2010 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 pallid sturgeon population assessment crew conducted random sampling of segment 3 of the Missouri River between Wolf Point, MT and the confluence of the Yellowstone River for the fifth consecutive year during 2010. A total of 22 individual randomly selected river bends were sampled both during the sturgeon and fish community seasons. These bends were sampled with trammel nets, otter trawls and mini fyke nets. An additional 22 river bends were sampled once with experimental trotlines. The sampling began with the sturgeon season on April 19th and ended with the fish community season on October 21st. A total of 385 trammel nets were deployed and caught a total of 719 fish, 433 otter trawls were towed which captured 833 fish, and 176 mini fyke nets were set which captured 2,422 total fish. An additional 306 trotlines were fished throughout segment 3 to catch 647 total fish

Pallid sturgeon *Scaphirhynchus albus* total catch (n=180) was slightly down in 2010 from the 2009 total of 190, which was the largest catch in five years of sampling. No wild pallid sturgeon were caught in segment three during 2010. Pallid sturgeon were captured throughout the entire segment three sampling area with a higher proportion sampled in downstream areas starting at about river mile 1620.

Overall trammel net CPUE slightly decreased from 2009, but has remained somewhat constant over the last five years, whereas otter trawl CPUE increased in 2010, although it has also remained relatively constant over the five sampling years. The five year average CPUE for the otter trawl and trammel net was estimated at 0.04 fish/100m and while the trammel net five 0.03 fish/100m, respectively. The increase in total catch of pallid sturgeon in the previous four years was related to an increase in sampling effort with both standard and experimental gears and did not appreciably affect the overall CPUE. A total of 52 pallid sturgeon were sampled using standard otter trawl tows, while 33 were capture in standard trammel net drifts.

Trotlines were once again determined to be an effective gear at sampling pallid sturgeon and were used in 2010 throughout segment 3 to increase our total catch. Trotlines sampled 52% (n=95) of the total pallid sturgeon catch for segment 3 in 2010. An intensive trotline effort occurred again during August in the lower part of segment 3 resulting in 47 of the total 95 trotline captures for 2010. An evaluation on timed versus overnight sets resulted in overnight sets capturing 83% of the pallid sturgeon while timed daytime sets captured the remaining 13%.

Trotlines continued to do a better job of capturing larger fish, which mostly consisted of older age classes, when compared to the otter trawl and trammel nets

Over the past five years of sampling the size structure of pallid sturgeon sampled in segment 3 has changed. A higher proportion of larger fish are being sampled during both the fish community and sturgeon seasons when compared to the first year of sampling. Nine different year classes were captured in 2010 with the 2008 and 2009 year class making up 51% of the total catch. Pallid sturgeon from all stocking sites in RPMA 2 were sampled in segment 3 during 2010. Segment 3 continues to show a higher diversity of year classes and size structure of pallid sturgeon than segment 2 further up stream, indicating the many differences between these two sampling segments below Fort Peck Dam.

Shovelnose sturgeon *S. platorynchus* catch in 2010 decreased in 2010 (n=323) from that of 2009 (n=375. Both otter trawl and trammel net CPUE remained relatively constant from the previous four years. A slight increase was seen in otter trawl CPUE for sub stock size fish as there were several YOY shovelnose captured this year. The size structure of shovelnose sturgeon sampled in segment 3 is comprised mostly of adults in the 400mm to 700mm range. However, each year we catch younger age classes of shovelnose sturgeon lending evidence that shovelnose are successfully recruiting in RPMA 2 in most if not all years. Over the five years of sampling, the majority of YOY shovelnose sturgeon have been captured in lower part of segment 3. This lower area of the river is the major rearing area for YOY shovelnose sturgeon. However, in 2010 a YOY shovelnose sturgeon was sampled at river mile 1656, the farthest upstream a YOY sturgeon has been sampled in the five years of sampling. This was a good indication of shovelnose spawning farther upstream in segment 2 in 2010 due to tremendous water flows out of the Milk River, a major tributary in segment 2.

Overall a total of 4,620 fish consisting of 35 species were sampled in segment 3 during 2010. This was the lowest total number of fish caught in five years of sampling. Some species of native fishes such as fathead minnows *Pimephales promelas* and white suckers *Catostomus commersoni* showed significant decreases in their relative abundance during 2010 from 2009 others like as flathead chubs *Platygobio gracilis* and western silvery minnows *Hybognathus argyritis* showed increases. Otter trawl CPUE data for sturgeon chub *Macrhybopsis gelida* have shown a decrease while sicklefin chub *M. meeki* CPUE has remained relatively the same over the last five seasons. Sand shiner *Notropis stramineus* mini fyke net CPUE was also the lowest in

five years. The blue sucker *Cycleptus elongates* catch remained low in segment 3 when compared to segment 2. Otter trawl and trammel nets CPUE data for sauger *Sander canadense* remained stable, while mini fyke net CPUE has greatly fluctuated over the fiver year sampling period, with 2010 being the second highest catch of YOY sauger.

The Milk River had a significant influence on the Missouri River in 2010. Both large peak discharge and the duration of discharge greatly enhanced production of many native fishes in the Missouri River downstream of Fort Peck Dam. Two peaks over 6,000 cfs occurred and discharge was well over 1,000 cfs well into the later part of August. The population assessment crew sampled their first YOY shovelnose sturgeon in the middle reaches of segment 3 during 2010, which was likely due to the influence the Milk River had on the Missouri. Shovelnose sturgeon may have spawned further upstream in the Missouri River in 2010 due to the higher water temperatures and increased suspended sediment loads that the Milk River contributed. In addition, more YOY sauger were sampled in the previous years, again likely due more advantageous spawning conditions due to Milk River flows. Increases in production were witnessed with many other native fishes in both segment 2 and 3, lending further evidence that warmer springtime and summer waters in the Missouri River could potentially benefit the native fish community.

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Introduction

The U.S. Fish and Wildlife Service (USFWS) listed pallid sturgeon *Scaphirhynchus albus* as endangered in 1990. In response to listing, the USFWS issued a Biological Opinion to the U.S. Army Corps of Engineers (COE), the primary water management entity responsible for the Missouri River main stem 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 2009). 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 2009). 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 2009), 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 (2009). 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. All 22 bends were sampled during both the sturgeon season (April 1 through June 30) and the Fish Community Season (July 1 through October 28) during 2010.

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

Trotlines were used again in segment 3 during 2010 as an experimental gear with the intent to further evaluate its use as a pallid sturgeon gear. Twenty-two randomly chosen river bends were sampled using trotlines, 11 during the sturgeon season and 11 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 2010.

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 (2009).

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 3/0 Eagle Claw circle hook. Experimental trotlines were set overnight and checked the next morning.

Data Collection and Analysis

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

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

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

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

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

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

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

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

Genetic Verification

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

Relative Condition

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

L (r^2 = 0.9740)] derived by Keenlyne and Evanson (1993) for pallid sturgeon throughout their range.

Size Classes of Pallid and Shovelnose Sturgeon

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

Analyses

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

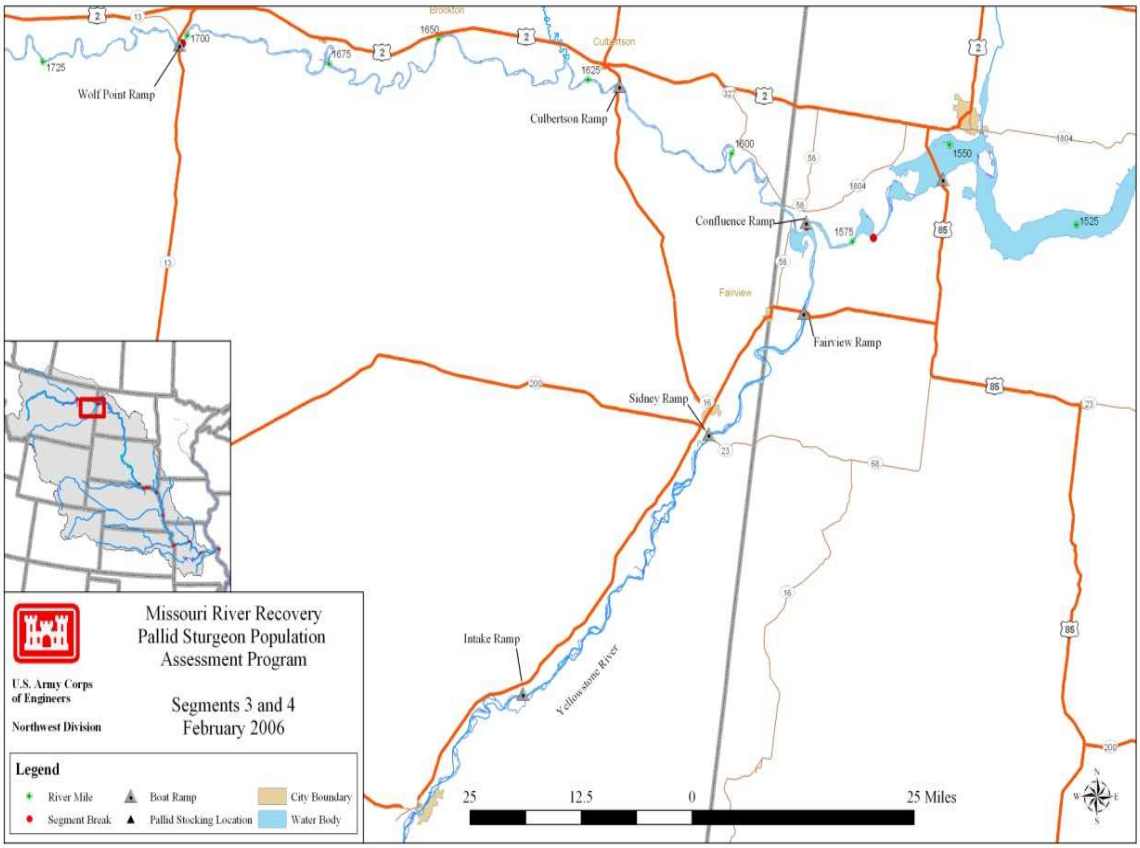

Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 22 randomly selected river bends were sampled using trammel nets and the otter trawl during the sturgeon season of 2010. Each gear had an average of 8 random deployments (Table 1). In addition, 36 non random otter trawl and 18 trammel net deployments were made as duplicate passes subsequent to capturing pallid sturgeon. Trotlines were used in 11 randomly selected bends during the sturgeon season, each with eight subsamples.

During the fish community season the same 22 randomly selected bends were sampled with trammel nets and the otter trawl as well as mini fyke nets. Otter trawl and trammel nets had an additional 45 and 8 non-random duplicate subsamples deployed after catching a pallid sturgeon. Trotlines were set in 11 random river bends during the fish community season.

From August 24th through 26th non-random trotline samples as well as otter trawl and trammel nets deployments were made in non-random river bends to increase our pallid sturgeon catch. The increased numbers will be used to populate survival estimates of pallid sturgeon released into RPMA 2.

Pallid Sturgeon

During 2010 a total of 180 pallid sturgeon were sampled in segment 3 of the Missouri River, which was slightly lower than the 2009 field season (Figure 9). No wild pallid sturgeon were captured this year in segment 3, all fish were of hatchery origin. Over the five year span a total of 640 pallid sturgeon have been sampled in segment 3.

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 1620 (Figure 2). Experimental trotlines sampled 95 pallid sturgeon, more than any other gear. For the standard gears, the otter trawl sampled 52 pallid sturgeon, while trammel nets caught 33. Mini fyke nets did not capture a pallid sturgeon. More pallid sturgeon were sampled in the fish community season (n = 109) than during the sturgeon season (n = 71).

The proportion of pallid sturgeon sampled by length group has subtly changed since 2006. In 2010 a few fish from the quality and larger size groups were seen in the catch. Little change has been observed during the sturgeon season, where the last three years of sampling

have consisted of sub-stock and stock sized fish. The subtle change that has occurred has occurred during the fish community season, where more stock size fish have been sampled. Most of these larger sized pallid sturgeon have been sampled using trotlines.

Nine different year classes of pallid sturgeon were sampled during 2010, a decrease from 11 year classes sampled in 2009. The 2008 year class was the most abundant year class sampled with 46 captured, followed by 2009 (n = 45), 2007 (n=24), 2006 (n = 28), 2005 (n = 19), 2004 (n = 2), 2002 (n = 4), 2001 (n = 7), 1997 (n = 1). The relative condition of pallid sturgeon within a size class has remained similar between years of sampling. However, a pattern of decreasing relative condition is seen as fish move from smaller to larger size classes (Figure 4).

Although the total number of pallid sturgeon sampled has increased over the past five years of sampling, this pattern has not been manifested in the CPUE data for either trammel nets or the otter trawl (Figures 6 and 7). Overall trammel net CPUE in 2010 was the lowest seen in the last five years of sampling (Figure 6). While the CPUE for the otter trawl was the highest in 2010 than the previous five years. With the high variance associated with the estimates no conclusions can be made at this time about the relative abundance of pallid sturgeon using this gear. Interestingly, the pattern of overall CPUE for the trammel net and otter trawl have been opposite of one another over the past four years. For instance, overall trammel net CPUE was higher in 2006 then lower in 2007 then back to higher in 2008 and lower in 2009 then decreasing further in 2010. Otter trawl CPUE showed an opposite pattern being lower in 2006 then higher in 2007 then lower in 2008 and higher in 2009 and increasing again in 2010.

Trotlines proved to be a very effective gear at sampling pallid sturgeon again in 2010. From August 23rd through 25th we implemented an intensive trotline effort which consisted of setting 32 trotlines at a time as both an overnight and timed sets between river miles 1594 to 1587. A total of 47 pallid sturgeon representing 9 distinct year classes were sampled. These fish originated from nine separate stocking sites within RPMA 2 including sites on both the Missouri and Yellowstone River. This sampling effort captured many of the largest pallid sturgeon seen throughout the entire year of sampling.

For specific environmental variables associated with pallid sturgeon captures by macro and macro habitat types see Table 2. For the proportion of pallid sturgeon captured by gear in macro habitat and the proportion those habitats were sampled by pallid sturgeon size class see Tables 4 through 7 and for all sizes of pallid sturgeon combined see Table 8.

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 2010. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deploy-ments	Macrohabitat[a]												
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season															
1.0" Trammel Net	22	8	N-E	58	0	N-E	N-E	59	55	4	0	0	N-E	0	N-E
Otter Trawl	22	8	N-E	55	0	N-E	N-E	63	52	6	0	0	N-E	0	N-E
Fish Community Season															
1.0" Trammel Net	22	8.00	N-E	61	0	N-E	N-E	59	51	5	0	0	N-E	0	N-E
Mini-Fyke Net	22	7.95	N-E	50	0	N-E	N-E	64	0	10	48	1	N-E	2	N-E
Otter Trawl	21	8.38	N-E	58	2	N-E	N-E	61	51	4	0	0	N-E	0	N-E

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

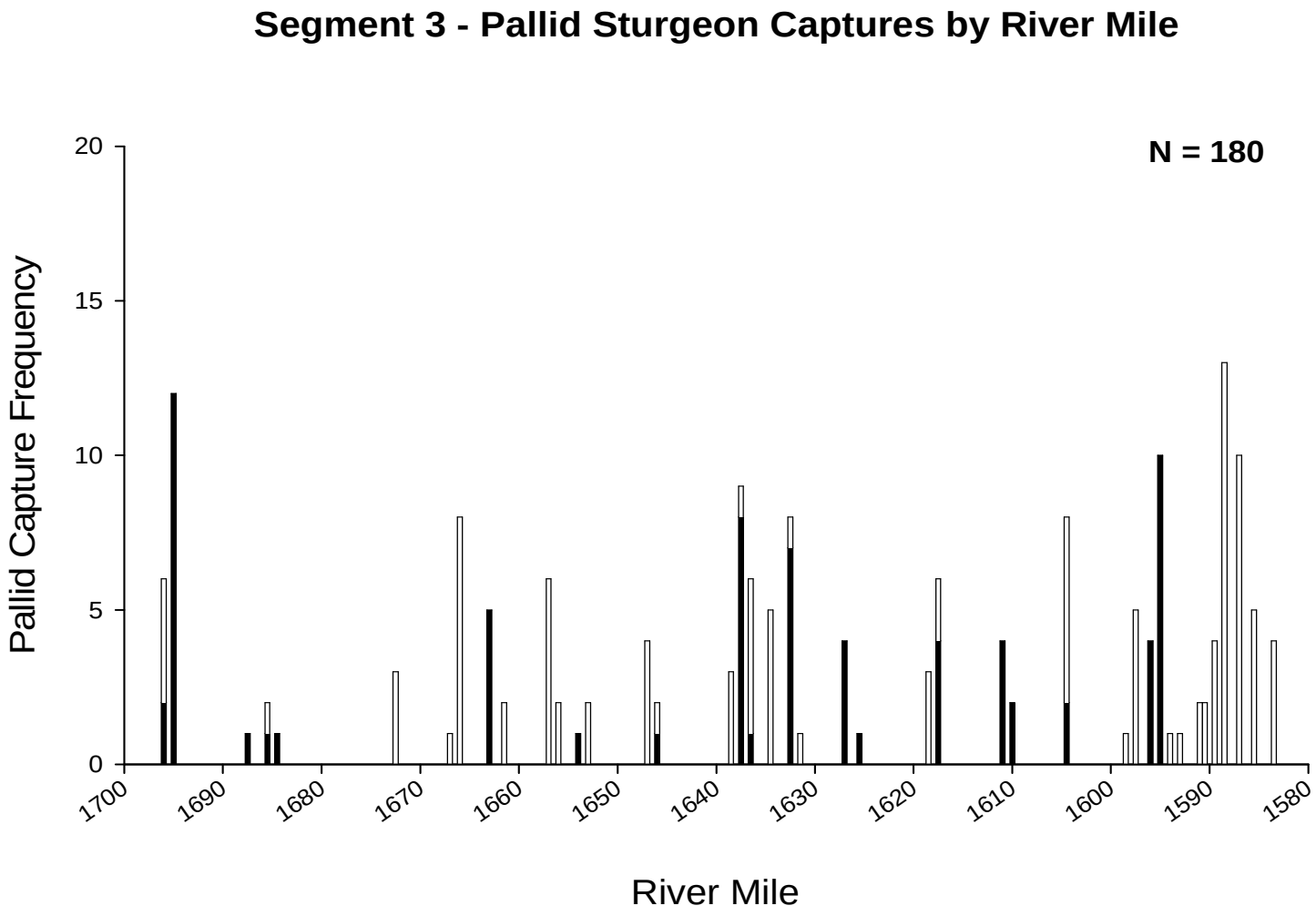

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2010. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2010. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallids caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CHXO	BARS	0.4 (0.2-0.6)		0.04 (0.00-0.14)		16.7 (9.3-23.2)		97 (35-309)		
	CHNB	1.6 (0.8-4.3)	1.6 (0.8-3.1)	0.65 (0.00-0.97)	0.60 (0.00-0.90)	16.1 (6.3-22.7)	15.7 (8.6-22.7)	471 (30-3944)	214 (30-1448)	75
CONF	BARS									
	CHNB	1.6 (1.5-1.6)		0.68 (0.68-0.68)		9.2 (9.1-9.3)		39 (39-39)		
ISB	BARS	0.4 (0.1-0.6)		0.08 (0.00-0.19)		16.7 (9.3-22.6)		110 (32-324)		
	CHNB	1.5 (0.5-6.1)	1.5 (0.5-3.7)	0.61 (0.00-0.96)	0.57 (0.00-0.96)	16.6 (6.3-28.8)	17.1 (6.8-22.5)	436 (30-3300)	243 (30-2150)	59
OSB	BARS									
	CHNB	2.3 (1.0-5.4)	2.2 (1.0-4.5)	0.68 (0.11-1.01)	0.64 (0.11-0.95)	16.5 (6.3-23.0)	16.7 (7.7-22.7)	490 (34-3576)	231 (37-2100)	42
SCCL	BARS	0.4 (0.3-0.7)		0.01 (0.00-0.02)		19.9 (19.1-21.8)		75 (60-90)		
	CHNB	1.3 (0.9-4.1)	1.3 (1.1-1.6)	0.63 (0.43-0.81)	0.64 (0.44-0.74)	18.3 (12.0-21.2)	19.3 (18.4-21.0)	368 (45-1700)	426 (45-650)	4
SCCS	BARS	0.4 (0.2-0.6)		0.13 (0.00-0.80)		16.8 (9.3-22.8)		103 (31-318)		
	CHNB									
SCN	BARS	0.2 (0.2-0.2)		0.00 (0.00-0.00)		23.0 (23.0-23.0)				
	CHNB									
TRMS	BARS	0.7 (0.6-0.8)		0.00 (0.00-0.00)		9.9 (9.8-9.9)				
	CHNB									

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 2010 from Segment 3 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al. (In review).

