# 2016 Annual Report

# Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 2

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

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# EXECUTIVE SUMMARY

The 2016 field season marked the 11th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 2 of the Missouri River. However, it was the first year without using the otter trawl and mini-fyke nets as standard gears. Despite the loss of the otter trawl as a sampling gear, crews were still able to capture 53 hatchery-reared juvenile pallid sturgeon, which was the fifth highest total recorded for Segment 2 since the Program's inception in 2006.

A total of 12 randomly selected river bends were sampled within Segment 2 during 2016. All 12 bends were sampled once each, with trammel net during both sturgeon and fish community seasons, respectively. Comparatively, trotlines were used to sample each bend once; with half of the bends sampled during sturgeon season and the other half sampled during fish community season. A total of 221 trammel nets were drifted throughout Segment 2 in 2016, which accounted for 50.8 km of river being sampled. Additionally, using the standard sampling method of eight trotlines per bend, 96 over-night trotlines were deployed in Segment 2 during 2016, totaling 1,920 nightcrawler-baited hooks.

A total of 53 pallid sturgeon were captured in Segment 2 during the 2016 field season, all of which were of hatchery origin. Temporally, 18 were captured during sturgeon season and the 35 were captured during fish community season. Random sampling resulted in the capture of 43 pallid sturgeon, while non-random duplicate sampling accounted for an additional 10. Trammel net was the most successful gear at capturing pallid sturgeon (N=31), while trotlines sampled the remaining 22 individuals. As in previous years, localized "hotspots" weighed heavily on pallid sturgeon capture data; with a single event during 2016 leading to the capture of 16 individual hatchery-reared juvenile pallid sturgeon. This "hotspot" was found near the confluence of the Missouri and Milk Rivers in the most upstream portion of Segment 2 on August 1st and 2nd.

Trammel net CPUE for Segment 2 during 2016 was calculated at 0.02 fish/100m and 0.09 fish/100m for the sturgeon and fish community seasons, respectively. A combined-season CPUE of 0.05 fish/100m was recorded across the entire field season. Fish community season and combined-season trammel net CPUE were both marked as the second highest catch rates tabulated in the history of Population Assessment sampling within Segment 2. Trotline captures

in Segment 2 during 2016 led to CPUEs of 0.25 fish/20 hooks and 0.21 fish/20 hooks for the sturgeon and fish community seasons, respectively. The combined -season CPUE for trotlines was 0.23 fish/20 hooks.

All 53 pallid sturgeon captured in Segment 2 during the 2016 field season were of known age and represented 10 different year classes. Year classes in rank of abundance were; 2009 (N=13), 2010 (N=12), 2008 (N=9), 2006 (N=6), 2015 (N=5), 2007 (N=4), while 2001, 2003, 2004, 2013 all had one individuals represented in the pallid sturgeon catch data. Of the 53 pallid sturgeon sampled throughout Segment 2 in 2016, 36 were of a known stocking location; all of which originated in RPMA 2. Stocking origination in rank of abundance were; Culbertson (N=17), Wolf Point (N=12), Fallon (N=3), Intake (N=2), and School Trust FAS (N=2). Although the majority of the pallid sturgeon sampled (N=29) originated from stocking events in the Missouri River, pallid sturgeon stocked in the Yellowstone River continue to be captured on an annual basis.

Pallid sturgeon handled in Segment 2 during the 2016 field season averaged 419 mm in fork length, and averaged 244 g in weight. Lengths ranged from 522 mm to 341 mm fork length. On average, trammel nets captured larger individuals (427 mm) than trotlines (408 mm). All 53 individuals captured in 2016 fell into the stock size category, in which relative condition (Kn) has remained relatively similar since the Program's implementation in 2006. In that time, Kn has ranged from 0.83 to 1.14, with an 11 year average of 0.95.

Shovelnose sturgeon continue to be highly abundant across Segment 2 of the Missouri River, particularly in the upper reaches. A total of 1,002 shovelnose sturgeon were captured in 2016. Seasonally, a larger proportion (N=624) were captured during fish community season compared to sturgeon season (N=378). In relation to gears, trammel nets captured more shovelnose sturgeon (N=677) than did trotlines (N=325). More shovelnose sturgeon were sampled in Segment 2 during the 2016 field season than any other species.

Shovelnose sturgeon trammel net CPUE for the quality and above size class was at an all-time high for both fish community season (1.88 fish/100m), as well as combined-season (1.31 fish/100m). Trotline CPUEs in Segment 2 for 2016 were recorded at 3.38 fish/20 hooks and 2.40 fish/20 hooks for sturgeon and fish community seasons, respectively. The combined-season CPUE was then calculated at 3.38 fish/20 hooks. Catch rates regarding stock and sub-stock categories of shovelnose sturgeon remain low for both trammel net and trotline.

The shovelnose sturgeon observed during the 2016 field season in Segment 2 averaged 617 mm in fork length and 959 g in weight. With the lack of smaller size classes of shovelnose sturgeon residing in Segment 2, observed average length has remained nearly identical over time. Relative weight (Wr) for both the stock and quality size classes of shovelnose sturgeon remains highly variable due to low sample size. Conversely, the Wr for the preferred and memorable/trophy size class of shovelnose sturgeon in Segment 2 has remained much more stable and comparable. In addition, the relative weights for the latter size classes have become nearly identical in recent years

A total of seven blue suckers were captured during 2016 sampling events throughout Segment 2, all of which were observed in trammel nets. Nearly all of the observations (N=6) were witnessed during sturgeon season, while one blue sucker was captured during fish community season. Trammel net CPUEs of 0.24 fish/100 m and 0.0 fish/100 m for the sturgeon and fish community seasons, respectively. Combined-season trammel net CPUE for blue suckers was 0.12 fish/100 m. Blue suckers observed in Segment 2 during the 2016 field season averaged 730 mm in total length and 3,351 g in weight. It has remained typical in Segment 2 to catch large individuals and to capture them during sturgeon season.

Segment 2 sampling events during 2016 led to the capture of 144 sauger; nearly all (N=143) of which were observed via trammel net deployments. Trotlines caught one sauger during 2016. Seasonally, more sauger were captured during sturgeon season (N=94) than during fish community season (N=50). The combined-season trammel net CPUE for Segment 2 during the 2016 sampling season was recorded at 0.28 fish/100m. Seasonally, CPUE was tabulated at 0.40 fish/100m and 0.16 fish/100 m for the sturgeon and fish community seasons, respectively. The sauger captured in Segment 2 during the 2016 season averaged 335 mm in total length and 298 g in weight, with a range from 222 mm to 518 mm.

With the suspension of the otter trawl and mini-fyke net as sampling gears for the 2016 field season, none of the small-bodied target species (sturgeon and sicklefin chubs, *Hybognathus* spp., and sand shiner) were represented in the catch data for Segment 2.

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# Introduction

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

The Pallid Sturgeon Population Assessment Program (program) is guided by the RPA's in the 2003 Amendment to the 2000 Biological Opinion. The program is a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitats used by wild and hatchery reared juvenile pallid sturgeon (Welker et al. 2017). The 2000 Biological Opinion divides the program area into river and reservoir segments and assigns high, moderate, or low priority management action to these segments for pallid sturgeon (Welker et al. 2017). The focus of the program is on the high priority management action segments. The Missouri River from Fort Peck Dam downstream to the headwaters of Lake Sakakawea, ND is listed as a high priority action segment.

The program has stratified the Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea into four study segments based on biological, hydrological and fluvial geomorphological characteristics. The COE contracted Montana Fish, Wildlife & Parks (FWP) to conduct program sampling from Fort Peck Dam downstream to the confluence of the Yellowstone River, 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 and swift current and therefore are not used in any segment situated in Montana. Trammel nets, otter trawl and trotlines are standard gears used in segments 1-4 during sturgeon season, and appear to be an effective method to sample pallid sturgeon. However, due to an exercise in gear/effort reduction, otter trawls were not performed in segments 1-3 during the 2016 field season.

The fish community season extends from the beginning of July till the end of October and is designed not only to monitor sturgeon, but also monitor other native Missouri River fish populations. In the past trammel nets and otter trawls were used during the fish community season, however mini-fyke nets were added as a standard gear to more effectively sample shallow water habitats less than 1.2 m in depth and smaller bodied fishes. However, in accordance with the aforementioned gear reduction, neither otter trawls nor mini-fyke nets were used in 2016.

Trotlines were used as an evaluation gear in 2009 to evaluate their effectiveness at capturing pallid sturgeon. Trotlines became a standard gear starting in 2010. All randomly selected river bends were sampled once with trotlines throughout the two seasons.

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

Segment 2 of the Missouri River Pallid Sturgeon Population Assessment Program begins at the confluence of the Missouri and Milk Rivers and runs downriver 59 river miles to Wolf Point, Montana (Welker et al. 2017). This reach of the Missouri River is impacted by the presence and operations of Fort Peck Dam. Fort Peck Dam inhibits the natural spring pulses and distributes that water more evenly throughout the remainder of the year. Fort Peck Dam draws its water for power production from the hypolimnetic regions of Fort Peck reservoir, which are significantly colder during the summer months and warmer during the winter months, when compared to the Missouri River above the reservoir.

Fort Peck Reservoir traps the sediment loads of the Missouri River and therefore releases sediment free water to the Missouri River. This sediment free high-energy water scours the river of fine sediments and has reduced the amount of sand bars within the river.

Segment 2 is a transitional segment, which exhibits both the characteristics of the hypolimnetic water releases from Fort Peck Dam and of the warmer sediment packed waters of the Milk and Redwater Rivers. The water transitions through segment 2 from very cold and clear in the upper most reaches to warmer and more turbid in the downstream reaches near Wolf Point, MT.

The Milk River is the largest tributary in this segment and its flows can influence water temperature and discharge of the Missouri River (Kapuscinski, 2002). Throughout the spring, the Milk River forms a plume of warm turbid water that mixes with the cold clear waters of the Missouri. When the Milk River is flowing, it results in a warm turbid river on the north side of the channel and a cold clear river on the south side (Gardner and Stewart, 1987). The warm and cold waters do not generally mix until after moving 15 river miles downstream near Frazer Rapids, where the water remains relatively cold and clear (Kapuscinski, 2002). Water withdrawals for irrigation have reduced the Milk Rivers influence on the Missouri River during low water years.

Geologically, the entire segment is surrounded by the Bearpaw Shale formation, where upstream reaches are comprised of gravelly areas, which transition into sandbar habitats farther downstream near Wolf Point (NRIS, 2007). Fish distribution changes throughout the segment in accordance with turbidity, temperature, and substrate.

# Methods

Sampling methods for the Pallid Sturgeon Population Assessment Program were conducted in accordance with the Standard Operating Procedures (Welker et al. 2017), which was established by representatives from State and Federal agencies involved with pallid sturgeon recovery on the Missouri River. For a detailed description of methodologies please see Welker et al. (2017). A general description of those guidelines follows:

## *Sampling Site Selection and Habitat 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 2 consisted of twelve randomly selected bends. All 12 bends were sampled during both the sturgeon season and the Fish Community Season during 2016.

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

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

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

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

## *Sampling Gear*

For specific information pertaining to the specific habitats gears are utilized in and physical measurements taken in accordance with sampling the various gears described below see Welker et al. (2017).

### Trammel Net

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

### Otter Trawl

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

### Mini-Fyke Nets

The standard mini-fyke net consists of two rectangular frames 1.2 m wide and 0.6 m high and two 0.6 m tempered steel hoops. A 4.5 m long and 0.6 m high lead is connected to the first frame. The fyke net is made of 3 mm “ace” style mesh. The lead has small floats attached to the top and lead weights on the bottom. Mini-fyke nets are set with a “T” stake on shore and extend

into river as perpendicular to the shoreline as possible or angled slightly downstream where higher velocities existed. Mini-fyke nets were set overnight and checked the following morning.

### Trotlines

Trotlines consisted of 32 m nylon rope attached to both upstream and downstream anchors. Octopus style circle hooks were attached to the ropes using 136 kg monofilament line and commercial fishing clips. Twenty 45.7 cm leaders were used on each trotline each with a 3/0 Eagle Claw circle hook. Trotlines were set overnight and checked the next morning.

## Data Collection and Analysis

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

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

Time was recorded at the beginning of each sample with all gears and an end time was always recorded when pulling mini-fyke net sets. A global positioning satellite (GPS) position was taken at the beginning and end of all otter and beam trawls and trammel net drifts. One GPS

location was taken for mini-fyke net samples (middle of the seine). All GPS locations were taken using a Garmin GPS 76 unit with Wide Area Augmentation System (WAAS) capability.

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

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

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

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

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

### *Genetic Verification*

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker et al. (2017). Two fin pectoral fin clips (~ 2 $cm^2$) are taken from any pallid sturgeon of unknown origin. Fin samples are then preserved in 95% non-denatured alcohol for genetic analysis. All samples are sent to the U.S. Fish and Wildlife Service's Lamar Laboratory for analysis and archiving.

### *Relative Condition*

Relative condition (Kn) for all sampled pallid sturgeon was calculated using the following formula: Kn = W / W', where W is the fork length of the specimen and W' is the

length-specific mean weight predicted by the weight-length relationship equation calculated for that population. Since no weight length-relationship exists for the hatchery reared pallid sturgeon population in segment 2, we used relative condition factor calculated by Shuman et al. (2011).

### *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.

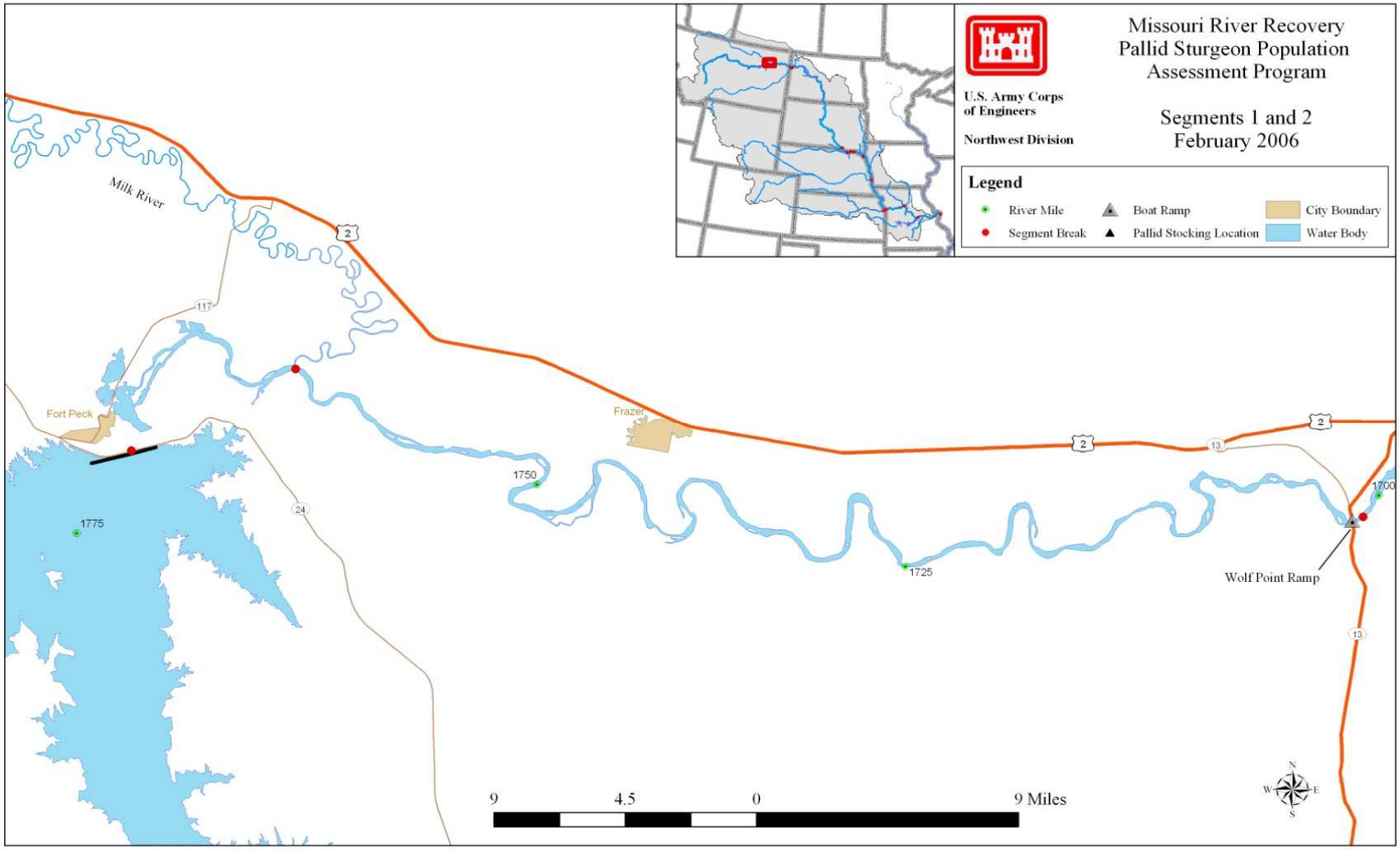


Figure 1. Map of Segment 2 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 2 encompasses the Missouri River from the mouth of the Milk River (River Mile 1761.5) to Wolf Point, MT (River Mile 1701.5).

# Results

## Effort

A total of 12 randomly selected river bends were sampled in Segment 2 during 2016. All 12 bends were sampled once each, with trammel net, during both sturgeon and fish community seasons, respectively. Comparatively, trotlines were used to sample each bend once; with half of the bends sampled during sturgeon season, and the other half sampled during fish community season.

A total of 221 trammel nets were drifted throughout Segment 2 in 2016. Those drifts accounted for 50.8 km of river being sampled. Of those trammel net deployments, 102 were performed during sturgeon season; accounting for 23.0 km of sampling. The remaining 119 were executed during fish community season, resulting in 27.8 km of sampling. Random trammel net deployments (N=192) amassed a total of 44.8 km of river sampling, while non-random deployments (N=29) accounted for an additional 6.0 km of sampling.

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

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

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 2 on the Missouri River during the sturgeon season and fish community season in 2016. N-E indicates the habitat is non-existent in the segment.

| Gear | Number of Bends | Mean Effort | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | CHXO | CONF | ISB | OSB | SCCL | TRML |
| **Sturgeon Season** | | | | | | | | |
| 1.0” Trammel Net | 12 | 8 | 28 | 2 | 38 | 28 | 0 | 0 |
| **Fish Community Season** | | | | | | | | |
| 1.0” Trammel Net | 12 | 8 | 30 | 2 | 29 | 32 | 3 | 0 |
| **Both Seasons** | | | | | | | | |
| Trot Line | 12 | 8 | 33 | 2 | 30 | 27 | 2 | 2 |

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

## Pallid Sturgeon

A total of 53 pallid sturgeon were captured in Segment 2 during the 2016 field season; all of which were hatchery-reared juveniles. Temporally, 18 were captured during sturgeon season, while the remaining 35 were captured during fish community season. Random sampling resulted in the capture of 43 pallid sturgeon, while non-random duplicate sampling accounted for an additional 10 pallid sturgeon.

Trammel net was the most successful gear at sampling pallid sturgeon in Segment 2 during the 2016 season; leading to the capture of 31 pallid sturgeon. Temporally, six were captured during sturgeon season, while the remaining 25 were observed during fish community season. Random trammel net drifts resulted in the capture of 21 pallid sturgeon, while the other 10 were observed during non-random duplicate drifts.

Trammel net CPUE for Segment 2 during 2016 was calculated at 0.02 fish/100m and 0.09 fish/100m for the sturgeon and fish community seasons, respectively. A combined-season CPUE of 0.05 fish/100m was recorded across the entire field season. Although sturgeon season CPUE has been variable but comparable since the Program's inception in 2006, a general pattern of increasing CPUE during fish community season has also led to a general increase in combined-season CPUE during that same time period. A complete detail of Segment 2 trammel net CPUE can be found in Figure 5.

Trotlines continued to be a viable gear for capturing pallid sturgeon in Segment 2 of the Missouri River; sampling 22 fish during the 2016 field season. All 22 pallid sturgeon were captured during random sampling efforts, as no non-random trotlines were set in Segment 2 in 2016. Temporally, 12 pallid sturgeon were captured during sturgeon season, while the other 10 were captured during fish community season.

Trotline captures in Segment 2 during 2016 led to CPUEs of 0.25 fish/20 hooks and 0.21 fish/20 hooks for the sturgeon and fish community seasons, respectively. A combined-season CPUE was calculated to be 0.23 fish/20 hooks. Although trotlines have been a trusted gear for sampling pallid sturgeon in Segment 2, CPUE has remained variable among seasons, with a slightly more stable pattern exhibited when seasons are combined. A complete comparison of trotline CPUE can be found in Figure 7.

Pallid sturgeon handled in Segment 2 during the 2016 field season averaged 419 mm in fork length, and averaged 244 g in weight. Lengths ranged from 341 mm to 522 mm fork length. Although comparable, trammel nets captured, on average, larger individuals (427 mm) than did trotlines (408 mm). A full description of length frequency can be found in Figure 3, while Relative Stock Density (RSD) can be found in Figure 8.

The relative condition (Kn) for all pallid sturgeon captured in Segment 2 can be viewed in Figure 4. All 53 individuals captured in 2016 fell into the stock size category, in which Kn has remained relatively comparable, with a slight increasing pattern, since the Program's implementation in 2006; particularly from 2009 on, when standard error reached more adequate levels for comparisons to be made.

Pallid sturgeon distribution throughout Segment 2 remains variable, with emphasis on the timing and locality of sampling (Fig. 2). Pallid sturgeon were sampled in eight of the 12 randomly selected trammel net bends, while they were detected in 11 of the 12 randomly selected trotline bends. Localized hotspots were once again a driving factor of pallid sturgeon observations in 2016; for example 30% (N=16) of all the pallid sturgeon sampled in Segment 2 were captured during one trammel net sampling event during fish community season at Bend 1. These 16 pallid sturgeon were captured on August 1$^{st}$ and 2$^{nd}$ near the confluence of the Milk and Missouri Rivers in Bend 1 of Segment 2. The second highest total catch of pallid sturgeon for an individual river bend in Segment 2 occurred at Bend 12. A total of eight pallid sturgeon were captured at Bend 12 during 2016, which comprised 15% of the years catch. However, the eight pallid sturgeon that were sampled in this bend were sampled between the two sampling seasons.

