2014 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

By:

Patricia Herman and Colby Wrasse

USFWS
Columbia Fish and Wildlife Conservation Office
101 Park DeVille Drive, Suite A
Columbia, MO 65203

April 2015

EXECUTIVE SUMMARY

We deployed 140 standard gill nets, 232 standard otter trawls, 111 standard trammel nets, 114 standard trotlines and 112 standard mini-fyke nets in Segment 14 during the 2014 sampling season. We also deployed 790 hooks baited with nightcrawlers and 5 non-standard (76 mm bar mesh) gill nets as part of broodstock collection efforts. A total of 11,611 fish were collected from all samples in Segment 14 during 2014, representing 59 identified species. Shovelnose Sturgeon (*n* = 3,896) Shoal Chub (*n* = 1,647) and Channel Catfish (*n* = 1,155) were the most abundant species.

We captured 19 Pallid Sturgeon, of which, three were suspected to be of wild origin based on genetic results. The three suspected wild Pallid Sturgeon lengths were between 745 and 801 mm FL. Natural recruitment of Pallid Sturgeon in Segment 14 appeared to be minimal. Only 25 suspected wild Pallid Sturgeon have been captured in Segment 14 since the current monitoring program began in 2003. Areas near major tributary confluences (Osage River, RM 130 and Gasconade River, RM 105) accounted for over a quarter (32%) of the Pallid Sturgeon collected. Catch per unit effort (CPUE) of Pallid Sturgeon from gill nets and trotlines appeared similar to 2013, but lower than 2012. In 2014, the Pallid Sturgeon catch in Segment 14 was dominated by young hatchery fish. The 2011 and 2014 year classes combined represented 56% of the hatchery origin Pallid Sturgeon captured in 2014. Relative condition factor indicated that Pallid Sturgeon in all size categories were in good condition; these metrics have been fairly consistent since 2005. Interestingly, condition factor for quality and preferred size Pallid Sturgeon was

greater in Segment 14 when compared to Segment 13. This could be due in part to greater abundances of prey (e.g., Sicklefin and Shoal chubs) in Segment 14.

There appeared to be a slight downward trend in gill net catch rates for Shovelnose Sturgeon; however, this was not noted with other gears. In the 2012 annual report, we noted a trend for decreasing relative weights for preferred and memorable/trophy size Shovelnose Sturgeon for 2010-2012; however, relative weights for this size class increased dramatically in 2013 and 2014. Relatively high otter trawl CPUE for sub-stock Shovelnose Sturgeon indicated successful reproduction in 2013 and 2014. Six percent of all Shovelnose Sturgeon captured during the 2013 fish community season were sub-stock (0-149 mm FL) size. Improved condition scores coupled with an increased abundance of young-of-year sturgeon (e.g., successful spawning) may be explained by dietary shifts (i.e., piscivory) in Shovelnose Sturgeon. These increases may also be correlated with Similarity of Appearance listing in 2010 and the cessation of commercial Shovelnose Sturgeon harvest in Segment 14. Increased Wr's may be a reflection of increased abundances of preferred and greater sized Shovelnose Sturgeon and fecund individuals.

Since 2012, catch rates for all three *Macrhybopsis* chub species have been relatively high. The increase in chub relative abundance correlates temporally with post flood conditions. Both Age-0 and adult size specimens of all three species of chubs were commonly captured during the 2014 field season. Sand shiner CPUE was the highest since 2006 and *Hybognathus* spp. CPUE was the highest on record; however, overall captures of these cyprinid species remained low.

Blue Sucker abundance in Segment 14 appeared to be stable or slightly increased. The strong 2011 year class has now fully recruited to our gears and was likely a driver behind increased Blue Sucker relative abundance. Sauger relative abundance in Segment 14 continued to be low, but stable. As in 2013, age-0 Sauger were captured mainly in mouths of large tributaries (TRML macrohabitats) during 2014. Eight state endangered Lake Sturgeon were collected in 2014. All Lake Sturgeon were of hatchery origin, and five of eight (63%) were captured near the Osage River confluence.

TABLE OF CONTENTS

INTRODUCTION **1**

STUDY AREA **3**

METHODS **5**

Sampling Site Selection and Habitat Description 5

Sampling Gear 7

Data Collection and Analysis 10

RESULTS **15**

Effort 15

Pallid Sturgeon 17

Shovelnose x Pallid Sturgeon Hybrids 39

Targeted Native River Species 40

Shovelnose Sturgeon 40

Sturgeon Chub 57

Sicklefin Chub 60

Shoal Chub 63

Sand Shiner 66

Hybognathus spp. 69

Blue Sucker 72

Sauger 79

MISSOURI RIVER FISH COMMUNITY **85**

DISCUSSION **87**

ACKNOWLEDGMENTS **93**

REFERENCES **94**

APPENDICES **98**

LIST OF TABLES

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 2014. N-E indicates the habitat is non-existent in the segment. 16

Table 2. Pallid Sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2014. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. Table includes all Pallid Sturgeon captures including non-random samples. 21

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 2014 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. 23

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 2014. 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. 32

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 2014. 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. 33

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 2014. 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. 34

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 2014. 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. 35

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 2014. 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. 36

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 2014. 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. 49

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 2014. 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. 50

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 2014. 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. 51

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 2014. 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. 52

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 2014. 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. 53

Table 14. Total number of Blue Suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2014. 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. 77

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 2014. 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. 83

LIST OF FIGURES

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). 14

Figure 2. Distribution of Pallid Sturgeon captures by river mile for Segment 14 of the Missouri River during 2014. 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... 20

Figure 3. Incremental proportional size distribution (PSD) for all Pallid Sturgeon captured with all gear by length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). 24

Figure 4. Relative condition factor (K_n) for all Pallid Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 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). 25

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 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification. 28

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 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification. 29

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 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification. 30

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 2010-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification. 31

Figure 9. Length frequency of Pallid Sturgeon captured in Segment 14 of the Missouri River during 2014. 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 2014. Pallid Sturgeon of unknown origin are awaiting genetic verification. 37

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 2003-2014. 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. 38

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 2003-2014. 42

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 2003-2014. 43

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 2003-2014. 44

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 2010-2014. 45

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 2013. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 54

Figure 16. Incremental proportional size distribution (PSD) for all Shovelnose Sturgeon captured with all gear by length category from 2003 to 2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998). 55

Figure 17. Relative weight (Wr) for all Shovelnose Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998). 56

Figure 18. Mean annual catch per unit effort (± 2 SE) of Sturgeon Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014. 58

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 59

Figure 20. Mean annual catch per unit effort (± 2 SE) of Sicklefin Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014. 61

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 62

Figure 22. Mean annual catch per unit effort (± 2 SE) of Shoal Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014. 64

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 65

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 2003-2014. 67

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 2014. Standard samples include standard gears, random bends and random subsamples. All samples include all sampling conducted during 2014. 68

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 2003-2014. 70

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 71

Figure 28. Mean annual catch per unit effort (± 2 SE) of Blue Suckers using gill nets in Segment 14 of the Missouri River from 2003-2014. 74

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 2003-2014. 75

Figure 30. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using otter trawls in Segment 14 of the Missouri River from 2003-2014. 76

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 78

Figure 32. Mean annual catch per unit effort (± 2 SE) of Sauger using gill nets in Segment 14 of the Missouri River from 2003-2014. 80

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 2003-2014. 81

Figure 34. Mean annual catch per unit effort (± 2 SE) of Sauger using otter trawls in Segment 14 of the Missouri River from 2003-2014 82

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 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. 84

LIST OF 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. 99

Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term Pallid Sturgeon and associated fish community sampling program. 105

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 106

Appendix D. Stocking locations and codes for Pallid Sturgeon by Recovery Priority Management Area (RPMA) in the Missouri River Basin. 107

Appendix E. Juvenile and adult Pallid Sturgeon stocking summary for Segment 14 of the Missouri River (RPMA 4). 108

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 2013. 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. 109

Appendix G. Hatchery names, locations and abbreviations. 130

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 2014 for Segment 14 of the Missouri River. 131

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 - 2014. 134

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 species 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 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 spring 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 data analysis.

The macrohabitat type describes the general location of the sample within a bend (e.g., inside bend, outside bend, etc.). Mesohabitat describes 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

One-inch (25.4 cm) trammel nets were 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 earthworms, 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 (meters) (beginning, mid-point and end for all gears except mini-fykes; where depth is measured at the opening/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 Pallid Sturgeon Population Assessment Team selected eight target species that were either thought to be important forage species or were 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*) and Plains Minnow (*H. placitus*), Blue Sucker (*Cycleptus elongatus*) and Sauger (*Sander canadense*). Fork length (mm FL) and weight measurements (g) were collected on Pallid Sturgeon and Shovelnose Sturgeon, and total length (mm) 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, as well as hatchery origin, and digital images were taken for documentation. All Pallid Sturgeon that were captured with no evidence of previously being tagged, or otherwise could not be 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. Length measurements only were taken from smaller 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, in general, 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 fork length < 330 mm, stock fork length 330-629 mm, quality fork length 630-839 mm, preferred fork length 840-1,039 mm, memorable fork length 1,040-1,269 mm and trophy fork length > 1,270 mm; sub-stock were further divided as 0-199 mm FL and 200-329. Length categories based on a percentage of length of the largest known

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

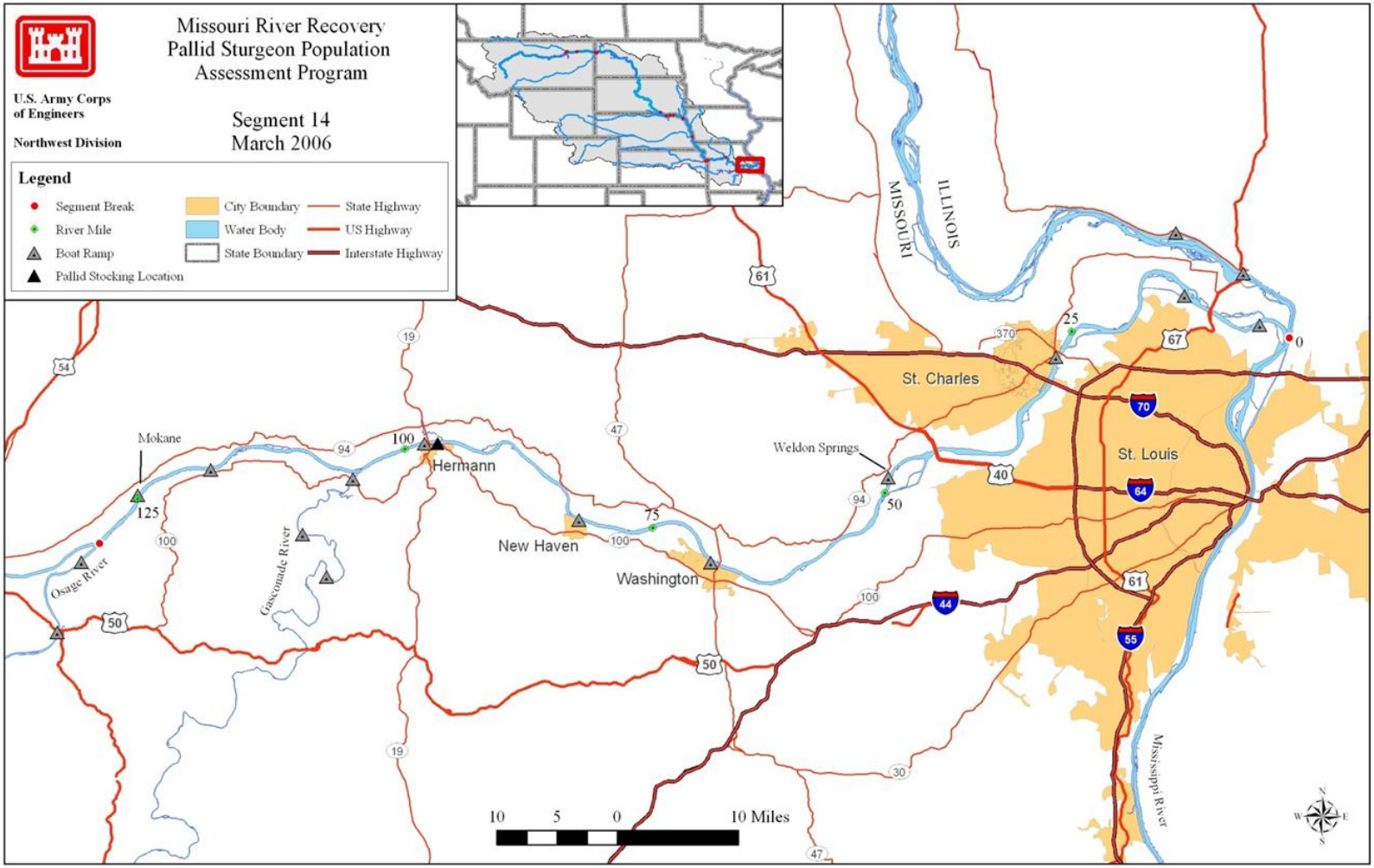

Figure 1. Map of Segment 14 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for Pallid Sturgeon. Segment 14 encompasses the Missouri River from the Osage River (River Mile 130.2) to the Mississippi River (River Mile 0.0).

Results

Effort

We completed 100% of the targeted standard sampling effort on 14 randomly selected bends, deploying 140 standard gill nets, 114 standard trotlines, 232 standard otter trawls, 111 standard trammel nets and 112 standard mini-fyke nets in Segment 14 during 2014. Three mini-fyke net sets malfunctioned and were not included in analyses, one trammel net deployment was omitted. Of the 240 standard otter trawls deployed, 118 were deployed during fish community season and 114 during sturgeon season. Most standard gear deployments sampled the ISB macrohabitat (67.3%, Table 1), followed by CHXO macrohabitat (16.4%) and OSB macrohabitat (9%). In addition to standard sampling, targeted gear deployments to capture mature broodstock quality Pallid Sturgeon for use in the propagation program were implemented from March through April with seven wild trotlines comprising 790 hooks and five 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 2014. 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	10.00	N-E	33	0	N-E	N-E	N-E	0	79	22	2	0	0	4	0	0
Otter Trawl	14	8.14	N-E	19	0	N-E	N-E	N-E	0	86	2	2	0	0	5	0	0
Fish Community Season																	
1.0” Trammel Net	14	7.86	N-E	13	0	N-E	N-E	N-E	0	95	0	1	0	0	1	0	0
Mini-Fyke Net	14	7.86	N-E	16	0	N-E	N-E	N-E	0	55	21	4	7	0	3	4	0
Otter Trawl	14	8.07	N-E	17	0	N-E	N-E	N-E	0	86	0	5	0	0	5	0	0
Both Seasons																	
Trot Lines	14	8.14	N-E	25	2	N-E	N-E	N-E	0	64	17	3	0	0	3	0	0

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

Pallid Sturgeon

We collected 19 Pallid Sturgeon (16 hatchery-reared, 3 presumed wild) during 2014 in Segment 14. Pallid Sturgeon captures were relatively evenly distributed by river mile in Segment 14, however, few Pallid Sturgeon were captured downstream of river mile 40 (Figure 2). Areas near major tributary confluences (Osage River, RM 130 and Gasconade River, RM 105) accounted for over a quarter (32%) of the Pallid Sturgeon collected. Pallid Sturgeon were found in half of all macrohabitats sampled, including; CHXO, CONF, ISB and TRML, which represented nearly 88% of all gear deployments. The majority of Pallid Sturgeon were captured from ISB – CHNB habitat, from the lower 100 miles of the Missouri River. Bottom current velocities where Pallid Sturgeon were captured ranged from 0.15 to 0.78 m/s, whereas bottom velocity at all gear deployments ranged from 0.00 to 1.15 m/s (Table 2). Water depth where Pallid Sturgeon were captured ranged from 1.7 to 6.1 m across all habitat types sampled, whereas water depth at all gear deployments across habitats ranged from 0.2 to 12.0 m (Table 2). Water temperatures where Pallid Sturgeon were captured ranged from 4.4 to 23.0˚C. Mean depth of gear deployments yielding Pallid Sturgeon in the ISB-CHNB mesohabitat were deeper than mean depths of all gear deployments in the ISB-CHNB mesohabitat, 3.85 m and 2.94 m, respectively (Table 2). Mean bottom water velocity was slower for gear deployments both capturing and not-capturing Pallid Sturgeon in the ISB-CHNB mesohabitat, 0.45m/s and 0.55 m/s, respectively (Table 2).

We captured 16 Pallid Sturgeon of hatchery origin, representing five different year classes (Table 3). The 2014 year class had the highest representation with five individuals, followed by the 2011 year class with four individuals captured. The 2014 year class, at large for less than 30 days, had mean length of 160 mm, mean weight of 20 g and a relative condition factor of 1.919 (Table 3). The 1992 year class continues to be represented in sampling efforts with three captures in 2014. The 1992 year class had mean length of 914 mm FL, mean weight of 3,247 g and a relative condition factor of 1.038. In comparison, five Pallid Sturgeon captured from the 1992 year class in 2013 had mean length of 838 mm FL, mean weight of 2,710 g and a relative condition factor of 1.158 (Herman and Wrasse 2014). Because mean lengths and weights are not known for the majority of year classes captured in Segment 14, daily growth rates could only be calculated for the 2002 year class and averaged 0.158 mm/d (Table 3).

Pallid Sturgeon captures in Segment 14 occurred during both sturgeon and fish community seasons. Five sub-stock size (0-199 mm FL) Pallid Sturgeon were captured during 2014, more than in all years combined and comprising 26% of total Pallid Sturgeon captures in Segment 14 (Figure 3). No sub-stock (200-329 mm) were captured. Most Pallid Sturgeon captured in Segment 14 were stock sized, comprising 32% of total Pallid Sturgeon captured. Quality sized captures, of which the three wild Pallid Sturgeon captures from Segment 14 were included, represented 21%. Preferred size Pallid Sturgeon also comprised 21% of the catch during the 2014 sample year. The proportion of stock sized fish captured during the 2014 sturgeon increased from 2012, when stock sized captures were the lowest on record (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, and the proportion of preferred size fish has been relatively consistent since 2007 (Figure 3). No memorable or trophy size Pallid Sturgeon have been collected in Segment 14.

With the exception of sub-stock (0-199 mm), mean relative condition factors (*Kn*) were similar across all size classes, ranging from 0.937 to 1.919, in 2014. A noticeable increase in Kn was observed in sub-stock (0-199 mm) Pallid Sturgeon in Segment 14. 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). Between years 2003-2014, *Kn* factors have typically been above 0.900 across all size classes (Figure 4).

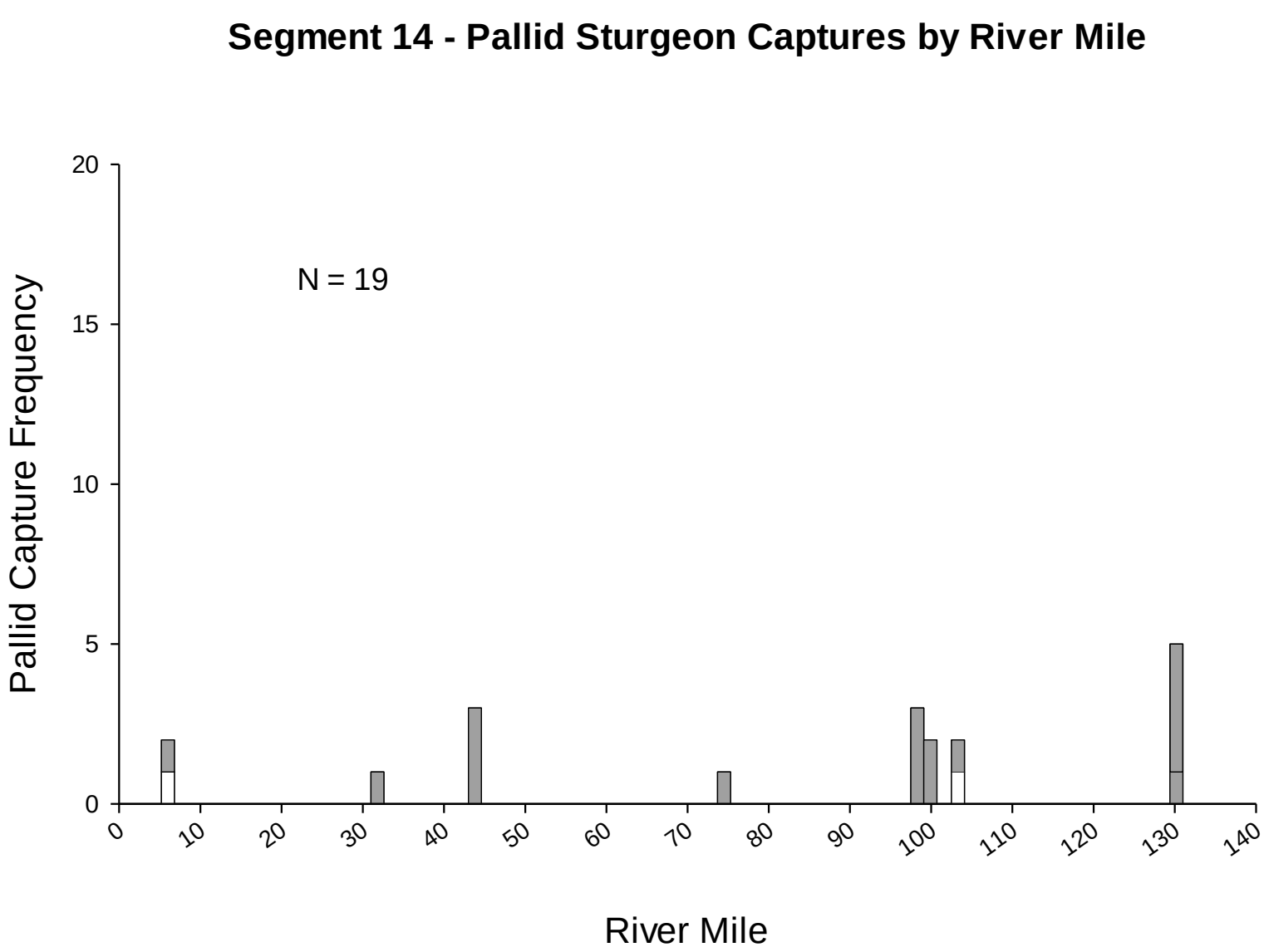

Figure 2. Distribution of Pallid Sturgeon captures by river mile for Segment 14 of the Missouri River during 2014. White bars represent presumed wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent Pallid Sturgeon of unknown origin. Figure 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 2014. 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)		0.05 (0.04-0.06)		20.1 (15.0-27.0)		149 (74-340)		.
	CHNB	3.7 (1.3-7.0)	4.1 (2.8-5.8)	0.47 (0.05-1.03)	0.24 (0.18-0.33)	16.8 (2.0-30.0)	10.1 (4.4-23.0)	441 (18-1484)	55 (22-105)	5
	ITIP									.
	POOL	6.5 (3.5-12.0)	5.0 (5.0-5.0)	0.23 (0.04-0.90)	0.15 (0.15-0.15)	11.8 (2.0-20.5)	4.5 (4.5-4.5)	197 (17-722)	41 (41-41)	1
CONF	BARS									.
	CHNB									.
	ITIP									.
	POOL	5.3 (4.1-6.6)	5.8 (5.5-6.1)	0.66 (0.54-0.78)	0.66 (0.54-0.78)	10.6 (7.7-11.5)	11.3 (11.2-11.3)	95 (90-99)	95 (90-99)	2
	TLWG									.
	ITIP									.
	POOL									.
ISB	BARS	0.6 (0.2-1.1)		0.21 (0.04-0.63)		21.2 (17.0-29.0)		265 (44-810)		.
	CHNB	2.9 (1.2-8.2)	2.7 (1.7-3.5)	0.55 (0.04-1.15)	0.56 (0.43-0.68)	17.5 (2.0-30.0)	16.9 (8.0-19.4)	570 (17-1700)	734 (192-1278)	8
	ITIP									.
	POOL	5.9 (3.0-11.0)		0.34 (0.00-1.06)		13.2 (3.0-18.7)		201 (39-785)		.
OSB	BARS	0.6 (0.4-0.7)		0.02 (0.00-0.04)		21.2 (17.0-27.0)		180 (74-357)		.
	CHNB	4.3 (2.0-6.1)		0.33 (0.11-0.58)		10.3 (3.0-19.3)		93 (23-234)		.

