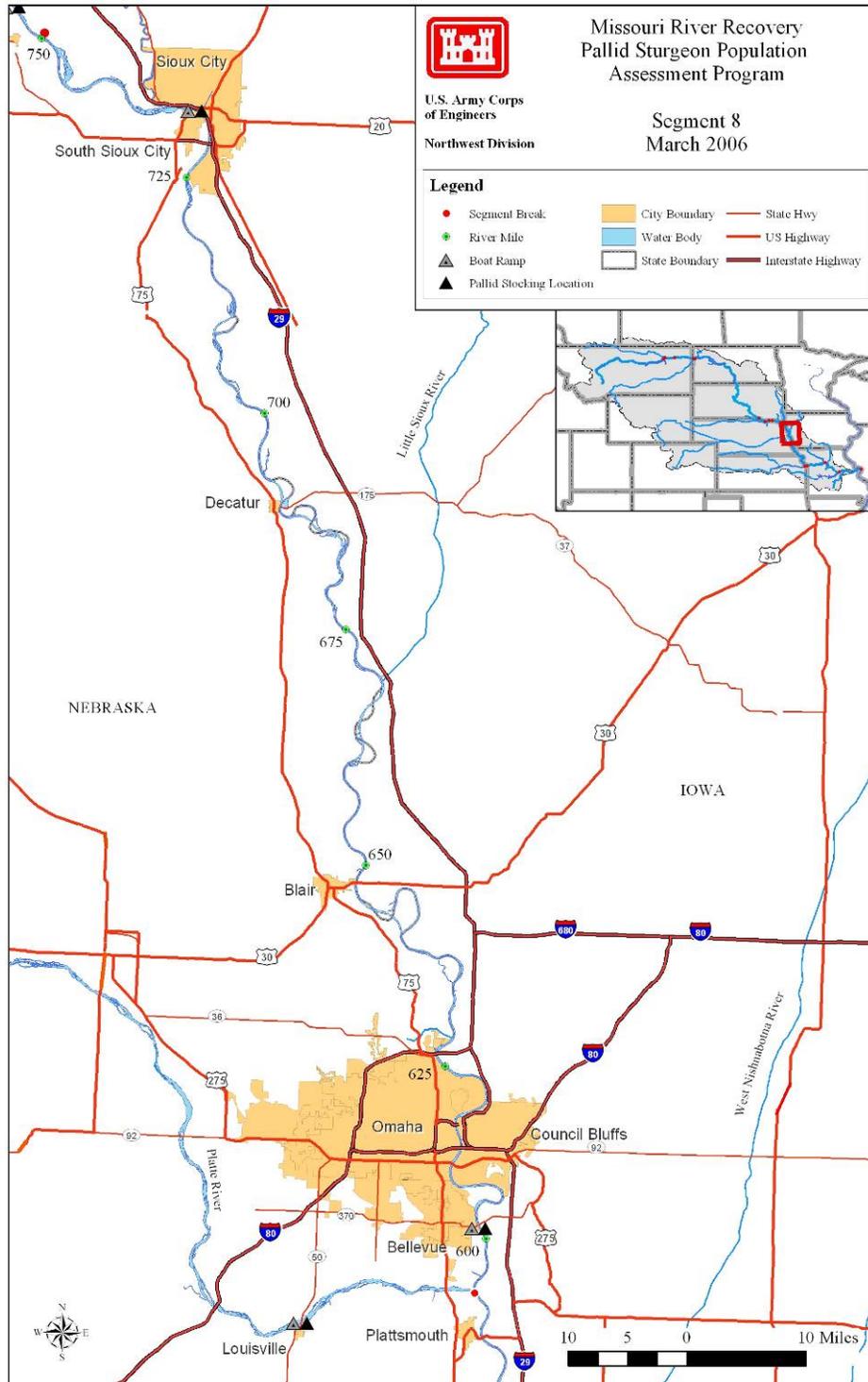


Figure 1a. Map of segment 8 of the Missouri River with major tributaries and common landmarks. Segment 8 encompasses the Missouri River from Lower Ponca Bend (River Mile 753.0) to the Platte River (River Mile 595.0).

## Results

### Effort

Sampling effort in segment 8 is limited to a few macro and mesohabitats due to the simplification of the river by channelization. Sampling was conducted primarily in bar, pool, and channel border mesohabitats within channel cross-over and inside bend macrohabitats. The 100' and 200' standard gill nets were only used to sample fish during the sturgeon season due to temperature restrictions (Appendix C). Gill nets were set on the channel border and pool mesohabitats within the inside bend and channel cross-over macrohabitats. A total of 177 deployments resulted in 278 net nights of effort in the inside bend and 76 net nights of effort in channel cross-overs in segment 8 during 2006 (Tables 1 and 2).

The standard 16' otter trawl was used during both the sturgeon and the fish community season. Otter trawls were used to sample the channel border mesohabitat within the inside bend, channel cross-over, and secondary channel connected (large) macrohabitats. Otter trawls were deployed 435 times in segment 8 during 2006. Effort for the sturgeon season was the equivalent of 154.4 one hundred meter trawl deployments compared to 333 deployments for the fish community season.

The 1.0" trammel nets were used for sampling during both the sturgeon and fish community season. They were used to sample the channel border mesohabitat within the inside bend and channel cross-over macrohabitats. A total of 433 trammel net drifts were conducted in segment 8 during 2006. Effort for the sturgeon season was the equivalent of 210.8 one hundred meter trammel net deployments compared to 190.7 for the fish community season.

Mini-fyke nets were used for sampling during the fish community season. This gear is specific to sampling bar mesohabitats within the inside bend and channel cross-over macrohabitats. A total of 143 deployments resulted in 35 net nights of effort in channel cross-over macrohabitats and 108 net nights of effort in the inside bend macrohabitat.

The 2.5" trammel nets were used for sampling during the sturgeon season only. This gear was developed to increase catch of larger fish, particularly adult pallid sturgeon. Sampling in segment 8 resulted in 121 fish representing 15 different species. Effort for the sturgeon season was the equivalent of 137.1 one hundred meter trammel net deployments.

Table 1. Number of bends sampled, mean effort per bend (total number of deployments), and total effort by macrohabitat for segment 8 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Fall through Spring - Sturgeon Season</b>																
<b>1 Inch Trammel Net</b>	18	11.7 (217)	N-E	50.9		N-E	N-E	159.9				N-E				
<b>2.5 Inch Trammel Net</b>	18	7.2 (152)		28.4				108.7								
<b>Gill Net</b>	18	19.7 (177)		76.0				278.0								
<b>Otter Trawl</b>	18	8.6 (144)		35.5				114.8		4.07						
<b>Summer – Fish Community Season</b>																
<b>1 Inch Trammel Net</b>	18	10.6 (216)	N-E	48.1		N-E	N-E	142.6				N-E				
<b>Mini-Fyke Net</b>	18	7.9 (143)		35.00				108.0								
<b>Otter Trawl</b>	18	18.5 (291)		78.2				255.4								

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat for segment 8 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat				
			BAR	POOL	CHNB	TLWG	ITIP
<b>Fall through Spring – Sturgeon Season</b>							
<b>1 Inch Trammel Net</b>	18	11.7 (217)			210.8	N-E	N-E
<b>2.5 Inch Trammel Net</b>	18	7.2 (152)			137.1		
<b>Gill Net</b>	18	19.7 (177)		174.0	180.0		
<b>Otter Trawl</b>	18	8.6 (144)			154.4		
<b>Summer – Fish Community Season</b>							
<b>1 Inch Trammel Net</b>	18	10.6 (216)			190.7	N-E	N-E
<b>Mini-Fyke Net</b>	18	7.9 (143)	143				
<b>Otter Trawl</b>	18	18.5 (291)			333.5		

## **Pallid Sturgeon**

A total of 17 pallid sturgeon were sampled in segment 8 during the 2006 sampling season. Twelve of the fish were of known hatchery origin and five are awaiting genetic verification and are therefore classified as unknown. The sturgeon season was the most productive for pallid sturgeon captures, with thirteen fish sampled compared to four during the fish community season.

Pallid sturgeon were captured throughout segment 8 ranging from Upper Dakota Bend (R.M. 726.0) downstream to Manawa Bend (R.M. 608.8). Omadi Bend (R.M. 722.0) yielded the most pallid sturgeon with a combined total of 4 captures from both the sturgeon and fish community season. Upper Little Sioux Reach Bend (R.M. 676.7) and Manawa Bend both yielded three pallid sturgeon. No other single bend had more than 2 pallid sturgeon sampled from it in 2006 (Figure 1b).

Most pallid sturgeon (88%, N = 15) were captured from inside bend macrohabitat in 2006 (Table 3). Within the inside bend, almost all pallid sturgeon were sampled from channel border mesohabitats (80%). Mean depth, mean bottom velocity, and mean turbidity of channel border habitats where pallid sturgeon were captured were very similar to the proportion of habitat that was sampled; however, pallid sturgeon were captured in colder temperatures compared to the mean of all temperatures sampled (56.0°C vs. 66.7°C). Capture locations in pool mesohabitats within the inside bend were found in greater mean depths (4.5 m vs. 3.6 m) and mean turbidities (373.0 ntu vs. 154.6 ntu), while mean temperature and bottom velocity at capture locations was less than the proportion of what was sampled (6.9°C vs. 7.8°C and 0.5 m/s vs. 0.8 m/s, respectively). Conversely, pallid sturgeon that were captured in pools within the channel cross-over macrohabitat were found in lower mean depths (1.5 m vs. 2.6 m), greater mean temperatures (10.6°C vs. 8.1°C), and lower mean turbidities (29.5 ntu vs. 106.9 ntu) than where the mean sampling effort took place.

Hatchery reared pallid sturgeon collected in 2006 were representative of five different year classes (1997, 1999, 2001, 2002, and 2004) (Table 6). All fish grew in length since stocking and appeared to be in good health. The mean relative condition factor (Kn) for all year classes of recaptured fish ranged from 0.62 to 0.93. Most hatchery and wild pallid sturgeon collected in 2006 were stock size (<329 mm) or smaller (Shuman et al. 2006).

Three pallids were of quality size and one fish fell into the preferred category. Relative condition factor was lower during the sturgeon season and varied little between length categories (Table 7).

## Segment 8 - Pallid Sturgeon Captures by River Mile

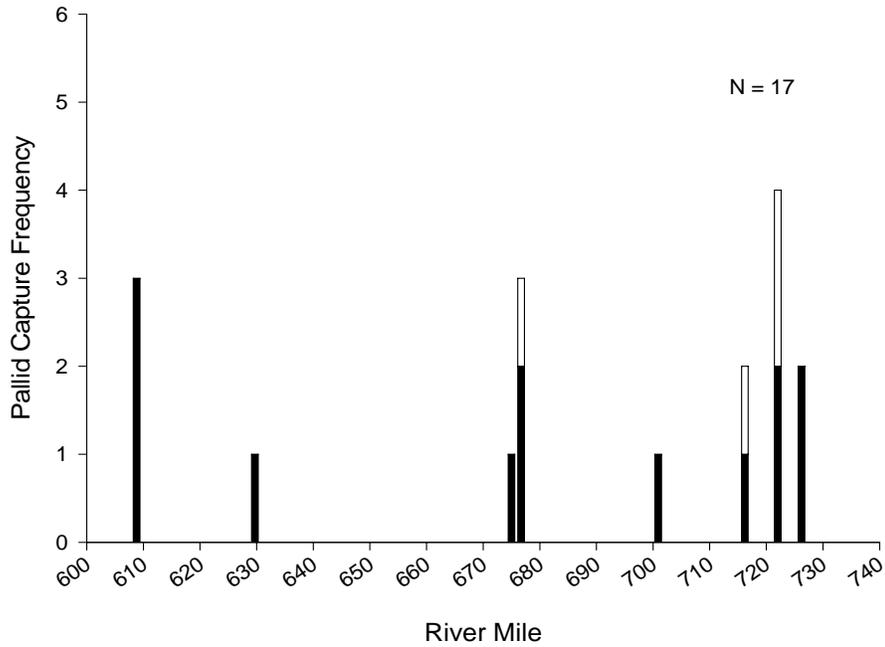


Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 8 in randomly selected bends of the Missouri River during 2006. Black bars represent pallid captures during sturgeon season and white bars during fish community season.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2006. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
ISB	BAR	0.4 (0.2-0.6)		0.07 (0.0-0.3)		22.4 (13.9-29.8)		28.5 (18-52)		
	POOL	3.6 (1.3-9.2)	4.5 (4.2-4.8)	0.5 (0.2-1.0)	0.8 (0.7-1.0)	7.8 (3.1-12.6)	6.9 (6.6-7.0)	154.6 (15-724)	373.0	3
	CHNB	2.6 (1.0-9.7)	2.7 (1.2-4.5)	0.6 (0.0-1.3)	0.6 (0.1-4.5)	19.2 (3.1-30.0)	17.8 (9.1-27.5)	66.7 (3-724)	56.0 (21-332)	12
CHXO	BAR	0.4 (0.3-0.6)		0.04 (0.0-0.2)		22.1 (13.7-29.3)		29.4 (18-52)		
	POOL	2.6 (1.3-6.4)	1.5 (1.4-1.7)	0.5 (0.1-1.2)	0.2 (0.2-0.3)	8.1 (3.4-12.2)	10.6 (9.7-11.4)	106.9 (15-724)	29.5 (27-32)	2
	CHNB	2.6 (1.0-5.4)		0.7 (0.05-1.8)		19.3 (3.4-29.1)		56.2 (15-724)		
SCCL	CHNB	1.25 (1.2-1.3)		0.2		20.3		34.0		

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 2006 from segment 8 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)
1997	1	546	650	1.00	621	618	0.62	0.04	-0.02
1999	1	490	490	1.09	668	1010	0.79	0.14	0.40
2001	1	190			406	204	0.83	0.15	
2002	2	296	84	1.18	443	288	0.86	0.16	0.32
		(26)			(83)	(196)	(0.07)	(0.10)	
2003	0				372	140	0.78		
2004	3	216			323	100	0.93	0.22	
		(57)			(39)	(19)	(0.27)	(0.05)	

Table 7. Incremental relative stock density (RSD)<sup>a</sup> and relative condition factor (Kn) for all pallid sturgeon captured with all gear by a length category during 2006 in the Missouri River. Length categories<sup>b</sup> 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)
<b>Sturgeon Season</b>			
Sub-stock (0-199)			
Sub-stock (200-329)			
Stock (330-629)	13		0.76 (0.07)
Quality (630-839)	4	31	0.81 (0.09)
Preferred (840-1039)	1	8	0.77
Memorable (1040-1269)			
Trophy (>1270)			
Overall Kn			0.77 (0.04)
<b>Fish Community Season</b>			
Sub-stock (0-199)			
Sub-stock (200-329)	2		
Stock (330-629)	2		0.94 (0.07)
Quality (630-839)			
Preferred (840-1039)			
Memorable (1040-1269)			
Trophy (>1270)			
Overall Kn			0.94 (0.06)

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

<sup>b</sup> Length categories based on the percentage of the largest known 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 17 pallid sturgeon were captured in otter trawls (N = 5), gill nets (N = 8), 1.0" trammel nets (N = 3), and 2.5" trammel nets (N = 1) during the 2006 sampling season. Gill nets had the highest overall mean annual CPUE (0.023 fish per net night) (Appendix F1). During the sturgeon season gill nets had the highest CPUE for unknown/wild pallid sturgeon followed by 1.0" trammel nets. No other gear collected unknown/wild pallids for either season (Figures 2 and 3). Conversely, in 2005, gill nets and otter trawls had the highest mean annual CPUE (0.015 fish per net night for gill nets and fish per 100 m trawled for otter trawls) (Barada and Steffensen 2006). In 2006, hatchery reared pallid sturgeon were captured with four standard gears and displayed similar CPUE values, while 1.0" trammel nets failed to capture unknown/wild or hatchery reared pallid sturgeon in 2005. Only hatchery reared pallid sturgeon were collected during the fish community season, and otter trawls were the only gear to collect hatchery reared pallid sturgeon during 2006 (Figure 5, Appendix H).

During 2006, there were no pallid sturgeon less than 200 mm sampled during any season. There were two sub-stock size (200-329 mm) pallid sturgeon captured with otter trawls within the inside bend macrohabitat during the fish community season (Table 11). These sub-stock pallid sturgeon were captured in the channel border mesohabitat; however, this is the only mesohabitat that otter trawls were deployed in (Table 12). Nine stock sized (330-629 mm) pallid sturgeon were captured during the sturgeon season. All but one of these fish (89%) were captured within the inside bend macrohabitat, which is where approximately 75% of all sampling took place (Table 13). Gill nets were the only gear that collected pallid sturgeon outside of a channel border mesohabitat (Table 14). Two stock sized pallid sturgeon were sampled during the fish community season; both fish were on the channel border mesohabitat within the inside bend macrohabitat. Four quality-sized (630-839 mm) pallid sturgeon were sampled during the sturgeon season while none were sampled during fish community season. All four fish were sampled with gill nets on the inside bend and channel cross-over macrohabitats (Table 15). Within these macrohabitats, two of the fish were caught in channel borders and two were caught in pool habitats (Table 16).

A length-frequency distribution was generated for pallid sturgeon captured from segment 8 during 2006. Pallid sturgeon fork length ranged from 267 to 857 mm. On

average, the sturgeon season caught a significantly larger size distribution of pallid sturgeon compared to the fish community season ( $D = 1.00$ ,  $p = 0.006$ ). Larger pallids were collected during the sturgeon season and ranged from 355 to 857 mm, while pallid sturgeon that were caught during the fish community season ranged from 267 to 437 mm (Figure 8). Hatchery reared pallid sturgeon were sampled more frequently than unknown/wild pallid sturgeon, which was similar to 2005 (Figure 9). In general, unknown/wild pallid sturgeon were larger than hatchery reared pallid sturgeon.

## Segment 8 - Pallid Sturgeon / Sturgeon Season

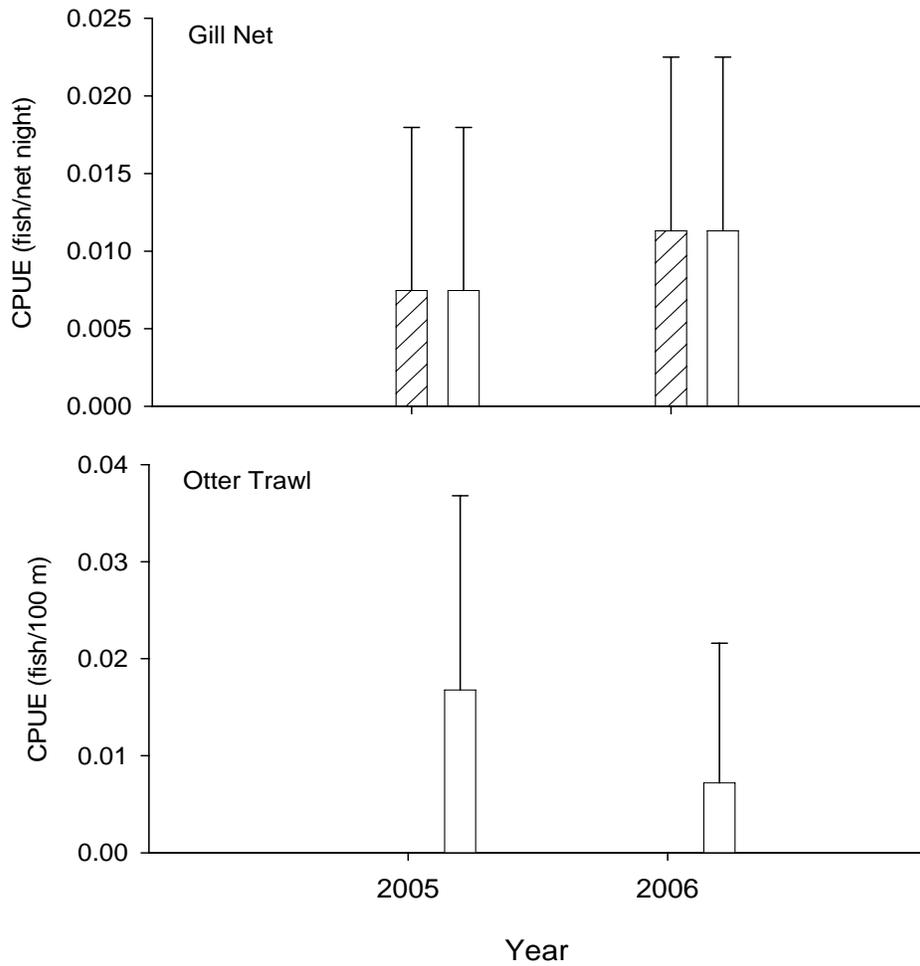


Figure 2. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars), unknown (cross-hatched) and hatchery reared (white bars) pallid sturgeon using gill nets and otter trawls in segment 8 of the Missouri River during sturgeon season 2005-2006.

