2007 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
By:

Tyler Haddix, Landon Holte and Cindy Lott

Montana Fish, Wildlife & Parks
Government Bldg.
East Kansas Street
Fort Peck, MT 59223

April 2008

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 second 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 autumn) seasons. Standard gears included otter trawls and trammel nets, which were used in both seasons, and mini fyke nets, which were utilized during the fish community season. Additionally, the "experimental" push trawl and "wild" trotlines were used in segment 2 during the fish community season.

Twenty-two pallid sturgeon *Scaphiryhynchus albus* were captured in segment 2 during 2007, an increase of eight from 2006. All pallid sturgeon sampled were of hatchery origin and therefore no signs of natural reproduction or recruitment were observed. The majority (N = 13) of pallid sturgeon captures occurred during the fish community season compared to the sturgeon season (N = 9). While all pallid sturgeon were captured in randomly selected bends, 16 were sampled in random subsamples and 6 were sampled in non-random additional subsamples.

Pallid sturgeon were not evenly distributed throughout the segment. Although sampling encompassed an area of approximately 54.5 river miles (1759 to 1704.5), no pallid sturgeon was captured upstream of river mile 1732.

Three age classes of pallid sturgeon were sampled during 2007, age-1 (N = 11), age-2 (N = 10) and age-5 (N = 1). Of the 22 pallids captured, 11 were stocked at Wolf Point, 4 near the confluence of the Milk River and 7 were of unknown stocking location.

Similar to 2006, otter trawls were the most effective standard pallid sturgeon sampling gear in segment 2 during 2007, with a CPUE of 0.021 fish/100 m and 0.023 fish/100 m during the sturgeon and fish community seasons, respectively. This was an increase in CPUE during the sturgeon season from 2006, which had a CPUE of 0.012 fish/ 100 m and a slight decrease from the CPUE of 0.026 fish/ 100 m during the fish community season of 2006. Pallid sturgeon CPUE was considerably less for trammel nets for both seasons and both years. Trammel net CPUE during the sturgeon season was estimated at 0.008 and 0.000 fish / 100 m for 2007 and 2006, respectively. During the fish community season CPUE was estimated at and 0.009 and

0.003 fish/ 100 m for the 2007 and 2006 seasons, respectively. No pallid sturgeon were sampled in the standard mini fyke nets during either 2007 or 2006. However, four pallid sturgeon were sampled in 2007 with the experimental push trawl, which equates to a CPUE of 0.038 fish/ 100 m, the highest CPUE for pallid sturgeon for any gear for either year. Additionally, 1 pallid sturgeon was sampled using wild trotlines during 2007.

A total of 517 shovelnose sturgeon *Scaphirhynchus platorynchus* were sampled in segment 2 during 2007, resulting in a pallid to shovelnose sturgeon ration of 1:23.5 a decrease of the 1:30.5 ratio observed in 2006. Of the total shovelnose sturgeon, trammel nets captured 53.2% (N = 275), otter trawls 30.9 % (N =160), trotlines15.7% (N = 81), push trawl 0.2% (N = 1) and mini-fyke nets 0.0%. More shovelnose sturgeon were sampled during fish community season (N = 335) when compared to sturgeon season (N = 182).

The majority (N = 512) of shovelnose sturgeon were of quality size or greater (≥ 380 mm FL), while few (N = 5) were of stock size. No shovelnose sturgeon smaller than 332 mm FL were sampled. The lack of smaller shovelnose sturgeon indicates that either limited recruitment or limited juvenile rearing is occurring in segment 2.

Six of the remaining eight native Missouri River target species were collected in segment 2 during 2007. The total number of individuals captured for the target species in order of abundance is as follows: sand shiners *Notropis stramineus* (N =808), sauger *Sander canadense* (N = 157), sturgeon chubs *Macrhybopsis gelida* (N = 150), western silvery minnows *Hybognathus argyritis* (N = 64), blue suckers *Cycleptus elongatus* (N = 36) sicklefin chubs *H. meeki* (N = 2), and plains minnow *Hybognathus placitus* (N = 1). No speckled chubs *Macrhybopsis aestivalis* were sampled in segment 2 during 2006.

In total, 7,726 fish consisting of 34 species were collected during all standard and non-standard sampling in segment 2 during 2007, including 7 nonnative fishes.

TABLE OF CONTENTS

LIST OF TABLES

Pallid sturgeon

Shovelnose sturgeon

Sturgeon chub

Sicklefin chub

Speckled chub

No speckled chubs were sampled in segment 2 during 2007.

Sand shiner

***Hybognathus* spp.**

Blue sucker

Sauger

LIST OF FIGURES

Sturgeon chub

Sicklefin chub

Speckled chub

No speckled chubs were collected in segment 2 during 2007.

Sand shiner

***Hybognathus* spp.**

Blue sucker

Sauger

LIST OF APPENDICES

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 2008). 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 2008). 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, 2008). 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 2008), 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 (2008). 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 (2008).

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.

Push Trawl

The experimental push trawl consists of two booms that extend out in front of the bow that are attached to two 30 x 15 inch doors. These doors open in the same manner as the otter trawl doors, except the net is pushed in front of the boat as apposed to being pulled. The net is 8 ft wide x 2 feet high and 6 feet long. The mesh is 3/16 inch with a zipper. The trawl is pushed in a downstream direction just faster than the current. To deploy the push trawl the two booms are lowered parallel to the water surface and line is let out until the doors are scraping on the bottom of the river. Each door can be deployed at different depths making it an effective gear in areas with steep bottom slopes. When the trawl is done, the

lines are brought in and the booms are raised up, close to being perpendicular to the waters surface.

Trotlines

Trotlines are a passive gear with a number of baited hooks set on a line anchored to the bottom of the river. We used octopus circle hooks of size 2 and 1/0 baited with either earthworm or cut bait. There are a variety of hook sizes and styles and numerous ways to configure trotlines. Therefore, for further description of trotline Standard Operating Procedures for the Program please see Drobish (2008).

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 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.

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 (2008). 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. Catch-per-unit-effort was both stratified by season, 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.

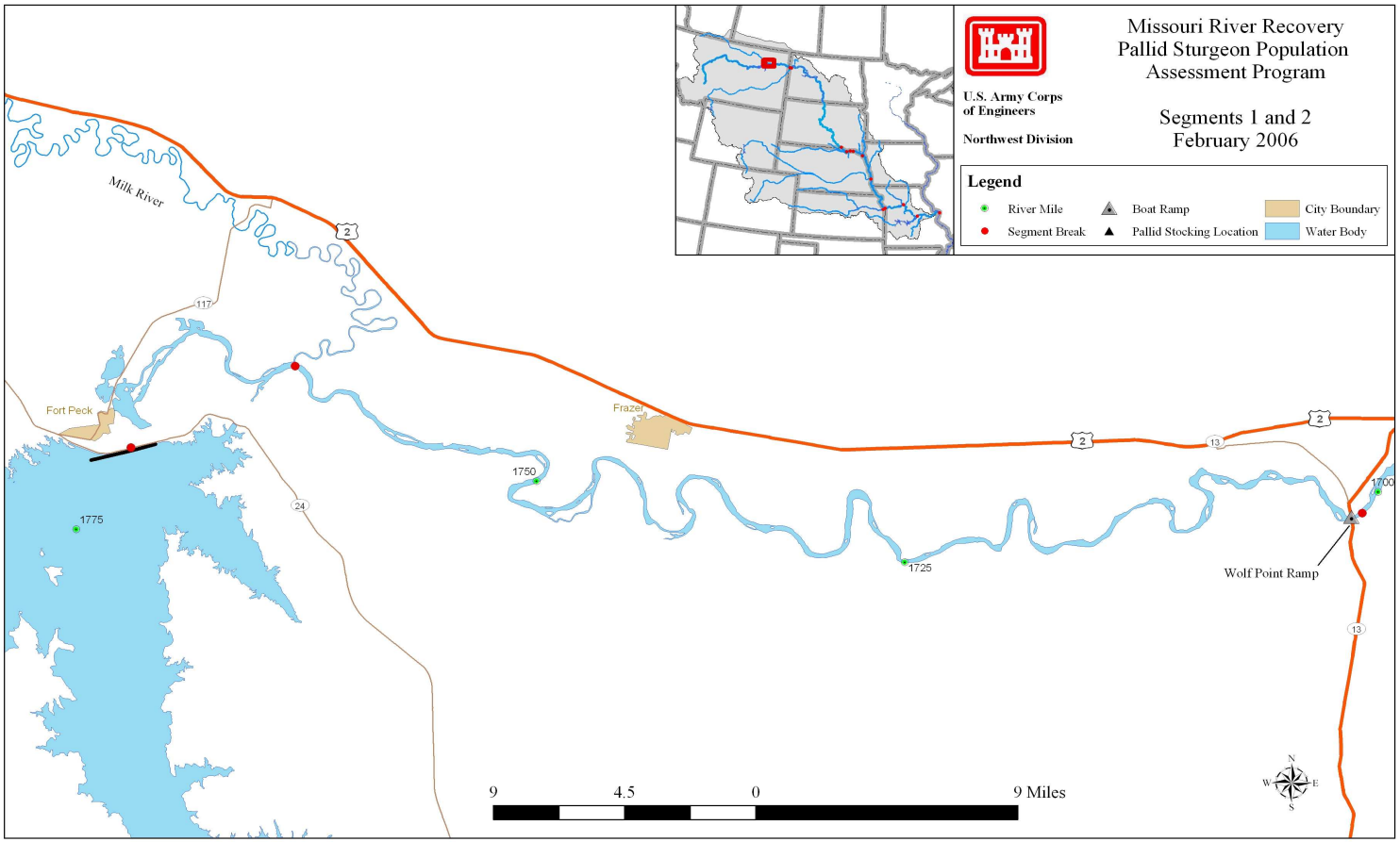

Figure 1a. Map of segment 2 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 2 encompasses the Missouri River from the mouth of the Milk River (River Mile 1760.0) to Wolf Point, MT (River Mile 1701.0).

Results

Pallid Sturgeon

No wild pallid sturgeon were sampled in segment 2 during 2007. However, twenty-two hatchery reared juvenile pallid sturgeon were collected. Of the total 13 and 9 were sampled during the fish community and sturgeon seasons, respectively. For both 2007 and 2006 combined, 36 hatchery reared juvenile pallid sturgeon and zero wild pallid sturgeon have been captured in segment 2.

Trammel net CPUE for pallid sturgeon was higher in 2007 when compared to 2006 for both sturgeon and fish community seasons (Figures 3 and 5). However, while otter trawl CPUE was up from 2006 during the sturgeon season, it was slightly lower during the fish community season (Figures 2 and 5). The highest pallid sturgeon CPUE for any gear observed during 2007 was for the otter trawl during the sturgeon season, which had a CPUE of 0.021 fish/ 100. No pallid sturgeon were sampled using mini fyke nets during either 2006 or 2007. One pallid sturgeon was captured on trotlines in segment 2 during 2007.

Of the 2007 total, 11, 10 and 1 originated from the 2006, 2005 and 2001 year classes, respectively. Pallid sturgeon averaged 287.0 mm FL and weighed an average of 87.9 g. The largest pallid by length measured 380 mm FL at time of captured on July 16, 2007 and was from the 2005-year class stocked in 2006. Similarly, the largest pallid by weight (262.0 g) was also from the 2005-year class. The one fish from the 2001-year class had a length of 362 mm FL and weighed 161 g. Average growth rates for the 2005 and 2006-year class pallids were estimated at 0.117 mm/day and 0.403 mm/day, respectively (Table 6).

The size distribution pallid sturgeon for 2007 was similar to that of 2006, with no pallid sturgeon being larger than 400 mm FL. The incremental stock density for pallid sturgeon captured during 2007 further illustrates that no adult pallid sturgeon were captured in segment 2 (Table 7). During both seasons the largest pallids sampled fell within the stock length category.

The frequency of pallid sturgeon captures was not equally distributed throughout segment 2 during 2007. More pallid sturgeon were captured in the downstream portions of segment 2 than in the upstream areas (Figure 1b). The furthest upstream location a pallid

sturgeon was sampled at was river mile 1732 and five river bends (river miles 1759, 1753, 1744, 1740 and 1736.5) were sampled upstream of that location during both sturgeon and fish community seasons and no pallid sturgeon were found.

By abundance, pallid sturgeon were sampled in macro habitats as follows; channel crossover (N = 7), secondary channel connected large (N = 7), inside bend (N = 6) and outside bend (N = 2). Bottom velocity averaged 0.61 m/s for all pallid captures and all random velocity samples using active gears. However, turbidity averaged 643 NTU's for pallid captures and 587 NTU's for all turbidity samples taken using active gears. Similarly, river temperature averaged 15.4 C^o for pallid captures and 14.4 C^o for all samples taken using active gears.

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 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	12	8.33	N-E	30	N-E	N-E	N-E	32	27	11	0	0	N-E	N-E	0	N-E
Gill Net																
Otter Trawl	12	9.75	N-E	32	N-E	N-E	N-E	31	30	23	1	0	N-E	N-E	0	N-E
Summer – Fish Community Season																
1 Inch Trammel Net	12	8.17	N-E	32	N-E	N-E	N-E	31	29	6	0	0	N-E	N-E	0	N-E
Mini-Fyke Net	12	7.83	N-E	29	N-E	N-E	N-E	25	6	14	16	2	N-E	N-E	2	N-E
Otter Trawl	12	9.50	N-E	37	N-E	N-E	N-E	30	30	15	2	0	N-E	N-E	0	N-E

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segment 02 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	**Mesohabitat**					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	12	8.33	0	98	N-E	2	N-E	N-E
Gill Net								
Otter Trawl	12	9.75	0	109	N-E	8	N-E	N-E
Summer – Fish Community Season								
1 Inch Trammel Net	12	8.17	0	98	N-E	0	N-E	N-E
Mini-Fyke Net	12	7.83	94	0	N-E	0	N-E	N-E
Otter Trawl	12	9.50	0	110	N-E	4	N-E	N-E

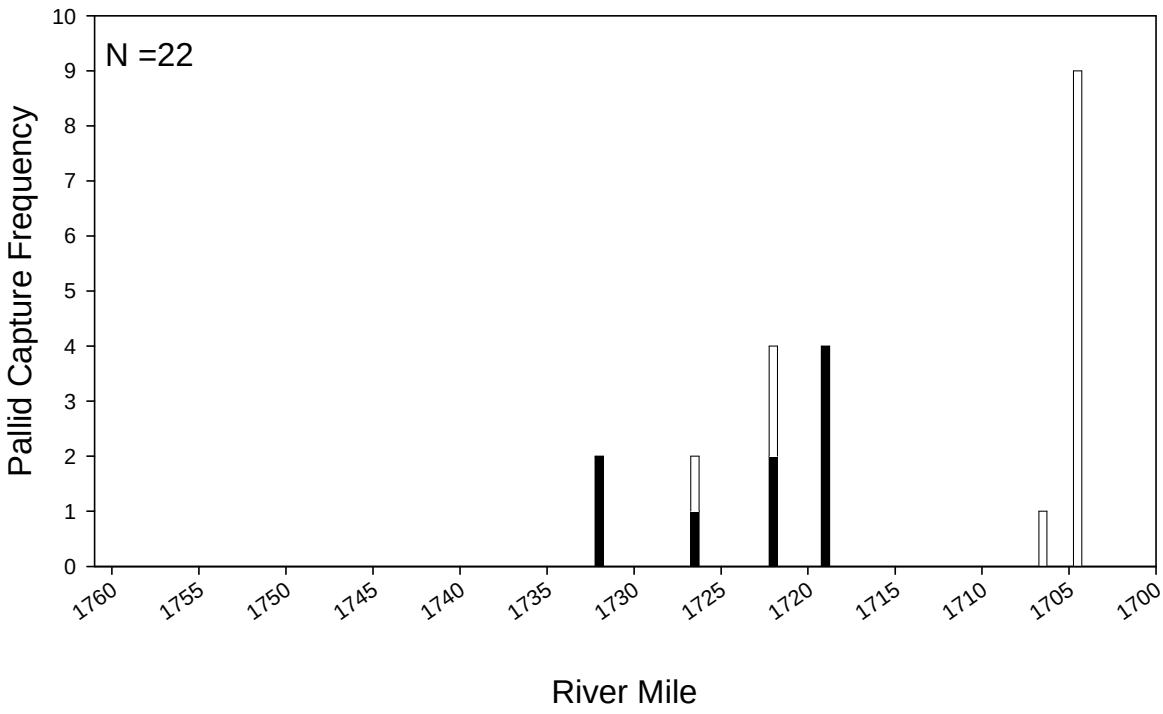

Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 2 of the Missouri River during 2007. Black bars represent pallid captures during sturgeon season and white bars during fish community season. Figure includeds all pallid captures including non-random and wild samples.

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

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. ℃ (Effort)	Temp. ℃ (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
CHXO	BAR	0.5		0.2		14.4		40		.
		(0.2-1.0)		(0.00-0.78)		(8.0-20.0)		(5-380)		
	CHNB	1.7	1.8	0.65	0.72	14.3	16.6	514	203	7
		(0.5-4.5)	(1.1-4.0)	(0.15-0.97)	(0.51-0.81)	(8.0-19.9)	(14.2-18.9)	(3-5500)	(16-750)	
ISB	BAR	0.6	0.8	0.2	0.24	13.5	9.9	17	10	1
		(0.1-1.3)	(0.8-0.8)	(0.00-0.62)	(0.24-0.24)	(8.0-20.2)	(9.9-9.9)	(5-34)	(10-10)	
	CHNB	1.6	1.4	0.62	0.51	14.5	15.4	624	1143	5
		(0.6-3.3)	(0.6-2.1)	(0.13-1.10)	(0.30-0.67)	(8.8-20.2)	(10.3-18.0)	(3-6500)	(11-3600)	
OSB	BAR	0.4		0.15		16.1		18		.
		(0.2-0.5)		(0.10-0.25)		(11.2-19.0)		(11-36)		
	CHNB	2	1.3	0.63	0.81	14.6	17.6	525	128	2
		(0.5-4.0)	(1.2-1.4)	(0.25-1.07)	(0.80-0.81)	(8.1-20.5)	(16.1-19.0)	(4-4750)	(15-240)	
SCCL	BAR	0.6	1.1	0.28	0.74	13.7	9.5	13	10	3
		(0.3-1.2)	(1.0-1.2)	(0.00-0.80)	(0.67-0.80)	(9.0-20.0)	(9.5-9.5)	(6-24)	(10-10)	
	CHNB	1.5	1.8	0.57	0.48	15.2	18	1170	2508	2
		(0.6-4.0)	(1.5-2.2)	(0.32-1.01)	(0.47-0.48)	(9.5-21.2)	(16.5-19.5)	(8-5000)	(15-5000)	
	ITIP	1.4	1.4	0.71	0.51	17.4	17.9	1739	240	2
		(0.7-2.3)	(1.4-1.5)	(0.51-0.86)	(0.51-0.51)	(15.3-18.7)	(17.8-18.0)	(16-3600)	(240-240)	
SCCS	BAR	0.4		0.07		15.6		16		.
		(0.3-0.7)		(0.00-0.19)		(11.0-19.0)		(8-31)		
	CHNB	0.5				11.2				.
		(0.5-0.5)				(11.2-11.2)				
	ITIP	0.9		0.41		15.3		10		.
		(0.6-1.1)		(0.41-0.41)		(15.2-15.3)		(10-10)		

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
SCCN	BAR	0.5		0		15.7		260		.
		(0.4-0.5)		(0.00-0.00)		(15.2-16.1)		(260-260)		
TRMS	BAR	0.3		0		20.6		45		.
		(0.3-0.3)		(0.00-0.00)		(20.1-21.0)		(45-45)		

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 2007 from segment 02 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001	1	.	.	.	362	161.0	0.989	.	.
		.	.	.	.	.	.	.	.
2002									
2003									
2004									
2005	8	261	52.0	1.402	305	114.0	1.346	0.117	0.094
		30	.	.	32	44.4	0.609	0.031	.
2006	11	260	68.3	1.150	265	63.0	0.988	0.403	0.177
		36	30.4	0.075	39	24.5	0.099	0.051	0.032

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 2007 in the Missouri River. Length categories[b] determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)	2	.	1.297 (0.027)
Sub-stock (200-329)	5	.	1.429 (0.912)
Stock	2	100	1.436 (1.062)
Quality	0	.	0
Preferred	0	.	0
Memorable	0	.	0
Trophy			
Overall Kn	.	.	1.401 (0.514)
Fish Community Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	9	.	0.951 (0.060)
Stock	4	100	0.849 (0.148)
Quality	0	.	0
Preferred	0	.	0
Memorable	0	.	0
Trophy			
Overall Kn	.	.	0.919 (0.064)

[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 %).

