

2007 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 3



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

Eighty-six hatchery reared juvenile pallid sturgeon were sampled in segment 3 of the Missouri River during 2007, an increase from 49 in 2006. Four individual pallid sturgeon were sampled twice in 2007 and one individual was sampled three times. Additionally, 86 pallid capture events occurred in randomly selected river bends in accordance with the Pallid Sturgeon Population Assessment Program, while 6 capture events occurred in non-randomly sampled river bends. The CPUE for pallid sturgeon in standard gears did not differ greatly in 2007 than that of 2006. The increase in numbers of pallid sturgeon sampled was due to an increase in total effort in 2007. Twenty random river bends were sampled in 2007, an increase from 12 in 2006. Increased effort in 2007 also included the use of the experimental push trawl and wild sampling of trotlines.

No wild or adult pallid sturgeon were sampled in segment 3 during 2006 or 2007. Hatchery reared juvenile pallid sturgeon were sampled throughout the length of segment 3 in 2007. Thirteen pallid sturgeon were sampled in one river bend at river mile 1589.5, near Nohly, MT. Congregations of pallid sturgeon were observed throughout the segment with 16 captures taking place in non-random duplicate subsamples.

Six different age classes of pallid sturgeon were sampled. Pallid sturgeon consisted of age-1 (N = 27), age-2 (N = 37), age-3 (N = 4), age-4 (N = 7) and age-5 (N = 8). This was an increase from 2006 when only four age classes were found.

The experimental push trawl had a lower CPUE for pallid or shovelnose sturgeon than that of the standard otter trawl. However, the push trawl did have a significantly higher CPUE of sturgeon chubs, a native target species of the Population Assessment Program. Additionally, trotlines sampled 16 pallid sturgeon in only 4 river bends effort. Trotlines will be further evaluated in 2008 to better understand their potential utility in the Population Assessment Program.

Nearly twice as many shovelnose sturgeon were sampled in segment 3 during 2007 from 2006. Again, an increase in effort was the main reason the total catch increased so substantially, since the CPUE of standard gears stayed relatively consistent between 2007 and 2006. The

presence of YOY and age-1 shovelnose sturgeon in segment 3 indicates that successful recruitment is occurring within this segment.

Some species of native fishes showed significant decreases in their relative abundance during 2007 from 2006 (e.g. fathead minnows and white suckers), while others had substantial increases (e.g. river carpsuckers, flathead chubs, and goldeye). Differences in discharge and turbidity between 2007 and 2006 are likely factors affecting the recruitment of many species within segment 3. Further years of study will be needed to directly tie the effects of discharge and turbidity to specific species production.

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Introduction

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

The Pallid Sturgeon Population Assessment Program (program) is guided by the RPA's in the 2003 Amendment to the 2000 Biological Opinion. The program is a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitats used by wild and hatchery reared juvenile pallid sturgeon (Drobish 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 2007 the experimental push trawl and wild trotlines were used at a lesser effort than standard gears in segment 3.

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 platyrhynchus*, 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

Montana Fish, Wildlife & Parks samples three segments on the Missouri River below Fort Peck Dam to its confluence with the Yellowstone River in accordance with the Pallid Sturgeon Population Assessment Program. Study segment 3 of the Missouri River Pallid Sturgeon Population Assessment Program encompasses 119 river miles from Wolf Point, MT to the confluence of the Missouri and Yellowstone Rivers in North Dakota. In this large section, the river has completely transitioned from a cold clear cobble substrate river to a warm turbid prairie river, more similar to its natural characteristics (Galat et al, 2005). The aggrading streambed of segment 3 is flanked by stream deposited sediment of the Fort Union Formation (NRIS, 2007). This stretch of river is less flow regulated than upstream segments due to the upstream tributaries and runoff events. There are five major tributaries that influence this section of river, which include the Milk River, Redwater River, Poplar River, Big Muddy Creek, and Prairie Elk Creek. These sediment packed tributaries flush their warmer turbid waters into the Missouri River increasing flows and sediment load, which in turn enables sandbar and island formation. Turbidities in this stretch of river are greater than that of segment 2 and discharge constantly changes with precipitation events and tributary discharge. The species composition of this stretch of river is vastly different from the uppermost segment just below Fort Peck Dam. The non-native fish stocked for recreation are much less prevalent and the prevalence of native, non-sport fish is increased (Gardner and Stewart, 1987). This stretch of ever-changing river is diverse with over 36 species of fish, many of which are benthic specialists, exhibiting streamlined bodies and well-developed chemosensory organs for surviving the sometimes high flows and ever-turbid waters (Galat et al, 2005; Berry et al. 2004). This highly dynamic stretch of river is more reminiscent of what the Missouri River looked like before it became one of the most regulated and impounded rivers in the United States (Galat et al, 2005).

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 nephelometric 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 ($\sim 2 \text{ cm}^2$) 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.

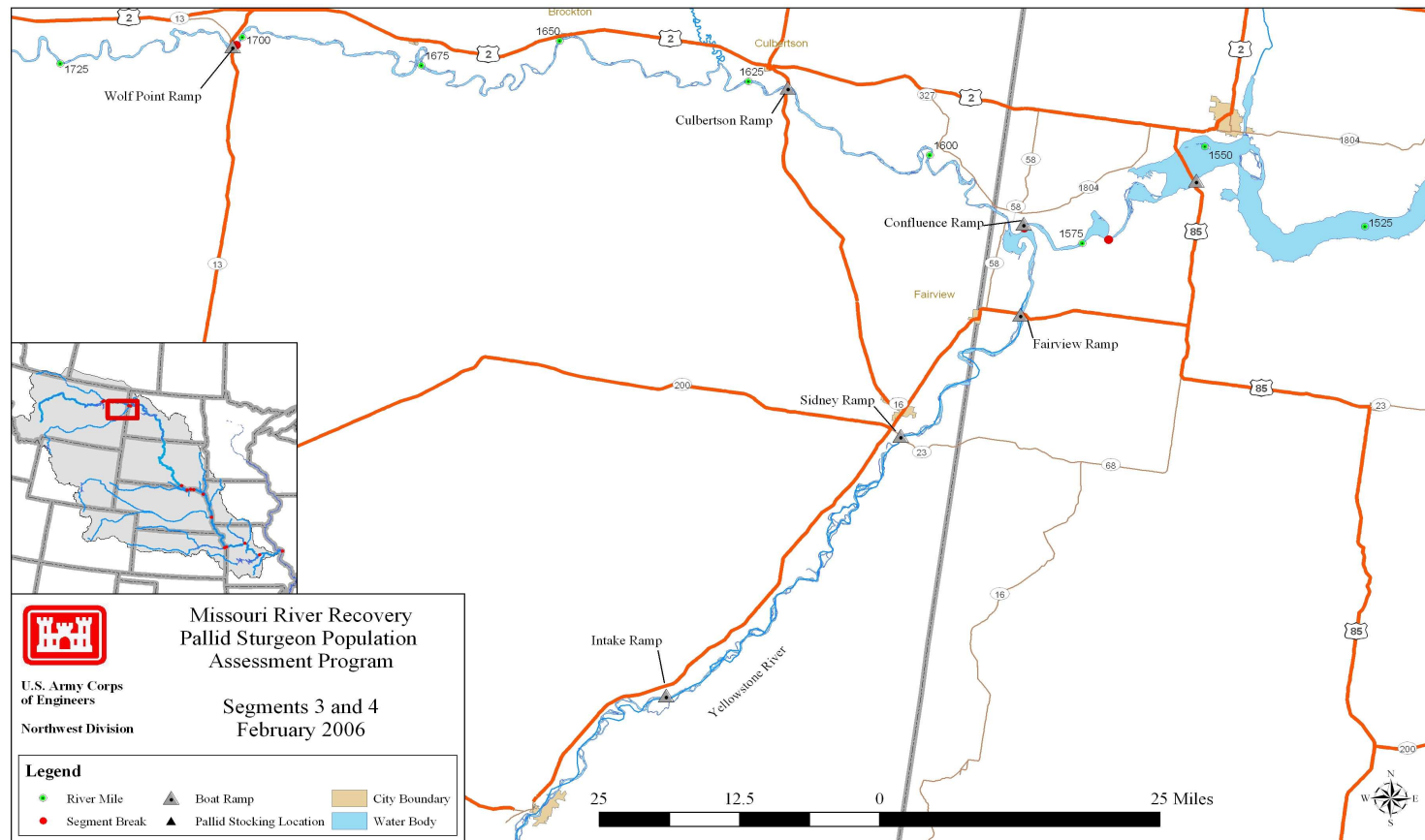


Figure 1a. Map of segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile.1701.0) to the confluence of the Yellowstone, River (River Mile 1582.0).

Results

Pallid Sturgeon

A total of 86 pallid sturgeon were sampled in segment 3 during 2007. However, 92 pallid sturgeon capture events occurred given that 4 individual pallids were captured on two occasions and one was recaptured on 3 separate occasions. All CPUE estimates, abundance graphs, and distribution graphs are for pallid captures, and therefore may be slightly biased by recaptures. Sampling in 2007 consisted of 20 random bends sampled both during the sturgeon and fish community seasons. This was an increase in both effort and pallid captured from 2006 when 12 river bends were sampled and 49 pallid sturgeon were captured (Figure 9). One pallid sturgeon sampled in 2007 was of unknown origin, while the remaining 85 were of verified hatchery origin. A genetic sample was taken on this one unknown fish, but the results are not available at this time. During 2006 one pallid sturgeon of unknown origin was sampled in segment 3, but since then genetic results have positively identified this fish as being of hatchery origin. Subsequently, no known wild pallid sturgeon have been observed during standard sampling in segment 3 for either 2006 or 2007.

Pallid sturgeon were sampled in 19 river bends throughout the length of segment 3 (Figure 1b). The most pallids captured in one river bend was 13, at river mile 1589.5, which is situated in the downstream portion of segment 3 near Nohly, MT. The next highest catch of pallid sturgeon ($N = 11$) was observed at river mile 1695.0, which is in the upstream area of segment 3 approximately 7-river miles from its border with segment 2 near Wolf Point, MT.

A limited size distribution of pallid sturgeon was observed for segment 3 during 2007 (Figure 8). No pallid sturgeon larger than 483 mm FL or smaller than 161 mm FL were sampled. Therefore, no evidence of adult pallid sturgeon were found in segment 3. However, six age classes of pallid sturgeon were sampled during 2007. Pallid sturgeon consisted of age-1 ($N = 27$), age-2 ($N=37$), age-3 ($N = 4$), age-4 ($N = 7$), age-5 ($N = 8$), and age-6 ($N = 7$) (Table 6). This was an increase over 2006 where only four-year classes were found.

Although the average lengths of pallid sturgeon in segment 3 increased as fish aged, a decreasing trend was seen in the relative condition factors (Table 6). Interestingly, the average size of age-6 pallid sturgeon were smaller (mean FL = 387 mm) than that of age-5 fish (mean FL = 412 mm) (Table 6). Similarly, for the most part growth rates of pallid sturgeon decreased as age increased (Table 6). The highest growth rate for a year class was observed for the 2006-year class at 0.32 mm/day, compared to the lowest growth rate of 0.076 mm/day for the 2001-year class pallids (Table 6).

More pallid sturgeon were sampled during the fish community season (N = 64) than during the sturgeon season (N = 28). The otter trawl captured more pallid sturgeon (N = 49), than trammel nets (N = 23), trotlines (N = 16), or push trawls (N = 4). During the sturgeon season, otter trawl CPUE was similar in 2007 (0.034 fish/ 100 m) to 2006 (0.030 fish/ 100 m) (Figure 2). However, an increase in CPUE for trammel nets did occur in 2007 (0.014 fish/ 100 m), when compared to 2006 (0.007 fish/ 100 m) (Figure 3). This increase will likely be higher if the one pallid of unknown origin turns out to be a hatchery-reared fish, since the current CPUE is based on hatchery-reared pallids only. In contrast to the sturgeon season, trammel net CPUE decreased in 2007 (0.030 fish/ 100 m) from 2006 (0.069 fish/ 100 m) during the fish community season (Figure 5). However, otter trawl CPUE did increase during the fish community season of 2007 (0.05 fish/ 100m) from 2006 (0.03 fish/ 100 m) (Figure 5). No pallid sturgeon were sampled in the mini fyke nets during either 2006 or 2007. Push trawl CPUE can be found in Appendix H. Additionally, trotline CPUE has not been estimated for 2007 at this time.

Of the total pallid captures 86 were in random and 6 were in non-randomly chosen river bends. Additionally, of the 86 captures in random river bends, 70 were in random subsamples and 16 were in non-random subsamples (duplicates). These captures in duplicate subsamples indicates that juvenile pallid sturgeon were often times sampled in aggregates.

For macrohabitats, more pallid sturgeon were sampled in channel crossovers (N = 29), than in inside bends (N = 27), large connected secondary channels (N = 21), or outside bends (N = 13) (Table 3). The specific habitat parameters of pallid captures for all macro- and mesohabitats is displayed in Table 6. The proportion of sub-stock and stock sized pallids captured with specific gears in specific habitats and the proportion those habitats were sampled with each gear is given in Tables 9 through 16.

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 03 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	20	9.15	N-E	48	N-E	N-E	N-E	51	37	47	0	0	N-E	N-E	N-E	N-E
Gill Net																
Otter Trawl	20	10.95	N-E	51	N-E	N-E	N-E	64	43	60	0	1	N-E	N-E	N-E	N-E
Summer – Fish Community Season																
1 Inch Trammel Net	20	9.20	N-E	63	N-E	N-E	N-E	56	52	13	0	0	N-E	N-E	N-E	N-E
Mini-Fyke Net	19	7.21	N-E	35	N-E	N-E	N-E	44	1	31	22	4	N-E	N-E	N-E	N-E
Otter Trawl	20	10.70	N-E	61	N-E	N-E	N-E	66	57	30	0	0	N-E	N-E	N-E	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 03 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	Mesohabitat					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	20	9.15	0	177	N-E	6	N-E	N-E
Gill Net								
Otter Trawl	20	10.95	0	211	N-E	7	N-E	N-E
Summer – Fish Community Season								
1 Inch Trammel Net	20	9.20	0	183	N-E	1	N-E	N-E
Mini-Fyke Net	19	7.21	132	5	N-E	0	N-E	N-E
Otter Trawl	20	10.70	0	212	N-E	2	N-E	N-E

Segment 3 - Pallid Sturgeon Captures by River Mile

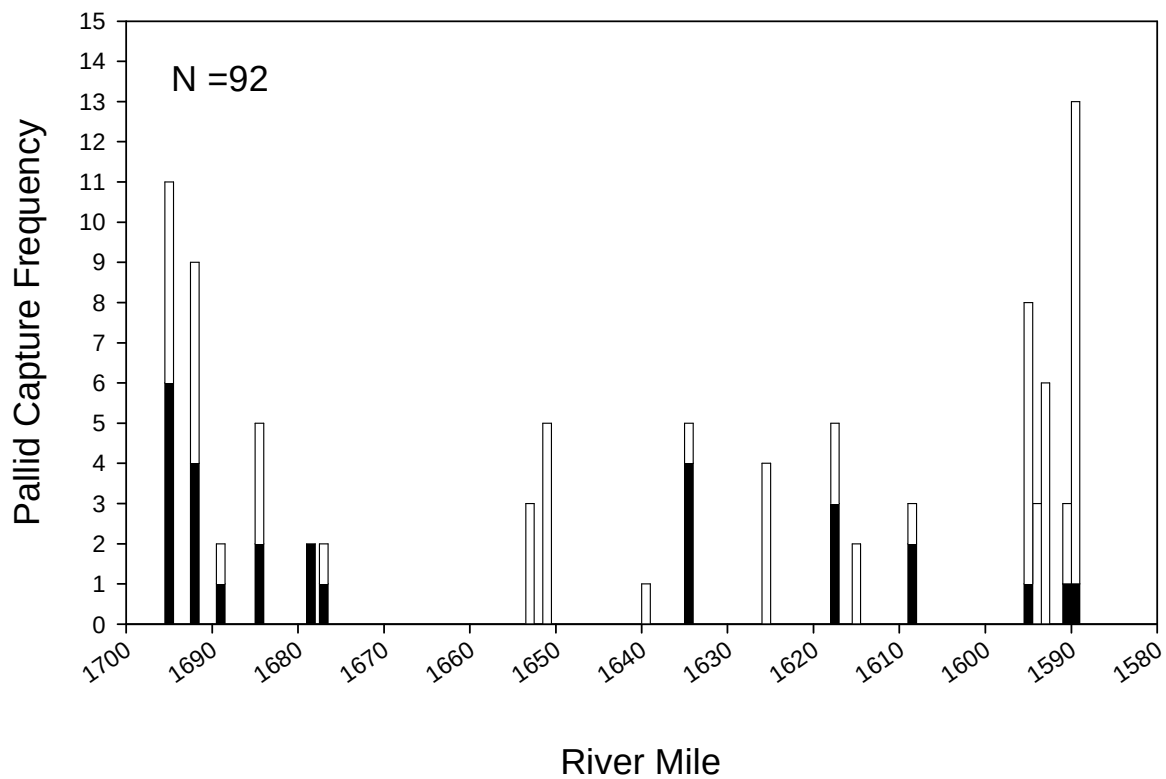


Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 3 of the Missouri River during 2007. Black bars represent pallid captures during sturgeon season and white bars during fish community Season. Figure included all pallid captures including non-random and wild samples.

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

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
CHXO	BAR	0.6 (0.2-1.6)	0.9 (0.5-1.1)	0.26 (0.00-0.77)	0.55 (0.14-0.77)	16.8 (9.0-26.3)	14.6 (9.2-26.2)	81 (26-290)	181 (35-290)	7
	CHNB	1.7 (0.3-4.3)	1.5 (0.7-2.7)	0.69 (0.02-1.14)	0.69 (0.26-0.84)	17.5 (6.4-26.4)	14.9 (6.4-22.2)	310 (16-1600)	160 (16-1300)	22
	ITIP									
ISB	BAR	0.5 (0.2-1.4)	1.1 (1.1-1.1)	0.21 (0.01-0.66)	0.66 (0.66-0.66)	16.2 (7.0-28.0)	7 (7.0-7.0)	51 (11-280)	11 (11-11)	1
	CHNB	1.6 (0.4-4.9)	1.5 (0.7-3.4)	0.65 (0.17-0.88)	0.53 (0.17-0.83)	17.8 (6.6-26.4)	16.1 (6.6-24.6)	317 (16-1600)	313 (16-1600)	26
	ITIP									
OSB	BAR	0.2 (0.2-0.2)		0.03 (0.03-0.03)		9.8 (9.8-9.8)		230 (230-230)		
	CHNB	2.3 (0.5-5.9)	2.5 (1.3-4.0)	0.74 (0.43-1.08)	0.7 (0.57-0.82)	17.8 (6.6-26.5)	17.2 (13.3-26.1)	324 (17-1500)	45 (30-67)	13
	ITIP									
SCCL	BAR	0.6 (0.2-1.1)	0.9 (0.7-1.1)	0.22 (0.00-0.64)	0.59 (0.54-0.64)	18.6 (7.0-26.3)	21.6 (19.7-23.4)	48 (21-85)	45 (45-45)	2
	CHNB	1.3 (0.0-3.6)	1.1 (0.0-2.0)	0.6 (0.02-1.10)	0.52 (0.24-0.71)	18.1 (7.1-26.3)	17 (7.1-22.1)	462 (11-1700)	448 (11-1500)	20
	ITIP	1.5 (0.8-2.5)	1.7 (1.7-1.7)	0.62 (0.49-0.76)	0.52 (0.52-0.52)	16.2 (9.9-21.6)	10 (10.0-10.0)	176 (20-450)	120 (120-120)	1
SCCS	BAR	0.5 (0.1-1.2)		0.1 (0.00-0.34)		19.2 (10.0-24.0)		58 (20-270)		
	CHNB	0.9 (0.6-1.1)		0 (0.00-0.00)		23.2 (23.0-23.4)		80 (80-80)		
	ITIP									
SCCN		0.8				20.3				

Macro-	Meso-	Depth (m) (Effort)	Depth (m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
		(0.8-0.8)				(20.3-20.3)				
	BAR	0.4 (0.2-0.5)		0 (0.00-0.00)		21.6 (18.8-23.5)		106 (23-190)		
	CHNB	0.7 (0.6-0.7)		0 (0.00-0.00)		21.6 (21.3-21.8)		210 (210-210)		

Table 6. Mean fork length, weight, relative condition factor (Kn), growth rates, and water temperature for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from segment 03 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	7	263			387	189.9	0.903	0.076	
		21			27	42.7	0.023	0.020	
2002	8	274	95.3	1.231	412	233.6	0.904	0.106	0.101
		21	9.3	0.020	32	57.2	0.039	0.037	0.087
2003	7	249			334	115.1	0.928	0.080	
					13	10.5	0.077		
2004	4				314	100.3	0.968		
					37	36.1	0.095		
2005	37	264	47.5	1.220	300	84.4	0.961	0.121	0.068
		16	8.7	0.165	11	8.9	0.039	0.011	0.029
2006	27	244	57.3	1.315	228	44.4	1.143	0.320	0.169
		17	11.1	0.135	20	11.4	0.066	0.120	0.063

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

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)	10	.	1.192 (0.078)
Sub-stock (200-329)	9	.	1.014 (0.168)
Stock	9	100	0.858 (0.051)
Quality	0	.	0
Preferred	0	.	0
Memorable	.	.	.
Trophy	.	.	.
Overall Kn	.	.	1.028 (0.081)
Fish Community Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	43	.	1.042 (0.034)
Stock	21	100	0.891 (0.030)
Quality	0	.	0
Preferred	0	.	0
Memorable			
Trophy			
Overall Kn	.	.	0.992 (0.030)

