2012 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

By:

Tyler Haddix, Landon Holte, John Hunziker and Ryan Lott

Montana Fish, Wildlife & Parks
PO Box 165
Fort Peck, MT 59223

June 2013

EXECUTIVE SUMMARY

The 2012 season was the seventh consecutive year that the pallid sturgeon population assessment program (Program) has been in place in Segment 3 of the Missouri River. With the historically high flows of 2011, data obtained in 2012 were extremely valuable in understanding the effects the high flows had on pallid sturgeon *Scaphirhynchus albus* and the rest of the fish community. Since high waters in 2011 made sampling difficult and likely reduced the efficiencies of the Programs standard gears, relative abundance data obtained in 2012 are best compared to years prior to 2011. However, other types of data such as relative condition, distribution and size structure are comparable across all years.

Sampling began in the sturgeon season on April 9th and ended on June 21st. A total of 24 randomly selected river bends were sampled during the sturgeon season using both the otter trawl and trammel nets. In addition, 11 randomly selected river bends were sampled using standard trotlines. The fish community season in Segment 3 began on July 17th and went until October 24th. A total of 23 randomly selected river bends were sampled using the otter trawl and mini fyke nets, while 25 bends were sampled with trammel nets. During the fish community season trotlines were used in 14 random river bends.

More pallid sturgeon were captured within segment 3 during 2012 than any previous sampling year. A total of 253 pallid sturgeon, all of hatchery origin were sampled in random and non-random sampling. The longitudinal distribution of pallid sturgeon captures during 2012 differed from previous years of sampling, with the majority of pallid sturgeon captures occurred upstream of river mile 1,640. In years prior to 2011, the majority of pallid sturgeon captures occurred downstream of this area in the lower most portions of Segment 3. A similar change in the distribution of pallid sturgeon prior and post 2011 occurred in upstream Segment 2. By far more pallid sturgeon were captured in Segment 2 during 2012 than any previous year. These fish likely migrated upstream out of Segment 3 into Segment 2. The change in pallid sturgeon distribution is likely due to the high flows of 2011 and the changes in habitat created by that event.

A total of 11 year classes of hatchery reared pallid sturgeon were sampled in 2012, with the most common being the 2009 year class with 78 sampled. The largest pallid sturgeon sample was from the 1997 year class, which measured 795 mm in length and weighed 1,730 g. The size structure of pallid sturgeon captured in Segment 3 has been changing in a positive way since

beginning the Program in 2006. From 2006 to 2012 the proportion of larger pallid sturgeon in the catch has increased every year. During 2006, a majority of the pallid sturgeon captured during the sturgeon season were of sub-stock size, whereas in 2012 no sub-stock sized fish were captured. This is positive in terms of the hatchery reared pallid sturgeon population growing into larger size classes, but also indicates no natural recruitment has been documented in the river. While the size structure of hatchery reared pallid sturgeon is increasing, there are still relatively few fish of quality or larger size classes present.

The average relative condition factor of pallid sturgeon has not appreciably changed over the seven years of the Program's sampling. This is an important metric to keep track of, since it may help identify if the carrying capacity of *Scaphirhynchus spp.*is being met. Although no significant change in relative condition has been observed, the growth rates of stocked pallid sturgeon do generally decline as fish get older. In other words, the growth rates of younger year classes are on average growing at a faster rate than the older year classes of hatchery stocked fish. While the growth rates of fish often decline at some age, the decrease that is being observed in the Missouri River may be due to the switch a pallid sturgeon from insectivory to piscivory.

During 2012 a total of 456 shovelnose sturgeon *Scaphirhynchus platorynchus* were sampled within Segment 3 in random and non-random sampling. The catch-per-unit-effort (CPUE) of shovelnose sturgeon for both otter trawls and trammel nets during 2012 drastically increased from 2011. However, the large increase in CPUE was likely due to low gear efficiencies in 2011 due to high Missouri River discharge. Total shovelnose sturgeon CPUE in 2012 was similar to years prior to 2011. Although the overall CPUE of shovelnose sturgeon has not changed greatly over the years, with the exception of 2011, data collected have proven valuable in determining recruitment.

Shovelnose data indicate that through the seven years of sampling, two years stand out as far as good production and recruitment years, 2007 and 2010. During 2007 and 2010 standard sampling collected a higher proportion of shovelnose sturgeon smaller than 150 mm in length than all other sampling years. Subsequently, each of those cohorts were identified the following season as fish between 150 and 250 mm, and again they made up a larger proportion of the total catch than other sampling years. The ability to detect and follow a strong year class of shovelnose sturgeon is extremely important in identifying environmental conditions that may

influence year class strength. The strong year classes of shovelnose sturgeon produced in 2007 and 2010 were likely related to Missouri and Milk River discharge. During 2007 the Missouri River peaked at nearly 12,000 cfs in early June and had a second peak of over 10,000 cfs in late June. During this time period, the Milk River was inputting approximately 5,000 cfs into the Missouri River, which was roughly half of the Missouri River's discharge. Similar to 2007, during 2010 flows Missouri River flows in late June were at nearly 12,000 cfs. In addition, during late June in 2010 the Milk River was inputting approximately 6,000 cfs or approximately half of the Missouri Rivers discharge. For both years, the warm and turbid water of the Milk River likely had a great influence on the Missouri River and made for excellent spawning, incubating and hatching conditions.

The relative abundance of many native cyprinids such as sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, sand shiner *Notropis stramineus* and western silvery minnows *Hypognathus argyritis* have been being monitored by the combination of otter trawls and mini fyke nets. The relative abundance of all these species have either decreased in recent years or have remained at very low detection levels. For instance, sturgeon chub CPUE using the otter trawl was at a seven year high in 2006 with more than 0.6 fish/100 m trawled. Since 2006 otter trawl CPUE has decreased to 0.21 fish/100 m, in 2012. A similar pattern has been observed in sand shiner CPUE in mini fyke nets. During 2006 mini fyke nets captured an average of 13.7 sand shiners per net night, while during 2012 only 1.7 sand shiners were capture on average per net night. Similar to sturgeon chubs and sand shiners, the relative abundance of western silvery minnows has went from a high in 2008 to very few fish captured the last four years. While the relative abundance of sicklefin chubs has not significantly changed, the presence of this species in our otter trawling has consistently been low since sampling began.

The apparent decrease in several native cyprinid populations might be explained by the relatively high number of predators in the system over the past couple of years. The sauger population appears to have increased since the inception of the program. The good water years of 2007, 2010 and 2011 seem to have produced good year classes of sauger. As mentioned for shovelnose sturgeon, Milk River flows likely had an important influence on good sauger recruitment. In addition to good sauger numbers, the stocking of pallid sturgeon within RPMA 2 may be putting more stress on native cyprinid populations. In addition, the spill event that took place at Fort Peck Dam for the majority of the spring and summer of 2011 increased the numbers

of adult predators in the system instantly. Walleye, northern pike, smallmouth bass, channel catfish and lake trout all were entrained through the spillway and were displaced in the Missouri River downstream of the dam.

While the same good water years that produced sauger and shovelnose sturgeon and likely led to higher survival and growth of hatchery reared pallid sturgeon, likely had a positive effect on native cyprinid populations. However, while native cyprinids only live for a short few years, sauger and sturgeon are longer lived and may make it harder for cyprinid populations to bounce back after years of poor water conditions. The fact that we haven't seen any bump in native cyprinid numbers after the 2011 water year may provide evidence of heavy predation of native cyprinids by predators.

In summary, the data the Program is collecting is invaluable as far as gaining further insight into pallid sturgeon growth, distribution, habitat use and condition. The data collected over the past seven years will provide the baseline for the aquatic ecosystem of the Missouri River and will allow us to monitor both pallid sturgeon and their prey base as hatchery stocked fish reach larger sizes and eventually become sexually mature. Native cyprinid data, coupled with relative condition of both pallid and shovelnose sturgeon will give us insights in to prey availability and whether the carrying capacity of the system has been reached or not. Water seems to be the key to many of the questions that have historically been asked. The flows out of the Fort Peck Project in 2011 greatly influenced adult and juvenile pallid sturgeon behavior and habitat use. Additionally, data collected from the Project is allowing us to understand how important inputs from the lower Missouri Rivers largest tributary, the Milk River is to native fish, including pallid and shovelnose sturgeon. The Milk River's importance is likely heightened due to the hypolimnetic withdrawals and altered hydrograph that occurs do to the normal operations of Fort Peck Dam. Developing a flow regime from Fort Peck Dam that would satisfy the needs of the majority of the users of the Missouri River and the pallid sturgeon sounds daunting. However, the Programs data are ever clearer in understanding that small changes in flow, temperature and suspended sediment may lead to large benefits in the health of the Missouri River and get us closer to recovering the pallid sturgeon.

TABLE OF CONTENTS

LIST OF TABLES

Pallid sturgeon

Shovelnose sturgeon

LIST OF FIGURES

Shovelnose sturgeon

Sturgeon chub

Sicklefin chub

Sand shiner

***Hybognathus* spp.**

Blue sucker

Sauger

LIST OF APPENDICES

Introduction

The 2012 field season was the seventh consecutive year that standardized monitoring occurred in Segment 3 of the Missouri River. Data collected in the Missouri River during 2012 were of significant importance due to the extremely high water year of 2011. The monitoring program is designed to detect changes in fish populations, growth rates and habitat use following a management action or a significant natural event. Data from 2012 give us insight into how the flooding of 2011 may have influenced fish populations within Segment 3. While the water year of 2012 was more similar to years prior to 2011, flows were slightly elevated throughout the summer season due to releases at Fort Peck Dam. Direct comparisons between 2012 and 2011 should be cautioned due to changing gear efficiencies with changing river flows. However, data collected in 2012 should be comparable to years prior to 2011.

Sampling in Segment 3 occurred from April 9th to June 21st for the sturgeon season, where the otter trawl, trammel nets and trotlines were used. Water temperatures ranged from 5.6 to 19.1 C^{o} during the sturgeon season. Sampling during the fish community season occurred from July 17th through October 24th, where mini fyke nets were added. Water temperatures during the fish community season ranged from 8.0 to 21.1 C^{o}. Missouri River discharge ranged from 6,800 to 13,100 cfs during the sampling season.

Background

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

(Welker and Drobish 2011). 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 (Welker and Drobish 2011). 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.

In addition to pallid sturgeon, the program is designed to monitor nine other native Missouri River species labeled "target" species. These include, shovelnose sturgeon *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, plains minnow *Hybognathus placitus*, western silvery minnow *H. argyritis*, and sand shiner *Notropis stramineus*. This suite of species was selected for various reasons. First, some species may have similar habitat requirements as pallid sturgeon and therefore by monitoring their populations we may gain further insight into pallid sturgeon habitat and how anthropomorphic and natural changes to the Missouri River affect native fish assemblages. Secondly, it is hypothesized that various chub species and other native fishes are an important component of pallid sturgeon diet, and thereby monitoring pallid sturgeon prey 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 in segment 2 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 slightly less flow regulated than upstream segments due to the 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 suspended sediment, 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 stretch of river can be highly dynamic and 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). However, due to the extremely low spring and summer flows that we've experienced in the past three years due to the operations of Fort Peck Dam, habitat formation is not occurring as it might have during the high runoff years of the 1990's.

Methods

Sampling methods for the Pallid Sturgeon Population Assessment Program were conducted in accordance with the Standard Operating Procedures (Welker and Drobish 2011), 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 Welker and Drobish (2011). A general description of sampling 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 3 consisted of 22 randomly selected bends.

Two gears, the trammel net and otter trawl are considered standard gears for the sturgeon and fish community seasons. Trammel nets were used in 22 bends during season and 22 during fish community. Otter Trawls were used in 22 bends during sturgeon and 22 during fish community season. Additionally, mini fyke nets are also considered a standard gear for the fish community season and 22 randomly selected bends were sampled with mini fyke nets.

Trotlines were used again in segment 3 during 2012 as a standard gear during both the sturgeon and fish community seasons to monitor changes in relative abundance, size structure, growth, habitat use and potential movements. All 22 randomly chosen river bends were sampled using trotlines, eleven during the sturgeon season and eleven during the fish community season. Random river bends for trotlines were chosen by moving one river bend upstream from the randomly chosen river bends for standard gears. This was done to minimize the influence of trotlines on our standard gears and make logistics easier. Since trotlines are a gear that requires attending a river bend on two consecutive days, it is logistically better to be able to set trotlines on the same day as otter trawling or drifting trammel nets occurs. We also wanted to make sure that one gear wasn't influencing the catch of other gears and by sampling the next river bend upstream we believe we achieved this. No marked pallid sturgeon captured in standard gears or trotlines were subsequently captured in different gear at an adjacent bend within the same

sampling period in 2012. In addition, trotlines were used in wild fashion during September in the lower sections of segment 3 to increase the total catch of hatchery reared pallid sturgeon to further populate survival estimate models.

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 Welker and Drobish (2011).

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.

Trotlines

Trotlines consisted of 32 m nylon rope attached to both upstream and downstream anchors. Octopus style circle hooks were attached to the ropes using 136 kg monofilament line

and commercial fishing clips. Twenty 45.7 cm leaders were used on each trotline each with a 2/0 Eagle Claw circle hook. Trotlines are set overnight and checked the next morning.

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.

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

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker and Drobish (2009). Two fin pectoral fin clips (~ 2 cm^2) are taken from any pallid sturgeon of unknown origin. Fin samples are then preserved in 95% non-denatured alcohol for genetic analysis. All samples are sent to the U.S. Fish and Wildlife Service's Lamar Laboratory 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.

Size Classes of Pallid and Shovelnose Sturgeon

We used the length categories proposed by Shuman et al. (2006) for pallid sturgeon and Quist et al. (1998) for shovelnose sturgeon when looking at the total proportion of fish captured by length. 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 size classes.

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 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.

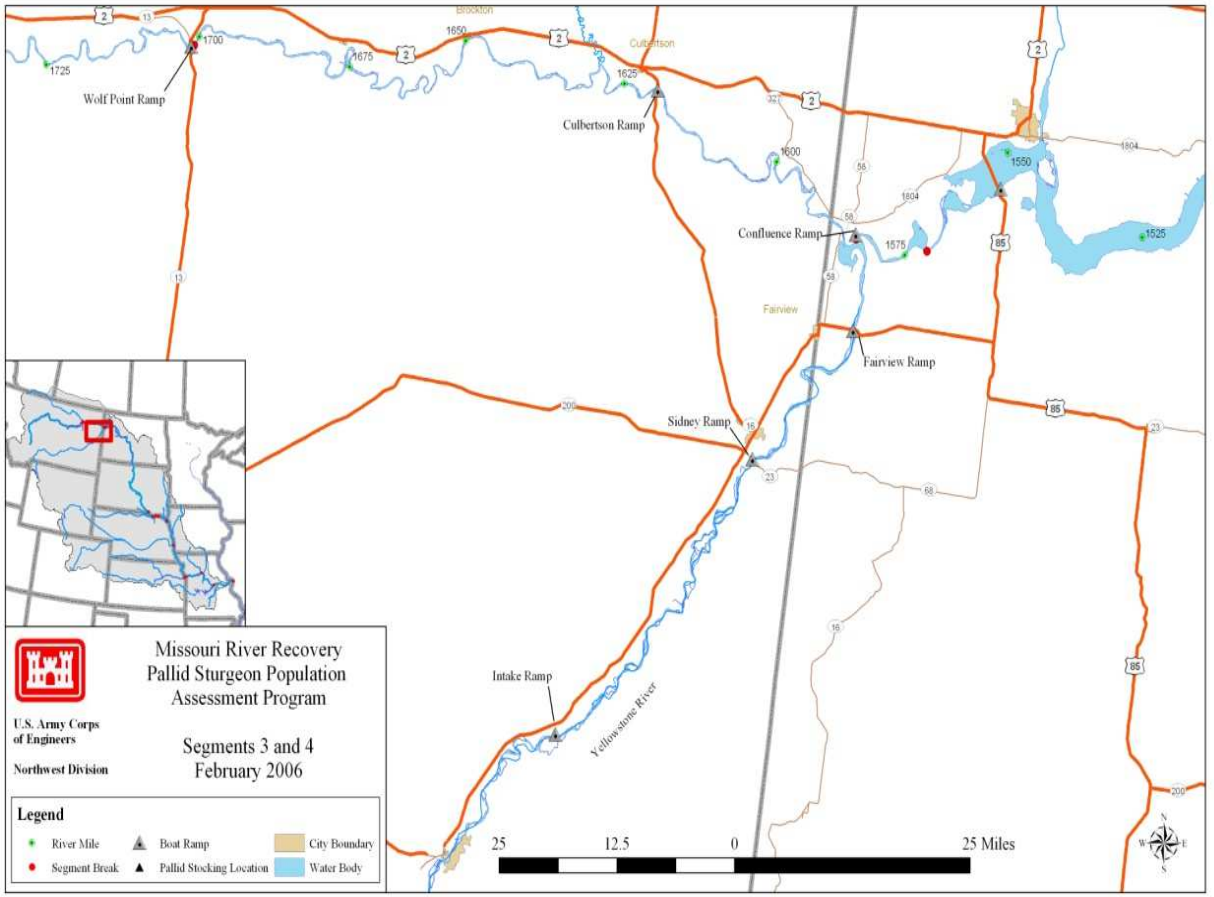

Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 22 individual river bends were sampled during the 2012 field season within Segment 3. Each bend was sampled during both the sturgeon and fish community seasons, for an overall total of 44 sampling events. While trammel nets and otter trawls were used in all bends during both seasons, mini fyke nets were only deployed during the fish community season. Trotlines were used during both seasons, but each river bend was only sampled once through the entire field season. All gears had an average of 8.0 to 8.23 standard deployments per bend (Table 1).

Pallid Sturgeon

A total of 253 pallid sturgeon were sampled in Segment 3 during 2012 in random and non random sampling (Figure 2), which was the highest number of captures during a single field season to date. The longitudinal distribution of pallid sturgeon captures during 2012 was different than previous years of sampling (Figure2). The majority of pallid sturgeon captures occurred upstream of river mile 1,640, whereas prior to 2011 the majority of pallid sturgeon were captured in the lower portions of Segment 3. The change in distribution is likely due to the high flows of 2011 and the changes in habitat created by the event. Additionally, during 2011 and 2012 more pallid sturgeon were captured in upstream locations of Segment 2 closer to Fort Peck Dam when compared to prior years.

More pallid sturgeon were sampled in channel crossover habitats (n = 126), than inside bends (n = 76), outside bends (n = 39), and secondary connected channels (n = 12) (Table 2). Pallid sturgeon were captured in depths ranging from 0.5 m to 5.2 m and bottom velocities from near zero flow to 1.28 m/second. In general, the proportion of pallid sturgeon captured in the channel crossover was higher than the proportion channel crossovers were sampled with trammel nets (Table 6 and 7).

A total of 11 year classes of hatchery reared pallid sturgeon were sampled in 2012 (Table 3). The most common year class was the 2009 year class with 78 sampled. The largest pallid sturgeon sample was from the 1997 year class, which measured 795 mm in length and weighed 1,730 g. Growth rates of each year class captured are shown in Table 3, which shows that as pallid sturgeon age in the river, growth rates slowly decrease. However, relative condition factor

does not seem to be declining appreciably (Table 3 and Figure 4). In fact, average relative condition factor for pallid sturgeon of various size classes has remained extremely constant over the seven years of sampling.

The size structure of pallid sturgeon captured in Segment 3 has been changing in a positive way since beginning the Program in 2006. From 2006 to 2012 the proportion of larger pallid sturgeon in the catch has increased every year (Figure 3). During 2006, a majority of the pallid sturgeon captured during the sturgeon season were of substock size, whereas in 2012 no substock sized fish were captured. This is positive in terms of the hatchery reared pallid sturgeon population growing into larger size classes, but also indicates no natural recruitment has been documented in the river. While the size structure of hatchery reared pallid sturgeon is increasing, there are still relatively few fish of quality or larger size classes present.

To monitor relative abundance of pallid sturgeon within Segment 3, three standard gears have been used, the otter trawl, trammel nets and trotlines. Trammel net CPUE during the sturgeon season was the highest recorded in the seven years of sampling with an estimate of 0.06 fish/100m (Figure 6). However, trammel net CPUE declined during the fish community season to 0.02 fish/100m, which was the lowest observed in the seven years of sampling that season. Overall trammel net CPUE for both seasons combined was estimated at 0.04 fish/100m, which was similar to both 2006 and 2008.

Similar to trammel net CPUE, otter trawl CPUE for the sturgeon season was at a seven year high in 2012 with 0.06 fish/100m (Figure 7). However, CPUE stayed high during the fish community season with an estimate of 0.06 fish/100m, again the highest of all sampling years. Similarly, the combined CPUE for both seasons was at a seven year high with an estimate of 0.06 fish/100m (Figure 7).

Trotline have only been used as a standard gear for the Program since 2010. While CPUE for the sturgeon season was at a three year high (CPUE = 0.68 fish/20 hook night), it was lower during the fish community season (CPUE = 0.49 fish/ 20 hook night) (Figure 8). Combined CPUE for both seasons was lower in 2012 (CPUE = 0.59 fish/20 hook night) when compared to 2011 (CPUE = 0.81 fish/20 hook night).

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 3 on the Missouri River during the sturgeon season and fish community season in 2012.

Gear	Number of Bends	Mean deployments	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season					
1.0" Trammel Net	22	8	59	61	52	4	0	0	0
Otter Trawl	22	8	54	63	49	10	0	0	0
				Fish Community Season					
1.0" Trammel Net	22	8.05	62	58	51	6	0	0	0
Mini-Fyke Net	22	8.23	46	64	11	9	31	18	2
Otter Trawl	22	8	58	63	49	6	0	0	0
				Both Seasons					
Trot Lines	22	8	62	72	33	9	0	0	0

[a] Habitat abbreviations and definitions presented in Appendix B.

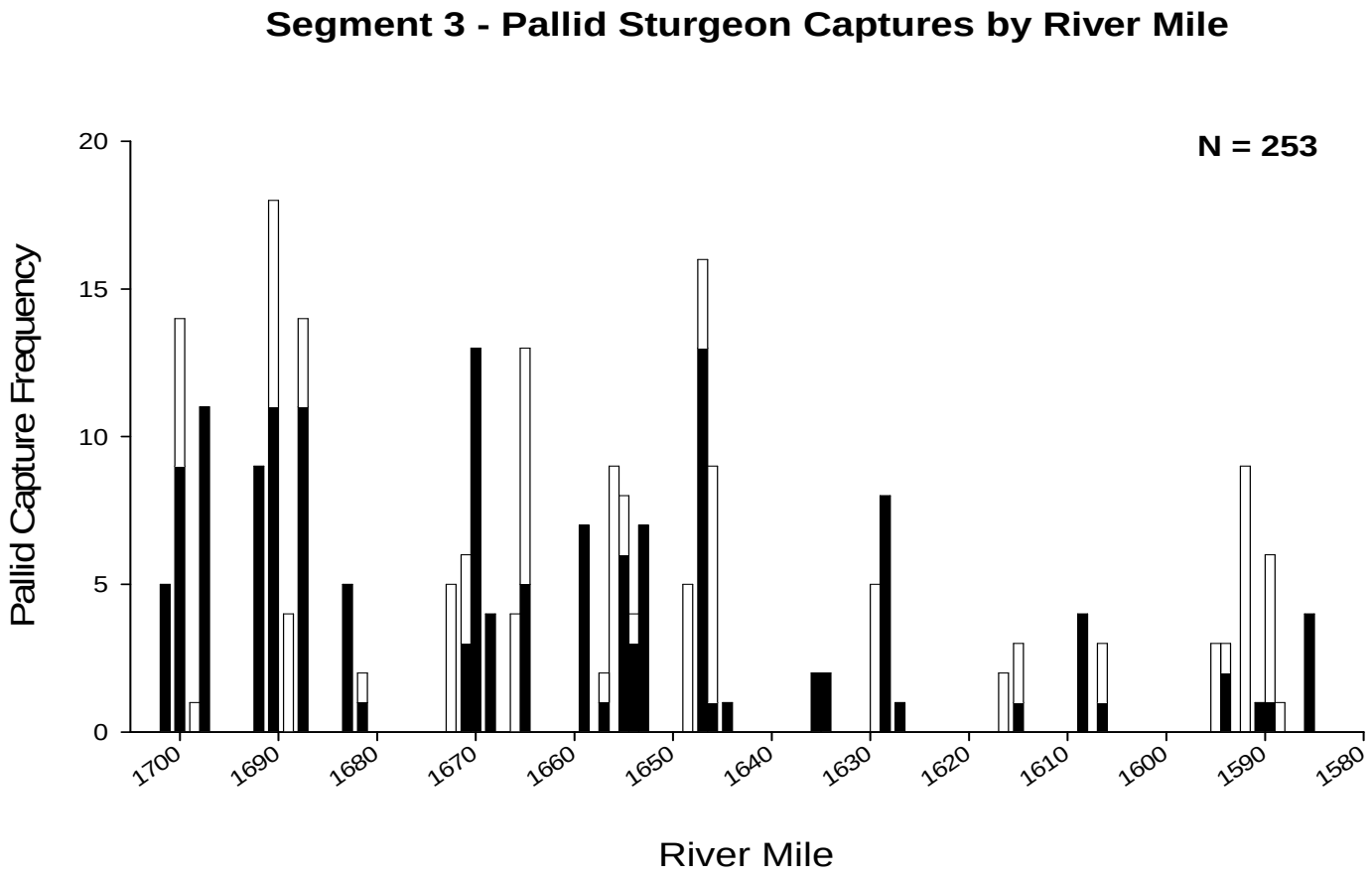

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2012. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2012. 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. (Effort)	Temp. (catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (catch)	Total Pallids caught
CHXO	BARS	0.5 (0.2-3.4)	3.4 (3.4-3.4)	0.11 (0.00-0.83)	0.83 (0.83-0.83)	16.9 (13.8-21.1)	14.7 (14.7-14.7)	38 (20-78)	31 (31-31)	1
	CHNB	2.2 (0.4-5.0)	2.1 (0.5-4.5)	0.66 (0.00-0.99)	0.59 (0.00-0.97)	16.0 (5.6-20.2)	15.7 (5.6-19.8)	78 (9-457)	74 (9-450)	125
ISB	CHNB	1.8 (0.6-4.1)	1.8 (1.0-3.5)	0.70 (0.02-1.07)	0.70 (0.44-0.93)	16.1 (6.2-20.5)	15.9 (6.3-20.5)	75 (15-401)	72 (15-213)	76
	BARS	0.4 (0.2-0.7)		0.10 (0.00-0.30)		17.4 (13.9 20.3)		44 (23-93)		.
OSB	CHNB	2.8 (0.7-8.5)	3.0 (0.7-5.2)	0.74 (0.22-1.28)	0.71 (0.22-1.28)	16.1 (6.5-20.0)	15.7 (10.9-19.3)	70 (15-350)	67 (25-205)	39
	BARS	0.5 (0.3-0.6)		0.08 (0.00-0.22)		15.1 (13.8-18.6)		37 (27-55)		
SCCL	CHNB	1.6 (0.8-2.8)	1.7 (1.2-2.8)	0.71 (0.54-0.83)	0.70 (0.63-0.83)	15.5 (10.8-19.3)	14.7 (12.8-16.0)	45 (20-91)	48 (24-79)	12
	BARS	0.5 (0.3-0.6)		0.03 (0.00-0.06)		16.1 (14.0-18.4)		26 (21-30)		.
SCCS	BARS	0.5 (0.2-1.2)		0.03 (0.00-0.11)		18.1 (13.8-21.0)		31 (14-60)		.
	CHNB	1.1 (1.1-1.1)				18.0 (18.0-18.0)				
SCN	BARS	0.5 (0.3-0.6)		. (.-.)		10.0 (10.0-10.0)		. (.-.)		.
TRMS	BARS	0.5 (0.5-0.5)		0.00 (0.00-0.00)		21.0 (21.0-21.0)		35 (35-35)		.