All 53 pallid sturgeon captured in Segment 2 during the 2016 field season were of known age and represented 10 different year classes (Table 3). Year classes in rank of abundance were; 2009 (N=13), 2010 (N=12), 2008 (N=9), 2006 (N=6), 2015 (N=5), 2007 (N=4), while 2001, 2003, 2004, 2013 all had one individuals represented in the pallid sturgeon catch data. 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 53 pallid sturgeon sampled throughout Segment 2 in 2016, 36 were of known stocking location; all of which originated in RPMA 2. Stocking origination in rank of abundance were; Culbertson (N=17), Wolf Point (N=12), Fallon (N=3), Intake (N=2), and School Trust FAS (N=2). Although the majority of the pallid sturgeon sampled (N=29) originated from

stocking events in the Missouri River, pallid sturgeon stocked in the Yellowstone River continue to be captured on an annual basis.

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.

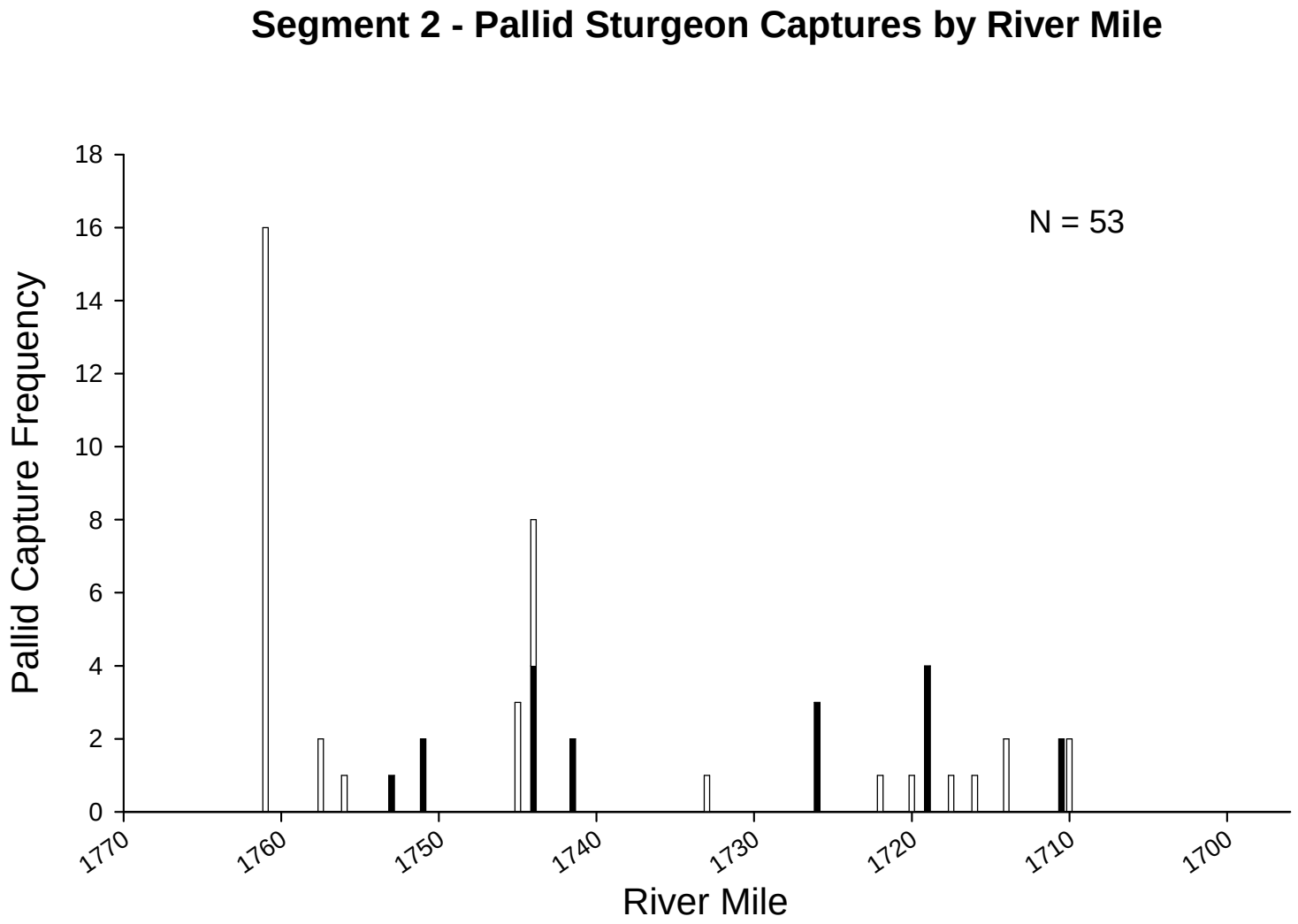


Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 2 of the Missouri River during 2016. Black bars represent pallid sturgeon captures during sturgeon season and white bars represent pallid sturgeon captures during fish community season. Figure includes all pallid captures including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

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2016. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. Table includes all pallid sturgeon captures including non-random samples.

| Habitat | | Depth (m) | | Bottom Velocity (m/s) | | Temperature (°C) | | Turbidity | | Total Pallids caught |
|---|---|---|---|---|---|---|---|---|---|---|
| MACRO | MESO | Effort | Catch | Effort | Catch | Effort | Catch | Effort | Catch | |
| CHXO | CHNB | 1.8 (0.6-3.6) | 1.7 (1.1-2.6) | 0.67 (0.36-1.07) | 0.36 (0.36-0.36) | 12.6 (1.3-16.9) | 12.5 (6.0-14.7) | 109 (1-501) | 111 (1-501) | 11 |
| CONF | CHNB | 1.4 (1.2-1.7) | 1.5 (1.4-1.6) | 0.59 (0.43-0.74) | 0.74 (0.74-0.74) | 15.8 (5.1-24.6) | 23.5 (22.3-24.6) | 331 (6-655) | 655 (655-655) | 7 |
| ISB | CHNB | 1.8 (0.5-4.2) | 1.6 (1.0-2.4) | 0.64 (0.40-0.79) | 0.54 (0.40-0.72) | 12.7 (5.0-18.9) | 14.2 (6.0-18.9) | 93 (6-432) | 63 (13-146) | 16 |
| OSB | CHNB | 2.1 (0.6-4.2) | 1.9 (1.0-3.0) | 0.65 (0.50-0.79) | 0.72 (0.72-0.72) | 12.7 (5.1-17.4) | 12.4 (5.2-16.0) | 72 (12-444) | 35 (12-110) | 18 |
| SCCL | CHNB | 1.6 (0.8-2.4) | 1.5 (1.5-1.5) | 0.64 (0.58-0.70) | 0.58 (0.58-0.58) | 14.2 (13.0-17.4) | 13.0 (13.0-13.0) | 19 (13-25) | . (.-.) | 1 |
| TRML | CHNB | 2.1 (2.0-2.2) | | . (.-.) | | 12.5 (7.1-23.0) | | . (.-.) | | . |

Table 3. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2016 from Segment 2 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al. (2011). Table includes all hatchery-reared pallid sturgeon captures including non-random and wild samples.

| Year Class | N | Length (mm) | Weight (g) | Kn | Length (mm) | Weight (g) | Kn | Length (mm/d) | Weight (g/d) |
|---|---|---|---|---|---|---|---|---|---|
| 2001 | 1 | . | . | . | 494 | 410.0 | 0.995 | . | . |
| . | . | . | . | . | . | . | . | . | . |
| 2003 | 1 | . | . | . | 421 | 260.0 | 1.069 | . | . |
| . | . | . | . | . | . | . | . | . | . |
| 2004 | 1 | . | . | . | 469 | 365.0 | 1.051 | . | . |
| . | . | . | . | . | . | . | . | . | . |
| 2006 | 6 | 246 | 45.0 | 1.085 | 449 | 286.3 | 0.944 | 0.072 | 0.089 |
| . | . | . | . | . | 18 | 41.4 | 0.080 | . | . |
| 2007 | 4 | . | . | . | 429 | 285.0 | 1.075 | . | . |
| . | . | . | . | . | 30 | 84.4 | 0.093 | . | . |
| 2008 | 9 | 228 | 39.5 | 1.223 | 425 | 263.2 | 1.036 | 0.060 | 0.060 |
| . | . | . | . | . | 18 | 34.6 | 0.055 | . | . |
| 2009 | 13 | 263 | 65.8 | 1.146 | 399 | 217.1 | 1.048 | 0.064 | 0.071 |
| . | . | 51 | 37.5 | 0.055 | 13 | 24.7 | 0.049 | 0.020 | 0.021 |
| 2010 | 12 | 292 | 89.4 | 1.048 | 420 | 231.3 | 0.921 | 0.067 | 0.071 |
| . | . | 42 | 45.5 | 0.241 | 27 | 51.3 | 0.045 | 0.009 | 0.018 |
| 2013 | 1 | 216 | 89.5 | 3.312 | 371 | 160.0 | 0.997 | 0.175 | 0.079 |
| . | . | . | . | . | . | . | . | . | . |
| 2015 | 5 | . | . | . | 399 | 178.0 | 0.856 | . | . |
| . | . | . | . | . | 30 | 42.0 | 0.049 | . | . |

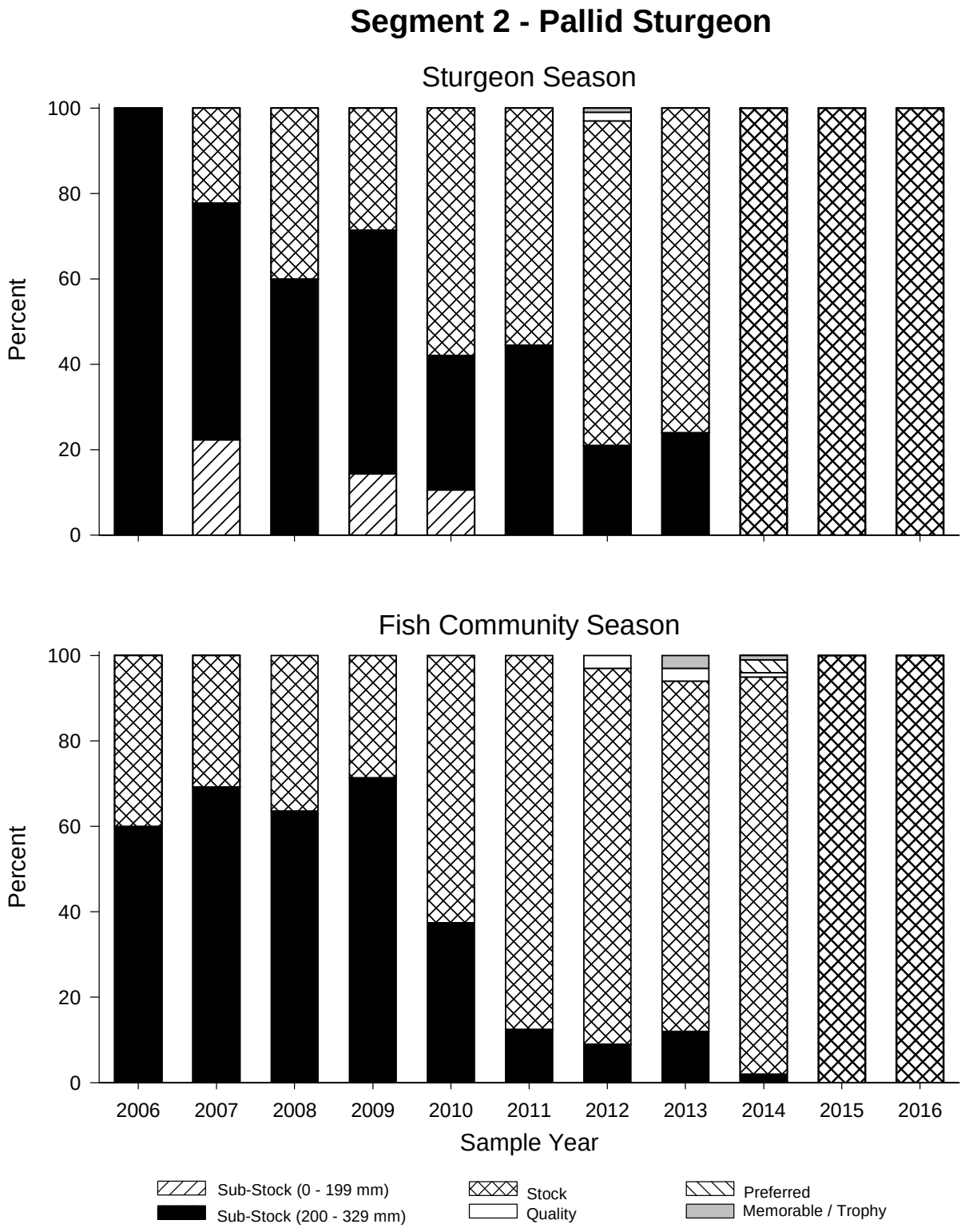


Figure 3. Incremental relative stock density (RSD) for all pallid sturgeon captured with all gear by length category from 2006-2016 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

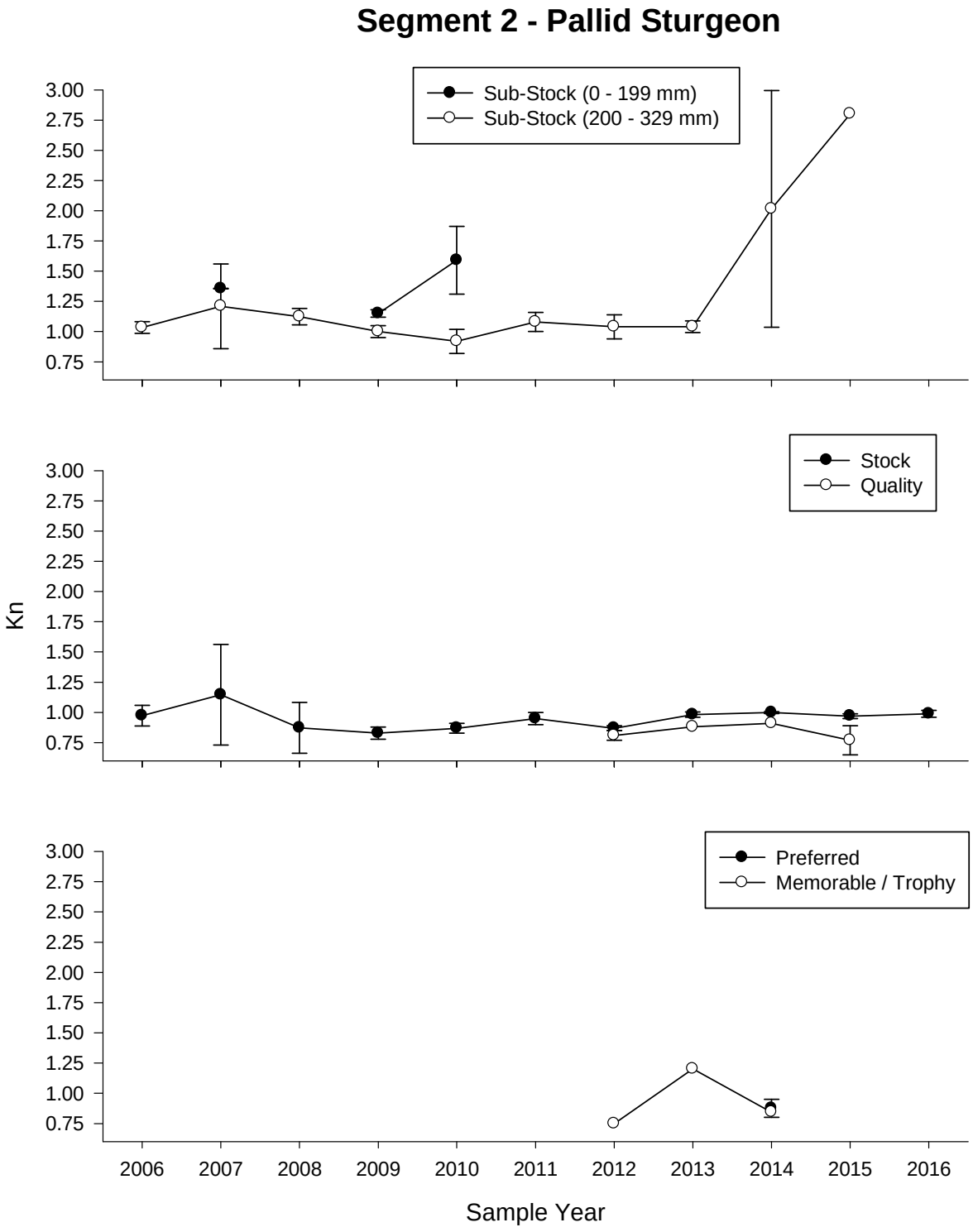


Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2016 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

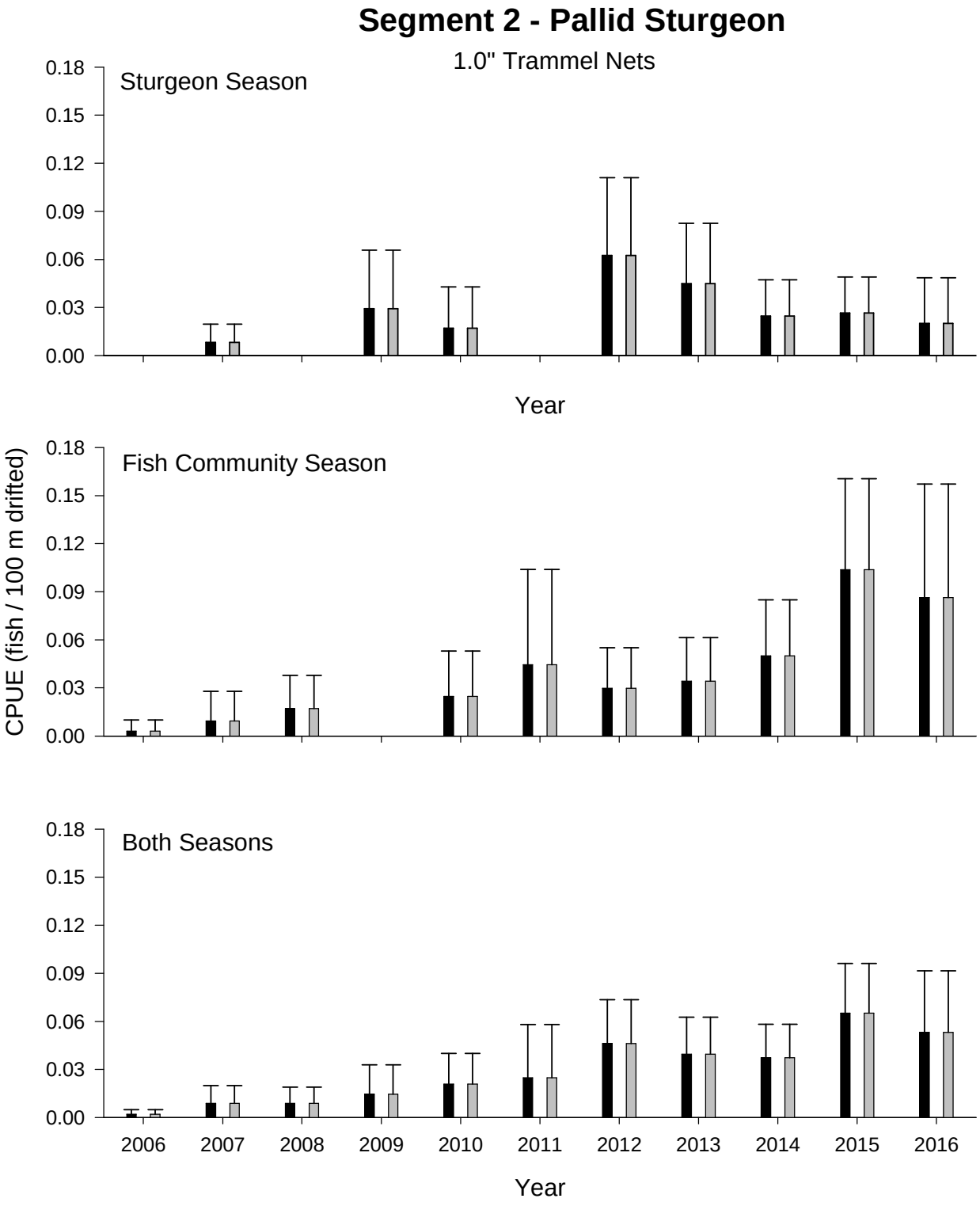


Figure 5. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0”

trammel nets in Segment 2 of the Missouri River from 2006-2016. Pallid sturgeon of unknown origin are awaiting genetic verification.

