2013 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segments 5 and 6

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

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EXECUTIVE SUMMARY

Pallid sturgeon *Scaphirhynchus albus* and the Missouri River fish community were sampled in the unchannelized Missouri River downstream of Fort Randall Dam to the headwaters of Lewis and Clark Lake (Segments 5 and 6; Recovery Priority Management Area 3 [RPMA 3]) using standardized gears and protocols during 2013. Ten randomly-selected bends were sampled with a minimum of eight deployments of each standard gear (i.e., gill net, trot line, otter trawl, trammel net, and mini-fyke net) in each bend. The confluence of the Niobrara River delineates Segment 5 (upstream of the confluence) from Segment 6 (downstream of the confluence to the headwaters of Lewis and Clark Lake); however, both segments were pooled for this report.

Pallid sturgeon propagation and stocking efforts appear to be maintaining a stable relative abundance in Segments 5 and 6. We captured 146 pallid sturgeon in 2013, 94% of which were confirmed hatchery origin; the remaining 6% are currently of unknown origin. Passive integrated transponder (PIT) tags were detected in 107 (73%) captured fish and the presence of PIT tags was unknown for two fish due to equipment malfunction. For standardized random gear deployments, 18 pallid sturgeon were captured with gill nets, 52 with trotlines, 19 with trammel nets, and 13 with otter trawls. An additional 44 pallid sturgeon were captured in duplicate samples with the otter trawl (N = 26) and trammel net (N = 18). Relative abundance estimates in 2013 were generally similar to previous years in Segments 5 and 6. Growth and condition in Segments 5 and 6 are consistent with populations in other segments of the Pallid Sturgeon Population Assessment Program. In 2013, we captured pallid sturgeon from 12 of the 14 year classes stocked in RPMA 3. Fish

from the 2010 and 2012 year classes were not collected in 2013, but the 2012 year class was stocked after most sampling was completed.

Pallid sturgeon were captured throughout Segments 5 and 6 (i.e., collected at every bend sampled) but 58% of captures were downstream of the Niobrara River confluence in Segment 6. Since 2003, 55% of pallid sturgeon captured in random gear deployments in Segments 5 and 6 have been collected in Segment 6, with 134 (13%) from Bend 8 and 117 (11%) from Bend 9.

Similar to previous years, most (50%) pallid sturgeon collected in 2013 were from braided channel macrohabitat. However, most of Segment 6 is classified as braided. We also collected pallid sturgeon from outside bend (13%), confluence (12%), channel crossover (11%), large-connected secondary channel (8%), and inside bend (6%) macrohabitats. All fish were captured in the channel border mesohabitat

The relative abundance of shovelnose sturgeon *S. platorynchus*, blue sucker *Cycleptus elongatus*, and sauger *Sander canadense* appear to be declining in 2013, potentially due to limited natural recruitment. Only large shovelnose sturgeon and blue sucker occurred in our sampling, suggesting a lack of natural recruitment. Although evidence of sauger reproduction exists, body condition is relatively low and the abundance of larger (likely sexually mature) fish is low.

Sturgeon chub *Macrhybopsis gelida*, shoal chub *M. aestivalis*, and sicklefin chub *M. meek*, population abundances are low or these species are absent from Segments 5 and 6, based on catch numbers. Only two sturgeon chub (collected in 2012) have been caught in Segments 5 and 6 during 11 years of monitoring, while sicklefin chub and shoal chub have not been caught.

Brassy minnow *Hybognathus hankinsoni*, plains minnow *H. placitus*, and western silvery minnow *H. argyritis* are rare in Segments 5 and 6 and may be declining. Only 177 brassy minnows, 6 plains minnows, and 6 western silvery minnows have been collected during 11 years of monitoring. Additionally, the relative abundance of *Hybognathus* spp. has been decreasing since 2010. However, the presence of smaller individuals in our sampling (e.g., 30 mm) suggests brassy minnows and western silvery minnows are reproducing in Segments 5 and 6.

The sand shiner *Notropis stramineus* population appears stable or increasing in Segments 5 and 6. The relative abundance of sand shiner is low, but appears to have rebounded from the extremely low relative abundances observed in 2009 and 2010. The abundance of small individuals collected during the Fish Community Season may indicate a strong year class during 2013 in Segments 5 and 6.

A total of 2,497 fish comprised of 45 fish species and one hybrid were caught in Segments 5 and 6 of the Missouri River during 2013. The four exotic Asian carps, bighead carp *Hypophthalmichthys noblis*, silver carp *H. molitrix*, grass carp *Ctenopharyngodon idella*, or black carp *Mylopharyngodon piceus* were not captured or observed. We collected two snapping turtles *Chelydra serpentine* and 25 false map turtles *Graptemys pseudogeographica*.

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Introduction

In response to population declines of pallid sturgeon *Scaphirhynchus albus* and subsequent listing as federally endangered, a team of biologists representing State and Federal resource management agencies (known as the Pallid Sturgeon Population Assessment Team) was assembled in 2002 to develop and implement a standardized long-term resource monitoring program for the Missouri River (Welker and Drobish 2012a). This team developed the Pallid Sturgeon Population Assessment Program (PSPAP) to monitor the status and recovery of pallid sturgeon and the native riverine fish community (Appendix A). This team developed standardized protocols for habitat classification (Appendix B), gear types and deployment methods (Appendix C), and data reporting and summarization (Welker and Drobish 2012b). The PSPAP delineated 14 sampling segments within the Missouri River to monitor the status of pallid sturgeon and the associated fish community. Each sampling segment was selected based on a variety of characteristics such as water temperature, turbidity, tributary influence, presence of degrading or aggrading stream beds, stream gradient, natural hydrograph, spillway releases, and flow fluctuations (Berry and Young 2001; Welker and Drobish 2012a). Sampling within these segments allows biologists to monitor trends in pallid sturgeon and native Missouri River fish abundance in relation to flow modification, mitigation efforts, and shallow water habitat restoration projects. Standardized monitoring throughout the Missouri River Basin facilitates comparison of fish relative abundance, distribution and population dynamics in disparate habitats (e.g. Upper vs. Middle basins or unchannelized vs. channelized river banks). Additional, focused studies have been initiated in conjunction with the PSPAP to fulfill unique biological information gaps (e.g., food habits, sturgeon hormone and disease studies, shovelnose sturgeon population estimates, gear evaluations, and telemetry projects).

Because pallid sturgeon abundance is low, data collection that solely targets pallid sturgeon likely would not provide adequate information to evaluate restoration projects and flow modifications to the Missouri River. An ecologically based, long-term population assessment approach was adopted to address this concern and evaluate the warmwater benthic fish community in the Missouri River as required by the U. S. Fish and Wildlife Service's (USFWS) 2000 Biological Opinion on operations of the main-stem Missouri River dams (USFWS 2000). Additionally, evaluating responses of native, short-lived Missouri River fishes to changes in habitat or flow modifications may be a more sensitive indicator of habitat change in the near term compared with the rare, long-lived pallid sturgeon. A representative group of native Missouri River fishes was selected as indicator species for detecting changes in the warmwater benthic fish community: blue sucker *Cycleptus elongates*, brassy minnow *Hybognathus hankinsoni*, Mississippi silvery minnow *H. nuchalis*, plains minnow *H. placitus*, sand shiner *Notropis stramineus*, sauger *Sander canadense*, shoal chub *Macrhybopsis aestivalis*, shovelnose sturgeon *S. platorynchus*, sicklefin chub *M. meeki*, sturgeon chub *M. gelida*, and western silvery minnow *H. argyritis*.

Goal

Information derived from the PSPAP will be used to evaluate the progress of current and future management actions. Specifically, the goal of the PSPAP is to:

Provide the information to detect changes in pallid sturgeon and native target species populations in the Missouri River basin (Welker and Drobish 2012a)**.**

Objectives

Six objectives have been identified for the monitoring program, and detailed hypotheses for each objective can be found in Welker and Drobish (2012a):

1. Evaluate annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River system.
2. Evaluate annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery-stocked pallid sturgeon by season and life stage.
3. Evaluate 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. Evaluate annual results and long-term trends of habitat usage of the target native species by season and life stage.
6. Evaluate annual results and long-term trends in all remaining species (minimum of 50 fish collected/species) population abundance and geographic distribution throughout the Missouri River system.

Success Criteria

Evaluation of success will be tied directly to the results of the PSPAP and the information that these assessments provide. The following four statements may be used to determine program success:

1. The program has the ability to detect population changes.
2. The program has the ability to measure survival of hatchery-reared and stocked pallid sturgeon in the river.
3. The program has the ability to detect reproduction of pallid sturgeon in the Missouri River.

4. The program has the ability to detect recruitment of wild pallid sturgeon in the Missouri River.

Study Area

We assessed the status of pallid sturgeon and the associated fish community for Segments 5 and 6 of the PSPAP. These segments encompass the 89-km riverine section of the Missouri River from Fort Randall Dam downstream to the headwaters of Lewis and Clark Lake near Springfield, South Dakota (Figure 1). Segment 5 (rkm 1,416-1,358, river mile [rm] 880-844) encompasses the riverine section from Fort Randall Dam downstream to the Niobrara River confluence. Segment 6 (rkm 1,358-1,331, rm 844-827) encompasses the riverine section from the confluence of the Missouri and Niobrara Rivers downstream to the headwaters of Lewis and Clark Lake. Lewis and Clark Lake is the most downstream reservoir of the Missouri River and was formed by the closure of Gavins Point Dam in 1955.

Segments 5 and 6 contain many historic riverine habitats including sandbars, sandbar pools, side channels, backwater areas, islands, and old growth riparian forest. Maximum depth in these segments of the Missouri River is approximately 12 m and channel width ranges from 45 to 90 m. Sediment from the Niobrara River has formed a large, braided delta in Segment 6. The delta spans from rkm 1,358 to approximately rkm 1,331 and has progressively expanded downriver into Lewis and Clark Lake.

Although Segments 5 and 6 retain many natural physical habitat features, the natural temperature, flow, and sediment regimes are highly altered by Fort Randall Dam (Pegg et al. 2003). Hypolimnetic discharge from Fort Randall Dam alters natural water temperature and turbidity in Segment 5, but Segment 6 has more natural water temperature and turbidity relative to Segment 5 due to inflows from the Niobrara River. Water levels fluctuate daily (up to 1 m)

and seasonally (Troelstrup and Hergenrader 1990). The lowest daily flows generally occur at 0600 hours and peak flows occur between 1200 to 1900 hours for power generation demands (USACE 1994). The USACE Missouri River Main Stem Reservoirs 2000-2001 Annual Operating Plan (http://www.nwd-mr.usace.army.mil/rcc/reports/aop.html) reported highest seasonal water releases from Fort Randall Dam from August through November to support navigation on the Missouri River downstream of Sioux City, Iowa. Lowest water releases were from December through April to prevent flooding due to ice jams.

The pallid sturgeon population in Segments 5 and 6 has been supplemented through stocking since 2000 (Appendix E). From June 2000 through September 2013, 11,761 pallid sturgeon have been released in Segments 5 and 6, consisting of 14 year classes: 1997-1999, 2001-2010, and 2012. Additionally, 12 adults that were former broodstock or rehabilitated fish were translocated to Segments 5 and 6 from Lake Sharpe, South Dakota (Appendix E). Most hatchery-reared fish were stocked at age-1 (N = 7,518); however during September of 2008 the first stocking of age-0 fingerlings occurred (N = 3,410). Since 2010, 129 fish were stocked as part of a detection probability and catchability study for standard sampling gears used in the PSPAP; these fish were implanted with internal sonic telemetry tags.

Methods

Our sampling protocol followed detailed guidelines, identified in "Pallid Sturgeon Population Assessment Project" and "Missouri River Standard Operating Procedures for Fish Sampling and Data Collection," developed by the Pallid Sturgeon Population Assessment Team (Welker and Drobish 2012a; Welker and Drobish 2012b). A general summary of those guidelines follows.

Sampling Site Selection and Habitat Description

The river bend served as the basic sampling unit within each river segment. All bends within each segment were sequentially numbered from upstream to downstream and 10 bends (five per segment) were randomly selected for sampling (Appendix I). Bends were determined by the hydrologic nature of the river. A bend typically extended from the upstream crossover to just upstream of the next downstream crossover and also encompassed any islands and secondary channels (i.e., discrete habitats). Typically, the river channel parallels the adjacent geographic landforms in the channelized river. However, in the unchannelized portions of the Missouri River, bends do not necessarily follow the general form of the landscape; multiple meanders occur within what appears as one large bend based on the shape of the entire river channel. Also, in unchannelized sections, the location of bends and the number of bends within a segment may change over time. The habitat classification scheme allows for bend comparisons between the channelized and unchannelized river despite changes in scale.

The habitat classification system from the Benthic Fishes Study (Berry and Young 2001) was adopted by the PSPAP to classify habitats within bends (Appendix B). This habitat classification system was further modified to address both broad and specific habitats using a hierarchical classification system (e.g., macrohabitat, mesohabitat, and microhabitat) to aid in consistent and comparable data collection across all segments of the Missouri River. Three continuous macrohabitats are present in nearly every bend: outside bends, inside bends, and channel crossovers. An additional 10 discrete macrohabitats have been identified that may not be present in each bend: large tributary mouths, small tributary mouths, confluence areas, large and small secondary connected channels, secondary non-connected channels, deranged channels, braided channels, dendritic channels, and dam tailwaters. Mesohabitats and microhabitats have

been defined to further describe fish habitat use. This hierarchal approach provides continuity with previous studies (e.g., Berry and Young 2001) while providing a more detailed and flexible habitat classification system for future work. All habitats were classified based on the conditions at the time of sampling.

Sampling Gear

Multiple standard gears were used to sample deep and shallow water habitats of the Missouri River, but sampling gears differed seasonally to meet PSPAP objectives. The sampling year (SY) was divided into a Sturgeon Season and a Fish Community Season. The Sturgeon Season encompassed the fall through spring (November-June) and the Fish Community Season occurred during summer (July-October). The Sturgeon Season focused on assessment of sturgeon species and sampling during in the Fish Community Season placed additional emphasis and effort towards description of the native fish community and age-0 fishes to provide evidence of natural reproduction and recruitment. Gill nets, trot lines, trammel nets, and otter trawls were deployed in deep waters (≥ 1.2 m) of the main channel, large secondary connected channels, and tributary confluences during the Sturgeon Season. In the Fish Community Season trammel nets and otter trawls were used in deep water (≥ 1.2 m), and mini-fyke nets were added to sample shallow water (< 1.2 m) habitats (i.e. bars mesohabitat). Detailed descriptions of sampling gears and gear deployment methods are available in Welker and Drobish (2012b).

Data Collection and Analysis

During each sampling season, a standard number of gear deployments were used for each bend: 10 gill nets (Sturgeon Season only), 8 trot lines, 8 otter trawls, 8 trammel nets, and 8 mini-fyke nets (Fish Community Season only; Welker and Drobish 2012a). Each mesohabitat within each macrohabitat present in a bend was sampled, and at least two gear deployments (i.e., sub-

samples) were conducted per habitat. Detailed descriptions of gear deployment methods are available in Welker and Drobish (2012b)

The stratified-random study design of the PSPAP shifted to targeted sampling whenever a pallid sturgeon was captured in a random deployment of an active gear (i.e., otter trawls and drifted trammel nets). Successive passes (i.e., duplicate passes) over the same location were done until two deployments failed to collect additional pallid sturgeon up to a maximum of nine deployments. These non-random deployments were excluded from CPUE calculations for relative abundance assessments but provided additional recaptures for determination of survival, growth, condition, and size structure (i.e., Objective 3).

All fish captured were identified, enumerated and measured to the nearest mm as total length (TL), fork length (FL; sturgeons), or eye to FL (EFL; paddlefish *Polyodon spathula*). Wet weight (0.1 g) was measured for pallid sturgeon and the other target native Missouri River fishes. Captured turtles were identified and enumerated (Appendices A, F4, H).

Water velocity and turbidity measurements were collected at each pallid sturgeon capture site and for one of the two sub-samples from each mesohabitat sampled in each bend. Sample location (degrees latitude and longitude), time of day, depth (m) and temperature (°C) were recorded for all subsamples. Detailed habitat data collection methods are found in Welker and Drobish (2012b).

The fundamental sampling unit for the PSPAP was the bend. Therefore, our effective sample size was the number of bends sampled with each gear in each season collectively for Segments 5 and 6 (Table 1). Data were pooled for Segments 5 and 6 because of the short length (in river miles) and low number of bends sampled in each segment (N = 5). Mean relative abundance (CPUE) was calculated for each species captured in each gear for the entire year and

each sampling season. Subsamples from each bend were used to calculate mean CPUE by gear, year, and season for each bend. Bend means were averaged to calculate the overall mean CPUE for Segments 5 and 6 by year and season. Overall CPUE was also calculated for each habitat by gear in each season (Appendix F). Variability of mean CPUE was calculated as two standard errors (±2SE), which approximates a 95% confidence interval (i.e., ±1.96*SE) assuming normally distributed data.

Indices of fish condition (Anderson and Newman 1996) were calculated for pallid sturgeon, shovelnose sturgeon, and sauger. Relative condition factor (K_n) was calculated to assess the condition of pallid sturgeon using a weight-length relationship developed by Shuman et al. (2011). Relative weight (W_r) was calculated using the standard weight equations obtained from Quist et al. (1998) for shovelnose sturgeon and Guy et al. (1990) for sauger.

Pallid sturgeon, shovelnose sturgeon, and sauger were classified into length categories to analyze habitat use, condition, and size structure. Incremental proportional size distribution (PSD; Gabelhouse 1984) was calculated using length categories for pallid sturgeon (Shuman et al. 2006a), shovelnose sturgeon (Quist et al. 1998), and sauger (Anderson and Newman 1996). For pallid sturgeon, FL categories are stock-quality (330-629 mm), quality-preferred (630-839 mm), preferred-memorable (840-1,039 mm), memorable-trophy (1,040-1,269 mm), and trophy (≥ 1,270 mm). The sub-stock size category was further divided for pallid sturgeon < 250 mm FL and shovelnose sturgeon < 150 mm FL to provide greater resolution on early life stages. Condition (mean ± 2SE) was summarized by length category for pallid sturgeon, shovelnose sturgeon, and sauger.

Current and long-term habitat use by target species was summarized as the percent of fish captured during random gear deployments by macrohabitat. For SY 2013, habitat use by pallid

sturgeon and shovelnose sturgeon was summarized by length category, gear, and sampling season. Habitat use by blue sucker and sauger was summarized by season and gear, and habitat use by sand shiner and *Hybognathus* spp. was summarized for mini-fyke nets. Long-term habitat use by pallid sturgeon was summarized by length category, gear, and sampling season. Long-term habitat use by shovelnose sturgeon, blue sucker, and sauger was summarized by season. Finally, long-term habitat use by sand shiners and *Hybognathus* spp. was summarized for mini-fyke nets. Prior to data summarization, macrohabitat classifications of Bends 2-11 in Segment 6 for SY 2003-2005 were reclassified to braided for consistency with SY 2006-2013 because Bends 2-11 in Segment 6 have been considered almost entirely braided since 2005.

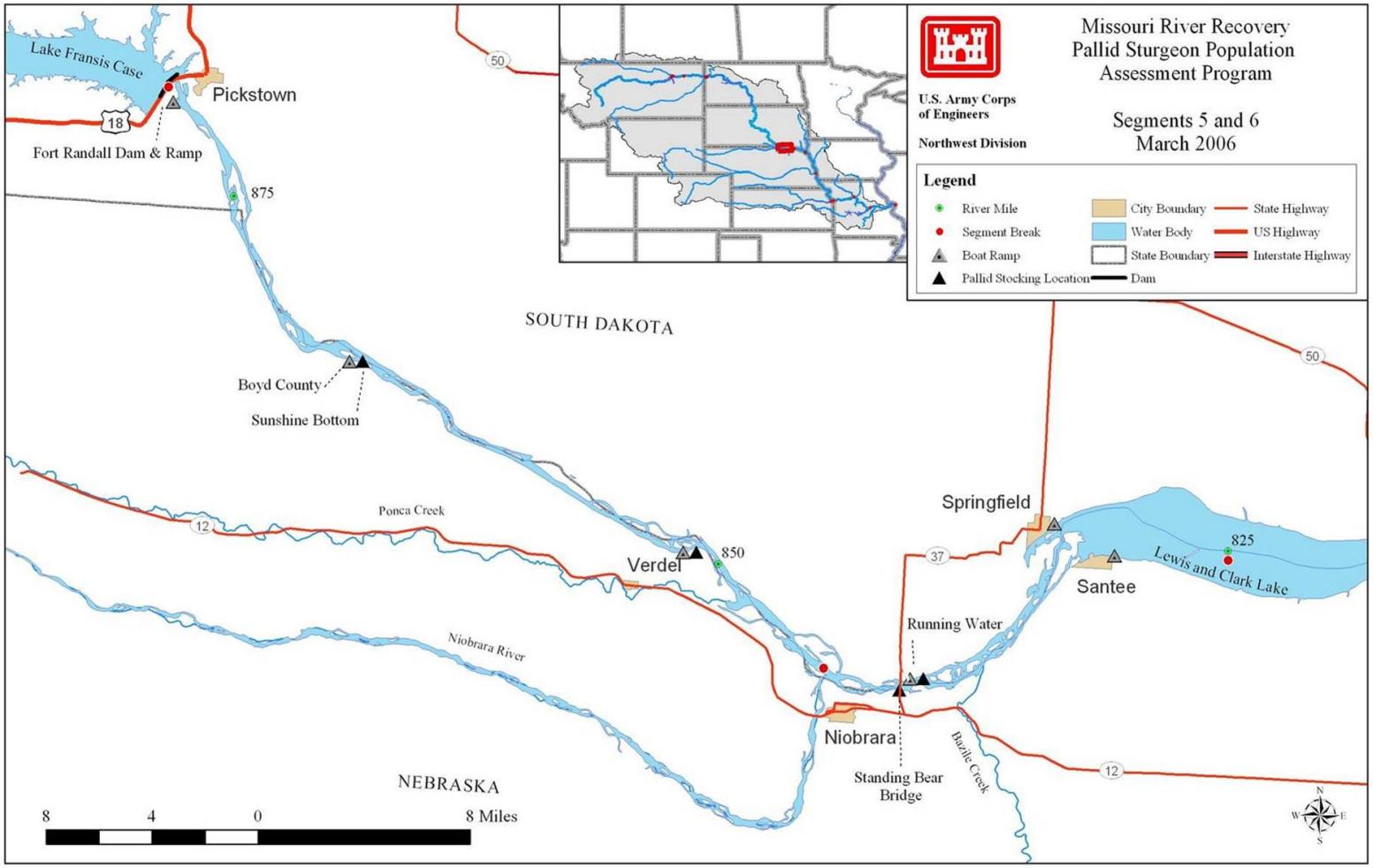

Figure 1. Map of Segments 5 and 6 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segments 5 and 6 encompass the Missouri River downstream from Fort Randall Dam (river mile 880) to the headwaters of Lewis and Clark Lake (river mile 827.5).

Results

In SY 2013 (i.e., November 1, 2012 to October 30, 2013), 10 randomly-selected bends (Appendix I) were sampled. Three alternate bends replaced three of the original bends when sampling conditions prohibited sampling at standard bends: Bend 7 replaced Bend 5 during trotline sampling in Segment 5, and Bends 8 and 11 replaced Bends 1 and 4 during gillnet sampling in Segment 6. Across all gears, the most frequently sampled macrohabitat was braided channels (Table 1). Inside bend, outside bend, channel crossover, and large-connected secondary channel macrohabitats were also sampled frequently (i.e., at least 8 sub-samples per gear per season). A total of 75 duplicate passes were conducted with active gears. Twenty-eight duplicate passes were conducted in Segment 5; 11 in channel crossover, 9 in outside bend, and 8 in inside bend macrohabitats. The 47 duplicates passes in Segment 6 occurred within braided channel (N = 36) and confluence (N = 11) macrohabitats. At least two duplicate samples were collected on 15 occasions, and 8 duplicate samples were achieved on two sampling occasions.

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segments 5 and 6 (pooled) of the Missouri River during the Sturgeon and Fish Community Seasons in 2013. Habitat abbreviations and definitions are in Appendix B.

Gear	Number of Bends	Mean Deployments	Macrohabitat									
			BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season												
1-Inch Trammel Net	10	8.1	32	10	4	8	11	16	0	0	0	0
Gill Net	10	10.0	50	13	0	14	14	9	0	0	0	0
Otter Trawl	10	8.0	32	12	4	11	11	10	0	0	0	0
Trot Line	10	8.0	29	12	4	10	12	10	0	0	0	3
Fish Community Season												
1-Inch Trammel Net	11	7.4	33	10	4	9	9	16	0	0	0	0
Mini-Fyke Net	10	8.0	32	10	2	11	12	9	1	2	1	0
Otter Trawl	10	8.0	32	12	4	10	12	10	0	0	0	0

Pallid Sturgeon

We captured 146 pallid sturgeon during SY 2013; 102 fish were caught in random gear deployments: trotline (N = 52), gill net (N = 18), drifted trammel net (N = 19), and16-ft otter trawl (N = 13). Duplicate otter trawl samples collected 26 pallid sturgeon, while duplicate trammel net samples collected 18 pallid sturgeon. Confirmed wild-origin pallid sturgeon were not captured in 2013.

Objective 1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.

Gill net CPUE was 0.18 fish per net night in SY 2013 (Appendix F1). Trammel net CPUE was approximately 0.05 fish per 100 m (Appendix F2), otter trawl CPUE was 0.03 fish per 100 m (Appendix F3), and trotline CPUE was 0.65 per 20 hook nights in SY 2013 (Appendix F5).

Relative abundance of pallid sturgeon in Segments 5 and 6 has been stable to increasing across the 11 years of monitoring (Figures 5-8); however, long-term trends were not evaluated statistically. Gill net CPUE in 2013 (0.18 fish per net night) was higher than the 11-year average (0.13 fish per net night; Figure 5). Trammel net and otter trawl CPUE increased from SY 2006 to SY 2007 and has shown little change since SY 2007 (Figures 6-7). Trotline CPUE in SY 2013 (0.65 fish per 20 hook nights) returned to near the 5-year mean (0.70 fish per 20 hook nights), following a year of lower than average CPUE in SY 2012 (0.34 fish per 20 hook nights; Figure 8).

Pallid sturgeon caught during SY 2013 were primarily from Segment 6 (58% of fish captured in random deployments, and 64% of all fish captured). Of the 43 (42%) pallid sturgeon captured in Segment 5 with random gear deployments, the majority were from Bend 13 (RM 851.7; N = 12) and Bend 12 (RM 853; N = 11; Figure 2). Of the 59 pallid sturgeon captured in

Segment 6 with random gear deployments, the majority were from Bend 9 (RM 830.5; N = 21) and Bend 7 (RM 834.9; N = 10; Figure 2).

Of the 737 pallid sturgeon captured during random deployments since 2003, 409 (55%) were from Segment 6. Of the 328 pallid sturgeon captured during random deployments in Segment 5, 68 (21%) were from Bend 12 and 65 (20%) were from Bend 15. However, these bends accounted for only 9 and 11%, respectively, of the random sampling effort since 2003. The majority of pallid sturgeon captured in random gear deployments in Segment 6 were from Bend 8 (N = 103; 25%) and Bend 9 (N = 74; 18%). These bends accounted for 12% and 8% of random sampling effort within Segment 6.

Objective 2. Document annual results and long-term trends of habitat usage of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.

During SY 2013, we captured pallid sturgeon from braided channel (N = 73), outside bend (N = 19), confluence (N = 18), channel crossover (N = 16), large-connected secondary channel (N = 11), and inside bend macrohabitats (N = 9) in random and non-random deployments (total N = 146; Table 2). All fish were captured in the channel border mesohabitat (Table 2). During the Sturgeon Season, pallid sturgeon collected by trammel nets were primarily from outside bend (38%) and braided channel macrohabitats (25%; Table 6). Pallid sturgeon collected by trammel nets during the Fish Community Season were primarily from braided channel macrohabitat (73%). Pallid sturgeon collected with otter trawl were primarily from confluence macrohabitat during the Sturgeon Season (44%) and braided channel macrohabitat during the Fish Community Season (50%; Table 6). During the Sturgeon Season, pallid sturgeon collected by gill nets and trotlines were primarily from braided channel macrohabitat (56 and 54%, respectively; Table 6).

The percentage of pallid sturgeon collected from each macrohabitat varied by gears, seasons and pallid sturgeon size class. Of the pallid sturgeon captured with trammel nets during the Sturgeon Season, stock-length fish (N = 3) were primarily from outside bend macrohabitat (67%; Table 4), and fish ≥ quality length (N = 5) were primarily from braided channel macrohabitat (40%; Table 5). During the Fish Community Season, stock-length (N = 7) and ≥ quality-length (N = 4) pallid sturgeon captured with trammel nets were primarily from braided channel macrohabitat (71% and 75%, respectively; Table 4 and Table 5). The stock length (N = 1) pallid sturgeon collected with an otter trawl in the Sturgeon Season was from an outside bend macrohabitat, while the eight pallid sturgeon ≥ quality length collected with the otter trawl during the Sturgeon Season were from confluence (50%), channel crossover (25%), braided channel (12.5%), and large-connected-secondary channel (12.5%) macrohabitats. During the Fish Community Season, two stock-length pallid sturgeon and two ≥ quality-length pallid sturgeon were collected with the otter trawl. The stock-length fish were from braided channel and outside bend macrohabitats while the quality-length fish were from braided channel and confluence macrohabitats. Pallid sturgeon collected with trotlines during the Sturgeon Season were primarily from braided channel macrohabitat (43% of stock-length fish and 62% of ≥ quality-length fish; Table 4 and Table 5). Stock-length pallid sturgeon collected with gill nets during the Sturgeon Season (N = 6) were primarily from inside bend macrohabitats (50%; Table 4) and the majority of pallid sturgeon ≥ quality-length fish collected with gill nets during the Sturgeon Season were from braided channel macrohabitats (75%; Table 5).

During 11 years of random sampling, pallid sturgeon have predominately been caught from braided channel macrohabitat across size-classes and sampling seasons. Sub-stock length pallid sturgeon were caught primarily from braided channel macrohabitat (N = 3; 50%) during

the Fish Community Season and from braided channel (N = 3; 30%) and outside bend macrohabitats (N = 3; 30) during the Sturgeon Season. Stock-length pallid sturgeon were caught primarily from braided channel macrohabitat (N = 46; 51%) during the Fish Community Season and from braided channel (N = 122; 36%), outside bend (N = 72; 21%), and channel crossover (N = 72; 21%) macrohabitats during the Sturgeon Season. Quality-length pallid sturgeon were caught primarily from braided channel macrohabitat during the Fish Community Season (N = 18; 78%) and Sturgeon Season (N = 73; 63%). All pallid sturgeon ≥ preferred-length caught during the Fish Community Season (N = 4) were from braided channel macrohabitat, and 82% of pallid sturgeon preferred-length and larger caught during the Sturgeon Season (N = 23) were from braided channel macrohabitat.

Across macrohabitats (for channel border mesohabitat), water depth and water velocity at pallid capture locations were greater than water depth and water velocity at all sampling locations, but water temperature was generally lower at pallid capture locations than at all sampling locations (Table 2). Mean water depth at pallid sturgeon capture locations ranged from 3.9 m in braided channel macrohabitat to 5.8 m in outside bend macrohabitat. Water depth ranged from 1.3 m (inside bend macrohabitat) to 9.2 m (inside bend macrohabitat) at pallid sturgeon capture locations. Confluence macrohabitat was the only macrohabitat that mean water depth at capture locations (4.3 m) was less than the mean water depth at all sample locations in that macrohabitat (4.4 m). Mean bottom water velocity at pallid sturgeon capture locations ranged from 0.41 m/s for braided channel macrohabitat to 0.84 m/s for confluence macrohabitat. Water velocity at pallid sturgeon capture locations ranged from 0.02 m/s (braided channel macrohabitat) to 1.02 m/s (confluence macrohabitat). Mean turbidity at pallid sturgeon capture locations in confluence macrohabitat (41 NTU) was greater than mean turbidity at all sampling

locations in this macrohabitat (31 NTU). Temperature at pallid sturgeon capture location was generally lower than the mean for all sampling locations, but 73% of pallid sturgeon were collected during the Sturgeon Season when water temperatures were low. However, at times of pallid sturgeon capture in the confluence macrohabitat, water temperature was higher than all confluence sampling effort (Table 2), despite the majority of the fish (17 of 18) being captured during the Sturgeon Season.

Objective 3. Document population structure and dynamics of pallid sturgeon in the Missouri River system.

Similar to the past 10 years of sampling, pallid sturgeon captured in Segments 5 and 6 in 2013 were predominantly stocked fish (137 of 146 fish; 94%; Figure 10). The origin of the remaining nine fish is currently unknown. Pallid sturgeon from 12 of the 14 year classes stocked in Segments 5 and 6 (Appendix E) were caught during SY 2013 (Table 3). Fish from the 2010 and 2012 year classes were not caught, but the 2012 year class was stocked after the majority of sampling was completed. Pallid sturgeon from the 2002 year class were most represented in the 2013 catch (N = 23), followed by the 2004 (N = 19), 2005 (N =18), and 2001 (N = 16) year classes (Table 3). Less than five fish were captured from the 1999, 2003, and 2008 year classes.

Pallid sturgeon captured during 2013 ranged in FL from 396 to 1,061 mm (Figure 9) and ranged in weight from 200 to 4,380 g. The sampled fish were primarily stock-length (Sturgeon Season: 36%; Fish Community Season: 46%) and quality-length (Sturgeon Season: 52%; Fish Community Season: 44%; Figure 3). Fish larger than quality length represented 11% of fish captured during the Sturgeon Season and 10% of fish captured during the Fish Community Season. Since 2011, the size distribution of pallid sturgeon in Segments 5 and 6 has shifted from predominantly stock-length fish to a mixture of stock- and quality-length fish (Figure 3).

Pallid sturgeon continued to increase in length and weight since stocking in Segments 5 and 6 (Table 3). Growth rates, in terms of length (mm/d), were highest for the youngest year classes: 2009 year class (0.24 mm/d) and 2007 year class (0.19 mm/day; Table 3). Meanwhile, growth for the 1997-2005 year classes ranged from 0.07 to 0.13 mm/d. Growth rates, in terms of weight (g/d), were highest for the youngest and oldest year classes: 1997 year class (0.55 g/d) and 2009 year class (0.36 g/day; Table 3). Growth for the 1998-2007 year classes ranged from 0.23 to 0.32 g/d.