Table 3. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2012 from Segment 3 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al 2010 (In review).

Year Class	N	Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
1997	1	.	.	.	795	1730.0	0.876	.	.
.	.	.	.	.	.	.	.	.	.
2001	2	210	.	.	663	1034.0	0.955	0.127	.
.	.	.	.	.	3	76.0	0.056	.	.
2002	5	303	107.0	1.342	700	1338.4	0.966	0.106	0.102
.	.	6	.	.	107	501.8	0.033	0.088	.
2003	2	.	.	.	432	261.0	0.986	.	.
.	.	.	.	.	21	50.0	0.031	.	.
2004	2	.	.	.	448	294.5	0.989	.	.
.	.	.	.	.	9	37.0	0.059	.	.
2005	17	240	44.3	1.445	438	265.5	0.951	0.083	0.084
.	.	21	8.5	0.186	12	23.6	0.039	0.011	0.021
2006	37	257	68.3	1.419	427	241.6	0.935	0.091	0.105
.	.	26	18.2	0.252	11	17.7	0.030	0.011	0.025
2007	21	218	34.2	1.158	399	213.6	1.049	0.123	0.114
.	.	27	12.4	0.104	12	16.6	0.070	0.023	0.019
2008	51	271	78.4	1.593	393	189.9	0.963	0.125	0.120
.	.	24	19.2	0.943	9	14.4	0.027	0.018	0.025
2009	78	251	56.4	1.170	353	142.6	1.043	0.153	0.130
.	.	13	9.9	0.053	9	9.4	0.063	0.010	0.013
2010	32	297	103.2	1.153	338	121.2	0.976	0.145	0.090
.	.	24	25.8	0.050	23	20.8	0.068	0.016	0.021

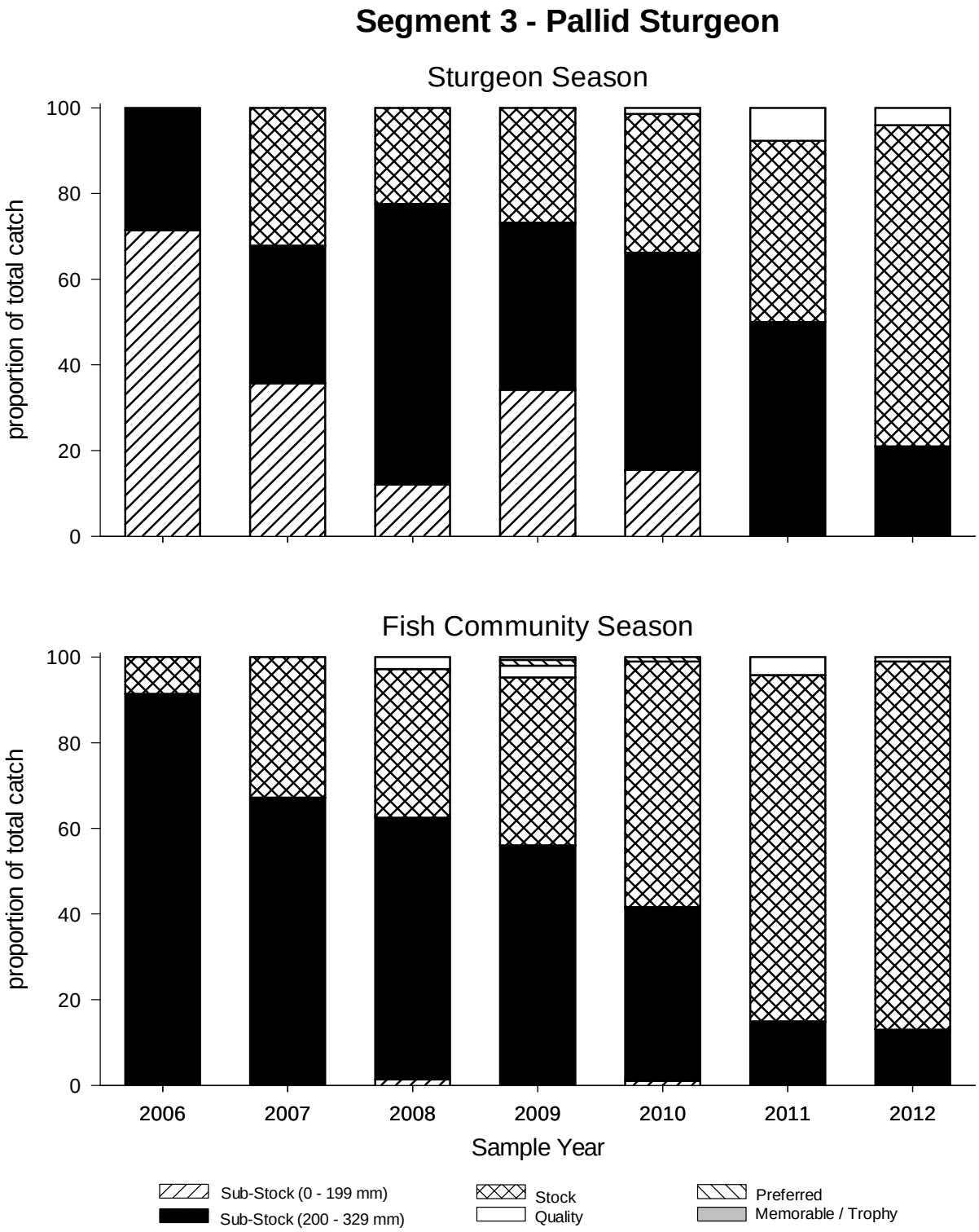

Figure 3. Proportion of total catch by length group for all pallid sturgeon captured with all gear by length category from 2006-2012 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

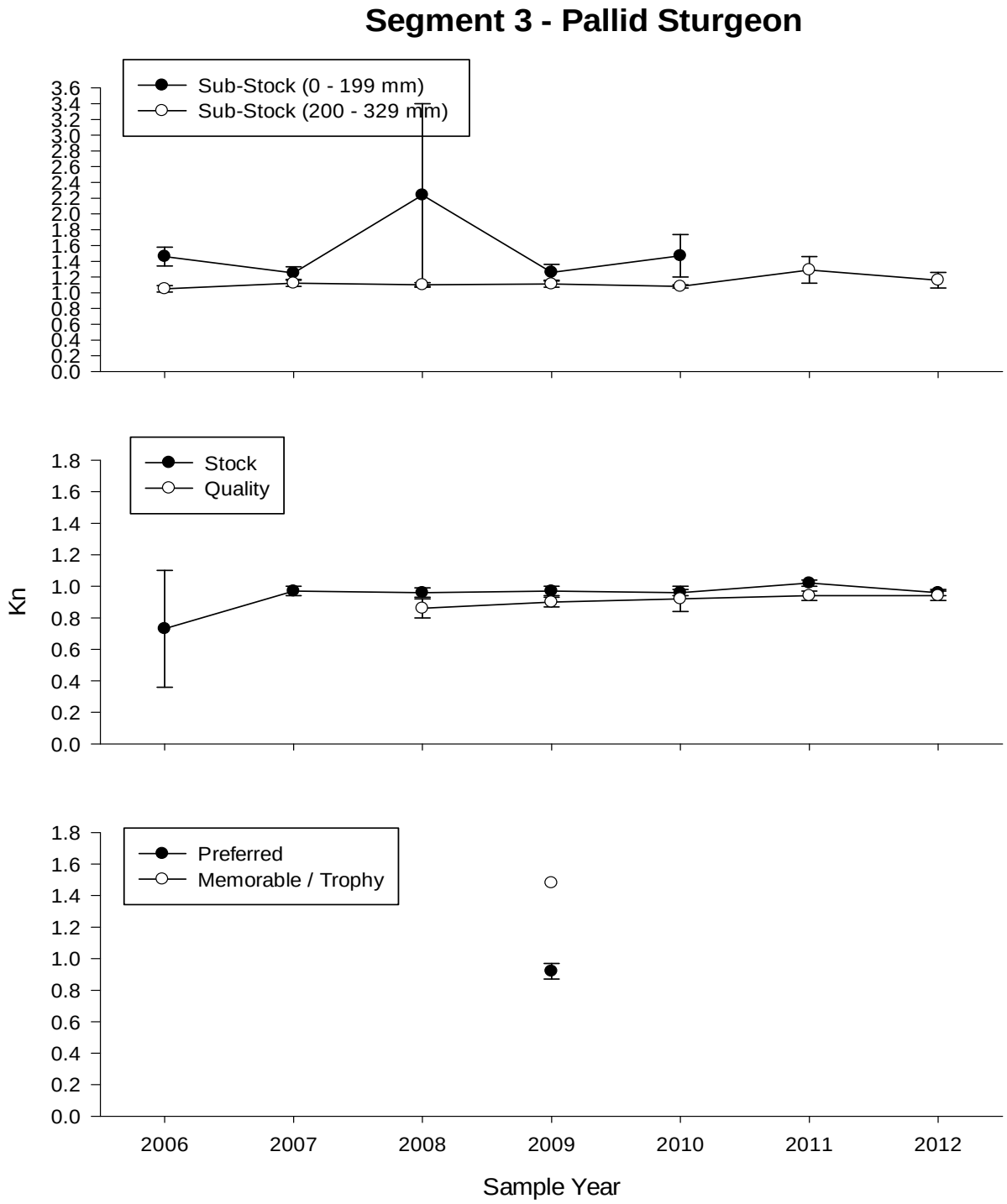

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2012 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

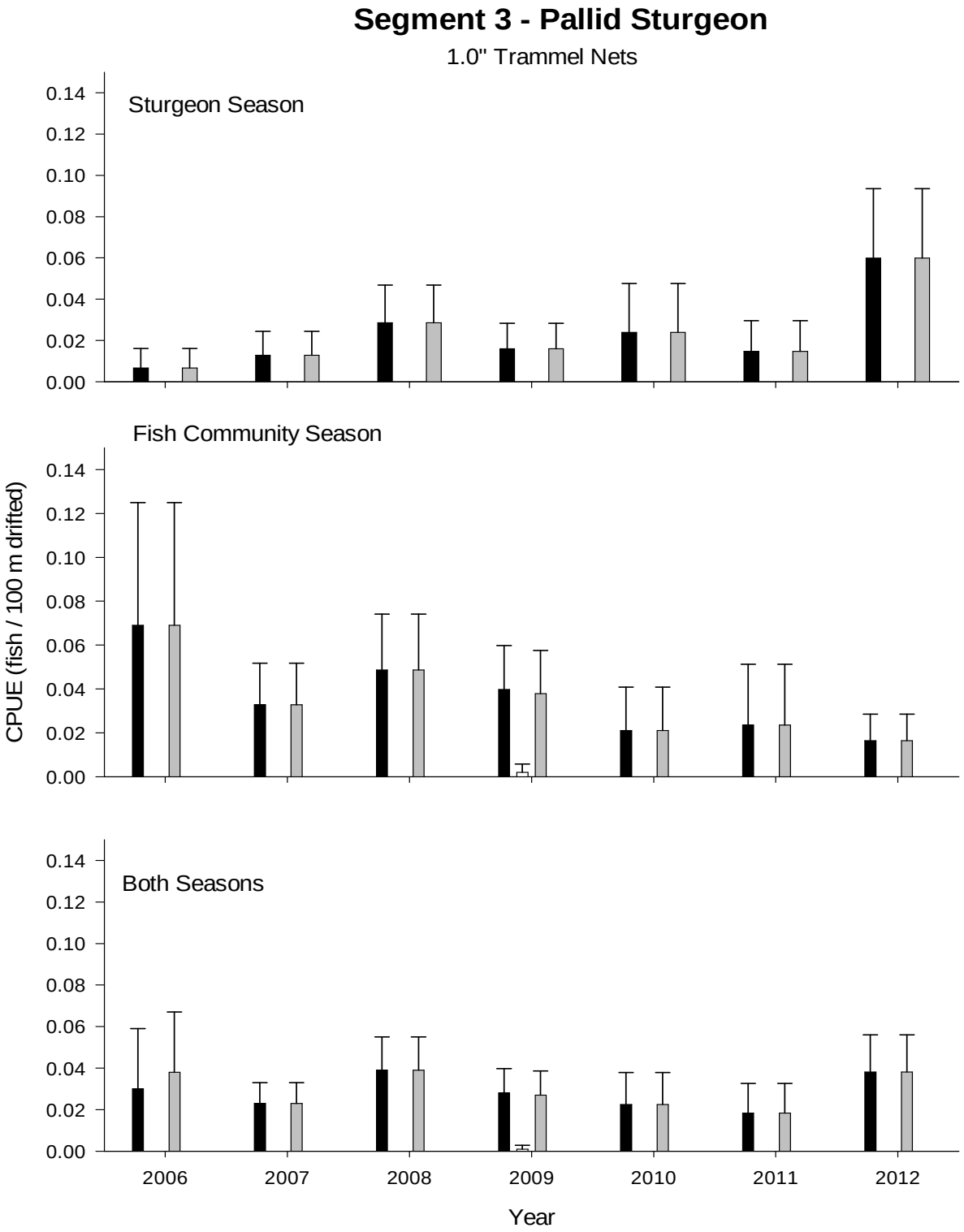

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2012. Pallid sturgeon of unknown origin are awaiting genetic verification.

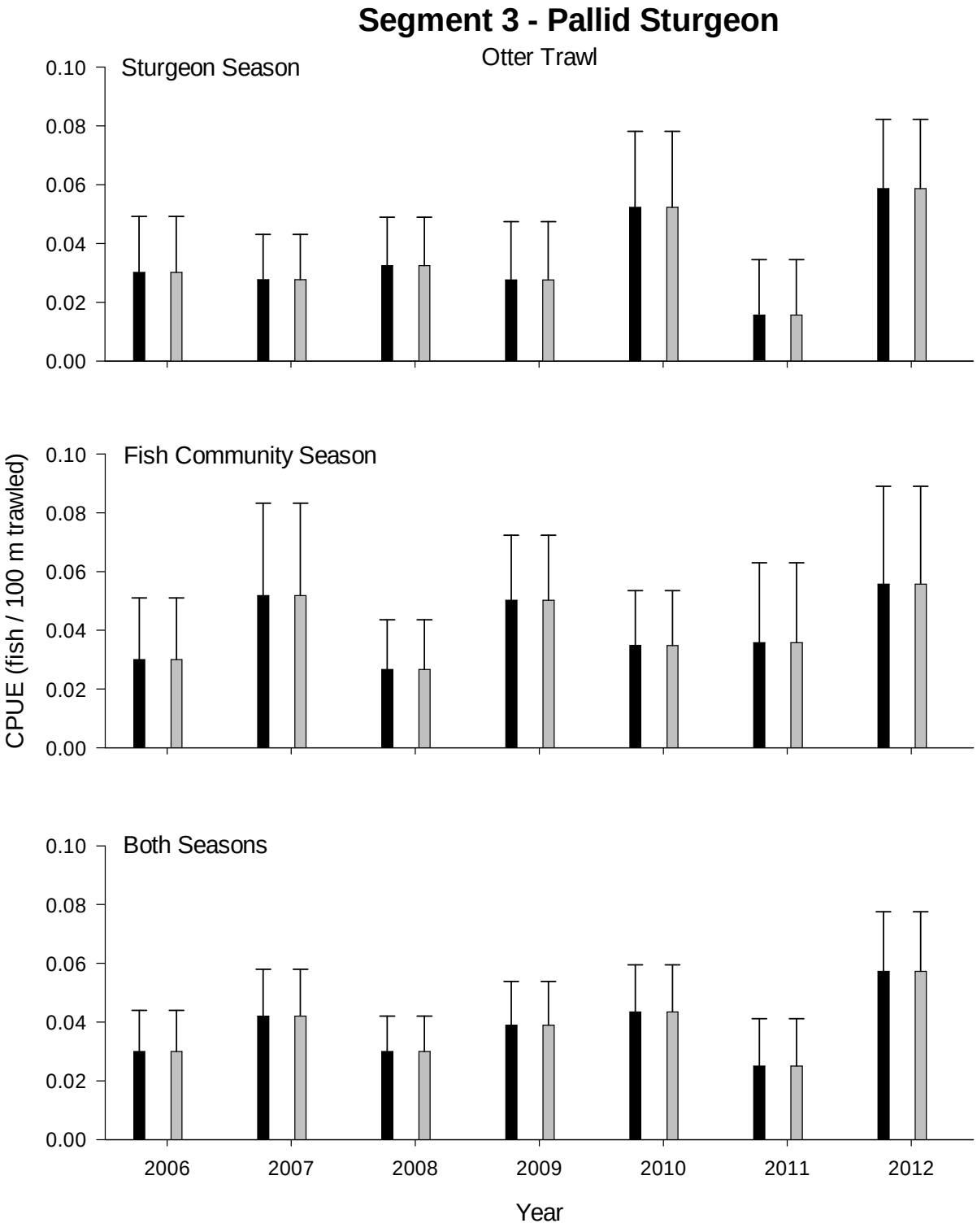

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2012. Pallid sturgeon of unknown origin are awaiting genetic verification.

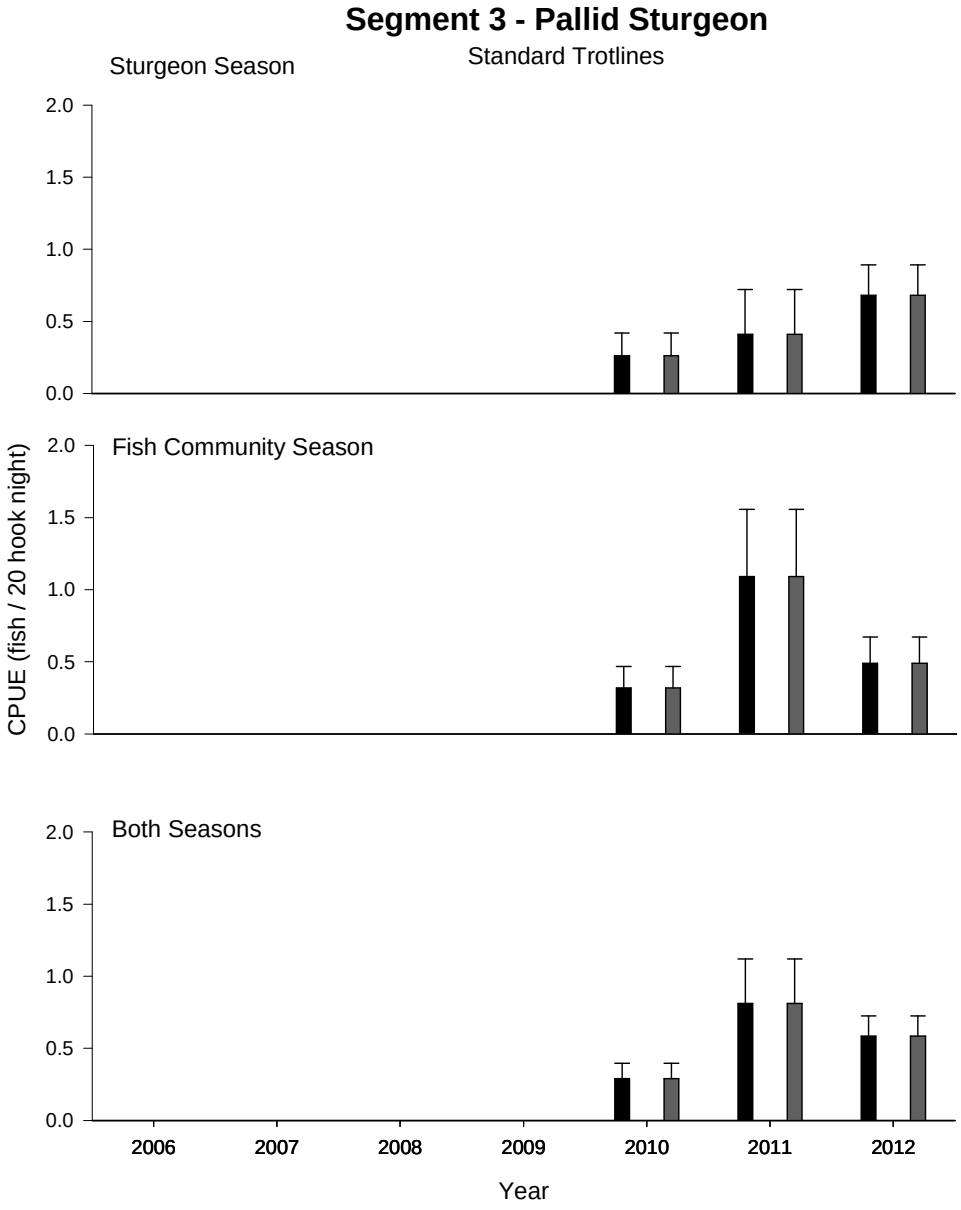

Figure 8. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 3 of the Missouri River from 2010-2012. Pallid sturgeon of unknown origin are awaiting genetic verification.