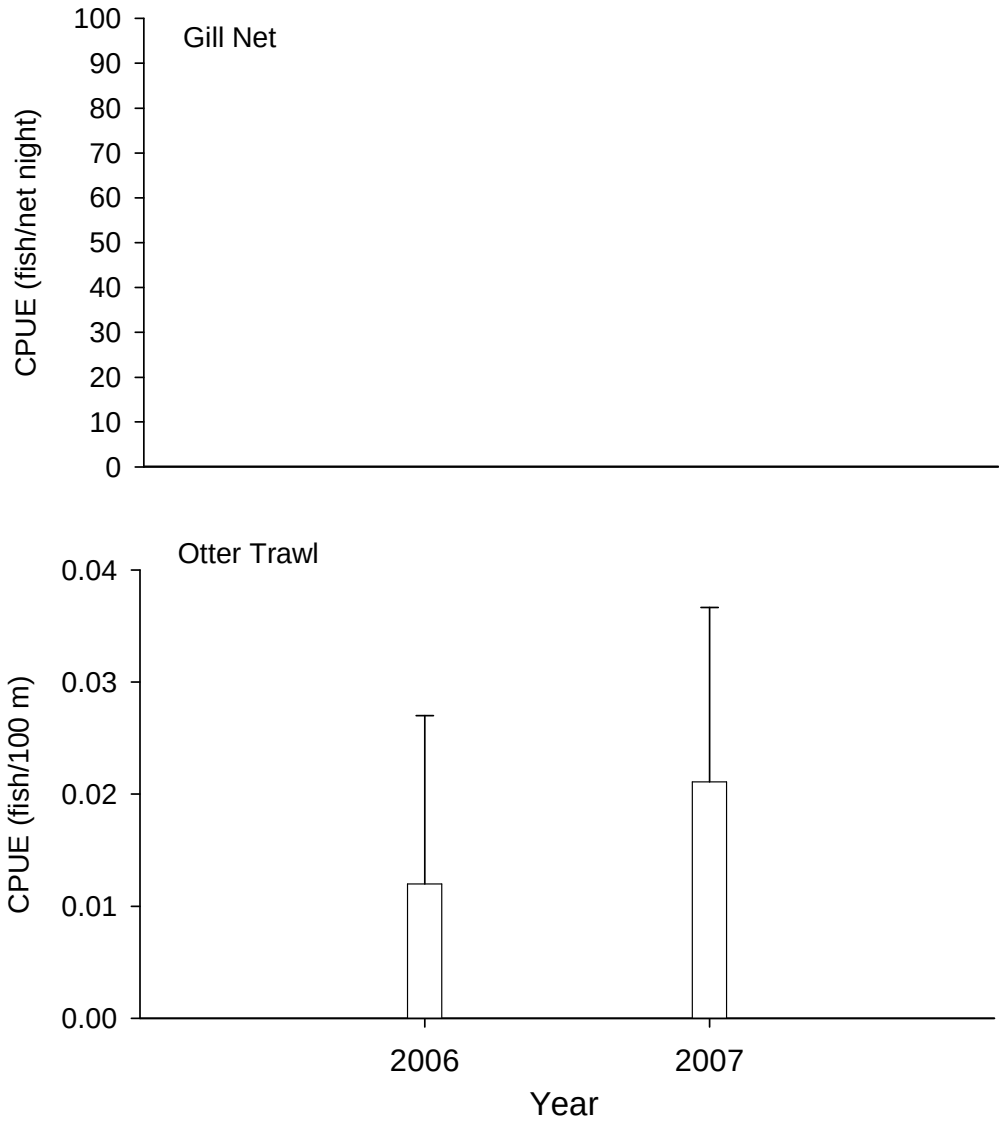

Figure 2. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting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

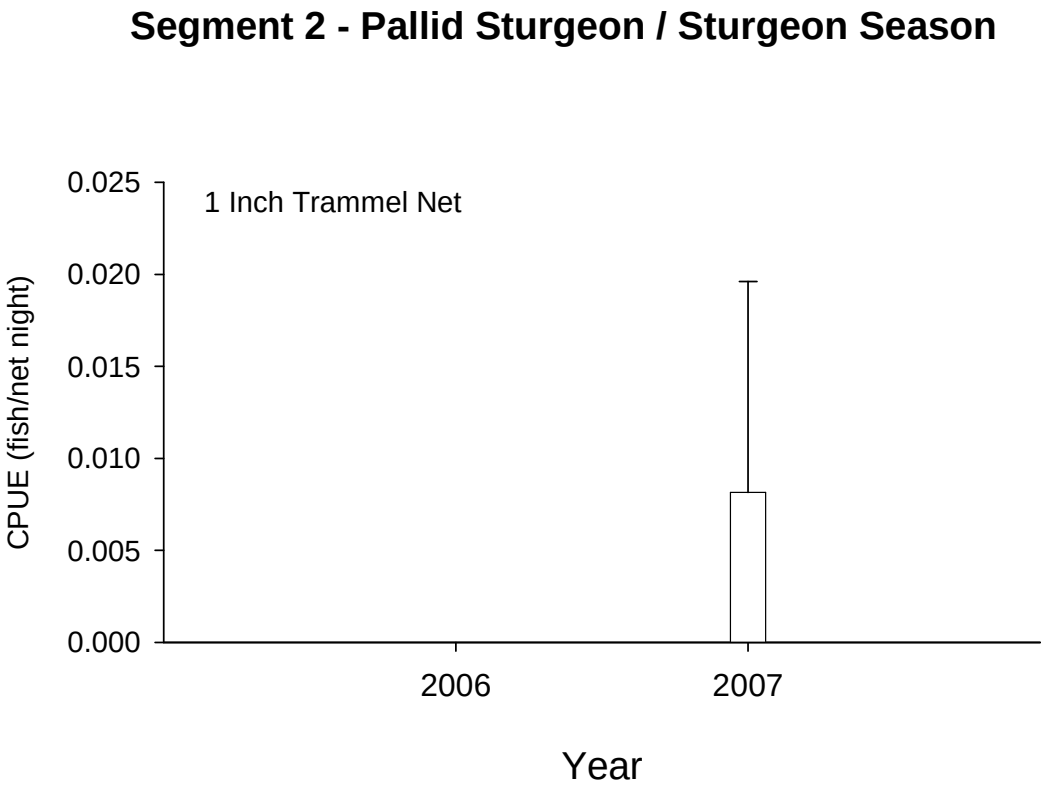

Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting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

Segment 2 - Pallid Sturgeon / Fish Community Season

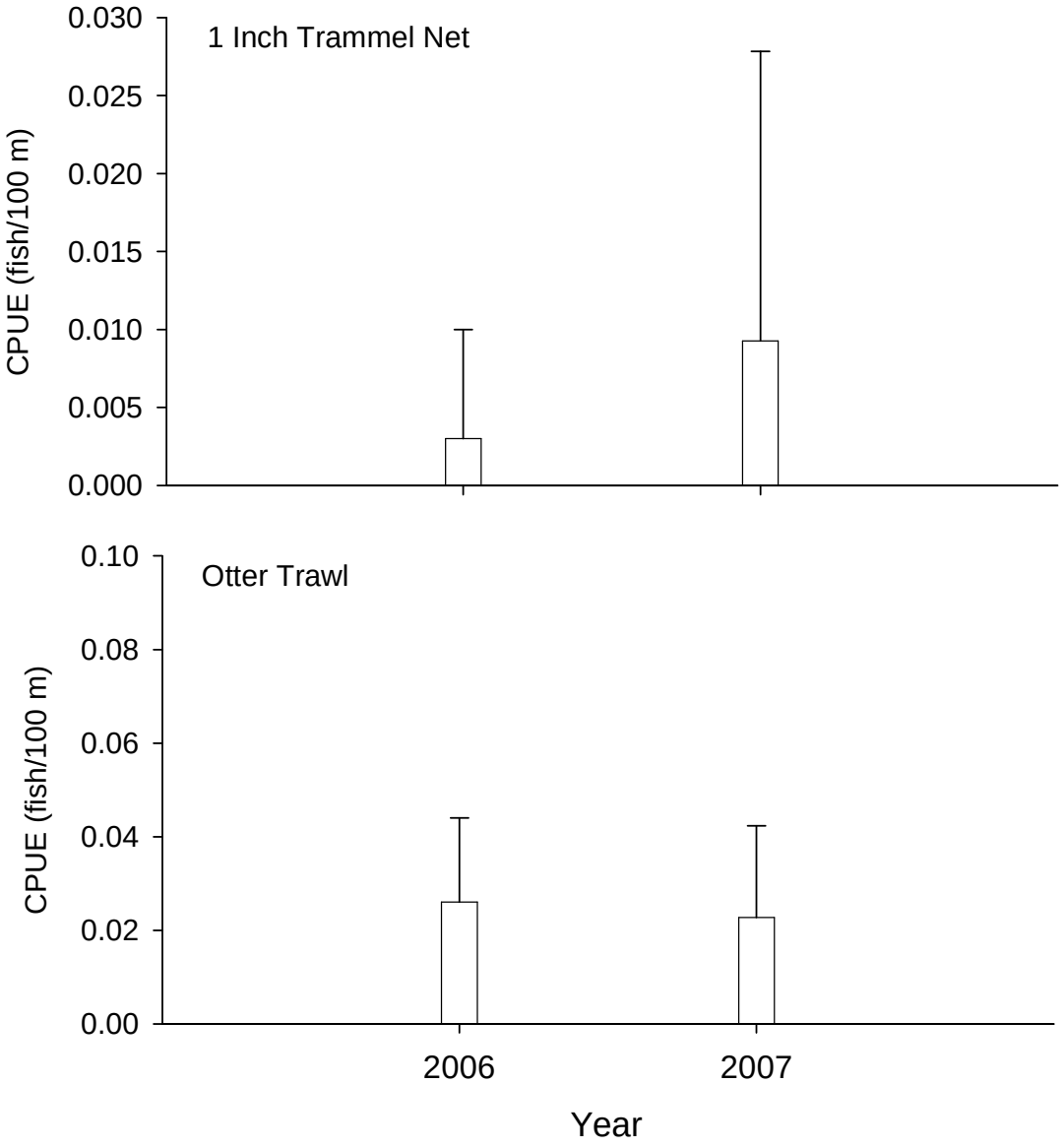

Figure 5. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 2 of the Missouri River during fish community season 2006-2007. Unknown origin pallid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

Segment 2 - Pallid Sturgeon / Fish Community Season

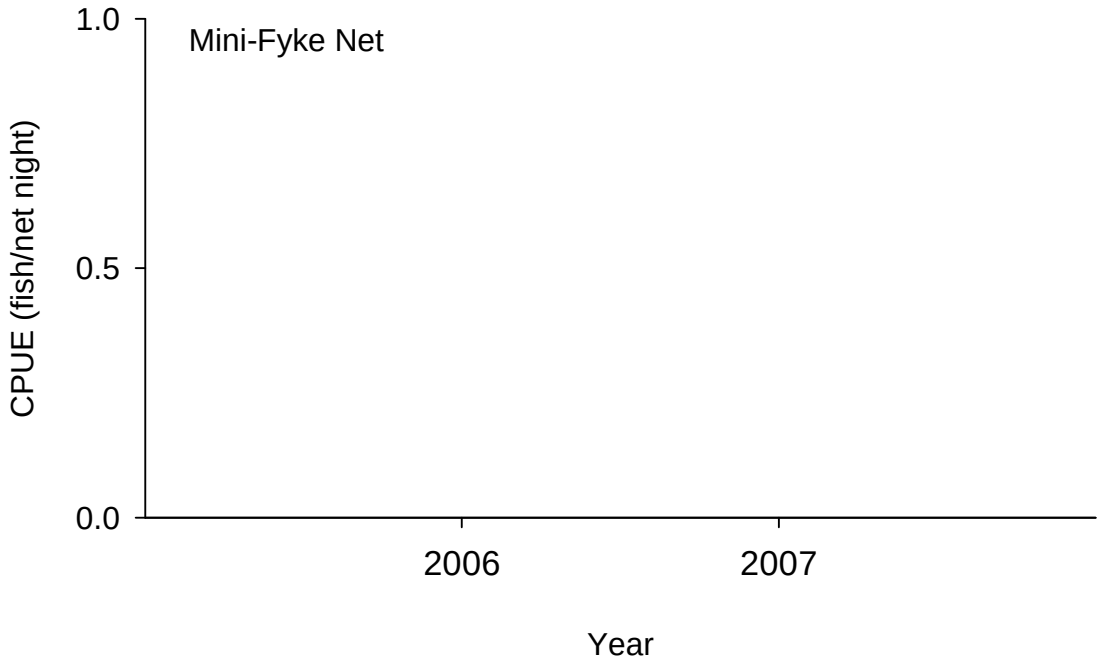

Figure 7. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007. Unknown origin pallid sturgeon are awaiting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

Table 9. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	34	0	N-E	N-E	31	27	8	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	2	0	50	0	N-E	N-E	0	0	50	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	33	0	N-E	N-E	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	27	25	11	1	0	0	0	0	0

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	N-E	N-E
		0	98	N-E	2	N-E	N-E
Gill Net				N-E		N-E	N-E
				N-E		N-E	N-E
Otter Trawl	2	0	100	N-E	0	N-E	N-E
		0	94	N-E	6	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	N-E	N-E
	.	0	100	N-E	0	N-E	N-E
Mini-Fyke Net	0	0	0	N-E	0	N-E	N-E
	.	100	0	N-E	0	N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	.	0	98	N-E	2	N-E	N-E

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

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	1	N-E	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
		N-E	34	0	N-E	N-E	31	27	8	0	0	0	0	0	0
Gill Net		N-E			N-E	N-E									
		N-E			N-E	N-E									
Otter Trawl	4	N-E	0	0	N-E	N-E	50	25	25	0	0	0	0	0	0
		N-E	28	0	N-E	N-E	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	N-E	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	33	0	N-E	N-E	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	N-E	31	0	N-E	N-E	27	6	15	17	2	0	0	2	0
Otter Trawl	6	N-E	100	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	N-E	36	0	N-E	N-E	27	25	11	1	0	0	0	0	0

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2006-2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1	0	100	N-E	0	N-E	N-E
		0	98	N-E	2	N-E	N-E
Gill Net				N-E			
				N-E			
Otter Trawl	4	0	75	N-E	25	N-E	N-E
		0	94	N-E	6	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	N-E	N-E
		0	100	N-E	0	N-E	N-E
Mini-Fyke Net	0	0	0	N-E	0	N-E	N-E
		100	0	N-E	0	N-E	N-E
Otter Trawl	6	0	100	N-E	0	N-E	N-E
		0	98	N-E	2	N-E	N-E

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

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	34	0	N-E	N-E	31	27	8	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	1	0	0	0	N-E	N-E	0	0	100	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	1	0	0	0	N-E	N-E	0	100	0	0	0	0	0	0	0
	.	0	33	0	N-E	N-E	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	31	0	N-E	N-E	27	6	15	17	2	0	0	2	0
Otter Trawl	1	0	0	0	N-E	N-E	0	0	100	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	27	25	11	1	0	0	0	0	0

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1	0	100	N-E	0	N-E	N-E
	.	0	98	N-E	2	N-E	N-E
Gill Net				N-E		N-E	N-E
				N-E		N-E	N-E
Otter Trawl	1	0	0	N-E	100	N-E	N-E
	.	0	94	N-E	6	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	1	0	100	N-E	0	N-E	N-E
	.	0	100	N-E	0	N-E	N-E
Mini-Fyke Net	0	0	0	N-E	0	N-E	N-E
	.	100	0	N-E	0	N-E	N-E
Otter Trawl	1	0	100	N-E	0	N-E	N-E
	.	0	98	N-E	2	N-E	N-E

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

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	34	0	N-E	N-E	31	27	8	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	28	0	N-E	N-E	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	33	0	N-E	N-E	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	31	0	N-E	N-E	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
		0	36	0	N-E	N-E	27	25	11	1	0	0	0	0	0

Table 16. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	0	N-E	N-E
		0	98	N-E	2	N-E	N-E
Gill Net				N-E		N-E	N-E
				N-E		N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
		0	94	N-E	6	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	0	N-E	N-E
		0	100	N-E	0	N-E	N-E
Mini-Fyke Net	0	0	0	N-E	0	N-E	N-E
		100	0	N-E	0	N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
		0	98	N-E	2	N-E	N-E

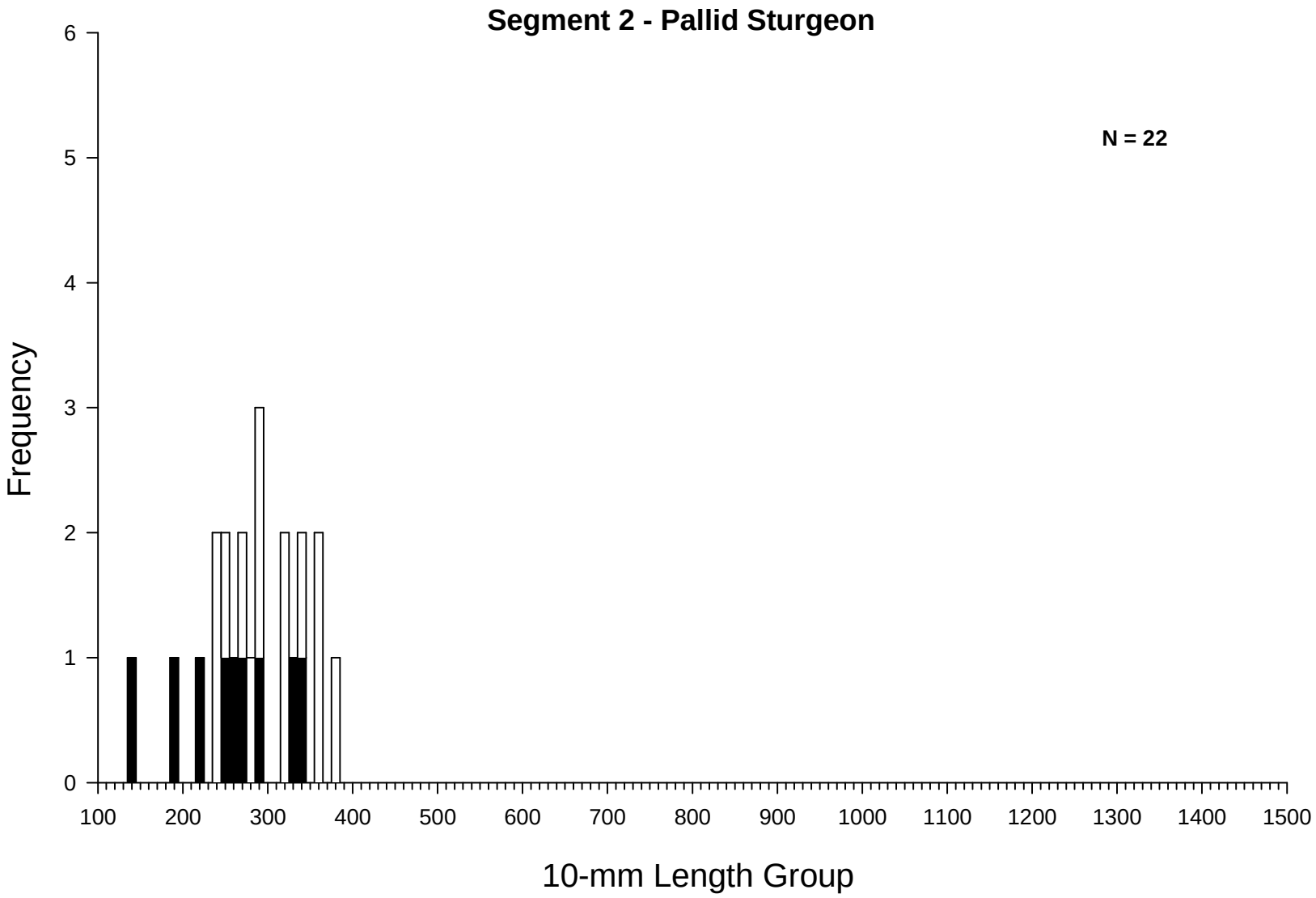

Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 including non-random and wild samples.

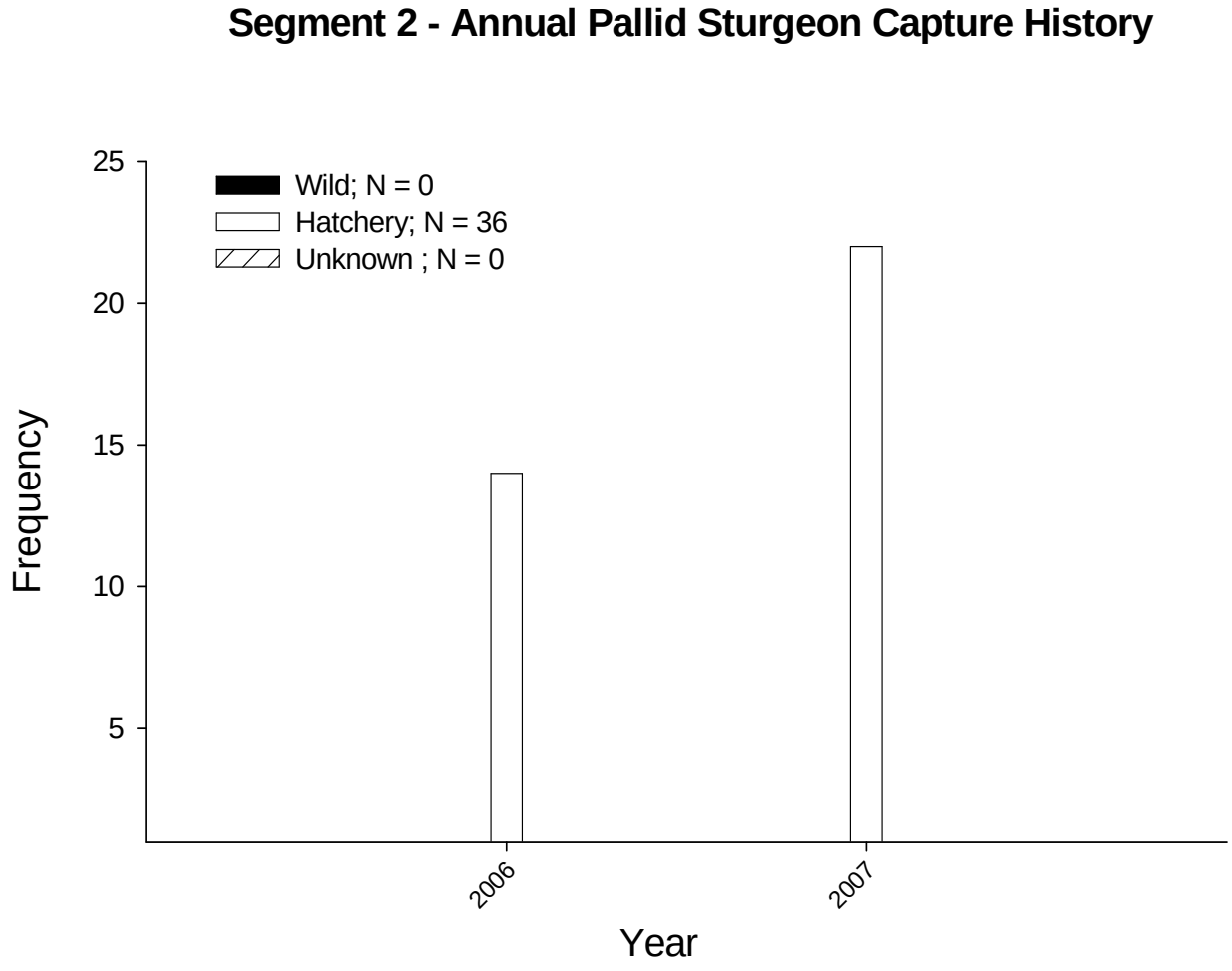

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 2 of the Missouri River from 2006 to 2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

Based on phenotype, no shovelnose x pallid sturgeon hybrids were collected during 2007 or 2006 in segment 2 of the Missouri River. No sturgeon sampled resembled a hybrid and therefore no genetic samples were sent in to verify the genetic makeup of any presumed hybrid.

Targeted Native River Species

Shovelnose Sturgeon

A total of 436 shovelnose sturgeon were sampled using standard and experimental gears in segment 2 during 2007, which was very similar to the 2006 catch of 427. Of the total shovelnose sampled, 275, 160, and 1 were sampled in trammel nets, otter trawls, and push trawls. Shovelnose CPUE for both trammel nets and otter trawls were similar for both years during both seasons (Figures 11, 12 and 14). However, CPUE was slightly higher for both gears during the sturgeon season when compared to the fish community season. No shovelnose sturgeon were sampled in mini fyke nets during either 2007 or 2006.

The vast majority of shovelnose sturgeon sampled were greater than 380 mm FL, with a small proportion being in the 250-379 mm stock size class, although no shovelnose sturgeon smaller than 332 mm FL (Figures 11, 12, 14 and 17). Incremental stock densities of shovelnose sturgeon indicate that the population is heavily made up of preferred and larger size fish (Table 25). Based on shovelnose sturgeon in segment 2 by Steffensen and Hamel (2008), no shovelnose sampled were younger than age-3, with the majority of fish being over age-8. Unlike pallid sturgeon, no distinct trend in the distribution of shovelnose sturgeon catch was seen in segment 2. While the furthest upstream capture of a pallid sturgeon was at rivermile 1732, 180 shovelnose sturgeon were captured upstream of this rivermile.

Shovelnose sturgeon were sampled in the channel crossovers (N = 158) more often than inside bends (N = 150), outside bends (N = 86), and large secondary connected side channels (N = 42). The vast majority of shovelnose (97.2%) were sampled in channel border mesohabitats, while the remaining 2.8% were sampled in island tip mesohabitats. Shovelnose sturgeon were captured at an average depth of 1.7 m.