Relative condition of each year class of pallid sturgeon in Segments 5 and 6 has declined since they were stocked (Table 3). Relative condition of stock-length pallid sturgeon captured in 2013 (0.88) was similar to that in 2012 (0.88), but has decreased since 2005 (0.96; Figure 4). Relative condition of quality-length pallid sturgeon captured in 2013 (0.86) was lower than that in 2012 (0.91), but was intermediate compared to the previous 10 years of sampling (mean = 0.88; Figure 4). Relative condition of preferred-length pallid sturgeon captured in 2013 (0.84) was lower than that in 2012 (0.97), and was the second lowest value recorded of the seven years preferred-length pallid sturgeon were captured (Figure 4). Mean relative condition of memorable and trophy-length pallid sturgeon was 0.84 in SY 2013 (N = 2), 0.84 in SY 2012 (N = 2), 0.93 in SY 2009 (N = 1), and 0.86 in SY 2007 (N = 1; Figure 4). Relative condition of fish recaptured in 2013 was highest for the 2002 and 2005 year classes (K_n = 0.90), and lowest for the 2008 year class (K_n = 0.81; Table 3).

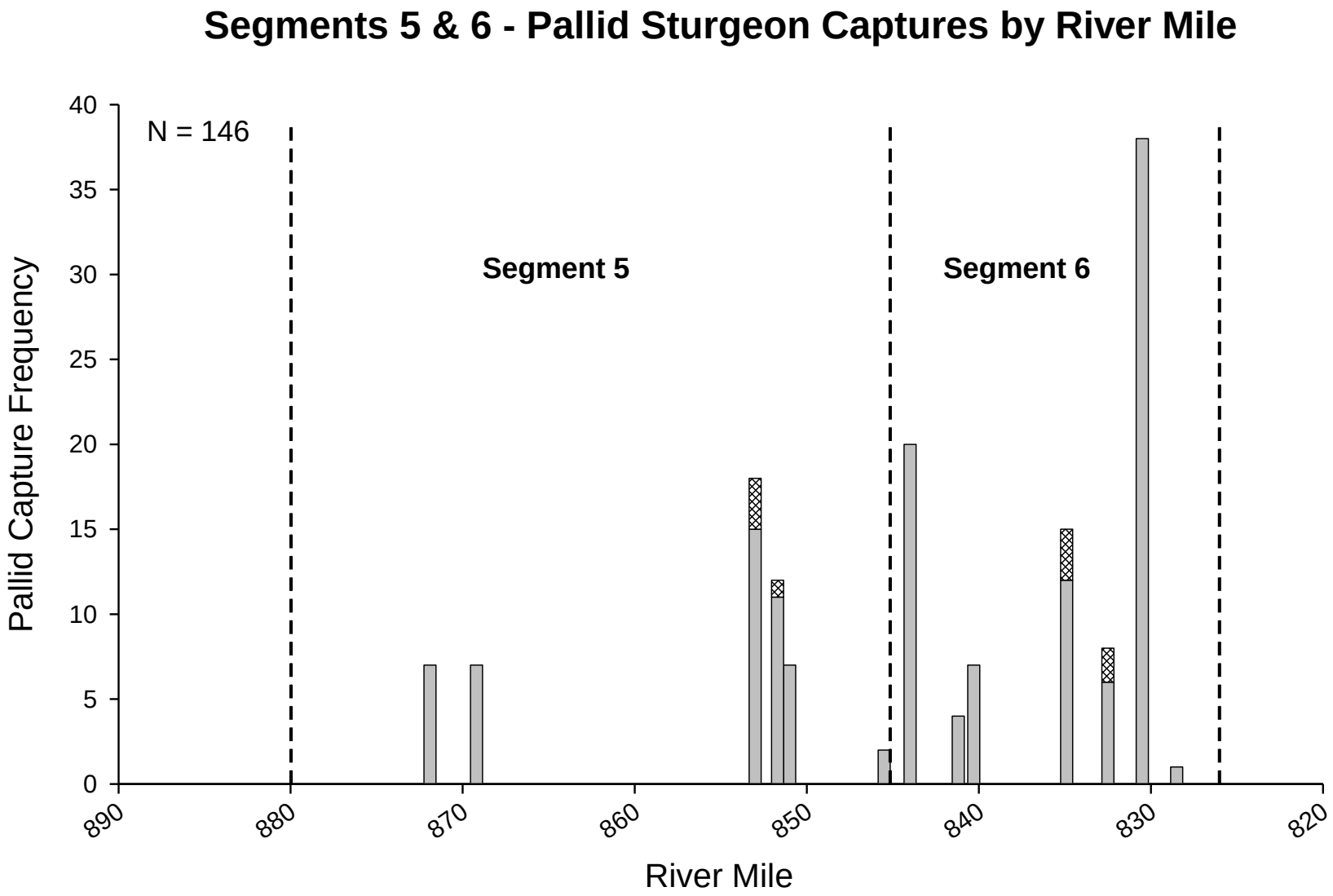

Figure 2. Distribution of pallid sturgeon captures by river mile for Segments 5 and 6 of the Missouri River during 2013. Gray bars represent random pallid sturgeon captures and cross-hatched bars represent non-random pallid sturgeon captures. Dashed line identifies upstream and downstream boundaries for Segments 5 and 6.

Table 2. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2013. 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 pallid sturgeon caught
Macro	Meso	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
BRAD	BARS	0.4 (0.3-0.5)		0.04 (0.00-0.11)		14.7 (12.0-22.0)		14 (6-20)		0
	CHNB	3.5 (1.2-6.9)	3.9 (1.5-6.8)	0.50 (0.02-1.04)	0.41 (0.02-0.76)	15.7 (2.3-25.8)	15.1 (3.7-25.8)	15 (4-32)	16 (4-32)	73
	ITIP	4.4 (4.4-4.4)				2.8 (2.8-2.8)				0
CHXO	BARS	0.4 (0.3-0.5)		0.10 (0.08-0.12)		18.4 (13.0-23.0)		7 (6-7)		0
	CHNB	3.8 (1.2-33.0)	4.3 (2.4-5.6)	0.42 (0.10-0.90)	0.47 (0.10-0.90)	13.7 (1.1-24.6)	12.9 (1.9-21.5)	5 (2-7)	5 (3-6)	16
CONF	BARS	0.4 (0.3-0.4)				24.3 (24.3-24.3)				0
	CHNB	4.4 (1.0-8.4)	4.3 (2.2-6.3)	0.72 (0.29-1.02)	0.84 (0.74-1.02)	18.7 (4.3-25.0)	20.2 (18.3-25.0)	31 (7-53)	41 (30-53)	18
ISB	BARS	0.4 (0.4-0.5)		0.01 (0.01-0.01)		18.0 (13.0-23.0)		5 (5-5)		0

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total pallid sturgeon caught
Macro	Meso	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	CHNB	3.4 (1.2-9.5)	4.6 (1.3-9.2)	0.37 (0.07-0.75)	0.49 (0.37-0.63)	13.1 (1.1-24.8)	3.5 (1.1-5.4)	6 (2-27)	3 (2-6)	9
OSB	BARS	0.4 (0.3-0.5)		0.10 (0.04-0.15)		18.3 (13.0-23.0)		6 (6-6)		0
	CHNB	5.4 (1.3-10.4)	5.8 (3.0-8.1)	0.41 (0.11-0.97)	0.43 (0.17-0.72)	13.4 (1.1-24.6)	10.2 (1.8-23.7)	6 (2-19)	6 (2-8)	19
SCCL	BARS	0.4 (0.4-0.5)		0.06 (0.03-0.09)		20.6 (13.0-23.2)		7 (5-8)		0
	CHNB	3.6 (1.2-6.4)	4.0 (2.3-5.9)	0.61 (0.28-0.91)	0.50 (0.28-0.65)	15.2 (1.9-24.2)	13.1 (4.3-22.1)	6 (4-11)	5 (4-6)	11
SCCS	BARS	0.4 (0.4-0.4)				23.2 (23.2-23.2)				0
SCN	BARS	0.4 (0.3-0.5)				23.4 (23.0-23.7)				0
TRML	BARS	0.4 (0.4-0.4)				22.0 (22.0-22.0)				0
TRMS	CHNB	1.7 (1.3-2.0)				6.1 (6.1-6.1)				0

Table 3. Mean (2SE) fork length, weight, relative condition factor (K_n) and absolute growth rates for hatchery-reared pallid sturgeon year classes at the time of stocking and capture during 2013 from Segments 5 and 6 of the Missouri River. Table includes all hatchery-reared pallid sturgeon captures including non-random and wild samples.

		Stocking Data			Recapture Data			Growth Data	
Year Class	N	Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
1997	6	536	677.2	1.24	970	3,285.0	0.86	0.09	0.55
		(30)	(141.5)	(0.17)	(54)	(531.4)	(0.02)	(0.01)	(0.09)
1998	5	471	331.3	0.89	865	2,316.0	0.83	0.07	0.32
		(53)	(146.5)	(0.08)	(106)	(1,072.7)	(0.02)	(0.01)	(0.08)
1999	2	424	260.5	1.02	754	1,512.5	0.89	0.08	0.31
		(59)	(135.0)	(0.07)	(67)	(775.0)	(0.21)	(0.00)	(0.16)
2001	16	202			740	1,377.2	0.85	0.13	
		(12)			(41)	(260.4)	(0.05)	(0.01)	
2002	23	249	65.1	1.45	704	1,223.7	0.90	0.12	0.31
		(10)	(9.1)	(0.11)	(29)	(173.8)	(0.03)	(0.01)	(0.04)
2003	4	336	150.0	1.24	671	988.8	0.85	0.11	0.26
		(60)	(73.3)	(0.12)	(67)	(304.3)	(0.05)	(0.02)	(0.08)
2004	19	304	134.3	1.58	664	944.7	0.86	0.12	0.27
		(17)	(33.3)	(0.35)	(17)	(98.4)	(0.03)	(0.01)	(0.03)
2005	18	318	145.2	1.48	596	692.4	0.90	0.12	0.23
		(14)	(18.1)	(0.09)	(19)	(61.0)	(0.04)	(0.01)	(0.02)
2006*	6	189	26.7	1.54	621	758.3	0.86		
		(5)	(2.7)	(0.29)	(33)	(132.6)	(0.05)		
2007	13	218	36.0	1.21	592	638.5	0.84	0.19	0.31
		(21)	(12.3)	(0.08)	(26)	(87.2)	(0.05)	(0.01)	(0.05)
2008	4				592	614.0	0.81		
					(34)	(128.6)	(0.05)		
2009	12	244	43.0	1.07	506	388.3	0.86	0.24	0.36
		(0)	(2.0)	(0.05)	(24)	(58.5)	(0.06)	(0.06)	(0.17)

*Mean length and weight at stocking derived from subsample of fish measured at tagging. All other year classes had passive integrated transponder (PIT) tags enabling growth rate calculations for individual fish. The 2006, 2008, and 2009 year classes had 0%, 8%, and 75% of the fish inserted with PIT tags respectively when stocked (Appendix E).

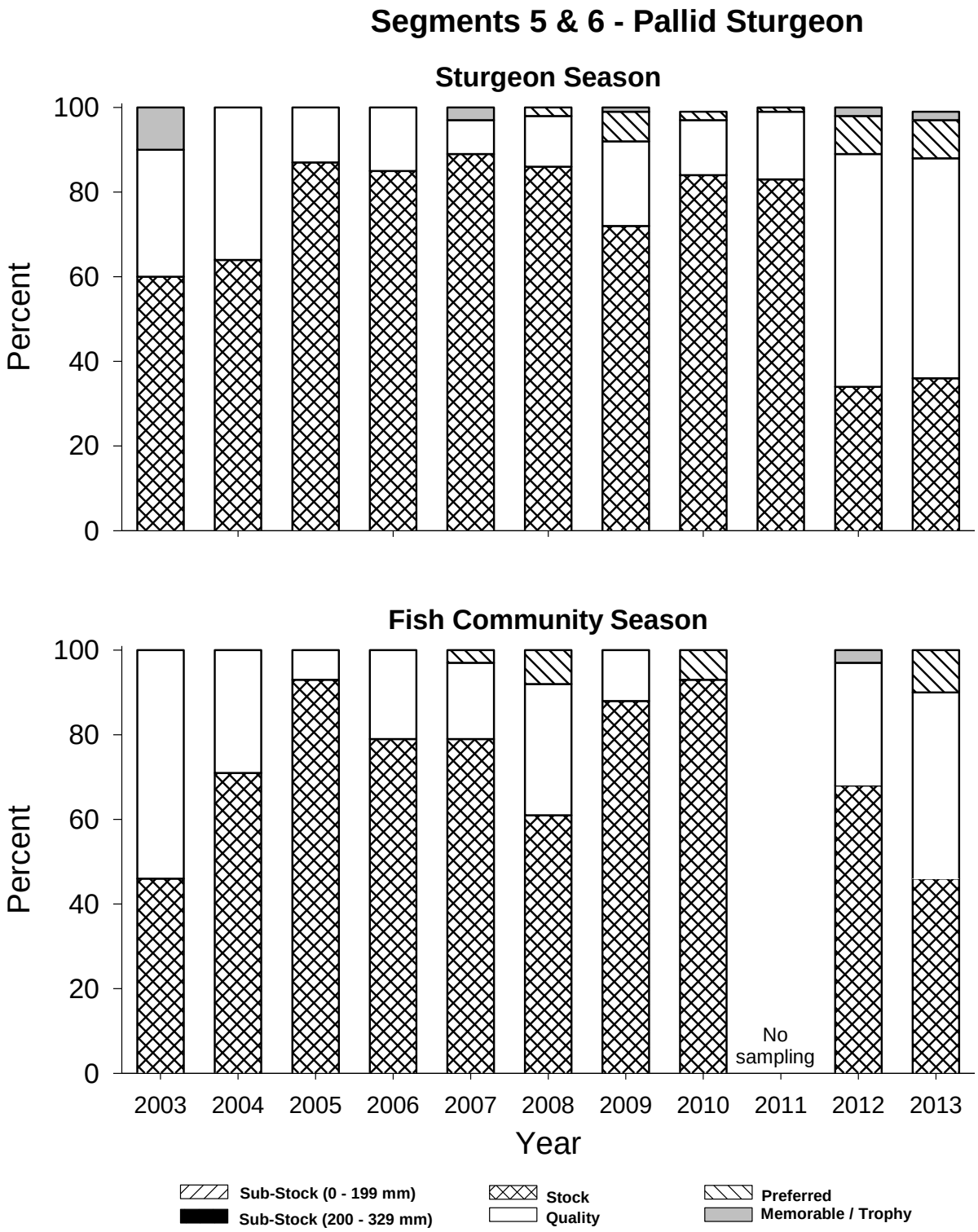

Figure 3. Percent of all pallid sturgeon captured with all gears by proportional size distribution length category from 2003 to 2013 in Segments 5 and 6 in the Missouri River.

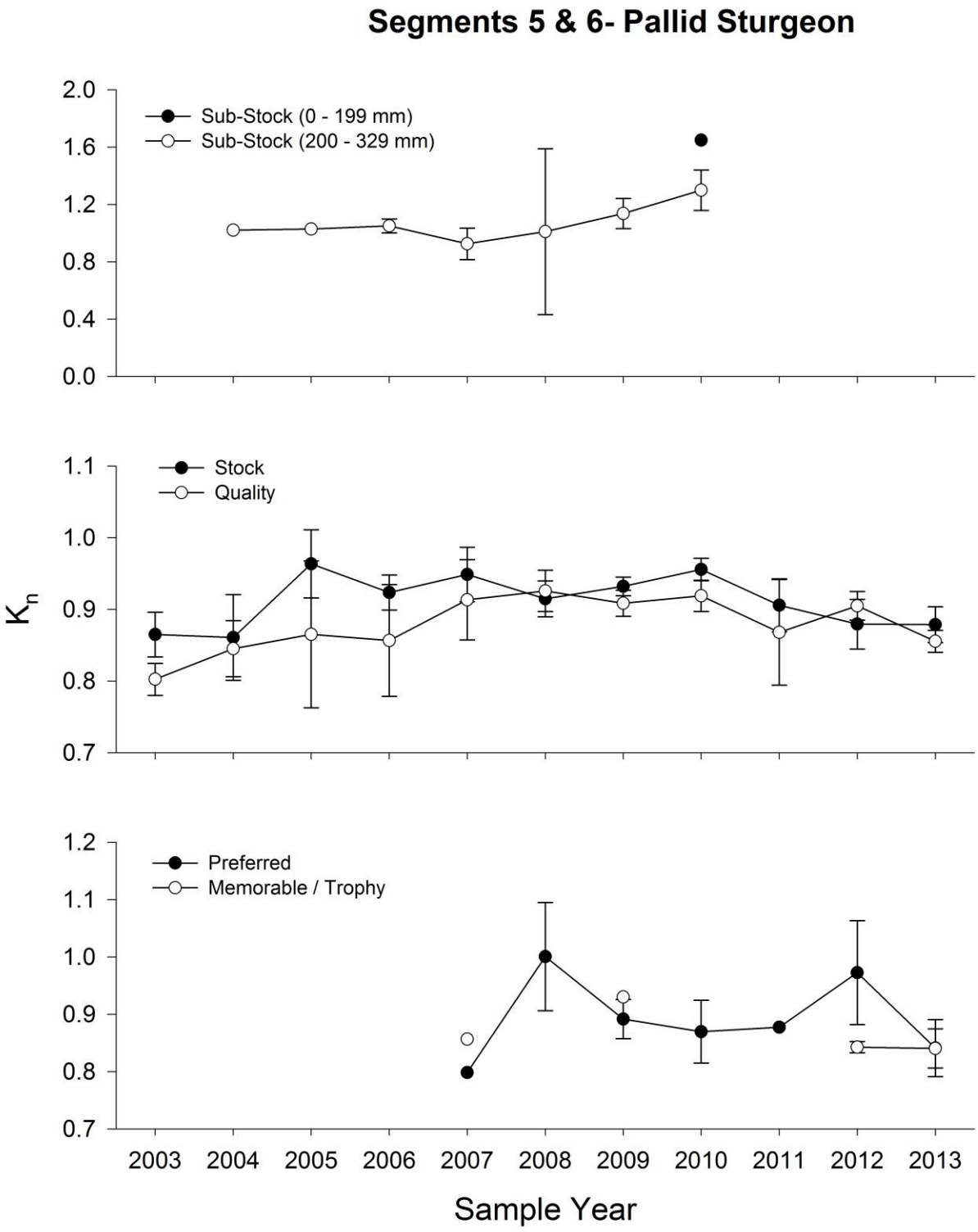

Figure 4. Relative condition factor (K_n) (±2SE) for all pallid sturgeon captured with all gears by length category from 2003 to 2013 in Segments 5 and 6 in the Missouri River.

Table 4. Total number of stock length (330-629 mm) pallid sturgeon randomly captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat									
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season											
1-Inch Trammel Net	3	0 (45)	0 (11)	0 (5)	0 (8)	67 (11)	33 (20)	0 (0)	0 (0)	0 (0)	0 (0)
Gill Net	6	17 (50)	0 (13)	0 (0)	50 (14)	33 (14)	0 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Otter Trawl	1	0 (43)	0 (14)	0 (5)	0 (13)	100 (13)	0 (13)	0 (0)	0 (0)	0 (0)	0 (0)
Trot Line	23	43 (36)	9 (15)	0 (5)	17 (13)	22 (15)	9 (13)	0 (0)	0 (0)	0 (0)	0 (4)
Fish Community Season											
1-Inch Trammel Net	7	71 (46)	14 (11)	0 (4)	0 (10)	14 (11)	0 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Mini-Fyke Net	0	0 (40)	0 (13)	0 (3)	0 (14)	0 (15)	0 (11)	0 (1)	0 (3)	0 (1)	0 (0)
Otter Trawl	2	50 (43)	0 (15)	0 (5)	0 (12)	50 (14)	0 (12)	0 (0)	0 (0)	0 (0)	0 (0)

Table 5. Total number of quality size and greater (≥ 630 mm) pallid sturgeon randomly captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat									
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season											
1-Inch Trammel Net	5	40 (45)	20 (11)	20 (5)	0 (8)	20 (11)	0 (20)	0 (0)	0 (0)	0 (0)	0 (0)
Gill Net	12	75 (50)	8 (13)	0 (0)	8 (14)	8 (14)	0 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Otter Trawl	8	13 (43)	25 (14)	50 (5)	0 (13)	0 (13)	13 (13)	0 (0)	0 (0)	0 (0)	0 (0)
Trot Line	29	62 (36)	7 (15)	0 (5)	3 (13)	14 (15)	14 (13)	0 (0)	0 (0)	0 (0)	0 (4)
Fish Community Season											
1-Inch Trammel Net	4	75 (46)	0 (11)	0 (4)	0 (10)	0 (11)	25 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Mini-Fyke Net	0	0 (40)	0 (13)	0 (3)	0 (14)	0 (15)	0 (11)	0 (1)	0 (3)	0 (1)	0 (0)
Otter Trawl	2	50 (43)	0 (15)	50 (5)	0 (12)	0 (14)	0 (12)	0 (0)	0 (0)	0 (0)	0 (0)

Table 6. Total number of pallid sturgeon captured in random gear deployments during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat									
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season											
1-Inch Trammel Net	8	25 (45)	13 (11)	13 (5)	0 (8)	38 (11)	13 (20)	0 (0)	0 (0)	0 (0)	0 (0)
Gill Net	18	56 (50)	6 (13)	0 (0)	22 (14)	17 (14)	0 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Otter Trawl	9	11 (43)	22 (14)	44 (5)	0 (13)	11 (13)	11 (13)	0 (0)	0 (0)	0 (0)	0 (0)
Trot Line	52	54 (36)	8 (15)	0 (5)	10 (13)	17 (15)	12 (13)	0 (0)	0 (0)	0 (0)	0 (4)
Fish Community Season											
1-Inch Trammel Net	11	73 (46)	9 (11)	0 (4)	0 (10)	9 (11)	9 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Mini-Fyke Net	0	0 (40)	0 (13)	0 (3)	0 (14)	0 (15)	0 (11)	0 (1)	0 (3)	0 (1)	0 (0)
Otter Trawl	4	50 (43)	0 (15)	25 (5)	0 (12)	25 (14)	0 (12)	0 (0)	0 (0)	0 (0)	0 (0)

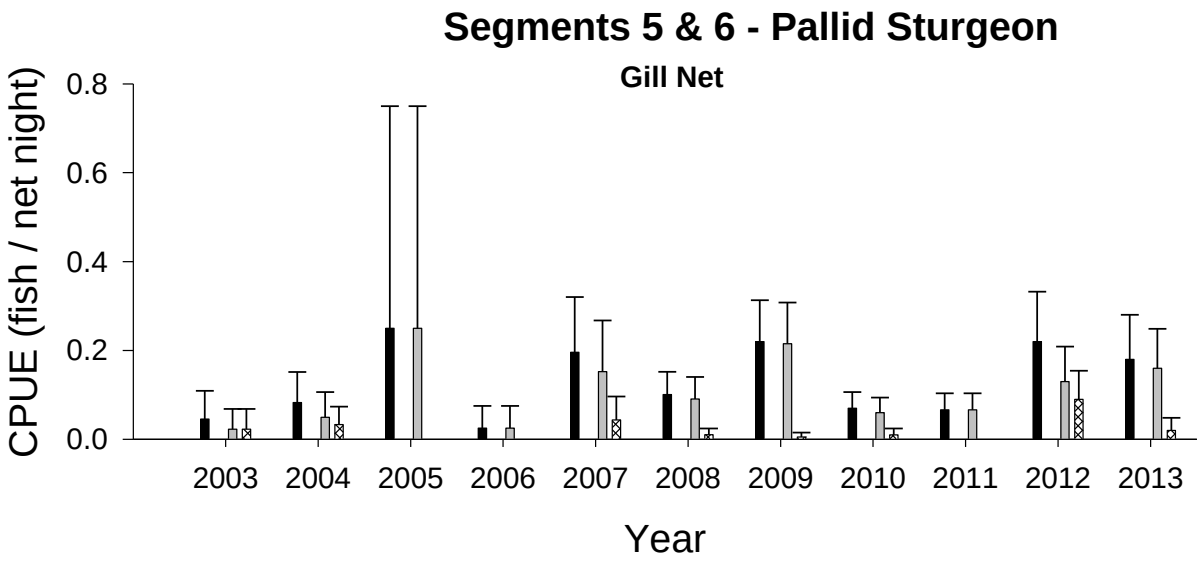

Figure 5. Mean annual catch per unit effort (+2SE) of all (black bars), wild (white bars), hatchery-reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon caught by gill nets in Segments 5 and 6 of the Missouri River from 2003 to 2013. Gill nets were set in fall and spring in 2003-2010 and only in spring in 2011-2013.

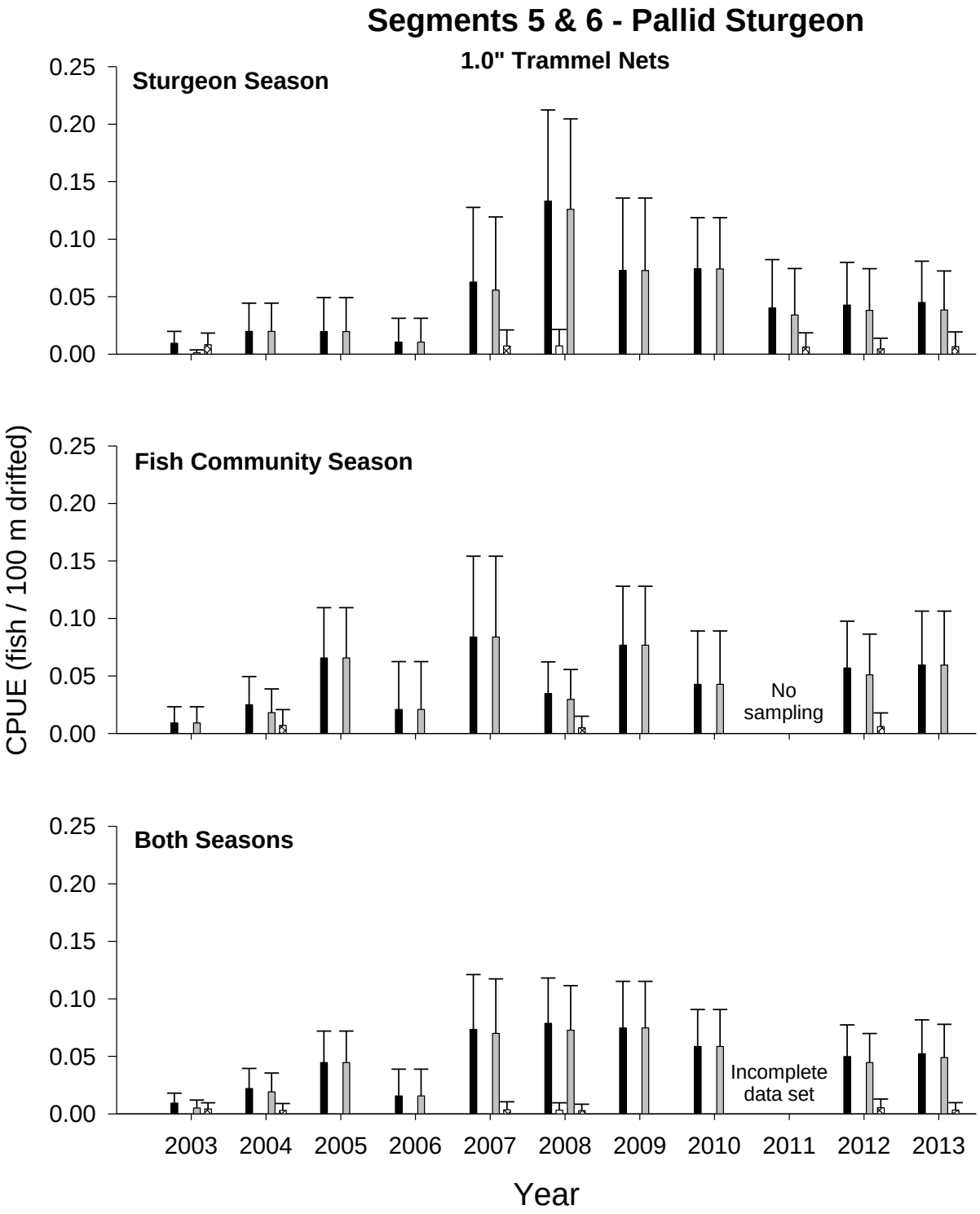

Figure 6. Mean annual catch per unit effort (+2SE) of all (black bars), wild (white bars), hatchery-reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon caught by 1-inch trammel nets in Segments 5 and 6 of the Missouri River from 2003 to 2013.

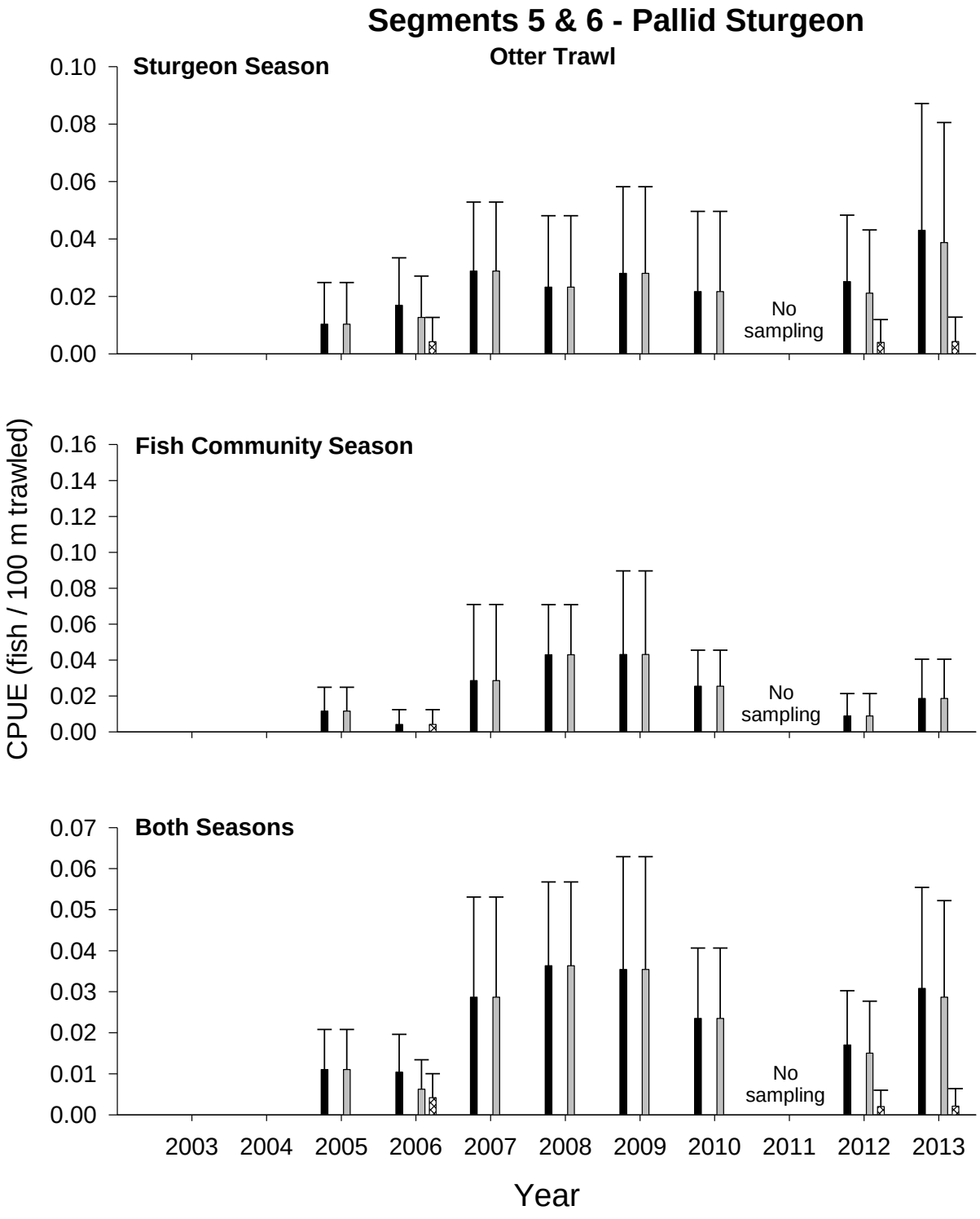

Figure 7. Mean annual catch per unit effort (+2SE) of all (black bars), wild (white bars), hatchery-reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon caught by otter trawls in Segments 5 and 6 of the Missouri River from 2003 to 2013.

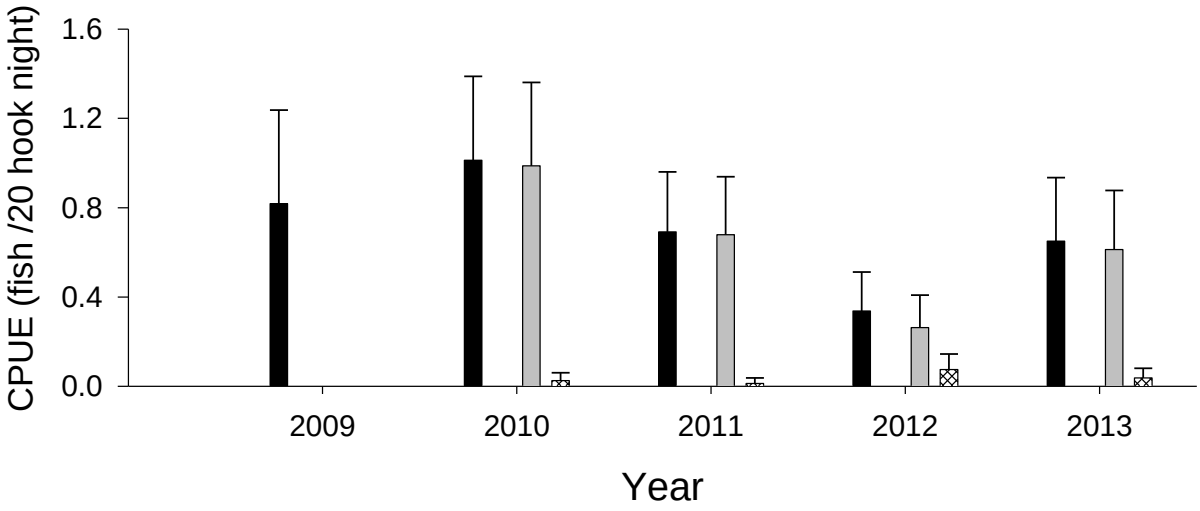

Figure 8. Mean annual catch per unit effort (+2SE) of all (black bars), wild (white bars), hatchery-reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon caught by trot lines in Segments 5 and 6 of the Missouri River from 2009 to 2013.