### Segment 8 - Pallid Sturgeon / Sturgeon Season

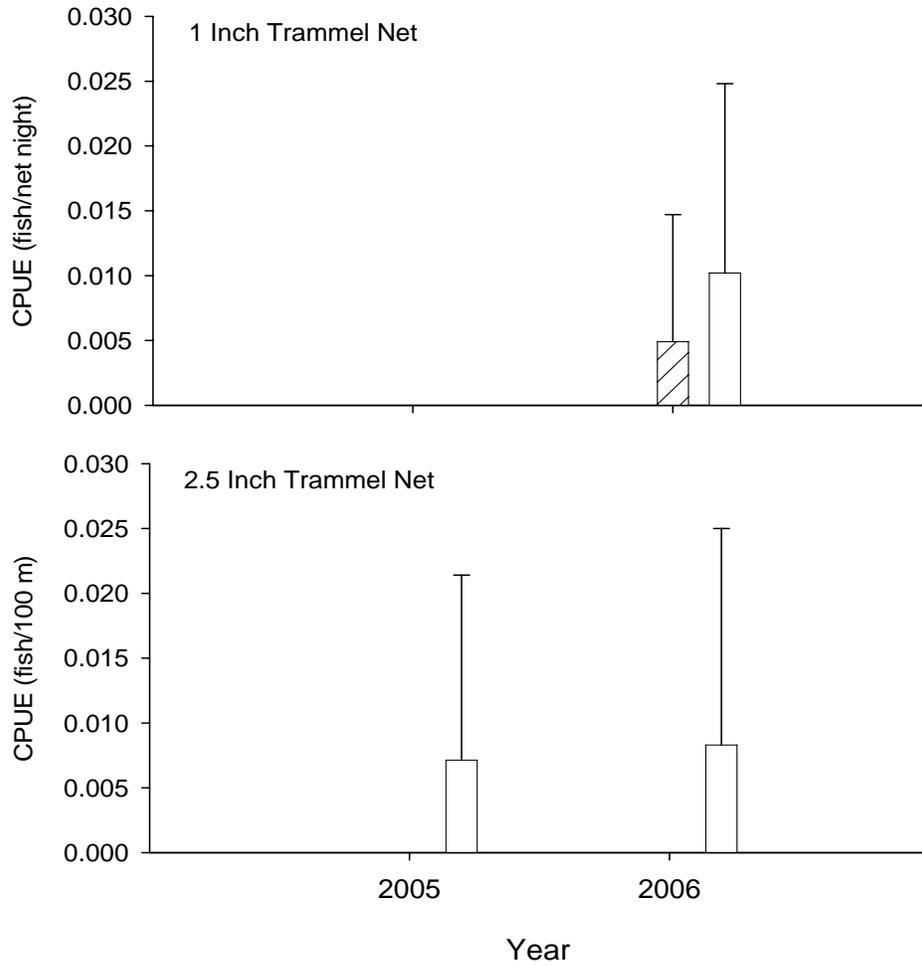


Figure 3. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars), unknown (cross-hatched) and hatchery reared (white bars), pallid sturgeon using 1.0 and 2.5 inch trammel nets in segment 8 of the Missouri River during sturgeon season 2005-2006.

## Segment 8 - Pallid Sturgeon / Fish Community Season

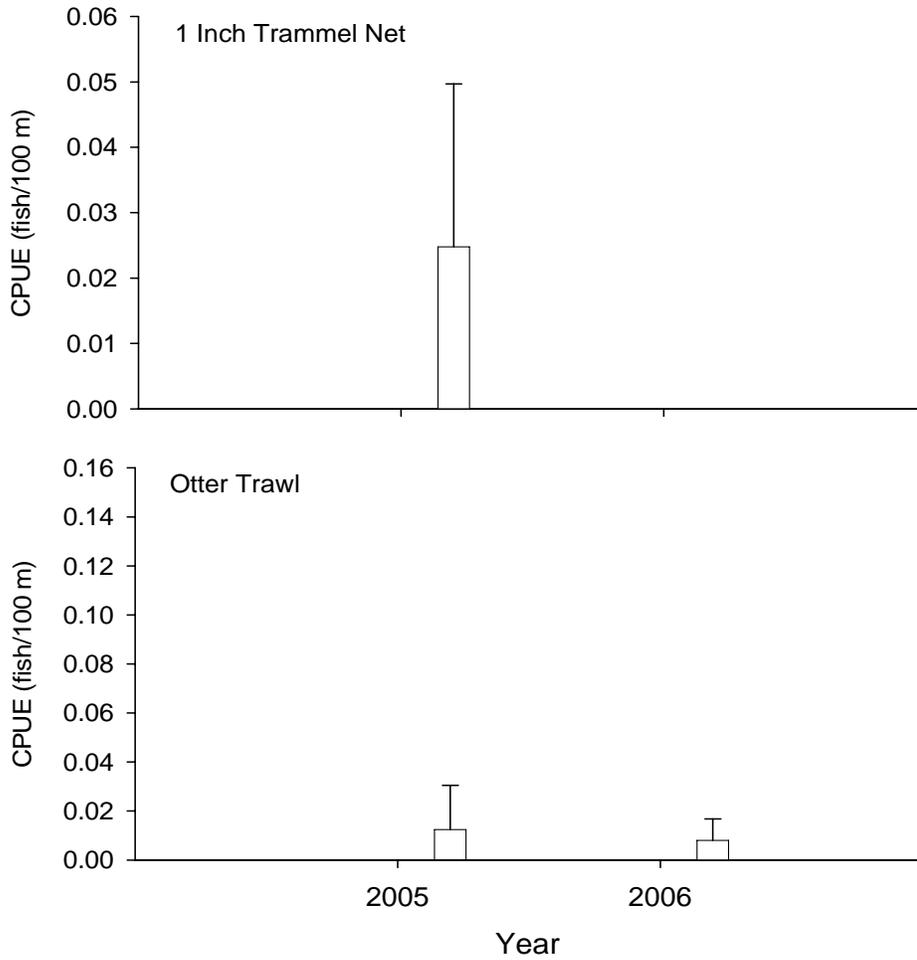


Figure 5. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars), unknown (cross-hatched) and hatchery reared (white bars) pallid sturgeon using 1.0 inch trammel nets and otter trawls in segment 8 of the Missouri River during fish community season 2005-2006.

Table 11. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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. 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
<b>Sturgeon Season (Fall through Spring)</b>															
1.0 Inch Trammel Net	0	N-E	24		N-E	N-E	76			N-E	N-E				
2.5 Inch Trammel Net	0		20				80								
Gill Net	0		22				78								
Otter Trawl	0		23				75		2						
<b>Fish Community Season (Summer)</b>															
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E				
Mini-Fyke Net	0		24				76								
Otter Trawl	2		23				100 77								

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	0		100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	0		51		49	
Otter Trawl	0		100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	2		100 100			

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 8 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. 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	
<b>Sturgeon Season (Fall through Spring)</b>																
1.0 Inch Trammel Net	3	N-E	24		N-E	N-E	100			N-E	N-E					
2.5 Inch Trammel Net	1		20				80									
Gill Net	4		25				75									
22			78													
Otter Trawl	1		23			100			2							
75																
<b>Fish Community Season (Summer)</b>																
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E					
Mini-Fyke Net	0		24				76									
Otter Trawl	1		23				100									
77																

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 8 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. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	3		100 100	N-E		
2.5 Inch Trammel Net	1		100 100			
Gill Net	4		25 51		75 49	
Otter Trawl	1		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	2		100 100			

Table 15. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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. 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
<b>Sturgeon Season (Fall through Spring)</b>															
1.0 Inch Trammel Net	0	N-E	24		N-E	N-E	76			N-E	N-E				
2.5 Inch Trammel Net	0		20				80								
Gill Net	4		25				75								
			22				78								
Otter Trawl	0	23		75		2									
<b>Fish Community Season (Summer)</b>															
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E				
Mini-Fyke Net	0		24				76								
Otter Trawl	0		23				77								

Table 16. Total number of quality size and greater ( $\geq 630$  mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	0		100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	4		50 51		50 49	
Otter Trawl	0		100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	0		100			

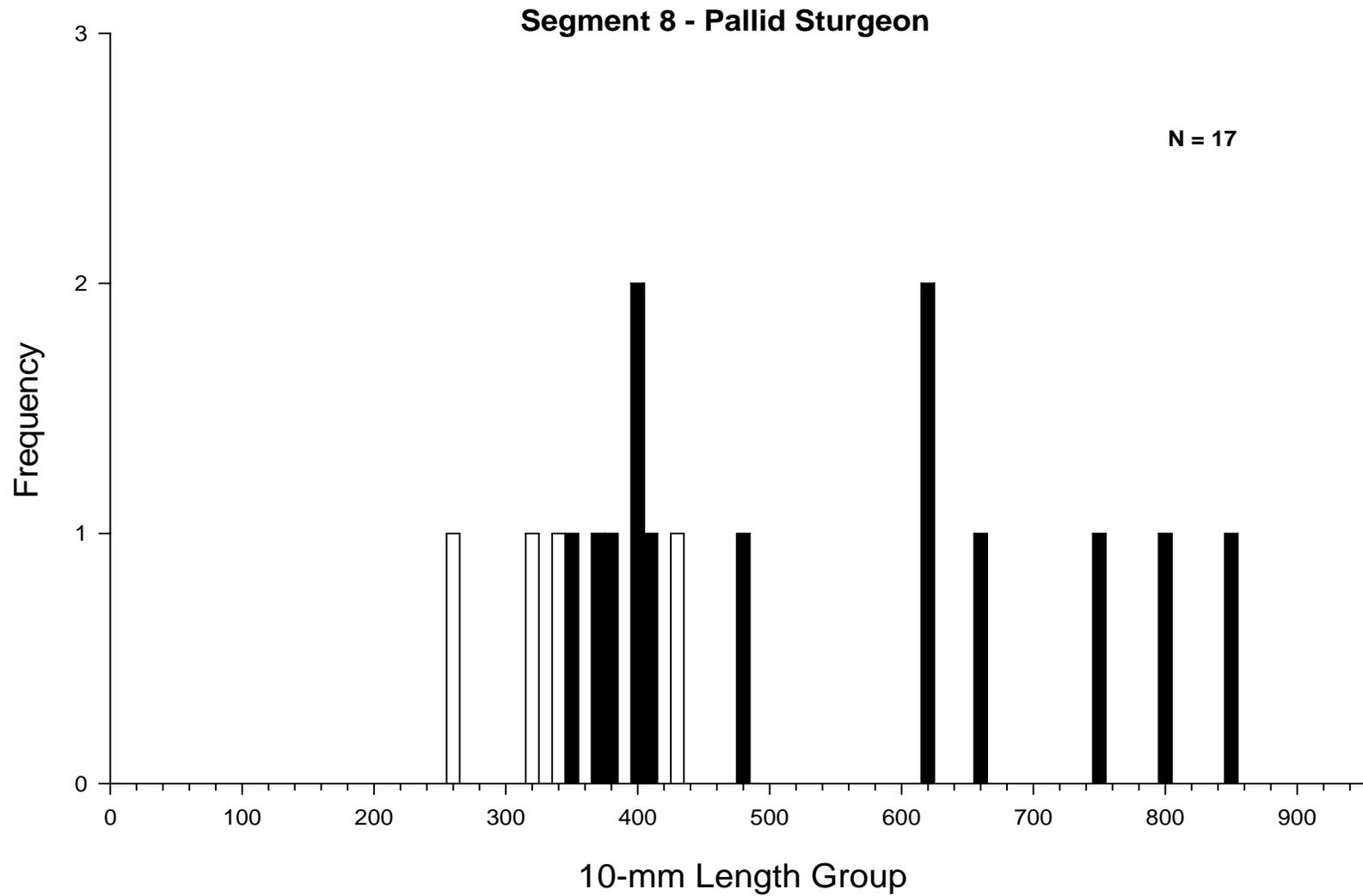


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2006 including non-random and wild samples.

## Segment 8 - Annual Pallid Sturgeon Capture History

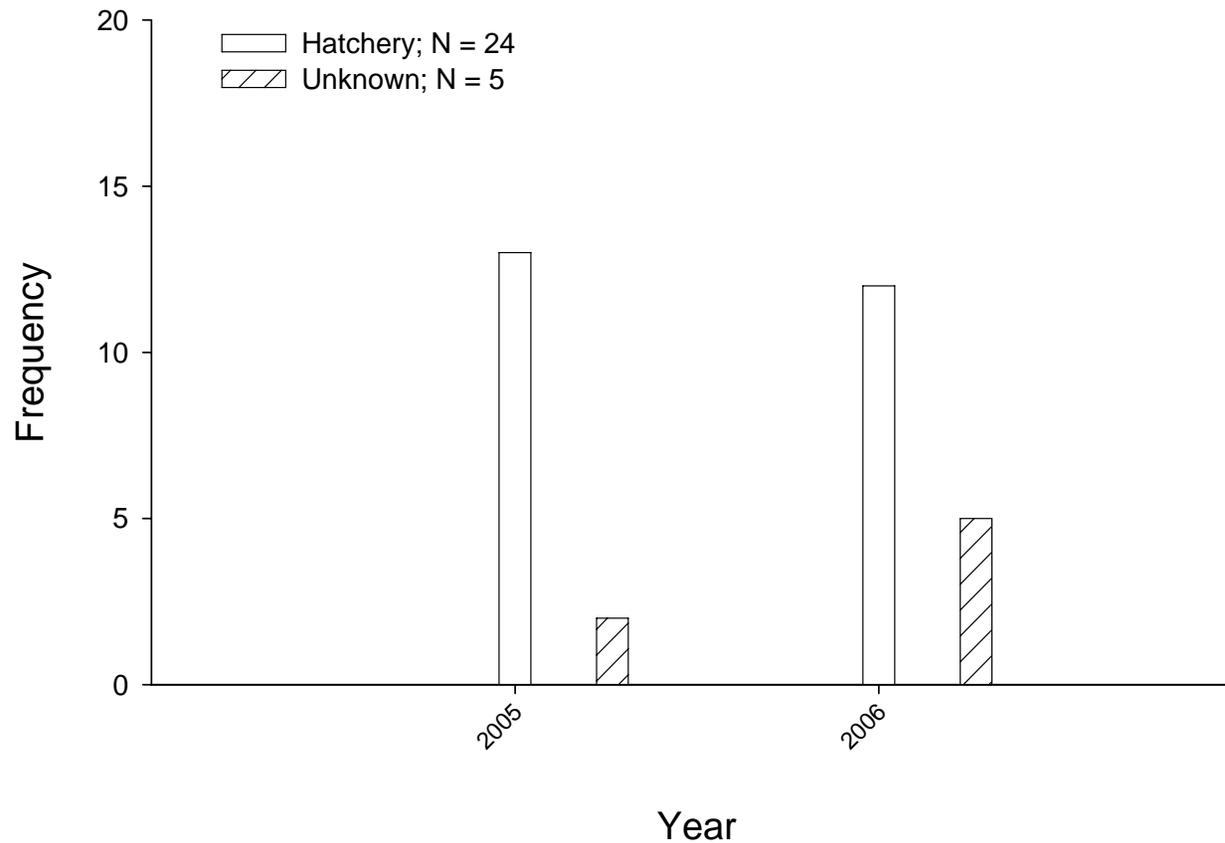


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown (cross-hatched) pallid sturgeon collected in segment 8 of the Missouri River from 2005 to 2006. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

## Targeted Native River Species

### Shovelnose Sturgeon

A total of 1,514 shovelnose sturgeon were captured in gill nets (N = 888), 1.0" trammel nets (N = 306), 2.5" trammel nets (N = 42), and otter trawls (N = 278) in segment 8 during 2006. Overall CPUE was greatest in gill nets (2.51 fish per net night) followed by 1.0" trammel nets (0.77 fish per 100 m drifted) (Appendix F1 and F2).

Gill nets were the most effective gear during the sturgeon season (CPUE = 2.51 fish per net night) (Figures 11 and 12), which was similar to 2005 (Barada and Steffensen 2006). One inch trammel nets and otter trawls had the highest CPUE during the fish community season in 2006 (0.7 and 0.61 fish per 100 m sampled), while 1.0" trammel nets had the highest catch rates for collecting shovelnose sturgeon in 2005 (2.27 fish per 100 m drift) (Figure 14, Appendix H). No standard gears were very effective at sampling sub-stock (0–149 mm and 150–249 mm) and stock size (250–379 mm) shovelnose sturgeon for any season or year; however, all gears except gill nets had a significantly higher mean CPUE for sub-stock (150–249 mm) compared to 2005 ( $\chi^2 = 24.44 - 50.43$ ,  $df = 1$ ,  $p < 0.0001$ ). For stock size fish, both gill nets and 1.0" trammel nets had a significantly higher mean CPUE compared to 2005 ( $\chi^2 = 5.11$  and  $7.85$ ,  $df = 1$ ,  $p = 0.0237$  and  $0.0051$ , respectively), while otter trawls did not differ ( $\chi^2 = 2.03$ ,  $df = 1$ ,  $p = 0.1543$ ). In 2006, gill nets had the highest CPUE (2.50 fish per net night) for quality and above (>380 mm) size shovelnose sturgeon during the sturgeon season followed by 1.0" trammel nets (0.81 fish per 100 m drifted). Conversely, gill nets were the only gear that did not significantly increase in mean CPUE for quality and above size shovelnose sturgeon compared to 2005 ( $\chi^2 = 0.90$ ,  $df = 1$ ,  $p = 0.3417$ ).

Catch rates for both sub-stock size ranges of shovelnose sturgeon during the fish community season remained very low (Tables 17 and 18). Otter trawls and trammel nets both captured sub-stock (150–249 mm) shovelnose sturgeon in 2006, but in very low numbers (CPUE = 0.003 and 0.0045, respectively) (Figure 14). No smaller substock (< 150 mm) shovelnose sturgeon were captured in 2006 by any gear during the fish community season. Similar to 2005, 1.0" trammel nets captured stock size (250–379 mm) shovelnose sturgeon more effectively than otter trawls during the fish community season (0.04 vs. 0.02 fish per 100 m drifted). Quality and above size shovelnose were sampled productively with 1.0" trammel nets and otter trawls (0.65 and 0.59 fish per 100 m drifted, respectively) during the fish community season; however, 1.0"

trammel nets caught many more quality and above size shovelnose sturgeon in 2005 ( $\chi^2 = 32.43$ ,  $df = 1$ ,  $p < 0.0001$ ). No shovelnose sturgeon were captured with mini-fyke nets in segment 8 during 2005 or 2006.

### Segment 8 - Shovelnose Sturgeon / Sturgeon Season

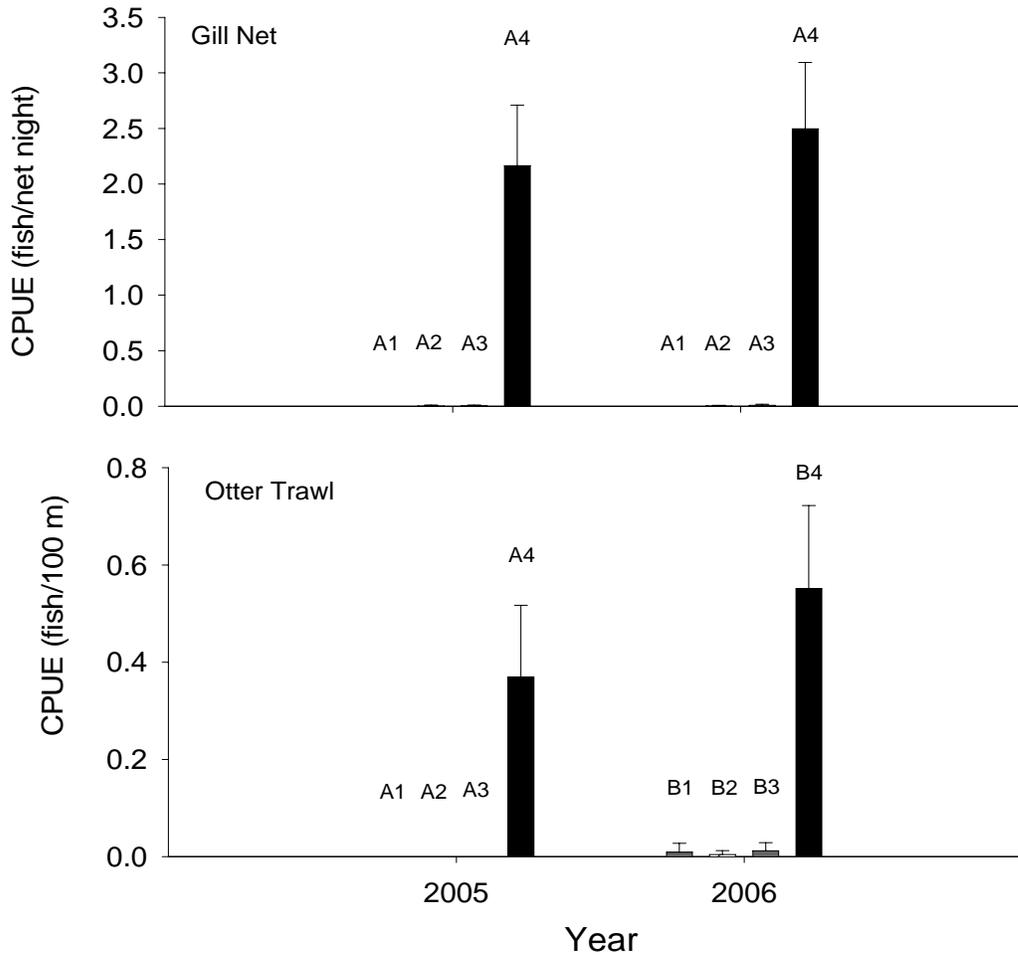


Figure 11. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 8 of the Missouri River during sturgeon season 2005 - 2006. Letters denote significant differences between years for each size class of shovelnose sturgeon.