Segment 2 - Shovelnose Sturgeon / Sturgeon Season

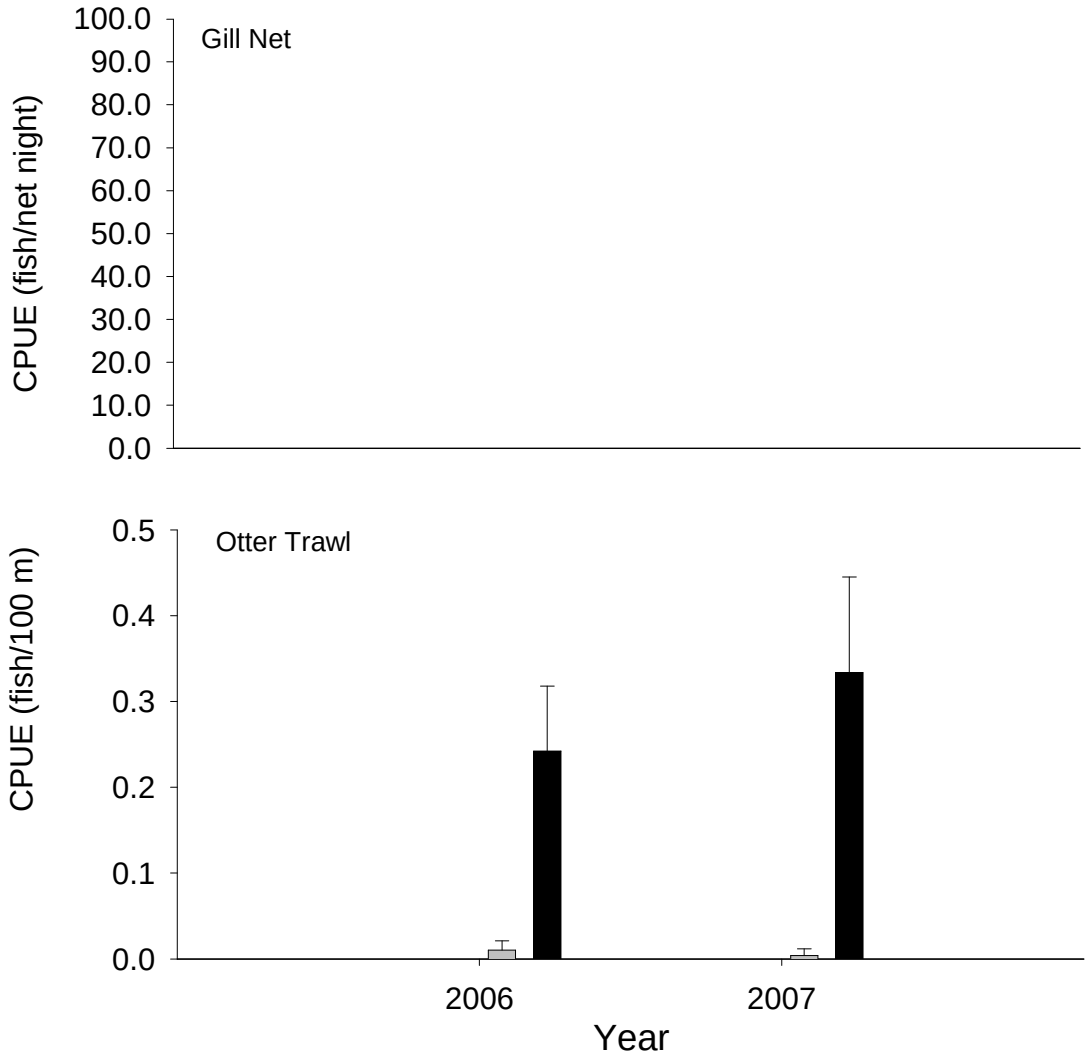

Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 2 of the Missouri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

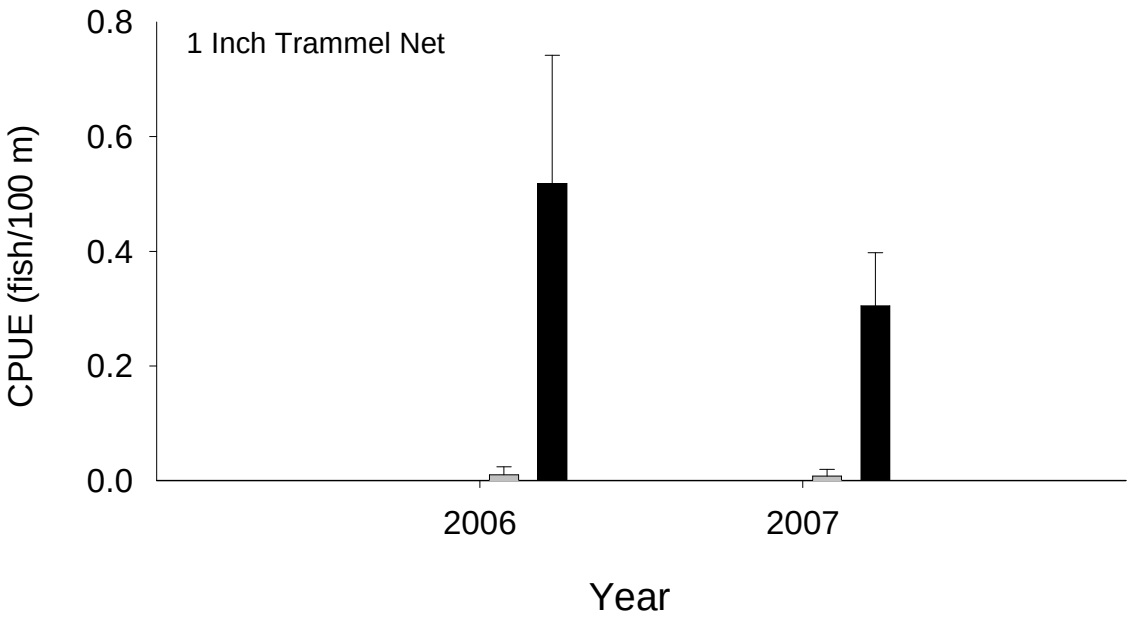

Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 2 of the Missouri River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

Segment 2 - Shovelnose Sturgeon / Fish Community Season

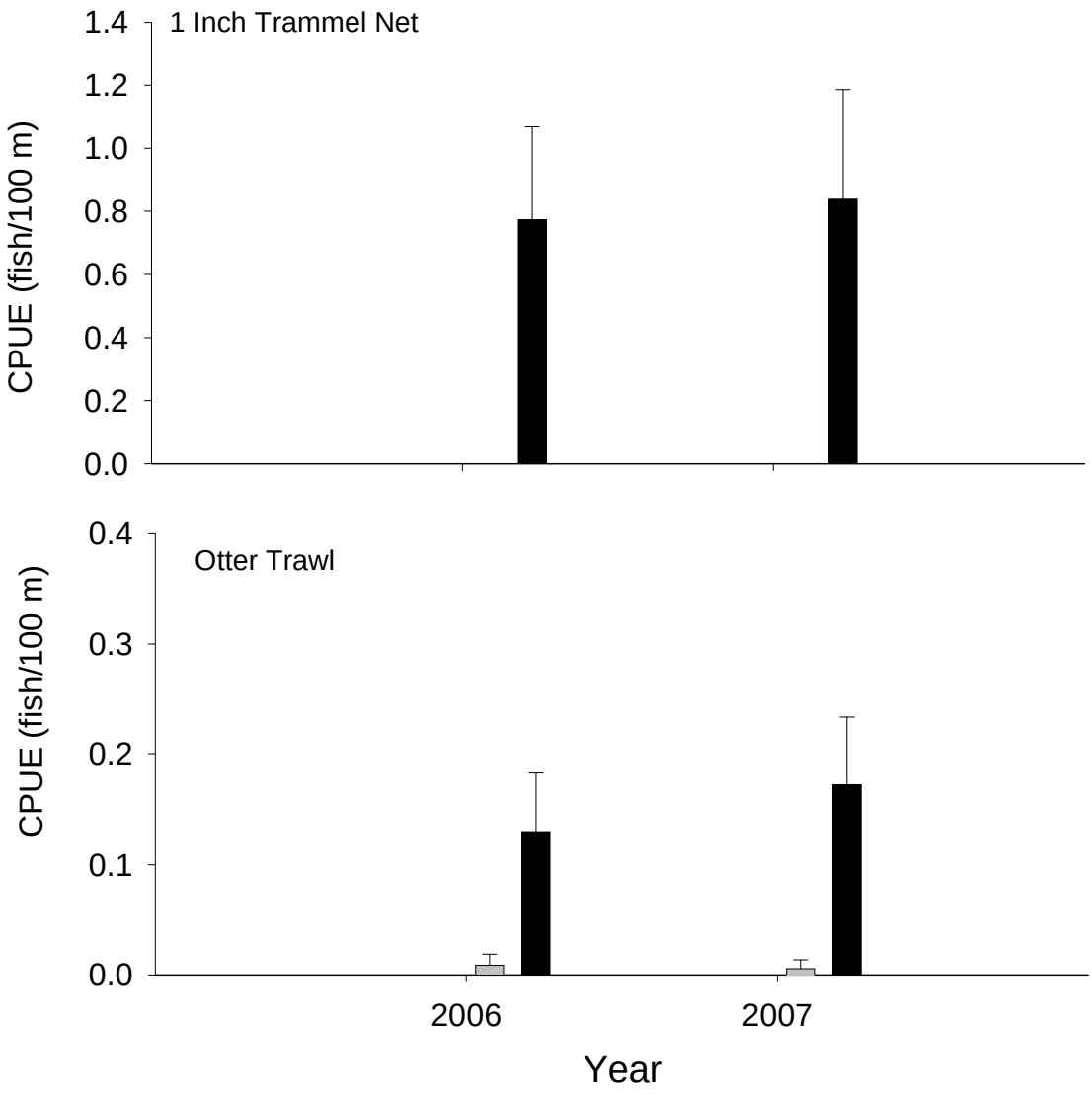

Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 2 of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

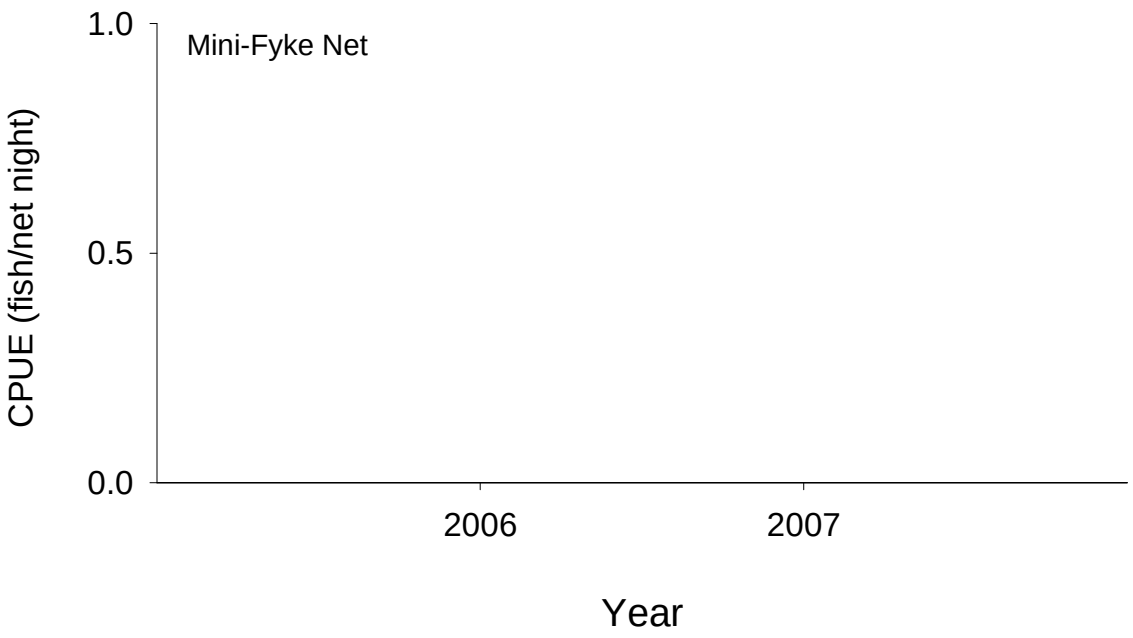

Figure 15. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using mini-fyke nets in segment 2 of the Missouri River during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

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

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	0	0	0	0
		0	98	0	2	0	0
Gill Net							
Otter Trawl	0	0	0	0	0	0	0
		0	94	0	6	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	0	0	0	0
		0	100	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0
		100	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0
		0	98	0	2	0	0

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0 0	0 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	0 .	0 0	0 94	0 0	0 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	0 .	0 0	0 98	0 0	0 2	0 0	0 0

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	2	0	50	0	0	0	50	0	0	0	0	0	0	0	0
		0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	1	0	0	0	0	0	0	100	0	0	0	0	0	0	0
		0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	2	0	50	0	0	0	0	50	0	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	2	0 0	100 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	1	0 0	100 94	0 0	0 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	2 .	0 0	100 98	0 0	0 2	0 0	0 0

Table 23. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	78	0	35	0	0	0	36	26	4	0	0	0	0	0	0
		0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	101.	0	41	0	0	0	21	27	12	0	0	0	0	0	0
		0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	196.	0	32	0	0	0	44	13	11	0	0	0	0	0	0
		0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	56.	0	48	0	0	0	21	20	11	0	0	0	0	0	0
		0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 24. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 02 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	78	0	100	0	0	0	0
	.	0	98	0	2	0	0
Gill Net							
Otter Trawl	101	0	88	0	12	0	0
	.	0	94	0	6	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	196	0	100	0	0	0	0
	.	0	100	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0
	.	100	0	0	0	0	0
Otter Trawl	56	0	100	0	0	0	0
	.	0	98	0	2	0	0

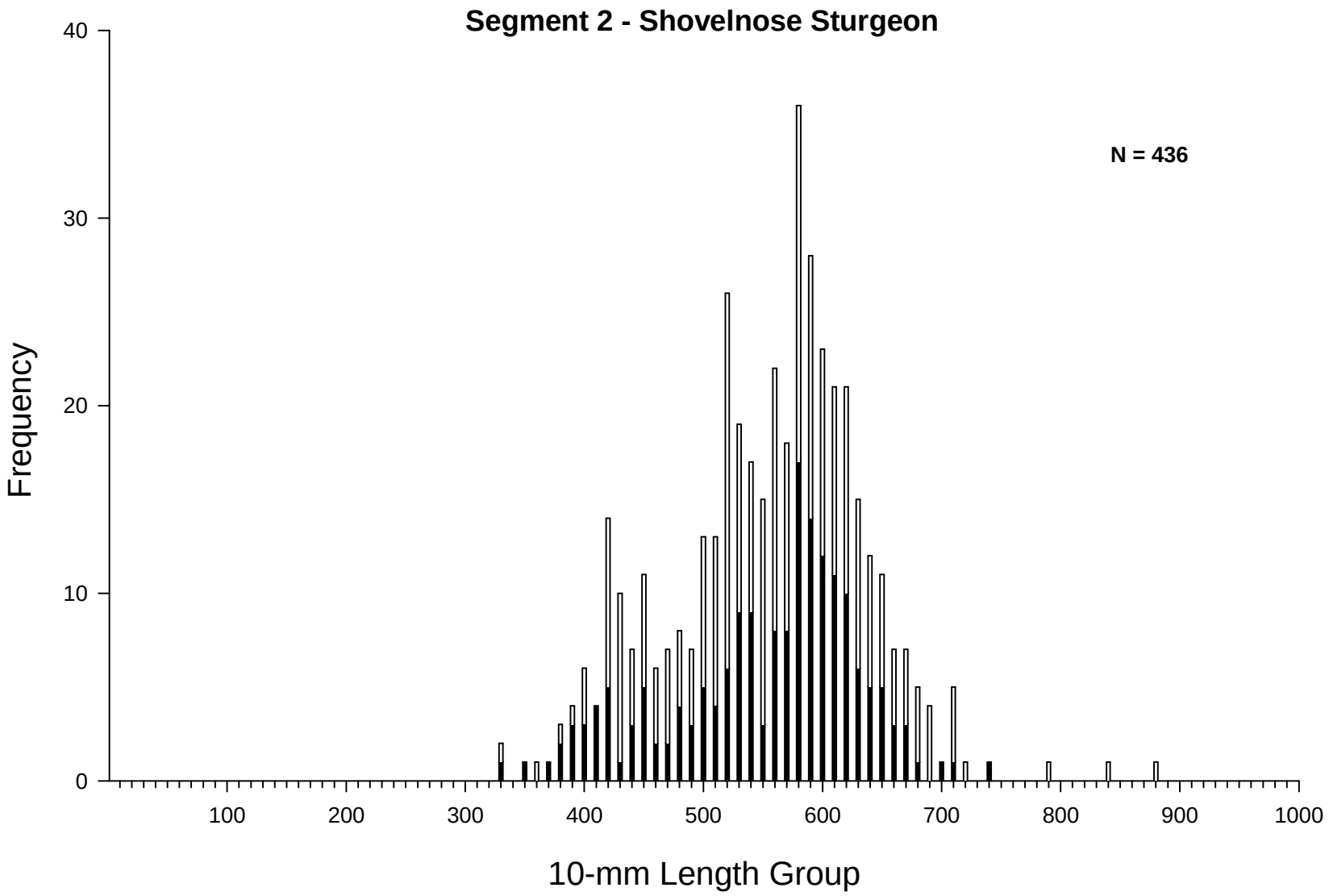

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

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 2007. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	0	.	0
Sub-stock (150-249 mm)	0	.	0
Stock	3	2	94.93 (17.73)
Quality	42	23	101.1 (9.919)
Preferred	117	64	91.32 (5.401)
Memorable	20	11	83.94 (12.28)
Trophy	0	.	0
Overall Wr	.	.	92.85 (4.421)
Fish Community Season			
Sub-stock (0-149 mm)	0	.	0
Sub-stock (150-249 mm)	0	.	0
Stock	2	1	85.49 (0.423)
Quality	57	23	86.32 (2.693)
Preferred	157	62	81.77 (1.584)
Memorable	35	14	80.80 (3.760)
Trophy	2	1	69.05 (60.12)
Overall Wr	.	.	82.59 (1.339)

[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 150 sturgeon chubs were collected during 2007, 141 in the otter trawl and 9 in the experimental push trawl. During 2006, 114 sturgeon chubs were collected, 87 in the otter trawl, 24 in the beam trawl and 2 in the bag seine. In all, more sturgeon chubs (N = 125) were collected during the sturgeon season than the fish community season (N = 25). Sturgeon chub CPUE for the otter trawl was higher in 2007 than in 2006 for the sturgeon season, but lower during the fish community season (Figures 18 and 19). The highest CPUE for any season and both years occurred in 2007 during the sturgeon season with a CPUE of 0.38 fish/ 100m. No sturgeon chubs were collected in mini fyke nets during either year of sampling.

During the sturgeon season, sturgeon chubs were collected at a higher rate in outside bends (34%) than other macrohabitats and at a relatively equal rate in channel crossovers (24%), large connected secondary channels (22%), and inside bends (20%) (Table 26). Similarly, during the fish community season sturgeon chubs were collected at a higher rate in the outside bend (38%), compared to inside bends (31%), channel crossovers (19%), and large connected secondary channels (13%) (Table 26).

The majority of sturgeon chubs collected in 2007 were between 60 and 80 mm TL, which was similar to 2006 (Figure 21). The smallest and largest sturgeon chubs collected during 2007 measured 40 and 95 mm TL, respectively. According to Herman et al. (2008a) the majority of sturgeon chubs collected were age-1 and age-2, with potentially a few of the larger specimens being age-3.

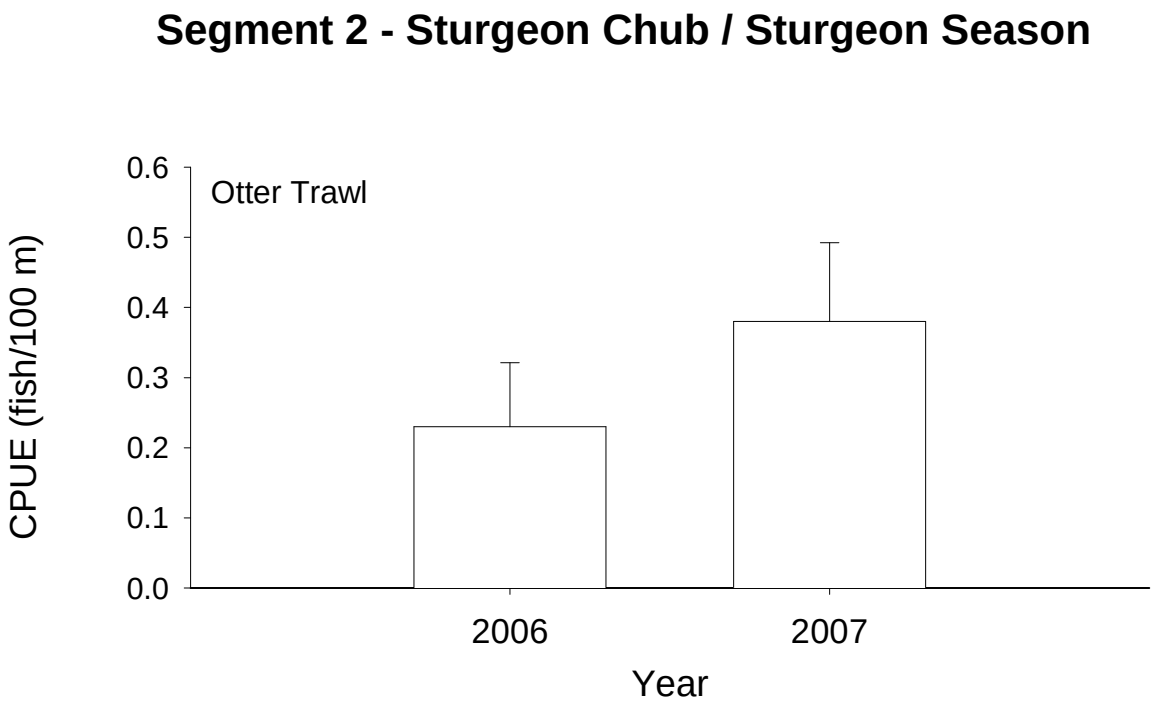

Figure 18. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007.

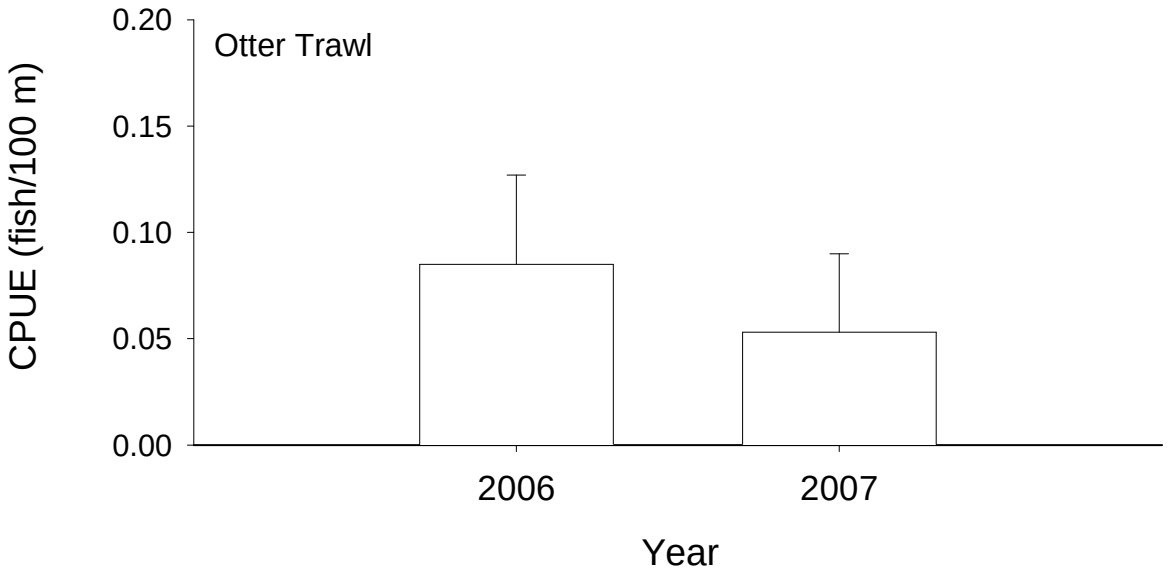

Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls in segment 2 of the Missouri River during fish community season 2006-2007.