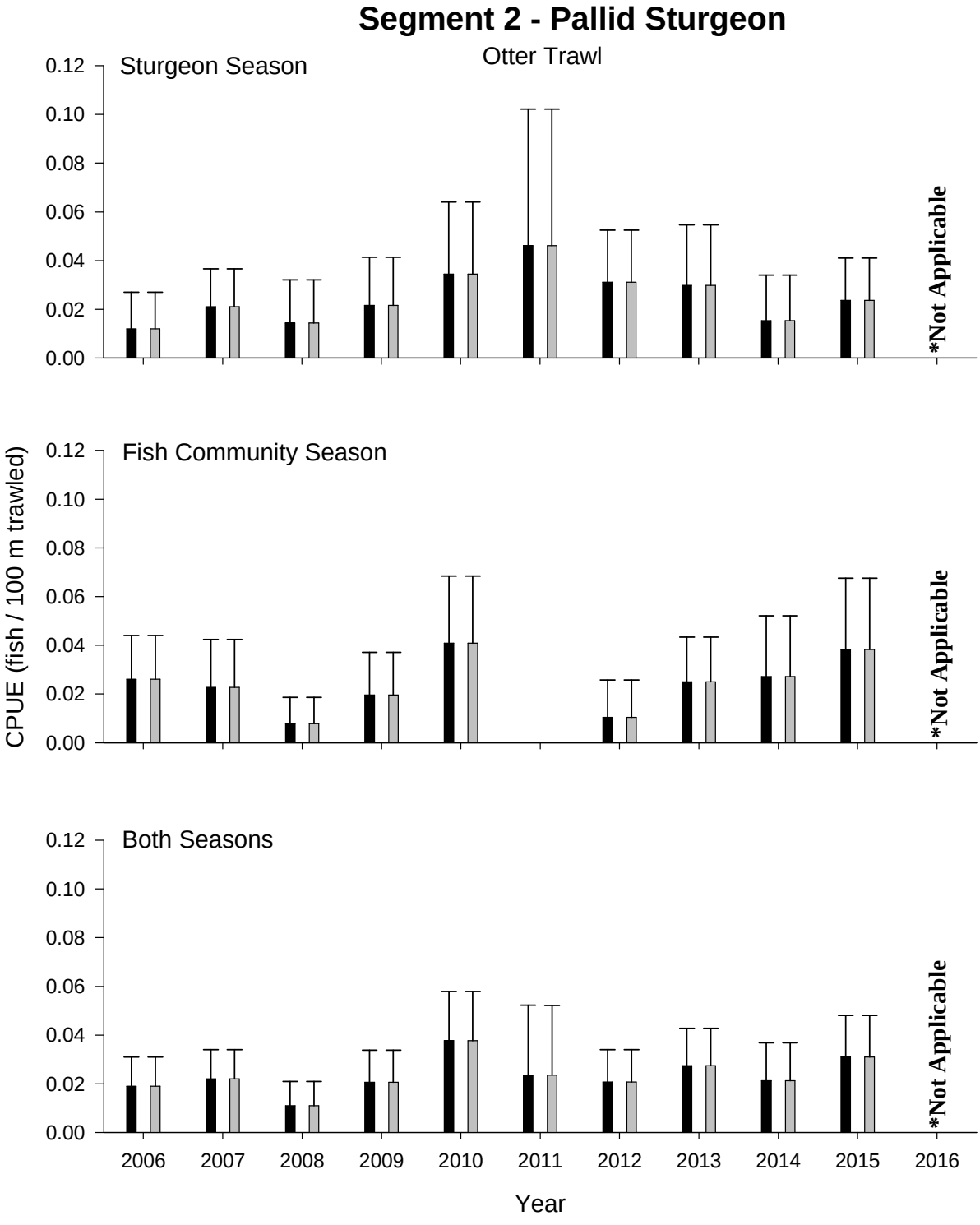


Figure 6. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using

otter trawls in Segment 2 of the Missouri River from 2006-2016. Pallid sturgeon of unknown origin are awaiting genetic verification. *Otter trawl not performed in 2016.

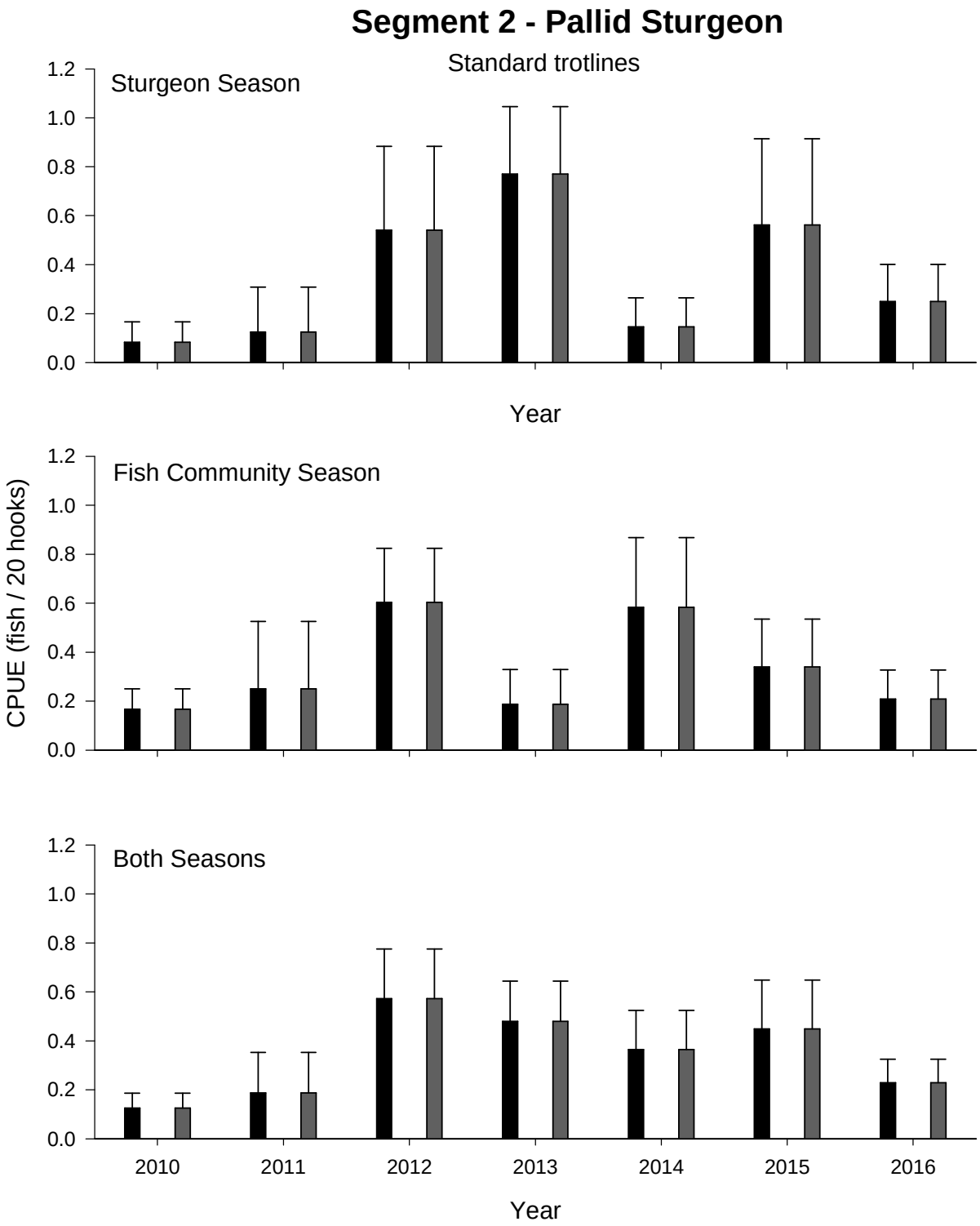

Figure 7. Mean annual catch per unit effort (+/- 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 2 of the Missouri River from 2010-2016. Pallid sturgeon of unknown origin are awaiting genetic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

Table 4. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 4 | 50 | 0 | 0 | 50 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 17 | 0 | 29 | 29 | 41 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 22 | 41 | 0 | 23 | 32 | 5 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 7. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 4 | 50 | 0 | 50 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 17 | 0 | 29 | 29 | 41 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 22 | 41 | 0 | 23 | 32 | 5 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

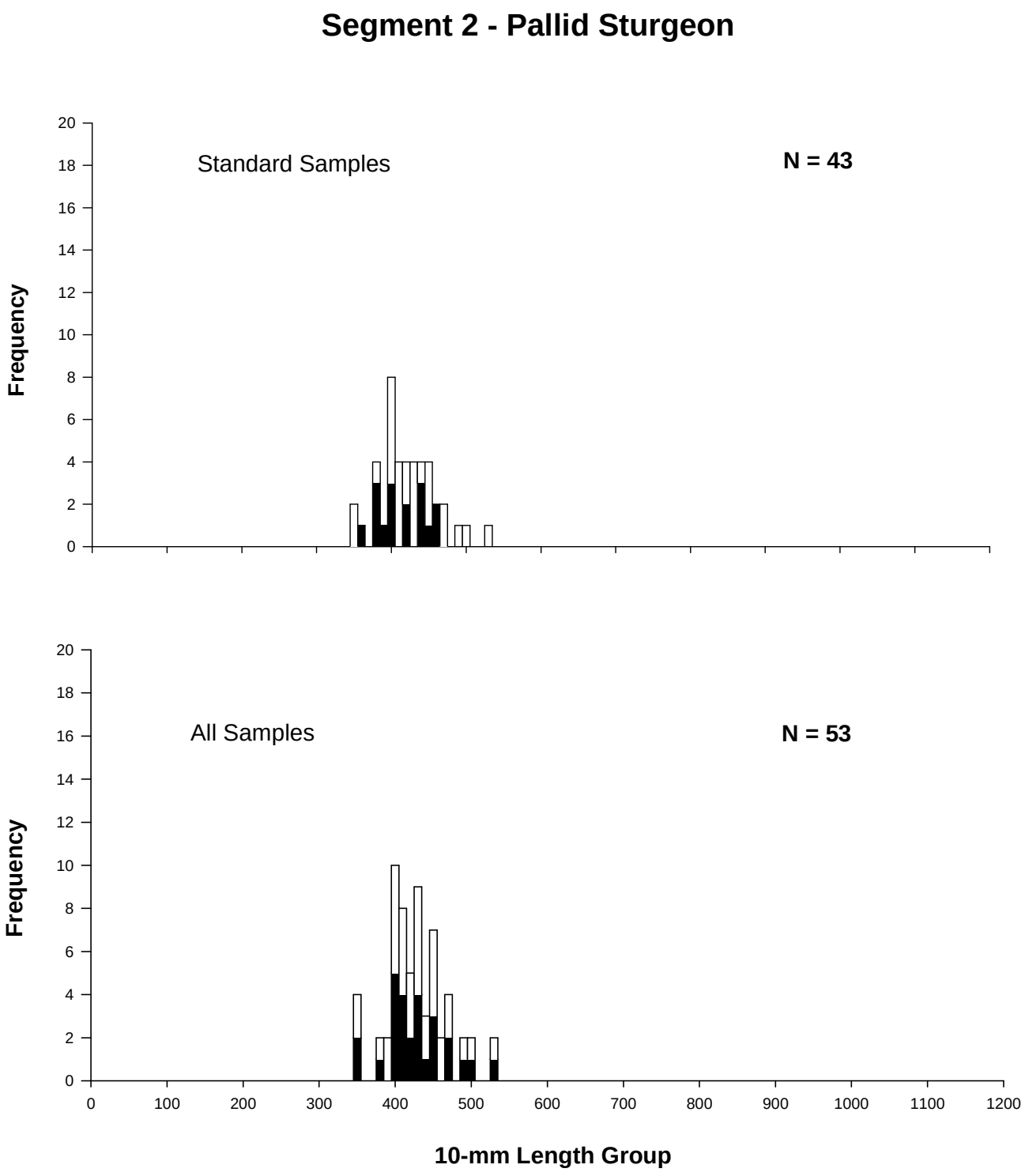


Figure 8. Length frequency of pallid sturgeon captured in Segment 2 of the Missouri River during 2016. Black bars represent captures during sturgeon season, while white bars represent captures during fish community season. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016. Pallid sturgeon of unknown origin are awaiting genetic verification

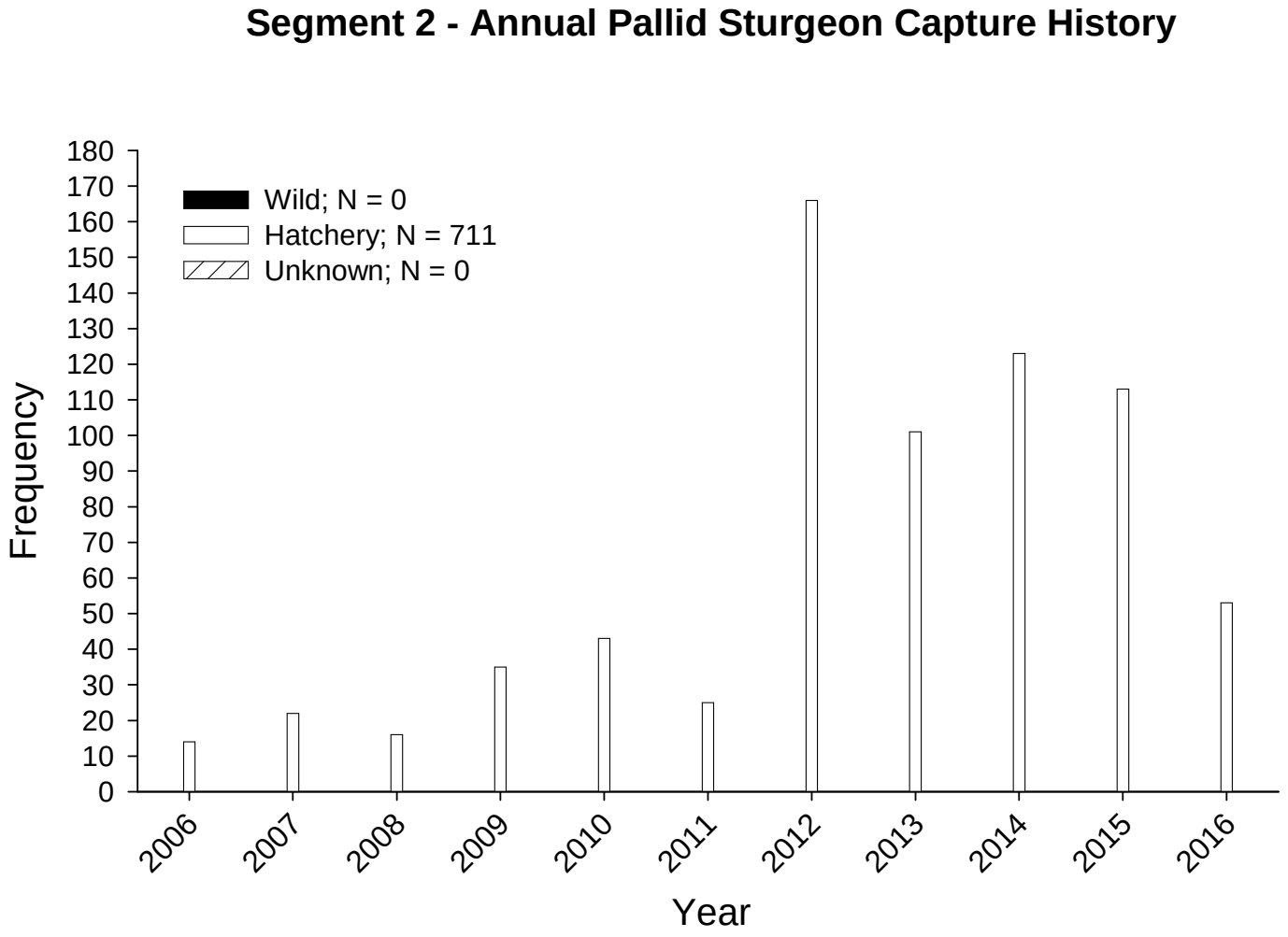


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 2 of the Missouri River from 2006-2016. Figure is designed to compare overall pallid sturgeon

captures from year to year and is biased by variable effort among years.  Figure includes all pallid captures including non-random and wild samples.

## Shovelnose X Pallid Sturgeon Hybrids

To date, one genetically verified shovelnose sturgeon x pallid sturgeon hybrid has been captured by Population Assessment crews in Segment 2. That individual (995 mm, 3500 g), captured in 2015, was observed during fish community season at river mile 1753.

## Targeted Native River Species

### Shovelnose Sturgeon

Shovelnose sturgeon observations in Segment 2 of the Missouri River were once again a common occurrence during the 2016 field season. A total of 1,002 shovelnose sturgeon were captured in 2016. Seasonally, a larger proportion (N=624) were captured during fish community season compared to sturgeon season (N=378). In relation to gears, trammel nets captured more shovelnose sturgeon (N=677) than did trotlines (N=325).

During the 2016 field season, Segment 2 trammel net CPUE (Fig. 10), in regards to shovelnose sturgeon of the quality or greater size class, was recorded as 0.75 fish/100m and 1.87 fish/100m for the sturgeon and fish community seasons, respectively. A combined-season CPUE was then reported to be 1.31 fish/100m. Calculated CPUE for both fish community season and combined-season were all-time highs for Segment 2. Trammel net CPUE remains very low for the stock and sub-stock categories due to the age structure of shovelnose sturgeon in Segment 2 of the Missouri River.

During the 2016 field season, Segment 2 trotline CPUE (Fig. 12) for sturgeon season (4.35 fish/20 hooks) and fish community season (2.40 fish/20 hooks) led to a combined-season CPUE of 3.38 fish/20 hooks. Trotline CPUE in Segment 2 of the Missouri River has remained variable, yet comparable since trotlines were implemented fully in 2010. Like trammel net, trotline captures of the stock and sub-stock size classes of shovelnose sturgeon have remained minimal in Segment 2.

A year by year comparison of relative weights (Wr) of shovelnose sturgeon captured in Segment 2 can be found in Figure 15. Wr for both the stock and quality size classes of shovelnose sturgeon remains highly variable due to low sample size. Conversely, the Wr for the preferred and memorable/trophy size class of shovelnose sturgeon in Segment 2 has remained much more stable and comparable. In addition, the relative weights for the latter size classes have become nearly identical over the past few years.

The shovelnose sturgeon observed during the 2016 field season in Segment 2 averaged 617 mm in fork length and 959 g in weight. With the lack of smaller size classes of shovelnose sturgeon residing in Segment 2 (Fig. 14), observed average length has remained nearly identical

over time. A complete Segment 2 length frequency histogram regarding shovelnose sturgeon captures in 2016 can be found in Figure 13.

The specific macro and meso habitats where shovelnose sturgeon were sampled in Segment 2 during 2016, by gear and size class, is depicted in Tables 9-12. Table 13 shows the total number of shovelnose sampled by gear and macro habitat.

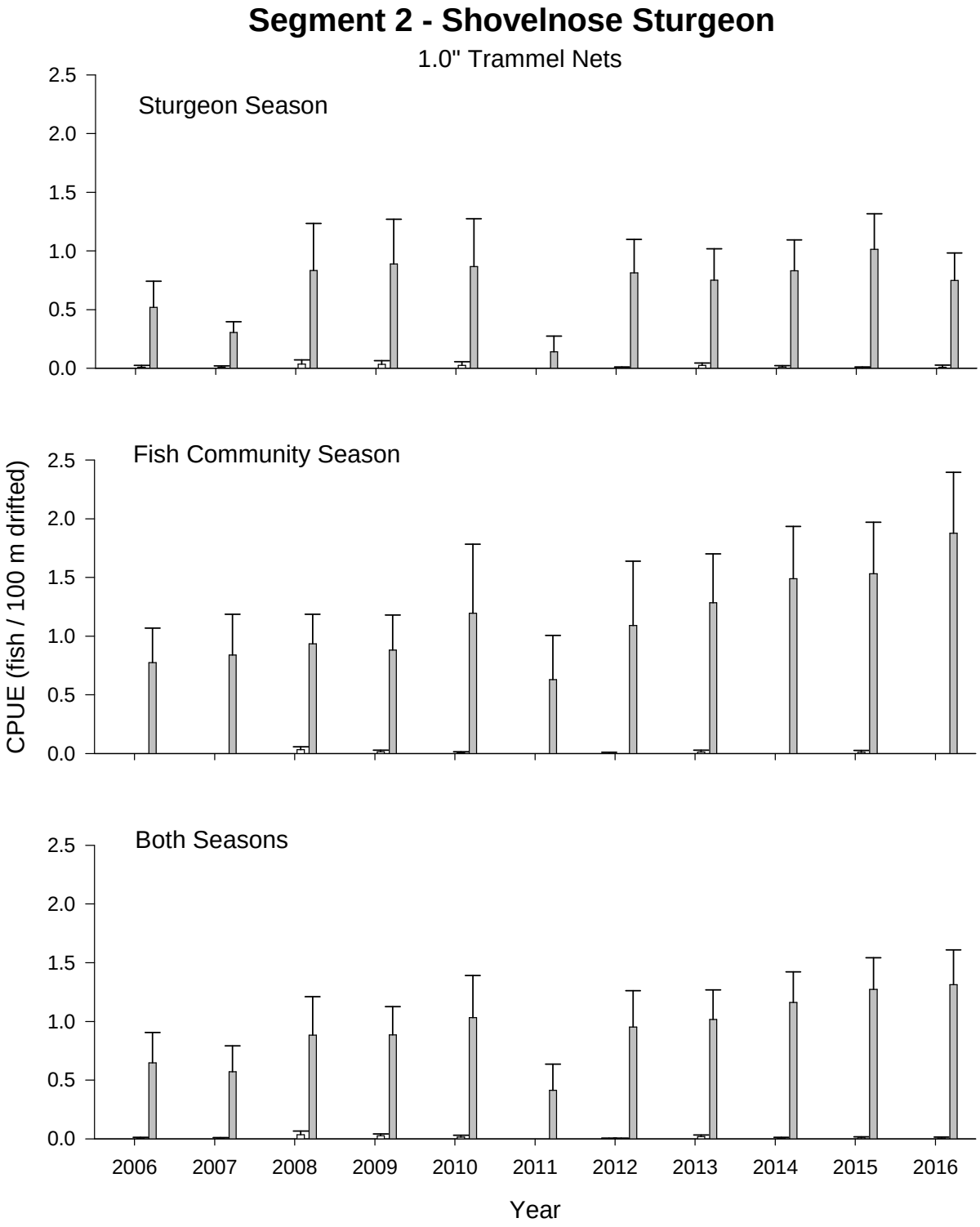


Figure 10. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0” trammel nets in Segment 2 of the Missouri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

