2015 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segment 14

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

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On the cover: A side by side comparison of Shovelnose Sturgeon (top) and Pallid Sturgeon (bottom) captured as part of the Pallid Sturgeon and Population Assessment and Monitoring Program.

EXECUTIVE SUMMARY

We deployed 134 standard gill nets, 153 standard otter trawls, 109 standard trammel nets, 114 standard trotlines and 113 standard mini-fyke nets in Segment 14 during the 2015 sampling season. During an extended high water event, high water contingency trotline effort replaced otter trawls. We deployed 585 hooks baited with nightcrawlers during June 2015 as part of the contingency sampling effort. Additionally, 1,553 baited hooks and three non-standard (76 mm bar mesh) gill nets were deployed for broodstock collection efforts. A total of 13,579 fish were collected from all samples in Segment 14 during 2015, representing 72 identified species. Shovelnose Sturgeon (*n* = 3,796), Blue Catfish (*n* = 1,845) and Channel Catfish (*n* = 1,099) were the most abundant species encountered.

Of 35 Pallid Sturgeon captures in Segment 14, four are suspected to be of wild origin based on genetic results. Natural recruitment of Pallid Sturgeon within Segment 14 during 2015 appears to be minimal based on the number and size ranges of wild Pallid Sturgeon (660 - 920 mm FL) captured. Only 29 suspected wild Pallid Sturgeon have been captured in Segment 14 since the current monitoring program began in 2003. Areas near the Osage River, RM 130, accounted for 37% of Pallid Sturgeon collected in 2015. Catch per unit effort (CPUE) of Pallid Sturgeon increased in 2015 for gill nets (52%), trotlines (50%) and trammel nets (43%) compared to catch rates observed in 2014. In 2015, the 2011 year-class of hatchery reared Pallid Sturgeon was the most frequently captured year class and represented nearly 36% of hatchery origin captures. Relative condition factor indicated that Pallid Sturgeon in all size categories declined in Segment 14 since 2014. Since 2013, a downstream progression of observations of declining

condition has been documented in segments below Gavin's Point Dam. In 2014, Pallid Sturgeon in poor condition were observed in Segment 13 and this year declines were detected in Segment 14. Mean condition factors were below 0.90 for most hatchery year classes captured. It is of note that relative abundance of many native cyprinid species also declined in Segment 14. The relatively poor condition factors suggest that food was a limiting resource for stock and quality size Pallid Sturgeon in 2015. Condition of Pallid Sturgeon could become an obstacle to recovery if K_n does not improve.

The Shovelnose Sturgeon population in Segment 14 appears to be stable as indicated by relatively consistent gill net CPUE, consistent PSD and evidence of reproduction and recruitment since 2003. Similar to Pallid Sturgeon, relative weights (W_r) for all size groups of Shovelnose Sturgeon, except stock sized, declined from 2014 and were ≤ 0.90. In the 2012 annual report, we noted a trend for decreasing relative weights for preferred, memorable and trophy sized Shovelnose Sturgeon for 2010-2012; however, relative weights for this size class increased dramatically in 2013 and 2014. Interestingly, relative weight trends for preferred and memorable and trophy size Shovelnose Sturgeon appeared to mirror relative abundance of *Macrhybopsis* spp. in Segment 14. These trends suggest some degree of dietary overlap with Pallid Sturgeon, or, perhaps, environmental conditions that were beneficial for native cyprinids were also beneficial for Shovelnose Sturgeon. Relatively high otter trawl CPUE for sub-stock Shovelnose Sturgeon indicated successful reproduction in 2014 and 2015. Increased abundance of young-of-year sturgeon (e.g., successful spawning) may be correlated with

Similarity of Appearance listing in 2010 and the cessation of commercial Shovelnose Sturgeon harvest in Segment 14.

Relative abundances of *Macrhybopsis* chubs declined in 2015 following three consecutive years of relatively high relative abundances. While the mechanisms driving *Macrhybopsis* populations in the Missouri River are not fully understood, we have noted relative high catch rates of age-0 size chubs during years of low summer flows, and conversely, lower catch rates during years of high summer flows. Chubs need relatively slow velocity habitat to recruit, but these slow velocity habitats are limited during high flows in Segment 14. Both age-0 and adult sized specimens of all three target species of chubs were captured during the 2015 field season.

Sand shiner CPUE was the highest since 2006 and *Hybognathus* spp. CPUE was the highest on record; however, catch rates are still low for these species when compared to many other small bodied Missouri River fish. Blue Sucker CPUE in gill nets for 2015 was the highest on record. The strong 2011 year class has now fully recruited to our gears and was likely a driver behind increased Blue Sucker relative abundance. Similar to most years, small Blue Sucker (i.e. <400 mm TL) were rare in our 2015 catch suggesting that Blue Sucker reproduction or recruitment was low in Segment 14. Sauger relative abundance in Segment 14 continued to be low, but relatively stable. All Sauger captured were greater than 280 mm, suggesting that reproduction and recruitment has not occurred in Segment 14 in recent years. Seventeen state endangered Lake Sturgeon were collected in 2015. Half of all Lake Sturgeon captured were of hatchery origin. All Lake Sturgeon were captured near the Osage River confluence.

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Introduction

Pallid Sturgeon *Scaphirhynchus albus* have declined throughout the Missouri River since dam construction and inception of the Bank Stabilization and Navigation Project in 1912 (Carlson et al. 1985). Loss of habitat, reduced turbidity, increased velocity, loss of natural flows, reduction in forage, increased hybridization and inadequate reproduction and recruitment are factors contributing to the decline of the Pallid Sturgeon and other native species (Pflieger and Grace 1987). Surveys conducted throughout the Missouri and Mississippi rivers have found evidence of hybridization between Pallid and Shovelnose Sturgeons and a continued decline of wild Pallid Sturgeon relative abundance (Shrey et al. 2011, Grady et al. 2001, Doyle and Starostka 2003, Doyle and Starostka 2004).

An independent scientific evaluation of the condition and management of the Missouri River conducted by the National Research Council (2002) concluded that altered flow and habitat conditions associated with current management practices on the Missouri River have resulted in an unhealthy river ecosystem. Similar conclusions presented in the U. S. Fish and Wildlife Service Biological Opinion recommended, in part, that Army Corps of Engineers (COE) initiate modified flow regimes by 2003 to avoid jeopardizing three listed species (endangered Pallid Sturgeon and Least Tern *Sternula antillarum*; threatened Piping Plover *Charadrius melodus*, and begin restoring altered flow and habitat conditions to promote beneficial riverine ecological processes. The COE is responsible for monitoring and evaluating biotic responses of the Pallid Sturgeon to operational and habitat changes on the Missouri River (USFWS 2000). Habitat restoration, higher spring and lower summer flows combined with adaptive management are

recommended measures to restore Pallid Sturgeon populations on the lower Missouri River. Adaptive management is an approach to natural resources management that promotes carefully designed management actions, monitoring and assessment of impacts and application of results and findings to subsequent policy and management strategies. Monitoring data for Pallid Sturgeon and other native fish populations provides the information input necessary to support the adaptive management approach towards reducing jeopardy, and restoring habitat, hydrology, and aquatic communities in the lower Missouri River.

In response to the 2000 Missouri River Biological Opinion, the COE developed monitoring and restoration projects to avoid jeopardizing Pallid Sturgeon populations. As part of their Implementation Plan, the COE has worked with the U. S. Fish and Wildlife Service (USFWS) and State natural resource agencies to refine and conduct a Pallid Sturgeon monitoring and assessment program. The goal of the Pallid Sturgeon Population Assessment Project (PSPAP) is to provide the information necessary to detect changes in Pallid Sturgeon and native target species populations in the Missouri River basin. Six objectives were established to address this goal:

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 usage 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 native target

species by season and life stage.

6. Evaluate 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.

Study Area

Historically, the Missouri River was wide and shallow, containing meandering channels with many islands and snags (Grady and Milligan 1998). Today, portions of the profoundly altered Missouri River and many of its tributaries are characterized by deep reservoirs and narrow, stabilized channels. Alterations to the river were executed by the COE to meet congressionally authorized purposes. High levees and armored banks not only serve to manage the navigation channel but also to protect adjacent farm land. Revetment armors banks and rock dikes direct flows in the lower 755 miles of river to create and maintain a self-scouring channel. While current river management has addressed authorized purposes in support of flood control, navigation, irrigation, hydropower, recreational areas and stable farmland; river management has had a negative impact on the native river ecosystem largely by an altered flow regime, poor water quality and reduced habitat heterogeneity (Dieterman and Galat 2004).

Segment 14 is the furthest downstream reach of the Missouri River. The Osage River is the largest tributary feeding Segment 14, entering the Missouri River at the top of the study area (RM 130.2). The Osage River originates in the foothills of the Ozark Mountains and feeds Lake of the Ozarks, a reservoir used to generate hydroelectric power. Because it is a bottom release reservoir, cool and clear water travels the remaining 80 miles (128.7 km) (with low sediment

inputs) over coarse sand and gravel substrates until its confluence with the Missouri River. Other smaller tributaries, such as the Gasconade River, deliver large silt loads from rain events and can quickly alter water stage height. Catastrophic floods rarely occur, though occasional breeched levies allow water to flow onto the floodplain during high flow events.

Over the last two decades, the COE has undertaken efforts to restore lost and degraded habitats by notching dikes to create shallow-water habitat (SWH), creating "pilot channels" on the floodplain to restore ecological benefits associated with side channel chutes and by controlled spring releases from upstream dams to imitate portions of the natural hydrograph thought to cue fish spawning behavior. In recent years, much emphasis has been given to dike modification projects and many of the existing dikes in this reach of river have been altered to promote development of SWH. Notches are now deeper and wider; following modifications initialized in 2003 and can divert water to promote erosion-deposition processes. Dike types vary in design but, in general, outside bends contain L-shaped dikes pointing downstream while dikes on the inside bend are more perpendicular to water flow, projecting straight into the channel and slightly downstream. Subsequent habitats that exist behind modified dikes vary widely. In its current condition, the river vaguely resembles the one explored by Lewis and Clark, though some remnant historical habitat types still exist at different water stages.

Methods

Sampling was conducted in accordance with Standard Operating Procedures established by a panel of representatives from various state and federal agencies involved with Pallid Sturgeon

recovery on the Missouri River (Welker and Drobish 2012). The sampling guidelines were meant to be adaptive and have been modified throughout the duration of the monitoring program to ensure sampling efficiency and scientific accuracy. For a history of modifications to the program see: USACE 2010.

Sampling Site Selection and Habitat Description

Segment 14 begins at the confluence of the Osage River (RM 130.2) and ends at the confluence with the Mississippi River (RM 0.0; Figure 1). Each segment represents a sampling stratum. Segments were divided into bends (defined as the crossing of the thalweg from one bank to the other) and fourteen bends were randomly selected prior to 1 November 2013 to be sampled as replicates, with a suite of gears. The sampling year was divided into two seasons: sturgeon season began in autumn of 2013 when water temperatures fell below 12.8˚ C and continued through 30 June 2014; fish community season began on 1 July 2014 and continued through 31 October 2014. The river was categorized into distinct habitat categories called "mesohabitats" which exist within "macrohabitats" (see Appendix B). Fish sampling effort was distributed in proportion to habitat availability within a bend. Samples that occurred outside of the predetermined (i.e., standard) sampling protocol were given a "wild" designation and not included in standard data analysis.

The macrohabitat type described the general location of the sample within a bend (e.g., inside bend, outside bend, etc.). Mesohabitat described the habitats that occur within the respective macrohabitat (e.g., pool, channel border, etc.). Microhabitat was used to specifically characterize the individual gear deployment as it related to features within the sample area

(e.g., wing dikes, sandbars, etc.). If available, all macro- and mesohabitat combinations were sampled. A comprehensive list of all habitat types and their definitions can be found in Appendix B.

In Segment 14, sampling was distributed among the following available habitats:

MACRO

CHXO (channel cross over)
ISB (inside bend)
OSB (outside bend)
CONF (confluence- area downstream of a tributary)
SCCS or SCCL (side channel connected small or large)
SCCN (side channel not connected)
TRMS or TRML (small or large tributary mouth)
TRIB (tributary)

MESO

CHNB (channel border- where depth is > 1.2 m to toe of thalweg)
POOL (scour hole)
ITIP (island tip- associated with SCCS or SCCL where the two water currents meet behind an island)
BARS (sand bar or shallow water habitat were depth is < 1.2 meters)
TLWG (thalweg- main channel between channel borders conveying majority of water)

Sampling Gear

Gill Nets

To avoid fish mortality, gill nets were only deployed when water temperatures were below 12.8^{o}C, during sturgeon season. Gill nets were anchored upstream with a heavy grappling hook-style anchor and back-anchored with a cement weight tied to a buoy. Gill nets were fished overnight with a minimum soak time of 12 hours and a maximum of 24 hours. Standard effort for gill nets was 10 sub-samples per bend. The standard gill net was an experimental mesh net 61 m long x 2.4 m in height with 7.6 m repeating 38 mm, 51 mm, 76 mm and 102 mm mesh panels.

Otter Trawls

Otter trawls were pulled downstream with a jet powered stern trawler. Otter trawls were used during both sampling seasons. Due to safety concerns, trawls were not pulled on outside bend revetment or in the thalweg. Standard otter trawls were a minimum of 75 m and a maximum of 300 m. The standard otter trawl had a width of 4.9 m, height of 0.9 m and a length of 7.6 m. The custom Skate design (Innovative Nets Systems; Greg Faulkner) consisted of 6.35 mm inner bar mesh, 19 mm # 9 Sapphire® outer bar mesh, 38 mm outer stretch mesh and 0.76 m boards. Standard effort for otter trawls was eight sub-samples per bend.

Trammel Nets

Trammel nets with one-inch (25.4 cm) mesh deployed perpendicular to the current from the boat bow with a 10-meter lead line. Orientation of the net was maintained by pulling the net

back to a perpendicular position when necessary. Trammel nets were fished in moderately shallow water away from eddies which could tangle the net. Trammel nets were only used during fish community season. Standard trammel net drifts were a minimum of 75 m and a maximum of 300 m. The standard trammel net was 38.1 m long with a 1.8 m outer wall and a 2.4 m inner wall. The inner mesh was 25.4 mm bar mesh and the outer wall was 203 mm bar mesh. Standard effort for trammel nets was eight sub-samples per bend.

Mini-Fyke Nets

Mini-fyke nets were deployed during fish community season. Mini-fykes were set on mud flats behind dikes and on sand bars in the main-channel. Steep slopes and shallow sand bars may have affected the efficiency of this gear. In many cases, the gear was set close to the bank behind bars and the lead wing was not fully extended because of the steep slope of the bank or the velocity of the water. On shallow sand bars there was not always enough lead to ensure the throat was in the water, especially when water levels were rising or falling. Standard mini-fyke nets had two 1.2 m by 0.6 m rectangular steel frames and two 0.6 m circular hoops. The lead was 4.5 m long and 0.6 m high. The net is made of 3 mm “ace” type nylon mesh, coated in green latex net dip. Standard effort for mini-fyke nets was eight sub-samples per bend.

Trotlines

Trotlines were set similarly to gill nets and in similar habitat types. A heavy grappling hook-style anchor was attached on the upstream end and the line was back-anchored with a cement weight tied to a buoy. Hooks on 35 cm tuna leader were attached to the mainline using ganion

clips. Forty 3/0 circle hooks baited with nightcrawlers, were attached per 61 m of mainline. On average, 320 hooks were deployed per bend. Trotlines were fished overnight with a minimum soak time of 12 hours and a maximum of 24 hours. Standard effort for trotlines was eight sub-samples per bend. Refer to Appendix C for additional detailed gear information.

Data Collection and Analysis

Associated Environmental Data

Latitude and longitude (decimal degrees), temperature (˚C) and depth (m) (beginning, mid-point and end for all gears except mini-fykes; where depth is measured at the opening of the box) were taken for each sample. In addition, turbidity (NTU) and velocity (m/s) samples were collected randomly from 25% of the mesohabitat types within each macrohabitat using Hach Model 2100P turbidimeter and Marsh-McBirney Flomate 2000 velocity meter. Water column velocity was measured at bottom, 80% and 20% of the depth. All habitat data were collected when Pallid Sturgeon were encountered.

Species Data and Genetic Verification

The PSPAP team selected eight target species that were either thought to be important forage species or was a potential surrogate species for Pallid Sturgeon (Appendix A). The eight target species are: Shovelnose Sturgeon *S. platorynchus*, Sturgeon Chub *Macrhybopsis gelida*, Sicklefin Chub *M. meeki*, Shoal Chub *M. aestivalis*, Sand Shiner *Notropis stramineus, Hybognathus* species (Western Silvery Minnow *H. argyritis*, Brassy Minnow *H. hankinsoni*, Mississippi Silvery Minnow *H. nuchalis* and Plains Minnow *H. placitus*, Blue Sucker *Cycleptus elongatus* and Sauger *Sander canadense*. Fork length (mm FL) and weight (g) was collected on Pallid Sturgeon and Shovelnose Sturgeon, and total length (mm TL) and weight (g) were collected on Blue Sucker and Sauger. A series of additional measurements were taken on Pallid Sturgeon and their suspected hybrids using Sheehan's index for verification (Sheehan et al. 1999). Sturgeon were deemed hybrid when they were verified to be within the hybrid range (-0.50 to +0.60) on

Sheehan's Character Index (CI) scale. Passive Integrated Transponder (PIT) tags were implanted under the dorsal fin of Pallid Sturgeon, hybrids (<0.5 CI) and Lake Sturgeon. Additionally, fin clips were collected from Pallid Sturgeon and hybrids to be analyzed for genetic purity, and hatchery origin, and digital images were taken for documentation. All unmarked Pallid Sturgeon captured that could not be otherwise positively identified as being of hatchery or wild origin, were deemed "unknown" until genetic verification. All Pallid Sturgeon deemed "wild" have been genetically verified as not being of hatchery origin, and are presumed to be wild. Only length measurements were taken from small bodied target species (*i.e.*, chub species, Sand Shiner, and *Hybognathus* species). Length measurements were collected on a sub-sample of non-target species (25 individuals); above that threshold, a count of individuals by species was recorded.

Catch Per Unit Effort

Catch per unit of effort (CPUE) was calculated as fish per 100 meters for active gears (otter trawl and trammel net). Gill net effort was calculated as fish per 100 feet (30.48 m) of net set overnight (less than 24 hours). Because the standard gill nets used in Segment 14 were 200 feet (60.96 m) long, CPUE was calculated for the net and divided by two. Mini-fyke nets were calculated as fish per overnight set. Trotline effort was calculated as fish per 20 hook night. Samples that occurred outside of the "standard" gear deployment protocol or samples that occurred in "non-random" bends were excluded from CPUE calculations. These data were, however, included in length frequencies, relative condition and population structure calculations.

Condition

Relative condition (a measure of a fish's plumpness) of recaptured hatchery reared Pallid Sturgeon was calculated using $K_n = (W/W')$, where W is weight of the individual and W' is the length-specific mean weight predicted by the weight-length equation calculated for that population. We used the weight-length regression: $\log_{10} W' = -6.2561 + 3.2932 * \log_{10} L$ (r^2 = 0.98) as defined by Shuman et al. (2011) where L is the length at capture (mm). Relative weight ($W_r = 100 \cdot W/W_s$; where W is the observed weight in grams and W_s is the length-specific standard weight value) was calculated for all Shovelnose Sturgeon captured in Segment 14. We used the standard weight equation: $\log_{10} W_s = -6.287 + 3.330 \log_{10} FL$ where FL is fork length (mm) as proposed by Quist et al. (1998).

Stock Densities

Stock densities were calculated to assess Pallid Sturgeon and Shovelnose Sturgeon population structure. Proportional size distribution (PSD) is the proportion of fish of a selected size group in a stock and, generally, indicates health of fish populations relative to reproductive potential and age of fish (Gabelhouse 1984, Guy et al. 2007). Length categories are based on a percentage of length of the largest known Pallid Sturgeon and are described as follows (Shuman et al. 2006): sub-stock (< 330 mm FL), stock (330-629 mm FL), quality (630-839 mm FL), preferred (840-1,039 mm FL), memorable (1,040- 1,269 mm FL) and trophy (> 1,270 mm FL); sub-stock were further divided as 0-199 mm FL and 200-329 mm FL. Length categories based on a percentage of length of the largest known Shovelnose Sturgeon are as follows (Quist et al.

1998): sub-stock (<250 mm FL), stock (250 – 379 mm FL), quality (380 – 509 mm FL), preferred (510 – 639 mm FL), memorable (640 – 809 mm FL) and trophy (> 810 mm FL); sub-stock were further divided as 0-149 mm FL and 150-249 mm FL groups.

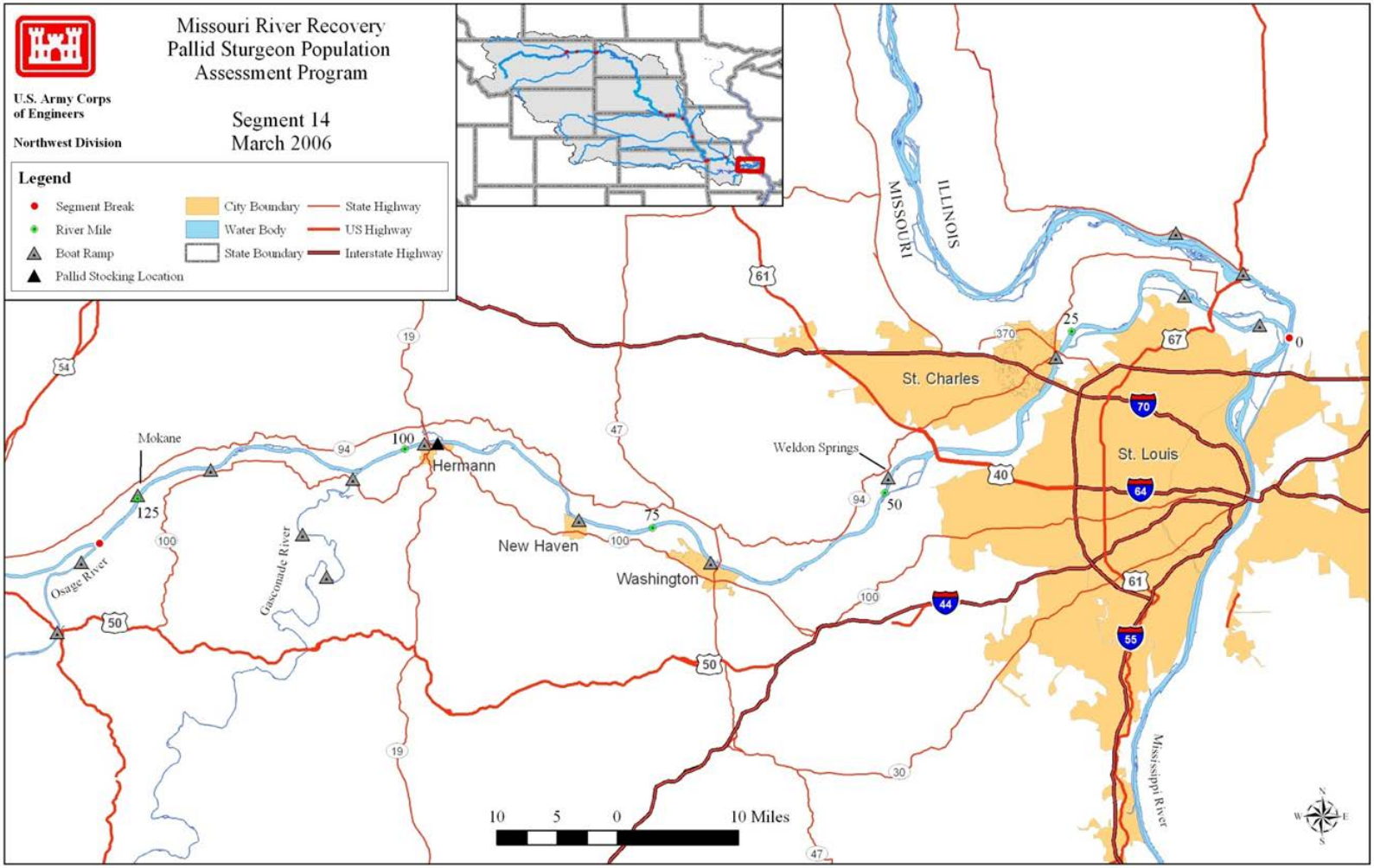

Figure 1. Map of Segment 14 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for Pallid Sturgeon. Segment 14 encompasses the Missouri River from the Osage River (River Mile 130.2) to the Mississippi River (River Mile 0.0).

Results

Effort

We completed 89% of the targeted standard sampling effort on 14 randomly selected bends, deploying 134 standard gill nets, 114 standard trotlines, 153 standard otter trawls, 109 standard trammel nets and 113 standard mini-fyke nets in Segment 14 during 2015. Standard sampling was not conducted during periods of high flow because of safety concerns. High flow conditions occurred during sturgeon season and persisted into fish community season. Standard gill net and trotline effort was completed for sturgeon season; however, due to the timing and duration of flooding, standard otter trawl sampling effort was incomplete for sturgeon season in Segment 14. Of the 153 standard otter trawls deployed, 111 were deployed during fish community season and 42 during sturgeon season. Due to short length of bends and unavailability of habitat at time of deployment, six gill nets and five trammel nets were not deployed. One mini-fyke net set malfunctioned and was not included in analyses. Most standard gear deployments sampled the ISB macrohabitat (64%), followed by CHXO macrohabitat (22.2%) and SCCL macrohabitat (6.3%) (Table 1). In addition to standard sampling, targeted gear deployments to capture mature broodstock Pallid Sturgeon were implemented from November through March with 17 non-standard or non-random (a.k.a., wild) trotlines comprising 1,553 hooks and three large-mesh (76 mm) gill nets.

Table 1. Number of bends sampled, mean number of deployments, and total number of deployments by macrohabitat for Segment 14 on the Missouri River during the sturgeon season and fish community season in 2015. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean deploy-ments	Macrohabitat[a]														
			BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																	
Gill Net	14	9.57	N-E	32	0	N-E	N-E	N-E	0	87	9	5	1	0	0	0	0
Otter Trawl	5	8.40	N-E	10	0	N-E	N-E	N-E	0	29	1	1	0	0	1	0	0
Fish Community Season																	
1.0” Trammel Net	14	7.64	N-E	17	0	N-E	N-E	N-E	0	85	0	5	0	0	0	0	0
Mini-Fyke Net	14	7.93	N-E	26	0	N-E	N-E	N-E	0	44	14	14	3	1	0	9	0
Otter Trawl	14	7.93	N-E	25	0	N-E	N-E	N-E	0	81	0	5	0	0	0	0	0
Both Seasons																	
Trot Lines	14	8.14	N-E	28	0	N-E	N-E	N-E	0	70	7	9	0	0	0	0	0

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

Pallid Sturgeon

We collected 35 Pallid Sturgeon (31 hatchery-reared, 4 presumed wild) during 2015 in Segment 14. The majority of Pallid Sturgeon captures were in the upper reaches of the segment, in relative proximity to the Osage River confluence. Six Pallid Sturgeon were collected in the lower 40 miles of Segment 14 (Figure 2), an area of historically low catch rates. Areas near the Osage River (RM130.2), a major tributary confluence, accounted for 37% of the Pallid Sturgeon collected. Of all Pallid Sturgeon captures in 2015, 68% were from bends with large sandbar and/or chute complexes. Pallid Sturgeon were found in half of all macrohabitats sampled, including; CHXO, CONF, ISB, SCCL and TRML, which represented 87% of all gear deployments. The majority, 46%, of Pallid Sturgeon were captured from ISB – CHNB habitat. Bottom current velocities where Pallid Sturgeon were captured ranged from 0.25 to 0.76 m/s, whereas bottom velocity at all gear deployments ranged from 0.00 to 1.2 m/s (Table 2). Water depth where Pallid Sturgeon were captured ranged from 1.5 to 4.6 m across all habitat types sampled, whereas water depth at all gear deployments across habitats ranged from 0.2 to 14.0 m (Table 2). Water temperatures where Pallid Sturgeon were captured ranged from 3.4 to 28.8˚C. Mean depth of gear deployments yielding Pallid Sturgeon in the ISB-CHNB mesohabitat were shallower than mean depths of all gear deployments in the ISB-CHNB mesohabitat, 2.6 m and 3.18 m, respectively (Table 2). Mean bottom water velocity was slower for gear deployments both capturing and not capturing Pallid Sturgeon when compared to overall mean bottom water velocities in the ISB-CHNB mesohabitat, 0.48m/s and 0.54 m/s, respectively (Table 2).

A total of 29 Pallid Sturgeon of hatchery origin were captured, representing 12 different year classes (Table 3). The 2011 year class had the highest representation with 11 individuals, followed by the 2001 year class with four individuals captured. The 2015 year class, at large for less than 30 days, had mean length of 203 mm, mean weight of 29 g and a relative condition factor of 1.317 (Table 3). The 1992 year class continues to be represented in sampling efforts with two captures in 2015; however, only one of those was genetically determined to be Pallid Sturgeon, the other was confirmed hybrid (Shovelnose Sturgeon x Pallid Sturgeon). The 1992 year class fish had a mean length of 735 mm FL, mean weight of 1,500 g and had a relative condition factor of 0.984. In comparison, three Pallid Sturgeon captured from the 1992 year class in 2014 had mean length of 914 mm FL, mean weight of 3,247 g and a relative condition factor of 1.038 (Herman and Wrasse 2015). Because mean lengths and weights are not known for many of the year classes captured in Segment 14, daily growth rates data are limited. Daily length estimates were only calculated for the 2001, 2003 and 2015 year classes and averaged 0.116, 0.148 and -10.9 mm/d, respectively (Table 3). Daily estimates of length and weight were calculated for 2002, 2005, 2007 and 2011 year classes (Table 3).

Pallid Sturgeon captures in Segment 14 occurred during both sturgeon and fish community seasons. Only one sub-stock (0-199 mm FL) Pallid Sturgeon was captured during 2015 (Figure 3). No sub-stock (200-329 mm) were captured. Most Pallid Sturgeon captured in Segment 14 were stock sized, comprising 49% of total Pallid Sturgeon captured. Quality sized captures, of which two wild Pallid Sturgeon captures from Segment 14 were included, represented 37%. Preferred size Pallid Sturgeon comprised 11% of the catch during the 2014 sample year and also

included two presumed wild Pallid Sturgeon. The proportion of stock sized fish captured during the 2015 sturgeon season has continued to increase since stock sized captures were the lowest on record in 2012 (14%). The proportion of stock sized fish captured during sturgeon season has been highly variable since 2003 (Figure 3). However, the proportion of quality size fish has remained relatively consistent since 2003. The proportion of preferred size fish has been relatively consistent since 2007; however, a noticeable decline was observed in 2015 (Figure 3). No memorable or trophy size Pallid Sturgeon have been collected in Segment 14.

Excepting sub-stock (0-199 mm FL), mean relative condition factors (*Kn*) were similar across all size classes, ranging from 0.816 to 1.317, in 2015. We should note the scale used to weigh fish in the field was only precise to 10 grams and lacked the precession necessary to accurately weigh small fish (e.g. sub-stock size Pallid Sturgeon). In 2015, declines in condition for all length categories of Pallid Sturgeon were detected. Between years 2003-2014, *Kn* factors have typically been above 0.900 across all size classes (Figure 4). In 2015, stock sized Pallid Sturgeon had the lowest relative *Kn* factor (*Kn* = 0.816) in the 13-year monitoring history and quality sized fish had the lowest condition scores (*Kn* = 0.883) observed since 2003 (Figure 4).

