

2006 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 second year within the Pallid Sturgeon Population Assessment Program in segment 10 at the beginning of the 2006 sampling season. Sampling was successfully completed in all required bends ($N = 4$) during the 2006 sturgeon and fish community season. A total of eleven pallid sturgeon (8 “unknown” pending genetic verification and 3 hatchery-stocked; fork length = 281 to 985 mm) were captured in segment 10 during the 2006 sturgeon and fish community seasons. Seven individuals were caught in gill nets (mean CPUE = 0.029 fish/100m), and three individuals were captured in standard 2.5-inch trammel nets (mean CPUE = 0.051 fish/100m). Standard otter trawls captured one pallid sturgeon with a CPUE of 0.014 fish/ 100m, that was an increase from 2005 (mean CPUE = 0.004 fish/100 m). There were no YOY sturgeons captured in segment 10 during the 2006 sampling season. Seven pallid sturgeons (3 hatchery-stocked, 4 unknowns) were captured from six river bends sampled between RM 321 and 342. Three river bends were sampled between RM 265 and 299 where three unknown pallid sturgeon were captured. One unknown pallid sturgeon was captured in the downtown Kansas City area at RM 368. Recaptured hatchery-stocked fish represented the 2002 and 2004 year classes ($N = 1$ for 2002, $N = 2$ for 2004) and all fish examined retained their PIT tags (i.e., PIT tag retention = 100%). Condition (K_n) values of hatchery-stocked pallid sturgeon ranged from 0.85 to 1.90 and were inversely related to time-at-large. Mean growth rates for the 2002 and 2004 year class individuals were 0.219 and 0.408 mm/d, respectively. Pallid sturgeon were captured in pool and channel border areas. Most (82%) were captured in areas influenced by dikes, and a small number ($N = 2$) of pallids were captured in habitats associated with sand bars. A total of 1130 shovelnose sturgeon (fork length = 23 to 764 mm) was captured with gill nets ($N = 882$), 1-inch trammel nets ($N = 147$), 2.5-inch trammel nets ($N = 24$), and otter trawls ($N = 77$). Most shovelnose sturgeon were captured within pool and channel border habitats and most were associated with below dikes. One pallid sturgeon X shovelnose sturgeon hybrid was captured at RM 335.2. This fish had a fork length of 472-mm and was captured in pool habitats. The ratio of hatchery-stocked pallid sturgeon to unknown pallid sturgeon was 1:2.3 and the ratio of all pallid sturgeon to shovelnose sturgeon was 1:102.

Sturgeon and speckled chubs were the least (N = 18) and most (N = 67) common *Macrhybopsis* species encountered, respectively, and were caught in channel borders and on sand bar mesohabitats with otter trawls and mini-fyke nets. Sicklefin chubs (N = 36) were captured with otter trawls in the channel border. All sand shiners (N = 54) were captured with mini-fyke nets on sand bars. One-inch trammel nets, 2.5-inch trammel nets, and otter trawls captured 33 blue suckers in channel border and pool mesohabitats. Twenty-six sauger were captured with gill nets, otter trawls, and 1-inch trammel nets in channel border and pool habitats. No *Hybognathus* sp. were captured during the 2006 sampling season. Overall, 7,192 fish representing 48 species was captured in segment 10 during the 2006 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, 2000, and 2002 through 2006 in all six RPMAs have resulted in approximately 200,000 pallid sturgeon being stocked into the Missouri and Mississippi River systems (Krentz and Wilson 2007). The total number of pallid sturgeon stocked per year has increased from an average of about 4,000 fish per year prior to 2000 to an average of nearly 32,000 fish per year since that time (USFWS 2005). Most pallid sturgeon were stocked as yearling (i.e., age-1) fish although some years age-0 and age-2 fish were released as well.

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

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

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

Study Area

The Missouri River was divided into segments for the PSPAP based on changes in physical attributes of the river (e.g., tributary influence, geology, turbidity, degrading or aggrading stream bed, etc.). These segments were numbered 1 through 14 in a downstream direction and included all riverine portions of the Missouri River from Fort Peck Dam to the confluence. The study area is composed of four distinct groups of segments. Segments 1 through 4 lie in RPMA 2 and includes the 203.5 river miles from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, North Dakota. Segments 5 and 6, that lie in RPMA 3, 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 Kansas River, from the Johnson County Weir (Kansas) to the mouth (15.4 miles), was given its own segment designation (segment 11) because this tributary was addressed by the 2000 Bi-Op as a high priority management area for pallid sturgeon. Segments 1 through 7 and 8 through 14 compose the “upper sampling universe” and “lower sampling universe”, respectively. The upper sampling universe is characterized by a meandering, often braided channel that lacks navigation structures and deep pools. The lower sampling universe is channelized, has revetted banks, and deep scour pools and sand bars that are associated with a variety navigation structures. This document reports activities during the 2005 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.

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 2006a, 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 2005 or when water temperatures dropped below 12.8°C (55°F) and continued through 30 June 2006. The fish community season began 01 July 2006 and continued through 31 October 2006. The Missouri Department of Conservation sampled both seasons during 2006, thus, data from both sampling seasons are included in this report. During these seasons, standard gear types included experimental gill nets, 1-inch trammel nets, 2.5-inch trammel nets, 16-foot otter trawls, and mini-fyke nets (Appendix C). Gill nets were the only sampling gear that would have been used during the sturgeon season until 01 March 2005. The beginning of this season was further divided into a pre-winter and spring gill netting period. Pre-winter gill netting was conducted from the onset of sturgeon season until 15 January. Spring gill netting efforts would have began 16 January and continued until water temperatures reached 12.8°C (55°F). Trammel netting and trawl efforts began 01 March 2006 and were conducted through 30 June.

Fish community season began 01 July 2006 and continued through 31 October 2006. Although this season utilized gears that capture sturgeon species (i.e., 1-inch trammel nets and otter trawls), particularly small (i.e., young) sturgeons, there was an additional emphasis placed on assessing the associated fish community. Standard gear types during the fish community season included 1-inch trammel nets, 16-foot otter trawls and mini-fyke nets (see Sampling Gear section for gear specifications). These gears were deployed throughout the season with efforts made to spatially and temporally distribute sampling across the 4 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 platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when practicable and measured for total length (TL) except sturgeon which were measured for fork length (FL) and paddlefish *Polyodon spathula* which were measured for eye-fork length. Shovelnose sturgeon, blue suckers, and sauger were weighed to the nearest 1 g and the remaining species of interest were weighed to the nearest 0.1 g.

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 2006 sampling season, bends within the channelized portion of the Missouri River (segments 8 through 14) were pooled to facilitate proportional representation of each segment due to large differences in segment length (113 to 228 river miles). Once all river bends were pooled, 72 river bends were randomly selected from segments 8 through 14 and evenly divided among the three agencies responsible for data collection in these segments (i.e., NGPC, MDC, and USFWS-CFRO). For the 2006 sampling season, the number of randomly selected bends for each segment of the lower sampling universe was: segment 8 – 18 bends; segment 9 – 21 bends; segment 10 – 4 bends; segment 11 – 1 bend, segment 13 – 12 bends; segment 14 – 16 bends. MDC and NGPC conducted sampling in segment 9. An additional 18 bends (6 per office) were selected for extra gill netting effort in the channelized reach to increase sturgeon capture. These were: segment 8 – 0 bends; segment 9 – 7 bends; segment 10 – 7 bends; segment 11 – 0 bends, segment 13 – 1 bend; segment 14 – 3 bends. MDC and NGPC conducted sampling in segment 9, while MDC and USFWS-CFRO conducted sampling in segments 10 and 13.

Within each randomly selected river bend in segment 10, sampling locations were selected based on the availability of standard habitats for each gear type. A minimum of two subsamples were collected within each standard mesohabitat within each available macrohabitat. Within each macrohabitat, subsamples were proportionately spaced throughout the bend among habitat features. For example, if four subsamples were conducted in the inside bend within the influence of wing dikes and there were 12 wing dikes, approximately every third wing dike would be sampled. For most gear types, two

subsamples were conducted in the channel crossover and six within the inside bend (8 subsamples per bend). Few deployments of any gear type 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 of the thalweg. Island tips were areas immediately downstream from islands where water depths were greater than 1.2 meters. Pools were areas immediately downstream from obstructions where there was a scour greater than 1.2-m in depth regardless of water velocity. The thalweg was defined as the area between the channel borders 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., 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, sand-bar lip, etc.). For complete definitions of each microhabitat type see Drobish (2006a,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 2006a). 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 same macro- and mesohabitats habitats 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 types was BARS.

Sampling Gear

Standard gill nets were set primarily parallel with flow downstream from structures (rock dikes) and along the channel border. Gill nets were also set perpendicular to the bank depending up flow in sampling areas. Gill nets were anchored to rock dikes from the upstream end. Nets were anchored on the downstream end as well to ensure complete extension during the sampling period. A line and buoy were attached to the downstream end to mark the net and for retrieval. In segment 10 during the 2006 sturgeon season, gill nets

were used as standard gear in CHXO, ISB, OSB and TRML 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, 101.6mm mesh sizes in panels 5, 6, 7, and 8, respectively. 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. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line.

Trammel nets were deployed off the bow of the boat by throwing a buoy attached to a 10-m line and motoring in reverse perpendicular to the flow toward the bank. A second buoy and line on the other end of the net remained on board and was held without tension as the net drifted downstream perpendicular to flow. Standard drifts ranged from a minimum distance of 75 m to a maximum distance of 300 m. In segment 10 during the 2006 fish community and sturgeon seasons, trammel nets were used as standard gear in CHXO, ISB, and SCCL macrohabitats and CHNB mesohabitats. Trammel nets (i.e., 1-inch trammel nets) were 38.1 m (125 ft.) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in.) bar mesh (#139 twine) that was 2.4-m deep (8 ft) and the outer wall was 203-mm (8 in.) bar mesh (# 9 twine) and was 1.8 m (6 ft.) in depth. All nets had a 13-mm braided polyfoam-core float line and a 7.1-mm diameter, 22.7 kg lead line.

Otter trawls were deployed from the stern of a custom-designed, inboard jet trawl boat while traveling in a downstream direction. A buoy and line were attached to the cod end of the trawl for retrieval if a snag was encountered. Common sampling locations included open water areas below wing dikes and on channel sand bars. The towing warp consisted of 13-mm low-stretch nylon line with a 13.7-m bridle. In segment 10 during the 2006 fish community and sturgeon seasons, otter trawls were used as standard gear in CHXO and ISB macrohabitats and CHNB mesohabitats. Standard trawl hauls ranged from a minimum

distance of 75 m to a maximum distance of 300 m. All otter trawls were a custom-designed skate balloon otter trawl with a 4.9-m (16 ft.) headrope, 0.9 m mouth height, and overall length of 7.6 m. Paired wooden otter doors were 762 mm (30 in.) x 381 mm (15 in.).

Mini-fyke nets were set in shallow, slack water areas with the lead extending perpendicular to the river bank or sand bar. In areas with moderate flow, nets were positioned at a slight downstream angle with weights attached to the upstream side of the cab to prevent the net from overturning. The perpendicular distance measured from the midpoint of the cab to the bank was recorded. Nets were generally set in the afternoon and left overnight with a maximum soak time of 24 hours. In segment 10 during the 2006 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB, SCCL, 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

In addition to water depth and temperature, that were recorded for every subsample, additional habitat data were collected for a minimum of 25% of subsamples within each mesohabitat within each macrohabitat. For example, if two subsamples were conducted in the channel border of the channel crossover, habitat data were collected at one (i.e., 50%) of the subsamples. The subsamples for which habitat data were collected were randomly selected and determined *a priori*. For most gear types deployed in segment 10, habitat data were generally collected for one subsample in the channel crossover and two 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). Substrate samples were collected using a Hesse sampler. The estimated percent composition of silt, sand, and gravel as well as the presence of cobble and organic matter (0 = none, 1 = incidental, 2 = dominant, 3 = ubiquitous) were recorded. Surface water velocity was estimated visually for every subsample by categorizing flow in meters per second (m/s) as: 0 = cannot determine, 1 = eddy or circular flow, 2 = 0.0-0.3 m/s, 3 = 0.3-0.6 m/s, 4 = 0.6-0.9 m/s, and 5 = >0.9 m/s. Water velocity was also recorded using a Marsh McBirney Flo-Mate Model 2000 and reported in m/s. Water velocity measurements were taken at the bottom, 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 150 m, habitat data were collected 75 m downstream from the starting point (the approximate midpoint of the tow); from a 61 m (200 ft.) gill net set, habitat data were collected at the midpoint (at 30.5 m or 100 ft) of the net. All habitat parameters for mini-fyke nets were measured at the point where the lead connected to the cab of the net.

Genetic Validation

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 2006 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). Comparisons of K_n for recaptured pallid sturgeon from time of stocking to recapture could not be made because weight at time of stocking was not recorded for any fish that were recaptured in segment 10 during 2006.

Relative Stock Densities

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

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

(Anderson and Neumann 1996). 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.

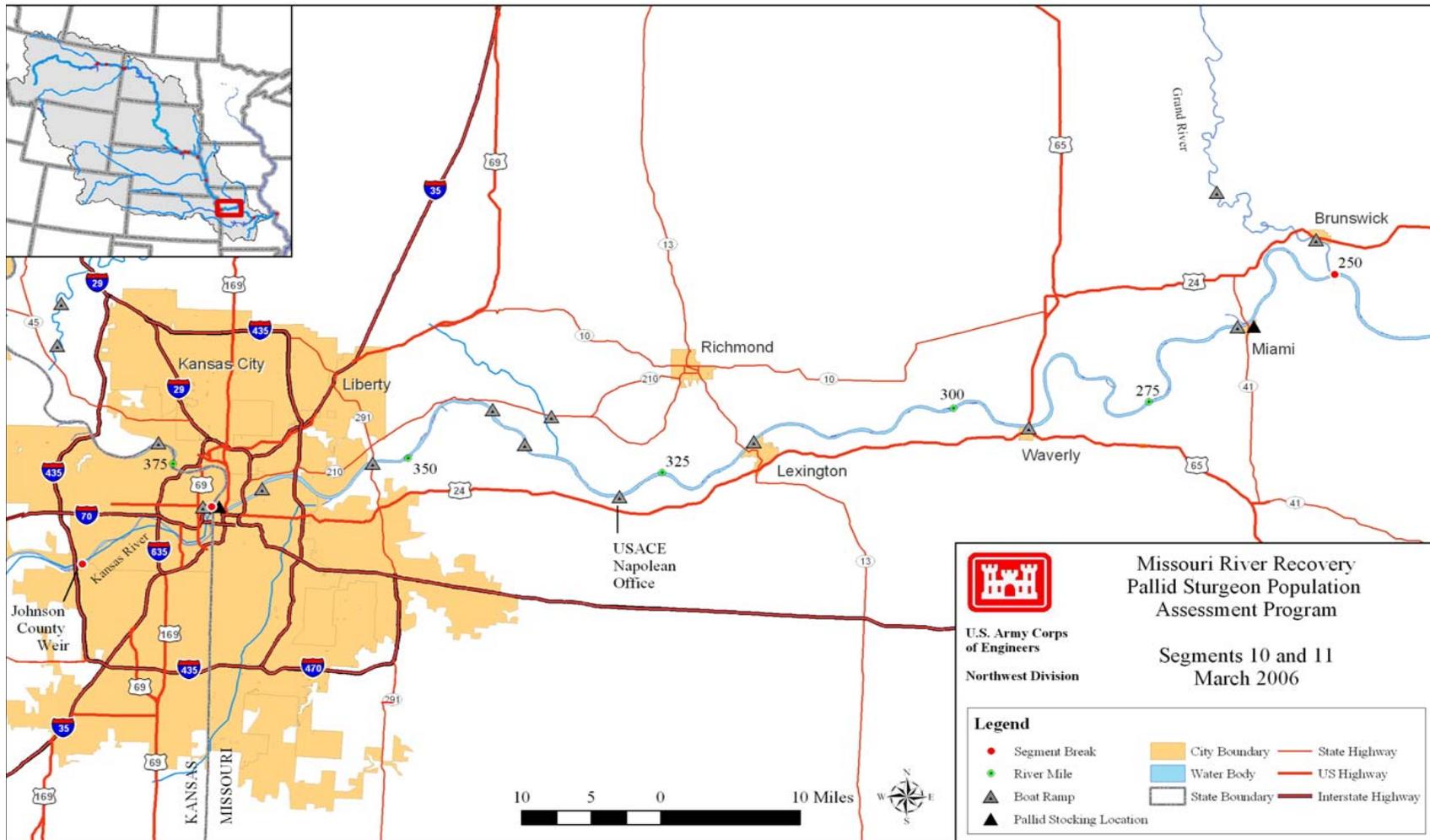


Figure 1a. Map of segment 10 and 11 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 10 encompasses the Missouri River from the Kansas River (River Mile 367.5) to the Grand River (River Mile 250.0)

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 pallid sturgeon of unknown origin (unknowns) and three hatchery-stocked pallid sturgeon (N = 11) were captured in segment 10 during the 2006 sampling season (Figure 8). There were 10 fish captured during sturgeon season (November 1-June 30) and one fish captured during fish community season (July 1-October 31). Pallid sturgeon were captured in 10 bends of the randomly-selected river bends in segment 10 during the 2006 season. Sampling occurred from RM 265 to RM 368, with capture locations ranging from RM 265 to RM 368 (Figure 1b). Seven pallid sturgeon (three hatchery-stocked, four unknown) were captured in six river bends between RM 321 and 342 (Lexington to Orrick, MO). Three river bends were sampled between RM 265 and 299 (Cranberry Is to Waverly, MO) that resulted in the capture of three unknown pallid sturgeon. One unknown pallid sturgeon was captured at RM 368 in downtown Kansas City. One unknown fish was captured at RM 336 that had been previously tagged (primary capture/ tagging location yet to be determined).

The unknown pallid sturgeon were 493 – to 985-mm fork length (FL) and the hatchery-stocked fish ranged from 281- to 497-mm FL (Figure 8). The (CI) values for the unknown pallids ranged from -0.21766 to -1.93753. The hatchery-stocked pallid sturgeon captured consisted of two individuals from the 2002 and one from the 2004 year classes. The 2002 and 2004 year class fish were both reared at the Garrison National Fish Hatchery and subsequently stocked at Boonville, Missouri (July 2003) and Kansas City, Missouri (April 2005), respectively. The 2002 year-class fish moved approximately 136 miles upstream, while the two 2004 year- class fish moved 34 and 43 miles downstream, respectively.

Relative condition of recaptured, hatchery-stocked pallid sturgeon was inversely related to time at large (Table 6). The condition (K_n) value for the 2002 year class was 0.85 (34 months at large). The 2004 year class had an average condition values of 0.90 (17 months at large) and 1.90 (11 months at large). The unknown pallid sturgeons had K_n values ranging from 0.69-0.85. Daily growth was inversely related to age. The daily growth rates for the 2002 (i.e., age-4) and 2004 (i.e., age-2) fish were 0.219 and 0.408 mm/d, respectively.

Relative stock density (RSD) values for pallid sturgeon for both quality (630-839 mm) and preferred (840-1039 mm) size categories were 100 (Table 7). There were two stock (330-629 mm), three quality, and three preferred size unknown fish captured. Among the 2004 year-class hatchery-stocked pallid sturgeon, one was sub-stock size (200-329 mm) and one was stock size. The 2002 year-class hatchery stocked pallid sturgeon was stock size.

River sturgeons in segment 10 during the 2005-2006 sampling season were captured at a ratio of 1 pallid sturgeon (unknown and hatchery-stocked) to 102 shovelnose sturgeon, compared to the ratio of 1:160 in the 2004-2005 sampling season. The ratio of unknown pallid sturgeon to shovelnose sturgeon was 1:141. The ratios of stocked to unknown pallid sturgeon and unknown pallid sturgeon to shovelnose X pallid sturgeon were 1:2.3 and 7:1, respectively.

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 2005 – 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1-Inch Trammel Net	4	8 (8)		8 (8)				23 (23)		1 (1)						
2.5-Inch Trammel Net	4	10.75 (9.25)		14 (12)				29 (26)								
Beam Trawl																
Gill Net	11	17.93 (17.88)		76(74)				122 (118)	21 (21)	(6) (6)				1 (1)		
Otter Trawl	4	8.25 (8)		7 (7)				26 (25)								
Summer – Fish Community Season																
1-Inch Trammel Net	4	8.25 (8)		8 (8)				25 (24)								
Beam Trawl																
Mini-Fyke Net	4	8 (8)		8 (8)				18 (18)	2 (2)	2 (2)					2 (2)	
Otter Trawl	4	9 (8.75)		8 (8)				28 (27)								

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 2005 – 2006. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat				
			BAR	POOL	CHNB	TLWG	ITIP
Fall through Spring – Sturgeon Season							
1 Inch Trammel Net	4	8 (8)			32 (32)		
2.5 Inch Trammel Net	4	10.75 (9.25)			43 (38)		
Beam Trawl							
Gill Net	11	17.93 (17.88)		110 (106)	114 (112)		2 (2)
Otter Trawl	4	8.25 (8)			33 (32)		
Summer – Fish Community Season							
1 Inch Trammel Net	4	8.25 (8)			33 (32)		
Beam Trawl							
Mini-Fyke Net	4	8 (8)	32 (32)				
Otter Trawl	4	9 (8.75)			36 (35)		

Segment 10 - Pallid Sturgeon Captures by River Mile

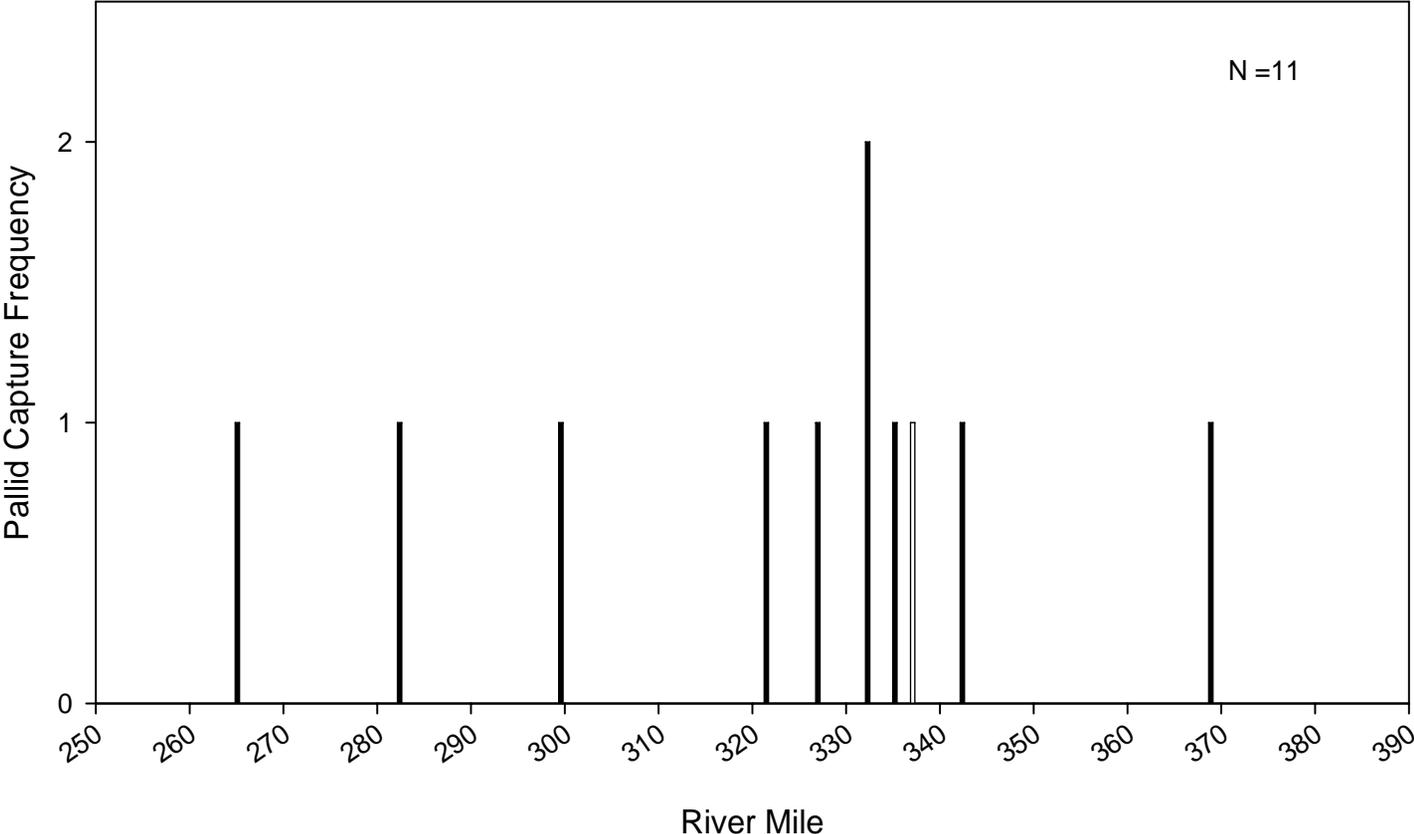


Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 10 of the Missouri River during 2005-2006. Black bars represent pallid captures during Sturgeon Season and white bars during Fish Community Season. Figure includes all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2005-2006. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
BRAD	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
CHXO	BAR	0.51 (0.4-0.7)		0.2 (0.01-0.07)		28.21 (21.1-31.0)		56 (43-73)		0
	POOL	3.7 (1.3-8.0)	3.8 (3.2-4.5)	0.35(0.01-0.98)	0.28(0.01-0.54)	6.5 (1.0-12.5)	6.0 (4.5-7.5)	56 (25-238)	34 (32-35)	2
	CHNB	2.9 (1.2-8.8)	3.4 (2.3-4.6)	0.62(0.09-1.25)	0.39 (0.22-0.55)	17.9 (3.0-31.5)	11.6 (6.2-17.0)	94 (27-331)	137 (81-193)	2
	TLWG									
	ITIP									
CONF	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
DEND	BAR									
	POOL									
	CHNB									
	TLWG									

Table 3 (continued).