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

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

Segment 3 - Pallid Sturgeon / Sturgeon Season

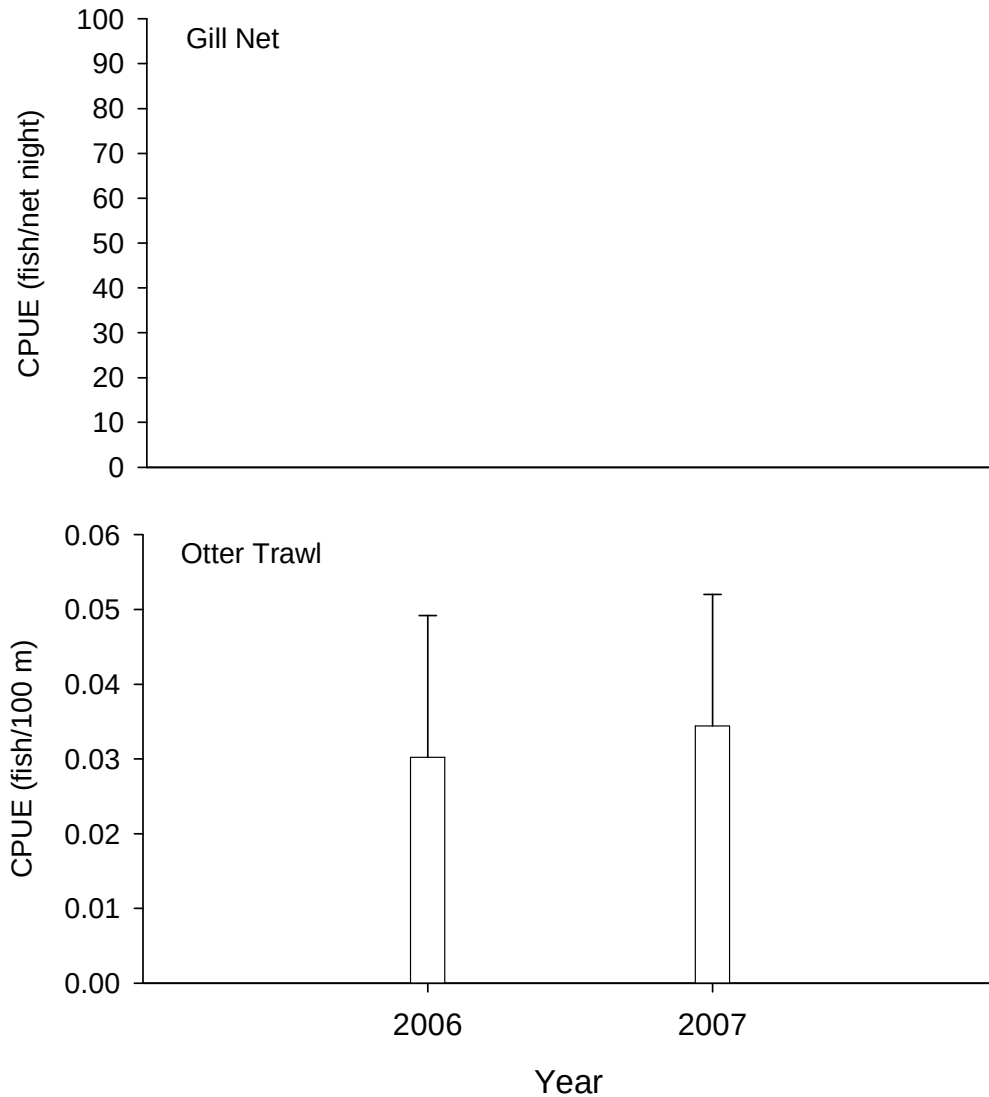


Figure 2. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting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

Segment 3 - Pallid Sturgeon / Sturgeon Season

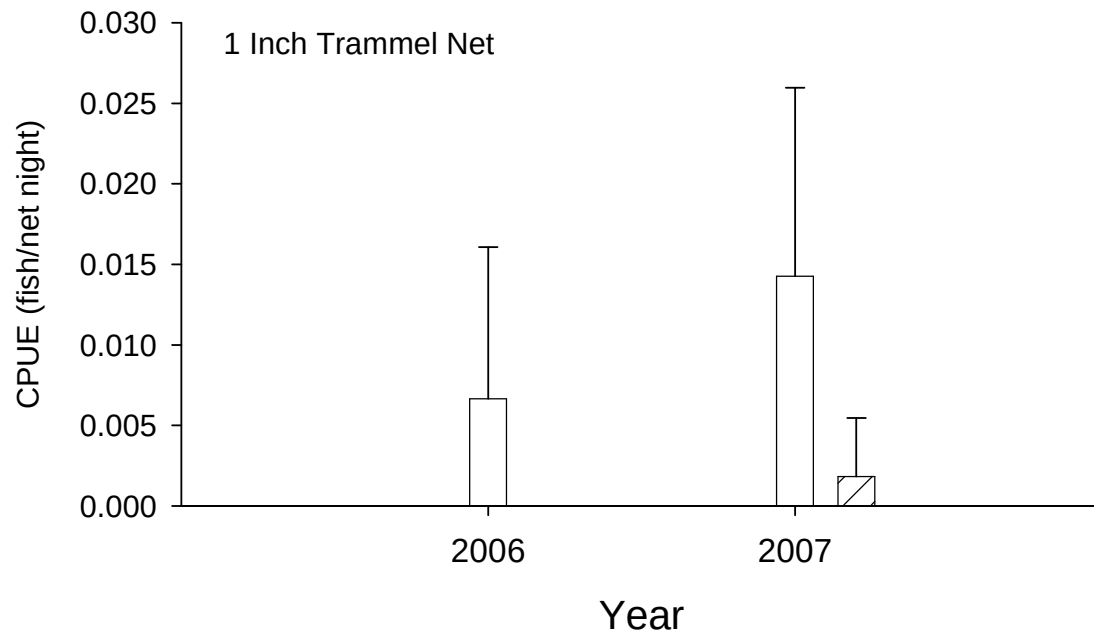


Figure 3. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 trammel nets in segment 3 of the Missouri River during sturgeon season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic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

Segment 3 - Pallid Sturgeon / Fish Community Season

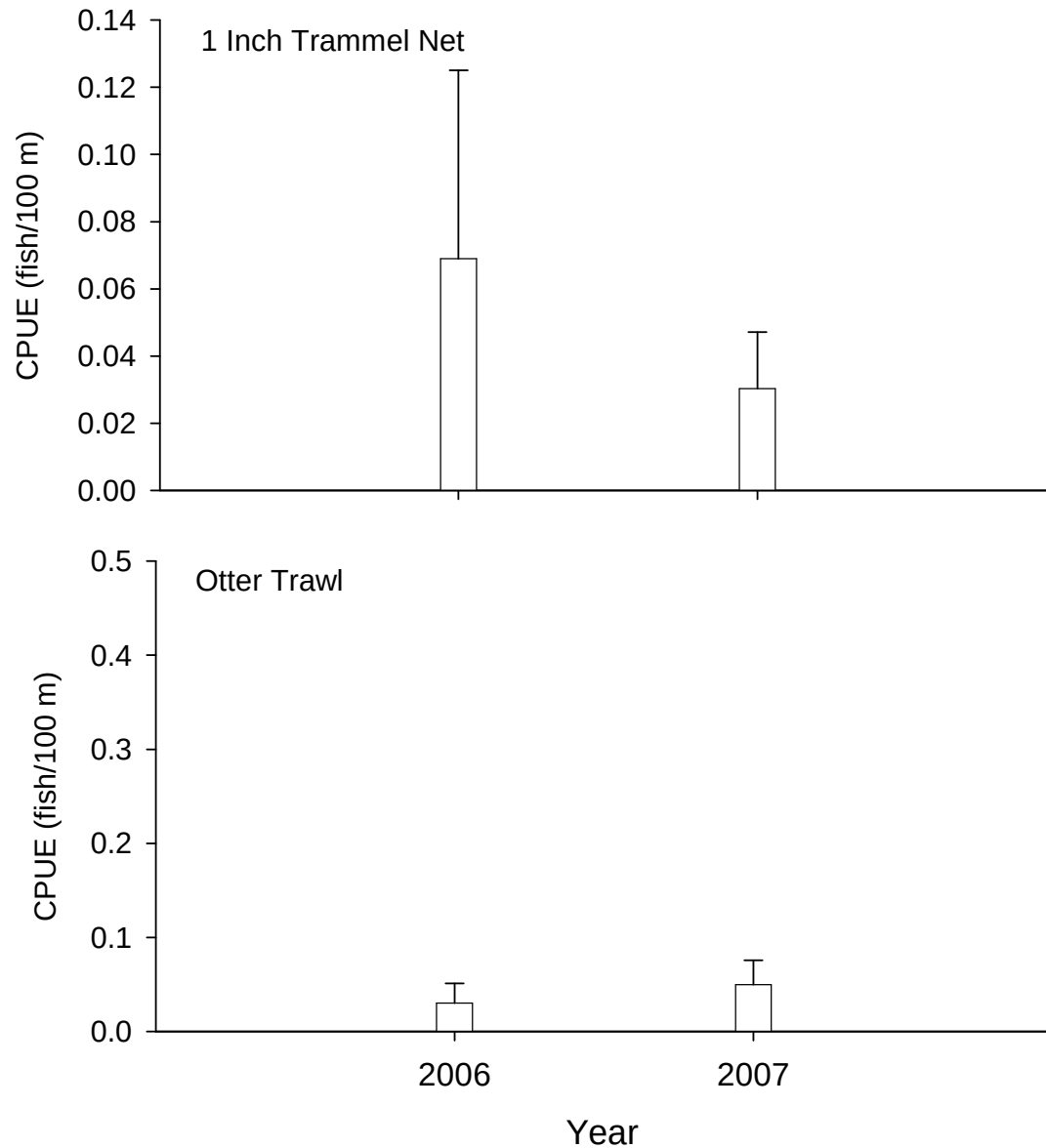


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 3 of the Missouri River during fish community season 2006-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 3 - Pallid Sturgeon / Fish Community Season

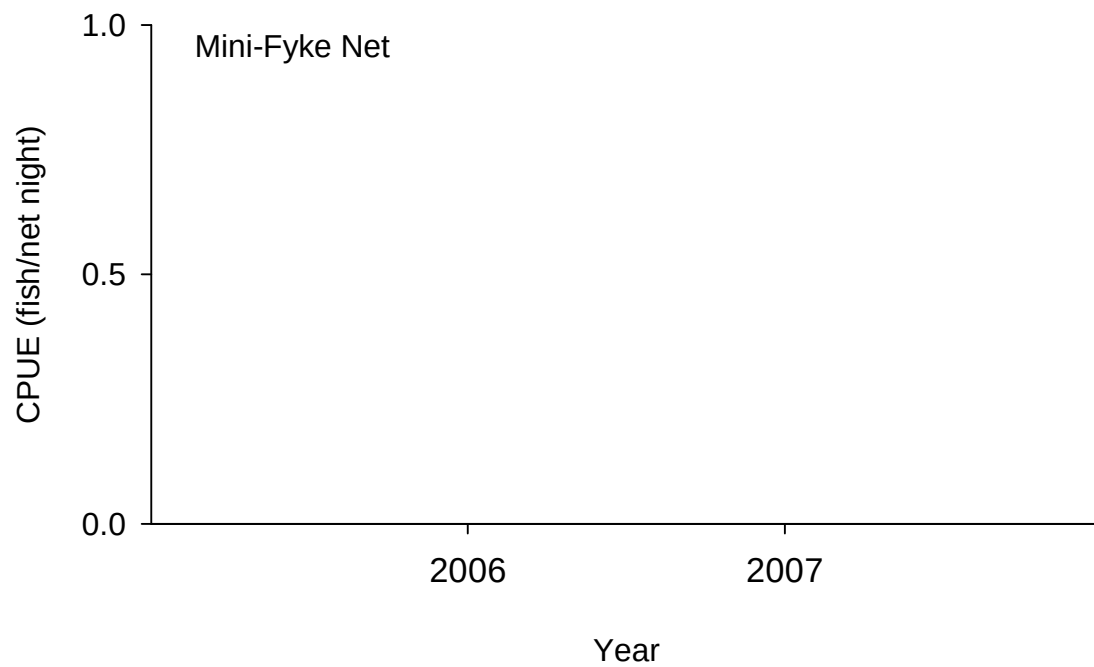


Figure 7. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007. Unknown origin pallid sturgeon are awaiting 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 03 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	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	10	0	30	0	N-E	N-E	50	10	10	0	0	0	0	0	0
	·	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	·	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	·	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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	10	0	100	N-E	0	N-E	N-E
	·	0	97	N-E	2	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	·	0	99	N-E	1	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 03 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	4	0	0	0	N-E	N-E	25	0	75	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net															
Otter Trawl	5	0	20	0	N-E	N-E	20	0	60	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	9	0	44	0	N-E	N-E	11	33	11	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	21	0	19	0	N-E	N-E	24	38	19	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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	4	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	5	0	80	N-E	20	N-E	N-E
	·	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	9	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	21	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	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 03 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	3	0	0	0	N-E	N-E	0	0	100	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	6	0	50	0	N-E	N-E	17	0	33	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	5	0	60	0	N-E	N-E	20	20	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	3	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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	3	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	6	0	100	N-E	0	N-E	N-E
	·	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	5	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	3	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	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 03 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	28	0	N-E	N-E	27	20	25	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	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	30	0	0	0	31	26	14	0	0	0	0	0	0

Table 16. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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.

		Mesohabitat					
Gear	N	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							
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	·	0	97	N-E	2	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

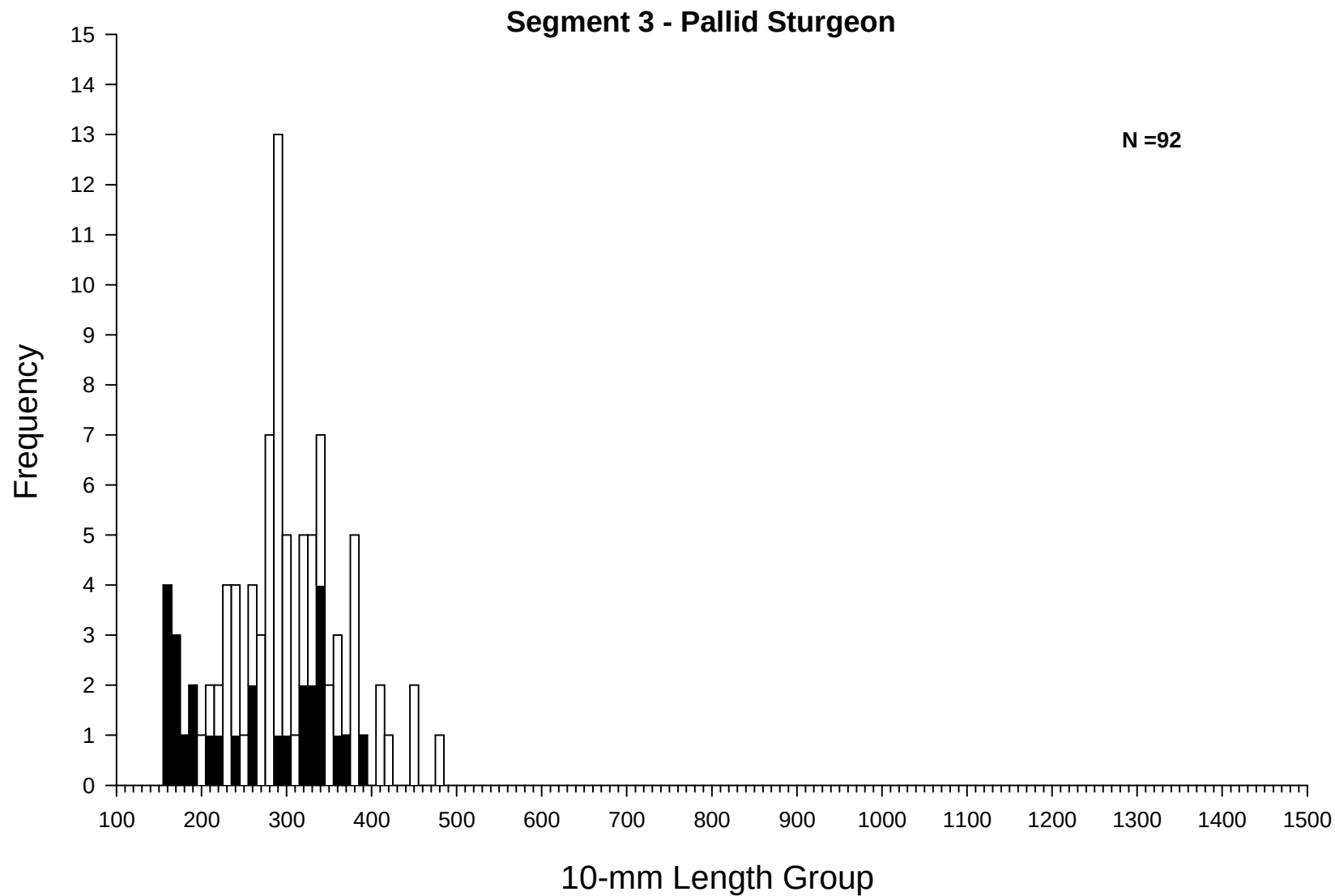


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007 including non-random and wild samples.

Segment 3 - Annual Pallid Sturgeon Capture History

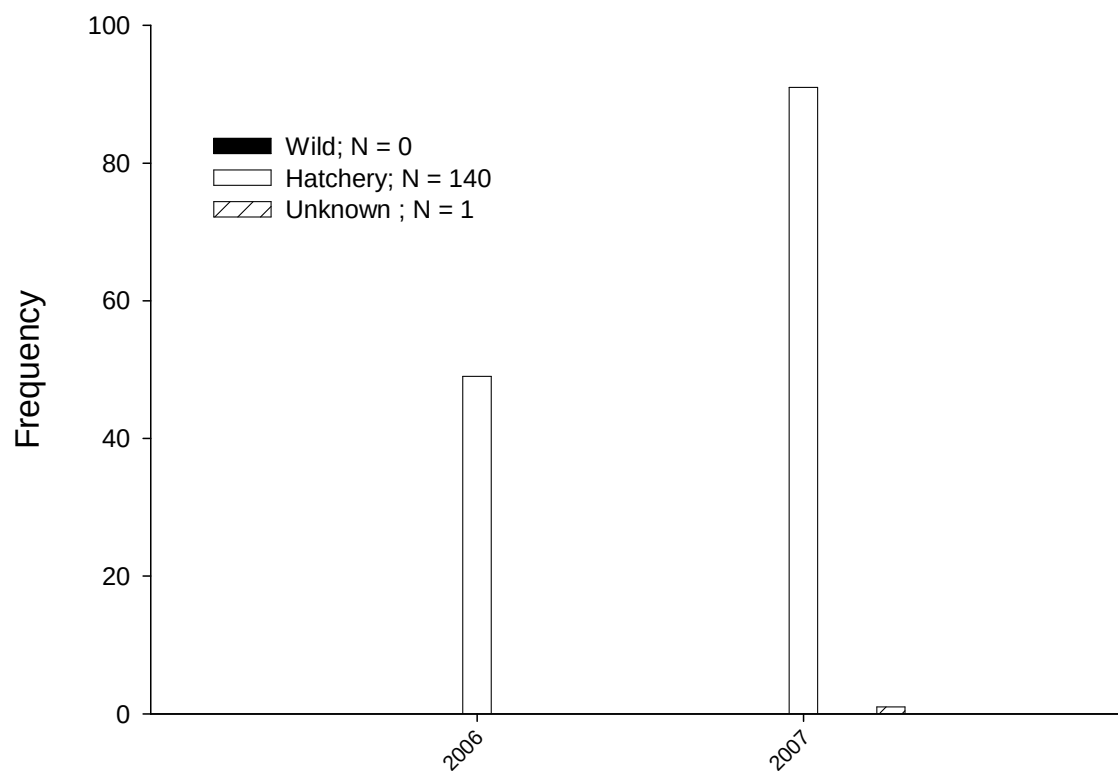


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 3 of the Missouri River from 2006 to 2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose x Pallid Sturgeon Hybrids

No shovelnose x pallid sturgeon hybrids were collected in segment 3 during 2007.

Shovelnose Sturgeon

A total of 293 shovelnose sturgeon were sampled in segment 3 during 2007, and increase from 150 sampled during 2006. Standard gears collected 251 including 178 in trammel nets and 73 in otter trawls. Trotlines, a wild gear, which was not used in 2006, collected an additional 42. More shovelnose sturgeon were sampled during the fish community season (N = 228) than during the sturgeon season (N = 65). Similarly, most small shovelnose (< 300 mm FL) were sampled during the fish community season. Shovelnose sturgeon were distributed throughout the length of segment 3, with more being captured in the upstream half of the segment.

A much wider size distribution of shovelnose sturgeon was observed in segment 3 when compared to pallid sturgeon (Figures 8 and 17). However, only three shovelnose sturgeon < 150 mm FL were sampled. All three of these fish were collected at or downstream of river mile 1595, which is within 10 river miles of the confluence of the Yellowstone River. Based on Steffenson and Hamel (2008) these shovelnose sturgeon < 150 mm FL are likely of age-0. The wide size distribution for 2007 in Figure 17 indicates shovelnose sturgeon from age-0 to older than age-8 (Steffensen and Hamel 2008). However, 73 % of all shovelnose captured were larger than 450 mm FL, which corresponds to fish older than age-7. From the size distribution observed and their corresponding ages, it is apparent that shovelnose sturgeon are recruiting to the adult life stage in segment 3.

The CPUE graphs in Figures 11, 12 and 14 further illustrate the size composition of shovelnose sturgeon sampled. During the sturgeon season, otter trawl and trammel net CPUE of quality and above sized shovelnose sturgeon was higher than that of stock sized fish, while no sub-stock specimens were sampled (Figures 11 and 12). This is similar to the 2006 sturgeon season where otter trawl and trammel net CPUE of quality and above sized shovelnose was higher than that of stock size and substock size (Figures 11 and 12). No sub-stock sized shovelnose sturgeon were sampled during the sturgeon season of 2007.

The fish community season had a similar pattern to that of the sturgeon season where both trammel net and otter trawl CPUE was higher for the quality and above sized fish than for

all other size categories (Figure 14). However, the otter trawl captured both sizes of sub-stock shovelnose in 2007. No sub-stock sized shovelnose sturgeon were sampled during 2006.

The three sub-stock sized (0-149 mm FL) shovelnose sturgeon sampled were evenly distributed among channel crossover, inside bend, and large connected secondary channel macrohabitats (Table 17). The one larger sub-stock (150-249 mm FL) shovelnose was sampled in the channel crossover macrohabitat. Stock sized shovelnose sturgeon (250-379 mm FL) were captured in outside bends at a higher proportion than outside bends were sampled for the otter trawl during both seasons and trammel nets during the fish community season (Table 21). In all, stock sized shovelnose were sampled in all macrohabitats sampled, with the exception of small secondary connected side channels.

Quality and above sized shovelnose sturgeon, which was the majority sampled, were collected again in all macrohabitats sampled, except small secondary connected channels (Table 23). Similar to stock sized shovelnose, quality and above sized shovelnose were sampled at a greater proportion in outside bend macrohabitats than what outside bends were sampled. More quality size and above shovelnose (N = 42) were sampled in trammel nets within the outside bend than any other gear or habitat.

