

2017 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 2017 field season marked the 12th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 2 of the Missouri River. Although this was the 12th year of sampling, it was also the second consecutive year of a reduction in sampling gears. Neither the otter trawl or mini-fyke net was used in sampling during the 2016 or 2017 field season. Sampling efforts with the two standard gears, trammel net and trotline, led to the capture of 31 pallid sturgeon, all of which were of hatchery origin.

A total of 12 randomly selected river bends were sampled in Segment 2 during 2017. All 12 bends were sampled with trammel nets during both sturgeon and fish community seasons. Comparatively, trotlines were used to sample each bend once; with half of the bends sampled during sturgeon season and the other half sampled during the fish community season. A total of 205 trammel nets were drifted throughout Segment 2 in 2017, which accounted for 48.2 km of sampling. Additionally, using the standard sampling method of eight trotlines per bend, a total of 96 trotlines were deployed, totaling 1,960 nightcrawler-baited hook nights.

A total of 31 pallid sturgeon were captured in Segment 2 during the 2017 field season, all of which were of hatchery origin. Temporally, more pallid sturgeon were captured during sturgeon season (n=17), than fish community season (n=14). Trotline was the most successful gear at capturing pallid sturgeon, resulting in 20 observations, while trammel net detected an additional 11 individuals. Pallid sturgeon were detected in five of the 12 randomly selected trammel net bends. In comparison, pallid sturgeon were captured in six of the 12 randomly selected trotline bends. Additionally, sampling events at localized spots once again bolstered total captures, with 23% of the total coming from a single bend during fish community season.

Trammel net CPUE for the 2017 field season throughout Segment 2 was tabulated at 0.02 fish/100m for all three seasonal metrics (sturgeon, fish community, and combined seasons). Trotline captures led to CPUEs of 0.26 fish/20 hooks and 0.17 fish/20 hooks for the sturgeon and fish community seasons, respectively. A combined-season CPUE was estimated at 0.21 fish/20 hook night.

Pallid sturgeon handled in Segment 2 during the 2017 field season averaged 471 mm in fork length and averaged 440 g in weight. Lengths ranged from 372 mm to 957 mm fork length. Trammel nets captured on average larger individuals (513 mm) than did trotlines (448 mm). The

vast majority (94%) of pallid sturgeon captured in 2017 fell into the stock size category, while the other 6% (n=2), were in the preferred size designation. No major variations in relative condition were observed between the two size designations.

Of the 31 pallid sturgeon sampled in Segment 2 during the 2017 field season, all but one were of a known year class. Year classes in rank of abundance were; 2006 (n=8), 2008 (n=7), 2009 (n=6), 2010 (n=4) and 1997, 2003, 2007, 2015, and 2016 were all represented by one individual. In regard to stocking location, 27 of the 31 pallid sturgeon captured throughout Segment 2 during the 2017 field season were tied to a known stocking location. In relation to stocking-river, more pallid sturgeon originated from the Missouri River (n=17) than originated from the Yellowstone River (n=10). Stocking location in rank of abundance were; Wolf Point (n=9), Culbertson (n=8), Fallon (n=4), Intake (n=3), Sidney (n=2), and Forsyth (n=1).

Shovelnose sturgeon observations in Segment 2 of the Missouri River were once again a common occurrence during the 2017 field season. A total of 536 shovelnose sturgeon were captured in 2017, which was more than any other species. Seasonally, a slightly higher proportion of shovelnose sturgeon (n=276) were captured during sturgeon season when compared to fish community season (n=260). In relation to gears, trammel nets captured more shovelnose sturgeon (n=363) than did trotlines (n=173).

Trammel net CPUE, regarding shovelnose sturgeon of the quality or greater size class, was recorded as 0.68 fish/100m for both the sturgeon and fish community seasons, respectively. Identical seasonal CPUEs in turn led to a calculated combined-season CPUE of 0.68 fish/100m. The observed trotline CPUE was tabulated at 1.96 fish/20 hooks and 1.73 fish/20 hooks for the sturgeon and fish community seasons, respectively. The combined-season CPUE was then calculated to be 1.84 fish/20 hooks. Due to the size structure of the shovelnose sturgeon population sampled in Segment 2, trammel net and trotline CPUE remained very low for the stock and sub-stock categories.

The shovelnose sturgeon observed during the 2017 field season throughout Segment 2 averaged 608 mm in fork length and 898 g in weight. With the rarity of smaller size classes of shovelnose sturgeon residing in Segment 2, observed average length has remained nearly identical over time. The relative weight for both the stock and quality size classes of shovelnose sturgeon remains highly variable due to low sample size. Conversely, the relative weight for the

preferred and memorable/trophy size class of shovelnose sturgeon in Segment 2 has remained much more stable and comparable

A total of 10 blue suckers were captured in Segment 2 during the 2017 field season; all of which were captured via trammel net during random deployments. Temporally, more blue suckers were captured during sturgeon season (n=6), when compared to fish community season (n=4). Reported trammel net CPUE of 0.03 fish/100m and 0.02 fish/100m for the sturgeon and fish community seasons, respectively, led to a combined-season CPUE of 0.02 fish/100m. The blue suckers observed during the 2017 field season averaged 648 mm in total length and 2,801 g in weight. It has remained typical in Segment 2 that blue sucker catches are dominated by large, adult individuals.

A total of 125 sauger were captured throughout Segment 2 during the 2017 field season. Nearly all sauger were observed via trammel net, sans a lone individual represented by a trotline capture. More sauger were captured during sturgeon season (n=103), than during fish community season (n=22). The combined-season trammel net CPUE for was recorded at 0.25 fish/100m. Seasonally, CPUE was tabulated at 0.42 fish/100m and 0.09 fish/100m for the sturgeon and fish community seasons, respectively. The sauger captured in 2017 season averaged 350 mm in total length and 327 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 and 2017 field seasons, 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, Drobish and Williams 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, Drobish and Williams 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 2 or 3 during the 2016 or 2017 field season. No sampling occurred in Segment 1 in 2017.

The fish community season extends from the beginning of July until the end of September 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 or 2017.

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 platyrhynchus*, 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, Drobish and Williams 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 (Kapusinski, 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 (Kapusinski, 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 (+, 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 and Drobish 2016), 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, Drobish and Williams (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 2017.

In 2016 and 2017, 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 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, Drobish and Williams 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, trammel net drifts, and trotline

deployments. One GPS location was taken for mini-fyke net samples (middle of the seine). All GPS locations were taken using the internal GPS of the Xplore Technologies iX104 tablet.

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

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

Genetic Verification

Genetic verification for pallid sturgeon or potential hybrids followed the methods outlined in Welker and Drobish (2016). Two fin pectoral fin clips (~ 2 cm²) 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.

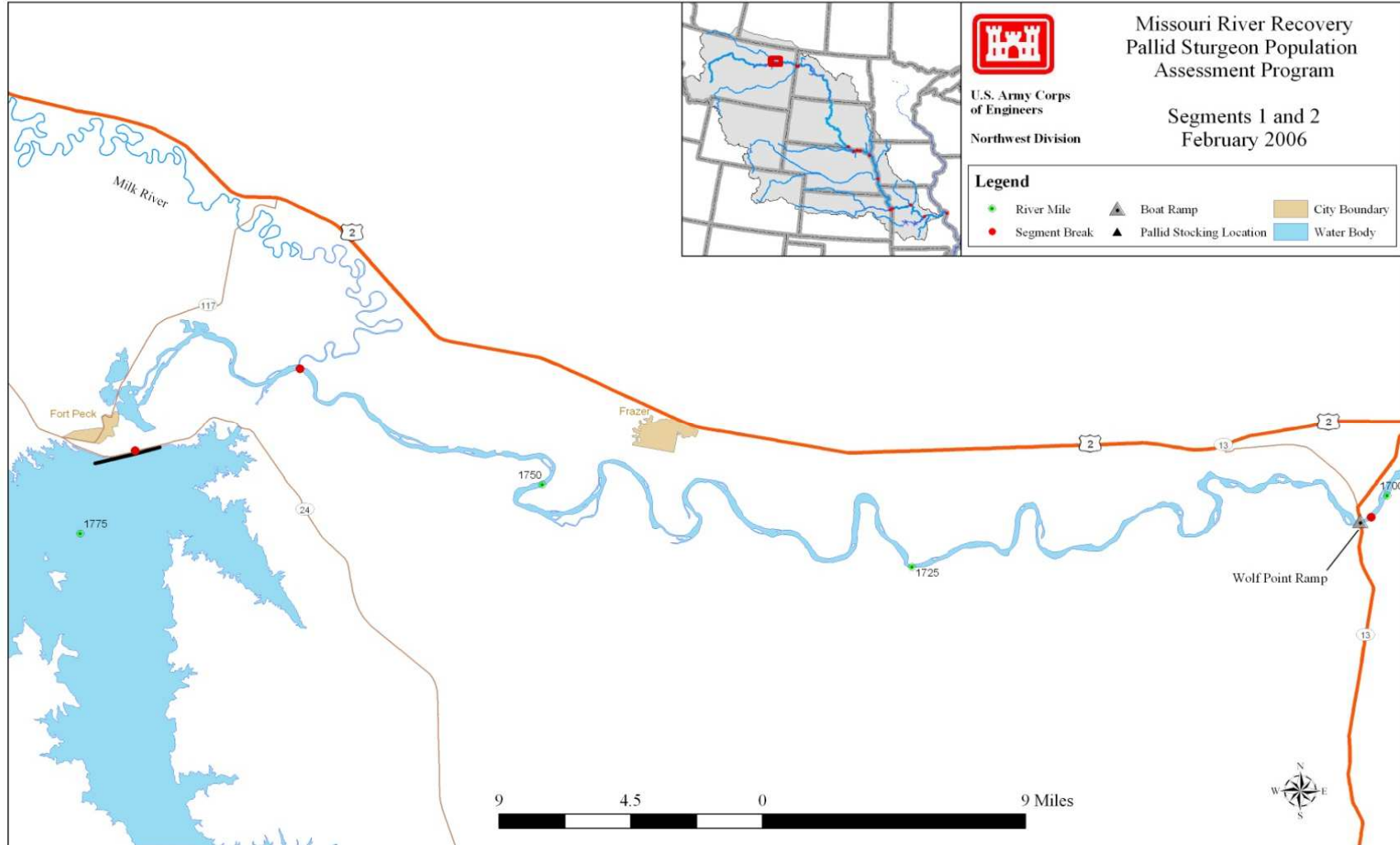


Figure 1. Map of Segment 2 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 2 encompasses the Missouri River from the mouth of the Milk River (River Mile 1761.5) to Wolf Point, MT (River Mile 1701.5).

Results

Effort

A total of 12 randomly selected river bends were sampled in Segment 2 during the 2017 field season. 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. In order to sample equally between seasons, half of the randomly selected river bends were sampled during sturgeon season, while the remaining six were sampled during fish community season.

A total of 205 trammel nets were drifted throughout Segment 2 in 2017, which accounted for 48.2 km of sampling. Seasonally, the number of trammel net deployments were nearly identical, with one more drift performed during fish community season (n=103), when compared to sturgeon season (n=102). Random trammel net deployments (n=192) amassed a total of 45.0 km of river sampling, while non-random deployments (n=13) accounted for an additional 3.2 km of sampling.

Using the standard sampling method of eight trotlines per bend, a total of 96 trotlines were deployed in Segment 2 during 2017. 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 2017.

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 2017.

Gear	Number of Bends	Mean Effort	Macrohabitat ^a					
			CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season								
1.0” Trammel Net	12	8	36	0	31	27	2	0
Fish Community Season								
1.0” Trammel Net	12	8	33	0	32	27	4	0
Both Seasons								
Trot Line	12	7.83	31	1	33	25	3	1

^a Habitat abbreviations and definitions presented in Appendix B.

Pallid Sturgeon

A total of 31 pallid sturgeon were captured in Segment 2 during the 2017 field season, all of which were of hatchery origin. Temporally, more pallid sturgeon were captured during sturgeon season (n=17), than fish community season (n=14). Additionally, all pallid sturgeon observations were made during random gear deployments, as no pallid sturgeon were captured during non-random, duplicate gear sets.

Trammel net deployments were responsible for the capture of 11 pallid sturgeon throughout Segment 2 in 2017. Seasonally, observations were nearly equal with five pallid sturgeon captures and six pallid sturgeon captures during the sturgeon and fish community seasons, respectively.

Trammel net CPUE for Segment 2 during 2017 was tabulated at 0.02 fish/100m for both sturgeon and fish community season, respectively. In turn, the combined-season CPUE was then reported at 0.02 fish/100m. A complete detail of Segment 2 trammel net CPUE for all years can be found in Figure 5.

Trotlines continued to be a viable gear for capturing pallid sturgeon in Segment 2 of the Missouri River during the 2017 field season. Temporally, 12 pallid sturgeon were observed during sturgeon season, while the remaining eight were captured during fish community season. All 20 pallid sturgeon sampled via trotline were captured during random sampling, as no non-random trotline sets were performed in Segment 2 in 2017.

Trotline captures in Segment 2 during 2017 led to CPUEs of 0.26 fish/20 hooks and 0.17 fish/20 hooks for the sturgeon and fish community seasons, respectively. A combined-season CPUE was then tabulated at 0.21 fish/20 hooks. A complete comparison of trotline CPUE between seasons and years can be found in Figure 7.

Pallid sturgeon handled in Segment 2 during the 2017 field season averaged 471 mm in fork length, and averaged 440 g in weight. Lengths ranged from 372 mm to 957 mm fork length. Trammel nets captured, on average, larger individuals (513 mm) than did trotlines (448 mm). The vast majority (94%) of pallid sturgeon captured in 2017 fell into the stock size category, while the other 6% (n=2), landed in the preferred size designation. No major variations in relative condition (Kn) were observed in 2017. 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 for all pallid sturgeon captured in Segment 2 can be viewed in Figure 4.

Pallid sturgeon distribution throughout Segment 2 remained variable, with emphasis on the timing and locality of sampling (Fig. 2). During the 2017 field season in Segment 2, pallid sturgeon were detected in five of the 12 randomly selected trammel net bends. In comparison, pallid sturgeon were captured in 6 of the 12 randomly selected trotline bends. Additionally, sampling events at localized sports once again bolstered total capture. For example, Bend 7, which was sampled once via a standard eight-trotline set during fish community season, was represented by seven (or 23%) of the total pallid sturgeon observations for Segment 2 in 2017. In another instance, five pallid (or 16%) were captured via trotline at Bend 1, which occurred during sturgeon season.

Of the 31 pallid sturgeon sampled in Segment 2 during the 2017 field season, all but one were of known year class. Year classes in rank of abundance were; 2006 (n=8), 2008 (n=7), 2009 (n=6), 2010 (n=4) and 1997, 2003, 2007, 2015, and 2016 were all represented by one individual, respectively. Mean fork length, weight, relative condition factor (Kn) and absolute growth rates for hatchery-reared pallid sturgeon captures by year class metrics can be found in Table 3.

In regard to stocking location, 27 of the 31 pallid sturgeon captured throughout Segment 2 during the 2017 field season were tied to a known stocking location. In relation to stocking-river, more pallid sturgeon originated from the Missouri River (n=17) than originated from the Yellowstone River (n=10). Stocking location in rank of abundance were; Wolf Point (n=9), Culbertson (n=8), Fallon (n=4), Intake (n=3), Sidney (n=2), and Forsyth (n=1). The stocking history related to RPMA 2 can be found in Appendix E.

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.

Segment 2 - Pallid Sturgeon Captures by River Mile

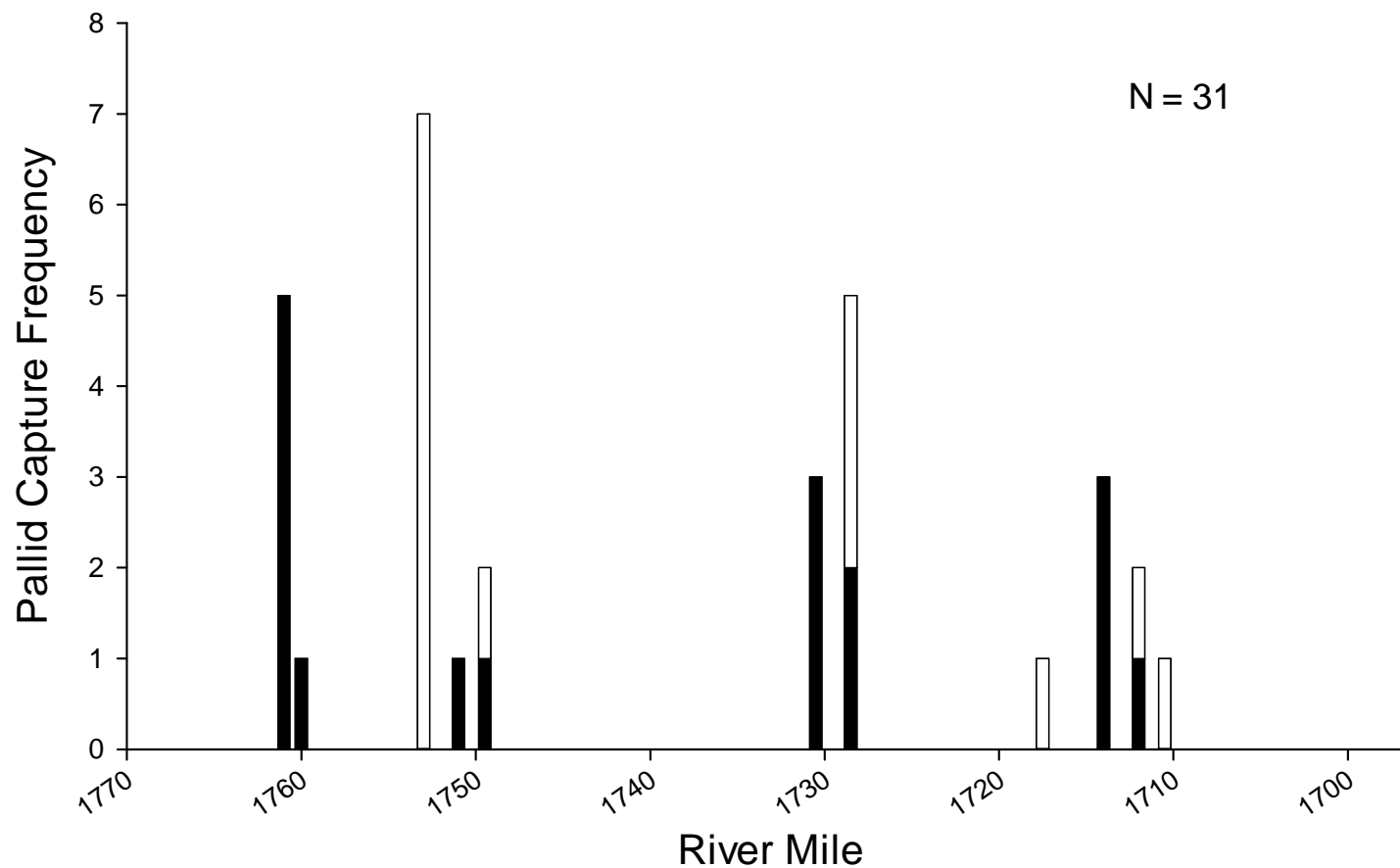


Figure 2. Distribution of pallid sturgeon captures by river mile for Segment 2 of the Missouri River during 2017. Black bars represent pallid sturgeon captures during sturgeon season and white bars represent pallid sturgeon captures during fish community season. Figure includes all pallid captures including 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 2017. 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 (ntu)		Total Pallids caught
MACRO	MESO	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CHXO	CHNB	1.7 (0.9-3.9)	1.7 (1.2-2.8)	0.69 (0.23-1.11)	0.55 (0.43-0.70)	12.5 (7.7-16.4)	12.0 (10.1-14.3)	19 (9-39)	13 (10-17)	9
CONF	CHNB	1.8 (1.8-1.8)		. (-.)		10.0 (10.0-10.0)		. (-.)		.
ISB	CHNB	1.7 (1.0-3.7)	1.7 (1.3-2.9)	0.72 (0.40-0.94)	0.70 (0.48-0.84)	12.8 (6.5-17.4)	12.4 (7.4-15.6)	22 (9-41)	20 (11-34)	13
OSB	CHNB	2.3 (0.3-4.3)	2.1 (1.2-3.2)	0.67 (0.34-1.01)	0.56 (0.40-0.86)	12.5 (1.9-17.1)	10.8 (6.3-15.7)	19 (5-49)	17 (5-29)	9
SCCL	CHNB	1.4 (1.2-2.0)		0.73 (0.66-0.79)		12.4 (10.1-14.5)		22 (11-46)		.
TRML	CHNB	2.2 (2.2-2.2)		. (-.)		10.0 (10.0-10.0)		. (-.)		.

