

2007 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 10



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

The Missouri Department of Conservation began its third year within the Pallid Sturgeon Population Assessment Program in segment 10 at the beginning of the 2007 sampling season. Sampling was successfully completed in all required bends (N = 10) during the 2007 sturgeon and fish community seasons. A total of ten pallid sturgeon (two “unknown” pending genetic verification and eight hatchery-stocked; fork length = 281 to 985 mm) was captured in segment 10 during the 2007 sturgeon and fish community seasons. Six individuals were caught in gill nets (mean CPUE = 0.03 fish/100m), and four individuals were captured in standard 1.0-inch trammel nets (mean CPUE = 0.015 fish/100m). Standard otter trawls captured no pallid sturgeon. There were forty-nine YOY sturgeons (19 – 179 mm) captured with otter trawl (N = 48) and one inch trammel nets (N = 1) in segment 10 during the 2007 sampling season. All YOY sturgeons were captured in channel border habitats. Three hatchery stocked pallid sturgeon were captured from two river bends sampled between RM 260 and 250. Three river bends were sampled between RM 280 and 300 where three hatchery pallid sturgeon were captured. Two unknown pallid sturgeon were captured downstream from Kansas City at RM 353.

Recaptured hatchery-stocked pallid sturgeon ranged in size from 374 – 708 mm. Three fish were from the 2001 year class (613 – 708 mm), two from the 2002 year class (541 – 652 mm), and one from the 2004 year class (374 mm). This past year (2007) was the first year a fish from the 2001 year class has been captured in Segment 10. Two hatchery pallid sturgeon (2001 and 2002 year classes) lost their PIT tags (i.e., PIT tag retention = 75%). The K_n value for the 2001, 2002, and 2004 year class was 0.793, 0.89, and 0.99, respectively. The unknown pallid sturgeon had relative condition factors of 0.73 and 0.789. In 2007, the 2001 (age 6), 2002 (age 5), and 2004 (age 3) year class had growth rates of 0.22, 0.24, and 0.32 mm/ day, respectively. The 2002 year classes growth has increased every year, from 0.201 mm/ day in 2005 (age 3), 0.22 mm/ day in 2006 (age 4) to 0.24 mm/ day in 2007 (age 5). Relative condition factor of fish captured during sturgeon season was similar among all size classes, averaging 0.85. The relative condition was lower for fish captured during fish community season (0.73). Pallid sturgeon were captured in pool (N = 5) and channel border areas (N = 5). Most fish (70%) were captured in areas influenced by dikes. Two pallid sturgeon were captured from open water, sand bar areas

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Sturgeon and speckled chubs were the least (N = 4) and most (N = 141) common *Macrhybopsis* species encountered, respectively, and were caught in channel borders and on sand bar mesohabitats with otter trawls and mini-fyke nets. Sicklefins (N = 85) were captured with otter trawls in the channel border. Sand shiners were captured with mini-fyke nets (N = 12) and otter trawl (N = 1) on sand bars. Gill nets, one-inch trammel nets, and otter trawls captured 31 blue suckers in channel border and pool mesohabitats. Thirty-six sauger were captured with gill nets, otter trawls, 1-inch trammel nets, and mini-fyke nets in channel border, pool, and sand bar habitats. Two hundred fifteen *Hybognathus* spp. were captured during the 2007 sampling season. Overall, 13,441 fish representing 51 species were captured in segment 10 during the 2007 sampling season.

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Introduction

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

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

The initial stocking of pallid sturgeon in 1994 consisted of about 6,500 fish from the 1992 year class that were stocked into RPMAs 4 (Missouri River below Gavins Point Dam) and 5 (middle Mississippi River; USFWS 2005). Subsequent stockings in 1997, 1998, and 2001 through 2007 in all six RPMAs have resulted in approximately 930,900 pallid sturgeon

being stocked into the Missouri, Mississippi, and Yellowstone Rivers (Krentz and Wilson 2008). The total number of pallid sturgeon stocked per year has increased from an average of about 4,000 fish per year prior to 2000 to an average of nearly 39,000 fish per year from 2001-2006. In 2007, there was a total of 577,936 pallid sturgeon stocked into the Yellowstone and Missouri Rivers, with most (529,152) of those stocked in RPMA 2. Most pallid sturgeon were stocked as fingerlings (age-0), advanced fingerlings, and yearlings (age-1), though some fish age-2 to age-5 were released as well.

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

The objectives of the PSPAP are as follows: 1) document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System; 2) document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage; 3) document population structure and dynamics of pallid sturgeon in the Missouri River System; 4) evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system; 5) document annual results and long-term trends of habitat usage of the native target species by season and

life stage; and 6) document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals. Results from the PSPAP will serve a valuable role in the collection and assembly of biological information to facilitate recovery of pallid sturgeon.

Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 through 4 lie in RPMA 2 and includes the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 and 6, that lie in RPMA 3, and consisting of the 55 river miles from Fort Randall Dam, South Dakota, downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only segment below Gavins Point Dam that is not channelized. Segments 8 through 14 include the entire channelized portion (750 miles) of the Missouri River that extends from Lower Ponca Bend to the confluence with the Mississippi River. The lower Kansas River, from Lawrence, Kansas to the mouth (40.0 miles), was given its own segment designation (segment 11) because this tributary was addressed by the 2000 Bi-Op as a high priority management area for pallid sturgeon. Segments 1 through 4 and 5 through 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by several impoundment and tailwater areas interdispersed by a meandering, often braided channel that lacks navigation structures and deep pools. The lower sampling universe is channelized, has revetted banks, and deep scour pools and sand bars that are associated with a variety navigation structures. Segments 5-7 of the lower sampling universe are influenced by reservoirs and are unchannelized. Segments 8-14 comprise the channelized portion of the Missouri River. This document reports activities during the 2007 sampling season specific to segment 10.

Segment 10 lies within RPMA 4 and consists of the 39 named river bends of the lower Missouri River between the confluence of the Kansas River (RM 367.5) and confluence of the Grand River (RM 250.0). River bends in this segment ranged from 1.1 to 6.5 miles in length with a mean bend length of 3.0 miles. Within segment 10, the USACE maintains a 9-foot-deep river channel for navigation traffic, bank revetment along the outside bends of the river, and various dike structures have been constructed to create a self-cleaning

navigation channel. Structures in this segment included kicker dikes, L-dikes, wing dikes and rootless dikes, some of which have been notched or otherwise modified to increase habitat diversity. There are few islands and side channels in this segment, but expansive sand bars exist in some areas and are often exposed depending on river stage.

SEGMENT 10

Methods

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

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 01 November 2006 or when water temperatures dropped below 12.8°C (55°F) and continued through 30 June 2007. The fish community season began 01 July 2007 and continued through 31 October 2007. The Missouri Department of Conservation sampled both seasons during 2007, thus, data from both sampling seasons are included in this report. Data from 2005 and 2006 are also included in this report for annual comparisons. During these seasons, standard gear types included experimental gill nets, 1-inch trammel nets, 16-foot otter trawls, and mini-fyke nets (Appendix C). Gill nets were the only sampling gear that would have been used during the sturgeon season until 01 March 2007. The beginning of this season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts would have began 16 January and continued until water temperatures reached 12.8°C (55°F). Trammel netting and trawl efforts began 01 March 2007 and were conducted through 30 June.

Fish community season began 01 July 2007 and continued through 31 October 2007. Although this season utilized gears that capture sturgeon species (i.e., 1-inch trammel nets and otter trawls), particularly small (i.e., juvenile or young) sturgeons, there was an additional emphasis placed on assessing the associated fish community. Standard gear types during the fish community season included 1-inch trammel nets, 16-foot otter trawls and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season with efforts made to spatially and temporally distribute sampling across the 10 randomly selected bends within the segment.

In addition to pallid sturgeon, the Team identified members of the associated fish community that were of particular interest due to their ecology (e.g., obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when practicable and measured for total length (TL) except sturgeon that were measured for fork length (FL) and paddlefish *Polyodon spathula* that were measured for eye-fork length. Shovelnose sturgeon, blue suckers, and sauger were weighed to the nearest 1 g.

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

In addition to meristic and morphometric measurements, all pallid sturgeon were examined for elastomer (color, orientation, and side of fish), coded wire (CWT), and passive integrated transponder (PIT) tags. If no tags were present, a PIT tag was implanted at the

base of the dorsal fin and a 1-cm² piece of tissue was removed from the trailing edge of the caudal fin for genetic analysis. Before each pallid sturgeon was released, voucher pictures were taken from a lateral and ventral view of the fish with a summary of capture information (e.g., PIT tag number, location, date, CI-score, etc.).

Sampling Site Selection and Description

Site selection.

Beginning with the 2007 sampling season, twenty-five percent of bends from each segment were randomly selected as bends to be sampled within each sampling season. For example, segment 10 has a total of 39 named river bends (Appendix I). Ten river bends were selected to deploy all gears in for sturgeon and fish community sampling seasons. MDC and NGPC conducted sampling in segment 9. This segment has 80 named river bends and the twenty selected for sampling are divided. Other segments selected bends in the same fashion throughout the Missouri River to sample for the 2007 season.

Within each randomly selected river bend in segment 10, sampling locations were selected based on the availability of standard habitats for each gear type. Due to varying lengths of each bend, proportionate sampling was implemented for gears targeting sturgeon in 2007 to gain a better representative sample for each bend. Additional subsamples were deployed for otter trawl and trammel nets depending upon the length of the bend, with an average of one subsample for every 0.3 river miles sampled. A minimum of two subsamples were collected within each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if six subsamples were conducted in the inside bend within the influence of wing dikes and there were 12 wing dikes, approximately every other wing dike would be sampled. For most gear types, at least two subsamples were conducted in the channel crossover and six or more within the inside bend (8 – 16 subsamples per bend depending upon bend length). Minimal deployments of gillnets, otter trawls, and mini-fyke nets were made on the outside bend due to the proximity of the thalweg to the bank (i.e., lack of sand bars and/or a channel border).

Site description.

Sampling sites were described using a three-tiered (macro-, meso-, and microhabitat) classification system that was based on the Missouri River Benthic Fish Study (Berry and Young 2001). Within this habitat designation system, by definition each river bend contained the following three continuous macrohabitats: main channel crossover (CHXO), inside bend (ISB), and outside bend (OSB). The channel crossover was the area where the thalweg crossed from one concave side of the river to the other. The inside bend was the convex side of the river and the outside bend was the concave side of the river. Classifications for discrete macrohabitats that may not be present in every bend included: braided channel (BRAD), tributary confluence (CONF), dendritic channel (DEND), deranged channel (DRNG), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), non-connected secondary channel (SCN), large tributary mouth (TRML) and small tributary mouth (TRMS). Braided channels were areas with multiple channels and an unidentifiable main channel. Tributary confluences were areas where tributaries influenced physical features (e.g., temperature, turbidity, sand bars, etc.) in the Missouri River for up to one bend in length downstream from the tributary mouth. Dendritic and deranged channels were transitions from a meandering channel to a tree-like pattern of multiple channels and vice versa, respectively. Large, connected secondary channels were channels that carried less water than the main channel, were open on both ends, and had flowing water with water depths greater than 1.2 m. Small, connected secondary channels were defined similarly to SCCL, but water depths did not exceed 1.2 meters. Non-connected secondary channels were channels that were blocked on one end. Large tributary mouths were areas within tributaries, with an annual discharge that exceeded $20 \text{ m}^3/\text{s}$ and extended 300-m upstream from the confluence with the main river. Small tributary mouths were areas within 300 m of the confluence with the main river, were greater than 6 m in width, and had an annual discharge less than $20 \text{ m}^3/\text{s}$.

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

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

Microhabitats were identified using a six-digit numeric code. The first three digits of this code described the general habitat structure (e.g., kicker dike, wing dike, sand bar, etc.) with which the gear deployment was associated. The last three digits described the exact location of the gear in relation to this structure (e.g., wing-dike pool, open water inside eddy, sand-bar crown, etc.). For complete definitions of each microhabitat type see Drobish (2007a,b).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 through 4, 5 through 7, and 8 through 14) in which each gear type could be deployed (Drobish 2007a). For segment 10, standard macrohabitats for 1-inch trammel nets included: CHXO, CONF, ISB, OSB, and SCCL. Within these macrohabitats, only CHNB and ITIP mesohabitats were standard. Otter trawls were standard in these macro- and mesohabitats as well as in TRML macrohabitats. Standard macrohabitats for mini-fyke nets included: CHXO, CONF, ISB, OSB, SCCL, SCCS, SCN, TRML, and TRMS. The only standard mesohabitat for this gear type was BARS.

Sampling Gear

Standard gill nets were set primarily parallel with flow downstream from structures (rock dikes) and along the channel border (channel sand bars). Gill nets were anchored to rock dikes from the upstream end. Nets were anchored on the downstream end as well to ensure complete extension during the sampling period. A line and buoy were attached to the downstream end to mark the net and for retrieval. In segment 10 during the 2007 sturgeon season, gill nets were used as standard gear in CHXO, ISB, OSB and SCCL macrohabitats and CHNB, ITIP, and POOL mesohabitats. The standard gill nets were 30.5 m (100 ft.) in length, 2.4 m (8 ft.) deep, constructed from multifilament nylon mesh and contained four panels. Each panel was 7.6 m (25 ft.) with mesh size of 38.1 mm (1 in.) Panel 1, 50.8mm (2 in.) Panel 2, 76.2 mm (3.0 in.) Panel 3, and 101.6 mm (4.0 in.) Panel 4. Panels repeat (5 through 8) in double length nets with 38.1mm, 50.8mm, 76.2mm, and 101.6mm mesh sizes

in panels 5, 6, 7, and 8, respectively. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line. Standard effort is calculated with a 30.5 m (100 ft.) net (1 net night). Sets made with 61 m (200 ft.) nets counted as double effort (2 net nights). The first panel (1, 4, or 8) deployed out of the boat for a set site was selected randomly and recorded. Gill nets were set overnight for a maximum of 24 hours.

Trammel nets were deployed off the bow of the boat by throwing a buoy attached to a 10-m line and motoring in reverse perpendicular to the flow toward the bank. A second buoy and line on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. In segment 10 during the 2007 fish community and sturgeon seasons, trammel nets were used as standard gear in CHXO, ISB, OSB and SCCL macrohabitats and CHNB and ITIP mesohabitats. Trammel nets (i.e., 1-inch trammel nets) were 38.1 m (125 ft.) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in.) bar mesh (#139 twine) that was 2.4-m deep (8 ft) and the outer wall was 203-mm (8 in.) bar mesh (# 9 twine) that was 1.8 m (6 ft.) in depth. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line.

Otter trawls were deployed from the stern of a custom-designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and line were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and on channel sand bars. The towing warp consisted of 13-mm low-stretch nylon line with a 13.7-m bridle. In segment 10 during the 2007 fish community and sturgeon seasons, otter trawls were used as standard gear in CHXO, ISB, OSB and SCCL macrohabitats and CHNB and ITIP mesohabitats. Standard trawl hauls ranged from a minimum distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom-designed skate balloon otter trawl with a 4.9-m (16 ft.) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.).

Mini-fyke nets were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. The lead length was adjusted so the top of the cab would rise above the water surface to minimize turtle mortalities. In areas with moderate

flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the cab to prevent the net from overturning. The perpendicular distance measured from the midpoint of the cab to the bank was recorded. Nets were generally set in the afternoon and left overnight with a maximum soak time of 24 hours. In segment 10 during the 2007 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, SCCS, and TRMS macrohabitats and BARS mesohabitats. Mini-fyke nets were constructed from 3-mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the cab. The body of the net was constructed with two 0.6 m steel hoops, with a single, 51-mm throat. The lead was 4.5-m in length and 0.6 m in height.

Data Collection and Analysis

Associated Environmental Data

For every subsample, water depth and temperature that were recorded. Additional habitat data were collected for a minimum of 25% of subsamples within each mesohabitat within each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in segment 10, habitat data were generally collected for one subsample in the channel crossover and two to four subsamples for the inside bend. In addition to the collection of habitat data for randomly selected subsamples, these data were also collected for all subsamples that captured a pallid sturgeon. These habitat data collections were recorded as non-random and were not included toward meeting the 25% minimum of subsamples in that bend.

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

nets, trammel nets, and otter trawls. This parameter was recorded at the bottom and 60% of the water column for mini-fyke nets.

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

Genetic Validation

All pallid sturgeon captured that did not appear to be previously marked were considered to be unknown fish pending genetic verification. Tissue samples collected at time of capture were subsequently sent to the USFWS Abernathy Fish Technology Center, Washington, to genetically determine the origin of the fish (i.e., hatchery-stocked or wild). Results for pallid sturgeon captured during the 2007 sampling season were still pending at the time of this report.

Relative Condition

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

$$K_n = W/W'$$

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

Relative Stock Densities

Relative stock densities were calculated for pallid and shovelnose sturgeon captured during the 2007 season. Relative stock density was calculated as:

$$\text{RSD} = \text{number of fish} \geq \text{specified length} / \text{number of fish} \geq \text{minimum stock length} \cdot 100$$

(Anderson and Neumann 1996). Minimum length specifications for pallid sturgeon were: stock = 330 mm; quality = 630 mm; preferred 840 mm; memorable 1,040 mm; trophy =

1,270 mm as reported by Shuman et al. (2006). For shovelnose sturgeon, minimum length specifications were: stock = 250 mm; quality = 380 mm; preferred = 510 mm; memorable = 640 mm; trophy = 810 mm as reported by Quist et al. (1998). In addition to these categories, two sub-stock length ranges for each species were defined by the PSPAP. Sub-stock categories were subdivided into 0 to 199 mm and 200 to 329 mm for pallid sturgeon and 0 to 149 mm and 150 to 249 mm for shovelnose sturgeon.

Analyses

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

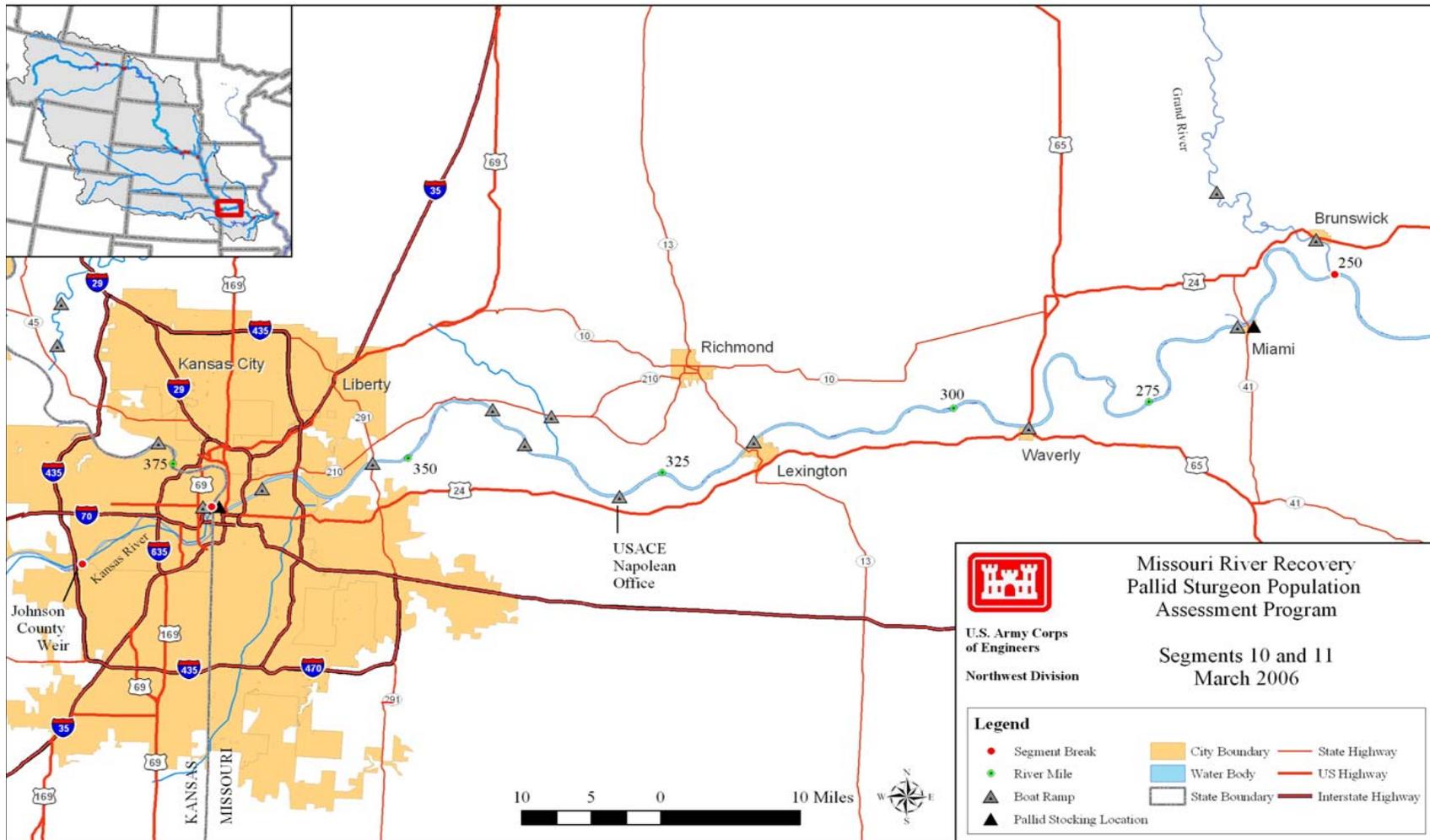


Figure 1a. Map of segment 10 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 10 compasses the Missouri River from the Kansas River (River Mile 367.5) to the Grand River (River Mile 250.0).

Results

Pallid Sturgeon

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

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

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

Eight hatchery-stocked pallid sturgeon and two pallid sturgeon of unknown origin (unknowns; awaiting genetic verification) were captured during the 2007 sampling season (Figure 9). During sturgeon season (November 1 – June 30), seven pallid sturgeon were captured. This is comparable to 2006 sturgeon season catch of ten pallid sturgeon. During 2007 fish community season (July 1 – October 31), three pallid sturgeon were captured, similarly compared to 2005 (N = 4) and 2006 (N = 1). No pallid sturgeon captured thus far in segment 10 have been confirmed as wild fish. In 2006, four hatchery and seven unknowns were captured. Three hatchery fish and one unknown origin pallid sturgeon were captured during the short 2005 sampling season.

Sampling during 2007 in segment 10 occurred between river miles (RM) 354.1 and 253.3, with pallid sturgeon capture locations ranging throughout this reach, from RM 353.7 to 250.7 (Figure 1b). Six of these fish were captured in three bends. Two were captured in Brunswick Bend (RM 253.3), one in September and one in March. Two were captured in Sibley Bend (RM 337.1), capture times separated by six months. Two pallid sturgeon were captured at Liberty Bend, both on the same day. One of these fish was sent to Neosho National Fish Hatchery to be used for broodstock; however, the fish was not reproductively viable at that time.

The hatchery-stocked pallid sturgeon ranged in size from 374 – 708 mm. These consisted of three fish from the 2001 year class (613 – 708 mm), two from the 2002 year class (541 – 652 mm), and one from the 2004 year class (374 mm). This past year (2007), was the first year a fish from the 2001 year class has been captured in Segment 10. The

hatchery, year class, and stocking site information could not be determined for two genetically-determined hatchery-stocked fish because we failed to detect a PIT tag. Both the 2001 and 2002 year classes were spawned at Garrison National Fish Hatchery. These fish were released a year later (April 2002 and July 2003, respectively) at Boonville, MO, except for one fish from the 2001 year class that was released at Bellevue, NE in April 2002. The 2004 year class was spawned at Neosho National Fish Hatchery, and released at Miami, MO in September 2005. One fish (stocked in 2001 at Bellevue, NE) moved 301 miles downstream in approximately 5 years, the longest movement by any hatchery-stocked pallid captured in segment 10 during 2007, and the only fish to move downstream. The other fish stocked at Boonville and Miami moved upstream from their stocking locations, traveling from 17 to 140 miles. The youngest fish captured (2004 year class) has the lowest travel distance at time of capture, moving 17 miles upstream from Miami, MO.

As in 2005 and 2006, relative condition factor (K_n) for hatchery-stocked pallid sturgeon captured in 2007 was inversely related to time-at-large (Table 6; Kennedy et al. 2006, Caton et al 2007). The K_n value for the 2001, 2002, and 2004 year classes was 0.79, 0.89, and 0.99, respectively. These results are very similar to 2006, that showed the 2002 year class ($N = 2$) to have a K_n of 0.85, and 2004 year class ($N = 1$) was 0.90. The unknown pallid sturgeon had relative condition factors of 0.73 and 0.79. As in the previous two years' results, daily growth was inversely related to age. In 2007, the 2001 (age 6), 2002 (age 5), and 2004 (age 3) year classes had growth rates of 0.22, 0.24, and 0.32 mm/ day, respectively. The 2002 year class growth has increased every year, from 0.20 mm/ day in 2005 (age 3), 0.22 mm/ day in 2006 (age 4) to 0.24 mm/ day in 2007 (age 5). This seems odd, however, the data are only from a five fish across all three years. The 2004 year class captured in segment 10 ($N = 4$) shows more predictable results, with their growth per day decreasing with age.

Stock-size (330 – 629 mm) was the most frequently captured size-class of pallid sturgeon (Table 7). Relative condition factor of fish captured during sturgeon season was similar among all size classes, averaging 0.85. The relative condition was lower of fish captured during fish community season (0.73).