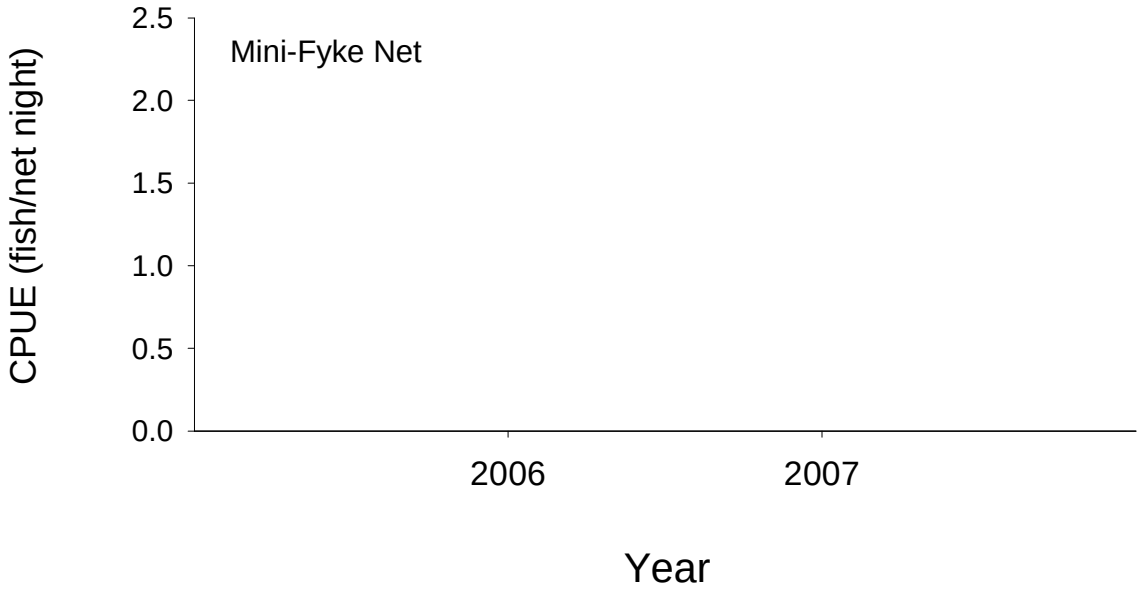

Figure 20. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	125	0	24	0	0	0	20	34	22	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	16	0	19	0	0	0	31	38	13	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	125 .	0 0	90 94	0 0	10 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	16 .	0 0	100 98	0 0	0 2	0 0	0 0

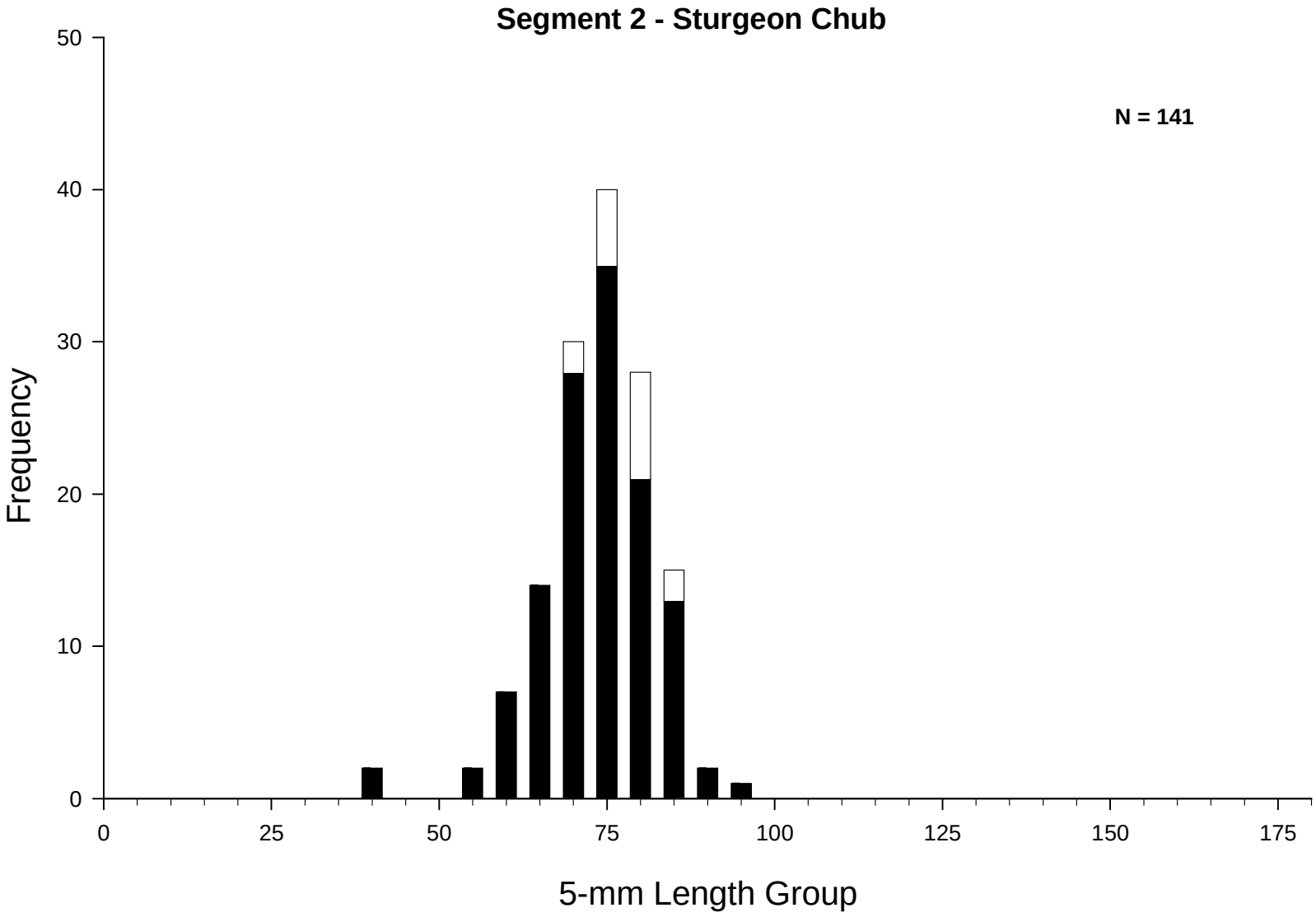

Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

Sicklefin Chub

A total of two sicklefin chubs were collected in segment 2 during 2007, one each in the sturgeon and fish community seasons. Both fish were collected in the otter trawl, which corresponded to an otter trawl CPUE of 0.003 and 0.001 fish/ 100 m for the sturgeon and fish community seasons, respectively (Figures 22 and 23). Little difference was seen in sicklefin chub abundance between 2007 and 2006. During 2006 one sicklefin chub was collected during the sturgeon season and zero were sampled during the fish community season.

The two sicklefin chubs collected in 2007 measured 90 and 96 mm TL, no weights were taken. The two collections occurred at river miles 1706.5 and 1719, both in the downstream portion of segment 2. Due to the size of these fish, they were most likely age-3 based on Herman et al. (2008b). The two sicklefin chubs were collected in an inside bend and a large connected secondary channel (Table 28).

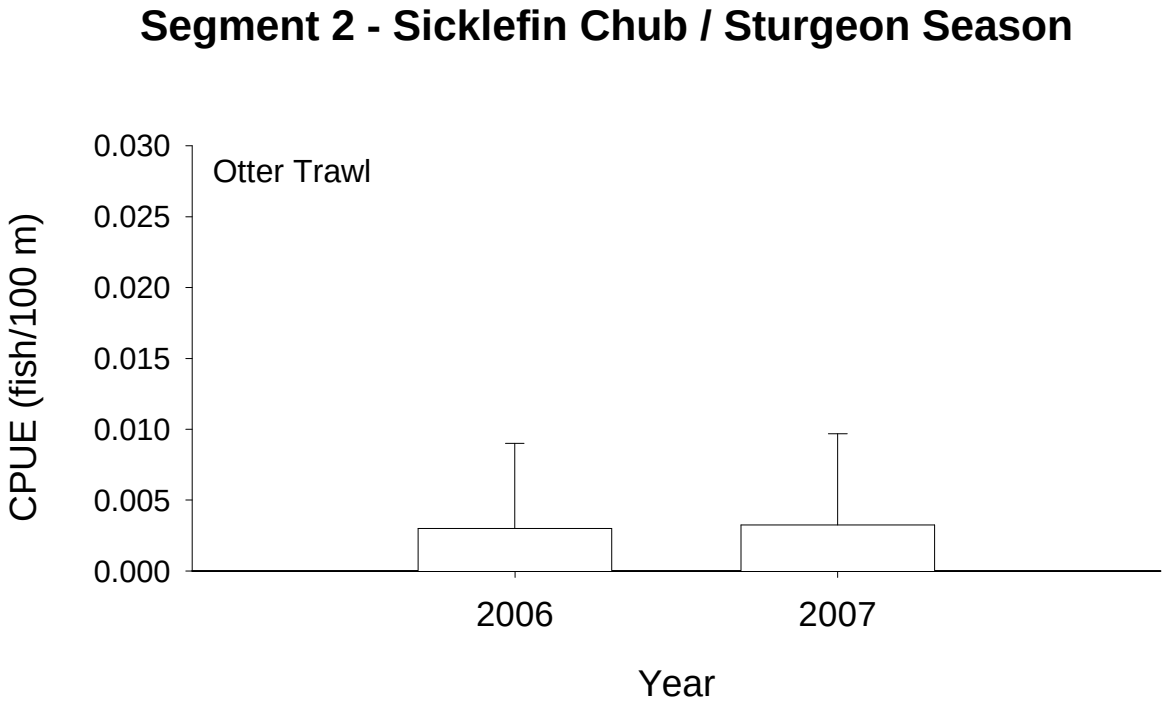

Figure 22. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007.

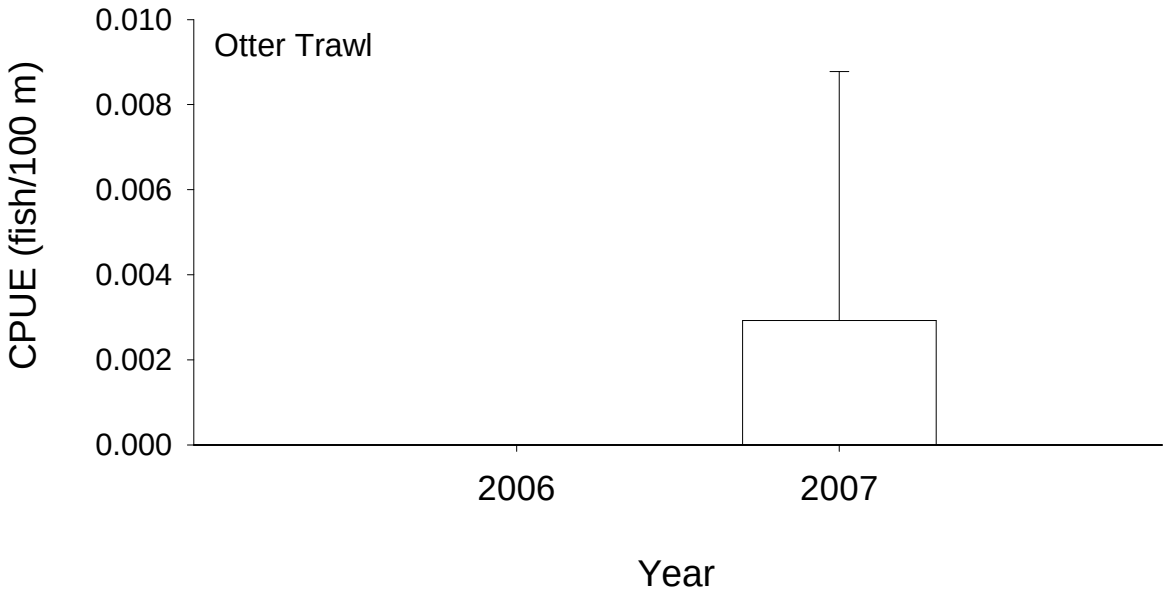

Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls in segment 2 of the Missouri River during fish community season 2006-2007.

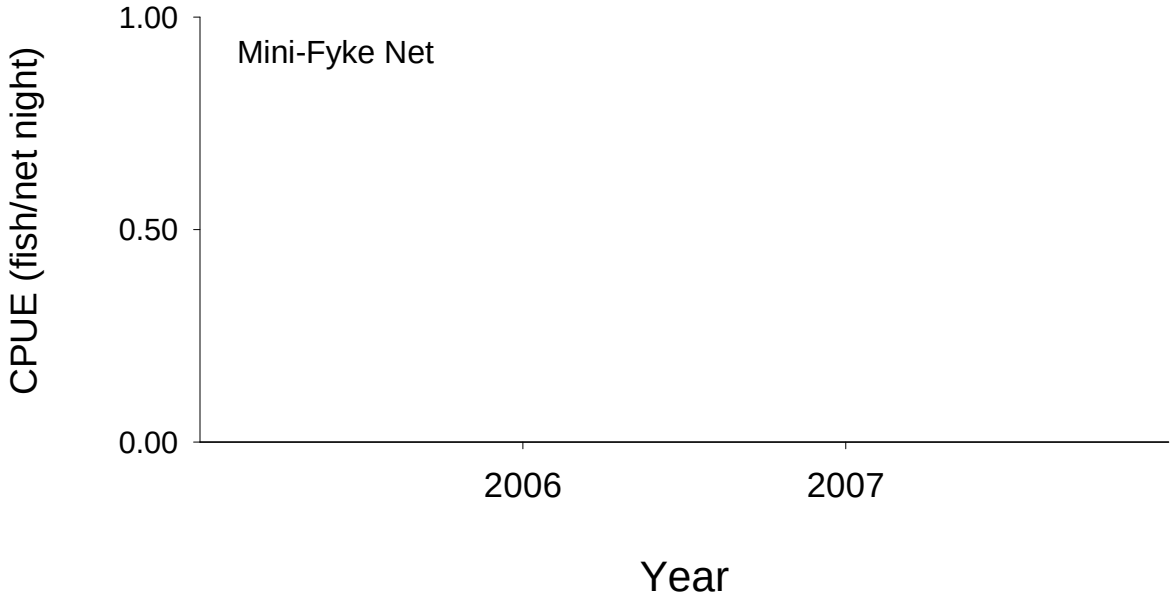

Figure 24. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	1	0	0	0	0	0	0	0	100	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	1 .	0 0	0 94	0 0	100 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	0 .	0 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	1 .	0 0	100 98	0 0	0 2	0 0	0 0

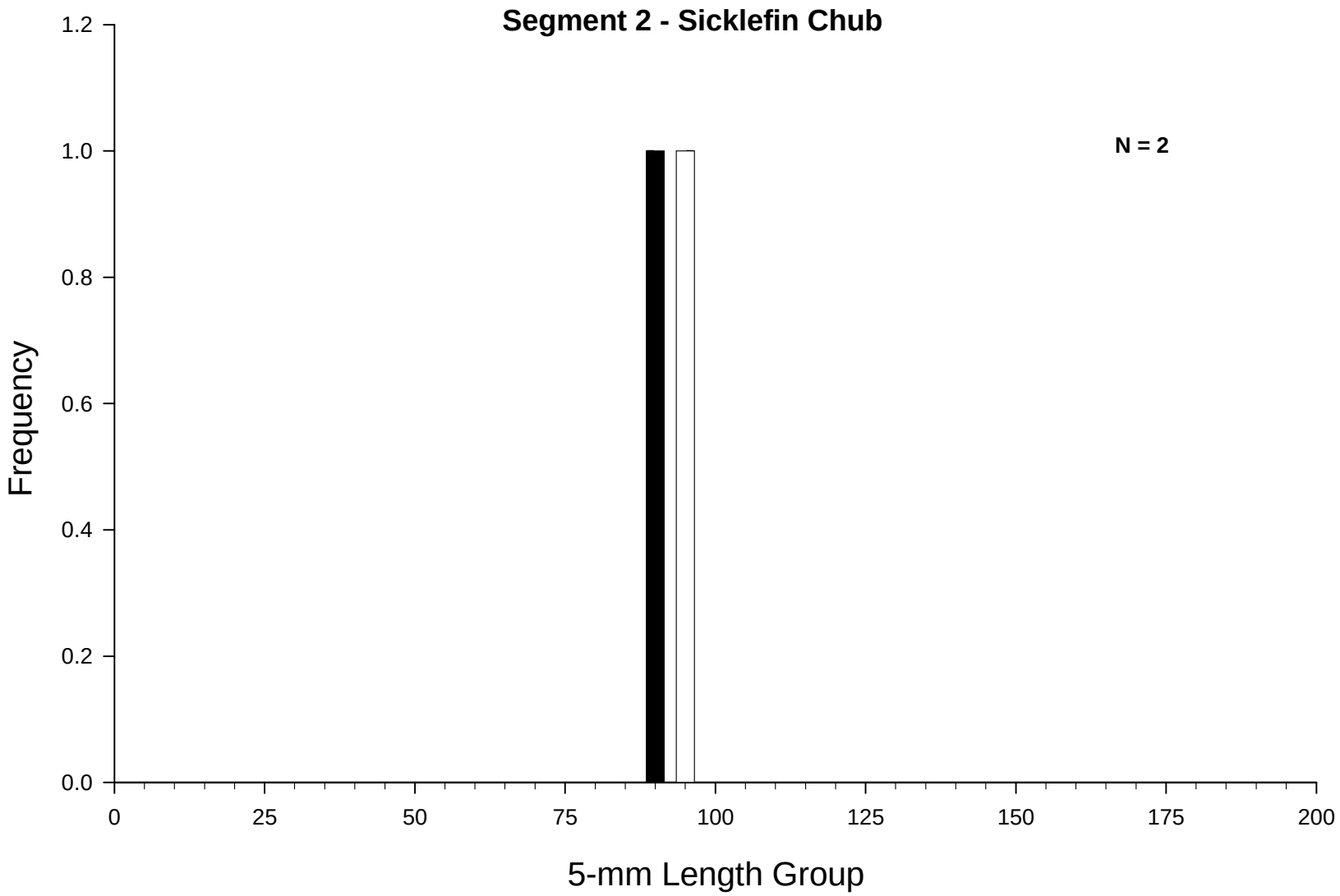

Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

Sand Shiner

A total of 807 sand shiners were sampled in segment 2 during 2007, of which 803 were sampled in standard mini fyke nets and 4 in the experimental push trawl. Mini fyke net CPUE was higher in 2007 (8.5 fish/ net night) than in 2006 (4.5 fish/ net night) (Figure 32). No spatial pattern was seen in the abundance of sand shiners throughout segment 2. However, 367 sand shiners were sampled at river mile 1719, which was over 3 times more than any other river bend sampled.

More sand shiners were collected in small connected secondary channels (52%) than inside bends (15%), small tributary mouths (14%), channel crossovers (13%), and outside bends (6%). The proportion of the total catch of sand shiners in both small connected secondary channels and small tributary mouths was much higher than the proportion they were sampled, given that side channels and tributary mouths made up only 17% and 2% of the total sampling effort, respectively.

Sand shiners were similar in size during both years sampled, averaging 41.9 and 41.5 mm TL for 2007 and 2006, respectively. The size distribution of sand shiners collected was also similar between years. During 2007, the majority of sand shiners collected were age-0 and age-1 fish, based on Datttilo et al. (2008).

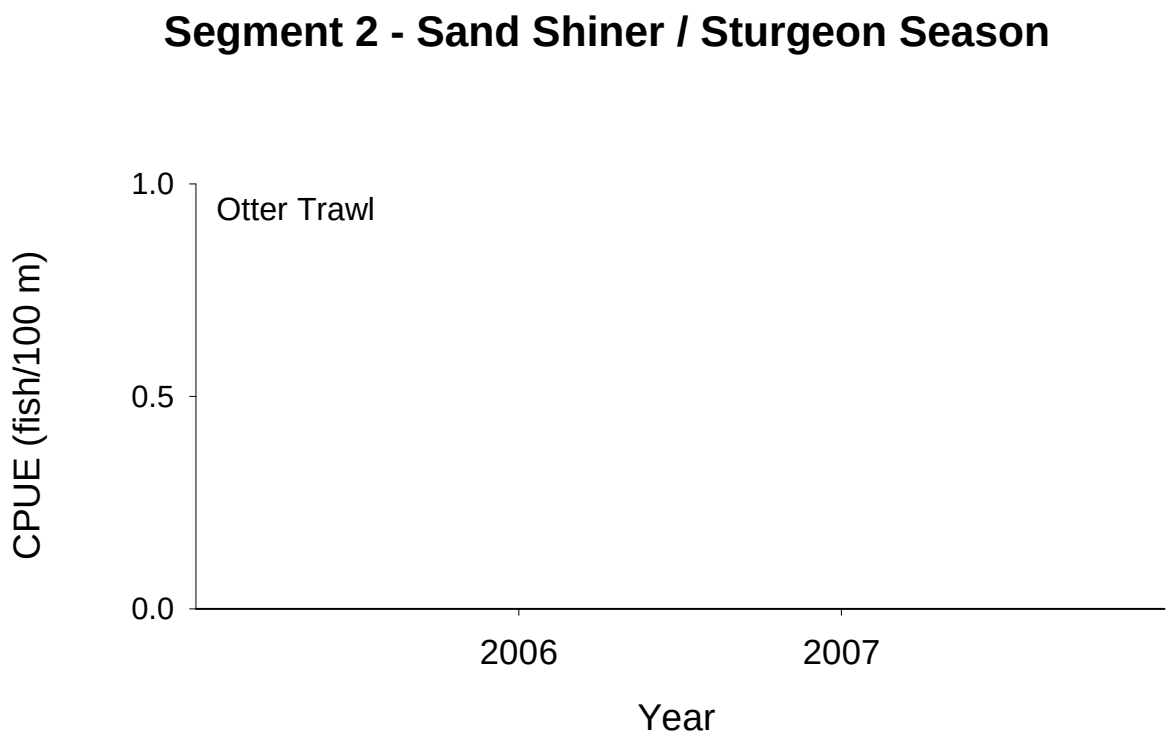

Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007.