Table 2. (continued)

Habitat		Depth (m)		Bottom Velocity (m/s)		Temperature (°C)		Turbidity (ntu)		Total PDSG caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
	ITIP									.
	POOL	5.4 (3.1-7.5)		0.26 (0.00-0.73)		11.5 (2.0-20.2)		241 (19-738)		.
SCCL	BARS	0.5 (0.2-0.7)		0.02 (0.02-0.02)		23.8 (20.0-27.0)		108 (35-180)		.
	CHNB	1.8 (1.3-2.4)		0.46 (0.07-0.62)		20.0 (18.0-25.0)		1119 (335-1470)		.
	ITIP	2.2 (1.3-3.0)		0.55 (0.39-0.70)		16.0 (8.0-27.0)		717 (50-1378)		.
	POOL	2.5 (2.5-2.5)		.		19.3 (19.3-19.3)		117 (117-117)		.
SCCS	BARS	0.5 (0.3-0.8)		0.08 (0.07-0.08)		17.0 (17.0-17.0)		89 (75-98)		.
	CHNB									.
	ITIP									.
	POOL									.
TRML	BARS	0.7 (0.4-0.8)		.		27.0 (27.0-27.0)		33 (26-40)		.
	CHNB	5.1 (2.3-8.4)	5.5 (5.5-5.5)	0.30 (0.27-0.33)	0.33 (0.33-0.33)	18.8 (16.3-22.1)	17.0 (17.0-17.0)	198 (36-489)	36 (36-36)	1
	ITIP									.
	POOL	5.9 (4.1-11.0)	4.7 (4.3-5.0)	0.35 (0.02-0.78)	0.52 (0.28-0.75)	14.6 (7.4-25.0)	9.5 (7.8-11.2)	110 (15-441)	134 (15-252)	2
TRMS	BARS	0.6 (0.4-0.7)		0.03 (0.00-0.05)		18.0 (17.0-21.0)		84 (51-105)		.
	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 2014 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	3	.	.	.	914	3246.67	1.038	.	.
± 2SE	.	.	.	.	37	266.92	0.061	.	.
2002	2	238	.	.	844	2325.0	0.969	0.158	.
± 2SE	.	.	.	.	15	30	0.044	.	.
2009	2	.	.	.	539	520.00	0.937	.	.
± 2SE	.	.	.	.	86	220.00	0.091	.	.
2011	4	.	.	.	547	565.00	0.975	.	.
± 2SE	.	.	.	.	34	113.87	0.046	.	.
2014	5	.	.	.	160	20.00	1.919	.	.
± 2SE	.	.	.	.	21	8.94	0.666	.	.

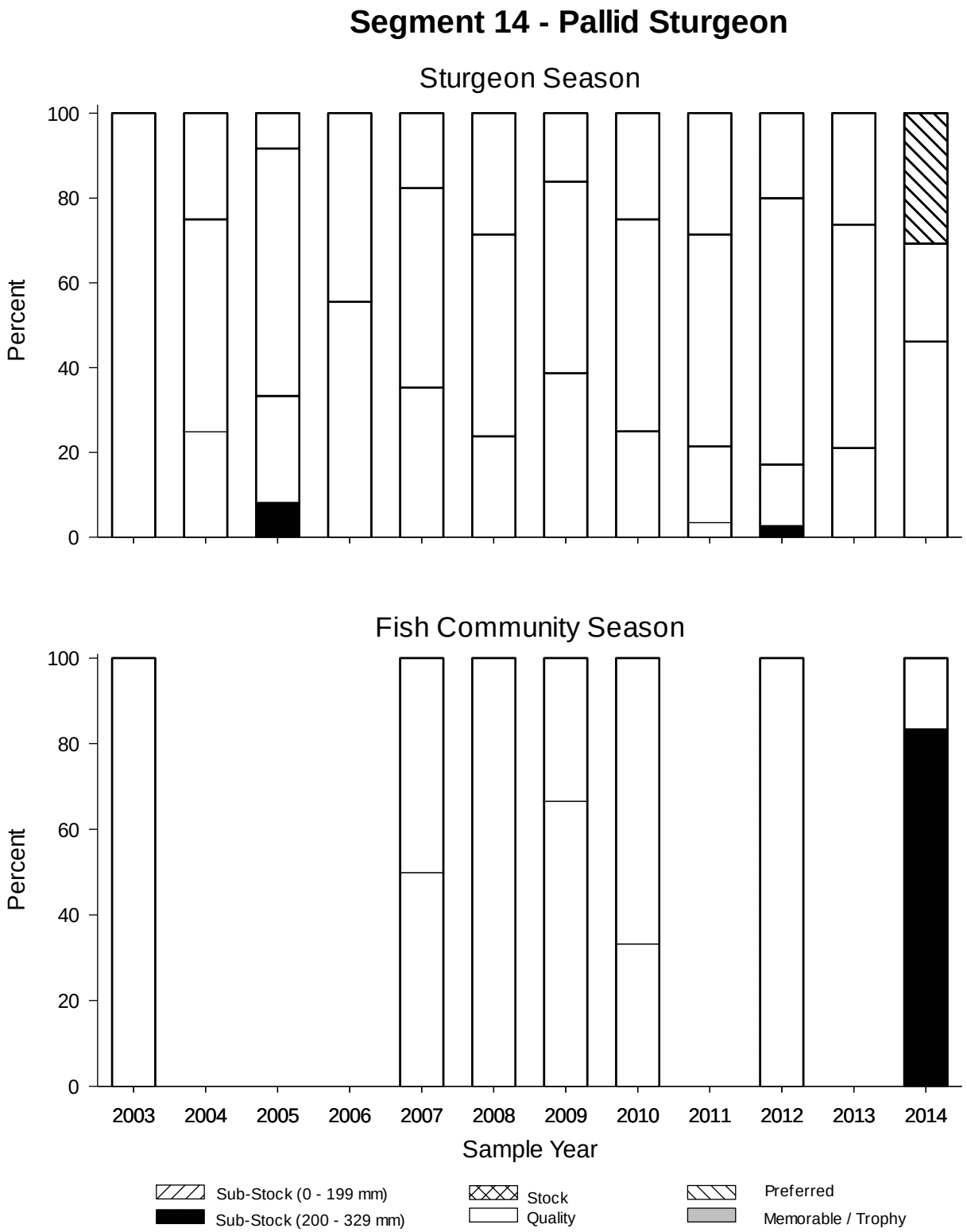

Figure 3. Incremental proportional size distribution (PSD) for all Pallid Sturgeon captured with all gear by length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006).

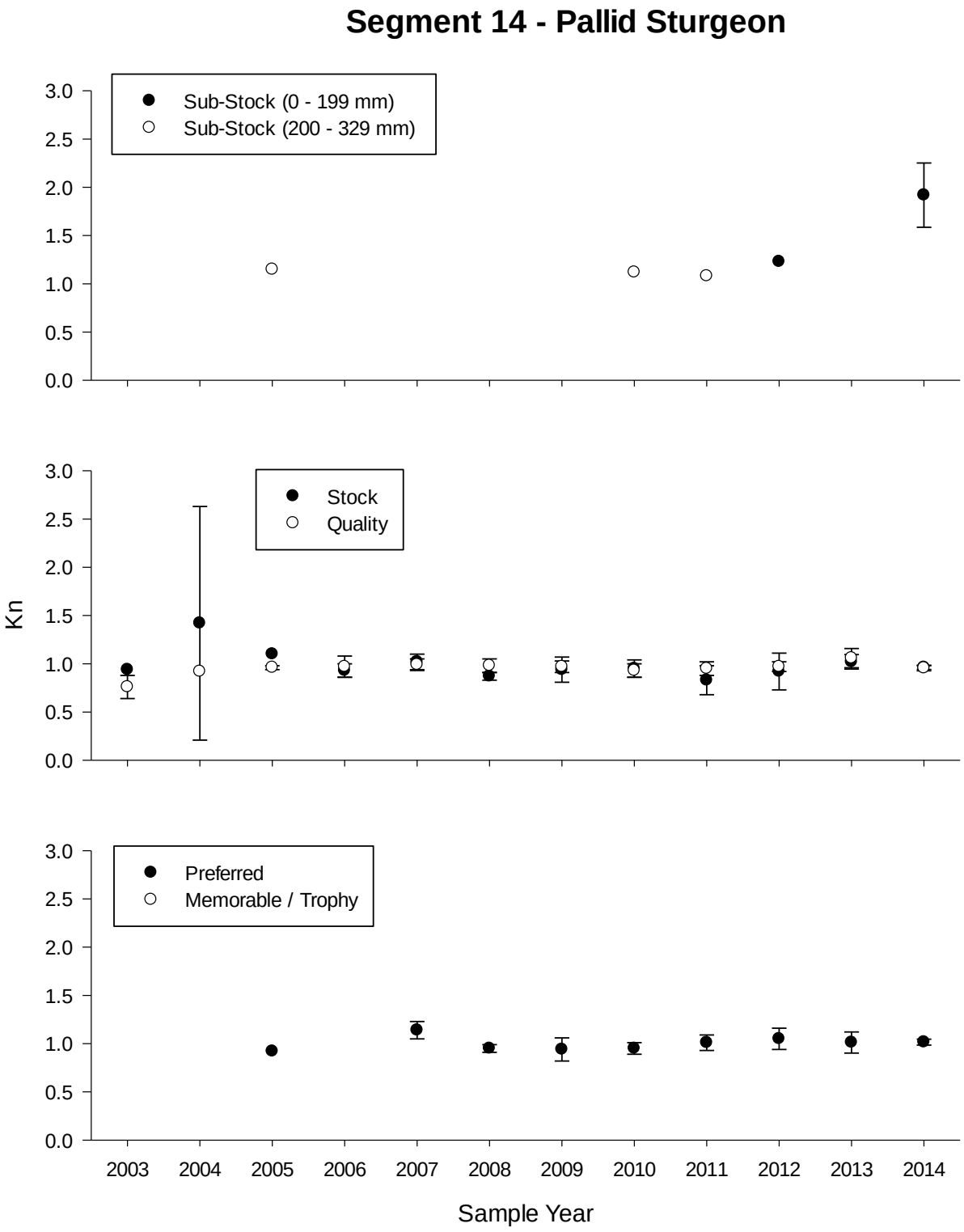

Figure 4. Relative condition factor (K_n) for all Pallid Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Shuman et al. (2011).

Year comparisons, gear evaluation and habitat associations

Mean Pallid Sturgeon CPUE for standard gill nets in 2014 (0.02 fish/net night ± 0.02 2SE) increased from 2013, returning to levels seen in 2011 (Figure 5). Catch per unit effort for Pallid Sturgeon in standard gill nets during 2014 increased 67% from 2013. Gill net CPUE has been relatively stable except in the years 2008 and 2012 (Figure 5) and 2014 catch rates reflect that baseline CPUE of 0.019 fish/net night ± 0.02 2SE. One Pallid Sturgeon was collected in a trammel net in 2014; mean CPUE 0.007 fish/100 m ± 0.01 (Figure 6). Pallid Sturgeon have not been captured in trammel nets since 2010 and this was the first wild Pallid Sturgeon captured with the gear since 2007. Mean CPUE of Pallid Sturgeon in otter trawls during 2014 was the highest on record since monitoring began (0.03 fish/100 m ± 0.03). No Pallid Sturgeon were captured in otter trawls during sturgeon season; five hatchery stock were captured during fish community sampling (Figure 7). Mean CPUE of Pallid Sturgeon captured on trotlines during 2014 was 0.03 fish/20 hook night ± 0.02 2SE (Figure 8). Of the seven Pallid Sturgeon captured on trotlines, two are presumed wild based on genetic analysis. Catch per unit effort for Pallid Sturgeon on standard trotlines during 2014 was nearly the same as CPUE during 2013.

In 2014, five sub-stock (0-199 mm) Pallid Sturgeon were captured from either CHXO or ISB macrohabitats during fish community season with otter trawls (Table 4). No sub-stock size (200-329 mm FL) size Pallid Sturgeon were captured in Segment 14 during standard sampling in 2014 (Table 5). Five stock size Pallid Sturgeon were captured from CHXO, CONF and ISB macrohabitats with gill nets and trotlines (Table 6). Quality size and greater (≥ 630 mm) Pallid Sturgeon were captured in standard gill nets (43%), standard trotlines (43%) and trammel nets

(14%; Table 7). Most quality size Pallid Sturgeon (43%) were found in the CHXO macrohabitat, but quality size Pallid Sturgeon were also captured from the ISB (29%), CONF(14%) and TRML (14%) macrohabitats (Table 7). When looking at all Pallid Sturgeon captured during standard effort combined, gill nets, otter trawls and trotlines were successful in ISB and CHXO macrohabitats (Table 8). Additionally, trotlines were successful in CONF macrohabitats and trammel nets in TRML macrohabitats (Table 8).

Pallid Sturgeon collected in all samples from Segment 14 during 2014 ranged from 136 to 940 mm FL, representing three distinct size "groups" (Figure 9). Three "genetically presumed wild" Pallid Sturgeon were captured, none of which were suitable for use in the Pallid Sturgeon Propagation and Population Augmentation Program in 2014. Overall catch rates of Pallid Sturgeon remained steady from 2013 and the catch aligns with the mean (*n* = 19) for Pallid Sturgeon captures in Segment 14 for all years (Figure 10). In general, capture of hatchery-reared Pallid Sturgeon appears to have stabilized in Segment 14 with the peak in 2009 (Figure 10).

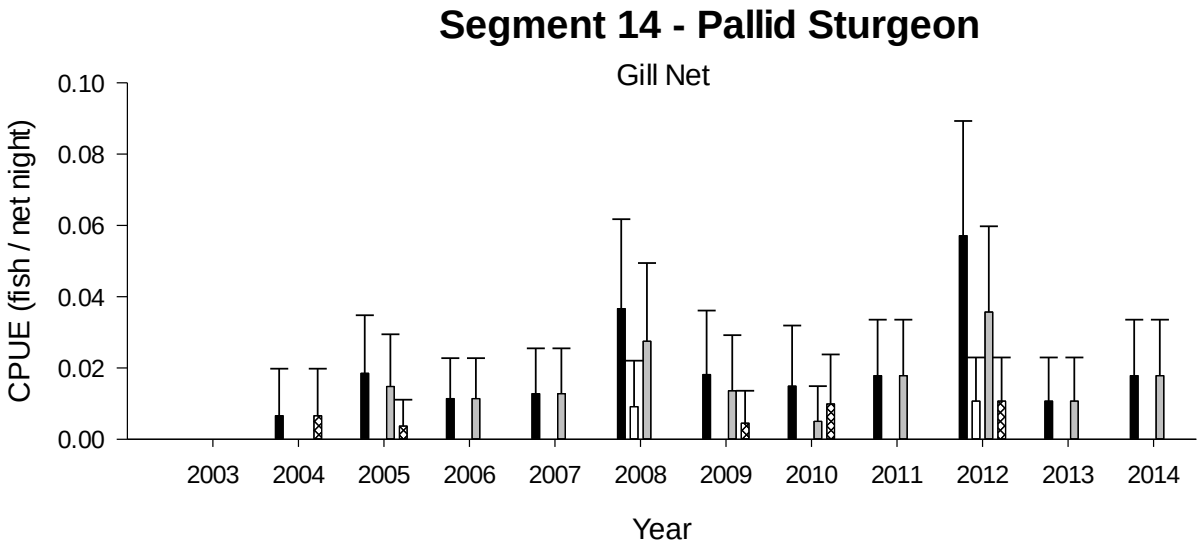

Figure 5. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using gill nets in Segment 14 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

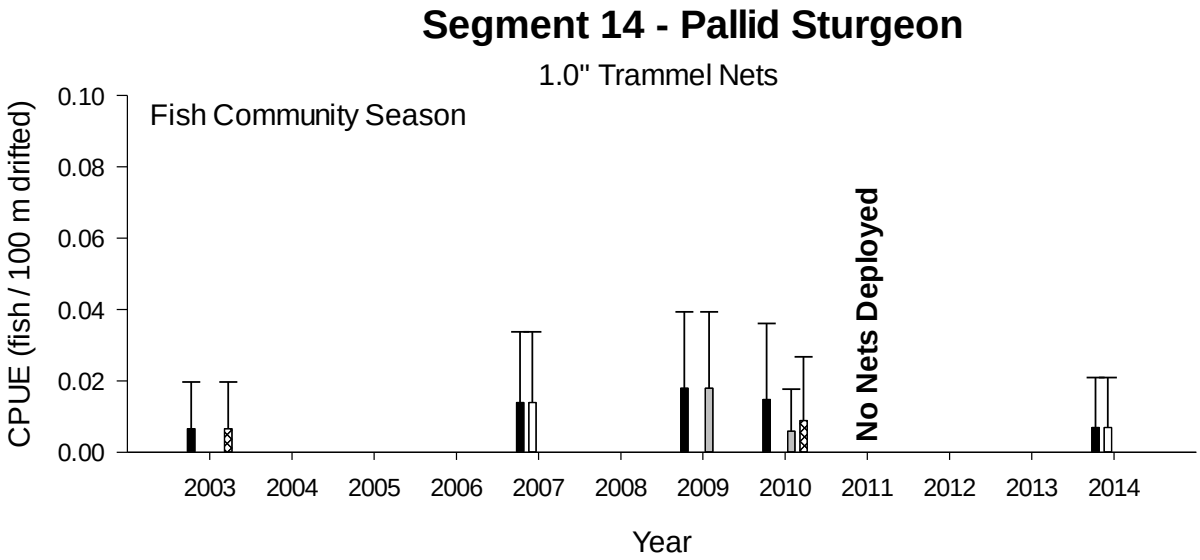

Figure 6. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using 1.0" trammel nets in Segment 14 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

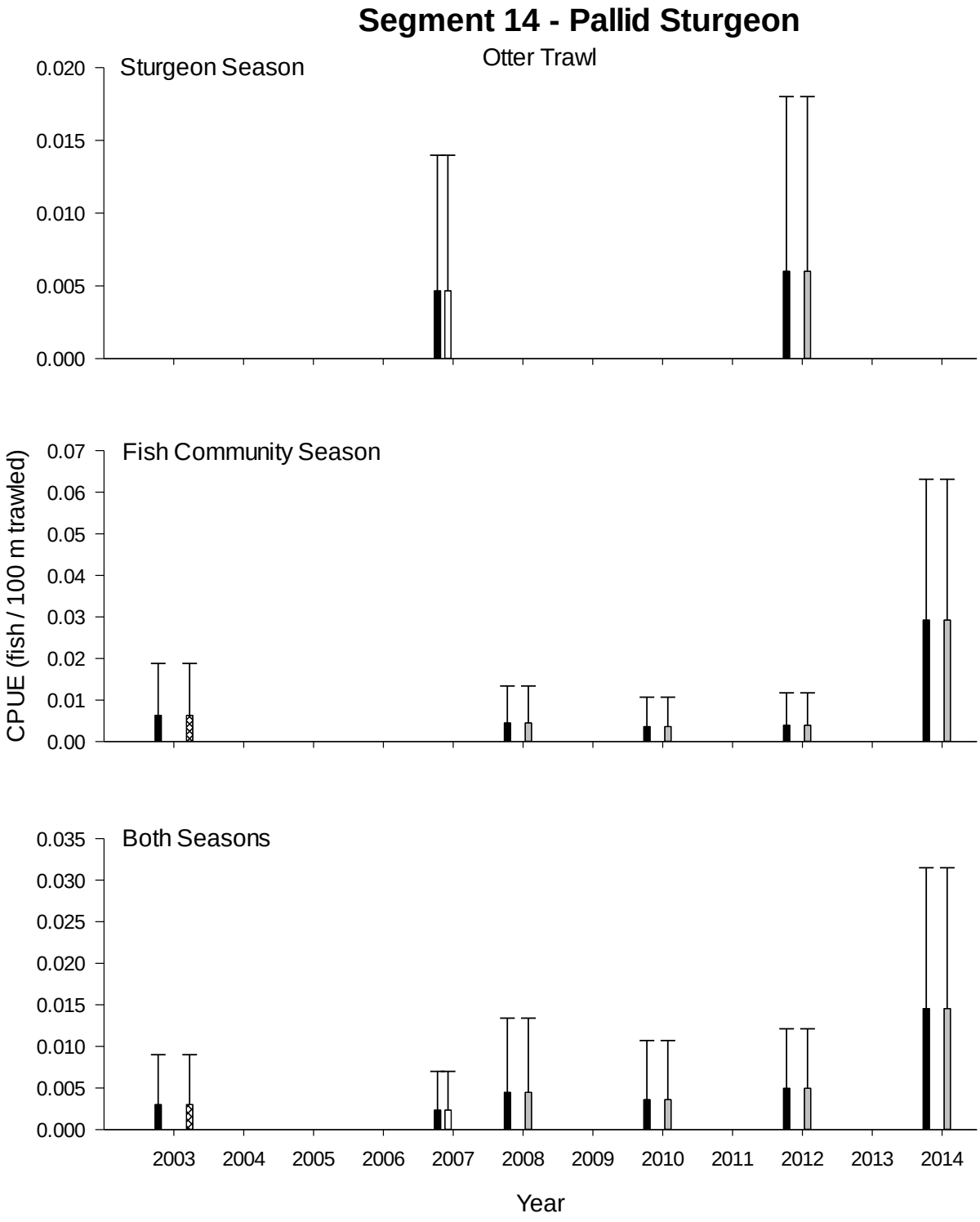

Figure 7. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using otter trawls in Segment 14 of the Missouri River from 2003-2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

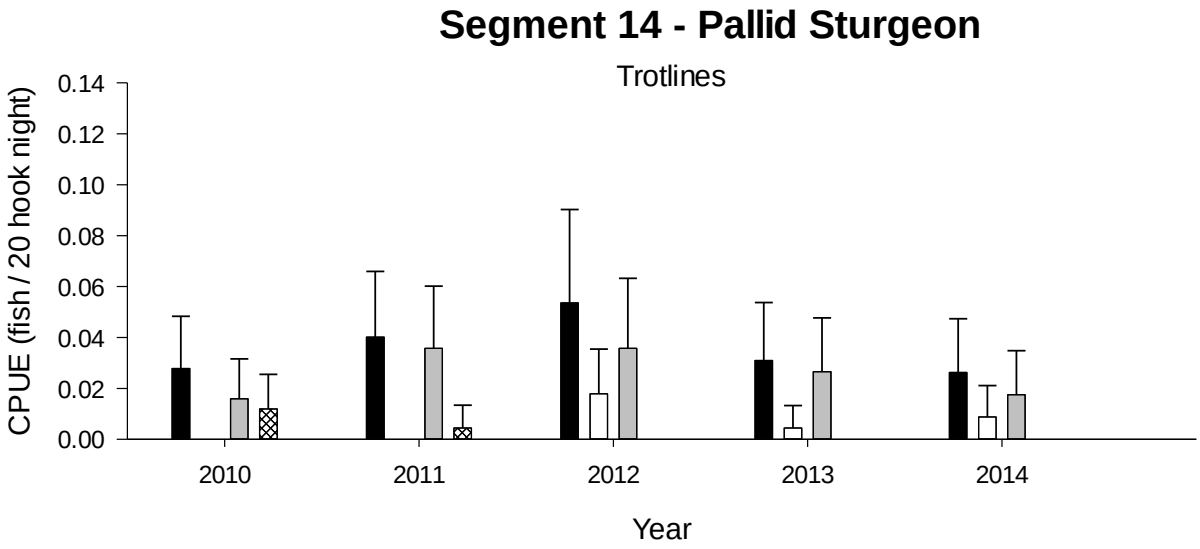

Figure 8. Mean annual catch per unit effort (± 2 SE) of all (black bars), presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon using trotlines in Segment 14 of the Missouri River from 2010-2014. Pallid Sturgeon of unknown origin are awaiting 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 2014. 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	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	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	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	5	N-E	40	0	N-E	N-E	N-E	0	60	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	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	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	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	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	2	N-E	50	0	N-E	N-E	N-E	0	50	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	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	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	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	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	3	N-E	0	33	N-E	N-E	N-E	0	67	0	0	0	0	0	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	3	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	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	0
Fish Community Season																
1.0” Trammel Net	1	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	100	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	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	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	3	N-E	0	33	N-E	N-E	N-E	0	67	0	0	0	0	0	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	80	0	N-E	N-E	N-E	0	20	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	0
Fish Community Season																
1.0” Trammel Net	1	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	100	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	5	N-E	40	0	N-E	N-E	N-E	0	60	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	70	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	6	N-E	0	33	N-E	N-E	N-E	0	67	0	0	0	0	0	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	0	0

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

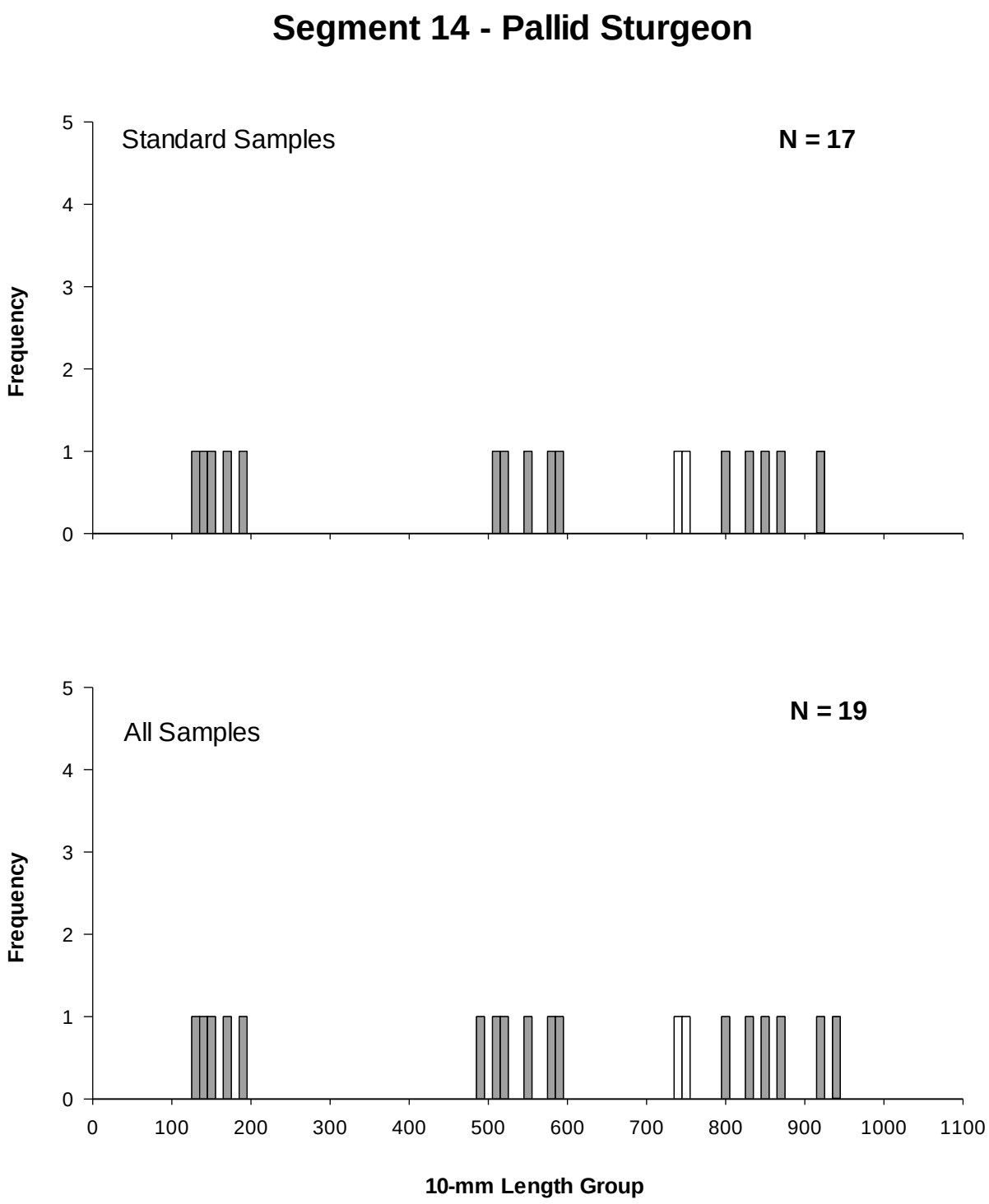

Figure 9. Length frequency of Pallid Sturgeon captured in Segment 14 of the Missouri River during 2014. White bars represent presumed wild Pallid Sturgeon captures, gray bars represent hatchery-reared Pallid Sturgeon and cross-hatched bars represent unknown Pallid Sturgeon. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014. Pallid Sturgeon of unknown origin are awaiting genetic verification.

