2016 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 2016 field season marked the 11th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 3 of the Missouri River. However, it was the first year of an exercise to reduce the amount of standard gears used, with the abandonment of the otter trawl and mini-fyke net. Additionally, effort was also reduced by nearly half, from 22 standard bends to 12 standard bends. With the reduction of gear and effort, total captures of pallid sturgeon reached an all-time low (N=25) for Segment 3.

All 12 bends were sampled once each, with trammel net during both the sturgeon and fish community seasons, respectively. Comparatively, trotlines were used to sample each bend just once, with half of the bends sampled during the sturgeon season, and the other half sampled during the fish community season. A total of 220 trammel net deployments were utilized throughout Segment 3 during the 2016 field season; which totaled roughly 49 km of riverine habitat sampled. Additionally, a total of 96 trotlines were deployed in Segment 3 during 2016. With 20 hooks per trotline, a total of 1,920 nightcrawler-baited hooks were set in Segment 3 during 2016.

Trammel net deployments throughout Segment 3 during the 2016 field season resulted in the capture of seven individual pallid sturgeon. Temporally, slightly more pallid sturgeon were observed during fish community season (N=4) than during sturgeon season (N=3). Trammel net sampling led calculated CPUEs of 0.01 fish/100m and 0.03 fish/100m for the sturgeon and fish community seasons, respectively. In turn, combined-season CPUE was calculated to be 0.02 fish/100m.

Trotlines accounted for the observation of 18 individual pallid sturgeon. Trotlines had a calculated CPUEs of 0.19 fish/20 hooks for all three metrics, which were the new all-time low catch rates for sturgeon season, fish community season, and the combined-season.

Pallid sturgeon captured in Segment 3 during the 2016 field season averaged 449 mm in fork length and 366 g in weight. Fork length ranged from 320 mm to 790 mm. Trotline, on average, sampled larger individuals (454 mm) than did trammel nets (434 mm). The relative condition (Kn) for the sub-stock 200-329 mm pallid sturgeon has remained at or above 1.0 dating back to the Program's inception in 2006. The Kn for both the stock and quality size classes of pallid sturgeon has remained relatively stable throughout time. No preferred or

memorable/trophy size class pallid sturgeon were captured in Segment 3 during the 2016 sampling season.

All 25 pallid sturgeon observed during 2016 were of known year class and hatchery origin. Year class observed, in order of abundance were; 2010 (N=5), 2008 (N=3), 2002, 2005, 2006, 2009, 2013, 2014 and 2015 (N=2) and 2001, 2007, and 2012 (N=1). Of the 25 pallid sturgeon observations, 20 were of known stocking location, all of which originated in RPMA 2. Stocking origination in rank of abundance were Culbertson (N=12), Wolf Point (N=5), Fairview (N=2), and Fallon (N=1).

A total of 216 shovelnose sturgeon were captured throughout Segment 3 during the 2016 sampling season. Temporally, more were captured during fish community season (N=144), than during sturgeon season (N=72). In relation to gears, more shovelnose sturgeon were observed in trammel net (N=124) compared to trotline (N=92).

Trammel net CPUE for the quality and above size class of shovelnose sturgeon, the most frequent size class observed, was reported at 0.07 fish/100m, 0.41 fish/100m, and 0.24 fish/100m for sturgeon season, fish community season, and combined-season, respectively. Catch rates for the sub-stock and stock size categories of shovelnose sturgeon in Segment 3 remain low. Trotline CPUE for quality and above size class of shovelnose sturgeon were 1.04 fish/20 hooks (sturgeon season), 0.88 fish/20 hooks (fish community season), and 0.96 fish/20 hooks (combined-season). Similarly, to trammel net, trotline captures of the sub-stock and stock size categories of shovelnose sturgeon remain low in Segment 3 of the Missouri River.

Shovelnose sturgeon captured in Segment 3 during the 2016 field season averaged 585 mm in fork length and 866 g in weight; with a range of 175 mm to 859 mm. Relative weight (Wr) for both sub-stock categories are difficult to compare from year to year based on low sample size. The observed Wr for the stock and quality size classes of shovelnose sturgeon are comparable, however the stock size class appears to be exhibiting an ever so slight downward trend since 2006. Even more comparable are the preferred and memorable/trophy size classes of shovelnose sturgeon. However, neither size class shows any particular trend in regards to relative weight.

A total of five blue suckers were observed throughout Segment 3 sampling during the 2016 field season; all blue suckers were captured during random trammel net deployments. Temporally, two blue suckers were captured during the sturgeon season, while the remaining

three individuals were caught during the fish community season. Blue sucker CPUE for trammel nets in Segment 3 during 2016 was 0.01 fish/100m for both sturgeon and fish community seasons. The average size (709 mm TL) of blue suckers in Segment 3 during 2016 once again exhibited an adult-only population structure. However, one individual captured in 2016 (472 mm) fell into a rarely observed “intermediary” size category.

A total of 109 sauger were collected within Segment 3 during the 2016 sampling season. The majority (N=89) of sauger observations came during the sturgeon season, when compared to the fish community season (N=20). In relation to gear, nearly all sauger were captured via trammel net (N=106), while trotline sampled just three individuals. Seasonal trammel net CPUE for 2016 was 0.38 fish/100m and 0.10 fish/100m for the sturgeon and fish community seasons, respectively. In turn, a combined-season CPUE was tabulated at 0.24 fish/100m. The sauger captured during 2016 sampling events across Segment 3 averaged 351 mm in total length and 353 g in weight. With the loss of otter trawl and mini-fyke net as sampling gears, smaller age classes, including young of the year, were absent from 2016 sampling.

With the suspension of the otter trawl and mini-fyke net as sampling gears, virtually all trend data for the small-bodied target species (sturgeon and sicklefin chubs, Hybognathus spp., and sand shiner) were lost for the 2016 field season.

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Introduction

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

The Pallid Sturgeon Population Assessment Program (program) is guided by the RPA's in the 2003 Amendment to the 2000 Biological Opinion. The program is a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitats used by wild and hatchery reared juvenile pallid sturgeon (Welker et al. 2017). 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 et al. 2017). 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, otter trawl and trotlines are standard gears used in segments 1-4 during sturgeon season, and appear to be an effective method to sample pallid sturgeon. However, due to an exercise in gear/effort reduction, otter trawls were not performed in segments 1-3 during the 2016 field season.

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. However, in accordance with the aforementioned gear reduction, neither otter trawls nor mini-fyke nets were used in 2016.

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 et al. 2017), 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 et al. (2017). 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). Typically, 22 standard bends are sampled in Segment 3, however, due to the effort reduction exercise in 2016, 12 random bends were sampled.

In 2016, trammel nets alone were used when sampling all 12 randomly selected river bends during both seasons. Trotlines were switched from an experimental gear, in 2009, to a standard gear for 2010 in segment 2. Twelve random trotline bends were selected by moving upstream one river bend from the 12 bends that were randomly selected for sampling by standard gears. This was done to the minimize the possibility of an attractant effect of trotlines to our standard gears and to optimize our time spent on any particular bend, since overnight trotlines require an additional trip to each sampled bend. Trotline bends were only sampled once, as opposed to standard bends, which were sampled by standard gears in both sturgeon season and fish community season. Half (N=6) were sampled with trotline in sturgeon season and half (N=6) were sampled during fish community season.

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 et al. (2017).

Trammel Net

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

Otter Trawl

The standard otter trawl has a length of 7.6 m, a width of 4.9 m and height of 0.9 m. The otter trawl has an inner mesh (6.35mm bar, #18 polyethylene twine) and outer mesh (38mmbar, #9 polyethylene twine) and a cod end opening of 406.4 mm. The trawl doors were made from 19.1 mm marine plywood and measured 762 mm x 381 mm. The trawl doors are used to keep the mouth of the trawl open while deployed on the riverbed. The trawl also has a 7.9 m long tickler chain attached to the bottom of the mouth of the trawl, which aids in keeping it orientated on the riverbed and protecting the mouth when snags are encountered. The otter trawl was deployed from the bow of the boat parallel to the current with two 30.5 m ropes and towed downstream slightly faster than current speed for a minimum of 75 m and a maximum distance of 300 m.

Mini Fyke Nets

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

Trotlines

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

Data Collection and Analysis

A minimum of eight random subsamples were taken in macrohabitats present at each randomly selected river bend. At least two subsamples (when possible) were taken using each gear in each macro habitat within a bend. More than two subsamples were taken in a macrohabitat for a gear when the number of discrete macrohabitats was less than four or less

than four could be effectively sampled. When a pallid sturgeon was captured, we duplicated the sample in a non-random manner. No more than eight duplicates were taken and we would stop taking duplicates whenever two contiguous duplicate subsamples contain no pallid sturgeon. Although this non-random sampling, it gives us a better understanding of relative abundance and identifies habitats that pallid sturgeon may congregate in.

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

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

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

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

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

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

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker et al. (2017). 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.

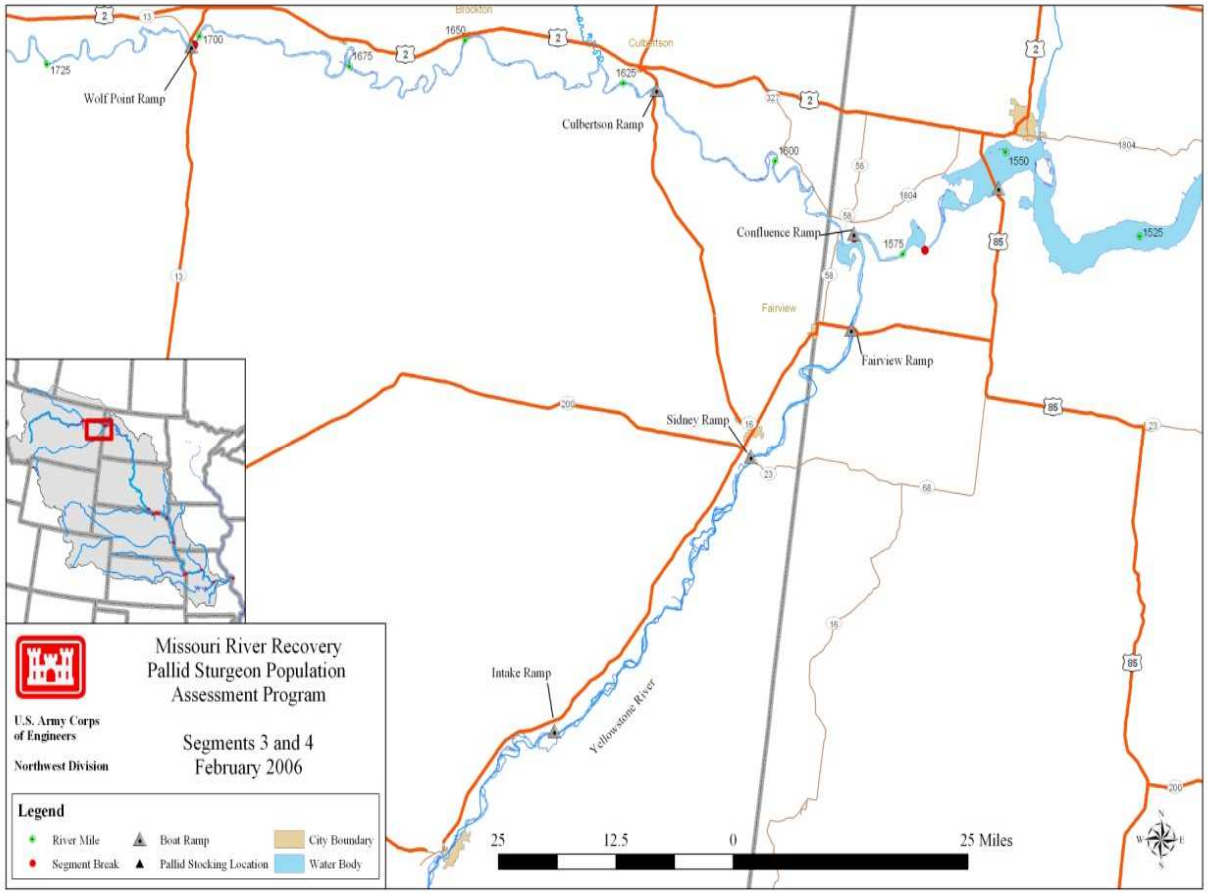

Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 12 randomly selected river bends were sampled in Segment 2 during 2016. All 12 bends were sampled once each, with trammel net, during both sturgeon and fish community seasons, respectively. Comparatively, trotlines were used to sample each bend once; with half of the bends sampled during sturgeon season, and the other half sampled during fish community season. The sampling regime in 2016 was a departure from the norm; where as in the previous 10 years of sampling, a total of 22 river bends were randomly sampled in Segment 3.

A total of 220 trammel net deployments were utilized throughout Segment 3 during the 2016 field season; which totaled roughly 49 km of riverine habitat being sampled. Seasonally, effort was nearly equal; with 98 drifts taking place during sturgeon season, and 102 drifts occurring during fish community season. Similarly, distance sampled was also comparable with 25.4 and 23.5 km of trammel net drifts during sturgeon and fish community, respectively. As expected, the 192 random trammel deployments accounted for the vast majority (47 km) of total distance sampled, compared to the eight non-random duplicate drifts (2 km).

Additionally, a total of 96 trotlines were deployed in Segment 3 during 2016. As stated above, half of the randomly selected bends (N=6) were sampled during sturgeon season, while the other half (N=6) were sampled during fish community season. With 20 hooks per trotline, a total of 1,920 nightcrawler-baited hooks were set in Segment 2 in 2016.

The specific habitat measurements for pallid sturgeon captured in random deployments by macro and meso habitat is displayed in Table 1. Additionally, Table 4 through 7 shows the number of pallid sturgeon captured by random deployments by gear and macro habitat, as well as effort expended in those macro habitats.

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 2016.

Gear	Number of Bends	Mean Effort	Macrohabitat[a]			
			CHXO	**ISB**	**OSB**	**SCCL**
			Sturgeon Season			
1.0” Trammel Net	12	8	39	31	26	0
			Fish Community Season			
1.0” Trammel Net	12	8	40	28	28	0
			Both Seasons			
Trotline	12	8	39	30	25	2

[a] Habitat abbreviations and definitions presented in Appendix B

Pallid Sturgeon

A total of 25 pallid sturgeon were captured in Segment 3 during the 2016 field season; all of which were hatchery-reared juveniles. Temporally, captures were nearly equal between seasons; with 12 pallid sturgeon being sampled during sturgeon season, and the remaining 13 were witnessed during fish community season. All 25 individuals were observed during random sampling efforts.

Trammel net deployments throughout Segment 3 during the 2016 field season resulted in the capture of seven individual pallid sturgeon. Temporally, slightly more pallid sturgeon were observed during fish community season (N=4) than during sturgeon season (N=3). Trammel net sampling (Fig. 5) led calculated CPUEs of 0.01 fish/100m and 0.03 fish/100m for the sturgeon and fish community seasons, respectively. In turn, combined-season CPUE was then calculated to be 0.02 fish/100m. The CPUE recorded during both sturgeon and fish community seasons, respectively, were the third lowest catch rates observed in the 11-year history of Population Assessment in Segment 3 of the Missouri River. Additionally, the observed combined-season CPUE was the second lowest catch rate on record.

Trotline was once again a useful gear in regards to capturing pallid sturgeon in Segment 3 during 2016. In total, trotlines accounted for the observation of 18 individual pallid sturgeon. However, with a calculated CPUE of 0.19 fish/20 hooks for all three seasonal metrics, new all-time low catch rates were reached for sturgeon season, fish community season, and combined-season. A full history of trotline CPUE can be found in Figure7.

The pallid sturgeon captured in Segment 3 during the 2016 field season averaged 449 mm in fork length and 366 g in weight. Fork length ranged from 320 mm to 790 mm. Trotline, on average, sampled larger individuals (454 mm) than did trammel nets (434 mm). A full description of length frequency can be found in Figure 3, while Relative Stock Density (RSD) can be found in Figure 8.

The relative condition (Kn) regarding pallid sturgeon captured in Segment 3 during 2016 can be found in Figure 4. Size category in order of abundance were; stock (N=21), quality (N=3), and sub-stock 200-329 mm (N=1). The Kn for the sub-stock 200-329 mm pallid sturgeon has remained at or above 1.0 dating back to the Program's inception in 2006. The Kn for both the stock and quality size classes of pallid sturgeon has remained nearly identical and stable

throughout time. No preferred or memorable/trophy size class pallid sturgeon were captured in Segment3 during the 2016 sampling season.

Pallid sturgeon distribution throughout Segment 3 remains variable, with emphasis on the timing and locality of sampling (Fig. 2); particularly during 2016, when an exercise in both gear reduction and effort reduction took place. Of the 12 bends sampled with trammel net, pallid sturgeon were observed in half. Comparatively, of the 12 bends sampled via trotline, pallid sturgeon were represented in 10 of them. Additionally, four of the 12 trotline bends sampled in Segment 3 during 2016 reported multiple captures of pallid sturgeon.

All 25 pallid sturgeon observed during 2016 sampling events in Segment 3 were of known year class (Table 3). Year class in order of abundance were; 2010 (N=5), 2008 (N=3), 2002, 2005, 2006, 2009, 2013, 2014 and 2015 (N=2) and 2001, 2007, and 2012 (N=1). Of the 25 pallid sturgeon observations, 20 were of known stocking location; all of which originated in RPMA 2. Stocking origination in rank of abundance were; Culbertson (N=12), Wolf Point (N=5), Fairview (N=2), and Fallon (N=1).

The specific habitat measurements for pallid sturgeon captured in random deployments by macro and meso habitat is displayed in Table 2. Additionally, Table 4 through 7 shows the number of pallid sturgeon captured by random deployments by gear and macro habitat, as well as effort expended in those macro habitats.

