2015 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 2015 sampling year marked the 10th consecutive field season for Pallid Sturgeon Population Assessment crews in Segment 3 of the Missouri River in Montana. A total of 22 randomly selected river bends were sampled once each during sturgeon and fish community seasons throughout Segment 3 during the 2015 sampling season. All 22 bends were sampled using the standard trammel net, otter trawl, trotline and mini-fyke gears. While each bend was sampled with trammel net and otter trawl twice, trotlines were deployed once each for all 22 river bends; half of which were deployed during sturgeon season, while the other half were deployed during fish community season. Additionally, each bend was also sampled with mini-fyke net during fish community season.

A total of 393 trammel nets were drifted in Segment 3 in 2015. Those drifts resulted in nearly 100.1 km of the river being sampled. In comparison, the otter trawl was deployed a total of 381 times in Segment 3 during the 2015 field season. Those trawls resulted in 109.9 km of river being sampled. Of the 22 randomly selected bends, 21 were set with standard overnight trotlines during the 2015 field season; 11 during surgeon season and 10 during fish community season. The aforementioned trotline sets totaled 3,360 worm-baited hooks. In addition to random standard sampling, an additional 12 trotlines were set during a one day targeted effort at the uppermost point of Segment 3. Like trotlines, mini-fyke nets are standardized at eight overnight sets per bend. With a total of 22 bends being sampled, all of which took place during fish community season, a total of 176 mini-fyke nets were deployed in Segment 3 during the 2015 field season.

A total of 90 pallid sturgeon were captured in Segment 3 during the 2015 sampling season. Interestingly, captures by season were identical; 45 for each sturgeon and fish community season. In relation to sampling method, 78 pallid sturgeon were captured during random gear deployments, while the other 12 were sampled in non-random fashion. Non-random captures were the result of either duplicate sampling or non-random gear deployments (i.e. targeted efforts). Trotlines were once again a formidable gear for sampling pallid sturgeon in Segment 3 during 2015, capturing the largest proportion of fish (N=37); however, trammel net was nearly effective capturing the second highest proportion of fish (N=33), while otter trawl captured the remaining 20 individuals.

Trammel net catch per unit effort (CPUE) regarding Segment 3 for combined seasons in 2015 was reported at 0.03 fish/100m, which was the result of both sturgeon and fish community season CPUE calculated at 0.03 fish/100m. Otter trawl CPUE for Segment 3 in 2015 was highly comparable to trammel net CPUE with a combined season catch rate of 0.02 fish/100m. Additionally, like trammel net, the CPUE for each season was identical at 0.02 fish/100m. The Segment 3 trotline CPUE during the 2015 field season exhibited a combined season catch rate of 0.22 fish/20 hooks. Seasonally, CPUEs were calculated at 0.23 fish/20 hooks and 0.22 fish/20 hooks for sturgeon and fish community seasons, respectively.

All 90 pallid sturgeon captured in Segment 3 in 2015, representing 15 year classes, were of known year class (Table 3). Year class in order of abundance were; 2009 (N=27), 2008 (N=16), 2006 (N=9), 2010 (N=8), 2012 & 2014 (N=5), 1997, 2004, 2007 & 2013 (N=3), 1998, 2002 & 2005 (N=2) and 1999 & 2001 each were represented by one individual. Of the 90 pallid sturgeon captured in Segment 3 in 2015, 71 were of known stocking location; all originating in RPMA 2. A larger proportion (80%) of pallid sturgeon captures originated in the Missouri River, compared to the Yellowstone River (20%). Further analysis indicates origin in rank of abundance as; Culbertson (N=34), Wolf Point (N=20), Intake (N=5), Sidney (N=4), Fallon (N=3), Forsyth & School Trust (N=2) and Big Sky Bend (N=1).

Pallid sturgeon captured in Segment 3 during the 2015 field year averaged 459 mm in fork length, and 604 g in weight, with a range of 315 mm TL to 1170 mm TL. The continual capture of larger individuals indicates that hatchery-reared pallid sturgeon stocked at a young age are continuing to grow and recruit into the population. In relation to gear, trotlines continued to catch the largest individuals, on average, in 2015 (470 mm FL). In comparison, trammel net captured the next largest (452 mm), and lastly, otter trawl (449 mm). The relative condition (Kn) of pallid sturgeon captured in Segment 3 for all years can be found in Figure 4. Relative condition for the sub-stock (200-329 mm), stock, and quality size classes of fish all appear to be holding steady and remain comparable from year to year. However, Kn for the preferred and memorable/trophy size classes of fish may be exhibiting a slight downward pattern. It is important to note that Kn, in particular for the larger size classes, tends to be calculated on a small number of samples and therefore can be greatly influenced by as little as one individual.

A total of 561 shovelnose sturgeon were captured in Segment 3 during 2015 sampling efforts. Seasonally, more shovelnose sturgeon were captured during fish community season

(N=373), than during sturgeon season (N=188). In relation to gear, trammel net was the most successive at sampling shovelnose sturgeon (N=325), followed by trotline (N=143), and otter trawl (N=93). Analyzing deployment type, a much larger proportion (88%) of shovelnose sturgeon were captured during random sampling, compared to only 12% during non-random duplicate or targeted effort sampling.

Trammel net CPUE regarding Segment 3 across both seasons during 2015 for stock sized shovelnose sturgeon was reported at 0.04 fish/100m. Seasonal catch rates were reported at 0.01 fish/100m and 0.07 fish/100m during sturgeon and fish community seasons, respectively. Comparatively, CPUE for stock size and above shovelnose sturgeon in Segment 3 during 2015 for combined seasons was calculated at 0.28 fish/100m. Temporally, CPUE for stock size or greater shovelnose sturgeon was higher during fish community season (0.41 fish/100m) than sturgeon season (0.14 fish/100m). Comparatively, otter trawl CPUE for greater than stock size shovelnose sturgeon exhibited a combined season catch rate of 0.07 fish/100m. The catch rate was tabulated using a sturgeon season CPUE of 0.06 fish/100m and a fish community CPUE of 0.08 fish/100m. The combined season trotline CPUE in Segment 3 during the 2015 field season was reported at 0.80 fish/20 hooks; which was calculated from a sturgeon season CPUE of 0.70 fish/20 hooks and a fish community CPUE of 0.90 fish/20 hooks. Trotline catch rates for individual seasons, as well as combined seasons, continues to be comparable across all years. Catch rates for sub-stock size classes of shovelnose sturgeon remain low in Segment 3 for all standard gear types.

The shovelnose sturgeon observed in Segment 3 during the 2015 sampling season averaged 575 mm in fork length and 833 g in weight. The range of shovelnose sturgeon observed was from 123 mm FL to 900 mm FL. 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. Relative weight (Wr) for both sub-stock categories is difficult to compare from year to year based on low sample size. Relative weights for the stock size category of fish remains somewhat variable, however, one pattern does emerge; Wr for stock size shovelnose sturgeon has remained higher every year when compared to the quality size class of fish. Meanwhile, Wr for the preferred and memorable/trophy size classes of fish has remained much more stable when compared across all years.

A total of 157 sturgeon chubs, all of which were captured in the otter trawl, were observed in Segment 3 in 2015. Seasonally, the majority of observations (61%) occurred during fish community season, while the remaining proportion (39%) was captured during sturgeon season. Catch per unit effort for sturgeon chub in Segment 3 in 2015 was recorded as follows; 0.11 fish/100m during sturgeon season, 0.18 fish/100m during fish community season, and 0.14 fish/100m for combined seasons. All three different catch rate metrics have remained comparable since 2009. The sturgeon chubs observed during the 2015 field season in Segment 3 averaged 63 mm in total length; with a range of 29 mm to 109 mm. The observed average length and range, especially when compared to Segment 2, continues to indicate that Segment 3 is suitable habitat for a variety of age classes of sturgeon chubs.

Sampling events during 2015 in Segment 3 resulted in the capture of 204 sicklefin chubs, all of which were sampled via otter trawl. Identical to sturgeon chubs, 61% of sicklefin chubs were captured during fish community season, while the other 31% were captured during sturgeon season. Sicklefin chub CPUE for 2015 within Segment 3 was reported as follows; 0.12 fish/100m during sturgeon season, 0.24 fish/100m during fish community season, and a combined season CPUE of 0.18 fish/100m, which was an all time high. Despite CPUEs being highly comparable the past two field seasons, there appears to be an every-other-year type pattern of elevated CPUE observed across all three metrics of measuring CPUE. The sicklefin chubs during 2015 in Segment 3 averaged 85 mm in total length, with a range of 35 mm to 115 mm. Although the observed range appears to have a multitude of size classes, the majority (99.5%) were greater than 60 mm TL, indicating that the smaller age classes either reside in areas we don’t sample, or are rearing in habitats further downstream.

A total of 761 sand shiners were sampled in Segment 3 during 2015, with all but one (otter trawl) being observed during mini-fyke net sampling. The mini-fyke net observations lead to a CPUE calculation of 4.32 fish/net night. The 2015 catch rate was much higher than recent years, with comparable catch rates not witnessed since 2009 (4.71 fish/ net night). The sand shiners observed in Segment 3 during 2015 averaged 38 mm in TL, with a range of 15 mm to 76 mm. The average and observed ranges fit well within the realm of those witnessed in previous years, suggesting that Segment 2 of the Missouri River continues to support a population of sand shiners made up of multiple age classes.

A total of 76 *Hybognathus* spp., all of which were identified as western silvery minnows, were captured in Segment 3 during 2015 sampling events. The majority (N=74) were observed in mini-fyke nets, while the remaining individuals (N=2) were captured via otter trawl. The aforementioned mini-fyke net captures led to a CPUE of 0.42 fish/net night. The observed catch rate represents the third consecutive year of CPUE decline for western silvery minnows in Segment 3. The *Hybognathus* spp. captured in Segment 3 during 2015 averaged 75 mm in TL, with a range of 27 mm to 110 mm. Although the observed range indicates multiple age classes, average length in Segment 3 can be heavily affected by dominant age classes. For example, the majority of *Hybognathus* spp. (74%) captured in 2015 were greater than 70 mm in TL

During the 2015 sampling season a total of eleven blue suckers were observed in Segment 3, all of which were captured drifting trammel nets. Seasonally, observations were nearly equal; with five captures during sturgeon season and six captures during fish community season.

Blue sucker CPUE in Segment 3 for 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 remains highly comparable to previous years of sampling. In comparison, the CPUE for otter trawl in Segment 3 during 2015 was 0.0 fish/100 m, which is a reoccurring phenomenon from year to year. Although captures in general are low, the otter trawl is a very poor gear to track the abundance of blue suckers in Segment 3. Similarly to all other years sampled, the average size (707 mm TL) of blue suckers in Segment 3 during 2015 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.

A total of 328 sauger were collected within Segment 3 during 2015. Sauger continue to be represented by all standard gears, with rank of abundance in relation to gear as follows; trammel net (N=267), otter trawl (N=34), mini-fyke net (N=23) and trotline (N=4). Temporally, more sauger were captured during sturgeon season (N=200), than during fish community season (N=128). Catch per unit of effort for trammel net sampling of sauger, across both seasons, in Segment 3 during 2015 exhibited a catch rate of 0.26 fish/100m. Within seasons, a higher CPUE was reported during sturgeon season (0.33 /100m) than fish community season (0.18 fish/100m). Comparatively, otter trawl CPUE was calculated at 0.03 fish/100m across all three seasonal metrics; sturgeon season, fish community season, and combined-season. Mini-fyke net captures

of sauger were again a common occurrence in Segment 3 during 2015 sampling. The aforementioned captures led to a mini-fyke net CPUE calculated at 0.16 fish/net night, which is highly comparable to all years of sampling. The sauger observed in Segment 3 during the 2015 field season averaged 329 mm in TL, with a range of 58 mm to 545 mm. Although a wide variety of size classes were available to sample, gear type greatly affects which size class is observed. For example, mini-fyke nets observed the smallest average sized sauger (213 mm), while trotlines observed the largest (427 mm). Meanwhile, trammel net (344 mm) and otter trawl (278) sampled those size classes in between with the greatest efficiency.

Evaluating trends, annually or long-term, for target species could potentially be a convoluted subject. In large part, the drivers behind the changes witnessed through time have been unclear. For example, hatchery reared juvenile pallid sturgeon “hot spots” seem to be more difficult to locate in Segment 3 since the high-water year of 2011; meanwhile, these “hotspots” have increased in Segments 2 and 4. It may also be difficult to evaluate changes in abundance for small-bodied, short-lived species such as sicklefin chubs, sturgeon chubs or sand shiners, due to stochastic year-class recruitment. Many of the metrics we measure by can be heavily impacted by single sampling events or sampling locations, especially for gears such as mini-fyke nets. It remains difficult to detect changes within such a large, ever-changing river system.

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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 and Drobish 2011). The 2000 Biological Opinion divides the program area into river and reservoir segments and assigns high, moderate, or low priority management action to these segments for pallid sturgeon (Welker and Drobish 2011). The focus of the program is on the high priority management action segments. The Missouri River from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, ND is listed as a high priority action segment.

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

The objectives of this program are as follows:

1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
2. Document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
3. Document population structure and dynamics of pallid sturgeon in the Missouri River

System.

4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
5. Document annual results and long-term trends of habitat usage of the native target species by season and life stage.
6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

Sampling Season and Species

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

The fish community season extends from the beginning of July till the end of October and is designed not only to monitor sturgeon, but also monitor other native Missouri River fish populations. Both trammel nets and otter trawls are used during the fish community season, however mini fyke nets are added as a standard gear to more effectively sample shallow water habitats < 1.2 m in depth.

In addition to pallid sturgeon, the program is designed to monitor nine other native Missouri River species labeled “target” species. These include, shovelnose sturgeon *Scaphirhynchus platorynchus*, blue sucker *Cycleptus elongatus*, sauger *Sander canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *M. meeki*, speckled chub *M. aestivalis*, plains minnow *Hybognathus placitus*, western silvery minnow *H. argyritis*, and sand shiner *Notropis stramineus*. This suite of species was selected for various reasons. First, some species may have similar habitat requirements as pallid sturgeon and therefore by monitoring their populations we may gain further insight into pallid sturgeon habitat and how anthropomorphic and natural

changes to the Missouri River affect native fish assemblages. Secondly, it is hypothesized that various chub species and other native fishes are an important component of pallid sturgeon diet, and thereby monitoring pallid sturgeon prey will allow us to better describe their habitat. Thirdly, we wouldn't expect to see an immediate response in a long-lived species like pallid sturgeon would be difficult to measure when environmental conditions change from either favorable or detrimental conditions. Thus, by monitoring short-lived native fishes we may be able to correlate environmental conditions to changes in fish populations on a much shorter time interval and make inferences on how pallid sturgeon populations may be affected.

Study Area

Montana Fish, Wildlife & Parks samples three segments on the Missouri River below Fort Peck Dam to its confluence with the Yellowstone River in accordance with the Pallid Sturgeon Population Assessment Program. Study segment 3 of the Missouri River Pallid Sturgeon Population Assessment Program encompasses 119 river miles from Wolf Point, MT to the confluence of the Missouri and Yellowstone Rivers in North Dakota. In this large section, the river has completely transitioned from a cold clear cobble substrate river in segment 2 to a warm turbid prairie river, more similar to its natural characteristics (Galat et al, 2005). The aggrading streambed of segment 3 is flanked by stream deposited sediment of the Fort Union Formation (NRIS, 2007). This stretch of river is slightly less flow regulated than upstream segments due to the tributaries and runoff events. There are five major tributaries that influence this section of river, which include the Milk River, Redwater River, Poplar River, Big Muddy Creek, and Prairie Elk Creek. These sediment packed tributaries flush their warmer turbid waters into the Missouri River increasing flows and suspended sediment, which in turn enables sandbar and island formation. Turbidities in this stretch of river are greater than that of segment 2 and discharge constantly changes with precipitation events and tributary discharge. The species composition of this stretch of river is vastly different from the uppermost segment just below Fort Peck Dam. The non-native fish stocked for recreation are much less prevalent and the prevalence of native, non-sport fish is increased (Gardner and Stewart, 1987). This stretch of ever-changing river is diverse with over 36 species of fish, many of which are benthic specialists, exhibiting streamlined bodies and well-developed chemosensory organs for surviving the sometimes high flows and ever-turbid waters (Galat et al, 2005; Berry et al. 2004). This stretch of river can be highly dynamic and is more reminiscent of what the Missouri River looked like before it became one of the most regulated and impounded rivers in the United States (Galat et al, 2005). However, due to the extremely low spring and summer flows that we've experienced in the past three years due to the operations of Fort Peck Dam, habitat formation is not occurring as it might have during the high runoff years of the 1990's.

Methods

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

Sampling Site Selection and Description

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

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

Trotlines were used again in Segment 3 during 2015 as a standard gear during both the sturgeon and fish community seasons to monitor changes in relative abundance, size structure, growth, habitat use and potential movements. All 22 randomly chosen river bends were sampled using trotlines, eleven during the sturgeon season and eleven during the fish community season. The aforementioned trotline sets totaled 3,360 worm-baited hooks. In addition to random standard sampling, an additional 12 trotlines were set during a one day targeted effort at the uppermost point of Segment 3."Random river bends for trotlines were chosen by moving one river bend upstream from the randomly chosen river bends for standard gears. This was done to minimize the influence of trotlines on our standard gears and make logistics easier. Since trotlines are a gear that requires attending a river bend on two consecutive days, it is logistically better to be able to set trotlines on the same day as otter trawling or drifting trammel nets occurs.

We also wanted to make sure that one gear wasn't influencing the catch of other gears and by sampling the next river bend upstream we believe we achieved this.

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

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

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

Sampling Gear

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

Trammel Net

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

Otter Trawl

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

Mini Fyke Nets

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

Trotlines

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

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

Data Collection and Analysis

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

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

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

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

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

Habitat samples were collected randomly for 25% of each mesohabitat within each macrohabitat sampled. Velocities (mps) were taken at three depths in the water column for habitats > 1.2 m in depth (bottom, 0.8 of bottom depth and 0.2 of the bottom depth) using either

a Current AA Price Meter and sounding reel or a Marsh-McBirney Flo Mate 2000. Velocities for shallow water habitats (< 1.2 m) were taken at the bottom and 0.6 of the bottom depth using the March-McBirney Flo Mate 2000.

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

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker and Drobish (2011). Two fin pectoral fin clips (~ 2 cm^2) are taken from any pallid sturgeon of unknown origin. Fin samples are then preserved in 95% non-denatured alcohol for genetic analysis. All samples are sent to the U.S. Fish and Wildlife Service's Lamar Laboratory for analysis and archiving.

Relative Condition

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

Size Classes of Pallid and Shovelnose Sturgeon

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

Analyses

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

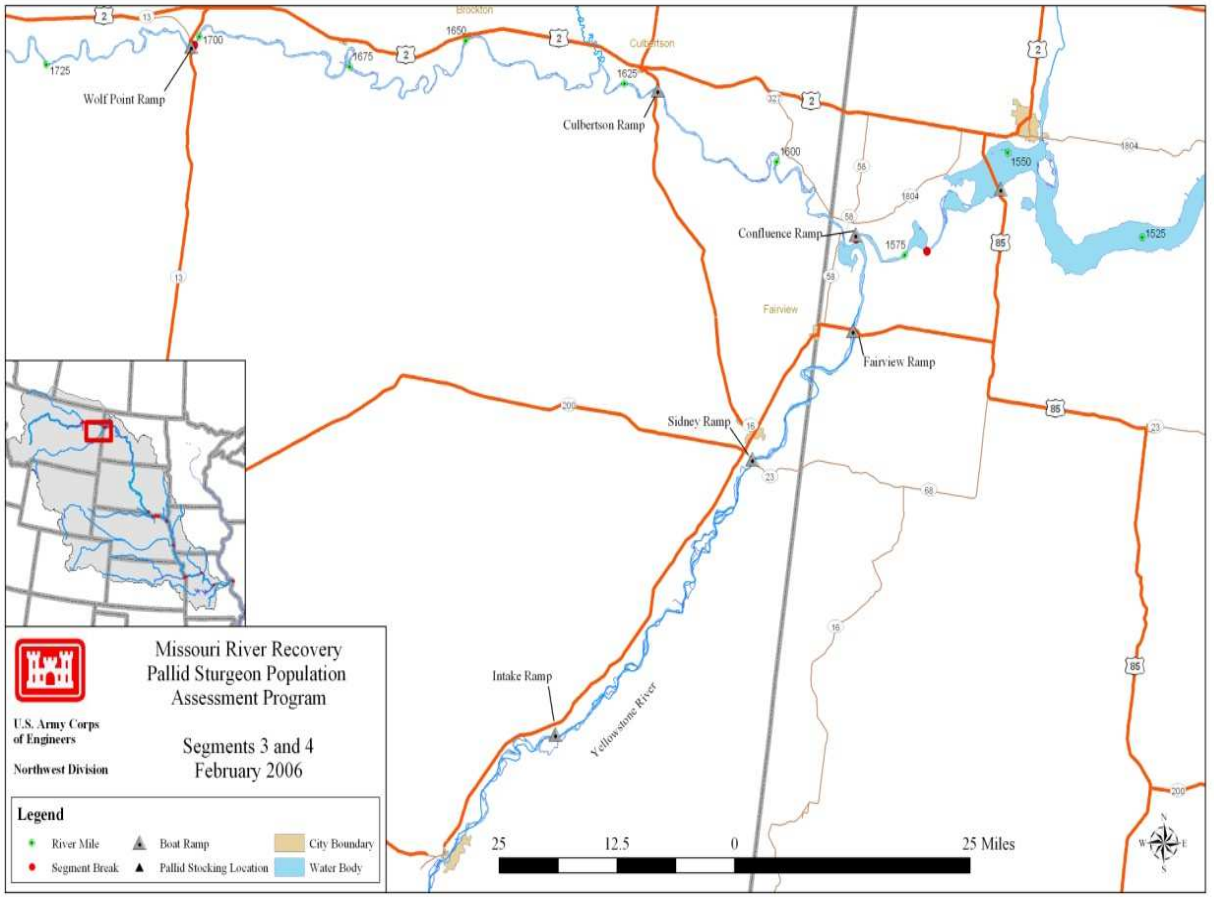

Figure 1. Map of Segment 3 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 3 encompasses the Missouri River from Wolf Point, MT (River Mile 1701.0) to the confluence of the Yellowstone River (River Mile 1582.0).

