2011 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 2011 water year in segment 3 of the Missouri River was historic in its magnitude as well as duration. Although standard sampling ceased during the highest discharge periods, the sampling that occurred during both the sturgeon and fish community seasons was done in significantly higher flows than the previous five years of sampling. The high flows were a combination of Missouri River releases through the Fort Peck Dam powerhouse and spillway, as well as historically high Milk River flows. At its peak, the Missouri River in segment 3 reached 97,200 cfs on June 21st, but remained at or above 30,000 cfs from June 4th to August 13th. The large flows resulted in a significant reduction in effort of the standard sampling that had taken place over the previous five years.

Although standard sampling effort was lower in 2011 and the sampling that did take place occurred during periods of discharge that were two to three times higher than previous sampling efforts, more pallid sturgeon were captured than in all prior sampling years. A total of 193 pallid sturgeon *Scaphirhynchus albus* were collected in 2011, 167 of which were collected in the fish community season with the remaining 26 being collected during the sturgeon season. The increase in total pallid sturgeon catch can mainly be attributed to the use of trotlines, which captured 134, while otter trawls captured 36 and trammel nets 23. Of the total pallid sturgeon sampled using trotlines, 77 were captured using standard random sets, while the remaining 57 were captured during non-random targeted effort in the lower sections of segment 3.

While the total number of pallid captures was at a six year high, the CPUE of both trammel nets and otter trawls were slightly lower than all previous years of sampling. The lower CPUE estimates were likely due to increased flow and decreased capture efficiencies of these two standard gears. On the other hand, overall standard trotline CPUE was over double that of 2010 at 0.81 fish/ 20 hook night. The increase in trotline CPUE and subsequent decline in CPUE of the otter trawl and trammel nets lends further evidence to the reduced capture efficiencies of those two gears.

The size structure of the pallid sturgeon population in segment 3 continues to change. Over the past six years the proportion of larger fish contributing to the catch has continuously increased, while smaller fish have decreased. The average size of pallid sturgeon captured in the otter trawl has increased in every subsequent sampling year beginning with 237 mm in 2006 and ending in 338 mm during 2011. While the size structure is changing, the relative condition of

pallid sturgeon does not appear to be. The relative condition of fish within individual size classes of pallid sturgeon has remained relatively constant over the six years of sampling. However, the larger size classes have on average lower condition than smaller size classes. This could be indicative of less food available for larger fish that are likely relying more heavily on fish as a prey item as opposed to smaller fish that rely more heavily on macroinvertebrates.

During 2011 a total of 11 year classes of hatchery reared pallid sturgeon were sampled. The 2008 year class was best represented with 62 individuals, followed by the 2009 year class with 58 and the 2010 year class with 18. The oldest fish captured was from the 1997 year class, which is the oldest age class of hatchery reared fish in the river. This fish was also the largest pallid we captured measuring 716 mm and weighing 1,320 g. No general patter was observed as to where pallid sturgeon were collected in segment 3 during 2011, since pallid sturgeon were collected throughout the length of segment 3 in a relatively uniform fashion.

Differing from pallid sturgeon, overall CPUE of shovelnose sturgeon *S. platorynchus* in all three standard gears were substantially lower in 2011, when compared to all prior sampling years. However, proportion of the total catch made up by stock and sub-stock sized shovelnose was higher in 2011 than previous years. This is likely due to the excellent shovelnose production and recruitment that was observed in 2010. The overall decrease in shovelnose CPUE was likely due to higher discharge and reduced capture efficiencies.

While shovelnose sturgeon showed a substantial decrease in CPUE for all gears, a similar magnitude in decline was not observed for pallid sturgeon. Therefore, it is possible that more pallid sturgeon were using segment 3 than in previous years. The high flows and suspended sediment loads in conjunction with a newly formed channel may have made conditions in segment 3 more suitable for pallid sturgeon and they may have migrated upstream into the area during the sampling season. Future sampling under more traditional flows will be required to understand if the relative abundance of pallid sturgeon in segment 3 has changed for the long-term.

Due to higher than normal flows it is also to make direct comparisons between years for other native target species like sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, western silvery minnows *Hybognathus argyritis*, sand shiner *Notropis stramineus*, blue sucker *Cyceptus elongates* and sauger *Sander canadense*. Both sturgeon chub and sicklefin chub have been monitored using the otter trawl. During 2011 sturgeon chub CPUE went down, while

sicklefin chub CPUE went up. While overall sturgeon chub CPUE declined, a relatively large proportion of the samples collected appeared to be age-1 fish, indicating relatively good recruitment in 2010. For sicklefin chubs, although their CPUE increased, all samples were age-2 or older. This is similar to previous sampling years, where no age-0 and few to zero age-1 fish have been collected in segment 3, indicating that production and rearing may be occurring downstream in segment 4 or in the Yellowstone River.

Too few blue suckers have been collected in our standard gears to make inferences on their relative abundance. The CPUE estimates of sauger were all lower in 2011 when compared to 2010, but within the range of estimates that have occurred in the past sampling years. For western silvery minnows and sand shiners, both had very low mini fyke net CPUE, but it is unknown how high flows may have affected that gear. Therefore, sampling in more normal flow conditions in 2012 should shed valuable light on how all these other native species were influenced by the historic waster conditions of 2011.

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Introduction

The sampling year of 2011 in segment 3 of the Missouri River was unique in several ways, including the historic water year, the abbreviated standard sampling seasons and the relatively high flows that occurred in tandem while sampling both the sturgeon and fish community seasons. The Missouri River peaked in segment 3 on June 21st at 97,200 cfs and flows were at or above 30,000 cfs from June 5th to August 15th. Although standard sampling did not take place during the extreme periods of flow, sampling did occur at flows that were two to three times more than during the previous five years of sampling. Due to the substantially higher than normal flows, our gear efficiencies were likely lower during 2011 than prior years. Therefore, making direct comparisons of CPUE from 2011 to previous years is cautioned.

Background

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

The Pallid Sturgeon Population Assessment Program (program) is guided by the RPA's in the 2003 Amendment to the 2000 Biological Opinion. The program is a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitats used by wild and hatchery reared juvenile pallid sturgeon (Welker and Drobish 2011). The 2000 Biological Opinion divides the program area into river and reservoir segments and assigns high, moderate, or low priority management action to these segments for pallid sturgeon (Welker and Drobish 2011). The focus of the program is on the high priority management action segments. The Missouri River from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, ND is listed as a high priority action segment.

The program has stratified the Missouri River from Fort Peck Dam to the headwaters of

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

The objectives of this program are as follows:

1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
2. Document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
3. Document population structure and dynamics of pallid sturgeon in the Missouri River System.
4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
5. Document annual results and long-term trends of habitat usage of the native target species by season and life stage.
6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

Sampling Season and Species

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

The fish community season extends from the beginning of July till the end of October and is designed not only to monitor sturgeon, but also monitor other native Missouri River fish

populations. Both trammel nets and otter trawls are used during the fish community season, however mini fyke nets are added as a standard gear to more effectively sample shallow water habitats < 1.2 m in depth.

In addition to pallid sturgeon, the program is designed to monitor nine other native Missouri River species labeled "target" species. These include, shovelnose sturgeon *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, plains minnow *Hybognathus placitus*, western silvery minnow *H. argyritis*, and sand shiner *Notropis stramineus*. This suite of species was selected for various reasons. First, some species may have similar habitat requirements as pallid sturgeon and therefore by monitoring their populations we may gain further insight into pallid sturgeon habitat and how anthropomorphic and natural changes to the Missouri River affect native fish assemblages. Secondly, it is hypothesized that various chub species and other native fishes are an important component of pallid sturgeon diet, and thereby monitoring pallid sturgeon prey will allow us to better describe their habitat. Thirdly, we wouldn't expect to see an immediate response in a long-lived species like pallid sturgeon would be difficult to measure when environmental conditions change from either favorable or detrimental conditions. Thus, by monitoring short-lived native fishes we may be able to correlate environmental conditions to changes in fish populations on a much shorter time interval and make inferences on how pallid sturgeon populations may be affected.

Study Area

Montana Fish, Wildlife & Parks samples three segments on the Missouri River below Fort Peck Dam to its confluence with the Yellowstone River in accordance with the Pallid Sturgeon Population Assessment Program. Study segment 3 of the Missouri River Pallid Sturgeon Population Assessment Program encompasses 119 river miles from Wolf Point, MT to the confluence of the Missouri and Yellowstone Rivers in North Dakota. In this large section, the river has completely transitioned from a cold clear cobble substrate river in segment 2 to a warm turbid prairie river, more similar to its natural characteristics (Galat et al, 2005). The aggrading streambed of segment 3 is flanked by stream deposited sediment of the Fort Union Formation (NRIS, 2007). This stretch of river is slightly less flow regulated than upstream

segments due to the tributaries and runoff events. There are five major tributaries that influence this section of river, which include the Milk River, Redwater River, Poplar River, Big Muddy Creek, and Prairie Elk Creek. These sediment packed tributaries flush their warmer turbid waters into the Missouri River increasing flows and suspended sediment, which in turn enables sandbar and island formation. Turbidities in this stretch of river are greater than that of segment 2 and discharge constantly changes with precipitation events and tributary discharge. The species composition of this stretch of river is vastly different from the uppermost segment just below Fort Peck Dam. The non-native fish stocked for recreation are much less prevalent and the prevalence of native, non-sport fish is increased (Gardner and Stewart, 1987). This stretch of ever-changing river is diverse with over 36 species of fish, many of which are benthic specialists, exhibiting streamlined bodies and well-developed chemosensory organs for surviving the sometimes high flows and ever-turbid waters (Galat et al, 2005; Berry et al. 2004). This stretch of river can be highly dynamic and is more reminiscent of what the Missouri River looked like before it became one of the most regulated and impounded rivers in the United States (Galat et al, 2005). However, due to the extremely low spring and summer flows that we've experienced in the past three years due to the operations of Fort Peck Dam, habitat formation is not occurring as it might have during the high runoff years of the 1990's.

Methods

Sampling methods for the Pallid Sturgeon Population Assessment Program were conducted in accordance with the Standard Operating Procedures (Welker and Drobish 2011), which was established by representatives from State and Federal agencies involved with pallid sturgeon recovery on the Missouri River. For a detailed description of methodologies please see Welker and Drobish (2011). A general description of sampling guidelines follows.

Sampling Site Selection and Description

Montana Fish Wildlife & Parks (FWP) was contracted to sample Segment 1 from Fort Peck Dam (RM 1771.5) to the mouth of the Milk River (RM 1761), Segment 2 from the mouth of the Milk River (RM 1761) to Wolf Point (RM 1701.5) and Segment 3 from Wolf Point (RM 1701.5) to the Montana/North Dakota border (RM 1586.5). Segment 3 consisted of 22 randomly selected bends. However, due to high water conditions in 2011only 15 bends were sampled

during sturgeon season (April 1 through June 30) and 16 bends sampled during fish community (July 1 through October 28) season.

Two gears, the trammel net and otter trawl are considered standard gears for the sturgeon and fish community seasons. Trammel nets were used in 15 bends during season and 11 during fish community. Otter Trawls were used in 11 bends during sturgeon and 10 during fish community season. Additionally, mini fyke nets are also considered a standard gear for the fish community season and 13 randomly selected bends were sampled with mini fyke nets.

Trotlines were used again in segment 3 during 2011 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. Fourteen randomly chosen river bends were sampled using trotlines, five during the sturgeon season and seven during the fish community season. Random river bends for trotlines were chosen by moving one river bend upstream from the randomly chosen river bends for standard gears. This was done to minimize the influence of trotlines on our standard gears and make logistics easier. Since trotlines are a gear that requires attending a river bend on two consecutive days, it is logistically better to be able to set trotlines on the same day as otter trawling or drifting trammel nets occurs. We also wanted to make sure that one gear wasn't influencing the catch of other gears and by sampling the next river bend upstream we believe we achieved this. No marked pallid sturgeon captured in standard gears or trotlines were subsequently captured in different gear at an adjacent bend within the same sampling period in 2011. In addition, trotlines were used in wild fashion during September in the lower sections of segment 3 to increase the total catch of hatchery reared pallid sturgeon to further populate survival estimate models.

The Population Assessment Team developed a standard set of habitat classifications for the Missouri River (Appendix B) which consists of three distinct macrohabitats found in every bend, a main channel crossover (CHXO), main channel outside bend (OSB), and main channel inside bend (ISB). Each sampling bend was comprised of these three main macrohabitats. Nine additional macrohabitats were identified that may or may not be present in every bend: large tributary mouths (TRML), small tributary mouths (TRMS), confluence areas (CONF), large and small secondary connected channels (SCCL& SCCS), deranged channels (DRNG), braided channels (BRAD), dendritic channels (DEND) and non-connected secondary channel (SCN).

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

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

Sampling Gear

For specific information pertaining to the specific habitats gears are utilized in and physical measurements taken in accordance with sampling the various gears described below, please see Welker and Drobish (2011).

Trammel Net

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

Otter Trawl

The standard otter trawl has a length of 7.6 m, a width of 4.9 m and height of 0.9 m. The otter trawl has an inner mesh (6.35mm bar, #18 polyethylene twine) and outer mesh (38mmbar, #9 polyethylene twine) and a cod end opening of 406.4 mm. The trawl doors were made from 19.1 mm marine plywood and measured 762 mm x 381 mm. The trawl doors are used to keep the

mouth of the trawl open while deployed on the riverbed. The trawl also has a 7.9 m long tickler chain attached to the bottom of the mouth of the trawl, which aids in keeping it orientated on the riverbed and protecting the mouth when snags are encountered. The otter trawl was deployed from the bow of the boat parallel to the current with two 30.5 m ropes and towed downstream slightly faster than current speed for a minimum of 75 m and a maximum distance of 300 m.

Mini Fyke Nets

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

Trotlines

Trotlines consisted of 32 m nylon rope attached to both upstream and downstream anchors. Octopus style circle hooks were attached to the ropes using 136 kg monofilament line and commercial fishing clips. Twenty 45.7 cm leaders were used on each trotline each with a 2/0 Eagle Claw circle hook. Trotlines are set overnight and checked the next morning.

Data Collection and Analysis

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

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

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

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

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

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

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

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker and Drobish (2009). Two fin pectoral fin clips (~ 2 cm^2) are taken from any pallid sturgeon of unknown origin. Fin samples are then preserved in 95% non-denatured

alcohol for genetic analysis. All samples are sent to the U.S. Fish and Wildlife Service's Lamar Laboratory for analysis and archiving.

Relative Condition

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

Size Classes of Pallid and Shovelnose Sturgeon

We used the length categories proposed by Shuman et al. (2006) for pallid sturgeon and Quist et al. (1998) for shovelnose sturgeon when looking at the total proportion of fish captured by length. Additionally, we broke up sub-stock sizes for both pallid and shovelnose into two groups to aid in determining recruitment of young-of-the-year (YOY) sturgeon. Fork length categories for both species of sturgeon are given in all figures and tables pertaining to size classes.

Analyses

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

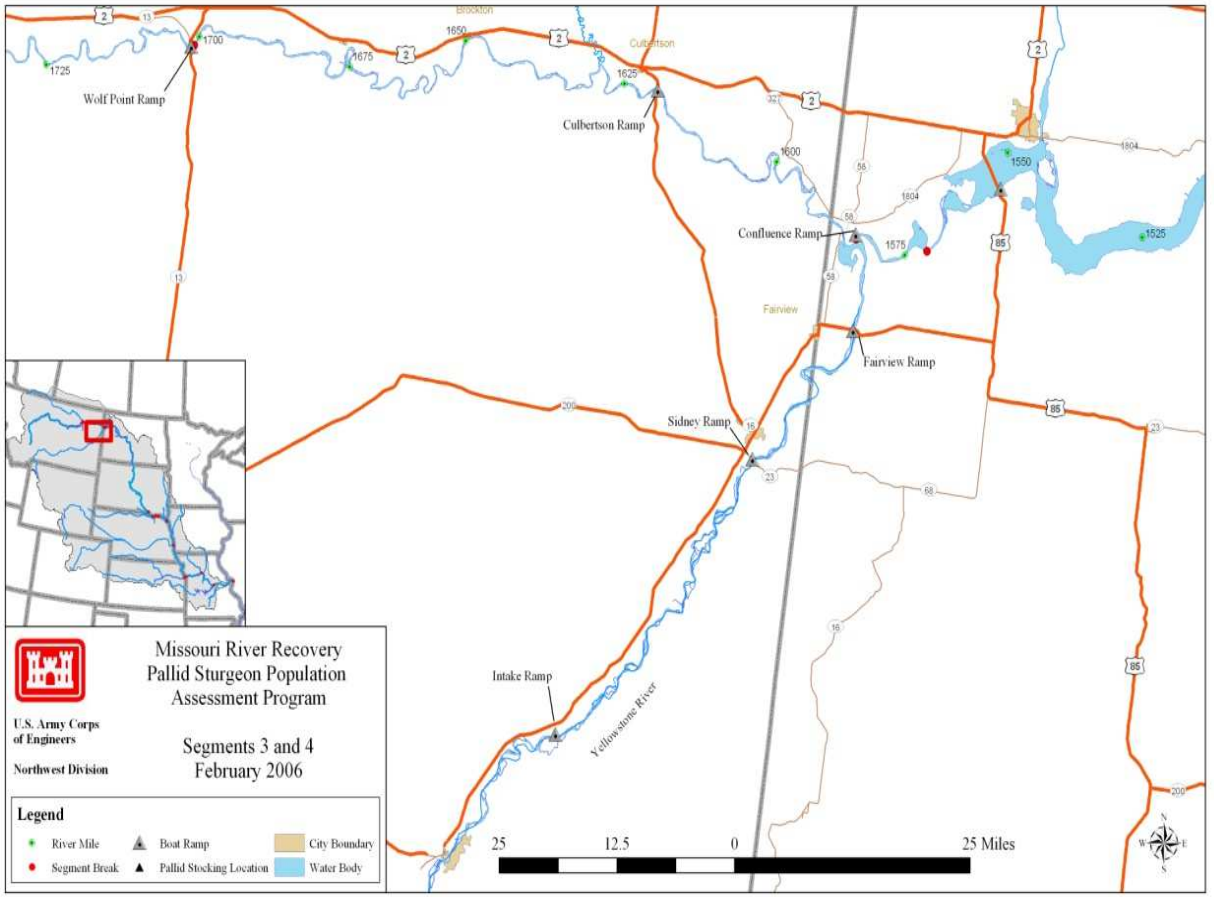

Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 15 randomly selected river bends were sampled using trammel nets and 11 bends sampled with the otter trawl during the sturgeon season of 2011. Each gear had an average of 8 random deployments (Table 1). In addition, 7 non random otter trawl and 8 trammel net deployments were made as duplicate passes subsequent to capturing pallid sturgeon. Trotlines were used in 5 randomly selected bends during the sturgeon season, each with eight subsamples.

During the fish community season 11 randomly selected bends were sampled with trammel nets and 10 with the otter trawl as well as 13 bends with mini fyke nets. Otter trawl and trammel nets had an additional 18 and 11 non-random duplicate subsamples deployed after catching a pallid sturgeon, respectively. Trotlines were set in 11 random river bends during the fish community season.

During September 19th and 20th, non-random trotline samples in addition to otter trawl and trammel nets deployments were made in non-random river bends to increase our pallid sturgeon catch. The increased numbers HRJPS recaptures will be used to populate survival estimates in RPMA 2.

Pallid Sturgeon

During 2011 a total of 193 pallid sturgeon were captured in segment 3 of the Missouri River during the standard sampling seasons, which was slightly higher than the 2010 field season when 172 were collected (Figure 10). This is substantial, since less effort was expended during the standard sampling seasons in 2011 due to high water when compared to 2010. By far more pallid sturgeon were sampled during the fish community season (n = 167) when compared to the sturgeon season (n = 26). Standard trotline sets accounted for 77 pallid sturgeon, while wild sampling captured 57. Standard trotline sets were the most effective gear at capturing pallid sturgeon even though only 12 bends were set using trotlines compared to 26 with trammel nets and 21 using otter trawls. Trotlines captured a total of 126 pallid sturgeon, followed by the otter trawl with 36, trammel nets with 23 and timed trotline sets with 8. Over the six years of standardized sampling in segment 3, a total of 833 pallid sturgeon have been collected.

Although the total numbers of pallid sturgeon captures has been high over the past three years, only one wild fish has been captured using standard gears (Figure 10).

More pallid sturgeon were captured in inside bends (n=109), when compared to channel crossovers (n = 48), large secondary channels (n=22) and outside bends (n = 14) (Table 2). In general, pallid sturgeon of all sizes are being captured in the inside bends at a higher proportion than inside bends are being sampled (Tables 4 through 8). Water temperature during pallid captures ranged from 4.6 C^o to 19.0 C^o (Table 2). Water clarity ranged from 32 NTU's to a high of 1,250 NTU's. Pallid sturgeon were captured at depths ranging from 0.7 m to 4.5 m.

While the total number of pallid sturgeon captured greatly increased starting in 2009 and has remained relatively high, the CPUE of our standard trammel nets and otter trawls has not. Overall trammel net CPUE was lower in 2011 when compared to both 2010 and 2009 (Figure 6). However, the higher discharges during the sampling season likely lowered our capture efficiency during 2011. Otter trawls followed a similar pattern, although CPUE was at a six year low in 2011 (Figure 7). Conversely, trotline CPUE was higher in 2011 from 2010 (Figure 8). During the fish community season trotline CPUE was 1.1 fish/ 20 hook night, or about 1 pallid sturgeon for every deployment. Similarly, overall trotline CPUE was more than twice as high during 2011 when compared to 2010. It is unclear at this time if higher discharge affected trotline efficiency, but these data suggest that the flows of approximately 30,000 cfs did not.

Pallid sturgeon were captured throughout the length of segment 3, however the highest catches occurred in the downstream portions of the segment starting at about river mile 1,630 (Figure 2). A similar pattern has been observed in all years of sampling, where higher catch rates occur at downstream river miles within segment 3. A similar pattern has been observed in segment 2 the upstream segment on the Missouri River.

Even though CPUE of our standard gears has not changed appreciably over the past six years of sampling, the size structure of the population has (Figure 3). Starting in 2006 the majority of the pallids captured where in the sub-stock size classes. In 2011 a much larger proportion of the total pallid catch from the stock and quality size classes showing that stocked fish are surviving and growing. During 2011, the average size of pallid sturgeon captured during the fish community season was larger than those of the sturgeon season. However, on average trotlines catch larger pallid sturgeon than the otter trawl, therefore as more fish are captured using trotlines the size structure of our total catch likely changes from gear selectivity.