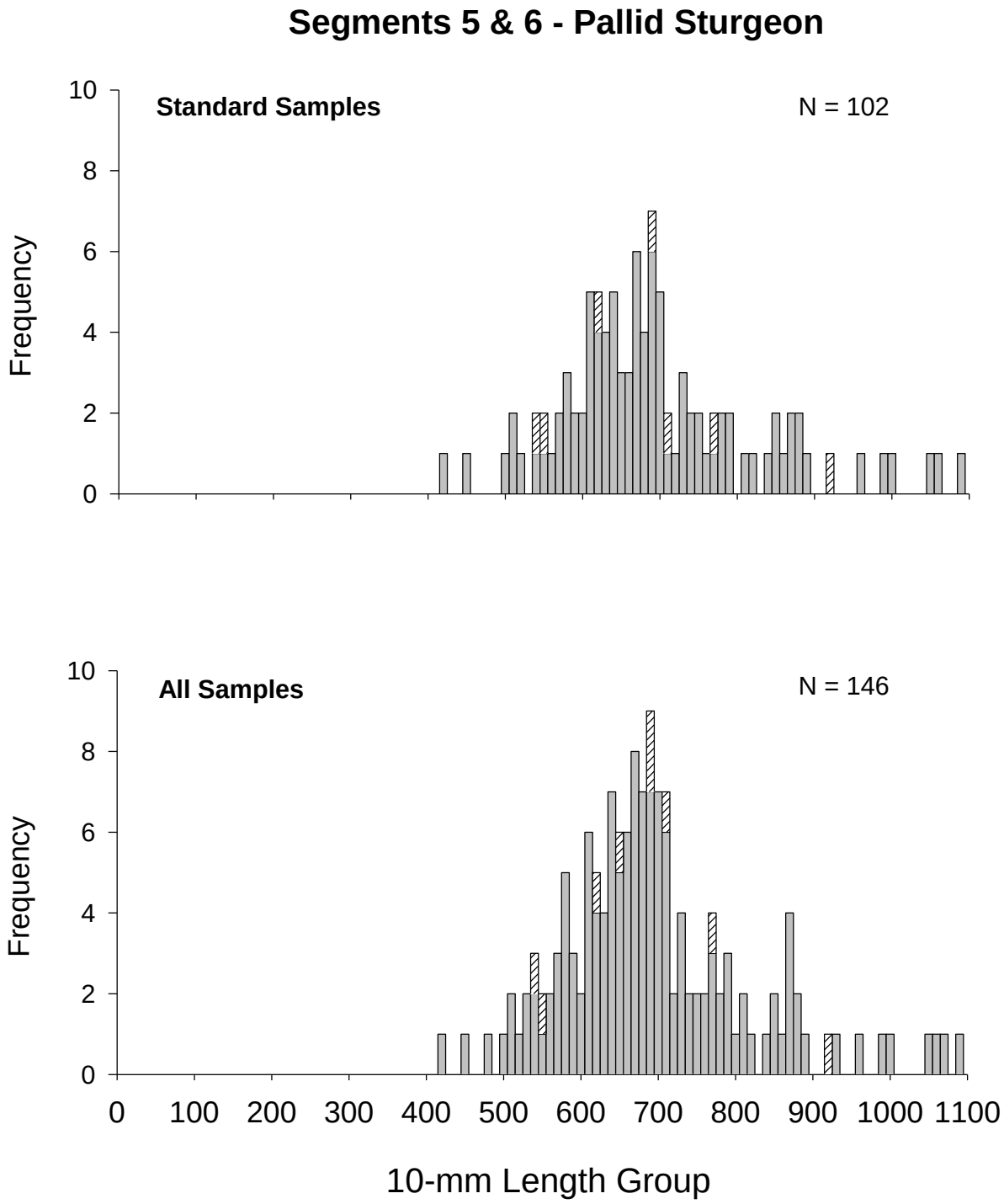

Figure 9. Length frequency of pallid sturgeon captured in Segments 5 and 6 of the Missouri River during 2013. White bars represent wild pallid sturgeon, gray bars represent hatchery-reared pallid sturgeon, and cross-hatched bars represent unknown origin pallid sturgeon. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

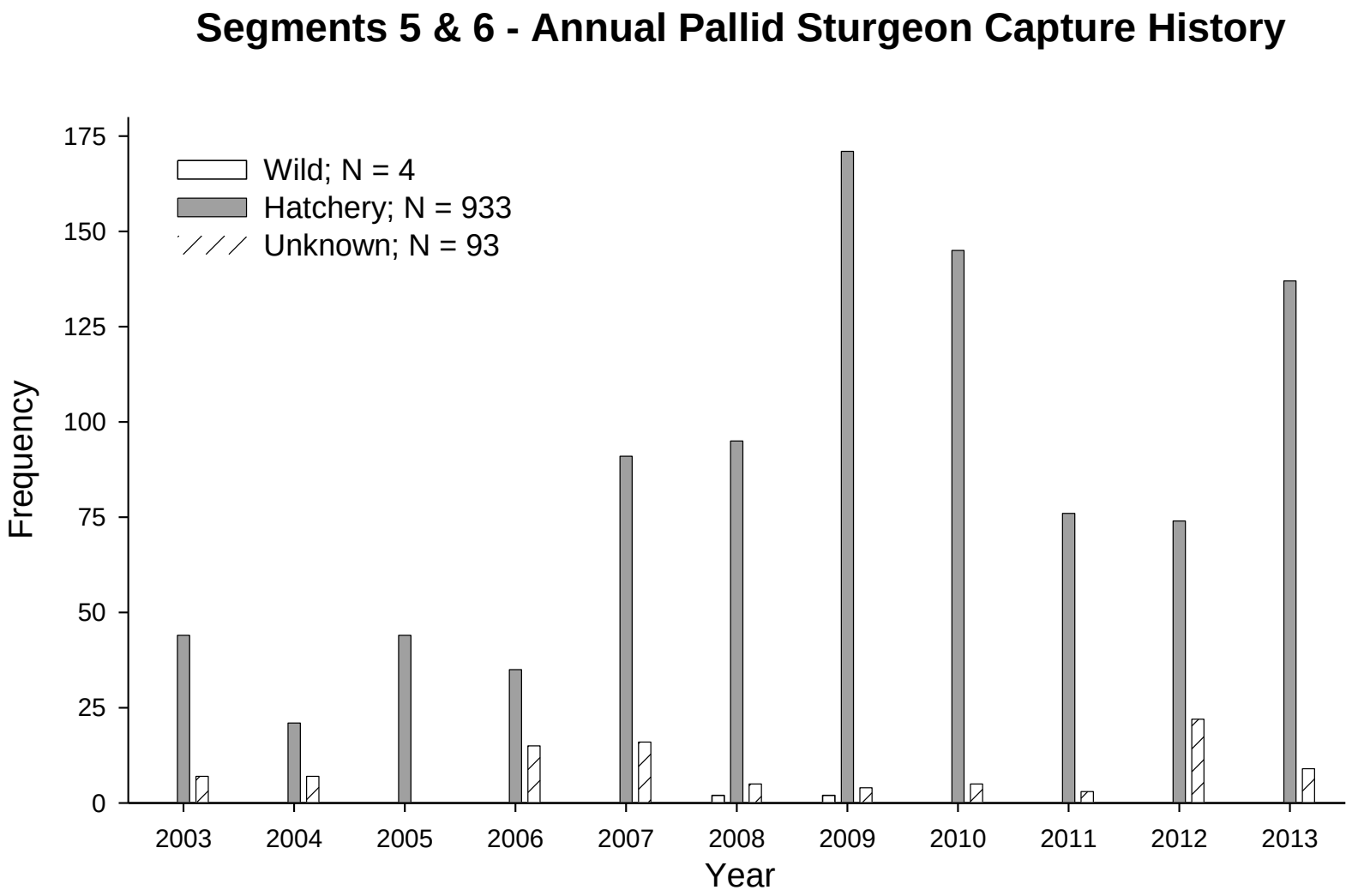

Figure 10. Annual capture history of wild (white bars), hatchery-reared (gray bars), and unknown origin (cross-hatched bars) pallid sturgeon caught in Segments 5 and 6 of the Missouri River from 2003 to 2013. Figure is designed to compare overall pallid sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid sturgeon captures including non-random and wild samples.

Shovelnose Sturgeon X Pallid Sturgeon Hybrids

Shovelnose sturgeon X pallid sturgeon hybrids were not captured in Segment 5 or Segment 6 during 2013, and none have been collected in these segments since the monitoring program began in 2003.

Targeted Native River Species

Shovelnose Sturgeon

A total of 106 shovelnose sturgeon were caught in 2013; 91 were caught during random gear deployments. During standardized random sampling, shovelnose sturgeon were collected with trammel nets (N = 60), gill nets (N = 12), trot lines (N = 10), and otter trawls (N = 9). An additional 13 shovelnose sturgeon were captured in duplicate trammel net samples, and 2 in duplicate otter trawl samples. Shovelnose sturgeon were not caught in mini-fyke nets in 2013. Shovelnose sturgeon collected in 2013 ranged in length from 564 to 783 mm (Figure 15). Length data was not recorded for three fish. The sampled fish were quality- and memorable-length (Figure 16). Memorable-length fish accounted for 67-70% of the fish captured, depending on season. During the 11 years of monitoring, shovelnose sturgeon size distribution has shifted from preferred-length fish to memorable-length fish (Figure 16). Shovelnose sturgeon collected in 2013 were generally in good condition (i.e., mean $W_r > 100$; Figure 17). Shovelnose sturgeon condition in 2013 was the second-highest value recorded during 11 years of monitoring in Segments 5 and 6 (Figure 17). Condition of preferred-length fish was consistently greater than the condition of memorable and trophy-length fish (Figure 17).

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

Shovelnose sturgeon relative abundance, indexed by gill net CPUE and trotline CPUE, was lower in 2013 than any of other year of monitoring (Figures 11 and 14). Additionally, gill net CPUE of ≥ quality-sized fish has decreased from 1.22 fish per net-night in SY 2007 to 0.10 fish per net-night in SY 2013. Meanwhile, shovelnose sturgeon relative abundance in 2013, indexed by otter trawl CPUE and trammel net CPUE, was similar to previous years (Figures 12 and 13).

Of the 91 shovelnose sturgeon captured in random gear deployments during 2013, 43 (47%) were collected from Segment 5 and 48 (53%) were collected from Segment 6. Similarly, 911 (45%) of the 2,032 shovelnose sturgeon collected in random sampling during the monitoring program were from Segment 5. Approximately 22% of shovelnose sturgeon sampled from Segment 5 during random sampling were from Bend 15 (N = 198), while only 11% of sampling effort was deployed in this bend. Approximately 21% of shovelnose sturgeon sampled from Segment 6 during random sampling were from Bend 6 (N = 234), while only 11% of sampling effort was deployed in this bend.

Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.

Shovelnose sturgeon were collected from braided channel, channel crossover, confluence, inside bend, outside bend, and large-connected secondary channel macrohabitats during standard sampling in 2013 (Tables 7 and 8). Shovelnose sturgeon captured with trammel nets were primarily captured in large-connected secondary channels (42%; 20% of effort) and outside bend (26%; 11% of effort) during the Sturgeon Season, and braided channel (52%, 46% of effort) and large-connected secondary channels (21%; 19% of effort) during the Fish Community Season (Tables 7 and 8). Twelve shovelnose sturgeon were captured with gill nets: 10 ≥ quality-length

fish were captured in braided channel macrohabitat (83%; 50% of effort), one unknown-length fish was captured in the channel crossover (8%; 13% of effort), and one unknown-length fish was captured in the outside bend macrohabitat (8%; 14% of effort; Tables 7 and 8). During the Sturgeon Season, we captured three shovelnose sturgeon with the otter trawl; two were from confluence macrohabitat (67%; 5% of effort) and one was from channel crossover macrohabitat (33%; 14% of effort). We captured six shovelnose sturgeon with the otter trawl during the Fish Community Season; two were from confluence macrohabitat (33%; 5% of effort) and one each was from braided channel, channel crossover, outside bend, and large-connected secondary channel macrohabitats (17%; 12-43% of effort).

Shovelnose sturgeon collected in the Fish Community Season during the 11 years of random sampling have primarily been captured in braided channel macrohabitats (57%; 45% of effort). Similarly, shovelnose sturgeon collected in the Sturgeon Season during the 11 years of random sampling were primarily from braided channel (51%) and outside bend (20%) macrohabitats, while 47% and 17% of gear deployments occurred in these habitats, respectively.

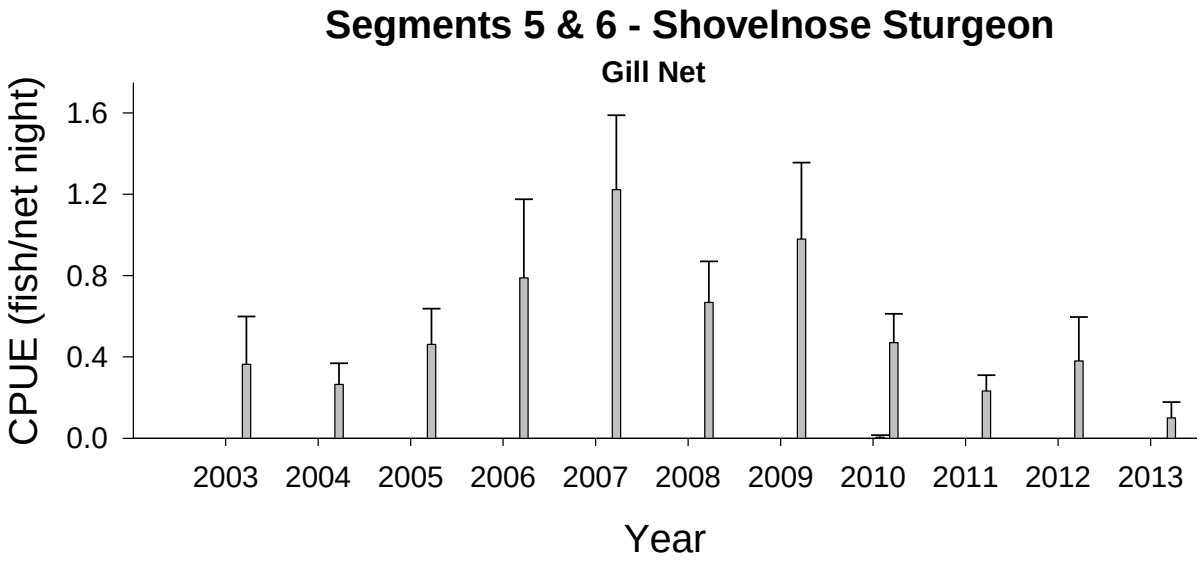

Figure 11. Mean annual catch per unit effort (+2SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and ≥ quality size (≥ 380 mm; gray bars) shovelnose sturgeon caught by gill nets in Segments 5 and 6 of the Missouri River from 2003 to 2013. Gill nets were set in fall and spring during 2003-2010 and only in spring in 2011-2013.

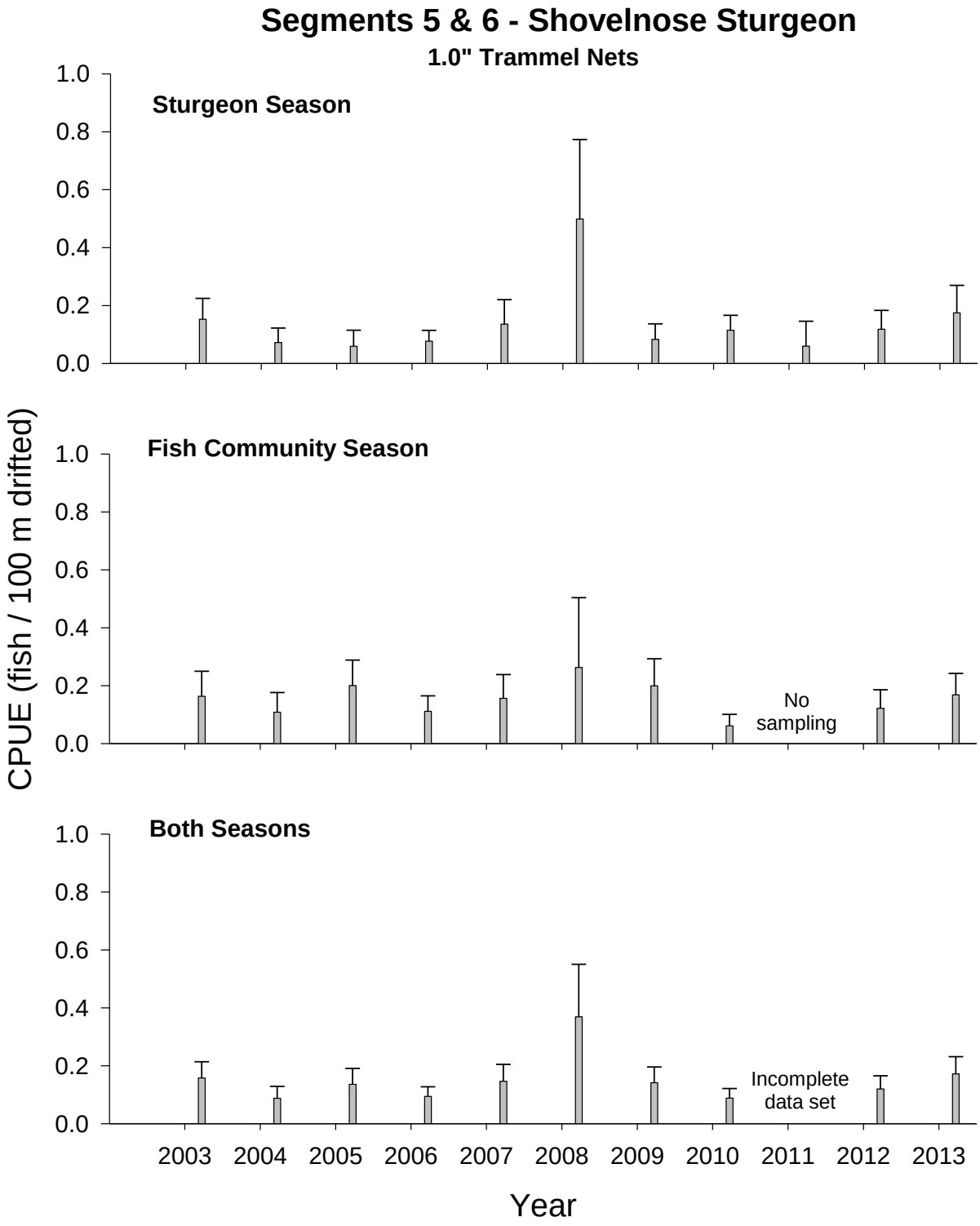

Figure 12. Mean annual catch per unit effort (+2SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and ≥ quality size (≥ 380 mm; gray bars) shovelnose sturgeon caught by 1-inch trammel nets in Segments 5 and 6 of the Missouri River from 2003 to 2013.

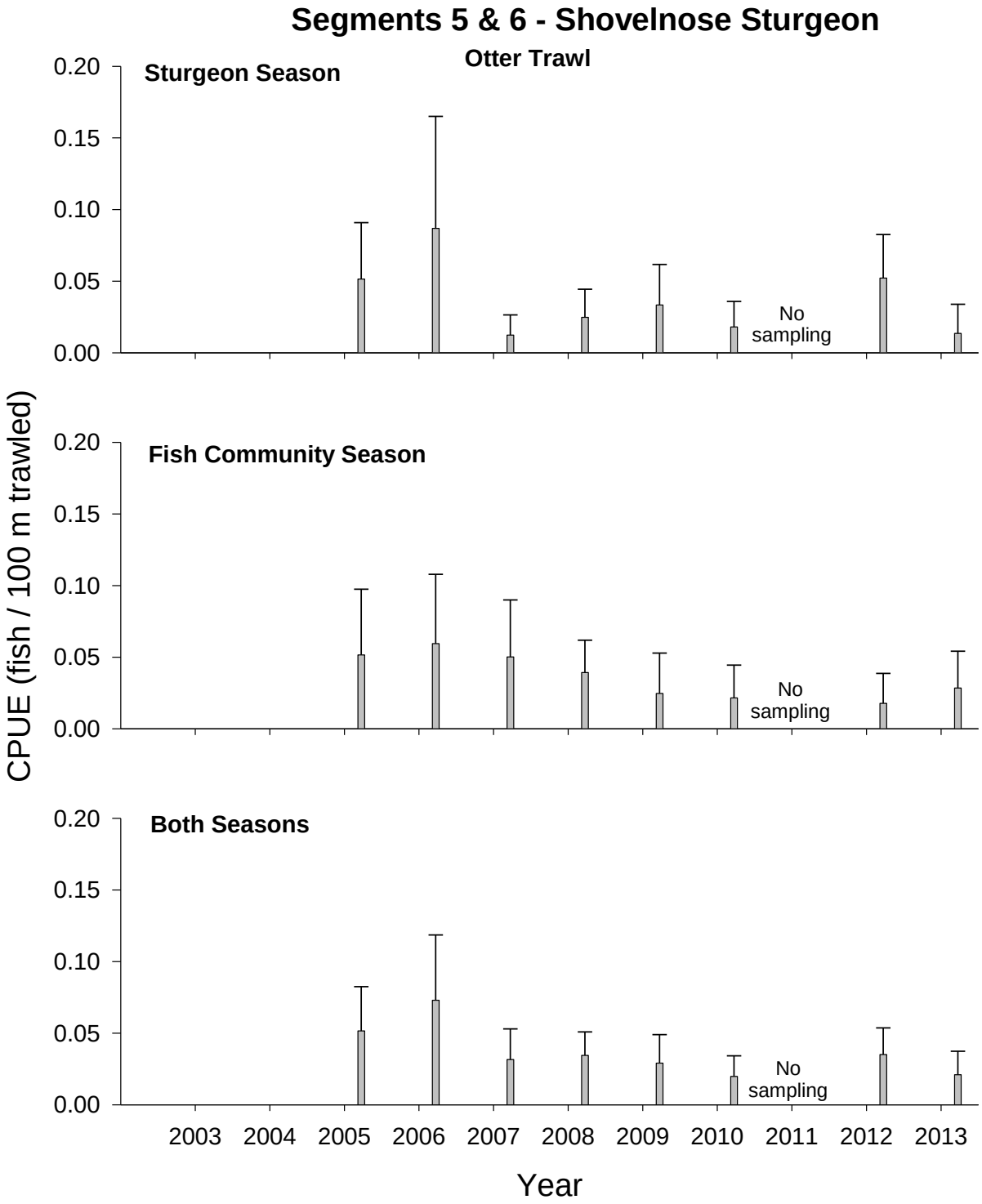

Figure 13. Mean annual catch per unit effort (+2SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and ≥ quality size (≥ 380 mm; gray bars) shovelnose sturgeon caught by otter trawls in Segments 5 and 6 of the Missouri River from 2003 to 2013.

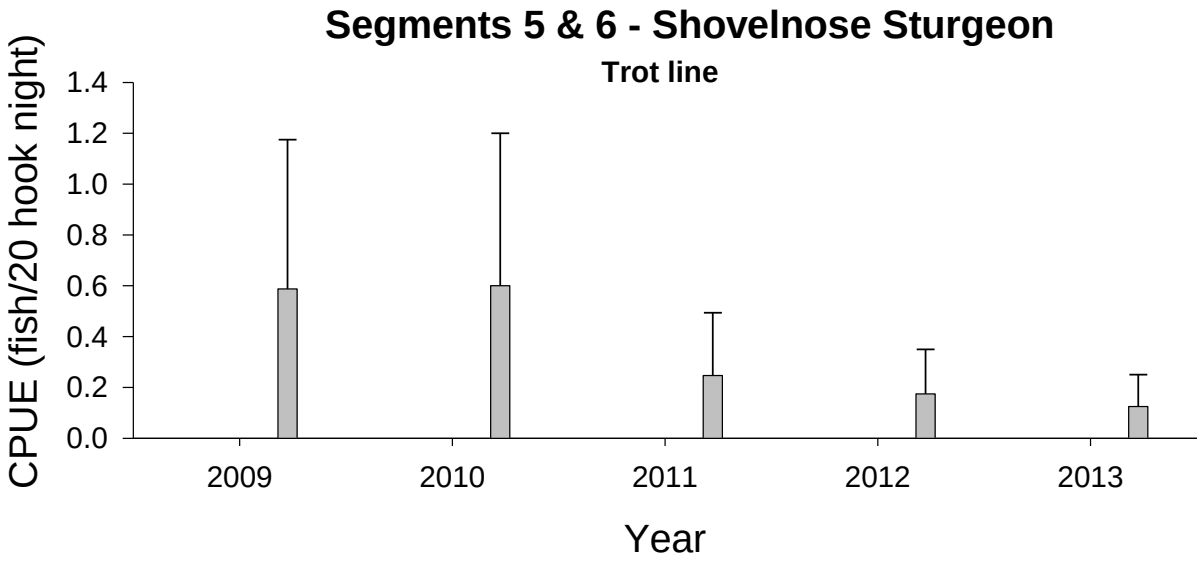

Figure 14. Mean annual catch per unit effort (+2SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and ≥ quality size (≥ 380 mm; gray bars) shovelnose sturgeon caught by trot lines in Segments 5 and 6 of the Missouri River from 2009 to 2012.

Table 7. Total number of quality size and greater (≥ 380 mm) shovelnose sturgeon captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat									
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season											
1-Inch Trammel Net	31	16 (45)	3 (11)	6 (5)	6 (8)	26 (11)	42 (20)	0 (0)	0 (0)	0 (0)	0 (0)
Gill Net	10	100 (50)	0 (13)	0 (0)	0 (14)	0 (14)	0 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Otter Trawl	3	0 (43)	33 (14)	67 (5)	0 (13)	0 (13)	0 (13)	0 (0)	0 (0)	0 (0)	0 (0)
Trot Line	10	30 (36)	20 (15)	0 (5)	40 (13)	10 (15)	0 (13)	0 (0)	0 (0)	0 (0)	0 (4)
Fish Community Season											
1-Inch Trammel Net	29	52 (46)	14 (11)	3 (4)	0 (10)	10 (11)	21 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Mini-Fyke Net	0	0 (40)	0 (13)	0 (3)	0 (14)	0 (15)	0 (11)	0 (1)	0 (3)	0 (1)	0 (0)
Otter Trawl	6	17 (43)	17 (15)	33 (5)	0 (12)	17 (14)	17 (12)	0 (0)	0 (0)	0 (0)	0 (0)

Table 8. Total number of shovelnose sturgeon captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat									
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS
Sturgeon Season											
1-Inch Trammel Net	31	16 (45)	3 (11)	6 (5)	6 (8)	26 (11)	42 (20)	0 (0)	0 (0)	0 (0)	0 (0)
Gill Net	12	83 (50)	8 (13)	0 (0)	0 (14)	8 (14)	0 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Otter Trawl	3	0 (43)	33 (14)	67 (5)	0 (13)	0 (13)	0 (13)	0 (0)	0 (0)	0 (0)	0 (0)
Trot Line	10	30 (36)	20 (15)	0 (5)	40 (13)	10 (15)	0 (13)	0 (0)	0 (0)	0 (0)	0 (4)
Fish Community Season											
1-Inch Trammel Net	29	52 (46)	14 (11)	3 (4)	0 (10)	10 (11)	21 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Mini-Fyke Net	0	0 (40)	0 (13)	0 (3)	0 (14)	0 (15)	0 (11)	0 (1)	0 (3)	0 (1)	0 (0)
Otter Trawl	6	17 (43)	17 (15)	33 (5)	0 (12)	17 (14)	17 (12)	0 (0)	0 (0)	0 (0)	0 (0)

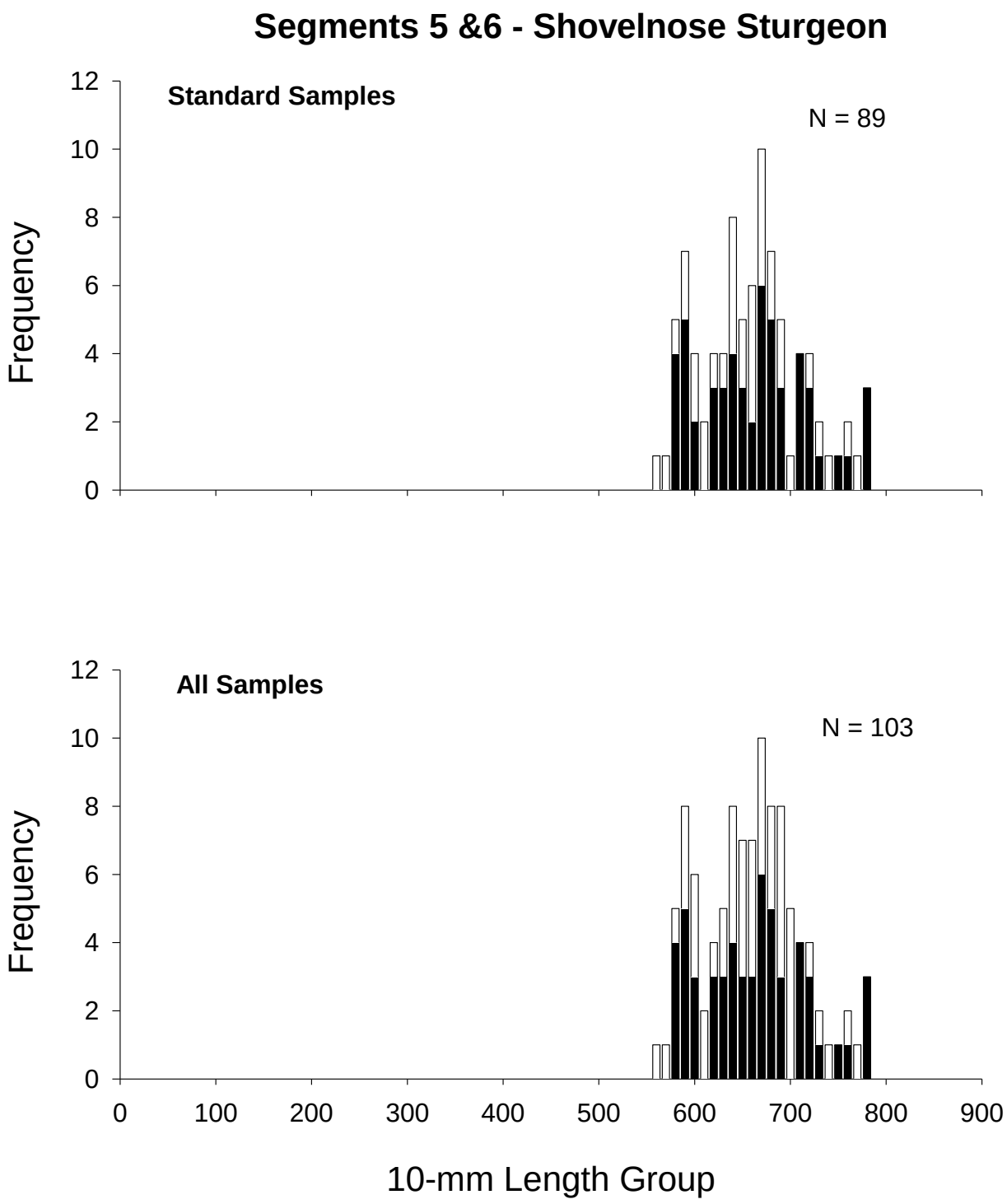

Figure 15. Length frequency histograms of shovelnose sturgeon caught during the Sturgeon Season (black bars) and Fish Community Season (white bars) in Segments 5 and 6 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include duplicate sampling conducted during 2013.

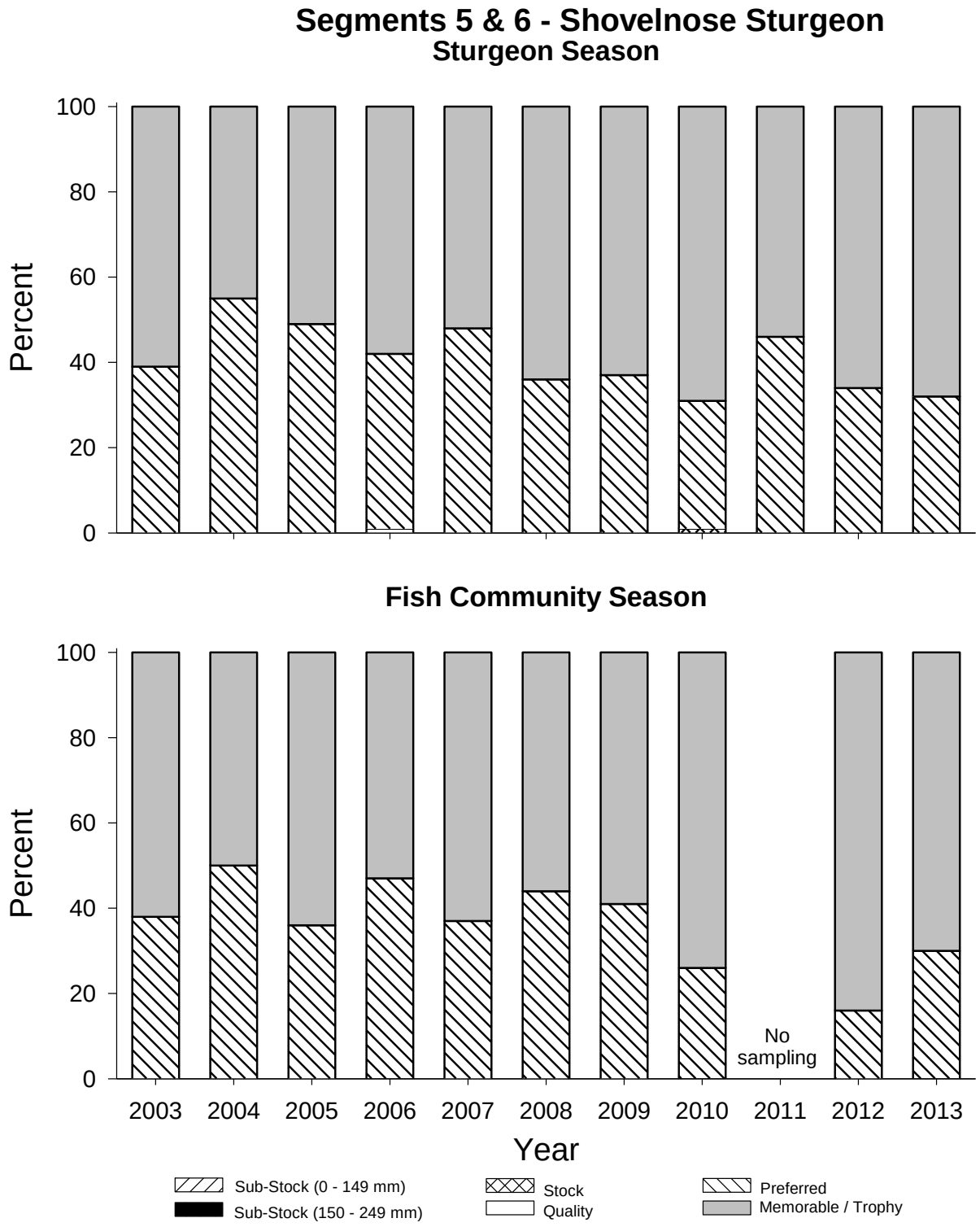

Figure 16. Percent of all shovelnose sturgeon captured with all gears by proportional size distribution (PSD) length category from 2003 to 2013 in Segments 5 and 6 in the Missouri River.

