

2005 Annual Report

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



Prepared for the U.S. Army Corps of Engineers – Northwest Division
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EXECUTIVE SUMMARY

The Missouri Department of Conservation began sampling within the Pallid Sturgeon Population Assessment Program in segment 10 midway through the 2005 sampling season. No sampling was conducted during the sturgeon sampling season, but sampling in all required bends (N = 12) was successfully completed during the 2005 fish community season. A total of four pallid sturgeon (1 wild and 3 hatchery-stocked; fork length = 252 to 611 mm) was captured in segment 10 during the 2005 fish community season. Two individuals were captured in standard 1-inch trammel nets (mean CPUE = 0.013 fish/100m) and two were caught in standard otter trawls (mean CPUE = 0.007 fish/100 m). Three pallid sturgeon (2 hatchery-stocked, 1 wild) were captured in the five river bends sampled between RM 335 and 363. Seven river bends were sampled between RM 257 and 310 in which only one (hatchery-stocked) pallid sturgeon was captured. Recaptured hatchery-stocked fish represented the 2002, 2003, and 2004 year class (N = 1 for each year class) and all fish examined retained their PIT tags (PIT tag retention = 100%). Condition (K_n) values of hatchery-stocked pallid sturgeon ranged from 0.769 to 1.036 and were inversely related to time-at-large. Mean growth rates for the 2002 and 2004 year class individuals were (0.201 and 0.678 mm/d, respectively; both, N = 1). All pallid sturgeon were captured in channel border, open water areas in association with wing dikes (one in channel crossover and three in the inside bend macrohabitats). Two of the four pallid sturgeon were caught in habitats associated with bank-notched wing dikes. A total of 637 shovelnose sturgeon (fork length = 21 to 762 mm) was captured with 1-inch trammel nets (N = 375) and otter trawls (N = 262) of which approximately 3% were age-0 fish. Most shovelnose sturgeon were captured within the channel border and were associated with open water areas below wing dikes. Two pallid sturgeon X shovelnose sturgeon hybrids were captured with character index values from (-0.0992 to 0.014). The ratio of wild pallid sturgeon to hatchery-stocked fish was 1:3 and the ratio of all pallid sturgeon to shovelnose sturgeon was 1:160.

Sturgeon and sicklefin chubs were the least (N = 19) and most (N = 130) common *Macrhybopsis* species encountered, respectively, and all were caught in channel border mesohabitats with otter trawls. Speckled chubs (N = 99) were captured with otter trawls, bag seines, and mini-fyke nets in the channel border and on sand bars. All sand shiners (N = 63)

were also captured with otter trawls, bag seines, and mini-fyke nets with most fish captured on sand bars using bag seines and mini-fyke nets. Bag seines hauled on sand bars were the most effective gear type for *Hybognathus* spp. (N = 8). One-inch trammel nets and otter trawls captured 13 blue suckers in channel border mesohabitats. Two sauger were captured on sand bars with mini-fyke nets and one individual was captured with a 1-inch trammel net. A total of 10,508 fish representing 55 species was captured in segment 10 during the 2005 fish community 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 System Reservoir system Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op; 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 natural hydrograph proposed by the USACE modified the existing water management schedule for Gavins Point Dam to include a two-peak “spring rise” that was intended to provide spawning cues for adult pallid sturgeon. The first rise would occur in

mid-March and consist of an approximately 30,000 cfs increase from winter flows released from Gavins Point Dam. The second peak would occur sometime in May when the water temperature reached 16°C. The second rise, about eight days in duration, would rapidly peak with a discharge of 30,000 cfs greater than navigation service flows, be reduced by at least 30% over a two- to three-day period, and subsequently decline back to navigation service flows.

The initial stocking of pallid sturgeon in 1994 consisted of approximately 7,000 fish from the 1992 year class that were stocked into RPMAs 4 (Missouri River below Gavins Point Dam) and 5 (middle Mississippi River; USFWS 2005). Subsequent stockings in 1997, 1998, 2000, and 2002 through 2005 in all six RPMAs have resulted in nearly 172,000 pallid sturgeon being stocked into the Missouri and Mississippi River systems. The total number of pallid sturgeon stocked per year has increased from an average of approximately 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 will add 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, which lie in RPMA 3, consist of the 55 river miles from Fort Randall Dam, South Dakota, downstream to the headwaters of Lewis and Clark Lake, Nebraska-South Dakota. Segment 7 extends from Gavins Point Dam downstream 61 miles to Lower Ponca Bend, Nebraska-Iowa, and is the only segment below Gavins Point Dam that is not channelized. Segments 8 through 14 include the entire channelized portion (750 miles) of the Missouri River 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 crew were entered via double-blind entry into a single database housed and managed by the Missouri Department of Conservation. Data were subsequently distributed to each participating office according to reporting responsibilities: 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. No data were collected in segments 1 through 3 and 11 during 2005 because the Montana Department of Fish, Wildlife, and Parks was not yet part of the Team and no bends in segment 11 were randomly selected during the pooled bend selection process for segments 8 through 14. It should be noted that segment 12 was incorporated into segment 13 beginning with the 2005 fish community season, and thus, segment 12 no longer exists.

Two distinct sampling seasons have been established to assess sturgeon species and the associated fish community. The sturgeon sampling season began 01 November 2004 or when water temperatures dropped below 12.8°C (55°F) and continued through 30 June 2005. The Missouri Department of Conservation did not sample during the 2005 sturgeon season, and thus, data from this sampling season are not included in this report. During this season standard gear types included experimental gill nets, 1-inch trammel nets, 2.5-inch trammel nets, and 16-foot otter trawls (see Sampling Gear section for gear specifications). Gill nets were the only sampling gear that would have been used during the sturgeon season until 01 March 2005. The beginning of this season was further divided into a pre-winter and spring

gill netting period. Pre-winter gill netting would have been 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 would have began 01 March 2005 and conducted through 30 June.

The fish community season was the first season that the Missouri Department of Conservation (or any other agency) conducted sampling within the PSPAP in segment 10. This season began 01 July 2005 and continued through 31 October 2005. 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, mini-fyke nets, and bag seines (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 12 randomly selected bends within the segment.

In addition to pallid sturgeon, the Team identified members of the associated fish community that were of particular interest due to their ecology (e.g., obligate big river species, benthic species, etc.). These species were identified as “species of interest” and include: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadensis*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, and sand shiner *Notropis stramineus*. All captured fish were identified to species when practicable and measured for total length (TL) except sturgeon which were measured for fork length (FL) and paddlefish *Polyodon spathula* which were measured for eye-fork length. Shovelnose sturgeon, blue suckers, and sauger were weighed to the nearest 1 g and the remaining species of interest were weighed to the nearest 0.1 g.

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, the length of each barbel, mouth to inner barbel length, and mouth width (see Sheehan et al. (1999) for descriptions of each measurement). The length from the fish’s snout to the anterior midline of the mouth was also recorded. Meristics included the number

of dorsal and anal fin rays, including rudimentary rays. Ranges of CI-scores for pallid, shovelnose X pallid hybrids, and shovelnose have been defined as -1.48 to -0.09, -0.45 to 0.51, and 0.37 to 1.33, respectively. In general, CI-scores were 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 2005 Fish Community 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 2005 fish community season, the number of randomly selected bends for each segment of the lower sampling universe was: segment 8 – 17 bends; segment 9 – 19 bends; segment 10 – 12 bends; segment 11 – 0 bends, segment 13 – 11 bends; segment 14 – 13 bends. As a result, both MDC and NGPC conducting sampling in segment 9.

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 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 m³/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 m³/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 (2006b).

The Team has established standard habitats (macro- and meso-) for groups of segments (1 through 4, 5 through 7, and 8 through 14) in which each gear type could be deployed (Drobish 2006a). For segment 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 bag seines and mini-fyke nets included: CHXO, CONF, ISB, OSB, SCCL SCCS, SCN, TRML, and TRMS. The only standard mesohabitat for these gear types was BARS.

Sampling Gear

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. Trammel nets were used as standard gear in CHXO, ISB, and SCCL macrohabitats and CHNB and ITIP mesohabitats. Trammel nets (i.e., 1-inch trammel nets) were 38.1 m (125 ft.) in length and constructed from multifilament nylon mesh. The inner wall was 25.4 mm (1 in.) bar mesh (#139 twine) that was 2.4-m deep (8 ft) and the outer wall was 203-mm (8 in.) bar mesh (# 9 twine) 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 2005 fish community season, otter trawls were used as standard gear in CHXO, ISB, SCCL 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. Nets were generally set in the afternoon and left overnight with a maximum soak time of 24 hours. In segment 10 during the 2005 fish community season, mini-fyke nets were set as a standard gear in CHXO, ISB, OSB macrohabitats and BARS mesohabitats. Mini-fyke nets were constructed from 3-mm ace mesh with two rectangular frames 1.2 m wide and 0.6 m high to form the cab. The body of the net was constructed with two 0.6 m steel hoops, with a single, 51-mm throat. The lead was 4.5-m in length and 0.6 m high.

Bag seines were deployed in shallow water (i.e., water depth < 1.2 m) areas using three seine haul configurations: quarter arc, half arc, and rectangular. Seining with any method could be conducted in an upstream or downstream direction. Standard seine hauls covered a minimum of 50 m² of river bottom. In segment 10 during the 2005 fish community season, bag seines were standard gear CHXO, ISB, and OSB macrohabitats and BARS mesohabitats. Bag seines were constructed from 6.4 mm ace mesh, were 9.1-m (30 ft.) in length and 1.8-m (6 ft.) in depth. Bag dimensions were 1.8 m x 1.8 m x 1.8 m. Seines were attached at each end to 1.8-m x 51-mm brails.

Data Collection and Analysis

Associated Environmental Data

In addition to water depth and temperature, which 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 in 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. Water velocity was recorded using a Marsh McBirney Flo-Mate Model 2000 and reported in meters per second (m/s). Water velocity was recorded at the bottom, 80%, and 20% of the water column for trammel nets and otter trawls. This parameter was recorded at 60% of the water column for bag seines and 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 trammel nets and otter trawls. For example, if a trammel net was drifted 300 m, habitat data were collected 150 m downstream from the starting point at the approximate midpoint of where the net was drifted. All habitat parameters were measured at the center of the haul area for bag seines, except for depth and water velocity which were measured at the center and outermost extent of the haul. 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 wild 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 2005 fish community 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 2005.

Relative Stock Densities

Relative stock densities were calculated for pallid and shovelnose sturgeon captured during the 2005 fish community season. Relative stock density was calculated as:

$RSD = \text{number of fish} \geq \text{specified length} / \text{number of fish} \geq \text{minimum stock length} \cdot 100$ (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. Catch-per-unit-effort for 1-inch trammel nets and otter trawls was reported as the number of fish/100 m drifted and trawled, respectively. Mini-fyke nets reported this parameter as the number of fish per net night. Relative abundance for bag seines was reported as the number of fish per 100 m². Habitat use was examined using chi-square (χ^2) goodness-of-fit tests (Zar 1999). Chi-square statistics were calculated as:

$$\chi^2 = \sum (O - E)^2 / E,$$

where O was the number of fish observed and E was the number of fish expected if the number of fish captured in each habitat was proportional to the amount of effort expended in each habitat. All tests were conducted at an $\alpha = 0.05$ level of significance.

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.

One wild and three hatchery-stocked pallid sturgeon ($N = 4$) were captured in segment 10 during the 2005 fish community season (Figure 8). Pallid sturgeon were captured in four of twelve randomly-selected river bends in segment 10 during the 2005 fish community season. Sampling occurred from RM 257 to RM 363 and capture locations ranged from RM 290 to RM 360 (Figure 1b). Three pallid sturgeon (2 hatchery-stocked, 1 wild) were captured in three of five river bends sampled between RM 335 and 363 (Napoleon to Kansas City, MO). Seven river bends were sampled between RM 257 and 310 (Dover to DeWitt, MO) that resulted in the capture of only one (hatchery-stocked) pallid sturgeon.

The wild pallid sturgeon was 611-mm FL and the hatchery-stocked fish ranged from 252- to 450-mm FL (Table 4). The (CI) value for the wild pallid sturgeon was -1.0813. The hatchery-stocked pallid sturgeon captured consisted of one individual each from the 2002, 2003, and 2004 year classes. The 2002 and 2004 year class fish were both reared at the Garrison National Fish Hatchery and subsequently stocked at Bellevue, Nebraska and Kansas City, Missouri, respectively. The hatchery-of-origin and stocking site could not be determined for the 2003-year-class fish because while it was marked with an elastomer tag (yellow-horizontal), we failed to detect a PIT tag. The 2002 year class fish moved approximately 256 miles downstream and the 2004 year class fish, which had only been at-large for four months, moved 52 miles downstream.

Relative condition of recaptured, hatchery-stocked pallid sturgeon was inversely related to year class (i.e., time at large; Table 6). Condition (K_n) values ranged from 0.769 to

1.036 with the 2002 year class individual having the lowest and the 2004 year class individual having the highest condition factor. The wild pallid sturgeon had a K_n value of 0.793. Daily growth was inversely related to age (Table 6). The daily growth rates for the 2005 (i.e., age-1) and 2002 (i.e., age-3) fish were 0.678 and 0.201 mm/d, respectively.

Relative stock density (RSD) values for pallid sturgeon for all size categories greater than stock were zero. The wild pallid sturgeon and two of the hatchery-stocked fish (year classes = 2002 and 2003) captured were stock-sized individuals (Table 7). In addition, one sub-stock (201 to 329 mm) sized individual (252-mm FL; 2004 year class) was captured.

River sturgeons in segment 10 during the 2005 fish community were captured at a ratio of 1 pallid sturgeon (wild and hatchery-stocked) to 160 shovelnose sturgeon (Table 8). The ratio of wild pallid sturgeon to shovelnose sturgeon was 1:637. The ratios of stocked to wild pallid sturgeon and wild pallid sturgeon to shovelnose X pallid sturgeon were 3:1 and 1:2, respectively.

Table 1. Number of bends sampled, mean effort per bend, and total effort by macrohabitat for segment 10 of the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. 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	SCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net																
2.5 Inch Trammel Net																
Gill Net																
Otter Trawl																
Beam Trawl																
Summer – Fish Community Season																
1 Inch Trammel Net	12	15.2	N-E	51.31		N-E	N-E	127.76	0.00	3.80						
Bag Seine	12	6.6	N-E	26.97		N-E	N-E	49.43	2.97	0.00						
Mini-Fyke Net	12	8.1	N-E	38.00		N-E	N-E	54.00	5.00	0.00						
Otter Trawl	12	21.3	N-E	73.12		N-E	N-E	181.92	0.00	0.00						
Beam Trawl																

Table 2. Number of bends sampled, mean effort per bend, and total effort by mesohabitat for segment 10 of the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean effort	Mesohabitat					
			BARS	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net								
2.5 Inch Trammel Net								
Gill Net								
Otter Trawl								
Beam Trawl								
Summer – Fish Community Season								
1 Inch Trammel Net	12	15.2	0.00	180.87	N-E	2.00		
Bag Seine	12	6.6	79.38	0.00	N-E	0.00		
Mini-Fyke Net	12	8.1	97.00	0.00	N-E	0.00		
Otter Trawl	12	21.3	0.00	255.04	N-E	0.00		
Beam Trawl								

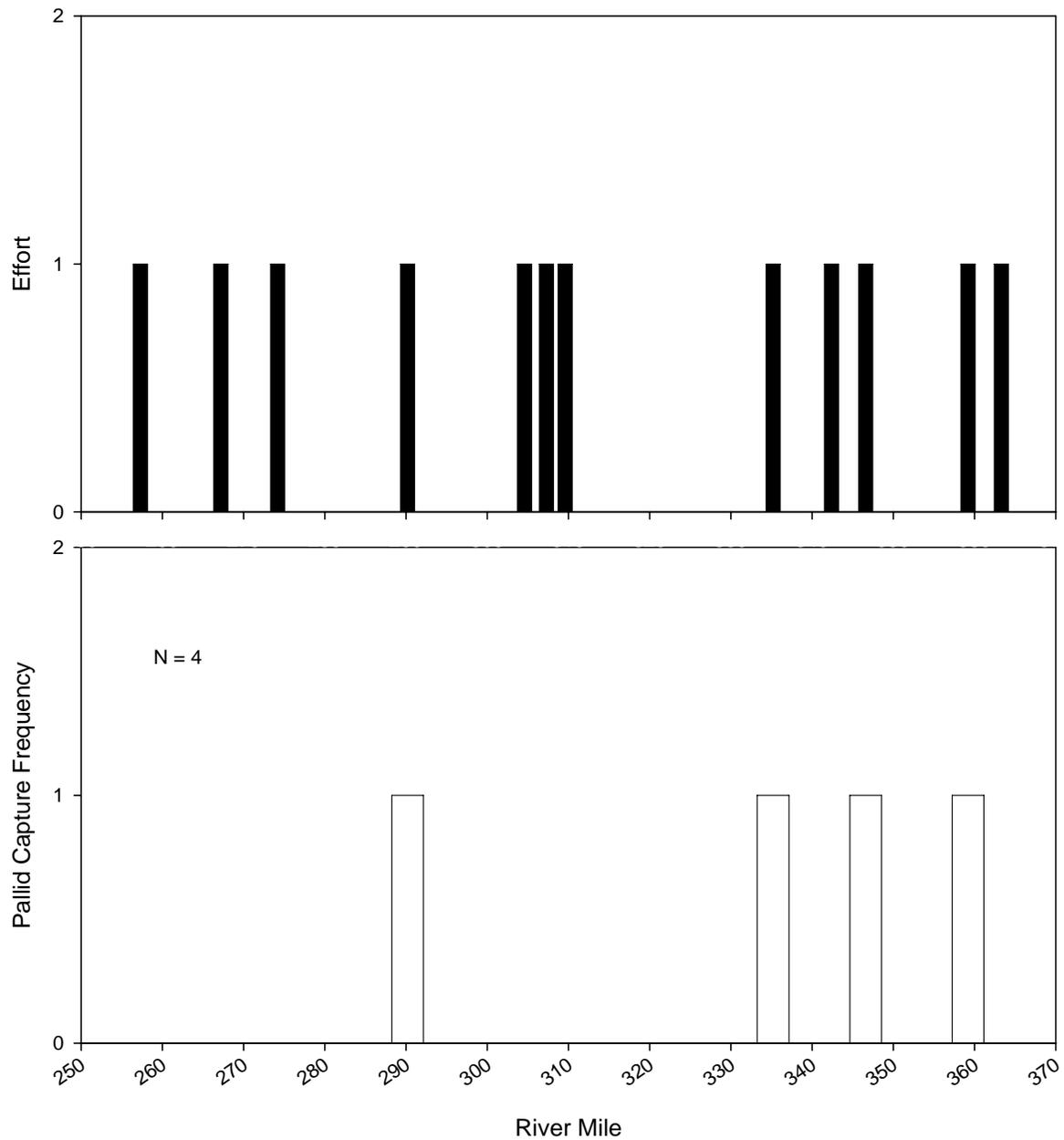


Figure 1b. Distribution of: A) seasonal sampling effort and B) pallid sturgeon captures by river mile for segment 10 in randomly selected bends of the Missouri River during 2004-2005. Sampling effort of 2 indicates bend sampled in both sturgeon and fish community seasons. Sampling effort of 1 indicates bend sampled in only one season. Black bars represent pallid captures during sturgeon season and white bars during fish community season.

Table 3. Pallid sturgeon (PDSG) capture summaries relative to habitat type and environmental variables on the Missouri River during 2004-2005. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

	OSB			ISB		
	BARS	CHNB	ITIP	BARS	CHNB	ITIP
Depth (m) (Effort)	0.8 (0.6-1.2)			0.6 (0.1-1.8)	2.3 (1.2-5.8)	
Depth (m) (Catch)					2.5 (1.8-3.8)	
Velocity (m/s) (Effort)				0.28 (0.28-0.28)	0.59 (0.10-1.01)	
Velocity (m/s) (Catch)					0.63 (0.61-0.66)	
Temp. °C (Effort)	27.3 (25.0-31.0)			27.9 (25.0-32.0)	25.7 (12.9-31.2)	
Temp. °C (Catch)					23.0 (13.9-30.5)	
Turbidity (ntu) (Effort)	96 (39-128)			75 (17-151)	225 (41-540)	
Turbidity (ntu) (Catch)					67 (47-83)	
Total Pallids caught	0			0	3	
	CHXO			SCCL		
	BARS	CHNB	ITIP	BARS	CHNB	ITIP
Depth (m) (Effort)	0.6 (0.1-1.2)	3.6 (1.2-6.1)			2.4 (2.4-2.4)	4.0 (4.0-4.0)
Depth (m) (Catch)		4.0 (4.0-4.0)				
Velocity (m/s) (Effort)		0.49 (0.03-0.96)				0.37 (0.37-0.37)
Velocity (m/s) (Catch)		0.6 (0.6-0.6)				
Temp. °C (Effort)	28.2 (24.5-31.5)	26.4 (12.4-30.0)			27.0 (27.0-27.0)	27.0 (27.0-27.0)
Temp. °C (Catch)		27.7 (27.7-27.7)				
Turbidity (ntu) (Effort)	85 (27-195)	234 (39-558)				217 (217-217)
Turbidity (ntu) (Catch)		300 (300-300)				
Total Pallids caught	0	1			0	0

Table 4. Individual pallid sturgeon fork length (mm), weights (g), morphometric character index (CI) (Sheehan et al. 1999), status (H = Hatchery, W = Wild^d), tags found, elastomer tags (color, position, orientation), if tags were inserted in field, stocking locations, and hatchery information on the Missouri River during 2004-2005.

ID	Recapture Data							Stocking Data				
	FL (mm)	Wt (g)	CI	Status	Tags found ^a	Elastomer ^b	Marked in field?	Year class	FL (mm)	Wt (g)	Site	Source ^c
MO-1-10-97-4	450	260	-1.1495	H	P		No	2002	301		Bellevue	Garrison
MO-1-10-268-16	252	50		H	E,P	Red-H	No	2004	174		Kansas City	Garrison
MO-1-10-600-4	424	230		H	E	Yellow-H	Yes	2003				
MO-1-10-752-4	611	740	-1.0813	W			Yes					

^a Tag types include: coded wire tag (C), elastomer tag (E) and passive induced transponder tag, i.e. PIT tag (P).

^b Positions and orientations listed after each color can include: fish's right (R), fish's left (L), center of rostrum (C), vertical (V), and horizontal (H).

^c Hatchery sources: source abbreviations reported in Appendix G.

^d All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Table 5. Pallid sturgeon (PDSG) and hybrid pallid X shovelnose sturgeon (SNPD) capture locations and habitat characteristics for segment 10 of the Missouri River during 2004-2005. ID number links pallid sturgeon habitat information with individual fish length, weight, and tagging data in Table 4. Gear codes presented in Appendix C. Habitat definitions and codes presented in Appendix B.

Species	ID#	Date	Gear	River mile	Habitat			Water Temp (°C)	Turb ^a (NTU)	Depth ^b (m)	Bottom velocity (m/s)	Substrate ^c (silt/sand/ gravel)
					Macro-	Meso-	Micro-					
PDSG	MO-1-10-97-4	7/26/2005	TNS	345.8	ISB	CHNB	222300	30.5	47	1.8	0.61	0 / 98 / 2
PDSG	MO-1-10-268-16	8/18/2005	OT16S	289.9	CHXO	CHNB	230310	27.7	300	4	0.60	0 / 100 / 0
PDSG	MO-1-10-600-4	9/21/2005	TNS	355.7	ISB	CHNB	220310	24.6	70	3.8	0.66	0 / 100 / 0
PDSG	MO-1-10-752-4	10/26/2005	OT16S	333.5	ISB	CHNB	217330	13.9	83	2	0.63	0 / 85 / 15
SNPD	MO-1-10-269-1	8/18/2005	OT16S	289.9	CHXO	CHNB	230310	27.7		4		
SNPD	MO-1-10-491-18	9/8/2005	TNS	274.7	CHXO	CHNB	221330	27.3	49	2.7	0.52	0 / 60 / 40

^aTurb = turbidity.

^bDepths presented are the average of the starting, middle, and ending depths measured during gear deployment.

^cSubstrates are percents determined visually and by feel in the field.

Table 6. Mean fork length, weight, relative condition factor (K_n), and growth rates of hatchery-reared pallid sturgeon by year class at the time of stocking and recapture in 2001-2005 in the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (\pm 2SE) was calculated where $N > 1$ and is represented on second line of each year.

Year class	N	Stocking Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
2001									
2002		301			450	260.0	0.769	0.201	
		-			-	-	-	-	
2003					424	230.0	0.831		
					-	-	-		
2004		174			252	50.0	1.036	0.678	
		-			-	-	-	-	
2005									

Table 7. Relative stock density (RSD)^a by a length category for wild and stocked pallid sturgeon in the Missouri River captured during 2004-2005. Length categories^b determined using the methods proposed by Shuman et al. (2006).

Length Category	Wild		Stocked	
	N	RSD	N	RSD
Sturgeon Season				
Sub-stock (0-199)				
Sub-stock (200-329)				
Stock				
Quality				
Preferred				
Memorable				
Trophy				
Fish Community Season				
Sub-stock (0-199)	0		0	
Sub-stock (200-329)	0		1	
Stock	1	100	2	100
Quality	0	0	0	0
Preferred	0	0	0	0
Memorable	0	0	0	0
Trophy	0	0	0	0

^a RSD = number of fish of a specified length ÷ number minimum stock length fish x 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 = 1,040 – 1,269 mm (59 – 74 %), Trophy FL > 1,270 mm (>74 %).

^c All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Table 8. Ratios of wild pallid sturgeon to shovelnose sturgeon, wild pallid sturgeon to hybrid sturgeon (pallid X shovelnose), and stocked pallid sturgeon to wild pallid sturgeon captured in the Missouri River during 2004-2005 including non-random and wild samples.

Year	All Pallids : Shovelnose	Wild Pallids: Shovelnose	Wild Pallids: Hybrids	Stocked Pallids: Wild Pallids
2003				
2004				
2005	1 : 160	1 : 637	1 : 2	3 : 1

* All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Year comparisons, Gear evaluation and Habitat associations

The 2005 fish community was the first sampling season for segment 10. As a result, we cannot make comparisons of data across years. Two pallid sturgeon were captured using 1-inch trammel nets and two were captured using otter trawls. The smallest and largest fish (252- and 611-mm FL, respectively) were captured in otter trawls. Sample size of pallid sturgeon was too small to make any inferences about size selectivity of any sampling gears. One-hundred twenty 1-inch trammel nets were deployed with an average drifted distance of 152 m. Catch-per-unit-effort for wild and hatchery-stocked pallid sturgeon for 1-inch trammel nets was zero and 0.013 fish/100m, respectively. Similarly, 120 otter trawls were deployed with an average haul distance of 213 m. Catch-per-unit-effort for wild and hatchery-stocked pallid sturgeon for otter trawls was 0.003 and 0.004 fish/100m, respectively. Bag seines (N = 98 hauls; 7,937 m²) and mini-fyke nets (97 net nights) in segment 10 did not capture any pallid sturgeon during the 2005 fish community season.

Inside bend and channel crossover macrohabitats were the only macrohabitats sampled with gears targeting pallid sturgeon (i.e., 1-inch trammel nets and otter trawls), with the exception of two 1-inch trammel drifts in a large, connected side channel (Tables 9, 11, 13, and 15). Pallid sturgeon were captured in approximate proportion to the amount of effort expended in each macrohabitat. Inside bend macrohabitats accounted for three pallid sturgeon captures (75% of the catch) and one fish (25% of the catch) was caught in the channel crossover. Similarly, within each sturgeon sampling gear type, approximately 75% and 25% of effort was expended in the inside bend and channel crossover, respectively (1-inch trammel nets = 70 and 28%, respectively; otter trawls = 71 and 29% respectively).

All pallid sturgeons were captured in channel border mesohabitats, that composed 98 and 100% of mesohabitats sampled with 1-inch trammel nets and otter trawls, respectively. All pallid sturgeons were captured in microhabitats that were influenced by wing dikes in areas defined as “open water” (see Drobish 2006b for habitat definitions). Only 17% of effort was expended in association with wing dikes with a bank notch, but samples in these microhabitats accounted for 50% (N = 2) of pallid sturgeon captured. All pallid sturgeon were captured by gears deployed on or inside of the eddy line created by the wing dike (i.e., no fish were captured outside of the eddy line).

Water temperature in segment 10 during the 2005 fish community season ranged from 12.9 to 31.2°C (Table 3). Pallid sturgeon were captured throughout this temperature range 13.9 to 30.5°C. Water depths for habitats in which sturgeon sampling gears were deployed ranged from 1.2 to 6.1 m (Tables 3, 5). Pallid sturgeon capture locations ranged from 1.8 to 4.0 m and was closer to the mean depths (ISB = 2.3 m; CHXO = 3.6 m) than the extremes. Turbidity during the 2005 fish community season ranged from 39 to 558 NTU and from 47 to 300 NTUs for pallid sturgeon capture locations. All three fish captured on the inside bend were caught when turbidity was less than 100 NTUs (NTU = 47 to 83). Bottom velocity was similar among all pallid sturgeon capture locations and ranged from 0.60 to 0.66 m/s. Substrates over which pallid sturgeon were captured were composed primarily of sand sediments (85 to 100%) that did not contain any silt (Table 5).

