

2013 Annual Report

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



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

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EXECUTIVE SUMMARY

The 2013 season was the eighth consecutive year that the pallid sturgeon population assessment program (Program) has been in place in Segment 3 of the Missouri River. During 2013 more pallid sturgeon *Scaphirhynchus albus* were sampled in Segment 3 than during any of the previous seven years. A total of 260 pallid sturgeon were sampled, comprised of 11 different year classes. The most abundant year class sampled was the 2009 class, followed by the 2008 and then 2010. These three year classes were also the most abundant during the 2012 sampling year. During 2013 the largest hatchery reared pallid sturgeon sampled in either Segment 2 or 3 was captured. This individual fish measured 995 mm in length and weighed 3,350 g and was captured at river mile 1,583.5 on April 27th. In addition to the large hatchery reared pallid sturgeon, one wild adult pallid sturgeon was captured within Segment 3 during 2013. This fish measured 1,357 mm in length and weighed 14,500 and was collected on October 3rd at river mile 1,603 in a trammel net.

Sampling within Segment 3 during 2013 occurred from April 23rd to June 21st for the sturgeon season, when the otter trawl, trammel nets and trotlines were used. Sampling during the fish community season occurred from July 11th through October 24th, where the same gears were used and mini fyke nets were also added. Twenty-two random river bends were sampled using standard gears during both the sturgeon and fish community season Missouri River discharge ranged from just over 6,000 to 19,100 cfs during the sampling season.

While the CPUE of pallid sturgeon using standard gears has not appreciably increased through the past eight years, pallid sturgeon stocked into Segment 3 are surviving and growing. This is indicated by the size distribution of pallids captured using standard gears. Over the past eight years the size distribution has shifted to a higher proportion of larger fish. For instance, during 2006 the average size of hatchery reared pallid sturgeon captured was 249.2 mm and by 2013 the average size has increased to 405.9 mm.

The relative condition of pallid sturgeon sampled within Segment 3 has not noticeably changed over the last eight sampling seasons. However, the smaller sized pallid sturgeon have on average higher relative condition than the larger size classes. In contrast to relative condition, the average age at length of hatchery reared pallid sturgeon has decreased over the last three years.

During 2013 a total of 635 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 2013 increased from 2012. However, the shovelnose sturgeon increase in CPUE of all three standard gears were relatively moderate. Total shovelnose sturgeon CPUE in 2013 was similar to 2012 and 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. Young shovelnose sturgeon have been collected in both the otter in most years, but a few years stand out as having relatively higher abundance. During 2007 and 2010 and to a lesser extent 2012 relatively higher numbers of age-0 shovelnose sturgeon were sampled. The standard gears were then subsequently able to follow those year classes in subsequent years of sampling. In all three of those years where the abundance of age-0 shovelnose sturgeon were higher, flows in the Missouri River and its main tributary the Milk River were higher than normal. Interestingly, during highest flow year on record, 2011, very few age-0 shovelnose sturgeon were sampled. This could have been due to low capture efficiencies with the extremely high flows, or that flows were too high for production or recruitment.

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 over the past eight years. The relative abundance of most of these species have either decreased in recent years or have remained at very low detection levels. The relative abundance of sturgeon chubs, sicklefin chubs and sand shiners were all at an eight year low during the 2013 sampling season. Western silvery minnows were the only native target cyprinid that increased in relative abundance in 2013. The decrease in many of the native cyprinids over the past few years may be in at least partly explained by the increase in predators such as sauger *Sander canadense*.

The sauger population appears to have increased since the inception of the program. Trammel net CPUE for sauger in 2013 was the highest of the eight sampling seasons. 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 *sander vitreus*, northern pike *Esox lucius*, smallmouth bass *Micropterus dolomieu*, channel catfish *Ictalurus punctatus* and lake trout *Salvelinus namaycush* were entrained through the spillway and were displaced in the Missouri River downstream of the dam.

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 eight 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.

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Introduction

The 2013 field season was the eighth consecutive year that standardized monitoring occurred in Segment 3 of the Missouri River. Data collected in the Missouri River during 2012 and 2013 were important due to the historic flows recorded during 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 the past two years give us insight into how the flooding of 2011 may have influenced fish populations within Segment 3. While the water years of 2012 and 2013 was more similar to years prior to 2011, flows were slightly elevated throughout the summer seasons due to releases at Fort Peck Dam. Direct comparisons between 2011 and any other year should be cautioned due to changing gear efficiencies with changing river flows. However, data collected in 2013 should be comparable to years prior to 2011.

Sampling in Segment 3 occurred from April 23rd to June 21st for the sturgeon season, where the otter trawl, trammel nets and trotlines were used. Sampling during the fish community season occurred from July 11th through October 24th, where the same gears were used and mini fyke nets were added. Missouri River discharge ranged from just over 6,000 to 19,100 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 platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, plains minnow *Hybognathus placitus*, western silvery minnow *H. argyritis*, and sand shiner *Notropis stramineus*. This suite of species was selected for various reasons. First, some species may have similar habitat requirements as pallid sturgeon and therefore by monitoring their populations we may gain further insight into pallid sturgeon habitat and how anthropomorphic and natural changes to the Missouri River affect native fish assemblages. Secondly, it is hypothesized that various chub species and other native fishes are an important component of pallid sturgeon diet, and thereby monitoring 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 downstream of 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). During 2011, historic flows out of the Fort Peck Dam Project created numerous new sand bars throughout the length of the Missouri River, something that had not occurred since the late 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 2013 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 a different gear at an adjacent bend within the same

sampling period in 2013. 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 assist in populating 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 nephelometric turbidity units (NTU) using a LaMotte 2020 turbidity meter. Turbidity was taken at the midpoint of all samples, except mini fyke sets, where it was taken at the convergence of the rectangular frame and float line.

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker and Drobish (2011). Two fin pectoral fin clips (~ 2 cm²) 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.

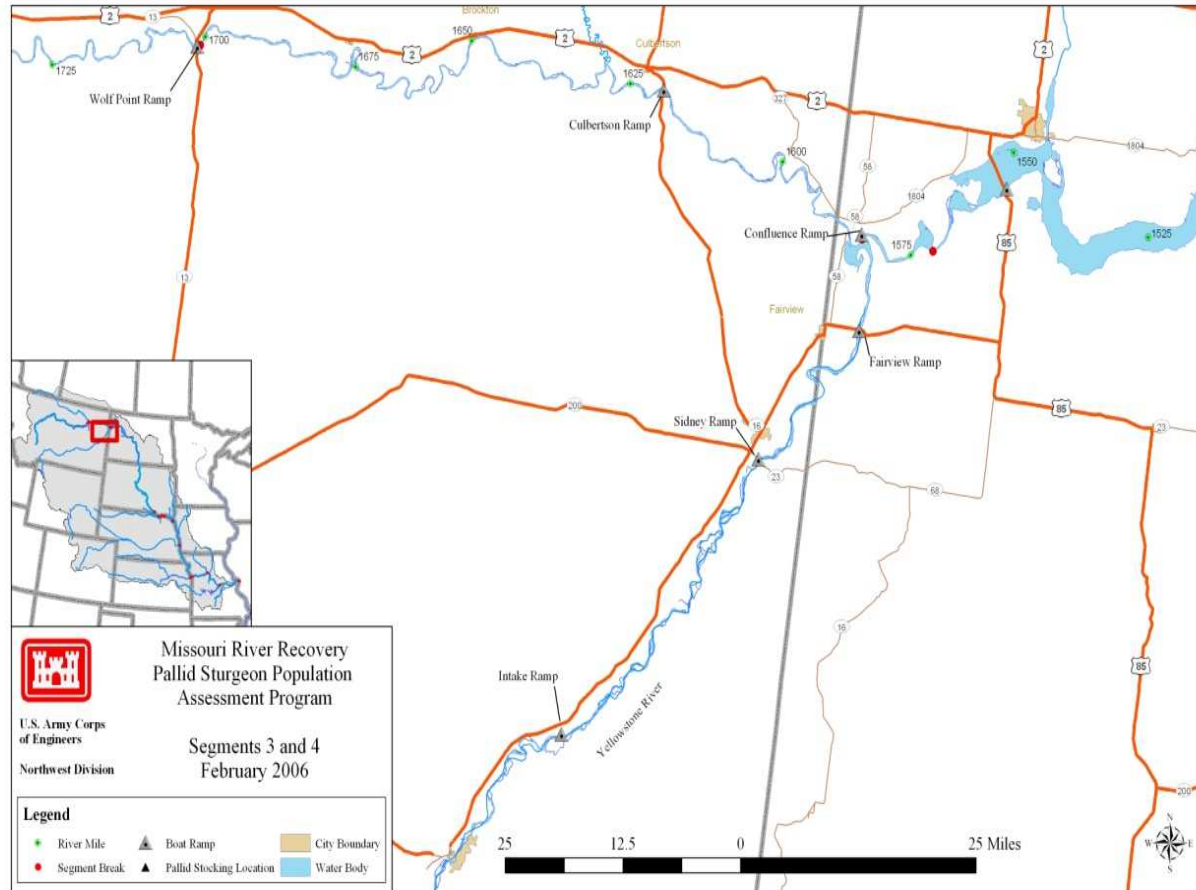


Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 22 individual river bends were sampled during the 2013 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 standard deployments per bend (Table 1).

Pallid Sturgeon

A total of 260 pallid sturgeon were sampled in Segment 3 during 2013 in random and non random sampling (Figure 2), which was the highest number of captures during a single field season to date. One wild adult pallid sturgeon was captured within Segment 3 during 2013. This fish measured 1,357 mm in length and weighed 14,500 and was collected on October 3rd at river mile 1,603 in a trammel net. All other pallid sturgeon captured within Segment 3 during 2013 were of hatchery origin.

The longitudinal distribution of pallid sturgeon captures during 2013 was similar to those of years prior to 2011 (Figure2). The majority of pallid sturgeon captures occurred downstream of river mile 1,640, again similar to years prior to 2011. The distribution of pallid catches in 2013 was different than what was observed in 2012, where more pallids were captured upstream of river mile 1,640. 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. From the 2013 data, it appears that pallids are beginning to use similar habitats that were used prior to the historical flows of 2011.

Similar to 2012, more pallid sturgeon were sampled in channel crossover habitats during 2013 (n = 151), than inside bends (n = 96), outside bends (n = 8), and secondary connected channels (n = 4) (Table 2). Pallid sturgeon were captured in depths ranging from 1.0 m to 4.4 m and bottom velocities from near zero flow to 0.96 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 2013 (Table 3). The most common year class captured during 2013 was the 2009 year class with 78 sampled. The largest pallid sturgeon sample was from the 1997 year class, which measured 995 mm in length and weighed 3,350 g. This individual was the largest hatchery reared pallid sturgeon caught by the Montana Population Assessment Crew to date. 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. In addition, relative condition factor also seems to be declining as these fish get larger, although few individuals of the larger size classes have been captured (Table 3 and Figure 4). Although the larger fish have slightly lower condition factors, they have remained relatively constant throughout the sampling years. This may in part be due to fish being stocked from the hatchery having unnaturally high condition and as they grow in the river condition decreases.

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 2013 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 2013 only one substock sized fish was captured during the sturgeon season. 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 appreciably lower than during 2012, which was the highest recorded in the eight years of sampling at 0.06 fish/100 m. During 2013 trammel net CPUE during the sturgeon season fell to 0.01 fish/ 100 m (Figure 6). However, trammel net CPUE increased during the fish community season to 0.07 fish/100m, which was the highest observed in the eight years of sampling that season. Overall trammel net CPUE for both seasons combined was estimated at 0.04 fish/100m, which was very similar to 2012, 2008 and 2006 sampling years.

Otter trawl CPUE for pallid sturgeon decreased from 2012 to 2013 during both seasons (Figure 7). Otter trawl CPUE was estimated at 0.023 fish/100 m during the sturgeon season and 0.028 fish/100 m during the fish community season. The overall CPUE for otter trawls was the

second lowest in eight sampling seasons, only lower than 2011, which was likely influenced by high flows.

Trotline have only been used as a standard gear for the Program since 2010. While CPUE for the sturgeon season was at a four-year high (CPUE = 1.24 fish/20 hook night), it was lower during the fish community season (CPUE = 0.35 fish/ 20 hook night) (Figure 8). Combined CPUE for both seasons was higher in 2013 (CPUE = 0.80 fish/20 hook night) when compared to 2012 (CPUE = 0.58 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 2013.

Gear	Number of Bends	Mean deployments								
			CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS	CONF
Sturgeon Season										
1.0” Trammel Net	22	8	67	67	42	0	0	0	0	0
Otter Trawl	22	8	63	67	40	6	0	0	0	0
Fish Community Season										
1.0” Trammel Net	22	8	70	64	39	3	0	0	0	0
Mini-Fyke Net	22	7.95	66	77	6	3	19	4	2	0
Otter Trawl	22	8	67	64	43	2	0	0	0	0
Both Seasons										
Trot Lines	22	8	77	77	22	2	0	0	0	4

^a Habitat abbreviations and definitions presented in Appendix B.

Segment 3 - Pallid Sturgeon Captures by River Mile

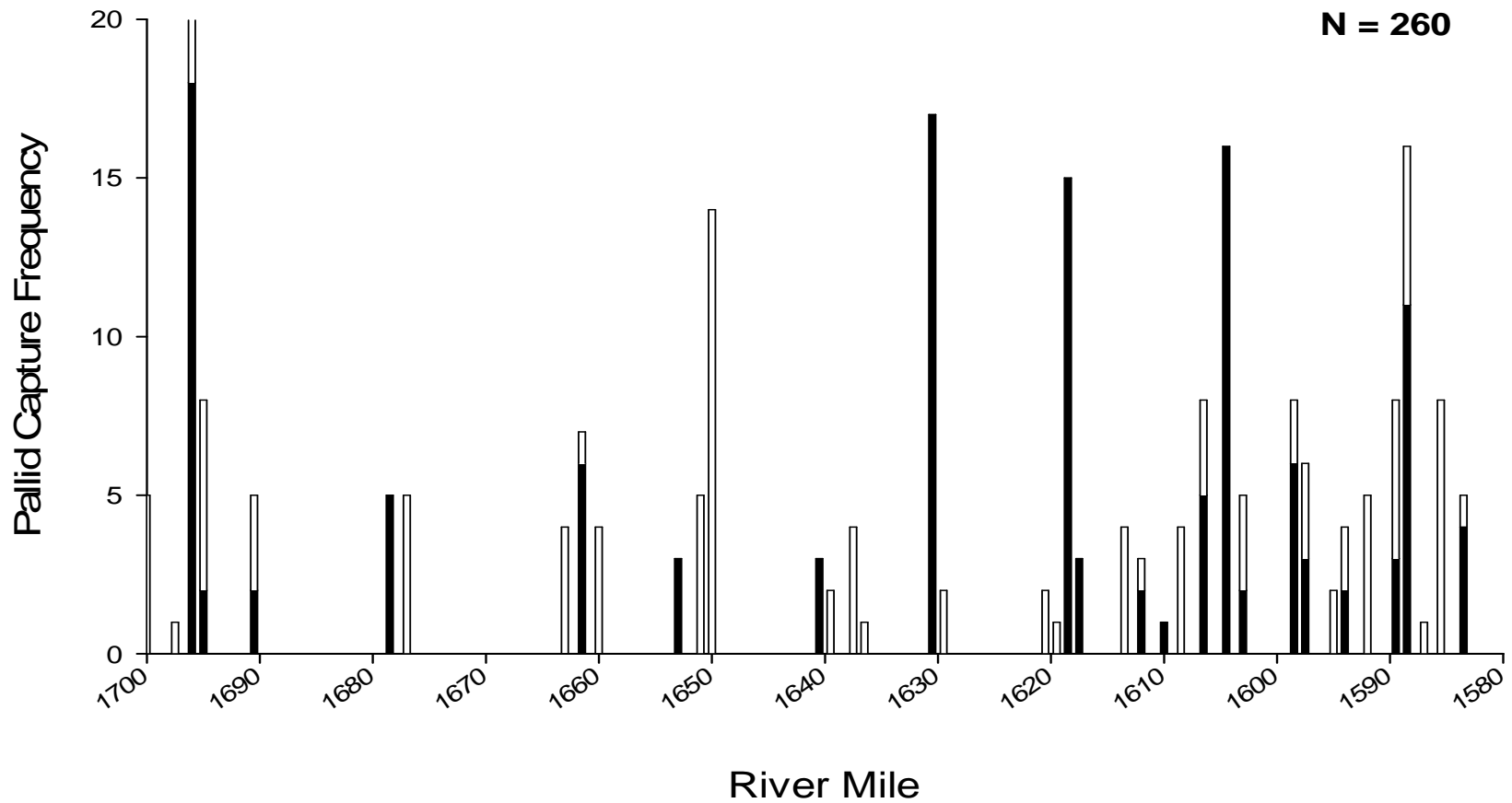


Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2013. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2013. 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	0.4 (0.1-0.6)		0.06 (0.00-0.19)	0.83 (0.83-0.83)	14.8 (8.4-21.4)		60 (18-105)		
	CHNB	1.9 (0.8-6.0)	1.8 (1.0-4.4)	0.69 (0.23-1.13)	0.62 (0.23-0.88)	14.9 (1.9-22.0)	14.3 (5.5-21.3)	310 (15-3392)	191 (15-1668)	151
ISB	CHNB	1.8 (0.7-5.0)	1.8 (1.0-4.4)	0.63 (0.00-0.94)	0.51 (0.00-0.84)	14.9 (1.8-21.5)	14.3 (5.2-21.4)	380 (15-2964)	283 (18-2140)	96
	BARS	0.4 (0.2-0.6)		0.04 (0.00-0.17)		15.8 (8.5-21.5)		56 (30-80)		.
OSB	CHNB	2.6 (1.0-5.5)	2.4 (1.4-4.4)	0.75 (0.00-0.96)	0.76 (0.63-0.88)	15.4 (1.5-21.4)	15.8 (5.2-21.0)	428 (15-2860)	212 (53-680)	8
	BARS	0.4 (0.3-0.6)		0.14 (0.12-0.15)		17.0 (11.9-20.0)		58 (47-69)		.
SCCL	CHNB	1.7 (1.0-4.3)	2.4 (1.4-4.3)	0.49 (0.21-0.76)	0.49 (0.21-0.76)	15.8 (8.7-19.8)	12.8 (8.7-18.7)	543 (18-2088)	715 (18-2088)	4
	BARS	0.5 (0.3-0.6)		. (-.)		18.4 (18.4-18.5)		33 (33-33)		.
SCCS	BARS	0.5 (0.2-0.6)		0.03 (0.00-0.05)		17.2 (8.6-22.8)		61 (30-86)		.
SCN	BARS	0.6 (0.5-0.6)		0.00 (0.00-0.00)		19.5 (19.0-20.0)		63 (50-75)		.
CONF	CHNB	1.6 (1.2-2.0)		. (-.)		14.3 (11.017.5)		. (-.)		.