Table 4. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	0	0	0	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	0	0	0	0	0	0	0	0
		35	41	19	5	0	0	0

Table 5. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	9	44	33	22	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	14	36	29	29	7	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	2	0	100	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	6	50	50	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	4	50	25	25	0	0	0	0
		35	41	19	5	0	0	0

Table 6. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	15	53	27	20	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	14	29	29	21	21	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	4	50	50	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	18	61	28	11	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	94	46	34	13	7	0	0	0
		35	41	19	5	0	0	0

Table 7. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	2	50	0	50	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	1	100	0	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	0	0	0	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	4	25	25	25	25	0	0	0
		35	41	19	5	0	0	0

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	26	50	27	23	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	28	32	29	25	14	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	7	43	57	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	24	58	33	8	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	103	45	34	14	8	0	0	0
		35	41	19	5	0	0	0

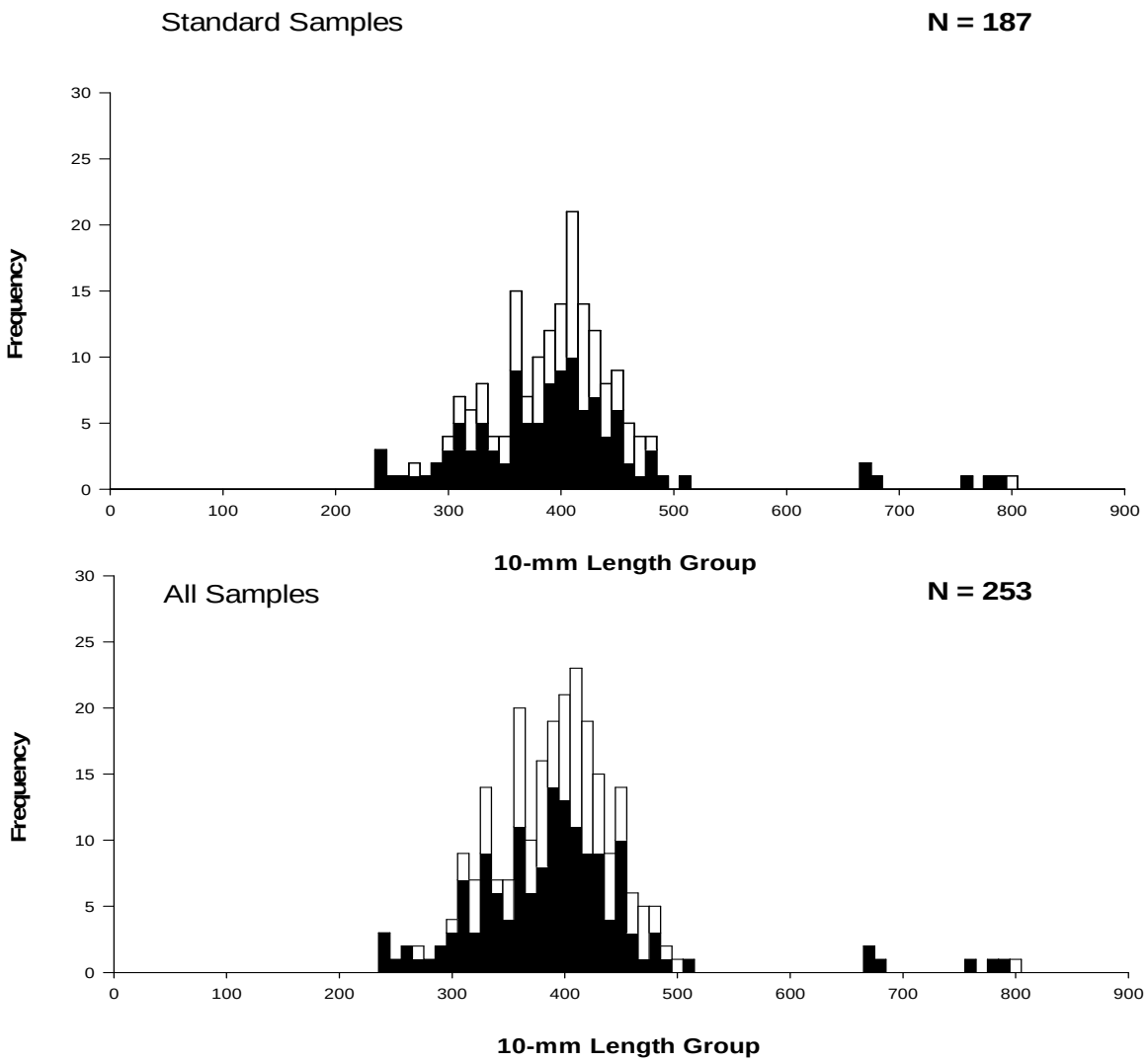

Figure 9. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012. Pallid sturgeon of unknown origin are awaiting genetic verification.

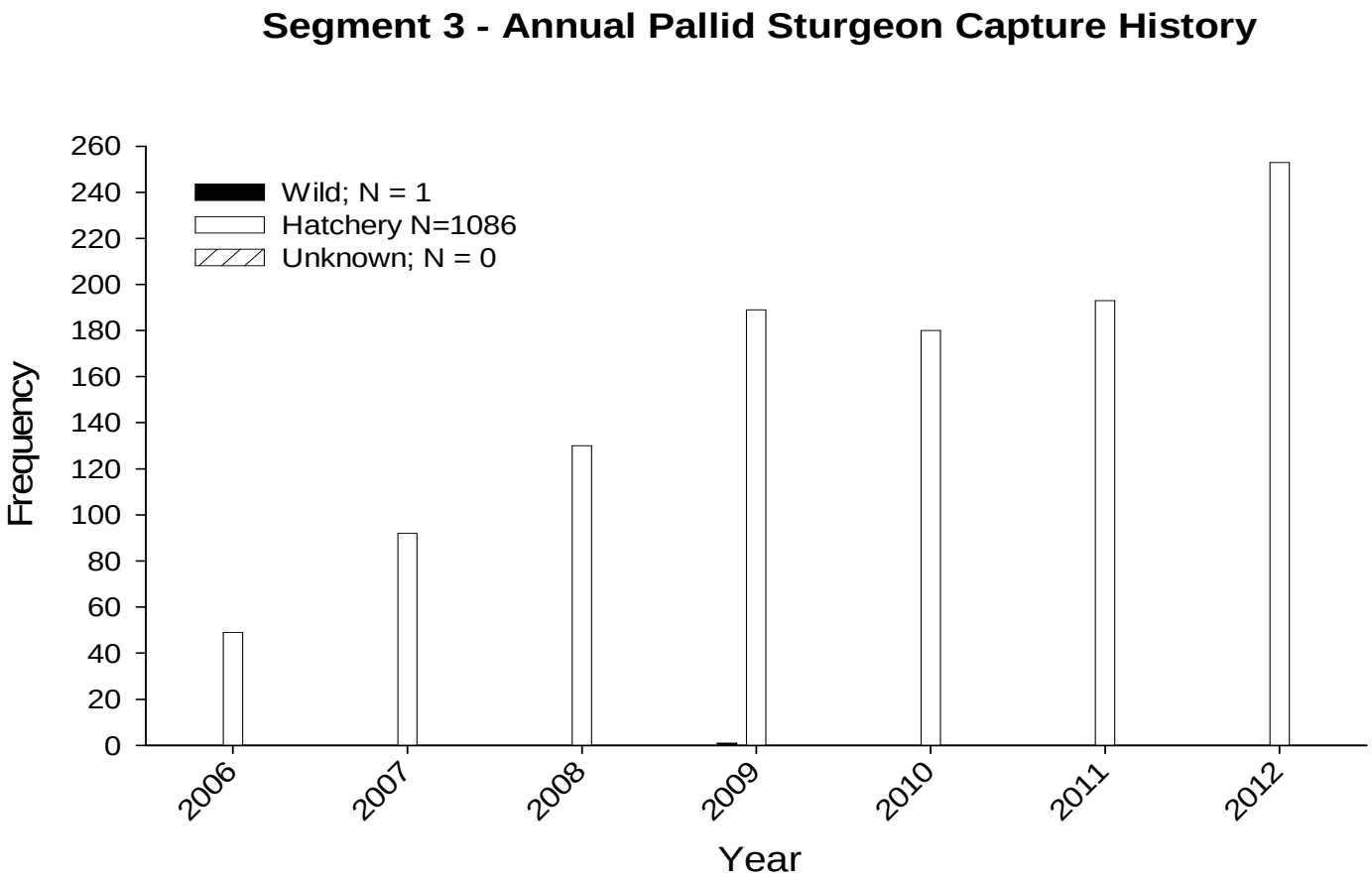

Figure 10. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2012. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples

Shovelnose X Pallid Sturgeon Hybrids

No shovelnose x pallid sturgeon hybrids were collected in Segment 3 during 2012 or during the previous six years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

A total of 481 shovelnose sturgeon were captured within Segment 3 during 2012, 254 and 227 during the sturgeon and fish community seasons, respectively. Shovelnose sturgeon averaged 535.4 mm in length and 828.7 g in weight.

Trammel net CPUE during the sturgeon season was at a seven year high in 2012, with an estimate of 0.19 fish/100m for quality and above sized fish (Figure 11). Conversely, CPUE for quality and above sized shovelnose sturgeon was at a seven year low during the fish community season at 0.16 fish/100m. However, due to the variability in catch within and among years, little to no differences in CPUE has likely occurred.

For the otter trawl, overall CPUE for both seasons was similar in 2012 to other years for quality and above sized shovelnose sturgeon, but smaller size classes such as stock sized fish was higher than previous years (Figure 12). The overall CPUE for stock sized fish was at a seven year high with an estimate of 0.024 fish/100m. In addition, some substock sized fish were captured.

While trotlines have only been deployed as a standard gear since 2010, CPUE for shovelnose sturgeon has remained extremely constant. The only appreciable difference between the three years of trotline data exists in the catches of fish smaller than quality sized fish (Figure 13).

Although it is hard to compare overall CPUE between years due to highly variable catches, difference in the sizes of shovelnose sturgeon captured does shed light on production. In 2011 several smaller shovelnose sturgeon were captured using trammel nets, otter trawl and trotlines. These smaller fish likely correlated to a high production year in 2010, which was documented by other Missouri River fisheries crews (Fuller and Braaten 2012). In 2012 these fish had likely grown into the stock size group, which all gears captured. The length frequency graph in Figure 14 shows these fish situated between 250 and 380 mm. Shovelnose sturgeon

captured in 2012 during the sturgeon season in the 250 to 300 size range where likely age-2 fish, again produced during 2010 (Steffensen and Hamel 2008). That same year class was observed in the 2011 fish community season data, where a relatively large number of fish were between 240 to 300 mm. During 2012 we could see this cohort grow from the sturgeon season through the fish community season, while they ended the season in the 310 to 380 mm range (Figure14.)

Interestingly, while 2011 was a significant flow year, we have yet to detect a strong year class of shovelnose sturgeon produced during from that year. Additionally, only one YOY shovelnose was captured during 2012. Further evidence supporting for the strong 2010 and weak 2011 and 2012 year classes is displayed in Figure 15.

The majority of shovelnose sturgeon catches over the seven years of sampling are of fish in the preferred and memorable/trophy categories (Figure 15). These fish are likely older than seven years old, at which time it becomes increasingly difficult to age them.

The relative weights of shovelnose sturgeon within Segment 3 have not changed greatly over the past seven years of sampling (Figure 16). However, since the good water years of 2010 and 2011 stock, quality and preferred sized fish have observed an increase in relative weight. The change in relative weights of these size classes of shovelnose sturgeon is contrary to pallid sturgeon relative condition (Figures 4 and 16). We did not see an appreciable increase in condition of pallid sturgeon since the water years of 2010 and 2011.

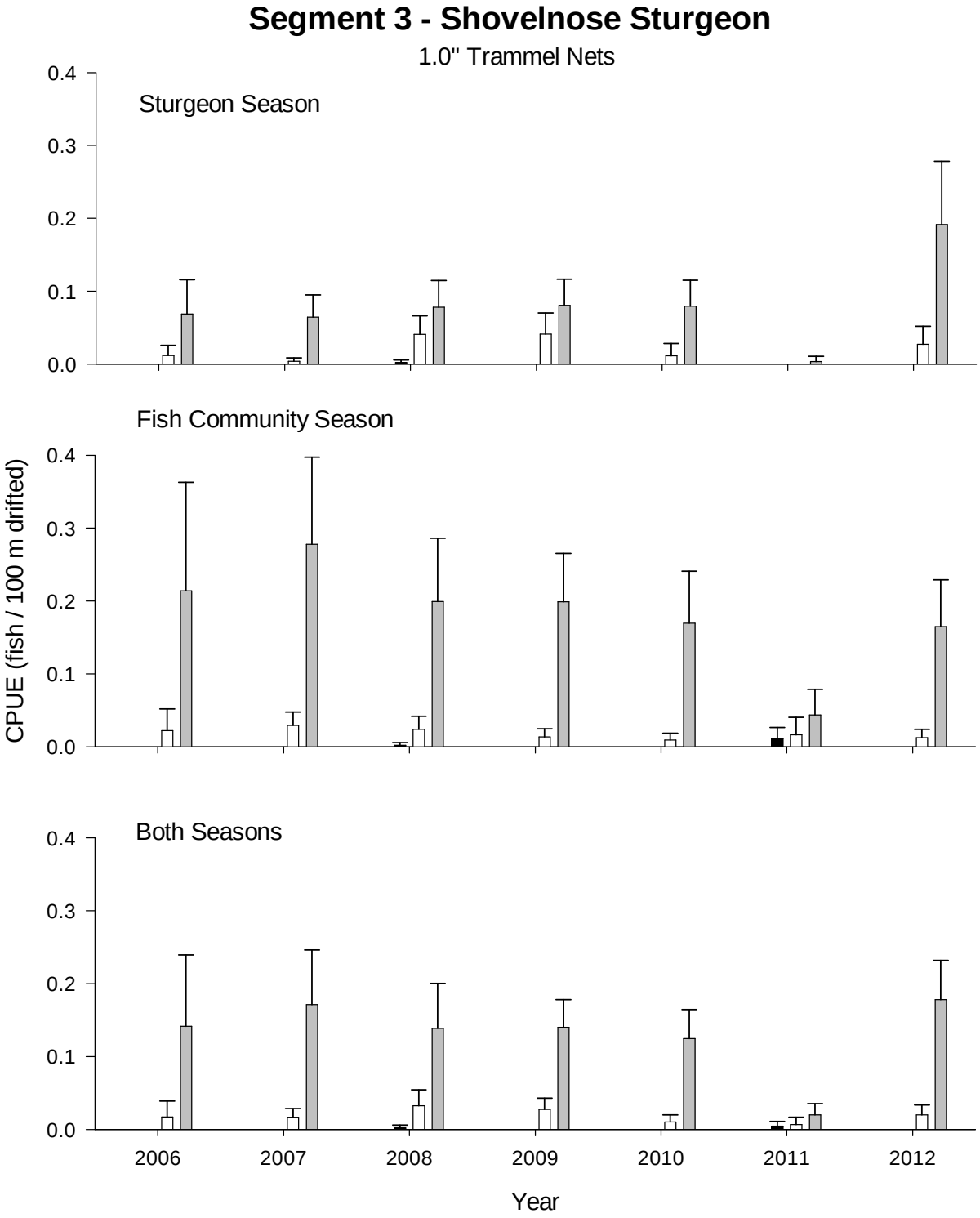

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2012.

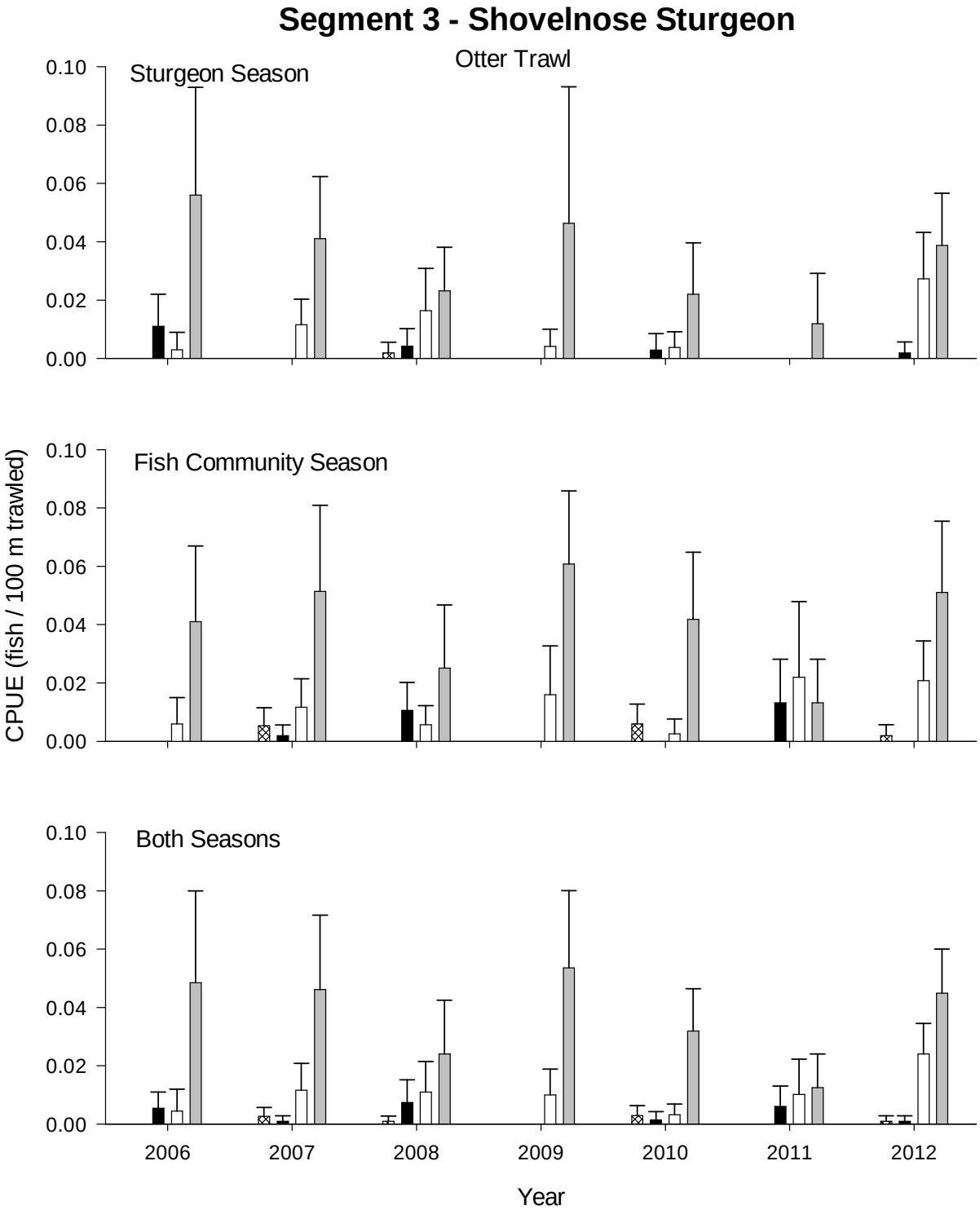

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2012.

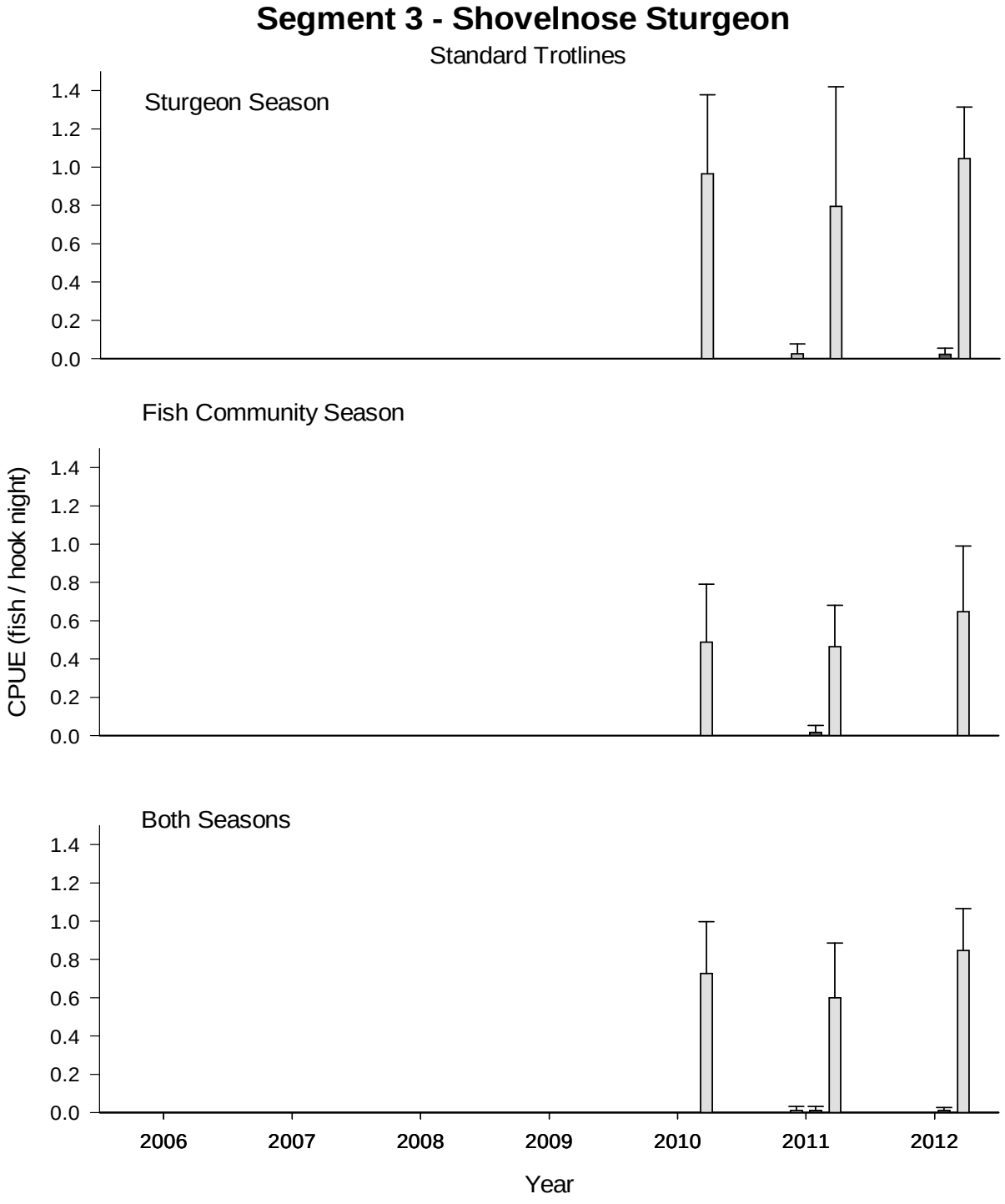

Figure 13. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2012. Note that trotlines were not used as a standard gear from 2006 to 2009.