Segment 10 - Pallid Sturgeon / Sturgeon Season

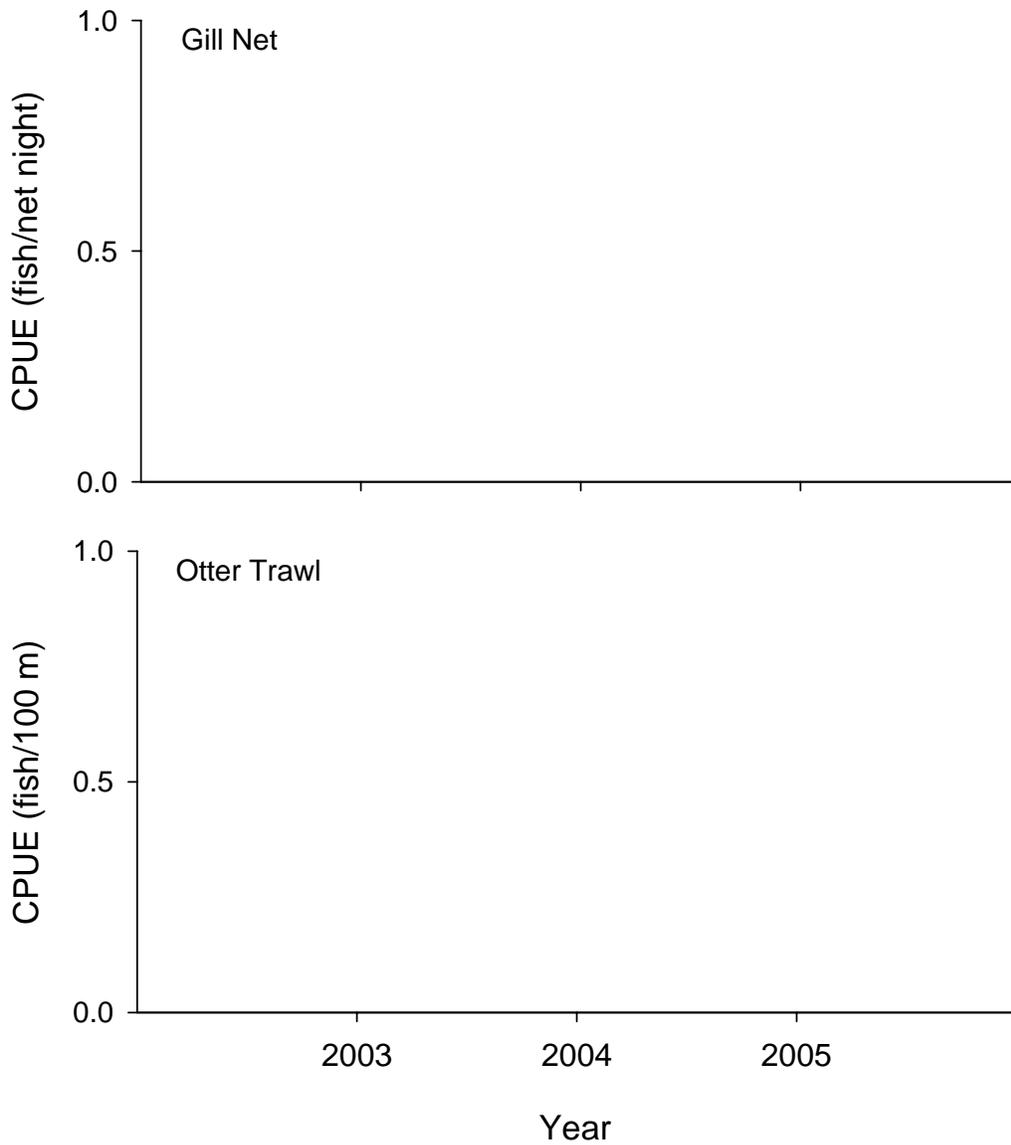


Figure 2. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Sturgeon Season

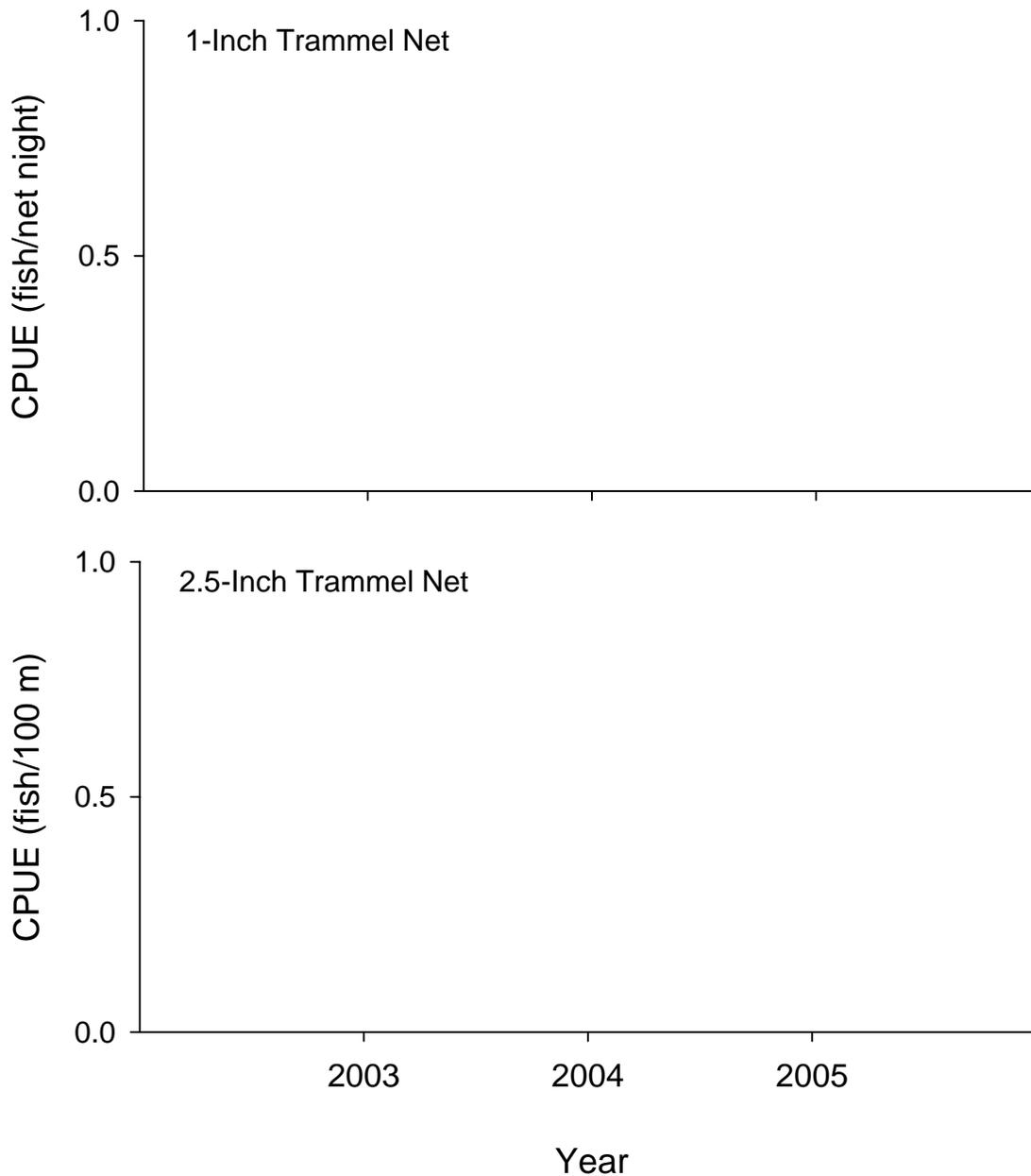


Figure 3. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for 1- and 2.5-inch trammel nets in segment 10 of the Missouri River during sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Sturgeon Season

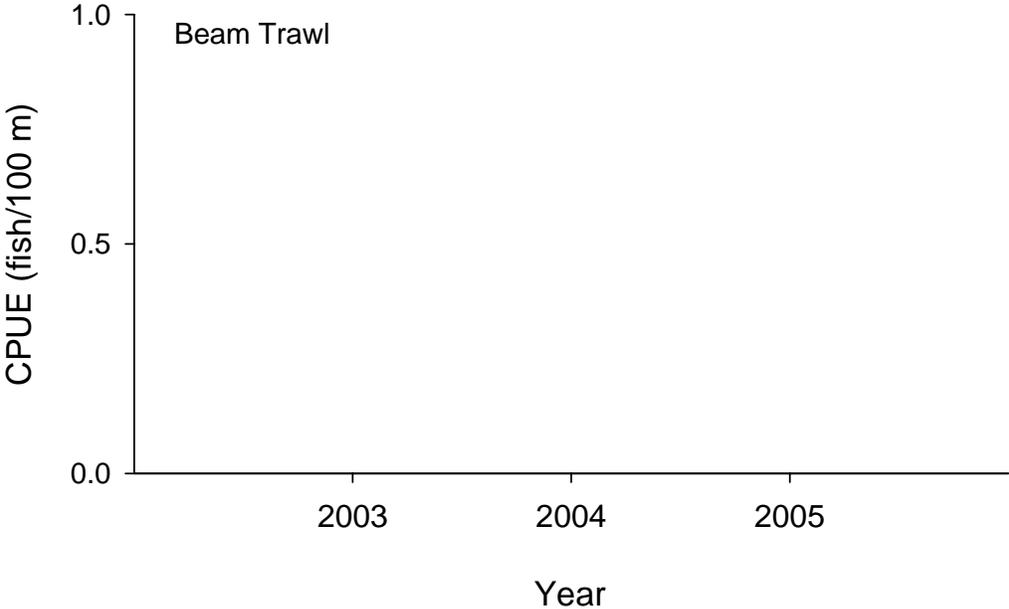


Figure 4. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

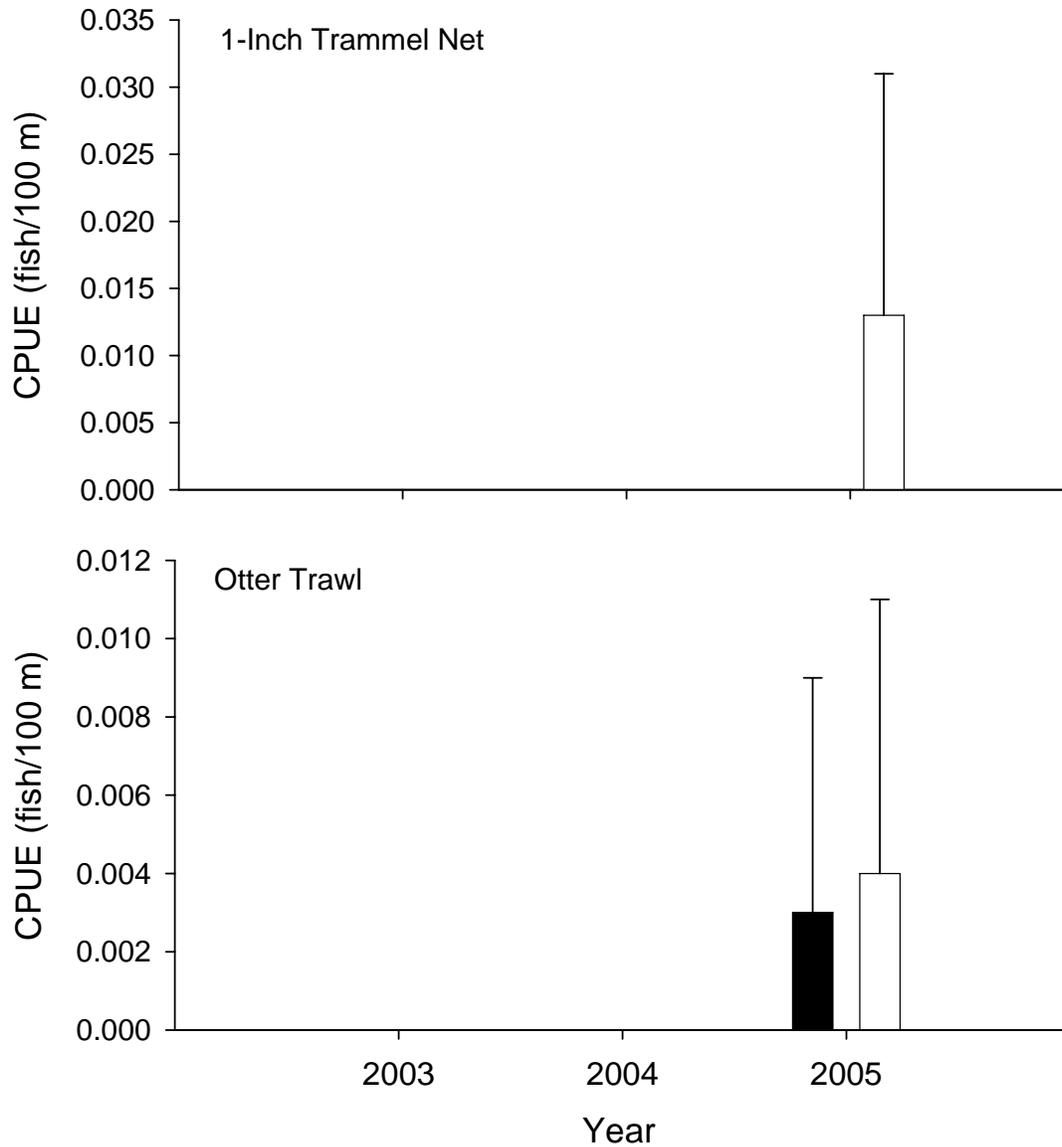


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for 1-inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

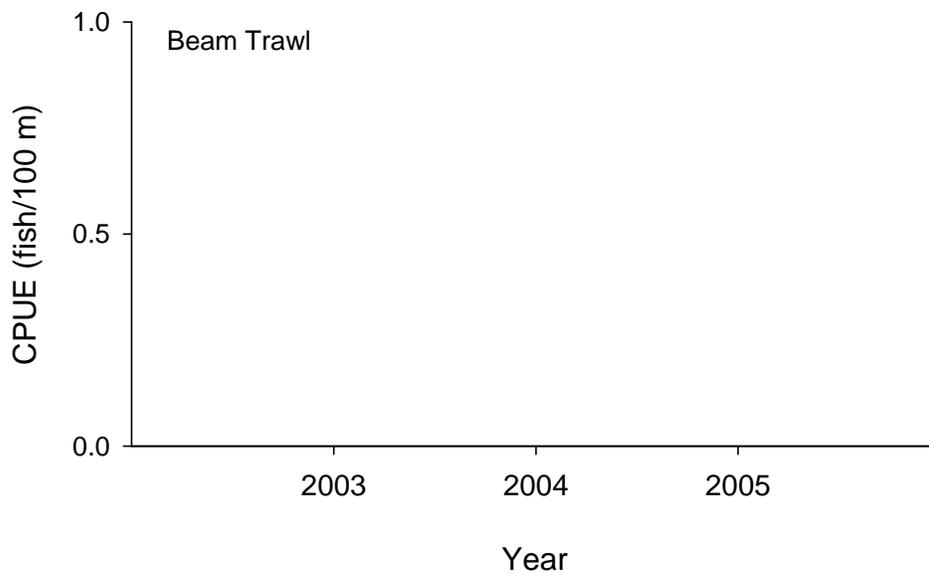


Figure 6. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for beam trawls in segment 10 of the Missouri River during fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Segment 10 - Pallid Sturgeon / Fish Community Season

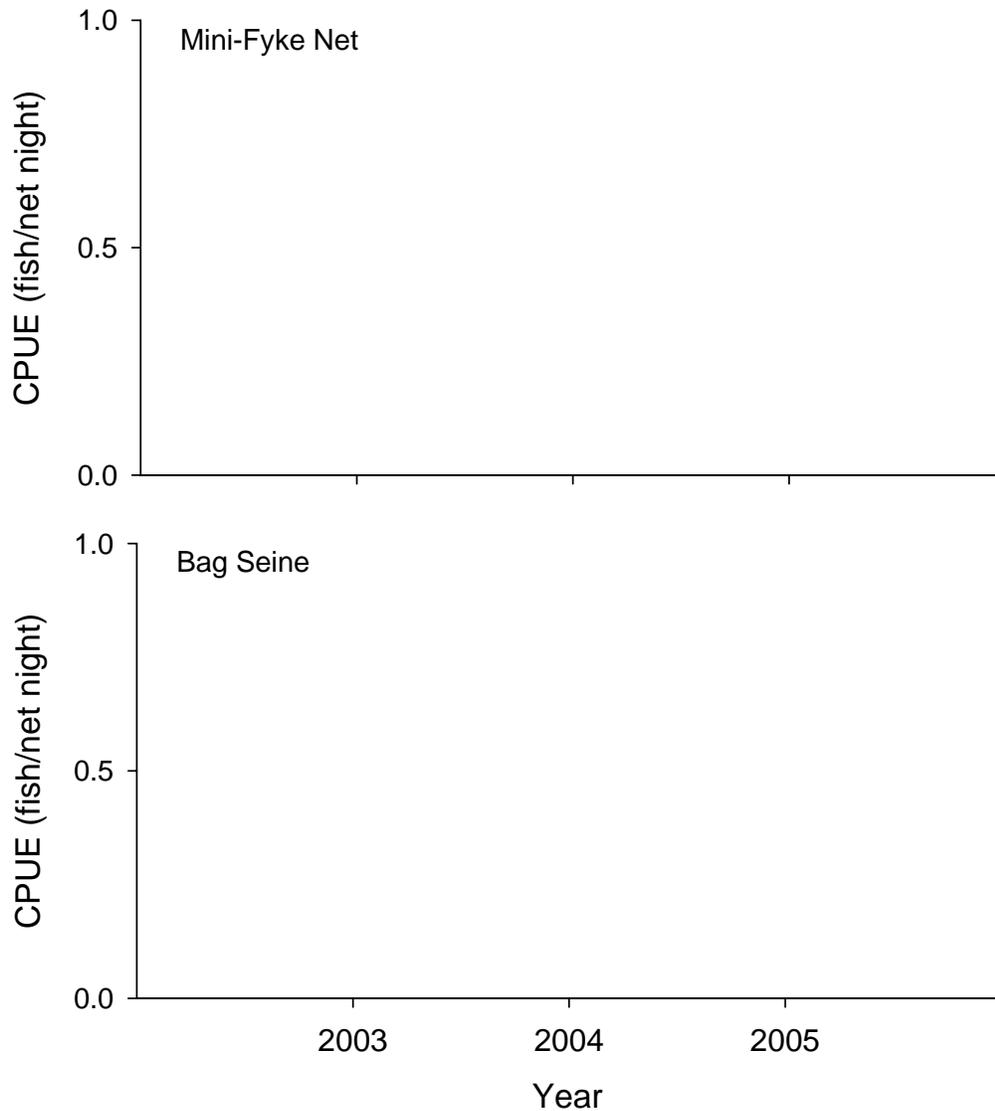


Figure 7. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were 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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	0	N-E	0		N-E	N-E	0	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	0	0	0	N-E	0		
		0	100	N-E	0		
Beam Trawl							

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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	1	N-E	100		N-E	N-E	0	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	1	0	100	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	0	0	0	N-E	0		
		0	100	N-E	0		
Beam Trawl							

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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	2	N-E	0		N-E	N-E	100	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	1	N-E	0		N-E	N-E	100	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	2	0	100	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	1	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

Table 15. Total number of quality and above size (>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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	0	N-E	0		N-E	N-E	0	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

Table 16. Total number of quality and above size (>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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	0	0	0	N-E	0		
		0	100	N-E	0		
Beam Trawl							

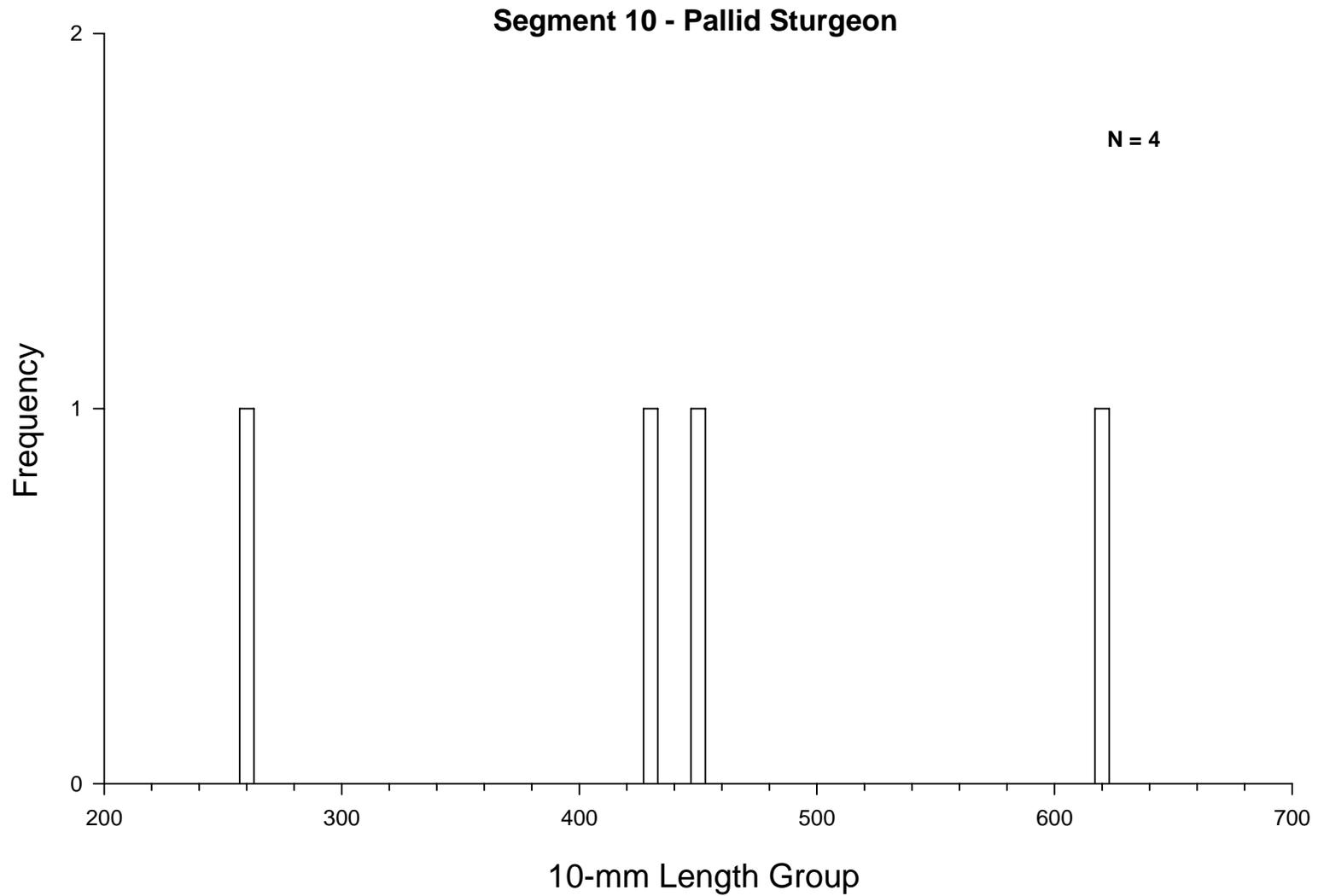


Figure 8. Length frequency of pallid sturgeon during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004 - 2005.

Segment 10 - Cumulative Pallid Sturgeon Capture History

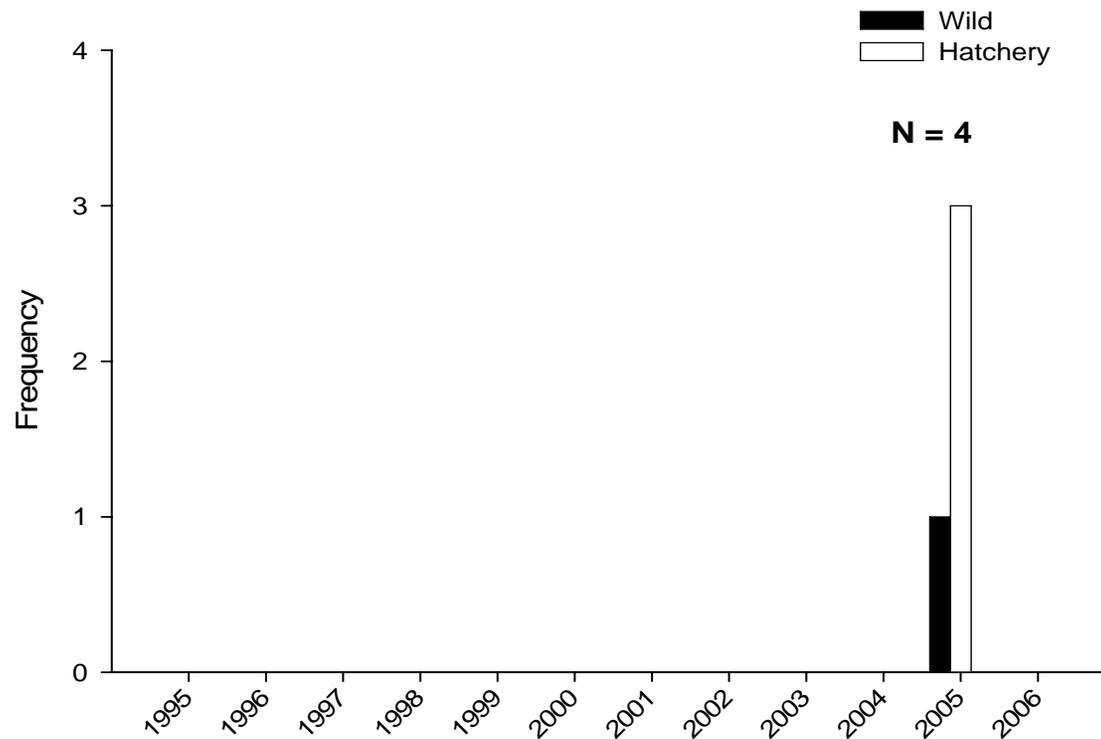


Figure 9. Cumulative capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 10 of the Missouri River from 1995 to 2005.

Segment 10 - Cumulative Pallid Sturgeon Length Frequency History

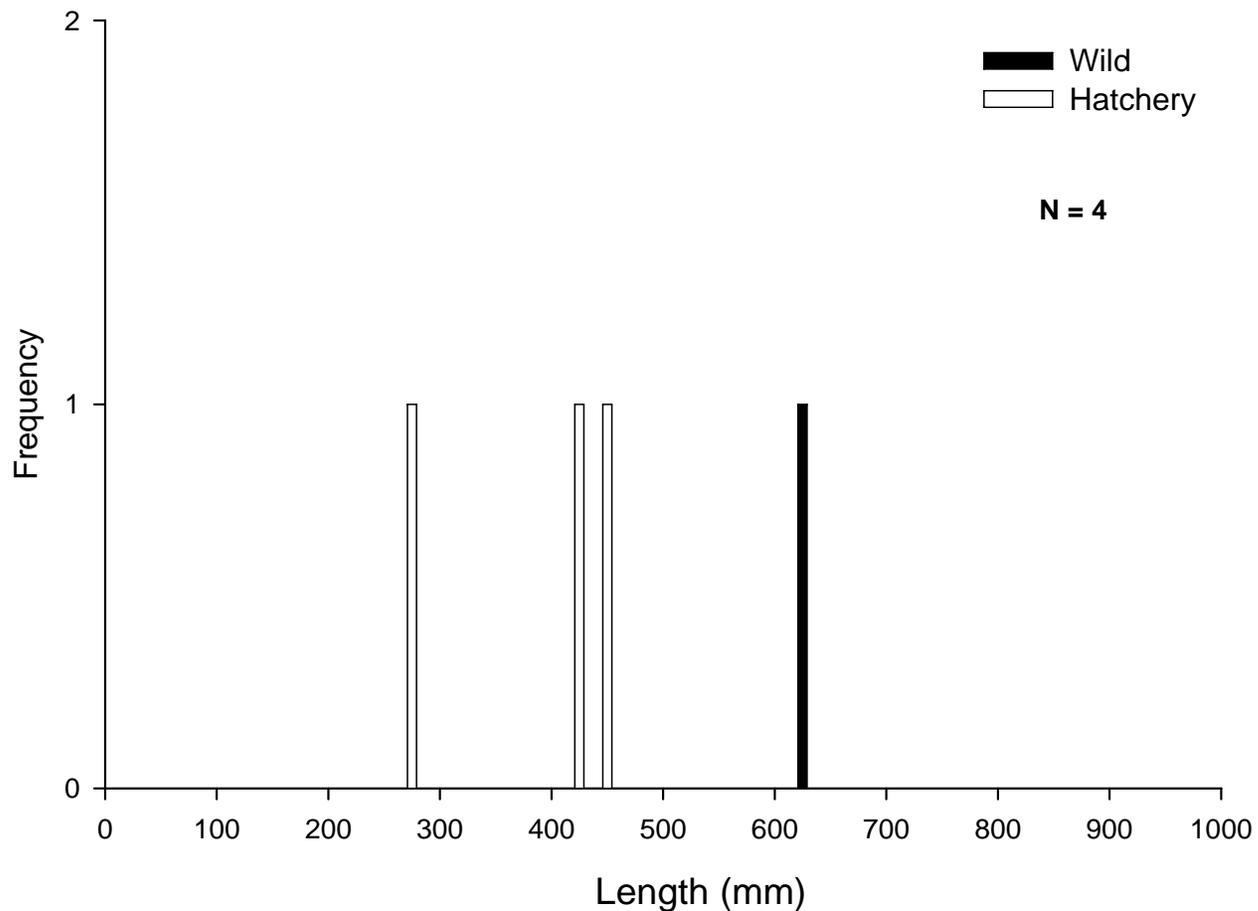


Figure 10. Cumulative pallid sturgeon length frequency histogram for segment 10 comparing hatchery reared (white bars), wild (black bars), and unknown origin (cross-hatched bars) pallid sturgeon captures in 2005.

Shovelnose X Pallid Sturgeon Hybrids

Two shovelnose X pallid sturgeon were captured in segment 10 during the 2005 fish community season (Table 5). One fish captured with an otter trawl at RM 289.9 was 668-mm FL and had a CI score of -0.0992. The other hybrid sturgeon was captured at RM 274.4 with a 1-inch trammel net, and it was 635-mm FL with a CI score of 0.0114. Both hybrid sturgeon were captured in the channel crossover in CHNB mesohabitats. Similar to pallid sturgeon, all hybrid sturgeon were captured in microhabitats associated with wing dikes in open water areas on or inside the eddy line.

Targeted Native River Species

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

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

Shovelnose Sturgeon

Year and gear comparisons

Six hundred thirty-seven shovelnose sturgeon were captured using 1-inch trammel nets (N = 375; CPUE = 2.05 fish/100m) and otter trawls (N = 262; CPUE = 1.43 fish/100m) during the 2005 fish community season. Fork length ranged from 78 to 708 mm (mean = 521 mm) and 21 to 762 mm (mean = 431 mm) for 1-inch trammel nets and otter trawls, respectively (Figure 17). Few fish (N = 72) less than stock size (250-mm FL) were captured and 66% of shovelnose sturgeon captured were greater than 510-mm (i.e., RSD-P = 66; Table 25). Approximately 3% of the catch consisted of fish from 21 to 85-mm FL that were assumed to be age-0.

Otter trawls captured a wider size range of fish and greater number of smaller (< 150-mm FL) fish than 1-inch trammel nets (Tables 17 and 19). For example, only three sub-stock (0 to 149 mm) sized individuals were captured (mean CPUE = 0.028 fish/100 m) with 1-inch trammel nets while 52 fish (mean CPUE = 0.194 fish/100 m) were captured with otter trawls (Figure 14). Stock size (250- to 379-mm FL) and quality size (380- to 509-mm FL) shovelnose sturgeon were about two and three-times more vulnerable to 1-inch trammel nets than otter trawls, respectively (stock mean CPUE = 0.156 and 0.096 fish/100m, respectively; quality mean CPUE = 2.182 and 0.644 fish/100m, respectively; Figure 14). Bag seines and mini-fyke nets captured a variety of small-bodied species, but did not capture any small (or large) shovelnose sturgeon.

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

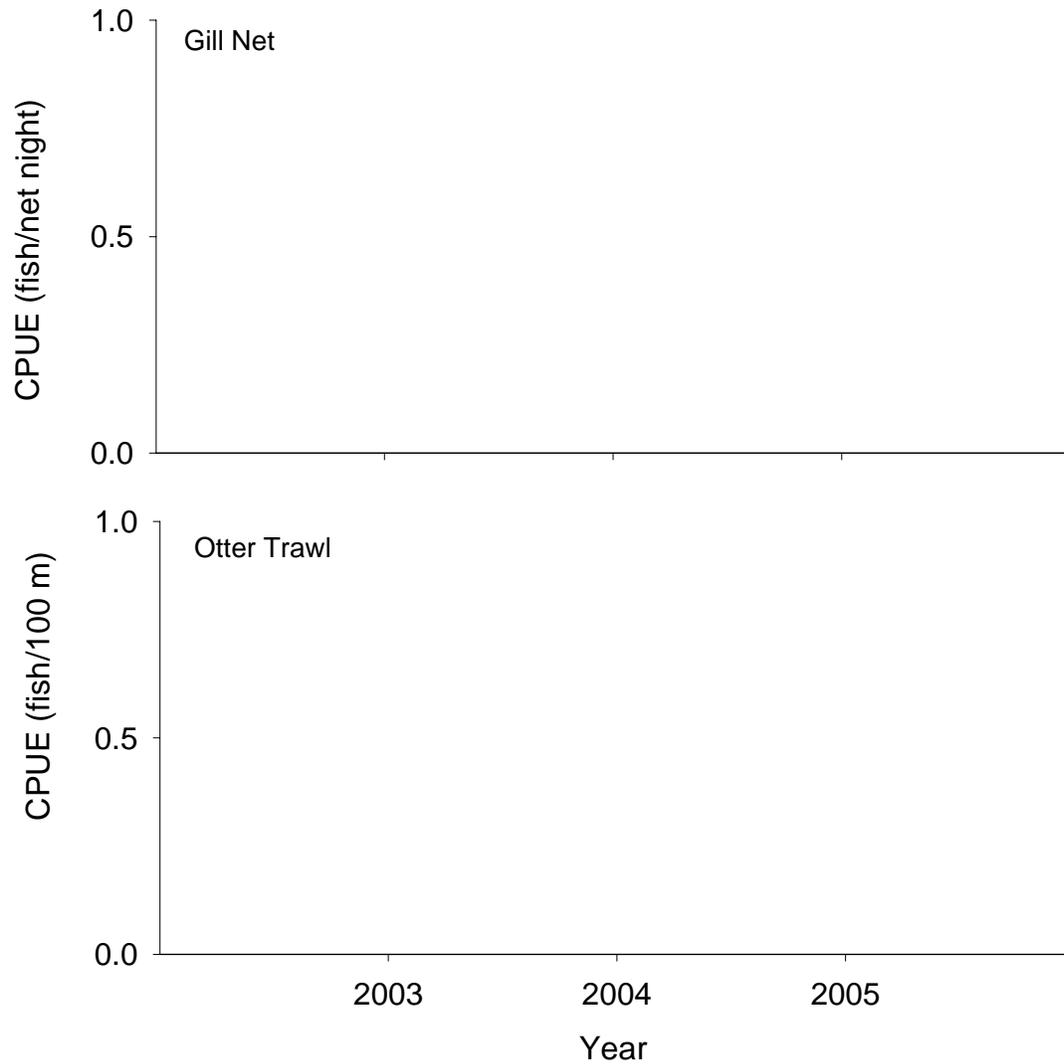


Figure 11. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon for gill nets and otter trawls segment 10 of the Missouri River during sturgeon season 2003 - 2005.

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

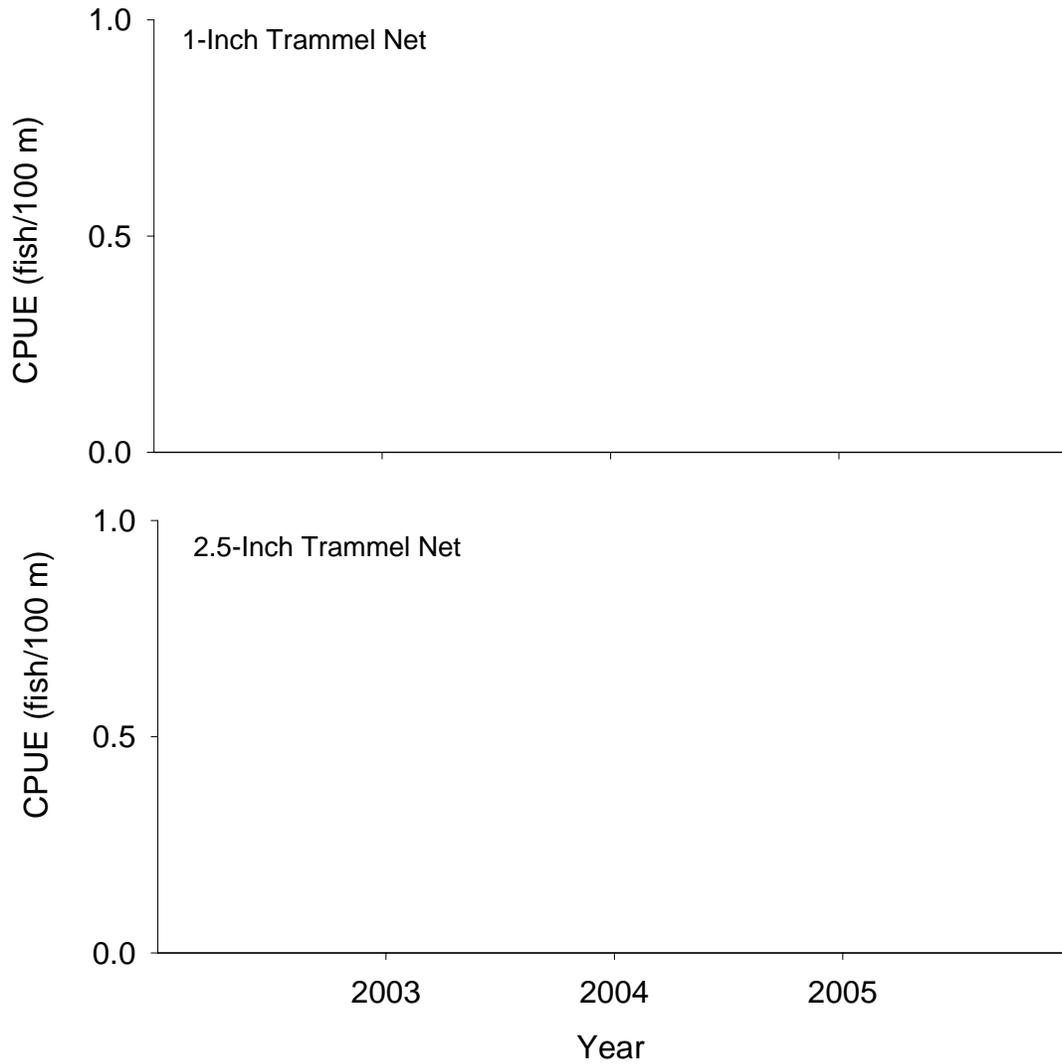


Figure 12. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon for 1- and 2.5-inch trammel nets in segment 10 of the Missouri River during sturgeon season 2003 - 2005.