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 2013 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	.	.	.	995	3350.0	0.810	.	.
.
2001	4	231	.	.	720	1310.8	0.882	0.098	.
.	.	.	.	.	96	535.9	0.016	.	.
2002	4	.	.	.	804	2058.0	0.953	.	.
.	.	.	.	.	72	975.0	0.140	.	.
2004	4	608	900.0	1.103	599	718.0	0.885	0.129	0.211
.	.	.	.	.	110	342.3	0.103	.	.
2005	15	268	.	.	462	311.0	0.931	0.077	.
.	.	9	.	.	19	43.0	0.062	0.002	.
2006	26	231	44.8	1.262	436	252.9	0.927	0.088	0.092
.	.	24	18.2	0.091	12	19.0	0.045	0.015	0.019
2007	18	219	33.3	1.201	402	211.9	1.003	0.102	0.100
.	.	17	5.2	0.214	17	27.2	0.065	0.017	0.029
2008	45	292	103.5	1.256	394	189.7	0.963	0.079	0.081
.	.	94	78.4	0.182	9	11.6	0.041	0.010	0.027
2009	92	261	64.9	1.152	374	164.8	0.985	0.111	0.097
.	.	17	13.3	0.041	7	9.9	0.022	0.008	0.010
2010	43	310	111.3	1.175	358	138.6	1.170	0.098	0.071
.	.	18	17.8	0.056	15	12.3	0.484	0.016	0.015
2012	6	336	142.5	1.228	367	163.8	1.096	0.278	0.279
.	.	10	10.3	0.080	20	16.8	0.273	0.317	0.234

Segment 3 - Pallid Sturgeon

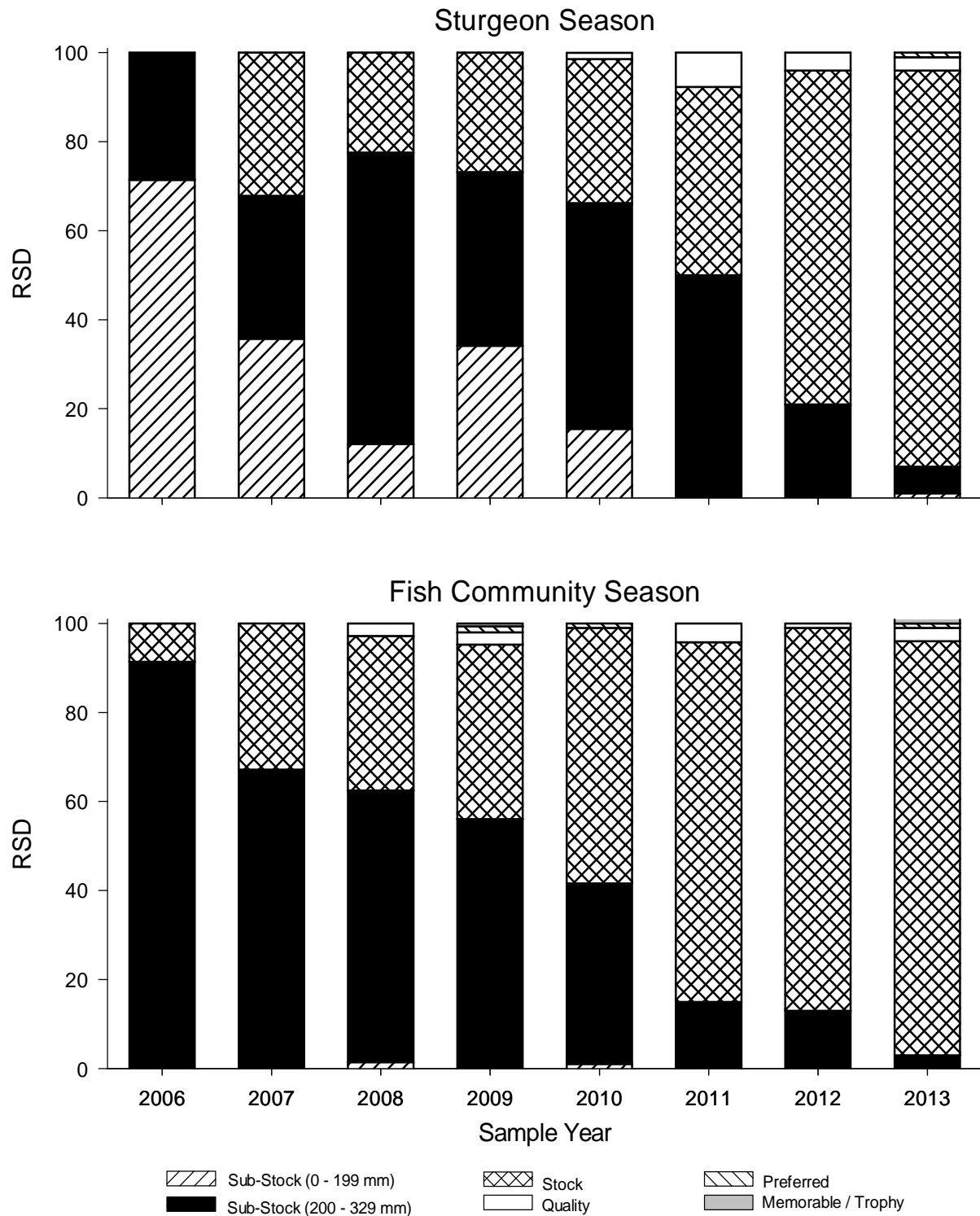


Figure 3. Proportion of total catch by length group for all pallid sturgeon captured with all gear by length category from 2006-2013 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

Segment 3 - Pallid Sturgeon

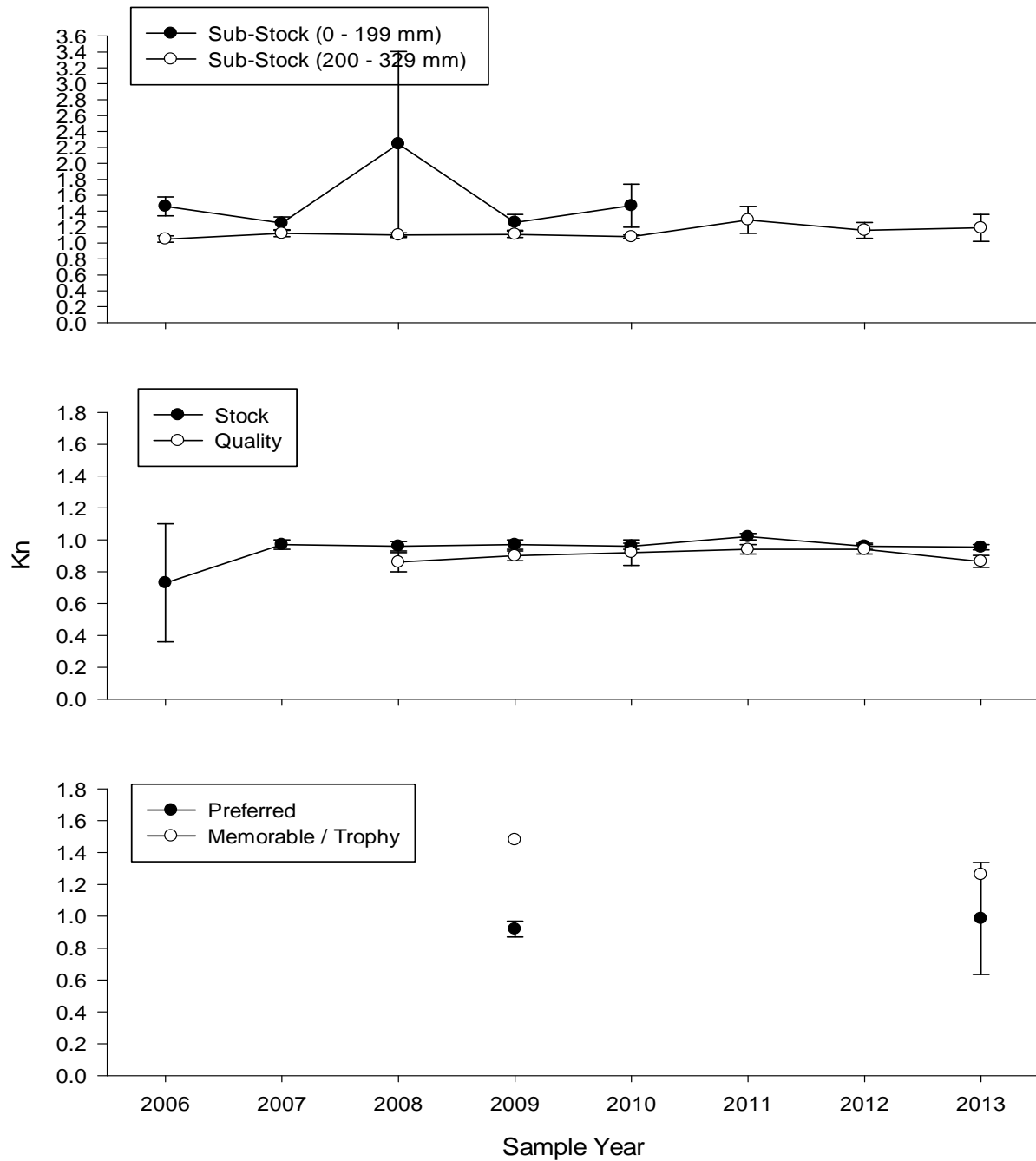


Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2013 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

Segment 3 - Pallid Sturgeon

1.0" Trammel Nets

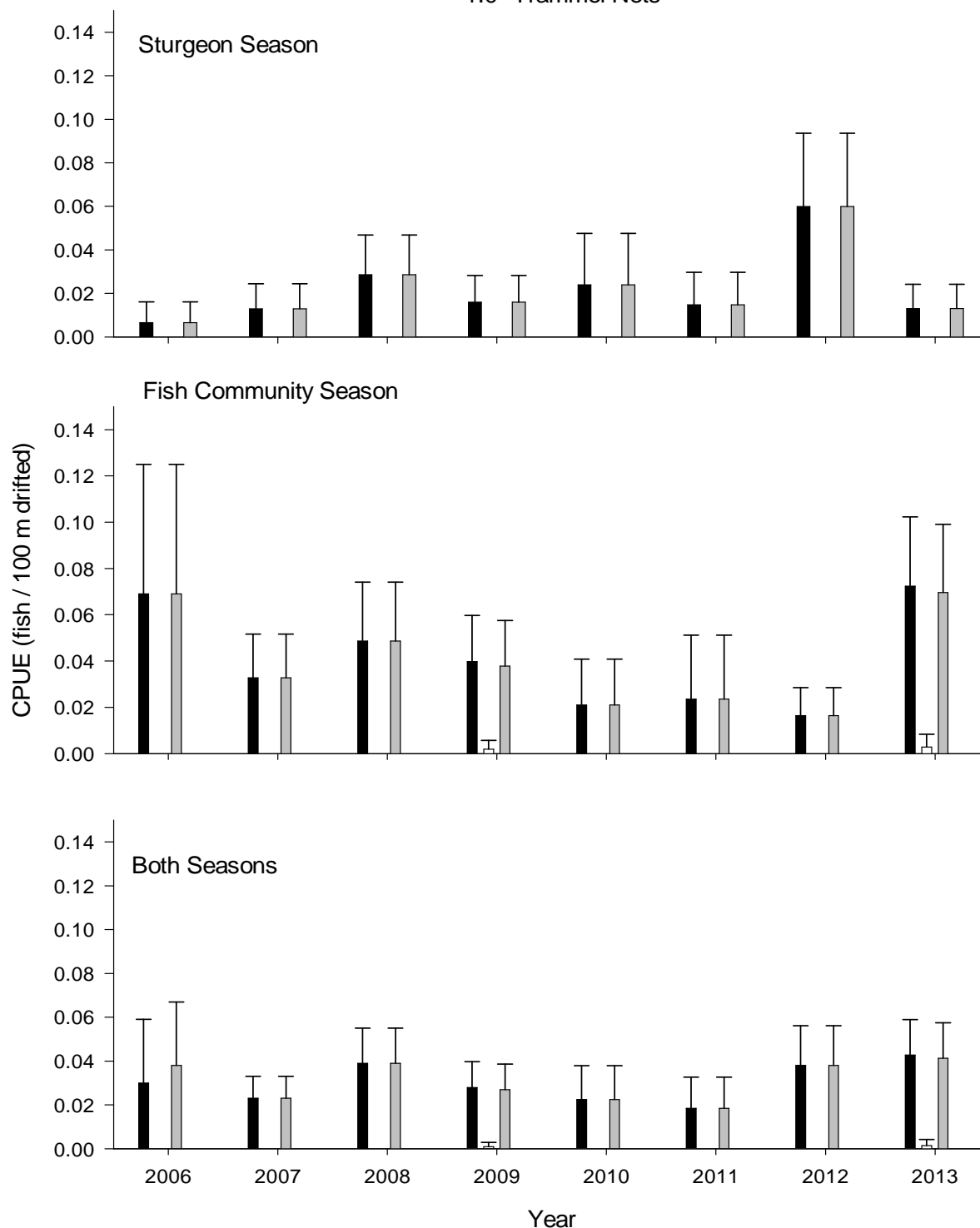


Figure 6. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2013. Pallid sturgeon of unknown origin are awaiting genetic verification.

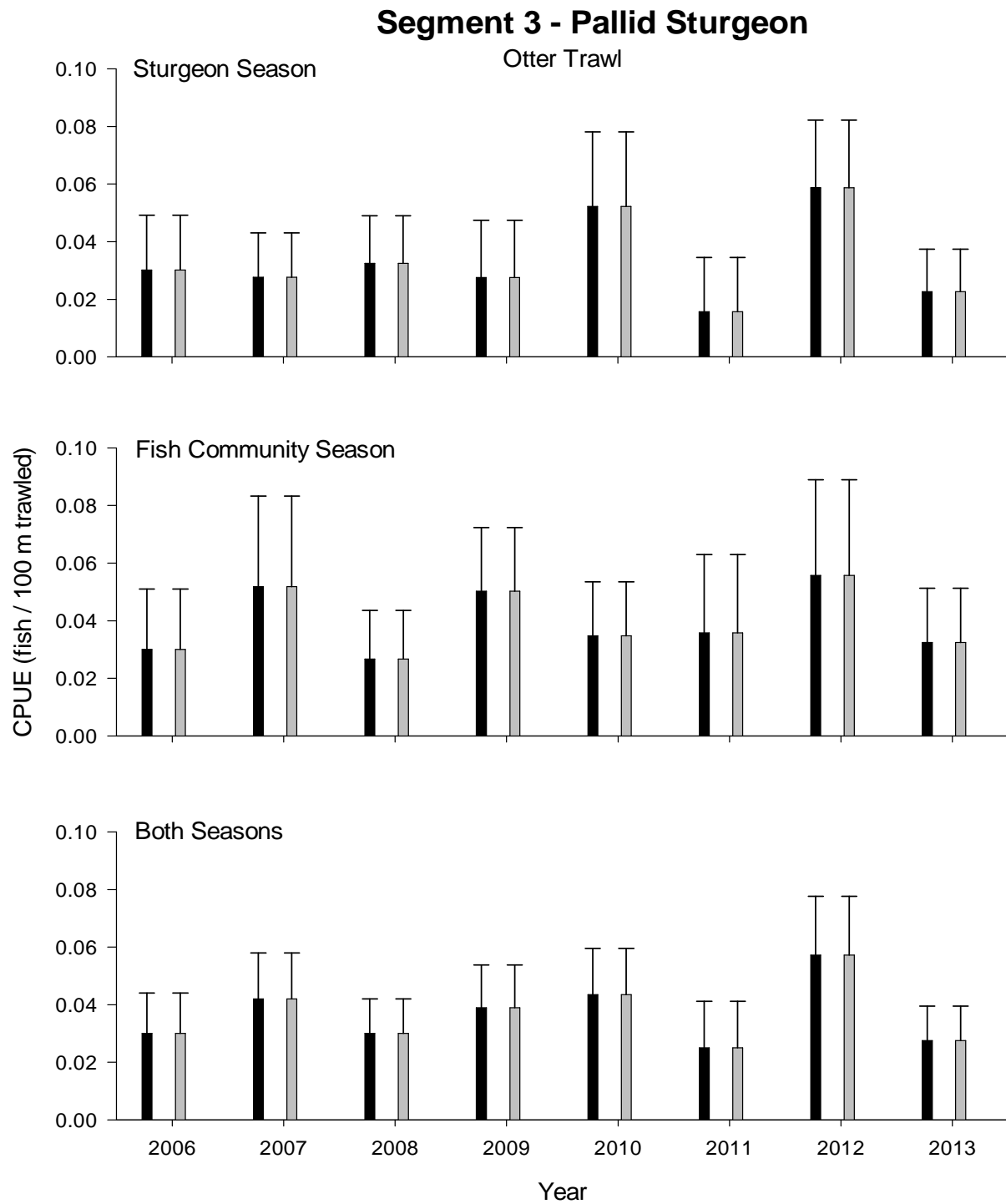


Figure 7. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2013. Pallid sturgeon of unknown origin are awaiting genetic verification.

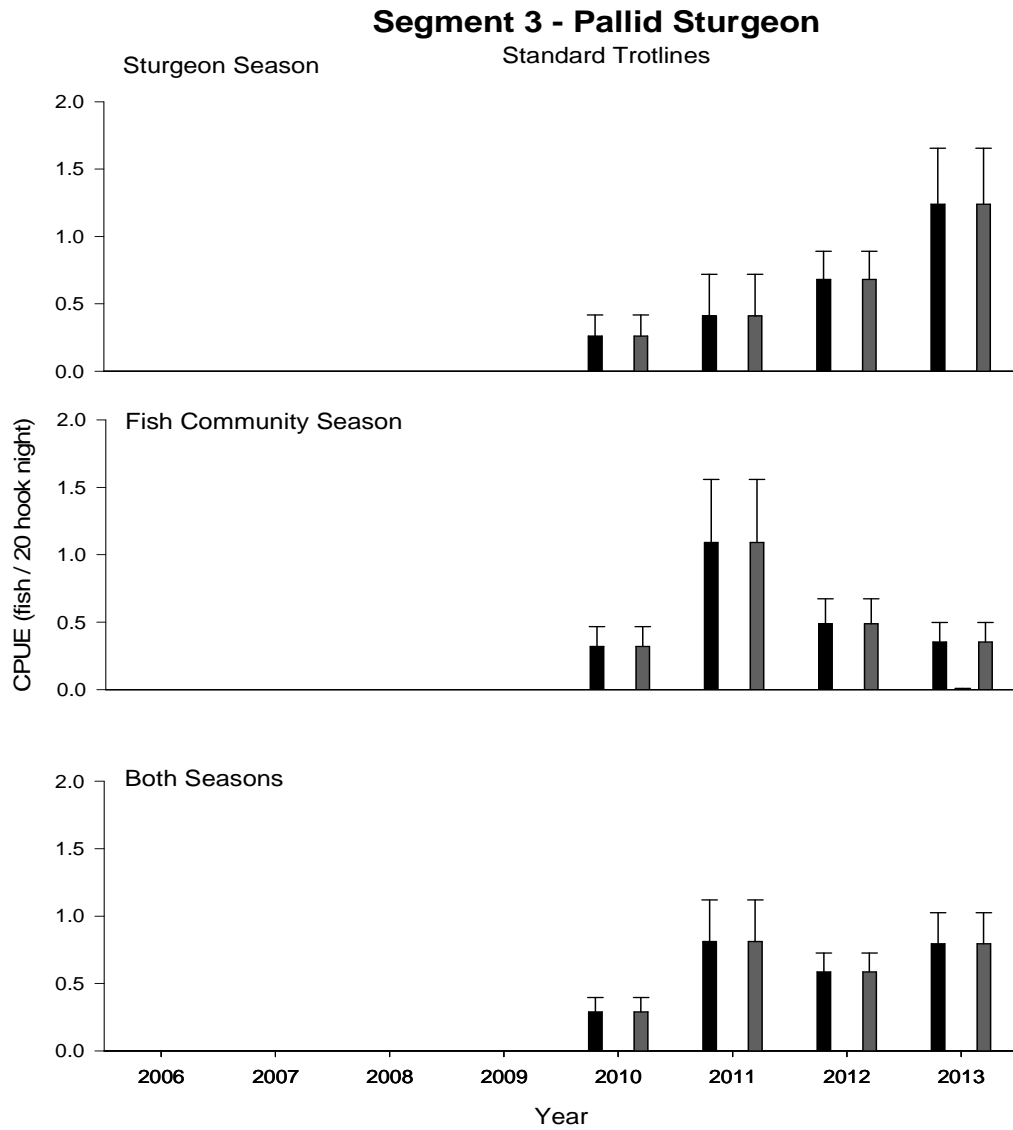


Figure 8. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 3 of the Missouri River from 2010-2013. Pallid sturgeon of unknown origin are awaiting genetic 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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		38	44	3	2	11	2	0
Otter Trawl	0	0	0	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	1	0	100	0	0	0	0	0
		44	40	13	1	0	0	2