Segment 3 - Shovelnose Sturgeon / Sturgeon Season

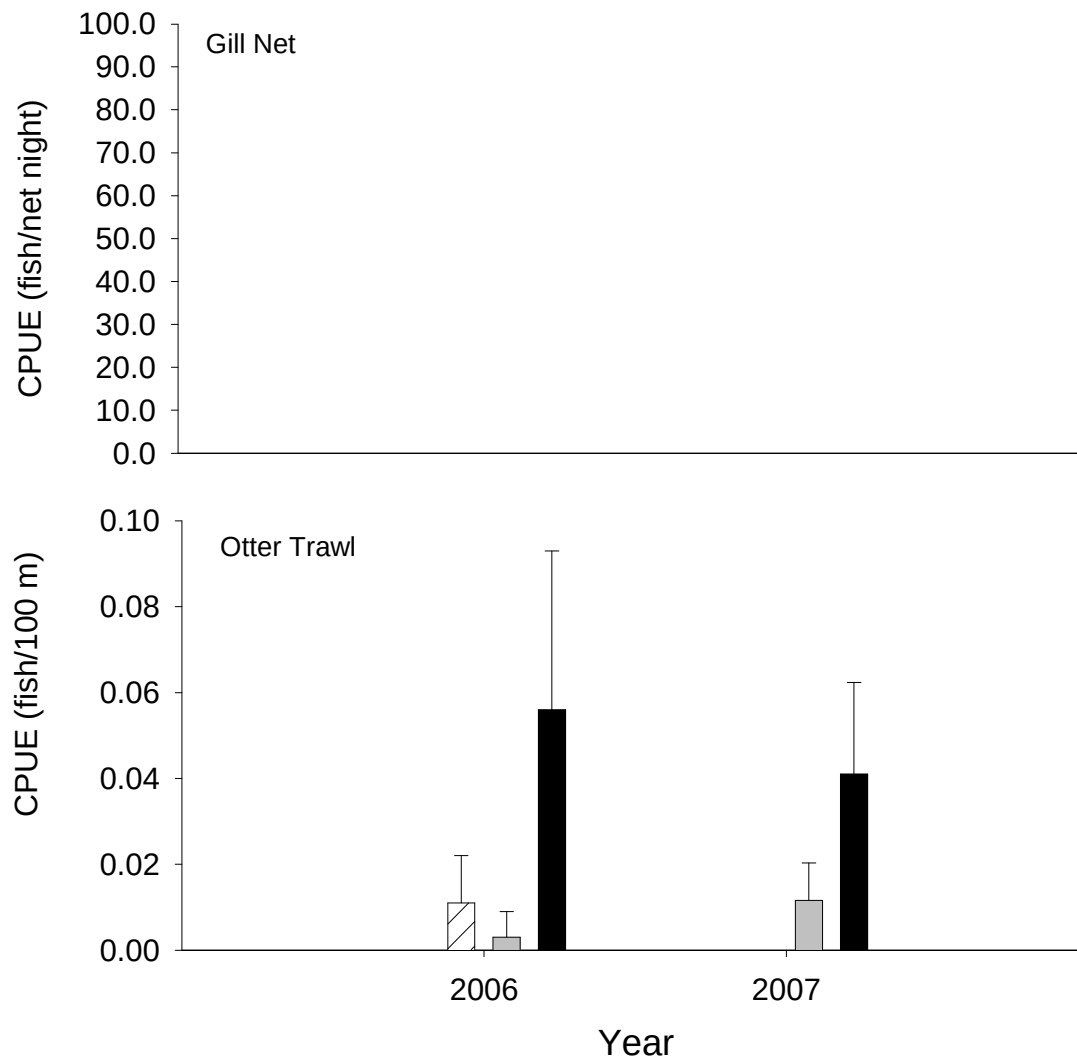


Figure 11. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Shovelnose Sturgeon / Sturgeon Season

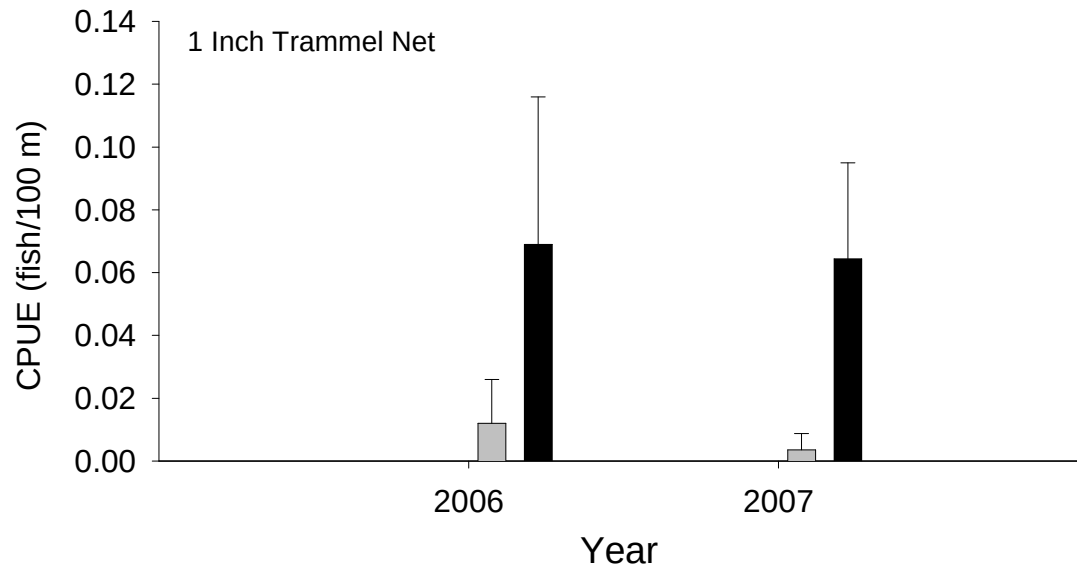


Figure 12. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Shovelnose Sturgeon / Fish Community Season

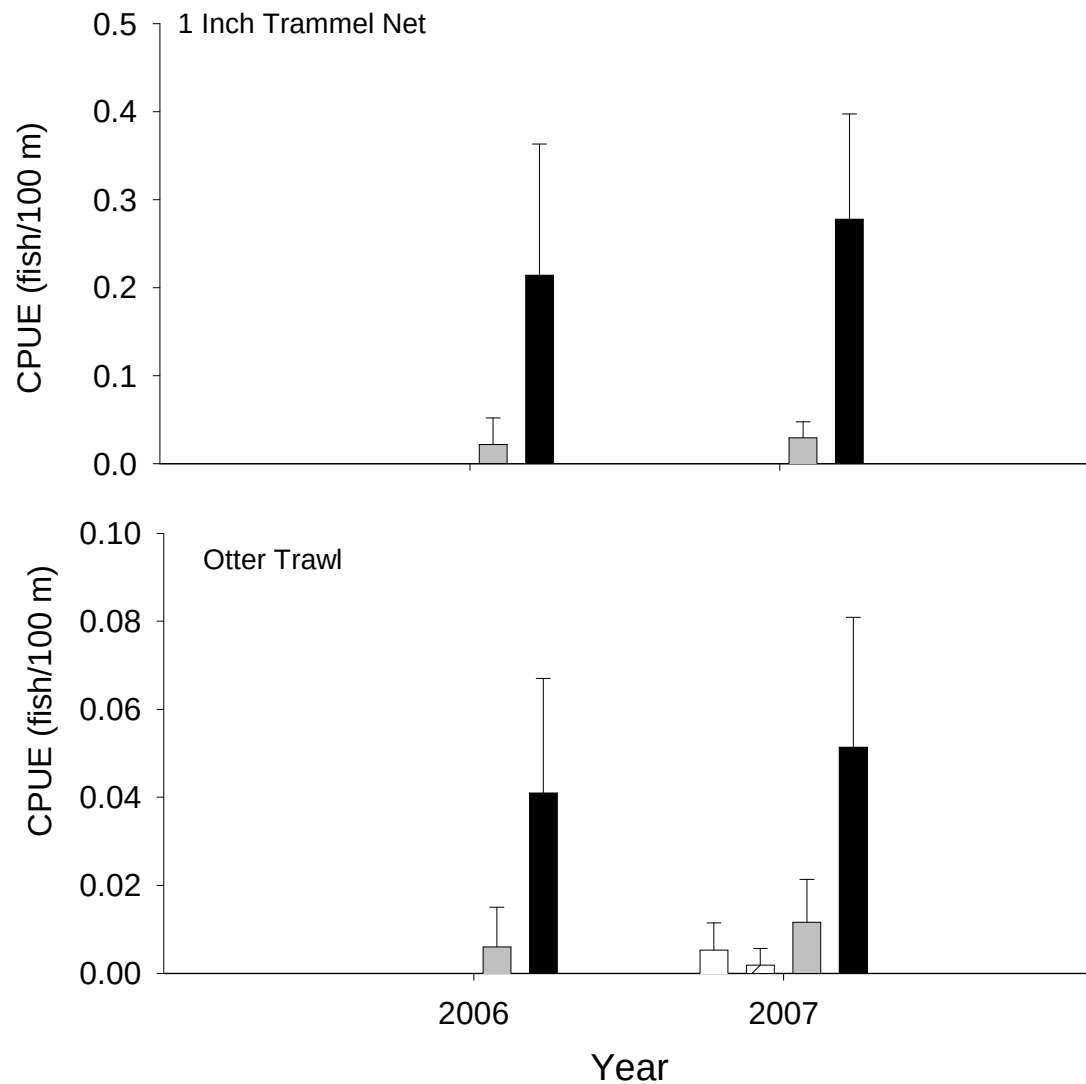


Figure 14. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 3 of the Missouri River during fish community season 2006-2007.

Segment 3 - Shovelnose Sturgeon / Fish Community Season

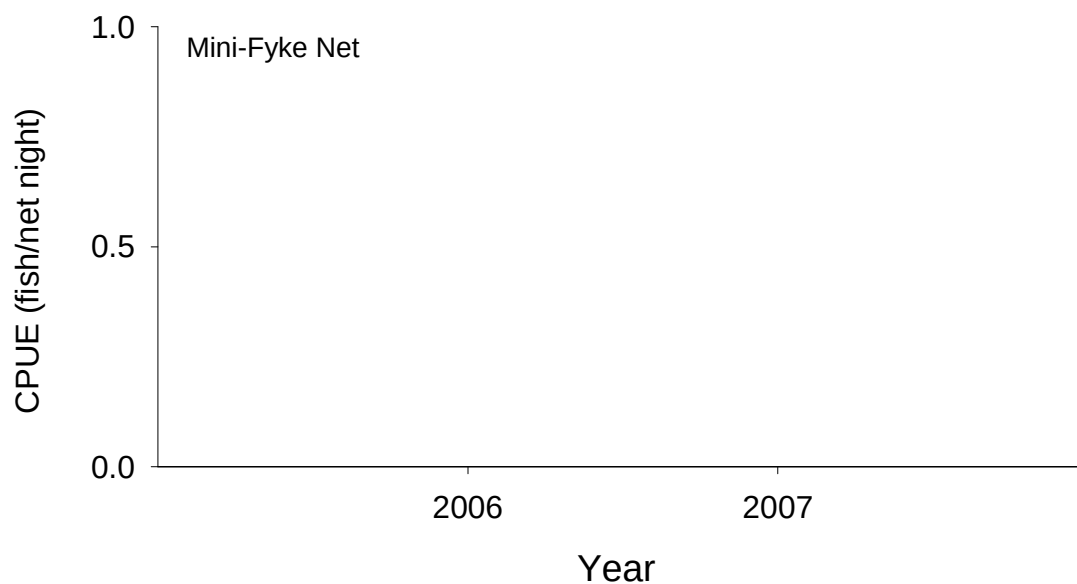


Figure 15. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ($>$ 380 mm; black bars) shovelnose sturgeon using mini-fyke nets in segment 3 of the Missouri 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 03 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	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	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	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	3	0	33	0	N-E	N-E	33	0	33	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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.

		Mesohabitat					
Gear	N	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
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	·	0	97	N-E	2	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	0
	·	96	4	N-E	0	N-E	0
Otter Trawl	3	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

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 03 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	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	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	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	1	0	100	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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.

		Mesohabitat					
Gear	N	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	97	N-E	2	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	1	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

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 03 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	0	0	N-E	N-E	0	0	100	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	7	0	0	0	N-E	N-E	29	43	29	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	12	0	33	0	N-E	N-E	17	42	8	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	6	0	50	0	N-E	N-E	17	33	0	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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.

		Mesohabitat					
Gear	N	BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	2	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	7	0	100	N-E	0	N-E	N-E
	.	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	12	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
	.	96	4	N-E	0	N-E	N-E
Otter Trawl	6	0	100	N-E	0	N-E	N-E
	.	0	99	N-E	1	N-E	N-E

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 03 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	30	0	23	0	N-E	N-E	30	7	40	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	26	0	27	0	N-E	N-E	23	38	12	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	116	0	24	0	N-E	N-E	27	36	13	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	24	0	25	0	N-E	N-E	33	33	8	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 24. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 03 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.

		Mesohabitat					
Gear	N	BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	30	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	26	0	96	N-E	4	N-E	N-E
	·	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	116	0	97	N-E	3	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	24	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

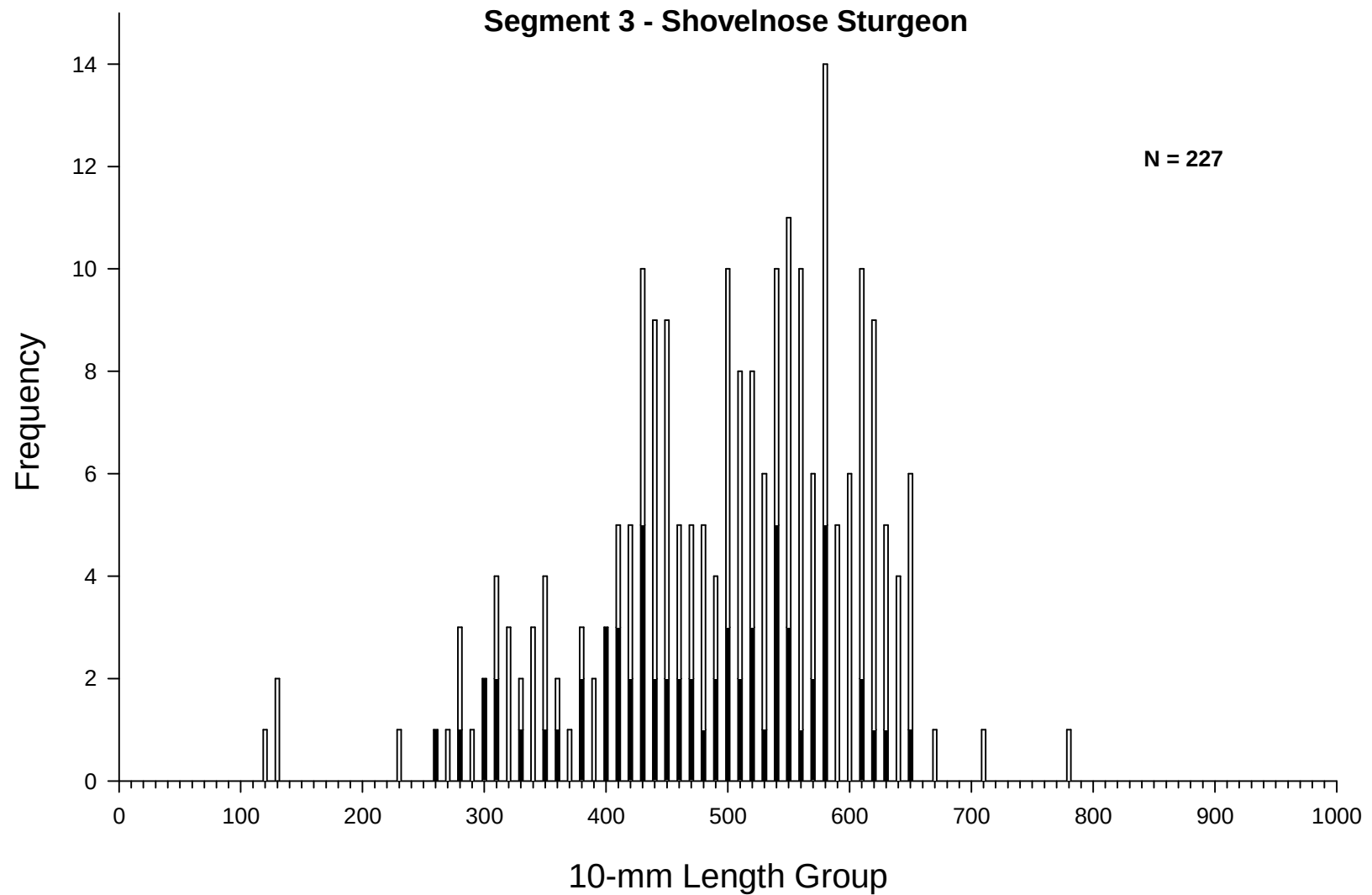


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007 for all random and non-random sampling.

Table 25. Incremental relative stock density (RSD)^a and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 3 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	9	14	84.25 (14.25)
Quality	29	45	83.32 (3.903)
Preferred	26	40	86.78 (7.804)
Memorable	1	2	83.18
Trophy	0	.	0
Overall Wr	.	.	84.83 (4.021)
Fish Community Season			
Sub-stock (0-149 mm)	3	.	128.7 (9.864)
Sub-stock (150-249 mm)	1	.	109.2
Stock	18	11	108.8 (31.38)
Quality	46	29	83.72 (1.570)
Preferred	82	52	82.66 (1.755)
Memorable	12	8	87.01 (6.062)
Trophy	0	.	0
Overall Wr	.	.	86.95 (3.893)

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

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

Sturgeon Chub

A total of 1,241 sturgeon chubs were sampled in segment 3 during 2007, and increase from the 598 collected during 2006. The increase in sturgeon chub catch can in part be explained by the addition of the experimental push trawl and by the increased effort of the otter trawl in 2007. By gear, sturgeon chubs were collected in the otter trawl (N = 778), push trawl (N = 444), and mini fyke nets (N = 19). More sturgeon chubs were sampled during the fish community season (N = 995) than during the sturgeon season (N = 246). Although sturgeon chubs were collected in all bends sampled in segment 3 during 2007, 54% of the catch was restricted to the three most downstream bends sampled, river miles 1593, 1590.5 and 1589.5.

Overall, sturgeon chubs were captured at a rate of 0.51 fish/ 100 m and 2.81 fish/ 100 m in the otter and push trawls, respectively (Appendix F7). For comparison between years, otter trawl CPUE decreased during the sturgeon season of 2007 (0.39 fish/ 100 m) from 2006 (0.72 fish/ 100 m) (Figure 18). However, a slight increase in CPUE was observed from 2006 (0.60 fish/ 100 m) to 2007 (0.63 fish/ 100 m) in the fish community season (Figure 19). A large relative increase in mini fyke CPUE was observed from 2006 (0.01 fish/ 100 m) to 2007 (0.10 fish/ 100 m), although CPUE was still somewhat minimal.

More sturgeon chubs were sampled with the otter trawl in the channel crossovers (N = 221) than inside bends (N = 174), outside bends (N = 134), or large connected secondary channels (N = 61) (Table 26). Sturgeon chubs were collected in channel crossovers at a greater proportion than channel crossovers were sampled.

The size distribution of sturgeon chubs indicates fish from age-0 to age-3 (Herman et al. 2008), with one outlier that could be older than age-3 (Figure 21). The seasonal difference in the size distribution clearly displays the presence of age-0 sturgeon chubs recruiting to the gears during the fish community season. However, fewer age-3 fish were collected during the fish community season, which may suggest a high mortality rate of this age group of fish from summer to fall.

Segment 3 - Sturgeon Chub / Sturgeon Season

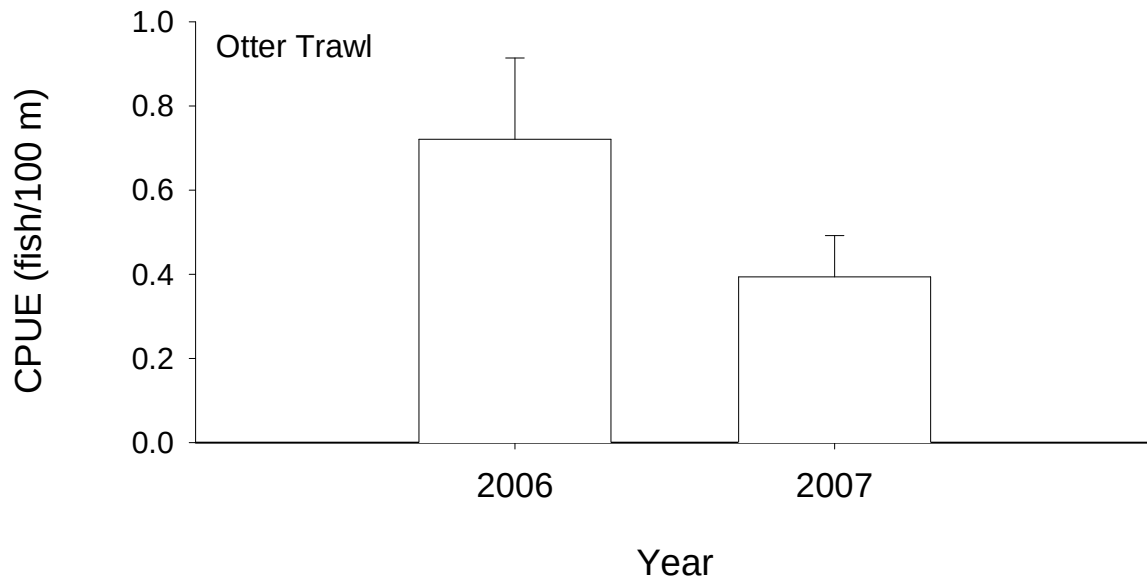


Figure 18. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sturgeon chub using otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Sturgeon Chub / Fish Community Season

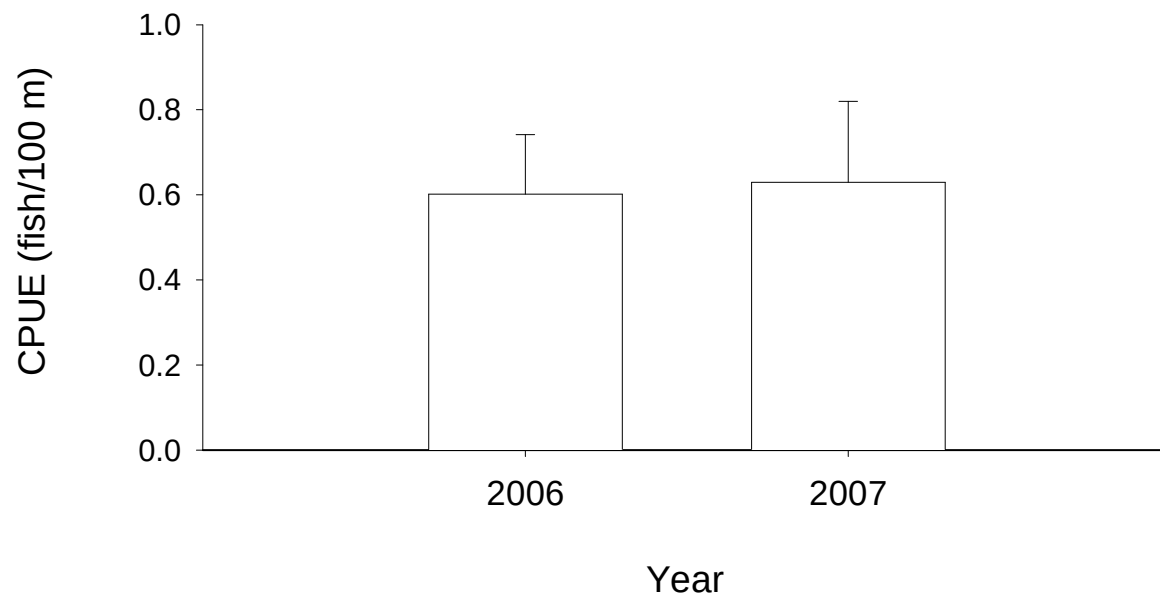


Figure 19. Mean annual catch-per-unit-effort ($\pm 2SE$) of sturgeon chub using otter trawls in segment 3 of the Missouri River during fish community season 2006-2007.