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
1997	1				818	2150.0	0.856		
1999									
2001	7	230			494	428.6	0.889	0.078	
		31			52	117.8	0.079	0.026	
2002	4	296			630	823.0	0.783	0.130	
		2			35	141.1	0.028	0.028	
2003									
2004	2				498	433.0	0.827		
					184	450.0	0.085		
2005	19				357	144.9	0.921		
					12	15.6	0.039		
2006	28	255	60.5	1.135	345	128.3	0.914	0.088	0.059
		34	27.9	0.066	13	15.1	0.048	0.008	0.014
2007	24	221	49.8	1.527	322	109.8	0.977	0.144	0.096
		21	16.0	0.432	16	18.3	0.045	0.023	0.036
2008	46	270	90.5	8.102	304	87.8	0.934	0.204	0.074
		45	28.9	13.94	14	11.0	0.038	0.096	0.053
2009	45	293	95.8	1.100	268	72.4	1.049	0.253	0.075
		21	20.4	0.054	26	16.6	0.097	0.074	0.027
2010									

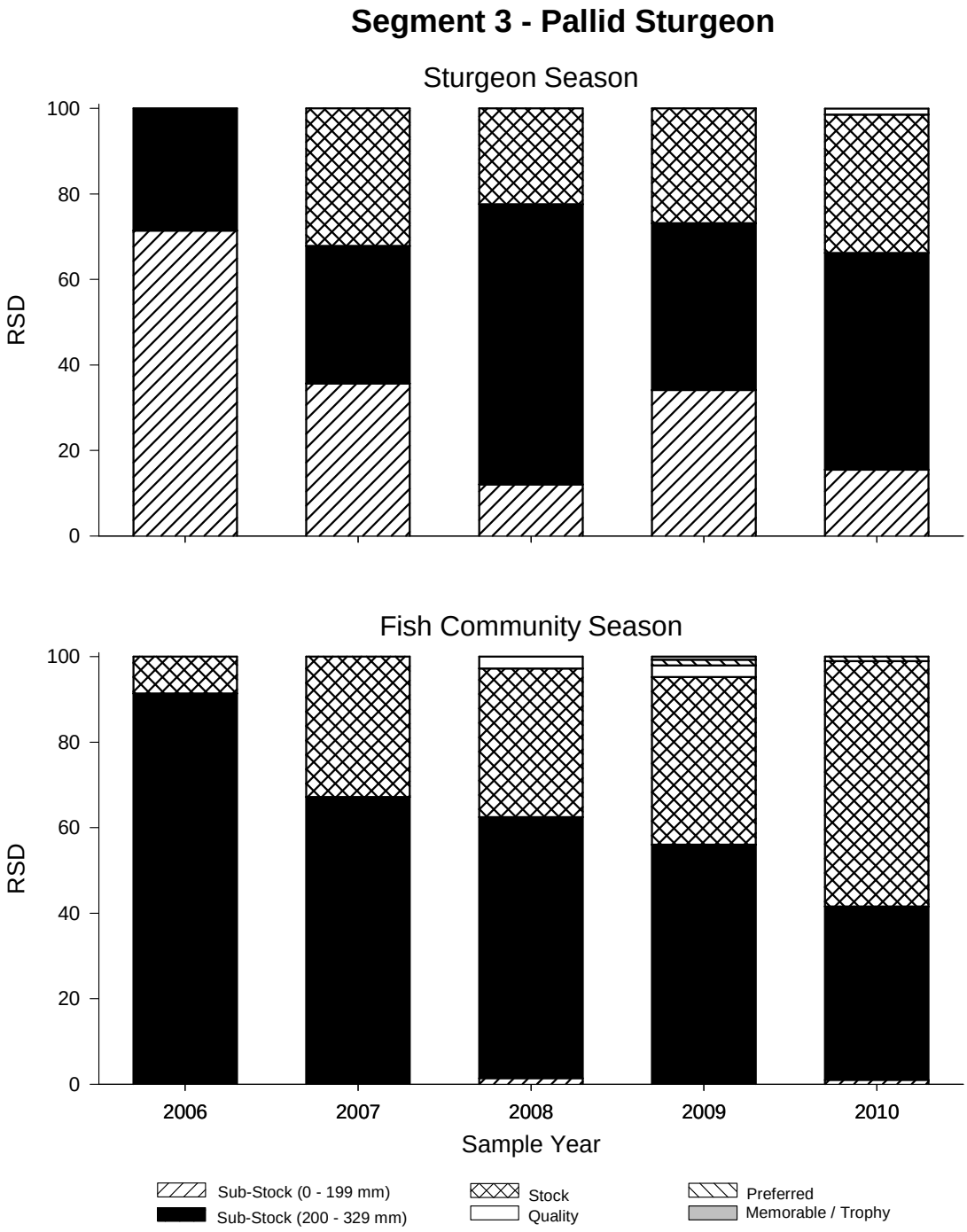

Figure 3. Proportion by length group for all pallid sturgeon captured with all gear by length category from 2006-2010 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

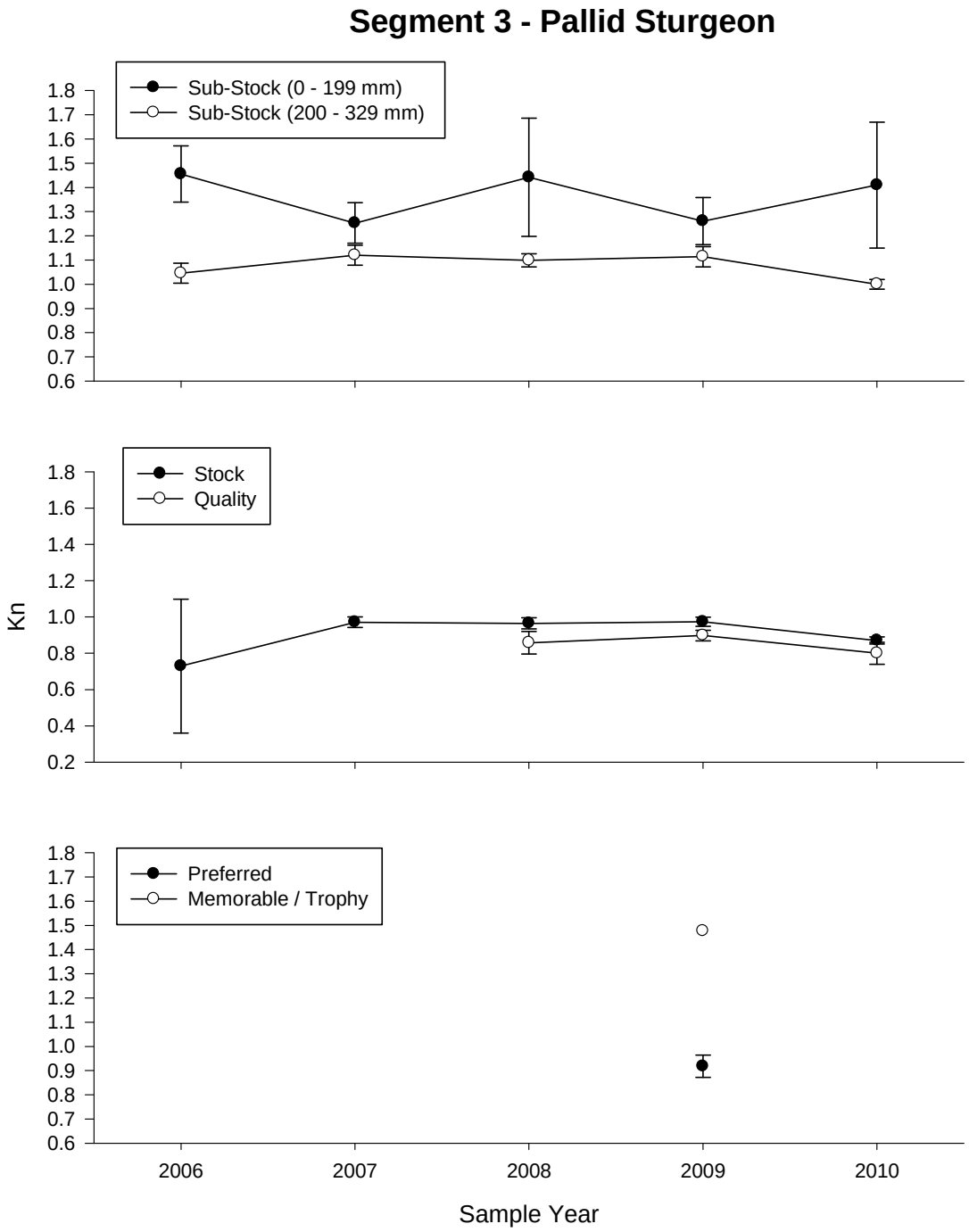

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011)

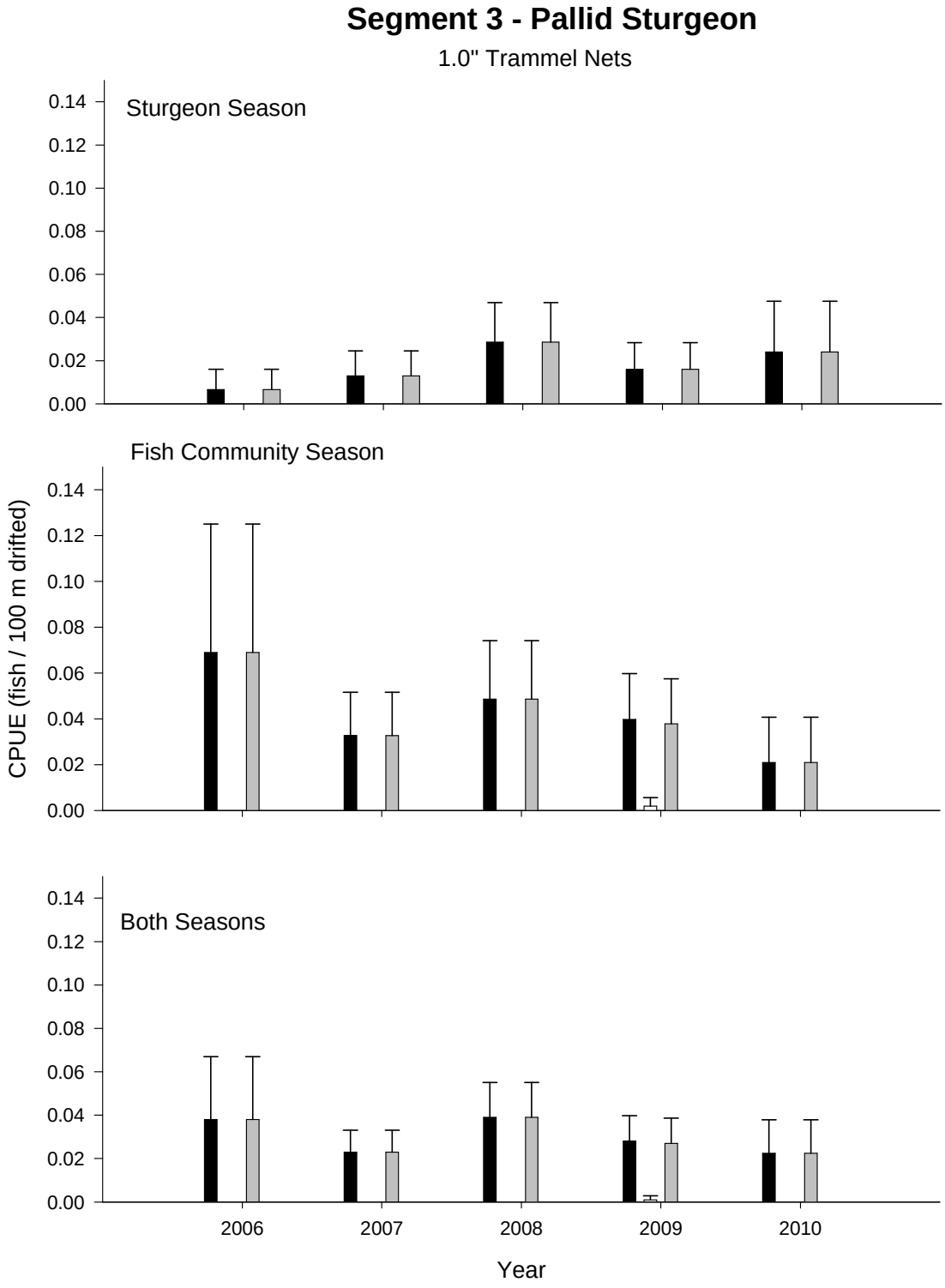

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic verification.

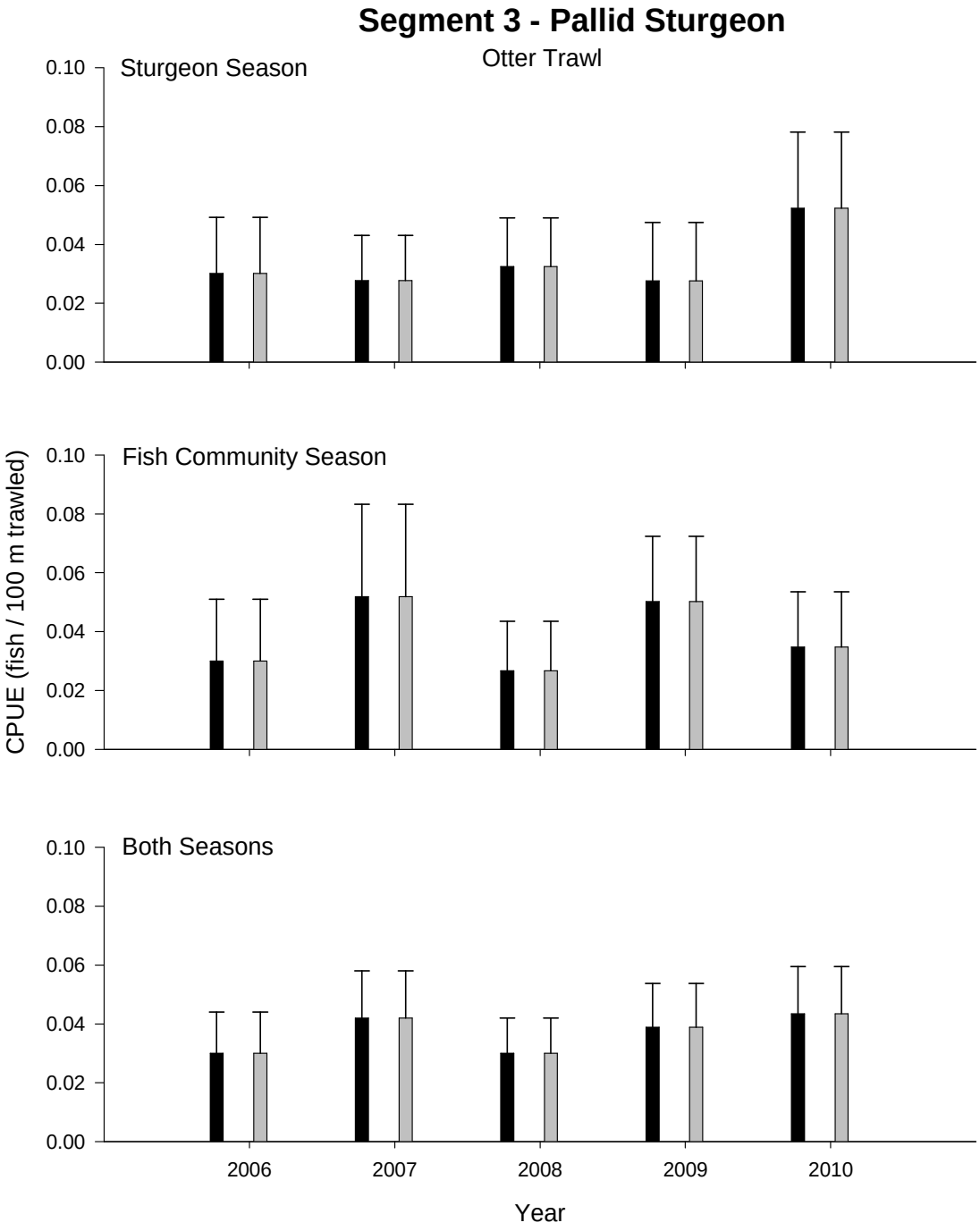

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2010. Pallid sturgeon of unknown origin are awaiting genetic 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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	2	0	50	0	0	0	0	50	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	6	0	33	0	0	0	67	0	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	4	0	50	0	0	0	0	25	25	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	10	0	30	0	0	0	20	50	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	5	0	20	0	0	0	40	40	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	10	0	50	0	0	0	30	10	10	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	1	0	100	0	0	0	0	0	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	2	0	50	0	0	0	50	0	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	2	0	50	0	0	0	50	0	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	6	0	17	0	0	0	67	17	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mean deploy-ments	Macrohabitat[a]												
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season															
1.0” Trammel Net	0		0	0	0	0	0	0	0	0	0	0	0	0	0
			0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	0		0	0	0	0	0	0	0	0	0	0	0	0	0
			0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season															
1.0” Trammel Net	0		0	0	0	0	0	0	0	0	0	0	0	0	0
			0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0		0	0	0	0	0	0	0	0	0	0	0	0	0
			0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	0		0	0	0	0	0	0	0	0	0	0	0	0	0
			0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	7	0	57	0	0	0	0	29	14	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	18	0	33	0	0	0	39	28	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	7	0	29	0	0	0	43	29	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	16	0	38	0	0	0	44	13	6	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	0	0	0

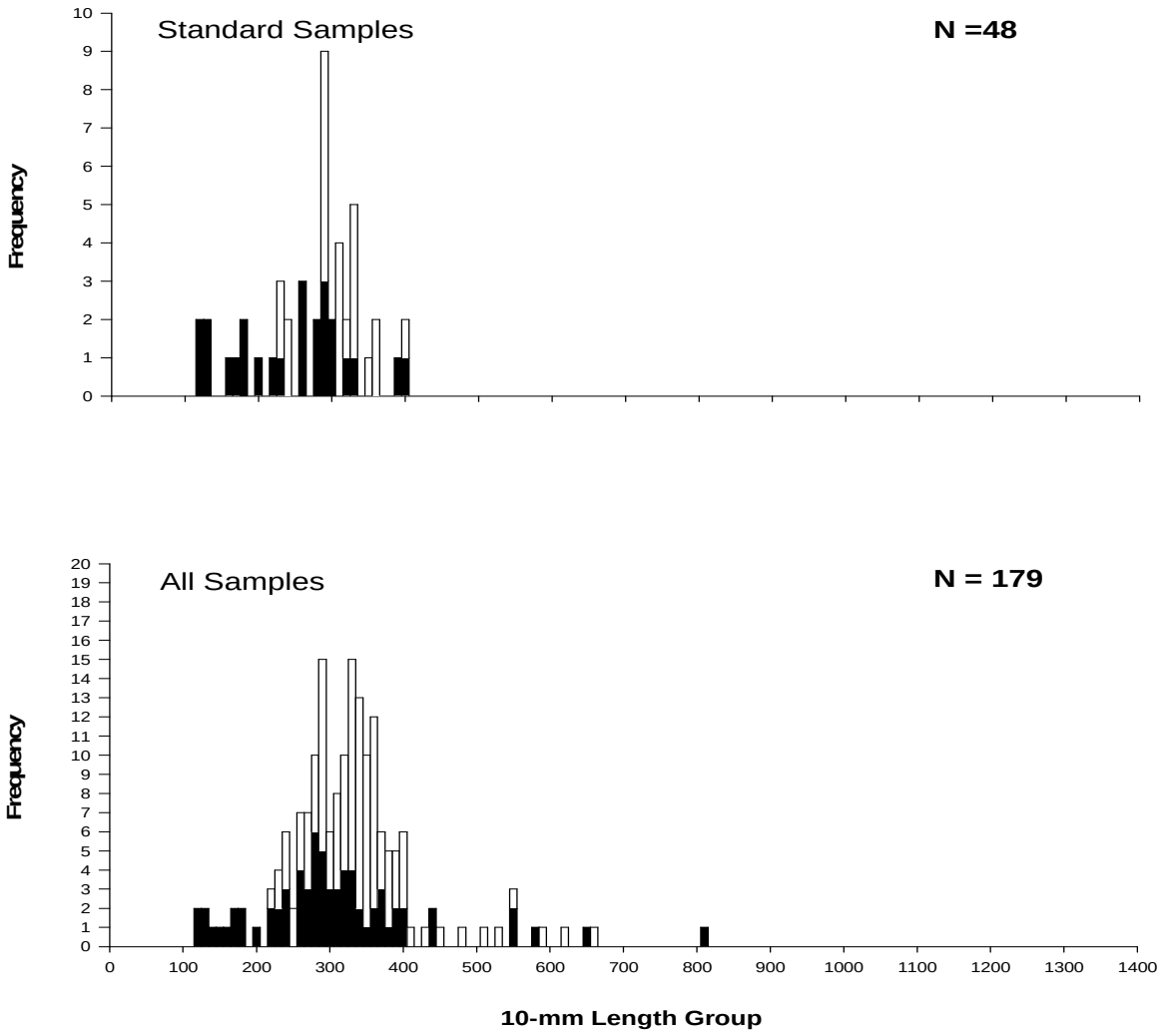

Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010. Pallid sturgeon of unknown origin are awaiting genetic verification.