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 2013. 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
Sturgeon Season							
1.0" Trammel Net	0	0	0	0	0	0	0
		40	38	22	0	0	0
Otter Trawl	3	33	33	0	33	0	0
		36	38	23	3	0	0
Fish Community Season							
1.0" Trammel Net	1	100	0	0	0	0	0
		40	35	23	2	0	0
Mini-Fyke Net	0	0	0	0	0	0	0
		38	44	3	2	11	2
Otter Trawl	0	0	0	0	0	0	0
		38	36	25	1	0	0
Both Seasons							
Trot Lines	2	50	50	0	0	0	0
		44	40	13	1	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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	7	43	57	0	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	9	44	56	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	26	77	19	0	4	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	15	38	44	3	2	11	2	0
		73	27	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	130	58	38	2	1	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	0	0	0	50	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	2	50	0	50	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		38	44	3	2	11	2	0
Otter Trawl	0	0	0	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	7	71	29	0	0	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	7	43	57	0	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	12	42	50	0	8	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	29	76	17	3	3	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	15	38	44	3	2	11	2	1
		73	27	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	140	59	39	2	1	0	0	0
		44	40	13	1	0	0	2

Segment 3 - Pallid Sturgeon

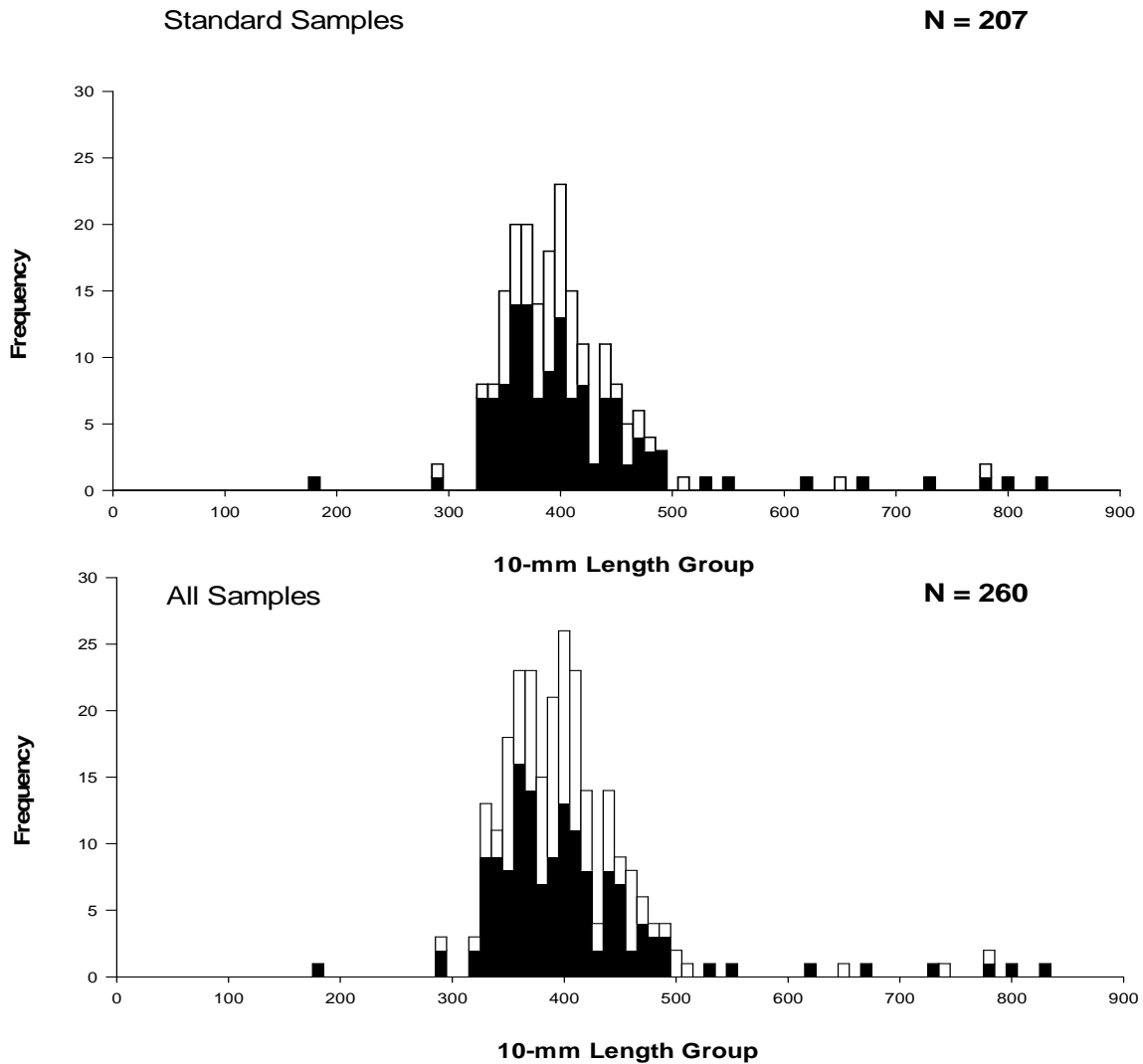


Figure 9. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013. Pallid sturgeon of unknown origin are awaiting genetic verification.

Segment 3 - Annual Pallid Sturgeon Capture History

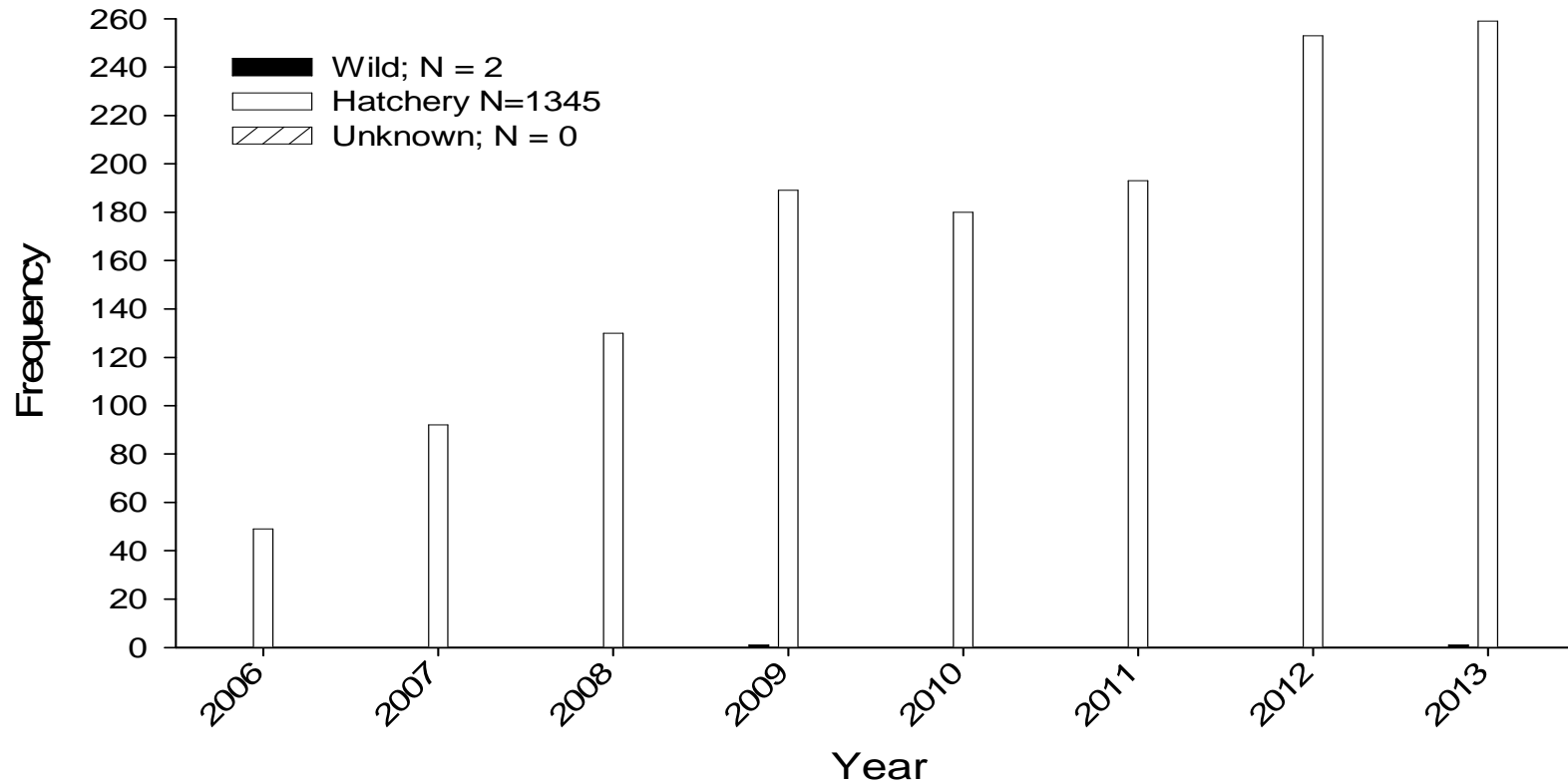


Figure 10. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2013. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by 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 2013 or during the previous seven years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

A total of 635 shovelnose sturgeon were captured within Segment 3 during 2013, 272 and 363 during the sturgeon and fish community seasons, respectively. Shovelnose sturgeon averaged 566.3.4 mm in length and 818.8.7 g in weight.

Combined trammel net CPUE was at a eight year high in 2013, with an estimate of 0.21 fish/100m for quality and above sized fish (Figure 11). In addition, CPUE for quality and above sized shovelnose sturgeon was at an eight year high during the fish community season at 0.34 fish/100m.

Similarly to trammel nets, combined otter trawl CPUE was at an eight year high (0.06 fish/100 m) for quality and larger sized shovelnose in 2013. No substock sized fish were captured in 2013, which was the first year that this size class was absent from the catch.

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 four years of trotline data exists in the catches of fish smaller than quality sized fish (Figure 13). A few substock sized shovelnose sturgeon were captured in 2013 using trotlines.

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 shovelnose recruitment. In 2012 a large number of shovelnose sturgeon between 250 and 300 mm in length were captured. Those fish were likely age 2 fish during 2012. While few fish of this size were sampled in 2013, that cohort is still present in the catch as age-3 fish.

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 eight 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 eight years of sampling (Figure 16). However, after the good water years of 2010 and 2011 stock, quality and preferred sized fish showed slight increases in relative condition. The average relative condition of those fish decreased during 2013. 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 after the water years of 2010 and 2011.

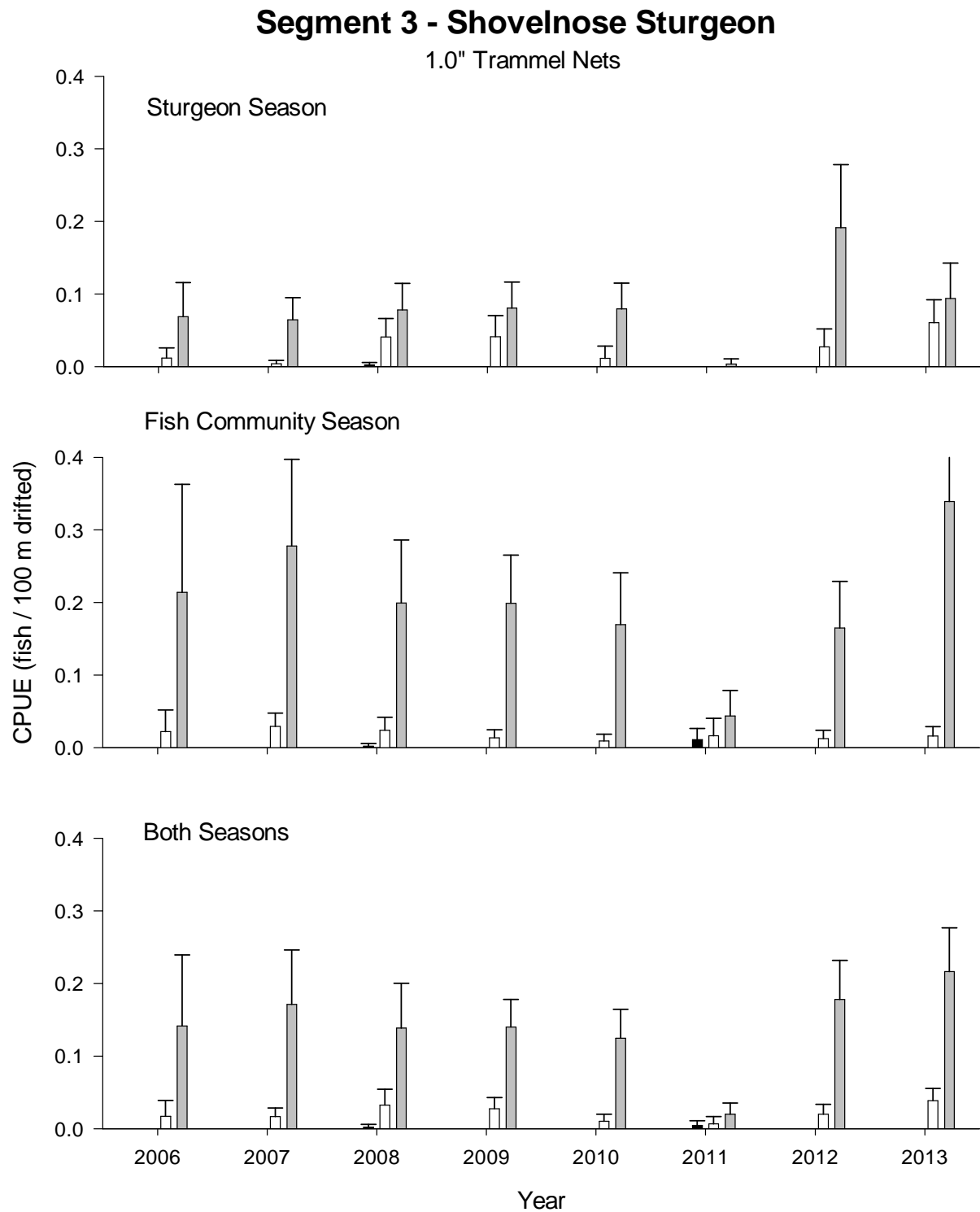


Figure 11. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2013.

Segment 3 - Shovelnose Sturgeon

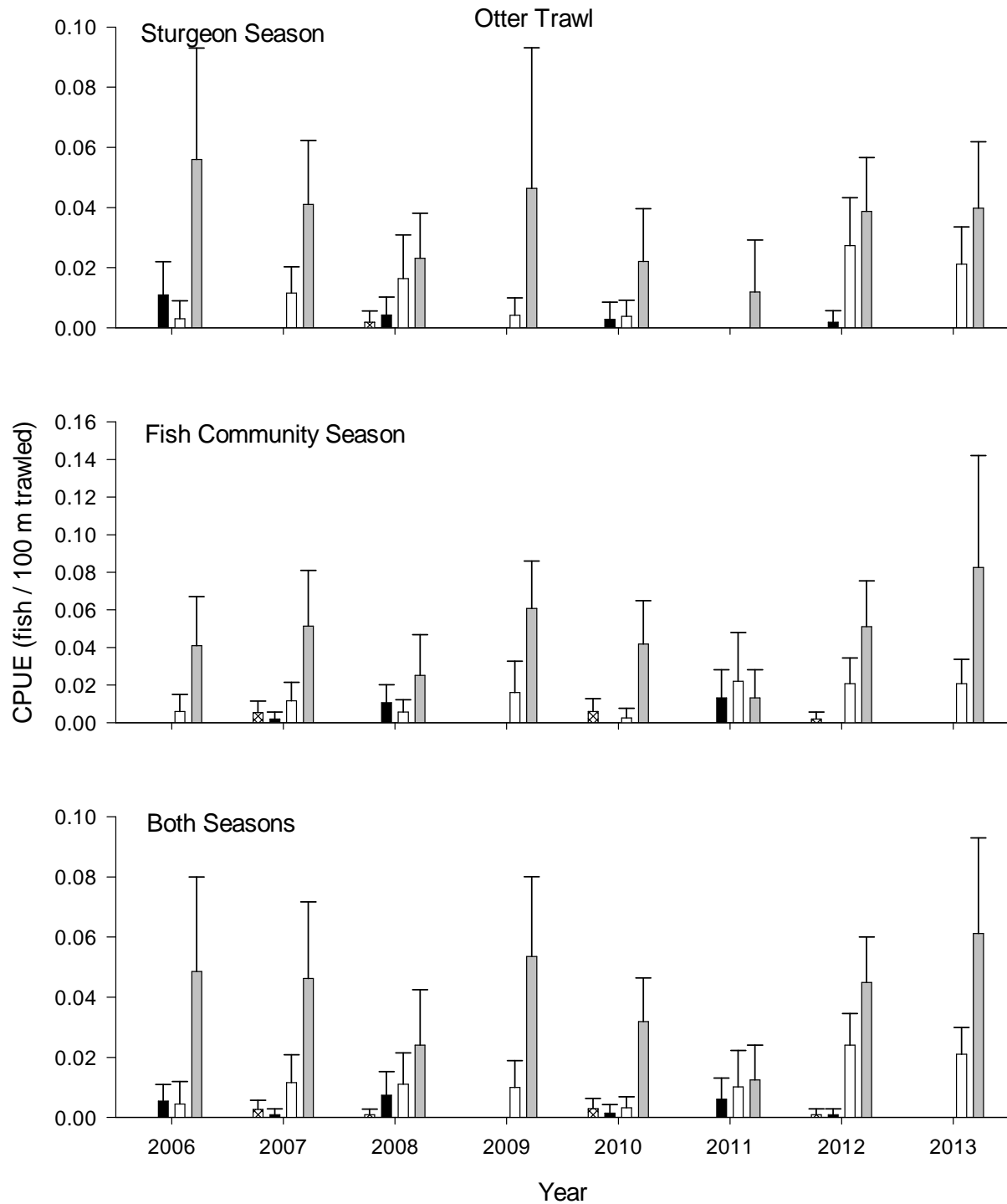


Figure 12. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2013.