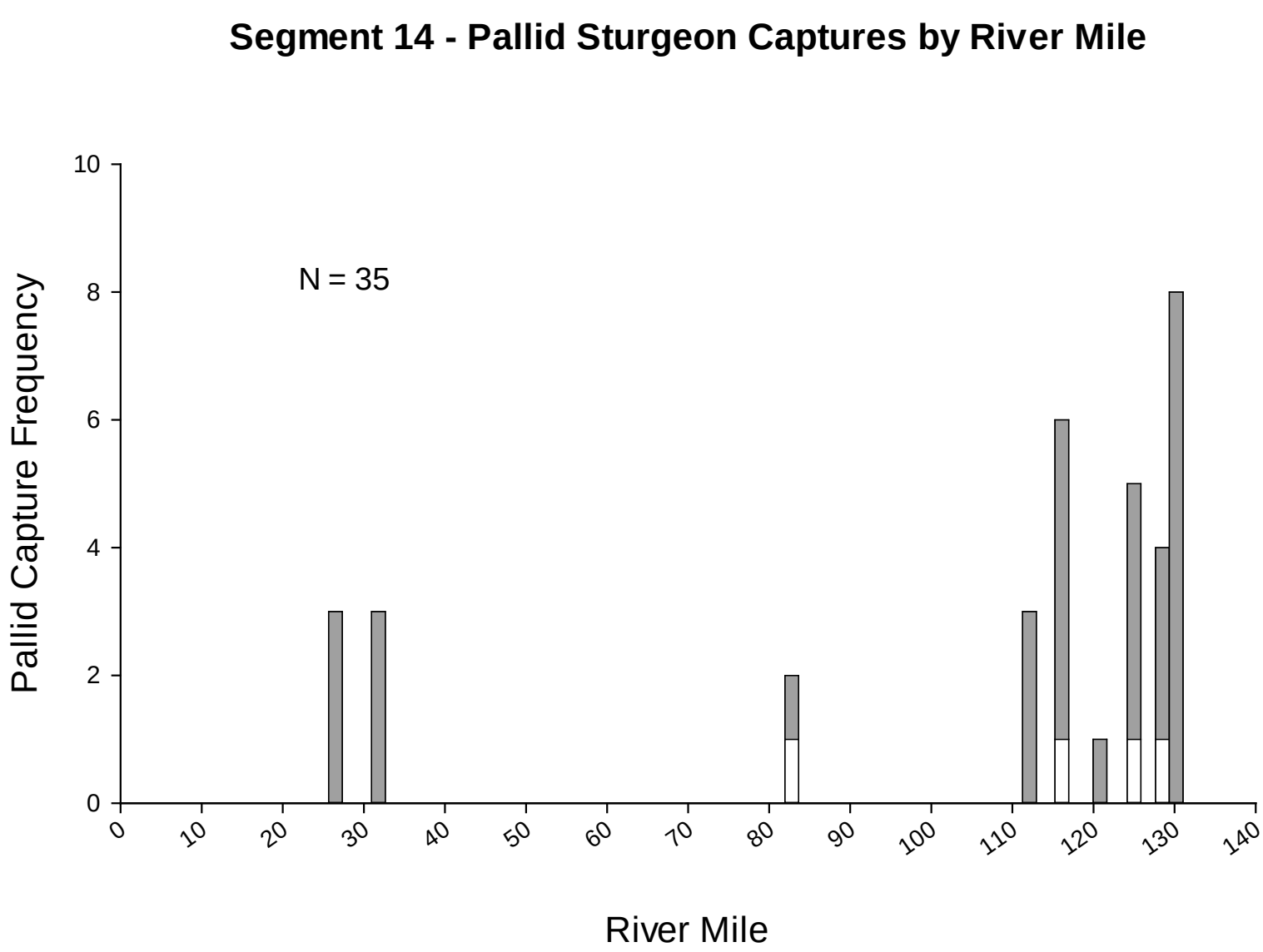

Figure 2. Distribution of Pallid Sturgeon captures by river mile for Segment 14 of the Missouri River during 2015. White bars represent presumed wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent Pallid Sturgeon of unknown origin. Figure includes all pallid captures including non-random and wild samples.

Table 2. Pallid Sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2015. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. Table includes all Pallid Sturgeon captures including non-random samples.

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (^{o}C)		Turbidity (NTU)		Total PDSG caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
CHXO	BARS	0.6 (0.4-0.8)		0.12 (0.01-0.42)		26.8 (24.0-29.8)		552 (49-1500)		.
	CHNB	3.7 (1.3-8.0)	2.7 (1.4-4.4)	0.46 (0.04-1.18)	0.65 (0.51-0.78)	19.3 (3.0-28.7)	16.3 (10.0-24.0)	257 (15-1184)	74 (61-86)	3
	ITIP									.
	POOL	5.9 (2.4-9.8)	4.5 (4.0-5.0)	0.35 (0.01-1.01)	.	9.9 (3.5-21.1)	7.0 (405-10.0)	154 (12-1416)	.	2
CONF	BARS									.
	CHNB	4.2 (2.8-7.0)	4.9 (2.8-7.0)	.	.	10.0 (10.0-10.0)	10.0 (10.0-10.0)	.	.	3
	ITIP									.
	POOL	5.8 (4.7-6.8)	.	.	.	10.4 (10.0-10.8)	.	.	.	.
	ITIP									.
	POOL									.
ISB	BARS	0.6 (0.3-1.1)	.	0.18 (0.00-0.71)	.	26.1 (24.0-29.3)	.	474 (64-1680)		.
	CHNB	3.1 (1.1-10.0)	2.6 (1.5-4.2)	0.54 (0.00-1.20)	0.48 (0.25-0.76)	19.1 (3.4-29.0)	13.5 (3.4-28.8)	241 (14-1484)	102 (21-361)	16
	ITIP									.
	POOL	4.6 (2.3-8.0)	4.0 (3.4-4.6)	0.40 (0.03-0.82)	0.50 (0.50-0.50)	10.7 (3.5-20.5)	7.8 (5.0-10.5)	89 (10-583)	23 (23-23)	2
OSB	BARS	0.5 (0.3-0.7)	.	0.03 (0.00-0.13)	.	27.0 (24.3-29.1)	.	362 (79-1252)	.	.
	CHNB	3.8 (2.3-6.0)	.	0.14 (0.00-0.22)	.	13.9 (3.4-21.0)	.	80 (64-115)	.	.
	ITIP									.

Table 2. (con't)

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (^{o}C)		Turbidity (NTU)		Total PDSG caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	POOL	4.8 (3.1-6.2)	.	0.12 (0.04-0.26)	.	9.5 (3.9-16.3)	.	67 (17-133)	.	.
SCCL	BARS	0.6 (0.2-1.1)	.	0.12 (0.02-0.22)	.	25.7 (24.0-26.7)	.	254 (112-536)	.	.
	CHNB	2.9 (1.8-4.5)	3.7 (3.3-4.0)	0.51 (0.00-0.82)	0.70 (0.70-.070)	17.7 (4.0-23.5)	19.6 (16.1-23.0)	224 (12-515)	462 (462-462)	2
	ITIP	2.2 (0.5-4.6)	3.0 (3.0-3.0)	0.31 (0.02-0.67)	0.67 (0.67-0.67)	20.0 (10.5-26.6)	10.5 (10.5-10.5)	115 (46-335)	49 (49-49)	1
	POOL	7.8 (7.5-8.0)	8.0 (8.0-8.0)	0.10 (0.02-0.17).	0.02 (0.02-0.02)	12.8 (5.0-20.5)	5.0 (5.0-5.0)	32 (17-46)	17 (17-17)	1.
SCCS	BARS	0.5 (0.4-0.7)	.	0.15 (0.10-0.18)	.	26.0 (25.0-28.0)	.	1028 (767-1532)	.	.
	CHNB									.
	ITIP	2.6 (2.6-2.6)	.	.	.	.	4.8 (4.8-4.8)	.	.	.
	POOL									.
SCN	BARS	0.4 (0.4-0.4)	.	0.00 (0.00-0.00).	.	25.0 (25.0-25.0)		229 (229-229)	.	.
	CHNB									.
TRML	BARS									.
	CHNB	6.7 (2.6-10.7)	9.5 (9.5-9.5)	0.40 (0.01-0.78)	0.78 (0.78-0.78)	17.1 (3.2-25.0)	24.0 (24.0-24.0)	24 (13-34)	13 (13-13)	1
	ITIP									.
	POOL	7.7 (3.5-13.7)	6.3 (3.5-10.3)	0.57 (0.57-0.57)	0.57 (0.57-0.57)	13.9 (4.0-24.8)	10.8 (4.0-24.5)	31 (31-31)	31 (31-31)	4.
TRMS	BARS	0.5 (0.3-0.6)	.	0.02 (0.00-0.09)	.	27.6 (25.0-29.4)	.	170 (30-684)		.
	CHNB									.
	ITIP									.
	POOL									.

Table 3. Mean fork length, weight, relative condition factor (K_n) and absolute growth rates ± 2SE for hatchery-reared Pallid Sturgeon captures by year class at the time of stocking and recapture during 2015 from Segment 14 of the Missouri River. Relative condition factor was calculated using the equation in Shuman et al. (2011). Table includes all hatchery-reared Pallid Sturgeon captures including non-random and wild samples.

Year Class	N	Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
1992	1	.	.	.	735	1500.0	0.984	.	.
± 2SE	.	.	.	.	.	.	.	.	.
2001	4	208	.	.	700	1208.8	0.817	0.116	.
± 2SE	.	54	.	.	127	808.2	0.090	0.022	.
2002	2	252	64.0	1.426	734	1390.0	0.844	0.106	0.280
± 2SE	.	.	.	.	77	220.0	0.150	.	.
2003	2	220	.	.	803	1987.5	0.978	0.148	.
± 2SE	.	.	.	.	45	145.0	0.109	.	.
2005	1	312	137.0	1.510	548	580.0	1.000	0.079	0.148
± 2SE	.	.	.	.	.	.	.	.	.
2006	2	.	.	.	566	525.0	0.803	.	.
± 2SE	.	.	.	.	79	230.0	0.012	.	.
2007	1	226	34.0	1.084	574	610.0	0.903	0.146	0.241
± 2SE	.	54	.	.	127	808.2	0.090	0.022	.
2002	2	252	64.0	1.426	734	1390.0	0.844	0.106	0.280
± 2SE	.	.	.	.	.	.	.	.	.
2008	1	.	.	.	625	670.0	0.750	.	.
± 2SE	.	.	.	.	.	.	.	.	.
2011	11	307	82.0	0.953	623	750.5	0.823	0207	0.254
± 2SE	.	.	.	.	28	128.7	0.043	.	.
2013	1	.	.	.	625	700.0	0.783	.	.
± 2SE	.	.	.	.	.	.	.	.	.
2015	1	203	296.0	1.317	127	.	.	-10.9	.
± 2SE	.	.	.	.	.	.	.	.	.

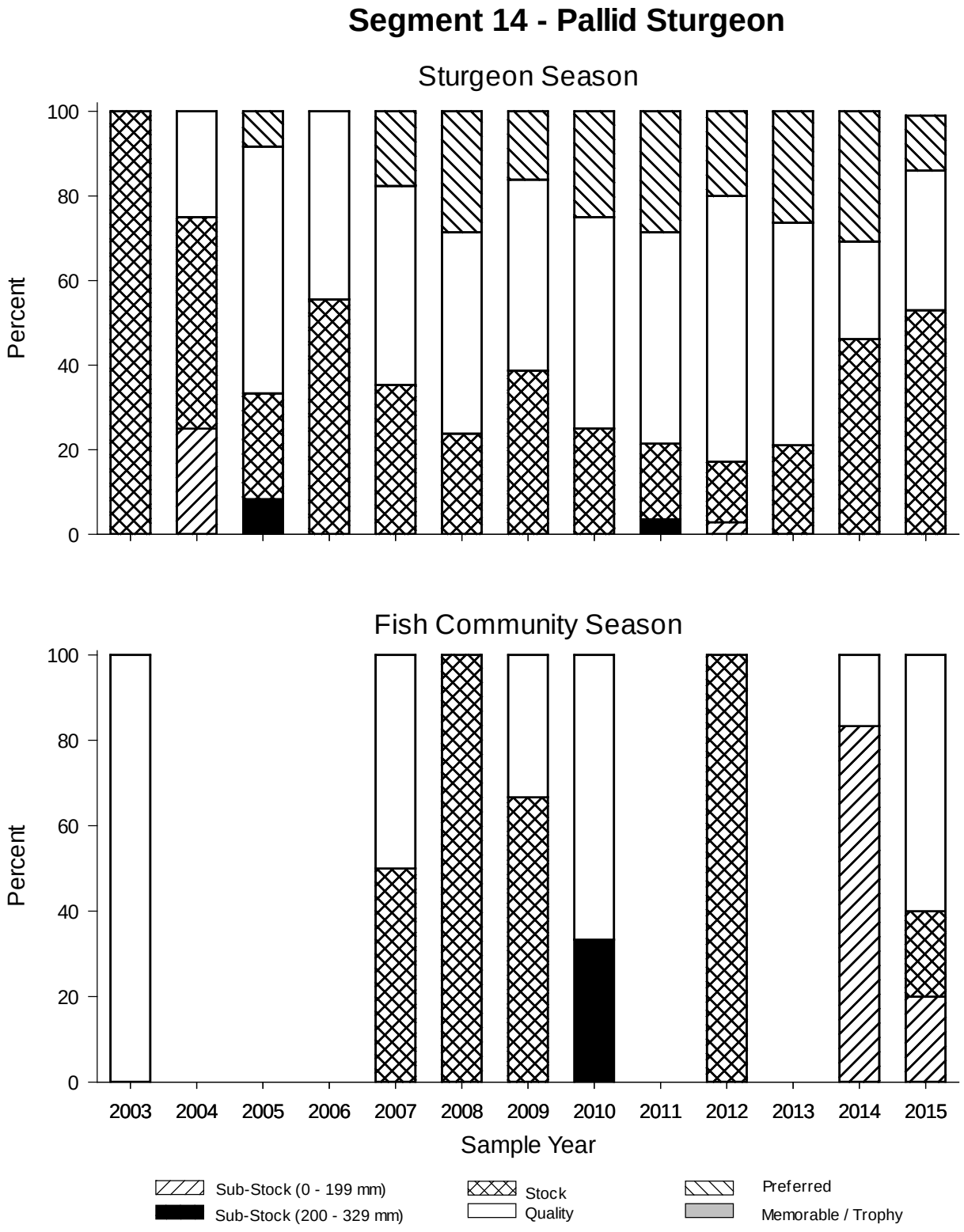

Figure 3. Incremental proportional size distribution (PSD) for all Pallid Sturgeon captured with all gear by length category from 2003-2015 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

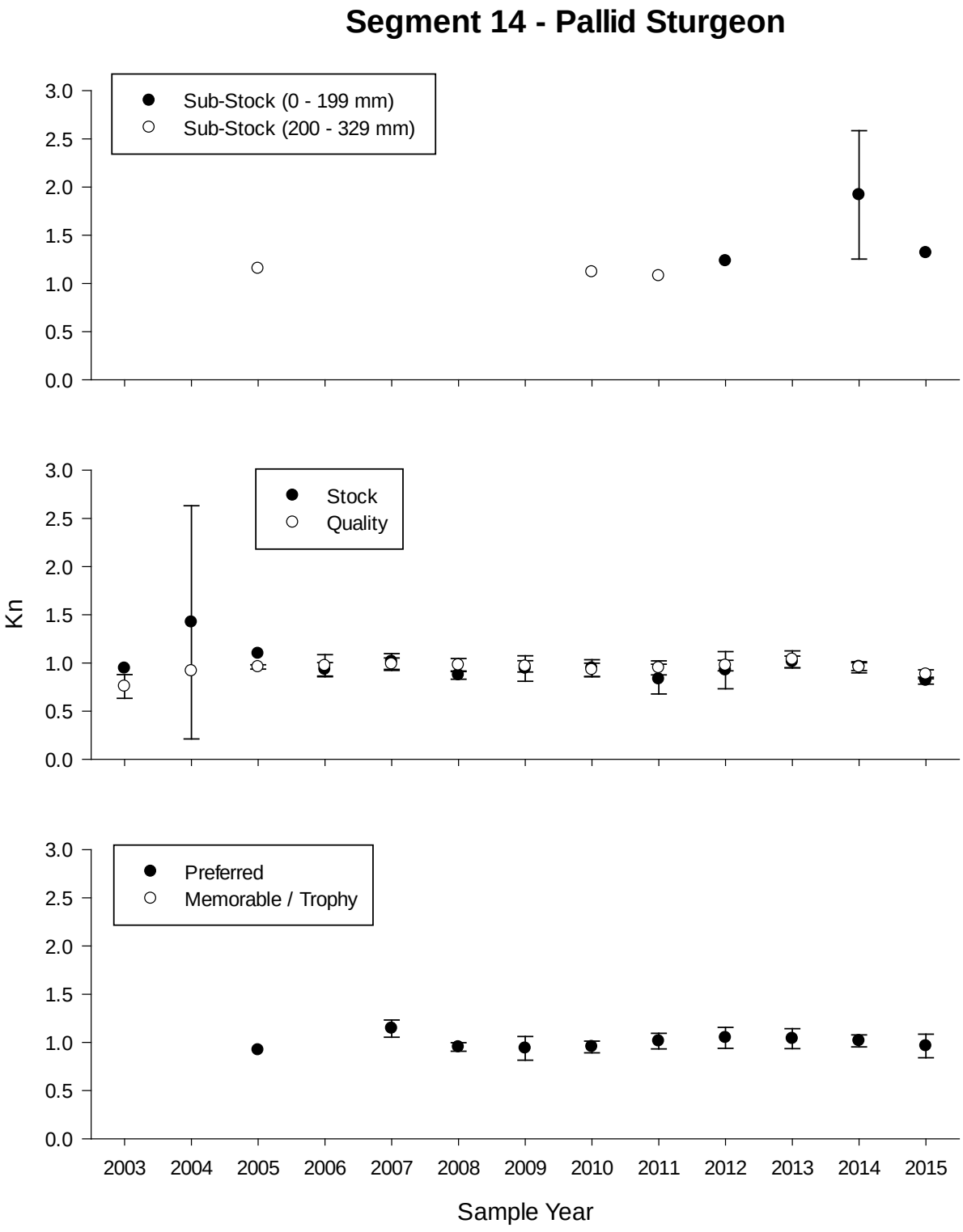

Figure 4. Relative condition factor (K_n) for all Pallid Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2015 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

Year comparisons, gear evaluation and habitat associations

Of the 35 total Pallid Sturgeon captured in 2015, 26 were captured during standard sampling efforts. Mean Pallid Sturgeon CPUE for standard gill nets in 2015 (0.03 fish/net night ± 0.02 2SE) increased from 2014, returning to levels seen in 2008 (Figure 5). Catch per unit effort for Pallid Sturgeon in standard gill nets during 2015 increased 88% from 2014 and has been relatively stable except in the years 2008 and 2012 (Figure 5). Our 2015 catch rates were above the 13-year mean of 0.021 fish/net night ± 0.02 2SE. Three Pallid Sturgeon were collected in trammel nets in 2015; mean CPUE 0.016 fish/100 m ± 0.02 (Figure 6). Few Pallid Sturgeon have been captured in trammel nets since 2003; however, 2015 was the second consecutive year a wild Pallid Sturgeon was captured with this gear. No Pallid Sturgeon were captured in otter trawls during sturgeon season; two hatchery stock were captured during fish community sampling (Figure 7). Mean CPUE of Pallid Sturgeon in otter trawls during fish community season declined nearly 70% from 2014, yet was the second highest on record since monitoring began (0.008 fish/100 m ± 0.01). Mean CPUE of Pallid Sturgeon captured on trotlines during 2015 was 0.05 fish/20 hook night ± 0.03 2SE (Figure 8). Of the 12 Pallid Sturgeon captured on standard trotlines, two are presumed wild based on genetic analysis. Catch per unit effort for Pallid Sturgeon on standard trotlines during 2015 was double the catch rate from 2014 and was the second highest since implementation of trotlines as standard gear (Figure 8).

In 2015, one sub-stock (0-199 mm) Pallid Sturgeon was captured in ISB macrohabitat during fish community season from an otter trawl (Table 4). No sub-stock size (200-329 mm FL) size Pallid Sturgeon were captured in Segment 14 during standard sampling in 2015 (Table 5). Twelve

stock size Pallid Sturgeon were captured during standard sampling in gill nets and on trotlines from CHXO, ISB and SCCL macrohabitats. One Pallid Sturgeon was caught in a trammel net from CHXO macrohabitat (Table 6). Quality size and greater (≥ 630 mm FL) Pallid Sturgeon were captured with trotlines (42%), gill nets (33%), trammel nets (17%) and otter trawls (8%; Table 7). Most quality size Pallid Sturgeon (66.6%) were found in the ISB macrohabitat, but quality size Pallid Sturgeon were also captured from the CHXO (16.6%) and SCCL (16.6%) macrohabitats (Table 7). When looking at all catch success during standard effort combined, trotlines were the most effective gear followed by gill nets, trammel nets and otter trawls. During 2015, most Pallid Sturgeon were detected in ISB macrohabitat (*n* = 12; Table 8). Pallid Sturgeon were also captured in CHXO (*n* = 5) and SCCL (*n* =4) macrohabitats (Table 8).

Pallid Sturgeon collected in all samples from Segment 14 during 2015 ranged from 127 to 920 mm FL, representing three distinct size groups (Figure 9). Four genetically presumed wild Pallid Sturgeon were captured, none of which were suitable for use in the Pallid Sturgeon Propagation and Population Augmentation Program in 2015. Overall catch rates of Pallid Sturgeon increased from 2014 and were higher than the 13-year mean (*n* = 20) for Pallid Sturgeon captures in Segment 14 for all years (Figure 10). Capture rates of hatchery stocked and wild Pallid Sturgeon have been variable throughout all years of monitoring; however, captures of hatchery reared fish peaked in 2015 (*n* = 31).

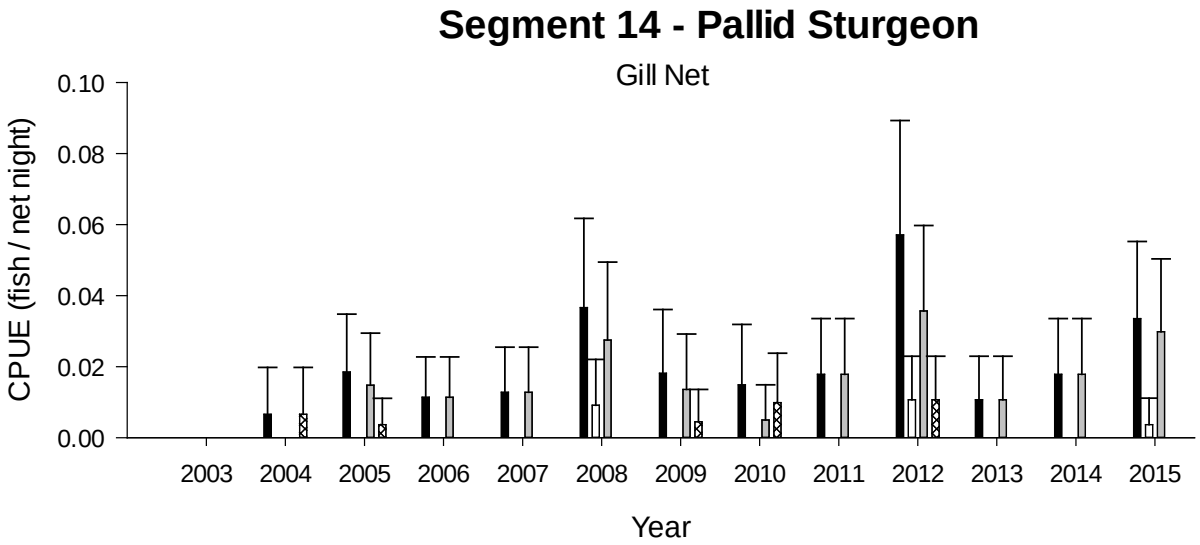

Figure 5. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using gill nets in Segment 14 of the Missouri River from 2003-2015. Pallid Sturgeon of unknown origin are awaiting genetic verification.

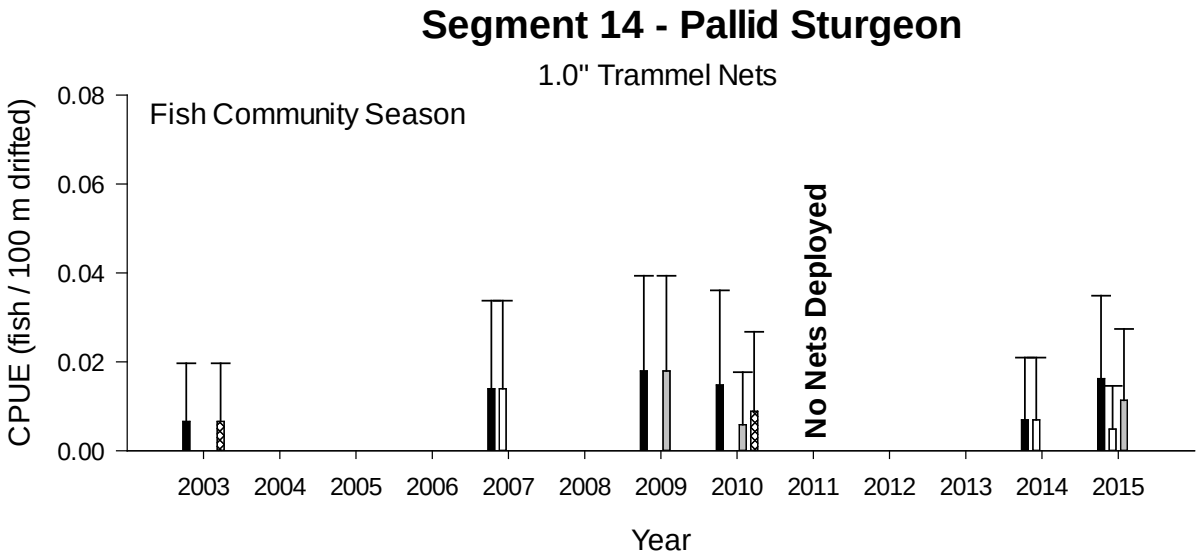

Figure 6. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using 1.0" trammel nets in Segment 14 of the Missouri River from 2003-2015. Pallid Sturgeon of unknown origin are awaiting genetic verification.

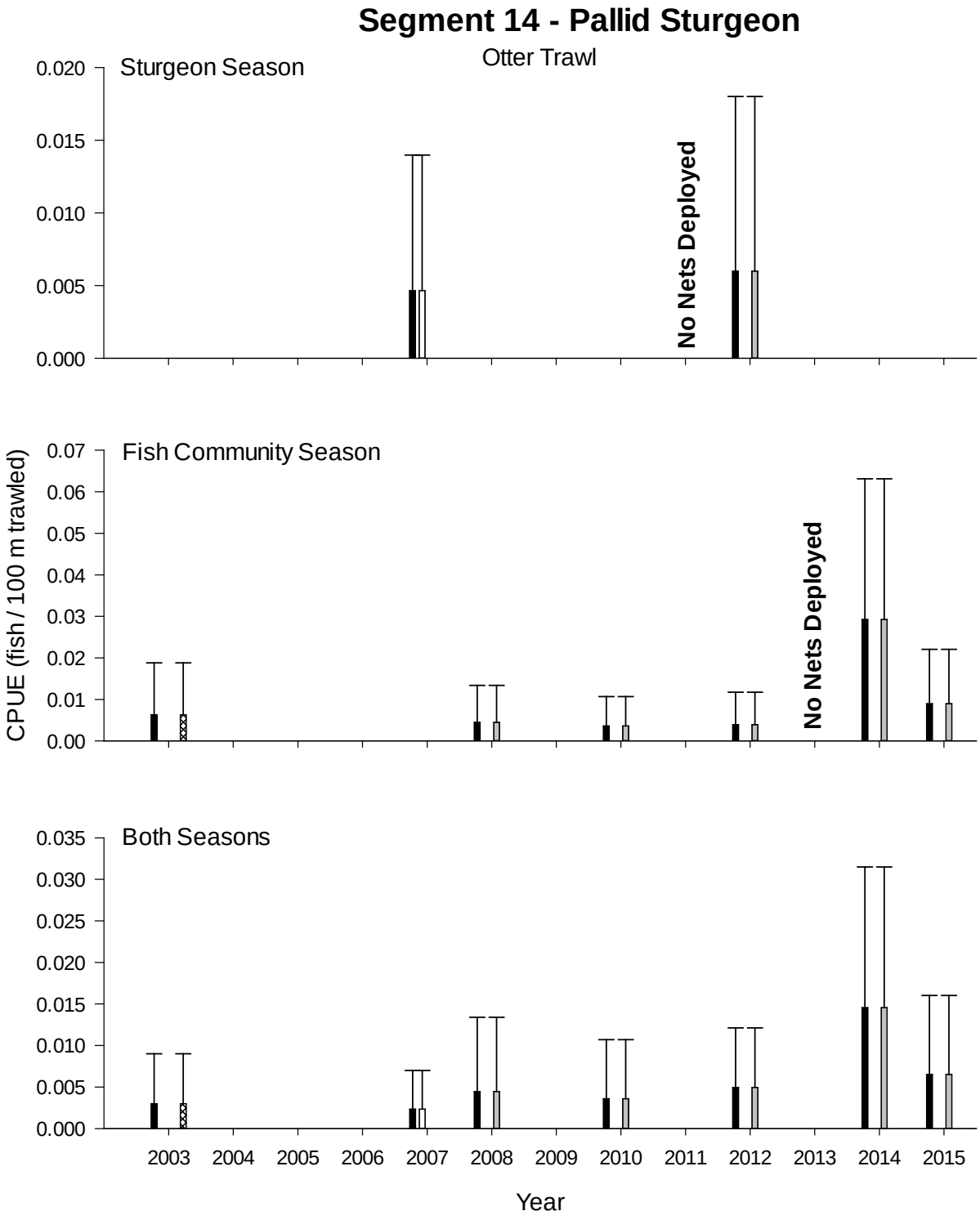

Figure 7. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using otter trawls in Segment 14 of the Missouri River from 2003-2015. Pallid Sturgeon of unknown origin are awaiting genetic verification.

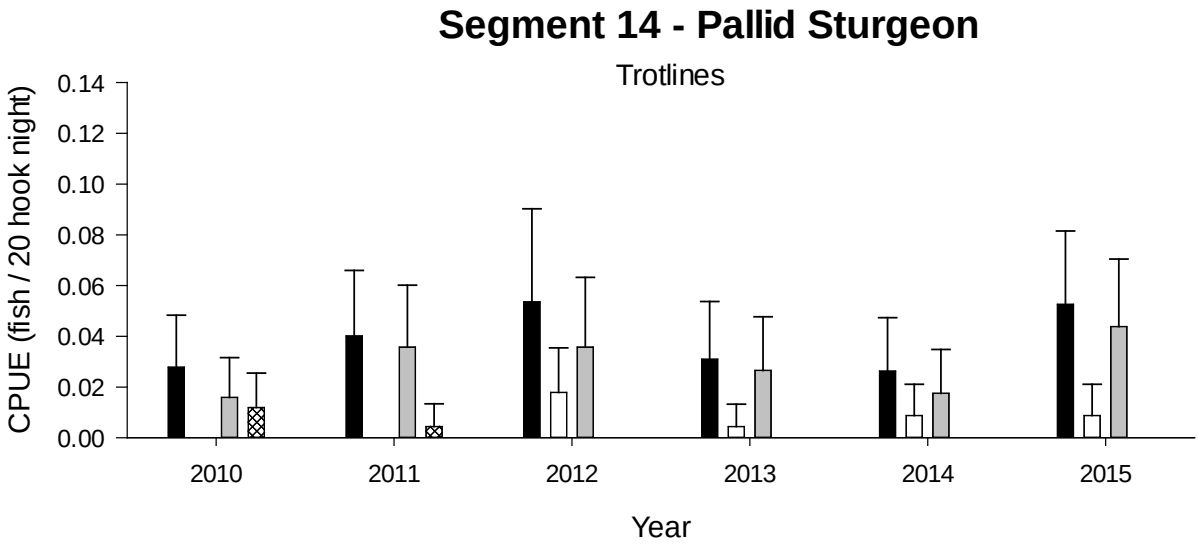

Figure 8. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using trotlines in Segment 14 of the Missouri River from 2010-2015. Pallid Sturgeon of unknown origin are awaiting genetic verification.

