2006 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 2

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

Segment 2 of the Missouri River extends from the confluence of the Milk River at river mile 1760 downstream to river mile 1701 near Wolf Point, MT. This was the first year segment 2 was sampled following the Population Assessment protocols. Twelve randomly selected river bends were sampled during both the sturgeon (spring) and fish community (summer and fall) seasons. Standard gears included otter trawls and trammel nets, which were used in both seasons, and mini fyke nets and beam trawls, which were utilized during the fish community season. Additionally, "wild" bag seines were used in segment 2 within 8 of the 12 randomly selected bends during the fish community season.

Fourteen pallid sturgeon *Scaphiryhynchus albus* capture events occurred in segment 2 during 2006, with one sturgeon being captured on two different occasions (May and August). All pallid sturgeon sampled were of hatchery origin and therefore no signs of natural reproduction or recruitment were observed. The majority (N = 10) of pallid sturgeon captures occurred during the fish community season when compared to the sturgeon season (N = 4). While all pallid sturgeon were captured in randomly selected bends, eight were sampled in random subsamples and six were sampled in duplicate non-random subsamples.

Pallid sturgeon were not evenly distributed throughout the segment. Although sampling encompassed an area of approximately 57 river miles (1761 to 1704), the majority (N = 12) of the pallid sturgeon captures occurred in a span of only six river miles (1710 to 1704), just upstream of the Wolf Point juvenile stocking site at river mile 1702.

One pallid sturgeon captured in segment 2 at river mile 1708.0 was initially stocked in the Yellowstone River at Fairview, ND (river mile 9.0) in 2002. As a result, the fish migrated at least 135 river miles from its initial stocking location. The majority (N = 10) of the pallid sturgeon recaptures were from 2006 stockings (2005-age class), while two fish were from the 2004 stocking (2003-year class), and one fish from each of the 2003 (2002-year class) and 2002 (2001-year class) stocking events.

Otter trawls were the most effective pallid sturgeon sampling gear in segment 2, with a CPUE of 0.012 fish/100 m and 0.026 fish/100 m during the sturgeon and fish community seasons, respectively. Pallid sturgeon CPUE was considerably less for trammel nets for both

seasons, with a CPUE of 0.0 fish.100 m during the sturgeon season and 0.003 fish/100 m during the fish community season. One pallid sturgeon was captured in the beam trawl, which equaled a CPUE of 0.009 fish/100 m and no pallid sturgeon were captured in either mini fyke nets or bag seines.

Pallid sturgeon relative condition averaged 0.99 and 0.91 for the sturgeon and fish community seasons, respectively. Incremental relative stock densities (RSD) showed 10 pallid sturgeon in the sub-stock category of 200-329 mm fork length (FL) and 4 in the stock category of 330-629 mm FL. Of the sampled sturgeon that had adequate stocking data, growth rated ranged from 0.25 to 0.75 mm/d. Due to stocking both pallid sturgeon with and without PIT tags in RPMA 2, no PIT tag retention estimates were made.

A total of 427 shovelnose sturgeon *Scaphirhynchus platorynchus* were sampled in segment 2 during 2006, resulting in a pallid to shovelnose sturgeon ration of 1:30.5. Of the total shovelnose sturgeon, trammel nets captured 72.1% (N = 308), otter trawls 27.4 % (N = 117), beam trawl 0.2% (N = 1), mini-fyke nets 0.0% (N = 0), and wild sampling using a bag seine captured 0.2 % (N = 1). More shovelnose sturgeon were sampled (N = 238) during fish community season when compared to sturgeon season (N = 189).

The majority (N = 418) of shovelnose sturgeon were of quality size or greater (≥ 380 mm), while few (N = 8) were of stock size. No shovelnose sturgeon smaller than 320 mm FL were sampled. The lack of smaller shovelnose sturgeon indicates that either limited recruitment or limited juvenile rearing is occurring in segment 2. Shovelnose sturgeon captured during sturgeon season had a higher mean relative weight (Wr) (89.2) than those captured during fish community season (80.5).

Six of the remaining eight native Missouri River target species were collected in segment 2 during 2006. The total number of individuals captured for the target species was as follows: sturgeon chubs *Macrhybopsis gelida* (N = 113), sicklefin chubs *H. meeki* (N = 1), sand shiners *Notropis stramineus* (N = 377), western silvery minnows *Hybognathus argyritis* (N = 215), blue suckers *Cycleptus elongatus* (N = 12), and sauger *Sander canadense* (N = 84). No speckled chubs *Macrhybopsis aestivalis* or plains minnows *Hybognathus placitus* were sampled in segment 2 during 2006.

Trammel nets were most effective at capturing shovelnose sturgeon, sauger and blue suckers, while the otter trawl was effective in sampling pallid sturgeon and sturgeon chubs. More western silvery minnows were sampled in the bag seine than any other gear. Conversely, mini fyke nets captured the majority of the sand shiners.

In total, 60,034 fish consisting of 34 species and one hybrid (sauger x walleye *Sander vitreus*) were collected during all standard and non-standard sampling in segment 2 during 2006, including 7 nonnative fishes.

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Introduction

The U.S. Fish and Wildlife Service (USFWS) listed pallid sturgeon *Scaphirhynchus albus* as endangered in 1990. In response to listing, the USFWS issued a Biological Opinion to the U.S. Army Corps of Engineers (COE), the primary water management entity responsible for the Missouri River mainstem from Fort Peck Dam and Reservoir to its confluence with the Mississippi River. Additionally, an amendment to the 2000 Biological Opinion was issued in 2003. The Amendment listed several Reasonable and Prudent Alternatives (RPA) to address the inability of pallid sturgeon to naturally reproduce and the need to be able to detect changes in their populations and ecosystem trends.

The Pallid Sturgeon Population Assessment Program (program) is guided by the RPA's in the 2003 Amendment to the 2000 Biological Opinion. The program is a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitats used by wild and hatchery reared juvenile pallid sturgeon (Drobish 2006). The 2000 Biological Opinion divides the program area into river and reservoir segments and assigns high, moderate, or low priority management action to these segments for pallid sturgeon (Drobish 2006). The focus of the program is on the high priority management action segments. The Missouri River from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, ND is listed as a high priority action segment.

The program has stratified the Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea into four study segments based on biological, hydrological and fluvial geomorphological characteristics. The COE contracted Montana Fish, Wildlife & Parks (FWP) to conduct program sampling from Fort Peck Dam downstream to the North Dakota border, which consists of study segments 1 through 3.

The objectives of this program 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.
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.

Sampling Season and Species

This program has two discrete seasons (sturgeon and fish community), which are primarily segregated by water temperatures. However, the sturgeon season is designed to sample sturgeon with gears that are temperature dependent, such as gill nets. Due to the nature of the majority of habitats in segment 1 through 3, gill nets are not an efficient gear for collecting pallid sturgeon due to debris flows and swift current and therefore they are not used in any segment situated in Montana. Trammel nets and otter trawl are standard gears used in segments 1-4 during sturgeon season, and appear to be an effective method to sample pallid sturgeon.

The fish community season extends from the beginning of July till the end of October and is designed not only to monitor sturgeon, but also monitor other native Missouri River fish populations. Both trammel nets and otter trawls are used during the fish community season, however mini fyke nets are added as a standard gear to more effectively sample shallow water habitats < 1.2 m in depth. Additionally, during 2006 bag seines and beam trawls were used on half of the combined bends in segments 2 and 3. This effort will provide a data that is more comparable to data collected by past researchers and particularly data from the Benthic Fishes Study.

In addition to pallid sturgeon, the program is designed to monitor nine other native Missouri River species labeled “target” species. These include, shovelnose sturgeon *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, plains minnow *Hybognathus placitus*, western silvery minnow *H. argyritis*, and sand shiner *Notropis stramineus*. This suite of species was selected for various reasons. First, some species may have similar habitat requirements as pallid sturgeon and therefore by monitoring their populations we may gain further insight into pallid sturgeon habitat and how

anthropomorphic and natural changes to the Missouri River affect native fish assemblages. Secondly, it is hypothesized that various chub species and other native fishes are an important component of pallid sturgeon diet, and thereby monitoring pallids sturgeon diet will allow us to better describe their habitat. Thirdly, we wouldn't expect to see an immediate response in a long-lived species like pallid sturgeon would be difficult to measure when environmental conditions change from either favorable or detrimental conditions. Thus, by monitoring short-lived native fishes we may be able to correlate environmental conditions to changes in fish populations on a much shorter time interval and make inferences on how pallid sturgeon populations may be affected.

Study Area

Study Segment 2 of the Missouri River Pallid Sturgeon Population Assessment Program begins at the confluence of the Missouri and Milk Rivers and runs downriver 59 river miles to Wolf Point, Montana (Drobish, 2007). This reach of the Missouri River is impacted by the presence and operations of Fort Peck Dam. Fort Peck Dam inhibits the natural spring pulses and distributes that water more evenly throughout the remainder of the year. Fort Peck Dam draws its water for power production from the hypolimnetic regions of Fort Peck reservoir, which are significantly colder during the summer months and warmer during the winter months, when compared to the Missouri River above the reservoir.

Fort Peck Reservoir traps the sediment loads of the Missouri River and therefore releases sediment free clear water to the Missouri River. This sediment free high-energy water scours the river of fine sediments and has reduced the amount of sand bars within the river.

Segment 2 is a transitional segment, which exhibits both characteristics of the hypolimnetic water releases from Fort Peck Dam and of the warmer sediment packed waters of the Milk and Redwater Rivers. The water transitions through segment 2 from, very cold clear waters in the upper most reaches to warmer more turbid waters in the downstream reaches near Wolf Point, MT.

The Milk River is the largest tributary in this segment and its flows can influence water temperature and discharge of the Missouri River (Kapuscinski, 2002). Throughout the spring, the Milk River forms a plume of warm turbid water that mixes with the cold clear waters of the Missouri. When the Milk River is flowing, it results in a warm turbid river on the north side of the channel and a cold clear river on the south side (Gardner and Stewart, 1987). The warm and cold waters do not generally mix until after moving 15 river miles downstream near Frazer Rapids, where the water remains relatively cold and clear (Kapuscinski, 2002). Water withdrawals for irrigation have reduced the Milk Rivers influence on the Missouri River during low water years.

Geologically, the entire segment is surrounded by the Bearpaw Shale formation, where upstream reaches are comprised of gravelly areas, which transition into sandbar

habitats farther downstream near Wolf Point (NRIS, 2007). Fish distribution changes throughout the segment in accordance with turbidity, temperature, and substrate.

Methods

Sampling methods for the Pallid Sturgeon Population Assessment Program were conducted in accordance with the Standard Operating Procedures (Drobish 2006), which was established by representatives from State and Federal agencies involved with pallid sturgeon recovery on the Missouri River. For a detailed description of methodologies please see Drobish (2006). A general description of those guidelines follows.

Sampling Site Selection and Description

Montana Fish Wildlife & Parks (FWP) was contracted to sample Segment 1 from Fort Peck Dam (RM 1771.5) to the mouth of the Milk River (RM 1761), Segment 2 from the mouth of the Milk River (RM 1761) to Wolf Point (RM 1701.5) and Segment 3 from Wolf Point (RM 1701.5) to the Montana/North Dakota border (RM 1586.5). Segment 2 consisted of twelve randomly selected bends. All 12 bends were sampled during both the sturgeon season (November through June) and the Fish Community Season (July through October).

Two gears, trammel net and otter trawl were considered standard gears for both the sturgeon and fish community seasons. The trammel net was used in all 12 randomly selected bends during both seasons, while the otter trawl was used in the 12 and 11 randomly selected bends during the sturgeon and fish community seasons, respectively. Additionally, mini fyke nets and the beam trawl were also considered standard gears for the fish community season. All 12 randomly selected bends were sampled with mini fyke nets during the fish community season. However, due to time constraints and the evaluation of the bag seine, we randomly selected half of the 24 bends in segments 2 and 3 combined for beam trawling and half to be sampled with the bag seine. Consequently, during the fish community season, four bends in segment 2 were randomly sampled with the beam trawl and eight were randomly sampled with the bag seine.

The Population Assessment Team developed a standard set of habitat classifications for the Missouri River (Appendix B) which consists of three distinct macrohabitats found in every bend, a main channel crossover (CHXO), main channel outside bend (OSB), and main channel inside bend (ISB). Each sampling bend was comprised of these three main

macrohabitats. Nine additional macrohabitats were identified that may or may not be present in every bend: large tributary mouths (TRML), small tributary mouths (TRMS), confluence areas (CONF), large and small secondary connected channels (SCCL& SCCS), deranged channels (DRNG), braided channels (BRAD), dendritic channels (DEND) and non-connected secondary channel (SCN).

Mesohabitats were established to further define macrohabitats. Mesohabitats include bars (BARS), pools (POOL), channel border (CHNB), thalweg (TLWG) and island tip (ITIP). Channel borders are situated in areas between the deepest portions of the river up to a depth of 1.2 m. Bars are considered shallow areas (< 1.2 m) where terrestrial and aquatic habitats merge. The thalweg is the deepest portion of the river between the two channel borders where the majority of the flow is directed. Pools are directly downstream of any feature that creates scour, thus creating a habitat of deep (> 1.2 m) slower moving water. Island tips are just downstream of bars or islands where two channels meet where the water is > 1.2 m in depth.

For all analysis, the sampling unit was the river bend, where every river bend has a channel crossover, inside and outside bend. The downstream border of a river bend is the beginning of the next downstream bend's channel crossover.

Sampling Gear

For specific information pertaining to the specific habitats gears are utilized in and physical measurements taken in accordance with sampling the various gears described below, please see Drobish (2006).

Trammel Net

The standard trammel net has a length of 38.1 m, an inner mesh wall 2.4 m and two outer mesh walls 1.8 m deep. The inner mesh is made of #139 multifilament twine with a bar mesh size of 25.4 mm. The outer walls are constructed of #9 multifilament twine with a bar mesh size of 203.2 mm. The float line is a 12.7 mm diameter foam core with a lead line of 22.7 kg. Trammel nets were drifted from the bow of the boat and orientated perpendicular to the river flow for a minimum of 75 m and a maximum drift distance of 300 m.

Otter Trawl

The standard otter trawl has a length of 7.6 m, a width of 4.9 m and height of 0.9 m. The otter trawl has an inner mesh (6.35mm bar, #18 polyethylene twine) and outer mesh (38mmbar, #9 polyethylene twine) and a cod end opening of 406.4 mm. The trawl doors were made from 19.1 mm marine plywood and measured 762 mm x 381 mm. The trawl doors are used to keep the mouth of the trawl open while deployed on the riverbed. The trawl also has a 7.9 m long tickler chain attached to the bottom of the mouth of the trawl, which aids in keeping it orientated on the riverbed and protecting the mouth when snags are encountered. The otter trawl was deployed from the bow of the boat parallel to the current with two 30.5 m ropes and towed downstream slightly faster than current speed for a minimum of 75 m and a maximum distance of 300 m.

Mini Fyke Nets

The standard mini-fyke net consists of two rectangular frames 1.2 m wide and 0.6 m high and two 0.6 m tempered steel hoops. A 4.5 m long and 0.6 m high lead is connected to the first frame. The fyke net was made of 3 mm “ace” style mesh. The lead has small floats attached to the top and lead weights on the bottom. Mini-fyke nets are set with a “T” stake on shore and extend into river as perpendicular to the shoreline as possible or angled slightly downstream where higher velocities existed. Mini-fyke nets were set overnight and checked the following morning.

Bag Seine

The bag seine is 9.1m long by 1.8m high with a bag of 1.8 m wide x 1.8 m high x 1.8m deep. The seine is made of 6.4 mm “ace” mesh and has a 29.5kg lead line attached to the bottom. A mud line was also attached to the bottom to facilitate seining silty or muddy bottoms. The bag seine was used in bar mesohabitats. Seines were pulled either in a downstream or upstream direction using a quarter arc, half arc, or rectangular method.

Beam Trawl

The standard beam trawl has a width of 2 m, a height of 0.5 m and a length of 5.5 m. The inner mesh size is 3.18 mm and outer mesh size of 38.1 mm and a cod end opening of 165.0 mm. The bottom of the mouth of the trawl has a 9.53 mm tickler chain attached. The beam trawl is attached to a steel frame with two steel skids to help in dragging the bottom The beam trawl is deployed over the bow of the boat and was towed parallel to the current in downstream direction for a minimum of 75 m with a maximum distance of 300 m.

Data Collection and Analysis

A minimum of eight random subsamples were taken in macrohabitats present at each randomly selected river bend. At least two subsamples (when possible) were taken using each gear in each macro habitat within a bend. More than two subsamples were taken in a macrohabitat for a gear when the number of discrete macrohabitats was less than four or less than four could be effectively sampled. When a pallid sturgeon was captured, we duplicated the sample in a non-random manner. No more than eight duplicates were taken and we would stop taking duplicates whenever two contiguous duplicate subsamples contain no pallid sturgeon. Although this non-random sampling, it gives us a better understanding of relative abundance and identifies habitats that pallid sturgeon may congregate in.

All fish were measured to the nearest mm. Fork length (FL) was used for pallid and shovelnose sturgeon, while other species were measured to TL, except for paddlefish *Polyodon spathula*, which were measured from the eye to the fork in the caudal fin. The first 25 fish of each species in each subsample were measured, after 25 they were counted.

Time was recorded at the beginning of each sample with all gears and an end time was always recorded when pulling mini fyke net sets. A global positioning satellite (GPS) position was taken at the beginning and end of all otter and beam trawls and trammel net drifts. One GPS location was taken for mini fyke net and bag seine samples (middle of the seine). All GPS locations were taken using a Garmin GPS 76 unit with Wide Area Augmentation System (WAAS) capability.

Sample depth was determined at the beginning, middle and end of each trawl and drift using a Lowrance X136 sonar unit. One depth was taken for mini fyke nets at the

intersection of the frame and floatline using a wading rod. A wading rod was also used to take two depths for bag seine hauls (midpoint between shore and the outer width of the seine and one at full extended width of the haul at the midpoint of the seine haul length).

Water temperature taken near the surface was recorded at every sample using the Lowrance X136 unit for trawls and trammel net drifts and using a hand held thermometer for mini fyke net and bag seine samples.

Habitat samples were collected randomly for 25% of each mesohabitat within each macrohabitat sampled. Velocities (mps) were taken at three depths in the water column for habitats > 1.2 m in depth (bottom, 0.8 of bottom depth and 0.2 of the bottom depth) using either a Current AA Price Meter and sounding reel or a Marsh-McBirney Flo Mate 2000. Velocities for shallow water habitats (< 1.2 m) were taken at the bottom and 0.6 of the bottom depth using the March-McBirney Flo Mate 2000.

Substrate was determined for habitats > 1.2 m in depth using a Hesse style substrate sampler. For habitats < 1.2 m in depth, a random hand grab was made. Substrate samples were reported as the percentage of sand, silt, gravel in each sample. In addition, the amount of cobble and organic material was qualitatively determined.

Turbidity was recorded in nephelometeric turbidity units (NTU) using a LaMotte 2020 turbidity meter. Turbidity was taken at the midpoint of all samples, except mini fyke sets, where it was taken at the convergence of the rectangular frame and float line.

In addition to 25% of all mesohabitats, habitat measurements were taken whenever a pallid sturgeon was captured.

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Drobish (2006). Two fin pectoral fin clips (~ 2 cm^2) are taken from any pallid sturgeon of unknown origin. Fin samples are then preserved in 95% non-denatured alcohol for genetic analysis. All samples are sent to the U.S. Fish and Wildlife Service's Abernathy Fish Technology Center for analysis and archiving.

Relative Condition

Relative condition (Kn) for all sampled pallid sturgeon was calculated using the following formula: Kn = W / W', where W is the fork length of the specimen and W' is the length-specific mean weight predicted by the weight-length relationship equation calculated for that population. Since no weight length-relationship exists for the hatchery reared pallid sturgeon population in segment 2, we used the weight-length relationship [$\log_{10} W = -6.378 + 3.357 \log_{10} L$ ($r^2 = 0.9740$)] derived by Keenlyne and Evanson (1993) for pallid sturgeon throughout their range.

Incremental Stock Density

Incremental stock density (RSD) was used to describe the size structure of pallid and shovelnose sturgeon sampled in segment 2. We used the length categories proposed by Shuman et al. (2006) for pallid sturgeon and Quist et al. (1998) for shovelnose sturgeon. Additionally, we broke up sub-stock sizes for both pallid and shovelnose into two groups to aid in determining recruitment of young-of-the-year (YOY) sturgeon. Fork length categories for both species of sturgeon are given in all figures and tables pertaining to RSD.

Analyses

The fundamental sampling unit for the Population Assessment Program is the river bend. Therefore, sample size was equal to the number of bends sampled. Accordingly, all catch-per-unit-effort (CPUE) estimates for each species by gear were made on a bend level and the mean bend CPUE's were averaged to obtain the segment CPUE. Cathc-per-unit-effort was both stratified by season and combined, depending on the analysis. In addition, stratification by macro- and mesohabitats was performed for each species. All CPUE estimates were performed by the Missouri Department of Conservation.

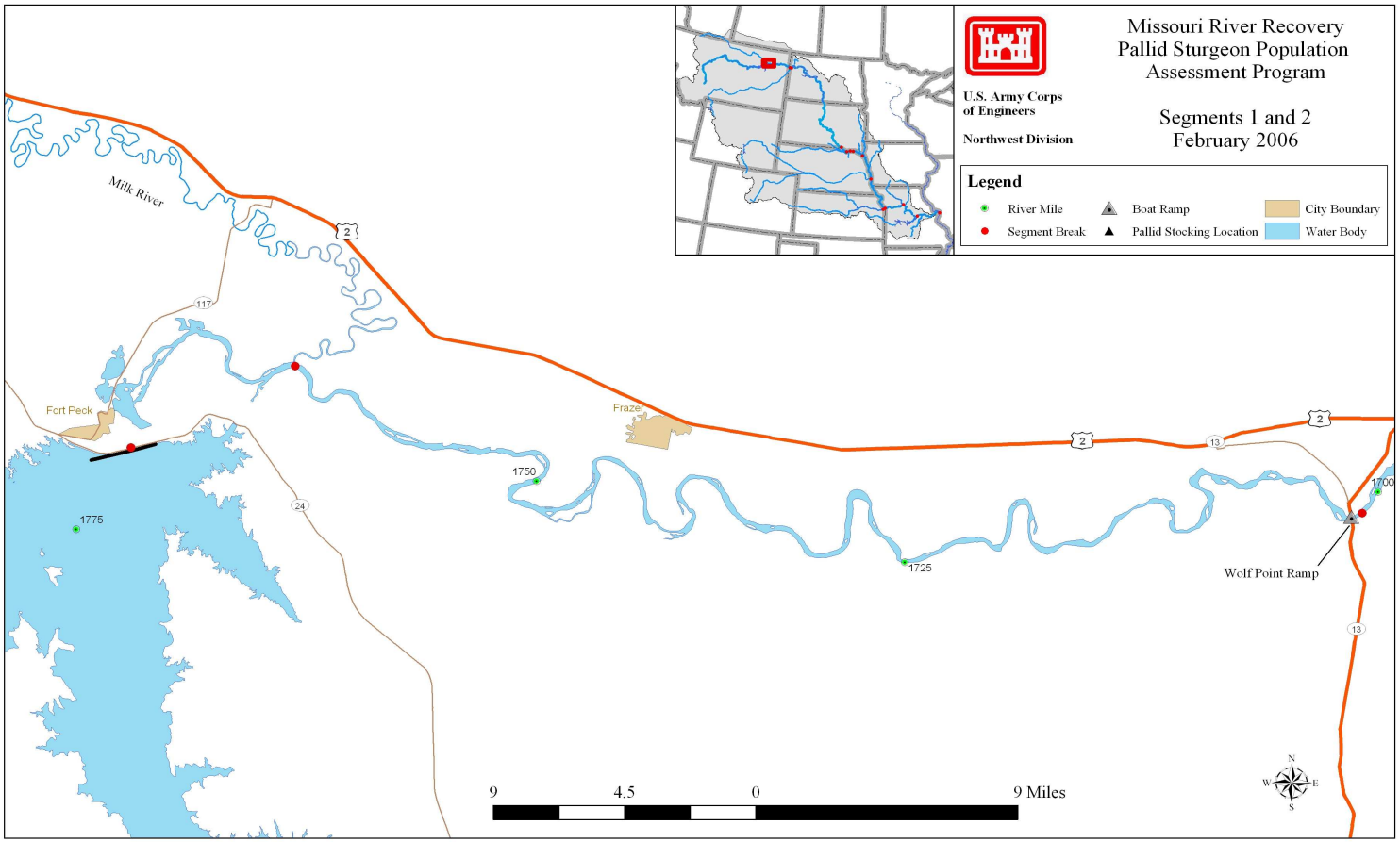

Figure 1a. Map of segment 2 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 2 encompasses the Missouri River from the mouth of the Milk River (River Mile 1760.0) to Wolf Point, MT (River Mile 1701.0)

Results

Pallid Sturgeon

During the 2006 field season a total of 13 hatchery reared pallid sturgeon were captured in segment 2, with one sturgeon being captured twice (May and August). No wild or pallid sturgeon of unknown origin, were sampled during 2006 (Figure 1b and 9). Of the 14 total pallid sturgeon captures, 4 and 10 were captured during the sturgeon and fish community seasons, respectively. Although sampling encompassed an area of approximately 57 river miles (1761 to 1704), the majority (N = 12) of pallid sturgeon captures were in a span of only six river miles (1710 to 1704). This six miles of river is situated just upstream of the Wolf Point stocking site at river mile 1702. The one pallid that was captured upstream of river mile 1719 was sample at river mile 1760, just 1.5 miles downstream of the 2006 Milk River stocking site.

No evidence of natural recruitment of pallid sturgeon or hybridization between pallid and shovelnose sturgeon was found in segment 2 during 2006. Pallid sturgeon demonstrated a limited length frequency histogram with all fish having a fork length between 260 and 370 mm (Figure 8), with a mean fork length (FL) of 310.4 mm. During sturgeon season all four pallid sturgeon sampled were within the sub-stock length category of 200-329 mm. Six of the 10 pallid sturgeon sampled during fish community season also fell within the sub-stock category of 200-329 mm, while the remaining four were in the larger stock category (330-629 mm) (Figure 8). The overall relative condition factor (Kn) for pallid sturgeon was higher during the sturgeon season (0.99) than during the fish community season (0.91), keeping in mind sample sizes were low. Data gaps in the stocking histories of pallid sturgeon recaptured during 2006 preclude a thorough analysis of growth data. However, the mean growth rate for two 2003 and seven 2005-year class pallid sturgeon recaptured in 2006 was 0.25 and 0.40 mm/day, respectively (Table 6). Four pallid sturgeon age classes were represented in 2006, 2001 (N = 1), 2002 (N = 1), 2003 (N = 2), and 2005 (N = 10).

All 14 pallid sturgeon captured in segment 2 were captured in randomly selected river bends using standard gears: 16-ft otter trawl (N=12), drifted trammel nets (N=1) and beam

trawl (N = 1) (Tables 11-16). Six of the 14 pallid sturgeon were sampled in non-random duplicate subsamples. No pallid sturgeon were captured in segment 2 using mini-fyke nets during 2006. Although all pallids were captured in random bends, eight were sampled in random subsamples and six were sampled in non-random duplicate subsamples.

Otter trawls had the highest catch-per-unit-effort (CPUE) for pallid sturgeon in both fish community (0.026 fish/100 m) (Figure 5) and sturgeon season (0.012 fish/100 m) (Figure 2) when compared to trammel nets drifted during fish community (0.003 fish/100 m) and sturgeon season (0.00 fish/100 m) (Figure 3). The beam trawl was only used during the fish community season and it had a CPUE for pallid sturgeon of 0.009 fish/100 m.

The specific macro- and mesohabitats where sampling occurred and pallid sturgeon were captured is displayed in Table 3. Four pallid sturgeon were sampled in each of the channel crossovers, inside bends, and large connected side channel macrohabitats, while the two remaining pallid sturgeon were found in outside bends (Table 3). All pallid sturgeon sampled in segment 2 were found in channel border mesohabitats (Tables 12 and 14).

The proportion of pallid sturgeon sampled in specific macro- and mesohabitats varied from the proportion in which those habitats were sampled. Fifty percent (N = 2) of sub-stock size (200-239 mm) pallid sturgeon sampled using otter trawls during sturgeon season were captured in channel crossovers, while channel crossovers only represented 23% of the macrohabitats sampled using the otter trawl during the same season (Table 11). Similarly, 60 % (N = 3) of substock (200-239 mm) pallid sturgeon sampled during the fish community season with the otter trawl were sampled in large connected side channels, while this macrohabitat was only represented 21 % of the macrohabitats sampled with the otter trawl. The only pallid sampled while drifting trammel nets occurred during the fish community season in an outside bend.