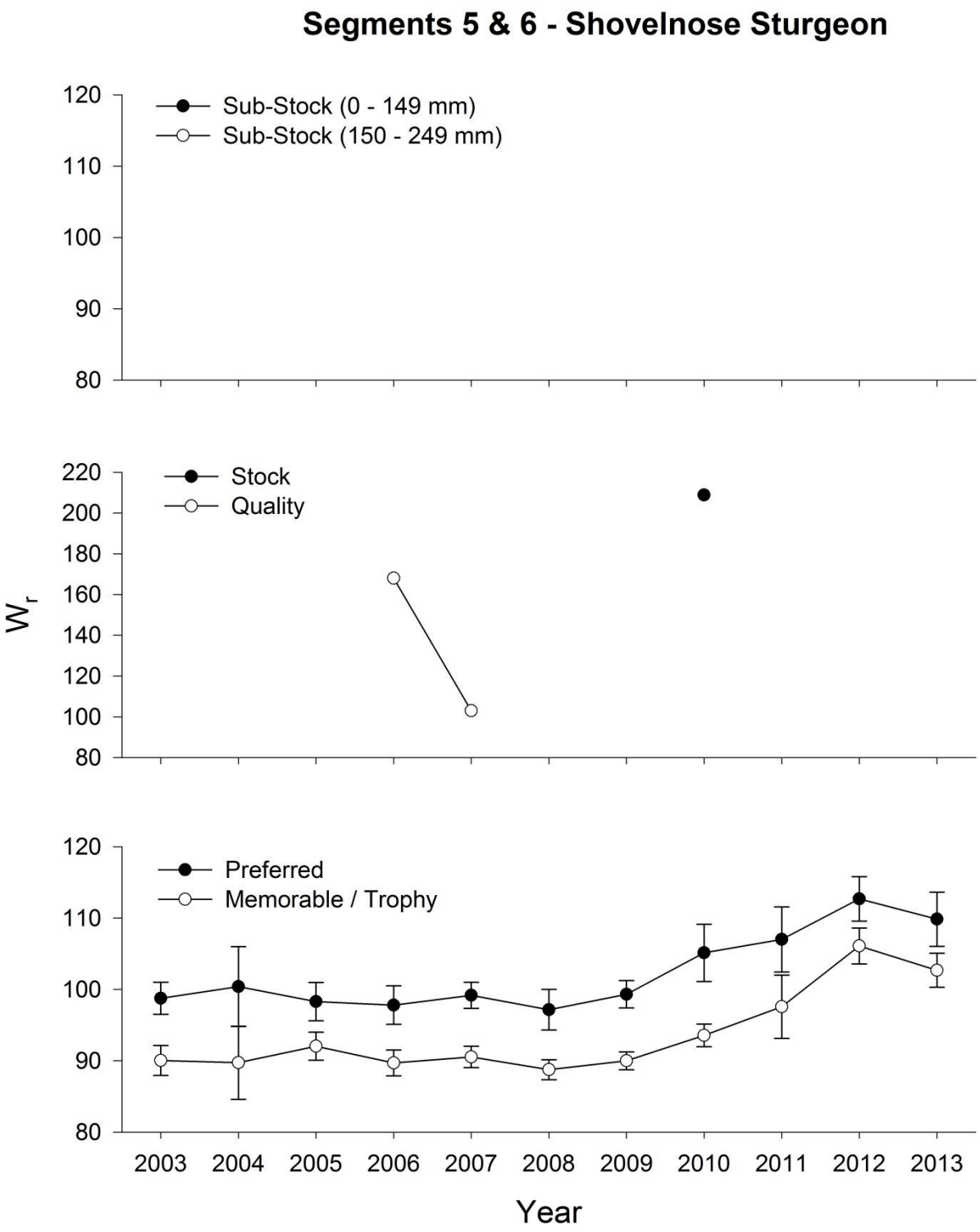

Figure 17. Relative weight (W_r) (±2SE) for all shovelnose sturgeon captured with all gears by proportional size distribution (PSD) length category from 2003 to 2013 in Segments 5 and 6 of the Missouri River.

Sturgeon Chub

Sturgeon chub were not collected in 2013 (Figure 18). Only two sturgeon chub have been collected in Segments 5 and 6 during the 11 years of the PSPAP. Both specimens were collected with the otter trawl in SY 2012 from Segment 5 Bend 3. One was collected from the channel crossover and one was collected from the inside bend macrohabitat. Both were collected from the channel border mesohabitat.

Sicklefin Chub

Sicklefin chubs have not been collected in Segments 5 and 6 during eleven years of the PSPAP.

Shoal Chub

Shoal chubs have not been collected in Segments 5 and 6 during eleven years of the PSPAP.

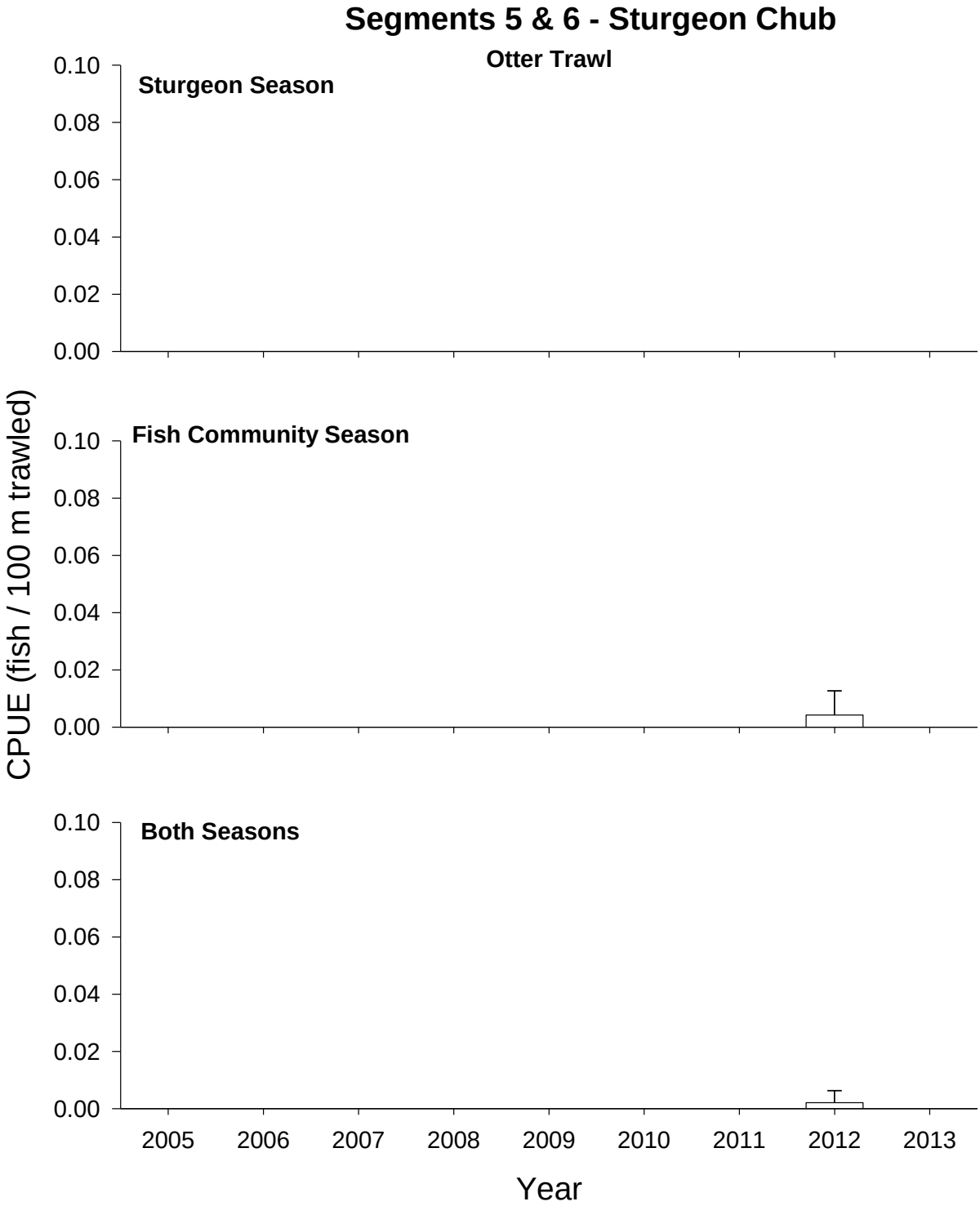

Figure 18. Mean annual catch per unit effort (+2SE) of sturgeon chub captured with otter trawl in Segments 5 and 6 of the Missouri River from 2003 to 2013.

Sand Shiner

We collected 163 sand shiner in standardized random gear deployments in 2013; 6 in otter trawls during the Sturgeon Season (Appendix F3) and 157 in mini-fyke nets during the Fish Community Season (Appendix F4). The six sand shiners collected during the Sturgeon Season ranged in length from 41 to 68 mm (mean = 54.7 mm). Sand shiners collected during the Fish Community Season ranged in length from 24 to 91 mm (mean = 36.7 mm). Seventy-six percent of the sand shiners captured were 30-40 mm (Figure 20).

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

In 2013, 77 (47%) sand shiners were collected with standard sampling in Segment 5 and 86 (53%) were collected in Segment 6. The relative abundance of sand shiner in 2013, indexed with mini-fyke net CPUE, increased 48% from the 2012 estimate and was the second-highest relative abundance recorded during 11 years of monitoring (Figure 19).

Nearly all of the sand shiners captured were adjacent to the Niobrara River confluence: 88% from Segment 5 were collected in Bend 17 and 80% from Segment 6 were collected in Bend 1. During 11 years of standardized sampling, 289 (35%) sand shiners were collected from Segment 5 and 541 (65%) were from Segment 6. The majority of sand shiners sampled in Segment 5 were from Bend 17 (26% of sand shiners, 7% of sampling effort) and Bend 10 (17% of sand shiners, 6% of sampling effort). Most sand shiners sampled in Segment 6 were from Bend 3 (43% of sand shiners, 3% of sampling effort) and Bend 1 (18% of sand shiners, 7% of sampling effort).

Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.

Relative abundance of sand shiner (i.e., mini-fyke net CPUE) during the Fish Community Season was greatest for confluence (18.0 fish/net-night), non-connected secondary channel (15.0 fish/net-night), and outside bend (5.3 fish/net-night) macrohabitats (Appendix F4). Mini-fyke nets were only set in the bar mesohabitat during 2013.

Sand shiners caught in randomly deployed mini-fyke nets in Segments 5 and 6 from 2004 to 2013 were primarily from braided channel macrohabitat (51%) and outside bend macrohabitat (21%). However, the majority of mini-fyke net effort was deployed in these macrohabitats (braided channel: 43%; outside bend: 21%).

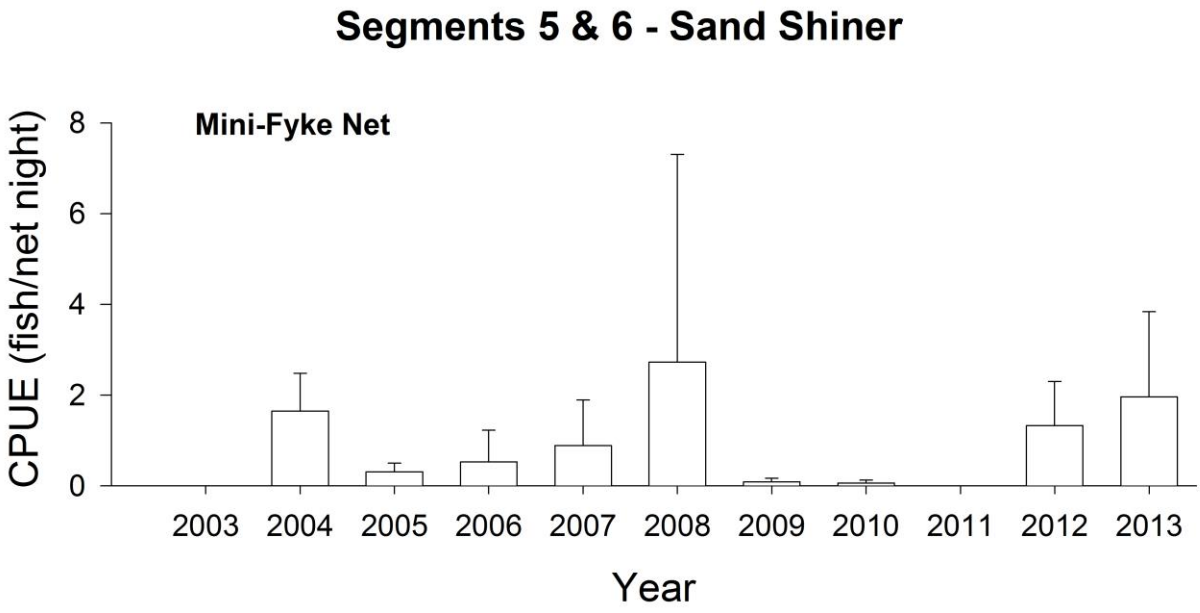

Figure 19. Mean annual catch per unit effort (+2SE) of sand shiner in mini-fyke nets in Segments 5 and 6 of the Missouri River during Fish Community Season from 2003 to 2013.

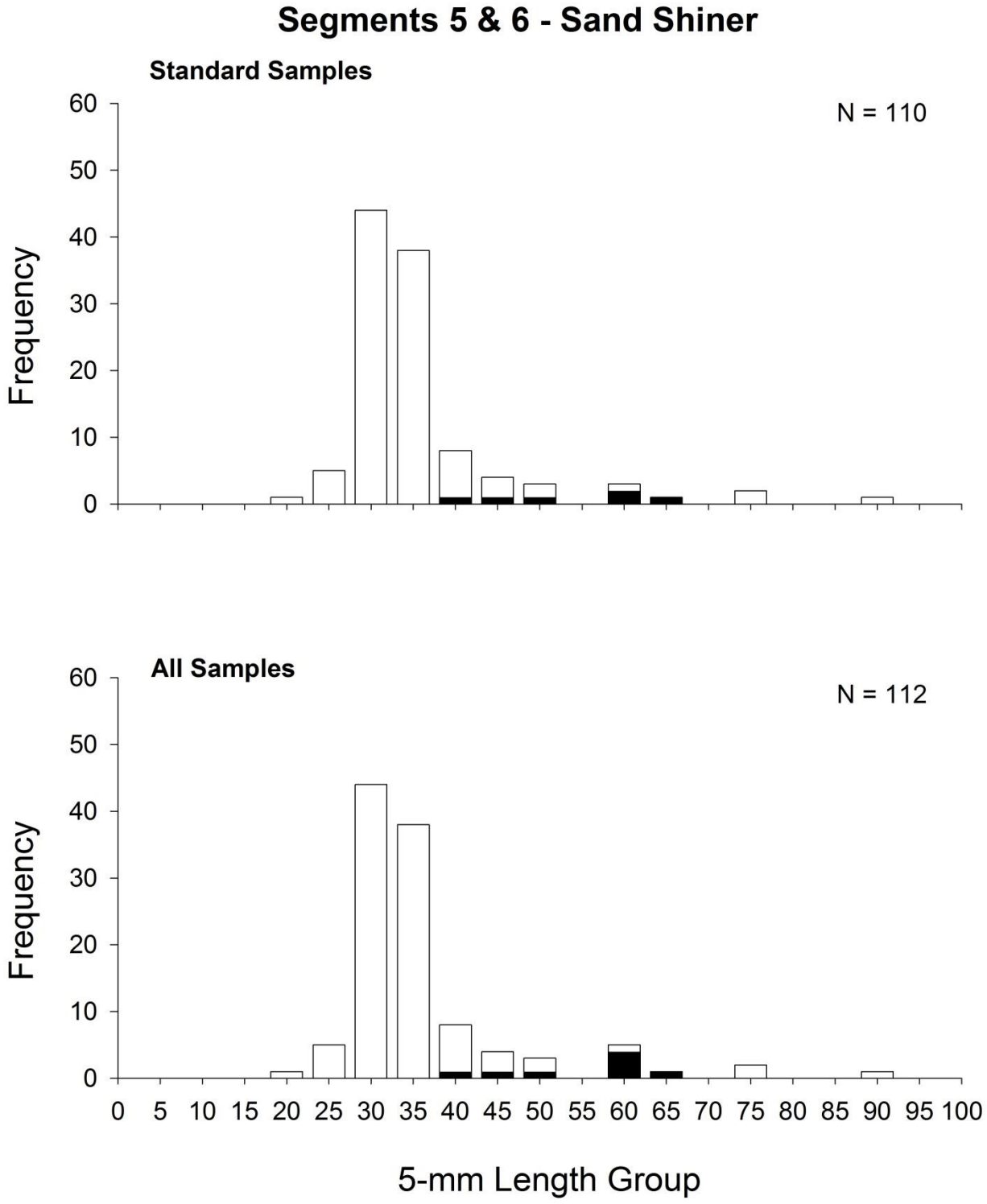

Figure 20. Length frequency of sand shiner during the Sturgeon Season (black bars) and the Fish Community Season (white bars) in Segments 5 and 6 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Hybognathus spp.

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

Four brassy minnow (31-63 mm; Figure 22) and four western silvery minnow (29-34 mm; Figure 22) were collected in Segments 5 and 6 during 2013, which was an increase from 2012 when only one brassy minnow was collected. Relative abundance of *Hybognathus* spp. in Segments 5 and 6 is generally low (i.e., <1 fish per net night) and has declined since 2010 when the highest relative abundance was observed (Figure 21). From 2003 to 2013, 177 brassy minnow, 11 unidentified *Hybognathus* spp., 6 plains minnows, and 6 western silvery minnows have been collected from Segments 5 and 6.

Four western silvery minnows and three brassy minnows collected in SY 2013 were collected from Segment 5. All four western silvery minnows were collected from Bend 17 in Segment 5. The brassy minnows were collected from Bends 13 (N = 2) and 14 (N = 1) in Segment 5, and Bend 1 in Segment 6 (N = 1). The majority of *Hybognathus* spp. have been collected in Segment 5 during the 11 years of monitoring: 156 brassy minnows (88%), 6 plains minnows (100%), and 6 Western silvery minnows (100%). Brassy minnows have primarily been sampled from Bend 2 (N = 36), Bend 8 (N = 32), Bend 9 (N = 40), and Bend 15 (N = 25) in Segment 5. Brassy minnows collected in Segment 6 have primarily been collected from Bend 5 (N = 5), Bend 6 (N = 4), and Bend 7 (N = 5). Plains minnows have primarily been sampled from Bend 10 in Segment 5 (N = 3), while western silvery minnows have primarily been sampled from Bend 17 in Segment 5 (N = 4) during standard sampling.

Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.

The four western silvery minnows collected in 2013 were collected in a single mini-fyke net deployed in a large connected secondary channel macrohabitat. The brassy minnows collected in 2013 were from large connected secondary channel (N = 2), inside bend (N = 1), and non-connected secondary channel (N = 1) macrohabitats.

Hybognathus spp. collected with mini-fyke nets during the Fish Community Season from 2004 to 2013 have primarily been from inside bend (13% of effort) and outside bend (21% of effort) macrohabitats. Brassy minnows were primarily caught from inside bend (N = 73; 41%) and outside bend (N = 51; 29%) macrohabitats. Of the six plains minnows caught, four were caught from outside bend macrohabitat and two were caught from inside bend macrohabitat. Of the six western silvery minnows collected, four were collected in large connected secondary channel macrohabitat (in 2013), one was collected from inside bend macrohabitat, and one was collected from outside bend macrohabitat.

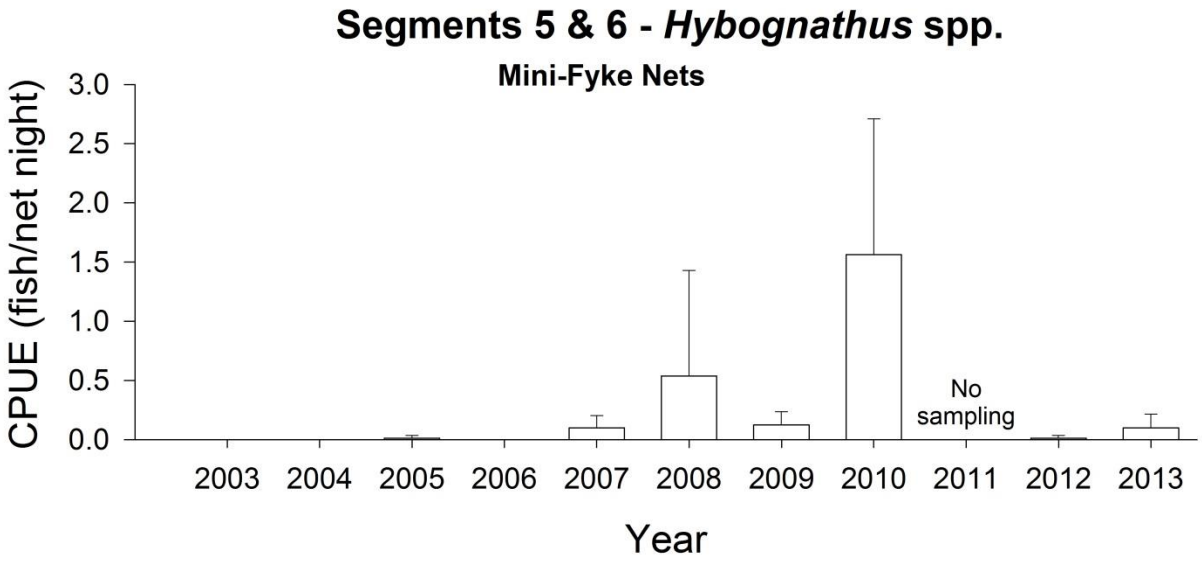

Figure 21. Mean annual catch per unit effort (+2SE) of *Hybognathus* spp. with mini-fyke nets in Segments 5 and 6 of the Missouri River during the Fish Community Season from 2003 to 2013.

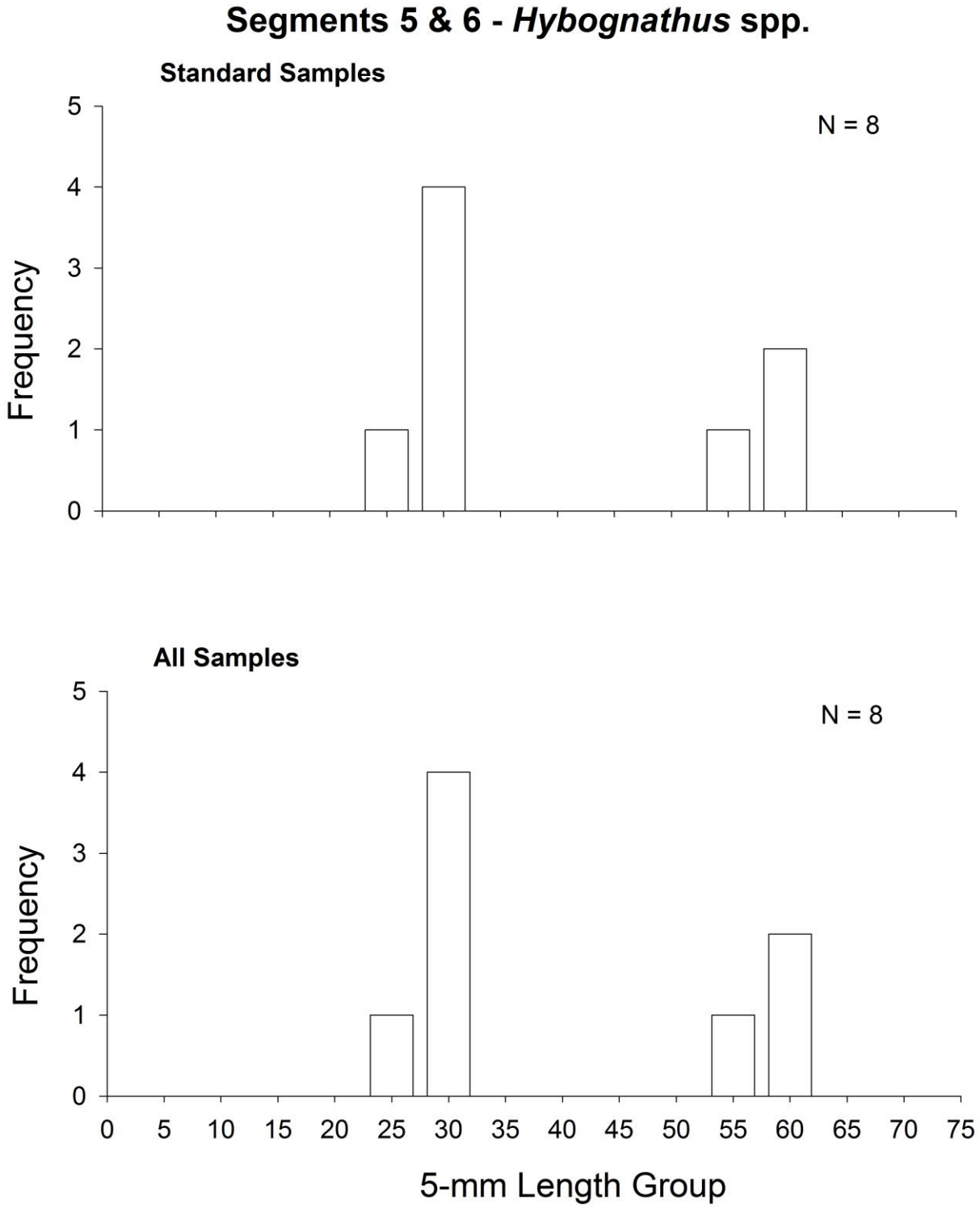

Figure 22. Length frequency of *Hybognathus* spp. caught during the Sturgeon Season (black bars) and the Fish Community Season (white bars) in Segments 5 and 6 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Blue Sucker

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

We collected two blue suckers in 2013. One was sampled during Sturgeon Season in a trammel net and the other was sampled during Fish Community Season in an otter trawl. The relative abundance of blue suckers in Segments 5 and 6 remained low in 2013 (Figures 23-25). Catch per unit effort of blue sucker caught in trammel nets and otter trawls was less than 0.01 fish per 100 m sampled, and blue suckers were not collected with gill nets or mini-fyke nets. The blue suckers collected in 2013 ranged in length from 840 to 859 mm (Figure 26). Both blue suckers captured in 2013 were from Segment 6; one was from Bend 1 and one was from Bend 4.

From 2003 to 2013, 91 blue suckers (203 to 925 mm TL) have been sampled during random sampling in Segments 5 and 6 and 112 have been caught during all sampling events. Only 1 blue sucker <600 TL has been collected during the PSPAP: a 203-mm fish collected in Segment 6 during the 2007 Sturgeon Season. Forty-five (49%) blue sucker were collected from Segment 5 and 46 (51%) were from Segment 6 during random sampling. Blue sucker have primarily been sampled from Bend 15 (N = 12) in Segment 5 and from Bend 4 (N = 29) and Bend 2 (N = 9) in Segment 6 during random sampling.

Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.

One blue sucker captured in 2013 was collected from the channel border mesohabitat of a braided channel macrohabitat and one was from the channel border mesohabitat of a confluence macrohabitat (Table 9).

Blue suckers collected in Segments 5 and 6 from 2003 to 2013 have primarily been from the outside bend and braided channel macrohabitats and channel border mesohabitat. During the Fish Community Season, six (43%) blue sucker were collected with random sampling from the outside bend macrohabitat and five (36%) were from braided channel macrohabitat. Outside bend macrohabitat accounted for 16% of sampling effort and braided channel accounted for 45% of sampling effort. Similarly, during the Sturgeon Season, blue sucker were primarily collected from braided channel (N = 37; 48%) and outside bend macrohabitats (N = 26; 34%), while 47% and 17% of sampling effort was expended in these macrohabitats, respectively. Ninety-six percent of blue sucker captures during random sampling have occurred in channel border mesohabitat.

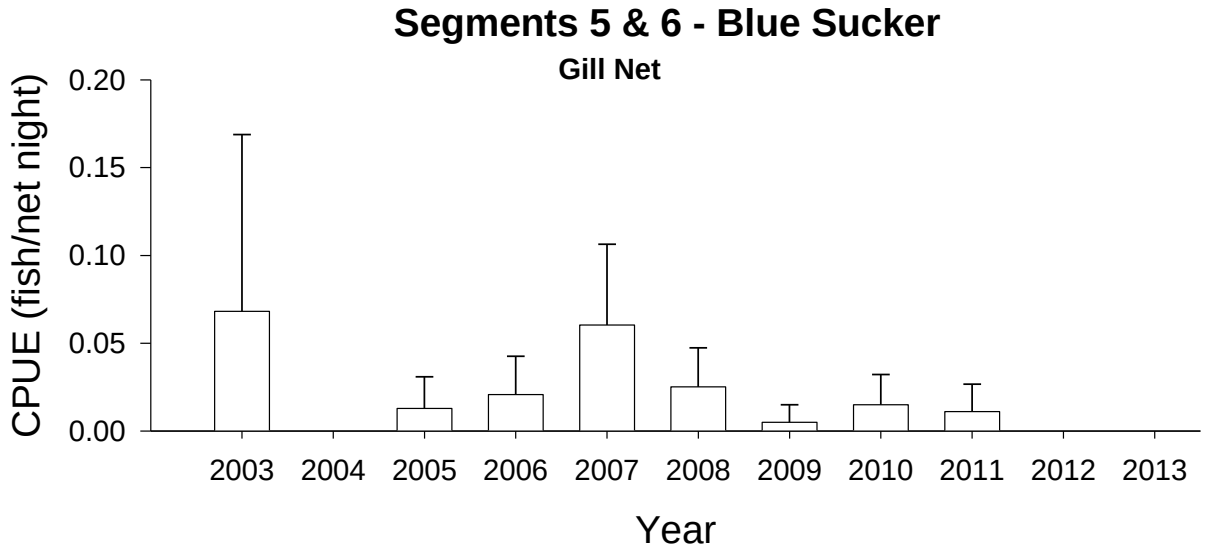

Figure 23. Mean annual catch per unit effort (+2SE) of blue suckers caught by gill nets in Segments 5 and 6 of the Missouri River from 2003 to 2013. Gill nets were set in fall and spring from 2003 to 2010 and only in spring from 2011 to 2013.

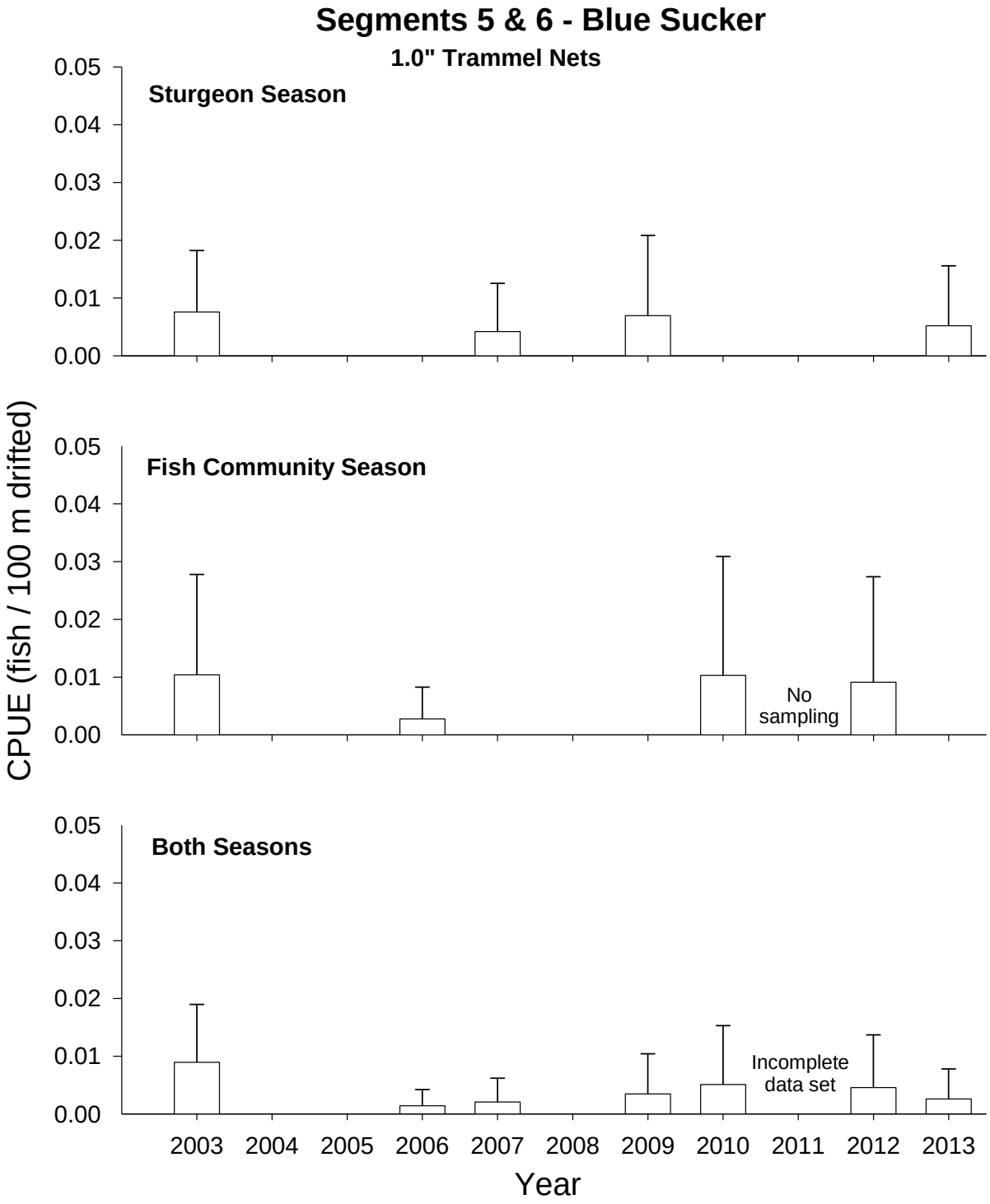

Figure 24. Mean annual catch per unit effort (+2SE) of blue sucker caught by 1-inch trammel nets in Segments 5 and 6 of the Missouri River from 2003 to 2013.