Segment 10 - Shovelnose Sturgeon / Sturgeon Season

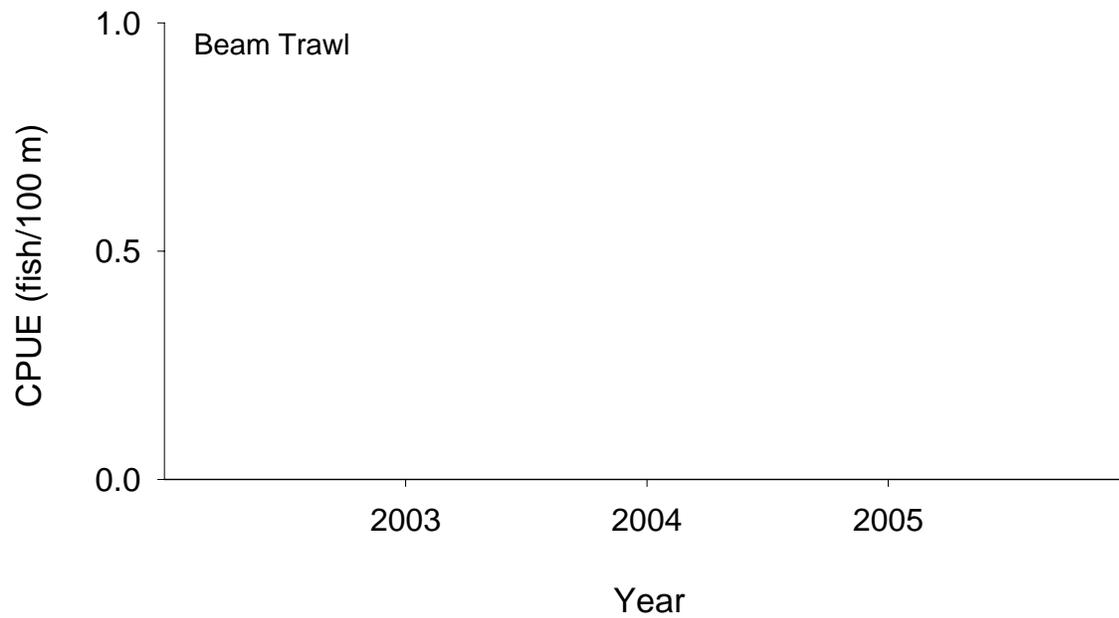


Figure 13. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon for beam trawls in segment 10 of the Missouri River during sturgeon season 2003 - 2005.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

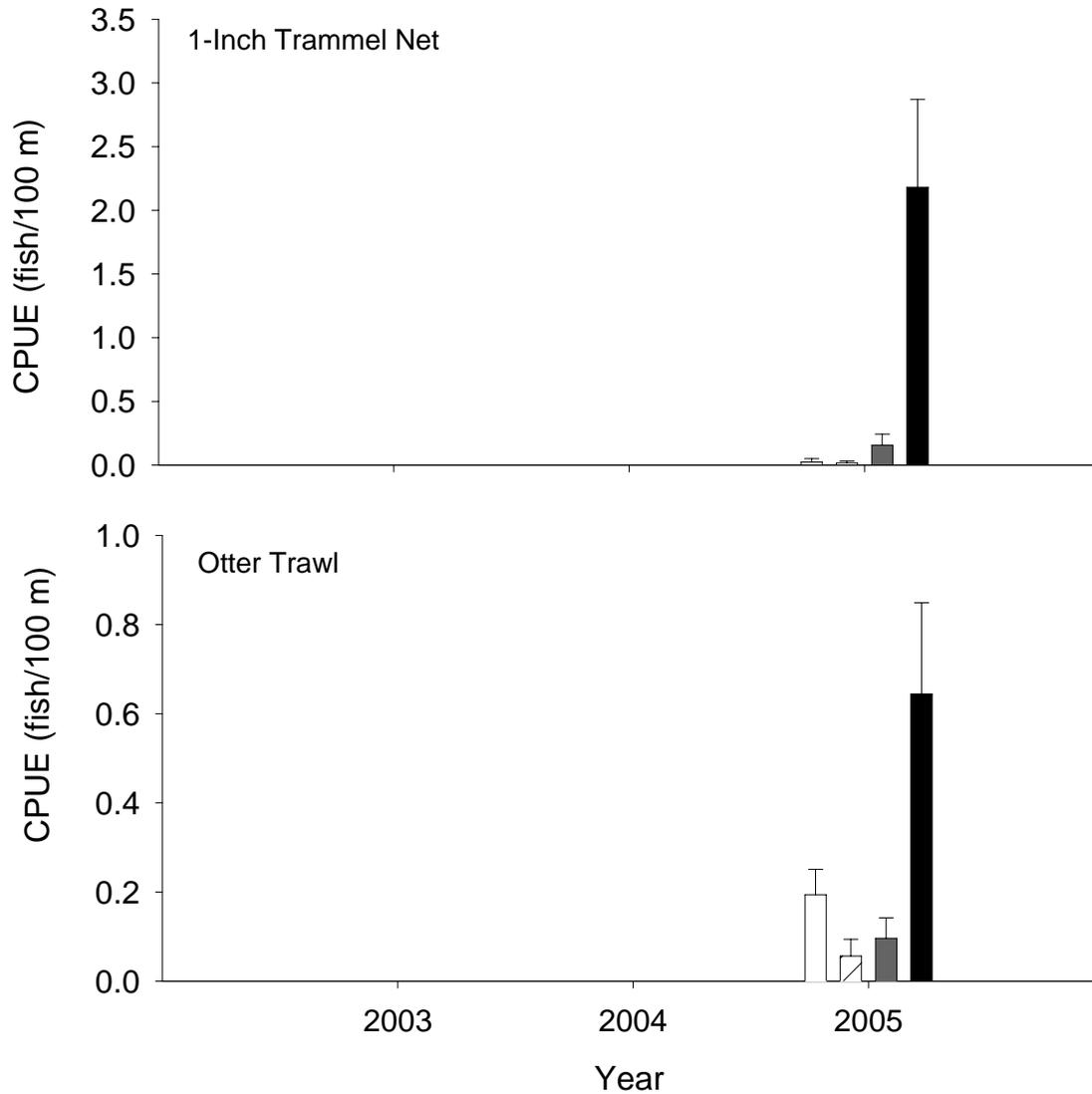


Figure 14. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon for 1-inch trammel nets and otter trawls in segment 10 of the Missouri River during fish community season 2003 - 2005.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

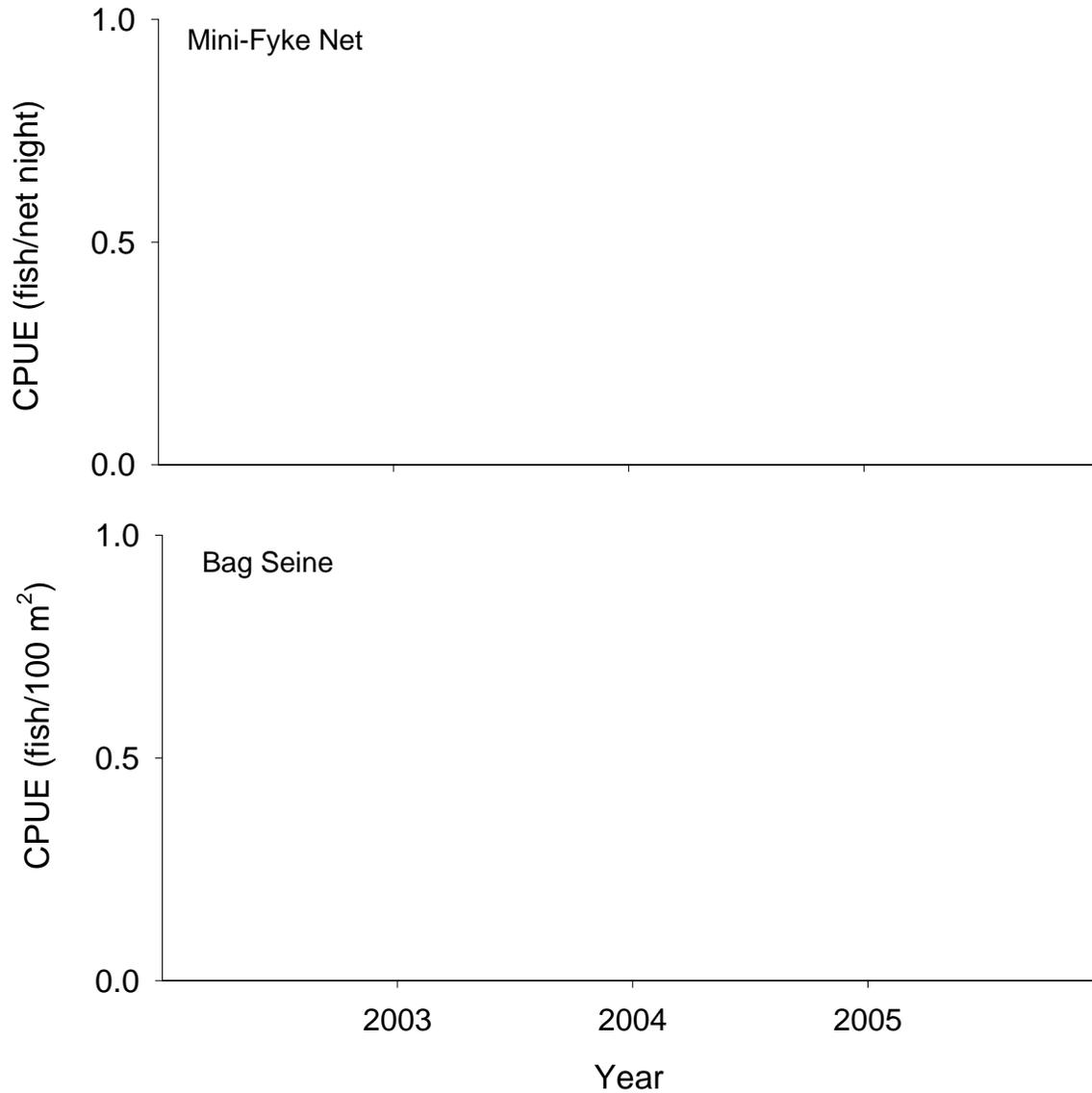


Figure 15. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003 - 2005.

Segment 10 - Shovelnose Sturgeon / Fish Community Season

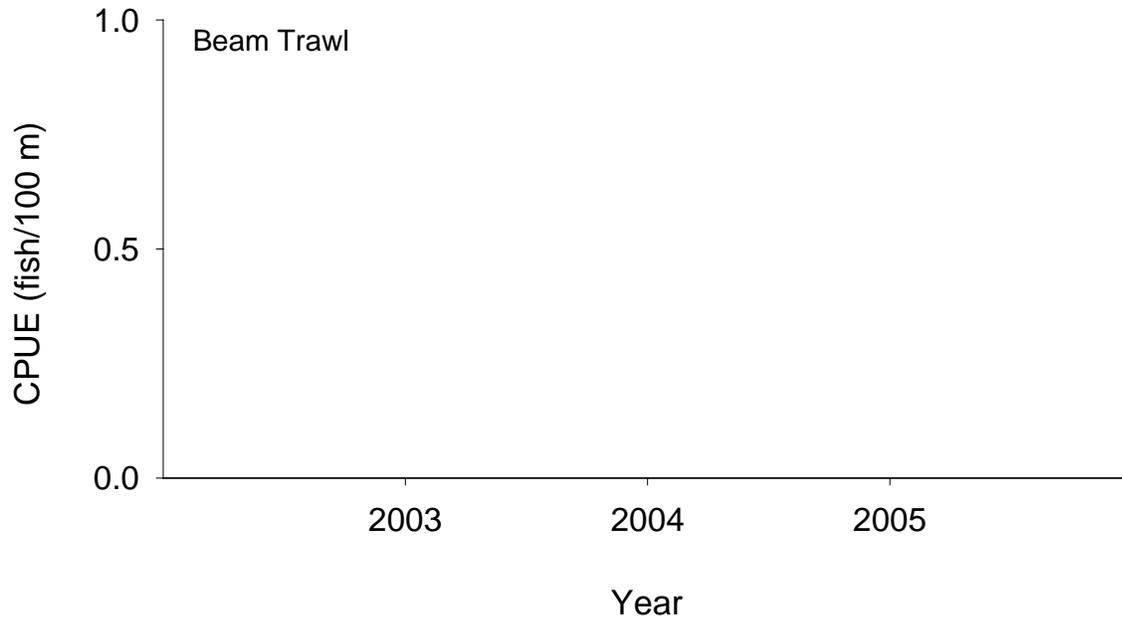


Figure 16. Mean annual catch-per-unit-effort (\pm 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon for beam trawls in segment 10 of the Missouri River during fish community season 2003 - 2005.

Habitat Use

Shovelnose sturgeon were not captured in proportion to the amount of effort expended in each macrohabitat with 1-inch trammel nets, but were captured in proportion to effort with otter trawls (1-inch trammel net: $\chi^2 = 20.83$; $df = 2$; $P < 0.001$; and otter trawl: $\chi^2 = 0.46$; $df = 1$; $P = 0.498$). One-inch trammel nets captured a greater number of fish from large, connected secondary channels ($N = 20$) and inside bend macrohabitats ($N = 278$) than expected ($N = 8$ and 263 , respectively) given the amount of effort expended in each macrohabitat with that gear. All shovelnose sturgeon were captured in 1-inch trammel nets and otter trawls, thus, all fish were captured in CHNB mesohabitats.

Eighty-two percent of all 1-inch trammel nets and otter trawls were deployed in microhabitats that were within the influence of wing dikes and accounted for 85% of the shovelnose sturgeon catch. The remaining portion (15%) of the shovelnose sturgeon catch was captured in association with kicker dikes, rootless dikes, and channel sand bar microhabitats. Channel sand bars were the most productive microhabitat for shovelnose sturgeon besides wing dikes and produced 7% of the catch. Rootless dikes were infrequently sampled and efforts in association with these structures captured 11 shovelnose sturgeon (1-inch trammel net CPUE = 0.78 fish/100 m). One-inch trammel nets did not capture any shovelnose sturgeon in microhabitats associated with kicker dikes (effort = 953 m) while otter trawls captured 15 individuals with about twice as much effort in this microhabitat (CPUE = 0.79 fish/100 m).

Shovelnose sturgeon were not captured in association with dry, partially overflowing and overflowing wing dikes in proportion the amount of effort expended in each of these habitats (1-inch trammel net: $\chi^2 = 102.59$; $df = 2$; $P < 0.001$; and otter trawl: $\chi^2 = 12.52$; $df = 2$; $P = 0.002$; Table 40). The percent of shovelnose sturgeon captured in association with dry and partially overflowing wing dikes (16 and 53%, respectively) was less than the proportion of effort expended in these habitat types (22 and 59%, respectively). Overflowing dikes accounted for 31% of the shovelnose sturgeon captured but composed only 19% of the habitats in which 1-inch trammel net and otter trawl efforts were expended.

Approximately 65% of effort with sturgeon sampling gears was expended within the influence of wing dikes that were not notched. Shovelnose sturgeon captured with 1-inch trammel nets and otter trawls were caught in proportion to the amount of effort expended within the influence of notched and unnotched wing dikes that were dry (1-inch trammel net: $\chi^2 = 3.65$;

$df = 1$; $P = 0.056$; and otter trawl: $\chi^2 = 2.79$; $df = 1$; $P = 0.095$) or partially overflowing (1-inch trammel net: $\chi^2 = 0.39$; $df = 1$; $P = 0.532$; and otter trawl: $\chi^2 = 0.00$; $df = 1$; $P = 1.0$; Table 41). We were unable to determine if overflowing wing dikes were notched due to high water levels, and thus, comparisons of shovelnose sturgeon catch could not be made for these structures.

The majority of sampling effort with 1-inch trammel nets (66%) and otter trawls (83%) was expended in “open water” areas in association with wing dike microhabitats. Shovelnose sturgeon did not utilize open water areas inside, outside, or on the eddy line in proportion to their availability (Table 42). In the channel crossover, shovelnose sturgeon were captured in greater numbers than expected in open water areas inside the eddy line created by wing dikes and in fewer numbers than expected outside the eddy line (1-inch trammel net: $\chi^2 = 115.31$; $df = 2$; $P < 0.001$; and otter trawl: $\chi^2 = 13.28$; $df = 2$; $P = 0.001$). On the inside bend, shovelnose sturgeon captured in 1-inch trammel nets were captured in greater numbers than expected in areas inside the eddy line ($\chi^2 = 28.52$; $df = 2$; $P < 0.001$) but were captured in proportion to the amount of otter trawl effort expended in each microhabitat ($\chi^2 = 2.49$; $df = 2$; $P = 0.288$).

Sub-stock (0 to 149 mm; $N = 55$) shovelnose sturgeon were captured in approximate proportion to the amount of effort expended in each macrohabitat type (Table 17). For example, one-third of all sub-stock fish were captured in the channel crossover that represented 29% of the effort expended in that habitat with otter trawls, and two-thirds were caught from the inside bend that accounted for 71% of trawling effort. Sub-stock (150 to 249 mm; $N = 17$) shovelnose sturgeon captured with otter trawls were within 12% of the amount of effort expended in each macrohabitat with a slightly larger percentage (83%) of fish captured on the inside bend than expended in that macrohabitat. Similarly, sub-stock (0 to 250 mm) shovelnose sturgeon were captured in proportion to the amount of effort expended inside, outside, or on the eddy line of wing dikes ($\chi^2 = 0.26$; $df = 2$; $P = 0.878$).

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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	3	N-E	0		N-E	N-E	100	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	52	N-E	33		N-E	N-E	67	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	3	0	100	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	52	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

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 204-2005. 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	SCN	TRIB	TRML	TRM	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	5	N-E	20		N-E	N-E	80	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	12	N-E	17		N-E	N-E	83	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	5	0	100	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	12	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

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 2004-2005. 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	SCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	30	N-E	13		N-E	N-E	60	0	27						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	22	N-E	23		N-E	N-E	77	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	30	0	77	N-E	23		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	22	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

Table 23. Total number of quality and above size (>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 2004-2005. 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															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	337	N-E	21		N-E	N-E	75	0	4						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	2	N-E	0		N-E	N-E	100	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	172	N-E	33		N-E	N-E	67	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

Table 24. Total number of quality and above size (>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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	337	1	97	N-E	2		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	2	100	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	172	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

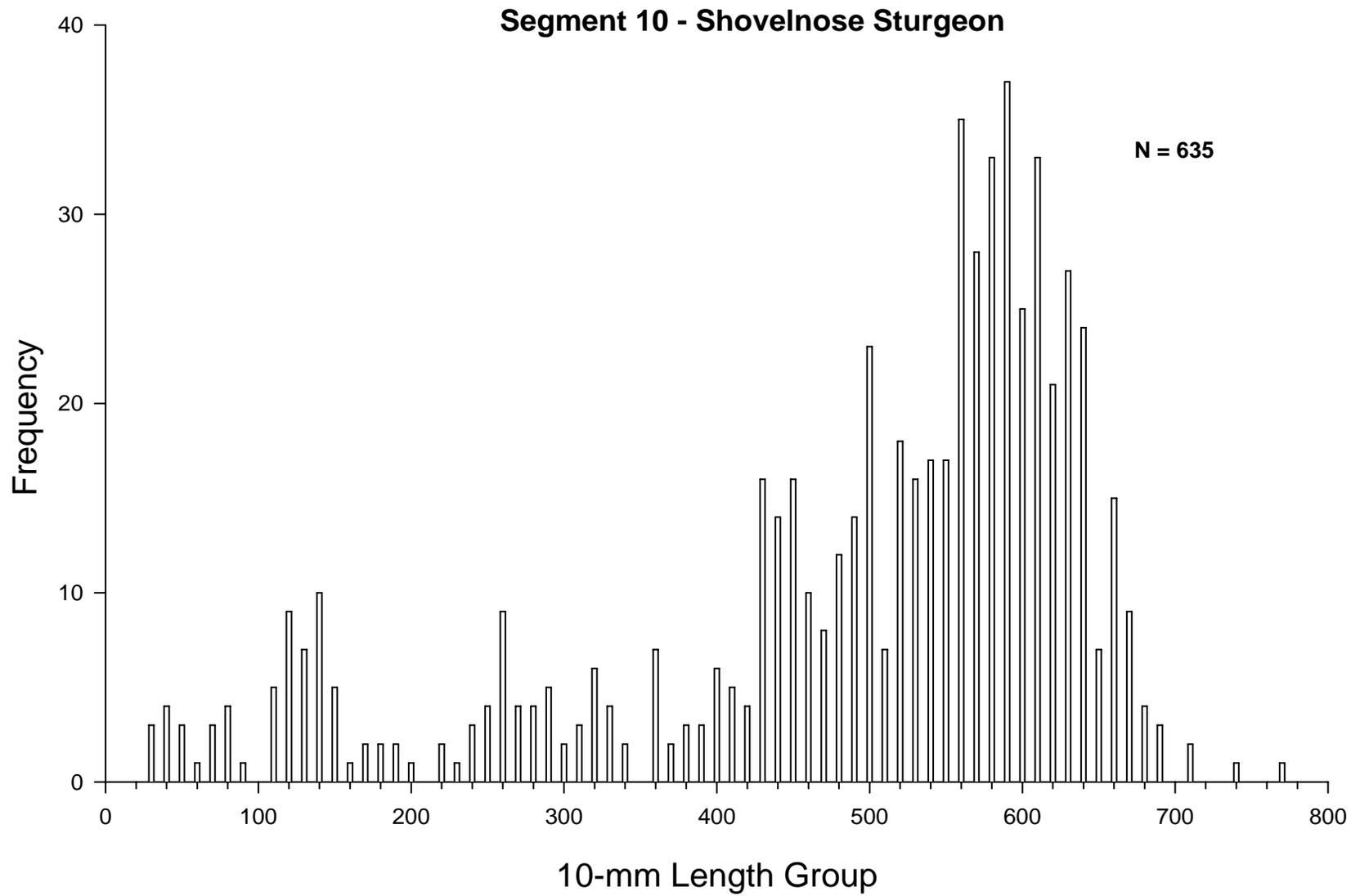


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004- 2005.

Table 25. Relative stock density (RSD)^a by a length category for shovelnose sturgeon in segment 10 of the Missouri River captured during 2004-2005. Length categories^b determined using methods proposed by Quist (1998).

Length category	N	RSD
Sturgeon Season		
Sub-stock (0-149 mm)		
Sub-stock (150-249 mm)		
Stock		
Quality		
Preferred		
Memorable		
Trophy		
Fish Community Season		
Sub-stock (0-149 mm)	55	
Sub-stock (150-249 mm)	17	
Stock	563	
Quality	511	91
Preferred	373	66
Memorable	44	8
Trophy	0	0

^a RSD = number of fish of a specified length ÷ number minimum stock length fish x 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 = 19) during the 2005 fish community season. Total length for this species ranged from 30 to 79 mm (mean = 51 mm). Mean CPUE for otter trawls was 0.073 fish/100 m and was the only gear that captured sturgeon chubs (Figure 19). As a result, all sturgeon chubs were captured in CHNB mesohabitats because this was the only mesohabitat sampled with otter trawls. Most sturgeon chubs (89%) were captured from inside bend macrohabitats, but only 71% of otter trawl effort was expended in this macrohabitat. The remaining 11% of fish were captured in the channel crossover.

Segment 10 - Sturgeon Chub / Sturgeon Season

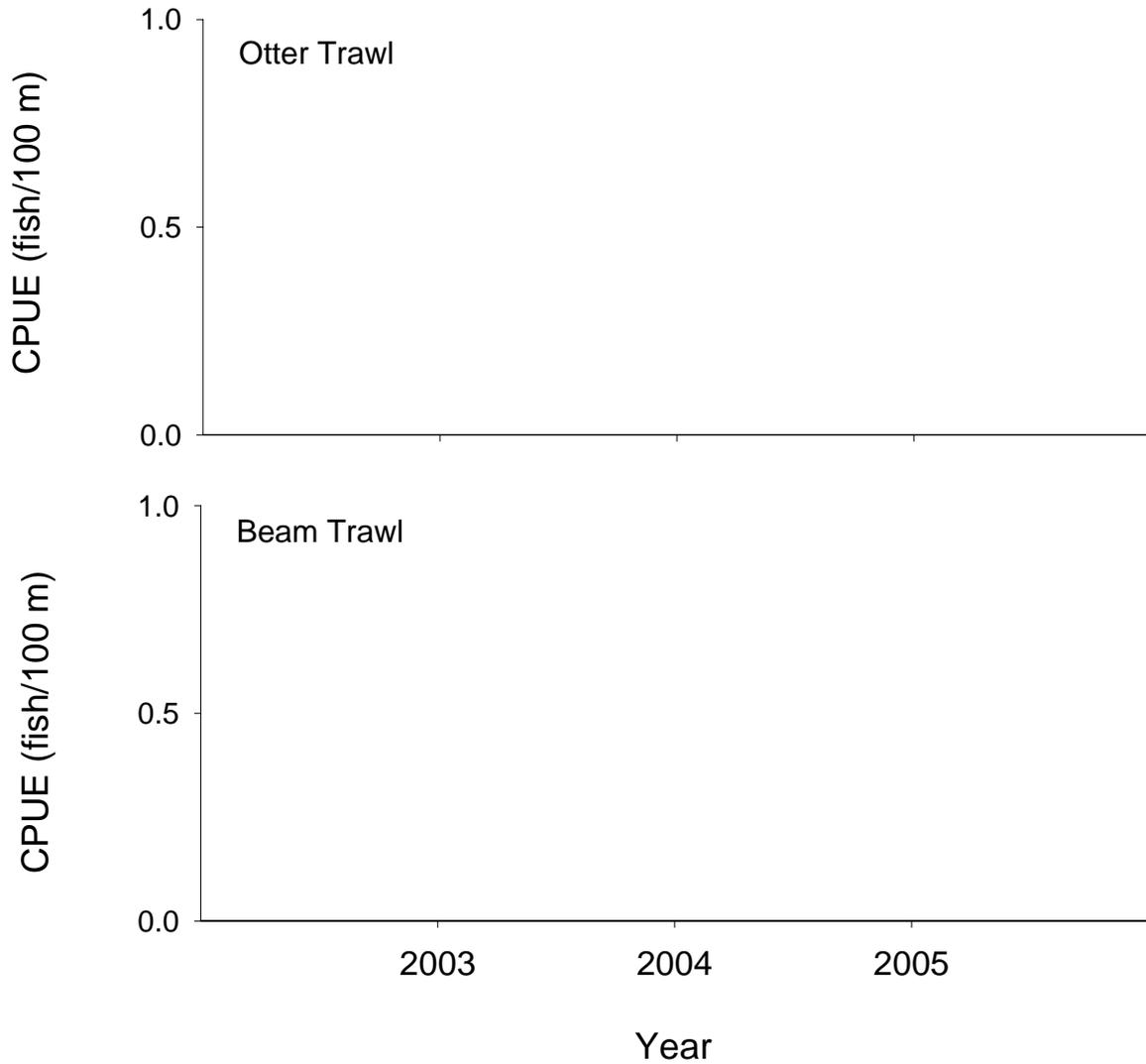


Figure 18. Mean annual catch-per-unit-effort ($\pm 2SE$) of sturgeon chub for otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sturgeon Chub / Fish Community Season

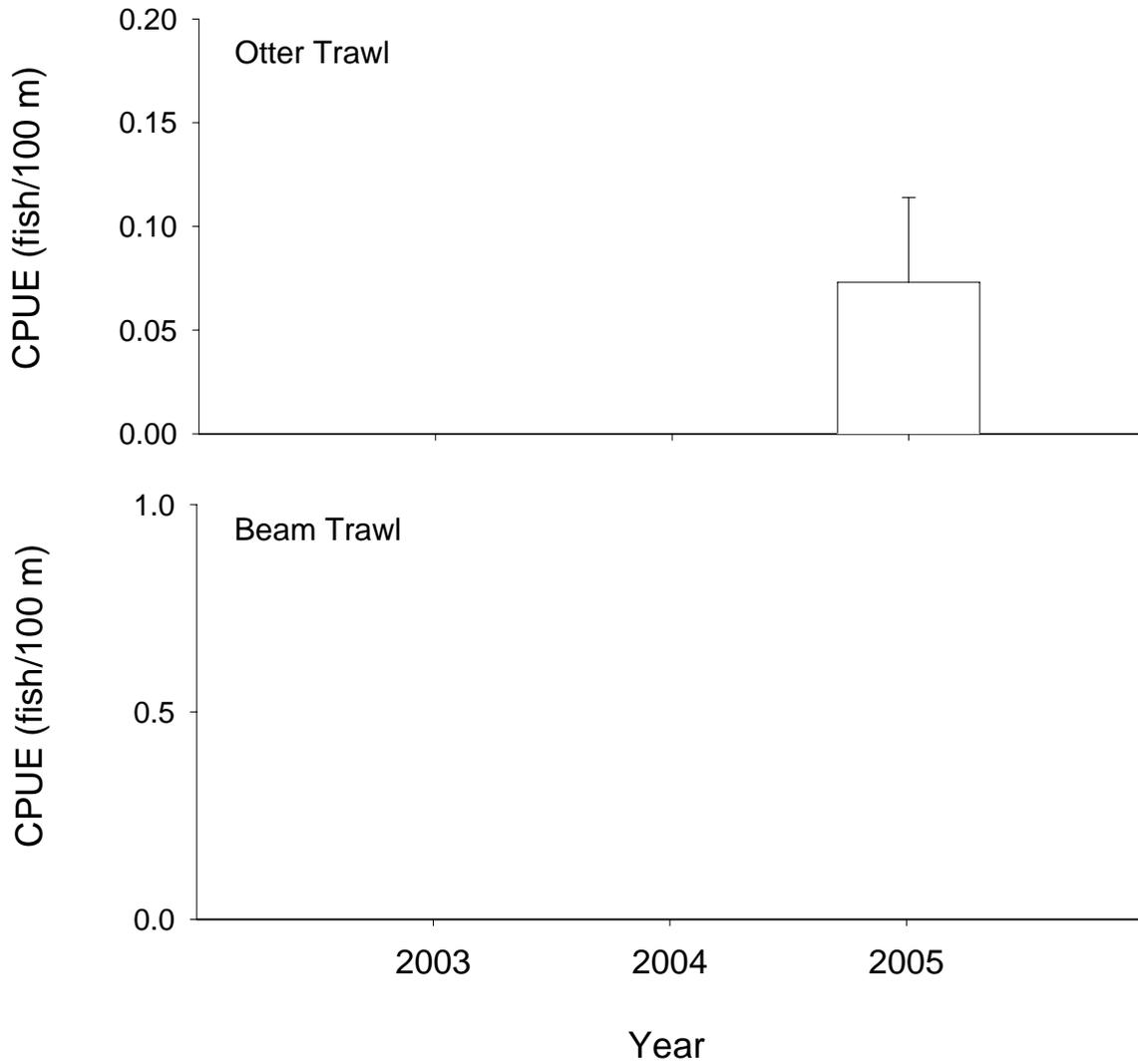


Figure 19. Mean annual catch-per-unit-effort (\pm 2SE) of sturgeon chub for otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Sturgeon Chub / Fish Community Season