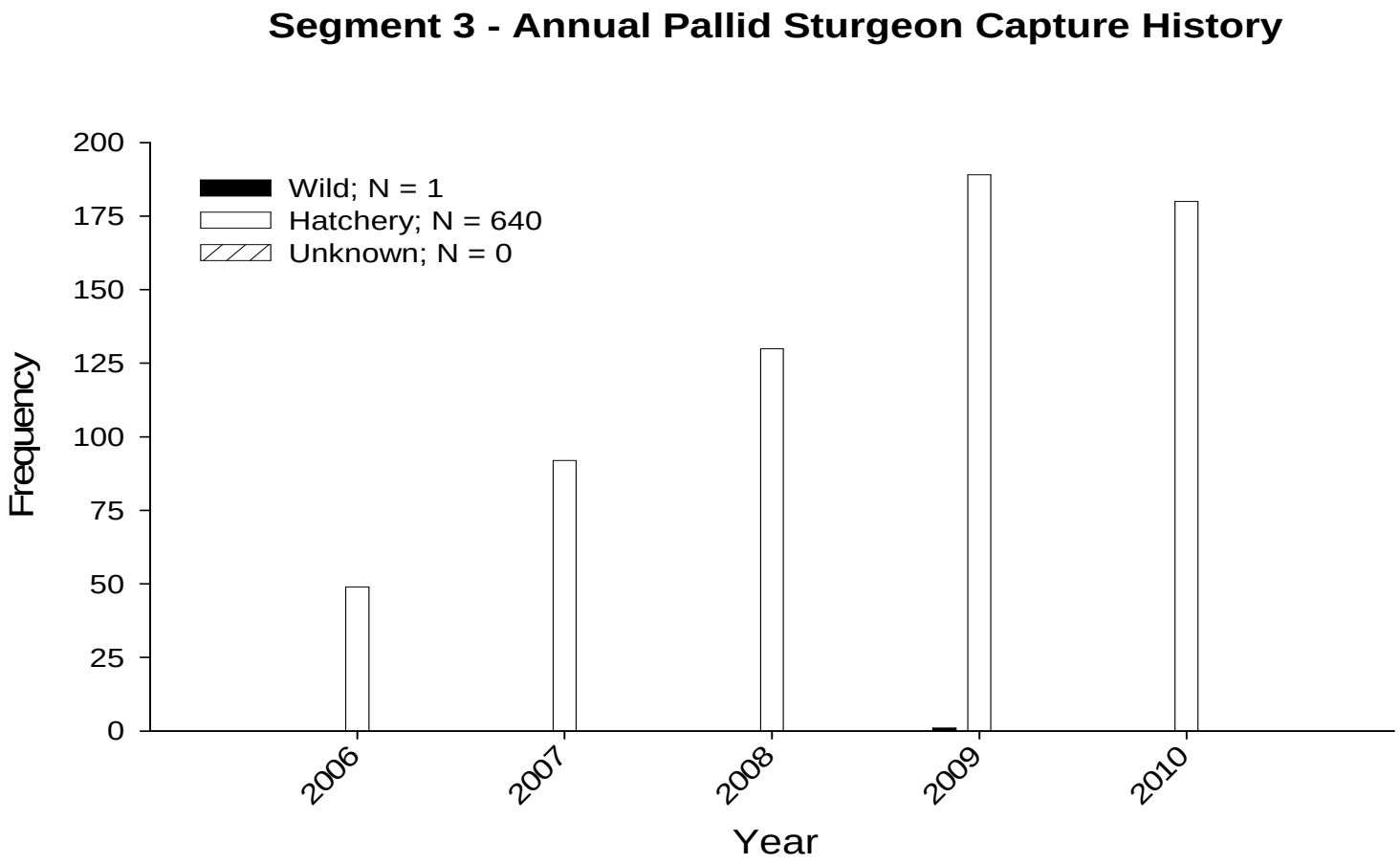

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2010. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable 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 2010 or during the previous four years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

During 2010 a total of 323 shovelnose sturgeon were sampled in segment 3 of the Missouri River, slightly lower than the 375 sampled in 2009. More were sampled during the sturgeon season (n = 163) than the fish community season (n = 160). Trotlines captured the most shovelnose sturgeon (n = 146) while trammel nets captured 136 and the otter trawl 41.

Over the past five years of sampling trammel net CPUE of shovelnose sturgeon has been considerably higher during the fish community season compared to the sturgeon season (Figure 11). Very few shovelnose sturgeon smaller than stock size have been captured using trammel nets in all five sampling years. Trammel net CPUE of stock size and larger shovelnose sturgeon has remained relatively constant over the five years of sampling.

In 2010 the otter trawl did capture sub stock size shovelnose sturgeon, similar to 2008 and 2007 (Figure 12). Overall otter trawl CPUE of stock size and larger shovelnose sturgeon was similar in 2010 to the five previous years.

The shovelnose sturgeon catch was relatively evenly distributed throughout the length of segment 3. With the exception of a few sub stock size fish captured in 2010, the overall size distribution of shovelnose captured was similar to past years since very few smaller fish have been captured in any year of sampling (Figure 14).

Shovelnose sturgeon averaged 526 mm FL and 610 g in segment 3 during 2010. The largest and smallest fish measured 864 and 78 mm FL, respectively. No pattern has been observed in the relative weight of shovelnose sturgeon within a size class over the five sampling seasons (Figure 15). 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.

The specific macro habitats where different size classes of shovelnose sturgeon were sampled by gear and the proportion that those habitats were sampled can be found in Tables 9 through 12. For the macro habitats where all shovelnose sturgeon combined were sampled is in Table 13.

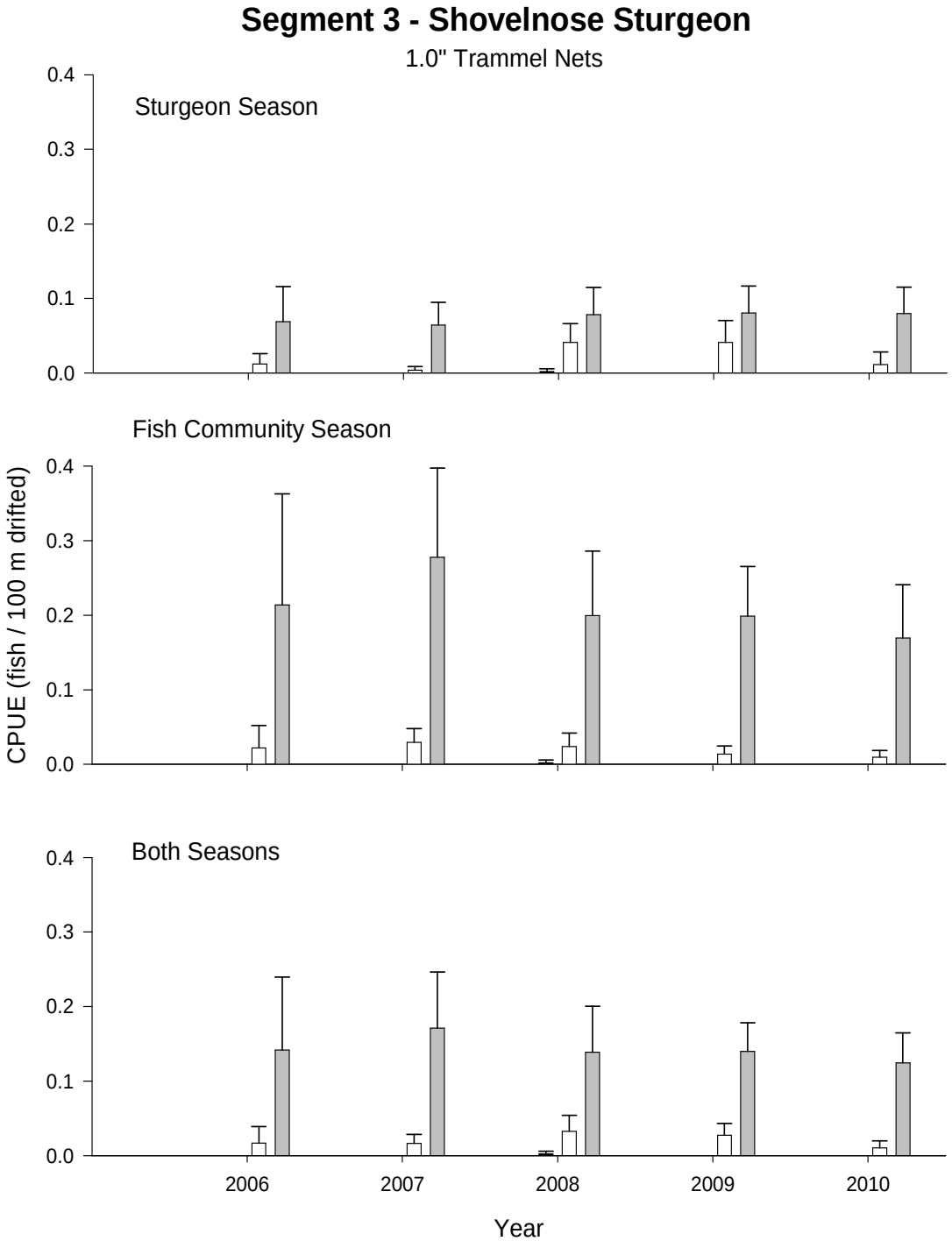

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2010.

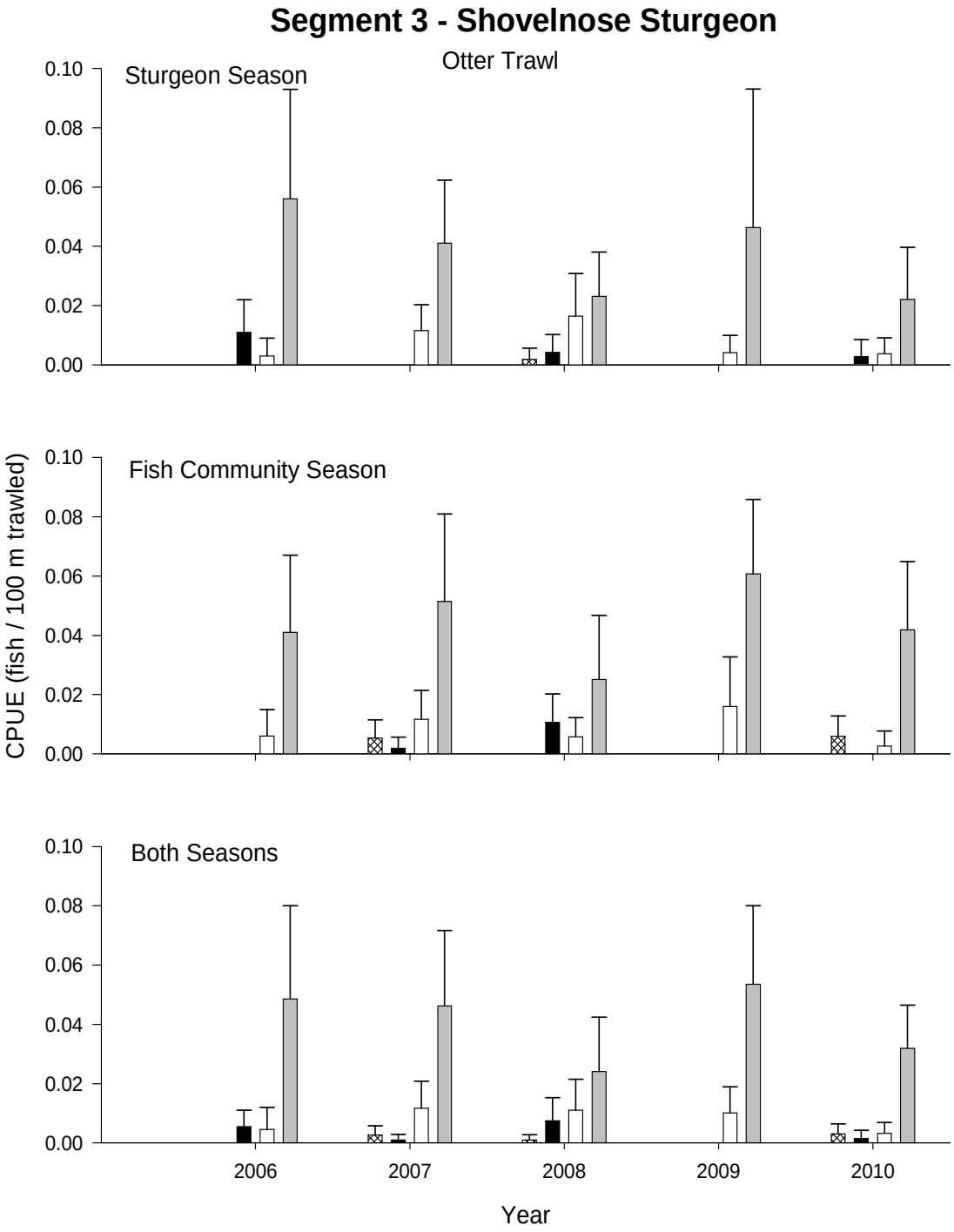

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2010.

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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	3	0	100	0	0	0	0	0	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	1	0	0	0	0	0	0	100	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	2	0	0	0	0	0	100	0	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	2	0	50	0	0	0	50	0	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	4	0	50	0	0	0	25	25	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	32	0	47	0	0	0	41	13	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	9	0	33	0	0	0	22	44	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	63	0	43	0	0	0	25	30	2	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	17	0	29	0	0	0	53	18	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	34	0	44	0	0	0	44	12	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	12	0	33	0	0	0	25	42	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	67	0	43	0	0	0	25	30	1	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	21	0	38	0	0	0	48	14	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	0	0	0