During 2011 a total of 11 year classes of hatchery reared pallid sturgeon were sampled (Table 3). The 2008 year class was best represented with 62 individuals, followed by the 2009 year class with 58 and the 2010 year class with 18. The oldest fish captured was from the 1997 year class, which is the oldest age class of hatchery reared fish in the river. This fish was also the largest pallid we captured measuring 716 mm and weighing 1,320 g. The average relative condition factor of the year classes collected in 2011 ranged from 0.81 Kn for the 2002 year class to 1.16 Kn for the 2006 year class (Table 3). Overall, relative condition factor for sampled pallid sturgeon has not appreciably changed over the six years of sampling (Figure 4). However, the smaller sub-stock category (0-199 mm) has continuously been slightly higher than the 200 to 329 mm group (Figure 4).

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 2011.

Gear	Number of Bends	Mean deployments	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season										
1.0” Trammel Net	15	7.47	33	2	40	26	9	0	0	2
Otter Trawl	11	8	27	2	33	20	4	0	0	2
Fish Community Season										
1.0” Trammel Net	11	7	30	0	27	19	1	0	0	0
Mini-Fyke Net	13	7.54	29	0	43	5	12	5	4	0
Otter Trawl	10	7.6	28	0	25	13	10	0	0	0
Both Seasons										
Trot Lines	12	7.92	31	0	42	12	10	0	0	0

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

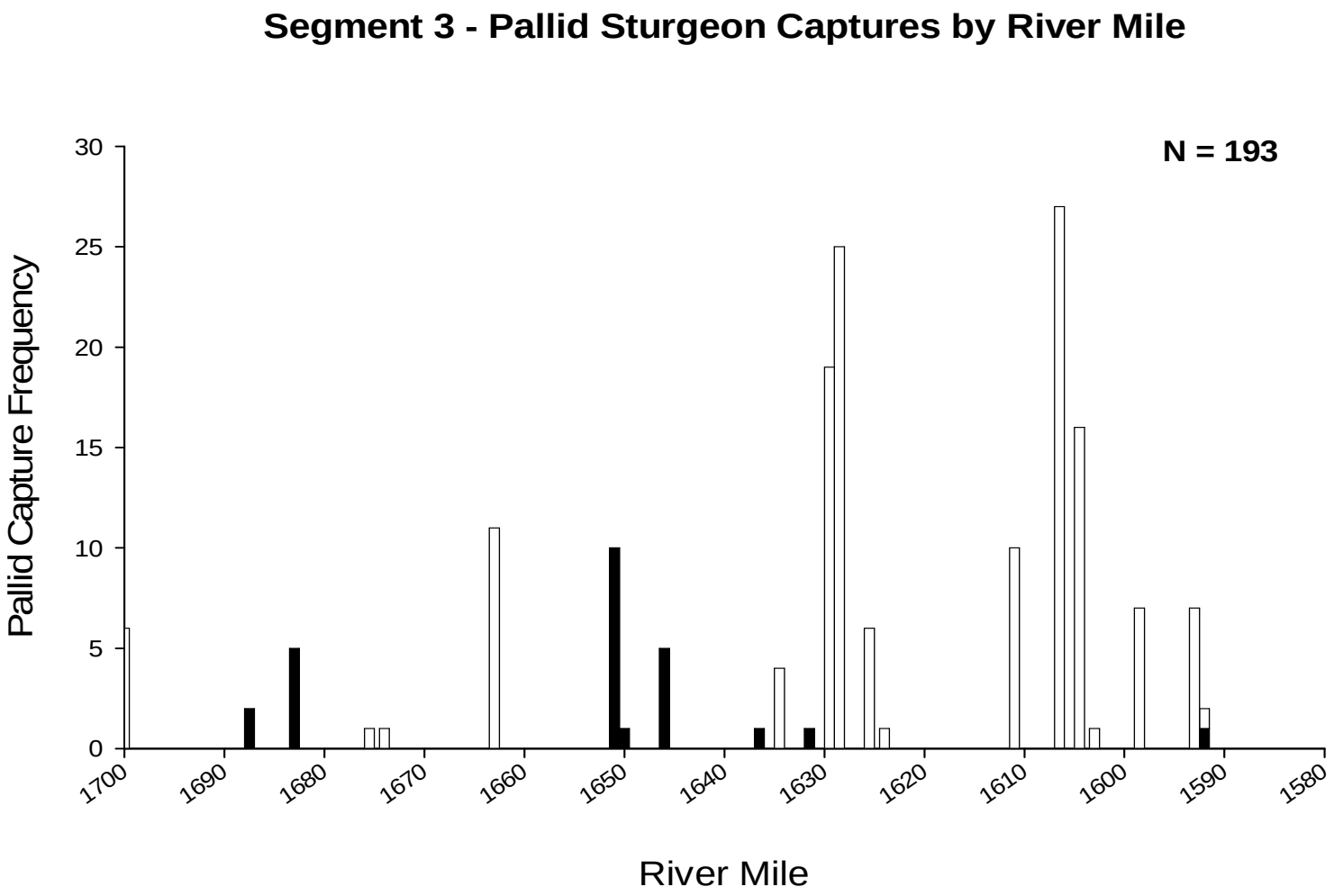

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2011. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2011. 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 (0.2-0.6)		0.02 (0.00-0.06)		14.9 (10.0-19.3)		55 (32-95)		.
	CHNB	2.7 (0.4-7.6)	2.1 (1.0-4.3)	0.79 (0.00-1.70)	0.59 (0.00-0.84)	12.4 (4.6-19.9)	12.2 (4.6-19.0)	316 (34-1148)	231 (34-1008)	48
CONF	CHNB	3.4 (2.4-4.5)		0.33 (0.32-0.34)		12.7 (12.3-13.6)		388 (359-416)		.
	BARS	0.4 (0.1-1.4)		0.02 (0.00-0.15)		14.6 (10.0-19.5)		56 (38-100)		.
ISB	CHNB	2.4 (0.7-7.6)	1.9 (0.7-3.3)	0.65 (0.00-1.30)	0.55 (0.00-1.00)	12.3 (4.6-20.1)	13.3 (5.3-19.0)	312 (35-1260)	150 (35-1050)	109
	BARS	0.4 (0.3-0.6)		0.00 (0.00-0.00)		15.8 (10.0-19.5)		60 (40-100)		.
OSB	CHNB	3.5 (1.4-6.2)	3.4 (2.0-4.5)	0.88 (0.26-1.46)	0.55 (0.26-0.80)	11.4 (4.8-19.0)	12.1 (5.1-15.5)	390 (37-1250)	286 (41-1250)	14
	BARS	0.4 (0.2-0.6)		0.00 (0.00-0.00)		19.1 (18.3-19.8)		59 (46-78)		.
SCCL	CHNB	2.3 (0.9-6.3)	2.1 (1.3-2.8)	0.63 (0.00-1.05)	0.48 (0.00-0.77)	13.4 (4.8-21.0)	16.3 (15.0-18.8)	399 (35-1156)	84 (35-100)	22
	BARS	0.3 (0.2-0.5)		0.07 (0.07-0.07)		16.7 (14.6-19.5)		69 (53-85)		.
SCCS	BARS	0.5 (0.4-0.6)		0.00 (0.00-0.00)		15.7 (14.4-19.5)		100 (100-100)		.
SCN	CHNB	8.0 (8.0-8.0)		. (.-.)		10.0 (10.0-10.0)		. (.-.)		.
TRML	CHNB	2.7 (2.1-3.1)		0.39 (0.39-0.39)		14.4 (12.7-15.3)		294 (290-298)		.

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 2011 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	.	.	.	716	1320.0	0.822	.	.
.	.	.	.	.	.	.	.	.	.
2001	2	.	.	.	526	482.5	0.824	.	.
.	.	.	.	.	69	261.0	0.093	.	.
2002	4	305	.	.	679	1090.8	0.805	0.126	.
.	.	.	.	.	28	176.1	0.038	.	.
2003	1	242	.	.	530	580.0	0.991	0.111	.
.	.	.	.	.	.	.	.	.	.
2004	6	626	1021.6	0.970	680	1203.5	0.831	0.260	0.833
.	.	56	319.2	0.003	90	467.6	0.060	0.170	1.194
2005	13	.	.	.	443	303.5	0.934	.	.
.	.	.	.	.	24	43.1	0.054	.	.
2006	12	225	34.0	1.031	385	201.1	1.164	0.134	0.146
.	.	.	.	.	33	27.3	0.531	.	.
2007	14	244	57.4	1.272	403	231.2	0.980	0.129	0.135
.	.	27	18.6	0.132	18	28.2	0.046	0.019	0.027
2008	62	261	67.9	1.107	377	180.9	0.958	0.152	0.160
.	.	31	29.0	0.078	11	15.3	0.038	0.027	0.030
2009	58	280	87.8	1.140	350	151.8	1.003	0.226	0.220
.	.	20	19.3	0.045	15	17.2	0.040	0.018	0.029
2010	18	310	110.3	1.050	360	148.9	0.897	0.476	0.403
.	.	24	29.1	0.067	25	27.0	0.067	0.066	0.108

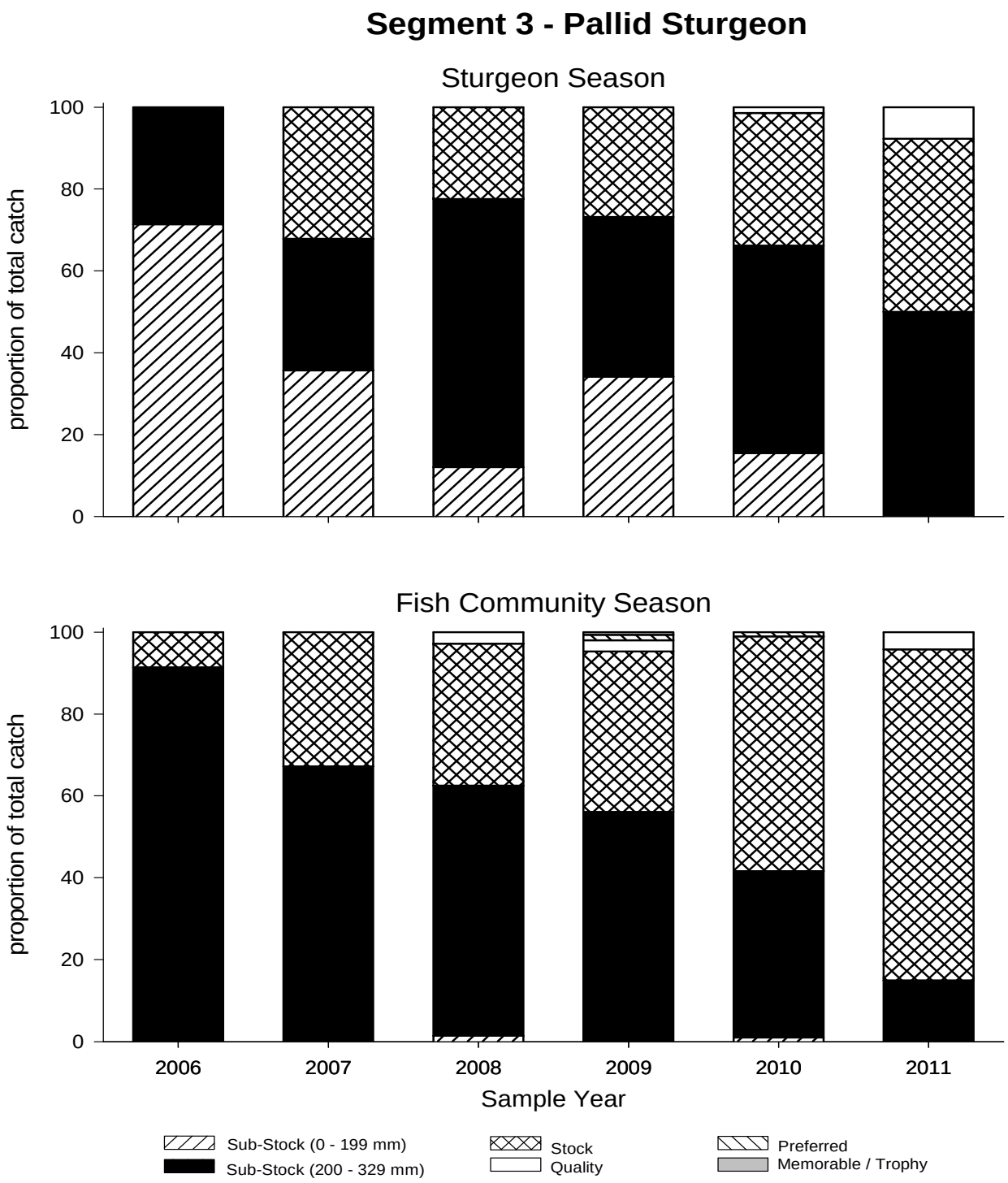

Figure 3. Proportion of total catch by length group for all pallid sturgeon captured with all gear by length category from 2006-2011 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

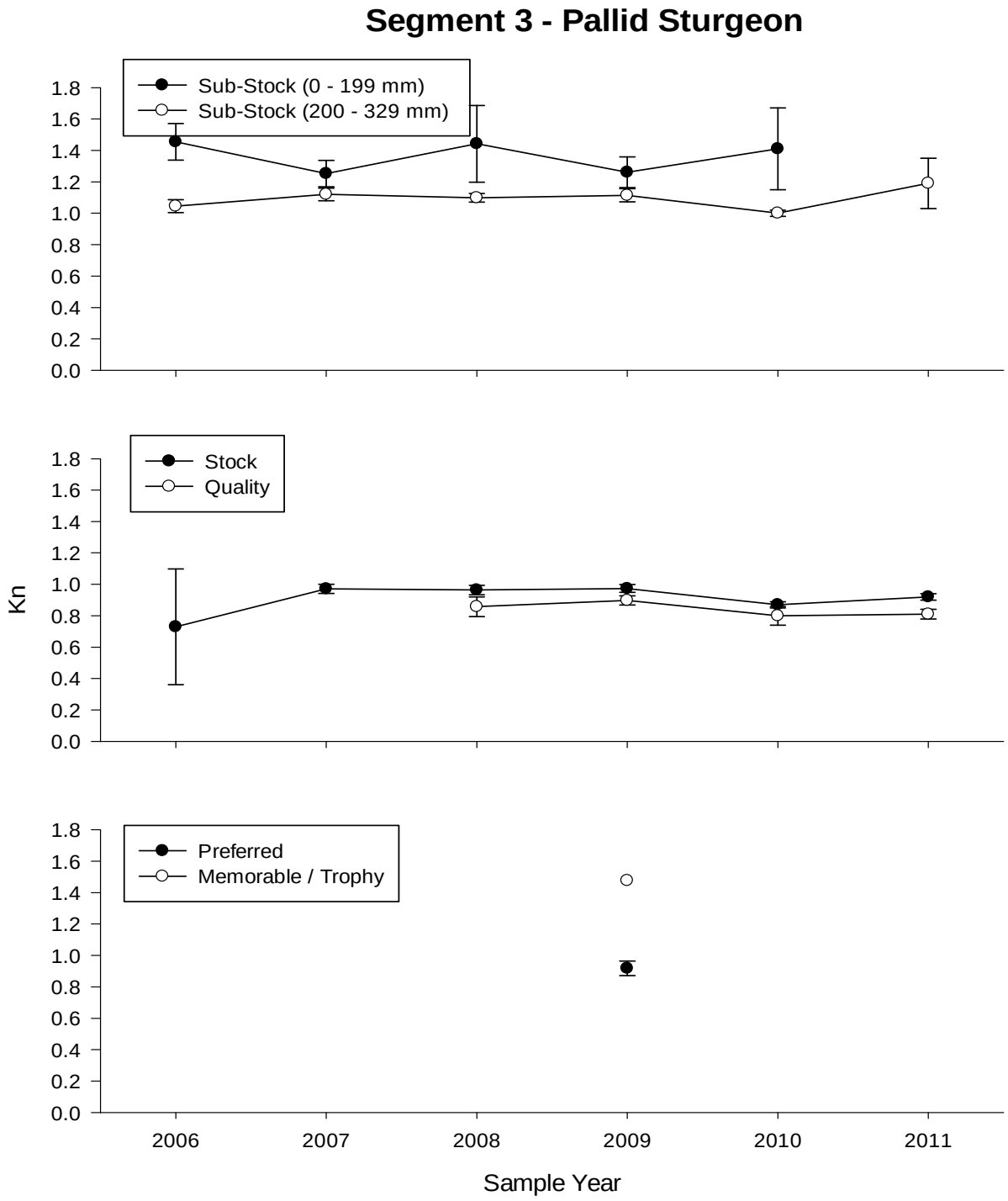

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2011 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor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

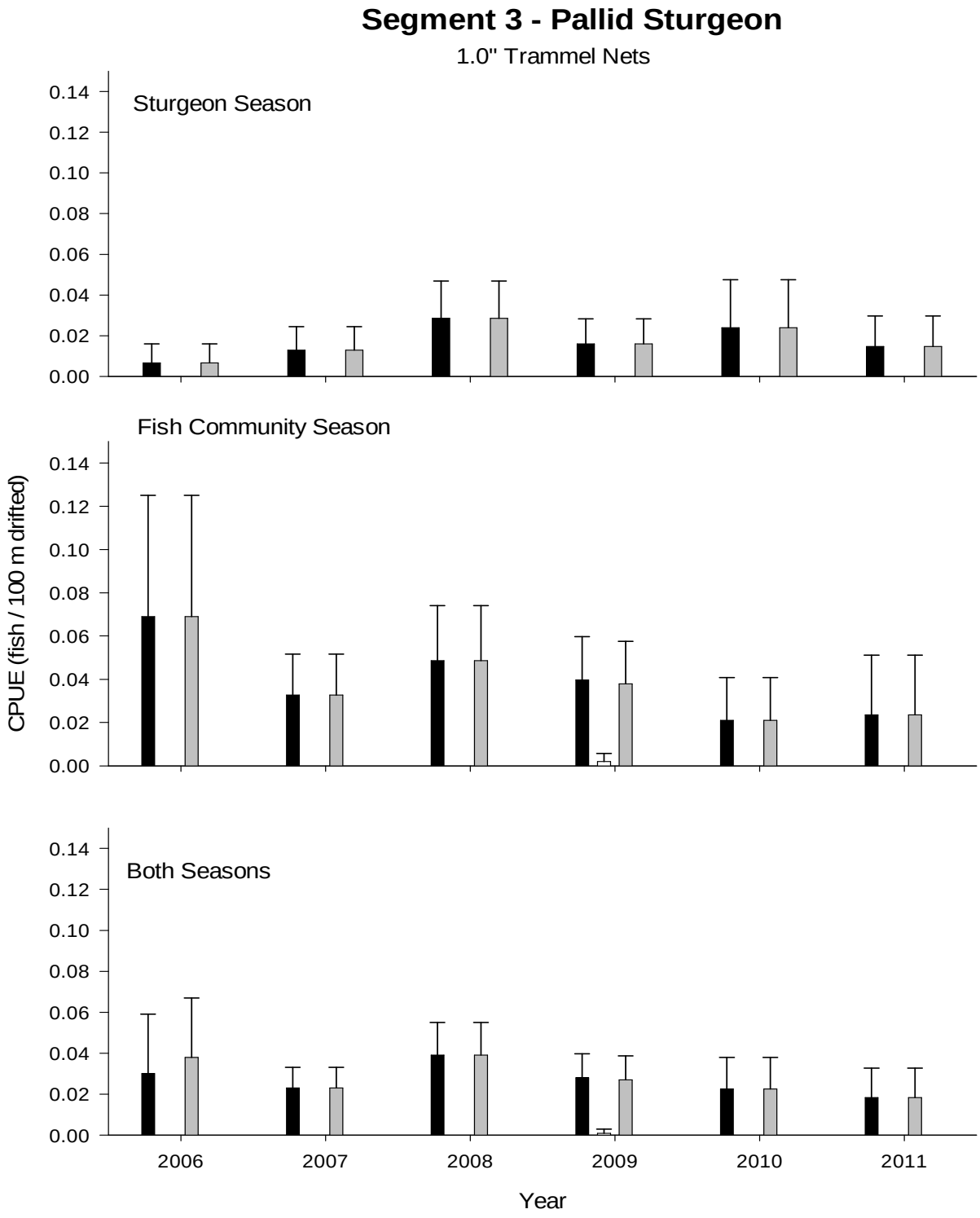

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2011. Pallid sturgeon of unknown origin are awaiting genetic verification.