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 2017 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)
1997	1	.	.	.	957	2985.0	0.821	.	.
.
2003	1	256	.	.	930	3185.0	0.963	0.145	.
.
2006	8	268	75.5	1.339	451	260.6	0.845	0.048	0.051
.	.	21	20.4	0.070	12	45.5	0.120	0.006	0.004
2007	1	165	16.0	1.437	456	350.0	1.106	0.085	0.098
.
2008	7	264	71.0	1.357	452	287.9	0.910	0.084	0.116
.	28	64.4	0.040	.	.
2009	6	248	57.5	1.269	421	225.0	0.907	0.078	0.089
.	.	55	47.0	0.169	30	53.0	0.058	0.019	0.014
2010	4	293	73.0	0.964	432	265.0	0.977	0.063	0.085
.	.	46	34.9	0.303	46	83.8	0.075	0.006	0.038
2015	1	.	.	.	385	165.0	0.910	.	.
.
2016	1	414	232.0	1.008	421	175.0	0.719	0.212	-1.73
.

Segment 2 - Pallid Sturgeon

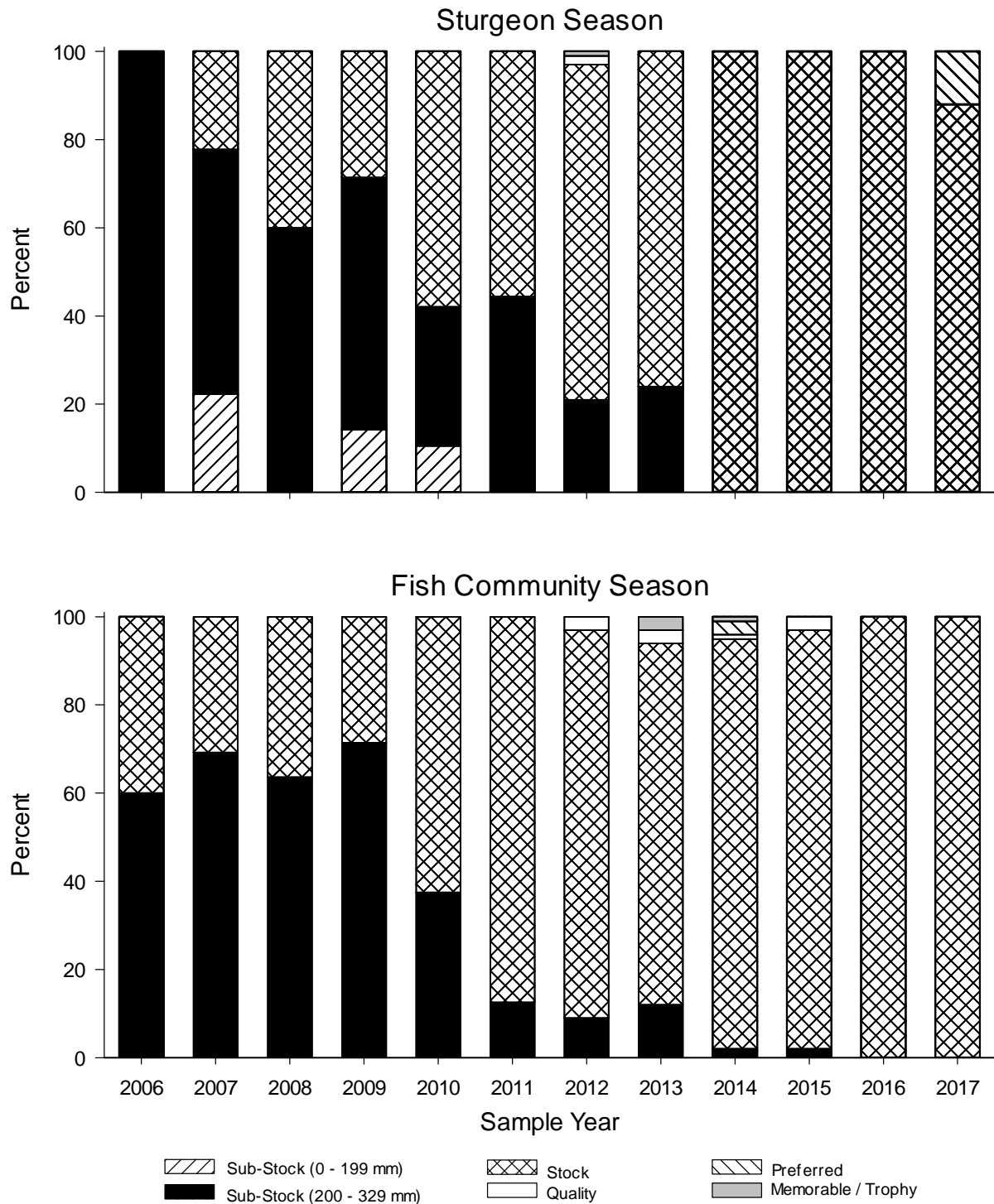


Figure 3. Incremental relative stock density (RSD) for all pallid sturgeon captured with all gear by length category from 2006-2017 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

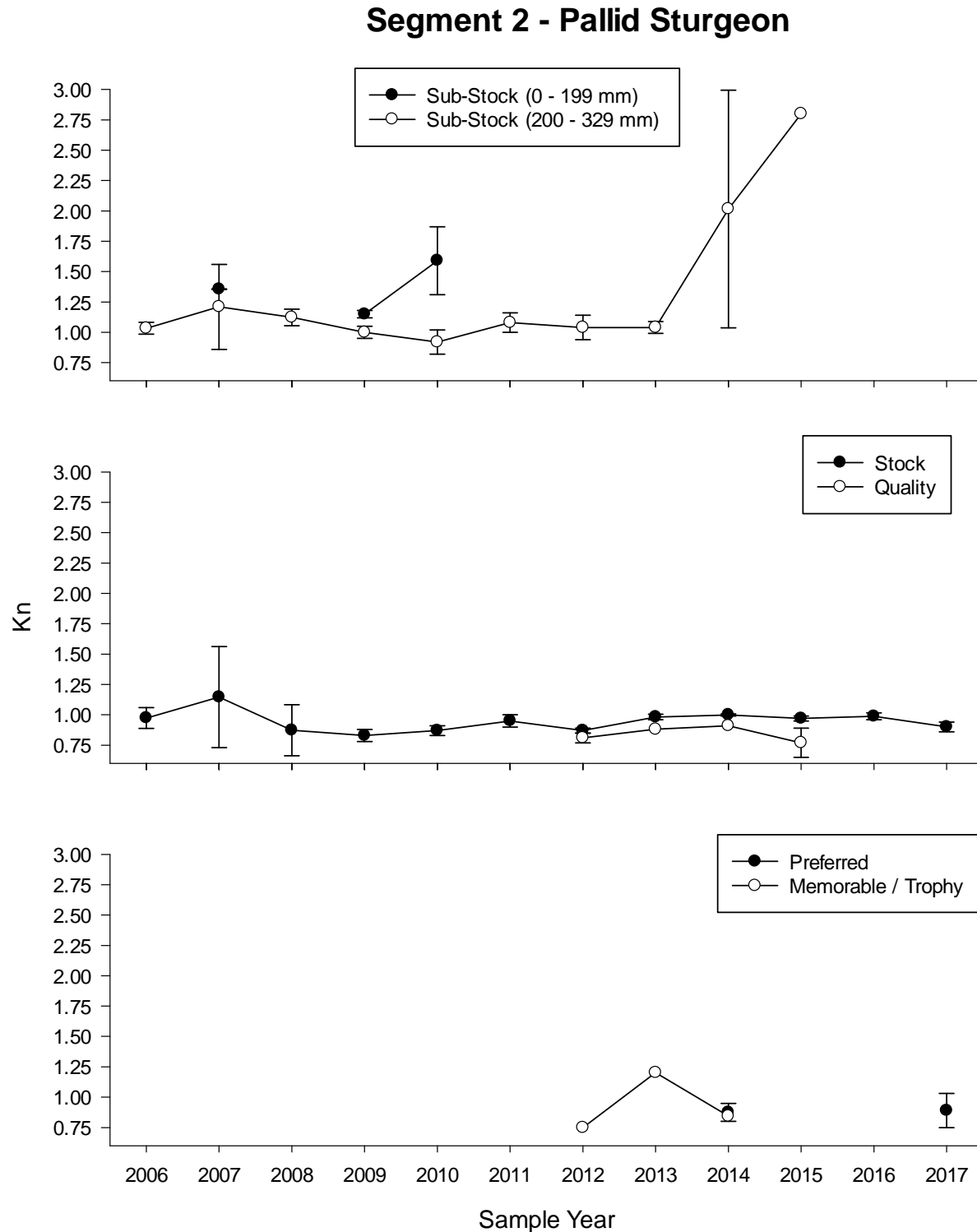


Figure 4. Relative condition factor (Kn) for all pallid sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2017 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

Segment 2 - Pallid Sturgeon

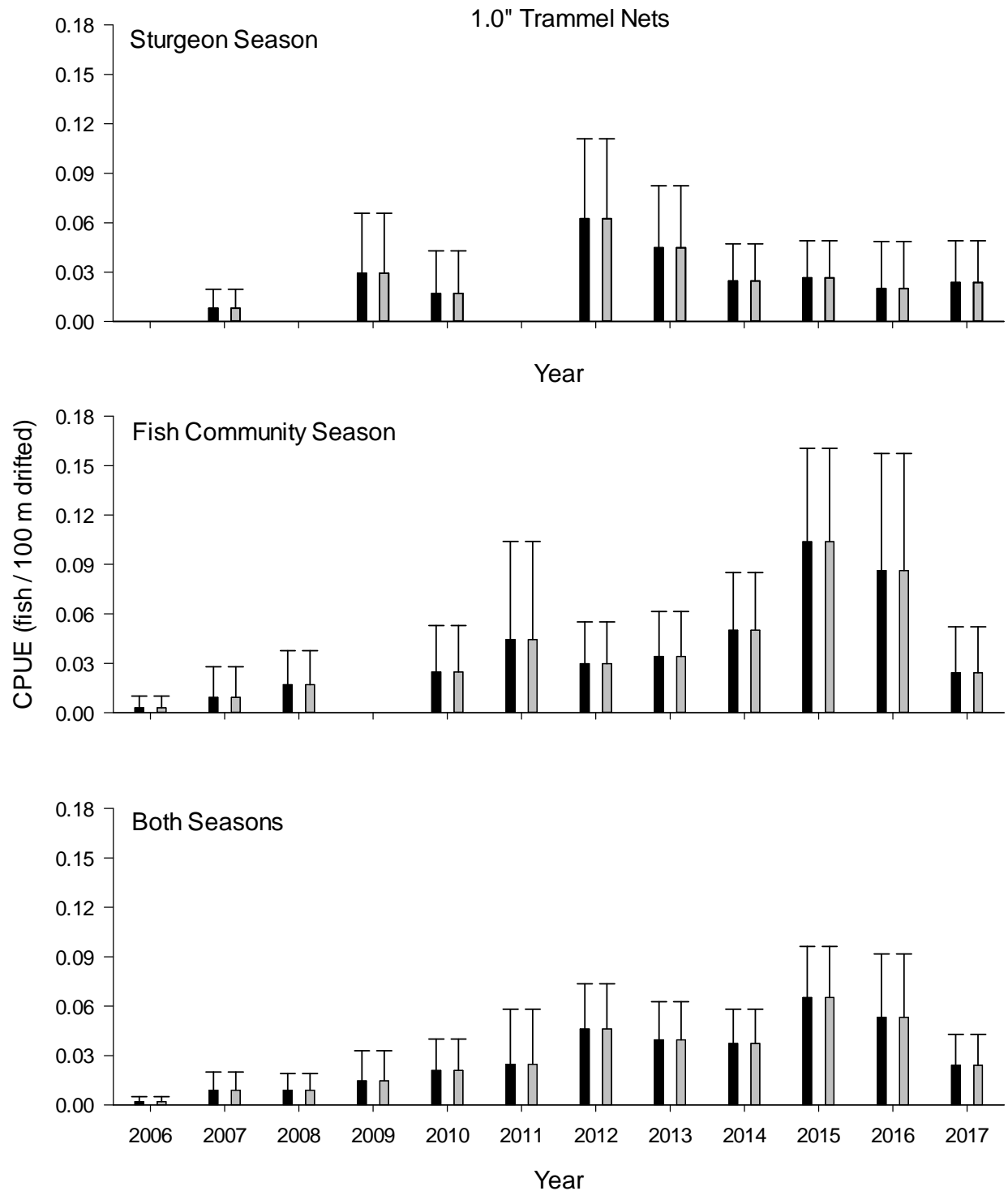


Figure 5. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2017. Pallid sturgeon of unknown origin are awaiting genetic verification.

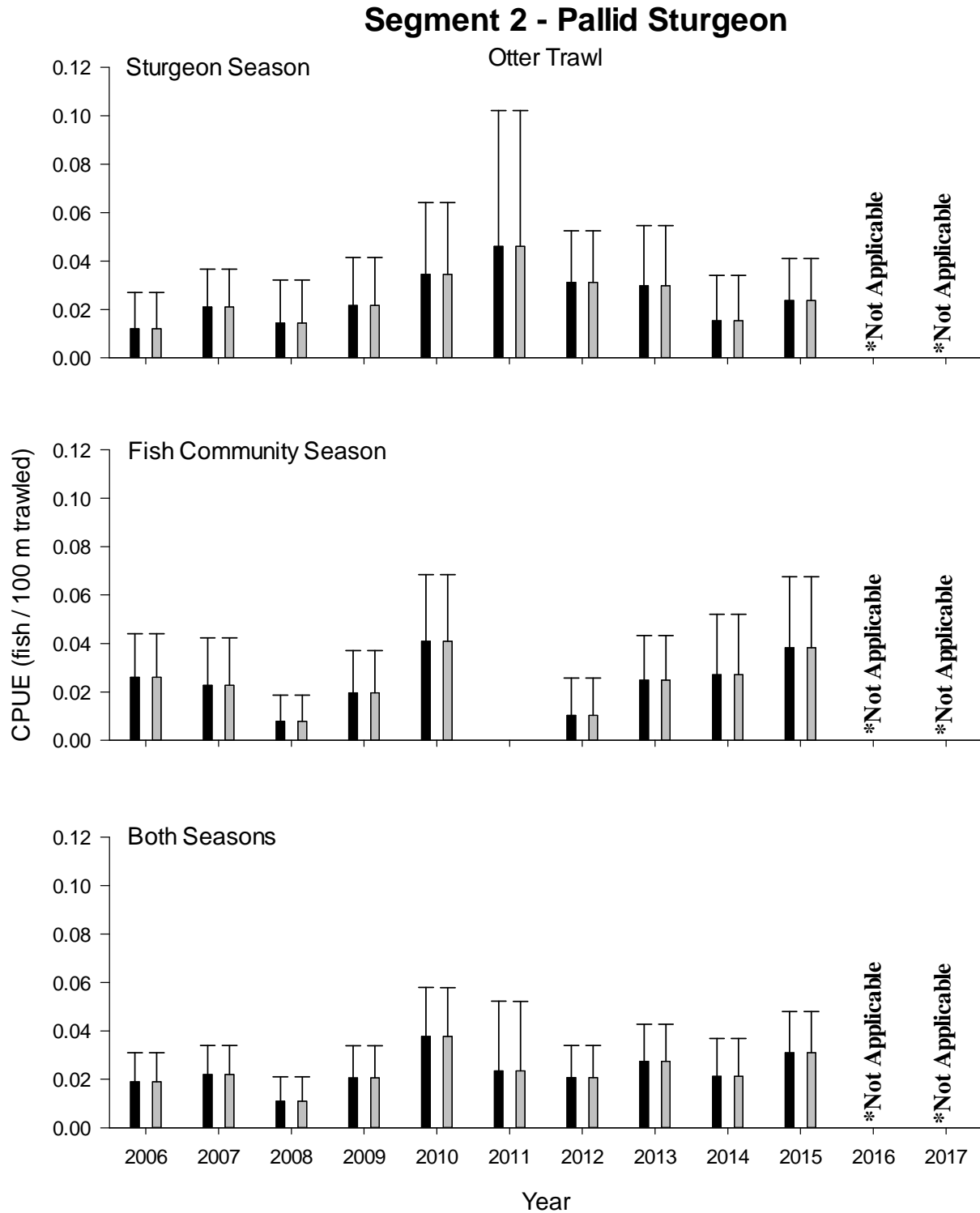


Figure 6. Mean annual catch per unit effort (\pm 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using otter trawls in Segment 2 of the Missouri River from 2006-2017. Pallid sturgeon of unknown origin are awaiting genetic verification. *Otter trawl not performed in 2016 or 2017.