Table 9. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	1	0	100	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	0	0	0	0	0	0	0	0
		35	41	19	5	0	0	0

Table 10. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	1	0	100	0	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	0	0	0	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	0	0	0	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	0	0	0	0	0	0	0	0
		35	41	19	5	0	0	0

Table 11. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	10	30	40	30	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	13	54	23	23	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	5	80	0	20	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	9	44	22	33	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	2	50	50	0	0	0	0	0
		35	41	19	5	0	0	0

Table 12. 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 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	68	25	44	16	15	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	19	53	32	11	5	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	67	40	37	10	12	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	22	50	32	18	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	149	42	41	12	5	0	0	0
		35	41	19	5	0	0	0

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	78	26	44	18	13	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	33	52	30	15	3	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	72	43	35	11	11	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	32	47	31	22	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	151	42	41	12	5	0	0	0
		35	41	19	5	0	0	0

Segment 3 - Shovelnose Sturgeon

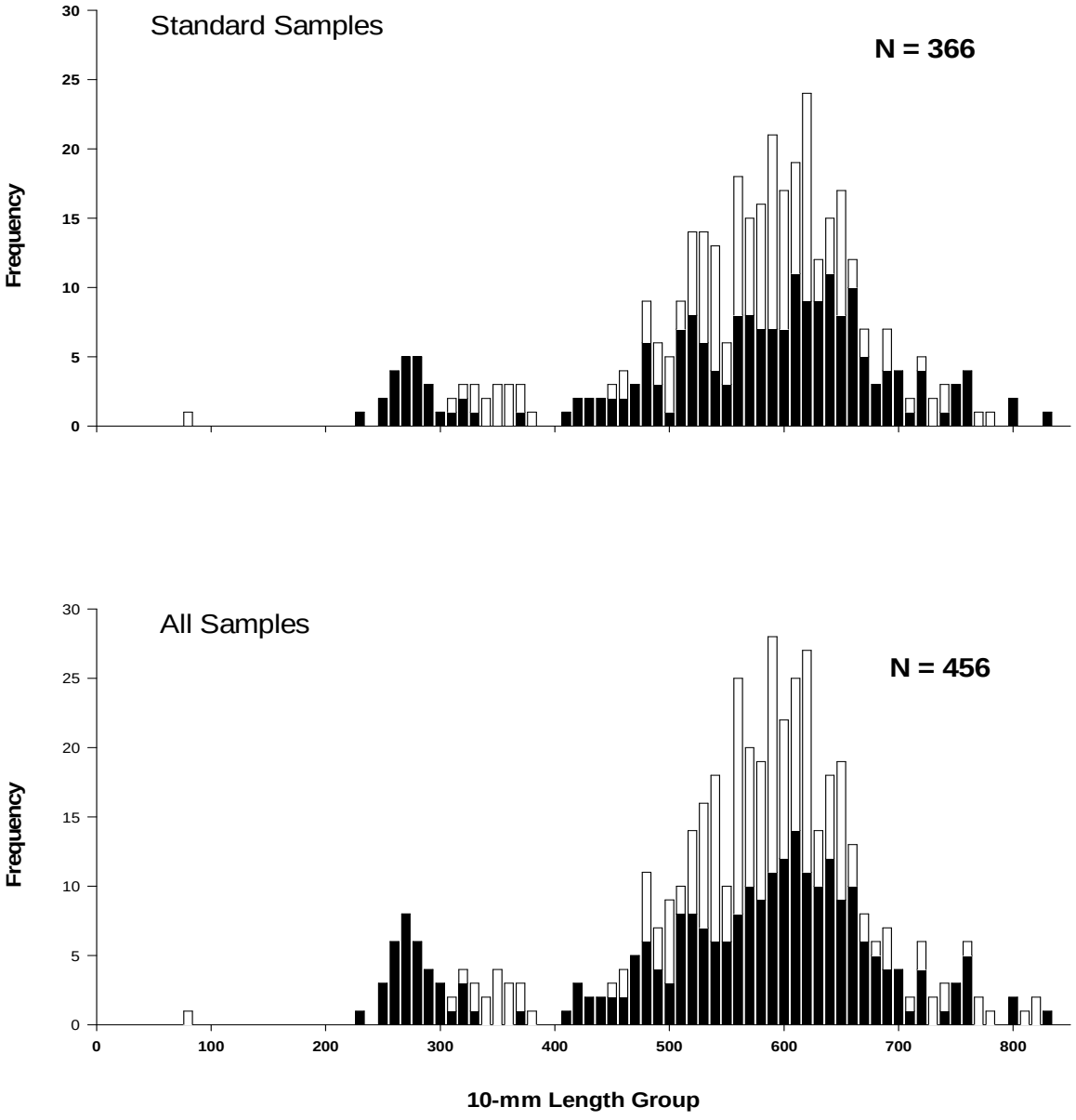

Figure 14. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

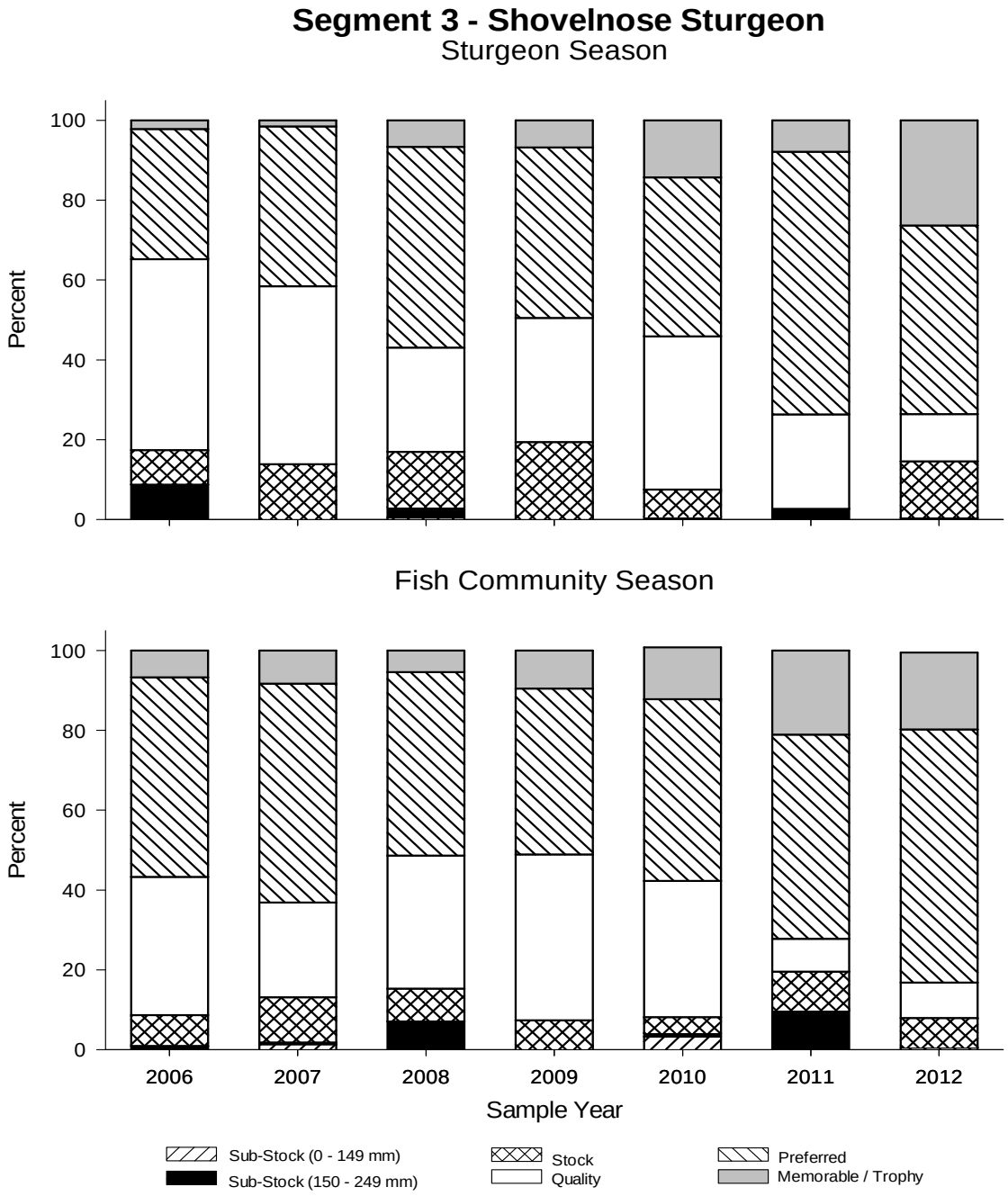

Figure 15. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2012 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

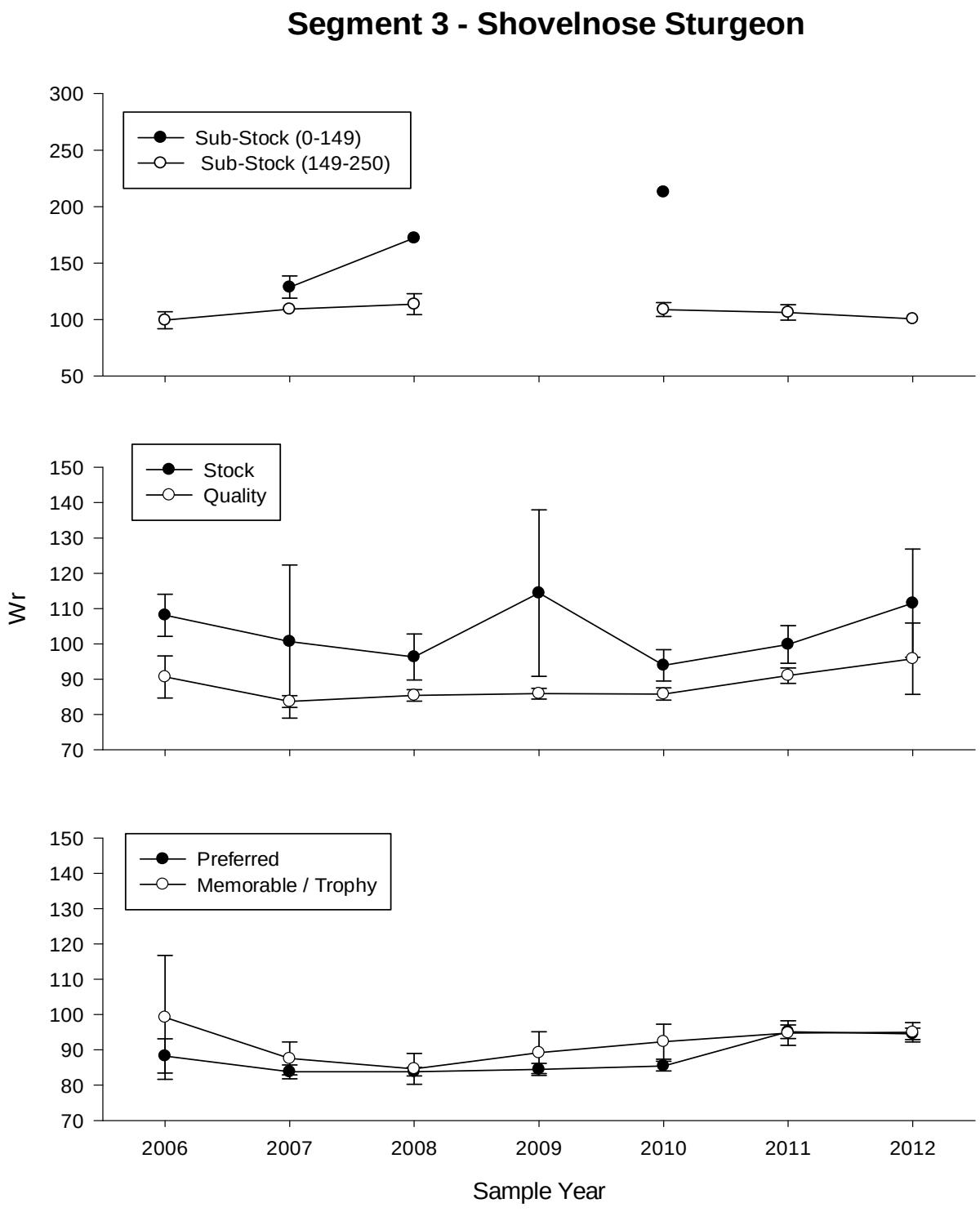

Figure 16. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2012 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

A total of 241 sturgeon chubs were sampled within Segment 3 during 2012, all of which were caught using the otter trawl. Random subsamples accounted for 201 sturgeon chubs, while non-random duplicate trawls accounted for the remaining 40. More sturgeon chubs were sampled during the sturgeon season (n = 134), when compared to the fish community season (n = 107). The total number of sturgeon chubs sampled in 2012 was over twice as many as were captured in 2011 (n = 107).

Although more overall sturgeon chubs were sampled in 2012 than 2011, CPUE did not appreciably increase (Figure 17). Sturgeon chub CPUE in the otter trawl was slightly higher during the sturgeon season (0.24 fish/100m), than the fish community season (0.19 fish/100m) and had an overall CPUE of 0.21 fish/100m (Figure 17). Since 2009 CPUE of sturgeon chubs has declined and stayed relatively low when compared to 2006 through 2008. The highest overall CPUE was observed in 2006, which had 0.67 fish/100m, more than triple that of 2012.

Sturgeon chubs sampled in Segment 3 during 2012 averaged 65.5 mm in length. Sturgeon chubs collected in 2012 were mainly comprised of one and two year old fish, with some YOY and three years old fish collected (Herman et al. 2008). The total proportion of YOY sturgeon chubs was lower in 2012 when compared to 2011 (Figure 18). During 2011 a relatively large proportion of the total catch was made up of YOY fish. That cohort was the dominant cohort sampled in 2012.

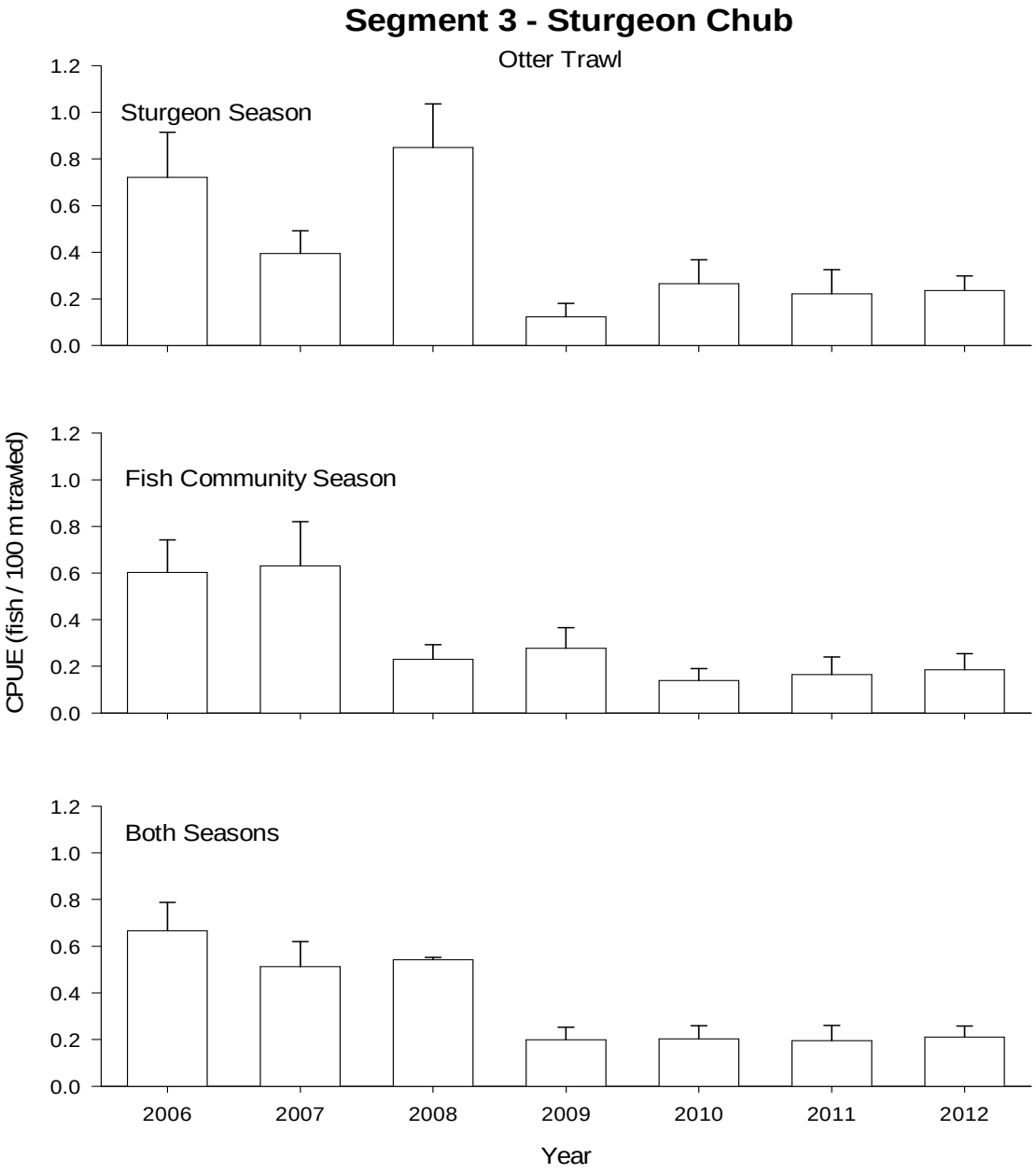

Figure 17. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2012.

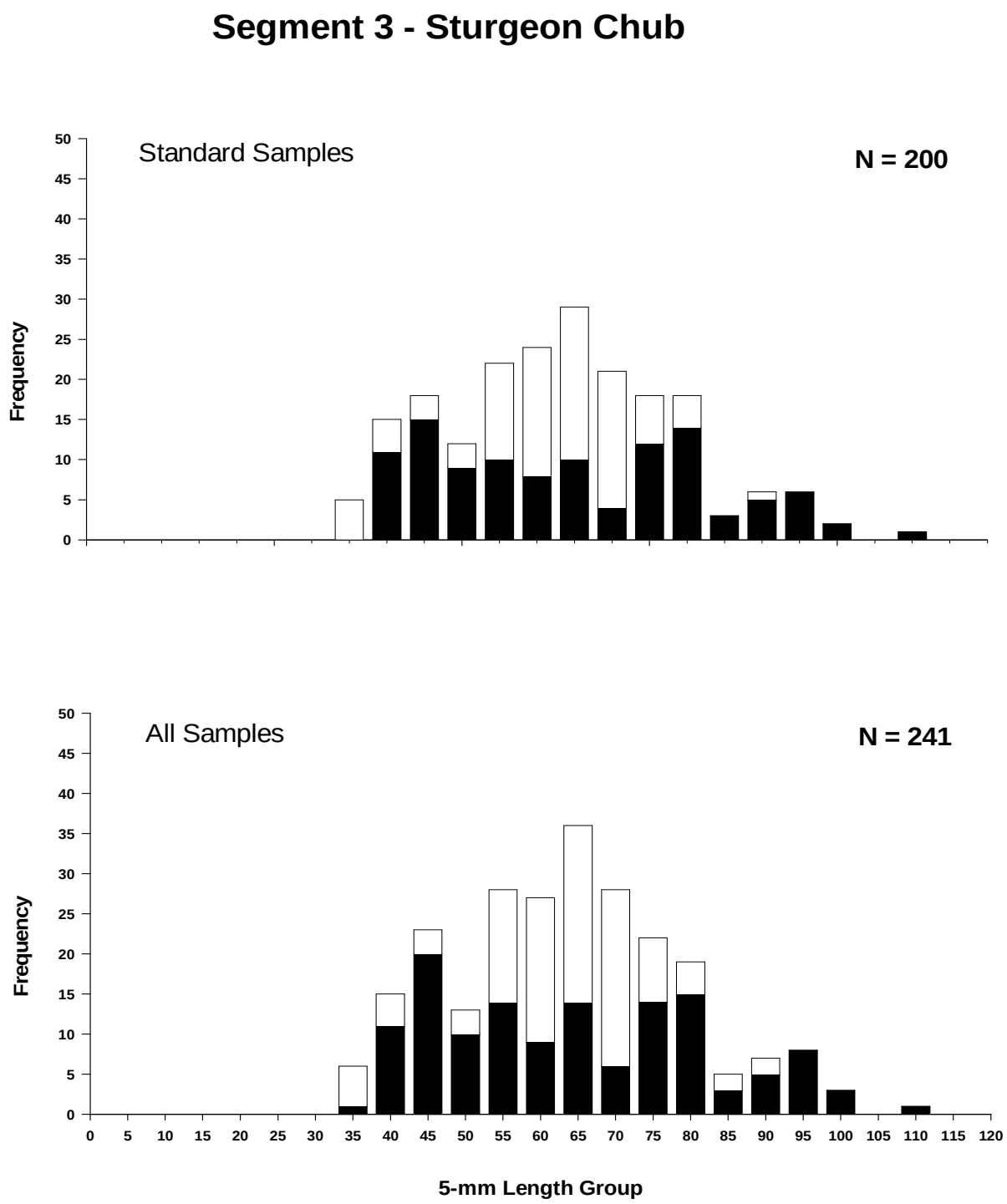

Figure 18. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

Sicklefin Chub

During 2012 a total of 111 sicklefin chubs were collected within Segment 3. More sicklefin chubs were collected during the sturgeon season (n = 86), when compared to the fish community season (n = 25). All sicklefin chubs collected in 2012 were captured in the otter trawl. Although more sicklefin chubs were collected during 2012 than during 2011, the overall CPUE for both seasons combined was less in 2012. Sicklefin chub CPUE for both seasons combined was estimated at 0.10 fish/100 m, slightly down from 2011, which had an estimate of 0.13 fish/100 m (Figure 19). Although overall CPUE was similar to prior years, the CPUE of sicklefin chubs was at a seven year high during the sturgeon season with an estimate of 0.15 fish/100 m. Sicklefin chub CPUE then declined to 0.05 fish/100 m during the fish community season, which was the second lowest over the seven years of sampling.

Based on Herman et al. (2008), the majority of sickelfin chubs collected within Segment 3 during 2012 were 3 years old. No YOY sicklefin chubs and few if any age-1 fish were collected during 2012 (Figure 20). Catching few YOY sickelfin chubs was not isolated to the 2012 season, very few YOY sicklefin chubs have been collected in the otter trawl over the past seven years of sampling. This may be attributed to the gear or the areas that the otter trawl can effectively sample.

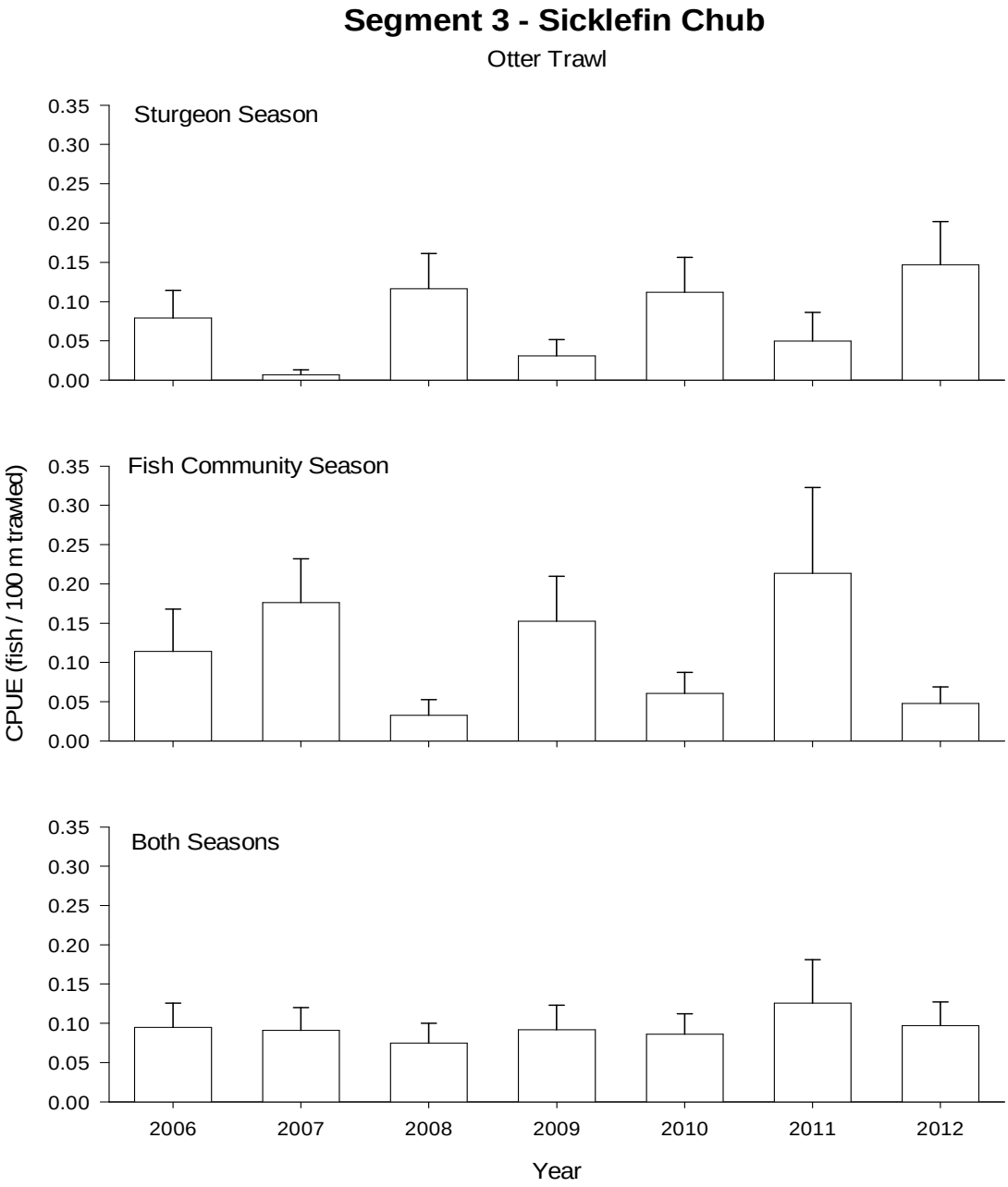

Figure 19. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2012.