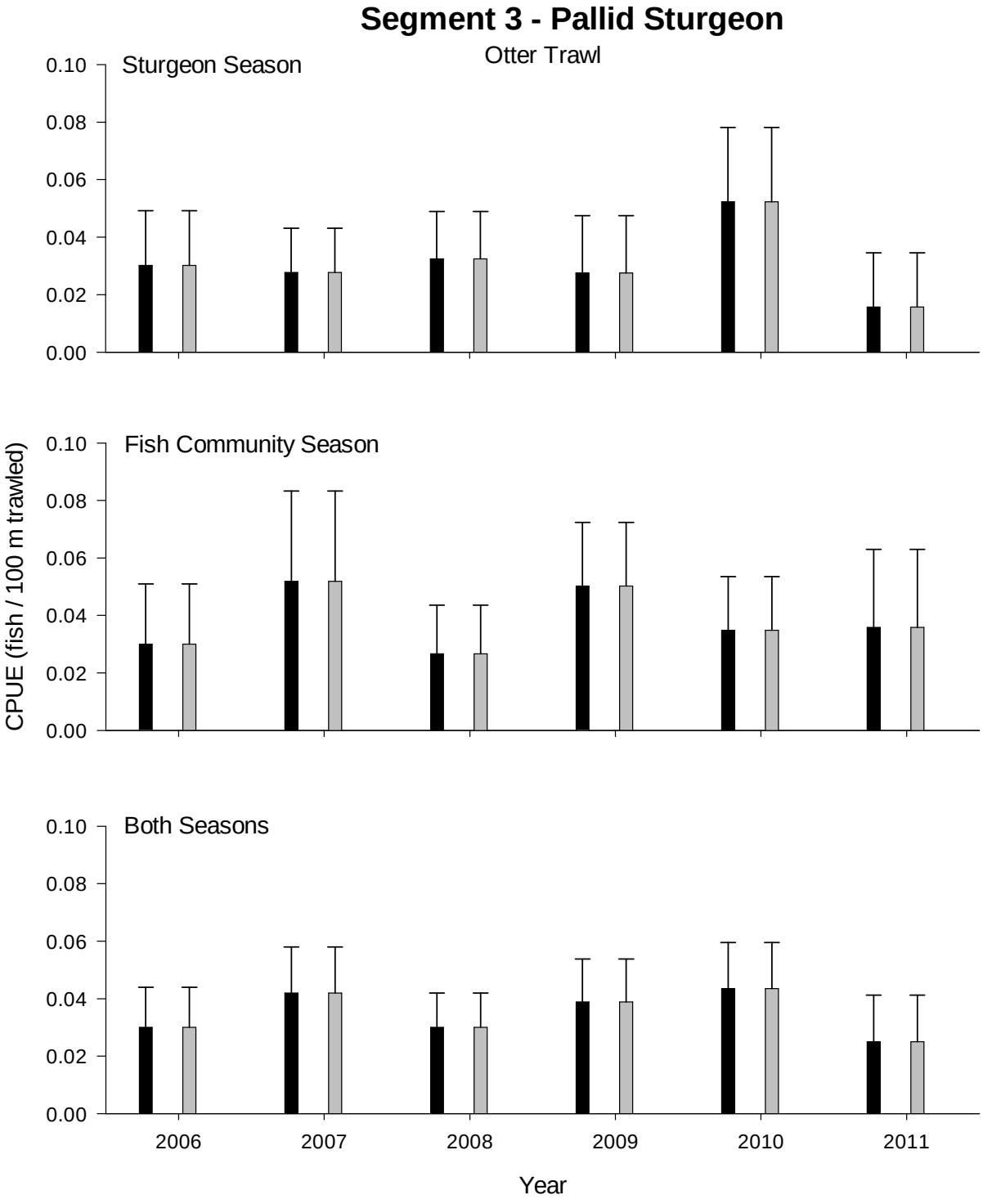

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2011. Pallid sturgeon of unknown origin are awaiting genetic verification.

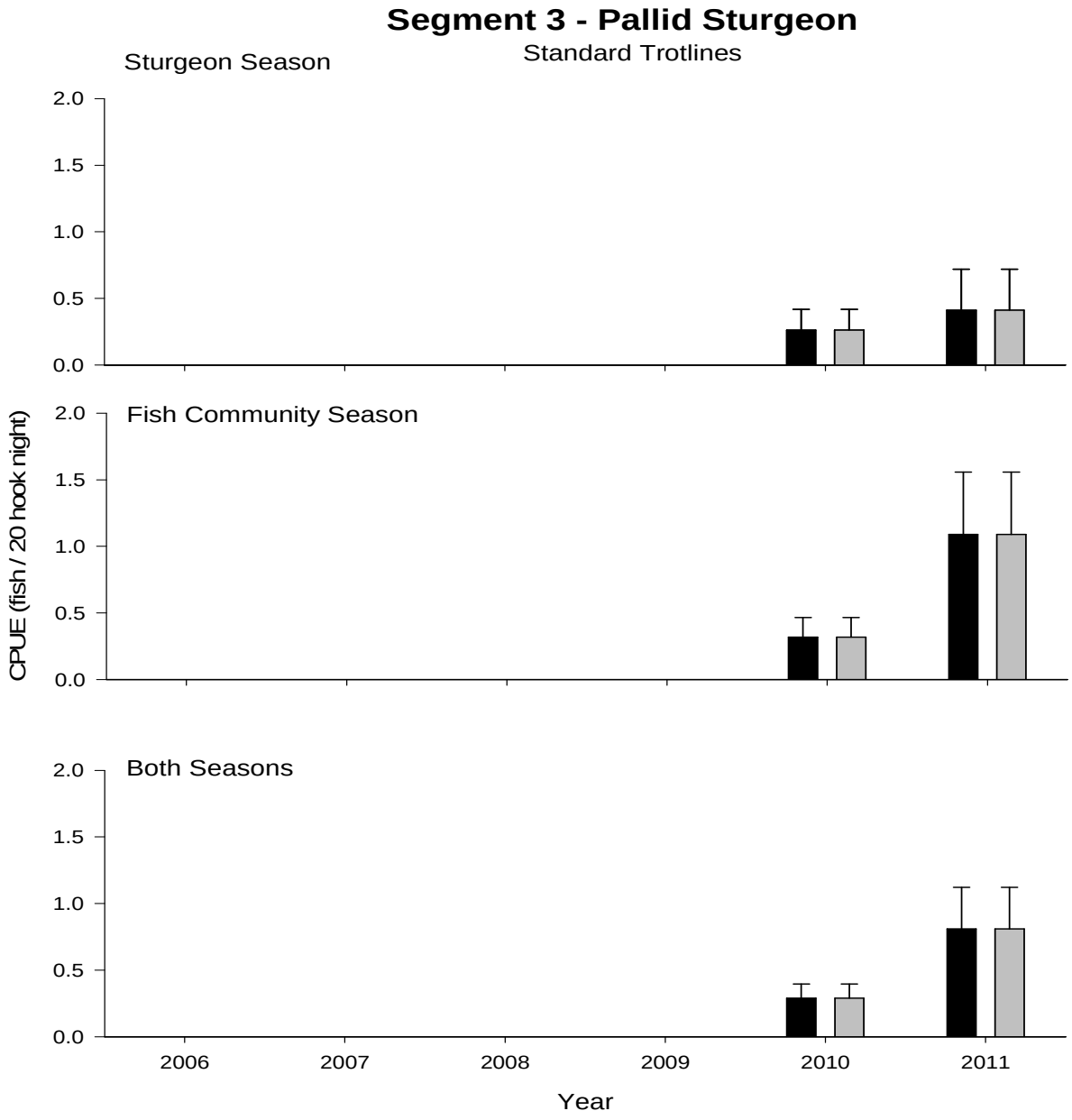

Figure 8. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 3 of the Missouri River from 2006-2011. Pallid sturgeon of unknown origin are awaiting genetic 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 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	0	0	0	0	0	0	0	0	0
		33	0	44	13	11	0	0	0

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
	2	50	0	50	0	0	0	0	0
1.0” Trammel Net		31	1	35	23	9	0	0	1
	3	33	0	33	33	0	0	0	0
Otter Trawl		32	2	39	21	4	0	0	2
Fish Community Season									
	3	33	0	67	0	0	0	0	0
1.0” Trammel Net		40	0	34	25	1	0	0	0
	0	0	0	0	0	0	0	0	0
Mini-Fyke Net		30	0	44	5	12	5	4	0
	1	100	0	0	0	0	0	0	0
Otter Trawl		37	0	34	17	12	0	0	0
Both Seasons									
	11	45	0	55	0	0	0	0	0
Trot Lines		33	0	44	13	11	0	0	0

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	2	50	0	0	50	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	1	100	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	7	43	0	43	0	14	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	59	24	0	69	2	5	0	0	0
		33	0	44	13	11	0	0	0

Table 7. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	7	14	0	86	0	0	0	0	0
		33	0	44	13	11	0	0	0

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0” Trammel Net	4	50	0	25	25	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	4	50	0	25	25	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0” Trammel Net	3	33	0	67	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	8	50	0	38	0	13	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	77	26	0	69	1	4	0	0	0
		33	0	44	13	11	0	0	0

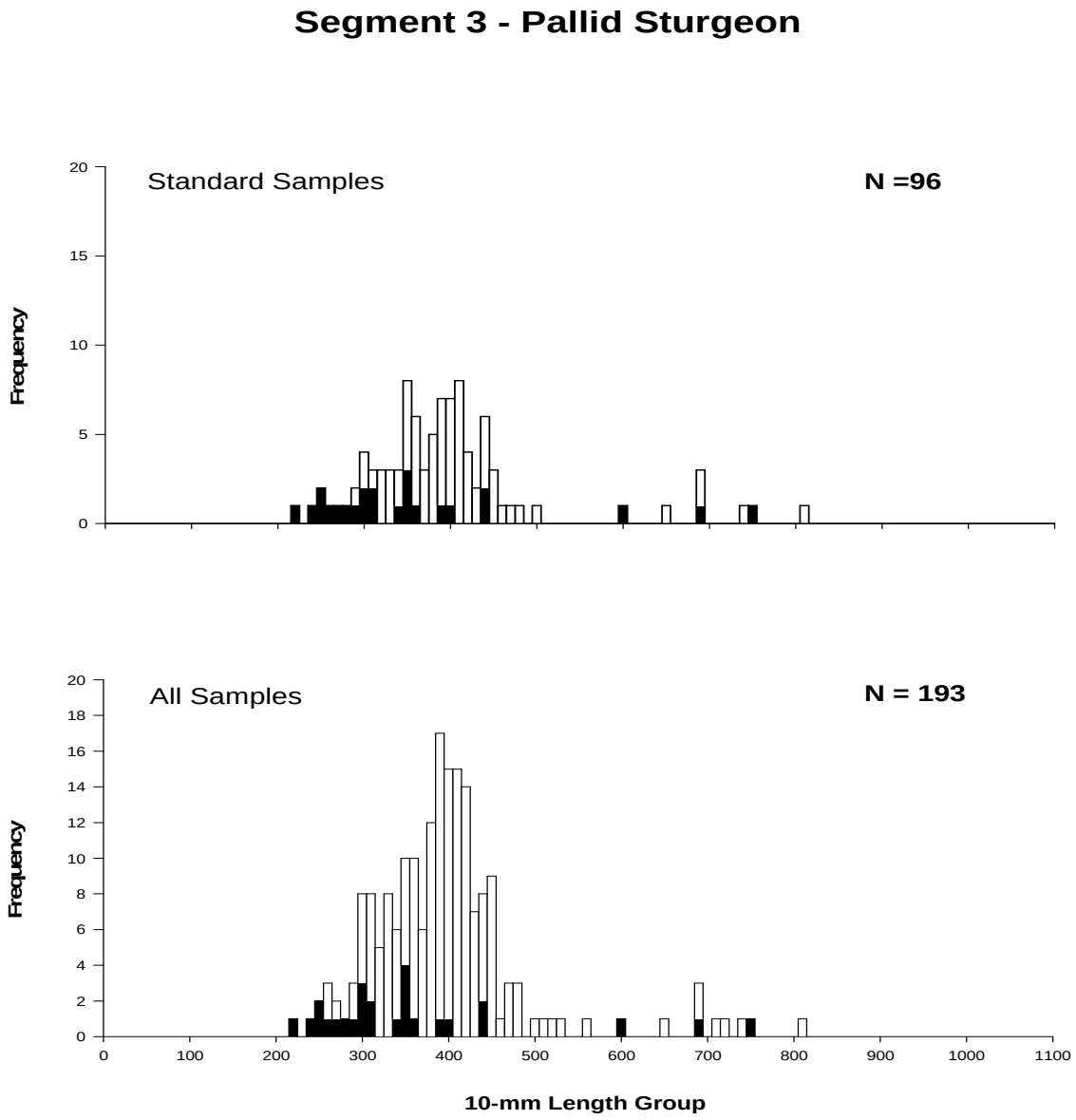

Figure 9. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011. Pallid sturgeon of unknown origin are awaiting genetic verification.

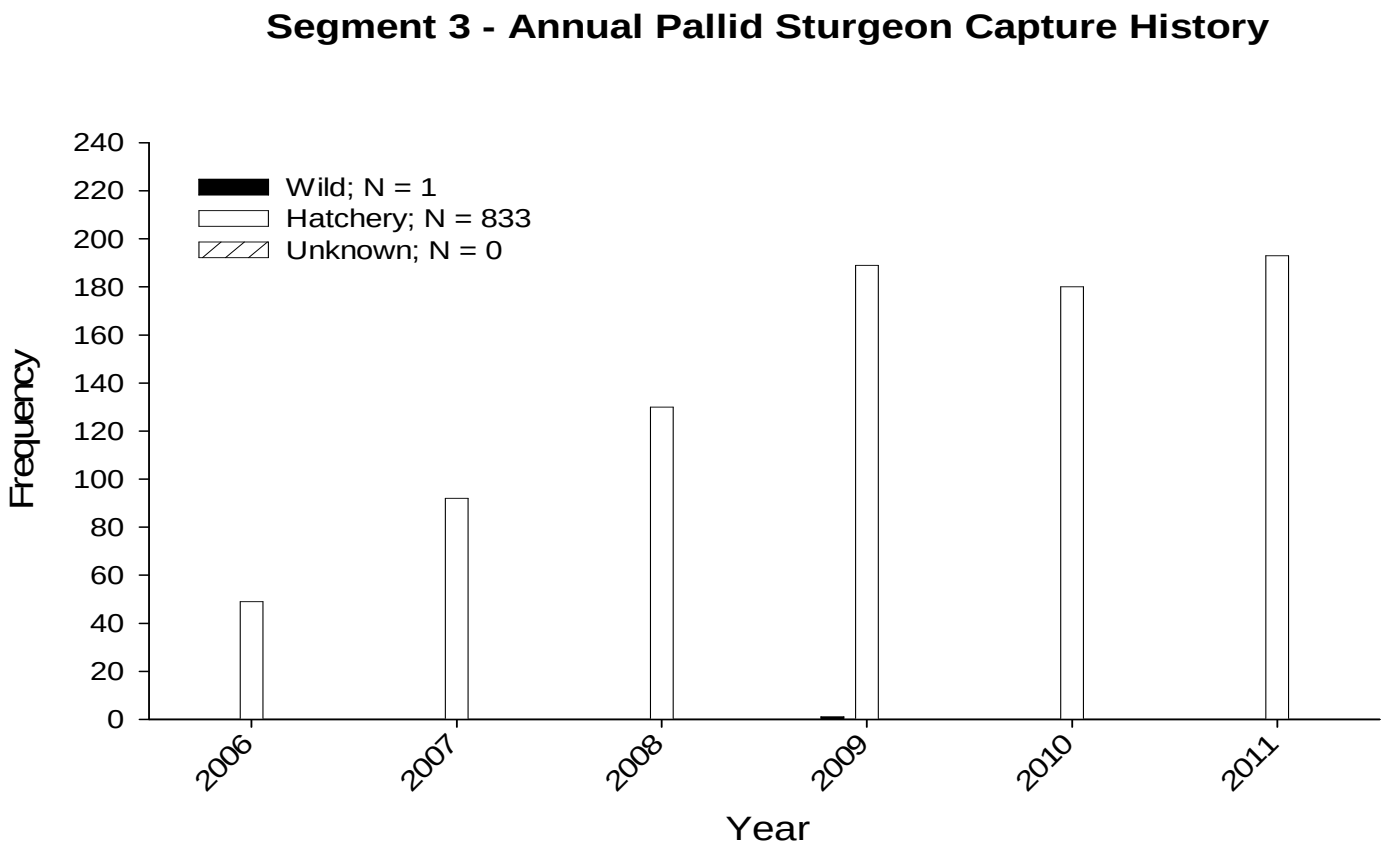

Figure 10. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2011. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by 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 2011 or during the previous five years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

During 2011 a total of 171 shovelnose sturgeon were sampled in segment 3 of the Missouri River, significantly lower than the 323 sampled in 2010, likely a relic of lower effort and high discharge throughout portions of both the sturgeon and fish community seasons. More shovelnose sturgeon were sampled during the fish community season (n = 133) than the sturgeon season (n = 38). Trotlines captured the most shovelnose sturgeon (n = 94) while trammel nets captured 55 and the otter trawl 22.

Overall shovelnose sturgeon CPUE was substantially down for both trammel nets and otter trawls during 2011(Figures 11 and 12). Due to the higher discharge in 2011, making direct comparisons between 2011 and the previous years would not be appropriate. However, even though overall CPUE was down, the CPUE of the smaller size classes was higher in 2011 when compared to previous years. This is likely due to the exceptional shovelnose sturgeon recruitment of 2010. Therefore, sampling in 2012 should give us a much clearer picture of how strong the 2010 year class of shovelnose sturgeon is. Dissimilar to the trammel net and otter trawl CPUE, trotline CPUE was similar in 2011 to 2010 (Figure 13). This lends evidence that trotlines may not be as affected by high flows as our other standard gears in regards to capturing shovelnose sturgeon.

The habitats where shovelnose sturgeon of various size classes were captured and the proportion those habitats were sampled can be found in Tables 9 through 13. In general, more shovelnose sturgeon are found in the channel crossover and inside bend habitats when compared to the outside bend.

The size structure of shovelnose sturgeon captured during 2011 lend further evidence to 2010 being an excellent production year (Figure 14). Although sampling efficiency was likely low, more sub-stock sized fish were collected in 2011 when compared to 2010 (Figure 15). Again, sampling in 2012 will further allow us to monitor the 2010 year class of shovelnose sturgeon.

Shovelnose sturgeon averaged 531 mm FL and 723 g in segment 3 during 2011. The largest and smallest fish measured 886 and 134 mm FL, respectively. No pattern has been observed in the relative weight of shovelnose sturgeon within a single size class over the six sampling seasons (Figure 16). However, the stock sized group has consistently had the highest on average relative weight of all size classes sampled, while the preferred size class has had the lowest.

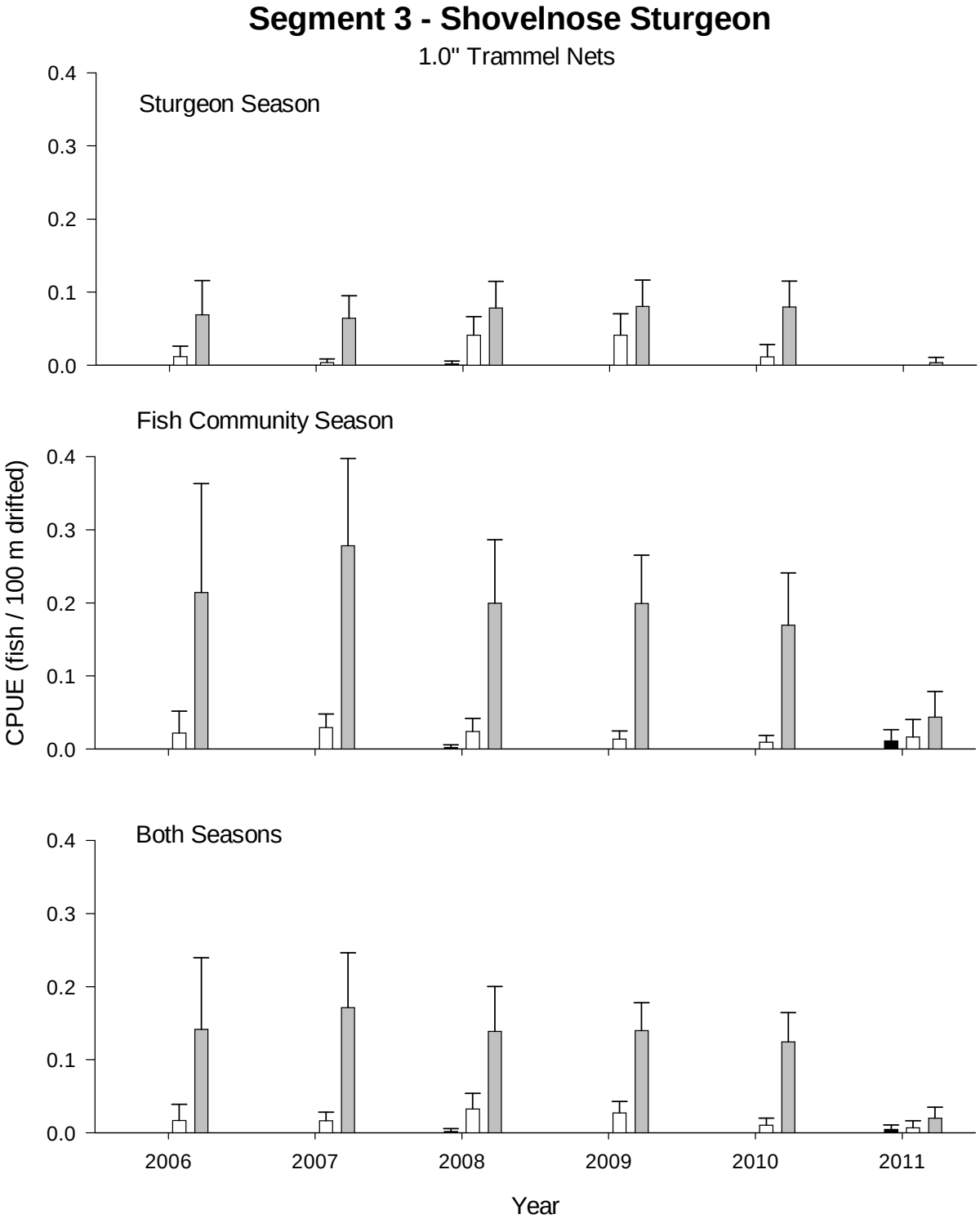

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2011.