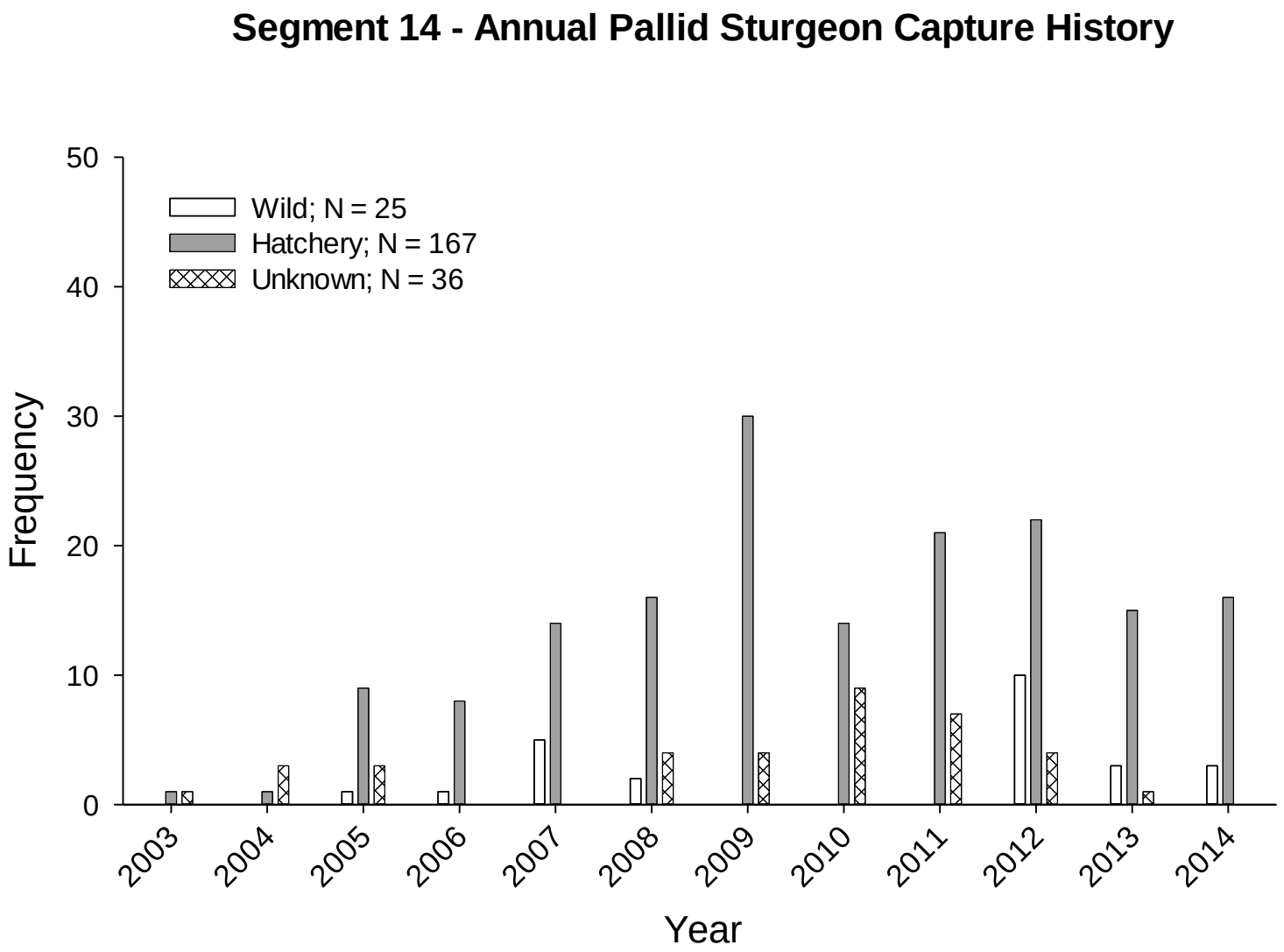

Figure 10. Annual capture history of presumed wild (white bars), hatchery reared (gray bars), and unknown origin (cross-hatched bars) Pallid Sturgeon collected in Segment 14 of the Missouri River from 2003-2014. Figure is designed to compare overall Pallid Sturgeon captures from year to year and is biased 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 9 Shovelnose Sturgeon x Pallid Sturgeon hybrids in Segment 14 during the 2014 sampling year. Eight Shovelnose Sturgeon x Pallid Sturgeon hybrids were captured during standard sampling efforts with three being captured on trotlines, three in gill nets and one each in otter trawls and trammel nets. One Shovelnose Sturgeon x Pallid Sturgeon hybrid was captured during targeted broodstock collection efforts on a trotline. Of note, genetic testing performed by Ed Heist, Southern Illinois University – Carbondale, indicated that two of the 1992 year class were, indeed, hybrid sturgeon. Shovelnose Sturgeon x Pallid Sturgeon hybrids ranged in length from 591 to 913 mm FL and weighed 720 to 3,540 g. All Shovelnose Sturgeon x Pallid Sturgeon hybrids were captured in CHNB and POOL mesohabitats within the ISB (n = 6), TRML (n = 2) and CHXO (n = 1) macrohabitats. Shovelnose x Pallid Sturgeon hybrids were captured in water depths ranging from 1.6 to 6.9 m, and bottom velocity (measured at the midpoint of a gear deployment) ranged from 0.42 to 1.06 m/s. Since 2003, 112 sturgeon identified as Shovelnose Sturgeon x Pallid Sturgeon hybrids in Segment 14. At least three of these have been captured multiple times.

Targeted Native River Species

Shovelnose Sturgeon

A total of 3,896 Shovelnose Sturgeon were collected in Segment 14 during 2014, of which 3,593 were collected with standard gears. Gill nets accounted for 41% 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 5.19 fish/net night ± 1.18SE, a 20% decrease from 2013 gill net CPUE (6.52 fish/net night ±1.27SE; Figure 11). Gill net CPUE has declined since the peak in 2007 (8.76 fish/night ± 1.92; Figure 11). Mean trammel net CPUE of quality size Shovelnose Sturgeon during 2014 was 4.12 fish/100 m ± 2.56SE. Trammel net CPUE has been highly variable through all years; however, 2014 remained nearly unchanged from the peak in 2013 (4.25 fish/100 m ± 1.28SE; Figure 12). Mean CPUE of quality size Shovelnose Sturgeon in otter trawls during the 2014 sturgeon season (0.63 fish/100 m ± 0.25SE) was 28% higher than CPUE in 2013. Though catch rates for otter trawl CPUE during sturgeon season were similar to catches in 2012 and 2013, sturgeon season CPUE has been variable throughout the duration of the monitoring program (Figure 13). Mean CPUE of quality size Shovelnose Sturgeon in otter trawls during the 2014 fish community season (1.17 fish/100 m ± 0.43SE) was 42% higher than CPUE in 2013; 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 both seasons combined, catch rates for sub-stock (0-149 mm) and sub-stock (150-249 mm) increased 122% and 100%, respectively, from 2013 (Figure 13). Mean CPUE of

quality size Shovelnose Sturgeon from trotlines (4.77 fish/20 hook night ± 0.71SE) during 2013 showed a 38% increase over catch rates in 2013 (Figure 14). Though trotline CPUE has fluctuated year-to-year, levels have remained near the mean CPUE of 4.48 fish/20 hook night ± 72SE since 2011 (Figure 14).

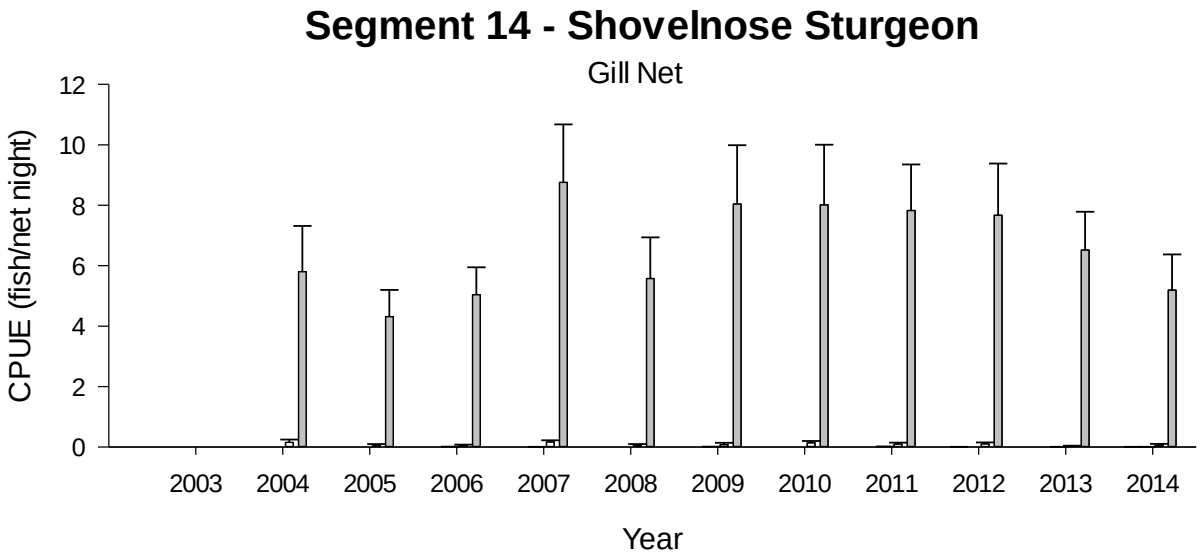

Figure 11. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using gill nets in Segment 14 of the Missouri River from 2003-2014.

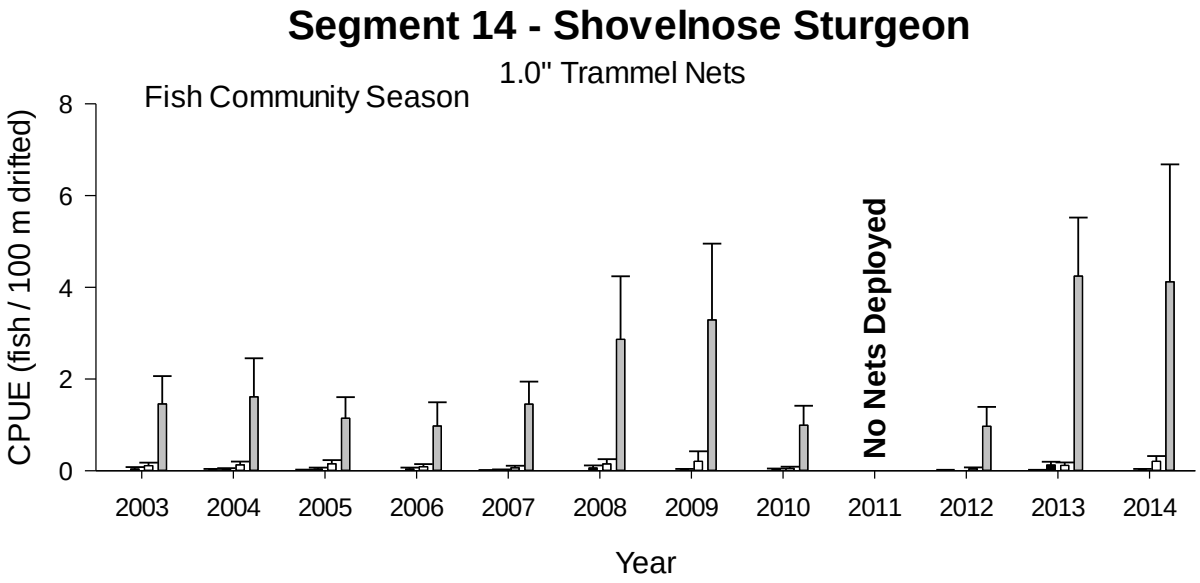

Figure 12. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using 1.0” trammel nets in Segment 14 of the Missouri River from 2003-2014.

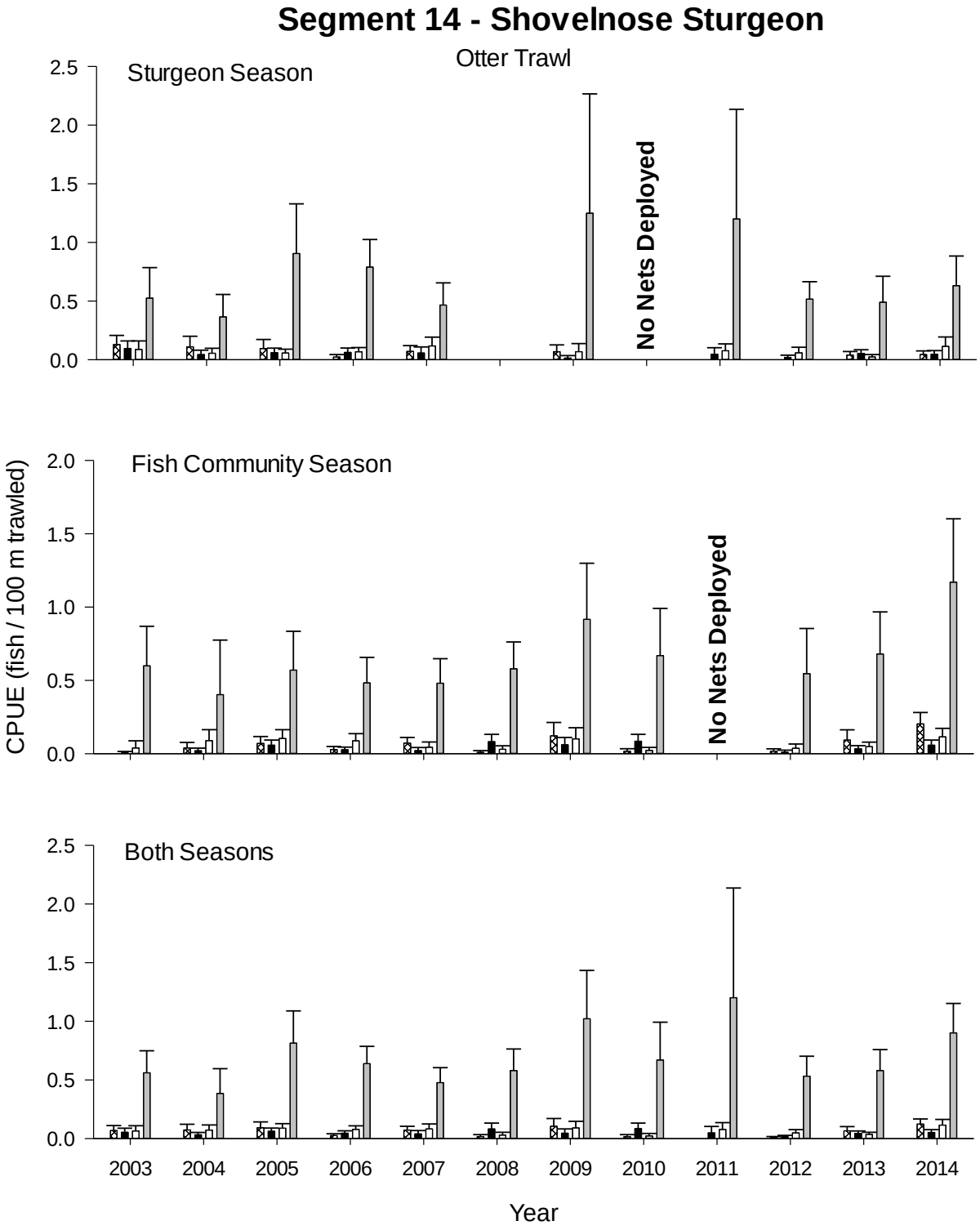

Figure 13. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using otter trawls in Segment 14 of the Missouri River from 2003-2014.

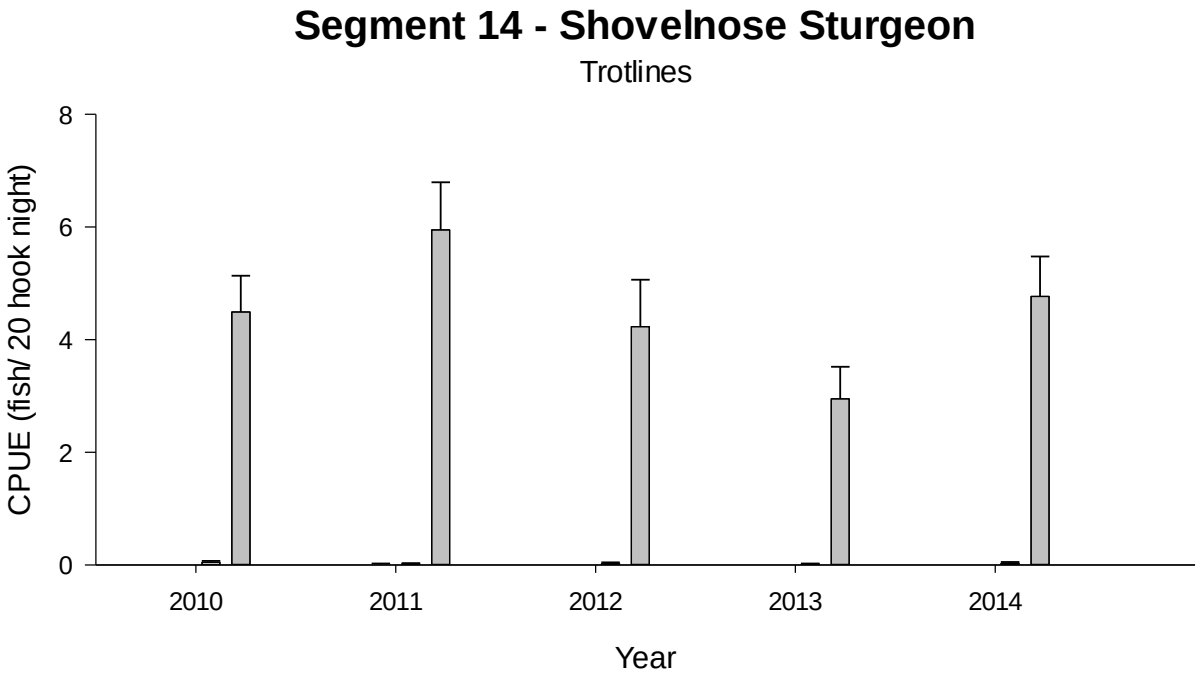

Figure 14. Mean annual catch per unit effort (± 2 SE) of sub-stock size (0-149 mm; cross-hatched bars), sub-stock size (150-249 mm; black bars), stock size (250-379 mm; white bars), and quality and above size (> 380 mm; gray bars) Shovelnose Sturgeon using trotlines in Segment 14 of the Missouri River from 2010-2014.

Habitat Use

Fifty-eight sub-stock size (0-149 mm FL) Shovelnose Sturgeon were captured during standard sampling in Segment 14 during 2014. 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 (98%) sub-stock (0-149 mm FL) Shovelnose Sturgeon were captured in otter trawls (Table 9). Sub-stock size (0-140 mmFL) Shovelnose Sturgeon were primarily found in ISB macrohabitats, but were also found in the CHXO macrohabitat (Table 9). Twelve sub-stock size (150-249 mm FL) Shovelnose Sturgeon were captured during standard sampling in otter trawls during sturgeon season and 12 were captured during fish community season. Two were captured in standard trammel nets 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 from otter trawls and trammel nets were captured from the ISB macrohabitat in greater proportions than sampled; additionally, Shovelnose Sturgeon from trammel nets were captured from CHXO macrohabitat in greater proportion than it was sampled (Table 10). Stock size Shovelnose Sturgeon (*n* = 101) were captured in all gears but mini-fyke nets during standard sampling in Segment 14 during 2014. Otter trawls captured the most (*n* = 52) stock size (250-379 mm FL) Shovelnose Sturgeon. Stock size Shovelnose Sturgeon captured in standard gill nets, trammel nets and otter trawls were captured in ISB macrohabitat in greater proportion than sampled; however, those captured on trotlines were captured in CHXO in greater proportion than sampled (Table 11). 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 (43%; Table 12). Most quality size and greater Shovelnose Sturgeon (60%) were found in

the ISB macrohabitat, but quality size and greater Shovelnose Sturgeon were also captured from the CHXO, OSB, TRML, SCCL and CONF macrohabitats (Table 12). Overall, Shovelnose Sturgeon were found in all macrohabitats in similar proportions to the effort expended in each habitat type (Table 13).

Shovelnose Sturgeon collected in Segment 14 during 2014 ranged from 21 to 805 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). Since 2004, the proportion of trophy/memorable size Shovelnose Sturgeon captured during sturgeon season has declined slightly; however, 2014 trophy/memorable sized populations appear unchanged from 2013 (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 (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 (Figure 16). 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 similar to those seen 2013. 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).