## Segment 8 - Shovelnose Sturgeon / Sturgeon Season

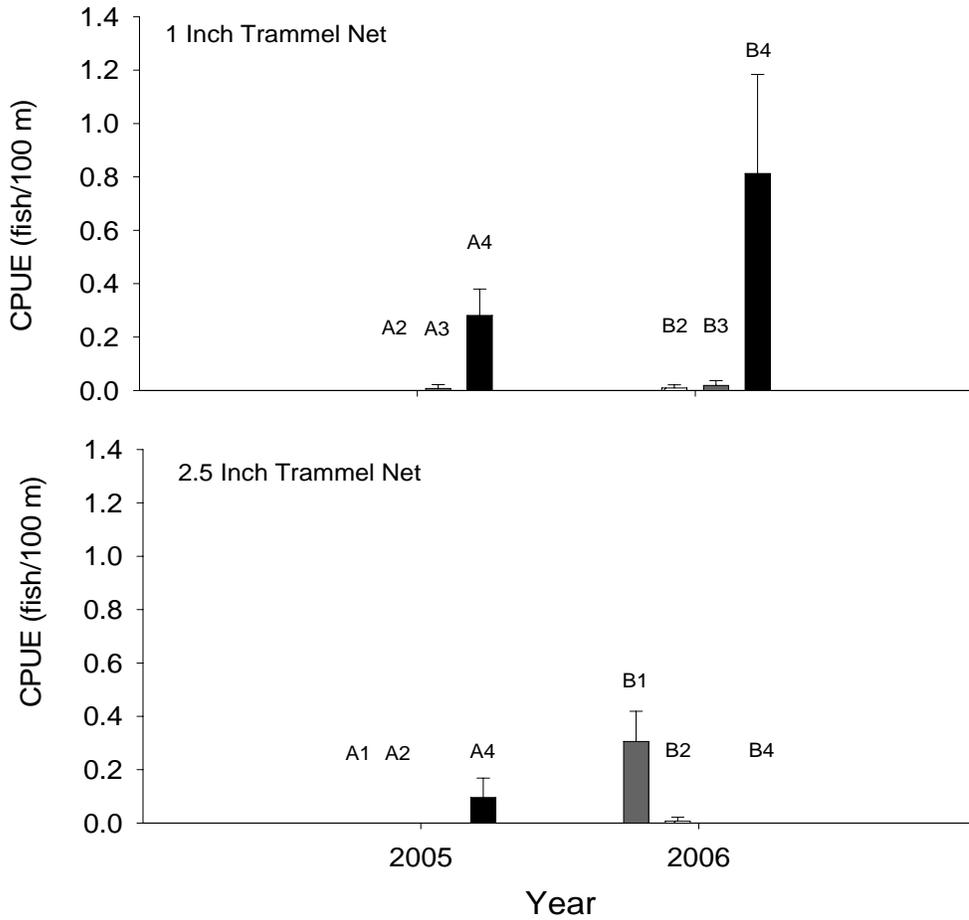


Figure 12. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 and 2.5 inch trammel nets in segment 8 of the Missouri River during sturgeon season 2005 - 2006. Letters denote significant differences between years for each size class of shovelnose sturgeon.

## Segment 8 - Shovelnose Sturgeon / Fish Community Season

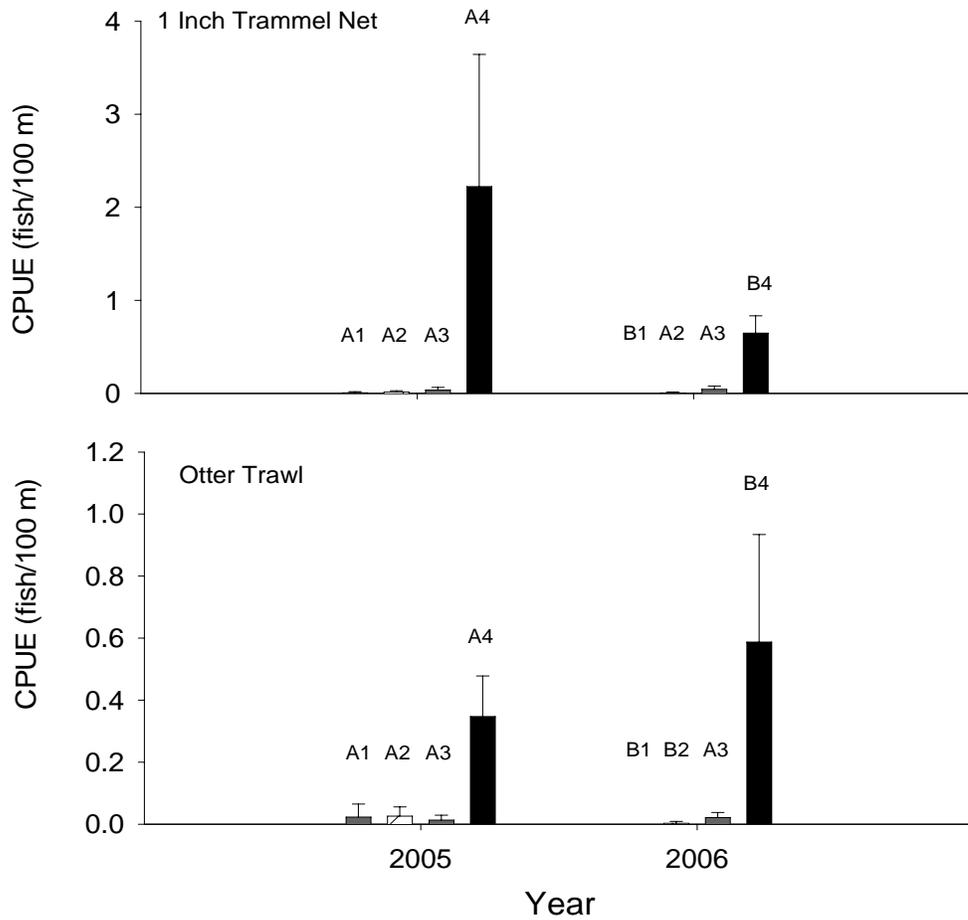


Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 8 of the Missouri River during fish community season 2005 - 2006. Letters denote significant differences between years for each size class of shovelnose sturgeon.

## *Habitat Use*

Very few sub-stock (0–149 mm and 150–249 mm; N = 9) and stock size (250–379 mm; N = 25) shovelnose sturgeon were captured compared to quality and above size (>380 mm; N = 1,489) fish in 2006. There was one shovelnose sturgeon caught that was in the 0–149 mm category and was sampled in the channel border mesohabitat within the channel cross-over macrohabitat (Tables 17 and 18). All sub-stock (150–249 mm) and stock-sized fish were caught in channel borders and pools within the inside bend macrohabitats during both the sturgeon and fish community season (Tables 19 and 22). There were many quality size and greater ( $\geq 380$  mm) fish sampled during the sturgeon season (N = 1,178). Most of these fish were sampled with gill nets on the inside bend and channel cross-over macrohabitats. During the sturgeon and fish community season, 1.0” trammel nets were the only gear to catch quality size and greater fish in a different proportion to what was sampled ( $\chi^2 = 12.706$  and  $12.054$ ,  $df = 1$ ,  $p = 0.0004$  and  $0.0005$ , respectively) (Table 23). Gill nets were the only gear to sample more than one mesohabitat. Although the amount of sampling effort was split between channel border and pool habitats, more (80 %) fish were caught in pools ( $\chi^2 = 18.143$ ,  $df = 1$ ,  $p < 0.0001$ ) (Table 24).

A total of 1,646 shovelnose sturgeon were measured in 2006 (Figure 17). The length range for shovelnose sturgeon was 127 to 811 mm for the sturgeon season, while the length range during the fish community season was 158 to 695 mm. The length-frequency distribution generated in Figure 17 is uni-modal with the highest percentage of fish occurring between the 500 to 600 mm length groups. There was a significant difference in the length frequency distribution between seasons with a larger size distribution of shovelnose sturgeon captured during the fish community season ( $D = 0.388$ ,  $p = 0.002$ ).

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 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1.0 Inch Trammel Net	0	N-E	24		N-E	N-E	76			N-E	N-E				
2.5 Inch Trammel Net	0		20				80								
Gill Net	0		22				78								
Otter Trawl	1		100 23				75		2						
<b>Fish Community Season (Summer)</b>															
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E				
Mini-Fyke Net	0		24				76								
Otter Trawl	0		23				77								

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 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	0		100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	0		51		49	
Otter Trawl	1		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	0		100			

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat																	
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD				
<b>Sturgeon Season (Fall through Spring)</b>																			
1.0 Inch Trammel Net	3	N-E	24		N-E	N-E	100			N-E	N-E								
2.5 Inch Trammel Net	1		20				100												
Gill Net	1		22				100												
Otter Trawl	1		23				100					2							
<b>Fish Community Season (Summer)</b>																			
1.0 Inch Trammel Net	1	N-E	25		N-E	N-E	100			N-E	N-E								
Mini-Fyke Net	0		24				76												
Otter Trawl	1		23				100					77							

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 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	3		100 100	N-E		
2.5 Inch Trammel Net	1		100 100			
Gill Net	1		51		100 49	
Otter Trawl	1		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	1		100 100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	1		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 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1.0 Inch Trammel Net	5	N-E	24		N-E	N-E	100			N-E	N-E				
2.5 Inch Trammel Net	0		20				80								
Gill Net	3		67				33								
22			78												
Otter Trawl	2	23				100		2							
75															
<b>Fish Community Season (Summer)</b>															
1.0 Inch Trammel Net	8	N-E	38		N-E	N-E	63			N-E	N-E				
			25				75								
Mini-Fyke Net	0		24				76								
Otter Trawl	7	23				100									
77															

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 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	5		100 100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	3		33 51		67 49	
Otter Trawl	2		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	8		100 100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	7		100 100			

Table 23. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat																		
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD					
<b>Sturgeon Season (Fall through Spring)</b>																				
1.0 Inch Trammel Net	168	N-E	6		N-E	N-E	94			N-E	N-E									
			24																	
2.5 Inch Trammel Net	41		29						71											
			20						80											
Gill Net	884		25				75													
			22				78													
Otter Trawl	85		29				71													
			23				75		2											
<b>Fish Community Season (Summer)</b>																				
1.0 Inch Trammel Net	121	N-E	7		N-E	N-E	93			N-E	N-E									
			25						75											
Mini-Fyke Net	0		24						76											
Otter Trawl	181		33				67													
			23				77													

Table 24. Total number of quality size and greater ( $\geq 380$  mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	168		100 100	N-E		
2.5 Inch Trammel Net	41		100 100			
Gill Net	884		22 51		78 49	
Otter Trawl	85		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	121		100 100	N-E		
Mini-Fyke Net	0	100				
Otter Trawl	181		100 100			

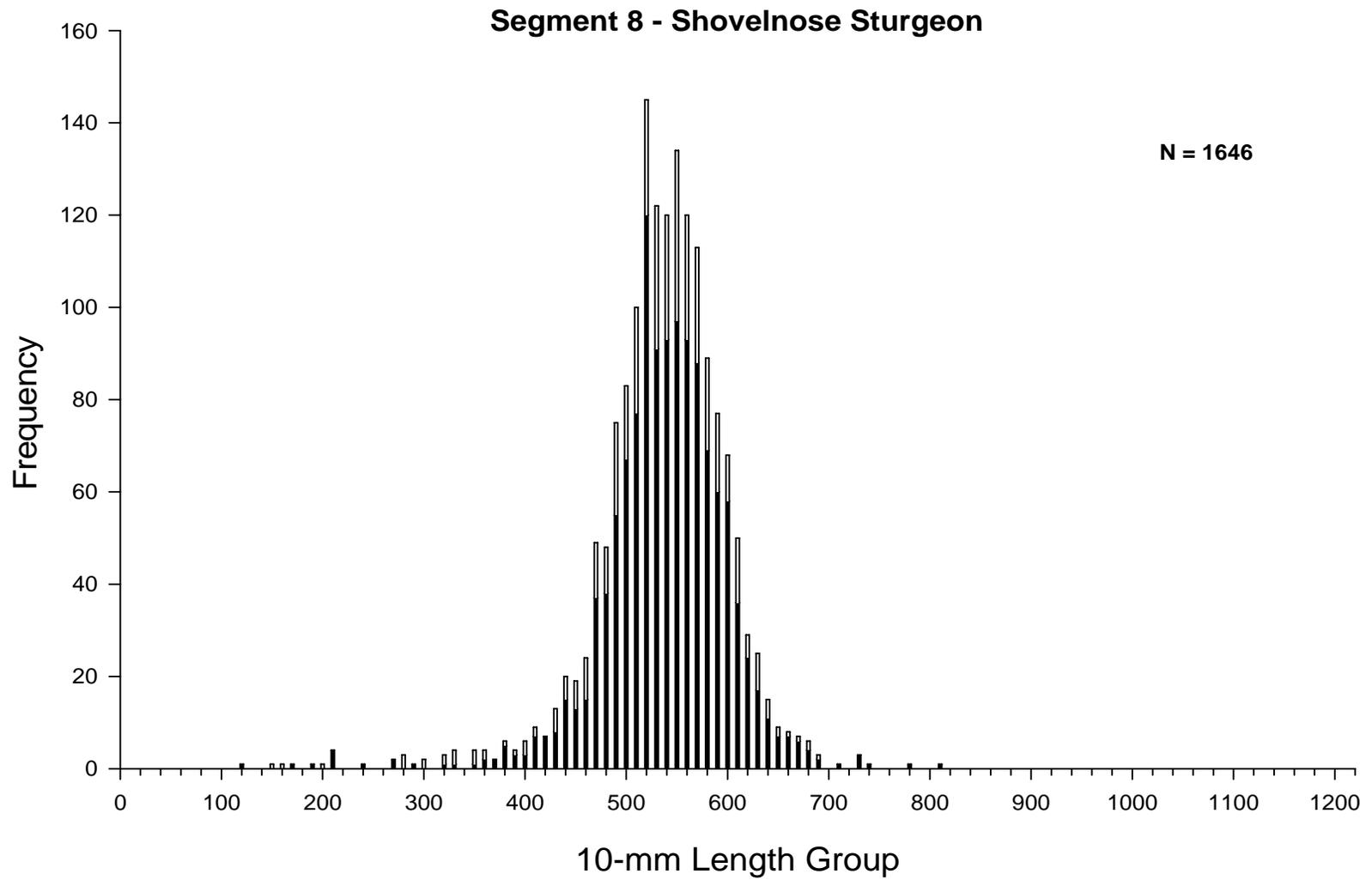


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2006.

Table 25. Incremental relative stock density (RSD)<sup>a</sup> and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 8 of the Missouri River captured during 2006. Length categories<sup>b</sup> determined using methods proposed by Quist (1998).

<b>Length category</b>	<b>N</b>	<b>RSD</b>	<b>Wr (+/- 2SE)</b>
<b>Sturgeon Season</b>			
Sub-stock (0-149 mm)	1		
Sub-stock (150-249 mm)	7		
Stock (250-379 mm)	1250		84 (8)
Quality (380-509 mm)	1240	99	88 (1)
Preferred (510-639 mm)	967	77	85 (1)
Memorable (640-809 mm)	44	4	81 (4)
Trophy (>810 mm)	1	< 1	
Overall Wr			
<b>Fish Community Season</b>			
Sub-stock (0-149 mm)	0		
Sub-stock (150-249 mm)	3		
Stock (250-379 mm)	388		81 (9)
Quality (380-509 mm)	371	96	88 (3)
Preferred (510-639 mm)	281	72	81 (1)
Memorable (640-809 mm)	12	3	78 (8)
Trophy (>810 mm)	0		
Overall Wr			

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

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

## **Sturgeon Chub**

A total of five sturgeon chubs were captured with standard gears during the 2006 sampling season. An additional three fish were caught with the experimental otter trawl (OTO1 - 4 mm bar-mesh). Of the five sturgeon chubs captured in the standard otter trawl, three were sampled during the sturgeon season and two fish during the fish community season. The remaining three fish that were sampled in the experimental gear were collected in the fish community season. No other gear used in either season captured any sturgeon chubs. Catch per unit effort for otter trawls was 0.019 fish per 100 m trawled during the sturgeon season and 0.006 fish per 100 m trawled during the fish community season (Appendix H). The average length of the sturgeon chubs sampled was 77.2 mm with a length range of 62 to 94 mm. Due to the low number of fish sampled habitat associations were not made.

## **Sicklefin Chub**

A total of six sicklefin chubs were captured with standard otter trawls during the 2006 sampling season. An additional two fish were sampled with the experimental otter trawl (OTO1 - 4 mm bar-mesh). Of the six fish captured with otter trawls, all but one fish was sampled during the fish community season. No other gear used in either season was very productive in capturing sicklefin chubs. Catch per unit effort for otter trawls during the fish community season was 0.015 fish per 100 m trawled (Appendix H). The average length of the sicklefin chubs sampled with otter trawls was 97.0 mm with a length range of 100 to 152 mm. Due to the low number of fish sampled habitat associations were not made.

## Speckled Chub

A total of 105 speckled chubs were captured in standard otter trawls (N = 102) and mini-fyke nets (N = 3) during the 2006 sampling season. An additional 145 fish were sampled with an experimental otter trawl (OTO1 - 4 mm bar-mesh) and were not included in this analysis. Catch per unit effort for standard otter trawls during the sturgeon season was 0.34 fish per 100 m trawled (Figure 26). This was a significant increase in mean CPUE compared to 2005 efforts ( $\chi^2 = 7.90$ ,  $df = 1$ ,  $p = 0.005$ ). During the fish community season, otter trawls again had the highest CPUE (0.16 fish per 100 m trawled) followed by mini-fyke nets (0.02 fish per net night) (Figures 27 and 28). Catch per unit effort for speckled chubs collected in otter trawls from 2006 was significantly higher than values in 2005 ( $\chi^2 = 4.10$ ,  $df = 1$ ,  $p = 0.043$ ).

All speckled chubs collected during the sturgeon season were sampled from the channel border mesohabitat within the inside bend or channel cross-over macrohabitats (Table 31). These catches were relatively proportionate to sampling effort in each habitat ( $\chi^2 = 2.216$ ,  $df = 1$ ,  $p = 0.1365$ ). Speckled chubs were collected from the same habitats during the fish community season; however, fish that were collected in otter trawls (N = 50) were captured in greater proportion in channel cross-overs and a lower proportion in inside bends to where the mean sampling effort took place ( $\chi^2 = 4.191$ ,  $df = 1$ ,  $p = 0.0407$ ) (Table 30).

A total of 250 speckled chubs were measured during 2006, with the majority of fish being sampled in the fish community season (N = 199) (Figure 29). The average length was 55.7 mm during the sturgeon season and 50.8 mm during the fish community season. The length range for sturgeon chubs sampled during the sturgeon season was 40 to 76 mm and 27 to 82 mm during the fish community season.