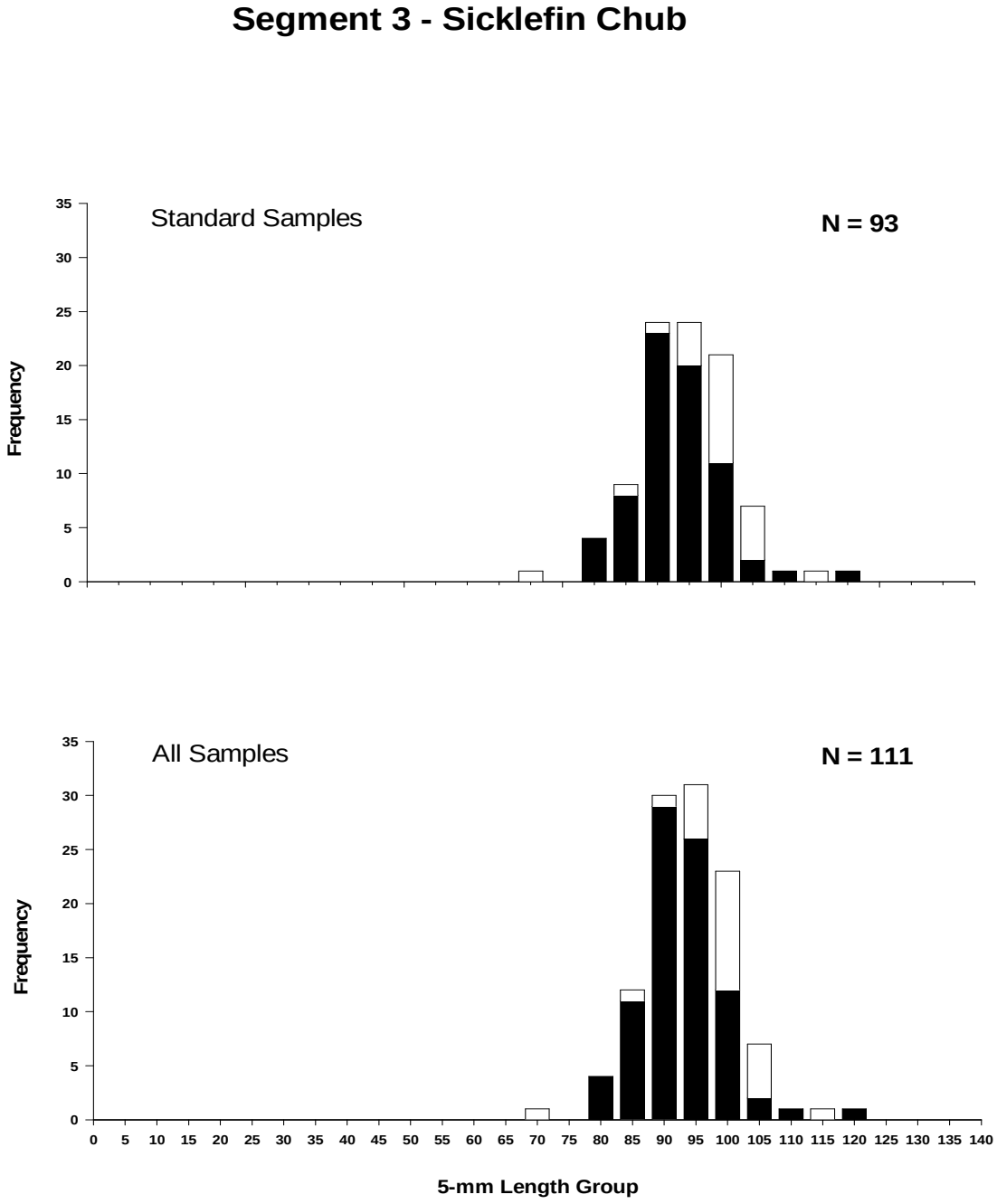

Figure 20. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

Sand Shiner

A total of 220 sand shiners were sampled in Segment 3 during 2012, all of which were caught in mini fyke nets during the fish community season. The relative abundance of sand shiners, while slightly higher in 2012 than in 2011, was still low when compared to 2006 through 2009. Sand shiner CPUE was 1.7 fish/net night in 2012, an increase from the 2011 estimate of 0.9 fish/net night. Sand shiner relative abundance was highest in 2006 with 13.7 fish/net night.

Based on Datillo et al. (2008) the majority of sand shiners collected in 2012 were YOY, with a few age-1 fish sampled (Figure 22). Sand shiners averaged 36.9 mm in length in 2012. It is not known why CPUE of sand shiners has decreased over the past seven years of sampling.

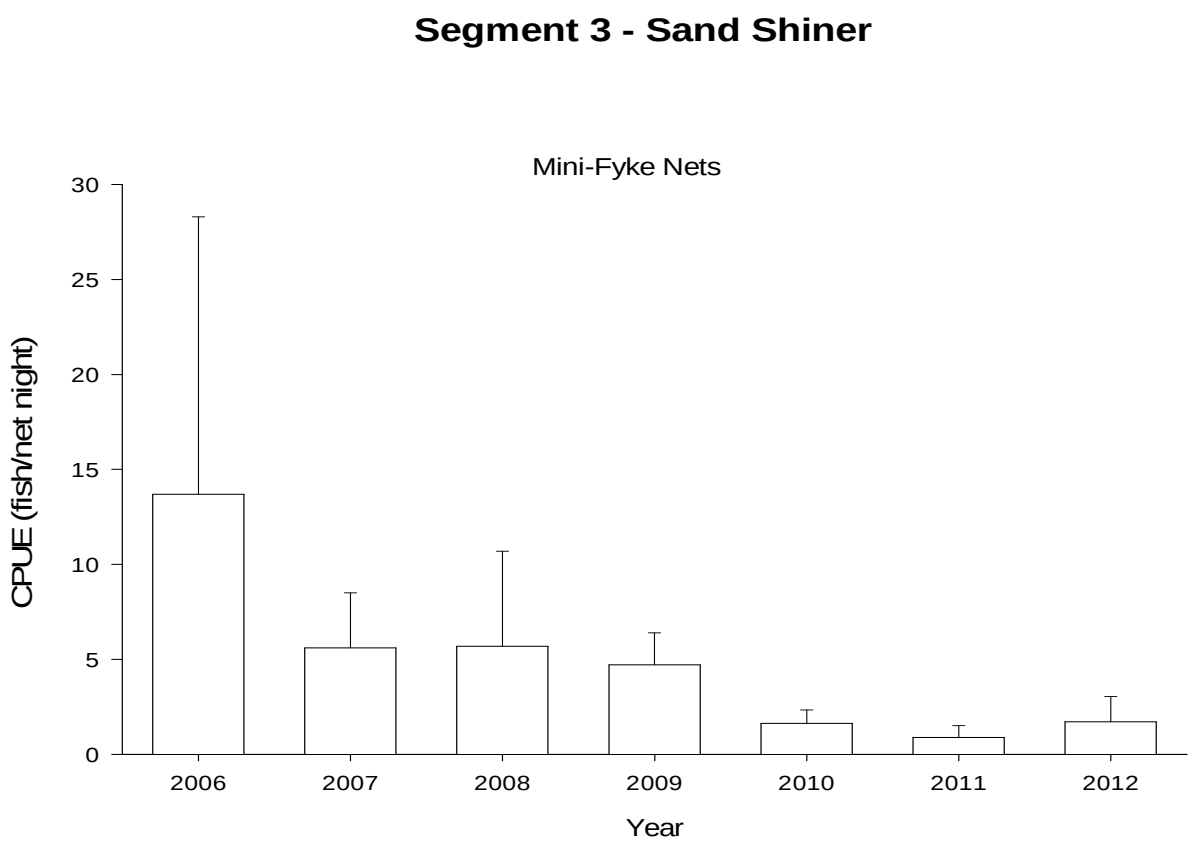

Figure 21. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2012.

Segment 3 - Sand Shiner

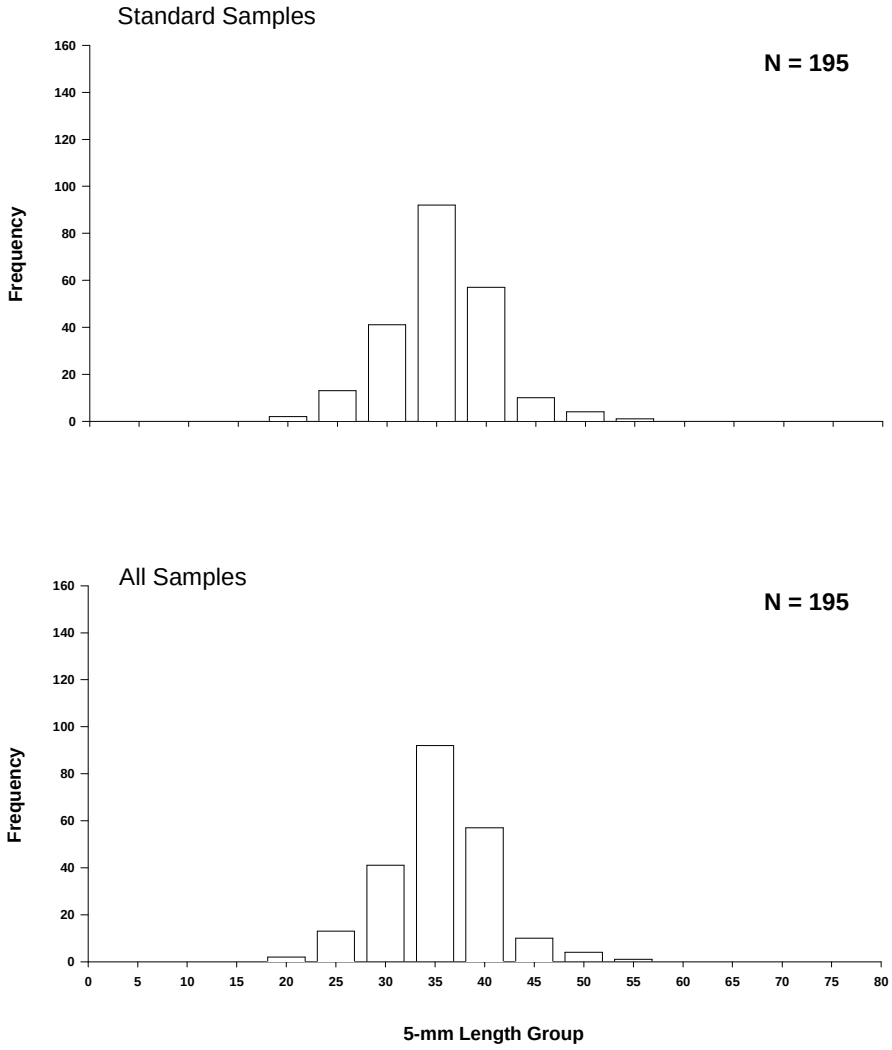

Figure 22. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

***Hybognathus* spp**.

Al l *Hybognathus spp.* that were collected within Segment 3 during 2012 were identified as western silvery minnows. In all, 36 western silvery minnows were collected, 27 in standard mini fyke net sets and 9 in non-standard bag seines. The relative abundance of western silvery minnows was estimated at 0.15 fish/net night for mini fyke nets in 2012. This was the second lowest CPUE over the past seven years of sampling. The relative abundance of western silvery minnows peaked in 2008 (CPUE = 2.8 fish/net night) and had a sharp decline in 2009 (CPUE = 0.1 fish/net night) and has stayed relatively low since (Figure 23).

Although the sample size was low, there were likely three age classes of western silver minnows collected in 2012, YOY, age-1 and age-2 (Figure 24). Fish in the 30 mm size were likely YOY, whereas fish in the 55 to 75 mm range were likely age-1 and fish of 90 mm were likely age-2 (Dattilo et al. 2008b). The size structure of western silver minnows in 2012 looked similar to that of 2011. However, during 2010 a large proportion of the total catch was comprised of YOY fish.

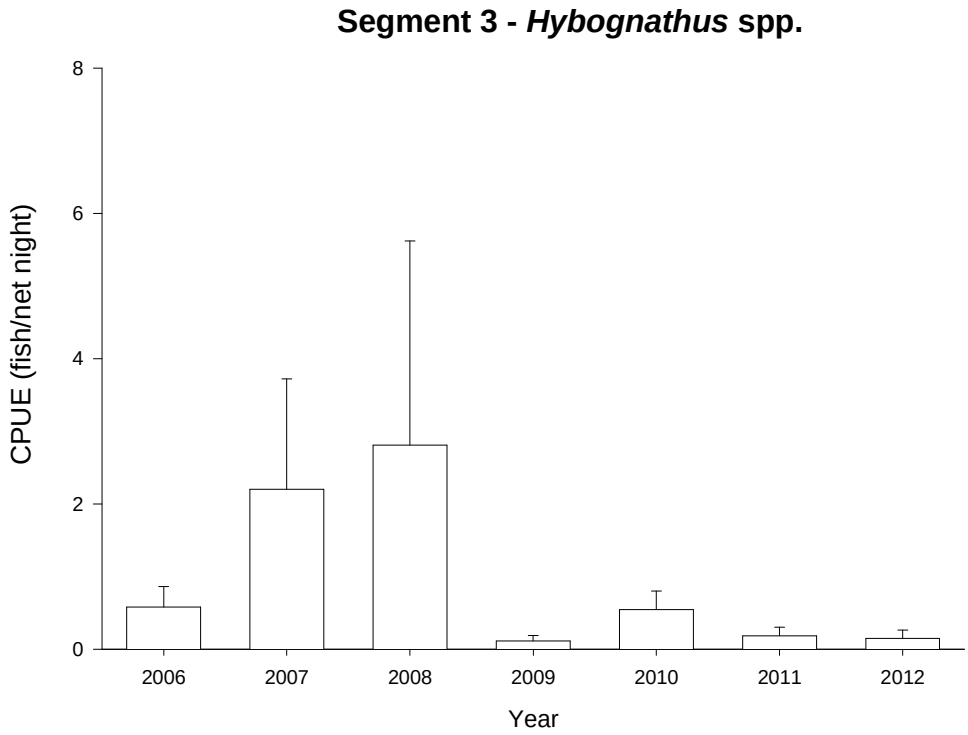

Figure 23. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2012.

Segment 3 - *Hybognathus* spp.

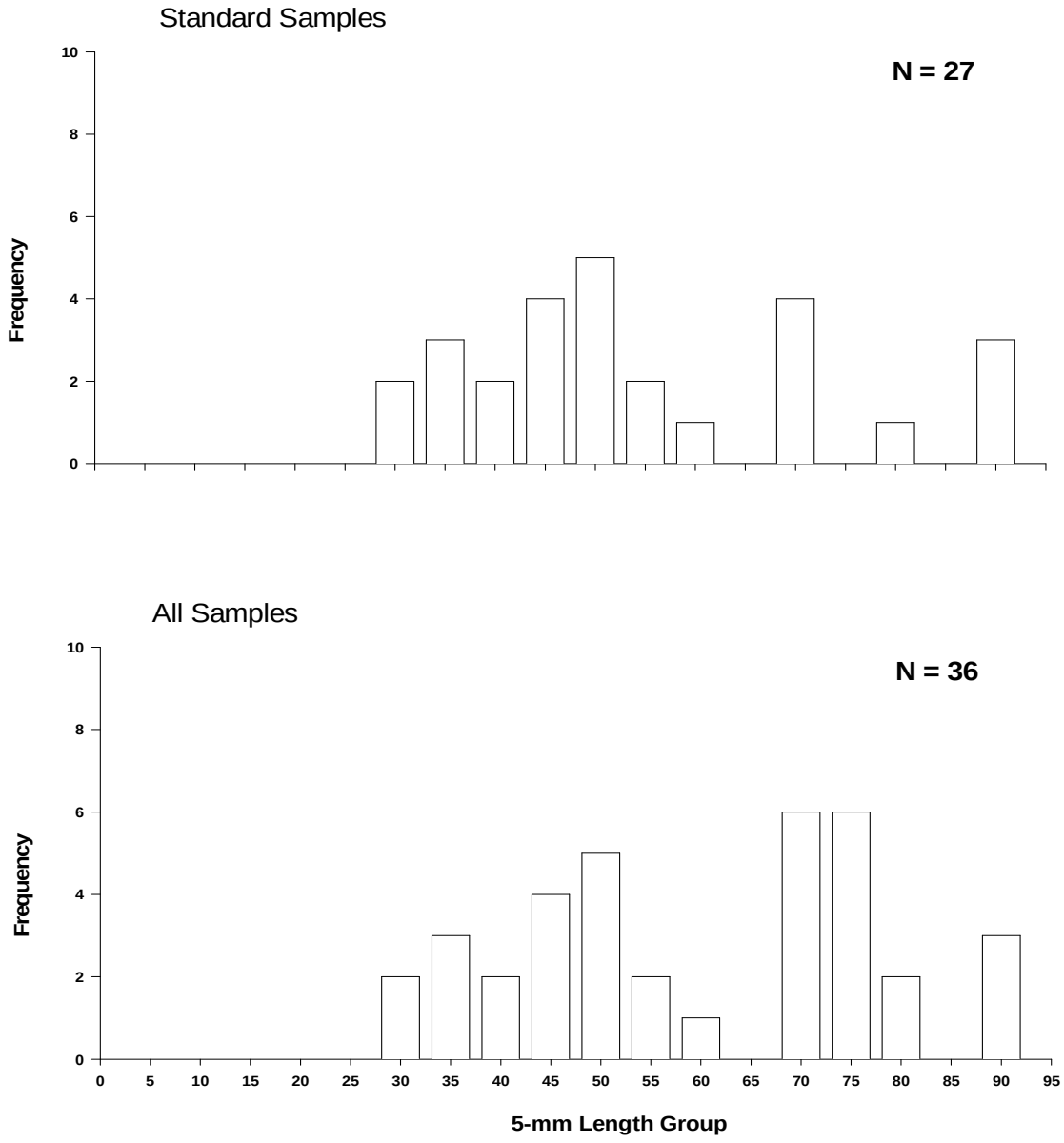

Figure 24. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

Blue Sucker

During 2012 a total of 10 blue suckers were collected within Segment 3, 8 with trammel nets and 2 with the otter trawl. Over the seven years of the Program, relatively few blue suckers have been collected in Segment 3. Trammel net CPUE has remained relatively constant and low (Figure 25). During 2012 trammel net CPUE was estimated at .007 fish/100m for both seasons combined. Whereas in 2009, which was had the highest CPUE was only at 0.024 fish/100m. The otter trawl is an inefficient gear at collecting adult blue suckers, therefore no comparisons between years should be made. However, the otter trawl may collect YOY or juvenile blue suckers if present, but since very little recruitment seems to be occurring in Segment 3 the gear has captured very few fish.

All but one blue sucker captured in 2012 was over 600 mm in length (Figure 27). The largest specimen collected was 815 mm and the smallest was 280 mm in length. The smaller fish was likely from a younger age class, while all the larger fish are of unknown ages due to difficulties aging large blue suckers.

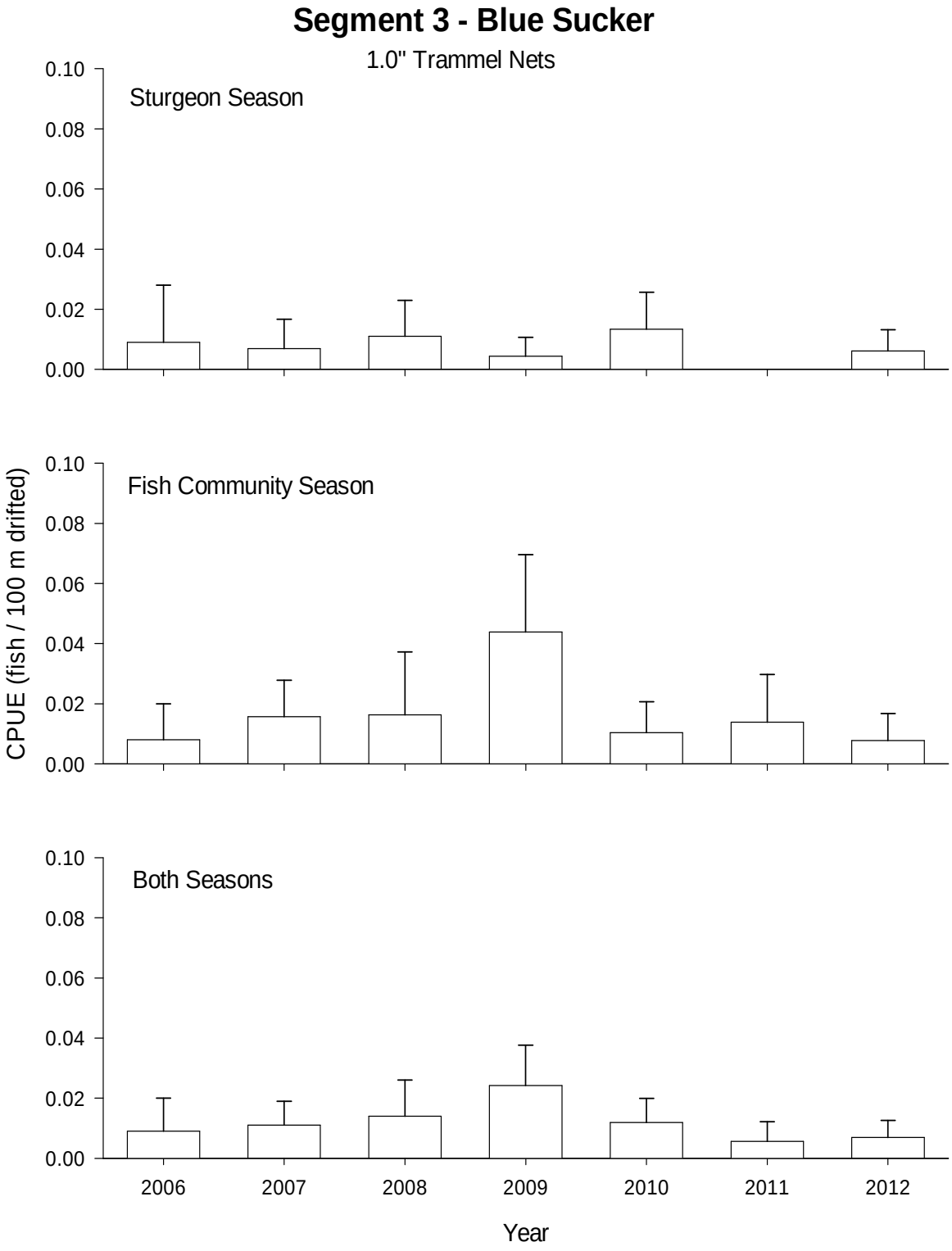

Figure 25. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2012.

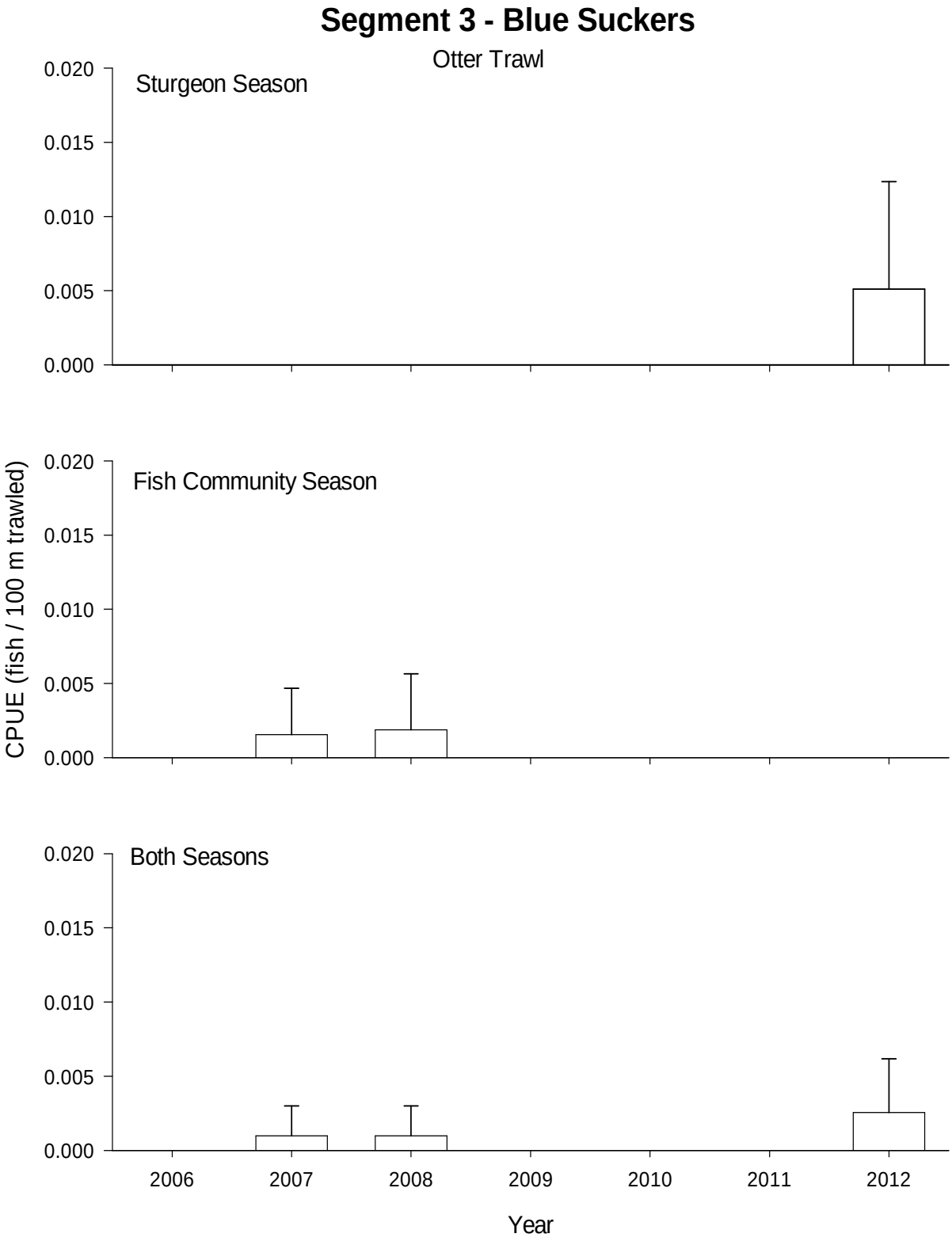

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2012.