For the larger substock size (330-629 mm), 33 % of pallid sturgeon (N =1) sampled with the otter trawl occurred in each of the channel crossover, inside bend, and large connected side channels, while those same habitats made up 26, 30, and 21 % of the macrohabitats sampled, respectively (Table 13).

Water temperature varied between pallid sturgeon captures, with a mean of 17.7 C^o, a minimum of 12.6 C^o, and a maximum of 21.4 C^o. Conversely, turbidity remained relatively

constant between pallid captures, with a mean 14.4 NTU, minimum of 12 NTU and a maximum turbidity of 18 NTU.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for segment 2 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006. Blanks indicate these habitats were not sampled or are non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	12	8.75		24	2			27	23	29						
2.5 Inch Trammel Net																
Otter Trawl	12	9.25		26	2			27	25	31						
Summer – Fish Community Season																
1 Inch Trammel Net	12	8.5		27				28	27	18				2		
Beam Trawl	4	8.5		11				11	9	3						
Mini-Fyke Net	12	6.75		6	2			20	18	14	13	7			1	
Otter Trawl	12	9.5		29	2			34	25	24						

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segment 2 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006. Blanks indicates the habitat is was not sampled or is non-existent in the segment.

Gear	Number of bends	Mean Effort	**Mesohabitat**				
			BAR	POOL	CHNB	TLWG	ITIP
Fall through Spring – Sturgeon Season							
1 Inch Trammel Net	12	8.75		84		2	19
Gill Net							
Otter Trawl	12	9.25		89		3	19
Summer – Fish Community Season							
1 Inch Trammel Net	12	8.50		93	1	8	
Beam Trawl	4	8.50		34			
Mini-Fyke Net	12	6.75	77	1			
Otter Trawl	12	9.50		110		4	

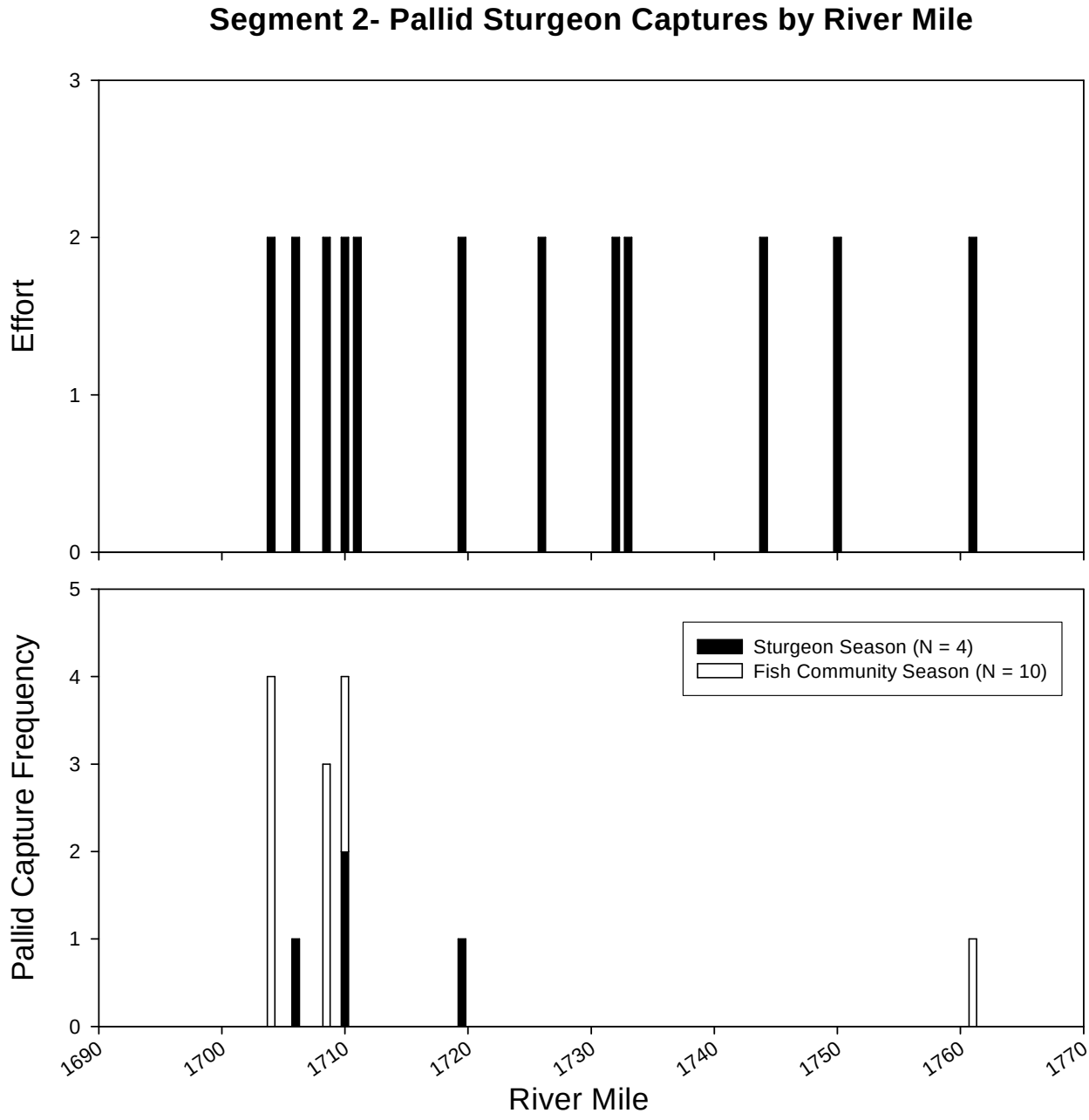

Figure 1b. Distribution of: A) seasonal sampling effort and B) pallid sturgeon captures by river mile for segment 2 of the Missouri River during 2006. Sampling effort of 2 indicates bend sampled in both sturgeon and fish community seasons. Sampling effort of 1 indicates bend was sampled in only one season. Black bars represent pallid captures during Sturgeon Season and white bars during Fish Community Season. Figure includes all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on segment 2 of the Missouri River during 2006. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. ℃ (Effort)	Temp. ℃ (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
CHXO	BAR	0.4 (0.3-0.6)		0.11 (0-0.25)		15.9 (13-18.8)		13 (9-21)		0
	CHNB	1.8 (0.4-3.7)	1.4 (1.0-2.1)	0.62 (0.11-0.32)	0.74 (0.71-0.76)	15.3 (8.2-20.3)	16.0 (15.3-17.2)	15 (6-160)	14 (12-15)	4
	TLWG	2.4		0.79		15.0		13		0
CONF	BAR	0.2 (0.2-0.3)		-		21.0 (17.9-24.0)		-		0
	CHNB	1.3 (0.8-2.3)		0.28 (0-0.55)		13.4 (10.4-22.9)		28 (9-56)		0
ISB	BAR	0.4 (0.1-0.6)		0.08 (0-0.21)		16.8 (9.3-20.8)		16 (4-45)		0
	CHNB	1.7 (0.6-3.4)	2.1 (1.0-3.1)	0.56 (0.17-0.84)	0.47 (0.17-0.72)	15.5 (8.3-20.6)	16.5 (15.4-17.8)	15 (6-150)	16 (14-18)	4
OSB	BAR	0.4 (0.2-0.7)		0.05 (0-0.17)		17.3 (9-20.8)		19 (8-65)		
	CHNB	1.9 (0.6-4.4)	1.8 (1.5-2.1)	0.57 (0.3-0.81)	0.55 (0.41-0.69)	15.3 (8.2-19.7)	15.0 (12.6-17.3)	12 (6-18)	13 (13-13)	2
SCCL	BAR	0.4 (0.1-1.0)		0.06 (0-0.14)		17.5 (9-20)		13 (7-20)		
	CHNB	1.5 (0.7-3.2)	1.5 (1.1-2.0)	0.59 (0.05-0.81)	0.64 (0.51-0.76)	16.7 (8.4-21.5)	21.2 (20.7-21.5)	17 (7-100)	14 (13-14)	4
	TLWG	1.2 (1-1.2)		0.66 (0.58-0.74)		15.9 (15.3-16.3)		11 (8-14)		0
	ITIP	1.5 (0.7-3.2)		0.52 (0.19-0.78)		15.5 (10.0-19.6)		19 (8-120)		0
SCCS	BAR	0.4 (0.2-0.7)		0.07 (0-.018)		15.3 (8.0-21.5)		12 (3-17)		0
SCN	BAR	0.5 (0.4-0.6)		0.05 (0-0.01)		20.0 (18.0-22.0)		27 (9-60)		0
	-	0.4 (0.3-0.6)		0 (0-0.01)		20.5 (19.5-23)		18 (10-27)		
TRML	BAR	0.4		0.17		17.9		7		0
	CHNB	1.2 (1.1-1.3)		0.31		15.8 (15.7-15.8)		6		0
TRMS	BAR	0.2		0		5.0		650		0

Table 6. Mean fork length, weight, relative condition factor (Kn), and growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2006 from segment 2 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year. Sample size is only for fish with sufficient stocking data.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001	1	230			342	118.0	0.88	0.75	
2002									
2003	2	94			296	79.5	0.96	0.25	
		(0)			(4)	(9.0)	(0.07)	(0.02)	
2004									
2005	7	267			308	93.0	0.95	0.40	
		23			(33)	(28.2)	(0.07)	(0.30)	
2006									

Table 7. Incremental relative stock density (RSD)[a] and relative condition factor (Kn) for all pallid sturgeon captured with all gears by a length category during 2006 in segment 2 of the Missouri River. Length categories[b] determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (2SE)
Sturgeon Season			
Sub-stock (0-199)			
Sub-stock (200-329)	4	--	0.99 (0.08)
Stock			
Quality			
Preferred			
Memorable			
Trophy			
Overall Kn	4		0.99 (0.08)
Fish Community Season			
Sub-stock (0-199)			
Sub-stock (200-329)	6	--	0.93 (0.06)
Stock	4	--	0.89 (0.08)
Quality			
Preferred			
Memorable			
Trophy			
Overall Kn	10		0.91 (0.04)

[a] RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 100.
[b] Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL < 330 mm (20 %), Stock FL =330 - 629 mm (20 – 36 %), Quality FL = 630 – 839 mm (36 – 45 %), Preferred FL = 840 – 1039 mm (45 – 59 %), Memorable FL = 1040 – 1269 mm (59 – 74 %), Trophy FL > 1270 mm (>74 %).

Segment 2 - Pallid Sturgeon / Sturgeon Season

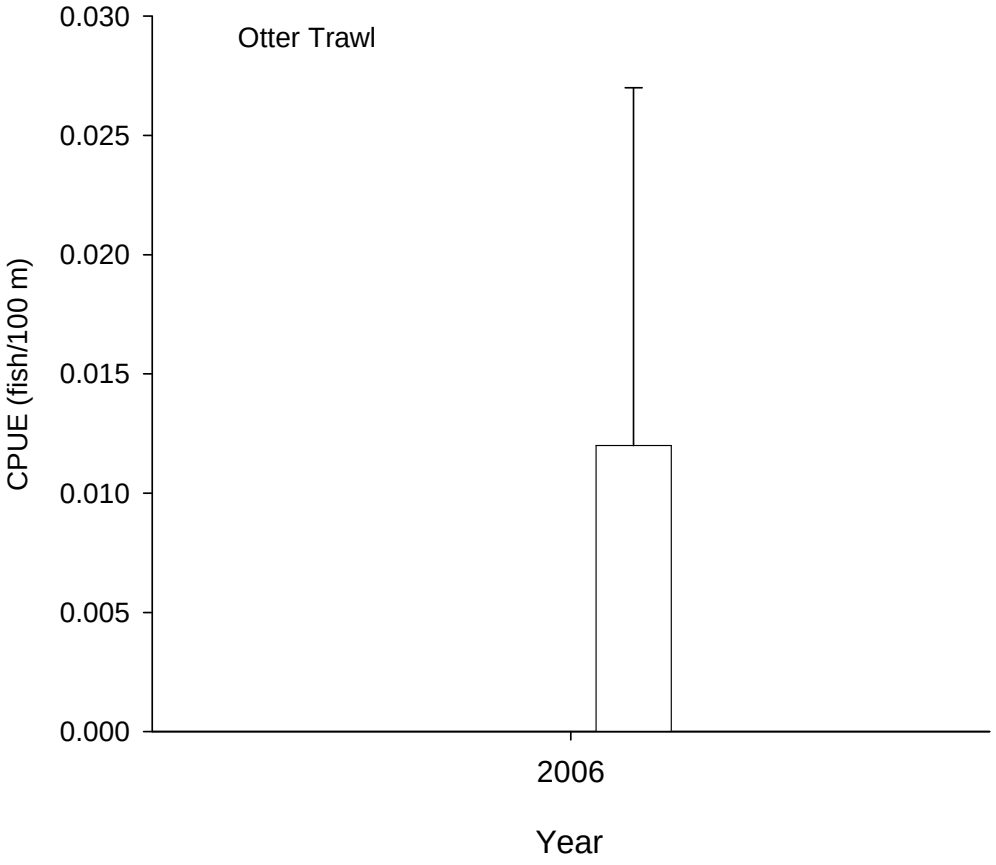

Figure 2. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and hatchery reared (white bars) pallid sturgeon using otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

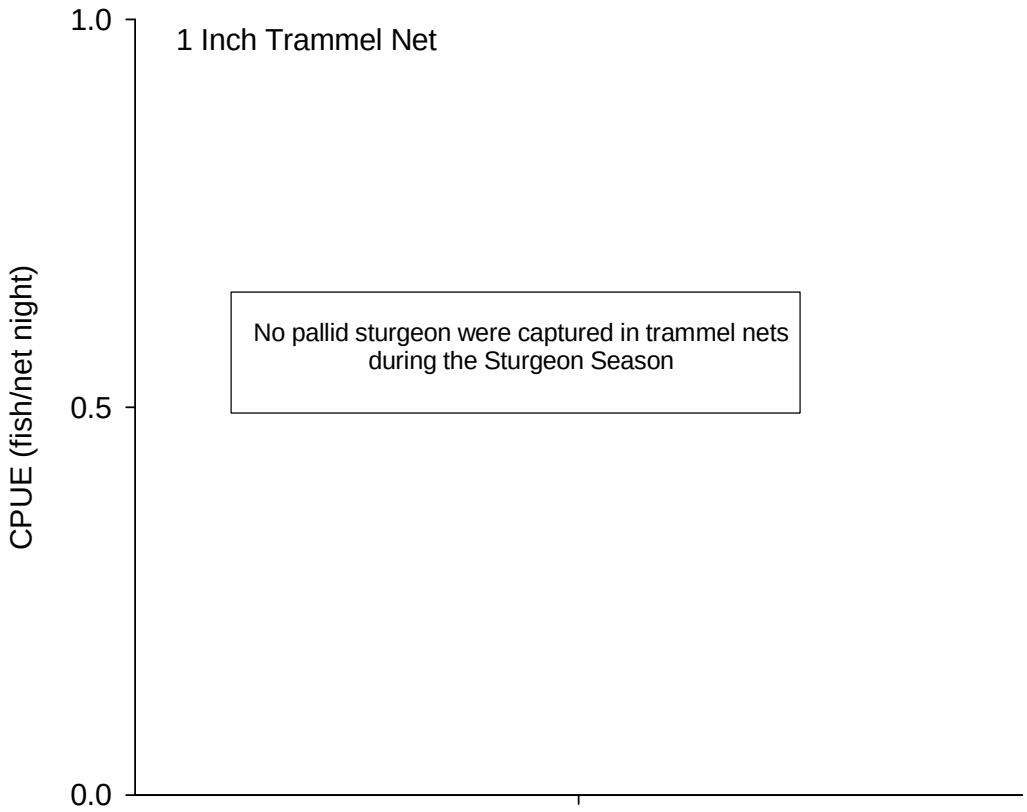

Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and hatchery reared (white bars) pallid sturgeon using 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006.

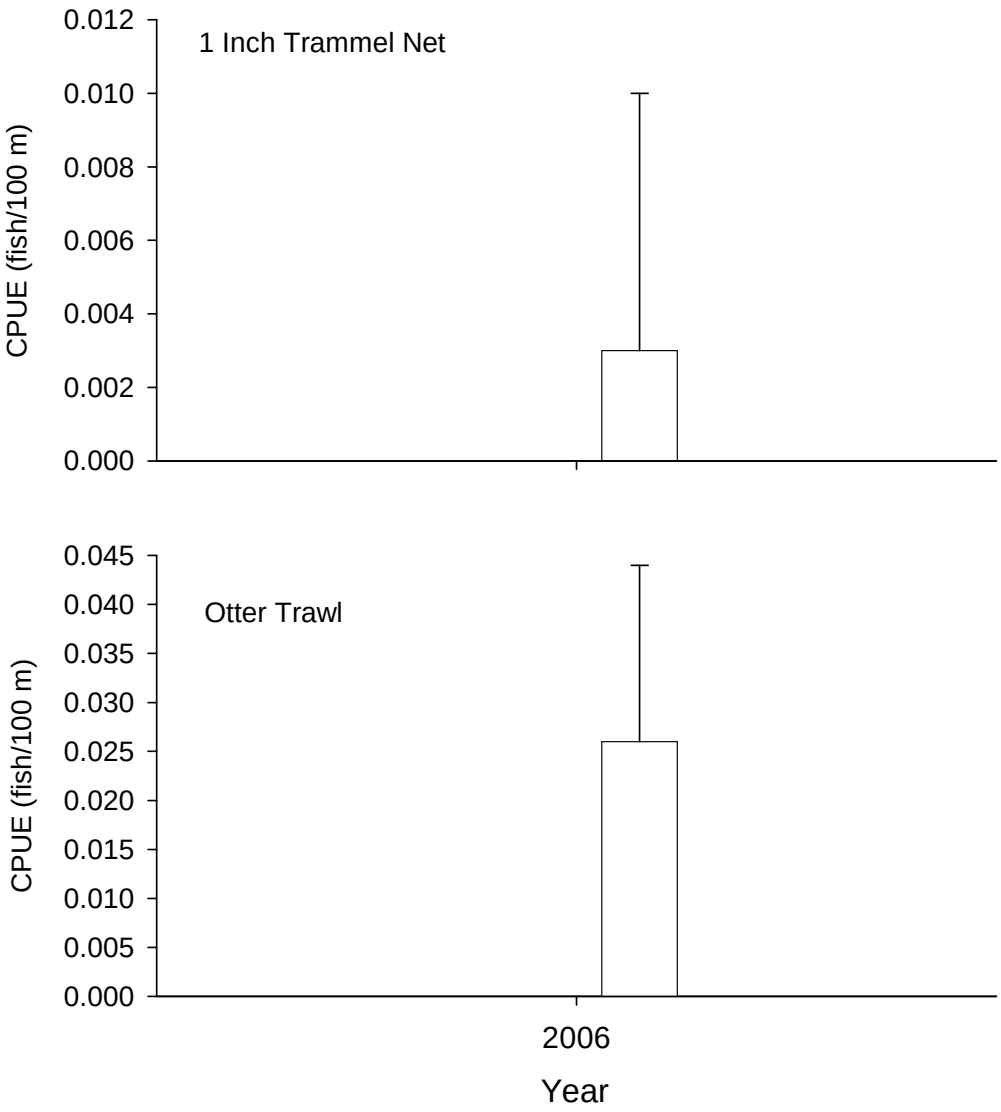

Figure 5. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and hatchery reared (white bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 2 of the Missouri River during fish community season 2006. Note the differences in the Y-axis'.

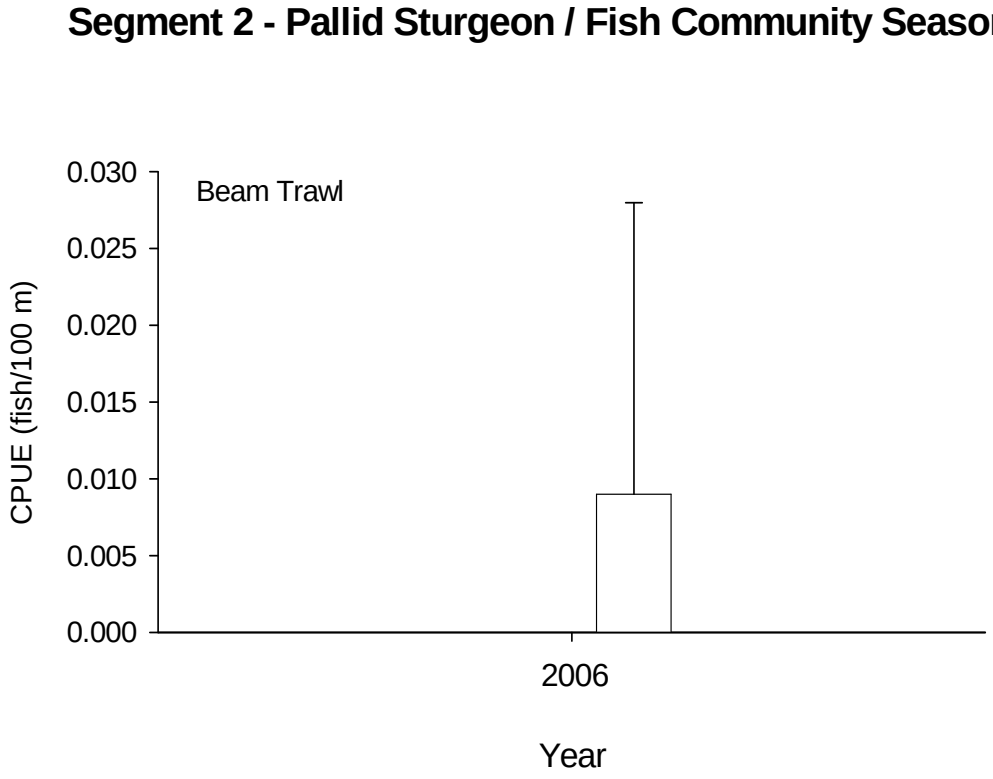

Figure 6. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and hatchery reared (white bars) pallid sturgeon using beam trawls in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Pallid Sturgeon / Fish Community Season

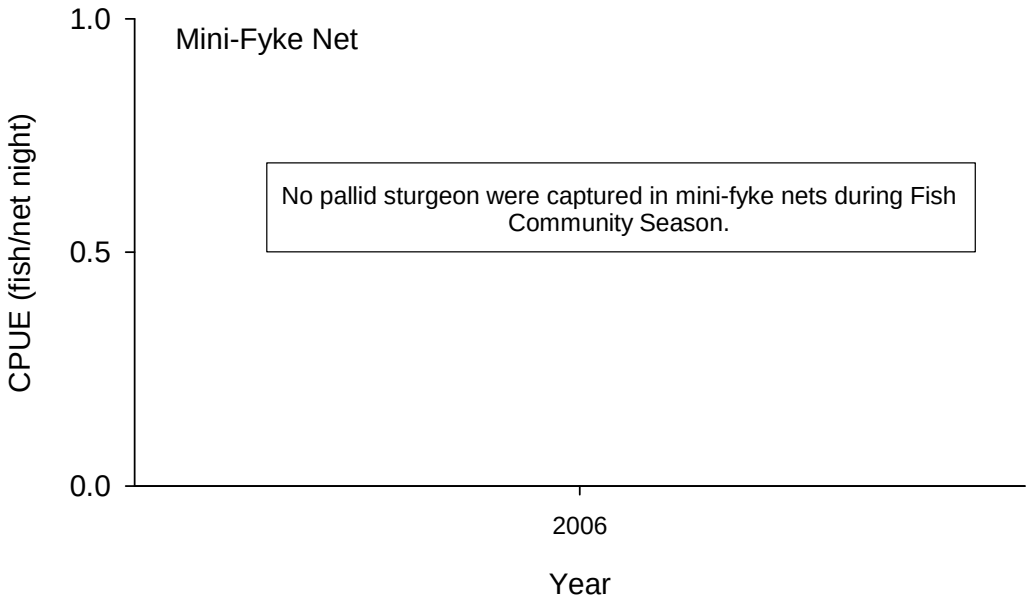

Figure 7. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and hatchery reared (white bars) pallid sturgeon using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Macrohabitat**													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	4		50 (23)	(2)			25 (26)	25 (25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	1		(28)				(29)	100 (27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	5		(26)	(1)			40 (30)	(21)	60 (21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	4		100 (84)	0 (13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	1		100 (92)	0 (6)		0 (1)
Beam Trawl			(100)			
Mini-Fyke Net		(95)	(1)			
Otter Trawl	5		100 (98)	0 (2)		

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Macrohabitat**													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	1		100 (34)				0 (32)	0 (26)	0 (8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	3		33 (26)	0 (1)			33 (30)	0 (21)	33 (21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	1		100 (100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	3		100 (98)	0 (2)		

Table 15. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

Table 16. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

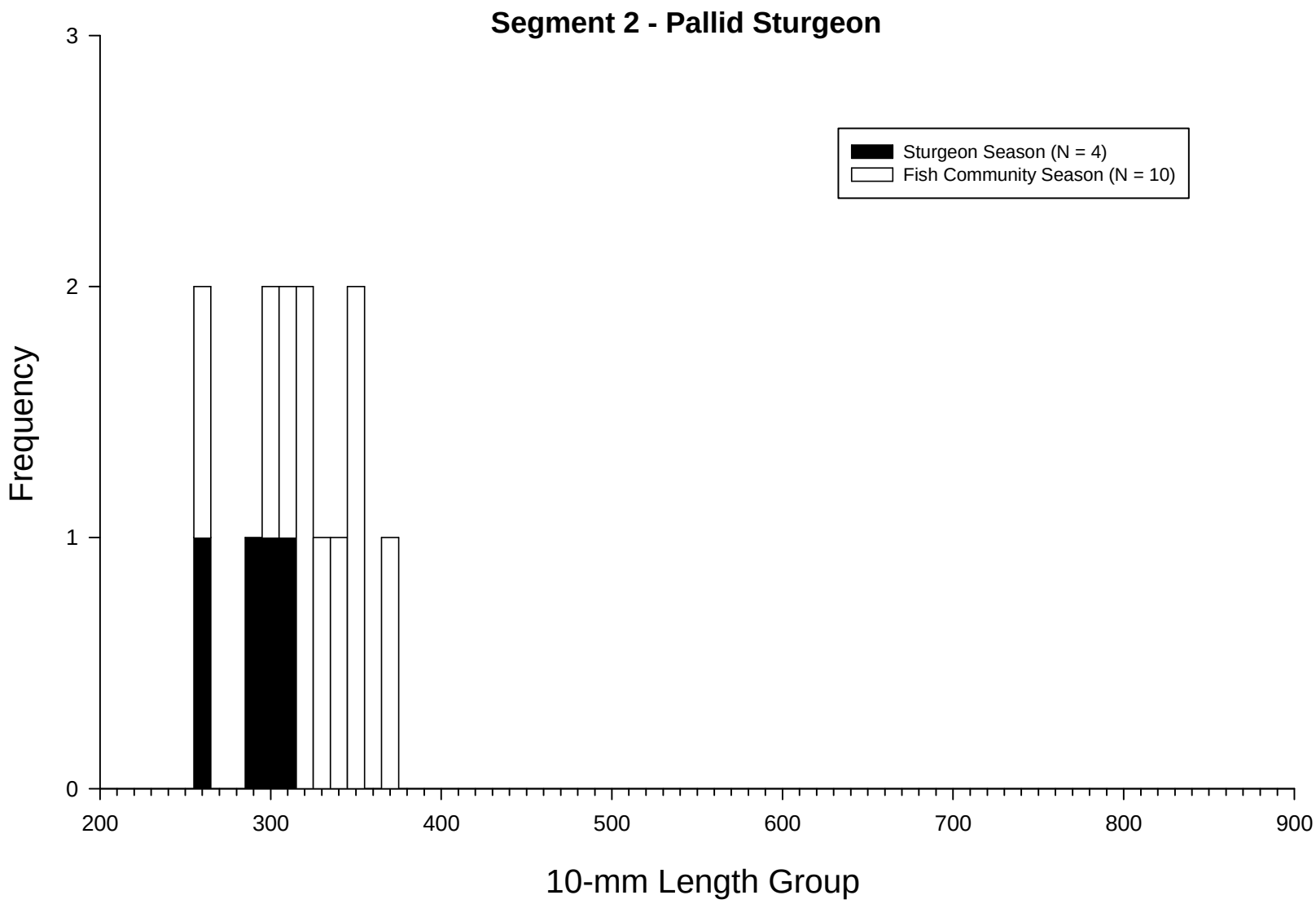

Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006 including non-random and wild samples.