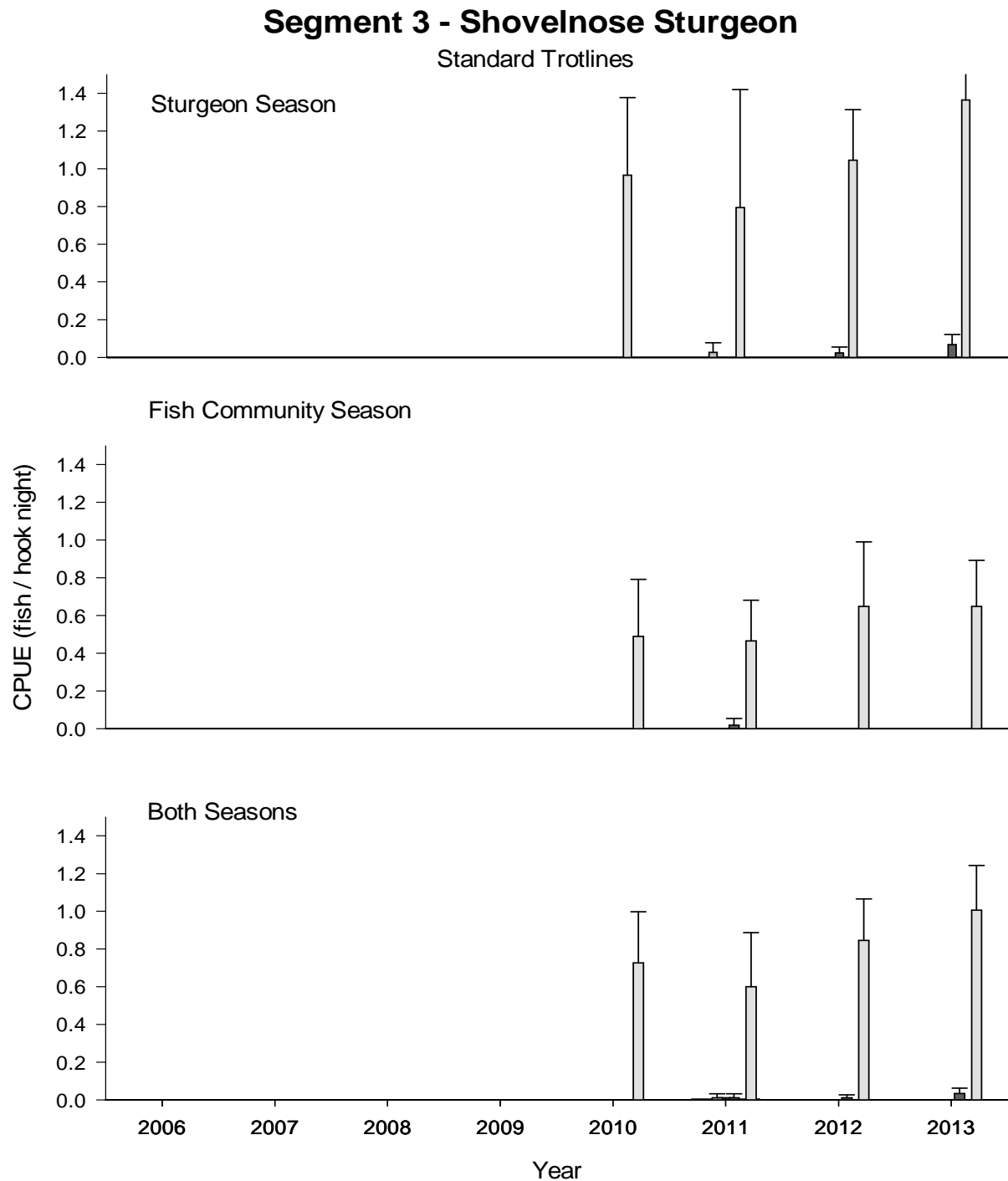


Figure 13. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2013. 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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		38	44	3	2	11	2	1
Otter Trawl	0	0	0	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	0	0	0	0	0	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	38	22	2	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	0	0	0	0	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
		38	44	3	2	11	2	0
Otter Trawl	0	0	0	0	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	0	0	0	0	0	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	29	48	38	14	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	11	27	55	9	9	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	8	75	13	13	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	10	38	44	3	2	11	2	0
		40	10	50	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	6	67	33	0	0	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	42	31	67	2	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	19	16	58	26	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	150	37	42	16	5	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	43	38	44	3	2	11	2	0
		67	19	14	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	177	32	55	11	2	0	0	0
		44	40	13	1	0	0	2

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	71	38	55	7	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	30	20	57	20	0	0	0	0
		36	38	23	0	0	0	0
Fish Community Season								
1.0" Trammel Net	159	39	41	16	4	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	53	38	44	3	2	11	2	0
		62	17	21	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	183	33	55	10	2	0	0	0
		44	40	13	1	0	0	2

Segment 3 - Shovelnose Sturgeon

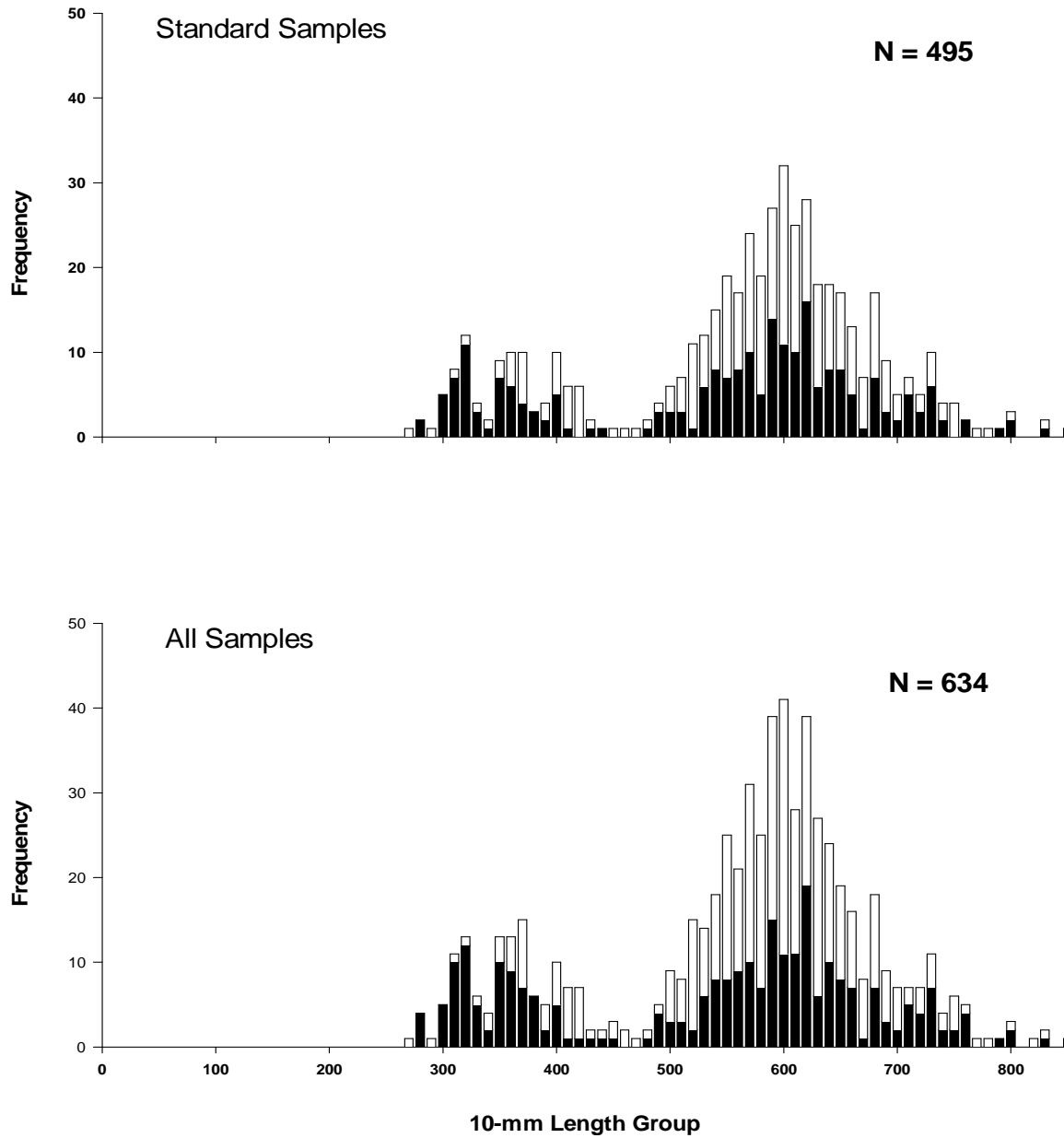
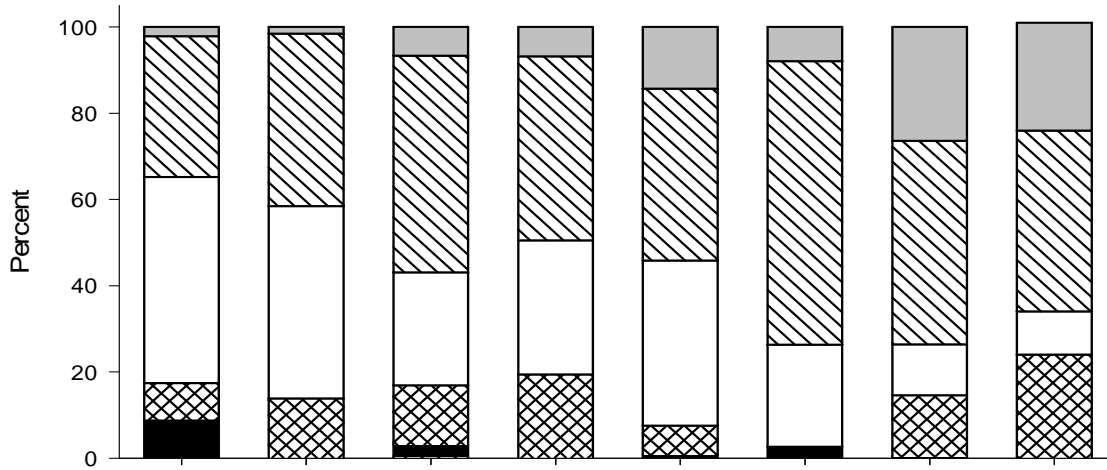
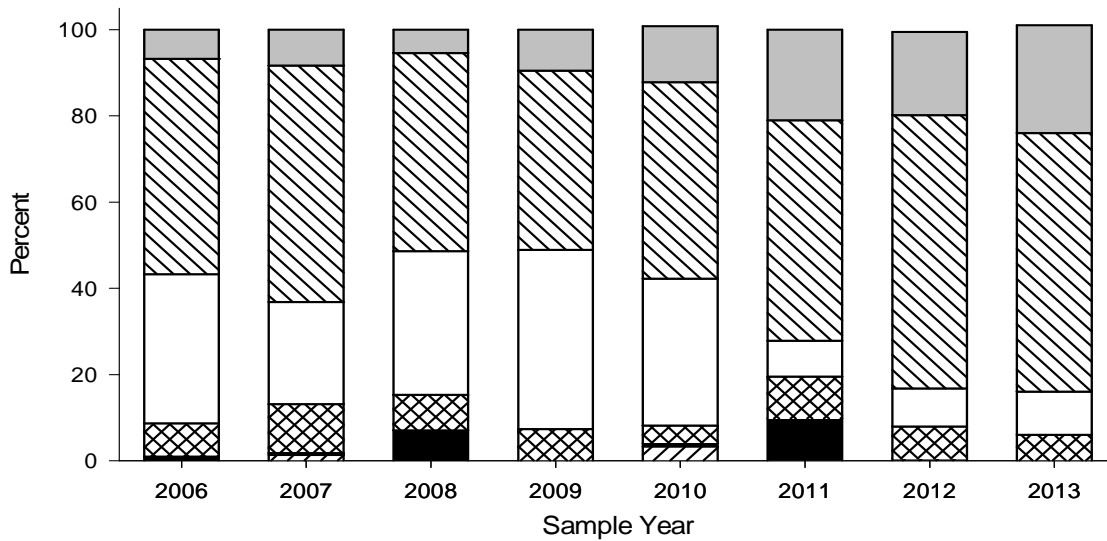


Figure 14. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Segment 3 - Shovelnose Sturgeon Sturgeon Season



Fish Community Season



Sub-Stock (0 - 149 mm) Stock Preferred
 Sub-Stock (150 - 249 mm) Quality Memorable / Trophy

Figure 15. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2013 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Segment 3 - Shovelnose Sturgeon

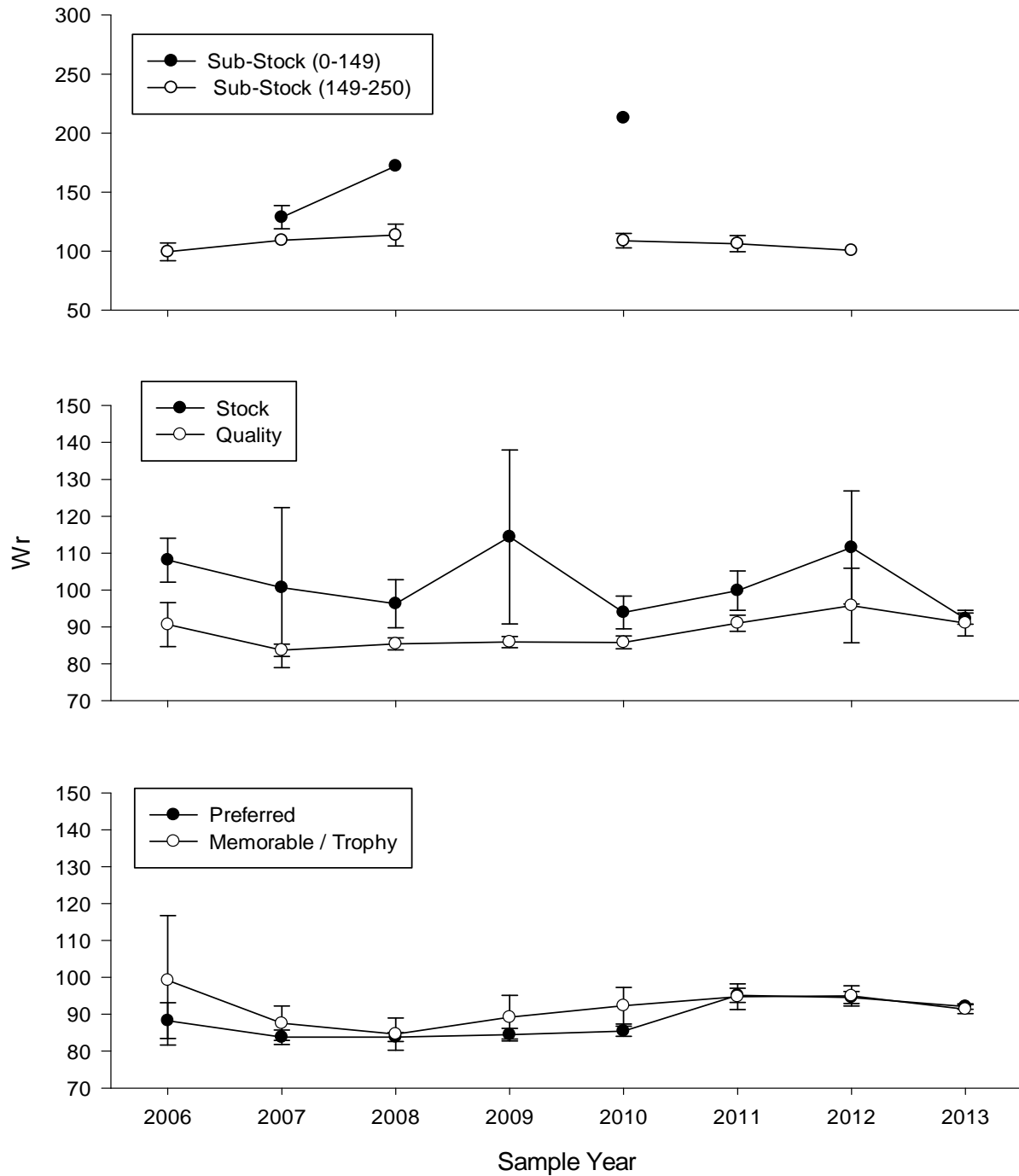


Figure 16. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2013 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

A total of 173 sturgeon chubs were sampled within Segment 3 during 2013, all of which were caught using the otter trawl. Random subsamples accounted for 157 sturgeon chubs, while non-random duplicate trawls accounted for the remaining 16. More sturgeon chubs were sampled during the fish community season ($n = 94$), when compared to the sturgeon season ($n = 79$). The total number of sturgeon chubs sampled in 2013 was less what were captured in 2012 ($n = 241$).

Otter trawl CPUE of sturgeon chub was slightly higher during the fish community season (0.17 fish/100 m) when compared to the sturgeon season (0.14 fish/100 m) (Figure17). 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 2013.

Sturgeon chubs sampled in Segment 3 during 2012 averaged 65.6 mm in length, very similar to the 2012 average length of 65.5 mm. Sturgeon chubs collected in 2013 were mainly comprised of one and two year old fish, with some YOY and three years old fish collected (Herman et al. 2008). The size distribution of sturgeon chubs captured in 2013 was very similar to that of 2012.

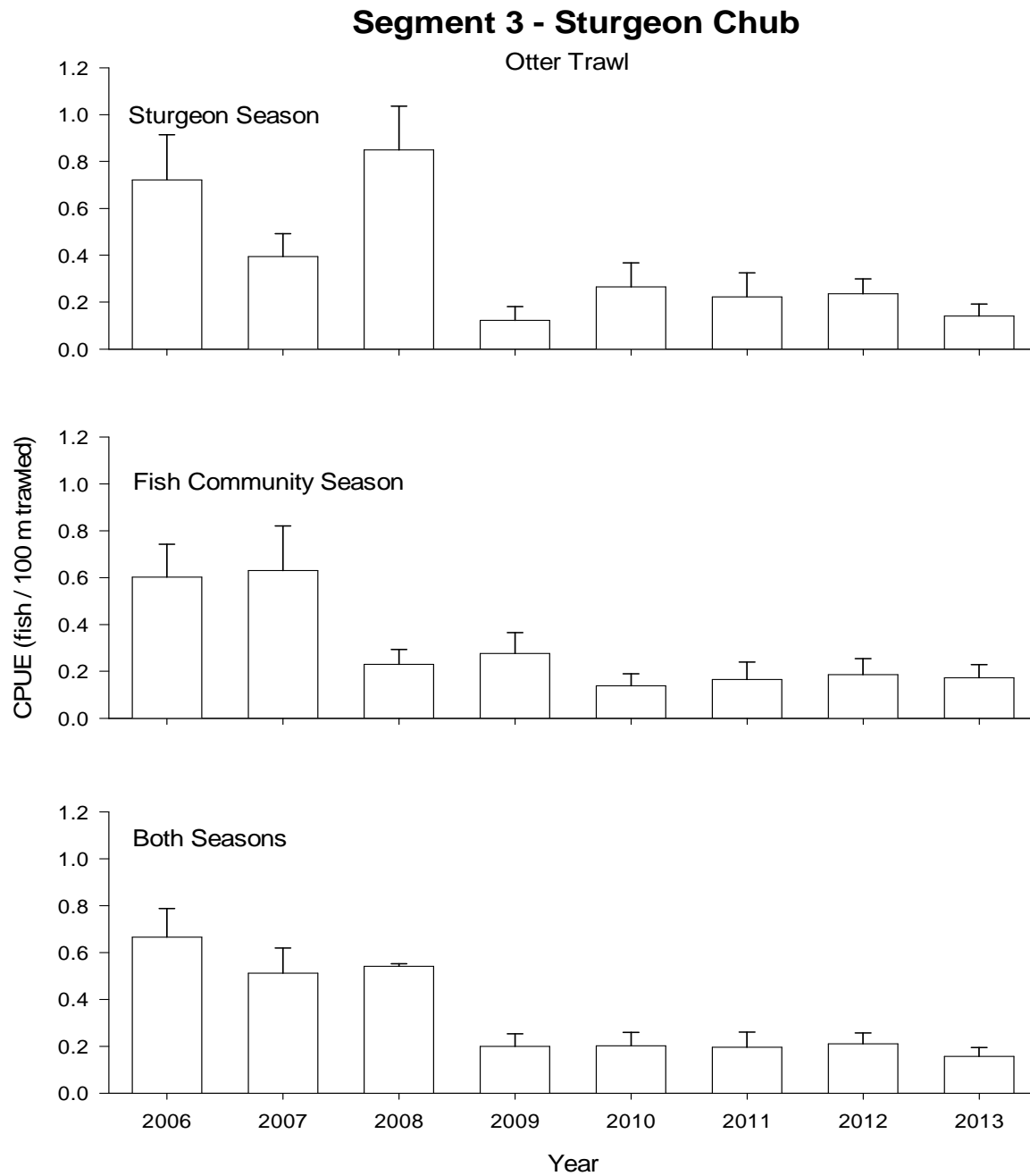


Figure 17. Mean annual catch per unit effort (± 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2013.