Segment 3 - Sturgeon Chub / Fish Community Season

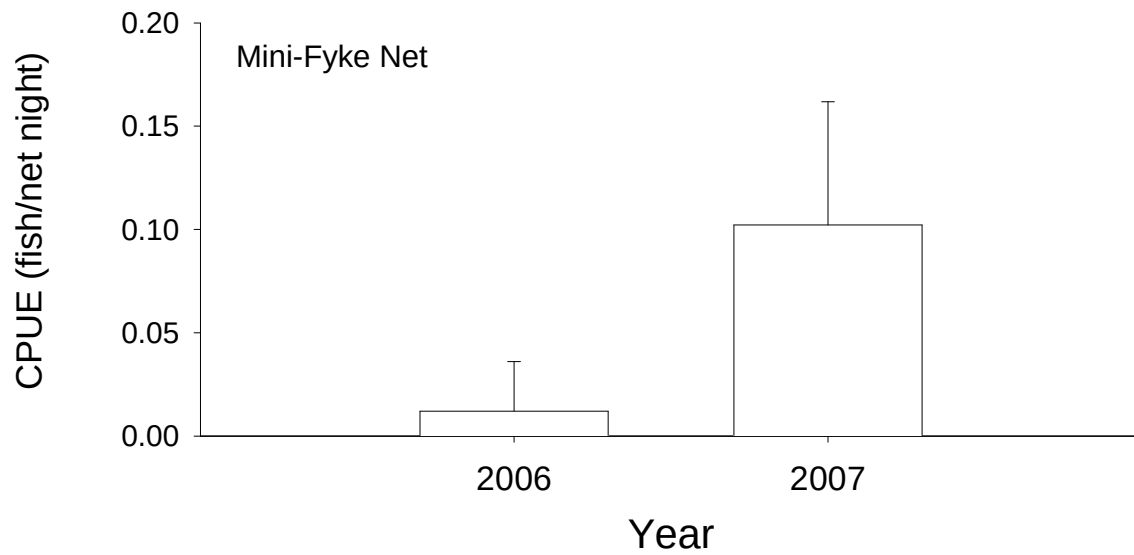


Figure 20. Mean annual catch-per-unit-effort ($\pm 2SE$) of sturgeon chub using mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	246	0	38	0	N-E	N-E	26	21	15	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	0	0	0	0	0	0
Mini-Fyke Net	14	0	36	0	N-E	N-E	50	0	7	7	0	0	0	0	0
	.	0	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	345	0	37	0	N-E	N-E	32	24	7	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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	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	246	0	99	N-E	1	N-E	N-E
	·	0	97	N-E	2	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	14	100	0	N-E	0	N-E	N-E
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	345	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

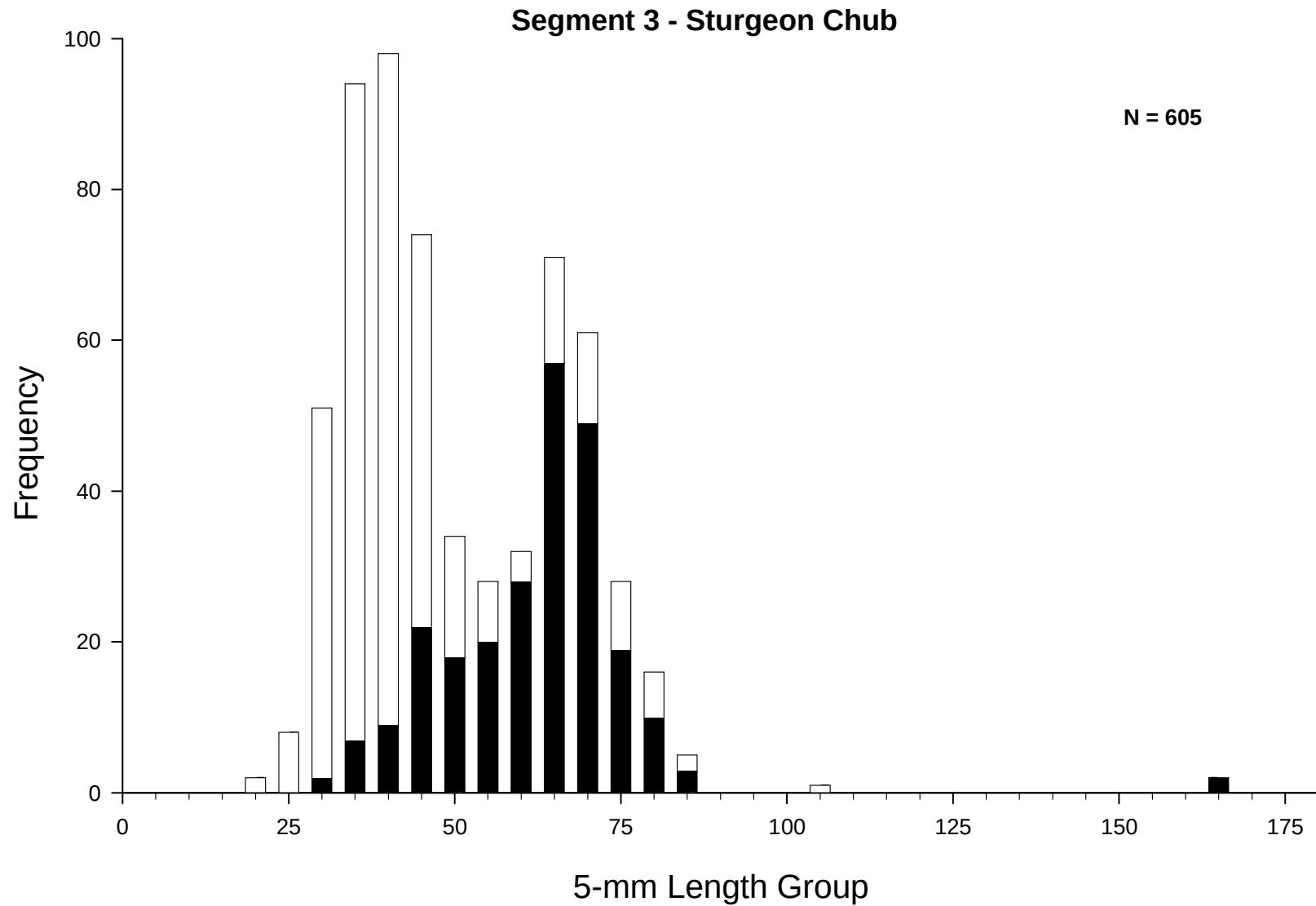


Figure 21. Length frequency of sturgeon chub during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007 for all random and non-random sampling.

Sicklefin Chub

A total of 141 sicklefin chubs were collected in segment 3 during 2007, an increase from 122 during 2006. The otter trawl and push trawl were the only gears to sample sicklefin chubs, catching 123 and 18, respectively. Ninety-seven percent of sicklefin chubs were collected during the fish community season. Similar to sturgeon chubs, sicklefin chubs were more abundant in the downstream sections of segment 3, with 69% occurring at or downstream of river mile 1595.

Overall, the otter and push trawl had a sicklefin chub CPUE of 0.09 and 0.11 fish/ 100 m, respectively. Between years, the otter trawl had a decrease in CPUE during the sturgeon season from 2006 (0.08 fish/ 100 m) to 2007 (0.007 fish/ 100 m) (Figure 22). Contrastingly, an increase was observed from 2006 (0.11 fish/ 100 m) to 2007 (0.18 fish/ 100 m) during the fish community season (Figure 23). No sicklefin chubs were sampled in mini fyke nets during 2007 or 2006 in segment 3.

Sicklefin chubs collected during the fish community season were sampled relatively equally between channel crossovers (33%), outside bends (30%) and inside bends (28%), with only 10% occurring in large secondary connected channels (Table 28).

A narrow size distribution of sicklefin chubs was observed in segment 3 during 2007 (Figure 25). A peak in the distribution occurred around 80 and 85 mm FL, which likely corresponds to age-2 fish (Herman et al. 2008b). Sicklefin chubs larger than 85 mm FL were likely age-3 fish, while fish in the range of 60-75 mm FL were likely age-1. From the distribution and aging from Herman et al. (2008b), there were likely no YOY sicklefin chubs collected in segment 3 during 2007. Three YOY sicklefins were collected during the 2006 sampling in segment 3.

Segment 3- Sicklefin Chub / Sturgeon Season

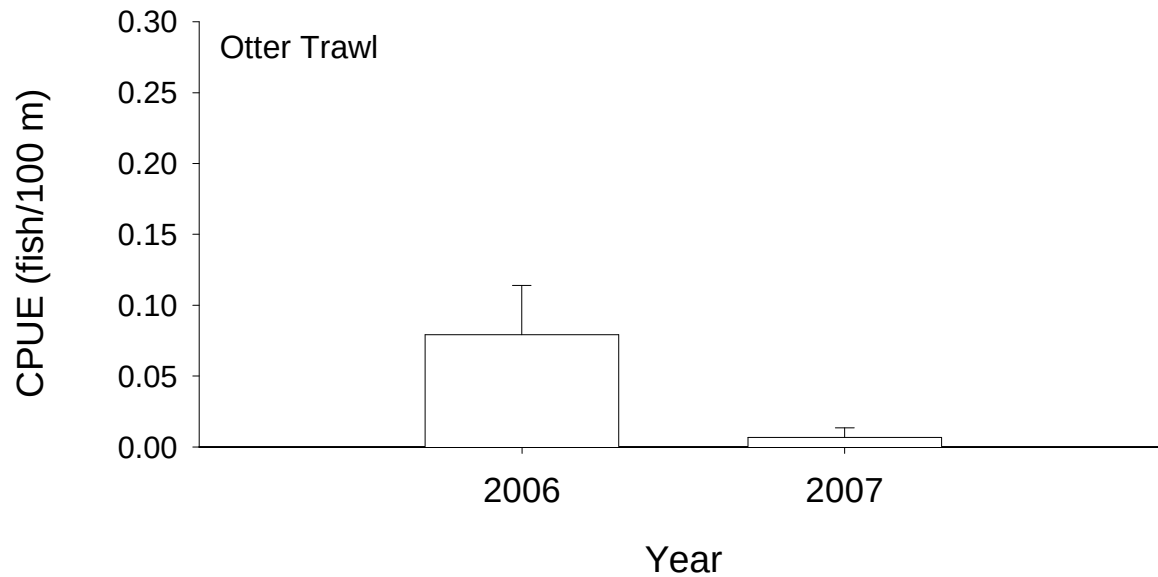


Figure 22. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sicklefin chub using otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Sicklefin Chub / Fish Community Season

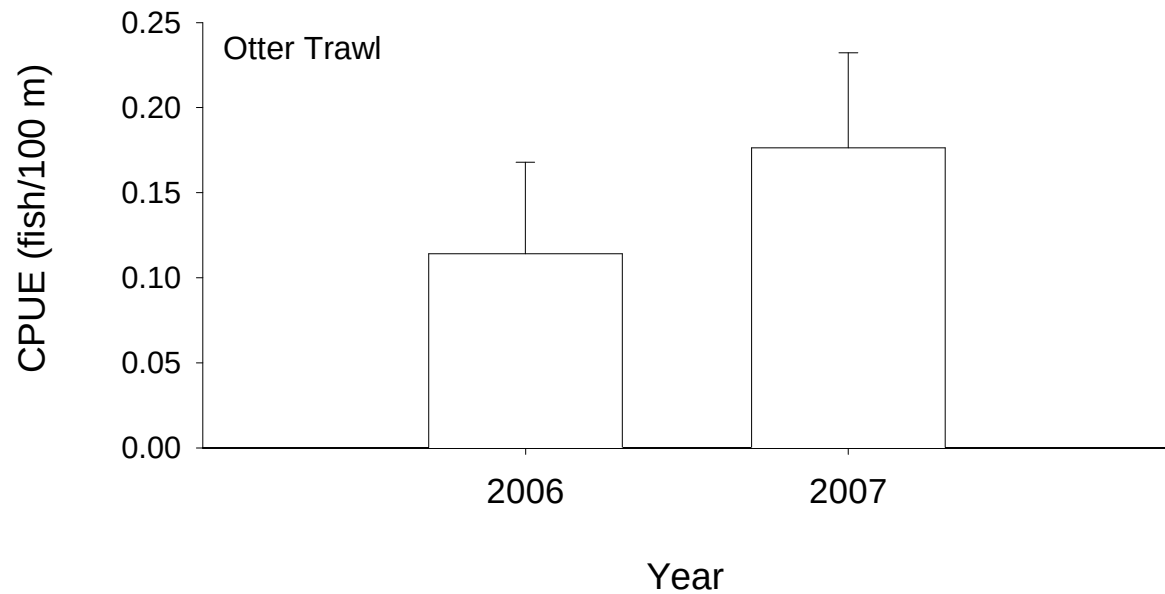


Figure 23. Mean annual catch-per-unit-effort ($\pm 2SE$) of sicklefin chub using otter trawls in segment 3 of the Missouri River during fish community season 2006-2007.

Segment 3 - Sicklefin Chub / Fish Community Season

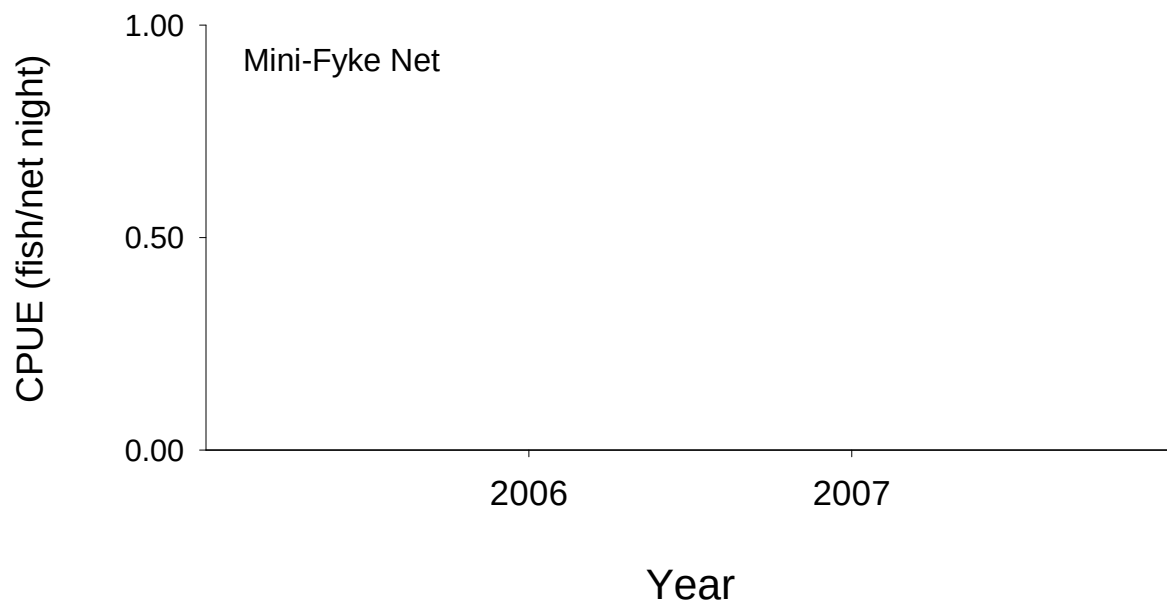


Figure 24. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sicklefin chub using mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	0	0	0	0	0	0
Gill Net					N-E	N-E									
					N-E	N-E									
Otter Trawl	4	0	25	0	N-E	N-E	25	50	0	0	0	0	0	0	0
	.	0	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	101	0	33	0	N-E	N-E	28	30	10	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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	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	4	0	100	N-E	0	N-E	N-E
	·	0	97	N-E	2	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	101	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

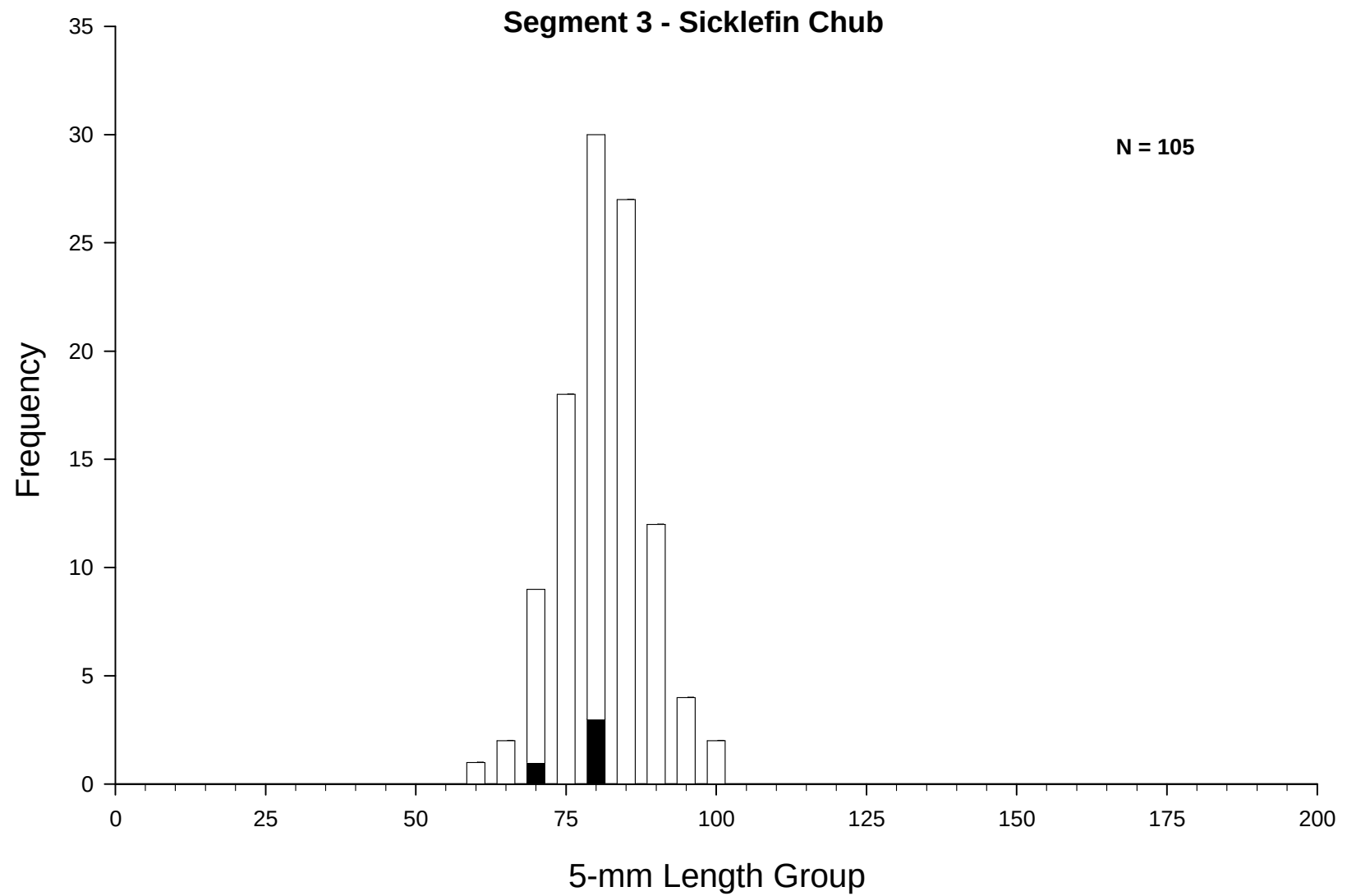


Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007.

Sand Shiner

A total of 1,015 sand shiners were sampled in segment 3 during 2007, a decrease from 2006 when 1,650 were sampled. Ninety-nine percent were sampled in mini fyke nets during the fish community season, while the other one percent was sampled in otter trawls during the sturgeon season. Sand shiners were sampled in all sampled river bends during 2007, with no obvious pattern in abundance throughout the segment.

Overall CPUE for sand shiners was 5.61 fish/net night for mini fyke nets and 0.01 fish/100 m for otter trawls (Appendix H). Interestingly, no sand shiners were sampled in the experimental push trawl during 2007. Between years, sand shiner CPUE in mini fykes decreased significantly during 2007 (506 fish/ 100 m) from 2006 (13.7 fish/ 100 m) (Figure 32).

More sand shiners were sampled in channel crossovers (44%) than large connected secondary channels (21%), small connected secondary channels (19%), or inside bends (15%) (Table 32). However, the proportion of the total sand shiner catch was higher in both channel crossovers and small secondary connected channels in relation to the proportion these habitats were sampled. While 44% of sand shiners were sampled in channel crossovers, channel crossovers made up only 26% of the habitats sampled. Similarly, 19 percent of the sand shiner catch occurred in small connected secondary channels, and these habitats only accounted for 16% of the total sampled.

The size distribution of sand shiners displayed in Figure 33 indicates a population of age-0 and age-1 fish (Datillo et al. 2008). It is likely that age-1 fish were from about 35 mm TL and above, since all fish collected during the sturgeon season were above 35 mm TL. Age-0 sand shiners were likely to small to sample during the sturgeon season after they hatched.