Table 14. 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 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	3	67	33	0	0	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	2	0	0	100	0	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	3	67	33	0	0	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		25	35	6	5	17	10	1
Otter Trawl	0	0	0	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	0	0	0	0	0	0	0	0
		35	41	19	5	0	0	0

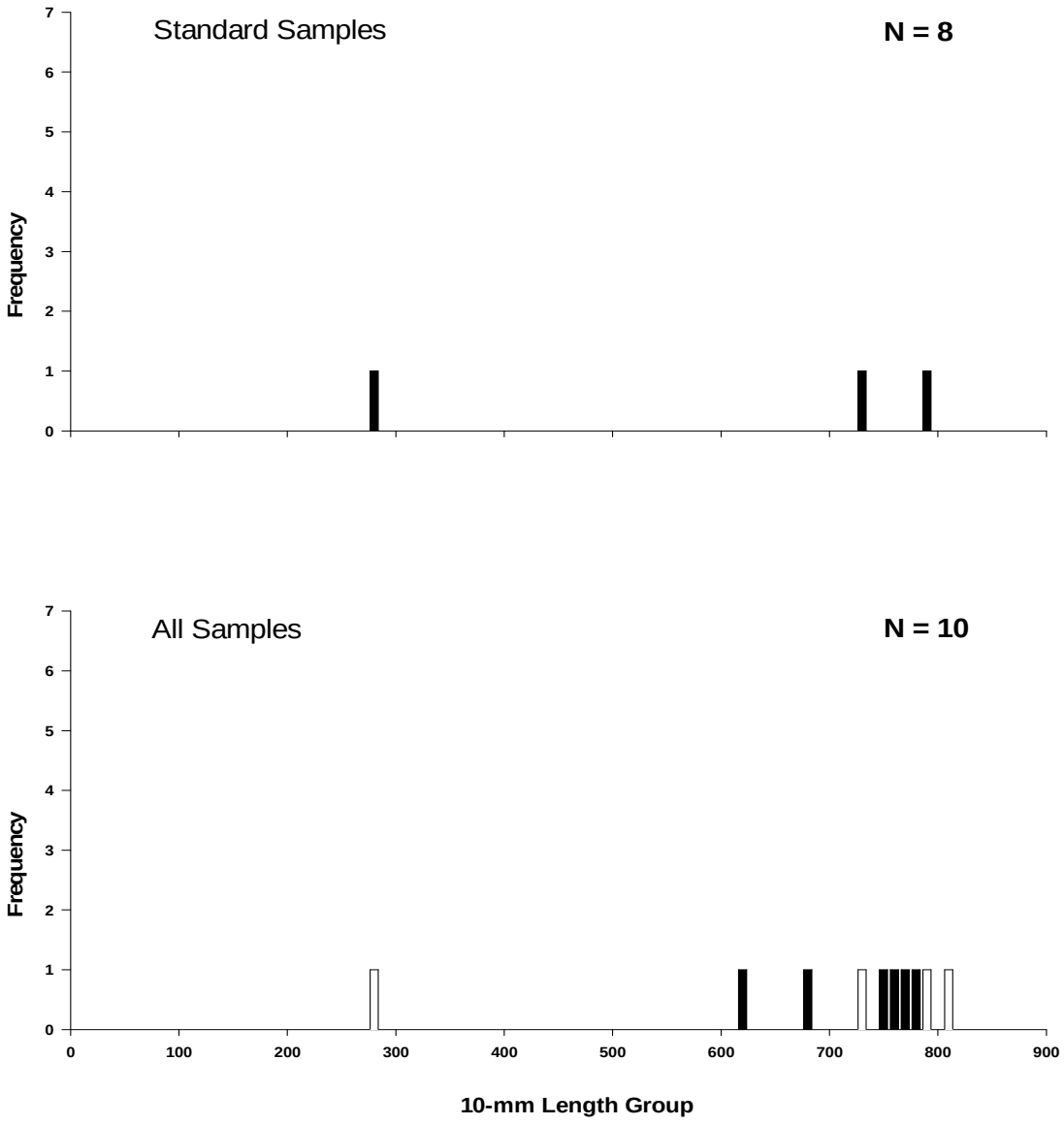

Figure 27. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

Sauger

A total of 369 sauger were collected within Segment 3 during 2012. Sauger were caught in all types of gears that were deployed, but were most commonly caught in trammel nets. Trammel nets captured 253 sauger, followed by otter trawl with 73, mini fyke nets captured 32, trotlines 10 and bag seines captured 1.

Trammel nets have been the best gear to estimate relative abundance of adult sauger through the past seven seasons. During the sturgeon season of 2012, sauger CPUE for trammel nets was at a seven year high, with an estimate of 0.39 fish/100 m (Figure 29). However, CPUE fell appreciably to 0.05 fish/100 m during the fish community season, which was at a seven year low. Nevertheless, overall trammel net CPUE of sauger was at 0.22 fish/100 m, which was a seven year high.

Mini fyke nets have been the best gear at assessing YOY sauger, although numbers have been relatively low during each year (Figure 28). During 2012 only eight sauger less than 100 mm in length were captured using mini fykes. These fish likely represent YOY sauger. For comparison, no sauger were captured in mini fyke nets during 2011 that were smaller than 222 mm.

Even though few YOY sauger have been captured in the multitude of gears used by the Program, the overall size distribution of sauger captured indicates that recruitment is occurring (Figure 31). The length frequency histogram in Figure 31 indicates that the sauger population of Segment 3 consists of fish from age-0 to approximately fish of age-7 or older (Dattilo et al. 2008). Relatively large year classes of age-1 and age-2 fish are present. When compared to drought year conditions, a much larger proportion of the sauger population was comprised of younger year classes of fish in 2012 and 2011 than during 2006.

In all, sauger caught in trammel nets averaged 362.7 mm in length and weighed 387.6 g. Sauger sampled in the otter trawl were on average smaller, measuring 287.3 mm and weighing 205.0 g. Sauger sampled in mini fyke nets were on average the smallest sauger sampled, averaging 243.3 mm and weighing 213.5 g.

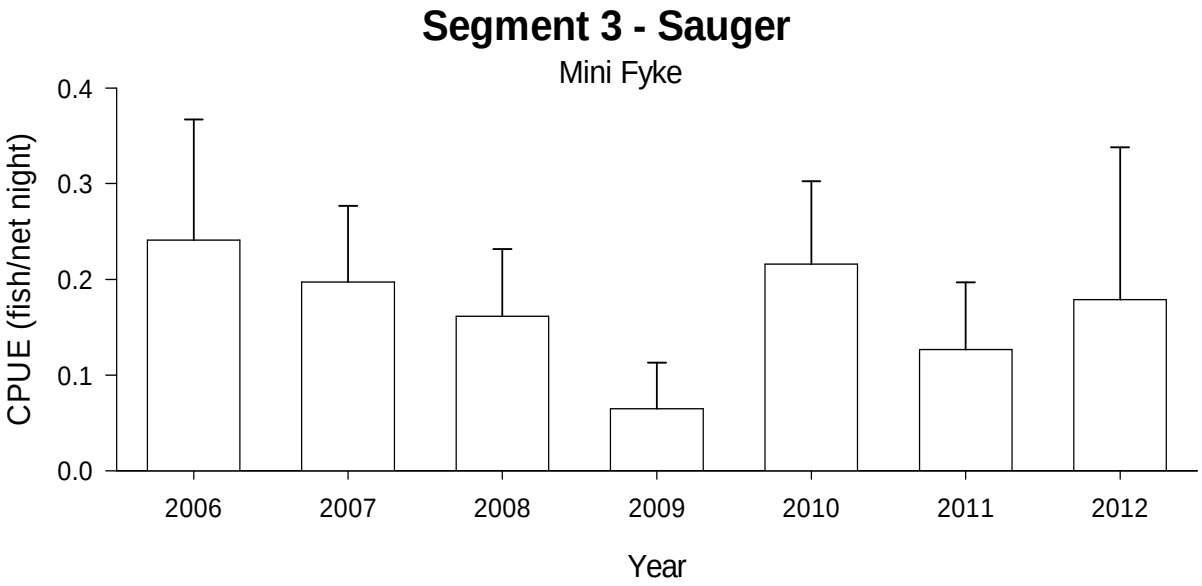

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2012.

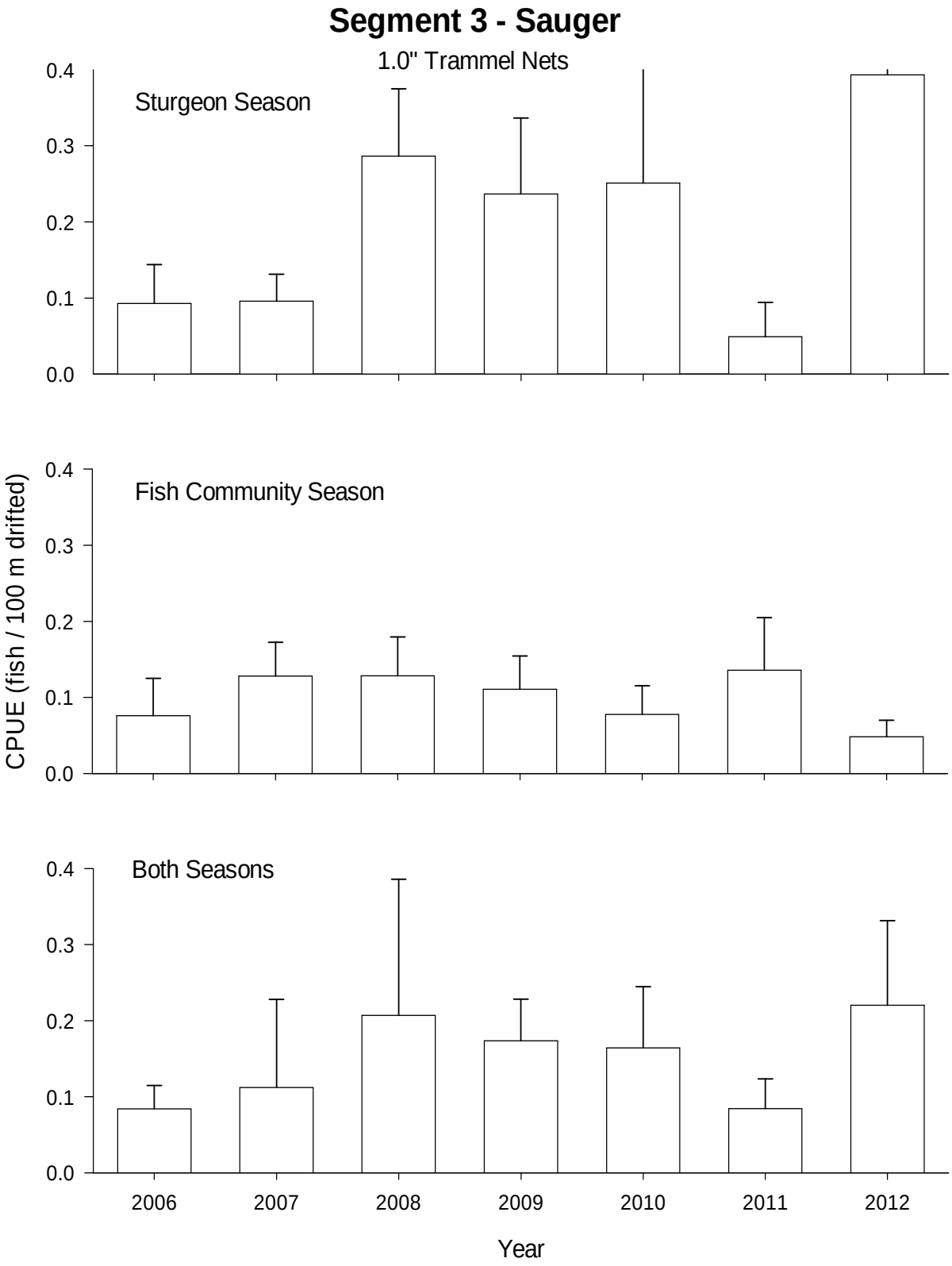

Figure 29. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2012.

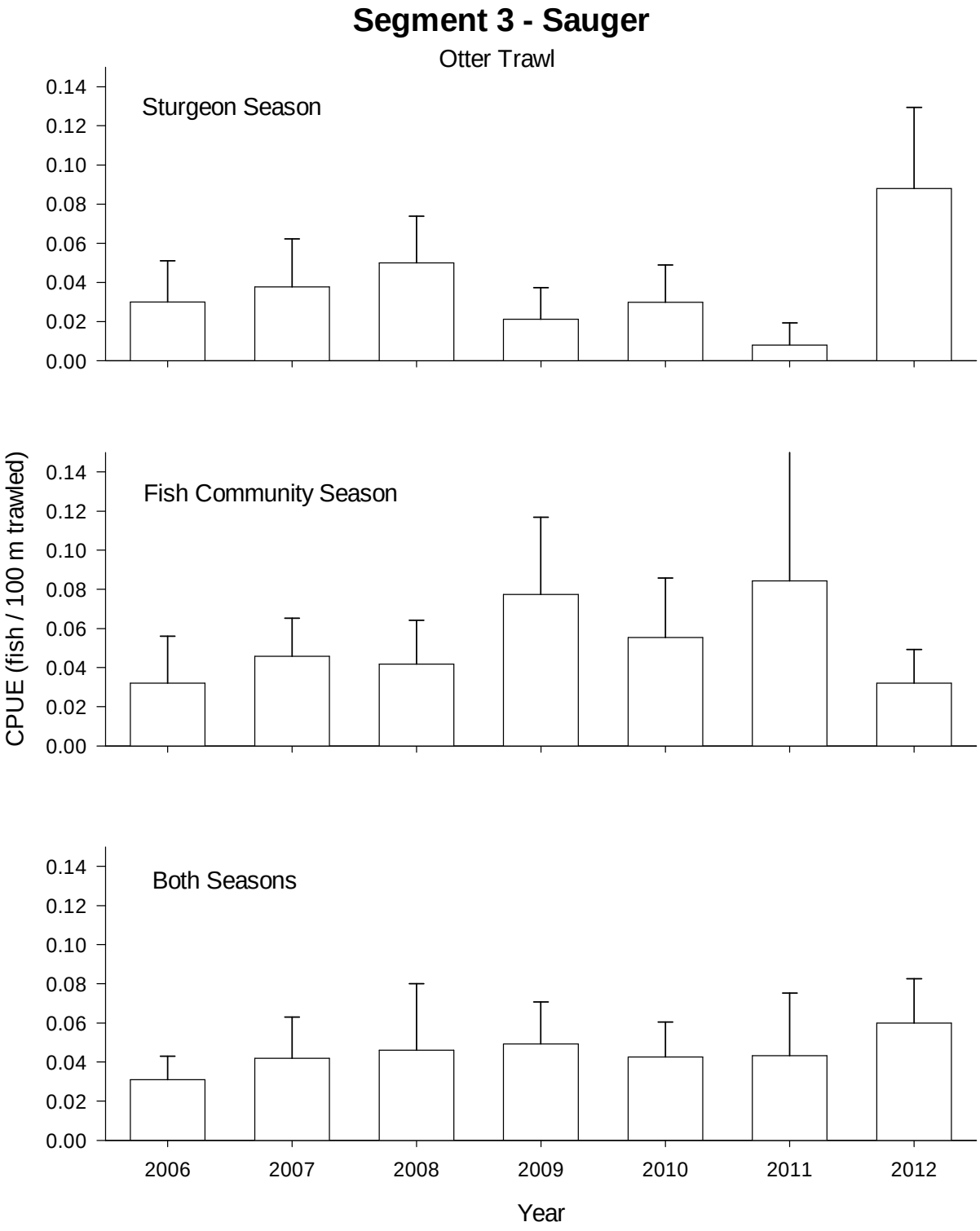

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2012.

Table 15. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2012. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS
				Sturgeon Season				
1.0" Trammel Net	173	49	24	26	1	0	0	0
		36	34	27	2	0	0	0
Otter Trawl	40	8	45	20	28	0	0	0
		33	35	27	5	0	0	0
				Fish Community Season				
1.0" Trammel Net	22	41	41	9	9	0	0	0
		36	32	28	4	0	0	0
Mini-Fyke Net	32	25	41	0	6	9	16	3
		25	35	6	5	17	10	1
Otter Trawl	16	38	63	0	0	0	0	0
		33	37	27	3	0	0	0
				Both Seasons				
Trot Lines	7	29	29	43	0	0	0	0
		35	41	19	5	0	0	0

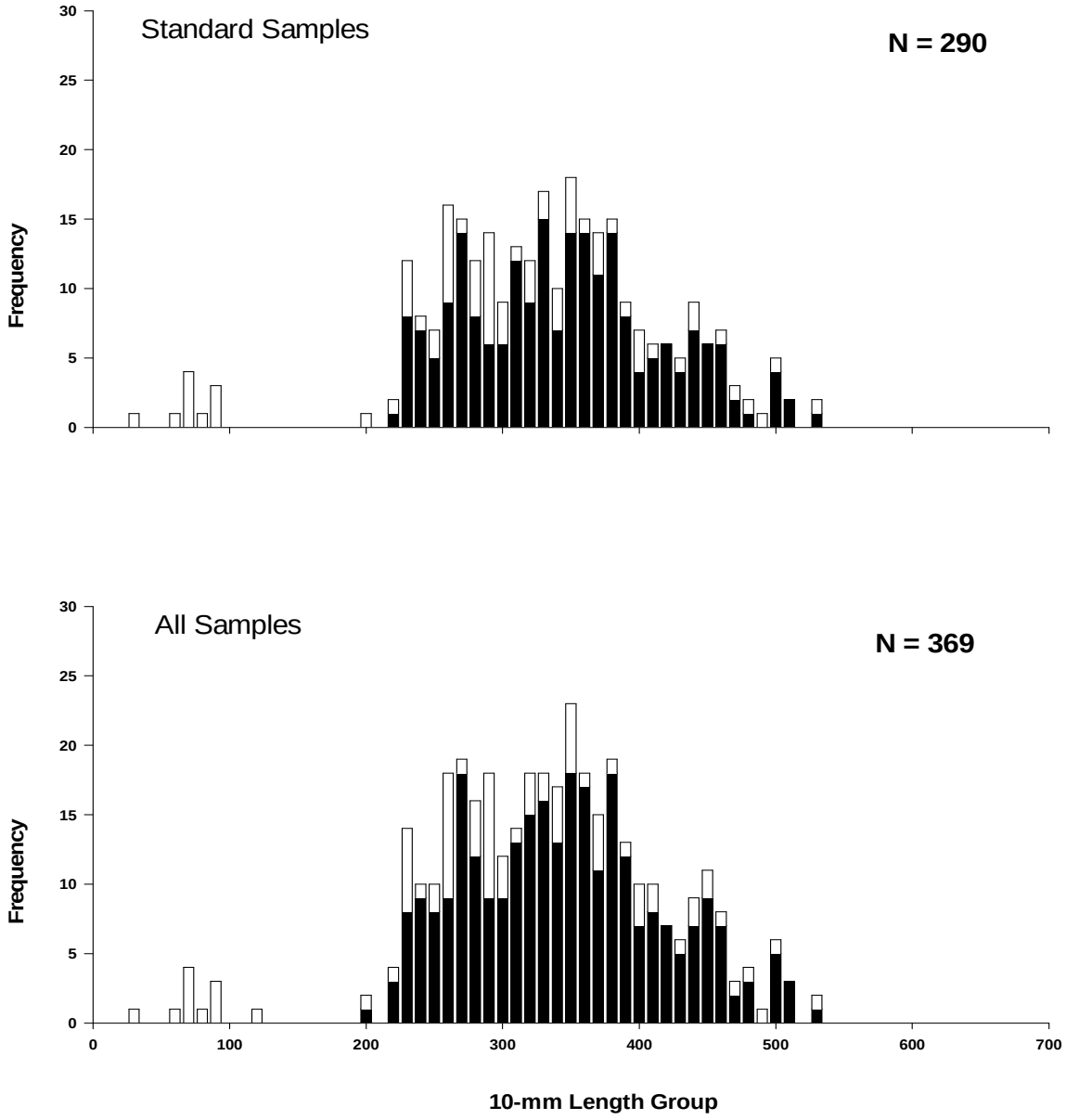

Figure 31. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2012. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2012.

Missouri River Fish Community

This section describes the total catch of fishes that are not target species and had more than 50 individuals captured during 2012. The most common fish sampled in all of 2012 was the emerald shiner *Notropis atherinoides*, with a total of 2,480 sampled. The vast majority (n = 2,436) were captured in mini fyke nets, while 35 were sampled using a non-standard beach seine and 9 were caught in the otter trawl. Emerald shiners averaged 68.6 mm in length.

The second most abundant species sampled was the river carpsucker *Carpiodes carpio* with 1,138 sampled. Mini fyke nets captured 1,033 river carpsuckers, most of which were YOY. River carpsuckers caught in the mini fyke net had an average length of 31.6 mm. The otter trawl caught a total of 27 river carpsuckers averaging 299.6 mm in length, while trammel nets caught 24, but on average were the larger than other gears with an average length of 475.6 mm. Non-standard bag seines caught the remaining river carpsuckers, which were mainly comprised of YOY fish.

A total of 646 flathead chubs *Platygobio gracilis* were sampled within Segment 3 during 2012, 224 using otter trawls, 186 using mini fykes, 105 using trammel nets, 78 using trotlines and 53 in non-standard bag seines. Several age classes of flathead chubs were caught, with the smallest fish being caught in mini fyke nets, which had an average length of 41.6 mm in length. On average, the largest flathead chubs were captured using trammel nets, which had an average length of 232.4 mm.

Channel catfish *Ictalurus punctatus* were sampled trotlines, trammel nets, otter trawls and fishing with hook and line. The otter trawl was the most effective gear in collecting large numbers of channel catfish, with a total of 273 sampled. While the average sized catfish caught in the otter trawl measured 236.3 mm, 23 channel catfish under 100 mm and 59 between 100 and 200 mm in length were caught. On average, standard trotlines caught the largest channel catfish, with an average size of 370.6 mm. In total, 514 channel catfish were sampled during 2012 in Segment 3.

At total of 275 white suckers *Catostomus commersonii* were sampled within Segment 3 during 2012. Mini fyke nets caught 131 white suckers, of the total all but 1 were age-0 fish. White suckers caught in mini fyke nets averaged 51.1 mm in length. Non-standard bag seines caught 126 white suckers and again were mainly comprised of age-0 fish.

Goldeye *Hiodon alosoides* were sampled in all standard gears, although the majority of the catch was sampled using trammel nets, which caught 174. All other gears combined to catch 76 goldeye. Few YOY goldeye were sampled during 2012 when compared to both 2011 and 2010.

A total of 162 common carp *Cyprinus carpio* were collected during 2012. All standard gears captured common carp, although the majority (n = 94) were sampled in mini fyke nets. Most common carp sampled in mini fyke nets were YOY fish and averaged 62.5 mm in length. Trammel nets captured a total of 33 common carp and averaged 538.6 mm in length.

Stonecats *Noturus flavus* were caught using trotlines (n = 58), otter trawls (n = 33) and mini fyke nets (n = 24) for a total of 115 sampled. Stonecats caught in mini fyke nets averaged 22.0 mm in length, while stonecats captured using trotlines averaged 176.8 mm.

A total of 104 fathead minnows *Pimephales promelas* were sampled during 2012, all of which were caught in mini fyke nets. Fathead minnows averaged 38.4 mm in length.

A total of 94 shorthead redhorse *Moxostoma macrolepidotum* were caught during 2012, 45 in trammel nets, 30 in otter trawls, 14 on trotlines and 5 in mini fyke nets. All five shorthead redhorses caught in mini fyke nets averaged 136.4 mm, while shorthead redhorses caught on trotlines averaged 383.3 mm.

Discussion

The 2012 sampling season was an interesting year to observe how the fish community of the Missouri River responded to the historical flood waters of 2011. Pallid sturgeon showed a significant response to the flows in 2011 moving further upstream in the Missouri River to areas closer to Fort Peck Dam than they had traditionally used during years of normal dam operations. Interestingly, pallid sturgeon that moved upstream in 2011 seemed to stay in upstream areas well into 2012. This finding is important in regards to the amount of available habitat available for pallid sturgeon in RPMA 2. During normal operations of Fort Peck Dam, few pallid sturgeon utilize habitats upstream of Wolf Point and by documenting the mass movement of 2011 and the continued presence of those fish in 2012, indicates that altered operations of Fort Peck Dam may be able to significantly increase the total amount of viable pallid sturgeon habitat within RPMA 2.

While more pallid sturgeon have been captured in Segment 3 of the Missouri River in every sampling year since the inception of the Program in 2006, CPUE of standard gears has not necessarily followed a similar pattern. Overall trammel net CPUE was actually slightly lower in 2012 than during 2008. However, overall otter trawl CPUE was at a seven year high in 2012, but it has not necessarily followed a linear increase since 2006. While the catch rates of standard gears have not increased in every year, the size structure of pallid sturgeon sampled has changed. Since the inception of the program less smaller pallid sturgeon and more larger pallid sturgeon have been being captured within Segment 3. The proportion sub-stock sized fish has significantly decreased over the seven years of sampling. The fact that catch rates for the standard gears have remained relatively constant, but a greater proportion of larger fish are being captured shows that stocked fish are surviving and growing within Segment 3. Furthermore, the relative condition of pallid sturgeon has remained relatively constant over time, lending evidence that food resources have likely not declined in the past seven years.