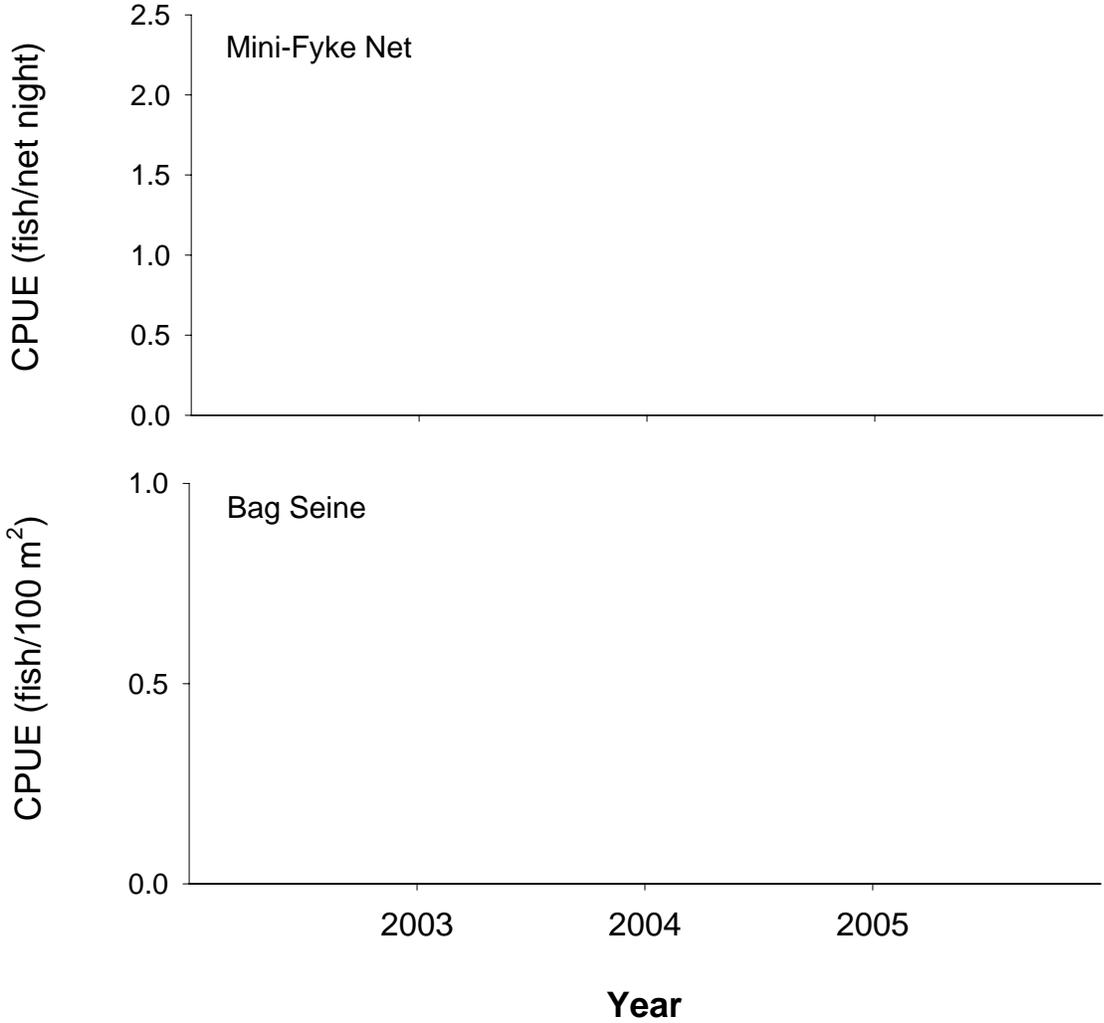


Figure 20. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
2.5 Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	19	N-E	11		N-E	N-E	89	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	19	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

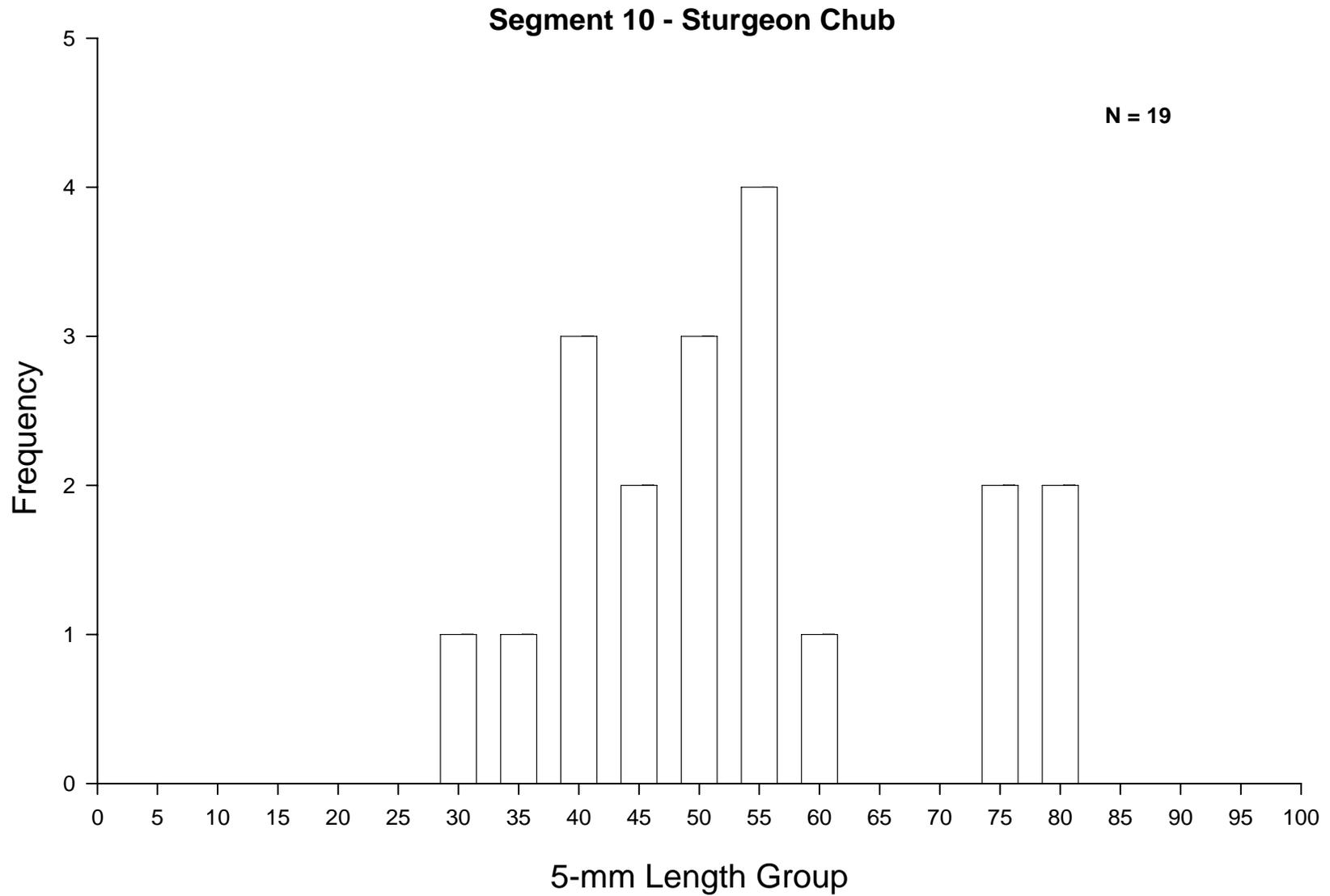


Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004 - 2005

Sicklefin Chub

Sicklefin chubs were the most common *Macrhybopsis* species encountered (N = 130) during the 2005 fish community season. Total length for this species ranged from 29 to 118 mm (mean = 65 mm). Mean CPUE for otter trawls was 0.487 fish/100 m and this was the only gear that captured sicklefin chubs (Figure 23). As a result, all sicklefin chubs were captured in CHNB mesohabitats because this was the only mesohabitat sampled with otter trawls. The number of sicklefin chubs captured in channel crossover (N = 58) and inside bend macrohabitats (N = 72, was greater than and less than expected (N = 38 and 92, respectively), given the amount of effort expended in each macrohabitat ($\chi^2 = 15.40$; $df = 1$; $P < 0.001$; Table 28).

Segment 10 - Sicklefin Chub / Sturgeon Season

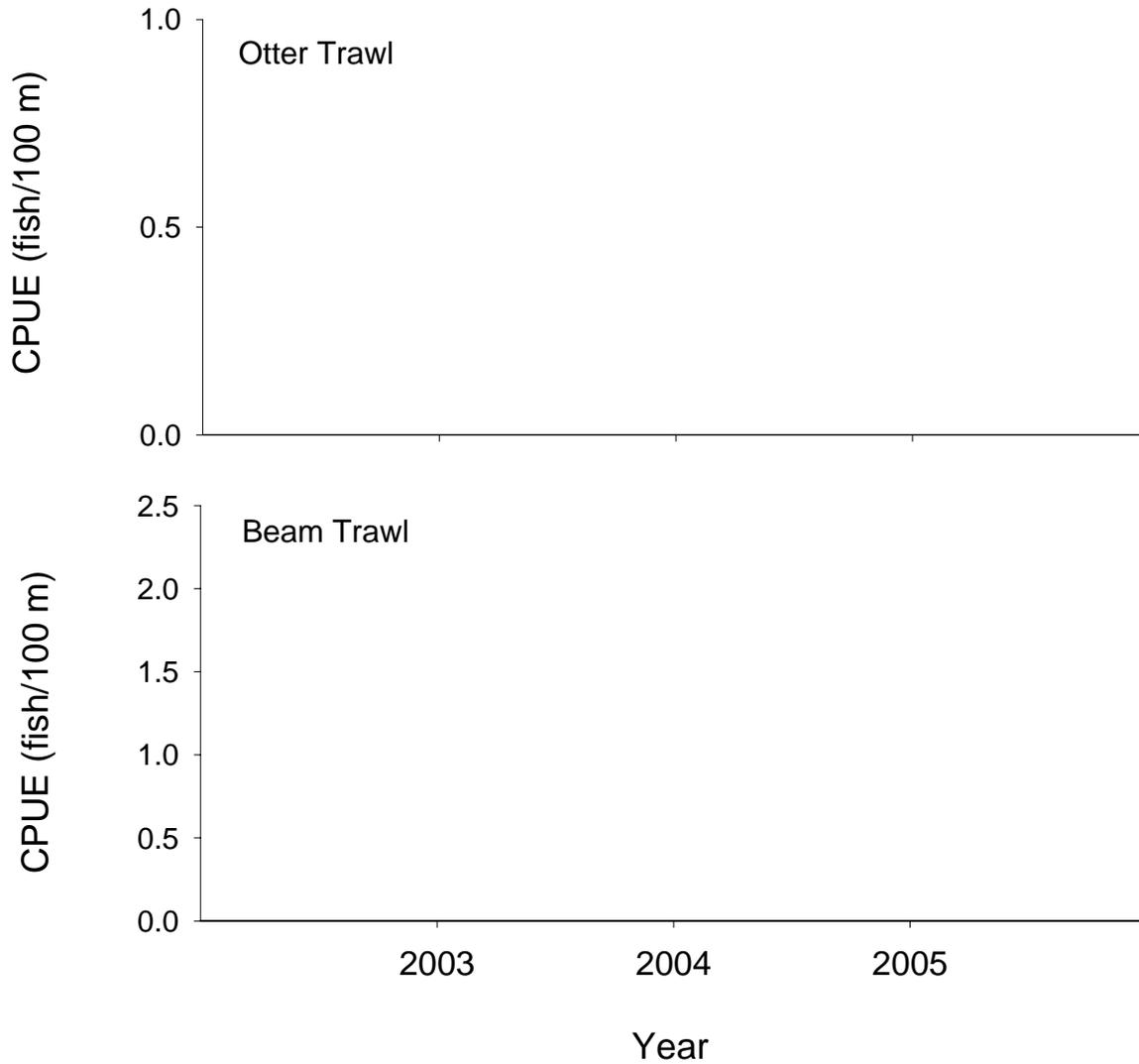


Figure 22. Mean annual catch-per-unit-effort ($\pm 2SE$) of sicklefin chub for otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sicklefin Chub / Fish Community Season

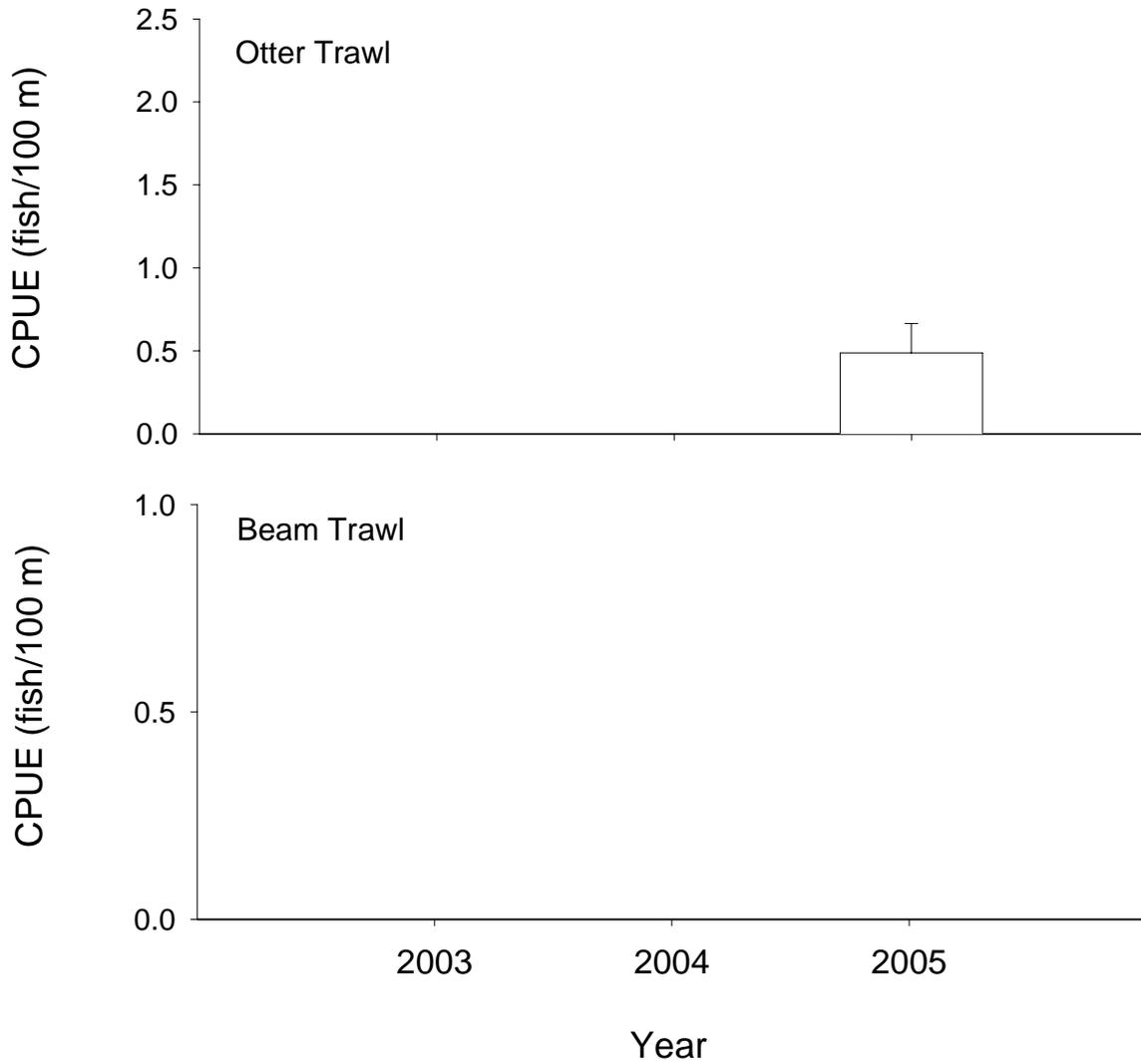


Figure 23. Mean annual catch-per-unit-effort (\pm 2SE) of sicklefin chub for otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Sicklefin Chub / Fish Community Season

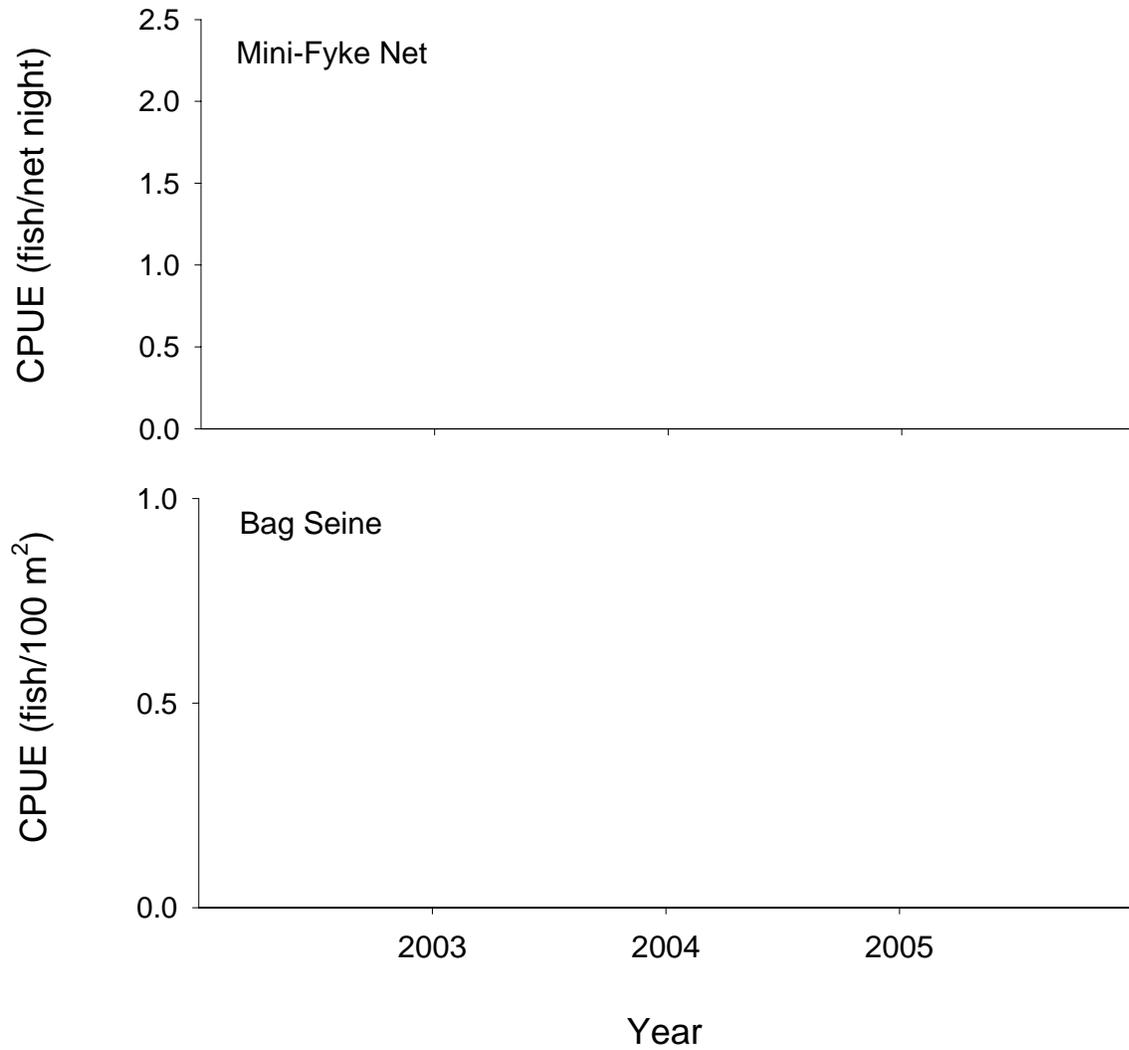


Figure 24. Mean annual catch-per-unit-effort (\pm 2SE) of sicklefin chub for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
2.5 Inch Trammel Net															
Gill Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	130	N-E	45		N-E	N-E	55	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	130	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

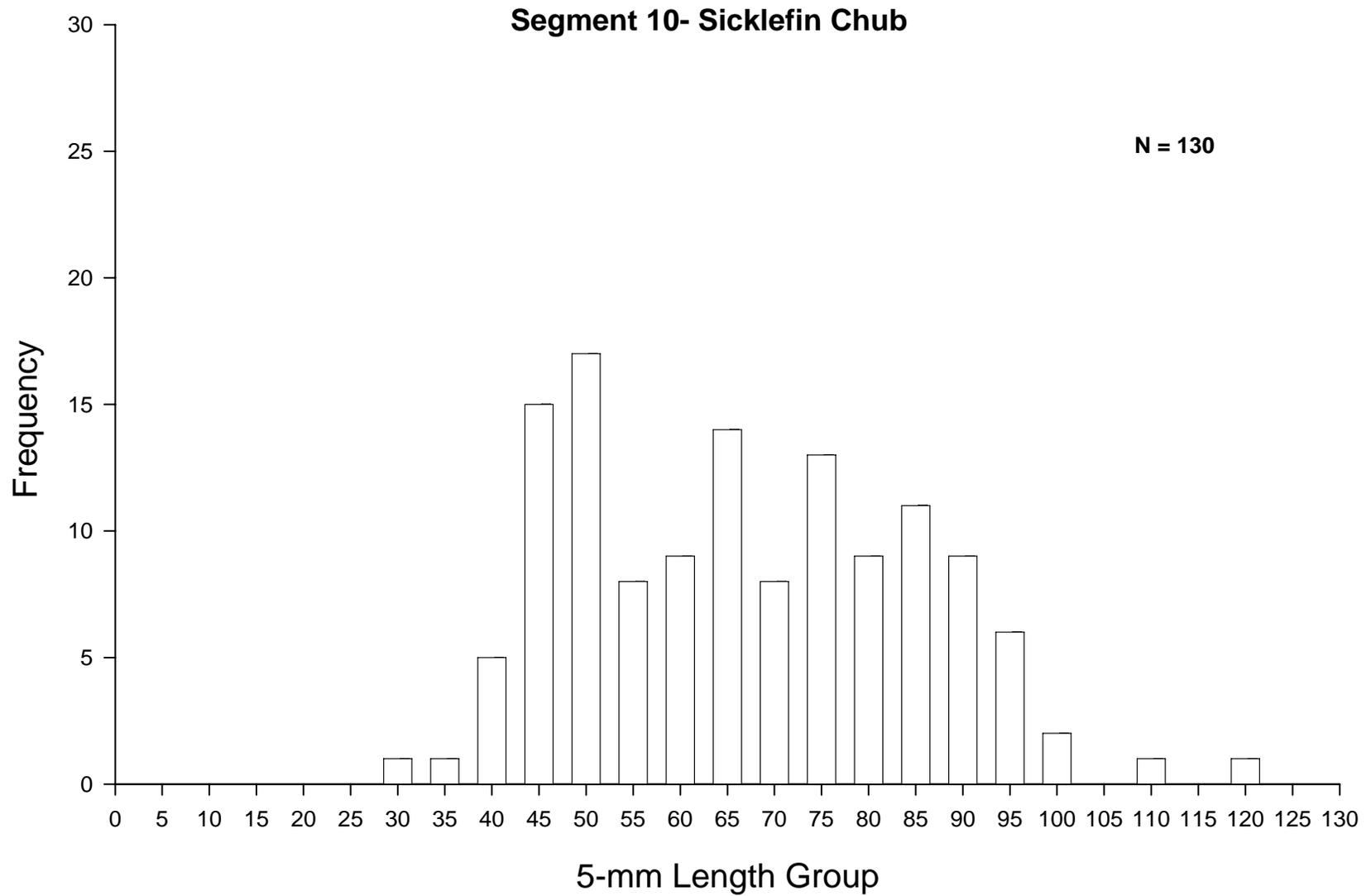


Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004 - 2005.

Speckled Chub

Speckled chubs were the only *Macrhybopsis* species captured by multiple gear types (otter trawls and mini-fyke nets) during the 2005 fish community season. A total of 99 speckled chubs was captured and total length ranged from 23 to 94 mm (mean = 42 mm). Otter trawls captured 75% (N = 75; mean CPUE = 0.295 fish/100 m; Figure 27) of speckled chubs while mini-fyke nets accounted for 25% of the catch (N = 25; mean CPUE = 0.247 fish/net night; Figure 28). In contrast to sicklefin chubs, otter trawls captured more speckled chubs from the inside bend (N = 65) than expected (N = 53) given the amount of effort expended in this macrohabitat ($\chi^2 = 8.94$; $df = 1$; $P = 0.003$; Table 30). Speckled chub catch in mini-fyke nets was approximately proportional to the amount of effort expended in each macrohabitat (CHXO, ISB, OSB; Table 30). 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.

Segment 10 - Speckled Chub / Sturgeon Season

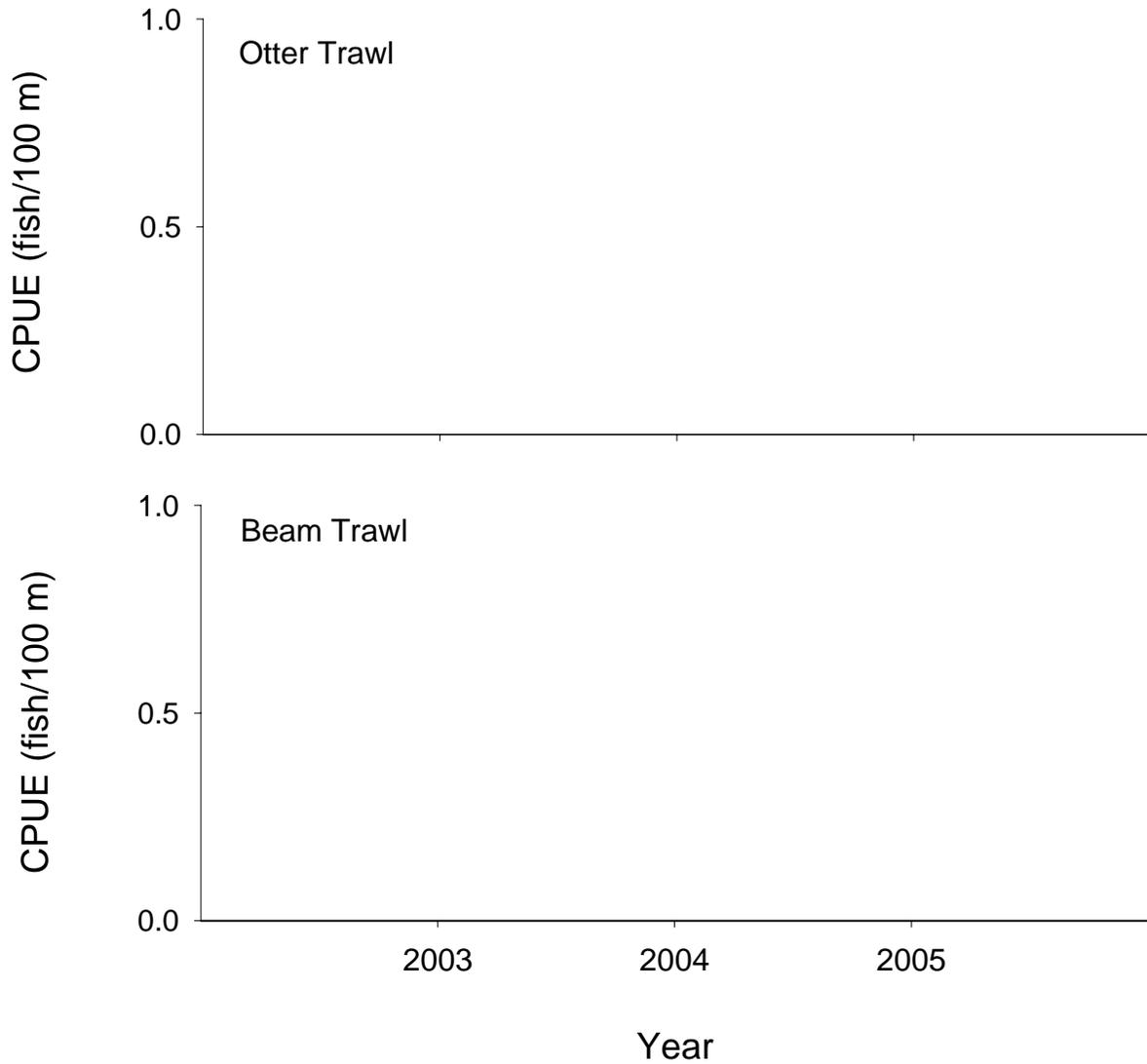


Figure 26. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub for otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Speckled Chub / Fish Community Season

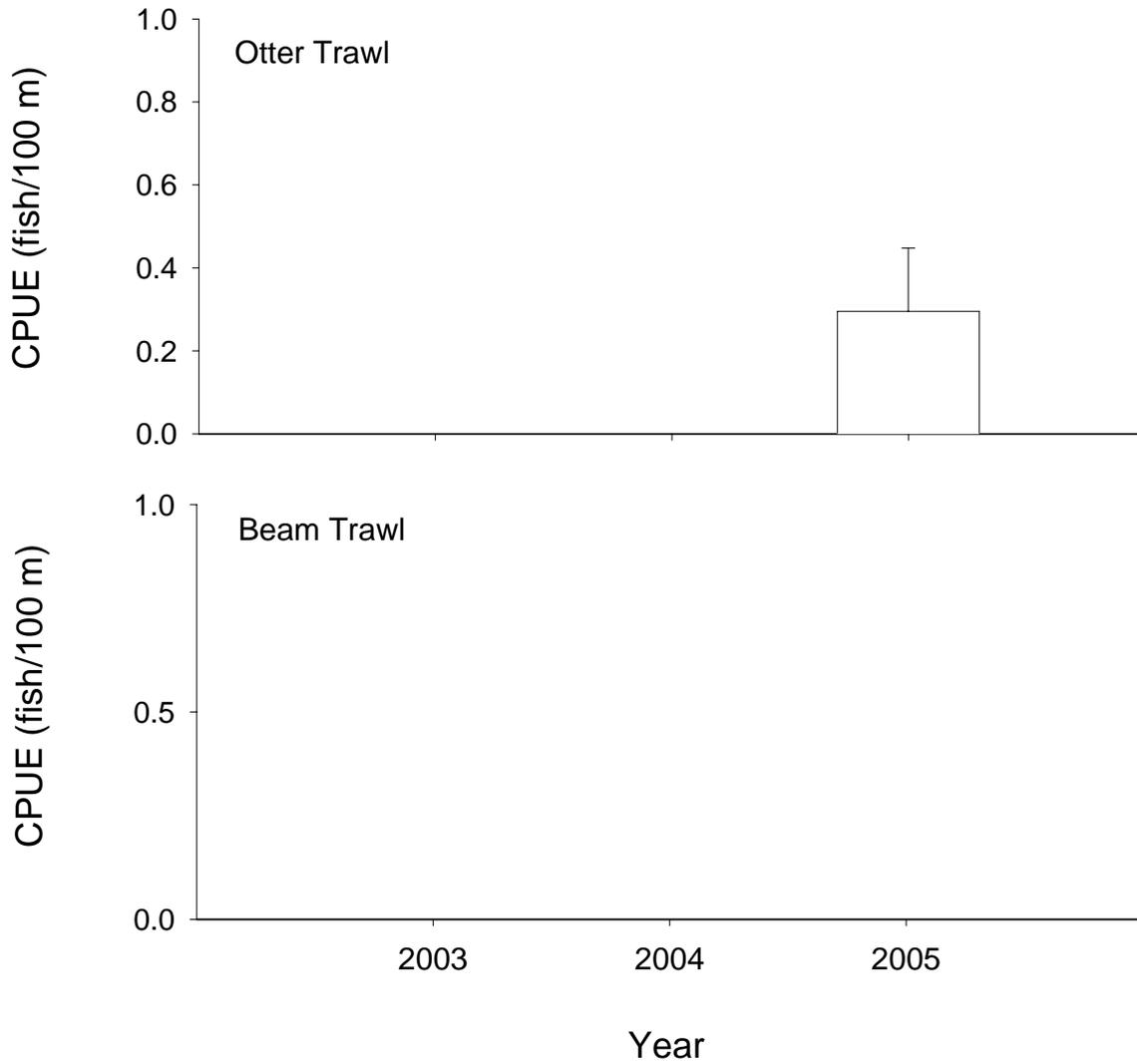


Figure 27. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub for otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Speckled Chub / Fish Community Season