Results

Effort

A total of 22 randomly selected river bends (Table 1) were sampled once each during sturgeon and fish community seasons throughout Segment 3 during the 2015 sampling season. All 22 bends were sampled using the standard trammel net, otter trawl, trotline and mini-fyke gears. While each bend was sampled with trammel net and otter trawl twice, trotlines were deployed once each for all 22 river bends; half of which were deployed during sturgeon season, while the other half were deployed during fish community season. Additionally, each bend was also sampled with mini-fyke net during fish community season.

A total of 393 trammel nets were drifted in Segment 3 in 2015. Those drifts resulted in nearly 100.1 km of the river being sampled. Deployment distance was nearly equal for both seasons; 50.2 km during sturgeon season and 49.8 km during fish community season. Of the 393 trammel net drifts, 90% of them were performed in random fashion, which resulted in 89.7 km of sampling. While the remaining 10% of drifts, which were performed in non-random fashion, accounted for only 10.3 km of river sampling.

In comparison, the otter trawl was deployed a total of 381 times in Segment 3 during the 2015 field season. Those trawls resulted in 109.9 km of river being sampled. As with trammel net, deployment distance of otter trawl was nearly equal for both seasons; 54.6 km and 55.3 km, during sturgeon and fish community season, respectively. Similarly to trammel nets, the majority of otter trawl deployments (N=352) occurred in random fashion and resulted in 101.7 km of sampling. Whereas the remaining 29 non-random otter trawl sets accounted for only 8.2 km of sampling.

Of the 22 randomly selected bends, 21 were set with standard overnight trotlines during the 2015 field season; 11 during surgeon season and 10 during fish community season. The aforementioned trotline sets totaled 3,360 worm-baited hooks. In addition to random standard sampling, an additional 12 trotlines were set during a one day targeted effort at the uppermost point of Segment 3.

Like trotlines, mini-fyke nets are standardized at eight overnight sets per bend. With a total of 22 bends being sampled, all of which took place during fish community season, a total of 176 mini-fyke nets were deployed in Segment 3 during the 2015 field season.

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 2015.

Gear	Number of Bends	Mean Effort	Macrohabitat[a]							
			CHXO	ISB	OSB	SCCL	SCCS	SCN	TRMS	TRML
Sturgeon Season										
1.0” Trammel Net	22	8	67	63	39	2	0	0	0	0
Otter Trawl	22	8	62	59	50	5	0	0	0	0
Fish Community Season										
1.0” Trammel Net	23	7.74	67	58	50	3	0	0	0	0
Mini-Fyke Net	21	8	57	70	5	11	19	6	0	0
Otter Trawl	22	8	71	58	47	0	0	0	0	0
Both Seasons										
Trot Lines	21	8.38	71	61	39	3	0	0	1	1

[a] Habitat abbreviations and definitions presented in Appendix B

Pallid Sturgeon

A total of 90 pallid sturgeon (Figure 9) were captured in Segment 3 during the 2015 sampling season. Interestingly, captures by season were identical; 45 for each sturgeon and fish community season. In relation to sampling method, 78 pallid sturgeon were captured during random gear deployments, while the other 12 were sampled in non-random fashion. Non-random captures were the result of either duplicate sampling or non-random gear deployments (i.e. targeted efforts).

Trotlines were once again a formidable gear for sampling pallid sturgeon in Segment 3 during 2015, capturing the largest proportion of fish (N=37); however, trammel net was nearly effective capturing the second highest proportion of fish (N=33), while otter trawl captured the remaining 20 individuals.

Trammel net catch per unit effort (CPUE) regarding Segment 3 for combined seasons in 2015 was reported at 0.03 fish/100m, which was the result of both sturgeon and fish community season CPUE calculated at 0.03 fish/100m. A comparison of trammel net CPUE for all years can be found in Figure 5.

Otter trawl CPUE for Segment 3 in 2015 was highly comparable to trammel net CPUE with a combined season catch rate of 0.02 fish/100m. Additionally, like trammel net, the CPUE for each season was identical at 0.02 fish/100m. An otter trawl CPUE comparison for all years can be found in Figure 6.

The Segment 3 trotline CPUE during the 2015 field season exhibited a combined season catch rate of 0.22 fish/20 hooks. Seasonally, CPUEs were calculated at 0.23 fish/20 hooks and 0.22 fish/20 hooks for sturgeon and fish community seasons, respectively. A complete comparison of trotline CPUE can be observed in Figure 7.

Pallid sturgeon captured in Segment 3, all of which were of hatchery origin, during the 2015 field year averaged 459 mm in fork length, and 604 g in weight, with a range of 315 mm TL to 1170 mm TL. The continual capture of larger individuals (Figure 3) indicates that hatchery-reared pallid sturgeon stocked at a young age are continuing to grow and recruit into the population. In relation to gear, trotlines continued to catch the largest individuals, on average, in 2015 (470 mm FL). In comparison, trammel net captured the next largest (452 mm), and

lastly, otter trawl (449 mm). A complete length frequency on pallid sturgeon captured during 2015 in Segment 3 can be viewed in Figure 8.

The relative condition (Kn) of pallid sturgeon captured in Segment 3 for all years can be found in Figure 4. Relative condition for the sub-stock (200-329 mm), stock, and quality size classes of fish all appear to be holding steady and remain comparable from year to year. However, Kn for the preferred and memorable/trophy size classes of fish may be exhibiting a slight downward pattern. It is important to note that Kn, in particular for the larger size classes, tends to be calculated on a small number of samples and therefore can be greatly influenced by as little as one individual.

Pallid sturgeon distribution in Segment 3 (Figure 2) remains variable; however, captures of juvenile pallid sturgeon are likely across the entire segment. Furthermore, elevated capture rates in any particular area can be driven by a few different things. For example, one pallid sturgeon captured during a drift or a trawl may lead to duplicate sampling where many more individuals are sampled. Another scenario may be that a particular trotline bend holds a high density of pallid sturgeon, in which the trotline is a very successful gear at capturing those fish.

All 90 pallid sturgeon captured in Segment 3 in 2015, representing 15 year classes, were of known year class (Table 3). Year class in order of abundance were; 2009 (N=27), 2008 (N=16), 2006 (N=9), 2010 (N=8), 2012 & 2014 (N=5), 1997, 2004, 2007 & 2013 (N=3), 1998, 2002 & 2005 (N=2) and 1999 & 2001 each were represented by one individual. Large stocking events in 2008 and 2009 continue to be reflected in the abundance of those year classes observed in sampling (Appendix E).

Of the 90 pallid sturgeon captured in Segment 3 in 2015, 71 were of known stocking location; all originating in RPMA 2. When stocking occurs, pallid sturgeon are released in to one of two rivers; the Yellowstone or Missouri River. In relation to stocking origin, a larger proportion (80%) of pallid sturgeon captures originated in the Missouri River, compared to the Yellowstone River (20%). Further analysis indicates origin in rank of abundance as; Culbertson (N=34), Wolf Point (N=20), Intake (N=5), Sidney (N=4), Fallon (N=3), Forsyth & School Trust (N=2) and Big Sky Bend (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.

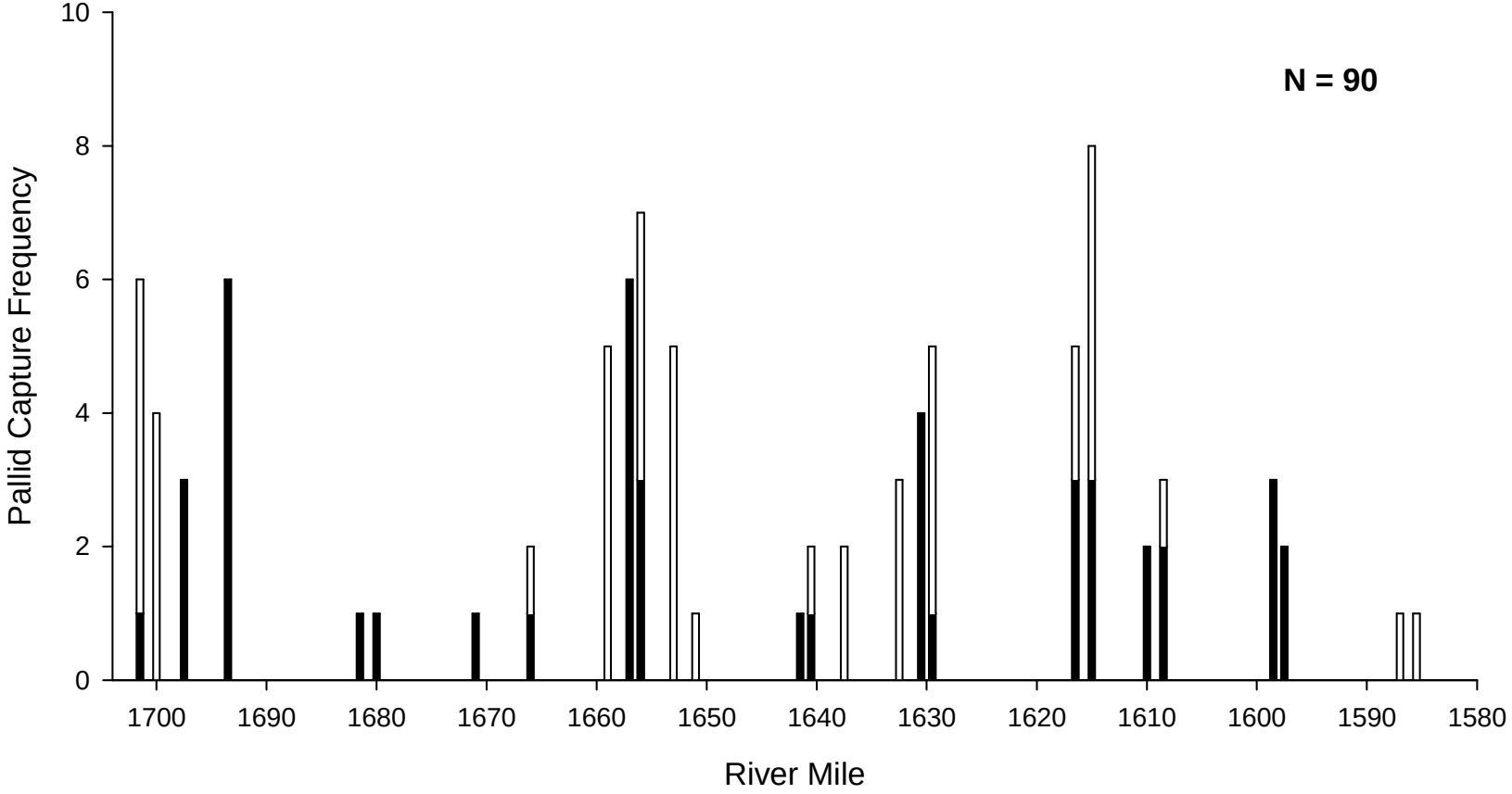

Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 3 of the Missouri River during 2015. Black bars represent pallid captures during the sturgeon season and white bars during the fish community season. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2015. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Habitat		Depth		Bottom Velocity (m/s)		Temperature (°C)		Turbidity		Total Pallids Caught
MACRO	MESO	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CHXO	BARS	0.4 (0.1-1.1)		0.08 (0.00-0.43)		15.8 (10.9-23.2)		54 (20-142)		.
CONF	CHNB	1.8 (1.0-4.6)	1.7 (1.1-3.5)	0.73 (0.00-1.02)	0.64 (0.00-1.02)	15.9 (1.1-23.8)	15.6 (8.0-21.0)	58 (17-320)	57 (20-127)	41
	BARS									.
ISB	CHNB	1.7 (1.2-2.0)		0.45 (0.45-0.45)		17.5 (14.0-21.0)		34 (34-34)		.
	BARS	0.4 (0.2-1.0)		0.06 (0.00-0.40)		15.9 (11.0-23.5)		56 (25-139)		.
OSB	CHNB	1.7 (0.9-4.0)	1.7 (1.0-4.0)	0.67 (0.32-0.94)	0.61 (0.37-0.89)	15.7 (2.2-23.6)	14.2 (8.0-22.0)	60 (17-232)	66 (20-165)	36
	BARS	0.8 (0.8-0.8)		. (.-.)		11.0 (11.0-11.0)		. (.-.)		.
SCCL	CHNB	2.5 (1.2-7.6)	2.3 (1.5-3.2)	0.75 (0.27-1.06)	0.69 (0.27-1.06)	16.0 (2.5-23.5)	16.2 (11.0-23.0)	56 (18-230)	69 (30-230)	13
	BARS	0.4 (0.3-0.4)		0.00 (0.00-0.00)		11.0 (11.0-11.0)		40 (40-40)		.
SCCS	CHNB	1.5 (1.1-1.9)		. (.-.)		15.3 (12.5-18.8)		38 (38-38)		.
	BARS	0.5 (0.3-0.6)		0.10 (0.00-0.41)		18.7 (14.5-23.0)		42 (29-54)		.
SCN	CHNB									.
	BARS	0.5 (0.3-0.6)		0.00 (0.00-0.00)		18.1 (12.0-25.0)		50 (29-109)		.
TRML	CHNB									.
	BARS	0.6 (0.6-0.6)		0.00 (0.00-0.00)		17.0 (17.0-17.0)		35 (35-35)		.
	CHNB									.

Table 3. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2015 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)
1997	3	.	.	.	1017	4800	1.021	.	.
.	.	.	.	.	152	2722.7	0.13	.	.
1998	2	530	.	.	1141	6525	1.001	0.106	.
.	.	.	.	.	58	1450	0.056	.	.
1999	1	350	.	.	1010	4500	1.036	0.123	.
.	.	.	.	.	.	.	.	.	.
2001	1	.	.	.	642	789	0.808	.	.
.	.	.	.	.	.	.	.	.	.
2002	2	288	95	1.363	794	1776.5	0.894	0.103	0.3
.	.	.	.	.	103	707	0.022	.	.
2004	3	.	.	.	619	883.3	0.933	.	.
.	.	.	.	.	158	576.1	0.129	.	.
2005	2	.	.	.	489	392	0.942	.	.
.	.	.	.	.	102	266	0.016	.	.
2006	9	213	32	1.235	444	268.4	0.913	0.065	0.058
.	.	35	14	0.122	23	44.1	0.039	0.002	0.003
2007	3	199	30.5	1.495	396	209.3	1.053	0.069	0.061
.	.	7	1	0.222	43	45	0.158	0.02	0.022
2008	16	.	.	.	408	213.4	0.964	.	.
.	.	.	.	.	10	17.4	0.037	.	.
2009	27	227	42	1.176	384	184.6	1.03	0.087	0.076
.	.	47	34.5	0.186	10	11.6	0.06	0.017	0.004
2010	8	247	51	1.053	377	163.9	0.962	0.079	0.061
.	.	54	46.1	0.182	7	18.9	0.071	0.03	0.022
2012	5	336	139	1.18	399	183.6	0.892	0.073	0.052
.	.	14	24.7	0.081	16	27.9	0.057	0.006	0.014
2013	3	250	76.8	2.024	332	113.3	1.025	0.15	0.068
.	.	57	14.1	1.399	17	8.8	0.107	0.076	0.012
2014	5	308	100.2	1.155	360	130.8	0.9	0.41	0.234
.	.	7	10	0.079	18	16.4	0.078	0.072	0.058

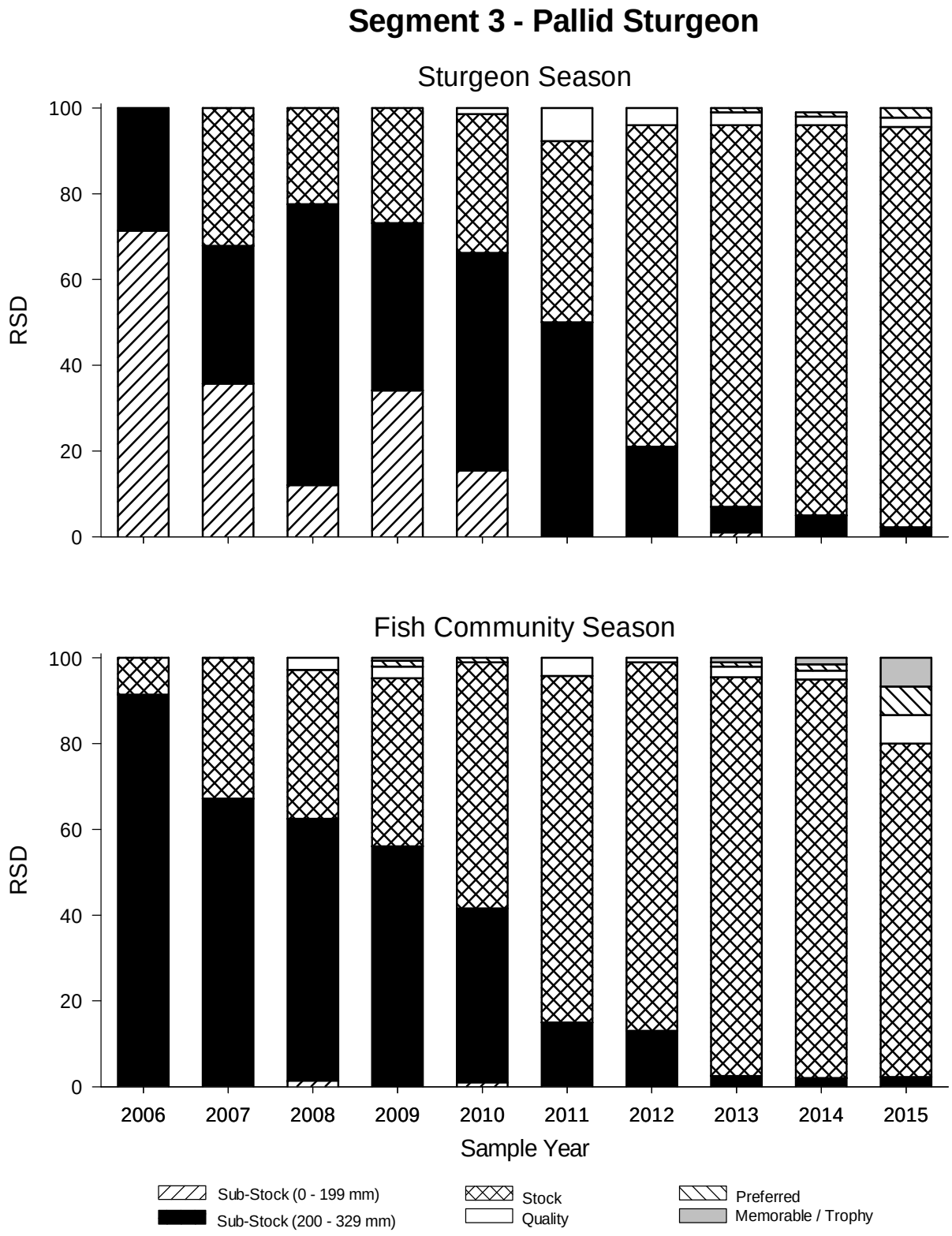

Figure 3. Proportion of total catch by length group for all pallid sturgeon captured with all gear by length category from 2006-2015 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

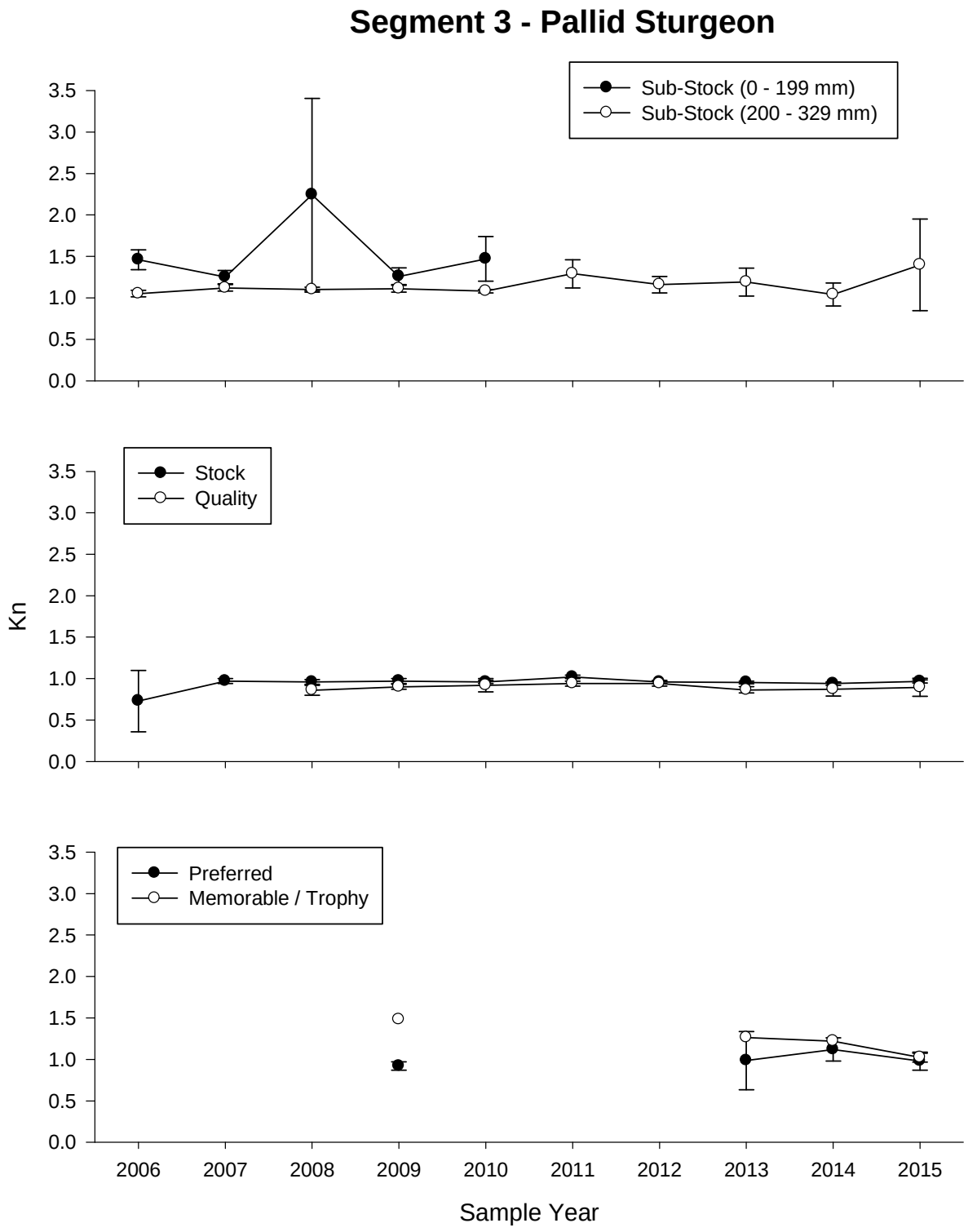

Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2015 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