Segment 3 - Shovelnose Sturgeon

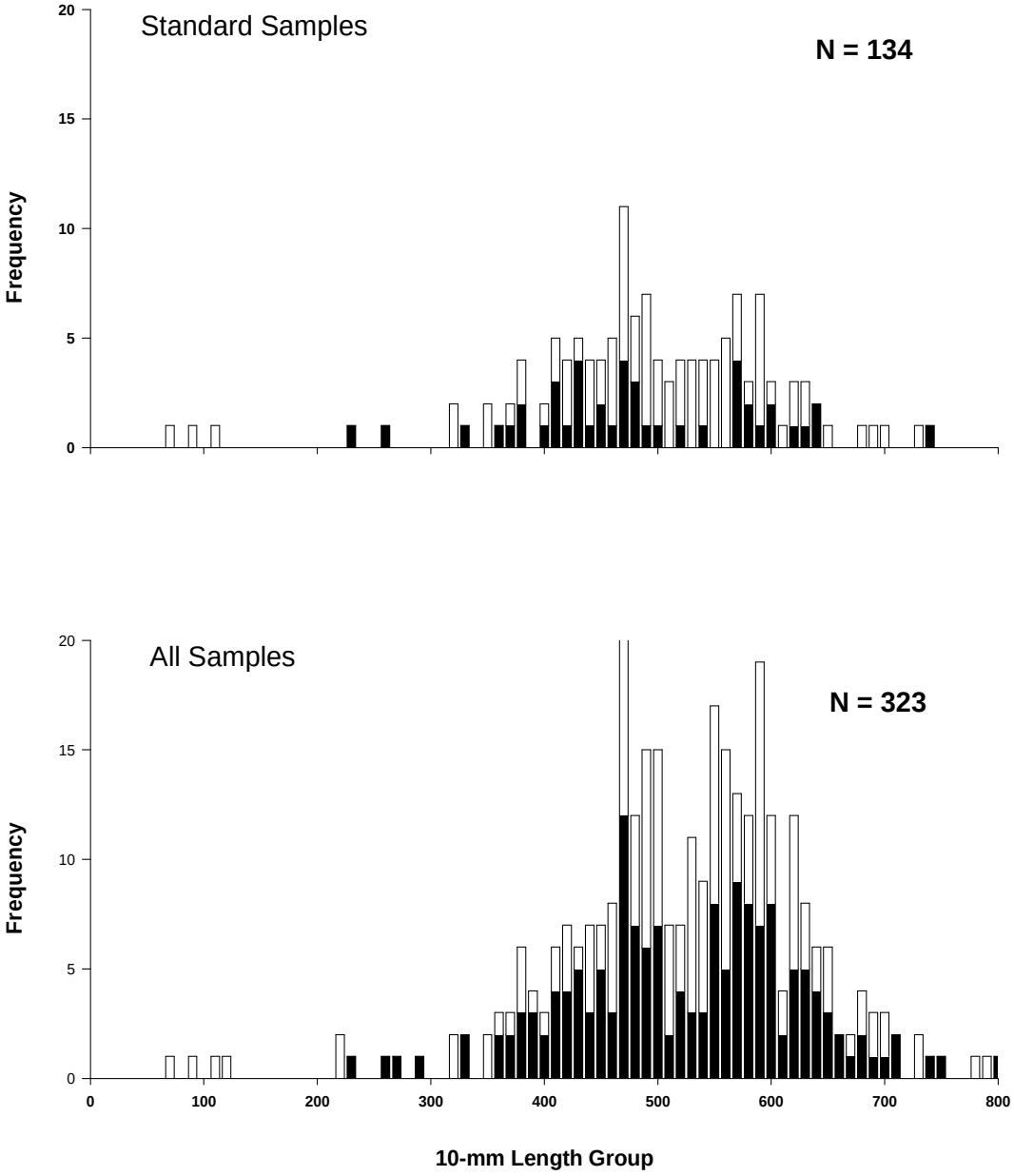

Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

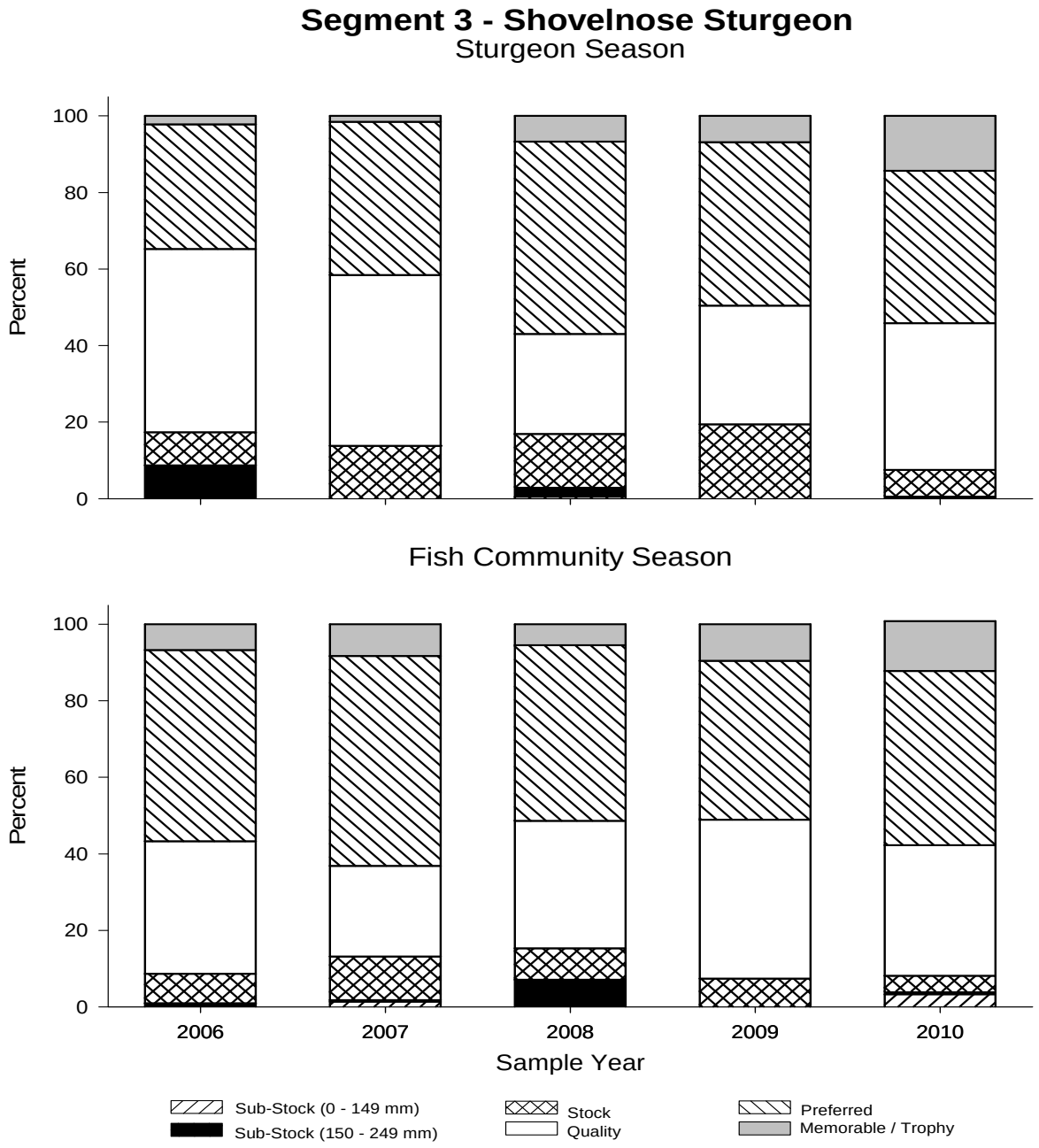

Figure 14. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2010 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

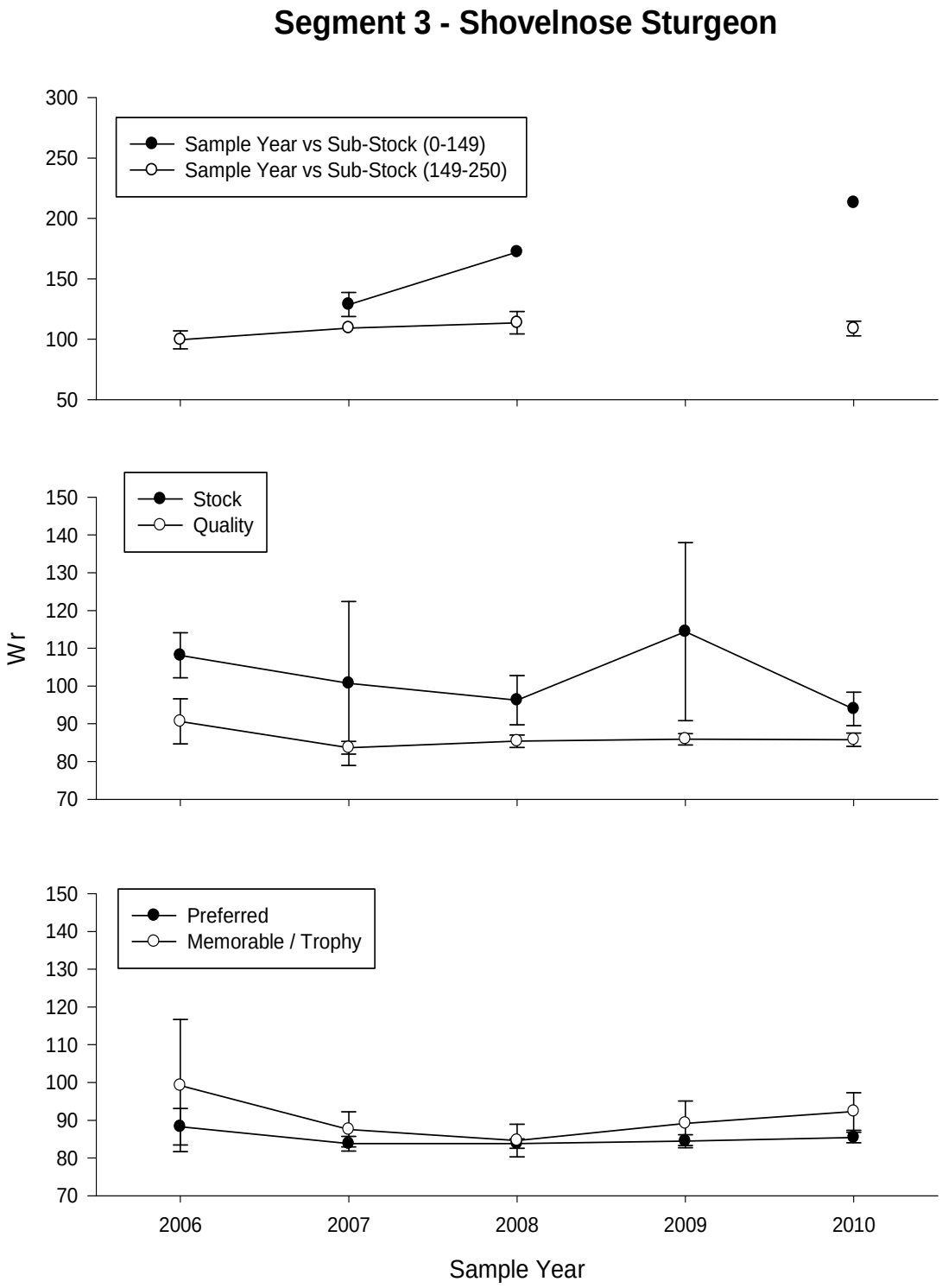

Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2010 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

A total of 196 sturgeon chubs were collected in 2010, a decrease from 2009 when 242 were sampled and a significant decrease from 2008 (n=663). More sturgeon chubs were collected during the sturgeon season (n = 116) than during the fish community season (n = 80). All sturgeon chubs were sampled using the otter trawl.

Overall otter trawl CPUE of sturgeon chubs was considerably lower again in 2010 than similar to 2009 (Figure 16). Up until 2009 CPUE had remained relatively constant.

Sturgeon chubs averaged 64 mm TL in 2010, which was slightly smaller than the 2009 average of 67 mm. In 2010 there was a slight increase in smaller sizes of sturgeon chubs, similar to 2008 (Figure 17). Based on Herman et al. 2008a the strong year class in 2008 was age-1 fish, while few age-0 fish were observed. During 2010 we saw a few age-1 fish and again few age-0 fish, while the majority of fish captured were age-2.

Although sturgeon chubs were present throughout the majority of segment 3, they were most abundant between river miles 1640.5 and 1644.5. This is somewhat interesting since in the past the abundance of sturgeon chubs for the most part has been greater as you go downstream in segment 3.

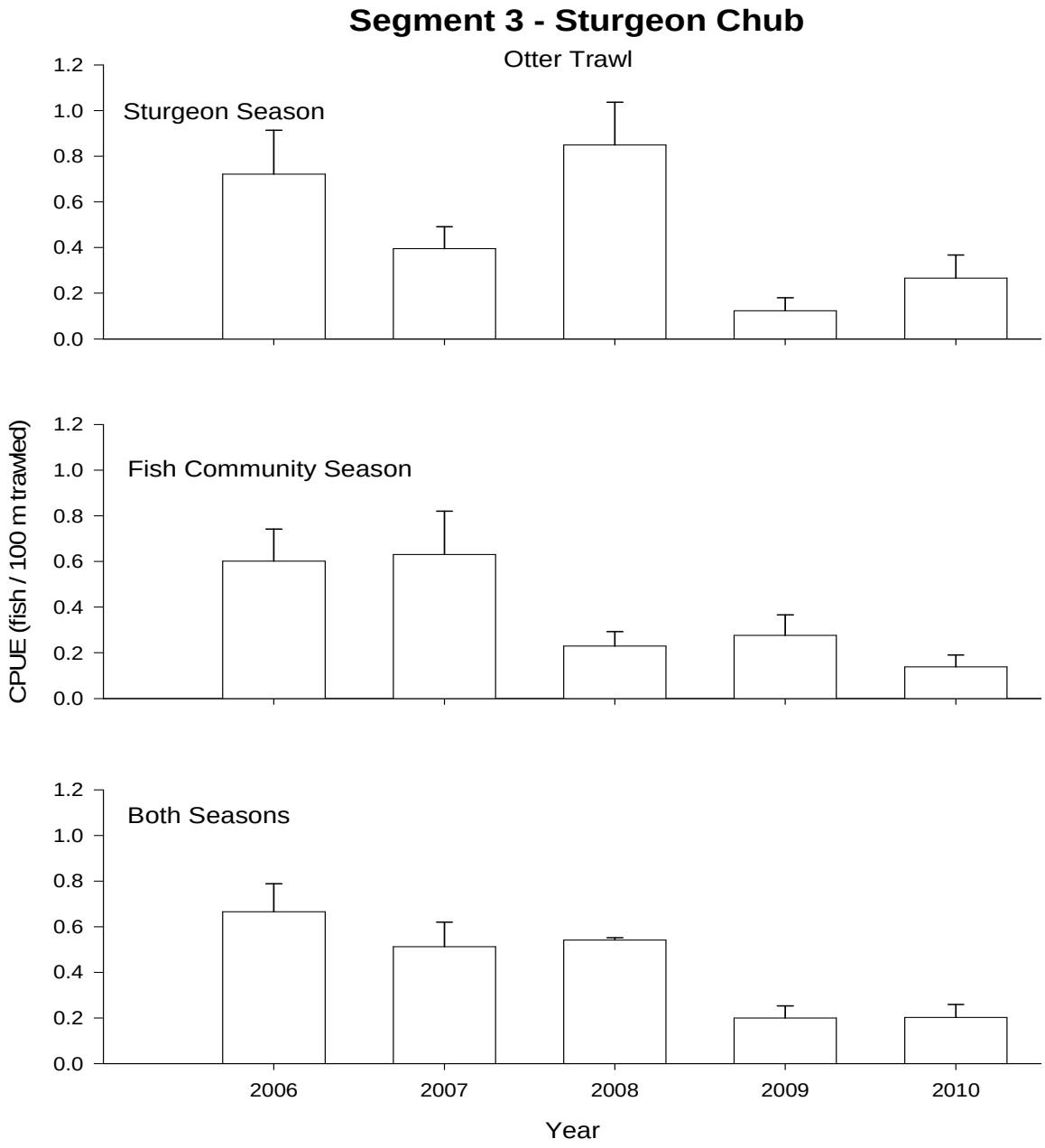

Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2010.

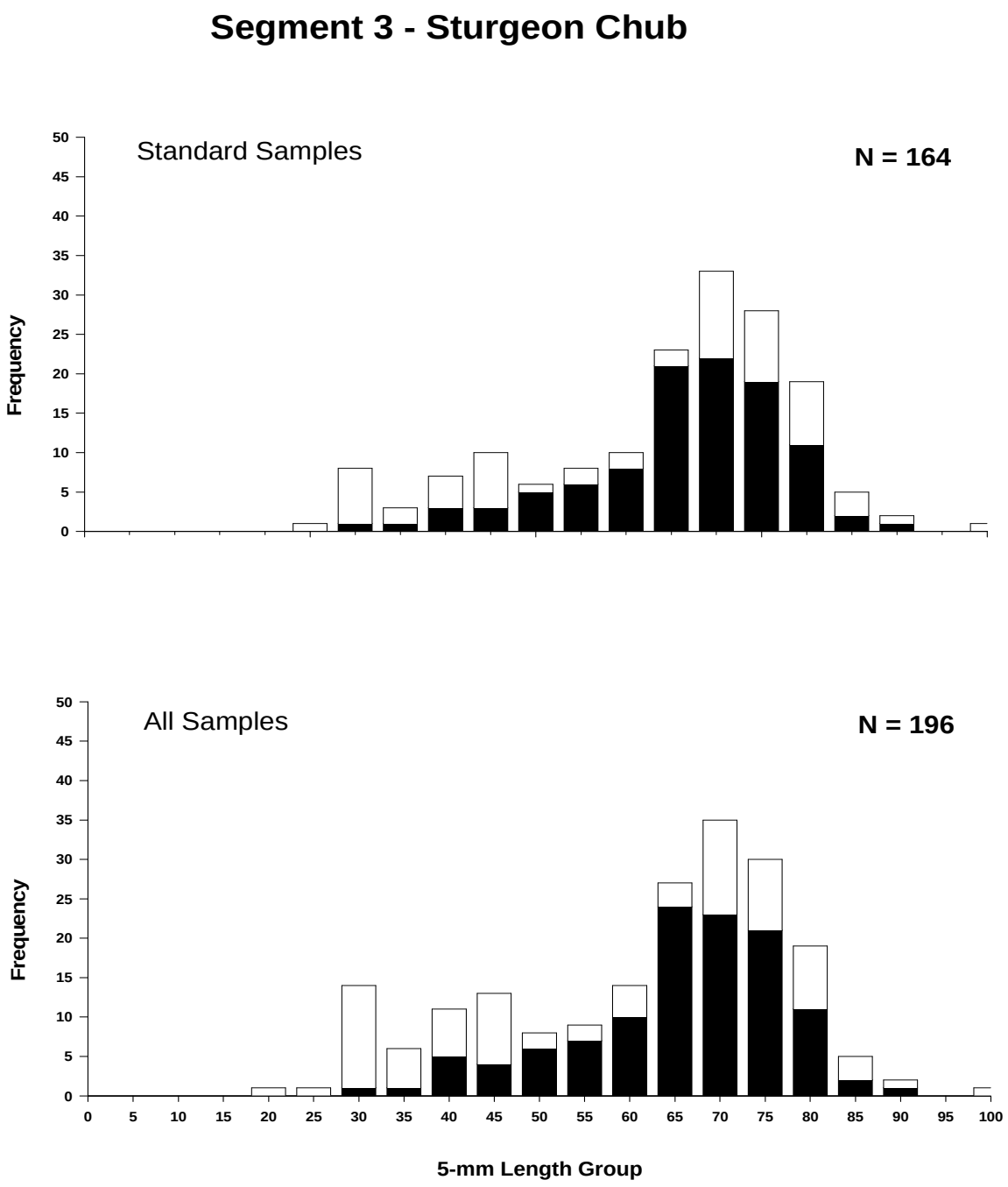

Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

Sicklefin Chub

A total of 85 sicklefin chubs were collected in segment 3 during 2010, a decrease from 2009 when 163 were sampled. More sicklefin chubs were collected during the sturgeon season (n = 54) than during the sturgeon season (n = 31). All sicklefin chubs were sampled in the otter trawl.

The total increase in sicklefin chubs captured was not manifested in the CPUE estimates. Otter trawl CPUE of sicklefin chubs was only slightly lower in 2010 when compared to 2009 and has been similar throughout the five years of sampling (Figure 18). Non-random subsamples accounted for 13 of the total 85 sicklefin chubs captured, which are not used to look at relative abundance and are not included in the CPUE estimates. The increase in non-random subsamples comes from both more duplicate subsamples do to the increase in pallid sturgeon catch and non-random sampling for pallid sturgeon using the otter trawl.

Sicklefin chubs averaged 88 mm TL in 2010 with the largest and smallest specimens measuring 109 and 42 mm TL, respectively. The 2010 average length was similar to the previous five years of sampling. The size frequency histogram of sicklefin chubs differed in 2010 to that of 2009 (Figure 19). In 2009 more fish smaller than 80 mm TL were observed, whereas in 2010 this size class made up a small proportion of the total. The majority of these fish are likely age-1 fish (Herman et al. 2008b). In 2010 few if any age-0 fish were observed, but both age-1 and age-2 were abundant and again similar to 2009 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. Sicklefin chubs were observed the farthest upstream in segment 3 (river mile 1696) than the previous five years of sampling.