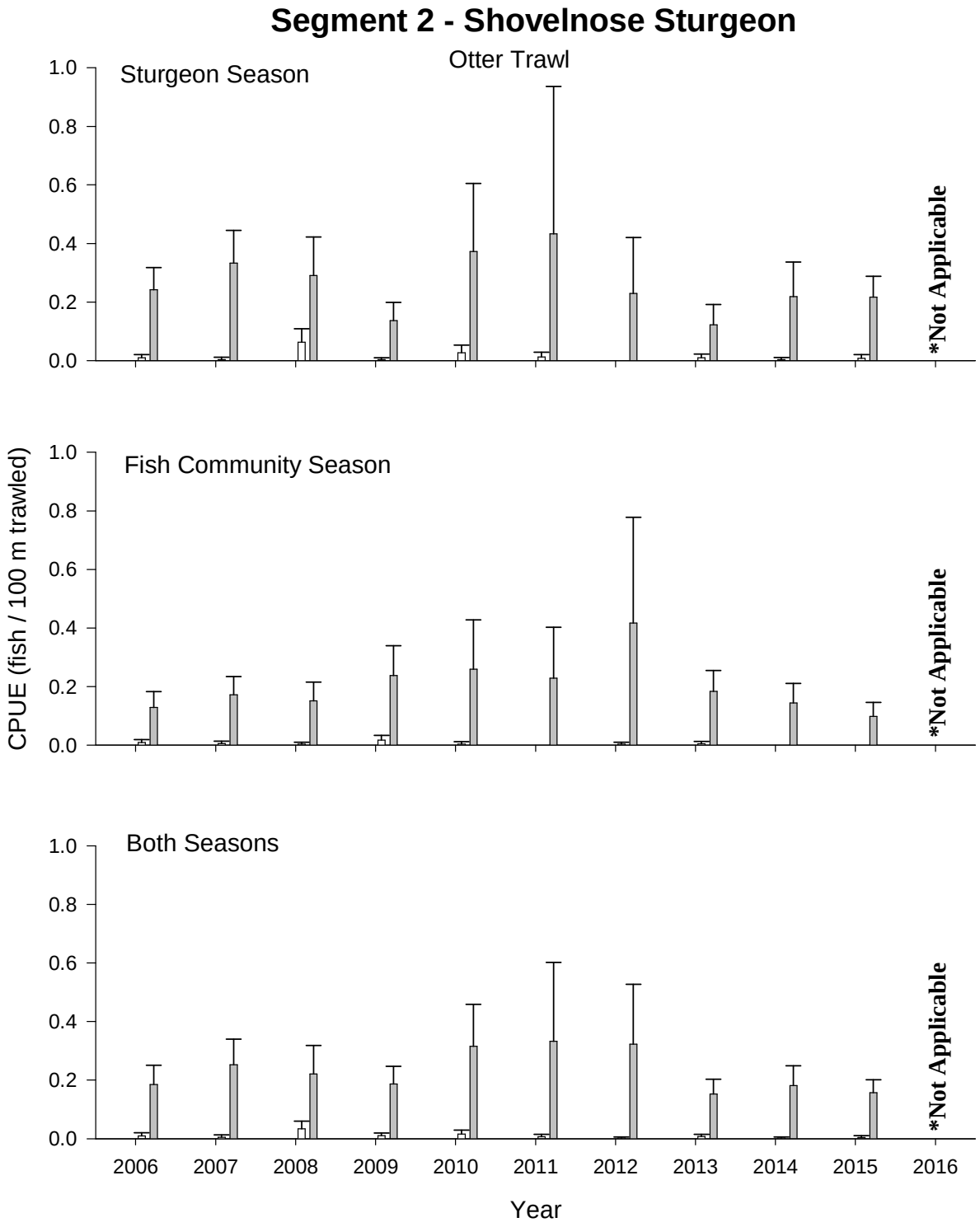


Figure 11. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 2 of the Missouri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

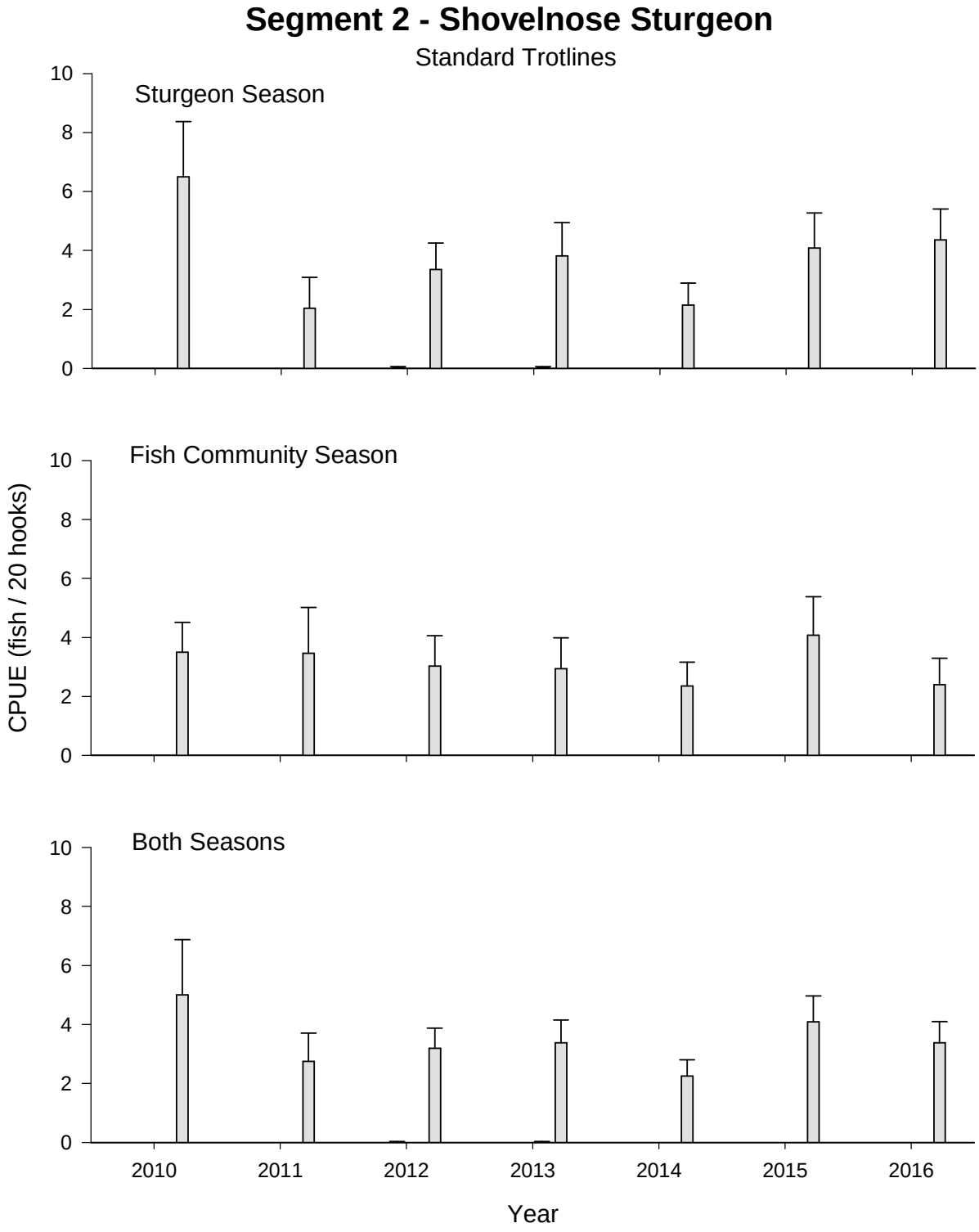


Figure 12. Mean annual catch per unit effort (+/- 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using trot lines in Segment 2 of the Missouri River from 2010-2016.

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 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 1 | 0 | 0 | 0 | 100 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 12. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 159 | 27 | 1 | 35 | 38 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 414 | 27 | 2 | 35 | 36 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 324 | 44 | 0 | 30 | 23 | 3 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 161 | 27 | 1 | 35 | 38 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 445 | 31 | 2 | 32 | 34 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 325 | 44 | 0 | 30 | 23 | 3 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

# Segment 2 - Shovelnose Sturgeon

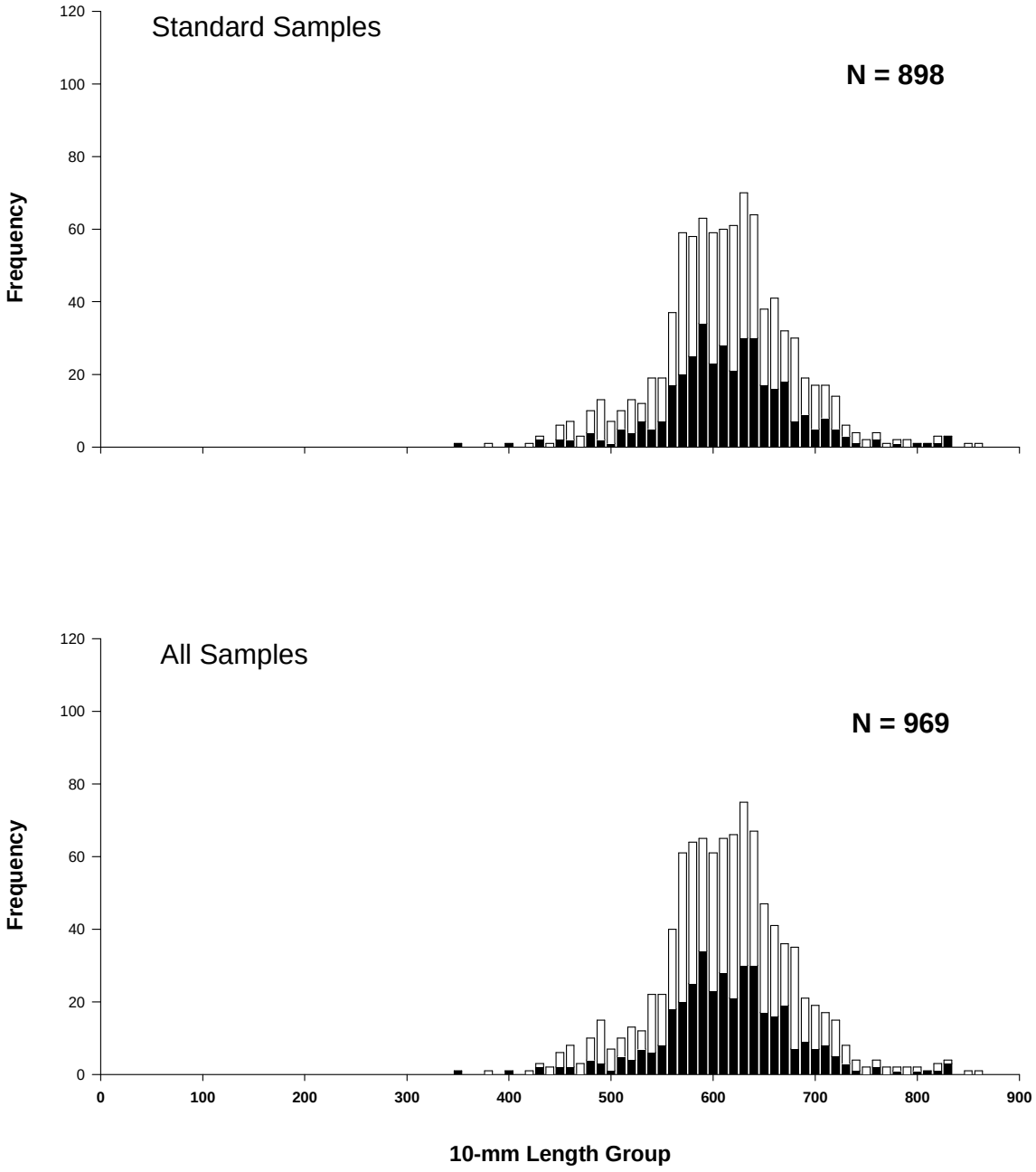


Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

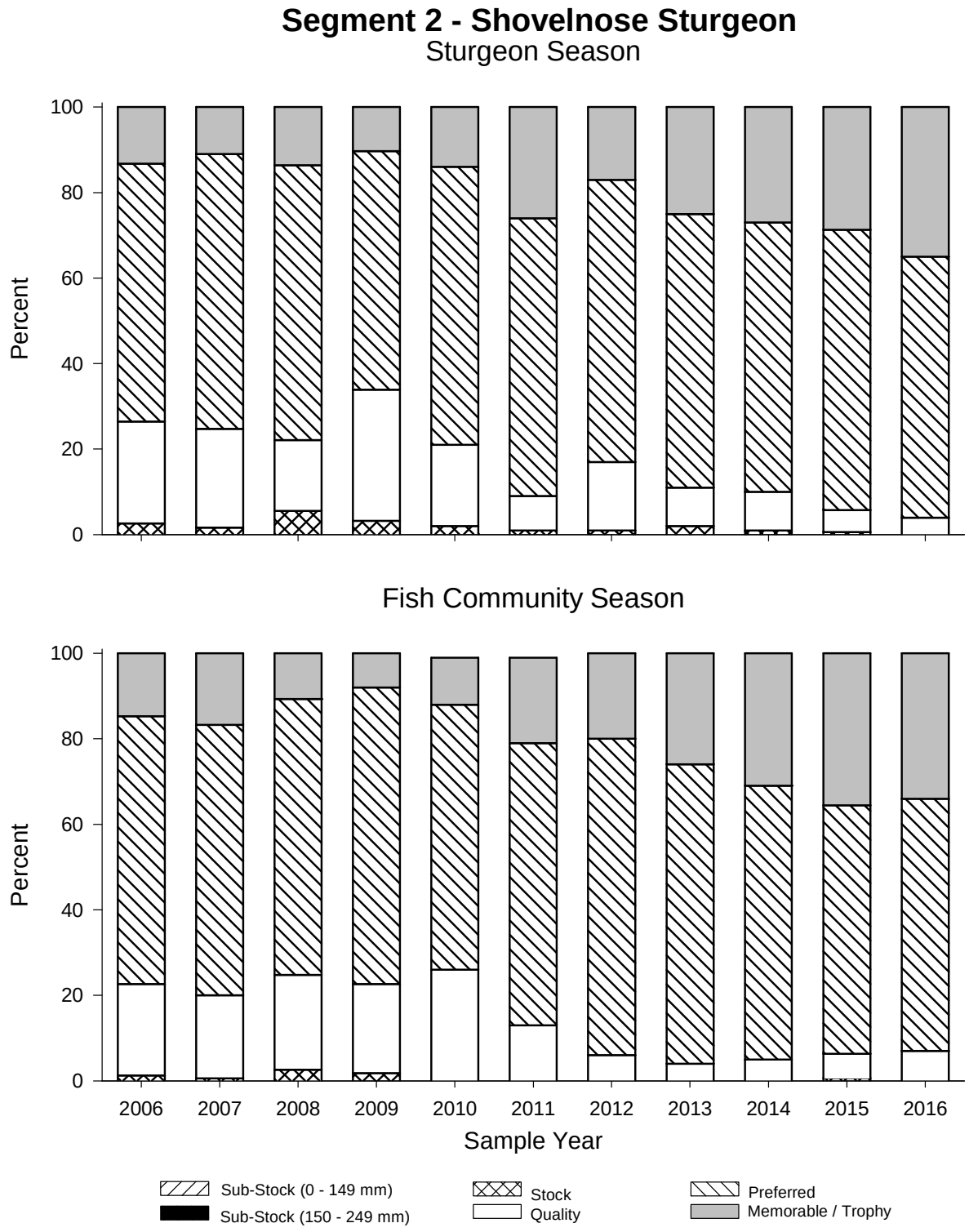


Figure 14. Incremental relative stock density (RSD) for all shovelnose sturgeon captured with all gear by length category from 2006 to 2016 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

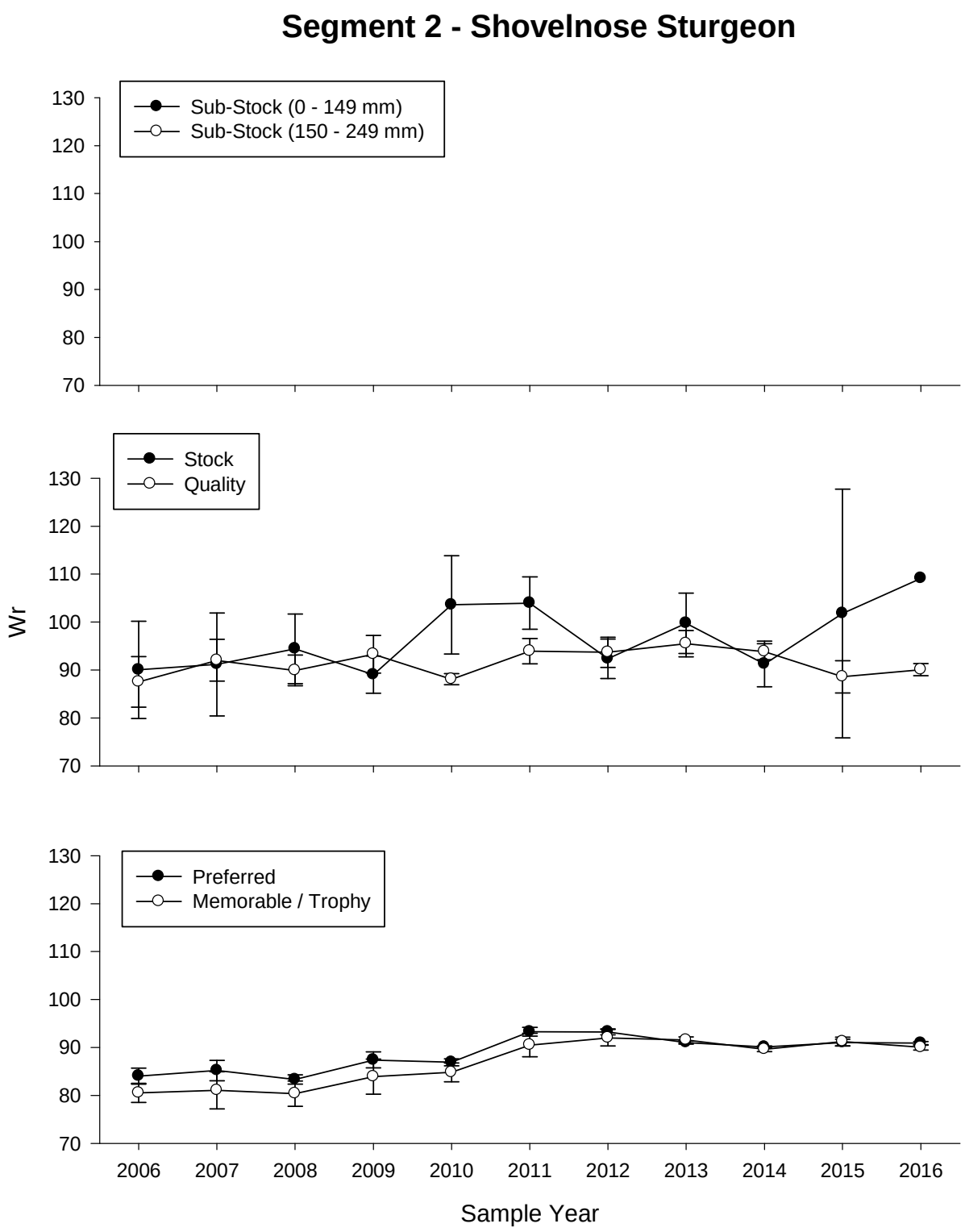


Figure 15. Relative weight (Wr) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2016 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

## Sturgeon Chub

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sturgeon chubs were captured in Segment 2 during the 2016 field season.