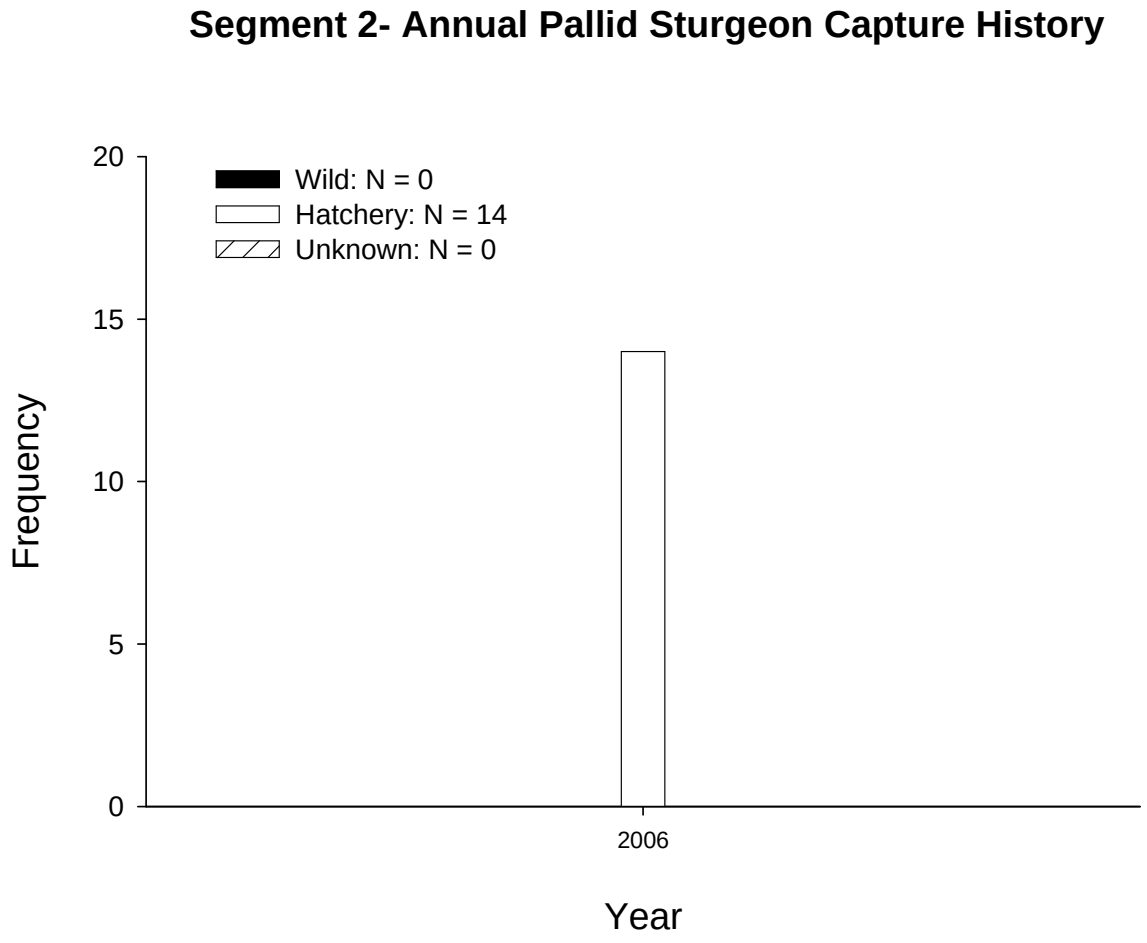

Figure 9. Annual capture history of wild (black bars) and hatchery reared (white bars) pallid sturgeon collected in segment 2 of the Missouri River during 2006. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years

Targeted Native River Species

Shovelnose Sturgeon

A total of 427 shovelnose sturgeon were sampled during 2006 in segment 2. All but one shovelnose sturgeon were captured using standard gears. Of the total shovelnose sturgeon sampled, trammel nets captured 72.1 % (N = 308), otter trawls 27.4 % (N = 117), beam trawl 0.2 % (N = 1), mini-fyke nets 0.0 % (N = 0), and wild sampling using a bag seine captured 0.2 % (N = 1). All shovelnose sturgeon were captured in randomly selected bends and 414 were captured during random subsamples, whereas the remaining 13 were sampled in non-random duplicate subsamples.

The length frequency histogram of shovelnose sturgeon (Figure 17) sampled in segment 2 indicates more age classes and the presence of older fish when compared to pallid sturgeon (Figure 8). However, no shovelnose sturgeon smaller than 320 mm FL were sampled. Based on data from Pierce et al. (2003), no shovelnose sturgeon younger than age-5 were observed in segment 2. In total, shovelnose sturgeon averaged 558.8 mm FL and 654.9 g in weight. When size classes are compared, 98.1 % (N = 418) of shovelnose were of quality size or greater (≥ 380 mm), while only 1.9 % (N = 8) were of stock size and no substock sized (≤249 mm) shovelnose sturgeon were sampled (Tables 17-24).

Relative stock densities for shovelnose sturgeon in segment 2 lend further evidence of an old aged population with little recruitment (Table 25). However, segment 2 is not a closed system and juvenile rearing habitat is most likely downstream in segment 3 and 4. Nevertheless, few (N = 8) stock-sized shovelnose sturgeon were found in segment 2 during 2006. Shovelnose sturgeon captured during sturgeon season had a higher mean relative weight (Wr) (89.21) than those captured during fish community season (80.53).

More shovelnose sturgeon were sampled (N = 238) during fish community season when compared to sturgeon season (N = 189) (Figure 17). The highest CPUE for shovelnose sturgeon were observed in quality and above sized fish in trammel nets, where a CPUE of 0.774 (Figure 14) and 0.518 fish/100m (Figure 12) was observed during the fish community and sturgeon seasons, respectively. For otter trawls, the CPUE for quality and above sized shovelnose sturgeon was almost double during the fish community season (0.242 fish/100 m) (Figure 11) when compared to the sturgeon season (0.129 fish/100m) (Figure 14), although a great amount of variability was present in all estimates. Catch-per-unit-effort estimates were considerably lower

for stock sized shovelnose sturgeon than for quality and above sized fish (Figures 11, 12 and 14). However, there was no evident difference in CPUE for stock sized shovelnose sturgeon between the otter trawl and trammel nets, even though no stock sized shovelnose sturgeon were captured in trammel nets during the fish community season (Figures 11, 12, 14 and 15). An overall CPUE for all sizes of CPUE by gear is found in the Appendix F section.

The proportion of shovelnose sturgeon sampled by size class, gear, macro-, and mesohabitats and the proportion that those habitats were sampled is found in Tables 17 through 24. In general, the proportion of shovelnose sturgeon sampled within a specific habitat was similar to the proportion that the particular habitat was sampled. Similarly, shovelnose sturgeon were sampled at a relatively equal proportion throughout the length of segment 2. One noticeable exception did occur at river mile 1744, where 33.8 % (N = 144) of shovelnose sturgeon were sampled. River mile 1744 had a large amount of gravel when compared to the majority of other bends sampled in segment 2 and was one of only three bends we sampled that had cobble present.

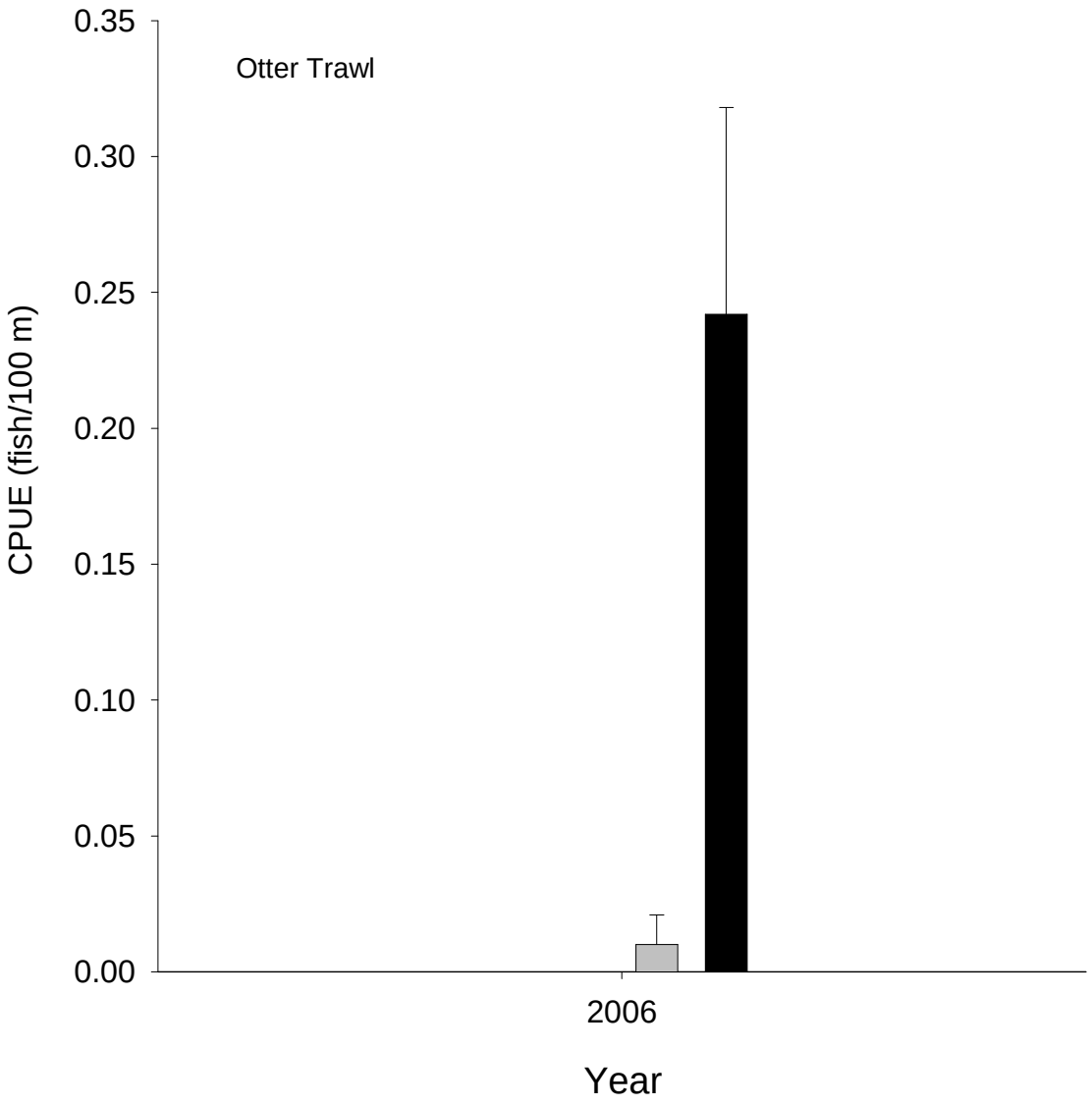

Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using otter trawls in segment 2 of the Missouri River during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

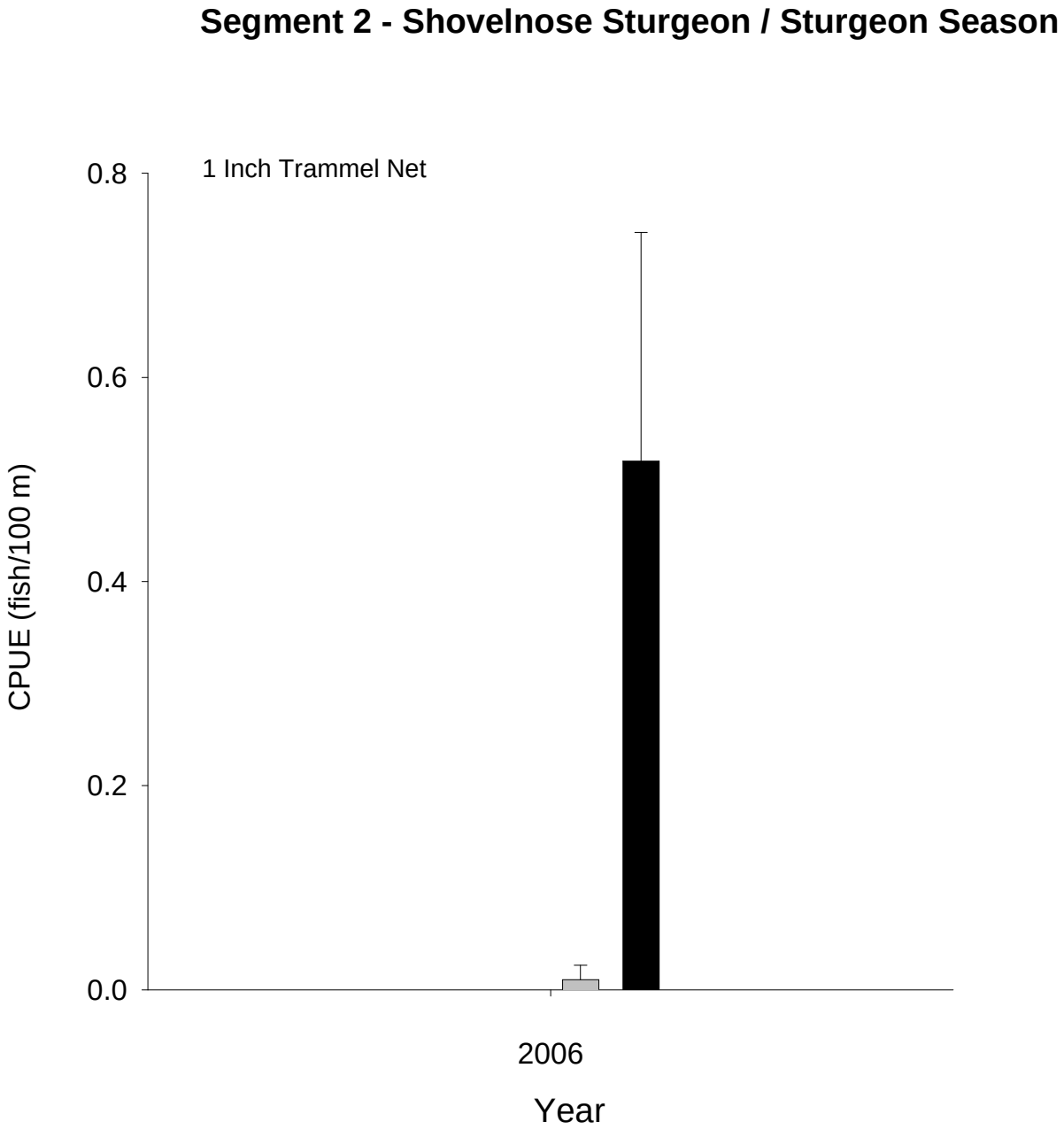

Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 2 of the Missouri River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

Segment 2 - Shovelnose Sturgeon / Fish Community Season

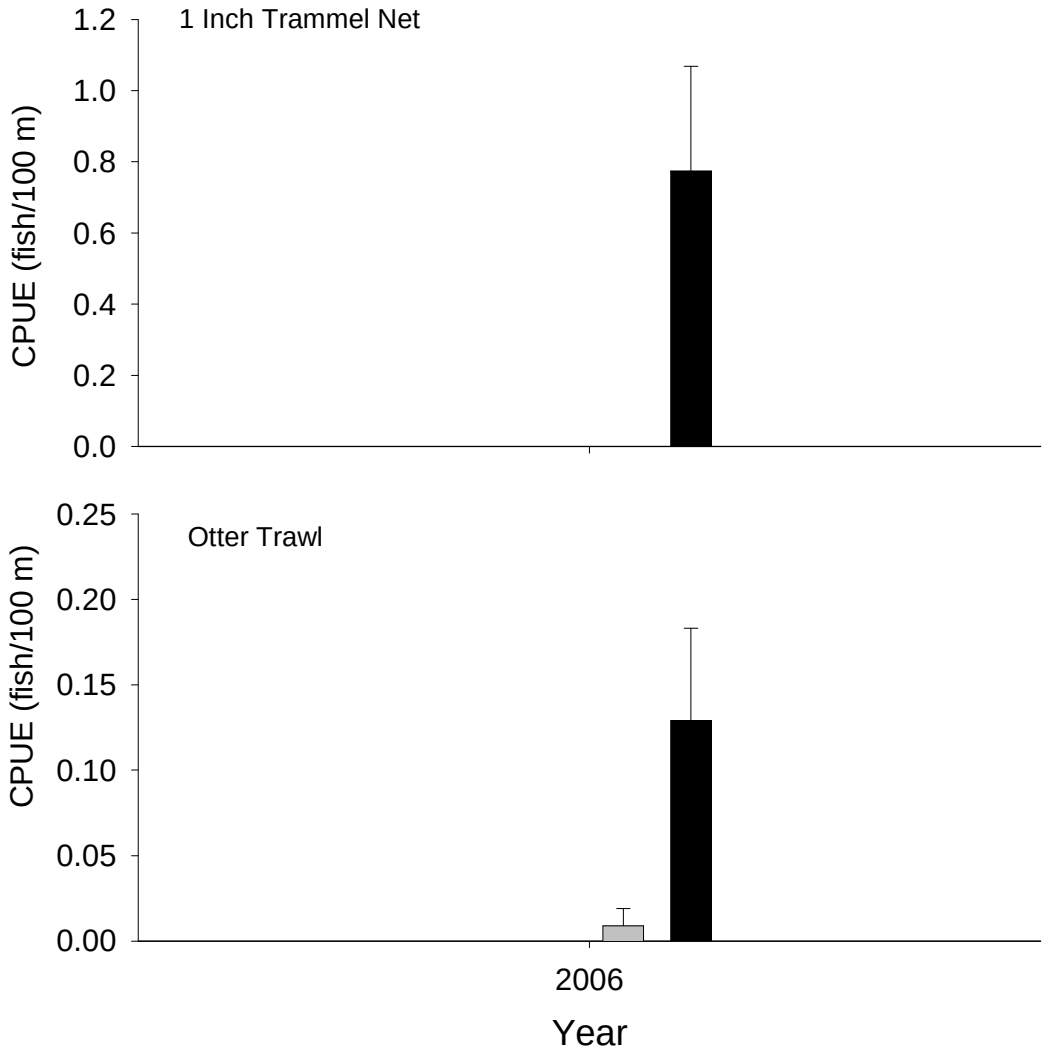

Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 2 of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

Segment 2 - Shovelnose Sturgeon / Fish Community Season

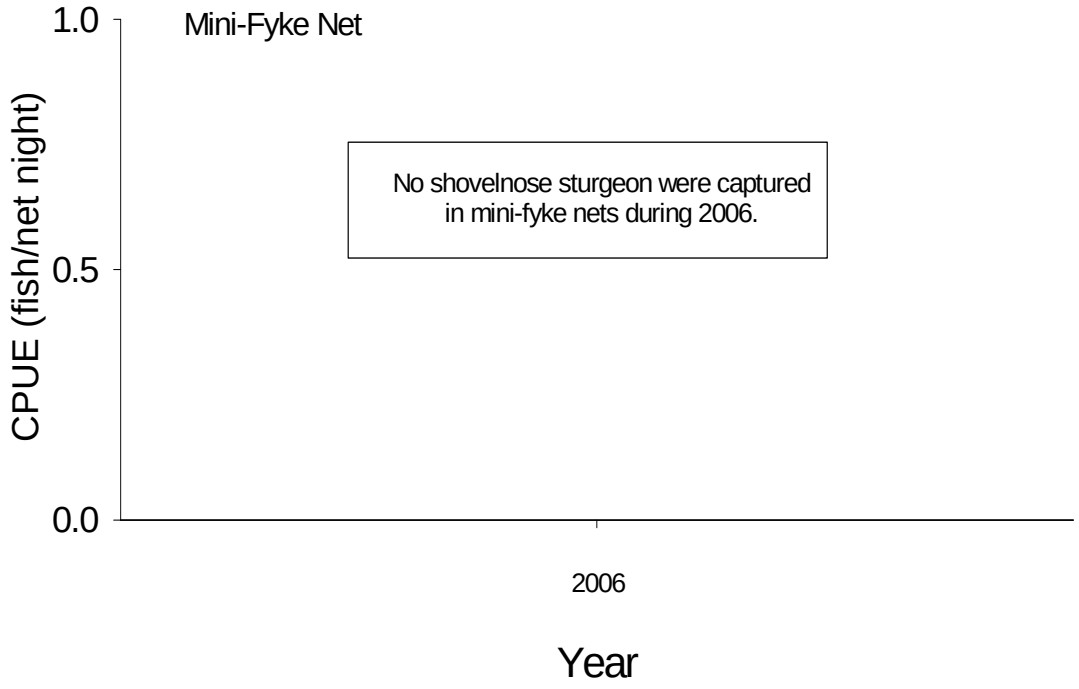

Figure 15. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using mini-fyke nets and bag seines in segment 2 of the Missouri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

Segment 2 - Shovelnose Sturgeon / Fish Community Season

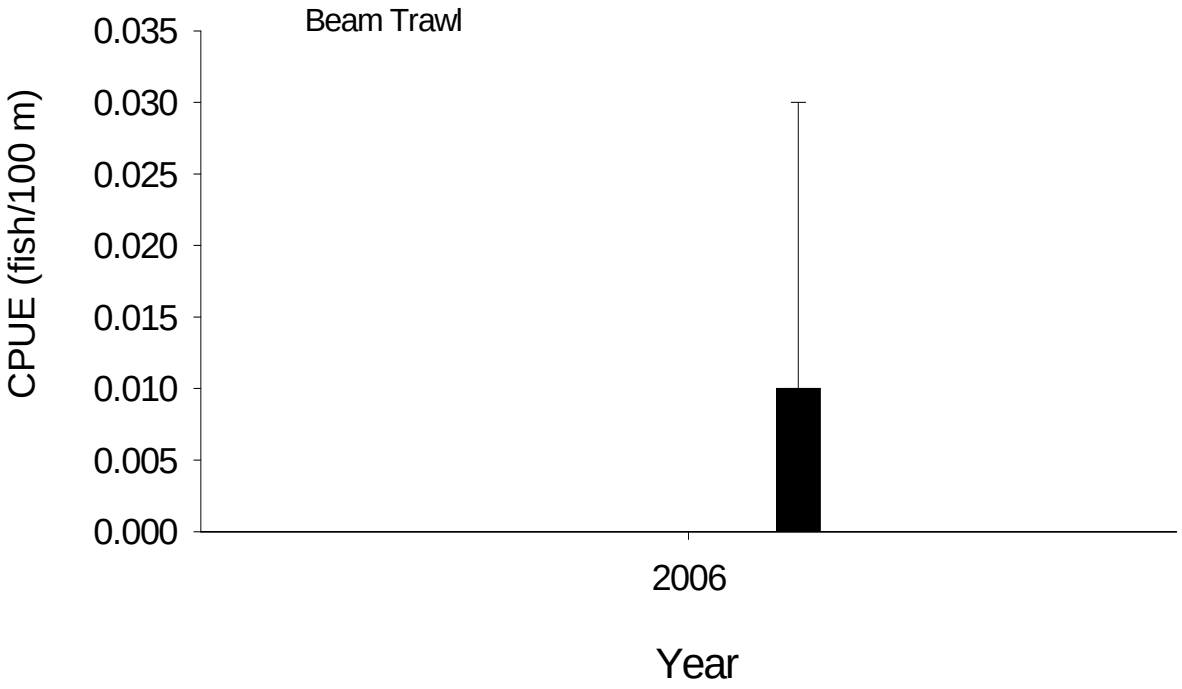

Figure 16. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using beam trawls in segment 2 of the Missouri River during fish community season 2006.

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or 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		(26)	(1)			(25)	50 (23)	50 (25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	3		33 (23)	(2)			33 (26)	(25)	33 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	3		(26)	(1)			33 (30)	(21)	67 (21)						

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 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	2		100 (81)	 (16)		 (2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	3		67 (84)	33 (13)		 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		 (92)	 (6)		 (1)
Beam Trawl	0		 (100)			
Mini-Fyke Net		 (95)	 (1)			
Otter Trawl	3		100 (98)	 (2)		

Table 23. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or 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	120		8 (26)	(1)			46 (25)	20 (23)	27 (25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	64		27 (23)	(2)			28 (26)	27 (25)	19 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	186		19 (28)				21 (29)	51 (27)	10 (15)				(1)		
Beam Trawl	1		 (34)				 (32)	100 (26)	 (8)						
Mini-Fyke Net	0		 (7)	(2)			 (25)	 (22)	 (17)	(16)	(9)			(1)	
Otter Trawl	47		26 (26)	(1)			49 (30)	19 (21)	6 (21)						

Table 24. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	120		87 (81)	12 (16)		1 (2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	64		84 (84)	14 (13)		2 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	186		93 (92)	7 (6)		 (1)
Beam Trawl	1		100 (100)			
Mini-Fyke Net	0	 (95)	 (1)			
Otter Trawl	47		100 (98)	 (2)		

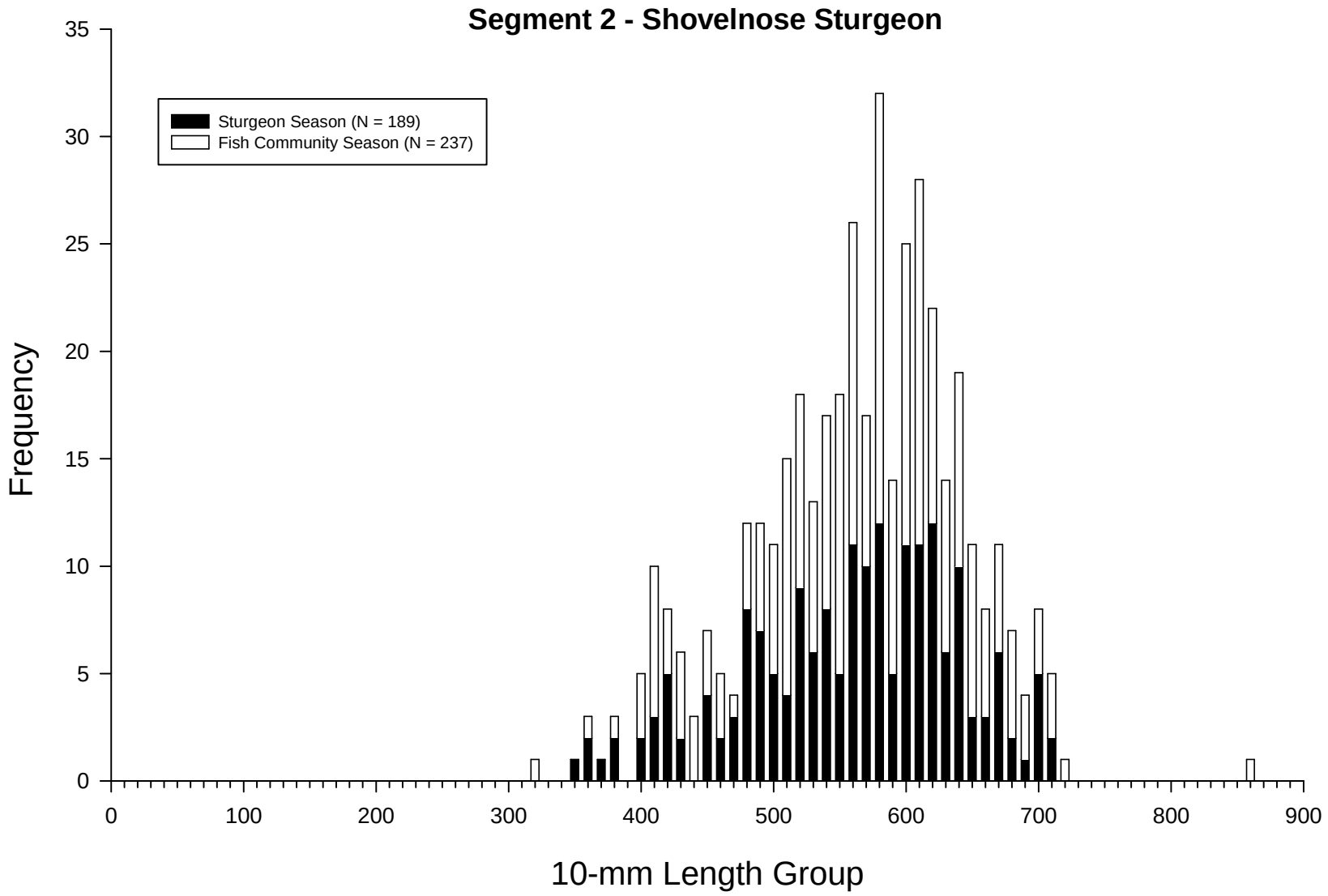

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Table 25. Incremental relative stock density (RSD)[a] and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 2 of the Missouri River captured during 2006. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	0		
Sub-stock (150-249 mm)	0		
Stock	5	2.65	95.34 (14.00)
Quality	45	23.81	96.71 (9.01)
Preferred	114	60.32	87.67 (2.98)
Memorable	25	13.23	81.47 (3.10)
Trophy	0		
Overall Wr	189		89.21 (2.92)
Fish Community Season			
Sub-stock (0-149 mm)	0		
Sub-stock (150-249 mm)	0		
Stock	3	1.27	81.14 (7.50)
Quality	51	21.52	79.22 (4.90)
Preferred	148	62.45	81.13 (1.74)
Memorable	34	14.35	79.67 (2.72)
Trophy	1	0.42	84.45
Overall Wr	237		80.53 (1.55)

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

[b] Length categories based on the percentage of the largest known 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

A total of 113 sturgeon chubs were sampled in segment 2 during 2006, of which 111 were captured using standard gears (Figure 21). The additional two sturgeon chubs were sampled using a bag seine. Of the 111 sturgeon chubs sampled using standards gears, 87 and 24 were sampled with the otter and beam trawls, respectively. No sturgeon chubs were captured in either the trammel or mini-fyke nets. The highest CPUE for sturgeon chubs was observed using the beam trawl during the fish community season (0.246 fish/100m), although CPUE for the otter trawl during the sturgeon season (0.230 fish/100m) was similar (Figures 18 and 19). The otter trawl had a considerably lower CPUE during fish community season (0.085 fish/100 m).