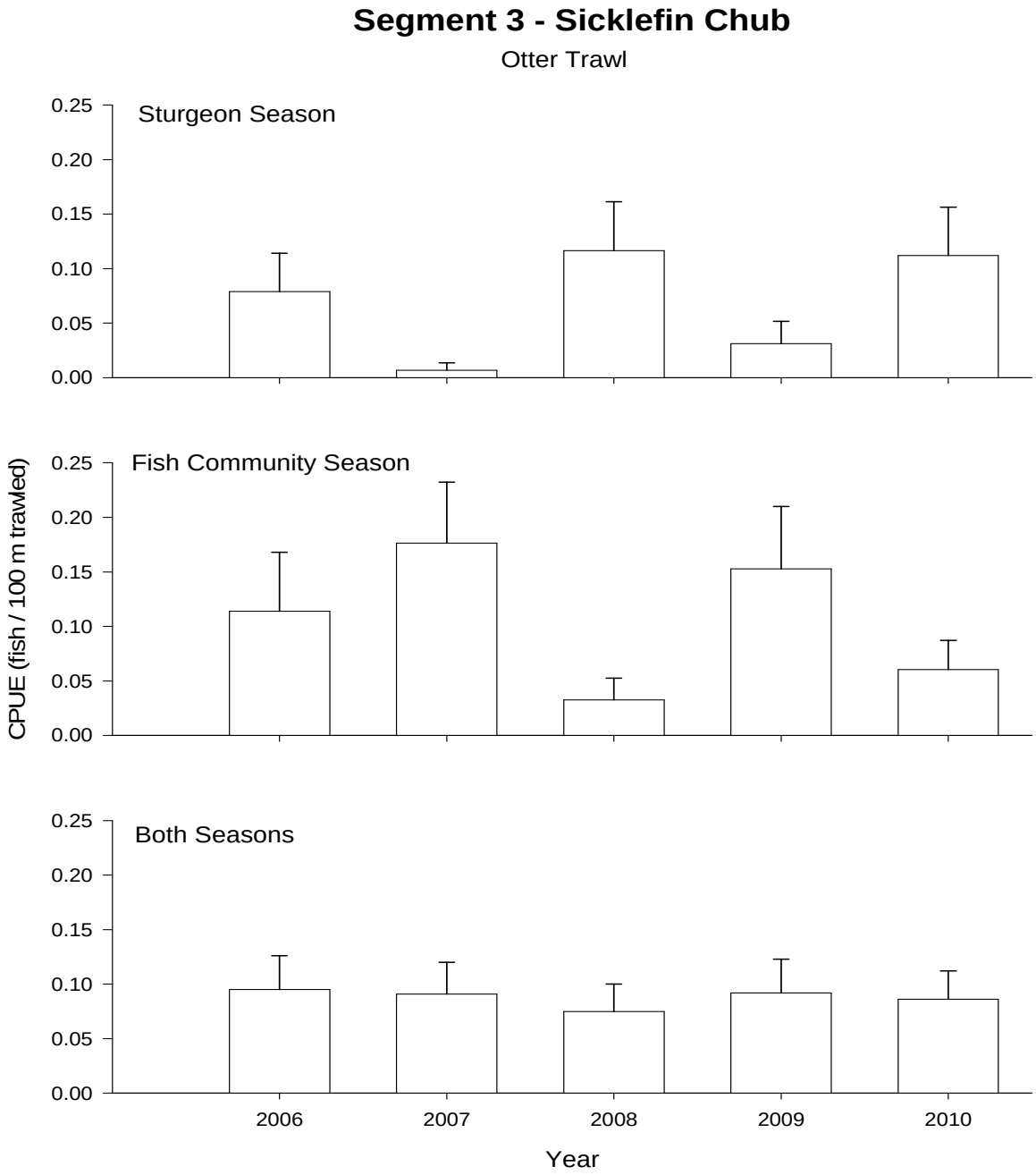

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2010.

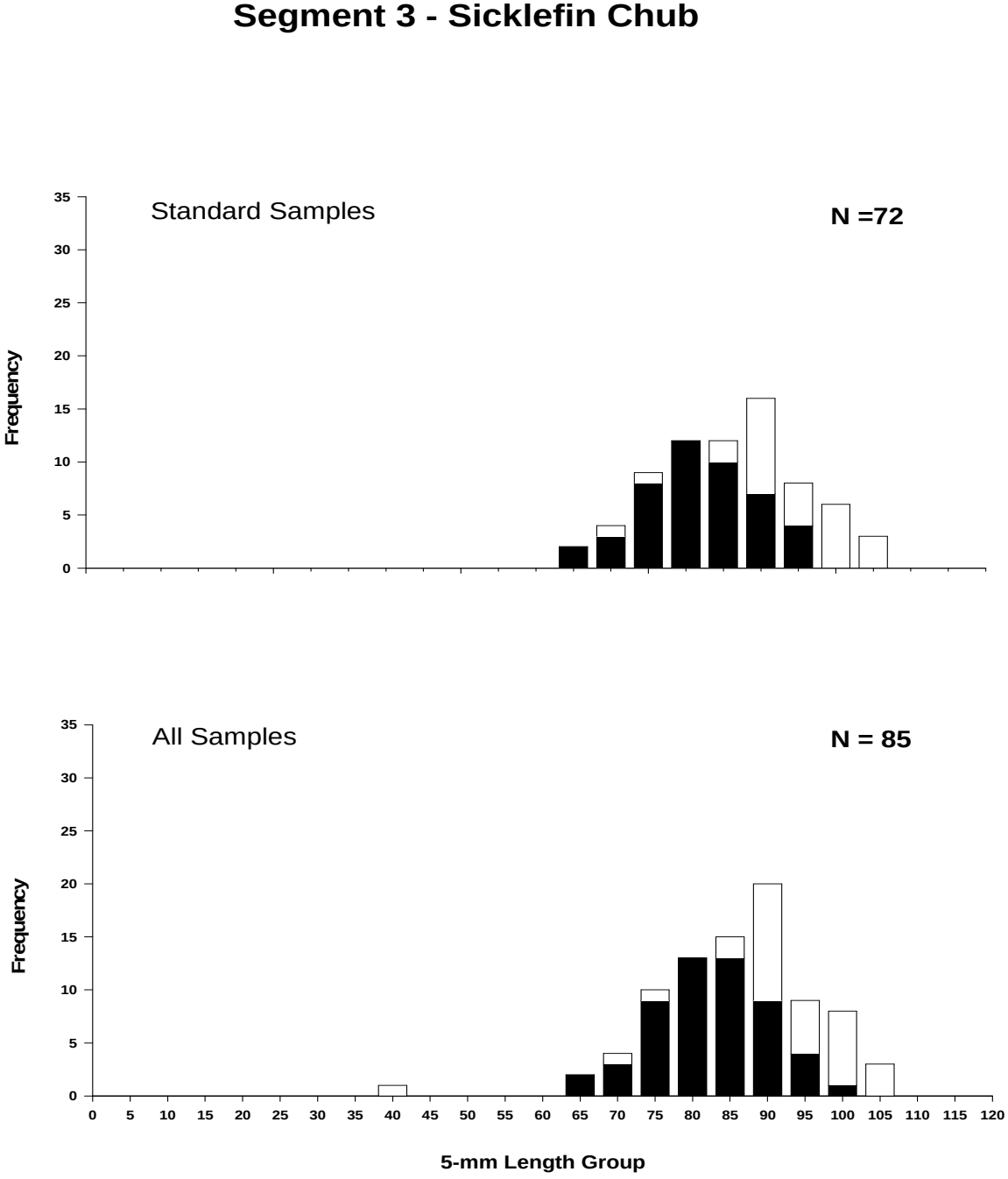

Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

Sand Shiner

A total of 285 sand shiners were sampled in segment 3 during 2010, a significant decrease from 2009 when 820 were collected. All sand shiners were collected during the fish community season and all but three were sampled using mini fyke nets. Sand shiner CPUE in mini fyke nets was 1.6 fish/net night in 2010. This was the lowest CPUE in five years of sampling (Figure 22). In 2010 sand shiner CPUE lees than half of the 2009 CPUE (4.7 fish/net night) and from 2007 to 2009 sand shiner CPUE has been less than half of the CPUE recorded in 2006 (13.7 fish/ net night).

Sand shiners averaged 45 mm TL in 2010, slightly larger than the 2009 average of 38.5 mm TL. The 2010 sand shiner length frequency histogram indicate similar ages of fish sampled in the past five years (Figure 23). However, during 2010 a slightly higher proportion of age-1 fish occurred in the catch compared to age-0 fish, while in 2008 both year classes were about equal. During both 2010 and 2009 sand shiners were comprised of age-0 and age-1 fish (Datillo et al. 2008a).

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.

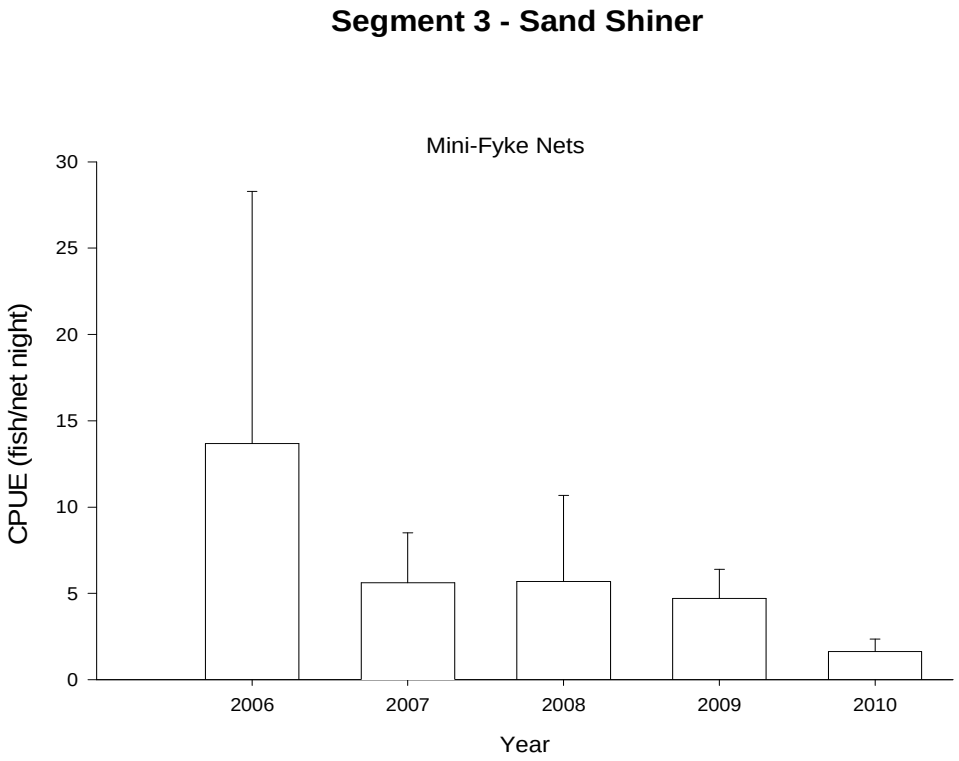

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2010.

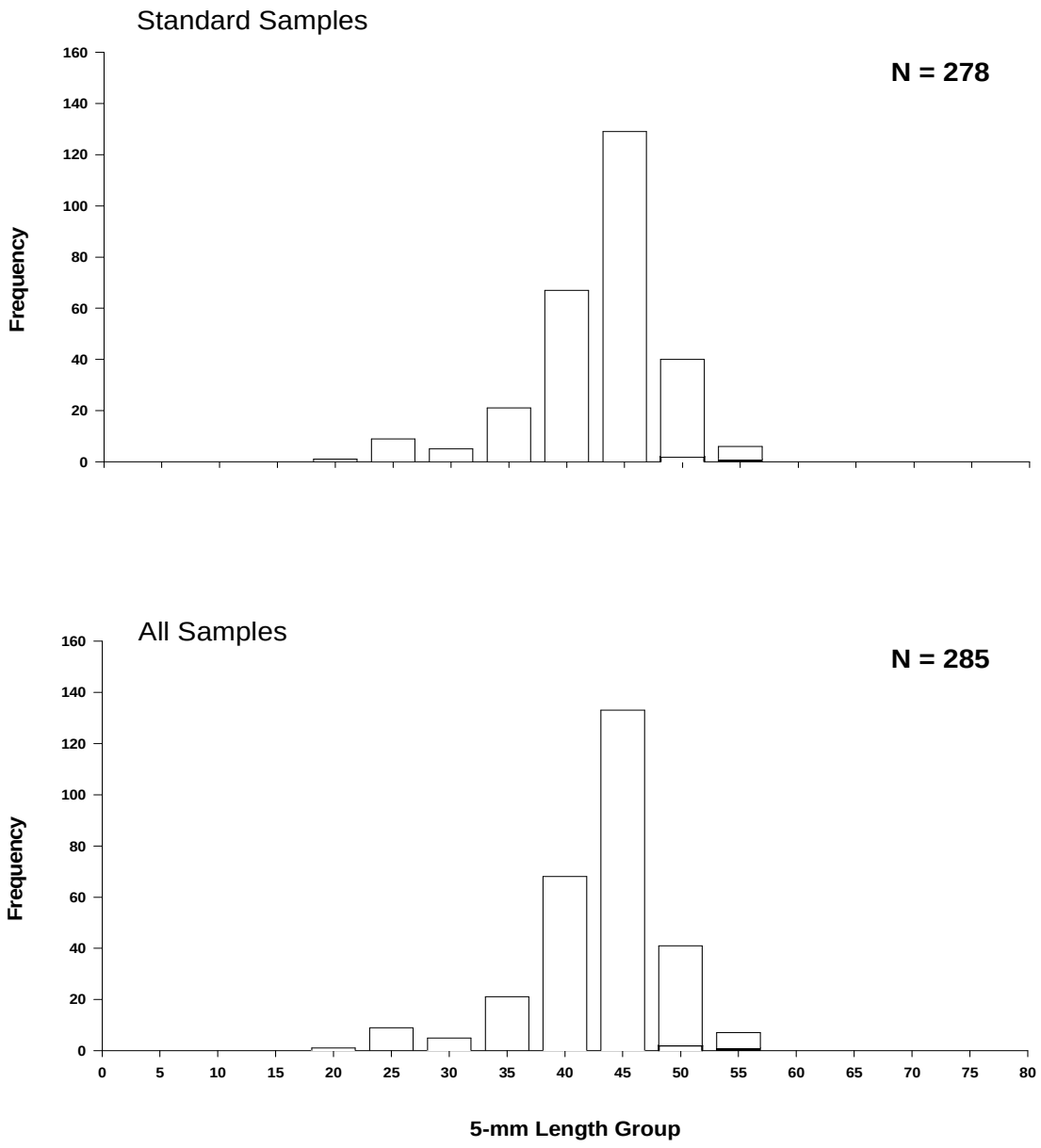

Figure 23. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

***Hybognathus* spp**.

All *Hybognathus spp.* collected in 2010 were identified as western silvery minnow *Hybognathus argyritis*. 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 four 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 five years of sampling.

During 2010 we identified a total of 100 *Hybognathus* specimens as western silvery minnows. Western silvery minnow CPUE in 2010 (0.5 fish/net night) was a slight increase from 2009, but still considerably lower than 2007 & 2008. For instance, during 2008 at total of 377 western silvery minnows were sampled. Western silver minnow CPUE using mini fyke nets was at a four year low in 2009 at 0.1 fish/net night (Figure 24). From 2006 to 2008 CPUE had steadily increased to a high in 2008 at 2.8 fish/net night. While 2007 and 2008 had relatively high variance associated with the estimates, the 2010 and 2009 catch had low variance and is likely attributed to a decline in the population.

Western silvery minnows averaged 48 mm TL in 2010, which was slightly larger than the 2009 average of 40.5 mm TL. The length frequency histogram of western silvery minnows in 2010 suggests the age structure was comprised of almost all age-0 fish, with few age-1 fish present and one possible age-2 fish (Datillo et al. 2008b). This is in contrast to 2008 when about equal numbers of age-0 and age-1 fish were present with a few fish were possibly of age-2.

The relatively few western silvery minnows that were sampled in 2010 were captured throughout the length of segment 3, with no distinct spatial pattern in abundance.

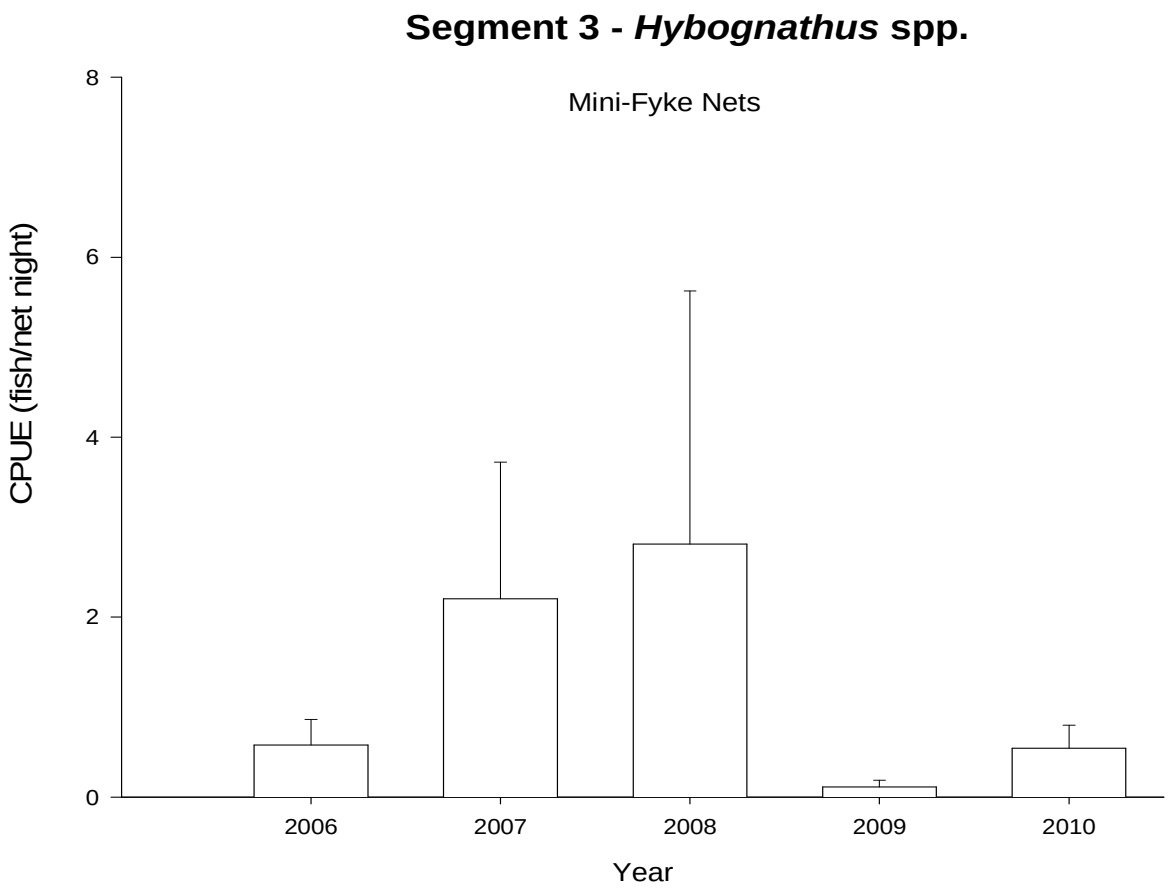

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2010.

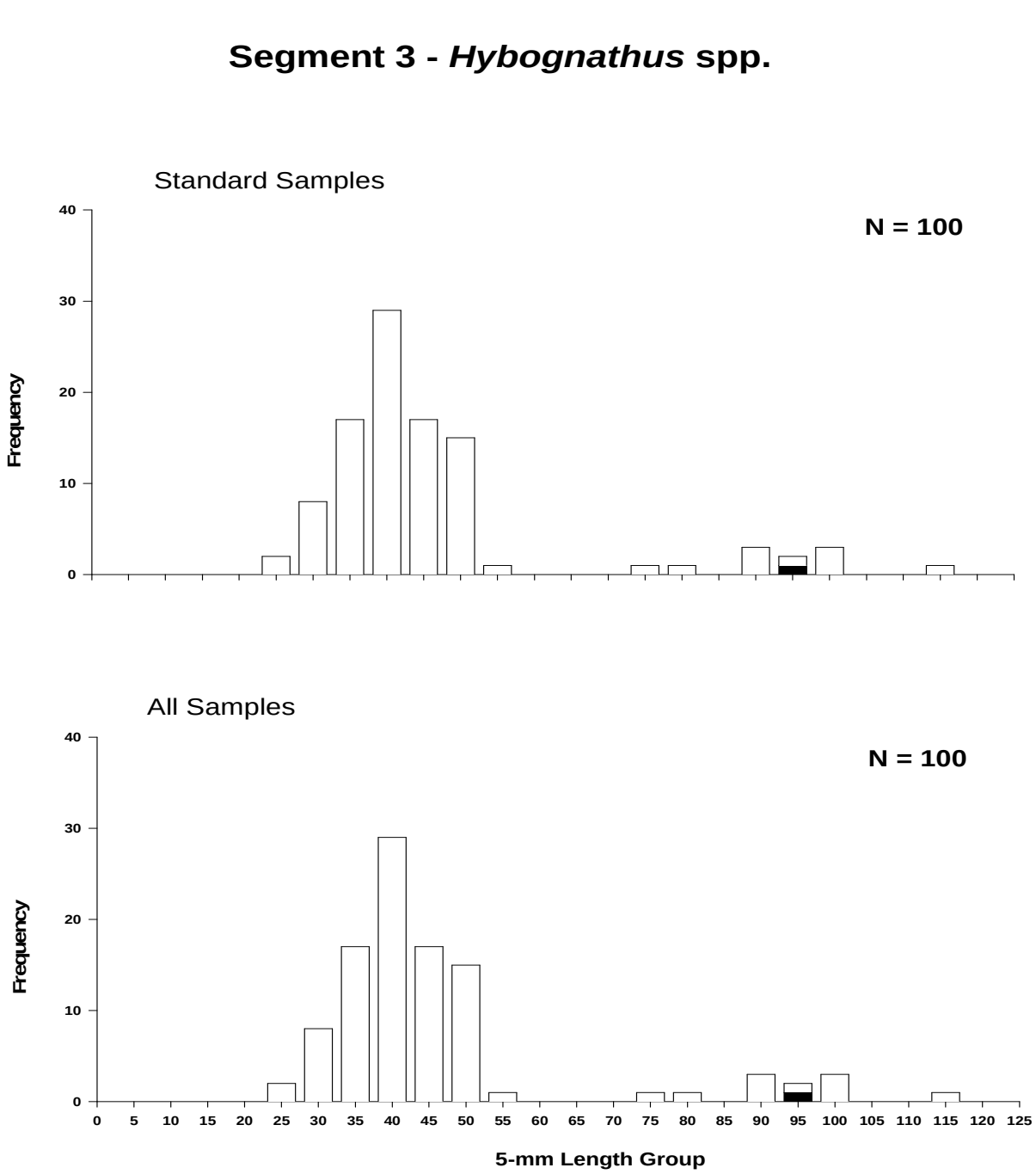

Figure 25. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

Blue Sucker

A total of 9 blue suckers were sampled in segment 3 during 2010, 4 and 5 during the fish community and sturgeon seasons, respectively. Trammel nets captured all the blue suckers in 2010. No small age o blue suckers were captured in 2010 compared to 2009.