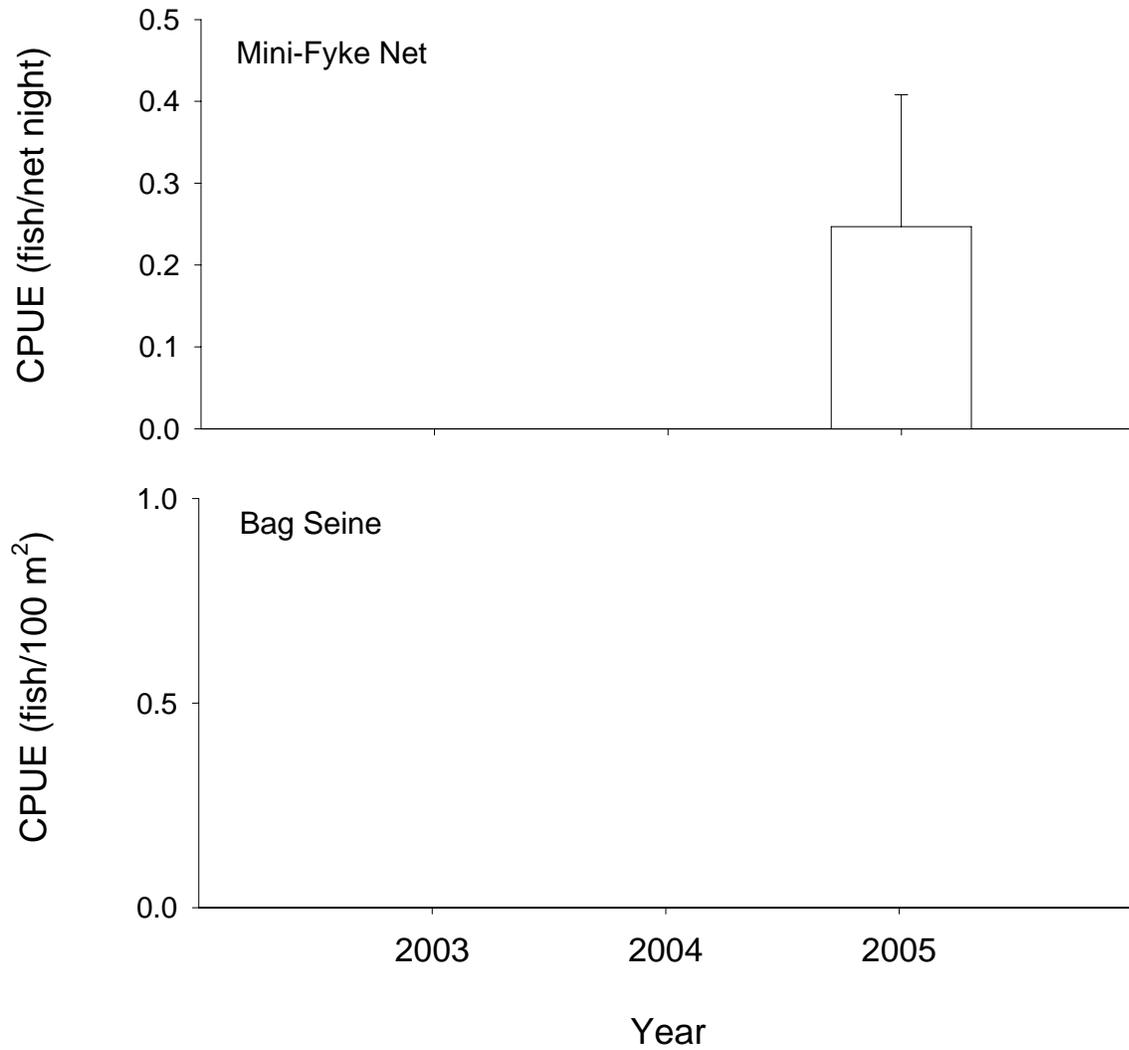


Figure 28. Mean annual catch-per-unit-effort (\pm 2SE) of speckled chub for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
2.5 Inch Trammel Net															
Beam Trawl															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	24	N-E	42		N-E	N-E	50	8	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	75	N-E	13		N-E	N-E	87	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	24	100	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	75	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

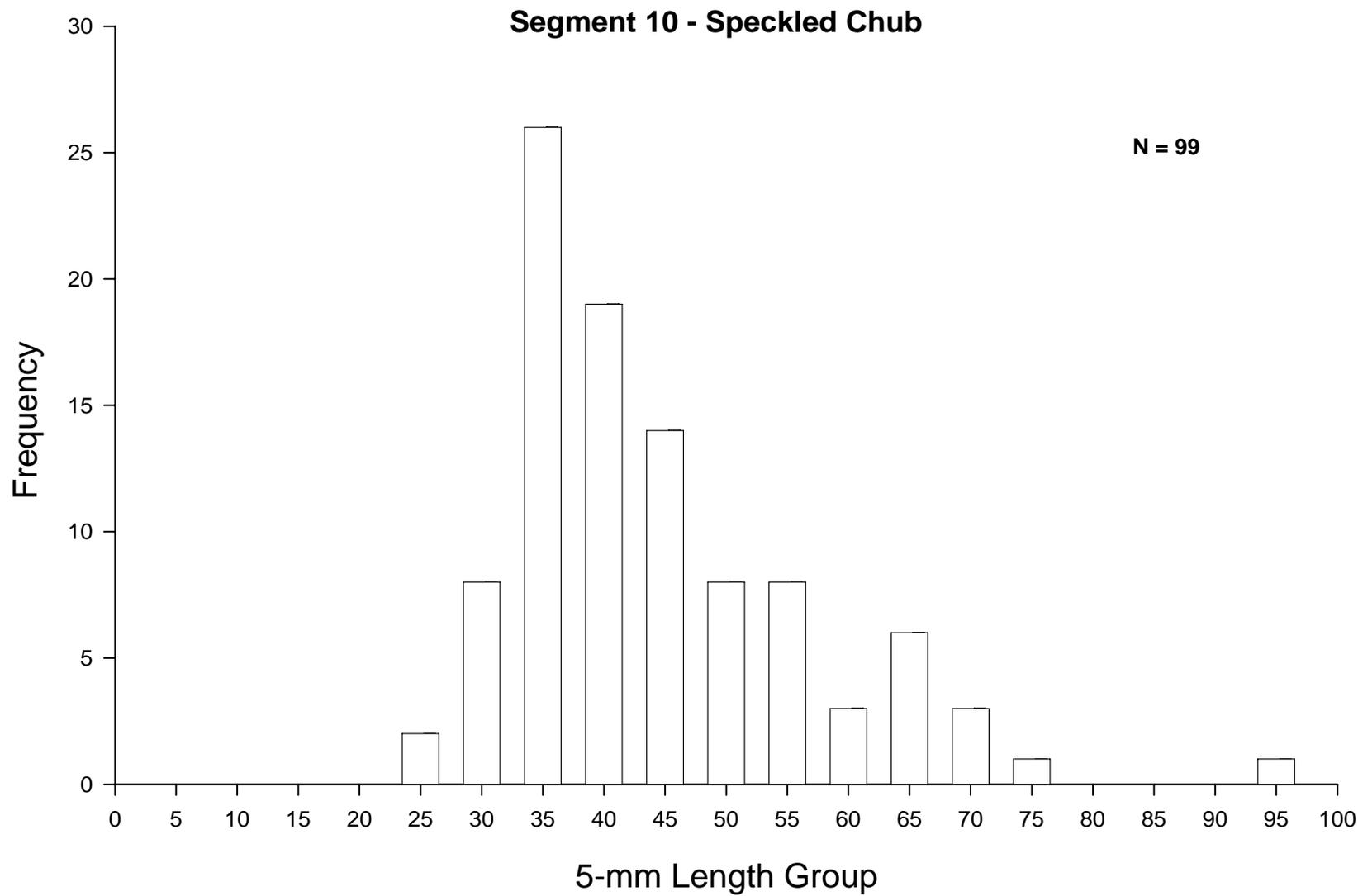


Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004 - 2005.

Sand Shiner

Sand shiners (N = 63) were captured using mini-fyke nets, bag seines, and otter trawls. Bag seines caught the greatest number of sand shiners (N = 43; mean CPUE = 0.652 fish/100 m²; Figure 32) followed by mini-fyke nets (N = 17; mean CPUE = 0.175 fish/net night; Figure 32) and otter trawls (N = 3; mean CPUE = 0.015; Figure 31). Total length of sand shiners ranged from 25 to 52 mm (mean = 40). Sand shiners captured with bag seines in BARS mesohabitats from the inside bend were captured in greater number (N = 37) than expected (N = 27) given the effort expended in that macrohabitat ($\chi^2 = 10.81$; $df = 2$; $P = 0.004$; Table 32). Similarly, 88% of sand shiners captured with mini-fyke nets were caught on the inside bend while only 56% of effort for this gear type occurred in this macrohabitat ($\chi^2 = 6.52$; $df = 2$; $P = 0.038$; Table 32). Only three sand shiners were caught in CHNB mesohabitats using otter trawls.

Segment 10 - Sand Shiner / Sturgeon Season

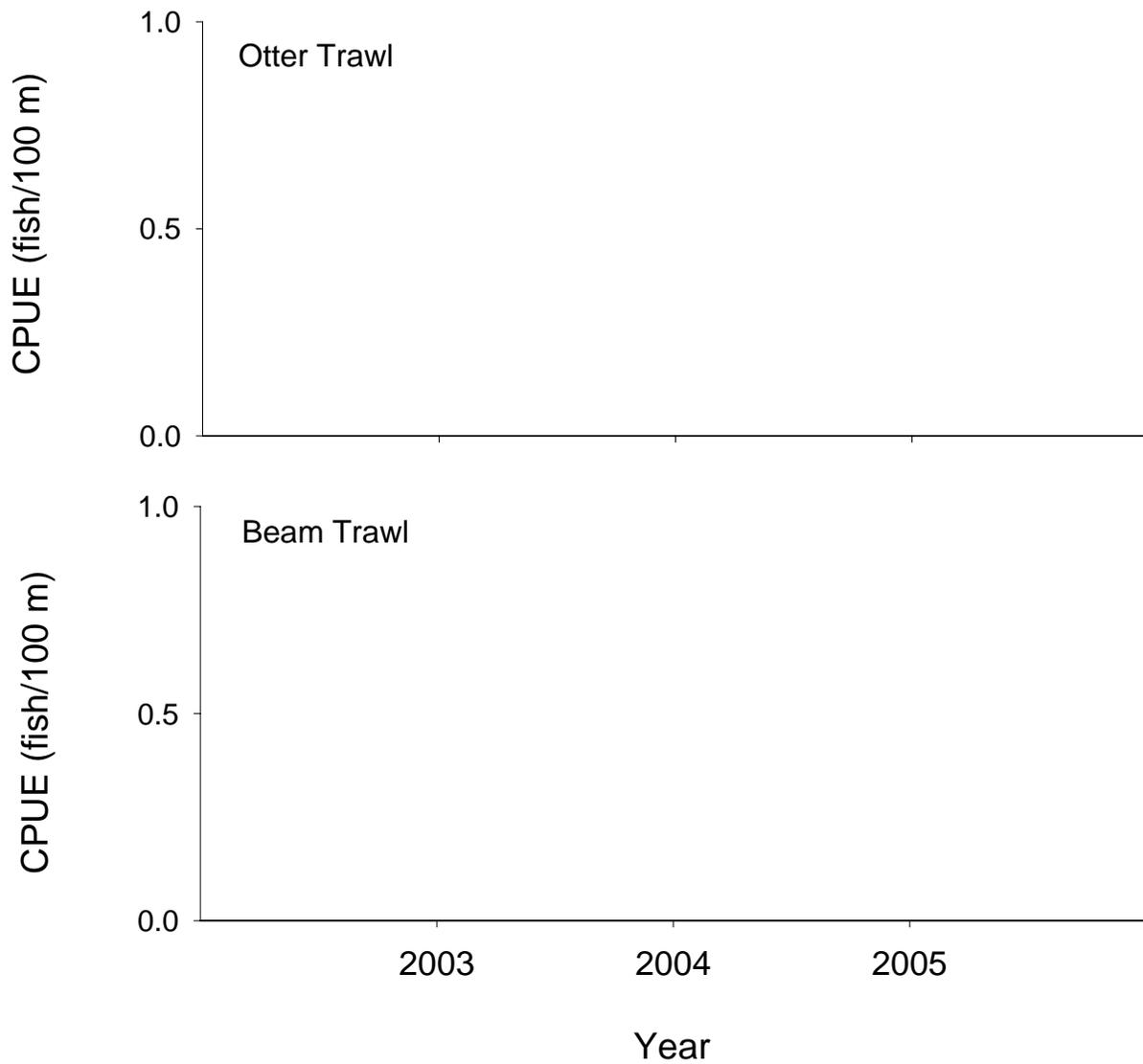


Figure 30. Mean annual catch-per-unit-effort (\pm 2SE) of sand shiner for otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sand Shiner / Fish Community Season

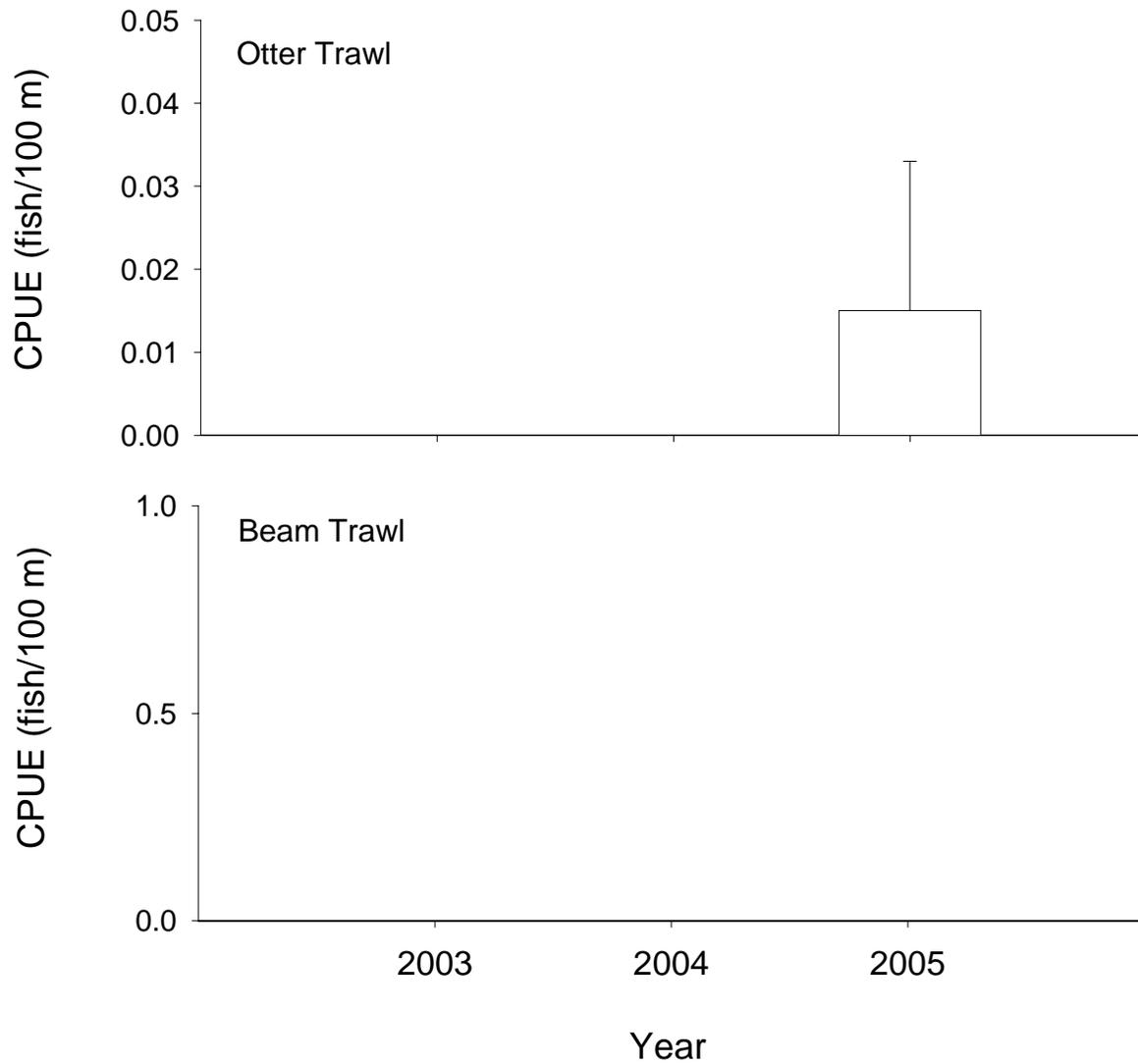


Figure 31. Mean annual catch-per-unit-effort (\pm 2SE) of sand shiner for otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Sand Shiner / Fish Community Season

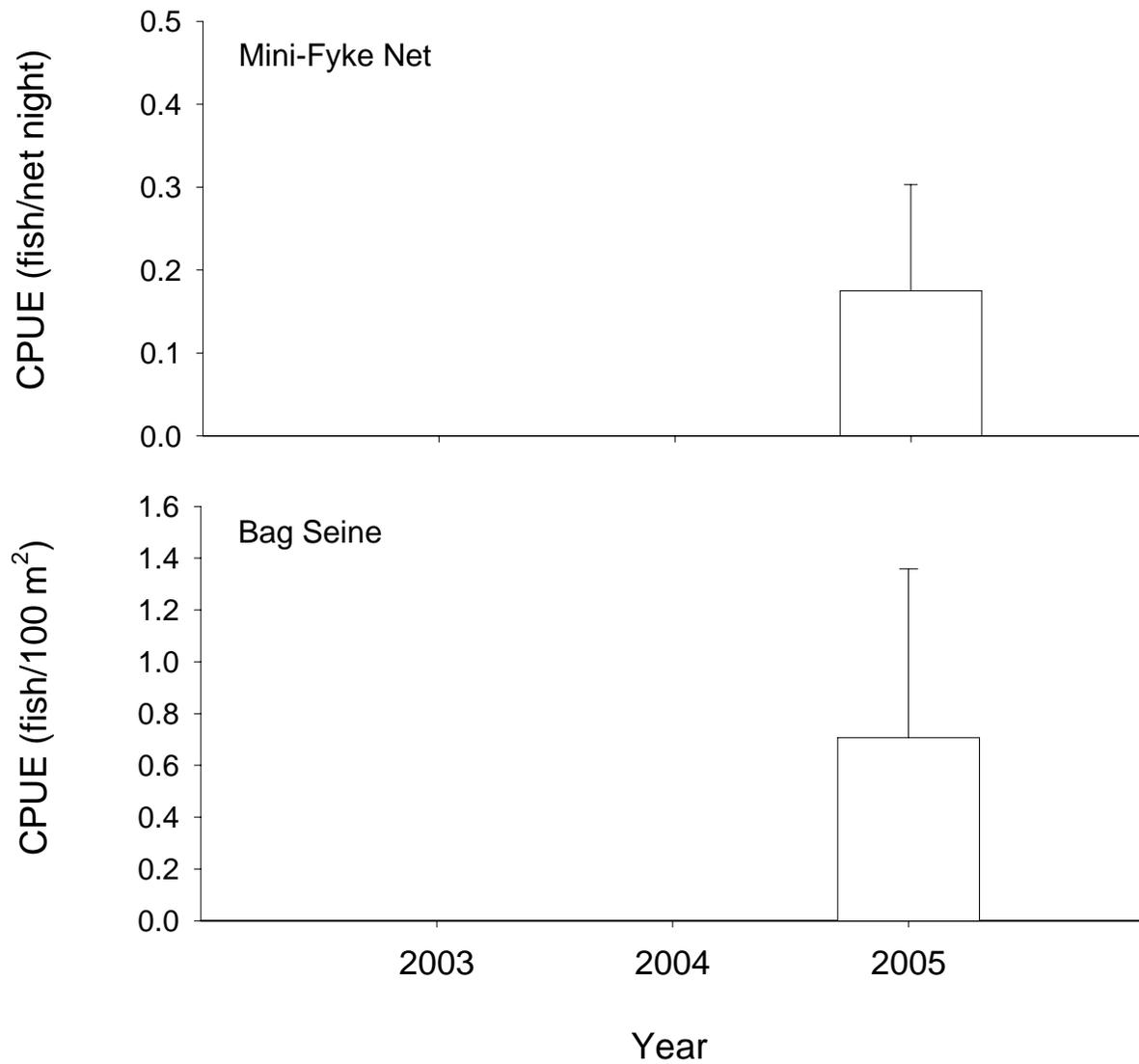


Figure 32. Mean annual catch-per-unit-effort (\pm 2SE) of sand shiner for mini-fyke and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
Bag Seine															
Mini-Fyke Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	43	N-E	14		N-E	N-E	86	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	17	N-E	12		N-E	N-E	88	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	3	N-E	33		N-E	N-E	67	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	43	100	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	17	100	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	3	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

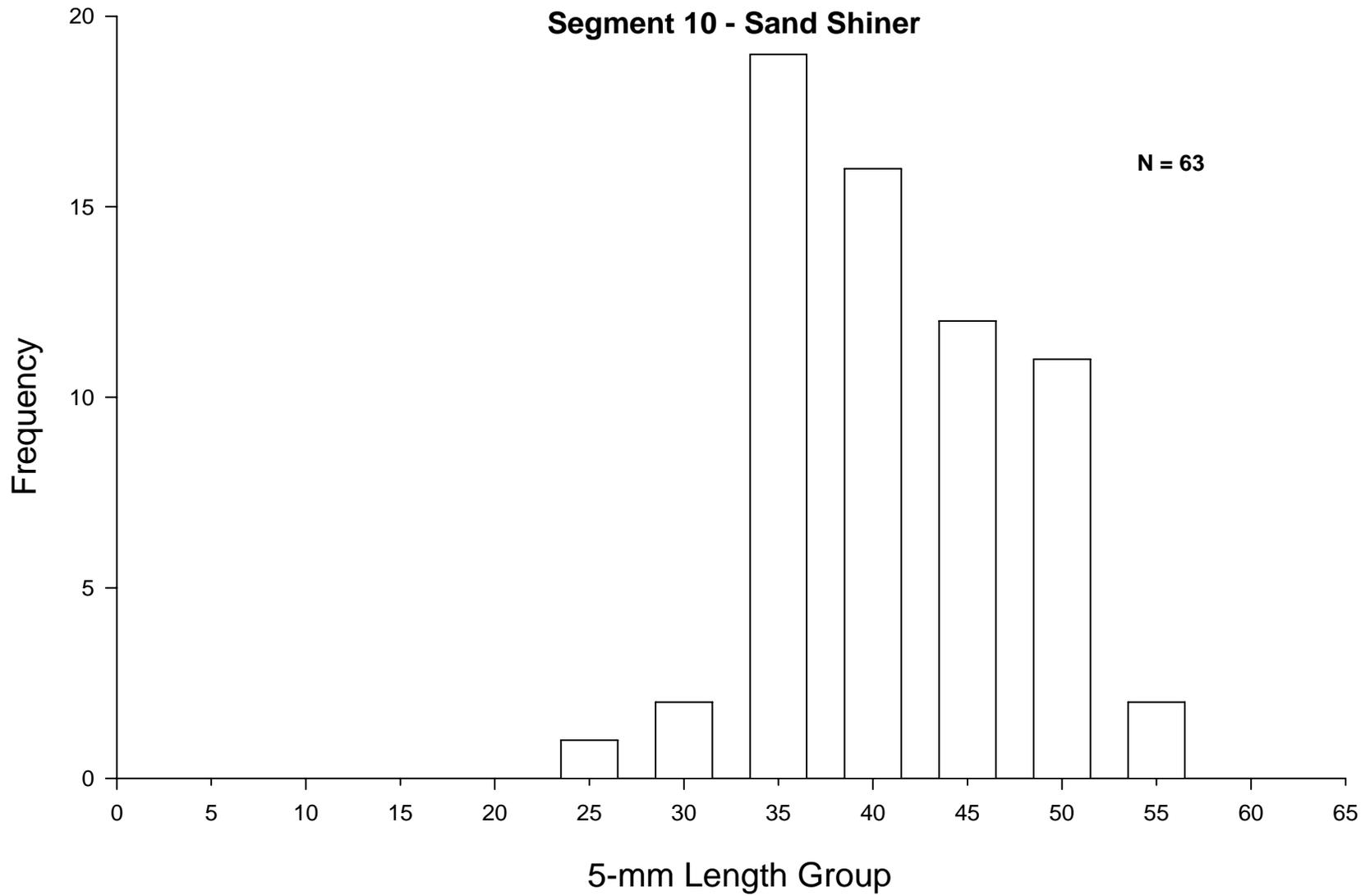


Figure 33. Length frequency of sand shiners in segment 10 of the Missouri River during summer (fish community season) 2004-2005.

***Hybognathus* spp.**

Hybognathus spp. were the least common (N = 8) cyprinid target species in segment 10 during the 2005 fish community season. Total length ranged from 44 to 52 mm (Figure 37). All *Hybognathus* spp. were captured in BARS mesohabitats within inside bend and channel crossover macrohabitats (Tables 34, 35). Bag seines captured seven fish (mean CPUE = 0.127 fish/100 m²) and only one fish was captured using mini-fyke nets (mean CPUE = 0.01 fish/net night; Figure 36).

Segment 10 - *Hybognathus* spp. / Sturgeon Season

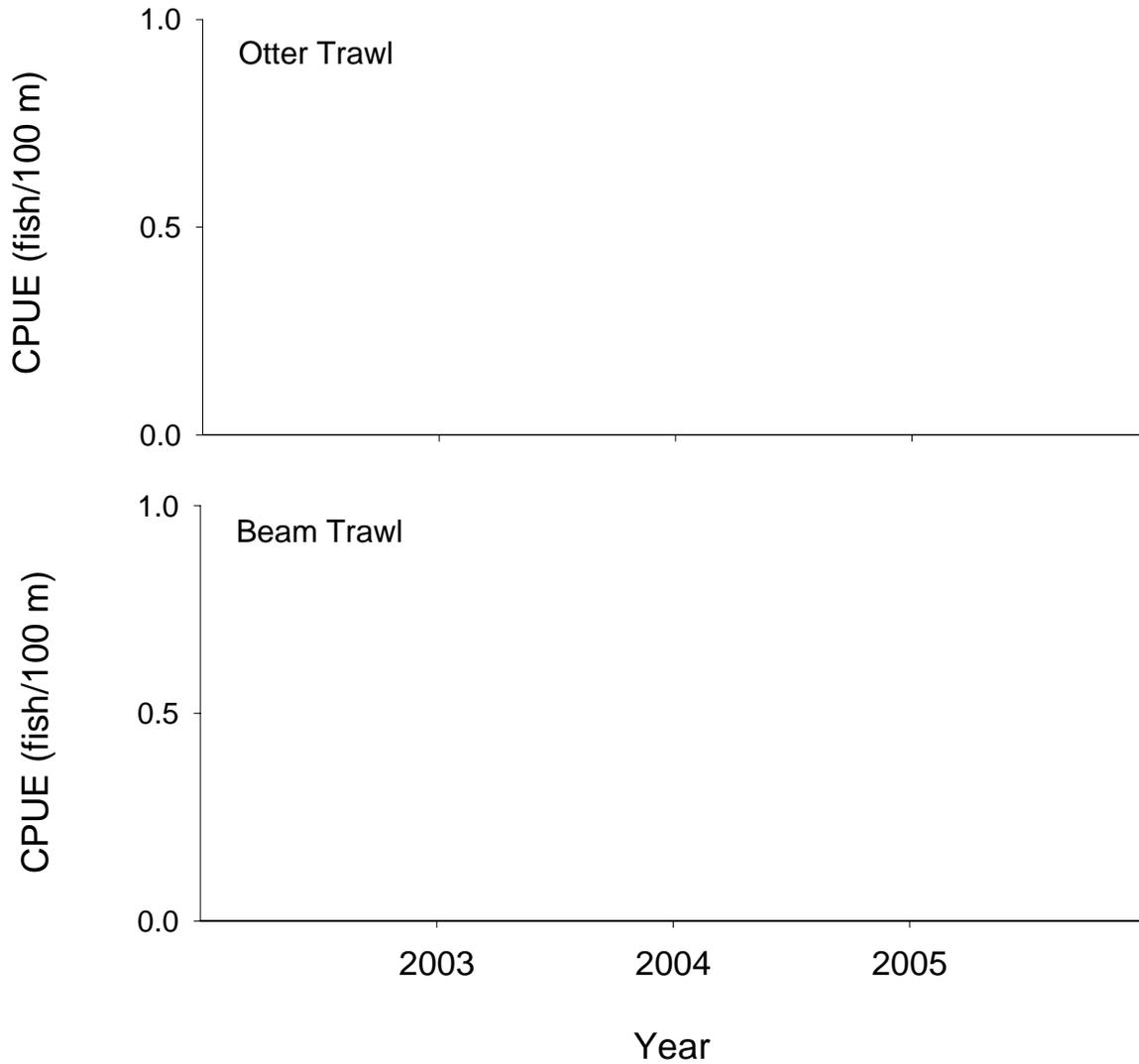


Figure 34. Mean annual catch-per-unit-effort (\pm 2SE) of *Hybognathus* spp. for otter trawls and beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

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

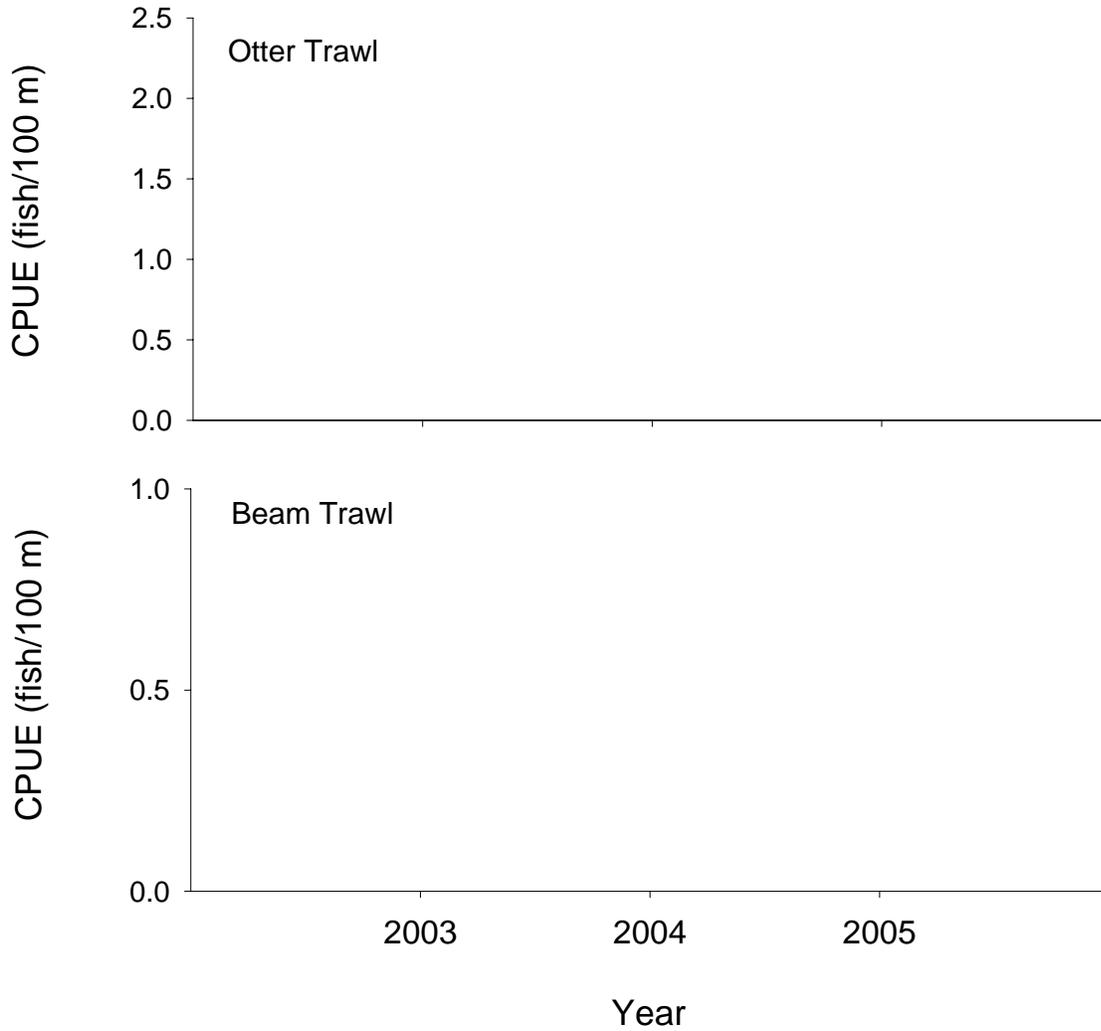


Figure 35. Mean annual catch-per-unit-effort (\pm 2SE) of *Hybognathus* spp. for otter trawls and beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

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

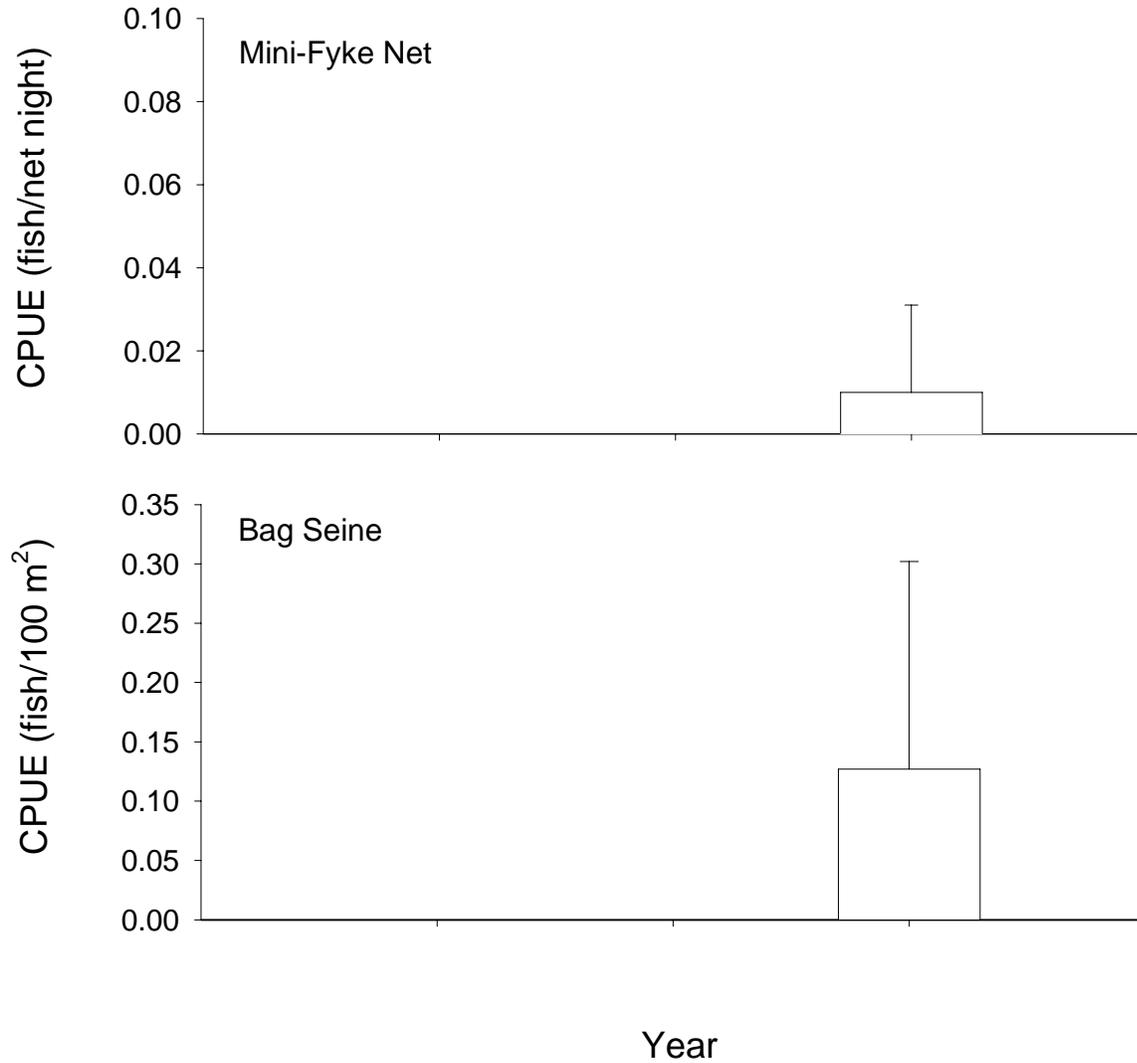


Figure 36. Mean annual catch-per-unit-effort ($\pm 2SE$) of *Hybognathus* spp. for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 10 of the Missouri River during 2004-2005. 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															
Bag Seine															
Mini-Fyke Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	7	N-E	43		N-E	N-E	57	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	1	N-E	0		N-E	N-E	100	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	0	N-E	0		N-E	N-E	0	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 10 of the Missouri River during 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	7	100	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	1	100	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	0	0	0	N-E	0		
		0	100	N-E	0		
Beam Trawl							

Segment 10 - *Hybognathus* spp.