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 2014. 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	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	9	N-E	11	0	N-E	N-E	N-E	0	89	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	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	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	47	N-E	9	0	N-E	N-E	N-E	0	85	0	6	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	12	N-E	8	0	N-E	N-E	N-E	0	92	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	0	0
Fish Community Season																
1.0” Trammel Net	2	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	12	N-E	8	0	N-E	N-E	N-E	0	92	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	19	N-E	26	0	N-E	N-E	N-E	0	68	5	0	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	28	N-E	11	0	N-E	N-E	N-E	0	89	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	1	0
Fish Community Season																
1.0” Trammel Net	23	N-E	4	0	N-E	N-E	N-E	0	96	0	0	0	0	0	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	24	N-E	8	0	N-E	N-E	N-E	0	92	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	7	N-E	29	0	N-E	N-E	N-E	0	43	29	0	0	0	0	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	1454	N-E	30	0	N-E	N-E	N-E	0	43	16	1	0	0	10	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	141	N-E	9	0	N-E	N-E	N-E	0	84	1	5	0	0	1	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	0	0
Fish Community Season																
1.0” Trammel Net	485	N-E	19	0	N-E	N-E	N-E	0	69	0	0	0	0	12	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	230	N-E	7	0	N-E	N-E	N-E	0	82	0	2	0	0	9	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	1087	N-E	25	3	N-E	N-E	N-E	0	45	19	1	0	0	7	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	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 2014. 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	1475	N-E	30	0	N-E	N-E	N-E	0	43	16	1	0	0	10	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	190	N-E	9	0	N-E	N-E	N-E	0	86	1	4	0	0	1	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	0	0
Fish Community Season																
1.0” Trammel Net	510	N-E	18	0	N-E	N-E	N-E	0	71	0	0	0	0	11	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	313	N-E	8	0	N-E	N-E	N-E	0	83	0	3	0	0	6	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	0	0
Both Seasons																
Trot Lines	1094	N-E	25	3	N-E	N-E	N-E	0	45	19	1	0	0	7	0	0
		N-E	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	0	0

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

Segment 14 - Shovelnose Sturgeon

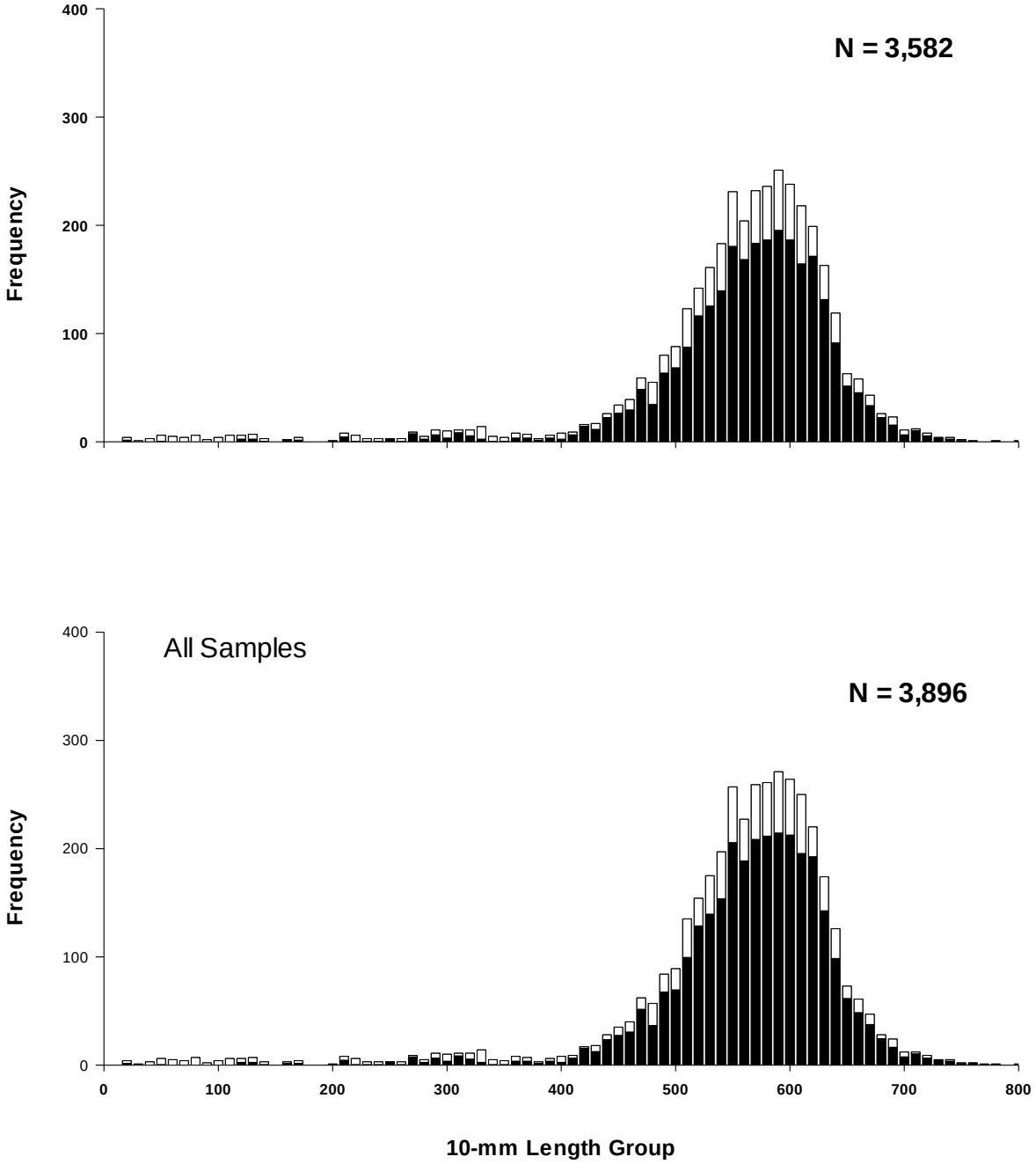

Figure 15. Length frequency of Shovelnose Sturgeon during the sturgeon season (black bars) and fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

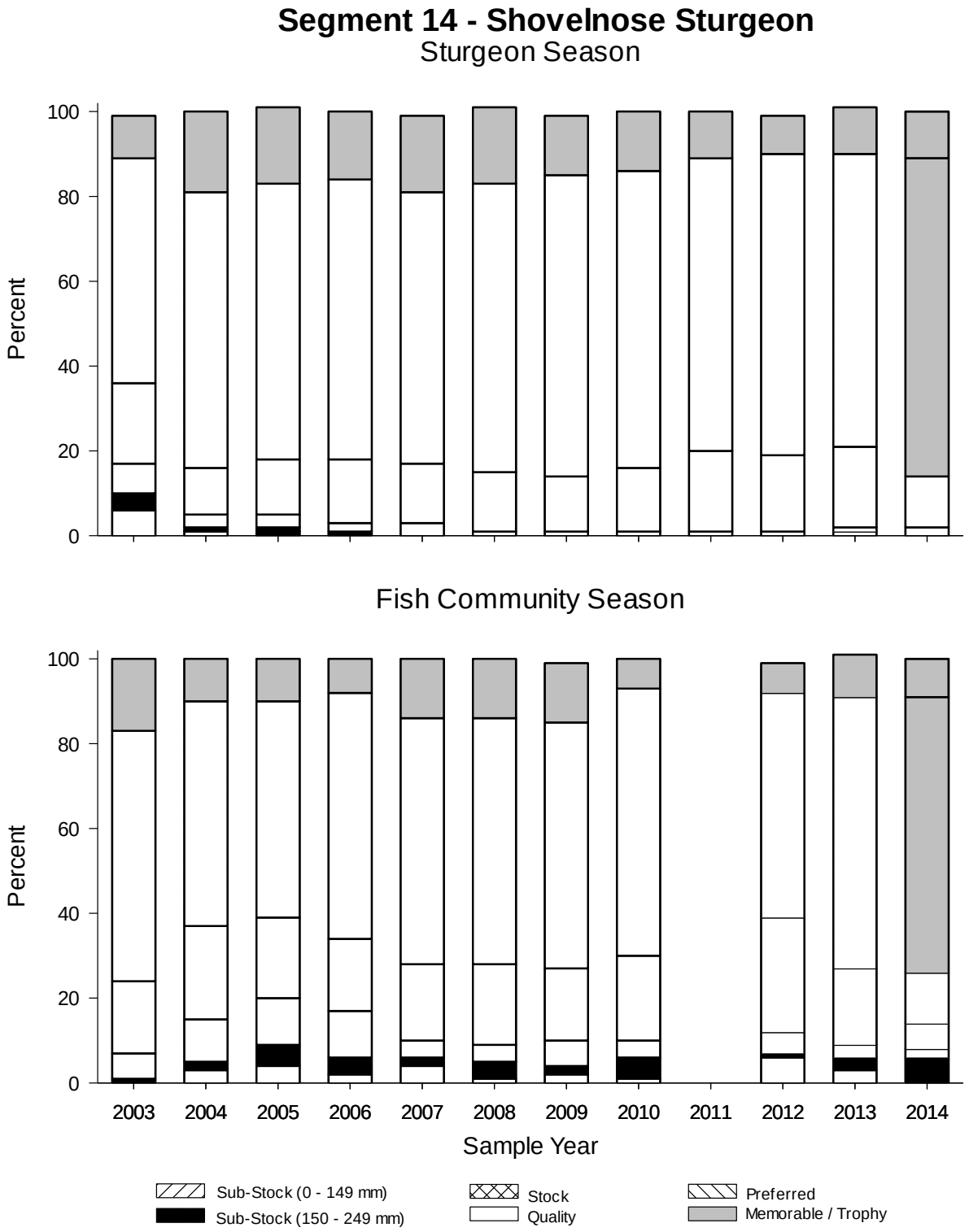

Figure 16. Incremental proportional size distribution (PSD) for all Shovelnose Sturgeon captured with all gear by length category from 2003 to 2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

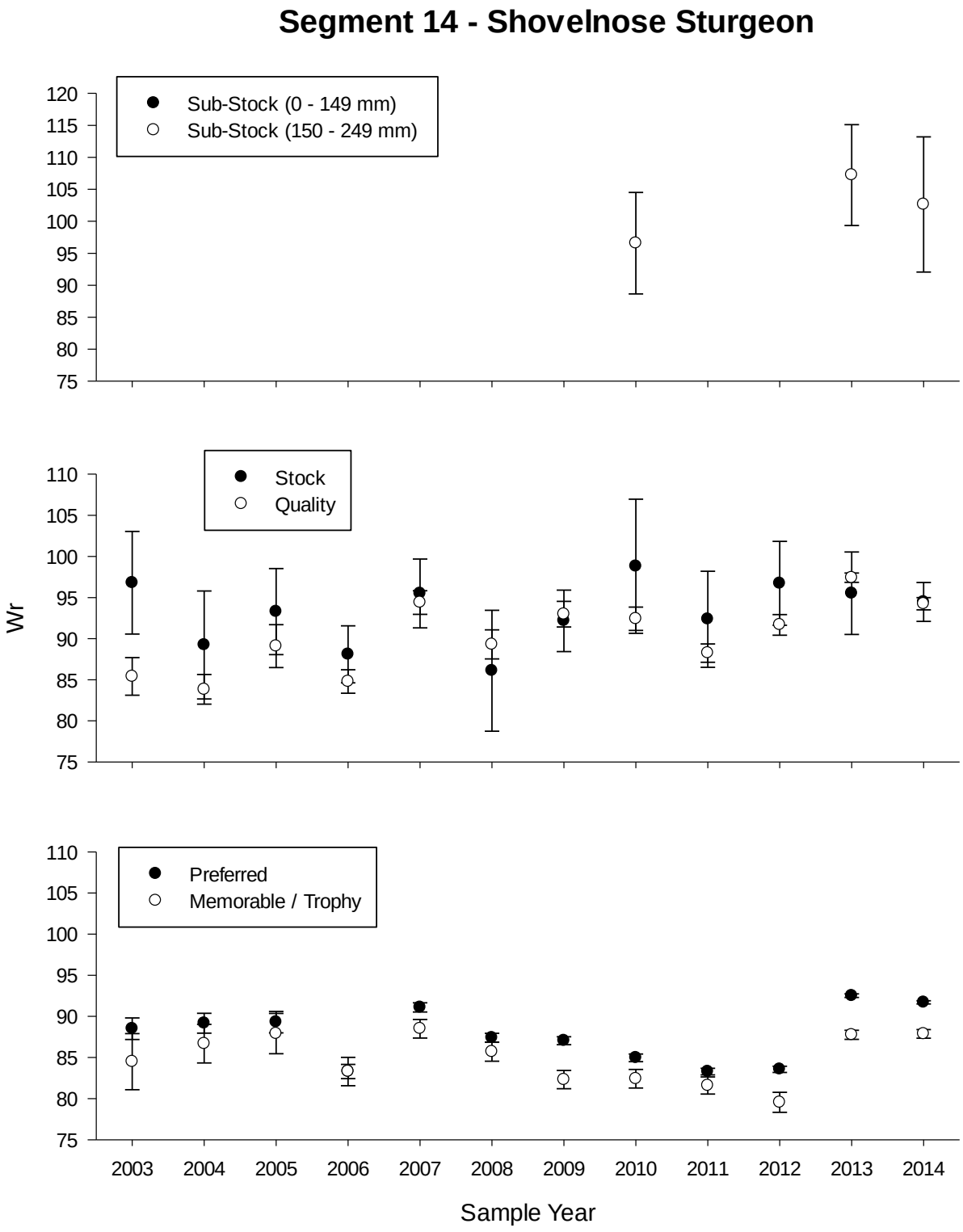

Figure 17. Relative weight (Wr) for all Shovelnose Sturgeon captured with all gear by incremental proportional size distribution (PSD) length category from 2003-2014 in Segment 14 in the Missouri River. Length categories determined using the methods proposed by Quist (1998).

Sturgeon Chub

We collected 102 Sturgeon Chub in Segment 14; 97% were collected with otter trawls and 3% in mini-fyke nets. Mean Sturgeon Chub CPUE from otter trawls during sturgeon season and fish community season was 0.18 fish/100m ± 0.08 and 0.23 fish/100 m ± 0.16, respectively, marking the highest Sturgeon Chub catch rate for sturgeon season and second highest for fish community season since the beginning of the program in 2003 (Figure 18). Sturgeon Chub ranged in length from 22 to 75 mm TL (Figure 19). Thirty-five Sturgeon Chubs 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 2014, indicating that all Sturgeon Chubs 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 (95%) within the ISB (93%), CHXO (6%) or SCCL (1%) macrohabitats. Depth at sites where Sturgeon Chub were captured ranged from 0.4 to 5.6 m, and mean depth at capture was 2.7 m ± 1.21SE. Velocity at capture sites ranged from 0.09 to 0.71 m/s, and mean bottom velocity where Sturgeon Chub were captured was 0.53 m/s ± 0.14.

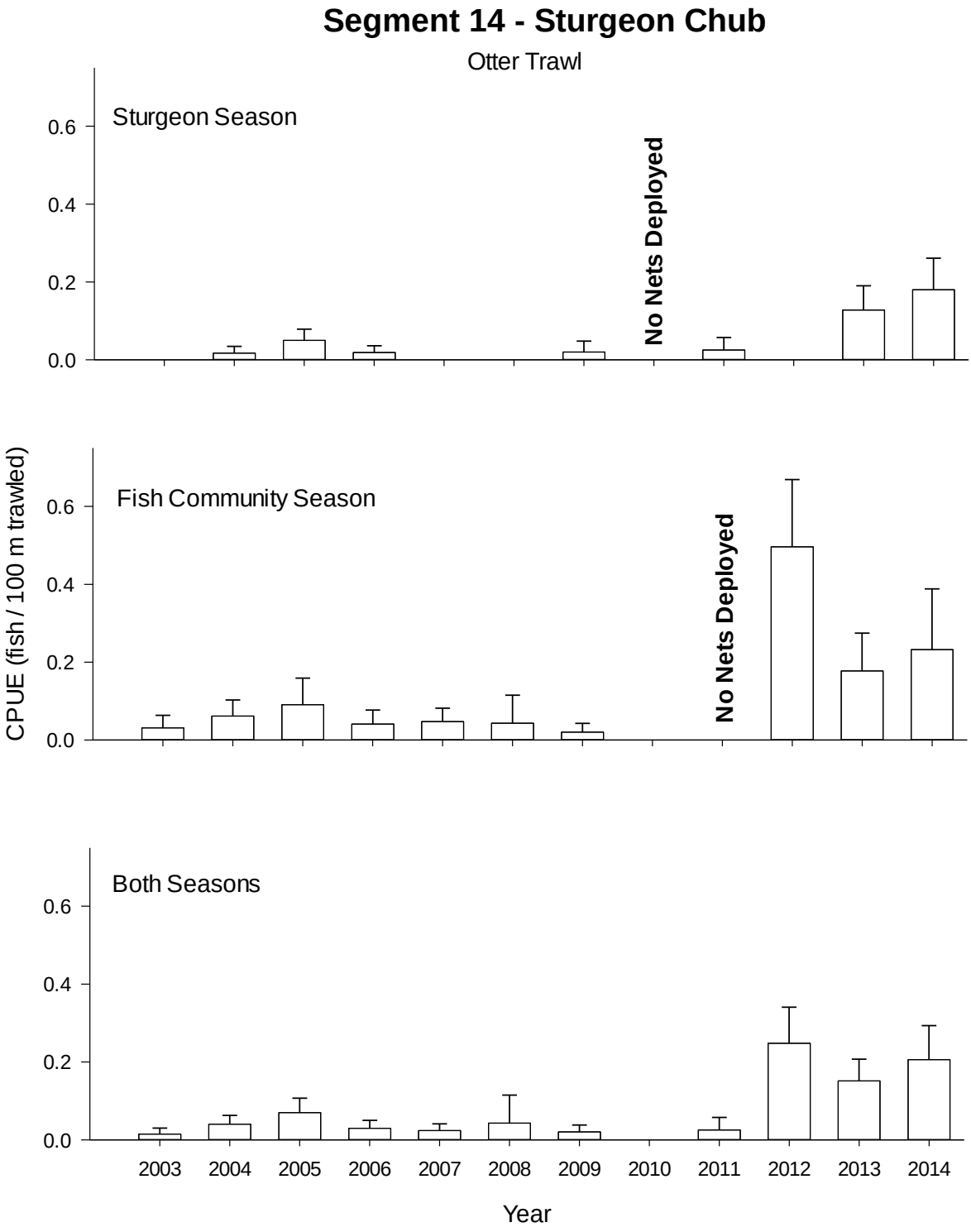

Figure 18. Mean annual catch per unit effort (± 2 SE) of Sturgeon Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014.

Segment 14 - Sturgeon Chub

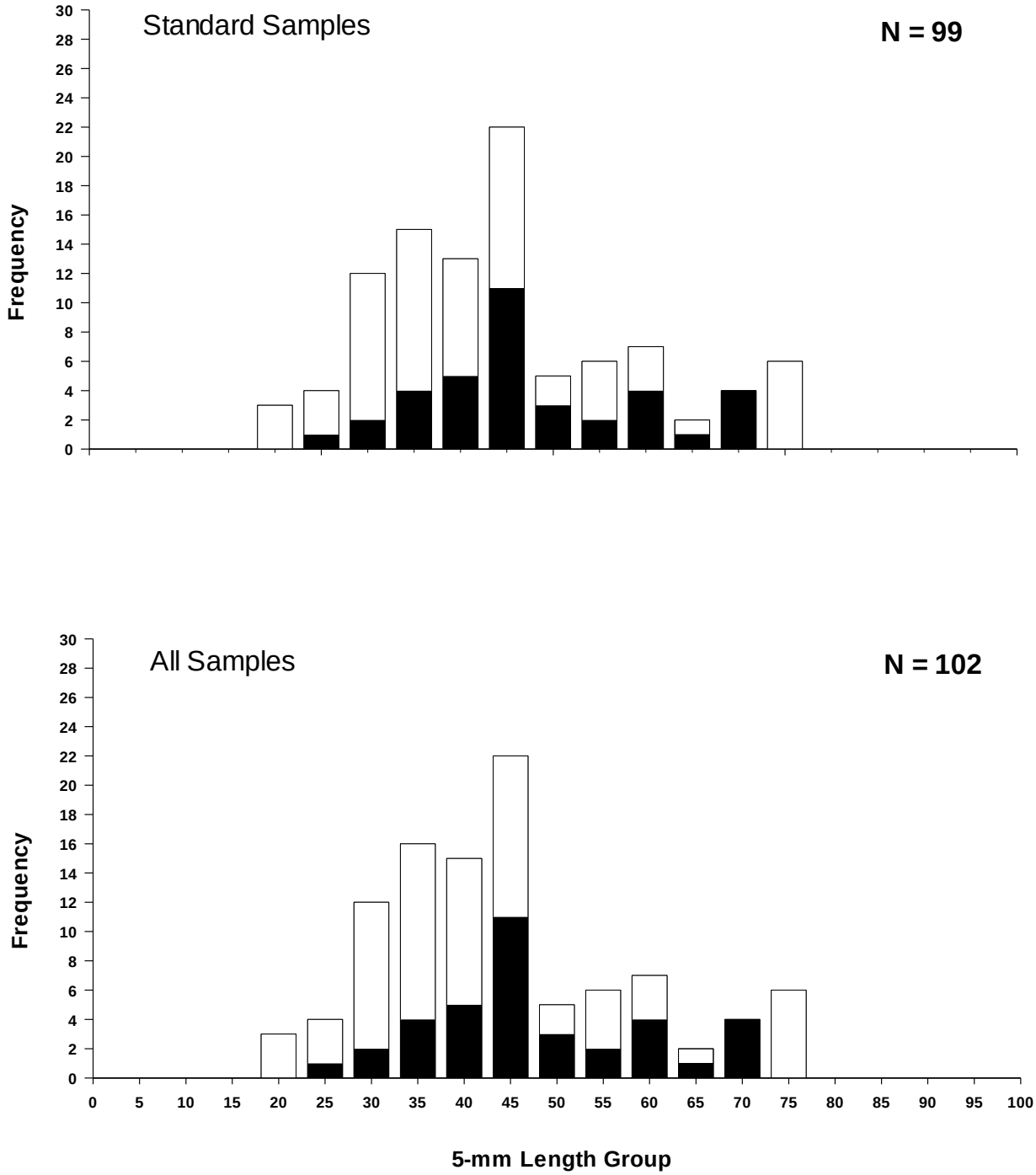

Figure 19. Length frequency of Sturgeon Chub during the sturgeon season (black bars) and fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sicklefin Chub

We collected 921 Sicklefin Chub with standard gears in Segment 14 during 2014. Sicklefin Chub were captured with otter trawls (98%) and mini-fyke nets (2%). Mean Sicklefin Chub otter trawl CPUE during the sturgeon season (0.89 fish/100 m ± 0.43) was the highest on record. Mean otter trawl CPUE during the fish community season (3.47 fish/100 m ± 0.92) and both seasons combined (2.18 fish/ 100m ±0.53) were the second highest on record (Figure 20). Sicklefin Chub ranged in length from 20 to 91 mm TL (Figure 21). We collected 48 Sicklefin Chub in Segment 14 that were consistent with age-0 size fish (< 30 mm TL; Herman et al. 2008b). Only one Sicklefin Chub > 90 mm TL were collected during 2014, 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 (84%), CHXO (14%), TRML (1%), SCCL (1%) and OSB (<1%) macrohabitats. Depth at sites where Sicklefin Chub were captured ranged from 0.4 to 6.8 m, and mean depth at capture was 3.0 m ± 0.04. Bottom velocities at capture sites ranged from 0.05 to 0.96m/s, and mean bottom velocity of Sicklefin Chub captures was 0.45 m/s ± 0.01.