Segment 3 - Sand Shiner / Sturgeon Season

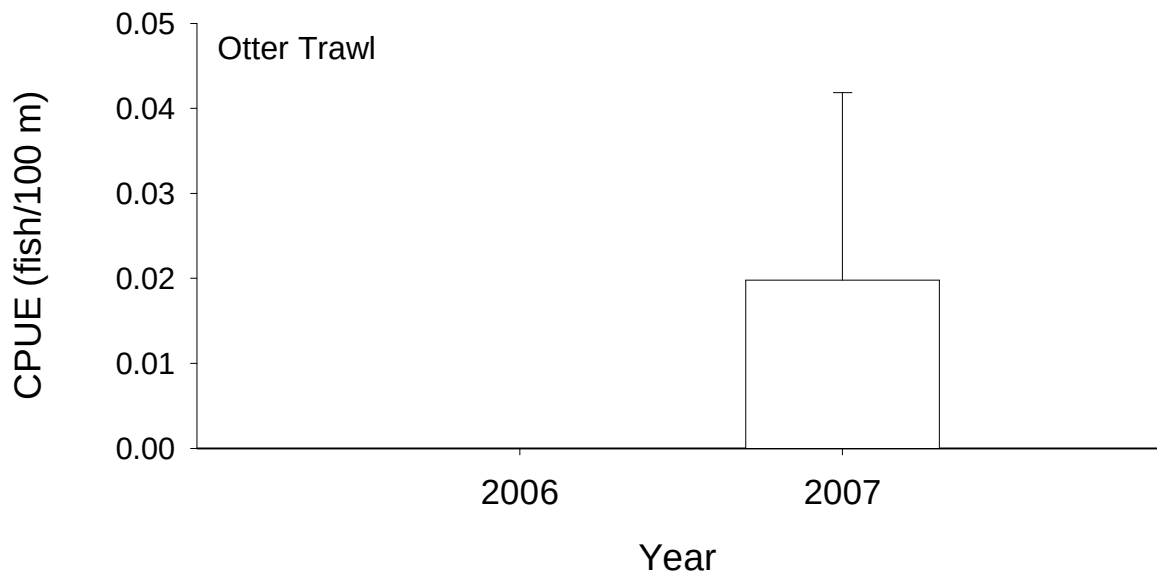


Figure 30. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sand shiner with otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Sand Shiner / Fish Community Season

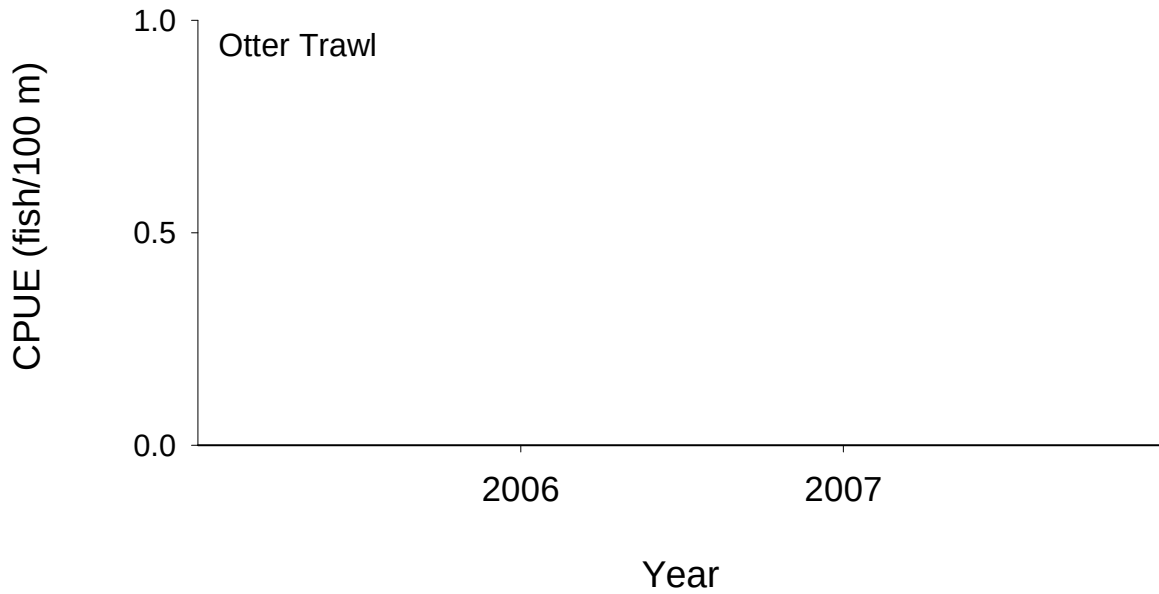


Figure 31. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sand shiner with otter trawls in segment 3 of the Missouri River during fish community season 2006 -2007.

Segment 3 - Sand Shiner / Fish Community Season

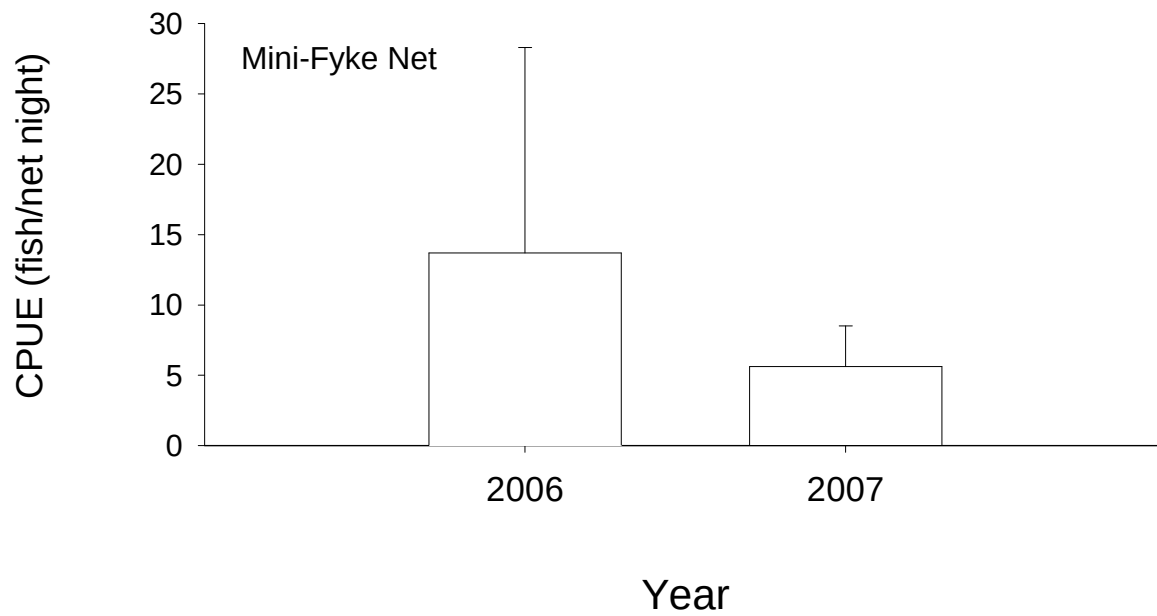


Figure 32. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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	N-E	0	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	0	27	20	25	0	0	0	0	0	0
Gill Net					N-E										
					N-E										
Otter Trawl	13	0	0	0	N-E	0	100	0	0	0	0	0	0	0	0
	.	0	24	0	N-E	0	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	0	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	0	31	26	7	0	0	0	0	0	0
Mini-Fyke Net	769	0	44	0	N-E	0	15	0	21	19	1	0	0	0	0
	.	0	26	0	N-E	0	32	1	23	16	3	0	0	0	0
Otter Trawl	0	0	0	0	N-E	0	0	0	0	0	0	0	0	0	0
	.	0	30	0	N-E	0	31	26	14	0	0	0	0	0	0

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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	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	13	0	100	N-E	0	N-E	N-E
	·	0	97	N-E	2	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	769	99	1	N-E	0	N-E	N-E
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	0	0	0	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

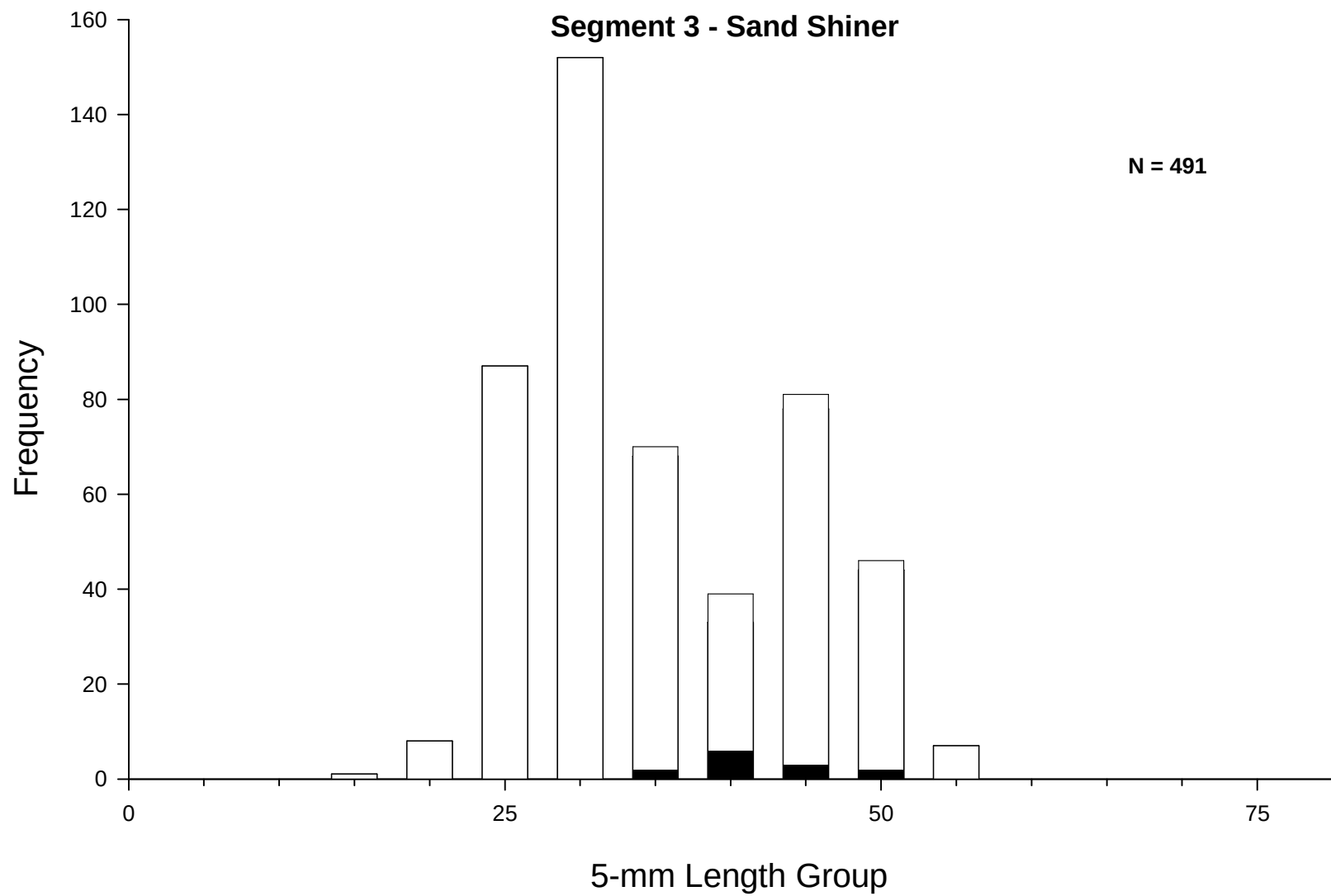


Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007.

***Hybognathus* spp.**

A total of 402 *Hybognathus* spp. were collected in segment 3 during 2007, consisting of 400 western silvery minnows and 2 plains minnows. Of the 400 western silvery minnow collected, 391 were sampled during the fish community season and 9 during the sturgeon season. The two plains minnows were sampled during the fish community season. Mini fyke nets collected 382 and 2 western silvery and plains minnows, respectively. The otter trawl collected 11 and the push trawl collected 7 western silvery minnows. Western silvery minnows were more abundant in segment 3 from about the middle of the segment downstream. The two plains minnows were collected at river mile 1678.5.

Otter trawl CPUE for western silver minnows was similar between 2006 and 2007, although a slight increase was seen in both seasons during 2007 (Figures 34 and 35). On the contrary, a significant increase in mini fyke net CPUE was observed in 2007 (2.20 fish/ 100 m) when compared to 2006 (0.58 fish/ 100 m) (Figure 36).

More western silvery minnow were sampled using fyke nets were sampled in small secondary connected channels (35%) than channel crossovers (22%), inside bends (19%), large connected secondary channels (12%) or non-connected secondary channels (12%) (Table 34). However, both small secondary connected side channels and non-connected side channels produced a greater percentage of western silvery minnows than the percentage these habitats were sampled relative to other habitats. While 35% of the western silver minnow catch was located in small connected secondary channels, these habitats only made up 16% of the total habitats sample. Similarly, 12% of western silvery minnow were collected in non-connected secondary channels, which made up only 3% of the total habitats sampled.

The size distribution in Figure 37 indicates a population composed of age-0, age-1 and age-2 fish (Datillo et al. 2008b). The large numbers of western silvery minnow collected during the fish community season smaller than 65 mm TL are likely age-0 fish. Age-1 fish are likely from about 75 mm TL to approximately 100 mm TL. Few age-2 fish were collected (> 100 mm TL).

Segment 3 - *Hybognathus* spp. / Sturgeon Season

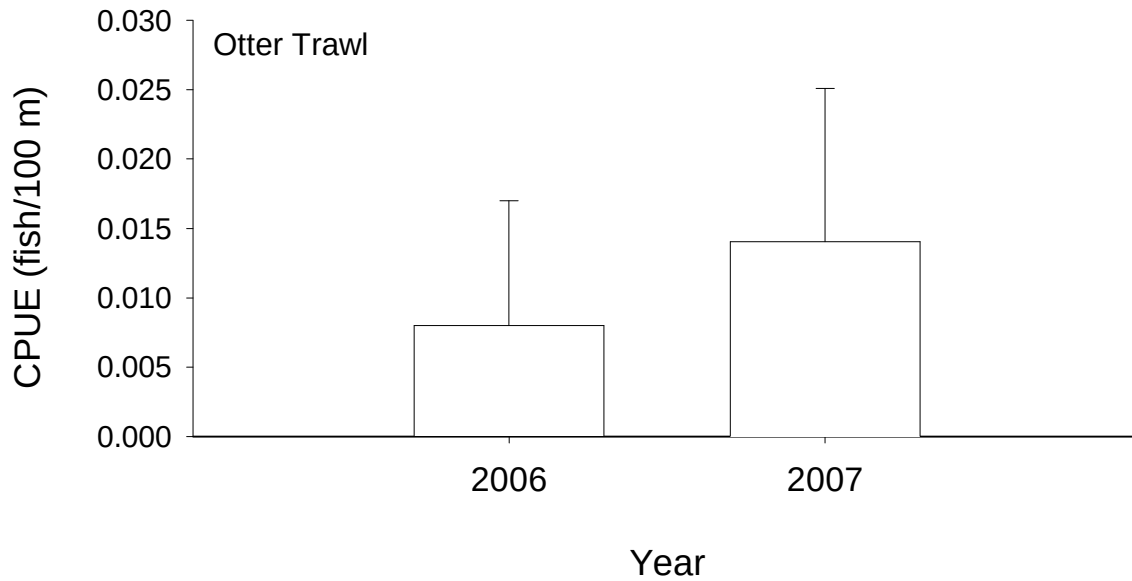


Figure 34. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - *Hybognathus* spp. / Fish Community Season

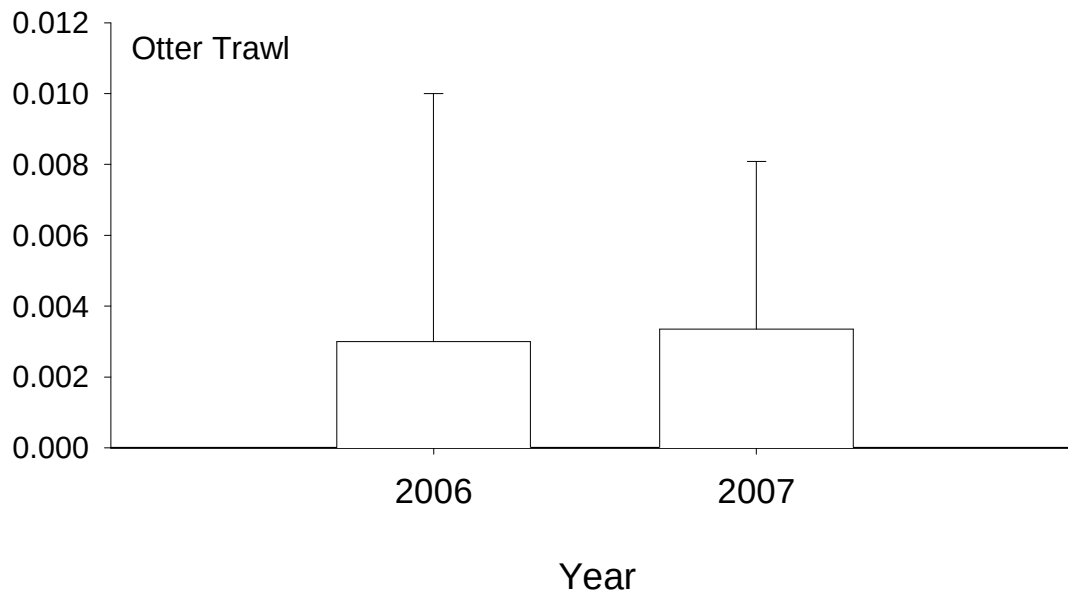


Figure 35. Mean annual catch-per-unit-effort ($\pm 2SE$) of *Hybognathus* spp. with otter trawls in segment 3 of the Missouri River during fish community season 2006-2007.

Segment 3 - *Hybognathus* spp. / Fish Community Season

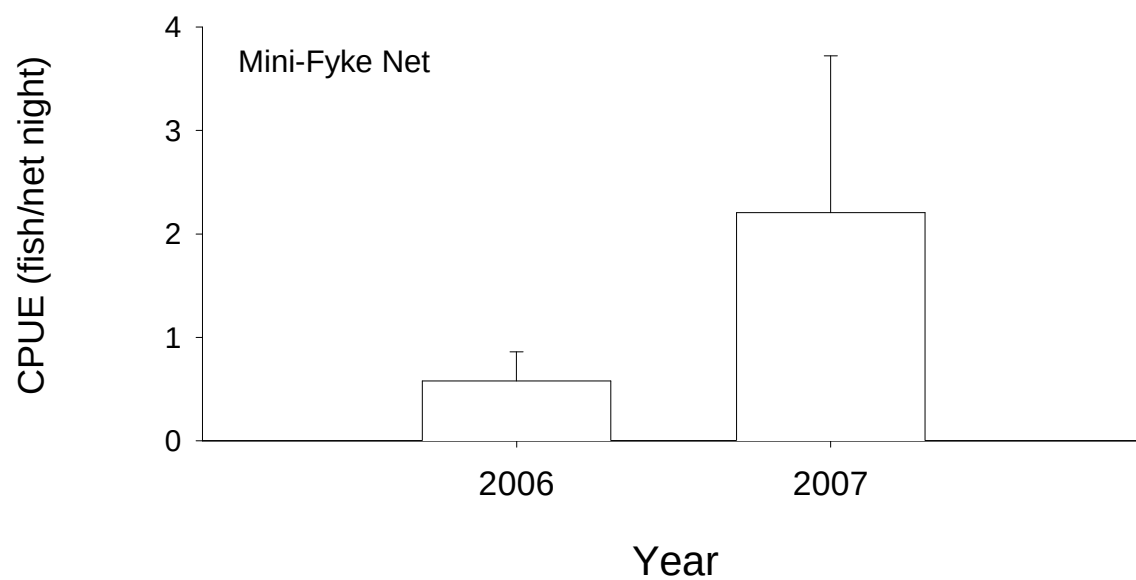


Figure 36. Mean annual catch-per-unit-effort ($\pm 2SE$) of *Hybognathus* spp. with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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	N-E	0	0	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	0	27	20	25	0	0	0	0	0	0
Gill Net					N-E										
					N-E										
Otter Trawl	9	0	11	0	N-E	0	33	11	44	0	0	0	0	0	0
	.	0	24	0	N-E	0	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	0	0	0	0	0	0	0	0	0	0
	.	0	36	0	N-E	0	31	26	7	0	0	0	0	0	0
Mini-Fyke Net	302	0	22	0	N-E	0	19	0	12	35	12	0	0	0	0
	.	0	26	0	N-E	0	32	1	23	16	3	0	0	0	0
Otter Trawl	2	0	50	0	N-E	0	50	0	0	0	0	0	0	0	0
	.	0	30	0	N-E	0	31	26	14	0	0	0	0	0	0

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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	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	9	0	100	N-E	0	N-E	N-E
	·	0	97	N-E	2	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	302	100	0	N-E	0	N-E	N-E
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	2	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

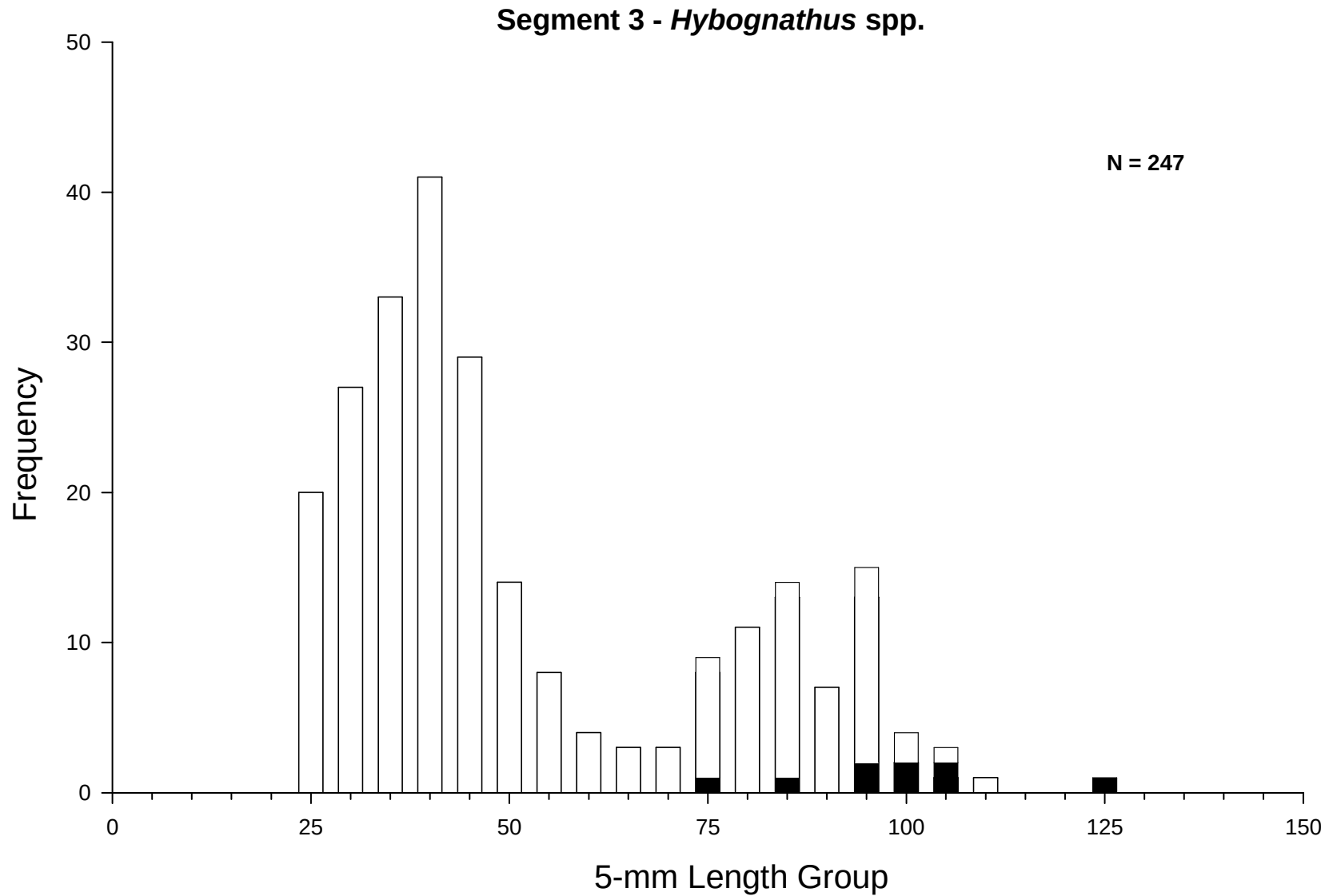


Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007.