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
ISB	BAR	0.5 (0.4-0.7)		0.04 (0.0-0.16)		27.7 (21.8-32.2)		52 (31-71)		0
	POOL	4.8 (1.3-10.0)	7.7 (7.7-7.7)	0.4 (0.06-0.93)	0.3 (0.33-0.33)	6.1 (1.2-12.5)	6.0 (6.0-6.0)	92 (28-256)	40 (40-40)	1
	CHNB	2.4 (1.2-5)	1.7 (1.4-2.1)	0.59 (0.06-1.04)	0.5 (0.21-0.84)	19 (1.0-31.8)	11.1 (6.0-19.0)	99 (27-322)	120 (46-255)	6
	TLWG									
	ITIP									
OSB	BAR	0.6 (0.6-0.6)		0 (0-0)		31 (31-31)		51 (51-51)		0
	POOL	4 (1.7-6.0)		0.15 (0.0-0.39)		7.7 (5.0-12.5)		72 (38-255)		0
	CHNB	2 (1.9-2.1)		0.54 (0.54-0.54)		7.5 (7.5-7.5)				0
	TLWG									
	ITIP									
SCCL	BAR	0.6 (0.6-0.7)		0 (0-0)		32.2 (32.2-32.2)		27 (27-27)		0
	POOL	5.5 (5.5-5.5)		0.25 (0.25-0.25)		6.3 (6.3-6.3)		85 (85-85)		0
	CHNB	2.2 (1.7-2.6)				13.0 (7.5-18.5)				0
	TLWG									
	ITIP	1.8 (1.8-1.8)		0.71 (0.71-0.71)		7.5 (7.5-7.5)				0
SCCS	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									

Table 3 (continued).

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
SCCN	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
TRIB	BAR									
	POOL									
	CHNB									
	TLWG									
	ITIP									
TRML	BAR									
	POOL									
	CHNB	5.2 (5.2-5.2)		0.04 (0.04-0.04)		1.2 (1.2-1.2)		27 (27-27)		0
	TLWG									
	ITIP									
TRMS	BAR	0.6 (0.6-0.7)		0.05 (0.05-0.05)		30.0 (29.6-30.3)		55 (55-55)		0
	POOL									
	CHNB									
	TLWG									
	ITIP									

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 2006 from segment 10 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001									
2002	1	282			497	399	0.847	0.219	
2003									
2004	2	186 (32)	29	1.263	370 (177)	227 (190)	1.398 (1)	0.408 (0.169)	0.5
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 2005 – 2006 in the Missouri River. Length categories^b determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)			
Sub-stock (200-329)	1		1.898
Stock	3		0.0809 (0.038)
Quality	3	100	0.777 (0.096)
Preferred	3	100	0.748 (0.036)
Memorable			
Trophy			
Overall Kn	10		0.890 (0.226)
Fish Community Season			
Sub-stock (0-199)			
Sub-stock (200-329)			
Stock	1		0.898
Quality			
Preferred			
Memorable			
Trophy			
Overall Kn	1		0.898

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

^b Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL < 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 > 1270 mm (>74 %).

Year comparisons, Gear evaluation and Habitat associations

The 2006 season was the first full year (including sturgeon season and fish community season) segment 10 was sampled. During the 2005 season, sampling was only conducted during fish community season from July 1-October 31. With only four pallid sturgeon captured in the first year of sampling, only a few comparisons between the two years can be made.

Seven pallid sturgeon were captured using gill nets (GN) and three with 2.5-inch trammel nets (TN25). There was one pallid sturgeon taken by an otter trawl (OT) in 2006, a decrease from two fish in 2005. No pallid sturgeon were captured using 1-inch trammel nets (TN) in 2006, compared to 2 in 2005. The smallest fish [281-mm fork length (FL)] and largest pallid sturgeon (985-mm FL) were captured in gill nets and trammel nets, respectively. The average size of pallid sturgeon in trammel nets was larger than that of gill nets (836.67- and 654.86-mm FL, respectively). The only pallid sturgeon captured in otter trawls had a fork length of 458 mm.

Two thousand twenty meters of GN was deployed in the 2006 season, with an average of 1787.88 meters per bend. Mean catch-per-unit-effort for unknown and hatchery-stocked pallid sturgeon was 0.021 and 0.008 fish/100 m gill net-night (Figure 2). Total number of deployments for TN25 nets was 65, with an average distance of 126.69 m. Mean CPUE for unknown pallid sturgeon caught in TN25 was 0.051 fish/ 100 m drifted (Figure 3). OT were deployed during sturgeon season and fish community season, with 32 deployments (average 188.38 m/ haul) and 36 deployments (average 168.75 m/ haul), respectively. One hatchery-stocked pallid sturgeon was caught in OT, resulting in a CPUE of 0.014 fish/ 100 m, up from 0.004 fish/ 100 m in 2005. No pallid sturgeon were captured in any TN deployed in 2006, compared to three caught in 2005 (Figure 5). No pallid sturgeon were caught in have been captured in mini-fyke nets (MF) in segment 10.

Inside bend (ISB), channel crossover (CHXO), outside bend (OSB), large connected secondary channel (SCCL) macrohabitats were sampled with gears targeting pallid sturgeon (i.e., gill nets, 1- and 2.5-inch trammel nets and otter trawls; Tables 9, 11, 13, and 15). Pallid sturgeon were only captured in CHXO and ISB microhabitats in 2005 and 2006. In 2006 all were captured in approximate proportion to the amount of effort expended in each macrohabitat. Inside bend macrohabitats accounted for seven pallid sturgeon captures (64% of the catch) and four pallid

sturgeon (36% of the catch) were caught in the channel crossover. Similarly, within each gear type that captured a pallid sturgeon, more of the effort was expended in the inside bend than channel crossover [TN25 = 70 and 30%; GN = 54 and 34%; OT (during FC season) = 80 and 20%].

Pallid sturgeon were captured in channel border (CHNB) and pool (POOL) mesohabitats (73 and 27% of the capture, respectively). About 51% of the GN were deployed in CHNB habitats and 48% in POOL habitats, but more pallid sturgeon were caught in CHNB (57%) than in POOL (43%) mesohabitats. All of the TN25 and OT were deployed in CHNB mesohabitats, therefore, all pallids caught with those gears were in CHNB habitat. Most pallid sturgeon captures were in microhabitats associated with dikes. Most pallid sturgeon were captured in gears deployed near wing dikes, and of those, five fish captures were associated with un-notched dikes and one with a notched dike (see Drobish 2006b for habitat definitions). Other pallid sturgeon captures were in habitats influenced by kicker dikes and L-dikes (two fish and one fish, respectively). Two pallid sturgeon were caught in habitats associated with sand bars. All hatchery fish were captured in habitats influenced by wing dikes.

Water temperature in segment 10 during the 2006 sampling season ranged from 1.0 to 31.5°C (Table 3). Pallid sturgeon were captured from a wide range of temperatures (4.5 to 19.0°C), with most captures falling between the 4-8°C range. Water depths for habitats where sturgeon sampling gears were deployed ranged from 1.2 to 10.0 m (Tables 3). Depths at pallid sturgeon capture locations virtually ranged across the entire spectrum of sampling depths (1.4 m to 7.7 m). Turbidity during the 2006 season ranged from 27 to 331 NTUs (a reduction from the high in the 2005 sampling season, 558 NTUs) and from 40 to 255 NTUs for pallid sturgeon capture locations. Capture locations in POOL mesohabitats showed a lower turbidity than CHNB mesohabitats, but also a lower number of captures (n = 3 and n = 8, respectively). Bottom velocity of pallid sturgeon capture locations ranged from 0.01 to 0.84 m/s, and with an overall average of 0.41 m/s.

Segment 10 - Pallid Sturgeon / Sturgeon Season

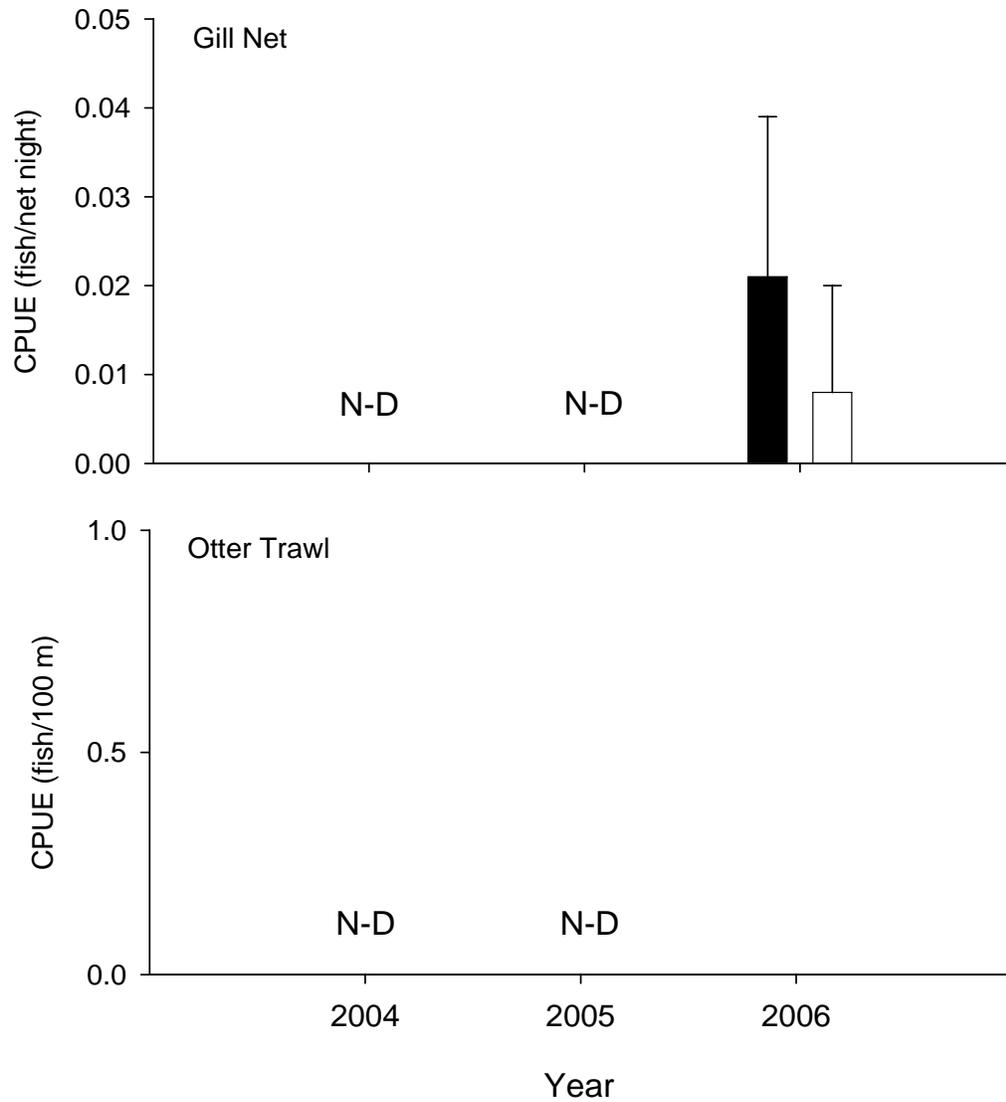


Figure 2. Mean annual catch-per-unit-effort (+/- 2 SE) of unknown (black bars) and hatchery reared (white bars) pallid sturgeon using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2005-2006. All pallid sturgeon that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Sturgeon Season

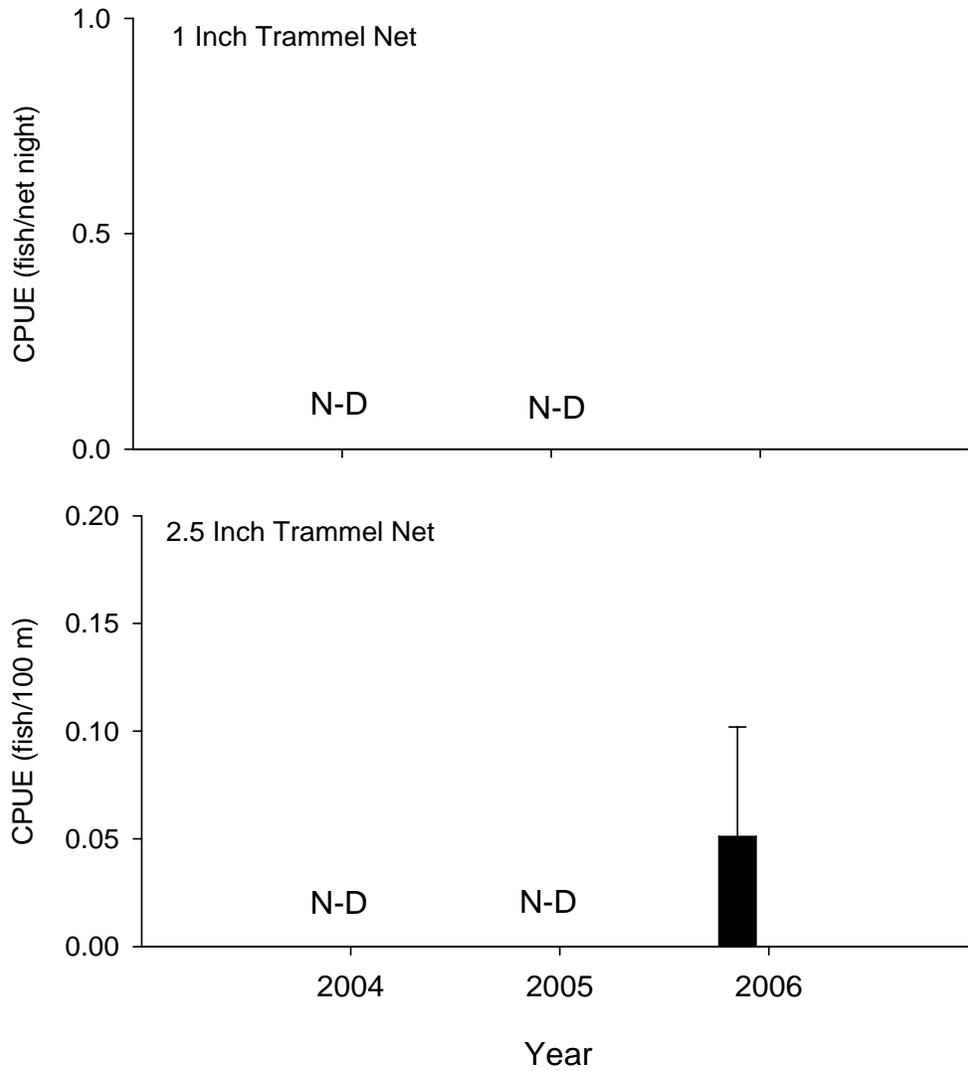


Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of unknown (black bars) and hatchery reared (white bars) pallid sturgeon using 1 and 2.5 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2005-2006. All pallid sturgeon that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Sturgeon Season



Figure 4. Mean annual catch-per-unit-effort (± 2 SE) of unknown (black bars) and hatchery reared (white bars) pallid sturgeon using beam trawls in segment 10 of the Missouri River during sturgeon season 2005 -2006. All pallid sturgeon that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

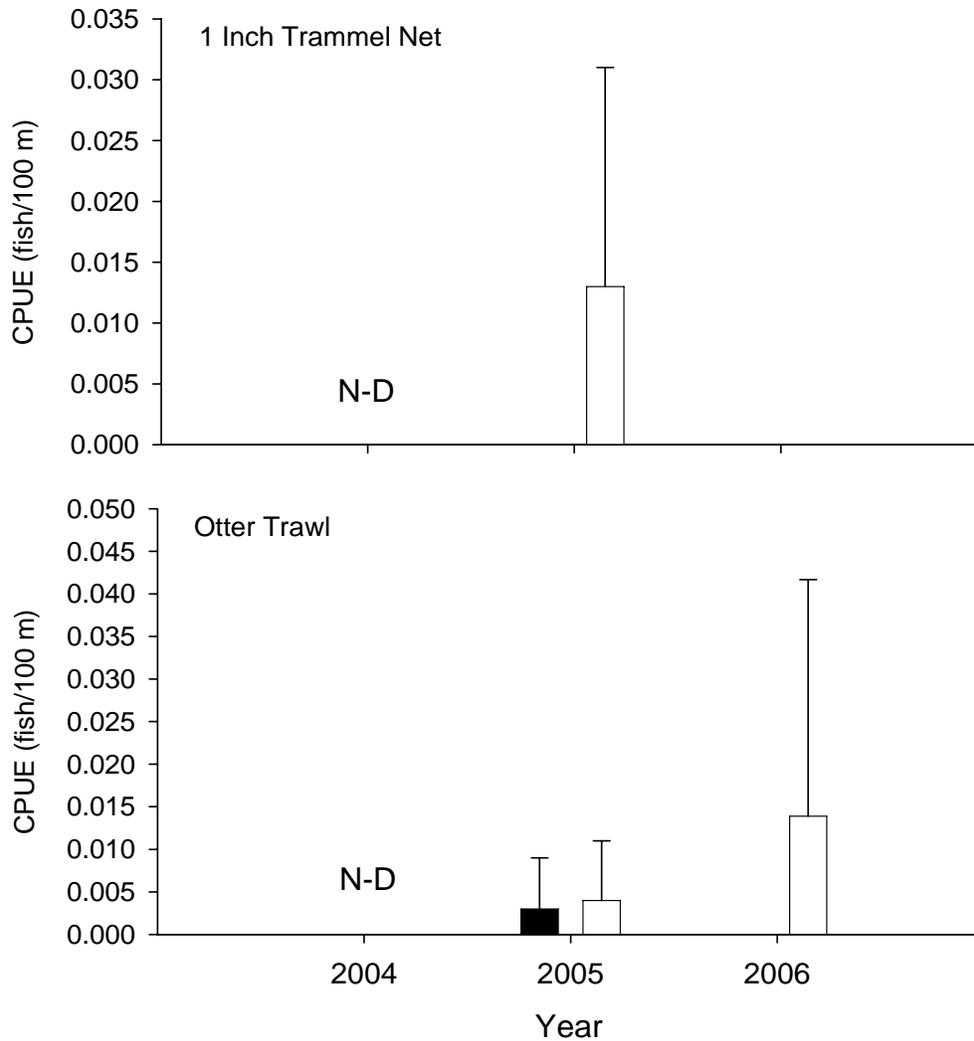


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of unknown (black bars) and hatchery reared (white bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2005-2006. All pallid sturgeon that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

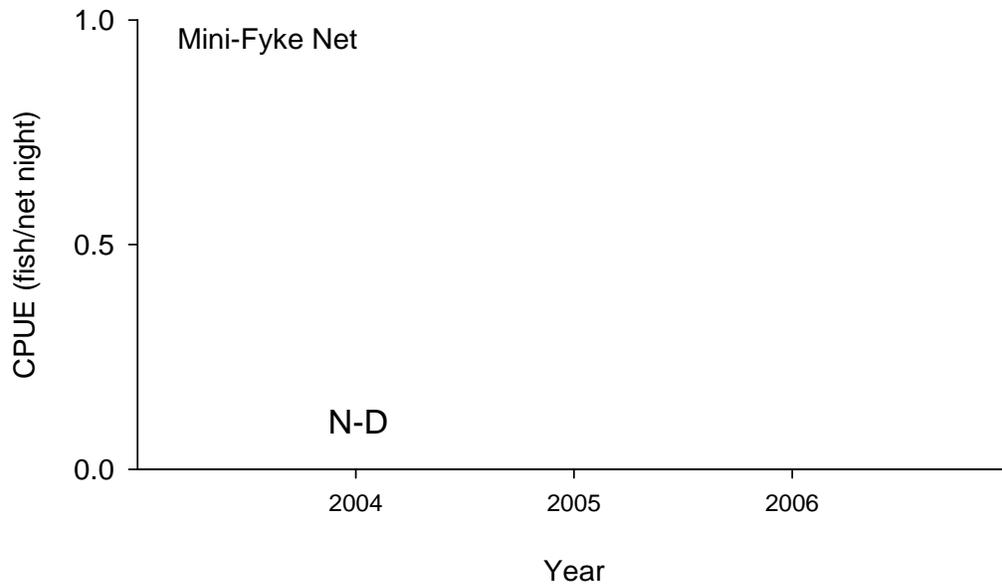


Figure 7. Mean annual catch-per-unit-effort (± 2 SE) of unknown (black bars) and hatchery reared (white bars) pallid sturgeon using mini-fyke nets in segment 10 of the Missouri River during fish community season 2005-2006. All pallid sturgeon that were captured with no evidence of previously being tagged were deemed wild pending 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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 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	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5 Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	0	N-E N-E	0 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	0		0 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Table 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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 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	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	1	N-E N-E	0 (34)		N-E N-E	N-E N-E	100 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	0	N-E N-E	0 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0				0 0		
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)				0 (6)		
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	1		100 (51)	0 (1)	0 (48)	
Otter Trawl	0		0 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Table 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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 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	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5 Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	3	N-E N-E	0 (34)		N-E N-E	N-E N-E	100 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	2	N-E N-E	0 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	1	N-E N-E	0 (20)		N-E N-E	N-E N-E	100 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	3		67 (51)	0 (1)	33 (48)	
Otter Trawl	0		0 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	1	0 0	100 (100)			

Table 15. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 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	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5 Inch Trammel Net	3	N-E N-E	67 (30)		N-E N-E	N-E N-E	33 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	3	N-E N-E	67 (34)		N-E N-E	N-E N-E	33 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	0	N-E N-E	0 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	3		100 (100)	0 0	0 0	
Beam Trawl						
Gill Net	3		33 (51)	0 (1)	67 (48)	
Otter Trawl	0		0 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

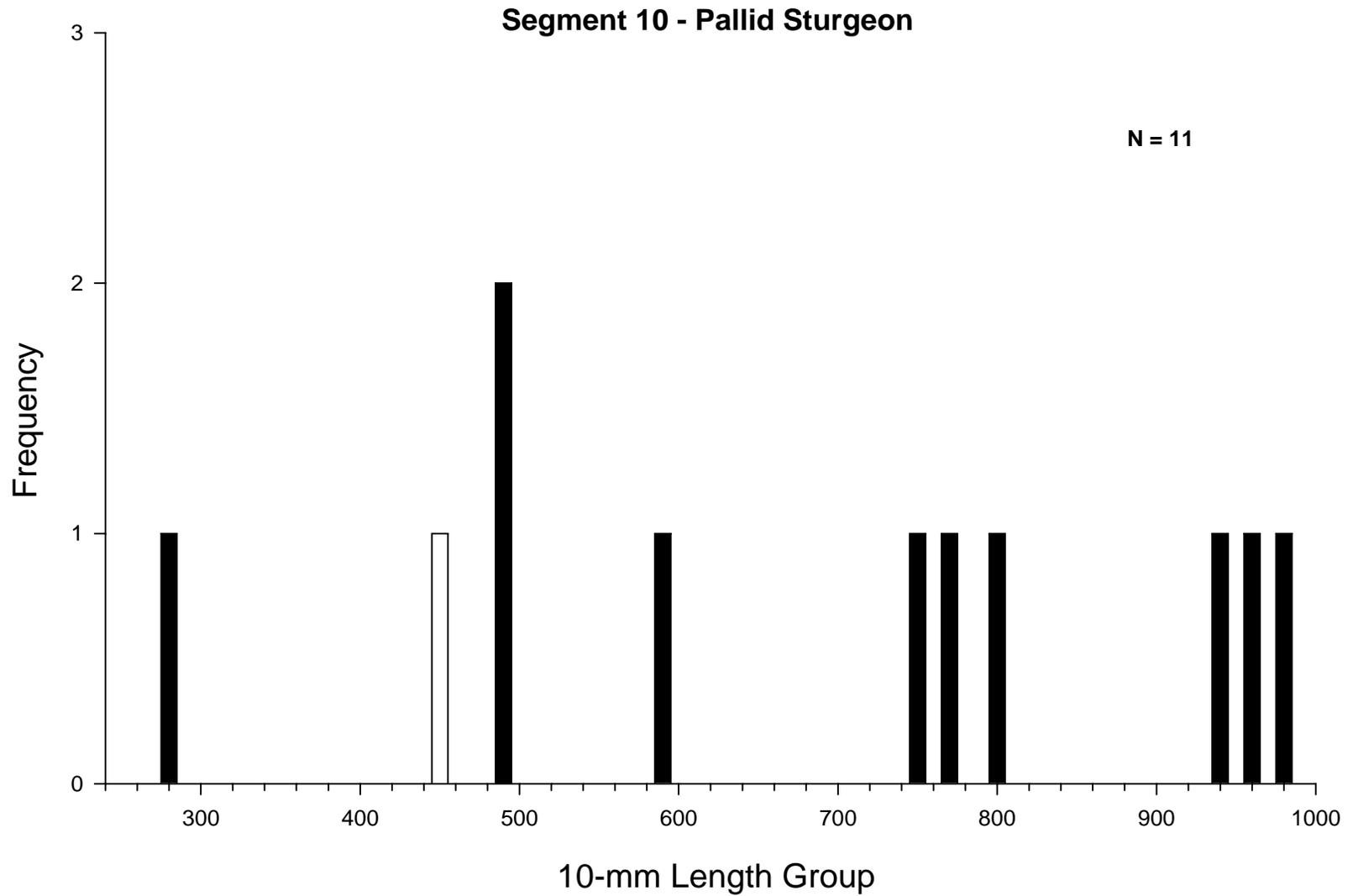


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006 including non-random and unknown samples.