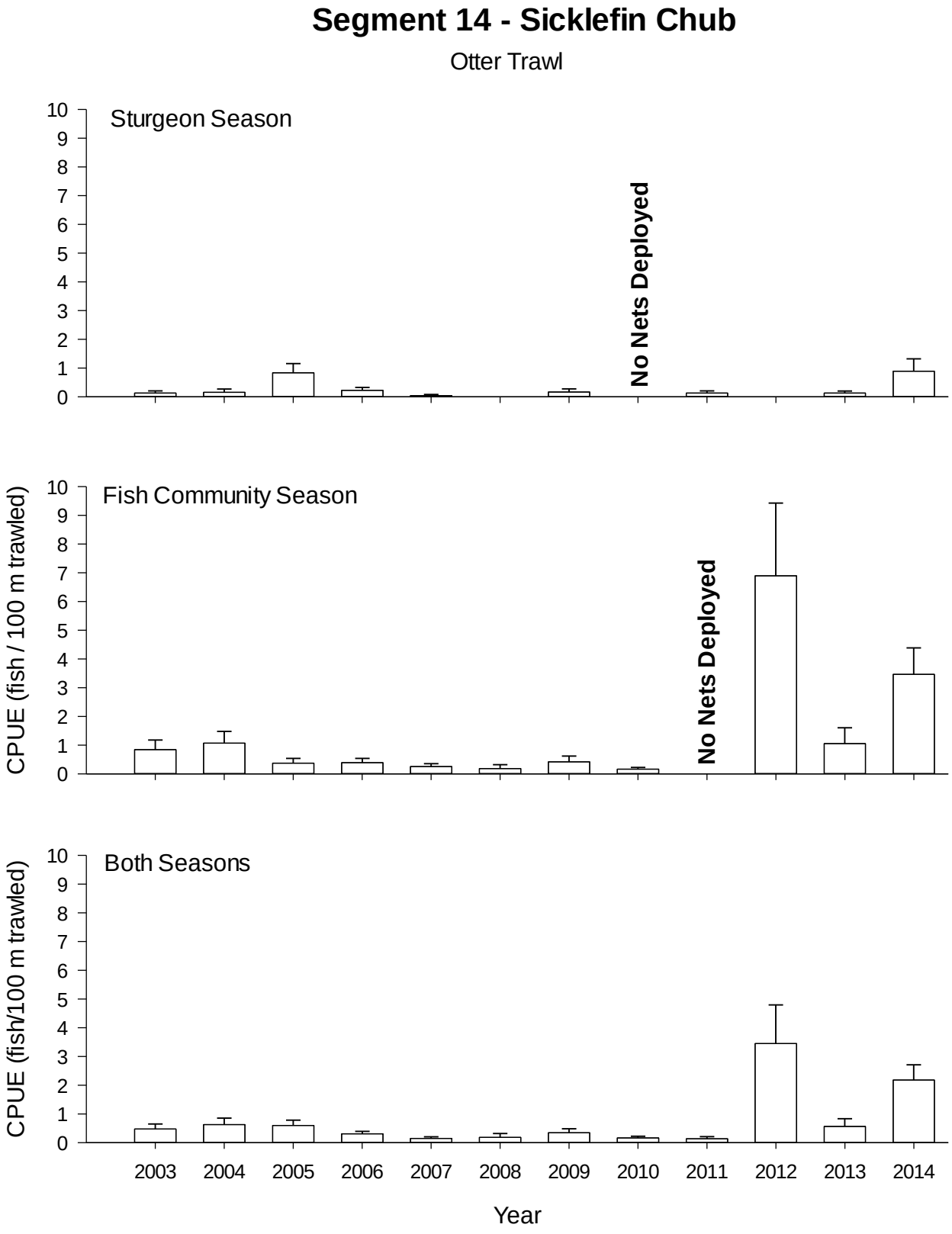

Figure 20. Mean annual catch per unit effort (± 2 SE) of Sicklefin Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014.

Segment 14 - Sicklefin Chub

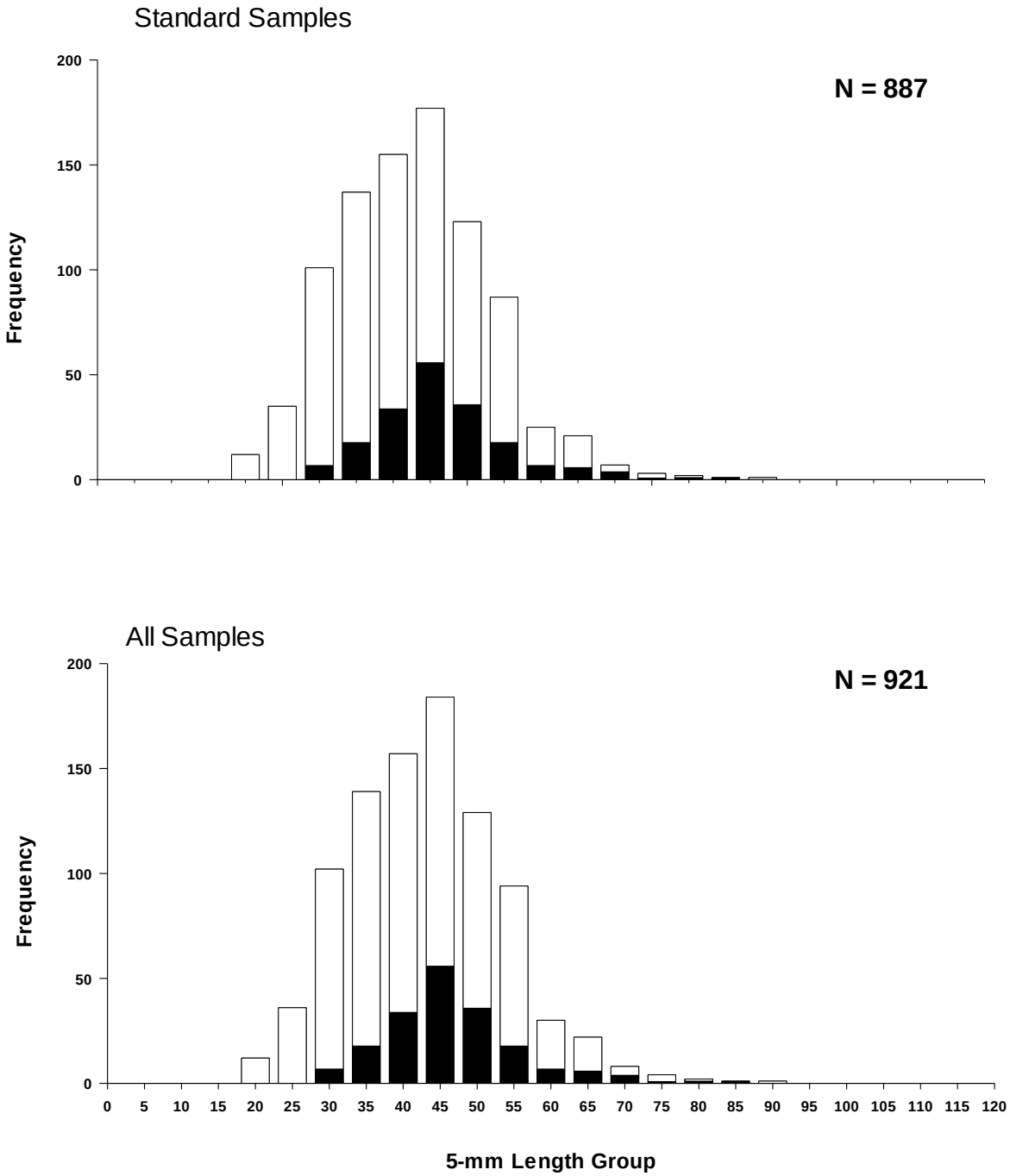

Figure 21. Length frequency of Sicklefin Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Shoal Chub

We collected 1,647 Shoal Chub in Segment 14 during 2014, of which 1,611 were captured in otter trawls and 36 with mini-fykes. Most Shoal Chub (73%) were captured during the sturgeon season. Mean Shoal Chub CPUE in otter trawls during the 2014 sturgeon season (5.47 fish/100m ±1.30) was the highest on record (Figure 22). Mean Shoal Chub CPUE was 2.26 fish/100m ± 1.15 during fish community season. For both seasons combined, Shoal Chub otter trawl CPUE (3.88 fish/100m ±0.90) was the second highest on record (Figure 22). Shoal Chub ranged in length from 12 to 76 mm TL (Figure 23). We collected 113 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 common during the sturgeon season, but were rare during fish community season (Figure 23). Shoal Chub captured in ISB (87%), CHXO (11%), TRML (2%), SCCL (<1%) and OSB(<1%) macrohabitats. Velocity at capture sites ranged from 0.03 to 0.82 m/s, and mean bottom velocity where Shoal Chub were captured was 0.45 m/s ± 0.02.

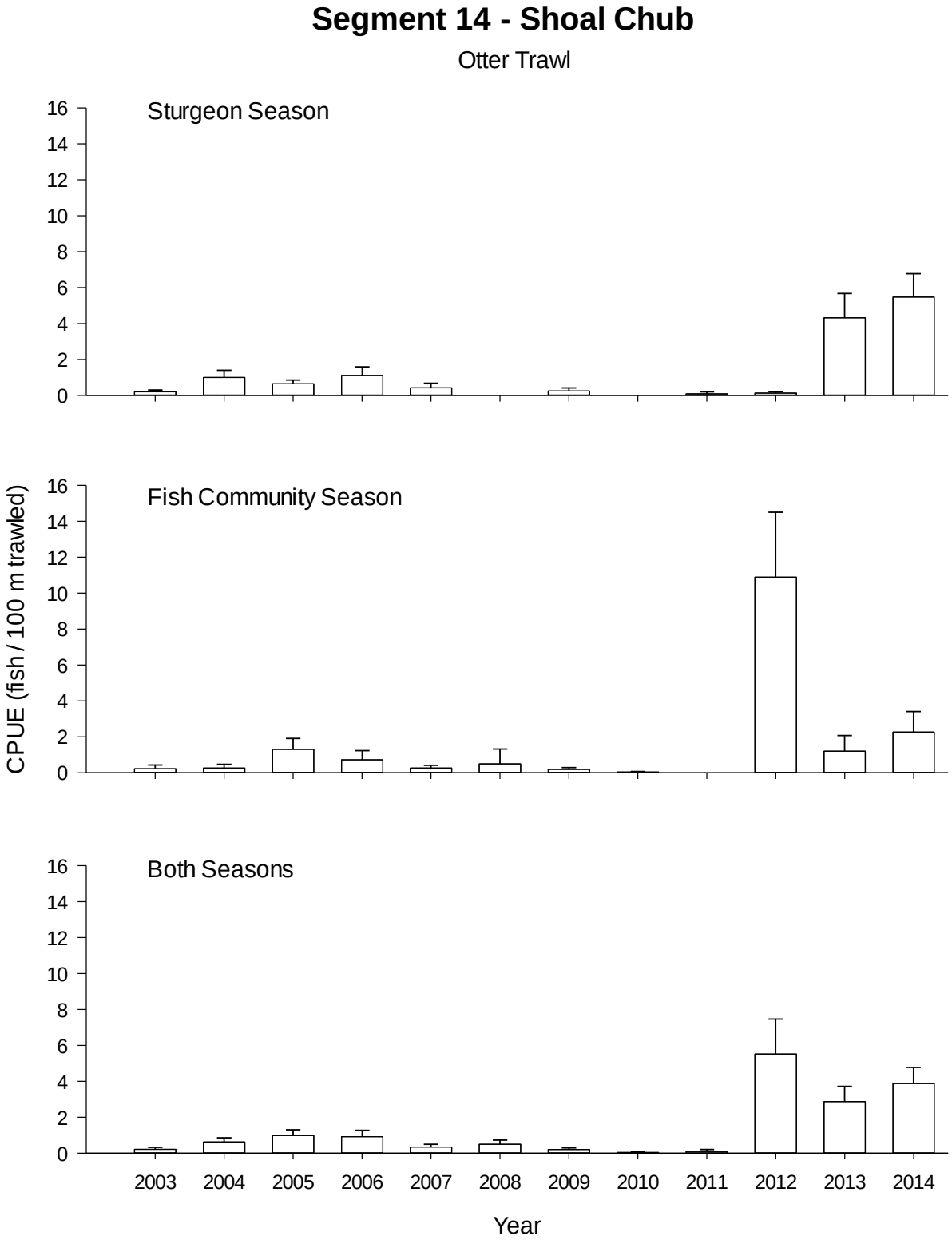

Figure 22. Mean annual catch per unit effort (± 2 SE) of Shoal Chub using otter trawls in Segment 14 of the Missouri River from 2003-2014.

Segment 14 - Shoal Chub

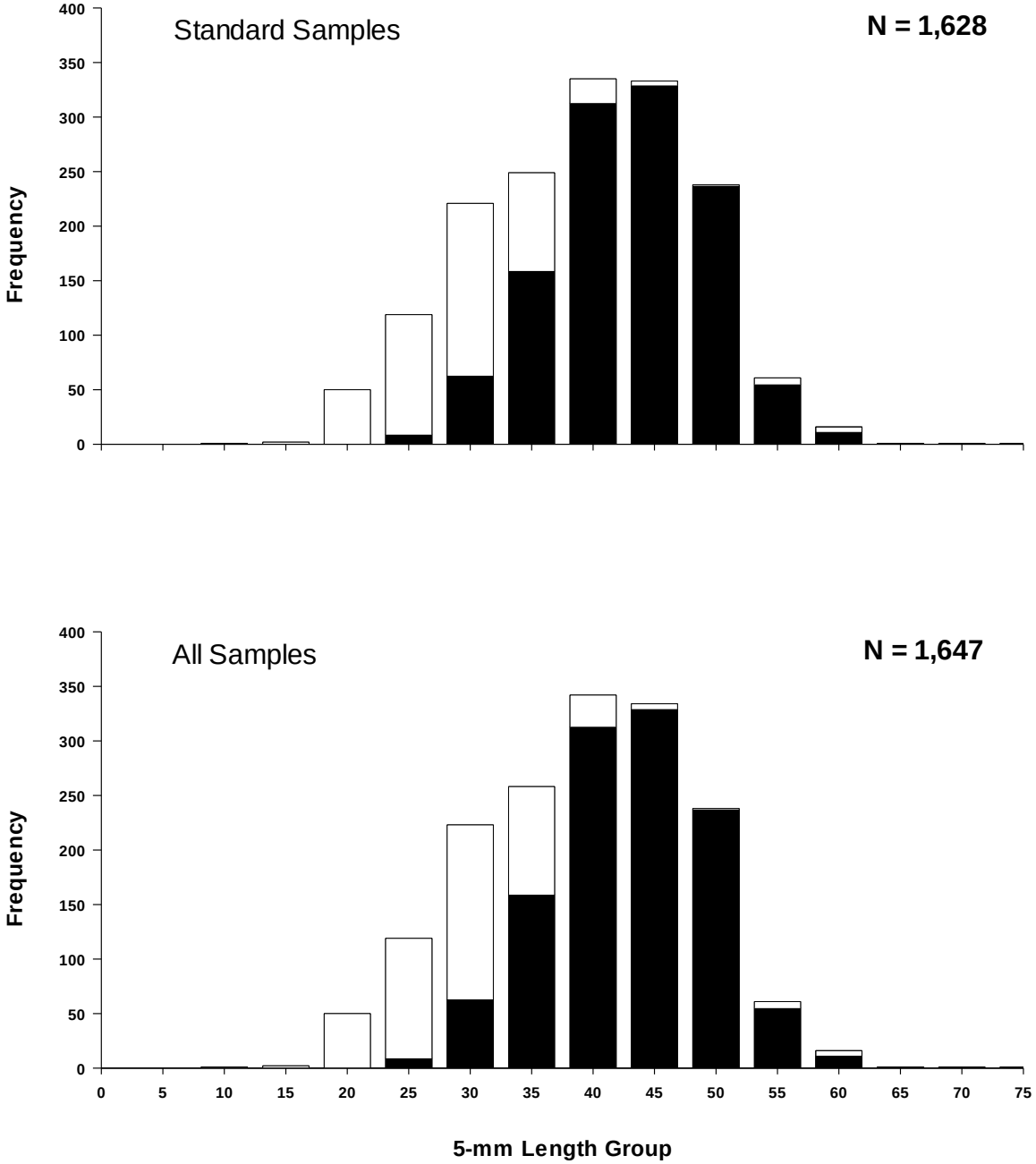

Figure 23. Length frequency of Shoal Chub during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sand Shiner

Thirty-five Sand Shiner were collected in Segment 14 during 2014 in mini-fyke nets and otter trawls. Sand Shiner CPUE (0.28 fish/net night ±0.13) in mini-fyke nets for 2014 was the highest since 2006 (Figure 24). Sand shiner collected in 2014 ranged in size from 28 to 59 mm (Figure 25). We collected eleven Sand Shiner in Segment 14 that were consistent with age-0 size fish (< 40 mm TL; Dattilo et al. 2008a). Only one Sand Shiner> 55 mm TL was collected during 2014, indicating that the majority of Sand Shiner captured were likely between the ages of 1 and 2 (Figure 25; Dattilo et al. 2008a).

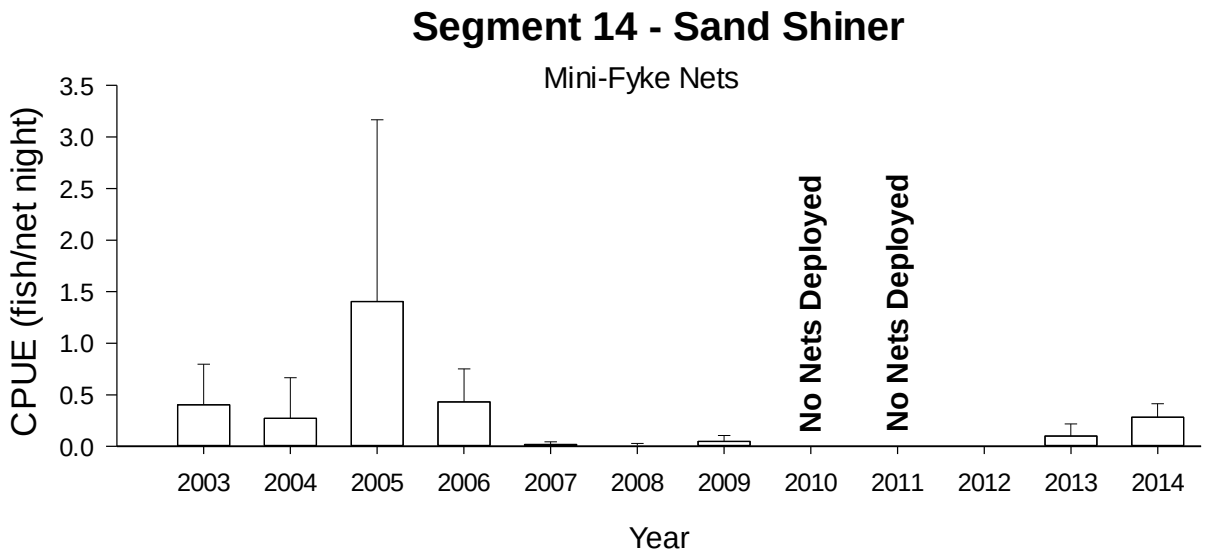

Figure 24. Mean annual catch per unit effort (± 2 SE) of Sand Shiner with mini-fyke nets in Segment 14 of the Missouri River during fish community season 2003-2014.

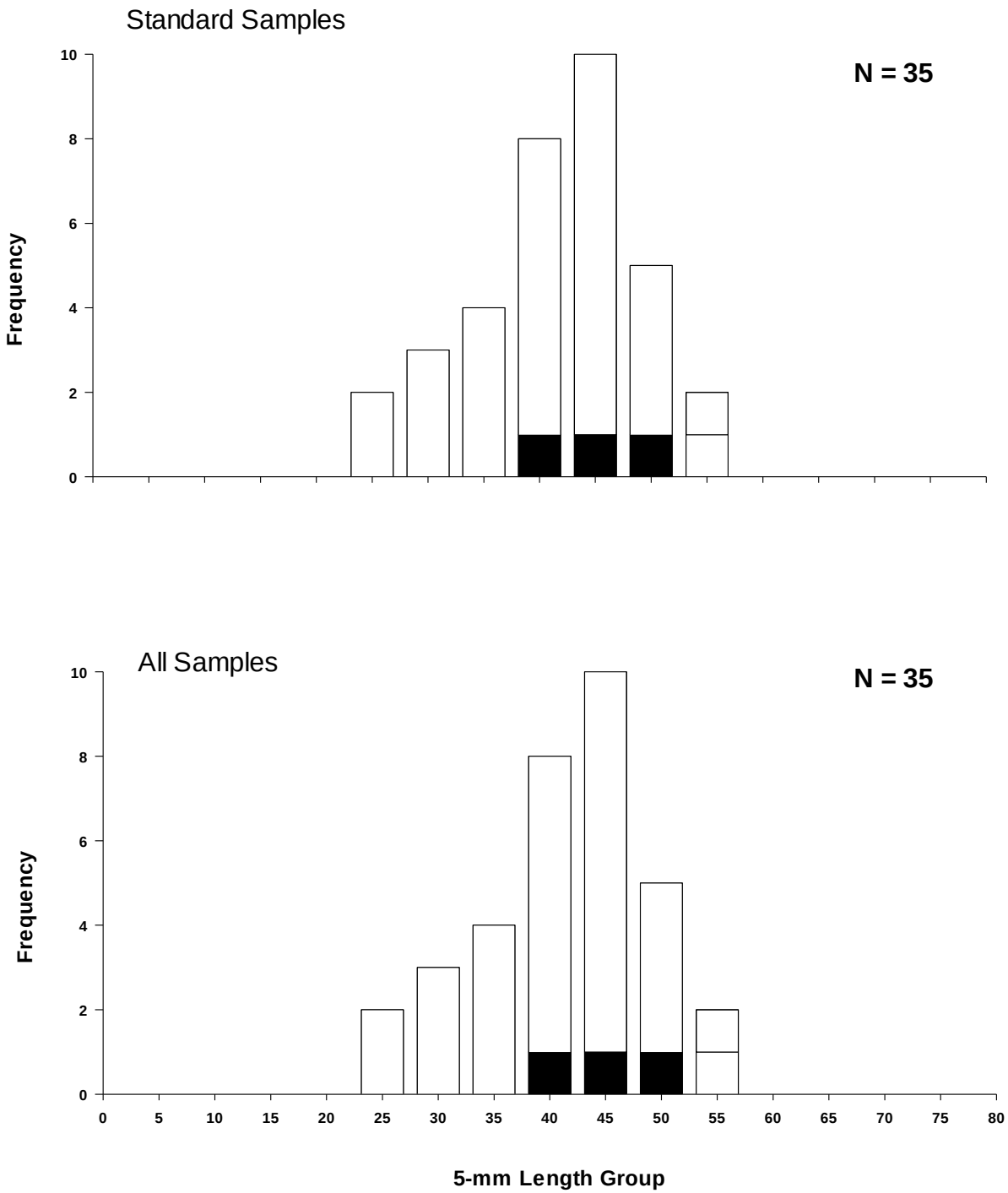

Figure 25. Length frequency of Sand Shiner during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends and random subsamples. All samples include all sampling conducted during 2014.

Hybognathus spp.

Sixteen *Hybognathus* spp. were collected in Segment 14 during 2014 in mini-fyke nets. *Hybognathus* spp. 2014 CPUE from mini-fyke nets was (0.15 fish/net night ±0.12) the highest on record (Figure 26). We were able to identify eleven individual *Hybognathus* spp. to species (nine Plains Minnows and two Western Silvery Minnows). *Hybognathus* spp. ranged in length from 18 to 52 mm TL (Figure 27). *Hybognathus* spp. captured in 2014 had lengths representative of age-0 and age-1 (Dattilo et al. 2008b).

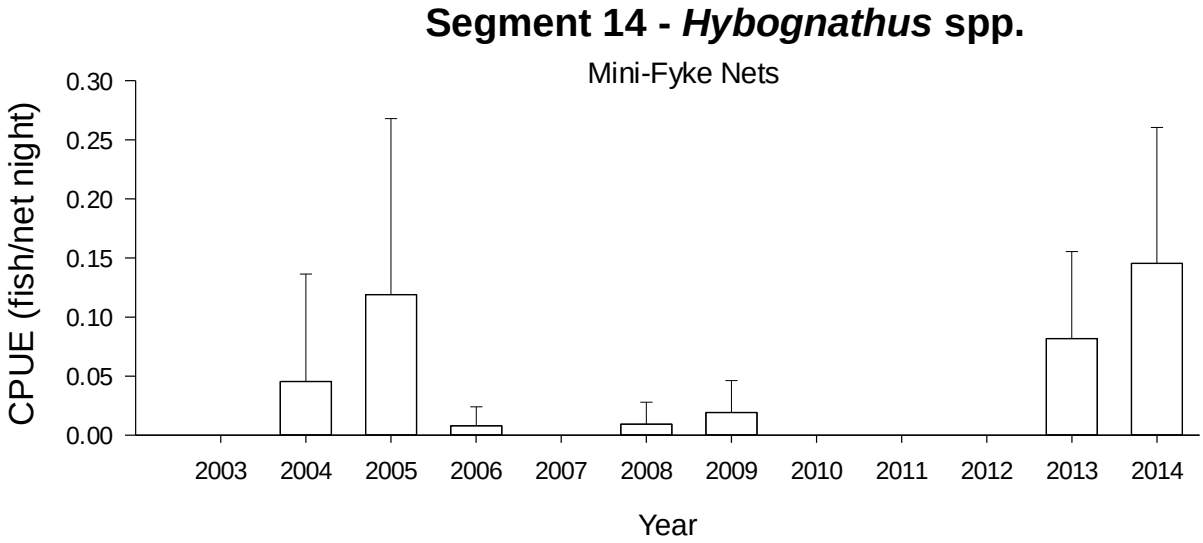

Figure 26. Mean annual catch per unit effort (+/- 2 SE) of *Hybognathus* spp. with mini-fyke nets in Segment 14 of the Missouri River during fish community season 2003-2014.

Segment 14 - *Hybognathus* spp.