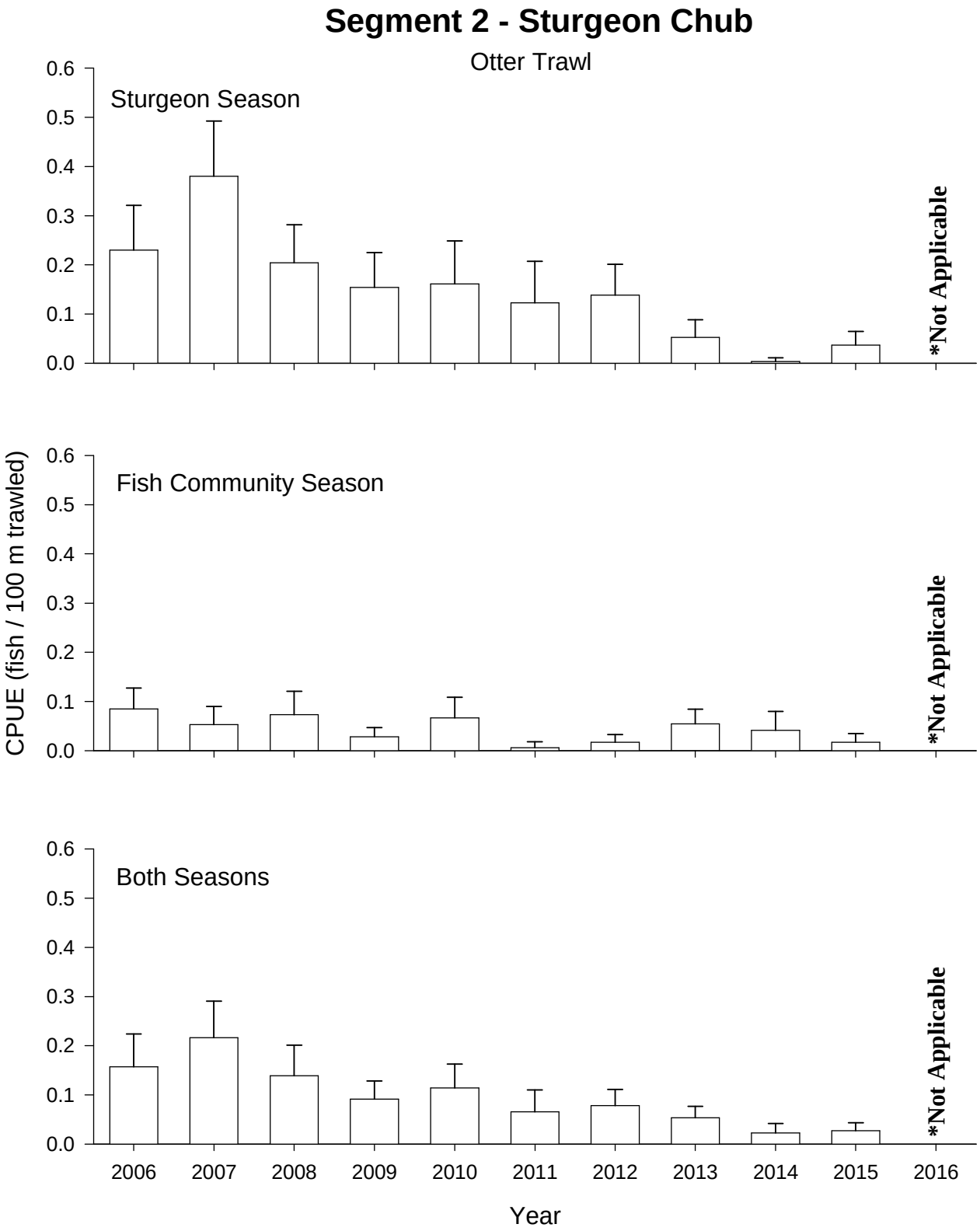


Figure 16. Mean annual catch per unit effort (+/- 2 SE) of sturgeon chub using otter trawls in Segment 2 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

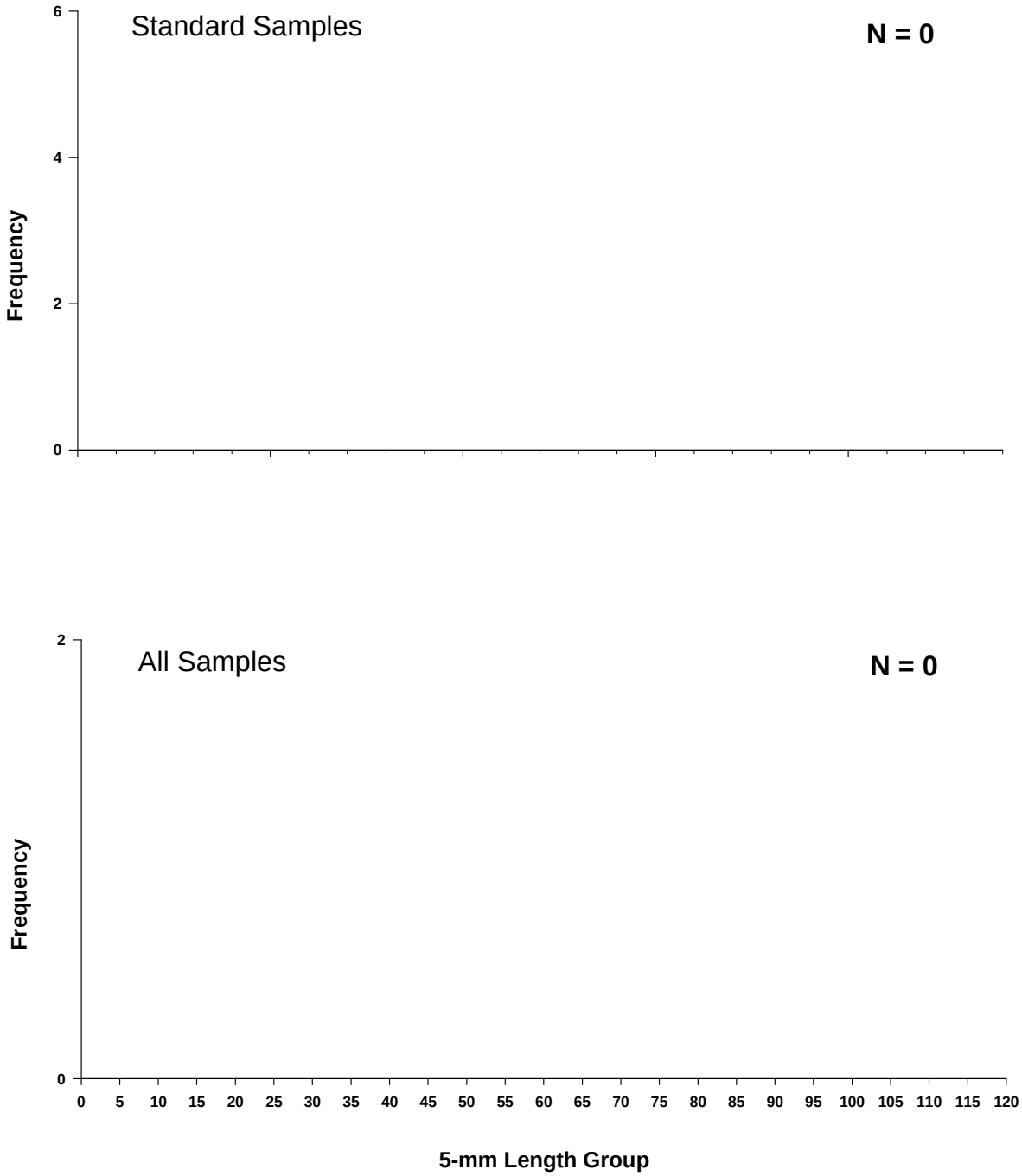


Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

## Sicklefin Chub

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sicklefin chubs were captured in Segment 2 during the 2016 field season.

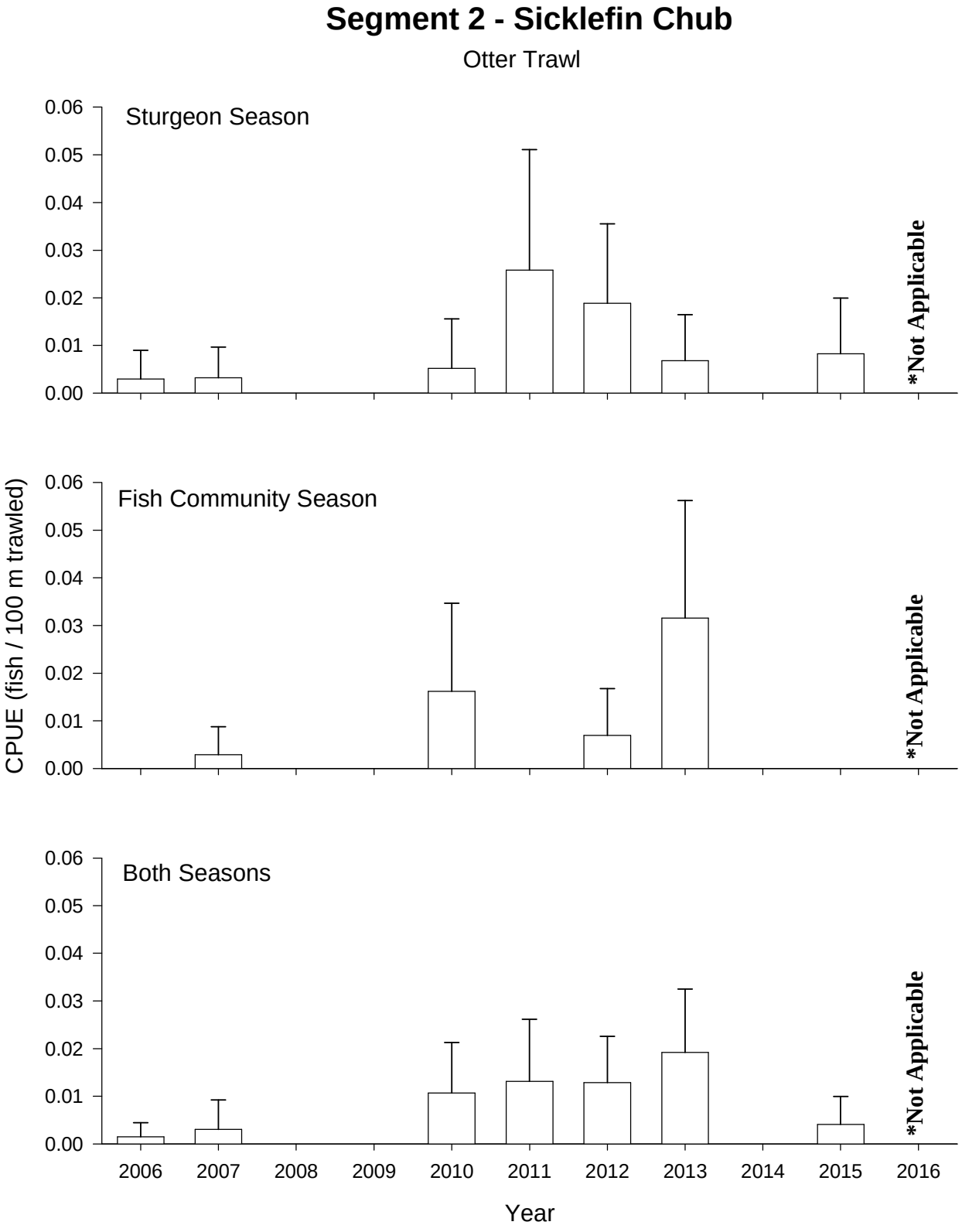


Figure 18. Mean annual catch per unit effort (+/- 2 SE) of sicklefin chub using otter trawls in Segment 2 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

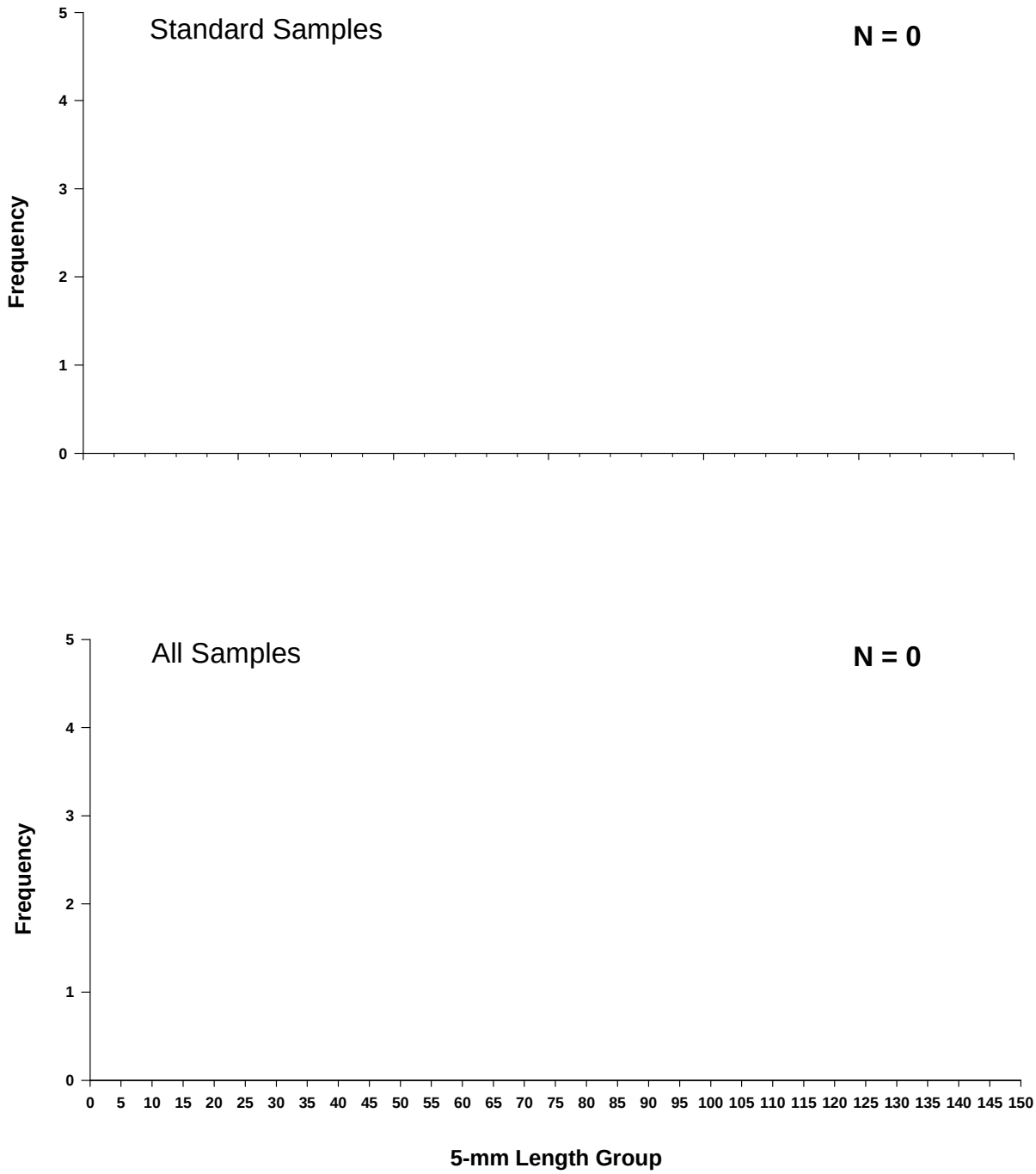


Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

## Sand Shiner

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no sand shiners were captured in Segment 2 during the 2016 field season.

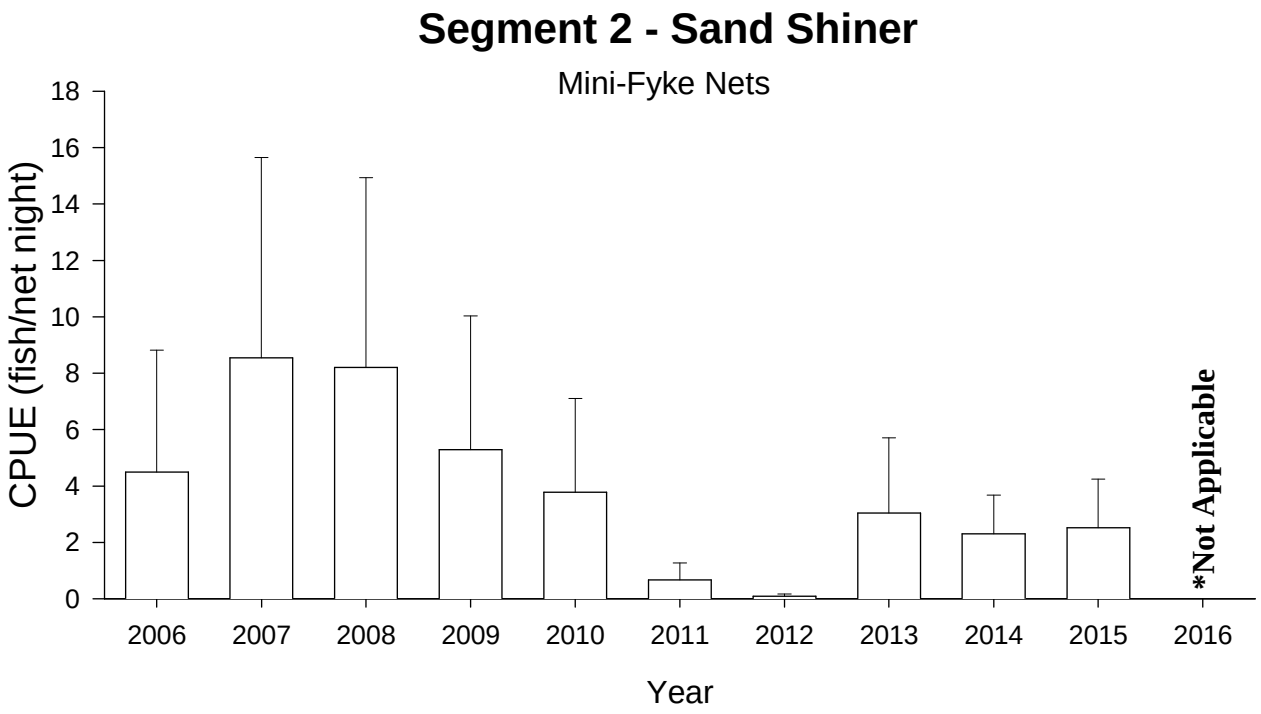


Figure 20. Mean annual catch per unit effort (+/- 2 SE) of sand shiner with mini-fyke nets in Segment 2 of the Missouri River during fish community season 2006-2016. *Mini-fyke nets were not performed in 2016.

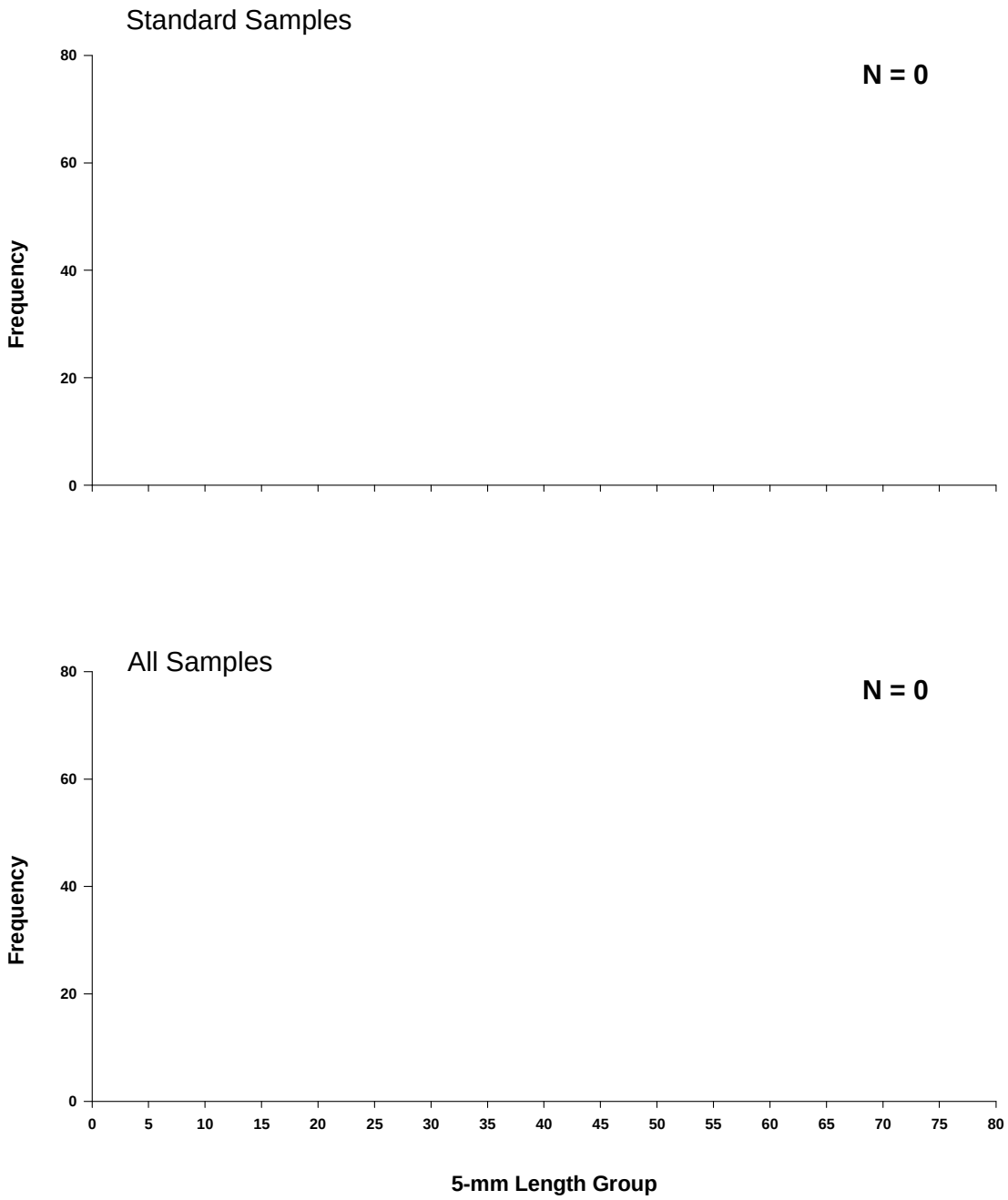


Figure 21. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

### *Hybognathus* spp.

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, *Hybognathus* spp. were captured in Segment 2 during the 2016 field season.

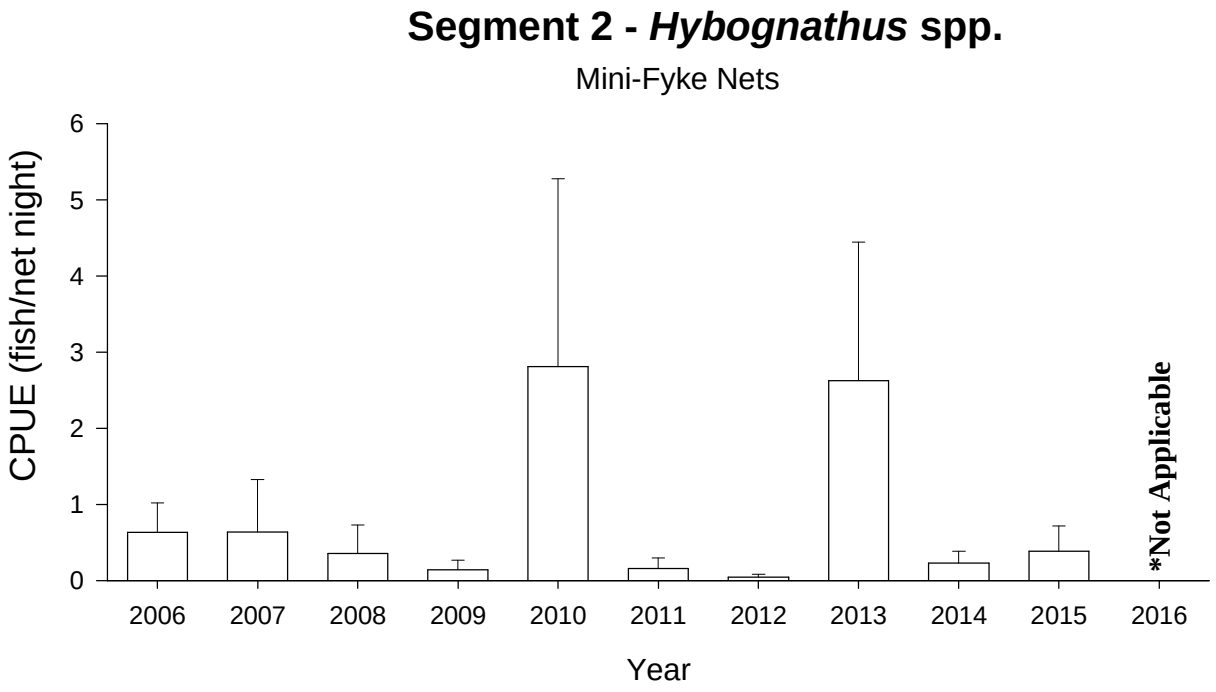


Figure 22. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 2 of the Missouri River during fish community season 2006-2016. *Mini-fyke nets were not performed in 2016.