Segment 10 - Annual Pallid Sturgeon Capture History

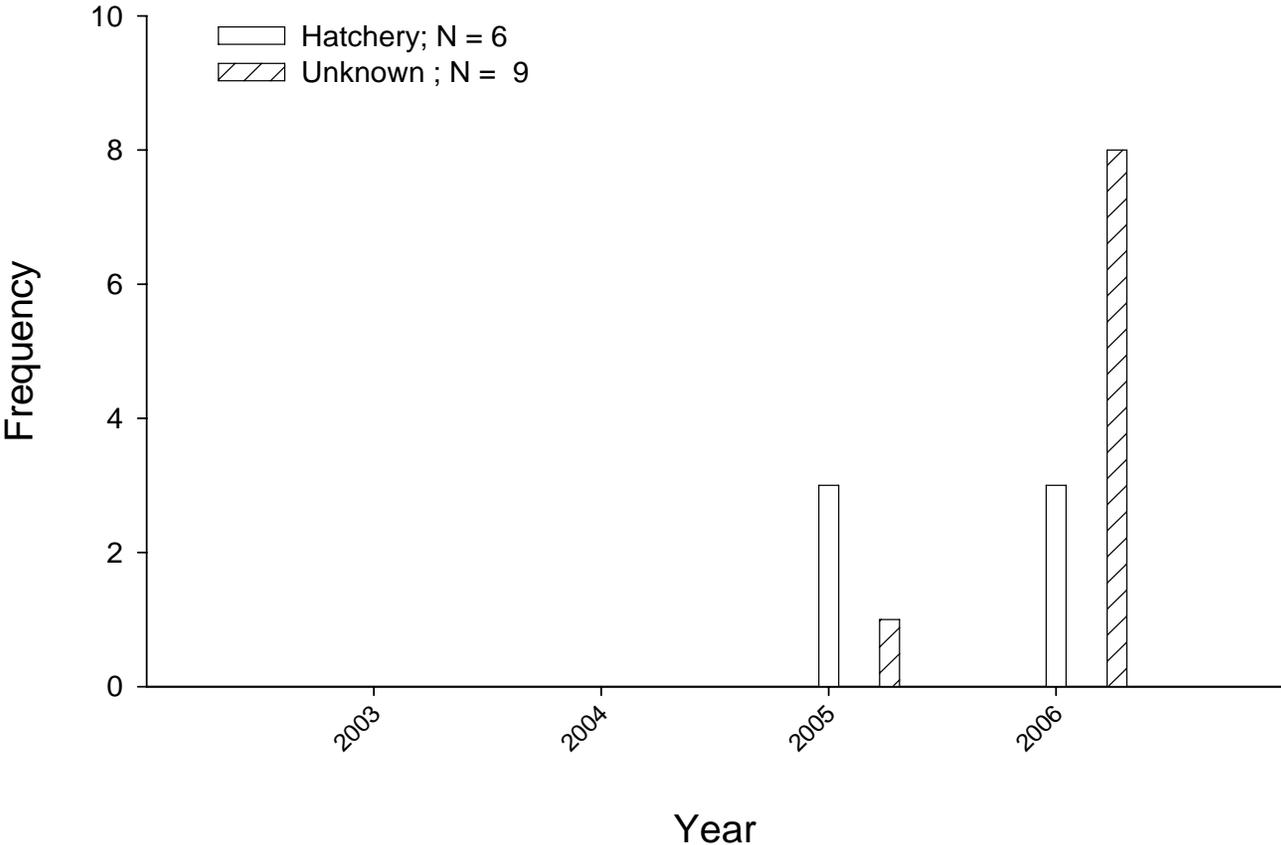


Figure 9. Annual capture history of unknown (black bars) and hatchery reared (white bars) pallid sturgeon collected in segment 10 of the Missouri River from 2005 to 2006. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

One shovelnose X pallid sturgeon was captured in segment 10 during the 2006 sampling season. This hybrid sturgeon was captured with a gill net at RM 335.2 and was 472-mm fork length. It was captured in the channel crossover in POOL mesohabitat. Similar to pallid sturgeon, this hybrid sturgeon was captured in a microhabitat associated with a wing dike.

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

One thousand one hundred and thirty shovelnose sturgeon were captured in gill nets [N = 882; 293-to 764-mm fork length (FL)], 1-inch trammel nets (N = 147; 191- to 700-mm FL), otter trawls (N = 77; 23- to 643-mm FL), and 2.5-inch trammel nets (N = 24; 251- to 71-mm FL) during the 2006 sampling season. Catch per unit effort (CPUE) for shovelnose sturgeon was greatest with gill nets but was only represented by stock size (250 to 379 mm; mean CPUE = 0.038 fish/net night) and quality and above size (> 380 mm; mean CPUE = 3.788 fish/net night) fish (Figure 11). Catch per unit effort for shovelnose sturgeon was least with 2.5-inch trammel nets and was only represented by a few stock size (250 to 379 mm; mean CPUE = 0.031 fish/net night) and quality and above size (> 308 mm; mean CPUE = 0.365 fish/net night) fish (Figure 12). During the 2006 sampling seasons, otter trawls captured a greater size range of fish and the only sub-stock sized fish (mean CPUE = 0.026 fish/100 and mean CPUE = 0.1350 fish/100 m for sturgeon season and fish community season, respectively). Otter trawl mean CPUE was down slightly across all size classes of shovelnose sturgeon during the fish community season from 2005 to 2006 (Figures 11 and 14). Mean CPUE for 1-inch trammel nets were relatively the same between seasons in 2006 for all size classes of shovelnose sturgeon but down from the 2005 fish community season (Figures 12 and 14). Mini-fyke nets captured a variety of small-bodied fish species, but did not capture any shovelnose sturgeon.

Relative stock densities (RSD) were very high for the quality, preferred, and memorable size categories (Table 25a). Stock-size fish had the highest relative weights (W_r), where memorable size-class fish (the largest class represented in our sample; 640- to 809-mm FL) had the lowest ($W_r = 98.5$ and 79.24 , respectively).

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

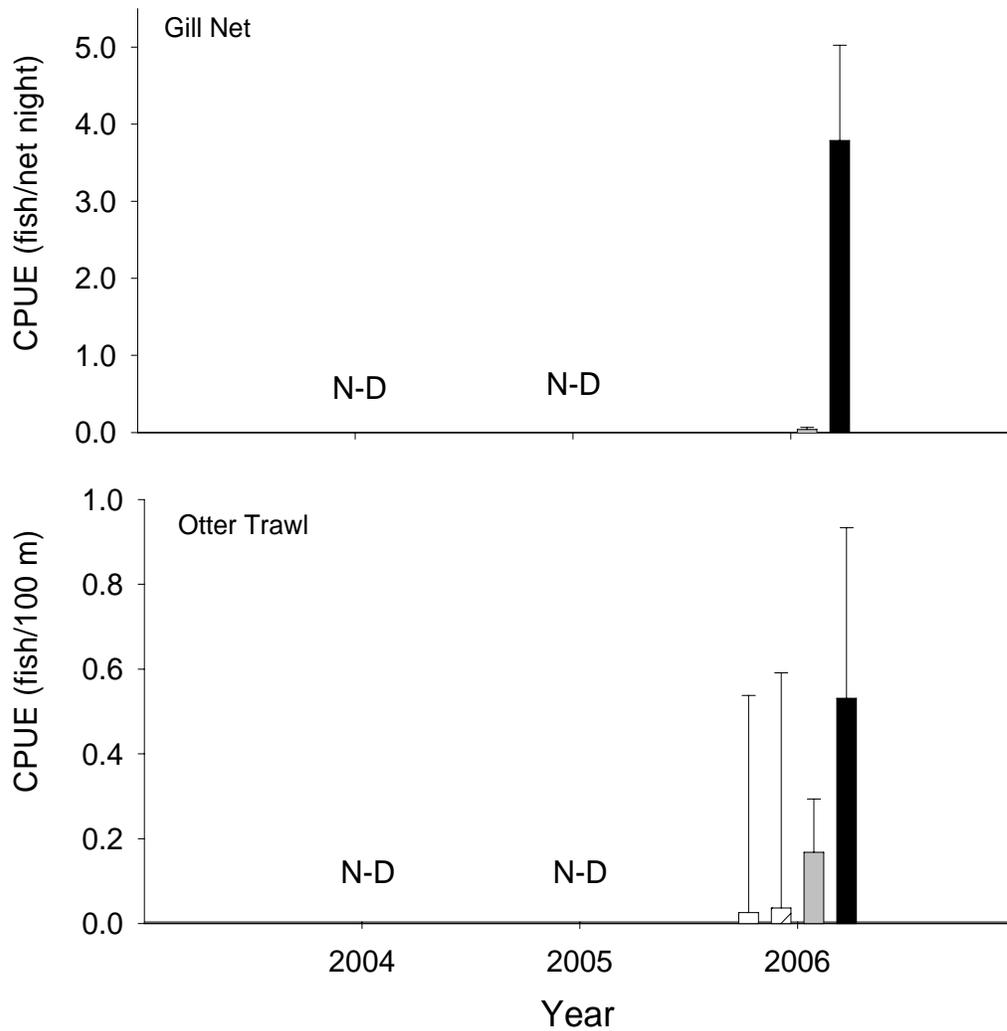


Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

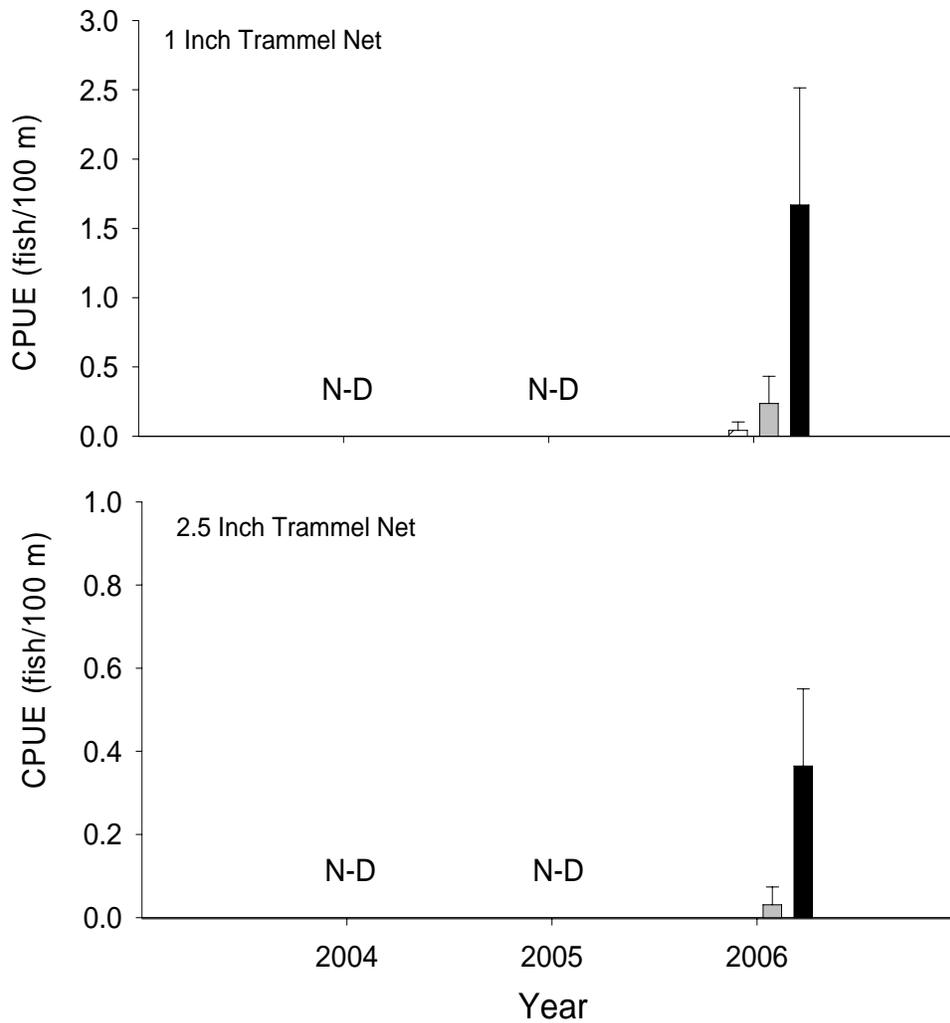


Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 and 2.5 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

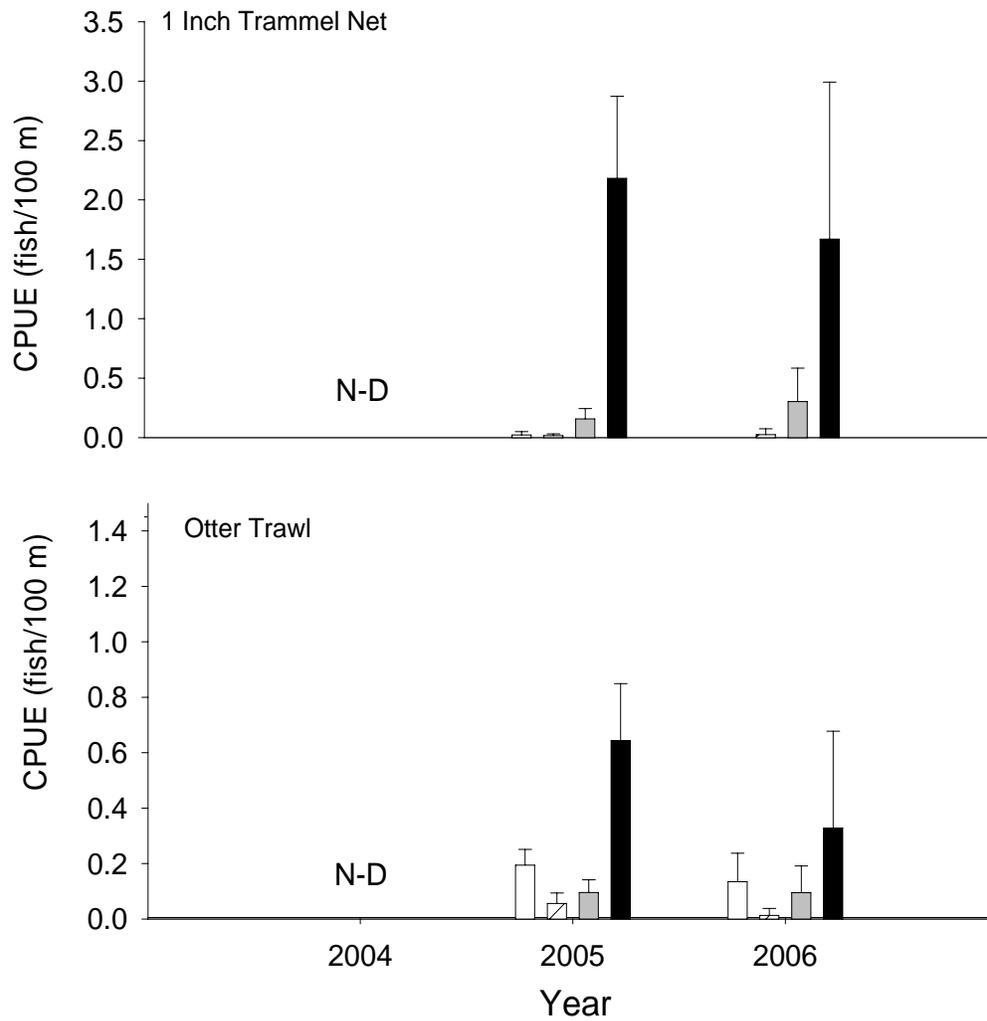


Figure 14. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2005 - 2006.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

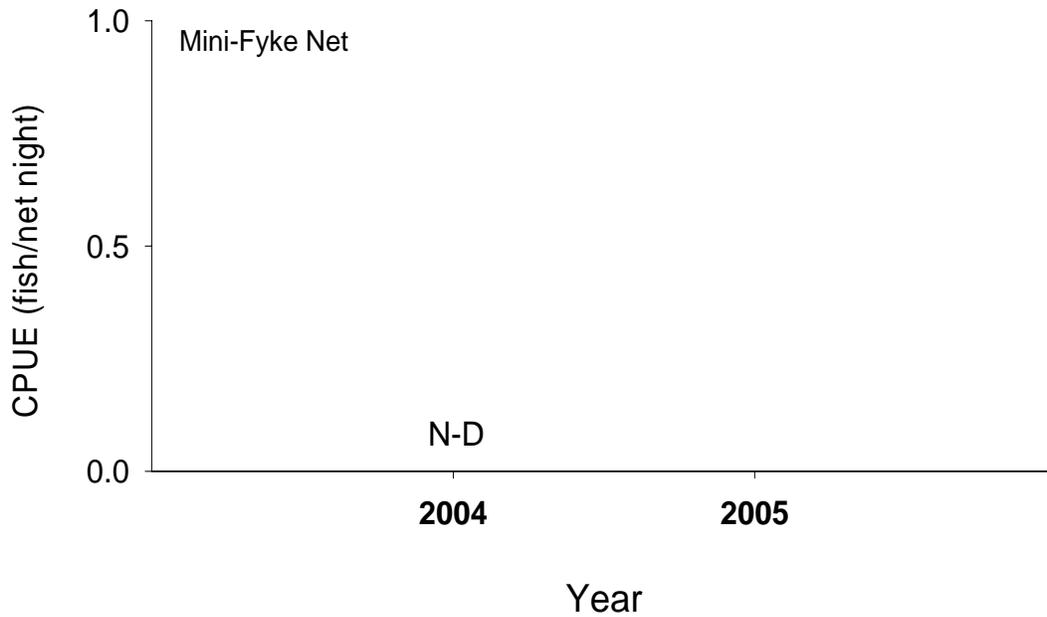


Figure 15. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2005 - 2006.

Habitat Use

Most shovelnose sturgeon were captured in CHXO and ISB macrohabitats (41% and 47%, respectively; Tables 17-24). More shovelnose sturgeon were captured in POOL mesohabitats than CHNB mesohabitats (60 and 40%, respectively). Eighty eight percent of shovelnose sturgeon were captured in habitats influenced by a dike. Of these, shovelnose sturgeon were caught in association with wing dikes most often, followed by kicker dikes, L-dikes, and rootless dikes. Among these dike habitats, most of the captures were associated with notched dikes. The remaining shovelnose sturgeon captured were in microhabitats influenced by chevrons and in 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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	0	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	1	N-E N-E	100 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	8	N-E N-E	0 (20)		N-E N-E	N-E N-E	100 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	1		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	8	0 0	100 (100)			

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	2	N-E N-E	0 (22)		N-E N-E	N-E N-E	100 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	2	N-E N-E	0 (15)		N-E N-E	N-E N-E	100 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	1	N-E N-E	0 (20)		N-E N-E	N-E N-E	100 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	1	N-E N-E	0 (20)		N-E N-E	N-E N-E	100 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	2		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	2		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	1	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	1	0 0	100 (100)			

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	9	N-E	11		N-E	N-E	89	0	0				0		
		N-E	(22)		N-E	N-E	(76)	0	(2)				0		
2.5-Inch Trammel Net	2	N-E	50		N-E	N-E	50	0	0				0		
		N-E	(30)		N-E	N-E	(70)	0	0				0		
Beam Trawl															
Gill Net	8	N-E	50		N-E	N-E	50	0	0				0		
		N-E	(34)		N-E	N-E	(54)	(10)	(3)				(0)		
Otter Trawl	8	N-E	29		N-E	N-E	71	0	0				0		
		N-E	(15)		N-E	N-E	(85)	0	0				0		
Fish Community Season (Summer)															
1-Inch Trammel Net	12	N-E	42		N-E	N-E	58	0	0					0	
		N-E	(20)		N-E	N-E	(80)	0	0					0	
Beam Trawl															
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0					0	
		N-E	(25)		N-E	N-E	(56)	(6)	(6)					(6)	
Otter Trawl	6	N-E	17		N-E	N-E	83	0	0					0	
		N-E	(20)		N-E	N-E	(80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	9		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	2		100 (100)	0 0	0 0	
Beam Trawl						
Gill Net	8		12 (51)	0 (1)	88 (48)	
Otter Trawl	8		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	12	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	6	0 0	100 (100)			

Table 23. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	58	N-E	24		N-E	N-E	76	0	0				0		
		N-E	(22)		N-E	N-E	(76)	0	(2)				0		
2.5-Inch Trammel Net	22	N-E	50		N-E	N-E	50	0	0				0		
		N-E	(30)		N-E	N-E	(70)	0	0				0		
Beam Trawl															
Gill Net	872	N-E	46		N-E	N-E	43	10	1				0		
		N-E	(34)		N-E	N-E	(54)	(10)	(3)				(0)		
Otter Trawl	33	N-E	6		N-E	N-E	94	0	0				0		
		N-E	(15)		N-E	N-E	(85)	0	0				0		
Fish Community Season (Summer)															
1-Inch Trammel Net	65	N-E	32		N-E	N-E	68	0	0				0		
		N-E	(20)		N-E	N-E	(80)	0	0				0		
Beam Trawl															
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0				0		
		N-E	(25)		N-E	N-E	(56)	(6)	(6)				(6)		
Otter Trawl	20	N-E	10		N-E	N-E	90	0	0				0		
		N-E	(20)		N-E	N-E	(80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	58		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	22		100 (100)	0 0	0 0	
Beam Trawl						
Gill Net	872		23 (51)	0 (1)	77 (48)	
Otter Trawl	33		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	65	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	20	0 0	100 (100)			

Segment 10 - Shovelnose Sturgeon

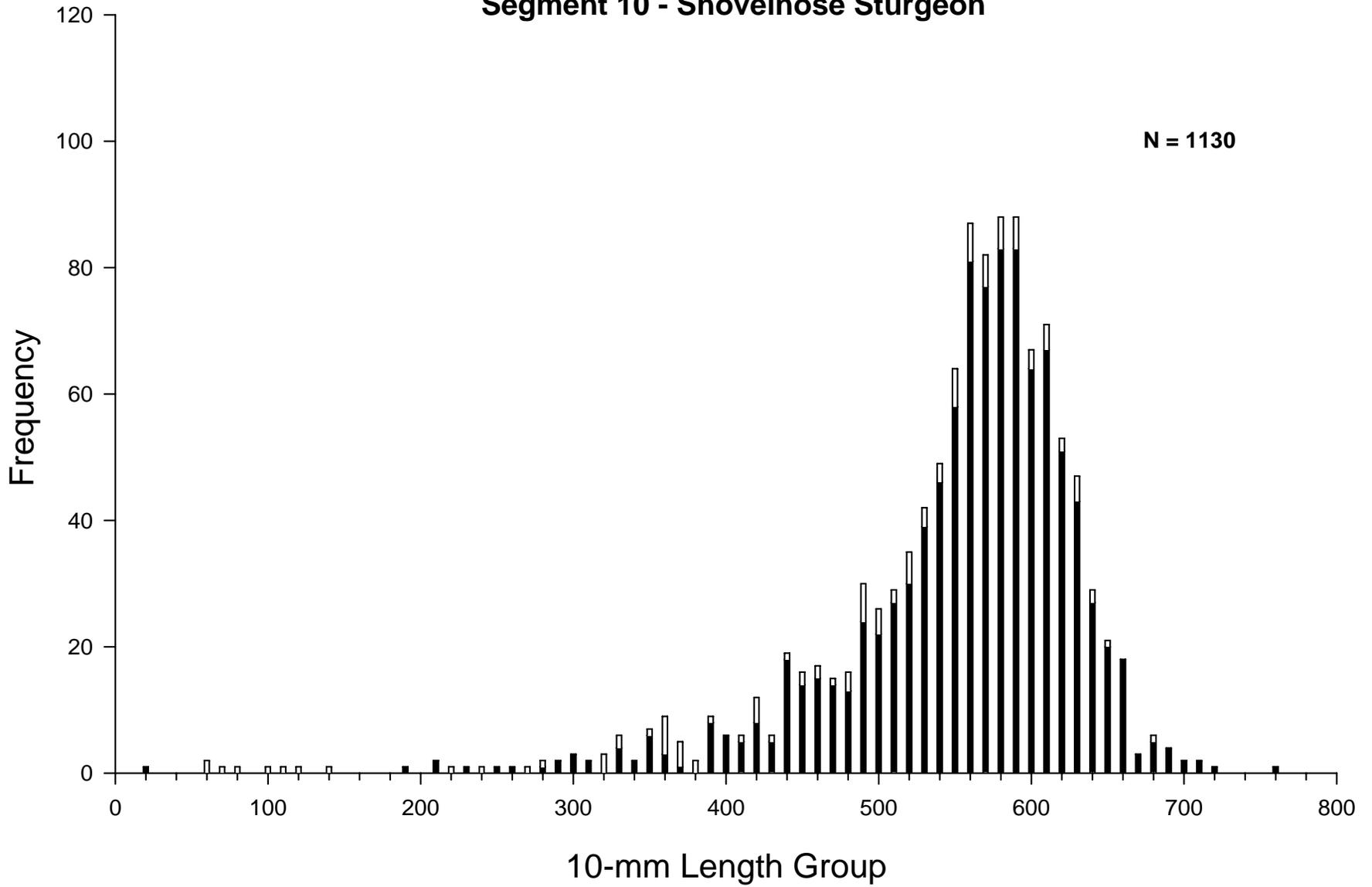


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006.

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 2005 – 2006. Length categories^b determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	1		
Sub-stock (150-249 mm)	4		91.085 (6.13)
Stock	27		98.507 (21.17)
Quality	153	584.62	90.578 (3.03)
Preferred	749	2880.77	84.171 (1.12)
Memorable	83	319.23	79.241 (3.56)
Trophy			
Overall Wr			88.716 (3.28)
Fish Community Season			
Sub-stock (0-149 mm)	8		86.75 (19.929)
Sub-stock (150-249 mm)	2		90.521 (6.865)
Stock	18		81.796 (6.236)
Quality	28	155.56	83.492 (3.165)
Preferred	53	294.44	83.135 (1.913)
Memorable	4	22.22	78.249 (6.947)
Trophy			
Overall Wr			83.026 (1.682)

^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 > 810 mm (>74 %).

Sturgeon Chub

Sturgeon chubs were the least common *Macrhybopsis* species encountered (N = 1 sturgeon season; N = 17 fish community season, Figures 18 and 19) during the 2006 sampling season. Total length for this species ranged from 33 to 65 mm (mean = 44 mm) during 2006, while in 2005 the total length ranged from 30 to 79 mm (mean = 51 mm). Mean CPUE for otter trawls for sturgeon season and fish community season was 0.026 fish/100 m and 0.255 fish/100 m, respectively (2005 fish community season otter trawl CPUE = 0.0730 fish/100 m). Otter trawl was the only gear that captured sturgeon chubs. As a result, all sturgeon chubs were captured in CHNB mesohabitats because this was the only mesohabitat sampled with otter trawls. Most sturgeon chubs (83%) were captured from inside bend macrohabitats. The remaining 17% of fish were captured in the channel crossover.