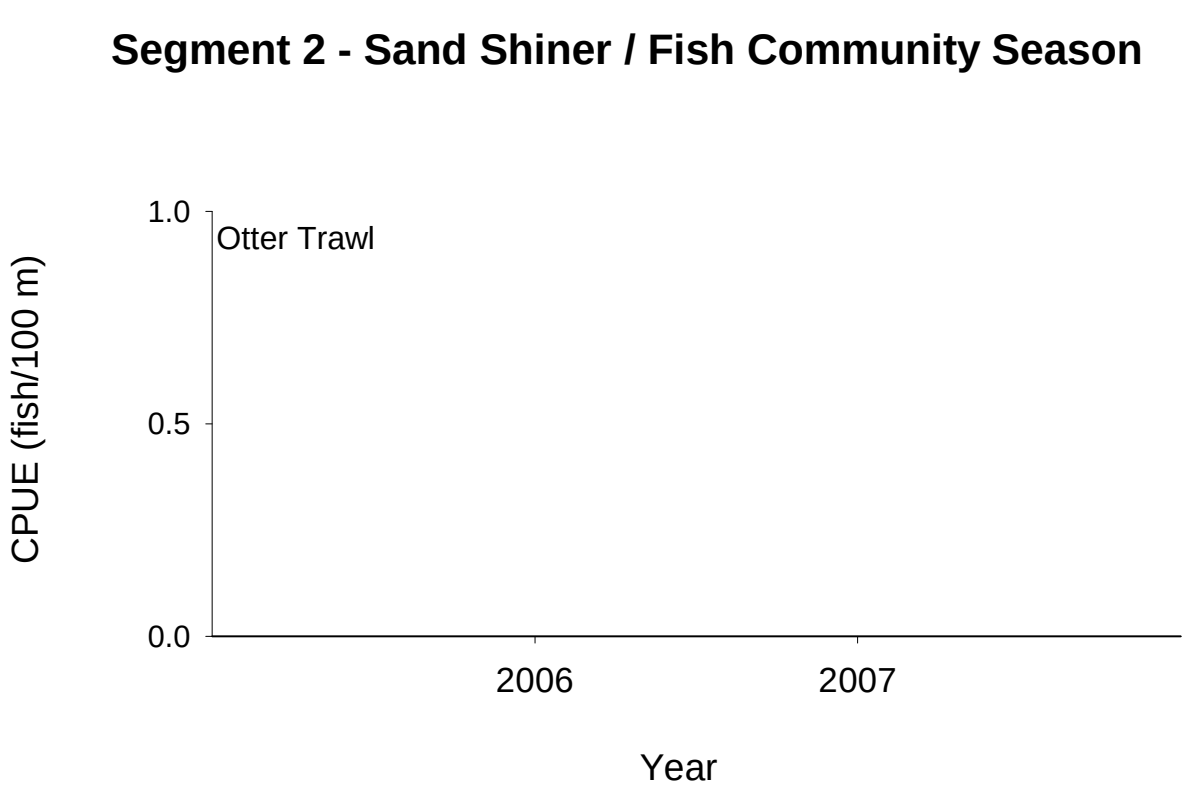

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls in segment 2 of the Missouri River during fish community season 2006-2007.

Segment 2 - Sand Shiner / Fish Community Season

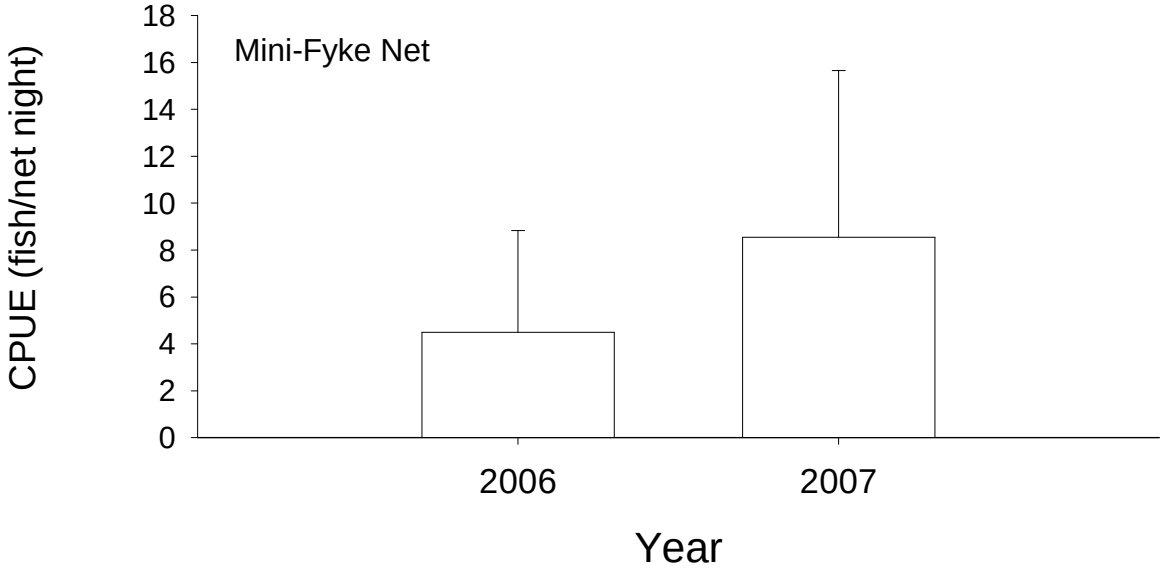

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	803	0	13	0	0	0	15	6	0	52	0	0	0	14	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	0 .	0 0	0 94	0 0	0 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	803 .	100 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	0 .	0 0	0 98	0 0	0 2	0 0	0 0

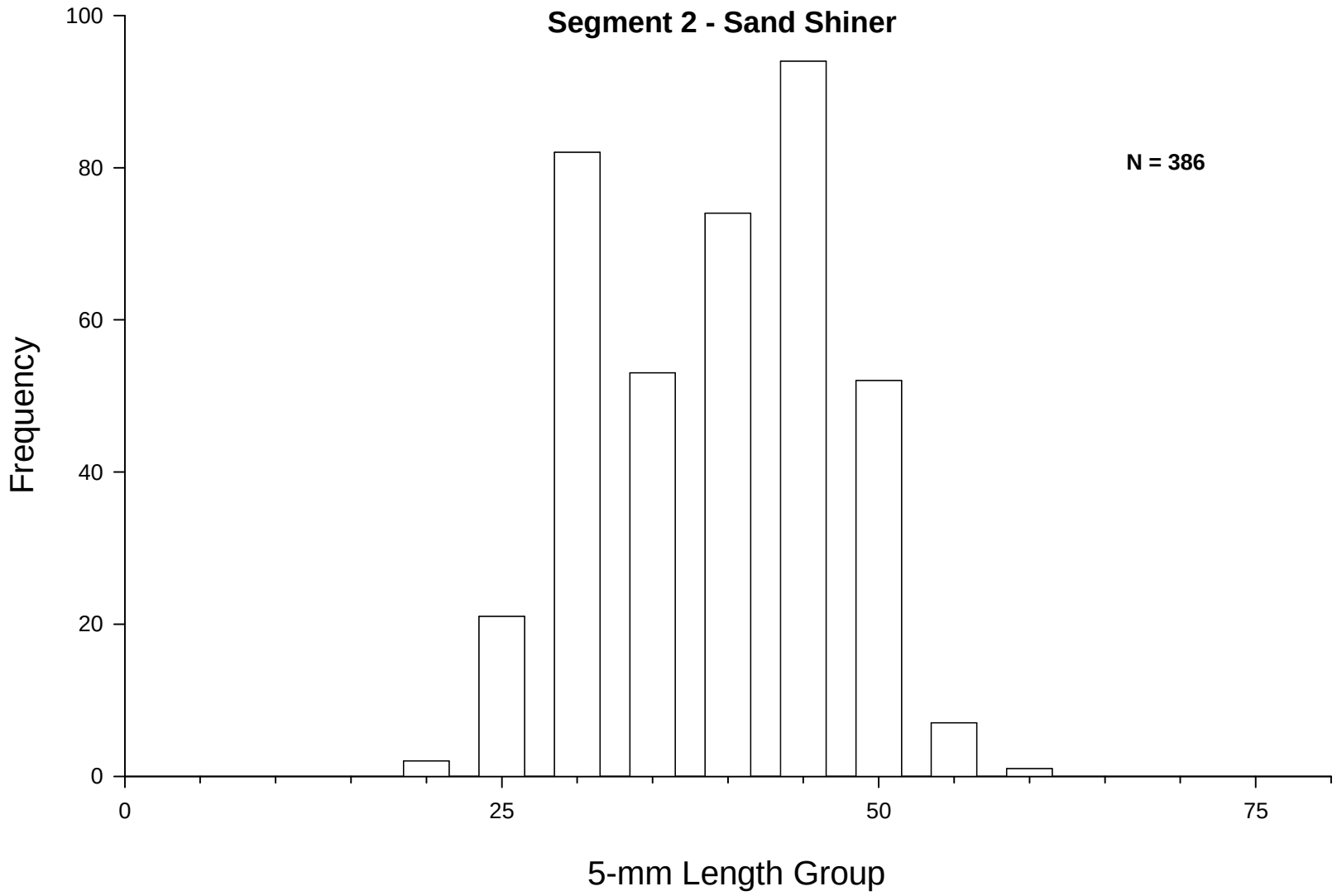

Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

***Hybognathus* spp**.

A total of 68 *Hybognathus spp.* were collected in segment 2 during 2007. Of this, 64 were identified as western silvery minnows, 1 plains minnow and 3 were only identified to genera *Hybognathus*. For these results, all *Hybognathus spp.* will be combined unless specified.

Mini fyke nets caught the majority of *Hybognathus spp.* (N = 60), with the remaining being collected in otter trawls (N = 8). All *Hybognathus spp.* collected in the otter trawl were sampled during the sturgeon season, whereas all captured in mini fykes were sampled during the fish community season, which was the only season the gear was used. Mini fyke net CPUE of *Hybognathus spp.* was similar in 2007 with a CPUE of 0.64 fish/ net night as to 2006, which had a CPUE of 0.63 fish/ net night (Figure 36). For the otter trawl in sturgeon season, CPUE was higher in 2007 (CPUE = 0.024 fish/ 100 m) when compared to 2006 (CPUE = 0.007 fish/ 100 m) (Figure 34). During the fish community season, no *Hybognathus spp.* were collected during 2007, whereas in 2006 one was collected, which equated to a CPUE of 0.002 fish/ 100 m (Figure 35).

For mini fyke nets, more *Hybognathus spp.* were collected in small connected side channels (50%), than in channel crossovers (32%), small tributary mouths (8%), inside bends (5%), small non-connected side channels (3%), and outside bends (2%) (Table 34). Proportionally the catch of *Hybognathus spp*. was higher in small connected side channels (50%) than what that habitat was sampled (17%).

Hybognathus spp. averaged 78.1 mm TL, with the minimum and maximum of 40 mm and 116 mm, respectively. The length distribution of *Hybognathus spp.* indicates three peaks, with a two large peaks occurring around 50-55 mm range and the other in the 105-110 mm range, and a much smaller peak around 80-85 mm (Figure 37). These three peaks most likely represent age-0, age-1 and age-2 fish, based on Datillo et al. (2008b). However, due to growth throughout the fish community season, age classes are most likely mixed between peaks in the observed distribution.

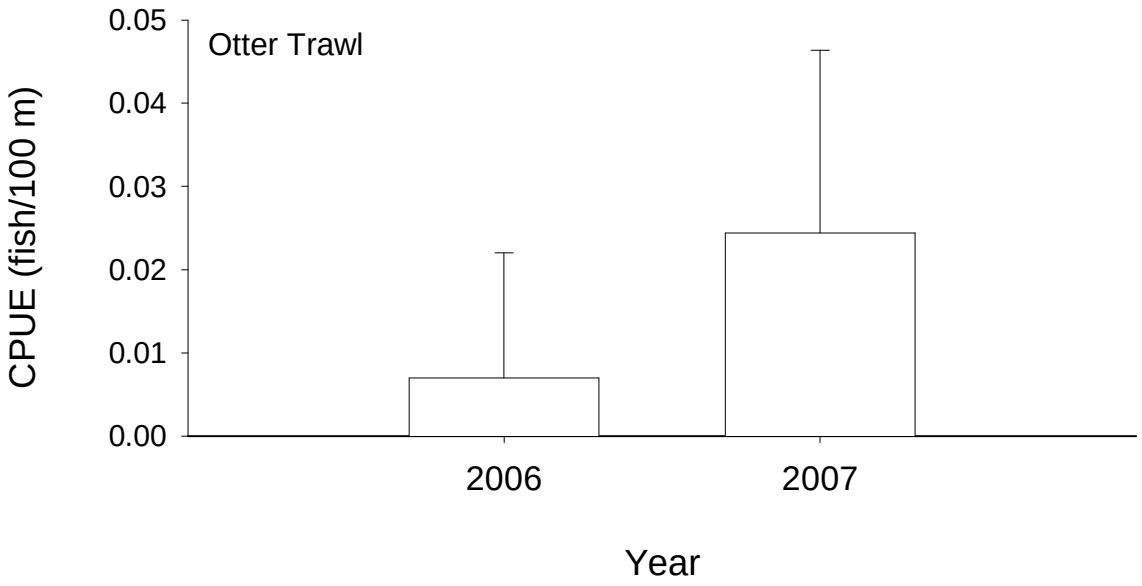

Figure 34. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus* spp. with otter trawls in segment 2of the Missouri River during sturgeon season 2006-2007.

Segment 2 - *Hybognathus* spp. / Fish Community Season

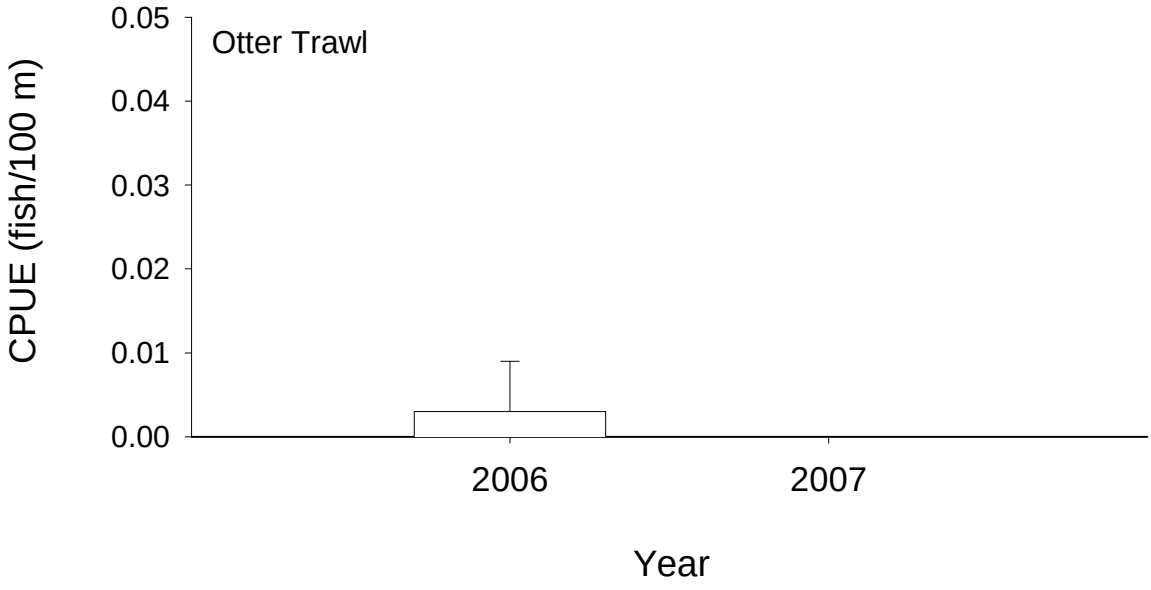

Figure 35. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus* spp. with otter trawls in segment 2 of the Missouri River during fish community season 2006-2007.

Segment 2 - *Hybognathus* spp. / Fish Community Season

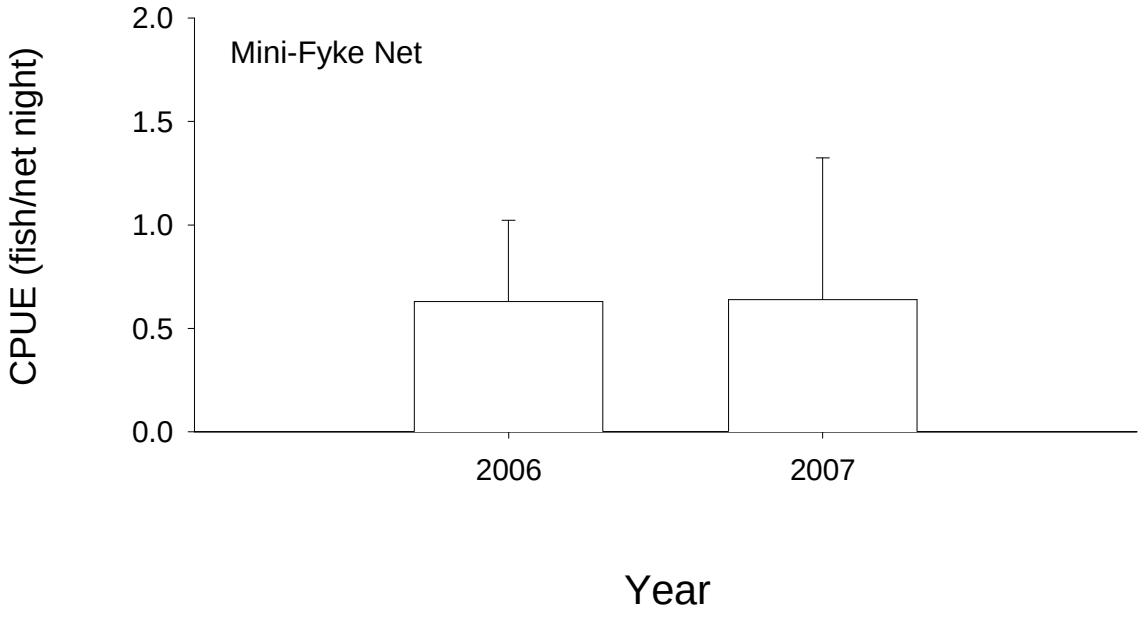

Figure 36. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus* spp. with mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Macrohabitat**													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	8	0	13	0	0	0	38	0	50	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	60	0	32	0	0	0	5	2	0	50	3	0	0	8	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0 .	0 0	0 98	0 0	0 2	0 0	0 0
Gill Net							
Otter Trawl	8 .	0 0	88 94	0 0	13 6	0 0	0 0
Fish Community Season (Summer)							
1 Inch Trammel Net	0 .	0 0	0 100	0 0	0 0	0 0	0 0
Mini-Fyke Net	60 .	100 100	0 0	0 0	0 0	0 0	0 0
Otter Trawl	0 .	0 0	0 98	0 0	0 2	0 0	0 0

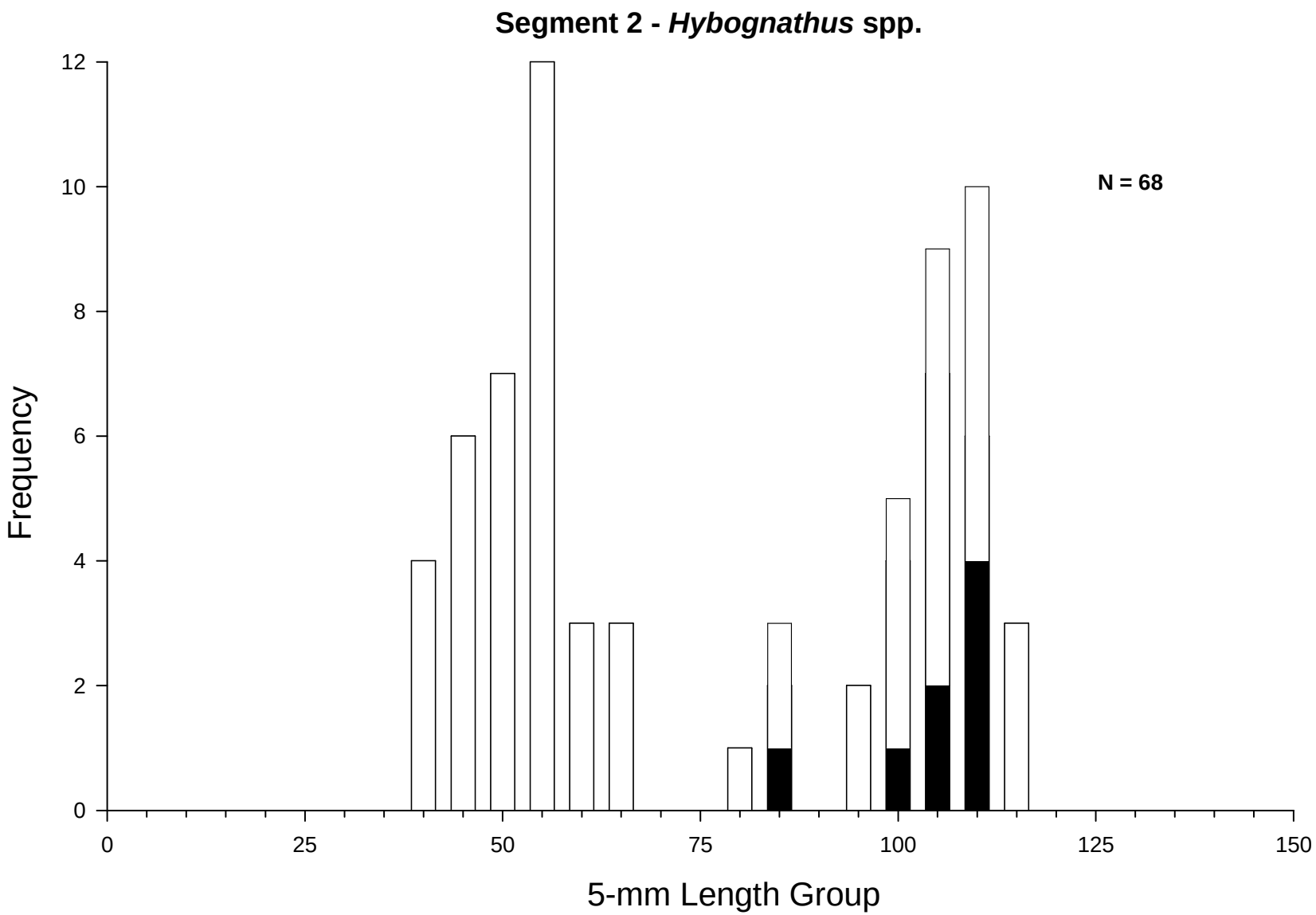

Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

Blue Sucker

A total of 36 blue suckers were sampled in segment 2 during 2007, an increase from 2006 when 12 were sampled. During 2007, 31 and 5 blue suckers were sampled during the sturgeon and fish community seasons, respectively. Trammel nets (N =33) and otter trawls (N = 3), were the only gears to collect blue suckers. During the sturgeon season, otter trawl CPUE was similar between 2007 (0.009 fish/ 100 m) and 2006 (0.007 fish/ 100 m) (Figure 38). In contrast, trammel net CPUE was higher during 2007 (0.098 fish/ 100 m) than in 2006 (0.028 fish/ 100 m) (Figure 39). The same pattern was seen for trammel nets during the fish community season, where CPUE was higher for 2007 (0.018) than for 2006 (0.01) (Figure 41).

The distribution of the blue sucker catch was not equal throughout segment 2. More blue suckers were captured in the more upstream river bends than in the downstream bends. Thirty-two of the 36 blue suckers sampled were at or above river mile 1744. Similarly, the majority of the blue sucker catch occurred in May (86%), even though sampling occurred until the end of October.

Blue suckers that were sampled using trammel nets were found in the channel crossovers at a higher rate during both the sturgeon (79%) and fish community (80%) seasons than other macrohabitats. Although 79% of blue suckers caught with trammel nets were found in the channel crossovers, channel crossovers only made up 34% of the sampling effort (Table 36). A similar pattern was seen during the fish community season (Table 36).