During 2012 a total of 11 year classes of pallid sturgeon were sampled within Segment 3. The 2009 year class had the most captures with a total of 78 fish sampled, followed by the 2008 year class with 51 captures. While fewer older year classes were captured, significantly less fish from the 1997 to 2004 year classes were stocked. The fact that all year classes that have been stocked into the river are being captured is a good indicator that the standard gears that are used are effective in capturing the variety of sizes of stocked pallid sturgeon that are present within

the system. Crews need to be cognizant of the fact that once the older year classes of pallid sturgeon reach a certain size they may not be as susceptible to our current standard gears. If that occurs, a larger meshed trammel net may need to be incorporated into the standard gear array.

There was a significant increase in shovelnose sturgeon CPUE for both trammel nets and otter trawls for 2012 when compared to 2011. This increase was likely due to the low capture efficiencies of 2011 due to extremely high water. While overall otter trawl and trammel net CPUE of shovelnose sturgeon have not greatly differed among the seven years of sampling, the two gears are doing a good job of identifying strong year classes. Our data indicate that during 2007 and 2010 strong year classes of shovelnose sturgeon were produced. This was identified in those years as fish smaller than 149 mm in length were collected. Those strong year classes were identified again in the following years of 2008 and 2011, with fish in the 150 to 249 mm size range being captured. This pattern is easily discernible in Figure 15. Interestingly, both 2007 and 2010 were very good flow years in the Milk River. During 2007 Milk River flows peaked at approximately 5,000 cfs and during 2010 flows peaked at over 6,000 cfs. Although no larval *Scaphirhynchus spp.* have ever been collected from the Milk River, high flows from this tributary greatly influence the Missouri River downstream of Fort Peck Dam. Milk River discharge increases both water temperature and the suspended sediment load of the Missouri River. Data from the Program and the Fort Peck Flow Modification Program give solid evidence that Milk River discharge influences shovelnose sturgeon production in the Missouri River. Furthermore, due to the drifting nature of shovelnose sturgeon free embryos, these fish that are produced in Segment 2 drift and settle in the lower portions of Segment 3 and further downstream in Segment 4. Over the seven years of the Program in Segment 3, most YOY and age-1 shovelnose sturgeon are captured in the lowest portions of Segment 3.

Although the high waters of 2011 influence the distribution of pallid sturgeon within Segments 2 and 3, we did not see increases in many of the target cyprinids. Sand shiners, western silvery minnows, sturgeon chub and sicklefin chub abundance did not appreciabley increase in 2012 when compared to prior sampling years. However, sauger the relative abundance of sauger, especially during the sturgeon season was at a seven year high. This increase in sauger is likely attributed to the good water years of 2010 and 2011. Not only did sauger increase, but northern pike and walleye populations also increased during 2011, both from natural recruitment and from entrainment over Fort Peck Dam. This increase in native and non-native predators including pallid sturgeon, could be cropping off cyprinid populations. In the

early years of the program, cyprinid catches were higher and sauger and larger pallid sturgeon catches were lower, whereas in 2012 the opposite was observed. It will be important to keep track of the relative abundance of native cyprinids into the future while more hatchery reared juvenile pallid sturgeon grow into larger size classes and become more dependent on fish as forage. Healthy water years likely produce a lot of cyprinids as well as predators, but since the predators like sauger and sturgeon have a much longer life span, drought years could place significant pressure on forage populations.

Acknowledgments

The U.S. Army Corps of Engineers provided funding for this project. We'd like to thank Tim Welker and George Williams for stewardship of the Population Assessment Program. Bob Lipscomb assisted in both the field and shop throughout the year. James Collins and Cara Holem-Bell were both excellent interns. Thanks to Steve Dalbey for taking care of much needed business while we were on the river. We'd like to thank Dave Fuller for his help in the field and office. Thanks to Pat Braaten of the U.S. Geological Survey for answering any type of question we may have pertaining to the Missouri River and its fishes. Thanks to Ryan Wilson, Zack Sandness, Everett Nelson and Steve Krentz of the U.S. Fish and Wildlife Service for all the collaboration between our offices.

References

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

Dattilo, J. E., R. R. Dirnberger, P. T. Horner, D. J. Niswonger, M. L. Miller and V. H. Travinchek. 2008b. Three Year Summary Age and Growth Report For Plains Minnow, Western Silvery Minnow, Brassy Minnow (*Hybognathus spp.*). Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River. Missouri Department of Conservation. Chillicothe, MO.

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

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

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

Hadley, G. L. and J. J. Rotella. 2009. Upper Basin Pallid Sturgeon Survival Estimation Project. Final Report. February 25, 2009. Montana State University, Bozeman, MT.

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

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

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

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

Shuman, D. A. et al. 2010. Pallid Sturgeon Size Structure, Condition, and Growth within the Missouri River Basin. (In Review). Journal of Applied Ichthyology.

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

Welker, T. L., and M. R. Drobish. (editors), 2011. Missouri River Standard Operating Procedures for Fish Sampling and Data Collection, Volume 1.5. U.S. Army Corps of Engineers, Omaha District Yankton, SD.

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

Scientific name	Common name	Letter Code
	CLASS CEPHALASPIDOMORPHI-LAMPREYS	
	ORDER PETROMYZONTIFORMES	
	Petromyzontidae – lampreys	
Ichthyomyzon castaneus	Chestnut lamprey	CNLP
Ichthyomyzon fossor	Northern brook lamprey	NBLP
Ichthyomyzon unicuspis	Silver lamprey	SVLP
Ichthyomyzon gagei	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
	CLASS OSTEICHTHYES – BONY FISHES	
	ORDER ACIPENSERIFORMES	
	Acipenseridae – sturgeons	
Acipenser fulvescens	Lake sturgeon	LKSG
Scaphirhynchus spp.	Unidentified Scaphirhynchus	USG
Scaphirhynchus albus	**Pallid sturgeon**	**PDSG***
Scaphirhynchus platorynchus	**Shovelnose sturgeon**	**SNSG***
S. albus X S. platorynchus	Pallid-shovelnose hybrid	SNPD
	Polyodontidae – paddlefishes	
Polyodon spathula	Paddlefish	PDFH
	ORDER LEPISOSTEIFORMES	
	Lepisosteidae – gars	
Lepisosteus oculatus	Spotted gar	STGR
Lepisosteus osseus	Longnose gar	LNGR
Lepisosteus platostomus	Shortnose gar	SNGR
	ORDER AMMIFORMES	
	Amiidae – bowfins	
Amia calva	Bowfin	BWFN
	ORDER OSTEOGLOSSIFORMES	
	Hiodontidae – mooneyes	
Hiodon alosoides	Goldeye	GDEY
Hiodon tergisus	Mooneye	MNEY
	ORDER ANGUILLIFORMES	
	Anguillidae – freshwater eels	
Anguilla rostrata	American eel	AMEL
	ORDER CLUPEIFORMES	
	Clupeidae – herrings	
Alosa alabame	Alabama shad	ALSD
Alosa chrysochloris	Skipjack herring	SJHR
Alosa pseudoharengus	Alewife	ALWF
Dorosoma cepedianum	Gizzard shad	GZSD
Dorosoma petenense	Threadfin shad	TFSD

Appendix A. (continued).

Scientific name	Common name	Lettter Code
D. cepedianum X D. petenense	Gizzard-threadfin shad hybrid	GSTS
	ORDER CYPRINIFORMES	
	Cyprinidae – carps and minnows	
Campostoma anomalum	Central stoneroller	CLSR
Campostoma oligolepis	Largescale stoneroller	LSSR
Carassius auratus	Goldfish	GDFH
Carassus auratus X Cyprinius carpio	Goldfish-Common carp hybrid	GFCC
Couesius plumbens	Lake chub	LKCB
Ctenopharyngodon idella	Grass carp	GSCP
Cyprinella lutrensis	Red shiner	RDSN
Cyprinella spiloptera	Spotfin shiner	SFSN
Cyprinus carpio	Common carp	CARP
Erimystax x-punctatus	Gravel chub	GVCB
Hybognathus argyritis	**Western slivery minnow**	**WSMN***
Hybognathus hankinsoni	Brassy minnow	BSMN
Hybognathus nuchalis	Mississippi silvery minnow	SVMW
Hybognathus placitus	**Plains minnow**	**PNMW***
Hybognathus spp.	Unidentified Hybognathus	HBNS
Hypophthalmichthys molitrix	Silver carp	SVCP
Hypophthalmichthys nobilis	Bighead carp	BHCP
Luxilus chrysocephalus	Striped shiner	SPSN
Luxilus cornutus	Common shiner	CMSN
Luxilus zonatus	Bleeding shiner	BDSN
Lythrurus unbratilis	Western redfin shiner	WRFS
Macrhybopsis aestivalis	**Shoal chub**	**SKCB***
Macrhybopsis gelida	**Sturgeon chub**	**SGCB***
Macrhybopsis meeki	**Sicklefin chub**	**SFCB***
Macrhybopsis storeriana	Silver chub	SVCB
M. aestivalis X M. gelida	Shoal-Sturgeon chub hybrid	SPST
M. gelida X M. meeki	Sturgeon-Sicklefin chub hybrid	SCSC
Macrhybopsis spp.	Unidentified chub	UHY
Margariscus margarita	Pearl dace	PLDC
Mylocheilus caurinus	Peamouth	PEMT
Nocomis biguttatus	Hornyhead chub	HHCB
Notemigonus crysoleucas	Golden shiner	GDSN
Notropis atherinoides	Emerald shiner	ERSN
Notropis blennius	River shiner	RVSN
Notropis boops	Bigeye shiner	BESN
Notropis buchanani	Ghost shiner	GTSN
Notropis dorsalis	Bigmouth shiner	BMSN
Notropis greenei	Wedgespot shiner	WSSN
	Cyprinidae – carps and minnows	
Notropis heterolepsis	Blacknose shiner	BNSN
Notropis hudsonius	Spottail shiner	STSN
Notropis nubilus	Ozark minnow	OZMW
Notropis rubellus	Rosyface shiner	RYSN
Notropis shumardi	Silverband shiner	SBSN
Notropis stilbius	Silverstripe shiner	SSPS
Notropis stramineus	**Sand shiner**	**SNSN***
Notropis topeka	Topeka shiner	TPSN
Notropis volucellus	Mimic shiner	MMSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
Notropis wickliffi	Channel shiner	CNSN
Notropis spp.	Unidentified shiner	UNO
Opsopoeodus emiliae	Pugnose minnow	PNMW
Phenacobius mirabilis	Suckermouth minnow	SMMW
Phoxinus eos	Northern redbelly dace	NRBD
Phoxinus erythrogaster	Southern redbelly dace	SRBD
Phoxinus neogaeus	Finescale dace	FSDC
Pimephales notatus	Bluntnose minnow	BNMW
Pimephales promelas	Fathead minnow	FHMW
Pimephales vigilax	Bullhead minnow	BHMW
Platygobio gracilis	Flathead chub	FHCB
P. gracilis X M. meeki	Flathead-sicklefin chub hybrid	FCSC
Rhinichthys atratulus	Blacknose dace	BNDC
Rhinichthys cataractae	Longnose dace	LNDC
Richardsonius balteatus	Redside shiner	RDSS
Scardinius erythrophthalmus	Rudd	RUDD
Semotilus atromaculatus	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
	Catostomidae - suckers	
Carpiodes carpio	River carpsucker	RVCS
Carpiodes cyprinus	Quillback	QLBK
Carpiodes velifer	Highfin carpsucker	HFCS
Carpiodes spp.	Unidentified Carpiodes	UCS
Catostomus catostomus	Longnose sucker	LNSK
Catostomus commersonii	White sucker	WTSK
Catostomus platyrhynchus	Mountain sucker	MTSK
Catostomus spp.	Unidentified *Catostomus* spp.	UCA
Cycleptus elongatus	**Blue sucker**	**BUSK***
Hypentelium nigricans	Northern hog sucker	NHSK
Ictiobus bubalus	Smallmouth buffalo	SMBF
Ictiobus cyprinellus	Bigmouth buffalo	BMBF
Ictiobus niger	Black buffalo	BKBF
Ictiobus spp.	Unidentified buffalo	UBF
Minytrema melanops	Spotted sucker	SPSK
Moxostoma anisurum	Silver redhorse	SVRH
Moxostoma carinatum	River redhorse	RVRH
Moxostoma duquesnei	Black redhorse	BKRH
Moxostoma erythrurum	Golden redhorse	GDRH
Moxostoma macrolepidotum	Shorthead redhorse	SHRH
Moxostoma spp.	Unidentified redhorse	URH
Catostomidae - suckers	Unidentified Catostomidae	UCT
	ORDER SILURIFORMES	
	Ictaluridae – bullhead catfishes	
Ameiurus melas	Black bullhead	BKBH
Ameiurus natalis	Yellow bullhead	YLBH
Ameiurus nebulosus	Brown bullhead	BRBH
Ameiurus spp.	Unidentified bullhead	UBH
Ictalurus furcatus	Blue catfish	BLCF

Appendix A. (continued).

Scientific name	Common name	Letter Code
Ictalurus punctatus	Channel catfish	CNCF
I. furcatus X I. punctatus	Blue-channel catfish hybrid	BCCC
Ictalurus spp.	Unidentified *Ictalurus* spp.	UCF
Noturus exilis	Slender madtom	SDMT
Noturus flavus	Stonecat	STCT
Noturus gyrinus	Tadpole madtom	TPMT
Noturus nocturnus	Freckled madtom	FKMT
Pylodictis olivaris	Flathead catfish	FHCF
	ORDER SALMONIFORMES	
	Esocidae - pikes	
Esox americanus vermiculatus	Grass pickerel	GSPK
Esox lucius	Northern pike	NTPK
Esox masquinongy	Muskellunge	MSKG
E. lucius X E. masquinongy	Tiger Muskellunge	TGMG
	Umbridae - mudminnows	
Umbra limi	Central mudminnow	MDMN
	Osmeridae - smelts	
Osmerus mordax	Rainbow smelt	RBST
	Salmonidae - trouts	
Coregonus artedi	Lake herring or cisco	CSCO
Coregonus clupeaformis	Lake whitefish	LKWF
Oncorhynchus aguabonita	Golden trout	GDTT
Oncorhynchus clarkii	Cutthroat trout	CTTT
Oncorhynchus kisutch	Coho salmon	CHSM
Oncorhynchus mykiss	Rainbow trout	RBTT
Oncorhynchus nerka	Sockeye salmon	SESM
Oncorhynchus tshawytscha	Chinook salmon	CNSM
Prosopium cylindraceum	Bonneville cisco	BVSC
Prosopium williamsoni	Mountain whitefish	MTWF
Salmo trutta	Brown trout	BNTT
Salvelinus fontinalis	Brook trout	BKTT
Salvelinus namaycush	Lake trout	LKTT
Thymallus arcticus	Arctic grayling	AMGL
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
Percopsis omiscomaycus	Trout-perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
Lota lota	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
Fundulus catenatus	Northern studfish	NTSF
Fundulus diaphanus	Banded killifish	BDKF
Fundulus notatus	Blackstripe topminnow	BSTM
Fundulus olivaceus	Blackspotted topminnow	BPTM
Fundulus sciadicus	Plains topminnow	PTMW

Appendix A. (continued).

Scientific name	Common name	Letter Code
Fundulus zebrinus	Plains killifish	PKLF
	Poeciliidae - livebearers	
Gambusia affinis	Western mosquitofish	MQTF
	Atherinidae - silversides	
Labidesthes sicculus	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	
	Gasterosteidae - sticklebacks	
Culaea inconstans	Brook stickleback	BKSB
	ORDER SCORPAENIFORMES	
	Cottidae - sculpins	
Cottus bairdi	Mottled sculpin	MDSP
Cottus carolinae	Banded sculpin	BDSP
	ORDER PERCIFORMES	
	Percichthyidae – temperate basses	
Morone Americana	White perch	WTPH
Morone chrysops	White bass	WTBS
Morone mississippiensis	Yellow bass	YWBS
Morone saxatilis	Striped bass	SDBS
M. saxatilis X M. chrysops	Striped-white bass hybrid	SBWB
	Centrarchidae - sunfishes	
Ambloplites rupestris	Rock bass	RKBS
Archoplites interruptus	Sacramento perch	SOPH
Lepomis cyanellus	Green sunfish	GNSF
Lepomis gibbosus	Pumpkinseed	PNSD
Lepomis gulosus	Warmouth	WRMH
Lepomis humilis	Orangespotted sunfish	OSSF
Lepomis macrochirus	Bluegill	BLGL
Lepomis megalotis	Longear sunfish	LESF
Lepomis microlophus	Redear sunfish	RESF
L. cyanellus X L. macrochirus	Green sunfish-bluegill hybrid	GSBG
	Centrarchidae - sunfishes	
L. cyanellus X L. humilis	Green-orangespotted sunfish hybrid	GSOS
L. macrochirus X L. microlophus	Bluegill-redear sunfish hybrid	BGRE
Lepomis spp.	Unidentified *Lepomis*	ULP
Micropterus dolomieu	Smallmouth bass	SMBS
Micropterus punctulatus	Spotted sunfish	STBS
Micropterus salmoides	Largemouth bass	LMBS
Micropterus spp.	Unidentified *Micropterus* spp.	UMC
Pomoxis annularis	White crappie	WTCP
Pomoxis nigromaculatus	Black crappie	BKCP
Pomoxis spp.	Unidentified crappie	UCP
P. annularis X P. nigromaculatus	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified Centrarchidae	UCN
	Percidae - perches	
Ammocrypta asprella	Crystal darter	CLDR

Appendix A. (continued).

Scientific name	Common name	Letter Code
Etheostoma blennioides	Greenside darter	GSDR
Etheostoma caeruleum	Rainbow darter	RBDR
Etheostoma exile	Iowa darter	IODR
Etheostoma flabellare	Fantail darter	FTDR
Etheostoma gracile	Slough darter	SLDR
Etheostoma microperca	Least darter	LTDR
Etheostoma nigrum	Johnny darter	JYDR
Etheostoma punctulatum	Stippled darter	STPD
Etheostoma spectabile	Orange throated darter	OTDR
Etheostoma tetrazonum	Missouri saddled darter	MSDR
Etheostoma zonale	Banded darter	BDDR
Etheostoma spp.	Unidentified Etheostoma spp.	UET
Perca flavescens	Yellow perch	YWPH
Percina caprodes	Logperch	LGPH
Percina cymatotaenia	Bluestripe darter	BTDR
Percina evides	Gilt darter	GLDR
Percina maculata	Blackside darter	BSDR
Percina phoxocephala	Slenderhead darter	SHDR
Percina shumardi	River darter	RRDR
Percina spp.	Unidentified Percina spp.	UPN
	Unidentified darter	UDR
Sander canadense	**Sauger**	**SGER***
Sander vitreus	Walleye	WLEY
S. canadense X S. vitreus	Sauger-walleye hybrid/Saugeye	SGWE
Sander spp.	Unidentified *Sander* (formerly *Stizostedion*) spp.	UST
	Unidentified Percidae	UPC
	Sciaenidae - drums	
Aplodinotus grunniens	Freshwater drum	FWDM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YOYF
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF
	Turtles	
Chelydra serpentine	Common Snapping Turtle	SNPT
Chrysemys picta bellii	Western Painted Turtle	PATT
Emydoidea blandingii	Blanding's Turtle	BLDT
Graptemys pseudogeographica	False Map Turtle	FSMT
Trachemys scripta	Red-Eared Slider Turtle	REST
Apalone mutica	Smooth Softshell Turtle	SMST
Apalone spinifera	Spiny Softshell Turtle	SYST
Terrapene ornata ornata	Ornate Box Turtle	ORBT
Sternotherus odoratus	Stinkpot Turtle	SPOT
Graptemys geographica	Map Turtle	MAPT
Graptemys kohnii	Mississippi Map Turtle	MRMT
Graptemys ouachitensis	Ouachita Map Turtle	OUMT
Pseudemys concinna metteri	Missouri River Cooter Turtle	MRCT
Terrapene carolina triunguis	Three-toed Box Turtle	TTBT

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, 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
Trammel Net – 1.0”inner mesh	TN	Standard	Both Seasons	2006 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2006 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2006 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2006	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2006	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Wild	Fish Comm.	2007-Present	Fish / 100 m^2
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trot Line	TL	Evaluation	Both Seasons	2009	Fish / hook night
Trot Line	TL	Standard	Both Seasons	2010-Present	Fish / hook night
Electrofishing	EF	Wild	Both Seasons	2010-Present	Fish/hour

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

State(s)	RPMA	Site Name	Code	River	R.M.
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	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KS/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 3of 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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2004	Milk River	821	2003	4/13/2004	Yearling	Elastomer	
2004	Culbertson	523	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Intake	347	2003	8/9/2004	Yearling	PIT Tag	Elasomer
2004	Sidney	397	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Wolf Point	379	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Larval Drift	30000	2004	7/2/2004	Fry		
2004	Larval Drift	50000	2004	7/8/2004	Fry		
2004	Larval Drift	25000	2004	7/20/2004	Fry		
2004	Larval Drift	25000	2004	7/23/2004	Fry		
2004	Larval Drift	25000	2004	7/27/2004	Fry		
2004	Culbertson	3819	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Sidney	2991	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Wolf Point	4040	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Mouth of Milk	3482	2004	10/15/2004	Advanced Fingerling	CWT	Elastomer
2004	Intake	2477	2004	11/18/2004	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	288	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Intake	309	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Wolf Point	271	2004	4/12/2005	Yearling	CWT	Elastomer
2005	Intake	175	2004	8/19/2005	Yearling	PIT Tag	Elastomer
2005	Brockton	229	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	226	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Intake	456	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Milk River	232	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Sidney	122	2005	10/5/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	611	2005	10/12/2005	Advanced Fingerling	CWT	Elastomer
2005	Brockton	371	2005	10/13/2005	Advanced Fingerling		

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
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	
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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark 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	
2008	Culbertson	1384	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Culbertson	643	2007	3/26/2008	Yearling	Elastomer	
2008	Fallon	1307	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Forsyth	1384	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Forsyth	106	2007	3/26/2008	Yearling	Elastomer	

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2008	Intake	2395	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Intake	103	2007	3/26/2008	Yearling	Elastomer	
2008	School Trust	1325	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	School Trust	654	2007	3/26/2008	Yearling	Elastomer	
2008	Sidney	149	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Sidney	67	2007	3/26/2008	Yearling	Elastomer	
2008	Wolf Point	1328	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Wolf Point	416	2007	3/26/2008	Yearling	Elastomer	
2008	Miles City	4797	2008	7/30/2008	Fry		
2008	Grand Champs	24395	2008	7/30/2008	Fry		
2008	Culbertson	15630	2008	9/24/2008	Fingerling	Elastomer	
2008	Fallon	7930	2008	9/29/2008	Fingerling	Elastomer	
2008	Forsyth	7723	2008	9/29/2008	Fingerling	Elastomer	
2008	Intake	12642	2008	9/29/2008	Fingerling	Elastomer	
2008	Sidney	3186	2008	9/29/2008	Fingerling	Elastomer	
2008	Wolf Point	11717	2008	9/24/2008	Fingerling	Elastomer	
2009	Culbertson	1387	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Fallon	1155	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Forsyth	1166	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Intake	2181	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Sidney	710	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Wolf Point	2162	2008	4/13/2009	Yearling	PIT Tag	Scute Removed
2009	Miles City	46260	2009	7/31/2009	Fry		
2009	Wolf Point	26175	2009	7/22/2009	Fry		

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stockinga	Primary Mark	Secondary Mark
2009	Culbertson	10238	2009	9/24/2009	Fingerling	Elastomer	
2009	Fallon	5133	2009	9/23/2009	Fingerling	Elastomer	
2009	Forsyth	5386	2009	9/23/2009	Fingerling	Elastomer	
2009	Intake	8374	2009	9/23/2009	Fingerling	Elastomer	
2009	Sidney	1865	2009	9/23/2009	Fingerling	Elastomer	
2009	Wolf Point	9946	2009	9/23/2009	Fingerling	Elastomer	
2009	Intake	8374	2009	9/23/2009	Fingerling	Elastomer	
2009	Sidney	1865	2009	9/23/2009	Fingerling	Elastomer	
2009	Wolf Point	9946	2009	9/23/2009	Fingerling	Elastomer	
2010	Fallon	721	2009	4/15/2010	Yearling	PIT Tag	Scute Removed
2010	Fallon	268	2009	8/3/2010	Yearling	PIT Tag	Scute Removed
2010	Fallon	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	Forsyth	1402	2009	4/15/2010	Yearling	PIT Tag	Scute Removed
2010	Forsyth	268	2009	8/3/2010	Yearling	PIT Tag	Scute Removed
2010	Intake	1890	2009	4/15/2010	Yearling	PIT Tag	Scute Removed
2010	Intake	816	2009	6/4/2010	Yearling	Elastomer	
2010	Intake	541	2009	8/3/2010	Yearling	PIT Tag	Scute Removed
2010	Intake	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	Sidney	331	2009	4/15/2010	Yearling	PIT Tag	Scute Removed
2010	Wolf Point	1309	2009	4/15/2010	Yearling	PIT Tag	Elastomer, Scute
2010	Wolf Point	858	2009	6/4/2010	Yearling	Elastomer	
2010	Wolf Point	425	2009	8/3/2010	Yearling	PIT Tag	Scute Removed
2010	Wolf Point	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	Culbertson	65	2004	9/21/2010	6 Yr Old	PIT Tag	
2010	Culbertson	1337	2009	4/15/2010	Yearling	PIT Tag	Elastomer, Scute