The ratio of pallid sturgeon (hatchery-stocked and unknown) to shovelnose sturgeon captured in segment 10 during the 2007 sampling season was 1:209. The ratio has more than doubled compared to 2006 (1:102), due to many more shovelnose being captured in 2007.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for segment 10 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	10	11.0	N-E	33	N-E	N-E	N-E	74	1	2	0	0	0	0	0	N-E
Gill Net	10	10.0	N-E	26	N-E	N-E	N-E	68	5	1	0	0	0	0	0	N-E
Otter Trawl	10	10.9	N-E	31	N-E	N-E	N-E	71	3	4	0	0	0	0	0	N-E
Summer – Fish Community Season																
1 Inch Trammel Net	10	11.7	N-E	30	N-E	N-E	N-E	87	0	0	0	0	0	0	0	N-E
Mini-Fyke Net	10	8.0	N-E	25	N-E	N-E	N-E	30	16	0	5	0	0	0	4	N-E
Otter Trawl	10	10.7	N-E	24	N-E	N-E	N-E	79	2	2	0	0	0	0	0	N-E

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segment 10 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	10	11.0	0	108	N-E	2	0	N-E
Gill Net	10	10.0	0	37	N-E	1	62	N-E
Otter Trawl	10	10.9	0	108	N-E	1	0	N-E
Summer – Fish Community Season								
1 Inch Trammel Net	10	11.7	0	117	N-E	0	0	N-E
Mini-Fyke Net	10	8.0	79	1	N-E	0	0	N-E
Otter Trawl	10	10.7	0	105	N-E	2	0	N-E

Segment 10 - Pallid Sturgeon Captures by River Mile

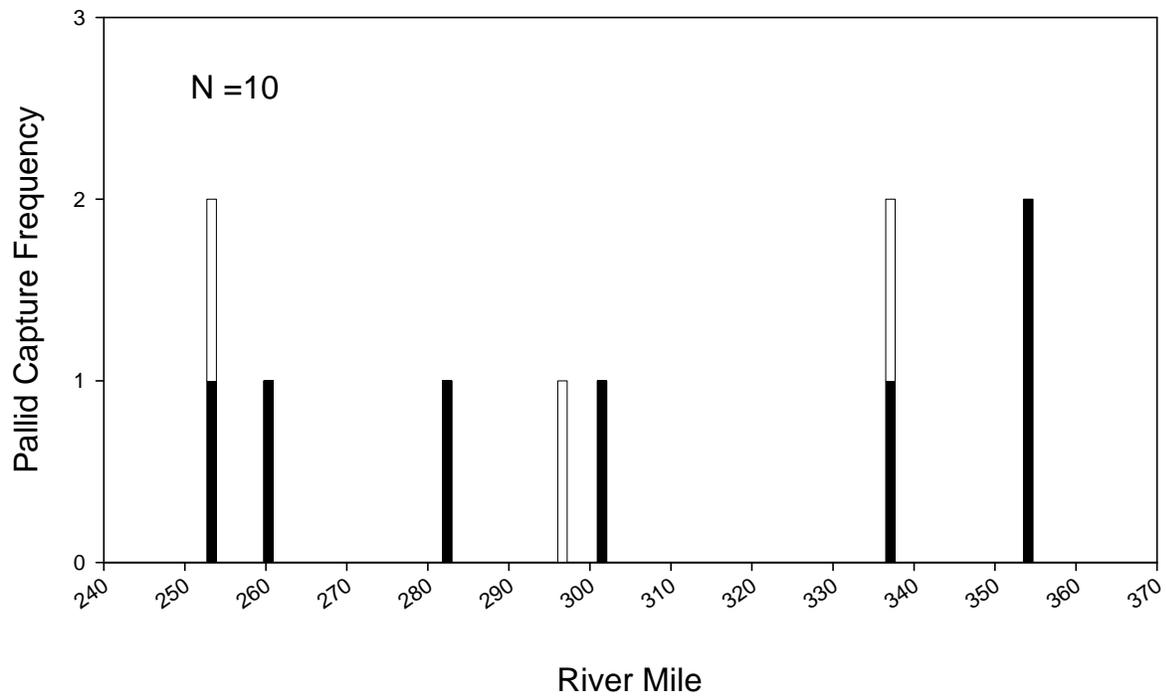


Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 10 of the Missouri River during 2006-2007. Black bars represent pallid captures during sturgeon season and white bars during fish community Season. Figure included all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2006-2007. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
BRAD	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
CHXO	BAR	0.6 (0.3-1.4)		0.06 (0.00-0.26)		26.4 (12.3-34.6)		110 (18-270)		.
	CHNB	3.4 (0.4-8.1)		0.43 (0.01-1.20)		24.0 (3.0-31.0)		155 (21-691)		.
	DTWT									.
	ITIP									.
	POOL	3.6 (1.6-8.8)	3.7 (3.3-4.1)	0.33 (0.01-0.67)	0.28 (0.12-0.45)	8.5 (3.0-12.5)	8.6 (7.8-9.3)	122 (27-420)	104 (29-180)	2
	TLWG									.
CONF	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.

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
	POOL									.
	TLWG									.
DEND	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
DRNG	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
ISB	BAR	0.5 (0.2-1.8)		0.14 (0.00-0.77)		25.8 (12.0-31.0)		146 (26-302)		.
	CHNB	2.6 (0.7-6.5)	2.1 (1.8-2.7)	0.58 (0.02-1.20)	0.72 (0.60-0.81)	24.1 (3.0-30.8)	20.4 (11.3-26.3)	172 (19-1346)	157 (31-271)	5
	DTWT									.
	ITIP	1.2 (1.2-1.2)				15.5 (15.5-15.5)				.

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
	POOL	4.8 (1.7-11.5)	4.7 (4.3-5.2)	0.26 (0.00-0.73)	0.20 (0.00-0.40)	7.7 (3.5-12.5)	8.0 (6.0-9.3)	106 (20-359)	145 (35-359)	3
	TLWG									.
OSB	BAR	0.6 (0.2-1.6)		0.06 (0.00-0.24)		25.6 (12.6-31.0)		167 (38-289)		.
	CHNB	3.8 (1.1-9.8)		0.64 (0.41-0.98)		21.9 (4.0-29.0)		143 (19-203)		.
	DTWT									.
	ITIP									.
	POOL	4.3 (3.0-5.3)		0.06 (0.02-0.10)		10.1 (8.3-12.5)		113 (22-222)		.
	TLWG									.
SCCL	BAR	1.0 (1.0-1.0)				23.4 (23.4-23.4)				.
	CHNB	2.6 (2.2-3.1)		0.63 (0.60-0.66)		26.6 (25.8-27.3)		158 (135-182)		.
	DTWT									.
	ITIP	2.4 (1.2-3.4)		0.59 (0.52-0.74)		23.6 (8.3-28.2)		138 (38-215)		.
	POOL									.
	TLWG									.

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
SCCS	BAR	0.6 (0.3-1.5)		0.19 (0.01-0.63)		27.4 (22.8-29.0)		89 (22-229)		.
	CHNB									.
	DTWT									.
	ITIP	1.6 (1.6-1.6)				4.0 (4.0-4.0)				.
	POOL									.
	TLWG									.
SCN	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
TRIB	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.

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
TRML	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
TRMS	BAR	0.4 (0.4-0.5)		0.03 (0.02-0.04)		24.5 (19.9-29.0)		570 (28-1112)		.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
WILD	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.

Table 6. Mean fork length, weight, relative condition factor (Kn), growth rates, and water temperature for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from segment 10 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2 SE) 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)
2001	2	233.3	.	.	640.5	790.3	0.84	0.221	.
		13.33	.	.	54.13	15.0	0.07	0.029	.
2002	2	278	.	.	597	800	0.886	0.241	.
		15	.	.	111	500.0	0.018	0.055	.
2003									
2004	1	241	48.0	1.156	374	180.0	0.991	0.323	0.320
	
2005									
2006									

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

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	0	.	0
Stock	4	57	0.886 (0.073)
Quality	2	29	0.810 (0.170)
Preferred	1	14	0.789
Memorable	0	.	0
Trophy	0	.	0
Overall Kn	.	.	0.850 (0.063)
Fish Community Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	0	.	0
Stock	0	.	0
Quality	3	100	0.729 (0.037)
Preferred	0	.	0
Memorable	0	.	0
Trophy	0	.	0
Overall Kn	.	.	0.729 (0.037)

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

^b Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL < 330 mm (20 %), Stock FL = 330 - 629 mm (20 - 36 %), Quality FL = 630 - 839 mm (36 - 45 %), Preferred FL = 840 - 1039 mm (45 - 59 %), Memorable FL = 1040 - 1269 mm (59 - 74 %), Trophy FL \geq 1270 mm (>74 %).

Year comparisons, Gear evaluation and Habitat associations

Six pallid sturgeon were captured using gill nets during the 2007 sampling season. A total of 6096 meters of gill nets were deployed and left overnight in 10 bends, an average of 609.6 meters per bend. Catch-per-unit-effort (CPUE) for hatchery-stocked pallid sturgeon in gill nets was 0.020 fish/ net night. Unknown pallid sturgeon were captured at a rate of 0.010 fish/ net night. It is difficult to compare these rates of capture to the 2006 results, because so few fish have been assigned a genetically-confirmed origin. Gill nets captured fish in a wide range of sizes, from 374 – 859 mm. This includes the smallest pallid sturgeon captured in segment 10 in 2007, as well as the largest (the potential broodstock fish).

Trammel nets were the only gear to capture pallid sturgeon during fish community season (N = 3), and one fish was captured during sturgeon season. During 2007 sturgeon season, ten bends were sampled with 14,652 drifted meters of trammel nets, an average of 1,465.2 meters/ bend. This resulted in an average of 0.006 hatchery-stocked pallid sturgeon (N = 1) per meter of drifted net (Figure 3). This was the first year that pallid sturgeon were captured in trammel nets during sturgeon season. In fish community season, 13,788 meters of trammel nets were drifted in ten bends. This effort resulted in the capture of three hatchery-stocked pallid sturgeon, with the highest pallid capture-rate average at 0.023 fish/ 100 drifted meters (Figure 5). This is roughly one-third more fish than were captured in 2005, when 0.013 fish/ 100 m were captured. No pallid sturgeon were captured in trammel nets during 2006.

Otter trawls were used during sturgeon season (17,005 trawled meters) and fish community season (17,872 trawled meters), however no pallid sturgeon were captured by this gear in 2007. During fish community season in 2005, hatchery-stocked and unknown fish generally the same CPUE, 0.004 and 0.003 fish/ 100 m, respectively (Figure 5). The catch increased in 2006, going up to 0.014 fish/ 100 m. No pallid sturgeon have been captured in a mini-fyke net in segment 10 (Figure 7).

Inside bend, channel cross-over, outside bend, and large secondary connected side channel macrohabitats were sampled with gears targeting pallid sturgeon (i.e. 1 inch trammel nets, gill nets, and otter trawls; Tables 9, 11, 13, and 15). These are the same habitats that were sampled with these gears in 2005 and 2006 and pallid sturgeon have only been captured in two of the four habitats sampled: channel cross-over and inside bend. Across all gear

types and size ranges, 20% of the pallid sturgeon were captured in the channel cross-over, while 80% were captured in the inside bend.

Including all size categories, 33% (N = 2) of the pallid sturgeon we captured in gill nets were in the channel border, and the remaining (67%, N = 4) were captured in the inside bend. This is in approximate proportion to the amount of gill net effort applied to those habitat types (26 and 68% in the channel cross-over and inside bend, respectively). When catch rates are broken down into length categories, however, the catch compared to the effort is disproportionate. Stock-size fish (N = 3) were all captured in the inside bend. Two quality-size fish were captured in the cross-over (67%), while only one was captured in the inside bend. Most of the pallid sturgeon captured in gill nets (N = 5) were found in pools, while only one was captured in the channel border mesohabitat.

All the pallid sturgeon captured during 2007 in trammel nets were found in the inside bend, while only $\frac{3}{4}$ of our effort was expended there. This is the case with the pallid sturgeon captured in 2005: 100% were found in the inside bend where only 70% of the effort was expended. No sturgeon captured by a trammel net in segment 10 has been captured in a channel cross-over habitat. All pallid sturgeon captured by trammel nets were captured in channel border habitats.

Most (N = 9) pallid sturgeon were caught in association with dikes, which is where the majority of our nets are set. More specifically, wing dikes were the area where the most pallid sturgeon were captured, while one was captured behind an L-dike. At the time of capture, most (66%) of the dikes were partially overflowing. One pallid sturgeon in segment 10 was captured at the mouth of a natural chute, which was dry at the time of the capture.

Segment 10 water temperatures when gears targeting pallid sturgeon were deployed ranged from 3.0 to 31.0°C (Table 3). Water temperatures at pallid sturgeon capture locations ranged from 6.0 – 26.9°C, but most (N = 7) were captured below 16°C. In 2006, most of the capture temperatures were between 4 and 8°C. Depths sampled by sturgeon-targeting gears ranged from 1.1 – 9.8 m. Pallid sturgeon were captured in depths ranging from 1.4 – 9.3 m, with an average of 3.4 m. This is similar to the depths from which pallid sturgeon were captured in 2006, which was 1.4 – 7.7 m. The depths in 2005 were more shallow (1.8 – 4.0) due to no gill nets set that year. Turbidity in habitats in which sturgeon-sampling gears were set ranged from 19 – 1346 NTU, much higher than the previous two years' maximums (558

and 331 NTU). The locations where pallids were captured in 2007 also had a higher maximum turbidity reading (27 – 359 NTU) than in 2005 and 2006 (47 – 300 and 40 – 255 NTU, respectively). Bottom velocity for areas that were sampled with gill nets, trammel nets, and otter trawls ranged from 0.0 – 1.20 m/sec in 2007. Pallid sturgeon were found in a smaller range of velocities, from the slowest recorded (0.00 m/sec) to 0.81 m/sec. This is comparable to 2006 data, the only other full year of data collections, where the turbidity at capture locations ranged from 0.01 to 0.84 m/sec.

Segment 10 - Pallid Sturgeon / Sturgeon Season

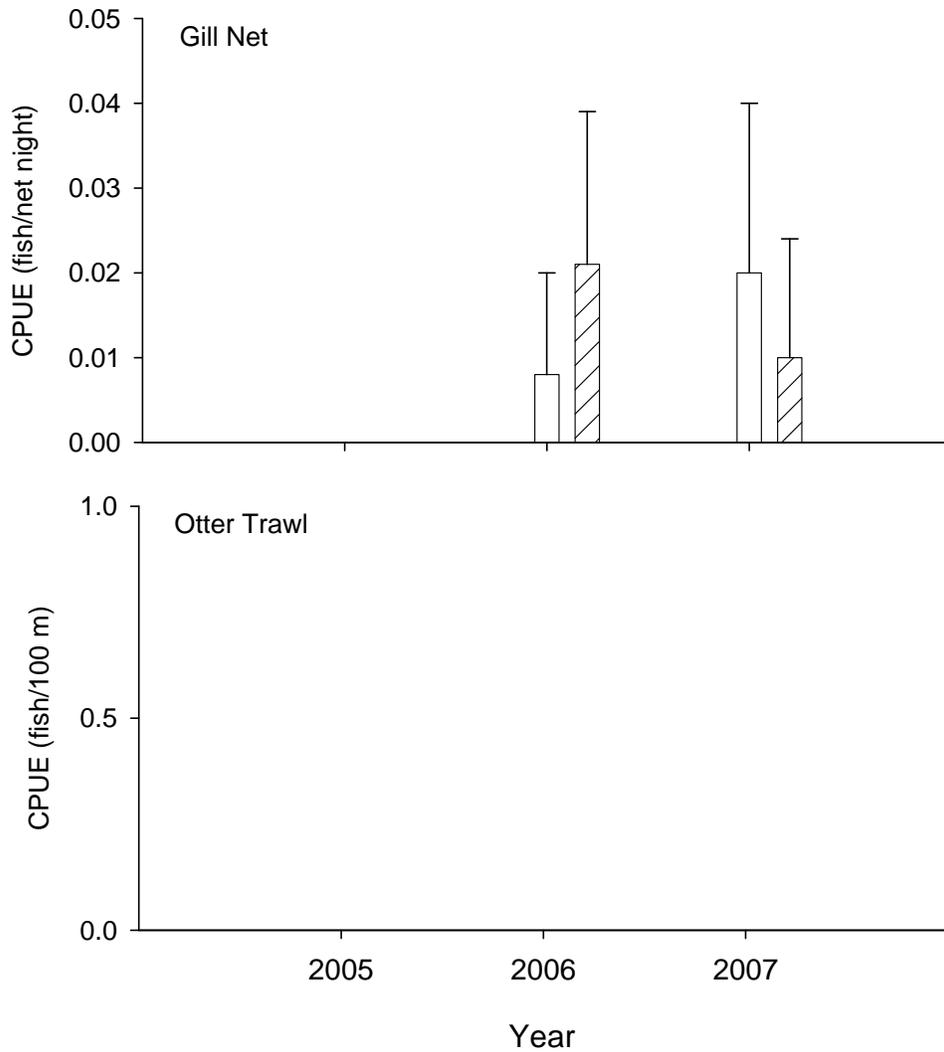


Figure 2. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 10 - Pallid Sturgeon / Sturgeon Season

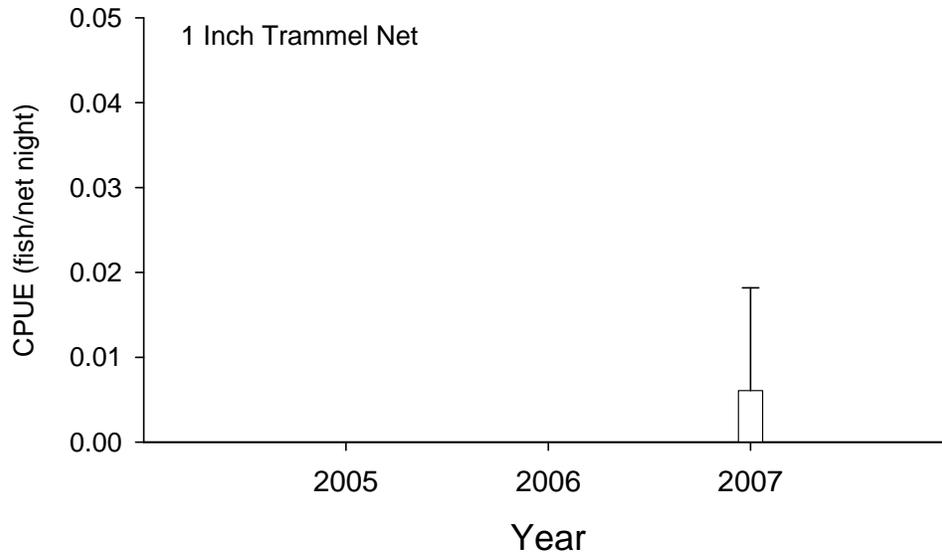


Figure 3. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

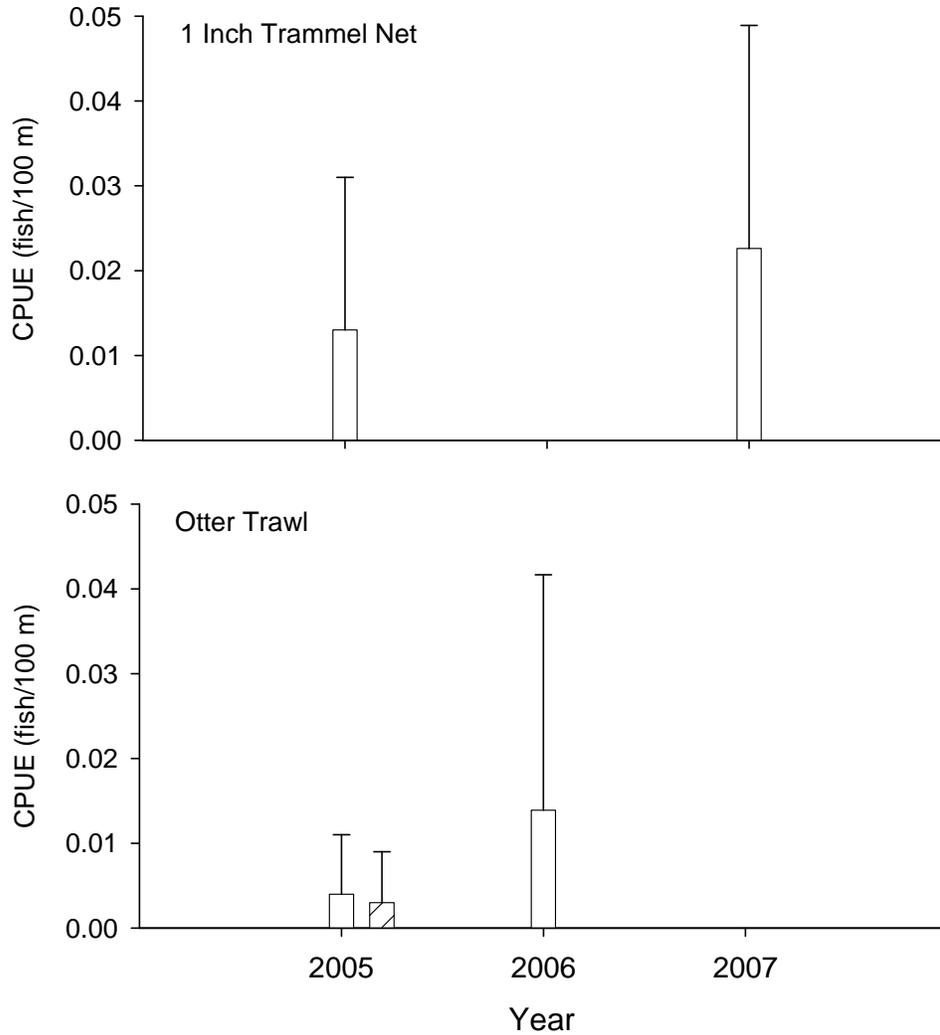


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

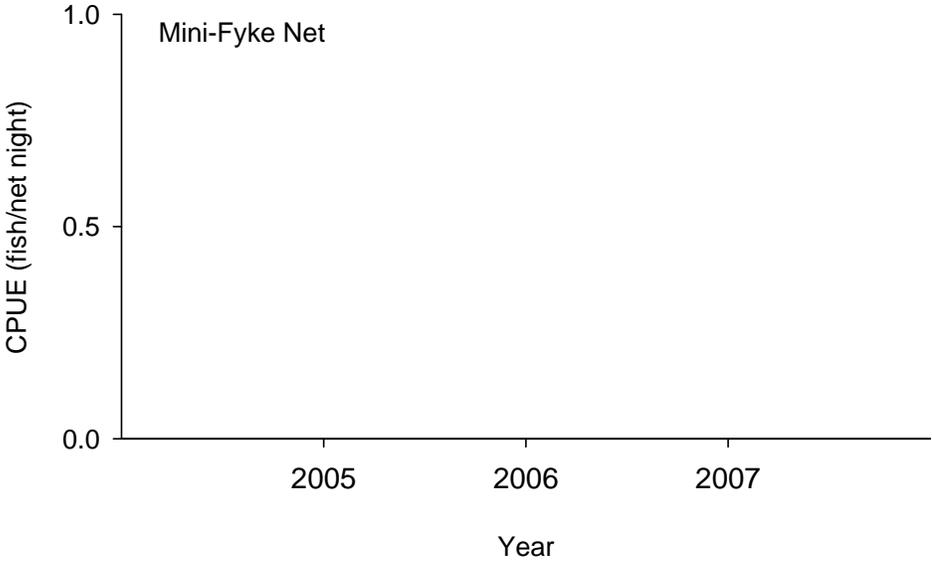


Figure 7. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using mini-fyke nets in segment 10 of the Missouri River during fish community season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Table 9. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	0	0	0	N-E	0	0	0
	.	0	37	N-E	1	62	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	98	N-E	2	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	0	0	0	N-E	0	0	0
	.	0	37	N-E	1	62	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	98	N-E	2	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	3	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1	0	100	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	3	0	33	N-E	0	67	0
	.	0	37	N-E	1	62	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	98	N-E	2	0	0

Table 15. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	3	0	67	0	N-E	N-E	33	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	3	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 16. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	3	0	0	N-E	0	100	0
	.	0	37	N-E	1	62	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	3	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	98	N-E	2	0	0

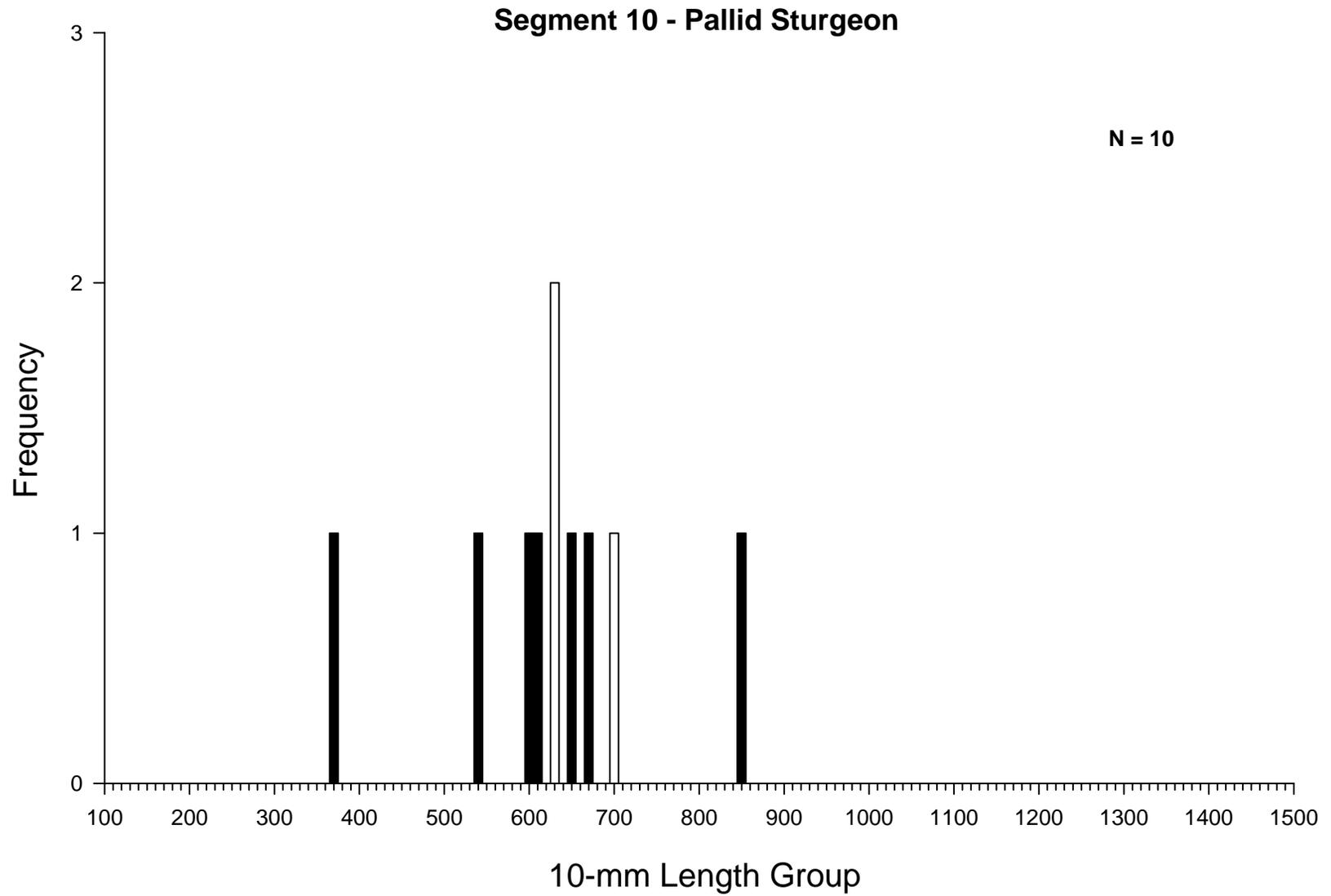


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Segment 10 - Annual Pallid Sturgeon Capture History