# Segment 2 - *Hybognathus* spp.

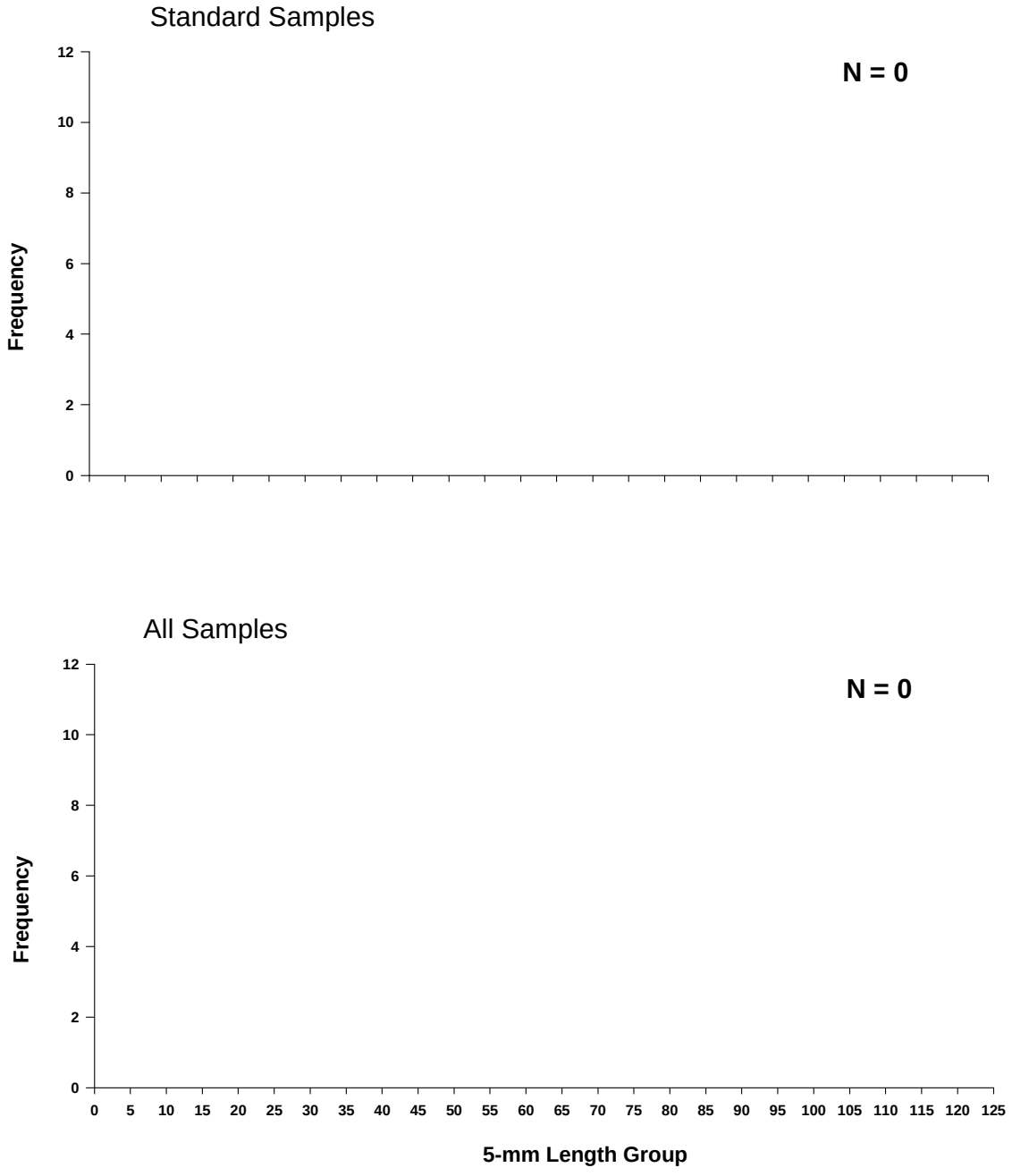


Figure 23. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

## Blue Sucker

A total of seven blue suckers were captured during 2016 sampling events throughout Segment 2; all of which were observed via trammel net. Nearly all of the observations (N=6) were witnessed during sturgeon season, while one blue sucker was captured during fish community season.

Trammel net CPUEs (Fig. 24) of 0.24 fish/100m and 0.0 fish/100m for the sturgeon and fish community seasons, respectively, led to a combined-season CPUE of 0.12 fish/100m regarding blue suckers in Segment 2 for the 2016 sampling year. All three CPUE metrics were at or near all time lows, and for the first time since the Program's inception in 2006, Population Assessment crews failed to catch a blue sucker during random trammel net efforts during fish community season in Segment 2.

Blue suckers observed in Segment 2 during the 2016 field season averaged 730 mm in total length and 3,351 g in weight. It has remained typical in Segment 2 to catch both large individuals, and to capture them during sturgeon season, presumptively while they are in the upper reaches during spawning season. A complete description of size structure can be found in Figure 26, while further information regarding the specific macro habitat and associated capture information can be viewed in Table 14.

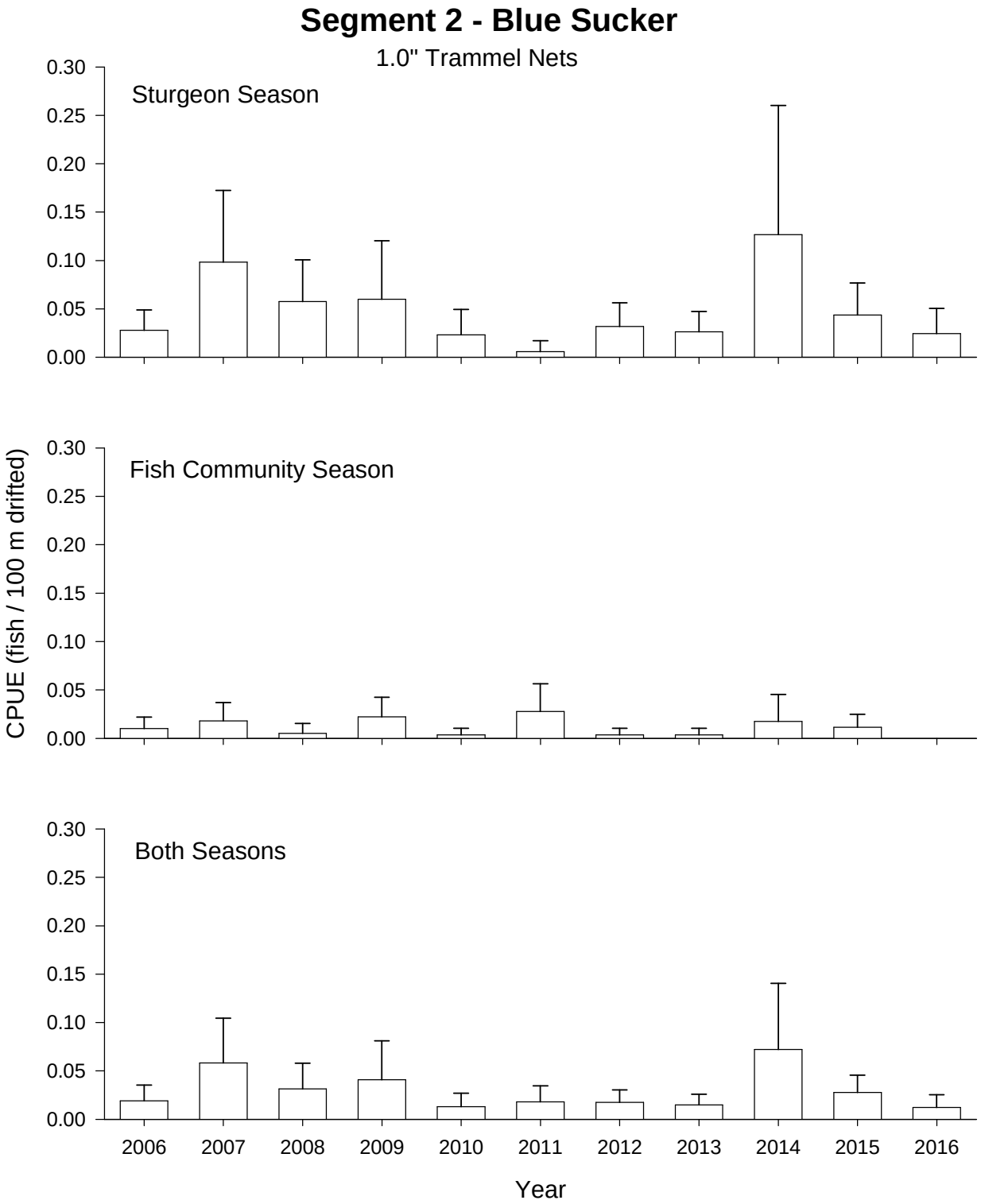


Figure 24. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2016.

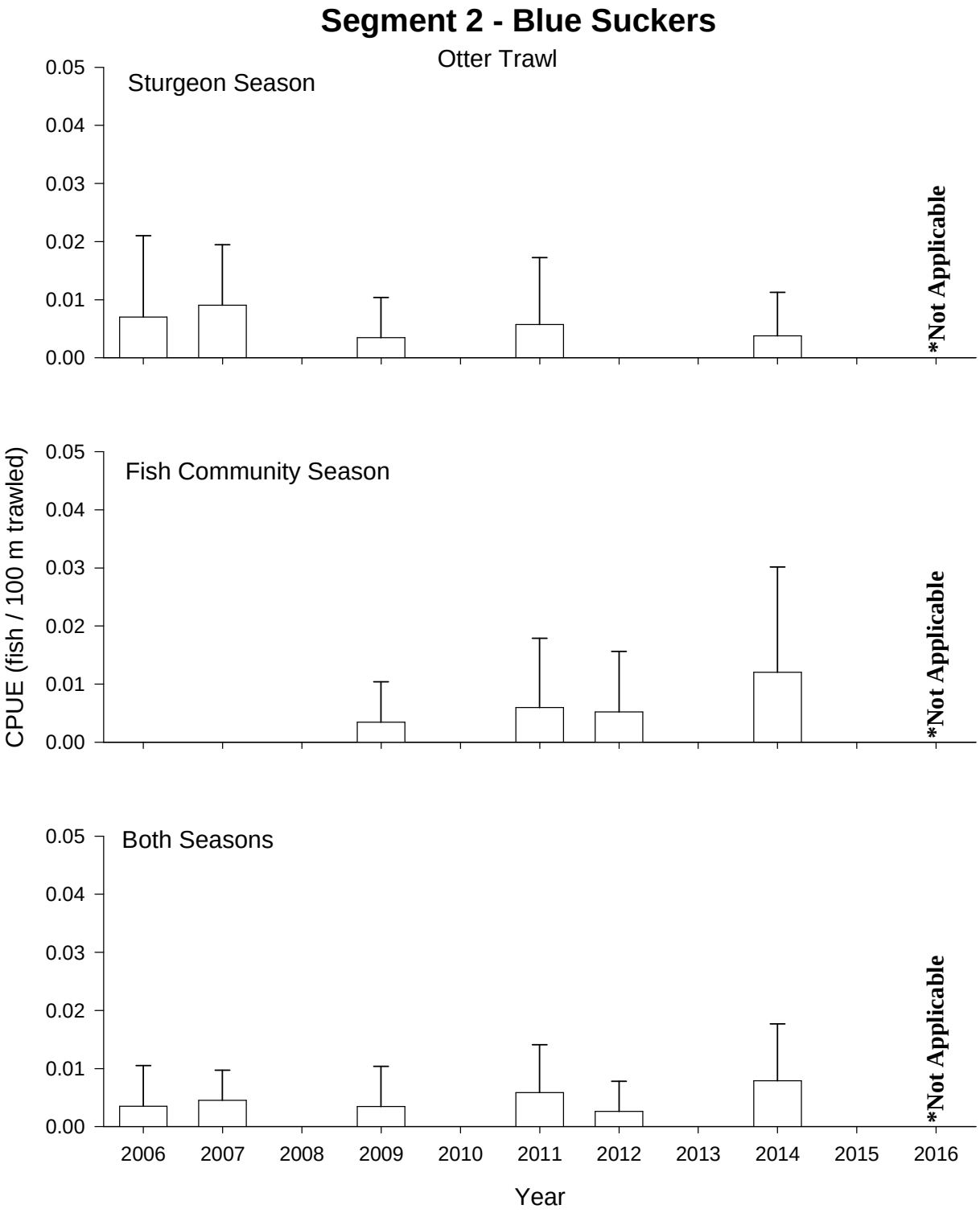


Figure 25. Mean annual catch per unit effort (+/- 2 SE) of blue sucker using otter trawls in Segment 2 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

Table 14. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 5 | 20 | 20 | 40 | 20 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

# Segment 2 - Blue Sucker

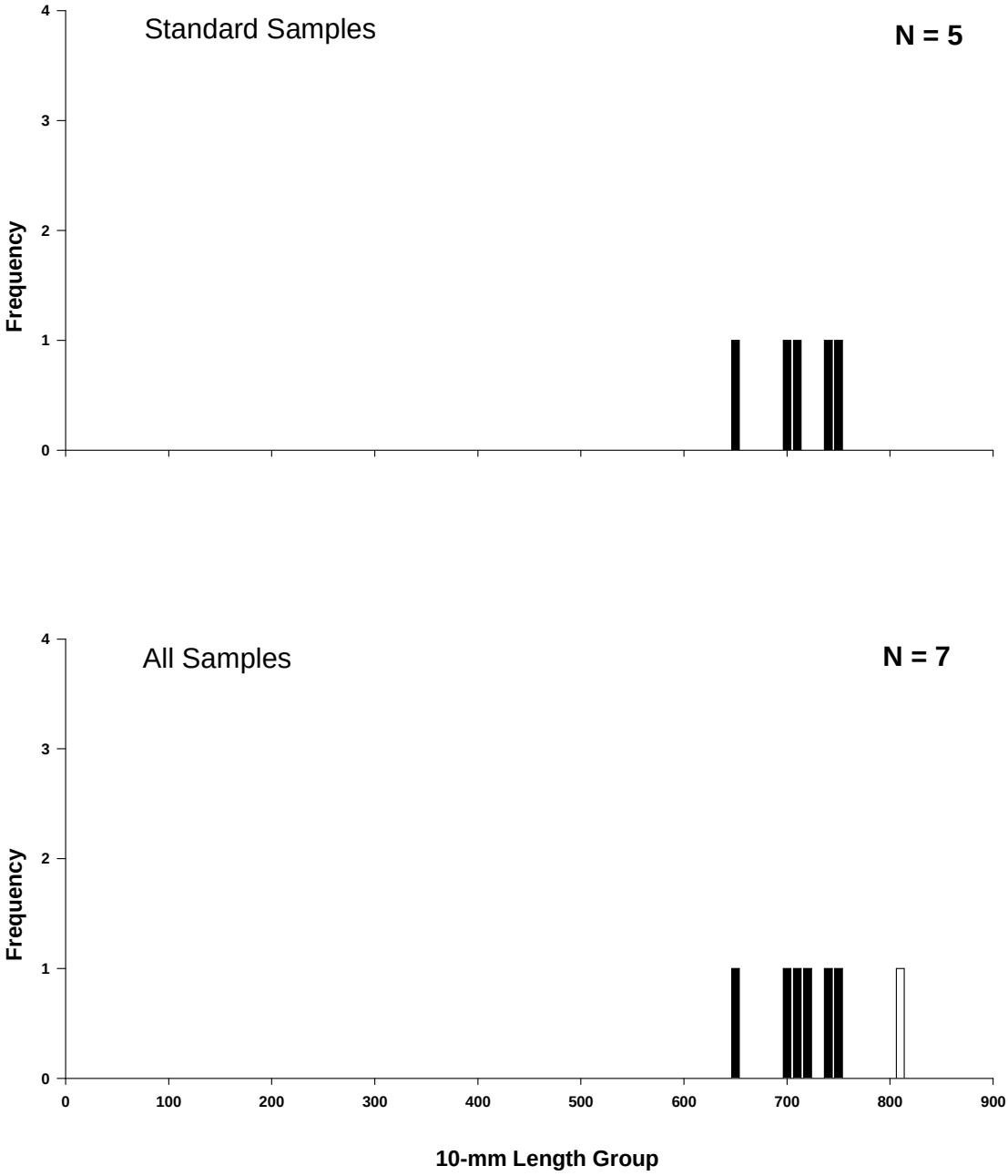


Figure 26. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

## Sauger

Segment 2 sampling events during 2016 led to the capture of 144 sauger; nearly all (N=143) of which were observed via trammel net deployments, while trotline caught the remaining one sauger. Seasonally, more sauger were captured during sturgeon season (N=94) than during fish community season (N=50).

The combined-season trammel net CPUE (Fig. 28) for Segment 2 during the 2016 sampling season was recorded at 0.28 fish/100m. Seasonally, CPUE was tabulated at 0.40 fish/100m and 0.16 fish/100m for the sturgeon and fish community seasons, respectively. Although no conclusive pattern has emerged based on year by year comparisons, it has become evident that higher sturgeon season CPUE can be related to spawning movements presumably related to the influence of the Milk River.

The sauger captured in Segment 2 during the 2016 season averaged 335 mm in total length and 298 g in weight, with a range from 222 mm to 518 mm. Although average length is only slightly larger than that observed in 2015 (328 mm), the abandonment of otter trawl and mini-fyke net as sampling gears could lead to the inability to sample smaller size classes of sauger. A complete length frequency histogram can be viewed in Figure 30.

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

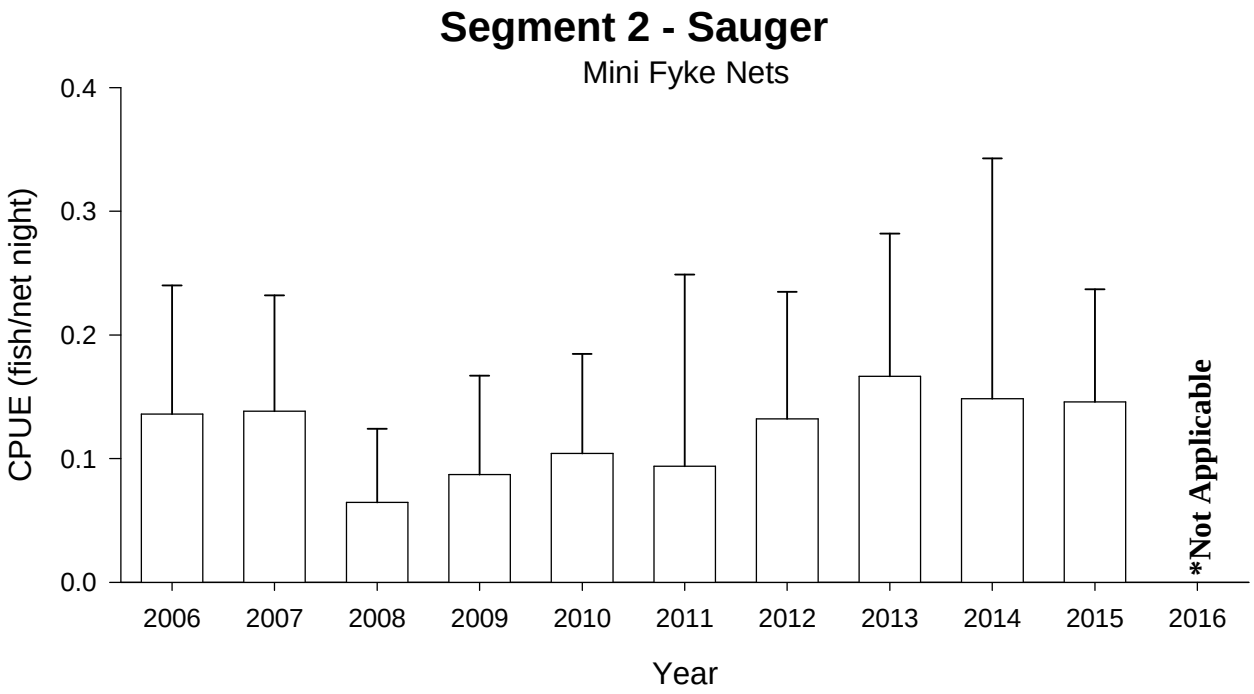


Figure 27. Mean annual catch per unit effort (+/- 2 SE) of sauger using mini-fyke nets in Segment 2 of the Missouri River from 2006-2016. *Mini-fyke nets were not performed in 2016.