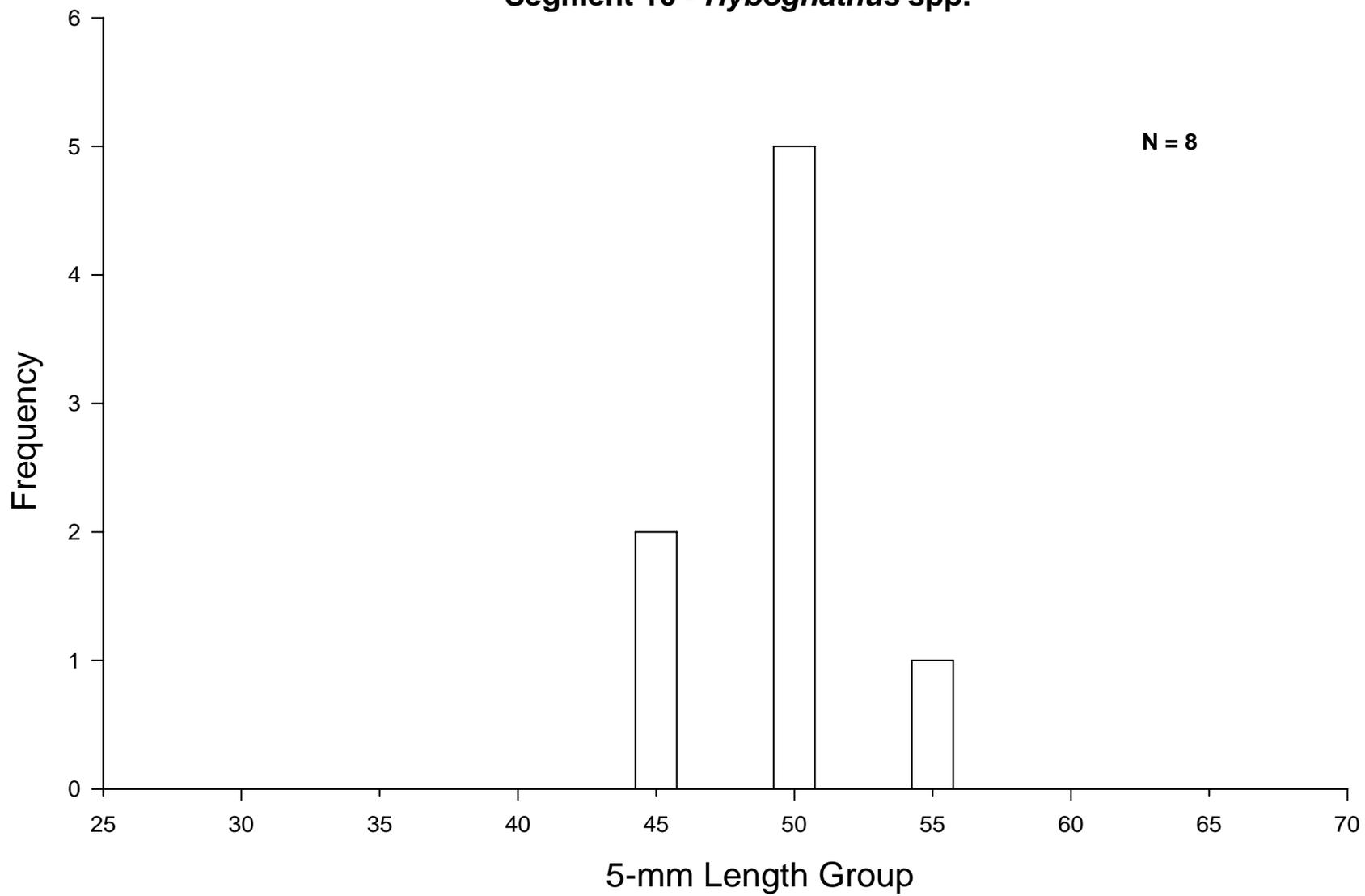


Figure 37. Length frequency of *Hybognathus* spp. caught in segment 10 of the Missouri River during summer (fish community season) 2004-2005.

Blue Sucker

Thirteen blue suckers were captured using 1-inch trammel nets (N = 10; mean CPUE = 0.053 fish/100 m) and otter trawls (N = 3; mean CPUE = 0.016 fish/100 m) during the 2005 fish community season (Figure 41). Bag seines and mini-fyke nets did not capture any blue suckers. Total length of blue suckers ranged from 494 to 722 mm (mean TL = 635 mm; Figure 44). All blue suckers were captured in channel crossover and inside bend macrohabitats in CHNB mesohabitat (Tables 36, 37).

Segment 10 - Blue Sucker / Sturgeon Season

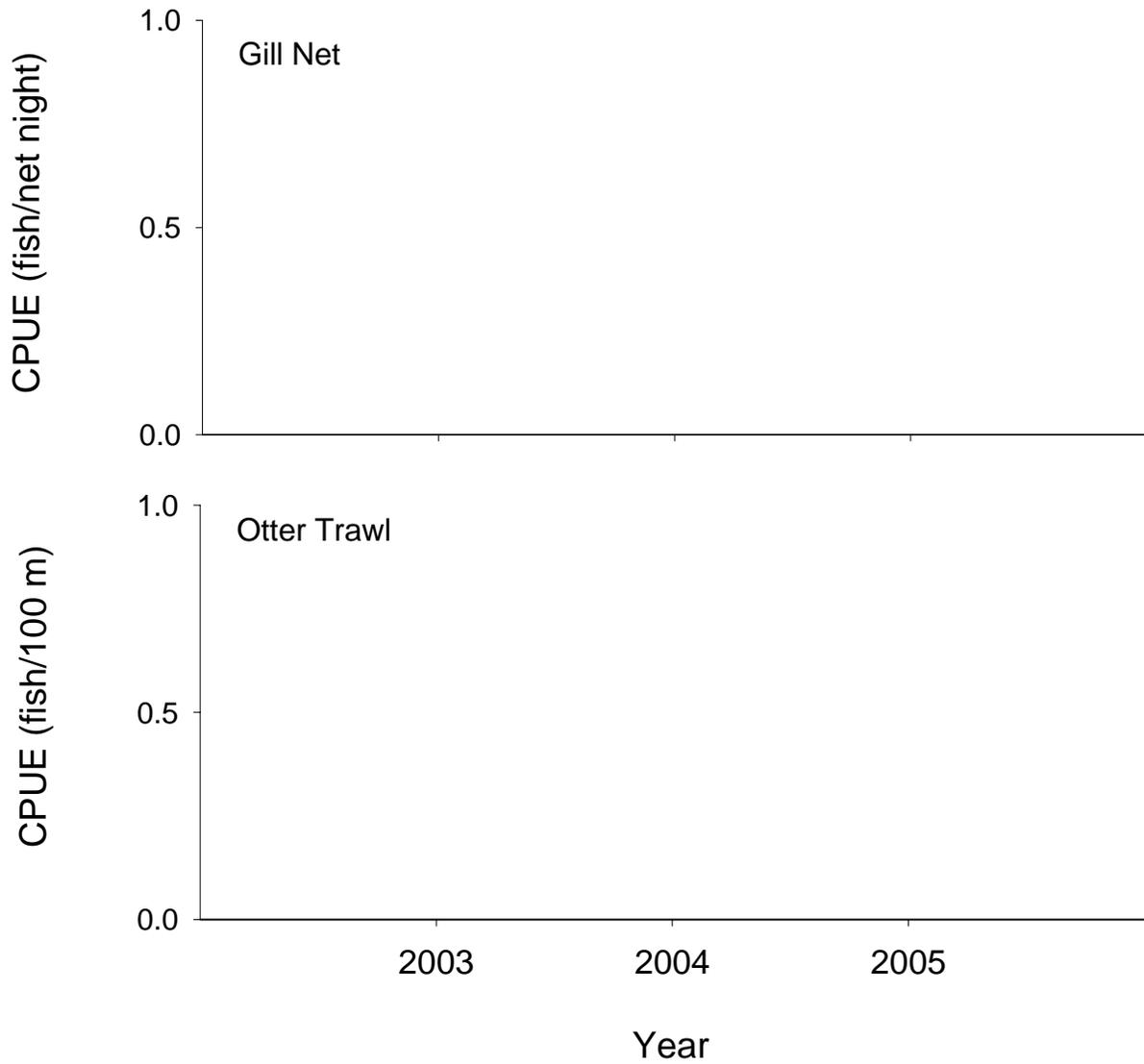


Figure 38. Mean annual catch-per-unit-effort (\pm 2SE) of blue sucker for gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Blue Sucker / Sturgeon Season

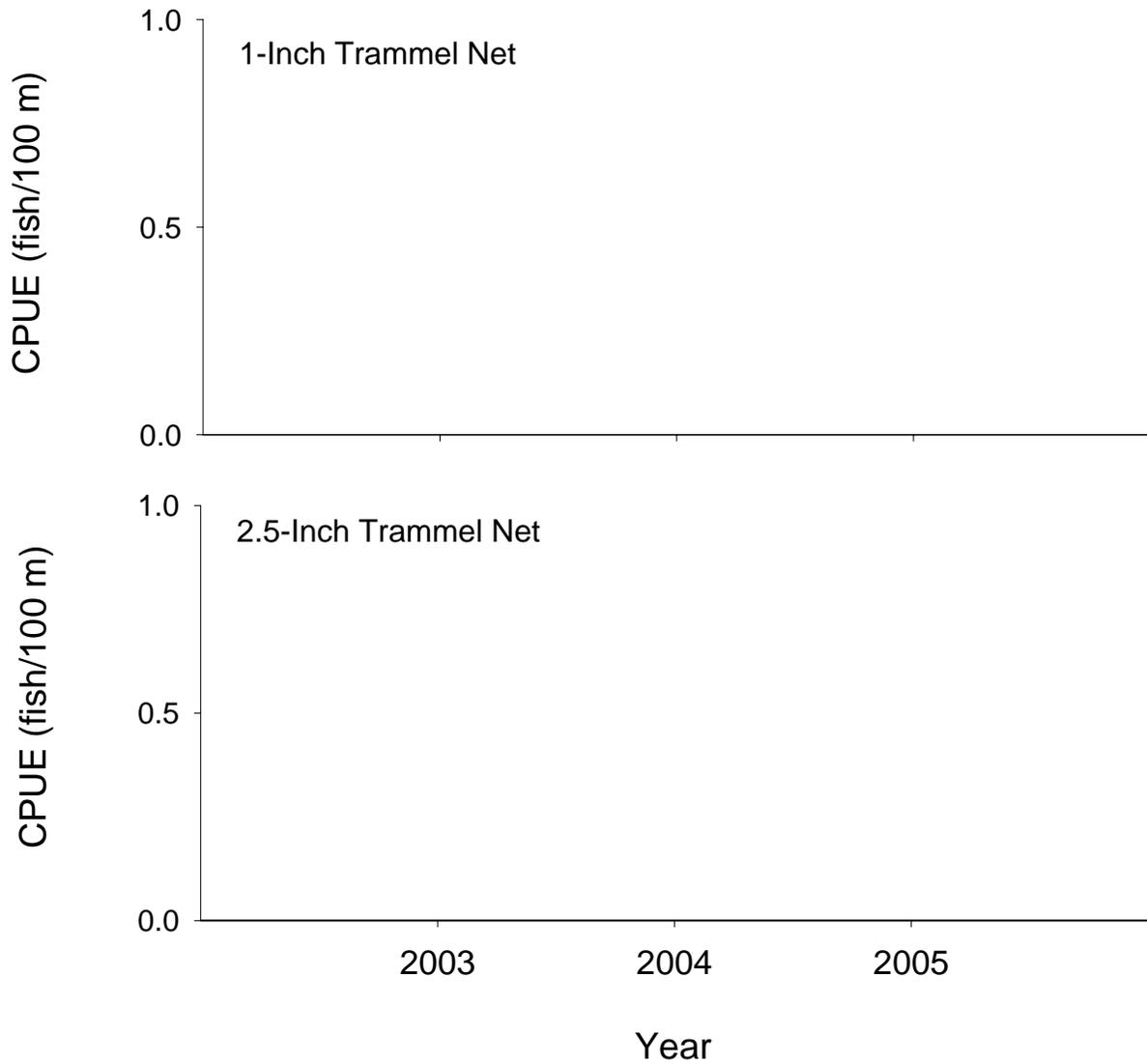


Figure 39. Mean annual catch-per-unit-effort (\pm 2SE) of blue sucker for 1- and 2.5-inch trammel nets in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Blue Sucker / Sturgeon Season

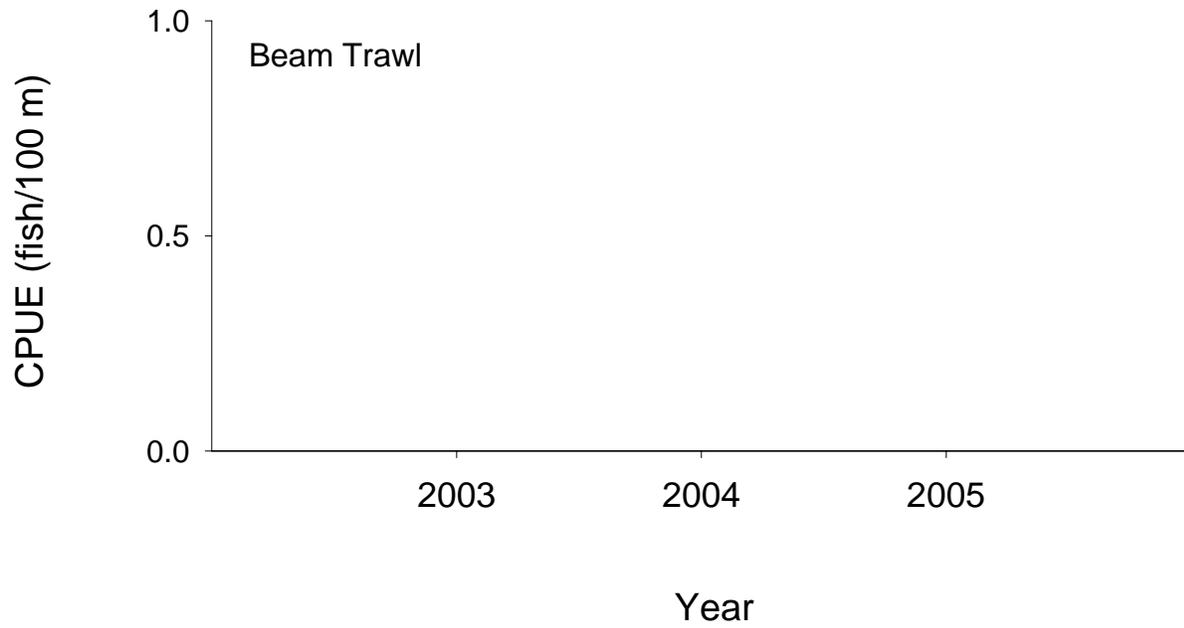


Figure 40. Mean annual catch-per-unit-effort (\pm 2SE) of blue sucker for beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Blue Sucker / Fish Community Season

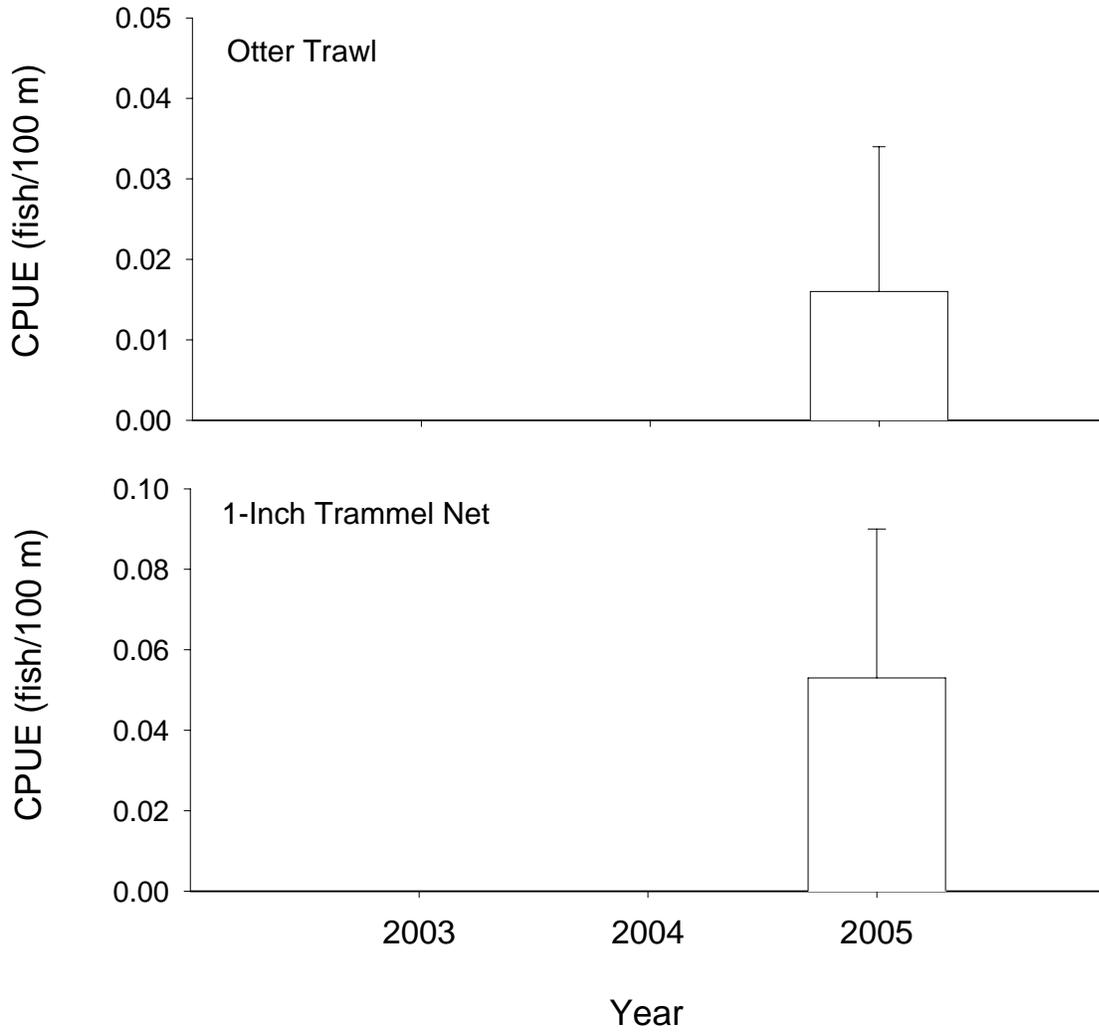


Figure 41. Mean annual catch-per-unit-effort (\pm 2SE) of blue sucker for otter trawls and 1-inch trammel nets in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Blue Sucker / Fish Community Season

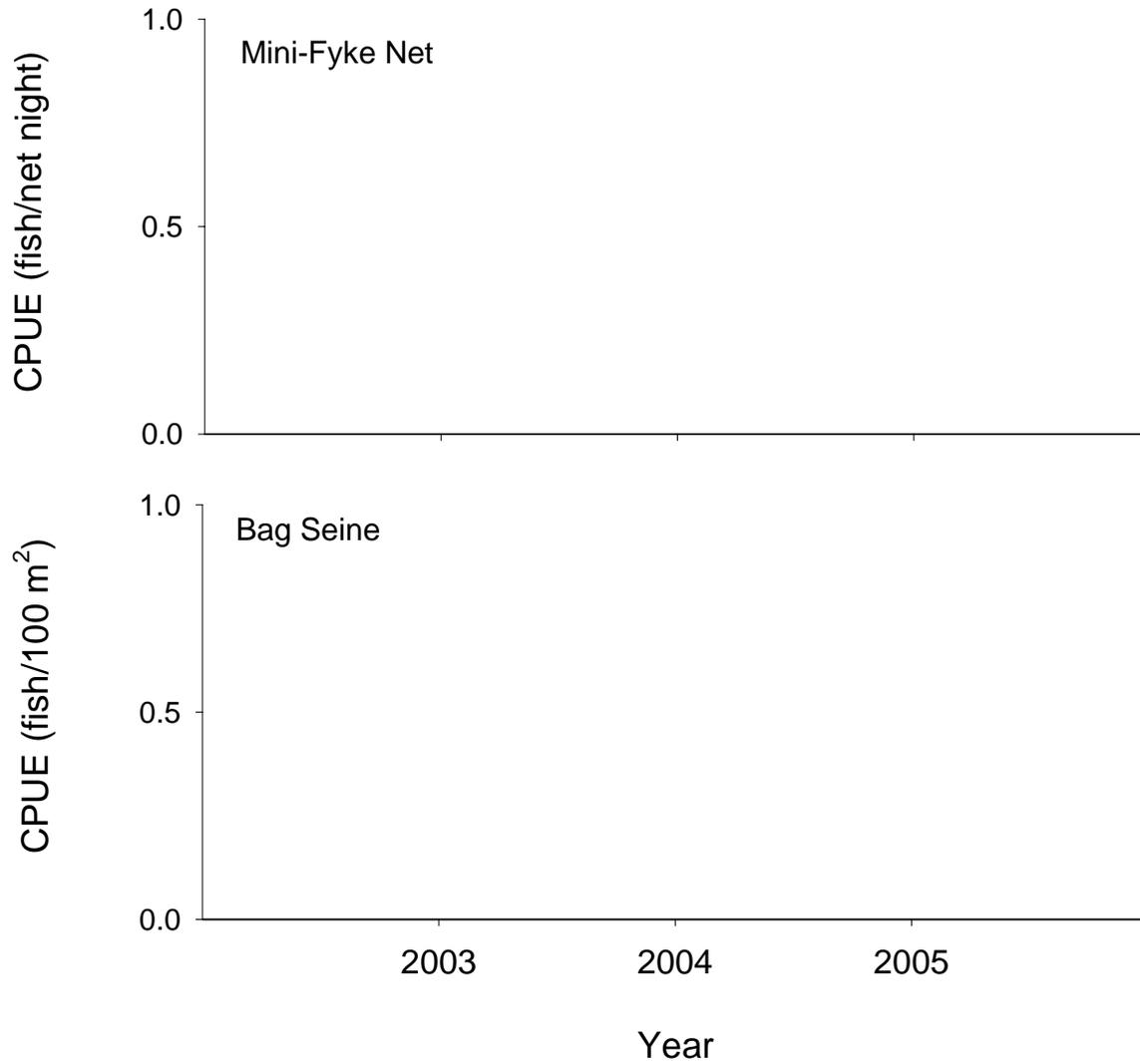


Figure 42. Mean annual catch-per-unit-effort (\pm 2SE) of blue sucker for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Blue Sucker / Fish Community Season

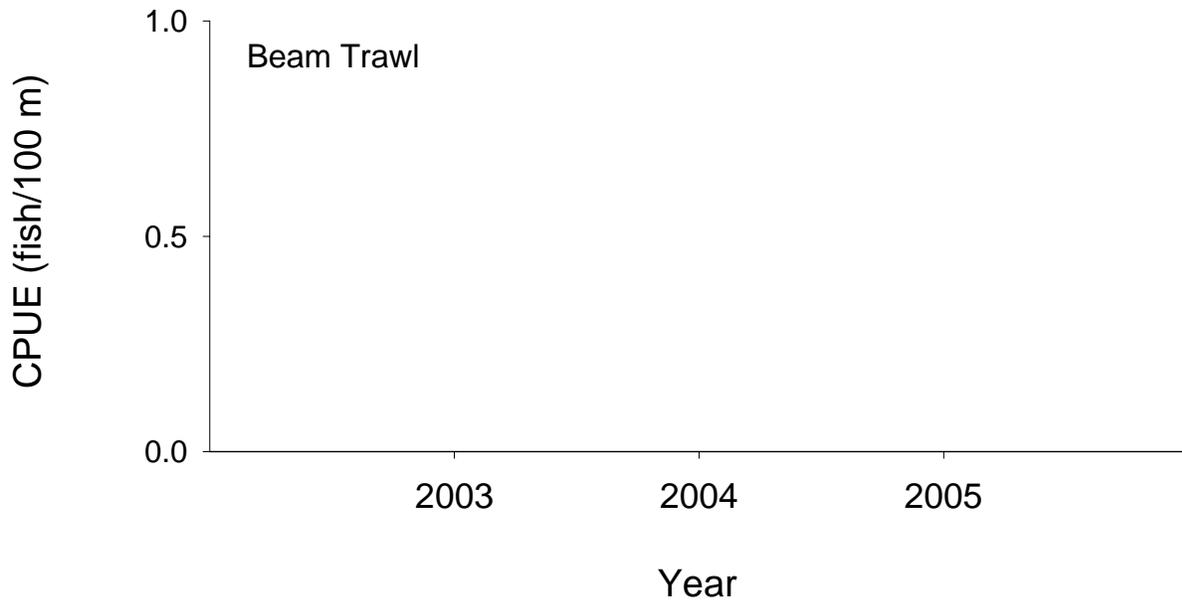


Figure 43. Mean annual catch-per-unit-effort ($\pm 2SE$) of blue sucker for beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
Bag Seine															
Mini-Fyke Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	10	N-E	20		N-E	N-E	80	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	3	N-E	67		N-E	N-E	33	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	10	10	90	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	0	0	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	3	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

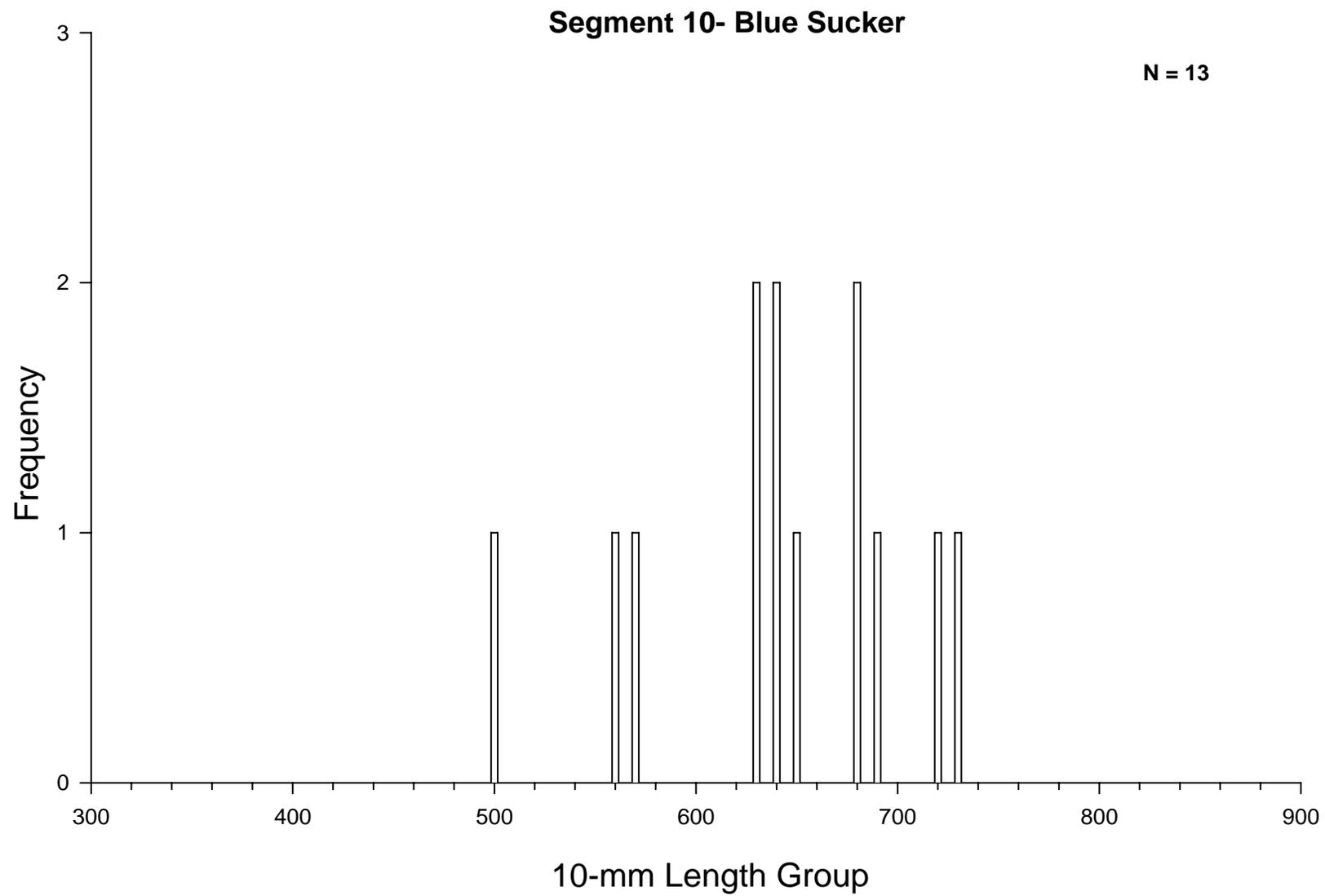


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004 - 2005.

Sauger

Sauger were infrequently sampled ($N = 3$) during the 2005 fish community season. Two individuals (228- and 452-mm TL) were captured in mini-fyke nets in BARS mesohabitats. One fish (TL = 321 mm) was captured with an otter trawl net in the CHNB of the inside bend. Mean CPUE for mini-fyke nets and otter trawls was 0.021 fish/net night and 0.004 fish/100 m, respectively.