## Segment 8 - Speckled Chub / Sturgeon Season

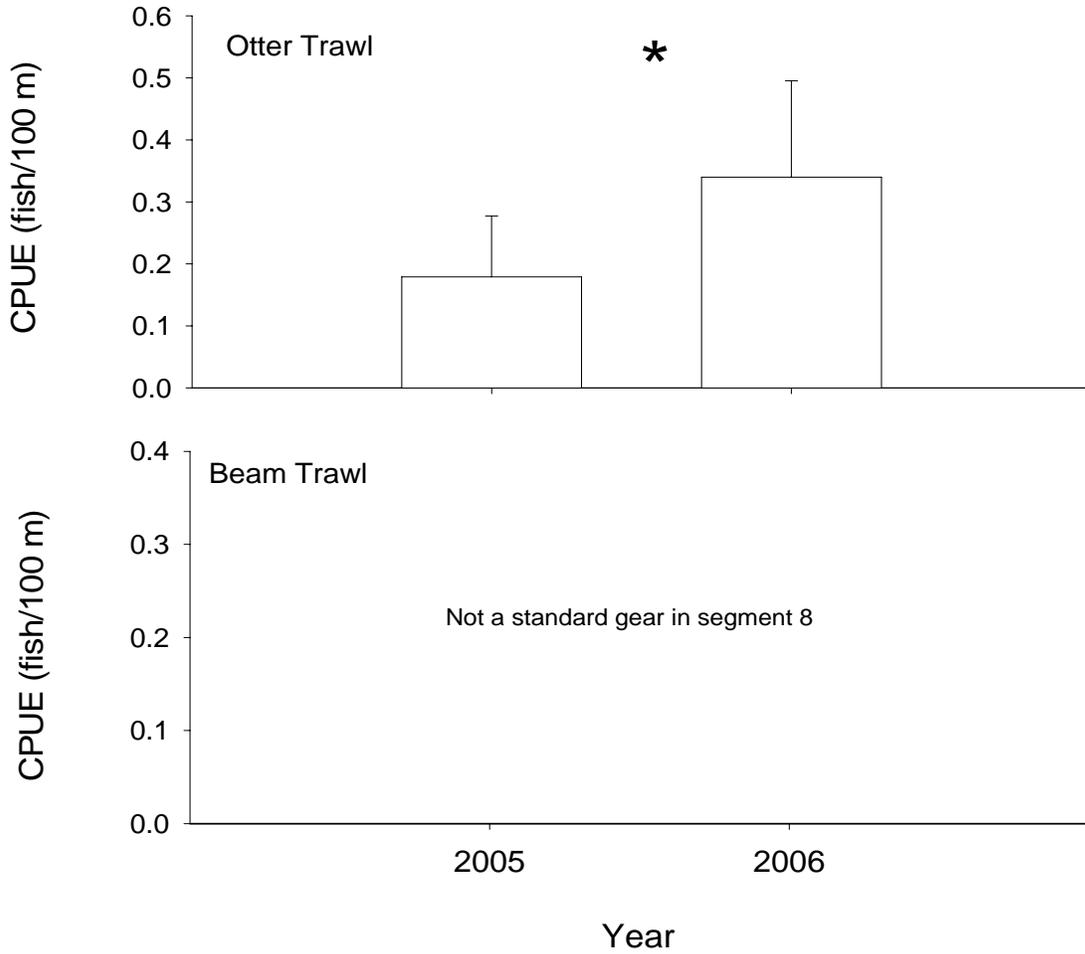


Figure 26. Mean annual catch-per-unit-effort ( $\pm$  2SE) of speckled chub using otter trawls and beam trawls in segment 8 of the Missouri River during sturgeon season 2005 -2006. An asterisk denotes a significant difference between years.

## Segment 8 - Speckled Chub / Fish Community Season

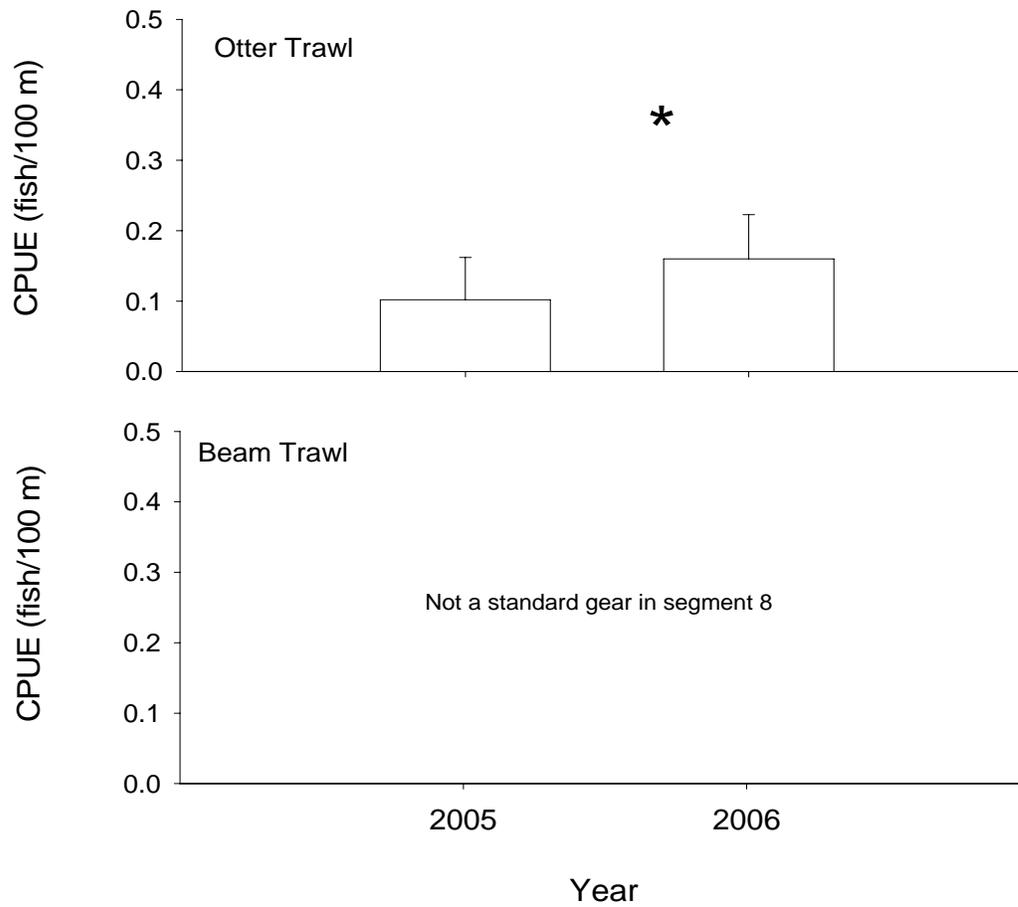


Figure 27. Mean annual catch-per-unit-effort ( $\pm$  2SE) of speckled chub in segment 8 of the Missouri River during fish community season 2005 -2006. An asterisk denotes a significant difference between years.

## Segment 8 - Speckled Chub / Fish Community Season

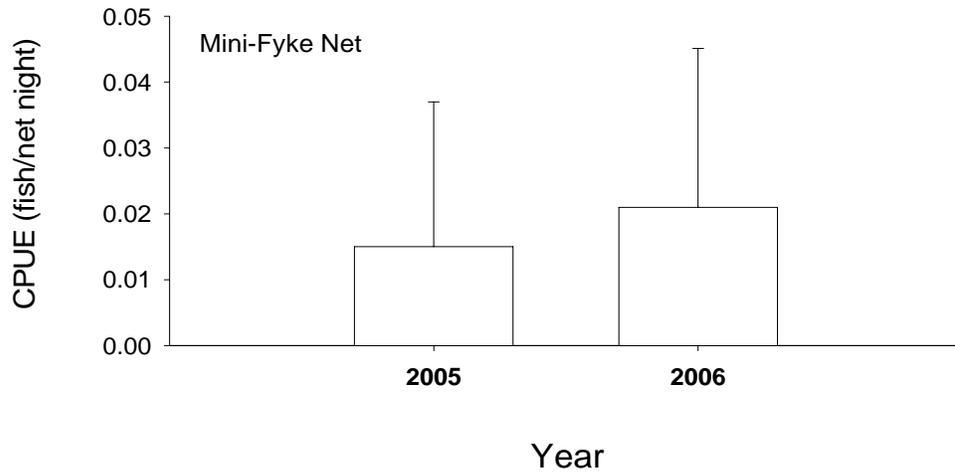


Figure 28. Mean annual catch-per-unit-effort ( $\pm$  2SE) of speckled chub using mini-fyke nets in segment 8 of the Missouri River during fish community season 2005 -2006. An asterisk denotes a significant difference between years.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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
<b>Sturgeon Season (Fall through Spring)</b>															
1.0 Inch Trammel Net	0	N-E	24		N-E	N-E	76			N-E	N-E				
2.5 Inch Trammel Net	0		20				80								
Gill Net	0		22				78								
Otter Trawl	51		33 23				67 75		2						
<b>Fish Community Season (Summer)</b>															
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E				
Mini-Fyke Net	3		33 24				67 76								
Otter Trawl	50		12 23				88 77								

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	0		100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	0		51		49	
Otter Trawl	51		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	3	100 100				
Otter Trawl	50		100 100			

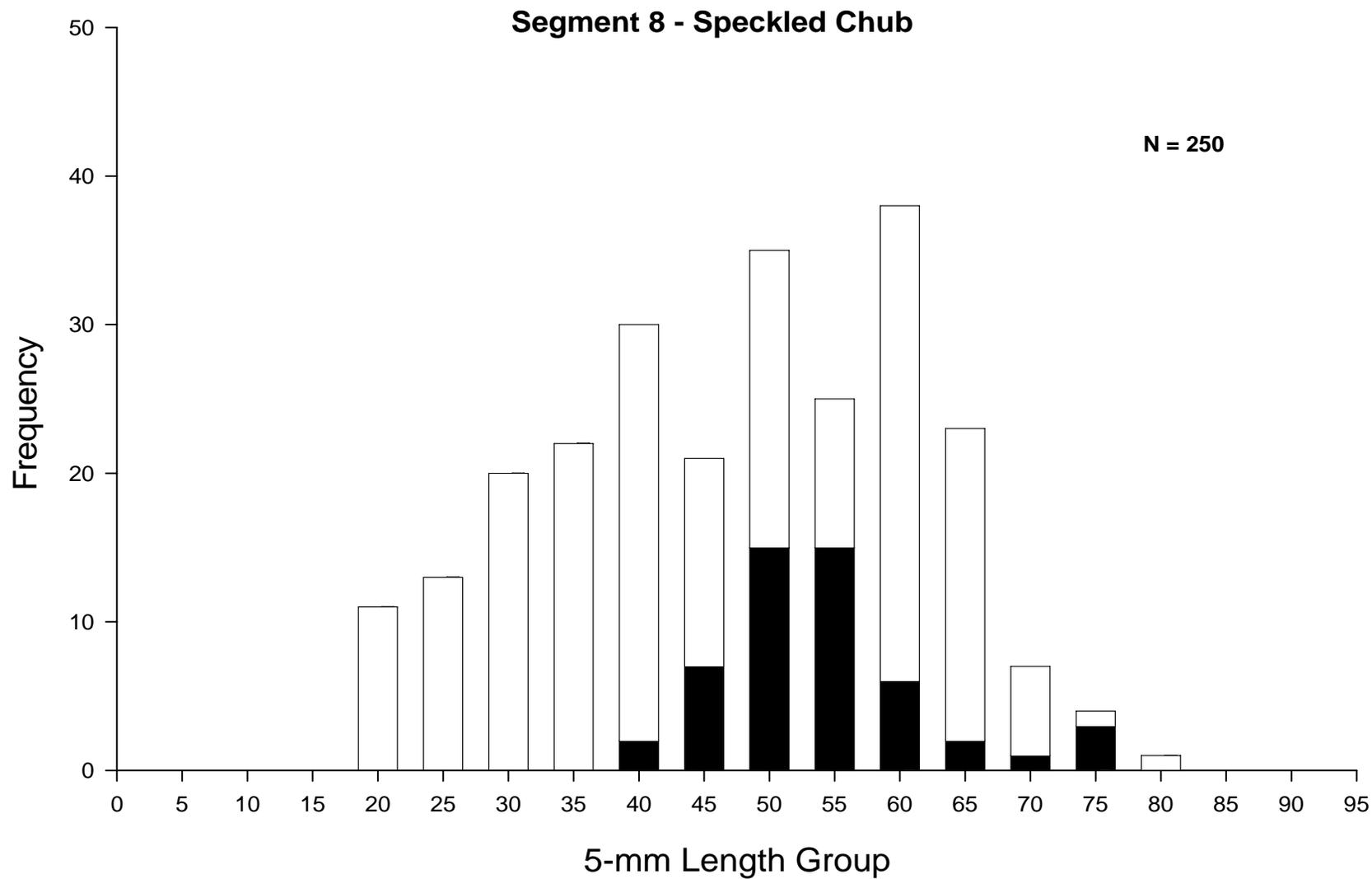


Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2005 - 2006

## Sand Shiner

A total of 881 sand shiners were captured in otter trawls (N = 6) and mini-fyke nets (N = 875) during the 2006 sampling season. An additional eight fish were sampled in an experimental otter trawl (OTO1 - 4 mm bar-mesh) and were not included in this analysis. Catch per unit effort for otter trawls during the sturgeon season was 0.005 fish per 100 m trawled (Figure 30). This was a significant decrease in mean CPUE from 2005 ( $\chi^2 = 4.73$ ,  $df = 1$ ,  $p = 0.0296$ ). During the fish community season, mini-fyke nets had the highest CPUE (19.29 fish per net night) of sand shiners followed by otter trawls (0.013 fish per 100 m trawled) (Figure 31 and 32). Both mini-fyke nets and otter trawls caught a significantly higher mean CPUE compared to 2005 ( $\chi^2 = 72.08$  and  $48.73$ ,  $df = 1$ ,  $p < 0.0001$ , respectively) (Barada and Steffensen 2006).

The majority of sand shiners (99.7%) collected during the fish community season in mini-fyke nets were within inside bend macrohabitats (Table 32). Catches were proportionate to sampling effort in both channel cross-over and inside bend macrohabitats. All fish were found in bar mesohabitats during the fish community season while the channel border mesohabitat were the only habitat sand shiners were sampled in during the sturgeon season (Table 33).

A total of 875 sand shiners were measured during 2006 (Figure 33). All but one fish were sampled during the fish community season. The average length was 38.1 mm with a length range of 26 to 69 mm.

## Segment 8 - Sand Shiner / Sturgeon Season

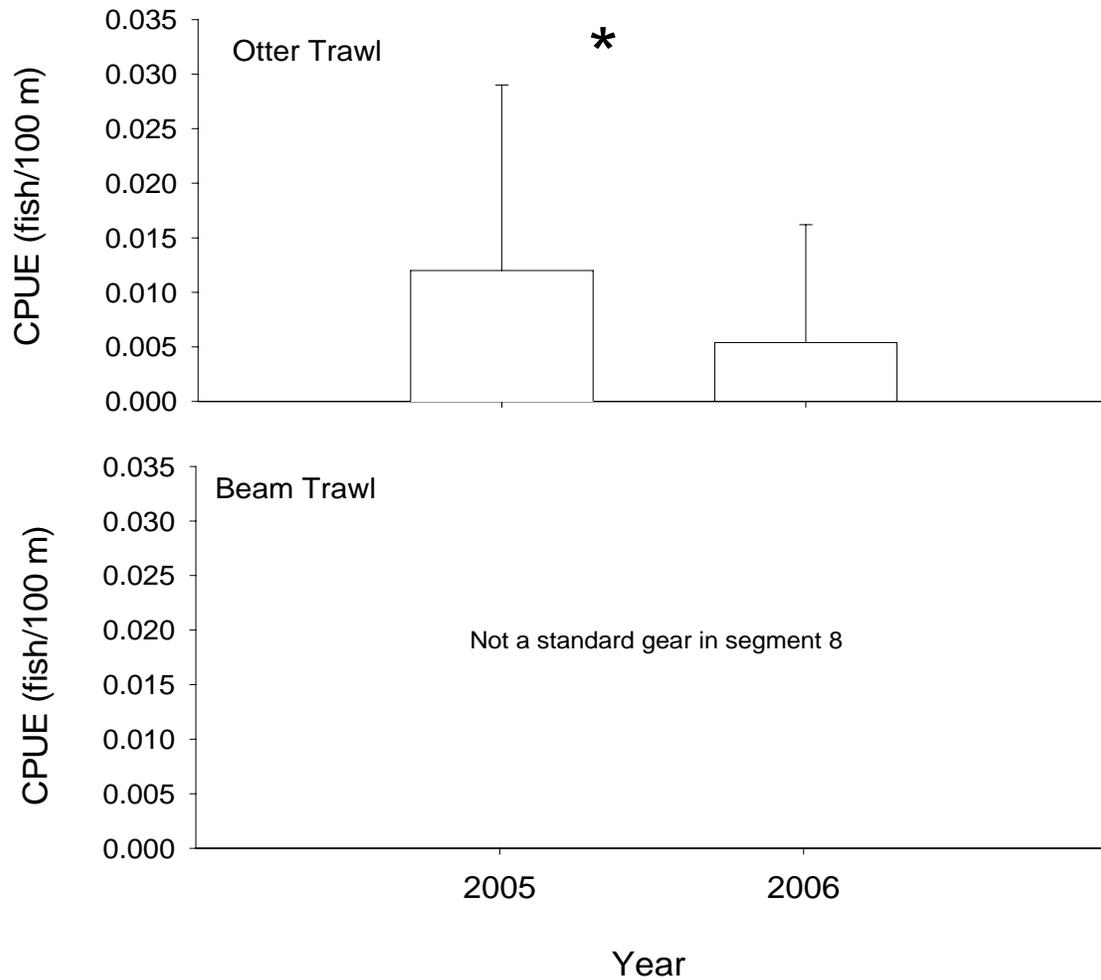


Figure 30. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sand shiner with otter trawls and beam trawls in segment 8 of the Missouri River during sturgeon season 2005 -2006. An asterisk denotes a significant difference between years.

## Segment 8 - Sand Shiner / Fish Community Season

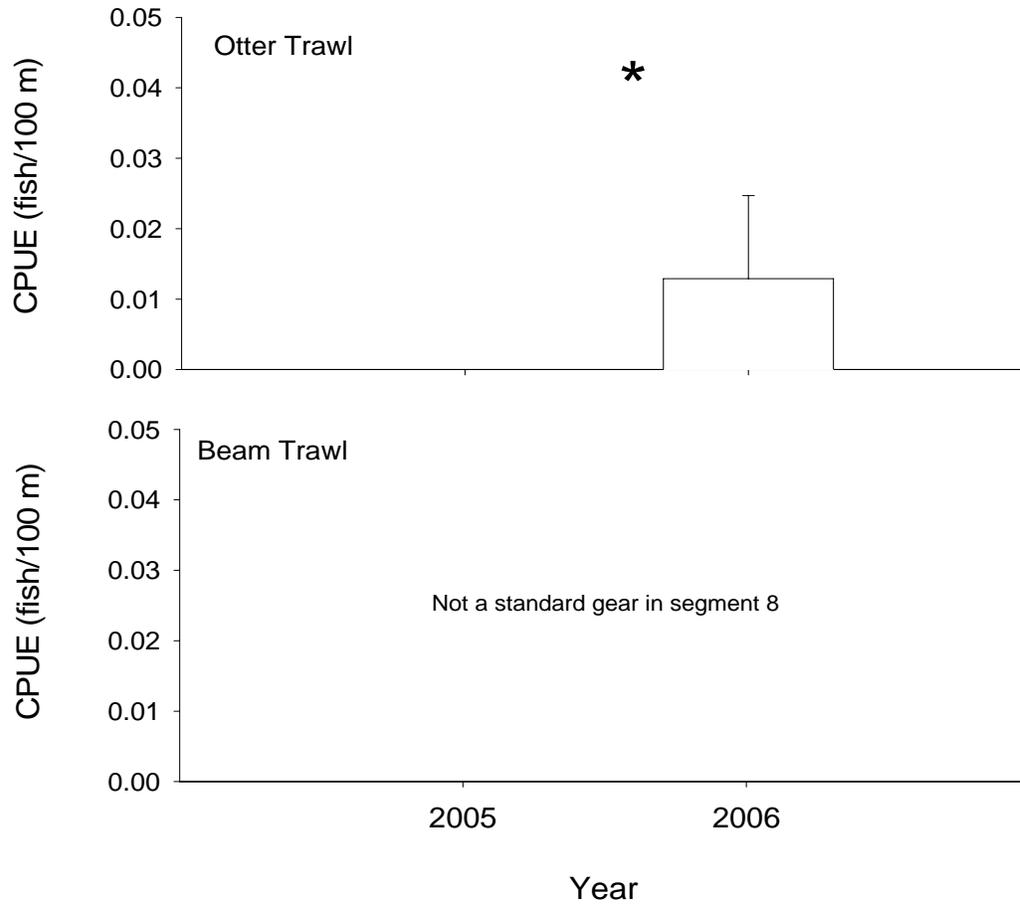


Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls and beam trawls in segment 8 of the Missouri River during fish community season 2005 -2006. An asterisk denotes a significant difference between years.