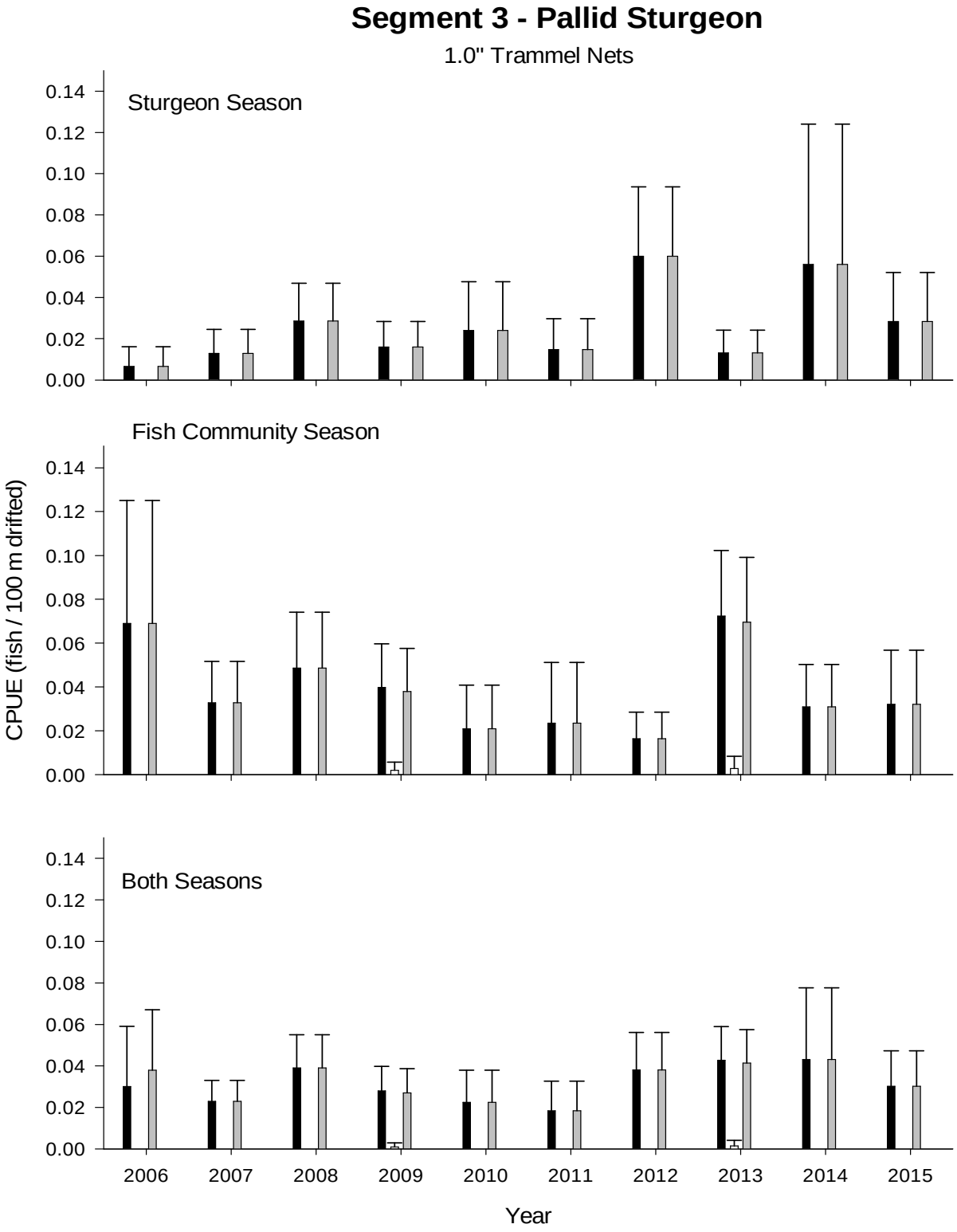

Figure 5. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars) pallid sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2015.

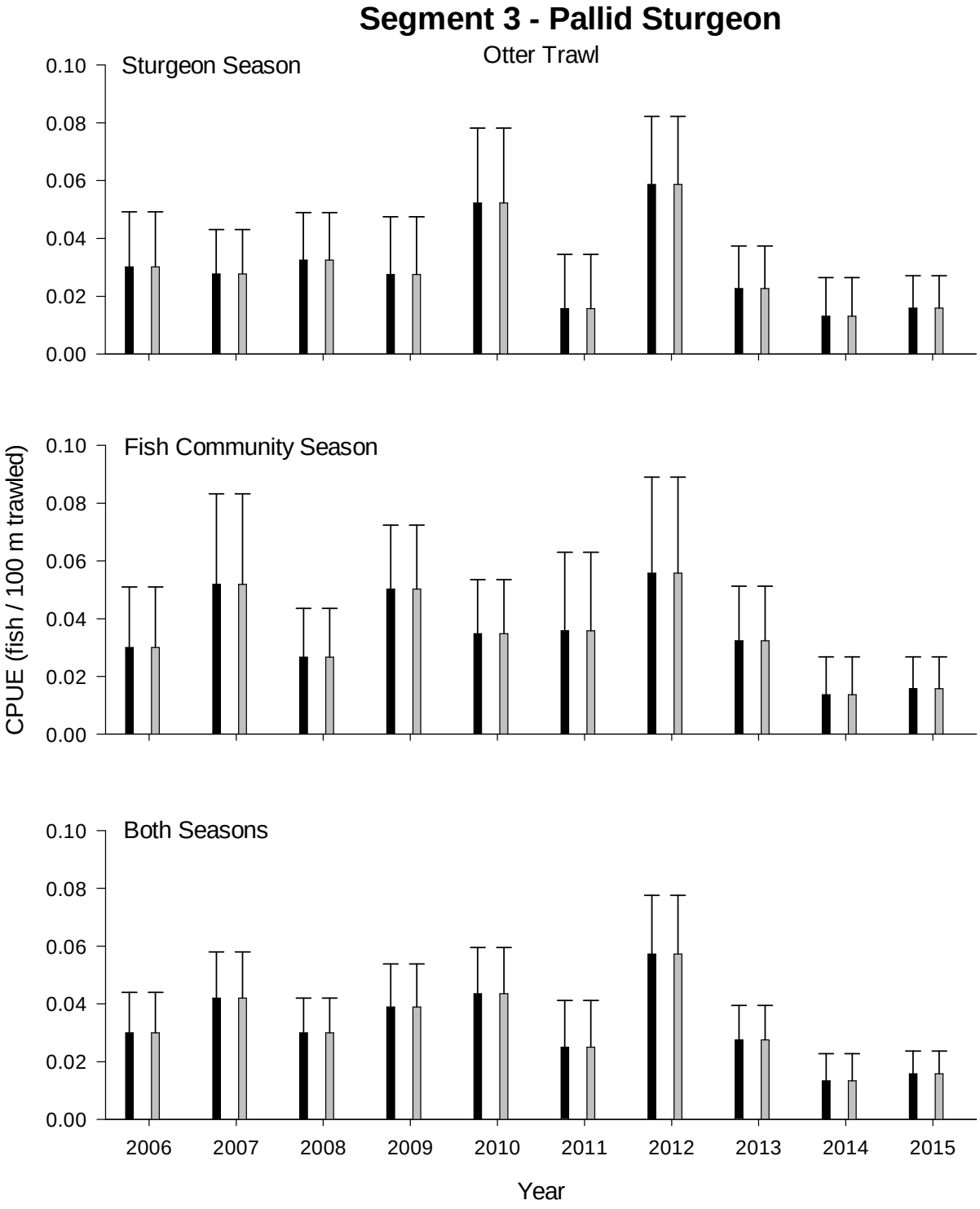

Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars) pallid sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2015.

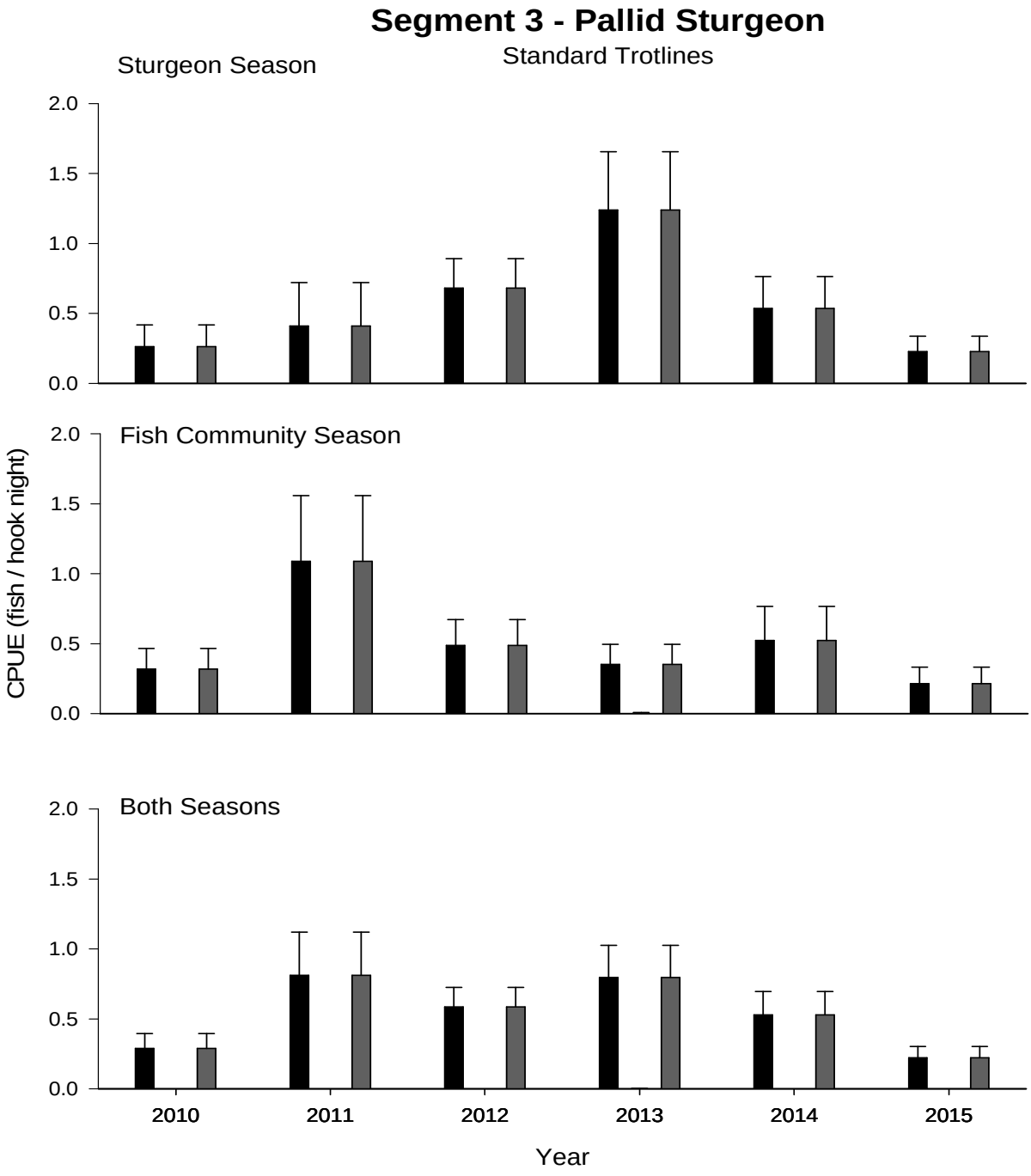

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 3 of the Missouri River from 2010-2015.

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 2015. 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	SCCS	SCN	TRML	CONF
Sturgeon Season									
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
Fish Community Season									
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	33	29	0	0	0	0	0
Both Seasons									
Trot Lines	0	0	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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	SCCS	SCN	TRML	CONF
					Sturgeon Season				
1.0” Trammel Net	1	0	0	100	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Lines	1	100	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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	SCCS	SCN	TRML	CONF
Sturgeon Season									
1.0” Trammel Net	11	73	27	0	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	7	14	43	43	0	0	0	0	0
		33	37	29	0	0	0	0	1
Fish Community Season									
1.0” Trammel Net	9	33	56	11	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	8	38	25	38	0	0	0	0	0
		37	33	29	0	0	0	0	0
Both Seasons									
Trot Lines	30	35	52	13	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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	SCCS	SCN	TRML	CONF
Sturgeon Season									
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	1	100	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
Fish Community Season									
1.0” Trammel Net	4	75	0	25	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	33	29	0	0	0	0	0
Both Seasons									
Trot Lines	5	60	40	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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	SCCS	SCN	TRML	CONF
Sturgeon Season									
1.0” Trammel Net	12	67	33	0	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	8	25	38	38	0	0	0	0	0
		33	37	29	0	0	0	0	1
Fish Community Season									
1.0” Trammel Net	13	46	38	15	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	8	38	25	38	0	0	0	0	0
		37	33	29	0	0	0	0	0
Both Seasons									
Trot Lines	37	41	49	11	0	0	0	0	0
		41	42	14	2	0	0	0	1

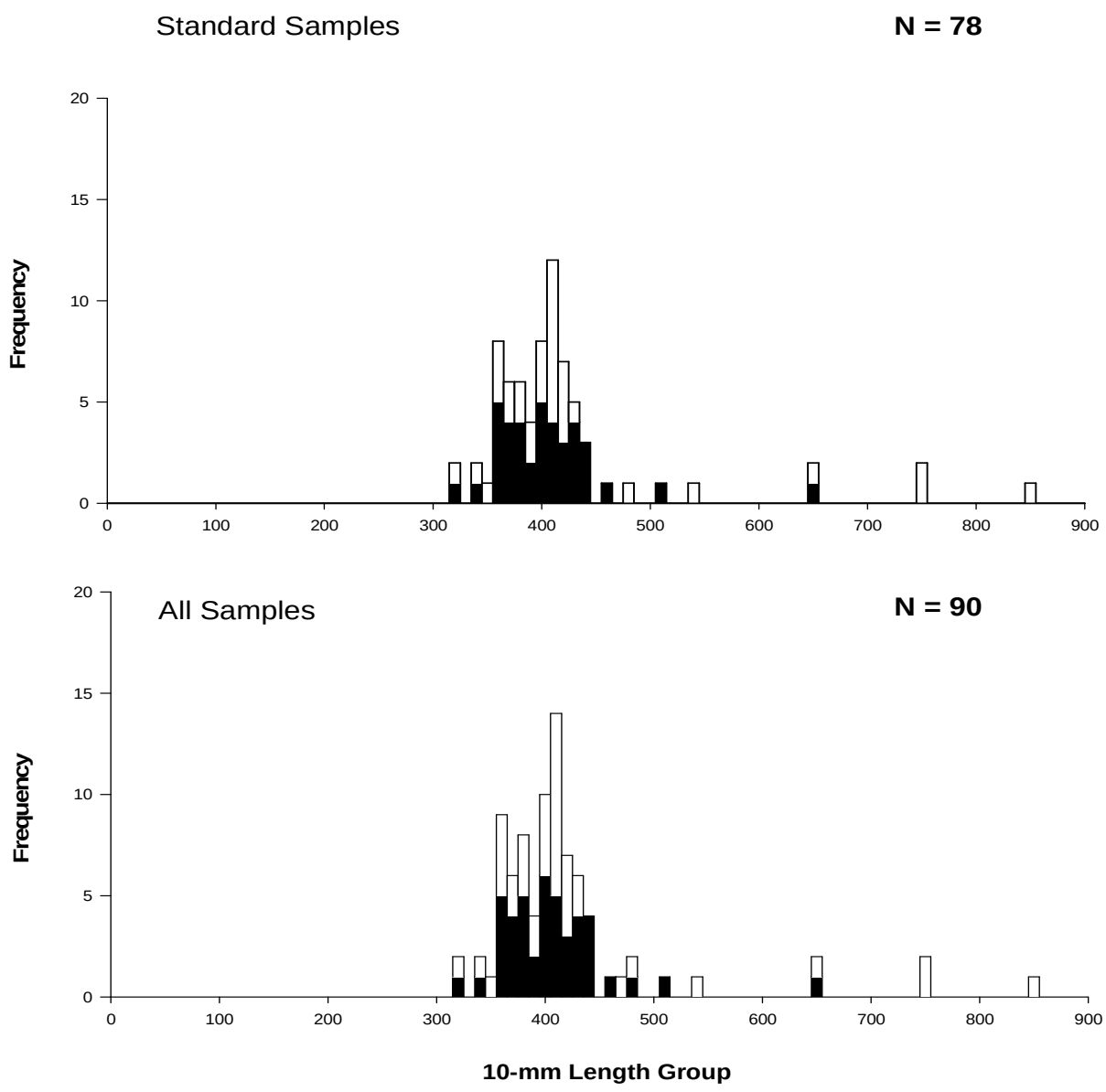

Figure 8. Length frequency of pallid sturgeon captured during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

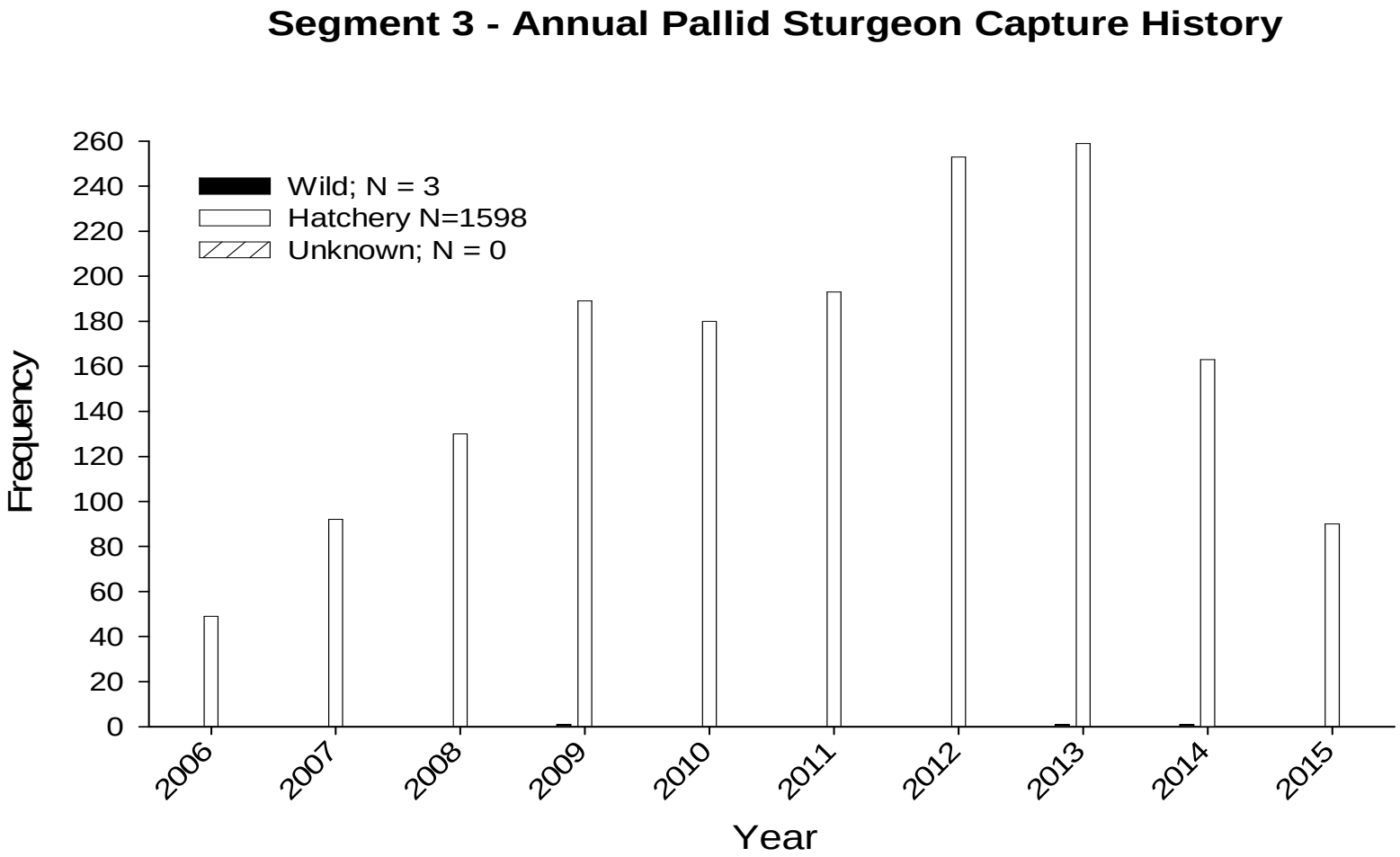

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 3 of the Missouri River from 2006-2015. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable 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 2015 or during the previous eight years of sampling.

Targeted Native River Species

Shovelnose Sturgeon

A total of 561 shovelnose sturgeon were captured in Segment 3 during 2015 sampling efforts. Seasonally, more shovelnose sturgeon were captured during fish community season (N=373), than during sturgeon season (N=188). In relation to gear, trammel net was the most successive at sampling shovelnose sturgeon (N=325), followed by trotline (N=143), and otter trawl (N=93). Analyzing deployment type, a much larger proportion (88%) of shovelnose sturgeon were captured during random sampling, compared to only 12% during non-random duplicate or targeted effort sampling.