Blue Sucker

A total of 10 blue suckers were collected in segment 3 during 2007, an increase from 4 collected during 2006. Of the total, eight were collected in the fish community season and two during the sturgeon season. The two specimens collected during the sturgeon season were captured on May 10, 2007 at river mile 1695. The eight specimens collected during the fish community season were all captured between August 6 and October 11, 2007 from river mile 1689 to 1589.5.

The CPUE of blue suckers was slightly lower for trammel nets during the sturgeon season of 2007, when compared to 2006 (Figure 39). However, a slight increase was observed for the fish community season (Figure 41). One blue sucker was sample in the otter trawl during the fish community season of 2007, while none were sampled in 2006 (Figure 41). No blue suckers were sampled in mini fyke nets during either 2007 or 2006.

Blue suckers were sampled in a variety of macrohabitats (Table 36). Since so few specimens were sampled, no specifics on habitat use will be discussed. However, blue suckers were captured in channel crossovers, inside bends, outside bends, and large secondary connected channels.

A limited size distribution of blue suckers was observed in segment 3 during 2007 (Figure 44). No juvenile blue suckers were sampled in either 2007 or 2006. According aging of blue suckers in the Missouri River below Gavins Point Dam, SD by Labay et al. (2008), blue suckers larger than 550 mm TL as seen in segment 3 are likely at least age-7 or older. Therefore, the sampled population in segment 3 consisted of all older mature adults.

Segment 3 - Blue Sucker / Sturgeon Season

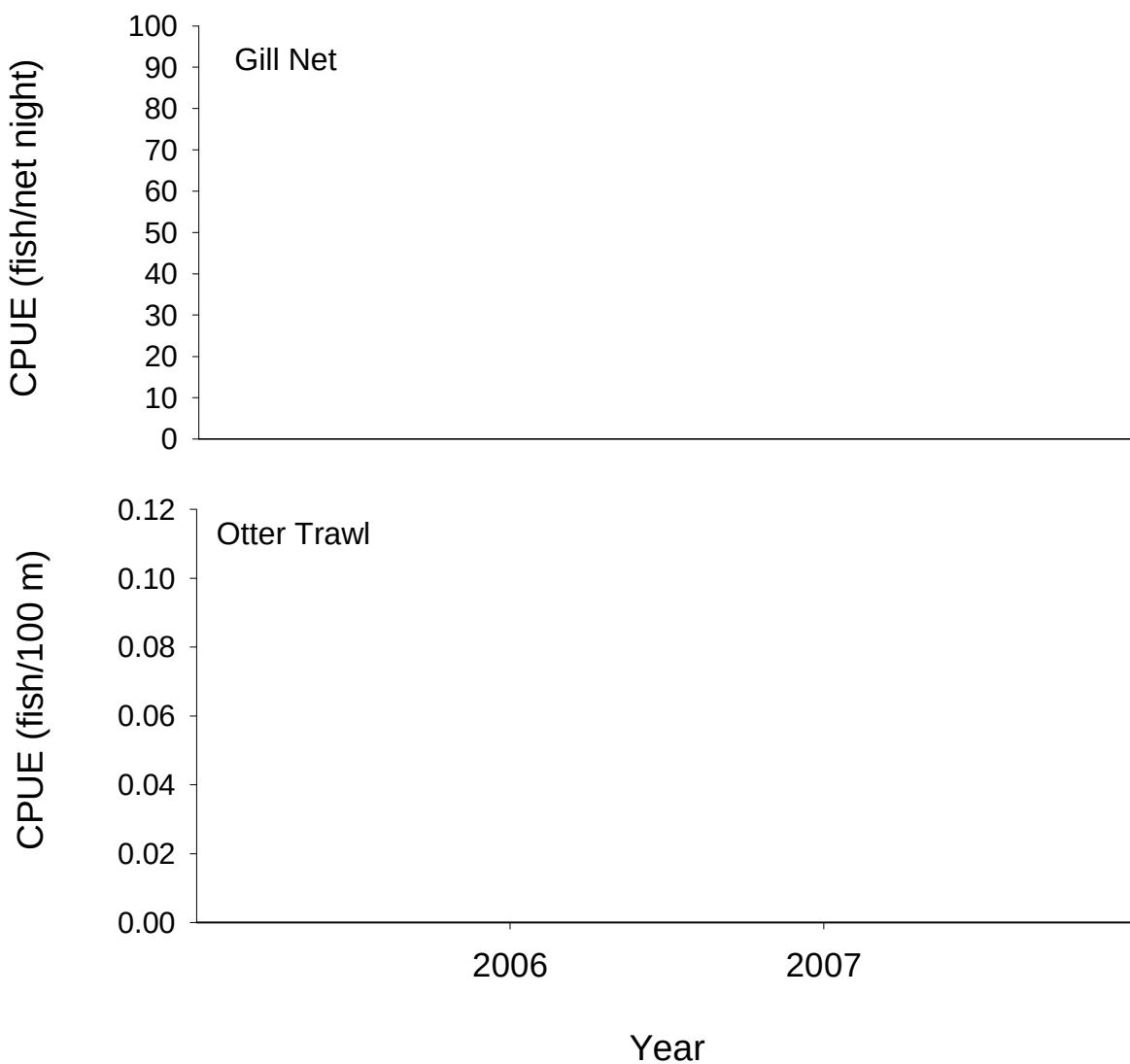


Figure 38. Mean annual catch-per-unit-effort ($\pm$ 2SE) of blue sucker with gill nets and otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Blue Sucker / Sturgeon Season

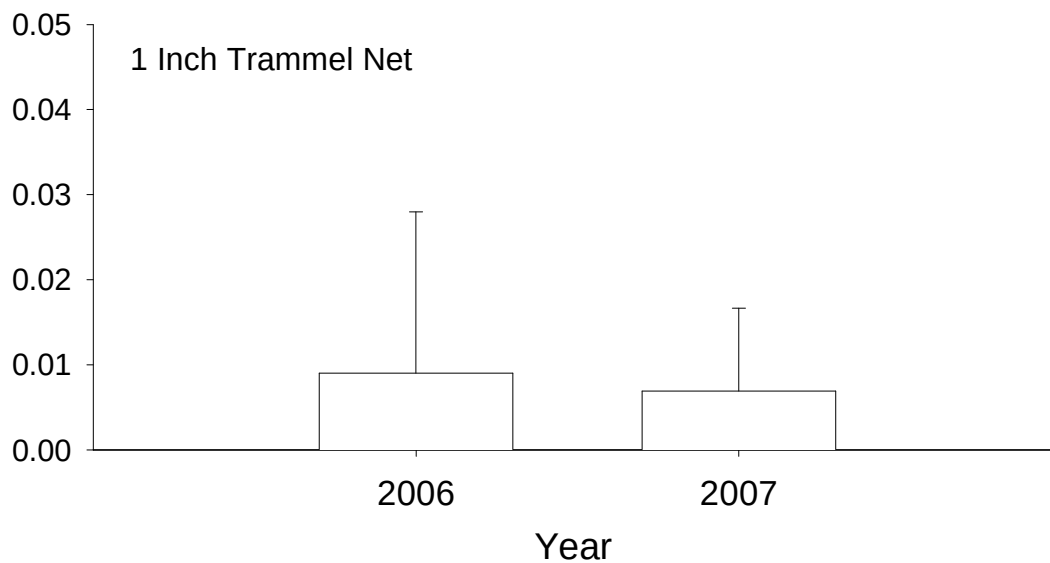


Figure 39. Mean annual catch-per-unit-effort ($\pm$ 2SE) of blue sucker with 1 inch trammel nets in segment 3 of the Missouri River during sturgeon season 2006 - 2007.

Segment 3 - Blue Sucker / Fish Community Season

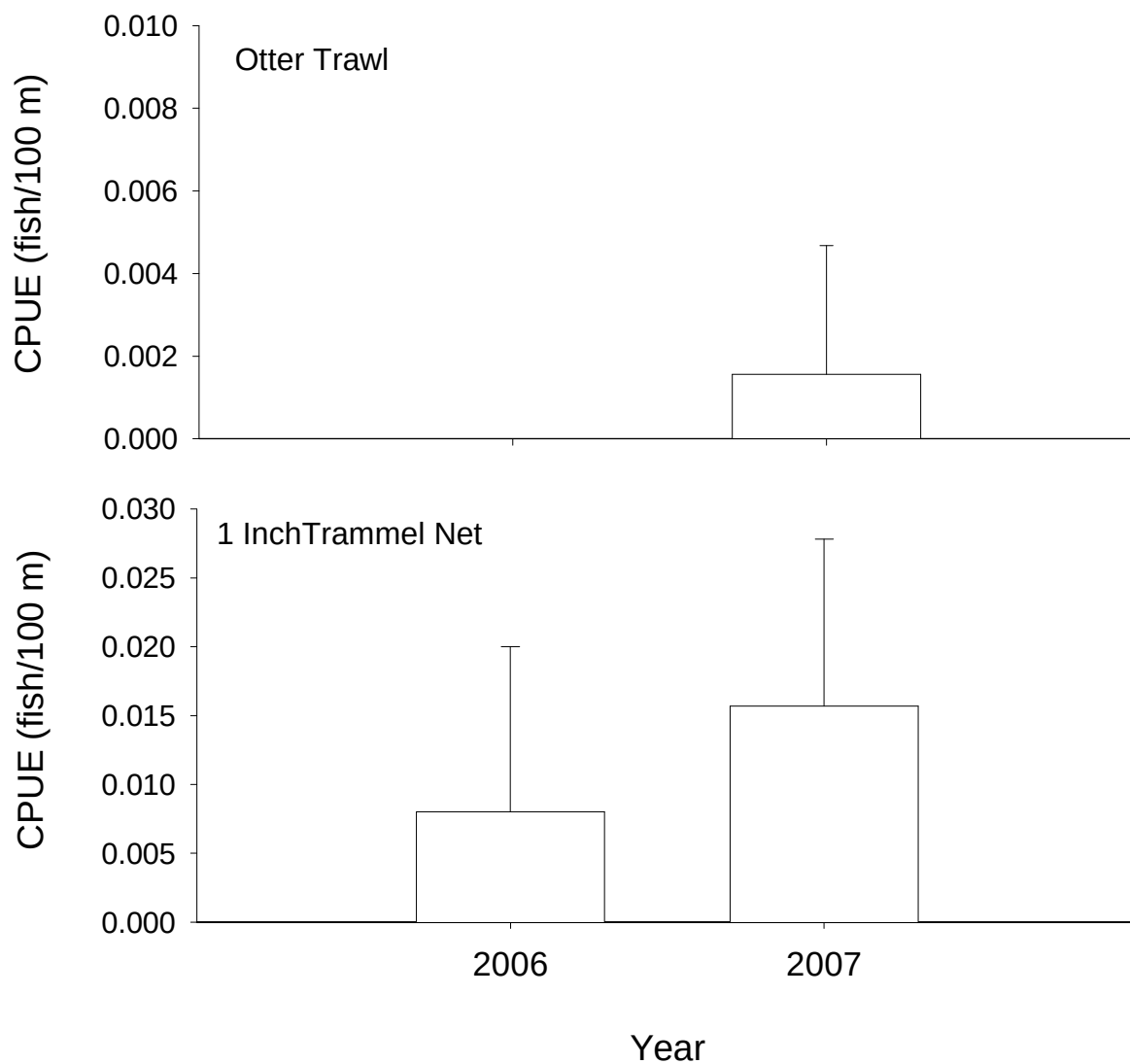


Figure 41. Mean annual catch-per-unit-effort (± 2 SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 3 of the Missouri River during fish community season 2006 - 2007.

Segment 3 - Blue Sucker / Fish Community Season

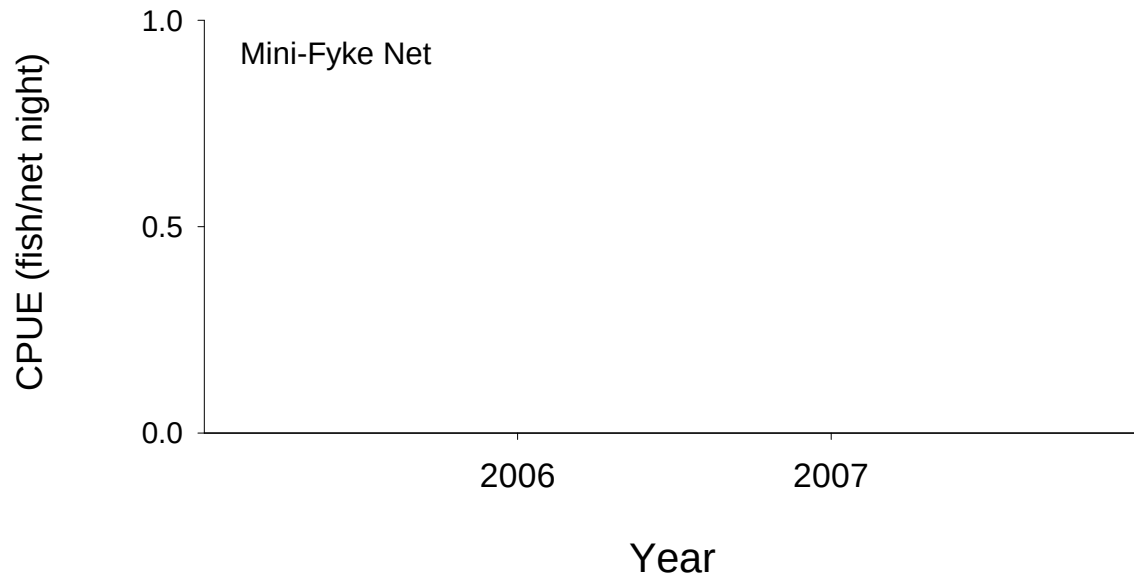


Figure 42. Mean annual catch-per-unit-effort ($\pm$ 2SE) of blue suckers using mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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.

Each gear type (N-E) indicates the habitat is non-existent in the segment.															
Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	2	0	50	0	N-E	N-E	50	0	0	0	0	0	0	0	0
	.	0	28	0	N-E	N-E	27	20	25	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	24	0	N-E	N-E	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	7	0	29	0	N-E	N-E	14	43	14	0	0	0	0	0	0
	.	0	36	0	N-E	N-E	31	26	7	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	26	0	N-E	N-E	32	1	23	16	3	0	0	0	0
Otter Trawl	1	0	0	0	N-E	N-E	100	0	0	0	0	0	0	0	0
	.	0	30	0	N-E	N-E	31	26	14	0	0	0	0	0	0

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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 type 1 = indicates the habitat is not present in the segment							
Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	2	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	0	0	0	N-E	0	N-E	N-E
	·	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	7	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
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	1	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

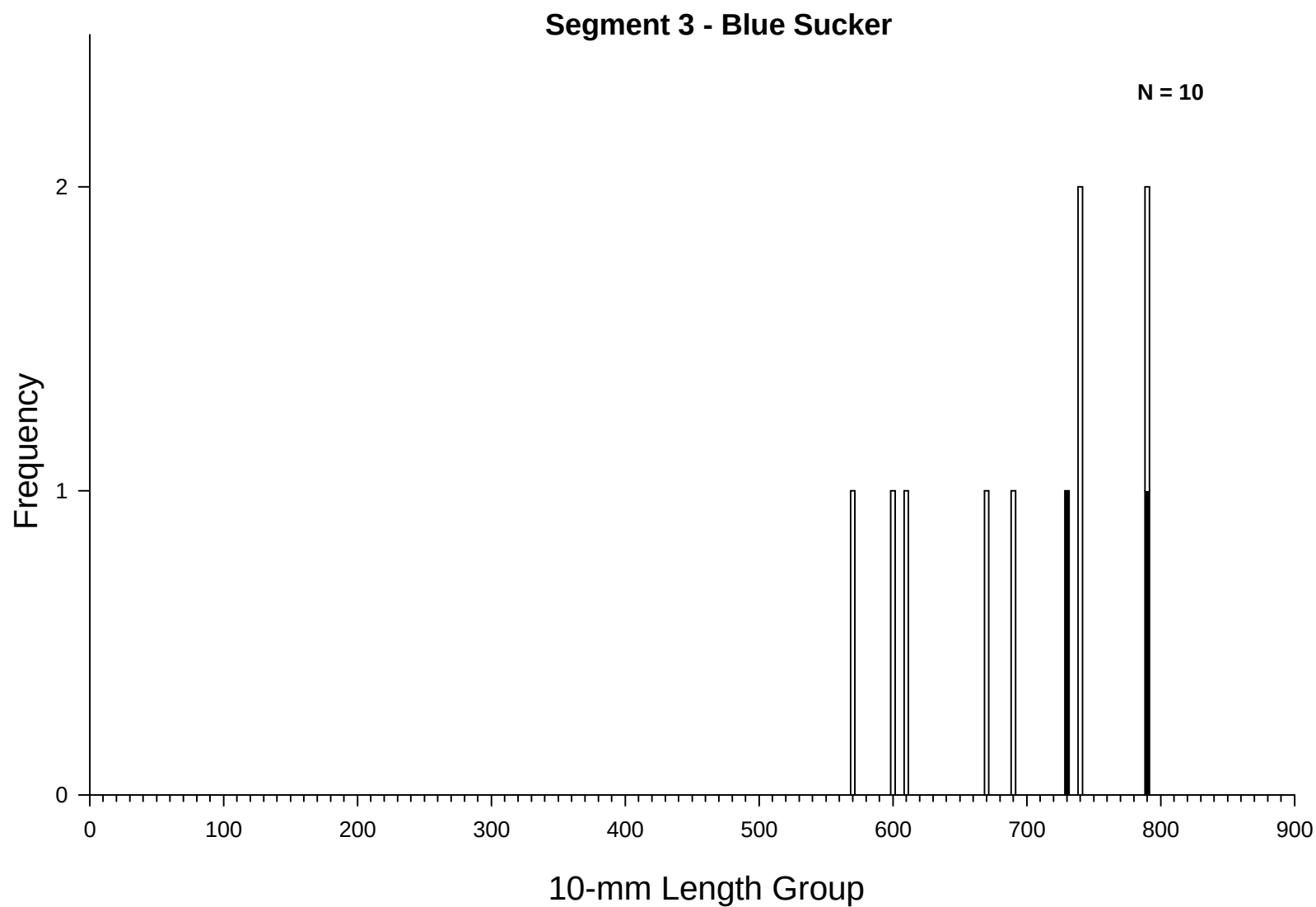


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007.

Sauger

A total of 195 sauger were sampled in segment 3 during 2007, an increase from 125 sampled in 2006. More sauger were sampled during the fish community season (N = 129) than during the sturgeon season (N = 66). Trammel nets sampled more sauger (N = 102) than otter trawls (N = 54), mini fyke nets (N = 30), trotlines (N = 6), or push trawls (N = 3).

For standard active gears, trammel nets and otter trawls had CPUE of 0.11 fish/ 100 m and 0.04 fish/ 100 m, respectively (Appendix F). Overall mini fyke net CPUE of sauger was 0.20 fish/ net night (Appendix F). Sauger CPUE in the otter trawl slightly increased in 2007 from 2006 for both the sturgeon and fish community seasons, even though it still remained relatively low (Figures 45 and 48). For trammel nets, sauger CPUE was slightly lower during the sturgeon season in 2007 from 2006, but increased during the fish community season (Figures 46 and 48).

Trammel net CPUE for sauger was highest in large connected secondary channels (0.20 fish/ 100 m), and progressively lower for channel crossovers (0.12 fish/ 100 m), inside bends (0.10 fish/ 100 m), and outside bends (0.08 fish/ 100 m) (Appendix F). The highest recorded CPUE for sauger in the otter trawl was within large secondary connected channels (0.07 fish/ 100 m) and outside bends (0.07 fish/ 100 m) (Appendix F). For mini fyke nets, CPUE was greatest in channel crossovers (0.41 fish/ net night).

Overall, sauger averaged 328 mm TL, but average length varied by gear. In order from largest to smallest, average length by gear were as follows; trotlines 378 mm, trammel nets 342 mm, otter trawls 312 mm, mini fyke nets 306 mm, and push trawl 225 mm. The length frequency histogram in Figure 51 indicates a sauger population with fish from age-0 to sauger older than age-5 (Datillo et al. 2008c). Few age-0 and age-1 sauger were sampled, with the majority of the catch consisting of fish age-2 and older.