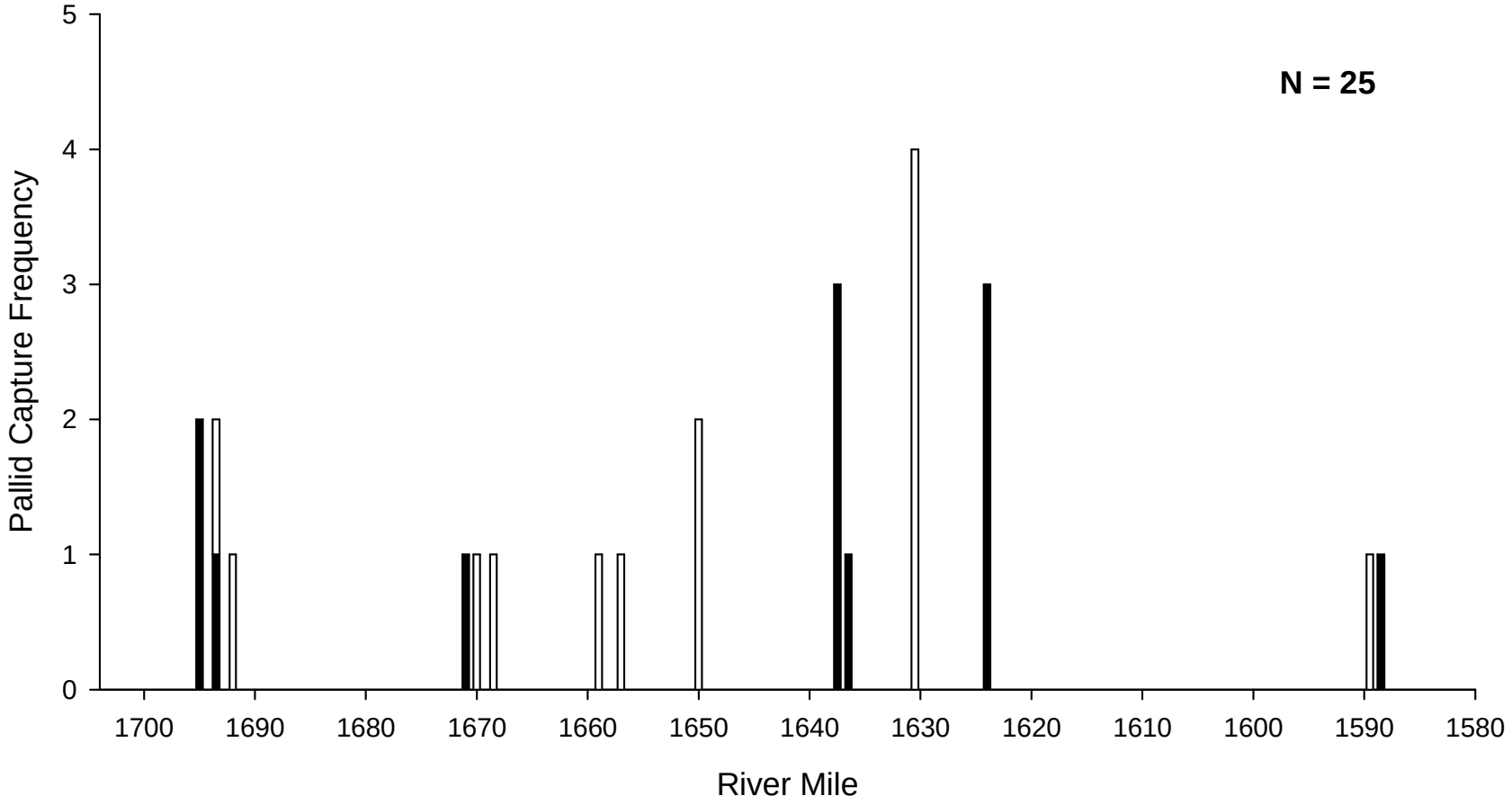

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2016. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2016. 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)		
MACRO	MESO	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	Total Pallids Caught
CHXO	CHNB	1.9 (1.0-4.0)	2.0 (1.0-4.0)	0.59 (0.32-0.77)	0.49 (0.32-0.68)	15.3 (12.0-19.0)	14.0 (12.4-17.0)	162 (34-1160)	134 (40-200)	14
ISB	CHNB	1.9 (1.0-4.0)	1.8 (1.3-2.5)	0.55 (0.19-0.75)	0.30 (0.19-0.40)	15.3 (12.0-19.1)	15.1 (13.7-19.0)	172 (34-1200)	395 (53-1200)	6
OSB	CHNB	2.4 (1.2-6.5)	1.6 (1.2-2.0)	0.66 (0.52-0.78)	. (.-.)	15.3 (12.0-19.1)	14.7 (14.0-15.0)	145 (34-1180)	87 (40-155)	4
SCCL	CHNB	1.6 (1.4-1.7)	1.4 (1.4-1.4)	. (.-.)	. (.-.)	13.9 (13.9-13.9)	13.9 (13.9-13.9)	218 (218-218)	218 (218-218)	1

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 2016 from Segment 3 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al. (2010).

Year Class	N	Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001	1	.	.	.	726	1350.0	0.922	.	.
.	.	.	.	.	.	.	.	.	.
2002	2	289	.	.	767	1627.5	0.926	0.100	.
.	.	4	.	.	46	285.0	0.020	0.009	.
2005	2	.	.	.	490	395.0	0.981	.	.
.	.	.	.	.	20	80.0	0.067	.	.
2006	2	.	.	.	425	197.5	0.791	.	.
.	.	.	.	.	47	45.0	0.107	.	.
2007	1	.	.	.	425	210.0	0.837	.	.
.	.	.	.	.	.	.	.	.	.
2008	3	.	.	.	400	200.0	0.971	.	.
.	.	.	.	.	19	34.6	0.068	.	.
2009	2	230	44.0	1.324	434	247.5	0.920	0.093	0.098
.	.	.	.	.	63	85.0	0.122	.	.
2010	5	260	51.0	1.025	388	174.0	0.932	0.072	0.077
.	.	.	.	.	10	15.9	0.030	.	.
2012	1	343	167.0	1.348	402	190.0	0.909	0.052	0.020
.	.	.	.	.	.	.	.	.	.
2013	2	300	105.5	1.317	362	150.0	1.017	0.079	0.057
.	.	30	29.0	0.070	19	20.0	0.040	0.014	0.012
2014	2	349	151.5	1.153	420	190.0	0.791	0.156	0.080
.	.	31	41.0	0.024	28	10.0	0.132	0.031	0.048
2015	2	340	139.0	1.129	367	152.5	1.013	0.129	0.406
.	.	38	66.0	0.130	93	65.0	0.407	0.363	0.662

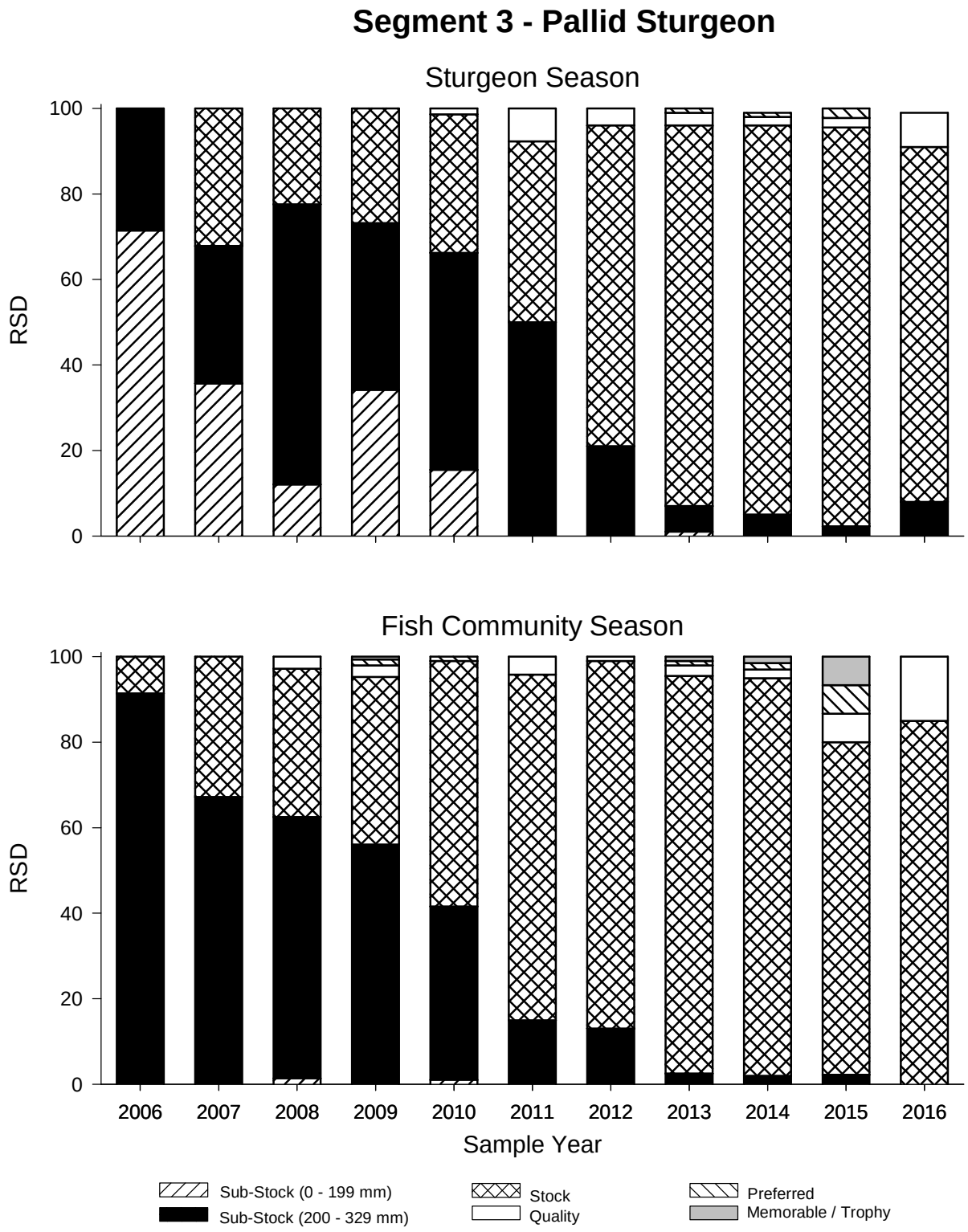

Figure 3. Proportion of total catch by length group for all pallid sturgeon captured with all gear by length category from 2006-2016 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

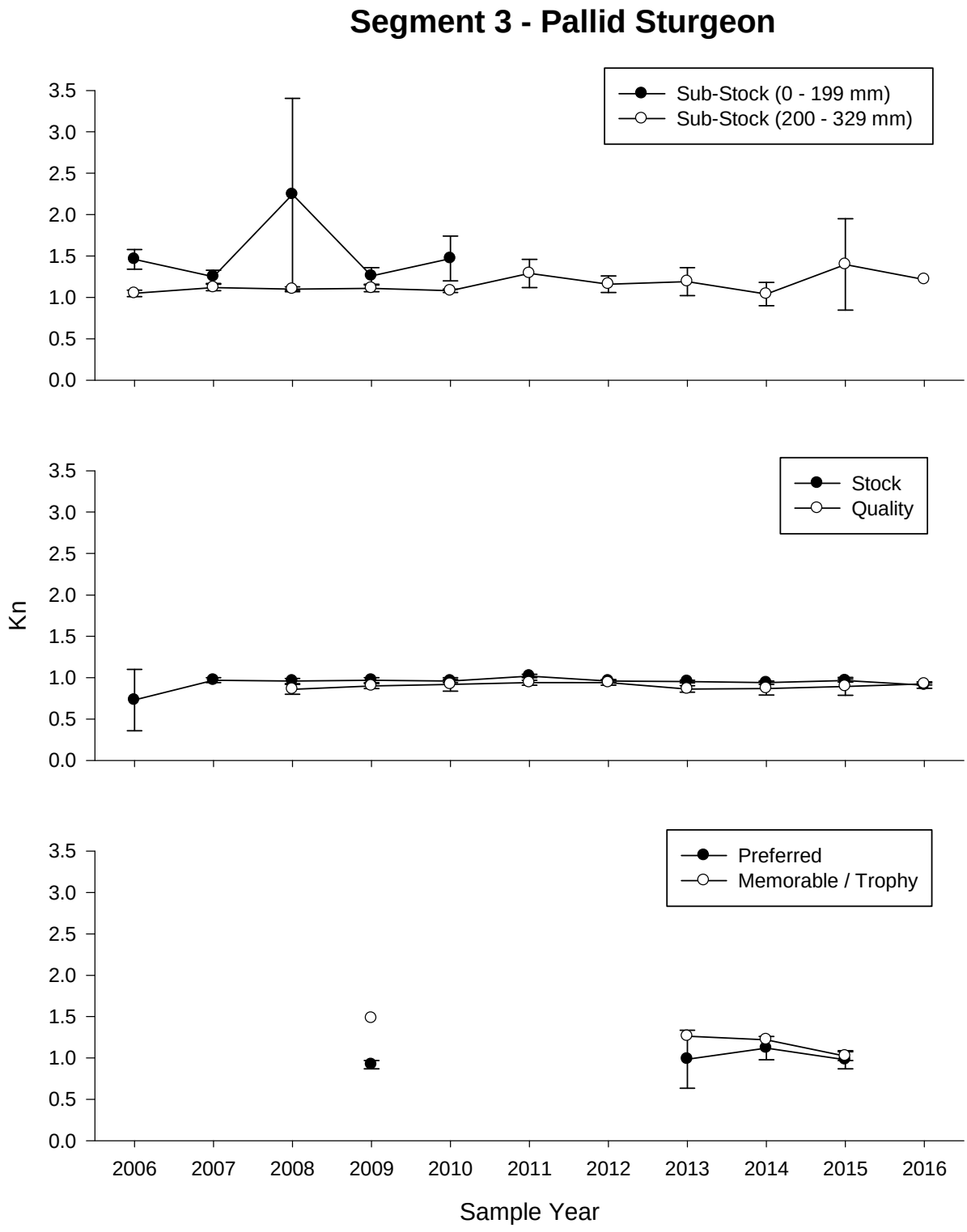

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2016 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

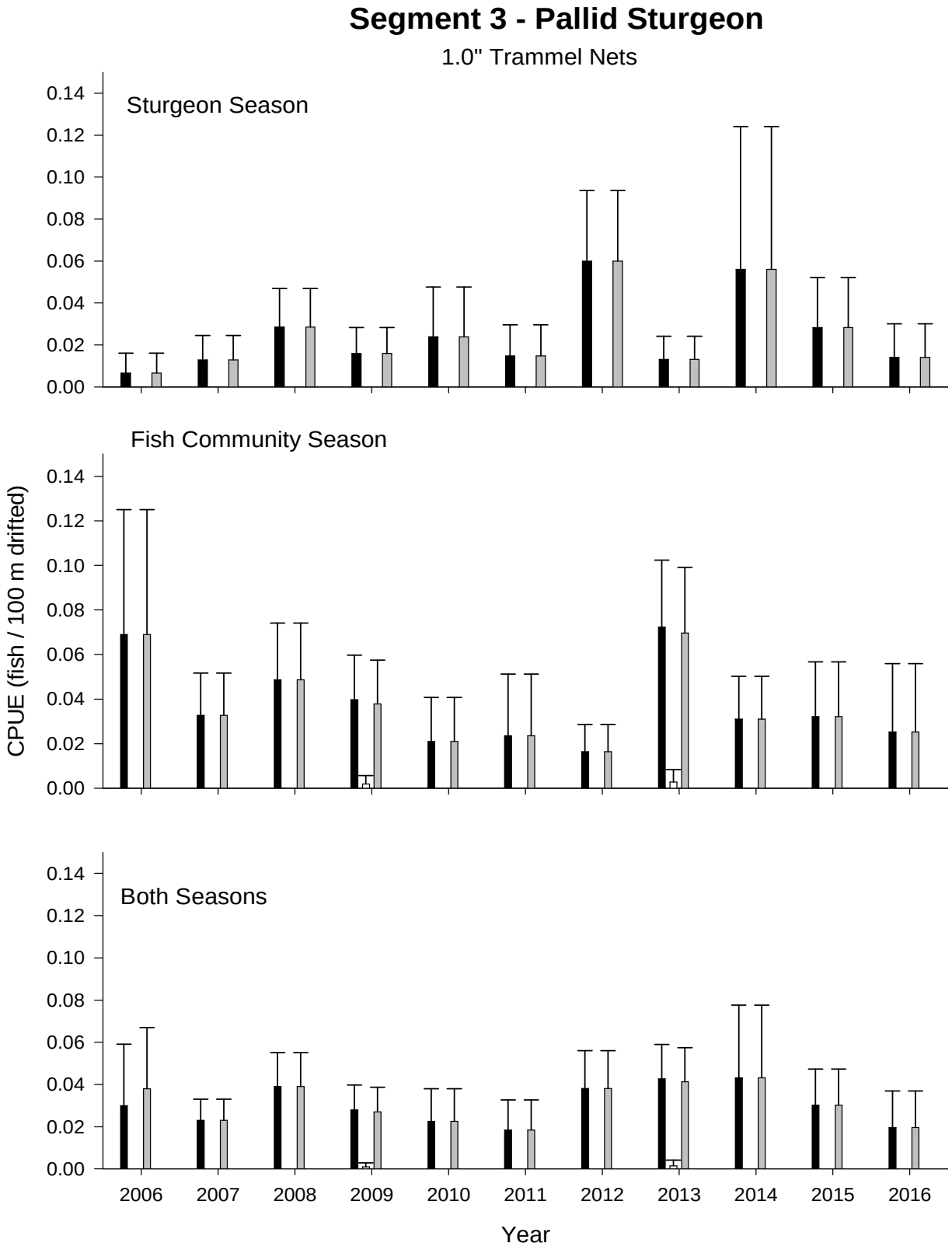

Figure 5. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2016.