Segment 10 - Sauger / Sturgeon Season

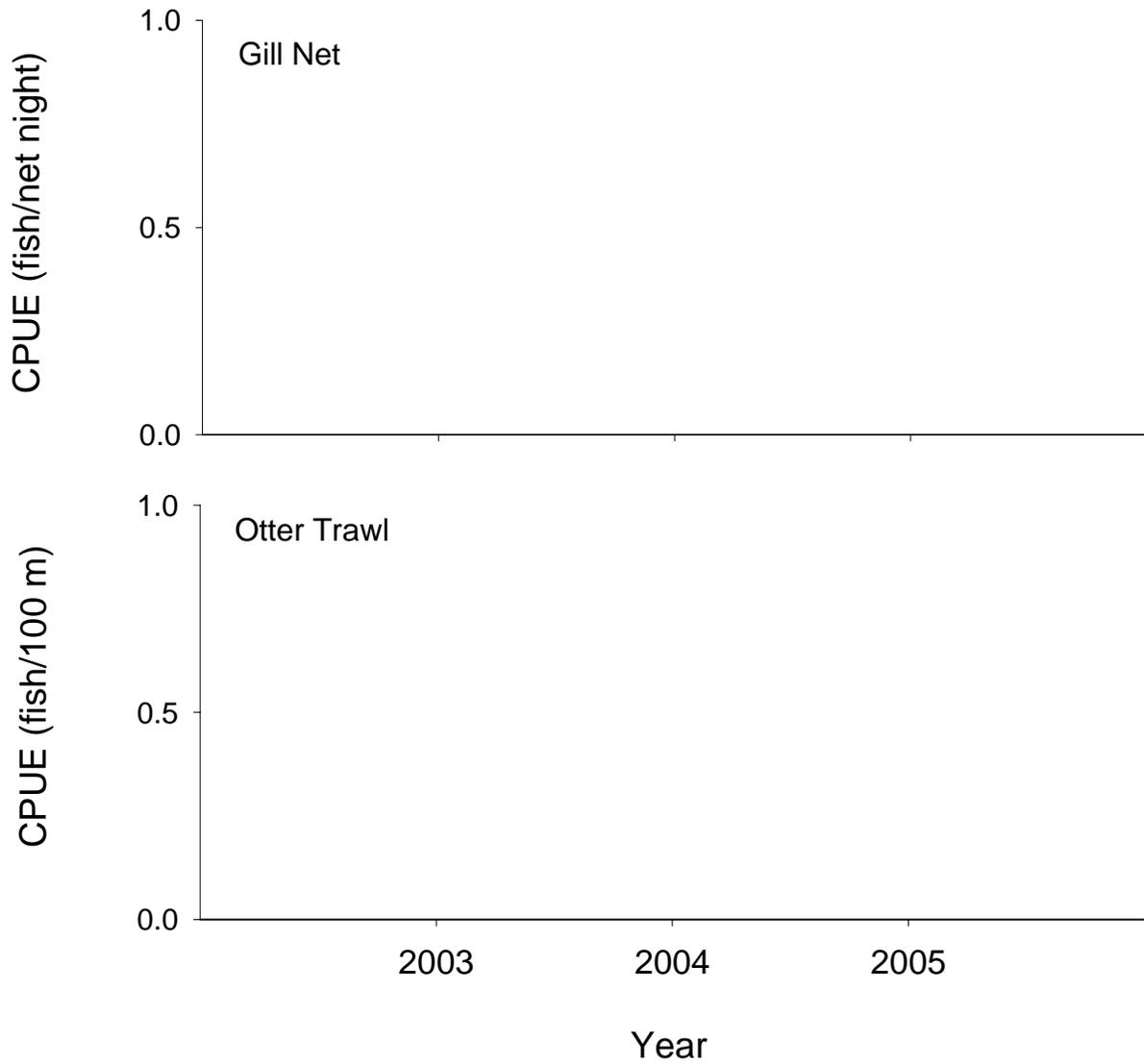


Figure 45. Mean annual catch-per-unit-effort ($\pm 2SE$) of sauger for gill nets and otter trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sauger / Sturgeon Season

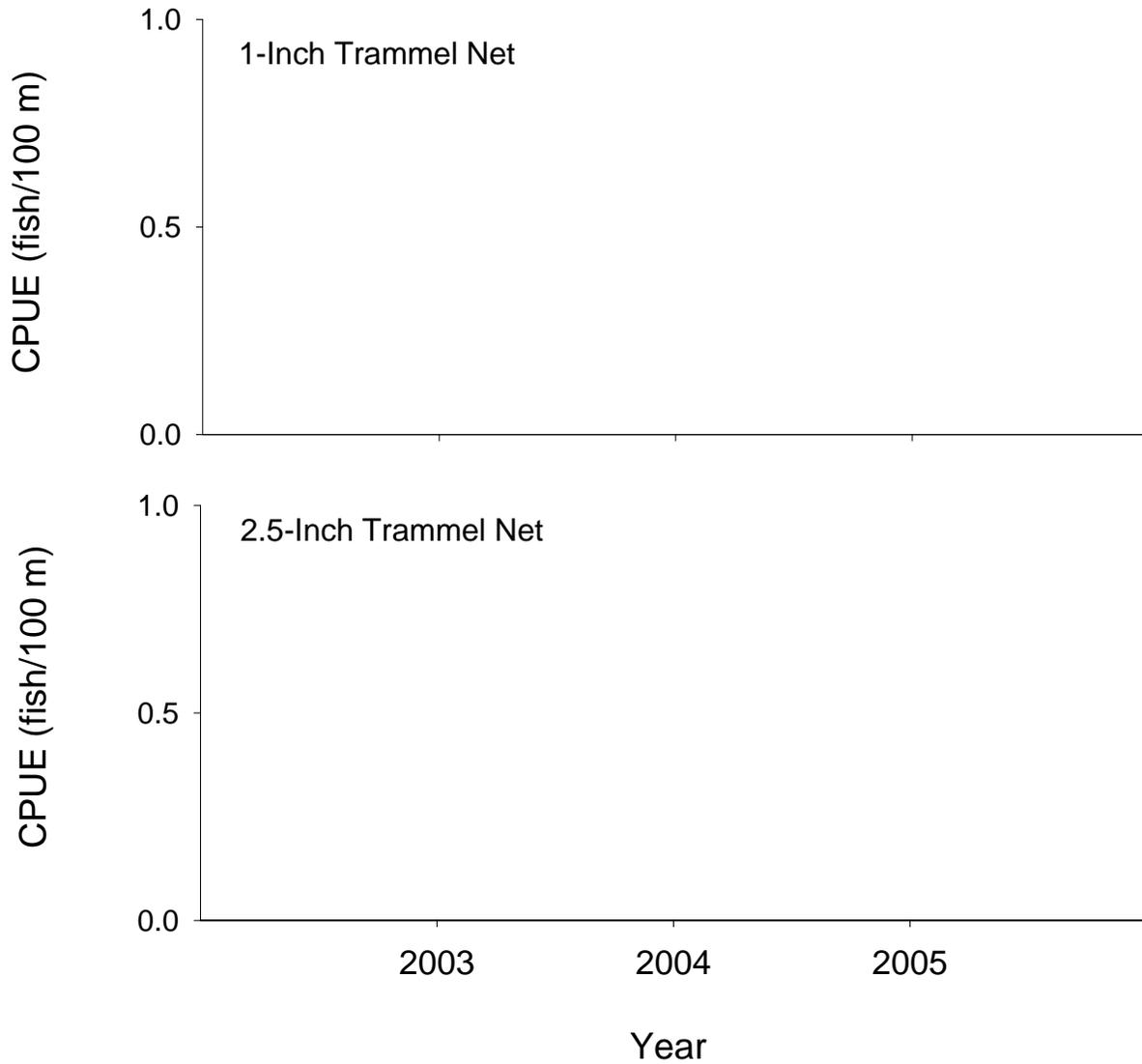


Figure 46. Mean annual catch-per-unit-effort (\pm 2SE) of sauger for 1- and 2.5-inch trammel nets in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sauger / Sturgeon Season

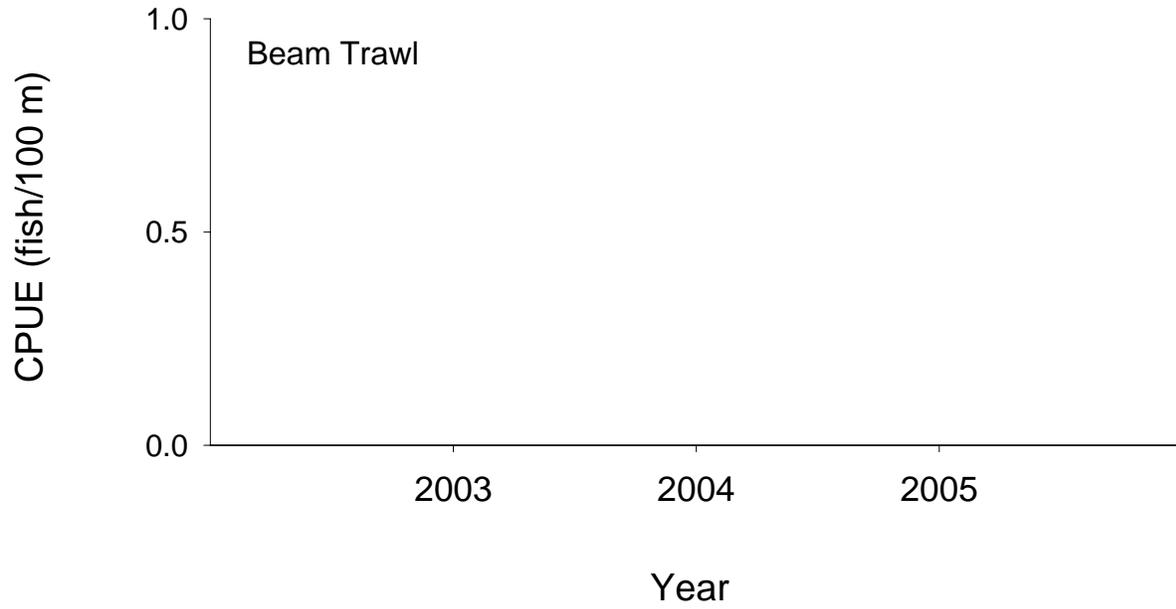


Figure 47. Mean annual catch-per-unit-effort ($\pm 2SE$) of sauger for beam trawls in segment 10 of the Missouri River during sturgeon season 2003-2005.

Segment 10 - Sauger / Fish Community Season

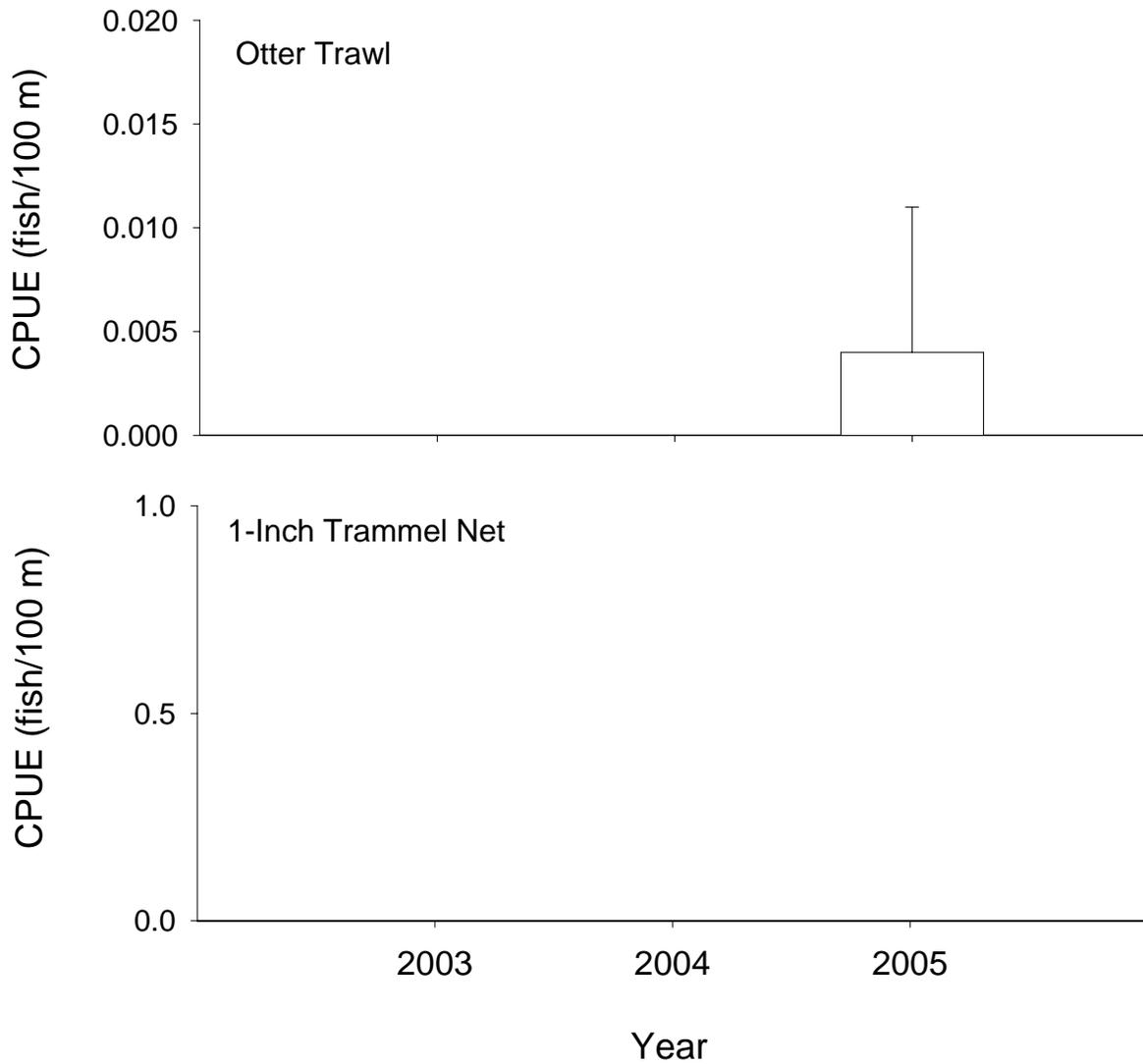


Figure 48. Mean annual catch-per-unit-effort ($\pm 2SE$) of sauger for otter trawls and 1-inch trammel nets in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Sauger / Fish Community Season

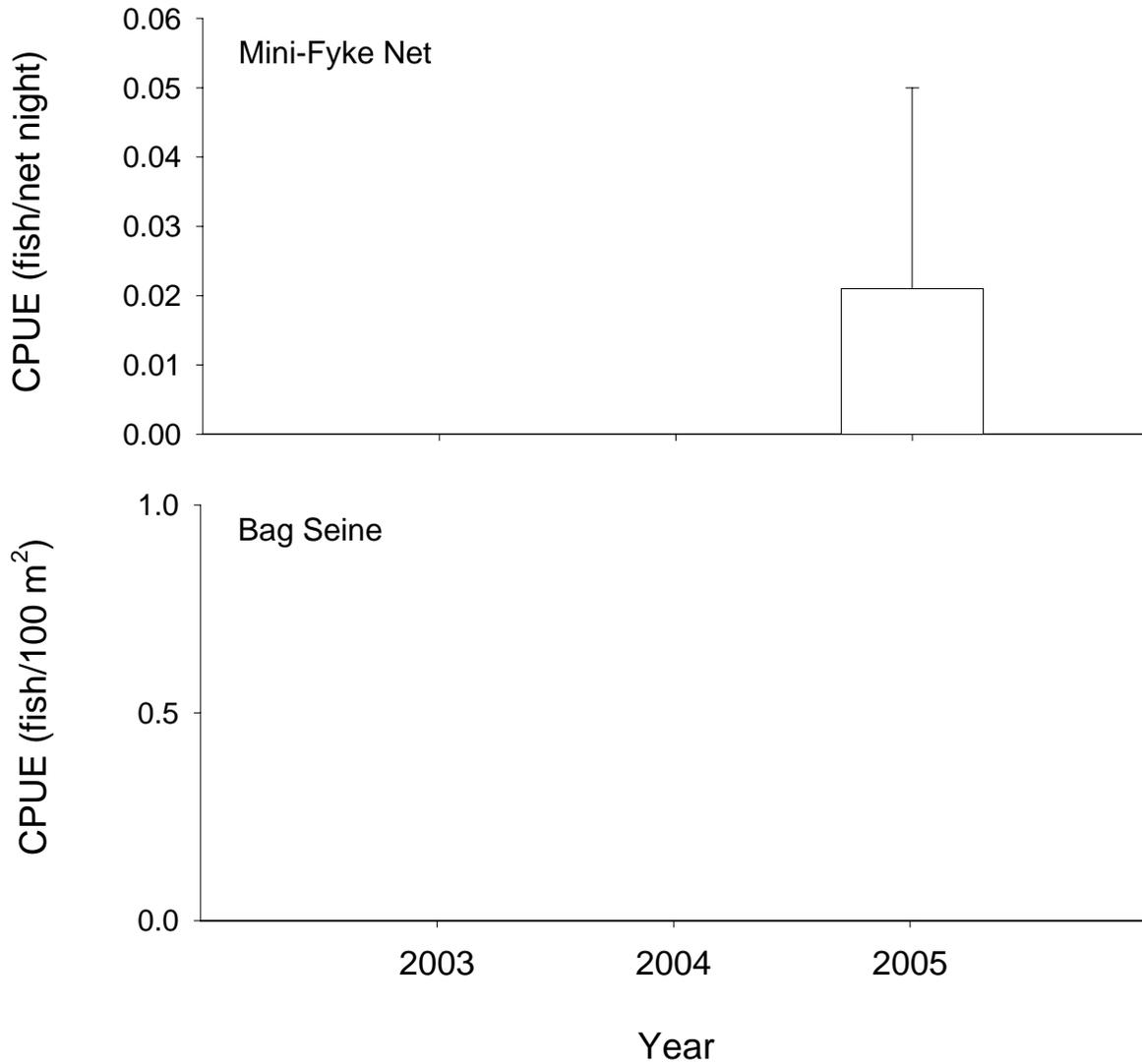


Figure 49. Mean annual catch-per-unit-effort (\pm 2SE) of sauger for mini-fyke nets and bag seines in segment 10 of the Missouri River during fish community season 2003-2005.

Segment 10 - Sauger / Fish Community Season

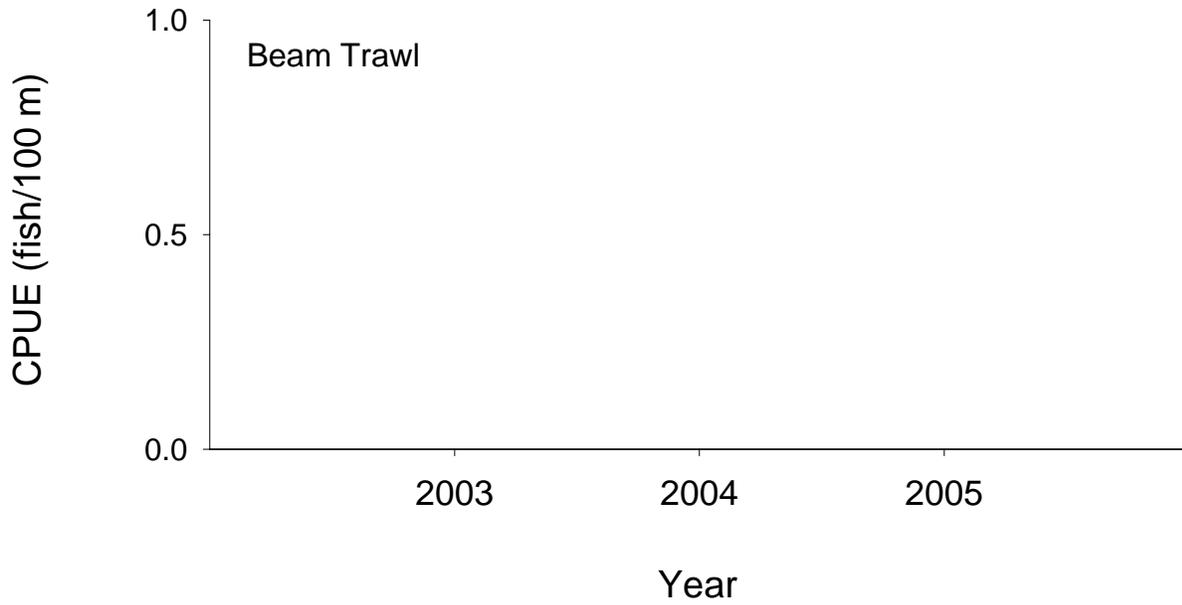


Figure 50. Mean annual catch-per-unit-effort (\pm 2SE) of sauger for beam trawls in segment 10 of the Missouri River during fish community season 2003-2005.

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 2004-2005. 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															
Bag Seine															
Mini-Fyke Net															
Otter Trawl															
Beam Trawl															
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0		N-E	N-E	0	0	0						
		N-E	28		N-E	N-E	70	0	2						
Bag Seine	0	N-E	0		N-E	N-E	0	0	0						
		N-E	34		N-E	N-E	62	4	0						
Mini-Fyke Net	2	N-E	50		N-E	N-E	50	0	0						
		N-E	39		N-E	N-E	56	5	0						
Otter Trawl	1	N-E	0		N-E	N-E	100	0	0						
		N-E	29		N-E	N-E	71	0	0						
Beam Trawl															

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 2004-2005. 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	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net							
2.5 Inch Trammel Net							
Gill Net							
Otter Trawl							
Beam Trawl							
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0		
		0	99	N-E	1		
Bag Seine	0	0	0	N-E	0		
		100	0	N-E	0		
Mini-Fyke Net	2	100	0	N-E	0		
		100	0	N-E	0		
Otter Trawl	1	0	100	N-E	0		
		0	100	N-E	0		
Beam Trawl							

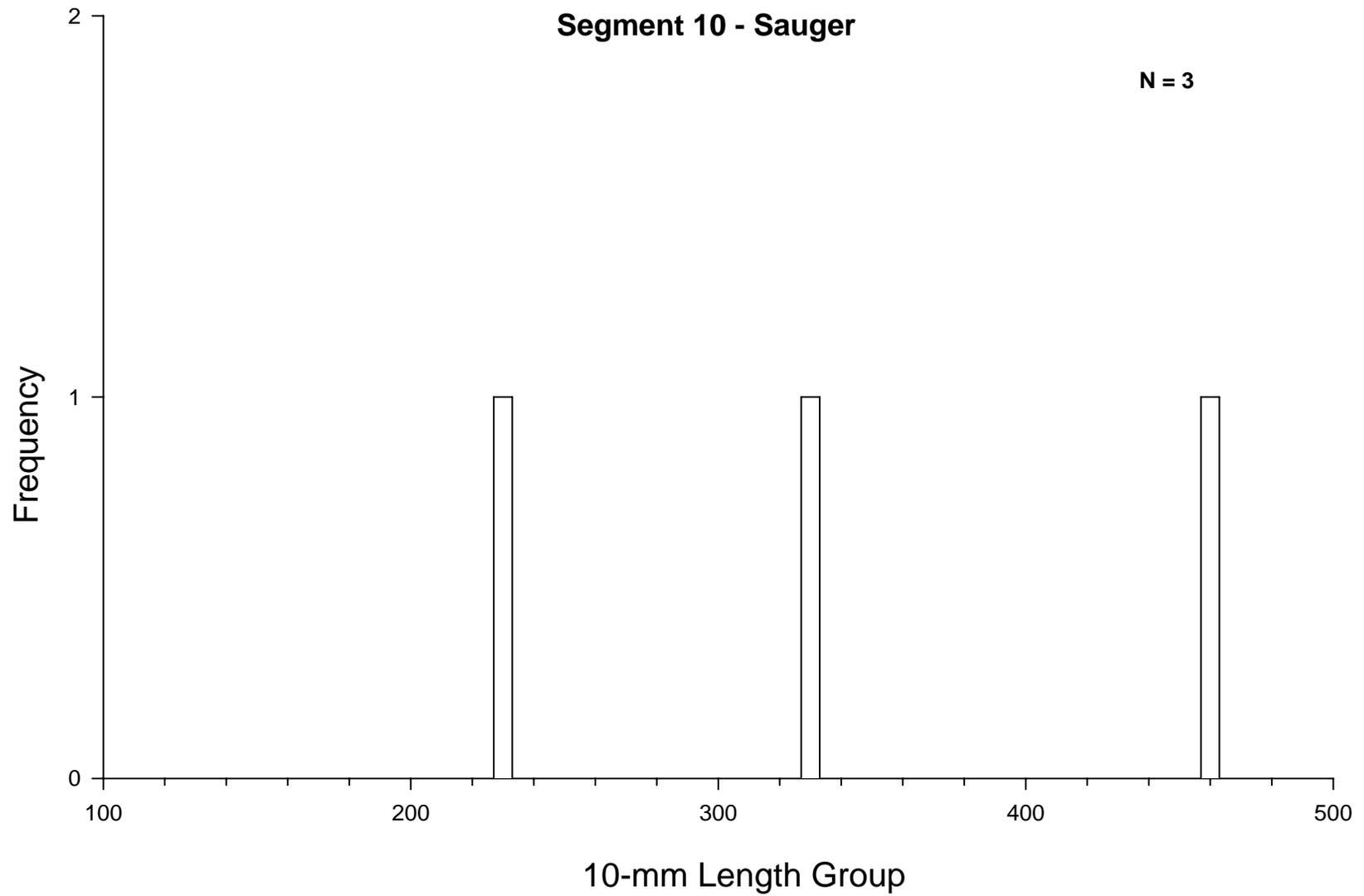


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 10 of the Missouri River during 2004-2005.

Table 40. Total effort, number of sturgeon captured, and the percent of effort expended and catch by wing dike exposure category (dry, partially overflowing, overflowing) for segment 10 of the Missouri River during the 2005 fish community season. Chi-square values represent the test statistic for chi-square goodness-of-fit tests. Chi-square values with an asterisk represent significance.

Wing Dike	1-Inch Trammel Nets					Otter Trawls				
	Distance (m)	% Effort	# SNSG	% Catch	χ^2	Distance (m)	% Effort	# SNSG	% Catch	χ^2
Dry	2,763	19	48	15		5,172	24	39	17	
Partial	9,886	69	170	54		11,360	53	118	51	
Overflowing	1,664	12	96	31		4,987	23	73	32	
Total	14,313	100	314	100	102.59*	21,519	100	230	100	12.51*

Table 41. Total effort, number of sturgeon captured, and the percent of effort expended and catch for notched and unnotched wing dikes by exposure category (dry, partially overflowing, overflowing) for segment 10 of the Missouri River during the 2005 fish community season. Chi-square values represent the test statistic for chi-square goodness-of-fit tests. Chi-square values with an asterisk represent significance.

Wing Dike	Exposure	1-Inch Trammel Net					Otter Trawl				
		Distance (m)	% Effort	# SNSG	% Catch	χ^2	Distance (m)	% Effort	# SNSG	% Catch	χ^2
Notch	Dry	810	29	8	17		2,497	48	24	62	
No-notch		1,953	71	40	83		2,675	52	15	38	
Total		2,763	100	48	100	3.65	5,172	100	39	100	2.79
Notch	Partial	3,428	35	63	37		4,792	42	50	42	
No-notch		6,458	65	107	63		6,568	58	68	58	
Total		9,886	100	170	100	0.39	11,360	100	118	100	0.00
Notch	Overflowing	0	0	0	0		0	0	0	0	
No-notch		1,664	100	96	100		4,987	100	73	100	
Total		1,664	100	96	100		4,987	100	73	100	

Table 42. Total effort, number of sturgeon captured, and the percent of effort expended and catch for channel crossover (CHXO) and inside bend (ISB) macrohabitats by open water category (inside, outside, or eddy line) for segment 10 of the Missouri River during the 2005 fish community season. Chi-square values represent the test statistic for chi-square goodness-of-fit tests. Chi-square values with an asterisk represent significance.

		1-Inch Trammel Net					Otter Trawl				
		Distance (m)	% Effort	# SNSG	% Catch	χ^2	Distance (m)	% Effort	# SNSG	% Catch	χ^2
CHXO	Inside	429	13	40	53		2,597	50	44	73	
	Outside	1,238	37	7	9		2,477	48	16	27	
	Eddy Line	1,709	51	28	37		106	2	0	0	
	Total	3,376	100	75	100	115.31*	5,180		60		13.28*
ISB	Inside	3,463	40	108	57		4,521	28	55	34	
	Outside	2,923	33	34	18		7,732	49	71	44	
	Eddy Line	2,367	27	47	25		3,675	23	37	23	
	Total	8,753	100	189	100	28.52*	15,928		163		2.49
Total	Inside	3,892	32	148	56		7,118	34	99	44	
	Outside	4,161	34	41	16		10,209	48	87	39	
	Eddy Line	4,076	34	75	28		3,781	18	37	17	
	Total	12,129	100	264	100	76.52*	21,108	100	223	100	11.78*

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 10,508 fish representing 55 species was captured in segment 10 all standard gear types during the 2005 fish community season. Four target species and 17 non-target species were represented by at least 50 individuals with non-target species composing 91% of the total catch. Sampling gears that were deployed in BARS mesohabitats captured a greater number of species than those deployed in CHNB mesohabitats. Further, gears deployed in BARS mesohabitats accounted for 79% of the total catch while CHNB mesohabitats produced 21%.

A total of 28 species was captured with bag seines (98 hauls; 7,937 m²) including seven non-target species with a minimum of 50 individuals (Appendix F7). Bag seines were the most effective gear to sample gizzard shad, river carpsucker, and silver chub (CPUE = 6.6, 1.2, and 0.5 fish/100 m², respectively). Mini-fyke nets captured 40 species in 97 net nights including 14 species represented by at least 50 individuals (Appendix F6). Mini-fyke nets were the most effective gear to sample the following 12 species (CPUE = number of fish/net night): emerald shiner = 26.4, red shiner = 8.9, freshwater drum = 6.9, bluegill = 3.4, bullhead minnow = 2.4, white bass = 1.7, orangespotted sunfish = 1.1, white crappie = 0.8, common carp = 0.8, mosquitofish = 0.7, river shiner = 0.7, and shortnose gar = 0.7.

Otter trawls captured a total of 24 species including two of the seventeen non-target species with at least 50 individuals (Appendix F4). Channel and blue catfish (CPUE = 2.7 and 1.7 fish/100 m, respectively) were most effectively sampled using otter trawls. One-inch trammel nets captured 17 species but did not capture fifty individuals of any non target species (Appendix F2). Catch-per-unit effort for all non-target species combined was less than 0.2 fish/100 m. No standardized sampling for the PSPAP was conducted in segment 10 prior to 2005, and thus, no comparisons among years could be made.

Discussion

Pallid sturgeon capture locations during the 2005 fish community season were not uniformly distributed throughout segment 10. Seventy-five percent ($N = 3$) of pallid sturgeon were captured in five river bends that were sampled in a 28-mile reach of the river (RM 335 to 363) immediately below Kansas City, Missouri. Only 25% of pallid sturgeon ($N = 1$) were captured in a 53-mile reach that included seven river bends sampled during the 2005 fish community season. Although Kansas City has been the stocking location for a large number of pallid sturgeon, at least one recaptured fish (2002 year class) had moved down to this area from a stocking location (Bellevue, Nebraska) over 250 miles upstream. This suggests that pallid sturgeon may be more concentrated in river bends in the Kansas City area than in the lower portion of segment 10.

A total of 61,815 pallid sturgeon have been stocked into RPMA 4 since 1994 consisting of about 2,000 to 9,250 yearling pallid sturgeon. An additional stocking of more than 30,000 age-0 fish in this RPMA occurred in 2004. The three hatchery-stocked pallid sturgeon captured during the 2005 fish community season represented fish from RPMA 4 stockings in 2002, 2003, and 2004. We were unable to determine the change in relative condition of hatchery-stocked pallid sturgeon recaptured in segment 10 during the 2005 fish community season because fish weight was not recorded prior to stocking for these individuals. However, relative condition values were inversely related to time-at-large suggesting that condition had declined from time of stocking. Declines in condition values for recaptured hatchery-stocked pallid sturgeon has also been noted in segments 13 and 14 and were likely due to harsh river environments (e.g., variable flows and temperatures, food availability, etc.) compared to a controlled hatchery setting (Doyle et al. 2005).

No quality size or larger pallid sturgeon were captured in segment 10 during the 2005 fish community season. Most large pallid sturgeon captured by the PSPAP have been caught in gill nets during the sturgeon season. This suggests that the lack of larger fish observed in segment 10 may be due to not sampling during the 2005 sturgeon season rather than the absence of large pallid sturgeon in this segment.

All four pallid sturgeon captured in segment 10 during the 2005 fish community season were caught within channel border mesohabitats where bottom velocities ranged from 0.60 to

0.66 m/s. This is similar to the mean water velocity reported for segment 13 (0.67 m/s; N = 14) for pallid sturgeon captures within channel border mesohabitats (Doyle et al. 2005). In segment 9, pallid sturgeon captured within the channel border with 1-inch trammel nets and otter trawls (N = 4) were caught in areas with slightly slower bottom velocities (0.32 to 0.54 m/s; mean = 0.42 m/s; Steffensen and Mestl 2005). Substrates at pallid sturgeon capture locations in segment 10 were primarily sand (85 to 100%) and was similar to observations for segment 9 (Steffensen and Mestl 2005).

The ratio of pallid sturgeon (hatchery-stocked and wild) to shovelnose sturgeon in segment 10 (1:160) was similar to the ratios observed during 2004 for segment 13 (1:133; that geographically borders segment 10), and higher than that observed in segments 9 and 14 (1:279 and 1:341, respectively; Doyle et al. 2005). During 2004, the ratio of wild pallid sturgeon to shovelnose sturgeon for segment 10 was higher (1:637) than for segments 13 and 14 (1:887 and 1:854, respectively). The lower wild pallid sturgeon to shovelnose sturgeon ratio for segments 13 and 14 is likely due to the fact that gill nets were used in these segments during the 2005 sturgeon season. As a result, the total number of shovelnose sturgeon captured in these segments was much greater than for segment 10 where gill nets were not used. Data from 2004 were unavailable for segment 9. The ratio of wild pallid sturgeon to shovelnose X pallid sturgeon hybrids for segment 10 was 1:2 which was lower than that for segments 13 and 14 (1:2.6 and 1:4.5, respectively; Doyle et al. 2005). No shovelnose X pallid hybrid individuals were captured in segment 9 during 2004 (Steffensen and Mestl 2005). Differences in these ratios among segments were likely due to the small number of wild pallid sturgeon and shovelnose X pallid sturgeon hybrids captured in segment 10 (N = 1 and 2, respectively).

Shovelnose sturgeon were the most common target species encountered during the 2005 fish community season. Catch-per-unit-effort for shovelnose sturgeon using 1-inch trammel nets in segment 10 (2.05 fish/100 m) was similar to relative abundance of this species reported for segment 13, (2 fish/100 m), greater than segment 14 (1.3 fish/100 m) and less than that reported for segment 9 (3.5 fish/100 m) during the 2004 fish community season (Doyle et al. 2005; Steffensen and Mestl 2005). Relative abundance of shovelnose sturgeon captured in otter trawls in segment 10 (CPUE = 1.43 fish/100 m) was greater than that reported for segments 9 (CPUE = 1.0 fish/100 m) and 14 (0.5 fish/100 m) during the 2004 fish community season (Doyle et al. 2005; Steffensen and Mestl 2005).