Trammel net CPUE regarding Segment 3 across both seasons during 2015 for stock sized shovelnose sturgeon was reported at 0.04 fish/100m. Seasonal catch rates were reported at 0.01 fish/100m and 0.07 fish/100m during sturgeon and fish community seasons, respectively. Comparatively, CPUE for stock size and above shovelnose sturgeon in Segment 3 during 2015 for combined seasons was calculated at 0.28 fish/100m. Temporally, CPUE for stock size or greater shovelnose sturgeon was higher during fish community season (0.41 fish/100m) than sturgeon season (0.14 fish/100m). Catch rates for sub-stock size classes of shovelnose sturgeon remain low in Segment 3. A complete comparison of all years trammel net CPUE can be found in Figure 10.

Segment 3 otter trawl CPUE for greater than stock size shovelnose sturgeon exhibited a combined season catch rate of 0.07 fish/100m. The catch rate was tabulated using a sturgeon season CPUE of 0.06 fish/100m and a fish community CPUE of 0.08 fish/100m. Otter trawl CPUE for both stock size or smaller continues to be very low when compared to the larger size classes of shovelnose sturgeon in Segment 3. A complete display of catch rates regarding otter trawl for all years and size classes can be found in Figure 11.

The combined season trotline CPUE in Segment 3 during the 2015 field season was reported at 0.80 fish/20 hooks; which was calculated from a sturgeon season CPUE of 0.70 fish/20 hooks and a fish community CPUE of 0.90 fish/20 hooks. Trotline catch rates for individual seasons, as well as combined seasons, continues to be comparable across all years. The entire year-by-year and seasonal comparison can be found in Figure 12.

A year by year comparison of relative weights (Wr) of shovelnose sturgeon captured in Segment 3 can be found in Figure 15. Wr for both sub-stock categories is difficult to compare from year to year based on low sample size. Relative weights for the stock size category of fish remains somewhat variable, however, one pattern does emerge; Wr for stock size shovelnose sturgeon has remained higher every year when compared to the quality size class of fish. Meanwhile, Wr for the preferred and memorable/trophy size classes of fish has remained much more stable when compared across all years.

The shovelnose sturgeon observed in Segment 3 during the 2015 sampling season averaged 575 mm in fork length and 833 g in weight. The range of shovelnose sturgeon observed was from 123 mm FL to 900 mm FL. 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 habitats where shovelnose sturgeon were sampled in 2015, 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.

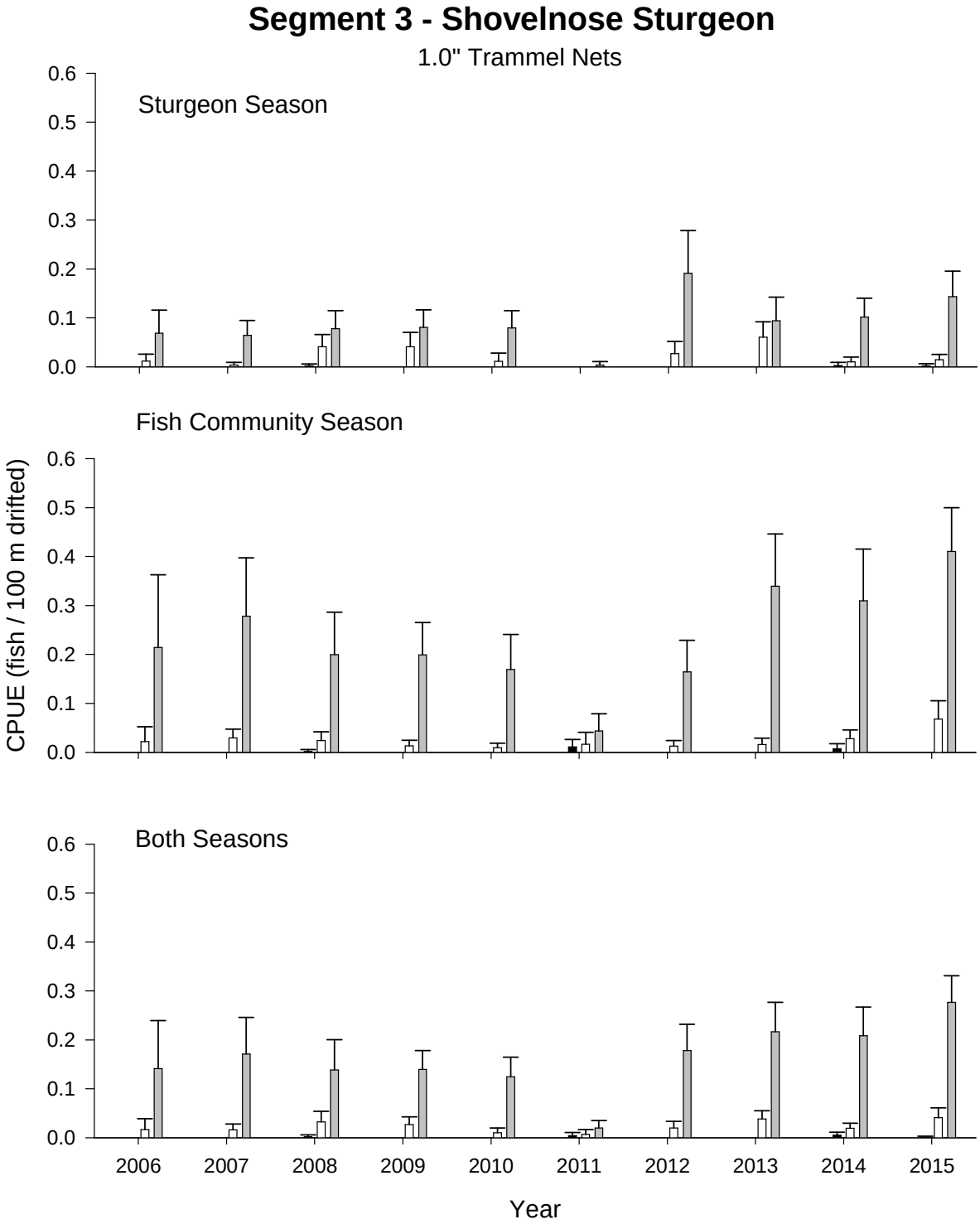

Figure 10. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0" trammel nets in Segment 3 of the Missouri River from 2006-2015.

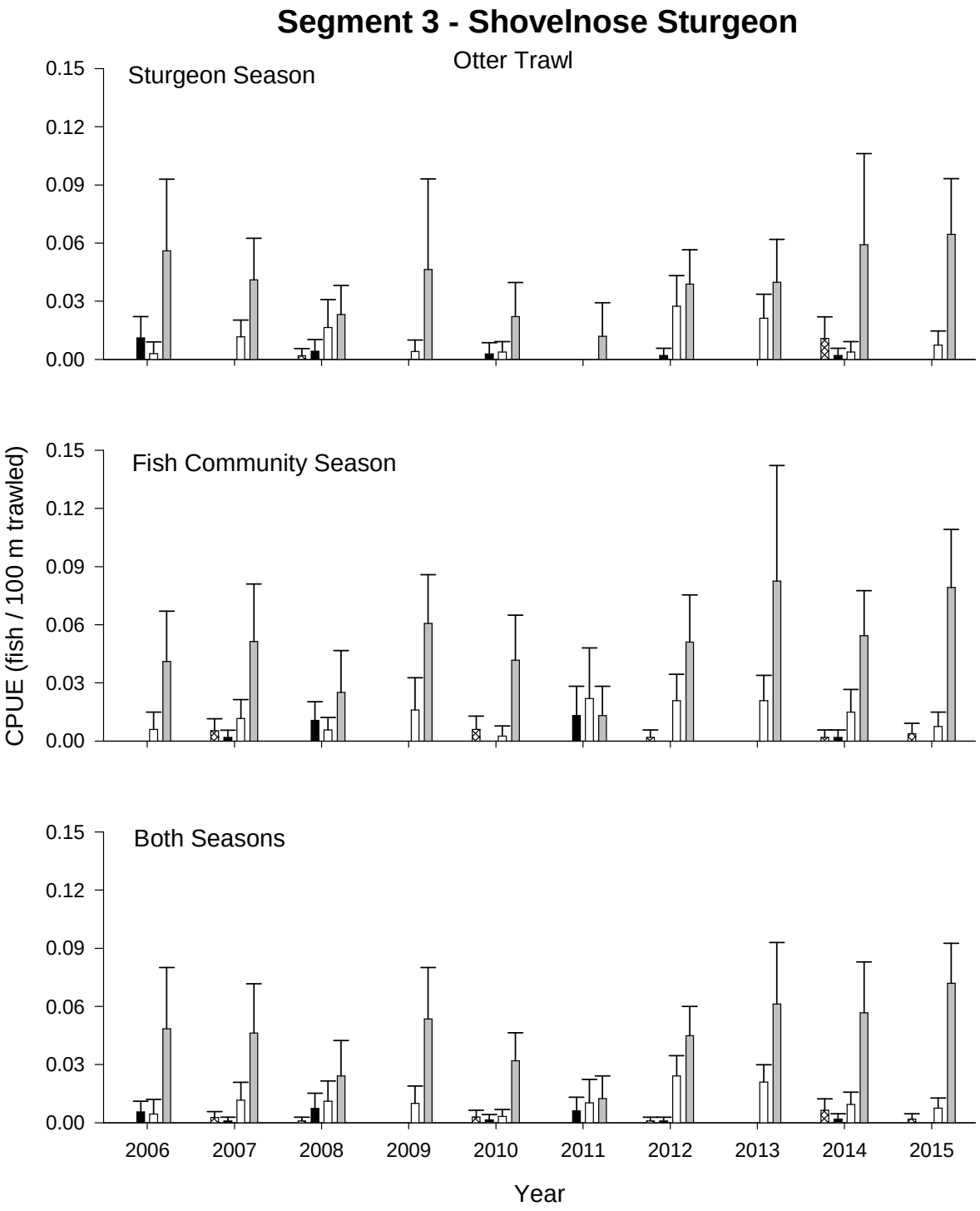

Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 3 of the Missouri River from 2006-2015.

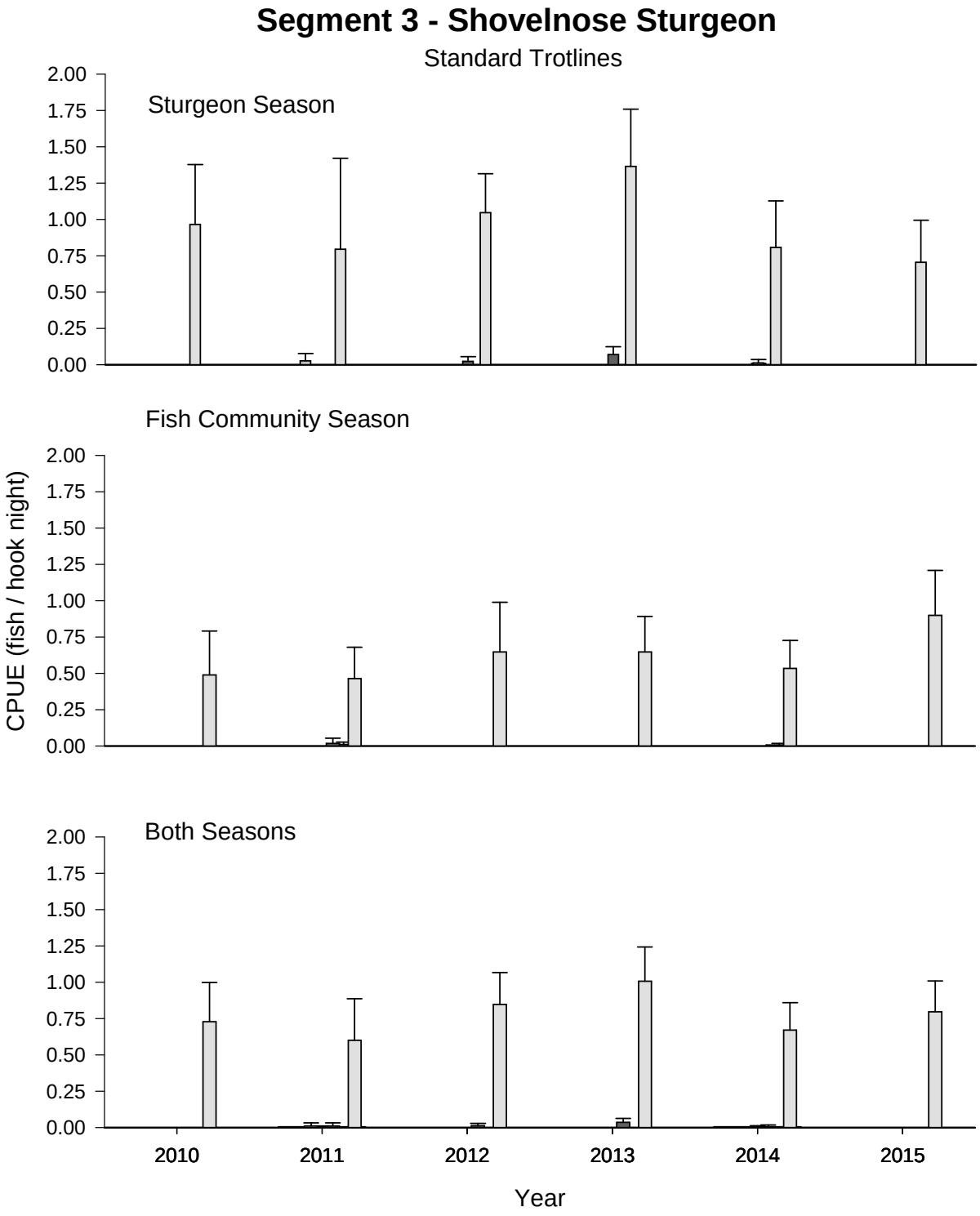

Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trotlines in Segment 3 of the Missouri River from 2010-2015. Note that trotlines were not used as a standard gear from 2006 to 2015.

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	2	0	0	100	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	0	0	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	1	0	0	100	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	0	0	0	0	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	0	0	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	7	14	71	14	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	4	50	0	50	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	27	26	37	37	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	4	50	25	25	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	0	0	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	66	52	33	15	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	33	55	21	24	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	173	58	27	13	2	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	41	54	12	34	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	33	35	52	11	2	0	0	0	0
		41	42	14	2	0	0	0	1

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	74	47	36	16	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	37	54	35	26	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	200	54	28	17	2	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	47	51	13	36	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	134	35	52	10	2	0	0	0	0
		41	42	14	2	0	0	0	1

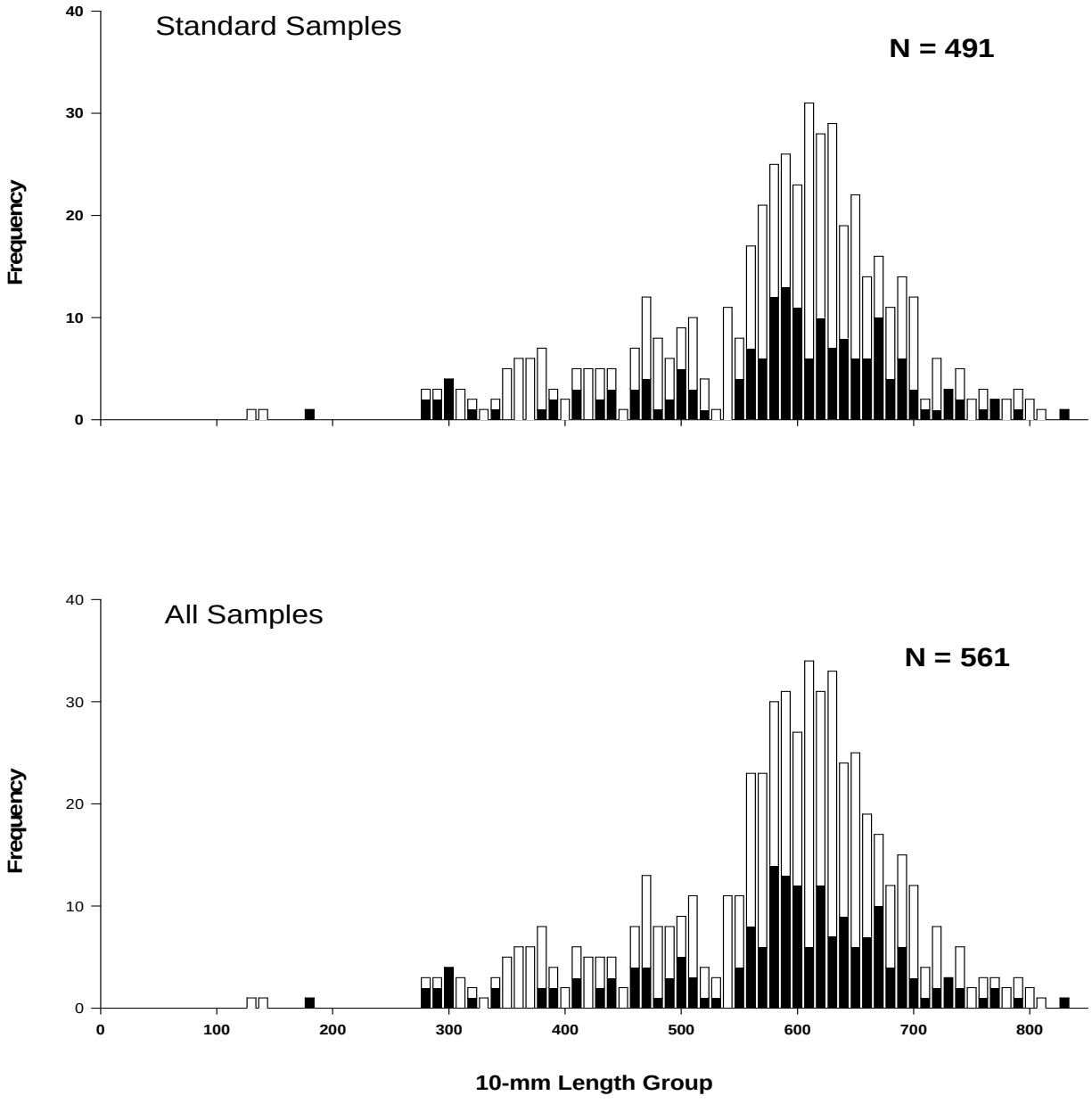

Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

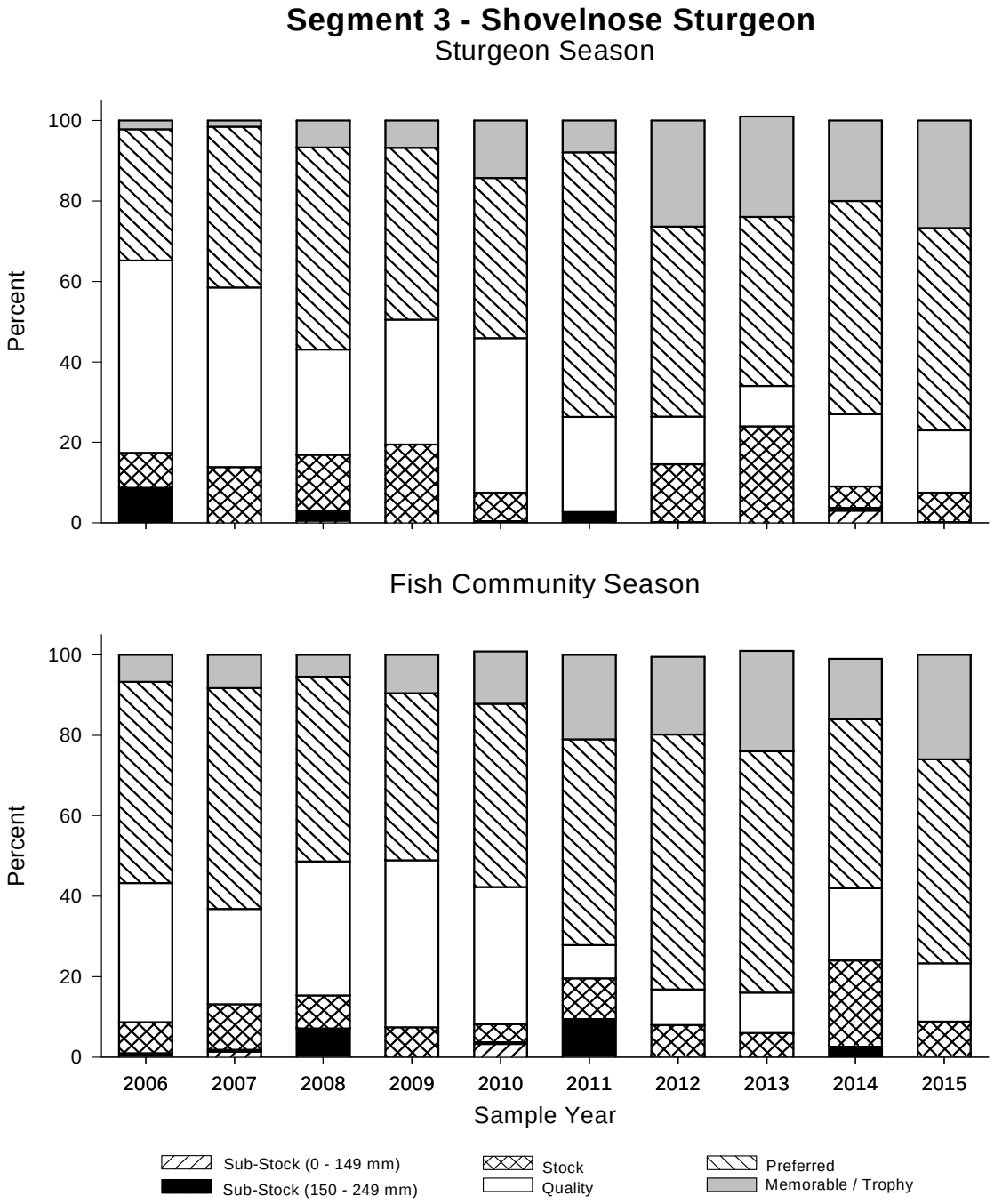

Figure 14. Proportion by length group for all shovelnose sturgeon captured with all gear by length category from 2006 to 2015 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