Segment 3 - Sauger / Sturgeon Season

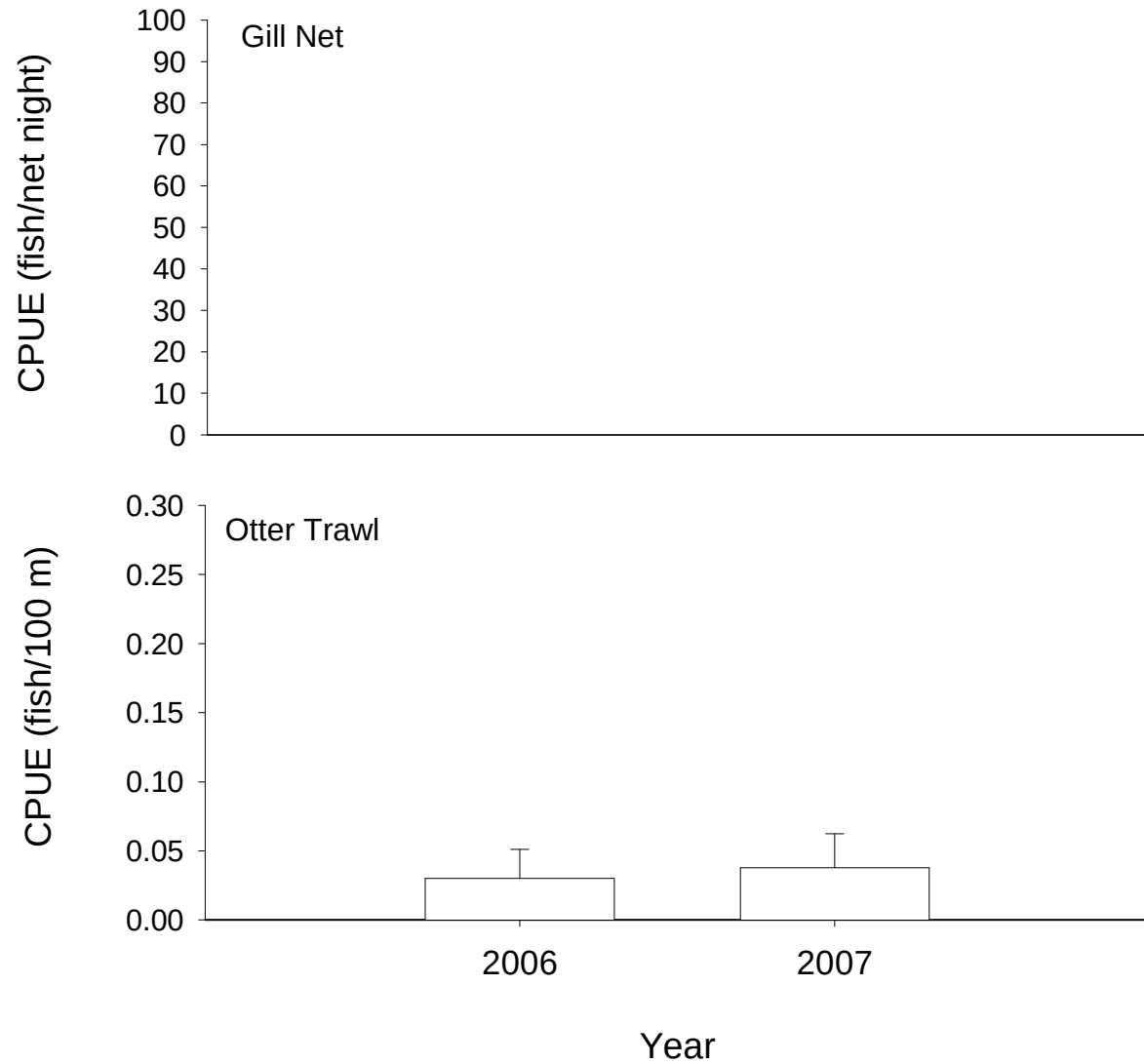


Figure 45. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sauger using gill nets and otter trawls in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Sauger / Sturgeon Season

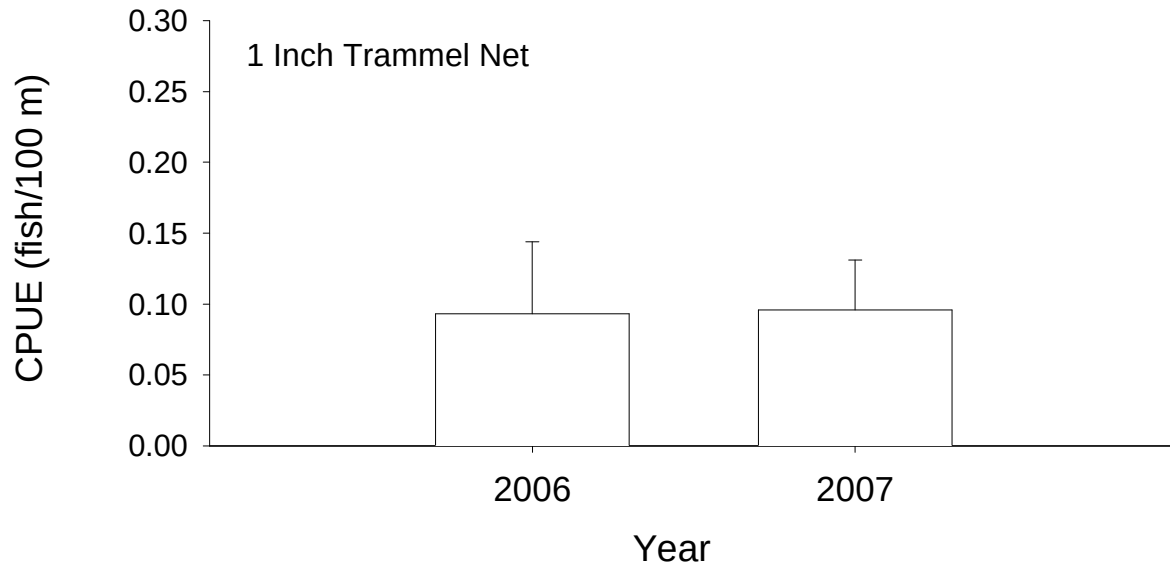


Figure 46. Mean annual catch-per-unit-effort ($\pm 2SE$) of sauger using 1 inch trammel nets in segment 3 of the Missouri River during sturgeon season 2006-2007.

Segment 3 - Sauger / Fish Community Season

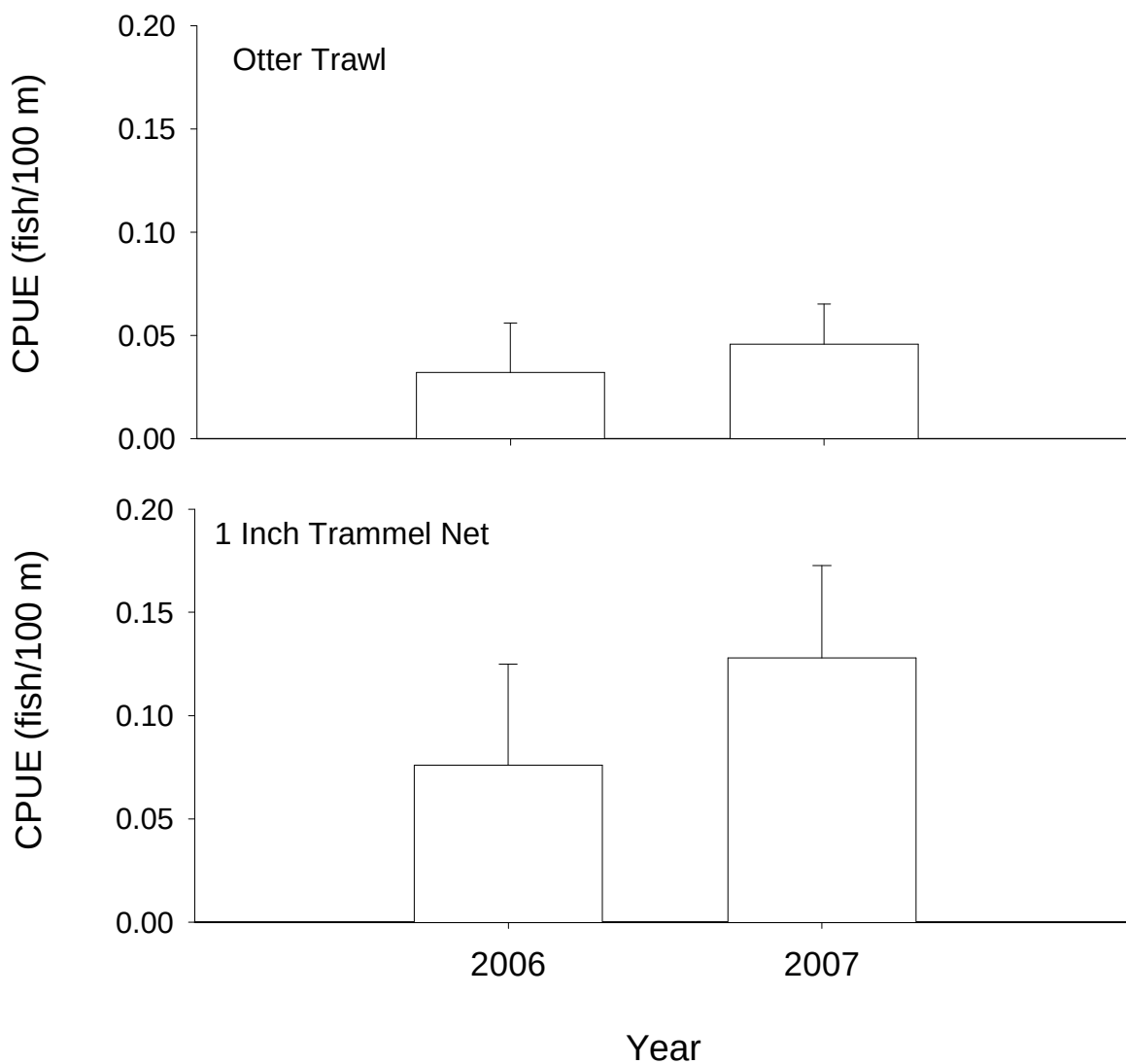


Figure 48. Mean annual catch-per-unit-effort (± 2 SE) of sauger using otter trawls and 1 inch trammel nets in segment 3 of the Missouri River during fish community season 2006-2007.

Segment 3 - Sauger / Fish Community Season

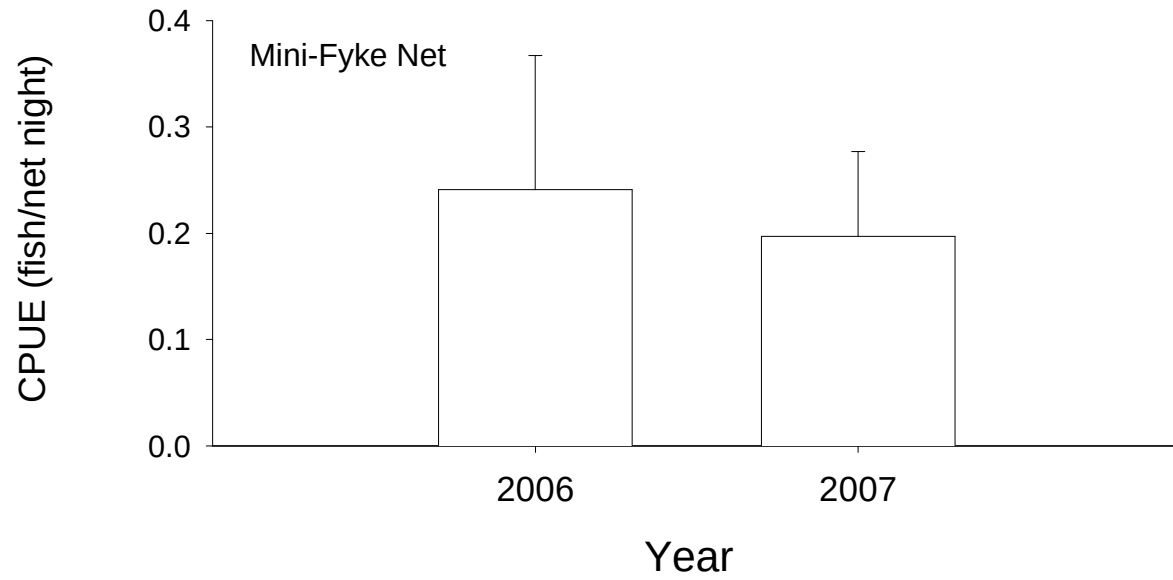


Figure 49. Mean annual catch-per-unit-effort ($\pm$ 2SE) of sauger using mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2007.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 3 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	44	0	30	0	N-E	0	20	11	39	0	0	0	0	0	0
	.	0	28	0	N-E	0	27	20	25	0	0	0	0	0	0
Gill Net					N-E										
					N-E										
Otter Trawl	22	0	5	0	N-E	0	18	50	23	0	5	0	0	0	0
	.	0	24	0	N-E	0	31	19	26	0	0	0	0	0	0
Fish Community Season (Summer)															
1 Inch Trammel Net	55	0	38	0	N-E	0	29	18	15	0	0	0	0	0	0
	.	0	36	0	N-E	0	31	26	7	0	0	0	0	0	0
Mini-Fyke Net	27	0	52	0	N-E	0	19	0	11	15	4	0	0	0	0
	.	0	26	0	N-E	0	32	1	23	16	3	0	0	0	0
Otter Trawl	27	0	22	0	N-E	0	26	19	33	0	0	0	0	0	0
	.	0	30	0	N-E	0	31	26	14	0	0	0	0	0	0

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 3 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	44	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	22	0	95	N-E	0	N-E	N-E
	·	0	97	N-E	2	N-E	N-E
Fish Community Season (Summer)							
1 Inch Trammel Net	55	0	100	N-E	0	N-E	N-E
	·	0	100	N-E	0	N-E	N-E
Mini-Fyke Net	27	100	0	N-E	0	N-E	N-E
	·	96	4	N-E	0	N-E	N-E
Otter Trawl	27	0	100	N-E	0	N-E	N-E
	·	0	99	N-E	1	N-E	N-E

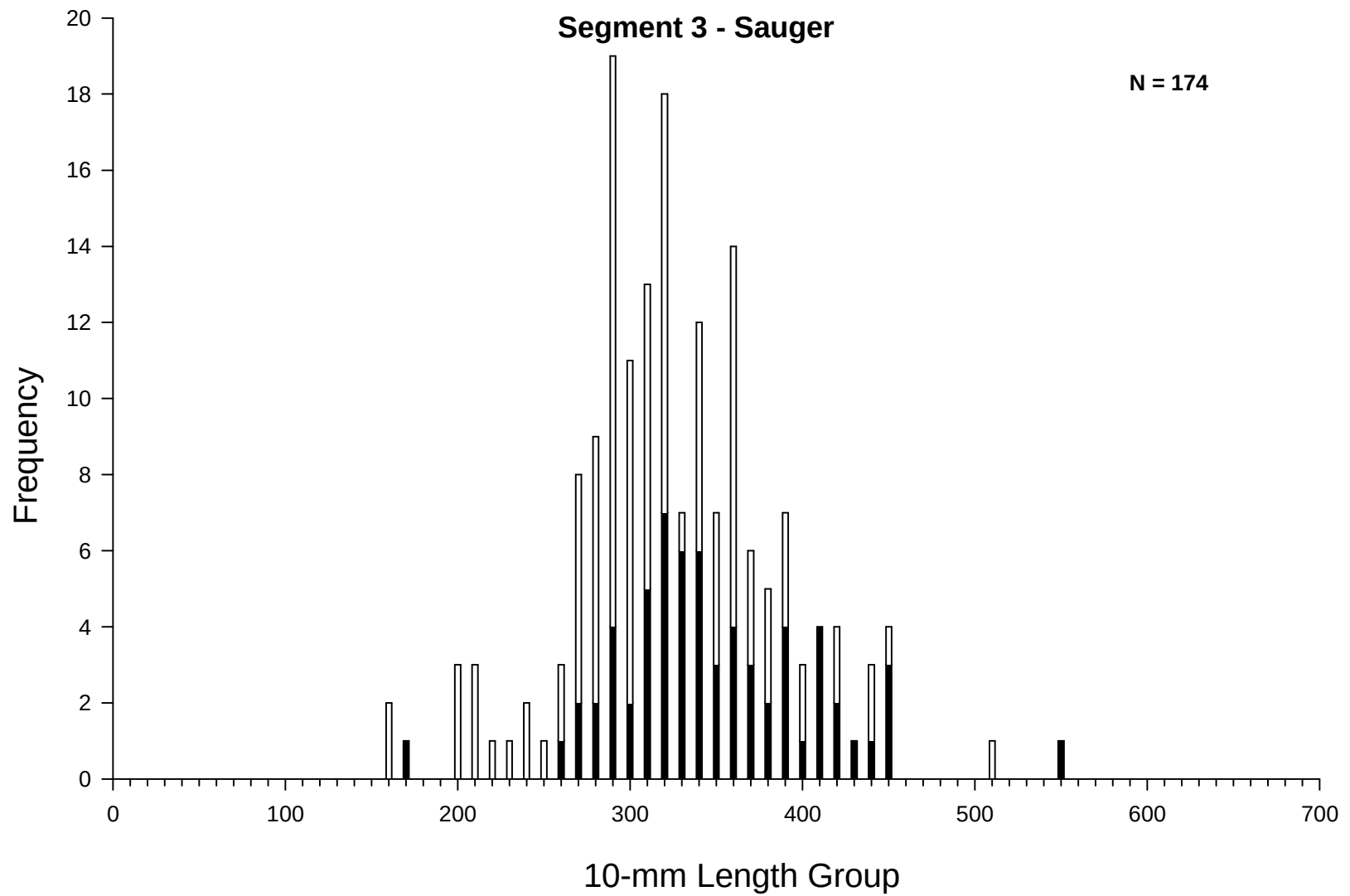


Figure 51. Length frequency of sauger during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segment 3 of the Missouri River during 2007.

Missouri River Fish Community

A total of 13,733 consisting of 35 species were collected in segment 3 during 2007. This was a decrease in total fish from 2006 when 17,180 fish were collected, but an increase in species from 31 collected in 2006. Of the species collected, 10 are not native to this section of the Missouri River, including in order of abundance; white crappie *Pomoxis annularis*, yellow bullhead *Ameiurus natalis*, common carp *Cyprinus carpio*, green sunfish *Lepomis cyanellus*, black bullhead *Ameiurus melas*, walleye *Sander vitreum*, lake whitefish *Coregonus clupeaformis*, spottail shiner *Notropis hudsonius*, northern pike *Esox lucius*, and rainbow smelt *Osmerus mordax*.

River carpsuckers *Carpiodes carpio* were the most abundant species with 4,590 collected. The total number of other species that had a sample size greater than 50 are as follows; 2,562 emerald shiners *Notropis atherinoides*, 1,591 flathead chubs *Platygobio gracilis*, 1,241 sturgeon chubs, 1,015 sand shiners, 449 goldeye *Hiodon alosoides*, 444 fathead minnows *Pimephales promelas*, 400 western silvery minnows, 293 shovelnose sturgeon, 195 sauger, 183 stonecats *Noturus flavus*, 152 channel catfish *Ictalurus punctatus*, 141 sicklefin chubs, 92 pallid sturgeon, and 66 white crappie.

Mini fyke nets collected 74% of fish sampled during 2007, with the otter trawl collecting 13%, push trawl 7%, trammel nets 5%, and trotlines 1%. However, the otter trawl collected more target species (N = 8) than mini fyke nets (N = 5), push trawls (N = 5), trammel nets (N = 4), or trotlines (N = 3).

The highest CPUE for mini fyke nets was for river carpsuckers at 30.8 fish/ net night, which was a large increase from 17.5/ net night in 2006 (Appendix F6). The majority of the river carpsucker catch in mini fyke nets were age-0 fish with an average total length of 31.1 mm. The relative abundance of emerald shiners was also significantly higher during 2007 (14.9 fish/ net) than in 2006 (6.9 fish/ net night). Similarly, fathead chubs increased to 8.8 fish/net night from 3.3 fish/ net night in 2006. Conversely, a large decrease was observed in the relative abundance of fathead minnows in 2007, with a CPUE of 3.1 fish/ net night versus 24.0 fish/ net night in 2006.

Channel catfish CPUE for the otter trawl decreased in 2007, with a CPUE of 0.07 fish/ 100 m, compared to 0.08 fish/ 100 m in 2006. However, the trammel net CPUE of channel catfish went up in 2007 to 0.05 fish/ 100 m from 0.03 fish/ 100 m in 2006. Because of the low

catch rates it is hard to make any conclusions on the overall relative abundance of channel catfish in segment 3. Nevertheless, YOY and age-1 channel catfish were sampled in both years, indicating spawning and recruitment in segment 3. For the most part, YOY channel catfish were collected in the downstream portions of segment 3, with the exception of the area just downstream of Poplar, MT. This pattern in YOY distribution was seen in both 2007 and 2006.

Discussion

A total of 20 randomly chosen river bends were sampled using all standard gears during both sturgeon and fish community seasons during 2007. No wild and/or adult pallid sturgeon were sampled in segment 3 during 2007. Although more pallid sturgeon were collected in 2007 when compared to 2006, the increase in numbers were due to an increase in effort and the addition of the push trawl and trotlines. Pallid sturgeon CPUE for standard gears did not differ greatly between 2007 and 2006. Nevertheless, more age classes of pallid sturgeon were sampled during 2007 than in 2006, indicating that the increased effort and/or gear types are potentially doing an improved job at describing the entire population of hatchery reared pallid sturgeon in segment 3. Pallid sturgeon were sampled throughout segment 3 during 2007, indicating suitable rearing habitat throughout the segment. Seventeen pallid sturgeon were sampled in duplicated subsamples, demonstrating that pallid sturgeon are often rearing in congregations.

Although the size distribution of shovelnose sturgeon sampled in segment 3 was skewed to larger fish, the presence of YOY and age-1 shovelnose indicates that at least some recruitment is occurring. The rearing area for YOY shovelnose is in the lower portion of segment 3, near the confluence of the Yellowstone River.

The push trawl was used in nine random river bends for evaluation purposes. The push trawl had a CPUE of 2.81 fish/ 100 m for sturgeon chubs, which was appreciably higher than otter trawls 0.51 fish/ 100m. However, the push trawls CPUE for pallid sturgeon (0.018 fish/ 100 m) and shovelnose sturgeon (0.0 fish/ 100 m) were lower than the otter trawls, which had a CPUE of 0.042 and 0.062 fish/ 100 m for pallid and shovelnose sturgeon, respectively. Therefore, as long as the otter trawl CPUE of sturgeon chubs is sufficient to detect changes in the relative abundance over time, the push trawl is not gaining anything in detecting changes in *Scaphirhynchus* spp.

Trotlines were only used in four river bends in segment 3 during 2007. Nevertheless, 16 pallid sturgeon were sampled using trotlines. In addition, trotlines collected 42 shovelnose sturgeon ranging in size from 465 mm to 853 mm FL. Trotlines will be further evaluated in 2008 as a gear to target pallid sturgeon. If trotlines are found to catch pallid sturgeon in areas where other gears are not effective and at a relatively high rate, they may be used in the future for survival or population estimate studies.