## Segment 8 - Sand Shiner / Fish Community Season

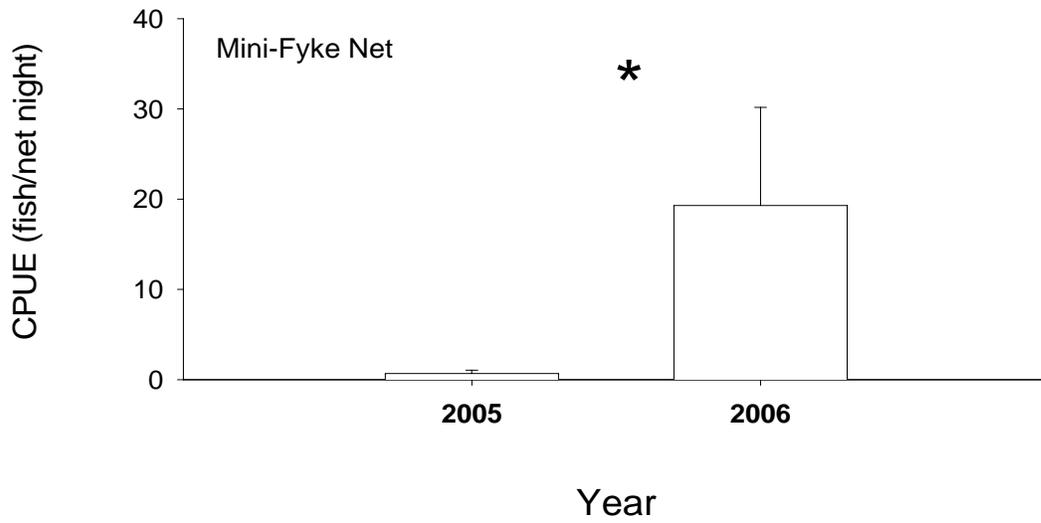


Figure 32. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sand shiner with mini-fyke nets in segment 8 of the Missouri River during fish community season 2005 - 2006. An asterisk denotes a significant difference between years.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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	
<b>Sturgeon Season (Fall through Spring)</b>																
1.0 Inch Trammel Net	0	N-E	24		N-E	N-E	76			N-E	N-E					
2.5 Inch Trammel Net	0		20				80									
Gill Net	0		22				78									
Otter Trawl	1		100 23				75		2							
<b>Fish Community Season (Summer)</b>																
1.0 Inch Trammel Net	0	N-E	25		N-E	N-E	75			N-E	N-E					
Mini-Fyke Net	2759		30 24				70 76									
Otter Trawl	5		20 23				80 77									

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	0		100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	0		51		49	
Otter Trawl	1		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	0		100	N-E		
Mini-Fyke Net	2759	100 100				
Otter Trawl	5		100 100			

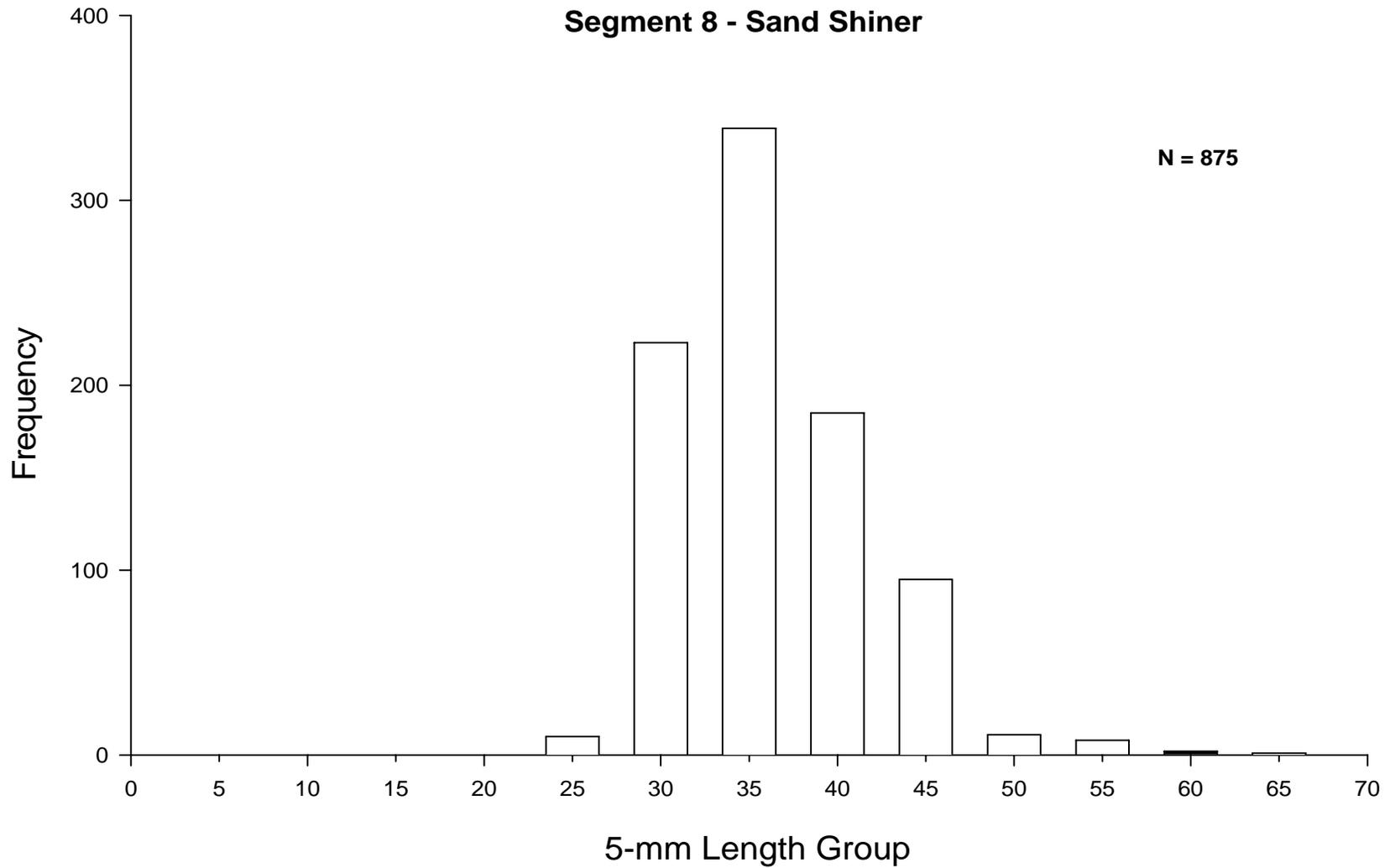


Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2006.

***Hybognathus* spp.**

A total of 26 *Hybognathus* spp. were captured in mini-fyke nets during the 2006 sampling season. All fish were captured during the fish community season. No other gear used in either season was very productive in capturing *Hybognathus* spp. Catch per unit effort for mini-fyke nets was 0.18 fish per net night (Appendix H). The average length of the *Hybognathus* spp. sampled was 45.65 mm with a length range of 34 to 62 mm. Due to the low number of fish sampled habitat associations were not made.

## Blue Sucker

A total of 981 blue suckers were captured in standard gill nets (N = 381), 1.0" trammel nets (N = 344), 2.5" trammel nets (N = 38), otter trawls (N = 213), and mini-fyke nets (N = 2) during the 2006 sampling season. An additional 177 blue suckers were sampled in green dyed trammel nets (N = 110) and in an experimental otter trawl (OTO1 - 4 mm bar-mesh; N = 65) and were not included in this analysis. During the sturgeon season, CPUE was highest for gill nets (1.08 fish per net night) followed by 1.0" trammel nets (0.69 fish per 100 m drifted) (Figures 38 and 39). In 2005, gill nets had the highest CPUE followed by 2.5" trammel nets (1.24 fish per net night and 0.56 fish per 100 m drifted, respectively). In 2006, mean annual CPUE for 1.0" trammel nets and otter trawls nearly doubled compared to 2005 ( $\chi^2 = 18.93$  and  $21.46$ ,  $df = 1$ ,  $p < 0.0001$ , respectively) (Barada and Steffensen 2006). Gill net catches were not significantly different ( $\chi^2 = 0.76$ ,  $df = 1$ ,  $p = 0.3825$ ) and 2.5" trammel net catches were significantly lower compared to 2005 ( $\chi^2 = 7.05$ ,  $df = 1$ ,  $p = 0.0079$ ). One inch trammel nets had the highest CPUE for blue suckers during the fish community season (CPUE = 1.04 fish per 100 m drifted) (Figure 41), which was similar to 2005. In addition, both otter trawls and mini-fyke nets had a significantly higher mean annual CPUE in 2006 compared to 2005 ( $\chi^2 = 10.75$  and  $41.04$ ,  $df = 1$ ,  $p = 0.0010$  and  $< 0.0001$ , respectively).

Blue suckers were most frequently sampled during the sturgeon and fish community season from inside bend macrohabitats with all gears (Table 36). Catches of blue suckers were nearly proportionate to sampling effort within each macrohabitat. The majority of blue suckers were sampled in pool mesohabitats during gill netting (81%) even though almost half of the sampling effort was in channel border mesohabitats (Table 37). All blue suckers were collected in channel border mesohabitats during the sturgeon and fish community season for all gears except mini-fyke nets, which are only deployed on bar mesohabitats.

A total of 1,158 blue suckers were measured during 2006 (Figure 44). The average length for blue suckers collected during the sturgeon and fish community season was 644.5 mm and 608.9 mm, respectively. The length range for blue suckers sampled during the sturgeon season (40 to 862 mm) was significantly larger compared to the fish community season (47 to 826 mm) ( $D = 0.306$ ,  $p = .0013$ ). Due to the large size range of adult fish, blue sucker recruitment is probably consistent. Blue suckers are present in almost all length groups below 500 mm; however, year class strength may be underestimated due to gear bias towards larger fish or sampling in areas that are not frequented by young blue suckers.

## Segment 8 - Blue Sucker / Sturgeon Season

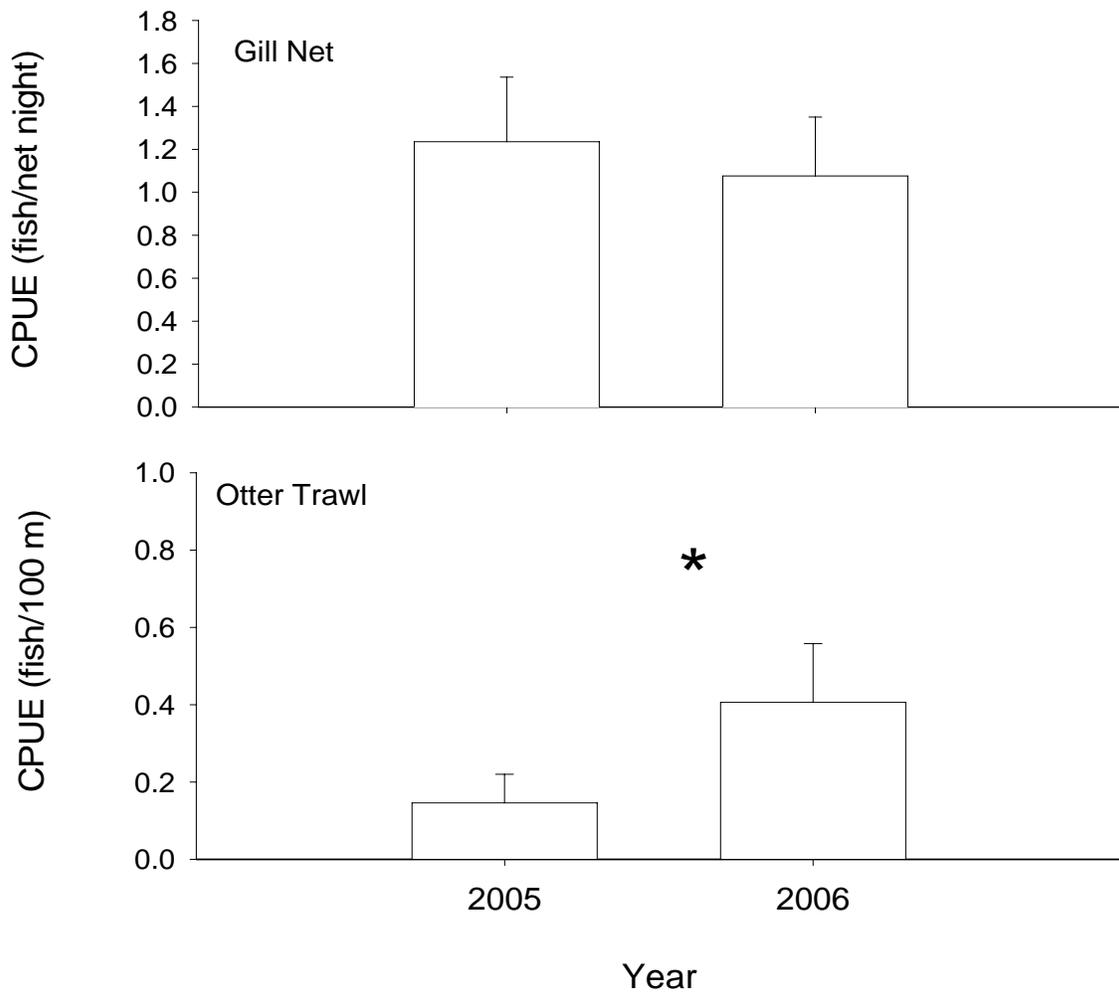


Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with gill nets and otter trawls in segment 8 of the Missouri River during sturgeon season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Blue Sucker / Sturgeon Season

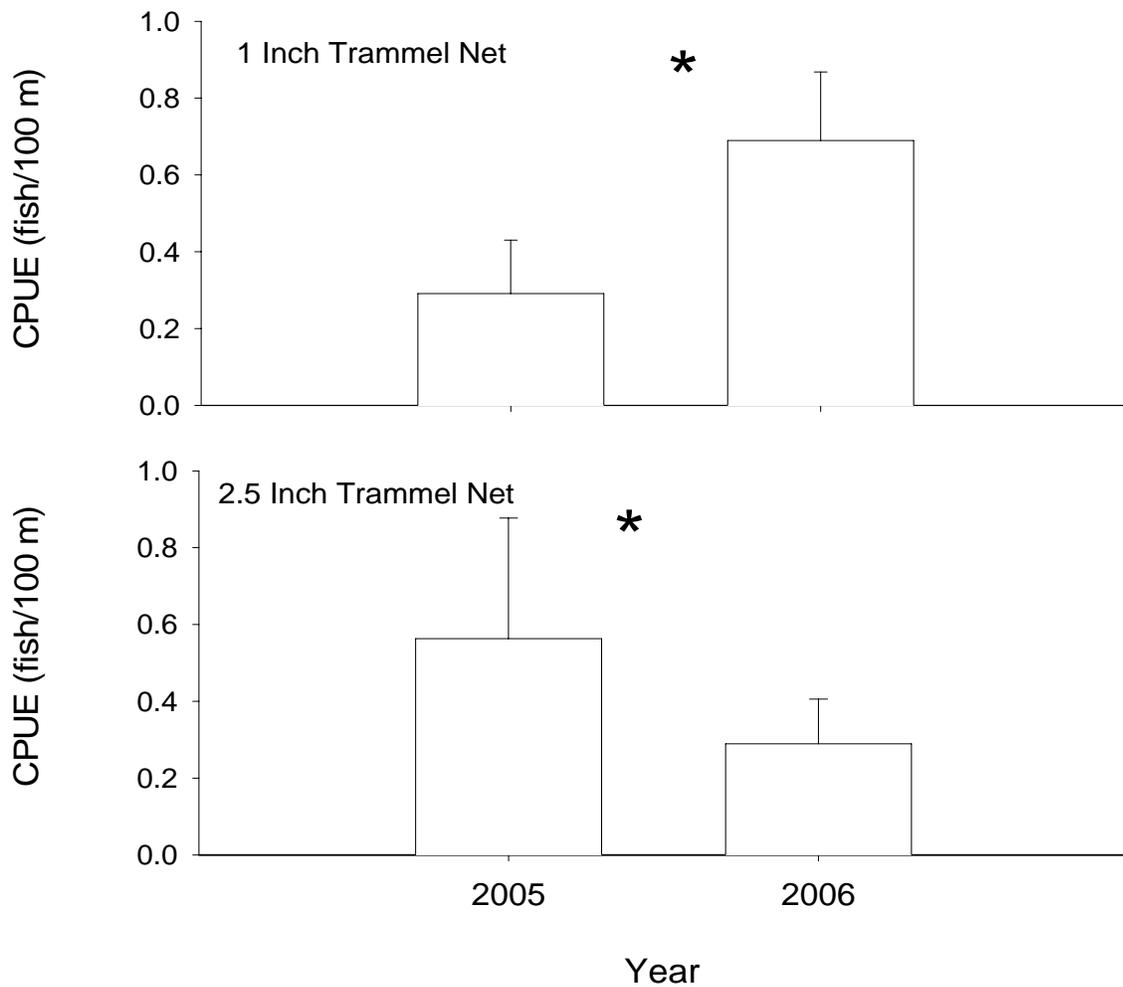


Figure 39. Mean annual catch-per-unit-effort ( $\pm 2$ SE) of blue sucker with 1 and 2.5 inch trammel nets in segment 8 of the Missouri River during sturgeon season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Blue Sucker / Fish Community Season

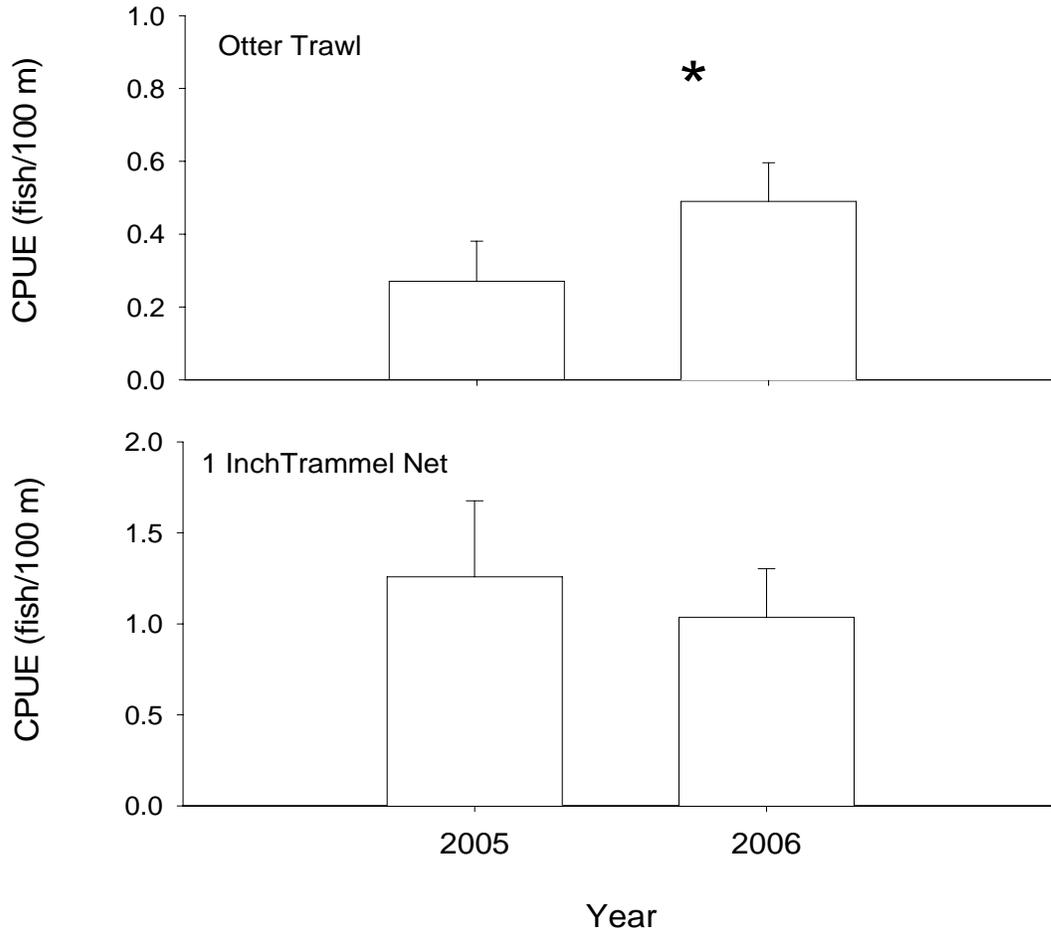


Figure 41. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of blue sucker using otter trawls and 1 inch trammel nets in segment 8 of the Missouri River during fish community season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Blue Sucker / Fish Community Season