Segment 2 - Pallid Sturgeon

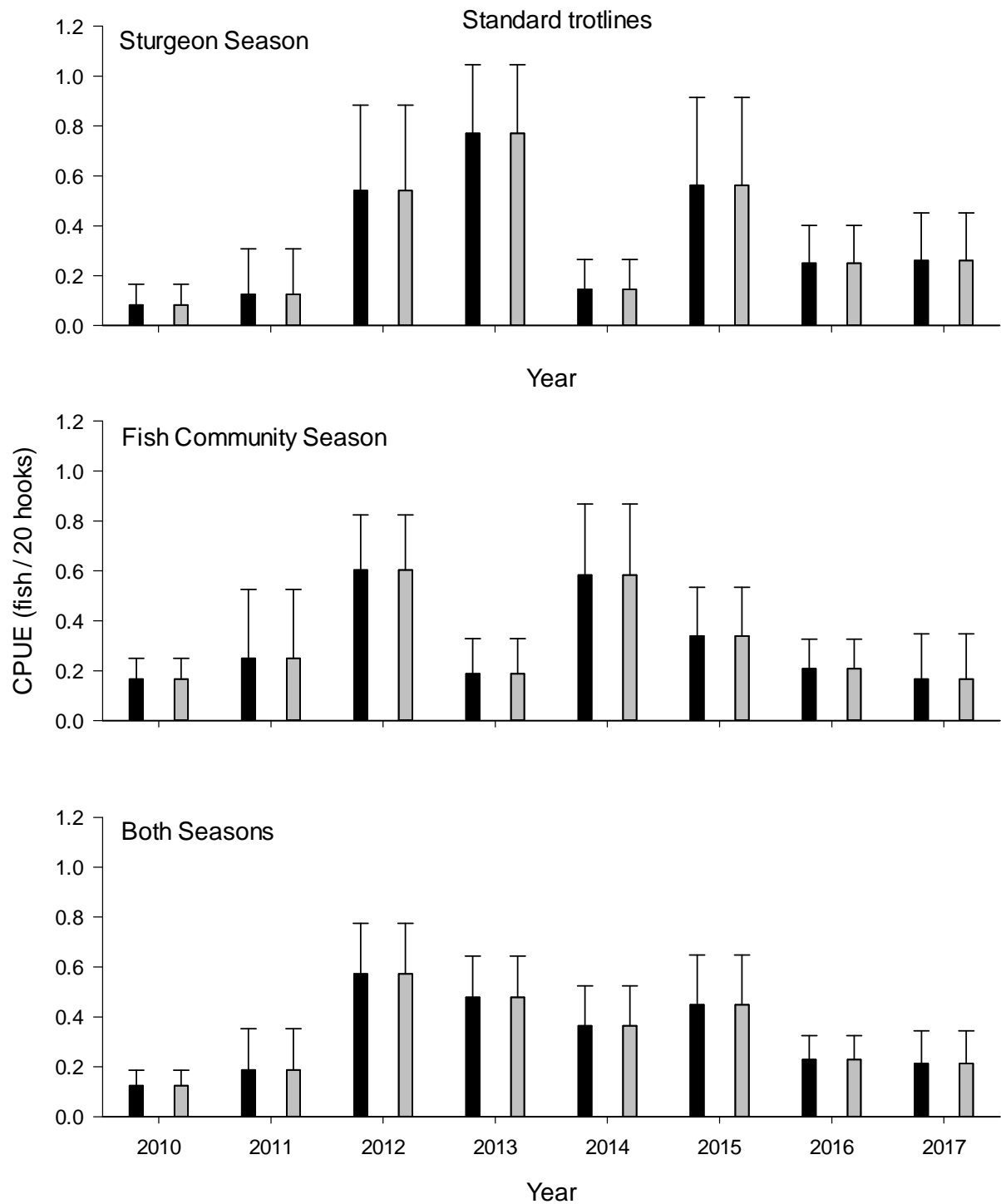


Figure 7. Mean annual catch per unit effort (± 2 SE) of all (black bars), wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon using trot lines in Segment 2 of the Missouri River from 2010-2017. Pallid sturgeon of unknown origin are awaiting genetic 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 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 5. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 6. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	3	100	0	0	0	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	6	50	0	33	17	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	20	15	0	50	35	0	0
		33	1	35	27	3	1

Table 7. Total number of quality size and greater (≥ 630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	2	0	0	50	50	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 8. Total number of pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	5	60	0	20	20	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	6	0	0	33	17	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	20	0	0	50	50	0	0
		33	1	35	27	3	1

Segment 2 - Pallid Sturgeon

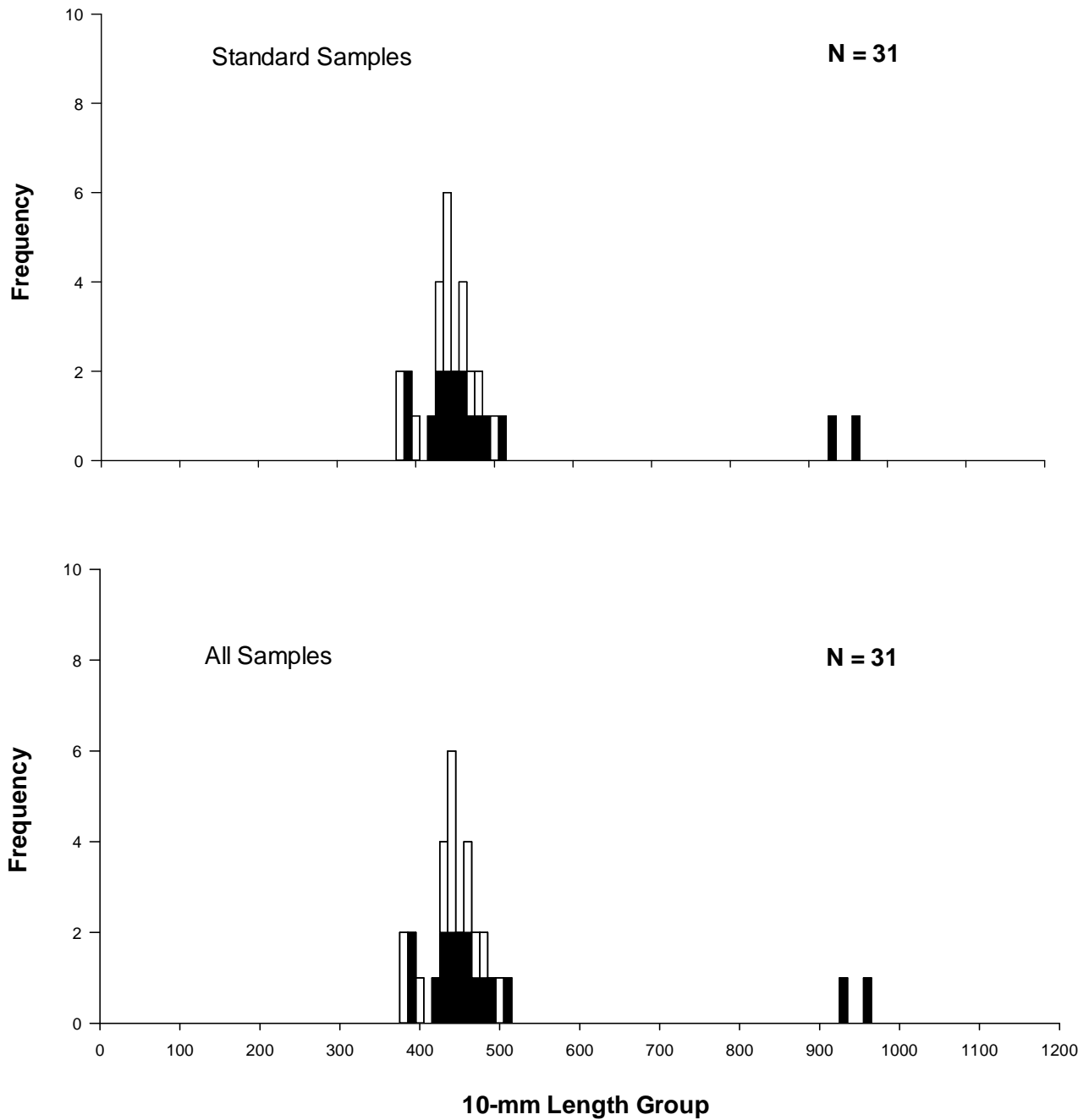


Figure 8. Length frequency of pallid sturgeon captured in Segment 2 of the Missouri River during 2017. Black bars represent captures during sturgeon season, while white bars represent captures during fish community season. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017. Pallid sturgeon of unknown origin are awaiting genetic verification.

Segment 2 - Annual Pallid Sturgeon Capture History

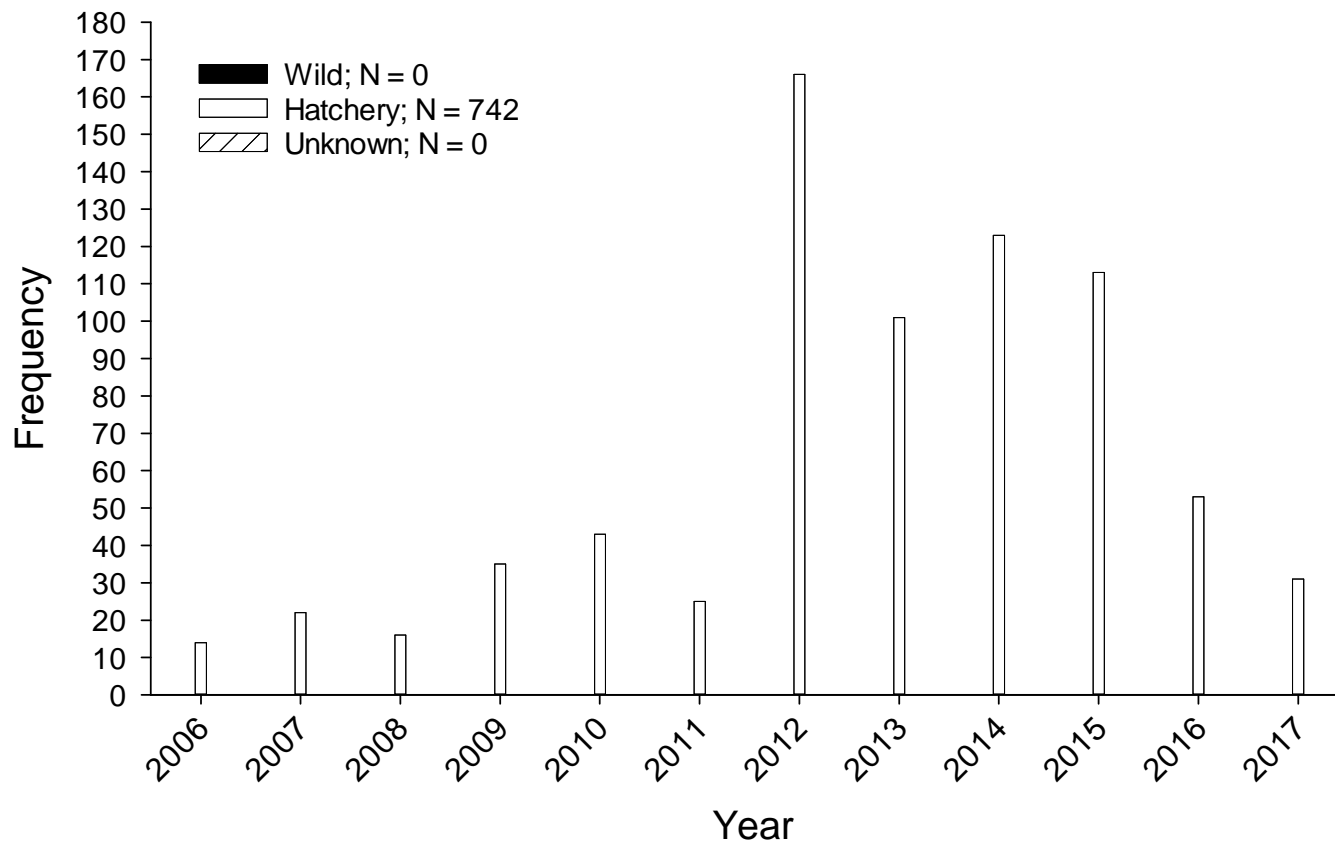


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in Segment 2 of the Missouri River from 2006-2017. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable 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 2017 field season. A total of 536 shovelnose sturgeon were captured in 2017. Seasonally, a slightly higher proportion of shovelnose sturgeon ($n=276$) were captured during sturgeon season when compared to fish community season ($n=260$). In relation to gears, trammel nets captured more shovelnose sturgeon ($n=363$) than did trotlines ($n=173$).

During the 2017 field season, Segment 2 trammel net CPUE (Fig. 10), regarding shovelnose sturgeon of the quality or greater size class, was recorded as 0.68 fish/100m for both the sturgeon and fish community seasons, respectively. Identical seasonal CPUEs in turn led to a calculated combined-season CPUE of 0.68 fish/100m. Due to the size structure of the shovelnose sturgeon population sampled in Segment 2, trammel net CPUE remains very low for the stock and sub-stock categories.

The observed Segment 2 trotline CPUE for the 2017 field season (Fig. 12) was tabulated at 1.96 fish/20 hooks and 1.73 fish/20 hooks for the sturgeon and fish community seasons, respectively. The combined-season CPUE was then calculated to be 1.84 fish/20 hooks. 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 (W_r) of shovelnose sturgeon captured in Segment 2 can be found in Figure 15. W_r for both the stock and quality size classes of shovelnose sturgeon remains highly variable due to low sample size. Conversely, the W_r for the preferred and memorable/trophy size class of shovelnose sturgeon in Segment 2 has remained much more stable and comparable

The shovelnose sturgeon observed during the 2017 field season throughout Segment 2 averaged 608 mm in fork length and 898 g in weight. With the rarity 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 2017 can be found in Figure 13.

The specific macro and meso habitats where shovelnose sturgeon were sampled in Segment 2 during 2017, 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.

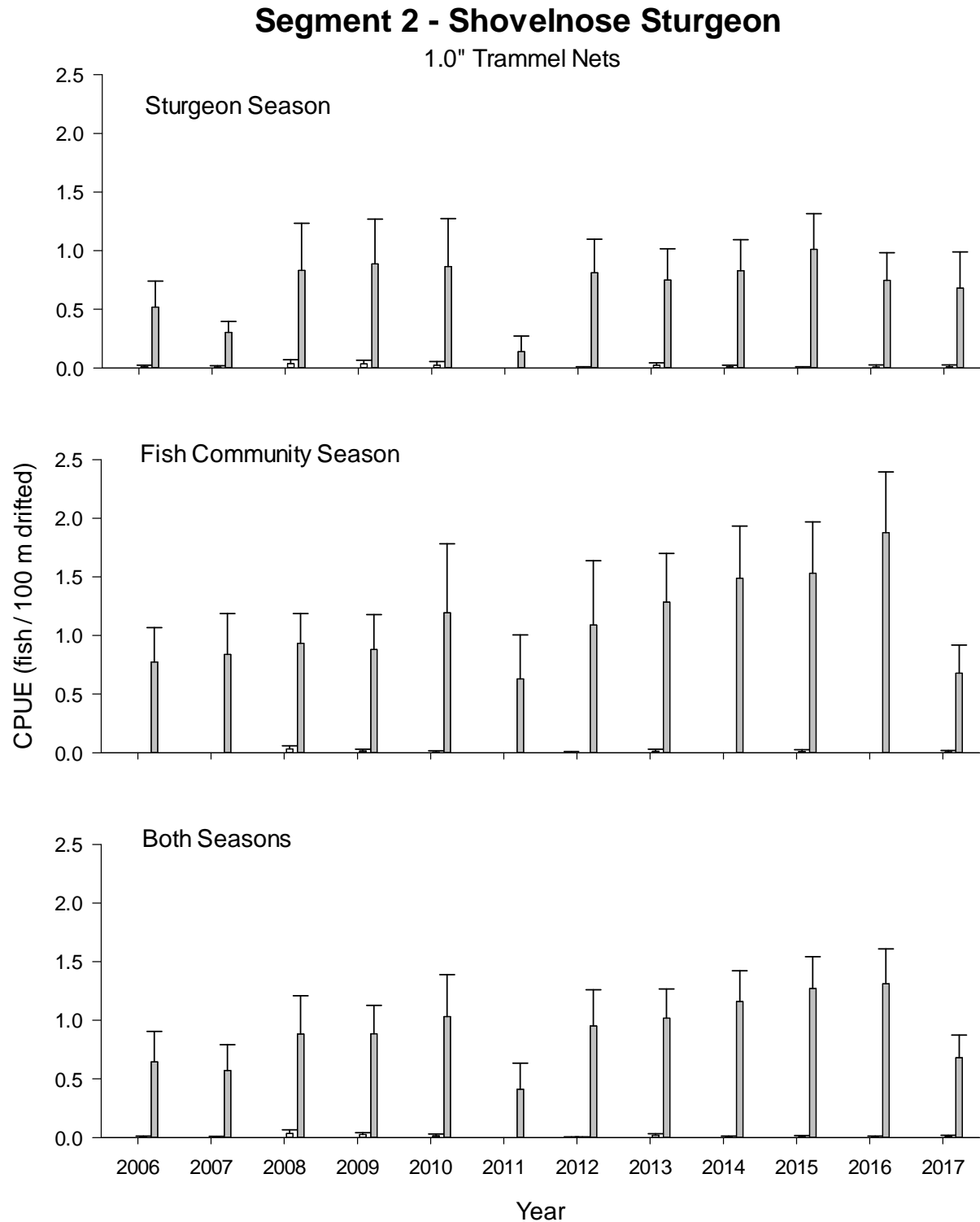


Figure 10. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) shovelnose sturgeon using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2017.

Segment 2 - Shovelnose Sturgeon

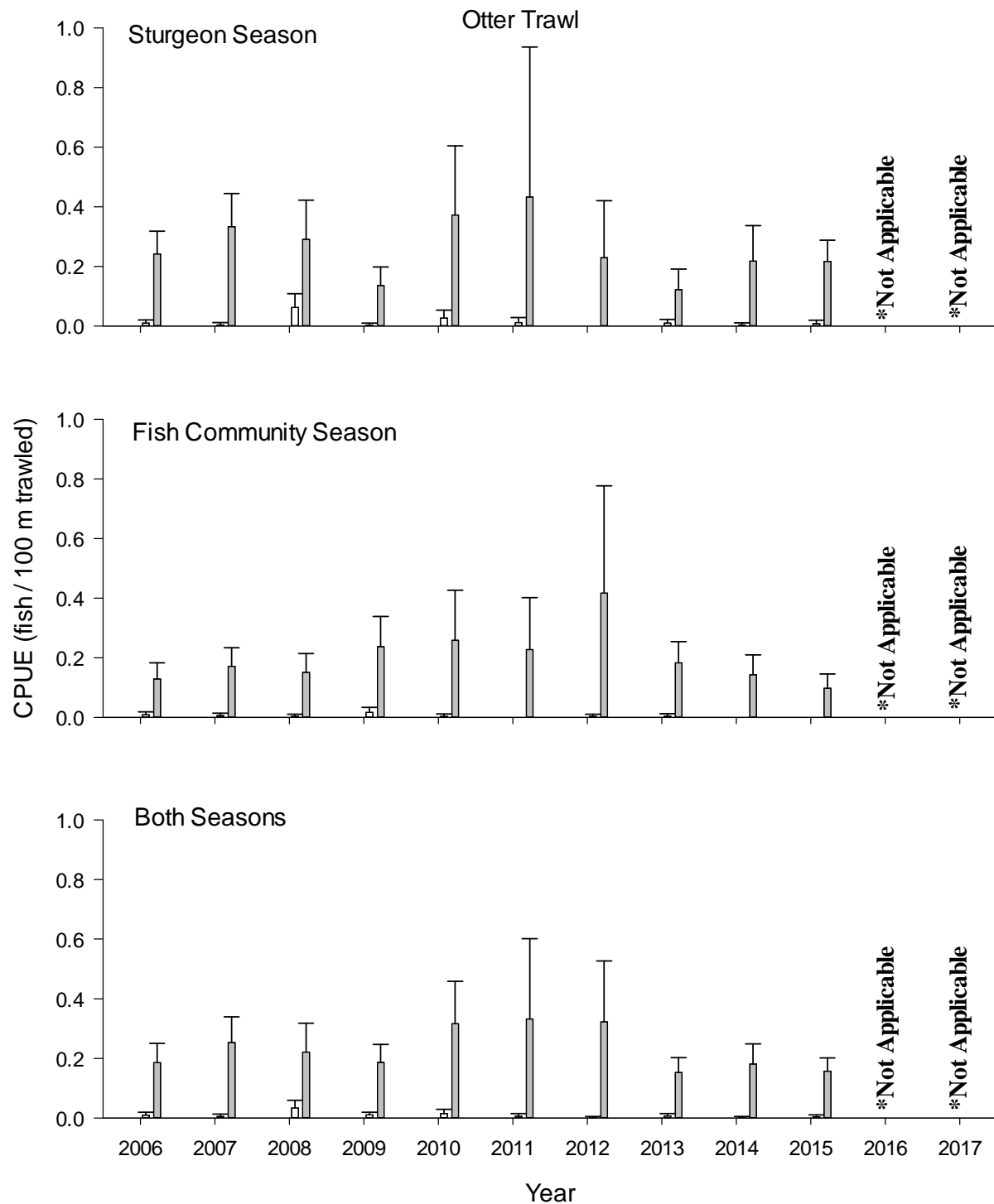


Figure 11. Mean annual catch per unit effort (\pm 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size ($>$ 380 mm; gray bars) shovelnose sturgeon using otter trawls in Segment 2 of the Missouri River from 2006-2017. *Otter trawl not performed in 2016 or 2017.