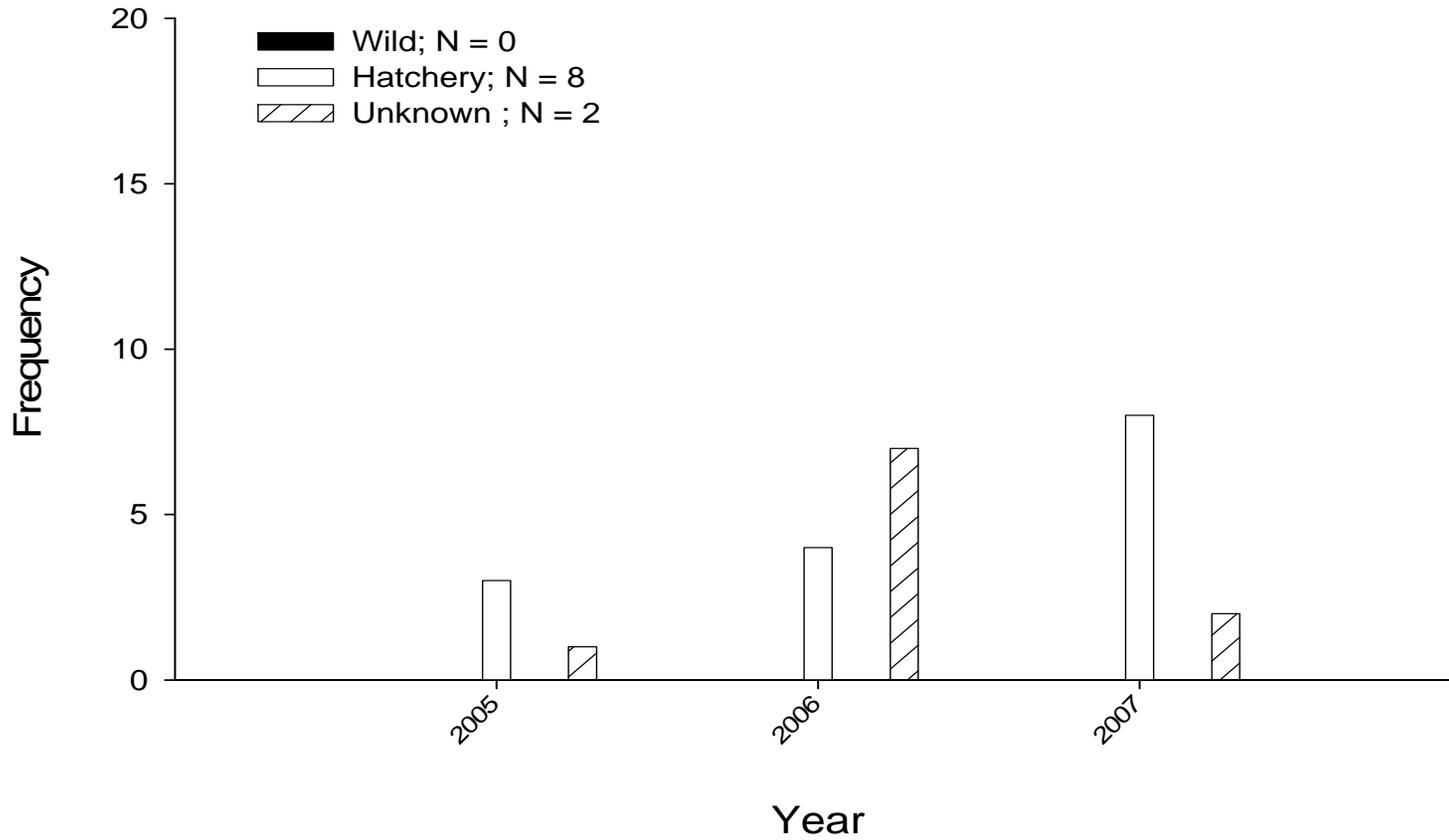


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 10 of the Missouri River from 2006 to 2007. Figure 9 is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

Eleven shovelnose X pallid sturgeon hybrids were captured in segment 10 during the 2007 sampling season. Ten hybrid sturgeon were caught during sturgeon season using gillnets (N = 8) and trammel nets (N = 2); only one was captured in an otter trawl during fish community season. Four fish were captured, on two separate set dates, in CHNB mesohabitat within the CHXO at RM 296.6. Four hybrid sturgeon were captured between RM 337.1 - 332.3 in POOL and CHNB mesohabitats within the ISB. The remaining three fish were captured at RM 301.5, 261.4, and 253.3. Hybrid sturgeon fork length ranged from 565 – 710 mm. Each fish displayed three strong characteristics of a hybrid sturgeon: a somewhat elongated snout, smaller inner barbules and patchy scales on the ventral side. CI scores were calculated for five (0.635, 0.120, 0.423, 0.615, 0.468) of the ten hybrid sturgeon. Morphometrics and meristics were not recorded for the other five fish. Ten fish were captured in association with a wing dike structure, one was captured along a bank line.

Targeted Native River Species

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

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

Shovelnose Sturgeon

Year and gear comparisons

There was a total of 2,086 shovelnose sturgeon captured in 2007, more than any other year of sampling in segment 10 (Figure 17). Gill nets deployed in 2007 captured more fish (N = 1,045) than in 2006 (N = 882). As in 2006, only fish stock-size and greater were captured by gill nets in 2007. The nets were the most effective at capturing quality size and greater (≤ 380 mm) fish, with an average of 5.2 fish per net night, almost a 1.5 fish per-net-night increase from the average in 2006 (3.79 fish/ net night; Figure 11). Catch of smaller size (250 – 379 mm) shovelnose sturgeon decreased, dropping to 0.025 fish/ net night in 2007 from 0.038 fish/ net night in 2006. Fork length of fish captured in gill nets ranged from 333 – 707 mm. This is a decrease in size range from fish captured in gill nets in 2006 (293 – 764 mm).

Otter trawls did not catch as many shovelnose sturgeon as gill nets (N = 180 and 129 for sturgeon season and fish community season, respectively), but captured the largest range of size class of any gear used, from sub-stock to quality and above. During sturgeon and fish community seasons, otter trawls were most effective at catching quality and above sizes across all three years of sampling in segment 10 (Figures 11 and 14). Shovelnose sturgeon catch in otter trawls increased during sturgeon season 2007 and was greater than that observed in 2006. The second-most abundant size class captured in otter trawls during sturgeon season was stock size, and similar catch rates occurred in both sampling seasons. The second-most abundant size class during fish community season was sub-stock size (0 – 149 mm) for all three years of sampling. The highest catch rates for this size class occurred in 2005, with an average of 0.194 fish/ 100 m. The most fish captured in an otter trawl during one season occurred during fish community season 2005 (N = 262), followed by 2007 sturgeon season (N = 180). Otter trawls in 2007 captured the smallest fish during fish community season (19 – 669 mm), and larger fish during sturgeon season (24 – 699 mm). A 19 mm shovelnose sturgeon was the smallest captured in segment 10 since the PSPAP began sampling.

Trammel nets captured the second-most shovelnose sturgeon in 2007. More were captured during fish community season (N = 460) than in sturgeon season (N = 270). There were many more shovelnose captured in trammel nets this year than in 2006 (N = 69 and 78 during sturgeon and fish community seasons, respectively). Trammel nets have captured all size classes of shovelnose sturgeon, but are most effective at capturing quality and above size fish (Figure 12 and 14). Comparing all years and size classes, the most effective season thus far has been fish community season 2007, in which the average catch rate for quality and above size was 3.167 fish/ 100 m. Fish community season 2005 was the only time in which all four size classes of shovelnose sturgeon were represented in 1 inch trammel nets. No shovelnose sturgeon were captured in mini-fyke nets (Figure 15).

Relative stock densities were highest for preferred size class fish (510 – 639 mm fork length) during sturgeon and fish community seasons (Table 25). Barring very small sample sizes, relative weight (Wr) was inversely related to size class, as was the case in 2006 (Wr was not calculated for shovelnose sturgeon captured in 2005).

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

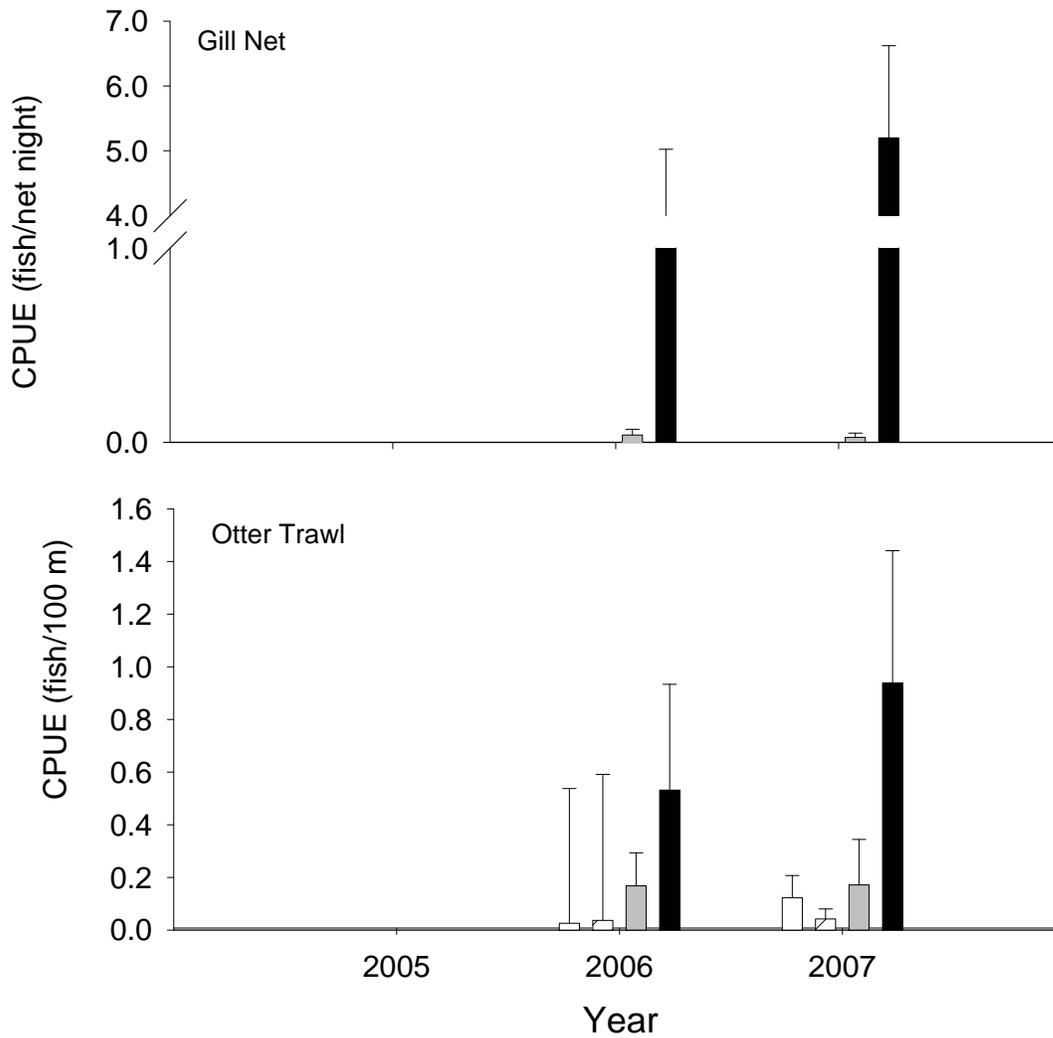


Figure 11. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (≤ 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

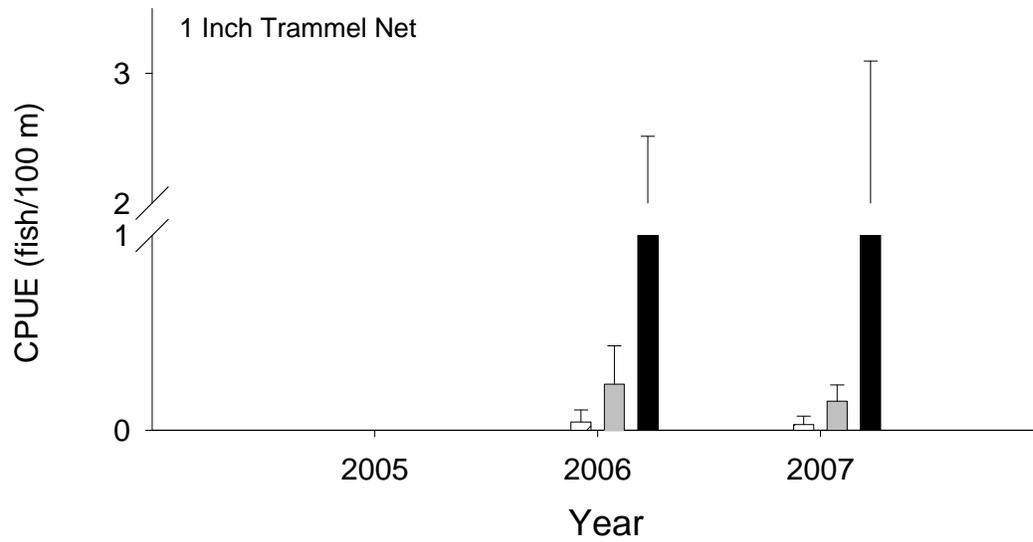


Figure 12. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (≥ 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

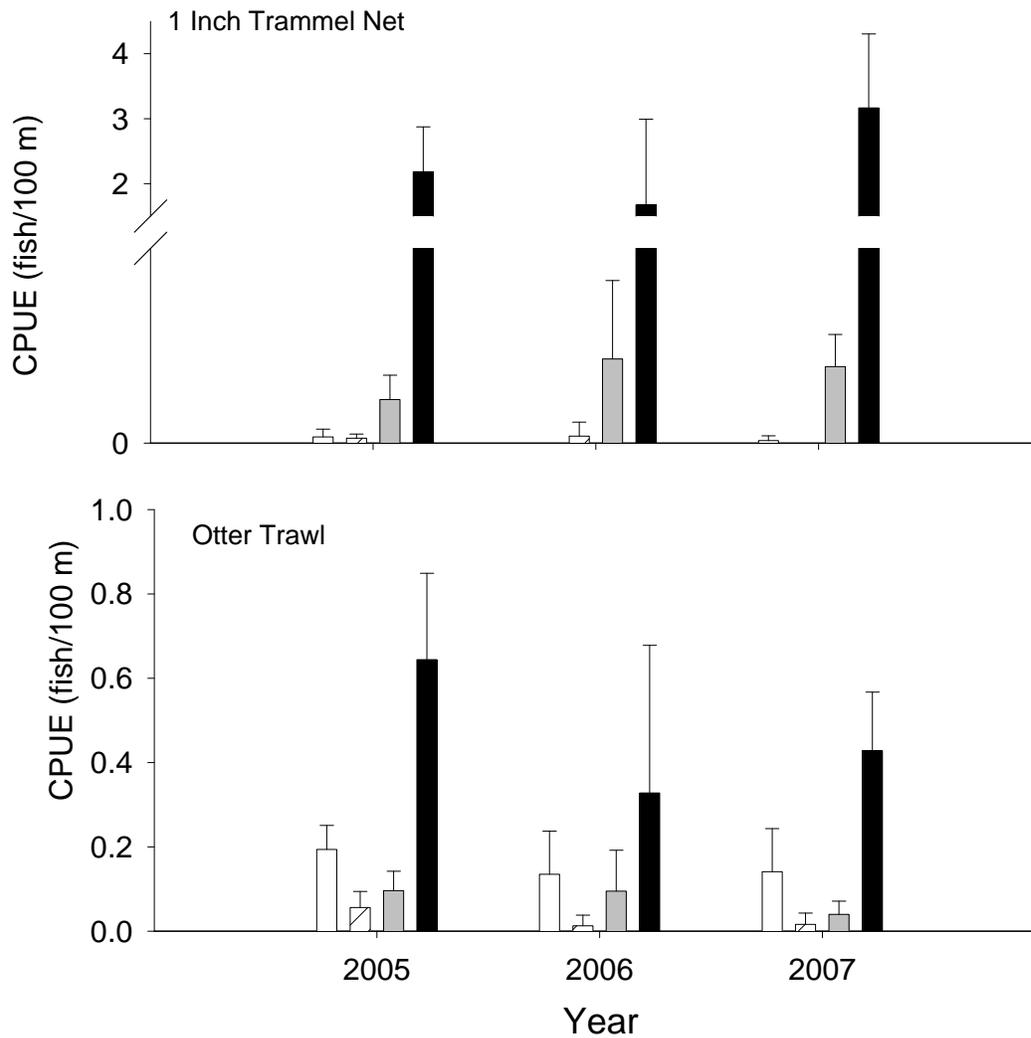


Figure 14. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (≥ 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2006 - 2007.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

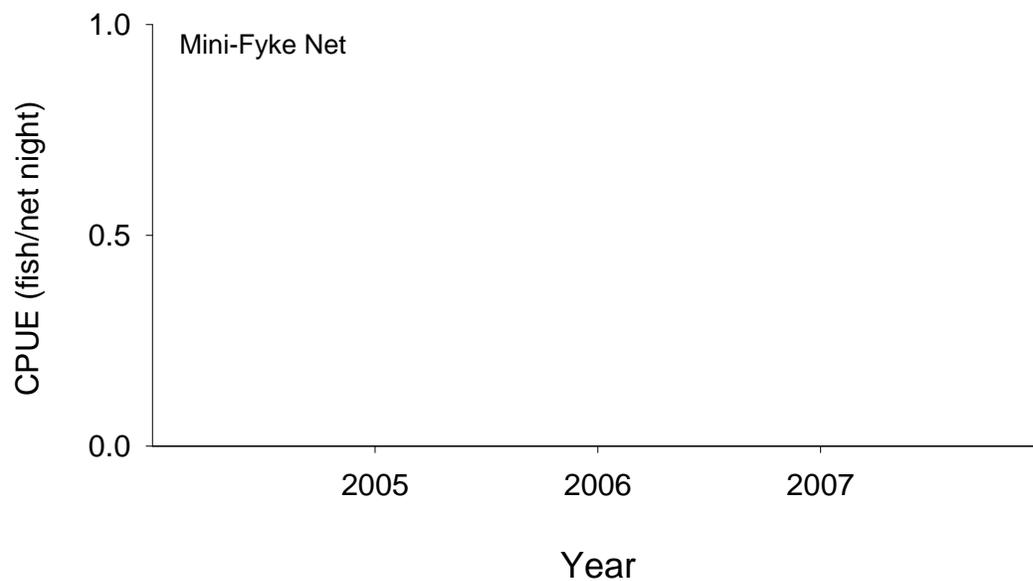


Figure 15. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (≥ 380 mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2006 - 2007.

Habitat Use

Most shovelnose sturgeon were captured in CHXO and ISB macrohabitats (31% and 65%, respectively; Tables 17-24). More shovelnose sturgeon were captured in CHNB mesohabitats than POOL mesohabitats (54 and 45%, respectively). Eighty nine percent of shovelnose sturgeon were captured in habitats influenced by a rock dike. Of these, shovelnose sturgeon were caught more frequently in association with wing dikes, followed by L, rootless and kicker dikes, and highly modified structures (73, 13, 2, 0.4, and 0.4 %, respectively). Twenty percent of shovelnose sturgeon were captured below notched rock dike structures. The remaining shovelnose sturgeon were captured in macrohabitats associated with channel sand bars, banklines and open water areas (6, 4 and 0.4 % respectively) associated with side channels or chutes.

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	19	0	16	0	N-E	N-E	79	0	5	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	26	0	19	0	N-E	N-E	73	8	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	0	0	0	N-E	0	0	0
	.	0	37	N-E	1	62	0
Otter Trawl	19	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	1	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	26	0	100	N-E	0	0	0
	.	0	98	N-E	2	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	3	0	33	0	N-E	N-E	67	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	8	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	3	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	3	0	100	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	0	0	0	N-E	0	0	0
	.	0	37	N-E	1	62	0
Otter Trawl	8	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	3	0	100	N-E	0	0	0
	.	0	98	N-E	2	0	0

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 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	19	0	11	0	N-E	N-E	89	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	5	0	20	0	N-E	N-E	80	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	23	0	70	0	N-E	N-E	30	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	37	0	35	0	N-E	N-E	65	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	9	0	11	0	N-E	N-E	89	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	19	0	84	N-E	16	0	0
	.	0	99	N-E	1	0	0
Gill Net	5	0	40	N-E	0	60	0
	.	0	37	N-E	1	62	0
Otter Trawl	23	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	37	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	9	0	100	N-E	0	0	0
	.	0	98	N-E	2	0	0

Table 23. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	248	0	43	0	N-E	N-E	54	0	4	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	1040	0	32	0	N-E	N-E	64	4	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	130	0	50	0	N-E	N-E	48	2	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	422	0	21	0	N-E	N-E	79	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	5	0	40	0	N-E	N-E	60	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	88	0	17	0	N-E	N-E	68	8	7	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 24. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	248	0	97	N-E	3	0	0
	.	0	99	N-E	1	0	0
Gill Net	1040	0	10	N-E	0	90	0
	.	0	37	N-E	1	62	0
Otter Trawl	130	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	422	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	5	100	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	88	0	93	N-E	7	0	0
	.	0	98	N-E	2	0	0

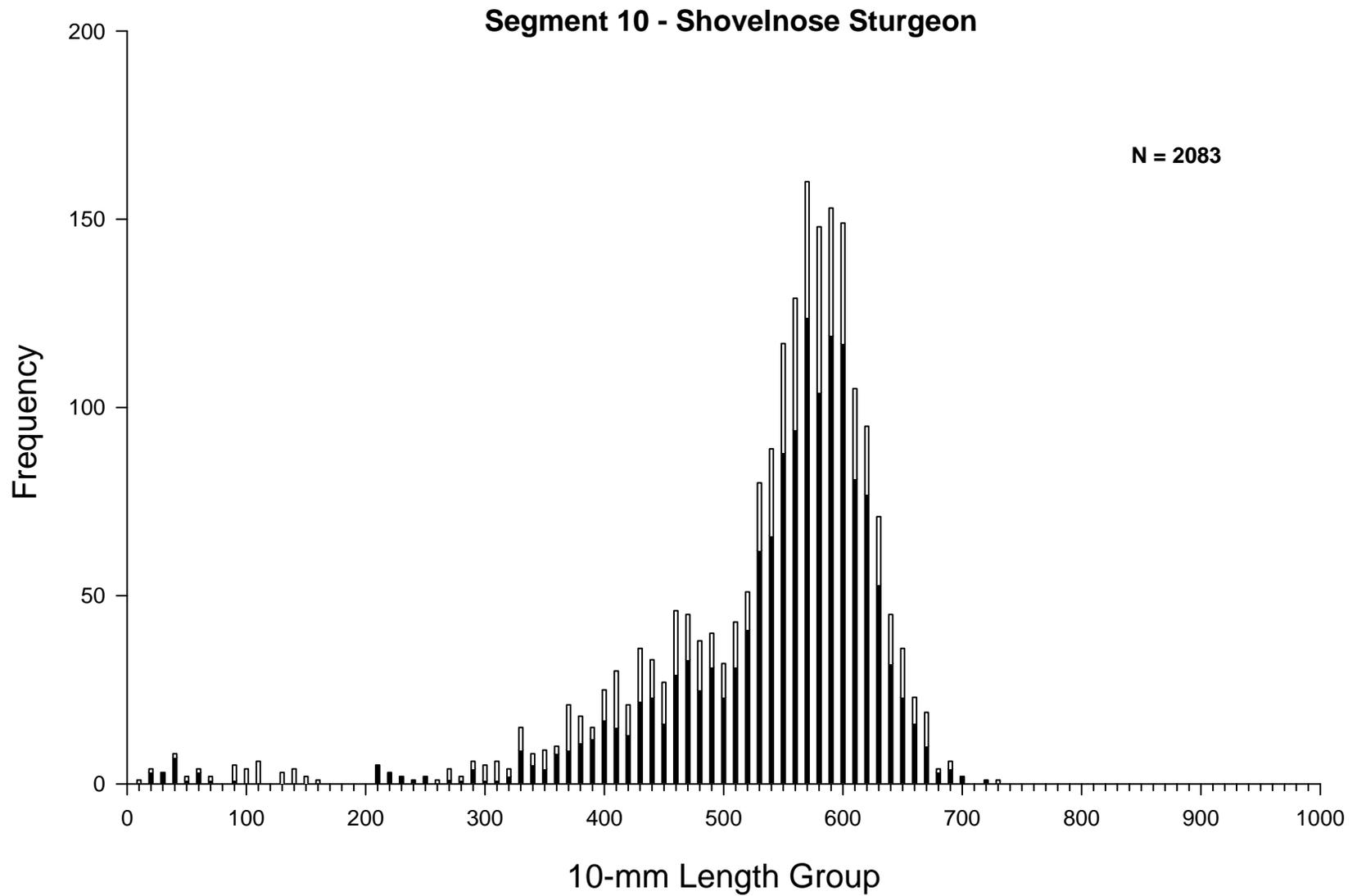


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Table 25. Incremental relative stock density (RSD)^a and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 10 of the Missouri River captured during 2006 – 2007. Length categories^b determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	19	.	.
Sub-stock (150-249 mm)	11	.	97.32 (17.40)
Stock	47	3	97.82 (11.81)
Quality	270	18	92.14 (2.297)
Preferred	1057	72	88.69 (0.588)
Memorable	91	6	81.42 (1.984)
Trophy	0	0	0
Overall Wr	.	.	89.22 (0.737)
Fish Community Season			
Sub-stock (0-149 mm)	27	.	112.7 (23.30)
Sub-stock (150-249 mm)	3	.	57.10
Stock	46	8	106.3 (18.93)
Quality	136	24	85.60 (1.717)
Preferred	333	59	82.42 (0.971)
Memorable	46	8	76.94 (2.256)
Trophy	0	0	0
Overall Wr	.	.	84.82 (1.831)

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

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

Sturgeon Chub

Sturgeon chubs were the least common target species encountered (N = 2 sturgeon season, N = 2 fish community season) during the 2007 sampling season. This is a decrease from a total of 19 and 18 sturgeon chubs in 2005 and 2006, respectively. Total lengths ranged from 20 to 87 mm (mean = 52 mm) in 2007. The smallest fish were captured in 2007, compared to 2005 (30 - 79 mm) and 2006 (33 – 65 mm). However, mean CPUE for otter trawls during sturgeon season declined in 2007 (0.006 fish/ 100 m) from 2006 (0.026 fish/ 100 m). CPUE in otter trawls during fish community season also declined in 2007 (0.015 fish/ 100 m) from 2006 (0.255 fish/ 100 m). Otter trawl was the only gear from all years (2005-2007) that has captured sturgeon chubs in segment 10. All fish were captured in the inside bend, channel border habitat, which is where most of our otter trawl effort was expended (Tables 26 and 27).