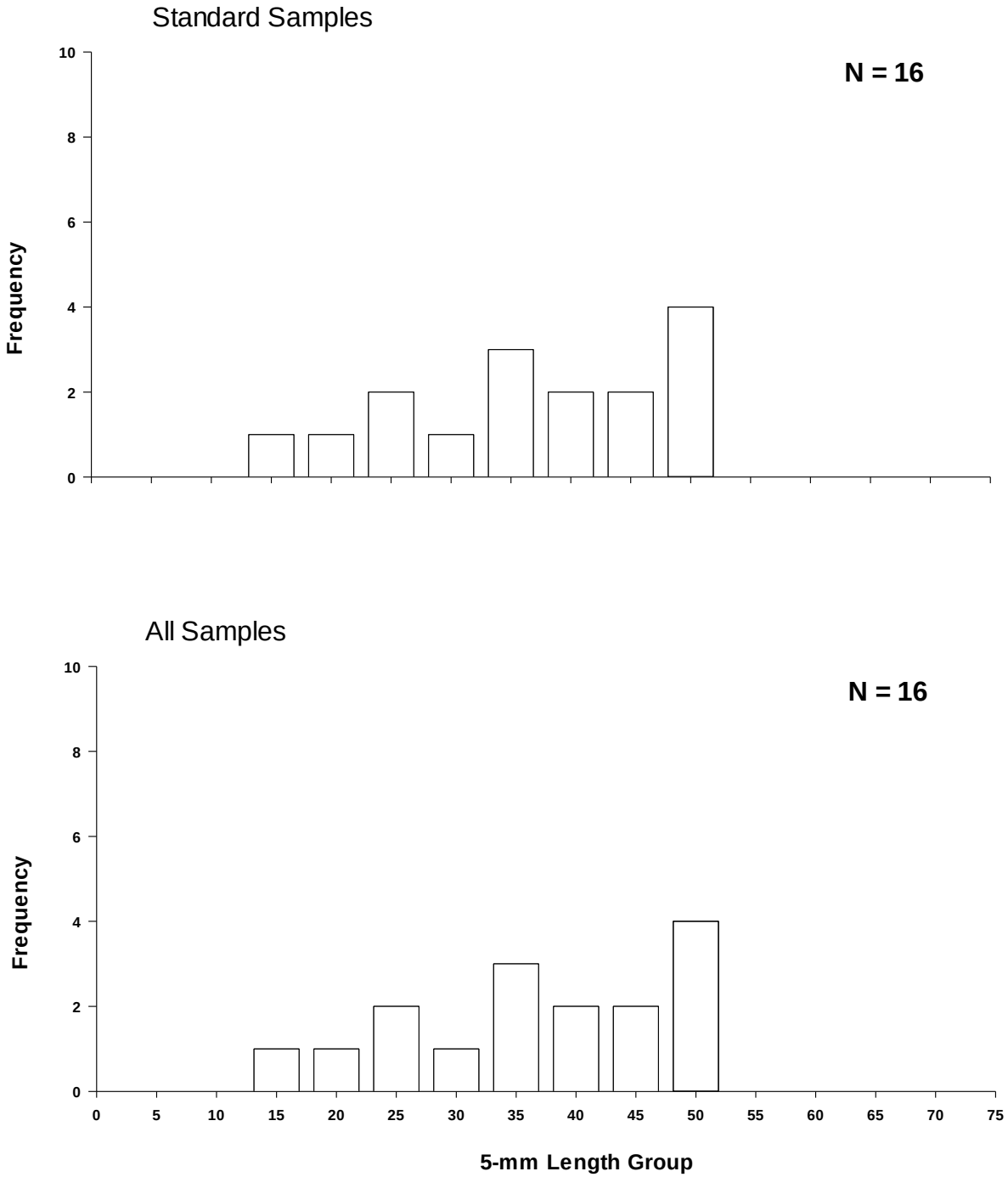

Figure 27. Length frequency of *Hybognathus* spp. caught during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Blue Sucker

We collected 263 Blue Suckers in Segment 14 during 2014. Blue Sucker CPUE from gill nets in 2014 (0.58 fish/net night ±0.11) was the highest on record and was two times greater than 2013 (Figure 28). Blue Sucker CPUE from trammel nets in 2014 (0.49 fish/100m ±0.30) was the second highest on record and was similar to 2013 (0.52 fish/100m ±0.19) (Figure 29). Blue Sucker CPUE from otter trawls during the 2014 sturgeon season (0.03 fish/100m ±0.02) was similar to 2013 (Figure 30). Otter trawl CPUE during the 2014 fish community season (0.08 fish/100 m ± 0.05) was also similar to 2013(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 Suckers (65%) were captured during sturgeon season in gill nets and during fish community season in trammel nets (26%) (Table 14). Blue Suckers captured in 2014 ranged in length from 364 to 819 mm TL.

According to LaBay et al. (2008), blue suckers 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 suckers captured in 2014 were older than age-1. This age data may be inaccurate, however, because aging methods for blue suckers produce highly variable results resulting in low reader agreement (Steve LaBay, South Dakota Game and Parks, personal communication). Pflieger (1997) noted that blue suckers 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 suckers captured in 2014 (77% of the total catch) were older than age-1 and perhaps sexually mature (Figure 31). During 2014, field crews

captured 60 blue suckers that were likely juvenile, ranging in size from 364 mm to 498 mm (Figure 31).

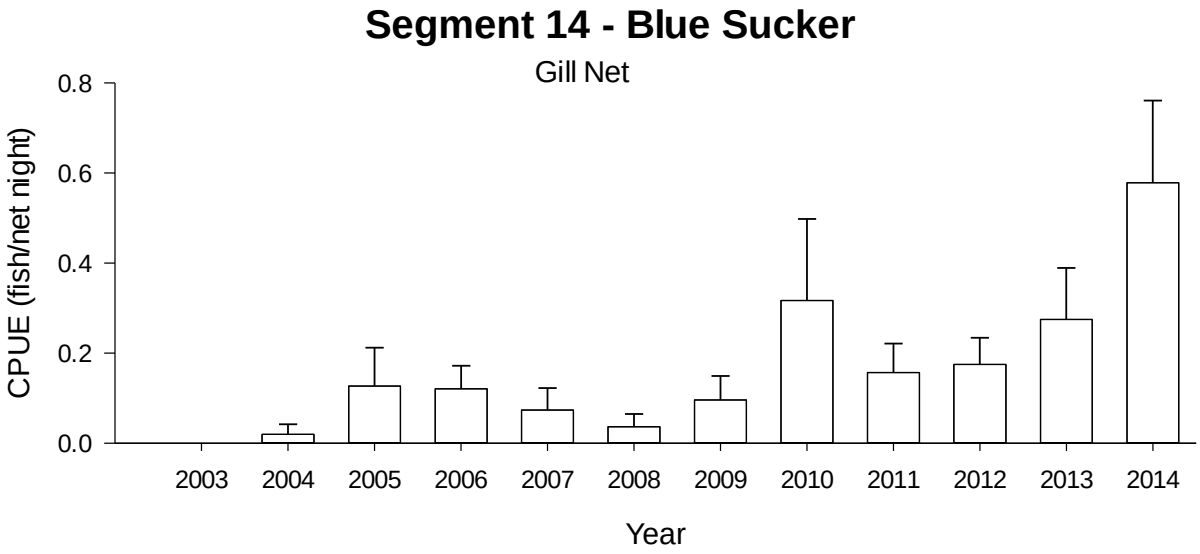

Figure 28. Mean annual catch per unit effort (± 2 SE) of Blue Suckers using gill nets in Segment 14 of the Missouri River from 2003-2014.

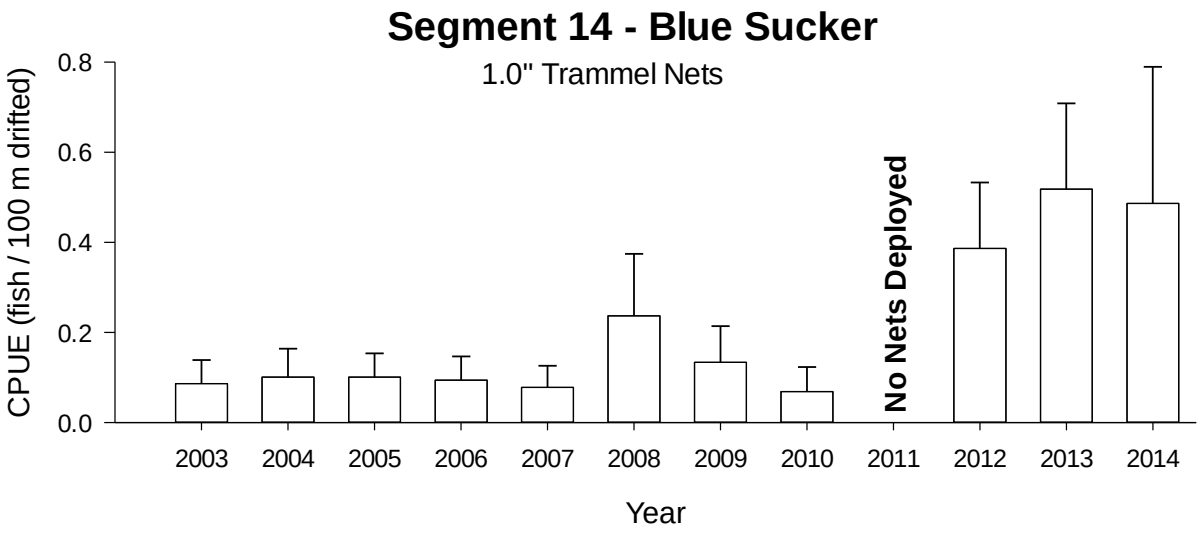

Figure 29. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using 1.0” trammel nets in Segment 14 of the Missouri River from 2003-2014.

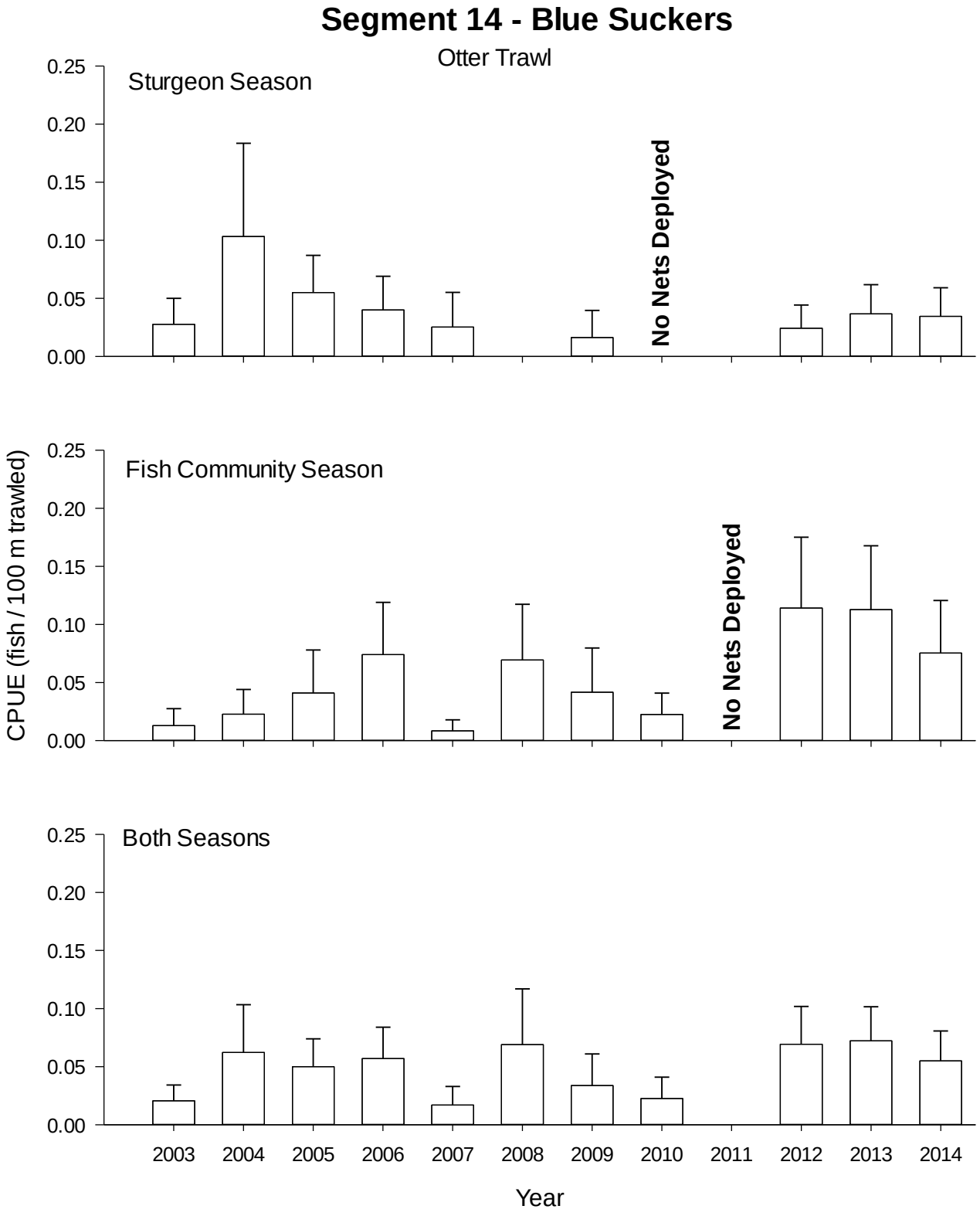

Figure 30. Mean annual catch per unit effort (± 2 SE) of Blue Sucker using otter trawls in Segment 14 of the Missouri River from 2003-2014.

Table 14. Total number of Blue Suckers captured for each gear during each season and the proportion caught within each macrohabitat type in Segment 14 of the Missouri River during 2014. 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	162	N-E	17	0	N-E	N-E	N-E	0	65	7	1	0	0	9	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	0	3	0	0
Otter Trawl	8	N-E	13	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
		N-E	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	0	0
Fish Community Season																
1.0" Trammel Net	65	N-E	2	0	N-E	N-E	N-E	0	98	0	0	0	0	0	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	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	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	16	N-E	13	0	N-E	N-E	N-E	0	88	0	0	0	0	0	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	0	0

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

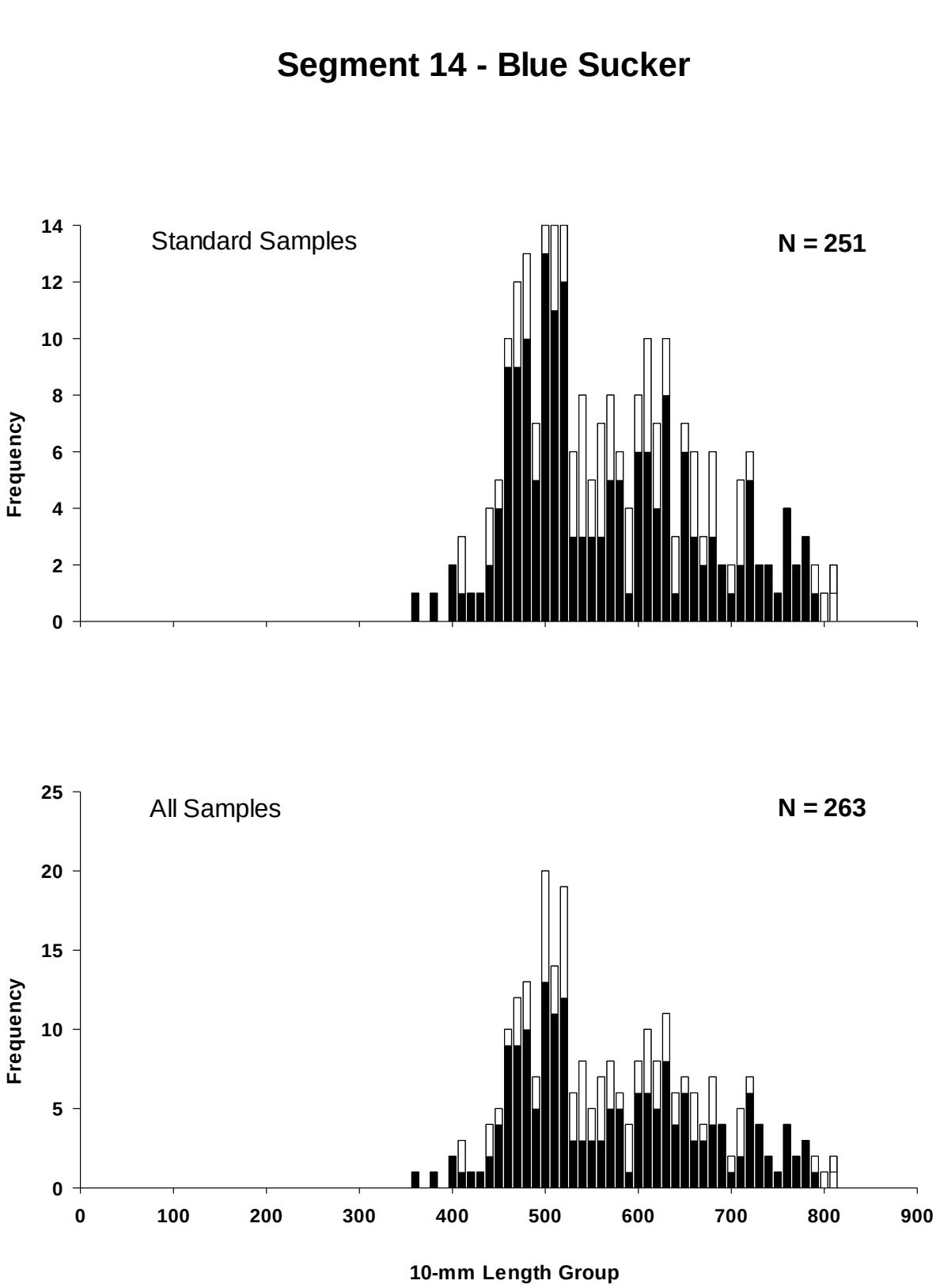

Figure 31. Length frequency of Blue Sucker during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Sauger

We collected 33 Sauger in Segment 14 during the 2013 sampling season (Table 15). Sauger CPUE from gill nets in 2014 (0.10 fish/net night ± 0.05) appeared to be similar to 2013 (0.08 fish/net night ± 0.04) (Figure 32). Similar to other years Sauger CPUE in trammel nets in 2014 (0.01 fish/100 m ±0.01) was low (Figure 33). No Sauger were caught in otter trawls during the sturgeon season and only one was caught during the fish community season (0.01 fish 100 m ±0.01). No Sauger were collected in otter trawls during 2009 and 2010 (Figure 34). Gill nets captured most Sauger (Table 15). Sauger were captured in CHXO, ISB, OSB, SCCL and TRML macrohabitats. Similar to 2013, Sauger captured in TRML habitat were age-0 size (Dattilo et al. 2008c). Sauger captured in Segment 14 ranged in length from 86 to 475 mm TL. Most Sauger (90%) were greater than 300 mm; however two Sauger were less than 110 mm, a size consistent with age-0 (Dattilo et al. 2008c; Figure 35).

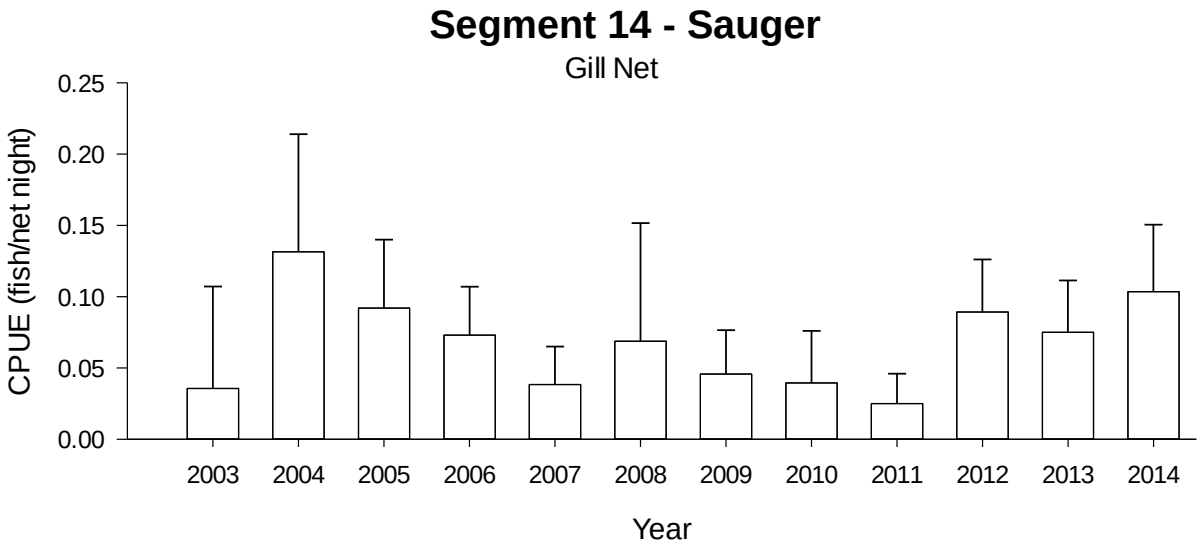

Figure 32. Mean annual catch per unit effort (± 2 SE) of Sauger using gill nets in Segment 14 of the Missouri River from 2003-2014.

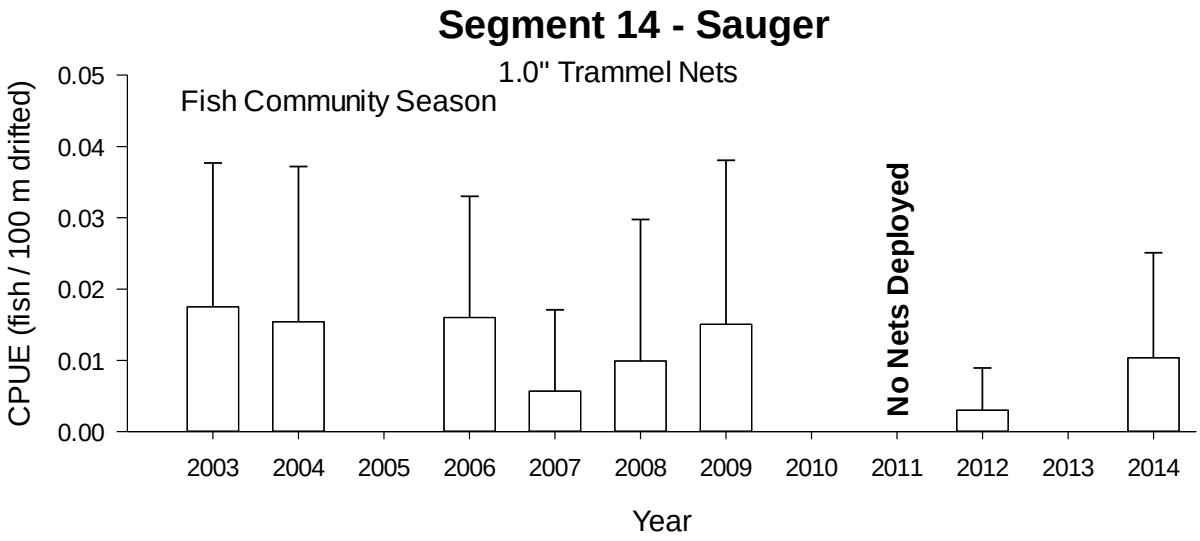

Figure 33. Mean annual catch per unit effort (± 2 SE) of Sauger using 1.0" trammel nets in Segment 14 of the Missouri River from 2003-2014.