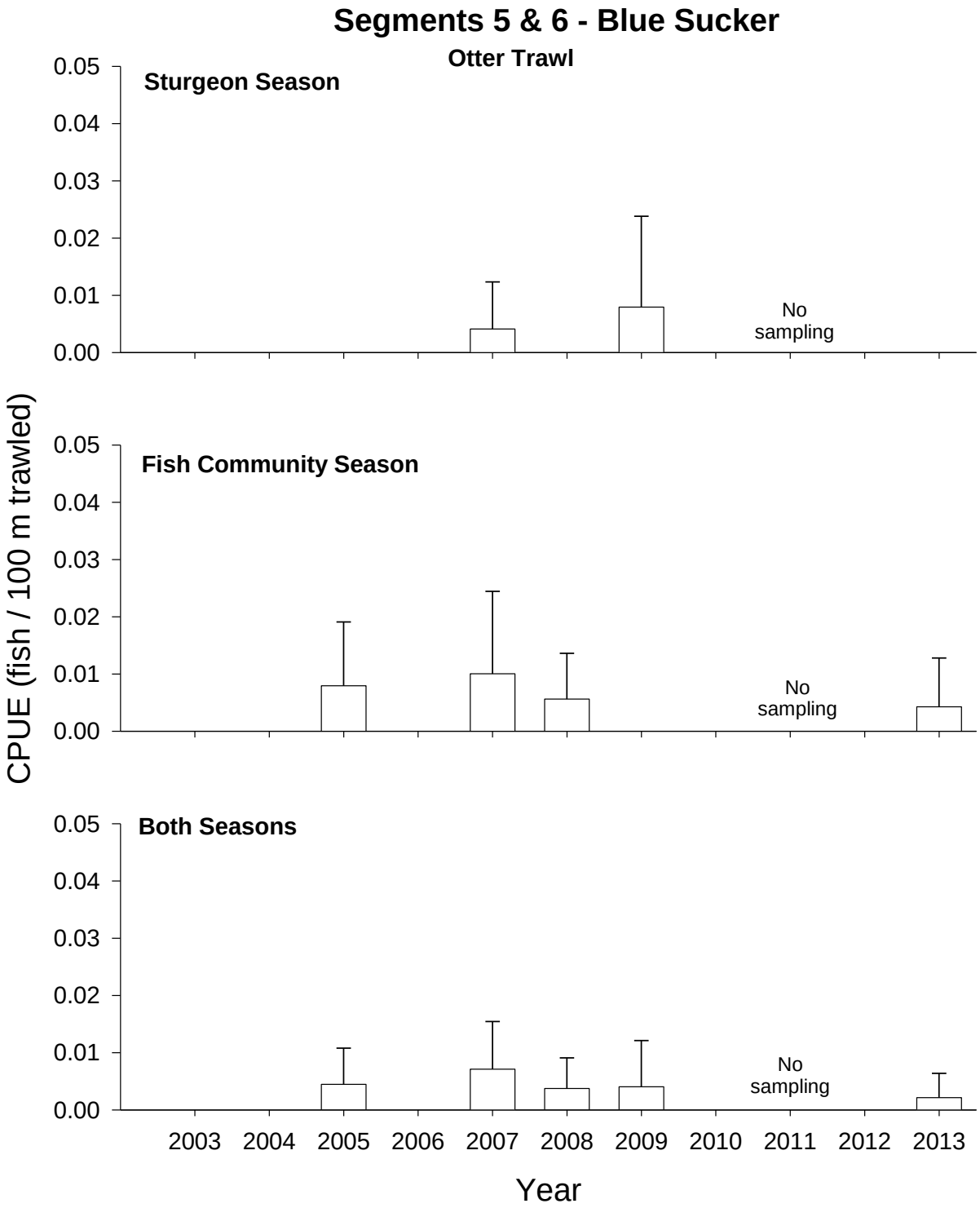

Figure 25. Mean annual catch per unit effort (+2SE) of blue sucker caught by otter trawls in Segments 5 and 6 of the Missouri River from 2003 to 2013.

Table 9. Total number of blue sucker captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat								
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season										
1-Inch Trammel Net	1	0	0	100	0	0	0	0	0	0
		(45)	(11)	(5)	(8)	(11)	(20)	(0)	(0)	(0)
Gill Net	0	0	0	0	0	0	0	0	0	0
		(50)	(13)	(0)	(14)	(14)	(9)	(0)	(0)	(0)
Otter Trawl	0	0	0	0	0	0	0	0	0	0
		(43)	(14)	(5)	(13)	(13)	(13)	(0)	(0)	(0)
Fish Community Season										
1-Inch Trammel Net	0	0	0	0	0	0	0	0	0	0
		(46)	(11)	(4)	(10)	(11)	(19)	(0)	(0)	(0)
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0
		(40)	(13)	(3)	(14)	(15)	(11)	(1)	(3)	(1)
Otter Trawl	1	100	0	0	0	0	0	0	0	0
		(43)	(15)	(5)	(12)	(14)	(12)	(0)	(0)	(0)

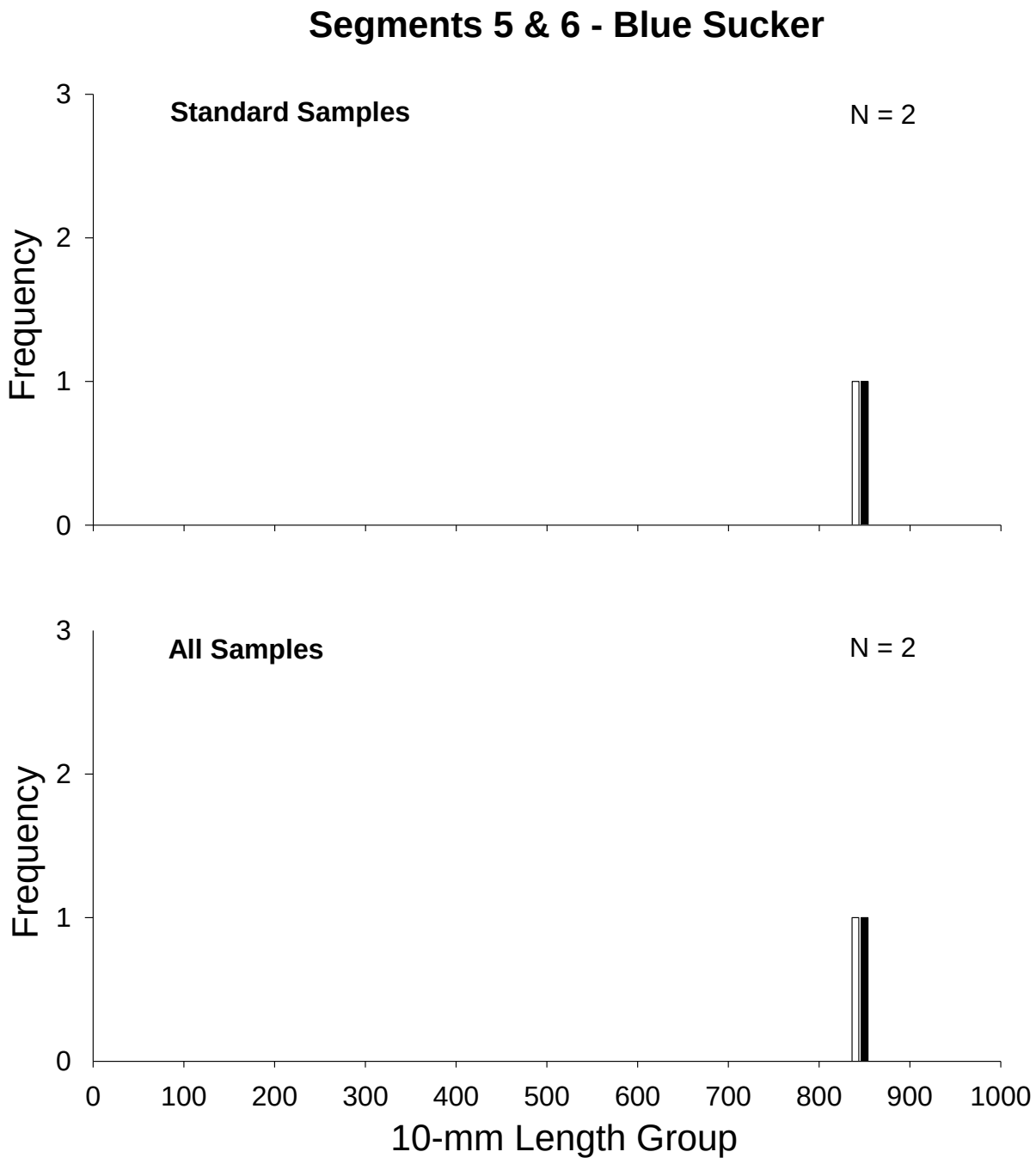

Figure 26. Length frequency of blue sucker during the Sturgeon Season (black bars) and the Fish Community Season (white bars) in Segments 5 and 6 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

Sauger

Fifty-eight sauger were collected in our standardized random gear deployments during 2013. The majority of sauger were collected with the otter trawl (N = 21), followed by the mini-fyke net (N = 16), trammel net (N = 15), and gill net (N = 6). Twenty-two sauger were collected during the Sturgeon Season and 36 were collected during the Fish Community Season. Sauger ranged in length from 71 to 549 mm (Figure 31). Mean relative weight of sauger was low for all size classes (mean W_r = 72- 81; Figure 32).

Objective 4. Document annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

Relative abundance, indicated by gill net, trammel net, and otter trawl CPUE, was low in 2013 relative to the past 10 years of standardized sampling (Figures 27-29). However, relative abundance of sauger captured with mini-fyke nets was similar to that in 2007-2012 and greater than that in 2003-2006 (Figure 30).

In 2013, 42 of the 58 (72%) sauger collected during random sampling were from Segment 6. Most sauger collected in Segment 5 (N = 7; 44%) were from Bend 17. Most sauger collected in Segment 6 were from Bend 5 (N = 16; 38%) and Bend 9 (N = 11; 26%).

Over 73% (718 of 978) of sauger collected during random sampling with current standard sampling gears from 2003 to 2013 were from Segment 6. Most (N = 164; 63%) of the 260 sauger collected with current standard gears in Segment 5 were from the four most downstream bends: Bend 14 (N = 17), Bend 15 (N = 70), Bend 16 (N = 40), and Bend 17 (N = 37). Bend 6 (N =115, 16%), Bend 7 (N = 104, 14%), and Bend 11 (N = 104, 14%), have accounted for the greatest number of sauger collected from Segment 6 during standard random sampling.

Objective 5. Document annual results and long-term trends of habitat usage of the target native species by season.

In 2013, most sauger (N = 39; 67%) were collected from braided macrohabitat followed by outside bend (N = 7; 12%) and large-connected secondary channel macrohabitats (N = 7; 12%). During the 2013 Sturgeon Season, 60% of sauger caught in trammel nets, 100% of sauger caught in gill nets, and 83% of sauger caught in otter trawl were collected in braided channel macrohabitat while only 43-50% of the total effort of these gears were deployed in braided macrohabitat (Table 10). During Fish Community Season, 60% of sauger captured in trammel nets and 94% of sauger captured in mini-fyke nets were from braided macrohabitat, while only 46% of trammel nets and 40% of mini-fyke net effort was in braided macrohabitat. Sauger captured with otter trawl during the Fish Community Season were primarily from outside bend (33%) and large secondary channel connected (27%) macrohabitats, though these macrohabitats only constituted 14% and 12% of deployments, respectively (Table 10).

During 11 years of standard monitoring (2003-2013), sauger were primarily caught from braided macrohabitat during the Fish Community Season (73%) and Sturgeon Season (70%). Braided channels only accounted for 45% of random sampling effort during the Fish Community Season, and 47% during the Sturgeon Season.

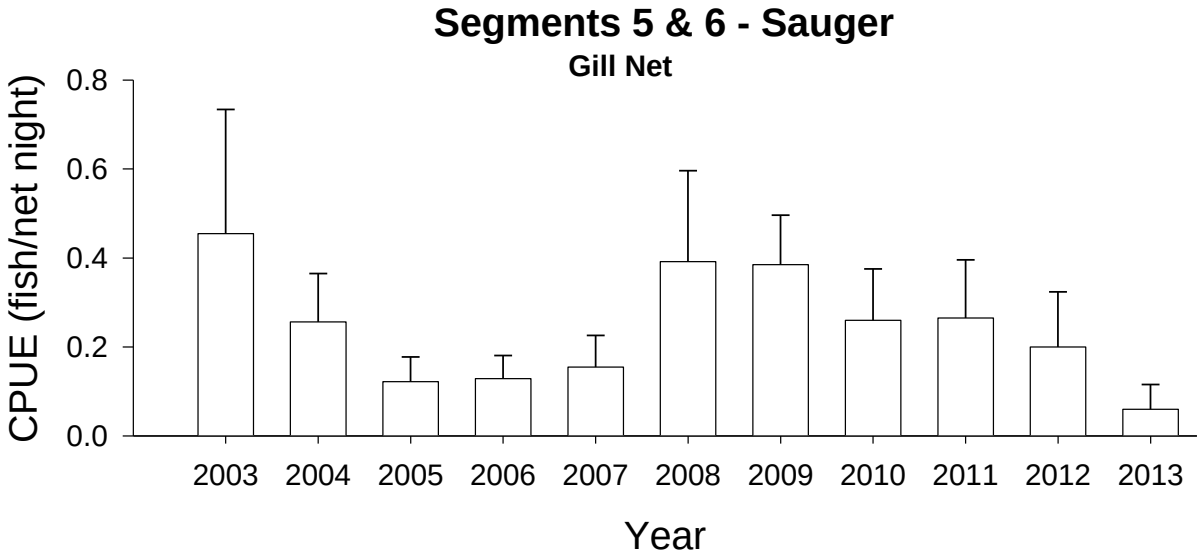

Figure 27. Mean annual catch per unit effort (+2SE) of sauger caught in gill nets in Segments 5 and 6 of the Missouri River from 2003 to 2013. Gill nets were set in fall and spring during 2003-2010 and only in spring in 2011-2013.

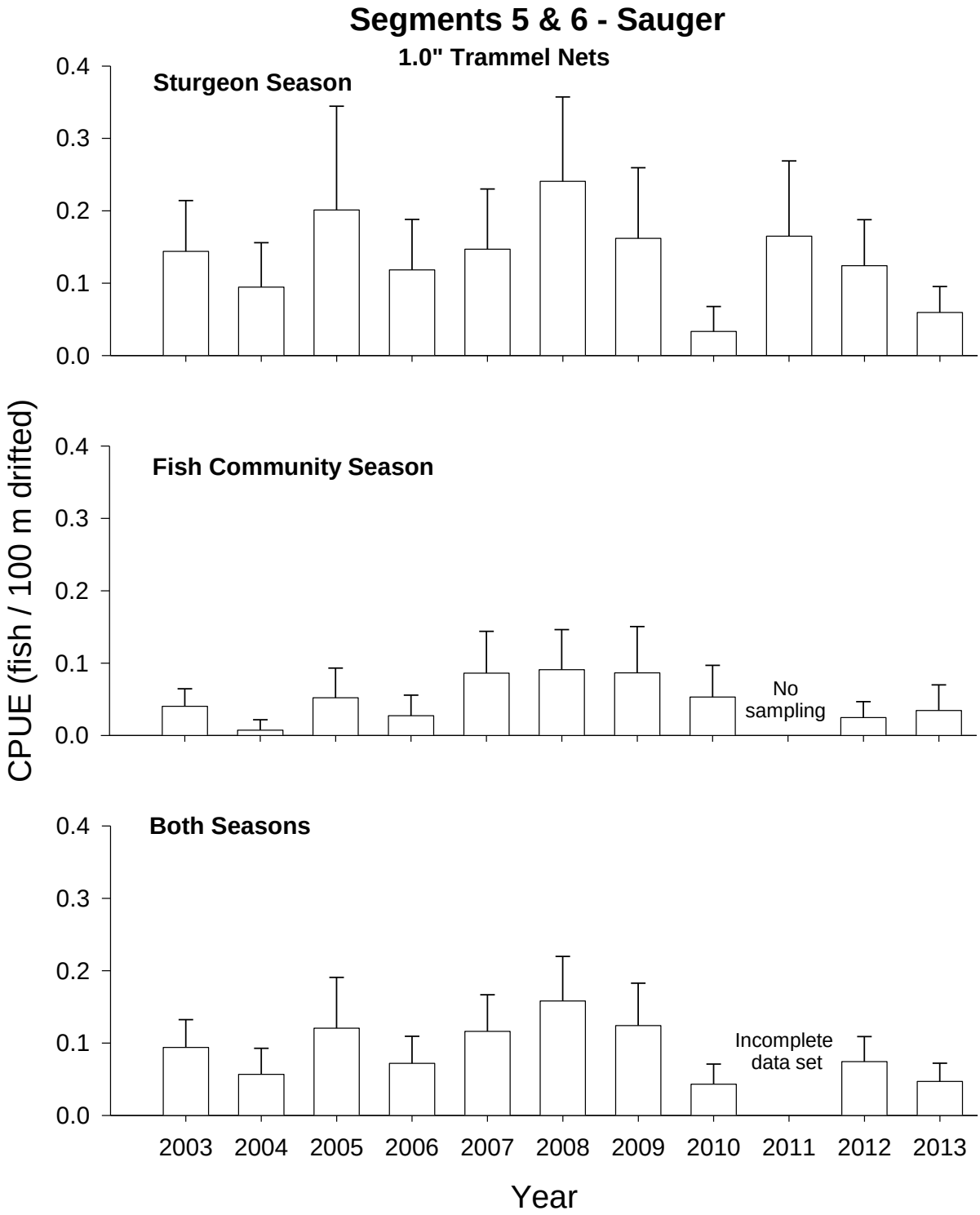

Figure 28. Mean annual catch per unit effort (+2SE) of sauger caught in1-inch trammel nets in Segments 5 and 6 of the Missouri River from 2003 to 2013.

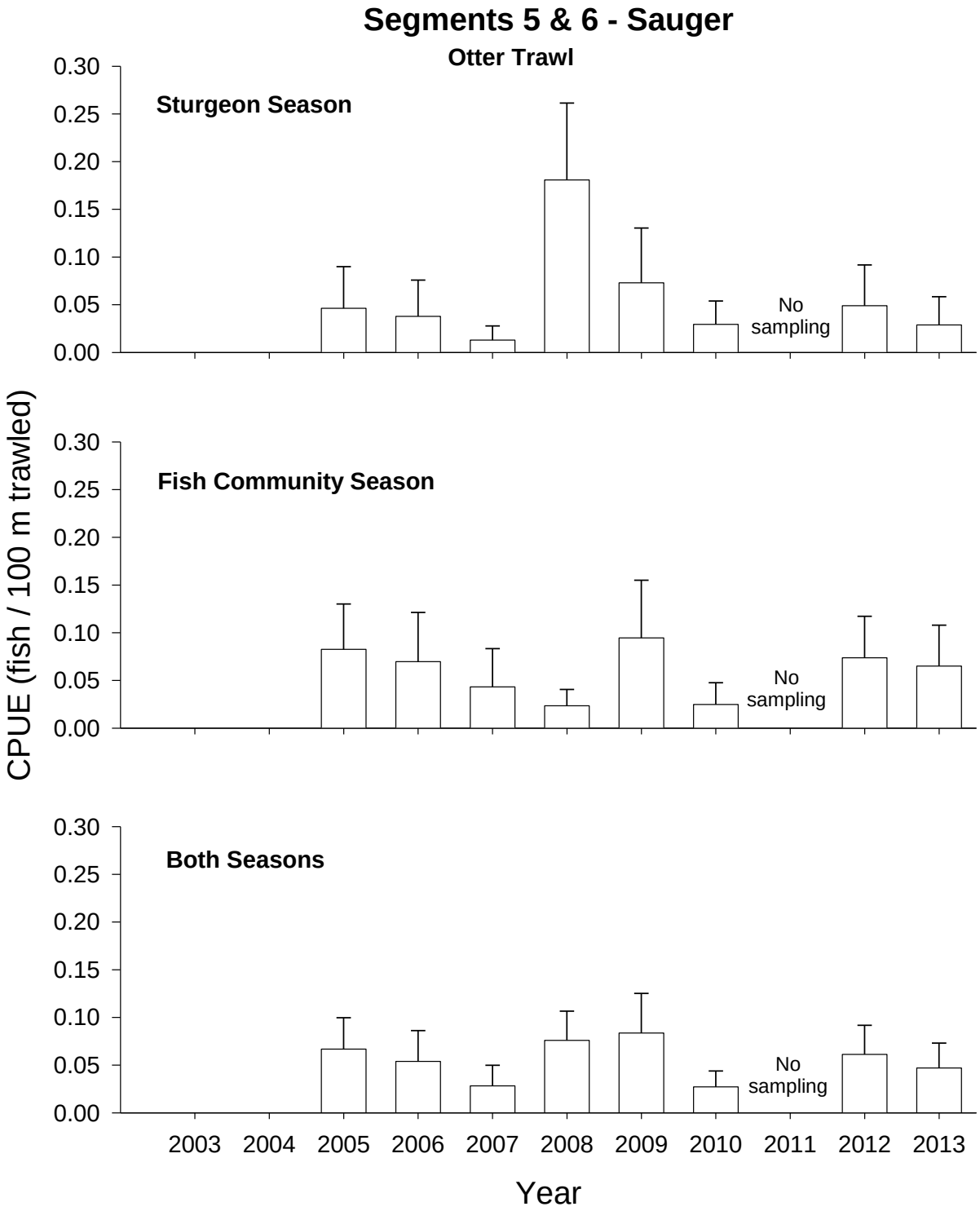

Figure 29. Mean annual catch per unit effort (+2SE) of sauger caught in otter trawls in Segments 5 and 6 of the Missouri River from 2003 to 2013.

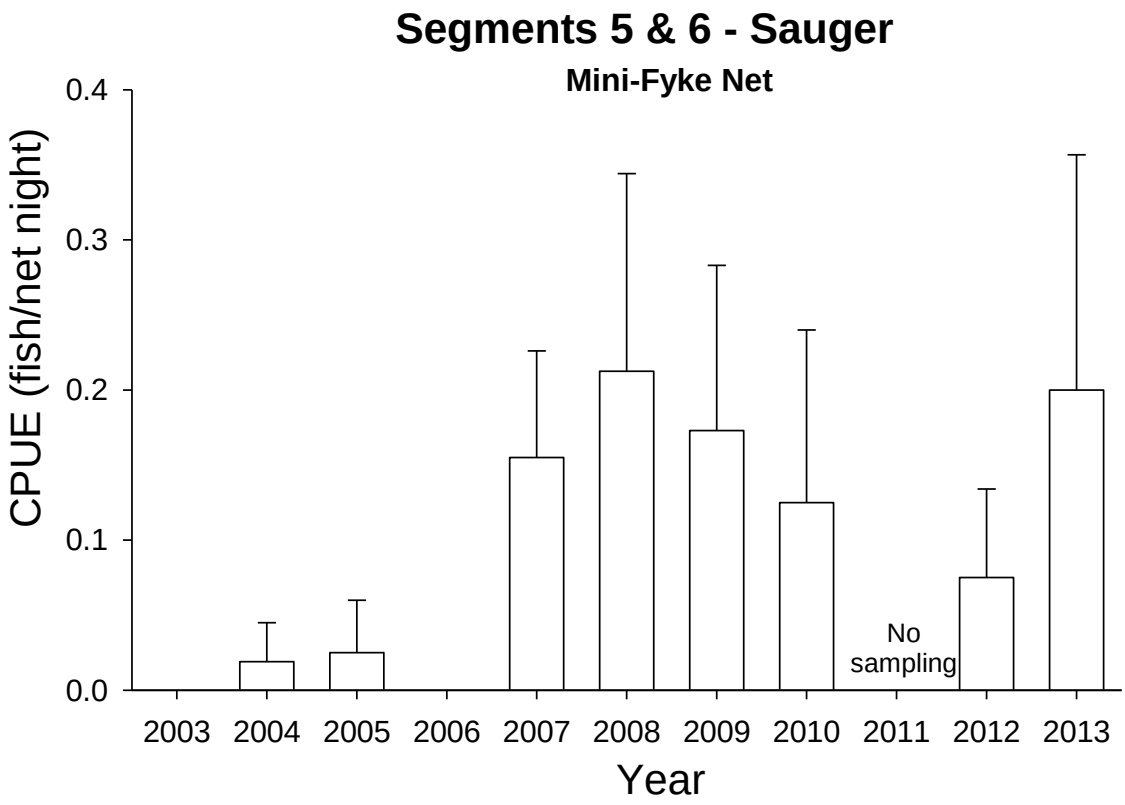

Figure 30. Mean annual catch per unit effort (+2SE) of sauger caught in mini-fyke nets in Segments 5 and 6 of the Missouri River during Fish Community Season from 2003 to 2013.

Table 10. Total number of sauger captured for each gear during each season and the percent caught within each macrohabitat type in Segments 5 and 6 of the Missouri River during 2013. The percent of total effort for each gear in each habitat is presented in parentheses. Habitat abbreviations and definitions presented in Appendix B.

		Macrohabitat								
Gear	N	BRAD	CHXO	CONF	ISB	OSB	SCCL	SCCS	SCN	TRML
Sturgeon Season										
1-Inch Trammel Net	10	60	0	0	10	10	20	0	0	0
		(45)	(11)	(5)	(8)	(11)	(20)	(0)	(0)	(0)
Gill Net	6	100	0	0	0	0	0	0	0	0
		(50)	(13)	(0)	(14)	(14)	(9)	(0)	(0)	(0)
Otter Trawl	6	83	0	0	17	0	0	0	0	0
		(43)	(14)	(5)	(13)	(13)	(13)	(0)	(0)	(0)
Fish Community Season										
1-Inch Trammel Net	5	60	20	0	0	0	20	0	0	0
		(46)	(11)	(4)	(10)	(11)	(19)	(0)	(0)	(0)
Mini-Fyke Net	16	94	0	0	0	6	0	0	0	0
		(40)	(13)	(3)	(14)	(15)	(11)	(1)	(3)	(1)
Otter Trawl	15	27	0	0	13	33	27	0	0	0
		(43)	(15)	(5)	(12)	(14)	(12)	(0)	(0)	(0)

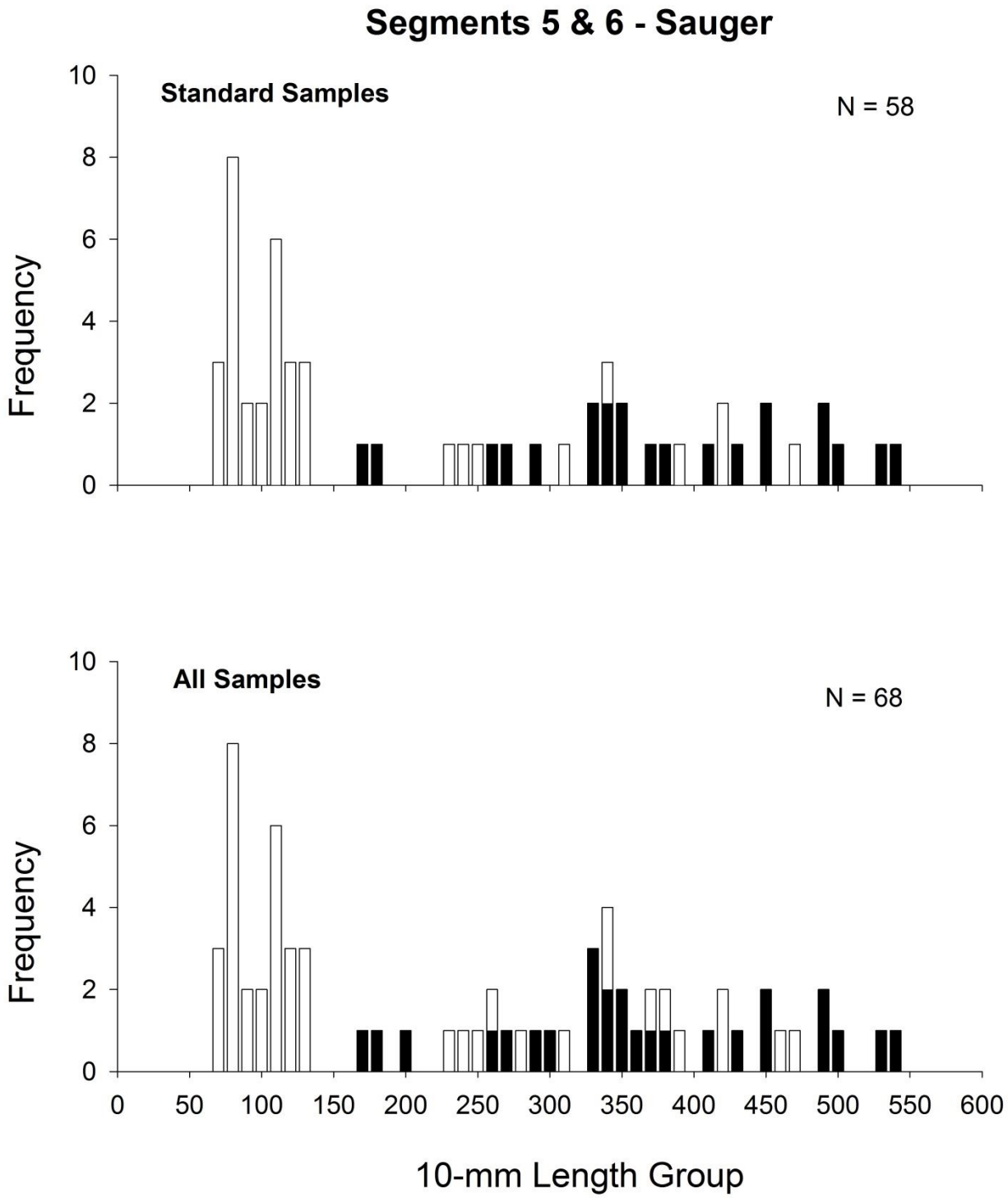

Figure 31. Length frequency of sauger during the Sturgeon Season (black bars) and Fish Community Season (white bars) in Segments 5 and 6 of the Missouri River during 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2013.

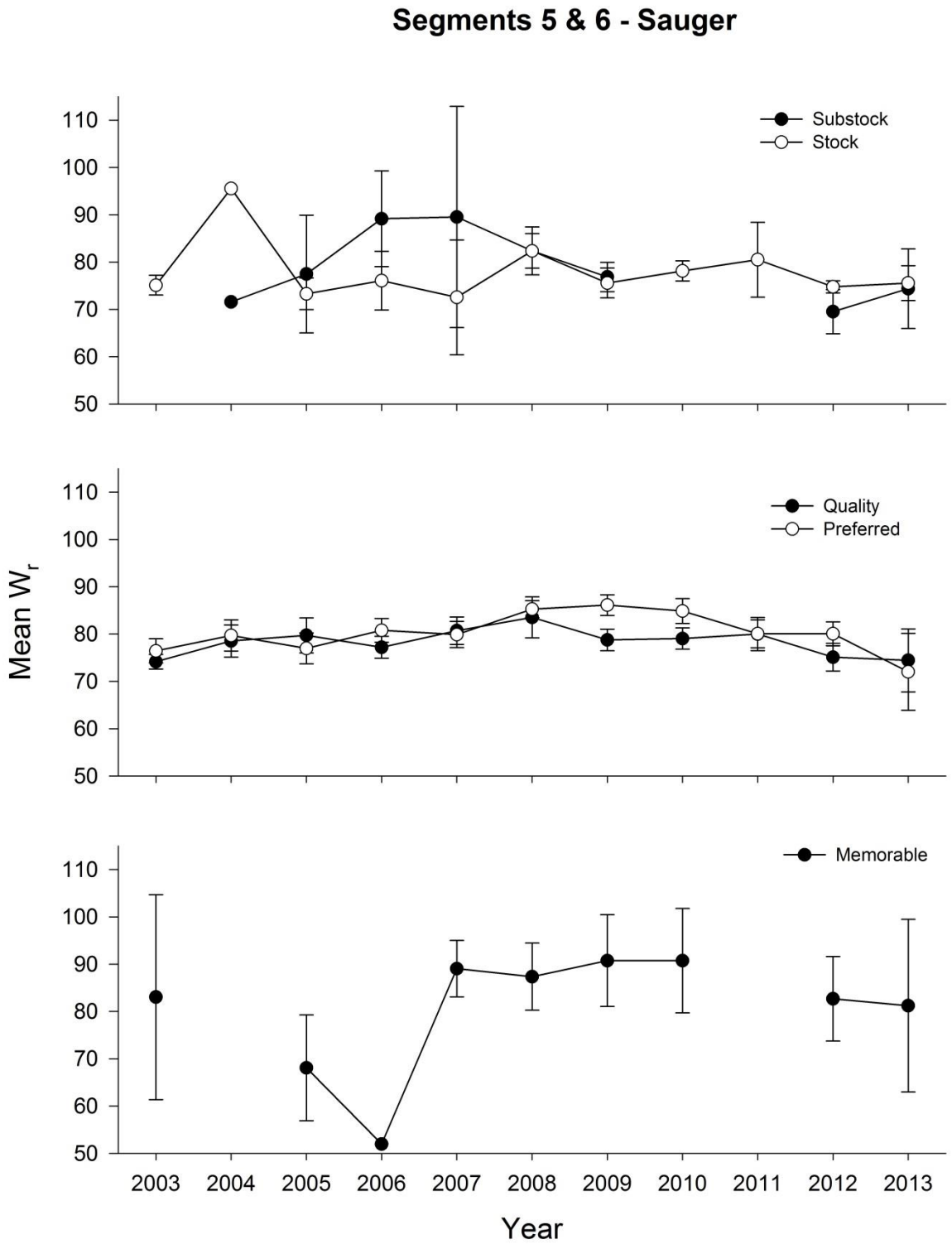

Figure 32. Relative weight (W_r) (±2SE) for all sauger captured with all gears by proportional size distribution (PSD) length category from 2003 to 2013 in Segments 5 and 6 in the Missouri River. Length categories determined using the methods proposed by Gabelhouse (1984) with the exception of sub-stock categories. Relative condition factor was calculated using the equation in Anderson and Neumann (1996).