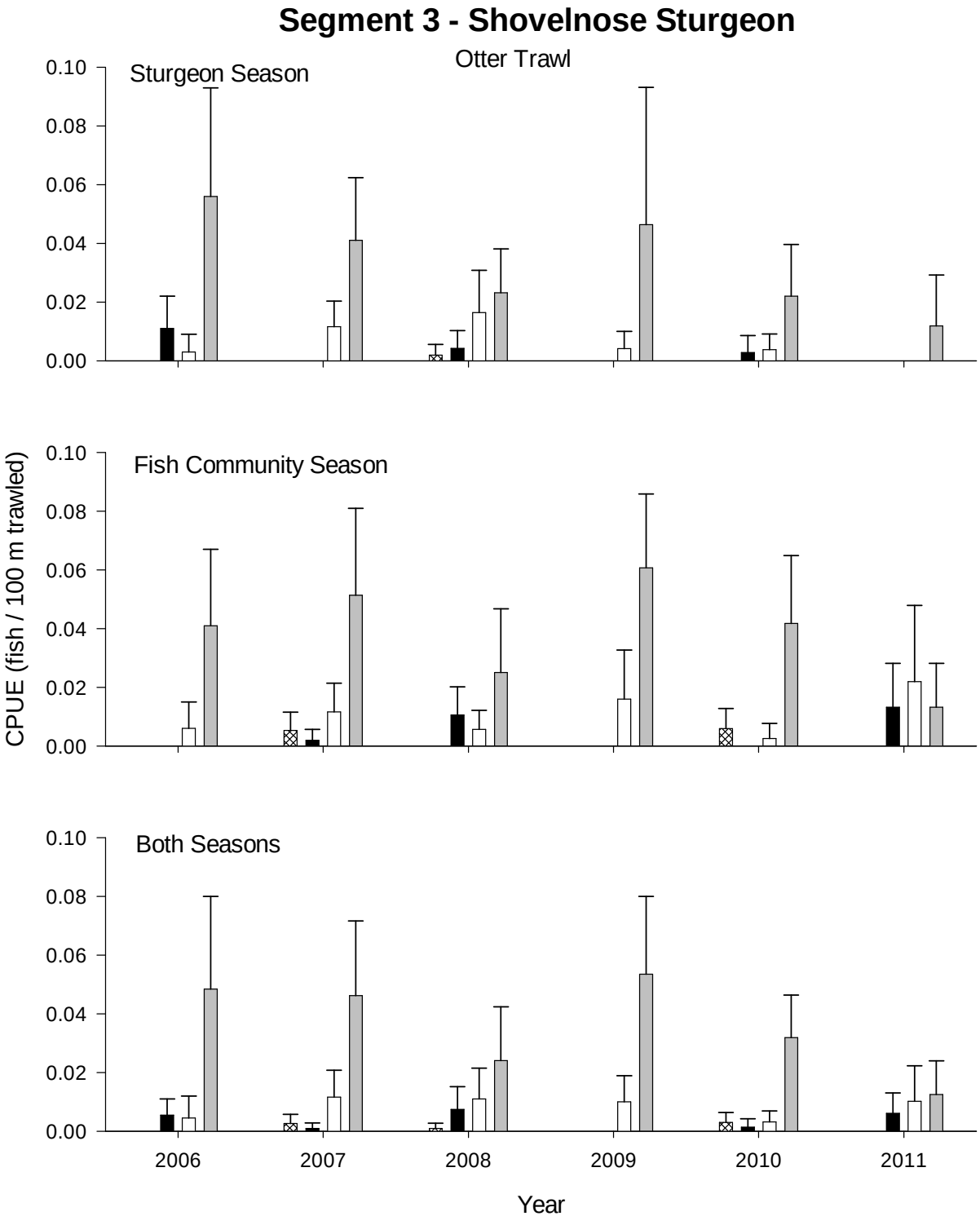

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2011.

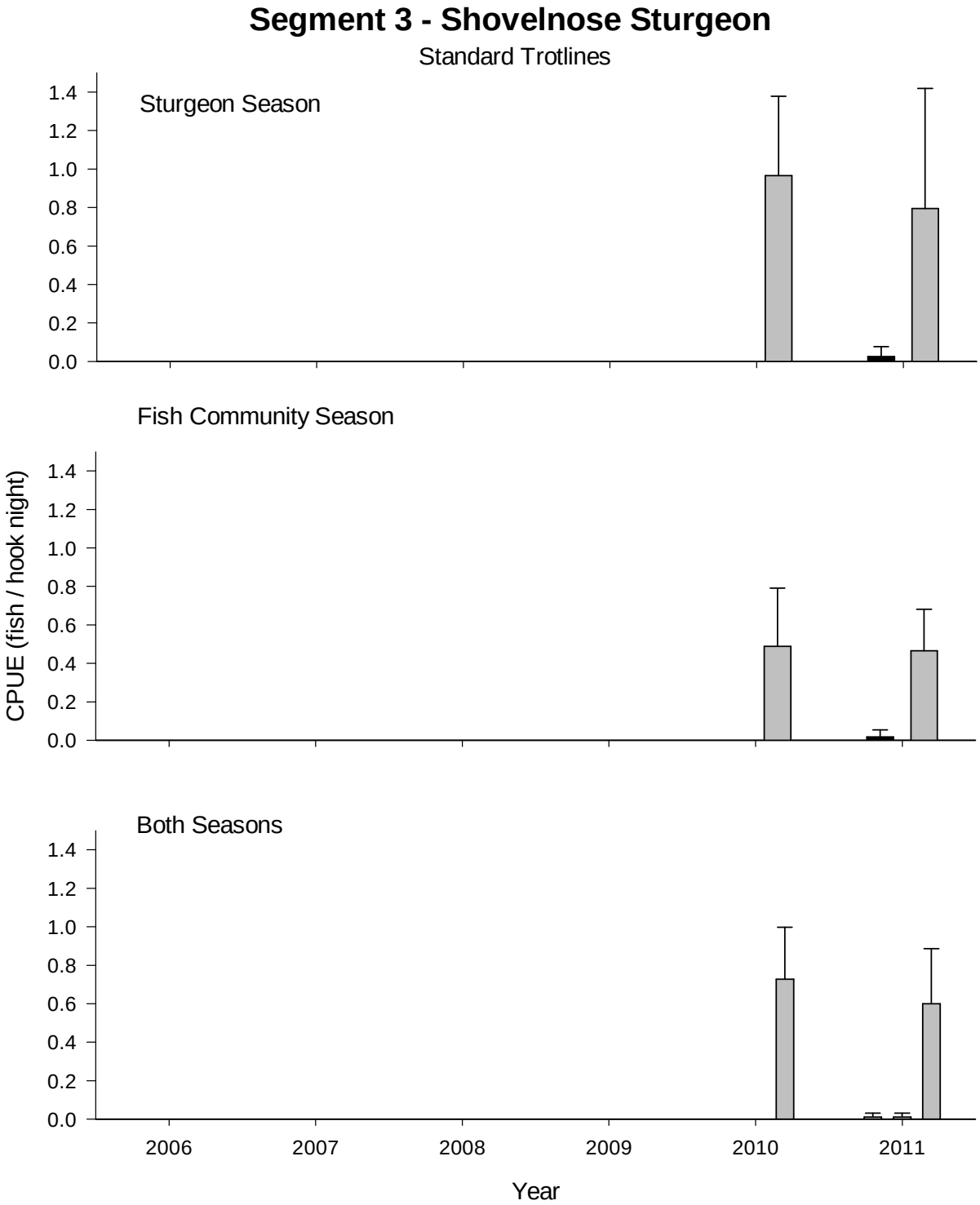

Figure 13. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2011. 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 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	0	0	0	0	0	0	0	0	0
		33	0	13	11	0	0	0	0

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	0	0	0	0	0	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	2	0	0	100	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	3	33	0	33	33	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	1	0	0	100	0	0	0	0	0
		33	0	44	13	11	0	0	0

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]								
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season										
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0
		0	31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0	0
		0	32	2	39	21	4	0	0	2
Fish Community Season										
1.0” Trammel Net	2	0	50	0	50	0	0	0	0	0
		0	40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0
		0	30	0	44	5	12	5	4	0
Otter Trawl	5	0	0	0	100	0	0	0	0	0
		0	37	0	34	17	12	0	0	0
Both Seasons										
Trot Lines	1	0	100	0	0	0	0	0	0	0
		0	33	0	44	13	11	0	0	0

Table 12. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0" Trammel Net	1	0	0	0	100	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	3	0	0	67	0	33	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0" Trammel Net	8	25	0	75	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	3	100	0	0	0	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	57	54	0	35	2	9	0	0	0
		33	0	44	13	11	0	0	0

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0” Trammel Net	1	0	0	0	100	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	3	0	0	67	0	33	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0” Trammel Net	12	25	0	75	0	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	11	36	0	55	9	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	59	54	0	36	2	8	0	0	0
		33	0	44	13	11	0	0	0

Segment 3 - Shovelnose Sturgeon

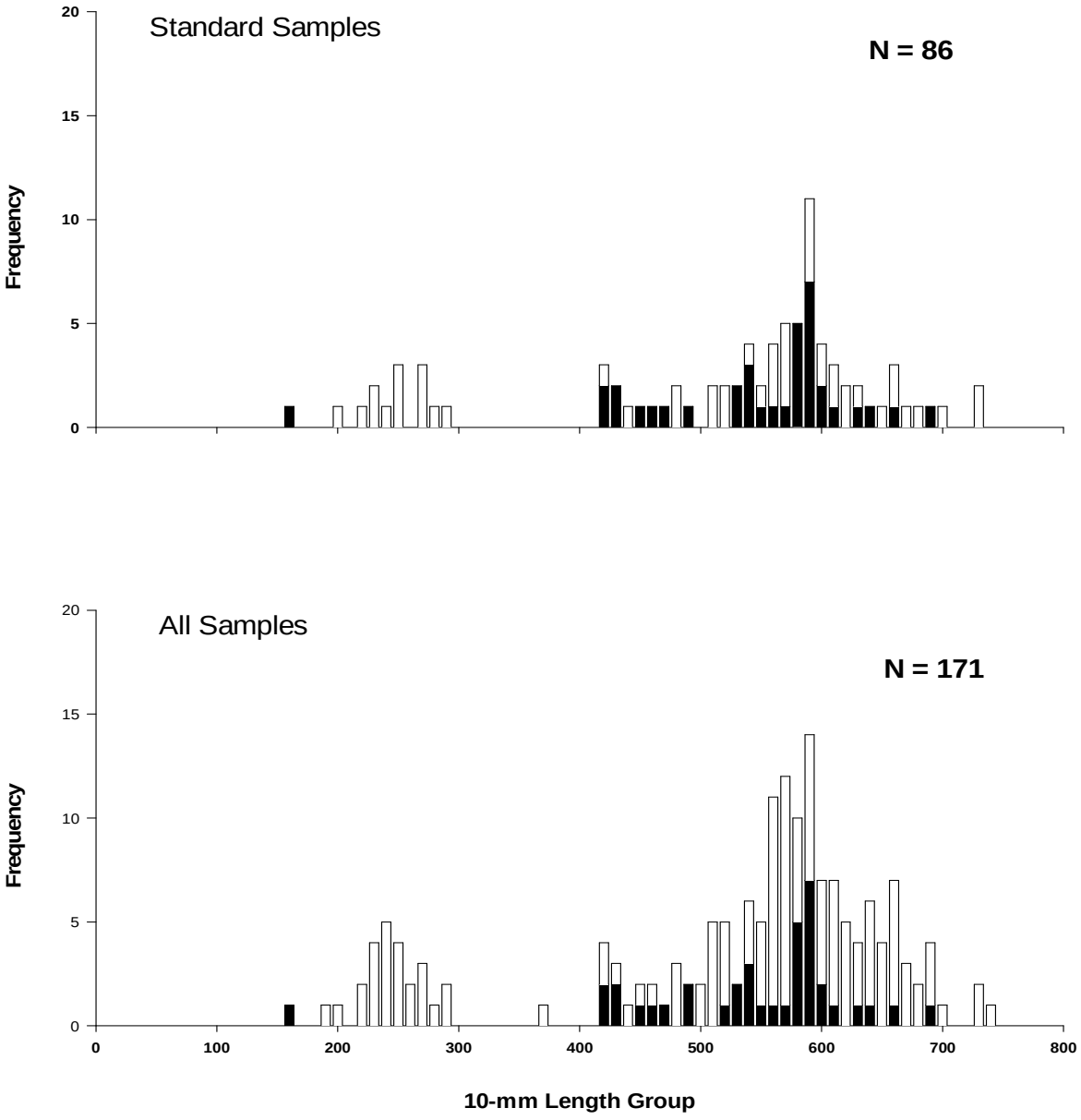

Figure 14. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

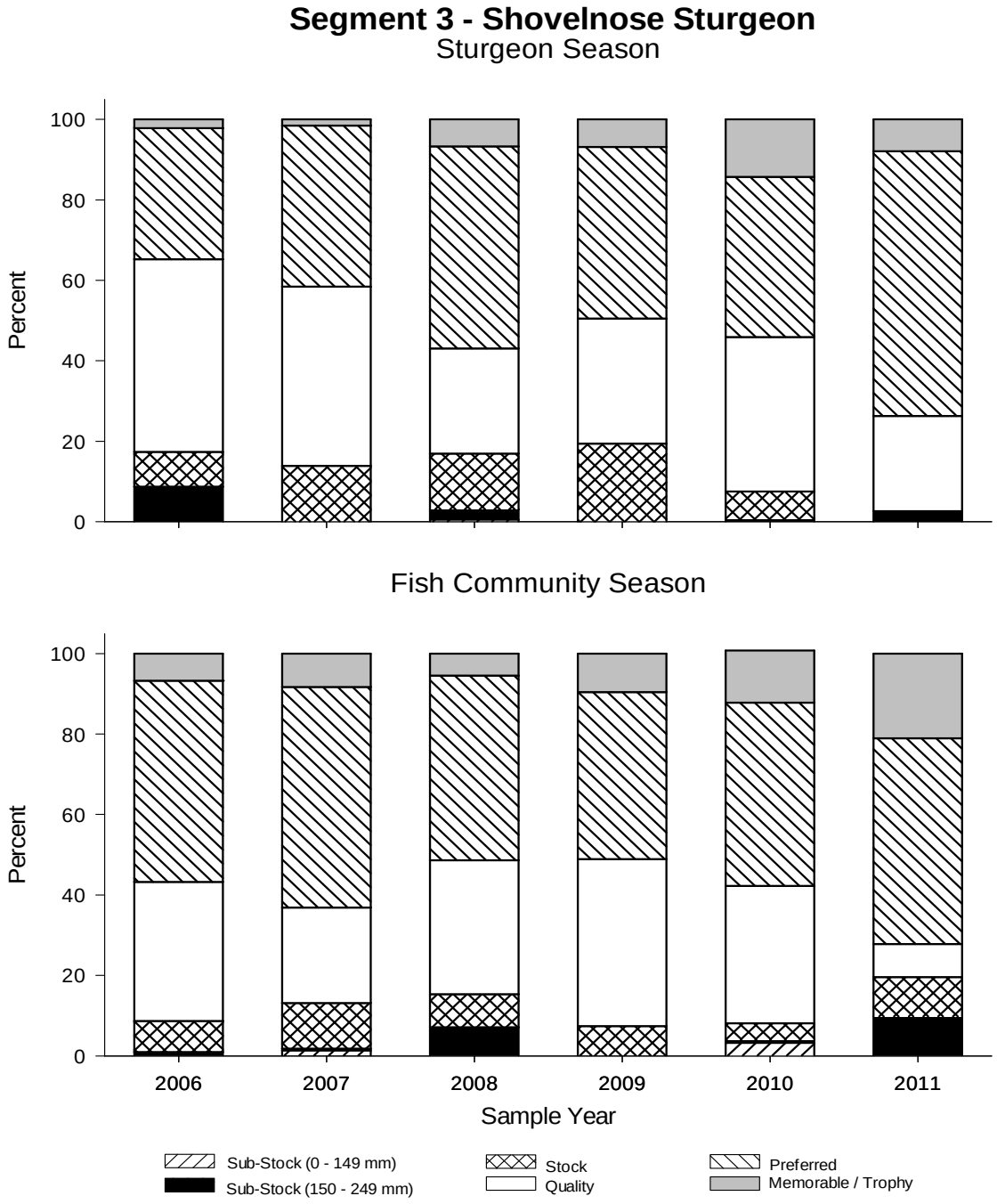

Figure 15. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2011 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

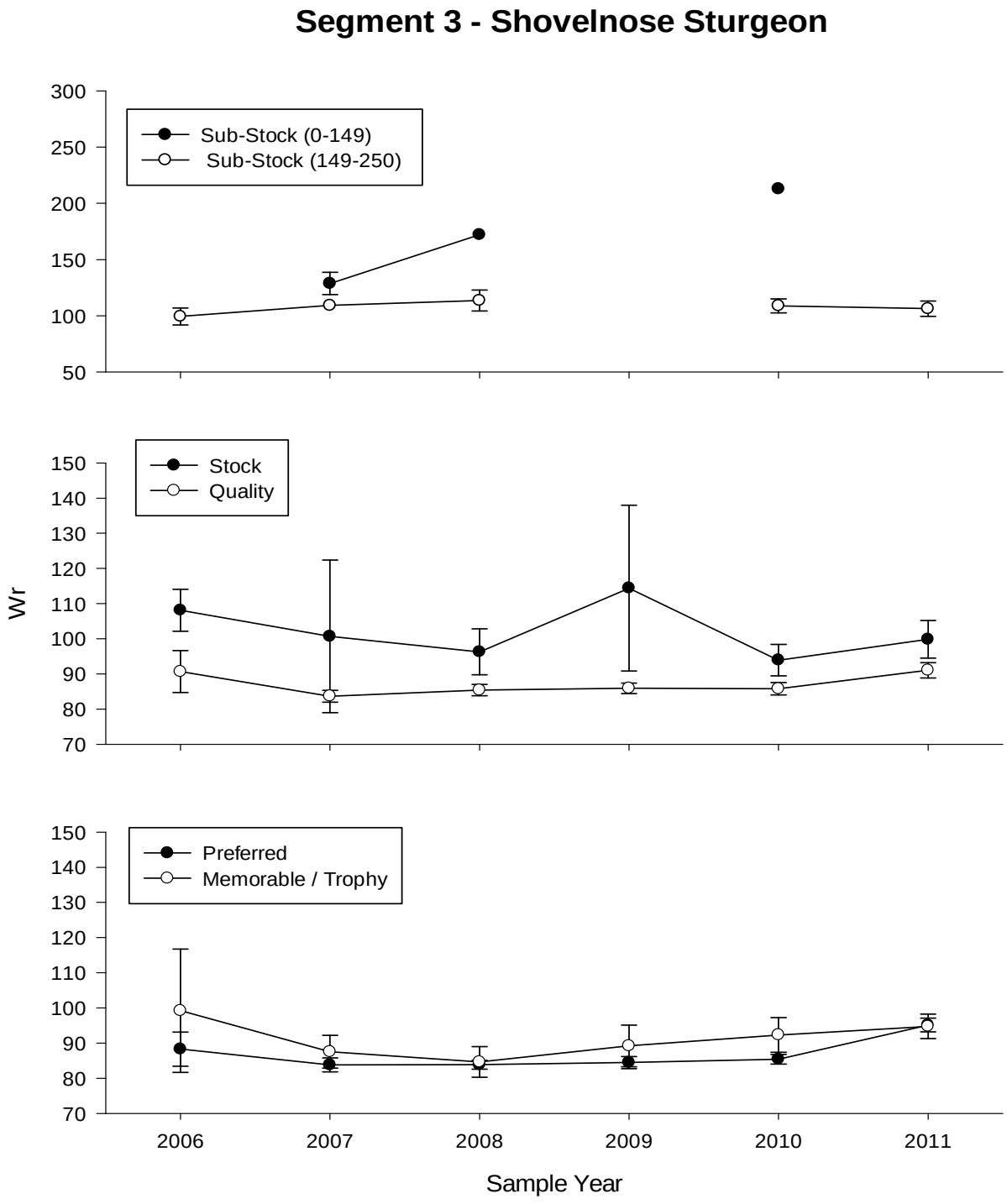

Figure 16. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2011 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

A total of 107 sturgeon chubs were collected in 2011, a decrease from 2010 when 196 were sampled and a significant decrease from 2008 when 663 were collected. Similar to the last six years more sturgeon chub were sampled during the sturgeon season (n=63) than the fish community season (n=44). All sturgeon chubs collected in 2011 were sampled using the otter trawl.

Overall otter trawl CPUE of sturgeon chubs was very similar to the previous two years (Figure 17). From 2006 to 2008 sturgeon chub CPUE for the otter trawl had remained relatively constant around 0.5 fish /100m and has since decreased to less than half of that in the last three years of sampling, with a low of 0.196 fish/ 100m in 2011 (Figure 17).

Sturgeon chubs averaged 62 mm TL in 2011, with the smallest sample measuring 25 mm and the largest 100 mm. The length frequency histogram of sturgeon chubs collected in 2011 indicate a that age-1 fish made up a larger proportion of the total population than was observed during 2010 (Figure 18). Fish in the 35 to 50 mm range were much more abundant than during 2010. Although overall sturgeon chub CPUE has been down the past three years, good production may have occurred in 2010. Sampling in 2012 under more normal flow conditions should allow us to better evaluate how the good water years of 2010 and 2011 influenced the sturgeon chub population.

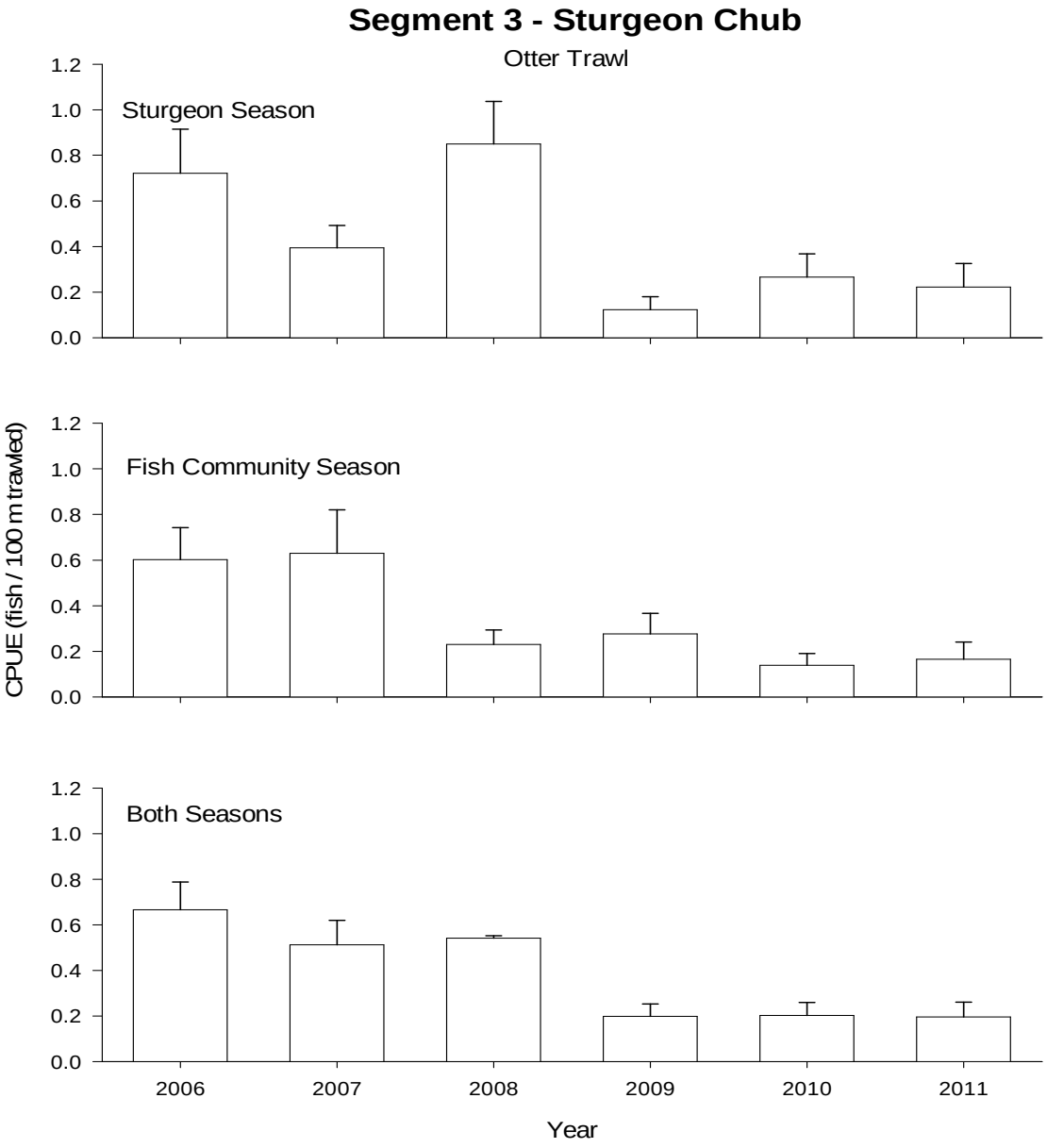

Figure 17. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2011.