Segment 10 - Sturgeon Chub / Sturgeon Season

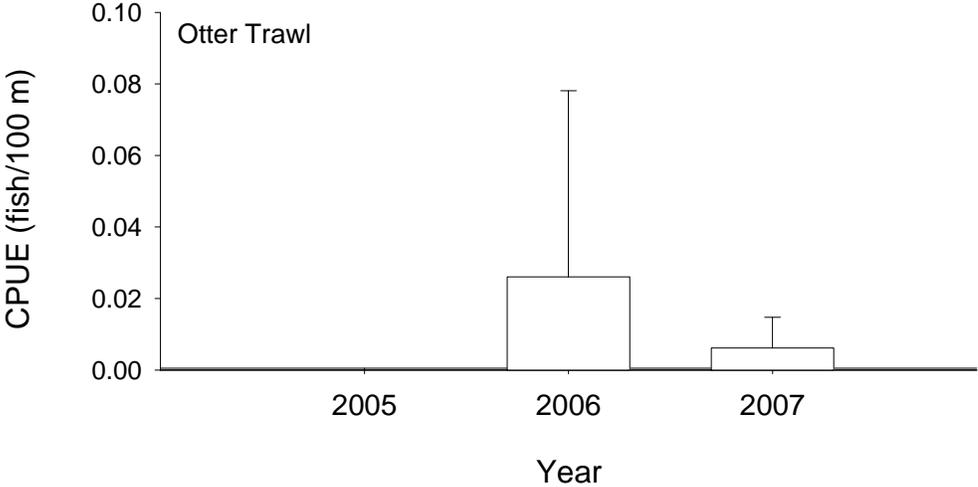


Figure 18. Mean annual catch-per-unit-effort (+/- 2 SE) of sturgeon chub using otter trawls in segment 10 of the Missouri River during sturgeon season 2006-2007.

Segment 10 - Sturgeon Chub / Fish Community Season

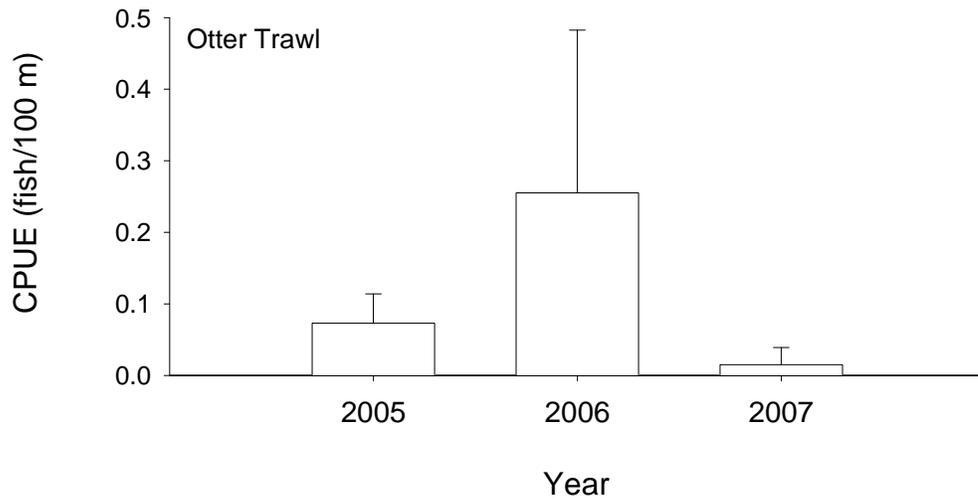


Figure 19. Mean annual catch-per-unit-effort (± 2 SE) of sturgeon chub using otter trawls in segment 10 of the Missouri River during fish community season 2006-2007.

Segment 10 - Sturgeon Chub / Fish Community Season

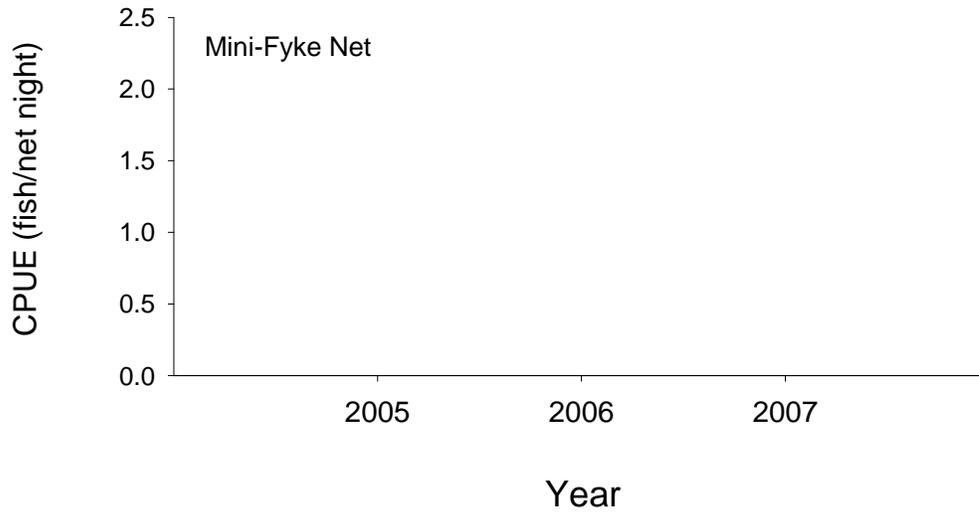


Figure 20. Mean annual catch-per-unit-effort (± 2 SE) of sturgeon chub using mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2006-2007.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0 .	0 0	0 27	0 0	0 0	0 0	0 70	0 1	0 2	0 0	0 0	0 0	0 0	0 0	0 0
Gill Net	0 .	0 0	0 26	0 0	0 0	0 0	0 68	0 5	0 1	0 0	0 0	0 0	0 0	0 0	0 0
Otter Trawl	2 .	0 0	0 22	0 0	0 0	0 0	100 74	0 2	0 2	0 0	0 0	0 0	0 0	0 0	0 0
Fish Community Season (Summer)															
1 Inch Trammel Net	0 .	0 0	0 25	0 0	0 0	0 0	0 75	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 0	0 31	0 0	0 0	0 0	0 38	0 20	0 0	0 6	0 0	0 0	0 0	0 5	0 0
Otter Trawl	2 .	0 0	0 17	0 0	0 0	0 0	100 78	0 3	0 2	0 0	0 0	0 0	0 0	0 0	0 0

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 99	N-E N-E	0 1	0 0	0 0
Gill Net	0 .	0 0	0 37	N-E N-E	0 1	0 62	0 0
Otter Trawl	2 .	0 0	100 100	N-E N-E	0 0	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 99	0 1	N-E N-E	0 0	0 0	0 0
Otter Trawl	2 .	0 0	100 98	N-E N-E	0 2	0 0	0 0

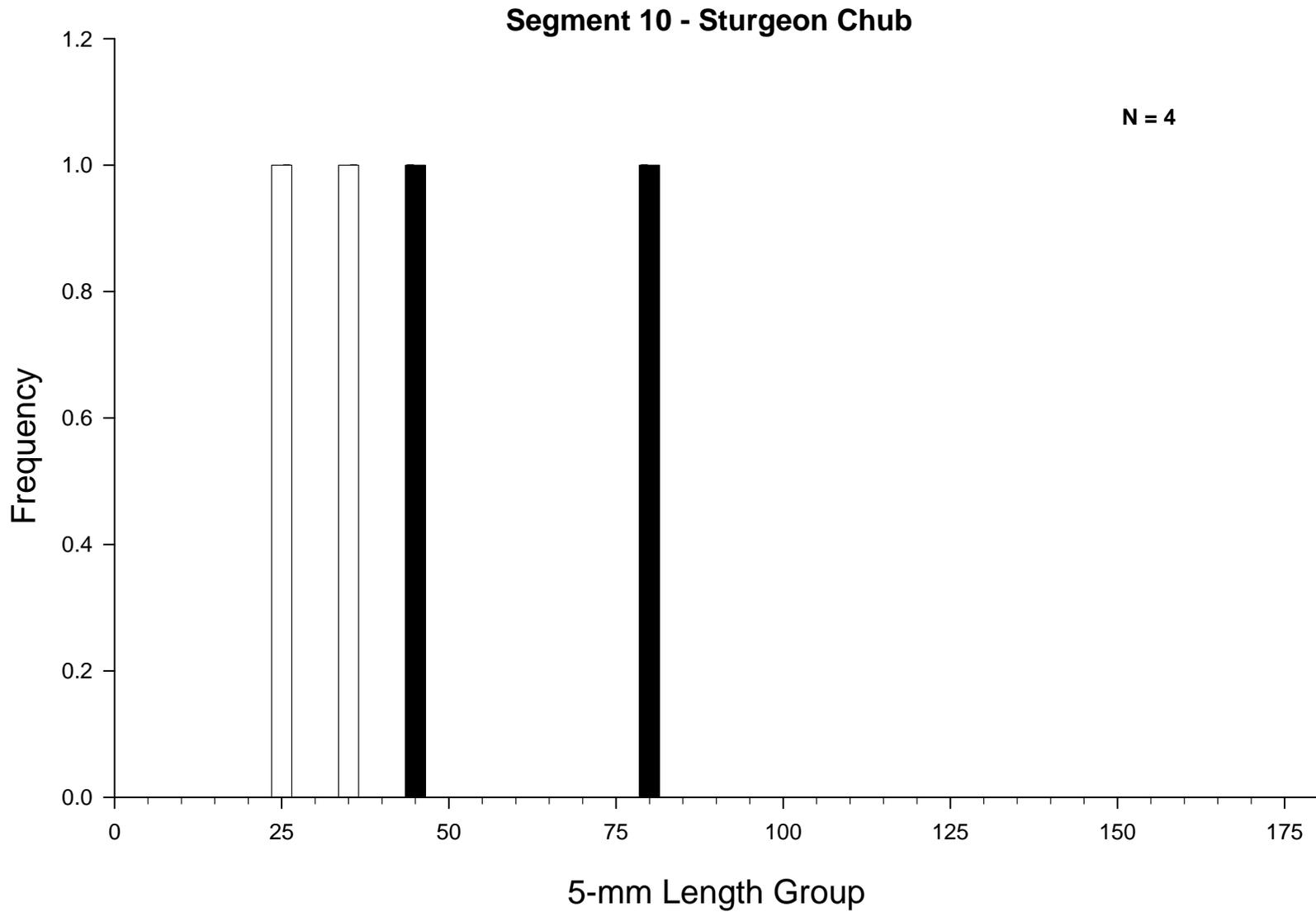


Figure 21. Length frequency of sturgeon chub during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Sicklefin Chub

Sicklefin chubs were the second most common *Macrhybopsis* species encountered (N = 16 sturgeon season, N = 69 fish community season, Figures 28 and 29) during the 2007 sampling season. A greater number of fish were captured in 2007 than captured in 2006 (N = 54), but fewer than in 2005 (N = 130), when gears were only deployed during fish community season. Smaller sicklefin chubs were captured in 2007 compared with 2005 and 2006, especially when comparing lengths across the 3 fish community seasons for segment 10. During the 2007 fish community season, lengths ranged from 18 – 90 mm (mean 30 mm), compared to 29 – 118 mm and 28 – 86 mm in 2005 and 2006, respectively (Figure 25). During 2007 sturgeon season, smaller sicklefin chubs were captured (33 – 71 mm) compared to 2006 (39 – 108 mm), but a wider range of lengths was recorded in 2006. Of the standard gears, sicklefin chubs have only been captured in otter trawls. Mean CPUE in otter trawls increased slightly during sturgeon season 2007 (0.091 fish/ 100 m) from 2006 (0.032 fish/ 100 m, Figure 22). Mean CPUE during fish community season has increased each subsequent year since sampling began in segment 10 in 2005 (0.487, 0.632 and 0.780 fish/ 100 m in 2005, 2006 and 2007, respectively, Figure 23). During 2007 sturgeon season, more sicklefin chubs were captured in inside bend habitats than in channel cross-overs, but most (74%) of our effort was expended in the inside bend. Similar results are recorded for sturgeon season 2006. During 2007 fish community season, 90% of the sicklefin chubs captured in otter trawls were found in the channel cross-over, where only 17% of our otter trawl effort was expended (Table 28). This consisted of 62 fish; however, all were captured in only four subsamples, with 51 (18 – 29 mm) of these captured in one subsample. Habitat data from 2005 and 2006 show similar disproportionate amount of sicklefin chubs captured in the channel cross-over relative to the amount of effort. In 2005, 45% were captured in channel cross-overs, where 29% of our effort was expended. In 2006, 31% were captured in the channel cross-over habitat, yet only 20% of the effort was expended there. All sicklefin chub were captured in channel border mesohabitats, which is the only mesohabitat sampled with otter trawls.

Segment 10 - Sicklefin Chub / Sturgeon Season

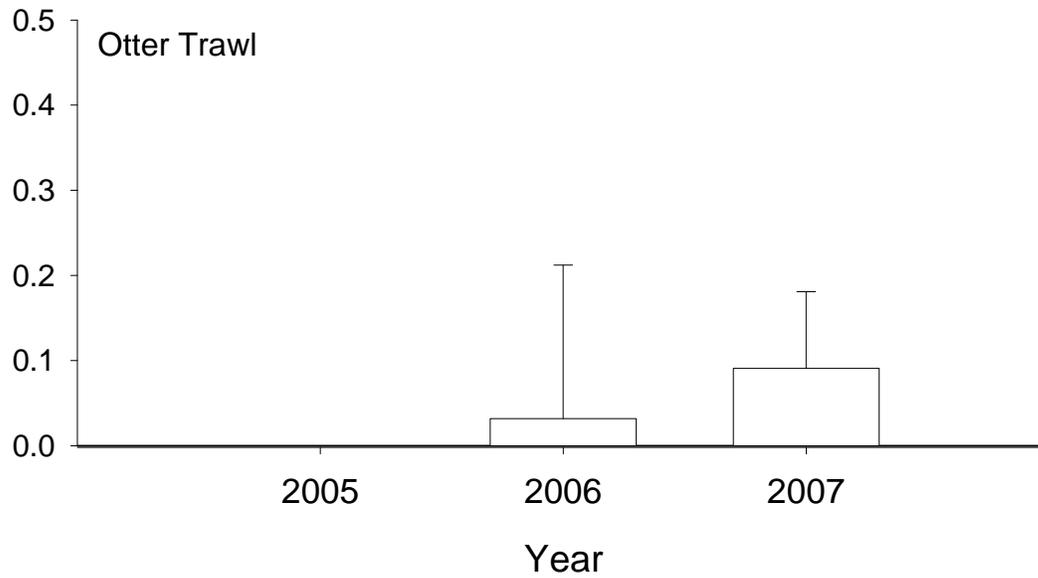


Figure 22. Mean annual catch-per-unit-effort (+/- 2 SE) of sicklefin chub using otter trawls in segment 10 of the Missouri River during sturgeon season 2006-2007.

Segment 10 - Sicklefin Chub / Fish Community Season

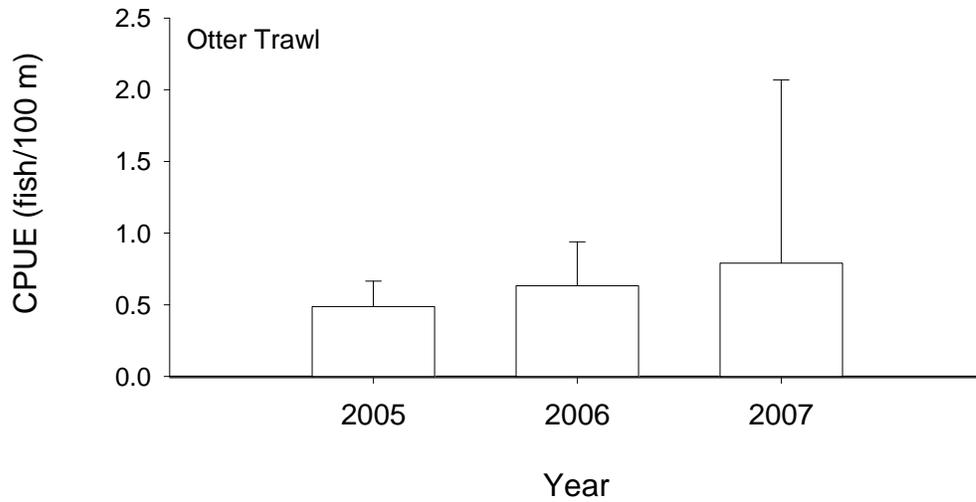


Figure 23. Mean annual catch-per-unit-effort (± 2 SE) of sicklefin chub using otter trawls in segment 10 of the Missouri River during fish community season 2006-2007.

Segment 10 - Sicklefin Chub / Fish Community Season

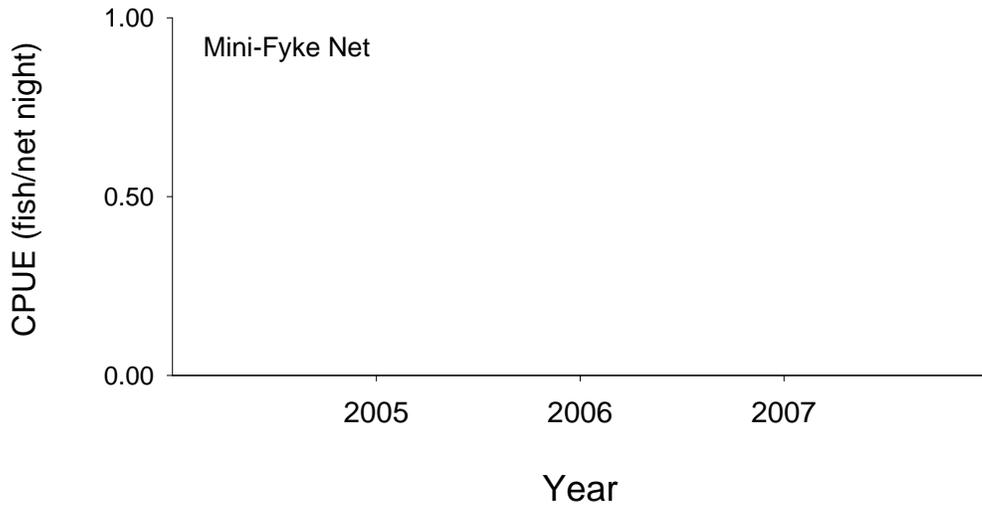


Figure 24. Mean annual catch-per-unit-effort (± 2 SE) of sicklefin chub using mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0 .	0 0	0 27	0 0	0 0	0 0	0 70	0 1	0 2	0 0	0 0	0 0	0 0	0 0	0 0
Gill Net	0 .	0 0	0 26	0 0	0 0	0 0	0 68	0 5	0 1	0 0	0 0	0 0	0 0	0 0	0 0
Otter Trawl	16 .	0 0	13 22	0 0	0 0	0 0	88 74	0 2	0 2	0 0	0 0	0 0	0 0	0 0	0 0
Fish Community Season (Summer)															
1 Inch Trammel Net	0 .	0 0	0 25	0 0	0 0	0 0	0 75	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 0	0 31	0 0	0 0	0 0	0 38	0 20	0 0	0 6	0 0	0 0	0 0	0 5	0 0
Otter Trawl	69 .	0 0	90 17	0 0	0 0	0 0	10 78	0 3	0 2	0 0	0 0	0 0	0 0	0 0	0 0

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 99	N-E N-E	0 1	0 0	0 0
Gill Net	0 .	0 0	0 37	N-E N-E	0 1	0 62	0 0
Otter Trawl	16 .	0 0	100 100	N-E N-E	0 0	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 99	0 1	N-E N-E	0 0	0 0	0 0
Otter Trawl	69 .	0 0	100 98	N-E N-E	0 2	0 0	0 0

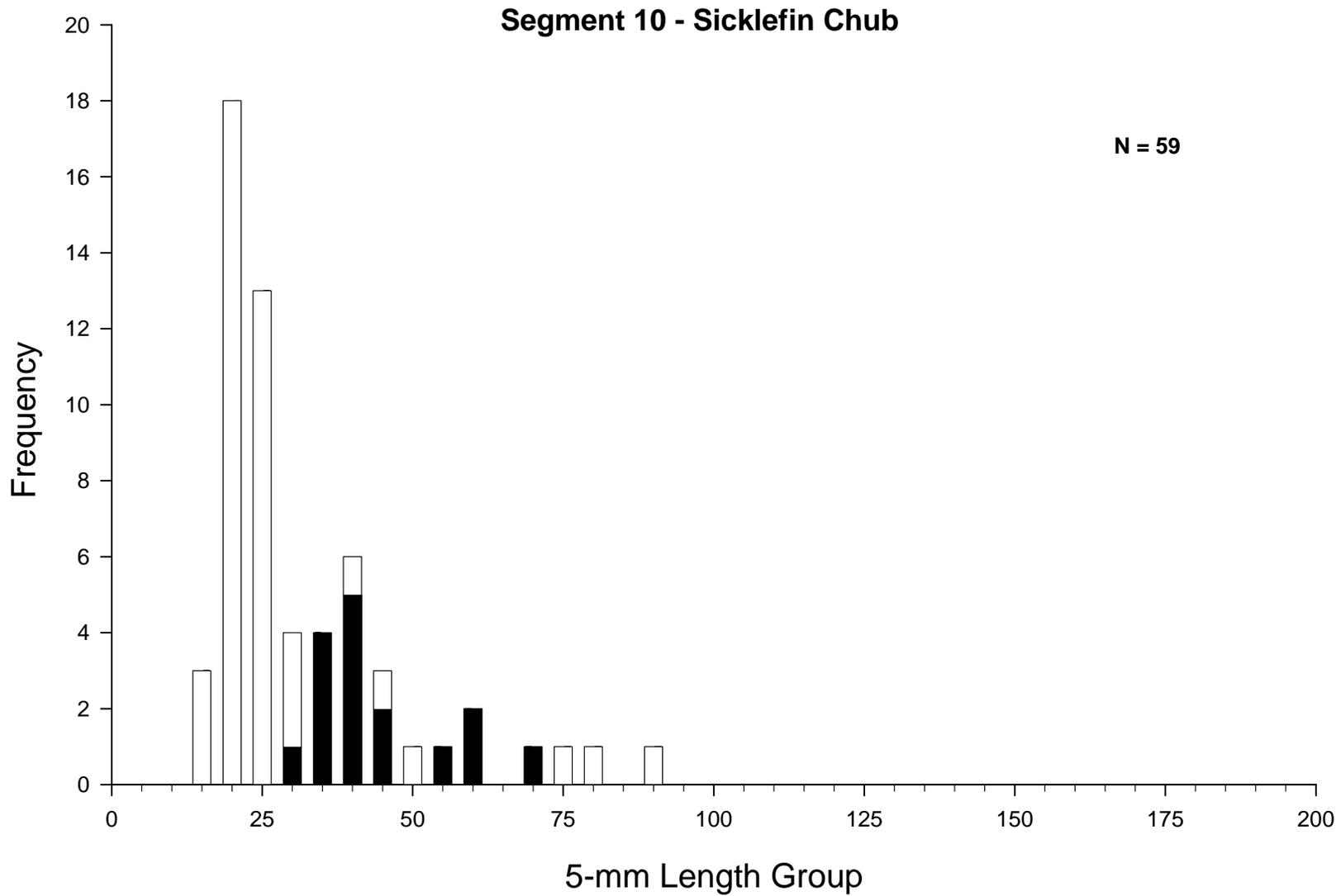


Figure 25. Length frequency of sicklefin chub during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Speckled Chub

Speckled chub were the most common *Macrhybopsis* species encountered during the 2007 sampling season (N = 22 sturgeon season, N = 119 fish community season; Table 30). This was the most common chub species in 2005 (N = 99) and 2006 (N = 67) sampling season, as well as the only chub target species to be captured in both otter trawl and mini-fyke nets all three years of sampling. Total length for the species in 2007 ranged from 39 – 65 mm (mean 55 mm) in sturgeon season and 20 – 69 mm (mean 37 mm) in fish community season (Figure 29). The opposite situation occurred in 2006, where size range increased from sturgeon season (22 – 65 mm) to fish community season (34 – 70 mm). The smallest fish from 3 years of sampling were captured during 2007. Speckled chubs were captured in otter trawls during the sturgeon season with mean CPUE = 0.128 fish/ 100 m, a reduction from 2006 (1.058 fish/ 100 m; Figure 26). Catch-per-unit-effort during fish community season in otter trawls has increased every year going from 0.295 fish/ 100 m (2005), to 0.348 fish/ 100 m (2006), to the present year totals of 0.844 fish/ 100 m (Figure 27). Conversely, CPUE in mini-fyke nets has decreased every year, with catch equaling 0.247, 0.156, and 0.100 in 2005, 2006, and 2007, respectively (Figure 28). In otter trawls, speckled chubs were captured in channel cross-over and inside bend habitats, in similar proportion to the amount of effort expended there (Table 30). Of the five macrohabitat types sampled using mini-fyke nets, speckled chubs were captured in only two of these (inside bend and outside bend). Though 31% of our net sets were in the channel cross-over, no speckled chubs were captured there. One must keep in mind, however, only eight speckled chubs were captured in mini-fyke nets in 2007. All otter trawl captures were in channel border mesohabitats, while all mini-fyke net captures were in bar mesohabitats.