Missouri River Fish Community

A total of 2,497 fish comprised of 45 species and one hybrid (sauger x walleye *S. canadense X S. vitreus*) were captured during 2013 standardized random sampling effort in Segments 5 and 6 of the Missouri River (Appendices F1-F5). Additionally, 67 fish of unknown species were collected: unknown *Lepomis* spp. (N = 2), unknown *Sander* spp. (N = 3), unknown *Carpiodes* spp. (N = 60), and unknown Cyprinidae (N = 2). We captured two species during the 2013 season that were not captured in 2012: burbot *Lota lota* (N = 2) and river shiner *Notropis blennius* (N = 3). Burbot were not collected in Segments 5 and 6 prior to 2013. Four species captured in 2012 were not observed in 2013: black bullhead *Ameiurus melas*, fathead minnow *Pimephales promelas*, rainbow smelt *Osmerus mordax*, and sturgeon chub *Macrhybopsis gelida*. We collected two snapping turtles *Chelydra serpentine* and 25 false map turtles *Graptemys pseudogeographica*.

Of the 45 species captured with standard gears, 14 species had > 50 individuals collected: spotfin shiner *Cyprinella spiloptera* (N = 439), emerald shiner *N. atherinoides* (N = 354), channel catfish *Ictalurus punctatus* (N = 262), river carpsucker *Carpiodes carpio* (N = 188), sand shiner (N = 163), black crappie *Poxomis nigromaculatus* (N = 127), bluntnose minnow *P. notatus* (N = 102), pallid sturgeon (N = 102), bluegill *L. macrochirus* (N = 98), shorthead redhorse *Moxostoma macrolepidotum* (N = 94), shovelnose sturgeon (N = 91), silver chub *M. storeriana* (N = 89), sauger (N = 58), and red shiner *Cyprinella lutrensis* (N = 51). All of these species except red shiner had >50 individuals collected in 2012. Seven species that had >50 individuals collected in 2012 had ≤50 individuals collected in 2013: common carp *Cyprinus carpio*, freshwater drum *Aplodinotus grunniens*, largemouth bass *Micropterus salmoides*, rock bass *Ambloplites rupestris*, smallmouth bass *M. dolomieu*, walleye *S. vitreus*, and yellow perch *Perca flavescens*.

Objective 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.

Spotfin shiner

Spotfin shiner relative abundance, indexed by mini-fyke net CPUE, decreased from 8.9 fish per net-night (SY 2012) to 5.5 fish per net-night (SY 2013; Appendix F4). The relative abundance of spotfin shiner in 2013 was the second lowest value recorded in 9 years of mini-fyke net deployments (CPUE range: 4.9-18.9 fish per net-night).

Seventy percent of spotfin shiner collected in 2013 during random gear deployments were collected from Segment 5, and 63% were sampled adjacent to the Niobrara River confluence: Segment-Bend 5-17 (51%) and Segment-Bend 6-1 (12%). During 11 years of monitoring, 53% of all spotfin shiner sampled with random gear deployments were from Segment 5, and 9% were collected adjacent to the Niobrara River confluence.

Emerald shiner

Emerald shiner relative abundance, indexed by mini-fyke net CPUE, decreased from 13.9 fish per net-night (SY 2012) to 1.5 fish per net-night (SY 2013; Appendix F4). Relative abundance of emerald shiner in 2013 was the second lowest value of the nine years that mini-fyke nets were used for random sampling in Segments 5 and 6 (minimum = 0.99 fish per net-night in SY 2007, excluding SY 2003 and SY 2011 when mini-fyke nets were not used). Emerald shiner relative abundance, indexed by otter trawl CPUE, increased from <0.01 fish per 100 m trawled (SY 2012) to 0.5 fish per 100 m trawled (SY 2013). Few emerald shiner (N = 69) had been collected in random otter trawl samples prior to 2013.

During SY 2013, 88% of emerald shiners caught with random sampling were from Segment 5. However, 44 (12%) emerald shiner were caught in one mini-fyke net in Segment-Bend 5-12, and 221 (62%) emerald shiner were caught in one otter trawl in Segment-Bend 5-13.

During 11 years of monitoring, 2,469 of the 8,455 (29%) emerald shiner caught with random sampling were from Segment 5.

Channel catfish

Channel catfish relative abundance, indexed by trammel net CPUE, in 2013 (0.33 fish per 100 m) was lower than that in 2012 (0.39 fish per 100 m), but was the second highest value during the PSPAP. Relative abundance of channel catfish, indexed by otter trawl CPUE, decreased from 0.51 fish per 100 m in 2012 to 0.12 fish per 100 m in 2013 and was the second lowest value recorded during the monitoring program (range: 0.10-0.74 fish per 100 m).

In 2013, 56% of channel catfish caught during random sampling were from Segment 5, with 25% (N = 66) sampled adjacent to the Niobrara River confluence: Segment-Bend 5-17 (N = 50; 19%) and Segment-Bend 6-1 (N = 16; 6%). During 11 years of random sampling, 1,503 of the 3,474 (43%) channel catfish caught were from Segment 5.

River carpsucker

Relative abundance of river carpsucker decreased from 2012 to 2013 across all sampling gears that collected the species (i.e., trammel nets, otter trawl, and mini-fyke net). Trammel net CPUE in 2013 (0.02 fish per 100 m) was lower than that in 2012 (0.03 fish per 100 m). Otter trawl CPUE decreased from 0.02 fish per 100 m (SY 2012) to 0.01 fish per 100 m (SY 2013). Mini-fyke net CPUE decreased from 7.4 fish per net-night to 2.2 fish per net-night, but 2013 represented the second highest relative abundance of river carpsucker in mini-fyke nets during the PSPAP (range: 0.0-7.4 fish per net-night).

In SY 2013, 123 of the 188 (65%) river carpsucker caught with random sampling were from Segment 6. During 11 years of random sampling, 61% of river carpsucker sampled were from Segment 6 and 18% were from bends adjacent to the Niobrara River confluence.

Black crappie

Relative abundance of black crappie, indexed by mini-fyke net CPUE, decreased from 3.6 fish per net-night in 2012 to 1.6 fish per net-night in 2013 (Appendix F4). Prior to 2010, black crappie were rare (< 12 sampled per year in mini-fyke nets; CPUE < 0.13 fish per net-night) in Segments 5 and 6. Since 2010, the number of black crappie sampled annually with mini-fyke nets has increased: 160 in SY 2010 (CPUE = 2 per net-night), 290 in SY 2012 (CPUE = 3.6 per net-night), and 127 in SY 2013 (CPUE = 1.6 per net-night).

During 2013, 115 of the 127 (91%) black crappie collected during random sampling were from Segment 6, with Segment-Bend 6-9 accounting for 73% of the total catch. During 11 years of monitoring, 69% of black crappie sampled during random sampling were from Segment 6. Additionally, 51% of all black crappie collected were from Bends 7-9 in Segment 6.

Bluntnose minnow

Relative abundance of bluntnose minnow increased from 0.84 fish per net-night (SY 2012 mini-fyke net) to 1.28 fish per net-night (SY 2013 mini-fyke net CPUE). The relative abundance of bluntnose minnow in 2013 represented the median value of the nine years (i.e., 2004-2010, 2012-2013) mini-fyke nets have been deployed (range: 0.15-3.10 fish per net-night).

In 2013, 67% of bluntnose minnows captured in random samples were from Segment 5, and 63% were collected adjacent to the Niobrara River confluence: Segment-Bend 5-17 (35.3%) and Segment-Bend 6-1 (27.5%). Segment 5 accounted for 54% of all bluntnose minnows captured in random samples from Segments 5 and 6 during 11 years of monitoring.

Bluegill

Relative abundance of bluegill was lower in 2013 (mini-fyke net CPUE = 1.2 fish per net-night; Appendix F4) than in 2012 (mini-fyke net CPUE = 3.1 fish per net-night), but was the fourth largest value of the nine years mini-fyke nets were used in Segments 5 and 6 (range: 0.2-3.1 fish per net-night).

In 2013, 61% of bluegills captured in random samples were from Segment 5; 55% were collected from Segment-Bend 5-5. Across all years of random sampling, 57% of bluegill sampled were from Segment 5.

Shorthead redhorse

Relative abundance of shorthead redhorse was lower in SY 2013 than in SY 2012 across all gears except trotline. Gill net CPUE decreased from 0.38 fish per net-night in 2012 to 0.22 fish per net-night in 2013 (Appendix F1). Mini-fyke net CPUE decreased from 0.55 fish per net-night in 2012 to 0.08 fish per net-night in 2013 (Appendix F4), but represented the third highest relative abundance in the nine years of mini-fyke net sampling. Trotline CPUE increased from 0.08 fish per 20 hook nights in 2012 to 0.41 fish per 20 hook nights in 2013 (Appendix F5).

Fifty-six of the 94 (60%) shorthead redhorse collected during random sampling in 2013 were from Segment 5. During 11 years of monitoring, 817 of 1,156 (71%) shorthead redhorse sampled were from Segment 5.

Silver chub

Silver chub relative abundance, indexed by otter trawl CPUE, increased to 0.21 fish per 100 m trawled in 2013 (Appendix F3) from 0.17 fish per 100 m trawled in 2012. Relative abundance of silver chub in 2013 was the third highest value of the eight years otter trawl was used as a standard gear (2005-2010, 2012-2013).

In 2013, 58 of the 89 (65%) silver chub collected with random sampling were from Segment 5. Of the 787 silver chubs collected during 11 years of random sampling, 480 (61%) were from Segment 5. Silver chub have been captured in all sampled bends except Segment-Bends 5-2 and 5-4. Captures of silver chubs has been distributed throughout the remaining bends (0.4- 8.6%).

Red shiner

Red shiner relative abundance, indexed with mini-fyke net CPUE, increased from 0.13 fish per net night in SY 2012 to 0.64 fish per net night in SY 2013. The 51 red shiners collected with standardized random mini-fyke sampling in 2013 were the most collected in a year during the PSPAP (mean = 21.6 fish per year).

Fifty of the 51 red shiner (98%) collected during random sampling in 2013 were adjacent to the Niobrara River, with seven (14%) from Segment 5 Bend 17 and 43 (84%) from Segment 6 Bend 1. Across all years of random sampling, 95 of the 203 (47%) red shiners sampled were from Segment 5.

Discussion

Stocking efforts appear to be maintaining a stable relative abundance of juvenile and sub-adult pallid sturgeon in Segments 5 and 6 that have similar growth rates and body condition to those in other segments. Almost all pallid sturgeon caught from Segments 5 and 6 during the PSPAP were hatchery-reared fish (only four wild-origin pallid sturgeon have been collected), indicating a lack of natural reproduction or recruitment. However, stocked pallid sturgeon are growing and surviving in Segments 5 and 6. Growth rates of pallid sturgeon recaptured in Segments 5 and 6 during 2013 (length: 0.07 mm/d to 0.24 mm/d; weight: 0.23 g/d to 0.55 g/d) were similar to growth rates in other PSPAP segments during SY 2012 (length: 0.01 mm/d to 0.32 mm/d; weight: -0.09 g/d to 0.67 g/d; see Haddix et al. 2013; Huenemann and Steffensen 2013; Hunziker et al. 2013; Meyer et al. 2013; Niswonger et al. 2013; Steffensen and Huenemann 2013; Stukel et al. 2013; Wilson et al. 2013; Wrasse et al. 2013). Similarly, condition of hatchery-reared pallid sturgeon captured in Segments 5 and 6 in 2013 (approximately 0.8- 0.9) was consistent with Shuman et al. (2011) who found that condition stabilized near 0.94 and that condition was consistently lower in RPMAs 1 (above Fort Peck) and

3 (Segments 5 and 6) relative to RPMAs 2 (Fort Peck to Lake Sakakawea, including the Yellowstone River) and 4 (below Gavins Point Dam).

The decrease in condition of hatchery-reared pallid sturgeon upon capture is consistent with previous years. Shuman et al. (2011) observed that condition of juvenile pallid sturgeon declined following stocking throughout the Missouri River Basin but stabilized around 0.90 within three years. Most pallid sturgeon are stocked at condition values > 1.0, which may improve survival by providing excess energy reserves to enable the transition from the hatchery to the wild (Shuman et al. 2011).

The shovelnose sturgeon population in Segments 5 and 6 appears to be declining due to a lack of natural recruitment. Relative abundance of shovelnose sturgeon is low and decreasing, or stable depending on sampling gear used. Currently, the size structure is dominated by large individuals, suggesting that little, if any, recent natural recruitment has occurred. Additionally, evidence of shovelnose sturgeon recruitment in the past 15 years is lacking. Shuman et al. (2013) indicated that catch of two stock–length fish in 2010 was the first indication of past recruitment in Segments 5 and 6. However, the presence of these smaller fish may be due to abnormally low growth rates or transcription errors while taking measurements. Similar to our results, Jordan and Willis (2001) and Pierce et al. (2003) reported capturing only large (i.e. ≥ preferred-length) shovelnose sturgeon in Segments 5 and 6. Although lack of recruitment is evident, the size structure is shifting toward larger individuals and fish are in good condition, suggesting conditions in Segments 5 and 6 are suitable for shovelnose sturgeon growth and survival.

Sturgeon chub, shoal chub, and sicklefin chub are either rare in Segments 5 and 6 or we are unable to detect them. Prior to the collection of two sturgeon chubs in Segment 5 during 2012, sturgeon chub were considered extirpated from this section of the Missouri River (Hesse

1994). Sturgeon chub had not been previously collected during the PSPAP or in the Benthic Fish Study (Young et al. 1998; Shuman et al. 2013), and these were the first documented occurrences since the 1950's (Bailey and Allum 1962). Sicklefin chub and shoal chub have not been captured in Segments 5 and 6 during the PSPAP or by Berry and Young (2004) from 1996-1998. Additionally, these species have not been found in the Niobrara River (Wanner et al. 2009; Wanner et al. 2010) though flathead chubs *Platygobio gracilis* were commonly collected, a species only encountered during 2005, 2012, and 2013 in Segments 5 and 6 (Shuman et al. 2006b; Shuman et al. 2013). Similar to Segments 5 and 6, sturgeon chub, speckled chub, and sicklefin chub are rarely captured in the unchannelized reach below Gavins Point Dam (i.e., Segment 7; Stukel et al. 2013).

The sand shiner population appears stable or increasing in Segments 5 and 6. The relative abundance of sand shiner is low, but appears to have rebounded from the extremely low relative abundances observed in 2009 and 2010. The abundance of small individuals collected during the Fish Community Season indicates a strong year class in 2013 in Segments 5 and 6. Similar to Segments 5 and 6, relative abundance of sand shiner in Segment 7 decreased in 2009 and 2010, but has increased since 2010 (Stukel et al. 2013). Although the sand shiner populations in Segments 5-7 appear to follow similar trends, relative abundance of sand shiner is generally higher in Segment 7 than Segments 5 and 6 (Berry and Young 2004; see Stukel et al. 2013).

Hybognathus spp. are rare in Segments 5 and 6 and may be declining. The presence of smaller individuals (e.g., 30 mm) in our sampling suggests reproduction of brassy minnows and western silvery minnows has occurred, but the relative abundance of *Hybognathus* spp. has been decreasing since 2010. During three years of sampling (1996-1998), Berry and Young (2004) only collected two brassy minnows and classified the genus as rare in the Fort Randall reach of

the Missouri River. Similar to Segments 5 and 6, *Hybognathus* spp. are rare in Segment 7 (Stukel et al. 2013), although Berry and Young (2004) collected 82 brassy minnow in this reach during their study.

Blue sucker are likely rare in Segments 5 and 6, with only a few large individuals sampled, suggesting natural reproduction and recruitment is limited. The only evidence of blue sucker recruitment in Segments 5 and 6 was the presence of five yolk-sac larvae collected in 2003 (R. Klumb, USFWS, unpublished data) and one 203 mm fish in 2007 (Shuman et al. 2013). In the other ten years of monitoring, blue suckers < 600 mm TL were not caught in Segments 5 and 6. Similar to our results, few small (< 250 mm TL) blue suckers have been captured in other segments of the Missouri River (Eder and Steffensen 2010; Haddix et al. 2010a, 2010b; Horner et al. 2010; Niswonger et al. 2010; Steffensen 2010; Stukel et al. 2010; Wilson et al. 2010) except downstream of the Big Sioux River in Segment 8 during 2006 (Hamel and Steffensen 2007). The low catch rates of small blue suckers in the Missouri River suggest that habitats used by early life stages are poorly known, poorly sampled, or that suitable spawning conditions in the Missouri River are limited.

The sauger population appears be declining, potentially due to limited natural recruitment or high mortality rates. Relative abundance is low across all sampling gears and decreasing across all gears except mini-fyke nets. The presence of multiple size-classes suggests some natural reproduction and recruitment of sauger occurs in Segments 5 and 6, but the low and declining relative abundance of large sauger suggest high mortality rates of sauger, with few sexually mature fish (i.e., based on length ≥249 mm; Bozek et al. 2011) present. Although sauger are a commonly sought after sportfish (Schmalz et al. 2011), it is unlikely that the lack of large sauger is due to angler exploitation because a 381-mm minimum length limit currently limits sauger harvest in Segments 5 and 6. Additionally, a noticeable change in sauger

abundance near the minimum length is not apparent (i.e., there is no stockpiling of fish <381 mm). In addition to low abundance of sexually mature fish, sauger recruitment may be limited by hydrological conditions and hybridization in Segments 5 and 6. Van Zee (1996) found that age-0 sauger abundance in Lewis and Clark Lake was positively associated with discharge from Fort Randall and Gavins Point Dams. Recruitment of sauger in Segments 5 and 6 may also be reduced by sauger hybridization with walleye. Hybridization between walleye and sauger occurs frequently in Lewis and Clark Lake, as 21% of fish examined were identified as hybrids that occurred in multiple year classes (Graeb 2006).

Numerous non-target species that were common (i.e., > 50 individuals) in Segments 5 and 6 during 2013 were also common in 1996-1998 (Berry and Young 2004) including river carpsucker, channel catfish, bluegill, red shiner, spotfin shiner, and emerald shiner. Species that were common in 2013 but not in 1996-1998 (Berry and Young 2004) include silver chub, bluntnose minnow, black crappie, and shorthead redhorse. Species that were common in 1996-1998 (Berry and Young 2004) but not in 2013 include goldeye, gizzard shad, common carp, largemouth bass, smallmouth bass, white crappie, Johnny darter, yellow perch, and walleye. Many of these species prefer lentic conditions and decline in these species may be due to recent hydrological conditions (e.g., the 2011 flood) that decreased lentic habitat in Segments 5 and 6.

The lack of some target species (e.g., *Macrhybopsis* spp.) and small-sized shovelnose sturgeon and blue sucker in our sampling is possibly due to an absence or low abundance of these fishes in Segments 5 and 6 rather than sampling inefficiency. *Macrhybopsis* spp., and small-sized shovelnose sturgeon and blue sucker are rare or absent in our sampling, but are collected with standard sampling gears in other segments (e.g., Eder and Steffensen 2010; Haddix et al. 2010a; Haddix et al. 2010b; Herman et al. 2010; Horner et al. 2010; Niswonger et al. 2010; Plauck et al. 2010; Steffensen 2010; Wilson et al. 2010; Meyer et al. 2013; Stukel et al.

2013; Wrasse et al. 2013). However, differences in fish habitat use and sampling efficiency between segments may account for differences in species composition and abundance in standard gears rather than true differences in fish assemblages.

Variability in our relative abundance data limits our ability to detect changes in relative abundance. Variability in our relative abundance data is high (often as large as or larger than the mean) across species and gears in Segments 5 and 6 and may reflect changes in catchability rather than true changes in abundance. With current standardized sampling effort, statistical power (β) to detect a 5% annual decline in pallid sturgeon abundance with gillnets over 20 years within Segments 5 and 6 was low (approximately 0.2; Bryan et al. 2009). However, this power analysis only used data from 2003-2005, when collectively few pallid sturgeon were stocked (Appendix E) and recaptured compared to recent years. Additionally, statistical power to detect a 3-5% annual decline in pallid sturgeon abundance over 20 years with trammel nets was 0.2-0.4 (Bryan et al. 2009). Statistical power was higher for more common species: power to detect a 5% annual decline in shovelnose sturgeon abundance over 20 years was ≥ 0.7 for trammel nets and otter trawls with current sampling effort (Bryan et al. 2009). Similarly, statistical power to detect a 5% annual decline in sauger abundance over 20 years with trammel nets was about 0.8 and ranged from 0.6-0.7 for gill nets (Bryan et al. 2009).

The Niobrara River appears to have substantial effects on the fish assemblage in Segments 5 and 6, perhaps due to increased water temperature, turbidity, and physical habitat diversity. Multiple target species, including pallid sturgeon, shovelnose sturgeon, sauger, and sand shiner, have primarily been collected in Segment 6 and the braided channel macrohabitat associated with the Niobrara River delta. Additionally, Spindler et al. (2009) detected three significant clusters of pallid sturgeon presence: one located one mile downstream of the Niobrara River confluence, and the other two in braided channels within the Niobrara River Delta near

rkm 1,336 (rm 830). The Niobrara River confluence and Segment 6 also account for a large percentage of the channel catfish, emerald shiner, river carpsucker, and black crappie collected in Segments 5 and 6. Graeb et al. (2009) found that sauger spawning locations have shifted from the clear, coldwater habitats below Fort Randall Dam to the warmer, more turbid waters of the Niobrara River delta following the delta formation.

In addition to altering mainstem habitat conditions, the Niobrara River and its confluence may provide valuable habitat for imperiled Missouri River fishes. In 2013, we caught 22 pallid sturgeon near the Niobrara River confluence (i.e., Segment 5 Bend 17 and Segment 6 Bend 1). In 2009, Wanner et al. (2010) collected an age-1 hatchery propagated pallid sturgeon (FL=388 mm, 109 g) in a trammel net near rkm 7 of the Niobrara River. Additionally, age-3 and age-6 pallid sturgeon were collected in the Niobrara River in 2008 indicating pallid sturgeon use the lower reaches of this tributary (Wanner et al. 2009).

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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 (AFS 1991). Asterisks and bold type denote targeted native Missouri River species.

Scientific name	Common name	Letter Code
CLASS CEPHALASPIDOMORPHI-LAMPREYS		
ORDER PETROMYZONTIFORMES		
Petromyzontidae – lampreys		
Ichthyomyzon castaneus	Chestnut lamprey	CNLP
Ichthyomyzon fossor	Northern brook lamprey	NBLP
Ichthyomyzon unicuspis	Silver lamprey	SVLP
Ichthyomyzon gagei	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
CLASS OSTEICHTHYES – BONY FISHES		
ORDER ACIPENSERIFORMES		
Acipenseridae – sturgeons		
Acipenser fulvescens	Lake sturgeon	LKSG
Scaphirhynchus spp.	Unidentified Scaphirhynchus	USG
Scaphirhynchus albus	**Pallid sturgeon**	**PDSG***
Scaphirhynchus platorynchus	**Shovelnose sturgeon**	**SNSG***
S. albus X S. platorynchus	Pallid-shovelnose hybrid	SNPD
Polyodontidae – paddlefishes		
Polyodon spathula	Paddlefish	PDFH
ORDER LEPISOSTEIFORMES		
Lepisosteidae – gars		
Lepisosteus oculatus	Spotted gar	STGR
Lepisosteus osseus	Longnose gar	LNGR
Lepisosteus platostomus	Shortnose gar	SNGR
ORDER AMMIFORMES		
Amiidae – bowfins		
Amia calva	Bowfin	BWFN
ORDER OSTEOGLOSSIFORMES		
Hiodontidae – mooneyes		
Hiodon alosoides	Goldeye	GDEY

Scientific name	Common name	Letter Code
Hiodon tergisus	Mooneye	MNEY
	ORDER ANGUILLIFORMES	
	Anguillidae – freshwater eels	
Anguilla rostrata	American eel	AMEL
	ORDER CLUPEIFORMES	
	Clupeidae – herrings	
Alosa alabame	Alabama shad	ALSD
Alosa chrysochloris	Skipjack herring	SJHR
Alosa pseudoharengus	Alewife	ALWF
Dorosoma cepedianum	Gizzard shad	GZSD
Dorosoma petenense	Threadfin shad	TFSD
D. cepedianum X D. petenense	Gizzard-threadfin shad hybrid	GSTS
	ORDER CYPRINIFORMES	
	Cyprinidae – carps and minnows	
Campostoma anomalum	Central stoneroller	CLSR
Campostoma oligolepis	Largescale stoneroller	LSSR
Carassius auratus	Goldfish	GDFH
Carassus auratus X Cyprinius carpio	Goldfish-Common carp hybrid	GFCC
Couesius plumbens	Lake chub	LKCB
Ctenopharyngodon idella	Grass carp	GSCP
Cyprinella lutrensis	Red shiner	RDSN
Cyprinella spiloptera	Spotfin shiner	SFSN
Cyprinus carpio	Common carp	CARP
Erimystax x-punctatus	Gravel chub	GVCB
Hybognathus argyritis	**Western slivery minnow**	**WSMN***
Hybognathus hankinsoni	Brassy minnow	BSMN
Hybognathus nuchalis	Mississippi silvery minnow	SVMW
Hybognathus placitus	**Plains minnow**	**PNMW***
Hybognathus spp.	Unidentified Hybognathus	HBNS
Hypophthalmichthys molitrix	Silver carp	SVCP
Hypophthalmichthys nobilis	Bighead carp	BHCP
Luxilus chrysocephalus	Striped shiner	SPSN
Luxilus cornutus	Common shiner	CMSN
Luxilus zonatus	Bleeding shiner	BDSN
Lythrurus unbratilis	Western redfin shiner	WRFS
Macrhybopsis aestivalis	**Shoal chub**	**SKCB***
Macrhybopsis gelida	**Sturgeon chub**	**SGCB***
Macrhybopsis meeki	**Sicklefin chub**	**SFCB***
Macrhybopsis storeriana	Silver chub	SVCB
M. aestivalis X M. gelida	Shoal-Sturgeon chub hybrid	SPST
M. gelida X M. meeki	Sturgeon-Sicklefin chub hybrid	SCSC

Scientific name	Common name	Letter Code
Macrhybopsis spp.	Unidentified chub	UHY
Margariscus margarita	Pearl dace	PLDC
Mylocheilus caurinus	Peamouth	PEMT
Nocomis biguttatus	Hornyhead chub	HHCB
Notemigonus crysoleucas	Golden shiner	GDSN
Notropis atherinoides	Emerald shiner	ERSN
Notropis blennius	River shiner	RVSN
Notropis boops	Bigeye shiner	BESN
Notropis buchanani	Ghost shiner	GTSN
Notropis dorsalis	Bigmouth shiner	BMSN
Notropis greenei	Wedgespot shiner	WSSN
	Cyprinidae – carps and minnows	
Notropis heterolepsis	Blacknose shiner	BNSN
Notropis hudsonius	Spottail shiner	STSN
Notropis nubilus	Ozark minnow	OZMW
Notropis rubellus	Rosyface shiner	RYSN
Notropis shumardi	Silverband shiner	SBSN
Notropis stilbius	Silverstripe shiner	SSPS
Notropis stramineus	**Sand shiner**	**SNSN***
Notropis topeka	Topeka shiner	TPSN
Notropis volucellus	Mimic shiner	MMSN
Notropis wickliffi	Channel shiner	CNSN
Notropis spp.	Unidentified shiner	UNO
Opsopoeodus emiliae	Pugnose minnow	PGMW
Phenacobius mirabilis	Suckermouth minnow	SMMW
Phoxinus eos	Northern redbelly dace	NRBD
Phoxinus erythrogaster	Southern redbelly dace	SRBD
Phoxinus neogaeus	Finescale dace	FSDC
Pimephales notatus	Bluntnose minnow	BNMW
Pimephales promelas	Fathead minnow	FHMW
Pimephales vigilax	Bullhead minnow	BHMW
Platygobio gracilis	Flathead chub	FHCB
P. gracilis X M. meeki	Flathead-sicklefin chub hybrid	FCSC
Rhinichthys atratulus	Blacknose dace	BNDC
Rhinichthys cataractae	Longnose dace	LNDC
Richardsonius balteatus	Redside shiner	RDSS
Scardinius erythrophthalmus	Rudd	RUDD
Semotilus atromaculatus	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
	Unidentified Asian Carp	UAC
	Catostomidae - suckers	
Carpiodes carpio	River carpsucker	RVCS
Carpiodes cyprinus	Quillback	QLBK

Scientific name	Common name	Letter Code
Carpiodes velifer	Highfin carpsucker	HFCS
Carpiodes spp.	Unidentified Carpiodes	UCS
Catostomus catostomus	Longnose sucker	LNSK
Catostomus commersonii	White sucker	WTSK
Catostomus platyrhynchus	Mountain sucker	MTSK
Catostomus spp.	Unidentified *Catostomus* spp.	UCA
Cycleptus elongatus	**Blue sucker**	**BUSK***
Hypentelium nigricans	Northern hog sucker	NHSK
Ictiobus bubalus	Smallmouth buffalo	SMBF
Ictiobus cyprinellus	Bigmouth buffalo	BMBF
Ictiobus niger	Black buffalo	BKBF
Ictiobus spp.	Unidentified buffalo	UBF
Minytrema melanops	Spotted sucker	SPSK
Moxostoma anisurum	Silver redhorse	SVRH
Moxostoma carinatum	River redhorse	RVRH
Moxostoma duquesnei	Black redhorse	BKRH
Moxostoma erythrurum	Golden redhorse	GDRH
Moxostoma macrolepidotum	Shorthead redhorse	SHRH
Moxostoma spp.	Unidentified redhorse	URH
Catostomidae - suckers	Unidentified Catostomidae	UCT
	ORDER SILURIFORMES	
	Ictaluridae – bullhead catfishes	
Ameiurus melas	Black bullhead	BKBH
Ameiurus natalis	Yellow bullhead	YLBH
Ameiurus nebulosus	Brown bullhead	BRBH
Ameiurus spp.	Unidentified bullhead	UBH
Ictalurus furcatus	Blue catfish	BLCF
Ictalurus punctatus	Channel catfish	CNCF
I. furcatus X I. punctatus	Blue-channel catfish hybrid	BCCC
Ictalurus spp.	Unidentified *Ictalurus* spp.	UCF
Noturus exilis	Slender madtom	SDMT
Noturus flavus	Stonecat	STCT
Noturus gyrinus	Tadpole madtom	TPMT
Noturus nocturnus	Freckled madtom	FKMT
Pylodictis olivaris	Flathead catfish	FHCF
	ORDER SALMONIFORMES	
	Esocidae - pikes	
Esox americanus vermiculatus	Grass pickerel	GSPK
Esox lucius	Northern pike	NTPK
Esox masquinongy	Muskellunge	MSKG
E. lucius X E. masquinongy	Tiger Muskellunge	TGMG
	Umbridae - mudminnows	

Scientific name	Common name	Letter Code
Umbra limi	Central mudminnow	MDMN
	Osmeridae - smelts	
Osmerus mordax	Rainbow smelt	RBST
	Salmonidae - trouts	
Coregonus artedi	Lake herring or cisco	CSCO
Coregonus clupeaformis	Lake whitefish	LKWF
Oncorhynchus aguabonita	Golden trout	GDTT
Oncorhynchus clarkii	Cutthroat trout	CTTT
Oncorhynchus kisutch	Coho salmon	CHSM
Oncorhynchus mykiss	Rainbow trout	RBTT
Oncorhynchus nerka	Sockeye salmon	SESM
Oncorhynchus tshawytscha	Chinook salmon	CNSM
Prosopium cylindraceum	Bonneville cisco	BVSC
Prosopium williamsoni	Mountain whitefish	MTWF
Salmo trutta	Brown trout	BNTT
Salvelinus fontinalis	Brook trout	BKTT
Salvelinus namaycush	Lake trout	LKTT
Thymallus arcticus	Arctic grayling	AMGL
	ORDER PERCOPSIFORMES	
	Percopsidae – trout-perches	
Percopsis omiscomaycus	Trout-perch	TTPH
	ORDER GADIFORMES	
	Gadidae - cods	
Lota lota	Burbot	BRBT
	ORDER ATHERINIFORMES	
	Cyprinodontidae - killifishes	
Fundulus catenatus	Northern studfish	NTSF
Fundulus diaphanus	Banded killifish	BDKF
Fundulus notatus	Blackstripe topminnow	BSTM
Fundulus olivaceus	Blackspotted topminnow	BPTM
Fundulus sciadicus	Plains topminnow	PTMW
Fundulus zebrinus	Plains killifish	PKLF
	Poeciliidae - livebearers	
Gambusia affinis	Western mosquitofish	MQTF
	Atherinidae - silversides	
Labidesthes sicculus	Brook silverside	BKSS
	ORDER GASTEROSTEIFORMES	

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

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

Scientific name	Common name	Letter Code
Apalone mutica	Smooth Softshell Turtle	SMST
Apalone spinifera	Spiny Softshell Turtle	SNST
Terrapene ornata ornata	Ornate Box Turtle	ORBT
Sternotherus odoratus	Stinkpot Turtle	SPOT
Graptemys geographica	Map Turtle	MAPT
Graptemys kohnii	Mississippi Map Turtle	MRMT
Graptemys ouachitensis	Ouachita Map Turtle	OUMT
Pseudemys concinna metteri	Missouri River Cooter Turtle	MRCT
Terrapene carolina triunguis	Three-toed Box Turtle	TTBT

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes in Segments 5 and 6 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for Segments 5 and 6. Two seasons are sampled: 1) the sturgeon season (ST) extends from fall through spring (October 1-June 30) and 2) fish community season (FC) in summer (July 1-September 30). Detailed gear descriptions and specifications provided in Welker and Drobish (2012b).

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
Trammel Net – 1-Inch inner mesh	TN	Standard	Both Seasons	2003 - Present	Fish / 100 m drift
Otter Trawl – 16 ft head rope	OT16	Standard	Both Seasons	2003 - Present	Fish / 100 m trawled
Mini-Fyke Net	MF	Standard	Fish Comm.	2003 - Present	Fish / net night
Beam Trawl	BT	Standard	Both Seasons	2003 - 2004	Fish / 100 m trawled
Hoop Net – 4 ft.	HN	Standard	Both Seasons	2003 - 2004	Fish / net night
Trammel Net – 2.5” inner mesh	TN25	Standard	Sturgeon	2005 – 2006	Fish / 100 m drift
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 – 2005	Fish / 100 m^2
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Bag seine – rectangular method pulled downstream	BSRD	Standard	Fish Comm.	2003 - 2005	Fish / 100 m^2
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Evaluation	Fish Comm.	2005 - 2006	Fish / 100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2006 - 2007	Fish / m trawled
Trot Line[d]	TL	Standard	Both Seasons	2010 - Present	Fish / 20 hook night

[a]Beam trawls were a standard gear from 2003 - 2004 and dropped as a standard gear in 2005.
[b]Bag seines were a standard gear from 2003 – 2005 and dropped as a standard gear in 2006.
[c]Hoop nets were a standard gear from 2003 – 2004 and dropped as a standard gear in 2005 but still used in Segments 5 and 6.
[d]Trot lines were an experimental gear during 2009.