Sturgeon chubs had a mean total length (TL) of 73.3 mm, a minimum TL of 45 mm and a maximum TL of 88 mm. The mean size of sturgeon chubs did not differ greatly between the sturgeon and fish community seasons. The total number of sturgeon chubs sampled as well as CPUE for both beam trawl and otter was appreciably higher in the downstream most river miles sampled. From river mile 1704 upstream to river mile 1711 (41.6 % of bends sampled) 76.6 % of all sturgeon chubs in segment 2 were sampled. Additionally, no sturgeon chubs were sampled upstream of river mile 1744.

For the most part, sturgeon chubs were sampled in all macro- and mesohabitats that were sampled and in a similar proportion to the way in which those habitats were sampled (Tables 26 and 27).

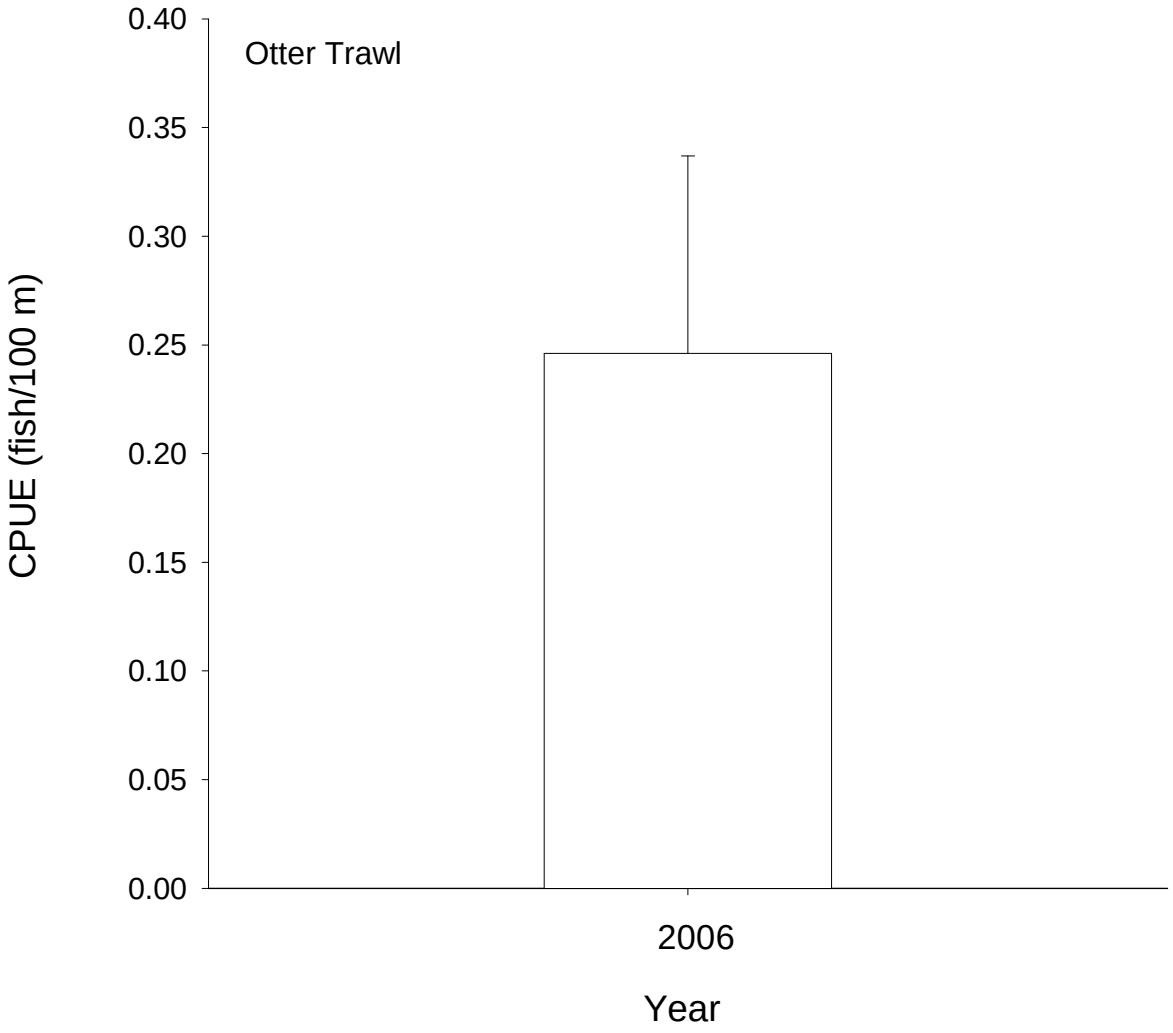

Figure 18. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls in segment 2 of the Missouri River during sturgeon season 2006

Segment 2 - Sturgeon Chub / Fish Community Season

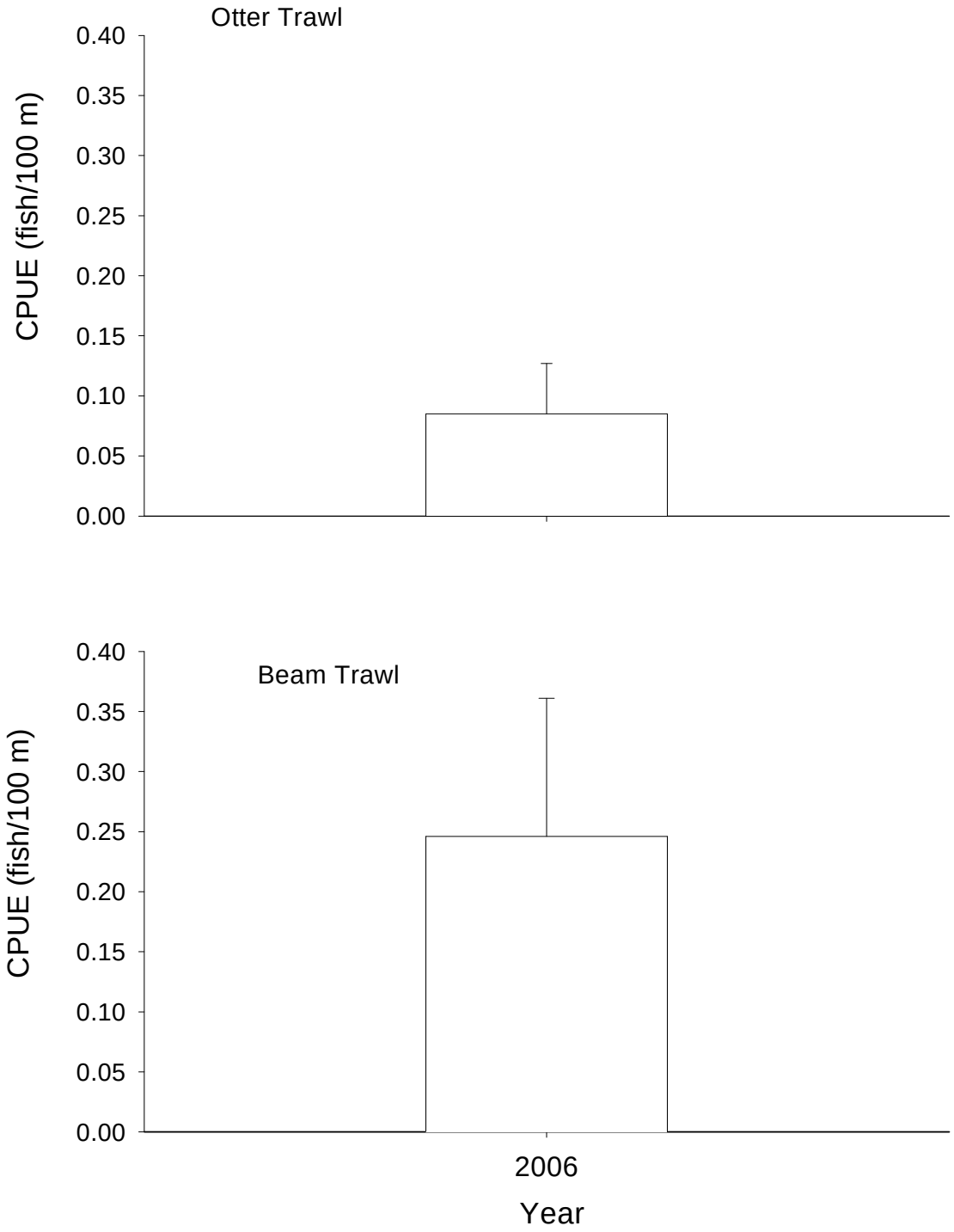

Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls and beam trawls in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Sturgeon Chub / Fish Community Season

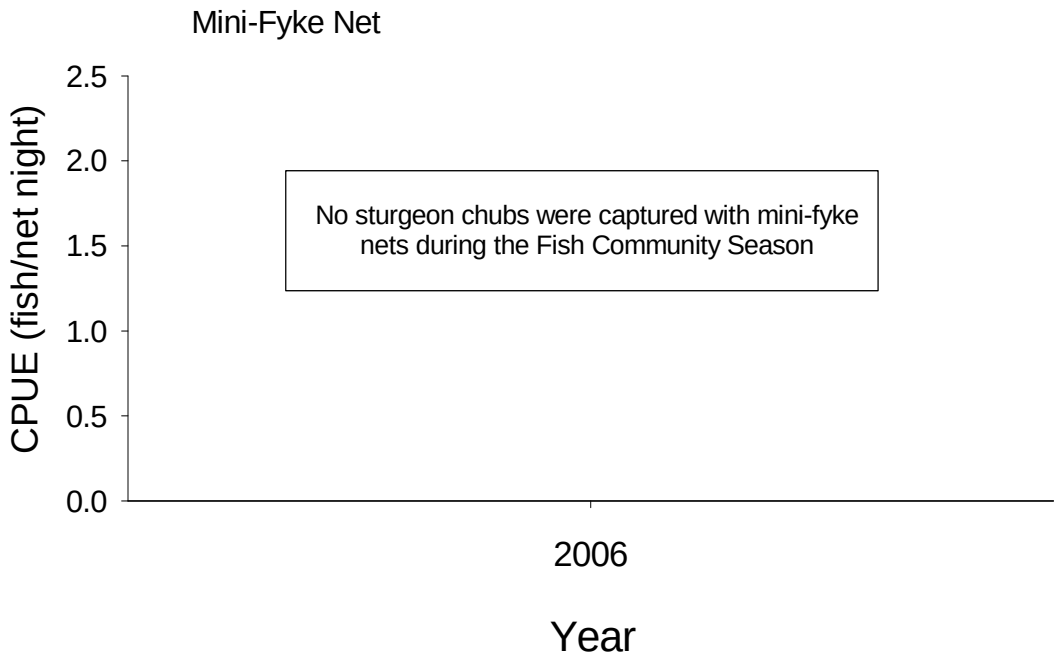

Figure 20. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	60		23 (23)	(2)			30 (26)	13 (25)	33 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	24		50 (34)				25 (32)	21 (26)	4 (8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	27		26 (26)	(1)			44 (30)	7 (21)	22 (21)						

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	60		77 (84)	18 (13)		5 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	24		100 (100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	27		96 (98)	4 (2)		

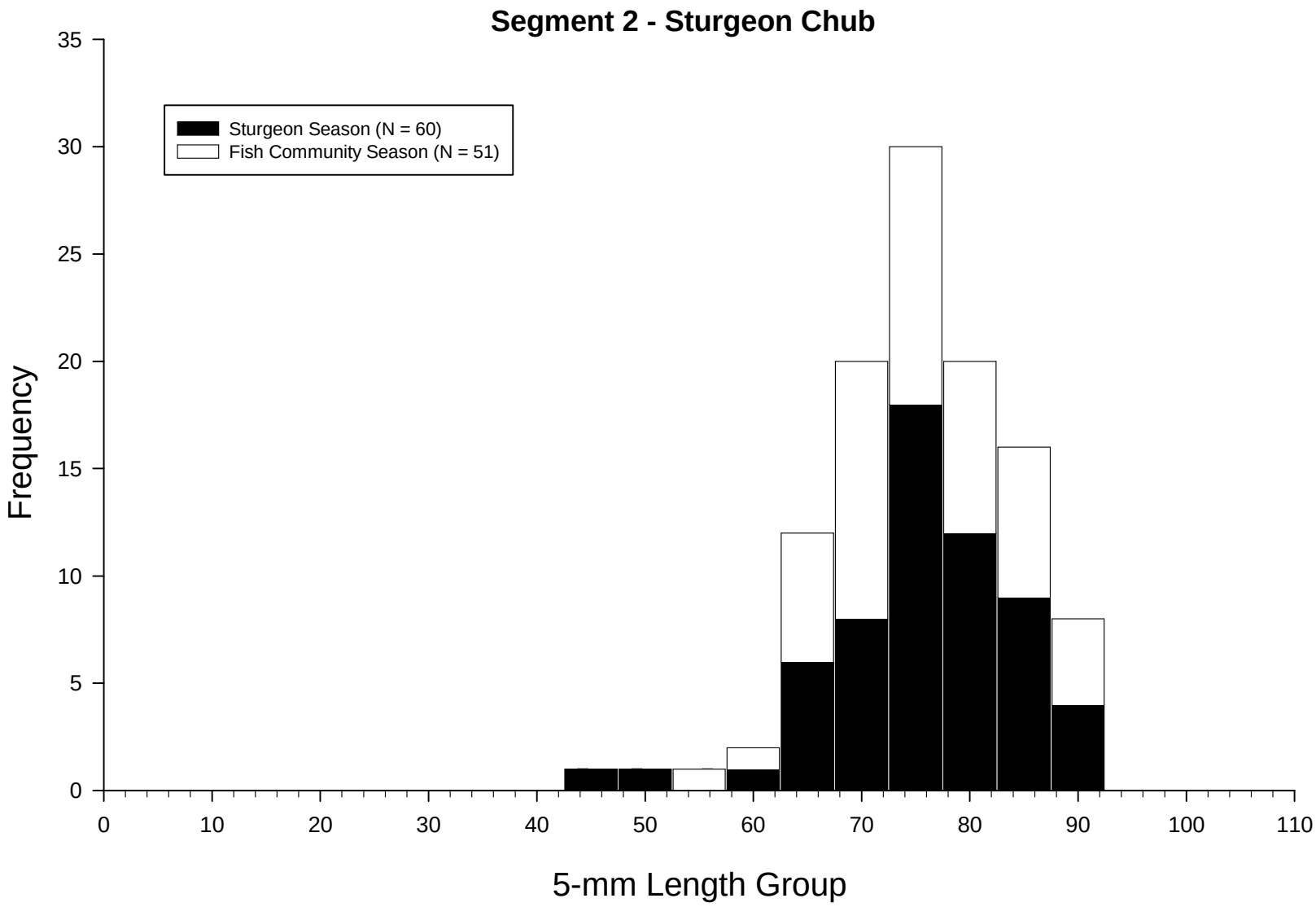

Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Sicklefin Chub

Only one sicklefin chub was sampled in segment 2 of the Missouri River during 2006. It was sampled in the channel border of an inside bend (Tables 28 and 29). That one fish was captured in an otter trawl during sturgeon season at river mile 1708.5, 7.5 river miles from the downstream border of segment 2. The sicklefin chub had a total length of 100 mm. With only one capture, CPUE for otter trawling was estimated at 0.003 fish/100 m, with a great amount of variability (Figure 22).

Segment 2 - Sicklefin Chub / Sturgeon Season

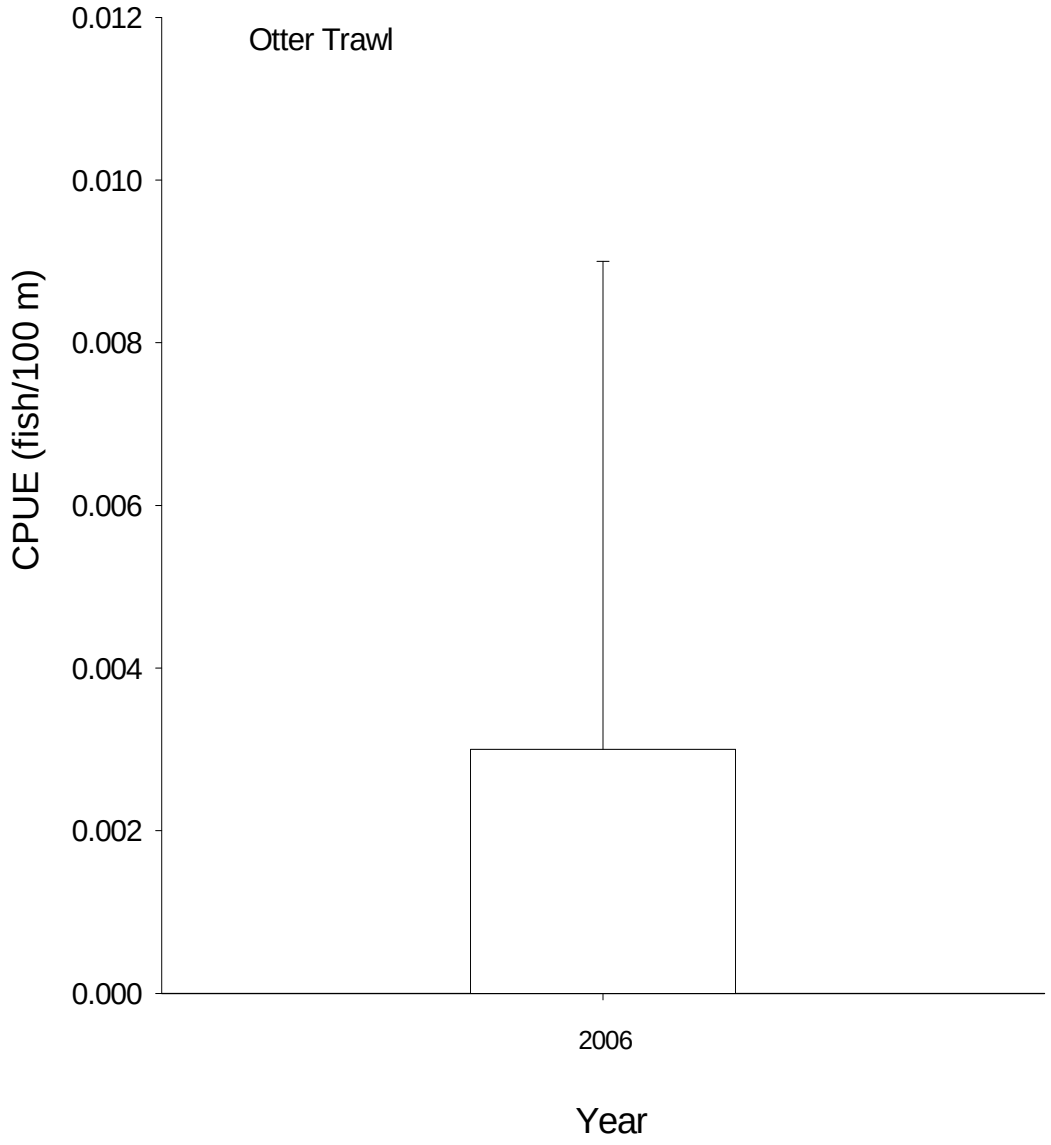

Figure 22. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Sicklefin Chub / Fish Community Season

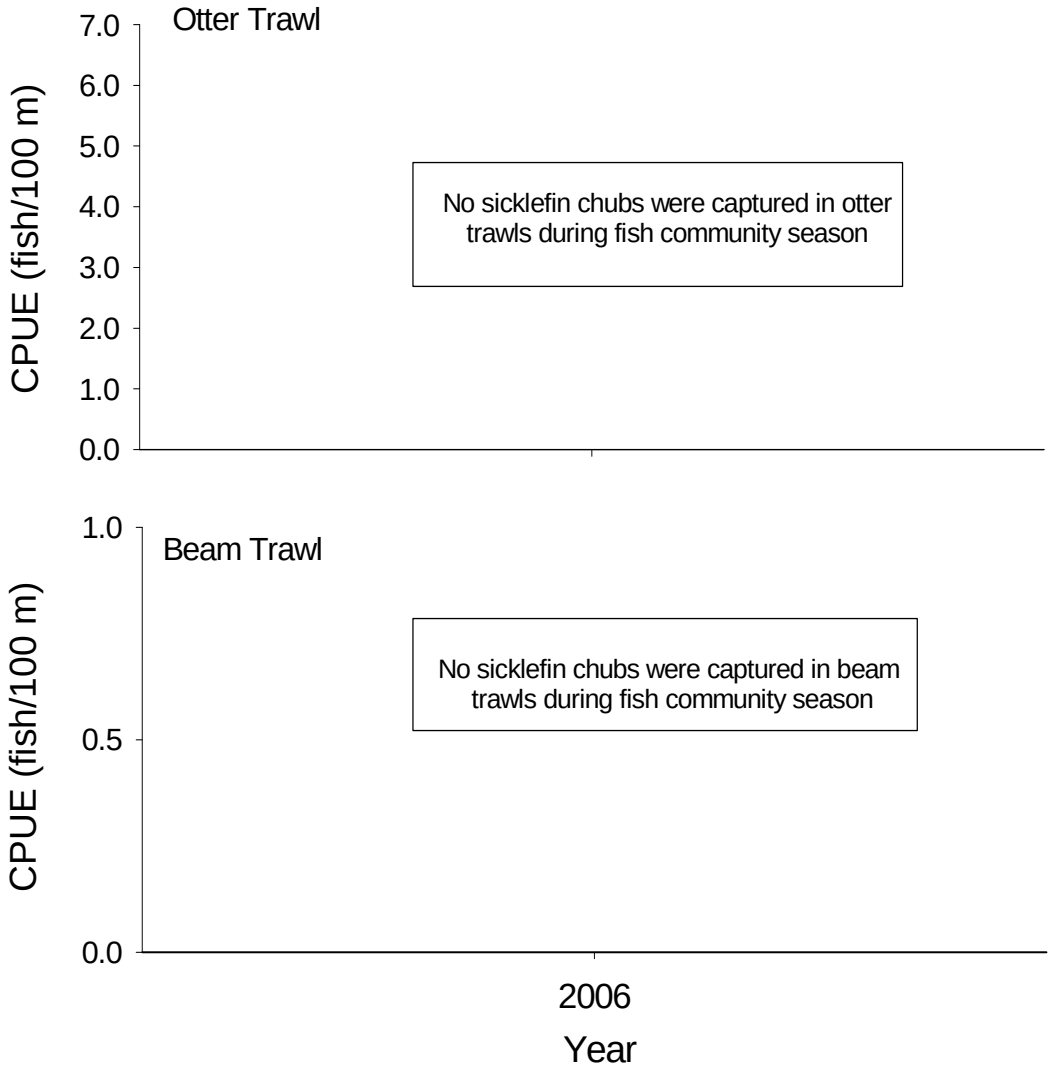

Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls and beam trawls in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Sicklefin Chub / Fish Community Season

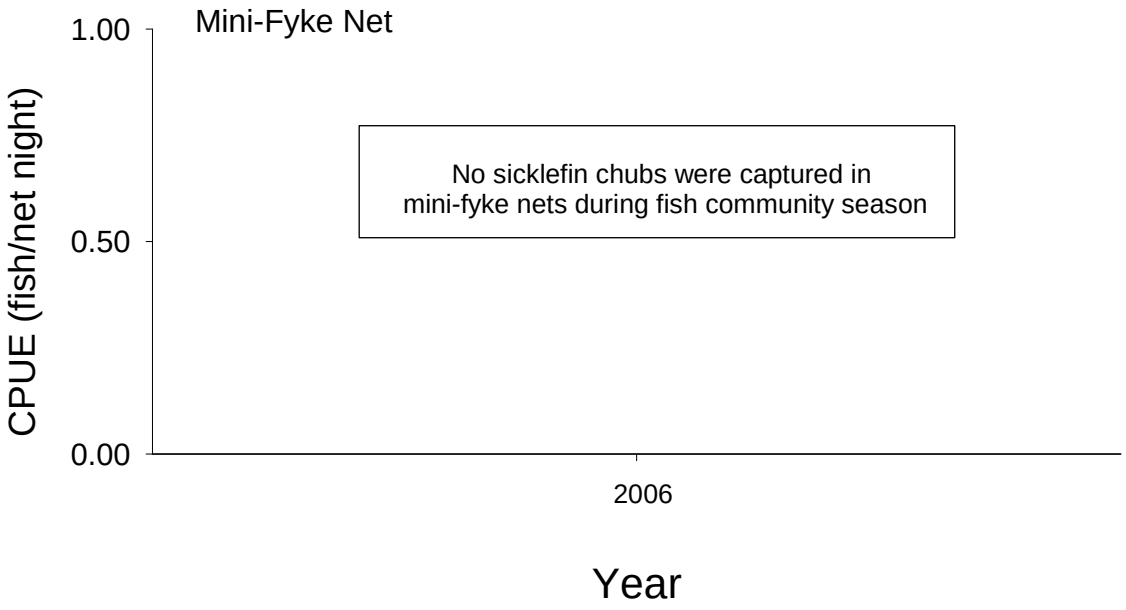

Figure 24. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	1		(23)	(2)			100 (26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	1		100 (84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

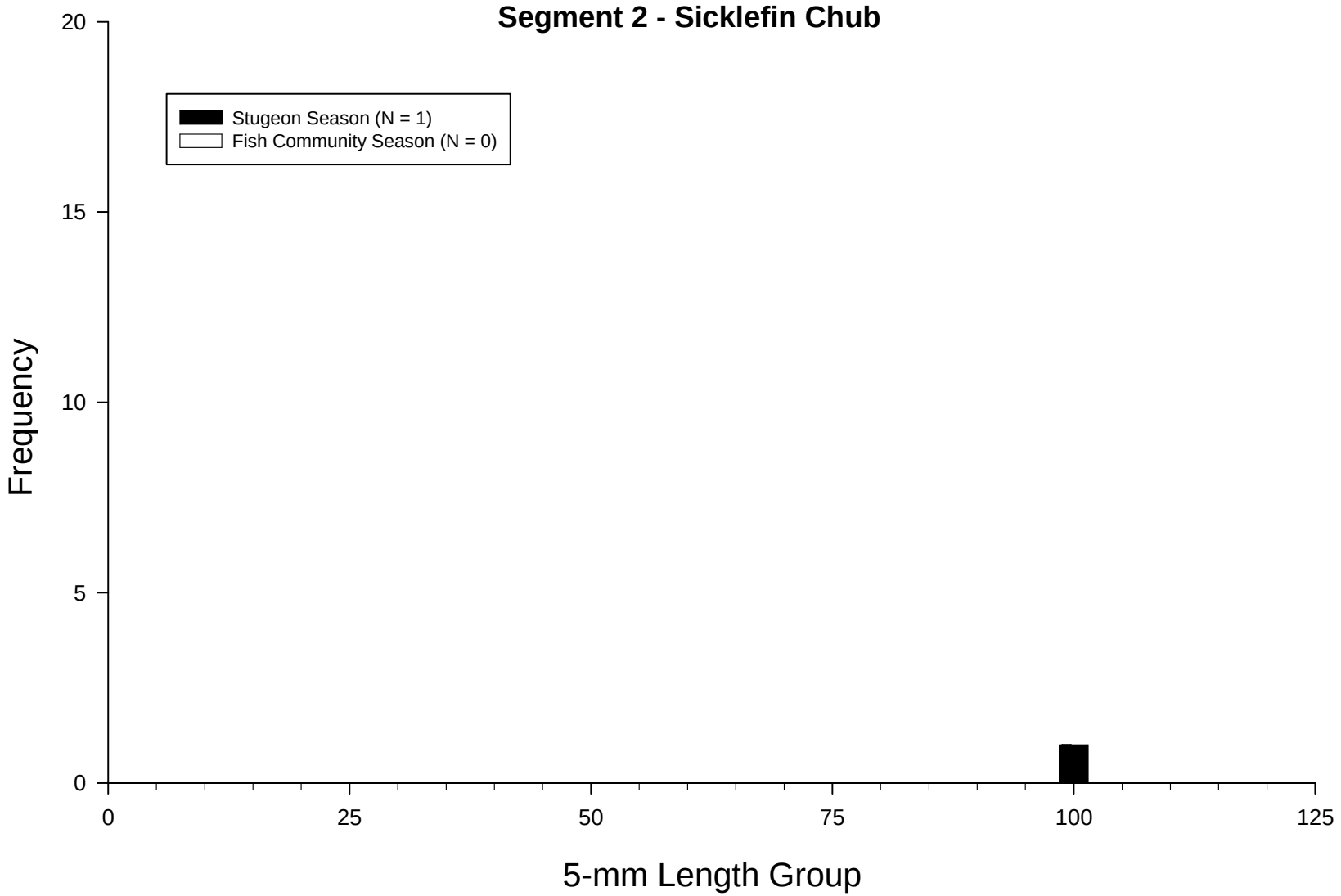

Figure 25. Length frequency of all sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Sand Shiner

A total of 377 sand shiners were collected in segment 2 during 2006. Of the total, 364 were collected in mini-fyke nets and 13 were collected during wild bag seine sampling, all of which occurred during fish community season.