Blue suckers averaged 707.8 mm TL and weighed an average of 3,014 g. All blue suckers were between 600 to 802 mm TL (Figure 44). Based on blue sucker aging from lower segments in the Missouri River (Labay et al. 2008), all blue suckers collected in 2007 were likely older than age-7.

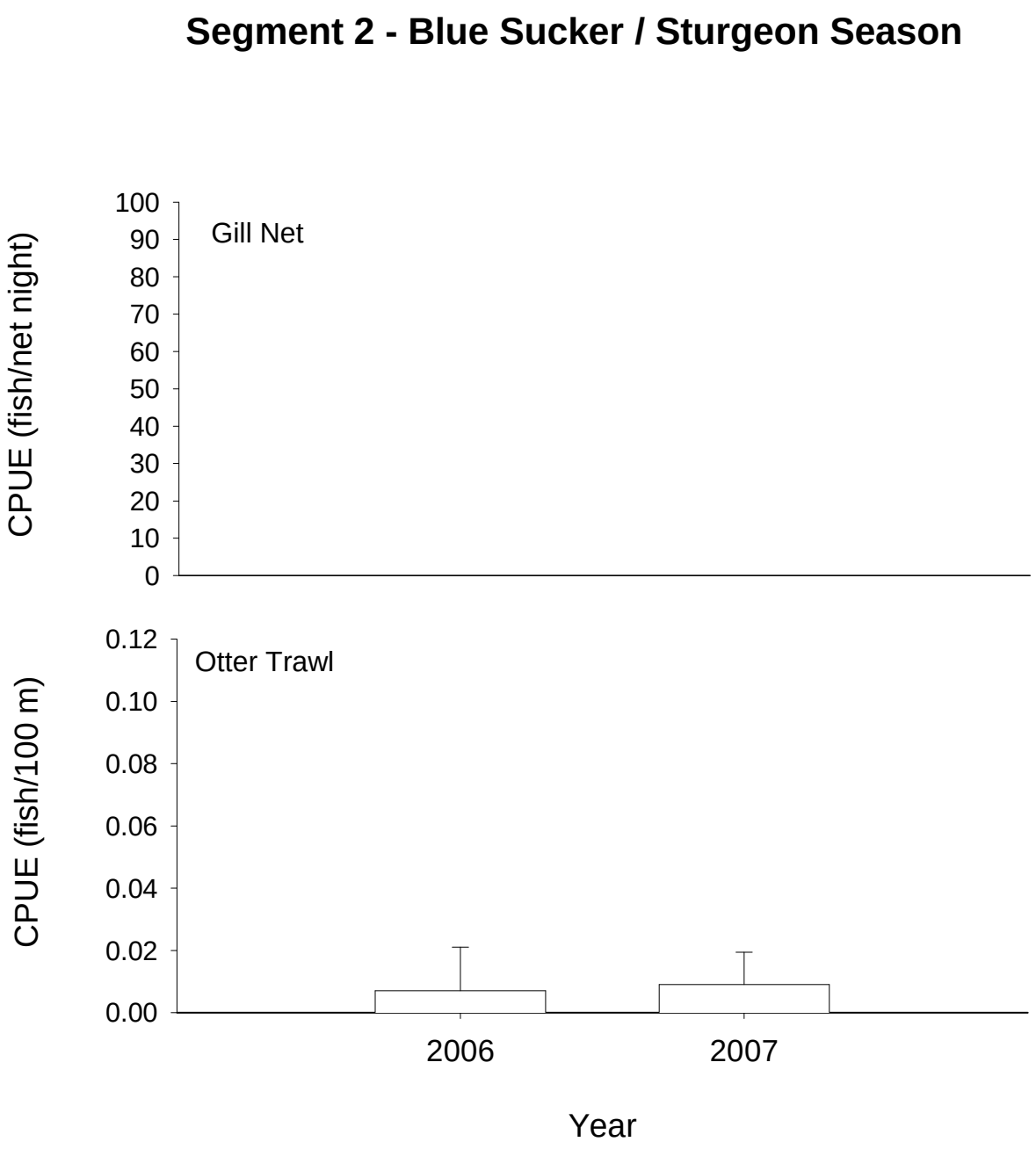

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with gill nets and otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007.

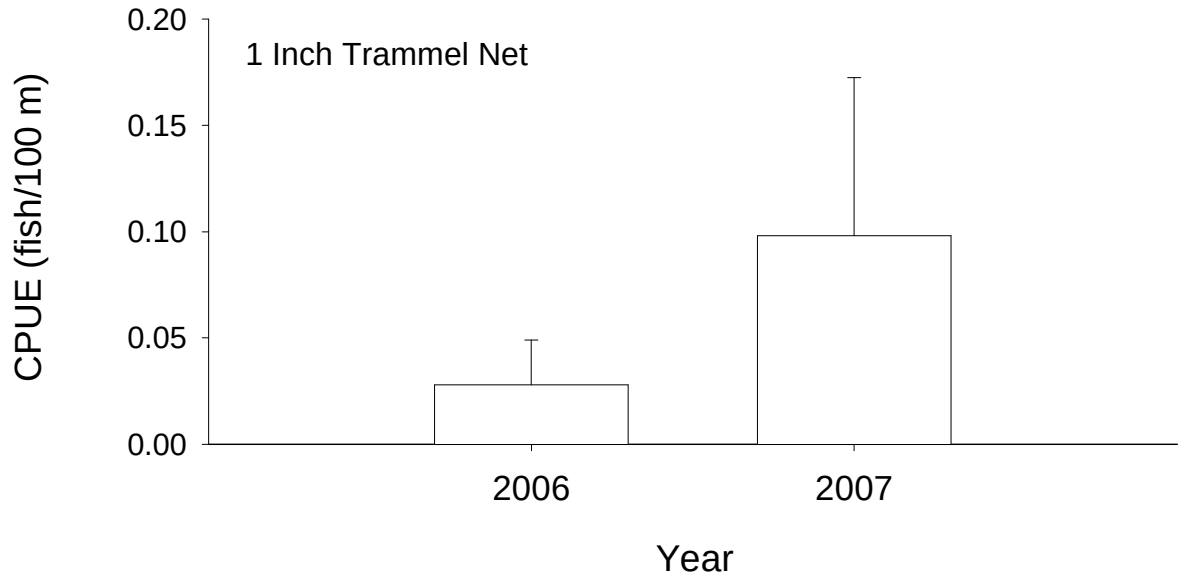

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006-2007.

Segment 2 - Blue Sucker / Fish Community Season

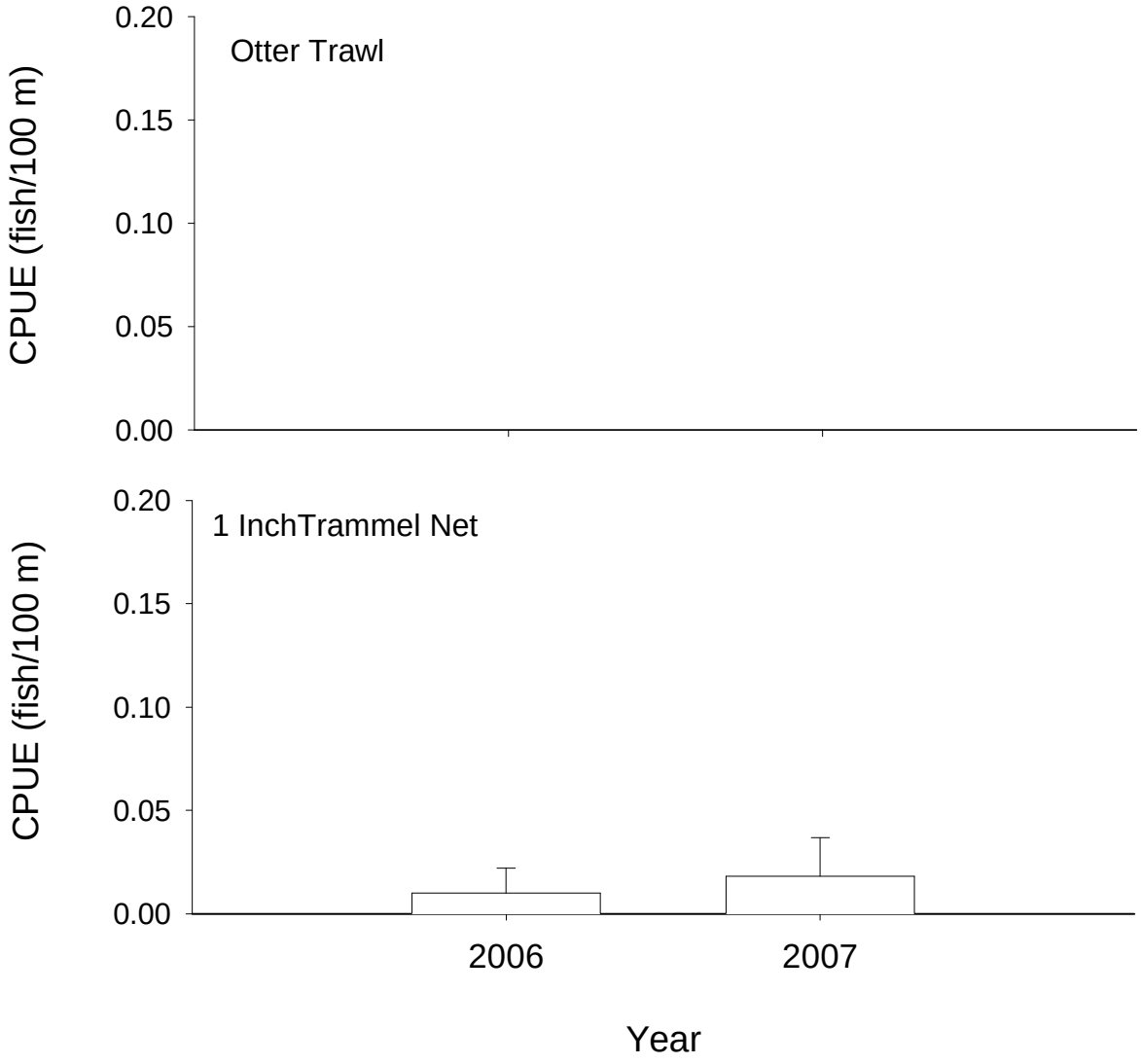

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 2 of the Missouri River during fish community season 2006-2007.

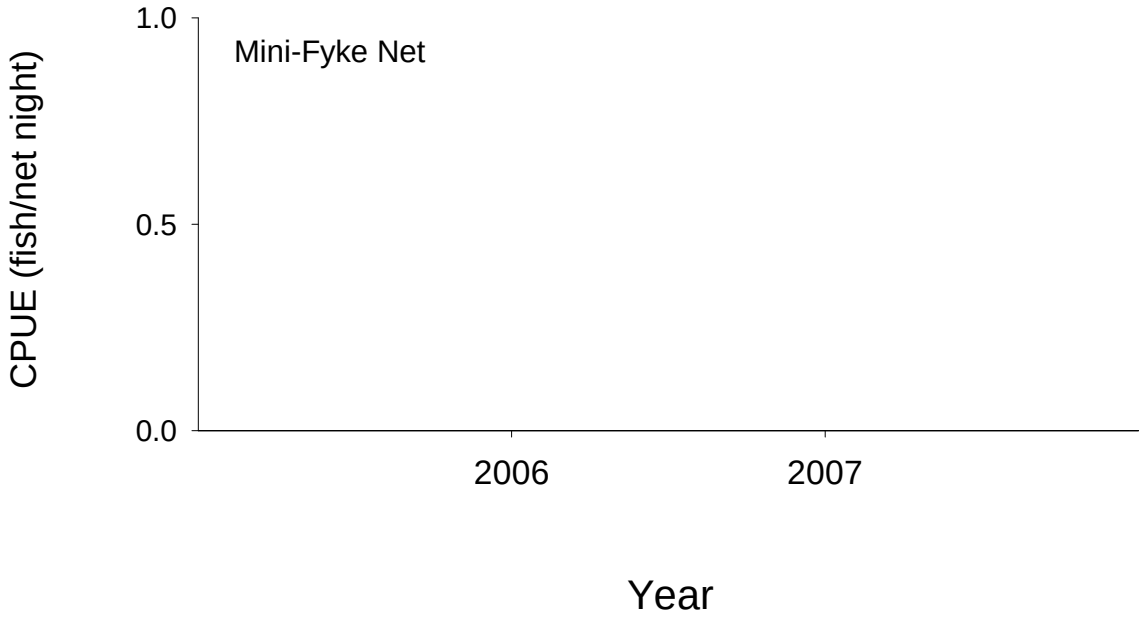

Figure 42. Mean annual catch-per-unit-effort (+/- 2SE) of blue suckers using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	28	0	79	0	0	0	7	14	0	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	3	0	33	0	0	0	0	67	0	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	5	0	80	0	0	0	20	0	0	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	28	0	100	0	0	0	0
	.	0	98	0	2	0	0
Gill Net							
Otter Trawl	3	0	100	0	0	0	0
	.	0	94	0	6	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	5	0	100	0	0	0	0
	.	0	100	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0
	.	100	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	98	0	2	0	0

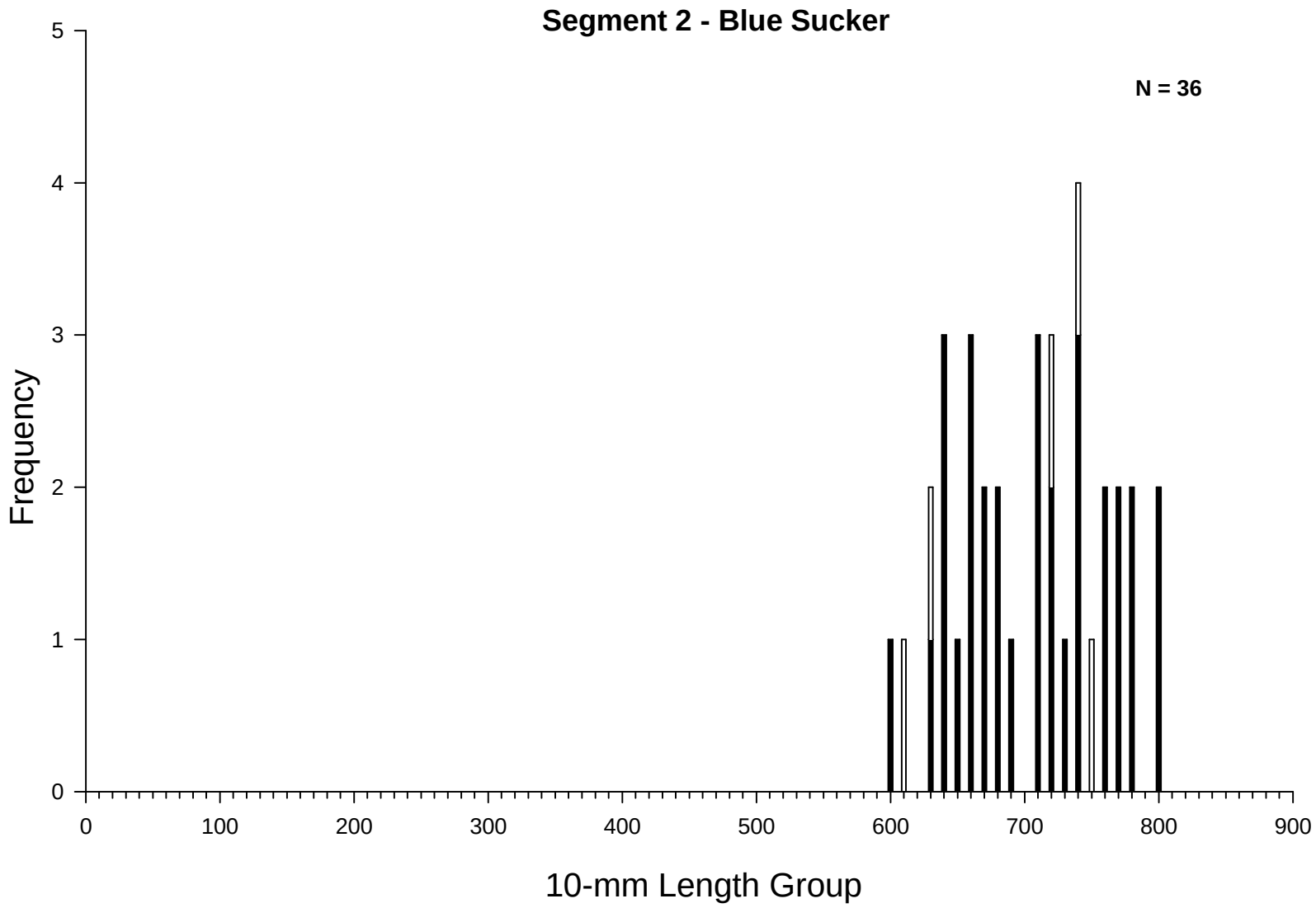

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 2 of the Missouri River during 2007 for all random and non-random samples.

Sauger

A total of 157 sauger were sampled in segment 2 during 2007, a substantial increase from 2006 when 84 were sampled. Of the total, 87 were sampled during the fish community season and 70 during the sturgeon season. Standard gears captured 149 sauger, including102 in trammel nets, 34 in otter trawls, and 13 in mini fyke nets. Sauger CPUE was higher for all gears in all seasons during 2007 when compared to 2006, with one exception (Figures 45, 46, 48 and 49). Sauger CPUE was lower for the otter trawl during the sturgeon season in 2007 (.055 fish/ 100 m) than in 2006 (0.060 fish/ 100 m) (Figure 45).

Sauger were sampled in outside bends (41%) more often than channel crossovers (21%), inside bends (18%), large connected secondary channels (15%), small connected secondary channels (3%), non-connected side channels (1%), and tributary mouths (1%). Similarly, with only one exception, sauger were captured at a higher proportion in outside bends for all gears during all seasons than the proportion outside bends were sampled relative to other habitats (Table 38). Trammel nets during the fish community season was the one exception, where sauger were sampled at a lower rate than what the habitat was sampled compared to other habitats.

The average size of sauger collected in 2007 was 328.6 mm TL, similar to an average of 326.0 mm TL in 2006. The average length of sauger captured in 2007 was different by gear, with trammel nets catching larger sauger (333.0 mm TL), than mini fyke nets (317.2 mm TL), and otter trawl (307.1 mm TL). The length frequency histogram of sauger collected in 2007 was similar to that of 2006, with 2007 having a few samples of both larger and smaller fish (Figure 51). Based on Dattilo et al. (2008c), the age composition of sauger collected consisted of age-0 to older than age-5 fish. However, only one age-0 fish and few age-1 fish were collected. The majority of the age distribution was made up of fish age-2 and older.

Segment 2 - Sauger / Sturgeon Season

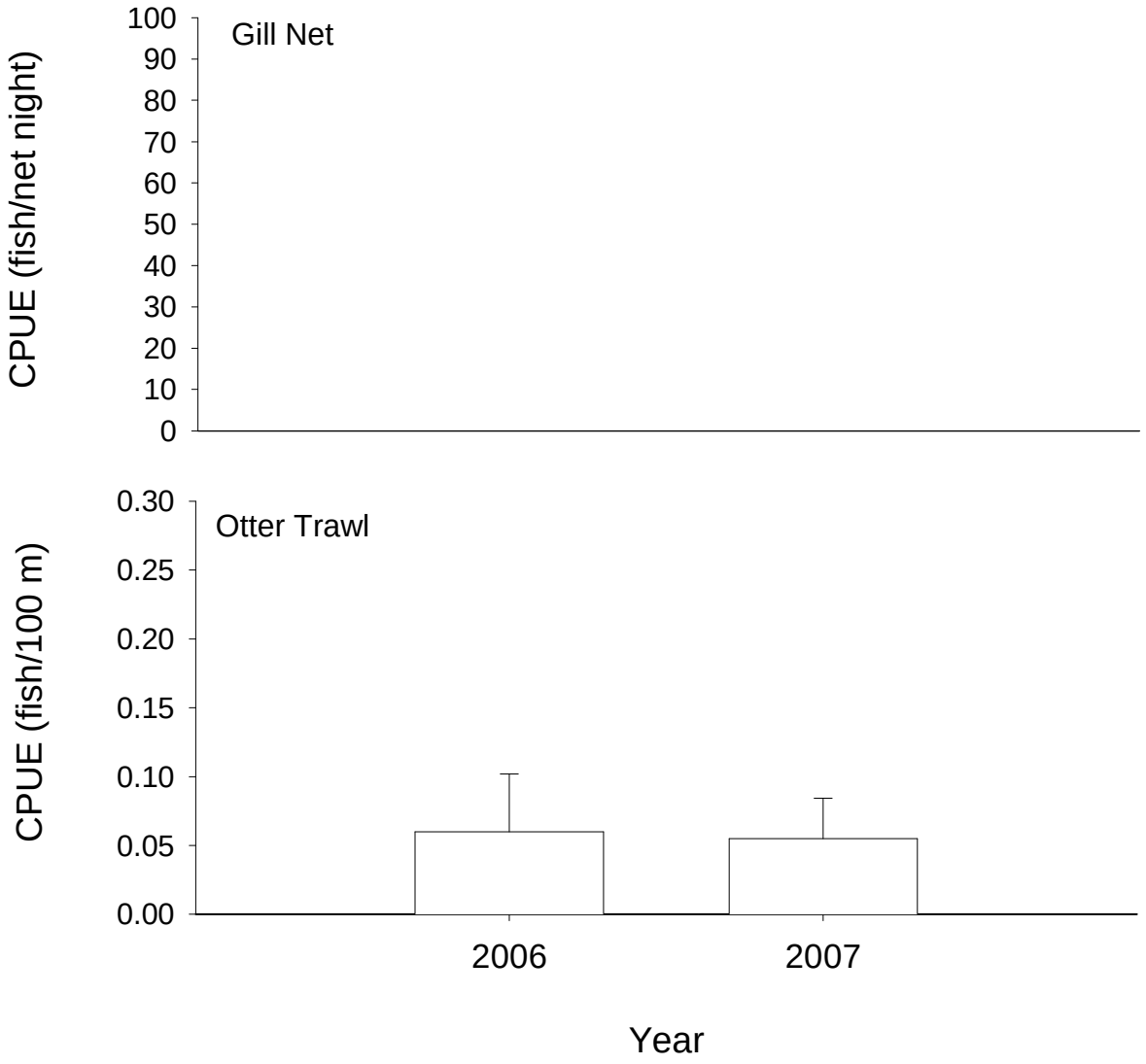

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using gill nets and otter trawls in segment 2 of the Missouri River during sturgeon season 2006-2007.