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stockinga	Primary Mark	Secondary Mark
2010	Culbertson	384	2009	6/4/2009	Yearling	PIT Tag	Scute Removed
2010	Culbertson	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	School Trust	1766	2009	4/15/2010	Yearling	PIT Tag	Elastomer, Scute
2011	Culbertson	795	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Wolf Point	797	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Fallon	531	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Forsyth	545	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Intake	510	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Culbertson	262	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Fallon	131	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Forsyth	174	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Intake	132	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Wolf Point	262	2010	8/22/2011	Yearling	PIT Tag	Scute

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 3 of the Missouri River during 2012. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. 1.0” 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 CHNB	ISB BARS	ISB CHNB	OSB CHNB	SCCL CHNB
BKCP	0	0	0	0	0	0	0
		0	0		0	0	0
BLGL	0	0	0	0	0	0	0
		0	0		0	0	0
BMBF	2	0.003	0	0	0.008	0	0
		0.004	0		0.011	0	0
BRBT	1	0.001	0	0	0	0	0.035
		0.002	0		0	0	0.07
BUSK	**6**	**0.007**	**0.013**	**0**	**0.007**	**0**	**0**
		0.006	**0.013**		**0.01**	**0**	**0**
CARP	23	0.028	0.036	0	0.038	0.01	0
		0.017	0.03		0.039	0.011	0
CNCF	51	0.06	0.085	0	0.07	0.024	0.035
		0.037	0.074		0.078	0.024	0.07
CSCO	0	0	0	0	0	0	0
		0	0		0	0	0
ERSN	0	0	0	0	0	0	0
		0	0		0	0	0
FHCB	92	0.107	0.104	0.588	0.14	0.064	0.141
		0.027	0.046		0.055	0.037	0.153
FHMW	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
GDEY	126	0.152	0.166	0	0.231	0.045	0.158
		0.043	0.077		0.094	0.034	0.131
GNSF	0	0	0	0	0	0	0

Species	Total	Overall	CHXO	ISB		OSB	SCCL
	Catch	CPUE	CHNB	BARS	CHNB	CHNB	CHNB
		0	0		0	0	0
LKWF	1	0.001	0.003	0	0	0	0
		0.002	0.006		0	0	0
LNDC	0	0	0	0	0	0	0
		0	0		0	0	0
LNSK	5	0.005	0.01	0	0.003	0.003	0
		0.005	0.011		0.006	0.006	0
NFSH	0	0	0	0	0	0	0
		0	0		0	0	0
NTPK	6	0.006	0.018	0	0	0	0
		0.006	0.018		0	0	0
PDFH	1	0.001	0.003	0	0	0	0
		0.002	0.006		0	0	0
PDSG	**33**	**0.038**	**0.052**	**0**	**0.038**	**0.025**	**0**
		0.018	**0.041**		**0.025**	**0.025**	**0**
RVCS	20	0.024	0.019	0.294	0.039	0.014	0
		0.013	0.015		0.032	0.016	0
SFCB	**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**
SGER	**195**	**0.22**	**0.298**	**0**	**0.166**	**0.191**	**0.252**
		0.111	**0.302**		**0.082**	**0.104**	**0.266**
SHRH	30	0.04	0.035	0	0.035	0.025	0.323
		0.018	0.022		0.028	0.037	0.273
SMBF	17	0.019	0.009	0	0.022	0.027	0.037
		0.012	0.01		0.023	0.028	0.074
SNGR	1	0.001	0	0	0	0.005	0
		0.003	0		0	0.009	0
SNSG	**150**	**0.198**	**0.174**	**0**	**0.208**	**0.124**	**1.141**

Species	Total	Overall	CHXO	ISB		OSB	SCCL
	Catch	CPUE	CHNB	BARS	CHNB	CHNB	CHNB
		0.057	**0.09**		**0.078**	**0.071**	**1.136**
SNSN	**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
STSN	0	0	0	0	0	0	0
		0	0		0	0	0
UCA	0	0	0	0	0	0	0
		0	0		0	0	0
UCY	0	0	0	0	0	0	0
		0	0		0	0	0
WLYE	7	0.008	0.012	0	0.008	0.003	0
		0.006	0.012		0.011	0.006	0
WSMW	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**		**0**	**0**	**0**
WTCP	0	0	0	0	0	0	0
		0	0		0	0	0
WTSK	4	0.005	0.01	0.294	0.003	0	0
		0.005	0.014		0.006	0	0

Appendix F2. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total	Overall	CHXO		ISB	OSB	SCCL
	Catch	CPUE	BARS	CHNB	CHNB	CHNB	CHNB
BKCP	0	0	0	0	0	0	0
		0		0	0	0	0
BLGL	0	0	0	0	0	0	0
		0		0	0	0	0
BMBF	0	0	0	0	0	0	0
		0		0	0	0	0
BRBT	2	0.002	0	0	0.003	0	0.021
		0.003		0	0.005	0	0.042
BUSK	**2**	**0.003**	**0**	**0**	**0**	**0.009**	**0**
		0.004		**0**	**0**	**0.013**	**0**
CARP	13	0.014	0	0.024	0.009	0.007	0.021
		0.009		0.024	0.01	0.01	0.042
CNCF	229	0.226	0.667	0.206	0.307	0.154	0.146
		0.12		0.157	0.297	0.089	0.182
CSCO	1	0.001	0	0.003	0	0	0
		0.002		0.006	0	0	0
ERSN	7	0.007	0	0.003	0.003	0.01	0.042
		0.006		0.006	0.005	0.015	0.083
FHCB	153	0.171	0	0.123	0.21	0.077	0.778
		0.05		0.084	0.086	0.051	0.483
FHMW	0	0	0	0	0	0	0
		0		0	0	0	0
FWDM	4	0.005	0	0.012	0.003	0	0
		0.005		0.014	0.005	0	0
GDEY	8	0.008	0	0	0.003	0.02	0.023
		0.012		0	0.005	0.041	0.045
GNSF	0	0	0	0	0	0	0

Species	Total	Overall	CHXO		ISB	OSB	SCCL
	Catch	CPUE	BARS	CHNB	CHNB	CHNB	CHNB
		0		0	0	0	0
LKWF	0	0	0	0	0	0	0
		0		0	0	0	0
LNDC	2	0.002	0	0.003	0.003	0	0
		0.003		0.006	0.005	0	0
LNSK	4	0.005	0	0.006	0.003	0	0.041
		0.005		0.009	0.005	0	0.083
NFSH	0	0	0	0	0	0	0
		0		0	0	0	0
NTPK	1	0.001	0	0.003	0	0	0
		0.002		0.006	0	0	0
PDFH	0	0	0	0	0	0	0
		0		0	0	0	0
PDSG	**52**	**0.057**	**0.333**	**0.077**	**0.05**	**0.034**	**0.104**
		0.02		**0.049**	**0.028**	**0.024**	**0.117**
RVCS	25	0.027	0	0.025	0.021	0.033	0.042
		0.016		0.024	0.02	0.043	0.083
SFCB	**93**	**0.097**	**0**	**0.083**	**0.07**	**0.148**	**0.104**
		0.03		**0.044**	**0.035**	**0.082**	**0.117**
SGCB	**200**	**0.211**	**0**	**0.207**	**0.199**	**0.245**	**0.125**
		0.047		**0.076**	**0.088**	**0.089**	**0.12**
SGER	**56**	**0.06**	**0**	**0.029**	**0.085**	**0.027**	**0.281**
		0.023		**0.019**	**0.038**	**0.027**	**0.324**
SHRH	24	0.025	0	0.036	0.031	0	0.05
		0.018		0.053	0.018	0	0.069
SMBF	0	0	0	0	0	0	0
		0		0	0	0	0
SNGR	0	0	0	0	0	0	0

Species	Total	Overall	CHXO		ISB	OSB	SCCL
	Catch	CPUE	BARS	CHNB	CHNB	CHNB	CHNB
		0		0	0	0	0
SNSG	**65**	**0.071**	**0**	**0.107**	**0.062**	**0.051**	**0.021**
		0.019		**0.043**	**0.027**	**0.028**	**0.042**
SNSN	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0		**0**	**0**	**0**	**0**
STCT	21	0.025	0	0.006	0.042	0.024	0.021
		0.017		0.008	0.044	0.022	0.042
STSN	3	0.003	0	0.008	0.003	0	0
		0.004		0.011	0.005	0	0
UCA	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
WLYE	0	0	0	0	0	0	0
		0		0	0	0	0
WSMW	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0		**0**	**0**	**0**	**0**
WTCP	0	0	0	0	0	0	0
		0		0	0	0	0
WTSK	8	0.008	0	0.003	0.016	0.004	0
		0.006		0.006	0.015	0.008	0

Appendix F3. Mini-fyke net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total	Overall	CHXO		ISB		OSB	SCCL	SCCS	SCN	TRMS
	Catch	CPUE	BARS	CHNB	BARS	CHNB	BARS	BARS	BARS	BARS	BARS
BKCP	1	0.006	0	0	0	0	0	0	0	0.056	0
		0.011	0		0		0	0	0	0.111	0
BLGL	3	0.017	0.044	0	0.016	0	0	0	0	0	0
		0.019	0.062		0.032		0	0	0	0	0
BMBF	1	0.006	0	0	0	0	0	0	0	0	0.5
		0.011	0		0		0	0	0	0	1
BRBT	8	0.044	0.022	0	0.079	0	0	0.111	0.032	0	0
		0.031	0.044		0.069		0	0.222	0.065	0	0
BUSK	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**		**0**		**0**	**0**	**0**	**0**	**0**
CARP	94	0.519	0.111	0	0.079	0	0.091	0	0.516	0.222	31.5
		0.611	0.182		0.082		0.182	0	0.481	0.258	45
CNCF	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
CSCO	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
ERSN	2436	13.459	8.756	12	17.698	0	0.909	0.556	1.387	47.611	0
		12.527	8.152		23.873		1.818	0.676	1.46	92.651	0
FHCB	186	1.028	1.756	0	1.365	0	0.545	0.333	0.323	0.111	0
		0.399	0.819		0.932		0.625	0.333	0.339	0.222	0
FHMW	104	0.575	0.622	0	0.175	0	1.182	0	0.645	1.778	0
		0.269	0.481		0.124		0.887	0	0.42	2.148	0
FWDM	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
GDEY	2	0.011	0	0	0	0	0	0	0	0.111	0
		0.016	0		0		0	0	0	0.152	0
GNSF	1	0.006	0.022	0	0	0	0	0	0	0	0

Species	Total	Overall	CHXO		ISB		OSB	SCCL	SCCS	SCN	TRMS
	Catch	CPUE	BARS	CHNB	BARS	CHNB	BARS	BARS	BARS	BARS	BARS
		0.011	0.044		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
LNDC	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
LNSK	13	0.072	0	0	0.063	0	0.091	0.222	0.032	0.278	0
		0.044	0		0.077		0.182	0.294	0.065	0.271	0
NFSH	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
NTPK	9	0.05	0.044	0	0.063	0	0	0	0.065	0	0.5
		0.032	0.062		0.062		0	0	0.09	0	1
PDFH	0	0	0	0	0	0	0	0	0	0	0
		0	0		0		0	0	0	0	0
PDSG	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**		**0**		**0**	**0**	**0**	**0**	**0**
RVCS	1033	5.707	2.133	2	3.603	0	0.909	1.889	20.645	2.111	1.5
		4.69	1.36		3.899		0.736	3.063	25.779	1.664	3
SFCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**		**0**		**0**	**0**	**0**	**0**	**0**
SGCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**		**0**		**0**	**0**	**0**	**0**	**0**
SGER	**32**	**0.177**	**0.178**	**0**	**0.206**	**0**	**0**	**0.222**	**0.097**	**0.278**	**0.5**
		0.079	**0.194**		**0.144**		**0**	**0.294**	**0.108**	**0.271**	**1**
SHRH	5	0.028	0	0	0.016	0	0	0	0	0	2
		0.045	0		0.032		0	0	0	0	4
SMBF	6	0.033	0.022	0	0	0	0	0	0	0.278	0
		0.056	0.044		0		0	0	0	0.556	0
SNGR	1	0.006	0	0	0.016	0	0	0	0	0	0

Species	Total	Overall	CHXO		ISB		OSB	SCCL	SCCS	SCN	TRMS
	Catch	CPUE	BARS	CHNB	BARS	CHNB	BARS	BARS	BARS	BARS	BARS
		0.011	0		0.032		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
SNSN	**220**	**1.713**	**4.311**	**2**	**0.333**	**1**	**3.091**	**0**	**0.29**	**2.389**	**3**
		1.334	**4.981**		**0.286**		**4.12**	**0**	**0.581**	**3.688**	**2**
STCT	24	0.133	0.267	0	0.143	0	0	0.222	0.032	0	0
		0.103	0.327		0.168		0	0.444	0.065	0	0
STSN	12	0.066	0.022	0	0.111	0	0	0	0.032	0.167	0
		0.037	0.044		0.08		0	0	0.065	0.181	0
UCA	14	0.077	0.133	0	0.016	0	0	0	0.226	0	0
		0.084	0.197		0.032		0	0	0.39	0	0
UCY	1	0.006	0	0	0.016	0	0	0	0	0	0
		0.011	0		0.032		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
WSMW	**27**	**0.149**	**0.156**	**0**	**0.27**	**0**	**0**	**0**	**0.097**	**0**	**0**
		0.116	**0.142**		**0.301**		**0**	**0**	**0.194**	**0**	**0**
WTCP	34	0.188	0.311	0	0.048	0	0	0.111	0.065	0.778	0
		0.173	0.578		0.071		0	0.222	0.129	0.879	0
WTSK	131	0.724	1.111	0	0.302	0	0.636	1	0.484	1.556	1.5
		0.239	0.64		0.14		1.088	1.106	0.333	1.286	1

Appendix F4. Trotlines: overall season and segment summary. Lists CPUE (fish/20 hooks) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
BKCP	0	0	0	0	0	0
		0	0	0	0	0
BLGL	0	0	0	0	0	0
		0	0	0	0	0
BMBF	0	0	0	0	0	0
		0	0	0	0	0
BRBT	1	0.006	0.016	0	0	0
		0.011	0.032	0	0	0
BUSK	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**
CARP	12	0.068	0.048	0.028	0.121	0.333
		0.044	0.055	0.039	0.145	0.471
CNCF	115	0.653	0.726	0.361	0.697	2.333
		0.173	0.269	0.16	0.295	2.028
CSCO	0	0	0	0	0	0
		0	0	0	0	0
ERSN	0	0	0	0	0	0
		0	0	0	0	0
FHCB	48	0.273	0.226	0.389	0.121	0.222
		0.096	0.168	0.17	0.115	0.294
FHMW	0	0	0	0	0	0
		0	0	0	0	0
FWDM	1	0.006	0.016	0	0	0
		0.011	0.032	0	0	0
GDEY	45	0.256	0.306	0.278	0.091	0.333
		0.091	0.163	0.154	0.102	0.471
GNSF	0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
		0	0	0	0	0
LKWF	0	0	0	0	0	0
		0	0	0	0	0
LNDC	0	0	0	0	0	0
		0	0	0	0	0
LNSK	0	0	0	0	0	0
		0	0	0	0	0
NFSH	0	0	0	0	0	0
		0	0	0	0	0
NTPK	3	0.017	0.016	0	0.03	0.111
		0.02	0.032	0	0.061	0.222
PDFH	0	0	0	0	0	0
		0	0	0	0	0
PDSG	**103**	**0.585**	**0.742**	**0.486**	**0.424**	**0.889**
		0.139	**0.26**	**0.194**	**0.314**	**0.619**
RVCS	0	0	0	0	0	0
		0	0	0	0	0
SFCB	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**
SGCB	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**
SGER	**7**	**0.04**	**0.032**	**0.028**	**0.091**	**0**
		0.03	**0.045**	**0.039**	**0.102**	**0**
SHRH	13	0.074	0.032	0.083	0.152	0
		0.048	0.045	0.086	0.154	0
SMBF	0	0	0	0	0	0
		0	0	0	0	0
SNGR	0	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
		0	0	0	0	0
SNSG	**151**	**0.858**	**1.032**	**0.861**	**0.545**	**0.778**
		0.218	**0.448**	**0.315**	**0.315**	**1.042**
SNSN	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**
STCT	58	0.33	0.468	0.264	0.273	0.111
		0.127	0.271	0.158	0.279	0.222
STSN	0	0	0	0	0	0
		0	0	0	0	0
UCA	0	0	0	0	0	0
		0	0	0	0	0
UCY	0	0	0	0	0	0
		0	0	0	0	0
WLYE	4	0.023	0.048	0.014	0	0
		0.023	0.055	0.028	0	0
WSMW	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**
WTCP	0	0	0	0	0	0
		0	0	0	0	0
WTSK	1	0.006	0.016	0	0	0
		0.011	0.032	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 the sturgeon season and the fish community season during 2012 for Segment 3 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**		**Fish Community Season**			**Both Seasons**
	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
BKCP	0	0	0	0.006	0	0
BLGL	0	0	0	0.017	0	0
BMBF	0	0	0.005	0.006	0	0
BRBT	0	0.002	0.002	0.044	0.002	0.006
BUSK	**0.006**	**0.005**	**0.008**	**0**	**0**	**0**
CARP	0.054	0.019	0.002	0.519	0.008	0.068
CNCF	0.110	0.165	0.011	0	0.288	0.653
CSCO	0	0.002	0	0	0	0
ERSN	0	0.008	0	13.459	0.006	0
FHCB	0.081	0.155	0.133	1.028	0.187	0.273
FHMW	0	0	0	0.575	0	0
FWDM	0	0	0	0	0.010	0.006
GDEY	0.118	0	0.185	0.011	0.015	0.256
GNSF	0	0	0	0.006	0	0
LKWF	0	0	0.002	0	0	0
LNDC	0	0.002	0	0	0.002	0
LNSK	0.009	0.004	0.002	0.072	0.006	0
NTPK	0.013	0.002	0	0.050	0	0.017
PDFH	0.002	0	0	0	0	0
PDSG	**0.060**	**0.059**	**0.016**	**0**	**0.056**	**0.585**
RVCS	0.032	0.030	0.017	5.707	0.024	0
SFCB	**0**	**0.147**	**0**	**0**	**0.048**	**0**
SGCB	**0**	**0.236**	**0**	**0**	**0.186**	**0**
SGER	**0.393**	**0.088**	**0.048**	**0.177**	**0.032**	**0.040**
SHRH	0.058	0.017	0.023	0.028	0.032	0.074
SMBF	0.028	0	0.011	0.033	0	0
SNGR	0.003	0	0	0.006	0	0
SNSG	**0.219**	**0.068**	**0.177**	**0**	**0.074**	**0.858**
SNSN	**0**	**0**	**0**	**1.713**	**0**	**0**
STCT	0	0.042	0	0.133	0.008	0.330
STSN	0	0.002	0	0.066	0.005	0
UCA	0	0	0	0.077	0	0

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	1.0” Trammel Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
UCY	0	0	0	0.006	0	0
WLYE	0.016	0	0	0	0	0.023
WSMW	**0**	**0**	**0**	**0.149**	**0**	**0**
WTCP	0	0	0	0.188	0	0
WTSK	0.009	0.002	0.002	0.724	0.014	0.006

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 3 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2006 - 2012.

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012
1	1701.5	48.06744	105.53246						ST, FC	
2	1700	48.07314	105.52296							ST,FC
3	1698.5									
4	1697.5	48.0919	105.49388							ST,FC
5	1696	48.09072	105.45751					ST, FC		
6	1695	48.08947	105.43861		ST, FC		ST, FC	ST, FC		
7	1693.5									
8	1692	48.09134	105.3734		ST, FC	ST, FC				
9	1690.5	48.0929	105.33356							ST,FC
10	1689	48.08243	105.324		ST, FC					
11	1687.5	48.0797	105.30329						ST, FC	ST,FC
12	1685.5	48.08757	105.257			ST, FC		ST, FC		
13	1684.5	48.0912	105.24746		ST, FC		ST, FC	ST, FC		
14	1683	48.08517	105.22466	ST, FC			ST, FC		ST, FC	
15	1681.5	48.06341	105.21178				ST, FC			ST,FC
16	1680	48.06636	105.19965	ST, FC						
17	1678.5	48.09023	105.18363		ST, FC					
18	1677	48.10268	105.17349		ST, FC					
19	1675.5	48.09255	105.17268			ST, FC				
20	1674	48.07865	105.16694			ST, FC			ST, FC	
21	1672.5	48.07616	105.12389					ST, FC		

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012
22	1671	48.07116	105.10641							ST,FC
23	1670									
24	1668.5	48.06103	105.09673							ST,FC
25	1667	48.07748	105.06696				ST, FC			
26	1666	48.06939	105.04797			ST, FC	ST, FC	ST, FC	ST, FC	
27	1665	48.05456	105.05145							ST,FC
28	1664	48.05832	105.04102				ST, FC			
29	1663									
30	1661.5	48.08338	105.00873					ST, FC	ST, FC	
31	1660	48.07323	104.99768				ST, FC		ST, FC	
32	1659	48.06867	104.99927	ST, FC						
33	1657	48.09531	104.98125	ST, FC						ST,FC
34	1656	48.09737	104.98157				ST, FC			
35	1655	48.10115	104.96768			ST, FC	ST, FC			ST,FC
36	1654	48.09348	104.94374							ST,FC
37	1653	48.09515	104.93953		ST, FC	ST, FC		ST, FC		
38	1651	48.12806	104.92393		ST, FC	ST, FC			ST, FC	
39	1650	48.13711	104.92179						ST, FC	
40	1648.5	48.14876	104.89821		ST, FC		ST, FC			
41	1647	48.14244	104.8712						ST, FC	ST,FC
42	1646	48.12876	104.85751				ST, FC	ST, FC		ST,FC

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012
43	1644.5	48.1204	104.83851				ST, FC		ST, FC	ST,FC
44	1643	48.12765	104.79225				ST, FC			
45	1641.5	48.12736	104.76171					ST, FC		
46	1640.5	48.1135	104.74879				ST, FC			
47	1639.5	48.11303	104.73495		ST, FC	ST, FC				
48	1638.5	48.11906	104.71559		ST, FC	ST, FC				
49	1637.5	48.12048	104.70437					ST, FC		
50	1636.5	48.10395	104.68213	ST, FC				ST, FC	ST, FC	
51	1635.5	48.10472	104.68209						ST, FC	
52	1634.5	48.10719	104.65868		ST, FC					ST,FC
53	1633.5	48.11139	104.6321			ST, FC	ST, FC	ST, FC	ST, FC	
54	1632.5	48.11786	104.62228					ST, FC		
55	1631.5	48.13085	104.61791				ST, FC			
56	1630.5	48.13984	104.6045	ST, FC				ST, FC	ST, FC	
57	1629.5	48.13993	104.60433			ST, FC				
58	1628.5	48.12988	104.58845						ST, FC	ST,FC
59	1627	48.11385	104.59247						ST, FC	
60	1625.5	48.11823	104.56667		ST, FC		ST, FC	ST, FC		ST,FC
61	1624	48.12555	104.53561						ST, FC	
62	1623	48.11155	104.51026	ST, FC						
63	1622									
64	1620.5	48.12325	104.4721		ST, FC	ST, FC				

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012
65	1619.5	48.11113	104.45372						ST, FC	
66	1618.5	48.09912	104.44811				ST, FC			
67	1617.5	48.09658	104.4437		ST, FC	ST, FC		ST, FC		
68	1616.5	48.08134	104.41538	ST, FC						
69	1615	48.07642	104.3929		ST, FC					ST,FC
70	1613.5	48.07464	104.37304			ST, FC				
71	1612									
72	1611	48.04604	104.33904			ST, FC			ST, FC	
73	1610	48.04465	104.32111					ST, FC		
74	1608.5	48.04829	104.28288		ST, FC	ST, FC	ST, FC			
75	1606.5	48.035	104.25092	ST, FC		ST, FC				ST,FC
76	1604.5	48.03568	104.20708	ST, FC			ST, FC	ST, FC		
77	1603	48.0441	104.19778			ST, FC				
78	1598.5	48.04596	104.18368	ST, FC		ST, FC				
79	1597.5	48.03868	104.16394			ST, FC			ST, FC	
80	1596	48.04502	104.15459				ST, FC			
81	1595	48.05317	104.14133		ST, FC	ST, FC		ST, FC		
82	1594	48.0378	104.12411		ST, FC					ST,FC
83	1593	48.02956	104.10265		FC	ST, FC				
84	1592	48.02939	104.1001						ST, FC	
85	1591	48.02138	104.09813			ST, FC				
86	1590.5	48.02015	104.10017		ST, FC			ST, FC		
87	1589.5	48.0052	104.10172		ST, FC					ST,FC
88	1588.5									

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012
89	1587									
90	1585.5	47.98677	104.01939							ST,FC
91	1583.5									