The total number of blue suckers sampled in 2010 was down from that of 2009 (n = 23), 2008 (n=14), 2007 (n = 10) and 2006 (n = 4). Overall trammel net CPUE for blue suckers has also risen over the past four years to a high in 2009 of 0.02 fish/100 m, with the exception of 2010, which is still relatively low compared to other fishes sampled (Figure 27). The general pattern over the last four years for slightly higher catch rates to occur during the fish community season when compared to the sturgeon season (Figure 27). The otter trawl has not been an effective gear at monitoring relative abundance of adult blue sucker, although it is the gear we would expect to see recruitment of age-0 fish as was seen in 2009 (Figure 28).

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.

The length frequency histogram looks similar to past years with a majority of fish being larger than 500 mm TL (Figure 29).

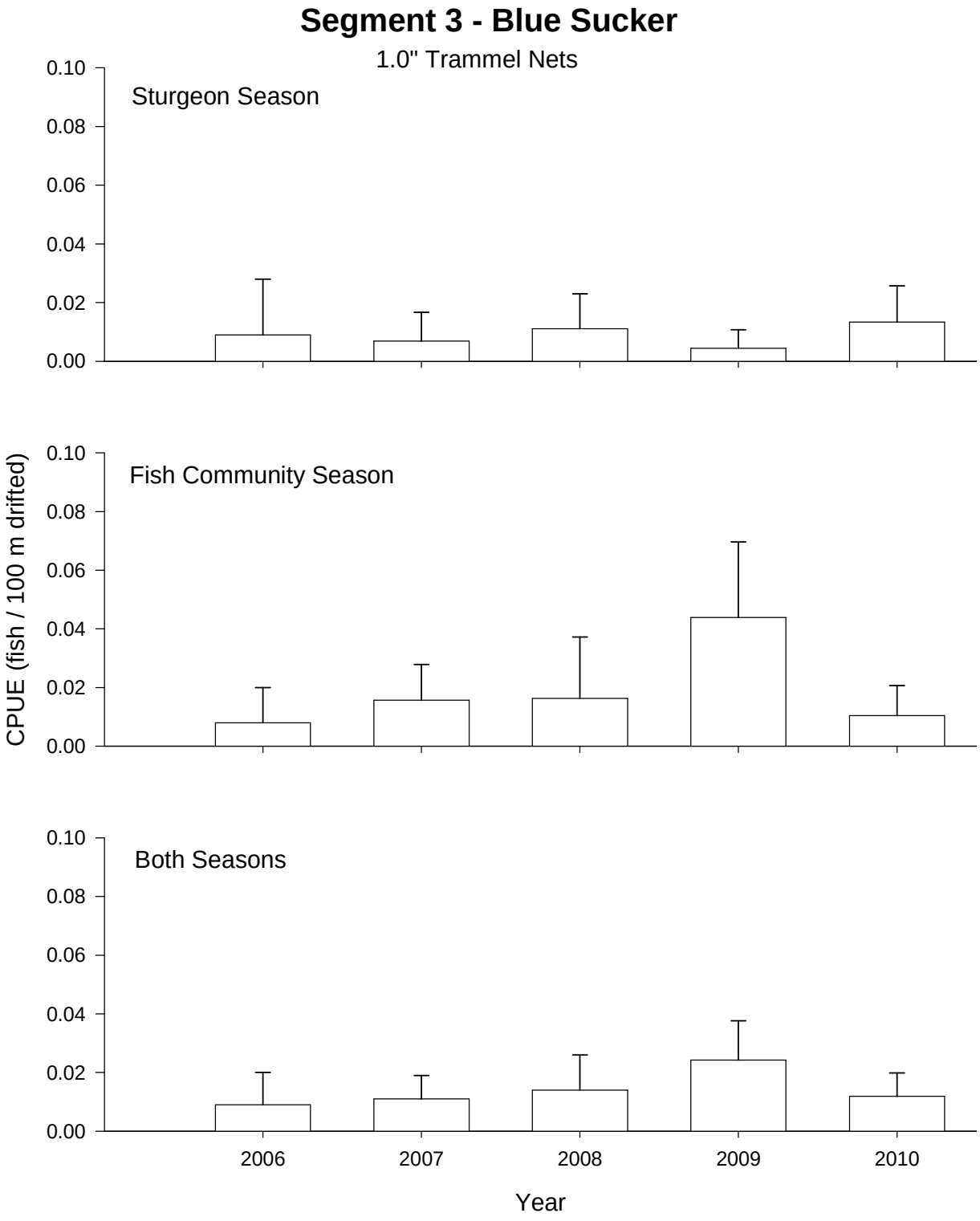

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2010.

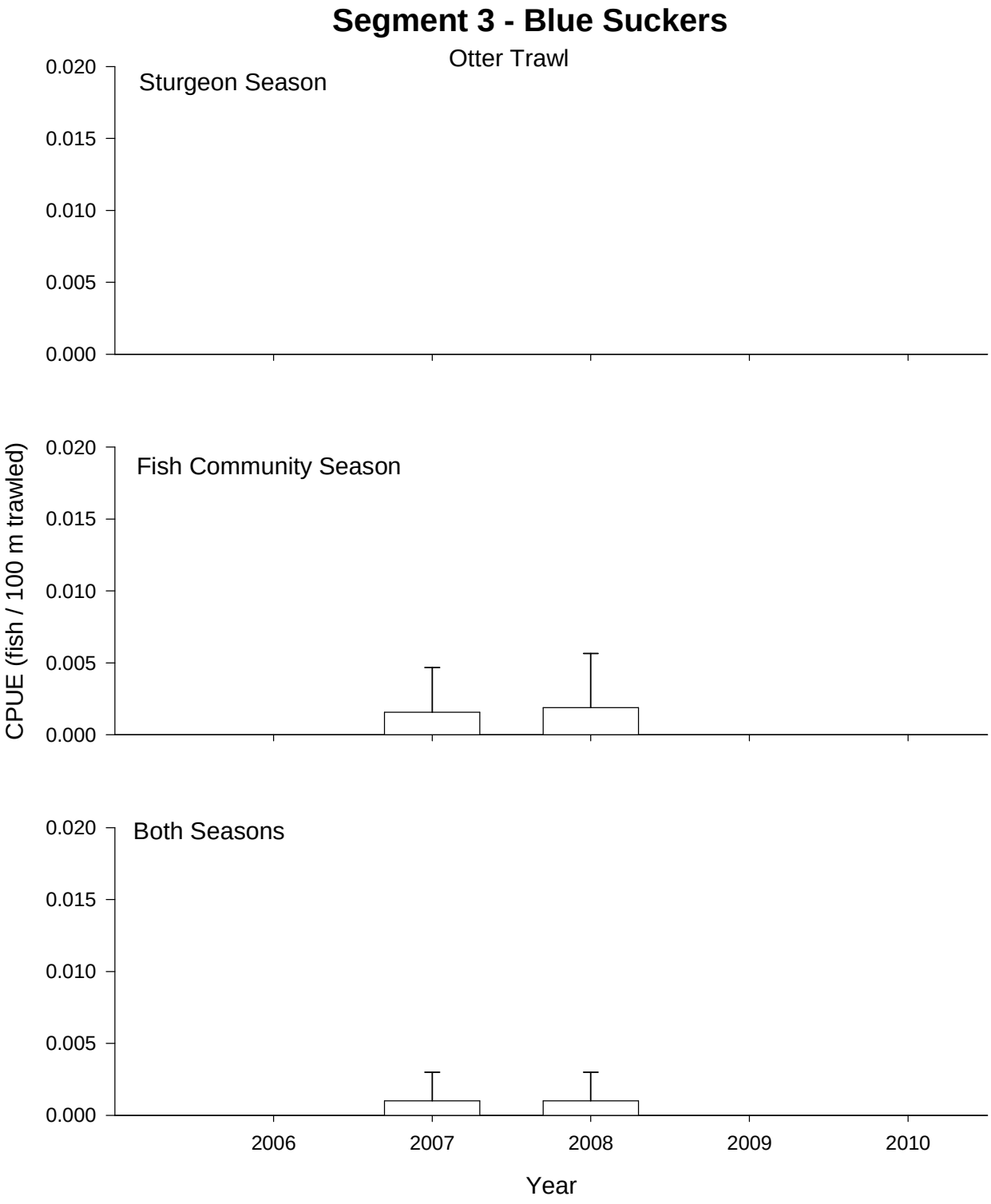

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2010.

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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	5	0	0	0	0	0	60	40	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	4	0	50	0	0	0	25	25	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	0	0	0

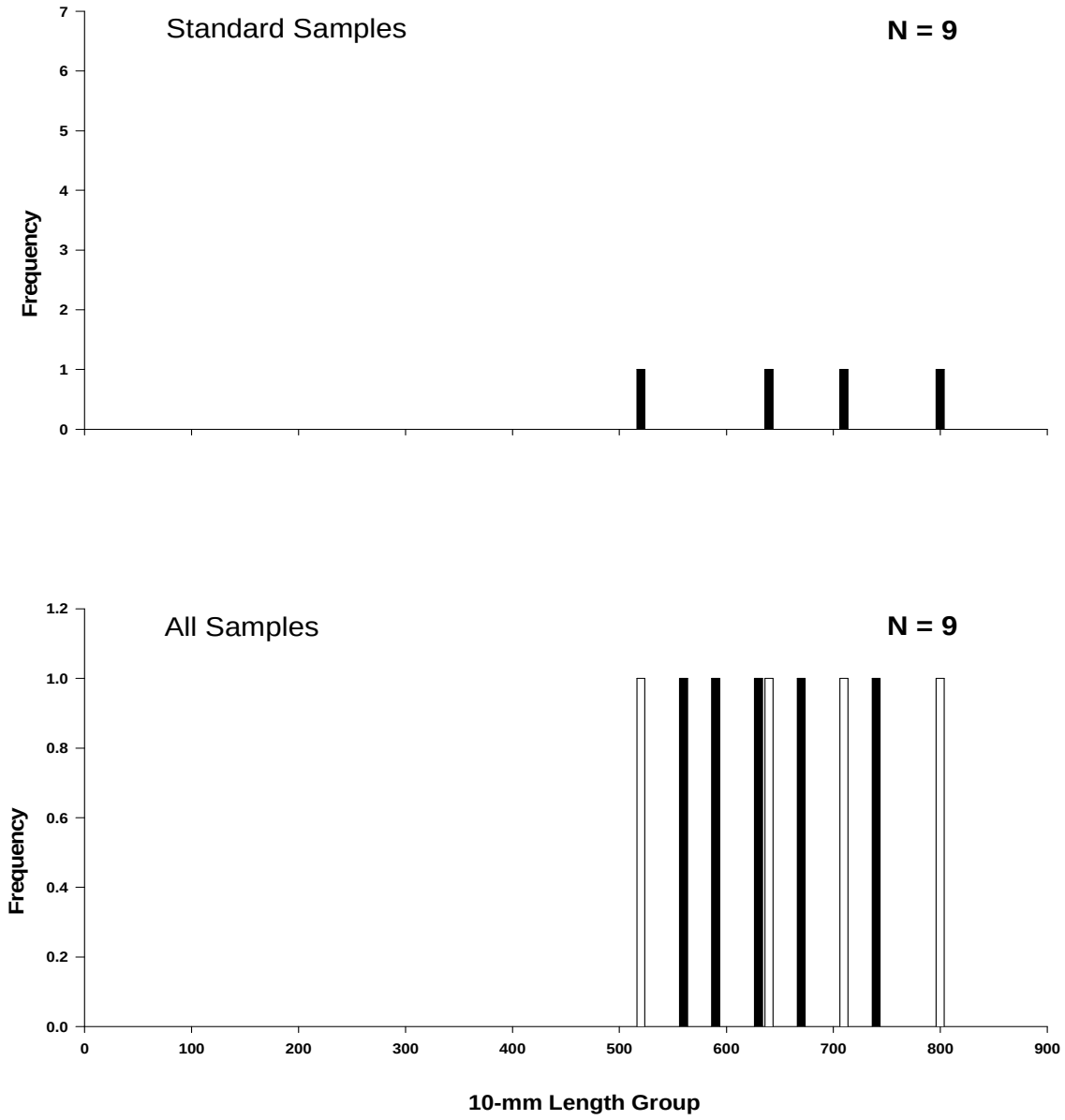

Figure 29. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

Sauger

A total of 240 sauger were sampled in segment 3 during 2010, 96 and 144 during the fish community and sturgeon seasons, respectively. This was a slight decrease from 253 sampled during 2009. During 2010 trammel nets caught 160 sauger, while the otter trawl captured 37, mini fyke nets 38 and trotlines5. On average trotlines captured the largest sauger (mean TL = 428 mm), followed by trammel nets (mean TL = 356 mm), otter trawl (mean TL = 335 mm) and mini fyke nets (mean TL = 261 mm).

Overall trammel net CPUE (0.16 fish/100m) was relatively the same as 2009 (0.17 fish/net night) both of which are lower when compared to 2008 (0.21 fish/100 m), but was still higher than 2006 and 2007 (Figure 21). During the past three years sauger CPUE in trammel nets has been considerably higher during the sturgeon season when compared to the fish community season. Trammel nets have been the most effective gear in sampling adult sauger in segment 3 over the past five years of sampling.

Overall sauger CPUE using the otter trawl was similar to 2009 with 0.04 fish/100 m (Figure 32). With such low catch rates the otter trawl doesn't seem to be nearly as effective at monitoring the relative abundance of sauger as trammel nets.

Mini fyke nets have been the main gear to monitor the abundance of age-0 sauger in segment 3 during the past five years. In 2010 few if any age-0 sauger were sampled using mini fyke nets. The smallest sauger sampled measured 63 mm and was caught on July 22nd, therefore this fish was likely age-1. The overall mini fyke net CPUE (0.2 fish/net night) of sauger increased in 2010 to the second highest CPUE in five years of sampling (Figure 30).

Sauger were captured throughout both seasons and the length of segment 3. However, the largest catches occurred during both May through early June and October. During the spring three river bends between river miles 1648.5 and 1695 had significantly higher catches of sauger than other river bends sampled during the spring. Similarly, during October three river bends between river miles 1640.5 and 1644.5 had higher catches than other river bends sampled during the fall.

The length frequency histogram for sauger sampled in 2010 looks very similar to that of 2009, with the exception that a few YOY sauger were sampled in 2010 while none were sampled in 2009. The sauger rearing habitat that occurs in segment 3 is in the downstream most portions

of the segment and therefore random bend selection can have an influence on the detection of YOY sauger within a given year. Segment 4, which is downstream of segment 3 is a better indicator of YOY sauger abundance than either segment 3 or 2.

For the specific marco habitats where sauger where sampled by gear in segment 3 during 2009 see Table 15.

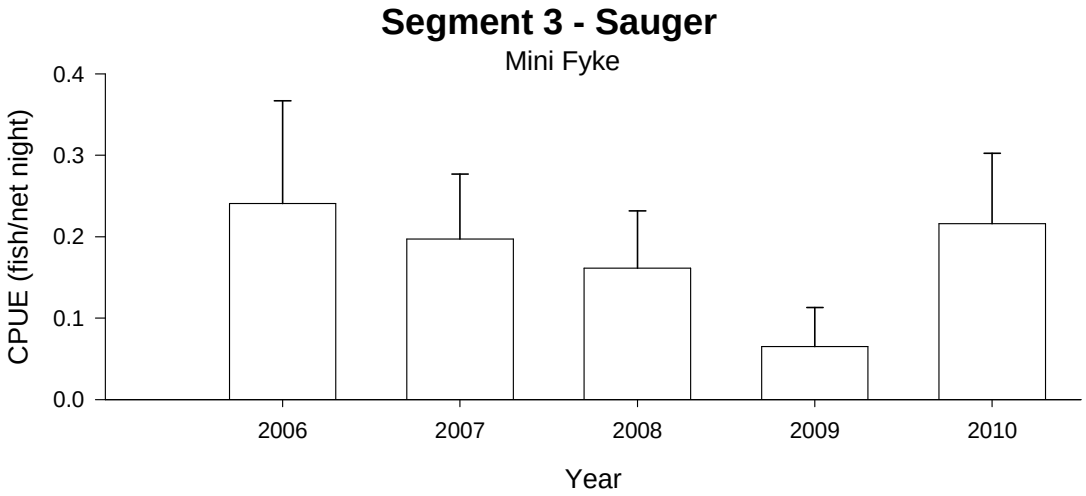

Figure 30. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2010.