Segment 2 - Shovelnose Sturgeon

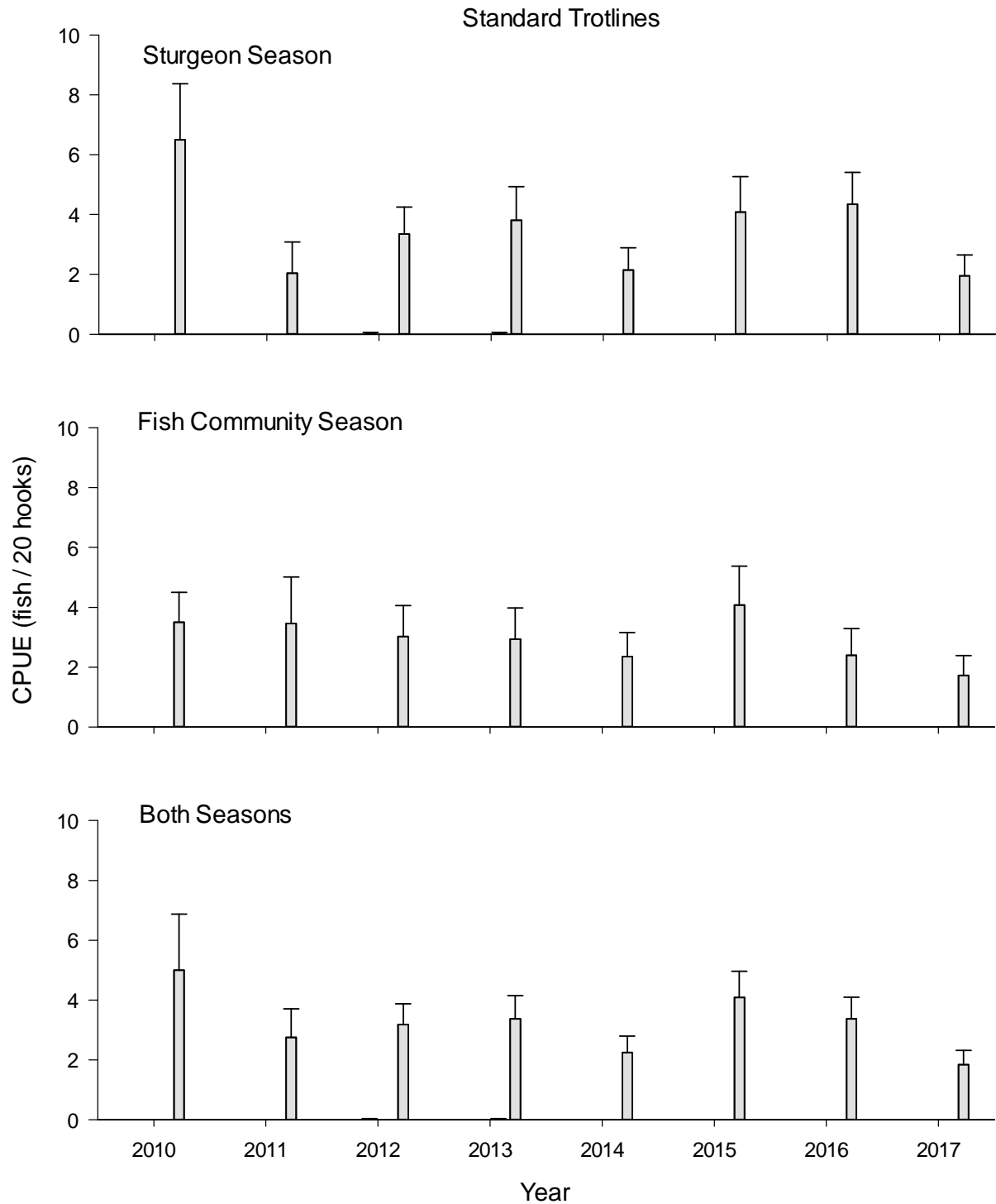


Figure 12. Mean annual catch per unit effort (\pm 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size ($>$ 380 mm; gray bars) shovelnose sturgeon using trot lines in Segment 2 of the Missouri River from 2010-2017.

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 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 10. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	0	0	0	0	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 11. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	3	0	0	33	67	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	2	50	0	0	50	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Table 12. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	153	27	0	33	40	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	157	57	0	17	23	4	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	173	36	0	30	29	5	0
		33	1	35	27	3	1

Table 13. Total number of shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 2 of the Missouri River during 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	156	27	0	33	40	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	159	57	0	16	23	4	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	173	36	0	30	29	5	0
		33	1	35	27	3	1

Segment 2 - Shovelnose Sturgeon

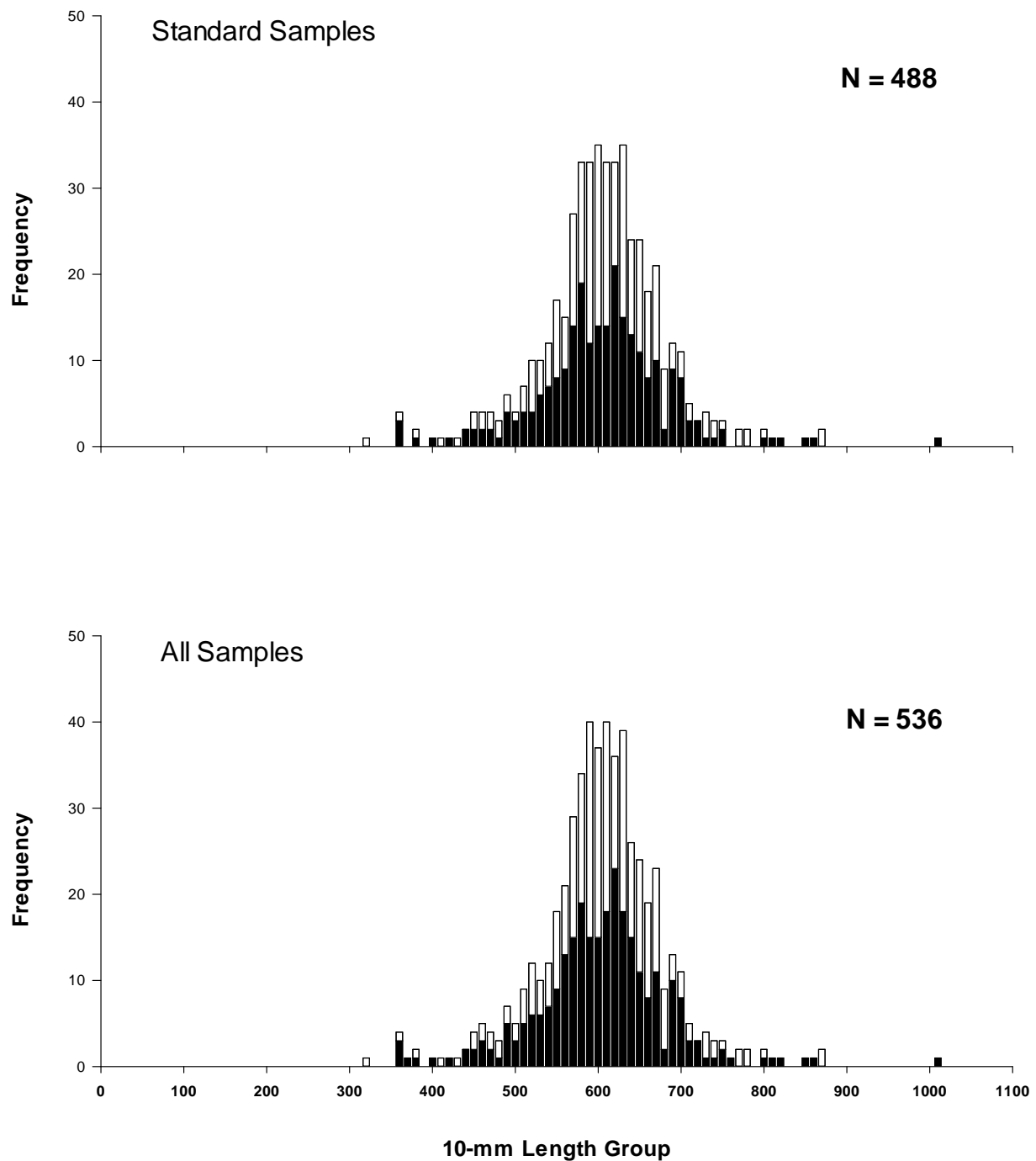
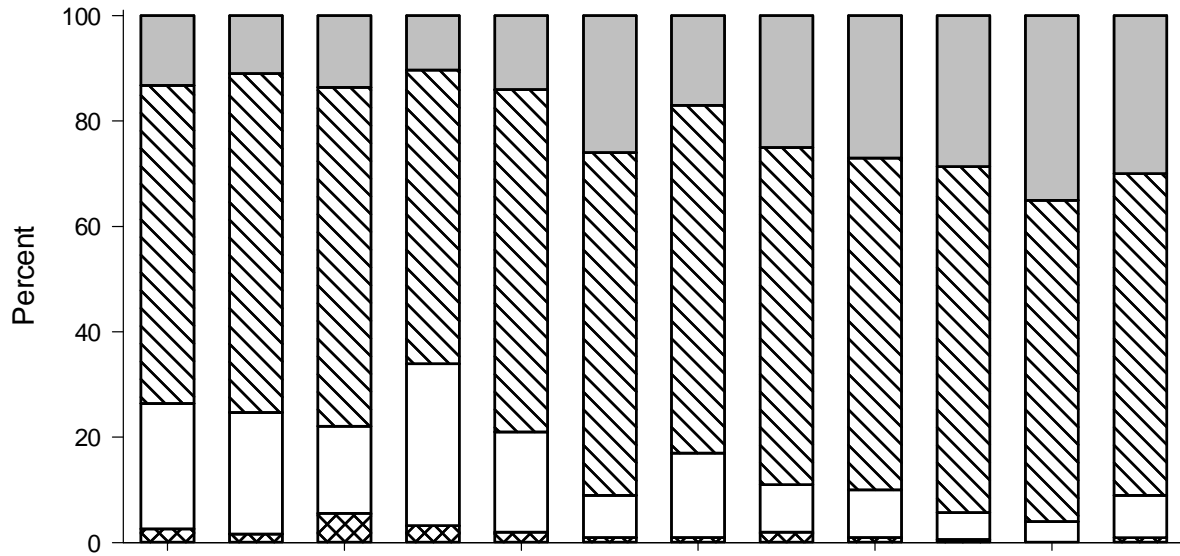


Figure 13. Length frequency of shovelnose sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

Segment 2 - Shovelnose Sturgeon

Sturgeon Season



Fish Community Season

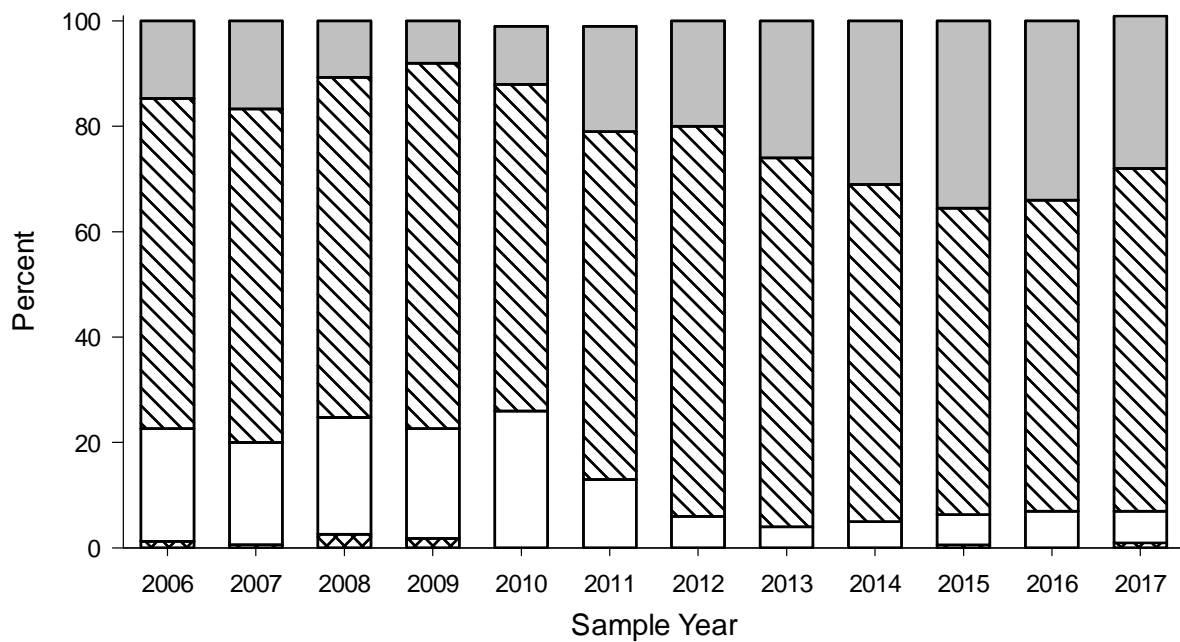


Figure 14. Incremental relative stock density (RSD) for all shovelnose sturgeon captured with all gear by length category from 2006 to 2017 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Segment 2 - Shovelnose Sturgeon

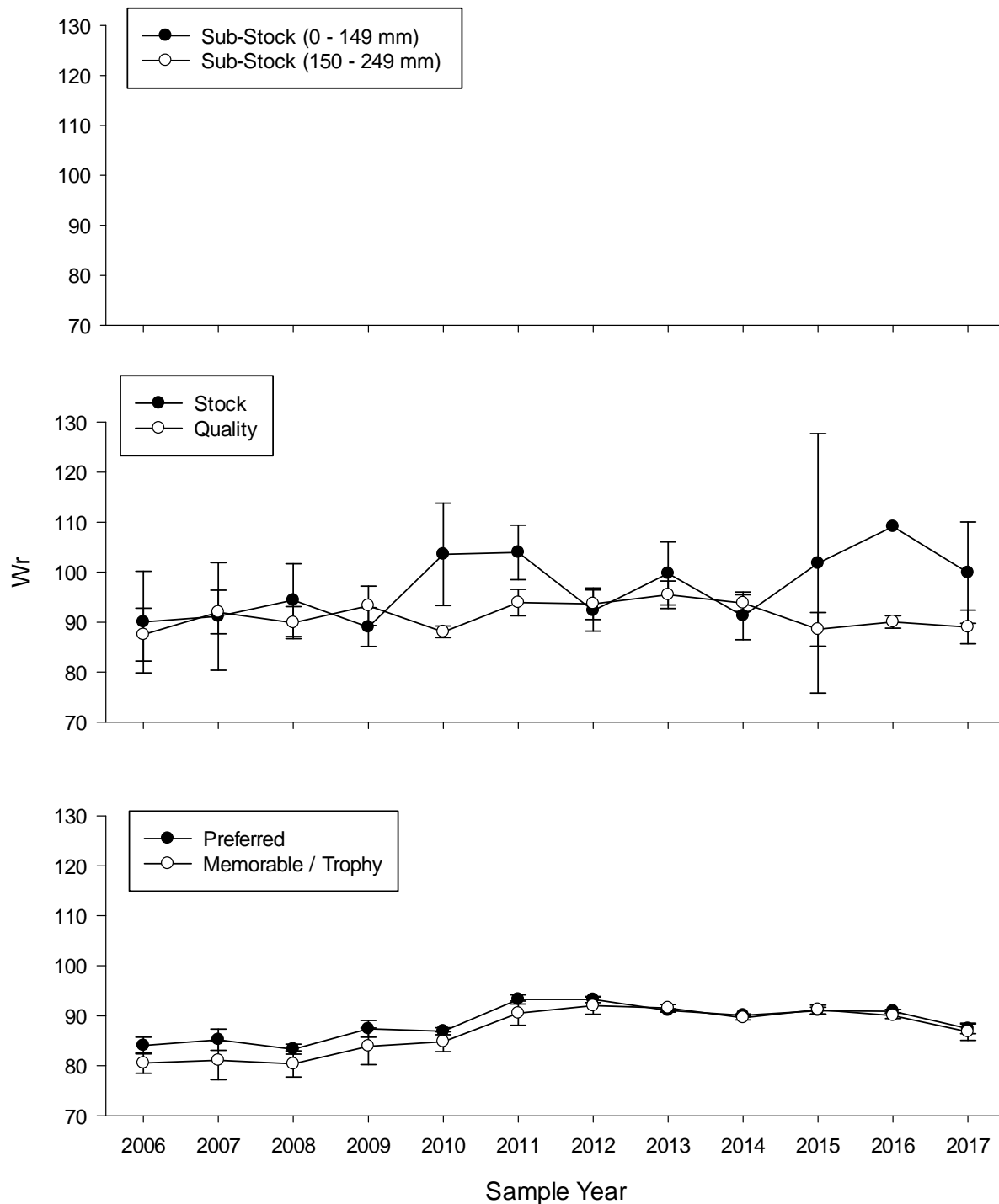


Figure 15. Relative weight (W_r) for all shovelnose sturgeon captured with all gear by incremental relative stock density (RSD) length category from 2006-2017 in Segment 2 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

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 2017 field season.