Segment 10 - Speckled Chub / Sturgeon Season

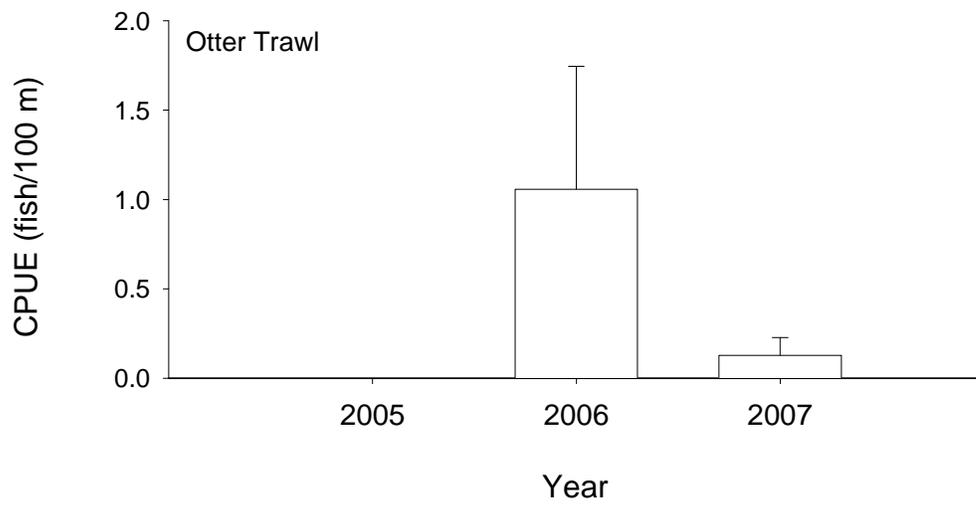


Figure 26. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub using otter trawls in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Speckled Chub / Fish Community Season

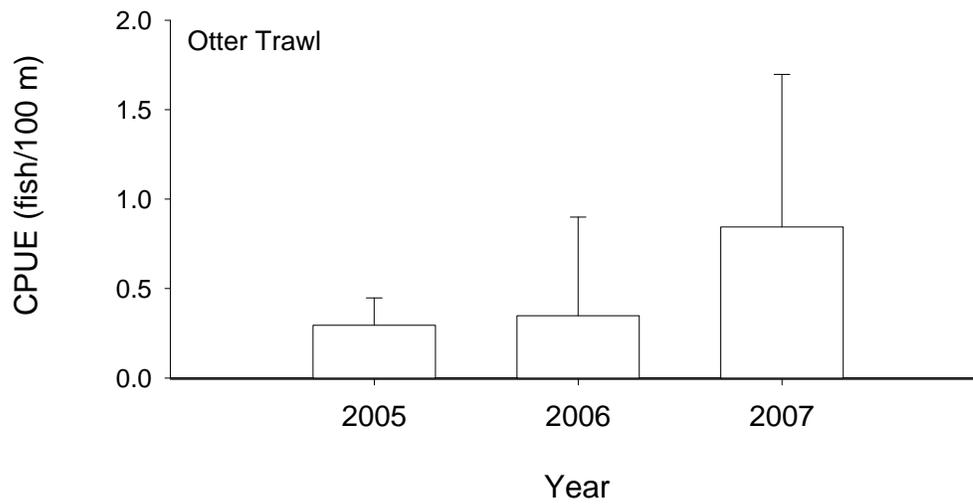


Figure 27. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub in segment 10 of the Missouri River during fish community season 2006 -2007.

Segment 10 - Speckled Chub / Fish Community Season

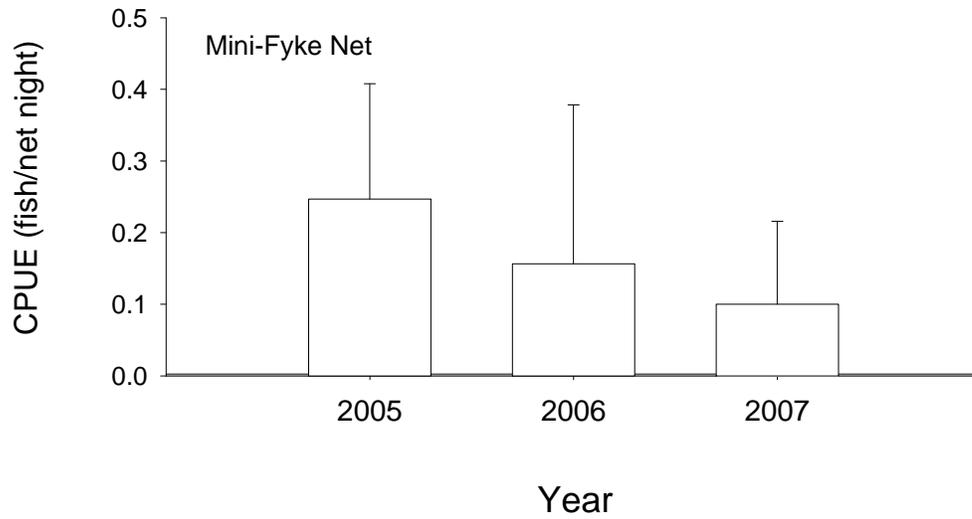


Figure 28. Mean annual catch-per-unit-effort (± 2 SE) of speckled chub using mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 -2007.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	22	0	18	0	N-E	N-E	82	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	8	0	0	0	N-E	N-E	88	13	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	111	0	15	0	N-E	N-E	80	0	5	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 99	N-E N-E	0 1	0 0	0 0
Gill Net	0 .	0 0	0 37	N-E N-E	0 1	0 62	0 0
Otter Trawl	22 .	0 0	100 100	N-E N-E	0 0	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Mini-Fyke Net	8 .	100 100	0 0	N-E N-E	0 0	0 0	0 0
Otter Trawl	111 .	0 0	95 98	N-E N-E	5 2	0 0	0 0

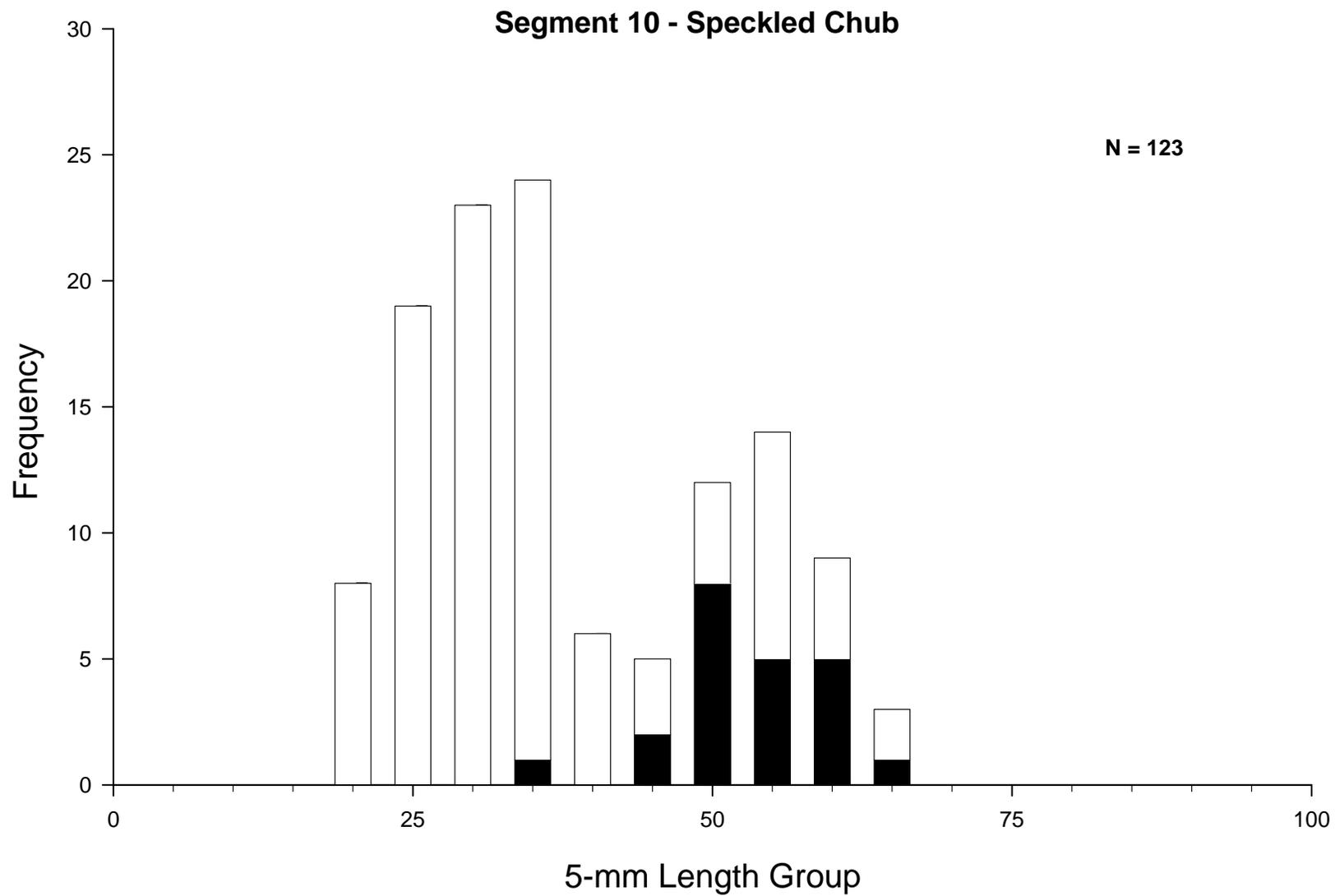


Figure 29. Length frequency of speckled chub during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Sand Shiner

Sand shiners were captured during sturgeon season (N = 1) and fish community season (N = 12; Table 32). The fish were captured in both mini-fyke nets and sturgeon season otter trawls. Length of sand shiners lengths captured during fish community season ranged from 29 – 48 mm (mean 40 mm; Figure 33). This range is comparable to the length ranges in 2005 and 2006 (25 – 52 and 32 – 49 mm, respectively). In 2007, otter trawls during sturgeon season captured one sand shiner (Figure 30), but was the smallest collected at 21 mm. Sand shiners have not been captured in otter trawls during fish community season since 2005, when the CPUE was low at 0.015 fish/ 100 m (Figure 31). Mini-fyke nets have captured sand shiners all three years. CPUE was highest in 2006, at 1.685 fish /100 m (Figure 32). The years 2005 and 2007 showed similar results, with CPUE at 0.175 and 0.150 fish/ 100 m, respectively. The inside-bend habitat was the most common place sand shiners were captured in mini-fyke nets (67% of the catch) while 25% of the sand shiners catch occurred in channel-cross over habitats (Table 32). The remaining fish were captured in outside bend habitats.

Segment 10 - Sand Shiner / Sturgeon Season

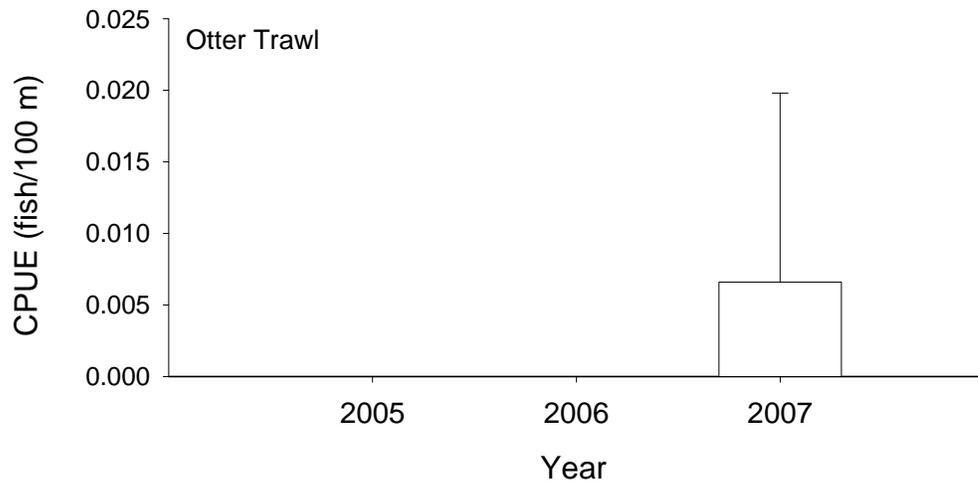


Figure 30. Mean annual catch-per-unit-effort (± 2 SE) of sand shiner with otter trawls in segment 10 of the Missouri River during sturgeon season 2006 -2007.

Segment 10 - Sand Shiner / Fish Community Season

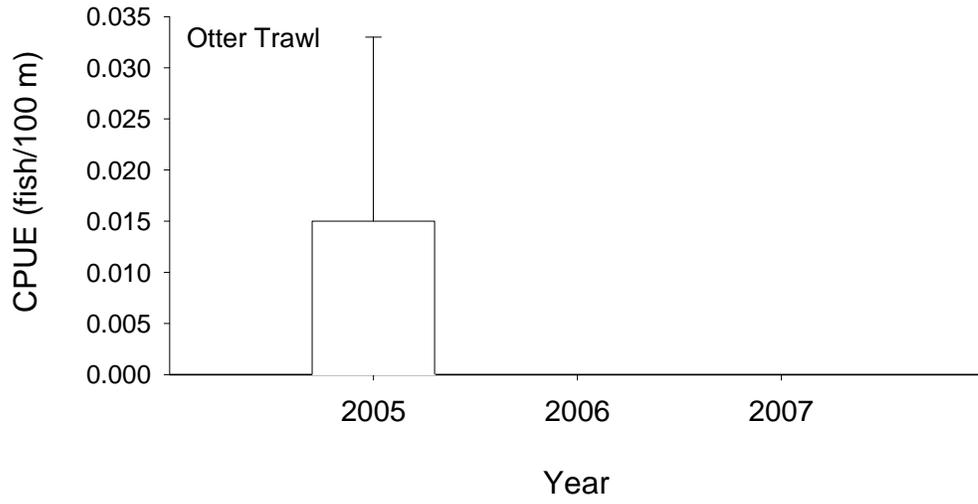


Figure 31. Mean annual catch-per-unit-effort (± 2 SE) of sand shiner with otter trawls in segment 10 of the Missouri River during fish community season 2006 -2007.

Segment 10 - Sand Shiner / Fish Community Season

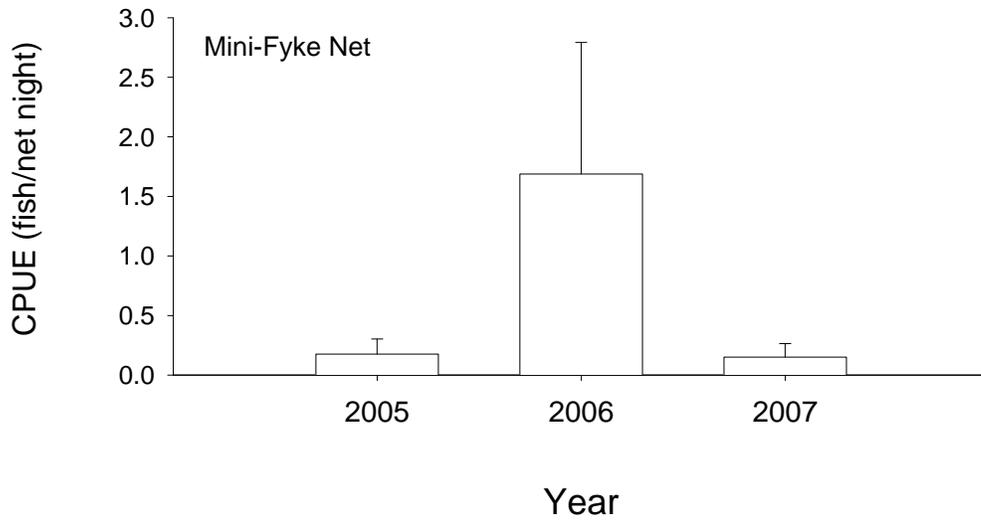


Figure 32. Mean annual catch-per-unit-effort (± 2 SE) of sand shiner with mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	12	0	25	0	N-E	N-E	67	8	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 99	N-E N-E	0 1	0 0	0 0
Gill Net	0 .	0 0	0 37	N-E N-E	0 1	0 62	0 0
Otter Trawl	1 .	0 0	100 100	N-E N-E	0 0	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Mini-Fyke Net	12 .	100 100	0 0	N-E N-E	0 0	0 0	0 0
Otter Trawl	0 .	0 0	0 98	N-E N-E	0 2	0 0	0 0

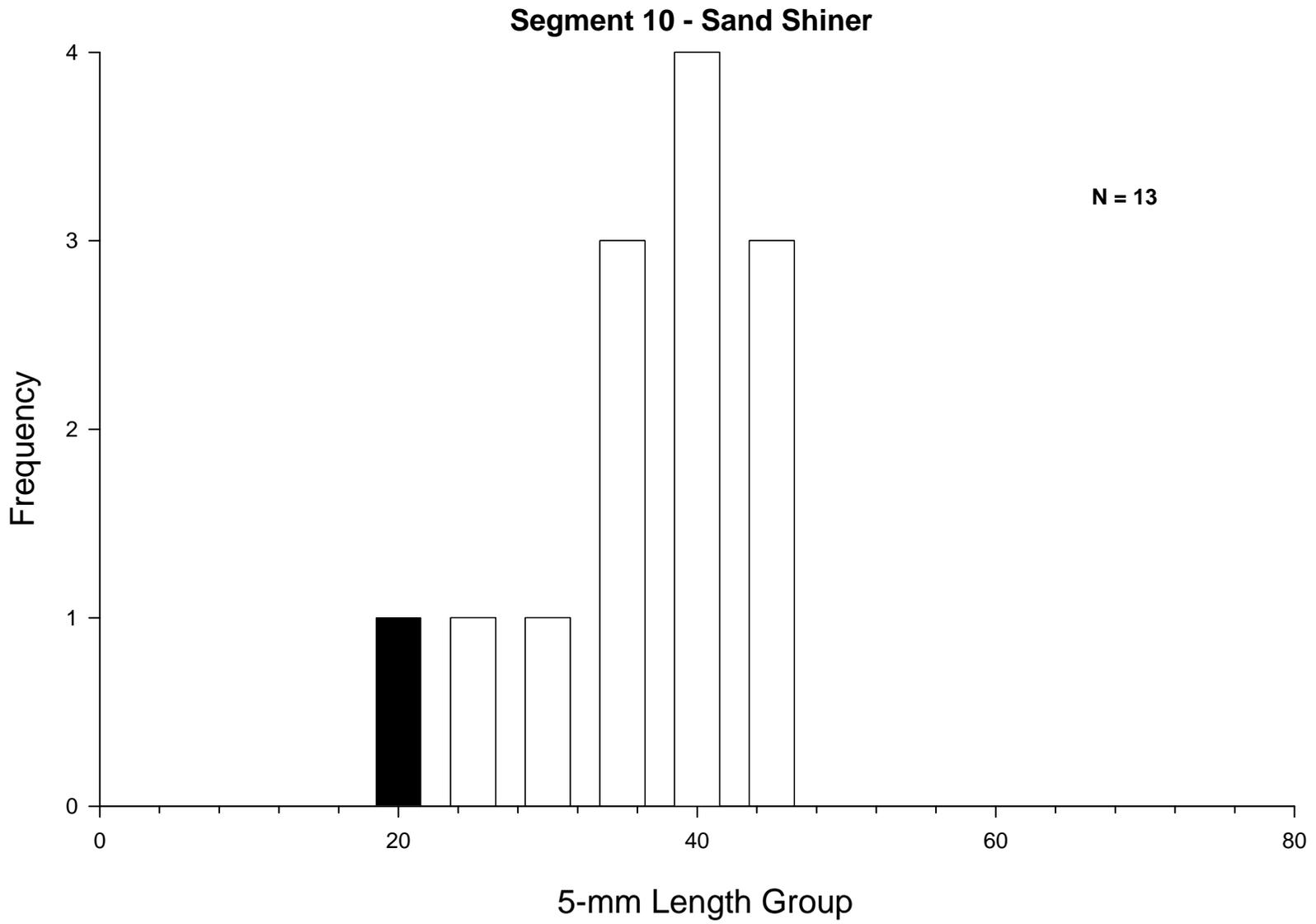


Figure 33. Length frequency of sand shiner during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

***Hybognathus* spp.**

There were 215 *Hybognathus* target species captured in 2007. These species include the plains minnow (N = 211), western silvery minnow (N = 2), brassy minnow (N = 1), and unidentified *Hybognathus* spp (N = 1). Of the total number of plains minnows captured, 134 individuals came from one mini-fyke net. Fish lengths ranged from 16 – 63 mm. The range of lengths was much more narrow in 2005 (44 – 55 mm), but only 8 individuals were captured. No *Hybognathus* spp. were captured in 2006. These species were captured in mini-fyke nets, with a CPUE of 2.688 fish/ 100 m. This is a large increase from 2005, when only one *Hybognathus* spp. was captured, and the CPUE was 0.010 fish/ 100 m. During the 2007 sampling season, most (83%) of this genus was captured in the inside bend habitat. The remaining individuals were captured in channel cross-over and small, connected secondary side channels.

Segment 10 - *Hybognathus* spp. / Sturgeon Season

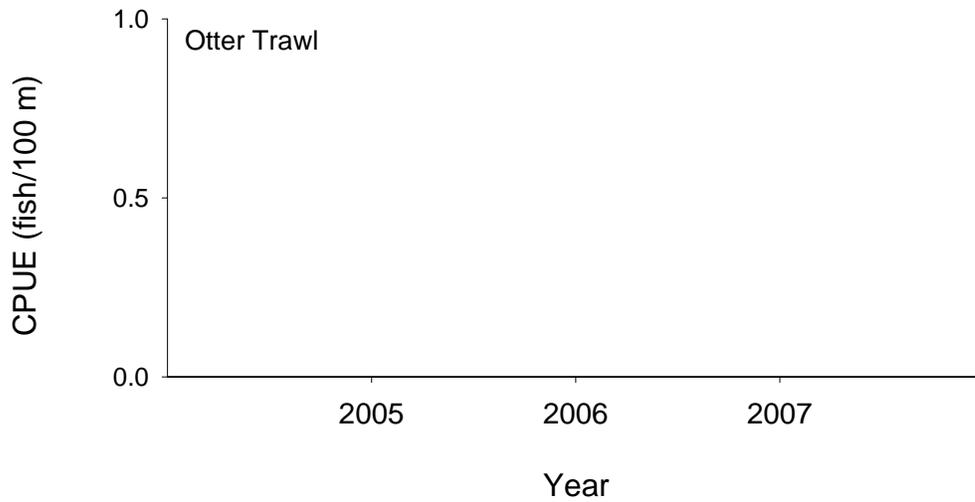


Figure 34. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with otter trawls in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - *Hybognathus* spp. / Fish Community Season

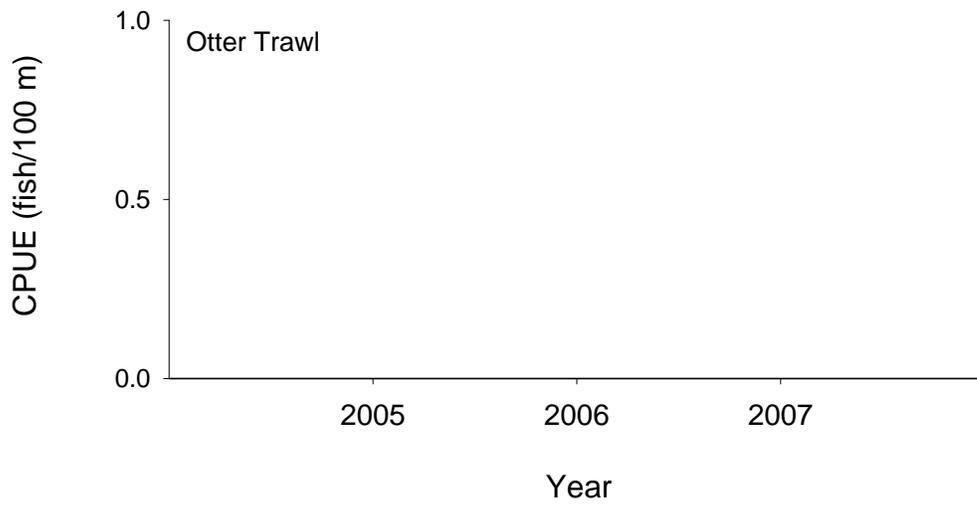


Figure 35. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with otter trawls in segment 10 of the Missouri River during fish community season 2006 - 2007.