Table 4. Total number of sub-stock size (0-199 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	3	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	1	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 5. Total number of sub-stock size (200-329 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	3	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	1	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 6. Total number of stock size (330-629 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	5	N-E	40	0	N-E	N-E	N-E	0	40	0	20	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	1	N-E	100	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	7	N-E	0	0	N-E	N-E	N-E	0	86	0	14	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 7. Total number of quality size and greater (≥630 mm) Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	4	N-E	25	0	N-E	N-E	N-E	0	50	0	25	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	2	N-E	0	0	N-E	N-E	N-E	0	50	0	50	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	5	N-E	20	33	N-E	N-E	N-E	0	80	0	0	0	0	0	0	0
		N-E	25	2	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 8. Total number of Pallid Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	9	N-E	33	0	N-E	N-E	N-E	0	44	0	22	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	3	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	3	N-E	33	0	N-E	N-E	N-E	0	33	0	33	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	8	8	0
Otter Trawl	2	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	12	N-E	8	0	N-E	N-E	N-E	0	83	0	8	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

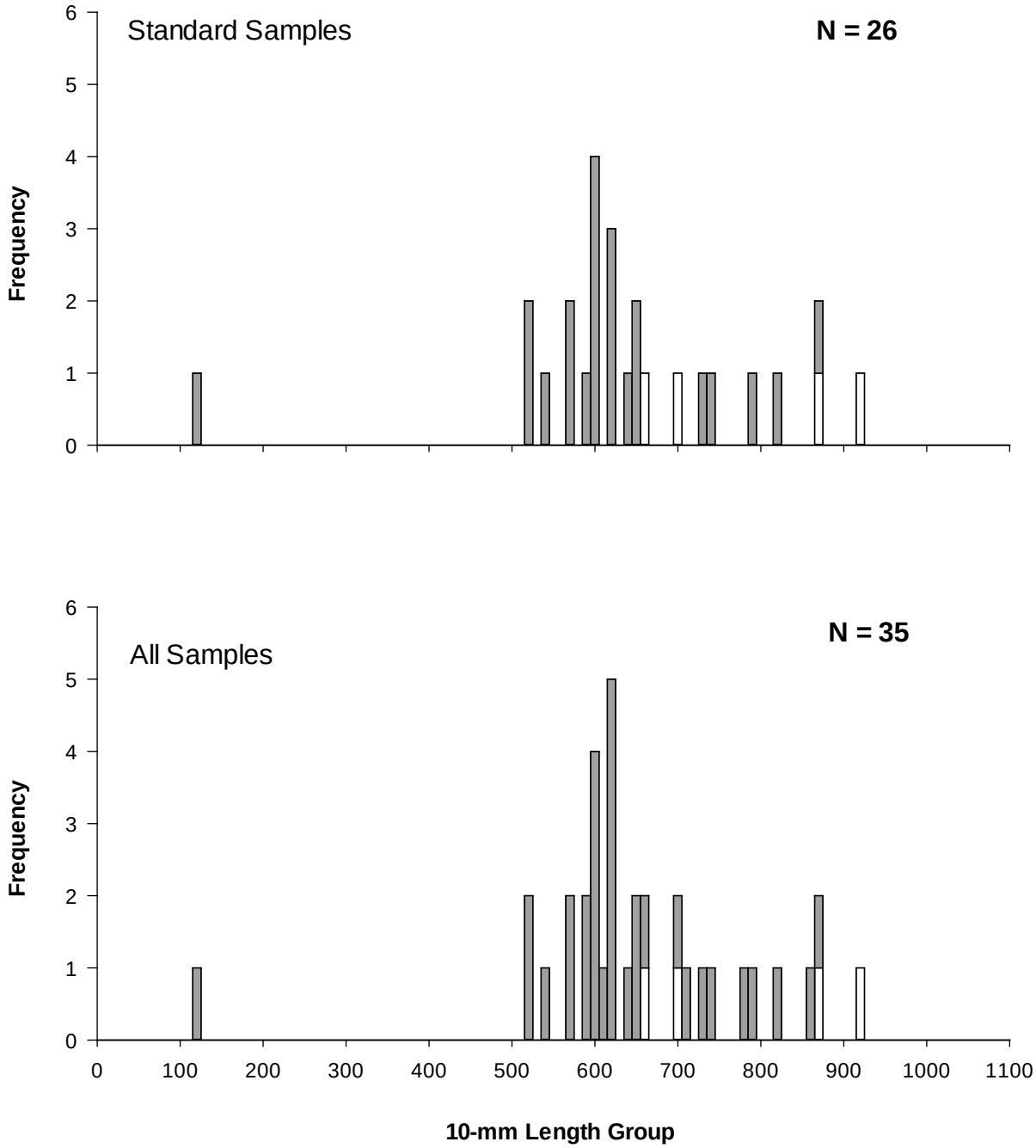

Figure 9. Length frequency of Pallid Sturgeon captured in Segment 14 of the Missouri River during 2015. White bars represent presumed wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent unknown Pallid Sturgeon. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015. Pallid Sturgeon of unknown origin are awaiting genetic verification.

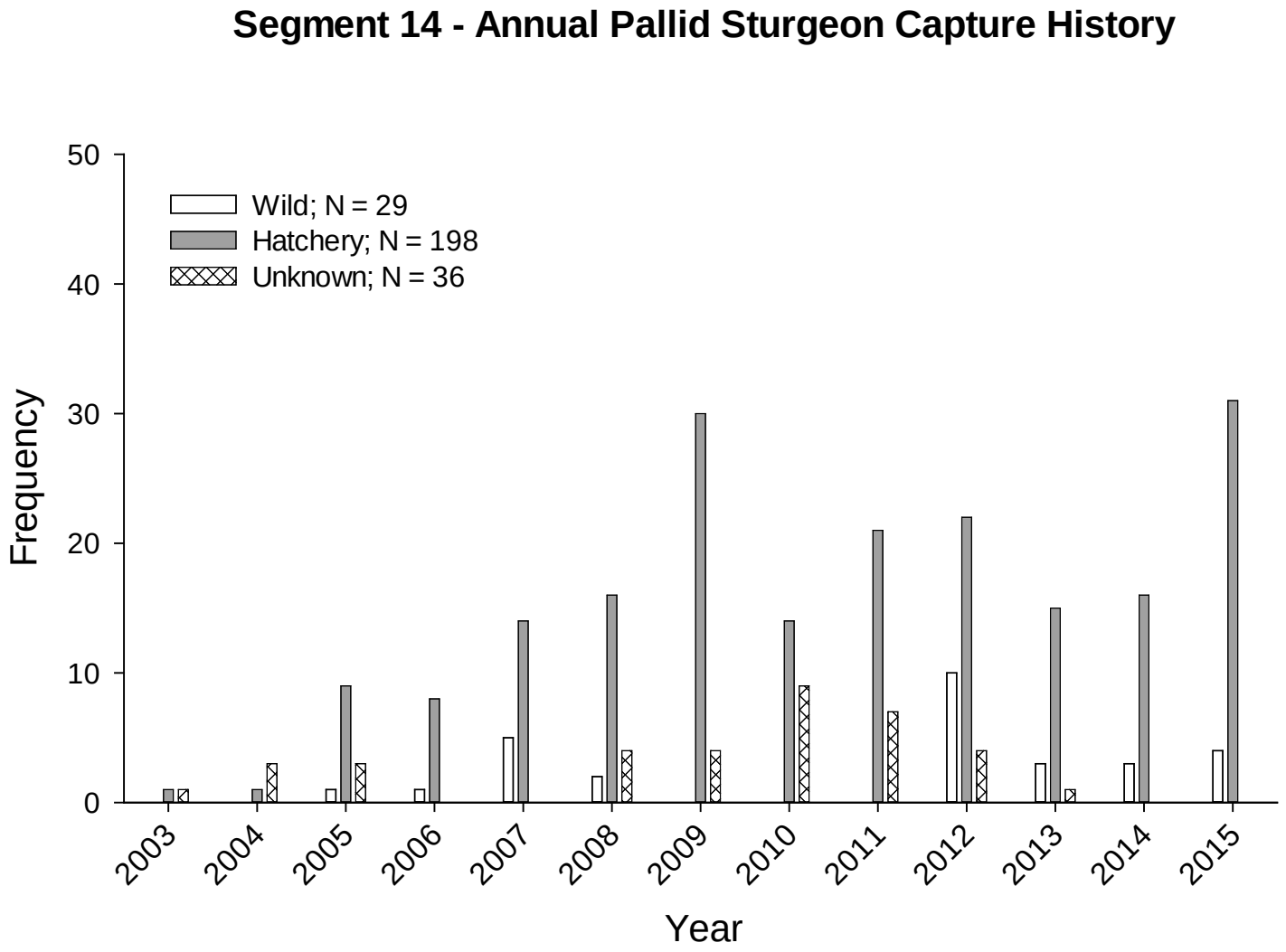

Figure 10. Annual capture history of presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon collected in Segment 14 of the Missouri River from 2003-2015. Figure is designed to compare overall Pallid Sturgeon captures from year to year and is biased by variable effort among years. Figure includes all pallid captures including non-random and wild samples.

Shovelnose X Pallid Sturgeon Hybrids

We captured a total of eight Shovelnose Sturgeon x Pallid Sturgeon hybrids in Segment 14 during the 2015 sampling year. All hybrids were captured during standard sampling efforts on trotlines (*n* = 4), gill nets (*n* = 2) and trammel nets (*n* = 2). Of note, genetic testing performed by Ed Heist, Southern Illinois University – Carbondale, indicated that one of the 1992 year class was a hybrid sturgeon. Shovelnose Sturgeon x Pallid Sturgeon hybrids ranged in length from 599 to 977 mm FL and weighed 650 to 3,360 g. Seven of the Shovelnose Sturgeon x Pallid Sturgeon hybrids were captured in ISB macrohabitats and one from SCCL macrohabitat. Of the hybrids captured in ISB macrohabitat, 71% were captured in CHNB mesohabitat and 29% from POOL mesohabitats. The hybrid captured in SCCL macrohabitat was collected from an ITIP mesohabitat. Shovelnose x Pallid Sturgeon hybrids were captured in water depths ranging from 2.3 to 6.4 m, and bottom velocity ranged from 0.38 to 1.05 m/s. Since 2003, 120 sturgeon identified as Shovelnose Sturgeon x Pallid Sturgeon hybrids have been captured in Segment 14 and three have been captured multiple times.

Targeted Native River Species

Shovelnose Sturgeon

A total of 3,948 Shovelnose Sturgeon were collected in Segment 14 during 2015, of which 3,427 were collected with standard gears. Gill nets accounted for 45.9% of Shovelnose Sturgeon captures from standard gears. The quality and above size class (> 380 mm FL) continues to dominate the CPUE of Shovelnose Sturgeon for all gear types (Figures 11-14). Mean CPUE of quality size and larger Shovelnose Sturgeon in gill nets was 5.81 fish/net night ± 1.11SE, a 10% increase from 2014 (Figure 11). Gill net CPUE has declined since 2007. Mean trammel net CPUE of quality size Shovelnose Sturgeon during 2015 was 3.78 fish/100 m ± 1.55SE. Trammel net CPUE has been highly variable through all years; however, catch rates have remained comparatively high for the last three years (Figure 12). Mean CPUE of quality size Shovelnose Sturgeon in otter trawls during the 2015 sturgeon season (0.71 fish/100 m ± 0.45SE) was 10% higher than CPUE in 2014; however, this increase may be an artifact of smaller sample size and limited temporal representation where only five bends were otter trawled during sturgeon season. Sturgeon season CPUE has been notably variable throughout the duration of the monitoring program (Figure 13). Mean CPUE of quality size Shovelnose Sturgeon in otter trawls during the 2015 fish community season (0.89 fish/100 m ± 0.34SE) was 14% lower than CPUE in 2014; the highest recorded since monitoring efforts began. Otter trawl CPUE during fish community season has remained relatively stable through all years (Figure 13). Otter trawls also frequently captured sub-stock size Shovelnose Sturgeon and when examining CPUE of both seasons combined, catch rates for sub-stock (0-149 mm) increased 72% but declined 56% for sub-stock (150-249 mm) sicne 2014 (Figure 13). Mean CPUE of quality size Shovelnose

Sturgeon from trotlines (3.61 fish/20 hook night ± 0.62SE) during 2015 showed a 76% decrease over catch rates in 2014 (Figure 14). Trotline CPUE has remained near the mean CPUE of 4.33 fish/20 hook night ± 0.70SE since 2010 (Figure 14).

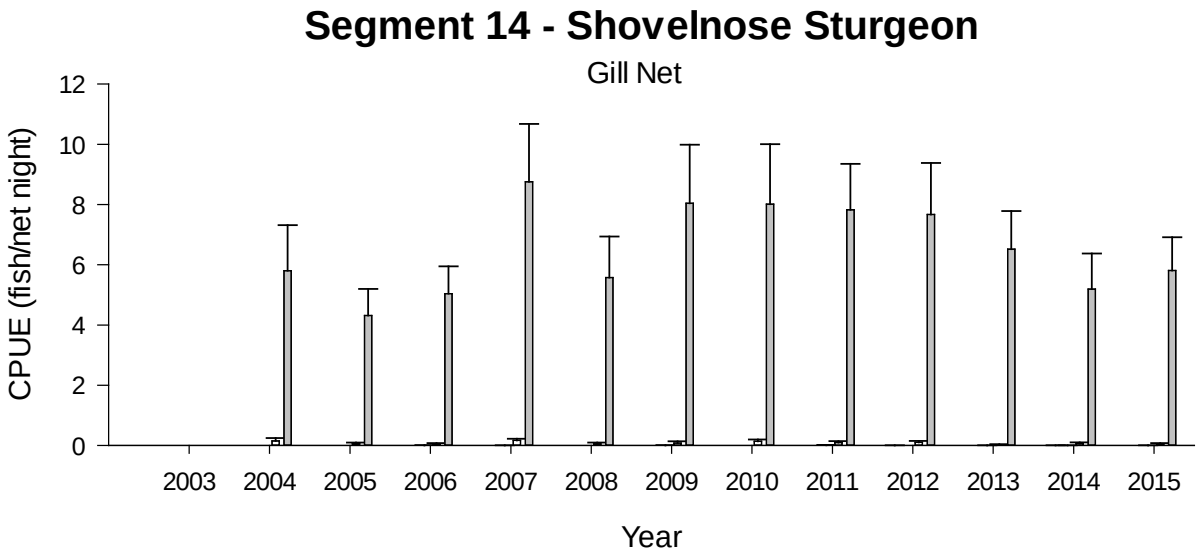

Figure 11. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using gill nets in Segment 14 of the Missouri River from 2003-2015.

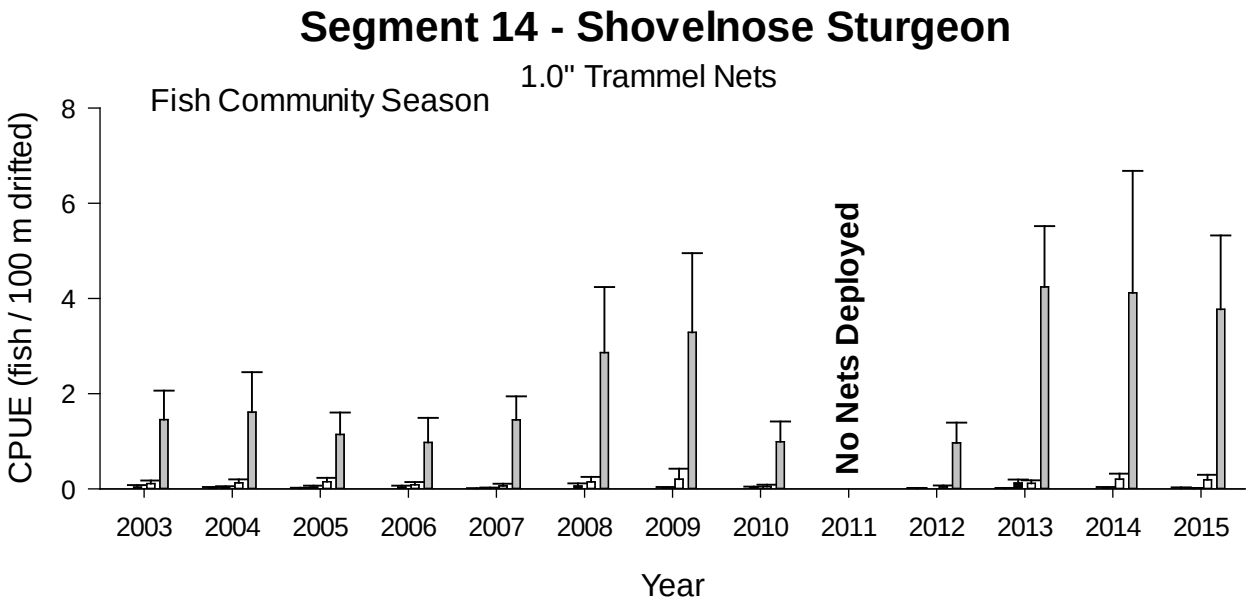

Figure 12. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using 1.0" trammel nets in Segment 14 of the Missouri River from 2003-2015.

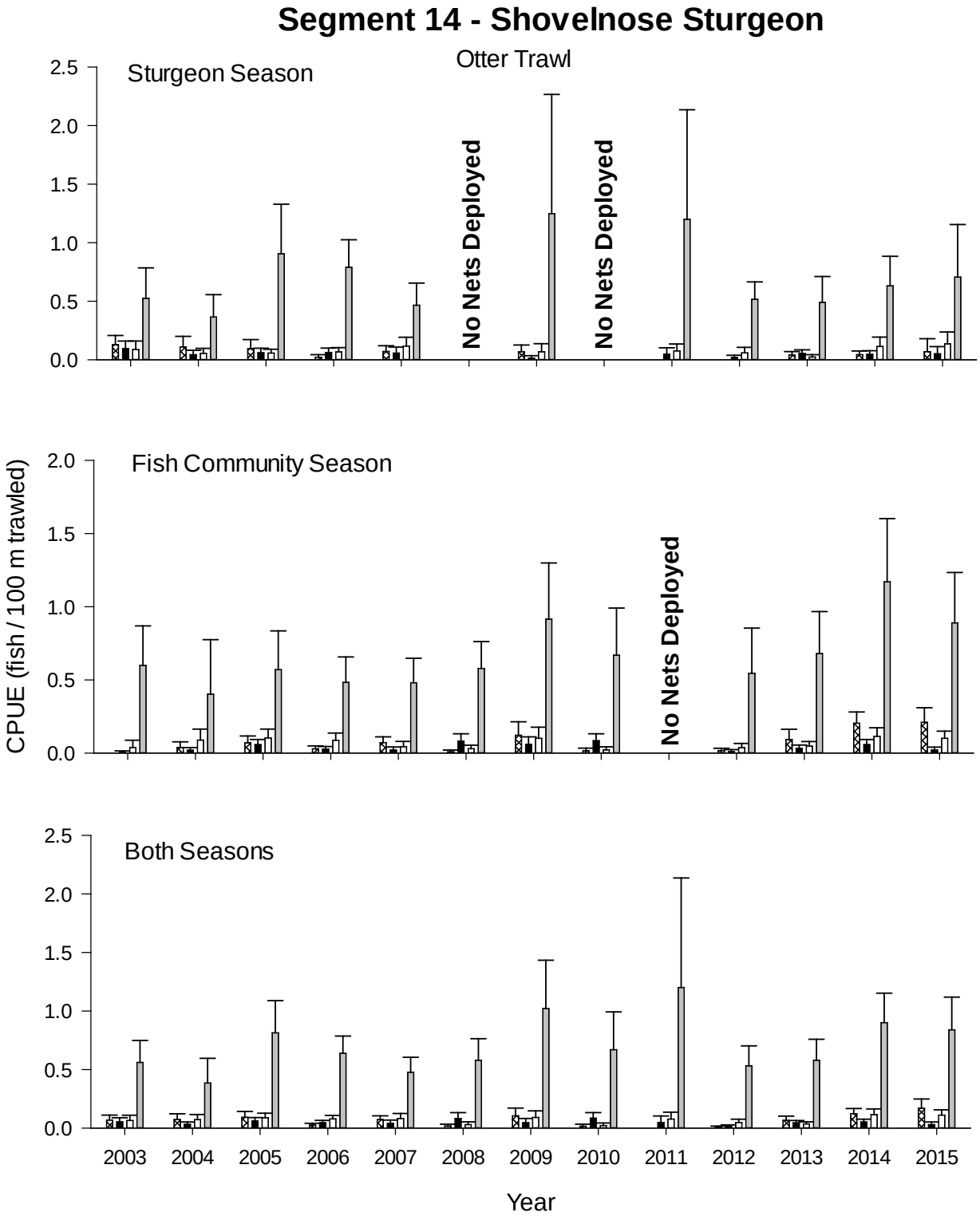

Figure 13. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using otter trawls in Segment 14 of the Missouri River from 2003-2015.

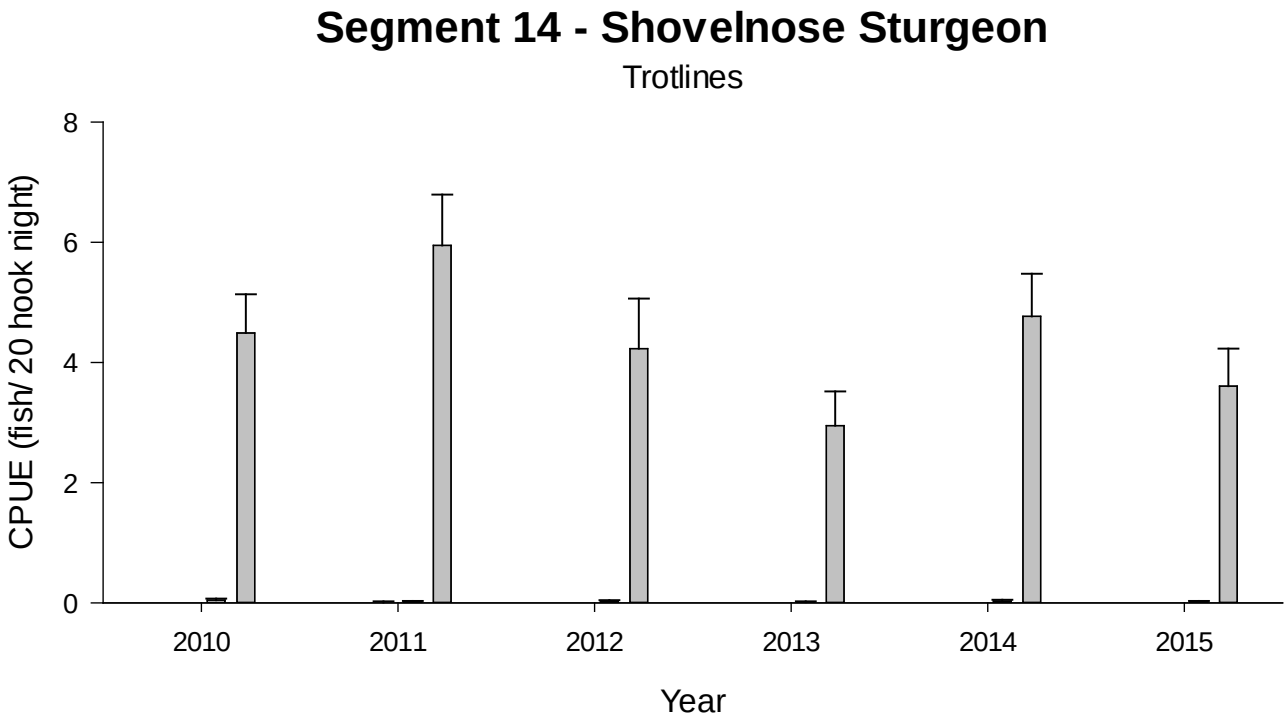

Figure 14. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using trotlines in Segment 14 of the Missouri River from 2010-2015.

Habitat Use

One hundred ninety-two sub-stock size (0-149 mm FL) Shovelnose Sturgeon were captured during standard sampling in Segment 14 during 2015. Caudal fin clips from those shorter than 110 mm FL were sent to Southern Illinois University-Carbondale (Dr. Edward J. Heist) for genetic verification. Most (76%) sub-stock (0-149 mm FL) Shovelnose Sturgeon were captured in otter trawls (Table 9). Sub-stock size (0-149 mm FL) Shovelnose Sturgeon were primarily found in ISB macrohabitats, but were also found in the CHXO macrohabitat (Table 9). Three sub-stock size (150-249 mm FL) Shovelnose Sturgeon were captured during standard sampling in otter trawls during sturgeon season and six were captured during fish community season. One was captured in a standard trammel net during fish community season and one was captured in a standard gill net during sturgeon season (Table 10). Sub-stock size (150-249 mm) Shovelnose Sturgeon were most often captured from the ISB macrohabitat (78.0%; Table 10). Stock size (250-379 mm FL) Shovelnose Sturgeon (*n* = 74) were captured in all gears, except mini-fyke nets, during standard sampling in Segment 14 during 2015. Otter trawls captured the greatest number of stock size Shovelnose Sturgeon (*n* =41). Stock size Shovelnose Sturgeon were most often captured in ISB macrohabitat; however, those captured from CHXO habitat were in greater proportion than sampled (Table 11). A total of 3,149 quality size and greater Shovelnose Sturgeon were captured in all gears except mini-fyke nets, with most quality size fish being caught in gill nets (49%; Table 12). Most quality size and greater Shovelnose Sturgeon (61%) were found in the ISB macrohabitat, but quality size and greater Shovelnose Sturgeon were also captured from the CHXO, OSB, SCCL and SCCS macrohabitats (Table 12). The proportion of sturgeon captured from SCCS macrohabitat was 0.22% (*n* = 7); however, due

to rounding, this is reflected as zero in Table 12. Shovelnose Sturgeon captured in CHXO, ISB and OSB macrohabitats were found in similar proportions to the effort expended in each habitat type; proportions of Shovelnose Sturgeon were lower in SCCL, SCCS, SCN, TRML and TRMS macrohabitats relative to effort (Table 13).

Shovelnose Sturgeon collected in Segment 14 during 2015 ranged from 31 to 863 mm FL. The majority were between 500-650 mm FL (Figure 15). Preferred size Shovelnose Sturgeon dominated the catch during both the sturgeon season and the fish community season, indicating the sampled population consists mostly of larger adults. The proportion of preferred size Shovelnose Sturgeon captured during sturgeon season has generally been stable since 2003 (Figure 16). From 2004 through 2012, the proportion of trophy/memorable size Shovelnose Sturgeon captured during sturgeon season declined; however, 2013 – 2105 captures indicate a reversal of that trend (Figure 16). The proportions of quality, stock and sub-stock size Shovelnose Sturgeon captured during sturgeon season has been more variable during the past ten years (Figure 16). The proportion of preferred size Shovelnose Sturgeon captured during fish community season has generally been stable since 2003 (Figure 16). The proportion of trophy/memorable size Shovelnose Sturgeon captured during fish community season has been variable, with 2010 and 2012 representing the lowest proportion of trophy/memorable size fish (Figure 16). The proportion of quality size Shovelnose Sturgeon captured during fish community season has been relatively stable during the past ten years; however, 2014 showed a marked decline in the number captured and 2015 continued that trend (Figure 16). The proportion of stock size Shovelnose Sturgeon captured during the fish community season has

been variable over the duration of the monitoring program but proportions remain unchanged from 2014 (Figure 16). Mean W_r of Shovelnose Sturgeon ranged from 82.3 to 99.9 in Segment 14 in the 2015 sample year. Relative weight of stock and quality size shovelnose has been variable in Segment 14 (Figure 17). Relative weights for preferred and memorable/trophy size shovelnose are notably lower than those seen in 2013 and 2014. Relative weights in 2013 showed a marked increase in W_r for these size classes, where W_r had declined since 2007 (Figure 17). In general, larger size classes of Shovelnose Sturgeon appear to have lower W_r's in Segment 14 (Figure 17). Relative weights of quality and sub-stock (150 – 249 mm FL) sized Shovelnose Sturgeon continued to decline in 2015 from the peak in 2013. In contrast, W_r of stock size sturgeon was highest since monitoring began.