Segment 3 - Sturgeon Chub

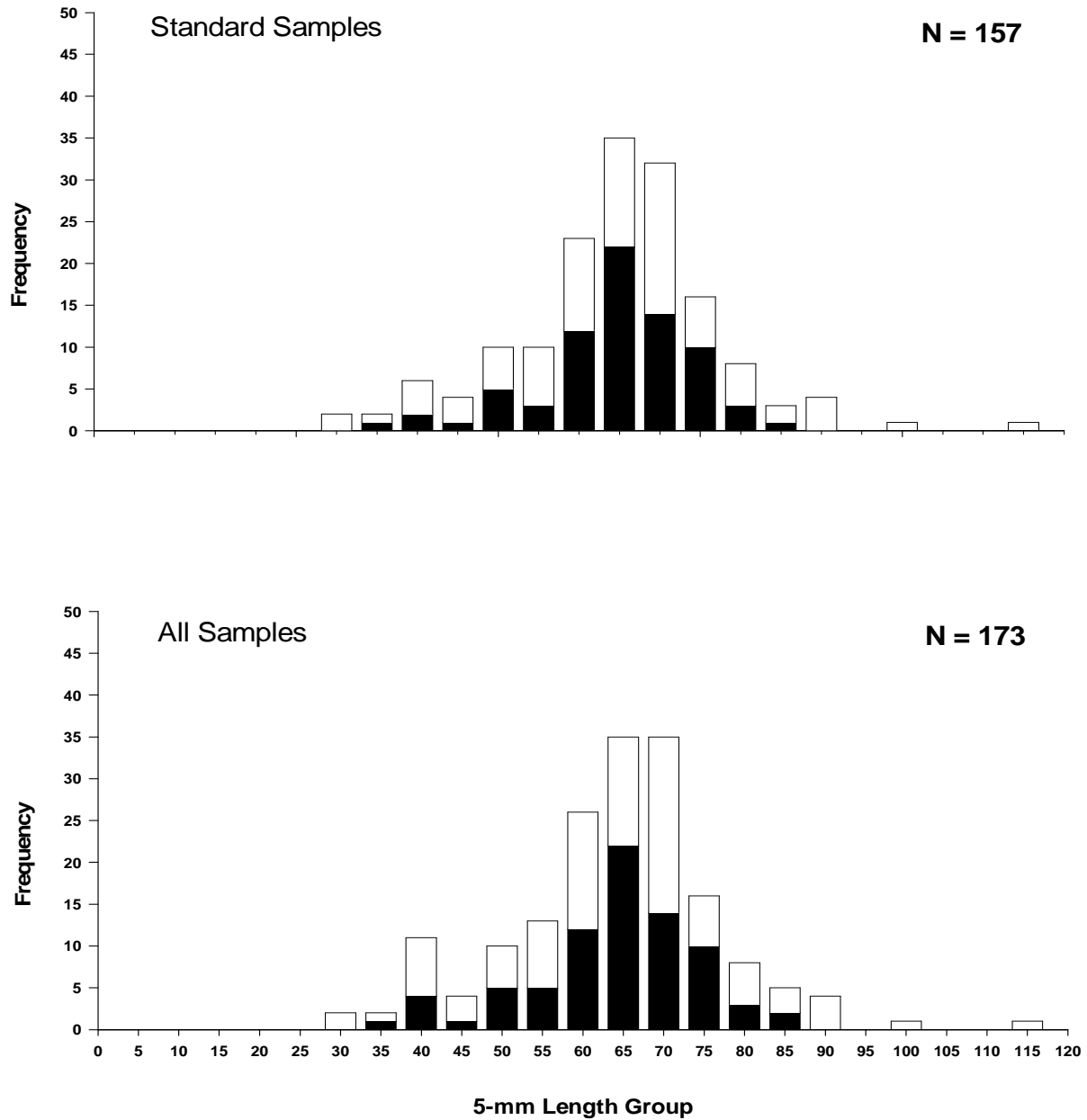


Figure 18. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Sicklefin Chub

During 2013 a total of 77 sicklefin chubs were collected within Segment 3. More sicklefin chubs were collected during the fish community season ($n = 67$), when compared to the sturgeon season ($n = 10$). All sicklefin chubs collected in 2013 were captured in the otter trawl. Fewer sicklefin chubs were collected during 2013 when compared to 2012 ($n = 111$). The lower number of sicklefin chubs in 2013 resulted in a combined CPUE of 0.07 fish/100 m, which was the lowest CPUE for the eight years of sampling. However, during the fish community season, CPUE was higher during 2013 than during 2012. Combined CPUE of sicklefin chubs has remained relatively constant since the Program has been implemented.

Sicklefin chubs averaged 88.4 mm in length during 2013, which was smaller than the 95.7 mm average observed in 2012. The length frequency histogram displayed in Figure 20 indicates that more 2 year old sicklefin chubs were collected in 2013 when compared to 2012. However, similar to 2012 the majority of sicklefins collected in 2013 were likely 3 year old fish (Herman et al. 2008). Catching few YOY sickelfin chubs was not isolated to the 2013 season, very few YOY sicklefin chubs have been collected in the otter trawl over the past eight years of sampling. This may be attributed to the gear or the areas that the otter trawl can effectively sample.

Segment 3 - Sicklefin Chub

Otter Trawl

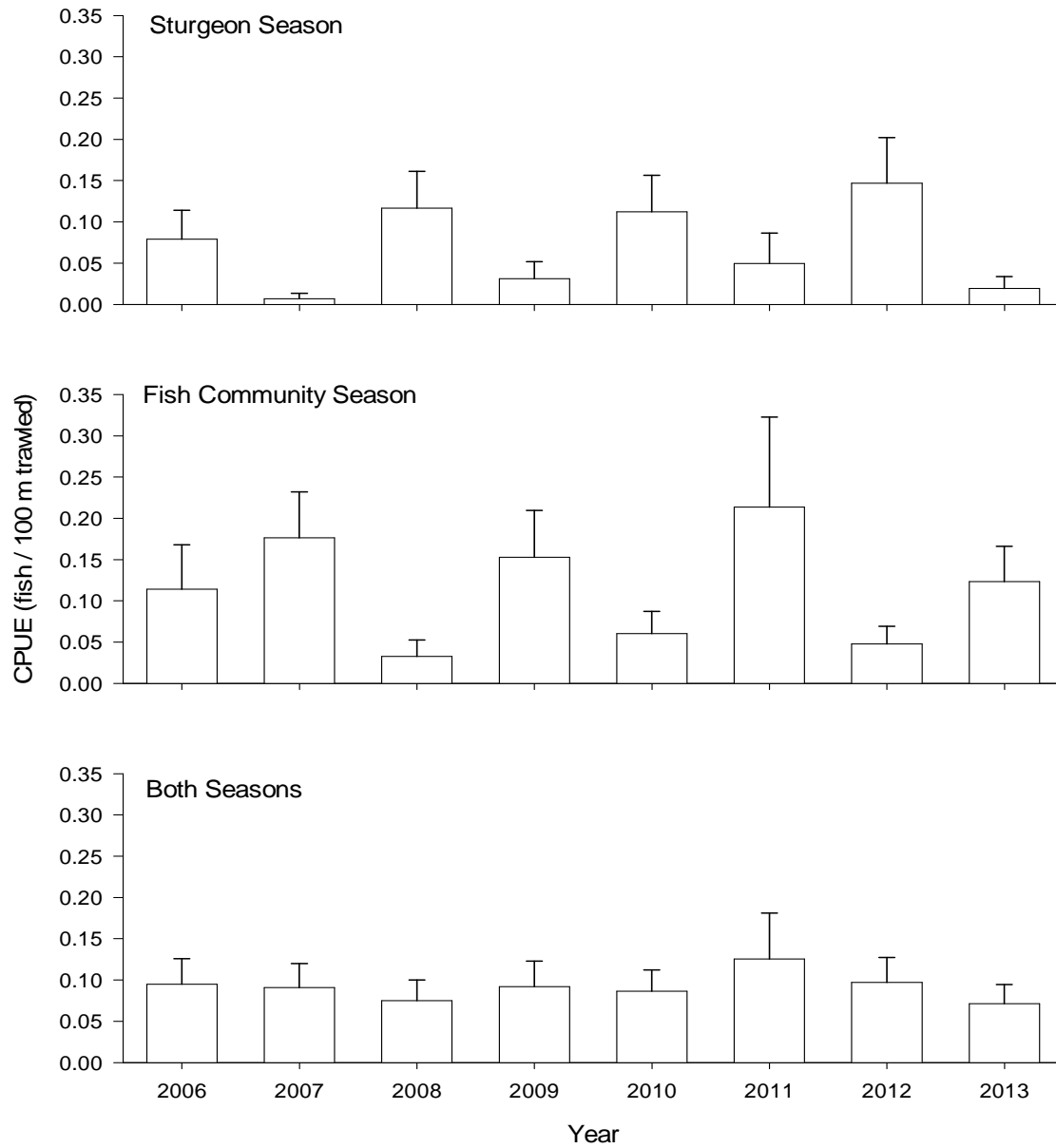


Figure 19. Mean annual catch per unit effort (± 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2013.

Segment 3 - Sicklefin Chub

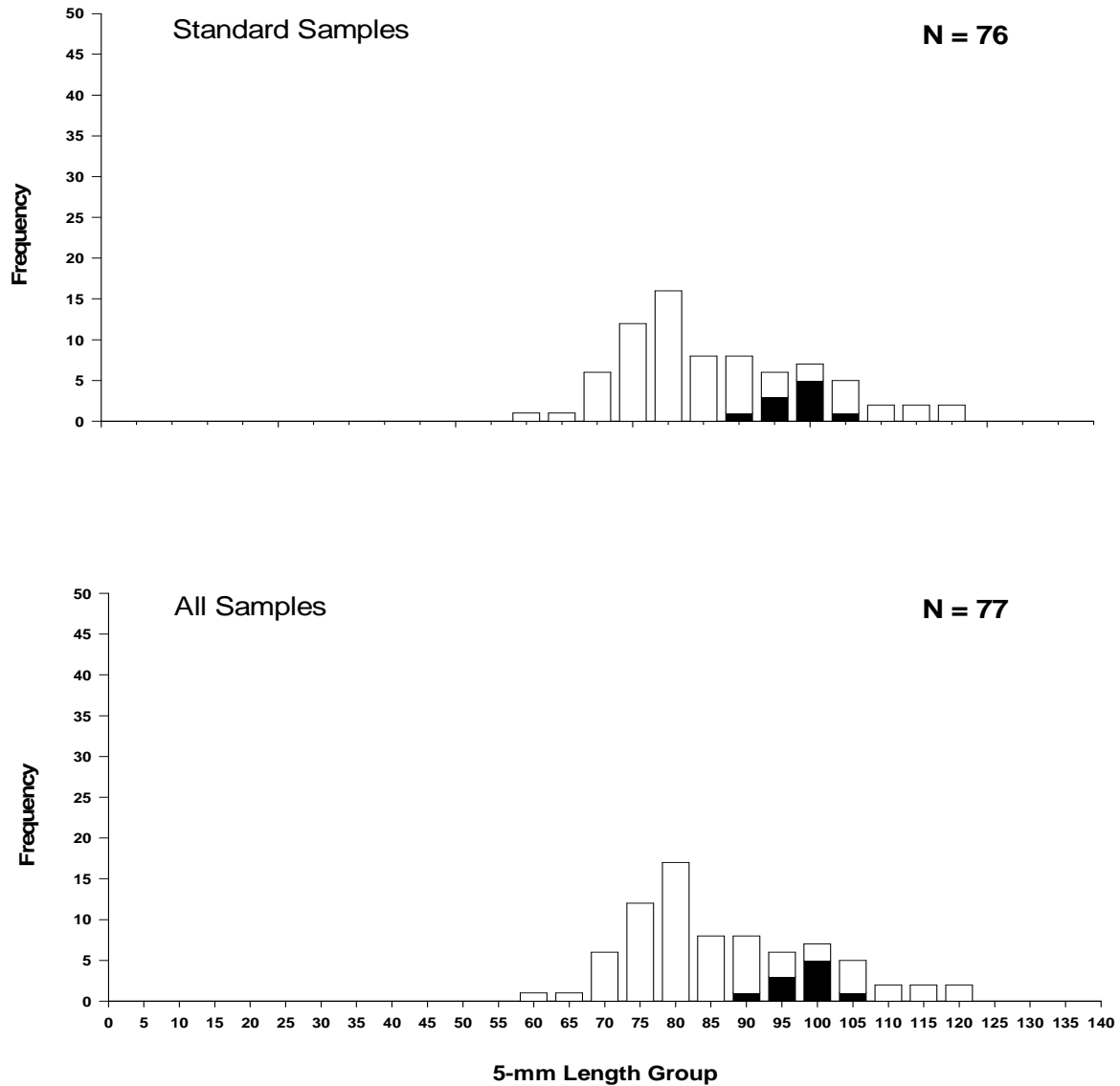


Figure 20. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Sand Shiner

A total of 21 sand shiners were sampled in Segment 3 during 2013, all of which were caught in mini fyke nets during the fish community season. The relative abundance of sand shiners in 2013 was at an all time low of 0.12 fish/net night (Figure 21). This was a decrease from 1.7 fish/net night in 2012. 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 40.8.9 mm in length in 2013. It is not known why CPUE of sand shiners has decreased over the past eight years of sampling.

Segment 3 - Sand Shiner

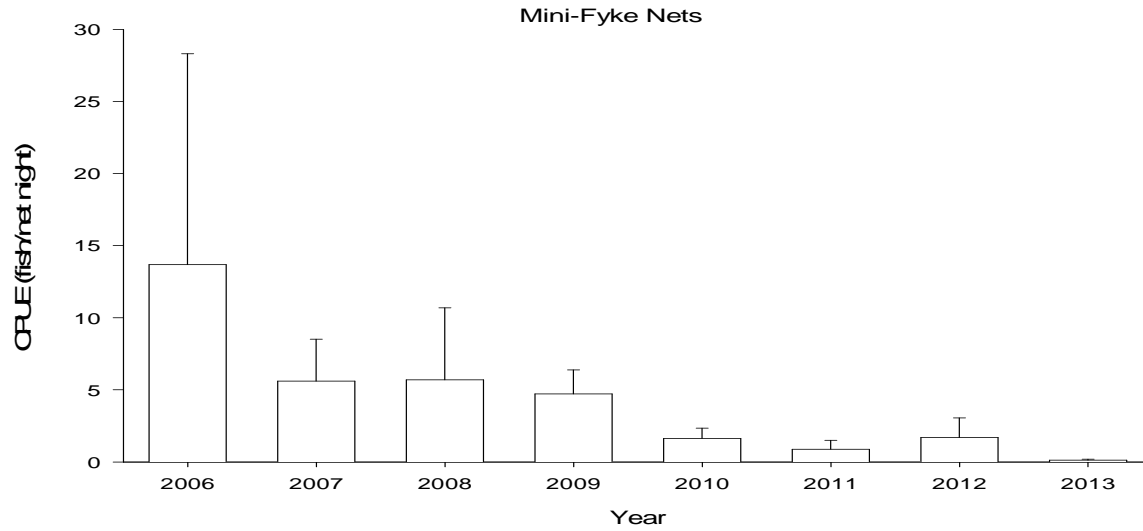


Figure 21. Mean annual catch per unit effort (± 2 SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2013.

Segment 3 - Sand Shiner

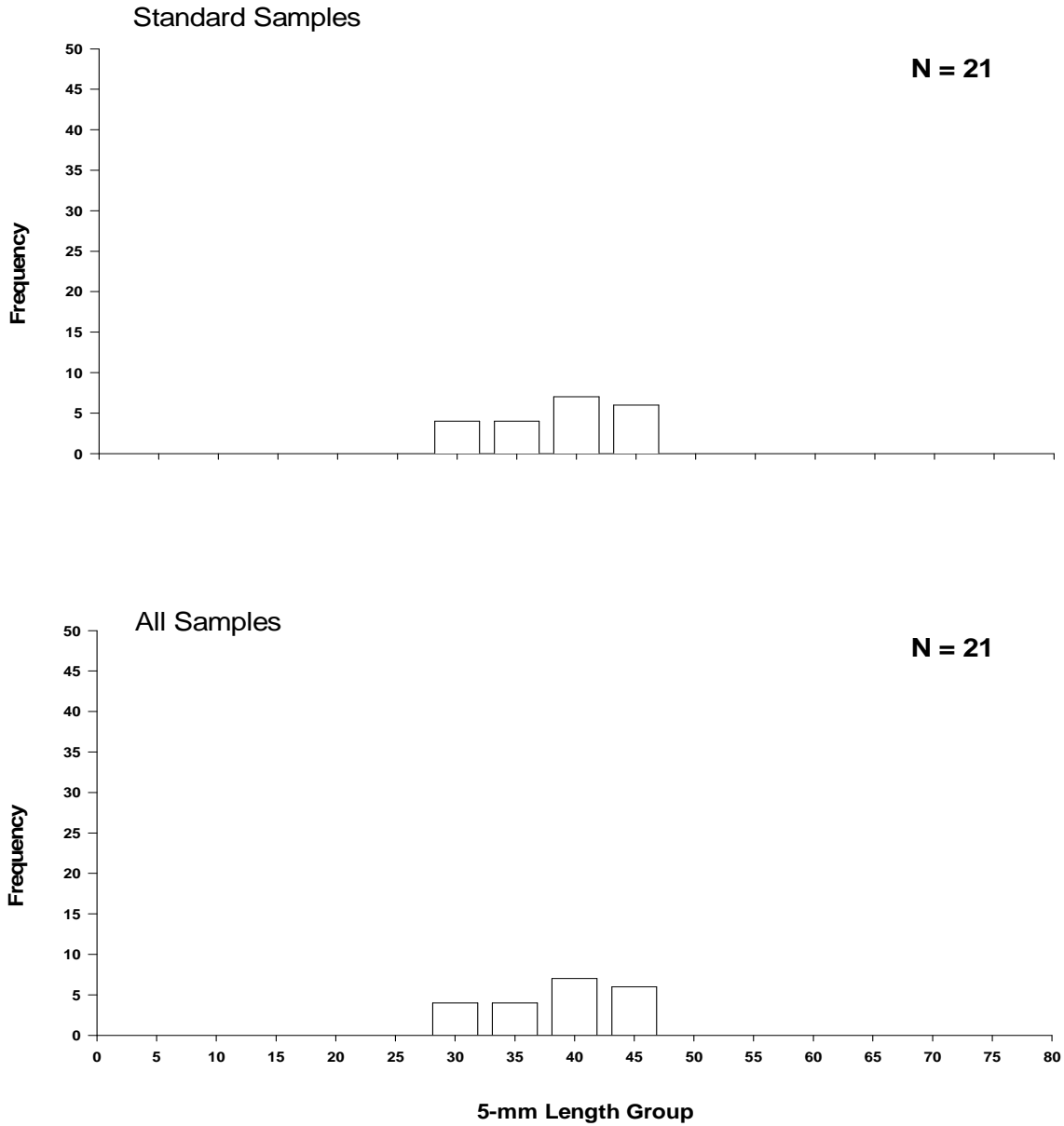


Figure 22. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

***Hybognathus* spp.**

All *Hybognathus* spp. that were collected within Segment 3 during 2013 were identified as western silvery minnows. In all, 267 western silvery minnows were collected, 266 in standard mini fyke net sets and 1 in an otter trawl. The relative abundance of western silvery minnows was estimated at 1.52 fish/net night for mini fyke nets in 2013. This was the third highest CPUE over the past eight 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), but seemed to begin to rebound in 2013 (Figure 23).

There were at least three age classes of western silver minnows collected in 2013, YOY, age-1 and age-2 (Figure 24). Fish in the 30 mm or smaller 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). More YOY western silvery minnows were collected in 2013 when compared to 2012.

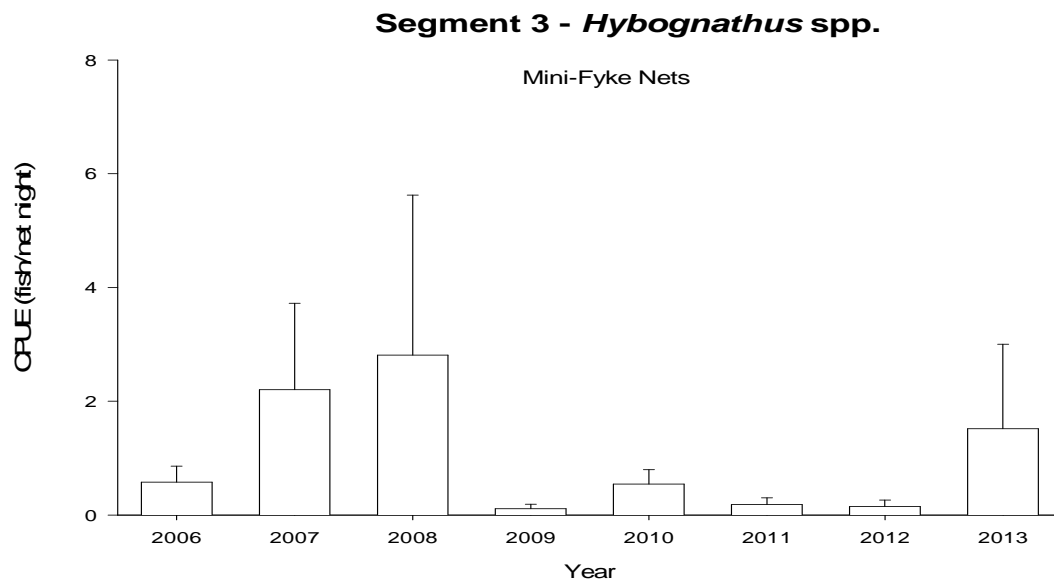


Figure 23. Mean annual catch per unit effort (± 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2013.