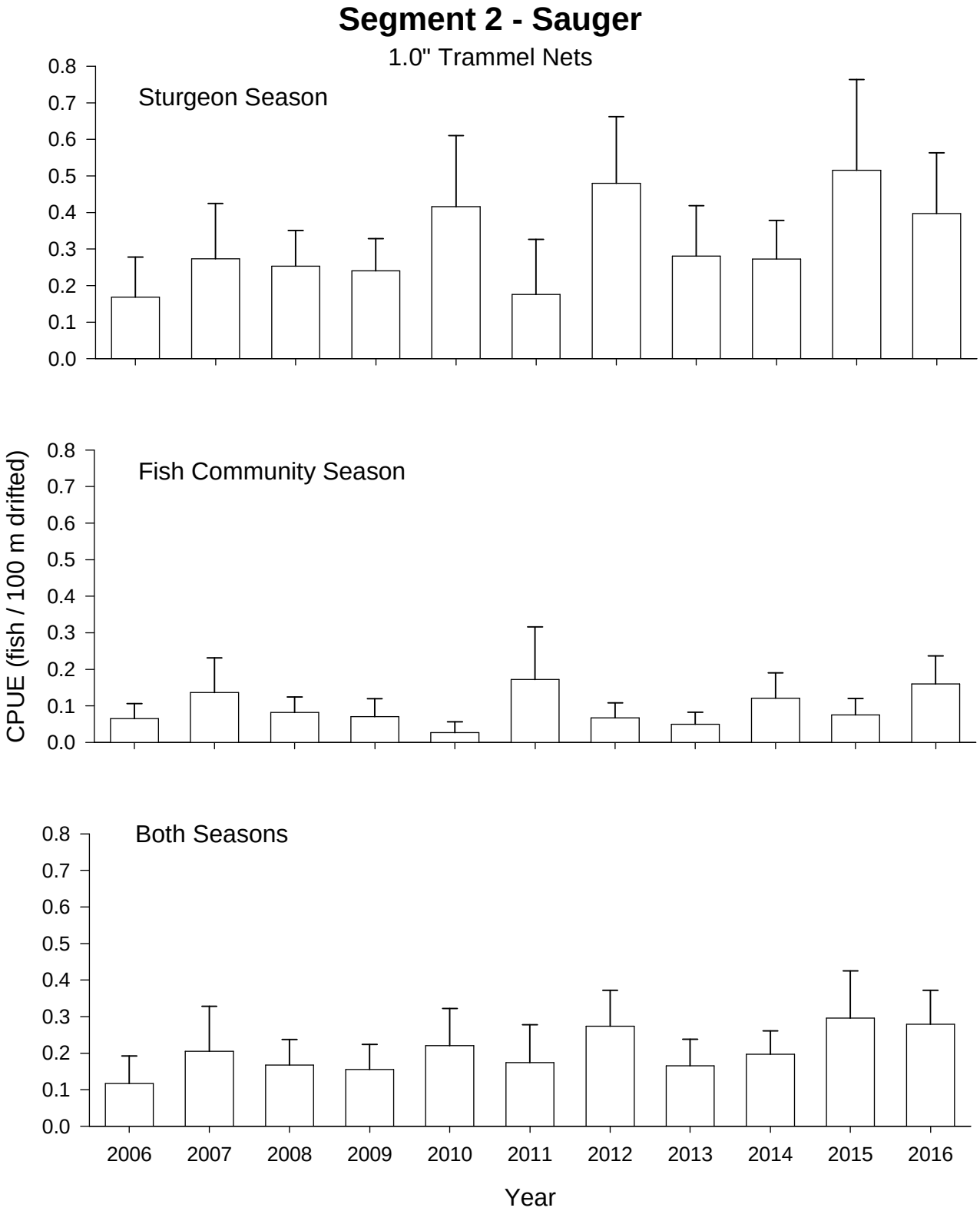


Figure 28. Mean annual catch per unit effort (+/- 2 SE) of sauger using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2016.

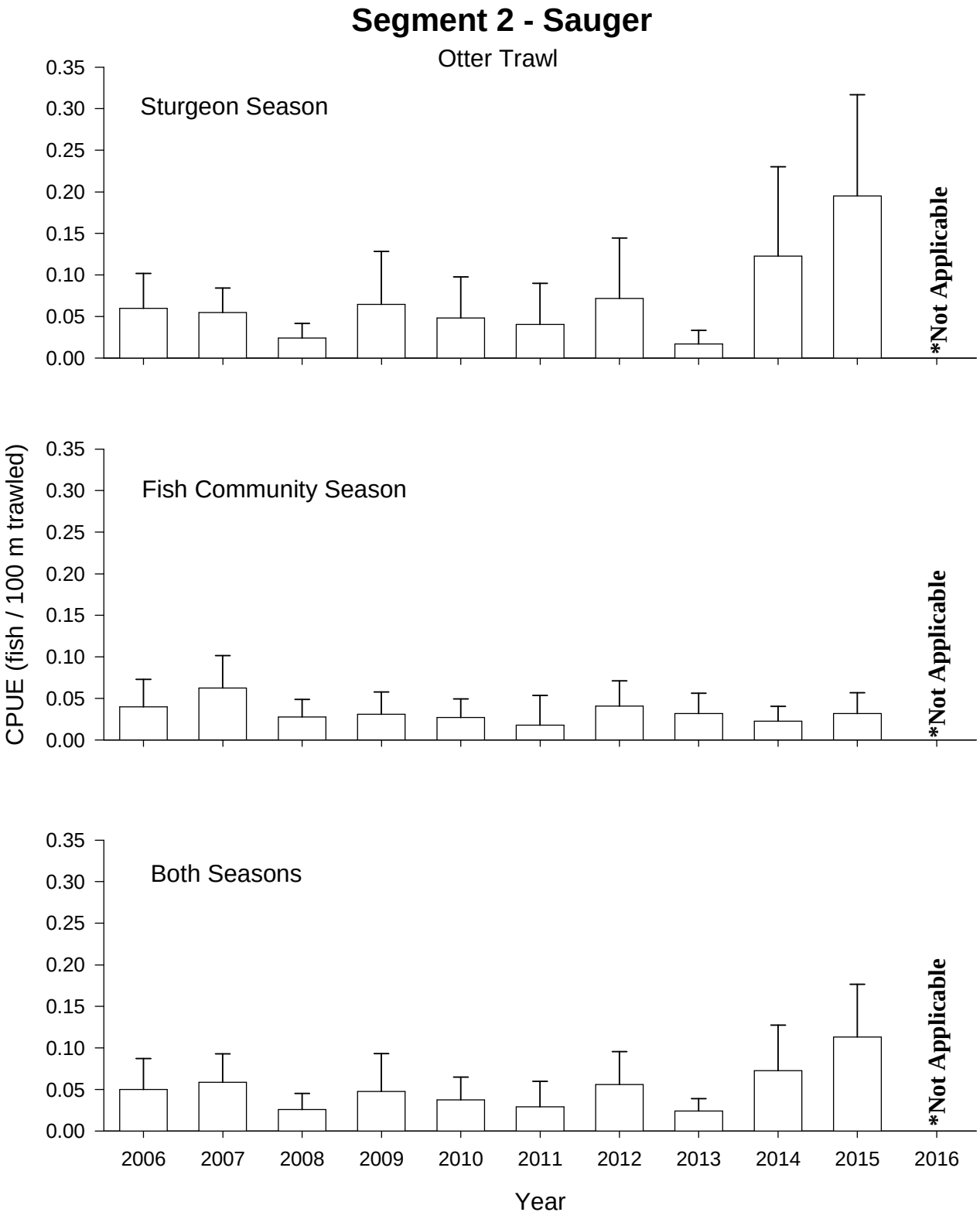


Figure 29. Mean annual catch per unit effort (+/- 2 SE) of sauger using otter trawls in Segment 2 of the Missouri River from 2006-2016. *Otter trawl not performed in 2016.

Table 15. Total number of sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2016. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

| | | Macrohabitat[a] | | | | | |
|---|---|---|---|---|---|---|---|
| **Gear** | **N** | **CHXO** | **CONF** | **ISB** | **OSB** | **SCCL** | **TRML** |
| | | | | **Sturgeon Season** | | | |
| 1.0” Trammel Net | 90 | 30 | 1 | 48 | 21 | 0 | 0 |
| | | 32 | 1 | 40 | 27 | 0 | 0 |
| | | | | **Fish Community Season** | | | |
| 1.0” Trammel Net | 34 | 26 | 9 | 53 | 12 | 0 | 0 |
| | | 33 | 2 | 30 | 32 | 4 | 0 |
| | | | | **Both Seasons** | | | |
| Trot Line | 1 | 0 | 0 | 0 | 100 | 0 | 0 |
| | | 34 | 2 | 31 | 28 | 2 | 2 |

# Segment 2 - Sauger

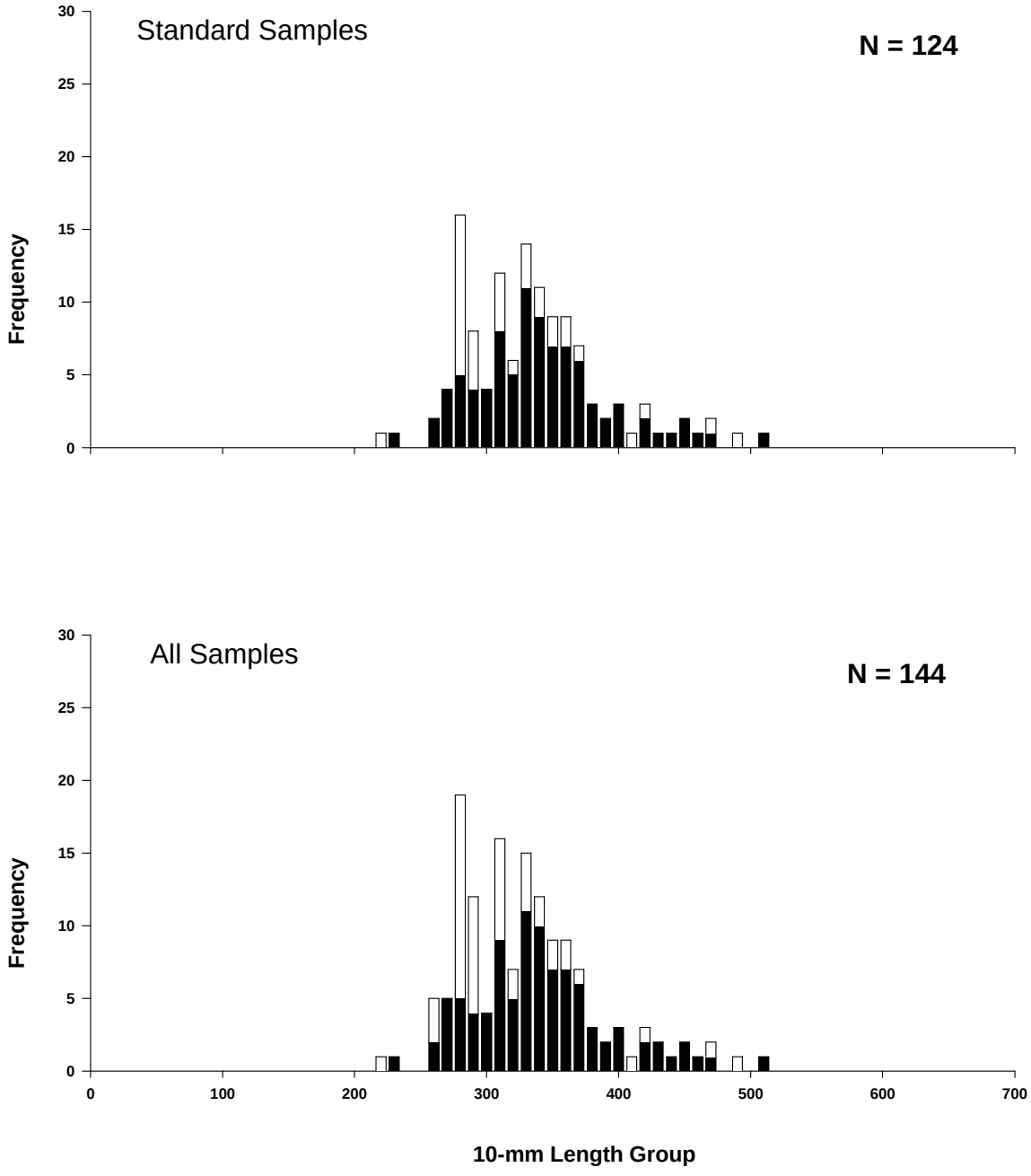


Figure 30. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2016. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2016.

## Missouri River Fish Community

The sampling regime that took place throughout Segment 2 during the 2016 field season culminated in the capture of 1,746 individual fish, which consisted of 19 different species. Considering the reduction of sampling gears, particularly mini-fyke nets, total captures and species diversity were down considerably compared to previous years.

The most frequently observed species throughout Segment 2 in 2016 was shovelnose sturgeon (N=1,002). Shovelnose sturgeon have continued to be an integral staple of the Segment 2 fish community, and continue to be sampled in high abundance throughout the entire segment using both trammel nets and trotlines.

The second most regularly sampled species was channel catfish *Ictalurus punctatus*. Sampling events in Segment 2 during the 2016 resulted in the capture of 162 individuals. Trotline was the most successful gear at catching channel catfish, with 122. Comparatively, trammel nets sampled 40 individuals.

With 144 observations, sauger were the third most frequently sampled species in Segment 2 for 2016. As stated above, and like previous sampling years, sauger captures have been more likely to occur during sturgeon season; likely the result of upstream spawning movements and in relation to spring-time flows out of the Milk River.

Goldeye *Hiodon alosoides* (N=118) and river carpsucker *Carpiodes carpio* (N=64) rounded out the top five of the most frequently observed fish species in Segment 2 during the 2016 field season. Other species, in rank of abundance were; pallid sturgeon (N=53), flathead chub *Platygobio gracilis* (N=44), shorthead redhorse *Moxostoma macrolepidotum* (N=38), longnose sucker *Catostomus catostomus* (N=35), walleye *Sander vitreus* (N=28), whites sucker *Catostomus commersoni* (N=22), 9 each of smallmouth buffalo *Ictiobus bubalus* and common carp *Cyprius carpio*, blue sucker (N=7), bigmouth buffalo *Ictiobus cyprinellus* (N=5), paddlefish *Polyodon spathula* and burbot *Lota lota* (n=2), and one observation each for rainbow trout *Oncorhynchus mykiss* and northern pike *Esox lucius*.

# Discussion

The 2016 field season marked the 11th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 2 of the Missouri River. However, it was the first year of an exercise to reduce the amount of standard gears used, with the abandonment of the otter trawl and mini-fyke net. Despite the loss of the otter trawl as a sampling gear, crews were still able to capture 53 hatchery-reared juvenile pallid sturgeon, which was the fifth highest total recorded for Segment 2 since the Program's inception in 2006.

In recent years, localized "hotspots" within Segment 2 have aided in boosting total pallid sturgeon observations. One such hotspot amid the 2016 field season led to the capture of 16 individual pallid sturgeon during a single trammel net sampling event, which comprised 30% of all the pallid sturgeon detections in Segment 2. This event, which took place near the mouth of the Milk River, is believed to have been influenced by the draining of an off river, upstream storage reservoir, which prolonged sustained flows through most of the field season. Higher summer inputs from the Milk River increase water temperature in the Missouri River in portion of Segment 2, which was observed during 2016. On a small scale, this difference in temperature can even be seen within the river bend. On August 1st, water temperature varied from a high of 24.6 $C^o$ in areas heavily influenced by the Milk River to a low of 13.5 $C^o$ in the outside bend, where the volume of water is more heavily dominated by the Missouri River upstream of the confluence.

In addition to the 16 fish sampled by gears, it is likely that a considerable number of other pallid sturgeon may have entered and remained in the Milk River itself throughout much of the 2016 field season. At least four radio telemetered hatchery reared pallid sturgeon were observed using the lower portions of the Milk River from early June through early July (MFWP unpublished data, 2016). Similarly, MFWP received anecdotal information from anglers who caught pallid sturgeon in the Milk River during the summer, while fishing for game species.

In regards to pallid sturgeon, fish community season trammel net CPUE (0.09 fish/100 m) and combined-season trammel net CPUE (0.05 fish/100 m) were both the second highest tabulated CPUEs since the Program started in Segment 2. For comparison, the previous high in regards for both of these metrics was observed in 2015 at 0.10 fish/100m and 0.07/100m, respectively. Although over time sturgeon season trammel net CPUE has remained variable, a general pattern of increasing fish community season CPUE has emerged, in turn causing a

general increasing pattern of combined-season trammel net CPUE. The mechanism for the phenomena of increased fish community season CPUE, when compared to the sturgeon season is unclear.

Conversely, trotline CPUE remained similar between seasons during 2016. Trotline CPUEs of 0.25 fish/20 hooks, 0.21 fish/20 hooks, and 0.23 fish/20 hooks were calculated for the sturgeon, fish community, and combined-seasons, respectively. Overall CPUE for trotlines was at its lowest since 2011. Trotlines remained an effective gear for sampling pallid sturgeon in Segment 2 of the Missouri River during 2016.

Pallid sturgeon captured in Segment 2 during the 2016 field season averaged 419 mm in fork length, and averaged 244 g in weight. Although the average total length of observed individuals was comparable to previous years, larger individuals (>700 mm) were absent from 2016 sampling. After an influx of larger size class pallid sturgeon in recent years, it is unclear why crews failed to capture any in 2016. However, it is possible given the sampling design and that larger juvenile pallid sturgeon potentially exist in Segment 2 in low abundance, crews simply did not sample them.

Shovelnose sturgeon continue to be highly abundant throughout Segment 2, particularly in the upper reaches. Consequentially, more shovelnose sturgeon were captured during 2016 (N=1,002) than any other species. Trammel net and trotline were both highly successful gears at sampling shovelnose sturgeon, with 679 and 325 observations, respectively.

Shovelnose sturgeon trammel net CPUE for Segment 2 in 2016 were calculated at an all-time highs for both fish community season (1.88 fish/100m), as well as combined-season (1.31 fish/100m). A general increasing pattern of fish community CPUE is causing a general increasing CPUE pattern when combined-season CPUE is tabulated. Also similarly to pallid sturgeon, the mechanism for increased CPUE during fish community season is unclear.

Trotline CPUEs in Segment 2 for 2016 were recorded at 3.38 fish/20 hooks and 2.40 fish/20 hooks for sturgeon and fish community seasons, respectively. The combined-season CPUE was then calculated at 3.38 fish/20 hooks. All three-seasonal metrics continue to be variable from year to year.

The shovelnose sturgeon observed during the 2016 field season in Segment 2 averaged 617 mm in fork length and 959 g in weight. With the lack of smaller size classes of shovelnose sturgeon residing in Segment 2, observed average length has remained similar over time. Given that the vast majority of YOY shovelnose sturgeon presumably drift downstream and rear in

Segment 4 of the Missouri River, it appears to take a considerable amount of time before those fish recruit back to the upper reaches of the Missouri River below Fort Peck Dam.

Blue sucker observations in Segment 2 were once again heavily weighted towards sturgeon season sampling events during the 2016 field season, with six of the seven individuals being sampled during that time period. With the above pattern noted, it has become obvious that the blue sucker captures in Segment 2 are positively correlated to upstream spawning movements of adult blue suckers. Furthermore, since the Program's inception in 2006, the only year in which fish community season trammel net CPUE eclipsed sturgeon season CPUE was 2011; which was challenging year given the record flow events that occurred throughout much of the field season.

Similarly to blue suckers, sauger catch rates are heavily influenced by perceived spring time spawning migrations; with 62% of the sauger observations occurring during sturgeon season in 2016. Also identical to blue suckers, 2011 was the only year in which fish community trammel net CPUE was greater than the observed CUPE during sturgeon season. It is clear that the Milk River, and its influence to the reaches below Fort Peck Dam, is an important tributary to many of the native fish species found in Segment 2 of the Missouri River, particularly blue sucker and sauger.

With the suspension of the otter trawl and mini-fyke net as sampling gears, virtually all trend data for the small-bodied target species (sturgeon and sicklefin chubs, *Hybognathus* spp., and sand shiner) were lost for the 2016 field season. Although captures of sturgeon chub, and more so sicklefin chub, were fairly rare in Segment 2, the remaining standard gears offer no possible method for tracking abundance of these two target species. Similarly, although more frequently captured in otter trawl and mini-fyke, no *Hybognathus* spp or sand shiners were captured using trammel net and trotlines as standard sampling gears during the 2016 field season.

## Acknowledgments

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

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# Appendices

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program.

| 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 2 for the long-term pallid sturgeon and associated fish community sampling program.

| Gear | Code | Type | Season | Years | CPUE units |
|---|---|---|---|---|---|
| Gill Net – 4 meshes, small mesh set upstream | GN14 | Standard | Sturgeon | 2003 - Present | Fish / net night |
| Gill Net – 4 meshes, large mesh set upstream | GN41 | Standard | Sturgeon | 2003 - Present | Fish / net night |
| Gill Net – 8 meshes, small mesh set upstream | GN18 | Standard | Sturgeon | 2003 - Present | Fish / net night |
| Gill Net – 8 meshes, large mesh set upstream | GN81 | Standard | Sturgeon | 2003 - Present | Fish / net night |
| Trammel Net – 1.0”inner mesh | TN | Standard | Sturgeon | 2003 - Present | Fish / 100 m drift |
| | | Standard | Fish Comm. | 2003 - 2009 | Fish / 100 m drift |
| Otter Trawl – 16 ft head rope | OT16 | Standard | Both Seasons | 2003 - Present | Fish / 100 m trawled |
| Mini-Fyke Net | MF | Standard | Fish Comm. | 2003 - Present | Fish / net night |
| Beam Trawl | BT | Standard | Both Seasons | 2003 - 2004 | Fish / 100 m trawled |
| Hoop Net – 4 ft. | HN | Standard | Both Seasons | 2003 - 2004 | Fish / net night |
| Trammel Net – 2.5” inner mesh | TN25 | Standard | Sturgeon | 2005 – 2006 | Fish / 100 m drift |
| Bag Seine – quarter arc method pulled upstream | BSQU | Standard | Fish Comm. | 2003 – 2005 | Fish / 100 $m^2$ |
| Bag Seine – quarter arc method pulled downstream | BSQD | Standard | Fish Comm. | 2003 - 2005 | Fish / 100 $m^2$ |
| Bag Seine – half arc method pulled upstream | BSHU | Standard | Fish Comm. | 2003 - 2005 | Fish / 100 $m^2$ |
| Bag Seine – half arc method pulled downstream | BSHD | Standard | Fish Comm. | 2003 - 2005 | Fish / 100 $m^2$ |
| Bag seine – rectangular method pulled upstream | BSRU | Standard | Fish Comm. | 2003 - 2005 | Fish / 100 $m^2$ |
| Bag seine – rectangular method pulled downstream | BSRD | Standard | Fish Comm. | 2003 - 2005 | Fish / 100 $m^2$ |
| Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR | OT01 | Evaluation | Fish Comm. | 2006 | Fish / 100 m trawled |
| Push Trawl – 8 ft 4mm x 4mm | POT02 | Evaluation | Fish Comm. | 2007 | Fish / m trawled |
| Trot Line | TL | Evaluation | Both Season | 2009 | Fish / hook night |
| | | Standard | Both Seasons | 2010 - Present | Fish / hook night |

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

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

Appendix E. Juvenile and adult pallid sturgeon stocking summary for Segment 2 of the Missouri River (RPMA 4).