Table 9. Total number of sub-stock size (0-149 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	2	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	39	N-E	18	0	N-E	N-E	N-E	0	79	0	3	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 10. Total number of sub-stock size (150-249 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	1	N-E	100	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	3	N-E	33	0	N-E	N-E	N-E	0	67	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	1	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	4	N-E	0	0	N-E	N-E	N-E	0	75	0	25	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 11. Total number of stock size (250-379 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	15	N-E	27	0	N-E	N-E	N-E	0	67	7	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	7	N-E	29	0	N-E	N-E	N-E	0	71	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	27	N-E	19	0	N-E	N-E	N-E	0	78	0	4	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	21	N-E	14	0	N-E	N-E	N-E	0	81	0	5	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	4	N-E	50	0	N-E	N-E	N-E	0	25	25	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 12. Total number of quality size and greater (≥380 mm) Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	1557	N-E	34	0	N-E	N-E	N-E	0	57	6	2	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	35	N-E	43	0	N-E	N-E	N-E	0	54	3	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	544	N-E	26	0	N-E	N-E	N-E	0	73	0	1	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	190	N-E	13	0	N-E	N-E	N-E	0	84	0	3	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	823	N-E	26	0	N-E	N-E	N-E	0	55	10	8	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Table 13. Total number of Shovelnose Sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	1573	N-E	34	0	N-E	N-E	N-E	0	57	6	2	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	47	N-E	40	0	N-E	N-E	N-E	0	57	2	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	573	N-E	25	0	N-E	N-E	N-E	0	74	0	1	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	254	N-E	14	0	N-E	N-E	N-E	0	83	0	4	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	827	N-E	26	0	N-E	N-E	N-E	0	55	10	8	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Segment 14 - Shovelnose Sturgeon

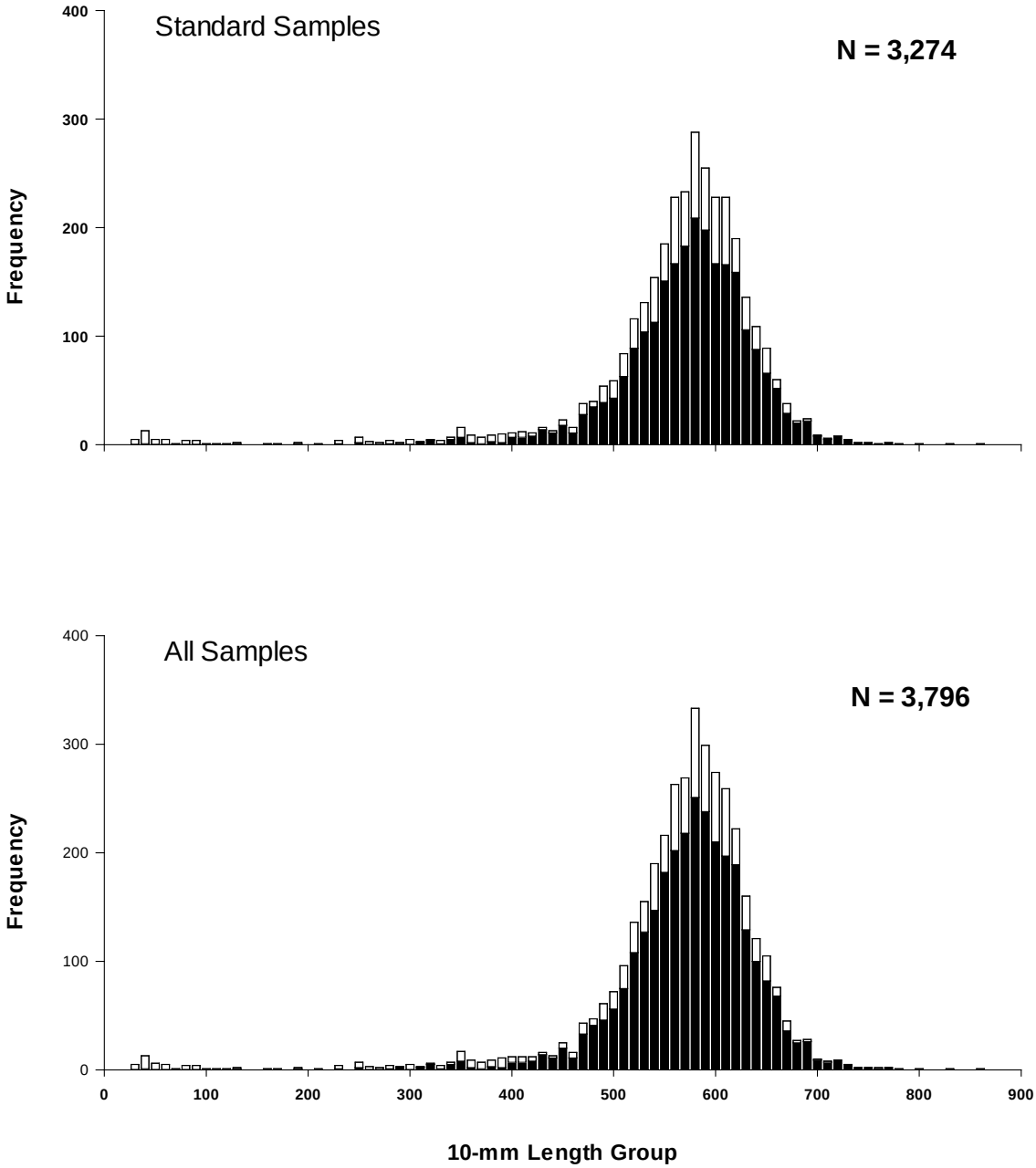

Figure 15. Length frequency of Shovelnose Sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

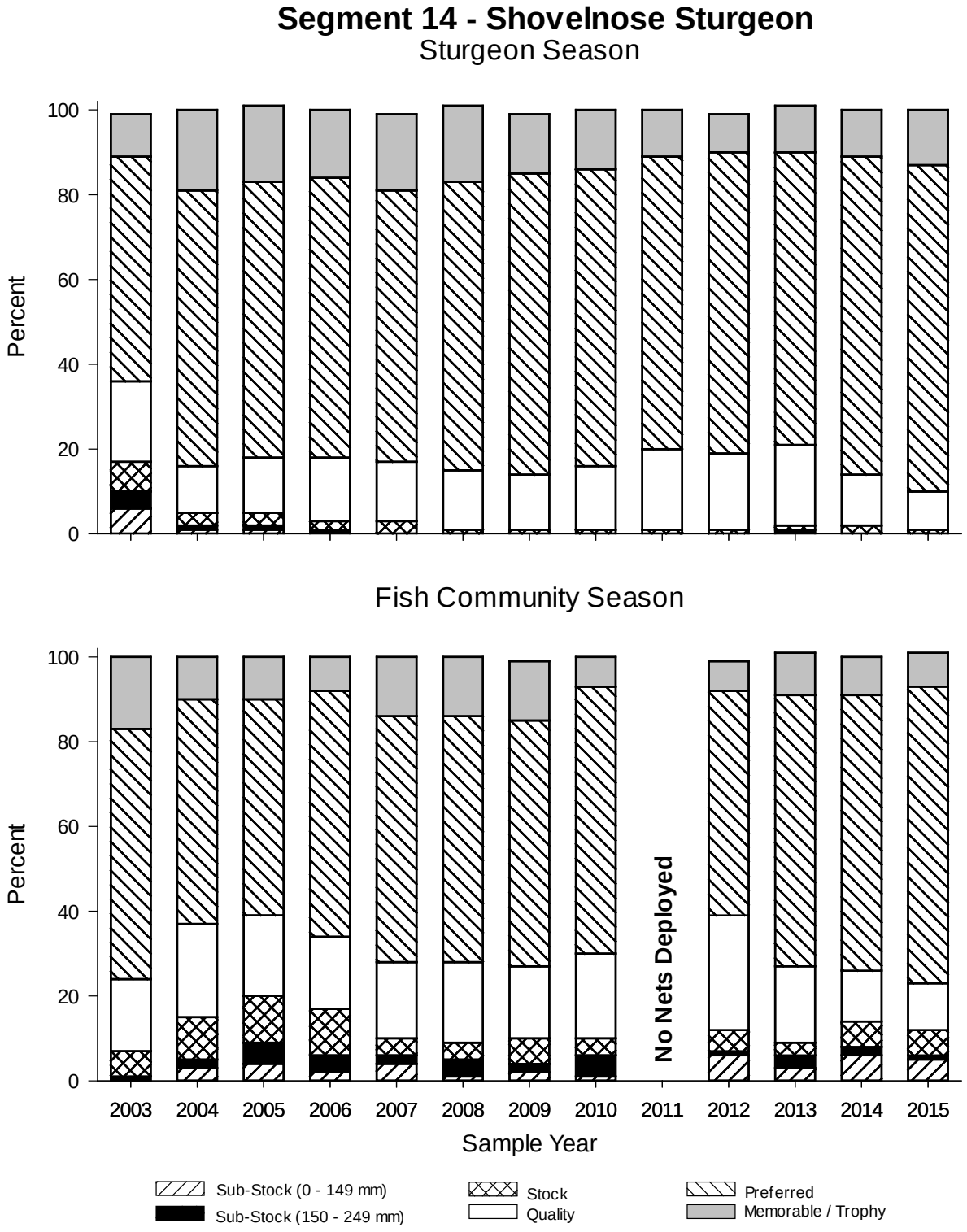

Figure 16. Incremental proportional size distribution (PSD) for all Shovelnose Sturgeon captured with all gear by length category from 2003 to 2015 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

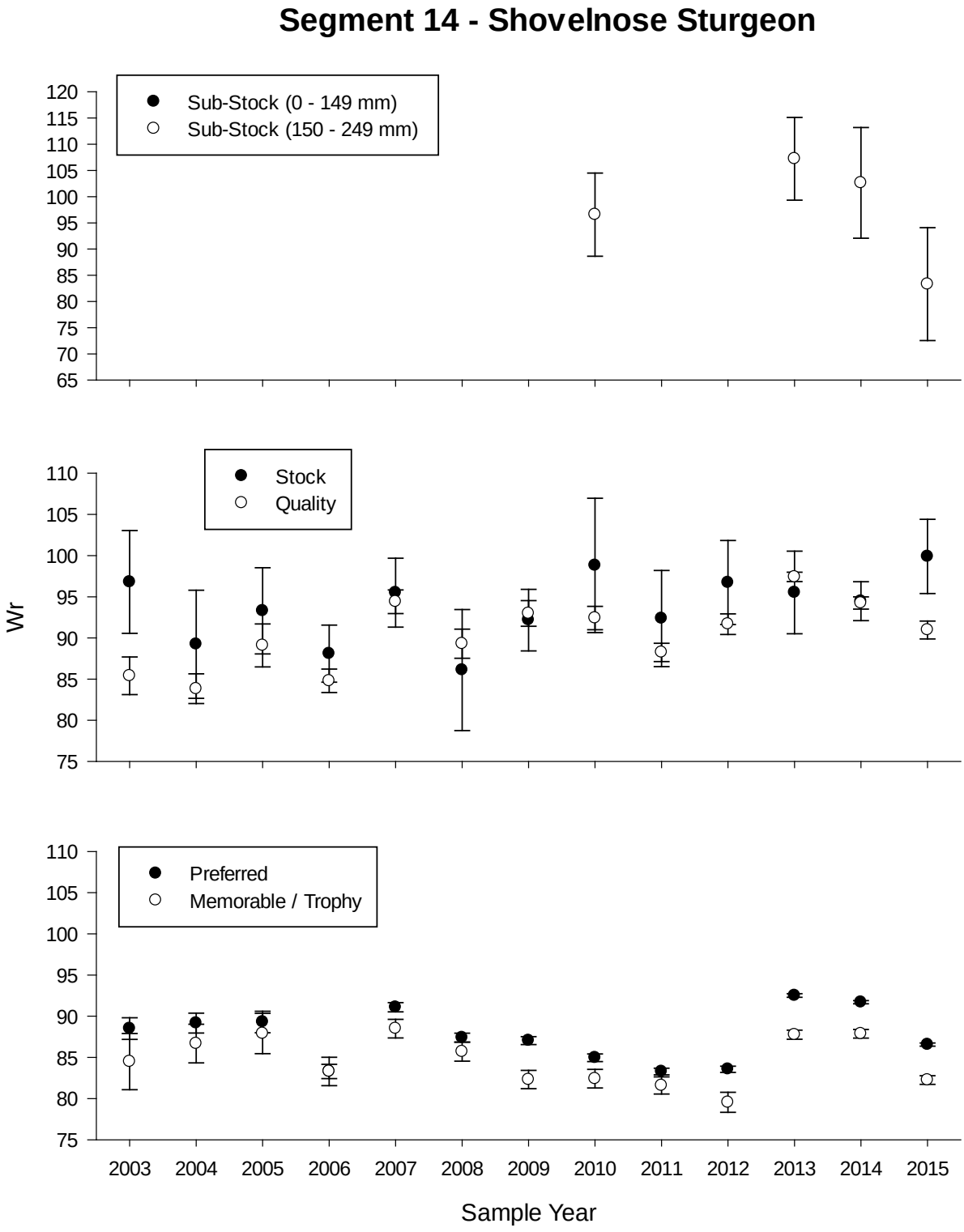

Figure 17. Relative weight (Wr) for all Shovelnose Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2015 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

We collected 30 Sturgeon Chub during standard sampling in Segment 14; all from otter trawls. Mean Sturgeon Chub CPUE from otter trawls during sturgeon season and fish community season was 0.14 fish/100m ± 0.09 and 0.11 fish/100 m ± 0.08, respectively. Overall, CPUE in 2015 continues to be at or above the 13-year mean of 0.04 fish/100m ± 0.03 (sturgeon season), 0.11 fish/100m ± 0.07 (fish community season); however, catch rates are notably lower than in 2014. Sturgeon Chub ranged in length from 25 to 72 mm TL (Figure 19). Thirteen Sturgeon Chub were collected in Segment 14 that were consistent with age-0 size fish (< 40 mm TL; Herman et al. 2008a). No Sturgeon Chub > 80 mm TL were collected during 2015, indicating that all Sturgeon Chub captured in Segment 14 were likely less than age-4 (Figure 19; Herman et al. 2008a). The majority of Sturgeon Chub captured in Segment 14 were captured in the CHNB mesohabitats (97%) within the ISB (70%), CHXO (20%) or SCCL (10%) macrohabitats. Depth at sites where Sturgeon Chub were captured ranged from 1.0 to 8.1 m, and mean depth at capture was 2.8 m ± 0.15 2SE. Velocity at capture sites ranged from 0.11 to 0.79 m/s, and mean bottom velocity where Sturgeon Chub were captured was 0.49 m/s ± 0.06 2SE.

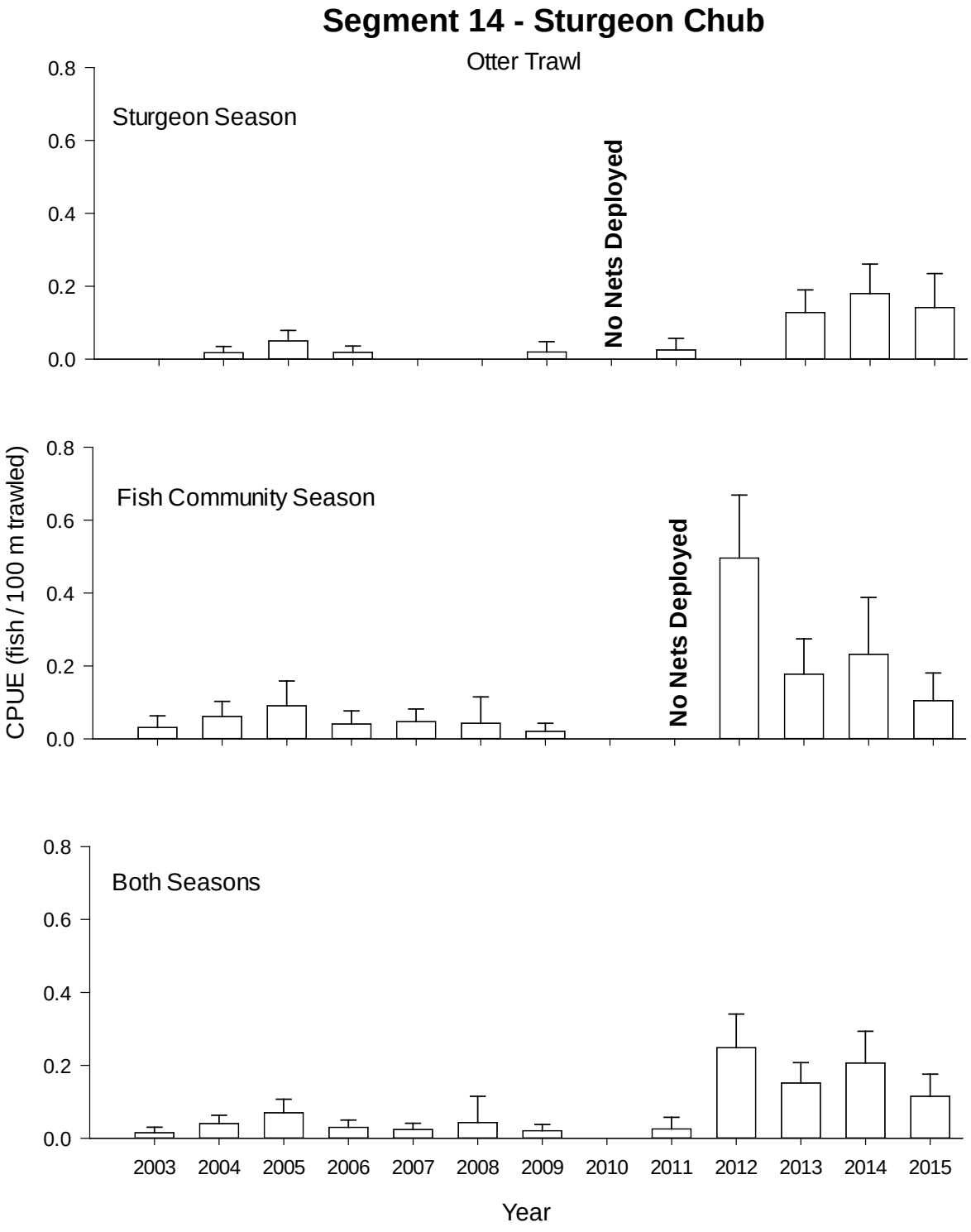

Figure 18. Mean annual catch per unit effort (± 2 SE) of Sturgeon Chub using otter trawls in Segment 14 of the Missouri River from 2003-2015.

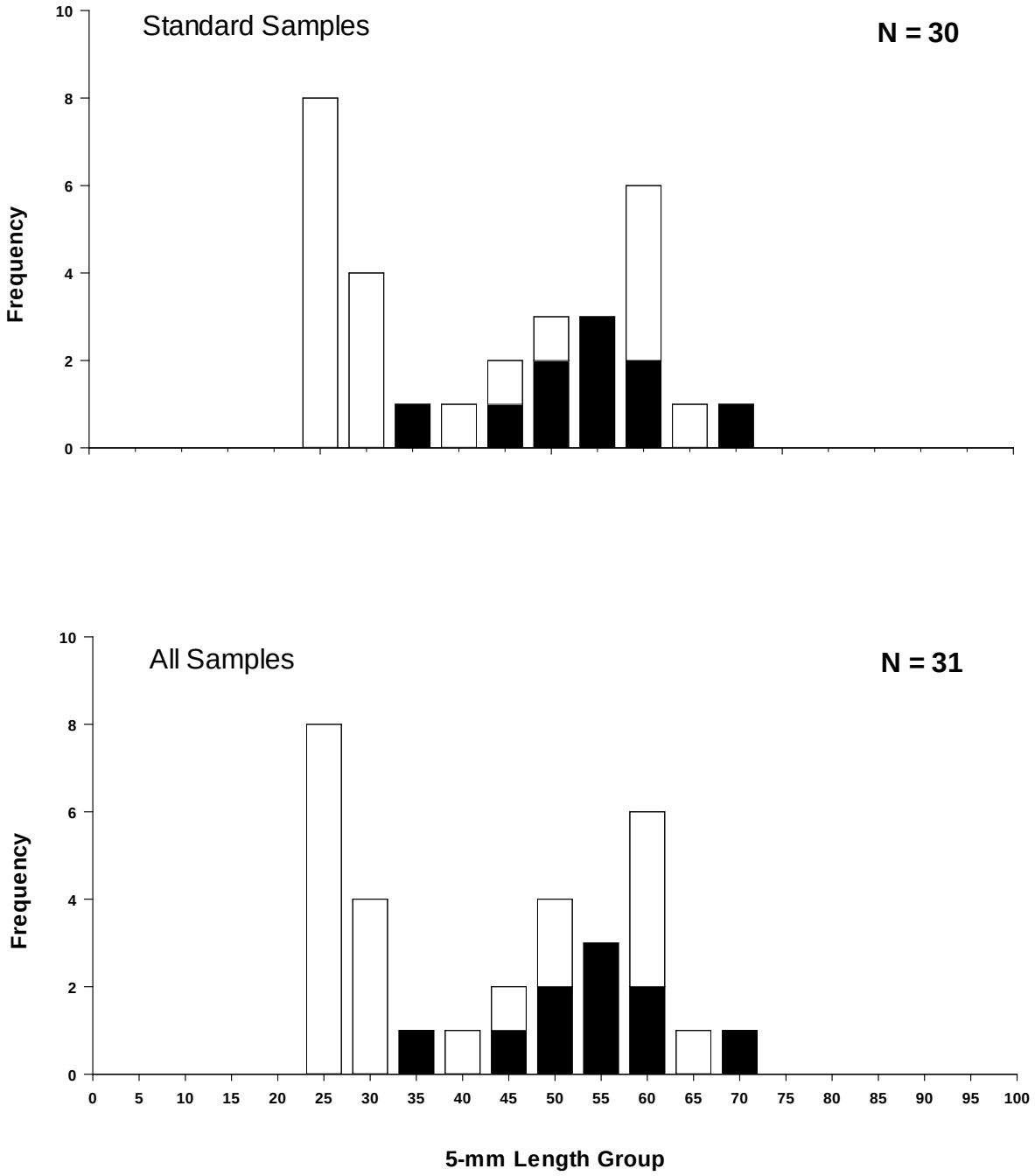

Figure 19. Length frequency of Sturgeon Chub during the sturgeon season (black bars) and fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sicklefin Chub

We collected 213 Sicklefin Chub with standard gears in Segment 14 during 2015. Sicklefin Chub were captured with otter trawls (94%) and mini-fyke nets (6%). Mean Sicklefin Chub otter trawl CPUE during the sturgeon season (0.77 fish/100 m ± 0.32) was the higher than the 13-year average (0.29 fish/100 ± 0.19) but lower than effort in 2014 (0.89 fish/100 m ± 0.43). Mean otter trawl CPUE during the fish community season (0.80 fish/100 m ± 0.35) and both seasons combined (0.79 fish/ 100m ±0.27) were the third highest since 2013; however, a marked decline from 2014 was observed (Figure 20). Sicklefin Chub ranged in length from 21 to 100 mm TL (Figure 21). We collected 13 Sicklefin Chub in Segment 14 that were consistent with age-0 size fish (< 30 mm TL; Herman et al. 2008b). Only eight Sicklefin Chub > 90 mm TL were collected during 2015, indicating that the majority of Sicklefin Chub captured were likely less than age-3 (Figure 21; Herman et al. 2008b). Sicklefin Chub were captured in ISB (69%), CHXO (23%), SCCL (8%) and SCCS (<1%) macrohabitats. Depth at sites where Sicklefin Chub were captured ranged from 0.6 to 8.1 m, and mean depth at capture was 3.0 m ± 0.11. Bottom velocities at capture sites ranged from 0.1 to 1.20 m/s, and mean bottom velocity of Sicklefin Chub captures was 0.54 m/s ± 0.04.

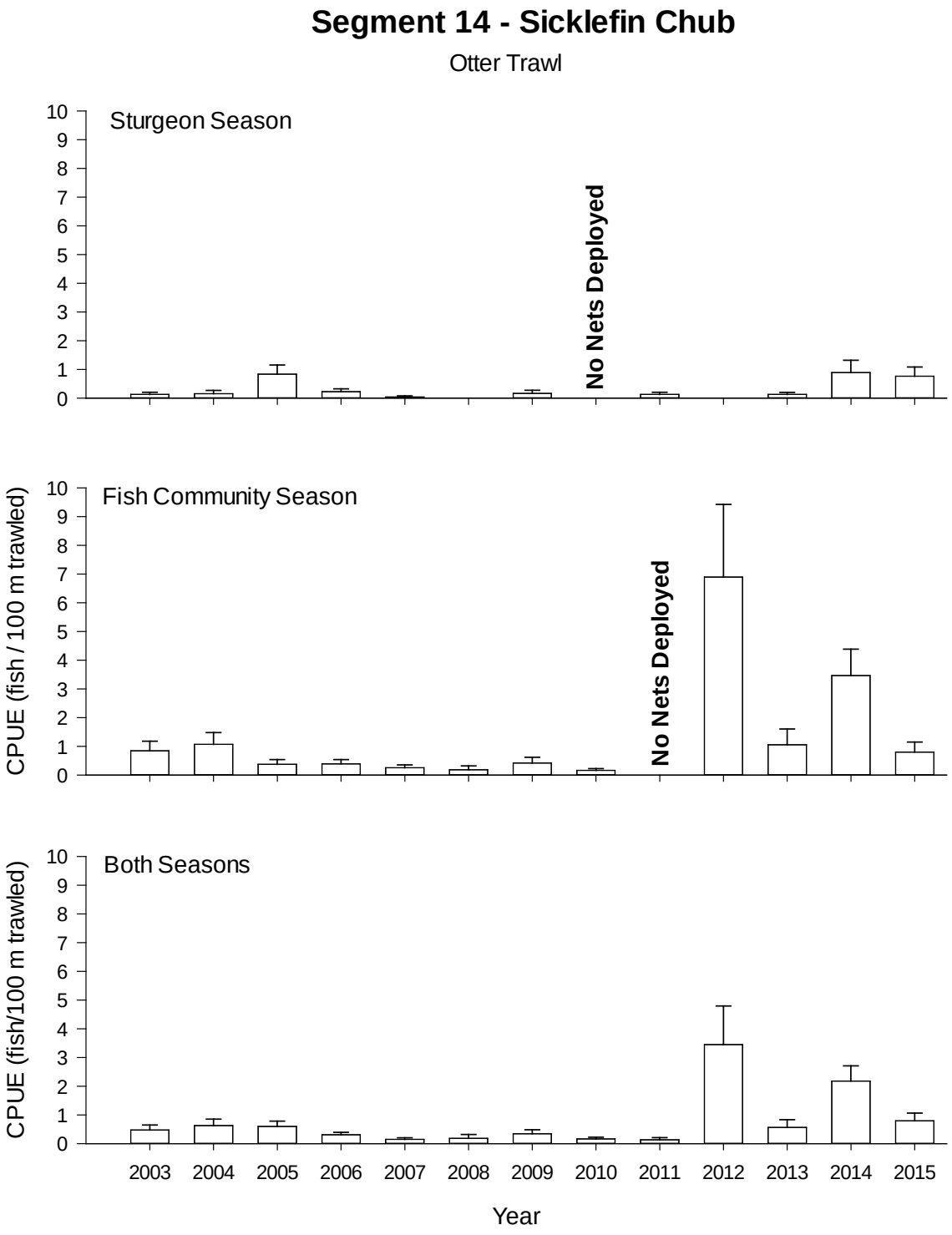

Figure 20. Mean annual catch per unit effort (± 2 SE) of Sicklefin Chub using otter trawls in Segment 14 of the Missouri River from 2003-2015.

Segment 14 - Sicklefin Chub

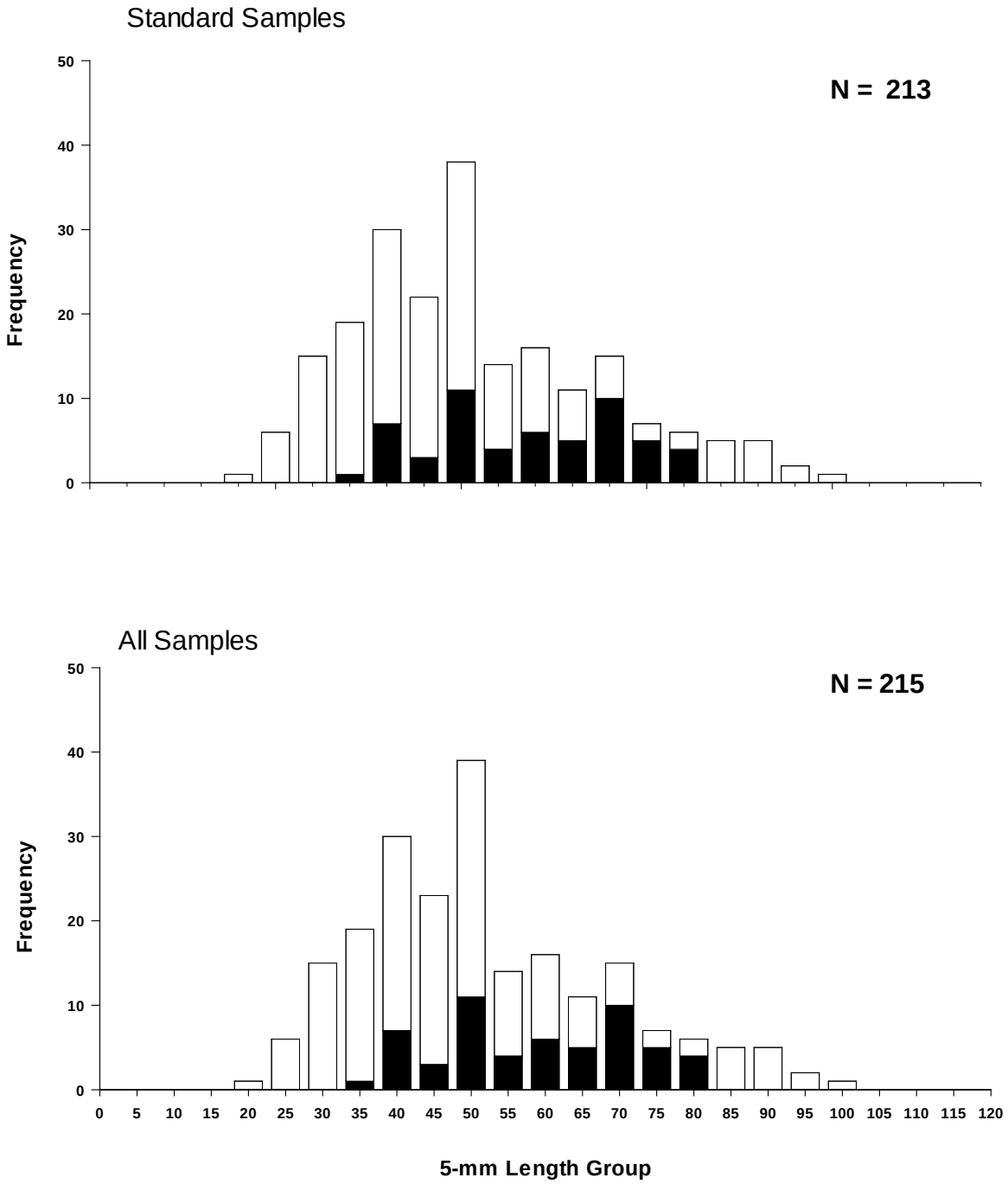

Figure 21. Length frequency of Sicklefin Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Shoal Chub

We collected 111 Shoal Chub in Segment 14 during 2015, of which 66% were captured in otter trawls and 34% with mini-fykes. Mean Shoal Chub CPUE in otter trawls during the 2015 sturgeon season (0.51 fish/100m ±0.35) was the below the 13-year mean (1.18 fish/100m ±0.40) and was a notable drop from effort in 2014 (5.47 fish/100m ±1.31) (Figure 22). Most Shoal Chub (70%) were captured during the fish community season. Mean Shoal Chub CPUE was 0.24 fish/100m ± 0.23 during fish community season, also below the 13-year average (1.51 fish/100m ±0.71) and lower than effort in 2014 (2.26 fish/100 ±1.15). Similarly, for both seasons combined, Shoal Chub otter trawl CPUE (0.32 fish/100m ±0.19) was lower than 2014 effort and below project mean (1.27 fish/100m ±0.42) (Figure 22). Shoal Chub ranged in length from 20 to 70 mm TL (Figure 23). We collected 47 Shoal Chub in Segment 14 that were consistent with age-0 size fish (< 28 mm TL; Herman et al. 2008c). Shoal Chub greater than 45 mm TL were not common during the sampling in 2015 (Figure 23). Shoal Chub captured in ISB (51%), CHXO (25%), SCCL (18%), SCCS (3%) and OSB(3%) macrohabitats. Depth at sites where Shoal Chub were captured ranged from 0.2 to 8.1 m, and mean depth at capture was 2.1 m ± 0.09. Velocity at capture sites ranged from 0.00 to 0.78 m/s, and mean bottom velocity where Shoal Chub were captured was 0.34 m/s ± 0.05.