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 Segments 5 and 6 of the Missouri River (RPMA 3).

Year	Stocking site[a]	Number stocked	Year class	Stocking date	Age at stocking	Primary mark	Secondary mark
2000	VER	416	1997	6/6/2000	Age - 3	PIT	Elastomer / Dangler
2000	VER	4	Adults[c,]	7/6/2000	Unknown - Adult	Sonic tag[d]	PIT
2000	RNW	2	Adults[c]	7/6/2000	Unknown - Adult	PIT	
2000	VER	22	1997	8/2/2000	Age - 3	Sonic tag[b]	PIT
2000	VER	98	1998	9/20/2000	Age - 2	PIT	
2000	VER	3	Adults[c,]	9/20/2000	Unknown - Adult	2 w/ sonic tags[d]	PIT
2002	VER	558	2001	4/21/2002	Age - 1	PIT	Elastomer
2002	SUN	181	1999	4/27/2002	Age - 3	PIT	Elastomer
2003	STB	300	2002	7/26/2003	Age - 1	PIT	Elastomer
2003	SUN	301	2002	7/26/2003	Age - 1	PIT	Elastomer
2004	SUN	244	2003	10/7/2004	Age - 1	PIT	Elastomer
2004	STB	271	2003	10/7/2004	Age - 1	PIT	Elastomer
2005	RNW	868	2004	8/30/2005	Age - 1	PIT	Elastomer
2006	STB	1,005	2005	8/25/2006	Age - 1	PIT	Elastomer
2006	Sand Creek	3	Adults[c]	12/8/2006	Unknown - Adult	PIT	
2007	STB	600	2006	5/9/2007	Age - 1	3rd right scute	Elastomer
2008	STB	600	2007	4/17/2008	Age - 1	PIT	4th left scute
2008	SUN	569	2007	5/8/2008	Age - 1	PIT	3rd and 4th left scute[e]
2008	STB	3,410	2008	9/14/2008	Age - 0	Elastomer[f]	
2009	STB	340	2008	4/13/2009	Age - 1	4th right scute	Elastomer
2009	VER	297	2008	5/28/2009	Age - 1	PIT	4th right scute
2010	VER	491	2009	4/15/2010	Age - 1	PIT	5th Left scute
2010	VER	3	2009	4/15/2010	Age - 1	5th left scute	
2010	VER	144	2009	4/22/2010	Age - 1	PIT	5th left scute
2010	VER	210	2009	4/22/2010	Age - 1	5th left scute	Elastomer
2010	VER	12	2004	10/29/2010	Age - 6	Sonic tag[g]	PIT
2010	VER	1	2004	10/29/2010	Age - 6	PIT	

Year	Stocking site[a]	Number stocked	Year class	Stocking date	Age at stocking	Primary mark	Secondary mark
2010	RNW	12	2004	10/29/2010	Age - 6	Sonic tag[g]	PIT
2010	RNW	1	2004	10/29/2010	Age - 6	PIT	
2011	VER	220	2010	4/12/2011	Age - 1	5th right scute	
2011	VER	75	2010	4/12/2011	Age - 1	Elastomer	
2011	RNW	152	2010	4/12/2011	Age - 1	5th right scute	
2011	RNW	152	2010	4/12/2011	Age - 1	Elastomer	
2011	VER	27	2010	5/13/2011	Age - 1	Sonic tag[g]	PIT
2011	VER	9	2010	5/13/2011	Age - 1	PIT	
2013	RNW	2	1997	5/29/2013	Age - 16	Sonic tag[g]	PIT
2013	RNW	8	2003	5/29/2013	Age - 10	Sonic tag[g]	PIT
2013	RNW	3	2006	5/29/2013	Age - 7	Sonic tag[g]	PIT
2013	Springfield	3	1997	5/29/2013	Age - 16	Sonic tag[g]	PIT
2013	Springfield	2	2003	5/29/2013	Age - 10	Sonic tag[g]	PIT
2013	Springfield	1	2006	5/29/2013	Age - 7	Sonic tag[g]	PIT
2013	SSB	3	1997	5/29/2013	Age - 16	Sonic tag[g]	PIT
2013	SSB	4	2003	5/29/2013	Age - 10	Sonic tag[g]	PIT
2013	VER	1	1997	5/29/2013	Age - 16	Sonic tag[g]	PIT
2013	VER	11	2003	5/29/2013	Age - 10	Sonic tag[g]	PIT
2013	VER	1	2006	5/29/2013	Age - 7	Sonic tag[g]	PIT
2013	RNW	15	2010	5/29/2013	Age - 3	Sonic tag[g]	PIT
2013	VER	11	2010	5/29/2013	Age - 3	Sonic tag[g]	PIT
2013	Springfield	7	2010	5/31/2013	Age - 3	Sonic tag[g]	PIT
2013	SSB	6	2010	5/31/2013	Age - 3	Sonic tag[g]	PIT
2013	RNW	27	2012	9/9/2013	Age - 1	PIT	
2013	VER	26	2012	9/10/2013	Age - 1	PIT	
2013	SUN	29	2012	9/10/2013	Age - 1	PIT	

[a]Stocking site abbreviation presented in Appendix D.
[b]Stocked for telemetry study by Jordan et al. (2006).
[c] Translocated fish from Lake Sharpe, South Dakota.

[d]Stocked for telemetry study by Wanner et al. (2007c).
[e]Only about 100 fish had wrong scute removed (3rd left) and had correct scute (4th left) also removed.
[f]2008 year class had approximately 300 fish (< 10%) incorrectly tagged with purple elastomer on left and yellow on right. Yellow last used as year class designation in 2005.
[g]Stocked for catchability/detectability study (Klumb et al. 2011).

Appendix F

Total catch, overall mean catch per unit effort (2SE), and mean CPUE (fish/100 m) by mesohabitat within a macrohabitat for all species caught with each gear type combining the sturgeon (fall through spring) and fish community (summer) seasons for Segments 5 and 6 of the Missouri River during 2012. Species captured are listed alphabetically and their codes are presented in Appendix A. Bold type indicates targeted native Missouri River species and habitat abbreviations and definitions are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. Gill net catch, relative abundance (CPUE as fish/net night) with variation (2SE in parentheses) river wide and for habitats sampled in Segments 5 and 6 of the Missouri River during 2013.

Species	Total Catch	Overall CPUE	BRAD		CHXO	ISB	OSB	SCCL
			CHNB	ITIP	CHNB	CHNB	CHNB	CHNB
CARP	1	0.010	0.000	0.000	0.000	0.071	0.000	0.000
		(0.020)	(0.000)	(0.000)	(0.000)	(0.143)	(0.000)	(0.000)
CNCF	5	0.050	0.061	0.000	0.000	0.143	0.000	0.000
		(0.044)	(0.069)	(0.000)	(0.000)	(0.194)	(0.000)	(0.000)
NTPK	6	0.060	0.082	0.000	0.077	0.000	0.000	0.111
		(0.069)	(0.128)	(0.000)	(0.154)	(0.000)	(0.000)	(0.222)
PDSG	**18**	**0.180**	**0.204**	**0.000**	**0.077**	**0.286**	**0.214**	**0.000**
		(0.100)	**(0.165)**	**(0.000)**	**(0.154)**	**(0.327)**	**(0.228)**	**(0.000)**
QLBK	1	0.010	0.000	0.000	0.000	0.071	0.000	0.000
		(0.020)	(0.000)	(0.000)	(0.000)	(0.143)	(0.000)	(0.000)
SGER	**6**	**0.060**	**0.122**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
		(0.056)	**(0.111)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
SGWE	1	0.010	0.020	0.000	0.000	0.000	0.000	0.000
		(0.020)	(0.041)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SHRH	22	0.220	0.122	0.000	0.077	0.786	0.286	0.000
		(0.129)	(0.095)	(0.000)	(0.154)	(0.669)	(0.441)	(0.000)
SNSG	**12**	**0.120**	**0.204**	**0.000**	**0.077**	**0.000**	**0.071**	**0.000**
		(0.082)	**(0.154)**	**(0.000)**	**(0.154)**	**(0.000)**	**(0.143)**	**(0.000)**
WLYE	5	0.050	0.061	0.000	0.000	0.000	0.143	0.000
		(0.052)	(0.091)	(0.000)	(0.000)	(0.000)	(0.194)	(0.000)

Appendix F2. 1-Inch trammel net catch and relative abundance (CPUE as fish/100 m) with variation (2SE in parentheses) river wide and for habitats sampled in Segments 5 and 6 of the Missouri River during 2013.

Species	Total Catch	Overall CPUE	BRAD CHNB	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
BMBF	2	0.006	0.014	0.000	0.000	0.000	0.000	0.000
		(0.008)	(0.021)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BUSK	**1**	**0.003**	**0.000**	**0.000**	**0.053**	**0.000**	**0.000**	**0.000**
		(0.005)	**(0.000)**	**(0.000)**	**(0.105)**	**(0.000)**	**(0.000)**	**(0.000)**
CARP	13	0.038	0.033	0.031	0.000	0.147	0.000	0.029
		(0.024)	(0.026)	(0.062)	(0.000)	(0.175)	(0.000)	(0.041)
CNCF	123	0.330	0.318	0.185	0.000	0.095	0.334	0.650
		(0.118)	(0.134)	(0.144)	(0.000)	(0.106)	(0.393)	(0.445)
FHCF	1	0.004	0.009	0.000	0.000	0.000	0.000	0.000
		(0.008)	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDEY	1	0.003	0.007	0.000	0.000	0.000	0.000	0.000
		(0.005)	(0.014)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PDFH	1	0.002	0.000	0.000	0.000	0.000	0.000	0.011
		(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.023)
PDSG	**19**	**0.052**	**0.064**	**0.046**	**0.059**	**0.000**	**0.096**	**0.031**
		(0.029)	**(0.056)**	**(0.065)**	**(0.117)**	**(0.000)**	**(0.118)**	**(0.043)**
RVCS	5	0.015	0.011	0.027	0.000	0.067	0.000	0.000
		(0.013)	(0.016)	(0.055)	(0.000)	(0.092)	(0.000)	(0.000)
SGER	**15**	**0.047**	**0.058**	**0.037**	**0.000**	**0.038**	**0.028**	**0.059**
		(0.025)	**(0.039)**	**(0.074)**	**(0.000)**	**(0.076)**	**(0.056)**	**(0.072)**
SHRH	14	0.046	0.078	0.000	0.051	0.035	0.023	0.031
		(0.035)	(0.079)	(0.000)	(0.101)	(0.071)	(0.047)	(0.043)
SMBF	6	0.019	0.024	0.000	0.000	0.035	0.000	0.031
		(0.017)	(0.025)	(0.000)	(0.000)	(0.070)	(0.000)	(0.061)

Species	Total Catch	Overall CPUE	BRAD CHNB	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB
SMBS	1	0.002	0.000	0.000	0.000	0.000	0.019	0.000
		(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.038)	(0.000)
SNSG	**60**	**0.172**	**0.127**	**0.143**	**0.175**	**0.067**	**0.249**	**0.285**
		(0.060)	**(0.073)**	**(0.140)**	**(0.180)**	**(0.092)**	**(0.245)**	**(0.184)**
WLYE	4	0.010	0.026	0.000	0.000	0.000	0.000	0.000
		(0.010)	(0.025)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Appendix F3. Otter trawl catch and relative abundance (CPUE as fish/100 m) with variation (2SE in parentheses) river wide and for habitats sampled in Segments 5 and 6 of the Missouri River during 2013.

			BRAD		CHXO	CONF		ISB	OSB	SCCL
Species	Total Catch	Overall CPUE	BARS	CHNB	CHNB	BARS	CHNB	CHNB	CHNB	CHNB
BLGL	1	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
		(0.004)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BMSN	1	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000
		(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.030)	(0.000)
BUSK	**1**	**0.002**	**0.000**	**0.005**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
		(0.004)	**(0.000)**	**(0.011)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
CARP	12	0.031	0.000	0.048	0.014	0.000	0.229	0.000	0.000	0.000
		(0.030)	(0.000)	(0.066)	(0.029)	(0.000)	(0.297)	(0.000)	(0.000)	(0.000)
CKCB	1	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
		(0.005)	(0.000)	(0.012)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CNCF	49	0.115	0.000	0.131	0.114	0.000	0.053	0.126	0.099	0.108
		(0.038)	(0.000)	(0.062)	(0.113)	(0.000)	(0.106)	(0.120)	(0.086)	(0.106)
ERSN	235	0.504	0.000	0.000	0.000	0.000	0.119	0.000	0.000	3.987
		(0.947)	(0.000)	(0.000)	(0.000)	(0.000)	(0.238)	(0.000)	(0.000)	(7.558)
FHCB	1	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
		(0.004)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FSMT	1	0.003	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000
		(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)	(0.000)	(0.000)
FWDM	5	0.011	0.000	0.023	0.000	0.000	0.000	0.018	0.000	0.000
		(0.012)	(0.000)	(0.027)	(0.000)	(0.000)	(0.000)	(0.036)	(0.000)	(0.000)
GZSD	1	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
		(0.004)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
NTPK	1	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
		(0.004)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PDSG	**13**	**0.031**	**0.000**	**0.015**	**0.028**	**0.000**	**0.263**	**0.000**	**0.038**	**0.028**

			BRAD		CHXO	CONF		ISB	OSB	SCCL
Species	Total Catch	Overall CPUE	BARS	CHNB	CHNB	BARS	CHNB	CHNB	CHNB	CHNB
		(0.025)	**(0.000)**	**(0.022)**	**(0.057)**	**(0.000)**	**(0.419)**	**(0.000)**	**(0.054)**	**(0.056)**
QLBK	1	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000
		(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.030)	(0.000)
RVCS	4	0.009	0.000	0.011	0.000	0.000	0.000	0.032	0.000	0.000
		(0.008)	(0.000)	(0.016)	(0.000)	(0.000)	(0.000)	(0.044)	(0.000)	(0.000)
SGER	**21**	**0.047**	**0.000**	**0.051**	**0.000**	**0.000**	**0.000**	**0.059**	**0.074**	**0.068**
		(0.026)	**(0.000)**	**(0.043)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.066)**	**(0.095)**	**(0.094)**
SGWE	1	0.003	0.000	0.000	0.000	0.000	0.060	0.000	0.000	0.000
		(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.119)	(0.000)	(0.000)	(0.000)
SHRH	19	0.045	0.000	0.028	0.190	0.000	0.000	0.042	0.000	0.000
		(0.037)	(0.000)	(0.029)	(0.224)	(0.000)	(0.000)	(0.059)	(0.000)	(0.000)
SMBF	1	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000
		(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.030)	(0.000)
SMBS	1	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
		(0.005)	(0.000)	(0.012)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SNSG	**9**	**0.021**	**0.000**	**0.006**	**0.039**	**0.639**	**0.106**	**0.000**	**0.015**	**0.017**
		(0.016)	**(0.000)**	**(0.011)**	**(0.055)**	**(0.000)**	**(0.212)**	**(0.000)**	**(0.030)**	**(0.035)**
SNSN	**6**	**0.014**	**0.000**	**0.030**	**0.000**	**0.000**	**0.000**	**0.016**	**0.000**	**0.000**
		(0.017)	**(0.000)**	**(0.043)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.032)**	**(0.000)**	**(0.000)**
STCT	1	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
		(0.005)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SVCB	88	0.205	0.000	0.075	0.147	0.000	0.106	0.330	0.495	0.271
		(0.109)	(0.000)	(0.068)	(0.166)	(0.000)	(0.212)	(0.315)	(0.603)	(0.272)
UCS	1	0.002	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000
		(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.102)	(0.000)	(0.000)	(0.000)
UST	3	0.009	0.000	0.000	0.000	0.000	0.000	0.030	0.019	0.017
		(0.010)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.060)	(0.039)	(0.034)
WLYE	6	0.013	0.000	0.017	0.000	0.000	0.000	0.000	0.029	0.017
		(0.010)	(0.000)	(0.019)	(0.000)	(0.000)	(0.000)	(0.000)	(0.041)	(0.034)

			BRAD		CHXO	CONF		ISB	OSB	SCCL
Species	Total Catch	Overall CPUE	BARS	CHNB	CHNB	BARS	CHNB	CHNB	CHNB	CHNB
WTBS	2	0.005	0.000	0.011	0.000	0.000	0.000	0.000	0.000	0.000
		(0.006)	(0.000)	(0.016)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
YWPH	1	0.002	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
		(0.004)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Appendix F4. Mini-fyke net catch and relative abundance (CPUE as fish/net night) with variation (2SE in parentheses) river wide and for habitats sampled in Segments 5 and 6 of the Missouri River during 2013.

Species	Total Catch	Overall CPUE	BRAD BARS	CHXO BARS	CONF BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS	TRML BARS
BKCP	127	1.588	3.375	0.400	0.000	0.091	0.583	0.667	1.000	0.000	0.000
		(0.944)	(2.185)	(0.800)	(0.000)	(0.182)	(0.672)	(1.106)	(0.000)	(0.000)	(0.000)
BLGL	97	1.213	1.156	1.900	0.000	0.727	2.750	0.000	0.000	0.000	0.000
		(0.883)	(0.857)	(2.657)	(0.000)	(0.813)	(4.967)	(0.000)	(0.000)	(0.000)	(0.000)
BNMW	102	1.275	0.188	2.200	3.000	0.545	0.750	5.444	0.000	2.000	0.000
		(0.925)	(0.209)	(3.745)	(2.000)	(0.780)	(1.500)	(6.273)	(0.000)	(2.000)	(0.000)
BRBT	2	0.025	0.031	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.035)	(0.063)	(0.200)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BSMW	4	0.050	0.000	0.000	0.000	0.091	0.000	0.222	0.000	0.500	0.000
		(0.061)	(0.000)	(0.000)	(0.000)	(0.182)	(0.000)	(0.444)	(0.000)	(1.000)	(0.000)
CARP	2	0.025	0.031	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000
		(0.035)	(0.063)	(0.000)	(0.000)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)
CKCB	1	0.013	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000
		(0.025)	(0.000)	(0.000)	(0.000)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)
CNCF	7	0.088	0.031	0.100	0.000	0.182	0.167	0.000	0.000	0.000	1.000
		(0.073)	(0.063)	(0.200)	(0.000)	(0.244)	(0.333)	(0.000)	(0.000)	(0.000)	(0.000)
ERSN	119	1.488	1.250	0.600	0.500	1.000	1.250	5.111	0.000	0.000	0.000
		(1.250)	(1.440)	(0.611)	(1.000)	(1.321)	(1.258)	(9.727)	(0.000)	(0.000)	(0.000)
FHCB	1	0.013	0.000	0.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
		(0.025)	(0.000)	(0.000)	(1.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FSMT	24	0.300	0.000	1.500	0.500	0.091	0.333	0.222	1.000	0.000	0.000
		(0.381)	(0.000)	(3.000)	(1.000)	(0.182)	(0.376)	(0.294)	(0.000)	(0.000)	(0.000)
FWDM	2	0.025	0.031	0.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000
		(0.035)	(0.063)	(0.000)	(1.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDSN	1	0.013	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.025)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GNSF	9	0.113	0.031	0.000	0.500	0.000	0.083	0.000	0.000	3.000	0.000
		(0.155)	(0.063)	(0.000)	(1.000)	(0.000)	(0.167)	(0.000)	(0.000)	(6.000)	(0.000)
GZSD	41	0.513	0.719	0.000	0.000	0.000	0.000	2.000	0.000	0.000	0.000
		(0.518)	(0.747)	(0.000)	(0.000)	(0.000)	(0.000)	(3.756)	(0.000)	(0.000)	(0.000)
JYDR	13	0.163	0.125	0.300	0.000	0.000	0.333	0.111	0.000	0.500	0.000
		(0.115)	(0.149)	(0.600)	(0.000)	(0.000)	(0.376)	(0.222)	(0.000)	(1.000)	(0.000)

Species	Total Catch	Overall CPUE	BRAD BARS	CHXO BARS	CONF BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS	TRML BARS
LMBS	7	0.088	0.188	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000
		(0.089)	(0.209)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(1.000)	(0.000)
NTPK	3	0.038	0.000	0.100	0.000	0.000	0.083	0.111	0.000	0.000	0.000
		(0.043)	(0.000)	(0.200)	(0.000)	(0.000)	(0.167)	(0.222)	(0.000)	(0.000)	(0.000)
OSSF	16	0.200	0.344	0.000	0.000	0.000	0.000	0.000	0.000	0.500	4.000
		(0.193)	(0.408)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(1.000)	(0.000)
QLBK	2	0.025	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.035)	(0.087)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RDSN	51	0.638	0.000	0.200	13.500	0.000	0.417	0.222	1.000	2.000	10.000
		(0.661)	(0.000)	(0.267)	(21.000)	(0.000)	(0.672)	(0.294)	(0.000)	(4.000)	(0.000)
RKBS	7	0.088	0.000	0.000	0.000	0.000	0.333	0.333	0.000	0.000	0.000
		(0.073)	(0.000)	(0.000)	(0.000)	(0.000)	(0.376)	(0.333)	(0.000)	(0.000)	(0.000)
RVCS	179	2.238	0.656	3.700	0.000	0.091	0.083	0.333	0.000	9.500	97.000
		(2.598)	(0.966)	(6.339)	(0.000)	(0.182)	(0.167)	(0.471)	(0.000)	(19.000)	(0.000)
RVSN	3	0.038	0.063	0.000	0.000	0.000	0.000	0.111	0.000	0.000	0.000
		(0.043)	(0.087)	(0.000)	(0.000)	(0.000)	(0.000)	(0.222)	(0.000)	(0.000)	(0.000)
SFSN	439	5.488	2.500	8.100	15.500	2.545	2.333	20.222	0.000	4.500	0.000
		(3.489)	(1.951)	(13.147)	(13.000)	(2.884)	(3.156)	(24.644)	(0.000)	(9.000)	(0.000)
SGER	**16**	**0.200**	**0.469**	**0.000**	**0.000**	**0.000**	**0.083**	**0.000**	**0.000**	**0.000**	**0.000**
		(0.157)	**(0.370)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.167)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
SGWE	1	0.013	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.025)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SHRH	6	0.075	0.063	0.300	0.000	0.000	0.083	0.000	0.000	0.000	0.000
		(0.069)	(0.087)	(0.427)	(0.000)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)
SMBS	16	0.200	0.000	0.600	0.000	0.182	0.083	0.667	0.000	0.500	0.000
		(0.168)	(0.000)	(0.998)	(0.000)	(0.244)	(0.167)	(0.882)	(0.000)	(1.000)	(0.000)
SNGR	28	0.350	0.156	0.400	1.000	0.091	0.083	0.889	1.000	1.000	4.000
		(0.178)	(0.158)	(0.442)	(2.000)	(0.182)	(0.167)	(0.909)	(0.000)	(0.000)	(0.000)
SNPT	2	0.025	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.050)	(0.125)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SNSN	**157**	**1.963**	**0.375**	**0.800**	**18.000**	**0.091**	**5.333**	**0.333**	**2.000**	**15.000**	**1.000**
		(1.876)	**(0.308)**	**(1.108)**	**(32.000)**	**(0.182)**	**(10.133)**	**(0.667)**	**(0.000)**	**(30.000)**	**(0.000)**
STSN	23	0.288	0.000	0.400	0.000	0.182	0.000	1.889	0.000	0.000	0.000
		(0.388)	(0.000)	(0.800)	(0.000)	(0.244)	(0.000)	(3.290)	(0.000)	(0.000)	(0.000)
SVCB	1	0.013	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Species	Total Catch	Overall CPUE	BRAD BARS	CHXO BARS	CONF BARS	ISB BARS	OSB BARS	SCCL BARS	SCCS BARS	SCN BARS	TRML BARS
		(0.025)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
UCS	59	0.738	0.125	0.400	1.000	1.455	1.667	0.111	11.000	0.500	0.000
		(0.481)	(0.174)	(0.800)	(0.000)	(1.358)	(2.151)	(0.222)	(0.000)	(1.000)	(0.000)
UCY	2	0.025	0.031	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		(0.035)	(0.063)	(0.200)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ULP	2	0.025	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.500	0.000
		(0.035)	(0.000)	(0.000)	(0.000)	(0.000)	(0.167)	(0.000)	(0.000)	(1.000)	(0.000)
WLYE	5	0.063	0.063	0.100	0.000	0.091	0.000	0.111	0.000	0.000	0.000
		(0.065)	(0.125)	(0.200)	(0.000)	(0.182)	(0.000)	(0.222)	(0.000)	(0.000)	(0.000)
WSMW	4	0.050	0.000	0.000	0.000	0.000	0.000	0.444	0.000	0.000	0.000
		(0.100)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.889)	(0.000)	(0.000)	(0.000)
WTBS	5	0.063	0.063	0.100	0.000	0.000	0.167	0.000	0.000	0.000	0.000
		(0.054)	(0.087)	(0.200)	(0.000)	(0.000)	(0.225)	(0.000)	(0.000)	(0.000)	(0.000)
WTCP	2	0.025	0.031	0.000	0.000	0.000	0.000	0.111	0.000	0.000	0.000
		(0.035)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.222)	(0.000)	(0.000)	(0.000)
YWPH	2	0.025	0.031	0.000	0.000	0.000	0.000	0.111	0.000	0.000	0.000
		(0.035)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.222)	(0.000)	(0.000)	(0.000)

Appendix F5. Trot line catch and relative abundance (CPUE as fish/20 hook nights) with variation (2SE in parentheses) river wide and for habitats sampled in Segments 5 and 6 of the Missouri River during 2013.

Species	Total Catch	Overall CPUE	BRAD CHNB	CHXO CHNB	CONF CHNB	ISB CHNB	OSB CHNB	SCCL CHNB	TRMS CHNB
CARP	2	0.025	0.069	0.000	0.000	0.000	0.000	0.000	0.000
		(0.035)	(0.096)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CNCF	78	0.975	0.655	0.917	0.000	1.700	1.833	0.800	0.333
		(0.326)	(0.318)	(0.626)	(0.000)	(1.368)	(1.275)	(0.833)	(0.667)
FWDM	5	0.063	0.172	0.000	0.000	0.000	0.000	0.000	0.000
		(0.054)	(0.143)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PDSG	**52**	**0.650**	**0.966**	**0.333**	**0.000**	**0.500**	**0.750**	**0.600**	**0.000**
		(0.285)	**(0.557)**	**(0.449)**	**(0.000)**	**(0.537)**	**(1.019)**	**(0.680)**	**(0.000)**
SHRH	33	0.413	0.207	0.500	0.000	0.400	0.250	0.600	2.667
		(0.207)	(0.208)	(0.835)	(0.000)	(0.442)	(0.261)	(0.611)	(1.333)
SNSG	**10**	**0.125**	**0.103**	**0.167**	**0.000**	**0.400**	**0.083**	**0.000**	**0.000**
		(0.082)	**(0.152)**	**(0.225)**	**(0.000)**	**(0.327)**	**(0.167)**	**(0.000)**	**(0.000)**
STCT	1	0.013	0.000	0.083	0.000	0.000	0.000	0.000	0.000
		(0.025)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
WTSK	1	0.013	0.000	0.083	0.000	0.000	0.000	0.000	0.000
		(0.025)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

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 (fall through spring) and the fish community (summer) seasons during 2013 for Segments 5 and 6 of the Missouri River. Species codes are located in Appendix A. Bold type denotes targeted native Missouri River species.

	Sturgeon Season				Fish Community Season		
Species	1-Inch Trammel Net	Gill Net	Otter Trawl	Trot Line	1-Inch Trammel Net	Mini-Fyke Net	Otter Trawl
BKCP	0.000	0.000	0.000	0.000	0.000	1.588	0.000
BLGL	0.000	0.000	0.000	0.000	0.000	1.213	0.004
BMBF	0.004	0.000	0.000	0.000	0.007	0.000	0.000
BMSN	0.000	0.000	0.004	0.000	0.000	0.000	0.000
BNMW	0.000	0.000	0.000	0.000	0.000	1.275	0.000
BRBT	0.000	0.000	0.000	0.000	0.000	0.025	0.000
BSMW	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.050**	**0.000**
BUSK	**0.005**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.004**
CARP	0.047	0.010	0.051	0.025	0.030	0.025	0.011
CKCB	0.000	0.000	0.000	0.000	0.000	0.013	0.005
CNCF	0.390	0.050	0.157	0.975	0.270	0.088	0.074
ERSN	0.000	0.000	1.007	0.000	0.000	1.488	0.000
FHCB	0.000	0.000	0.000	0.000	0.000	0.013	0.004
FHCF	0.000	0.000	0.000	0.000	0.008	0.000	0.000
FSMT	0.000	0.000	0.006	0.000	0.000	0.300	0.000
FWDM	0.000	0.000	0.013	0.063	0.000	0.025	0.009
GDEY	0.000	0.000	0.000	0.000	0.005	0.000	0.000
GDSN	0.000	0.000	0.000	0.000	0.000	0.013	0.000
GNSF	0.000	0.000	0.000	0.000	0.000	0.113	0.000
GZSD	0.000	0.000	0.000	0.000	0.000	0.513	0.004
JYDR	0.000	0.000	0.000	0.000	0.000	0.163	0.000
LMBS	0.000	0.000	0.000	0.000	0.000	0.088	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NTPK	0.000	0.060	0.004	0.000	0.000	0.038	0.000
OSSF	0.000	0.000	0.000	0.000	0.000	0.200	0.000
PDFH	0.005	0.000	0.000	0.000	0.000	0.000	0.000
PDSG	**0.045**	**0.180**	**0.043**	**0.650**	**0.059**	**0.000**	**0.019**
QLBK	0.000	0.010	0.004	0.000	0.000	0.025	0.000
RDSN	0.000	0.000	0.000	0.000	0.000	0.638	0.000
RKBS	0.000	0.000	0.000	0.000	0.000	0.088	0.000
RVCS	0.014	0.000	0.013	0.000	0.016	2.238	0.004
RVSN	0.000	0.000	0.000	0.000	0.000	0.038	0.000
SFSN	0.000	0.000	0.000	0.000	0.000	5.488	0.000

	Sturgeon Season				Fish Community Season		
Species	1-Inch Trammel Net	Gill Net	Otter Trawl	Trot Line	1-Inch Trammel Net	Mini-Fyke Net	Otter Trawl
SGER	**0.059**	**0.060**	**0.029**	**0.000**	**0.034**	**0.200**	**0.065**
SGWE	0.000	0.010	0.005	0.000	0.000	0.013	0.000
SHRH	0.015	0.220	0.052	0.413	0.078	0.075	0.038
SMBF	0.015	0.000	0.004	0.000	0.023	0.000	0.000
SMBS	0.000	0.000	0.005	0.000	0.005	0.200	0.000
SNGR	0.000	0.000	0.000	0.000	0.000	0.350	0.000
SNPT	0.000	0.000	0.000	0.000	0.000	0.025	0.000
SNSG	**0.175**	**0.120**	**0.014**	**0.125**	**0.168**	**0.000**	**0.028**
SNSN	**0.000**	**0.000**	**0.028**	**0.000**	**0.000**	**1.963**	**0.000**
STCT	0.000	0.000	0.005	0.013	0.000	0.000	0.000
STSN	0.000	0.000	0.000	0.000	0.000	0.288	0.000
SVCB	0.000	0.000	0.109	0.000	0.000	0.013	0.301
UCS	0.000	0.000	0.000	0.000	0.000	0.738	0.004
UCY	0.000	0.000	0.000	0.000	0.000	0.025	0.000
ULP	0.000	0.000	0.000	0.000	0.000	0.025	0.000
UST	0.000	0.000	0.000	0.000	0.000	0.000	0.018
WLYE	0.000	0.050	0.004	0.000	0.021	0.063	0.021
WSMW	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.050**	**0.000**
WTBS	0.000	0.000	0.000	0.000	0.000	0.063	0.009
WTCP	0.000	0.000	0.000	0.000	0.000	0.025	0.000
WTSK	0.000	0.000	0.000	0.013	0.000	0.000	0.000
YWPH	0.000	0.000	0.004	0.000	0.000	0.025	0.000

Appendix I. Comprehensive list of bend numbers (randomly selected) and corresponding bend river miles for Segments 5 and 6 of the Missouri River sampled from 2003 to 2013 during the Sturgeon Season (ST), Fish Community Season (FC), or both seasons (B). A "(W)" indicates wild sampling.

Segment-bend	Bend river mile	Year										
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
5-1	880											
5-2	878.9						B					
5-3	875.7			FC				B			B	
5-4	873.2		ST				B					
5-5	871.9		ST			ST	B					B
5-6	870.7	B	FC		B	B			B		B	
5-7	869.2	B	B	B	B	B						ST
5-8	865.7				B				B			
5-9	864.4								B			
5-10	863.2	B	ST	ST		B		B				
5-11	861.5	ST (W)		FC	B	B						
5-12	853		B	B				B	B			B
5-13	851.7	ST (W)	FC									B
5-14	851				B		B				B	B
5-15	849.5	B	ST	ST				B	B		B	
5-16	847.9	ST (W)	ST	FC	(W)	B	B				B	
5-17	845.5	B	FC	ST				B				B
6-1	844		B	ST	B	B		B			B	B
6-2	843.2	B	ST	ST		ST						
6-3	842.5	ST (W)	FC				B					
6-4	841.2	B	B	B	B				B		B	B
6-5	840.3	B	B	ST					B			B
6-6	836.9	B	ST		B	B		B			B	
6-7	834.9	ST (W)	ST	B	B	B	B		B		B	B
6-8	832.5	B		FC	B	B		B	B			ST
6-9	830.5	ST (W)	B	FC			B		B			B
6-10	829.5	ST (W)		FC			B	B				
6-11	828.5	ST (W)				B	B	B			B	B

Appendix J. Amended pallid sturgeon length and weights at stocking and recapture, with recalculated growth rates and relative condition factors ($K_{n,}$) for 2003-2008 reports in Segments 5 and 6 of the Missouri River. Additional report (2009-2010) data provided for reference and continuity. Condition was recalculated using a new weight-length relation specific for the Missouri River presented in Shuman et al. (2011); whereas, previous reports used the equation from Keenlyne and Evenson (1993).