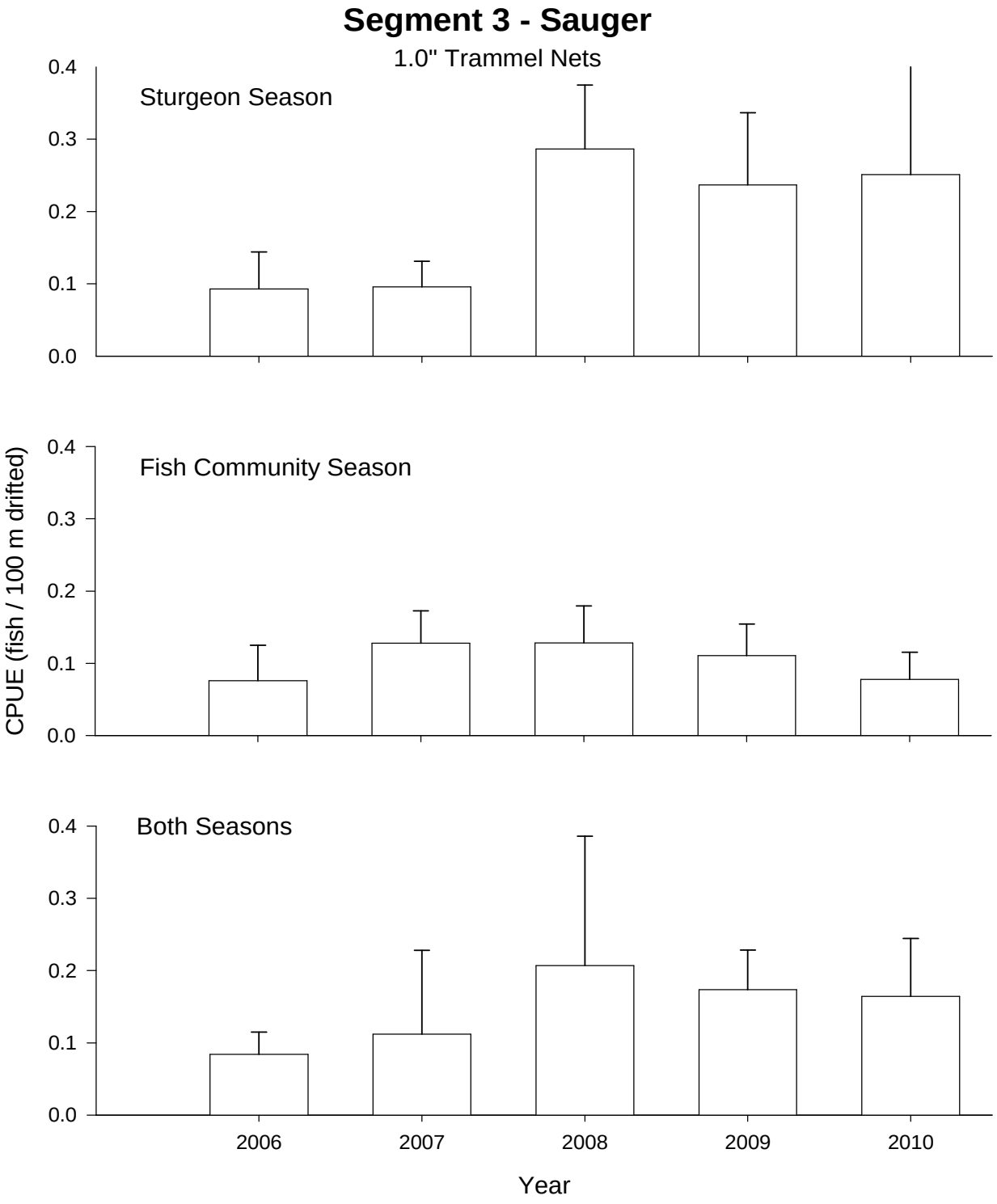

Figure 31. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2010.

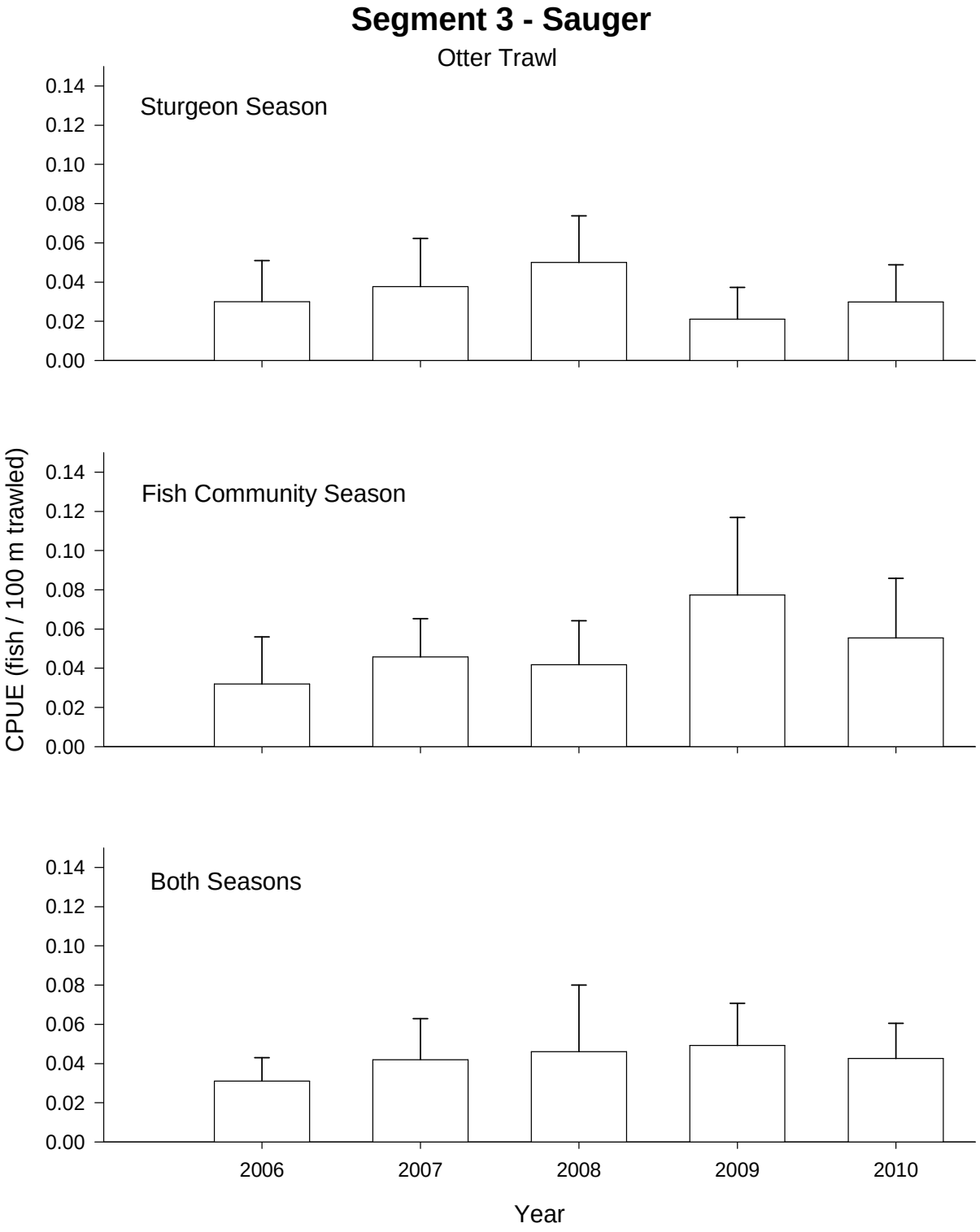

Figure 32. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2010.

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 2010. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]												
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season														
1.0” Trammel Net	122	0	40	0	0	0	12	48	0	0	0	0	0	0
		0	37	0	0	0	33	29	2	0	0	0	0	0
Otter Trawl	13	0	31	0	0	0	31	31	8	0	0	0	0	0
		0	33	0	0	0	36	28	4	0	0	0	0	0
Fish Community Season														
1.0” Trammel Net	25	0	36	0	0	0	44	20	0	0	0	0	0	0
		0	38	0	0	0	32	27	3	0	0	0	0	0
Mini-Fyke Net	38	0	24	0	0	0	26	0	5	45	0	0	0	0
		0	29	0	0	0	37	0	6	27	1	0	1	0
Otter Trawl	22	0	23	0	0	0	68	9	0	0	0	0	0	0
		0	35	1	0	0	34	27	3	0	0	0	0	0

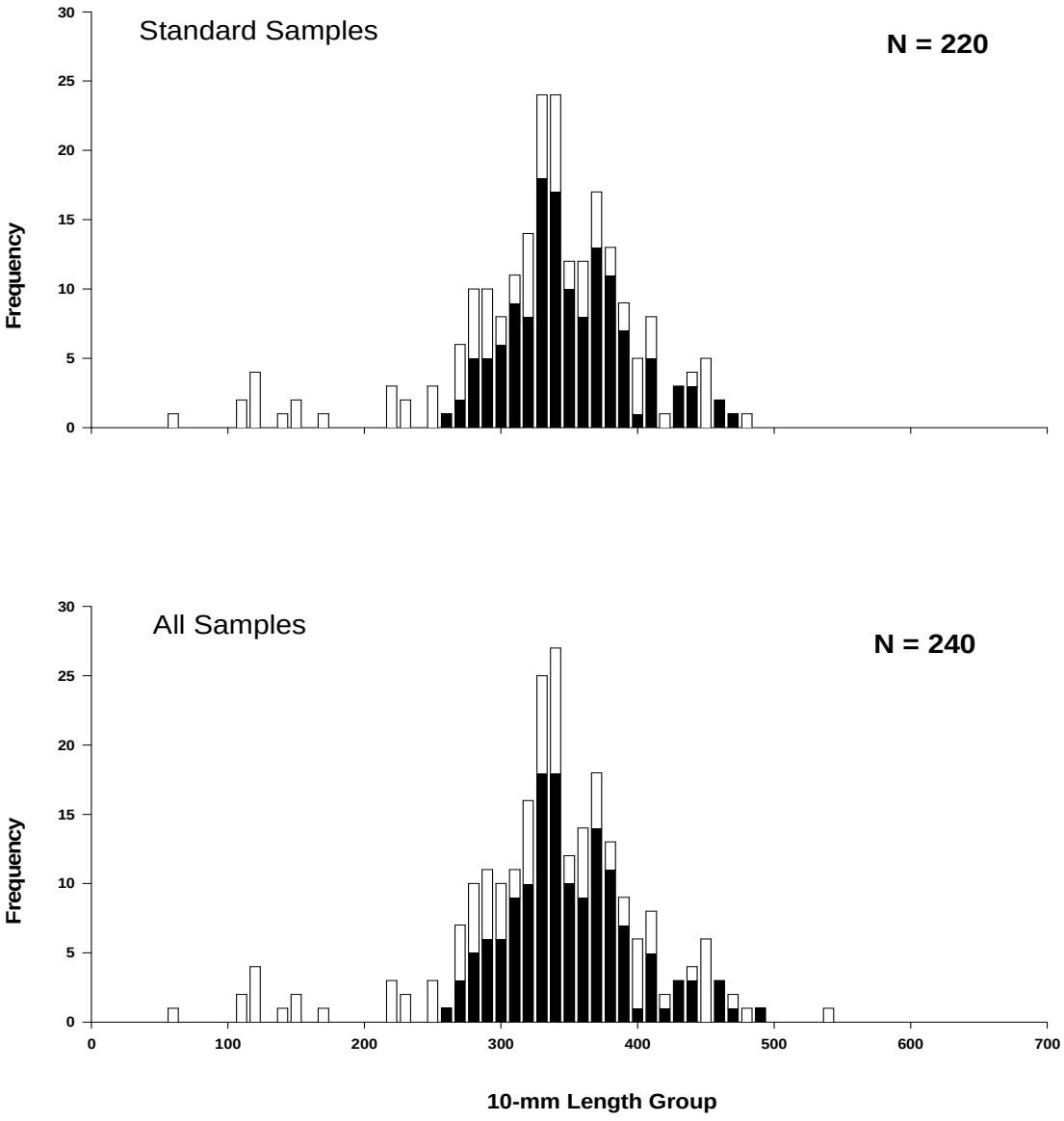

Figure 33. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2010. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2010.

Missouri River Fish Community

During 2010 a total of 4,620 fish consisting of 35 species were collected in segment 3 of the Missouri River. This is less than half of the 2009 total of 9,461 fish collected. Mini fyke nets collected 47% of all fish sampled, followed by otter trawls (21%), trammel nets (18%) and trotlines 14%. For this section, I will only talk about fish that had a sample size of greater than 50 and are not a target species within the population assessment program.

River carpsuckers *Carpiodes carpio* were the most abundant fish sampled in 2010 with 988. Ninety-two percent (n=961) of all river carpsuckers were sampled with mini fyke nets. A majority of river carpsuckers sampled were YOY. Trammel nets captured 51 adults and the otter trawl caught 21. River carpsuckers averaged 27 mm TL in mini fyke nets, 467 mm TL in otter trawls and 476 mm TL in trammel nets. Both adult and YOY river carpsuckers were sampled throughout the length of segment 3. The 2010 river carpsucker catch was down from 2009 when 1,069 were sampled.

Goldeye *Hiodon alosoides* were the second most abundant fish sampled in 2010 with 523. Goldeye were evenly distributed throughout segment three. Trammel nets caught more goldeye (n= 224), than otter trawl (n=50) and trotlines (n=81). Mini fyke nets sampled 168 goldeye with an average length of 36 mm TL. Average length of goldeye captured using the otter trawl was 149 mm TL about 50% of these were under 70mm TL and likely YOY. In 2009 no young-of-the-year goldeye were sampled where in 2010 a majority of the mini fyke and otter trawl catch was comprised of YOY.

Flathead chubs *Platygobio gracilis* were the third most abundant species in 2010 with 494, a decrease from 2009 when 965 were captured. Mini fyke nets caught the most flathead chubs with 220. All other gears also captured flathead chubs. Otter trawls sampled larger flathead chubs (mean TL=136 mm) than mini fyke nets (mean=53mm). Flathead chubs were sampled throughout segment 3.

A total of 276 emerald shiners *Notropis atherinoides* were collected in 2010. Mini fyke nets accounted for 96% of the total catch, with otter trawls capturing 9 specimens. The 2010 total catch was greatly decreased from the 2009 catch of 1,028. Less than half of the 176 mini fyke net sets resulted in the total catch for 2010.

Channel catfish *Ictalurus punctatus* were relatively evenly distributed throughout segment 3 with a total of 273. This was a slight decrease from 2009 when 366 were sampled.

Trotlines were the most effective gear with a total of 152 sampled. The otter trawl captured 89 and the trammel net caught 32. Channel catfish averaged 327 mm TL, with a minimum length of 54 mm and a maximum length of 725 mm. On average trotlines captured the largest channel catfish with the otter trawl sampling the smallest.

A total of 172 fathead minnows *Pimephales promelas* were sampled in 2010. All but one fathead minnow, were sampled with mini fyke nets. Fathead minnow catch decreased substantially from 2009 (n=988) when they were the most abundant fish sampled. This was the lowest catch in five years of sampling segment 3.

Stonecats *Noturus flavus* were sampled throughout segment 3 with a total of 101 sampled. Trotlines were again the most effective gear at sampling stonecats (n=54), followed by the otter trawl (n=32) and mini fyke nets (n=14).

Common carp *Cyprinus carpio* total catch decreased in 2010 (n=97) from 2009 when 568 were sampled. The majority (85%) were young-of-the-year sampled in mini fyke nets. The remaining 15% were sampled with otter trawls, trotlines, and trammel nets. This was the lowest common carp catch in five years of sampling.

In 2010 a total of 62 green sunfish *Lepomis cyanellus* were sampled throughout segment 3. All of these were sampled with mini fyke nets. This was an increase from 2009 where only 4 were sampled.

Other species sampled that had a sample size of less than 50 included shorthead redhorse *Moxostoma macrolepidotum* (n=45), white sucker *Catostomus commersoni* (n=41), longnose dace *Rhinichtys cataractae* (n=15), white crappie *Pomoxis annularis* (n=15), walleye *Sander vitreus* (n=12), burbot *Lota lota* (n=12), smallmouth buffalo *Ictiobus bubalus* (n=10), freshwater drum *Aplodinotus grunniens* (n=9), northern pike *Esox lucius* (n=9), bigmouth buffalo *Ictiobus cyprinellus* (n=7), longnose sucker *Catostomus catostomus* (n=7), spottail shiner *Notropis hudsonius* (n=7), black crappie *Pomoxis nigromaculatus* (n=5), lake whitefish *Coregonus clupeaformis* (n=3), whitebass *Morone chrysops* (n=2), yellow perch *Perca flavescens* (n=2), brook stickleback *Culaea inconstans* (n=2), smallmouth bass *Micropterus dolimeu* (n=1).

Discussion

The 2010 field season was the fifth year of sampling segment 3 for the pallid sturgeon population assessment project. Overall pallid sturgeon total catch in 2010 was down from 2009. Pallid sturgeon otter trawl CPUE was higher in 2010 than 2009, while trammel net CPUE was lower, although any differences were negligible from the previous year. Trotlines remained a very effective gear for capturing pallid sturgeon, capturing over 50% of the total pallid sturgeon in 2010. Trotlines are still providing us with catches of larger, older year classes of fish that are currently not seen with other standard gears. Increases in pallid sturgeon captures have also been helpful in determining survival rates for all year classes and sizes of fished stocked throughout RPMA 2. Pallid sturgeon were sampled throughout segment 3 with the largest densities occurring in the downstream part of segment 3.

Shovelnose sturgeon CPUE data for both otter trawl and trammel nets remained relatively the same as 2009. However, a YOY shovelnose was captured at river mile 1656 which was the farthest upstream one has been sampled in five years of sampling. This is a good indication that successful spawning occurred farther upstream in segment 2 in 2010. 2010 provided the Missouri River with high discharges from many tributaries throughout the sturgeon season lasting through early fish community season. The Milk River, a tributary located in the upper part of segment 2, had relatively high discharges that lasted for a much longer duration than many other years. Milk river discharges peaked twice during 2010 at 6,000 cfs during June and July. This prolonged discharge along with increased temperatures and turbidities may account for some slight decreases in CPUE data for target species in segment 3. During these high discharges we've seen a general pattern of many fishes moving further upstream when the Milk River is delivering suspended sediment to the Missouri River making it more turbid than normal. What was so unique about the 2010 Milk River water year was the duration of the flows. On a normal "good" Milk River water year peak discharge comes and diminishes in a relatively small window, whereas in 2010 the flows were sustained well into July. The last relatively good Milk River water year was 2007, with peak flows at approximately 5,000 cfs. Although the flows were not sustained near as long as they were in 2010. During both 2007 and 2010 YOY shovelnose sturgeon captures were higher than other three years of sampling, Similar increases in CPUE for YOY sauger have been observed during these high water years. Non-target species such as YOY goldeye also saw substantial increases in CPUE during 2010 likely another result of this event.

Future efforts to rehabilitate the native fishes of the Missouri River below Fort Peck Dam should take into account not only temperature, but suspended sediment and flows that create and maintain aquatic habitats.

Throughout the past five years of sampling segment three several trends have begun to show up in data collected. Total pallid sturgeon catch increased for several years, and now remaining steady for the last two, while CPUE for standard gears has not increased. This is likely due to the expanded effort that was put into the program in 2008, which was stabilized over the past couple of years. Pallid sturgeon are found in greater densities lower part of segment 3 when compared to upper segment 3 and segment 2. The relative abundance of shovelnose sturgeon, blue sucker, sicklefin chub, western silver minnow, and sauger have remained relatively constant, with some increases in YOY captures during high water years. The relative abundance of sturgeon chub have slightly decreased over the five year sampling period. A similar pattern has been observed in sand shiner abundance. The relative abundance of non target species such as goldeye, flathead chubs, river carpsuckers and fathead minnows have all fluctuated on a yearly basis, while species such as channel catfish have remained relatively stable the same throughout the five years of sampling. Many of these changes in abundances could be attributed to the results of different environmental conditions experienced over the last five seasons. High water discharges from major tributaries has shown to increase the abundance of YOY and age-1 fish in several different species throughout both segments 3 and 2. This is especially important for the highly altered stretch of river below Fort Peck dam. The next few years of monitoring will shed more light on how good water years from tributaries such as the Milk River influence both pallid sturgeon and other native Missouri River fishes. Future restoration methods will likely need to take into account water management in these large tributaries, especially since key features like suspended sediment will likely have to come from tributaries and not from the Missouri River above Fort Peck Dam.

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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 XX for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for Segment XX.