Segment 2 - Sauger / Sturgeon Season

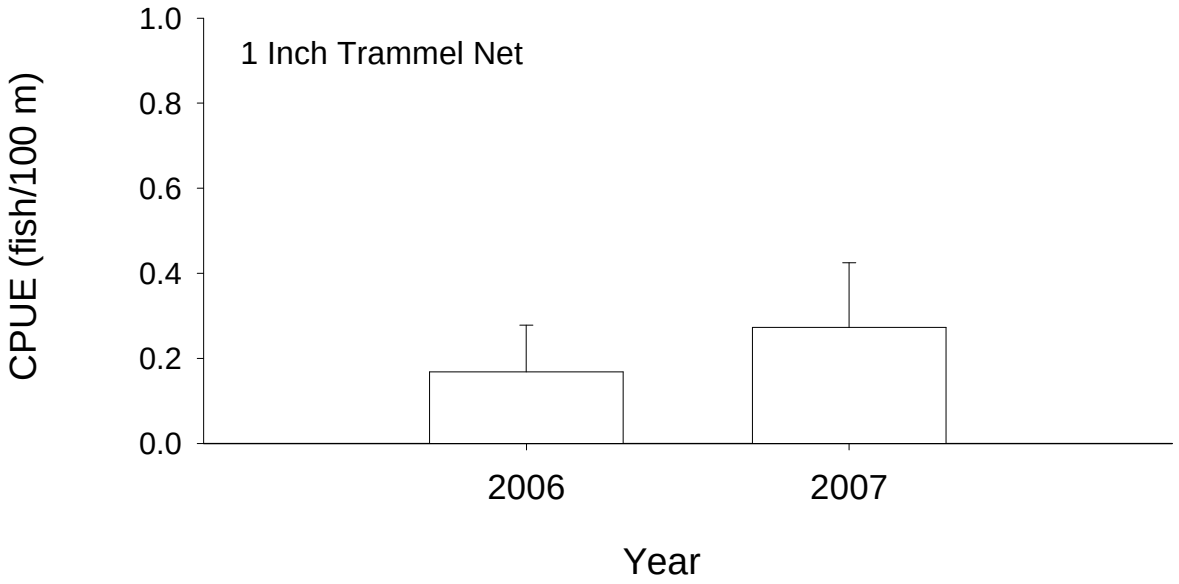

Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using 1 inch trammel nets in segment 2 of the Missouri River during sturgeon season 2006-2007.

Segment 2 - Sauger / Fish Community Season

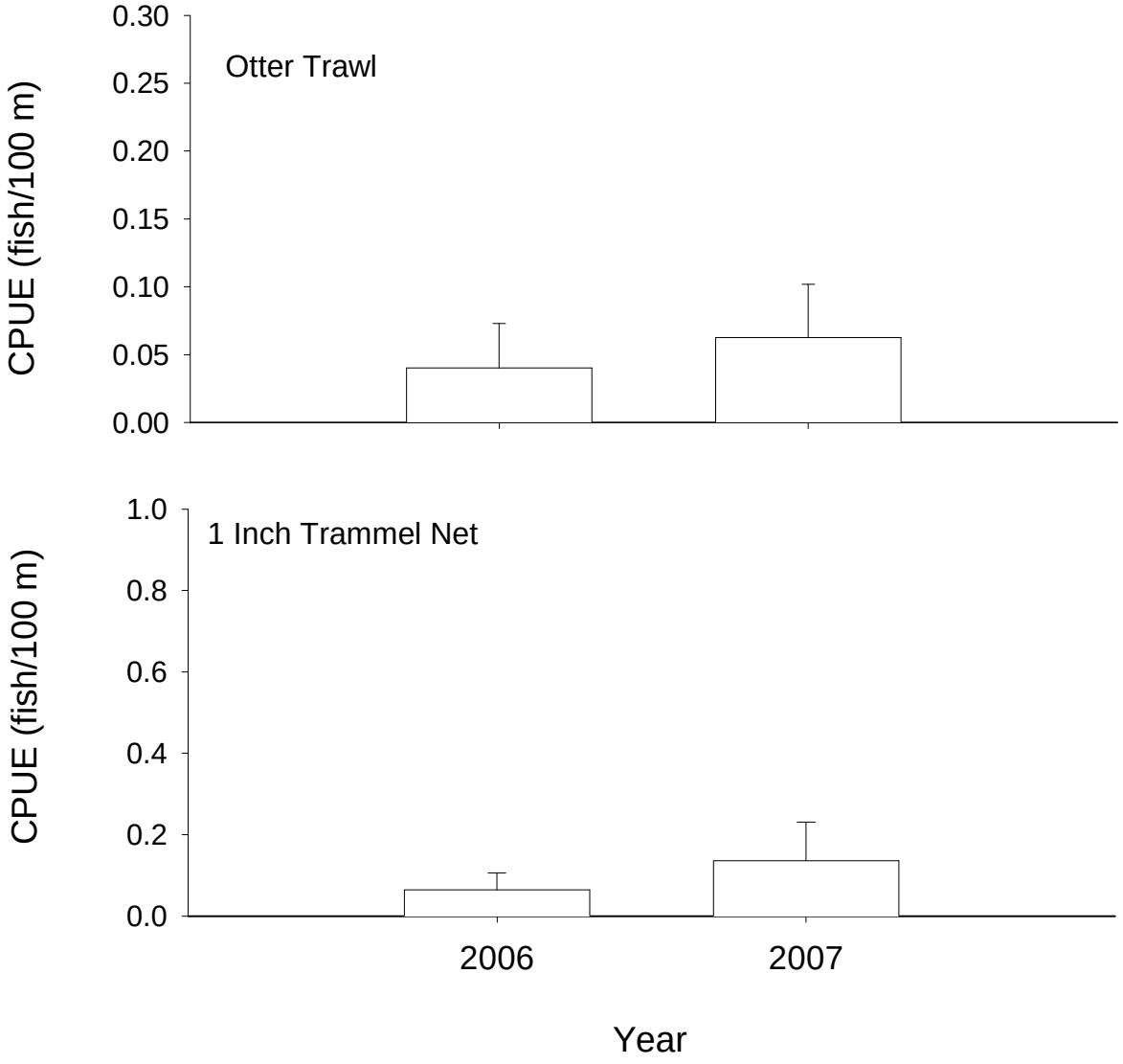

Figure 48. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using otter trawls and 1 inch trammel nets in segment 2 of the Missouri River during fish community season 2006-2007.

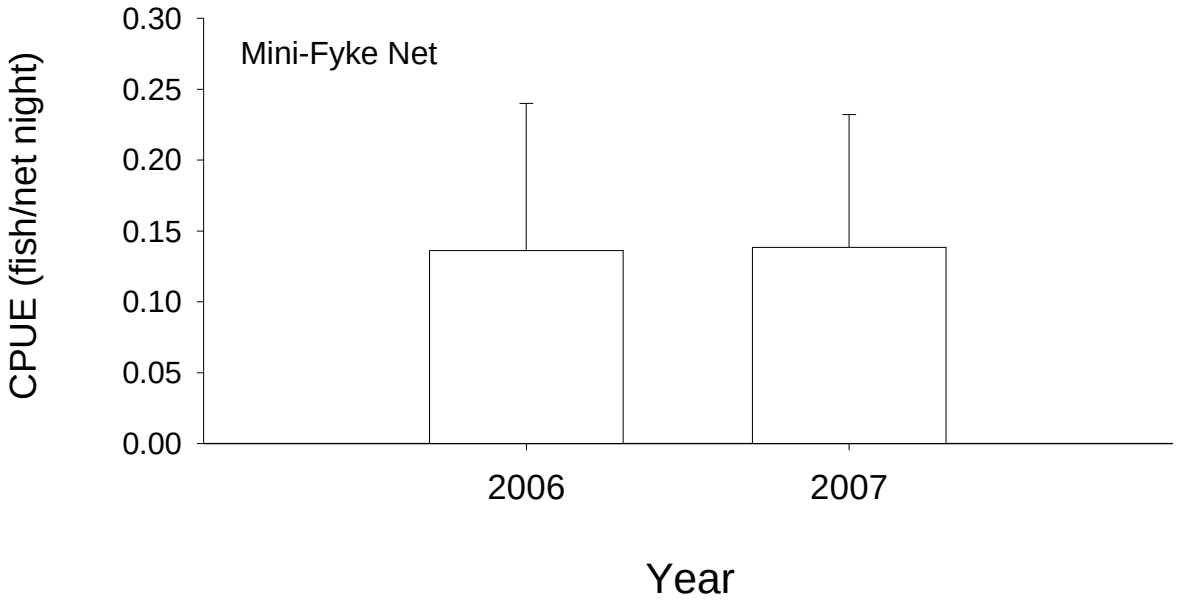

Figure 49. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using mini-fyke nets in segment 2 of the Missouri River during fish community season 2006-2007.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	70	0	21	0	0	0	16	56	7	0	0	0	0	0	0
	.	0	34	0	0	0	31	27	8	0	0	0	0	0	0
Gill Net															
Otter Trawl	17	0	24	0	0	0	0	65	12	0	0	0	0	0	0
	.	0	28	0	0	0	27	26	18	1	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	32	0	25	0	0	0	31	9	34	0	0	0	0	0	0
	.	0	33	0	0	0	33	28	6	0	0	0	0	0	0
Mini-Fyke Net	13	0	23	0	0	0	15	23	0	23	8	0	0	8	0
	.	0	31	0	0	0	27	6	15	17	2	0	0	2	0
Otter Trawl	17	0	12	0	0	0	24	29	29	6	0	0	0	0	0
	.	0	36	0	0	0	27	25	11	1	0	0	0	0	0

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 2 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	70	0	100	0	0	0	0
	.	0	98	0	2	0	0
Gill Net							
Otter Trawl	17	0	94	0	6	0	0
	.	0	94	0	6	0	0
Fish Community Season (Summer)							
1 Inch Trammel Net	32	0	100	0	0	0	0
	.	0	100	0	0	0	0
Mini-Fyke Net	13	100	0	0	0	0	0
	.	100	0	0	0	0	0
Otter Trawl	17	0	94	0	6	0	0
	.	0	98	0	2	0	0

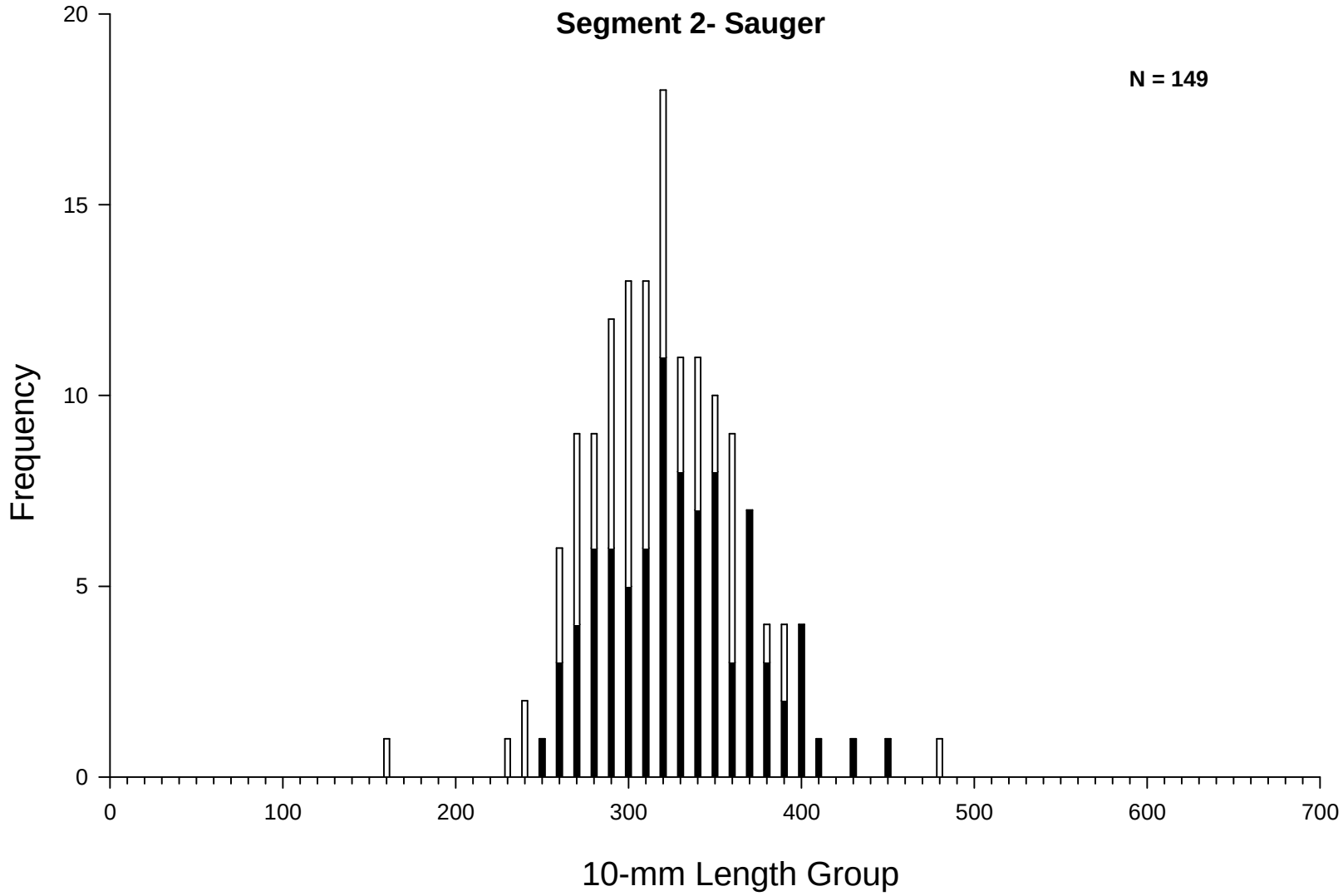

Figure 51. Length frequency of sauger during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 2 of the Missouri River during 2007 for all random and non-random sampling.

Missouri River Fish Community

A total of 7,726 fish consisting of 34 species were collected in segment 2 during 2007, a substantial decrease from the 60,034 fish collected in 2006. Although bag seines were used during 2006 and captured a total of 9,937 fish, the difference between years was still substantial even not including bag seines during 2006. Considerably more fish were sampled during the fish community season (N = 6,836) when gears that target smaller fish are used than during the sturgeon season (N = 890), when only otter trawls and trammel nets were deployed. Seven non-native species were collected during 2007, which included in order of abundance common carp *Cyprinus carpio* (N = 25), spottail shiner *Notropis hudsonius* (N = 10), white crappie *Pomoxis annularis* (N = 7), rainbow trout *Oncorhynchus mykiss* (N = 3), walleye *Sander vitreum* (N = 2), northern pike *Esox lucius* (N = 2), and yellow perch *Perca flavescens* (N = 1).

During 2007, river carpsuckers *Carpiodes carpio* were the most abundant species with 2,039 sampled, followed by longnose sucker *Catostomus catostomus* (N = 821), sand shiner (N = 808), fathead minnow *Pimephales promelas* (N = 742), flathead chub *Platygobio gracilis* (N = 736), shovelnose sturgeon (N = 517), longnose dace *Rhinichthys cataractae* (N = 476), emerald shiner *Notropis atherinoides* (N = 401), white sucker *Catostomus commersoni* (N = 262), goldeye *Hiodon alosoides* (N = 194), sauger (N = 157), sturgeon chub (N = 150), shorthead redhorse *Moxostoma macrolepidotum* (N = 118), channel catfish *Ictalurus punctatus* (N = 66), and western silvery minnow (N = 64). All other species collected had a sample size less than 50 and therefore will not be discussed in detail. However, CPUE for all species collected by gear and habitat can be found in Appendix F and overall CPUE of all species by gear and season can be found in Appendix H.

Significant increases in relative abundance were observed between 2007 and 2006 for some species. The abundance of juvenile river carpsuckers increased in 2007, where mini fyke nets had a CPUE of 20.8 fish/ net night compared to 3.6 fish/ net night during 2006. Similarly, the abundance of juvenile goldeye increased in 2007 with a mini fyke net CPUE of 0.25 fish/ net night compared to 0.05 fish/ net night in 2006. However, the large differences in relative abundance were not seen in the adults of river carpsuckers or goldeyes between the two sampling years.

Decreases in some juvenile fish were also seen in 2007 from 2006. Most noticeably were white suckers and fathead minnows, which had mini fyke net CPUE of 494.6 and 52.3 fish/ net night during 2006, respectively, and decreased to 2.4 and 7.9 fish/ net night during 2007.

Discussion

More pallid sturgeon were sampled during 2007 (N = 22) than in 2006 (N = 14). The increase in catch was due to the addition of two gears in 2007, the push trawl and trotlines. The push trawl captured four pallids and trotlines captured one. Pallid sturgeon CPUE was actually lower for trammel nets during both seasons and for the otter trawl during the sturgeon season in 2007, when compared to 2006. The experimental push trawl had a pallid sturgeon CPUE of 0.038 fish/ 100 m during the fish community season, which was higher than the otter trawl (0.023 fish/ 100 m) or trammel nets (0.009 fish/ 100 m) for the same time period (Appendix H).

Three age-classes of pallid sturgeon were sampled in 2007, age-1 (N = 11), age-2 (N = 10) and age-6 (N = 1). Of the 22 pallids captured, 11 were stocked at Wolf Point, 4 near the confluence of the Milk River and 7 were of unknown stocking location. A total of eight pallid sturgeon were PIT tagged in the field. All of these PIT tagged fish had their left 2nd lateral scute removed for further PIT tag retention analysis. No adult or wild juvenile pallid sturgeon were sampled in segment 2 during 2007.

Similar to pallid sturgeon, more shovelnose sturgeon (N = 517) were sampled during 2007 than in 2006 (N = 427). Again the 2007 total was inflated by the new gears, since trotlines and the push trawl captured 81 and 1 shovelnose sturgeon, respectively. Overall trammel net CPUE for shovelnose sturgeon was lower during the sturgeon season of 2007 than in 2006, but slightly higher during the fish community season (Appendix H). Shovelnose sturgeon CPUE in the otter trawl was higher for both seasons during 2007 than in 2006.

Although 517 shovelnose sturgeon were sampled in segment 2, no shovelnose sturgeon were less than age-3 (Steffenson and Hamel 2008). Similar results were seen in 2006, when the size distribution was of shovelnose sturgeon was comparable. Due to the presence of Fort Peck Dam and the knowledge that *Scaphirhynchus spp*. drift at the larval stage, it is reasonable to believe that none or little age-0 rearing of either shovelnose or pallid sturgeon is currently occurring in segment 2. However, spawning may occur in the Milk River on years with adequate flow, which could allow enough drift distance for larvae to settle out in the lower portions of segment 2, but has yet to be documented by this project.

Significant changes in the relative abundance of some juvenile fishes (e.g. river carpsuckers, white suckers, goldeye and fathead minnows) occurred between 2006 and 2007. Although it is unknown why these changes occurred, one variable stands out between the two

years. The Milk River, which enters the Missouri River at the upstream end of segment 2 had discharges that were near 5,000 cfs during June of 2007, while during the same period in 2006 was for the most part below 200 cfs. Additionally, the maximum spring discharge of the Missouri River in segment 2 was near 12,000 cfs in 2007, a substantial increase from the maximum of 9,000 cfs during 2006. In relation to discharge, a substantial increase in the maximum sampled turbidity of the Missouri River was observed in segment 2 during 2007 when compared to 2006. The maximum recorded turbidity for 2007 was estimated at 6,500 NTU's, where as during 2006 the maximum was 650 NTU's. This increase in turbidity was primarily from the Milk River discharge.

The increase in spring discharge and turbidity during 2007 may have had different effects on species spawning in the Missouri and Milk River systems. Species like white suckers and fathead minnows had substantially decreased abundance in the 2007 sampling when compared to 2006. In contrast, the relative abundance of young-of-the-year goldeye substantially increased in 2007. During 2006 no goldeye smaller than 140 mm TL were found in segment 2 indicating little to no recruitment in this area. During 2007, 23 goldeye 55 mm TL or smaller were sampled, indicating successful spawning and recruitment to age-0. Additionally, age-0 abundance of river carpsuckers increased approximately six and one half times in 2007 from 2006. Therefore, it is likely that goldeye and river carpsuckers, both known to be large turbid river species, benefited from the increase in discharge and turbidity during 2007. Further years of sampling will hopefully allow us to better understand how variables like flow and turbidity affect many of the Missouri River species in segment 2.

For the different gears, the otter trawl sampled seven target species, with the trammel nets sampling five, mini fyke nets and push trawl sampled four each and trotlines sampled three target species. The highest CPUE observed for any species with trammel nets was for shovelnose sturgeon during the fish community season, with a CPUE of 0.839 fish/ 100 m. The otter trawl had its highest CPUE for sturgeon chubs during the sturgeon season with a CPUE of 0.380 fish/ 100 m. The experimental push trawl had its highest CPUE for longnose dace with a CPUE of 0.195 fish/ 100m. The highest CPUE for mini fyke nets was for river carpsuckers, with at 20.830 fish/ net night.

Acknowledgments

The U.S. Army Corps of Engineers provided funding for this project. We'd like to thank Mark Drobish for continuing to support us in all aspects. John Hunziker, Bob Lipscomb and Landon Johnson assisted in both the field and shop throughout the year. Mike Ruggles took care many details in the office and beyond while we were busy playing on the river. We'd like to thank the entire Flow Modification Crew for their help in the field and office. Thanks to Pat Braaten of the U.S. Geological Survey for answering any type of question we may have pertaining to the Missouri River and its fishes. Thanks to Ryan Wilson and Steve Krentz of the U.S. Fish and Wildlife Service for all the collaboration between our offices.

References

Dattilo, J. E., R. R. Dirnberger, P. T. Horner, D. J. Niswonger, M. L. Miller and V. H. Travinchek. 2008a. Three Year Summary Age and Growth Report For Sand Shiner (*Notropis stramineus*). Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. Missouri Department of Conservation. Chillicothe, MO.

Dattilo, J. E., R. R. Dirnberger, P. T. Horner, D. J. Niswonger, M. L. Miller and V. H. Travinchek. 2008b. Three Year Summary Age and Growth Report For plains minnow, western silvery minnow, brassy minnow. Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. Missouri Department of Conservation. Chillicothe, MO.

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.

Herman, P., A Plauck, N. Utrup and Tracy Hill. 2008a. Three Year Summary Age and Growth Report For Sturgeon Chub *Macrohybopsis aestivalis*. Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. United States Fish and Wildlife Service Columbia National Fish and Wildlife Conservation Office, Columbia, MO.

Herman, P., A Plauck, N. Utrup and Tracy Hill. 2008b. Three Year Summary Age and Growth Report For Sicklefin Chub *Macrohybopsis meeki*. Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. United States Fish and Wildlife Service Columbia National Fish and Wildlife Conservation Office, Columbia, MO.

Labay, S., J. Kral and S. Stukel. 2008. Three Year Summary Age and Growth Report For Blue Sucker. Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. South Dakota Department of Game, Fish and Parks. Yankton, SD.

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.

Steffensen, K. and M. Hamel. 2008. Four Year Summary Age and Growth Report For Shovelnose Sturgeon. Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. Nebraska Game and Parks Commission. Lincoln, NE.