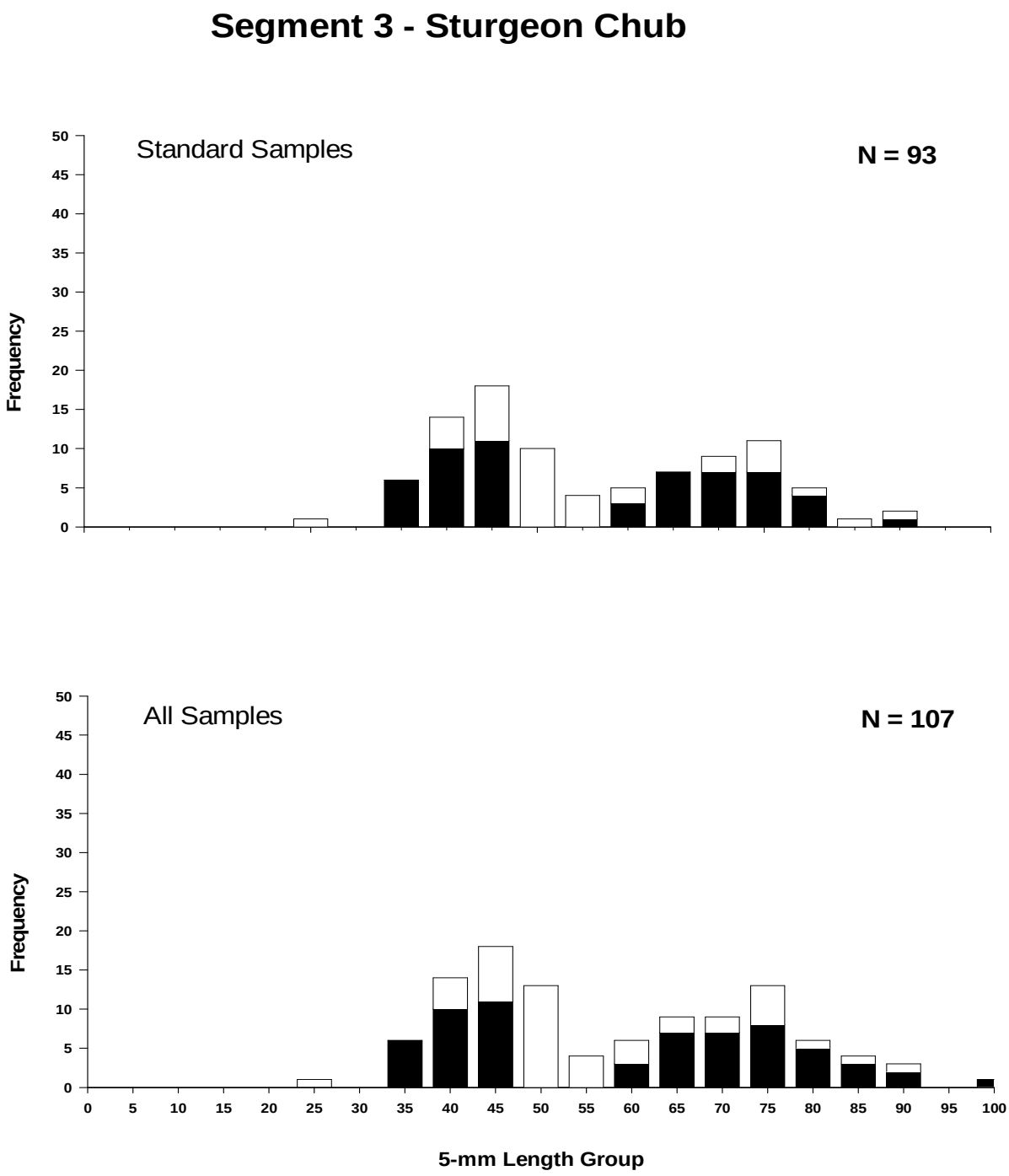

Figure 18. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

Sicklefin Chub

A total of 75 sicklefin chubs were collected in segment 3 during 2011, a decrease from 2010 when a total of 85 were sampled. However, due to the lower effort put into sampling in 2011 from the flooding, the relative abundance of sicklefin chubs increased. More sicklefin chubs were collected during the fish community season (n = 59) than during the sturgeon season (n = 16). All sicklefin chubs were sampled in the otter trawl.

Overall otter trawl CPUE for sicklefin chub showed a slight increase when compared to the last five years. While the sturgeon season CPUE was actually lower than that of 2010, 2008 and 2006, the CPUE during the fish community season was at a six year high, which equated to a six year high in overall CPUE (0.13 fish /100m) (Figure 19). Non-random subsamples accounted for 14 of the total 75 sicklefin chubs captured, which are not included in the CPUE estimates.

Sicklefin chubs averaged 85 mm TL in 2011 with the largest and smallest specimens measuring 115 and 70 mm TL, respectively. The 2011 average length was similar to the previous six years of sampling. The size distribution of sicklefin chubs for 2011 was similar to that of 2010 (Figure 20). Over the six years of sampling, few very small sicklefin chubs have been collected, possibly indicating that their rearing habitat may be in the lower portions of the river downstream of segment 3. The majority of the fish collected in 2011 were likely age-1 fish (Herman et al. 2008b). In 2011 few if any age-0 fish were observed, but both age-1 and age-2 were abundant and again similar to 20010 few age-3 fish were found. Similar to previous years of sampling, sicklefin chubs were more abundant in the downstream most river bends in segment 3. However, likely due to higher flows and higher suspended sediment loads, sicklefin chubs were observed farther upstream in segment 3 (river mile 1696) than they had been the previous five years of sampling.

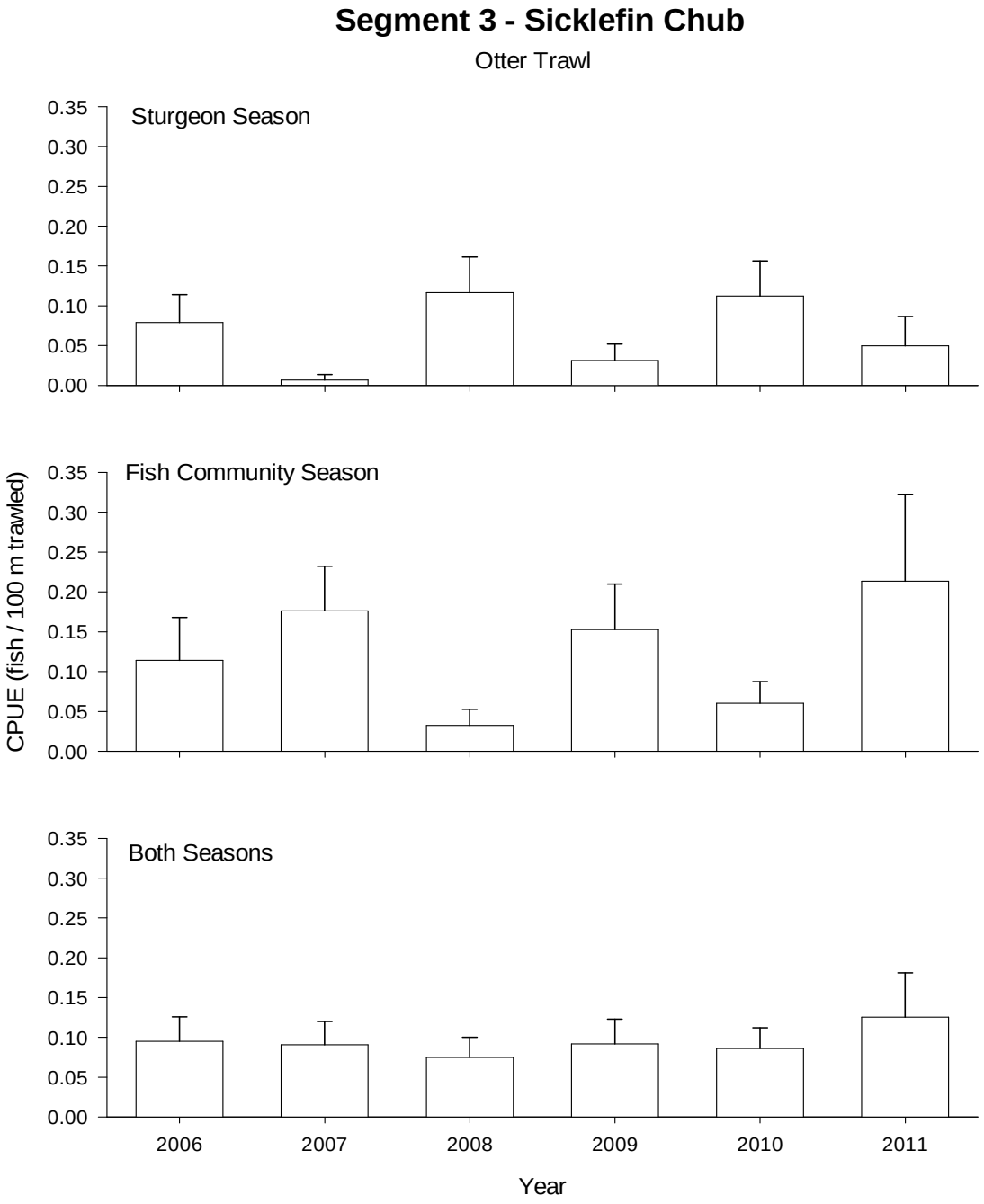

Figure 19. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2011.

Segment 3 - Sicklefin Chub

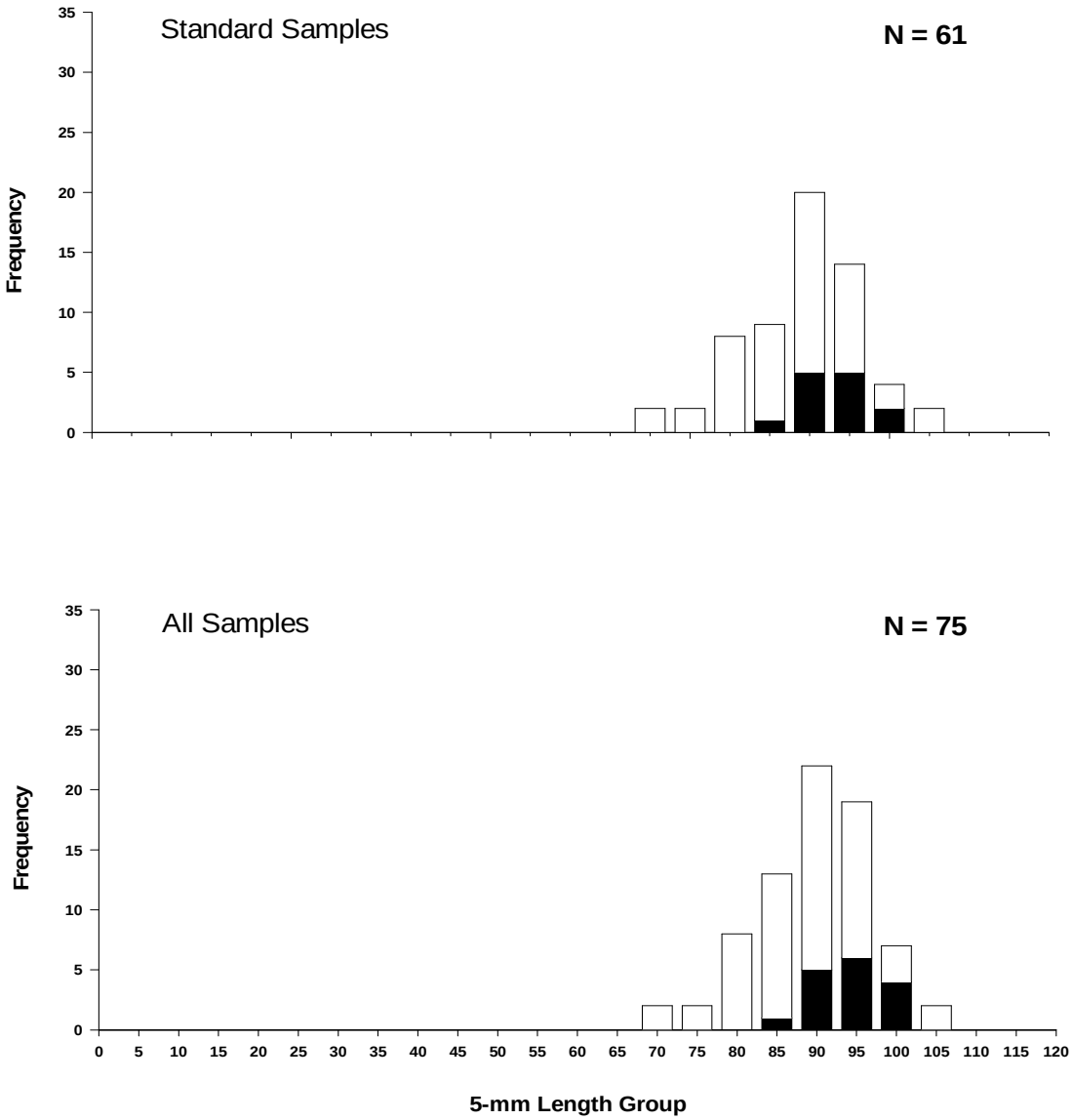

Figure 20. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

Sand Shiner

A total of 105 sand shiners were sampled in segment 3 during 2011, a substantial decrease from 2010 when 285 were collected. All sand shiners were collected during the fish community season using mini fyke nets. Sand shiner CPUE in mini fyke nets was 0.9 fish/net night in 2011. This was the lowest CPUE in six years of sampling (Figure 21). In the last five years mini fyke CPUE data has shown a decrease in sand shiner abundance. During the 2011 sampling, only half of the random bends were sampled with mini fyke nets, which could account for the lower total catch, but the trend in decreasing CPUE for mini fyke nets has continued.

Sand shiners averaged 44 mm TL in 2011, which has remained somewhat constant throughout the last five years. The 2011 sand shiner size structure indicates similar ages of fish sampled in the past five years (Figure 22).

Sand shiners were collected throughout the length of segment 3, although their abundance was somewhat patchy. We collected sand shiners in all types of macro habitats that were sampled using mini fyke nets.

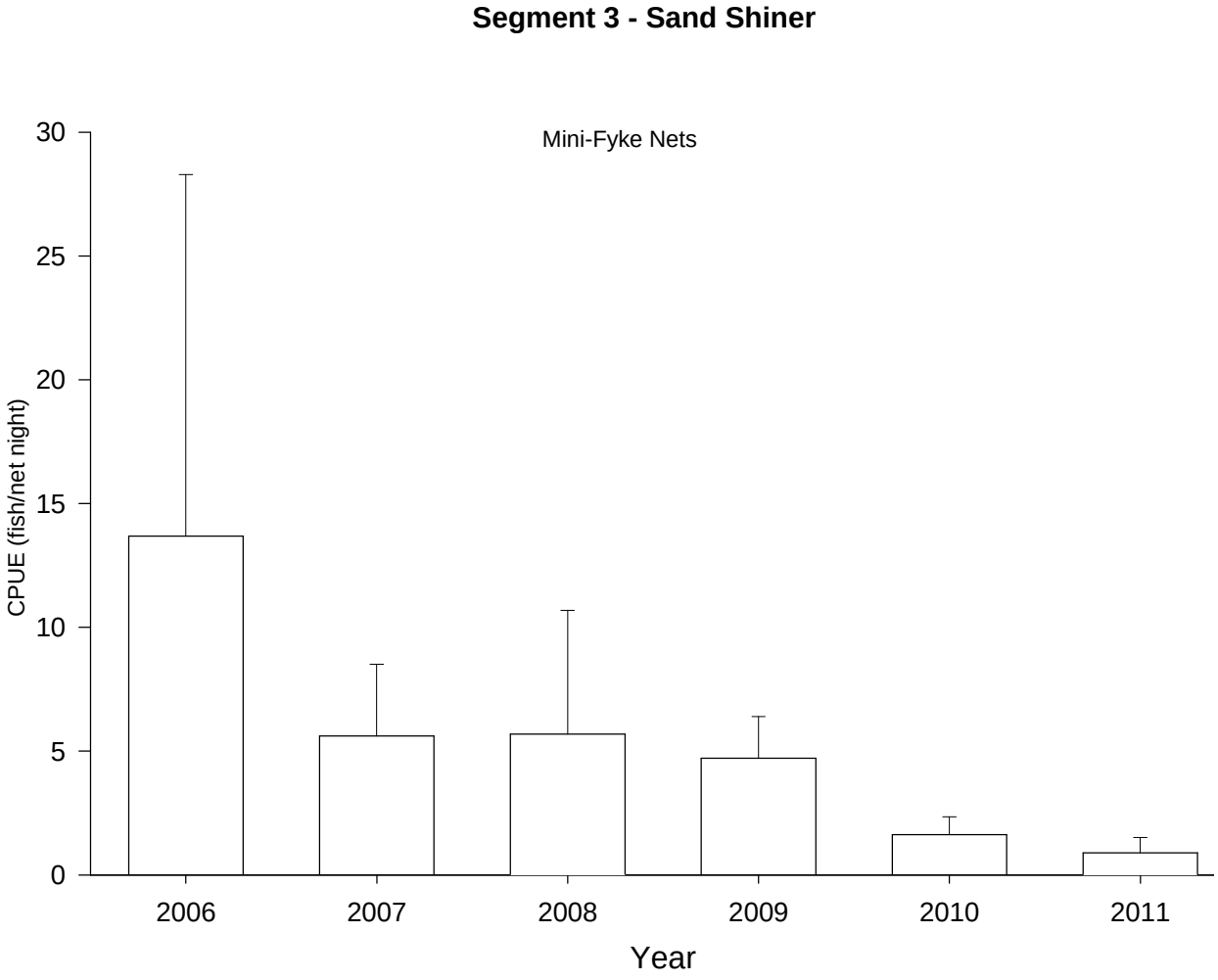

Figure 21. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2011.

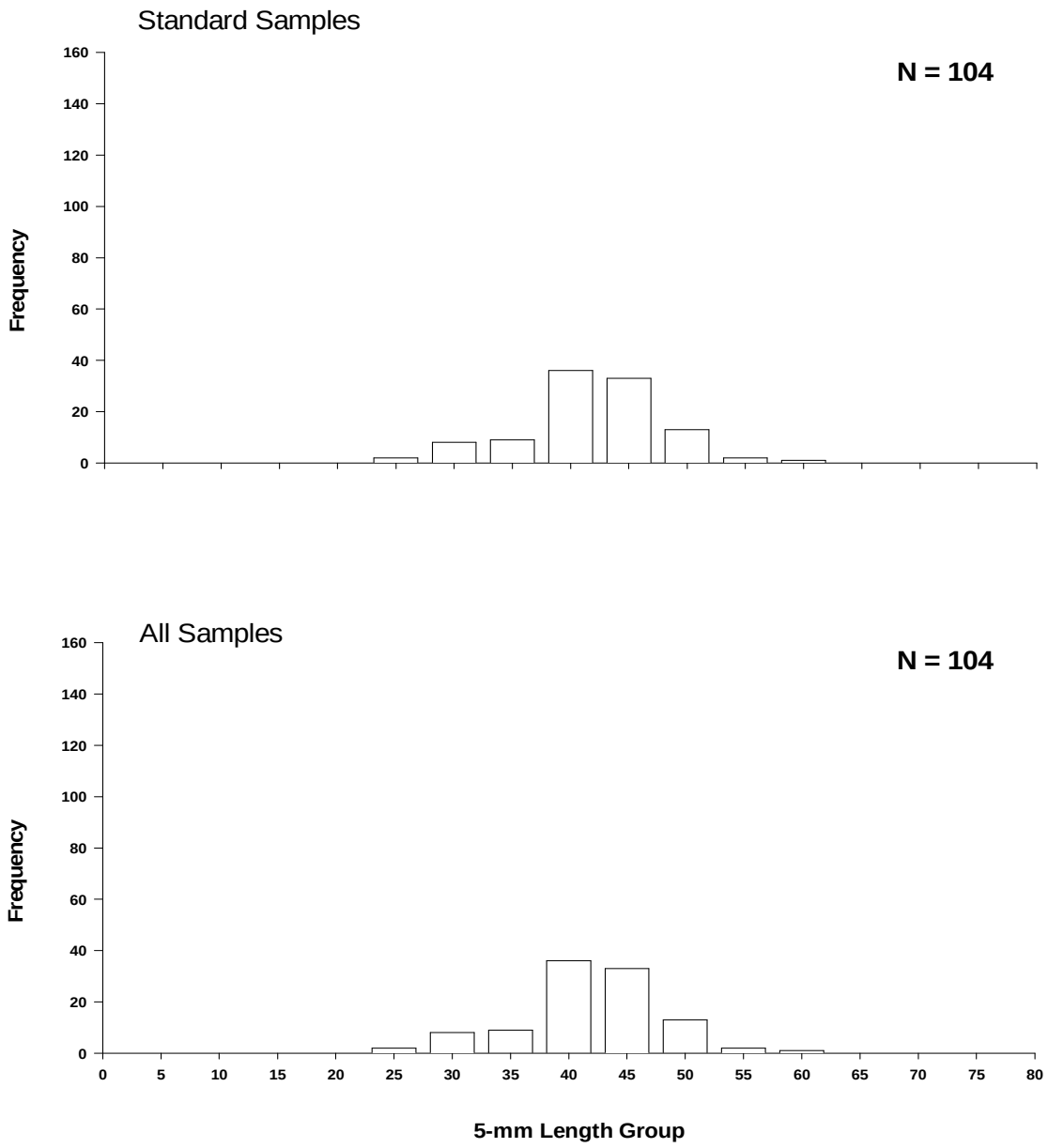

Figure 22. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

***Hybognathus* spp**.

All *Hybognathus spp.* collected in 2011 were identified as western silvery minnow. In the field we take a subsample of all *Hybognathus spp.* collected and open their heads up to look at the basioccipital process to identify them between western silvery and plains minnows *Hybognathus placitus*. In addition, general phenotype is also used to identify suspected plains minnows. In the past six years we've had only two confirmed plains minnows identified, which could be a slight under representation of this species abundance in the Missouri River downstream of Fort Peck Dam. Additionally, we have not collected any brassy minnows *Hybognathus hankinsoni* in all six years of sampling.