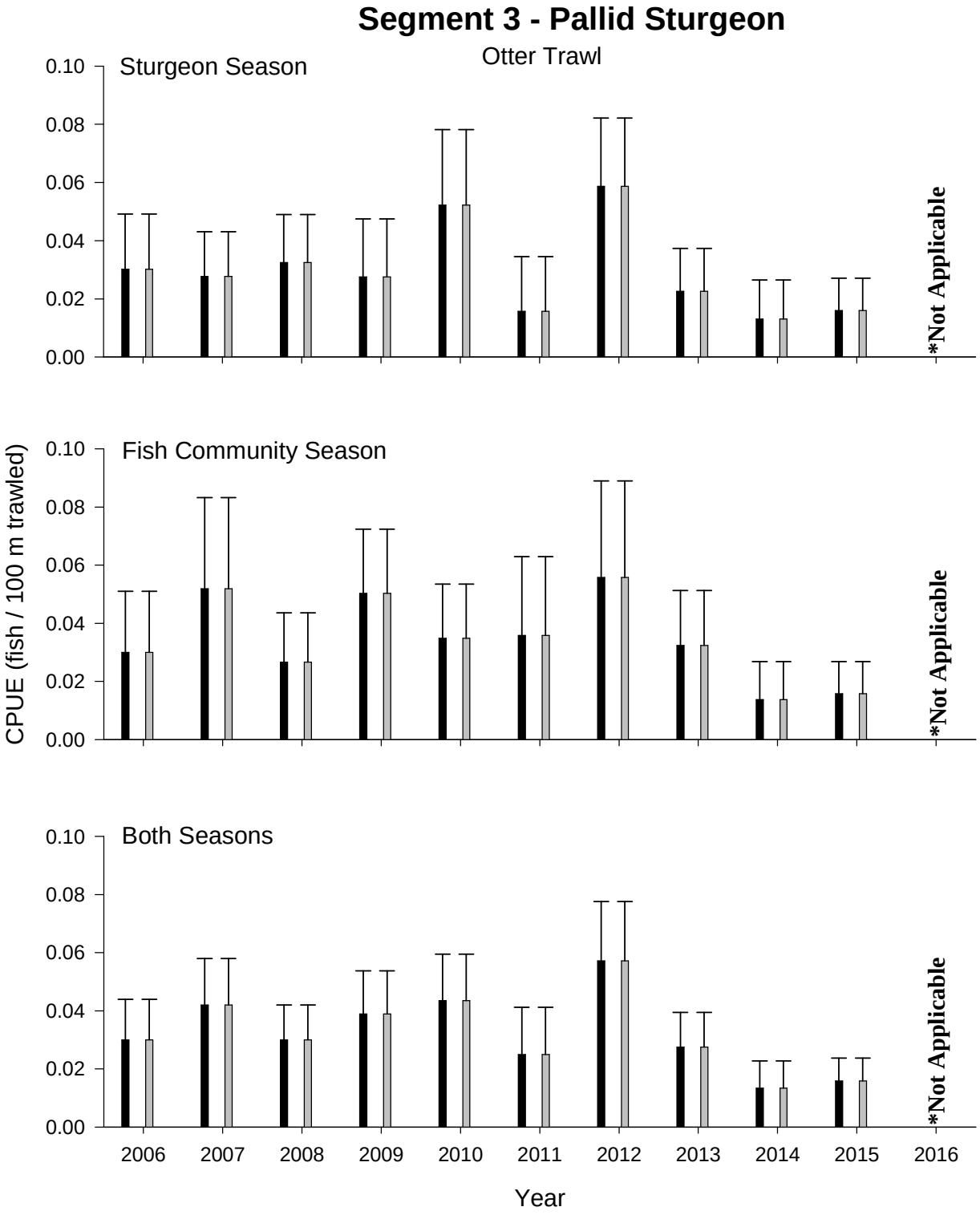

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

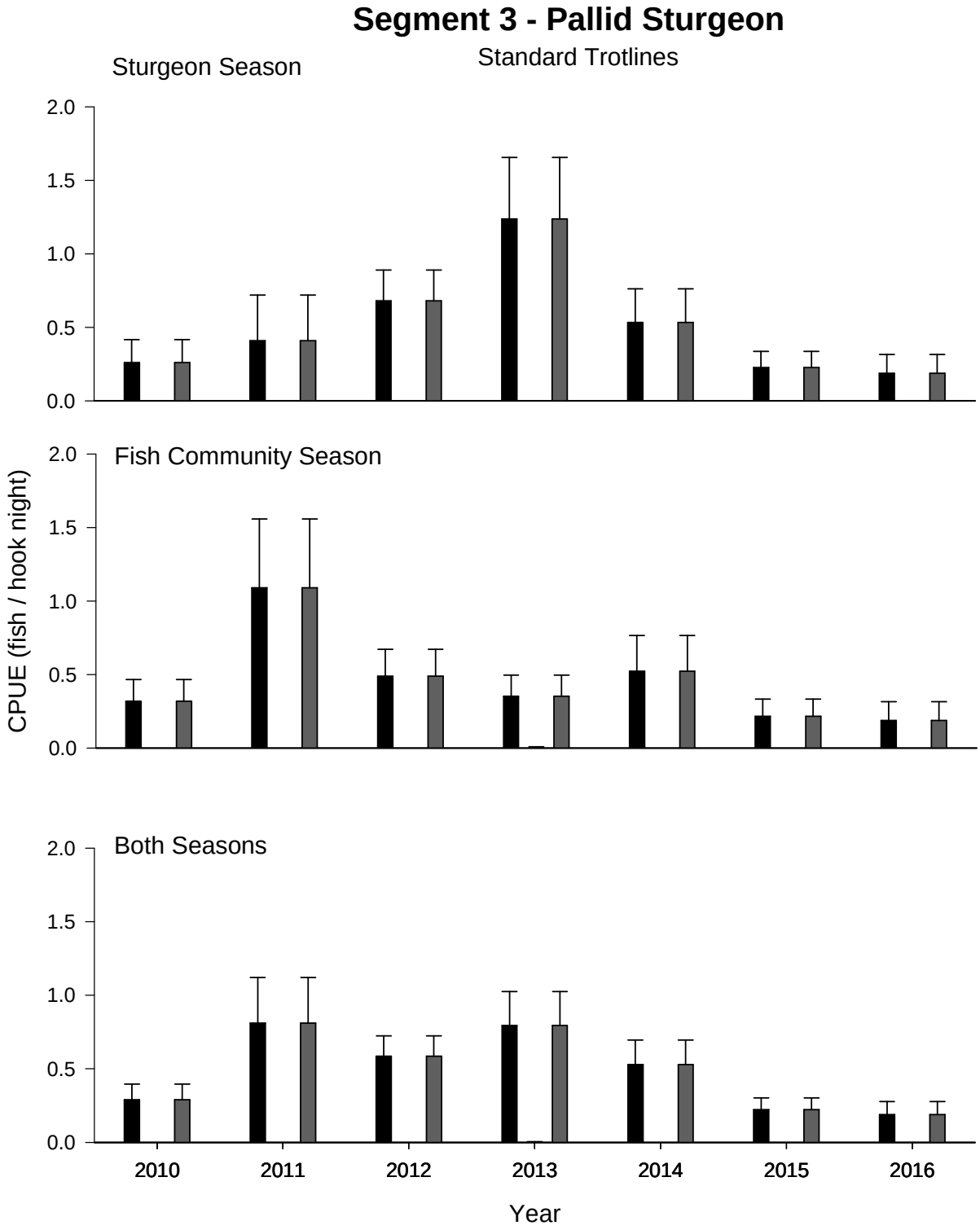

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2016.

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 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	0	0	0	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	0	0	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	0	0	0	0	0
		41	31	26	2

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	1	0	100	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	0	0	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	0	0	0	0	0
		41	31	26	2

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 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	1	100	0	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	4	100	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	16	56	19	19	6
		41	31	26	2

Table 7. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	1	0	100	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	0	0	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	2	0	50	50	0
		41	31	26	2

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat[a]			
		CHXO	**ISB**	**OSB**	**SCCL**
Sturgeon Season					
1.0” Trammel Net	3	33	67	0	0
		42	32	26	0
Fish Community Season					
1.0” Trammel Net	4	100	0	0	0
		44	29	26	0
Both Seasons					
Trot Line	18	50	22	22	6
		41	31	26	2

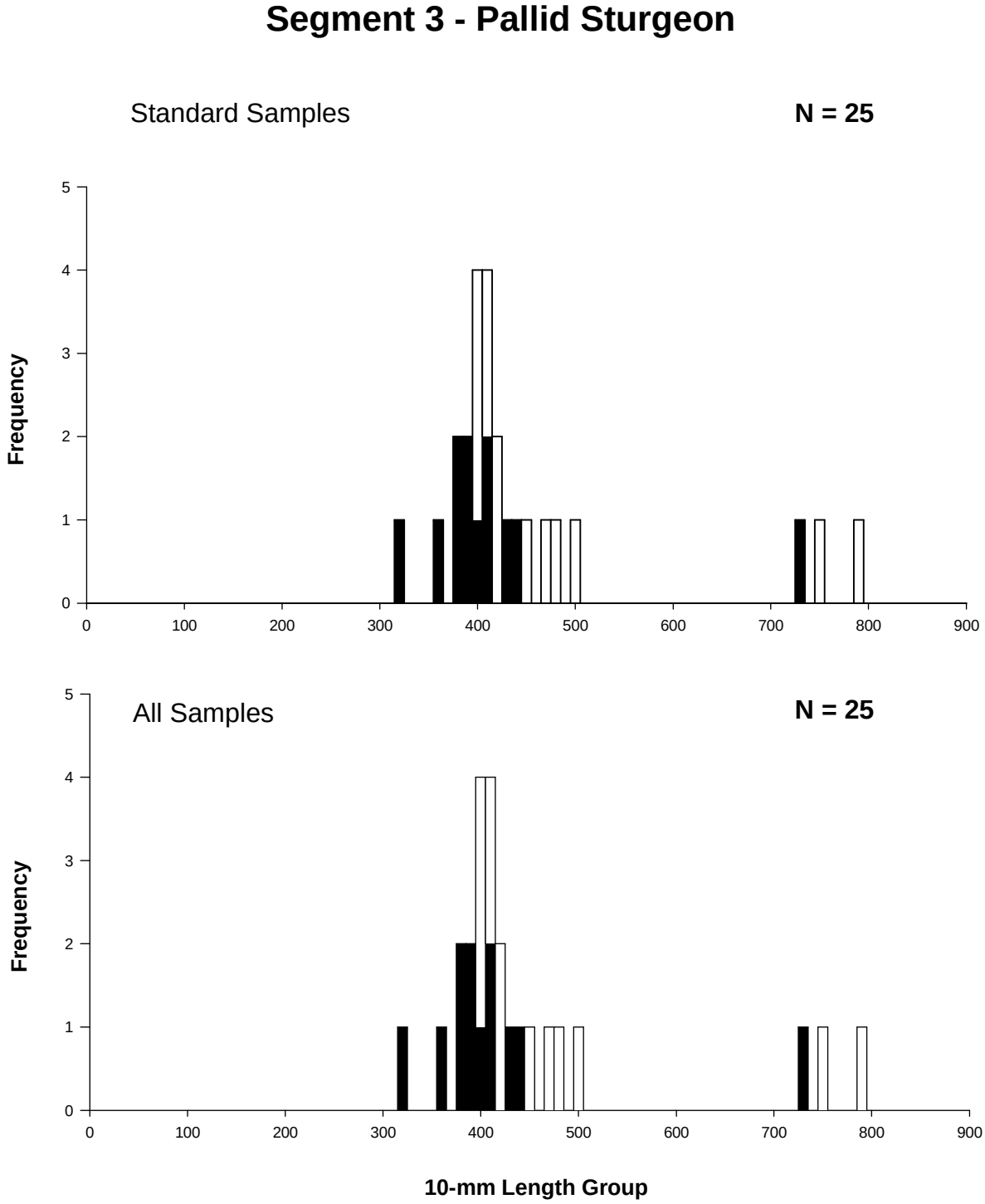

Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016. Pallid sturgeon of unknown origin are awaiting genetic verification.

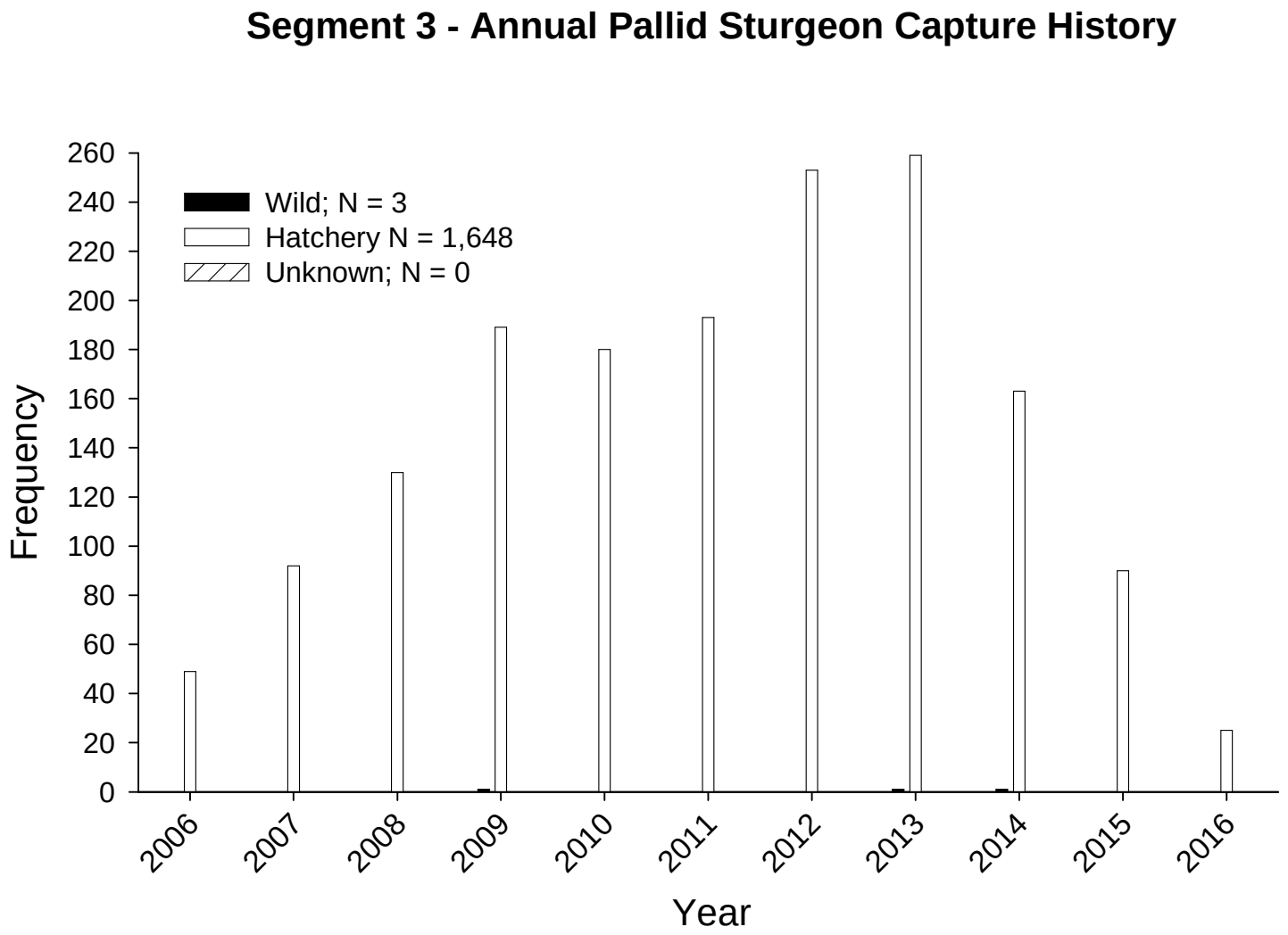

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2016. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable 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 2016 or during the previous ten years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

A total of 216 shovelnose sturgeon were captured throughout Segment 3 during the 2016 sampling season. Temporally, more were captured during fish community season (N=144), than during sturgeon season (N=72). In relation to gears, more shovelnose sturgeon were observed in trammel net (N=124) compared to trotline (N=92). Random gear deployments accounted for the majority of observations (N=211), while nonrandom duplicate trammel net drifts netted an additional 5 individuals.

The history of Segment 3 shovelnose sturgeon trammel net CPUE can be found in Figure 10. In 2016, trammel net CPUEs for the quality and above size class of shovelnose sturgeon, the most frequent size class observed, were reported at 0.07 fish/100m, 0.41 fish/100m, and 0.24 fish/100m for sturgeon season, fish community season, and combined-season, respectively. The aforementioned catch rate observed during fish community season was a record high in the 11 year history of the Program in Segment 3. Additionally, the observed catch rate for combined-seasons was the second highest CPUE tabulated since the Program's inception in 2006. Catch rates for the sub-stock and stock size categories of shovelnose sturgeon in Segment 3 remain low, yet comparable, on a year by year basis.

Trotline CPUE for Segment 3 in 2016 (Fig. 12), regarding the quality and above size class of shovelnose sturgeon, was reported for the following three seasonal metrics; 1.04 fish/20 hooks (sturgeon season), 0.88 fish/20 hooks (fish community season), and 0.96 fish/20 hooks (combined-season). Similarly to trammel net, trotline captures of the sub-stock and stock size categories of shovelnose sturgeon remain low in Segment 3 of the Missouri River.

A year by year comparison of relative weights (Wr), related to the observed shovelnose sturgeon in Segment 3, can be found in Figure 15. Wr for both sub-stock categories are difficult to compare from year to year based on low sample size. The observed Wr for the stock and quality size classes of shovelnose sturgeon are comparable, however, the stock size class appears to be exhibiting an ever so slight downward trend when comparing back to the Program's inception in 2006. Even more comparable are the preferred and memorable/trophy size classes of

shovelnose sturgeon; however, neither size class shows any particular trend in regards to relative weight.

The shovelnose sturgeon representatives captured in Segment 3 during the 2016 field season averaged 585 mm in fork length and 866 g in weight; with a range of 175 mm to 859 mm. The observed average length and range has remained comparable over time, and when compared to Segment 2, Segment 3 exhibits a much more complete population structure of shovelnose sturgeon; indicating it much more suitable for all age classes. A complete length frequency histogram can be viewed in Figure 13.

The specific macro and meso habitats where shovelnose sturgeon were sampled in Segment 3 during 2016, by gear and size class, is depicted in Tables 9-12. Table 13 shows the total number of shovelnose sampled by gear and macro habitat.

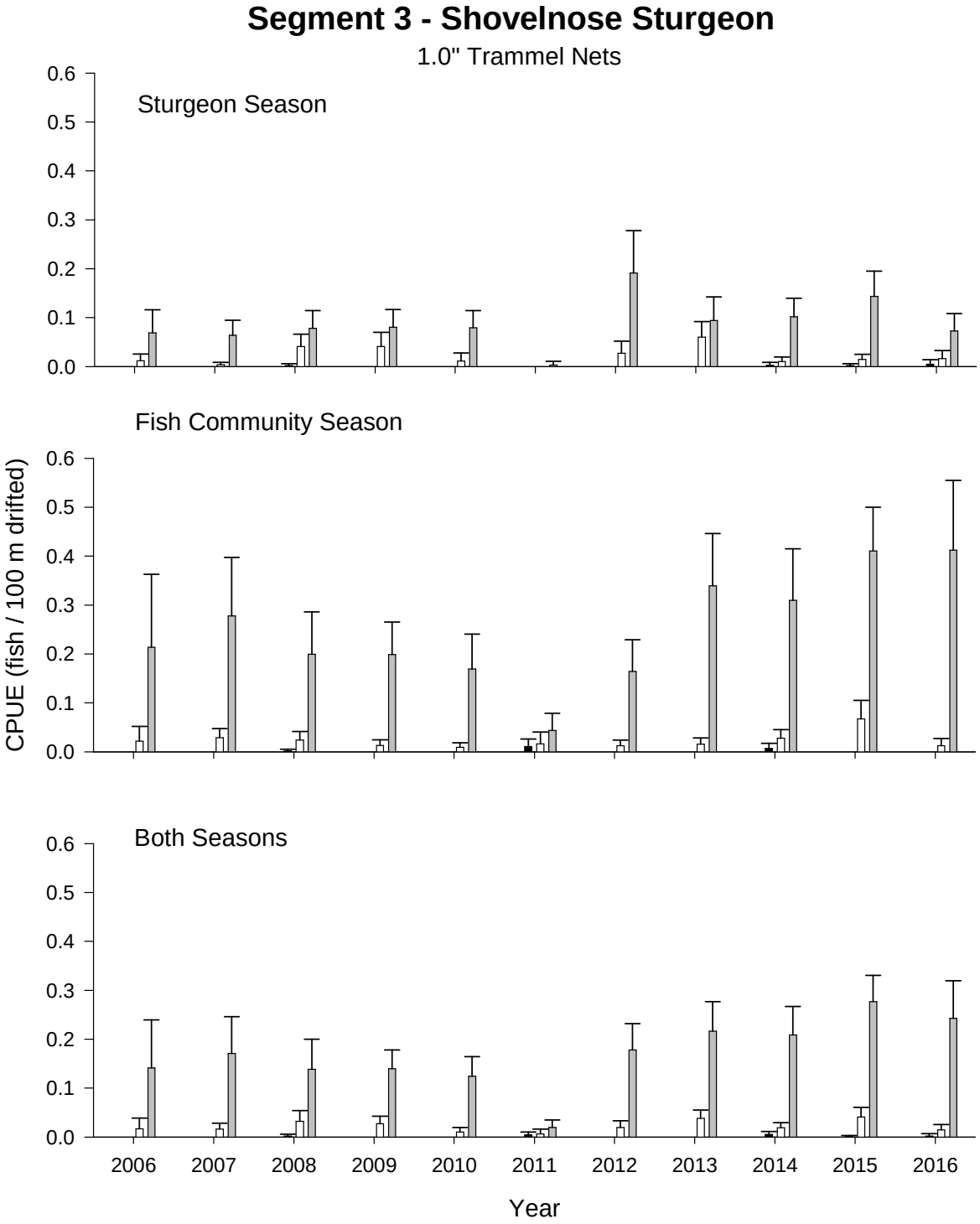

Figure 10. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2016.