Segment 10 - Sturgeon Chub / Sturgeon Season

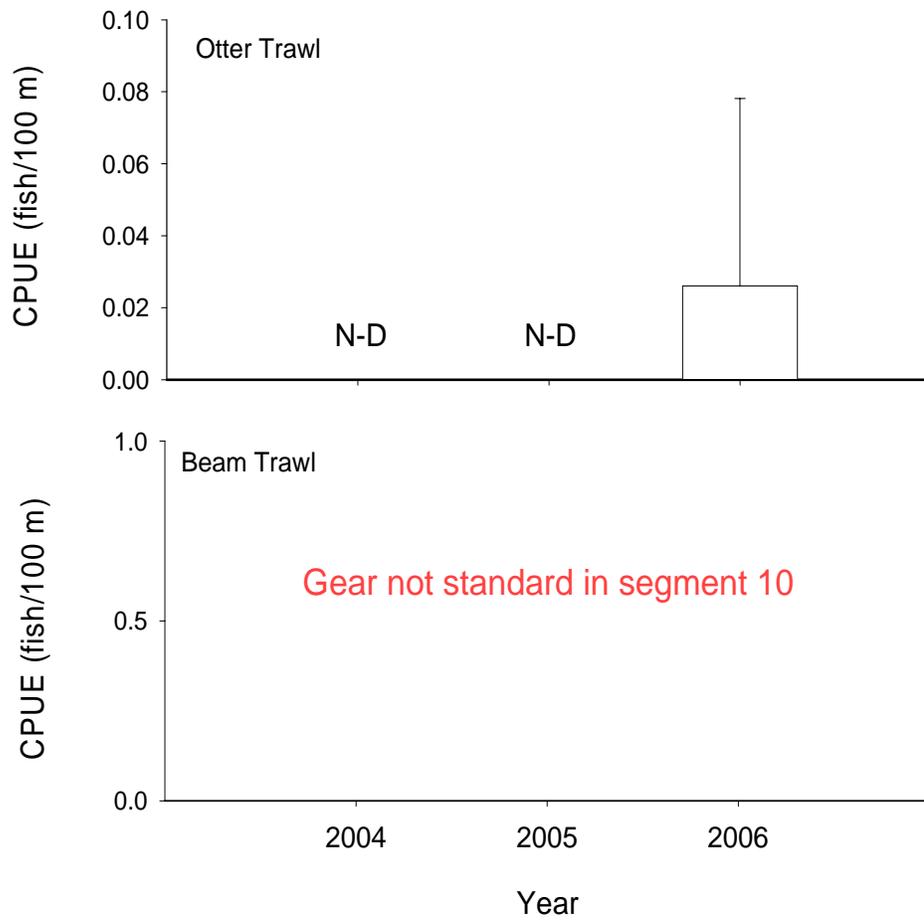


Figure 18. Mean annual catch-per-unit-effort ($\pm 2SE$) of sturgeon chub using otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2005-2006.

Segment 10 - Sturgeon Chub / Fish Community Season

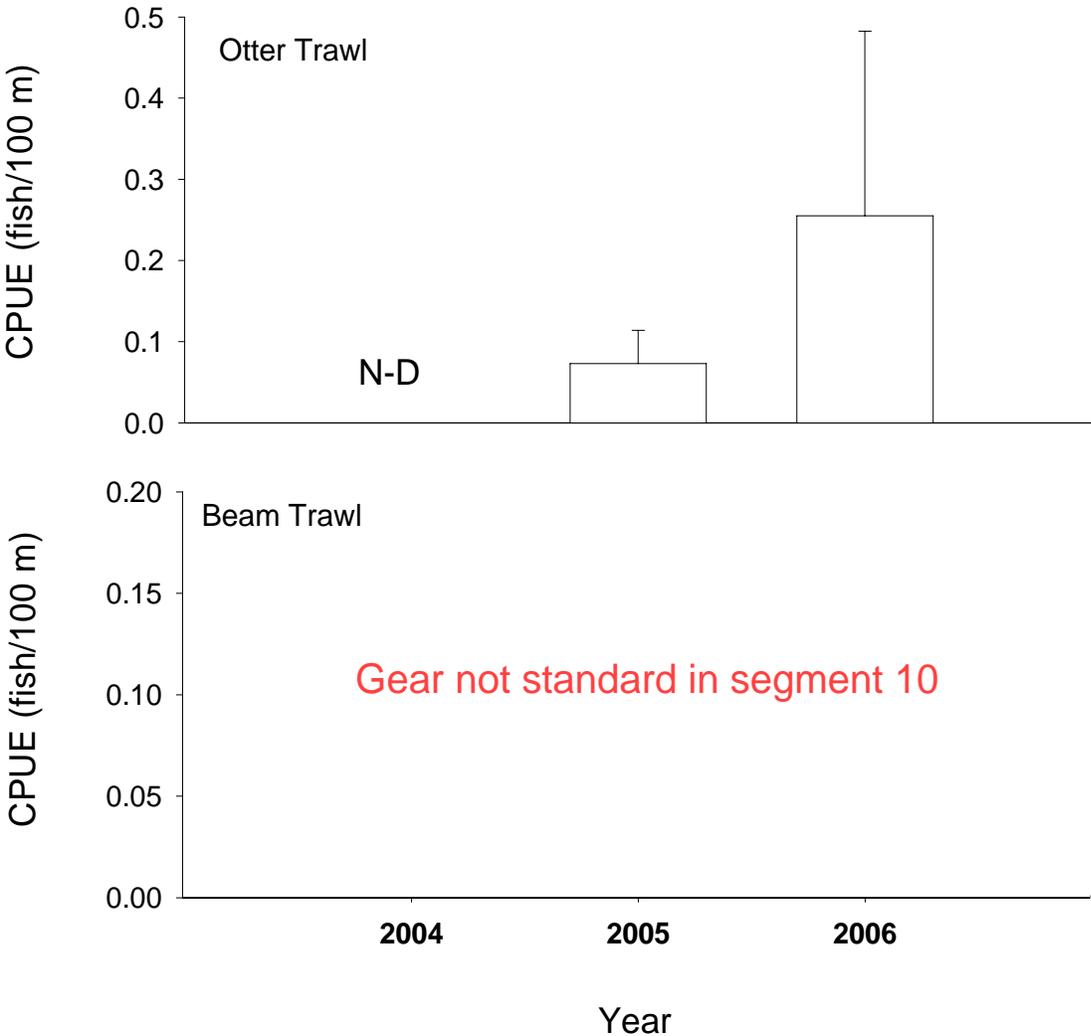


Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2005-2006.

Segment 10 - Sturgeon Chub / Fish Community Season

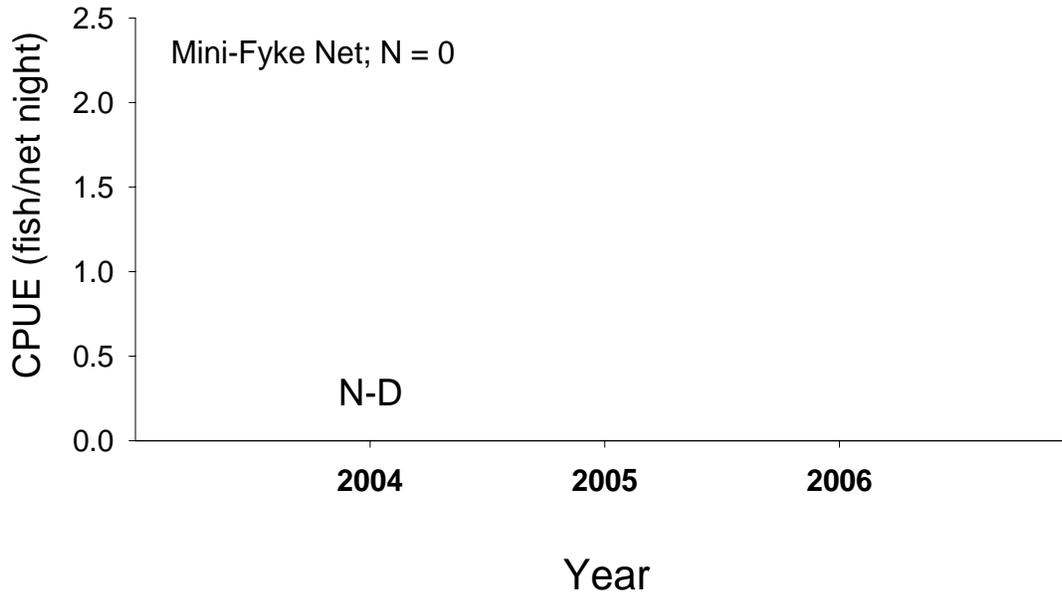


Figure 20. Mean annual catch-per-unit-effort ($\pm 2SE$) of sturgeon chub using mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2005-2006.

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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	0	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	1	N-E N-E	0 (15)		N-E N-E	N-E N-E	100 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	17	N-E N-E	18 (20)		N-E N-E	N-E N-E	82 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	1		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	17	0 0	100 (100)			

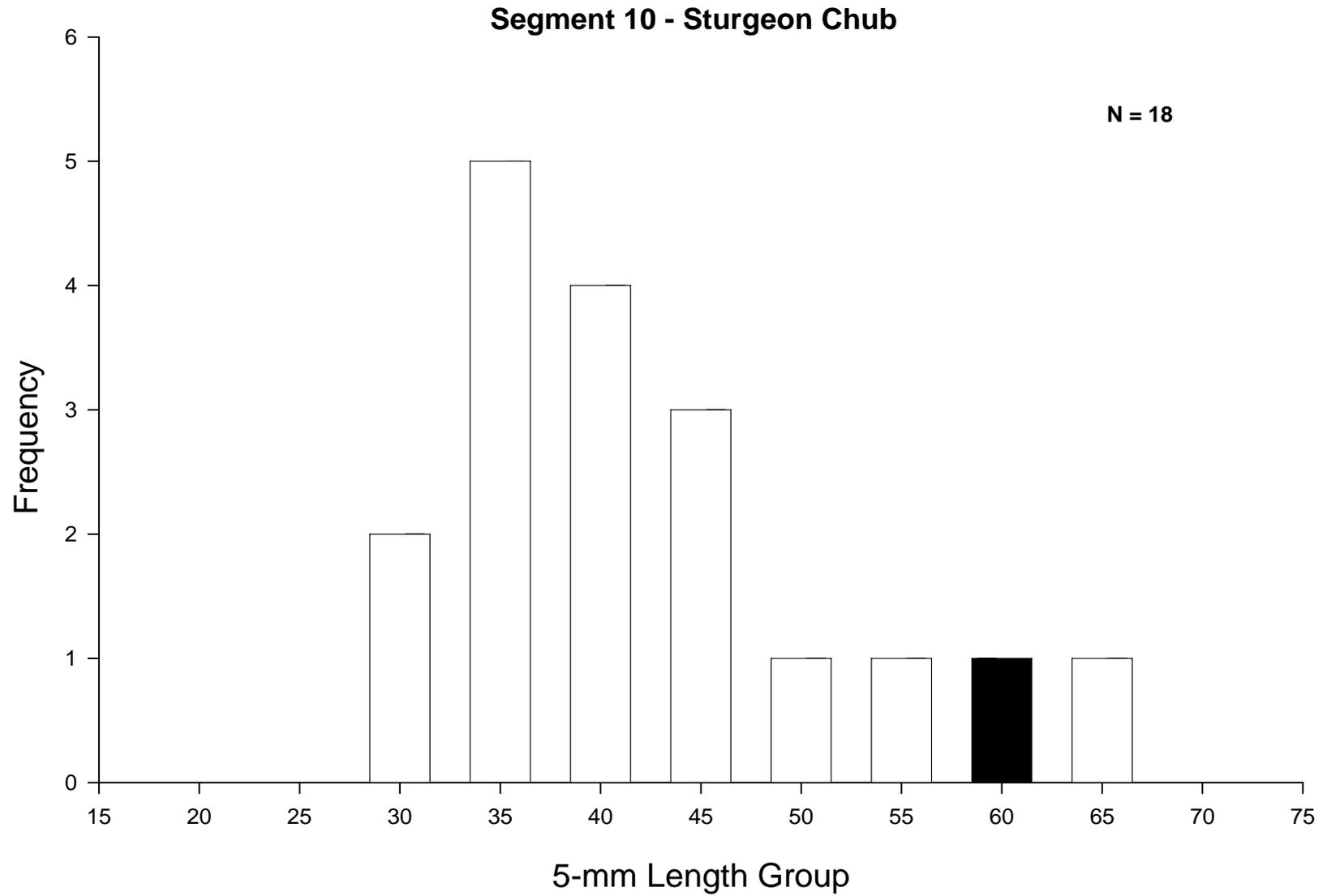


Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006.

Sicklefin Chub

Sicklefin chubs were the second most common *Macrhybopsis* species encountered (N = 36 sturgeon season; N = 18 fish community season, Figure 25) during the 2006 sampling season. Total length for this species ranged from 39 to 108 mm (mean = 68 mm) for sturgeon season and 28 to 86 mm (mean = 52 mm) for fish community season. This is similar to the 2005 fish community season range of 29 to 118 mm (mean = 65 mm). Mean CPUE for otter trawls for sturgeon season and fish community season was 0.0317 fish/100 m and 0.632 fish/100 m, respectively. This is an increase from the 2005 fish community season mean otter trawl CPUE of 0.487 fish/ 100 m (Figures 22-23). Otter trawl was the only gear that captured sicklefin chubs. As a result, all sicklefin chubs were captured in CHNB mesohabitats because this was the only mesohabitat sampled with otter trawls (Table 28 and 29). Most sicklefin chubs (69%) were captured from inside bend macrohabitats. The remaining 31% of fish were captured in the channel crossover.

Segment 10 - Sicklefin Chub / Sturgeon Season

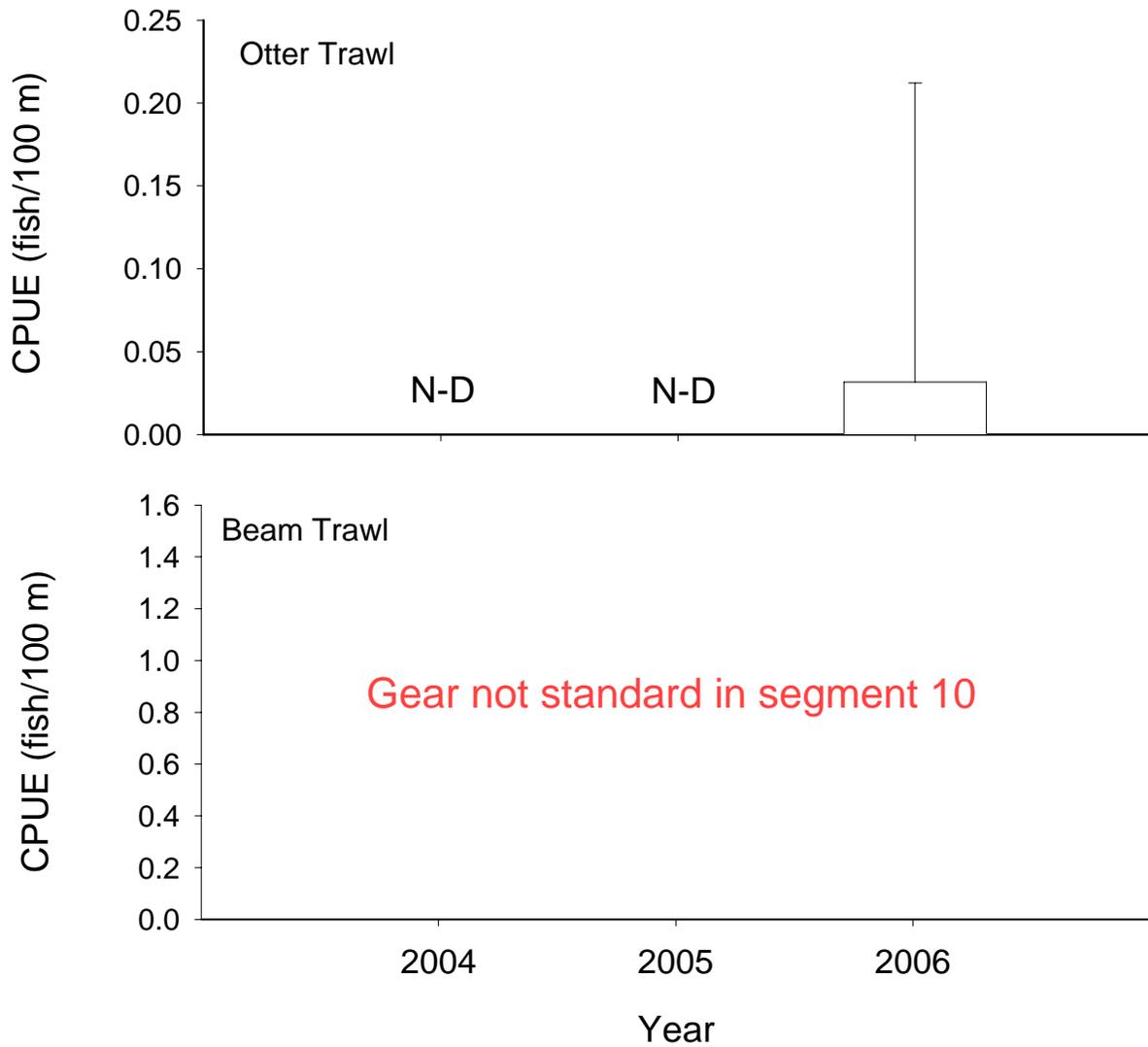


Figure 22. Mean annual catch-per-unit-effort (\pm 2SE) of sicklefin chub using otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2005-2006.

Segment 10 - Sicklefin Chub / Fish Community Season

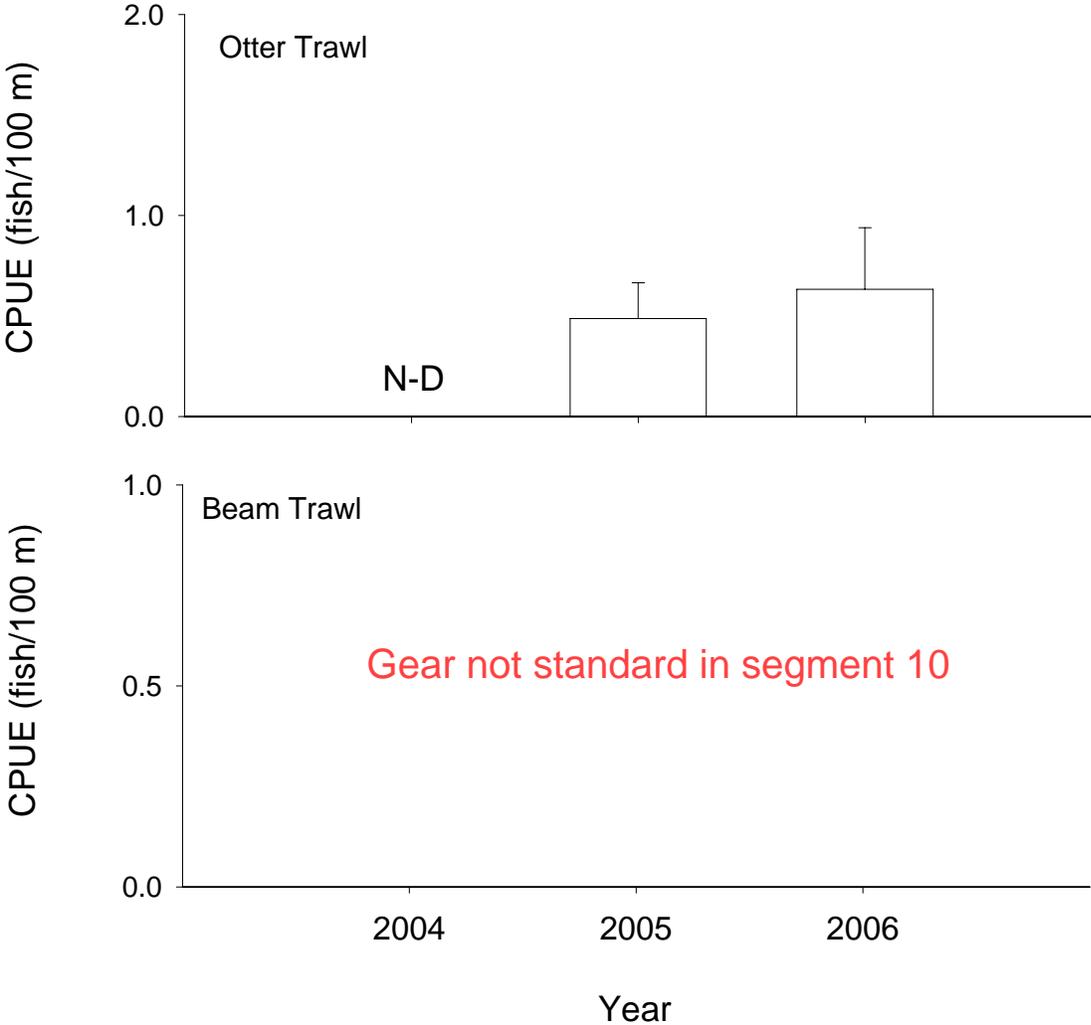


Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2005-2006.

Segment 10 - Sicklefin Chub / Fish Community Season

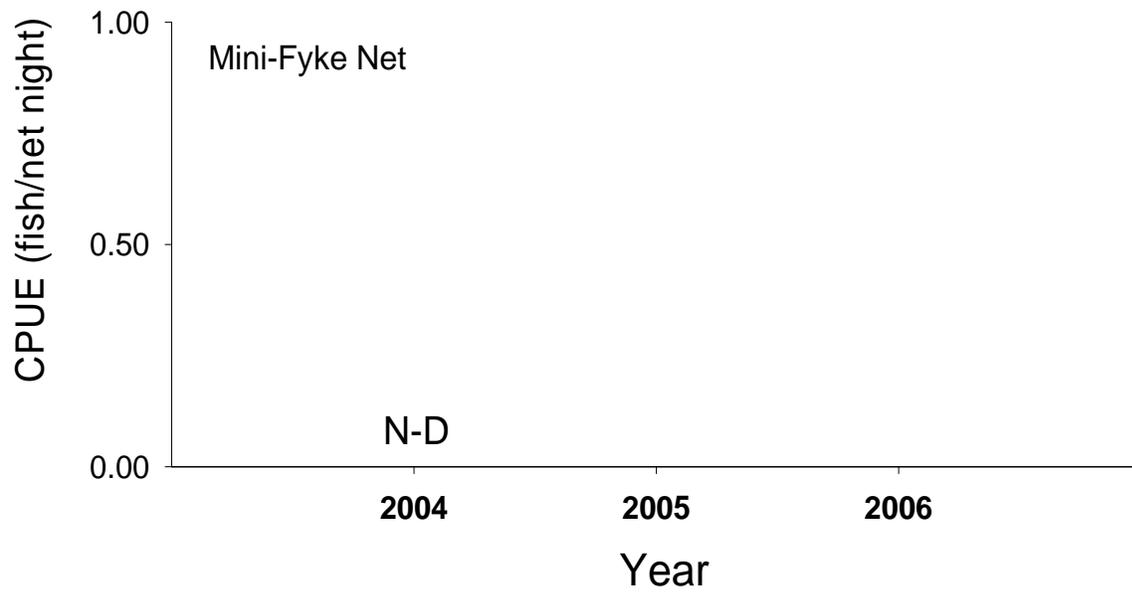


Figure 24. Mean annual catch-per-unit-effort ($\pm 2SE$) of sicklefin chub using mini-fyke nets in segment 10 of the Missouri River during fish community season 2005-2006.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	0	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 0				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	18	N-E N-E	11 (15)		N-E N-E	N-E N-E	89 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0				0 0		
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)				0 (6)		
Otter Trawl	36	N-E N-E	31 (20)		N-E N-E	N-E N-E	69 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	18		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	36	0 0	100 (100)			

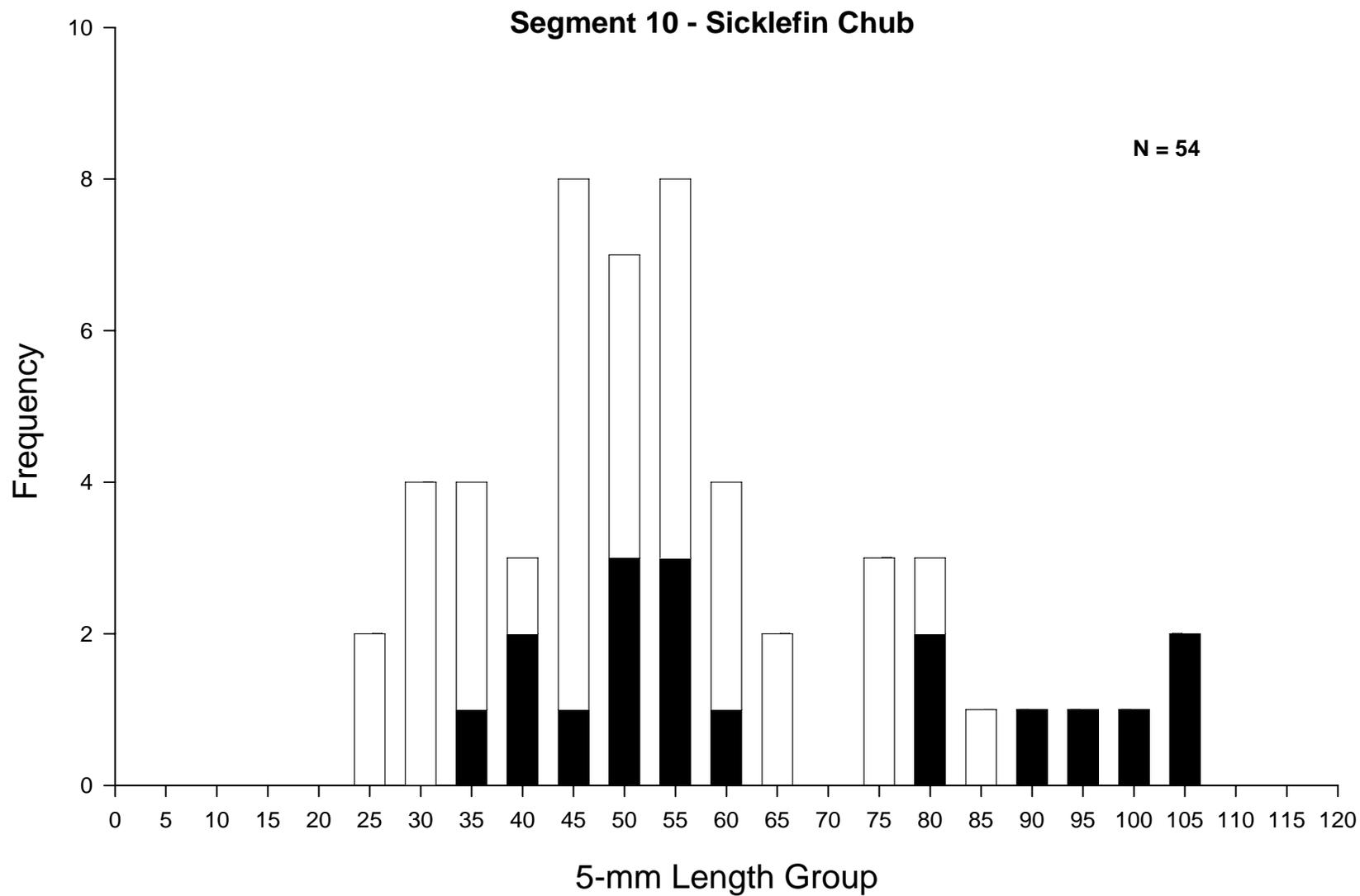


Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005- 2006.