Gear	Code	Type	Season	Years	CPUE units
Gill Net – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	Fish / net night
Trammel Net – 1.0”inner mesh	TN	Standard	Both Seasons	2003 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2003 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2003 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Hoop Net – 4 ft.	HN	Standard	Both Seasons	2003 - 2004	Fish / net night
Trammel Net – 2.5” inner mesh	TN25	Standard	Sturgeon	2005 – 2006	Fish / 100 m drift
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 – 2005	Fish / 100 m^2
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled downstream	BSRD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2006	Fish / 100 m trawled
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

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

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

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

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

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

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

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

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

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

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stockinga	Primary Mark	Secondary Mark
2010	Culbertson	384	2009	6/4/2009	Yearling	PIT Tag	Scute Removed
2010	Culbertson	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	School Trust	1766	2009	4/15/2010	Yearling	PIT Tag	Elastomer, Scute

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 F2. 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	BRAD	CHXO	CONF	ISB	OSB	SCCL		SCCS	TRML	TRMS	WILD
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	CHNB	DTWT
BKCP	0	0		0		0	0	0					
		0		0		0	0	0					
BKSB	0	0		0		0	0	0					
		0		0		0	0	0					
BMBF	6	0.006		0.009		0.008	0	0					
		0.005		0.011		0.012	0	0					
BRBT	0	0		0		0	0	0					
		0		0		0	0	0					
BUSK	**9**	**0.012**		**0.007**		**0.014**	**0.015**	**0**					
		0.008		**0.011**		**0.014**	**0.018**	**0**					
CARP	4	0.006		0.004		0.004	0.01	0					
		0.006		0.008		0.008	0.015	0					
CNCF	26	0.035		0.052		0.031	0.022	0					
		0.015		0.033		0.022	0.024	0					
ERSN	0	0		0		0	0	0					
		0		0		0	0	0					
FHCB	17	0.023		0.026		0.026	0.017	0					
		0.016		0.034		0.027	0.017	0					
FHMW	0	0		0		0	0	0					
		0		0		0	0	0					
FWDM	0	0		0		0	0	0					
		0		0		0	0	0					
GDEY	210	0.303		0.251		0.328	0.289	0.836					
		0.07		0.1		0.107	0.154	0.689					
GNSF	0	0		0		0	0	0					
		0		0		0	0	0					
LKWF	3	0.004		0.004		0	0.009	0					
		0.006		0.007		0	0.017	0					
LNDC	0	0		0		0	0	0					
		0		0		0	0	0					
LNSK	1	0.001		0		0	0	0.036					
		0.002		0		0	0	0.073					
NFSH	0	0		0		0	0	0					
		0		0		0	0	0					
NTPK	1	0.002		0		0.006	0	0					
		0.004		0		0.011	0	0					
PDSG	**14**	**0.023**		**0.025**		**0.014**	**0.022**	**0.111**					
		0.015		**0.026**		**0.019**	**0.031**	**0.222**					
RVCS	49	0.07		0.022		0.075	0.125	0					
		0.051		0.018		0.034	0.164	0					
SFCB	**0**	**0**		**0**		**0**	**0**	**0**					
		0		**0**		**0**	**0**	**0**					

Appendix F2. 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	BRAD	CHXO	CONF	ISB	OSB	SCCL		SCCS	TRML	TRMS	WILD
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	CHNB	DTWT
SGCB	**0**	**0**		**0**		**0**	**0**	**0**					
		0		**0**		**0**	**0**	**0**					
SGER	**147**	**0.164**		**0.158**		**0.117**	**0.238**	**0**					
		0.08		**0.085**		**0.057**	**0.241**	**0**					
SHRH	18	0.027		0.007		0.055	0.02	0					
		0.017		0.01		0.046	0.02	0					
SMBF	3	0.003		0.003		0.007	0	0					
		0.004		0.006		0.01	0	0					
SMBS	0	0		0		0	0	0					
		0		0		0	0	0					
SNSG	**101**	**0.135**		**0.152**		**0.141**	**0.117**	**0.037**					
		0.042		**0.084**		**0.07**	**0.064**	**0.074**					
SNSN	**0**	**0**		**0**		**0**	**0**	**0**					
		0		**0**		**0**	**0**	**0**					
STCT	0	0		0		0	0	0					
		0		0		0	0	0					
STSN	0	0		0		0	0	0					
		0		0		0	0	0					
UCA	0	0		0		0	0	0					
		0		0		0	0	0					
WLYE	6	0.011		0.025		0.006	0	0					
		0.01		0.028		0.013	0	0					
WSMW	**0**	**0**		**0**		**0**	**0**	**0**					
		0		**0**		**0**	**0**	**0**					
WTBS	0	0		0		0	0	0					
		0		0		0	0	0					
WTCP	0	0		0		0	0	0					
		0		0		0	0	0					
WTSK	5	0.007		0.003		0.01	0.005	0.056					
		0.008		0.006		0.019	0.009	0.111					
YWPH	0	0		0		0	0	0					
		0		0		0	0	0					

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD		CHXO		CONF	ISB	OSB	SCCL		SCCS	TRML	TRMS	WILD
			CHNB	ITIP	CHNB	ITIP	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	CHNB	DTWT
BKCP	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
BKSB	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
BMBF	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
BRBT	2	0.002			0.003		0	0	0.003	0					
		0.003			0.006		0	0	0.006	0					
BUSK	**0**	**0**			**0**		**0**	**0**	**0**	**0**					
		0			**0**		**0**	**0**	**0**	**0**					
CARP	2	0.002			0		0	0.006	0	0					
		0.003			0		0	0.008	0	0					
CNCF	74	0.091			0.057		0	0.101	0.11	0.167					
		0.035			0.04		0	0.06	0.081	0.179					
ERSN	8	0.01			0.006		0	0.01	0.016	0					
		0.008			0.008		0	0.014	0.02	0					
FHCB	146	0.169			0.137		0.217	0.227	0.115	0.366					
		0.044			0.052		0.435	0.103	0.05	0.351					
FHMW	1	0.001			0		0	0.004	0	0					
		0.003			0		0	0.008	0	0					
FWDM	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
GDEY	47	0.058			0.112		0	0.041	0.028	0					
		0.035			0.099		0	0.034	0.031	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	2	0.002			0.003		0	0.003	0	0					
		0.003			0.006		0	0.005	0	0					
NFSH	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
NTPK	1	0.001			0		0	0.003	0	0					
		0.002			0		0	0.007	0	0					
PDSG	**34**	**0.044**			**0.042**		**0**	**0.055**	**0.034**	**0.033**					
		0.016			**0.027**		**0**	**0.031**	**0.025**	**0.067**					
RVCS	19	0.025			0.02		0	0.032	0.022	0.033					
		0.016			0.021		0	0.036	0.023	0.067					
SFCB	**72**	**0.086**			**0.093**		**0**	**0.076**	**0.07**	**0.32**					
		0.026			**0.042**		**0**	**0.038**	**0.036**	**0.501**					

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD		CHXO		CONF	ISB	OSB	SCCL		SCCS	TRML	TRMS	WILD
			CHNB	ITIP	CHNB	ITIP	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	CHNB	CHNB	DTWT
SGCB	**163**	**0.202**			**0.167**		**0**	**0.199**	**0.243**	**0.252**					
		0.057			**0.081**		**0**	**0.113**	**0.106**	**0.299**					
SGER	**35**	**0.043**			**0.028**		**0**	**0.069**	**0.028**	**0.033**					
		0.018			**0.022**		**0**	**0.041**	**0.026**	**0.067**					
SHRH	12	0.018			0.003		0	0.011	0.045	0					
		0.016			0.006		0	0.011	0.053	0					
SMBF	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
SMBS	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
SNSG	**33**	**0.039**			**0.038**		**0**	**0.047**	**0.037**	**0**					
		0.016			**0.025**		**0**	**0.03**	**0.028**	**0**					
SNSN	**6**	**0.005**			**0.005**		**0**	**0.006**	**0**	**0.033**					
		0.004			**0.008**		**0**	**0.008**	**0**	**0.067**					
STCT	29	0.043			0.024		0	0.058	0.052	0					
		0.024			0.026		0	0.045	0.056	0					
STSN	2	0.002			0		0	0.003	0.003	0					
		0.003			0		0	0.005	0.007	0					
UCA	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
WLYE	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
WSMW	**5**	**0.007**			**0.008**		**0**	**0.003**	**0.011**	**0**					
		0.006			**0.011**		**0**	**0.005**	**0.016**	**0**					
WTBS	1	0.001			0		0	0	0.004	0					
		0.002			0		0	0	0.008	0					
WTCP	0	0			0		0	0	0	0					
		0			0		0	0	0	0					
WTSK	5	0.006			0		0	0.015	0.003	0					
		0.006			0		0	0.015	0.006	0					
YWPH	1	0.001			0.003		0	0	0	0					
		0.002			0.006		0	0	0	0					

Appendix F4. 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	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
BKCP	5	0.029		0.02		0.047		0	0.021	0		0
		0.03		0.04		0.069		0	0.042			0
BKSB	2	0.011		0		0.031		0	0	0		0
		0.016		0		0.044		0	0			0
BMBF	0	0		0		0		0	0	0		0
		0		0		0		0	0			0
BRBT	2	0.011		0.02		0.016		0	0	0		0
		0.016		0.04		0.031		0	0			0
BUSK	**0**	**0**		**0**		**0**		**0**	**0**	**0**		**0**
		0		**0**		**0**		**0**	**0**			**0**
CARP	83	0.474		0.56		0.359		0.3	0.271	16		0
		0.24		0.468		0.18		0.306	0.204			0
CNCF	0	0		0		0		0	0	0		0
		0		0		0		0	0			0
ERSN	267	1.526		2.5		1.047		1.3	1.271	1		0
		0.633		1.943		0.629		1.077	0.66			0
FHCB	220	1.257		1.54		1.391		1.2	0.875	0		0
		0.305		0.732		0.449		1.185	0.479			0
FHMW	171	0.977		1.88		0.547		1.2	0.542	4		0
		0.515		1.67		0.367		1.572	0.297			0
FWDM	4	0.023		0.04		0.031		0	0	0		0
		0.028		0.056		0.063		0	0			0
GDEY	168	0.96		1.7		0.469		2.7	0.5	2		0
		0.551		1.745		0.278		3.156	0.315			0
GNSF	62	0.354		0.4		0.406		0	0.313	1		0
		0.226		0.4		0.449		0	0.391			0
LKWF	0	0		0		0		0	0	0		0
		0		0		0		0	0			0
LNDC	15	0.086		0.04		0.188		0	0.021	0		0
		0.07		0.056		0.183		0	0.042			0
LNSK	3	0.017		0.02		0.031		0	0	0		0
		0.02		0.04		0.044		0	0			0
NFSH	0	0		0		0		0	0	0		0
		0		0		0		0	0			0
NTPK	7	0.04		0.04		0.016		0	0.083	0		0
		0.03		0.056		0.031		0	0.081			0
PDSG	**0**	**0**		**0**		**0**		**0**	**0**	**0**		**0**
		0		**0**		**0**		**0**	**0**			**0**
RVCS	916	5.234		5.2		5.984		11.5	3.292	0		0
		2.448		7.157		3.064		9.799	1.855			0
SFCB	**0**	**0**		**0**		**0**		**0**	**0**	**0**		**0**
		0		**0**		**0**		**0**	**0**			**0**

Appendix F4. 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	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS	BARS
SGCB	**1**	**0.006**		**0**		**0.016**		**0**	**0**	**0**		**0**
		0.011		**0**		**0.031**		**0**	**0**			**0**
SGER	**38**	**0.217**		**0.18**		**0.156**		**0.2**	**0.354**	**0**		**0**
		0.087		**0.136**		**0.091**		**0.267**	**0.249**			**0**
SHRH	4	0.023		0.02		0.016		0	0.042	0		0
		0.023		0.04		0.031		0	0.058			0
SMBF	5	0.029		0		0.047		0.1	0.021	0		0
		0.025		0		0.053		0.2	0.042			0
SMBS	1	0.006		0		0		0	0.021	0		0
		0.011		0		0		0	0.042			0
SNSG	**0**	**0**		**0**		**0**		**0**	**0**	**0**		**0**
		0		**0**		**0**		**0**	**0**			**0**
SNSN	**285**	**1.629**		**1.8**		**1.531**		**3.5**	**0.75**	**26**		**0**
		0.716		**1.28**		**1.136**		**5.927**	**0.478**			**0**
STCT	14	0.08		0.1		0.078		0	0.083	0		0
		0.044		0.103		0.068		0	0.081			0
STSN	5	0.029		0.08		0.016		0	0	0		0
		0.03		0.096		0.031		0	0			0
UCA	2	0.011		0		0.016		0	0.021	0		0
		0.016		0		0.031		0	0.042			0
WLYE	2	0.011		0		0.016		0	0.021	0		0
		0.016		0		0.031		0	0.042			0
WSMW	**95**	**0.543**		**0.68**		**0.609**		**1**	**0.167**	**4**		**0**
		0.256		**0.658**		**0.412**		**1.033**	**0.161**			**0**
WTBS	1	0.006		0		0		0.1	0	0		0
		0.011		0		0		0.2	0			0
WTCP	15	0.086		0.14		0.109		0	0.021	0		0
		0.068		0.181		0.119		0	0.042			0
WTSK	28	0.16		0.16		0.125		0	0.229	1		0
		0.066		0.119		0.114		0	0.136			0
YWPH	1	0.006		0.02		0		0	0	0		0
		0.011		0.04		0		0	0			0

Appendix G. Hatchery names, locations and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2010 for Segment 3 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season		Fish Community Season		
	1.0” Trammel Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl
BKCP	0.000	0.000	0.000	0.029	0.000
BKSB	0.000	0.000	0.000	0.011	0.000
BMBF	0.007	0.000	0.005	0.000	0.000
BRBT	0.000	0.000	0.000	0.011	0.004
BUSK	**0.013**	**0.000**	**0.010**	**0.000**	**0.000**
CARP	0.003	0.002	0.009	0.474	0.002
CNCF	0.023	0.093	0.047	0.000	0.089
ERSN	0.000	0.018	0.000	1.526	0.002
FHCB	0.023	0.185	0.022	1.257	0.153
FHMW	0.000	0.003	0.000	0.977	0.000
FWDM	0.000	0.000	0.000	0.023	0.000
GDEY	0.466	0.039	0.141	0.960	0.078
GNSF	0.000	0.000	0.000	0.354	0.000
LKWF	0.000	0.000	0.008	0.000	0.000
LNDC	0.000	0.000	0.000	0.086	0.000
LNSK	0.000	0.000	0.002	0.017	0.004
NFSH	0.000	0.000	0.000	0.000	0.000
NTPK	0.000	0.000	0.004	0.040	0.002

Species Code	Sturgeon Season		Fish Community Season		
	1.0” Trammel Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl
PDSG	**0.024**	**0.052**	**0.021**	**0.000**	**0.035**
RVCS	0.123	0.028	0.017	5.234	0.023
SFCB	**0.000**	**0.112**	**0.000**	**0.000**	**0.060**
SGCB	**0.000**	**0.266**	**0.000**	**0.006**	**0.139**
SGER	**0.251**	**0.030**	**0.078**	**0.217**	**0.055**
SHRH	0.015	0.002	0.039	0.023	0.034
SMBF	0.005	0.000	0.002	0.029	0.000
SMBS	0.000	0.000	0.000	0.006	0.000
SNSG	**0.091**	**0.029**	**0.179**	**0.000**	**0.050**
SNSN	**0.000**	**0.004**	**0.000**	**1.629**	**0.005**
STCT	0.000	0.071	0.000	0.080	0.015
STSN	0.000	0.000	0.000	0.029	0.004
UCA	0.000	0.000	0.000	0.011	0.000
WLYE	0.002	0.000	0.019	0.011	0.000
WSMW	**0.000**	**0.003**	**0.000**	**0.543**	**0.010**
WTBS	0.000	0.000	0.000	0.006	0.002
WTCP	0.000	0.000	0.000	0.086	0.000
WTSK	0.008	0.007	0.006	0.160	0.005
YWPH	0.000	0.002	0.000	0.006	0.000

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 (FCS) between years from 2006 - 2010.

Bend Number	Bend River Mile	Coordinates Latitude	Longitude		2006	2007	2008	2009	2010
1	1701.5								
2	1700								
3	1698.5								
4	1697.5								
5	1696	48.0893	105.089						ST,FC
6	1695	48.0895	105.439			ST, FC		ST, FC	ST,FC
7	1693.5								
8	1692	48.0913	105.373			ST, FC	ST, FC		
9	1690.5								
10	1689	48.0824	105.324			ST, FC			
11	1687.5								
12	1685.5	48.0887	105.253				ST, FC		ST,FC
13	1684.5	48.0912	105.248			ST, FC		ST, FC	ST,FC
14	1683	48.0852	105.225		ST, FC			ST, FC	
15	1681.5							ST, FC	
16	1680	48.0664	105.2		ST, FC				
17	1678.5	48.0902	105.184			ST, FC			
18	1677	48.1027	105.174			ST, FC			
19	1675.5	48.0932	105.171				ST,		

							FC		
20	1674	48.0769	105.164				ST, FC		
21	1672.5	48.0782	105.11963						ST,FC
22	1671								
23	1670								
24	1668.5								
25	1667							ST, FC	
26	1666	48.0656	105.05				ST, FC	ST, FC	ST,FC
27	1665								
28	1664							ST, FC	
29	1663								
30	1661.5	48.08461	105.0036						ST,FC
31	1660							ST, FC	
32	1659	48.0687	104.999		ST, FC				
33	1657	48.0953	104.981		ST, FC				
34	1656							ST, FC	
35	1655	48.1006	104.965				ST, FC	ST, FC	
36	1654								
37	1653	48.0952	104.94			ST, FC	ST, FC		ST,FC
38	1651	48.1281	104.924			ST, FC	ST, FC		
39	1650								
40	1648.5	48.1488	104.898			ST, FC		ST,	

								FC	
41	1647								
42	1646	48.12918	104.85711					ST, FC	ST,FC
43	1644.5							ST, FC	
44	1643							ST, FC	
45	1641.5	48.12684	104.76282						ST,FC
46	1640.5							ST, FC	
47	1639.5	48.113	104.735			ST, FC	ST, FC		
48	1638.5	48.1191	104.716			ST, FC	ST, FC		
49	1637.5	48.12009	104.70154						ST,FC
50	1636.5	48.104	104.682		ST, FC				ST,FC
51	1635.5								
52	1634.5	48.1072	104.659			ST, FC			
53	1633.5	48.1119	104.634				ST, FC	ST, FC	ST,FC
54	1632.5	48.11972	104.62374						ST,FC
55	1631.5							ST, FC	
56	1630.5	48.1398	104.605		ST, FC				ST,FC
57	1629.5	48.1403	104.604				ST, FC		
58	1628.5								
59	1627								
60	1625.5	48.1182	104.567			ST, FC		ST, FC	ST,FC

61	1624								
62	1623	48.1116	104.51		ST, FC				
63	1622								
64	1620.5	48.1233	104.472			ST, FC	ST, FC		
65	1619.5								
66	1618.5							ST, FC	
67	1617.5	48.0966	104.444			ST, FC	ST, FC		ST,FC
68	1616.5	48.0813	104.415		ST, FC				
69	1615	48.0764	104.393			ST, FC			
70	1613.5	48.0746	104.371				ST, FC		
71	1612								
72	1611	48.0461	104.327				ST, FC		
73	1610	48.04511	104.32154						ST,FC
74	1608.5	48.0483	104.283			ST, FC	ST, FC	ST, FC	
75	1606.5	48.035	104.251		ST, FC		ST, FC		
76	1604.5	48.0357	104.207		ST, FC			ST, FC	ST,FC
77	1603	48.0446	104.199				ST, FC		
78	1598.5	48.046	104.184		ST, FC		ST, FC		
79	1597.5	48.0362	104.175				ST, FC		
80	1596							ST, FC	

81	1595	48.0532	104.141			ST, FC	ST, FC		ST,FC
82	1594	48.0378	104.124			ST, FC			
83	1593	48.0296	104.103			FC	ST, FC		
84	1592								
85	1591	48.021	104.098				ST, FC		
86	1590.5	48.0202	104.1			ST, FC			ST,FC
87	1589.5	48.0052	104.102			ST, FC			
88	1588.5								
89	1587								
90	1585.5								
91	1583.5								