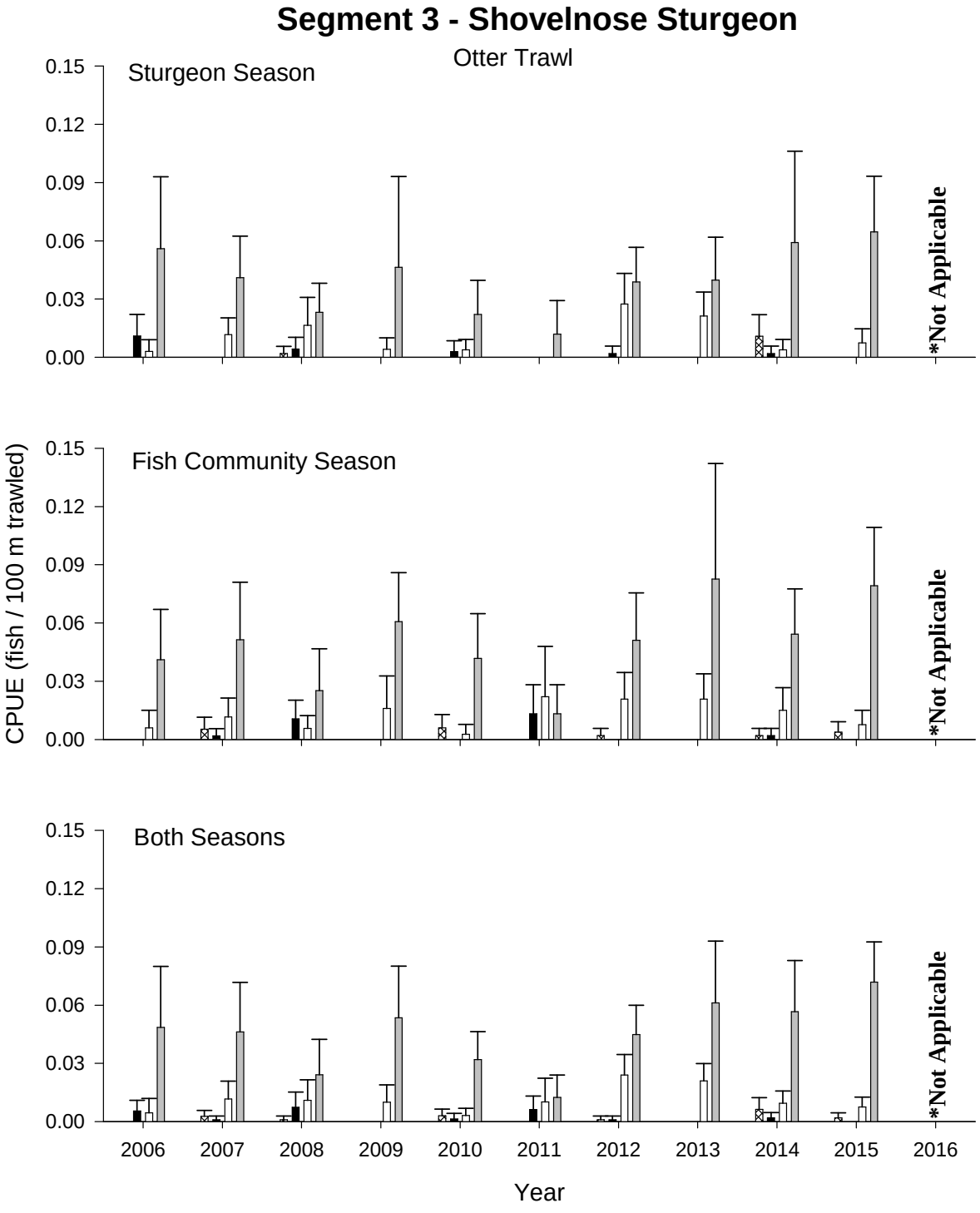

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

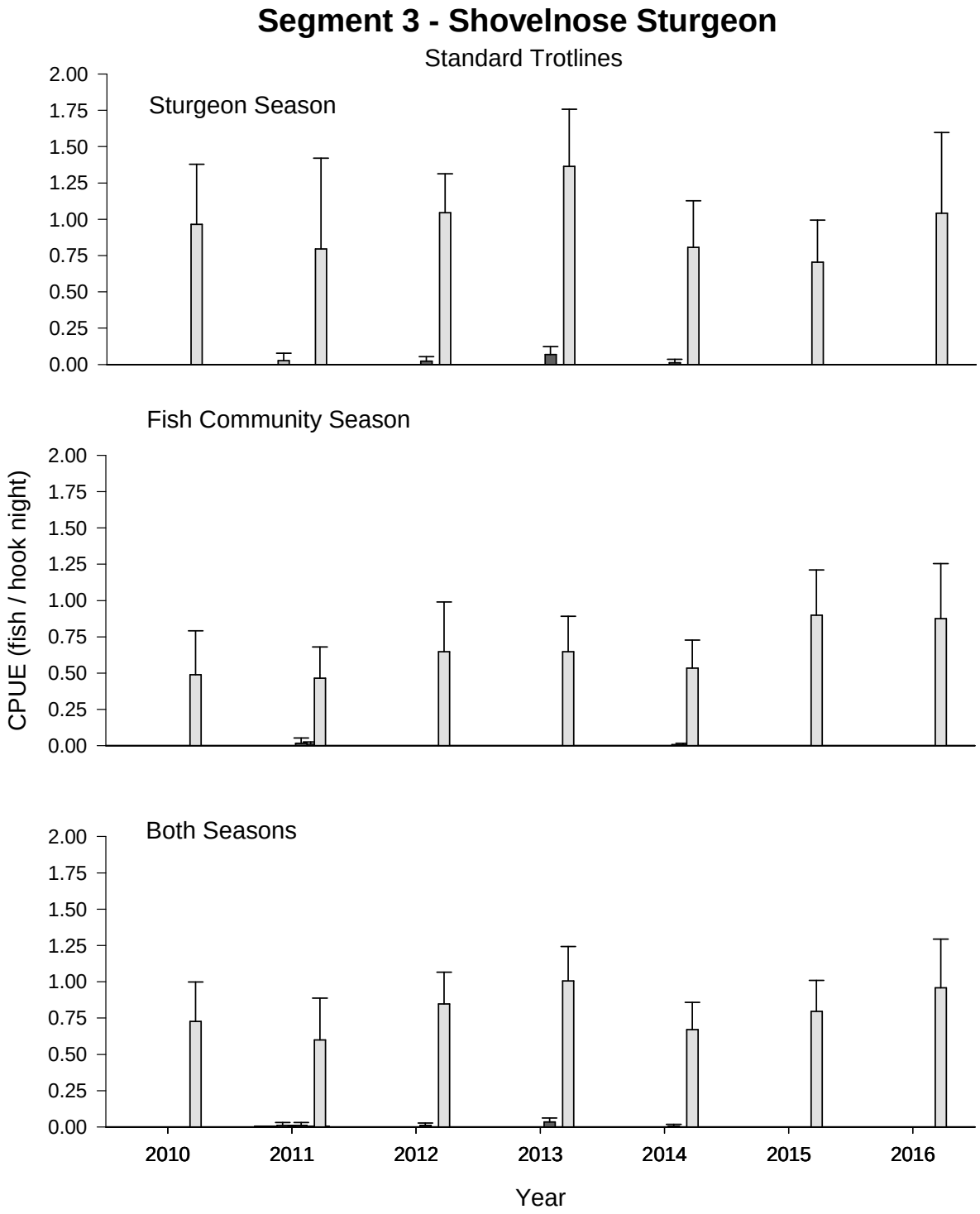

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2016. Note that trotlines were not used as a standard gear from 2006 to 2009.

Table 9. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	0	0	0	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	0	0	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	0	0	0	0	0
		41	31	26	2

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	1	0	100	0	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	0	0	0	0	0
		44	29	26	0
		Both Seasons			
Trot Line	0	0	0	0	0
		41	31	26	2

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	4	0	50	50	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	3	33	33	33	0
		44	29	26	0
		Both Seasons			
Trot Line	0	0	0	0	0
		41	31	26	2

Table 12. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	17	12	59	29	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	94	47	29	24	0
		44	29	26	0
		Both Seasons			
Trot Line	92	47	24	21	9
		41	31	26	2

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 3 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat[a]			
		CHXO	**ISB**	**OSB**	**SCCL**
Sturgeon Season					
1.0” Trammel Net	22	9	59	32	0
		42	32	26	0
Fish Community Season					
1.0” Trammel Net	97	46	29	25	0
		44	29	26	0
Both Seasons					
Trot Line	92	47	24	21	9
		41	31	26	2

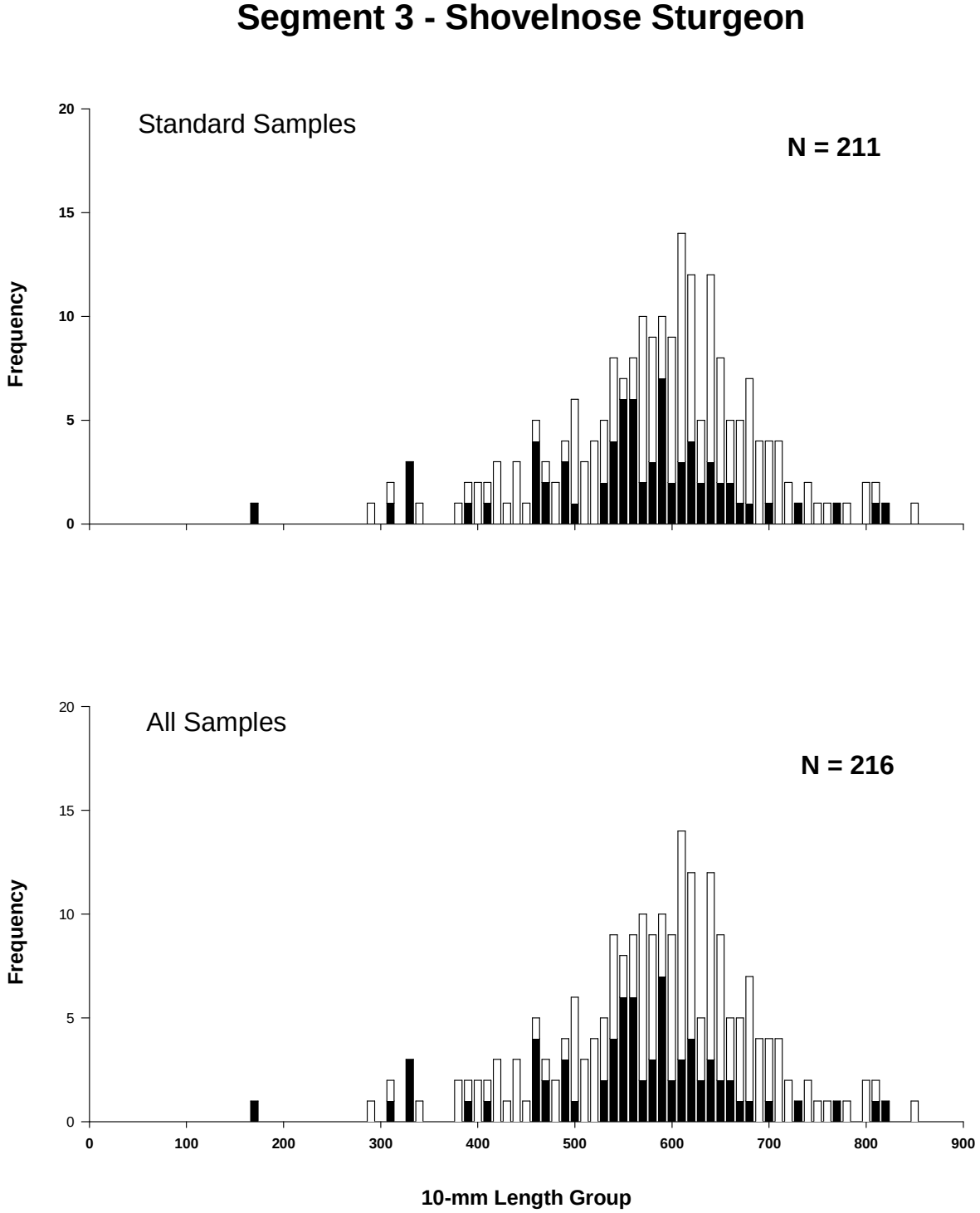

Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

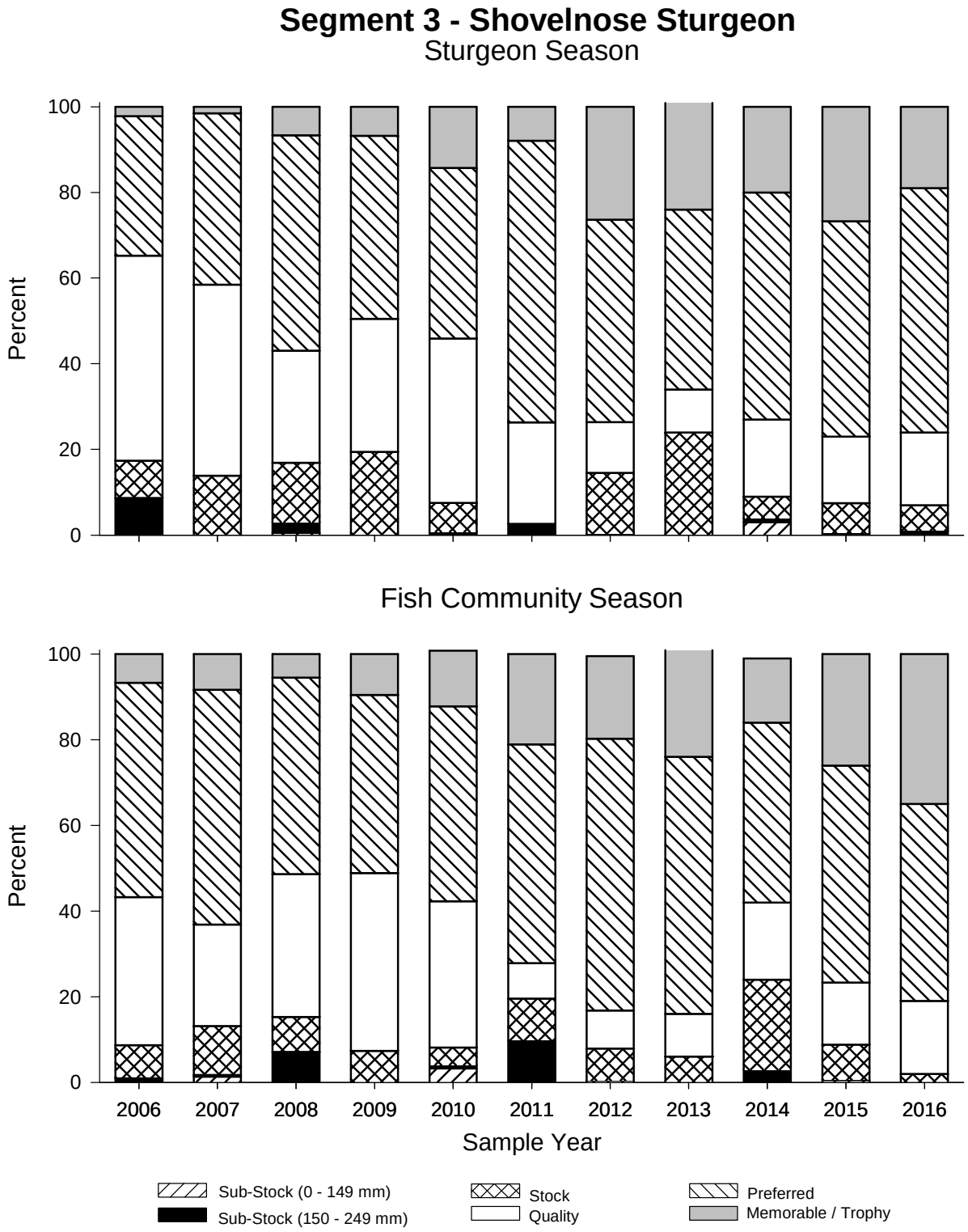

Figure 14. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2016 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

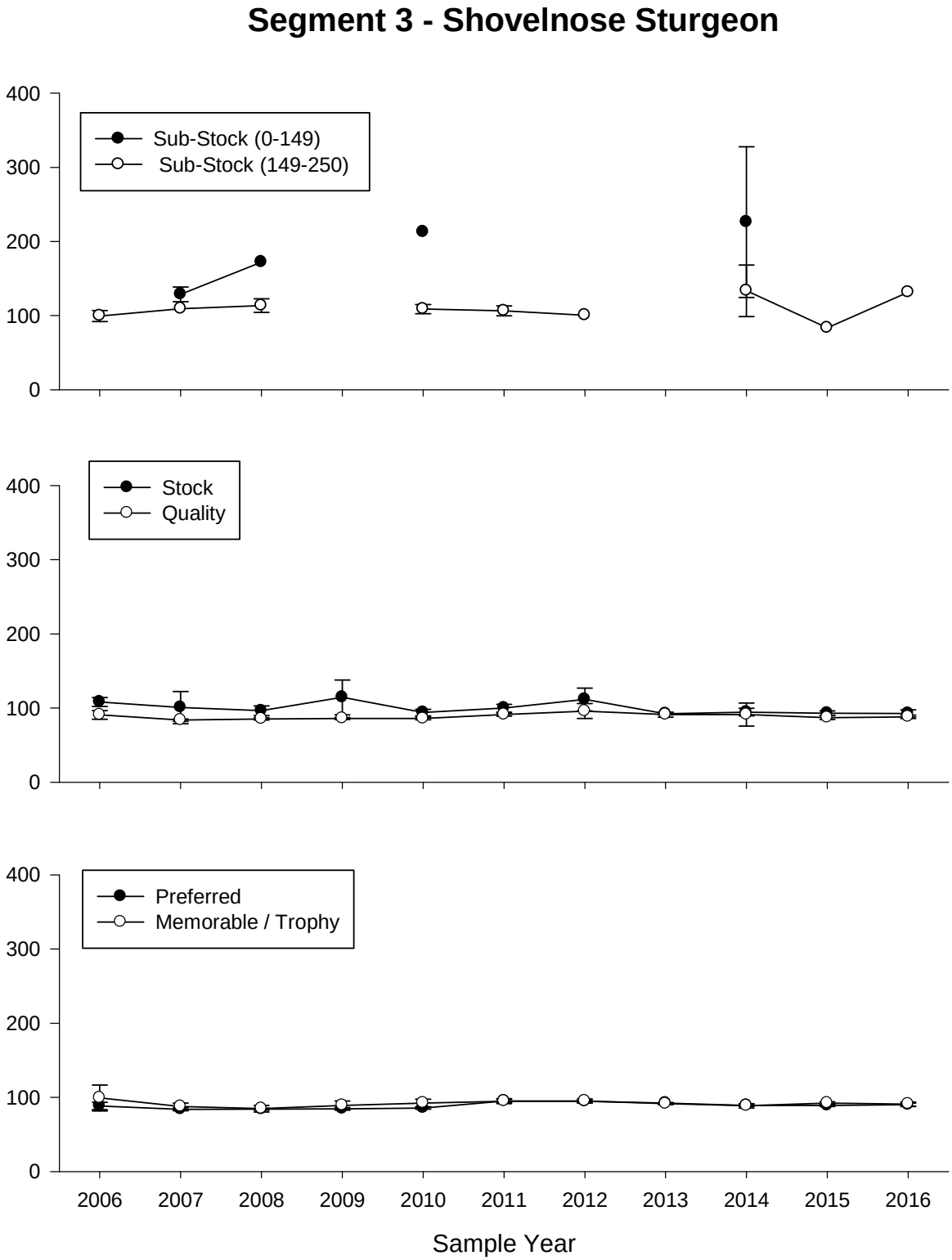

Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2016 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sturgeon chubs were captured in Segment 3 during the 2016 field season.