Otter trawls captured several presumed age-0 shovelnose sturgeon (FL = 21 to 85 mm; N = 19) while mini-fyke nets and bag seines did not capture any of these fish. These results are similar to reports for segments 13 and 14, and suggest that shovelnose sturgeon do not use BARS mesohabitats (i.e., water depth < 1.2 m) as much as CHNB mesohabitats (Doyle et al. 2005). The number of sub-stock (i.e., < 250-mm FL) shovelnose sturgeon captured in segment 10 during the 2005 fish community season (N = 55) was greater than reports for segments 9 (N = 46), 13 (N = 37), and 14 (N = 16) during the 2004 fish community season (Doyle et al. 2005; Steffensen and Mestl 2005). This could be due to improvements in trawling techniques or differences in shovelnose sturgeon year class strength in 2004 and 2005.

Shovelnose sturgeon did not use microhabitats associated with wing dikes equally. Overflowing wing dikes produced more shovelnose sturgeon compared to partially overflowing and dry structures. This may be attributed to greater depths, water velocities, and dissolved oxygen, or a food supply being deposited on the downstream side of these structures. Open water areas inside the eddy line (i.e., from the dike tip to the bank) produced more shovelnose sturgeon than areas on or outside this feature. Water velocities inside the eddy line are generally slower, thus, allowing fish to hold their position with less energy exertion. Further, organic matter is deposited in these areas that may produce more aquatic invertebrates providing food for fish.

The number of sturgeon chubs captured in segment 10 during the 2005 fish community season (N = 19) was similar to reports for segments 9, 13, and 14 (N = 19, 17, and 15, respectively; Doyle et al. 2005; Steffensen and Mestl 2005). Habitat use was also similar among segments, and all fish in each segment were captured with otter trawls in CHNB mesohabitats. The number of sicklefin chubs captured in segment 10 during the 2005 fish community season (N = 130) was intermediate compared to segments 9, 13, and 14 (N = 13, 695, and 977, respectively) during the 2004 fish community season (Doyle et al. 2005; Steffensen and Mestl 2005). This suggests that there is a gradient along which sicklefin chub abundance declines from the confluence of the Missouri River with the Mississippi River upstream to the confluence of the Platte River, Nebraska. Fewer speckled chubs were captured in segment 10 during the 2005 fish community season (N = 99) compared to segments 9, 13, and 14 (N = 180, 147, and 298, respectively) during the 2004 fish community season (Doyle et al. 2005; Steffensen and Mestl 2005). In contrast to sturgeon and sicklefin chubs, speckled chubs were captured with multiple

gears (i.e., otter trawls and mini-fyke nets) in both channel border and BARS mesohabitats. Speckled chub habitat use was similar among segments 9, 10, 13, and 14 with fish using both channel border mesohabitats (Doyle et al. 2005; Steffensen and Mestl 2005).

The number of sand shiners captured in segment 10 during the 2005 fish community season ($N = 63$) was intermediate to reports for segments 9, 13, and 14 ($N = 158, 31,$ and $48,$ respectively; Doyle et al. 2005; Steffensen and Mestl 2005). Relative abundance of sand shiners in segment 10 during the 2005 fish community season for bag seines (CPUE = 0.652 fish/100 m^2) was greater compared to segment 9 (CPUE = 0.30 fish/100 m^2) while CPUE for mini-fyke nets in segment 10 (CPUE = 0.175 fish/net night) was less compared to segment 9 (CPUE = 1.51 fish/net night) during the 2004 fish community season. Few sand shiners were captured with otter trawls ($N = 5$) in any of the segments in the channelized reach (i.e., segments 9, 10, 13, and 14) during fish community seasons from 2003 to 2005, suggesting that sand shiners prefer BARS relative to CHNB mesohabitats (Doyle et al. 2005; Steffensen and Mestl 2005).

The number of *Hybognathus* spp. captured in segment 10 during the fish community season ($N = 8$) was similar to reports for the 2004 fish community season in segments 13 and 14 ($N = 5$ and $4,$ respectively) but much less than that in segment 9 ($N = 280$). This suggests that river conditions below the mouth of the Kansas River are not favorable for *Hybognathus* spp. survival and reproduction. Bag seines and mini-fyke nets were the only gears that captured *Hybognathus* spp. in segment 10 during 2005 fish community season and thus all fish were captured in BARS mesohabitats. Bag seines accounted for the majority of the *Hybognathus* spp. catch in segment 10 (88%) and is similar to the percentages captured by this gear type in segment 9 (85%) during the 2004 fish community season.

Blue sucker CPUE for 1-inch trammel nets in segment 10 during the 2005 fish community season (0.05 fish/100 m) was similar to reports for segments 13 and 14 (< 0.07 fish/100 m), but much lower compared to segment 9 (0.8 fish/100 m). Twenty blue suckers were captured in otter trawls during the 2004 fish community season in segment 9 (Steffensen and Mestl 2005) but only one fish was captured in this gear type in segment 10 during the 2005 fish community season. Only one blue sucker less than 500 mm total length was captured suggesting that reproductive success of this species may be low, small blue suckers use habitats that we did not sample, or the gears that we used are not effective at collecting small size classes of this

species. The lack of small (i.e., young) blue suckers is not unique to segment 10 and has been noted for other segments in the PSPAP (Doyle et al. 2005).

Only three sauger were collected in segment 10 during 2005 fish community season. Similarly, few sauger were collected during the fish community season in segments 9, 13, and 14 (N = 2, 3, and 6, respectively). Most sauger captured by the PSPAP have been caught during the sturgeon season in gill nets, and this gear was not deployed in segment 10 during the 2005 sampling year.

Acknowledgments

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APPENDICES

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
Centrarchidae - sunfishes		
<i>L. cyanellus</i> X <i>L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus</i> X <i>L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis</i> X <i>P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
Percidae - perches		
<i>Ammocrypta asprella</i>	Crystal darter	CLDR
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orangethroated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caproides</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculate</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<i>Sander canadense</i>	Sauger	SGER*
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-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
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m ³ /s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m ³ /s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
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	2003 - Present	fish/100 m drift
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2005 - Present	fish/100 m drift
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	fish/net night
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Beam trawl	BT	Standard*	All	2003 - 2004	fish/100 m trawled
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Bag seine – rectangular method pulled upstream	BSRD	Standard	Fish Comm.	2003 - Present	fish/100 m ²
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night

* Standard only in upper Missouri River segments

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	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	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

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 2004-2005. 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		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
BHCP							
BHMW							
BKBF							
BKBH							
BKCP							
BLCF							
BLGL							
BMBF							
BNMW							
BUSK							
CARP							
CLSR							
CNCF							
CNSN							
ERSN							
FHCF							

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
FHMW							
FWDM							
GDEY							
GDFH							
GDSN							
GNSF							
GSBG							
GZSD							
HBNS							
LESF							
LGPH							
LKSG							
LMBS							
LNGR							
MMSN							
MQTF							

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
NFSH							
OSSF							
PDSG							
RDSN							
RVCS							
RVSN							
SFCB							
SGCB							
SGER							
SJHR							
SKCB							
SMBF							
SMMW							
SNGR							
SNPD							
SNSG							

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
SNSN							
SVCB							
UBF							
UCF							
UCN							
UCS							
UCT							
UCY							
UHY							
ULP							
UNID							
UNO							
WSMW							
WTBS							
WTCP							
YLBH							

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
YOYF							

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		SCCS	
			CHNB	CHNB	BARS	CHNB	CHNB	ITIP
BHCP	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BHMW	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BKBF	1	0.006	0	0	0	0.008	0	0
		[0.011]	[0]			[0.016]		
BKBH	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BKCP	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BLCF	10	0.067	0.143	0	0	0.041	0	0
		[0.058]	[0.17]			[0.051]		
BLGL	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BMBF	1	0.005	0.017	0	0	0	0	0
		[0.009]	[0.034]			[0]		
BNMW	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
BUSK	10	0.053	0.06	0.4	0.4	0.047	0	0
		[0.037]	[0.088]			[0.04]		
CARP	1	0.005	0	0	0	0.006	0	0
		[0.009]	[0]			[0.013]		
CLSR	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
CNCF	17	0.101	0.155	0	0	0.085	0	0
		[0.076]	[0.168]			[0.087]		
CNSN	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
ERSN	0	0	0	0	0	0	0	0
		[0]	[0]			[0]		
FHCF	3	0.015	0	0	0	0.022	0	0
		[0.019]	[0]			[0.026]		

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
FHMW	0	0	0	0	0	0	0
		[0]	[0]		[0]		
FWDM	1	0.007	0	0	0.009	0	0
		[0.013]	[0]		[0.019]		
GDEY	3	0.023	0.047	0	0.015	0	0
		[0.027]	[0.065]		[0.03]		
GDFH	0	0	0	0	0	0	0
		[0]	[0]		[0]		
GDSN	0	0	0	0	0	0	0
		[0]	[0]		[0]		
GNSF	0	0	0	0	0	0	0
		[0]	[0]		[0]		
GSBG	0	0	0	0	0	0	0
		[0]	[0]		[0]		
GZSD	0	0	0	0	0	0	0
		[0]	[0]		[0]		
HBNS	0	0	0	0	0	0	0
		[0]	[0]		[0]		
LESF	0	0	0	0	0	0	0
		[0]	[0]		[0]		
LGPH	0	0	0	0	0	0	0
		[0]	[0]		[0]		
LKSG	3	0.015	0.039	0	0.006	0	0
		[0.023]	[0.079]		[0.013]		
LMBS	0	0	0	0	0	0	0
		[0]	[0]		[0]		
LNGR	7	0.051	0.02	0	0.064	0	0
		[0.047]	[0.039]		[0.064]		
MMSN	0	0	0	0	0	0	0
		[0]	[0]		[0]		
MQTF	0	0	0	0	0	0	0
		[0]	[0]		[0]		

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
NFSH	0	0	0	0	0	0	0
		[0]	[0]		[0]		
OSSF	0	0	0	0	0	0	0
		[0]	[0]		[0]		
PDSG	2	0.013	0	0	0.019	0	0
		[0.018]	[0]		[0.026]		
RDSN	0	0	0	0	0	0	0
		[0]	[0]		[0]		
RVCS	9	0.056	0.025	0	0.07	0	0
		[0.04]	[0.049]		[0.054]		
RVSN	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SFCB	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SGCB	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SGER	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SJHR	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SKCB	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SMBF	25	0.141	0.229	0	0.113	0	0
		[0.072]	[0.162]		[0.081]		
SMMW	0	0	0	0	0	0	0
		[0]	[0]		[0]		
SNGR	7	0.098	0.054	0	0.118	0	0
		[0.085]	[0.078]		[0.116]		
SNPD	1	0.005	0.02	0	0	0	0
		[0.01]	[0.039]		[0]		
SNSG	375	2.376	1.87	1.2	2.511	2.778	7.5
		[0.713]	[1.567]		[0.81]		

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB		SCCS	
			CHNB		BARS	CHNB	CHNB	ITIP
SNSN	0	0	0		0	0	0	0
		[0]	[0]			[0]		
SVCB	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UBF	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UCF	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UCN	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UCS	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UCT	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UCY	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UHY	0	0	0		0	0	0	0
		[0]	[0]			[0]		
ULP	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UNID	0	0	0		0	0	0	0
		[0]	[0]			[0]		
UNO	0	0	0		0	0	0	0
		[0]	[0]			[0]		
WSMW	0	0	0		0	0	0	0
		[0]	[0]			[0]		
WTBS	0	0	0		0	0	0	0
		[0]	[0]			[0]		
WTCP	0	0	0		0	0	0	0
		[0]	[0]			[0]		
YLBH	0	0	0		0	0	0	0
		[0]	[0]			[0]		

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB		SCCS	
			CHNB	BARS	CHNB	CHNB	ITIP
YOYF	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	Standard Errors	
			CHNO	ISB
			CHNB	CHNB
BHCP				
BHMW				
BKBF				
BKBH				
BKCP				
BLCF				
BLGL				
BMBF				
BNMW				
BUSK				
CARP				
CLSR				
CNCF				
CNSN				
ERSN				
FHCF				

Appendix F3 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
			CHNB	CHNB
FHMW				
FWDM				
GDEY				
GDFH				
GDSN				
GNSF				
GSBG				
GZSD				
HBNS				
LESF				
LGPH				
LKSG				
LMBS				
LNGR				
MMSN				
MQTF				

Appendix F3 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
			CHNB	CHNB
NFSH				
OSSF				
PDSG				
RDSN				
RVCS				
RVSN				
SFCB				
SGCB				
SGER				
SJHR				
SKCB				
SMBF				
SMMW				
SNGR				
SNPD				
SNSG				

Appendix F3 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
			CHNB	CHNB
SNSN				
SVCB				
UBF				
UCF				
UCN				
UCS				
UCT				
UCY				
UHY				
ULP				
UNID				
UNO				
WSMW				
WTBS				
WTCP				
YLBH				

Appendix F3 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
YOYF			CHNB	CHNB

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	
			CHNB	ISB
BHCP	0	0 [0]	0 [0]	0 [0]
BHMW	0	0 [0]	0 [0]	0 [0]
BKBF	0	0 [0]	0 [0]	0 [0]
BKBH	1	0.011 [0.021]	0.037 [0.073]	0 [0]
BKCP	0	0 [0]	0 [0]	0 [0]
BLCF	425	1.738 [0.61]	2.944 [1.606]	1.242 [0.519]
BLGL	1	0.011 [0.021]	0.037 [0.073]	0 [0]
BMBF	0	0 [0]	0 [0]	0 [0]
BNMW	0	0 [0]	0 [0]	0 [0]
BUSK	3	0.016 [0.018]	0.035 [0.05]	0.008 [0.015]
CARP	0	0 [0]	0 [0]	0 [0]
CLSR	0	0 [0]	0 [0]	0 [0]
CNCF	711	2.697 [0.947]	1.735 [0.978]	3.092 [1.267]
CNSN	0	0 [0]	0 [0]	0 [0]
ERSN	4	0.013 [0.013]	0.035 [0.039]	0.005 [0.009]
FHCF	3	0.014 [0.017]	0.018 [0.037]	0.013 [0.018]

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO	
			CHNB	ISB
FHMW	0	0	0	0
		[0]	[0]	[0]
FWDM	34	0.164	0.416	0.061
		[0.117]	[0.367]	[0.057]
GDEY	0	0	0	0
		[0]	[0]	[0]
GDFH	0	0	0	0
		[0]	[0]	[0]
GDSN	0	0	0	0
		[0]	[0]	[0]
GNSF	1	0.003	0.011	0
		[0.006]	[0.022]	[0]
GSBG	0	0	0	0
		[0]	[0]	[0]
GZSD	6	0.028	0.073	0.009
		[0.026]	[0.081]	[0.013]
HBNS	0	0	0	0
		[0]	[0]	[0]
LESF	0	0	0	0
		[0]	[0]	[0]
LGPH	0	0	0	0
		[0]	[0]	[0]
LKSG	0	0	0	0
		[0]	[0]	[0]
LMBS	1	0.007	0	0.009
		[0.013]	[0]	[0.019]
LNGR	0	0	0	0
		[0]	[0]	[0]
MMSN	0	0	0	0
		[0]	[0]	[0]
MQTF	0	0	0	0
		[0]	[0]	[0]

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO		ISB	
			CHNB		CHNB	
NFSH	0	0 [0]	0		0	
OSSF	1	0.003 [0.006]	0		0.005	[0.009]
PDSG	2	0.007 [0.01]	0.012		0.005	[0.009]
RDSN	0	0 [0]	0		0	
RVCS	3	0.01 [0.011]	0.012		0.009	[0.013]
RVSN	0	0 [0]	0		0	
SFCB	130	0.487 [0.178]	0.751		0.379	[0.185]
SGCB	19	0.073 [0.041]	0.025		0.092	[0.056]
SGER	1	0.004 [0.007]	0		0.005	[0.01]
SJHR	0	0 [0]	0		0	
SKCB	75	0.295 [0.153]	0.134		0.361	[0.21]
SMBF	1	0.003 [0.007]	0		0.005	[0.01]
SMMW	0	0 [0]	0		0	
SNGR	0	0 [0]	0		0	
SNPD	1	0.004 [0.007]	0.012		0	[0]
SNSG	262	1.002 [0.243]	1.054		0.981	[0.272]

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
			CHNB	CHNB
SNSN	3	0.015 [0.018]	0.021 [0.042]	0.013 [0.018]
SVCB	25	0.091 [0.055]	0.011 [0.022]	0.123 [0.075]
UBF	0	0 [0]	0 [0]	0 [0]
UCF	1	0.004 [0.008]	0 [0]	0.006 [0.011]
UCN	0	0 [0]	0 [0]	0 [0]
UCS	0	0 [0]	0 [0]	0 [0]
UCT	0	0 [0]	0 [0]	0 [0]
UCY	0	0 [0]	0 [0]	0 [0]
UHY	9	0.033 [0.034]	0.012 [0.025]	0.042 [0.047]
ULP	0	0 [0]	0 [0]	0 [0]
UNID	0	0 [0]	0 [0]	0 [0]
UNO	0	0 [0]	0 [0]	0 [0]
WSMW	0	0 [0]	0 [0]	0 [0]
WTBS	0	0 [0]	0 [0]	0 [0]
WTCP	1	0.011 [0.021]	0.037 [0.073]	0 [0]
YLBH	0	0 [0]	0 [0]	0 [0]

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB
			CHNB	CHNB
YOYF	4	0.016 [0.018]	0.023 [0.046]	0.013 [0.018]

Appendix F5. Beam 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
			BARS	BARS	BARS
BHCP					
BHMW					
BKBF					
BKBH					
BKCP					
BLCF					
BLGL					
BMBF					
BNMW					
BUSK					
CARP					
CLSR					
CNCF					
CNSN					
ERSN					
FHCF					

Appendix F5 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
FHMW					
FWDM					
GDEY					
GDFH					
GDSN					
GNSF					
GSBG					
GZSD					
HBNS					
LESF					
LGPH					
LKSG					
LMBS					
LNGR					
MMSN					
MQTF					

Appendix F5 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
NFSH					
OSSF					
PDSG					
RDSN					
RVCS					
RVSN					
SFCB					
SGCB					
SGER					
SJHR					
SKCB					
SMBF					
SMMW					
SNGR					
SNPD					
SNSG					

Appendix F5 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
SNSN					
SVCB					
UBF					
UCF					
UCN					
UCS					
UCT					
UCY					
UHY					
ULP					
UNID					
UNO					
WSMW					
WTBS					
WTCP					
YLBH					

Appendix F5 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
YOYF					

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
			BARS	BARS	BARS
BHCP	4	0.041 [0.082]	0 [0]	0.074 [0.148]	0 [0]
BHMW	228	2.351 [0.888]	2.316 [1.233]	2.315 [1.318]	3 [3.347]
BKBF	0	0 [0]	0 [0]	0 [0]	0 [0]
BKBH	0	0 [0]	0 [0]	0 [0]	0 [0]
BKCP	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
BLCF	26	0.268 [0.165]	0.421 [0.351]	0.185 [0.159]	0 [0]
BLGL	328	3.381 [2.06]	3.132 [2.714]	3.685 [3.178]	2 [3.098]
BMBF	0	0 [0]	0 [0]	0 [0]	0 [0]
BNMW	5	0.052 [0.045]	0.053 [0.073]	0.056 [0.063]	0 [0]
BUSK	0	0 [0]	0 [0]	0 [0]	0 [0]
CARP	74	0.763 [0.952]	1.526 [2.41]	0.278 [0.214]	0.2 [0.4]
CLSR	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
CNCF	167	1.722 [0.734]	1.237 [0.778]	2.093 [1.186]	1.4 [1.855]
CNSN	2	0.021 [0.041]	0.053 [0.105]	0 [0]	0 [0]
ERSN	2557	26.361 [19.258]	17.974 [17.611]	32.352 [32.285]	25.4 [28.111]
FHCF	7	0.072 [0.053]	0.079 [0.089]	0.074 [0.072]	0 [0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
FHMW	10	0.103 [0.115]	0.079 [0.116]	0.13 [0.191]	0 [0]
FWDM	666	6.866 [3.83]	7.553 [5.612]	6.815 [5.658]	2.2 [2.857]
GDEY	0	0 [0]	0 [0]	0 [0]	0 [0]
GDFH	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
GDSN	0	0 [0]	0 [0]	0 [0]	0 [0]
GNSF	46	0.474 [0.339]	0.289 [0.225]	0.63 [0.587]	0.2 [0.4]
GSBG	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
GZSD	241	2.485 [2.706]	1.447 [1.805]	3.426 [4.696]	0.2 [0.4]
HBNS	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
LESF	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
LGPH	2	0.021 [0.029]	0.026 [0.053]	0.019 [0.037]	0 [0]
LKSG	0	0 [0]	0 [0]	0 [0]	0 [0]
LMBS	8	0.082 [0.127]	0.026 [0.053]	0.13 [0.225]	0 [0]
LNGR	4	0.041 [0.041]	0.053 [0.073]	0.037 [0.052]	0 [0]
MMSN	1	0.01 [0.021]	0.026 [0.053]	0 [0]	0 [0]
MQTF	71	0.732 [0.537]	0.947 [0.902]	0.648 [0.729]	0 [0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
NFSH	0	0	0	0	0
		[0]	[0]	[0]	[0]
OSSF	110	1.134	1.5	0.852	1.4
		[0.54]	[1.227]	[0.397]	[2.332]
PDSG	0	0	0	0	0
		[0]	[0]	[0]	[0]
RDSN	862	8.887	8.158	9.389	9
		[3.391]	[6.035]	[4.31]	[11.278]
RVCS	10	0.103	0.132	0.074	0.2
		[0.069]	[0.111]	[0.089]	[0.4]
RVSN	69	0.711	0.395	0.981	0.2
		[0.383]	[0.503]	[0.583]	[0.4]
SFCB	0	0	0	0	0
		[0]	[0]	[0]	[0]
SGCB	0	0	0	0	0
		[0]	[0]	[0]	[0]
SGER	2	0.021	0.026	0.019	0
		[0.029]	[0.053]	[0.037]	[0]
SJHR	1	0.01	0	0.019	0
		[0.021]	[0]	[0.037]	[0]
SKCB	24	0.247	0.263	0.222	0.4
		[0.161]	[0.317]	[0.173]	[0.8]
SMBF	4	0.041	0.079	0.019	0
		[0.05]	[0.116]	[0.037]	[0]
SMMW	1	0.01	0.026	0	0
		[0.021]	[0.053]	[0]	[0]
SNGR	65	0.67	0.605	0.741	0.4
		[0.223]	[0.35]	[0.314]	[0.49]
SNPD	0	0	0	0	0
		[0]	[0]	[0]	[0]
SNSG	2	0.021	0	0.037	0
		[0.041]	[0]	[0.074]	[0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
SNSN	17	0.175 [0.128]	0.053 [0.073]	0.278 [0.221]	0 [0]
SVCB	35	0.361 [0.216]	0.316 [0.24]	0.426 [0.349]	0 [0]
UBF	17	0.175 [0.351]	0 [0]	0.315 [0.63]	0 [0]
UCF	0	0 [0]	0 [0]	0 [0]	0 [0]
UCN	7	0.072 [0.094]	0.026 [0.053]	0.111 [0.164]	0 [0]
UCS	2	0.021 [0.029]	0 [0]	0.037 [0.052]	0 [0]
UCT	0	0 [0]	0 [0]	0 [0]	0 [0]
UCY	1	0.01 [0.021]	0 [0]	0.019 [0.037]	0 [0]
UHY	4	0.041 [0.041]	0.026 [0.053]	0.056 [0.063]	0 [0]
ULP	138	1.423 [0.833]	2.237 [1.44]	0.981 [1.083]	0 [0]
UNID	67	0.691 [1.259]	0.132 [0.216]	1.148 [2.259]	0 [0]
UNO	0	0 [0]	0 [0]	0 [0]	0 [0]
WSMW	0	0 [0]	0 [0]	0 [0]	0 [0]
WTBS	166	1.711 [0.617]	1.895 [0.923]	1.722 [0.895]	0.2 [0.4]
WTCP	78	0.804 [0.433]	0.289 [0.183]	1.222 [0.751]	0.2 [0.4]
YLBH	1	0.01 [0.021]	0.026 [0.053]	0 [0]	0 [0]

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
YOYF	34	0.351 [0.257]	0.658 [0.614]	0.167 [0.147]	0 [0]

Appendix F7. Bag Seine: overall season and segment summary. Lists CPUE (fish/100 m²) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
BHCP	0	0	0	0	0
		[0]	[0]	[0]	[0]
BHMW	32	0.451	0.209	0.598	0
		[0.253]	[0.182]	[0.381]	[0]
BKBF	0	0	0	0	0
		[0]	[0]	[0]	[0]
BKBH	0	0	0	0	0
		[0]	[0]	[0]	[0]
BKCP	0	0	0	0	0
		[0]	[0]	[0]	[0]
BLCF	20	0.362	0.215	0.446	0.214
		[0.551]	[0.43]	[0.835]	[0.427]
BLGL	7	0.087	0.026	0.122	0
		[0.093]	[0.053]	[0.142]	[0]
BMBF	1	0.019	0	0.03	0
		[0.038]	[0]	[0.06]	[0]
BNMW	0	0	0	0	0
		[0]	[0]	[0]	[0]
BUSK	0	0	0	0	0
		[0]	[0]	[0]	[0]
CARP	3	0.032	0	0.051	0
		[0.046]	[0]	[0.071]	[0]
CLSR	0	0	0	0	0
		[0]	[0]	[0]	[0]
CNCF	90	1.241	1.512	1.15	0.214
		[0.706]	[1.713]	[0.671]	[0.427]
CNSN	1	0.021	0	0.032	0
		[0.041]	[0]	[0.064]	[0]
ERSN	323	4.73	2.794	5.937	0.427
		[2.477]	[2.221]	[3.678]	[0.855]
FHCF	0	0	0	0	0
		[0]	[0]	[0]	[0]

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
FHMW	5	0.077 [0.076]	0 [0]	0.121 [0.118]	0 [0]
FWDM	116	1.533 [0.813]	0.966 [0.653]	1.9 [1.219]	0 [0]
GDEY	1	0.008 [0.017]	0.025 [0.05]	0 [0]	0 [0]
GDFH	0	0 [0]	0 [0]	0 [0]	0 [0]
GDSN	1	0.008 [0.016]	0 [0]	0.013 [0.025]	0 [0]
GNSF	0	0 [0]	0 [0]	0 [0]	0 [0]
GSBG	0	0 [0]	0 [0]	0 [0]	0 [0]
GZSD	565	6.579 [4.525]	3.417 [2.165]	8.53 [6.961]	0 [0]
HBNS	6	0.113 [0.173]	0.1 [0.201]	0.125 [0.25]	0 [0]
LESF	0	0 [0]	0 [0]	0 [0]	0 [0]
LGPH	0	0 [0]	0 [0]	0 [0]	0 [0]
LKSG	0	0 [0]	0 [0]	0 [0]	0 [0]
LMBS	7	0.067 [0.072]	0.017 [0.034]	0.096 [0.111]	0 [0]
LNGR	0	0 [0]	0 [0]	0 [0]	0 [0]
MMSN	0	0 [0]	0 [0]	0 [0]	0 [0]
MQTF	10	0.146 [0.147]	0.079 [0.116]	0.188 [0.222]	0 [0]

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
NFSH	0	0	0	0	0
		[0]	[0]	[0]	[0]
OSSF	28	0.277	0.397	0.229	0
		[0.204]	[0.418]	[0.236]	[0]
PDSG	0	0	0	0	0
		[0]	[0]	[0]	[0]
RDSN	283	4.042	1.482	5.326	4.801
		[2.254]	[0.884]	[3.45]	[6.659]
RVCS	143	1.201	0.327	1.7	0.214
		[1.167]	[0.339]	[1.811]	[0.427]
RVSN	8	0.095	0	0.149	0
		[0.105]	[0]	[0.163]	[0]
SFCB	0	0	0	0	0
		[0]	[0]	[0]	[0]
SGCB	0	0	0	0	0
		[0]	[0]	[0]	[0]
SGER	0	0	0	0	0
		[0]	[0]	[0]	[0]
SJHR	1	0.01	0.031	0	0
		[0.02]	[0.061]	[0]	[0]
SKCB	0	0	0	0	0
		[0]	[0]	[0]	[0]
SMBF	6	0.099	0.148	0.079	0
		[0.11]	[0.225]	[0.129]	[0]
SMMW	6	0.086	0.043	0.112	0
		[0.09]	[0.086]	[0.133]	[0]
SNGR	2	0.015	0.046	0	0
		[0.03]	[0.092]	[0]	[0]
SNPD	0	0	0	0	0
		[0]	[0]	[0]	[0]
SNSG	0	0	0	0	0
		[0]	[0]	[0]	[0]

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
SNSN	43	0.707 [0.652]	0.258 [0.516]	0.973 [0.982]	0 [0]
SVCB	40	0.539 [0.311]	0.431 [0.404]	0.622 [0.439]	0 [0]
UBF	1	0.008 [0.017]	0 [0]	0.013 [0.026]	0 [0]
UCF	0	0 [0]	0 [0]	0 [0]	0 [0]
UCN	0	0 [0]	0 [0]	0 [0]	0 [0]
UCS	185	1.975 [2.886]	0 [0]	3.09 [4.503]	0 [0]
UCT	34	0.55 [0.655]	0 [0]	0.86 [1.019]	0 [0]
UCY	1	0.009 [0.018]	0 [0]	0.014 [0.028]	0 [0]
UHY	0	0 [0]	0 [0]	0 [0]	0 [0]
ULP	7	0.117 [0.1]	0.05 [0.1]	0.157 [0.147]	0 [0]
UNID	0	0 [0]	0 [0]	0 [0]	0 [0]
UNO	5	0.083 [0.085]	0.142 [0.207]	0.056 [0.08]	0 [0]
WSMW	1	0.014 [0.028]	0.043 [0.086]	0 [0]	0 [0]
WTBS	90	1.258 [0.617]	0.767 [0.69]	1.552 [0.891]	0.427 [0.855]
WTCP	0	0 [0]	0 [0]	0 [0]	0 [0]
YLBH	0	0 [0]	0 [0]	0 [0]	0 [0]

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB
			BARS	BARS	BARS
YOYF	24	0.404 [0.524]	0.021 [0.042]	0.621 [0.817]	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 2004 – 2005 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 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seigne	Mini-Fyke Net	Otter Trawl
BDKF								
BESN								
BHCP							0.041	
BHMW						0.451	2.351	
BKBF					0.006			
BKBH								0.011
BKCP							0.01	
BKSS								
BLCF					0.067	0.362	0.268	1.738
BLGL						0.087	3.381	0.011
BMBF					0.005	0.019		
BMSN								
BNMW							0.052	
BRBT								
BSMW								
BTM								
BUSK*					0.053			0.016
CARP					0.005	0.032	0.763	
CKCB								
CLSR							0.01	
CMSN								
CNCF					0.101	1.241	1.722	2.697
CNLP								
CNSN						0.021	0.021	
ERSN						4.73	26.361	0.013
FHCB								
FHCF					0.015		0.072	0.014
FHMW						0.077	0.103	
FWDM					0.007	1.533	6.866	0.164
GDEY					0.023	0.008		

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seigne	Mini-Fyke Net	Otter Trawl
GDFH							0.01	
GDRH								
GDSN						0.008		
GNSF							0.474	0.003
GSBG							0.01	
GSCP								
GSPK								
GZSD						6.579	2.485	0.028
HBNS						0.113	0.01	
HFCS								
JYDR								
LAB								
LESF							0.01	
LGPH							0.021	
LKSG					0.015			
LMBS						0.067	0.082	0.007
LNDC								
LNGR					0.051		0.041	
MMSN							0.01	
MNEY								
MQTF						0.146	0.732	
NFSH					0	0		0
NTPK								
OSSF						0.277	1.134	0.003
PDFH								
PDSG*					0.013			0.007
PNMW								
QLBK								
RBST								
RDSN						4.042	8.887	
RESF								

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seigne	Mini-Fyke Net	Otter Trawl
RFSN								
RKBS								
RVCS					0.056	1.201	0.103	0.01
RVRH								
RVSN						0.095	0.711	
SBWB								
SDBS								
SFCB*								0.487
SFSN								
SGCB*								0.073
SGER*							0.021	0.004
SGWE								
SHRH								
SJHR						0.01	0.01	
SKCB*							0.247	0.295
SMBF					0.141	0.099	0.041	0.003
SMBS								
SMMW						0.086	0.01	
SNGR					0.098	0.015	0.67	
SNPD					0.005			0.004
SNSG*					2.376		0.021	1.002
SNSN*						0.707	0.175	0.015
SPSK								
STBS								
STCT								
STSN								
SVCB						0.539	0.361	0.091
SVCP								
TPMT								
UBF						0.008	0.175	
UCF								0.004

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seigne	Mini-Fyke Net	Otter Trawl
UCN							0.072	
UCS						1.975	0.021	
UCT						0.55		
UCY						0.009	0.01	
UHY							0.041	0.033
ULP						0.117	1.423	
UNID							0.691	
UNO						0.083		
URH								
USG								
WLYE								
WSMW						0.014		
WTBS						1.258	1.711	
WTCP							0.804	0.011
WTSK								
YLBH							0.01	
YOYF						0.404	0.351	0.016
YWPH								