Segment 10 - *Hybognathus* spp. / Fish Community Season

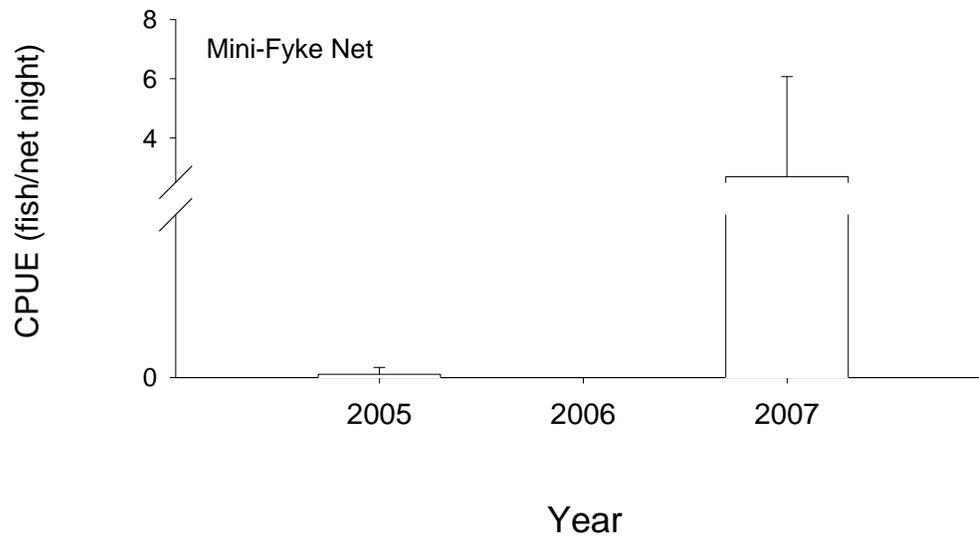


Figure 36. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	215	0	13	0	N-E	N-E	83	0	0	3	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 99	N-E N-E	0 1	0 0	0 0
Gill Net	0 .	0 0	0 37	N-E N-E	0 1	0 62	0 0
Otter Trawl	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	N-E N-E	0 0	0 0	0 0
Mini-Fyke Net	215 .	100 100	0 0	N-E N-E	0 0	0 0	0 0
Otter Trawl	0 .	0 0	0 98	N-E N-E	0 2	0 0	0 0

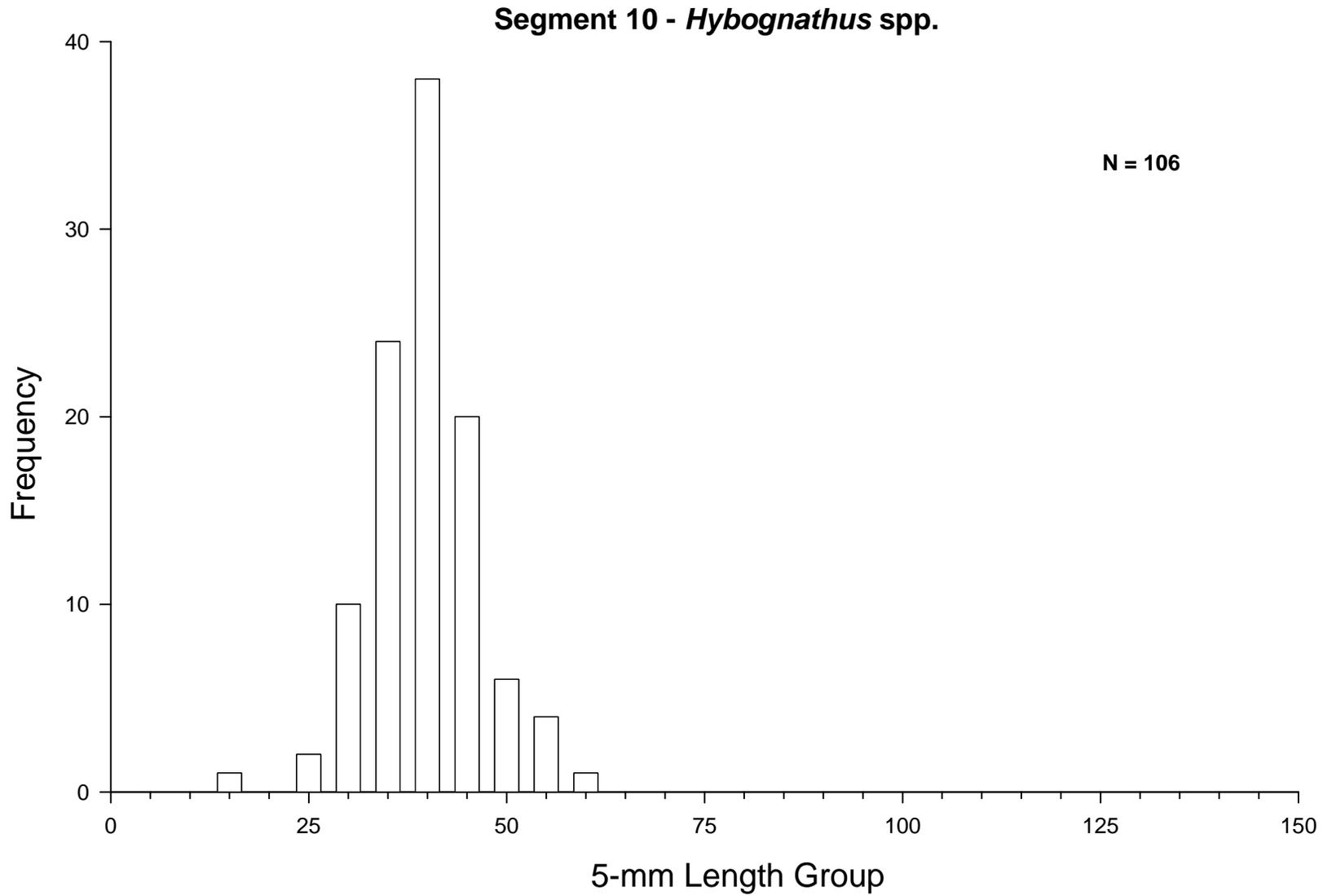


Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Blue Sucker

Thirty-one blue suckers were captured in 2007. More were captured during fish community season (N = 20) than in sturgeon season (N = 11; Table 36). Fish length ranged from 494 – 734 mm during sturgeon season to 384 – 726 mm during fish community season (Figure 44). Gill nets were the most effective gears (CPUE = 0.035 fish/ net night) for capturing blue suckers during sturgeon season in 2007, but the fish were also captured in 1 inch trammel nets (0.022 fish/ 100 m) and otter trawls (0.005 fish/ 100 m; Figures 38 and 39). Results from 2007 show a reduction in catch from 2006, particularly in gill and trammel nets. During fish community season, otter trawls captured blue suckers with similar CPUE to 2005 (0.016 and 0.019 in 2005 and 2007, respectively; Figure 41). These fish were captured with 1 inch trammel nets during fish community season every year since 2005, with the highest CPUE occurring in 2007 (0.145 fish/ 100 m). Most blue suckers were captured in the inside bend habitat, where most of the sampling effort was directed (Table 36). On average, about 25% of our sampling was in channel cross-overs; however, for some gears, the blue sucker catch did not reflect this proportion (i.e., sturgeon season otter trawls, fish community season trammel nets). Most of the catch in otter trawls and trammel nets came from channel border mesohabitats, though most of the gill net catch came from pool mesohabitats (Table 37).

Segment 10 - Blue Sucker / Sturgeon Season

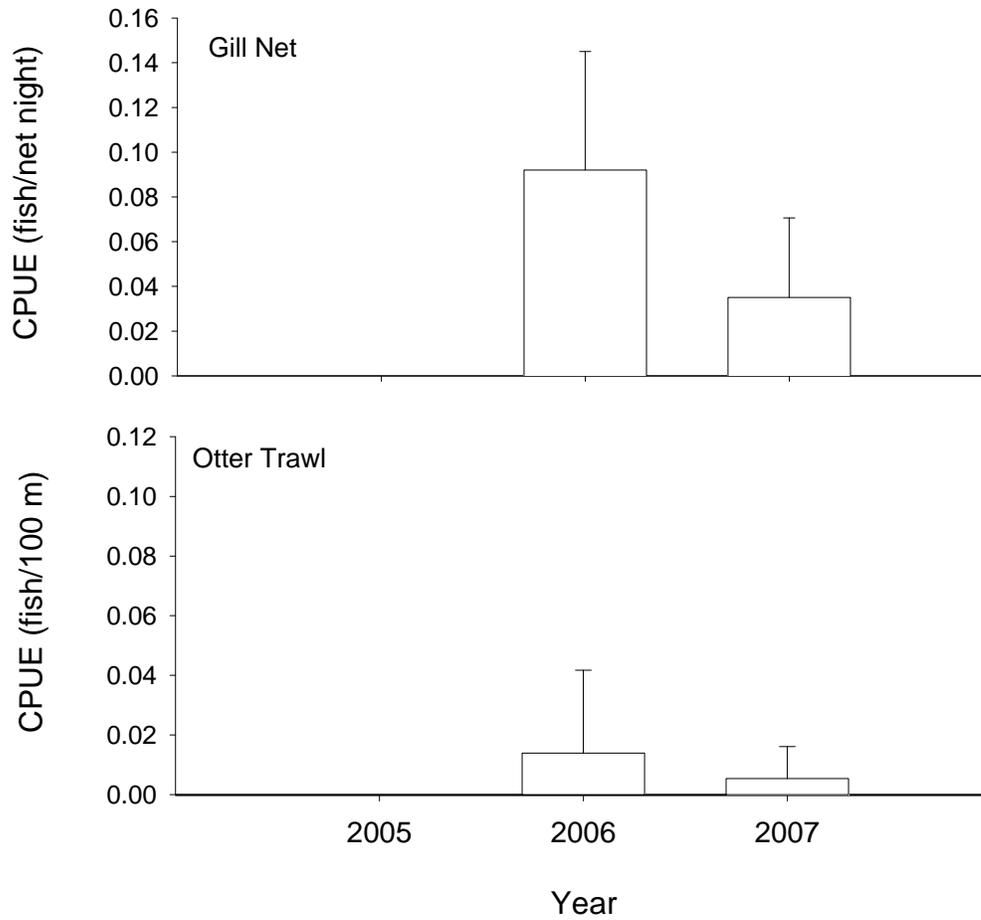


Figure 38. Mean annual catch-per-unit-effort (± 2 SE) of blue sucker with gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Blue Sucker / Sturgeon Season

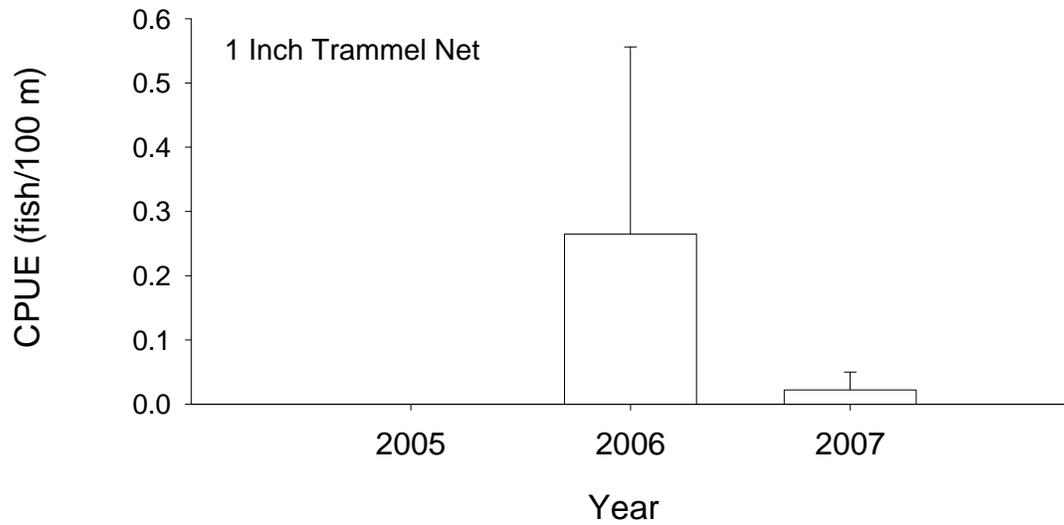


Figure 39. Mean annual catch-per-unit-effort (± 2 SE) of blue sucker with 1 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Blue Sucker / Fish Community Season

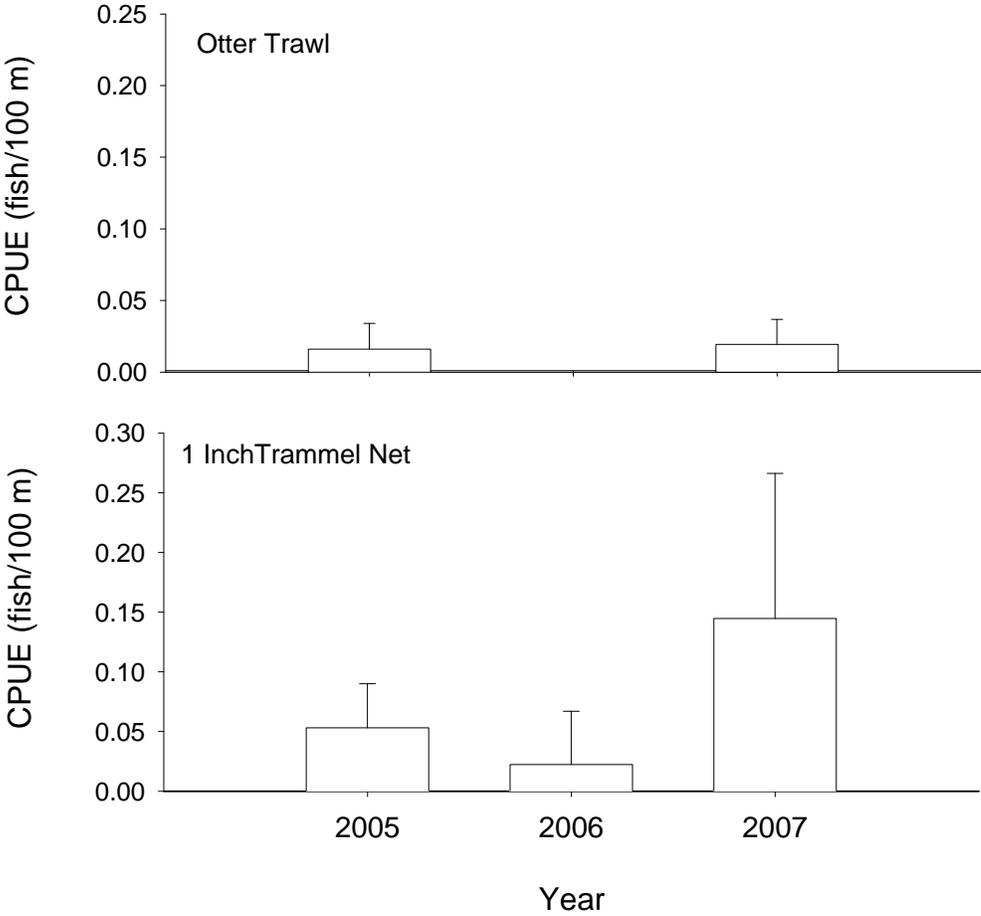


Figure 41. Mean annual catch-per-unit-effort (± 2 SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Segment 10 - Blue Sucker / Fish Community Season

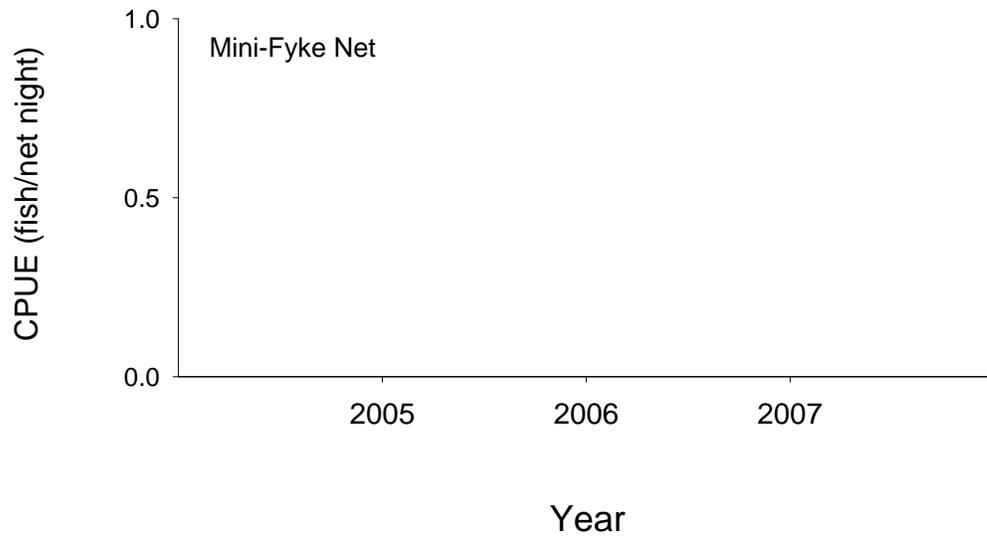


Figure 42. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers using mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	3	0	33	0	N-E	N-E	67	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	7	0	14	0	N-E	N-E	86	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	15	0	7	0	N-E	N-E	93	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	5	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	3	0	100	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	7	0	14	N-E	0	86	0
	.	0	37	N-E	1	62	0
Otter Trawl	1	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	15	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	0	0	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	5	0	100	N-E	0	0	0
	.	0	98	N-E	2	0	0

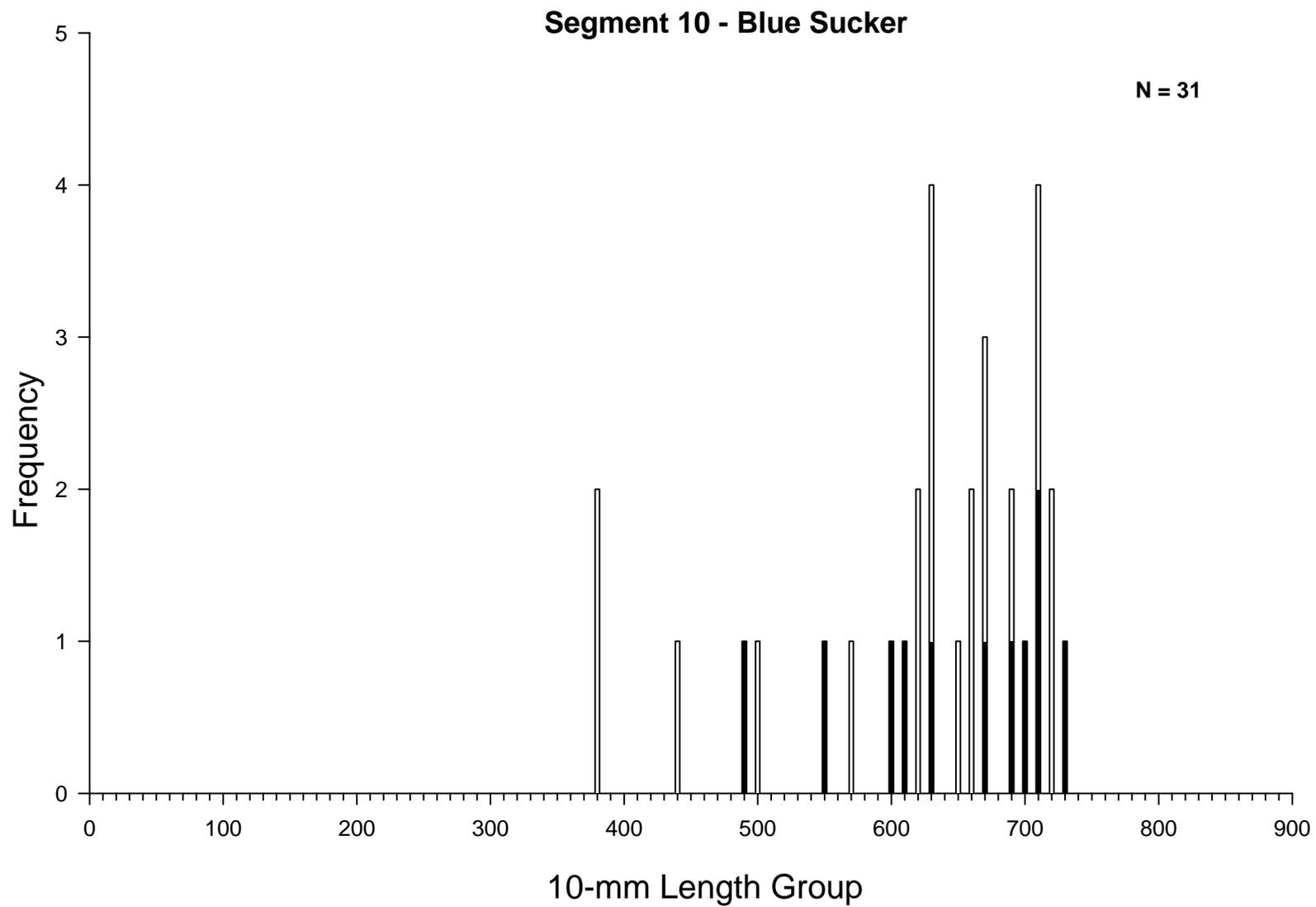


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Sauger

A total of 36 sauger was captured during sturgeon season ($N = 29$) and fish community season ($N = 7$; Table 38). This is more than we captured in 2005 ($N = 3$) and 2006 ($N = 26$). Sizes of fish captured in 2007 ranged from 114 – 512 mm, which is a more narrow range than results in 2006 (32 – 539 mm; Figure 51). Catch in gill nets increased in 2007 (0.130 fish/ net night), up from 0.070 fish/ net night in 2006 (Figure 45). A very slight increase in sauger catch occurred in 2007 (0.023 fish/ 100 m), compared to 2006 (0.016 fish/ 100 m; Figure 46). There were no fish captured in otter trawls during sturgeon season 2007. During fish community season, sauger have been captured in otter trawls and mini-fyke nets in two of the three years sampled (i.e., 2005 and 2007; Figures 48 and 49). Otter trawl catch rates were slightly higher in 2007 than in 2005, at 0.012 and 0.004 fish/ 100 m, respectively (Figure 48). Mini-fyke catch rates were slightly lower in 2007 than in 2005, at 0.013 and 0.021 fish/ net night, respectively (Figure 49). The 2007 sampling season was the first year sauger were captured in trammel nets during fish community season. Gill nets captured the most sauger in 2007 ($N = 26$), and most of these were captured in the inside bend (Table 38). Eleven (42%) of these were captured in the channel cross-over, where only 26% of our gill nets were set. However, seven of these fish were captured in a single gill net. Most of the sauger were captured in gill nets set in pool mesohabitats, with only one fish captured in gill nets set in channel border habitats.

Segment 10 - Sauger / Sturgeon Season

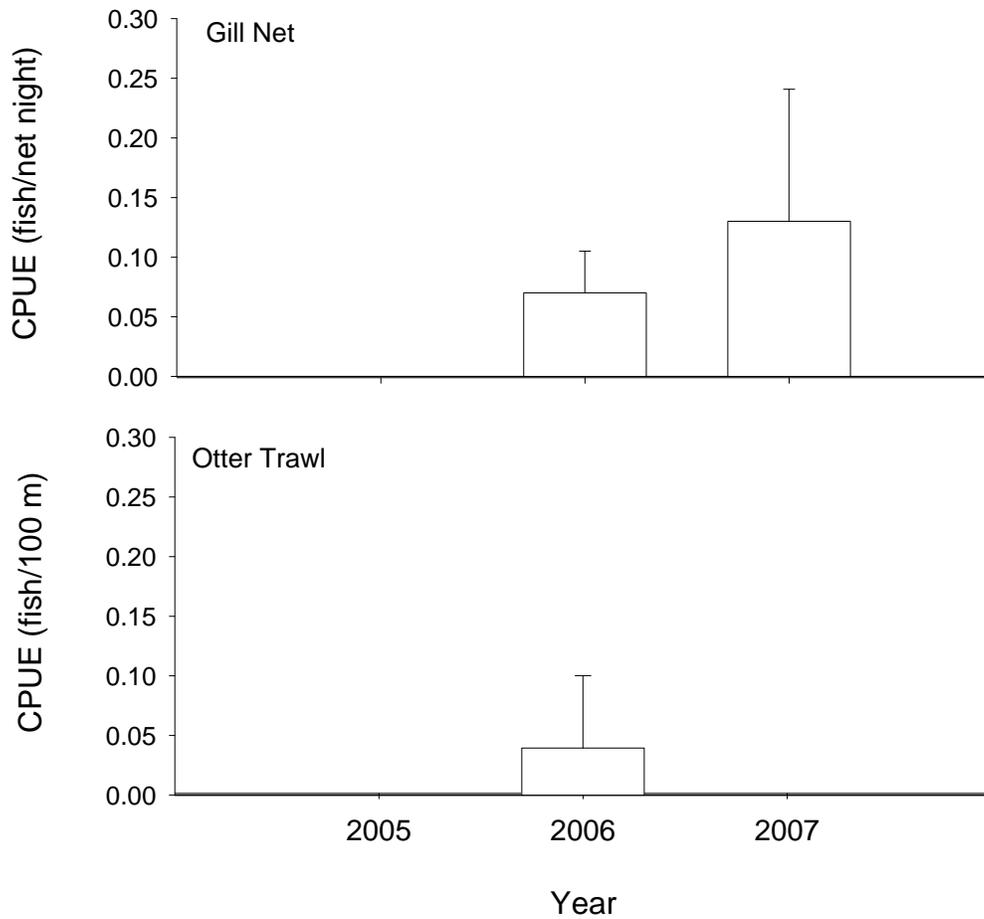


Figure 45. Mean annual catch-per-unit-effort (± 2 SE) of sauger using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Sauger / Sturgeon Season

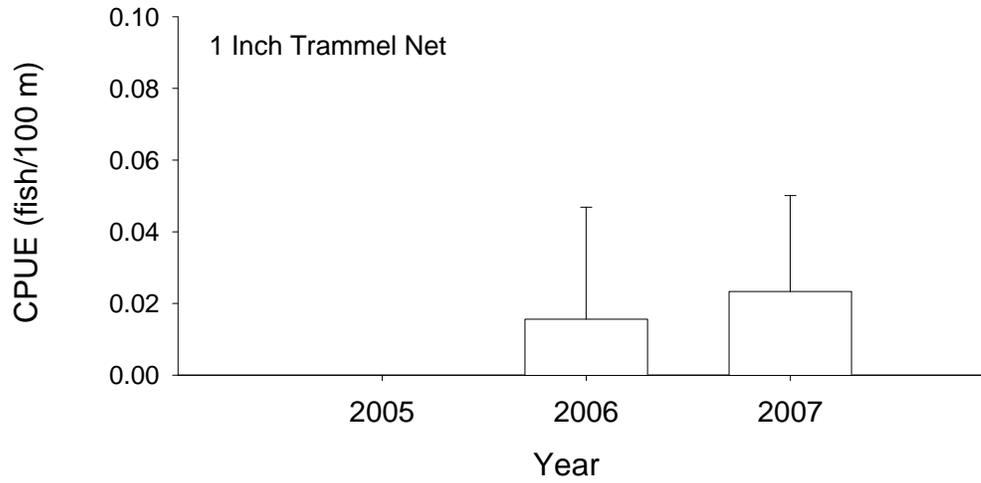


Figure 46. Mean annual catch-per-unit-effort (± 2 SE) of sauger using 1 and 2.5 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2006 - 2007.