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. The abundance of YOY river carpsuckers in mini fyke nets increased to 30.77 fish/ net night in 2007 from 17.50 fish/ net night in 2006. Similarly, the CPUE of YOY flathead chubs in mini fyke nets increased to 8.83 fish/ net night in 2007 from 3.30 fish/ net night in 2006. Interestingly, no YOY goldeye were sampled in mini fyke nets during 2006, while 2007 had a CPUE of 0.14 fish/ net night.

Decreases in abundance of YOY fish were also observed in 2007 when compared to 2006. A substantial decrease in the relative abundance was seen for white suckers in segment 3 during 2007. Mini fyke CPUE of white suckers was 0.10 fish/ net night in 2007 and 5.96 fish/ net night in 2006. Similarly, fathead minnow abundance decreased from 24.04 fish/ net night in 2006 to 3.12 fish/ net night in 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 3 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 3 was near 12,000 cfs in June of 2007, a substantial increase from the maximum of just over 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 3 during 2007 when compared to 2006. The maximum recorded turbidity for 2007 was estimated at 1,700 NTU's, where as during 2006 the maximum was 402 NTU's. This increase in turbidity was primarily from the Milk River discharge. Although the specific mechanisms for the changes seen in YOY fishes in segment 3 are unknown, further years of analysis may help draw conclusions on the relationship between flow, turbidity and production of many species residing in segment 3 of the Missouri River.

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APPENDICES

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 3 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2006 for segment 3.

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.	2007 - 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
MO	4	Miami	MIA	Missouri	262.8

State(s)	RPMA	Site Name	Code	River	RM
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 3 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	Elastomer
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
2004	Wolf Point	4040	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	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	
2006	Mouth Milk	1117	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	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	

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

Appendix F

Total catch, overall mean catch per unit effort [± 2 SE], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 03 of the Missouri River during 2006-2007. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when $N < 2$.

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

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	
			CHNB	CHNB	CHNB	CHNB	ITIP
BKBH	0	0	0	0	0	0	0
		0	0	0	0	0	0
BKSB	0	0	0	0	0	0	0
		0	0	0	0	0	0
BMBF	2	0.002	0.007	0	0	0	0
		0.003	0.009	0	0	0	0
BRBT	0	0	0	0	0	0	0
		0	0	0	0	0	0
BUSK*	9	0.011	0.011	0.013	0.014	0.006	0
		0.008	0.013	0.018	0.016	0.013	0
CARP	8	0.008	0.003	0.022	0	0.006	0
		0.007	0.006	0.024	0	0.013	0
CNCF	44	0.053	0.047	0.07	0.027	0.044	0.285
		0.027	0.06	0.055	0.026	0.052	0.427
ERSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
FHCB	6	0.009	0.004	0.014	0.004	0	0.174
		0.009	0.007	0.016	0.008	0	0.348
FHMW	0	0	0	0	0	0	0
		0	0	0	0	0	0
FWDM	0	0	0	0	0	0	0
		0	0	0	0	0	0
GDEY	255	0.293	0.242	0.356	0.276	0.311	0.213
		0.053	0.089	0.108	0.106	0.126	0.426
GNSF	0	0	0	0	0	0	0
		0	0	0	0	0	0
LKWF	1	0.001	0	0	0.005	0	0
		0.003	0	0	0.011	0	0
LNDC	0	0	0	0	0	0	0
		0	0	0	0	0	0
LNSK	2	0.003	0.005	0.005	0	0	0
		0.004	0.01	0.009	0	0	0
PATT	0	0	0	0	0	0	0
		0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	
			CHNB	CHNB	CHNB	CHNB	ITIP
PDSG*	21	0.023	0.025	0.014	0.018	0.051	0
		0.01	0.019	0.016	0.021	0.037	0
PNMW*	0	0	0	0	0	0	0
		0	0	0	0	0	0
RBST	0	0	0	0	0	0	0
		0	0	0	0	0	0
RVCS	58	0.066	0.088	0.048	0.047	0.096	0
		0.023	0.056	0.035	0.038	0.055	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*	99	0.112	0.116	0.104	0.076	0.197	0
		0.029	0.05	0.057	0.055	0.077	0
SHRH	10	0.012	0.008	0.008	0.01	0.035	0
		0.008	0.012	0.015	0.015	0.034	0
SMBF	6	0.008	0.012	0.011	0	0.009	0
		0.007	0.014	0.016	0	0.019	0
SNSG*	160	0.189	0.153	0.171	0.229	0.232	0.195
		0.063	0.077	0.081	0.201	0.16	0.39
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
		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	5	0.005	0.007	0	0	0.019	0
		0.004	0.01	0	0	0.022	0
WSMW*	0	0	0	0	0	0	0
		0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	
			CHNB	CHNB	CHNB	CHNB	ITIP
WTCP	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTSK	0	0	0	0	0	0	0
		0	0	0	0	0	0
YLBH	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 on second line.

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL		SCN
			CHNB	CHNB	CHNB	CHNB	ITIP	(blank)
BKBH	1	0.001 0.002	0 0	0 0	0 0	0.004 0.008	0 0	0
BKSB	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
BRBT	6	0.006 0.005	0.01 0.011	0.003 0.005	0 0	0.013 0.018	0 0	0
BUSK*	1	0.001 0.002	0 0	0.003 0.005	0 0	0 0	0 0	0
CARP	18	0.016 0.009	0.009 0.014	0.013 0.013	0.007 0.013	0.044 0.037	0 0	0
CNCF	82	0.067 0.027	0.056 0.024	0.092 0.08	0.039 0.024	0.087 0.051	0 0	0
ERSN	19	0.016 0.01	0.018 0.025	0.02 0.019	0.007 0.009	0.021 0.024	0 0	0
FHCB	273	0.23 0.043	0.148 0.045	0.232 0.083	0.128 0.058	0.399 0.141	0.655 0.362	1.667
FHMW	2	0.001 0.002	0 0	0.002 0.004	0 0	0.004 0.008	0 0	0
FWDM	0	0 0	0 0	0 0	0 0	0 0	0 0	0
GDEY	27	0.022 0.013	0.007 0.01	0.05 0.04	0.01 0.011	0.016 0.02	0 0	0
GNSF	0	0 0	0 0	0 0	0 0	0 0	0 0	0
LKWF	1	0.001 0.001	0 0	0 0	0 0	0.004 0.008	0 0	0
LNDC	1	0.001 0.002	0 0	0 0	0 0	0.004 0.008	0 0	0
LNSK	4	0.003 0.004	0.006 0.012	0 0	0 0	0.008 0.012	0 0	0
PATT	0	0 0	0 0	0 0	0 0	0 0	0 0	0

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL		SCN
			CHNB	CHNB	CHNB	CHNB	ITIP	(blank)
PDSG*	45	0.042	0.035	0.04	0.055	0.04	0.047	0
		0.016	0.027	0.021	0.049	0.026	0.093	
PNMW*	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	
RBST	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	
RVCS	24	0.021	0.015	0.023	0.01	0.041	0	0
		0.01	0.013	0.018	0.011	0.034	0	
SFCB*	105	0.091	0.117	0.079	0.128	0.041	0	0
		0.029	0.07	0.046	0.069	0.044	0	
SGCB*	591	0.513	0.714	0.505	0.546	0.257	0.152	0
		0.107	0.263	0.204	0.217	0.111	0.152	
SGER*	49	0.042	0.021	0.027	0.065	0.066	0	0.333
		0.016	0.016	0.019	0.052	0.039	0	
SHRH	18	0.019	0.006	0.02	0.032	0.024	0	0
		0.011	0.009	0.017	0.035	0.022	0	
SMBF	2	0.002	0	0.003	0.003	0	0	0
		0.002	0	0.005	0.007	0	0	
SNSG*	67	0.062	0.06	0.054	0.1	0.03	0.047	0
		0.02	0.028	0.027	0.066	0.027	0.093	
SNSN*	13	0.01	0	0.034	0	0	0	0
		0.011	0	0.037	0	0	0	
STCT	123	0.114	0.019	0.14	0.179	0.135	0	0
		0.046	0.02	0.112	0.111	0.087	0	
STSN	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	
UNID	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	
WLYE	1	0.001	0	0	0	0.004	0	0
		0.002	0	0	0	0.008	0	
WSMW*	11	0.009	0.006	0.011	0.003	0.016	0	0
		0.006	0.008	0.011	0.007	0.023	0	
WTCP	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	

Species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL		SCN
			CHNB	CHNB	CHNB	CHNB	ITIP	(blank)
WTSK	1	0.001	0	0.003	0	0	0	0
		0.002	0	0.005	0	0	0	
YLBH	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	

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

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB	SCCL		SCCS	SCN
			BAR	CHNB	BAR	CHNB	BAR	BAR	CHNB	BAR	BAR
BKBH	21	0.153	0.235	0	0.279	0	0	0	0	0	0.25
		0.133	0.268		0.36			0	0	0	0.5
BKSB	1	0.007	0	0	0	0	0	0	0	0	0.25
		0.015	0		0			0	0	0	0.5
BMBF	1	0.007	0	0	0	0	0	0	0	0.045	0
		0.015	0		0			0	0	0.091	0
BRBT	9	0.066	0.088	0	0.093	0	1	0.036	0	0	0
		0.047	0.099		0.112			0.071	0	0	0
BUSK*	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
CARP	16	0.117	0.029	0	0	0	0	0.036	0	0.182	2.5
		0.151	0.059		0			0.071	0	0.214	5
CNCF	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
ERSN	2048	14.949	13.559	2	10.698	63	17	26.75	7	12.273	1.25
		8.466	7.8		7.215			37.661	4	12.068	1.893
FHCB	1210	8.832	3.882	1	9.977	6	0	5.571	9.667	20.409	2
		4.588	2.124		9.078			5.829	16.425	20.432	4
FHMW	428	3.124	1.882	3	0.953	3	0	5.643	0.667	4.864	12.5
		1.552	1.255		0.645			6.299	1.333	2.854	20.599
FWDM	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
GDEY	19	0.139	0	0	0.047	0	0	0.036	0	0.227	2.75
		0.125	0		0.065			0.071	0	0.225	3.403
GNSF	26	0.19	0.294	0	0.186	0	0	0.071	0	0.273	0
		0.122	0.274		0.251			0.099	0	0.376	0
LKWF	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
LNDC	12	0.088	0.206	0	0.07	0	0	0	0	0.091	0
		0.096	0.356		0.079			0	0	0.182	0
LNSK	2	0.015	0	0	0.047	0	0	0	0	0	0
		0.021	0		0.065			0	0	0	0
PATT	5	0.036	0	0	0	0	0	0	0	0.045	1
		0.06	0		0			0	0	0.091	2

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB	SCCL		SCCS	SCN
			BAR	CHNB	BAR	CHNB	BAR	BAR	CHNB	BAR	BAR
PDSG*	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
PNMW*	2	0.015	0.059	0	0	0	0	0	0	0	0
		0.021	0.082		0			0	0	0	0
RBST	1	0.007	0	0	0	0	0	0.036	0	0	0
		0.015	0		0			0.071	0	0	0
RVCS	4216	30.774	14.735	5	28.326	2	1	41.929	20	48.591	46.5
		15.327	13.443		32.194			47.556	31.432	29.274	90.338
SFCB*	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
SGCB*	14	0.102	0.147	0	0.163	0	0	0.036	0	0.045	0
		0.06	0.149		0.132			0.071	0	0.091	0
SGER*	27	0.197	0.412	0	0.116	0	0	0.107	0	0.182	0.25
		0.08	0.225		0.099			0.119	0	0.214	0.5
SHRH	4	0.029	0	0	0	0	0	0.036	0.333	0.091	0
		0.036	0		0			0.071	0.667	0.182	0
SMBF	1	0.007	0	0	0	0	0	0	0	0	0.25
		0.015	0		0			0	0	0	0.5
SNSG*	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
SNSN*	769	5.613	9.912	0	2.512	8	0	5.714	0.667	6.591	2.25
		2.893	8.213		1.672			5.26	1.333	10.308	4.5
STCT	19	0.139	0.206	1	0.07	0	0	0.107	0	0.227	0
		0.088	0.25		0.14			0.119	0	0.225	0
STSN	2	0.015	0	0	0	0	0	0.036	0	0.045	0
		0.021	0		0			0.071	0	0.091	0
UCY	23	0.168	0.618	0	0	0	0	0.071	0	0	0
		0.238	0.944		0			0.143	0	0	0
UNID	7	0.051	0.029	0	0.093	0	0	0.036	0.333	0	0
		0.048	0.059		0.13			0.071	0.667	0	0
WLYE	0	0	0	0	0	0	0	0	0	0	0
		0	0		0			0	0	0	0
WSMW*	300	2.19	1.853	1	1.302	0	1	1.286	0	4.864	9
		1.518	1.71		0.942			1.107	0	8.263	18

Species	Total Catch	Overall CPUE	CHXO		ISB		OSB	SCCL		SCCS	SCN
			BAR	CHNB	BAR	CHNB	BAR	BAR	CHNB	BAR	BAR
WTCP	56	0.409	0.147	1	0.186	0	0	0.179	0	1.455	1.25
		0.304	0.149		0.191			0.292	0	1.729	1.893
WTSK	13	0.095	0.294	0	0	0	0	0	0	0.136	0
		0.109	0.418		0			0	0	0.199	0
YLBH	47	0.343	0	0	0	0	0	0	0	0	11.75
		0.686	0		0			0	0	0	23.5

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

Species	Total Catch	Overall CPUE	CHXO		ISB		SCCL		SCCS		SCN
			BAR	CHNB	BAR	CHNB	BAR	CHNB	BAR	CHNB	CHNB
BKBH	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
BKSB	0	0	0	0	0	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	0	0	0	0	0
BRBT	0	0	0	0	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	0	0	0	0
CARP	1	0.009	0	0	0	0	0	0	0.092	0	0
		0.017	0	0	0	0	0	0	0.183	0	0
CNCF	4	0.032	0	0	0	0	0	0	0	1.176	0
		0.064	0	0	0	0	0	0	0	2.353	0
ERSN	48	0.33	0.1	0.182	0.543	0	0.097	0.048	0.246	5	0.787
		0.285	0.201	0.364	0.361	0	0.109	0.095	0.493	10	0.331
FHCB	45	0.267	0.445	0	0.316	0.192	0.258	0	0.152	0.571	0
		0.123	0.366	0	0.296	0.283	0.223	0	0.205	1.143	0
FHMW	1	0.005	0.02	0	0	0	0	0	0	0	0
		0.01	0.04	0	0	0	0	0	0	0	0
FWDM	4	0.038	0	0	0	0	0	0	0	0	1.408
		0.056	0	0	0	0	0	0	0	0	0.911
GDEY	123	0.982	0.037	1.053	0.026	0	0.087	0.642	0	18.655	13.188
		0.898	0.051	2.105	0.052	0	0.099	0.626	0	14.454	0.29
GNSF	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
LKWF	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
LNDC	2	0.012	0.021	0	0.036	0	0	0	0	0	0
		0.016	0.042	0	0.073	0	0	0	0	0	0
LNSK	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO		ISB		SCCL		SCCS		SCN
			BAR	CHNB	BAR	CHNB	BAR	CHNB	BAR	CHNB	CHNB
PATT	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
PDSG*	4	0.018	0.038	0	0	0	0.042	0	0	0	0
		0.018	0.053	0	0	0	0.057	0	0	0	0
PNMW*	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
RBST	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
RVCS	231	1.891	0.085	0	0.109	0.056	0.066	0	0.571	55.882	9.876
		3.036	0.137	0	0.122	0.112	0.071	0	1.143	111.765	2.609
SFCB*	18	0.106	0.225	0	0.209	0.107	0.02	0	0	0	0
		0.066	0.215	0	0.179	0.138	0.039	0	0	0	0
SGCB*	444	2.809	4.103	3.498	6.162	1.622	0.409	0.075	2.887	2.882	1.263
		1.107	2.969	1.732	3.357	1.366	0.21	0.15	4.119	2.235	1.284
SGER*	3	0.024	0.044	0	0	0	0	0	0.057	0.294	0
		0.029	0.089	0	0	0	0	0	0.114	0.588	0
SHRH	1	0.006	0	0	0.036	0	0	0	0	0	0
		0.013	0	0	0.073	0	0	0	0	0	0
SMBF	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
SNSG*	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
SNSN*	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
STCT	24	0.143	0.019	0	0.589	0.052	0.046	0.048	0	0.571	0
		0.172	0.037	0	0.945	0.104	0.063	0.095	0	1.143	0
STSN	0	0	0	0	0	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	0	0	0	0	0
UNID	0	0	0	0	0	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	0	0	0	0	0
WSMW*	7	0.04	0.065	0	0.093	0	0	0	0	0.294	0
		0.033	0.071	0	0.128	0	0	0	0	0.588	0

Species	Total Catch	Overall CPUE	CHXO		ISB		SCCL		SCCS		SCN
			BAR	CHNB	BAR	CHNB	BAR	CHNB	BAR	CHNB	CHNB
WTCP	8	0.069	0	0	0.062	0	0	0	0	0.588	1.553
		0.092	0	0	0.123	0	0	0	0	1.176	3.106
WTSK	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
YLBH	0	0	0	0	0	0	0	0	0	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 2006 – 2007 for segment 03 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
BKBH	0.000		0.001	0.000	0.153	0.000	0.000
BKSB	0.000		0.000	0.000	0.007	0.000	0.000
BMBF	0.002		0.000	0.002	0.007	0.000	0.000
BRBT	0.000		0.007	0.000	0.066	0.005	0.000
BUSK*	0.007		0.000	0.016	0.000	0.002	0.000
CARP	0.012		0.022	0.005	0.117	0.009	0.009
CNCF	0.048		0.085	0.057	0.000	0.048	0.031
ERSN	0.000		0.026	0.000	14.949	0.006	0.326
FHCB	0.007		0.319	0.012	8.832	0.136	0.264
FHMW	0.000		0.003	0.000	3.124	0.000	0.005
FWDM	0.000		0.000	0.000	0.000	0.000	0.038
GDEY	0.285		0.012	0.297	0.139	0.033	0.969
GNSF	0.000		0.000	0.000	0.190	0.000	0.000
LKWF	0.000		0.000	0.003	0.000	0.002	0.000
LNDC	0.000		0.000	0.000	0.088	0.002	0.011
LNSK	0.000		0.003	0.006	0.015	0.003	0.000
NFSH	0.000		0.000	0.000	0.000	0.000	0.000
PATT	0.000		0.000	0.000	0.036	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*	0.016		0.034	0.030	0.000	0.050	0.018
PNMW*	0.000		0.000	0.000	0.015	0.000	0.000
RBST	0.000		0.000	0.000	0.007	0.000	0.000
RVCS	0.078		0.025	0.053	30.774	0.016	1.865
SFCB*	0.000		0.007	0.000	0.000	0.176	0.104
SGCB*	0.000		0.394	0.000	0.102	0.630	2.772
SGER*	0.096		0.038	0.128	0.197	0.046	0.024
SHRH	0.012		0.021	0.012	0.029	0.018	0.006
SMBF	0.012		0.003	0.005	0.007	0.000	0.000
SNSG*	0.068		0.053	0.307	0.000	0.070	0.000
SNSN*	0.000		0.020	0.000	5.613	0.000	0.000
STCT	0.000		0.191	0.000	0.139	0.034	0.141
STSN	0.000		0.000	0.000	0.015	0.000	0.000
UCY	0.000		0.000	0.000	0.168	0.000	0.000
UNID	0.000		0.000	0.000	0.051	0.000	0.000
WLYE	0.002		0.000	0.008	0.000	0.002	0.000
WSMW*	0.000		0.014	0.000	2.190	0.003	0.040
WTCP	0.000		0.000	0.000	0.409	0.000	0.068

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
WTSK	0.000		0.002	0.000	0.095	0.000	0.000
YLBH	0.000		0.000	0.000	0.343	0.000	0.000

Appendix I. Comprehensive list of bend numbers and locations for segment 3 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2006-2007.

Bend Number	Bend River Mile	Coordinates* Latitude Longitude		2006	2007
1	1701.5				
2	1700				
3	1698.5				
4	1697.5				
5	1696				
6	1695	48.08947	105.4386		ST, FC
7	1693.5				
8	1692	48.09134	105.3734		ST, FC
9	1690.5				
10	1689	48.08243	105.324		ST, FC
11	1687.5				
12	1685.5				
13	1684.5	48.0912	105.2475		ST, FC
14	1683	48.08517	105.2247	ST, FC	
15	1681.5				
16	1680	48.06636	105.1997	ST, FC	
17	1678.5	48.09023	105.1836		ST, FC
18	1677	48.10268	105.1735		ST, FC
19	1675.5				
20	1674				
21	1672.5				
22	1671				
23	1670				
24	1668.5				
25	1667				
26	1666				
27	1665				
28	1664				
29	1663				
30	1661.5				
31	1660				

32	1659	48.06867	104.9993	ST, FC	
33	1657	48.09531	104.9813	ST, FC	
34	1656				
35	1655				
36	1654				
37	1653	48.09515	104.9395		ST, FC
38	1651	48.12806	104.9239		ST, FC
39	1650				
40	1648.5	48.14876	104.8982		ST, FC
41	1647				
42	1646				
43	1644.5				
44	1643				
45	1641.5				
46	1640.5				
47	1639.5	48.11303	104.735		ST, FC
48	1638.5	48.11906	104.7156		ST, FC
49	1637.5				
50	1636.5	48.10395	104.6821	ST, FC	
51	1635.5				
52	1634.5	48.10719	104.6587		ST, FC
53	1633.5				
54	1632.5				
55	1631.5				
56	1630.5	48.13984	104.6045	ST, FC	
57	1629.5				
58	1628.5				
59	1627				
60	1625.5	48.11823	104.5667		ST, FC
61	1624				
62	1623	48.11155	104.5103	ST, FC	
63	1622				
64	1620.5	48.12325	104.4721		ST, FC
65	1619.5				
66	1618.5				

67	1617.5	48.09658	104.4437		ST, FC
68	1616.5	48.08134	104.4154	ST, FC	
69	1615	48.07642	104.3929		ST, FC
70	1613.5				
71	1612				
72	1611				
73	1610				
74	1608.5	48.04829	104.2829		ST, FC
75	1606.5	48.035	104.2509	ST, FC	
76	1604.5	48.03568	104.2071	ST, FC	
77	1603				
78	1598.5	48.04596	104.1837	ST, FC	
79	1597.5				
80	1596				
81	1595	48.05317	104.1413		ST, FC
82	1594	48.0378	104.1241		ST, FC
83	1593	48.02956	104.1027		FC
84	1592				
85	1591				
86	1590.5	48.02015	104.1002		ST, FC
87	1589.5	48.0052	104.1017		ST, FC
88	1588.5				
89	1587				
90	1585.5				
91	1583.5				

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