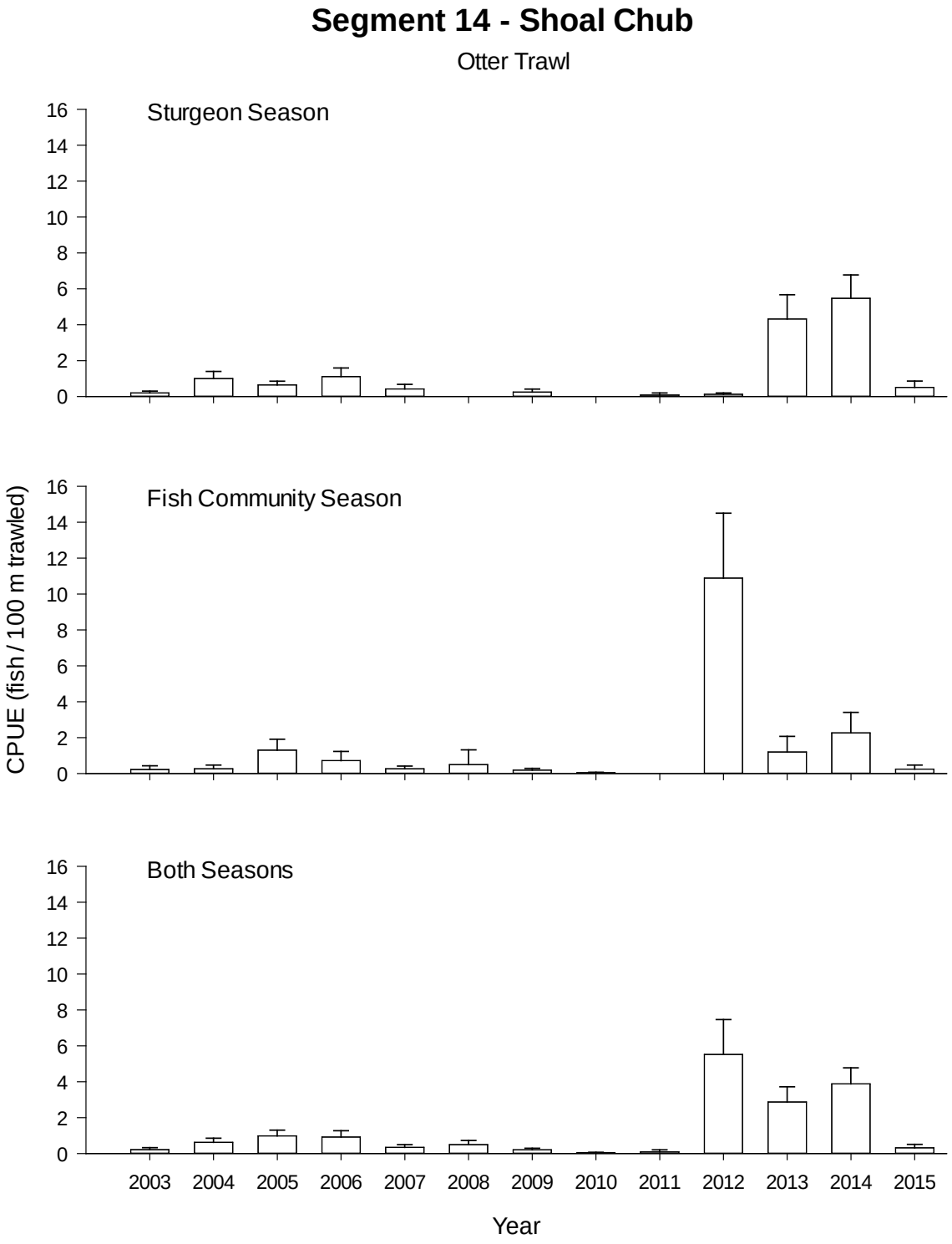

Figure 22. Mean annual catch per unit effort (± 2 SE) of Shoal Chub using otter trawls in Segment 14 of the Missouri River from 2003-2015.

Segment 14 - Shoal Chub

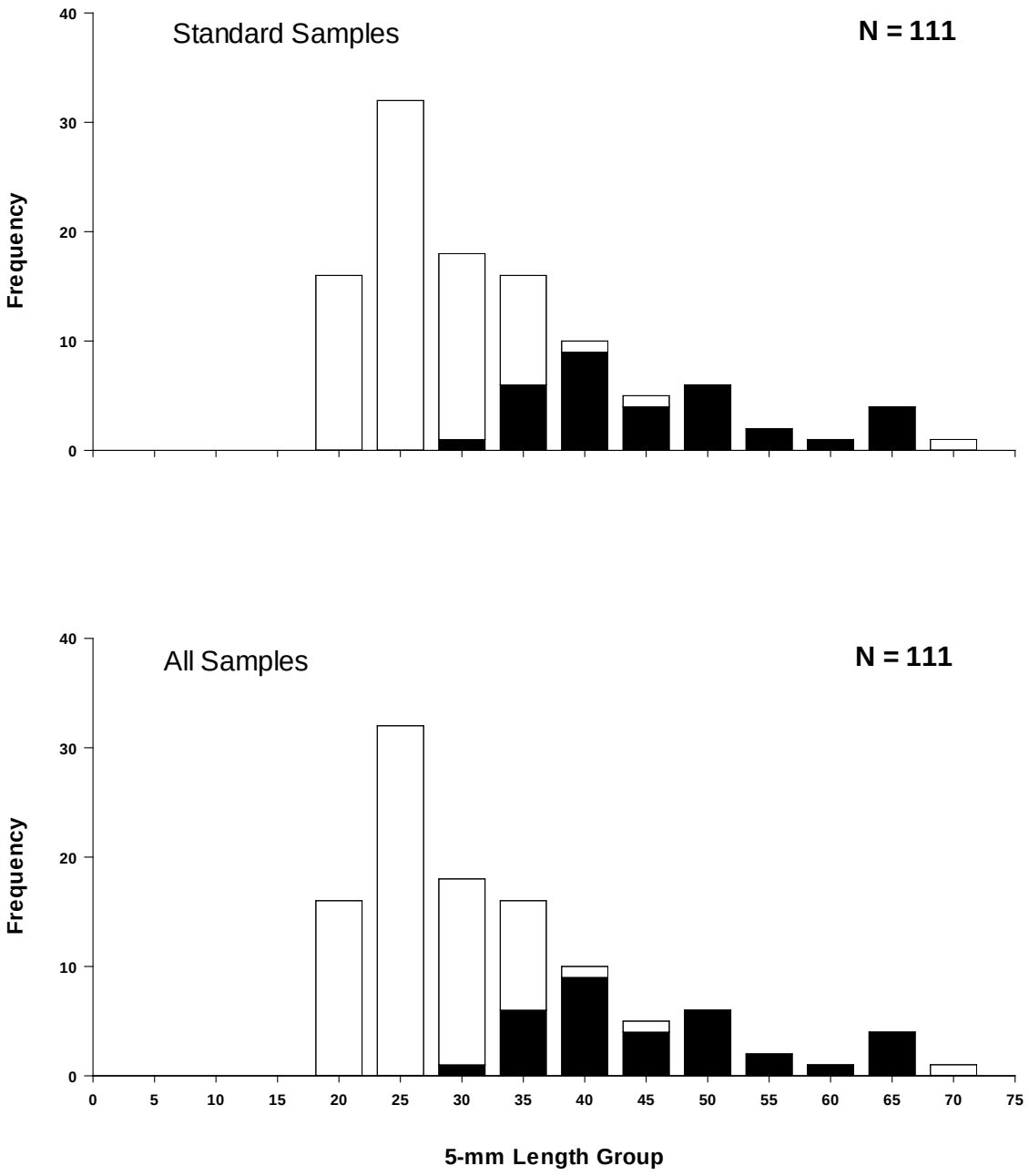

Figure 23. Length frequency of Shoal Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sand Shiner

Thirty-two Sand Shiner were collected in Segment 14 during 2015 from otter trawls. Sand Shiner CPUE (0.29 fish/net night ±0.16) in mini-fyke nets for 2015 was the highest since 2006 (Figure 24); catch rates were similar to 2014 (0.28 fish/net night ±0.13). Sand shiner collected in 2015 ranged in size from 24 to 46 mm (Figure 25). We collected 25 Sand Shiner in Segment 14 that were consistent with age-0 size fish (< 40 mm TL; Dattilo et al. 2008a). No Sand Shiner > 55 mm TL was collected during 2015, indicating that the majority of Sand Shiner captured were likely between the ages of 0 and 1 (Figure 25; Dattilo et al. 2008a). Sand Shiner were captured in ISB (59%), CHXO (22%), SCCL (9%), OSB(6%) and SCCS (3%) macrohabitats. Depth at sites where Sand Shiner were captured ranged from 0.3 to 0.7 m, and mean depth at capture was 0.16 m ± 0.04. Velocity at capture sites ranged from 0.01 to 0.32 m/s, and mean bottom velocity where Sand Shiner were captured was 0.16 m/s ± 0.04.

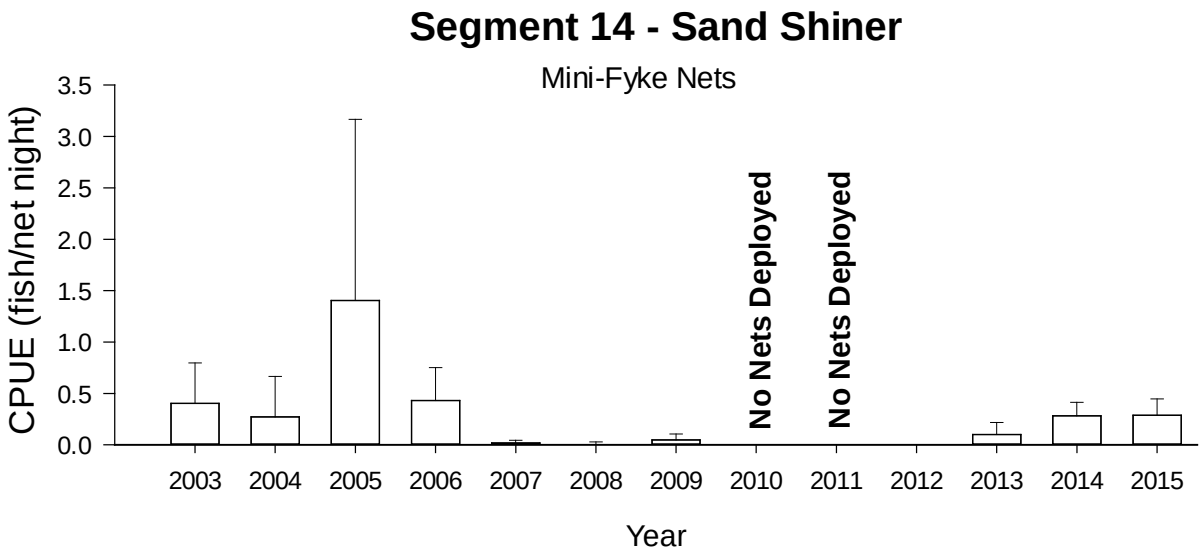

Figure 24. Mean annual catch per unit effort (± 2 SE) of Sand Shiner with mini-fyke nets in Segment 14 of the Missouri River during fish community season 2003-2015.

Segment 14 - Sand Shiner

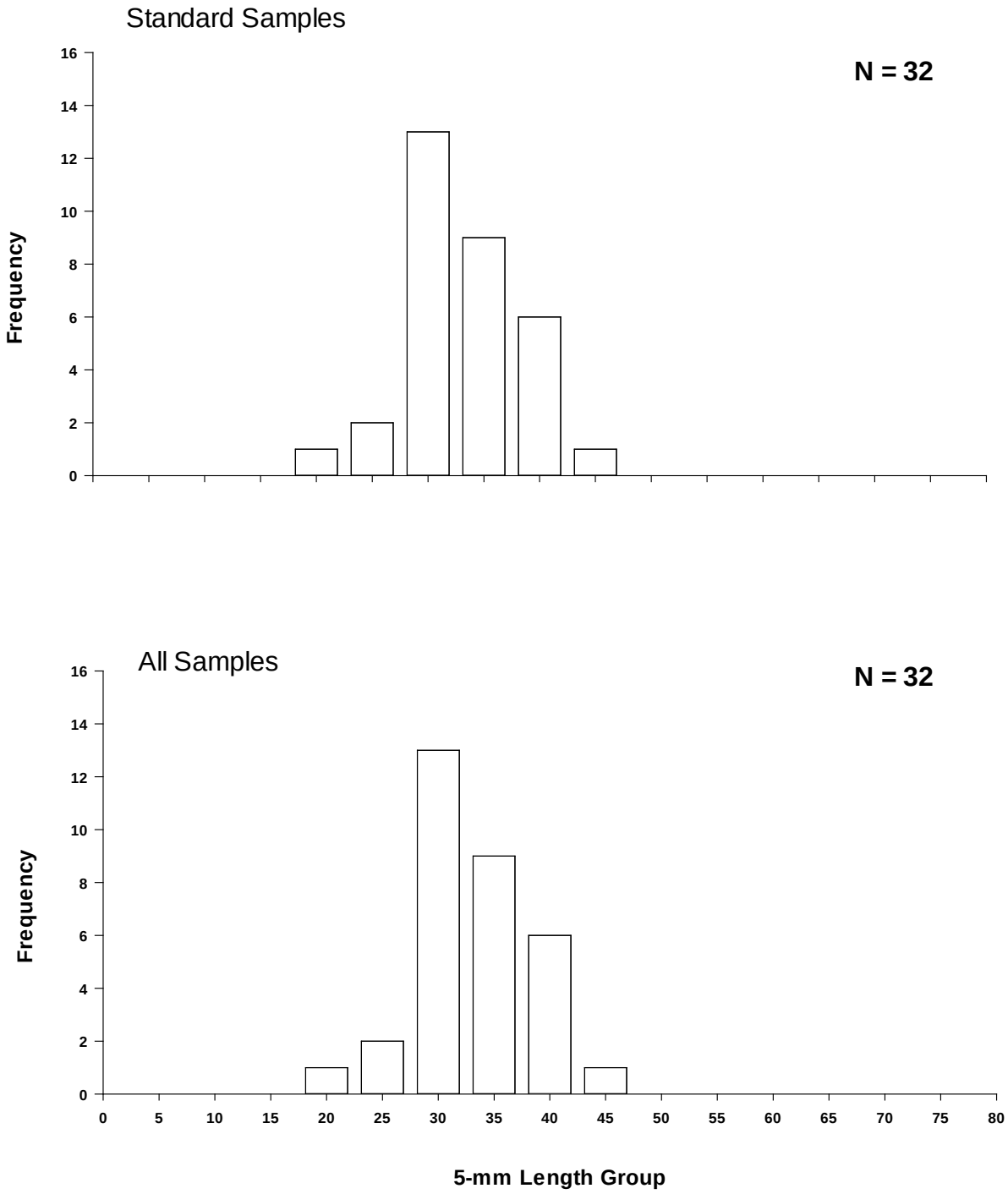

Figure 25. Length frequency of Sand Shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends and random subsamples. All samples include all sampling conducted during 2015.

Hybognathus spp.

Sixty-eight *Hybognathus* spp. were collected in Segment 14 during 2015 in mini-fyke nets. Species identification of Plains Minnow (46%) was made for nearly half of *Hybognathus* spp. captured in 2015; Western Silvery Minnow was also represented in samples (4%). The combined CPUE of Plains Minnow, Western Silvery Minnow and *Hybognathus* spp. was (0.61 fish/net night ±0.41), the highest catch rate since monitoring began and four times greater than record catch rates in 2014 (Figure 26). Plains Minnows ranged in length from 25 to 50 mm TL, Western Silvery Minnow ranged from 29 to 50 mm TL and *Hybognathus* spp. ranged from 23 to 70 mm TL (Figure 27). *Hybognathus* spp. captured in 2015 had lengths representative of age-0 and age-1 (<70 mm TL; Dattilo et al. 2008b). Plains Minnow were captured in ISB (65%), CHXO (32%), and OSB (3%) macrohabitats; Western Silvery Minnow and *Hybognathus* spp., combined, were captured in ISB (68%), SCCL (11%), OSB (11%), CHXO (8%) and TRMS (2%). Depths at sites where Plains Minnow and *Hybognathus* spp. were captured ranged from 0.2 to 0.7 m, and mean depth at capture was 0.52 m ± 0.03. Velocity at capture sites ranged from 0.00 to 0.42 m/s, and mean bottom velocity where Sand Shiner were captured was 0.17 m/s ± 0.03.

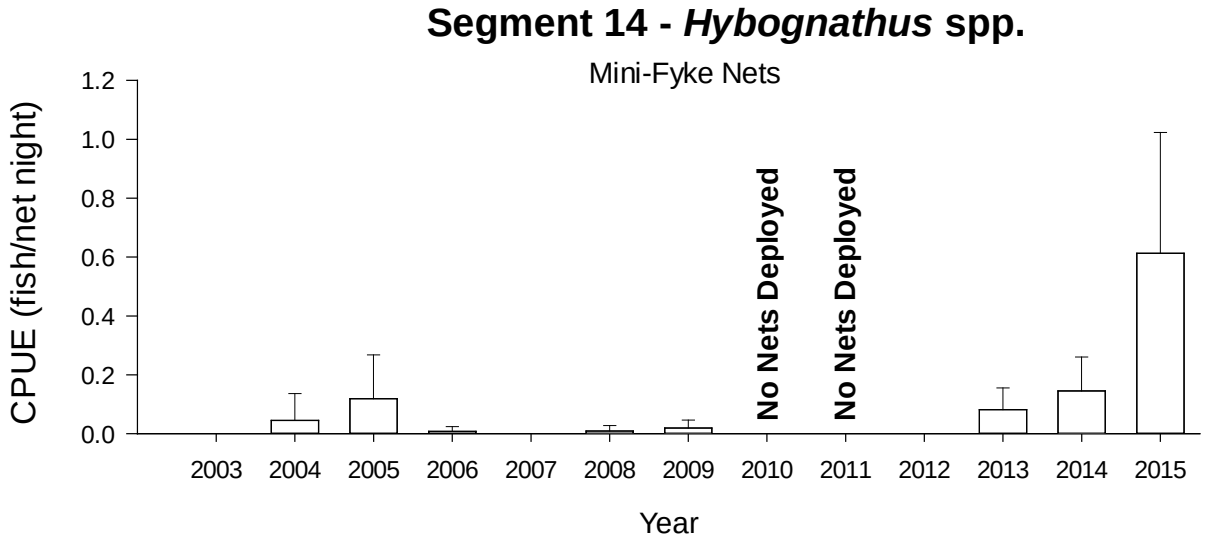

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 14 of the Missouri River during fish community season 2003-2015.

Segment 14 - *Hybognathus* spp.

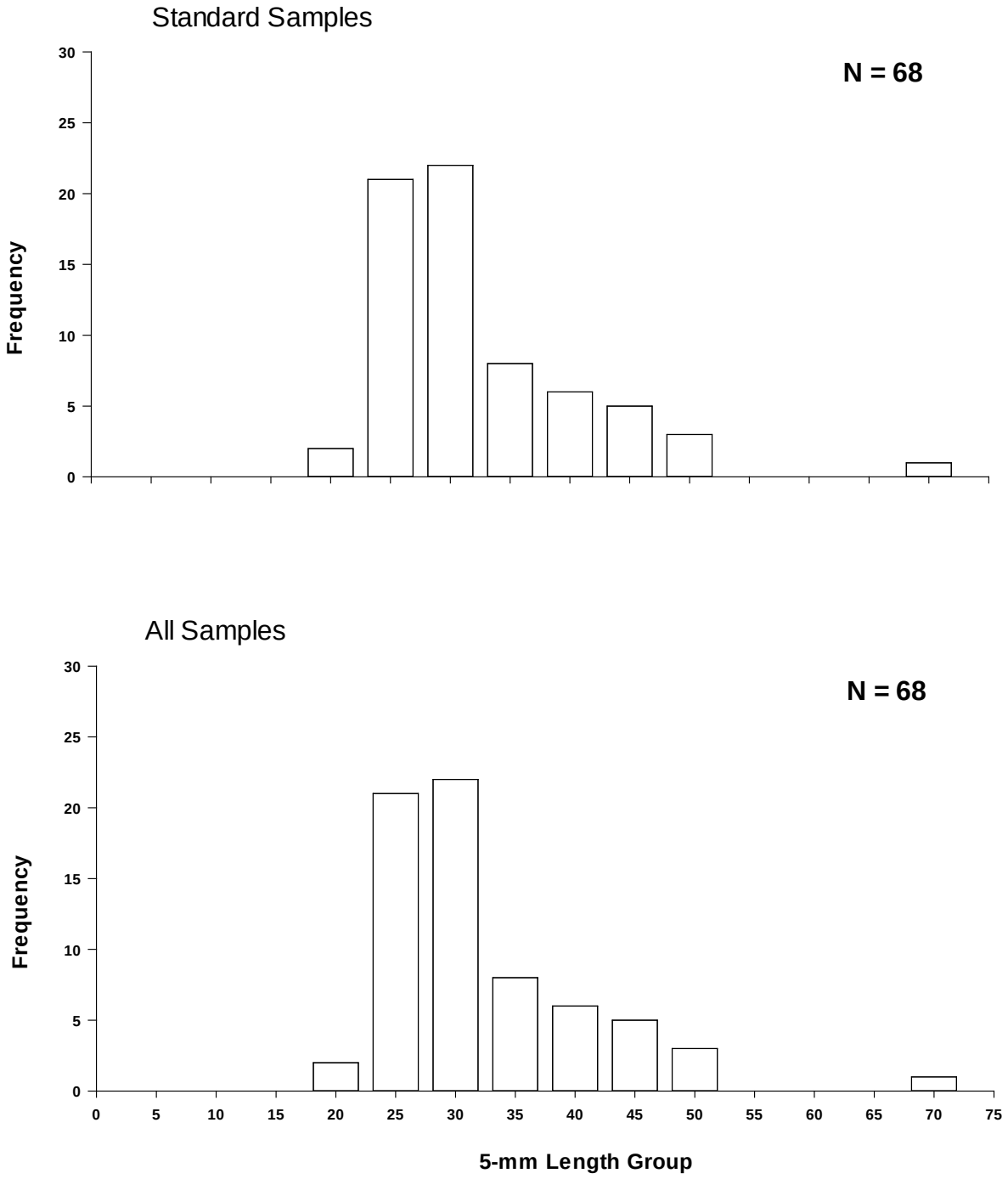

Figure 27. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Blue Sucker

We collected 247 Blue Sucker in Segment 14 during 2015. Blue Sucker CPUE from gill nets in 2015 (0.69 fish/net night ±0.25) was the highest on record (Figure 28). Blue Sucker CPUE from trammel nets in 2015 (0.19 fish/100m ±0.09) showed strong declines from peak capture rates in 2013 and 2014 (0.52 fish/100m ±0.19 and 0.49 fish/100m ±0.30; respectively) (Figure 29). Blue Sucker CPUE from otter trawls during the 2015 sturgeon season (0.13 fish/100m ±0.11) the highest observed since 2004 (Figure 30). Otter trawl CPUE during the 2015 fish community season (0.08 fish/100 m ± 0.05) was similar to 2014 (Figure 30). Most Blue Sucker were captured in ISB macrohabitat where the greatest amount of effort was deployed (Table 14). For standard gears, most Blue Sucker (93%) were captured during sturgeon season in gill nets and during fish community season in trammel nets (60%) (Table 14). Depth at sites where Blue Sucker were captured ranged from 1.0 to 10.0 m, and mean depth at capture was 3.0 m ± 0.05. Velocity at capture sites ranged from 0.0 to 1.15 m/s, and mean bottom velocity where Blue Sucker were captured was 0.44 m/s ± 0.06. Blue Sucker captured in 2015 ranged in length from 380 to 845 mm TL. According to LaBay et al. (2008), Blue Sucker in Segment 14 of the Missouri River reach a length of about 500 mm in their first year of life. Based on this knowledge, the majority of Blue Sucker captured in 2015 were older than age-1. These age data may be inaccurate, however, because aging methods for Blue Sucker produce highly variable results resulting in low reader agreement (Steve LaBay, South Dakota Game and Parks, personal communication). Pflieger (1997) noted that Blue Sucker sexually mature at a size between 500 and 660 mm which is the most common size at capture. Using both sources of information (Pflieger 1997 and LaBay et al 2008), we can assume that the majority of Blue Sucker captured

in 2015 (83% of the total catch) were older than age-1 and perhaps sexually mature (Figure 31). During 2015, field crews captured 43 Blue Sucker that were likely juvenile, ranging in size from 380 mm to 499 mm (Figure 31).

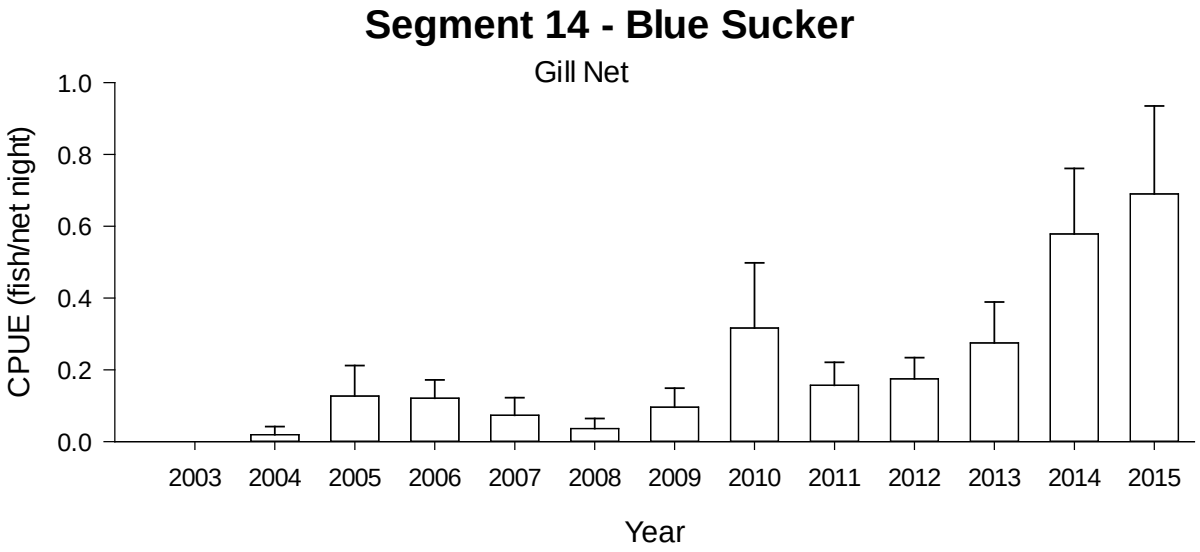

Figure 28. Mean annual catch per unit effort (± 2 SE) of Blue Suckers using gill nets in Segment 14 of the Missouri River from 2003-2015.

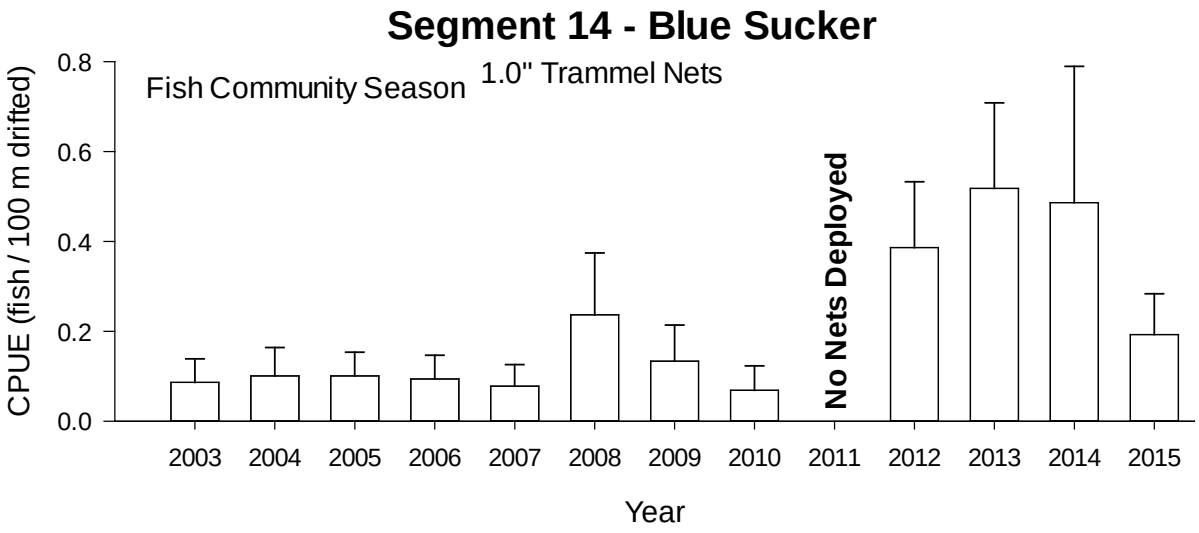

Figure 29. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using 1.0" trammel nets in Segment 14 of the Missouri River from 2003-2015.

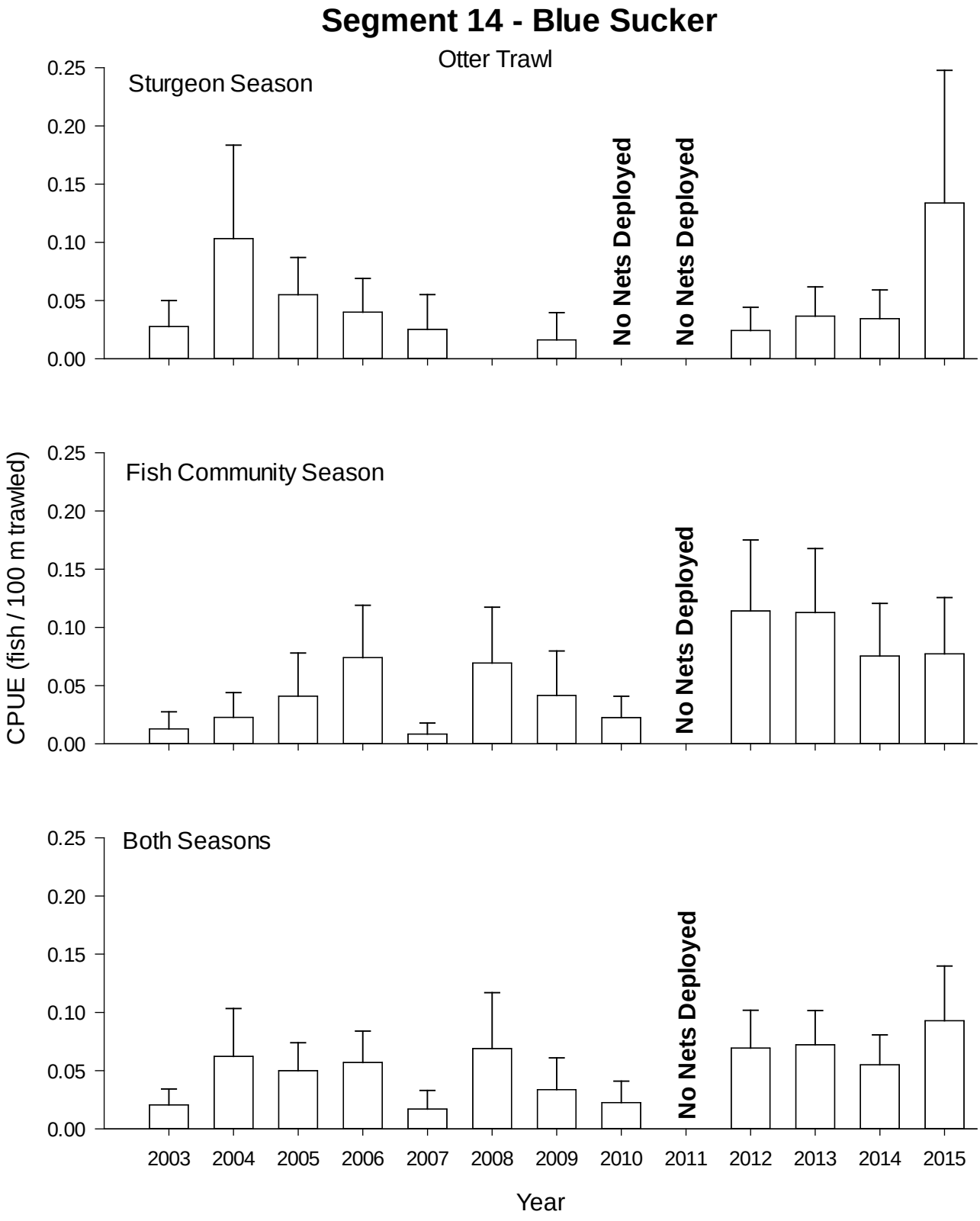

Figure 30. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using otter trawls in Segment 14 of the Missouri River from 2003-2015.