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
Carassus auratus	Goldfish	GDFH
Carassus auratus X Cyprinius carpio	Goldfish-Common carp hybrid	GFCC
Couesis 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 vigilas	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 platyrhyncus	Mountain sucker	MTSK
Catastomus spp.	Unidentified *Catastomus* spp.	UCA
Cycleptus elongates	**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
Ameiurusnebulosus	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 nocturnes	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	Bonniville 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 daphanus	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	
Culea 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 punctatus	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 caproides	Logperch	LGPH
Percina cymatotaenia	Bluestripe darter	BTDR
Percina evides	Gilt darter	GLDR
Percina maculate	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
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Dam Tailwaters	Meso	Area below dam	DTWT
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 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
Gillnet – 4 meshes, small mesh set upstream	GN14	Wild	Sturgeon	NOT USED	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Wild	Sturgeon	NOT USED	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Wild	Sturgeon	NOT USED	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Wild	Sturgeon	NOT USED	fish/net night
Mini-fyke net	MF	Standard	Fish Comm.	2006 - Present	fish/net night
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2006 - Present	fish/ 100 m trawled
Trammel net – 1 inch inner mesh	TN	Standard	All	2006 - Present	fish/100 m drift
Trot Line – Circle hooks**	TLC_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – Octopus hooks**	TLO_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – O'Shaughnessy hooks**	TLS_	Wild	Sturgeon	2007 - Present	fish/hook night
Otter trawl – 16 ft head rope	OT16	Standard	All	2006 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	NOT USED	fish/100 m trawled

* Standard only in upper Missouri River segments

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

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

State(s)	RPMA	Site Name	Code	River	RM
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124
MT	2	Intake	INT	Yellowstone	70
MT	2	Sidney	SID	Yellowstone	31
MT	2	Big Sky Bend	BSB	Yellowstone	17
ND	2	Fairview	FRV	Yellowstone	9
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678
MT	2	Culbertson	CBS	Missouri	1621
MT	2	Nohly Bridge	NOB	Missouri	1590
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
SD/NE	3	Standing Bear Bridge	STB	Missouri	845
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799
SD/NE	4	Mullberry Bend	MUL	Missouri	775
NE/IA	4	Ponca State Park	PSP	Missouri	753
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709
NE/IA	4	Decatur	DCT	Missouri	691
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
KA/MO	4	Leavenworth	LVW	Missouri	397
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342

State(s)	RPMA	Site Name	Code	River	RM
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

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

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		
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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
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 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	
2007	Culbertson	651	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Fallon	491	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Forsyth	492	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Sidney	983	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	School Trust	639	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Wolf Point	651	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Wolf Point	428285	2007	7/9/2007	Fry		
2007	Grand Champs	5558	2007	7/13/2007	Fry		
2007	Miles City	13125	2007	7/18/2007	Fry		
2007	Intake	20763	2007	8/9/2007	Fry		
2007	Miles City	13675	2007	8/9/2007	Fry		
2007	Intake	336	2007	8/27/2007	Fingerling		
2007	Miles City	336	2007	8/27/2007	Fingerling		
2007	Wolf Point	672	2007	8/27/2007	Fingerling		
2007	Forsyth	690	2007	8/31/2007	Fingerling	CWT	
2007	Intake	615	2007	8/31/2007	Fingerling	CWT	
2007	School Trust	1160	2007	9/6/2007	Fingerling	CWT	
2007	Intake	293	2007	9/12/2007	Fingerling		
2007	Miles City	293	2007	9/12/2007	Fingerling		
2007	Wolf Point	586	2007	9/12/2007	Fingerling		
2007	Culbertson	6455	2007	9/14/2007	Fingerling	Elastomer	
2007	Fallon	4827	2007	9/14/2007	Fingerling	Elastomer	
2007	Forsyth	5370	2007	9/14/2007	Fingerling	Elastomer	
2007	Intake	7812	2007	9/14/2007	Fingerling	Elastomer	
2007	School Trust	6096	2007	9/14/2007	Fingerling	Elastomer	
2007	Sidney	1934	2007	9/14/2007	Fingerling	Elastomer	
2007	Wolf Point	6455	2007	9/14/2007	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 2007. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

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

			CHXO	ISB	OSB	SCCL	
	Total	Overall					
Species	Catch	CPUE	CHNB	CHNB	CHNB	CHNB	ITIP
BKSB	0	0	0	0	0	0	0
		0	0	0	0	0	0
BMBF	0	0	0	0	0	0	0
		0	0	0	0	0	0
BRBT	1	0.002	0.007	0	0	0	0
		0.004	0.014	0	0	0	0
BUSK*	**33**	**0.059**	**0.139**	**0.02**	**0.03**	**0**	**0**
		0.039	**0.112**	**0.03**	**0.042**	**0**	**0**
CARP	0	0	0	0	0	0	0
		0	0	0	0	0	0
CNCF	25	0.052	0.073	0.05	0.047	0	0
		0.029	0.062	0.037	0.061	0	0
ERSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
FHCB	29	0.051	0.098	0.036	0.032	0	0
		0.03	0.085	0.032	0.033	0	0
FHMW	0	0	0	0	0	0	0
		0	0	0	0	0	0
GDEY	147	0.274	0.364	0.227	0.26	0.153	0.249
		0.111	0.274	0.133	0.197	0.145	0.498
HBNS*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
IODR	0	0	0	0	0	0	0
		0	0	0	0	0	0
LNDC	0	0	0	0	0	0	0
		0	0	0	0	0	0
LNSK	15	0.026	0.058	0.014	0.011	0	0
		0.019	0.051	0.02	0.023	0	0
NRBD	0	0	0	0	0	0	0

			CHXO	ISB	OSB	SCCL	
	Total	Overall					
		0	0	0	0	0	0
NTPK	2	0.003	0	0	0.006	0.022	0
		0.005	0	0	0.012	0.044	0
PDFH	3	0.005	0.005	0.011	0	0	0
		0.006	0.011	0.015	0	0	0
PDSG*	**3**	**0.009**	**0**	**0.013**	**0.016**	**0**	**0**
		0.011	**0**	**0.018**	**0.032**	**0**	**0**
PNMW*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
RBTT	0	0	0	0	0	0	0
		0	0	0	0	0	0
RVCS	47	0.099	0.061	0.137	0.107	0.084	0
		0.039	0.053	0.083	0.074	0.122	0
SFCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
SGER*	**102**	**0.205**	**0.131**	**0.131**	**0.302**	**0.486**	**0**
		0.09	**0.076**	**0.061**	**0.259**	**0.555**	**0**
SHRH	33	0.07	0.067	0.048	0.105	0.057	0
		0.036	0.047	0.039	0.103	0.114	0
SMBF	3	0.006	0	0	0.021	0	0
		0.012	0	0	0.043	0	0
SNSG*	**276**	**0.573**	**0.54**	**0.784**	**0.34**	**0.774**	**0**
		0.182	**0.204**	**0.451**	**0.135**	**1.107**	**0**
SNSN*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
STCT	0	0	0	0	0	0	0
		0	0	0	0	0	0
STSN	0	0	0	0	0	0	0

			CHXO	ISB	OSB	SCCL	
	Total	Overall					
		0	0	0	0	0	0
UCA	0	0	0	0	0	0	0
		0	0	0	0	0	0
UCS	0	0	0	0	0	0	0
		0	0	0	0	0	0
UCY	0	0	0	0	0	0	0
		0	0	0	0	0	0
UNID	0	0	0	0	0	0	0
		0	0	0	0	0	0
WLYE	1	0.002	0.005	0	0	0	0
		0.003	0.011	0	0	0	0
WSMW*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
WTCP	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTSK	9	0.017	0.011	0.032	0.012	0	0
		0.012	0.015	0.028	0.024	0	0
YWPH	0	0	0	0	0	0	0
		0	0	0	0	0	0

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

			CHXO	ISB	OSB	SCCL		SCCS	
Species	Total Catch	Overall CPUE	CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP
BKSB	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
BMBF	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
BRBT	3	0.005	0	0	0.008	0.013	0.036	0	0
		0.006	0	0	0.015	0.025	0.073		0
BUSK*	**3**	**0.005**	**0.005**	**0**	**0.012**	**0**	**0**	**0**	**0**
		0.005	**0.01**	**0**	**0.017**	**0**	**0**		**0**
CARP	7	0.011	0.007	0.011	0.012	0.012	0.037	0	0
		0.008	0.014	0.015	0.017	0.024	0.075		0
CNCF	32	0.052	0.027	0.07	0.053	0.048	0.133	0	0
		0.025	0.024	0.043	0.066	0.045	0.267		0
ERSN	11	0.02	0.005	0.045	0.008	0.036	0	0	0
		0.015	0.01	0.049	0.016	0.04	0		0
FHCB	53	0.084	0.055	0.12	0.058	0.1	0.171	0.392	0
		0.028	0.041	0.056	0.045	0.107	0.193		0
FHMW	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
GDEY	16	0.025	0	0.005	0.09	0	0	0	0
		0.029	0	0.011	0.109	0	0		0
HBNS*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**		**0**
IODR	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
LNDC	20	0.033	0.029	0.055	0.031	0.013	0	0	0
		0.022	0.042	0.059	0.033	0.025	0		0
LNSK	36	0.06	0.068	0.077	0.045	0.026	0.037	0.784	0
		0.038	0.091	0.086	0.041	0.036	0.074		0
NRBD	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
NTPK	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
PDFH	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL		SCCS	
			CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP
PDSG*	**14**	**0.022**	**0.038**	**0.011**	**0.007**	**0.024**	**0.073**	**0**	**0**
		0.012	**0.032**	**0.015**	**0.013**	**0.033**	**0.098**		**0**
PNMW*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**		**0**
RBTT	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
RVCS	34	0.056	0.039	0.082	0.022	0.071	0.202	0	0
		0.029	0.032	0.083	0.025	0.099	0.19		0
SFCB*	**2**	**0.003**	**0**	**0.005**	**0**	**0**	**0.038**	**0**	**0**
		0.004	**0**	**0.011**	**0**	**0**	**0.075**		**0**
SGCB*	**141**	**0.219**	**0.178**	**0.164**	**0.285**	**0.233**	**0.46**	**0**	**0**
		0.063	**0.098**	**0.104**	**0.153**	**0.183**	**0.397**		**0**
SGER*	**34**	**0.059**	**0.029**	**0.023**	**0.098**	**0.115**	**0.044**	**0**	**0.303**
		0.024	**0.026**	**0.023**	**0.055**	**0.129**	**0.089**		**0.606**
SHRH	22	0.036	0.029	0.026	0.055	0.039	0.036	0	0
		0.016	0.023	0.026	0.039	0.059	0.073		0
SMBF	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
SNSG*	**160**	**0.259**	**0.339**	**0.22**	**0.263**	**0.085**	**0.478**	**0**	**0**
		0.066	**0.163**	**0.101**	**0.123**	**0.076**	**0.258**		**0**
SNSN*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**		**0**
STCT	5	0.008	0.005	0	0.026	0	0	0	0
		0.009	0.01	0	0.031	0	0		0
STSN	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
UCA	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
UCS	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
UCY	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
UNID	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
WLYE	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL		SCCS	
			CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP
WSMW*	**8**	**0.012**	**0.005**	**0.017**	**0**	**0.036**	**0.048**	**0**	**0**
		0.011	**0.01**	**0.019**	**0**	**0.071**	**0.096**		**0**
WTCP	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0		0
WTSK	15	0.03	0.031	0.054	0.011	0.014	0.038	0	0
		0.027	0.044	0.084	0.022	0.027	0.075		0
YWPH	1	0.001	0	0.006	0	0	0	0	0
		0.003	0	0.011	0	0	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 BAR	ISB BAR	OSB BAR	SCCL BAR	SCCS BAR	SCN BAR	TRMS BAR
BKSB	16	0.17	0.034	0.04	1.667	0	0.25	0	0
		0.173	0.069	0.08	2.348	0	0.342	0	0
BMBF	2	0.021	0.034	0	0.167	0	0	0	0
		0.03	0.069	0	0.333	0	0	0	0
BRBT	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
BUSK*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CARP	16	0.17	0.069	0.4	0.167	0.143	0.062	0	0
		0.112	0.138	0.327	0.333	0.286	0.125	0	0
CNCF	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
ERSN	380	4.043	6.172	3.56	2.833	1.429	1.688	0.5	23.5
		2.19	6.482	2.092	2.39	1.354	0.908	1	3
FHCB	626	6.66	2.586	3.52	0.167	1.357	26.688	0.5	7.5
		8.666	2.086	2.436	0.333	1.549	50.716	1	11
FHMW	740	7.872	4	10.68	14.167	1.357	13.5	5.5	13
		4.655	2.916	14.739	17.308	1.462	11.9	5	18
GDEY	23	0.245	0.103	0.16	1	0.429	0	1	1
		0.181	0.207	0.32	1.366	0.718	0	0	2
HBNS*	**3**	**0.032**	**0**	**0**	**0**	**0**	**0**	**0**	**1.5**
		0.047	**0**	**0**	**0**	**0**	**0**	**0**	**1**
IODR	0	0	0	0	0	0	0	0	0

			CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
		0	0	0	0	0	0	0	0
LNDC	431	4.585	2.69	9.28	2.167	2.786	3.938	0	3
		2.955	2.259	10.349	1.406	3.472	3.253	0	0
LNSK	765	8.138	9.621	18.12	0	0.071	1.938	0	0.5
		6.8	12.217	20.875	0	0.143	3.349	0	1
NRBD	1	0.011	0	0	0	0	0	0	0.5
		0.021	0	0	0	0	0	0	1
NTPK	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
PDFH	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
PDSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PNMW*	**1**	**0.011**	**0**	**0**	**0.167**	**0**	**0**	**0**	**0**
		0.021	**0**	**0**	**0.333**	**0**	**0**	**0**	**0**
RBTT	2	0.021	0.069	0	0	0	0	0	0
		0.03	0.096	0	0	0	0	0	0
RVCS	1958	20.83	13.138	20.88	0.5	18.786	44.062	6.5	35.5
		9.526	16.565	15.6	0.683	14.389	36.591	13	71
SFCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
SGER*	**13**	**0.138**	**0.103**	**0.08**	**0.5**	**0**	**0.188**	**0.5**	**0.5**
		0.094	**0.115**	**0.111**	**1**	**0**	**0.272**	**1**	**1**
SHRH	38	0.404	0.069	0.16	0	0.571	1.438	0	0.5
		0.488	0.138	0.222	0	0.857	2.745	0	1
SMBF	4	0.043	0.034	0.12	0	0	0	0	0

			CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
		0.052	0.069	0.176	0	0	0	0	0
SNSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
SNSN*	**803**	**8.543**	**3.483**	**4.96**	**8**	**0.071**	**26.188**	**0**	**55**
		7.102	**2.912**	**5.031**	**9.223**	**0.143**	**39.241**	**0**	**18**
STCT	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
STSN	10	0.106	0.103	0.28	0	0	0	0	0
		0.088	0.115	0.295	0	0	0	0	0
UCA	2	0.021	0.069	0	0	0	0	0	0
		0.03	0.096	0	0	0	0	0	0
UCS	15	0.16	0.517	0	0	0	0	0	0
		0.298	0.966	0	0	0	0	0	0
UCY	3	0.032	0.034	0.08	0	0	0	0	0
		0.036	0.069	0.111	0	0	0	0	0
UNID	2	0.021	0	0	0	0.143	0	0	0
		0.043	0	0	0	0.286	0	0	0
WLYE	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0
WSMW*	**56**	**0.596**	**0.655**	**0.12**	**0**	**0**	**1.875**	**1**	**1**
		0.684	**0.814**	**0.133**	**0**	**0**	**3.75**	**2**	**0**
WTCP	7	0.074	0	0	0	0.429	0	0.5	0
		0.129	0	0	0	0.857	0	1	0
WTSK	225	2.394	2.552	1.52	2	0.714	5.562	0	1
		1.648	2.701	1.065	3.225	0.768	8.103	0	0
YWPH	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0

Appendix F7. Push Trawl: overall season and segment summary. Lists CPUE (fish/ 100 m trawled) and 2 standard errors in brackets.

			CHXO	ISB	OSB	SCCL	
Species	Total Catch	Overall CPUE	BAR	BAR	BAR	BAR	CHNB
BKSB	0	0	0	0	0	0	0
		0	0	0	0	0	
BMBF	0	0	0	0	0	0	0
		0	0	0	0	0	
BRBT	0	0	0	0	0	0	0
		0	0	0	0	0	
BUSK*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
CARP	0	0	0	0	0	0	0
		0	0	0	0	0	
CNCF	2	0.016	0.031	0.017	0	0	0
		0.023	0.062	0.033	0	0	
ERSN	10	0.094	0.031	0.014	0	0.342	0
		0.143	0.062	0.028	0	0.607	
FHCB	14	0.127	0.073	0.192	0	0.103	0
		0.107	0.101	0.215	0	0.205	
FHMW	2	0.024	0	0.028	0	0.051	0
		0.033	0	0.056	0	0.103	
GDEY	1	0.009	0	0	0	0.038	0
		0.018	0	0	0	0.076	
HBNS*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
IODR	1	0.006	0	0	0	0.026	0

			CHXO	ISB	OSB	SCCL	
		0.012	0	0	0	0.051	
LNDC	25	0.195	0.133	0.366	0	0	0
		0.144	0.195	0.298	0	0	
LNSK	3	0.029	0	0.045	0	0.043	0
		0.034	0	0.065	0	0.087	
NRBD	0	0	0	0	0	0	0
		0	0	0	0	0	
NTPK	0	0	0	0	0	0	0
		0	0	0	0	0	
PDFH	0	0	0	0	0	0	0
		0	0	0	0	0	
PDSG*	**4**	**0.038**	**0**	**0.038**	**0**	**0.093**	**0**
		0.044	**0**	**0.075**	**0**	**0.126**	
PNMW*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
RBTT	0	0	0	0	0	0	0
		0	0	0	0	0	
RVCS	0	0	0	0	0	0	0
		0	0	0	0	0	
SFCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
SGCB*	**9**	**0.07**	**0.132**	**0.025**	**0**	**0.092**	**0**
		0.056	**0.149**	**0.05**	**0**	**0.125**	
SGER*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
SHRH	10	0.11	0.031	0.074	1.61	0.051	0
		0.1	0.062	0.084	1.658	0.103	
SMBF	0	0	0	0	0	0	0
		0	0	0	0	0	

			CHXO	ISB	OSB	SCCL	
SNSG*	**1**	**0.009**	**0**	**0.02**	**0**	**0**	**0**
		0.017	**0**	**0.04**	**0**	**0**	
SNSN*	**4**	**0.042**	**0**	**0.014**	**0**	**0.154**	**0**
		0.072	**0**	**0.028**	**0**	**0.308**	
STCT	0	0	0	0	0	0	0
		0	0	0	0	0	
STSN	0	0	0	0	0	0	0
		0	0	0	0	0	
UCA	0	0	0	0	0	0	0
		0	0	0	0	0	
UCS	0	0	0	0	0	0	0
		0	0	0	0	0	
UCY	0	0	0	0	0	0	0
		0	0	0	0	0	
UNID	0	0	0	0	0	0	0
		0	0	0	0	0	
WLYE	0	0	0	0	0	0	0
		0	0	0	0	0	
WSMW*	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	
WTCP	0	0	0	0	0	0	0
		0	0	0	0	0	
WTSK	8	0.088	0	0.028	1.626	0.077	0
		0.123	0	0.057	3.252	0.154	
YWPH	0	0	0	0	0	0	0
		0	0	0	0	0	

Appendix G. Hatchery names, locations, and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2007 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	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
BKSB	0.000		0.000	0.000	0.170	0.000	0.000
BMBF	0.000		0.000	0.000	0.021	0.000	0.000
BRBT	0.000		0.010	0.004	0.000	0.000	0.000
BUSK*	**0.098**		**0.009**	**0.018**	**0.000**	**0.000**	**0.000**
CARP	0.000		0.022	0.000	0.170	0.000	0.000
CNCF	0.072		0.096	0.032	0.000	0.006	0.016
ERSN	0.000		0.039	0.000	4.043	0.000	0.094
FHCB	0.087		0.123	0.014	6.660	0.045	0.127
FHMW	0.000		0.000	0.000	7.872	0.000	0.024
GDEY	0.408		0.046	0.137	0.245	0.003	0.009
HBNS*	**0.000**		**0.000**	**0.000**	**0.032**	**0.000**	**0.000**
IODR	0.000		0.000	0.000	0.000	0.000	0.006
LNDC	0.000		0.065	0.000	4.585	0.000	0.195
LNSK	0.021		0.073	0.031	8.138	0.048	0.029
NFSH	0.000		0.000	0.000	0.000	0.000	0.000
NRBD	0.000		0.000	0.000	0.011	0.000	0.000
NTPK	0.003		0.000	0.003	0.000	0.000	0.000
PDFH	0.010		0.000	0.000	0.000	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
PDSG*	**0.008**		**0.021**	**0.009**	**0.000**	**0.023**	**0.038**
PNMW*	**0.000**		**0.000**	**0.000**	**0.011**	**0.000**	**0.000**
RBTT	0.000		0.000	0.000	0.021	0.000	0.000
RVCS	0.166		0.101	0.031	20.830	0.011	0.000
SFCB*	**0.000**		**0.003**	**0.000**	**0.000**	**0.003**	**0.000**
SGCB*	**0.000**		**0.380**	**0.000**	**0.000**	**0.053**	**0.070**
SGER*	**0.273**		**0.055**	**0.136**	**0.138**	**0.062**	**0.000**
SHRH	0.109		0.039	0.030	0.404	0.033	0.110
SMBF	0.012		0.000	0.000	0.043	0.000	0.000
SNSG*	**0.313**		**0.337**	**0.839**	**0.000**	**0.178**	**0.009**
SNSN*	**0.000**		**0.000**	**0.000**	**8.543**	**0.000**	**0.042**
STCT	0.000		0.016	0.000	0.000	0.000	0.000
STSN	0.000		0.000	0.000	0.106	0.000	0.000
UCA	0.000		0.000	0.000	0.021	0.000	0.000
UCS	0.000		0.000	0.000	0.160	0.000	0.000
UCY	0.000		0.000	0.000	0.032	0.000	0.000
UNID	0.000		0.000	0.000	0.021	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
WLYE	0.003		0.000	0.000	0.000	0.000	0.000
WSMW*	**0.000**		**0.024**	**0.000**	**0.596**	**0.000**	**0.000**
WTCP	0.000		0.000	0.000	0.074	0.000	0.000
WTSK	0.030		0.041	0.004	2.394	0.018	0.088
YWPH	0.000		0.000	0.000	0.000	0.003	0.000

Appendix I. Comprehensive list of bend numbers and locations for segment 2 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2006-2007.

		Coordinates*			
Bend Number	**Bend River Mile**	**Lattidude**	**Longitude**	**2006**	**2007**
1	1761	48.05581	106.32055	ST, FC	
2	1760				
3	1759	48.04416	106.28819		ST, FC
4	1757.5				
5	1756				
6	1754.5				
7	1753	48.02938	106.16258		ST, FC
8	1751				
9	1749.5	48.02872	106.12263	ST, FC	
10	1747				
11	1745				
12	1744	48.03534	106.08521	ST, FC	ST, FC
13	1741.5				
14	1740	48.00255	106.02716		ST, FC
15	1738				
16	1736.5	48.03137	106.00100		ST, FC
17	1735				
18	1733	48.01287	105.95323	ST, FC	
19	1732	48.01149	105.93182	ST, FC	ST, FC
20	1730.5				
21	1728.5				
22	1727.5				
23	1726.5	48.019	105.87228	ST, FC	ST, FC
24	1725.5				
25	1723.5				
26	1722	48.02402	105.79479		ST, FC
27	1720				
28	1719	48.04468	105.76749	ST, FC	ST, FC
29	1717.5				
30	1716				
31	1714				
32	1712	48.05313	105.66531		ST, FC

		Coordinates*			
Bend Number	**Bend River Mile**	**Lattidude**	**Longitude**	**2006**	**2007**
33	1710.5	48.04739	105.66245	ST, FC	
34	1710	48.05159	105.64158	ST, FC	
35	1709	48.0696	105.64798	ST, FC	
36	1707.5				
37	1706.5	48.07407	105.62061	ST, FC	ST, FC
38	1705.5				
39	1704.5	48.08012	105.58631	ST, FC	ST, FC
40	1703				

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