Sand shiners were sampled at a rate of 4.49 fish/net night with mini fyke nets (Figure 32). No sand shiners were captured in otter or beam trawls during both sampling seasons. Sand shiner catch was not evenly distributed throughout segment 2. The majority (88.7 %) of the mini fyke net catch was limited to two river bends (16.7 % of bends sampled) at river miles 1719.5 and 1726. Additionally, 42 % of all sand shiners sampled with mini fyke nets occurred in a small tributary mouth (Prairie Elk Creek) (Table 32) at river mile 1726, which only accounted for 1 % of all macrohabitats sampled.

Segment 2 sand shiners had a mean TL of 41.5 mm (N = 178) with a minimum and maximum TL of 27 and 60 mm, respectively (Figure 33).

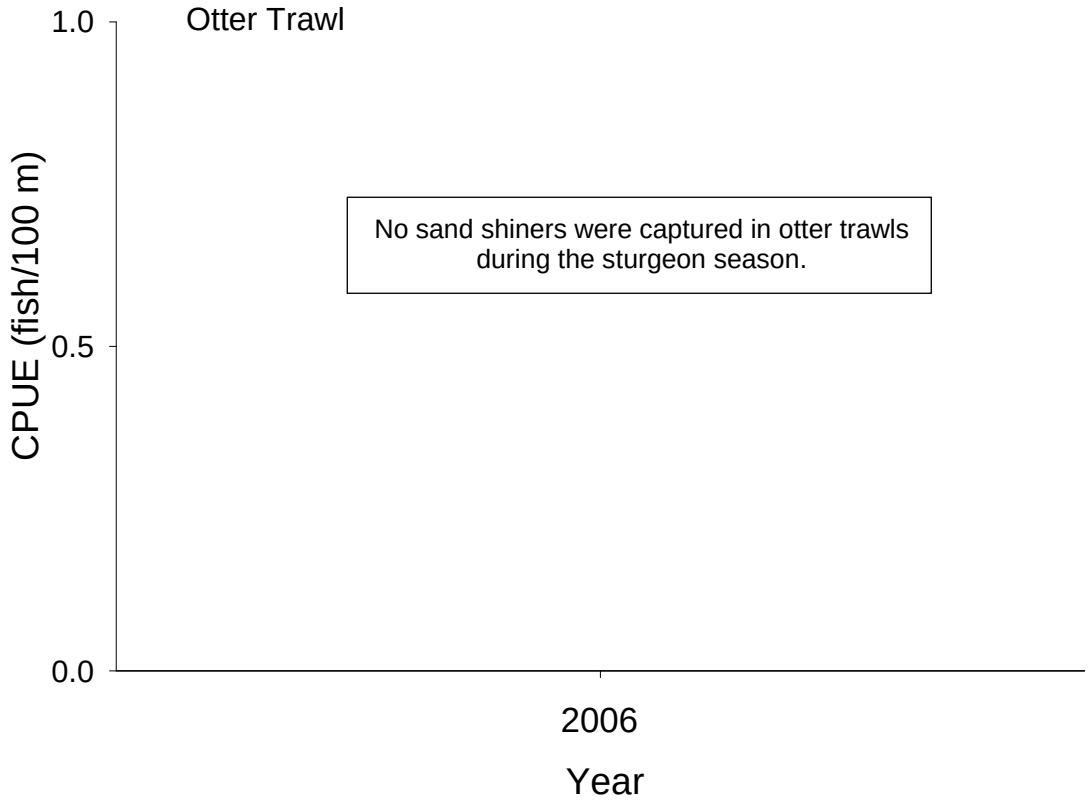

Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

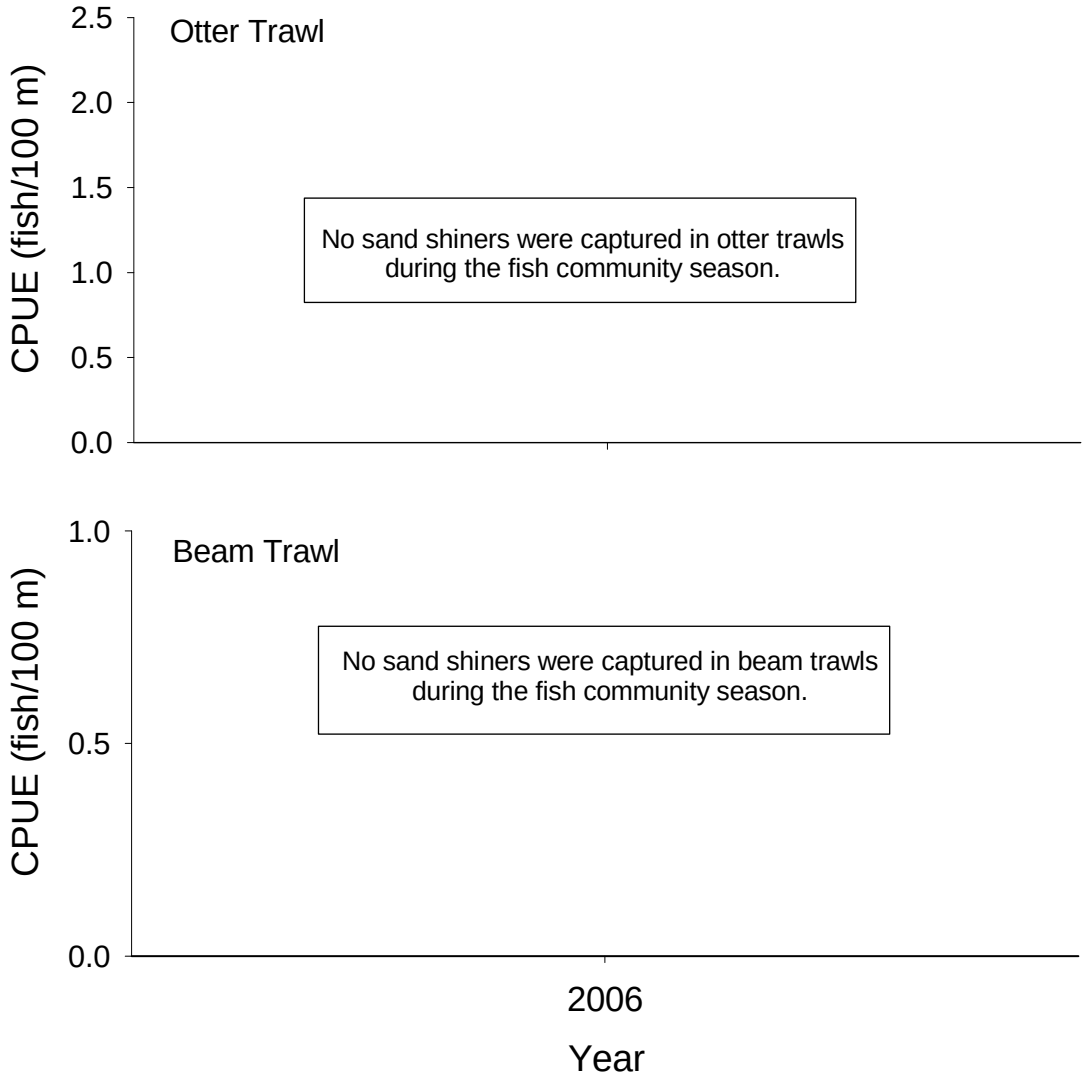

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls and beam trawls in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Sand Shiner / Fish Community Season

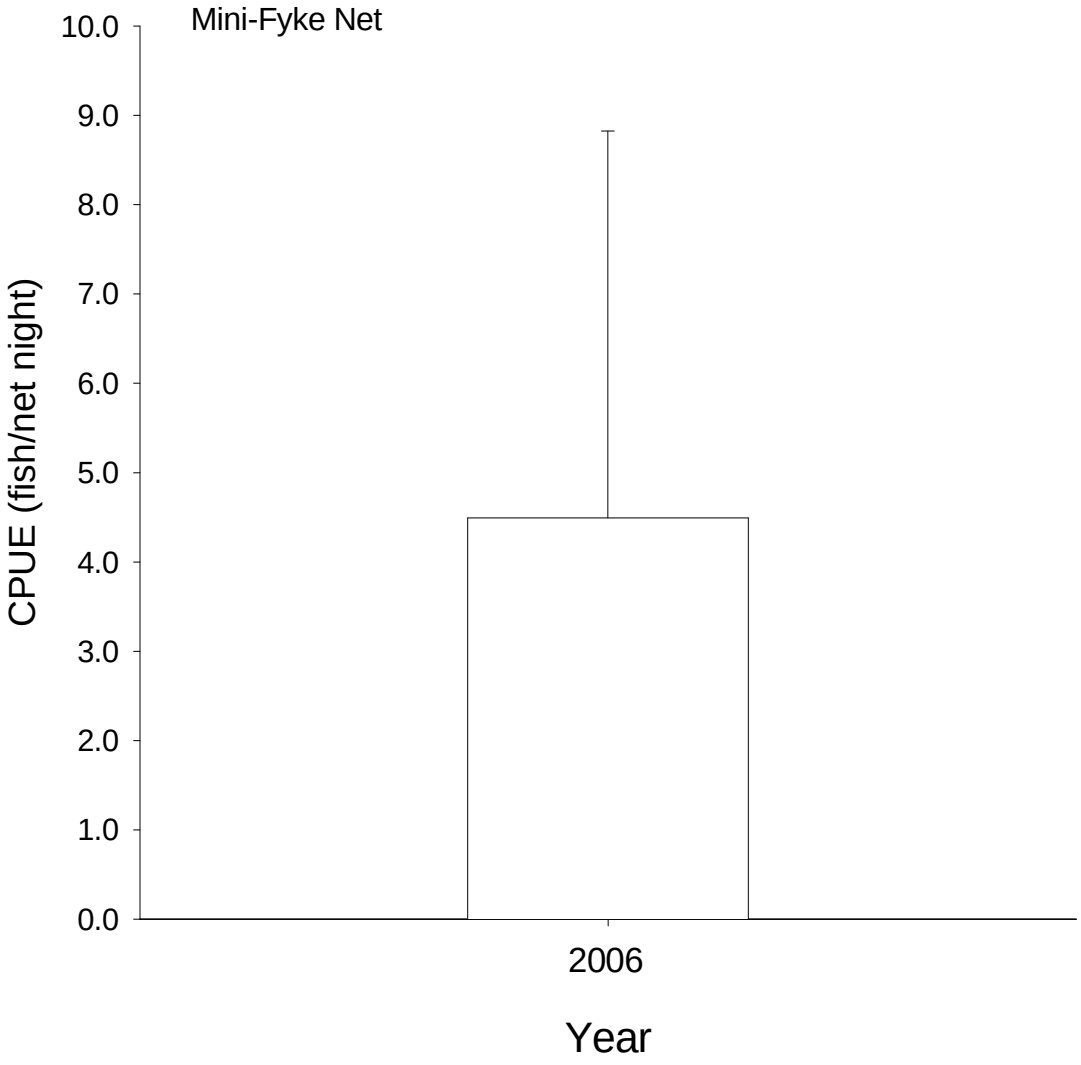

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		(26)	(1)			(25)	(23)	(25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	0		(23)	(2)			(26)	(25)	(24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	364		4 (7)	4 (2)			3 (25)	34 (22)	1 (17)	12 (16)	5 (9)			42 (1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	0		(84)	(13)		(3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	364	96 (95)	0 (1)			
Otter Trawl	0		(98)	(2)		

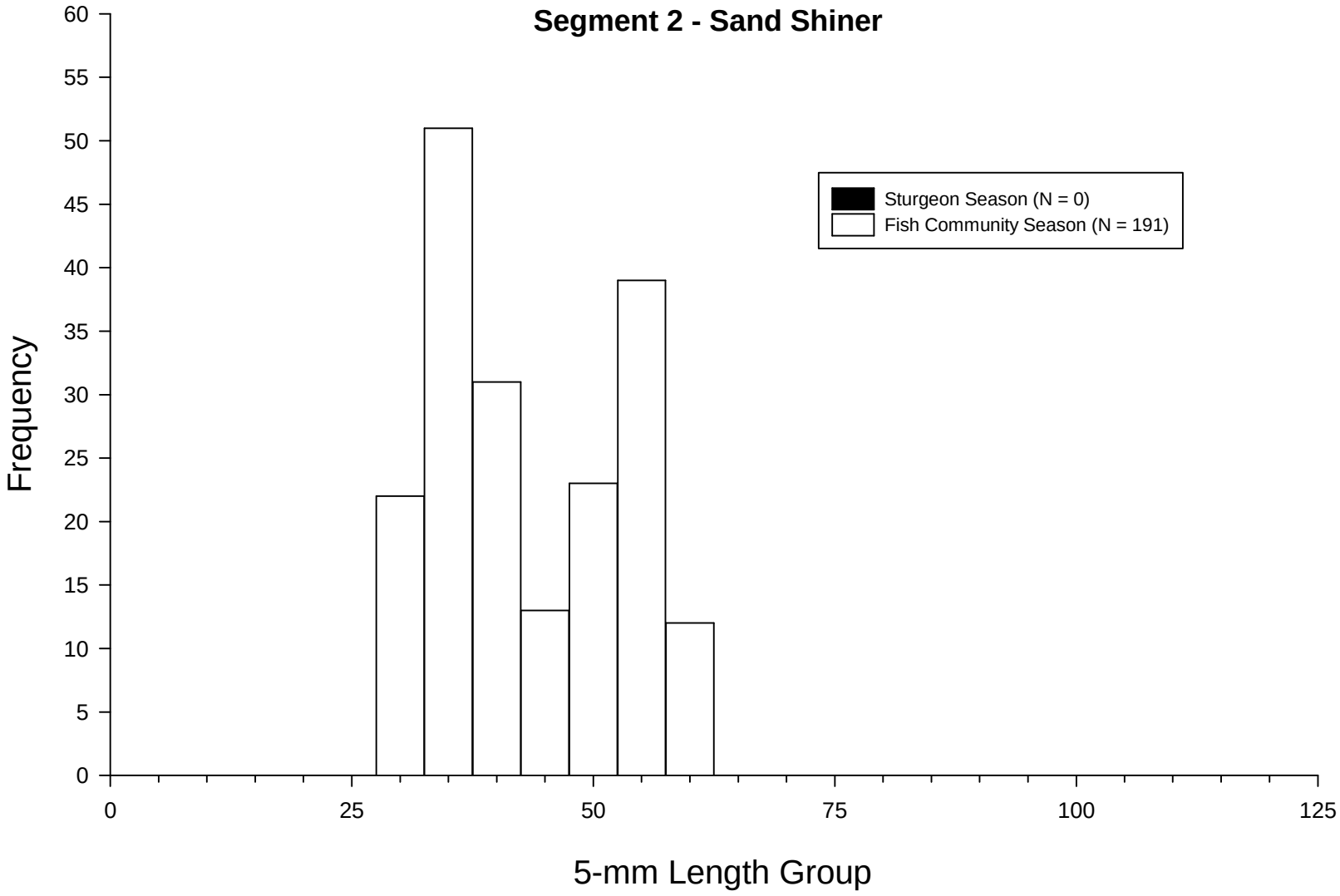

Figure 33. Length frequency of all sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Western Silvery Minnow

A total of 196 western silvery minnows and 19 *Hybognathus* spp. that was not identified to species were collected in segment 2 during 2006. Since no plains minnows were sampled in segments 1 through 3 of RPMA 2, we are assuming the 19 *Hybognathus* spp. were western silvery minnows and therefore all analysis was conducted combining the two categories. Of the total, 54 western silvery minnows were captured using standard gears (mini fyke nets: N = 51; otter trawl: N = 3) and 161 were captured using wild bag seine sampling. Although bag seining accounted for 74.9 % of all western silvery minnows collected, only 66.7 % (N = 8) of the river bends in segment 2 were sampled using this gear, compared to 100 % (N = 12) of bends that were sampled with mini-fyke nets.

Only two western silvery minnows were captured during sturgeon season, while the remaining 213 were sampled during the fish community season. Catch-per-unit-effort estimates for western silvery minnows for standard gears were as followed: mini fyke nets = 0.63 fish/net night; otter trawl sturgeon season = 0.007 fish/100m and fish community season = 0.003 fish/100m (Figures 34 to 36).

Western silvery minnows had a mean TL of 95.9 mm (N = 141) with a minimum and maximum TL of 45 and 128 mm, respectively. The size structure of western silvery minnows sampled using standard gears is shown in Figure 37.

The highest catch of western silvery minnows occurred at river mile 1761 (~ one mile downstream of the Milk River confluence), where 49.8 % (N = 107) of all western silvery minnows were sampled. Twenty five percent of the total western silvery minnow catch in mini fyke nets occurred in a small tributary mouth at river mile 1726 (Prairie Elk Creek), although this habitat was only 1 % of the total macrohabitats sampled (Table 34). Additionally, at least one western silver minnow was sample in all other river bends sampled in segment 2.

Segment 2 - Western Silvery Minnow / Sturgeon Season

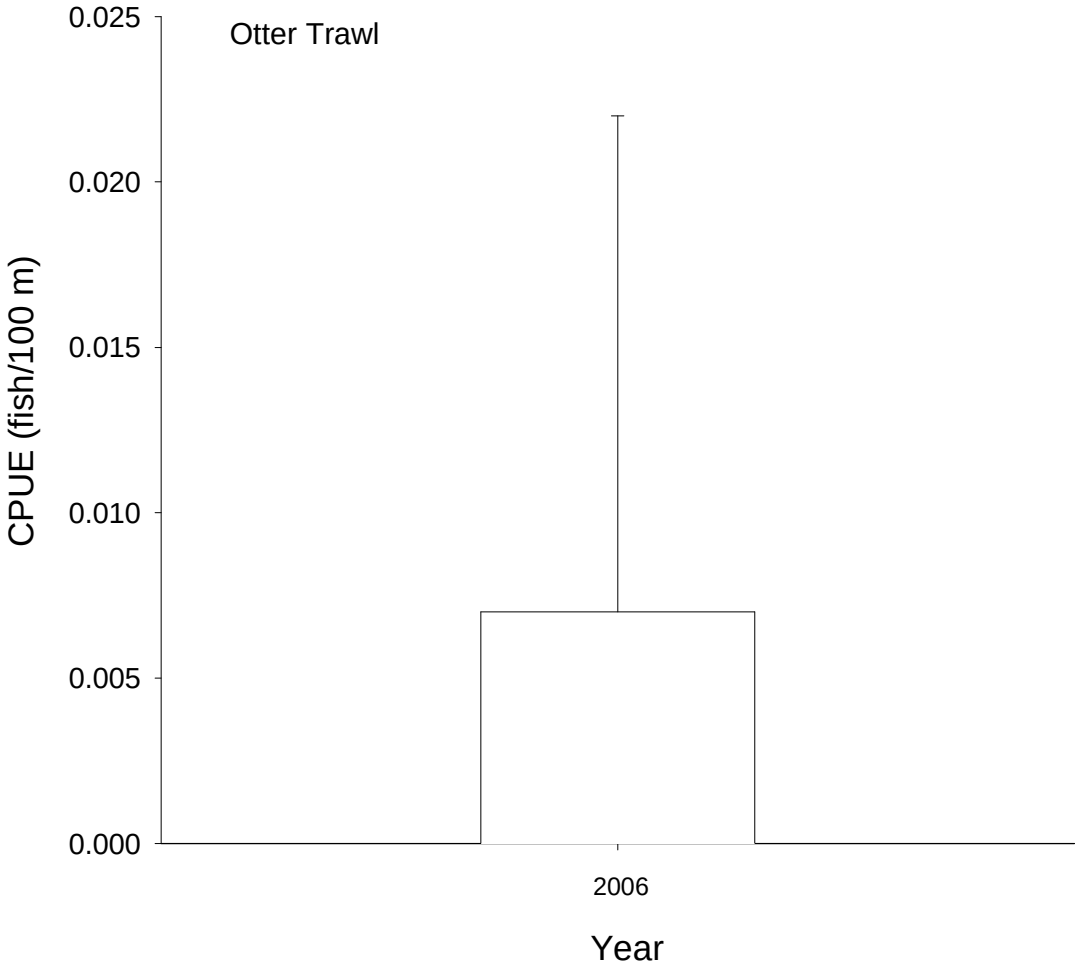

Figure 34. Mean annual catch-per-unit-effort (+/- 2SE) of western silvery minnows with otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Western Silvery Minnow / Fish Community Season

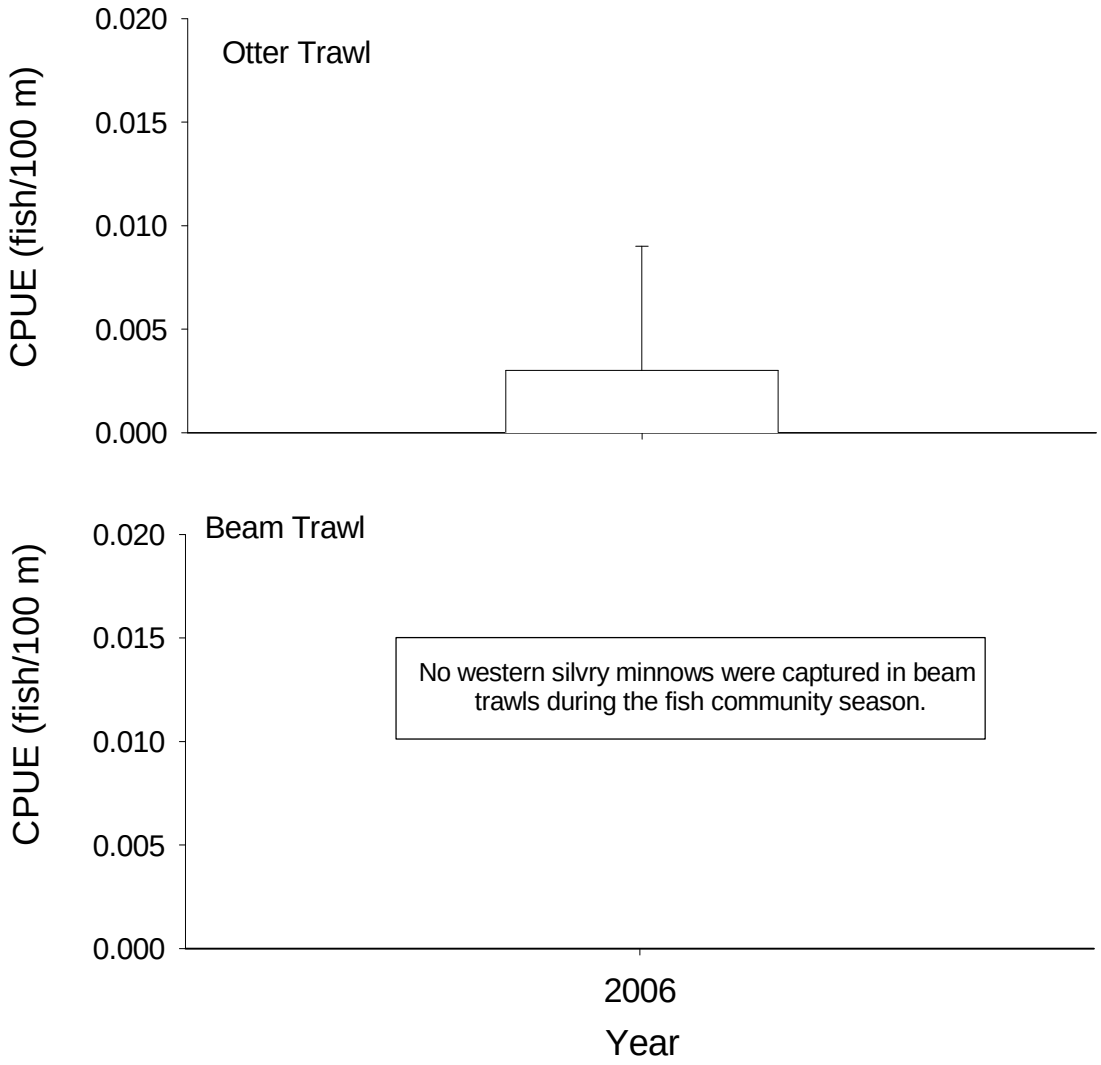

Figure 35. Mean annual catch-per-unit-effort (+/- 2SE) western silvery minnows with otter trawl and beam trawls in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Western silvery minnow / Fish Community Season

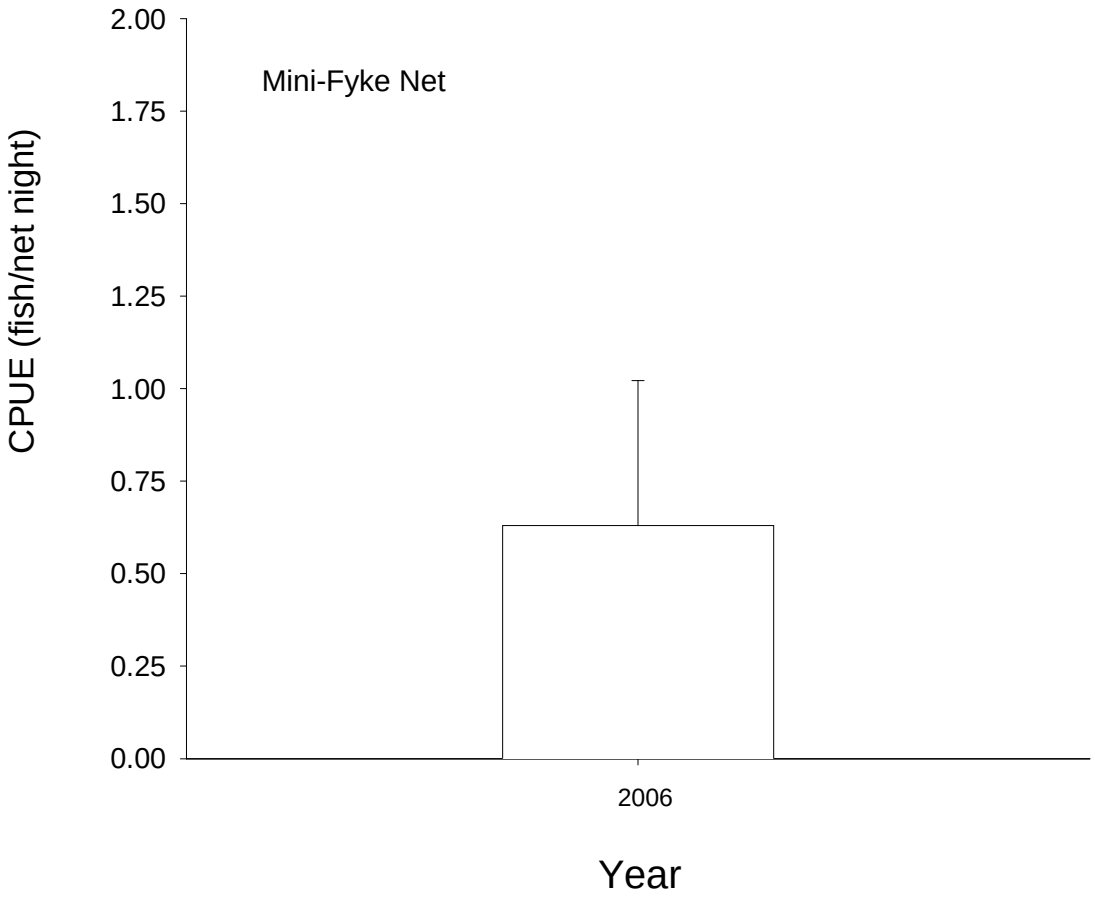

Figure 36. Mean annual catch-per-unit-effort (+/- 2SE) of western silvery minnows with mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