In 2011 a total of 20 western silvery minnows were collected. Western silvery minnow CPUE was estimated at 0.2 fish/ net night for mini fyke nets during 2011 (Figure 23). This was the second lowest year for mini fyke net CPUE in six years of sampling. Since 2009 overall CPUE has consistently remained under 0.54 fish/net night, with a low of 0.18 fish/ net night in 2011.

Western silvery minnows averaged 57 mm TL in 2011, which was larger than the 2010 average of 48 mm TL. This difference is likely due to a larger proportion of smaller fish being collected in 2010 when compared to 2011 (Figure 24). The length frequency histogram of western silvery minnows in 2011 suggests the age structure was comprised of mostly age-0 fish, with few age-1 fish present and no age-2 fish present (Datillo et al. 2008b). This is very similar to the previous two years.

The relatively few western silvery minnows that were sampled in 2011 were captured throughout the length of segment 3, from river mile 1,592 to 1,701.5.

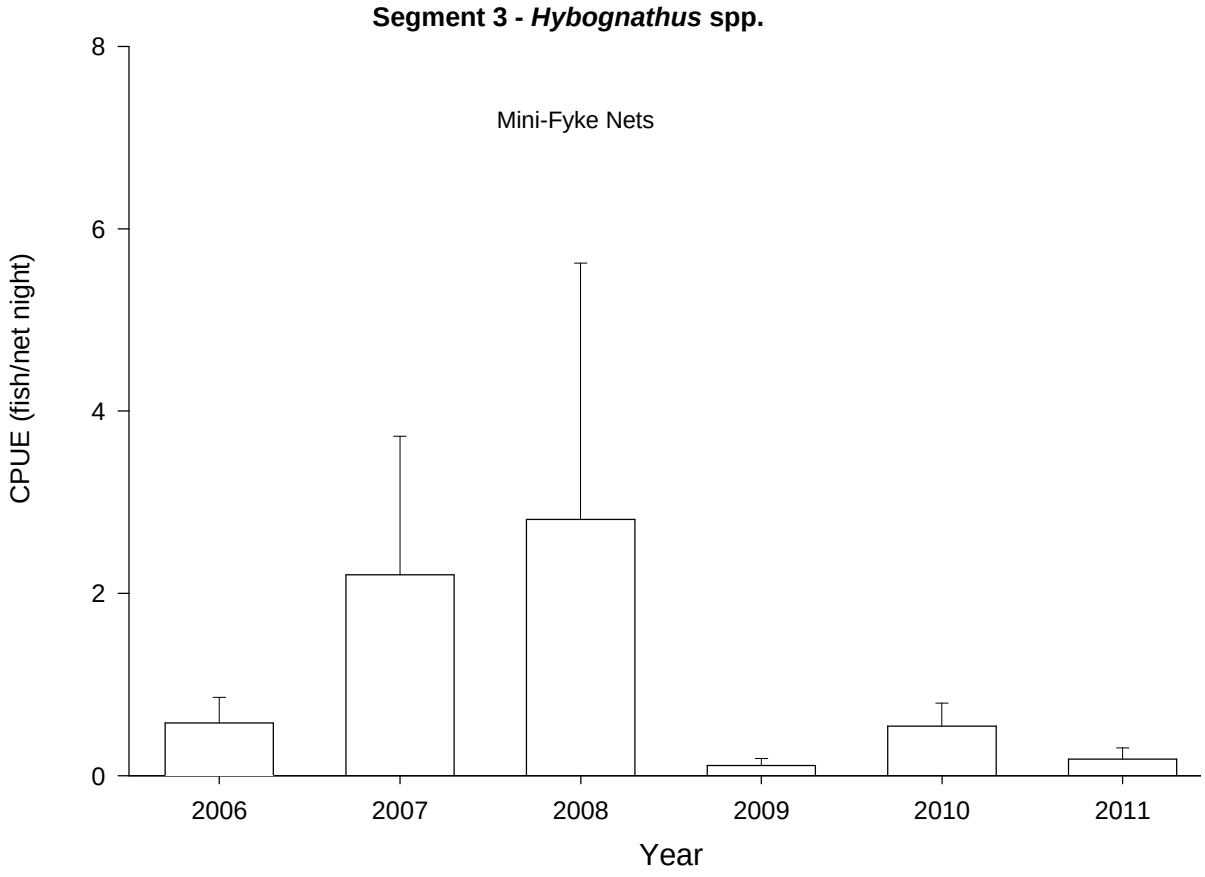

Figure 23. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2011.

Segment 3 - *Hybognathus* spp.

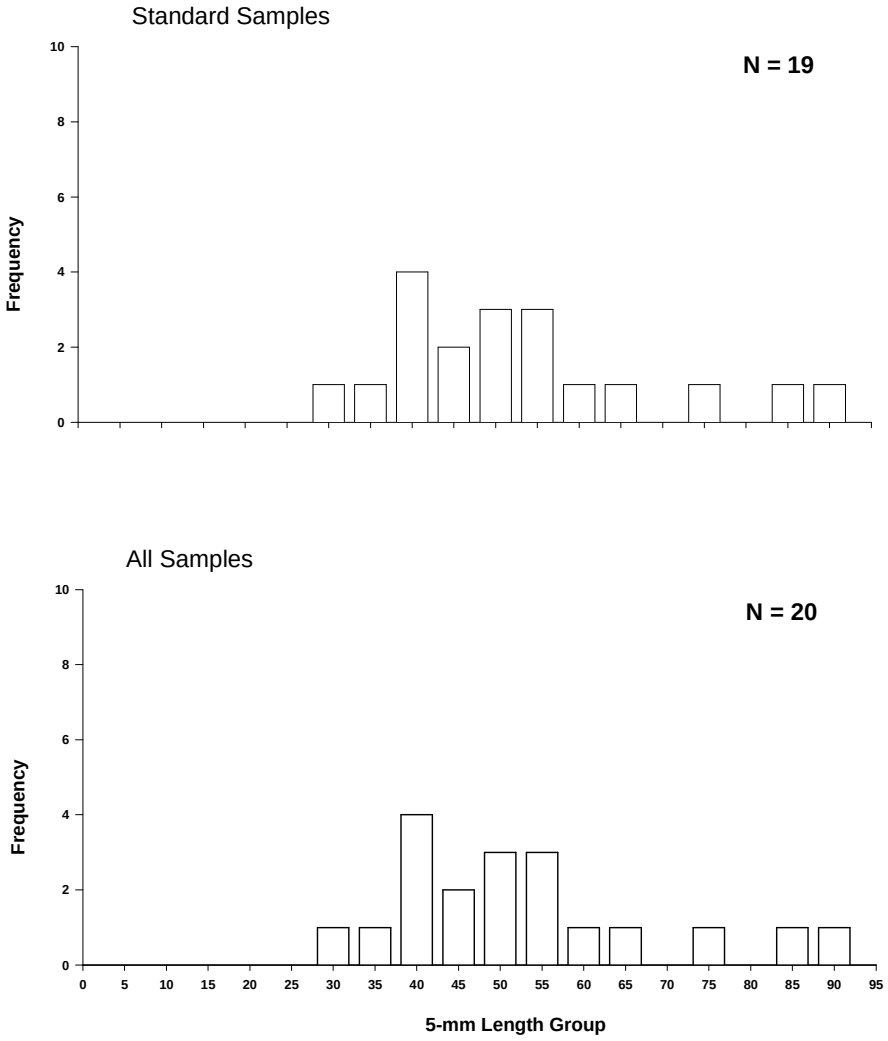

Figure 24. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

Blue Sucker

In 2011 a total of 4 blue suckers were caught during random sampling. All four blue suckers were caught during the fish community season using trammel nets. This is the first year out of six years of sampling that no blue suckers were sampled during the sturgeon season, likely due to less effort being expended.

The total number of blue suckers captured in segment 3 has remained relatively low throughout six years of sampling. Overall trammel net CPUE has remained somewhat constant during past six years, although the lowest CPUE was observed in 2011 at 0.006 fish/100m. (Figure 25). There has been a general pattern over the last six years of slightly higher catch rates during the fish community season when compared to the sturgeon season (Figure 25). The otter trawl has not been an effective gear at monitoring relative abundance of adult blue suckers. However, if there were abundant age-0 or age-1 fish in the segment, the otter trawl should be able to detect them.

Average length of blue suckers sampled was 729 mm, all adult fish. The size distribution of blue suckers captured in 2011 looks similar to past years with a majority of fish being larger than 500 mm TL (Figure 27).

Blue suckers were sampled throughout much of the length of segment 3, with similar catches occurring throughout the sampling area. For the specific macro habitats that blue suckers were sampled by gear see Table 14.

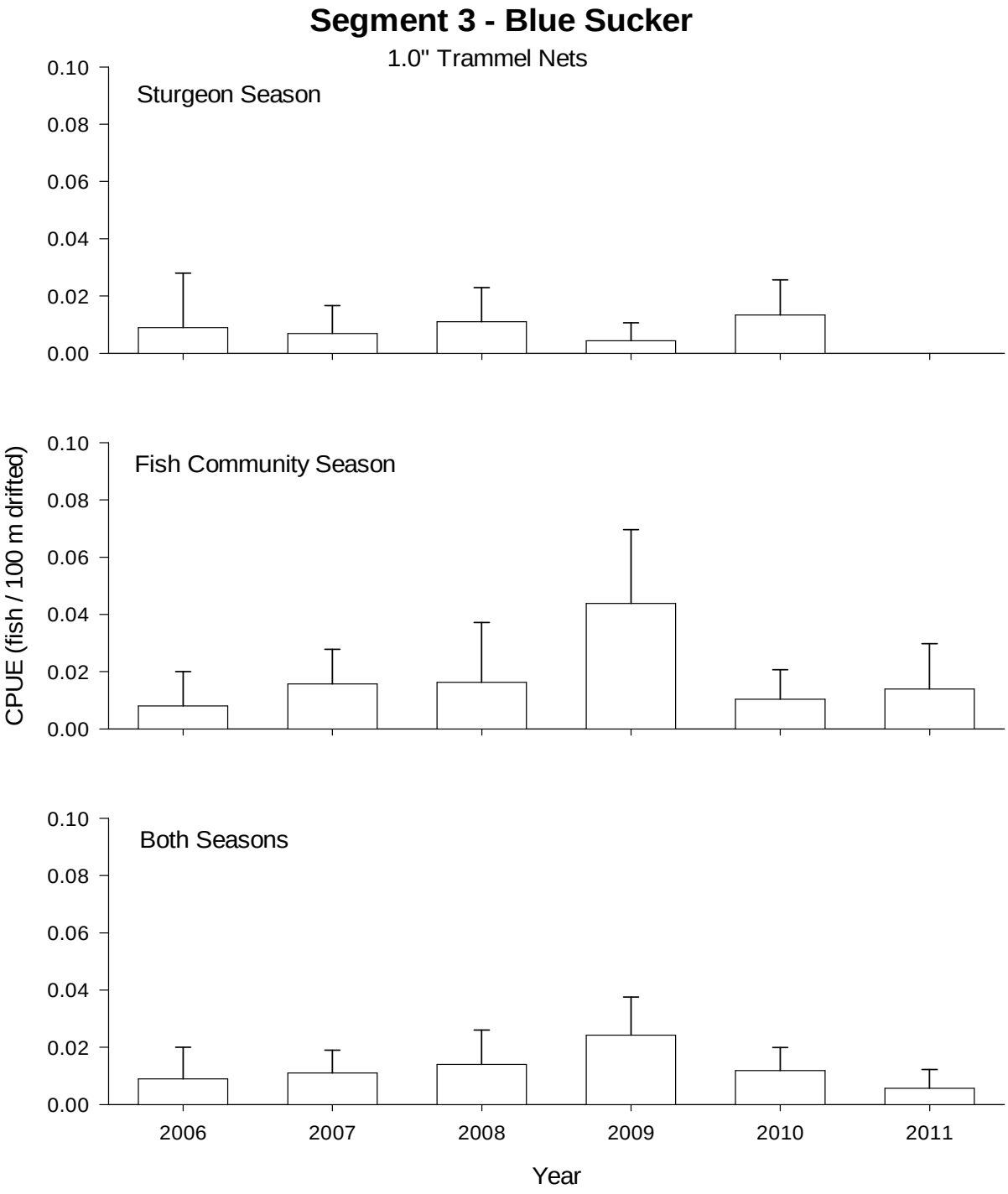

Figure 25. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2011.

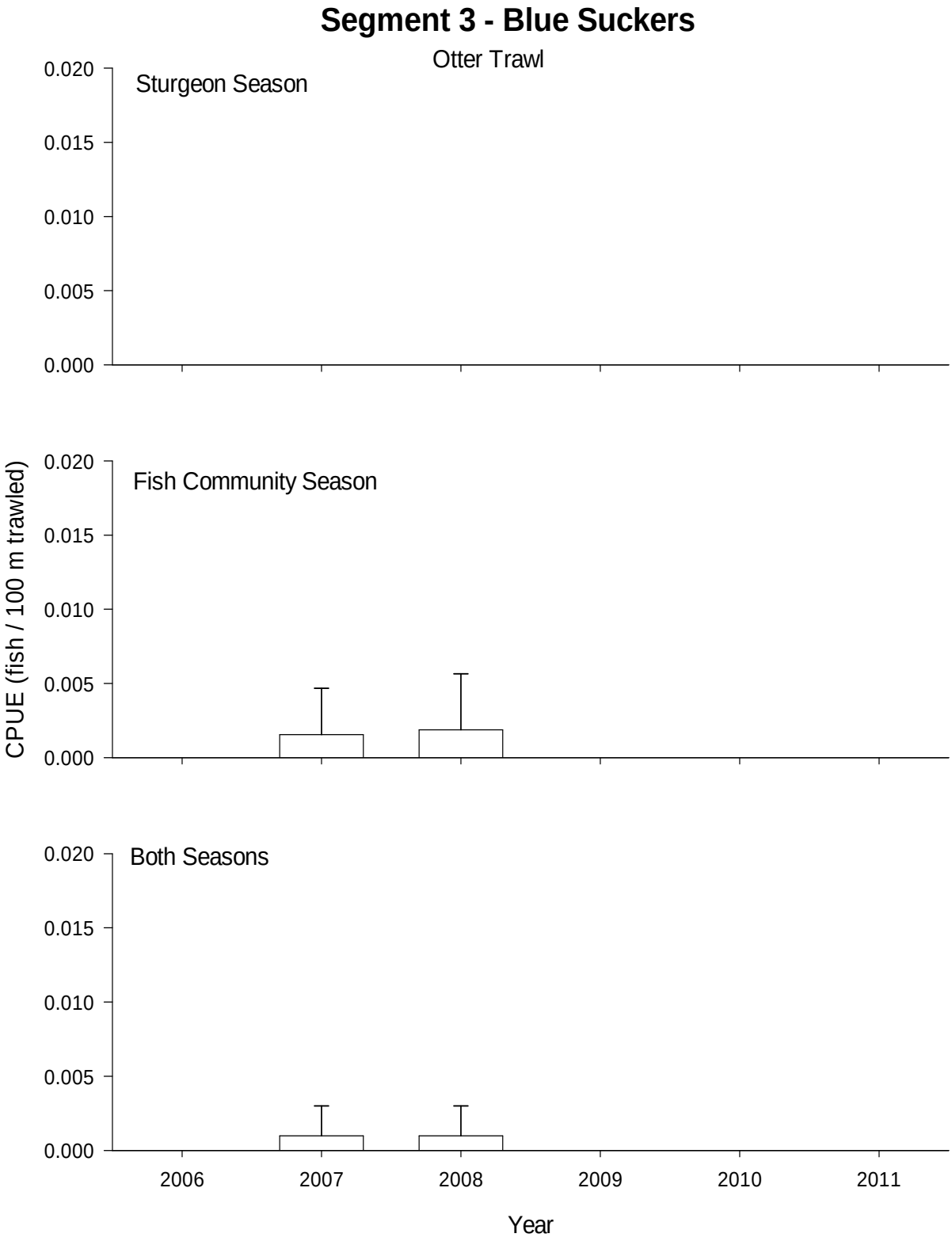

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2011.

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 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		31	1	35	23	9	0	0	1
Otter Trawl	0	0	0	0	0	0	0	0	0
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0” Trammel Net	3	0	0	1	2	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		30	0	44	5	12	5	4	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	0	0	0	0	0	0	0	0	0
		33	0	44	13	11	0	0	0

Segment 3 - Blue Sucker

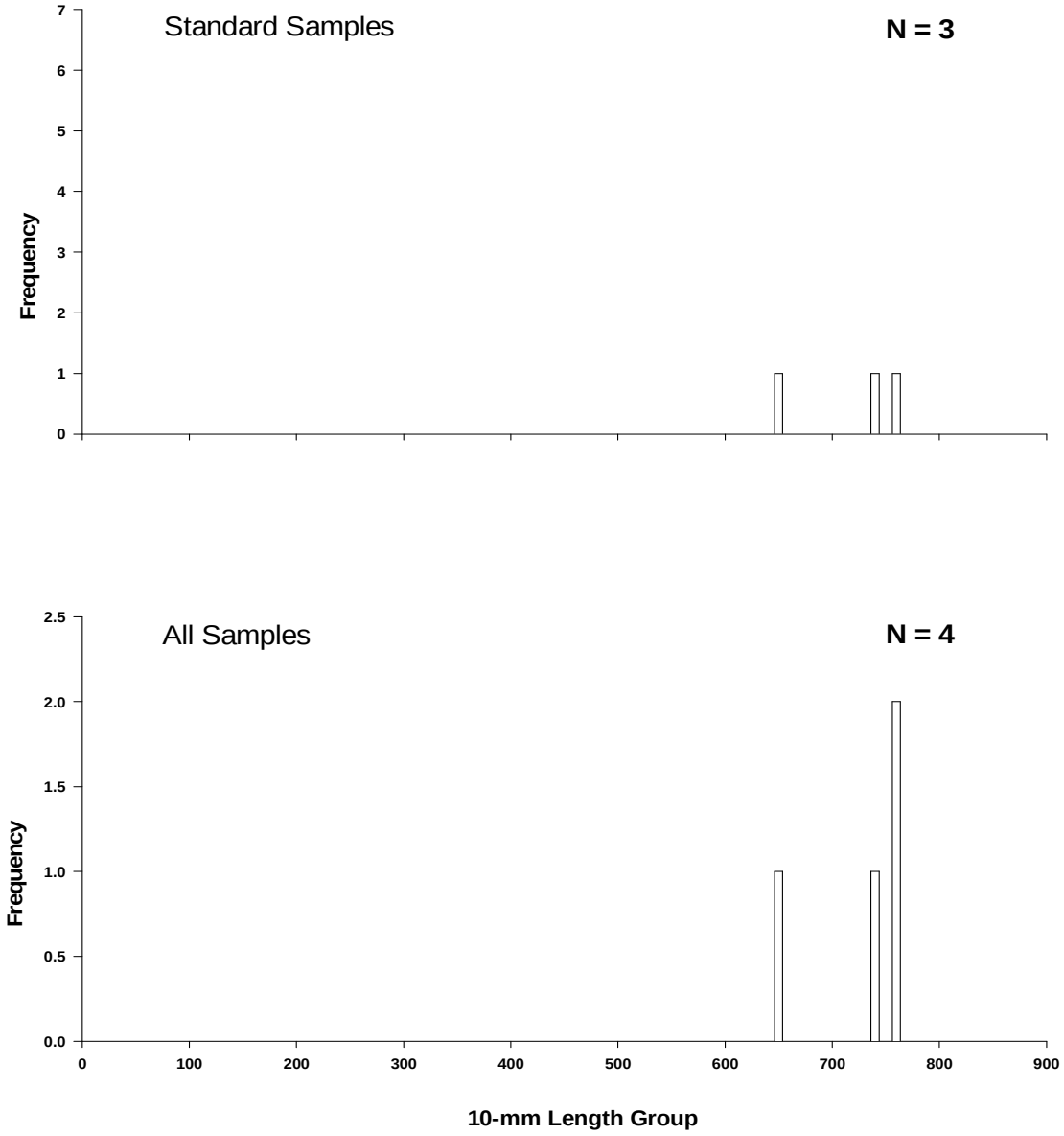

Figure 27. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

Sauger

A total of 138 sauger were sampled in segment 3 during 2011, 78 which were captured in random sampled. Of the total 115 were collected during the fish community season, while the remaining 23 were captured in the spring during the sturgeon season. This was a decrease in the total number of sauger sampled, compared to 2010 when 240 were collected. Again, this reduction in total catch was likely due to the reduced effort in 2011 from high water.

For standard gears, trammel nets captured 95 sauger, with the otter trawl capturing 22, mini fyke nets 10 and trotlines 8. Trammel nets are likely the best gear to look at adult sauger abundance. Sauger CPUE for trammel nets was down in 2011 at .08 fish /100m when compared to 2007 to 2010 (Figure 29). However, sauger CPUE during the fish community season was at a six year high of 0.14 fish /100m.

Sauger CPUE for the otter trawl has remained relatively constant, but low over the past six years. Few inferences can be made from these data due to the limited sample size in each year.