Segment 10 - Sauger / Fish Community Season

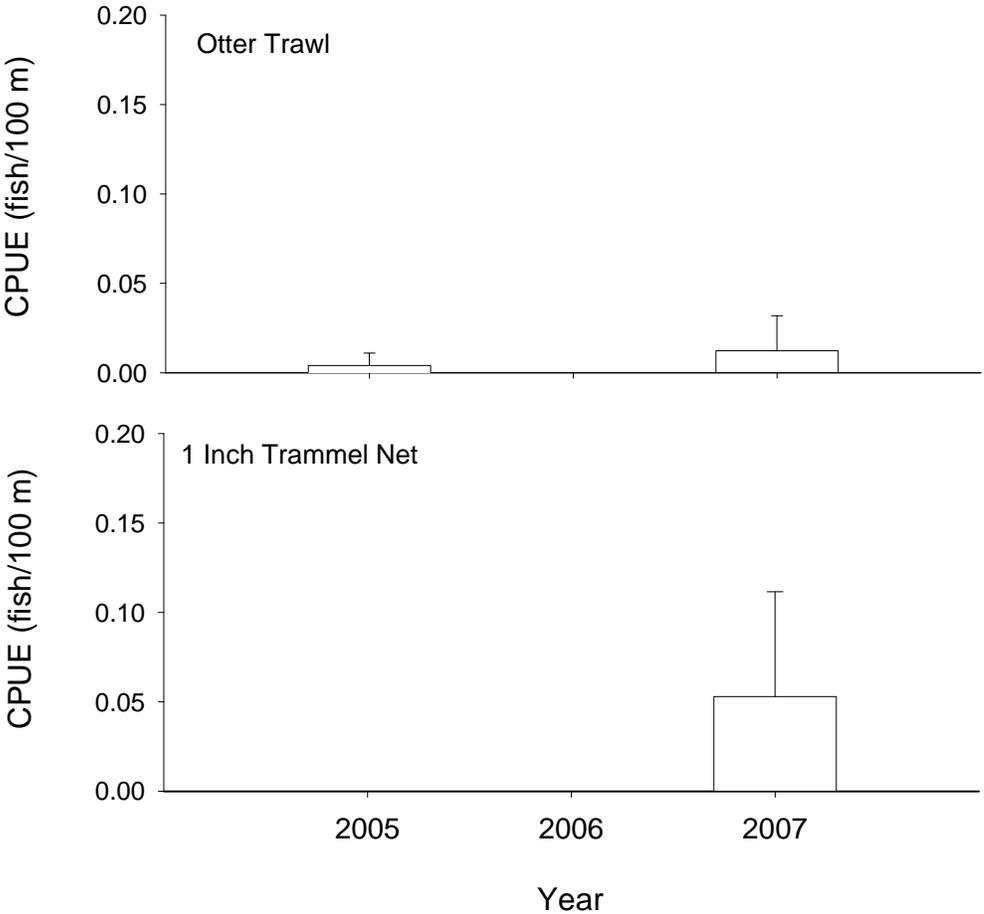


Figure 48. Mean annual catch-per-unit-effort (+/- 2 SE) of sauger using otter trawls and 1 inch trammel nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Segment 10 - Sauger / Fish Community Season

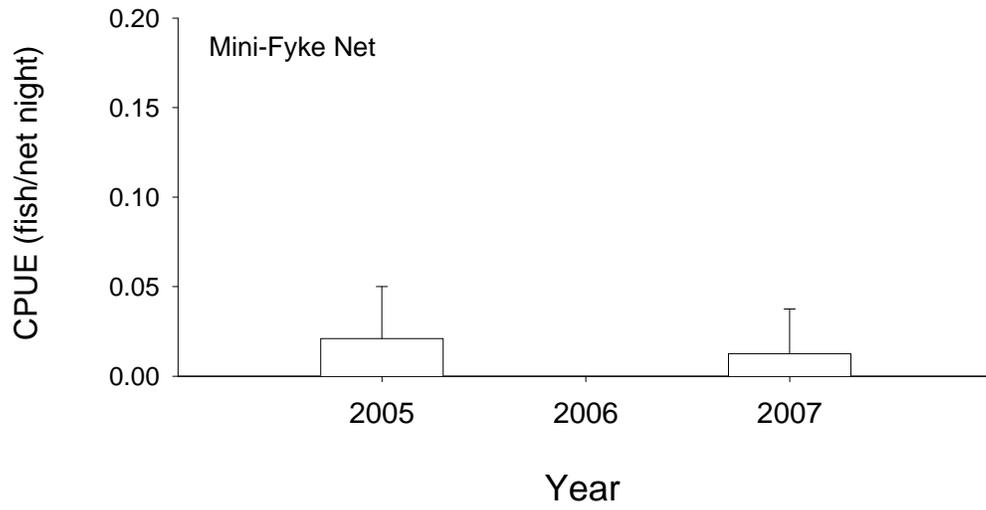


Figure 49. Mean annual catch-per-unit-effort (± 2 SE) of sauger using mini-fyke nets in segment 10 of the Missouri River during fish community season 2006 - 2007.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	3	0	67	0	N-E	N-E	33	0	0	0	0	0	0	0	0
	.	0	27	0	N-E	N-E	70	1	2	0	0	0	0	0	0
Gill Net	26	0	42	0	N-E	N-E	58	0	0	0	0	0	0	0	0
	.	0	26	0	N-E	N-E	68	5	1	0	0	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	22	0	N-E	N-E	74	2	2	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	4	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
	.	0	25	0	N-E	N-E	75	0	0	0	0	0	0	0	0
Mini-Fyke Net	1	0	100	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	38	20	0	6	0	0	0	5	0
Otter Trawl	2	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	17	0	N-E	N-E	78	3	2	0	0	0	0	0	0

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	3	0	100	N-E	0	0	0
	.	0	99	N-E	1	0	0
Gill Net	26	0	4	N-E	0	96	0
	.	0	37	N-E	1	62	0
Otter Trawl	0	0	0	N-E	0	0	0
	.	0	100	N-E	0	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	4	0	100	N-E	0	0	0
	.	0	100	N-E	0	0	0
Mini-Fyke Net	1	100	0	N-E	0	0	0
	.	100	0	N-E	0	0	0
Otter Trawl	2	0	100	N-E	0	0	0
	.	0	98	N-E	2	0	0

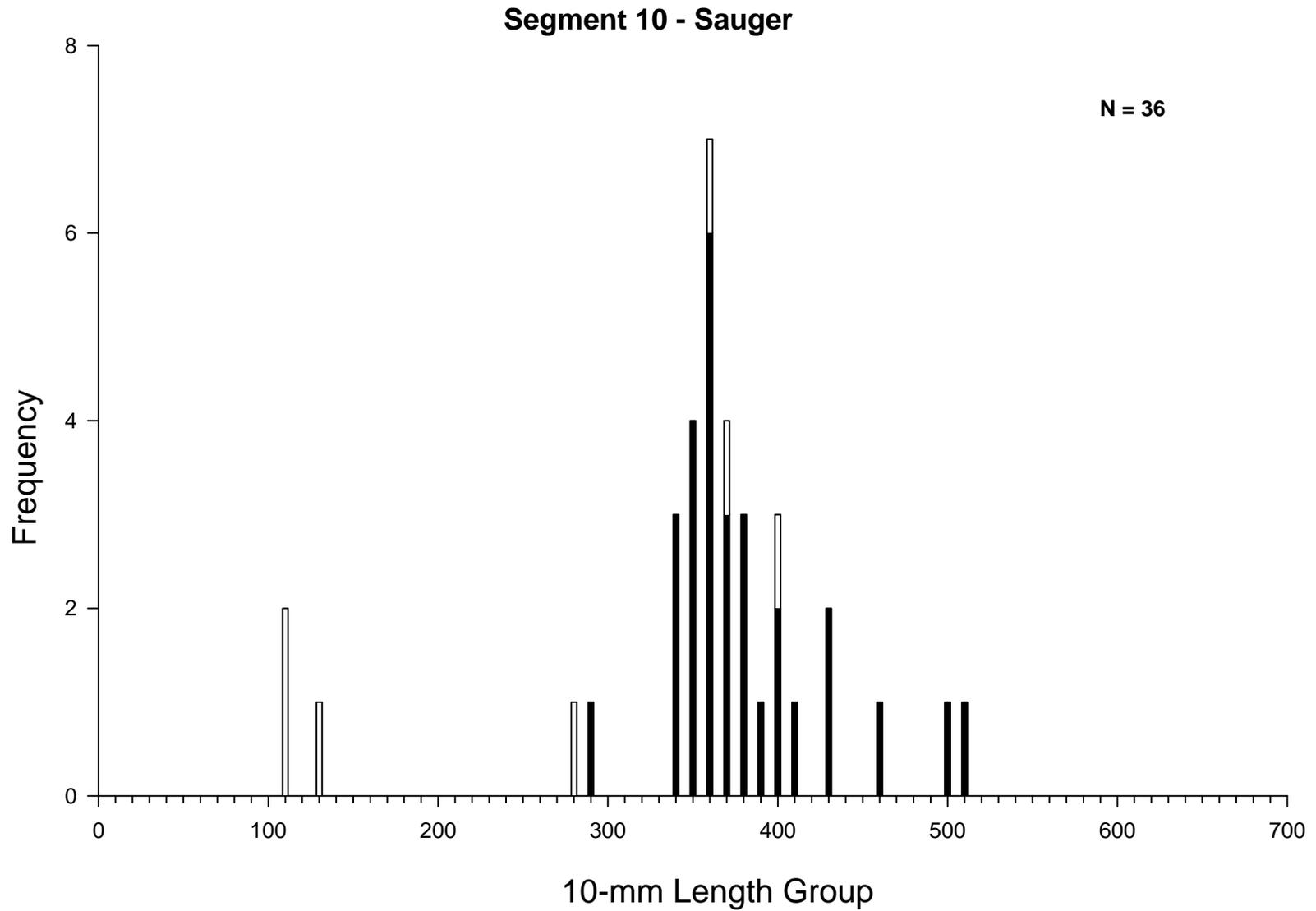


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2006 - 2007.

Missouri River Fish Community

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

A total of 3,173 fish representing 35 species was captured in segment 10 with all standard gear types during the 2007 sturgeon season. There were eight target species captured, but only one of those was represented by at least 50 individuals (shovelnose sturgeon, $N=1,496$). Because of the large number of shovelnose sturgeon captured, target species comprised 50% of the total catch. We captured 1,589 non-target individuals, and only five species were represented by over 50 individuals during this season.

During the 2007 fish community season, a total of 10,268 individuals was captured, about the same as 2005 (10,508) but nearly a 50% increase over the number of fish captured during 2006 (5,199). Among the species captured, there were nine target and 40 non-target species. Four target species were represented by at least 50 individuals, *Hybognathus* spp., sicklefin and speckled chubs, and shovelnose sturgeon. Among the non-target species, fourteen were represented by at least 50 individuals. Overall, non-target species comprised 90% of the fish community catch, about the same as 2005 (91%) but a slight decrease from 2006 (95%).

Sampling gears deployed in ISB macrohabitats accounted for the majority of the catch (61%). Twenty-nine percent of the fish caught during 2007 were in CHXO habitats, followed by OSB, TRMS, SCCL, and SCCS habitats (8, 0.7, 0.5, and 0.2%, respectively). Most species from 2005, 2006, and 2007 were caught in BARS mesohabitat (56, 79, and 46%, respectively). In 2007 CHNB catch increased to 41% from 2005 (21%) and 2006 (28%). Target and non-target species were also captured in ITIP and POOL mesohabitats in 2007 (12 and 0.4%, respectively).

A total of 24 species was captured with gill nets (200 net nights) including eight non-target species with a minimum of 50 individuals (Appendix F1). Gill nets were the most effective gear to sample non-target species such as goldeye and shortnose gar (CPUE = 1.25 and 0.69 fish/net night, respectively). Notable catch in gill nets were one quillback, two bigmouth buffalo, two mooneye, and two paddlefish. One-inch trammel nets captured 18 species in 28,440 meters drifted including five species represented by at least 50 individuals (Appendix F2). Non-target species captured with 1-inch trammel nets were blue catfish, channel catfish, freshwater drum, goldeye, and river carpsucker (CPUE = 0.22, 0.14, 0.02, 0.07, and 0.04 fish/100 m,

respectively). Gill nets and trammel nets captured fewer blue and channel catfish, freshwater drum, and river carpsuckers but captured larger individuals of these species than other gears.

Mini-fyke nets captured 36 non-target species, including 16 species represented by at least 50 individuals (Appendix F6). CPUE (number of fish/net night) for the species mini-fyke nets most efficiently captured was: bullhead minnows = 2.78, bluegill sunfish = 0.7, emerald shiners = 34, green sunfish = 1.38, gizzard shad = 1.73, mosquito fish = 1.24, red shiners = 10.58, river carpsuckers = 6.21, and river shiners = 6.29. There were more species represented by at least 50 individuals in 2007 than in 2005 (N = 12) and 2006 (N = 9). Notable catch in mini-fyke nets were one of each of the following species: black bullhead, central stoneroller, golden shiner, ghost shiner, logperch, and suckermouth minnow.

Otter trawls captured 13 of the non-target species represented by at least 50 individuals (Appendix F4). Blue catfish, channel catfish, freshwater drum, and silver chubs (CPUE = 3.81, 4.66, 4.22, and 0.29 fish/100m, respectively) were most effectively sampled using otter trawls. There was a two-fold increase in blue and channel catfish in 2007 (N = 1,103 and 1,371, respectively) from 2005 (N = 425 and 711, respectively) and three fold increase from 2006 (N = 304 and 502, respectively). This may have been attributed to the flood event of 2007. Otter trawls captured a greater number of catfish, freshwater drum, and river carpsuckers (N = 2474, 1,009, and 89, respectively) than gillnets (N = 115, 18, and 14, respectively) and trammel nets (N = 90, 5, and 9, respectively), but they were mostly smaller individuals. Of the aforementioned species of fish, otter trawl captured 7 – 498 mm individuals, gill nets captured 182 – 951 mm individuals, and trammel nets captured 132 – 667 mm individuals. This is evident across all years sampled in segment 10. Notable catch in otter trawls were one suckermouth minnow and one stonecat.

Discussion

Ten pallid sturgeon were captured in segment 10 during 2007 sampling season. These fish were captured in November, January, March, and April, with a lapse of time until September when three pallid sturgeon were captured. In the past, fish have shown an affinity to the area of segment 10 downstream of the Kansas City metro area (river mile 321 – 342; Caton et al 2007a). However, in 2007, fish were captured from locations spanning the length of the segment, perhaps due to the increase in the number of randomly selected bends sampled in the lower portion of segment 10 (RM 300 – 250).

Gill nets were the most effective gear in 2007 for capturing pallid sturgeon (including hatchery-stocked and unknown-status individuals). During fish community season, trammel nets were the most effective gear at capturing hatchery-stocked pallid sturgeon, with a slightly higher CPUE than the catch of hatchery-stocked fish in gill nets. However, this is inconsequential considering the small sample size of fish captured in trammel nets during fish community season (N = 3), and in gill nets (N = 6). During the 2006 sampling season, 2.5 inch mesh trammel nets were the most effective at capturing pallid sturgeon. The 2.5 inch trammel net captured pallid sturgeon greater than 777 mm (777 – 985 mm). However, this gear was removed from our standard sampling in 2007 because it was found to capture the same size range of fish (in some cases fewer individuals) than the standard 1-inch mesh trammel net (Kueter et al 2007). One inch trammel nets did not capture any pallid sturgeon in 2006. In Segment 10, one inch trammel nets have captured pallid sturgeon that range in size from 450 – 708 mm. Gill nets captured pallid sturgeon that range 281 – 968 mm.

This year (2007) was the first the 2001 year class of pallid sturgeon were detected in segment 10, with a total of four fish. In 2005 and 2006, only 2002 and 2004 year class fish were sampled; however, the origin of seven fish captured in 2006 are awaiting genetic verification. Therefore, additional year classes may have been collected. The majority of hatchery-stocked fish recaptured from RPMA 4 (river mile 799 – 0) from sample year 2004 – 2006 (including 2007 captures from segments 10 and 11) have been from the 2002 year class (N = 29), followed closely by the 2003 (N = 19) year class (Doyle et al 2005, Steffenson and Mestl 2005, Barada and Steffenson 2006, Kennedy et al 2006, Steffenson and Barada 2006, Stukel et al 2006 and 2007, Utrup et al 2006a and b, Caton et al 2007a and b, Hamel and Steffenson 2007, Plauck et al 2007a and b, Steffenson and Hamel 2007). Of the 78,578 pallid sturgeon that have been stocked into RPMA 4, the largest year class has been 2004, with 39, 177 individuals stocked in the river.

This is over three times as many as from any other year class (four times as much as the 2002 year class), but yet only 17 have been recaptured within the RPMA. This could be the result of those fish being too small to recruit to our gears. The relative poor success in recapture of the 2002 year class from RPMA could be the result of several factors, including favorable river conditions in the stocking year (2003) and size at stocking (yearling). Since the greatest number of recaptures occurred with the older year classes (2001-2003), these fish might simply have grown to the size that most readily recruited to our gears by the start of standard sampling in 2004.

There were more sturgeon chubs and sicklefin chubs captured in the 2005 sample year than in 2006 and 2007. This is remarkable, considering that only four months of sampling occurred in 2005 (fish community season only) than in the 12 months of sampling in 2006 and 2007. Twenty sturgeon chubs were captured in 2005, compared to 18 and 4 in 2006 and 2007, respectively. A total of 130, 54, and 85 sicklefin chubs were captured in 2005, 2006 and 2007, respectively. However, the CPUE does not reflect this increase in catch of individual sturgeon and sicklefin chubs. Comparing just fish community season for all three years, the lowest CPUE was recorded in 2005 for both species. Total effort for trammel nets during fish community season was 18,240, 4,325 and 13,788 m in 2005, 2006, and 2007, respectively. Total effort for otter trawls during fish community season was 25,560, 6,075, and 17,872 m for 2005, 2006, and 2007, respectively. Though there were less sample months in 2005, there was a relatively high number of meters sampled; therefore, the CPUE is low compared to the number of individuals captured.

When comparing habitat types for all *Macrhybopsis* target species, more fish are captured in the inside bend habitat (60%). However, there is a high number of captures in the channel cross-over habitat (37%) compared to the amount of effort expended there by otter trawls (19%). This is similar to the trend observed in 2006, when the CPUE was higher for all *Macrhybopsis* target species in the channel cross-over compared to the inside bend habitat (Caton et al 2006). Since these species are a food item for the pallid sturgeon (Gerrity et al 2006), there could be a connection between this habitat affinity and the large amount of pallid sturgeon found in association with cross-overs during certain times of the year (personal communication with S. Davenport et al 2008).

Flood events occurred in segment 10 during the 2005 and 2007 sampling season (Appendix J). Because of this increase in flow, it was hypothesized more small (YOY) fish of many species would be captured during these years, due to the increased wetted area and

potential increase in availability of spawning habitat. Young-of-year shovelnose sturgeon (≤ 179 mm; Steffenson and Hamel 2008) were captured in the highest percent in 2005 (9.4%), followed by 2007 (2.3%) and 2006 (0.8%). This suggests that the sustained flooding experienced in 2005 may have improved steps in the reproduction process of shovelnose sturgeon more than the sharp spike of flooding in 2007. The low flow (lower than the 50-year average daily flow) in 2006 could be the reason few YOY shovelnose sturgeon were captured. Since it is difficult to identify very small *Scaphirhynchus* to species, several small sturgeon were collected for genetic verification of species.

Of all *Macrhybopsis* target species, there were more (65%) under 50 mm in 2007 than in 2005 (43%) and 2006 (38%). It is possible this increase in the presence of smaller chubs is the result of flood conditions experienced on the Missouri River in 2007. Proficiency in gear use may have caused an increase in catch rates, especially due to change in staff and unfamiliarity of gear deployment. Fluctuations in the hydrograph in 2005 and 2007 may provide some semblance of a natural hydrograph and encourage fish production (Niswonger et al 2008).

EVALUATION GEAR

During the 2007 fish community season, PSPAP implemented an evaluation of a small benthic trawl (push trawl) throughout the basin. The push trawl was used to sample water between 0.25 - 2.0 meters and deployed from the bow of a jet outboard powered boat while traveling in a downstream direction. A specialized boom configuration extending from the bow allowed this net to be pushed, rather than towed, along the river bottom. Standard trawl hauls ranged from a minimum distance of 15 m to a maximum distance of 150 m. All push trawls were constructed from 4 mm (1/8 inch) nylon mesh, designed with a 2.4 m (8 ft.) headrope, 0.6 m mouth height, and an overall length of 1.8 meters. Paired wooden doors were 762 mm (30in.) x 381 mm (15 in.).

The premise of this push trawl gear evaluation was to measure its effectiveness in sampling the fish community and compare it to the standard otter trawl and mini-fyke net catch (Utrup 2007). From the ten bends randomly selected in segment 10 for the 2007 sampling season, five bends were subsequently randomly selected for deployment of the push trawl during fish community season. The net was deployed with a minimum of eight subsamples with two deployments in each available macrohabitat and mesohabitat combination.

Push trawl and mini-fyke deployments were categorized into three groups. The first classification (A) is where the push trawl was deployed in an area not suitable for mini-fyke and otter trawl deployment. This includes unsuitable areas where standard otter trawl and mini-fyke cannot be deployed according to protocols (Drobish 2008b). The second area (B) is where a mini-fyke net was deployed in an area not accessible by the push trawl. These habitats include backwaters, isolated bar scour areas, and areas with woody debris present. Lastly, push trawl was deployed in areas (C) that can be compared to mini-fyke net sets. This area was deemed fishable by both gears.

Morisita's (1959) index of community similarity was selected to measure the catch of area C sampled both by mini-fyke nets and push trawls. Values are generated from zero (dissimilar) to 1 (similar). A value of 0.282 was assigned to the gear comparison. Although these areas were presumed fishable by both gears, clear differences are present in species composition of these two gear types. Mini-fyke nets had greater species diversity but push trawls caught a greater percentage of chub species and captured small YOY sturgeon. Mini-fyke nets captured more sand shiners and *Hybognathus* spp.

Acknowledgments

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APPENDICES

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
Catostomidae - suckers	Unidentified Catostomidae	UCT
ORDER SILURIFORMES		
Ictaluridae – bullhead catfishes		
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurusnebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnes</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
ORDER SALMONIFORMES		
Esocidae - pikes		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
Umbridae - mudminnows		
<i>Umbra limi</i>	Central mudminnow	MDMN
Osmeridae - smelts		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
Salmonidae - trouts		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarki</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonniville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL

Appendix A. (continued).

Scientific name	Common name	Letter Code
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
<i>Lota lota</i>	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus daphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
	Poeciliidae - livebearers	
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
	Atherinidae - silversides	
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	Gasterosteidae - sticklebacks	
<i>Culea inconstans</i>	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	Cottidae - sculpins	
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	Percichthyidae – temperate basses	
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
	Centrarchidae - sunfishes	
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis magalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

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

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

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
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 ³ /s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m ³ /s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Dam Tailwaters	Meso	Area below dam	DTWT
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 10 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 20xx for segment 10.

Gear	Code	Type	Season	Years	CPUE units
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	fish/net night
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2006 - Present	fish/ m trawled
Trammel net – 1 inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Trot Line – Circle hooks**	TLC_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – Octopus hooks**	TLO_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – O’Shaughnessy hooks**	TLS_	Wild	Sturgeon	2007 - Present	fish/hook night
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2006 - Present	fish/100 m trawled

* Standard only in upper Missouri River segments

** Code ends with line length in feet (1 = 105 ft, 2 = 205 ft, 3 = 305 ft, 4 = 405 ft). Hooks are placed between 5 and 10 feet apart.

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

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KA/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9

MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 10 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking ^a	Primary Mark	Secondary Mark
1997	Waverly	24	1997	09/18/1997	Fingerling	PIT tag/ Floy tag	N/A
1997	Buckner	389	1997	07/24/1997	Fingerling	CWT/ Floy tag	N/A
2005	Miami	264	2004	06/15/2005	Yearling	PIT Tag	Elastomer
2005	Miami	1279	2004	06/16/2005	Yearling	PIT Tag	Elastomer
2005	Miami	241	2004	06/30/2005	Yearling	PIT Tag	Elastomer
2005	Miami	353	2004	09/19/2005	Yearling	PIT Tag	Elastomer
2005	Miami	1476	2004	09/22/2005	Yearling	PIT Tag	Elastomer
2005	Kansas City	2365	2004	04/25/2005	Yearling	PIT Tag, some Coded Wire	Elastomer

^aAge of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc...

Appendix F

Total catch, overall mean catch per unit effort [± 2 SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 10 of the Missouri River during 2006-2007. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when $N < 2$.