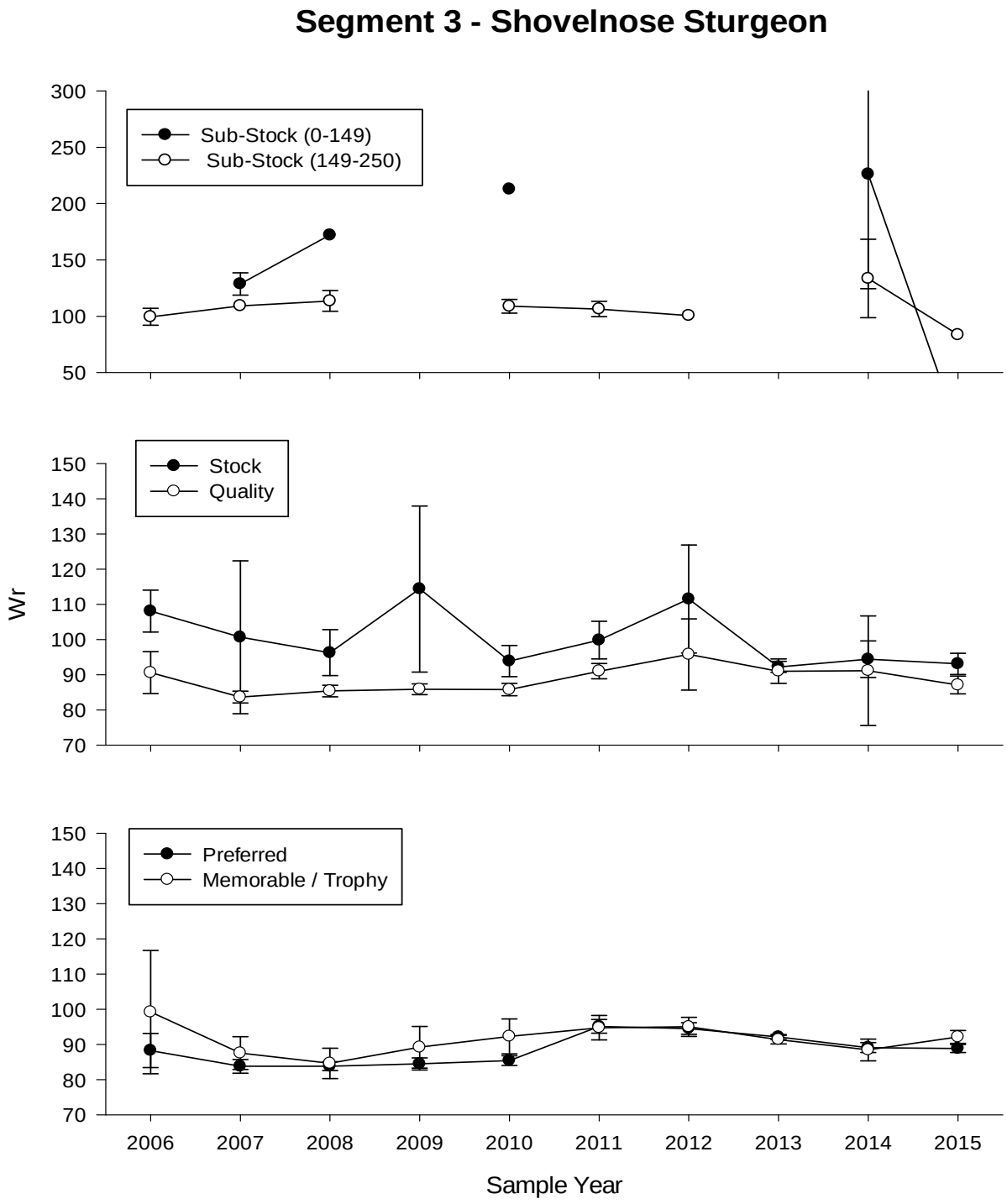

Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2015 in Segment 3 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

A total of 157 sturgeon chubs, all of which were captured in the otter trawl, were observed in Segment 3 in 2015. Seasonally, the majority of observations (61%) occurred during fish community season, while the remaining proportion (39%) was captured during sturgeon season. Random sampling detected 149 of the captures, while the remaining 8 specimens were observed during non-random, duplicate otter trawl sampling.

Catch per unit effort for sturgeon chub in Segment 3 in 2015 was recorded as follows; 0.11 fish/100m during sturgeon season, 0.18 fish/100m during fish community season, and 0.14 fish/100m for combined seasons. All three different catch rate metrics have remained comparable since 2009. A full comparison of all years can be seen in Figure 16.

The sturgeon chubs observed during the 2015 field season in Segment 3 averaged 63 mm in total length; with a range of 29 mm to 109 mm. The observed average length and range, especially when compared to Segment 2, continues to indicate that Segment 3 is suitable habitat for a variety of age classes of sturgeon chubs. A full illustration of complete size structure can be found in Figure 17.

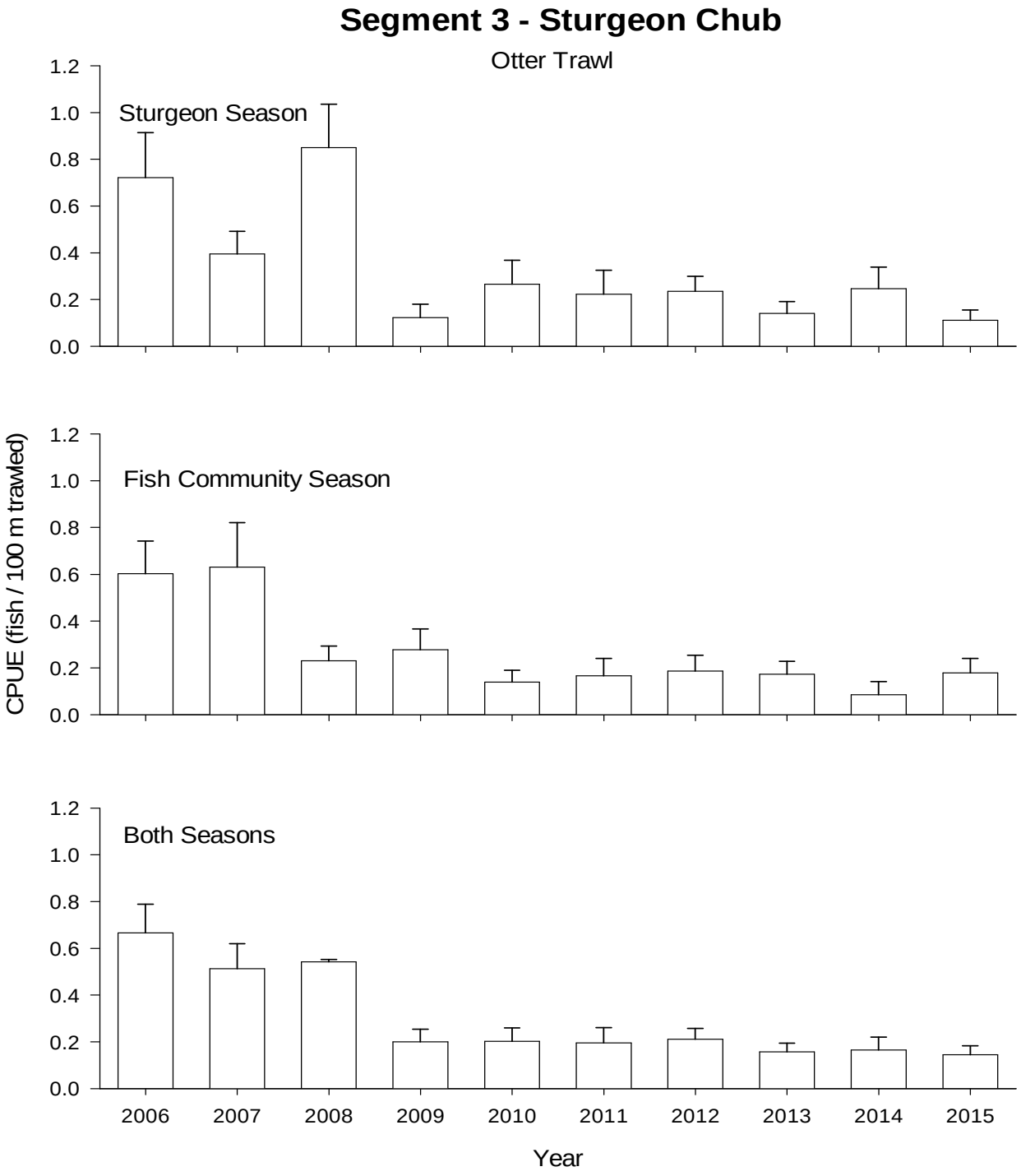

Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 3 of the Missouri River from 2006-2015.

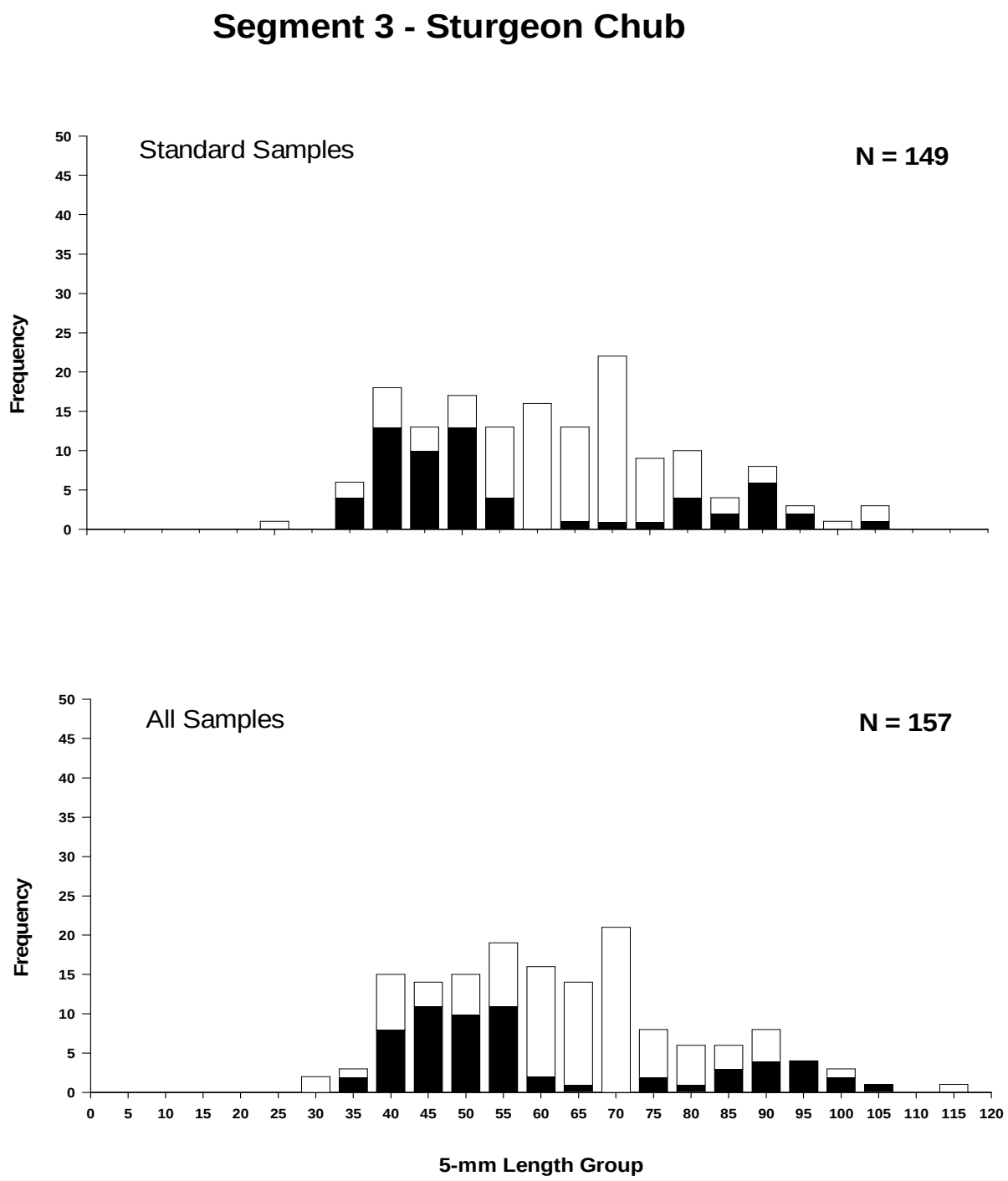

Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sicklefin Chub

Sampling events during 2015 in Segment 3 resulted in the capture of 204 sicklefin chubs, all of which were sampled via otter trawl. Identical to sturgeon chubs, 61% of sicklefin chubs were captured during fish community season, while the other 31% were captured during sturgeon season. In terms of sampling method, 188 sicklefin chubs were observed during random sampling, while the other 16 were captured during non-random, duplicate otter trawling.

Sicklefin chub CPUE for 2015 within Segment 3 was reported as follows; 0.12 fish/100m during sturgeon season, 0.24 fish/100m during fish community season, and a combined season CPUE of 0.18 fish/100m, which was an all time high. Despite CPUEs being highly comparable the past two field seasons, there appears to be an every-other-year type pattern of elevated CPUE observed across all three metrics of measuring CPUE. A full seasonal and combined CPUE comparison can be found in Figure 18.

The sicklefin chubs during 2015 in Segment 3 averaged 85 mm in total length, with a range of 35 mm to 115 mm. Although the observed range appears to have a multitude of size classes, the majority (99.5%) were greater than 60 mm TL, indicating that the smaller age classes either reside in areas we don’t sample, or are rearing in habitats further downstream. A complete length frequency histogram can be observed in Figure 19.

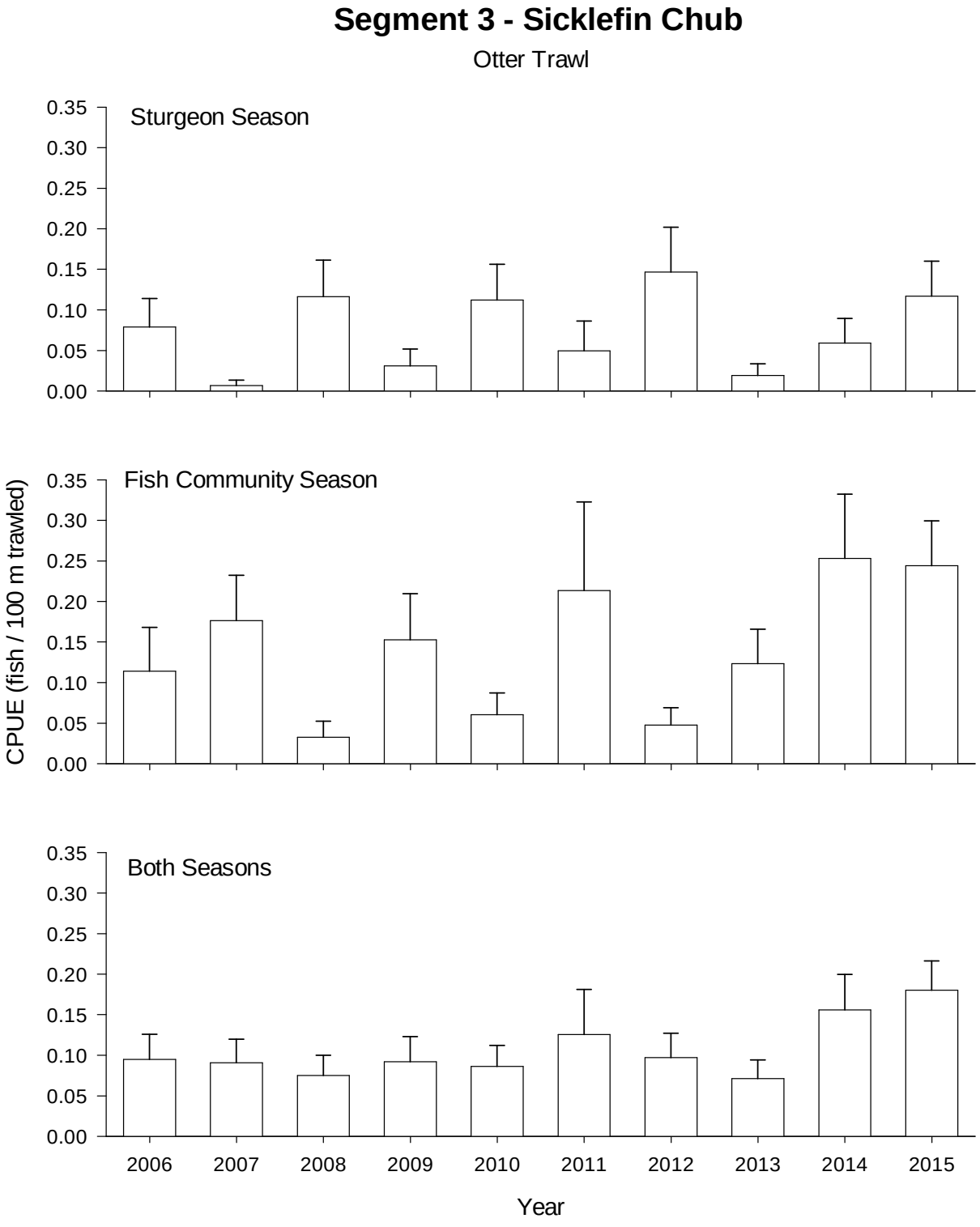

Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 3 of the Missouri River from 2006-2015.

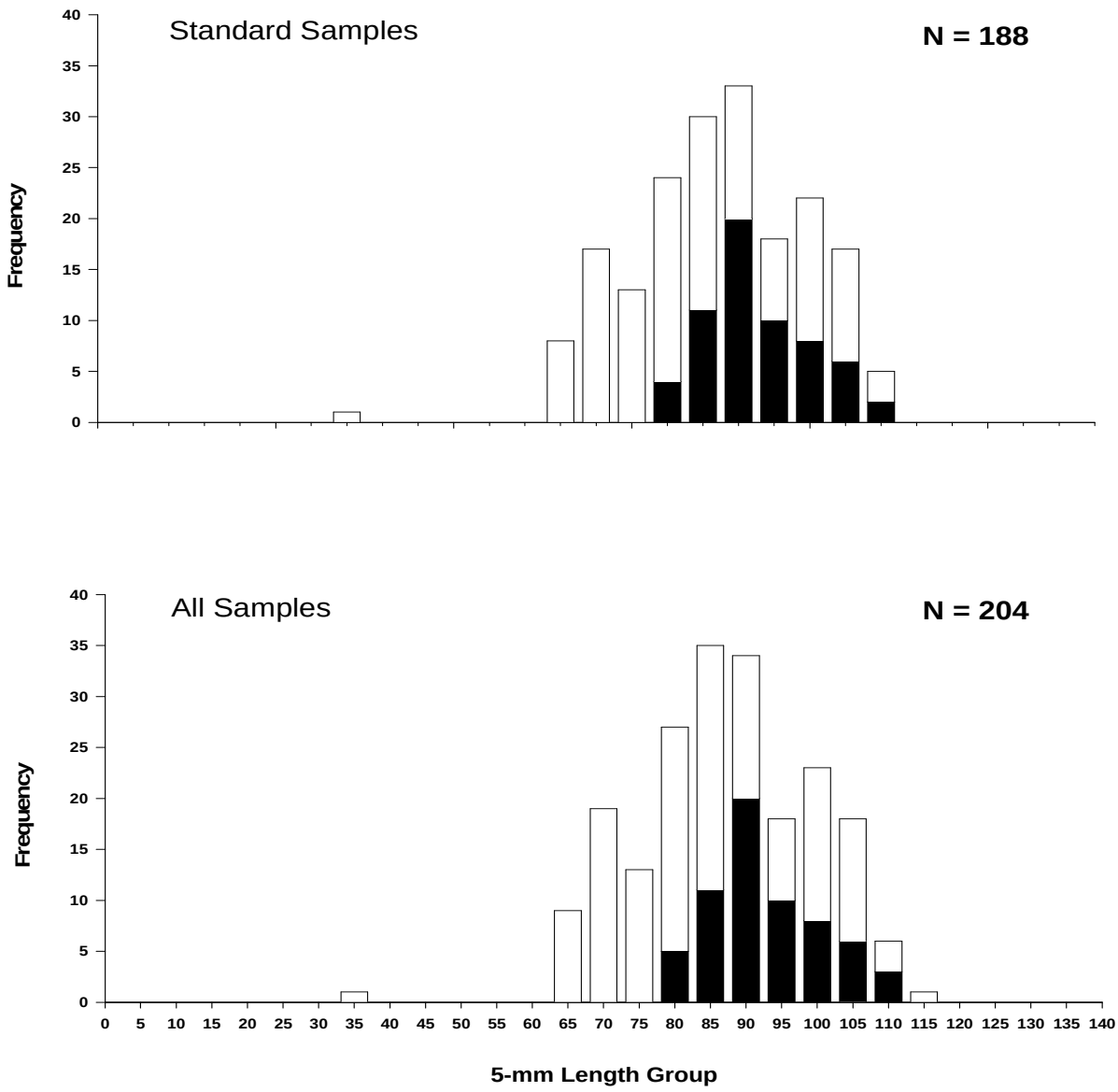

Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sand Shiner

A total of 761 sand shiners were sampled in Segment 3 during 2015, with all but one (otter trawl) being observed during mini-fyke net sampling. The mini-fyke net observations lead to a CPUE calculation of 4.32 fish/net night. The 2015 catch rate was much higher than recent years, with comparable catch rates not witnessed since 2009 (4.71 fish/ net night). A full comparison of mini-fyke net CPUE regarding sand shiner can be found in Figure 19.

The sand shiners observed in Segment 3 during 2015 averaged 38 mm in TL, with a range of 15 mm to 76 mm. The average and observed ranges fit well within the realm of those witnessed in previous years, suggesting that Segment 2 of the Missouri River continues to support a population of sand shiners made up of multiple age classes. A complete length frequency diagram can be witnessed in Figure 21.