Speckled Chub

Speckled chubs were the most common *Macrhybopsis* species encountered (N = 45 sturgeon season; N = 22 fish community season, Figure 29) during the 2006 sampling season. Total length for this species ranged from 22 to 65 mm (mean = 52 mm) for sturgeon season and 34 to 70 mm (mean = 48 mm) for fish community season, comparable to the 2005 fish community range of 23 to 94 mm (mean = 42 mm). Speckled chubs were captured in otter trawls during the sturgeon season with mean CPUE = 1.057 fish/100 m (Figure 26). During fish community season, speckled chubs were captured in both otter trawl and mini-fyke nets with mean CPUE = 0.348 fish/100 m and CPUE = 0.156 fish/net night, respectively (Figures 27 and 28). All speckled chubs captured in otter trawls and mini-fyke nets were caught in CHNB and BARS mesohabitats, respectively, because these were the only mesohabitats sampled with each respective gear (Tables 30 and 31). Most speckled chubs (85%) were captured from inside bend macrohabitats. The remaining 15% of fish were captured in the channel crossover.

Segment 10 - Speckled Chub / Sturgeon Season

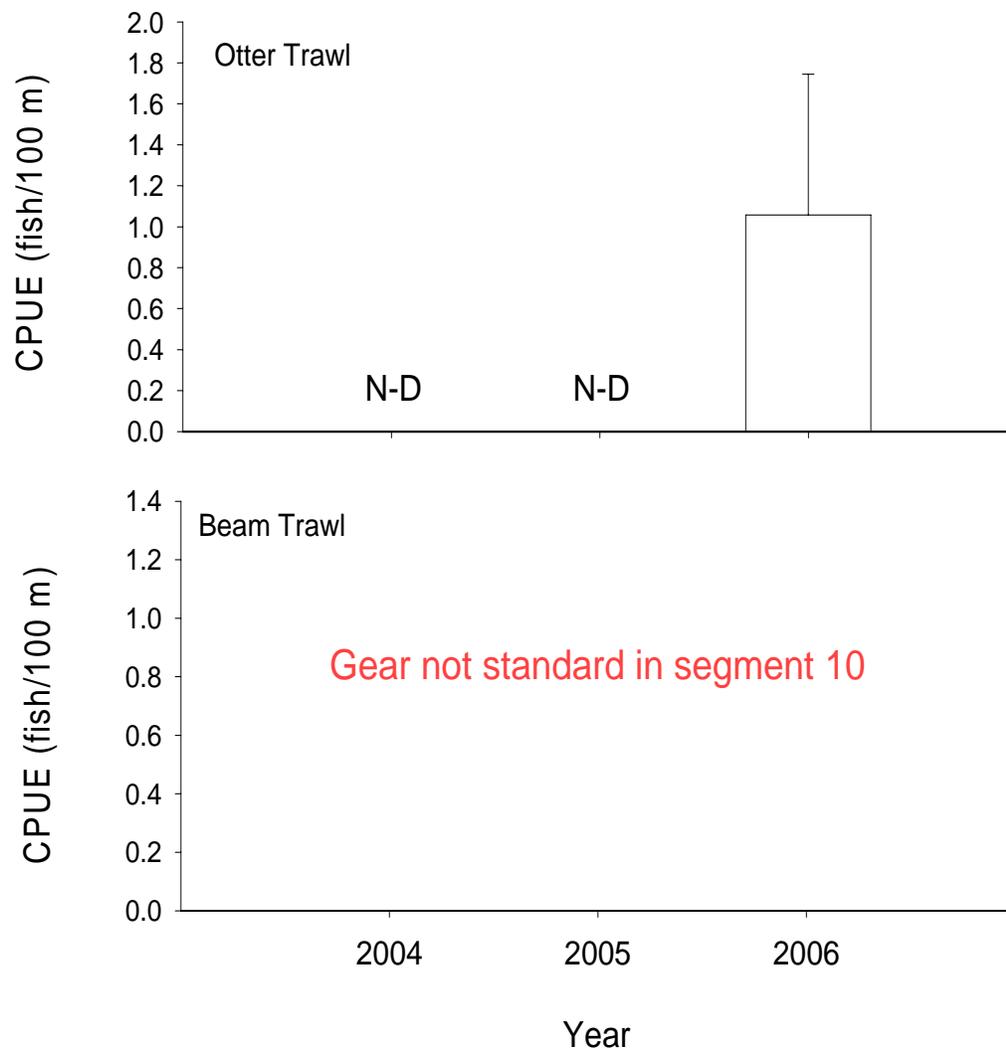


Figure 26. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub using otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2005 -2006.

Segment 10 - Speckled Chub / Fish Community Season

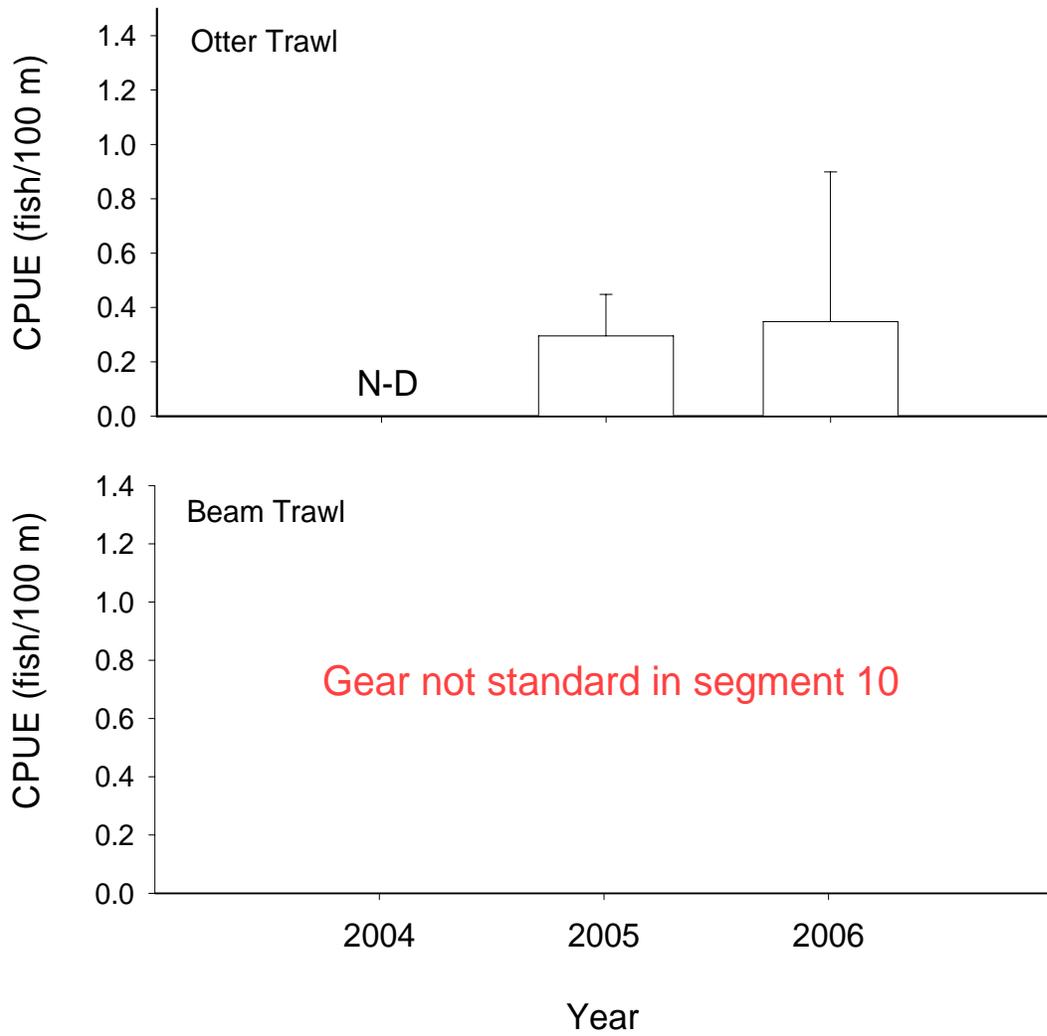


Figure 27. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub in segment 10 of the Missouri River during fish community season 2005 -2006.

Segment 10 - Speckled Chub / Fish Community Season

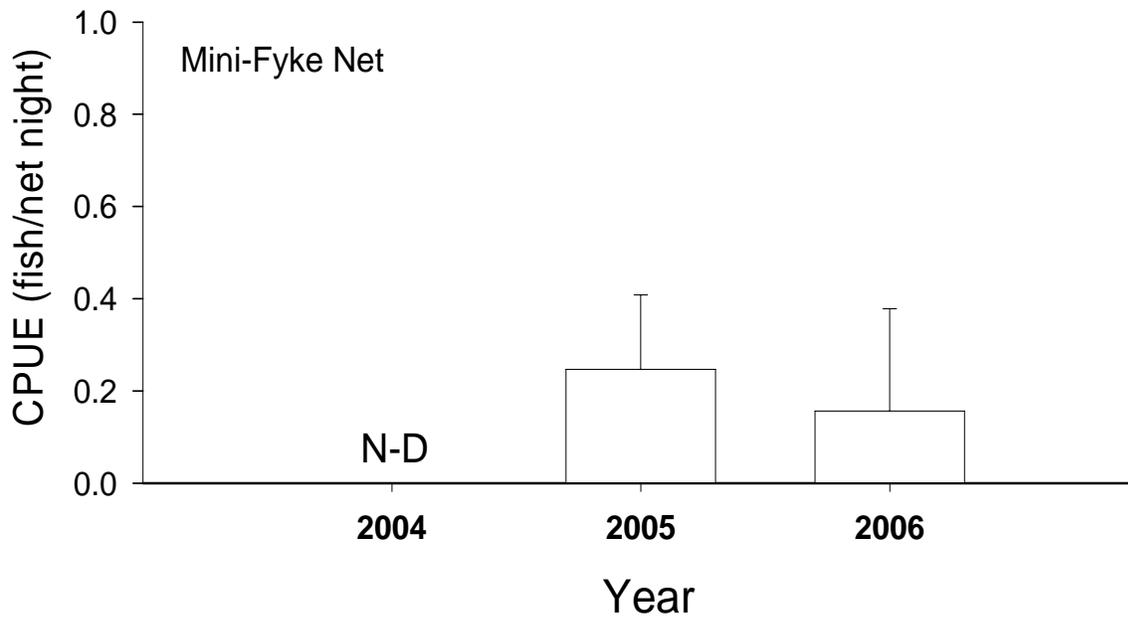


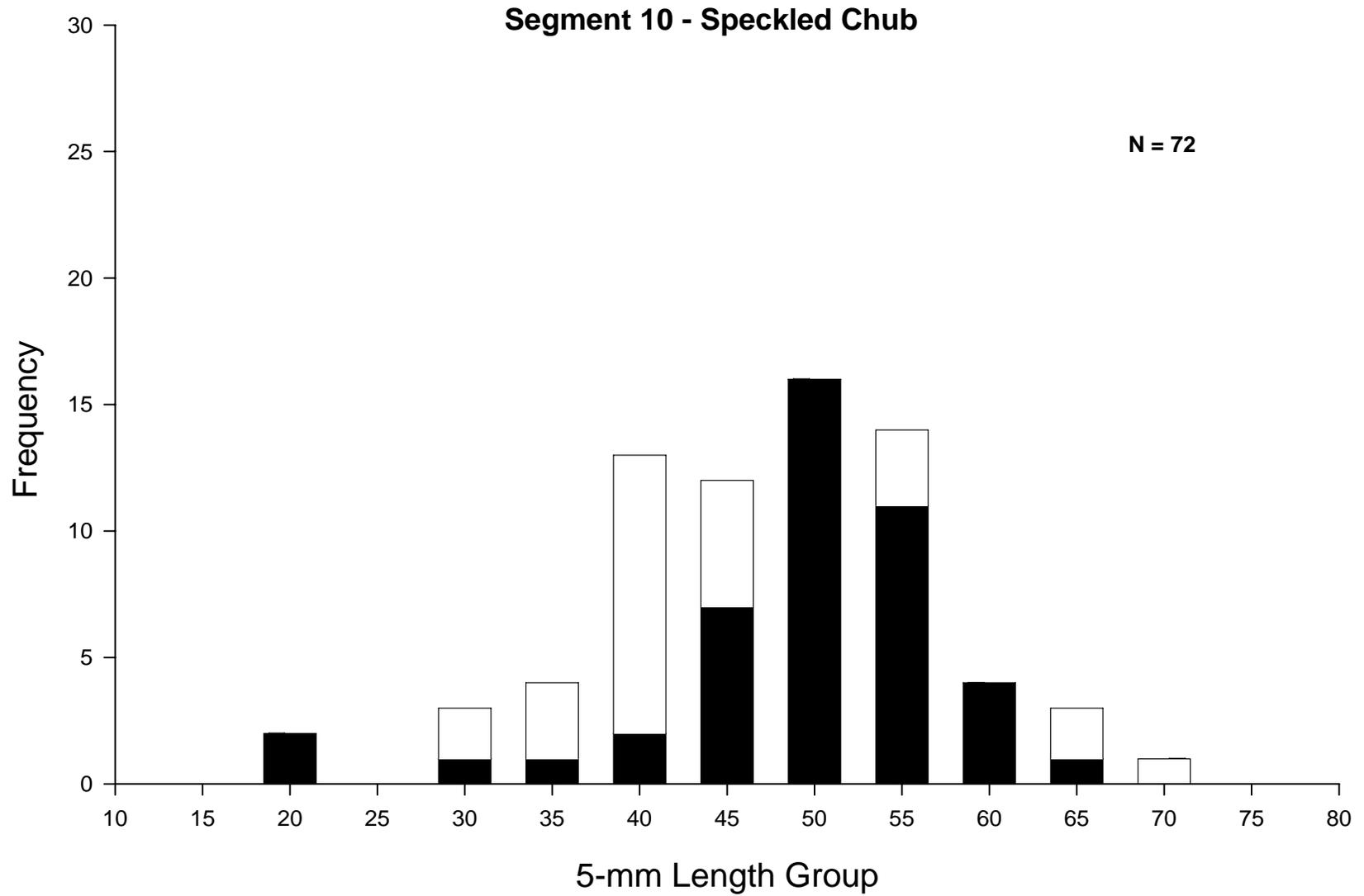
Figure 28. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub using mini-fyke nets in segment 10 of the Missouri River during fish community season 2005 -2006.

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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	0	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 (2)				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	45	N-E N-E	20 (15)		N-E N-E	N-E N-E	80 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0				0 0		
Beam Trawl															
Mini-Fyke Net	5	N-E N-E	100 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)				0 (6)		
Otter Trawl	22	N-E N-E	5 (20)		N-E N-E	N-E N-E	95 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	45		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	5	100 (100)	0 0			
Otter Trawl	22	0 0	100 (100)			



+ Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006.

Sand Shiner

During the 2006 fish community season, sand shiners ($N = 54$) were captured using mini-fyke nets with a mean CPUE = 1.688 fish/net night (Figure 32). During the 2005 fish community season, sand shiners were captured in both otter trawls and mini-fyke nets with mean CPUE = 0.0150 fish/100 m and CPUE = 0.1750 fish/net night, respectively (Figures 31 and 32). Total length of sand shiners ranged from 32 to 49 mm (mean = 38 mm; Figure 33). Mini-fyke nets were the only gear that captured sand shiners in 2006. As a result, all sand shiners were captured in BARS mesohabitats because this was the only mesohabitat sampled with mini-fyke nets (Tables 32 and 33). Most sand shiners (54%) were captured from inside bend macrohabitats. The remaining 28%, 9%, and 9% of fish were captured in the TRMS, CHXO, and OSB macrohabitats, respectively.

Segment 10 - Sand Shiner / Sturgeon Season

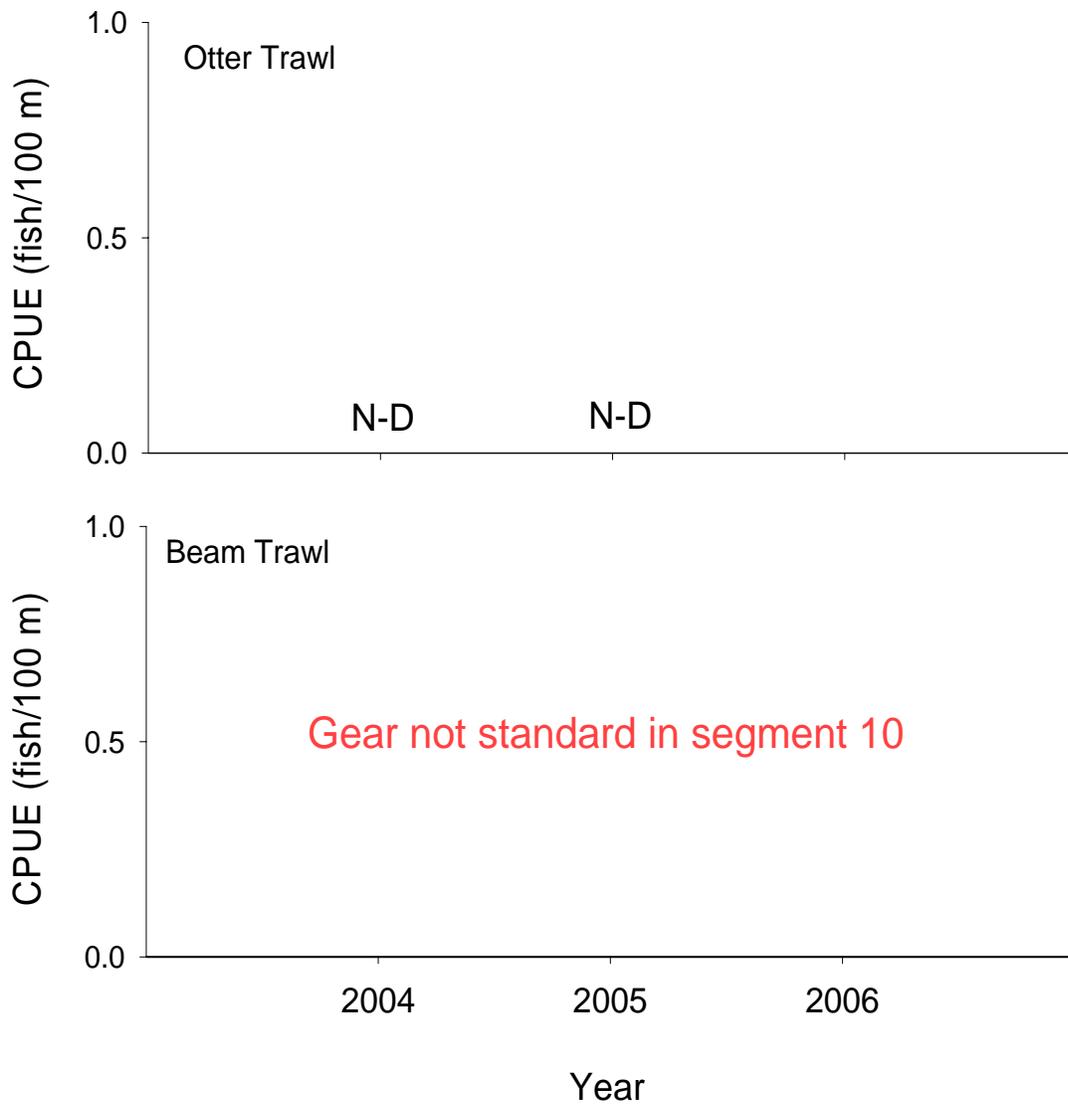


Figure 30. Mean annual catch-per-unit-effort ($\pm 2SE$) of sand shiner with otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2005 -2006.

Segment 10 - Sand Shiner / Fish Community Season

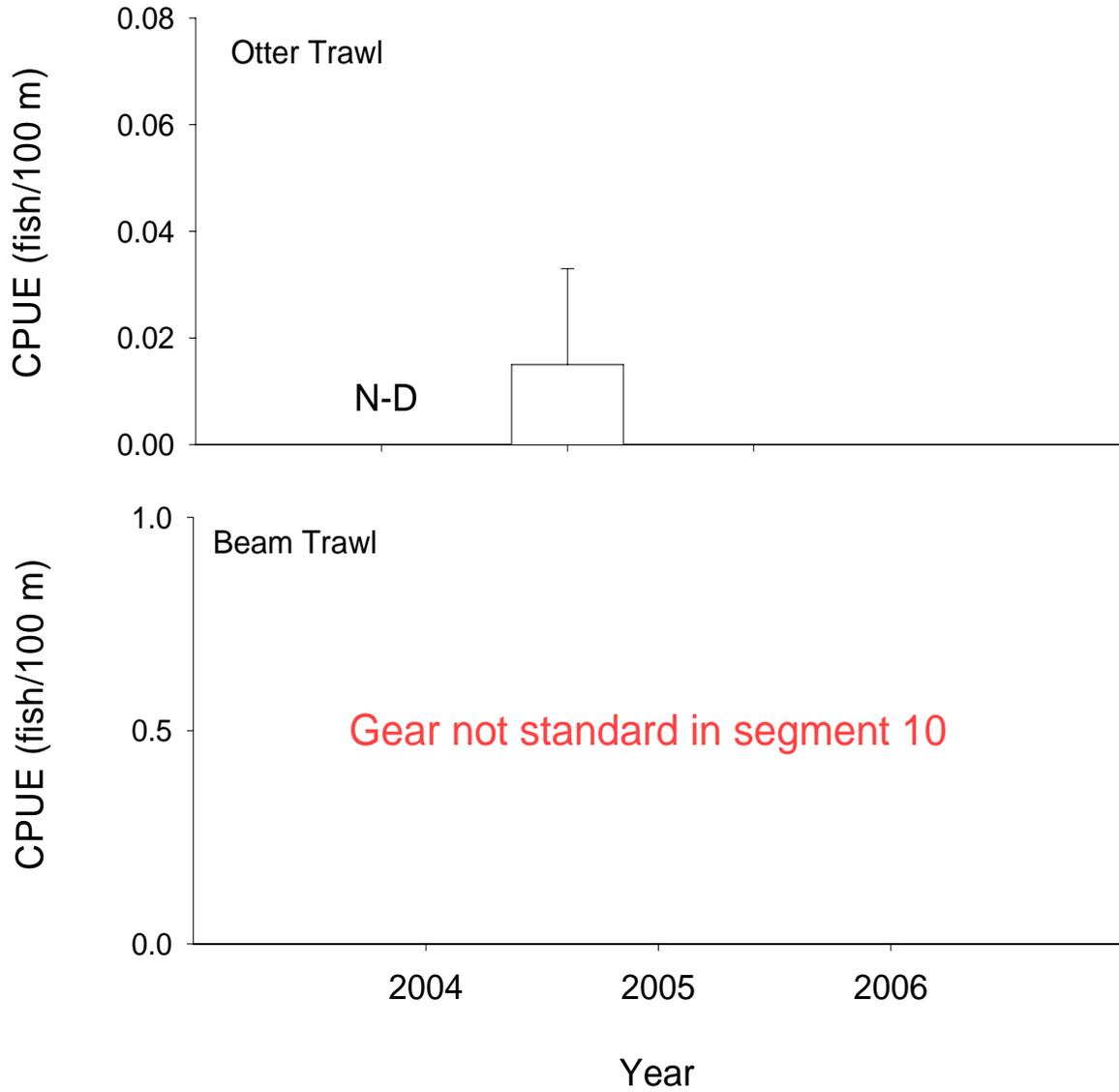


Figure 31. Mean annual catch-per-unit-effort ($\pm 2SE$) of sand shiner with otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2005 -2006.