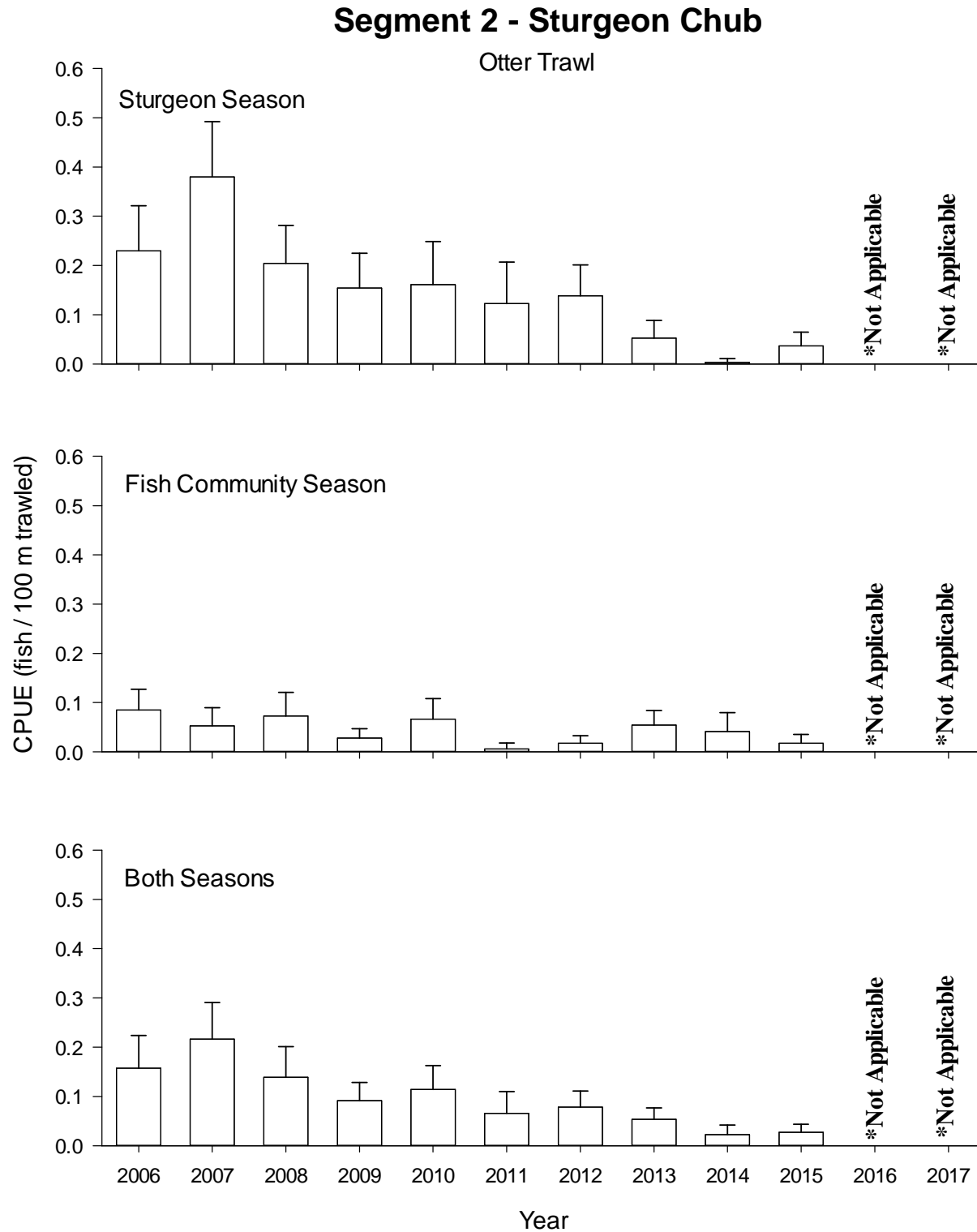


Figure 16. Mean annual catch per unit effort (\pm 2 SE) of sturgeon chub using otter trawls in Segment 2 of the Missouri River from 2006-2017. *Otter trawl not performed in 2016 or 2017.

Segment 2 - Sturgeon Chub

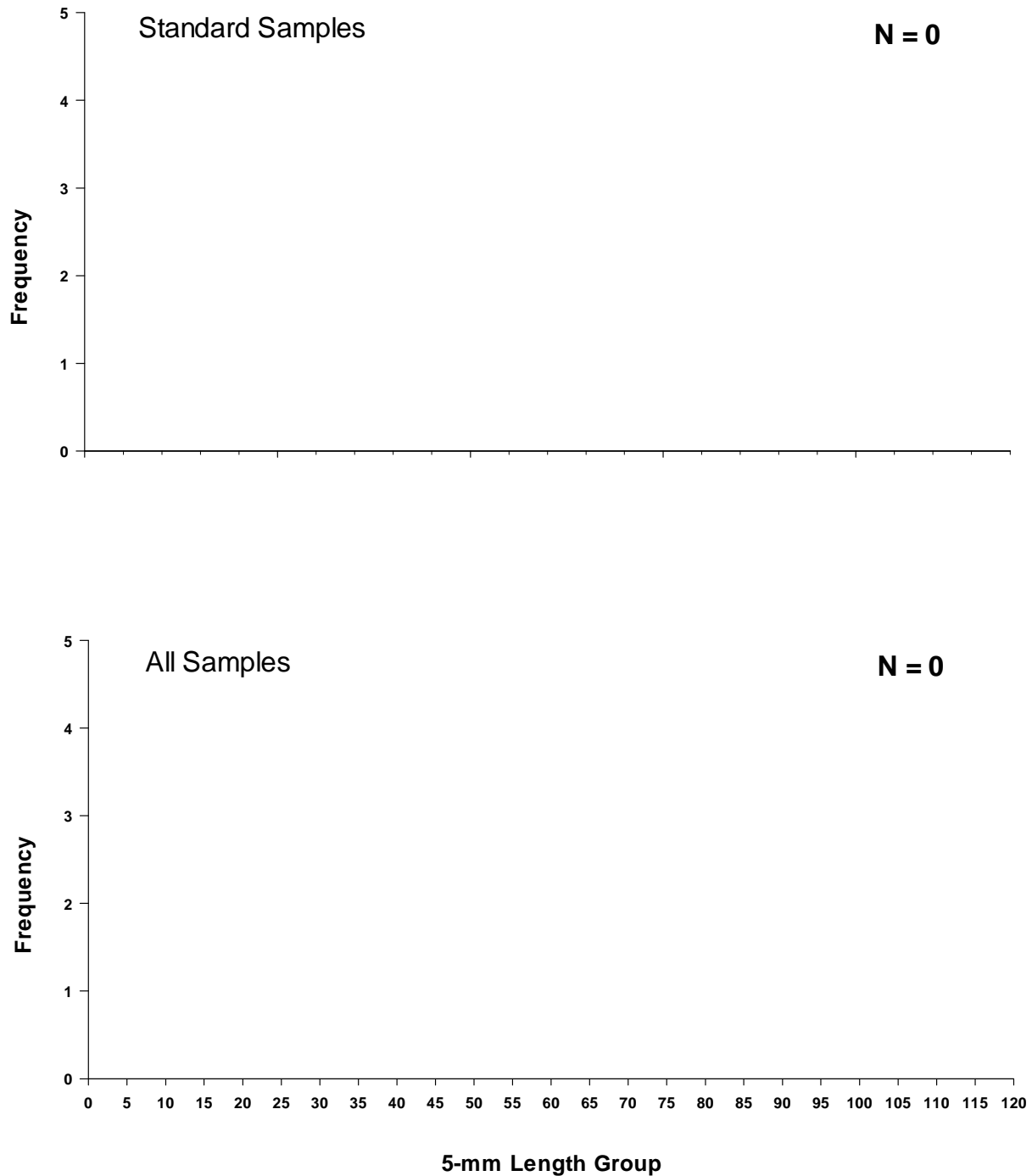


Figure 17. Length frequency of sturgeon chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

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 2017 field season.

Segment 2 - Sicklefin Chub

Otter Trawl

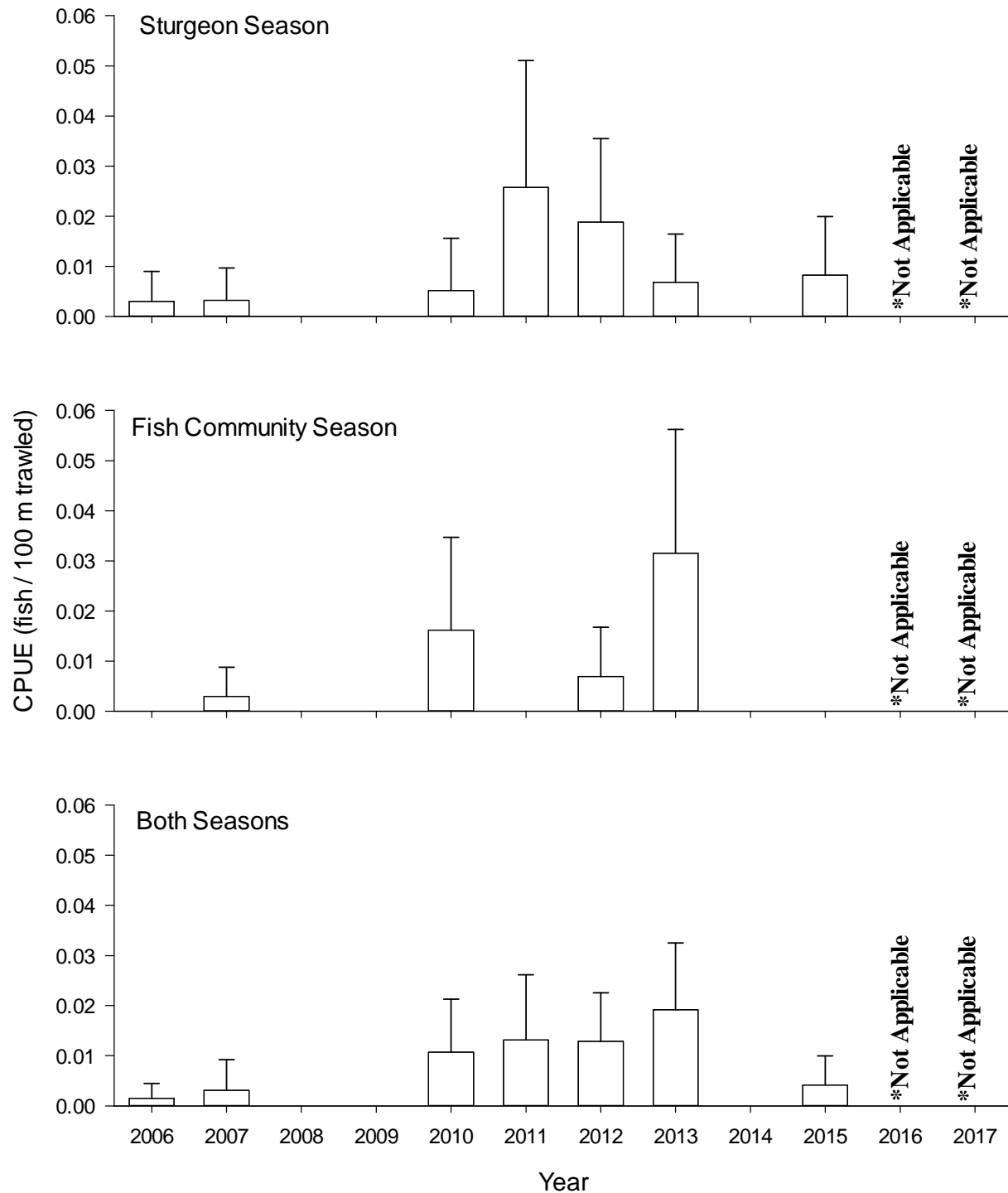


Figure 18. Mean annual catch per unit effort (± 2 SE) of sicklefin chub using otter trawls in Segment 2 of the Missouri River from 2006-2017. *Otter trawl not performed in 2016 or 2017.

Segment 2 - Sicklefin Chub

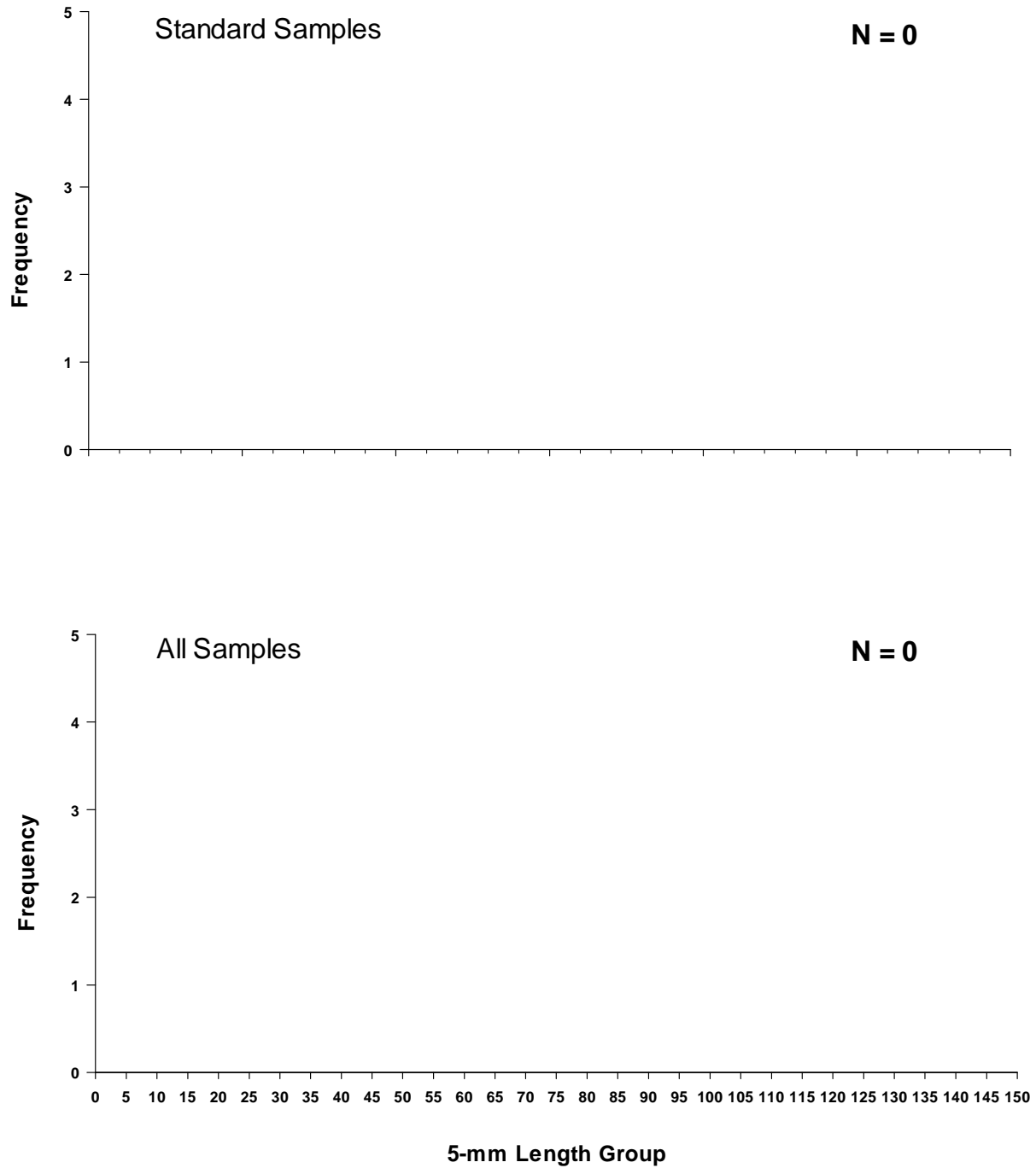


Figure 19. Length frequency of sicklefin chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

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 2017 field season.

Segment 2 - Sand Shiner

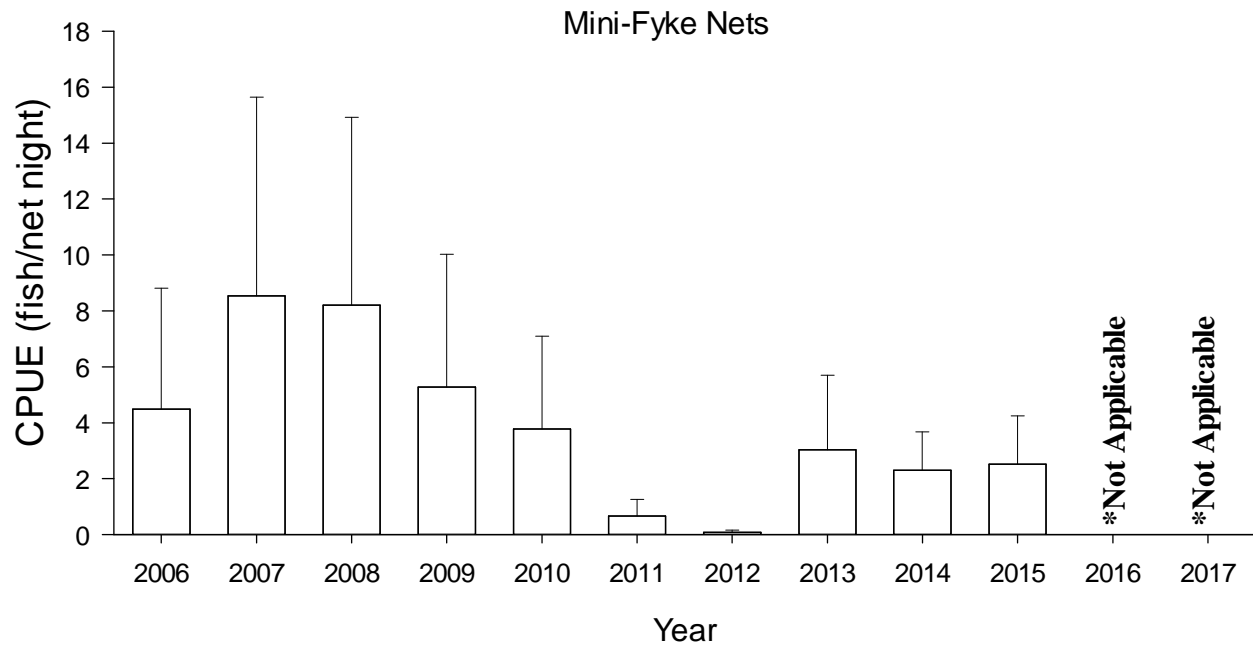


Figure 20. Mean annual catch per unit effort (\pm 2 SE) of sand shiner with mini-fyke nets in Segment 2 of the Missouri River during fish community season 2006-2017. *Mini-fyke nets were not performed in 2016 or 2017.