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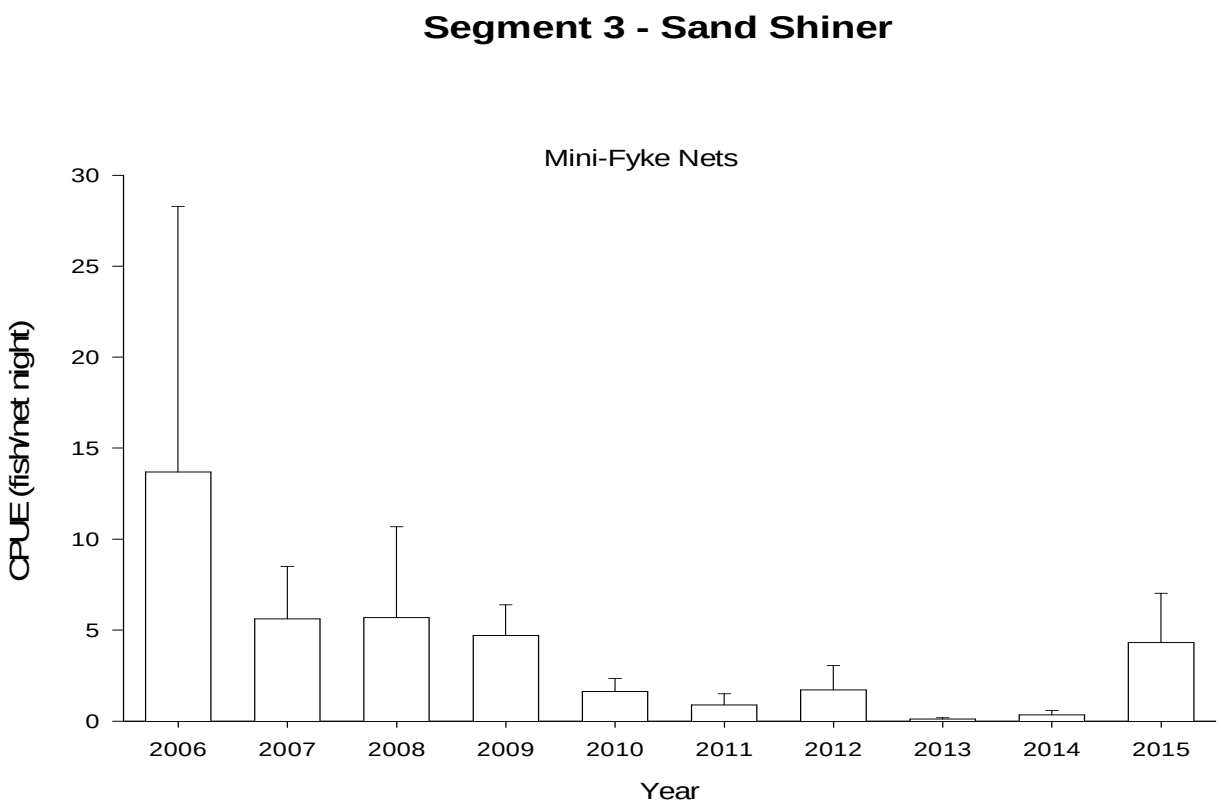

Figure 20. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in segment 3 of the Missouri River during fish community season 2006-2015.

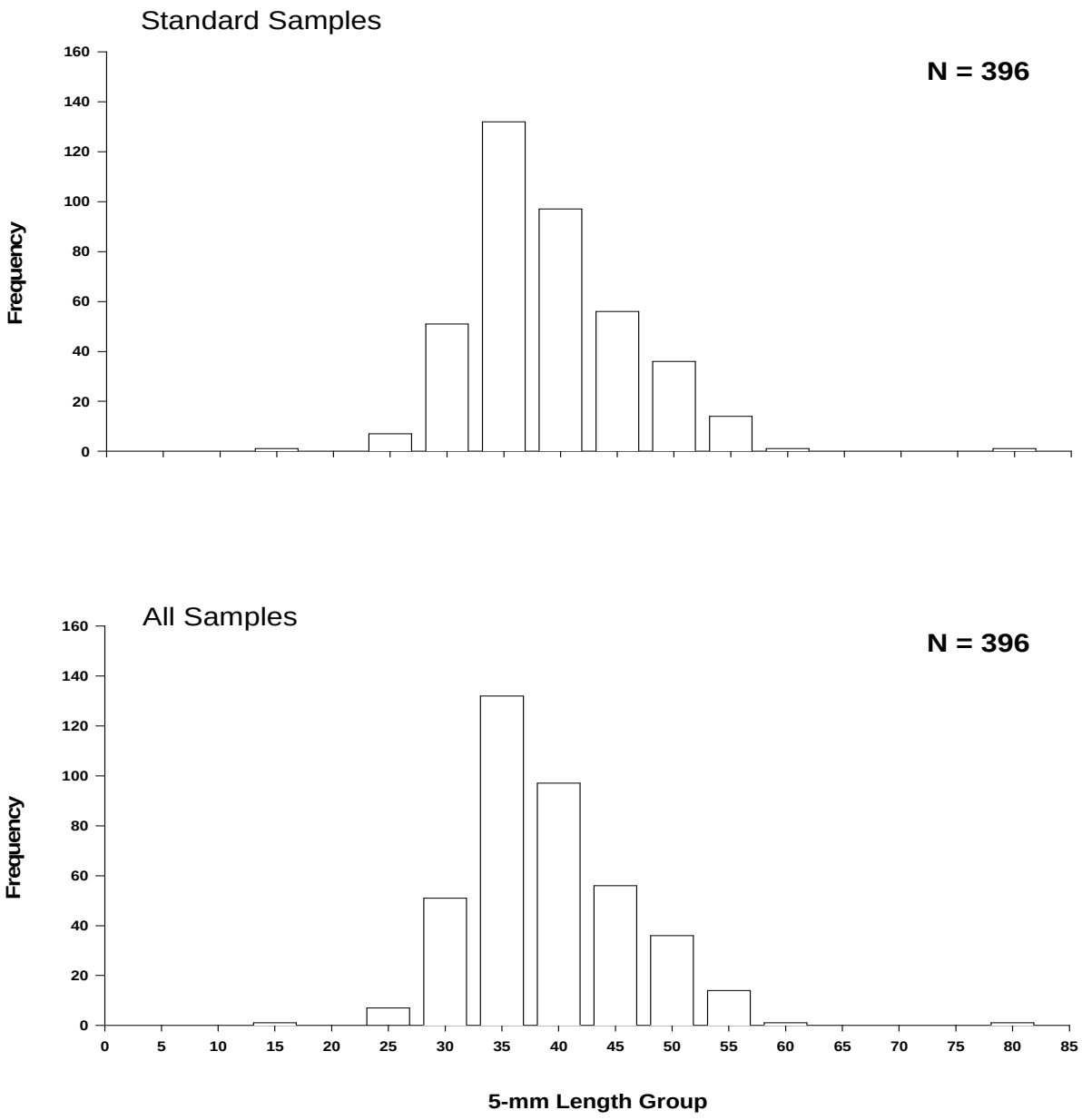

Figure 21. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

***Hybognathus* spp**.

A total of 76 *Hybognathus* spp., all of which were identified as western silvery minnows, were captured in Segment 3 during 2015 sampling events. The majority (N=74) were observed in mini-fyke nets, while the remaining individuals (N=2) were captured via otter trawl. The aforementioned mini-fyke net captures led to a CPUE of 0.42 fish/net night. The observed catch rate represents the third consecutive year of CPUE decline for western silvery minnows in Segment 3. A complete CPUE comparison among years can be found in Figure 22.

The *Hybognathus* spp. captured in Segment 3 during 2015 averaged 75 mm in TL, with a range of 27 mm to 110 mm. Although the observed range indicates multiple age classes, average length in Segment 3 can be heavily affected by dominant age classes. For example, the majority of *Hybognathus* spp. (74%) captured in 2015 were greater than 70 mm in TL. A complete visual of *Hybognathus* spp. length frequency for Segment 3 in 2015 can be found in Figure 23.

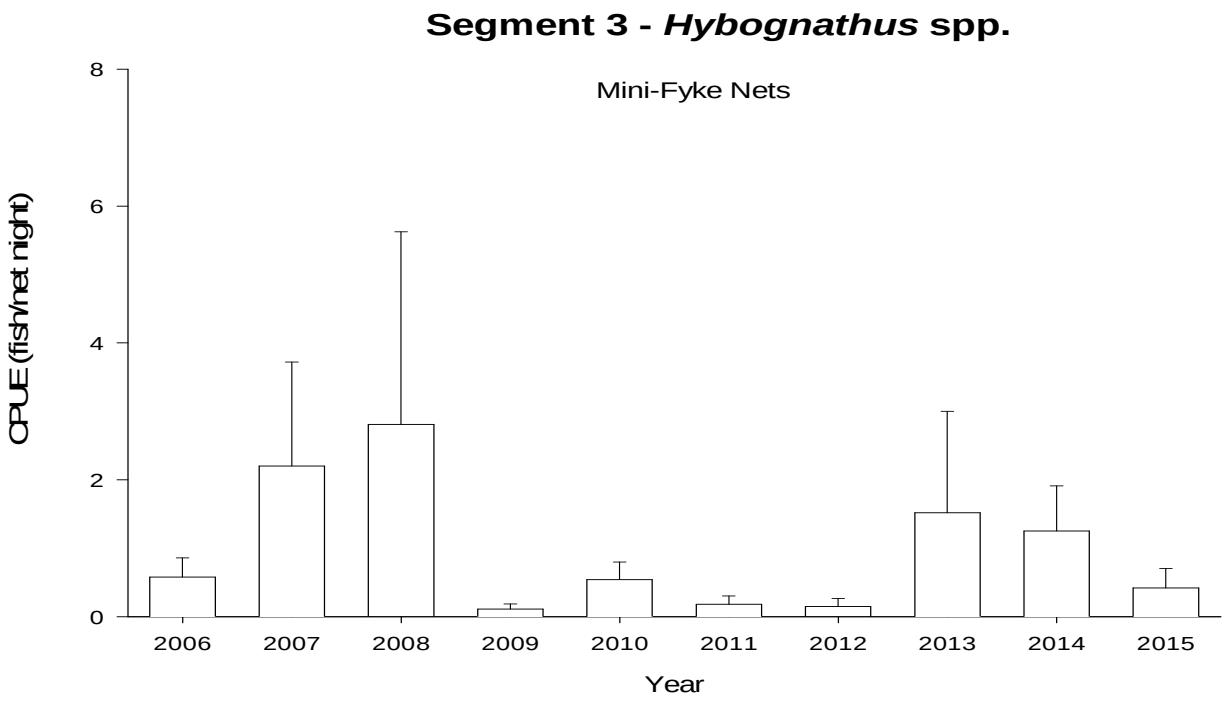

Figure 22. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 3 of the Missouri River during fish community season 2006-2015.

Segment 3 - *Hybognathus* spp.

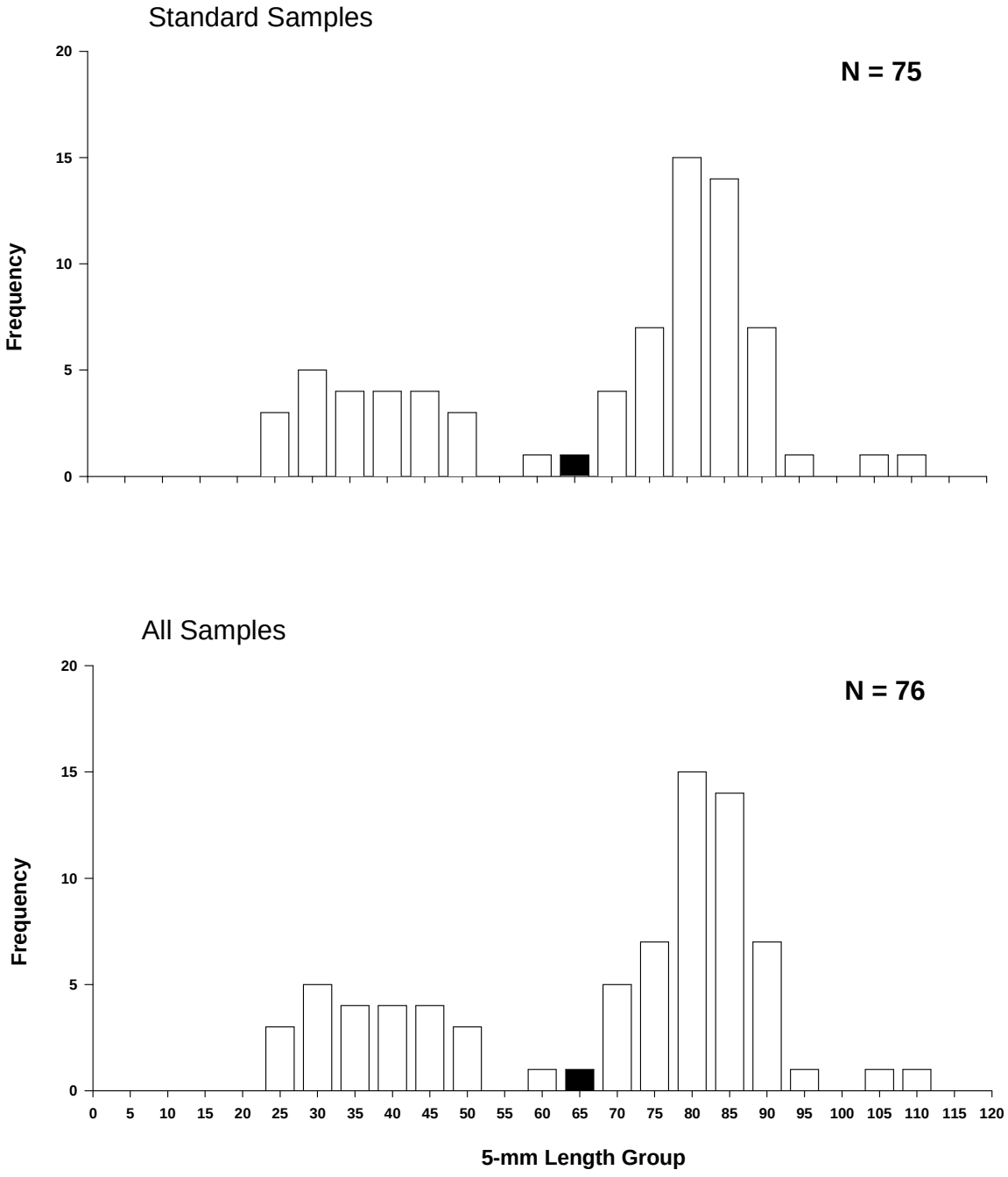

Figure 23. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Blue Sucker

During the 2015 sampling season a total of eleven blue suckers were observed in Segment 3, all of which were captured drifting trammel nets. Seasonally, observations were nearly equal; with five captures during sturgeon season and six captures during fish community season.

Blue sucker CPUE (Figure 24) in Segment 3 for 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 remains highly comparable to previous years of sampling. In comparison, the CPUE for otter trawl in Segment 3 during 2015 was 0.0 fish/100 m, which is a reoccurring phenomenon from year to year. Although captures in general are low, the otter trawl is a very poor gear to track the abundance of blue suckers in Segment 3.

Similarly to all other years sampled, the average size (707 mm TL) of blue suckers in Segment 3 during 2015 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. A further detailed length frequency regarding blue suckers captured in Segment 3 during 2015 can be found in Figure 26.

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

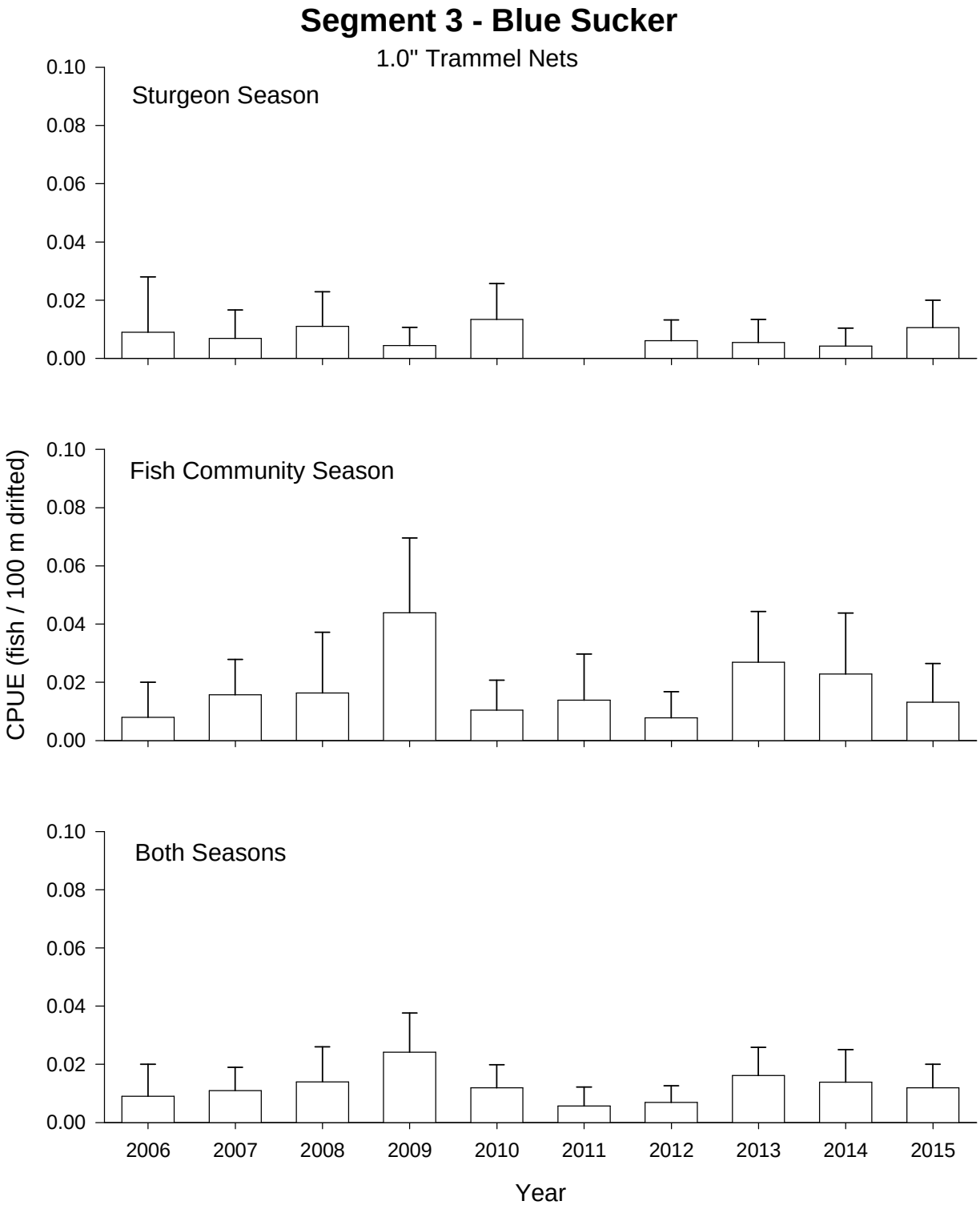

Figure 24. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2015.

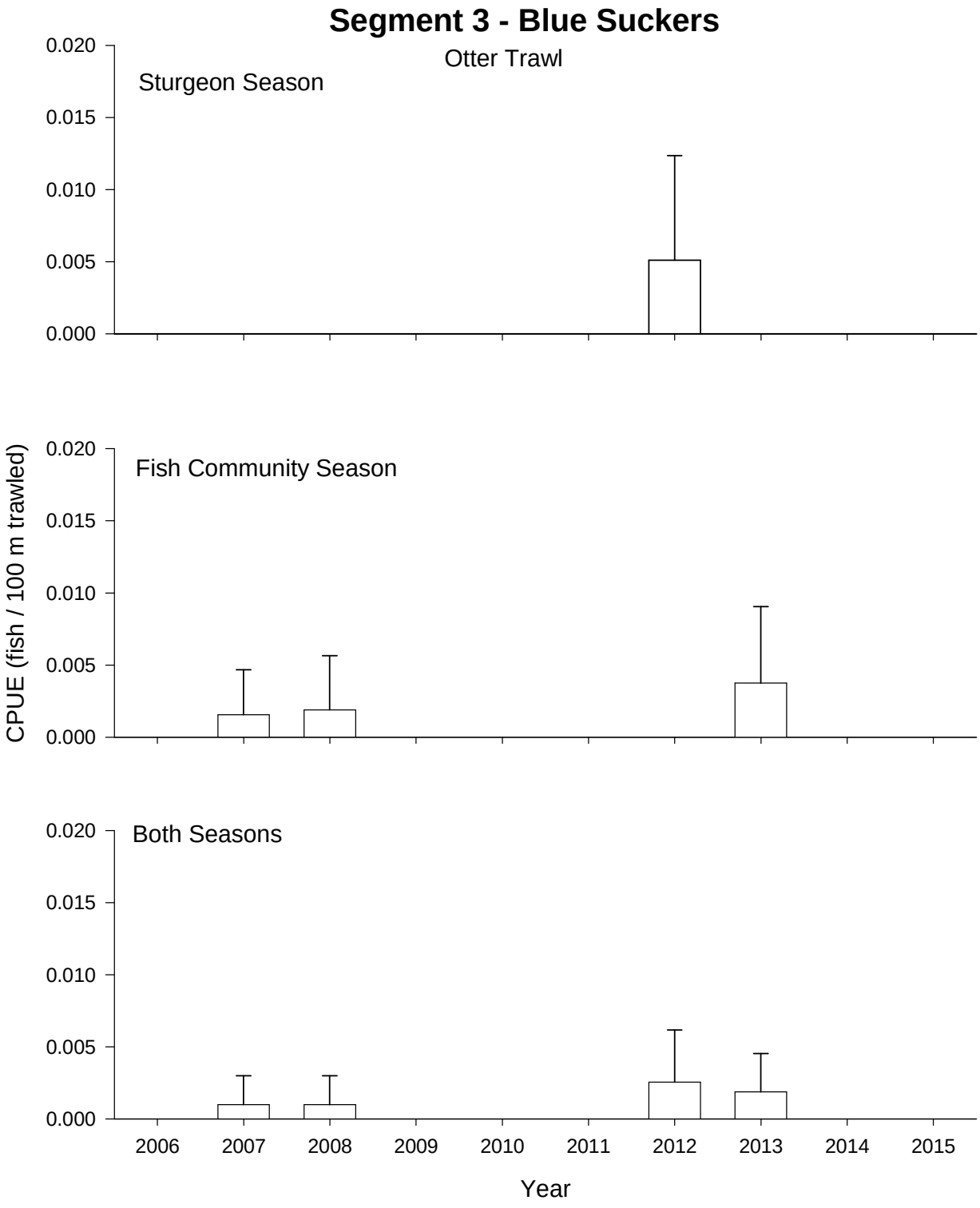

Figure 25. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 3 of the Missouri River from 2006-2015.