Segment 3 - *Hybognathus* spp.

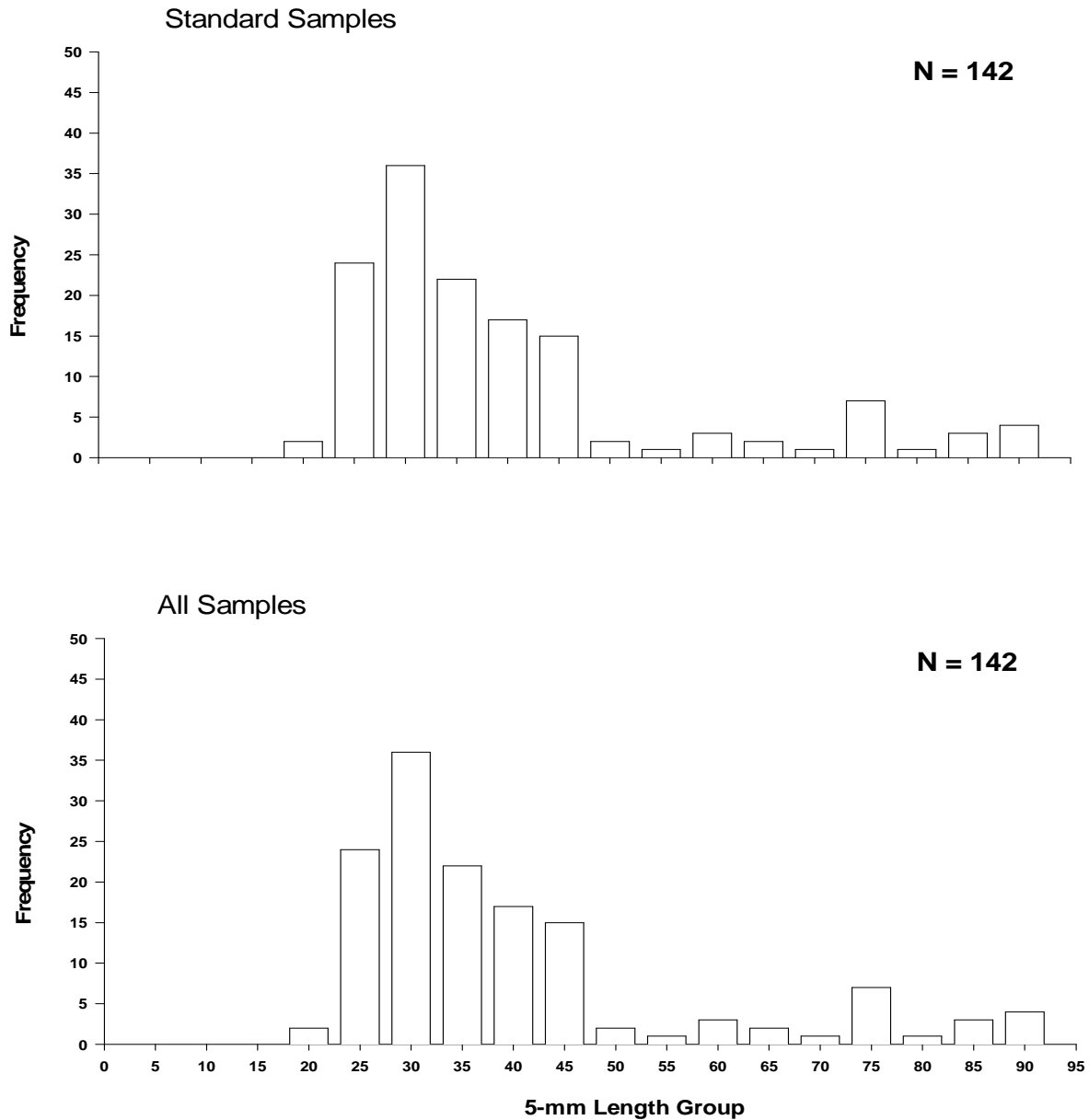


Figure 24. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Blue Sucker

During 2013 a total of 18 blue suckers were collected within Segment 3, 14 with trammel nets 4 2 with the otter trawl. Over the eight 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 2013 trammel net CPUE was estimated at 0.016 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 2013 was over 500 mm in length (Figure 27). The largest specimen collected was 830 mm and the smallest was 290 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.

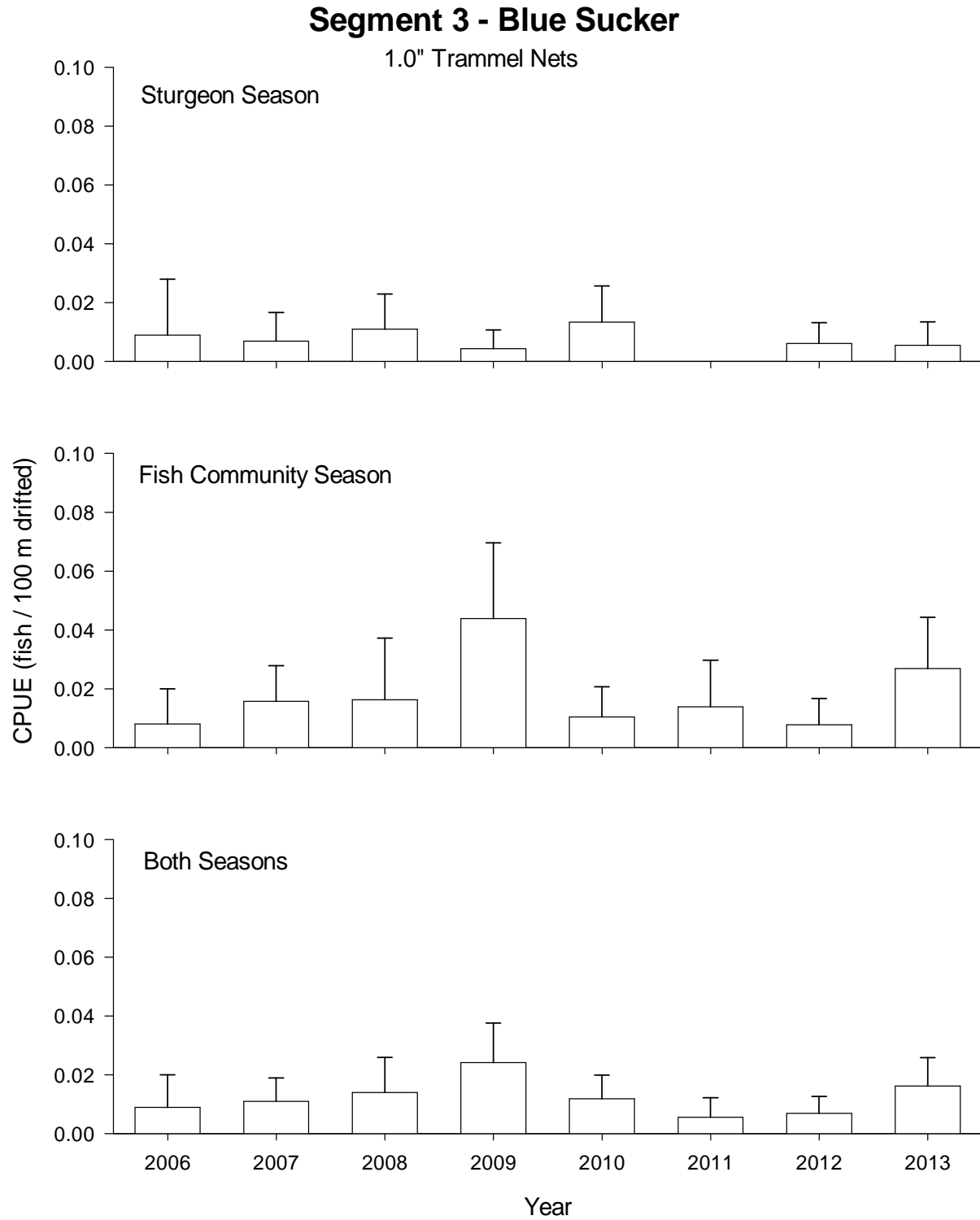


Figure 25. Mean annual catch per unit effort (± 2 SE) of blue sucker using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2013.

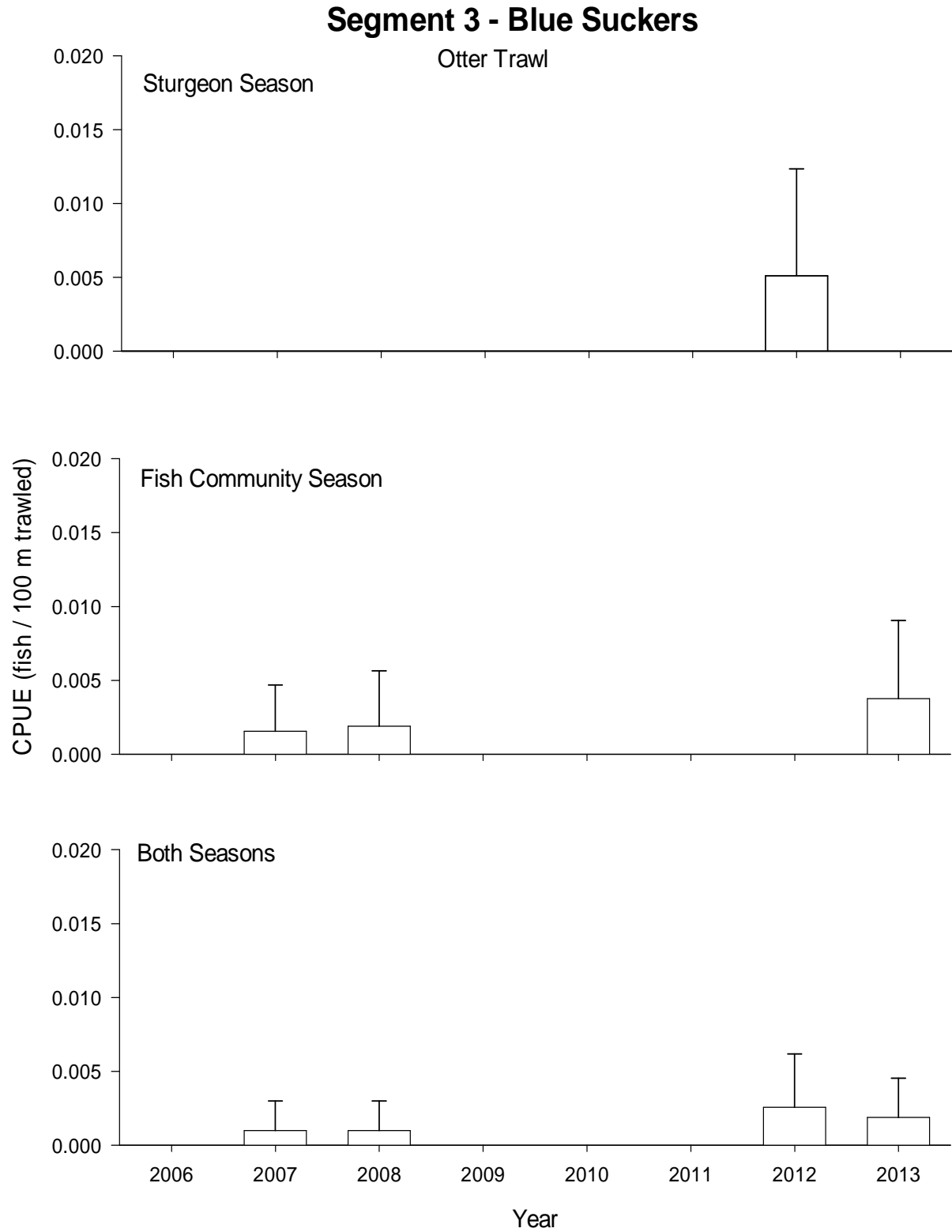


Figure 26. Mean annual catch per unit effort (± 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2013.

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 2013. 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	0	0	100	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	11	36	27	36	0	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0
Otter Trawl	2	38	44	3	2	11	2	0
		0	50	50	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	0	0	0	0	0	0	0	0
		44	40	13	1	0	0	2

Segment 3 - Blue Sucker

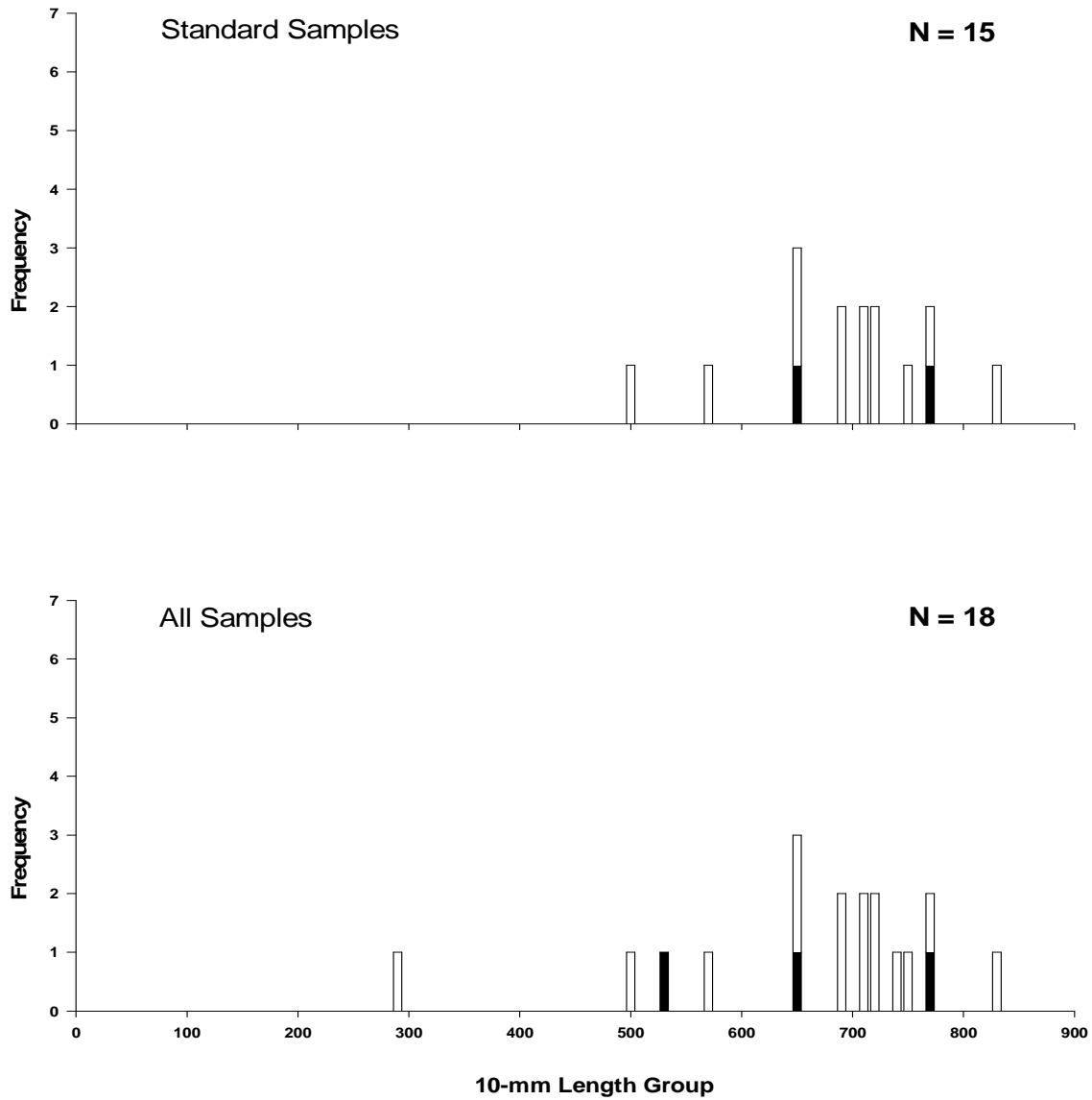


Figure 27. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Sauger

A total of 384 sauger were collected within Segment 3 during 2013. Sauger were caught in all types of gears that were deployed, but were most commonly caught in trammel nets. Trammel nets captured 284 sauger, followed by otter trawl with 62, mini fyke nets captured 29 and trotlines 9.

Trammel nets have been the best gear to estimate relative abundance of adult sauger through the past eight seasons. During the sturgeon season of 2013, sauger CPUE for trammel nets was at a eight year high, with an estimate of 0.42 fish/100 m (Figure 29). However, CPUE fell appreciably to 0.09 fish/100 m during the fish community season. Nevertheless, overall trammel net CPUE of sauger was at 0.25 fish/100 m, which was a eight 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 2013 no sauger less than 100 mm in length were captured using mini fykes.

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 the catch of sauger in 2012 consisted of age-1 through age-7 or older (Dattilo et al. 2008). Relatively large year classes of age-2 and age-3 fish are present.

In all, sauger caught in trammel nets averaged 361.5 mm in length and weighed 382.6 g. Sauger sampled in the otter trawl were on average smaller, measuring 323.2 mm and weighing 300.1 g. Sauger sampled in mini fyke nets were on average the smallest sauger sampled, averaging 297.8 mm and weighing 202.8 g.

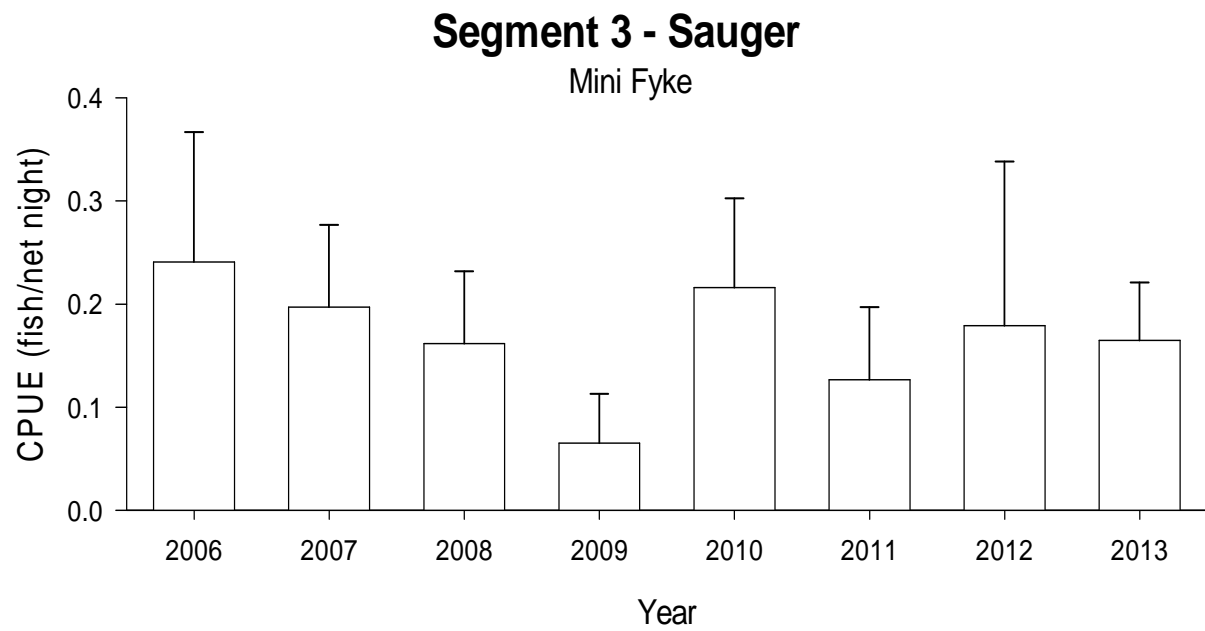


Figure 28. Mean annual catch per unit effort (± 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2013.