Table 34. Total number of western silvery minnows captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0		0 (26)	0 (1)			0 (25)	0 (23)	0 (25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	2		0 (23)	100 (2)			0 (26)	0 (25)	0 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	0		(28)				(29)	(27)	(15)				(1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	51		14 (7)	12 (2)			6 (25)	10 (22)	12 (17)	2 (16)	20 (9)			25 (1)	
Otter Trawl	1		0 (26)	0 (1)			0 (30)	100 (21)	0 (21)						

Table 35. Total number of western silvery minnows captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	0		(81)	(16)		(2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	2		100 (84)	0 (13)		0 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	0		(92)	(6)		(1)
Beam Trawl	0		(100)			
Mini-Fyke Net	51	88 (95)	8 (1)			
Otter Trawl	1		100 (98)	0 (2)		

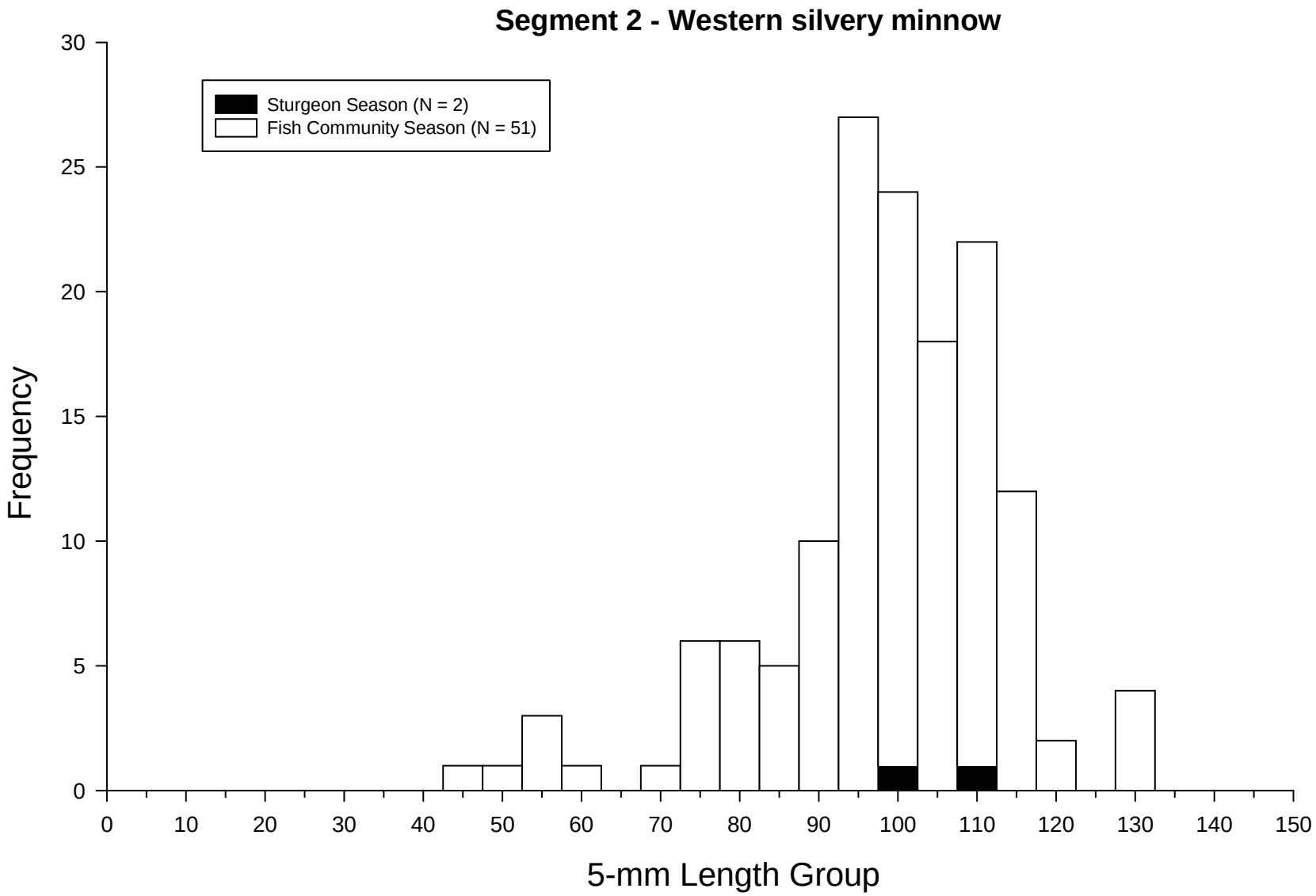

Figure 37. Length frequency of all western silvery minnows caught during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Blue Sucker

A total of 12 blue suckers were captured in segment 2 during 2006, 9 during sturgeon season and 3 during fish community season (Figure 44). No juvenile blue suckers were sampled in segment 2 during 2006. Blue suckers had a mean TL of 712.9 mm and a minimum and maximum of 635 and 800 mm, respectively.

Trammel nets captured eight of the nine blue suckers during sturgeon season (CPUE = 0.028 fish/100 m) and all three during fish community season (CPUE = 0.01) (Figures 39 and 41). The otter trawl caught one blue sucker during the fish community season (CPUE = 0.007 fish/100 m)(Table 36). The macrohabitas where blues suckers were sampled consisted of channel crossovers (N = 6), outside bends (N = 4) and inside bends (N = 2) (Table 36). All blue suckers were sampled in channel border mesohabiats (Table 37).

The highest catch of blue suckers occurred at river mile 1744 where 66.7 % (N = 8) of the total were sampled. Six blue suckers were sampled at river mile 1744 during the sturgeon season and two during the fish community season. Substrate samples in river mile 1744 contained considerably more gravel (5 to 95 %) and cobble than other bends sampled in segment 2.

Segment 2 - Blue Sucker / Sturgeon Season

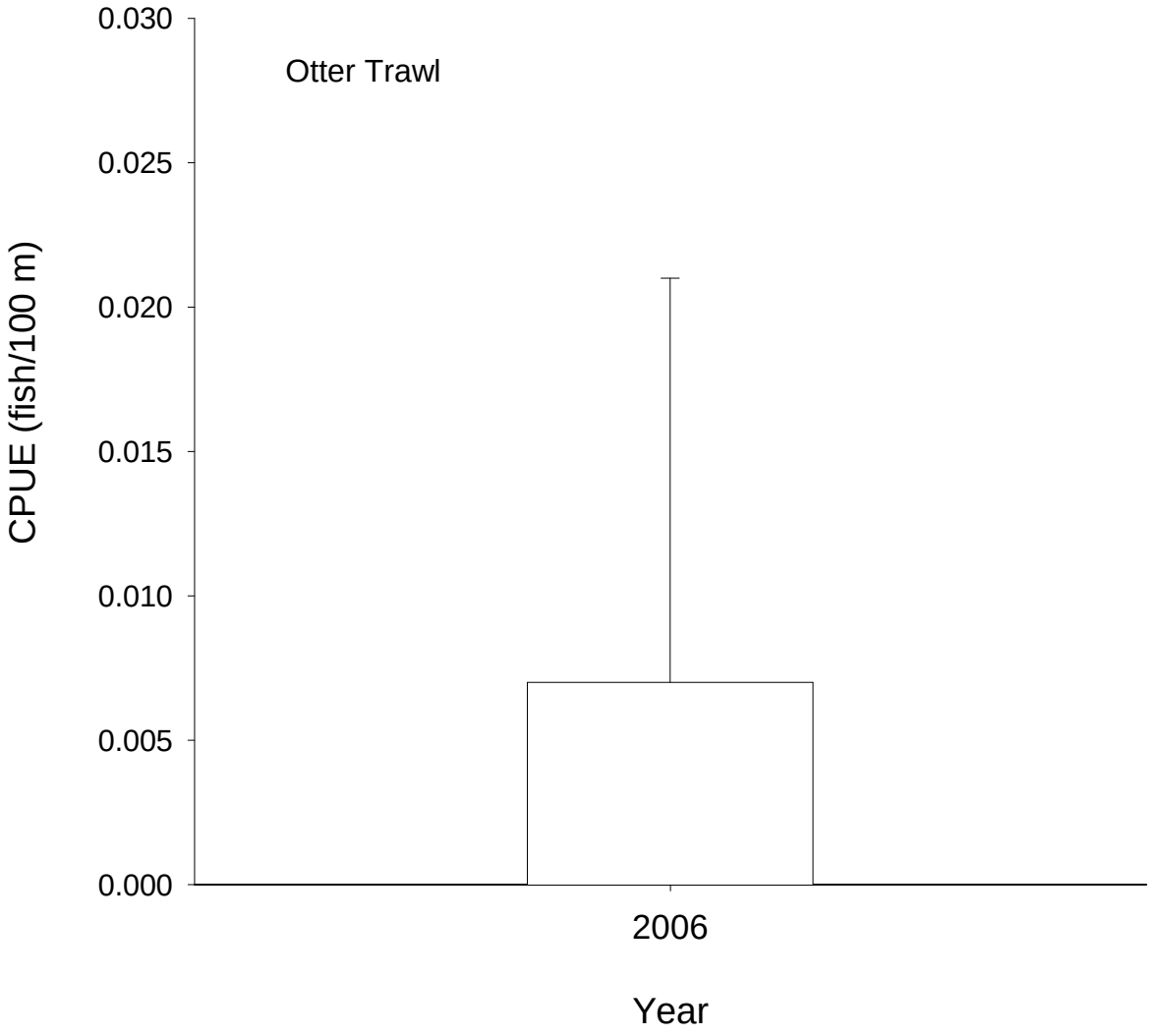

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Blue Sucker / Sturgeon Season

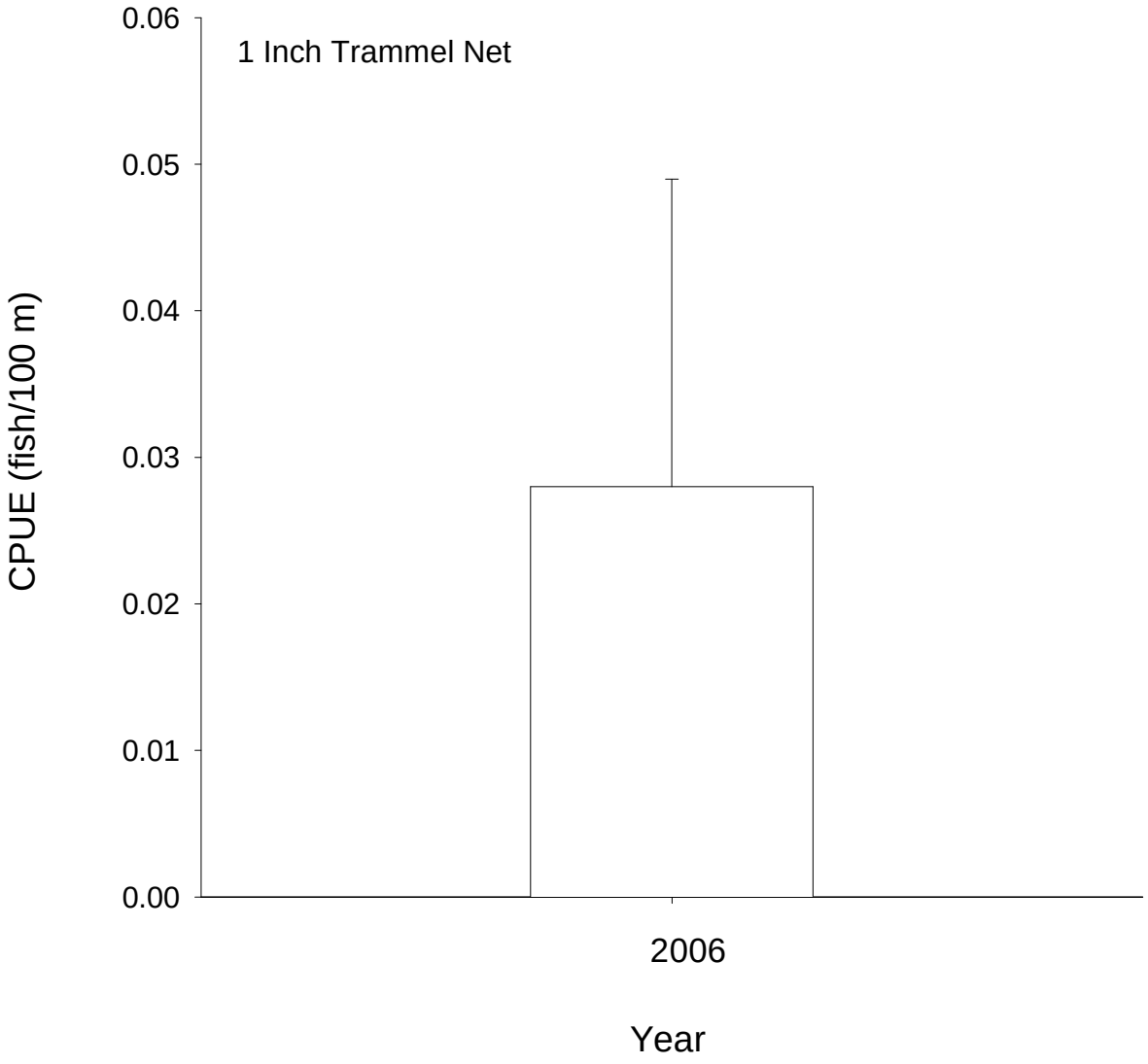

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Blue Sucker / Fish Community Season

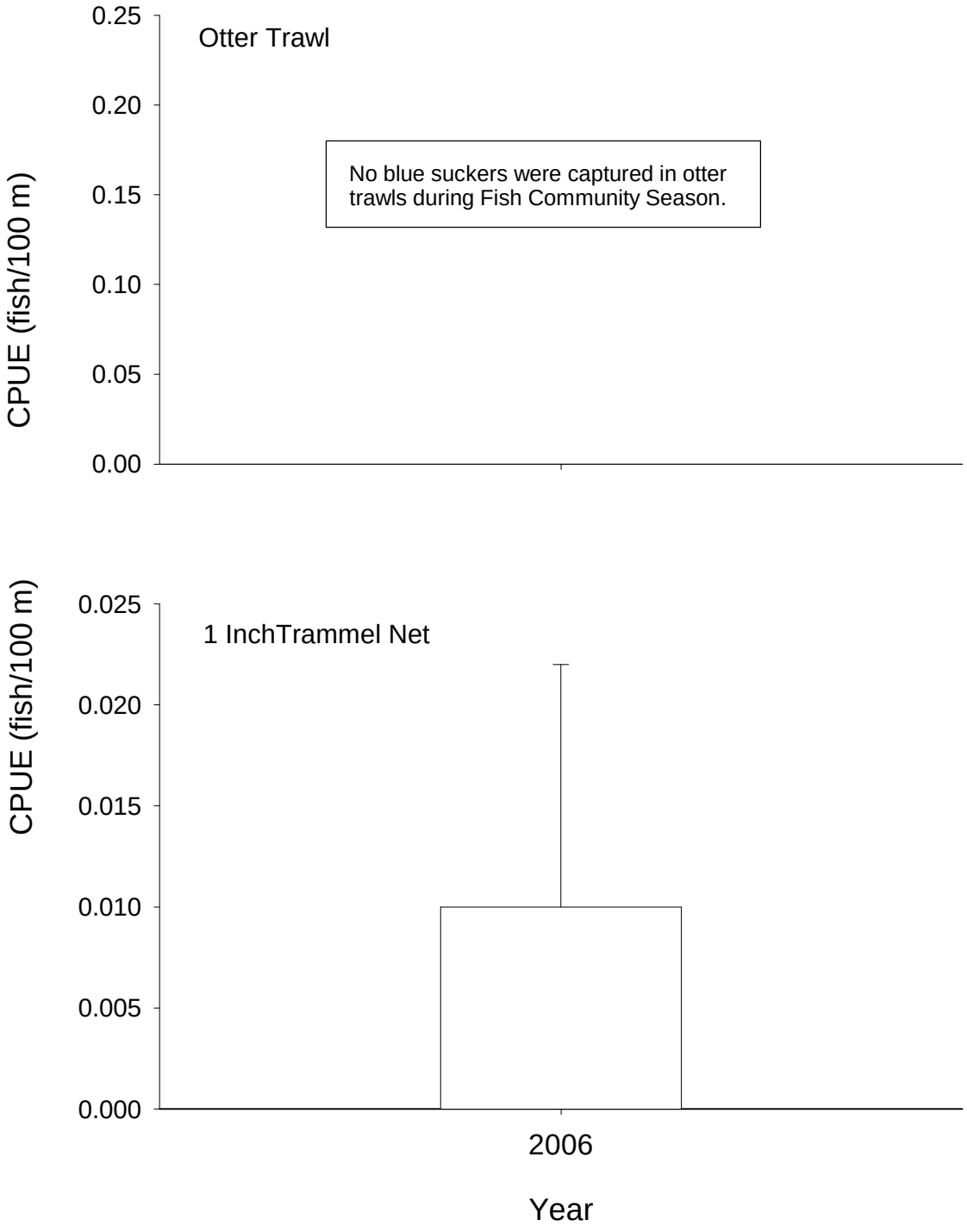

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 2 of the Missouri River during fish community season 2006.

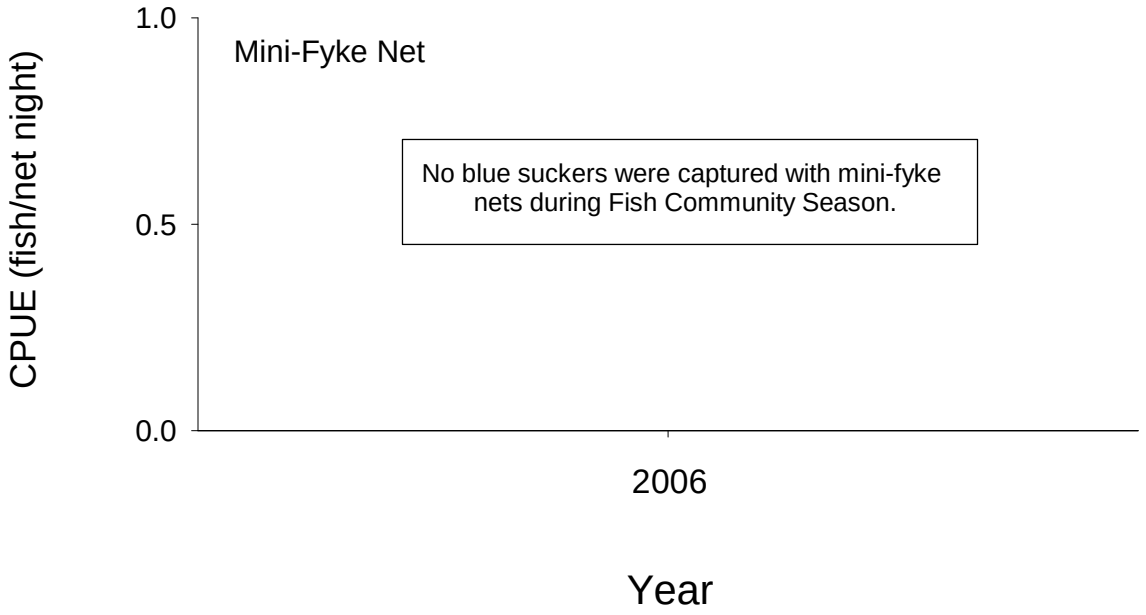

Figure 42. Mean annual catch-per-unit-effort (+/- 2SE) of blue suckers using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Blue Sucker / Fish Community Season

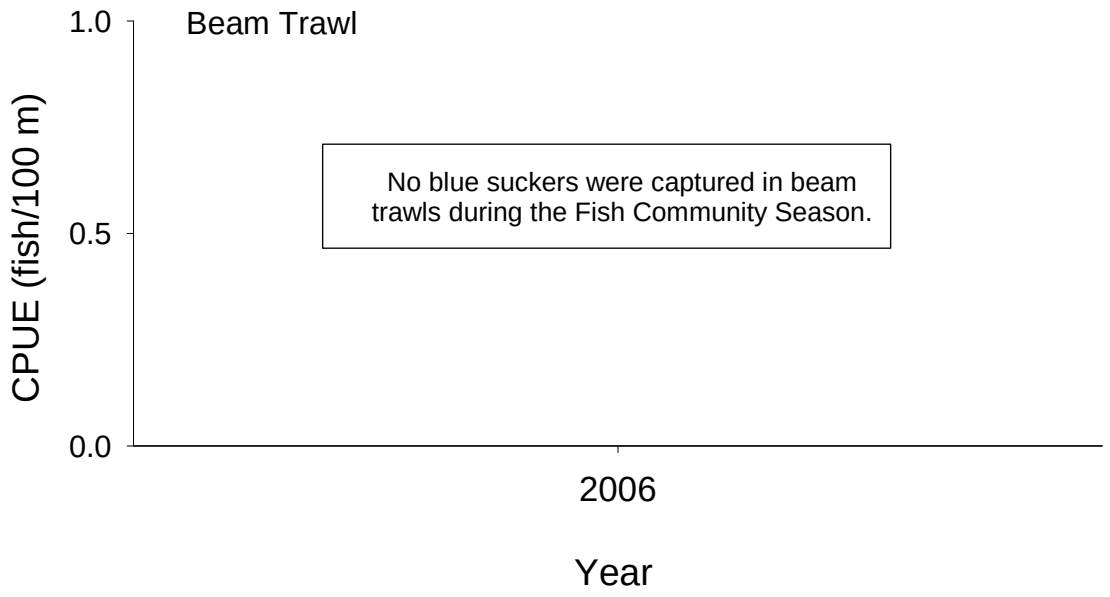

Figure 43. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker using beam trawls in segment 2 of the Missouri River during fish community season 2006.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or 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	8		50 (26)	0 (1)			12 (25)	38 (23)	0 (25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	1		100 (23)	0 (2)			0 (26)	0 (25)	0 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	3		33 (28)				33 (29)	33 (27)	0 (15)				0 (1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	0		(7)	(2)			(25)	(22)	(17)	(16)	(9)			(1)	
Otter Trawl	0		(26)	(1)			(30)	(21)	(21)						

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	**Mesohabitat**				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	8		100 (81)	0 (16)		0 (2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	1		100 (84)	0 (13)		0 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	3		100 (92)	0 (6)		0 (1)
Beam Trawl	0		(100)			
Mini-Fyke Net	0	(95)	(1)			
Otter Trawl	0		(98)	(2)		

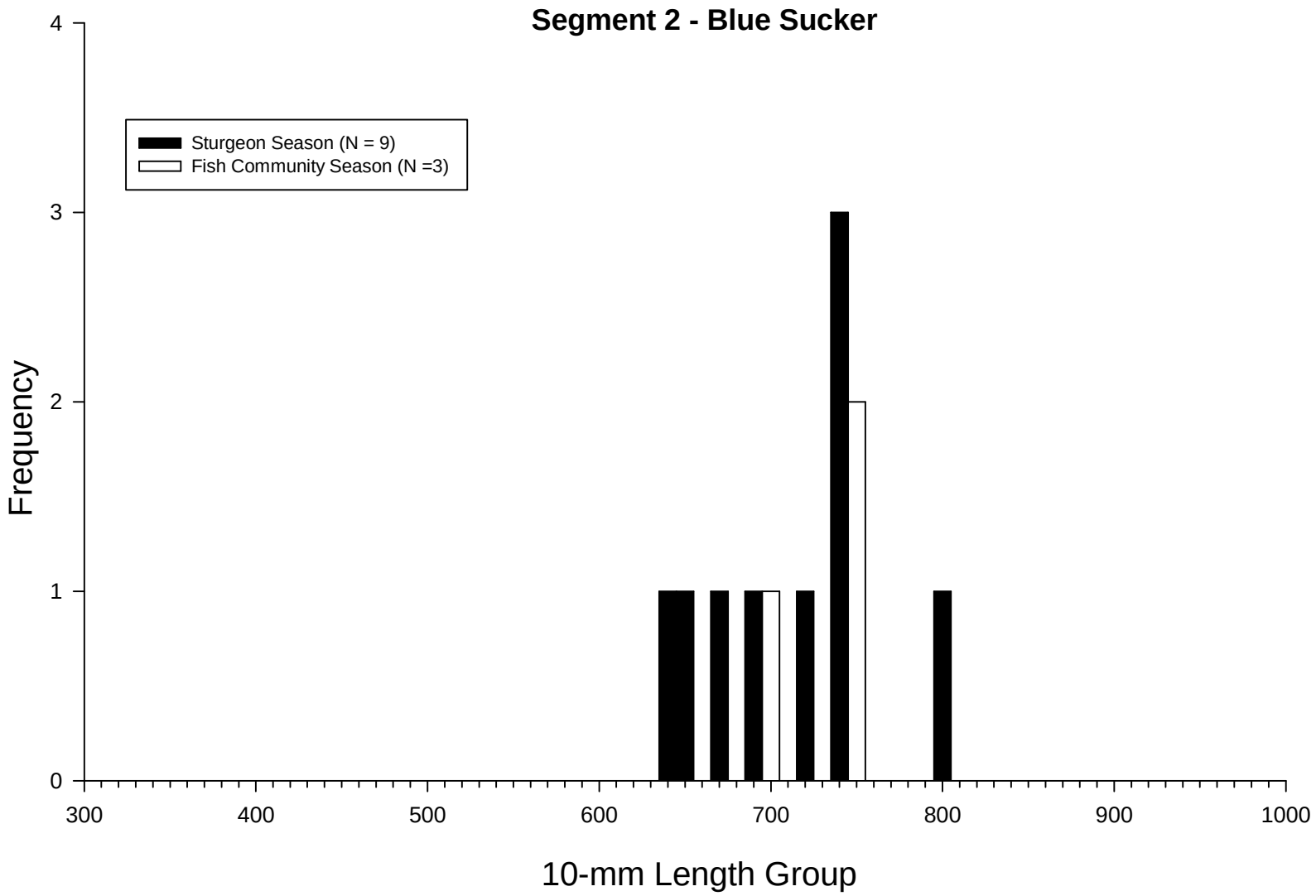

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Sauger

Standard gears captured 83 saugers (trammel net N = 47; otter trawl N = 25; mini fyke net N = 11) in segment 2 during 2006, whereas only 1 sauger was captured in bag seines. Forty-nine and 35 saugers were sampled during the sturgeon and fish community seasons, respectively. Trammel net CPUE (0.168 fish/100 m) was over twice as high during the sturgeon season than during the fish community season (0.065 fish/100 m) (Figures 46 and 48). Conversely, otter trawl CPUE similar during the sturgeon (0.06 fish/100 m) and fish community seasons (0.04 fish/100m).

No YOY or age-1 saugers were sampled during 2006 (Pierce et al. 2003). Saugers averaged 326.0 mm (N = 84) TL with a minimum and maximum TL of 241 and 449 mm, respectively. The size structure of sampled saugers is shown in the length frequency histogram in Figure 51. No YOY saugers were sampled in segment 2 during 2006.

Sauger catch was distributed throughout the length of segment 2, with no obvious areas of congregation. Saugers were sampled in a relatively proportionate manner to the macrohabitats that were sampled (Table 38). At a smaller scale, saugers were proportionally sampled at a higher frequency in channel borders and island tips mesohabitas during the sturgeon and fish community seasons, respectively (Table 39).