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	5	40	40	20	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	5	40	60	0	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0
		40	43	1	2	6	7	1	0
Otter Trawl		0	0	0	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	0	0	0	0	0	0	0	0	0
		41	42	14	2	0	0	0	1

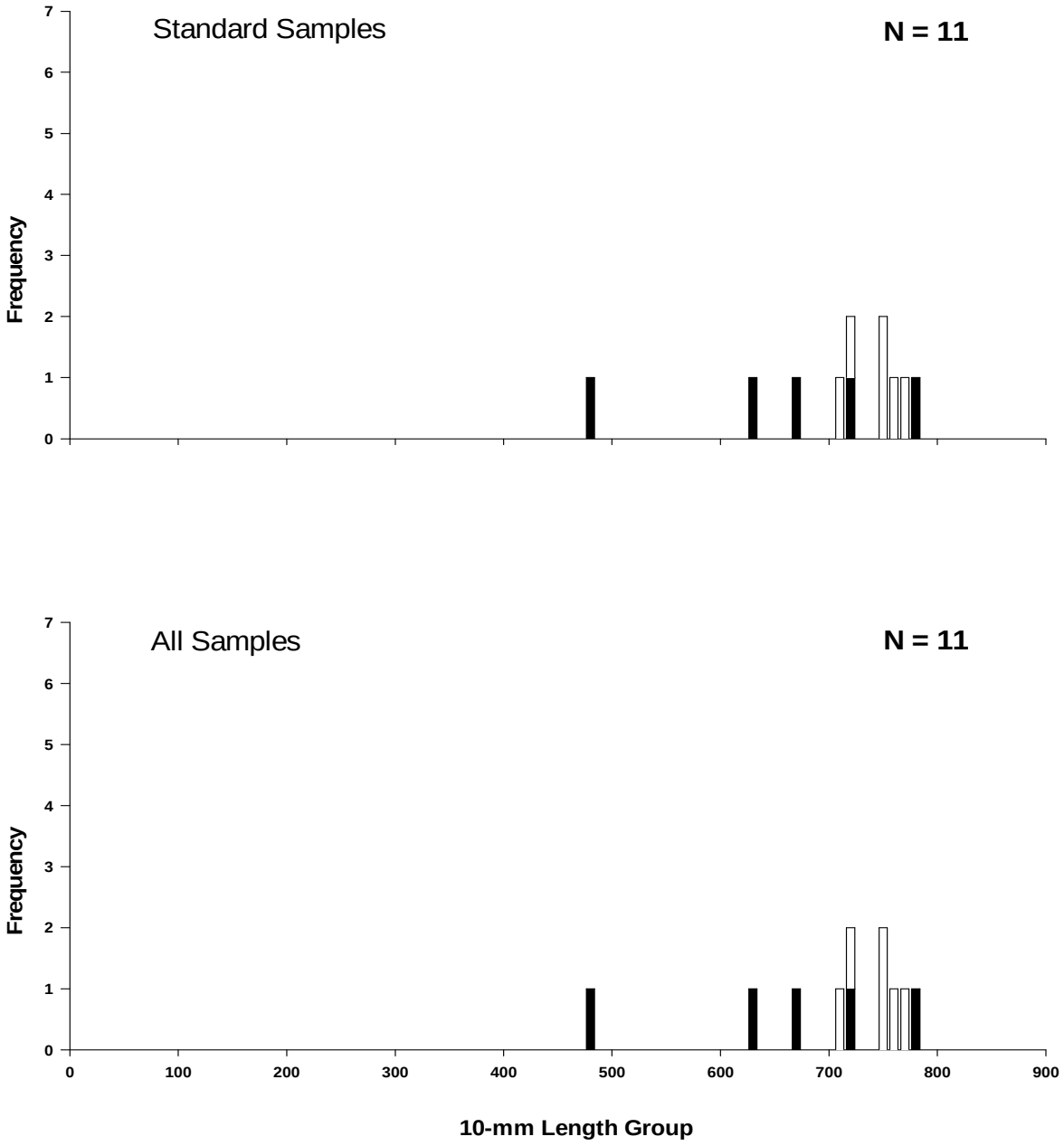

Figure 26. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sauger

A total of 328 sauger were collected within Segment 3 during 2015. Sauger continue to be represented by all standard gears, with rank of abundance in relation to gear as follows; trammel net (N=267), otter trawl (N=34), mini-fyke net (N=23) and trotline (N=4). In relation to gear deployment type, the largest proportion (N=294) were captured during random gear deployments, while the other 34, were captured during non-random or duplicate sampling. Temporally, more sauger were captured during sturgeon season (N=200), than during fish community season (N=128).

Catch per unit of effort for trammel net sampling (Figure 28) of sauger, across both seasons, in Segment 3 during 2015 exhibited a catch rate of 0.26 fish/100m. Within seasons, a higher CPUE was reported during sturgeon season (0.33 /100m) than fish community season (0.18 fish/100m). Comparatively, otter trawl CPUE (Figure 29) was calculated at 0.03 fish/100m across all three seasonal metrics; sturgeon season, fish community season, and combined-season.

Mini-fyke net captures of sauger were again a common occurrence in Segment 3 during 2015 sampling. The aforementioned captures led to a mini-fyke net CPUE calculated at 0.16 fish/net night, which is highly comparable to all years of sampling. A complete reference to Segment 3 sauger mini-fyke net CPUE across all years can be found in Figure 29.

The sauger observed in Segment 3 during the 2015 field season averaged 329 mm in TL, with a range of 58 mm to 545 mm. Although a wide variety of size classes were available to sample, gear type greatly affects which size class is observed. For example, mini-fyke nets observed the smallest average sized sauger (213 mm), while trotlines observed the largest (427 mm). Meanwhile, trammel net (344 mm) and otter trawl (278) sampled those size classes in between with the greatest efficiency. A full length frequency for 2015 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.

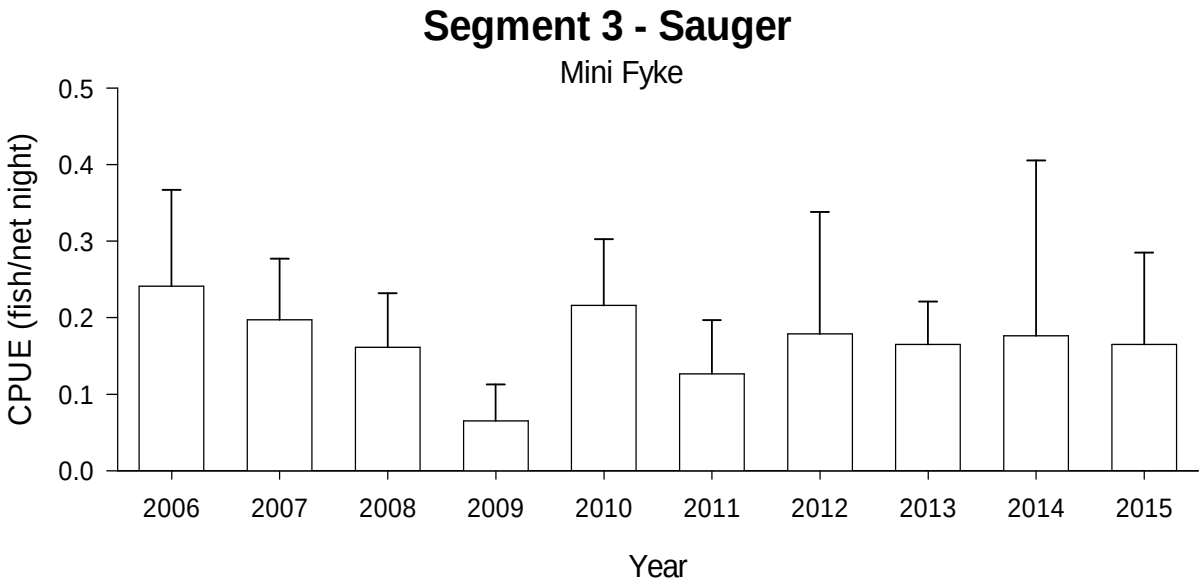

Figure 27. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 3 of the Missouri River from 2006-2015

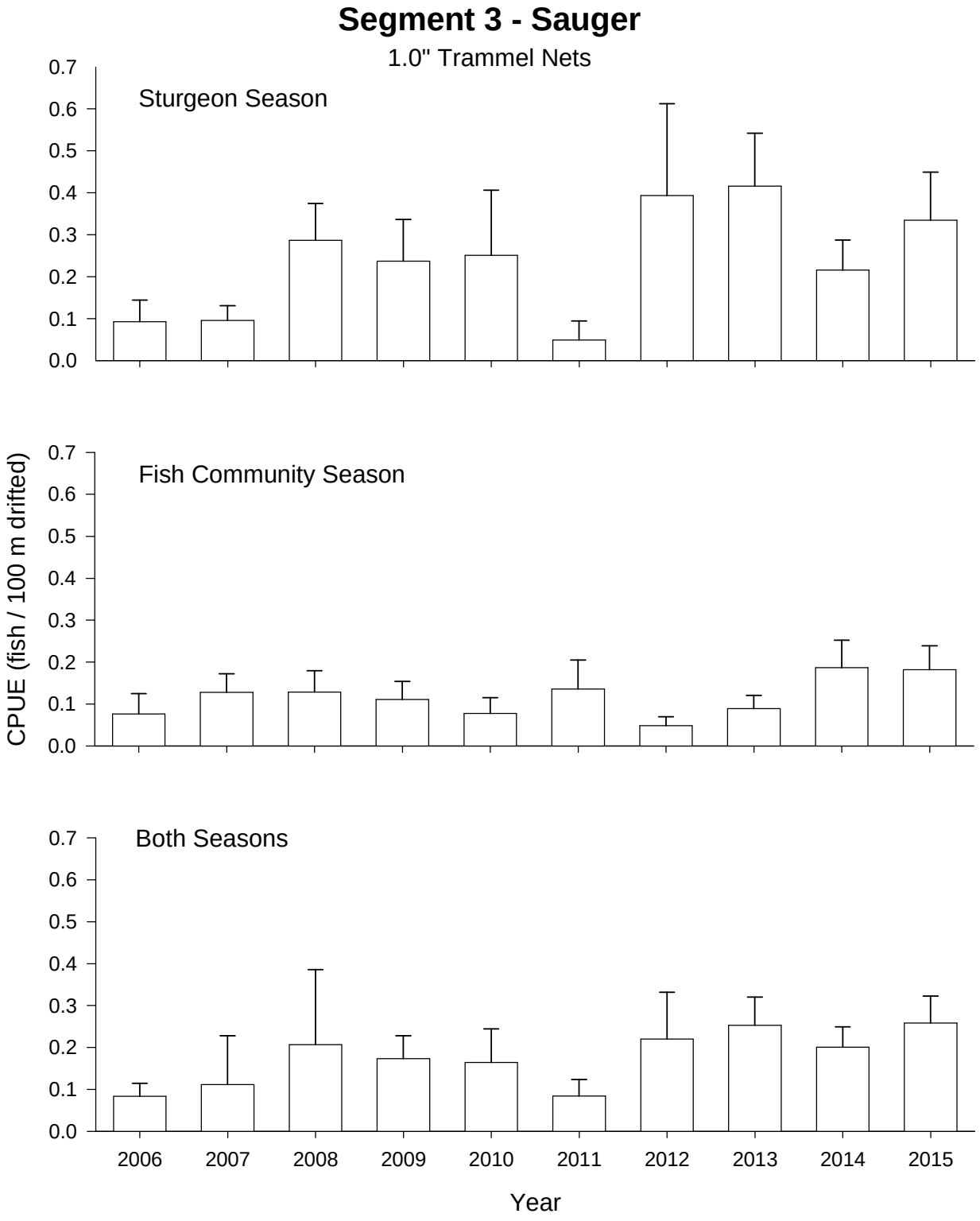

Figure 28. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0” trammel nets in Segment 3 of the Missouri River from 2006-2015

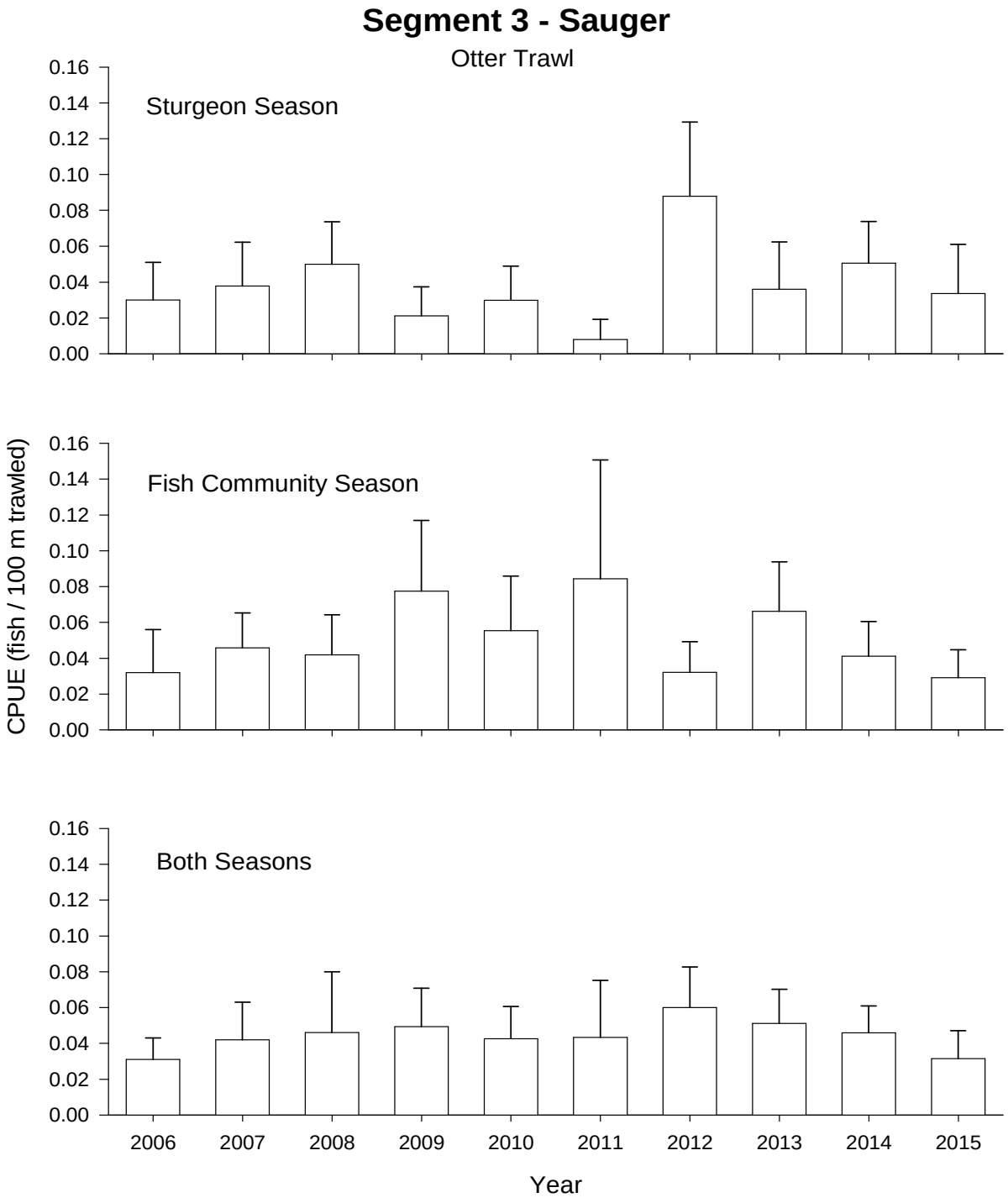

Figure 29. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 3 of the Missouri River from 2006-2015.

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 2015. 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**	**SCCS**	**SCN**	**TRML**	**CONF**
					Sturgeon Season				
1.0” Trammel Net	162	41	36	23	0	0	0	0	0
		39	35	26	0	0	0	0	0
Otter Trawl	16	56	31	13	0	0	0	0	0
		33	37	29	0	0	0	0	1
					Fish Community Season				
1.0” Trammel Net	74	47	20	31	0	0	0	0	0
		41	31	27	1	0	0	0	0
Mini-Fyke Net	23	26	57	0	0	4	13	0	0
		40	43	1	2	6	7	1	0
Otter Trawl	15	40	47	13	0	0	0	0	0
		37	33	29	0	0	0	0	0
					Both Seasons				
Trot Line	4	75	0	25	0	0	0	0	0
		41	42	14	2	0	0	0	1

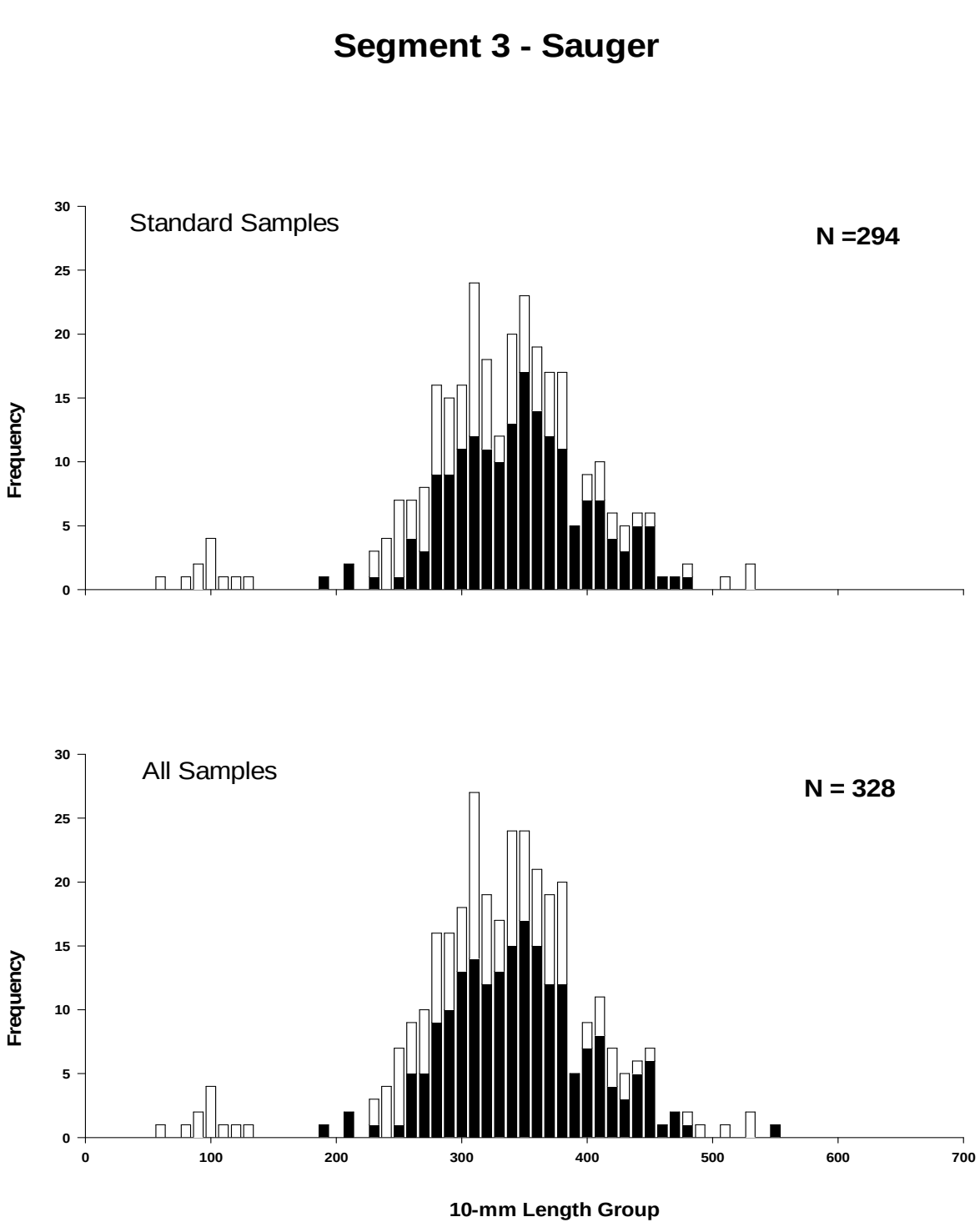

Figure 30. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 3 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Missouri River Fish Community

The sampling events which took place in Segment 3 during the 2015 field season led to the capture of 16,237 individual fish specimens, consisting of 32 different species. As with most years, mini-fyke nets have the ability to drive the total number of fish handled, and 2015 was no different. The five most abundant species, all of which rely heavily on mini-fyke net sampling ability, were; emerald shiner *Notropis atherinoides* (N=9,498), fathead minnow *Platygobio gracilis* (N=1,041), sand shiner *Notropis stramineus* (N=761), white sucker *Catostomus commersonii* (N=660), and river carpsucker *Carpiodes carpio* (N=642).

The sixth most abundant species, and the first to not rely mainly on mini-fyke net for capture probability, was shovelnose sturgeon *Scaphirhynchus platorynchus* (N=561). The seventh most abundance species, also common in mini-fyke nets captures, was longnose sucker *C. catostomus* (N=543). The eighth most abundant species, channel catfish *Ictalurus punctatus* (N=374), was caught commonly across all three large-bodied fish selecting gears, with rank in order of proportion as; trotline (42%), otter trawl (39%), and trammel net (19%).