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL
			CHNB	POOL	CHNB	POOL	CHNB	POOL	ITIP
BHCP	1	0.005 0.01	0 0	0 0	0 0	0.013 0.026	0 0	0 0	0
BKBF	1	0.005 0.01	0 0	0 0	0.017 0.034	0 0	0 0	0 0	0
BLCF	103	0.515 0.249	0 0	0.632 0.404	0.052 0.076	0.936 0.571	0 0	0.375 0.75	0
BMBF	2	0.01 0.014	0 0	0.053 0.072	0 0	0 0	0 0	0 0	0
BUSK*	7	0.035 0.036	0.071 0.143	0 0	0 0	0.077 0.086	0 0	0 0	0
CARP	11	0.055 0.037	0.071 0.143	0.132 0.129	0 0	0.026 0.036	0.5 0	0.25 0.5	0
CNCF	12	0.06 0.046	0 0	0.105 0.123	0.017 0.034	0.064 0.084	0 0	0.25 0.5	0
FHCF	1	0.005 0.01	0 0	0 0	0 0	0 0	0 0	0.125 0.25	0
FWDM	18	0.09 0.085	0 0	0.289 0.369	0 0	0.038 0.057	0 0	0.5 1	0
GDEY	249	1.245 0.605	0.071 0.143	2 1.649	0.586 1.137	1.679 0.988	0.5 0	0.75 1.5	0
GSCP	11	0.055 0.042	0 0	0.026 0.053	0.069 0.082	0.064 0.084	0 0	0.125 0.25	0
GZSD	44	0.22 0.137	0 0	0.237 0.221	0.052 0.076	0.41 0.322	0 0	0 0	0
LNGR	21	0.105 0.076	0 0	0.132 0.214	0.017 0.034	0.154 0.143	0 0	0.375 0.75	0
MNEY	2	0.01 0.014	0 0	0 0	0 0	0.026 0.036	0 0	0 0	0
PDFH	2	0.01 0.014	0 0	0 0	0 0	0.026 0.036	0 0	0 0	0
PDSG*	6	0.03 0.024	0 0	0.053 0.072	0.017 0.034	0.038 0.043	0 0	0 0	0

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL
			CHNB	POOL	CHNB	POOL	CHNB	POOL	ITIP
RVCS	14	0.07	0	0.053	0.052	0.09	0	0.25	0
		0.062	0	0.072	0.103	0.127		0.5	
SGER*	26	0.13	0	0.289	0.017	0.179	0	0	0
		0.111	0	0.421	0.034	0.193		0	
SMBF	17	0.085	0.071	0.053	0.017	0.154	0.5	0	0
		0.064	0.143	0.105	0.034	0.148		0	
SNGR	138	0.69	0	2.026	0.086	0.692	0	0.25	0
		0.779	0	3.777	0.141	0.784		0.289	
SNPD	8	0.04	0.143	0.026	0.017	0.051	0	0	0
		0.031	0.286	0.053	0.034	0.049		0	
SNSG*	1045	5.225	3.429	7.526	1.017	7.859	0.5	4.625	0.5
		1.422	4.935	3.695	0.683	2.605		2.658	
SVCP	19	0.095	0	0.079	0	0.192	0	0.125	0
		0.058	0	0.086	0	0.136		0.25	
WTBS	4	0.02	0	0.079	0	0.013	0	0	0
		0.024	0	0.115	0	0.026		0	

Appendix F2. 1 Inch Trammel Net:overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO	ISB		OSB	
			CHNB	CHNB	ITIP	CHNB	ITIP
BHCP	3	0.012	0.014	0.011	0	0	0
		0.014	0.029	0.017			
BKBF	3	0.012	0	0.017	0	0	0
		0.014	0	0.02			
BLCF	57	0.22	0.248	0.214	0	0	0
		0.086	0.147	0.108			
BUSK*	18	0.085	0.025	0.111	0	0	0
		0.064	0.035	0.09			
CARP	6	0.023	0.041	0.01	0.909	0	0
		0.027	0.083	0.017			
CNCF	33	0.142	0.028	0.19	0	0	0
		0.101	0.04	0.142			
FHCF	2	0.01	0	0.014	0	0	0
		0.014	0	0.02			
FWDM	5	0.015	0.016	0.015	0	0	0
		0.014	0.024	0.018			
GDEY	19	0.068	0.066	0.067	0	0	0
		0.034	0.071	0.04			
GSCP	3	0.011	0.006	0.013	0	0	0
		0.013	0.013	0.018			
GZSD	2	0.004	0.01	0.002	0	0	0
		0.006	0.02	0.004			
LNGR	4	0.016	0.021	0.014	0	0	0
		0.017	0.042	0.017			
PDSG*	4	0.015	0	0.021	0	0	0
		0.015	0	0.021			
RVCS	9	0.036	0.042	0.035	0	0	0
		0.025	0.043	0.031			
SGER*	7	0.039	0.039	0.039	0	0	0
		0.033	0.044	0.043			
SMBF	22	0.081	0.067	0.088	0	0	0
		0.042	0.067	0.053			
SNGR	8	0.045	0.087	0.03	0	0	0
		0.036	0.111	0.027			

Species	Total Catch	Overall CPUE	CHXO	ISB	ITIP	OSB	ITIP
			CHNB	CHNB		CHNB	
SNSG*	732	2.819	2.879	2.779	9.091	0	0
		0.858	2.162	0.871			
SNPD	2	0.009	0.033	0	0	0	0
		0.014	0.048	0			

Appendix F4. Otter Trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	
			CHNB	CHNB	CHNB	CHNB	ITIP
BHMW	18	0.094	0.351	0.006	0	0	0
		0.179	0.702	0.013	0	0	0
BLCF	1103	3.81	5.143	3.313	6.167	0	4.087
		1.311	3.43	1.377	8.728	0	4.77
BLGL	4	0.021	0.083	0	0	0	0
		0.042	0.165	0	0	0	0
BMBF	1	0.004	0.014	0	0	0	0
		0.007	0.028	0	0	0	0
BUSK*	6	0.012	0	0.018	0	0	0
		0.01	0	0.015	0	0	0
CARP	11	0.055	0.103	0.041	0	0	0
		0.04	0.112	0.041	0	0	0
CNCF	1371	4.655	4.924	4.756	2.743	1.152	1.357
		1.708	2.706	2.249	3.919	1.262	0.427
ERSN	12	0.045	0.009	0.062	0	0	0
		0.071	0.018	0.102	0	0	0
FHCF	27	0.094	0.024	0.127	0	0	0
		0.15	0.047	0.216	0	0	0
FHMW	1	0.004	0	0.005	0	0	0
		0.007	0	0.01	0	0	0
FWDM	1009	4.222	9.19	2.691	0.467	0	0.145
		1.808	5.915	1.343	0.933	0	0.29
GDEY	137	0.367	0.183	0.452	0.2	0	0.145
		0.289	0.17	0.411	0.4	0	0.29
GZSD	20	0.104	0.3	0.039	0	0	0
		0.098	0.373	0.031	0	0	0
OSSF	9	0.041	0.124	0.013	0	0	0
		0.066	0.248	0.027	0	0	0
RDSN	3	0.013	0	0.019	0	0	0
		0.026	0	0.038	0	0	0
RVCS	89	0.379	0.575	0.333	0	0	0.145
		0.289	0.496	0.374	0	0	0.29

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	
			CHNB	CHNB	CHNB	CHNB	ITIP
RVSN	5	0.02	0	0.029	0	0	0
		0.036	0	0.051	0	0	0
SFCB*	85	0.437	1.445	0.1	0	0	0
		0.636	2.486	0.073	0	0	0
SGCB*	4	0.01	0	0.015	0	0	0
		0.013	0	0.018	0	0	0
SGER*	2	0.006	0	0.009	0	0	0
		0.01	0	0.014	0	0	0
SKCB*	133	0.483	0.355	0.55	0	0	0.768
		0.427	0.431	0.595	0	0	0.788
SMBF	2	0.007	0.007	0.008	0	0	0
		0.011	0.015	0.016	0	0	0
SMMW	1	0.002	0	0.003	0	0	0
		0.005	0	0.007	0	0	0
SNGR	5	0.022	0.045	0.015	0	0	0
		0.026	0.091	0.018	0	0	0
SNPD	1	0.003	0	0.005	0	0	0
		0.006	0	0.009	0	0	0
SNSG*	306	0.953	1.702	0.684	1.118	0.362	0.978
		0.352	1.287	0.169	0.729	0.725	1.542
SNSN*	1	0.003	0	0.005	0	0	0
		0.007	0	0.01	0	0	0
STCT	1	0.002	0	0.003	0	0	0
		0.004	0	0.005	0	0	0
SVCB	86	0.288	0.211	0.334	0.118	0	0
		0.131	0.213	0.171	0.235	0	0
UHY	8	0.036	0.073	0.026	0	0	0
		0.04	0.145	0.023	0	0	0
UIC	32	0.137	0.299	0.087	0	0	0
		0.093	0.319	0.063	0	0	0
UTB	4	0.015	0.024	0.013	0	0	0
		0.022	0.047	0.027	0	0	0
WTBS	1	0.005	0.021	0	0	0	0
		0.011	0.041	0	0	0	0
WTCP	5	0.029	0.115	0	0	0	0
		0.049	0.193	0	0	0	0

Appendix F6. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO		ISB	OSB	SCCS	TRMS
			BAR	CHNB	BAR	BAR	BAR	BAR
BHMW	182	2.275 0.746	2.667 1.776	0	2.367 1.207	2.312 1.3	0.6 0.49	1.75 0.5
BKBH	1	0.012 0.025	0.042 0.083	0	0 0	0 0	0 0	0 0
BKCP	9	0.112 0.138	0.292 0.442	0	0.033 0.067	0 0	0.2 0.4	0 0
BLCF	2	0.025 0.035	0 0	0	0.033 0.067	0.062 0.125	0 0	0 0
BLGL	55	0.688 0.353	1.083 0.842	0	0.067 0.093	0.875 0.727	0.4 0.49	2.75 3.202
BNMW	9	0.112 0.08	0.167 0.197	0	0.167 0.138	0 0	0 0	0 0
BSMW*	1	0.012 0.025	0 0	0	0.033 0.067	0 0	0 0	0 0
CARP	10	0.125 0.125	0.208 0.24	0	0.133 0.267	0 0	0.2 0.4	0 0
CLSR	1	0.012 0.025	0 0	0	0.033 0.067	0 0	0 0	0 0
CNCF	189	2.362 1.336	0.5 0.269	0	4.867 3.333	1.188 0.841	2.2 2.638	0.25 0.5
ERSN	2715	33.938 18.819	28.042 31.976	47	48.133 41.266	29.375 24.004	7.8 9.217	10.5 5.066
FHCF	17	0.212 0.127	0.208 0.24	1	0.2 0.223	0.125 0.171	0.6 0.8	0 0
FHMW	1	0.012 0.025	0 0	0	0.033 0.067	0 0	0 0	0 0
FWDM	290	3.625 1.735	5.625 5.25	8	3.3 1.697	2.312 1.423	1.2 0.98	1.25 0.5
GDEY	8	0.1 0.131	0.083 0.115	0	0.167 0.333	0 0	0.2 0.4	0 0
GDSN	1	0.012 0.025	0 0	0	0 0	0 0	0 0	0.25 0.5
GNSF	110	1.375 0.616	2.417 1.655	0	1.233 0.8	0.375 0.403	1 2	1

Species	Total Catch	Overall CPUE	CHXO		ISB	OSB	SCCS	TRMS
			BAR	CHNB	BAR	BAR	BAR	BAR
GSOS	1	0.012	0	0	0	0.062	0	0
		0.025	0		0	0.125	0	0
GTSN	1	0.012	0	0	0.033	0	0	0
		0.025	0		0.067	0	0	0
GZSD	138	1.725	2.208	0	2.067	1	0.4	0.75
		0.858	1.378		1.891	1.183	0.49	1.5
HBNS*	1	0.012	0	0	0	0.062	0	0
		0.025	0		0	0.125	0	0
LGPH	1	0.012	0.042	0	0	0	0	0
		0.025	0.083		0	0	0	0
LMBS	18	0.225	0.292	0	0.2	0	0.6	0.5
		0.133	0.255		0.223	0	0.8	1
LNDR	21	0.262	0.458	0	0.2	0.188	0.2	0
		0.122	0.294		0.149	0.272	0.4	0
MQTF	99	1.238	2.25	0	0.733	1.312	0.2	0.25
		0.468	1.287		0.488	0.598	0.4	0.5
OSSF	33	0.412	1.167	0	0.067	0	0	0.5
		0.381	1.22		0.093	0	0	0.577
PNMW*	210	2.638	1.125	0	5.9	0	1.2	0.25
		3.386	1.585		8.898	0	1.939	0.5
QLBK	0	0	0	0	0	0	0	0
		0	0		0	0	0	0
RDSN	846	10.575	4.917	0	18.233	6.938	11	2
		4.359	4.379		10.042	5.548	10.431	1.414
RVCS	497	6.212	5.542	0	9.3	2.125	7.2	1.25
		3.687	4.475		9.01	2.105	4.578	1.5
RVSN	503	6.288	1.833	0	13.133	3.375	1.4	0.75
		4.451	1.591		11.4	2.442	2.8	1.5
SGER*	1	0.012	0.042	0	0	0	0	0
		0.025	0.083		0	0	0	0
SKCB*	8	0.1	0	0	0.233	0.062	0	0
		0.116	0		0.298	0.125	0	0
SMBF	1	0.012	0	0	0	0.062	0	0
		0.025	0		0	0.125	0	0
SMBS	1	0.012	0.042	0	0	0	0	0
		0.025	0.083		0	0	0	0

Species	Total Catch	Overall CPUE	CHXO		ISB	OSB	SCCS	TRMS
			BAR	CHNB	BAR	BAR	BAR	BAR
SMMW	1	0.012	0	0	0.033	0	0	0
		0.025	0		0.067	0	0	0
SNGR	120	1.5	2.167	0	1.2	1.375	0.4	0
		0.467	1.081		0.639	0.602	0.49	0
SNSG*	5	0.062	0.083	0	0.1	0	0	0
		0.09	0.167		0.2	0	0	0
SNSN*	12	0.15	0.125	0	0.267	0.062	0	0
		0.113	0.183		0.252	0.125	0	0
SVCB	39	0.488	0.167	0	0.733	0.188	2	0
		0.244	0.197		0.449	0.375	1.897	0
SVCP	1	0.012	0	0	0.033	0	0	0
		0.025	0		0.067	0	0	0
UAC	2	0.025	0.042	0	0	0.062	0	0
		0.035	0.083		0	0.125	0	0
UCT	9	0.112	0	0	0	0	1.8	0
		0.225	0		0	0	3.6	0
UCY	10	0.125	0.208	0	0.033	0	0.8	0
		0.161	0.417		0.067	0	1.6	0
UIC	1	0.012	0	0	0.033	0	0	0
		0.025	0		0.067	0	0	0
UNID	1	0.012	0	0	0.033	0	0	0
		0.025	0		0.067	0	0	0
UNO	1	0.012	0	0	0	0.062	0	0
		0.025	0		0	0.125	0	0
UTB	13	0.162	0.292	0	0.2	0	0	0
		0.103	0.255		0.177	0	0	0
WSMW*	2	0.025	0.042	0	0.033	0	0	0
		0.035	0.083		0.067	0	0	0
WTBS	15	0.188	0.25	0	0.267	0.062	0	0
		0.155	0.346		0.302	0.125	0	0
WTCP	21	0.262	0.417	0	0.267	0.125	0	0.25
		0.204	0.433		0.406	0.171	0	0.5

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

Species	Total Catch	Overall CPUE	CHXO		ISB	OSB	SCCL	SCCS
			BAR	CHNB	BAR	BAR	BAR	BAR
BHMW	237	13.623	13.564	0	2.571	42.898	0	3.509
		12.156	15.637		4.132	54.776		7.018
BLCF	53	2.897	2.036	0	3.11	5.281	0	1.365
		1.339	1.947		2.976	1.97		1.765
CNCF	565	28.608	17.396	61.111	23.323	55.178	3.509	27.069
		13.395	14.223		12.104	58.061		30.181
ERSN	42	2.595	7.648	0	0.453	0.98	0	0
		3.036	10.023		0.522	0.976		0
FHCF	2	0.115	0	0	0.159	0.291	0	0
		0.16	0		0.317	0.581		0
FWDM	98	5.767	11.015	0	1.294	10.171	0	0.877
		2.79	7.458		1.677	4.23		1.754
GZSD	1	0.079	0.269	0	0	0	0	0
		0.157	0.538		0	0		0
OSSF	11	0.514	1.757	0	0	0	0	0
		0.881	2.976		0	0		0
PNMW*	1	0.059	0.203	0	0	0	0	0
		0.119	0.407		0	0		0
RDSN	36	2.17	1.829	0	0.575	7.065	0	0.463
		2.645	3.659		0.751	12.373		0.926
RVCS	6	0.354	0.769	0	0	0.223	0	0.877
		0.382	1.131		0	0.446		1.754
RVSN	23	1.123	0.61	0	0.837	0.543	0	5.458
		0.906	1.22		0.835	1.087		7.061
SFCB*	15	1.126	2.957	0	0.36	0.658	0	0
		1.756	5.914		0.721	1.316		0
SGCB*	4	0.153	0	0	0.418	0	0	0
		0.22	0		0.589	0		0
SKCB*	346	18.321	7.757	5.556	17.735	42.571	3.509	10.609
		9.522	8.556		11.075	39.066		9.703

Species	Total Catch	Overall CPUE	CHXO		ISB	OSB	SCCL	SCCS
			BAR	CHNB	BAR	BAR	BAR	BAR
SNGR	2	0.136	0.463	0	0	0	0	0
		0.271	0.926		0	0		0
SNSG*	4	0.166	0	0	0.234	0	0	0.82
		0.231	0		0.468	0		1.639
SVCB	13	0.608	0.337	0	0.694	1.31	0	0
		0.574	0.457		1.031	2.156		0
UHY	193	11.122	17.819	0	12.929	1.426	0	9.211
		6.804	11.645		15.035	1.118		18.421
ULP	11	0.479	1.637	0	0	0	0	0
		0.958	3.274		0	0		0
WTCP	1	0.044	0.149	0	0	0	0	0
		0.087	0.298		0	0		0
YOYF	1	0.054	0.185	0	0	0	0	0
		0.108	0.37		0	0		0

Appendix G. Hatchery names, locations, and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2006 – 2007 for segment 10 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
BHCP	0.016	0.005	0.000	0.008	0.000	0.000	0.000
BHMW	0.000	0.000	0.000	0.000	2.275	0.189	13.623
BKBF	0.007	0.005	0.000	0.017	0.000	0.000	0.000
BKBH	0.000	0.000	0.000	0.000	0.013	0.000	0.000
BKCP	0.000	0.000	0.000	0.000	0.113	0.000	0.000
BLCF	0.191	0.515	0.718	0.246	0.025	6.959	2.897
BLGL	0.000	0.000	0.000	0.000	0.688	0.042	0.000
BMBF	0.000	0.010	0.007	0.000	0.000	0.000	0.000
BNMW	0.000	0.000	0.000	0.000	0.113	0.000	0.000
BSMW*	0.000	0.000	0.000	0.000	0.013	0.000	0.000
BUSK*	0.022	0.035	0.005	0.145	0.000	0.019	0.000
CARP	0.011	0.055	0.046	0.034	0.125	0.064	0.000
CLSR	0.000	0.000	0.000	0.000	0.013	0.000	0.000
CNCF	0.068	0.060	2.379	0.212	2.363	6.973	28.608
ERSN	0.000	0.000	0.005	0.000	33.938	0.087	2.595
FHCF	0.000	0.005	0.154	0.019	0.213	0.033	0.115
FHMW	0.000	0.000	0.007	0.000	0.013	0.000	0.000
FWDM	0.010	0.090	2.680	0.020	3.625	5.793	5.767
GDEY	0.058	1.245	0.007	0.077	0.100	0.733	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
GDSN	0.000	0.000	0.000	0.000	0.013	0.000	0.000
GNSF	0.000	0.000	0.000	0.000	1.375	0.000	0.000
GSCP	0.000	0.055	0.000	0.021	0.000	0.000	0.000
GSOS	0.000	0.000	0.000	0.000	0.013	0.000	0.000
GTSN	0.000	0.000	0.000	0.000	0.013	0.000	0.000
GZSD	0.009	0.220	0.008	0.000	1.725	0.201	0.079
HBNS*	0.000	0.000	0.000	0.000	0.013	0.000	0.000
LGPH	0.000	0.000	0.000	0.000	0.013	0.000	0.000
LMBS	0.000	0.000	0.000	0.000	0.225	0.000	0.000
LNGR	0.006	0.105	0.000	0.025	0.263	0.000	0.000
MNEY	0.000	0.010	0.000	0.000	0.000	0.000	0.000
MQTF	0.000	0.000	0.000	0.000	1.238	0.000	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OSSF	0.000	0.000	0.000	0.000	0.413	0.082	0.514
PDFH	0.000	0.010	0.000	0.000	0.000	0.000	0.000
PDSG*	0.006	0.030	0.000	0.023	0.000	0.000	0.000
PNMW*	0.000	0.000	0.000	0.000	2.638	0.000	0.059
QLBK	0.000	0.005	0.000	0.000	0.000	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
RDSN	0.000	0.000	0.000	0.000	10.575	0.027	2.170
RVCS	0.027	0.070	0.038	0.045	6.213	0.727	0.354
RVSN	0.000	0.000	0.000	0.000	6.288	0.040	1.123
SFCB*	0.000	0.000	0.091	0.000	0.000	0.790	1.126
SGCB*	0.000	0.000	0.006	0.000	0.000	0.015	0.153
SGER*	0.023	0.130	0.000	0.053	0.013	0.012	0.000
SJHR	0.000	0.000	0.000	0.011	0.000	0.000	0.000
SKCB*	0.000	0.000	0.128	0.000	0.100	0.844	18.321
SMBF	0.075	0.085	0.004	0.087	0.013	0.011	0.000
SMBS	0.000	0.000	0.000	0.000	0.013	0.000	0.000
SMMW	0.000	0.000	0.000	0.000	0.013	0.005	0.000
SNGR	0.012	0.690	0.008	0.076	1.500	0.037	0.136
SNPD	0.019	0.040	0.000	0.000	0.000	0.006	0.000
SNSG*	2.140	5.225	1.275	3.458	0.000	0.625	0.166
SNSN*	0.000	0.000	0.007	0.000	0.150	0.000	0.000
STCT	0.000	0.000	0.000	0.000	0.000	0.004	0.000
SVCB	0.000	0.000	0.059	0.000	0.488	0.522	0.608
SVCP	0.000	0.095	0.000	0.000	0.013	0.000	0.000
UAC	0.000	0.000	0.000	0.000	0.025	0.000	0.000
UCT	0.000	0.000	0.000	0.000	0.113	0.000	0.000
UCY	0.000	0.000	0.000	0.000	0.125	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
UHY	0.000	0.000	0.022	0.000	0.000	0.052	11.122
UIC	0.000	0.000	0.185	0.000	0.013	0.088	0.000
ULP	0.000	0.000	0.000	0.000	0.000	0.000	0.479
UNID	0.000	0.000	0.000	0.000	0.013	0.000	0.000
UNO	0.000	0.000	0.000	0.000	0.013	0.000	0.000
UTB	0.000	0.000	0.000	0.000	0.163	0.031	0.000
WSMW*	0.000	0.000	0.000	0.000	0.025	0.000	0.000
WTBS	0.000	0.020	0.000	0.000	0.188	0.011	0.000
WTCP	0.000	0.000	0.000	0.000	0.263	0.059	0.044
YOYF	0.000	0.000	0.000	0.000	0.000	0.000	0.054

Appendix I. Comprehensive list of bend numbers and locations for segment 10 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2005 – 2007.

Bend Number	Bend River Mile	Coordinates*		2003	2004	2005	2006	2007
		Latitude	Longitude					
1	253.3	39.39428	-93.15643					ST, FCS
2	257.3	39.39292	-93.19841			FCS		
3	260.3	39.35655	-93.20347					ST, FCS
4	261.4	39.34274	-93.21281					ST, FCS
5	263.6	39.32647	-93.24270					
6	265.1	39.31844	-93.26730					
7	267.2	39.31054	-93.30167			FCS		
8	271.9	39.27278	-93.33320					
9	274.2	39.24623	-93.34240			FCS		
10	275.7	39.23503	-93.36554					
11	279.9	39.24853	-93.40914					
12	282.4	39.26728	-93.42536					ST, FCS
13	285.0	39.28594	-93.45674					
14	290.2	39.24673	-93.48992			FCS		
15	296.6	39.22691	-93.56764					ST, FCS
16	299.6	39.23687	-93.61158				ST, FCS	
17	301.5	39.23259	-93.64411					ST, FCS
18	304.6	39.21977	-93.69111			FCS		
19	307.3	39.20940	-93.73250			FCS		
20	309.6	39.20175	-93.77281			FCS	ST	
21	311.5	39.20854	-93.80446					
22	318.0	39.17873	-93.90433					
23	319.5	39.16527	-93.92519					
24	321.5	39.14790	-93.95275				ST	
25	324.2	39.15638	-93.99346					
26	327.0	39.14588	-94.03803				ST	
27	332.3	39.15676	-94.11968				ST	ST, FCS
28	335.2	39.17664	-94.16208			FCS	ST, FCS	ST, FCS
29	337.1	39.18837	-94.18866				ST, FCS	ST, FCS
30	338.9	39.20616	-94.20833					

* Coordinates represent the upper most point of the bend (i.e., the top of the bend going upstream).

Appendix I. (continued).

Bend Number	Bend River Mile	Coordinates*		2003	2004	2005	2006	2007
		Latitude	Longitude					
31	340.4	39.21707	-94.23083					
32	342.4	39.23606	-94.25531			FCS	ST	
33	343.6	39.23677	-94.27731					
34	346.6	39.21433	-94.31603			FCS		
35	351.3	39.16828	-94.37013					
36	354.1	39.15528	-94.41484					ST, FCS
37	359.2	39.14354	-94.48210			FCS		
38	363.3	39.13487	-94.54504			FCS		
39	368.9	39.13213	-94.59470				ST, FCS	

* Coordinates represent the upper most point of the bend (i.e., the top of the bend going upstream).

USGS Gage Data at Waverly, Missouri 2005 - 2007