Segment 2 - Sauger / Sturgeon Season

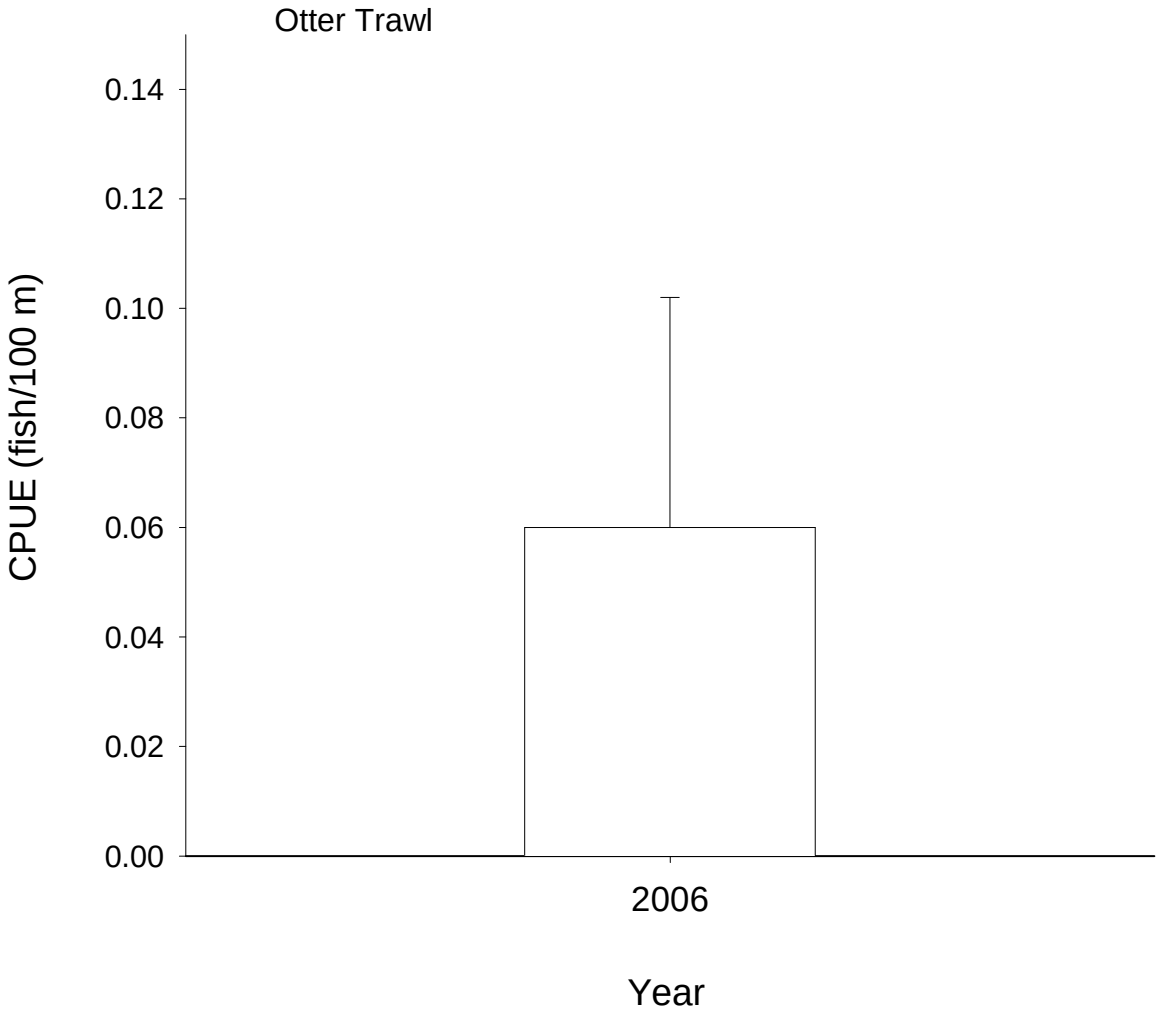

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using otter trawls in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Sauger / Sturgeon Season

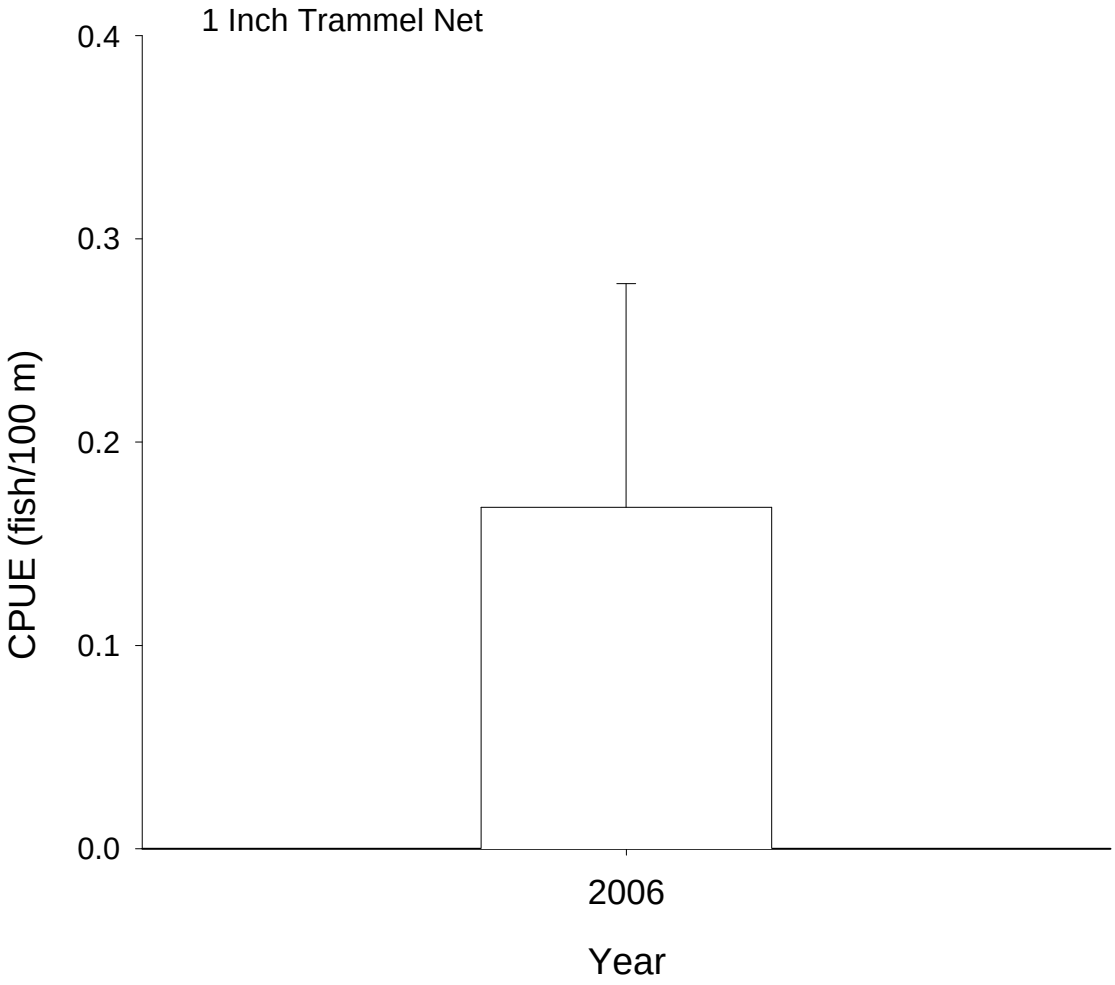

Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006.

Segment 2 - Sauger / Fish Community Season

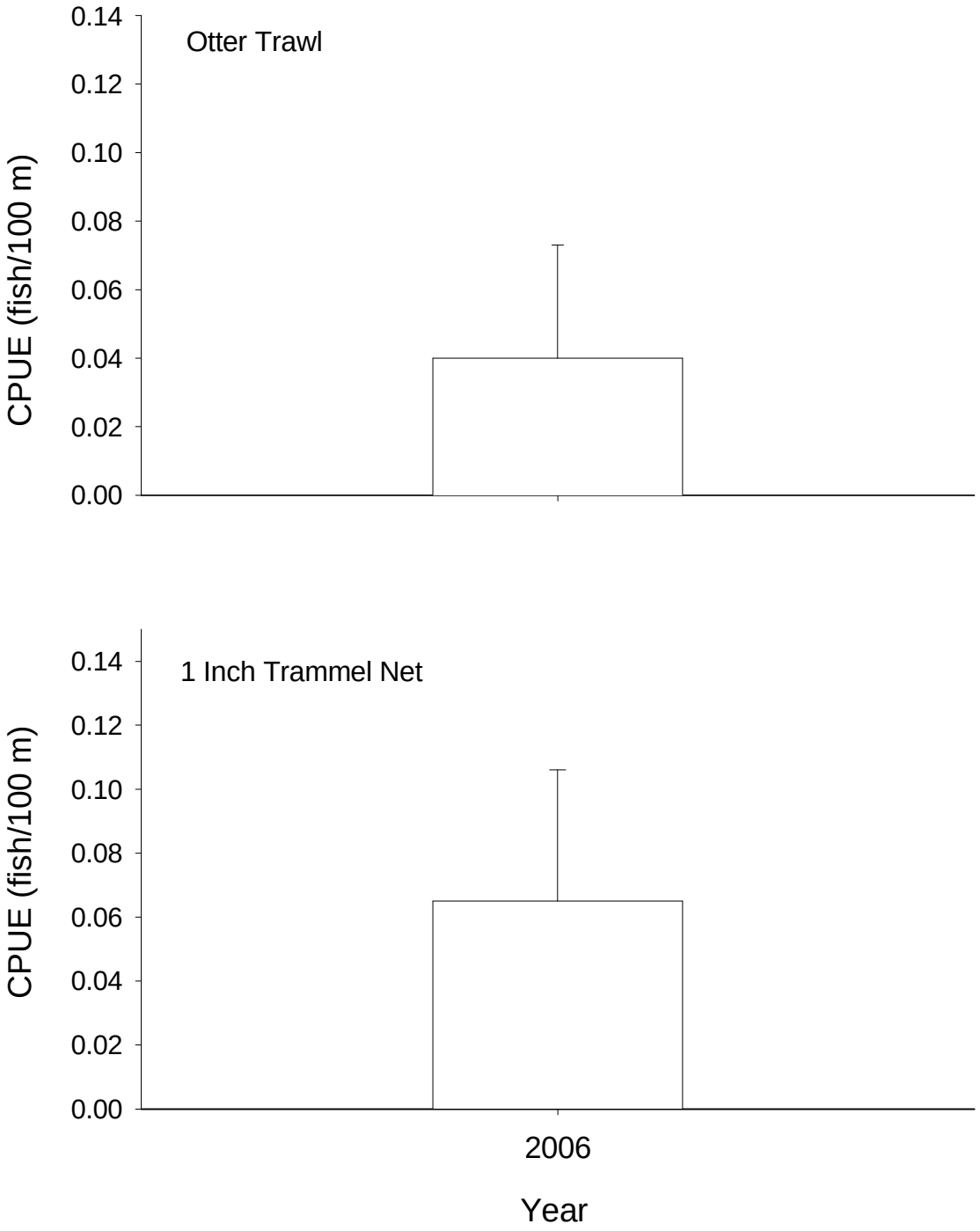

Figure 48. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using otter trawls and 1 inch trammel nets in segment 2 of the Missouri River during fish community season 2006.

Segment 2 - Sauger / Fish Community Season

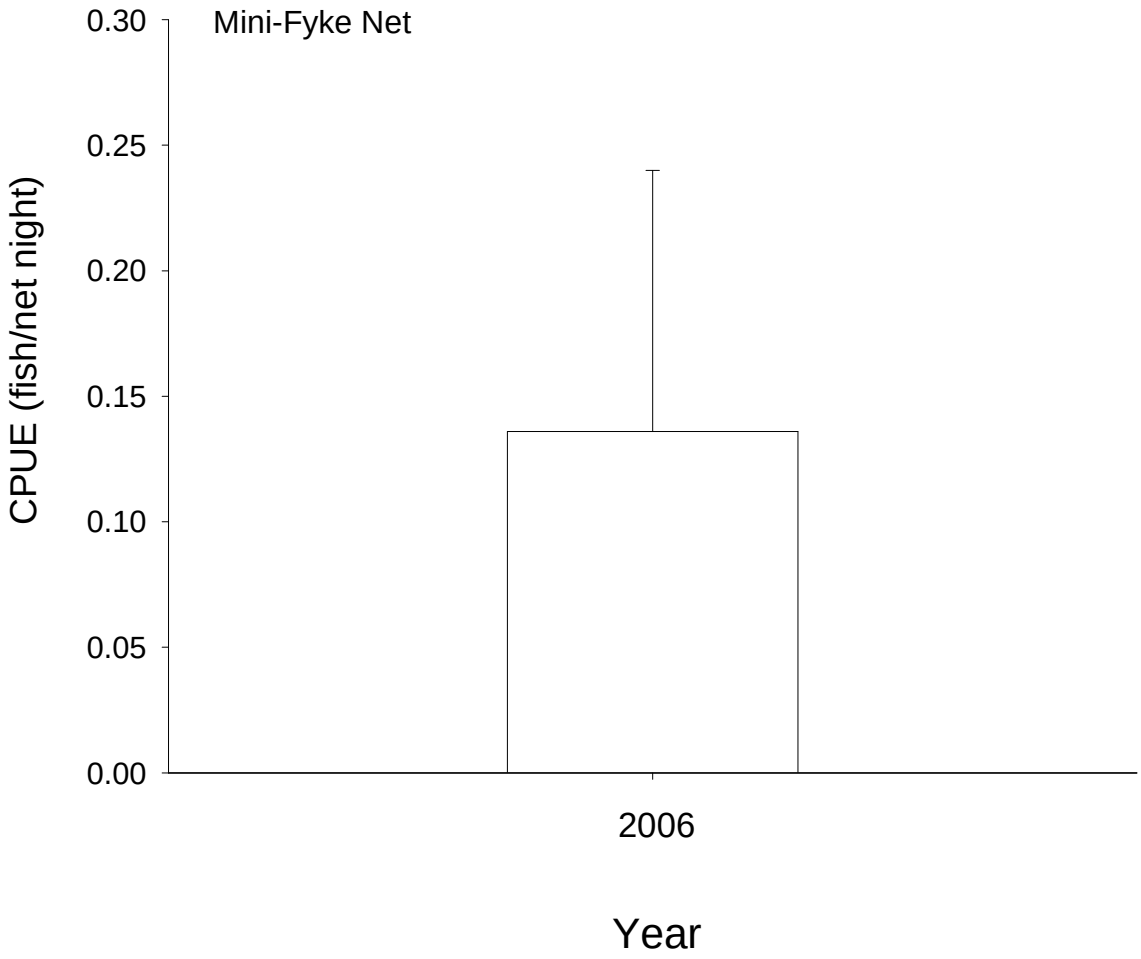

Figure 49. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006.

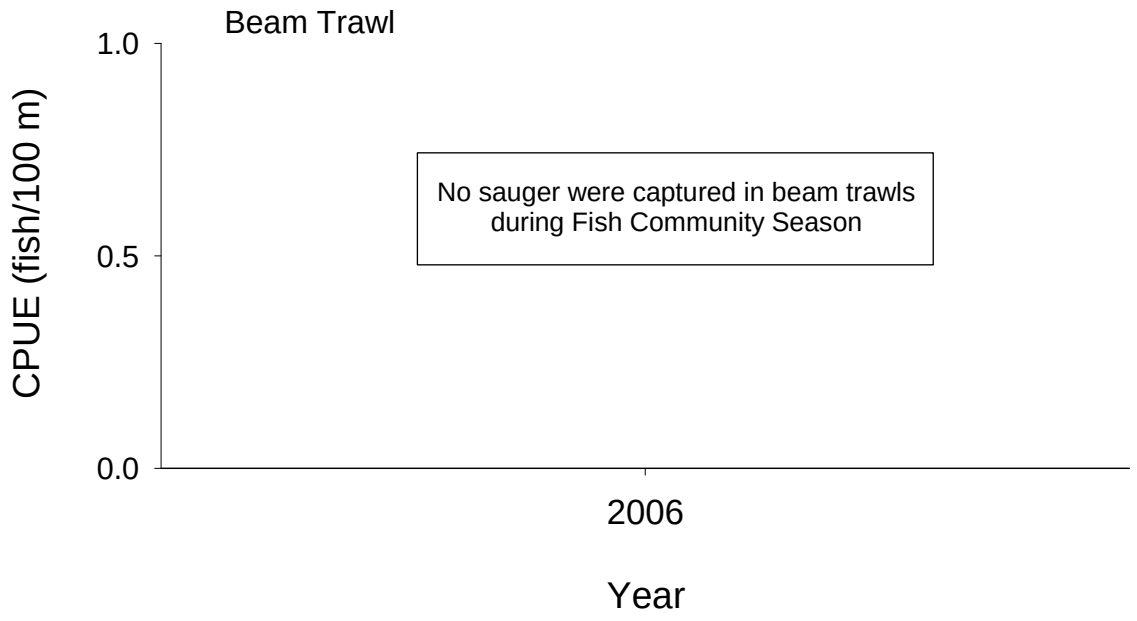

Figure 50. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using beam trawls in segment 2 of the Missouri River during fish community season 2006.

Table 38. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or 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	35		23 (26)	0 (1)			31 (25)	23 (23)	23 (25)						
2.5 Inch Trammel Net															
Beam Trawl															
Gill Net															
Otter Trawl	14		14 (23)	0 (2)			21 (26)	50 (25)	14 (24)						
Fish Community Season (Summer)															
1 Inch Trammel Net	12		17 (28)				8 (29)	17 (27)	50 (15)				8 (1)		
Beam Trawl	0		(34)				(32)	(26)	(8)						
Mini-Fyke Net	11		9 (7)	36 (2)			27 (25)	0 (22)	9 (17)	0 (16)	9 (9)			9 (1)	
Otter Trawl	11		27 (26)	27 (1)			18 (30)	18 (21)	9 (21)						

Table 39. Total number of sauger captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2006. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Blanks indicate the habitat was either not sampled or is non-existent in the segment.

Gear	N	Mesohabitat				
		BARS	CHNB	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)						
1 Inch Trammel Net	35		97 (81)	3 (16)		0 (2)
2.5 Inch Trammel Net						
Beam Trawl						
Gill Net						
Otter Trawl	14		93 (84)	7 (13)		0 (3)
Fish Community Season (Summer)						
1 Inch Trammel Net	12		83 (92)	17 (6)		0 (1)
Beam Trawl	0		 (100)			
Mini-Fyke Net	11	91 (95)	0 (1)			
Otter Trawl	11		91 (98)	9 (2)		

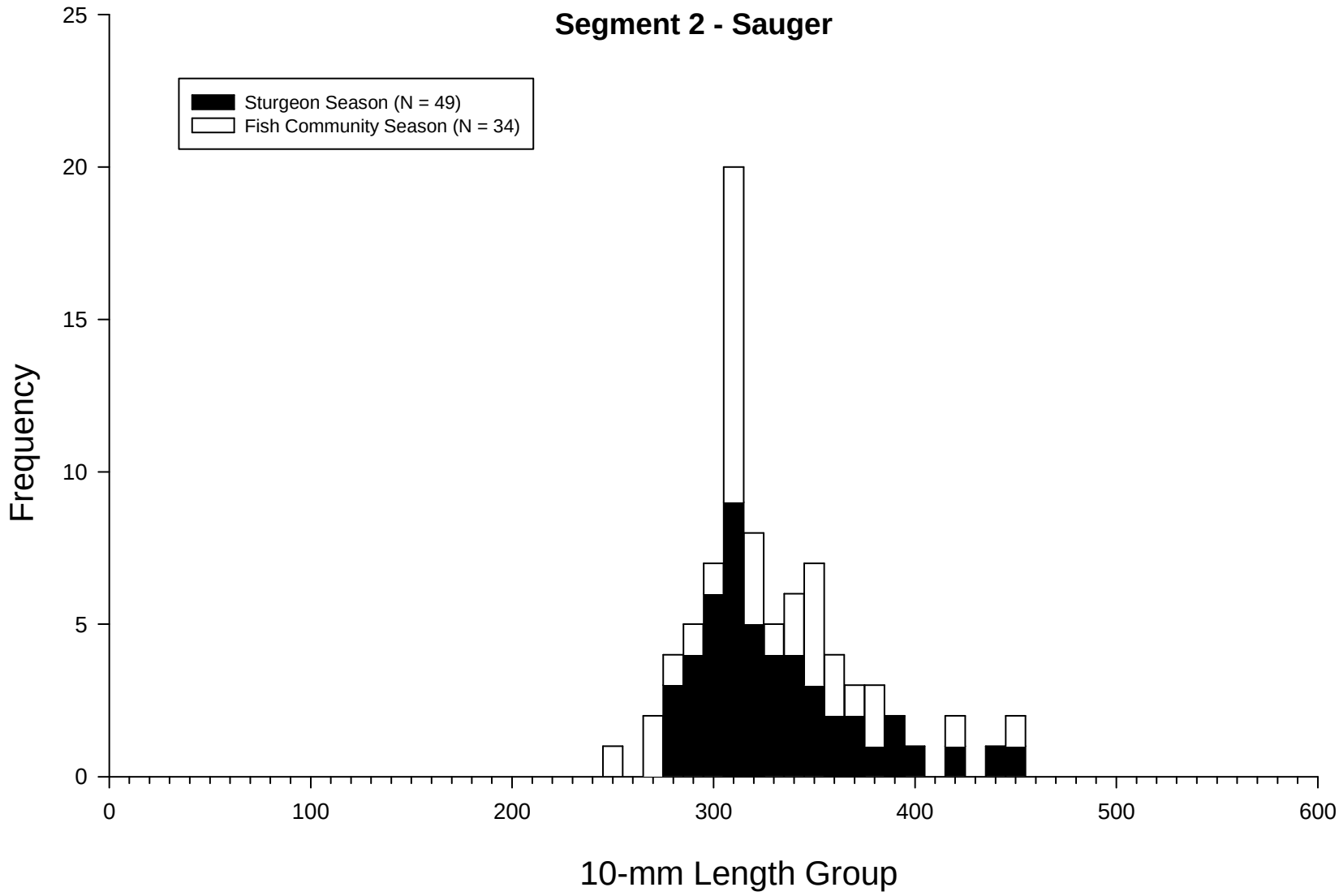

Figure 51. Length frequency of all sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2006.

Missouri River Fish Community

A total of 60,034 fish consisting of 34 species and one hybrid (sauger x walleye) were collected during all standard and non-standard sampling in segment 2 during 2006. White suckers *Catostomus commersoni* were the most common species with 48,920 sampled followed by fathead minnows *Pimephales promelas* (N = 4,374), emerald shiners *Notropis atherinoides* (N = 1,788), longnose suckers *Catostomus catostomus* (N = 1,039), shovelnose sturgeon (N = 427), river carpsuckers *Carpiodes carpio* (N = 396), sand shiners, (N = 377), shorthead redhorse *Moxostoma macrolepidotum* (N = 359), longnose dace *Rhinichthys cataractae* (N = 358), flathead chubs *Platygobio gracilis* (N = 355), western silvery minnows (N = 196), goldeyes *Hiodon alosoides* (N = 182), common carp *Cyprinus carpio* (N = 138), sturgeon chubs (N = 113), sauger (N = 84) and channel catfish *Ictalurus punctatus* (N = 78), all other species had a sample size less than 50.

Considerably more fish were collected in the summer months during the fish community season (N =59,360), when compared to the earlier sturgeon season (N = 674). Of the fish sampled during the fish community season, mini fyke nets (N = 48,000) and bag seines (N = 10,656) made up the majority of the catch. On average mini fyke nets (Mean TL = 46.9; N = 3,773) captured smaller fish than bag seines (Mean TL = 55.21; N = 1,493), while the average size of fish sampled by trammel nets (Mean TL = 442.2; N = 739) was larger than for both the otter (Mean TL = 252.4; N = 544) and beam (Mean TL = 79.9; N = 85) trawls.

The otter trawl sampled the greatest number of target species (N = 7), while both trammel nets and bag seines sampled four each. Moreover, mini fyke nets and the beam trawl each collected three target species. The greatest number of individuals from target species were collected in the mini fyke nets (N = 410). However, target species only made up 0.9% of the mini fyke net total catch, but mini fyke nets caught 92.1% of all western silvery minnows captured using standard gears and 17.9% using all gears. Conversely, target species made up 49.3% (N = 364) of the trammel net and 45.2% (N = 246) of the otter trawl catch. For wild gears, target species made up 1.6% and 27.4 % of the total catch for bag seines and beam trawls, respectively.

For gears that fish water > 1.2 m in depth, the otter trawl captured more total species (N = 25) than either trammel nets (N = 15) or beam trawls (N = 8). Only three species had an overall CPUE > 0.1 fish/100 m for otter trawl, shovelnose sturgeon (0.195 fish/100m), flathead chub

0.169 fish/100m), sturgeon chub (0.157 fish/100m) and white sucker (0.149 fish/100m) (Appendix F). However, CPUE > 0.2 fish/100m occurred during the sturgeon season for shovelnose sturgeon (0.252 fish/100m) and during the fish community season for white sucker (0.266 fish/100m) and flathead chub (0.202 fish/100m) (Appendix H).

Five species had overall CPUE > 0.1 fish/100m for trammel nets, shovelnose sturgeon (0.652 fish/100m), goldeye (0.412 fish/100m), sauger (0.116 fish/100m), river carpsucker (0.16 fish/100m) and channel catfish (0.114 fish/100m) (Appendix F). Trammel nets captured shovelnose sturgeon at a rate of 0.774 fish/100 m during fish community season, which was the highest CPUE for any deep water gear for any species during either season (Appendix H).

The beam trawl sampled three species with a CPUE > 0.1 fish/100m, longnose dace (0.456 fish/100m) sturgeon chub (0.246 fish/100m) and white sucker (0.187 fish/100m) (Appendix H). However, the beam trawl was only used in four river bends during the fish community season in segment 2, which may have influenced the CPUE when compared to other gears that were sampled in a greater diversity of river bends. For shallow water gears, mini fyke nets sampled 24 total species, whereas the bag seine sampled 17.

For standard shallow water gears (<1.2 m in depth), five species had a mini fyke net CPUE of > 4.0 fish/ net night, white suckers (494.61 fish/net night), fathead minnow (52.32 fish/net night), emerald shiner (16.89 fish/net night), longnose sucker (9.38 fish/ net night) and sand shiner (4.494 fish/net night). Five other species had a mini fyke net CPUE > 1.0 fish/net night, common carp, fathead chub, shorthead redhorse, river carpsucker and longnose dace (Appendix H).

Other species sampled in segment 2 during 2006 with sample sizes < 50 and were not target species include the following; black bullhead *Ameiurus melas*, brook stickleback *Culaea inconstans*, bigmouth buffalo *Ictiobus cyprinellus*, brown trout *Salmo trutta*, burbot *Lota lota*, brassy minnow *Hybognathus hankinsoni*, lake chub *Couesius plumbens*, northern redbelly dace *Phoxinus eos*, pumpkinseed *Lepomis gibbosus*, rainbow trout *Oncorhynchus mykiss*, smallmouth buffalo *Ictiobus bubalus*, spottail shiner *Notropis hudsonius*, stonecat *Noturus flavus*, yellow perch *Perca flavescens*.

A total of seven nonnative species were captured in segment 2 during 2006, which included in order of abundance, common carp (N = 138), pumpkinseed (N = 6), yellow perch (N = 2), walleye (N = 2), rainbow trout (N = 2), spottail shiner (N = 1), brown trout (N = 1), black bullhead (N = 1).

Discussion

The 2006 field season was the first year of the Population Assessment Program in Montana. A total of 13 hatchery reared pallid sturgeon and no wild or unknown origin pallid sturgeon were captured in segment 2. However, one pallid sturgeon was captured on two occasions, May 31st at river mile 1710 and August 21st at river mile 1708. This recaptured pallid sturgeon was part of the 2003-year class stocked in the Milk River during 2004.

Spatial distribution for the majority of pallid sturgeon recaptures (N = 12) was limited to a span of six river miles (1710 to 1704), which is just upstream of the Wolf Point, MT stocking location. However, 2 of the 12 pallids captured in this location were stocked in the Milk River, and therefore moved downstream approximately 51 river miles. Another pallid sturgeon from a Milk River stocking was captured 1.5 miles downstream of its initial stocking site. One pallid sturgeon captured in segment 2 at river mile 1708.0 was stocked in the Yellowstone River at Fairview, ND (river mile 9.0) in 2002. The pallid sturgeon migrated at least 135 river miles from its initial stocking site.

Hatchery reared pallid sturgeon captured in 2006 represented four-year classes. The majority (N = 10) of the pallid sturgeon recaptures were from 2006 stockings (2005-age class), while two fish were from the 2004 stocking (2003-year class), and one fish from each of the 2003 (2002-year class) and 2002 (2001-year class) stocking events.

Otter trawls were the most effective pallid sturgeon sampling gear in segment 2, with a CPUE of 0.026 fish/100 m and 0.012 fish/100 m during the fish community and sturgeon seasons, respectively. Pallid sturgeon CPUE was considerably less for trammel nets for both seasons, with a CPUE of 0.003 fish/100 m during fish community season and a CPUE of 0.00 during sturgeon season. One pallid sturgeon was captured in the beam trawl, with a CPUE of 0.009 fish/ 100m.

Shovelnose sturgeon were the most commonly captured target fish in segment 2, with a total of 427 sampled. Drifting trammel nets was the most effective way in sampling shovelnose sturgeon with a CPUE of 0.774 and 0.528 fish/100 m during the fish community and sturgeon seasons, respectively. Shovelnose sturgeon sampled with trammel nets (mean FL = 566 mm) were on average larger than those sampled by otter trawls (mean FL = 540 mm). However, no shovelnose sturgeon < 310 mm FL were sampled in segment 2, indicated little or no rearing of YOY or age-1 fish was occurring during 2006 in this segment (Pierce et al. 2003).