The ninth most abundant species witnessed was sauger *Sander Canadensis* (N=328). While flathead chub *Platygobio gracilis* (N=326) were the tenth most abundant species observed. With flathead chub length ranging from 25 mm to 293 mm, captures were common across all four standard gears. Goldeye *Hiodon alosoides* (N=261) were the eleventh most commonly observed species. Although no goldeye were witnessed in mini-fyke nets, the other three standard gears all capture their fair share of individuals.

Shorthead redhorse *Moxostoma macrolepidotum* (N=238), which was sampled in both YOY form in mini-fyke net, as well as juvenile and adult forms with the other three standard gears, was the 12th most abundant species captured. Sicklefin chub *Macrhybopsis meeki*, which was captured solely with otter trawl, was the 13th most abundant fish sampled, followed by the similarly captured sturgeon chub *M. gelida* (N=157).

Other species with less than 100 total captures in order of abundance were; white crappie *Pomoxis annularis* (N=92), pallid sturgeon *S. albus* (N=90), black bullhead *Ameiurus melas* (N=83), walleye *S. vitreus* (N=77), western silvery minnow *Hybognathus argyritis* (N=65), common carp *Cyprinus carpio* (N=61), smallmouth buffalo *Ictiobus bubalus* (N=31), stonecat *Noturus flavus* (N=27) and freshwater drum *Aplodinotus grunniens* (N=21).

Other species that were captured, but in low abundance were; spottail shiner *N. hudsonius*, burbot *Lota lota*, northern pike *Esox lucius*, blue sucker *Cycleptus elongates*, bigmouth buffalo *I. cyprinellus*, longnose dace *Rhinichthys cataractae*, lake whitefish *Coregonus clupeaformis*, white bass *Morone chrysops*, and smallmouth bass *Micropterus dolomieu.*

Discussion

The 2015 sampling year marked the 10th consecutive field season for Pallid Sturgeon Population Assessment crews in Segment 3 of the Missouri River in Montana. With a reduction in the number of bends, from 22 to 12, scheduled to be sampled in 2016, crews were excited to put in the last full effort in Segment 3 for the foreseeable future.

Since an all time high of total captures (Figure 10) was witnessed during 2013 (N=260), total captures have been on a sharp decline in Segment 3; down to 164 in 2014 and 90 total captures in 2015. Although Segment 3 was once thought to be a highly sought after habitat for hatchery reared juvenile pallid sturgeon, total captures in Segments 2 and 4 have witnessed elevated captures during that same time frame. Although it seems obvious that the influx of pallid sturgeon in Segment 4 would be due to the much more naturalized and productive nature of that habitat, it is unclear why some pallid appear to be vacating Segment 3 and moving upstream into the colder, clearer waters of Segment 2. Localized hotspots, once targeted in the lower part of Segment 3 for population estimates, seem to be fewer and further in between, and when found, are not as dense as years past.

Although all three of the pallid-selecting standard gears are viable options to sample pallid sturgeon abundance, it appears that trammel net and trotline are the most effective gears, particularly for sampling both larger and a wider variety of pallid sturgeon size classes. Catch rates for these gears (Figures 5-7), particularly otter trawl and trotline, appear to correlate with the lower total captures of pallid sturgeon in Segment 3.

Pallid sturgeon captured in Segment 3 during the 2015 field year averaged 459 mm in fork length, and 604 g in weight, with a range of 315 mm TL to 1170 mm TL. The continual capture of larger individuals (Figure 3) indicates that hatchery-reared pallid sturgeon stocked at a young age are continuing to grow and recruit into the population. Although, with a large proportion of the pallid sturgeon captured falling into the stock-sized length category and considering this size class is made up of multiple ages classes, further investigation into growth rates may be warranted. Furthermore, by only using relative condition (Figure 4) as a metric of health, the data suggests the pallid sturgeon residing in Segment 3 are healthy.

Currently, hatchery reared pallid sturgeon are thriving in the Missouri River within RMPA 2. Nevertheless, the amount of quality habitat for pallid sturgeon and in particular pallid

sturgeon of larger sizes and older age classes seems to be significantly limited by the effects of Fort Peck Dam. Most larger hatchery reared pallid sturgeon captured within RPMA 2 are captured at the downstream most areas, where tributary influences and natural solar warming have somewhat naturalized the river. This is similar to the behavior of adult pallid sturgeon residing within RPMA 2. Those fish spend the majority of the year in the lower sections of the river downstream of the confluence of the Missouri and Yellowstone Rivers. As hatchery reared pallid sturgeon grow, there may be more competition among themselves and other predatory fish for the resources of the lower Missouri River. Trawling and mini fyke net data indicate a significantly reduced population of native cyprinids in the upper portion of the Missouri River downstream of Fort Peck Dam. Thus, as pallid sturgeon grow in size and become obligate piscivores, they will likely need to reside in the lower portion of the river where food is more available. Continuing to monitor this population for indications of density dependent growth and survival will be critical for clearly understanding the long-term viability of this population, especially in the very altered habitat that which they reside in.

Acknowledgments

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

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

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

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

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

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

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

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

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 2015. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

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

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
BKBH	0	0	0	0	0	0
		0	0	0	0	0
BMBF	8	0.009	0.002	0.014	0.014	0
		0.007	0.005	0.018	0.014	0
BRBT	0	0	0	0	0	0
		0	0	0	0	0
BUSK	10	0.012	0.015	0.016	0.003	0
		0.008	0.016	0.014	0.007	0
CARP	24	0.025	0.028	0.026	0.02	0
		0.013	0.023	0.022	0.022	0
CNCF	72	0.077	0.067	0.08	0.092	0
		0.025	0.039	0.042	0.055	0
ERSN	0	0	0	0	0	0
		0	0	0	0	0
FHCB	93	0.096	0.114	0.094	0.072	0
		0.028	0.053	0.042	0.045	0
FHMW	0	0	0	0	0	0
		0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
FWDM	4	0.004	0.002	0.006	0.003	0
		0.004	0.004	0.008	0.007	0
GDEY	184	0.224	0.212	0.299	0.143	0.514
		0.062	0.079	0.151	0.076	0.024
HBNS	0	0	0	0	0	0
		0	0	0	0	0
LKWF	4	0.004	0.008	0.003	0	0
		0.005	0.012	0.006	0	0
LNDC	0	0	0	0	0	0
		0	0	0	0	0
LNSK	2	0.002	0.002	0.003	0	0
		0.003	0.005	0.006	0	0
NFSH	0	0	0	0	0	0
		0	0	0	0	0
NTPK	3	0.004	0.004	0.007	0	0
		0.004	0.007	0.01	0	0
PDSG	25	0.03	0.039	0.039	0.007	0
		0.017	0.031	0.035	0.01	0
RVCS	79	0.093	0.088	0.091	0.107	0
		0.031	0.043	0.052	0.072	0

species	Total Catch	Overall CPUE	CHXO CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
SFCB	0	0	0	0	0	0
		0	0	0	0	0
SGCB	0	0	0	0	0	0
		0	0	0	0	0
SGER	236	0.258	0.281	0.242	0.245	0.263
		0.064	0.115	0.091	0.128	0.526
SHRH	59	0.071	0.097	0.063	0.04	0.251
		0.023	0.039	0.045	0.033	0.503
SMBF	14	0.016	0.012	0.016	0.022	0
		0.012	0.016	0.02	0.027	0
SMBS	0	0	0	0	0	0
		0	0	0	0	0
SNSG	274	0.319	0.422	0.297	0.181	1.017
		0.06	0.121	0.084	0.08	0.981
SNSN	0	0	0	0	0	0
		0	0	0	0	0
STCT	0	0	0	0	0	0
		0	0	0	0	0
STSN	0	0	0	0	0	0
		0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
WLYE	45	0.05	0.046	0.059	0.046	0
		0.02	0.032	0.039	0.036	0
WSMW	0	0	0	0	0	0
		0	0	0	0	0
WTBS	2	0.002	0.002	0.003	0	0
		0.003	0.005	0.006	0	0
WTCP	0	0	0	0	0	0
		0	0	0	0	0
WTSK	2	0.002	0.004	0.003	0	0
		0.003	0.007	0.006	0	0

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

			CHXO	CONF	ISB	OSB
species	**Total Catch**	**Overall CPUE**	**CHNB**	**CHNB**	**CHNB**	**CHNB**
BKBH	0	0	0	0	0	0
		0	0	0	0	0
BMBF	0	0	0	0	0	0
		0	0	0	0	0
BRBT	3	0.003	0	0	0.003	0.007
		0.003	0	0	0.005	0.009
BUSK	0	0	0	0	0	0
		0	0	0	0	0
CARP	9	0.012	0.009	0.347	0.016	0.003
		0.008	0.011	0.694	0.017	0.006
CNCF	136	0.154	0.101	0	0.196	0.17
		0.094	0.074	0	0.176	0.224
ERSN	74	0.071	0.129	0	0.05	0.032
		0.05	0.124	0	0.059	0.047
FHCB	101	0.098	0.102	0	0.104	0.087
		0.029	0.057	0	0.047	0.046
FHMW	0	0	0	0	0	0
		0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB
			CHNB	CHNB	CHNB	CHNB
FWDM	5	0.006	0	0.347	0.011	0
		0.009	0	0.694	0.021	0
GDEY	2	0.002	0.003	0	0.003	0
		0.003	0.005	0	0.005	0
HBNS	0	0	0	0	0	0
		0	0	0	0	0
LKWF	1	0.001	0	0	0	0.003
		0.002	0	0	0	0.006
LNDC	0	0	0	0	0	0
		0	0	0	0	0
LNSK	4	0.004	0.008	0	0.003	0
		0.004	0.009	0	0.005	0
NFSH	0	0	0	0	0	0
		0	0	0	0	0
NTPK	0	0	0	0	0	0
		0	0	0	0	0
PDSG	16	0.016	0.014	0	0.014	0.02
		0.008	0.012	0	0.013	0.016
RVCS	5	0.005	0	0	0.005	0.009
		0.004	0	0	0.008	0.011

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB
			CHNB	CHNB	CHNB	CHNB
SFCB	188	0.18	0.206	0	0.163	0.176
		0.036	0.06	0	0.059	0.07
SGCB	149	0.145	0.165	0	0.135	0.136
		0.038	0.067	0	0.07	0.061
SGER	31	0.031	0.041	0	0.034	0.018
		0.016	0.036	0	0.022	0.019
SHRH	37	0.041	0.03	0	0.051	0.043
		0.017	0.023	0	0.03	0.034
SMBF	2	0.002	0.003	0	0.003	0
		0.003	0.006	0	0.005	0
SMBS	0	0	0	0	0	0
		0	0	0	0	0
SNSG	84	0.081	0.123	0	0.036	0.089
		0.021	0.05	0	0.019	0.035
SNSN	1	0.001	0	0	0	0.003
		0.002	0	0	0	0.006
STCT	10	0.011	0.005	0	0.016	0.012
		0.007	0.008	0	0.014	0.014
STSN	1	0.001	0	0	0	0.003
		0.002	0	0	0	0.006

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB
			CHNB	CHNB	CHNB	CHNB
WLYE	18	0.022	0.02	0	0.029	0.017
		0.012	0.017	0	0.022	0.023
WSMW	1	0.001	0	0	0.003	0
		0.002	0	0	0.005	0
WTBS	0	0	0	0	0	0
		0	0	0	0	0
WTCP	0	0	0	0	0	0
		0	0	0	0	0
WTSK	5	0.005	0.005	0	0.005	0.003
		0.004	0.008	0	0.007	0.006

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

species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS	TRML BARS
BKBH	83	0.472	0	0	0	0	0	6.385	0
		0.943	0	0	.	0	0	12.769	0
BMBF	2	0.011	0.014	0	0	0	0	0.077	0
		0.016	0.028	0	.	0	0	0.154	0
BRBT	4	0.023	0.028	0.026	0	0	0	0	0
		0.023	0.04	0.037	.	0	0	0	0
BUSK	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
CARP	14	0.08	0.085	0.066	0	0	0.1	0.077	0.5
		0.041	0.066	0.057	.	0	0.2	0.154	1
CNCF	1	0.006	0.014	0	0	0	0	0	0
		0.011	0.028	0	.	0	0	0	0
ERSN	9409	53.46	73.563	52.395	2	35.333	7.6	1.538	0
		22.792	45.315	30.766	.	47.893	9.513	1.19	0
FHCB	60	0.341	0.38	0.382	0	0	0	0.308	0
		0.162	0.27	0.265	.	0	0	0.474	0
FHMW	1041	5.915	2.338	11.197	0	1	0.8	0.846	1
		8.737	1.992	20.158	.	1.155	0.777	0.812	2

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRML
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
FWDM	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
GDEY	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
HBNS	11	0.063	0	0.145	0	0	0	0	0
		0.097	0	0.224	.	0	0	0	0
LKWF	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
LNDC	8	0.045	0.056	0.053	0	0	0	0	0
		0.042	0.055	0.083	.	0	0	0	0
LNSK	537	3.051	0.338	6.605	0	0	0.4	0.538	0
		5.615	0.464	12.998	.	0	0.442	0.923	0
NFSH	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
NTPK	6	0.034	0.028	0.026	0	0	0	0.154	0
		0.027	0.04	0.037	.	0	0	0.208	0
PDSG	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
RVCS	542	3.08	0.394	6.303	0	0	1.7	1.385	0
		5.091	0.369	11.782	.	0	1.579	1.847	0

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL	SCCS	SCN	TRML
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
SFCB	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
SGCB	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
SGER	23	0.131	0.085	0.171	0	0	0.1	0.231	0
		0.07	0.066	0.142	.	0	0.2	0.243	0
SHRH	80	0.455	0.451	0.447	0	0.333	0.9	0.308	0
		0.192	0.265	0.301	.	0.667	1.59	0.417	0
SMBF	14	0.08	0.127	0.066	0	0	0	0	0
		0.096	0.227	0.068	.	0	0	0	0
SMBS	1	0.006	0	0	0	0	0	0	0.5
		0.011	0	0	.	0	0	0	1
SNSG	0	0	0	0	0	0	0	0	0
		0	0	0	.	0	0	0	0
SNSN	760	4.318	4.211	5.408	0	0	0.4	0.538	19.5
		2.712	3.837	5.081	.	0	0.442	0.923	33
STCT	2	0.011	0.028	0	0	0	0	0	0
		0.016	0.04	0	.	0	0	0	0

species	Total Catch	Overall CPUE	CHXO BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS	TRML BARS
STSN	18	0.102	0.042	0.066	0	0	0	0	5
		0.111	0.048	0.087	.	0	0	0	8
WLYE	4	0.023	0.028	0.013	0	0	0	0.077	0
		0.023	0.04	0.026	.	0	0	0.154	0
WSMW	63	0.358	0.648	0.171	0	0	0	0.308	0
		0.272	0.645	0.165	.	0	0	0.35	0
WTBS	1	0.006	0	0.013	0	0	0	0	0
		0.011	0	0.026	.	0	0	0	0
WTCP	92	0.523	0.563	0.053	0	0	1.1	2.231	4
		0.276	0.455	0.052	.	0	1.775	2.053	4
WTSK	647	3.676	0.761	7.605	0	0.333	0.4	0.769	0
		6.102	0.641	14.119	.	0.667	0.611	0.852	0

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

			CHXO	CONF	ISB	OSB	SCCL
species	**Total Catch**	**Overall CPUE**	**CHNB**	**CHNB**	**CHNB**	**CHNB**	**CHNB**
BKBH	0	0	0	0	0	0	0
		0	0	0	0	0	0
BMBF	0	0	0	0	0	0	0
		0	0	0	0	0	0
BRBT	6	0.036	0.059	0	0	0.087	0
		0.045	0.093	0	0	0.174	0
BUSK	0	0	0	0	0	0	0
		0	0	0	0	0	0
CARP	10	0.06	0.015	0.5	0.114	0	0
		0.047	0.029	1	0.104	0	0
CNCF	157	0.94	0.853	0.5	0.929	1.261	1
		0.225	0.263	1	0.427	0.606	0.816
ERSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
FHCB	24	0.144	0.132	0	0.171	0.087	0.25
		0.066	0.083	0	0.129	0.12	0.5
FHMW	0	0	0	0	0	0	0
		0	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB
FWDM	10	0.06	0	3	0.057	0	0
		0.061	0	2	0.069	0	0
GDEY	52	0.311	0.324	0.5	0.243	0.261	1.5
		0.096	0.17	1	0.125	0.187	0.577
HBNS	0	0	0	0	0	0	0
		0	0	0	0	0	0
LKWF	1	0.006	0	0	0.014	0	0
		0.012	0	0	0.029	0	0
LNDC	0	0	0	0	0	0	0
		0	0	0	0	0	0
LNSK	0	0	0	0	0	0	0
		0	0	0	0	0	0
NFSH	0	0	0	0	0	0	0
		0	0	0	0	0	0
NTPK	3	0.018	0.044	0	0	0	0
		0.021	0.05	0	0	0	0
PDSG	37	0.222	0.221	0	0.257	0.174	0
		0.08	0.117	0	0.139	0.205	0
RVCS	0	0	0	0	0	0	0
		0	0	0	0	0	0

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB
SFCB	0	0	0	0	0	0	0
		0	0	0	0	0	0
SGCB	0	0	0	0	0	0	0
		0	0	0	0	0	0
SGER	4	0.024	0.044	0	0	0.043	0
		0.024	0.05	0	0	0.087	0
SHRH	39	0.234	0.25	0	0.171	0.391	0.25
		0.078	0.141	0	0.099	0.208	0.5
SMBF	1	0.006	0	0	0.014	0	0
		0.012	0	0	0.029	0	0
SMBS	0	0	0	0	0	0	0
		0	0	0	0	0	0
SNSG	134	0.802	0.691	0	1	0.609	0.75
		0.214	0.354	0	0.338	0.431	1.5
SNSN	0	0	0	0	0	0	0
		0	0	0	0	0	0
STCT	15	0.09	0.059	0	0.1	0.174	0
		0.053	0.057	0	0.092	0.205	0
STSN	0	0	0	0	0	0	0
		0	0	0	0	0	0

			CHXO	CONF	ISB	OSB	SCCL
species	**Total Catch**	**Overall CPUE**	**CHNB**	**CHNB**	**CHNB**	**CHNB**	**CHNB**
WLYE	5	0.03	0.059	0	0.014	0	0
		0.026	0.057	0	0.029	0	0
WSMW	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTBS	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTCP	0	0	0	0	0	0	0
		0	0	0	0	0	0
WTSK	1	0.006	0	0	0.014	0	0
		0.012	0	0	0.029	0	0

Appendix G. Hatchery names, locations and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2015 for Segment 3 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

	Sturgeon Season		**Fish Community Season**			**Both Seasons**
species	1.0” Trammel Net	Otter Trawl	1.0” Trammel Net	Mini Fyke	Otter Trawl	Trotline
BKBH	0.000	0.000	0.000	0.472	0.000	0.000
BMBF	0.013	0.000	0.006	0.011	0.000	0.000
BRBT	0.000	0.004	0.000	0.023	0.002	0.036
BUSK	0.011	0.000	0.013	0.000	0.000	0.000
CARP	0.039	0.012	0.011	0.080	0.011	0.060
CNCF	0.081	0.253	0.074	0.006	0.056	0.940
ERSN	0.000	0.009	0.000	53.460	0.134	0.000
FHCB	0.100	0.072	0.091	0.341	0.124	0.144
FHMW	0.000	0.000	0.000	5.915	0.000	0.000
FWDM	0.007	0.004	0.000	0.000	0.008	0.060
GDEY	0.236	0.002	0.211	0.000	0.002	0.311
HBNS	0.000	0.000	0.000	0.063	0.000	0.000
LKWF	0.002	0.000	0.007	0.000	0.002	0.006
LNDC	0.000	0.000	0.000	0.045	0.000	0.000
LNSK	0.004	0.004	0.000	3.051	0.004	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000
NTPK	0.007	0.000	0.000	0.034	0.000	0.018

	Sturgeon Season		Fish Community Season			Both Seasons
species	1.0” Trammel Net	Otter Trawl	1.0” Trammel Net	Mini Fyke	Otter Trawl	Trotline
PDSG	0.028	0.016	0.032	0.000	0.016	0.222
RVCS	0.148	0.006	0.038	3.080	0.004	0.000
SFCB	0.000	0.117	0.000	0.000	0.244	0.000
SGCB	0.000	0.112	0.000	0.000	0.178	0.000
SGER	0.335	0.034	0.182	0.131	0.029	0.024
SHRH	0.030	0.025	0.112	0.455	0.058	0.234
SMBF	0.019	0.002	0.013	0.080	0.002	0.006
SMBS	0.000	0.000	0.000	0.006	0.000	0.000
SNSG	0.160	0.072	0.478	0.000	0.091	0.802
SNSN	0.000	0.000	0.000	4.318	0.002	0.000
STCT	0.000	0.014	0.000	0.011	0.009	0.090
STSN	0.000	0.000	0.000	0.102	0.002	0.000
WLYE	0.075	0.016	0.025	0.023	0.029	0.030
WSMW	0.000	0.002	0.000	0.358	0.000	0.000
WTBS	0.004	0.000	0.000	0.006	0.000	0.000
WTCP	0.000	0.000	0.000	0.523	0.000	0.000
WTSK	0.002	0.005	0.003	3.676	0.004	0.006

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 3 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2006 - 2015.

Bend Number	Bend River Mile	Coordinates* Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
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		
7	1693.5	48.09039	105.3633										ST,FC
8	1692	48.09134	105.3734		ST, FC	ST, FC							
9	1690.5	48.0929	105.3336							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			

23	1670	48.06138	105.1035									ST,FC	ST,FC
24	1668.5	48.06103	105.0967							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						
29	1663	48.08657	105.0019									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									
33	1657	48.09531	104.9813	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
39	1650	48.13711	104.9218						ST, FC		ST,FC		
40	1648.5	48.14876	104.8982		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

50	1636.5	48.10395	104.6821	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				
57	1629.5	48.13993	104.6043			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				
62	1623	48.11155	104.5103	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			
88	1588.5												
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	