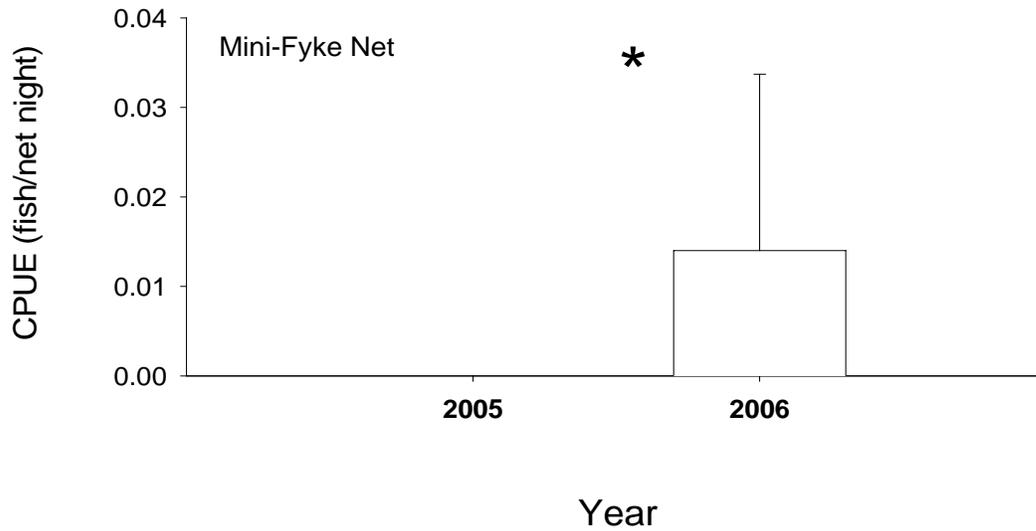


Figure 42. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of blue suckers using mini-fyke nets in segment 8 of the Missouri River during fish community season 2005 - 2006. An asterisk denotes a significant difference between years.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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					
<b>Sturgeon Season (Fall through Spring)</b>																				
1.0 Inch Trammel Net	153	N-E	19		N-E	N-E	81			N-E	N-E									
			24																	
2.5 Inch Trammel Net	39		21						80											
			20						80											
Gill Net	381		22				78													
			22				78													
Otter Trawl	59		25				75													
			23				75		2											
<b>Fish Community Season (Summer)</b>																				
1.0 Inch Trammel Net	192	N-E	15		N-E	N-E	85			N-E	N-E									
			25						75											
Mini-Fyke Net	2		24						100											
			19				76													
Otter Trawl	155		19				81													
			23				77													

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	153		100 100	N-E		
2.5 Inch Trammel Net	39		100 100			
Gill Net	381		19 51		81 49	
Otter Trawl	59		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	192		100 100	N-E		
Mini-Fyke Net	2	100 100				
Otter Trawl	155		100 100			

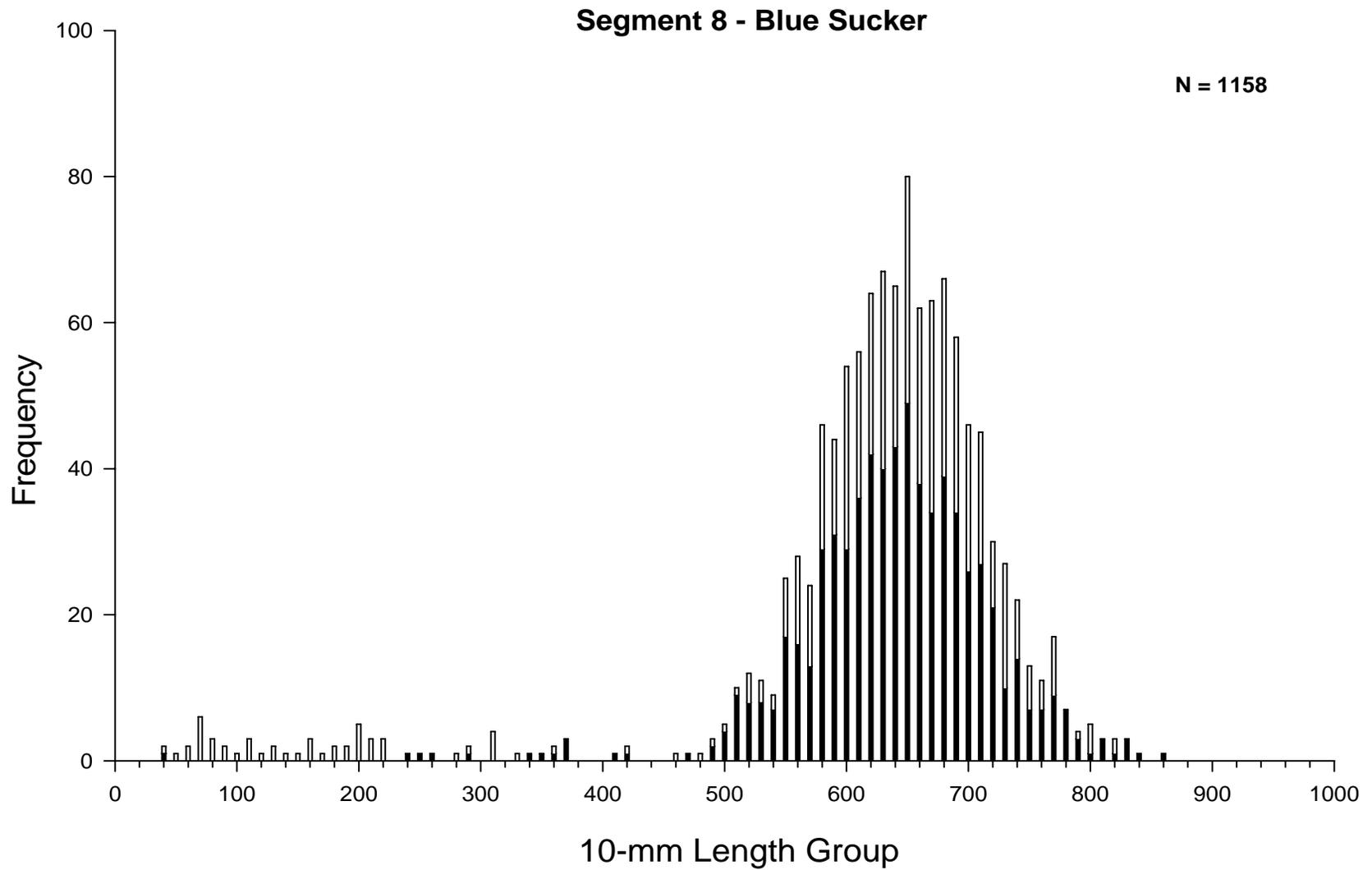


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2006.

## Sauger

A total of 100 sauger were captured in gill nets (N = 36), 1.0" trammel nets (N = 13), otter trawls (N = 38), and mini-fyke nets (N = 13) during the 2006 sampling season. An additional 20 sauger were sampled with experimental otter trawls (4 mm bar mesh) and trammel nets (green netting) were not included in this analysis. During the sturgeon season in 2006, CPUE was highest for gill nets (1.00 fish per net night) and otter trawls (1.00 fish per 100 m trawled) (Figures 45 and 46). Catch per unit effort increased substantially for otter trawls in 2006 compared to 2005 (0.10 vs. 0.01 fish per 100 m trawled). Both otter trawls and 1.0" trammel nets had a significant increase in mean CPUE compared to 2005 ( $\chi^2 = 44.55, 5.68, df = 1, p < 0.0001, 0.0172$ , respectively).

During the fish community season in 2006, mini-fyke nets displayed the greatest mean annual CPUE of sauger (0.09 fish per net night) followed by otter trawls (CPUE = 0.07 fish per 100 m trawled) and trammel nets (CPUE = 0.04 fish per 100 m drifted) (Figures 48 and 49). Both mini-fyke net and otter trawl CPUE values were significantly higher in 2006 ( $\chi^2 = 17.43$  and 6.25,  $df = 1, p < 0.0001$  and 0.0124, respectively).

Saugers were sampled in similar numbers between the sturgeon (N = 59) and fish community season (N = 41). During the sturgeon season, all sauger were sampled from inside bend and channel cross-over macrohabitats. All sampling took place in channel border and pool mesohabitats, and sauger catch was relatively proportionate to where sampling took place (Table 38 and 39).

A total of 120 sauger were measured during 2006 (Figure 51). The average length of sauger that were sampled during the sturgeon and fish community season was 349.4 mm and 180.0 mm, respectively. The length range for sauger sampled during the sturgeon season was 28 to 560 mm compared to 62 to 593 mm for the fish community season, resulting in a significant difference between the two distributions ( $D = 0.407, p = 0.023$ ). A bi-modal distribution is evident when examining the length frequency distribution, indicating that smaller sauger are vulnerable to capture with the current standard gears that are being used to target Missouri River species.

## Segment 8 - Sauger / Sturgeon Season

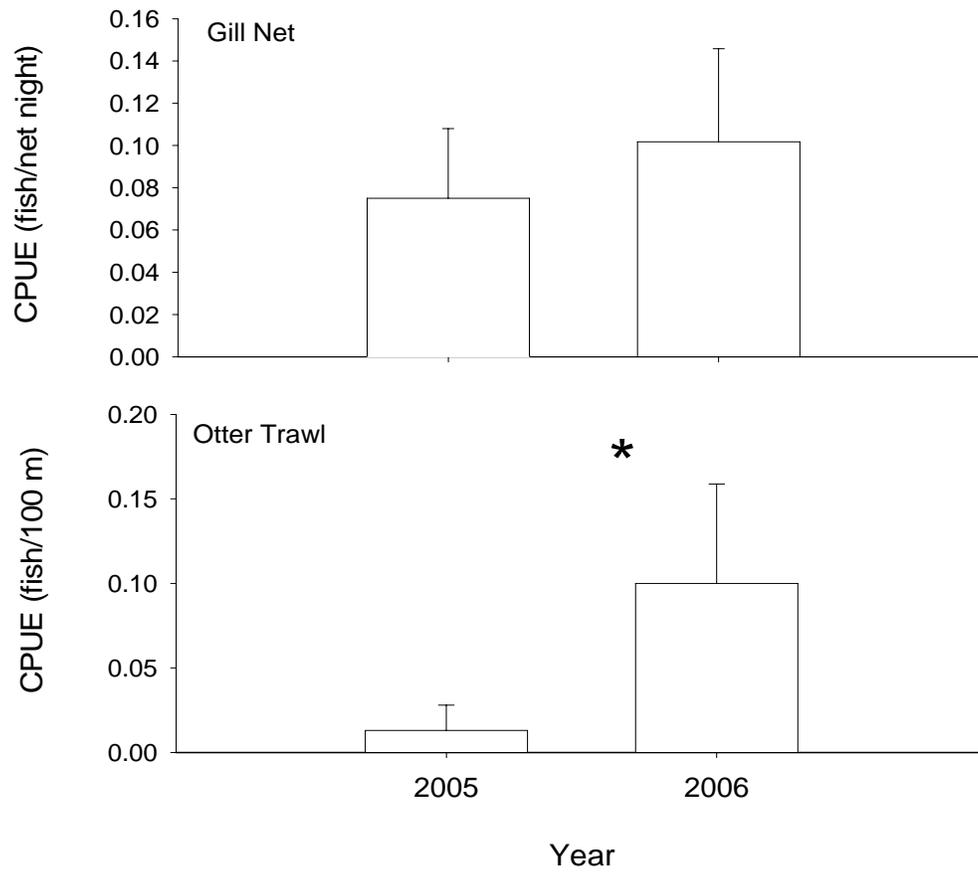


Figure 45. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sauger using gill nets and otter trawls in segment 8 of the Missouri River during sturgeon season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Sauger / Sturgeon Season

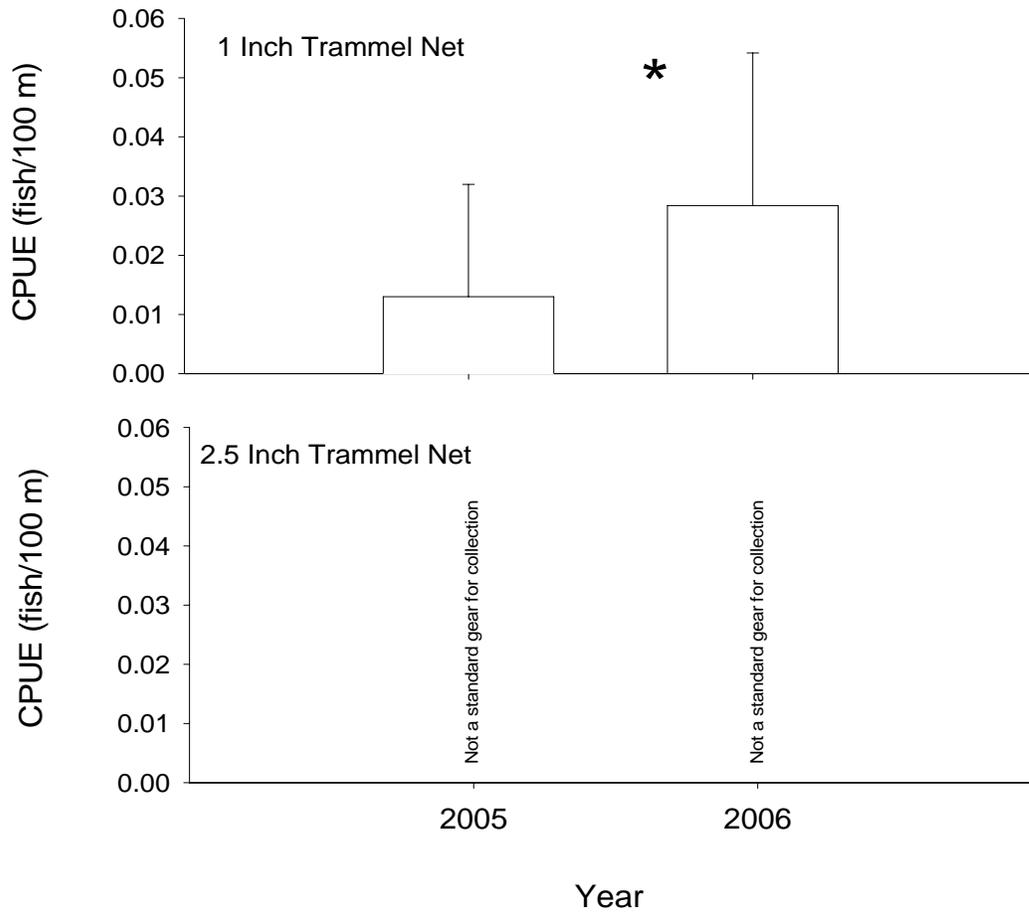


Figure 46. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger using 1 and 2.5 inch trammel nets in segment 8 of the Missouri River during sturgeon season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Sauger / Fish Community Season

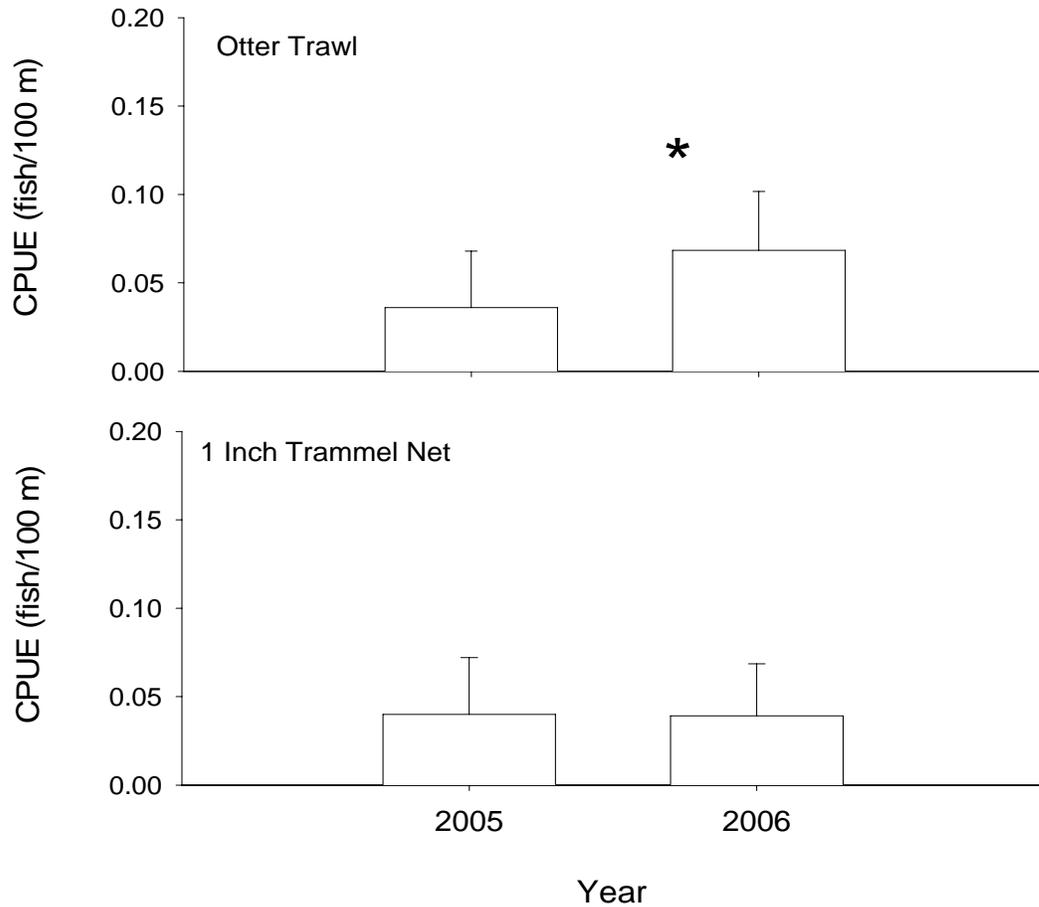


Figure 48. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sauger using otter trawls and 1 inch trammel nets in segment 8 of the Missouri River during fish community season 2005 - 2006. An asterisk denotes a significant difference between years.