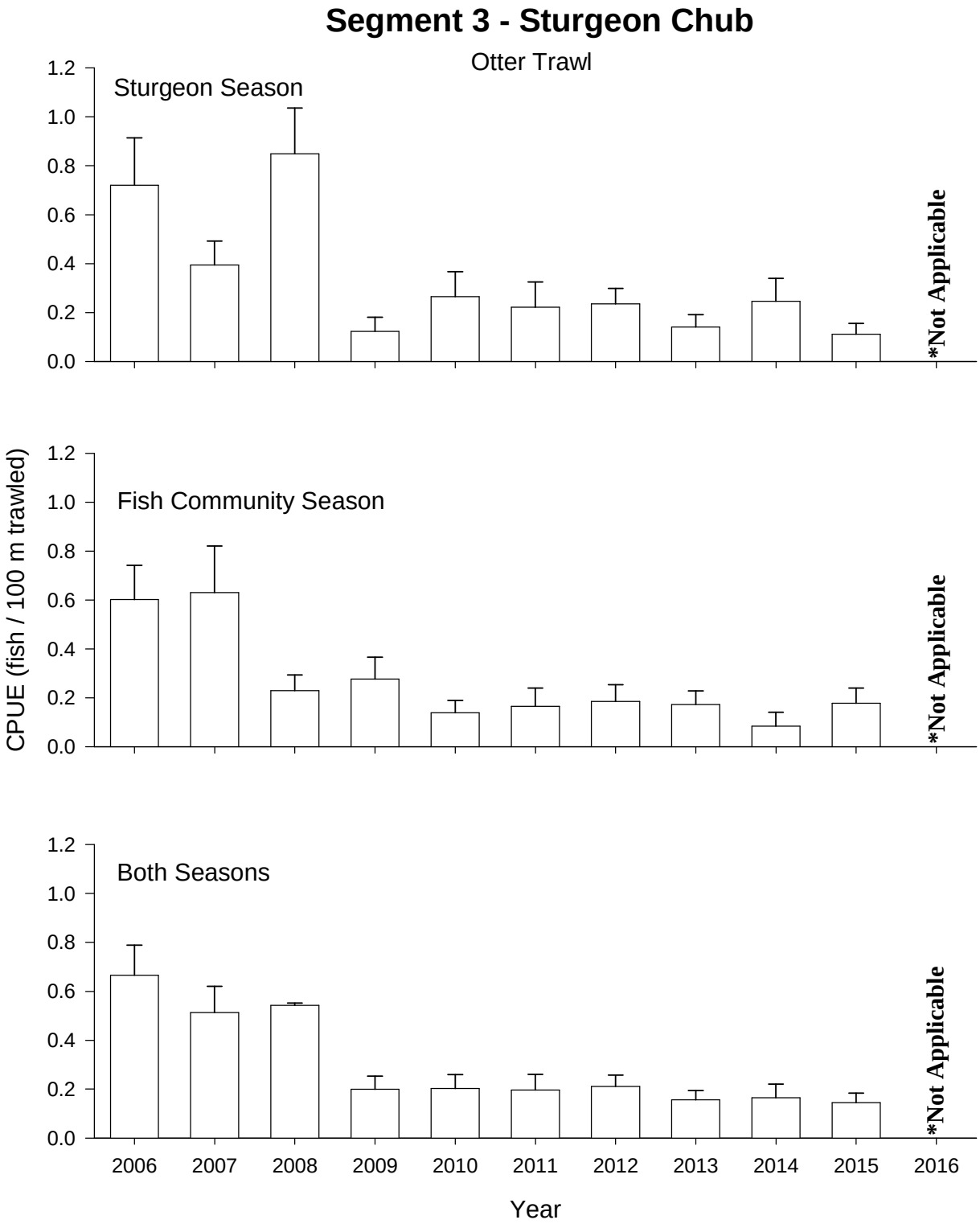

Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

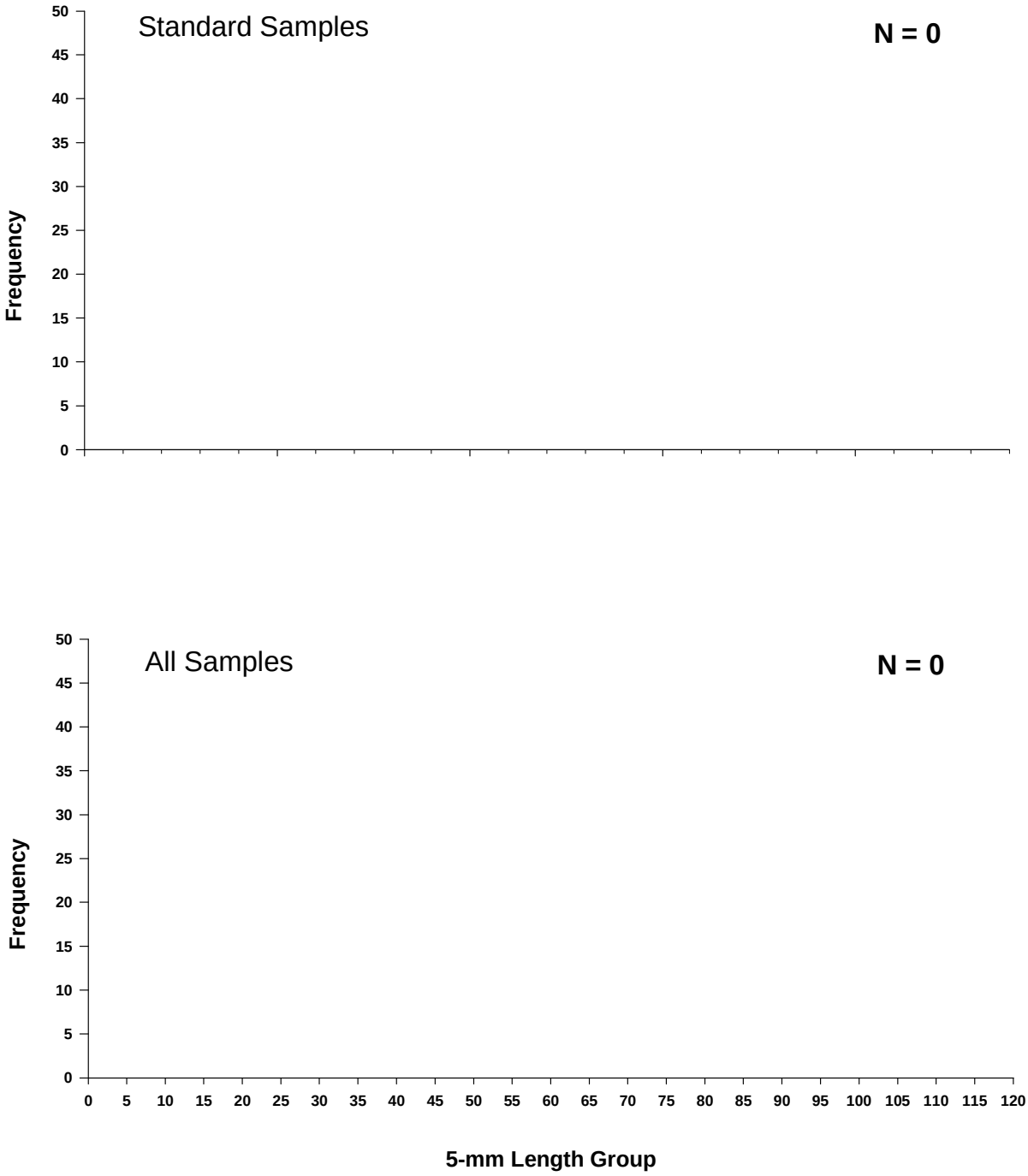

Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

Sicklefin Chub

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sicklefin chubs were captured in Segment 3 during the 2016 field season.

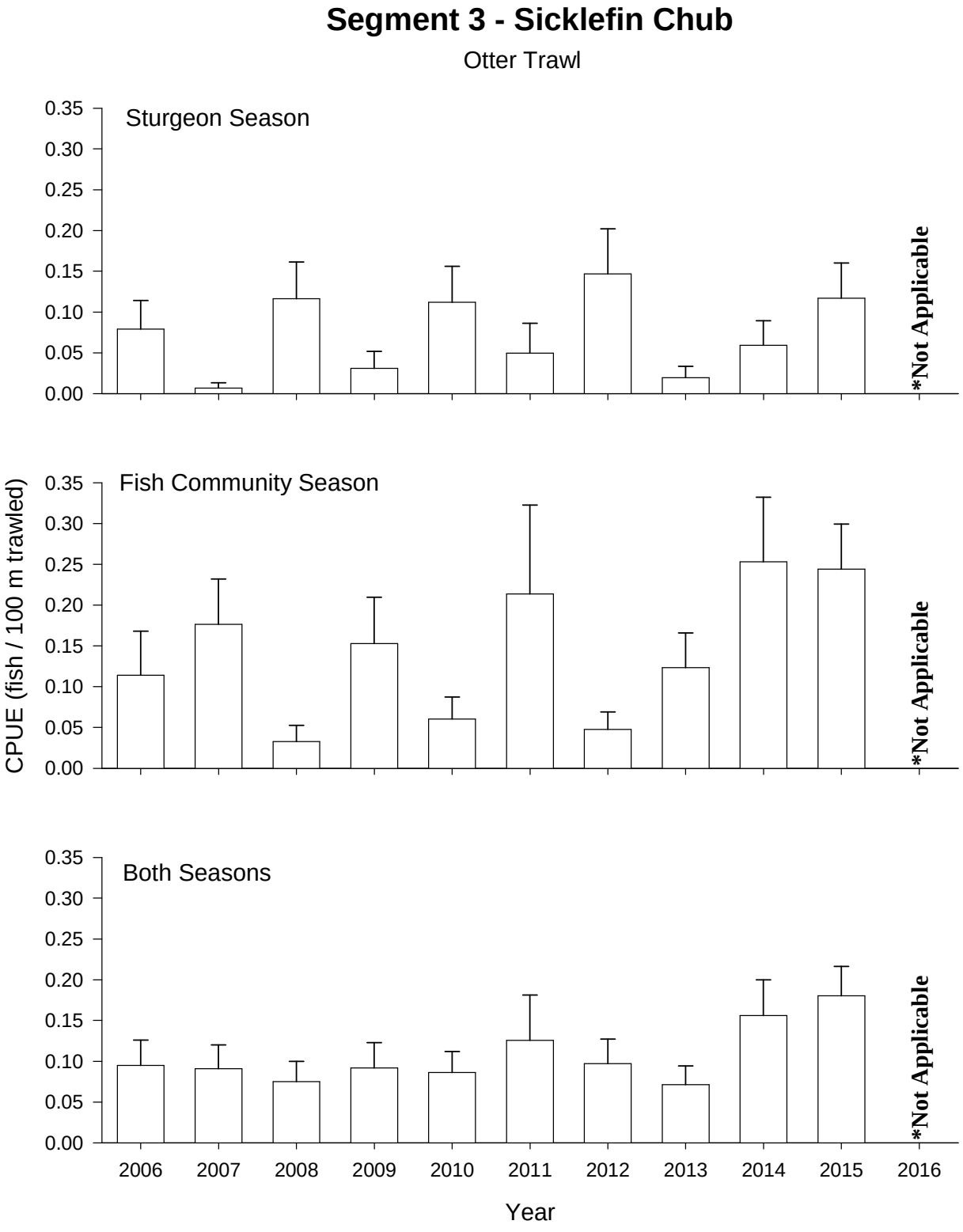

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

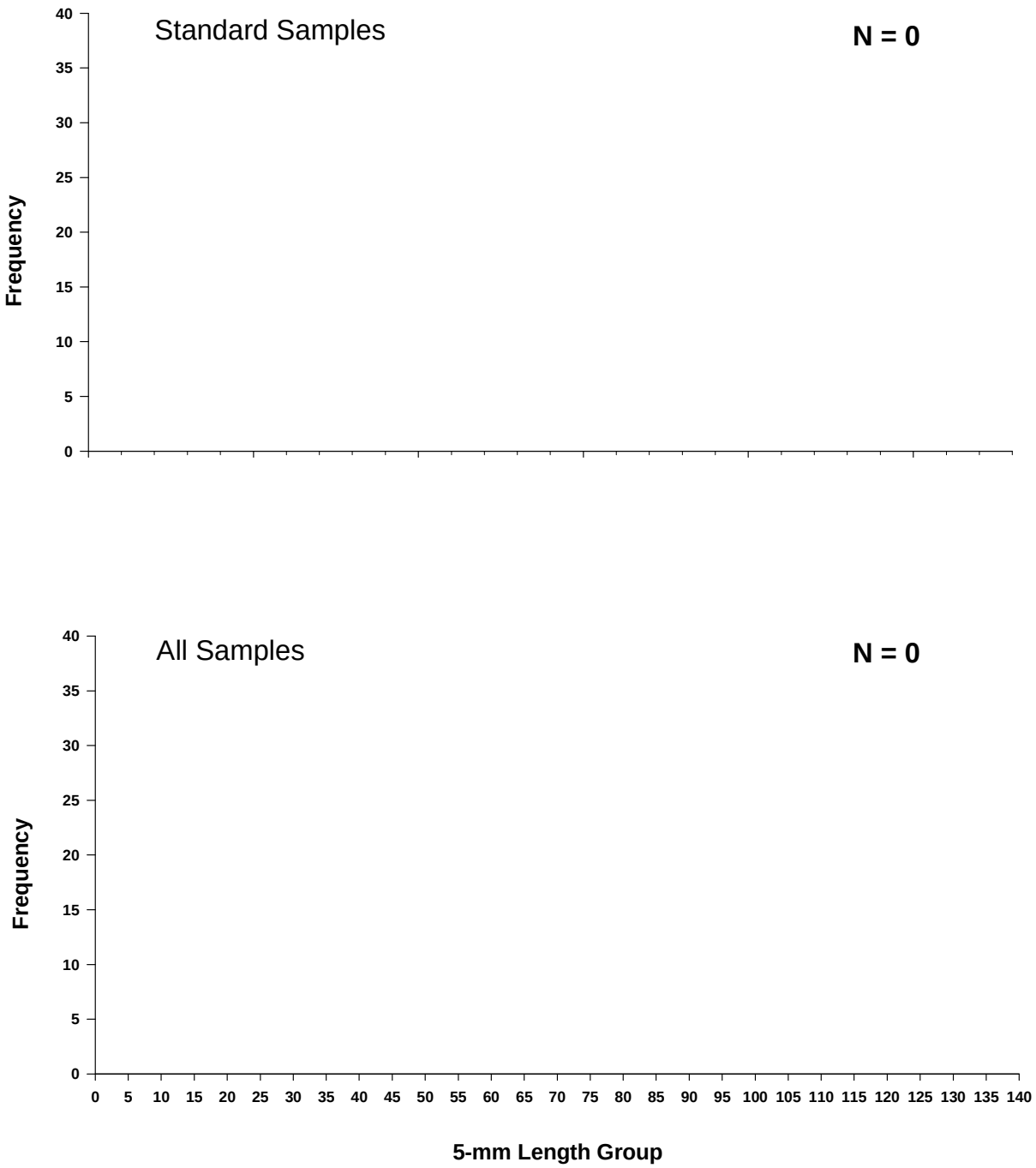

Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

Sand Shiner

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sand shiners were captured in Segment 3 during the 2016 field season.

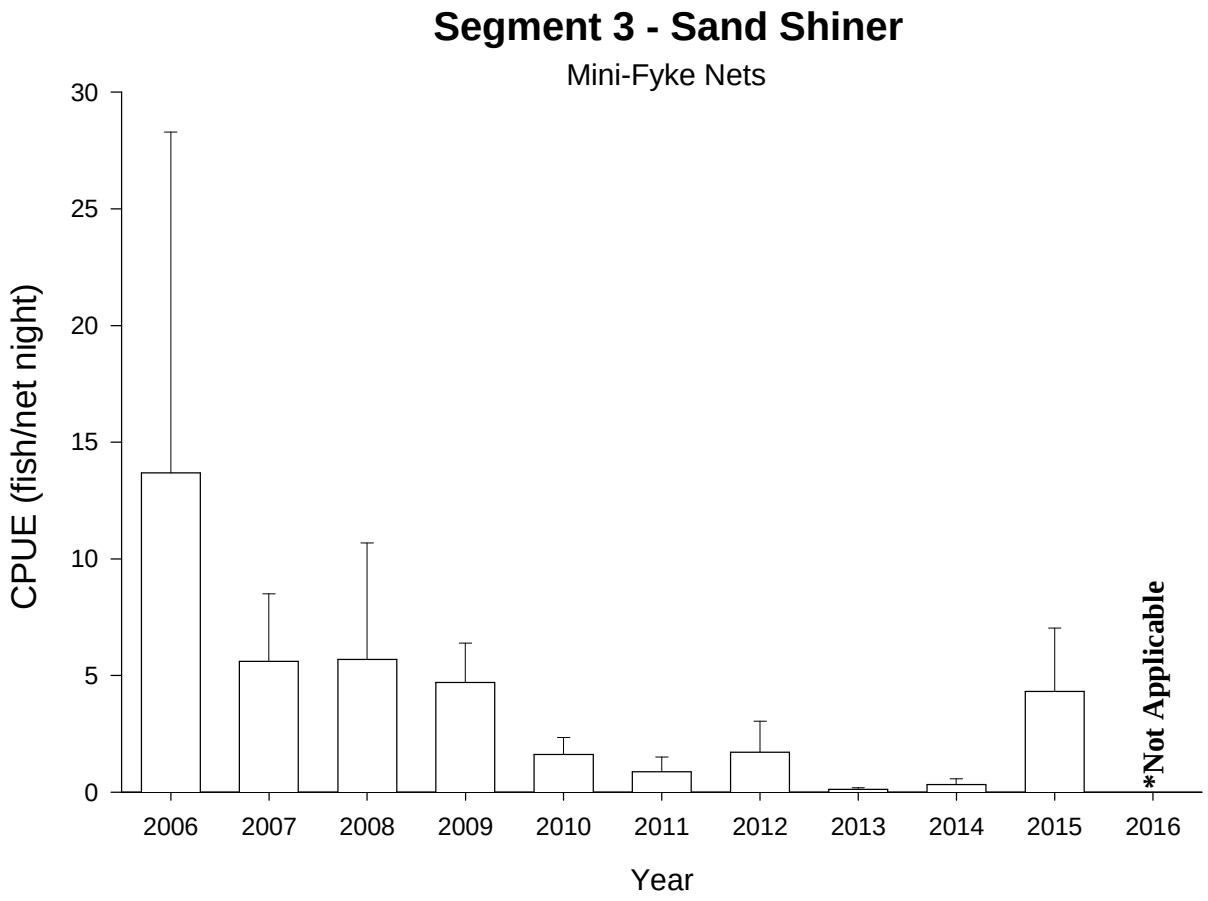

Figure 20. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2016. *Mini-fyke net not performed in 2016.