Table 14. Total number of Blue Sucker captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]														
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	185	N-E	17	0	N-E	N-E	N-E	0	72	10	0	1	0	9	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	14	N-E	14	0	N-E	N-E	N-E	0	86	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0" Trammel Net	29	N-E	3	0	N-E	N-E	N-E	0	93	0	3	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	6	0	0	1	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	19	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	5	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	2	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Segment 14 - Blue Sucker

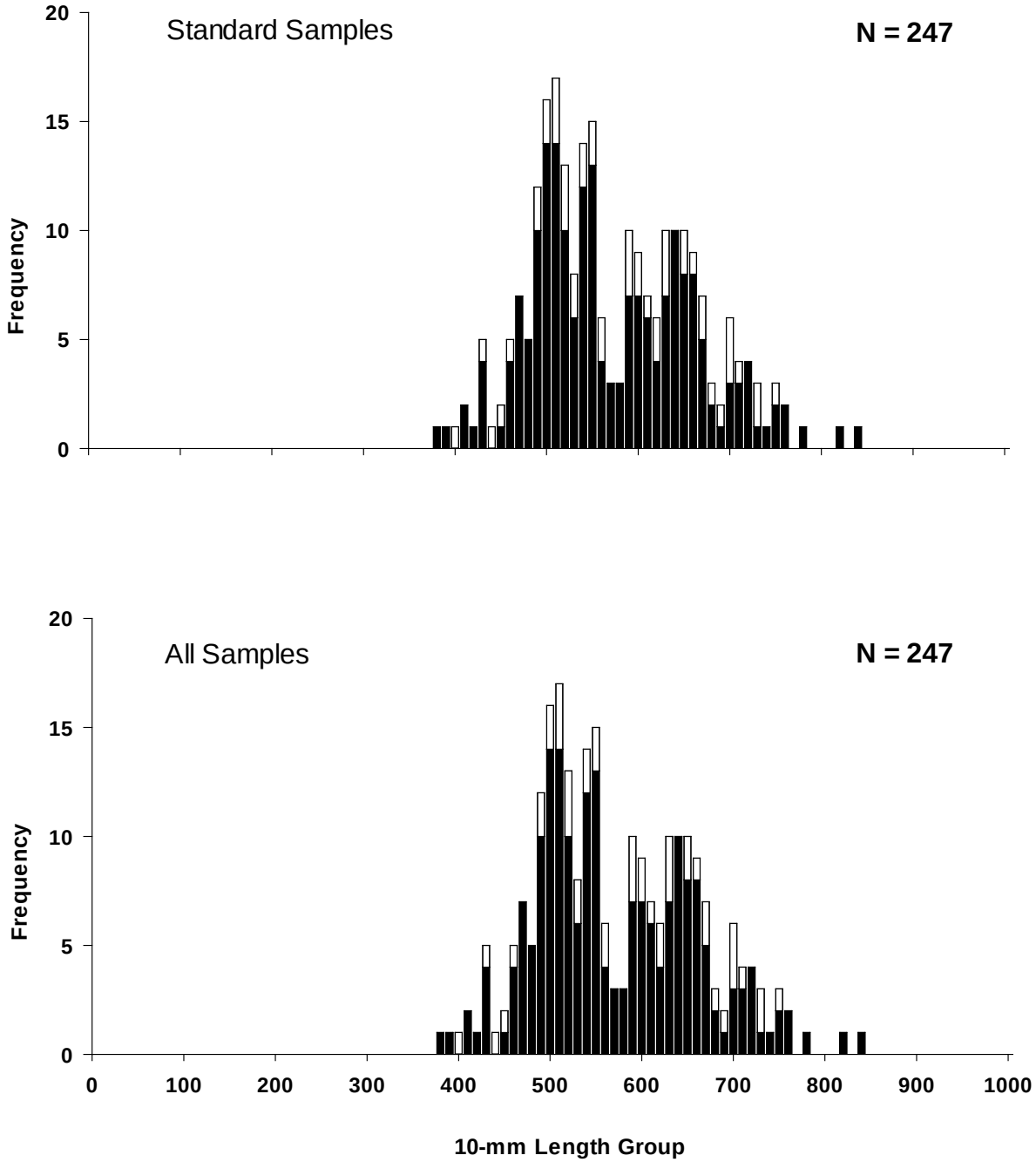

Figure 31. Length frequency of Blue Sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Sauger

We collected 17 Sauger in Segment 14 during the 2015 sampling season (Table 15). The majority of Sauger were captured in gill nets; however, CPUE from gill nets has been variable throughout sampling and notable declines in catch rates were observed in 2015 (0.05 fish/net night ± 0.04) (Figure 32). Similar to other years, Sauger CPUE from trammel nets in 2015 (0.01 fish/100 m ±0.02) was low (Figure 33). No Sauger were caught in otter trawls during sturgeon season or fish community season (0.01 fish 100 m ±0.01) in 2015, similar to other years (Figure 34). Sauger were captured in ISB (65%) and CHXO(35%) macrohabitats. Depth at sites where Sauger were captured ranged from 1.3 to 6.3 m, and mean depth at capture was 3.0 m ± 0.18. Velocity at capture sites ranged from 0.53 to 0.62 m/s. Sauger captured in Segment 14 ranged in length from 331 to 485 mm TL. All Sauger were greater than 280 mm suggesting the population in Segment 14 is age-2 and older (Dattilo et al. 2008c; Figure 35).

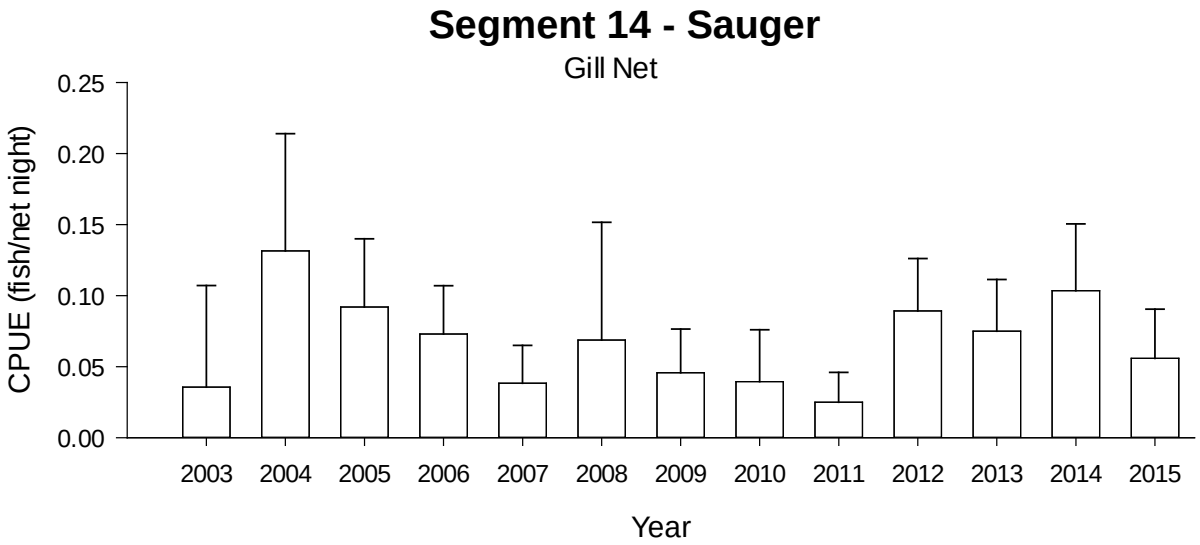

Figure 32. Mean annual catch per unit effort (± 2 SE) of Sauger using gill nets in Segment 14 of the Missouri River from 2003-2015.

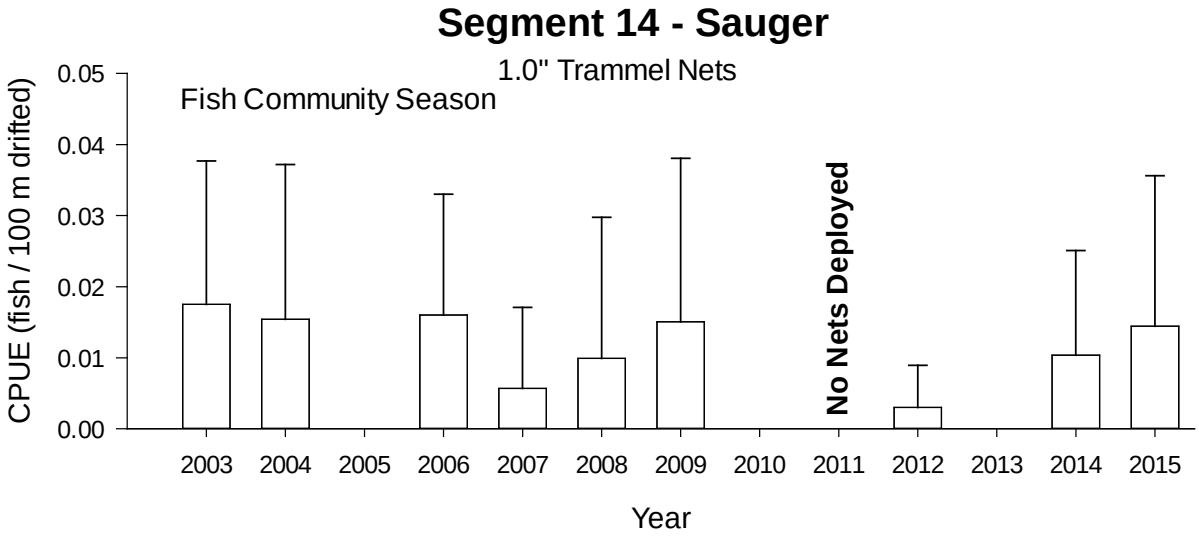

Figure 33. Mean annual catch per unit effort (± 2 SE) of Sauger using 1.0” trammel nets in Segment 14 of the Missouri River from 2003-2015.

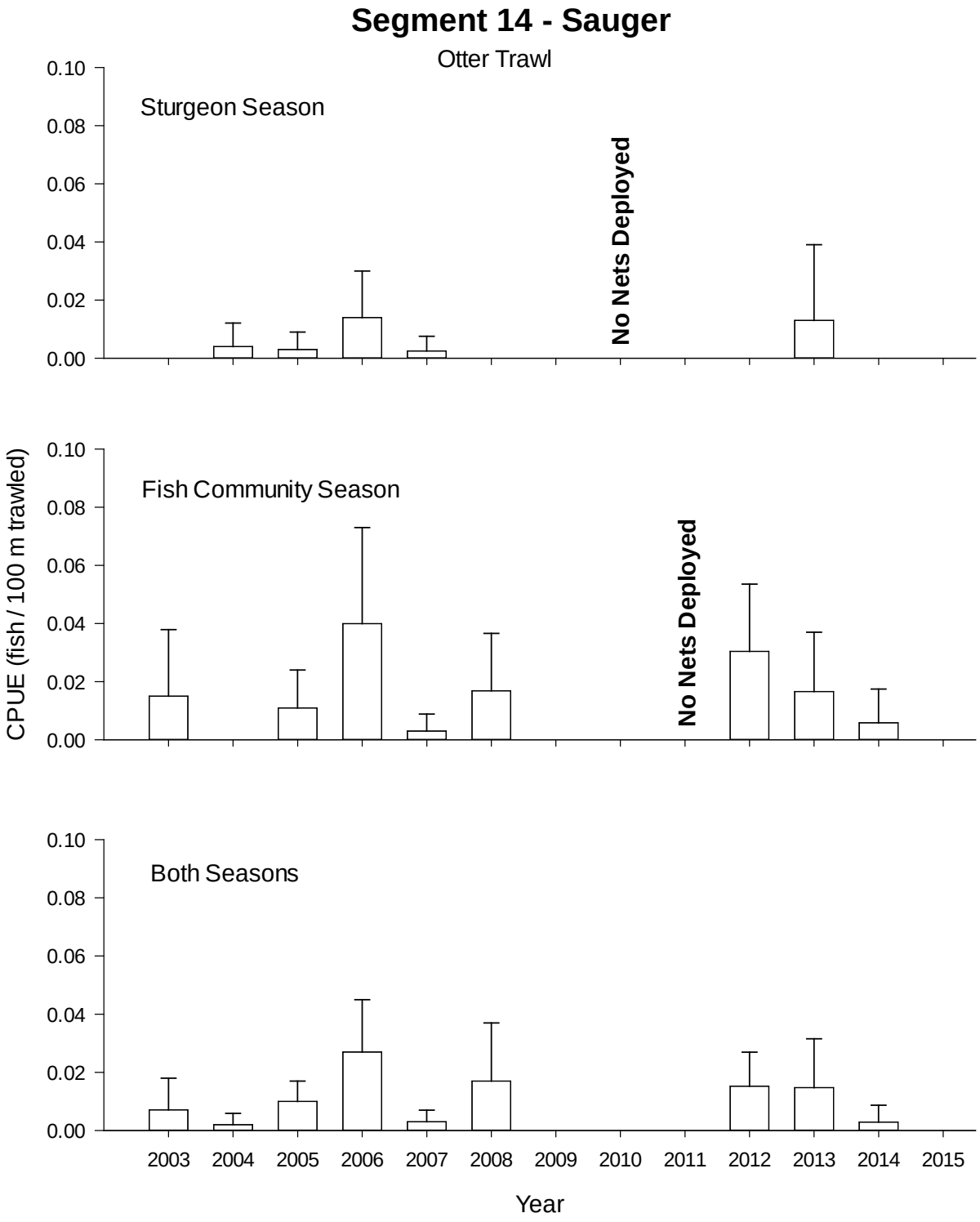

Figure 34. Mean annual catch per unit effort (± 2 SE) of Sauger using otter trawls in Segment 14 of the Missouri River from 2003-2015.

Table 15. Total number of Sauger captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2015. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat[a]													
		BRAD	CHXO	CONF	DEND	DRNG	DTWT	FDPN	ISB	OSB	SCCL	SCCS	SCN	TRML	TRMS	WILD
Sturgeon Season																
Gill Net	15	N-E	33	0	N-E	N-E	N-E	0	67	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	65	7	4	1	0	0	0	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	20	0	N-E	N-E	N-E	0	75	1	1	0	0	2	0	0
Fish Community Season																
1.0” Trammel Net	2	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	80	0	0	0	0	0	0	0
Mini-Fyke Net	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	23	0	N-E	N-E	N-E	0	40	13	13	3	1	0	8	0
Otter Trawl	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	19	0	N-E	N-E	N-E	0	75	0	0	0	0	0	0	0
Both Seasons																
Trot Lines	0	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	0	0	0
		N-E	25	0	N-E	N-E	N-E	0	61	6	8	0	0	0	0	0

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

Segment 14 - Sauger

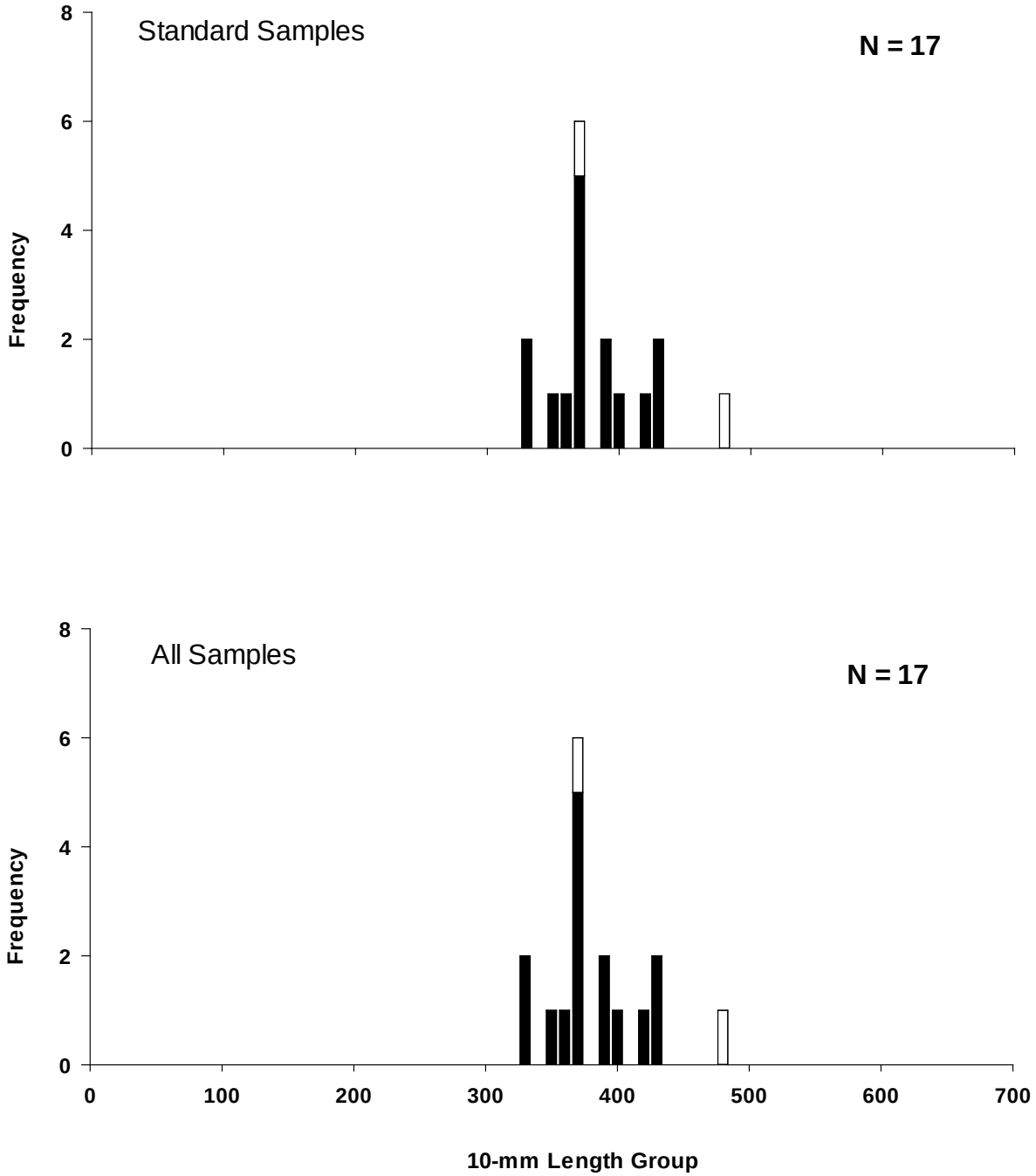

Figure 35. Length frequency of Sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2015. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2015.

Missouri River Fish Community

A total of 13,579 fish were collected from all samples in Segment 14 during 2015, representing 72 identified species. Shovelnose Sturgeon (*n* = 3,796) Blue Catfish (*n* = 1,845) and Channel Catfish (*n* = 1,099) were the most abundant species. Red Shiner numbers continued to sharply decline in 2015 (*n* = 248), a trend continued since 2012 (*n* = 9,146). Other notable species included: Lake Sturgeon *Acipenser fulvescens* (*n* = 17), Paddlefish *Polyodon spathula* (*n* = 3), and Quillback *Carpiodes cyprinus* (*n*= 3). Twenty species were collected from Segment 14 in 2015 that were not detected in 2014: American Eel *Anguilla rostrata*, Bighead Carp *Hypophthalmichthys nobilis*, Black Crappie *Pomoxis nigromaculatus*, Central Stoneroller *Campostoma anomalum*, Common Shiner *Luxilus cornutus*, Fathead Minnow *Pimephales promelas*, Golden Shiner *Notemigonus crysoleucas*, Green Sunfish *Lepomis cyanellus*, Logperch *Percina caprodes*, Largemouth Bass *Micropterus salmoides*, Mimic Shiner *Notropis volucellus*, Mooneye *Hiodon tergisus*, Redfin Shiner *Lythrurus umbratilis*, Striped Bass , *Morone saxatilis* Skipjack Herring *Alosa chrysochloris*, Tadpole Madtom *Noturus gyrinus*, Walleye *Sander vitreus*, Warmouth *Lepomis gulosus*, White Crappie *Pomoxis annularis* and Yellow Bullhead *Ameiurus natalis*. Conversely, only 10 species were collected in 2014 and not in 2015. Non-native carp continue to be relatively common in Segment 14 with 35 Common Carp *Cyprinus carpio*, 18 Silver Carp *Hypophthalmichthys molitrix* , 11 Grass Carp *Ctenopharyngodon idella* and one Bighead Carp captured in 2015. Our standard gears likely underestimate true abundances of Asian carp because we frequently observe more fish jumping out of the water than we collect in fishing gears. In 2015, 67% of Silver Carp and 57% of Common Carp were age-0 size (i.e., less than 75 mm).

Lake Sturgeon are a state endangered species in Missouri and are of special interest. We captured 17 Lake Sturgeon in Segment 14 during 2015. Nearly all Lake Sturgeon were captured within two river miles of the Osage River confluence. Lake Sturgeon captured in 2015 ranged in length from 621 to 1,120 mm FL and ranged in weight from 1,400 to 4,400 g. Only eight Lake Sturgeon were weighed; fish collected greater than 900 mm FL exceeded maximum weight limits for scales. Eleven Lake Sturgeon had coded wire tags(indicating these were hatchery stocked fish) and three were recaptures with PIT tags. All Lake Sturgeon were captured on trotlines.

Highwater Contingency Sampling

During highwater contingency sampling, 585 hooks were deployed in TRML macrohabitat, near the confluence of the Osage River. A total of 103 fish were captured with trotlines in Segment 14. Shovelnose sturgeon (*n* = 85) were the most commonly captured fish. Three hatchery stocked Pallid Sturgeon were also captured.

Pallid Sturgeon stocking locations for RPMA 4 are listed in Appendix D. Pallid Sturgeon stocking locations for Segment 14, numbers stocked and stocking date can be found in Appendix E. Appendix F provides a detailed list of species CPUE by gear type. Hatchery names and locations are listed in Appendix G. An alphabetic list of Missouri River fishes with CPUE by gear type is found in Appendix H. Appendix I provides a comprehensive list of Segment 13 bends sampled between 2003 and 2015.

Discussion

Pallid Sturgeon

Relative abundance of Pallid Sturgeon in 2015 rebounded to levels observed in 2009 (n = 34) and 2012 (n = 36). After record high Pallid Sturgeon catches in 2012, relative abundance appeared to recede to average levels for Segment 14 until 2015. Likely, the driver of this increase is the 2011 hatchery stocked year class. Nearly 22,000 Pallid Sturgeon from the 2011 year class were stocked into RPMA 4 and, in 2015, the 2011 year-class had fully recruited to our gears. Over 31% (*n* = 11) of total Pallid Sturgeon catches in 2015 were from the 2011 year class. Interestingly, the highest Pallid Sturgeon gill net and trotline CPUE in Segment 14 occurred in late 2011/early 2012 – immediately following the historic 2011 flood and preceding the 2012 drought. Fall conditions (September through October 2014) in Segment 14 were also characterized by sustained high flow events immediately followed by lower than average flows. Observed environmental conditions may have encouraged Pallid Sturgeon to temporarily migrate into Segment 14 during flood events. Additionally, higher flows and increased debris load late in fall 2014 may have encouraged fish to seek refugia and move from main channel areas into channel border and pool habitats found within dike fields. Higher concentrations of fish would, therefore, likely increase catch rate. In nearby Segment 13, which experienced similar flows to Segment 14, Pallid Sturgeon catch rates from 2012 through 2015 were similar (Wrasse 2016). This tends to suggest that gear bias does not best explain the disparity in Pallid Sturgeon catch rates seen in Segment 14 between 2012 and 2015.

While catch rates were above average in Segment 14, the condition of Pallid Sturgeon was below average. Stock and quality sized Pallid Sturgeon were found in poor condition throughout 2015. The decline in condition may be related to declines in cyprinid species in Segment 14. Diet studies of Pallid Sturgeon from Upper Basin habitats (Gerrity et al. 2006) and Lower Basin (Winders et al. 2014) both indicated the importance of native cyprinids, particularly *Macrhybobsis* chubs, for stock size and larger fish. Relative abundance of *Macrhybobsis* chubs, as well as other native cyprinid species, has sharply declined from peak abundance in 2012. Another explanation for observed decreases in *Wr* may also be correlated with Similarity of Appearance (SOA) listing in 2010 and the cessation of commercial Shovelnose Sturgeon harvest in Segment 14. The success of SOA appears to have influenced condition and reproductive success of Shovelnose Sturgeon populations within the segment. It is possible that increased survival, reproduction and year-class recruitment of Shovelnose Sturgeon may have increased interspecific competition with Pallid Sturgeon and, ultimately, may be contributing to declines in Pallid Sturgeon populations.

Of hatchery stocked recaptures, it is notable that average lengths of Pallid Sturgeon from the 2002 and 2003 year classes (734 mm FL/± 77 and 803 mm FL/± 45; respectively; Table 3) were nearly the same as the average lengths from the 1992 year class (735 mm FL; Table 3) despite a 10-year age difference. The 1992 year class were progeny of Pallid Sturgeon captured from the middle Mississippi River; the 2002 and 2003 year classes were propagated from upper Missouri River Basin fish captured near the confluence of the Yellowstone and Missouri rivers (Huenemann 2014). These disparities provide additional evidence for counter gradient variation between genetic subunits within Pallid Sturgeon stocks. Several studies have

detected latitudinal variation in growth and longevity among Pallid Sturgeon captured throughout the Missouri and Mississippi rivers (Meyer 2011, Killgore 2007 and Murphy 2007). A better understanding of local adaptations between populations will be crucial for improving the captive breeding and stocking program and, ultimately, recovery of the species.

Of note in 2015, was the capture of a sub-stock (0-199 mm) Pallid Sturgeon in an otter trawl. The fingerling captured was a hatchery stocked fish, stocked at St. Charles (RM 28.5). This fish was recaptured at RM 26.2, 8 days after stocking. Recaptures of fingerling Pallid Shovelnose confirm stocking survival and provide post-stocking movement pattern data. Relative condition factors for this fingerling was also high, likely due to energy rich diets fed in the hatcheries and the near post-stock capture.

In 2014, Habitat Assessment Monitoring Program field crews working in Segment 14 captured two genetically confirmed Pallid Sturgeon larvae. These represented the first confirmed larval Pallid Sturgeon from the lower Missouri River and indicated that successful reproduction and larval survival had, indeed, occurred in Segment 14. However; low abundance of larvae, relative to the extensive sampling effort, suggested that reproduction and survival rates are low in the segment. Only four wild Pallid Sturgeon were captured as part of PSPAP in 2015. The presumed wild fish were greater than 660 mm FL, providing additional evidence that Pallid Sturgeon reproduction and recruitment are low in the segment.

Shovelnose Sturgeon

Continued high relative abundance of adult and juvenile sized Shovelnose Sturgeon were observed in 2015 and suggest a comparatively stable population to other sturgeon species in Segment 14. Abundant catches of age-0 Shovelnose Sturgeon in 2015 suggest high reproductive success in Segment 14. Length frequencies of Shovelnose Sturgeon in Segment 14 provide evidence of annual reproduction and survival and a stable adult population. Sturgeon CPUE from all gears remained relatively unchanged from 2014. Trammel net and otter trawl CPUE was lower during fish community season in Segment 14. Increased river discharges during summer months may have decreased CPUE, while low, stable flows (like those that dominated Segment 14 in 2013 and 2014) may provide the most reliable catches (Guy et al. 2009).

In 2013, *Wr* for all size categories of Shovelnose Sturgeon were highest in history of monitoring. Relative weights for most size classes remained high in 2014; however, noticeable declines in condition were observed for all size classes in 2015 except stock sized Shovelnose Sturgeon. Presumably, relative weights are tied to food availability in Segment 14. Interestingly, trends for Shovelnose Sturgeon mean W_r have mirrored the trends of K_n for Pallid Sturgeon in 2015. This may suggest some degree of diet overlap; or, environmental conditions which decreased prey abundance for Shovelnose Sturgeon also decreased prey for Pallid Sturgeon. Numerous upper basin diet studies show no dependence on small bodied fish by Shovelnose Sturgeon (Bramblett and White 2001, Gerrity et al. 2006, Wanner et al. 2007). Unfortunately, the paucity of information regarding diets of sturgeon in Segment 14 only allowed speculation to

the degree that Shovelnose Sturgeon and Pallid Sturgeon may have consumed chubs, or other minnow species, when abundant.

Macrhybopsis Chubs

*Macrhybopsi*s chub relative abundance for all three species declined in 2015. Meyer et al. (2013) and others had suggested that sampling bias could have led to the unusually high catch rates of *Macrhybopsis* chubs in 2012, as the low flow conditions may have concentrated fish; however, under similar flow conditions in 2013 and 2014, chub relative abundances waned. Alternatively, low flows post 2011 may have provided optimal conditions for reproduction and recruitment. In Segment 13, strong year classes of chubs have been correlated with low summer flows and, conversely, poor year classes are associated with high summer flows (Wrasse 2015). High late spring and early summer flows in Segment 14 may have negatively impacted spawning and recruitment. Also of note, the unusually warm water temperatures seen in 2012 contrasts with 2015 - and most other years. Warmer water temperatures early in 2012 may have led to earlier spawn dates for *Macrhybopsis* spp.; thereby, increasing growth rates. If this is true, then age-0 *Macrhybopsis* spp. in 2012 may have recruited to the gear earlier than other years and increased chub detectability.

Sand Shiner

Although catch rates of Sand Shiner increased in 2015, overall numbers remained low. Pflieger (1997) indicated that Sand Shiner are typically found in shallow pools of creeks and small rivers with moderately clear water and low or moderate gradients. In Missouri, Sand Shiner are often

captured in bends with tributary influences. It is probable that many Sand Shiner collected in Segment 14 may be individuals washed out of tributaries. The turbid swift waters of the Missouri River may limit abundance of this species.

Hybognathus spp.

Improved catch rates of age-0 size *Hybognathus* spp. during 2014 and 2015 suggested environmental conditions may have been favorable for reproduction. However the lack of age-1 and older size individuals suggested poor survival. Plains Minnow was the most common *Hybognathus* spp. in Segment 14. In 1997, Pflieger expressed concern that Plains Minnow were in danger of extirpation from Missouri if declines continued. Monitoring data from PSPAP suggested that Plains Minnow is not in immediate danger of extirpation but the species is still struggling and the population should not be thought of as robust or stable.

Although catch rates of Sand Shiner and *Hybognathus* spp. increased in 2015, overall numbers remained relatively low. Interestingly, while catch rates of these target species cyprinids appear to have increased in 2015, catch rates of common cyprinids (i.e., Red Shiner and Emerald Shiner) have sharply declined (Appendices F3, F4).

Blue Sucker

Blue Sucker CPUE for all the sampling gears suggests an increasing population in Segment 14. Length frequency distribution of Blue Sucker indicated juvenile size (e.g., <500 mm TL) Blue Sucker were less common than in 2014. In 2013, we noted a strong year class, presumably

2011, which has persisted into 2015. This year class is likely the driver behind higher detection rates of adult (> 500 mm TL) Blue Sucker.