## Segment 8 - Sauger / Fish Community Season

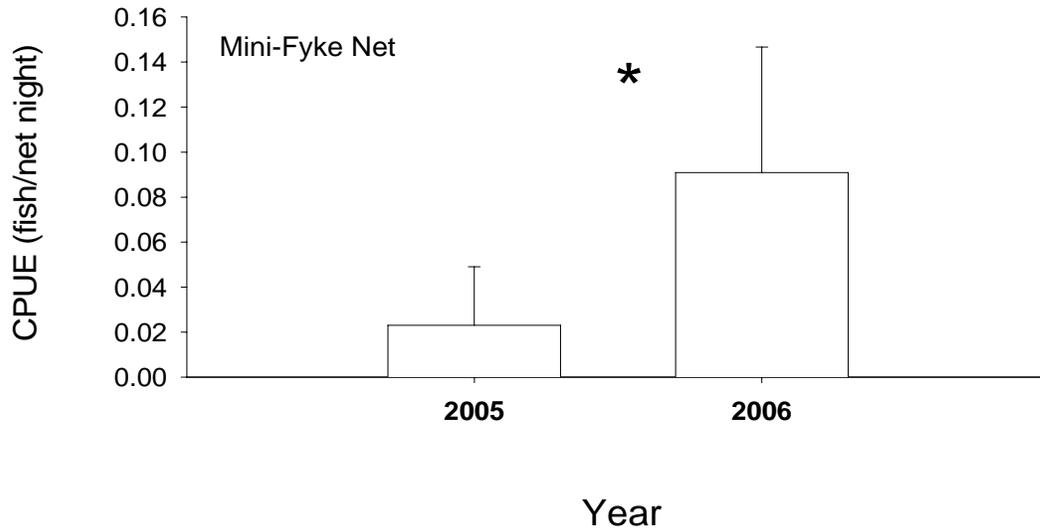


Figure 49. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger using mini-fyke nets in segment 8 of the Missouri River during fish community season 2005 - 2006. An asterisk denotes a significant difference between years.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 8 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				
<b>Sturgeon Season (Fall through Spring)</b>																			
1.0 Inch Trammel Net	6	N-E	17		N-E	N-E	83			N-E	N-E								
			24																
2.5 Inch Trammel Net	0		20					80											
Gill Net	36		19					81											
			22			78													
Otter Trawl	17		35			65													
			23			75		2											
<b>Fish Community Season (Summer)</b>																			
1.0 Inch Trammel Net	7	N-E			N-E	N-E	100			N-E	N-E								
			25																
Mini-Fyke Net	13		38					62											
		24			76														
Otter Trawl	21		48			52													
			23			77													

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 8 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				
		BARS	CHNB	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>						
1.0 Inch Trammel Net	6		100 100	N-E		
2.5 Inch Trammel Net	0		100			
Gill Net	36		50 51		50 49	
Otter Trawl	17		100 100			
<b>Fish Community Season (Summer)</b>						
1.0 Inch Trammel Net	7		100 100	N-E		
Mini-Fyke Net	13	100 100				
Otter Trawl	21		100 100			

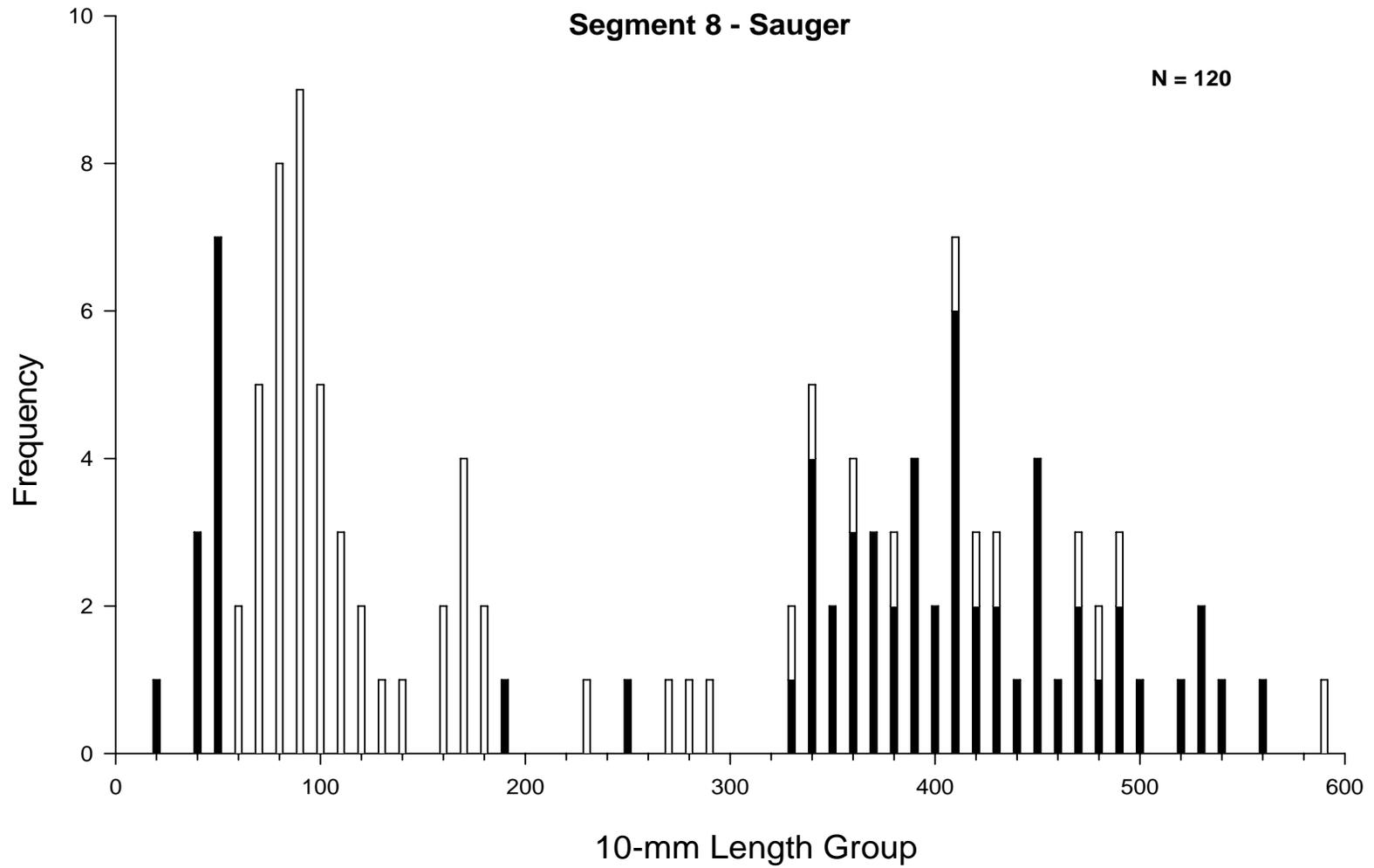


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 8 of the Missouri River during 2006.

## Missouri River Fish Community

A total of 40,694 fish were sampled with standard gears in segment 8 of the Missouri River in 2006. These gears collected 58 species with emerald shiners (34.2%, N = 13,926), red shiners (22.0%, N = 8,963), and river shiners (11.1%, N = 4,525) being the most abundant. Target species accounted for 13.6% of the total catch in 2006. Relative abundance of these species were as follows: shovelnose sturgeon (N = 1,514), blue suckers (N = 981), sand shiners (N = 881), speckled chubs (N = 105), sauger (N = 100), *Hybognathus* species (N = 26), pallid sturgeon (N = 17), sicklefin chub (N = 6), and sturgeon chub (N = 5).

Gill nets continue to be the most productive gear for collecting fish during the sturgeon season. In 2006, effort increased by 86 net nights resulting in 421 more fish sampled (CPUE = 5.8 fish per net night). Similar to 2005, shovelnose sturgeon were the most abundant fish sampled in gill nets (N = 888) with a mean CPUE of 2.51 fish per net night. In addition, gill nets were the most successful gear for collecting both unknown and hatchery reared pallid sturgeon.

Trammel nets and otter trawls both appear to be productive gears for sampling the fish community in the Missouri River during both of the sampling seasons. During the sturgeon season, both gears caught almost twice as many fish in 2006 compared to 2005. Otter trawls caught more fish species and had a greater overall mean CPUE (N = 26, CPUE = 7.05 fish per 100 m trawled); however, 1.0" trammel nets appeared to be more productive at capturing shovelnose sturgeon and blue suckers (CPUE = 0.84 and 0.69 fish per 100 m drifted, respectively). During the fish community season, otter trawls were the most productive active sampling gear for collecting a broad range of fish species. There were a total of 4,744 fish, representing 34 species, captured in 33,300 meters of trawling in 2006; whereas 1.0" trammel nets yielded a total of 523 fish, represented by 19 species, in 16,057 meters of drifting. Similar to the sturgeon season, 1.0" trammel nets appeared to be the most productive at capturing shovelnose sturgeon and blue suckers (CPUE = 2.27 and 1.26 fish per 100 m drifted, respectively). The top three species that were caught most frequently by otter trawl catches were silver chubs (CPUE = 8.76 fish per 100 m trawled), emerald shiners (CPUE = 3.04 fish per 100 m trawled), and channel catfish (CPUE = 0.87 fish per 100 m trawled).

Two and a one-half inch trammel nets were only deployed during the sturgeon season. This gear was developed to catch larger fish with an emphasis on catching adult pallid sturgeon for broodstock. Shovelnose sturgeon and blue suckers were the most frequently sampled fish in

2006 (CPUE = 0.31 and 0.29 fish per 100 m drifted). Similarly, these two species made up the bulk (66%) of the fish species caught in 2005 (Barada and Steffensen 2006). Only two pallid sturgeon have been sampled with the 2.5” trammel nets (1 each year). Since 1.0” trammel nets and gill nets catch more fish, including shovelnose sturgeon and blue suckers, this gear has been dropped as a standard gear for the 2007 sampling season.

Mini-fyke nets catch the most diverse assortment of fish compared to any other gear. In 2006, a total of 31,979 fish representing 44 species were captured in 143 net nights, resulting in an overall CPUE of 223.63 fish per net night. This was a substantial increase over the previous year. In 2005, only 2,604 fish representing 34 species were captured in 130 net nights, which resulted in an overall CPUE of 20.03 fish per net night. These differences can be attributed to various shiner species. Emerald shiners displayed the greatest disparity between years with a mean CPUE of 90.5 fish per net night in 2006 and only 2.17 fish per net night in 2005. Red shiners and river shiners were also caught in greater numbers in 2006 with a mean CPUE of 61.9 and 31.1 fish per net night, respectively, compared to 3.69 and 1.79 fish per net night in 2005.

## Discussion

### *Pallid Sturgeon*

Seventeen pallid sturgeon were collected during the 2006 sampling season in segment 8 of the Missouri River (Figure 1b). Hatchery reared fish made up the majority of the pallid sturgeon sampled (N = 12). The sturgeon season was the most productive season at capturing pallid sturgeon, catching almost three times as many fish compared to the fish community season, which was similar to 2005 (Barada and Steffensen 2006) (Table 7). Pallid sturgeon were captured almost throughout the length of segment 8 with the exception of the upper-most 27 miles. Omadi bend (R.M. 722.0) yielded four pallid sturgeon in both 2005 and 2006, which is the most fish caught per bend for either years (Figure 1b).

All pallid sturgeon were captured within inside bend or channel cross-over macrohabitats, with the majority of fish (88%) caught on the inside bend (Table 3). Within macrohabitats, the channel border was the mesohabitat where most fish were captured and catch locations were similar to the proportion of habitat sampled. However, during the sturgeon season, when gill nets are sampled in the pool mesohabitats, there seemed to be differences in habitat preferences compared to channel borders. Capture locations in pool mesohabitats within the inside bend were found in greater mean depths and higher turbidities compared to the proportion of habitat that was sampled.

Gill nets have been the most effective gear for capturing pallid sturgeon in past years for other segments (Steffensen and Mestl 2005, Shuman et al. 2005). However, during the 2005 sampling season, otter trawls caught the most fish in segment 8 (Barada and Steffensen 2006). In 2006, gill nets again were the most successful gear at collecting pallid sturgeon (N = 8) (Figure 2). In addition, gill nets had the highest CPUE values for unknown/wild pallid sturgeon, with only one other gear that collected any unknown/wild fish (1.0' trammel nets; N = 2). No unknown/wild pallid sturgeon have been collected during the fish community season for segment 8.

Almost 3,700 hatchery reared pallid sturgeon were stocked at Bellevue and Decatur in segment 8 during 2006 (Appendix E). All of these fish were from the 2005 year class. Nine hatchery reared fish were recaptured during our 2006 efforts. These fish belonged to the 1997, 1999, 2001, 2002, and 2004 year classes. Of the 19,838 pallid sturgeon that have been stocked into RPMA #4, only 24 have been recovered. As these fish grow and become recruited to our

sampling gears, sampling will enable us to determine survival rates of hatchery reared pallid sturgeon. If the number of recaptured pallid sturgeon does not increase, more sampling effort or an adjustment in sampling design and standard gears may be needed.

### *Shovelnose Sturgeon*

Gill nets (N = 888) were the most effective gear for collecting shovelnose sturgeon, collecting 59% of all fish. One inch trammel nets (N = 306) and otter trawls (N=278) had similar catch rates and were most effective during the fish community season (Figure 11 and 12). No standard gear was very effective at catching sub-stock or stock size shovelnose sturgeon. Gill nets had the highest CPUE for quality and above size shovelnose sturgeon followed by 1.0” trammel nets.

Shovelnose sturgeon catches were very similar to the proportion of sampling effort in each macrohabitat (Tables 17 – 24). Gill nets were the only gear used to sample more than one mesohabitat and, similar to pallid sturgeon, shovelnose sturgeon were found in greater quantities in pools compared to channel borders. Very few stock and sub-stock size shovelnose sturgeon were captured in segment 8 during 2006; however, recruitment of shovelnose sturgeon is probably occurring based on the length frequency distribution (Figure 17). It is unknown why catch rates are low for small shovelnose sturgeon. Gears that target small fish may be inefficient or difficult to use due to the variable flows, snags, and lack of habitat in segment 8 on the Missouri River. In addition, small shovelnose sturgeon may be selecting habitat that is currently not sampled by the population assessment team.

### *Macrophybopsis* species

Otter trawling was the most effective sampling method for all *Macrophybopsis* species. Otter trawling collected all sturgeon chubs (N = 5), all sicklefin chubs (N = 6) and 102 of 105 speckled chubs throughout both seasons. Mini-fyke nets were the only other gear to collect *Macrophybopsis* species, which resulted in three speckled chubs. Since otter trawls are only in deployed in channel border mesohabitats, which collected over 98% of *Macrophybopsis* species, no habitat associations were made.

### *Hybognathus* species

Very few *Hybognathus* species were collected in 2006 (N = 26). Mini-fyke nets were the only gear that collected fish. Due to low sample size, little is known about *Hybognathus* species

in segment 8. Currently, the population seems to be very low compared to catches in similar segments in previous years.

### *Sand Shiners*

Mini-fyke nets were the most productive gear for sand shiners in segment 8 during the 2006 sampling season (98%). Mini-fyke nets were only deployed on bar habitats during the fish community season and caught a total of 875. Otter trawl was the only other gear to collect sand shiners; however, sample size was very low (N = 6).

### *Blue Sucker*

Gill nets and 1.0" trammel nets were the most effective sampling gears, collecting nearly 75% of all blue suckers during 2006 (Figures 38 and 39). Large blue suckers were caught throughout both seasons and the percentage of fish caught with all gears was proportionate to the area being sampled (Tables 36 and 37). During the sturgeon season, gill nets caught the majority of blue suckers in pool mesohabitats. Similar to shovelnose sturgeon, very few small blue suckers were captured in 2006, further suggesting that gear types and efforts may not be targeting all sizes of fish equally or that small blue suckers are choosing different habitats than where sampling occurs.

### *Sauger*

Gill nets (N = 36) and otter trawls (N = 38) were the most effective gears for collecting sauger in 2006 (Figures 45 and 46). Both gill nets and otter trawls had similar CPUE values (1.00 fish per net night and 1.00 fish per 100 m trawled) during the sturgeon season. Otter trawls, 1.0" trammel nets, and mini-fyke nets displayed similar catch rates during the fish community season, catching a proportionately smaller size range from the population (Tables 38 and 39).

### ***Miscellaneous Work***

Beside the completion of the required contractual work, the Nebraska Game and Parks Commission Pallid Sturgeon Assessment (PSA) Crew also participate in several side projects. During late April, Tony Barada and Kirk Steffensen attended the annual project training at the confluence of the Yellowstone and Missouri Rivers. A Missouri River channelized crew training was then attended during mid-May by the entire NGPC PSA crew.

The NGPC PSA crew assisted the United States Geological Service (USGS) with the collection of blood and egg samples from gravid shovelnose sturgeon. Eggs were extracted from 5 fish per week and a blood sample was taken from 20 individual fish per week. These samples were then processed and shipped to USGS Columbia for analysis. Also, in coordination with the USGS, the NGPC, PSA crews marked shovelnose sturgeon with floy tags. Approximately 1,035 shovelnose sturgeon were marked and 14 tagged fish were recaptured.

In addition to the standardized sampling that had been completed, the PSA crew participated in three gear evaluations. An experimental small mesh otter trawl was developed and evaluated in an attempt to collect additional information on small bodied fishes, especially small *Scaphirhynchus* species. The results of the experimental otter trawl are pending. A gear avoidance study using green and white dyed trammel and gill nets was also completed. The NGPC PSA crew participated by drifting white and green trammel nets on 21 bends at 4 sub-samples per bend. The results of this experiment are pending. An independent gear assessment was also completed to compare stern and bow trawling. The standard OT16 was used in two different trawling configurations on 21 bends at 4 sub-samples per bend. The results of this experiment are pending.

Assistance was also 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 transported to Gavin's Point Hatchery and Aksarben Aquarium for a preliminary tag retention study.

Travis Kueter and Tony Barada provided Missouri River tours of the newly constructed Ponca backwater during the Ponca State Park Outdoor Expo. Travis Kueter, Ryan Ruskamp, Tony Barada, Bill Garvey and Josh Wilhelm provided boats and assistance during the Omaha river front clean-up efforts.

The Nebraska Game and Parks Commission hosted the 67<sup>th</sup> Midwest Fish and Wildlife Conference in Omaha during December. The entire crew provided technical assistance with the audio/visual equipment and the cyber café during the conference sessions.

Finally, fish were collected and transported for the Nebraska State Fair and for the new Cabela's in La Vista, Nebraska.

## **Acknowledgments**

Funding for this project was provided by the United State Army Corps of Engineers, Omaha District. Lab, office and storage space was provided by Nebraska Game and Parks Commission. Supervisors: Gerald Mestl (NGPC) and Mark Drobish (USACE). Biologist: Kirk Steffensen and Tony Barada. Field Staff: Ryan Ruskamp, Travis Kueter, Bill Garvey, Josh Wilhelm and Ben Neely. Vince Travnichek, Yan Hong and staff for their efforts key punching our data and with the database management.

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# APPENDICES

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
ORDER SILURIFORMES		
<b>Ictaluridae – bullhead catfishes</b>		
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurus nebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnus</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
ORDER SALMONIFORMES		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedii</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	
	<b>Percopsidae – trout-perches</b>	
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
	ORDER GADIFORMES	
	<b>Gadidae - cods</b>	
<i>Lota lota</i>	Burbot	BRBT
	ORDER ATHERINIFORMES	
	<b>Cyprinodontidae - killifishes</b>	
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus diaphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	<b>Poeciliidae - livebearers</b>	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	<b>Atherinidae - silversides</b>	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	<b>Gasterosteidae - sticklebacks</b>	
<i>Culaea inconstans</i>	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	<b>Cottidae - sculpins</b>	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	<b>Percichthyidae – temperate basses</b>	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	<b>Centrarchidae - sunfishes</b>	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis magalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Centrarchidae - sunfishes</b>		
<i>L. cyanellus</i> X <i>L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus</i> X <i>L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctulatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis</i> X <i>P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
<b>Percidae - perches</b>		
<i>Ammocrypta asprella</i>	Crystal darter	CLDR
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orangethroated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caprodes</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculata</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER*</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
<b>Sciaenidae - drums</b>		
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
NON-TAXONOMIC CATEGORIES		
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch per unit effort units for collection of Missouri River fishes in segment 8 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2005 for segment 8.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	Standard	All	2005 - Present	fish/100 m drift
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2005 - Present	fish/100 m drift
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2005 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2005 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2005 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2005 - Present	fish/net night
Otter trawl – 16 ft head rope	OT16	Standard	All	2005 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2006	fish/100 m trawled
Bag Seine – quarter arc method pulled upstream	BSQU	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Bag Seine – quarter arc method pulled downstream	BSQD	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Bag Seine – half arc method pulled upstream	BSHU	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Bag Seine – half arc method pulled downstream	BSHD	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Bag seine – rectangular method pulled upstream	BSRU	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Bag seine – rectangular method pulled upstream	BSRD	Wild	Fish Comm.	2005	fish/100 m <sup>2</sup>
Mini-fyke net	MF	Standard	Fish Comm.	2005 - Present	fish/net night

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

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Above Intake	AIN	Yellowstone	70 +
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KA/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 8 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking <sup>a</sup>	Primary Mark	Secondary Mark
2002	Bellevue	579	2001	4/3/2002	Yearling	Pit Tag	
2002	Bellevue	1530	2001	4/11/2002	Yearling	Pit Tag	
2002	Bellevue	298	2001	11/1/2002	Yearling	Pit Tag	Elastomere
2002	Bellevue	187	1999	11/1/2002	3 yo	Pit Tag	
2003	Bellevue	1938	2002	7/16/2003	Yearling	Pit Tag	
2003	Bellevue	500	2002	9/4/2003	Yearling	Pit Tag	Elastomere
2003	Bellevue	717	2002	10/30/2003	Yearling	Pit Tag	Elastomere
2003	Bellevue	1770	2003	12/2/2003	Fingerling	Elastomere	CWT
2004	Bellevue	56	2003	7/8/2004	Yearling	Elastomere	CWT
2004	Bellevue	762	2003	7/8/2004	Yearling	Pit Tag	Elastomere
2004	Bellevue	416	2003	7/30/2004	Yearling	Pit Tag	Elastomere
2004	Boyer Chute	51	2003	8/2/2004	Yearling	Pit Tag	Elastomere
2004	Bellevue	6634	2004	9/10/2004	Fingerling	Elastomere	CWT
2005	Sioux City	2004	2004	4/22/2005	Yearling	Pit Tag	Elastomere
2005	Sioux City	554	2004	4/22/2005	Yearling	Elastomere	CWT
2006	Bellevue	628	2005	5/5/2006	Yearling	Pit Tag	Elastomere
2006	Bellevue	607	2005	8/31/2006	Yearling	Pit Tag	Elastomere
2006	Decatur	607	2005	9/1/2006	Yearling	Pit Tag	Elastomere

<sup>a</sup>Age of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc...