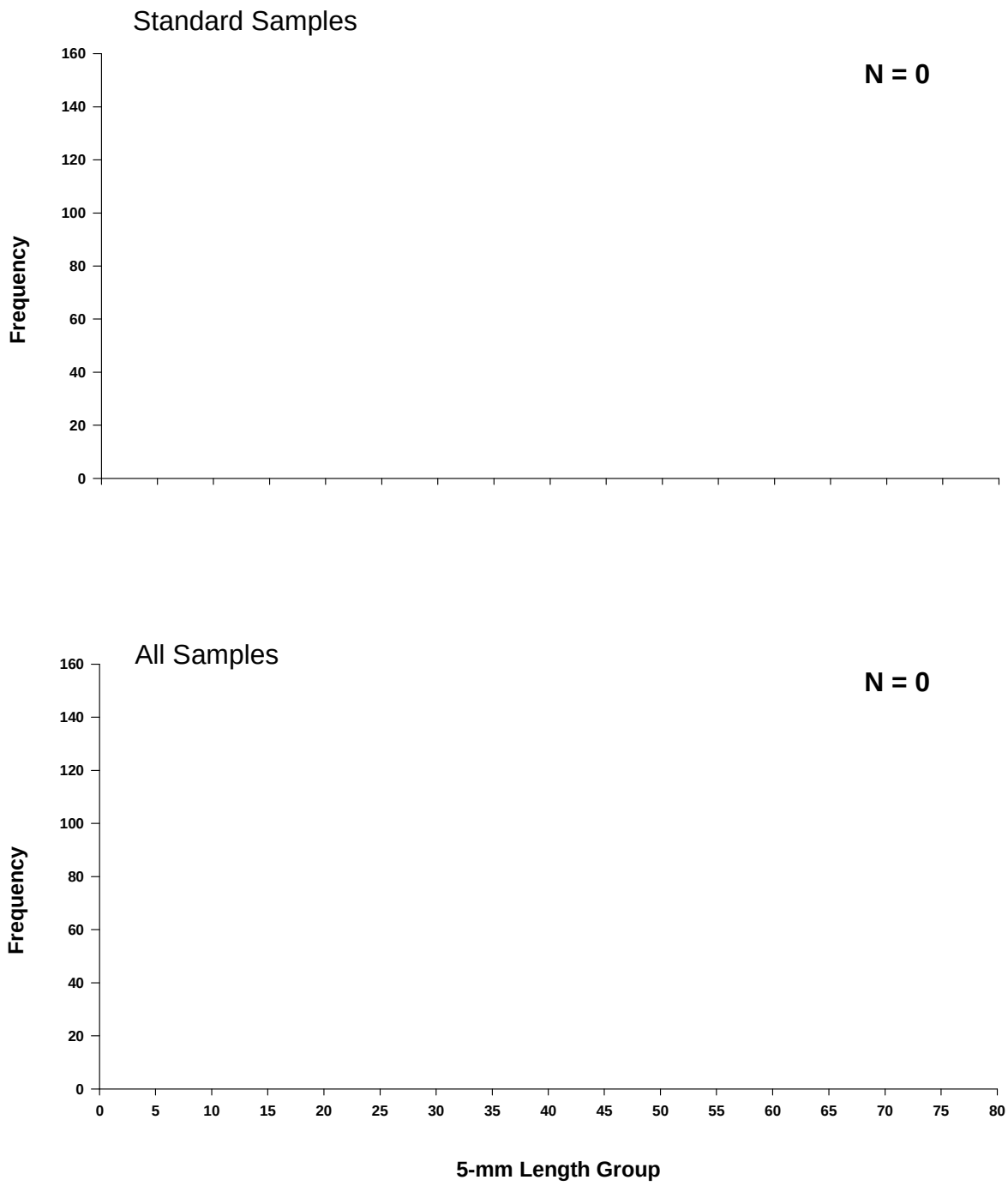

Figure 21. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

***Hybognathus* spp**.

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no *Hybognathus* spp. were captured in Segment 3 during the 2016 field season.

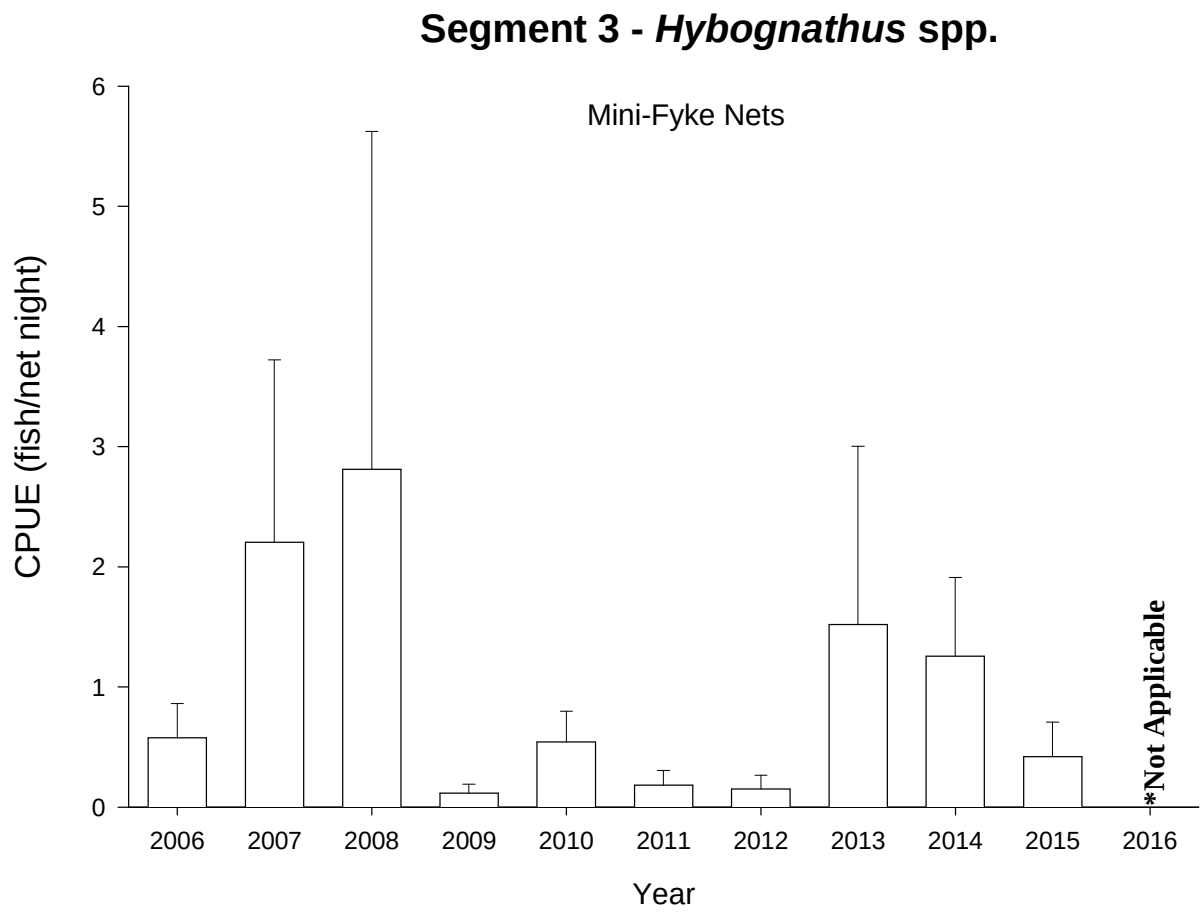

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2016. *Mini-fyke net not performed in 2016.

Segment 3 - *Hybognathus* spp.

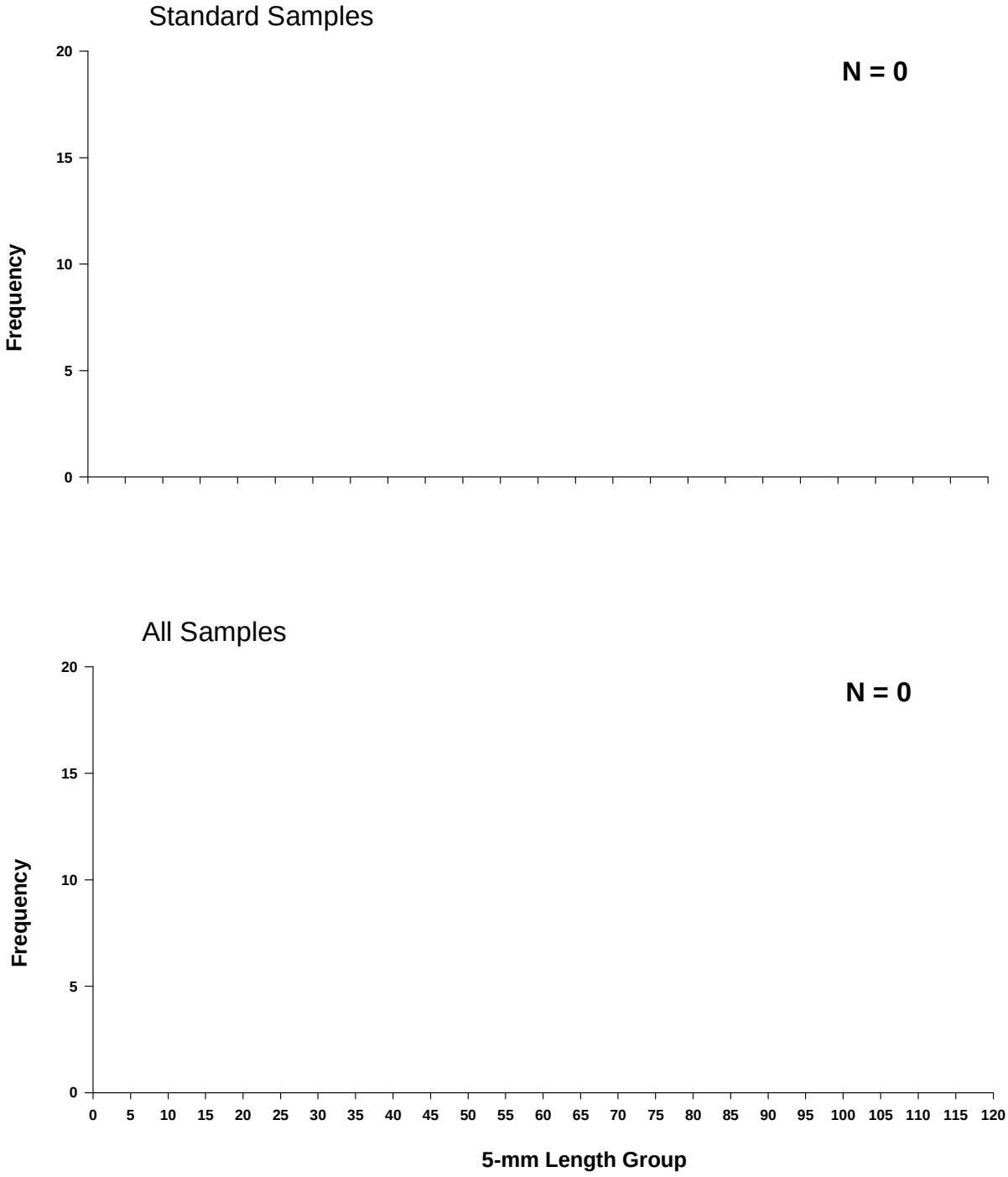

Figure 23. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

Blue Sucker

A total of five blue suckers were observed throughout Segment 3 sampling during the 2016 field season; all of which were captured during random trammel net deployments. Temporally, two were captured during sturgeon season, while the remaining three individuals were witnessed during fish community season.

Blue sucker CPUE (Figure 24) in Segment 3 during 2016 regarding trammel net was reported at 0.01 fish/100 m for both sturgeon and fish community seasons, respectively. It stands to reason then, that the combined-season CPUE was also 0.01 fish/100 m, which is highly comparable to previous years of sampling.

Similarly, to all other years sampled, the average size (709 mm TL) of blue suckers in Segment 3 during 2016 indicates a population dominated by adult fish. To further emphasize the size structure, only three blue suckers <300 mm in TL have ever been captured in Segment 3. However, one individual captured in 2016 (472 mm) fell into an also rarely seen “intermediary” size category. A further detailed length frequency regarding blue suckers captured in Segment 3 during 2016 can be found in Figure 26.

Further information regarding the specific macro habitat and associated capture information can be viewed in Table 14.

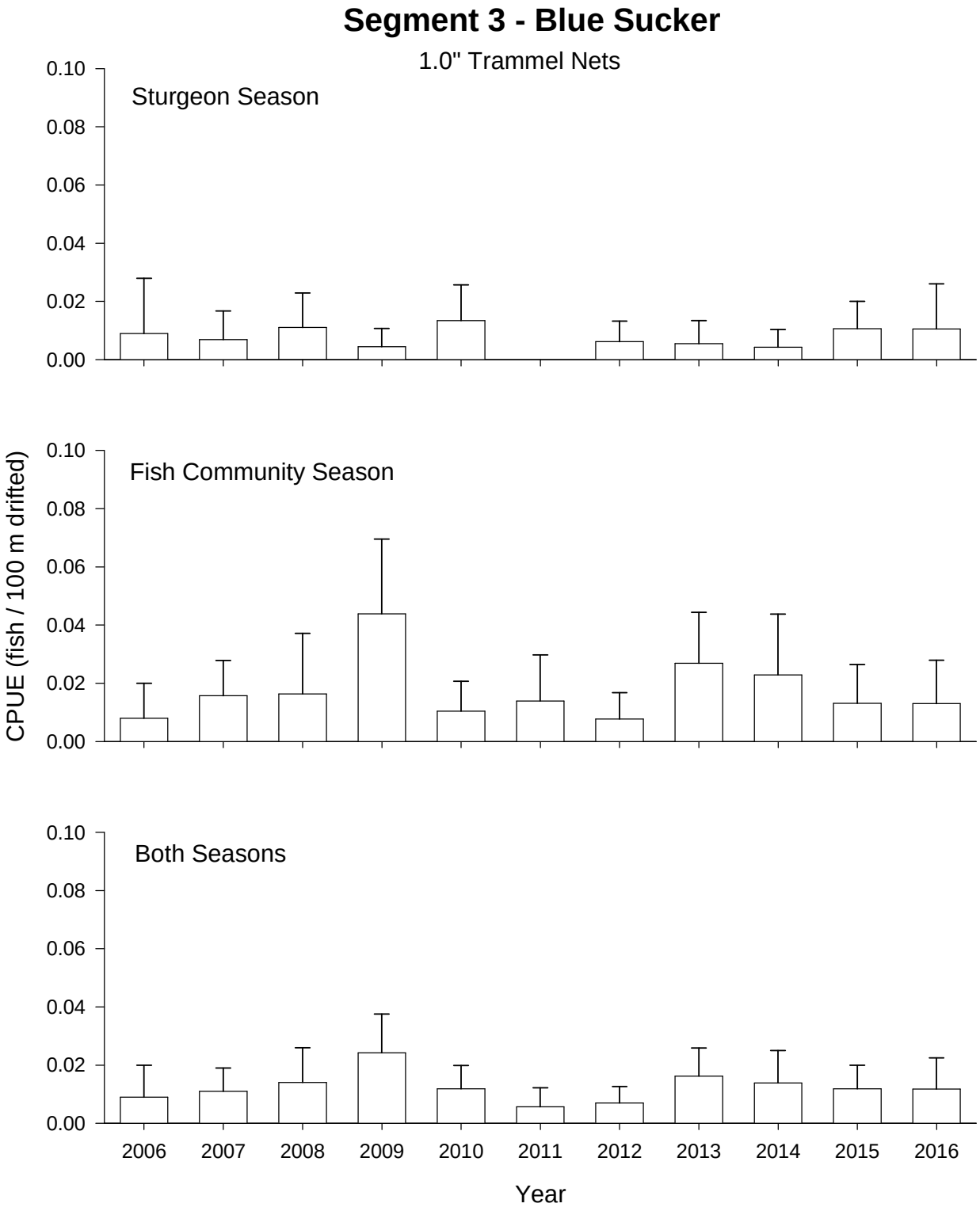

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2016.

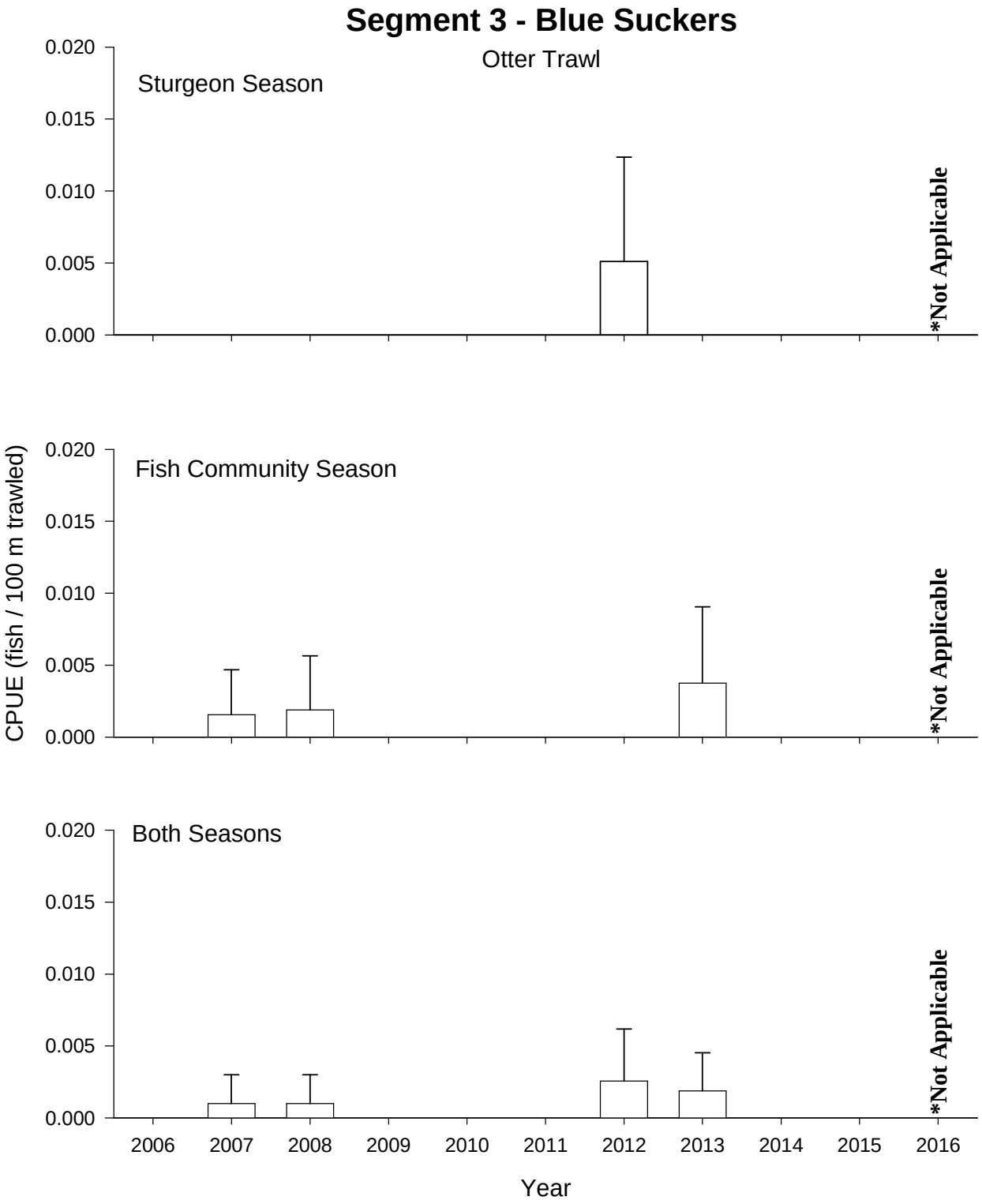

Figure 25. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

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 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat[a]			
		CHXO	**ISB**	**OSB**	**SCCL**
Sturgeon Season					
1.0” Trammel Net	2	0	0	100	0
		42	32	26	0
Fish Community Season					
1.0” Trammel Net	3	67	33	0	0
		44	29	26	0
Both Seasons					
Trot Line	0	0	0	0	0
		41	31	26	2