Segment 10 - Sand Shiner / Fish Community Season

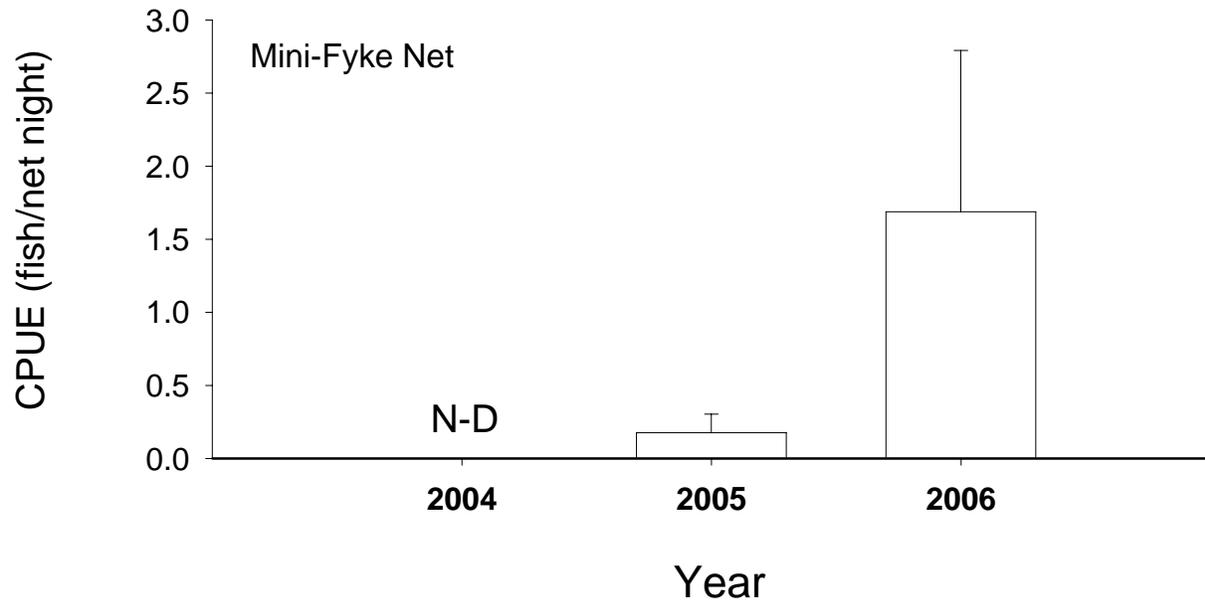


Figure 32. Mean annual catch-per-unit-effort ($\pm 2SE$) of sand shiner with mini-fyke nets in segment 10 of the Missouri River during fish community season 2005 - 2006.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	0	N-E N-E	0 (22)		N-E N-E	N-E N-E	0 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 (2)				0 0		
Beam Trawl															
Gill Net	0	N-E N-E	0 (34)		N-E N-E	N-E N-E	0 (54)	0 (10)	0 (3)				0 (0)		
Otter Trawl	0	N-E N-E	0 (15)		N-E N-E	N-E N-E	0 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	54	N-E N-E	9 (25)		N-E N-E	N-E N-E	54 (56)	9 (6)	0 (6)					28 (6)	
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		0 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	0		0 (51)	0 (1)	0 (48)	
Otter Trawl	0		0 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	54	100 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

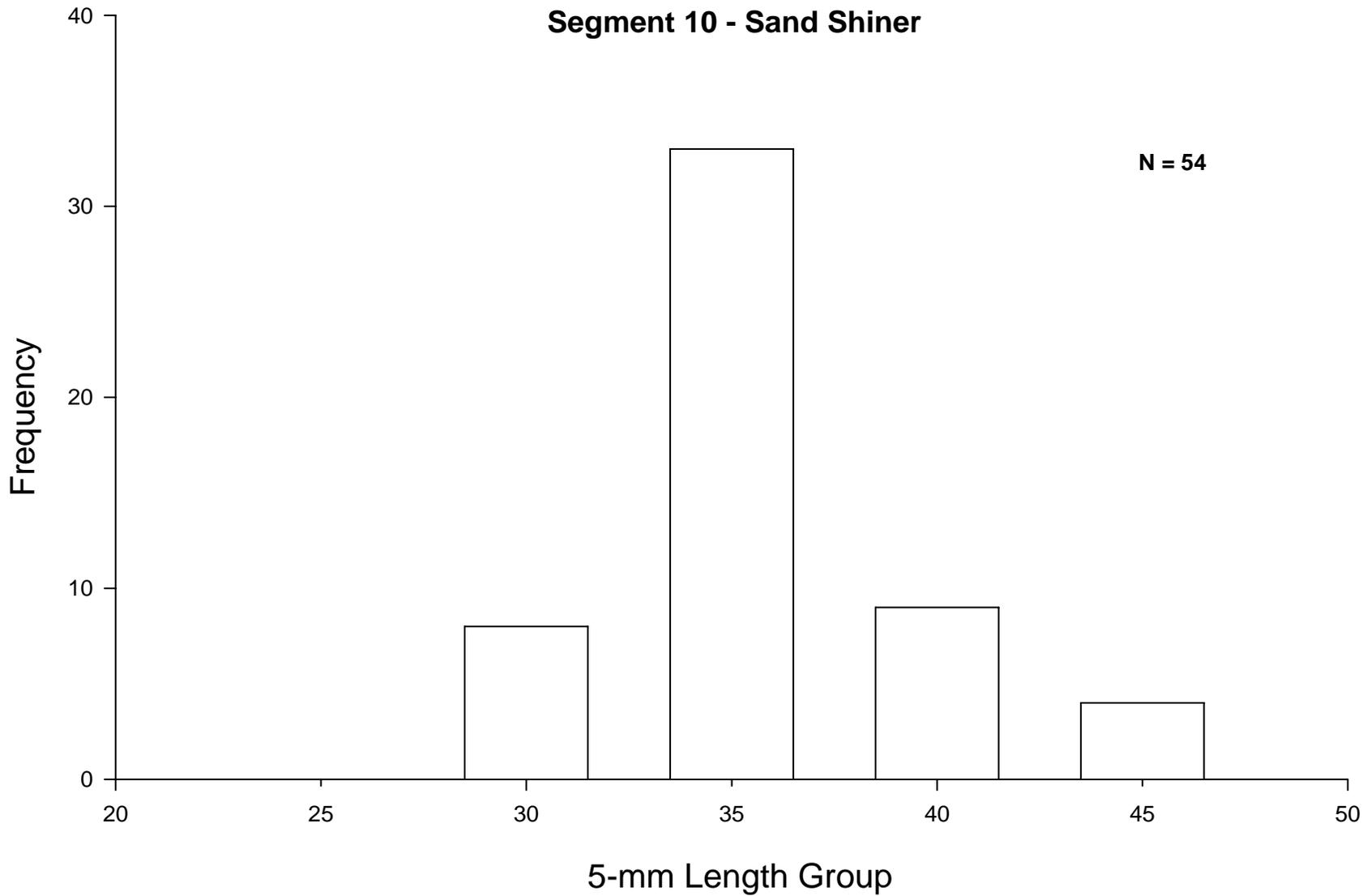


Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006.

***Hybognathus* spp.**

There were no *Hybognathus* spp. sampled in segment 10 during the 2005-2006 sampling seasons.

Blue Sucker

Thirty-three blue suckers were captured during the sturgeon seasons using gillnets (N = 17; mean CPUE = 0.0920), 1-inch trammel nets (N = 10; mean CPUE = 0.265 fish/100 m), 2.5-inch trammel nets (N = 5; mean CPUE = 0.067 fish/100 m) and otter trawls (N = 1; mean CPUE = 0.018 fish/100 m; Figures 38-42). Only one blue sucker was captured during the 2006 fish community season in 1-inch trammel nets (mean CPUE = 0.0223 fish/100 m) (Figure 41). Total length of blue suckers ranged from 240 to 845 mm (mean = 626 mm; Figure 44). All blue suckers were captured in channel crossover, inside bend macrohabitats in CHNB and POOL mesohabitats (Tables 36 and 37).

Segment 10 - Blue Sucker / Sturgeon Season

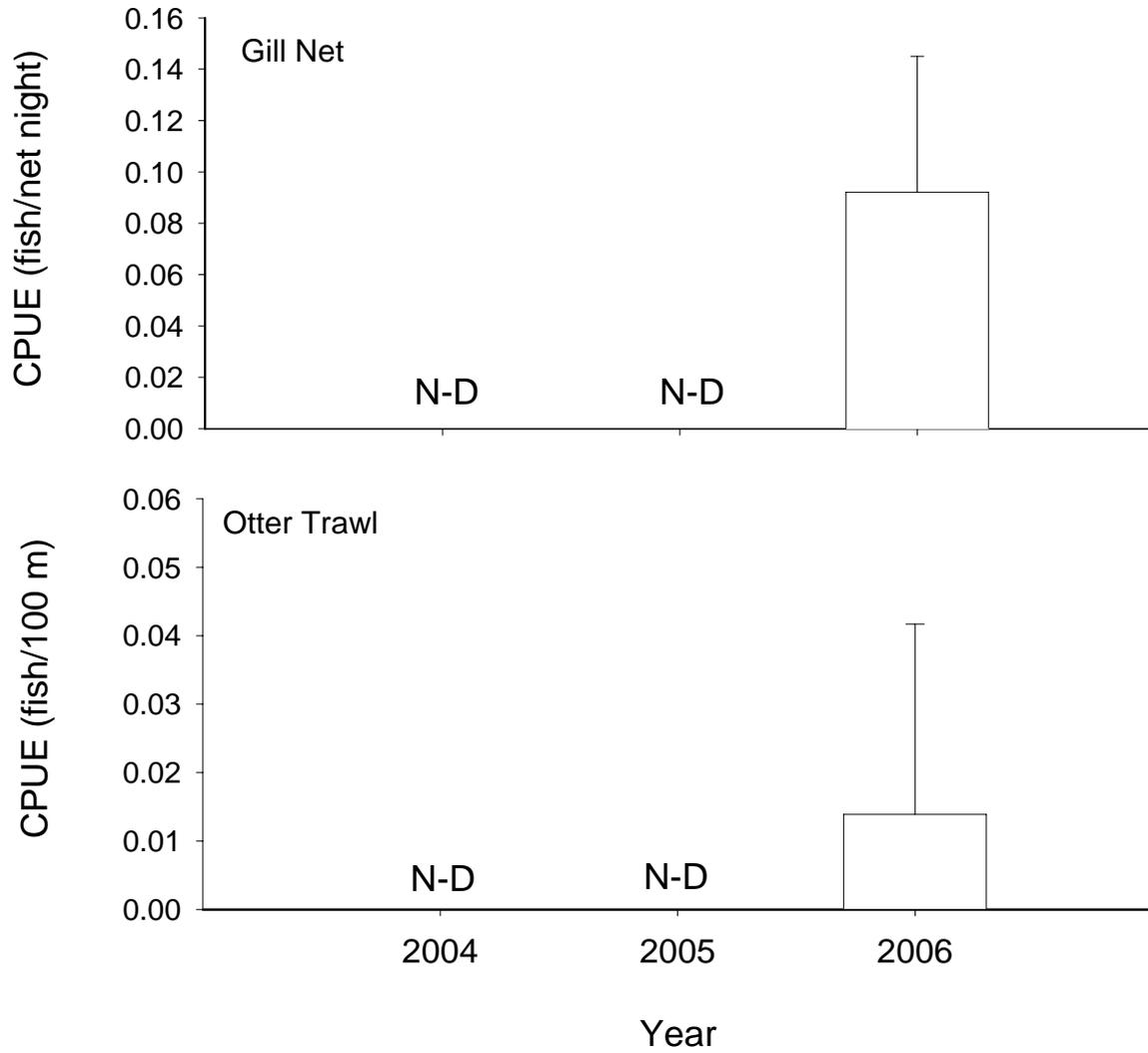


Figure 38. Mean annual catch-per-unit-effort ($\pm 2SE$) of blue sucker with gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Blue Sucker / Sturgeon Season

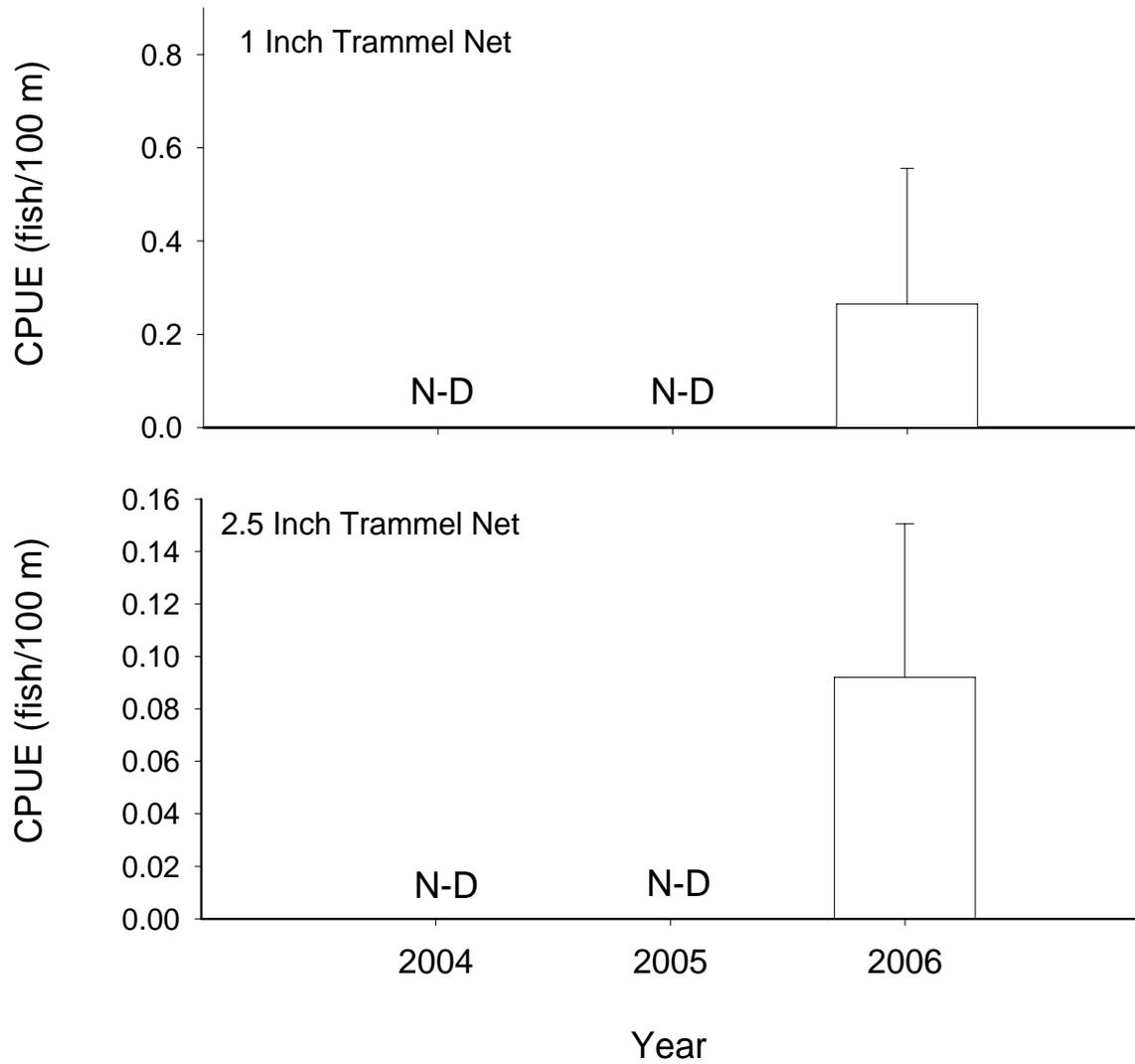


Figure 39. Mean annual catch-per-unit-effort ($\pm 2SE$) of blue sucker with 1 and 2.5 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Blue Sucker / Fish Community Season

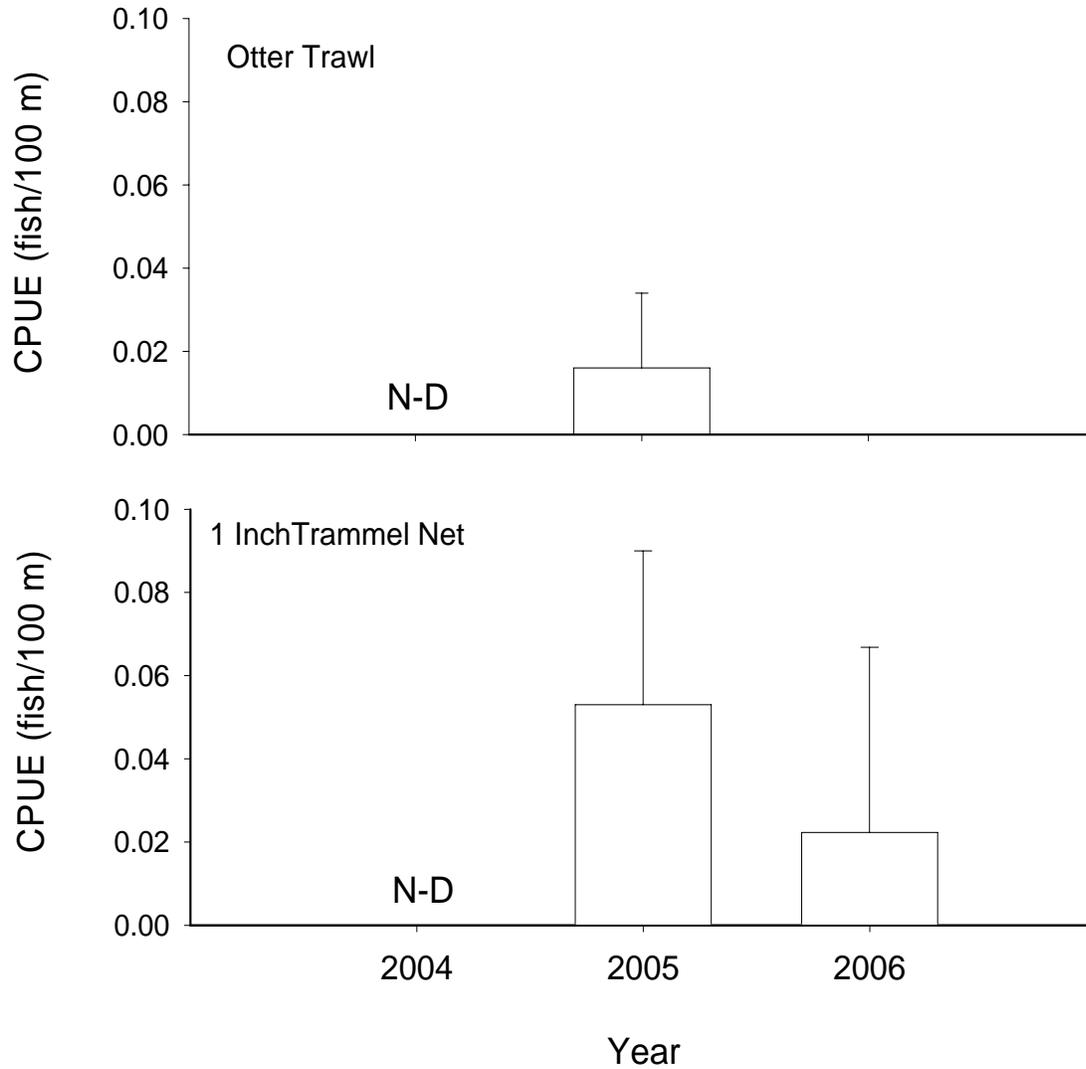


Figure 41. Mean annual catch-per-unit-effort ($\pm 2SE$) of blue sucker using otter trawls and 1 inch trammel nets in segment 10 of the Missouri River during fish community season 2005 - 2006.

Segment 10 - Blue Sucker / Fish Community Season

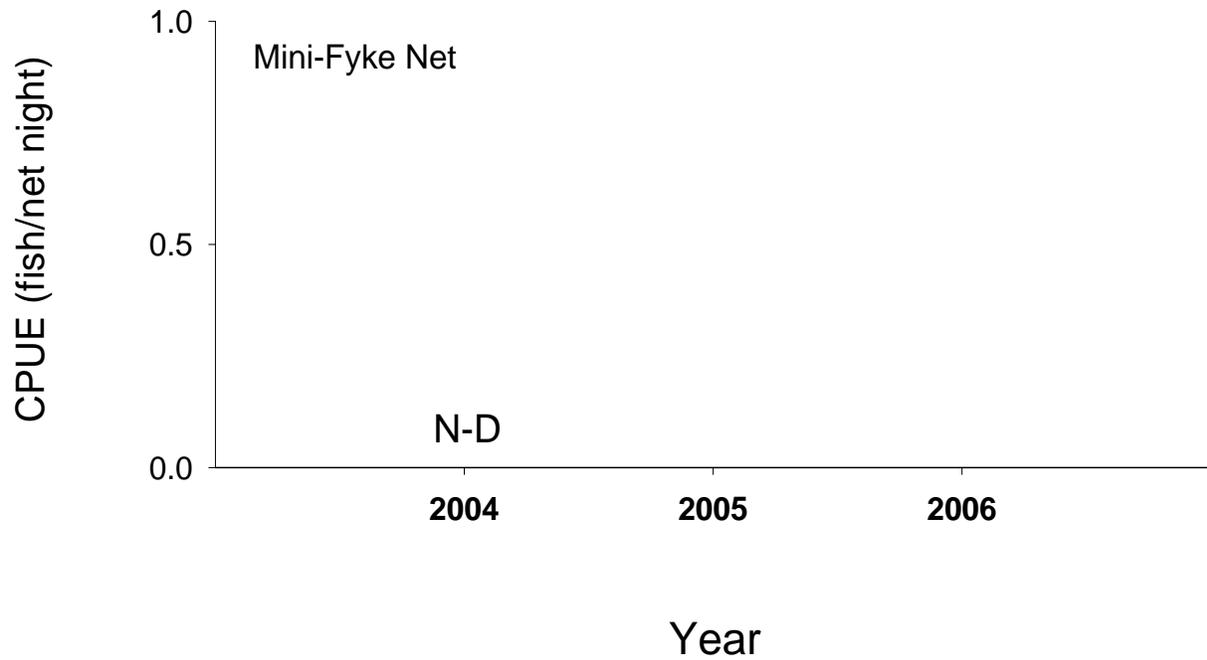


Figure 42. Mean annual catch-per-unit-effort (\pm 2SE) of blue suckers using mini-fyke nets in segment 10 of the Missouri River during fish community season 2005 - 2006.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	10	N-E N-E	60 (22)		N-E N-E	N-E N-E	40 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	5	N-E N-E	20 (30)		N-E N-E	N-E N-E	80 (70)	0 0	0 (2)				0 0		
Beam Trawl															
Gill Net	17	N-E N-E	29 (34)		N-E N-E	N-E N-E	47 (54)	24 (10)	0 (3)				0 (0)		
Otter Trawl	1	N-E N-E	0 (15)		N-E N-E	N-E N-E	100 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	1	N-E N-E	100 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0					0 0	
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)					0 (6)	
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	10		100 (100)	0 0	0 0	
2.5 Inch Trammel Net	5		100 (100)	0 0	0 0	
Beam Trawl						
Gill Net	17		41 (51)	0 (1)	59 (48)	
Otter Trawl	1		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	1	0 0	100 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

Segment 10 - Blue Sucker

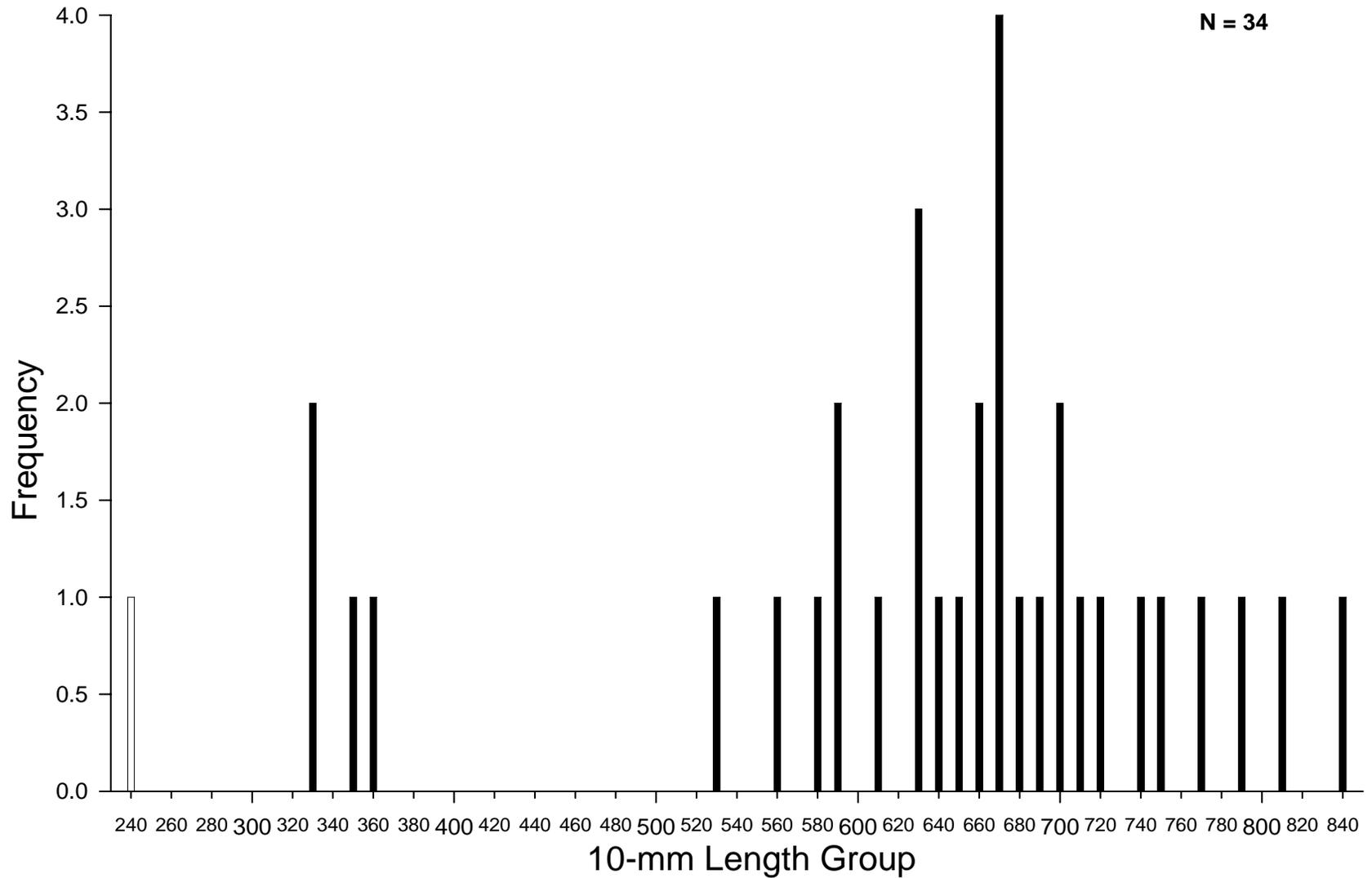


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005 - 2006.

Sauger

Twenty-six sauger were captured in gill nets (N = 23; mean CPUE = 0.121 fish/net night), otter trawls (N = 2; mean CPUE = 0.039 fish/100 m), and 1-inch trammel nets (N= 1; mean CPUE = 0.016 fish/100 m) during the 2006 sturgeon season (Figures 45-49). Total length of sauger ranged from 32 to 539 mm (mean = 386 mm; Figure 44). All sauger were captured in channel crossover, inside bend, and outside bend macrohabitats in CHNB and POOL mesohabitats (Tables 38 and 39). No sauger were captured during the 2006 fish community season.