## **Appendix F**

Total catch, overall mean catch per unit effort [ $\pm 2$  SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 8 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 in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	1	0.003 [0.006]					0.007 [0.014]							
BMBF	1	0.003 [0.006]						0.007 [0.015]						
<b>BUSK</b>	<b>381</b>	<b>1.076</b> <b>[0.273]</b>	<b>0.395</b> <b>[0.237]</b>	<b>1.816</b> <b>[1.027]</b>			<b>0.394</b> <b>[0.191]</b>	<b>1.772</b> <b>[0.559]</b>						
CARP	1	0.003 [0.006]	0.026 [0.053]											
CNCF	16	0.045 [0.024]	0.026 [0.053]	0.053 [0.072]			0.035 [0.037]	0.059 [0.045]						
FHCF	5	0.014 [0.015]					0.014 [0.020]	0.022 [0.033]						
FWDM	2	0.006 [0.008]						0.015 [0.021]						
GDEY	192	0.542 [0.204]	0.026 [0.053]	0.632 [0.621]			0.148 [0.147]	1.074 [0.449]						
GSCP	1	0.003 [0.006]						0.007 [0.015]						
GZSD	12	0.034 [0.022]		0.026 [0.053]			0.042 [0.039]	0.037 [0.038]						
<b>PDSG</b>	<b>8</b>	<b>0.023</b> <b>[0.016]</b>		<b>0.053</b> <b>[0.072]</b>			<b>0.021</b> <b>[0.024]</b>	<b>0.022</b> <b>[0.025]</b>						
QLBK	1	0.003 [0.006]						0.007 [0.015]						
RVCS	12	0.034 [0.023]		0.079 [0.086]			0.014 [0.020]	0.051 [0.052]						
<b>SGER</b>	<b>36</b>	<b>0.0102</b> <b>[0.044]</b>	<b>0.053</b> <b>[0.072]</b>	<b>0.132</b> <b>[0.129]</b>			<b>0.113</b> <b>[0.090]</b>	<b>0.096</b> <b>[0.052]</b>						
SGWE	1	0.003 [0.006]						0.007 [0.015]						
SHRH	19	0.054 [0.026]	0.053 [0.072]	0.053 [0.072]			0.028 [0.034]	0.081 [0.050]						
SJHR	1	0.003 [0.006]					0.007 [0.014]							
SMBF	3	0.009 [0.010]						0.022 [0.025]						

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SMBS	1	0.003 [0.006]					0.007 [0.014]							
SNGR	18	0.051 [0.033]					0.035 [0.046]	0.096 [0.070]						
<b>SNSG</b>	<b>888</b>	<b>2.509</b> <b>[0.598]</b>	<b>1.526</b> <b>[0.938]</b>	<b>4.368</b> <b>[2.769]</b>			<b>0.993</b> <b>[0.372]</b>	<b>3.846</b> <b>[1.152]</b>						
WLYE	8	0.023 [0.016]		0.026 [0.053]				0.051 [0.037]						
WTBS	1	0.003 [0.006]						0.007 [0.015]						

Appendix F2. 1.0 inch trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	2	0.006 [0.008]	0.012 [0.025]				0.004 [0.008]							
BMBF	1	0.003 [0.006]					0.004 [0.008]							
<b>BUSK</b>	<b>345</b>	<b>0.860</b> <b>[0.160]</b>	<b>0.612</b> <b>[0.273]</b>				<b>0.940</b> <b>[0.192]</b>							
CARP	4	0.012 [0.011]					0.015 [0.015]							
CNCF	61	0.154 [0.052]	0.100 [0.088]				0.171 [0.062]							
FHCF	1	0.003 [0.006]					0.004 [0.008]							
FWDM	4	0.004 [0.010]					0.012 [0.013]							
GDEY	298	0.749 [0.124]	0.736 [0.269]				0.754 [0.139]							
GSCP	10	0.023 [0.016]	0.023 [0.032]				0.023 [0.019]							
GZSD	18	0.043 [0.039]	0.079 [0.144]				0.031 [0.022]							
LNGR	10	0.028 [0.021]	0.025 [0.035]				0.029 [0.025]							
<b>PDSG</b>	<b>3</b>	<b>0.008</b> <b>[0.009]</b>					<b>0.010</b> <b>[0.012]</b>							
QLBK	16	0.039 [0.027]	0.039 [0.060]				0.039 [0.031]							
RVCS	26	0.062 [0.036]	0.131 [0.117]				0.039 [0.029]							
<b>SGER</b>	<b>13</b>	<b>0.034</b> <b>[0.020]</b>	<b>0.009</b> <b>[0.019]</b>				<b>0.042</b> <b>[0.025]</b>							
SHRH	8	0.022 [0.016]	0.012 [0.025]				0.025 [0.019]							
SMBF	13	0.032 [0.020]	0.012 [0.023]				0.038 [0.025]							
SNGR	8	0.019 [0.013]	0.021 [0.030]				0.018 [0.015]							

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
<b>SNSG</b>	<b>306</b>	<b>0.769</b>	<b>0.231</b>				<b>0.943</b>							
		<b>[0.213]</b>	<b>[0.113]</b>				<b>[0.277]</b>							
UCT	1	0.003					0.004							
		[0.006]					[0.007]							
WLYE	1	0.002					0.003							
		[0.005]					[0.006]							
WTBS	1	0.002					0.003							
		[0.005]					[0.006]							

Appendix F3. 2.5 inch trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	5	0.041 [0.036]	0.038 [0.076]				0.042 [0.041]							
BMBF	1	0.008 [0.017]					0.011 [0.022]							
<b>BUSK</b>	<b>39</b>	<b>0.289</b> <b>[0.117]</b>	<b>0.298</b> <b>[0.287]</b>				<b>0.287</b> <b>[0.126]</b>							
CARP	6	0.047 [0.038]	0.037 [0.073]				0.050 [0.045]							
CNCF	1	0.009 [0.017]					0.011 [0.022]							
FWDM	1	0.005 [0.010]					0.006 [0.013]							
GDEY	5	0.038 [0.039]					0.048 [0.050]							
GSCP	7	0.049 [0.037]	0.037 [0.073]				0.053 [0.043]							
PDFH	2	0.017 [0.024]					0.022 [0.030]							
<b>PDSG</b>	<b>1</b>	<b>0.008</b> <b>[0.017]</b>					<b>0.011</b> <b>[0.022]</b>							
QLBK	1	0.009 [0.017]					0.011 [0.022]							
RVCS	2	0.017 [0.024]	0.075 [0.104]											
SMBF	7	0.017 [0.035]	0.097 [0.109]				0.032 [0.032]							
<b>SNSG</b>	<b>42</b>	<b>0.313</b> <b>[0.115]</b>	<b>0.420</b> <b>[0.303]</b>				<b>0.282</b> <b>[0.120]</b>							
STCT	1	0.008 [0.015]					0.010 [0.020]							

Appendix F4. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BKSS	1	0.002 [0.005]					0.003 [0.006]							
BLCF	1	0.002 [0.004]					0.003 [0.005]							
BLGL	2	0.003 [0.005]					0.004 [0.006]							
BMBF	1	0.003 [0.006]					0.004 [0.008]							
<b>BUSK</b>	<b>214</b>	<b>0.463</b> <b>[0.087]</b>	<b>0.431</b> <b>[0.160]</b>				<b>0.476</b> <b>[0.104]</b>							
CARP	2	0.006 [0.008]					0.008 [0.011]							
CNCF	650	1.500 [0.495]	1.745 [1.218]				1.427 [0.527]				0.500 [1.000]			
ERSN	986	2.105 [1.541]	2.264 [3.848]				2.065 [1.630]							
FHCF	8	0.015 [0.011]	0.007 [0.014]				0.017 [0.014]				0.167 [0.333]			
<b>FWDM</b>	<b>209</b>	<b>0.477</b> <b>[0.233]</b>	<b>0.656</b> <b>[0.564]</b>				<b>0.422</b> <b>[0.250]</b>							
GDEY	4	0.008 [0.008]	0.007 [0.015]				0.008 [0.009]							
GZSD	28	0.059 [0.069]	0.009 [0.018]				0.075 [0.092]							
LNDC	1	0.002 [0.004]					0.003 [0.006]							
LNGR	3	0.007 [0.009]	0.024 [0.034]				0.002 [0.003]							
OSSF	2	0.005 [0.007]					0.007 [0.010]							
<b>PDSG</b>	<b>5</b>	<b>0.008</b> <b>[0.008]</b>					<b>0.010</b> <b>[0.010]</b>							
QLBK	4	0.012 [0.011]	0.024 [0.034]				0.008 [0.011]							
RDSN	118	0.250 [0.137]	0.138 [0.174]				0.286 [0.174]				0.467 [0.935]			

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
RVCS	42	0.098 [0.058]	0.222 [0.213]				0.057 [0.033]					0.167 [0.333]		
RVSN	70	0.123 [0.075]	0.078 [0.112]				0.138 [0.092]							
<b>SFCB</b>	<b>7</b>	<b>0.012</b> <b>[0.011]</b>					<b>0.016</b> <b>[0.015]</b>							
SFSN	59	0.138 [0.072]	0.068 [0.082]				0.161 [0.091]							
<b>SGCB</b>	<b>5</b>	<b>0.010</b> <b>[0.010]</b>					<b>0.014</b> <b>[0.013]</b>							
<b>SGER</b>	<b>38</b>	<b>0.079</b> <b>[0.030]</b>	<b>0.139</b> <b>[0.075]</b>				<b>0.060</b> <b>[0.031]</b>							
SGWE	1	0.003 [0.006]					0.004 [0.008]							
SHRH	15	0.033 [0.019]	0.054 [0.052]				0.027 [0.018]							
<b>SKCB</b>	<b>101</b>	<b>0.219</b> <b>[0.067]</b>	<b>0.205</b> <b>[0.139]</b>				<b>0.225</b> <b>[0.077]</b>							
SMBS	1	0.003 <b>[0.006]</b>					0.004 <b>[0.008]</b>							
SNGR	1	0.002 [0.004]					0.003 [0.006]							
<b>SNSG</b>	<b>278</b>	<b>0.599</b> <b>[0.239]</b>	<b>0.905</b> <b>[0.864]</b>				<b>0.504</b> <b>[0.151]</b>							
<b>SNSN</b>	<b>6</b>	<b>0.010</b> <b>[0.009]</b>	<b>0.012</b> <b>[0.017]</b>				<b>0.010</b> <b>[0.010]</b>							
STCT	6	0.012 [0.011]	0.023 [0.032]				0.009 [0.010]							
SVCB	2939	6.439 [1.723]	9.005 [4.989]				5.643 [1.618]					0.467 [0.935]		
SVCP	1	0.002 [0.003]	0.007 [0.014]											
WLYE	16	0.035 [0.020]	0.082 [0.068]				0.019 [0.014]							
WTBS	10	0.023 [0.015]	0.027 [0.031]				0.021 [0.017]							

Appendix F6. Mini-fyke net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BKCP	2	0.014 [0.020]												
BKSS	32	0.224 [0.176]		0.057 [0.114]										
BLGL	289	2.021 [0.960]		2.371 [1.704]										
BMBF	1	0.007 [0.014]		0.029 [0.057]										
BMSN	8	0.056 [0.071]		0.114 [0.179]									0.037 [0.074]	
BNMW	11	0.077 [0.056]		0.029 [0.057]									0.093 [0.072]	
<b>BUSK</b>	<b>2</b>	<b>0.014</b> <b>[0.020]</b>											<b>0.019</b> <b>[0.026]</b>	
CARP	1	0.007 [0.014]											0.009 [0.019]	
CKCB	1	0.007 [0.014]		0.029 [0.057]										
CNCF	68	0.476 [0.194]		0.571 [0.570]									0.444 [0.181]	
ERSN	12940	90.489 [103.271]		16.343 [11.493]									114.519 [136.523]	
FHCF	1	0.007 [0.014]											0.009 [0.019]	
FHMW	360	2.518 [2.296]		1.086 [0.957]									2.981 [3.023]	
FWDM	42	0.294 [0.124]		0.486 [0.264]									0.231 [0.138]	
GNSF	34	0.238 [0.119]		0.286 [0.240]									0.222 [0.138]	
GZSD	188	1.315 [0.818]		1.686 [2.061]									1.194 [0.858]	
HHCB	1	0.007 [0.014]											0.009 [0.019]	
JYDR	3	0.021 [0.024]		0.029 [0.057]									0.019 [0.026]	

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
LMBS	10	0.067 [0.051]		0.057 [0.080]				0.074 [0.063]						
LNGR	14	0.098 [0.057]		0.143 [0.167]				0.083 [0.053]						
MQTF	3	0.021 [0.031]						0.028 [0.041]						
OSSF	154	1.077 [0.804]		1.514 [2.305]				0.935 [0.765]						
<b>PNMW</b>	<b>26</b>	<b>0.182</b> <b>[0.240]</b>		<b>0.029</b> <b>[0.057]</b>				<b>0.231</b> <b>[0.316]</b>						
QLBK	5	0.035 [0.037]		0.029 [0.057]				0.037 [0.045]						
RDSN	8845	61.853 [21.918]		68.400 [49.184]				59.731 [24.379]						
RVCS	48	0.336 [0.209]		0.114 [0.136]				0.407 [0.272]						
RVSN	4454	31.147 [26.006]		9.343 [3.816]				38.213 [34.340]						
SFSN	1081	7.559 [4.697]		6.543 [4.855]				7.889 [6.027]						
<b>SGER</b>	<b>13</b>	<b>0.091</b> <b>[0.056]</b>		<b>0.143</b> <b>[0.145]</b>				<b>0.074</b> <b>[0.057]</b>						
SHRH	16	0.112 [0.063]		0.086 [0.126]				0.120 [0.073]						
SJHR	1	0.007 [0.014]						0.009 [0.019]						
<b>SKCB</b>	<b>3</b>	<b>0.021</b> <b>[0.024]</b>		<b>0.029</b> <b>[0.057]</b>				<b>0.019</b> <b>[0.026]</b>						
SMBF	54	0.378 [0.229]		0.257 [0.190]				0.417 [0.297]						
SMBS	7	0.049 [0.041]		0.086 [0.096]				0.037 [0.045]						
SNGR	51	0.357 [0.138]		0.314 [0.179]				0.370 [0.174]						
<b>SNSN</b>	<b>2759</b>	<b>19.294</b> <b>[10.890]</b>		<b>23.257</b> <b>24.666</b>				<b>18.009</b> <b>[12.061]</b>						

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	BARS	CHNB	POOL	CHNB	BARS	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
STSN	3	0.021 [0.024]					0.028 [0.032]							
SVCB	219	1.532 [0.483]		1.571 [1.012]			1.519 [0.552]							
UCN	1	0.007 [0.014]		0.029 [0.057]										
UCY	19	0.133 [0.199]		0.029 [0.057]			0.167 [0.262]							
ULP	1	0.007 [0.014]		0.029 [0.057]										
WLYE	2	0.014 [0.020]		1.486 [0.673]			0.019 [0.026]							
WTBS	201	1.406 [0.766]					1.380 [0.992]							
WTCP	5	0.035 [0.031]		0.086 [0.096]			0.019 [0.026]							

Appendix G. Hatchery names, locations, and abbreviations.

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

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Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2006 for segment 8 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)		
	1.0 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1.0 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
BHCP	0.012	0.041	0.003				
BKCP						0.014	
BKSS						0.224	0.003
BLCF							0.003
BLGL						2.021	0.005
BMBF	0.006	0.008	0.003			0.007	0.004
BMSN						0.026	
BNMW						0.077	
<b>BUSK</b>	<b>0.689</b>	<b>0.289</b>	<b>1.076</b>	<b>0.407</b>	<b>1.036</b>	<b>0.014</b>	<b>0.490</b>
CARP	0.017	0.047	0.003	0.009	0.006	0.007	0.005
CKCB						0.007	
CNCF	0.156	0.009	0.045	2.769	0.152	0.476	0.876
ERSN				0.204		90.489	3.039
FHCF			0.014	0.017	0.006	0.007	0.014
FHMW						2.518	
FWDM	0.012	0.005	0.006	0.838	0.006	0.294	0.299
GDEY	0.842	0.038	0.542	0.012	0.655		0.005
GNSF						0.238	
GSCP	0.034	0.049	0.003		0.011		
GZSD	0.084		0.034			1.315	0.088
HHCB						0.007	
JYDR						0.021	
LMBS						0.069	
LNDC							0.003
LNGR	0.033			0.013	0.024	0.098	0.004
MQTF						0.021	
OSSF				0.005		1.077	0.005
PDFH		0.017					
<b>PDSG</b>	<b>0.015</b>	<b>0.008</b>	<b>0.023</b>	<b>0.007</b>			<b>0.008</b>

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1.0 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1.0 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
<b>PNMW</b>						<b>0.182</b>	
QLBK	0.039	0.009	0.003		0.039	0.035	0.017
RDSN				0.207		61.853	0.272
RVCS	0.059	0.017	0.034	0.058	0.065	0.336	0.117
RVSN				0.009		31.146	0.178
<b>SFCB</b>				<b>0.007</b>			<b>0.015</b>
SFSN				0.195		7.559	0.109
<b>SGCB</b>				<b>0.019</b>			<b>0.006</b>
<b>SGER</b>	<b>0.028</b>		<b>0.102</b>	<b>0.100</b>	<b>0.039</b>	<b>0.091</b>	<b>0.068</b>
SGWE			0.003				0.005
SHRH	0.006		0.054	0.007	0.039	0.112	0.046
SJHR			0.003			0.007	
<b>SKCB</b>				<b>0.339</b>		<b>0.021</b>	<b>0.159</b>
SMBF	0.048	0.047	0.009		0.015	0.378	
SMBS			0.003			0.049	0.004
SNGR	0.022		0.051	0.007	0.015	0.357	
<b>SNSG</b>	<b>0.840</b>	<b>0.313</b>	<b>2.509</b>	<b>0.576</b>	<b>0.695</b>		<b>0.612</b>
<b>SNSN</b>				<b>0.005</b>		<b>19.294</b>	<b>0.013</b>
STCT		0.008		0.037			
STSN						0.021	
SVCB				1.715		1.532	8.762
SVCP							0.003
UCN						0.007	
UCT					0.006		
UCY						0.133	
ULP						0.007	
WLYE	0.005		0.023	0.033		0.014	0.035
WTBS	0.005		0.003	0.015		1.406	0.026
WTCP						0.035	

Appendix I. Comprehensive list of bend numbers and bend river miles for segment 8 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2005 – 2006.

<b>Bend Number</b>	<b>Bend River Mile</b>	<b>2005</b>	<b>2006</b>
1	753	FCS	
2	750.1	ST	ST, FCS
3	747	ST	
4	742.4		
5	738.4	ST	
6	734.7	FCS	
7	732.8		
8	732	ST, FCS	
9	726.2		ST, FCS
10	723.4	ST	
11	722	ST, FCS	ST, FCS
12	718.6		
13	716.2	ST	ST, FCS
14	713.8		
15	710.8	ST	
16	708	ST	ST, FCS
17	706.3		
18	704	FCS	ST, FCS
19	702.6	ST	
20	700.9	FCS	ST, FCS
21	697.5		
22	693.6	FCS	
23	691.4		
24	689		
25	687.4		ST, FCS
26	686	ST, FCS	
27	683.3	ST	
28	681.2	FCS	ST, FCS
29	679.9		
30	677.9	FCS	

Appendix I. (continued).

<b>Bend Number</b>	<b>Bend River Mile</b>	<b>2005</b>	<b>2006</b>
31	676.7	FCS	ST, FCS
32	675	ST, FCS	ST, FCS
33	672.8		
34	670.4	FCS	
35	666.5	ST	
36	663.1	ST, FCS	
37	660.8		
38	657.8		
39	654.8	ST, FCS	
40	651.7	ST	ST, FCS
41	649.1	FCS	
42	644.5	ST	
43	642		
44	639.8		ST, FCS
45	638.5	FCS	
46	637.1	FCS	ST, FCS
47	634.1		
48	632.5	ST, FCS	ST, FCS
49	631.1	ST, FCS	
50	629.7	FCS	ST, FCS
51	627.8	FCS	
52	622.8		
53	617.5	ST	
54	614.6		
55	612.8	ST	
56	608.8		ST, FCS
57	604.5	FCS	ST, FCS
58	600.8		
59	599.3		
60	598		
61	596		