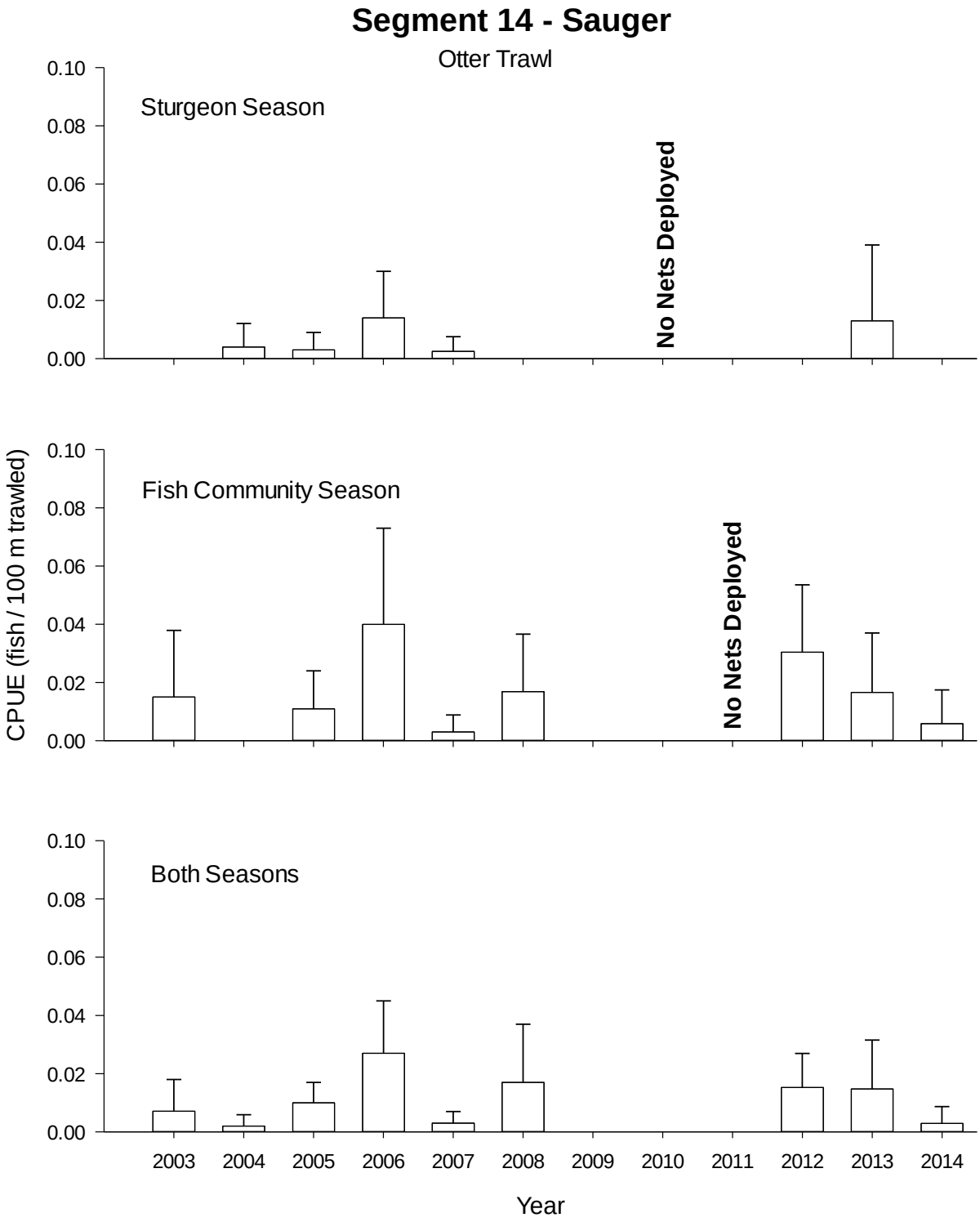

Figure 34. Mean annual catch per unit effort (± 2 SE) of Sauger using otter trawls in Segment 14 of the Missouri River from 2003-2014.

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 2014. 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	29	N-E	17	0	N-E	N-E	N-E	0	69	10	3	0	0	0	0	0
		N-E	24	0	N-E	N-E	N-E	0	56	16	1	0	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	14	0	N-E	N-E	N-E	0	79	1	1	0	0	4	0	0
Fish Community Season																
1.0” Trammel Net	2	N-E	0	0	N-E	N-E	N-E	0	100	0	0	0	0	0	0	0
		N-E	10	0	N-E	N-E	N-E	0	88	0	1	0	0	1	0	0
Mini-Fyke Net	1	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	100	0	0
		N-E	15	0	N-E	N-E	N-E	0	50	19	4	6	0	3	4	0
Otter Trawl	1	N-E	0	0	N-E	N-E	N-E	0	0	0	0	0	0	100	0	0
		N-E	12	0	N-E	N-E	N-E	0	78	0	5	0	0	5	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	22	2	N-E	N-E	N-E	0	56	15	3	0	0	3	0	0

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

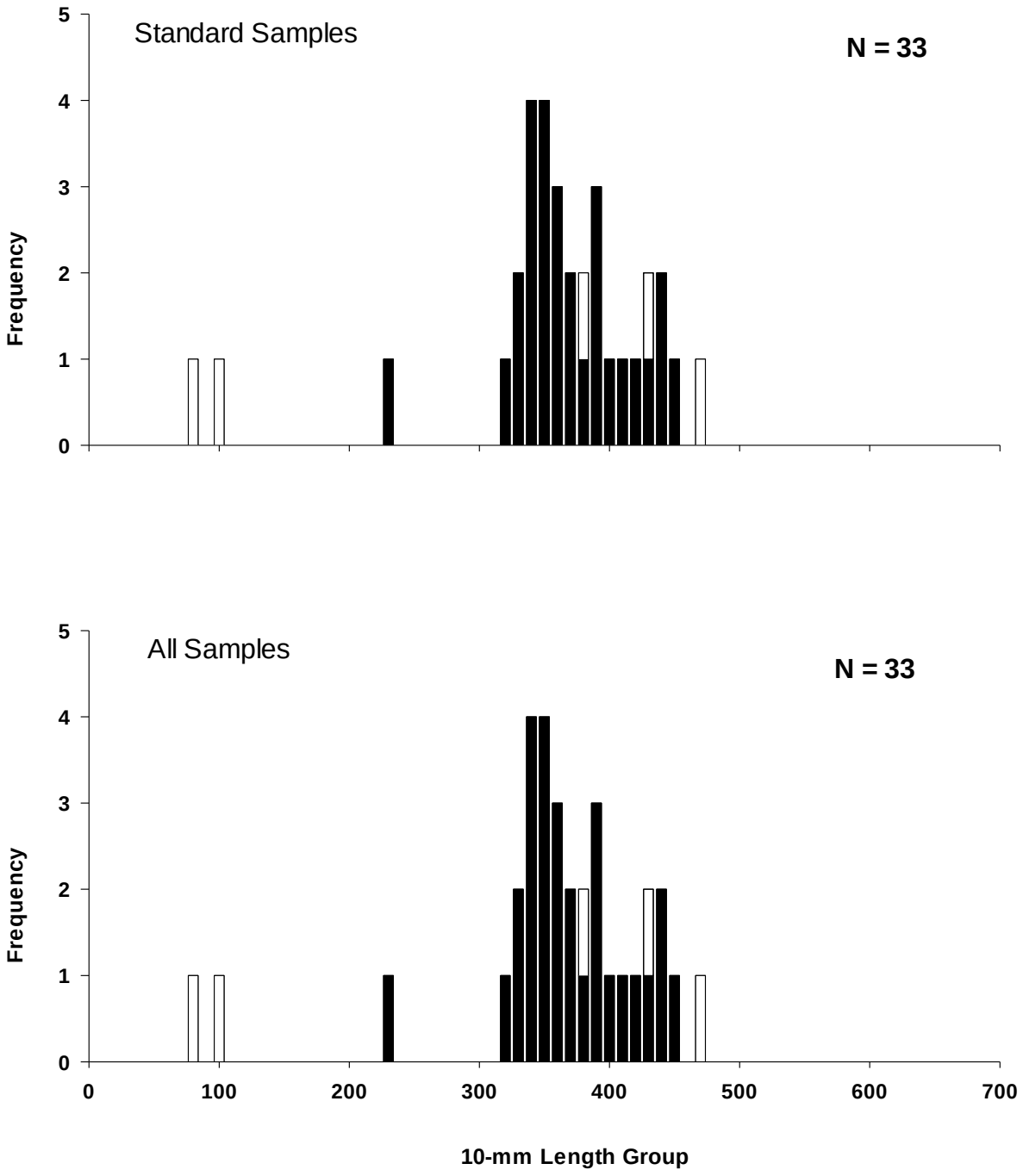

Figure 35. Length frequency of Sauger during the sturgeon season (black bars) and the fish community season (white bars) in Segment 14 of the Missouri River during 2014. Standard samples include standard gears, random bends, and random subsamples. All samples include all sampling conducted during 2014.

Missouri River Fish Community

A total of 11,611 fish were collected from all samples in Segment 14 during 2014, representing 59 identified species. Shovelnose Sturgeon (*n* = 3,896) Shoal Chub (*n* = 1,647) and Channel Catfish (*n* = 1,155) were the most abundant species. Red shiner numbers in 2014 (*n* = 959) decreased by more than 50% from 2013 (*n* = 2,378). Other notable species included: Lake Sturgeon (*n* = 8), Paddlefish (*n* = 14), and Highfin Carpsucker (*n*= 1). Some species rare to Segment 14 were also encountered: Gravel Chub (*n* = 2), Banded Darter (*n* = 1) and Yellow Bass (*n* = 1) Non-native carp continue to be relatively common in Segment 14, with 272 Silver Carp, 11 Common Carp and 16 Grass Carp captured in 2014. 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 2014, 80% of Silver Carp and 19% of Grass Carp captured were age-0 size (i.e. less than 75 mm).

Lake Sturgeon are a state endangered species in Missouri and, therefore, are of special interest. We captured eight Lake Sturgeon (*Acipenser fulvescens*) in Segment 14 during 2014. Five of the eight Lake Sturgeon were captured near the Osage River confluence. Lake Sturgeon captured in 2014 ranged in length from 764 to 1,005 mm FL and ranged in weight from 2,690 to 7,640 g. All eight Lake Sturgeon had coded wire tags, indicating these were hatchery stocked fish, and four were previously PIT tagged. Seven of the eight Lake Sturgeon were captured on trotlines.

Pallid Sturgeon stocking locations for RPMA 4 are listed in Appendix D. Pallid Sturgeon stocking locations for Segment 13, 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 2013.

Discussion

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, while late 2012 through 2014 were characterized by low flows. 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 monitoring population trends in Segment 14.

After record high Pallid Sturgeon catches in 2012, relative abundance appeared to recede to *average* levels for Segment 14. Interestingly, the highest Pallid Sturgeon gill net CPUE in Segment 14 occurred in late 2011/early 2012 – immediately following the historic 2011 flood and preceding the 2012 drought. Perhaps environmental (e.g., flow) conditions encouraged many Pallid Sturgeon to temporarily migrate into Segment 14 in 2011/early 2012. Alternatively, higher flows during 2012 sturgeon season may have encouraged fish to move from main channel areas, into pool habitats where they were more concentrated and, therefore, easier to catch. Conversely, the low flows of 2013 and 2014 may have encouraged fish to move into main channel habitats making them more difficult to capture. In nearby Segment 13, which experienced similar flows to Segment 14, Pallid Sturgeon catch rates in 2014 were similar to

2012 (Wrasse 2015). 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 2014.

Of note in 2014, were catches of sub-stock (0-199 mm) Pallid Sturgeon in otter trawls. The five fingerlings captured were hatchery stock, stocked at Hermann (RM 97.6) and Klondike Park (RM56.3). Two fish were recaptured at RM 97.9, 13 days after stocking. Three fish were recaptured between RM 40.0 and 42.6, having been at-large for 20 days. Recaptures of fingerling Pallid Shovelnose confirm stocking survival and provide post-stocking movement pattern data. Relative condition factors for these fingerlings were also high, likely due to energy rich diets fed in the hatcheries and the post-stock timing.

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 2014. However; low abundance of larvae, relative to the extensive sampling effort, suggested that reproduction and survival rates are low in the segment. Only three wild Pallid Sturgeon were captured as part of the Pallid Sturgeon Population Assessment and Monitoring Project (PSPAP) in 2014. The presumed wild fish were greater than 740 mm FL, providing additional evidence that Pallid Sturgeon reproduction and recruitment are low in the segment. Of hatchery stocked recaptures, it is notable that average lengths of Pallid Sturgeon from the 2002 year class (844 mm FL/± 29; Table 3) were nearly the same as the average lengths from the 1992 year class (914 mm FL/± 49; 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 year class 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.

Abundant catches of age-0 Shovelnose Sturgeon in 2014 suggest high reproductive success in Segment 14. Length frequencies of Shovelnose Sturgeon in Segment 14 provide evidence of annual reproduction and survival, as well as a stable adult population. Sturgeon CPUE from otter trawls and trotlines decreased from previous years; indicating that populations may be more stable than gill and trammel net catch rates suggest. The high inter-annual variation seen in Shovelnose Sturgeon CPUE from trammel nets (Figure 12) may limit this gear's ability to detect long term trends in Shovelnose 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) may provide the most reliable catches (Guy et al. 2009). Despite the high trammel net catch rates of Shovelnose Sturgeon, only one Pallid Sturgeon was captured with trammel nets. This may suggest that Pallid Sturgeon were not common in Segment 14 during the fish community season, may have inhabited areas which we did not sample (e.g., thalweg), or

trammel nets were not effective at capturing Pallid Sturgeon in Segment 14. Since 2003, few Pallid Sturgeon have been captured with trammel nets in Segment 14.

In 2013, *Wr* for preferred and memorable/trophy size Shovelnose Sturgeon increased after several years of decline. Relative weights in these size classes remained high in 2014. Presumably, relative weights are tied to food availability in Segment 14. Interestingly, the increase in *Wr* for large Shovelnose Sturgeon correlated with high catch rates of *Macrhybopsis* and Shiner species seen since 2012. 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. The increase 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. Increased Wr's may be a reflection of increased abundances of preferred and greater sized Shovelnose Sturgeon and an increase in the number of fecund individuals captured. Additionally, increased catch rates of adult (preferred and greater) as well as sub-stock and stock sized Shovelnose Sturgeon have been observed in Segment 14; lending support to the idea that SOA has influenced condition and reproductive success of Shovelnose Sturgeon populations within the segment.

*Macrhybopsi*s chub relative abundance in 2014 was greater than in 2013 but demonstrated a decline from record high abundances in 2012. 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 making them easier to capture; however, under similar flow conditions in 2014, chub relative abundances waned. Alternatively, low flows could have affected chub populations by increasing survival of age-0 chubs. Ridenour et al. 2009 indicated that age-0 *Macrhybopsis* spp. were found in low flow habitats. Anecdotally, low flow habitats were relatively common in Segment 14 during the summer drought of 2012, and throughout 2013 and 2014. Also of note, the unusually warm water temperatures seen in 2012 contrasts with 2014 - and most other years. Perhaps, warm water temperatures in 2012 led to earlier spawn dates for *Macrhybopsis* spp. and increased growth rates. If this is true, then age-0 *Macrhybopsis* spp. in 2012 may have recruited to the gear earlier than other years, which could have also increased catch rates.

Although catch rates of Sand Shiner and *Hybognathus* spp. increased in 2014, overall numbers remained relatively low. Interestingly, while catch rates of target species cyprinids appear to have increased in 2014, catch rates of a common cyprinids, Red Shiner and Emerald Shiner, declined.

Blue Sucker CPUE for all the sampling gears suggested a stable, or slightly, 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 2013. In the 2013 report we noted a strong year class, presumably 2011, which has persisted into 2014. This year class is likely the driver behind higher detection rates of adult Blue Sucker (> 500 mm TL).

While capture success of Sauger is highly variable in Segment 14, abundance is persistently low. Capture of age-0 size Sauger suggested that reproduction happened in 2014, however it is unclear if spawning occurred within Segment 13 or if age-0 captures are due to drift dynamics of the species.

Acknowledgments

Funding for this project was provided by the U.S. Army Corps of Engineers, Omaha District. This template report reflects several years of revision and contribution from four state and two federal agencies that make up the Pallid Sturgeon Population Assessment Team. Special thanks to the following Biologists and Technicians at the U.S. Fish and Wildlife Service, Columbia Fish and Wildlife Conservation Office for collecting and processing these data: Jeremiah Smith, Amber Masters, Sarah Ettinger-Dietzel, Cal Yonce, Jeff Finley, Adam McDaniel, Brett Witte, Heather Garrison, Adam Prehoda, Jordan Fox, Javar Henry, Jared Kneer, Kevin Drews, Russ Grigoriev and Skyler Schlick. Ron Budde provided critical administrative support to help this monitoring program run smoothly. Wyatt Doyle provided editing and program guidance. We thank the many volunteers that helped during the intensive brood stock period and throughout the sampling year. Thanks to Coral Huber with U.S. Army Corps of Engineers, Yankton, SD for designing, implementing and providing technical support for electronic data collection. Kyle Winders of the Missouri Department of Conservation Chillicothe Office maintained the database, performed data summaries and executed the general analysis for this report. We thank Tim Welker and George Williams for facilitating the important discussions required to promote the adaptive processes to improve this monitoring project and annual report.

References

Bramblett, R. and R. White. 2001. Habitat use and movements of pallid and shovelnose sturgeon in the Yellowstone and Missouri rivers in Montana and North Dakota. Transactions of the American Fisheries Society, 130(6): 1006-1025.

Carlson, D., W. Pflieger, L. Trial and P. Haverland. 1985. Distribution, biology and hybridization of Scaphirhynchus albus and S. platorynchus in the Missouri and Mississippi rivers. Environmental biology of fishes 14: 51-59.

Dattilo, J., R. Dirnberger, P. Horner, D. Niswonger, M. Miller and V. Travnichek. 2008a. Three year summary age and growth report for Sand Shiner (Notropis stramineus). Pallid Sturgeon population assessment project and associated fish community monitoring for the Missouri River. Missouri Department of Conservation, Chillicothe, MO.

Dattilo, J., R. Dirnberger, P. Horner, D. Niswonger, M. Miller and V. Travnichek. 2008b. Three year summary age and growth report for Plains Minnow, Western Silvery Minnow, Brassy Minnow (Hybognathus spp.). Pallid Sturgeon population assessment project and associated fish community monitoring for the Missouri River. Missouri Department of Conservation, Chillicothe, MO.

Dattilo, J., R. Dirnberger, P. Horner, D. Niswonger, M. Miller and V. Travnichek. 2008c. Three year summary age and growth report for Sauger (Sander canadensis). Pallid Sturgeon population assessment project and associated fish community monitoring for the Missouri River. Missouri Department of Conservation, Chillicothe, MO.

Dieterman, D. and D. Galat. 2004. Large-scale factors associated with Sicklefin Chub distribution in the Missouri and lower Yellowstone rivers. Transactions of the American Fisheries Society. 133:577-587.

Doyle, W. and A. Starostka. 2003. 2002 Annual report: lower Missouri River pallid sturgeon monitoring and population assessment project. United States Fish and Wildlife Service, Columbia Fishery Resources Office, Columbia, Missouri.

Doyle, W. and A. Starostka. 2004. 2003 Annual report: lower Missouri River pallid sturgeon monitoring and population assessment project, Segments 13 and 14. United States Fish and Wildlife Service, Columbia Fishery Resources Office, Columbia, Missouri.

Gabelhouse, D. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273-285.

Gerrity, P., C. Guy and W. Gardner. 2006. Juvenile pallid sturgeon are piscivorous: a call for conserving native cyprinids. Transactions of the American Fisheries Society, 135(3):604-609.

Grady, J. and J. Milligan. 1998. Status of selected cyprinid species at historic lower Missouri River sampling sites. United States Fish and Wildlife Service, Columbia Fishery Resources Office, Columbia, Missouri.

Grady, J., J. Milligan, C. Gemming, D. Herzog, G. Mestle and R. Sheehan. 2001. Pallid and shovelnose sturgeons in the Lower Missouri and Middle Mississippi rivers. Final Report for MICRA.

Guy, C., R. Neumann, D. Willis and R. Anderson. 2007. Proportional Size Distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32(7):348.

Guy, C., P. Braaten, D. Herzog, J. Pitlo and R. Rogers. 2009. Warmwater fish in rivers. in S. A. Bonar, W. A. Hubert, and D. W. Willis, editors. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.

Herman, P., A. Plauck, N. Utrup and T. Hill. 2008a. Three year summary age and growth report for Sturgeon Chub (Macrhybopsis gelida) pallid sturgeon population assessment project and associated fish community monitoring for the Missouri River. U.S. Fish and Wildlife Service. U.S. Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office, Columbia, Missouri.

Herman, P., A. Plauck, N. Utrup and T. Hill. 2008b. Three year summary age and growth report for sicklefin chub (Macrhybopsis meeki) pallid sturgeon population assessment project and associated fish community monitoring for the Missouri River. U.S. Fish and Wildlife Service. U.S. Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office, Columbia, Missouri.

Herman, P., A. Plauck, N. Utrup and T. Hill. 2008c. Three year summary age and growth report for speckled chub (Macrhybopsis hyostoma) pallid sturgeon population assessment project and associated fish community monitoring for the Missouri River. U.S. Fish and Wildlife Service. U.S. Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office, Columbia, Missouri.

Herman, P and C. Wrasse. 2014. 2013 Annual report: Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 14. United States Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office. Columbia, Missouri.

Hubert, W. and M. Fabrizio. 2007. Relative abundance and catch per unit effort. Pages 279-326 in C.S. Guy and M.L. Brown, editors. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.

Huenemann, T. 2014. Central lowlonds and interior highlands pallid sturgeon spawning and stocking summary 1992-2013. Summary prepared for the Middle Basin Pallid Sturgeon Workgroup.

Killgore, K., J. Hoover, J. Kirk, S. George, B. Lewis and C. Murphy. 2007. Age and growth of pallid sturgeon in the free-flowing Mississippi River. Journal of Applied Ichthyology, 23(4): 452-456.

LaBay, S., J. Kral and S. Stukel. 2008. Three year summary age and growth report for Blue Sucker Pallid Sturgeon population assessment project and associated fish community monitoring for the Missouri River. South Dakota Department of Game, Fish and Parks, Wildlife Division. Yankton, South Dakota.

Meyer, H., C. Wrasse, C. Ridenour, W. Doyle and T. Hill. 2013. 2012 Annual report: Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 14. United States Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office. Columbia, Missouri.

Meyer, H. 2011. Influence of diet and environmental variation on physiological responses of juvenile pallid sturgeon (Scaphirhynchus albus). Master's Thesis. South Dakota State University, Brookings, South Dakota.

Murphy, C., J. Hoover, S. George and K. Killgore. 2007. Morphometric variation among river sturgeons (Scaphirhynchus spp.) of the Middle and Lower Mississippi River. Journal of Applied Ichthyology 23:354-358.

National Research Council. 2002. The Missouri River ecosystem: exploring the prospects for recovery. National Academy Press, Washington, D. C.

Pflieger, W.L. 1997. Revised Edition. The Fishes of Missouri. Missouri Department of Conservation. Jefferson City, MO.

Pflieger, W. and T. Grace. 1987. Changes in the fish fauna of the lower Missouri River, 1940-1983. Pages 166-177 in W.J. Matthews and D.C. Heins, editors. Community and Evolutionary Ecology of North American Stream Fishes. University of Oklahoma Press, Norman.

Poff, N., J. Allan, M. Bain, J. Karr, K. Prestegaard, B. Richter, R. Sparks and J. Stromberg. 1997. The Natural Flow Regime. BioScience 47: 769-784.

Quist, M., C. Guy and P. Braaten. 1998. Standard weight (Ws) equation and length categories for shovelnose sturgeon. North American Journal of Fisheries Management 18:992-997.

Ridenour, C., A. Starostka, W. Doyle, and T. Hill. 2009. Habitat used by Macrhybopsis chubs associated with channel modifying structures in a large regulated river: implications for river modification. River Research and Applications 25:472-485.

Schrey, A., R. Boley and E. Heist. 2011. Hybridizarion between Pallid Sturgeon Scaphirhynchus albus and Shovelnose Sturgeon Scaphirhynchus platorynchus. Journal of Fish Biology 79:1828-1850.

Sheehan, R., R. Heidinger, P. Wills, M. Schmidt, G. Conover, and K. Hurley. 1999. Guide to the pallid sturgeon shovelnose sturgeon character index (CI) and morphometric character index (mCI). SIUC Fisheries Bulletin No. 14, Southern Illinois University, Carbondale, Illinois. 16pp.

Shuman, D., D. Willis, and S. Krentz. 2006. Application of a length categorizing system for pallid sturgeon (Scaphirhynchus albus). Journal of Freshwater Ecology 21:71-76.

Shuman, D., R. Klumb, R. Wilson, M. Jaeger, T. Haddix, W. Gardner, W. Doyle, P. Horner, M. Ruggles, K. Steffensen, S. Stukel and G. Wanner. 2011. Pallid sturgeon size structure, condition, and growth in the Missouri River basin. Journal of Applied Ichthyology 27:269-281.

U.S. Army Corps of Engineers. 2010. Pallid Sturgeon population assessment project, volume 1.5. U.S.A.C.E., Omaha District, Yankton, South Dakota.

U.S. Fish and Wildlife Service. 2000. Biological opinion on the operation of the Missouri River main stem reservoir system, operation and maintenance of the Missouri River bank stabilization and navigation project and operation of the Kansas River reservoir system. Fort Snelling, Minnesota.

Wanner, G., D. Shuman and D. Willis. 2007. Food habits of juvenile pallid sturgeon and adult shovelnose sturgeon in the Missouri River downstream of Fort Randall Dam, South Dakota. Journal of Freshwater Ecology, 22(1): 81-92.