Mini fyke nets are our best gear at capturing YOY sauger. However, no YOY sauger were collected in mini fyke nets during 2011, while approximately 10 YOY were collected in 2010. Overall sauger CPUE for mini fykes was lower in 2011 at 0.13 fish /net night than during 2010 which had a CPUE of 0.22 fish/ net night (Figure 28).

The size distribution of sauger collected in 2011 differed with that of 2010 (Figure 21). During 2011 a peak between 270 to 280 mm occurred, which are likely age-1 fish. These fish were collected during late in the fish community season, which lends further evidence of them being age-1 fish. For 2010, a similar peak was not present in age-1 fish, however a peak did occur in age-0 fish, or fish smaller than 150 mm collected in the fish community season. Therefore, the age-1 peak we witnessed in 2011 correspond to the age-0 fish that were collected in 2010. Although we did not observe any age-0 fish in 2011, this could have been due to high water and less gear efficiencies. Sampling in 2012 under more normal water conditions should shed light on whether the large water year of 2012 was beneficial to sauger production.

Sauger were captured throughout the length of segment 3 during both seasons. For the specific macro habitats where sauger were sampled by gear see Table 15

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2011.

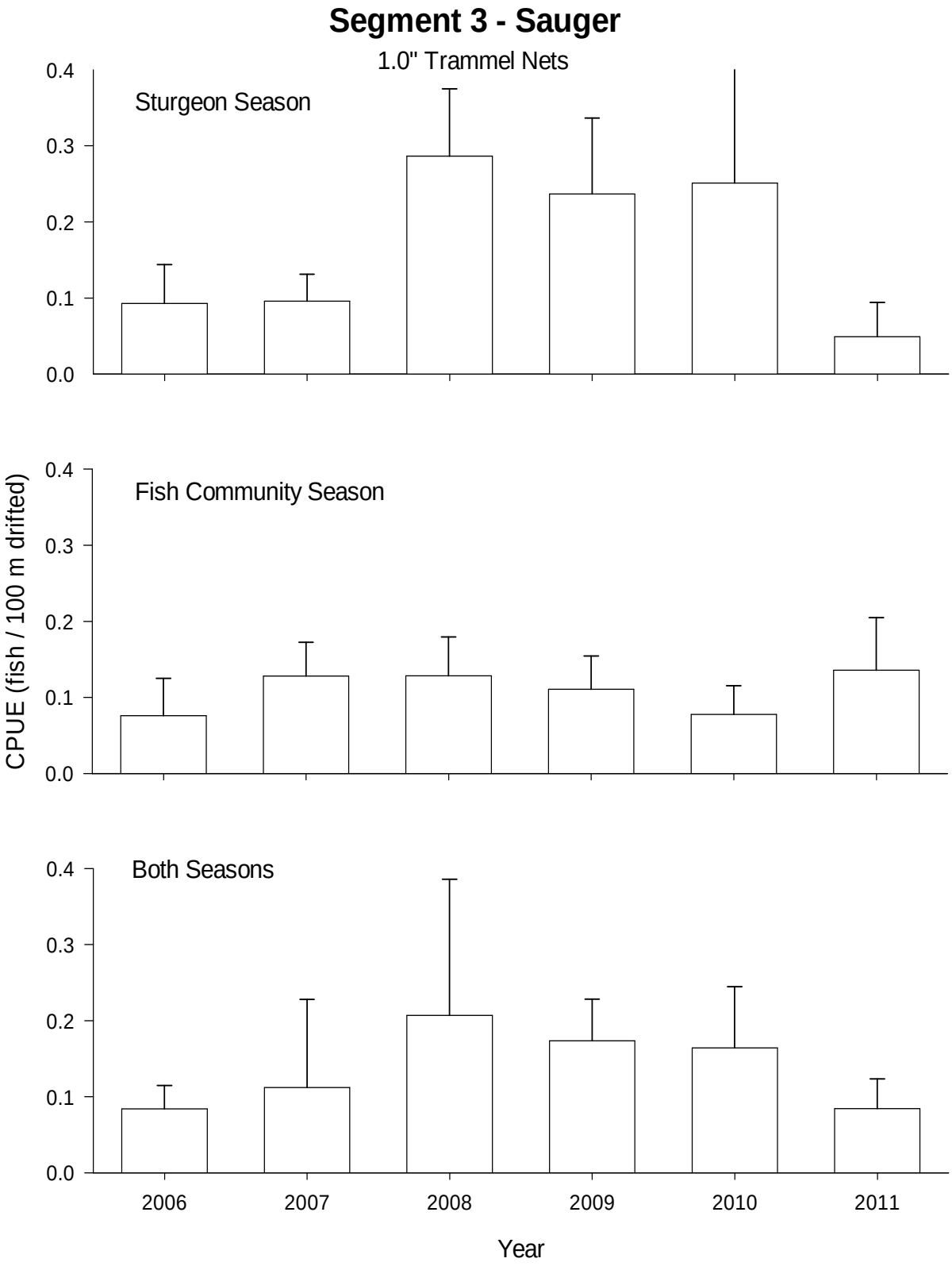

Figure 29. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2011.

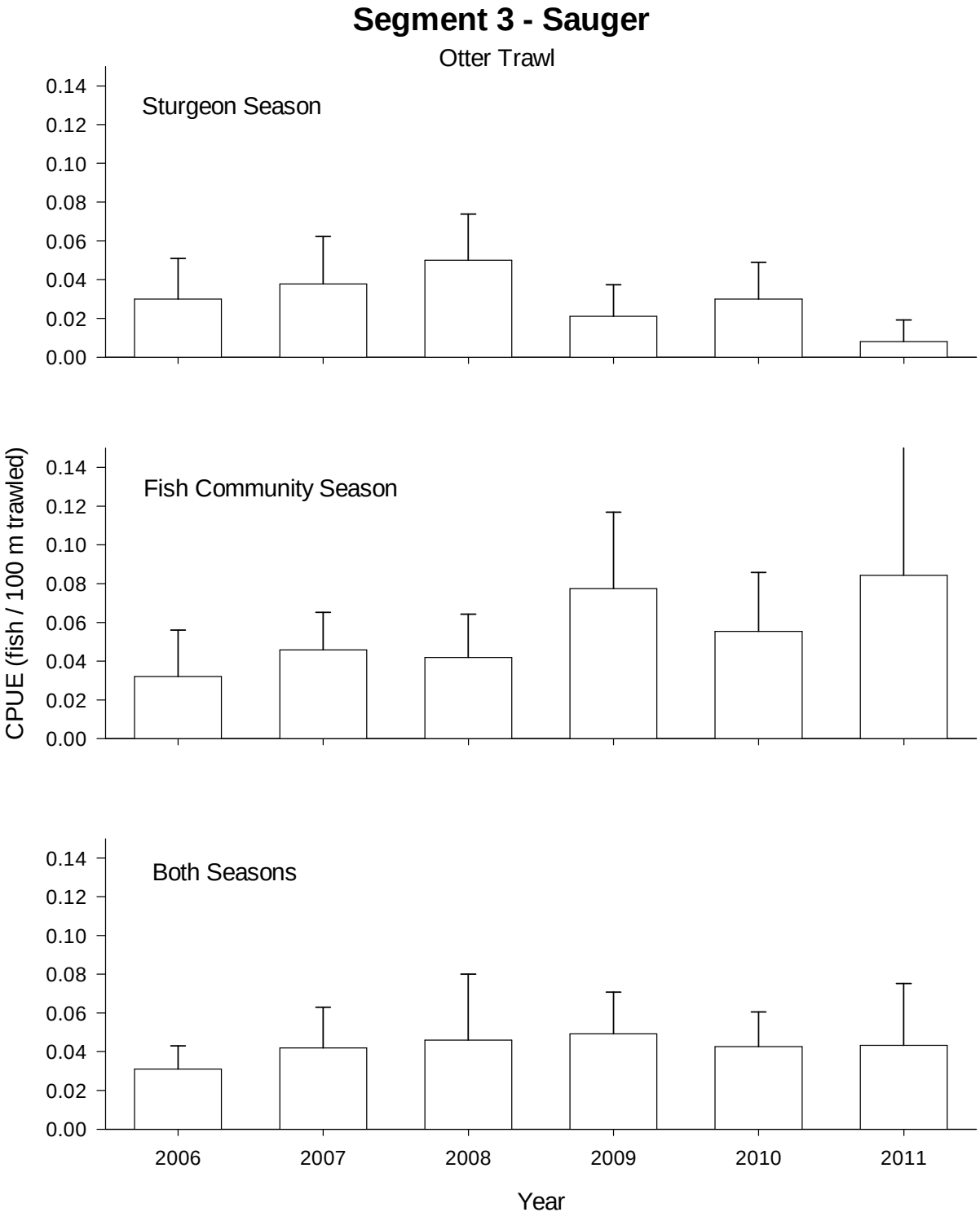

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2011.

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 2011. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season									
1.0” Trammel Net	14	0	0	29	36	0	0	0	36
		31	1	35	23	9	0	0	1
Otter Trawl	2	0	0	0	50	0	0	0	50
		32	2	39	21	4	0	0	2
Fish Community Season									
1.0” Trammel Net	25	28	0	64	8	0	0	0	0
		40	0	34	25	1	0	0	0
Mini-Fyke Net	10	40	0	40	0	0	10	10	0
		30	0	44	5	12	5	4	0
Otter Trawl	19	0	0	58	16	26	0	0	0
		37	0	34	17	12	0	0	0
Both Seasons									
Trot Lines	8	13	0	50	25	13	0	0	0
		33	0	44	13	11	0	0	0

Segment 3 - Sauger

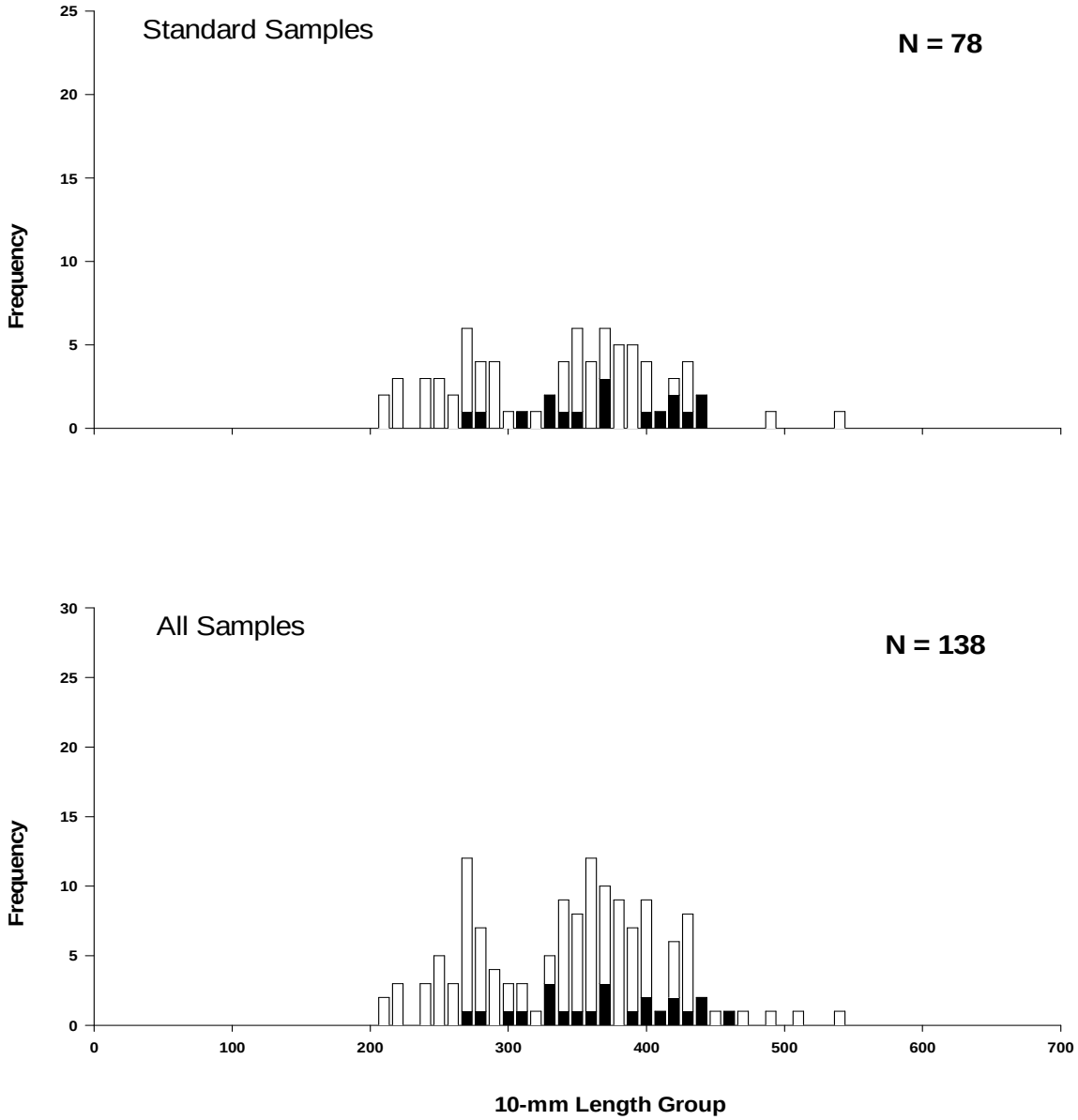

Figure 31. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2011. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2011.

Missouri River Fish Community

During 2011 a total of 2,542 fish consisting of 35 species were collected in segment 3 during the standard seasons. Of the total, 2,221 fish were collected during the fish community season and the remaining 321during the sturgeon season. Twelve species had total catches over 50 specimens, which include fathead minnows *Pimephales promelas* (n = 543), river carpsuckers *Carpiodes carpio* (n = 248), flathead chubs *Platygobio gracilis* (n = 215), pallid sturgeon (n = 193), shovelnose sturgeon (n = 171), channel catfish *Ictalurus punctatus* (n = 166), goldeye *Hiodon alosoides* (n = 159), sauger (n = 138), sturgeon chubs (n = 107), sand shiners (n = 105), sicklefin chub (n = 75) and stonecats *Notorus flavus* (n = 67).

Due to the extremely high water in 2011 and the substantially higher water in both the sturgeon and fish community seasons, making comparisons between years of non-target species is unlikely to lend insight into the fish assemblage. However, it is likely that the floodplain interaction that occurred in 2011 had a significant effect on many of the rivers native and non-native species alike. Sampling under more normal water conditions during 2012 should give us a better understanding of what the 2011 water year meant to several species in segment 3.

Discussion

The 2011 water year in the Missouri River basin was historical in many ways. In segment 3, a peak discharge of 97,200 cfs occurred on June 21st as measured by the USGS at Culbertson, MT. Due to late ice out and high water, standard sampling in the sturgeon season only occurred from April 14, when flows were at approximately 26,900 cfs to May 25th when flows were just over 30,000 cfs. A high water season then ensued between May 26th and August 2nd, when flows once again were near 30,000 cfs. Data collected during the high water season will be in an additional report. Although no standard sampling occurred during the peak of the runoff, both sturgeon and fish community seasons had significantly more flow than the previous five years of sampling. All our gears were likely affected by the higher flows and although we haven't quantified the differences in our gears capture efficiencies at varying flows, they were likely lower during 2011. Therefore, making direct comparisons in CPUE of any gear fished in 2011 to previous years could be misleading due to the underlying difference in capture efficiency.

Although much less effort was put into standard sampling in 2011, 193 pallid sturgeon were captured, which was the most ever collected in segment 3. The increase in total catch came mainly from trotlines, which captured 134 pallid sturgeon. Of the total captured by trotlines, 77 were collected with standard trotline sets while the remaining 57 were collected during the targeted trotlining effort in the lower river. Trotlines have become the most efficient gear in segment 3 to collect large numbers of hatchery reared pallid sturgeon, which helps populate survival models, growth models and look at changes in fish condition.

While the total number of pallid sturgeon captured was at an all time high, both trammel net and otter trawl CPUE data have not followed a similar pattern. Although high water in 2011 makes CPUE estimates for both trammel nets and otter trawls difficult, the total number of pallid sturgeon being caught has increased throughout the six years of monitoring and both trammel net and otter trawl CPUE has not changed appreciably. This is interesting, since we've stocked fish into the system in every year of sampling and from our survival estimates we know that stocked fish are surviving. With our survival estimates and the current propagation program, one would believe that CPUE would increase over time.

It is interesting to note that while the overall CPUE of pallid sturgeon did not appreciably change for either trammel nets or otter trawls in 2011 from previous years, the CPUE for

shovelnose sturgeon significantly decreased for both gears. There is no reason to believe that the shovelnose sturgeon population crashed from 2010 to 2011. The trotline data support that shovelnose did not crash, since the 2011 CPUE estimates had only a slight decrease from 2010. For that reason, it is possible that the true abundance of pallid sturgeon may have been at a much higher level than during previous years, but with low gear efficiencies it was not detected. The floodplain connectivity and higher levels of suspended sediment may have caused pallid sturgeon to migrate out of segment 4 (downstream of the confluence of the Yellowstone River) and into segment 3. During the previous few years the relative abundance of pallid sturgeon in segment 4 was significantly higher than that of segment 3.

Conversely to CPUE, the size structure of the pallid sturgeon population does appear to be changing in segment 3, although it too is not without its confounding factors. Since 2006 the proportion of smaller pallid sturgeon in the sub-stock size classes has diminished. In 2011, a larger proportion of the total catch was made of stock sized fish during both seasons when compared to previous years. Additionally, more quality sized fish were captured in 2011 than any prior year of sampling. However, trotlines could be somewhat confounding these data. On average, trotlines catch larger pallid sturgeon than the otter trawl and trammel nets. In 2011 the average size of a pallid sturgeon captured on trotlines was 415 mm, while the average size captured by trammel nets was 359 mm and 338 mm for the otter trawl. Consequently, as the total proportion of pallid sturgeon captured by trotlines increases, so would the overall size structure of the sampled population. In addition, since 2009 when the targeted effort has occurred, the number of pallid sturgeon captured in the lower part of the river has also increased. The lower sections of segment 3 have been the best area to collect larger older year classes of pallid sturgeon and more sampling in that area could also affect the size distribution of fish collected. Nevertheless, it does appear that the size structure of the true population is changing. The average size of pallid sturgeon captured in the otter trawl has continuously increased over the past six years. For instance, during 2006 the average was 237 mm, 266 mm in 2007, 272 mm in 2008, 277 mm in 2009, 282 mm in 2010 and 338 mm in 2011. Thus, it may be better to look at how the size structure is changing by gear instead of lumping gears that are known to be size selective.

Even though the high water reduced our catch rates for shovelnose sturgeon, the presumed large year class produced in 2010 was observed as age-1 fish in 2011. Overall shovelnose sturgeon CPUE was down significantly for both trammel nets and otter trawls when

compared to the previous five years. However, CPUE of sub-stock in the 150-249 mm length group was the highest for trammel nets in the six years of sampling and second highest for the otter trawl. These CPUE estimates would have likely been much higher under normal flow conditions and shows that the Program can track *Scaphirhnchus spp.* in their early life history stages and their recruitment to older ages. Interestingly, no age-0 shovelnose were collected in 2011, something that differed from 2010. The 2010 water year consisted of a "normal" Missouri River water year with exceptional Milk River discharges. Although the peak discharge of the Milk was much smaller in 2010 than during 2011, its flow was sustained throughout the spring and early summer months. These conditions influenced the discharge and the suspended sediment loads of the upper Missouri River and produced the best year class of YOY shovelnose sturgeon witnessed in the past 10 years of Montana Fish, Wildlife and Parks larval sampling. On the contrary, 2011 was a large water year in both the Missouri and Milk Rivers and the exceptional flow may have flushed larval shovelnose sturgeon past segment 3 into segment 4 or perhaps Lake Sakakawea. Additionally, the relatively large flows encountered during the fish community season may have reduced our capture efficiencies to the point that we were unable to capture YOY fish that were present. Sampling in 2012 under more normal flow conditions will be imperative in exploring if shovelnose sturgeon production and recruitment occurred downstream of Fort Peck Dam during the historically high water year of 2011.

While trammel net, otter trawl and mini fyke nets all seemed to have reduced capture efficiencies during the higher flow throughout the sturgeon and fish community seasons of 2011, trotline CPUE remained relatively stable for shovelnose sturgeon and CPUE actually increased more than two-fold for pallid sturgeon 2011. Although trotlines have their problems with monitoring relative abundance due to them not being an active gear, they may play an important role in monitoring *Scaphirhynchus spp.* in exceptional flow years, when the capture efficiencies of other active gears are significantly impeded.

Overall, 2011 was a difficult year to monitor the fishes of the Missouri River since conditions differed greatly compared to all other years of sampling in segment 3. However, the floodplain interaction that occurred in conjunction with higher suspended sediment loads and the forming of a new channel most likely had or will have significant effects on the fish assemblage. Sampling in the next few years should shed valuable light on how a flood affects not only pallid sturgeon, but other Missouri River fishes.