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

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

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

| Year | Stocking Site | Number Stocked | Year Class | Stock Date | Age at Stocking[a] | Primary Mark | Secondary Mark |
|---|---|---|---|---|---|---|---|
| 2006 | School Trust | 436 | 2006 | 11/8/2006 | Advanced Fingerling | Elastomer | |
| 2007 | Culbertson | 651 | 2006 | 4/5/2007 | Yearling | PIT Tag | Scute Removed |
| 2007 | Fallon | 491 | 2006 | 4/3/2007 | Yearling | PIT Tag | Scute Removed |
| 2007 | Forsyth | 492 | 2006 | 4/3/2007 | Yearling | PIT Tag | Scute Removed |
| 2007 | Sidney | 983 | 2006 | 4/3/2007 | Yearling | PIT Tag | Scute Removed |
| 2007 | School Trust | 639 | 2006 | 4/5/2007 | Yearling | PIT Tag | Scute Removed |
| 2007 | Wolf Point | 651 | 2006 | 4/5/2007 | Yearling | PIT Tag | Scute Removed |
| 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 | |

| Year | Stocking Site | Number Stocked | Year Class | Stock Date | Age at Stocking[a] | Primary Mark | Secondary Mark |
|---|---|---|---|---|---|---|---|
| 2008 | Fallon | 1307 | 2007 | 5/7/2008 | Yearling | PIT Tag | Scute Removed |
| 2008 | Forsyth | 1384 | 2007 | 5/7/2008 | Yearling | PIT Tag | Scute Removed |
| 2008 | Forsyth | 106 | 2007 | 3/26/2008 | Yearling | Elastomer | |
| 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 | |

| Year | Stocking Site | Number Stocked | Year Class | Stock Date | Age at Stocking[a] | Primary Mark | Secondary Mark |
|---|---|---|---|---|---|---|---|
| 2009 | Intake | 8374 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2009 | Sidney | 1865 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2009 | Wolf Point | 9946 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2009 | Intake | 8374 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2009 | Sidney | 1865 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2009 | Wolf Point | 9946 | 2009 | 9/23/2009 | Fingerling | Elastomer | |
| 2010 | Fallon | 721 | 2009 | 4/15/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Fallon | 268 | 2009 | 8/3/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Fallon | 1000 | 2010 | 10/7/2010 | Fingerling | Elastomer | |
| 2010 | Forsyth | 1402 | 2009 | 4/15/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Forsyth | 268 | 2009 | 8/3/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Intake | 1890 | 2009 | 4/15/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Intake | 816 | 2009 | 6/4/2010 | Yearling | Elastomer | |
| 2010 | Intake | 541 | 2009 | 8/3/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Intake | 1000 | 2010 | 10/7/2010 | Fingerling | Elastomer | |
| 2010 | Sidney | 331 | 2009 | 4/15/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Wolf Point | 1309 | 2009 | 4/15/2010 | Yearling | PIT Tag | Elastomer, Scute |
| 2010 | Wolf Point | 858 | 2009 | 6/4/2010 | Yearling | Elastomer | |
| 2010 | Wolf Point | 425 | 2009 | 8/3/2010 | Yearling | PIT Tag | Scute Removed |
| 2010 | Wolf Point | 1000 | 2010 | 10/7/2010 | Fingerling | Elastomer | |
| 2010 | Culbertson | 65 | 2004 | 9/21/2010 | 6 Yr Old | PIT Tag | |
| 2010 | Culbertson | 1337 | 2009 | 4/15/2010 | Yearling | PIT Tag | Elastomer, Scute |
| 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 Removed |
| 2011 | Wolf Point | 797 | 2010 | 5/5/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Fallon | 531 | 2010 | 5/5/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Forsyth | 545 | 2010 | 5/5/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Intake | 510 | 2010 | 5/5/2011 | Yearling | PIT Tag | Scute Removed |

| Year | Stocking Site | Number Stocked | Year Class | Stock Date | Age at Stocking[a] | Primary Mark | Secondary Mark |
|---|---|---|---|---|---|---|---|
| 2011 | Culbertson | 262 | 2010 | 8/22/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Fallon | 131 | 2010 | 8/22/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Forsyth | 174 | 2010 | 8/22/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Intake | 132 | 2010 | 8/22/2011 | Yearling | PIT Tag | Scute Removed |
| 2011 | Wolf Point | 262 | 2010 | 8/22/2011 | Yearling | PIT Tag | Scute Removed |
| 2013 | Wolf Point | 187 | 2012 | 4/22/2013 | Yearling | PIT Tag | Scute Removed |
| 2013 | Culbertson | 187 | 2012 | 4/22/2013 | Yearling | PIT Tag | Scute Removed |
| 2013 | Intake | 118 | 2012 | 4/22/2013 | Yearling | PIT Tag | Scute Removed |
| 2013 | Fallon | 185 | 2012 | 4/22/2013 | Yearling | PIT Tag | Scute Removed |
| 2014 | Culbertson | 212 | 2013 | 4/15/2014 | Yearling | PIT Tag | Scute Removed |
| 2014 | Kinsey Bridge | 214 | 2013 | 4/15/2014 | Yearling | PIT Tag | Scute Removed |
| 2014 | Powder River Depot | 210 | 2013 | 4/15/2014 | Yearling | PIT Tag | Scute Removed |
| 2014 | Wolf Point | 211 | 2013 | 4/15/2014 | Yearling | PIT Tag | Scute Removed |
| 2015 | Culbertson | 153 | 2014 | 4/20/2015 | Yearling | PIT Tag | Scute Removed |
| 2015 | Fallon | 146 | 2014 | 4/23/2015 | Yearling | PIT Tag | Scute Removed |
| 2015 | Intake | 109 | 2014 | 4/23/2015 | Yearling | PIT Tag | Scute Removed |
| 2015 | Wolf Point | 161 | 2014 | 4/20/2015 | Yearling | PIT Tag | Scute Removed |
| 2016 | Culbertson | 353 | 2015 | 4/5/2016 | Yearling | PIT Tag | Scute Removed |
| 2016 | Fallon | 357 | 2015 | 4/6/ 2016 | Yearling | PIT Tag | Scute Removed |
| 2016 | Fallon | 30 | | 5/2/16 | Yearling | PIT Tag/Radio | Scute Removed |
| 2016 | Intake | 358 | 2015 | 4/6/ 2016 | Yearling | PIT Tag | Scute Removed |
| 2016 | Intake | 30 | | 5/2/16 | Yearling | PIT Tag/Radio | Scute Removed |
| 2016 | Wolf Point | 357 | 2015 | 4/5/2016 | Yearling | PIT Tag | Scute Removed |

# Appendix F

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 2 of the Missouri River during 2016. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

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

| | | | CHXO | CONF | ISB | OSB | SCCL |
|---|---|---|---|---|---|---|---|
| species | Total Catch | Overall CPUE | CHNB | CHNB | CHNB | CHNB | CHNB |
| BMBF | 5 | 0.017 | 0 | 0.281 | 0.005 | 0.031 | 0 |
| | | 0.018 | 0 | 0.562 | 0.01 | 0.041 | 0 |
| BRBT | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 |
| BUSK | 5 | 0.012 | 0.006 | 0.125 | 0.015 | 0.008 | 0 |
| | | 0.013 | 0.012 | 0.25 | 0.03 | 0.017 | 0 |
| CARP | 6 | 0.012 | 0.022 | 0 | 0.005 | 0.012 | 0 |
| | | 0.012 | 0.034 | 0 | 0.01 | 0.018 | 0 |
| CNCF | 31 | 0.065 | 0.065 | 0.133 | 0.084 | 0.043 | 0 |
| | | 0.027 | 0.042 | 0.266 | 0.057 | 0.039 | 0 |
| FHCB | 39 | 0.075 | 0.079 | 0 | 0.101 | 0.051 | 0 |
| | | 0.031 | 0.059 | 0 | 0.064 | 0.035 | 0 |
| GDEY | 76 | 0.203 | 0.111 | 0.27 | 0.303 | 0.188 | 0 |
| | | 0.092 | 0.067 | 0.311 | 0.212 | 0.161 | 0 |
| LNSK | 24 | 0.058 | 0.018 | 0 | 0.091 | 0.067 | 0 |
| | | 0.035 | 0.025 | 0 | 0.074 | 0.071 | 0 |
| NTPK | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 |

| species | Total Catch | Overall CPUE | CHXO CHNB | CONF CHNB | ISB CHNB | OSB CHNB | SCCL CHNB |
|---|---|---|---|---|---|---|---|
| PDFH | 2 | 0.004 | 0 | 0 | 0.005 | 0.006 | 0 |
| | | 0.005 | 0 | 0 | 0.01 | 0.012 | 0 |
| PDSG | 21 | 0.053 | 0.016 | 0.683 | 0.03 | 0.076 | 0 |
| | | 0.038 | 0.032 | 1.366 | 0.033 | 0.068 | 0 |
| RBTT | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 |
| RVCS | 61 | 0.155 | 0.18 | 0.27 | 0.17 | 0.108 | 0.109 |
| | | 0.058 | 0.13 | 0.311 | 0.104 | 0.073 | 0.219 |
| SGER | 124 | 0.279 | 0.239 | 0.528 | 0.368 | 0.215 | 0 |
| | | 0.093 | 0.126 | 0.435 | 0.204 | 0.142 | 0 |
| SHRH | 19 | 0.045 | 0.057 | 0 | 0.043 | 0.041 | 0 |
| | | 0.027 | 0.047 | 0 | 0.043 | 0.054 | 0 |
| SMBF | 8 | 0.019 | 0 | 0.375 | 0.015 | 0.011 | 0.146 |
| | | 0.019 | 0 | 0.75 | 0.017 | 0.022 | 0.292 |
| SNSG | 606 | 1.386 | 1.24 | 1.2 | 1.335 | 1.661 | 0.117 |
| | | 0.347 | 0.648 | 1.191 | 0.439 | 0.773 | 0.233 |
| WLYE | 23 | 0.059 | 0.023 | 0.266 | 0.094 | 0.042 | 0 |
| | | 0.031 | 0.028 | 0.532 | 0.067 | 0.044 | 0 |
| WTSK | 12 | 0.027 | 0.027 | 0.125 | 0.025 | 0.023 | 0 |
| | | 0.018 | 0.039 | 0.25 | 0.022 | 0.036 | 0 |

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

*Otter trawl not performed in 2016.

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

*Mini-fyke net not performed in 2016.

Appendix F4. Trot lines: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

| | | | CHXO | CONF | ISB | OSB | SCCL | TRML |
|---|---|---|---|---|---|---|---|---|
| species | Total Catch | Overall CPUE | CHNB | CHNB | CHNB | CHNB | CHNB | CHNB |
| BMBF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BRBT | 2 | 0.021 | 0.061 | 0 | 0 | 0 | 0 | 0 |
| | | 0.042 | 0.121 | 0 | 0 | 0 | 0 | 0 |
| BUSK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CARP | 3 | 0.031 | 0.061 | 0 | 0 | 0.037 | 0 | 0 |
| | | 0.046 | 0.121 | 0 | 0 | 0.074 | 0 | 0 |
| CNCF | 122 | 1.271 | 1.212 | 7 | 0.6 | 0.889 | 0.5 | 12.5 |
| | | 0.495 | 0.65 | 8 | 0.402 | 0.469 | 1 | 3 |
| FHCB | 4 | 0.042 | 0.091 | 0 | 0.033 | 0 | 0 | 0 |
| | | 0.041 | 0.102 | 0 | 0.067 | 0 | 0 | 0 |
| GDEY | 26 | 0.271 | 0.273 | 0 | 0.3 | 0.222 | 0.5 | 0.5 |
| | | 0.113 | 0.2 | 0 | 0.218 | 0.195 | 1 | 1 |
| LNSK | 7 | 0.073 | 0.091 | 0 | 0.1 | 0.037 | 0 | 0 |
| | | 0.08 | 0.134 | 0 | 0.2 | 0.074 | 0 | 0 |
| NTPK | 1 | 0.01 | 0.03 | 0 | 0 | 0 | 0 | 0 |
| | | 0.021 | 0.061 | 0 | 0 | 0 | 0 | 0 |

| species | Total Catch | Overall CPUE | CHXO CHNB | CONF CHNB | ISB CHNB | OSB CHNB | SCCL CHNB | TRML CHNB |
|---|---|---|---|---|---|---|---|---|
| PDFH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PDSG | 22 | 0.229 | 0.273 | 0 | 0.167 | 0.259 | 0.5 | 0 |
| | | 0.096 | 0.2 | 0 | 0.138 | 0.172 | 1 | 0 |
| RBTT | 1 | 0.01 | 0.03 | 0 | 0 | 0 | 0 | 0 |
| | | 0.021 | 0.061 | 0 | 0 | 0 | 0 | 0 |
| RVCS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SGER | 1 | 0.01 | 0 | 0 | 0 | 0.037 | 0 | 0 |
| | | 0.021 | 0 | 0 | 0 | 0.074 | 0 | 0 |
| SHRH | 11 | 0.115 | 0.212 | 0 | 0.1 | 0.037 | 0 | 0 |
| | | 0.078 | 0.169 | 0 | 0.147 | 0.074 | 0 | 0 |
| SMBF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SNSG | 325 | 3.385 | 4.303 | 0 | 3.3 | 2.741 | 5 | 0 |
| | | 0.717 | 1.278 | 0 | 1.393 | 1.138 | 0 | 0 |
| WLYE | 3 | 0.031 | 0.03 | 0 | 0.033 | 0.037 | 0 | 0 |
| | | 0.036 | 0.061 | 0 | 0.067 | 0.074 | 0 | 0 |
| WTSK | 6 | 0.063 | 0.091 | 0 | 0.067 | 0.037 | 0 | 0 |
| | | 0.058 | 0.134 | 0 | 0.093 | 0.074 | 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 2016 for Segment 2 of the Missouri River.

| | **Sturgeon Season** | **Fish Community Season** | **Both Seasons** |
|---|---|---|---|
| **species** | 1.0” Trammel Net | 1.0” Trammel Net | Trotline |
| BMBF | 0.035 | 0.000 | 0.000 |
| BRBT | 0.000 | 0.000 | 0.021 |
| **BUSK** | 0.024 | 0.000 | 0.000 |
| CARP | 0.021 | 0.004 | 0.031 |
| CNCF | 0.064 | 0.066 | 1.271 |
| FHCB | 0.079 | 0.071 | 0.042 |
| GDEY | 0.120 | 0.287 | 0.271 |
| LNSK | 0.032 | 0.084 | 0.073 |
| NTPK | 0.000 | 0.000 | 0.010 |
| PDFH | 0.007 | 0.000 | 0.000 |
| **PDSG** | 0.020 | 0.086 | 0.229 |
| RBTT | 0.000 | 0.000 | 0.010 |
| RVCS | 0.246 | 0.064 | 0.000 |
| **SGER** | 0.397 | 0.160 | 0.010 |
| SHRH | 0.051 | 0.039 | 0.115 |
| SMBF | 0.030 | 0.008 | 0.000 |
| **SNSG** | 0.767 | 2.005 | 3.385 |
| WLYE | 0.048 | 0.069 | 0.031 |
| WTSK | 0.047 | 0.007 | 0.063 |

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 2 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2006 – 2016 and High Water in 2011.

| Bend Number | Bend River Mile | Coordinates Lattidude | Longitude | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1761 | 48.05581 | 106.32055 | ST, FC | | | | | ST, FC, HW | ST, FC | ST | ST, FC | ST, FC | ST, FC |
| 2 | 1760 | 48.04356 | 106.30328 | | | | | | | | | ST, FC | | |
| 3 | 1759 | 48.04416 | 106.28819 | | ST, FC | | | | HW | | | | FC | |
| 4 | 1757.5 | 48.03696 | 106.25307 | | | | | | HW | | | | ST, FC | FC |
| 5 | 1756 | 48.03379 | 106.24998 | | | | | ST, FC | FC | | | ST | ST, FC | ST, FC |
| 6 | 1754.5 | 48.02680 | 106.19850 | | | ST, FC | | ST, FC | FC, HW | | | ST, FC | ST, FC | |
| 7 | 1753 | 48.02938 | 106.16258 | | ST, FC | ST, FC | | | ST, FC | FC | ST | ST, FC | ST, FC | ST |
| 8 | 1751 | 48.03120 | 106.13605 | | | ST, FC | ST, FC | | ST, FC, HW | ST, FC | ST, FC | | | ST, FC |
| 9 | 1749.5 | 48.02872 | 106.12263 | ST, FC | | | | | ST, FC, HW | ST | FC | | | |
| 10 | 1747 | 48.00566 | 106.10929 | | | | | ST, FC | ST, FC, HW | ST, FC | ST, FC | | ST | FC |
| 11 | 1745 | 48.02677 | 106.08480 | | | | ST, FC | ST, FC | ST, FC | | | | ST, FC | ST, FC |
| 12 | 1744 | 48.03534 | 106.08521 | ST, FC | ST, FC | ST, FC | ST, FC | | FC | | | | ST, FC | ST, FC |
| 13 | 1741.5 | 48.00999 | 106.04510 | | | | ST, FC | ST, FC | | | | ST, FC | | ST |
| 14 | 1740 | 48.00255 | 106.02716 | | ST, FC | | | | | | | ST, FC | | ST, FC |
| 15 | 1738 | 48.03068 | 106.01973 | | | | | | | | ST | ST, FC | | |
| 16 | 1736.5 | 48.03137 | 106.00100 | | ST, FC | | ST, FC | | | FC | ST, FC | | | |
| 17 | 1735 | 48.02545 | 105.98821 | | | ST, FC | | | | ST, FC | | | | |
| 18 | 1733 | 48.01287 | 105.95323 | ST, FC | | | | | | ST | | ST | ST | FC |
| 19 | 1732 | 48.01149 | 105.93182 | ST, FC | ST, FC | | | | | ST, FC | FC | ST, FC | ST, FC | ST, FC |
| 20 | 1730.5 | 48.01514 | 105.89578 | | | | | | | | ST, FC | | | |
| 21 | 1728.5 | 48.03616 | 105.89557 | | | ST, FC | | | | | ST | | | |

| Bend Number | Bend River Mile | Coordinates Lattidude | Longitude | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 1727.5 | 48.03228 | 105.88458 | | | | | | FC | | ST, FC | | | |
| 23 | 1726.5 | 48.01900 | 105.87228 | ST, FC | ST, FC | | ST, FC | ST, FC | | | FC | | | ST |
| 24 | 1725.5 | 48.00855 | 105.85176 | | | ST, FC | | | | | ST, FC | | | ST, FC |
| 25 | 1723.5 | 48.01666 | 105.82971 | | | ST, FC | | ST, FC | | FC | | | FC | |
| 26 | 1722 | 48.02402 | 105.79479 | | ST, FC | | | | FC, HW | ST, FC | FC | FC | ST, FC | FC |
| 27 | 1720 | 48.04621 | 105.77785 | | | | ST, FC | ST, FC | HW | FC | FC | ST, FC | ST, FC | ST, FC |
| 28 | 1719 | 48.04468 | 105.76749 | ST, FC | ST, FC | | | | HW | ST | | ST, FC | | ST |
| 29 | 1717.5 | 48.02643 | 105.74791 | | | | | ST, FC | FC, HW | ST, FC | FC | ST, FC | | ST, FC |
| 30 | 1716 | 48.03228 | 105.71736 | | | | ST, FC | | FC, HW | FC | ST | | | FC |
| 31 | 1714 | 48.05327 | 105.69457 | | | | ST, FC | ST, FC | HW | FC | ST, FC | | | ST, FC |
| 32 | 1712 | 48.05313 | 105.66531 | | ST, FC | ST, FC | | | | ST, FC | ST, FC | | FC | |
| 33 | 1710.5 | 48.04739 | 105.66245 | ST, FC | | ST, FC | | | | ST, FC | ST, FC | ST | ST, FC | ST |
| 34 | 1710 | 48.05159 | 105.64158 | ST, FC | | | ST, FC | | | FC | | ST, FC | ST, FC | ST, FC |
| 35 | 1709 | 48.06960 | 105.64798 | ST, FC | | | | | HW | ST, FC | FC | | | ST, FC |
| 36 | 1707.5 | 48.07648 | 105.64107 | | | ST, FC | | | | ST, FC | FC | | | |
| 37 | 1706.5 | 48.07407 | 105.62061 | ST, FC | ST, FC | | ST, FC | ST, FC | HW | FC | ST, FC | | | |
| 38 | 1705.5 | 48.07725 | 105.60690 | | | | | ST, FC | | ST, FC | ST, FC | FC | FC | |
| 39 | 1704.5 | 48.08012 | 105.58631 | ST, FC | ST, FC | ST, FC | | | ST, FC | | ST, FC | ST, FC | ST, FC | |
| 40 | 1703 | 48.07828 | 105.56033 | | | | ST, FC | | ST, FC, HW | | ST, FC | | | |