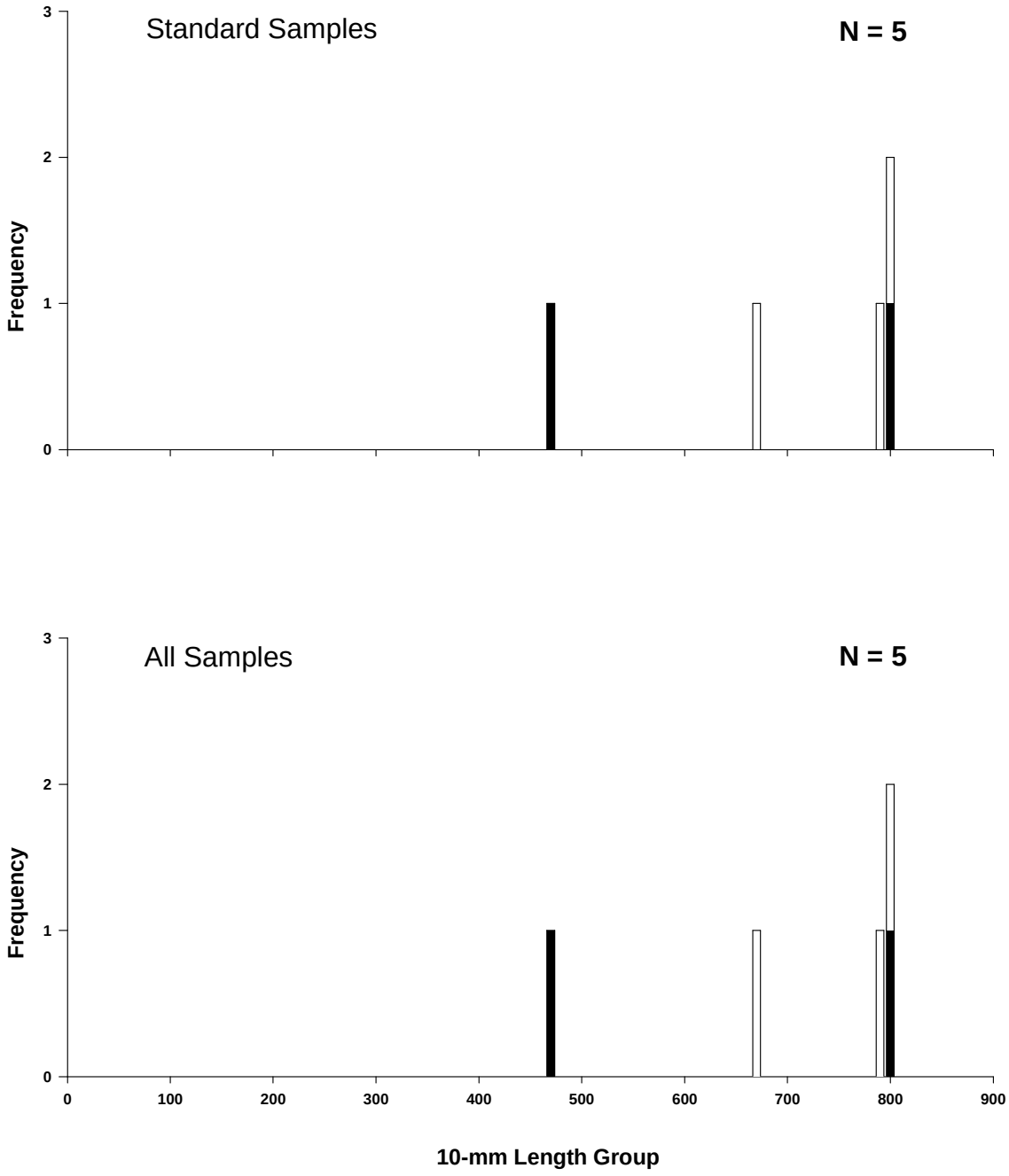

Figure 26. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

Sauger

A total of 109 sauger were collected within Segment 3 during the 2016 sampling season. The majority (N=89) of sauger observations came during sturgeon season, when compared to fish community season (N=20). In relation to gear, nearly all sauger were captured via trammel net (N=106), while trotline sampled just three individuals.

Catch per unit of effort, regarding Segment 3 sauger observations during 2016, can be found in Figure 28. Seasonal CPUE for 2016 was reported at 0.38 fish/100m and 0.10 fish/100m for the sturgeon and fish community seasons, respectively. In turn, a combined-season CPUE was tabulated at 0.24 fish/100m. Although sturgeon season CPUE has shown slightly more variability through time, fish community season and combined-season CPUE has exhibited a more stable and comparative pattern.

The sauger captured during 2016 sampling events across Segment 3 averaged 351 mm in total length and 353 g in weight. With the loss of otter trawl and mini-fyke net as sampling gears, smaller age classes, including young of the year, were absent from 2016 sampling. A complete length frequency for 2016 regarding the observed population of sauger in Segment 3 can be found in Figure 30.

Further information regarding the specific macro habitat and associated capture information can be viewed in Table 15.

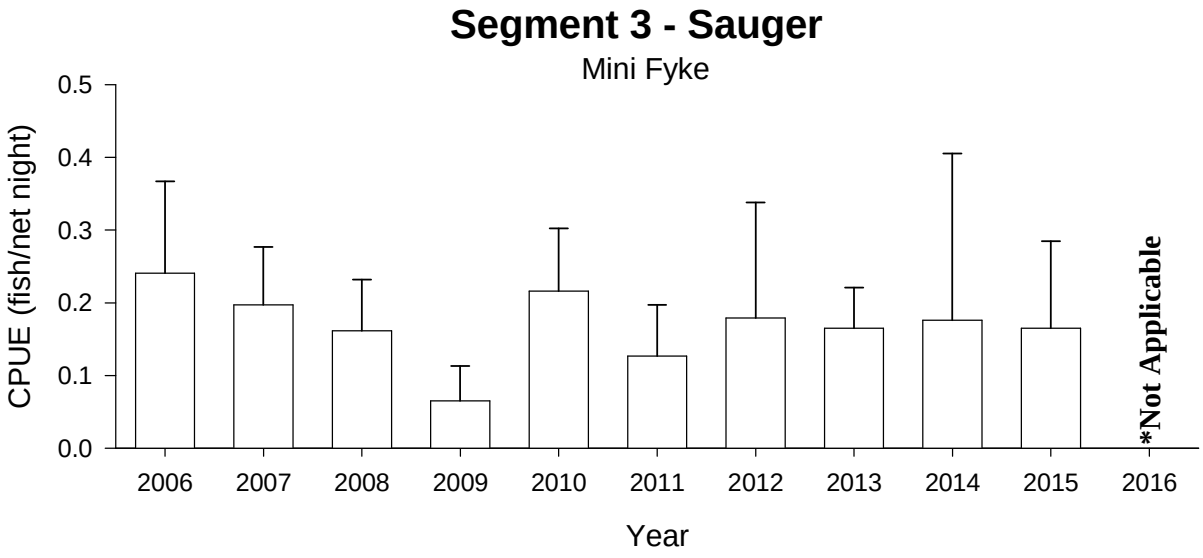

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2016. *Mini-fyke net not performed in 2016.

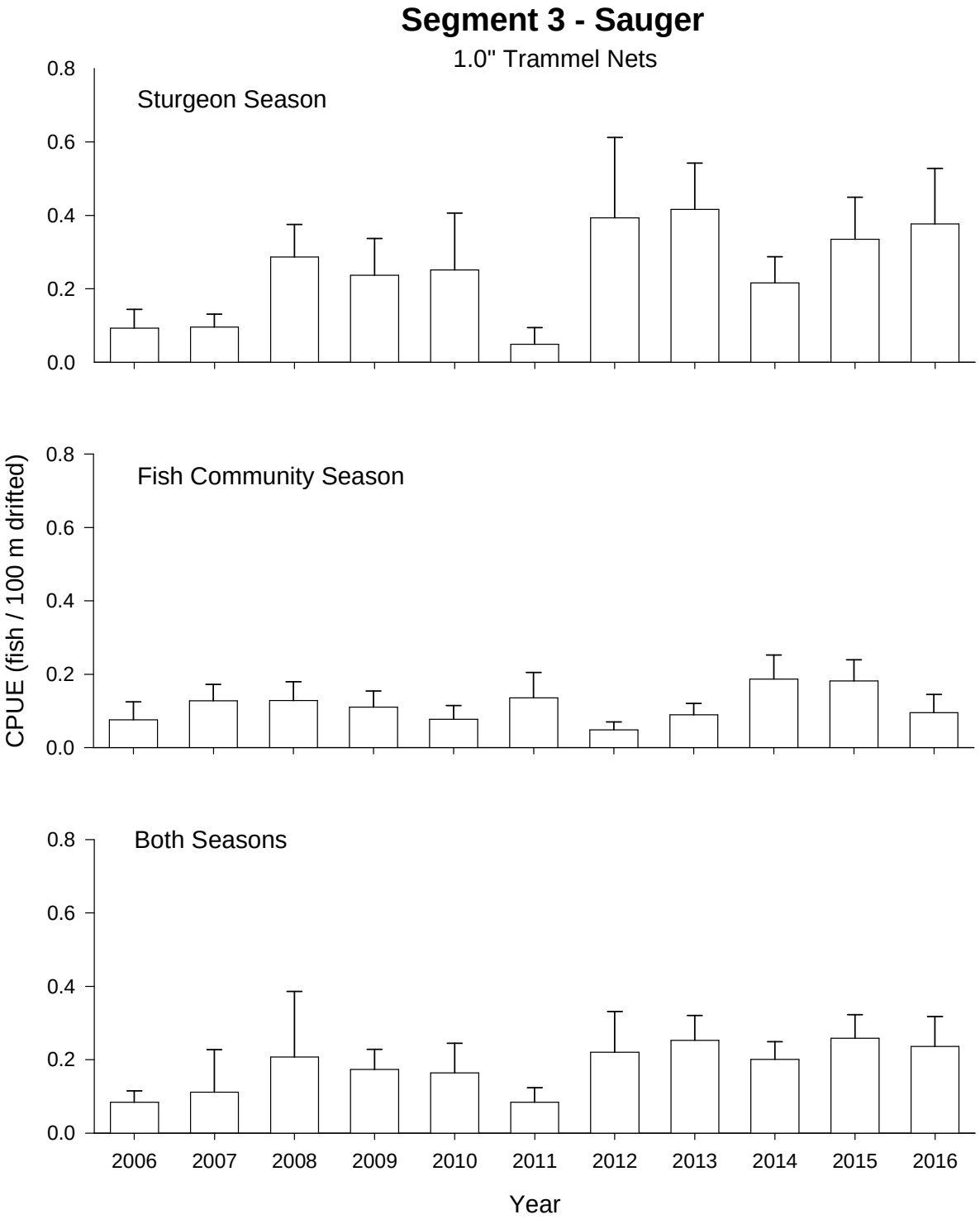

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2016.

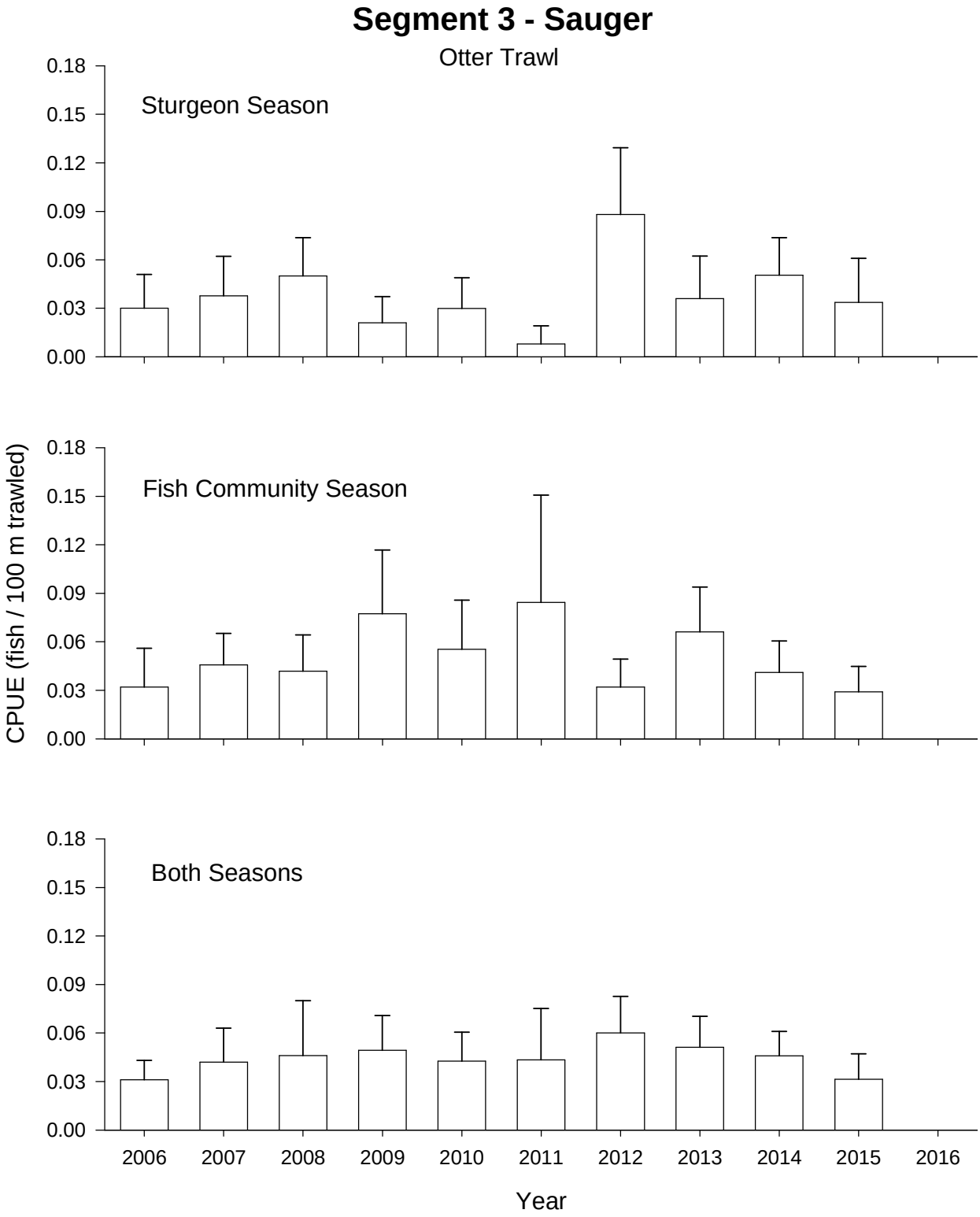

Figure 29. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2016. *Otter-trawl not performed in 2016.

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 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

		Macrohabitat[a]			
Gear	**N**	**CHXO**	**ISB**	**OSB**	**SCCL**
		Sturgeon Season			
1.0” Trammel Net	88	27	41	32	0
		42	32	26	0
		Fish Community Season			
1.0” Trammel Net	18	50	22	28	0
		44	29	26	0
		Both Seasons			
Trot Line	3	67	0	33	0
		41	31	26	2

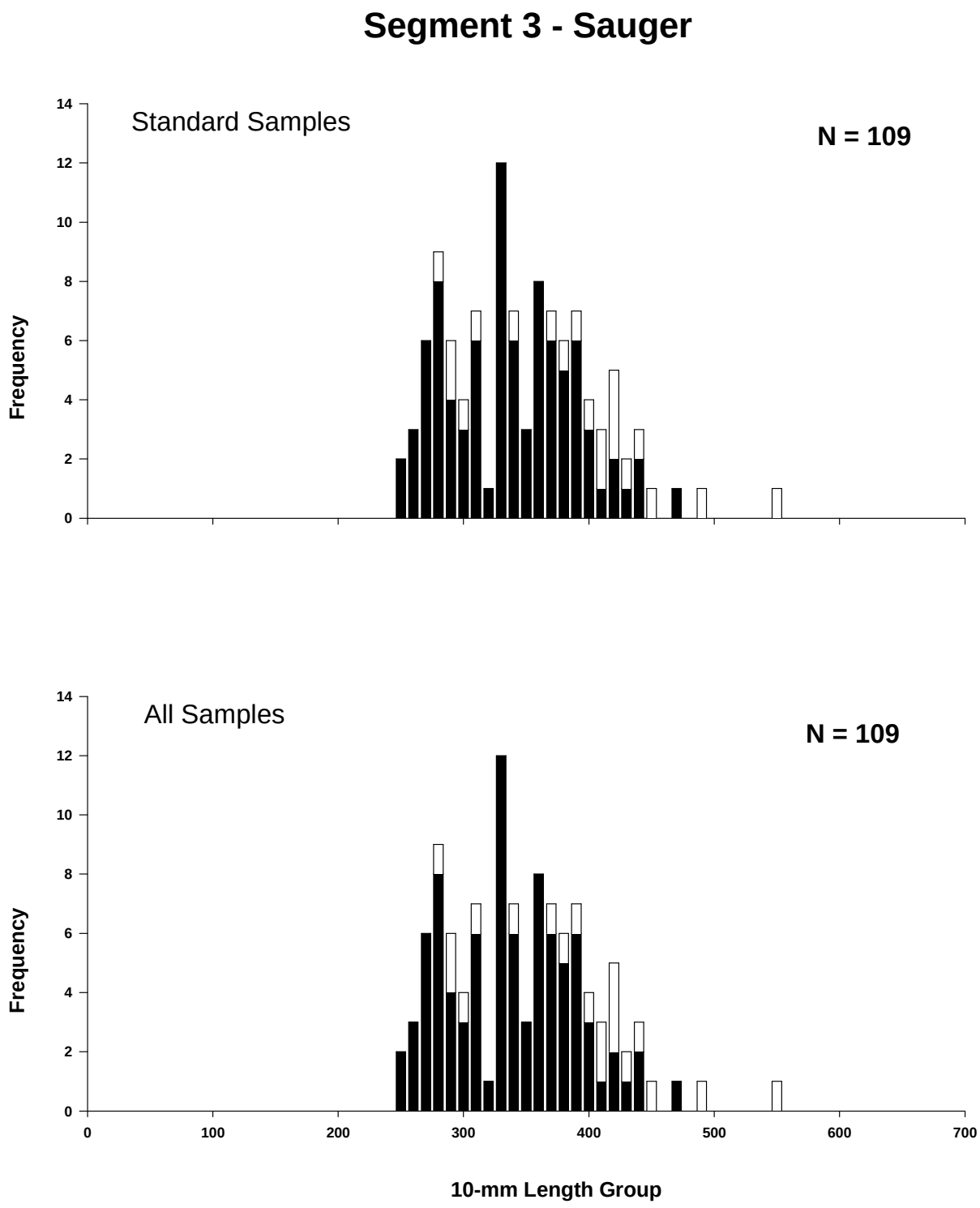

Figure 30. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

Missouri River Fish Community

The sampling events which took place throughout Segment 3 during the 2016 field season culminated in the capture of 755 individual fish, which were represented by 22 different species. Inevitably, with the loss of otter trawl and mini-fyke net as sampling gears, coupled with a reduction in effort, total captures and species diversity were down considerably from previous sampling years.

The most abundant species observed, with 216 collections, was shovelnose sturgeon. The second most encountered fish species (N=112) was channel catfish *Ictalurus punctatus,* which were captured frequently in both trammel net (N=32) and trotline (N=80). Sauger (N=109) was the third most abundant species captured in Segment 3 during 2016. Goldeye *Hiodon alosoides* (N=98), also represented in both trammel net and trotline sampling, were the fourth most abundant.

Other species captured in rank of abundance were; shorthead redhorse *Moxostoma macrolepidotum* (N=45), flathead chub *Platygobio gracilis* (N=40), walleye *Sander vitreus* (N=26), pallid sturgeon (N=25), river carpsucker *Carpiodes carpio* (N=23), stonecat *Noturus flavus* (N=17), and common carp *Cyprius carpio* (N=12).

The other 11 species present were in low abundance and consisted of smallmouth buffalo *Ictiobus bubalus* and bigmouth buffalo *I. cyprinellus*, blue sucker, freshwater drum *Aplodinotus grunniens*, white suker *Catostomus commersoni* and longnose sucker *C. catostomus,* northern pike *Esox Lucius*, lake whitefish *Coregonus clupeaformis*, paddlefish *Polyodon spathula*, white bass *Morone chrysops*, and burbot *Lota lota.*

Discussion

The 2016 field season marked the 11th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 3 of the Missouri River. However, it was the first year of an exercise to reduce the amount of standard gears used, with the abandonment of the otter trawl and mini-fyke net. Additionally, effort was also reduced by nearly half, from 22 standard bends to 12 standard bends.