Sauger

While capture success of Sauger is highly variable in Segment 14, abundance is persistently low. No captures of age-0 size Sauger occurred in Segment 14; however, it is unclear if spawning occurred within nearby segments or if the lack of age-0 captures are due to drift dynamics of the species.

Adaptive Management

The lower 130 miles of the channelized Missouri River (Segment 14) is subject to large inter-annual variation in flow. For example, 2011 was notable for the near flood flows that persisted for much of the year in Segment 14, while late 2012 through 2014 were characterized by low flows. High water and flow conditions returned in 2015. Unusually timed and sustained high water conditions occurred from May through July in Segment 14 (Appendix J). Variation in flow can affect fish catch rates in two ways: by changing the actual abundance of fish through natural processes (e.g. reproduction, recruitment, and productivity) (Poff et al. 1997), or by changing the effectiveness of fishery sampling gears and altering the catchability of fish (Hubert and Fabrizio 2007). Consequently, being able to separate these factors and distinguish the actual driver of relative abundance is important for informing the adaptive management process in Segment 14.

Historically, abundant shallow water habitat provided necessary slow water refugia for native Missouri River fishes. The loss of these shallow water habitats following river modifications has been implicated as a contributing factor for the demise of Pallid Sturgeon and other native species (USFWS 2003). The 2000 Biological Opinion Reasonable and Prudent Alternatives specified that 8,000 to 14,000 additional acres of shallow water habitat (i.e. depth < 1.5m and flow velocity < 0.6 m/s) should be created in the Lower Missouri River (USFWS 2003). The COE has constructed an estimated 1,758 acres of shallow water habitat (i.e < 1.5 m) designed to function at median August flows. These habitat projects have been accomplished largely through dike modifications and construction of side channels (USACE 2014).

Monitoring data has demonstrated the value of shallow water habitats and the limitations of these habitats as currently constructed and defined. For instance, during the prolonged flood conditions of 2011, results of high water contingency sampling indicated that otter trawl catch rates for most species were low on main channel sandbars which are typically thought of as suitable nursery habitat at low summer flows. During this same time period, catch rates were relatively high in off-channel areas that provided flow refuge (Ridenour et al. 2012). Similarly, during 2015 highwater contingency sampling in both Segment 13 and 14, catch rates were relatively lower in the main channel when compared with the tributary mouth and side channel habitats found at the confluence of the Osage River and in Lisbon and Jameson chutes (Wrasse 2016).

The data collected from 2003-2015 indicate that during summers of prolonged low water (e.g., 2012 and 2014) there may be adequate shallow water nursery habitat for recruitment of prey

species (e.g. *Macrhybopsis* spp.). However, during summers of high flow (e.g., 2010 and 2011), recruitment of these species was reduced (Wrasse 2015). This may be due to insufficient nursery (i.e. slow and shallow) habitats during periods of highwater. Ridenour et al. (2009) found that *Macrhybopsis* chubs need relatively slow velocity nursery habitat for successful recruitment. Dieterman and Galat (2004) found that occurrence of Sicklefin Chub was highest during years with low August flows and found that high summer flows inundate sandbars eliminating nursery habitat. Recruitment of important prey species, such as *Macrhybopsis* chubs (Winders et al. 2014, Geritty et al. 2006), has taken on greater importance given the recent declines in condition of Pallid Sturgeon in the lower Missouri River. Monitoring data from Segment 13 indicated a temporal correlation between Pallid Sturgeon condition trends and *Macrhybopsis* chub CPUE trends. Additionally, Segment 14 had greater Pallid Sturgeon condition factors and higher *Macrhybopsis* chub CPUE, when compared with Segment 13 (Wrasse et al. 2015). Understanding factors that drive Missouri River prey fish populations may become important if poor condition of Pallid Sturgeon persists and jeopardizes recovery.

Our monitoring data suggested that mainstem shallow water habitat may function fairly well at low flow conditions (i.e. median August flows); however during periods of higher flows, these areas cease to function as shallow water habitat and appear to hold little value as nursery habitat. During many years, flows much greater than median August flows occur during summer, a critical time period for survival of age-0 fish. To promote more consistent recruitment of Missouri River fishes, shallow water habitat would likely need to function under a variety of flows (Ridenour et al. 2012). High quality, off-channel habitats (e.g. chutes) could

provide important flow refuge during high water events; however, the relative scarcity of these habitats likely reduces their overall impact on the fishery.

Future Monitoring

Monitoring data provides valuable guidance for future monitoring efforts. The five standard gear types currently employed for PSPAP have strengths and weaknesses which need to be evaluated within the context of the evolving objectives of Pallid Sturgeon monitoring and research.

Gill nets and trotlines have had relatively consistent CPUE for sturgeon species over the course of monitoring. Gill nets commonly captured Shovelnose Sturgeon, Blue Sucker, Pallid Sturgeon, and other large bodied Missouri River fish. Annual catch rates with gills nets did not appear to be correlated with annual discharge. The relative consistency of this gear would make it a good choice for detecting trends in population abundance of *Scaphirhynchus* spp. and other large bodied Missouri River fish.

Trotline catch rates may be affected by abundance of natural prey within the system and flow conditions. From a bioenergetics standpoint, it makes sense that trotlines would be most effective in times and places where prey is limited, as this gear targets only feeding fish and does not effectively capture fully satiated fish. Because of these confounding factors, trotlines may have limited value as a population monitoring gear. However, trotlines remain the most

effective gear for capturing Pallid Sturgeon, and would be the best tool for detecting presence of Pallid Sturgeon greater than 500 mm FL.

The high inter-annual variation seen in Pallid Sturgeon and Shovelnose Sturgeon CPUE from trammel nets and otter trawls may limit our ability to detect long term trends in sturgeon populations in Segment 14 – a segment which can experience large inter-annual variations in flow. Increased river discharges may decrease trammel net CPUE, while low, stable flows (like those that dominated Segment 14 in 2013 and 2014; Herman et al. 2014, Herman et al. 2015) may provide the most reliable catches (Guy et al. 2009). 2015 was notable for three Pallid Sturgeon captures in trammel nets; however, trammel net effort occurred in late summer when flows had stabilized. Since 2003, few Pallid Sturgeon have been captured with trammel nets in Segment 14. Considerations for continued use of trammel nets in the PSPAP monitoring program should include deployment flow parameters; not only for optimal gear efficiency but also for crew safety. Otter trawls were the only PSPAP gear that effectively captured age-0 and age-1 size *Scaphirhynchus* spp. This gear also effectively captured *Macrhybopsis* spp. The capability for otter trawls to detect and measure *Scaphirhynchus* reproduction and recruitment to age-1 and detect population trends of important prey species, would likely make otter trawls a valuable gear for future monitoring.

In Segment 14, mini-fyke nets caught few target species, other than Sand Shiner and *Hybognathus* spp. Historically, this gear captured large numbers of certain native cyprinids and age-0 specimens of many riverine species. To the extent that researchers value these data, mini-fyke nets could be a useful monitoring gear for the wider fish community.

Continued monitoring of Pallid Sturgeon for condition and survival will be imperative for recovery of the species. Further research into causative effects from habitat alteration, prey abundance, interspecific competition and climate change and how these factors compound one another will be necessary to better understand survival challenges for Pallid Sturgeon. Habitat alteration may be human influenced (e.g., channelization or dike modification) or natural (e.g., flood event or drought conditions). Modifications to habitat could be profound and intense; such as historic flooding or dam failure, or more subtle and ancillary; such as timing or duration. Understanding of interspecific competition between native and non-native species may be a critical component of the recovery process. The successful implementation of SOA listing for Shovelnose Sturgeon, a species with similar diet and habitat requirements as Pallid Sturgeon, may be a driver in the current decline in Pallid Sturgeon condition. Additionally, the continued proliferation and range expansion of non-native carps may also be disrupting the trophic food web throughout Pallid Sturgeon range. A report from the Bureau of Reclamation (2013) provided climate and weather predictions for the Missouri River Basin, including: 5°F - 6°F increase in temperature, 0.6 to 7.3% increase in precipitation and 9.7% mean annual increase in basin runoff; however, temporal shifts are associated with runoff events (increased winter and decreased summer). The report also predicted increased fishery stress to occur in the Missouri River basin (Alexander et al. 2013).

As Pallid Sturgeon monitoring evolves, we feel it is important to take a holistic view and avoid the temptation to look for simple fixes. The inherent complexities of the Missouri River

ecosystem require equally complex restoration measures. A robust monitoring program that provides proper feedback will be important for making informed management decisions.

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Appendices

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

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendritic	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Dam Tailwaters	Macro	An area of the river downstream and near mainstem dams that is characterized by altered flow and temperature regimes, reduced turbidities, bank armoring, and/or channel bed degradation (incision).	DTWT
Floodplain	Macro	Flooded zone beyond river highbank not directly associated with the riparian zone of main river or tributary stream.	FDPN
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	SCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes in Segment 14 for the long-term Pallid Sturgeon and associated fish community sampling program.

Gear	Code	Type	Season	Years	CPUE units
Gill Net – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	Fish / net night
Gill Net – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	Fish / net night
Trammel Net – 1.0”inner mesh	TN	Standard	Sturgeon	2003 - 2009	Fish / 100 m drift
		Standard	Fish Comm.	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.	2006	Fish / 100 m trawled
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2007	Fish / m trawled
Trot Line	TL	Evaluation	Both Season	2009	Fish / hook night
		Standard	Both Seasons	2010 - Present	Fish / hook night

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

State(s)	RPMA	Site Name	Code	River	R.M.
MT	2	Forsyth	FOR	Yellowstone	253.2
MT	2	Cartersville	CAR	Yellowstone	235.3
MT	2	Miles City	MIC	Yellowstone	181.8
MT	2	Fallon	FAL	Yellowstone	124.0
MT	2	Intake	INT	Yellowstone	70.0
MT	2	Sidney	SID	Yellowstone	31.0
MT	2	Big Sky Bend	BSB	Yellowstone	17.0
ND	2	Fairview	FRV	Yellowstone	9.0
MT	2	Milk River	MLK	Milk	11.5
MT	2	Mouth of Milk	MOM	Missouri	1761.5
MT	2	Grand Champs	GRC	Missouri	1741.0
MT	2	Wolf Point	WFP	Missouri	1701.5
MT	2	Poplar	POP	Missouri	1649.5
MT	2	Brockton	BRK	Missouri	1678.0
MT	2	Culbertson	CBS	Missouri	1621.0
MT	2	Nohly Bridge	NOB	Missouri	1590.0
ND	2	Confluence	CON	Missouri	1581.5
SD/NE	3	Sunshine Bottom	SUN	Missouri	866.2
SD/NE	3	Verdel Boat Ramp	VER	Missouri	855.0
SD/NE	3	Standing Bear Bridge	STB	Missouri	845.0
SD/NE	3	Running Water	RNW	Missouri	840.1
SD/NE	4	St. Helena	STH	Missouri	799.0
SD/NE	4	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KS/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Parkville	PKV	Missouri	377.5
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	Klondike Park		Missouri	56.3
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult Pallid Sturgeon stocking summary for Segment 14 of the Missouri River (RPMA 4).

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
1994	St. Charles	837	1992	3/9/1994	2 yo	Coded Wire	Dangler
1994	Washington	607	1992	3/9/1994	2 yo	Coded Wire	Dangler
1994	Hermann	999	1992	3/9/1994	2 yo	Coded Wire	Dangler
1997	St. Charles	400	1997	10/15/1997	Fingerling	Coded Wire	Dangler
1997	Washington	400	1997	10/15/1997	Fingerling	Coded Wire	Dangler
1997	Hermann	400	1997	10/15/1997	Fingerling	Coded Wire	Dangler
2010	Hermann	349	2009	4/2/2010	Yearling	PIT Tag	Scute (5^{th} Left)
2010	Portland	349	2009	4/2/2010	Yearling	PIT Tag	Scute (5^{th} Left)
2010	Weldon Springs	347	2009	4/6/2010	Yearling	PIT Tag	Scute (5^{th} Left)
2014	Hermann	2,047	2014	9/18/2014	Fingerling	Elastomer	Scute (7^{th} Right)
2014	Klondike Park	2,100	2014	9/18/2014	Fingerling	Elastomer	Scute (7^{th} Right)
2015	Hermann	2,087	2014	8/25/2014	Fingerling	Elastomer (V-Purple)	Scute (8th Left)
2015	St. Charles	2,086	2014	8/25/2014	Fingerling	Elastomer (H-Purple)	Scute (8th Left)

Appendix F

Appendix F. Total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for Segment 14 of the Missouri River during 2015. Species captured are listed alphabetically and their codes are presented in Appendix A. Bold type indicates targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

Appendix F1. Gill net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
AMEL	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BHCP	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.007			.	0.015	0	.			.				.		.	.	.	.
BHMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BKBF	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.007			.	0.015	0	.			.				.		.	.	.	.
BKBH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BKCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BKSS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BLCF	362	1.351	1.154	5.026	.	0.462	1.159	.	0	0.813	.	0.813	3.5	0	.	3.500	.	.	.	.
		0.510	0.804	2.662	.	0.255	1.068	.		0.420	.	0.420			.		.	.	.	.
BLCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BLGL	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BNMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BTTM	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
BUSK	185	**0.690**	**0.500**	**0.474**	**.**	**0.777**	**0.750**	**.**	**0.500**	**1.125**	**.**	**1.125**	**0**	**0**	**.**	**0.500**	**.**	**.**	**.**	**.**
		0.245	**0.467**	**0.401**	**.**	**0.389**	**0.599**	**.**		**1.698**	**.**	**1.698**			**.**		**.**	**.**	**.**	**.**
CARP	8	0.030	0	0.105	.	0.015	0.045	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.023		0.123	.	0.022	0.063	.			.				.		.	.	.	.

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
CLSR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
CMSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
CNCF	5	0.019	0	0.053	.	0	0.045	.	0	0	.	0	0	0	.	0.500	.	.	.	.
		0.020		0.072	.		0.091	.			.				.		.	.	.	.
CNLP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
CNSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
ERSN	0		0	0	.	0	0	.	0	**0**	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
FHCF	3	0.011	0	0	.	0	0.023	.	0	0	.	0	1	0	.	0	.	.	.	.
		0.017		0	.		0.045	.			.				.		.	.	.	.
FHMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
FWDM	6	0.022	0	0.079	.	0.008	0	.	0	0.063	.	**0.063**	0	0	.	0	.	.	.	.
		0.021		0.115	.	0.015		.		0.125	.	**0.125**			.		.	.	.	.
GDEY	15	0.056	0.077	0.053	.	0.038	0.068	.	0	0.063	.	0.063	0	0	.	1.000	.	.	.	.
		0.029	0.104	0.072	.	0.033	0.075	.		0.125	.	0.125			.		.	.	.	.
GDFH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
GDSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
GNSF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
				0	.			.			.				.		.	.	.	.
GSCP	9	0.034	0	0.026	.	0.023	0.091	.	0	0.063	.	0.063	0	0	.	0	.	.	.	.
		0.024		0.053	.	0.026	0.107	.		0.125	.	0.125			.		.	.	.	.

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
GZSD	3	0.011	0	0	.	0.023	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.017		0	.	0.034		.			.				.		.	.	.	.
HBNS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
JYDR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
LGPH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
LKSG	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
LMBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
LNGR	325	1.213	0.615	0.474	.	1.123	2.773	.	0	0.313	.	0.313	0.500	0.000	.	7.500	.	.	.	.
		0.880	0.995	0.408	.	0.625	4.983	.		0.263	.	0.263			.		.	.	.	.
MMSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
MNEY	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.007			.	0.015		.			.				.		.	.	.	.
MQTF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
NFSH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
OSSF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
PDFH	3	0.011	0	0	.	0.008	0.045	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.017			.	0.015	0.091	.			.				.		.	.	.	.
PDSG	9	**0.034**	**0.038**	**0.053**	**.**	**0.015**	**0.045**	**.**	**0**	**0**	**.**	**0**	**0.5**	**0.5**	**.**	**0**	**.**	**.**	**.**	**.**
		0.022	**0.077**	**0.072**	**.**	**0.022**	**0.063**	**.**			**.**				**.**		**.**	**.**	**.**	**.**

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
PNMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
QLBK	1	0.004	0	0	.	0	0	.	0	0.063	.	0.063	0	0	.	0	.	.	.	.
		0.007			.			.		0.125	.	0.125			.		.	.	.	.
RDSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
RFSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
RVCS	19	0.071	0.038	0.316	.	0.023	0.023	.	0	0.125	.	0.125	0	0	.	0	.	.	.	.
		0.056	0.077	0.360	.	0.026	0.045	.		0.164	.	0.164			.		.	.	.	.
RVSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
SBWB	2	0.007	0.038	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.011	0.077		.	0.015		.			.				.		.	.	.	.
SDBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
SFCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**0**	**.**	**.**	**.**	**.**
					.			**.**			**.**				**.**		**.**	**.**	**.**	**.**
SGCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**0**	**.**	**.**	**.**	**.**
					.			**.**			**.**				**.**		**.**	**.**	**.**	**.**
SGER	15	0.056	0.154	0.026	.	0.069	0.023	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.035	0.237	0.053	.	0.048	0.045	.			.				.		.	.	.	.
SHRH	6	0.022	0.038	0.026	.	0.023	0.023	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.018	0.077	0.053	.	0.026	0.045	.			.				.		.	.	.	.
SJHR	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.007			.	0.015		.			.				.		.	.	.	.
SKCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**0**	**.**	**.**	**.**	**.**
					.			**.**			**.**				**.**		**.**	**.**	**.**	**.**

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
SMBF	43	0.160	0.346	0.237	.	0.077	0.159	.	0	0.313	.	0.313	0	0	.	0	.	.	.	.
		0.060	0.286	0.160	.	0.055	0.191	.		0.263	.	0.263			.		.	.	.	.
SNGR	30	0.112	0.038	0.053	.	0.100	0.295	.	0	0	.	0	0	0	.	0.500	.	.	.	.
		0.109	0.077	0.072	.	0.128	0.545	.			.				.		.	.	.	.
SNPD	2	**0.007**	**0**	**0**	**.**	**0**	**0.045**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**0**	**.**	**.**	**.**	**.**
		0.011			**.**		**0.063**	**.**			**.**				**.**		**.**	**.**	**.**	**.**
SNSG	1573	**5.869**	**6.615**	**9.579**	**.**	**4.531**	**7.045**	**.**	**0.500**	**5.813**	**.**	**5.813**	**15.500**	**3**	**.**	**3.500**	**.**	**.**	**.**	**.**
		1.114	**4.173**	**4.491**	**.**	**1.236**	**2.407**	**.**		**3.923**	**.**	**3.923**			**.**		**.**	**.**	**.**	**.**
SNSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
STBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
STCT	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
SVCB	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
SVCP	4	0.015	0	0	.	0.015	0	.	0	0.125	.	0.125	0	0	.	0	.	.	.	.
		0.015			.	0.022		.		0.164	.	0.164			.		.	.	.	.
TPMT	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UBF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UCA	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UCF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UCN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
UCT	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UCY	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UGR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UHR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UHY	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UIC	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
ULP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UNID	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
URH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
USG	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
UTB	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
WLYE	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	0	.	.	.	.
		0.007			.	0.015		.			.				.		.	.	.	.
WRMH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
WSMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.

Appendix F1 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
WTBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
WTCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
YLBH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.
YOYF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	0	.	.	.	.
					.			.			.				.		.	.	.	.

Appendix F2. 1.0” trammel net: overall season and Segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
AMEL	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BHCP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BHMW	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BKBF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BKBH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BKCP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BKSS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BLCF	9	0.058	0.038	.	.	0.065	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.039	0.076	.	.	0.047	.	.	.	.	.		.	.	.	.	.	.	.	.
BLCP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BLGL	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BNMW	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BTTM	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
BUSK	29	**0.193**	**0.052**	**.**	**.**	**0.227**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**0.495**	**.**	**.**	**.**	**.**	**.**	**.**
	.	**0.091**	**0.103**	**.**	**.**	**0.111**	**.**	**.**	**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
CARP	1	0.006	0	.	.	0.008	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.012		.	.	0.015	.	.	.	.	.		.	.	.	.	.	.	.	.
CLSR	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
CMSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
CNCF	2	0.011	0	.	.	0.014	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.016		.	.	0.02	.	.	.	.	.		.	.	.	.	.	.	.	.
CNLP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
CNSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
ERSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
FHCF	4	0.022	0	.	.	0.028	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.026		.	.	0.032	.	.	.	.	.		.	.	.	.	.	.	.	.
FHMW	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
FWDM	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
GDEY	1	0.008	0	.	.	0.010	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.016		.	.	0.020	.	.	.	.	.		.	.	.	.	.	.	.	.
GDFH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
GDSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
GNSF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
GSCP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
GZSD	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
HBNS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
JYDR	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
LGPH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
LKSG	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
LMBS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
LNGR	5	0.042	0.183	.	.	0.016	.	.	.	.	.	0	.	0.000	.	.	.	.	.	.
	.	0.049	0.285	.	.	0.022	.	.	.	.	.		.	.	.	.	.	.	.	.
MMSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
MNEY	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
MQTF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
NFSH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
OSSF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
PDFH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
PDSG	3	**0.016**	**0.038**	**.**	**.**	**0.006**	**.**	**.**	**.**	**.**	**.**	**0.142**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.	**0.019**	**0.076**	**.**	**.**	**0.012**	**.**	**.**	**.**	**.**	**.**	**0.284**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
PNMW	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
QLBK	2	0.017	0	.	.	0.022	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.027		.	.	0.033	.	.	.	.	.		.	.	.	.	.	.	.	.
RDSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
RFSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
RVCS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
RVSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SBWB	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SDBS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SFCB	0		**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.			**.**	**.**		**.**	**.**	**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
SGCB	0		**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.			**.**	**.**		**.**	**.**	**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
SGER	2	0.014	0.059	.	.	0.006	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.021	0.118	.	.	0.013	.	.	.	.	.		.	.	.	.	.	.	.	.
SHRH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SJHR	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
SKCB	0		**0**	.	.	**0**	.	.	.	.	.	**0**	.	**0**	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SMBF	8	0.064	0.059	.	.	0.069	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.046	0.085	.	.	0.056	.	.	.	.	.		.	.	.	.	.	.	.	.
SNGR	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SNPD	1	**0.010**	**0**	.	.	**0.012**	.	.	.	.	.	**0**	.	**0**	.	.	.	.	.	.
	.	**0.020**		.	.	**0.025**	.	.	.	.	.		.	.	.	.	.	.	.	.
SNSG	573	**3.982**	**6.755**	.	.	**3.631**	.	.	.	.	.	**0.273**	.	**1.485**	.	.	.	.	.	.
	.	**1.587**	**5.965**	.	.	**1.591**	.	.	.	.	.	**0.546**	.	.	.	.	.	.	.	.
SNSN	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
STBS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
STCT	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SVCB	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
SVCP	1	0.007	0	.	.	0.009	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.	0.014		.	.	0.018	.	.	.	.	.		.	.	.	.	.	.	.	.
TPMT	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
UBF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
UCA	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
UCF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
UCN	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UCT	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UCY	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UGR	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UHR	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UHY	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UIC	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
ULP	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UNID	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
URH	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
USG	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
UTB	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
WLYE	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
WRMH	0	.	0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.

Appendix F2 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
WSMW	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
WTBS	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
WTCP	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
YLBH	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.
YOYF	0		0	.	.	0	.	.	.	.	.	0	.	0	.	.	.	.	.	.
	.			.	.		.	.	.	.	.		.	.	.	.	.	.	.	.

Appendix F3. Otter trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
AMEL	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BHCP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BHMW	2	0.011	0.048	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.015	0.067	.	.		.		.	.	.		.		.	.	.	.	.	.
BKBF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BKBH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BKCP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BKSS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BLCF	1162	4.217	3.966	0	.	4.068	0	29.055	0	.	.	2.381	.	3.947	1.98	.	.	.	0	.
	.	1.068	1.261	.	.	1.295	.	11.302	.	.	.	4.762	.	4.176	.	.	.	.	.	.
BLCP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BLGL	1	0.003	0	0	.	0.004	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.006		.	.	0.009	.		.	.	.		.		.	.	.	.	.	.
BNMW	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BTTM	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
BUSK	33	0.093	0.026	0	.	0.119	0	0.294	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.047	0.036	.	.	0.065	.	0.588	.	.	.		.		.	.	.	.	.	.
CARP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
CLSR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
CMSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
CNCF	475	2.015	2.833	0	.	1.338	0	2.66	0	.	.	13.81	.	4.095	13.861	.	.	.	0	.
	.	0.734	1.482	.	.	0.486	.	5.319	.	.	.	27.619	.	8.19	.	.	.	.	.	.
CNLP	1	0.004	0	0	.	0.006	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.008		.	.	0.011	.		.	.	.		.		.	.	.	.	.	.
CNSN	3	0.01	0	0	.	0.014	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.012		.	.	0.018	.		.	.	.		.		.	.	.	.	.	.
ERSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
FHCF	3	0.013	0	0	.	0.018	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.015		.	.	0.021	.		.	.	.		.		.	.	.	.	.	.
FHMW	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
FWDM	26	0.145	0.422	0	.	0.063	0	0	1.163	.	.	0	.	0	0	.	.	.	0	.
	.	0.07	0.254	.	.	0.046	.		.	.	.		.		.	.	.	.	.	.
GDEY	5	0.014	0.013	0	.	0.016	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.018	0.026	.	.	0.024	.		.	.	.		.		.	.	.	.	.	.
GDFH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
GDSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
GNSF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
GSCP	1	0.002	0	0	.	0.003	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.004		.	.	0.006	.		.	.	.		.		.	.	.	.	.	.

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
GZSD	1	0.006	0	0	.	0.009	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.013		.	.	0.018	.		.	.	.		.		.	.	.	.	.	.
HBNS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
JYDR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
LGPH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
LKSG	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
LMBS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
LNGR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
MMSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
MNEY	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
MQTF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
NFSH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
OSSF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
PDFH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
PDSG	2	0.007	0	0	**.**	0.009	0	0	0	**.**	**.**	0	**.**	0	0	**.**	**.**	**.**	0	**.**
	.	0.01		.	**.**	0.014	.		.	**.**	**.**		**.**		.	**.**	**.**	**.**	.	**.**

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
PNMW	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
QLBK	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
RDSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
RFSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
RVCS	7	0.03	0.061	0	.	0.008	0	0	1.163	.	.	0	.	0.216	0	.	.	.	0	.
	.	0.024	0.073	.	.	0.012	.		.	.	.		.	0.431	.	.	.	.	.	.
RVSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SBWB	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SDBS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SFCB	200	0.792	0.848	0	.	0.747	0.769	0.294	0	.	.	3.139	.	0.832	0	.	.	.	0	.
	.	0.271	0.731	.	.	0.29	.	0.588	.	.	.	3.347	.	0.921	.	.	.	.	.	.
SGCB	30	0.115	0.107	0	.	0.104	0.769	0	0	.	.	0.714	.	0	0	.	.	.	0	.
	.	0.061	0.146	.	.	0.062	.		.	.	.	1.429	.		.	.	.	.	.	.
SGER	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SHRH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SJHR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
SKCB	73	0.317	0.375	0	.	0.211	0.769	0	0	.	.	4.118	.	0	0	.	.	.	0	.
	.	0.191	0.282	.	.	0.15	.		.	.	.	7.33	.		.	.	.	.	.	.

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
SMBF	2	0.012	0.038	0	.	0.005	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.018	0.075	.	.	0.01	.		.	.	.		.		.	.	.	.	.	.
SNGR	5	0.025	0.018	0	.	0.03	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.027	0.035	.	.	0.036	.		.	.	.		.		.	.	.	.	.	.
SNPD	0		0	0	**.**	0	0	0	0	**.**	**.**	0	**.**	0	0	**.**	**.**	**.**	0	**.**
	.			.	**.**		.		.	**.**	**.**		**.**		.	**.**	**.**	**.**	.	**.**
SNSG	262	0.987	0.864	4.808	**.**	1.028	0	0.532	1.163	**.**	**.**	1.303	**.**	0.401	0	**.**	**.**	**.**	0	**.**
	.	0.292	0.566	.	**.**	0.366	.	1.064	.	**.**	**.**	2.277	**.**	0.059	.	**.**	**.**	**.**	.	**.**
SNSN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
STBS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
STCT	1	0.003	0	0	.	0.004	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.006		.	.	0.008	.		.	.	.		.		.	.	.	.	.	.
SVCB	2	0.01	0	0	.	0.005	0	0	0	.	.	0	.	0	0.99	.	.	.	0	.
	.	0.014		.	.	0.009	.		.	.	.		.		.	.	.	.	.	.
SVCP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
TPMT	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UBF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UCA	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UCF	2	0.005	0.014	0	.	0	0	0	0	.	.	0.113	.	0	0	.	.	.	0	.
	.	0.007	0.027	.	.		.		.	.	.	0.225	.		.	.	.	.	.	.
UCN	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
UCT	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UCY	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UGR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UHR	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UHY	15	0.07	0.248	0	.	0.022	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.104	0.462	.	.	0.026	.		.	.	.		.		.	.	.	.	.	.
UIC	14	0.069	0.053	0	.	0.081	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.	0.066	0.106	.	.	0.088	.		.	.	.		.		.	.	.	.	.	.
ULP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
UNID	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
URH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
USG	39	0.151	0.159	0	.	0.162	0	0	0	.	.	0	.	0.186	0	.	.	.	0	.
	.	0.072	0.19	.	.	0.083	.		.	.	.		.	0.372	.	.	.	.	.	.
UTB	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
WLYE	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
WRMH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
WSMW	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
WTBS	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
WTCP	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
YLBH	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.
YOYF	0		0	0	.	0	0	0	0	.	.	0	.	0	0	.	.	.	0	.
	.			.	.		.		.	.	.		.		.	.	.	.	.	.