Segment 10 - Sauger / Sturgeon Season

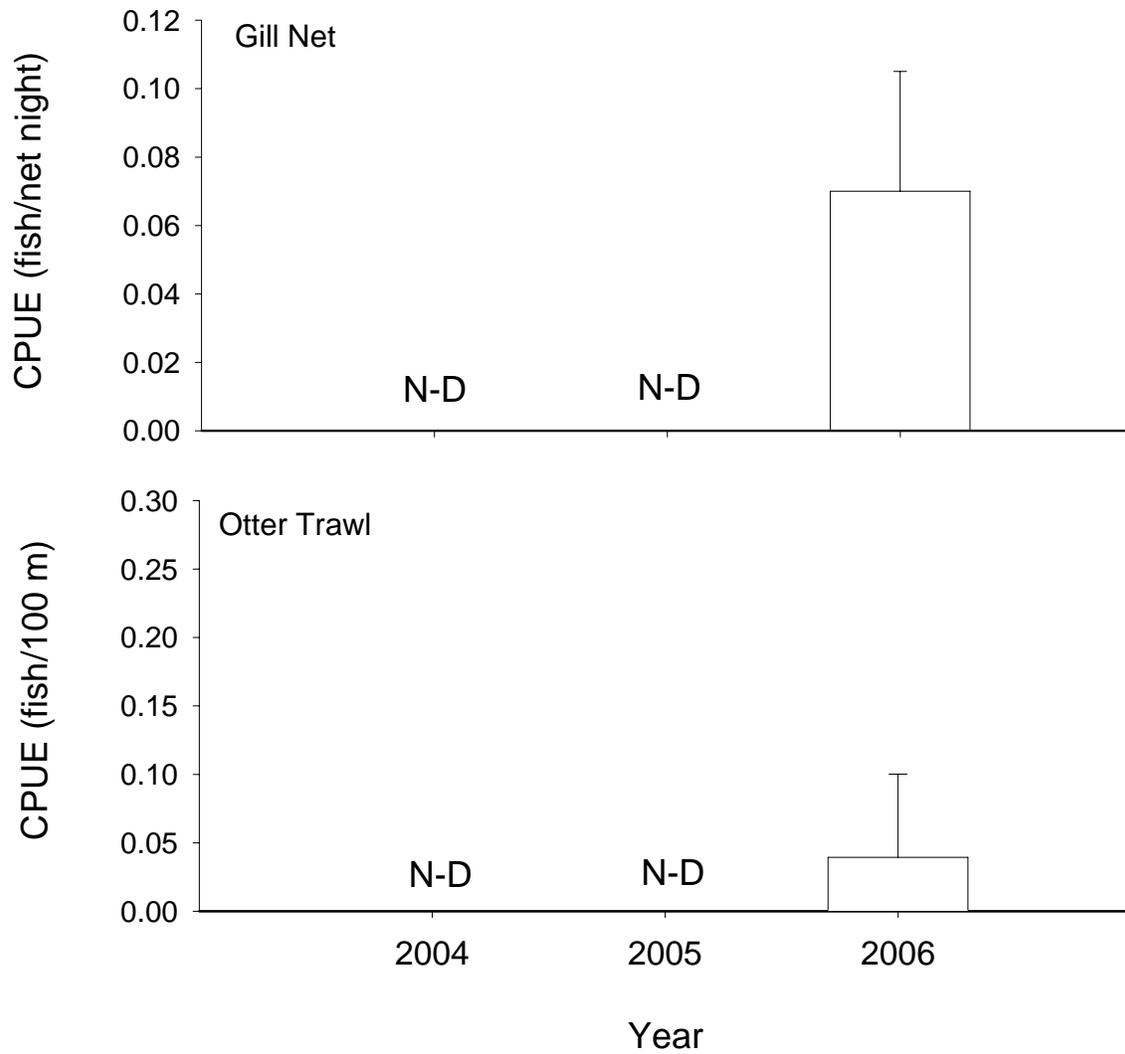


Figure 45. Mean annual catch-per-unit-effort (\pm 2SE) of sauger using gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Sauger / Sturgeon Season

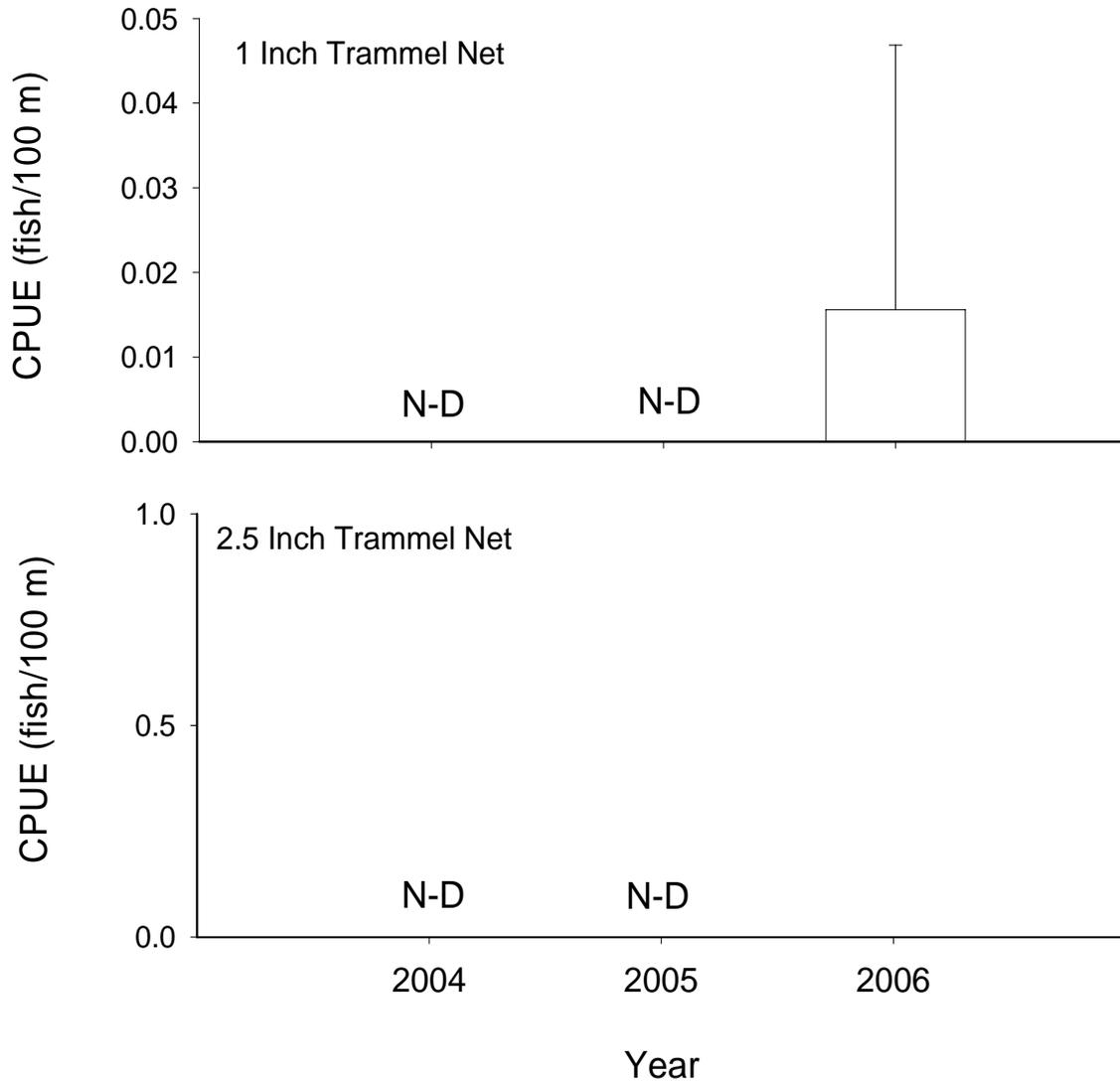


Figure 46. Mean annual catch-per-unit-effort (\pm 2SE) of sauger using 1 and 2.5 inch trammel nets in segment 10 of the Missouri River during sturgeon season 2005 - 2006.

Segment 10 - Sauger / Fish Community Season

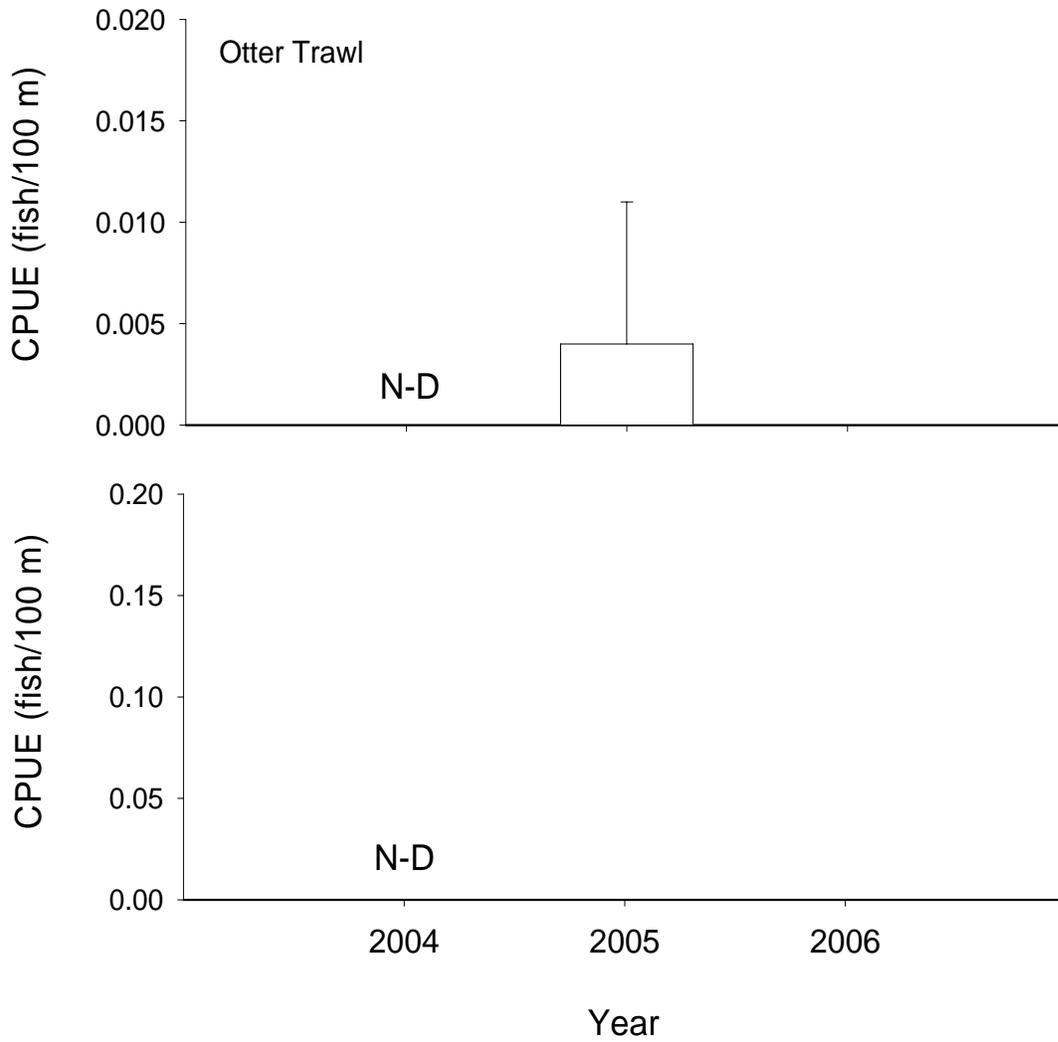


Figure 48. Mean annual catch-per-unit-effort (\pm 2SE) of sauger using otter trawls and 1 inch trammel nets in segment 10 of the Missouri River during fish community season 2005 - 2006.

Segment 10 - Sauger / Fish Community Season

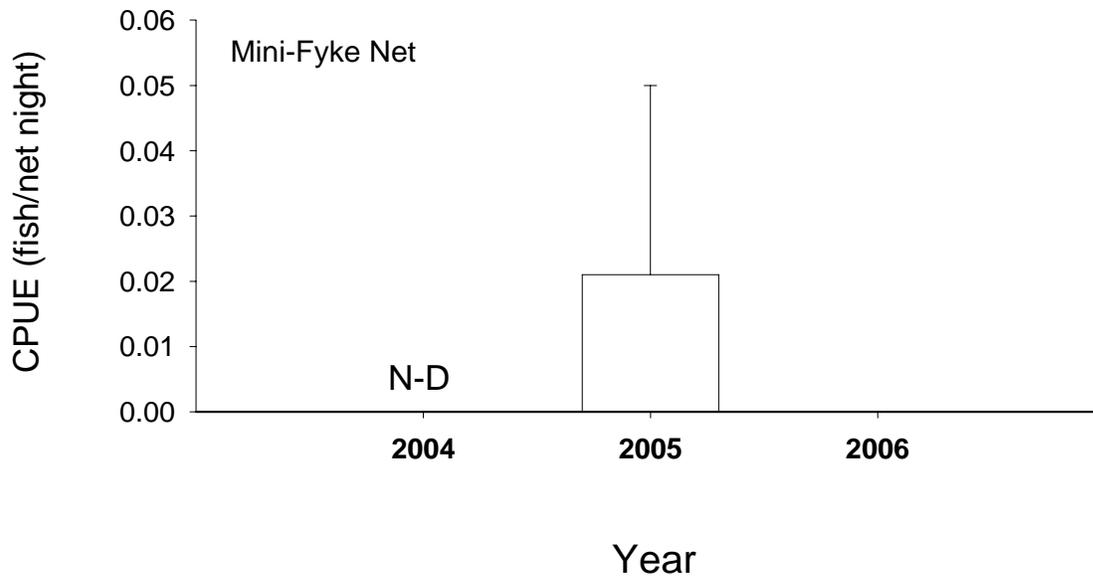


Figure 49. Mean annual catch-per-unit-effort (\pm 2SE) of sauger using mini-fyke nets in segment 10 of the Missouri River during fish community season 2005 - 2006.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-Inch Trammel Net	1	N-E N-E	0 (22)		N-E N-E	N-E N-E	100 (76)	0 0	0 (2)				0 0		
2.5-Inch Trammel Net	0	N-E N-E	0 (30)		N-E N-E	N-E N-E	0 (70)	0 0	0 (2)				0 0		
Beam Trawl															
Gill Net	23	N-E N-E	48 (34)		N-E N-E	N-E N-E	35 (54)	17 (10)	0 (3)				0 (0)		
Otter Trawl	2	N-E N-E	0 (15)		N-E N-E	N-E N-E	100 (85)	0 0	0 0				0 0		
Fish Community Season (Summer)															
1-Inch Trammel Net	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	0 0	0 0				0 0		
Beam Trawl															
Mini-Fyke Net	0	N-E N-E	0 (25)		N-E N-E	N-E N-E	0 (56)	0 (6)	0 (6)				0 (6)		
Otter Trawl	0	N-E N-E	0 (20)		N-E N-E	N-E N-E	0 (80)	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 2005 – 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	1		1 (100)	0 0	0 0	
2.5 Inch Trammel Net	0		0 (100)	0 0	0 0	
Beam Trawl						
Gill Net	23		48 (51)	0 (1)	52 (48)	
Otter Trawl	2		100 (100)	0 0	0 0	
Fish Community Season (Summer)						
1 Inch Trammel Net	0	0 0	0 (100)			
Beam Trawl						
Mini-Fyke Net	0	0 (100)	0 0			
Otter Trawl	0	0 0	0 (100)			

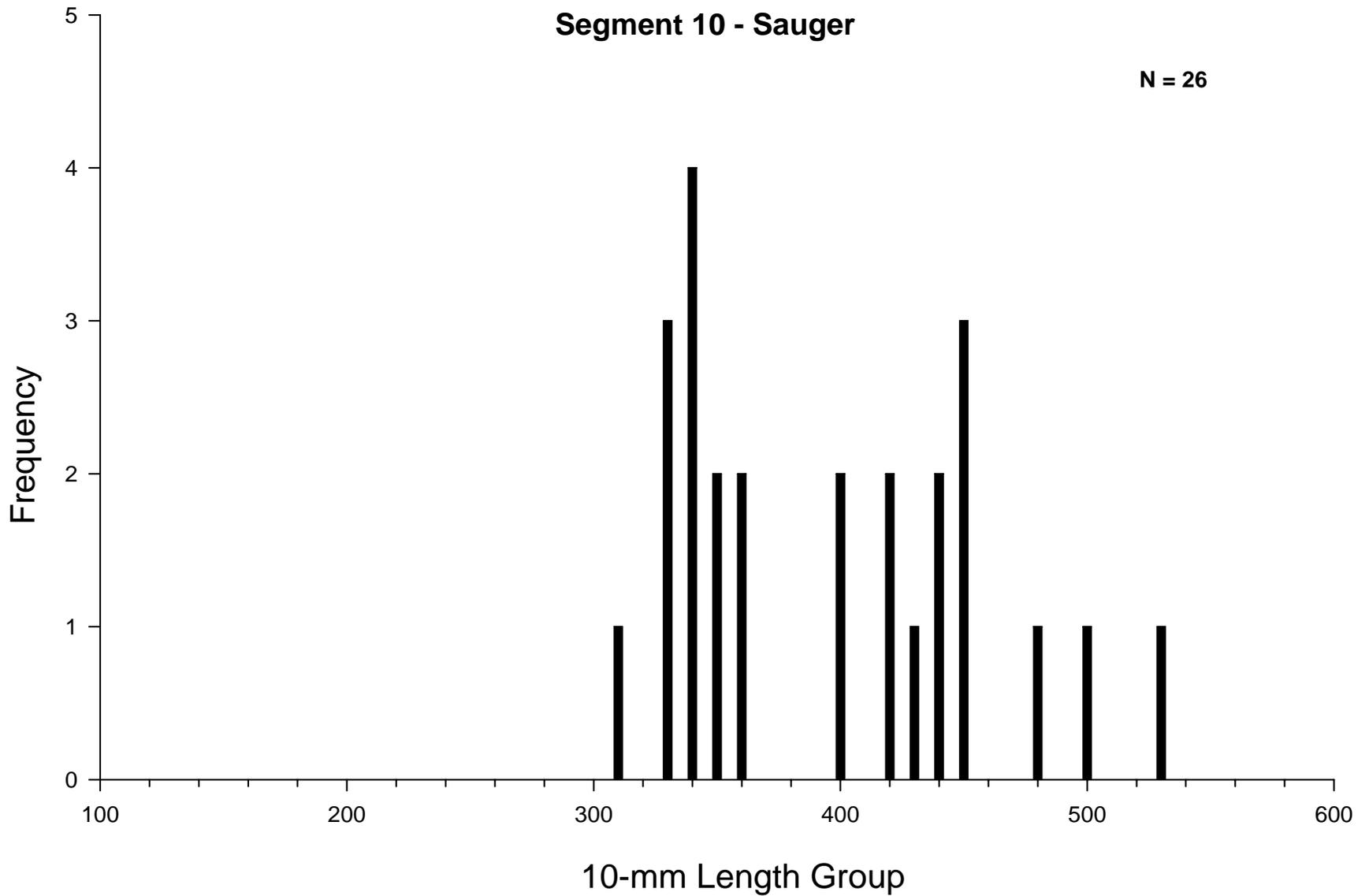


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2005-2006.

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 1,993 fish representing 35 species was captured in segment 10 with all standard gear types during the 2006 sturgeon season. There were seven target species, but only one of those was represented by at least 50 individuals (shovelnose sturgeon, N=1,017). Because of the large number of shovelnose sturgeon captured, target species comprised 57% of the catch. Eight hundred fifty-two non-target individuals were captured, and only six species were represented by over 50 individuals.

During the 2006 fish community season, a total of 5,199 individuals were captured, nearly a 50% decrease in the number of fish sampled during the 2005 season (10,508), but seines were not used a standard gear during 2006, unlike 2005. Among the 2006 species, there were eight target species and 38 non-target species. Two target species were represented by at least 50 individuals, shovelnose sturgeon and sand shiners. Among the non-target species, only 15 were represented by at least 50 individuals. Overall, non-target species comprised 95% of the fish community season catch, and increase of 4% from 2005.

Sampling gears that were deployed in ISB macrohabitats accounted for the majority of the catch (61%). Twenty-seven percent of the fish during 2006 were caught in CHXO habitats, followed by TRMS, OSB, SCCL, and TRML habitats (7, 4, 1, and 0.01 %, respectively). Most species from 2006 and 2005 were caught in BARS mesohabitat (56 and 79%, respectively). CHNB resulted in a similar percentage of fish between the two years (2006 = 28%, 2005 = 21%). Target and non-target species were also captured in POOL mesohabitats in 2006.

A total of 28 species was captured with gill nets (220 net nights) including seven 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, shortnose gar, and gizzard shad (CPUE = 0.9, 0.6, and 0.3 fish/net night, respectively). One-inch trammel nets captured 17 species in 8,235 meters drifted including seven species represented by at least 50 individuals (Appendix F2). Non-target species captured with 1-inch trammel nets were blue catfish, river carpsucker, channel catfish,

goldeye, shortnose gar, gizzard shad, and freshwater drum (CPUE = 0.1, 0.1, 0.07, 0.05, 0.04, 0.03, and 0.01 fish/100 m, respectively). The 2.5-inch trammel net captured four non-target species that include river carpsuckers, blue catfish, freshwater drum, and channel catfish (Appendix F3: CPUE = 0.16, 0.05, 0.03, and 0.02 fish/100 m, respectively). Catch rates were low in 1- 2.5 inch trammel nets for non-target species relative to otter trawls gears but captured larger individuals of the not-target species.

Mini-fyke nets captured 14 non-target species, including nine non-target species represented by greater than 50 individuals. CPUE (number of fish/net night) for these nine species was: emerald shiner = 55.31, red shiner = 18.09, bullhead minnow = 14.34, freshwater drum = 9.25, river carpsucker = 6.75, bluntnose minnow = 4.0, orangespotted sunfish = 3.45, bluegill = 2.38, and river shiner = 1.88 (Appendix 6). There were fewer species represented by at least 50 individuals captured in mini-fykes in 2006 (N = 9) than in 2005 (N = 12). However, all species had a greater CPUE in 2006 than in 2005. For example, mini-fyke nets captured emerald shiners more efficiently in 2006 than in 2005 (CPUE = 26.4 fish/ net night). Other species captured in both years showed the same trend.

Otter trawls captured a total of 10 species including three non-target species with at least 50 individuals (Appendix F4). Channel catfish, freshwater drum and blue catfish (CPUE = 4.72, 3.75, and 2.95 fish/100 m, respectively) were most effectively sampled using otter trawls. There were more channel and blue catfish caught in 2005 (N = 711 and 425, respectively) than in 2006 (N = 502 and 304, respectively). However, otter trawls were more efficient in capturing channel and blue catfish in 2006 compared to 2005 (CPUE in 2005 = 2.7 and 1.7 fish/ 100 m, respectively). This could be attributed to the fact that 12 bends were sampled in 2005 compared to four bends sampled in 2006. Otter trawls captured a greater number of freshwater drum, channel and blue catfish (N = 307, 502 and 304) than gill nets (N = 5, 19, and 83). However, gill nets captured more large-size individuals from these species. For example, blue catfish captured in otter trawls were smaller [30- to 331-mm fork length (FL), average 104 mm] than those captured in gill nets (135 to 1102-mm FL, average 633).

Discussion

Eleven pallid sturgeon were captured in segment 10 of the Missouri River. Gill nets captured the most pallids of all gears used. The eight pallid sturgeon (73% of the 2006 catch) captured with gill nets were all taken within a 6-week period in and around the month of March (27 February to 3 April). Additionally, all sturgeon captured with gill nets were taken when water temperatures were between 4.5 and 12.5°C. These items suggest the best time for capturing pallids with gill nets in segment 10 is the late winter/ early spring time frame when temperatures are above 4°C (with a limit of 12.5°C due to protocol stipulations; Drobish 2006b).

Two and a half-inch mesh size trammel nets captured three pallid sturgeon (27% of the 2006 catch), but had the highest mean CPUE for pallid sturgeon (0.0512 fish/ 100m drifted). All were captured in the late winter/ early-to-mid spring months, from 3 March to 8 May 2006, with a higher temperature range than gill nets (15.3-19°C). Turbidity and velocities were higher, on average, when pallids were captured with 2.5-inch trammel nets than with gill nets (139 NTUs and 0.536 m/s; 73 NTUs and 0.337 m/s, respectively). This could be attributed to trammel nets being used later in the year when the flows and turbidity are generally higher in the river. There were no pallids captured smaller than 252-mm FL in the 2005 or 2006 seasons. In 2005, otter trawls captured the smallest fish (252-mm FL), while gill nets captured the smallest length fish in 2006 (281-mm FL). Both of these fish were hatchery-stocked. The Pallid Sturgeon Population Assessment Team is developing methods to target these small size-class hatchery-stocked fish in order to gain more information on this rare and elusive species.

Most pallids captured in 2006 (64%) were taken in a 21-mile stretch of river downstream of the Kansas City Metro area (RM 321-342). Additionally, 75% (N = 3) of the pallids caught in 2005 were taken from a larger area, but in the same vicinity (RM 335-363). There have been a large number of stockings in the Kansas City area, but only three of the pallids captured in the area were also stocked there. The other hatchery-stocked pallids captured between RM 321 and 363 were stocked near Boonville, MO, and traveled approximately 136 miles upstream to its capture site. There were 12,203 pallids stocked into RPMA 4 in 2005 and 2006, but none of these fish have been captured in segment 10 thus far (Krentz and Wilson 2007).

Shovelnose sturgeon were the most frequently encountered fish among all target species (N = 1,130). Gill nets were the most effective gear in sampling shovelnose (CPUE = 3.79 fish/ net

night), but only captured stock size and above individuals (>250-mm FL). Otter trawls captured a larger range of sizes (sub-stock to memorable size categories) in both sturgeon and fish community seasons (23 to 643 mm-FL), and had the highest CPUE in quality and above size fish (0.5313 fish/ 100m). One-inch trammel nets sampled the largest range of fish sizes, from sub-stock to trophy-size fish (191 to 1285-mm FL). Shovelnose sturgeon were captured in every month but October during the 2006 sampling season, with almost half (42%) of the total number captured in March. Since our sampling among all gears is virtually evenly-spaced across the year, this suggests that catchability of shovelnose sturgeon is very high during March. Most of the pallid sturgeon were captured in POOL mesohabitats, and the rest were captured in CHNB mesohabitats (60 and 40%, respectively). On average, the temperature, turbidity, and velocity were lower in POOLS than in CHNB habitats.

Otter trawl was the only gear that captured sturgeon, speckled and sicklefin chub in the 2005 and 2006 sampling season. Catch-per-unit effort increased in 2006 for sturgeon and speckled chubs, but decreased in 2006 for sicklefin chub. Overall, the number of *Macrophybopsis sp.* captured in Segment 10 decreased from 2005 (N = 248) to 2006 (N = 139). No *Macrophybopsis sp.* were captured in bag seines in 2005, so the lower catch cannot be attributed to that gear not being used in 2006. Catch-per-unit effort increased from 2005 to 2006 for sturgeon and speckled chubs captured in otter trawls in the channel cross over/ channel border habitats, while it decreased for sicklefin chubs in the same habitat. In the inside bend/ channel border habitat, all chub CPUEs increased from 2005 to 2006. Comparing the habitat types within 2006, the average CPUE was slightly higher for all *Macrophybopsis sp.* captured in the CHXO/ CHNB habitat than the ISB/ CHNB habitat, even though less effort was expended in the CHXO habitat (average 17.5%) than in the ISB (average 83.5%).