With the reduction of both effort and gears, captures of pallid sturgeon (N=25) in Segment 3 during 2016 was by far the lowest total witnessed in the 11-year history of the Program in this segment. For comparison, the second lowest total captures of pallid sturgeon was observed in the Program's first year of implementation in Segment 3, with 49 observations in 2006.

Pallid sturgeon trammel net CPUE, for all three seasonal metrics was reported at 0.01 fish/100m, 0.03 fish/100m, and 0.02 fish/100m for the sturgeon, fish community, and combined-seasons, respectively. The tabulated CPUE for both sturgeon season and fish community season were the third lowest calculated catch rates in the history of Segment 3 sampling. Additionally, the combined-season CPUE was the second lowest catch rate observed in Segment 3 in 11 years of sampling.

Trotlines captured 72% of the total pallid sturgeon sampled in 2016. However, with all three seasonal catch rate metrics being tabulated at 0.19 fish/20 hooks, all-time low CPUE was reached for sturgeon season, fish community season, and combined-season.

Although the low total captures of pallid sturgeon in Segment 3 during 2016 can be explained by gear and effort reduction, the lower catch rates regarding the standard sampling gears cannot be as easily interpreted. However, the observed catch rates for both trammel net and trotline should not be overly alarming given the stochastic pattern of catch rates seasonally and yearly for both gears. Additionally, no discernable pattern has emerged, seasonally or yearly, for trammel net or trotline.

The pallid sturgeon captured in Segment 3 during the 2016 field season averaged 449 mm in fork length and 366 g in weight, and ranged from 320 mm to 790 mm. Despite the presence of 12 different year classes, 21 (84%) of the pallid sturgeon sampled fell between 350 and 500 mm. Based on size class grouping, a more in-depth investigation into growth rates may be warranted. Furthermore, by only using relative condition as a metric of health, the data suggests the pallid

sturgeon residing in Segment 3 are healthy, despite an underwhelming abundance of larger hatchery reared pallid sturgeon.

With the suspension of the otter trawl and mini-fyke net as sampling gears, virtually all trend data for the small-bodied target species (sturgeon and sicklefin chubs, Hybognathus spp., and sand shiner) was lost for the 2016 field season. Although more studies need to be done to quantify the importance of these species in relation to pallid sturgeon, it seems that as hatchery-reared pallid sturgeon shift to sub-adult and adult age classes, these small bodies fishes, as well as others, may become important, particularly to the lower sections of Segment 3.

Acknowledgments

We would like to thank the U.S. Army Corps of Engineers for providing funding to the Pallid Sturgeon Population Assessment Program, especially Tim Welker and George Williams for providing guidance to the work group. Our seasonal employees, Jeff Brown, Derek DuFault and Luke Gunderson, for their countless hours in the field pulling gear as well as in the shop assuring boats were stocked and gear was kept in working order. We would like to thank Steve Dalbey for taking care of the much needed business while we were out in the field. A special thanks to Pat Braaten of the U.S. Geological Survey for answering any type of questions regarding the Missouri River fish community. Thanks to Ryan Wilson et al. of the U.S. Fish and Wildlife Service for all of their collaboration between our offices.

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Appendices

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

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

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

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

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

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

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
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		
2005	Culbertson	1736	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Culbertson	182	2005	10/13/2005	Advanced Fingerling		
2005	Intake	313	2005	10/13/2005	Advanced Fingerling		
2005	Milk River	845	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Mouth of Milk	371	2005	10/13/2005	Advanced Fingerling		
2005	Sidney	105	2005	10/13/2005	Advanced Fingerling		
2005	Wolf Point	1521	2005	10/13/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	371	2005	10/13/2005	Advanced Fingerling		
2005	Culbertson	651	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Intake	2120	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Milk River	485	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Sidney	882	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2005	Wolf Point	650	2005	10/19/2005	Advanced Fingerling	CWT	Elastomer
2006	Culbertson	235	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	327	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Mouth of Milk	134	2005	3/28/2006	Advanced fingerling	Elastomer	
2006	Sidney	113	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Wolf Point	232	2005	3/28/2006	Advanced Fingerling	Elastomer	
2006	Intake	970	2005	4/3/2006	Yearling	PIT Tag	Elastomer
2006	Sidney	314	2005	4/3/2006	Yearling	PIT Tag	Elastomer
2006	Culbertson	844	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Mouth of Milk	1007	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Wolf Point	866	2005	4/5/2006	Yearling	PIT Tag	Elastomer
2006	Culbertson	669	2005	5/1/2006	Yearling	PIT Tag	Scute Removed
2006	Intake	765	2005	5/1/2006	Yearling	PIT Tag	Scute Removed

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

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
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
2010	Culbertson	384	2009	6/4/2009	Yearling	PIT Tag	Scute Removed
2010	Culbertson	1000	2010	10/7/2010	Fingerling	Elastomer	
2010	School Trust	1766	2009	4/15/2010	Yearling	PIT Tag	Elastomer, Scute
2011	Culbertson	795	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Wolf Point	797	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Fallon	531	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Forsyth	545	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Intake	510	2010	5/5/2011	Yearling	PIT Tag	Scute
2011	Culbertson	262	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Fallon	131	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Forsyth	174	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Intake	132	2010	8/22/2011	Yearling	PIT Tag	Scute
2011	Wolf Point	262	2010	8/22/2011	Yearling	PIT Tag	Scute
2013	Wolf Point	187	2012	4/22/2013	Yearling	PIT Tag	Scute
2013	Culbertson	187	2012	4/23/2013	Yearling	PIT Tag	Scute
2013	Intake	118	2012	4/24/2013	Yearling	PIT Tag	Scute
2013	Fallon	185	2012	4/25/2013	Yearling	PIT Tag	Scute
2014	Culbertson	212	2013	4/15/2014	Yearling	PIT Tag	Scute
2014	Kinsey Bridge	214	2013	4/15/2014	Yearling	PIT Tag	Scute
2014	Powder River Depot	210	2013	4/15/2014	Yearling	PIT Tag	Scute
2014	Wolf Point	211	2013	4/15/2014	Yearling	PIT Tag	Scute
2015	Culbertson	153	2014	4/20/2015	Yearling	PIT Tag	Scute
2015	Fallon	146	2014	4/23/2015	Yearling	PIT Tag	Scute
2015	Intake	109	2014	4/23/2015	Yearling	PIT Tag	Scute
2015	Wolf Point	161	2014	4/20/2015	Yearling	PIT Tag	Scute
2016	Culbertson	353	2015	4/5/2016	Yearling	PIT Tag	Scute
2016	Fallon	357	2015	4/6/2015	Yearling	PIT Tag	Scute
2016	Fallon	30	2015	5/2/2016	Yearling	PIT Tag/Radio	Scute
2016	Intake	358	2015	4/6/2015	Yearling	PIT Tag	Scute

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
2016	Intake	30	2015	5/2/2016	Yearling	PIT Tag/Radio	Scute
2016	Wolf Point	357	2015	4/5/2016	Yearling	PIT Tag	Scute

Appendix F

Total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 3 of the Missouri River during 2016. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. 1.0” trammel net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

			CHXO	ISB	OSB
species	Total Catch	Overall CPUE	CHNB	CHNB	CHNB
BMBF	1	0.002	0.004	0	0
		0.003	0.008	0	0
BRBT	1	0.003	0	0.008	0
		0.005	0	0.017	0
BUSK	5	0.012	0.011	0	0.025
		0.011	0.016	0	0.03
CARP	6	0.013	0.01	0.012	0.017
		0.012	0.014	0.017	0.033
CNCF	32	0.066	0.057	0.061	0.085
		0.026	0.04	0.047	0.051
FHCB	22	0.049	0.039	0.047	0.066
		0.023	0.029	0.039	0.054
FWDM	2	0.004	0	0.014	0
		0.006	0	0.02	0
GDEY	76	0.168	0.156	0.245	0.103
		0.056	0.088	0.123	0.069
LKWF	2	0.004	0.01	0	0
		0.006	0.014	0	0

			CHXO	ISB	OSB
species	Total Catch	Overall CPUE	CHNB	CHNB	CHNB
LNSK	1	0.002	0.005	0	0
		0.004	0.01	0	0
NTPK	3	0.006	0.004	0.012	0
		0.006	0.009	0.018	0
PDFH	2	0.007	0.013	0.007	0
		0.011	0.026	0.014	0
PDSG	7	0.02	0.036	0.016	0
		0.017	0.038	0.022	0
RVCS	22	0.05	0.046	0.082	0.02
		0.024	0.041	0.051	0.023
SGER	106	0.236	0.196	0.296	0.229
		0.082	0.084	0.129	0.224
SHRH	25	0.061	0.029	0.119	0.042
		0.028	0.036	0.066	0.038
SMBF	7	0.014	0	0.033	0.013
		0.01	0	0.028	0.018
SNSG	119	0.26	0.233	0.28	0.277
		0.078	0.112	0.145	0.162
STCT	0	0	0	0	0
		0	0	0	0

			CHXO	ISB	OSB
species	Total Catch	Overall CPUE	CHNB	CHNB	CHNB
WLYE	21	0.048	0.046	0.036	0.063
		0.03	0.04	0.037	0.079
WTBS	0	0	0	0	0
		0	0	0	0
WTSK	1	0.002	0	0.006	0
		0.003	0	0.011	0

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

*Otter trawl not performed in 2016.

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

*Mini-fyke net not performed in 2016.

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

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
BMBF	0	0	0	0	0	0
		0	0	0	0	0
BRBT	0	0	0	0	0	0
		0	0	0	0	0
BUSK	0	0	0	0	0	0
		0	0	0	0	0
CARP	6	0.063	0.026	0.033	0.16	0
		0.058	0.051	0.067	0.189	0
CNCF	80	0.833	0.974	0.433	1.12	0.5
		0.213	0.316	0.229	0.558	1
FHCB	18	0.188	0.205	0.233	0.08	0.5
		0.095	0.131	0.229	0.111	1
FWDM	3	0.031	0.051	0	0.04	0
		0.036	0.072	0	0.08	0
GDEY	22	0.229	0.256	0.2	0.24	0
		0.105	0.176	0.201	0.174	0
LKWF	0	0	0	0	0	0
		0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
LNSK	0	0	0	0	0	0
		0	0	0	0	0
NTPK	0	0	0	0	0	0
		0	0	0	0	0
PDFH	0	0	0	0	0	0
		0	0	0	0	0
PDSG	18	0.188	0.231	0.133	0.16	0.5
		0.09	0.155	0.126	0.189	1
RVCS	0	0	0	0	0	0
		0	0	0	0	0
SGER	3	0.031	0.051	0	0.04	0
		0.036	0.072	0	0.08	0
SHRH	18	0.188	0.205	0.1	0.28	0
		0.104	0.183	0.111	0.245	0
SMBF	0	0	0	0	0	0
		0	0	0	0	0
SNSG	92	0.958	1.103	0.733	0.76	4
		0.335	0.627	0.488	0.494	0

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
STCT	17	0.177	0.179	0.133	0.2	0.5
		0.103	0.193	0.159	0.163	1
WLYE	3	0.031	0.051	0.033	0	0
		0.036	0.072	0.067	0	0
WTBS	1	0.01	0	0	0.04	0
		0.021	0	0	0.08	0
WTSK	3	0.031	0	0	0.08	0.5
		0.036	0	0	0.111	1

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 2016 for Segment 3 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

	Sturgeon Season	**Fish Community Season**	**Both Season**
species	1.0” Trammel Net	1.0” Trammel Net	Trotline
BMBF	0.000	0.003	0.000
BRBT	0.005	0.000	0.000
BUSK	0.010	0.013	0.000
CARP	0.017	0.008	0.063
CNCF	0.044	0.088	0.833
FHCB	0.023	0.075	0.188
FWDM	0.005	0.004	0.031
GDEY	0.265	0.072	0.229
LKWF	0.000	0.008	0.000
LNSK	0.004	0.000	0.000
NFSH	0.000	0.000	0.000
NTPK	0.007	0.004	0.000
PDFH	0.015	0.000	0.000
PDSG	0.014	0.025	0.188
RVCS	0.056	0.044	0.000
SGER	0.377	0.095	0.031
SHRH	0.049	0.072	0.188
SMBF	0.024	0.004	0.000
SNSG	0.094	0.425	0.958

	Sturgeon Season	Fish Community Season	Both Season
species	1.0” Trammel Net	1.0” Trammel Net	Trotline
STCT	0.000	0.000	0.177
WLYE	0.088	0.008	0.031
WTBS	0.000	0.000	0.010
WTSK	0.003	0.000	0.031

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 3 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2006 - 2016.

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	1701.5	48.06744	105.5325						ST, FC				ST,FC	
2	1700	48.07314	105.523							ST,FC	ST,FC	ST,FC		
3	1698.5	48.09253	105.503										ST,FC	
4	1697.5	48.0919	105.4939							ST,FC				
5	1696	48.09072	105.4575					ST, FC			ST,FC		ST,FC	
6	1695	48.08947	105.4386		ST, FC		ST, FC	ST, FC			ST,FC			ST
7	1693.5	48.09039	105.3633										ST,FC	ST, FC
8	1692	48.09134	105.3734		ST, FC	ST, FC								FC
9	1690.5	48.0929	105.3336							ST,FC	ST,FC	ST,FC		ST, FC
10	1689	48.08243	105.324		ST, FC									
11	1687.5	48.0797	105.3033						ST, FC	ST,FC		ST,FC		
12	1685.5	48.08757	105.257			ST, FC		ST, FC				ST,FC		
13	1684.5	48.0912	105.2475		ST, FC		ST, FC	ST, FC						
14	1683	48.08517	105.2247	ST, FC			ST, FC		ST, FC					
15	1681.5	48.06341	105.2118				ST, FC			ST,FC				
16	1680	48.06636	105.1997	ST, FC									ST,FC	
17	1678.5	48.09023	105.1836		ST, FC								ST,FC	
18	1677	48.10268	105.1735		ST, FC						ST,FC			
19	1675.5	48.09255	105.1727			ST, FC								
20	1674	48.07865	105.1669			ST, FC			ST, FC					
21	1672.5	48.07616	105.1239					ST, FC						
22	1671	48.07116	105.1064							ST,FC				ST

23	1670	48.06138	105.1035									ST,FC	ST,FC	ST, FC
24	1668.5	48.06103	105.0967							ST,FC		ST,FC		ST, FC
25	1667	48.07748	105.067				ST, FC					ST,FC	ST,FC	
26	1666	48.06939	105.048			ST, FC	ST, FC	ST, FC	ST, FC					
27	1665	48.05456	105.0515							ST,FC				
28	1664	48.05832	105.041				ST, FC							ST
29	1663	48.08657	105.0019									ST,FC		ST, FC
30	1661.5	48.08338	105.0087					ST, FC	ST, FC		ST,FC			
31	1660	48.07323	104.9977				ST, FC		ST, FC		ST,FC			
32	1659	48.06867	104.9993	ST, FC										FC
33	1657	48.09531	104.9813	ST, FC						ST,FC			ST,FC	ST, FC
34	1656	48.09737	104.9816				ST, FC					ST,FC	ST,FC	
35	1655	48.10115	104.9677			ST, FC	ST, FC			ST,FC				
36	1654	48.09348	104.9437							ST,FC				
37	1653	48.09515	104.9395		ST, FC	ST, FC		ST, FC						
38	1651	48.12806	104.9239		ST, FC	ST, FC			ST, FC				ST,FC	ST
39	1650	48.13711	104.9218						ST, FC		ST,FC			ST, FC
40	1648.5	48.14876	104.8982		ST, FC		ST, FC							ST, FC
41	1647	48.14244	104.8712						ST, FC	ST,FC		ST,FC		
42	1646	48.12876	104.8575				ST, FC	ST, FC		ST,FC				
43	1644.5	48.1204	104.8385				ST, FC		ST, FC	ST,FC				
44	1643	48.12765	104.7923				ST, FC							
45	1641.5	48.12736	104.7617					ST, FC						
46	1640.5	48.1135	104.7488				ST, FC						ST,FC	
47	1639.5	48.11303	104.735		ST, FC	ST, FC					ST,FC		ST,FC	
48	1638.5	48.11906	104.7156		ST, FC	ST, FC								
49	1637.5	48.12048	104.7044					ST, FC				ST,FC	ST,FC	ST

50	1636.5	48.10395	104.6821	ST, FC				ST, FC	ST, FC		ST,FC			ST, FC
51	1635.5	48.10472	104.6821						ST, FC					
52	1634.5	48.10719	104.6587		ST, FC					ST,FC				
53	1633.5	48.11139	104.6321			ST, FC	ST, FC	ST, FC	ST, FC					
54	1632.5	48.11786	104.6223					ST, FC					ST,FC	
55	1631.5	48.13085	104.6179				ST, FC					ST,FC		
56	1630.5	48.13984	104.6045	ST, FC				ST, FC	ST, FC					FC
57	1629.5	48.13993	104.6043			ST, FC					ST,FC	ST,FC	ST,FC	ST, FC
58	1628.5	48.12988	104.5885						ST, FC	ST,FC		ST,FC		
59	1627	48.11385	104.5925						ST, FC					
60	1625.5	48.11823	104.5667		ST, FC		ST, FC	ST, FC		ST,FC				
61	1624	48.12555	104.5356						ST, FC					ST
62	1623	48.11155	104.5103	ST, FC										ST, FC
63	1622	48.11476	104.4969									ST,FC		
64	1620.5	48.12325	104.4721		ST, FC	ST, FC						ST,FC		
65	1619.5	48.11113	104.4537						ST, FC		ST,FC			
66	1618.5	48.09912	104.4481				ST, FC					ST,FC		
67	1617.5	48.09658	104.4437		ST, FC	ST, FC		ST, FC			ST,FC			
68	1616.5	48.08134	104.4154	ST, FC										
69	1615	48.07642	104.3929		ST, FC					ST,FC			ST,FC	
70	1613.5	48.07464	104.373			ST, FC								
71	1612	48.04856	104.3479								ST,FC			
72	1611	48.04604	104.339			ST, FC			ST, FC					
73	1610	48.04465	104.3211					ST, FC				ST,FC		
74	1608.5	48.04829	104.2829		ST, FC	ST, FC	ST, FC				ST,FC		ST,FC	
75	1606.5	48.035	104.2509	ST, FC		ST, FC				ST,FC	ST,FC		ST,FC	
76	1604.5	48.03568	104.2071	ST, FC			ST, FC	ST, FC				ST,FC		

77	1603	48.0441	104.1978			ST, FC					ST,FC			
78	1598.5	48.04596	104.1837	ST, FC		ST, FC					ST,FC			
79	1597.5	48.03868	104.1639			ST, FC			ST, FC		ST,FC		ST,FC	
80	1596	48.04502	104.1546				ST, FC							
81	1595	48.05317	104.1413		ST, FC	ST, FC		ST, FC				ST,FC		
82	1594	48.0378	104.1241		ST, FC					ST,FC	ST,FC			
83	1593	48.02956	104.1027		FC	ST, FC						ST,FC		
84	1592	48.02939	104.1001						ST, FC					
85	1591	48.02138	104.0981			ST, FC								
86	1590.5	48.02015	104.1002		ST, FC			ST, FC						
87	1589.5	48.0052	104.1017		ST, FC					ST,FC				FC
88	1588.5													ST, FC
89	1587	47.99909	104.0539								ST,FC			
90	1585.5	47.98677	104.0194							ST,FC			ST,FC	
91	1583.5	47.96973	104.0104								ST,FC	ST,FC		