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

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
AMEL	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
BHCP	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
BHMW	204	1.838	.	.	1.5	.	.	3.114	.	.	0.571	.	.	0	0.417	.	.	0	.	1.444
	.	0.786	.	.	0.64	.	.	1.85	.	.	0.619	.	.		0.52	.	.	.	.	1.419
BKBF	1	0.009	.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0.111
	.	0.018	.	.		.	.		.	.		.	.			.	.	.	.	0.222
BKBH	2	0.018	.	.	0	.	.	0.045	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.025	.	.		.	.	0.064	.	.		.	.			.	.	.	.	
BKCP	9	0.081	.	.	0.192	.	.	0.091	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.1	.	.	0.385	.	.	0.109	.	.		.	.			.	.	.	.	
BKSS	6	0.054	.	.	0.077	.	.	0.045	.	.	0.071	.	.	0	0.083	.	.	0	.	0
	.	0.043	.	.	0.107	.	.	0.064	.	.	0.143	.	.		0.167	.	.	.	.	
BLCF	9	0.081	.	.	0.077	.	.	0.114	.	.	0.143	.	.	0	0	.	.	0	.	0
	.	0.077	.	.	0.154	.	.	0.149	.	.	0.286	.	.			.	.	.	.	
BLCP	3	0.027	.	.	0.038	.	.	0	.	.	0.143	.	.	0	0	.	.	0	.	0
	.	0.04	.	.	0.077	.	.		.	.	0.286	.	.			.	.	.	.	
BLGL	300	2.703	.	.	5.808	.	.	1.409	.	.	0.429	.	.	0	0.167	.	.	1	.	7.667
	.	1.665	.	.	5.372	.	.	1.176	.	.	0.501	.	.		0.333	.	.	.	.	11.377
BNMW	49	0.441	.	.	0.231	.	.	0.818	.	.	0.071	.	.	0	0.333	.	.	0	.	0.222
	.	0.256	.	.	0.202	.	.	0.604	.	.	0.143	.	.		0.376	.	.	.	.	0.444
BTTM	1	0.009	.	.	0	.	.	0	.	.	0	.	.	0	0.083	.	.	0	.	0
	.	0.018	.	.		.	.		.	.		.	.		0.167	.	.	.	.	
BUSK	0		**.**	**.**	**0**	**.**	**.**	0	**.**	**.**	**0**	**.**	**.**	0	0	**.**	**.**	**0**	**.**	**0**
	.		**.**	**.**		**.**	**.**		**.**	**.**		**.**	**.**			**.**	**.**	**.**	**.**	

Appendix F4 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
CARP	23	0.207	.	.	0.577	.	.	0.091	.	.	0	.	.	0	0	.	.	0	.	0.444
	.	0.162	.	.	0.639	.	.	0.109	.	.		.	.			.	.	.	.	0.351
CLSR	2	0.018	.	.	0	.	.	0.045	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.025	.	.		.	.	0.064	.	.		.	.			.	.	.	.	
CMSN	1	0.009	.	.	0	.	.	0	.	.	0.071	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.		.	.	0.143	.	.			.	.	.	.	
CNCF	572	5.153	.	.	5.269	.	.	7.727	.	.	3	.	.	0.5	2.333	.	.	4	.	0.778
	.	1.431	.	.	3.239	.	.	2.755	.	.	2.179	.	.	1	1.214	.	.	.	.	0.648
CNLP	2	0.018	.	.	0.038	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.025	.	.	0.077	.	.	0.045	.	.		.	.			.	.	.	.	
CNSN	85	0.766	.	.	0.731	.	.	0.977	.	.	0	.	.	0	0.167	.	.	0	.	2
	.	0.346	.	.	0.652	.	.	0.649	.	.		.	.		0.333	.	.	.	.	1.795
ERSN	91	0.82	.	.	**0.654**	.	.	1.114	.	.	**0.929**	.	.	0.5	0.333	.	.	0	.	0.778
	.	0.354	.	.	**0.565**	.	.	0.764	.	.	**0.769**	.	.	1	0.449	.	.	.	.	0.729
FHCF	13	0.117	.	.	0.115	.	.	0.182	.	.	0	.	.	0.5	0.083	.	.	0	.	0
	.	0.076	.	.	0.128	.	.	0.163	.	.		.	.	1	0.167	.	.	.	.	
FHMW	10	0.09	.	.	0	.	.	0.227	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.163	.	.		.	.	0.411	.	.		.	.			.	.	.	.	
FWDM	586	5.279	.	.	4.115	.	.	8.932	.	.	2.357	.	.	0	0.75	.	.	3	.	3.111
	.	2.841	.	.	3.894	.	.	6.603	.	.	1.535	.	.		1.019	.	.	.	.	3.39
GDEY	5	0.045	.	.	0	.	.	0.068	.	.	0.071	.	.	0	0.083	.	.	0	.	0
	.	0.047	.	.		.	.	0.101	.	.	0.143	.	.		0.167	.	.	.	.	
GDFH	1	0.009	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.	0.045	.	.		.	.			.	.	.	.	
GDSN	1	0.009	.	.	0.038	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.	0.077	.	.		.	.		.	.			.	.	.	.	
GNSF	31	0.279	.	.	0.192	.	.	0.523	.	.	0.071	.	.	0.5	0	.	.	0	.	0.111
	.	0.152	.	.	0.158	.	.	0.353	.	.	0.143	.	.	1		.	.	.	.	0.222

Appendix F4 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
GSCP	1	0.009	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.	0.045	.	.		.	.			.	.	.	.	
GZSD	893	8.045	.	.	2.462	.	.	3.818	.	.	2.357	.	.	0	0.583	.	.	0	.	67.444
	.	8.791	.	.	1.452	.	.	3.416	.	.	1.646	.	.		0.716	.	.	.	.	104.095
HBNS	34	0.306	.	.	0.115	.	.	0.5	.	.	0.286	.	.	0	0.333	.	.	0	.	0.111
	.	0.218	.	.	0.128	.	.	0.522	.	.	0.251	.	.		0.449	.	.	.	.	0.222
JYDR	1	0.009	.	.	0	.	.	0	.	.	0	.	.	0	0.083	.	.	0	.	0
	.	0.018	.	.		.	.		.	.		.	.		0.167	.	.	.	.	
LGPH	9	0.081	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0.889
	.	0.103	.	.		.	.	0.045	.	.		.	.			.	.	.	.	1.176
LKSG	0	0	.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.	0	.	.		.	.		.	.		.	.			.	.	.	.	
LMBS	7	0.063	.	.	0.154	.	.	0.068	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.064	.	.	0.24	.	.	0.077	.	.		.	.			.	.	.	.	
LNGR	41	0.369	.	.	0.115	.	.	0.477	.	.	0.286	.	.	2	0.25	.	.	0	.	0.667
	.	0.184	.	.	0.128	.	.	0.387	.	.	0.251	.	.	2	0.261	.	.	.	.	0.882
MMSN	1	0.009	.	.	0.038	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.	0.077	.	.		.	.		.	.			.	.	.	.	
MNEY	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
MQTF	205	1.847	.	.	2.038	.	.	1.932	.	.	2.643	.	.	0	0.833	.	.	0	.	2.222
	.	0.57	.	.	1.09	.	.	0.911	.	.	2.556	.	.		0.847	.	.	.	.	1.519
NFSH	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
OSSF	349	3.144	.	.	3.5	.	.	3.977	.	.	0.571	.	.	0	0.917	.	.	1	.	6.444
	.	1.616	.	.	1.909	.	.	3.107	.	.	0.404	.	.		0.869	.	.	.	.	11.658
PDFH	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	

Appendix F4 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
PDSG	0		.	.	**0**	.	.	0	.	.	**0**	.	.	0	0	.	.	**0**	.	**0**
	.		.	.		.	.		.	.		.	.			.	.	.	.	
PNMW	31	0.279	.	.	0.385	.	.	0.455	.	.	0.071	.	.	0	0	.	.	0	.	0
	.	0.226	.	.	0.401	.	.	0.514	.	.	0.143	.	.			.	.	.	.	
QLBK	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
RDSN	248	2.234	.	.	1.808	.	.	3.636	.	.	0.286	.	.	0.5	2	.	.	1	.	0.778
	.	0.836	.	.	1.889	.	.	1.548	.	.	0.327	.	.	1	2.629	.	.	.	.	0.729
RFSN	3	0.027	.	.	0	.	.	0.068	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.04	.	.		.	.	0.101	.	.		.	.			.	.	.	.	
RVCS	15	0.135	.	.	0	.	.	0.045	.	.	0.071	.	.	0	0.167	.	.	0	.	1
	.	0.139	.	.		.	.	0.064	.	.	0.143	.	.		0.333	.	.	.	.	1.563
RVSN	7	0.063	.	.	0.154	.	.	0.068	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.059	.	.	0.182	.	.	0.101	.	.		.	.			.	.	.	.	
SBWB	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SDBS	1	0.009	.	.	0.038	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.	0.077	.	.		.	.		.	.			.	.	.	.	
SFCB	13	0.117	.	.	**0.269**	.	.	0.068	.	.	**0**	.	.	0	0.167	.	.	**0**	.	**0**
	.	0.122	.	.	**0.465**	.	.	0.101	.	.		.	.		0.333	.	.	.	.	
SGCB	0		.	.	**0**	.	.	0	.	.	**0**	.	.	0	0	.	.	**0**	.	**0**
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SGER	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SHRH	5	0.045	.	.	0.038	.	.	0.091	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.054	.	.	0.077	.	.	0.127	.	.		.	.			.	.	.	.	
SJHR	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	

Appendix F4 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
SKCB	38	0.342	.	.	**0.423**	.	.	0.409	.	.	**0.214**	.	.	0	0.25	.	.	**0**	.	**0**
	.	0.159	.	.	**0.418**	.	.	0.271	.	.	**0.309**	.	.		0.359	.	.	.	.	
SMBF	7	0.063	.	.	0	.	.	0.114	.	.	0.071	.	.	0	0	.	.	0	.	0.111
	.	0.093	.	.		.	.	0.227	.	.	0.143	.	.			.	.	.	.	0.222
SNGR	28	0.252	.	.	0.231	.	.	0.205	.	.	0.5	.	.	0	0.083	.	.	0	.	0.444
	.	0.101	.	.	0.279	.	.	0.139	.	.	0.277	.	.		0.167	.	.	.	.	0.351
SNPD	0		.	.	**0**	.	.	0	.	.	**0**	.	.	0	0	.	.	**0**	.	**0**
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SNSG	0		.	.	**0**	.	.	0	.	.	**0**	.	.	0	0	.	.	**0**	.	**0**
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SNSN	32	0.288	.	.	0.269	.	.	0.432	.	.	0.143	.	.	0	0.25	.	.	0	.	0
	.	0.159	.	.	0.237	.	.	0.353	.	.	0.194	.	.		0.359	.	.	.	.	
STBS	15	0.135	.	.	0.269	.	.	0.023	.	.	0.071	.	.	0	0	.	.	0	.	0.667
	.	0.09	.	.	0.237	.	.	0.045	.	.	0.143	.	.			.	.	.	.	0.745
STCT	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
SVCB	135	1.216	.	.	0.923	.	.	2.114	.	.	0.214	.	.	0	0.417	.	.	2	.	0.778
	.	0.627	.	.	0.947	.	.	1.431	.	.	0.309	.	.		0.458	.	.	.	.	0.648
SVCP	13	0.117	.	.	0.077	.	.	0.068	.	.	0.143	.	.	0	0	.	.	0	.	0.556
	.	0.08	.	.	0.107	.	.	0.077	.	.	0.286	.	.			.	.	.	.	0.676
TPMT	1	0.009	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.	0.045	.	.		.	.			.	.	.	.	
UBF	50	0.45	.	.	0.538	.	.	0.727	.	.	0	.	.	0	0	.	.	0	.	0.111
	.	0.504	.	.	0.746	.	.	1.187	.	.		.	.			.	.	.	.	0.222
UCA	4	0.036	.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0.444
	.	0.072	.	.		.	.		.	.		.	.			.	.	.	.	0.889
UCF	15	0.135	.	.	0.154	.	.	0.25	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.127	.	.	0.182	.	.	0.299	.	.		.	.			.	.	.	.	

Appendix F4 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
UCN	162	1.459	.	.	2.077	.	.	2.273	.	.	0.214	.	.	0	0.083	.	.	1	.	0.333
	.	1.471	.	.	2.41	.	.	3.422	.	.	0.309	.	.		0.167	.	.	.	.	0.667
UCT	3	0.027	.	.	0	.	.	0.068	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.031	.	.		.	.	0.077	.	.		.	.			.	.	.	.	
UCY	19	0.171	.	.	0.038	.	.	0.318	.	.	0.214	.	.	0	0.083	.	.	0	.	0
	.	0.099	.	.	0.077	.	.	0.213	.	.	0.309	.	.		0.167	.	.	.	.	
UGR	1	0.009	.	.	0.038	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.	0.077	.	.		.	.		.	.			.	.	.	.	
UHR	12	0.108	.	.	0.115	.	.	0.182	.	.	0.071	.	.	0	0	.	.	0	.	0
	.	0.126	.	.	0.231	.	.	0.285	.	.	0.143	.	.			.	.	.	.	
UHY	6	0.054	.	.	0	.	.	0.068	.	.	0.143	.	.	0	0	.	.	0	.	0
	.	0.05	.	.		.	.	0.077	.	.	0.286	.	.			.	.	.	.	
UIC	8	0.072	.	.	0.038	.	.	0.159	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.08	.	.	0.077	.	.	0.194	.	.		.	.			.	.	.	.	
ULP	830	7.477	.	.	14.269	.	.	6.977	.	.	1.5	.	.	0	0.083	.	.	0	.	12.111
	.	4.009	.	.	12.52	.	.	6.132	.	.	1.288	.	.		0.167	.	.	.	.	12.272
UNID	332	2.991	.	.	3.231	.	.	5.477	.	.	0.071	.	.	0	0	.	.	0	.	0
	.	3.209	.	.	5.926	.	.	7.283	.	.	0.143	.	.			.	.	.	.	
URH	6	0.054	.	.	0.115	.	.	0.045	.	.	0	.	.	0	0	.	.	0	.	0.111
	.	0.05	.	.	0.169	.	.	0.064	.	.		.	.			.	.	.	.	0.222
USG	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
UTB	2	0.018	.	.	0	.	.	0.045	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.036	.	.		.	.	0.091	.	.		.	.			.	.	.	.	
WLYE	0		.	.	0	.	.	0	.	.	0	.	.	0	0	.	.	0	.	0
	.		.	.		.	.		.	.		.	.			.	.	.	.	
WRMH	1	0.009	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.	0.045	.	.		.	.			.	.	.	.	

Appendix F3 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
WSMW		0.027	.	.	0	.	.	0.068	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.031	.	.		.	.	0.077	.	.		.	.			.	.	.	.	
WTBS	25	0.225	.	.	0.538	.	.	0.091	.	.	0	.	.	0	0.083	.	.	0	.	0.667
	.	0.137	.	.	0.487	.	.	0.109	.	.		.	.		0.167	.	.	.	.	0.577
WTCP	503	4.532	.	.	7.885	.	.	4.841	.	.	2.857	.	.	0	1	.	.	0	.	2.667
	.	2.459	.	.	8.009	.	.	3.812	.	.	2.609	.	.		1.155	.	.	.	.	3
YLBH	1	0.009	.	.	0	.	.	0.023	.	.	0	.	.	0	0	.	.	0	.	0
	.	0.018	.	.		.	.	0.045	.	.		.	.			.	.	.	.	
YOYF	19	0.171	.	.	0.269	.	.	0.25	.	.	0	.	.	0	0	.	.	0	.	0.111
	.	0.22	.	.	0.538	.	.	0.456	.	.		.	.			.	.	.	.	0.222

Appendix F5. Trot lines: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
AMEL	1	0.004	0	0	.	0.008	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.	0.009			.	0.016		.			.	.	.		.	.	.	.	.	.
BHCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BHMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BKBF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BKBH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BKCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BKSS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BLCF	238	1.044	0.944	1.4	.	0.746	2.556	.	1.3	2.25	.	0.5	2	0.857	.	.	.	.	.	.
	.	0.216	0.411	1.114	.	0.236	0.978	.	0.872	1.5	.	.	.	0.644	.	.	.	.	.	.
BLCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BLGL	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BNMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BTTM	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
BUSK	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.				**.**			**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**
CARP	1	0.004	0	0.05	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.	0.009		0.1	.			.			.	.	.		.	.	.	.	.	.

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
CLSR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
CMSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
CNCF	30	0.132	0.139	0	.	0.148	0.056	.	0	0	.	1	0	0.286	.	.	.	.	.	.
	.	0.056	0.158		.	0.071	0.111	.			.	.	.	0.429	.	.	.	.	.	.
CNLP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
CNSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
ERSN	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.				**.**			**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**
FHCF	9	0.039	0.056	0	.	0.033	0	.	0.1	0	.	0	0	0.143	.	.	.	.	.	.
	.	0.025	0.076		.	0.032		.	0.2		.	.	.	0.184	.	.	.	.	.	.
FHMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
FWDM	20	0.088	0.083	0.05	.	0.057	0	.	0.2	0	.	0	0.5	0.429	.	.	.	.	.	.
	.	0.047	0.121	0.1	.	0.047		.	0.245		.	.	.	0.459	.	.	.	.	.	.
GDEY	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
GDFH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
GDSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
GNSF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
GSCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
GZSD	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
HBNS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
JYDR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
LGPH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
LKSG	5	0.022	0	0.1	.	0.025	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.	0.023		0.2	.	0.028		.			.	.	.		.	.	.	.	.	.
LMBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
LNGR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
MMSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
MNEY	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
MQTF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
NFSH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
OSSF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
PDFH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
PDSG	12	0.053	**0.028**	**0**	**.**	**0.082**	**0**	**.**	**0**	**0**	**.**	**0.5**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.	0.029	**0.056**		**.**	**0.048**		**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
PNMW	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
QLBK	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
RDSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
RFSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
RVCS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
RVSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SBWB	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SDBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SFCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.				**.**			**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**
SGCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.				**.**			**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**
SGER	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SHRH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SJHR	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SKCB	0		**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**
	.				**.**			**.**			**.**	**.**	**.**		**.**	**.**	**.**	**.**	**.**	**.**

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
SMBF	4	0.018	0.028	0	.	0.008	0.111	.	0	0	.	0	0	0	.	.	.	.	.	.
	.	0.017	0.056		.	0.016	0.147	.			.	.	.		.	.	.	.	.	.
SNGR	1	0.004	0	0	.	0	0	.	0	0	.	0	0	0.071	.	.	.	.	.	.
	.	0.009			.			.			.	.	.	0.143	.	.	.	.	.	.
SNPD	4	0.018	**0**	**0**	**.**	**0.025**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0.071**	**.**	**.**	**.**	**.**	**.**	**.**
	.	0.021			**.**	**0.036**		**.**			**.**	**.**	**.**	**0.143**	**.**	**.**	**.**	**.**	**.**	**.**
SNSG	827		**3.111**	**5.2**	**.**	**2.992**	**5.056**	**.**	**5.9**	**6.75**	**.**	**7**	**2**	**3.643**	**.**	**.**	**.**	**.**	**.**	**.**
	.	0.626	**1.153**	**2.587**	**.**	**0.719**	**3.216**	**.**	**5.426**	**0.5**	**.**	**.**	**.**	**2.579**	**.**	**.**	**.**	**.**	**.**	**.**
SNSN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
STBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
STCT	2	0.009	0	0	.	0.008	0	.	0	0	.	0	0	0.071	.	.	.	.	.	.
	.	0.012			.	0.016		.			.	.	.	0.143	.	.	.	.	.	.
SVCB	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
SVCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
TPMT	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
UBF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
UCA	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
UCF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
UCN	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
UCT	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UCY	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UGR	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UHR	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UHY	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UIC	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
ULP	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UNID	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
URH	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
USG	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
UTB	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
WLYE	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
WRMH	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
WSMW	0	.	0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.

Appendix F5 cont'd.

Species	Total Catch	Overall CPUE	CHXO			ISB			OSB			SCCL				SCCS		SCN	TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	POOL	ITIP	BARS	ITIP	BARS	BARS	CHNB	BARS
WTBS	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
WTCP	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
YLBH	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.
YOYF	0		0	0	.	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.
	.				.			.			.	.	.		.	.	.	.	.	.

Appendix G. Hatchery names, locations and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch per unit effort by gear type for the sturgeon season and the fish community season during 2015 for Segment 14 of the Missouri River.

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
AMEL	0	0	0	0	0	0.004
BHCP	0.004	0	0	0	0	0
BHMW	0	0	0	1.838	0.015	0
BKBF	0.004	0	0	0.009	0	0
BKBH	0	0	0	0.018	0	0
BKCP	0	0	0	0.081	0	0
BKSS	0	0	0	0.054	0	0
BLCF	1.351	0.218	0.058	0.081	5.73	1.044
BLCP	0	0	0	0.027	0	0
BLGL	0	0	0	2.703	0.004	0
BNMW	0	0	0	0.441	0	0
BTTM	0	0	0	0.009	0	0
BUSK	0.69	0.134	0.193	0	0.077	0
CARP	0.03	0	0.006	0.207	0	0.004
CLSR	0	0	0	0.018	0	0
CMSN	0	0	0	0.009	0	0
CNCF	0.019	0.633	0.011	5.153	2.538	0.132
CNLP	0	0	0	0.018	0.005	0
CNSN	0	0.008	0	0.766	0.01	0
ERSN	0	0	0	0.82	0	0
FHCF	0.011	0.02	0.022	0.117	0.01	0.039
FHMW	0	0	0	0.09	0	0
FWDM	0.022	0.153	0	5.279	0.142	0.088
GDEY	0.056	0	0.008	0.045	0.02	0

Appendix H cont'd.

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
GDFH	0	0	0	0.009	0	0
GDSN	0	0	0	0.009	0	0
GNSF	0	0	0	0.279	0	0
GSCP	0.034	0.008	0	0.009	0	0
GZSD	0.011	0.023	0	8.045	0	0
HBNS	0	0	0	0.306	0	0
JYDR	0	0	0	0.009	0	0
LGPH	0	0	0	0.081	0	0
LKSG	0	0	0	0	0	0.022
LMBS	0	0	0	0.063	0	0
LNGR	1.213	0	0.042	0.369	0	0
MMSN	0	0	0	0.009	0	0
MNEY	0.004	0	0	0	0	0
MQTF	0	0	0	1.847	0	0
NFSH	0	0	0	0	0	0
OSSF	0	0	0	3.144	0	0
PDFH	0.011	0	0	0	0	0
PDSG	0.034	0	0.016	0	0.009	0.053
PNMW	0	0	0	0.279	0	0
QLBK	0.004	0	0.017	0	0	0
RDSN	0	0	0	2.234	0	0
RFSN	0	0	0	0.027	0	0
RVCS	0.071	0.052	0	0.135	0.021	0
RVSN	0	0	0	0.063	0	0
SBWB	0.007	0	0	0	0	0
SDBS	0	0	0	0.009	0	0
SFCB	0	0.769	0	0.117	0.801	0

Appendix H cont'd.

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
SGCB	0	0.142	0	0	0.105	0
SGER	0.056	0	0.014	0	0	0
SHRH	0.022	0	0	0.045	0	0
SJHR	0.004	0	0	0	0	0
SKCB	0	0.515	0	0.342	0.242	0
SMBF	0.16	0.013	0.064	0.063	0.012	0.018
SNGR	0.112	0.02	0	0.252	0.027	0.004
SNPD	0.007	0	0.01	0	0	0.018
SNSG	5.869	0.916	3.982	0	1.014	3.627
SNSN	0	0	0	0.288	0	0
STBS	0	0	0	0.135	0	0
STCT	0	0.01	0	0	0	0.009
SVCB	0	0.012	0	1.216	0.009	0
SVCP	0.015	0	0.007	0.117	0	0
TPMT	0	0	0	0.009	0	0
UBF	0	0	0	0.45	0	0
UCA	0	0	0	0.036	0	0
UCF	0	0	0	0.135	0.007	0
UCN	0	0	0	1.459	0	0
UCT	0	0	0	0.027	0	0
UCY	0	0	0	0.171	0	0
UGR	0	0	0	0.009	0	0
UHR	0	0	0	0.108	0	0
UHY	0	0	0	0.054	0.097	0
UIC	0	0	0	0.072	0.095	0
ULP	0	0	0	7.477	0	0
UNID	0	0	0	2.991	0	0

Appendix H cont'd.

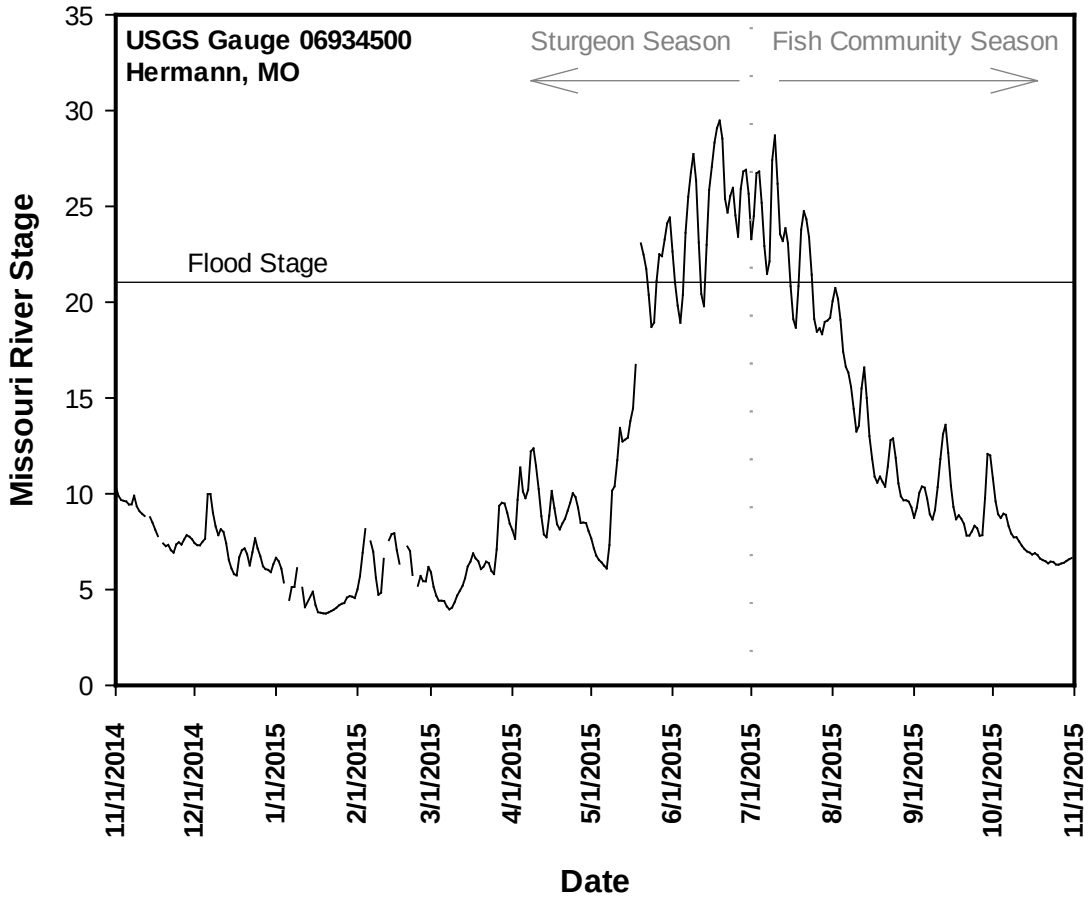
Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0" Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
URH	0	0	0	0.054	0	0
USG	0	0.019	0	0	0.202	0
UTB	0	0	0	0.018	0	0
WLYE	0.004	0	0	0	0	0
WRMH	0	0	0	0.009	0	0
WSMW	0	0	0	0.027	0	0
WTBS	0	0	0	0.225	0	0
WTCP	0	0	0	4.532	0	0
YLBH	0	0	0	0.009	0	0
YOYF	0	0	0	0.171	0	0

Appendix I. Comprehensive list of bend numbers and bend river miles for Segment 14 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2003 - 2015.

Bend Number	Bend RM	Coordinates Lat	Coordinates Long	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	3.4	38.82653	-90.1623			ST		ST, FC		ST, FC		ST		ST,FC		
2	6	38.82471	-90.2033		FC	ST, FC			ST, FC						ST,FC	
3	9.2	38.85036	-90.2545										ST, FC			ST, FC
4	10.6	38.86395	-90.2714		FC		ST, FC	ST, FC			ST, FC		ST, FC			
5	16.7	38.86586	-90.3426		ST, FC	FC										
6	21.9	38.82414	-90.399		FC					ST, FC						
7	25.4	38.81764	-90.4515				ST, FC		ST, FC			ST	ST, FC		ST,FC	
8	26.5	38.80487	-90.4597											ST,FC		ST, FC
9	28.2	38.77747	-90.4775			ST, FC										
10	31.9	38.74226	-90.5096						ST, FC		ST, FC		ST, FC		ST,FC	ST, FC
11	33.9	38.7202	-90.5337				ST, FC					ST			ST,FC	ST, FC
12	37.7	38.6814	-90.5531		FC		ST, FC			ST, FC	ST, FC					ST,FC
13	38.8	38.68203	-90.5766		ST											
14	40.7	38.68431	-90.6094		FC							ST	ST, FC			ST, FC
15	43.7	38.68812	-90.66	ST	FC		ST, FC	ST, FC				ST			ST,FC	
16	45.5	38.67971	-90.6834	FC			ST, FC			ST, FC		ST				
17	48.6	38.65753	-90.7324				ST, FC	ST, FC		ST, FC	ST, FC					
18	49.8	38.63889	-90.7404							ST, FC						
19	51.2	38.62224	-90.7535	FC			ST, FC						ST, FC	ST,FC	ST,FC	
20	54.4	38.59151	-90.7858	FC										ST,FC		
21	56.5	38.57962	-90.8229				ST, FC	ST, FC				ST		ST,FC		
22	58.9	38.56047	-90.8526								ST, FC		ST, FC		ST,FC	
23	60.6	38.55085	-90.8806					ST, FC		ST, FC		ST		ST,FC		ST,FC
24	65	38.54148	-90.9542		ST	FC						ST				
25	66.7	38.55407	-90.9864			FC			ST, FC							
26	69.6	38.57935	-91.0254	ST	FC			ST, FC						ST,FC		
27	74.6	38.6068	-91.0901					ST, FC							ST,FC	
28	76.9	38.59863	-91.1333	ST					ST, FC				ST, FC			

Appendix I. (continued)

Bend Number	Bend RM	Coordinates Lat	Long	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
29	77.9	38.60315	-91.1504				ST	ST, FC		ST, FC						
30	79.7	38.60848	-91.1847				ST, FC						ST, FC	ST,FC		
31	80.9	38.61417	-91.2011	FC				ST, FC		ST, FC						
32	82.7	38.62761	-91.2282		FC	ST			ST, FC				ST, FC	ST,FC	ST,FC	ST,FC
33	85.4	38.65893	-91.2444						ST, FC			ST	ST, FC			
34	86.7	38.66978	-91.2637				ST, FC		ST, FC		ST, FC	ST	ST, FC			
35	87.9	38.68436	-91.283		FC		ST	ST, FC						ST,FC		
36	89.7	38.69992	-91.3043		FC		ST						ST, FC			
37	91.8	38.70582	-91.3308													
38	93.9	38.69945	-91.3702			FC		ST, FC		ST, FC						
39	95.3	38.70691	-91.3924				ST, FC				ST, FC			ST,FC		
40	96.8	38.70992	-91.4178					ST, FC	ST, FC		ST, FC				ST,FC	ST,FC
41	97.9	38.70878	-91.4442				ST, FC		ST, FC						ST,FC	
42	100.1	38.70234	-91.4736				ST			ST, FC			ST, FC		ST,FC	
43	103.4	38.6843	-91.5312							ST, FC	ST, FC	ST			ST,FC	
44	104.9	38.67689	-91.5609	ST			ST		ST, FC						ST,FC	
45	106.3	38.68138	-91.5802									ST	ST, FC	ST,FC		
46	107.9	38.69099	-91.6078													
47	110.2	38.70366	-91.6433		ST	FC								ST,FC		
48	112.1	38.70411	-91.6787			ST			ST, FC			ST	ST, FC			ST,FC
49	116.1	38.69553	-91.7456	FC			ST, FC						ST, FC			ST,FC
50	118.3	38.68232	-91.78			ST		ST, FC			ST, FC					
51	120.8	38.67934	-91.8244	FC		ST, FC										ST,FC
52	122.3	38.67198	-91.8482								ST, FC		ST, FC			
53	125	38.6476	-91.8858	FC					ST, FC	ST, FC						ST,FC
54	127	38.6253	-91.9059	FC							ST, FC		ST, FC			
55	128.5	38.61124	-91.9263	FC			ST, FC		ST, FC	ST, FC	ST, FC			ST,FC		ST,FC
56	130.2	38.59569	-91.9474				ST				ST, FC				ST,FC	



Appendix J. Stage hydrograph of Missouri River at USGS Hermann, MO gauge during the 2015 sampling season. Vertical dashed line denotes transition between sturgeon season and fish community season. Solid horizontal line denotes flood stage at gauge station.