Segment 2 - Sand Shiner

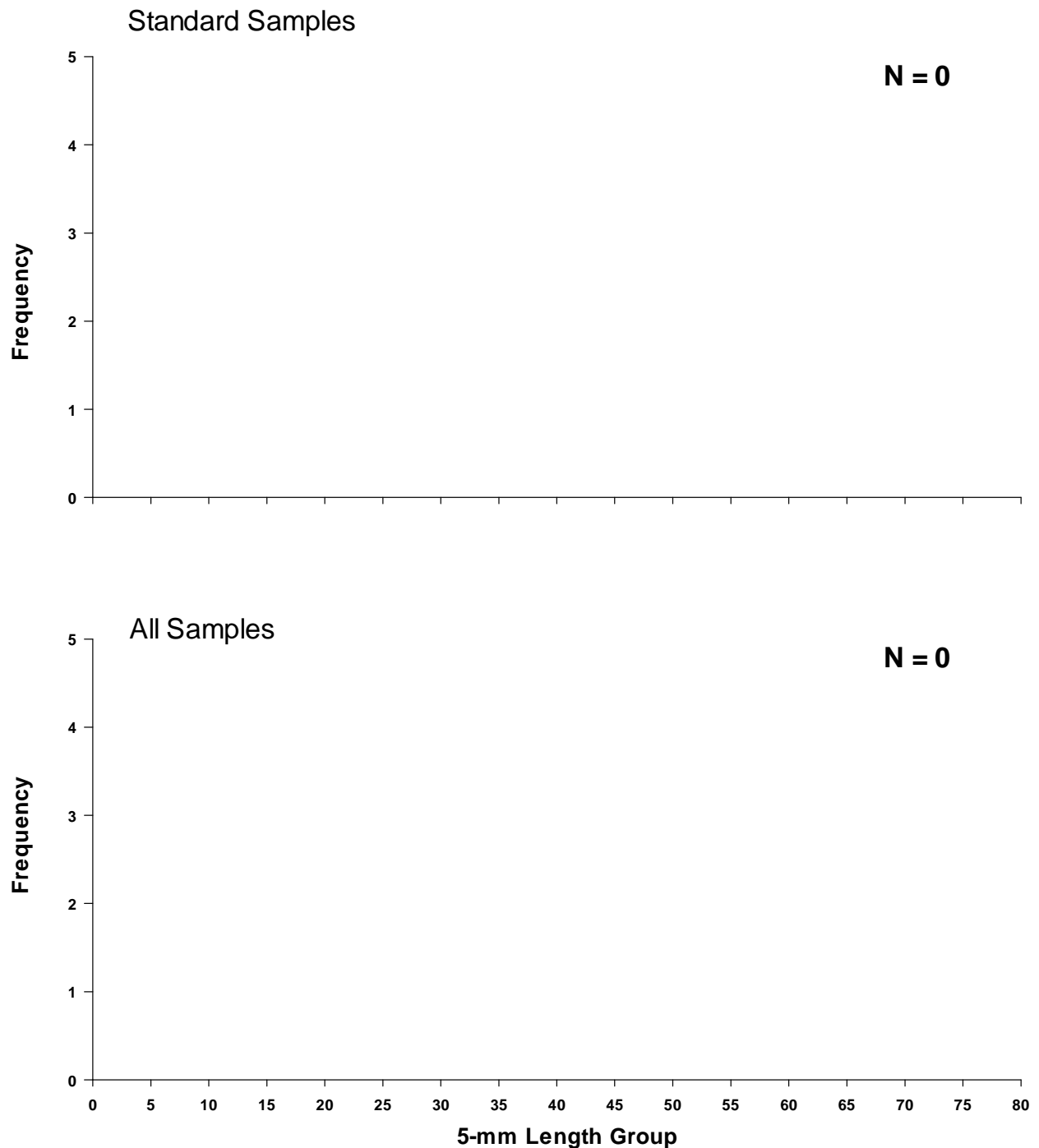


Figure 21. Length frequency of sand shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

***Hybognathus* spp.**

Due to the abandonment of otter trawl and mini-fyke net as sampling gears, no *Hybognathus* spp. were captured in Segment 2 during the 2017 field season.

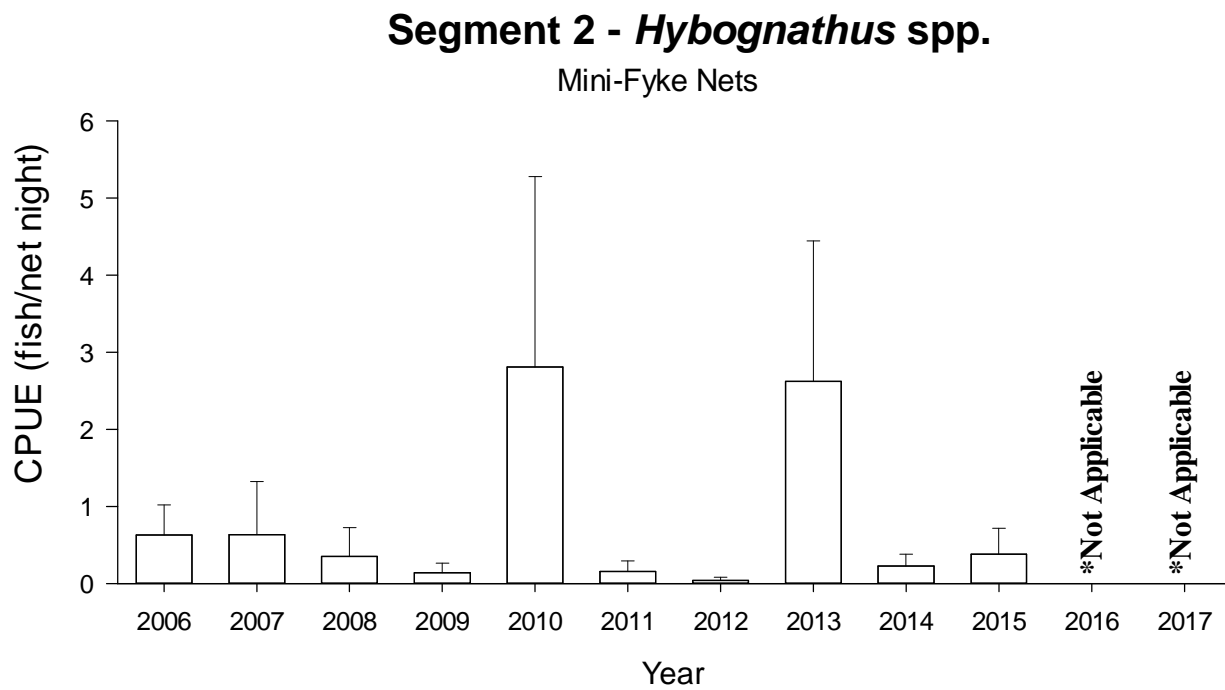


Figure 22. Mean annual catch per unit effort (\pm 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 2 of the Missouri River during fish community season 2006-2017. *Mini-fyke nets were not performed in 2016 or 2017.

Segment 2 - *Hybognathus* spp.

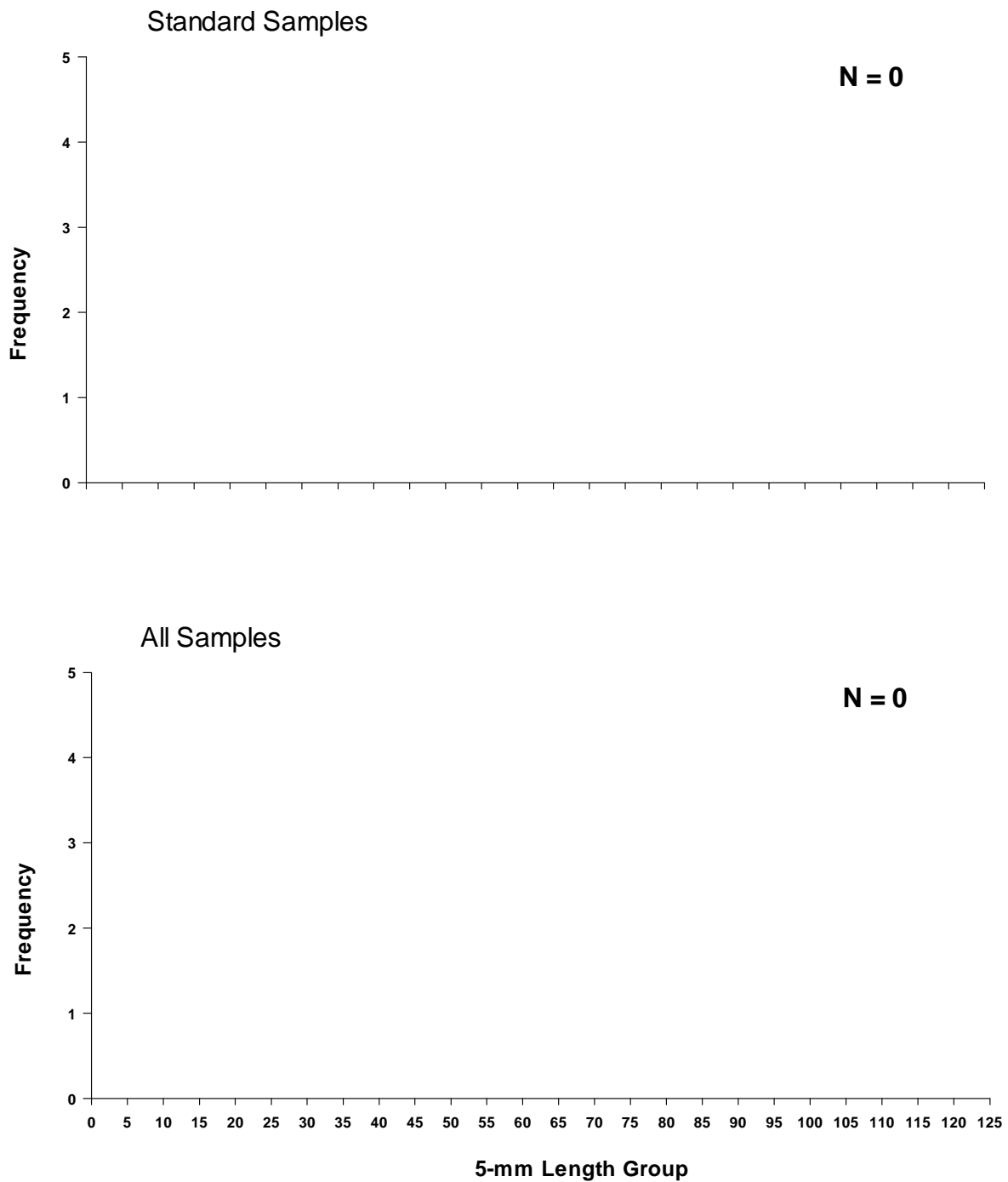


Figure 23. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

Blue Sucker

A total of 10 blue suckers were captured in Segment 2 during the 2017 field season; all of which were captured via trammel net during random deployments. Temporally, more blue suckers were captured during sturgeon season (n=6), when compared to fish community season (n=4).

Trammel net CPUEs (Fig. 24) of 0.03 fish/100m and 0.02 fish/100m for the sturgeon and fish community seasons, respectively, led to a combined-season CPUE of 0.02 fish/100m regarding blue suckers in Segment 2 for the 2017 sampling year.

Blue suckers observed throughout Segment 2 during the 2017 field season averaged 648 mm in total length and 2,801 g in weight. 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.

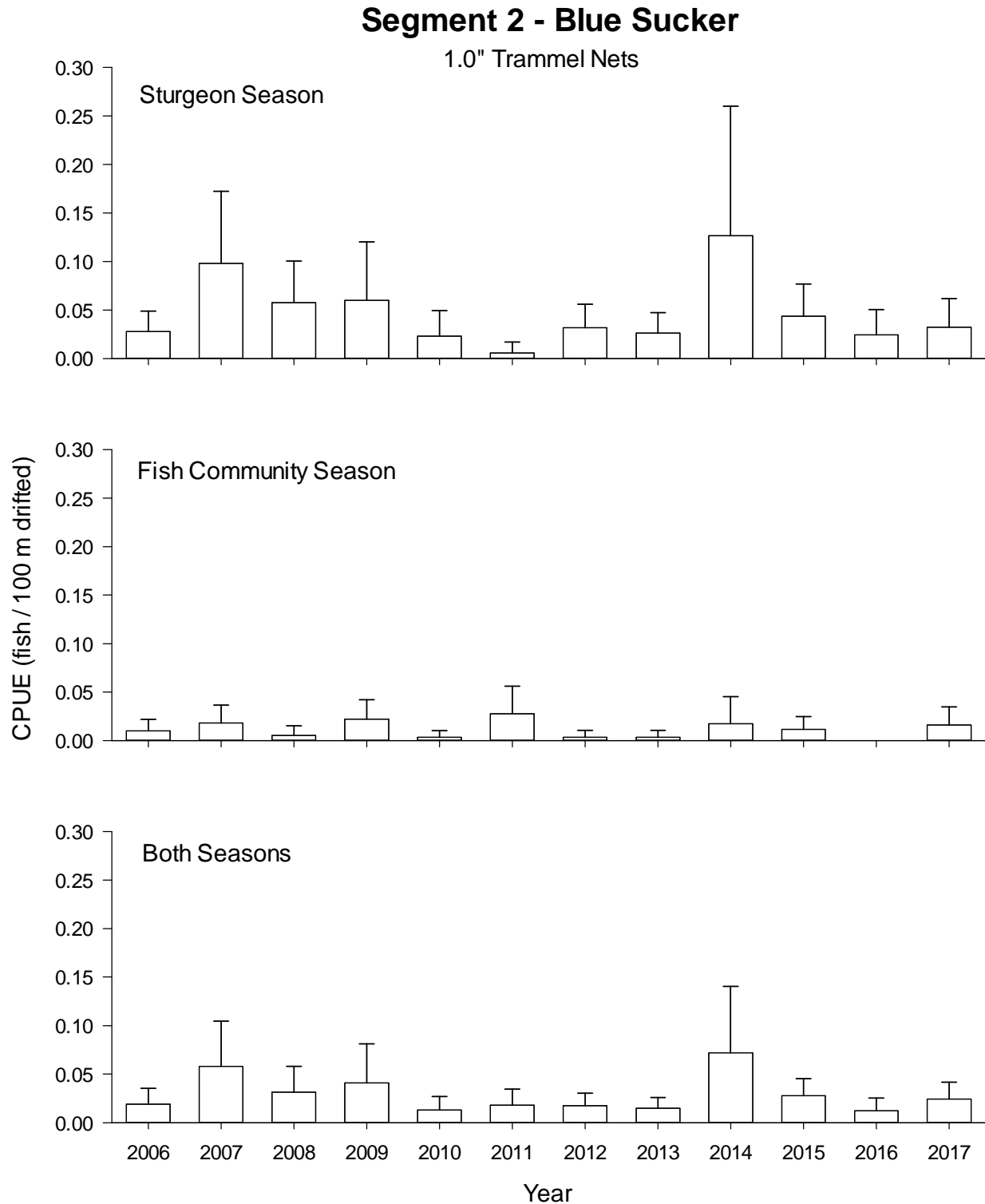


Figure 24. Mean annual catch per unit effort (± 2 SE) of blue sucker using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2017.

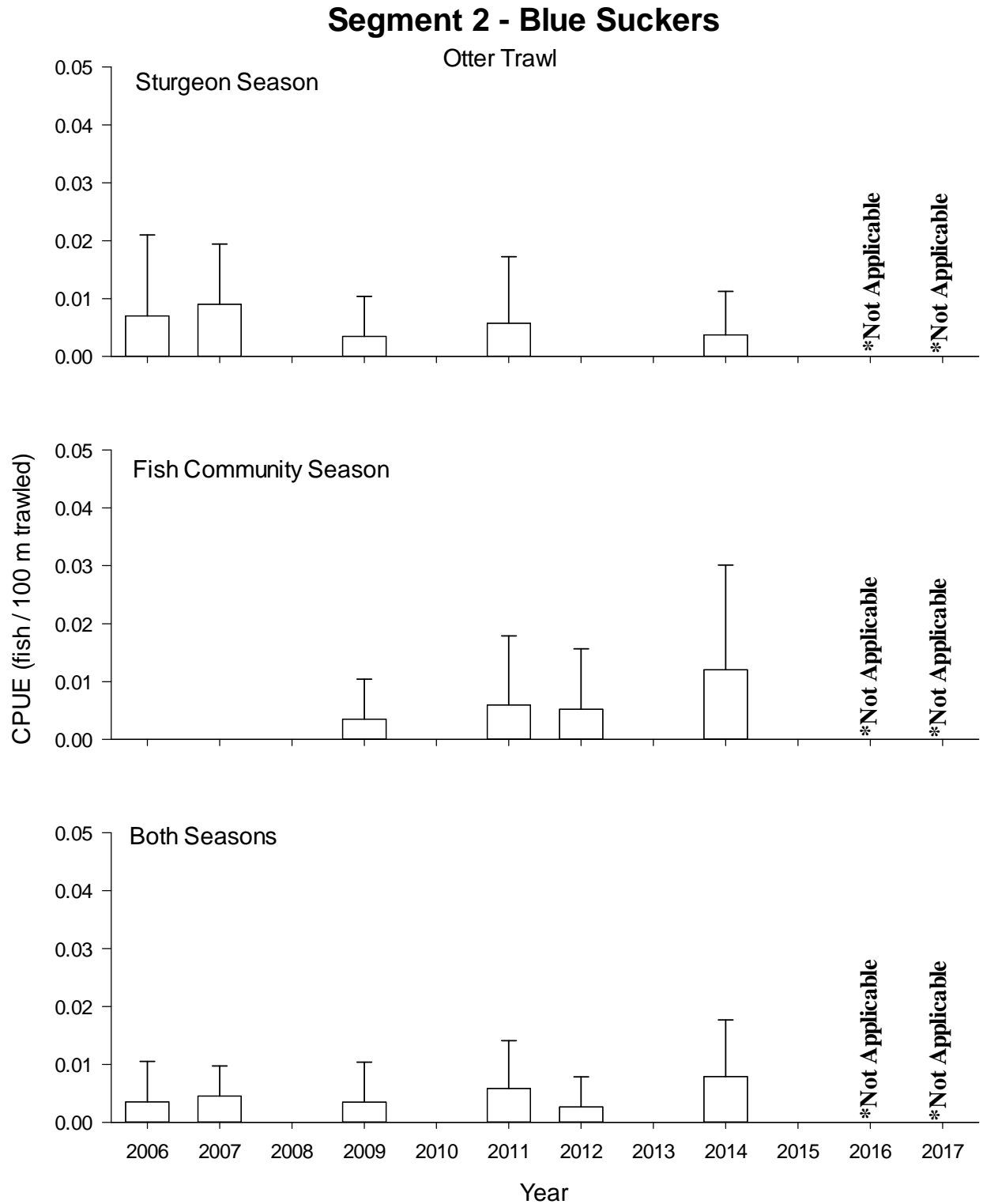


Figure 25. Mean annual catch per unit effort (± 2 SE) of blue sucker using otter trawls in Segment 2 of the Missouri River from 2006-2017. *Otter trawl not performed in 2016 or 2017.