Sand shiners were only captured in the 2006 fish community season, and only in mini-fyke nets. The number of sand shiners decreased from 2005 (N = 63) to 2006 (N = 54). This might be attributed to the fact that bag seines were used in 2005 and captured 43 individuals (68% of the catch). There were no *Hybognathus sp.* captured in 2006, though there were eight captured in 2005. Again, bag seines captured a large majority of the individuals (N = 7) in 2005.

One-inch trammel nets were the most effective gear at capturing blue suckers during the 2006 season (CPUE 0.265 fish/ 100m). Most of the individuals were captured during sturgeon season

(N = 33), and gill nets captured most of these (N = 17). Overall, more blue suckers were captured in 2006 (N = 33) than in 2005 (N = 13). However, there were more fish captured during fish community season in 2005 compared to 2006 (N = 13 and 1, respectively). Sauger were only captured during the sturgeon season in 2006, with gill nets being the most effective gear used (CPUE = 0.121 fish/ net night). Overall, there were more sauger captured in 2006 than in 2005 (N = 26 and 3, respectively). However, in 2005 all sauger were captured during fish community season (the only season sampled) and none was captured during that season in 2006.

As members of the Pallid Sturgeon Population Assessment Team, we are committed to exploring new techniques and gears to sample and accurately portray the pallid sturgeon and fish community populations in the Missouri River. Our protocol is a dynamic, and we are currently assessing new ways to sampling more pallid sturgeon that are less than age 4. Also, gears that are ineffective are assessed and dismissed if applicable. Segment 10 has only been sampled for a season and a half, in which time we have collected very few pallids and fish community species of interest. More data collection will be needed to assess long-term data trends on the pallid sturgeon and other species in the Missouri River.

WILD GEARS

There were several gears using during the 2006 sampling season that were not included in the standard, randomized sampling protocols reported in this document (see Drobish 2006b for definitions). These gears include the smaller-mesh otter trawl (OT01) that was implemented in 2006 as an experimental, or “wild”, gear. This gear did not capture any pallid sturgeon, though it did capture 802 individual fish, including 11 shovelnose sturgeon. Twenty-one species were captured; of those four were target species. Five species were represented by at least 50 individuals. Of the target species, the OT01 was most effective at capturing sicklefin chubs (N = 54), followed by speckled chubs (N = 47), sturgeon chubs (N = 23), and shovelnose sturgeon (N = 11); CPUE was 1.31, 1.05, 0.40, and 0.24 fish/ 100 m, respectively for each species.

Additionally, standard gears that were used to in a non-random way were not presented in this document. These include a 2.5-inch trammel net and a 16-foot otter trawl deployed in November, before trammel netting and otter trawling was supposed to begin for the sturgeon season. From these two “wild” gears, 67 individuals were captured, including 11 non-target species and four target species. No species was represented by at least 50 individuals, with channel catfish being the most frequently-caught species (N = 15). The four target species included blue suckers, sicklefin chubs, speckled chubs, and shovelnose sturgeon (N = 5, 14, 8, and 6, respectively).

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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>Carassius auratus</i>	Goldfish	GDFH
<i>Carassius auratus</i> X <i>Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<i>Hybognathus argyritis</i>	Western silvery minnow	WSMN*
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<i>Hybognathus placitus</i>	Plains minnow	PNMW*
<i>Hybognathus</i> spp.	Unidentified <i>Hybognathus</i>	HBNS*
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<i>Macrhybopsis aestivalis</i>	Speckled chub	SKCB*
<i>Macrhybopsis gelida</i>	Sturgeon chub	SGCB*
<i>Macrhybopsis meeki</i>	Sicklefin chub	SFCB*
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. aestivalis</i> X <i>M. gelida</i>	Speckled-Sturgeon chub hybrid	SPST
<i>M. gelida</i> X <i>M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennioides</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis burchanani</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greeniei</i>	Wedgespot shiner	WSSN

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 10 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2005 for segment 10.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	Standard	All	2005 - Present	fish/100 m drift
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2006 - Present	fish/100 m drift
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2006 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2006 - Present	fish/net night
Otter trawl – 16 ft head rope	OT16	Standard	All	2005 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2005 - Present	fish/100 m trawled
Mini-fyke net	MF	Standard	Fish Comm.	2005 - Present	fish/net night

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

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

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Average Length (mm)	Primary Mark	Secondary Mark
1997	Baltimore Bend	24	1992	N/A	N/A	Floy	N/A
1997	Cooley Lake	389	1997	09/20/1997	N/A	Floy	N/A
2005	Miami	195	2004	06/15/2005	284	PIT Tag	Elastomer
2005	Miami	788	2004	06/16/2005	259	PIT Tag	Elastomer
2005	Miami	801	2004	06/30/2005	247	PIT Tag	Elastomer
2005	Miami	354	2004	09/19/2005	243	PIT Tag	Elastomer
2005	Miami	1473	2004	09/22/2005	233	PIT Tag	Elastomer
2005	Kansas City	2349	2004	04/25/2005	203	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 2005 – 2006. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when $N < 2$.

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	4	0.017 (0.016)	0 [0]	0.052 (0.058)	0 [0]	0.024 (0.048)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BLCF	83	0.383 (0.146)	0.462 (0.487)	0.845 (0.439)	0.071 (0.064)	0.333 (0.287)	0 [0]	0.611 (0.547)	0 [0]	0 [0]	0 [0]	0 [0]
BMBF	1	0.004 (0.008)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0.056 (0.111)	0 [0]	0 [0]	0 [0]	0 [0]
BUSK*	17	0.092 (0.053)	0.077 (0.104)	0.069 (0.096)	0.071 (0.073)	0.095 (0.112)	0.25 (0.5)	0.278 (0.444)	0 [0]	0 [0]	0 [0]	0 [0]
CARP	11	0.062 (0.071)	0 [0]	0.172 (0.278)	0 [0]	0.071 (0.078)	0 [0]	0.111 (0.222)	0 [0]	0 [0]	0 [0]	0 [0]
CNCF	19	0.108 (0.071)	0 (0)	0.259 (0.236)	0.024 (0.048)	0.048 (0.066)	0.25 (0.5)	0.333 (0.441)	0 [0]	0 [0]	0 [0]	0 [0]
FHCF	1	0.004 (0.008)	0 [0]	0 [0]	0.012 (0.024)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	5	0.029 (0.027)	0 [0]	0.086 (0.1)	0 [0]	0 [0]	0 [0]	0.111 (0.147)	0 [0]	0 [0]	0 [0]	0 [0]
GDEY	192	0.958 (0.534)	0.462 (0.763)	1.172 (0.941)	0.595 (0.953)	1.071 (1.155)	1.75 (3.5)	2.667 (3.625)	0 [0]	0 [0]	0 [0]	0 [0]
GSCP	1	0.008 (0.017)	0 [0]	0 [0]	0 [0]	0.048 (0.095)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	68	0.458 (0.305)	0.077 (0.154)	1.017 (0.039)	0.214 (0.339)	0.238 (0.264)	0.5 (1)	1.056 (1.399)	0 [0]	0 [0]	0 [0]	0 [0]
LKSG	3	0.012 (0.014)	0.038 (0.077)	0.017 (0.034)	0 [0]	0.024 (0.048)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
LNDR	42	0.212 (0.137)	0.115 (0.231)	0.483 (0.425)	0.048 (0.095)	0.286 (0.429)	0 [0]	0.167 (0.236)	0 [0]	0 [0]	0 [0]	0 [0]
MNEY	1	0.004 (0.008)	0 [0]	0.017 (0.034)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
PDFH	3	0.012 (0.014)	0.038 (0.077)	0.017 (0.034)	0.012 (0.024)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
PDSG*	7	0.029 (0.021)	0 [0]	0.034 (0.048)	0.048 (0.046)	0.024 (0.048)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
QLBK	2	0.017 (0.023)	0 [0]	0.034 (0.069)	0 [0]	0.024 (0.048)	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	33	0.179 (0.106)	0 [0]	0.552 (0.359)	0 [0]	0.119 (0.136)	0 [0]	0.333 (0.553)	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SGER*	23	0.112 [0.049]	0.231 [0.215]	0.138 [0.121]	0.048 [0.057]	0.119 [0.118]	0.25 [0.5]	0.167 [0.167]	0 [0]	0 [0]	0 [0]	0 [0]
SHRH	1	0.008 [0.017]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	1 [0]
SMBF	4	0.021 [0.022]	0 [0]	0.052 [0.076]	0 [0]	0 [0]	0 [0]	0.111 [0.147]	0 [0]	0 [0]	0 [0]	0 [0]
SNGR	98	0.658 [0.649]	0.077 [0.154]	2.241 [2.583]	0.119 [0.238]	0.095 [0.148]	0 [0]	0.667 [1.106]	0 [0]	0 [0]	0 [0]	0 [0]
SNPD	1	0.004 [0.008]	0 [0]	0.017 [0.034]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SNSG*	882	3.833 [1.253]	2.269 [2.105]	6.431 [3.684]	1.667 [0.928]	5.833 [3.828]	1 [1]	5.167 [3.158]	0 [0]	0 [0]	0 [0]	0 [0]
SVCP	2	0.012 [0.019]	0 [0]	0.034 [0.069]	0 [0]	0 [0]	0 [0]	0.056 [0.111]	0 [0]	0 [0]	0 [0]	0 [0]
WLYE	1	0.004 [0.008]	0 [0]	0.017 [0.034]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
WTBS	6	0.033 [0.037]	0.038 [0.077]	0.034 [0.048]	0 [0]	0.024 [0.048]	0 [0]	0.222 [0.444]	0 [0]	0 [0]	0 [0]	0 [0]
WTSK	2	0.008 [0.017]	0.077 [0.104]	0.034 [0.069]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	2	0.027 [0.041]	0.076 [0.152]	0 [0]	0 [0]	0 [0]	0.012 [0.023]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BLCF	10	0.101 [0.092]	0.131 [0.186]	0 [0]	0 [0]	0 [0]	0.094 [0.109]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BUSK*	11	0.142 [0.147]	0.398 [0.556]	0 [0]	0 [0]	0 [0]	0.059 [0.067]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CARP	1	0.018 [0.036]	0 [0]	0 [0]	0 [0]	0 [0]	0.025 [0.049]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
CNCF	5	0.075 [0.07]	0.08 [0.16]	0 [0]	0 [0]	0 [0]	0.075 [0.079]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FHCF	1	0.008 [0.015]	0 [0]	0 [0]	0 [0]	0 [0]	0.01 [0.021]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
FWDM	1	0.018 [0.036]	0 [0]	0 [0]	0 [0]	0 [0]	0.025 [0.049]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GDEY	5	0.053 [0.047]	0 [0]	0 [0]	0 [0]	0 [0]	0.071 [0.063]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GSCP	1	0.009 [0.018]	0.036 [0.073]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	2	0.034 [0.048]	0.08 [0.16]	0 [0]	0 [0]	0 [0]	0.019 [0.039]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
LNGR	2	0.028 [0.043]	0 [0]	0 [0]	0 [0]	0 [0]	0.038 [0.058]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
RVCS	6	0.106 [0.085]	0 [0]	0 [0]	0 [0]	0 [0]	0.144 [0.113]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SGER*	1	0.008 [0.015]	0 [0]	0 [0]	0 [0]	0 [0]	0.01 [0.021]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SJHR	1	0.008 [0.015]	0 [0]	0 [0]	0 [0]	0 [0]	0.01 [0.021]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SMBF	4	0.064 [0.065]	0.083 [0.167]	0 [0]	0 [0]	0 [0]	0 [0]	0.059 [0.07]	0 [0]	0 [0]	0 [0]	0 [0]
SNGR	3	0.045 [0.076]	0.152 [0.305]	0 [0]	0 [0]	0 [0]	0.01 [0.021]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SNSG*	147	1.972 [0.921]	2.306 [2.539]	0 [0]	0 [0]	0 [0]	1.902 [0.931]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F3. 2.5 Inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHCP	1	0.040 [0.079]	0 [0]	0 [0]	0.060 [0.119]	0 [0]						
BKBF	1	0.019 [0.038]	0 [0]	0 [0]	0.029 [0.057]	0 [0]						
BLCF	3	0.053 [0.061]	0.111 [0.153]	0 [0]	0.024 [0.048]	0 [0]						
BMBF	2	0.042 [0.059]	0.126 [0.171]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
BUSK*	4	0.117 [0.069]	0.051 [0.101]	0 [0]	0.075 [0.073]	0 [0]						
CARP	4	0.086 [0.105]	0.051 [0.101]	0 [0]	0.103 [0.150]	0 [0]						
CNCF	1	0.025 [0.051]	0 [0]	0 [0]	0.038 [0.076]	0 [0]						
FWDM	2	0.033 [0.047]	0.062 [0.124]	0 [0]	0.018 [0.036]	0 [0]						
GSCP	1	0.016 [0.032]	0.048 [0.095]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
PDFH	1	0.015 [0.031]	0.046 [0.092]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
PDSG*	3	0.051 [0.058]	0.110 [0.151]	0 [0]	0.022 [0.044]	0 [0]						
RVCS	7	0.161 [0.148]	0.194 [0.309]	0 [0]	0.145 [0.164]	0 [0]						
SMBF	10	0.143 [0.094]	0.098 [0.134]	0 [0]	0.166 [0.125]	0 [0]						
SNSG*	24	0.395 [0.201]	0.629 [0.344]	0 [0]	0.278 [0.239]	0 [0]						
SVCP	1	0.040 [0.079]	0 [0]	0 [0]	0.060 [0.117]	0 [0]						

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHMW	2	0.01 [0.02]	0	0	0.013	0	0	0	0	0	0	0
BLCF	304	2.948 [1.438]	5.249	0	2.297	0	0	0	0	0	0	0
BNMW	1	0.012 [0.024]	0.054	0	0	0	0	0	0	0	0	0
BUSK*	1	0.007 [0.013]	0	0	0.008	0	0	0	0	0	0	0
CARP	3	0.027 [0.013]	0.123	0	0	0	0	0	0	0	0	0
CNCF	502	4.717 [4.734]	1.038	0	5.758	0	0	0	0	0	0	0
ERSN	8	0.066 [0.083]	0	0	0.084	0	0	0	0	0	0	0
FHCF	1	0.014 [0.027]	0	0	0.017	0	0	0	0	0	0	0
FWDM	307	3.745 [3.543]	3.511	0	3.811	0	0	0	0	0	0	0
GDEY	20	0.208 [0.348]	0.942	0	0	0	0	0	0	0	0	0
GZSD	1	0.007 [0.014]	0	0	0.009	0	0	0	0	0	0	0
PDSG*	1	0.007 [0.015]	0	0	0.009	0						
RDSN	1	0.01 [0.02]	0	0	0.013	0	0	0	0	0	0	0
RVCS	6	0.004 [0.007]	0	0.028	0	0	0	0	0	0	0	0
SFCB*	54	0.454 [0.187]	0.584	0	0.418	0						
SGCB*	18	0.147 [0.125]	0.094	0	0.162	0						
SGER*	2	0.019 [0.029]	0	0	0.024	0						
SKCB*	67	0.682 0.441	0.64	0	0.694	0						
			[0.818]	[0]	[0.52]	[0]						

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SNSG*	77	0.655 [0.341]	0.413 [0.298]	0 [0]	0.724 [0.429]	0 [0]						
SVCB	7	0.072 [0.073]	0.123 [0.19]	0 [0]	0.057 [0.078]	0 [0]						

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BHMW	459	14.344	0	15.5	0	7.056	0	5.5	0	4	0	94.5
		[9.564]	[0]	[13.104]	[0]	[4.964]	[0]	[11]	[0]	[4]	[0]	[91]
BKCP	1	0.031	0	0	0	0.056	0	0	0	0	0	0
		[0.062]	[0]	[0]	[0]	[0.111]	[0]	[0]	[0]	[0]	[0]	[0]
BLCF	1	0.031	0	0	0	0.056	0	0	0	0	0	0
		[0.062]	[0]	[0]	[0]	[0.111]	[0]	[0]	[0]	[0]	[0]	[0]
BLGL	76	2.375	0	0.875	0	1.667	0	0	0	0	0	19.5
		[2.004]	[0]	[1.278]	[0]	[1.231]	[0]	[0]	[0]	[0]	[0]	[21]
BNMW	128	4	0	0.125	0	7.056	0	0	0	0	0	0
		[3.941]	[0]	[0.25]	[0]	[6.732]	[0]	[0]	[0]	[0]	[0]	[0]
CARP	6	0.188	0	0.125	0	0.056	0	0.5	0	1.5	0	0
		[0.166]	[0]	[0.25]	[0]	[0.111]	[0]	[1]	[0]	[1]	[0]	[0]
CLSR	6	0.188	0	0.5	0	0.056	0	0	0	0	0	0.5
		[0.166]	[0]	[0.535]	[0]	[0.111]	[0]	[0]	[0]	[0]	[0]	[1]
CNCF	46	1.438	0	1.75	0	1.5	0	0.5	0	2	0	0
		[0.832]	[0]	[1.592]	[0]	[1.296]	[0]	[1]	[0]	[0]	[0]	[0]
ERSN	1770	55.312	0	34	0	77.778	0	7.5	0	3	0	38.5
		[39.173]	[0]	[32.763]	[0]	[66.605]	[0]	[1]	[0]	[6]	[0]	[75]
FHCF	1	0.031	0	0	0	0	0	0.5	0	0	0	0
		[0.062]	[0]	[0]	[0]	[0]	[0]	[1]	[0]	[0]	[0]	[0]
FHMW	17	17	0	1.125	0	0.444	0	0	0	0	0	0
		[0.531]	[0]	[1.485]	[0]	[0.69]	[0]	[0]	[0]	[0]	[0]	[0]
FWDM	296	9.25	0	11.375	0	6.333	0	19.5	0	8	0	18
		[3.799]	[0]	[9.015]	[0]	[3.282]	[0]	[27]	[0]	[10]	[0]	[36]
GDEY	1	0.031	0	0.125	0	0	0	0	0	0	0	0
		[0.062]	[0]	[0.25]	[0]	[0]	[0]	[0]	[0]	[0]	[0]	[0]
GNSF	10	0.312	0	0	0	0.222	0	0.5	0	0	0	2.5
		[0.329]	[0]	[0]	[0]	[0.202]	[0]	[1]	[0]	[0]	[0]	[5]
GSCP	1	0.031	0	0	0	0.056	0	0	0	0	0	0
		[0.062]	[0]	[0]	[0]	[0.111]	[0]	[0]	[0]	[0]	[0]	[0]
GZSD	11	0.344	0	0	0	0.444	0	0	0	1	0	0.5
		[0.231]	[0]	[0]	[0]	[0.369]	[0]	[0]	[0]	[0]	[0]	[1]
LMBS	2	0.062	0	0	0	0.111	0	0	0	0	0	0
		[0.125]	[0]	[0]	[0]	[0.222]	[0]	[0]	[0]	[0]	[0]	[0]
MMSN	3	0.094	0	0	0	0.056	0	0.5	0	0.5	0	0
		[0.105]	[0]	[0]	[0]	[0.111]	[0]	[1]	[0]	[1]	[0]	[0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
MQTF	9	0.281 [0.185]	0 [0]	0.375 [0.366]	0 [0]	0.333 [0.28]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
OSSF	111	3.469 [3.481]	0 [0]	0.5 [0.535]	0 [0]	1.667 [1.177]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	38.5 [23]
RDSN	579	0 [0]	0 [0]	20.5 [15.598]	0 [0]	19.222 [11.291]	0 [0]	17 [28]	0 [0]	4.5 [1]	0 [0]	13 [22]
RVCS	216	6.75 [4.321]	0 [0]	10 [14.432]	0 [0]	5.506 [2.876]	0 [0]	1 [2]	0 [0]	18 [34]	0 [0]	3.5 [7]
RVSN	60	1.875 [1.385]	0 [0]	0.625 [1.25]	0 [0]	3 2.287]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0.5 [1]
SJHR	1	0.031 [0.062]	0 [0]	0 [0]	0 [0]	0.056 [0.111]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SKCB	5	0.156 [0.222]	0.625 [0.84]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SMMW	1	0.031 [0.062]	0 [0]	0 [0]	0 [0]	0.056 [0.111]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
SNGR	40	1.25 [0.609]	0 [0]	1.25 [1.722]	0 [0]	1.056 [0.615]	0 [0]	2.5 [5]	0 [0]	1.5 [3]	0 [0]	1.5 [1]
SNSN	54	1.688 [1.105]	0 [0]	0.625 [0.648]	0 [0]	1.611 [1.233]	0 [0]	2.5 [5]	0 [0]	0 [0]	0 [0]	7.5 [13]
SVCB	29	0.906 [1.025]	0 [0]	0.75 [0.982]	0 [0]	1.167 [1.773]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	1 [2]
ULP	1	0.031 [0.062]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0.5 [1]	0 [0]	0 [0]	0 [0]	0 [0]
WTBS	43	1.344 [0.781]	0 [0]	2 [2.619]	0 [0]	0.788 [0.414]	0 [0]	0.5 [1]	0 [0]	3 [2]	0 [0]	3 [6]
WTCP	2	0.062 [0.087]	0 [0]	0 [0]	0 [0]	0.111 [0.152]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
WTPH	4	0.125 [0.25]	0 [0]	0 [0]	0 [0]	0.222 [0.444]	0 [0]	0 [0]	0 [0]	0 [0]	0 [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 2005 – 2006 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	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
BHCP	0.056	0.04	0.017	0			
BHMW	0		0		0	14.344	0
BKBF	0	0.019	0	0			
BKBH							
BKCP					0	0.031	0
BKRH							
BKSB							
BKSS							
BKTT							
BLCF	0	0.053	0.383	0.994	0.2	0.031	4.684
BLGL					0	2.375	0
BMBF	0	0.042	0.004	0			
BMSN							
BNDC							
BNMW					0	4	0.022
BNSN							
BNTT							
BPTM							
BRBT							
BSTM							
BTDR							
BUSK*	0.265	0.117	0.092	0.014	0.022	0	0
BVSC							
BWFN							
CARP	0.037	0.086	0.062	0.04	0	0.188	0.016
CHSM							
CKCB							
CLDR							
CLSR					0	0.188	0
CMSN							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
CNCF	0.119	0.025	0.108	2.577	0.032	1.438	6.619
ERSN					0	55.312	0.124
FCSC							
FHCB							
FHCF	0.016	0	0.004	0.029	0	0.031	0
FHMW					0	0.531	0
FKMT							
FSDC							
FTDR							
FWDM	0.037	0.033	0.029	1.524	0	9.25	5.718
GDEY	0.084	0	0.958	0.05	0.022	0.031	0.348
GDFH							
GDTT							
GFCC							
GLDR							
GNSF					0	0.312	0
GSBG							
GSCP	0.018	0.016	0.008	0	0	0.031	0
GSDR							
GSOS							
GSPK							
GSTS							
GTSN							
GVCB							
GZSD	0.069	0	0.458	0	0	0.344	0.013
HBNS*							
LGPH							
LKCB							
LKSG	0	0	0.012	0			
LKWF							
LMBS					0	0.062	0

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
LNDC							
LNGR	0.016	0	0.212	0	0.04	0	0
LNSK							
LSSR							
LTDR							
LVLP							
MDSP							
MMSN					0	0.094	0
MNEY	0	0	0.004	0			
MQTF					0	0.281	0
MSDR							
NTPK							
NTSF							
OSSF					0	3.469	0
OTDR							
OZMW							
PDFH	0	0.015	0.012	0			
PDSG*	0	0.051	0.029	0	0	0	0.014
PEMT							
PKLF							
PLDC							
PNMW							
PNMW*							
PNSD							
QLBK	0	0	0.017	0			
RBDR							
RBST							
RBTT							
RDSN					0	18.094	0.019
RDSS							
RKBS							

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
RRDR							
RUDD							
RVCS	0	0.161	0.179	0.01	0.21	6.75	0.098
RVRH							
RVSN					0	1.875	0
RYSN							
SESM							
SFCB*	0	0	0	0.254	0	0	0.633
SFSN							
SGCB*	0	0	0	0.026	0	0	0.255
SGER*	0.016	0	0.112	0.039			
SGWE							
SHRH	0	0	0.008	0			
SJHR	0.017	0	0	0	0	0.031	0
SKCB*	0	0	0	1.058	0	0.156	0.348
SLDR							
SMBF	0.048	0.143	0.021	0	0.08	0	0
SMBS							
SMMW					0	0.031	0
SNGR	0.092	0	0.658	0	0	1.25	0
SNPD	0	0	0.004	0			
SNSG*	1.948	0.395	3.833	0.751	1.996	0	0.57
SNSN*					0	1.688	0
SPSK							
SPSN							
SPST							
SRBD							
STSN							
SVCB					0	0.906	0.135

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)		
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl
SVCP	0	0.04	0.012	0			
SVLP							
SVMW							
SVRH							
WTBS	0	0	0.033	0	0	1.344	0
WTCP					0	0.062	0
WTPH					0	0.125	0
WTSK	0	0	0.008	0			
WYLE	0	0	0.004	0			
UCF							
UCN							

Appendix I. Comprehensive list of bend numbers and bend river miles for segment 10 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2005 – 2006.

Bend Number	Bend River Mile	2003	2004	2005	2006
1	253.3				
2	257.3			FC	
3	260.3				
4	261.4				
5	263.6				
6	265.1				
7	267.2			FC	
8	271.9				
9	274.2			FC	
10	275.7				
11	279.9				
12	282.4				
13	285.0				
14	290.2			FC	
15	296.6				
16	299.6				FC, ST
17	301.5				
18	304.6			FC	
19	307.3			FC	
20	309.6			FC	ST
21	311.5				
22	318.0				
23	319.5				
24	253.3				ST
25	321.5				
26	324.2				ST
27	327.0				ST
28	332.3			FC	FC, ST
29	335.2				FC, ST
30	337.1				
31	338.9				
32	340.4			FC	ST

Appendix I. (continued).

Bend Number	Bend River Mile	2003	2004	2005	2006
33	342.4				
34	343.6			FC	
35	346.6				
36	351.3				
37	354.1			FC	
38	359.2			FC	
39	363.3				FC, ST