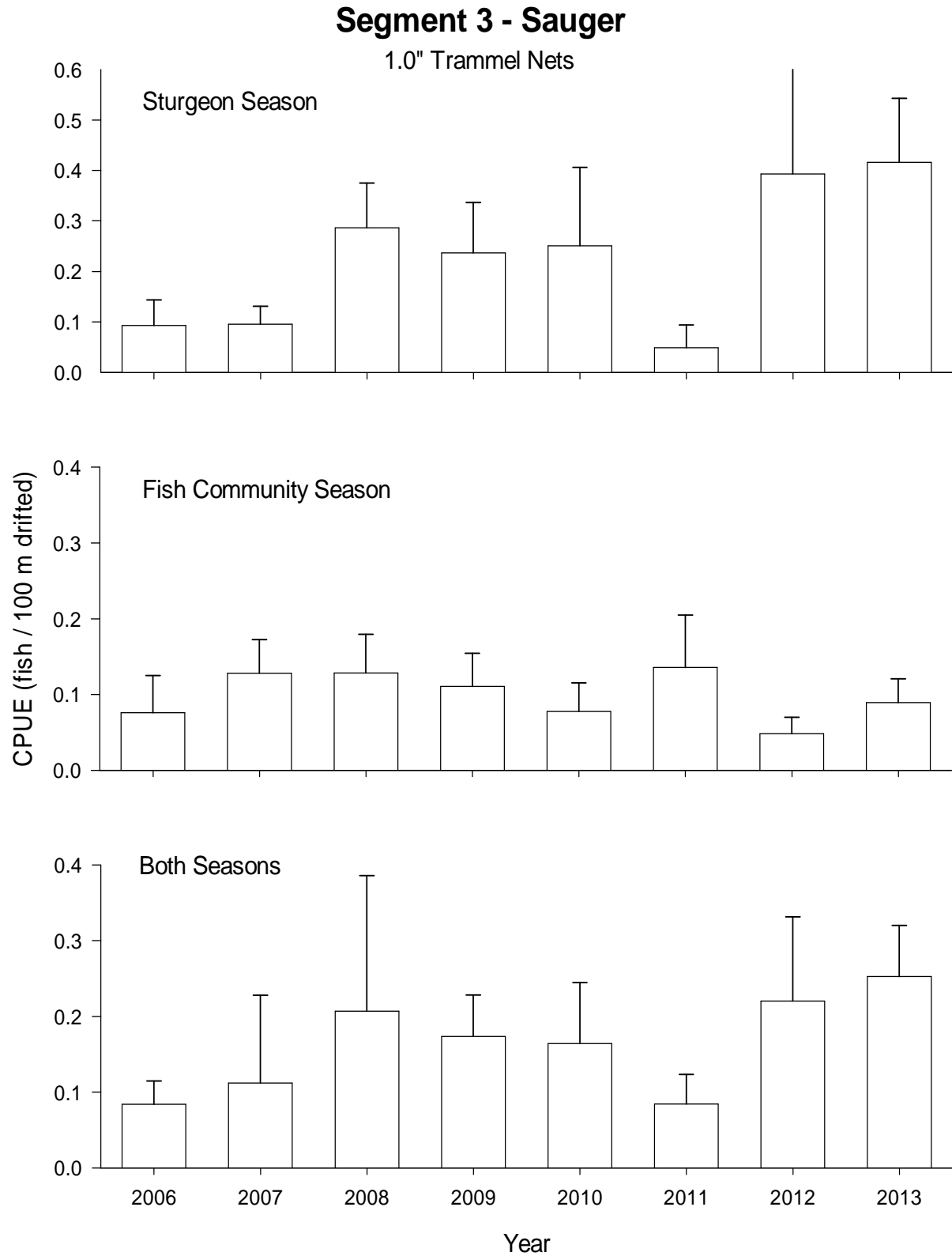


Figure 29. Mean annual catch per unit effort (± 2 SE) of sauger using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2013.

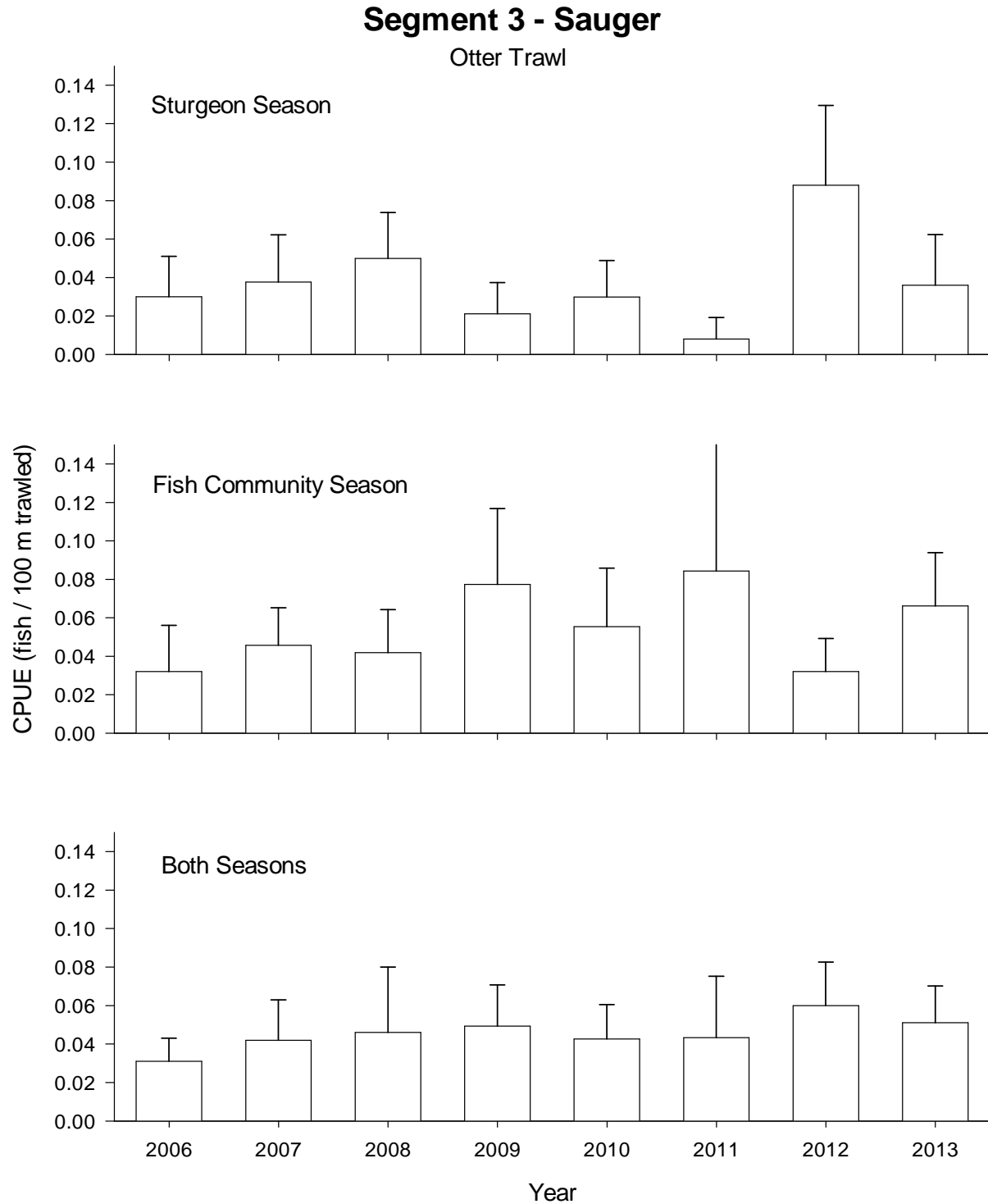


Figure 30. Mean annual catch per unit effort (± 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2013.

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 2013. 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	CONF
Sturgeon Season								
1.0" Trammel Net	196	50	42	8	0	0	0	0
		40	38	22	0	0	0	0
Otter Trawl	18	28	28	44	0	0	0	0
		36	38	23	3	0	0	0
Fish Community Season								
1.0" Trammel Net	35	43	29	26	3	0	0	0
		40	35	23	2	0	0	0
Mini-Fyke Net	29	17	62	3	0	3	14	0
Otter Trawl	30	38	44	3	2	11	2	0
		43	40	17	0	0	0	0
		38	36	25	1	0	0	0
Both Seasons								
Trot Lines	6	67	17	17	0	0	0	0
		44	40	13	1	0	0	2

Segment 3 - Sauger

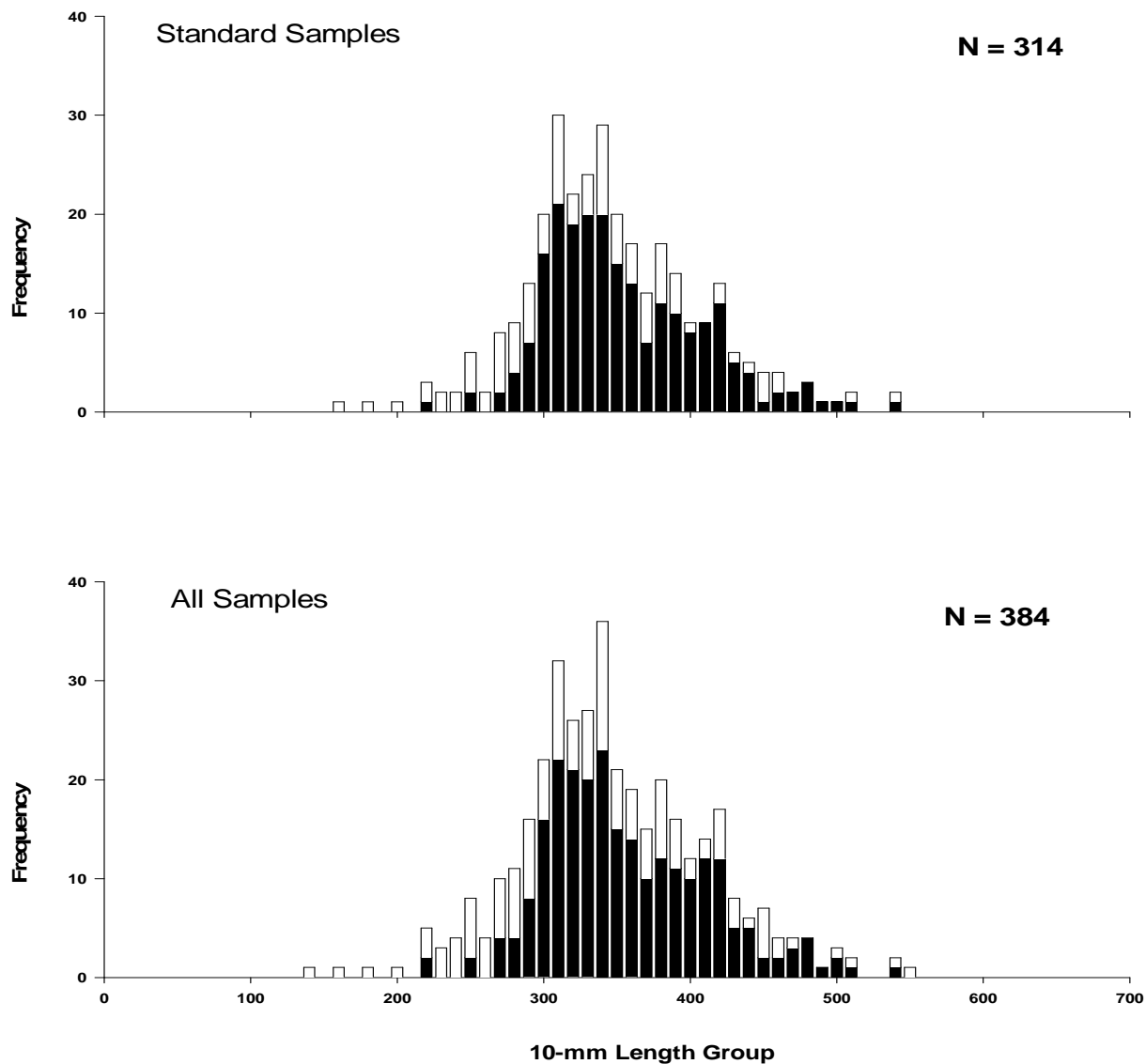


Figure 31. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

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 2013. The most common fish sampled in all of 2013 was the emerald shiner *Notropis atherinoides*, with a total of 6,033 sampled. The vast majority (n = 6,002) were captured in mini fyke nets, while 31 were sampled using the otter trawl. Emerald shiners averaged 61.8 mm in length.

While the second most abundant species captured was the shovelnose sturgeon, the third most abundant species was the channel catfish *Ictalurus punctatus* with 551 sampled in 2013. Channel catfish were sampled trotlines, trammel nets, otter trawls, fishing with hook and line. And one was caught in a mini fyke net. The otter trawl was the most effective gear in collecting large numbers of channel catfish, with a total of 268 sampled. While the average sized catfish caught in the otter trawl measured 280.3 mm, 13 channel catfish under 100 mm were caught. The smallest being 23 mm in length. On average, standard trotlines caught the largest channel catfish, with an average size of 403.0 mm.

Goldeye *Hiodon alosoides* were the fourth most abundant fish captured in Segment 3 during 2013 with 403 sampled. Goldeye were sampled in all standard gears, although the majority of the catch was sampled using trammel nets, which caught 220. A large number of young-of-the-year goldeye were captured in 2013.

A total of 392 flathead chubs *Platygobio gracilis* were sampled within Segment 3 during 2013, 119 using otter trawls, 109 using trammel nets, 100 using mini fyke nets and 64 using trotlines. Several age classes of flathead chubs were caught, with the smallest fish being caught in mini fyke nets, which had an average length of 61.3 mm in length. On average, the largest flathead chubs were captured using trammel nets, which had an average length of 236.8 mm.

A total of 281 river carpsuckers *Carpiodes carpio* were sampled in Segment 3 during 2013. Mini fyke nets captured 197 river carpsuckers, most of which were YOY. River carpsuckers caught in the mini fyke nets had an average length of 253.9 mm. The otter trawl caught a total of 20 river carpsuckers averaging 353.9 mm in length, while trammel nets caught 64 and were on average larger than those captured in other gears with an average length of 481.9 mm.

A total of 195 fathead minnows *Pimephales promelas* were sampled during 2013, all but 2 were sampled in mini fyke nets. Fathead minnows averaged 30.0 mm in length.

Stonecats *Noturus flavus* were caught using trotlines (n = 61), otter trawls (n = 27), mini fyke nets (n = 29), trammel nets (n = 2) and fishing (n = 1) for a total of 120 sampled. Stonecats caught in mini fyke nets averaged 22.2 mm in length, while stonecats captured using trotlines averaged 181.8 mm.

A total of 118 common carp *Cyprinus carpio* were collected during 2013. All standard gears captured common carp, although the majority (n = 55) were sampled in mini fyke nets. Most common carp sampled in mini fyke nets were YOY fish and averaged 32.5 mm in length. Trammel nets captured a total of 25 common carp and averaged 547.0 mm in length.

A total of 99 shorthead redhorse *Moxostoma macrolepidotum* were caught during 2013, 38 in trammel nets, 31 in otter trawls, 29 on trotlines and 1 in mini fyke nets.

A total of 72 white suckers *Catostomus commersonii* were sampled within Segment 3 during 2013. Mini fyke nets caught 67 white suckers, almost all white suckers captured in mini fyke nets were age-0 fish. White suckers caught in mini fyke nets averaged 47.0 mm in length.

During 2013, a total of 68 white crappie *Pomoxis annularis* were sampled in Segment 3, all of which were caught in mini fyke nets. White crappie averaged 45.8 mm in length.

Discussion

More pallid sturgeon were captured in Segment 3 of the Missouri River during the 2013 sampling season than during any of the previous seven years. With a total of 260 captures, pallid sturgeon were the ninth most abundant species sampled in 2013. Pallid sturgeon seemed to respond to the high flows in 2011 by using more of the upstream sections of Segment 3. During the 2012 field season, more pallid sturgeon were captured in upstream sections of Segment 3 than during years prior to 2011. However during 2013, the distribution of pallid sturgeon catches went back to looking more similar to years prior to 2011. Similar to years prior to 2011, a majority of the pallid sturgeon captures occurred downstream of river mile 1,640, with the exception of areas near the Wolf Point bridge (River mile 1,702), which is a stocking site.

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. While the overall trammel net CPUE was actually higher in 2013 than during any previous year, the increase was minimal. 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 the proportion of smaller sized pallid sturgeon has continued to decrease, while larger fish are becoming more abundant. For instance, the proportion sub-stock sized fish has significantly decreased over the eight years of sampling. Even though the catch rates for the standard gears have remained relatively constant, a greater number of larger fish are being captured, which shows that stocked fish are surviving to larger size classes.

While the size structure of hatchery reared pallid sturgeon in Segment 3 has changed since 2006, the shift in length has been slow. The average length of hatchery reared pallid sturgeon captured in 2006 was 249.2 mm, while in 2013 the average has increased to 409.5 mm. Data on age at length over time has indicated that growth rates for all year classes are began slowing down over the last three years. This could be a sign that the carrying capacity of sturgeon is close to being reached, however more analysis needs to be done to better understand the mechanisms at play. While growth of hatchery produced pallid sturgeon residing in Segment 3 has been relatively slow, their average relative condition has not changed appreciably.

During 2013 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 92 fish sampled, followed by the 2008

year class with 45 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.

The population of shovelnose sturgeon within Segment 3 appears to be strong. While there has been some variability between CPUE of the standard gears among years, shovelnose of various sizes have been captured in all eight sampling seasons. There was a significant increase in shovelnose sturgeon CPUE for both trammel nets and otter trawls for 2013 and 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 eight 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 influenced the distribution of pallid sturgeon within Segments 2 and 3, we did not see increases or changes in the distribution of many of the target

cyprinids in the following year. Sand shiners, western silvery minnows, sturgeon chub and sicklefin chub abundance did not appreciably increase in 2012 when compared to prior sampling years. However, the relative abundance of western silvery minnows did increase in 2013. The size distribution of western silvery minnows captured in 2013 would indicate many age-0 and age-1 fish. Interestingly, the relative abundance of sicklefin cuhs, sturgeon chubs and sand shiners did not mirror western silvery minnows. Mini fyke net catches of sand shiners were at an eight year low as was the otter trawl catch of sicklefin and sturgeon chubs. The decrease in relative abundance of many native cyprinids could be at least in part due to an increase in predatory fish. We continued to observe good catches of adult sauger during 2013. Trammel net CPUE was at an eight year high. Otter trawl CPUE has been relatively consistent, but low for all sampling years.