The beam trawl was most effective in capturing sturgeon chubs (CPUE = 0.246 fish/100 m) and longnose dace (CPUE = 0.465 fish/100 m) during the fish community season. While sturgeon chub CPUE for the beam trawl was considerably higher than for the otter trawl (CPUE = 0.085 fish/100 m) during the fish community season, the results may be spatially biased due to the random bend selection for beam trawls. One half of the 24 bends in segments 2 and 3 were randomly selected to beam trawl and as a consequence only four river bends in segment 2 were selected. Of those four river bends (river miles 1744, 1725, 1710 and 1706) bends 1710 and 1706 were near the downstream boundary of segment 2 where the majority of all sturgeon chubs were captured with both beam and otter trawls. In addition, out of the four total bends that both gears were used the beam trawl only captured more sturgeon chubs in two of the four bends when compared directly to the otter trawl. The fact that the otter trawl was sampled in more upstream bends where no sturgeon chubs were found likely drew its CPUE down. In conclusion, on a bend-by-bend basis there was little if any difference between the two gears CPUE for sturgeon chubs. Nevertheless, the beam trawl seems to be a more effective in sampling small benthic orientated fishes in the deep portions of the river.

No evidence of recent recruitment was observed for the blue sucker population in segment 2. All blue suckers sampled were ≥ 635 mm TL. Similarly, no small < 241 mm TL saugers were sampled in segment 2. Although no YOY or age-1 saugers were collected, the size frequency histogram in Figure 51 indicates recent recruitment and various age classes. Therefore, we either did not effectively sample juvenile sauger rearing habitat or sauger are rearing in other portions of the system. Evidence of YOY sauger rearing in downstream segment 3 was observed in 2006(Haddix et al. 2007).

Mini fyke nets were successful in sampling numerous species rarely seen in other gear types. For example, of the standard gears, mini fyke nets were the only gear to sample sand shiners. Many other non-target fishes like fathead minnow, burbot, pumpkinseed, brassy minnow, lake chub, northern redbelly dace, and yellow perch were only collected in mini fyke nets. The most abundant fishes sampled in mini fyke nets were white suckers (N = 40,063), fathead minnows (N = 4,238) emerald shiners (N =1,366) and longnose suckers (N = 760).

Bag seines were the most effective gear in collecting western silvery minnows. Limited bag seining occurred in segment 2 (8 river bends), but still collected 80.6% of the total western silvery minnows sampled. Similarly, bag seines collected more flathead chubs (N = 147) than any other gear and made up 41.4% of the total flathead chub catch.

Two chub species found in segment 2, sturgeon chub and flathead chub demonstrated a longitudinal gradient in abundance. Both species were fairly rare in the upper portions of segment 2 and became increasingly more abundant in downstream samples. Additionally, the only sicklefin chub was sampled at the most downstream bend sampled in segment 2. All three chub species were more abundant in downstream segment 3 during 2006 (Haddix et al. 2007). The distribution of these three species is likely being influenced by Fort Peck Dam, which precludes large sediment loads and has modified the historic thermal and hydrologic regimes.

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References

Berry, C.R. Jr., M. Wildhaber and D. L. Galat. 2004. Fish distribution and abundance. Volume 3. Population structure and habitat use of benthic fishes along the Missouri and lower Yellowstone Rivers. U.S. Geological Survey, Cooperative Research Units, South Dakota State University, Brookings, South Dakota.

Drobish, M.R. (editor), 2006. Missouri River Standard Operating Procedures and Data Collection, Volume 1.1. U.S. Army Corps of Engineers, Omaha District, Yankton, S.D.

Galat, D.L., C.R. Berry Jr., E.J. Peters and R.G. White. 2005. Missouri River. Pages 427-480 in A.C. Benke and C.E. Cushing (editors). Rivers of North America, Elesevier, Oxford.

Gardner, W.M. and P.A. Stewart. 1987. The Fishery of the Lower Missouri River. Federal Aid to Fish and Wildlife Restoration Project FW-2-R Job I-b. Montana Fish, Wildlife and Parks. Helena, Montana.

Haddix, T., L. Holte and C. Sampson. 2007. Pallid sturgeon population assessment and associated fish monitoring for the Missouri River: Segment 2. Prepared for the U.S. Army Corps of Engineers by Montana Fish, Wildlife & Parks. Fort Peck, MT.

Kapuscinski, K.L., and M.W. Baxter. 2002. Lower Missouri and Yellowstone Rivers Pallid Sturgeon Study. Montana Fish, Wildlife and Parks. Fort Peck, Montana.

Keenlyne, K. D. and P. D. Evenson. 1993. Standard and Relative Weight for the Pallid Sturgeon, *Scaphirhynchus albus*. Proceedings of the South Dakota Academy of Sciences 2:4149.

Pierce, C. L., C. S. Guy, P. J. Braaten, and M.A. Pegg. 2004. Fish growth, mortality, recruitment, condition, and size structure. Volume 4. Population structure and habitat use of benthic fishes along the Missouri and lower Yellowstone Rivers. U.S. Geological Survey, Cooperative Research Units, Iowa State University, Ames Iowa.

Shuman, D. A. , D. W. Willis, and S. C. Krentz. 2006. Application of a Length-Categorization System for Pallid Sturgeon (Scaphirhynchus albus). Journal of Freshwater Ecology. Volume 21, Number 1.

Quist, M. C., Guy, C. S., and Braaten, P. J. 1998. Standard Weight (Ws) Equation and Length Categories for Shovelnose Sturgeon. North American Journal of Fisheries Management 18:992-997.

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 2 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for segment 2.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	Standard	All	2006	fish/100 m drift
Otter trawl – 16 ft head rope	OT16	Standard	All	2006	fish/100 m trawled
Beam trawl	BT	Standard	Fish Comm.	2006	fish/100 m trawled
Bag Seine – quarter arc method pulled upstream	BSQU	Wild	Fish Comm.	2006	fish/100 m^2
Bag Seine – quarter arc method pulled downstream	BSQD	Wild	Fish Comm.	2006	fish/100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Wild	Fish Comm.	2006	fish/100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Wild	Fish Comm.	2006	fish/100 m^2
Bag seine – rectangular method pulled upstream	BSRU	Wild	Fish Comm.	2006	fish/100 m^2
Bag seine – rectangular method pulled upstream	BSRD	Wild	Fish Comm.	2006	fish/100 m^2
Mini-fyke net	MF	Standard	Fish Comm.	2006	fish/net night

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

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

Appendix E. Juvenile and adult pallid sturgeon stocking summary for RPMA 2 of the Missouri River.

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
1998	Big Sky Bend	255	1997	8/11/1998	Yearling	PIT Tag	Elastomer
1998	Confluence	40	1997	8/11/1998	Yearling	PIT Tag	Elastomer
1998	Nohly Bridge	255	1997	8/11/1998	Yearling	PIT Tag	Elastomer
1998	Sidney	230	1997	8/11/1998	Yearling	PIT Tag	Elastomer
2000	Culbertson	34	1998	10/11/2000	2 yr Old	PIT Tag	
2000	Fairview	66	1998	10/11/2000	2 yr Old	PIT Tag	
2000	Sidney	66	1998	10/11/2000	2 yr Old	PIT Tag	
2000	Wolf Point	34	1998	10/11/2000	2 yr Old	PIT Tag	
2000	Culbertson	89	1999	10/17/2000	Yearling	PIT Tag	
2000	Fairview	150	1999	10/17/2000	Yearling	PIT Tag	
2000	Sidney	149	1999	10/17/2000	Yearling	PIT Tag	
2000	Wolf Point	90	1999	10/17/2000	Yearling	PIT Tag	
2002	Culbertson	270	2001	7/18/2002	Yearling	CWT	Elastomer
2002	Fairview	270	2001	7/18/2002	Yearling	CWT	Elastomer
2002	Intake	199	2001	7/18/2002	Yearling	CWT	Elastomer
2002	Sidney	271	2001	7/18/2002	Yearling	CWT	Elastomer
2002	Wolf Point	269	2001	7/18/2002	Yearling	CWT	Elastomer
2002	Culbertson	317	2001	7/26/2002	Yearling	PIT Tag	
2002	Fairview	360	2001	7/26/2002	Yearling	PIT Tag	
2002	Intake	97	2001	7/26/2002	Yearling	PIT Tag	
2002	Sidney	427	2001	7/26/2002	Yearling	PIT Tag	
2002	Wolf Point	425	2001	7/26/2002	Yearling	PIT Tag	
2002	Intake	155	2001	9/18/2002	Yearling	PIT Tag	
2003	Culbertson	1033	2002	8/7/2003	Yearling	PIT Tag	Elastomer
2003	Fairview	887	2002	8/7/2003	Yearling	PIT Tag	Elastomer
2003	Intake	1040	2002	8/7/2003	Yearling	PIT Tag	Elastomer
2003	Wolf Point	926	2002	8/7/2003	Yearling	PIT Tag	Elastomer
2004	Milk River	821	2003	4/13/2004	Yearling	Elastomer	
2004	Culbertson	523	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Intake	347	2003	8/9/2004	Yearling	PIT Tag	Elasomer
2004	Sidney	397	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Wolf Point	379	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Larval Drift	30000	2004	7/2/2004	Fry		

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2004	Larval Drift	50000	2004	7/8/2004	Fry		
2004	Larval Drift	25000	2004	7/20/2004	Fry		
2004	Larval Drift	25000	2004	7/23/2004	Fry		
2004	Larval Drift	25000	2004	7/27/2004	Fry		
2004	Culbertson	3819	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Sidney	2991	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Wolf Point	4040	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Mouth of Milk	3482	2004	10/15/2004	Advanced Fingerling	CWT	Elastomer
2004	Intake	2477	2004	11/18/2004	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	288	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Intake	309	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Wolf Point	271	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Intake	175	2004	8/19/2005	Yearling	PIT Tag	Elastomer
2005	Brockton	229	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	226	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Intake	456	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Milk River	232	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Sidney	122	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	611	2005	10/12/2005	Advanced Fingerling	CWT	Elastomer
2005	Brockton	371	2005	10/13/2005	Advanced fingerling		
2005	Culbertson	1736	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	182	2005	10/13/2005	Advanced Fingerling		
2005	Intake	313	2005	10/13/2005	Advanced Fingerling		
2005	Milk River	845	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Mouth of Milk	371	2005	10/13/2005	Advanced Fingerling		
2005	Sidney	105	2005	10/13/2005	Advanced		

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
					Fingerling		
2005	Wolf Point	1521	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	371	2005	10/13/2005	Advanced Fingerling		
2005	Culbertson	651	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Intake	2120	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Milk River	485	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Sidney	882	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	650	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2006	Culbertson	235	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	327	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Mouth of Milk	134	2005	3/28/2006	Advanced fingerling	Elastomer	
2006	Sidney	113	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	232	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	970	2005	4/3/2006	Yearling	PIT Tag	Elastomer
2006	Sidney	314	2005	4/3/2006	Yearling	PIT Tag	Elastomer
2006	Culbertson	844	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Mouth of Milk	1007	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Wolf Point	866	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Culbertson	669	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Intake	765	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Mouth of Milk	650	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Sidney	228	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Wolf Point	653	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006		1355	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Culbertson	1544	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Intake	1680	2006	10/24/2006	Advanced Fingerling	Elastomer	

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2006	Mouth Milk	1117	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Sidney	586	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	1553	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	School Trust	436	2006	11/8/2006	Advanced Fingerling	Elastomer	

[a]Age of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc…

Appendix F

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

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

Species	Total	Overall	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
	Catch	CPUE	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BKBH	0													
BKSB	0													
BMBF	1	0.002 [0.004]							0.009 [0.018]					
BNTT	0													
BRBT	0													
BSMW	0													
BUSK	11	0.019 [0.012]	0.035 [0.036]	0	0	0	0.013 [0.018]	0	0.029 [0.028]	0	0	0	0	0
CARP	2	0.007 [0.009]	0.014 [0.028]	0	0	0	0	0	0	0	0.04 [0.028]	0	0	0
CNCF	40	0.114 [0.119]	0.061 [0.07]	0	0	0	0.017 [0.024]	0	0.032 [0.031]	0	1.013 [1.436]	0.051 [0.103]	0	0
CSCO	0													
ERSN	0													
FHCB	16	0.033 [0.02]	0.007 [0.013]	0	0	0	0.038 [0.03]	0	0.069 [0.068]	0	0.035 [0.069]	0.015 [0.031]	0	0
FHMW	0													
FWDM	0													
GDEY	176	0.412 [0.154]	0.242 [0.147]	0	0	0	0.34 [0.188]	0	0.295 [0.188]	0	1.323 [1.574]	0.595 [0.302]	0	0
GNSF	0													
HBNS	0													

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
LKCB	0													
LKWF	0													
LNDC	0													
LNSK	12	0.019 [0.013]	0.013 [0.018]	0 0	0	0	0.047 [0.042]	0	0.015 [0.021]	0	0	0	0	0
NRBD	0													
PDFH	0													
PDSG	1	0.002 [0.003]	0	0	0	0	0	0	0.007 [0.014]	0	0	0	0	0
PNSD	0													
RBTT	0													
RVCS	79	0.16 [0.056]	0.172 [0.112]	0	0	0	0.138 [0.098]	0	0.093 [0.063]	0	0.473 [0.432]	0.142 [0.117]		
SFCB	0													
SGCB	0													
SGER	47	0.116 [0.059]	0.105 [0.131]	0	0	0	0.087 [0.074]	0	0.072 [0.086]	0	0.437 [0.446]	0.064 [0.071]	0	0
SGWE	1	0.002 [0.003]	0	0	0	0	0	0	0	0	0.021 [0.042]	0	0	0
SHRH	21	0.046 [0.025]	0.017 [0.025]	0			0.066 [0.065]	0	0.033 [0.033]	0	0.081 [0.089]	0.065 [0.098]	0	0
SMBF	12	0.032 [0.026]	0.011 [0.022}	0	0	0	0.009 [0.019]	0	0.018 [0.026]	0	0.12 [0.24]	0.099 [0.119]	0	0
SNSG	308	0.652 [0.187]	0.376 0.227	0	0	0	0.621 [0.318]	0	0.972 [0.545]	0	0.963 [0.732]	0.626 [0.437]	0	0
SNSN	0													

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
STCT	0													
STSN	0													
WLYE	1	0.002 [0.003]	0	0	0	0	0.006 [0.013]	0	0	0	0	0	0	0
WSMW	0													
WTCP	0													
WTSK	11	0.017 [0.019]	0.033 [0.065]	0	0	0	0.019 [0.021]	0	0.014 [0.027]	0	0	0	0	0
YWPH	0													

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

Species	Total	Overall	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
	Catch	CPUE	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BKBH	1	0.002 [0.004]	0	0	0	0	0	0	0.01 [0.02]	0	0	0	0	0
BKSB	4	0.016 [0.031]	0	0	0	0	0	0	0	0	0	0.153 [0.305]	0	0
BMBF	1	0.001 [0.003]	0	0	0	0	0	0	0	0	0.011 [0.022]	0	0	0
BNTT	0													
BRBT	0													
BSMW	0													
BUSK	1	0.004 [0.007]	0.015 [0.03]	0	0	0	0	0	0	0	0	0	0	0
CARP	5	0.014 [0.017]	0.006 [0.013]		0.132 [0.265]							0.098 [0.157]		
CNCF	35	0.057 [0.045]	0.031 [0.032]	0	0	0	0.016 [0.033]	0	0.022 [0.024]	0	0.189 [0.267]	0.144 [0.22]	0	0
CSCO	0													
ERSN	3	0.009 [0.01]	0	0	0	0	0.017 [0.025]	0	0	0	0	0.038 [0.076]	0	0
FHCB	101	0.169 [0.051]	0.242 [0.138]	0	0	0	0.26 [0.11]	0	0.066 [0.081]	0	0.098 [0.061]	0.126 [0.106]	0	0
FHMW	0													
FWDM	0													
GDEY	1	0.003 [0.006]	0	0	0	0	0	0	0	0	0	0.031 [0.062]	0	0
GNSF	0													
HBNS	0													

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
LKCB	0													
LKWF	0													
LNDC	8	0.013 [0.019]	0.039 [0.078]	0	0	0	0	0	0.008 [0.016]	0	0	0.017 [0.035]	0	0
LNSK	10	0.017 [0.012]	0.019 [0.029]	0	0	0	0.013 [0.018]	0	0.023 [0.026]	0	0.011 [0.022]	0.023 [0.047]	0	0
NRBD	0													
PDFH	0													
PDSG	12	0.019 [0.012]	0.02 [0.029]	0	0	0	0.025 [0.025]	0	0.007 [0.014]	0	0.044 [0.042]	0	0	0
PNSD	1	0.004 [0.008]	0	0	0	0	0	0	0	0	0.038 [0.076]	0	0	0
RBTT	1	0.003 [0.006]	0.013 [0.025]	0	0	0	0	0	0	0	0	0	0	0
RVCS	19	0.035 [0.027]	0.013 [0.025]	0	0.132 [0.265]	0	0.012 [0.017]	0	0.032 [0.031]	0	0.078 [0.134]	0.084] [0.167]	0	0
SFCB	1	0.002 [0.035]	0	0	0	0	0.006 [0.012]	0	0	0	0	0	0	0
SGCB	87	0.157	0.16 [0.087]	0	0	0	0.185 [0.13]	0	0.073 [0.064]	0	0.148 [0.099]	0.268 0.201	0	0
SGER	25	0.05 [0.026]	0.043 [0.041]	0	0.397 [0.794]	0	0.042 [0.043]	0	0.066 [0.067]	0	0.011 [0.022]	0.051 [0.071]	0	0
SGWE	2	0.004 [0.006]	0	0	0.241 [0.281]	0	0	0	0	0	0	0	0	0
SHRH	24	0.044 [0.022]	0.025 [0.03]	0	0.132 [0.265]	0	0.005 [0.011]	0	0.093 [0.079]	0	0.056 [0.046]	0.063 [0.074]	0	0
SMBF	3	0.004 [0.005]	0	0	0	0	0	0	0.007 [0.014]	0	0.022 [0.031]	0	0	0
SNSG	117	0.195 [0.049]	0.224 [0.096]	0	0	0	0.259 [0.113]	0	0.159 [0.101]	0	0.08 [0.079]	0.204 [0.148]	0	0

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SNSN	0													
STCT	2	0.005 [0.008]	0.015 [0.029]	0	0.1 [0.2]	0	0	0	0	0	0	0	0	0
STSN	0													
WLYE	1	0.001 [0.003]	0	0	0	0	0.005 [0.011]	0	0	0	0	0	0	0
WSMW	3	0.005 [0.008]	0	0	0.2 [0.4]	0	0	0	0.006 [0.013]	0	0	0	0	0
WTCP	0													
WTSK	71	0.149 [0.157]	0.025 [0.029]	0	0	0	0.036 [0.029]	0	0.233 [0.303]	0	0.034 [0.051]	0.755 [1.369]	0	0
YWPH	0													

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		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
BKBH	0	0												
BKSB	0	0												
BMBF	0	0												
BNTT	0	0												
BRBT	0	0												
BSMW	0	0												
BUSK	0	0												
CARP	0	0												
CNCF	2	0.021 [0.029]	0	0	0	0	0	0	0.078 [0.103]	0	0	0	0	0
CSCO	0	0												
ERSN	0	0												
FHCB	6	0.063 [0.056]	0.15 [0.137]	0	0	0	0.046 [0.092]	0	0	0	0	0	0	0
FHMW	0	0												
FWDM	0	0												
GDEY	0	0												

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
GNSF	0	0												
HBNS	0	0												
LKCB	0	0												
LKWF	0	0												
LNDC	42	0.456 [0.689]	1.152 [2.111]	0	0	0	0.046 [0.092]	0.092	0.257 [0.356]		0	0	0	0
LNSK	3	0.029 [0.059]	0	0	0	0	0	0	0.111 [0.222]	0	0	0	0	0
NRBD	0	0												
PDFH	0	0												
PDSG	1	0.009 [0.019]	0.029 [0.058]	0	0	0	0	0	0	0	0	0	0	0
PNSD	0	0												
RBTT	0	0												
RVCS	0	0												
SFCB	0	0												
SGCB	24	0.246 [0.115]	0.373 [0.226]	0			0.194 [0.201]	0	0.198 [0.212]	0	0.12 [0.24]	0	0	0
SGER	0	0												
SGWE	0	0												
SHRH	0	0												
SMBF	0	0												

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL		SCCS	TRML
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	ITIP	TLWG
SNSG	1	0.01 [0.02]	0	0	0	0	0	0	0.037 [0.074]	0	0	0	0	0
SNSN	0	0												
STCT	0	0												
STSN	0	0												
WLYE	0	0												
WSMW	0	0												
WTCP	0	0												
WTSK	16	0.187 [0.166]	0.03 [0.061]	0	0	0	0.061 [0.081]	0	0.317 [0.285]	0	0.833 [1.667]	0	0	0
YWPH	0	0												

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

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB	SCCL	SCCS	SCN	SCN	TRMS
			CHNB	BARS	BARS	CHNB	BARS	BARS	BARS	BARS	BARS	-	BARS
BKBH	0												
BKSB	5	0.062 [0.064]	0	0	0	0	0.05 [0.10]	0.111 [0.222]	0	0 [0.154]	0.25 [0.5]	0	0
BMBF	0												
BNTT	1	0.012 [0.025]	0	0	0	0	0	0	0.071 [0.143]	0	0	0	0
BRBT	4	0.049 [0.06]	0	0	0	0	0	0	0	0.231 [0.332]	0	0	1
BSMW	1	0.012 [0.025]	0	0	0.5 [1.00]	0	0	0	0	0	0	0	0
BUSK	0												
CARP	98	1.21 [0.543]	0	1.8 [1.939]	0.5 [1.0]	0	0.95 [0.852]	0.5 [0.291]	0.357 [0.45]	1.538 [1.425]	6.5 [6.856]	2.667 [2.404]	0
CNCF	1	0.012 [0.025]	0	0	0.5 [1.0]	0	0	0	0	0	0	0	0
CSCO	0												
ERSN	1366	16.864 [11.837]	226	2 [2.28]	219.5 [339]	0	4.3 [4.185]	11.722 [11.725]	0	2.231 [1.95]	39.25 [47.577]	33 [56]	6
FHCB	85	1.049 [0.837]	0	1.2 [2.4]	2.0 [4.0]	0	1 [0.821]	0.222 [0.258]	0.857 [0.91]	0.385 [0.361]	0	0.667 [1.333]	0
FHMW	4238	52.321 [47.652]	2	23.2 [30.288]	34.5 [29.0]	0	5.25 [3.283]	18.889 [14.355]	5.286 [3.747]	41 [46.581]	90.25 [145.72]	824.667 [1031.3]	164
FWDM	0												
GDEY	4	0.049 [0.099]	0	0	0	0	0	0	0	0	0	0	4
GNSF	0												

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB	SCCL	SCCS	SCN	SCN	TRMS
			CHNB	BARS	BARS	CHNB	BARS	BARS	BARS	BARS	BARS	-	BARS
HBNS	16	0.198 [0.266]	0	0	0	0	0.05 [0.1]	0	0.357 [0.578]	0	0	0	10
LKCB	2	0.025 [0.035]	0	0	0.5 [1.0]	0	0	0.056 [0.111]	0	0	0	0	0
LKWF	0												
LNDC	305	3.765 [3.168]	0	6.4 [10.855]	0.5 [1.0]	0	2 [3.179]	7.556 [11.786]	0.714 [1.015]	5.231 [9.31]	2.75 [4.856]	1.667 [3.333]	2
LNSK	760	9.383 [8.61]		2.6 [4.224]		0	4.35 [4.927]	18.167 [23.875]	0.143 [0.286]	24.692 [41.416]	1.5 [3.0]	0.333 [0.667]	3
NRBD	9	0.111 [0.127]			1.5 [3.0]	0	0.3 [0.413]	0	0	0	0	0	0
PDFH	0												
PDSG	0												
PNSD	5	0.062 [0.081]	0	0.2 [0.4]	0	0	0	0	0	0	0	1.333 [1.764]	0
RBTT	0												
RVCS	291	3.593 [3.771]		1 [2.0]			2.7 [3.344]	0.278 [0.452]	0.071 [0.143]	0.846 [0.779]	4 [2.944]	65.333 [81.194]	3
SFCB	0												
SGCB	0												
SGER	11	0.136 [0.104]	0	0.2 [0.4]	2 [2]	0	0.15 [0.219]	0	0.071 [0.143]	0	0	0.333 [0.667]	1
SGWE	0												
SHRH	300	3.704 [3.646]	0	11 [22]	0	0	0.2 [0.234]	2.556 [5.111]	0	14.462 [19.459]	0.75 [0.957]	1.333 [1.764]	0
SMBF	0												
SNSG	0												

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB	SCCL	SCCS	SCN	SCN	TRMS
			CHNB	BARS	BARS	CHNB	BARS	BARS	BARS	BARS	BARS	-	BARS
SNSN	364	4.494 [4.329]	1	2.4 [4.317]	0.5 [1.0]	0	0.5 [0.703]	6.833 [9.53]	0.143 [0.286]	3.308 [2.999]	1.5 [2.38]	4.333 [5.207]	153
STCT	1	0.012 [0.025]								0.077 [0.154]			
STSN	0												
WLYE	0												
WSMW	35	0.432 [0.233]	4	0.6 [0.8]	3 [4.0]	0	0.1 [0.2]	0.278 [0.354]	0.071 [0.143]	0.077 [0.154]	2 [1.826]	0.667 [1.333]	3
WTCP	0												
WTSK	40,063	494.605 [450.605]	31	40.2 [33.523]	356.5 [101.0]	0	1,112.25 [1,742.79]	133.778 [103.97]	180.143 [144.158]	228.077 [200.112]	1,156.50 [2,163.99]	1,386.33 [1,910.27]	193
YWPH	2	0.025 [0.035]	0	0	0	0	0	0.056 [0.111]	0	0	0	0.333 [0.667]	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 20006 for segment 2 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	Otter Trawl	1 Inch Trammel Net	Beam Trawl	Otter Trawl	Mini-Fyke Net
BKBH	0	0	0	0	0.004	0
BKSB	0	0	0	0	0.031	0.062
BMBF	0	0.003	0.004	0	0	0
BNTT	0	0	0	0	0	0.012
BRBT	0	0	0	0	0	0.049
BSMW	0	0	0	0	0	0.012
BUSK	0.028	0.007	0.01	0	0	0
CARP	0.014	0.005	0	0	0.023	1.21
CNCF	0.179	0.106	0.051	0.021	0.009	0.012
ERSN	0	0	0	0	0.017	16.864
FHCB	0.046	0.135	0.02	0.063	0.202	1.049
FHMW	0	0	0	0	0	52.321
GDEY	0.512	0.006	0.313	0	0	0.049
HBNS	0	0	0	0	0	0.198
LKCB	0	0	0	0	0	0.025
LNDC	0	0.004	0	0.456	0.022	3.765
LNSK	0.015	0	0.024	0.029	0.034	9.383
NRBD	0	0	0	0	0	0.111
PDSG	0	0.012	0.003	0.009	0.026	0
PNSD	0	0	0	0	0.008	0.062
RBTT	0	0	0	0	0.006	0
RVCS	0.274	0.063	0.048	0	0.008	3.593
SFCB	0	0.003	0	0	0	0
SGCB	0	0.23	0	0.246	0.085	0
SGER	0.168	0.06	0.065	0	0.04	0.136
SGWE	0.003	0	0	0	0.009	0

Species Code	Sturgeon Season (Fall through Spring)		Fish Community Season (Summer)			
	1 Inch Trammel Net	Otter Trawl	1 Inch Trammel Net	Beam Trawl	Otter Trawl	Mini-Fyke Net
SHRH	0.054	0.026	0.039	0	0.062	3.704
SMBF	0.037	0.006	0.027	0	0.003	0
SNSG	0.528	0.252	0.774	0.01	0.138	0
SNSN	0	0	0	0	0	4.494
STCT	0	0.011	0	0	0	0.012
WLYE	0.003	0	0	0	0.003	0
WSMW	0	0.007	0	0	0.003	0.432
WTSK	0.023	0.029	0.01	0.187	0.266	494.605
YWPH	0	0	0	0	0	0.025

Appendix I. Comprehensive list of bend numbers and bend river miles for segment 2 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) for 2006.

Bend Number	Bend River Mile	2006
1	1761	ST, FCS
2	1760	
3	1759	
4	1757.5	
5	1756	
6	1754.5	
7	1753	
8	1751	ST, FCS
9	1749.5	
10	1747	
11	1745	
12	1744	ST, FCS
13	1741.5	
14	1740	
15	1738	
16	1736.5	
17	1735	
18	1733	ST, FCS
19	1732	ST, FCS
20	1730.5	
21	1728.5	
22	1727.5	
23	1726.5	ST, FCS
24	1725.5	
25	1723.5	
26	1722	
27	1720	
28	1719	ST, FCS
29	1717.5	
30	1716	
31	1714	
32	1712	
33	1710.5	ST, FCS
34	1710	ST, FCS
35	1709	ST, FCS
36	1707.5	
37	1706.5	ST, FCS

Bend Number	Bend River Mile	2006
38	1705.5	
39	1704.5	ST, FCS
40	1703	