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 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	6	33	0	50	17	0	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	4	25	0	75	0	0	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	0	0	0	0	0	0	0
		33	1	35	27	3	1

Segment 2 - Blue Sucker

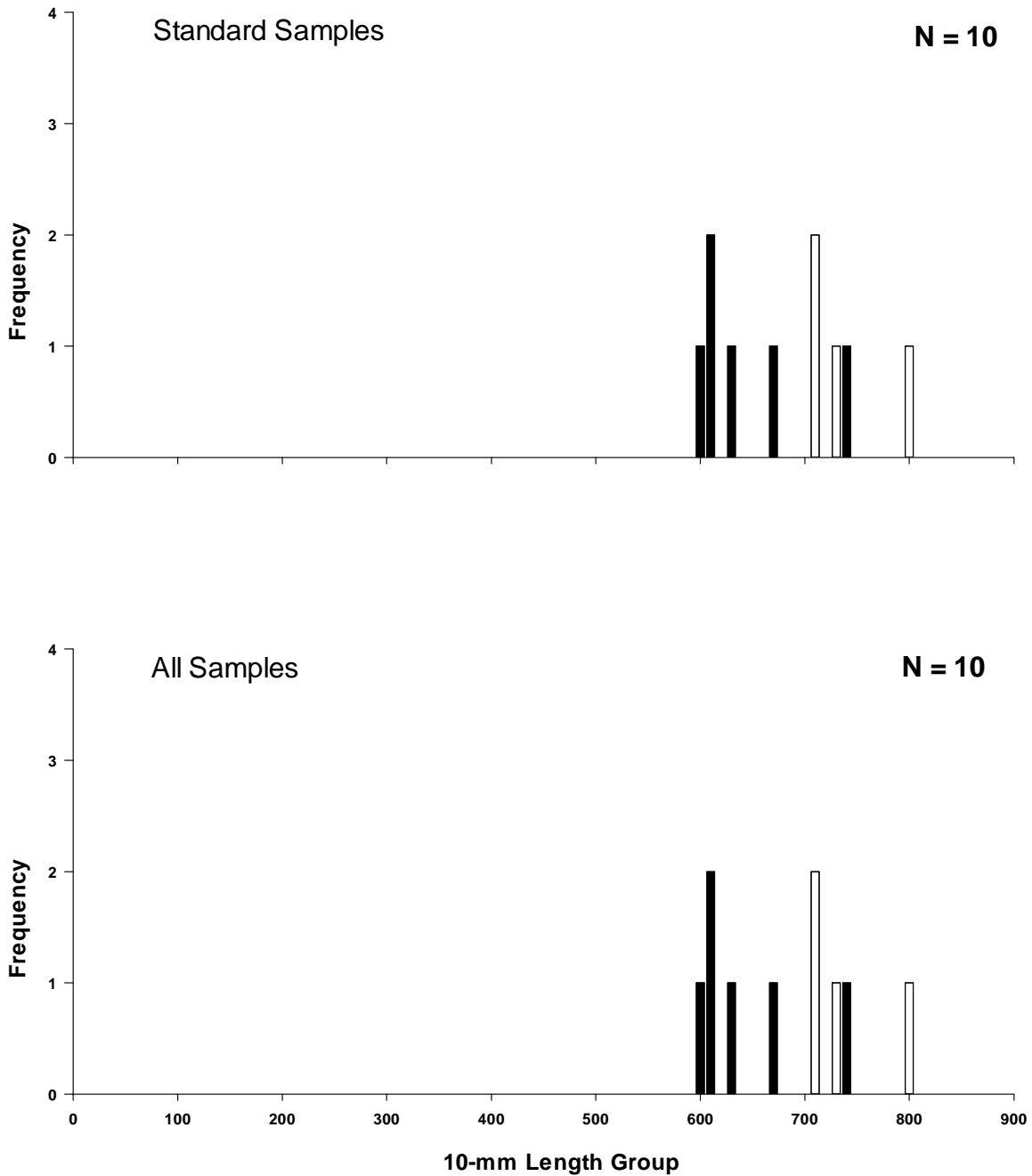


Figure 26. Length frequency of blue sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

Sauger

A total of 125 sauger were captured throughout Segment 2 during the 2017 field season. Nearly all sauger were observed via trammel net, sans a lone individual represented by a trotline capture. Temporally, more sauger were captured during sturgeon season (n=103), than during fish community season (n=22). The vast majority (98%) of sauger were captured during random gear deployments, while the remaining sauger (2%) were captured during non-random duplicate drifts.

The combined-season trammel net CPUE (Fig. 28) for Segment 2 during the 2017 sampling season was recorded at 0.25 fish/100m. Seasonally, CPUE was tabulated at 0.42 fish/100m and 0.09 fish/100m for the sturgeon and fish community seasons, respectively.

The sauger captured in Segment 2 during the 2017 season averaged 350 mm in total length and 327 g in weight, with a range from 222 mm to 518 mm. 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.

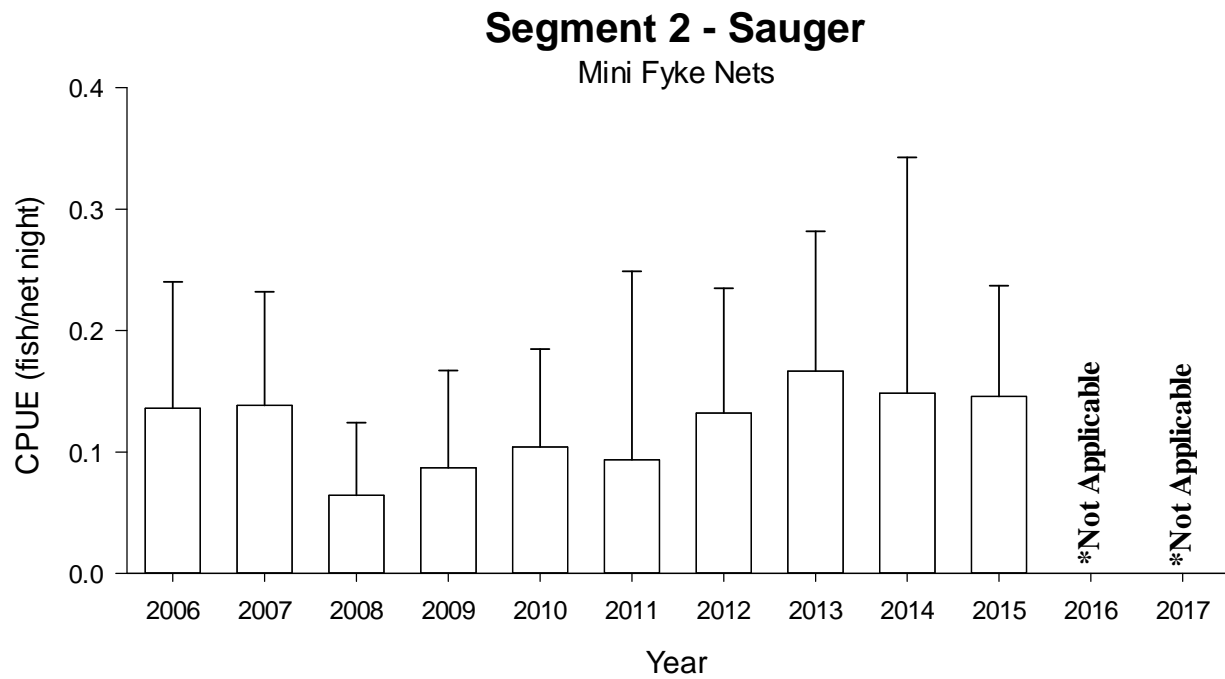


Figure 27. Mean annual catch per unit effort (\pm 2 SE) of sauger using mini-fyke nets in Segment 2 of the Missouri River from 2006-2017. *Mini-fyke nets were not performed in 2016 or 2017.

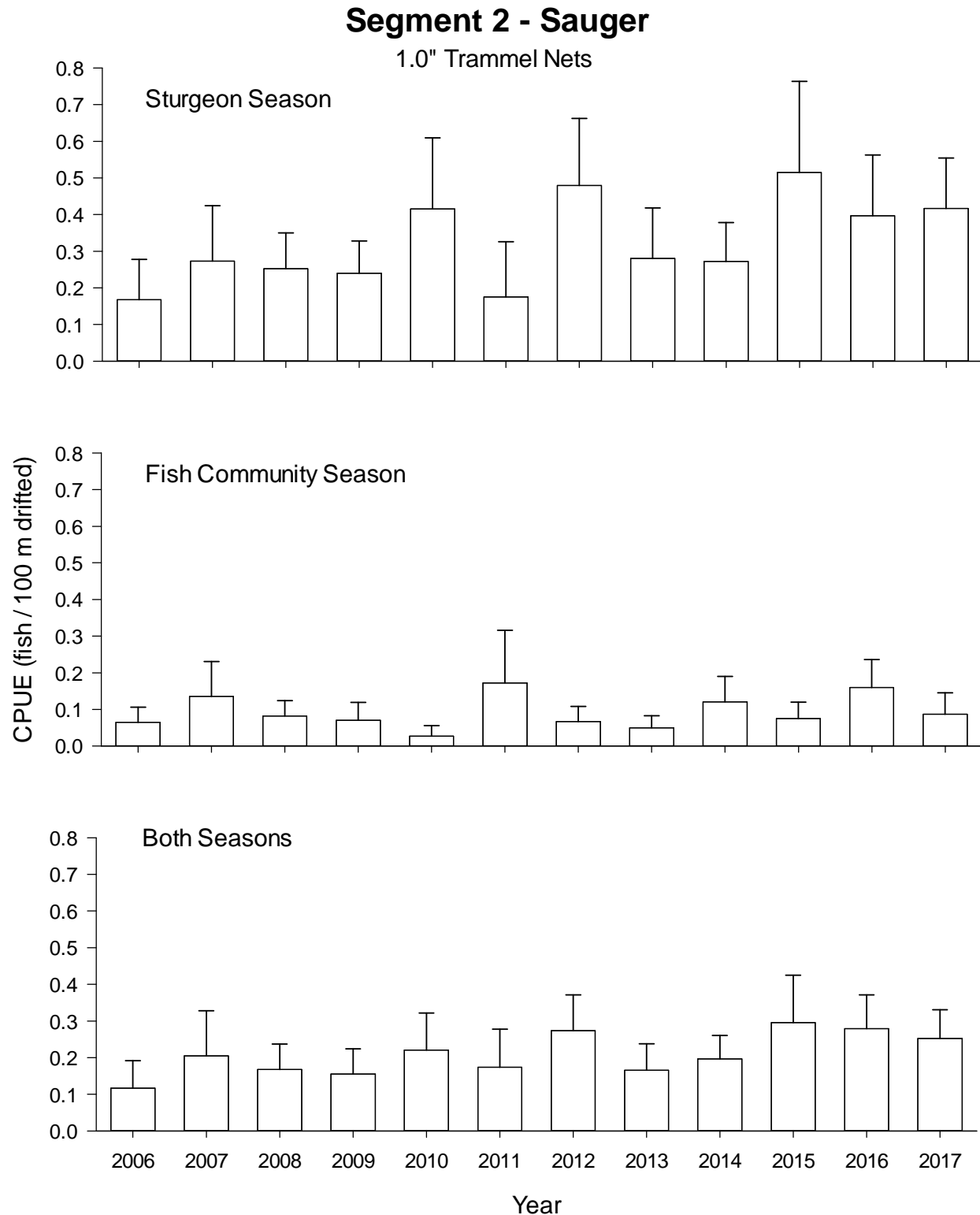


Figure 28. Mean annual catch per unit effort (± 2 SE) of sauger using 1.0" trammel nets in Segment 2 of the Missouri River from 2006-2017.

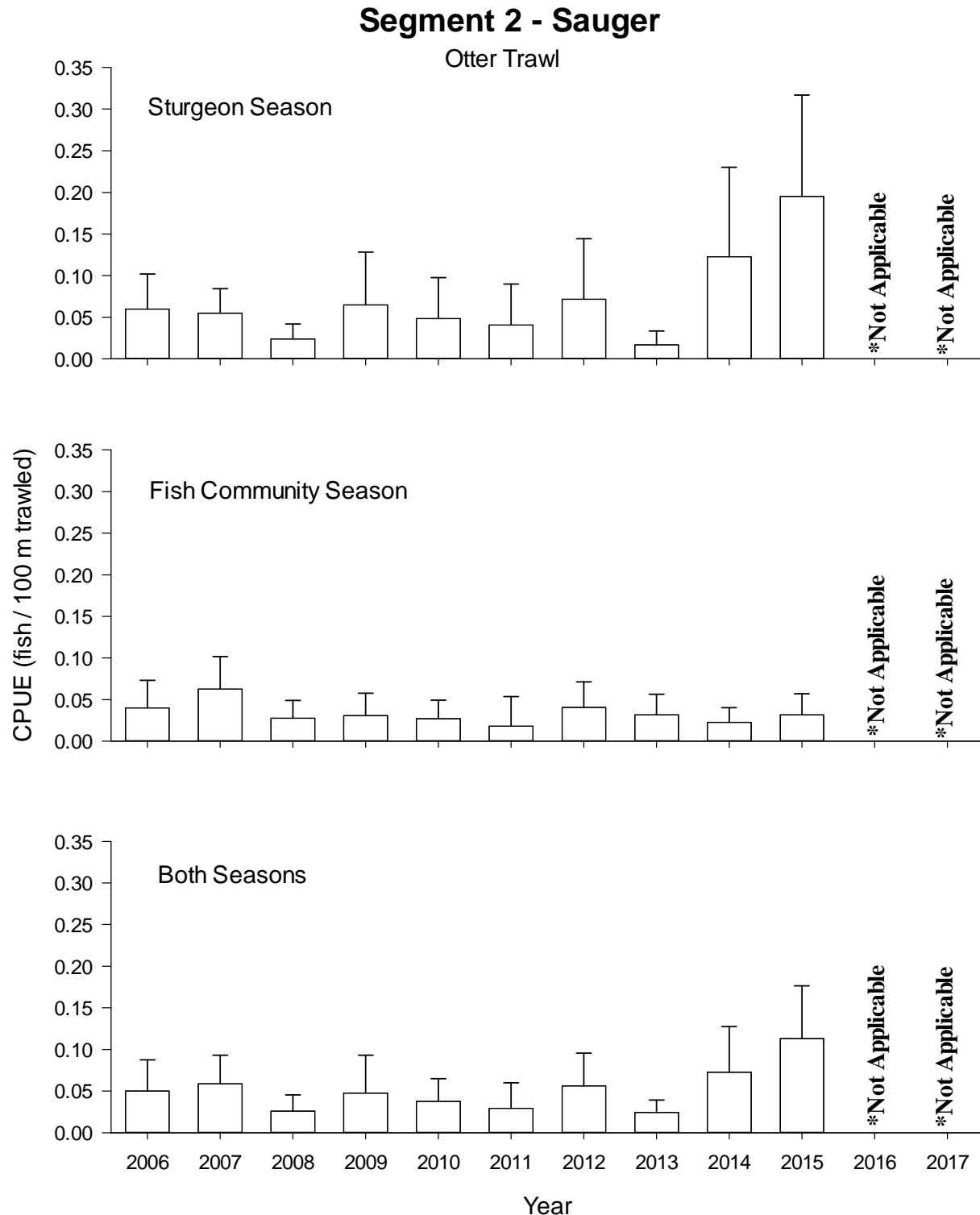


Figure 29. Mean annual catch per unit effort (\pm 2 SE) of sauger using otter trawls in Segment 2 of the Missouri River from 2006-2017. *Otter trawl not performed in 2016 or 2017.

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 2017. The percent of total effort for each gear in each habitat is presented on the second line of each gear type.

Gear	N	Macrohabitat ^a					
		CHXO	CONF	ISB	OSB	SCCL	TRML
Sturgeon Season							
1.0” Trammel Net	101	34	0	22	44	1	0
		41	0	30	27	1	0
Fish Community Season							
1.0” Trammel Net	20	30	0	20	40	10	0
		36	0	34	26	4	0
Both Seasons							
Trot Line	1	100	0	0	0	0	0
		33	1	35	37	3	1

Segment 2 - Sauger

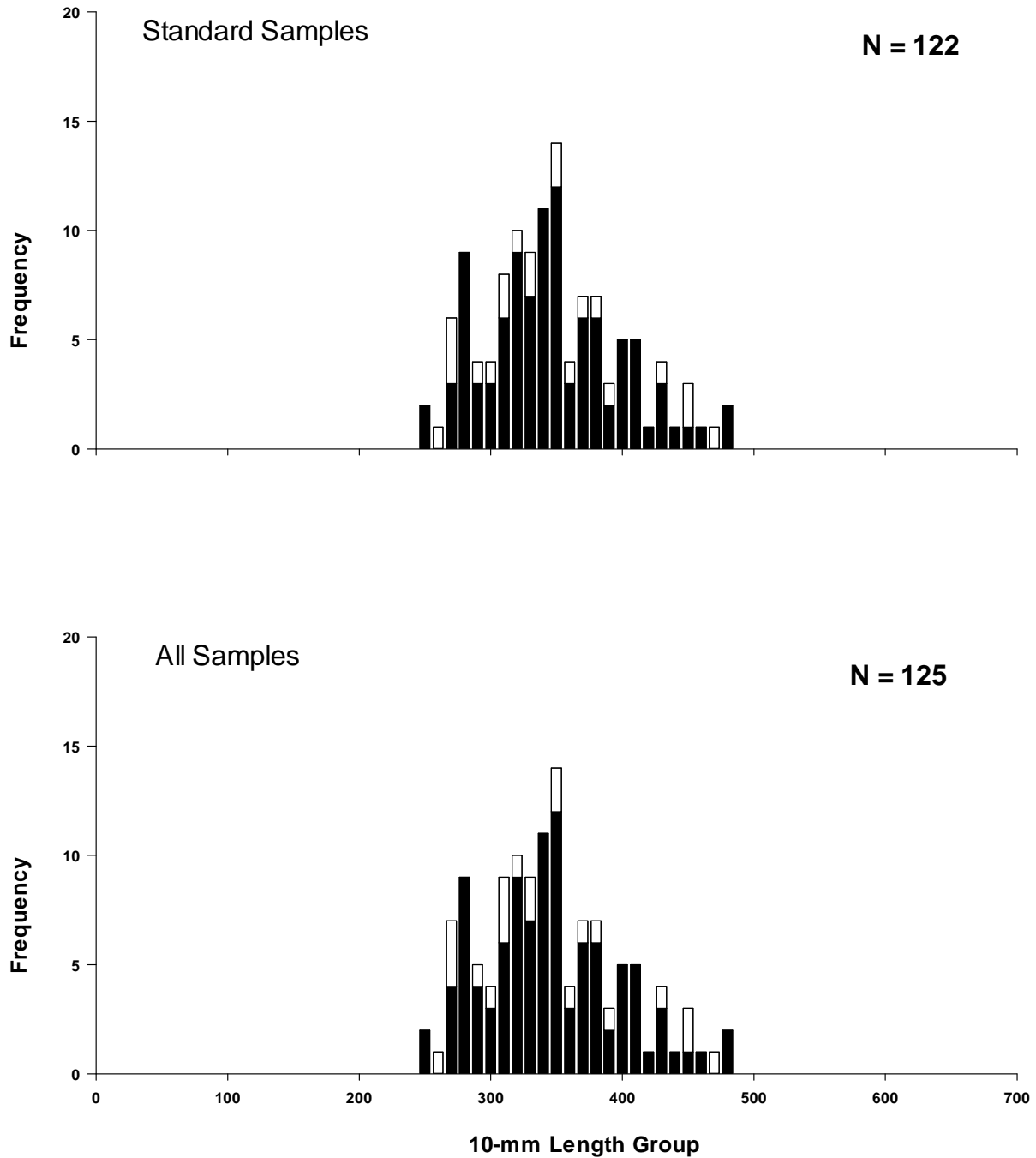


Figure 30. Length frequency of sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 2 of the Missouri River during 2017. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2017.