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

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

Gear	Code	Type	Season	Years	CPUE units
Trammel Net – 1.0”inner mesh	TN	Standard	Both Seasons	2006 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2006 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2006 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2006	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2006	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Wild	Fish Comm.	2007-Present	Fish / 100 m^2
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trot Line	TL	Evaluation	Both Seasons	2009	Fish / hook night
Trot Line	TL	Standard	Both Seasons	2010-Present	Fish / hook night
Electrofishing	EF	Wild	Both Seasons	2010-Present	Fish/hour

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

State(s)	RPMA	Site Name	Code	River	R.M.
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KS/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 3of the Missouri River (RPMA 2)

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

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2005	Culbertson	1736	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	182	2005	10/13/2005	Advanced Fingerling		
2005	Intake	313	2005	10/13/2005	Advanced Fingerling		
2005	Milk River	845	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Mouth of Milk	371	2005	10/13/2005	Advanced Fingerling		
2005	Sidney	105	2005	10/13/2005	Advanced Fingerling		
2005	Wolf Point	1521	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	371	2005	10/13/2005	Advanced Fingerling		
2005	Culbertson	651	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Intake	2120	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Milk River	485	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Sidney	882	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	650	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2006	Culbertson	235	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	327	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Mouth of Milk	134	2005	3/28/2006	Advanced fingerling	Elastomer	
2006	Sidney	113	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	232	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	970	2005	4/3/2006	Yearling	PIT Tag	Elastomer
2006	Sidney	314	2005	4/3/2006	Yearling	PIT Tag	Elastomer

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2006	Culbertson	844	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Mouth of Milk	1007	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Wolf Point	866	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Culbertson	669	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Intake	765	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Mouth of Milk	650	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Sidney	228	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Wolf Point	653	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006		1355	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Culbertson	1544	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Intake	1680	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Mouth Milk	1117	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Sidney	586	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	1553	2006	10/24/2006	Advanced Fingerling	Elastomer	
2006	School Trust	436	2006	11/8/2006	Advanced Fingerling	Elastomer	
2007	Culbertson	651	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Fallon	491	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Forsyth	492	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	Sidney	983	2006	4/3/2007	Yearling	PIT Tag	Scute Removed
2007	School Trust	639	2006	4/5/2007	Yearling	PIT Tag	Scute Removed
2007	Wolf Point	651	2006	4/5/2007	Yearling	PIT Tag	Scute

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark Removed
2007	Wolf Point	428285	2007	7/9/2007	Fry		
2007	Grand	5558	2007	7/13/2007	Fry		
2007	Champs Miles City	13125	2007	7/18/2007	Fry		
2007	Intake	20763	2007	8/9/2007	Fry		
2007	Miles City	13675	2007	8/9/2007	Fry		
2007	Intake	336	2007	8/27/2007	Fingerling		
2007	Miles City	336	2007	8/27/2007	Fingerling		
2007	Wolf Point	672	2007	8/27/2007	Fingerling		
2007	Forsyth	690	2007	8/31/2007	Fingerling	CWT	
2007	Intake	615	2007	8/31/2007	Fingerling	CWT	
2007	School Trust	1160	2007	9/6/2007	Fingerling	CWT	
2007	Intake	293	2007	9/12/2007	Fingerling		
2007	Miles City	293	2007	9/12/2007	Fingerling		
2007	Wolf Point	586	2007	9/12/2007	Fingerling		
2007	Culbertson	6455	2007	9/14/2007	Fingerling	Elastomer	
2007	Fallon	4827	2007	9/14/2007	Fingerling	Elastomer	
2007	Forsyth	5370	2007	9/14/2007	Fingerling	Elastomer	
2007	Intake	7812	2007	9/14/2007	Fingerling	Elastomer	
2007	School Trust	6096	2007	9/14/2007	Fingerling	Elastomer	
2007	Sidney	1934	2007	9/14/2007	Fingerling	Elastomer	
2007	Wolf Point	6455	2007	9/14/2007	Fingerling	Elastomer	
2008	Culbertson	1384	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Culbertson	643	2007	3/26/2008	Yearling	Elastomer	
2008	Fallon	1307	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Forsyth	1384	2007	5/7/2008	Yearling	PIT Tag	Scute Removed
2008	Forsyth	106	2007	3/26/2008	Yearling	Elastomer	

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

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

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

Appendix F

Total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 3 of the Missouri River during 2010. 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	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB	TRML CHNB
BKBH	0	0	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	0	0
BMBF	1	0.002	0	0	0.005	0	0	0
		0.004	0	0	0.01	0	0	0
BRBT	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
BUSK	**3**	**0.006**	**0**	**0**	**0.01**	**0.009**	**0**	**0**
		0.007	**0**	**0**	**0.014**	**0.018**	**0**	**0**
CARP	14	0.033	0.005	0	0.088	0	0	0
		0.041	0.011	0	0.113	0	0	0
CNCF	13	0.029	0	0	0.03	0	0	1.694
		0.029	0	0	0.042	0	0	0.248
ERSN	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
FHCB	18	0.038	0.047	0	0.053	0.014	0	0
		0.022	0.044	0	0.04	0.029	0	0
FHMW	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
FWDM	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
GDEY	87	0.184	0.112	0.333	0.318	0.034	0.033	1.956
		0.082	0.12	0.667	0.179	0.042	0.067	0.276
GNSF	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
LKWF	1	0.002	0	0	0.005	0	0	0

Species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB	TRML CHNB
		0.003	0	0	0.01	0	0	0
LNDC	0	0	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	0	0
NFSH	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
NTPK	4	0.009	0.014	0	0.012	0	0	0
		0.011	0.028	0	0.018	0	0	0
PDSG	**7**	**0.018**	**0.029**	**0**	**0.02**	**0.007**	**0**	**0**
		0.014	**0.034**	**0**	**0.023**	**0.015**	**0**	**0**
PNMW	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
RBTT	1	0.003	0	0	0.007	0	0	0
		0.005	0	0	0.015	0	0	0
RVCS	17	0.043	0.031	0	0.019	0	0.033	2.252
		0.039	0.033	0	0.022	0	0.067	1.778
SFCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
SGCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
SGER	**39**	**0.084**	**0.046**	**0**	**0.122**	**0.057**	**0**	**1.136**
		0.039	**0.045**	**0**	**0.071**	**0.046**	**0**	**2.273**
SHRH	14	0.034	0.046	0	0.048	0.009	0	0
		0.028	0.061	0	0.052	0.018	0	0
SMBF	5	0.01	0.008	0	0.02	0	0	0
		0.009	0.016	0	0.019	0	0	0
SNGR	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
SNSG	**13**	**0.031**	**0.024**	**0**	**0.059**	**0.009**	**0**	**0**

Species	Total Catch	Overall CPUE	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB	TRML CHNB
		0.023	**0.029**	**0**	**0.056**	**0.018**	**0**	**0**
SNSN	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
STCT	1	0.002	0.005	0	0	0	0	0
		0.004	0.011	0	0	0	0	0
STSN	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
WLYE	9	0.023	0.013	0	0.023	0	0	0.944
		0.019	0.026	0	0.023	0	0	0.84
WSMW	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
WTCP	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
WTSK	1	0.002	0.005	0	0	0	0	0
		0.004	0.011	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	TRML 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	1	0.002	0	0.006	0	0	0
		0.004	0	0.011	0	0	0
BRBT	5	0.01	0.006	0.017	0.01	0	0
		0.009	0.012	0.02	0.02	0	0
BUSK	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
CARP	12	0.032	0.012	0.006	0	0.309	0
		0.03	0.017	0.011	0	0.31	0
CNCF	31	0.07	0.073	0.072	0.055	0.048	0.37
		0.037	0.071	0.067	0.063	0.065	0.741
ERSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
FHCB	58	0.121	0.076	0.145	0.03	0.443	0
		0.049	0.047	0.074	0.045	0.399	0
FHMW	1	0.002	0	0.006	0	0	0
		0.005	0	0.013	0	0	0
FWDM	0	0	0	0	0	0	0
		0	0	0	0	0	0
GDEY	23	0.051	0.06	0.03	0.02	0.19	0
		0.042	0.091	0.038	0.04	0.286	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
LNDC	0	0	0	0	0	0	0
		0	0	0	0	0	0
LNSK	3	0.007	0	0	0	0.081	0
		0.011	0	0	0	0.12	0
NFSH	0	0	0	0	0	0	0
		0	0	0	0	0	0
NTPK	0	0	0	0	0	0	0
		0	0	0	0	0	0
PDSG	**12**	**0.025**	**0.037**	**0.023**	**0.012**	**0.024**	**0**
		0.016	**0.038**	**0.022**	**0.023**	**0.048**	**0**
PNMW	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB	TRML CHNB
		0	**0**	**0**	**0**	**0**	**0**
RBTT	0	0	0	0	0	0	0
		0	0	0	0	0	0
RVCS	4	0.009	0.006	0.007	0.01	0	0.222
		0.009	0.012	0.015	0.02	0	0.444
SFCB	**61**	**0.126**	**0.176**	**0.109**	**0.13**	**0.024**	**0**
		0.056	**0.129**	**0.072**	**0.114**	**0.048**	**0**
SGCB	**93**	**0.196**	**0.212**	**0.282**	**0.105**	**0.048**	**0**
		0.065	**0.115**	**0.133**	**0.095**	**0.065**	**0**
SGER	**21**	**0.043**	**0**	**0.064**	**0.04**	**0.119**	**0.185**
		0.032	**0**	**0.075**	**0.063**	**0.133**	**0.37**
SHRH	11	0.026	0.006	0.017	0.01	0.183	0
		0.022	0.012	0.02	0.02	0.221	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	**14**	**0.029**	**0.024**	**0.046**	**0.01**	**0.027**	**0**
		0.019	**0.029**	**0.042**	**0.02**	**0.054**	**0**
SNSN	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**
STCT	19	0.046	0.007	0.075	0	0.199	0
		0.047	0.014	0.117	0	0.241	0
STSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
WLYE	2	0.005	0	0	0	0	0.444
		0.011	0	0	0	0	0.889
WSMW	**1**	**0.002**	**0**	**0.007**	**0**	**0**	**0**
		0.005	**0**	**0.013**	**0**	**0**	**0**
WTCP	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTSK	3	0.009	0	0	0	0.107	0
		0.018	0	0	0	0.214	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	0.01	0	0.023	0	0	0	0
		0.02	0	0.047	0	0	0	0
BLGL	1	0.01	0	0.023	0	0	0	0
		0.02	0	0.047	0	0	0	0
BMBF	5	0.051	0	0.047	0	0.25	0	0
		0.053	0	0.065	0	0.359	0	0
BRBT	11	0.112	0.103	0.14	0.2	0	0.2	0
		0.07	0.152	0.107	0.4	0	0.4	0
BUSK	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
CARP	6	0.061	0.034	0.023	0	0.25	0.2	0
		0.049	0.069	0.047	0	0.261	0.4	0
CNCF	1	0.01	0.034	0	0	0	0	0
		0.02	0.069	0	0	0	0	0
ERSN	40	0.408	0.345	0.488	0.2	0.5	0.4	0
		0.209	0.286	0.401	0.4	0.522	0.8	0
FHCB	84	0.857	1.31	0.372	0	1.833	1.6	0
		0.484	1.101	0.2	0	2.706	1.625	0
FHMW	537	5.48	9.931	4.953	0.8	0.583	2.6	3
		3.515	9.1	4.991	0.98	0.386	5.2	6
FWDM	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
GDEY	6	0.061	0	0.047	0	0.167	0.4	0
		0.057	0	0.065	0	0.225	0.8	0
GNSF	2	0.02	0	0.047	0	0	0	0
		0.029	0	0.065	0	0	0	0
LKWF	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
LNDC	14	0.143	0.138	0.233	0	0	0	0
		0.154	0.164	0.332	0	0	0	0
LNSK	1	0.01	0	0	0	0	0.2	0
		0.02	0	0	0	0	0.4	0
NFSH	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
NTPK	25	0.255	0.103	0.349	0.4	0.333	0.2	0
		0.124	0.152	0.229	0.49	0.376	0.4	0
PDSG	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
PNMW	**1**	**0.01**	**0.034**	**0**	**0**	**0**	**0**	**0**

Species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS
		0.02	**0.069**	**0**	**0**	**0**	**0**	**0**
RBTT	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0
RVCS	217	2.214	3.483	0.884	0	5.583	2.2	0
		0.903	2.208	0.625	0	3.58	2.993	0
SFCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
SGCB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
SGER	**10**	**0.102**	**0.138**	**0.093**	**0**	**0**	**0.2**	**0.25**
		0.079	**0.164**	**0.13**	**0**	**0**	**0.4**	**0.5**
SHRH	6	0.061	0.138	0.047	0	0	0	0
		0.049	0.13	0.065	0	0	0	0
SMBF	2	0.02	0	0.023	0	0.083	0	0
		0.029	0	0.047	0	0.167	0	0
SNGR	4	0.041	0	0.07	0	0.083	0	0
		0.064	0	0.14	0	0.167	0	0
SNSG	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**	**0**	**0**	**0**
SNSN	**87**	**0.888**	**1.034**	**0.535**	**0**	**2.833**	**0**	**0**
		0.623	**1.029**	**0.322**	**0**	**4.263**	**0**	**0**
STCT	2	0.02	0	0.023	0.2	0	0	0
		0.029	0	0.047	0.4	0	0	0
STSN	26	0.265	0.448	0.163	0	0.5	0	0
		0.135	0.323	0.132	0	0.577	0	0
WLYE	5	0.051	0.034	0.047	0	0.167	0	0
		0.053	0.069	0.065	0	0.333	0	0
WSMW	**17**	**0.173**	**0.207**	**0.116**	**0**	**0.417**	**0.2**	**0**
		0.12	**0.23**	**0.119**	**0**	**0.672**	**0.4**	**0**
WTCP	30	0.306	0.172	0.302	0	1	0	0
		0.245	0.143	0.216	0	1.826	0	0
WTSK	9	0.092	0.069	0.023	0.2	0.333	0.2	0
		0.082	0.138	0.047	0.4	0.512	0.4	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	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	0	0	0	0	0	0
	.	0	0	0	0	0
BRBT	5	0.053	0.032	0.071	0.083	0
	.	0.055	0.065	0.105	0.167	0
BUSK	0	0	0	0	0	0
	.	0	0	0	0	0
CARP	7	0.074	0.032	0.143	0	0
	.	0.091	0.065	0.2	0	0
CNCF	51	0.537	0.903	0.262	0.917	0.1
	.	0.272	0.696	0.194	0.869	0.2
ERSN	0	0	0	0	0	0
	.	0	0	0	0	0
FHCB	23	0.242	0.29	0.238	0.333	0
	.	0.126	0.19	0.224	0.376	0
FHMW	0	0	0	0	0	0
	.	0	0	0	0	0
FWDM	3	0.032	0	0.024	0.083	0.1
	.	0.036	0	0.048	0.167	0.2
GDEY	20	0.211	0.226	0.214	0.083	0.3
	.	0.089	0.179	0.128	0.167	0.306
GNSF	0	0	0	0	0	0
	.	0	0	0	0	0
LKWF	0	0	0	0	0	0
	.	0	0	0	0	0
LNDC	0	0	0	0	0	0
	.	0	0	0	0	0
LNSK	0	0	0	0	0	0
	.	0	0	0	0	0
NFSH	0	0	0	0	0	0
	.	0	0	0	0	0
NTPK	0	0	0	0	0	0
	.	0	0	0	0	0
PDSG	77	0.811	0.645	1.262	0.083	0.3
	.	0.31	0.366	0.602	0.167	0.6
PNMW	0	0	0	0	0	0
	.	0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
RBTT	0	0	0	0	0	0
	.	0	0	0	0	0
RVCS	0	0	0	0	0	0
	.	0	0	0	0	0
SFCB	0	0	0	0	0	0
	.	0	0	0	0	0
SGCB	0	0	0	0	0	0
	.	0	0	0	0	0
SGER	8	0.084	0.032	0.095	0.167	0.1
	.	0.065	0.065	0.114	0.225	0.2
SHRH	1	0.011	0	0.024	0	0
	.	0.021	0	0.048	0	0
SMBF	0	0	0	0	0	0
	.	0	0	0	0	0
SNGR	0	0	0	0	0	0
	.	0	0	0	0	0
SNSG	59	0.621	1.032	0.5	0.083	0.5
	.	0.286	0.709	0.336	0.167	0.537
SNSN	0	0	0	0	0	0
	.	0	0	0	0	0
STCT	29	0.305	0.387	0.238	0.417	0.2
	.	0.144	0.317	0.202	0.297	0.267
STSN	0	0	0	0	0	0
	.	0	0	0	0	0
WLYE	1	0.011	0	0.024	0	0
	.	0.021	0	0.048	0	0
WSMW	0	0	0	0	0	0
	.	0	0	0	0	0
WTCP	0	0	0	0	0	0
	.	0	0	0	0	0
WTSK	3	0.032	0	0.048	0.083	0
	.	0.036	0	0.067	0.167	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 2011 for Segment 3 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

	Sturgeon Season		**Fish Community Season**			**Both Seasons**
Species Code	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
BKBH	0	0	0	0.01	0	0
BLGL	0	0	0	0.01	0	0
BMBF	0	0	0.004	0.051	0.004	0
BRBT	0	0.004	0	0.112	0.018	0.053
BUSK	**0**	**0**	**0.014**	**0**	**0**	**0**
CARP	0.003	0.004	0.076	0.061	0.066	0.074
CNCF	0.036	0.045	0.017	0.01	0.098	0.537
ERSN	0	0	0	0.408	0	0
FHCB	0.003	0.082	0.089	0.857	0.166	0.242
FHMW	0	0.004	0	5.48	0	0
FWDM	0	0	0	0	0	0.032
GDEY	0.094	0	0.315	0.061	0.11	0.211
GNSF	0	0	0	0.02	0	0
LKWF	0.003	0	0	0	0	0
LNDC	0	0	0	0.143	0	0
LNSK	0	0	0	0.01	0.015	0
NFSH	0	0	0	0	0	0
NTPK	0	0	0.022	0.255	0	0
PDSG	**0.015**	**0.016**	**0.024**	**0**	**0.036**	**0.811**
PNMW	**0**	**0**	**0**	**0.01**	**0**	**0**
RBTT	0	0	0.006	0	0	0
RVCS	0.057	0.013	0.022	2.214	0.006	0
SFCB	**0**	**0.05**	**0**	**0**	**0.214**	**0**
SGCB	**0**	**0.222**	**0**	**0**	**0.165**	**0**
SGER	**0.049**	**0.008**	**0.136**	**0.102**	**0.084**	**0.084**
SHRH	0.003	0	0.08	0.061	0.056	0.001
SMBF	0.01	0	0.009	0.02	0	0
SNGR	0	0	0	0.041	0	0
SNSG	**0.004**	**0.012**	**0.071**	**0**	**0.048**	**0.621**
SNSN	**0**	**0**	**0**	**0.888**	**0**	**0**
STCT	0	0.049	0.004	0.02	0.042	0.305
STSN	0	0	0	0.265	0	0
WLYE	0.02	0.01	0.027	0.051	0	0.011
WSMW	**0**	**0**	**0**	**0.173**	**0.005**	**0**

	Sturgeon Season		Fish Community Season			Both Seasons
Species Code	1.0" Trammel Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
WTCP	0	0	0	0.306	0	0
WTSK	0	0	0.004	0.092	0.02	0.002

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 - 2011.

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011
1	1701.5	48.06744	105.53246						ST, FC
2	1700								
3	1698.5								
4	1697.5								
5	1696	48.09072	105.45751					ST, FC	
6	1695	48.08947	105.43861		ST, FC		ST, FC	ST, FC	
7	1693.5								
8	1692	48.09134	105.37340		ST, FC	ST, FC			
9	1690.5								
10	1689	48.08243	105.32400		ST, FC				
11	1687.5	48.07970	105.30329						ST, FC
12	1685.5	48.08757	105.25700			ST, FC		ST, FC	
13	1684.5	48.09120	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		
16	1680	48.06636	105.19965	ST, FC					
17	1678.5	48.09023	105.18363		ST, FC				
18	1677	48.10268	105.17349		ST, FC				
19	1675.5	48.09255	105.17268			ST, FC			
20	1674	48.07865	105.16694			ST, FC			ST, FC
21	1672.5	48.07616	105.12389					ST, FC	
22	1671								
23	1670								
24	1668.5								

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011
25	1667	48.07748	105.06696				ST, FC		
26	1666	48.06939	105.04797			ST, FC	ST, FC	ST, FC	ST, FC
27	1665								
28	1664	48.05832	105.04102				ST, FC		
29	1663								
30	1661.5	48.08338	105.00873					ST, FC	ST, FC
31	1660	48.07323	104.99768				ST, FC		ST, FC
32	1659	48.06867	104.99927	ST, FC					
33	1657	48.09531	104.98125	ST, FC					
34	1656	48.09737	104.98157				ST, FC		
35	1655	48.10115	104.96768			ST, FC	ST, FC		
36	1654								
37	1653	48.09515	104.93953		ST, FC	ST, FC		ST, FC	
38	1651	48.12806	104.92393		ST, FC	ST, FC			ST, FC
39	1650	48.13711	104.92179						ST, FC
40	1648.5	48.14876	104.89821		ST, FC		ST, FC		
41	1647	48.14244	104.87120						ST, FC
42	1646	48.12876	104.85751				ST, FC	ST, FC	
43	1644.5	48.12040	104.83851				ST, FC		ST, FC
44	1643	48.12765	104.79225				ST, FC		
45	1641.5	48.12736	104.76171					ST, FC	
46	1640.5	48.11350	104.74879				ST, FC		
47	1639.5	48.11303	104.73495		ST, FC	ST, FC			
48	1638.5	48.11906	104.71559		ST, FC	ST, FC			
49	1637.5	48.12048	104.70437					ST, FC	
50	1636.5	48.10395	104.68213	ST, FC				ST, FC	ST, FC
51	1635.5	48.10472	104.68209						ST, FC

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011
52	1634.5	48.10719	104.65868		ST, FC				
53	1633.5	48.11139	104.63210			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	104.60450	ST, FC				ST, FC	ST, FC
57	1629.5	48.13993	104.60433			ST, FC			
58	1628.5	48.12988	104.58845						ST, FC
59	1627	48.11385	104.59247						ST, FC
60	1625.5	48.11823	104.56667		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	104.47210		ST, FC	ST, FC			
65	1619.5	48.11113	104.45372						ST, FC
66	1618.5	48.09912	104.44811				ST, FC		
67	1617.5	48.09658	104.44370		ST, FC	ST, FC		ST, FC	
68	1616.5	48.08134	104.41538	ST, FC					
69	1615	48.07642	104.39290		ST, FC				
70	1613.5	48.07464	104.37304			ST, FC			
71	1612								
72	1611	48.04604	104.33904			ST, FC			ST, FC
73	1610	48.04465	104.32111					ST, FC	
74	1608.5	48.04829	104.28288		ST, FC	ST, FC	ST, FC		
75	1606.5	48.03500	104.25092	ST, FC		ST, FC			
76	1604.5	48.03568	104.20708	ST, FC			ST, FC	ST, FC	
77	1603	48.04410	104.19778			ST, FC			
78	1598.5	48.04596	104.18368	ST, FC		ST, FC			

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011
79	1597.5	48.03868	104.16394			ST, FC			ST, FC
80	1596	48.04502	104.15459				ST, FC		
81	1595	48.05317	104.14133		ST, FC	ST, FC		ST, FC	
82	1594	48.03780	104.12411		ST, FC				
83	1593	48.02956	104.10265		FC	ST, FC			
84	1592	48.02939	104.10010						ST, FC
85	1591	48.02138	104.09813			ST, FC			
86	1590.5	48.02015	104.10017		ST, FC			ST, FC	
87	1589.5	48.00520	104.10172		ST, FC				
88	1588.5								
89	1587								
90	1585.5								
91	1583.5								