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orange throated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caprodes</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculata</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<i>Sander canadense</i>	Sauger	SGER*
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i>) spp.	UST
	Unidentified Percidae	UPC
	Sciaenidae - drums	
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YOYF
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF
	Turtles	
<i>Chelydra serpentina</i>	Common Snapping Turtle	SNPT
<i>Chrysemys picta bellii</i>	Western Painted Turtle	PATT
<i>Emydoidea blandingii</i>	Blanding's Turtle	BLDT
<i>Graptemys pseudogeographica</i>	False Map Turtle	FSMT
<i>Trachemys scripta</i>	Red-Eared Slider Turtle	REST
<i>Apalone mutica</i>	Smooth Softshell Turtle	SMST
<i>Apalone spinifera</i>	Spiny Softshell Turtle	SYST
<i>Terrapene ornata ornata</i>	Ornate Box Turtle	ORBT
<i>Sternotherus odoratus</i>	Stinkpot Turtle	SPOT
<i>Graptemys geographica</i>	Map Turtle	MAPT
<i>Graptemys kohnii</i>	Mississippi Map Turtle	MRMT
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	OUMT
<i>Pseudemys concinna metteri</i>	Missouri River Cooter Turtle	MRCT
<i>Terrapene carolina triunguis</i>	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 3 of the Missouri River (RPMA 2)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking ^a	Primary Mark	Secondary Mark
1998	Big Sky Bend	255	1997	8/11/1998	Yearling	PIT Tag	Elastomer
1998	Confluence Nohly Bridge	40	1997	8/11/1998	Yearling	PIT Tag	Elastomer
1998	Sidney	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	Elastomer
2004	Sidney	397	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Wolf Point	379	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Larval Drift	30000	2004	7/2/2004	Fry		
2004	Larval Drift	50000	2004	7/8/2004	Fry		
2004	Larval Drift	25000	2004	7/20/2004	Fry		
2004	Larval Drift	25000	2004	7/23/2004	Fry		
2004	Larval Drift	25000	2004	7/27/2004	Fry		
2004	Culbertson	3819	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Sidney	2991	2004	9/10/2004	Fingerling	CWT	Elastomer
2004	Wolf Point	4040	2004	9/10/2004	Fingerling	CWT	Elastomer
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		

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 of Milk	1117	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Sidney	586	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	1553	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	School Trust	436	2006	11/8/2006	Advanced Fingerling	Elastomer	
2007	Culbertson	651	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Fallon	491	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Forsyth	492	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Sidney	983	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	School Trust	639	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Wolf Point	651	2006	4/5/2007	Yearling	PIT Tag	Scute

							Removed
Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking ^a	Primary Mark	Secondary Mark
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 Stocking	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
2013	Wolf Point	187	2012	4/22/2013	Yearling	PIT Tag	Scute
2013	Culbertson	187	2012	4/23/2013	Yearling	PIT Tag	Scute
2013	Intake	118	2012	4/24/2013	Yearling	PIT Tag	Scute
2013	Fallon	185	2012	4/25/2013	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 2013. 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 CHNB	OSB CHNB	SCCL CHNB
BKBH	0	0	0	0	0	0
	.	0	0	0	0	0
BLGL	0	0	0	0	0	0
	.	0	0	0	0	0
BMBF	20	0.022	0.017	0.029	0.021	0
	.	0.01	0.016	0.019	0.019	0
BRBT	2	0.002	0	0.006	0	0
	.	0.003	0	0.008	0	0
BUSK	13	0.016	0.015	0.009	0.03	0
	.	0.01	0.017	0.01	0.024	0
CARP	19	0.022	0.025	0.022	0.019	0
	.	0.011	0.019	0.017	0.019	0
CNCF	56	0.063	0.057	0.077	0.051	0
	.	0.019	0.027	0.037	0.033	0
CSCO	1	0.001	0	0.003	0	0
	.	0.002	0	0.005	0	0
ERSN	0	0	0	0	0	0
	.	0	0	0	0	0
FHCB	74	0.083	0.092	0.079	0.076	0
	.	0.026	0.045	0.039	0.058	0
FHMW	0	0	0	0	0	0
	.	0	0	0	0	0
FWDM	0	0	0	0	0	0
	.	0	0	0	0	0
GDEY	159	0.184	0.184	0.265	0.062	0
	.	0.04	0.063	0.08	0.037	0
GNSF	0	0	0	0	0	0
	.	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
LKWF	3	0.004	0	0.011	0	0
.	.	0.005	0	0.012	0	0
LNDC	0	0	0	0	0	0
.	.	0	0	0	0	0
LNSK	2	0.002	0.006	0	0	0
.	.	0.003	0.009	0	0	0
NFSH	0	0	0	0	0	0
.	.	0	0	0	0	0
NTPK	0	0	0	0	0	0
.	.	0	0	0	0	0
PDFH	3	0.003	0.005	0.002	0	0
.	.	0.003	0.007	0.005	0	0
PDSG	36	0.043	0.073	0.03	0.006	0.178
.	.	0.016	0.034	0.021	0.012	0.357
RVCS	59	0.069	0.063	0.096	0.035	0
.	.	0.022	0.039	0.041	0.028	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	231	0.253	0.31	0.272	0.127	0.147
.	.	0.067	0.141	0.096	0.062	0.295
SHRH	32	0.042	0.038	0.062	0.016	0
.	.	0.017	0.026	0.034	0.026	0
SMBF	22	0.027	0.025	0.022	0.038	0
.	.	0.012	0.019	0.02	0.028	0
SNGR	0	0	0	0	0	0
.	.	0	0	0	0	0
SNSG	230	0.256	0.257	0.306	0.142	1.108

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
	.	0.064	0.106	0.114	0.098	0.733
SNSN	0	0	0	0	0	0
	.	0	0	0	0	0
SPSN	0	0	0	0	0	0
	.	0	0	0	0	0
STCT	0	0	0	0	0	0
	.	0	0	0	0	0
STSN	0	0	0	0	0	0
	.	0	0	0	0	0
UCT	0	0	0	0	0	0
	.	0	0	0	0	0
UCY	0	0	0	0	0	0
	.	0	0	0	0	0
UST	0	0	0	0	0	0
	.	0	0	0	0	0
WLYE	12	0.014	0.014	0.024	0	0
	.	0.009	0.012	0.021	0	0
WSMW	0	0	0	0	0	0
	.	0	0	0	0	0
WTBS	1	0.001	0.003	0	0	0
	.	0.002	0.006	0	0	0
WTCP	0	0	0	0	0	0
	.	0	0	0	0	0
WTSK	0	0	0	0	0	0
	.	0	0	0	0	0
YWPH	0	0	0	0	0	0
	.	0	0	0	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 Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
BKBH	0	0	0	0	0	0
	.	0	0	0	0	0
BLGL	0	0	0	0	0	0
	.	0	0	0	0	0
BMBF	2	0.002	0.003	0.003	0	0
	.	0.003	0.005	0.005	0	0
BRBT	3	0.004	0.007	0	0.004	0
	.	0.004	0.01	0	0.008	0
BUSK	2	0.002	0	0.003	0.004	0
	.	0.003	0	0.005	0.008	0
CARP	15	0.015	0.015	0.024	0	0.042
	.	0.009	0.016	0.017	0	0.083
CNCF	192	0.185	0.124	0.324	0.076	0.041
	.	0.163	0.075	0.431	0.056	0.082
CSCO	0	0	0	0	0	0
	.	0	0	0	0	0
ERSN	31	0.032	0.026	0.051	0.013	0
	.	0.029	0.025	0.073	0.015	0
FHCB	104	0.109	0.082	0.159	0.066	0.169
	.	0.036	0.038	0.084	0.045	0.128
FHMW	2	0.002	0.005	0	0	0
	.	0.004	0.01	0	0	0
FWDM	0	0	0	0	0	0
	.	0	0	0	0	0
GDEY	40	0.06	0.119	0.041	0	0.041
	.	0.066	0.176	0.034	0	0.082
GNSF	1	0.003	0.008	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
	.	0.006	0.016	0	0	0
LKWF	1	0.001	0	0.003	0	0
	.	0.002	0	0.005	0	0
LNDC	0	0	0	0	0	0
	.	0	0	0	0	0
LNSK	2	0.002	0.006	0	0	0
	.	0.003	0.009	0	0	0
NFSH	0	0	0	0	0	0
	.	0	0	0	0	0
NTPK	0	0	0	0	0	0
	.	0	0	0	0	0
PDFH	0	0	0	0	0	0
	.	0	0	0	0	0
PDSG	27	0.028	0.046	0.026	0	0.041
	.	0.012	0.025	0.019	0	0.083
RVCS	16	0.019	0.026	0.026	0	0
	.	0.014	0.033	0.016	0	0
SFCB	76	0.071	0.06	0.093	0.061	0
	.	0.023	0.028	0.051	0.035	0
SGCB	157	0.157	0.208	0.138	0.118	0.045
	.	0.038	0.074	0.056	0.061	0.09
SGER	48	0.051	0.051	0.052	0.054	0
	.	0.019	0.03	0.033	0.042	0
SHRH	26	0.029	0.046	0.029	0.004	0.042
	.	0.015	0.031	0.026	0.008	0.083
SMBF	0	0	0	0	0	0
	.	0	0	0	0	0
SNGR	0	0	0	0	0	0
	.	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
SNSG	83	0.082	0.105	0.068	0.071	0.041
.	.	0.033	0.079	0.033	0.037	0.083
SNSN	0	0	0	0	0	0
.	.	0	0	0	0	0
SPSN	0	0	0	0	0	0
.	.	0	0	0	0	0
STCT	25	0.028	0.024	0.03	0.029	0.041
.	.	0.016	0.029	0.027	0.031	0.083
STSN	1	0.001	0	0.003	0	0
.	.	0.002	0	0.005	0	0
UCT	0	0	0	0	0	0
.	.	0	0	0	0	0
UCY	0	0	0	0	0	0
.	.	0	0	0	0	0
UST	0	0	0	0	0	0
.	.	0	0	0	0	0
WLYE	6	0.006	0.005	0.008	0.004	0
.	.	0.006	0.01	0.01	0.009	0
WSMW	1	0.001	0	0.003	0	0
.	.	0.002	0	0.005	0	0
WTBS	0	0	0	0	0	0
.	.	0	0	0	0	0
WTCP	0	0	0	0	0	0
.	.	0	0	0	0	0
WTSK	2	0.002	0.003	0.003	0	0
.	.	0.003	0.005	0.005	0	0
YWPH	0	0	0	0	0	0
.	.	0	0	0	0	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 Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS
BKBH	1	0.006	0	0	0.167	0	0	0
	.	0.011	0	0	0.333	0	0	0
BLGL	2	0.011	0.015	0.013	0	0	0	0
	.	0.016	0.03	0.026	0	0	0	0
BMBF	19	0.109	0.182	0.026	0.333	0	0.158	0
	.	0.08	0.183	0.036	0.422	0	0.316	0
BRBT	3	0.017	0.015	0.026	0	0	0	0
	.	0.02	0.03	0.036	0	0	0	0
BUSK	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
CARP	55	0.314	0.273	0.286	1.5	0	0	1.5
	.	0.176	0.227	0.271	2.62	0	0	1.291
CNCF	1	0.006	0	0.013	0	0	0	0
	.	0.011	0	0.026	0	0	0	0
CSCO	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
ERSN	6002	34.297	27.545	34.273	33.167	153	46.684	0
	.	13.139	14.704	20.93	36.053	285.071	54.814	0
FHCB	100	0.571	0.667	0.597	0.667	0.333	0.263	0
	.	0.263	0.303	0.525	1.333	0.667	0.3	0

species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS
FHMW	193	1.103	1.879	0.675	0.667	0	0.684	0
	.	0.749	1.899	0.43	0.843	0	0.866	0
FWDM	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
GDEY	37	0.211	0.167	0.234	0.167	0.667	0.158	0.5
	.	0.102	0.14	0.173	0.333	1.333	0.316	0.577
GNSF	16	0.091	0.182	0.039	0.167	0	0	0
	.	0.08	0.197	0.058	0.333	0	0	0
LKWF	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
LNDC	19	0.109	0.076	0.156	0.167	0	0.053	0
	.	0.068	0.09	0.128	0.333	0	0.105	0
LNSK	8	0.046	0.076	0.026	0	0	0.053	0
	.	0.036	0.079	0.036	0	0	0.105	0
NFSH	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
NTPK	5	0.029	0.015	0.026	0	0	0.053	0.25
	.	0.025	0.03	0.036	0	0	0.105	0.5
PDFH	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
RVCS	197	1.126	1.015	1.545	0.833	0.333	0.263	0
	.	0.448	0.634	0.844	0.955	0.667	0.337	0
SFCB	0	0	0	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS
	.	0	0	0	0	0	0	0
SGCB	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
SGER	29	0.166	0.076	0.234	0.167	0	0.053	1
	.	0.071	0.066	0.122	0.333	0	0.105	1.414
SHRH	1	0.006	0.015	0	0	0	0	0
	.	0.011	0.03	0	0	0	0	0
SMBF	21	0.12	0.152	0.091	0.167	0	0	0.75
	.	0.105	0.229	0.112	0.333	0	0	1.5
SNGR	2	0.011	0	0.026	0	0	0	0
	.	0.023	0	0.052	0	0	0	0
SNSG	0	0	0	0	0	0	0	0
	.	0	0	0	0	0	0	0
SNSN	21	0.12	0.061	0.195	0	0.667	0	0
	.	0.069	0.073	0.134	0	1.333	0	0
SPSN	1	0.006	0	0	0	0	0.053	0
	.	0.011	0	0	0	0	0.105	0
STCT	29	0.166	0.061	0.195	0.333	0	0.421	0
	.	0.106	0.095	0.196	0.422	0	0.441	0
STSN	32	0.183	0.318	0.143	0	0	0	0
	.	0.216	0.548	0.147	0	0	0	0
UCT	2	0.011	0.03	0	0	0	0	0
	.	0.023	0.061	0	0	0	0	0
UCY	2	0.011	0.03	0	0	0	0	0
	.	0.023	0.061	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS
UST	1	0.006	0	0.013	0	0	0	0
	.	0.011	0	0.026	0	0	0	0
WLYE	2	0.011	0.03	0	0	0	0	0
	.	0.016	0.043	0	0	0	0	0
WSMW	266	1.52	3.47	0.273	0.333	1.333	0.526	0
	.	1.484	3.896	0.155	0.422	1.333	0.739	0
WTBS	2	0.011	0	0.026	0	0	0	0
	.	0.016	0	0.036	0	0	0	0
WTCP	68	0.389	0.485	0.208	0	0	0.368	3.25
	.	0.299	0.622	0.241	0	0	0.438	6.5
WTSK	67	0.383	0.5	0.221	0.5	3.333	0.053	0.75
	.	0.189	0.399	0.146	0.683	4.667	0.105	0.957
YWPH	3	0.017	0.03	0.013	0	0	0	0
	.	0.02	0.043	0.026	0	0	0	0

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	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
BKBH	0	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	0
BMBF	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
BRBT	9	0.051	0.052	0	0.056	0	0.5
.	.	0.037	0.063	0	0.055	0	1
BUSK	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
CARP	15	0.085	0.065	0.75	0.07	0.091	0
.	.	0.056	0.057	0.957	0.093	0.182	0
CNCF	149	0.847	0.714	1.75	0.958	0.818	0.5
.	.	0.2	0.266	0.5	0.362	0.537	1
CSCO	0	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	0
FHCB	51	0.29	0.286	0	0.352	0.182	0
.	.	0.107	0.156	0	0.193	0.214	0
FHMW	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
FWDM	3	0.017	0	0.25	0	0.045	0.5
.	.	0.02	0	0.5	0	0.091	1
GDEY	55	0.313	0.325	0.5	0.366	0.091	0
.	.	0.104	0.163	0.577	0.18	0.125	0
GNSF	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
LKWF	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
LNDC	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
LNSK	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
NFSH	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
NTPK	1	0.006	0.013	0	0	0	0
.	.	0.011	0.026	0	0	0	0
PDFH	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
PDSG	140	0.795	1.065	0	0.761	0.136	0.5
.	.	0.23	0.394	0	0.358	0.15	1
RVCS	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SFCB	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SGCB	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SGER	6	0.034	0.052	0	0.014	0.045	0
.	.	0.032	0.063	0	0.028	0.091	0
SHRH	26	0.148	0.169	0	0.169	0.045	0
.	.	0.084	0.15	0	0.127	0.091	0
SMBF	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SNGR	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SNSG	183	1.04	0.792	0	1.408	0.864	1.5
.	.	0.237	0.327	0	0.424	0.531	1
SNSN	0	0	0	0	0	0	0
.	.	0	0	0	0	0	0
SPSN	0	0	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
	.	0	0	0	0	0	0
STCT	60	0.341	0.364	0.75	0.239	0.5	0.5
	.	0.138	0.185	1.5	0.168	0.681	1
STSN	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
UCT	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
UCY	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
UST	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
WLYE	3	0.017	0.013	0.25	0	0.045	0
	.	0.02	0.026	0.5	0	0.091	0
WSMW	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
WTBS	1	0.006	0.013	0	0	0	0
	.	0.011	0.026	0	0	0	0
WTCP	0	0	0	0	0	0	0
	.	0	0	0	0	0	0
WTSK	2	0.011	0	0	0.014	0.045	0
	.	0.016	0	0	0.028	0.091	0
YWPH	0	0	0	0	0	0	0

Appendix G. Hatchery names, locations and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2013 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	<u>Sturgeon Season</u>		<u>Fish Community Season</u>			<u>Both Seasons</u>
	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
BKBH	0	0	0	0.006	0	0
BLGL	0	0	0	0.011	0	0
BMBF	0.016	0	0.028	0.109	0.004	0
BRBT	0.002	0.003	0.002	0.017	0.004	0.051
BUSK	0.005	0	0.027	0	0.004	0
CARP	0.032	0.016	0.012	0.314	0.015	0.085
CNCF	0.079	0.299	0.046	0.006	0.072	0.847
CSCO	0.002	0	0	0	0	0
ERSN	0	0.002	0	34.297	0.061	0
FHCB	0.047	0.034	0.119	0.571	0.183	0.29
FHMW	0	0	0	1.103	0.004	0
FWDM	0	0	0	0	0	0.017
GDEY	0.185	0.008	0.183	0.211	0.112	0.313
GNSF	0	0	0	0.091	0.006	0
LKWF	0	0	0.008	0	0.002	0
LNDC	0	0	0	0.109	0	0
LNSK	0	0.002	0.005	0.046	0.003	0
NFSH	0	0	0	0	0	0
NTPK	0	0	0	0.029	0	0.006
PDFH	0.006	0	0	0	0	0
PDSG	0.013	0.023	0.072	0	0.032	0.795
RVCS	0.071	0.011	0.066	1.126	0.027	0
SFCB	0	0.019	0	0	0.123	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
SGCB	0	0.141	0	0	0.173	0
SGER	0.416	0.036	0.089	0.166	0.066	0.034
SHRH	0.015	0.004	0.069	0.006	0.055	0.148
SMBF	0.028	0	0.025	0.12	0	0
SNGR	0	0	0	0.011	0	0
SNSG	0.155	0.061	0.357	0	0.103	1.04
SNSN	0	0	0	0.12	0	0
SPSN	0	0	0	0.006	0	0
STCT	0	0.042	0	0.166	0.014	0.341
STSN	0	0	0	0.183	0.002	0
UCT	0	0	0	0.011	0	0
UCY	0	0	0	0.011	0	0
UST	0	0	0	0.006	0	0
WLYE	0.019	0.004	0.009	0.011	0.008	0.017
WSMW	0	0	0	1.52	0.002	0
WTBS	0	0	0.002	0.011	0	0.006
WTCP	0	0	0	0.389	0	0
WTSK	0	0.002	0	0.383	0.002	0.011
YWPH	0	0	0	0.017	0	0

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 - 2013.

Bend Number	Bend River Mile	Coordinates*		2006	2007	2008	2009	2010	2011	2012	2013
		Latitude	Longitude								
1	1701.5	48.06744	105.53246						ST, FC		
2	1700	48.07314	105.52296							ST,FC	ST,FC
3	1698.5										
4	1697.5	48.0919	105.49388							ST,FC	
5	1696	48.09072	105.45751					ST, FC			ST,FC
6	1695	48.08947	105.43861		ST, FC		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	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						ST,FC
19	1675.5	48.09255	105.17268			ST, FC					

Bend Number	Bend River	Coordinates*		2006	2007	2008	2009	2010	2011	2012	2013
		Latitude	Longitude								
20	1674	48.07865	105.16694			ST, FC			ST, FC		
21	1672.5	48.07616	105.12389					ST, FC			
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		ST,FC
31	1660	48.07323	104.99768				ST, FC		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		ST,FC

Bend Number	Bend River	Coordinates*		2006	2007	2008	2009	2010	2011	2012	2013
		Latitude	Longitude								
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	
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					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		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					ST,FC
58	1628.5	48.12988	104.58845						ST, FC	ST,FC	
59	1627	48.11385	104.59247						ST, FC		

Bend Number	Bend River	Coordinates*		2006	2007	2008	2009	2010	2011	2012	2013
		Latitude	Longitude								
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					
65	1619.5	48.11113	104.45372						ST, FC		ST,FC
66	1618.5	48.09912	104.44811				ST, FC				
67	1617.5	48.09658	104.4437		ST, FC	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	48.04856	104.34785								ST,FC
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				ST,FC
75	1606.5	48.035	104.25092	ST, FC		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					ST,FC
78	1598.5	48.04596	104.18368	ST, FC		ST, FC					ST,FC

Bend Number	Bend River	Coordinates*		2006	2007	2008	2009	2010	2011	2012	2013
		Latitude	Longitude								
79	1597.5	48.03868	104.16394			ST, FC			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	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										
89	1587	47.99909	104.05392								ST,FC
90	1585.5	47.98677	104.01939							ST,FC	
91	1583.5	47.96973	104.01037								ST,FC