Missouri River Fish Community

Sampling events throughout Segment 2 during the 2017 field season culminated in the capture of 1,192 individual fish, comprising of 16 different species. With the abandonment of otter trawl and mini-fyke net as sampling gears, total captures and species diversity was once again significantly lower from a historical perspective.

The most frequently observed species throughout Segment 2 in 2017 was shovelnose sturgeon (n=536). 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. In addition, non-random duplicate sampling regularly leads to increased captures, as shovelnose sturgeon are often observed in the same areas and pallid sturgeon.

The second most regularly sampled species was channel catfish *Ictalurus punctatus*. Sampling events in Segment 2 during the 2017 resulted in 134 channel catfish observations. Trotline was the most successful gear at catching channel catfish (n=87), while trammel netting captured the remaining 47 individuals.

With 125 observations, sauger were the third most frequently witnessed species in Segment 2 during 2017. As with previous years, sauger were once again more likely to be captured during sturgeon season, presumably in relation to upstream, spring-time spawning movements.

Goldeye *Hiodon alosoides* (n=117) and flathead chub *Platygobio gracilis* (n=44) rounded out the top five of the most frequently observed fish species in Segment 2 during the 2017 field season. Other species sampled in order of abundance were; river carpsucker *Carpiodes carpio* (n=59), shorthead redhorse *Moxostoma macrolepidotum* (n=39), pallid sturgeon (n=31), walleye *Sander vitreus* (n=18), common carp *Cyprinus carpio* (n=16), white sucker *Catostomus commersoni* (n=11), longnose sucker *C. catostomus* (n=10), blue sucker (n=10), smallmouth buffalo *Ictiobus bubalus* (n=7), northern pike *Esox Lucius* (n=4), and burbot *Lota lota* (n=3).

Discussion

The 2017 field season marked the 12th consecutive sampling year for Pallid Sturgeon Population Assessment crews in Segment 2 of the Missouri River. Although this was the 12th year of sampling, it was also the second consecutive year of a reduction in sampling gears. Neither the otter trawl or mini-fyke net was used in sampling during the 2016 or 2017 field season. Although sampling efforts with standard gears, trammel net and trotline, were comparable over the last two field seasons, less pallid sturgeon ($n=31$) were captured in 2017 than 2016 ($n=53$).

During the 2017 field season, sampling indicated that pallid sturgeon remained present longitudinally throughout the entire stretch of Segment 2 of the Missouri River. However, sampling events at localized “hotspots” once again bolstered total capture numbers. For example, one bend, which was sampled via trotline during the fish community season, harbored 23% of the total pallid sturgeon captures for Segment 2. Augmented catch totals of pallid sturgeon continue to hinge on timing, locality, and efficiency of sampling events at any given time or location throughout Segment 2.

Trammel net CPUE for the 2017 field season throughout Segment 2 was tabulated at 0.02 fish/100m for all three seasonal metrics (sturgeon, fish community, and combined seasons, respectively). No clear pattern has emerged in relation to sturgeon season trammel net CPUE, however, it has remained nearly identical dating back to 2014. A slightly more general pattern of increasing observed CPUE appeared to be present in both fish community and combined seasons, respectively, from 2006 through 2016. However, that pattern was not discernable in Segment 2 during the 2017 field season. Fish community CPUE hit its lowest mark since 2009 (0.0 fish/100m), while a lower combined-season CPUE had not been observed since 2010 (0.02 fish/100m). Catch metrics, like those observed in 2017, and particularly during fish community season, make it difficult to discern any pattern over time.

Segment 2 trotline CPUE for 2017 was calculated at 0.26 fish/20 hooks, 0.17 fish/20 hooks, and 0.21 fish/20 hooks for sturgeon, fish community and combined seasons, respectively. Any kind of emerging pattern is even less clear for trotlines. Observed CPUE for sturgeon season was the 4th highest recorded since trotlines were introduced as a standard gear in 2010. Fish community season CPUE was tied for worst (2010), which in turn lent to a combine-season CPUE to be calculated at the 3rd lowest observed mark. Trotline CPUE patterns remain even

more difficult than trammel net catch rates to differentiate any kind of yearly or seasonal relationship. Regardless, since the introduction of trotlines as a standard sampling gear in Segment 2 of the Missouri River, that gear has remained a staple for capturing pallid sturgeon.

The pallid sturgeon captured throughout Segment 2 during the 2017 sampling year averaged 471 mm in fork length and 439 grams in weight. Although average size has remained relatively comparable from year to year, it is of potential concern that a large portion of represented year classes are similar in average length. However, unlike 2016, two larger hatchery-reared pallid sturgeon (>900 mm) were captured in Segment 2 in 2017. It is likely that, although in lower abundance, larger hatchery-reared fish do inhabit Segment 2 on an annual basis but, with sampling design and varying efficiency, they are not captured regularly.

Shovelnose sturgeon continued to be highly abundant throughout Segment 2, particularly in the upper reaches. Consequentially, more shovelnose sturgeon were captured during 2017 (n=536) than any other species. Trammel net and trotline were both highly successful gears at sampling shovelnose sturgeon, with 363 and 173 observations, respectively.

After reaching an all-time high trammel net CPUE, regarding shovelnose sturgeon, for both fish community season and combined season in 2016, those same catch metrics dropped abruptly during the 2017 field season. In comparison, fish community CPUE was recorded at 1.88 fish/100m in 2016 but fell to 0.68 fish/100m in 2017. In turn, a combined-season CPUE was recorded at 1.31 fish/100m in 2016, and 0.68 fish/100m in 2017. It is unclear as to why trammel net CPUE exhibited such a dramatic decrease from 2016 to 2017 regarding the fish community and combined seasons, respectively. Conversely, shovelnose sturgeon trammel net CPUE during sturgeon seasons has remained much more stable when comparing it to previous years.

Like pallid sturgeon, shovelnose sturgeon trotline CPUE patterns remain complicated to interpret. Although trotlines are a formidable gear at catching shovelnose sturgeon in Segment 2 of the Missouri River, it is possible that numerous variables are at play. For example, filamentous algae in the in the upper section of Segment 2 may reduce efficiency due to fouled hooks, while warmer water temperatures in the lower sections may lead to more worm-less hooks due to a higher density of “bait robbers”.

The shovelnose sturgeon observed during the 2017 field season in Segment 2 averaged 608 mm in fork length and 898 g in weight. With the scarcity of smaller size classes of shovelnose sturgeon residing in Segment 2, observed average length has remained nearly identical over time. Given that the vast majority of young of the year shovelnose sturgeon

presumably drift down stream 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.

A total of 10 blue suckers were captured in Segment 2 during 2017. Unlike previous years, where the majority of fish were captured during sturgeon season, observations were nearly equal between sturgeon season (n=6) and fish community season (n=4). 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. The population size structure of blue suckers in Segment 2 of the Missouri River continues to be dominated by adult fish; averaging 648 mm in total length in 2017. Although captures of young age-class blue suckers have been historically rare during Population Assessment sampling, it is potentially even more unlikely with the abolishment of the otter trawl and mini-fyke net sampling gears.

Sauger encounters (n=125) were once again a common occurrence in Segment 2 during the 2017 field seasons. As with previous years, observations and associated catch data, sauger were more prevalent during sturgeon season; with 82% of the sightings coming in the first half of the field season. Like blue sucker, 2011 was the only year in which fish community trammel net CPUE was greater than the observed CUPE during sturgeon season regarding sauger. 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 and 2017 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 abundant, no *Hybognathus* spp or sand shiners were captured using trammel net and trotlines as standard sampling gears during the 2017 field season.

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
<i>Etheostoma blennioides</i>	Greenside darter	GS DR
<i>Etheostoma caeruleum</i>	Rainbow darter	RB DR
<i>Etheostoma exile</i>	Iowa darter	IO DR
<i>Etheostoma flabellare</i>	Fantail darter	FT DR
<i>Etheostoma gracile</i>	Slough darter	SL DR
<i>Etheostoma microperca</i>	Least darter	LT DR
<i>Etheostoma nigrum</i>	Johnny darter	JY DR
<i>Etheostoma punctulatum</i>	Stippled darter	ST PD
<i>Etheostoma spectabile</i>	Orange throated darter	OT DR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MS DR
<i>Etheostoma zonale</i>	Banded darter	BD DR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YW PH
<i>Percina caprodes</i>	Logperch	LG PH
<i>Percina cymatotaenia</i>	Bluestripe darter	BT DR
<i>Percina evides</i>	Gilt darter	GL DR
<i>Percina maculata</i>	Blackside darter	BS DR
<i>Percina phoxocephala</i>	Slenderhead darter	SH DR
<i>Percina shumardi</i>	River darter	RR DR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UP N
	Unidentified darter	UD R
<i>Sander canadense</i>	Sauger	SG ER*
<i>Sander vitreus</i>	Walleye	WLE Y
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SG WE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i>) spp.	UST
	Unidentified Percidae	UP C
	Sciaenidae - drums	
<i>Aplodinotus grunniens</i>	Freshwater drum	FW DM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YO YF
	No fish caught	NF SH
	Unidentified larval fish	LV FS
	Unidentified	UN ID
	Net Malfunction (Did Not Fish)	ND NF
	Turtles	
<i>Chelydra serpentina</i>	Common Snapping Turtle	SN PT
<i>Chrysemys picta bellii</i>	Western Painted Turtle	PA TT
<i>Emydoidea blandingii</i>	Blanding's Turtle	BL DT
<i>Graptemys pseudogeographica</i>	False Map Turtle	FS MT
<i>Trachemys scripta</i>	Red-Eared Slider Turtle	RE ST
<i>Apalone mutica</i>	Smooth Softshell Turtle	SM ST
<i>Apalone spinifera</i>	Spiny Softshell Turtle	SY ST
<i>Terrapene ornata ornata</i>	Ornate Box Turtle	OR BT
<i>Sternotherus odoratus</i>	Stinkpot Turtle	SP OT
<i>Graptemys geographica</i>	Map Turtle	MA PT
<i>Graptemys kohnii</i>	Mississippi Map Turtle	MR MT
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	OU MT
<i>Pseudemys concinna metteri</i>	Missouri River Cooter Turtle	MR CT
<i>Terrapene carolina triunguis</i>	Three-toed Box Turtle	TT BT

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 2).

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

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking ^a	Primary Mark	Secondary Mark
2004	Milk River	821	2003	4/13/2004	Yearling	Elastomer	
2004	Culbertson	523	2003	8/9/2004	Yearling	PIT Tag	Elastomer
2004	Intake	347	2003	8/9/2004	Yearling	PIT Tag	Elastomer
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	2015	5/2/2016	Yearling	PIT Tag/Radio	Scute Removed
2016	Intake	358	2015	4/6/2016	Yearling	PIT Tag	Scute Removed
2016	Intake	30	2015	5/2/2016	Yearling	PIT Tag/Radio	Scute Removed
2016	Wolf Point	357	2015	4/5/2016	Yearling	PIT Tag	Scute Removed
2016	Mouth of Milk	697,388	2016	6/27/2016	Free Embryo		
2017	Culbertson	133	2016	4/12/2017	Yearling	PIT Tag	Scute Removed
2017	Culbertson	416	2016	4/12/2017	Yearling	PIT Tag	Elastomer, Scute
2017	Fallon	132	2016	4/12/2017	Yearling	PIT Tag	Scute Removed
2017	Fallon	430	2016	4/12/2017	Yearling	PIT Tag	Elastomer, Scute
2017	Intake	131	2016	4/12/2017	Yearling	PIT Tag	Scute Removed
2017	Intake	411	2016	4/12/2017	Yearling	PIT Tag	Elastomer, Scute

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking ^a	Primary Mark	Secondary Mark
2017	Wolf Point	232	2016	4/12/2017	Yearling	PIT Tag	Scute Removed
2017	Wolf Point	315	2016	4/12/2017	Yearling	PIT Tag	Elastomer, Scute

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 2017. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when $N < 2$.

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

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
BRBT	2	0.008	0.021	0	0	0
		0.012	0.033	0	0	0
BUSK	10	0.024	0.015	0.048	0.01	0
		0.017	0.022	0.043	0.021	0
CARP	2	0.005	0.005	0.011	0	0
		0.008	0.01	0.022	0	0
CNCF	46	0.101	0.161	0.089	0.04	0.075
		0.041	0.094	0.063	0.031	0.151
FHCB	65	0.131	0.167	0.072	0.169	0
		0.049	0.113	0.047	0.075	0
GDEY	59	0.141	0.099	0.189	0.118	0.329
		0.051	0.082	0.1	0.084	0.315
LNSK	6	0.014	0.005	0.021	0.019	0
		0.014	0.01	0.034	0.027	0
NTPK	1	0.003	0	0	0	0.095
		0.006	0	0	0	0.189
PDSG	11	0.024	0.04	0.016	0.016	0
		0.019	0.046	0.018	0.022	0

species	Total Catch	Overall CPUE	CHXO	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB
RVCS	54	0.119	0.065	0.132	0.134	0.452
		0.05	0.044	0.089	0.089	0.905
SGER	121	0.252	0.216	0.177	0.39	0.213
		0.078	0.098	0.097	0.217	0.196
SHRH	22	0.055	0.02	0.08	0.044	0.313
		0.026	0.024	0.056	0.04	0.352
SMBF	3	0.008	0	0.005	0.021	0
		0.009	0	0.011	0.029	0
SNSG	315	0.689	0.77	0.554	0.784	0.328
		0.195	0.318	0.31	0.425	0.656
WLYE	15	0.034	0.036	0.029	0.04	0
		0.019	0.033	0.025	0.046	0
WTSK	2	0.004	0	0.011	0	0
		0.005	0	0.015	0	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 2017.

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 2017.

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

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
BRBT	1	0.011	0.032	0	0	0	0	0
		0.021	0.065	.	0	0	0	.
BUSK	0	0	0	0	0	0	0	0
		0	0	.	0	0	0	.
CARP	14	0.149	0.194	0	0.212	0	0	1
		0.113	0.195	.	0.258	0	0	.
CNCF	87	0.926	0.516	13	0.848	0.44	2	13
		0.43	0.369	.	0.409	0.233	3.055	.
FHCB	7	0.074	0.065	0	0.061	0.12	0	0
		0.062	0.129	.	0.084	0.133	0	.
GDEY	56	0.596	0.774	0	0.606	0.36	1	0
		0.177	0.368	.	0.229	0.303	2	.
LNSK	4	0.043	0	0	0.091	0.04	0	0
		0.052	0	.	0.134	0.08	0	.
NTPK	3	0.032	0.032	0	0	0.04	0.333	0
		0.036	0.065	.	0	0.08	0.667	.
PDSG	20	0.213	0.097	0	0.303	0.28	0	0
		0.131	0.142	.	0.268	0.295	0	.

species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	SCCL	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
RVCS	0	0	0	0	0	0	0	0
		0	0	.	0	0	0	.
SGER	1	0.011	0.032	0	0	0	0	0
		0.021	0.065	.	0	0	0	.
SHRH	13	0.138	0.065	0	0.121	0.28	0	0
		0.094	0.09	.	0.115	0.295	0	.
SMBF	3	0.032	0	0	0	0.04	0.333	1
		0.036	0	.	0	0.08	0.667	.
SNSG	173	1.84	2.032	0	1.576	2	2.667	0
		0.478	0.882	.	0.657	0.993	5.333	.
WLYE	3	0.032	0.032	0	0	0.08	0	0
		0.036	0.065	.	0	0.111	0	.
WTSK	8	0.085	0.161	0	0.091	0	0	0
		0.065	0.163	.	0.102	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 2017 for Segment 2 of the Missouri River.

	Sturgeon Season	Fish Community Season	Both Seasons
species	1.0" Trammel Net	1.0" Trammel Net	Trotline
BRBT	0.000	0.015	0.011
BUSK	0.033	0.016	0.000
CARP	0.011	0.000	0.149
CNCF	0.112	0.089	0.926
FHCB	0.175	0.087	0.074
GDEY	0.199	0.084	0.596
LNSK	0.020	0.009	0.043
NTPK	0.000	0.006	0.032
PDSG	0.024	0.024	0.213
RVCS	0.178	0.059	0.000
SGER	0.417	0.087	0.011
SHRH	0.063	0.048	0.138
SMBF	0.012	0.003	0.032
SNSG	0.692	0.687	1.840
WLYE	0.054	0.013	0.032
WTSK	0.004	0.004	0.085

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 – 2017 and High Water in 2011.

Bend Number	Bend River Mile	Coordinates		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
		Latitude	Longitude												
1	1761	48.05581	106.32055	ST, FC					ST, FC, HW	ST, FC	ST	ST, FC	ST, FC	ST, FC	ST
2	1760	48.04356	106.30328									ST, FC			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	FC
8	1751	48.03120	106.13605			ST, FC	ST, FC		ST, FC, HW	ST, FC	ST, FC			ST, FC	ST, FC
9	1749.5	48.02872	106.12263	ST, FC					ST, FC, HW	ST	FC				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	FC
19	1732	48.01149	105.93182	ST, FC	ST, FC					ST, FC	FC	ST, FC	ST, FC	ST, FC	ST, FC
20	1730.5	48.01514	105.89578								ST, FC				ST
21	1728.5	48.03616	105.89557			ST, FC					ST				ST, FC
22	1727.5	48.03228	105.88458						FC		ST, FC				FC

		Coordinates													
Bend	Bend														
Number	River Mile	Latitude	Longitude	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
23	1726.5	48.01900	105.87228	ST, FC	ST, FC		ST, FC	ST, FC			FC			ST	ST, FC
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	ST
28	1719	48.04468	105.76749	ST, FC	ST, FC				HW	ST		ST, FC		ST	ST, FC
29	1717.5	48.02643	105.74791					ST, FC	FC, HW	ST, FC	FC	ST, FC		ST, FC	FC
30	1716	48.03228	105.71736				ST, FC		FC, HW	FC	ST			FC	ST, FC
31	1714	48.05327	105.69457				ST, FC	ST, FC	HW	FC	ST, FC			ST, FC	ST
32	1712	48.05313	105.66531		ST, FC	ST, FC				ST, FC	ST, FC		FC		ST, FC
33	1710.5	48.04739	105.66245	ST, FC		ST, FC				ST, FC	ST, FC	ST	ST, FC	ST	ST, FC
34	1710	48.05159	105.64158	ST, FC			ST, FC			FC		ST, FC	ST, FC	ST, FC	ST
35	1709	48.06960	105.64798	ST, FC					HW	ST, FC	FC			ST, 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		FC
40	1703	48.07828	105.56033				ST, FC		ST, FC, HW		ST, FC				ST, FC