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
					2003				
1997	26	532	654	1.25	647	811	0.80	0.10	0.13
		(12)	(52)	(0.09)	(13)	(54)	(0.02)	(0.01)	(0.04)
1998	3	499	460	1.03	566	530	0.79	0.06	0.07
		(69)	(222)	(0.10)	(75)	(257)	(0.08)	(0.03)	(0.09)
1999	6	465	426	1.21	514	429	0.87	0.11	0.02
		(40)	(127)	(0.25)	(64)	(151)	(0.03)	(0.08)	(0.21)
2001	6	210			392	187	0.96	0.37	
		(16)			(25)	(38)	(0.04)	(0.07)	
2002	1	294	91	1.22	385	143	0.79	1.00	0.57
					2004				
1997	8	554	705	1.16	656	857	0.80	0.08	0.11
		(17)	(119)	(0.11)	(21)	(156)	(0.09)	(0.02)	(0.12)
1998	1	487	491	1.25	546	420	0.73	0.05	(0.05)
1999	6	477	519	1.29	540	478	0.85	0.10	(0.08)
		(52)	(173)	(0.20)	(45)	(103)	(0.05)	(0.03)	(0.12)
2001	3	213			402	204	0.93	0.24	
		(7)			(58)	(122)	(0.14)	(0.07)	
2002	3	234	52	1.42	350	133	0.99	0.32	0.22
		(24)	(19)	(0.08)	(27)	(32)	(0.06)	(0.10)	(0.06)
					2005				
1997	3	558	807	1.30	664	1034	0.93	0.06	0.13
		(30)	(183)	(0.06)	(70)	(350)	(0.07)	(0.03)	(0.10)
1998	2	508	485	1.08	580	530	0.76	0.04	0.03
		(3)	(7)	(0.01)	(10)	(20)	(0.07)	(0.00)	(0.14)
1999	2	426	267	1.02	470	385	1.03	0.05	0.13
		(64)	(147)	(0.07)	(79)	(330)	(0.37)	(0.02)	(0.20)
2001	8	182			465	349	0.93	0.20	
		(10)			(59)	(172)	(0.07)	(0.02)	
2002	7	235	52	1.42	449	325	1.02	0.29	0.36

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
		(16)	(12)	(0.06)	(63)	(24)	(0.13)	(0.056)	(0.15)
2003	10	332	158	1.32	415	223	0.91	0.25	0.19
		(32)	(44)	(0.10)	(39)	(67)	(0.09)	(0.06)	(0.14)
2004	7	302	111	1.36	351	145	1.08	1.25	0.87
		(11)	(13)	(0.06)	(11)	(18)	(0.09)	(0.09)	(0.39)
					2006				
1997	7	498	533	1.18	688	1096	0.89	0.09	0.26
		(55)	(185)	(0.161))	(19)	(113)	(0.05)	(0.02)	(0.10)
1999	1	393	200	1.03	606	710	0.88	0.14	0.34
2001	11	210			542	516	0.92	0.22	
		(15)			(20)	(59)	(0.03)	(0.02)	
2002	8	253	68	1.49	498	401	0.93	0.23	0.31
		(19)	(13)	(0.21)	(34)	(72)	(0.06)	(0.03)	(0.06)
2003	4	308	122	1.30	413	215	0.93	0.21	0.18
		(52)	(62)	(0.17)	(26)	(39)	(0.05)	(0.02)	(0.06)
2004	8	278	89	1.41	348	127	0.98	0.32	0.16
		(16)	(16)	(0.09)	(19)	(18)	(0.07)	(0.13)	(0.09)
					2007				
1997	9	543	682	1.19	755	1526	0.90	0.08	0.33
		(38)	(134)	(0.11)	(49)	(310)	(0.07)	(0.02)	(0.13)
1998	2	472	331	0.88	554	765	1.38	0.03	0.17
		(90)	(254)	(0.16)	(87)	(200)	(1.02)	0.00	(0.177))
1999	1	453	328	1.06	593	725	0.96	0.08	0.24
2001	10	224			521	458	0.92	0.17	
		(14)			(29)	(79)	(0.04)	(0.02)	
2002	17	243	58	1.38	501	432	0.97	0.19	0.27
		(12)	(10)	(0.10)	(24)	(71)	(0.04)	(0.02)	(0.05)
2003	17	319	127	1.26	490	387	0.94	0.18	0.27
		(19)	(22)	(0.06)	(23)	(52)	(0.04)	(0.01)	(0.04)
2004	20	294	103	1.33	435	256	0.89	0.21	0.22
		(15)	(16)	(0.09)	(23)	(49)	(0.09)	(0.04)	(0.06)
2005	12	322	147	1.45	396	210	1.02	0.23	0.18
		(23)	(34)	(0.11)	(26)	(50)	(0.07)	(0.04)	(0.10)
2006*	8	189	27	1.54	321	94	0.94	0.85	0.44
		(5)	(3)	(0.29)	(10)	(16)	(0.11)	(0.07)	(0.10)

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
					2008				
1997	12	534	630	1.17	792	1960	0.98	0.09	0.46
		(21)	(86)	(0.12)	(42)	(360)	(0.05)	(0.01)	(0.11)
1998	1	427	212	0.83	677	1000	0.86	0.09	0.28
		.	.		.	.	.	.	.
2001	19	194	.	.	616	803	0.94	0.18	.
		(12)		.	(23)	(80)	(0.04)	(0.02)	.
2002	21	251	60	1.33	540	522	0.91	0.16	0.25
		(12)	(8)	(0.05)	(21)	(80)	(0.05)	(0.01)	(0.04)
2003	10	318	126	1.23	523	453	0.91	0.16	0.26
		(30)	(34)	(0.05)	(20)	(56)	(0.06)	(0.02)	(0.03)
2004	12	322	136	1.33	480	343	0.89	0.15	0.20
		(18)	(26)	(0.09)	(24)	(58)	(0.04)	(0.03)	(0.06)
2005	11	313	126	1.35	446	260	0.87	0.22	0.22
		(20)	(26)	(0.10)	(21)	(47)	(0.10)	(0.06)	(0.10)
2006	1				392	190	0.99		
2007	5	262	61	1.13	305	106	0.99	0.13	(0.28)
		(26)	(30)	(0.19)	(84)	(104)	(0.45)	(0.05)	(1.053))
					2009				
1997	16	541	685	1.20	816	1978	0.89	0.09	0.41
		(18)	(107)	(0.13)	(38)	(274)	(0.02)	(0.01)	(0.08)
1998	3	460	309	0.92	540	515	0.93	0.03	0.07
		(37)	(150.7)	(0.179)	(30)	(50)	(0.077)	(0.001)	(0.03)
1999	4	426	258	0.98	653	933	0.89	0.09	0.27
		(41)	(101)	(0.13)	(44)	(228.6)	(0.07)	(0.02)	(0.06)
2001	27	203	.	.	608	784	0.93	0.16	.
		(11)	.	.	(23)	(92)	(0.02)	(0.02)	.
2002	21	252	62	1.36	588	688	0.92	0.17	0.31
		(10)	(8)	(0.05)	(23)	(89)	(0.03)	(0.01)	(0.04)
2003	18	322	127	1.23	521	443	0.90	0.12	0.20
		(12)	(15)	(0.03)	(16)	(40)	(0.02)	(0.01)	(0.03)
2004	31	296	107	1.41	487	374	0.93	0.14	0.19
		(10)	(7)	(0.08)	(14)	(36)	(0.03)	(0.01)	(0.03)
2005	22	315	133	1.36	457	305	0.95	0.14	0.18
		(14)	(22)	(0.08)	(16)	(32)	(0.03)	(0.02)	(0.03)
2006*	8	189	27	1.54	454	297	0.93	0.33	0.34

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
		(5)	(3)	(0.29)	(23)	(55)	(0.07)	(0.02)	(0.06)
2007	5	231	40	1.08	402	199	0.95	0.47	0.44
		(25)	(22)	(0.31)	(14)	(23)	(0.03)	(0.15)	(0.17)
2008	3	263	55	1.06	299	87	1.06	0.47	0.19
		(22)	(14)	(0.02)	(42)	(41)	(0.12)	(0.18)	(0.54)
					2010				
1997	6	560	699	1.12	858	2304	0.89	0.09	0.49
		(5)	(72)	(0.096)	(68)	(501)	(0.05)	(0.015)	(0.12)
1998	2	425	201	0.80	654	1020	0.96	0.07	0.24
		(4)	(7)	(0.00)	(179)	(710)	(0.17)	(0.05)	(0.19)
1999	2	388	147	0.79	595	665	0.88	0.07	0.18
		0	0	0.00	0	(30)	(0.04)	(0.00)	(0.01)
2001	19	206			597	747	0.95	0.13	
		(19)			(33)	(121)	(0.06)	(0.02)	
2002	17	247	62	1.43	566	622	0.95	0.13	0.21
		(13)	(11)	(0.07)	(22)	(81)	(0.02)	(0.01)	(0.03)
2003	10	337	155	1.28	544	533	0.93	0.10	0.19
		(27)	(36)	(0.12)	(28)	(87)	(0.03)	(0.01)	(0.04)
2004	24	298	112	1.41	505	432	0.97	0.12	0.18
		(9)	(12)	(0.06)	(9)	(26)	(0.03)	(0.01)	(0.02)
2005	28	312	130	1.40	496	402	0.95	0.14	0.20
		(14)	(18)	(0.07)	(14)	(33)	(0.03)	(0.01)	(0.03)
2006*	8	189	27	1.54	500	431	1.00	0.24	0.31
		(5)	(3)	(0.29)	(12)	(43)	(0.07)	(0.01)	(0.03)
2007	8	245	56	1.30	461	328	0.95	0.27	0.34
		(34)	(19)	(0.19)	(49)	(90)	(0.06)	(0.03)	(0.10)
2008*	7	330	112	1.03	415	220	0.93	0.29	0.39
					(28)	(46)	(0.03)		
2009*	7	294	97	1.28	273	84	1.30	0.45	0.35
		(13)	(22)	(0.12)	(54)	(39)	(0.18)	(0.14)	(0.12)
					2011				
1997	3	561	703	1.12	837	2170	0.90	0.08	0.45
		(11)	(160)	(0.18)	(118)	(927)	(0.05)	(0.13)	(0.32)
1998	1	427	212	0.83	736	1575	0.91	0.09	0.35
2001	12	203			630	900	0.96	0.14	
		(37)			(36)	(166)	(0.03)	(0.03)	

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
2002	13	233	46	1.31	611	768	0.93	0.13	0.26
		(11)	(7)	(0.08)	(30)	(112)	(0.09)	(0.01)	(0.04)
2003	4	301	108	1.34	534	528	0.99	0.10	0.18
		(13)	(6)	(0.12)	(41)	(115)	(0.08)	(0.01)	(0.05)
2004	8	293	109	1.46	551	556	0.95	0.13	0.22
		(18)	(20)	(0.11)	(32)	(70)	(0.12)	(0.02)	(0.04)
2005	10	330	151	1.39	540	507	0.92	0.13	0.21
		(14)	(16)	(0.16)	(25)	(49)	(0.08)	(0.02)	(0.03)
2006	4	189	27	1.54	558	533	0.87		
		(5)	(3)	(0.29)	(20)	(87)	(0.12)		
2007	9	246	54	1.26	537	464	0.87	0.26	0.37
		(13)	(12)	(0.11)	(36)	(62)	(0.11)	(0.04)	(0.07)
2008	4				492	301	0.74		
					(38)	(72)	(0.16)		
2009	4	283	85	1.23	379	159	0.91	0.34	0.26
		(30)	(35)	(0.12)	(23)	(36)	(0.07)	(0.23)	(0.17)
					2012				
1997	4	493	613	1.46	998	4139	1.00	0.12	0.81
		(60)	(212)	(0.21)	(47)	(359)	(0.14)	(0.02)	(0.11)
1998	3	436	229	0.83	770	1695	0.92	0.08	0.35
		(21)	(57)	(0.06)	(122)	(858)	(0.05)	(0.03)	(0.21)
2001	12	203			724	1340	0.91	0.14	
		(10)			(31)	(183)	(0.02)	(0.01)	
2002	8	263	72	1.36	692	1233	0.94	0.14	0.38
		(17)	(16)	(0.09)	(50)	(359)	(0.05)	(0.02)	(0.13)
2003	6	300	99	1.21	676	1072	0.89	0.14	0.35
		(18)	(22)	(0.07)	(56)	(300)	(0.03)	(0.02)	(0.10)
2004	5	320	139	1.37	679	1057	0.89	0.15	0.38
		(27)	(43)	(0.07)	(23)	(151)	(0.04)	(0.02)	(0.08)
2005	12	317	132	1.36	606	778	0.94	0.14	0.31
		(17)	(24)	(0.10)	(25)	(107)	(0.03)	(0.10)	(0.06)
2006*	8	189	27	1.54	624	786	0.89		
		(5)	(3)	(0.29)	(27)	(84)	(0.10)		
2007	7	231	46	1.29	581	645	0.90	0.22	0.36
		(47)	(23)	(0.18)	(34)	(121)	(0.03)	(0.03)	(0.07)
2008	9				586	601	0.82		
					(19)	(61)	(0.17)		
2009	11	272	77	1.28	530	432	0.82	0.33	0.47

Year class	N	Stocking data			Recapture data			Growth rate	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
		(24)	(23)	(0.05)	(25)	(78)	(0.11)	(0.04)	(0.11)
2010	3	241	47	1.19	431	250	0.93	0.44	0.50
		(36)	(19)	(0.09)	(45)	(83)	(0.04)	(0.02)	(0.04)

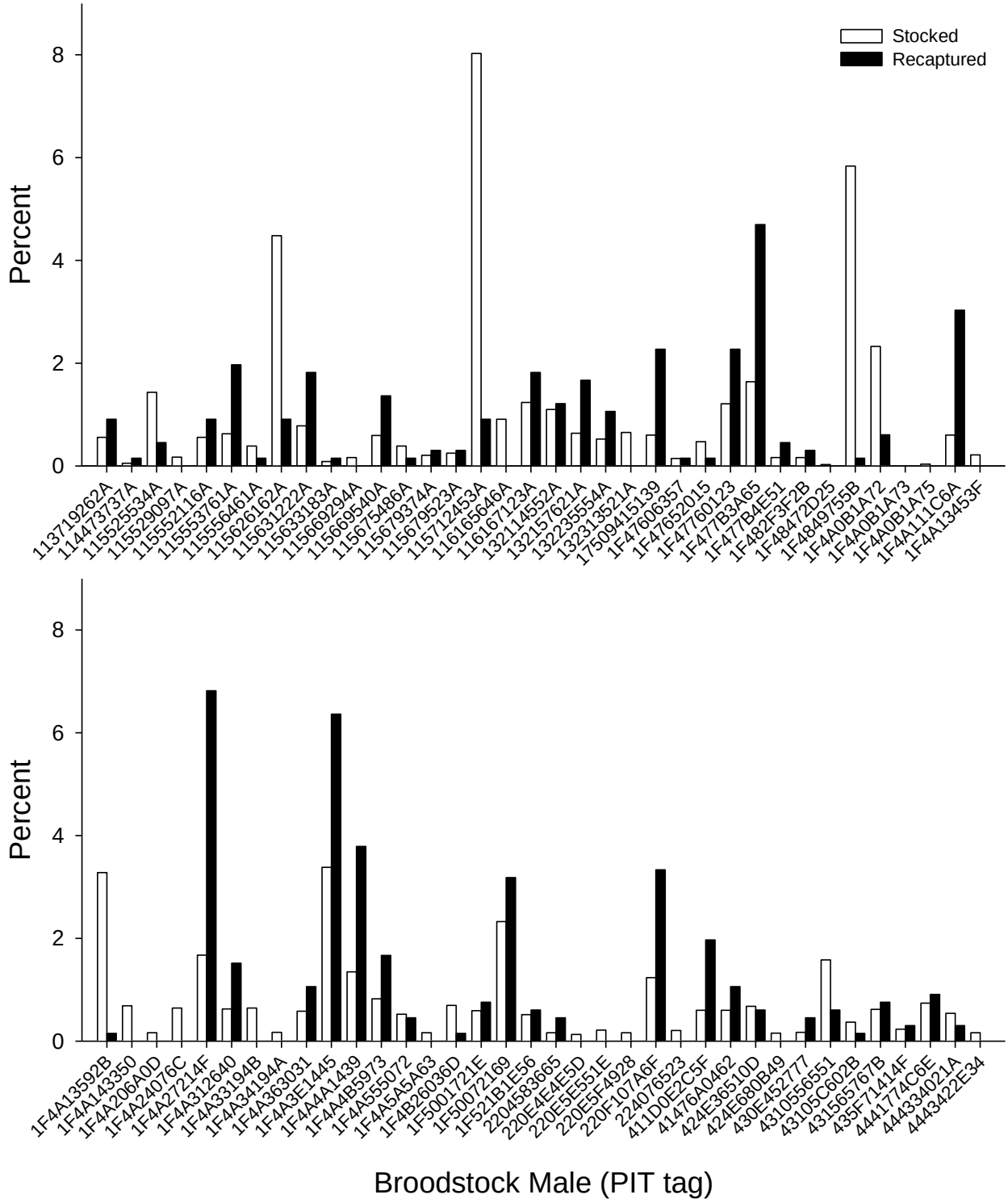
* Mean length and weight at stocking derived from subsample of fish measured at tagging. All other year classes had passive integrated transponder (PIT) tags enabling growth rate calculations for individual fish. The 2006, 2008, and 2009 year classes had 0%, 8%, and 75% of the fish inserted with PIT tags respectively when stocked (Appendix E).

Appendix K. Total number of individual fish stocked and recaptured and percent of stocked fish recaptured from each parental male in RPMA 3 during 2003-2013. Duplicate captures of individual fish were removed.

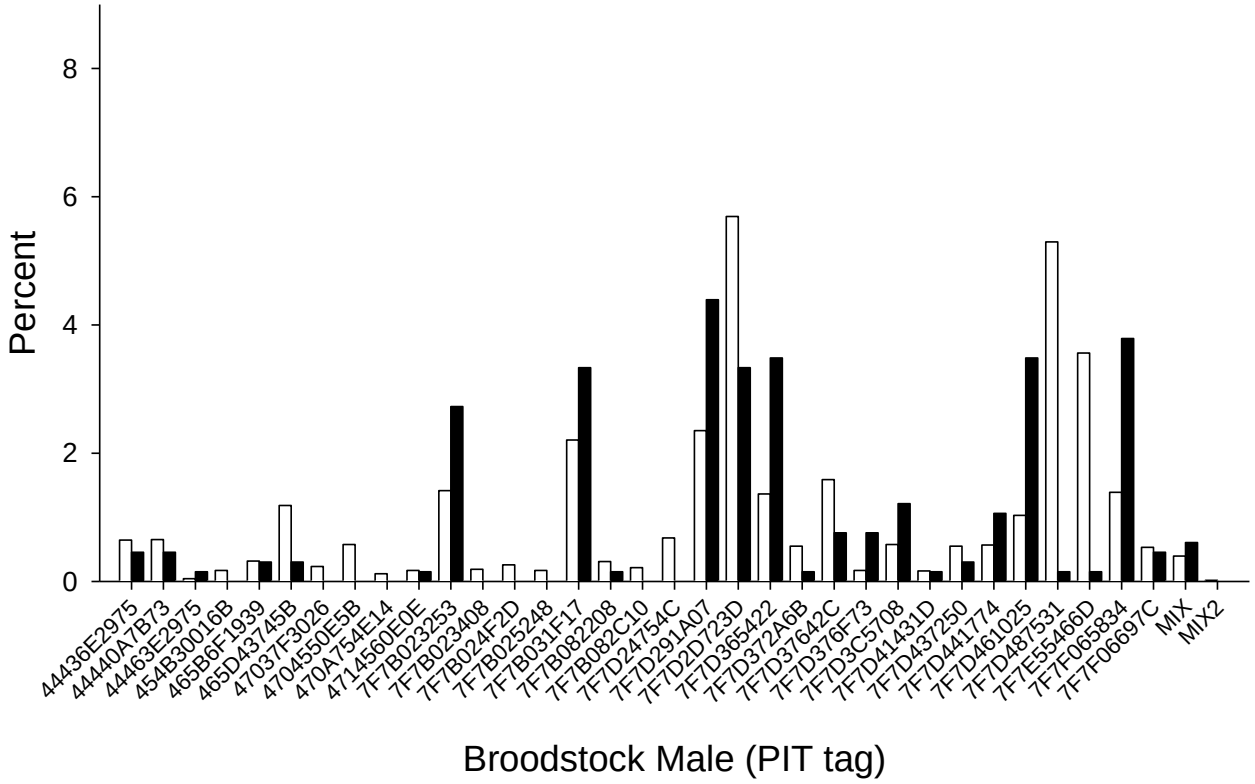
Male	Year class	Number stocked	Number recaptured	Percent recaptured
113719262A	1999	65	6	9.2
114473737A	2004	6	1	16.7
115525534A	2007	72	1	1.4
115525534A	2009	95	1	1.1
115529097A	2007	20	0	0.0
115552116A	2004	26	3	11.5
115552116A	2007	39	3	7.7
115553761A	2005	73	13	17.8
115556461A	2007	45	1	2.2
115626162A	2008	500	6	1.2
115626162A	2009	22	0	0.0
115631222A	2001	71	12	16.9
115631222A	2007	20	0	0.0
115633183A	2005	10	1	10.0
115669294A	2007	19	0	0.0
115669540A	2003	69	9	13.0
115675486A	2003	45	1	2.2
115679374A	2004	24	2	8.3
115679523A	2009	29	2	6.9
115712453A	2007	19	0	0.0
115712453A	2008	916	6	0.7
116165646A	2010	106	0	0.0
116167123A	2002	121	11	9.1
116167123A	2004	23	1	4.3
132114552A	2003	55	6	10.9
132114552A	2007	73	2	2.7
132157621A	2003	55	9	16.4
132157621A	2007	19	2	10.5
132235554A	2004	61	7	11.5
132313521A	2010	76	0	0.0
17509415139	2001	70	15	21.4
1F47606357	2004	17	1	5.9
1F47652015	2007	55	1	1.8
1F47760123	1998	49	6	12.2
1F47760123	2003	92	9	9.8
1F477B3A65	2002	120	22	18.3
1F477B3A65	2004	29	6	20.7
1F477B3A65	2009	42	3	7.1
1F477B4E51	2007	19	2	10.5
1F482F3F2B	2005	19	2	10.5
1F48472D25	2009	3	0	0.0
1F4849755B	2008	680	1	0.1
1F4A0B1A72	2006	271	4	1.5
1F4A0B1A73	2006	1	0	0.0
1F4A0B1A75	2006	4	0	0.0
1F4A111C6A	2001	70	20	28.6
1F4A13453F	2009	25	0	0.0
1F4A13592B	2008	382	1	0.3

Male	Year class	Number stocked	Number recaptured	Percent recaptured
1F4A143350	2010	80	0	0.0
1F4A206A0D	2007	19	0	0.0
1F4A24076C	2010	75	0	0.0
1F4A27214F	2001	70	18	25.7
1F4A27214F	2002	120	26	21.7
1F4A27214F	2004	5	1	20.0
1F4A312640	2004	73	10	13.7
1F4A33194B	2010	75	0	0.0
1F4A34194A	2007	20	0	0.0
1F4A363031	1998	49	7	14.3
1F4A363031	2007	19	0	0.0
1F4A3E1445	2004	394	42	10.7
1F4A4A1439	1997	157	25	15.9
1F4A4B5973	2001	70	10	14.3
1F4A4B5973	2004	26	1	3.8
1F4A555072	2009	61	3	4.9
1F4A5A5A63	2007	19	0	0.0
1F4B26036D	2007	81	1	1.2
1F5001721E	2007	69	5	7.2
1F50072169	2005	271	21	7.7
1F521B1E56	2003	60	4	6.7
2204583665	2007	19	2	10.5
220E4E4E5D	2009	15	0	0.0
220E5E551E	2008	25	0	0.0
220E5F4928	2007	19	0	0.0
220F107A6F	2002	120	19	15.8
220F107A6F	2004	24	3	12.5
224076523	2012	24	0	0.0
411D0E2C5F	2001	70	13	18.6
41476A0462	2001	70	7	10.0
424E36510D	2007	79	4	5.1
424E680B49	2009	18	0	0.0
430E452777	2004	20	3	15.0
4310556551	2006	158	4	2.5
4310556551	2008	26	0	0.0
43105C602B	2009	43	1	2.3
431565767B	2004	33	3	9.1
431565767B	2007	39	2	5.1
435F71414F	2009	27	2	7.4
4441774C6E	2007	86	6	7.0
444334021A	2005	10	2	20.0
444334021A	2008	53	0	0.0
4443422E34	2007	19	0	0.0
44436E2975	2010	75	4	5.3
44440A7B73	2007	50	2	4.0
44440A7B73	2009	26	1	3.8
44463E2975	2010	5	0	0.0
454B30016B	2007	20	0	0.0
465B6F1939	2009	37	2	5.4
465D43745B	2006	138	2	1.4
47037F3026	2009	27	0	0.0
4704550E5B	2010	67	0	0.0
470A754E14	2009	14	0	0.0

Male	Year class	Number stocked	Number recaptured	Percent recaptured
4714560E0E	2007	20	1	5.0
7F7B023253	2005	165	18	10.9
7F7B023408	2009	22	0	0.0
7F7B024F2D	2012	30	0	0.0
7F7B025248	2012	20	0	0.0
7F7B031F17	2005	257	22	8.6
7F7B082208	2009	36	1	2.8
7F7B082C10	2009	25	0	0.0
7F7D24754C	2010	79	0	0.0
7F7D291A07	1997	188	24	12.8
7F7D291A07	2003	33	3	9.1
7F7D291A07	2006	33	0	0.0
7F7D291A07	2007	20	1	5.0
7F7D2D723D	2005	200	21	10.5
7F7D2D723D	2008	463	1	0.2
7F7D365422	2003	131	22	16.8
7F7D365422	2009	28	0	0.0
7F7D372A6B	2007	64	1	1.6
7F7D37642C	2009	185	5	2.7
7F7D376F73	2004	20	5	25.0
7F7D3C5708	2001	67	7	10.4
7F7D41431D	2007	19	1	5.3
7F7D437250	2004	18	2	11.1
7F7D437250	2008	46	0	0.0
7F7D441774	1999	66	7	10.6
7F7D461025	2002	120	23	19.2
7F7D487531	2004	22	1	4.5
7F7D487531	2007	63	0	0.0
7F7D487531	2008	532	0	0.0
7F7E55466D	2004	19	1	5.3
7F7E55466D	2008	396	0	0.0
7F7F065834	1997	79	12	15.2
7F7F065834	1999	50	4	8.0
7F7F065834	2004	33	6	18.2
7F7F06697C	2009	62	4	6.5
MIX	2004	18	3	16.7
MIX	2008	28	0	0.0
MIX2	2004	2	0	0.0
Total		11,650	651	5.6



Appendix K-1. Percent of population stocked (white bars) and recaptured (black bars) per wild broodstook male used in the propagation program.

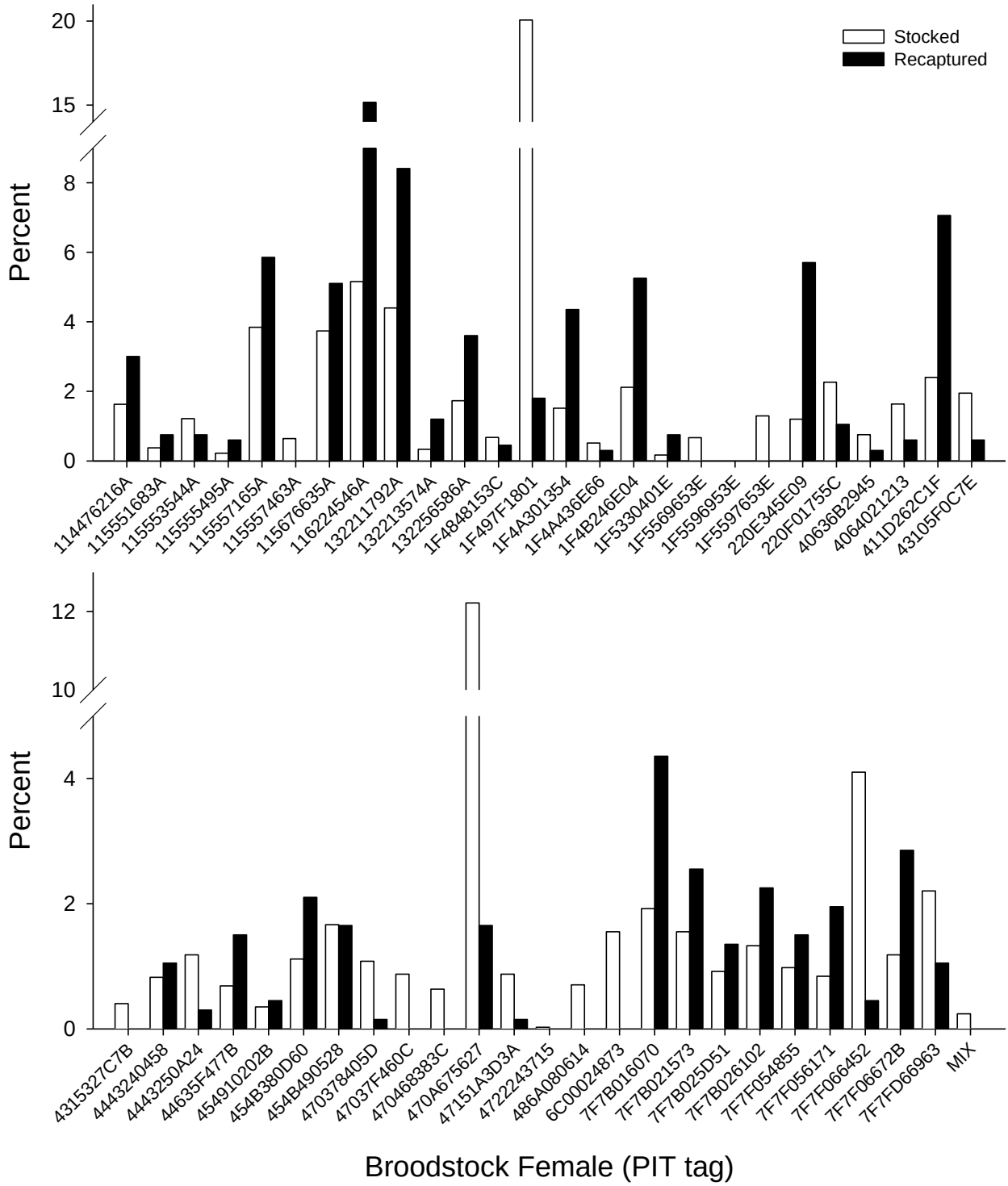


Appendix K-2. Percent of population stocked (white bars) and recaptured (black bars) per wild broodstook male used in the propagation program.

Appendix L. Total number individual fish stocked and recaptured and percent of stocked fish recaptured from each parental female in RPMA 3 during 2003-2013. Duplicate captures of individual fish were removed.

Female	Year class	Number stocked	Number recaptured	Percent recaptured
114476216A	2004	190	20	10.5
115551683A	2004	44	5	11.4
115553544A	2007	142	5	3.5
115555495A	2004	26	4	15.4
115557165A	2005	275	31	11.3
115557165A	2007	40	2	5.0
115557165A	2009	133	6	4.5
115557463A	2008	75	0	0.0
115676635A	2005	436	34	7.8
116224546A	2002	601	101	16.8
132211792A	2004	513	56	10.9
132213574A	2005	39	8	20.5
132256586A	2003	202	24	11.9
1F4848153C	2009	79	3	3.8
1F497F1801	2006	276	4	1.4
1F497F1801	2008	2,063	8	0.4
1F4A301354	1997	177	29	16.4
1F4A436E66	2007	60	2	3.3
1F4B246E04	1997	247	35	14.2
1F5330401E	2004	20	5	25.0
1F5569653E	2010	78	0	0.0
1F5596953E	2010	1	0	0.0
1F5597653E	2010	151	0	0.0
220E345E09	2001	140	38	27.1
220F01755C	2009	264	7	2.7
40636B2945	2007	88	2	2.3
4064021213	2006	191	4	2.1
411D262C1F	2001	280	47	16.8
43105F0C7E	2010	227	4	1.8
4315327C7B	2009	47	0	0.0
4443240458	2005	20	3	15.0
4443240458	2007	76	4	5.3
4443250A24	2006	138	2	1.4
44635F477B	2005	80	10	12.5
454910202B	2004	41	3	7.3
454B380D60	2004	38	10	26.3
454B380D60	2007	92	4	4.3
454B490528	2007	99	5	5.1
454B490528	2009	95	6	6.3
470378405D	2007	126	1	0.8
47037F460C	2007	102	0	0.0
470468383C	2009	74	0	0.0
470A675627	2008	1,424	11	0.8
47151A3D3A	2007	102	1	1.0
4722243715	2009	3	0	0.0
486A080614	2012	82	0	0.0

Female	Year class	Number stocked	Number recaptured	Percent recaptured
6C00024873	2010	181	0	0.0
7F7B016070	2003	224	29	12.9
7F7B021573	1999	181	17	9.4
7F7B025D51	2007	107	9	8.4
7F7B026102	2005	155	15	9.7
7F7F054855	2003	114	10	8.8
7F7F056171	1998	98	13	13.3
7F7F066452	2004	21	2	9.5
7F7F066452	2008	457	1	0.2
7F7F06672B	2001	138	19	13.8
7F7FD66963	2007	110	3	2.7
7F7FD66963	2009	147	3	2.0
MIX	2008	28	0	0.0
Total		11,658	665	5.7



Appendix L-1. Percent of population stocked (white bars) and recaptured (black bars) per wild broodstook female used in the propagation program.

Appendix M. Total number, mean length (FL mm), weight (g), and relative weight (W_r) of marked and recaptured shovelnose sturgeon in segments 5 and 6 of the Missouri River during 2006-2012. Two standard errors are presented in parentheses.

			Marked Fish			Recaptured Fish		
SY	Marked	Recaptured	Mean Length	Mean Weight	W_r	Mean Length	Mean Weight	W_r
2006	161		645 (7)	1,120.1 (39.5)	95 (1.83)			
2007	396	12	645 (4)	1,110.9 (22.6)	94 (1.3)	637 (26)	1,091.7 (98.3)	97 (5.66)
2008	271	22	656 (6)	1,143.6 (29.5)	92 (1.55)	651 (18)	1122 (121.5)	92 (4.25)
2009	259	39	657 (6)	1,166.3 (29.4)	93 (1.27)	635 (13)	1,087.2 (64.2)	98 (3.2)
2010	176	20	658 (7)	1,219.7 (36.9)	97 (1.96)	685 (18)	1,370.8 (95.6)	96 (4.41)
2011	61	10	656 (13)	1267 (73.4)	101 (3.61)	646 (31)	1,230.5 (114.2)	105 (10.1)
2012	98	18	662 (8)	1,394.7 (63.7)	108 (2.44)	687 (16)	1,546.1 (111.4)	107 (3.04)
2013	86	17	669 (11)	1,397.4 (79.9)	104 (2.3)	641 (19)	1,285.3 (161)	110 (5.06)