Welker, T. L. and M. R. Drobish (editors). 2012. Missouri River standard operating procedures for fish sampling and data collection, volume 1.7. U.S. Army Corps of Engineers, Omaha District, Yankton, South Dakota.

Wrasse, C., P. Herman, J. Smith, A. Masters, C. Yonce and J. Henry. 2015. 2014 Annual report: Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 13. United States Fish and Wildlife Service Columbia Fish and Wildlife Conservation Office. Columbia, Missouri.

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	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Wild	Macro	All habitats not covered in the previous habitat descriptions	WILD
Bars	Meso	Sandbar or shallow bank-line areas with depth < 1.2 m	BARS
Pools	Meso	Areas immediately downstream from sandbars, dikes, snags, or other obstructions with a formed scour hole > 1.2 m	POOL
Channel border	Meso	Area in the channelized river between the toe and the thalweg, area in the unchannelized river between the toe and the maximum depth	CHNB
Thalweg	Meso	Main channel between the channel borders conveying the majority of the flow	TLWG
Island tip	Meso	Area immediately downstream of a bar or island where two channels converge with water depths > 1.2 m	ITIP

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed, years used, and catch per unit effort units for collection of Missouri River fishes in Segment 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)

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 2014. 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			CONF	OSB			SCCL			TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	POOL	CHNB
BDDR	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
BHMW	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
BKBF	2	0.007	0	0	.	0.007	0	.	.	0	0	.	.	0	.	0.125.	.
		0.010	0	0	.	0.014	0	.	.	0	0	.	.	0	.	0.250	.
BLCF	273	0.975	0.636	1.227	.	0.308	0.167	.	.	1.00	5.333	.	.	5.250	.	0.250	.
		0.526	0.523	1.331	.	0.184	0.211	.	.	0.760	5.058	.	.	10.500	.	0.500	.
BSDR	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
BUSK	**162**	**0.579**	**0.523**	**0.227**	**.**	**0.726**	**0**	**.**	**.**	**0.400**	**0.125**	**.**	**.**	**0.5000**	**.**	**1.875**	**.**
		0.183	**0.290**	**0.207**	**.**	**0.289**	**0**	**.**	**.**	**0.359**	**0.131**	**.**	**.**	**1.00**	**.**	**2.750**	**.**
CARP	5	0.018	0	0	.	0	0	.	.	0.100	0.125	.	.	0	.	0	.
		0.024	0	0	.	0	0	.	.	0.133	0.250	.	.	0	.	0	.
CNCF	7	0.025	0.023	0	.	0.041	0	.	.	0	0	.	.	0	.	0	.
		0.018	0.045	0	.	0.032	0	.	.	0	0	.	.	0	.	0	.
CNLP	1	0.004	0	0.045	.	0	0	.	.	0	0	.	.	0	.	0	.
		0.007	0	0.091	.	0	0	.	.	0	0	.	.	0	.	0	.
CNSN	0	0	0	0	.	0	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	.	0	0	.	.	0	0	.	.	0	.	.	.
FHCF	4	0.014	0	0.045	.	0	0	.	.	0	0.083	.	.	0	.	0.125	.
		0.014	0	0.091	.	0	0	.	.	0	0.112	.	.	0	.	0.250	.
FWDM	10	0.036	0	0	.	0.014	0	.	.	0.050	0.292	.	.	0	.	0	.
		0.040	0	0	.	0.019	0	.	.	0.100	0.434	.	.	0	.	0	.
GDEY	42	0.150	0.273	0.773	.	0.048	0	.	.	0.200	0.083	.	.	0	.	0	.
		0.092	0.205	0.966	.	0.040	0	.	.	0.306	0.112	.	.	0	.	0	.
GDRH	1	0.004	0	0	.	0	0	.	.	0.050	0	.	.	0	.	0	.
		0.007	0	0	.	0	0	.	.	0.100	0	.	.	0	.	0	.
GSCP	11	0.039	0.068	0.045	.	0.041	0	.	.	0.050	0	.	.	0	.	0	.
		0.031	0.100	0.091	.	0.047	0	.	.	0.100	0	.	.	0	.	0	.
GVCB	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
GZSD	7	0.025	0	0.045	.	0.021	0	.	.	0	0.042	.	.	0.250	.	0.125	.
		0.018	0	0.091	.	0.023	0	.	.	0	0.083	.	.	0.500	.	0.250	.
LKSG	1	0.004	0	0.045	.	0	0	.	.	0	0	.	.	0	.	0	.
		0.007	0	0.091	.	0	0	.	.	0	0	.	.	0	.	0	.
LNGR	82	0.293	0.273	0.273	.	0.137	0.500	.	.	0.500	0.125	.	.	5.000	.	0.625	.
		0.180	0.277	0.455	.	0.102	0.816	.	.	1.000	0.131	.	.	10.00	.	1.250	.
NFSH	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	.	.

Appendix F1. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	POOL	CHNB
NHSK	1	0.004	0	0	.	0	0	.	.	0	0	.	.	0.250	.	0	.
		0.007	0	0	.	0	0	.	.	0	0	.	.	0.500	.	0	.
PDFH	1	0.004	0	0	.	0	0	.	.	0	0.042	.	.	0	.	0	.
		0.007	0	0	.	0	0	.	.	0	0.083	.	.	0	.	0	.
PDSG	**5**	**0.018**	**0.068**	**0.045**	**.**	**0.007**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
		0.016	**0.075**	**0.091**	**.**	**0.014**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
QLBK	1	0.004	0	0	.	0	0	.	.	0	0.042	.	.	0	.	0	.
		0.007	0	0	.	0	0	.	.	0	0.083	.	.	0	.	0	.
RDSN	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
RRDR	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
RVCS	33	0.118	0.091	0.227	.	0.007	0.500	.	.	0.050	0.583	.	.	0.250	.	0.125	.
		0.087	0.084	0.207	.	0.014	0.516	.	.	0.100	0.911	.	.	0.500	.	0.250	.
RVRH	1	0.004	0	0	.	0	0	.	.	0	0.026	.	.	0	.	0	.
		0.007	0	0	.	0	0	.	.	0	0.053	.	.	0	.	0	.
RVSN	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
SBWB	1	0.004	0	0	.	0	0	.	.	0	0	.	.	0	.	0.125	.
		0.007	0	0	.	0	0	.	.	0	0	.	.	0	.	0.250	.
SFCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
SGCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
SGER	**29**	**0.104**	**0.091**	**0.045**	.	**0.137**	**0**	.	.	**0.150**	**0**	.	.	**0.250**	.	0	.
		0.047	**0.107**	**0.091**	.	**0.079**	**0**	.	.	**0.153**	**0**	.	.	**0.500**	.	0	.
SHRH	13	0.046	0.068	0	.	0.021	0	.	.	0.150	0.083	.	.	0	.	0.250	.
		0.030	0.075	0	.	0.023	0	.	.	0.300	0.112	.	.	0	.	0.289	.
SKCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	.	**0**	**.**	**0**	**.**
SMBF	24	0.086	0.023	0.273	.	0.034	0.083	.	.	0.100	0.375	.	.	0	.	0	.
		0.058	0.045	0.312	.	0.041	0.167	.	.	0.200	0.509	.	.	0	.	0	.
SNGR	14	0.050	0.023	0.045	.	0.034	0.083	.	.	0.100	0.375	.	.	0	.	0	.
		0.034	0.045	0.091	.	0.036	0.167	.	.	0.200	0.509	.	.	0	.	0	.
SNPD	3	0.011	0	0	.	0.007	0.083	.	.	0	0	.	.	0	.	0.125	.
		0.012	0	0	.	0.014	0.167	.	.	0	0	.	.	0	.	0.250	.
SNSG	**1475**	**5.268**	**4.068**	**12.182**	**.**	**2.952**	**17.083**	**.**	**.**	**5.800**	**4.958**	**.**	.	**4.000**	**.**	**17.625**	**.**
		1.191	**1.266**	**5.259**	**.**	**0.988**	**13.766**	**.**	**.**	**3.088**	**3.311**	**.**	.	**1.000**	**.**	**9.446**	**.**
SNSN	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	**.**	**0**	**.**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**.**	**0**	**0**	**.**	**.**	**0**	**.**	**0**	**.**
STBS	1	0.004	0	0	.	0.007	0	.	.	0	0	.	.	0	.	0	.
		0.007	0	0	.	0.014	0	.	.	0	0	.	.	0	.	0	.
STCT	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
SVCB	0	0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	.	0	.	0	.

Appendix F1. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML	TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	POOL	CHNB
SVCP	14	0.050	0.068	0.045	.	0.041	0	.	.	0.050	0.125	.	0	0	.	0	.
		0.036	0.100	0.091	.	0.043	0	.	.	0.100	0.250	.	0	0	.	0	.
UCY	0	0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
UHY	0	0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
UIC	0	0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
UTB	0	0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
		0	0	0	.	0	0	.	.	0	0	.	0	0	.	0	.
YWBS	1	0.004	0	0	.	0.007	0	.	.	0	0	.	0	0	.	0	.
		0.007	0	0	.	0.014	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			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	BARS	CHNB
BDDR	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
BHMW	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
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	2	0.018	0.085	.	.	0.010	.	.	.	.	.	.	0	.	.	0	.	.
		0.026	0.171	.	.	0.019	.	.	.	.	.	.	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	.	.
BPTM	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
BSDR	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
BTTM	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
BUSK	**65**	**0.486**	**0.051**	**.**	**.**	**0.556**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
		0.303	**0.101**	**.**	**.**	**0.349**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
CARP	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
CNCF	2	0.016	0	.	.	0.018	.	.	.	.	.	.	0	.	.	0	.	.
		0.023	0	.	.	0.027	.	.	.	.	.	.	0	.	.	0	.	.
CNLP	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
CNSN	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
ERSN	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
FHCF	3	0.019	0	.	.	0.022	.	.	.	.	.	.	0	.	.	0	.	.
		0.022	0	.	.	0.025	.	.	.	.	.	.	0	.	.	0	.	.
FWDM	3	0.025	0.115	.	.	0.013	.	.	.	.	.	.	0	.	.	0	.	.
		0.029	0.157	.	.	0.026	.	.	.	.	.	.	0	.	.	0	.	.
GDEY	3	0.027	0.129	.	.	0.013	.	.	.	.	.	.	0	.	.	0	.	.
		0.031	0.175	.	.	0.026	.	.	.	.	.	.	0	.	.	0	.	.

Appendix F2. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	BARS	CHNB
GDFH	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
GDRH	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
GSCP	1	0.006	0	.	.	0.007	.	.	.	.	.	.	0	.	.	0	.	.
		0.011	0	.	.	0.013	.	.	.	.	.	.	0	.	.	0	.	.
GVCB	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
GZSD	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
HBNS	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
HFCS	1	0.005	0	.	.	0.006	.	.	.	.	.	.	0	.	.	0	.	.
		0.011	0	.	.	0.012	.	.	.	.	.	.	0	.	.	0	.	.
JYDR	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
LKSG	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
LNGR	5	0.037	0	.	.	0.043	.	.	.	.	.	.	0	.	.	0	.	.
		0.048	0	.	.	0.056	.	.	.	.	.	.	0	.	.	0	.	.
LMBS	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	.	.
NHSK	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	1	0.007	0	.	.	0	.	.	.	.	.	.	0	.	.	0.769	.	.
		0.014	0	.	.	0	.	.	.	.	.	.	0	.	.	.	.	.
PNMW	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**
QLBK	1	0.006	0	.	.	0.006	.	.	.	.	.	.	0	.	.	0	.	.
		0.011	0	.	.	0.013	.	.	.	.	.	.	0	.	.	0	.	.
RDSN	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
RRDR	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
RVCS	2	0.010	0	.	.	0.012	.	.	.	.	.	.	0	.	.	0	.	.
		0.014	0	.	.	0.016	.	.	.	.	.	.	0	.	.	0	.	.
RVSN	0	0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.
		0	0	.	.	0	.	.	.	.	.	.	0	.	.	0	.	.

Appendix F2. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	BARS	CHNB
SBWB	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
SFCB	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
SFSN	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
SGCB	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
SGER	**2**	**0.010**	**0**	**.**	**.**	**0.012**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
		0.015	**0**	**.**	**.**	**0.017**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
SHRH	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
SKCB	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	0	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	0	**.**	**.**
SMBF	13	0.112	0.281	.	.	0.083	.	.	.	0	.	.	.	.	.	0.769	.	.
		0.074	0.298	.	.	0.074	.	.	.	0	.	.	.	.	.	.	.	.
SNGR	1	0.007	0	.	.	0.008	.	.	.	0	.	.	.	.	.	0	.	.
		0.014	0	.	.	0.017	.	.	.	0	.	.	.	.	.	0	.	.
SNPD	1	0.006	0	.	.	0.007	.	.	.	0	.	.	.	.	.	0	.	.
		0.012	0	.	.	0.014	.	.	.	0	.	.	.	.	.	0	.	.
SNSG	**510**	**4.341**	**5.257**	**.**	**.**	**3.853**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**43.077**	**.**	**.**
		2.608	**7.095**	**.**	**.**	**2.749**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
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	.	.
STGR	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	0.038	0	.	.	0.044	.	.	.	0	.	.	.	.	.	0	.	.
		0.058	0	.	.	0.067	.	.	.	0	.	.	.	.	.	0	.	.
UAC	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UBF	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UCN	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UCT	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UCY	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UDR	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.

Appendix F2. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	BARS	CHNB
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	.	.
UPP	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
UTB	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
WSMW	**0**	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
		0	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**.**	**.**	**.**	**0**	**.**	**.**
WTBS	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
YOYF	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
YWBS	0	0	0	.	.	0	.	.	.	0	.	.	.	.	.	0	.	.
		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			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	CHNB	POOL	CHNB
BDDR	1	0.002	0	0	.	0.002	.	0	.	.	0	.	0	0	.	0	0	.
		0.004	0	0	.	0.005	.	0	.	.	0	.	0	0	.	0	0	.
BHMW	25	0.070	0.081	0	.	0.016	.	0.147	.	.	0	.	0	0	.	0	1.248	.
		0.065	0.092	0	.	0.016	.	0.294	.	.	0	.	0	0	.	0	1.638	.
BKBF	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BKBH	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BKCP	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BKSS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BLCF	108	0.288	0.578	1.039	.	0.233	.	0	.	.	0	.	0.382	0	.	0	0.246	.
		0.098	0.337	1.399	.	0.107	.	0	.	.	0	.	0.764	0	.	0	0.248	.
BLGL	1	0.004	0	0	.	0.005	.	0	.	.	0	.	0	0	.	0	0	.
		0.007	0	0	.	0.010	.	0	.	.	0	.	0	0	.	0	0	.
BNMW	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BPTM	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BSDR	2	0.008	0	0	.	0.011	.	0	.	.	0	.	0	0	.	0	0	.
		0.011	0	0	.	0.015	.	0	.	.	0	.	0	0	.	0	0	.
BTTM	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
BUSK	**24**	**0.055**	**0.055**	**0**	**.**	**0.063**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
		0.026	**0.065**	**0**	**.**	**0.032**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
CARP	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
CNCF	1037	2.474	1.679	1.829	.	2.763	.	1.033	.	.	0.794	.	2.288	5.125	.	0.741	0.723	.
		0.533	0.839	2.943	.	0.685	.	1.562	.	.	1.587	.	1.800	2.086	.	0.451	0.519	.
CNLP	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
CNSN	112	0.282	0.158	0	.	0.297	.	1.038	.	.	0	.	0.612	0	.	0.757	0.098	.
		0.110	0.130	0	.	0.139	.	1.655	.	.	0	.	0.787	0	.	0.548	0.197	.
ERSN	13	0.034	0.039	0	.	0.036	.	0	.	.	0	.	0	0.220	.	0	0	.
		0.031	0.055	0	.	0.040	.	0	.	.	0	.	0	0.441	.	0	0	.
FHCF	4	0.008	0.031	0	.	0.004	.	0	.	.	0	.	0	0	.	0	0	.
		0.008	0.046	0	.	0.006	.	0	.	.	0	.	0	0	.	0	0	.
FWDM	69	0.199	0.395	0.316	.	0.037	.	0	.	.	1.148	.	1.353	0	.	3.012	1.234	.
		0.085	0.262	0.632	.	0.030	.	0	.	.	0.878	.	1.680	0	.	1.193	0.985	.
GDEY	1	0.003	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.082	.
		0.006	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.164	.

Appendix F3. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	CHNB	POOL	CHNB
GDFH	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
GDRH	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
GSCP	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
GVCB	2	0.003	0	0	.	0.005	.	0	.	.	0	.	0	0	.	0	0	.
		0.005	0	0	.	0.007	.	0	.	.	0	.	0	0	.	0	0	.
GZSD	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
HBNS	**0**	**0**	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
HFCS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
JYDR	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
LKSG	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
LNGR	4	0.010	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.296	.
		0.014	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.349	.
LMBS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
MQTF	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
NFSH	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
NHSK	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
OSSF	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
PDFH	13	0.031	0.083	0.316	.	0.020	.	0	.	.	0	.	0	0	.	0	0	.
		0.019	0.080	0.632	.	0.016	.	0	.	.	0	.	0	0	.	0	0	.
PDSG	**5**	**0.015**	**0.051**	**0**	**.**	**0.010**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
		0.017	**0.102**	**0**	**.**	**0.011**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
PNMW	**0**	**0**	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
QLBK	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
RDSN	11	0.037	0	0	.	0.046	.	0	.	.	0	.	0	0	.	0	0.098	.
		0.031	0	0	.	0.040	.	0	.	.	0	.	0	0	.	0	0.197	.
RRDR	1	0.005	0	0	.	0.007	.	0	.	.	0	.	0	0	.	0	0	.
		0.010	0	0	.	0.013	.	0	.	.	0	.	0	0	.	0	0	.
RVCS	11	0.028	0.031	0	.	0.011	.	0	.	.	0	.	0	0	.	0.483	0.303	.
		0.019	0.062	0	.	0.011	.	0	.	.	0	.	0	0	.	0.966	0.300	.
RVSN	2	0.004	0	0	.	0.006	.	0	.	.	0	.	0	0	.	0	0	.
		0.006	0	0	.	0.008	.	0	.	.	0	.	0	0	.	0	0	.

Appendix F3. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	CHNB	POOL	CHNB
SBWB	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
SFCB	**865**	**2.175**	**2.440**	**0.871**	**.**	**2.365**	**.**	**0.472**	**.**	**.**	**0**	**.**	**0.262**	**1.271**	**.**	**0.773**	**0.518**	**.**
		0.532	**1.771**	**0.125**	**.**	**0.619**	**.**	**0.513**	**.**	**.**	**0**	**.**	**0.325**	**1.863**	**.**	**1.546**	**0.551**	**.**
SFSN	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
SGCB	**96**	**0.206**	**0.109**	**0**	**.**	**0.246**	**.**	**0.325**	**.**	**.**	**0**	**.**	**0.115**	**0**	**.**	**0**	**0**	**.**
		0.088	**0.083**	**0**	**.**	**0.115**	**.**	**0.330**	**.**	**.**	**0**	**.**	**0.230**	**0**	**.**	**0**	**0**	**.**
SGER	**1**	**0.003**	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0.082**	**.**
		0.006	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0.164**	**.**
SHRH	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
SKCB	**1592**	**3.876**	**3.825**	**0.316**	**.**	**4.119**	**.**	**12.513**	**.**	**.**	**0**	**.**	**0.639**	**0.881**	**.**	4.686	**0.568**	**.**
		0.895	**1.605**	**0.632**	**.**	**1.076**	**.**	**24.493**	**.**	**.**	**0**	**.**	**0.595**	**1.762**	**.**	3.187	**0.826**	**.**
SMBF	5	0.012	0.032	0	.	0.010	.	0	.	.	0	.	0	0	.	0	0	.
		0.018	0.065	0	.	0.020	.	0	.	.	0	.	0	0	.	0	0	.
SNGR	1	0.005	0.031	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0.009	0.062	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
SNPD	1	0.003	0	0	.	0.004	.	0	.	.	0	.	0	0	.	0	0	.
		0.006	0	0	.	0.008	.	0	.	.	0	.	0	0	.	0	0	.
SNSG	**503**	**1.191**	**0.787**	**0**	**.**	**1.243**	**.**	**5.422**	**.**	**.**	**0.709**	**.**	**1.122**	**1.171**	**.**	**0**	**1.073**	**.**
		0.281	**0.496**	**0**	**.**	**0.309**	**.**	**9.976**	**.**	**.**	**1.418**	**.**	**1.727**	**0.301**	**.**	**0**	**1.551**	**.**
SNSN	**4**	**0.010**	**0**	**0.158**	**.**	**0.006**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0.098**	**.**
		0.010	**0**	**0.316**	**.**	**0.008**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0.197**	**.**
STBS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
STCT	9	0.025	0.049	0	.	0.020	.	0	.	.	0	.	0	0	.	0	0.079	.
		0.018	0.069	0	.	0.020	.	0	.	.	0	.	0	0	.	0	0.157	.
STGR	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
SVCB	49	0.119	0.147	0	.	0.105	.	0.147	.	.	0	.	0.230	0.220	.	0.757	0.101	.
		0.039	0.135	0	.	0.041	.	0.294	.	.	0	.	0.282	0.441	.	0.548	0.202	.
SVCP	5	0.014	0.032	0	.	0.009	.	0	.	.	0.355	.	0	0	.	0	0	.
		0.015	0.065	0	.	0.013	.	0	.	.	0.709	.	0	0	.	0	0	.
UAC	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UBF	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UCN	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UCT	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UCY	20	0.062	0	0	.	0.019	.	0	.	.	0	.	0	0.220	.	0	1.314	.
		0.069	0	0	.	0.020	.	0	.	.	0	.	0	0.441	.	0	1.792	.
UDR	1	0.002	0	0	.	0.002	.	0	.	.	0	.	0	0	.	0	0	.
		0.003	0	0	.	0.004	.	0	.	.	0	.	0	0	.	0	0	.

Appendix F3. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	CHNB	POOL	CHNB
UHY	52	0.145	0.105	0	.	0.137	.	0	.	.	0	.	0	0	.	0	0.773	.
		0.124	0.166	0	.	0.153	.	0	.	.	0	.	0	0	.	0	1.162	.
UIC	36	0.103	0.135	0	.	0.112	.	0	.	.	0	.	0	0	.	0	0	.
		0.089	0.194	0	.	0.114	.	0	.	.	0	.	0	0	.	0	0	.
ULP	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UNID	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
UPP	1	0.003	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.082	.
		0.006	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0.164	.
UTB	13	0.029	0	0	.	0	.	0	.	.	0	.	0	0	.	3.334	0	.
		0.055	0	0	.	0	.	0	.	.	0	.	0	0	.	5.702	0	.
WSMW	**0**	**0**	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**.**	**0**	**.**	**.**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**.**
WTBS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
YOYF	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
		0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	0	.
YWBS	0	0	0	0	.	0	.	0	.	.	0	.	0	0	.	0	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	Overall	CHXO			ISB			CONF	OSB			SCCL			SCCS	TRML			TRMS
	Catch	CPUE	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	BARS	CHNB	POOL	BARS	BARS
BDDR	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
BHMW	75	0.682	.	.	0.875	.	.	0.564	.	.	.	0.714	.	.	0.250	0.143	.		2.000	1.750
		0.250	.	.	0.814	.	.	0.347	.	.	.	0.481	.	.	0.500	0.286	.		2.000	2.062
BKBF	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
BKBH	1	0.009	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0.250
		0.018	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0.500
BKCP	1	0.009	.	.	0.063	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0.018	.	.	0.125	.	.	0	.	.	.	0	.	.	0	0	.		0	0
BKSS	1	0.009	.	.	0	.	.	0.018	.	.	.	0	.	.	0	0	.		0	0
		0.018	.	.	0	.	.	0.036	.	.	.	0	.	.	0	0	.		0	0
BLCF	1	0.009	.	.	0.018	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0.018	.	.	0.036	.	.	0	.	.	.	0	.	.	0	0	.		0	0
BLGL	36	0.327	.	.	0.250	.	.	0.273	.	.	.	0.524	.	.	0	0.286	.		0.667	0.500
		0.159	.	.	0.289	.	.	0.211	.	.	.	0.528	.	.	0	0.571	.		0.667	1.000
BNMW	14	0.127	.	.	0.063	.	.	0.091	.	.	.	0.190	.	.	0	0	.		0	1.000
		0.094	.	.	0.125	.	.	0.119	.	.	.	0.223	.	.	0	0	.		0	1.414
BPTM	4	0.036	.	.	0.063	.	.	0.018	.	.	.	0.048	.	.	0	0	.		0.333	0
		0.036	.	.	0.125	.	.	0.036	.	.	.	0.095	.	.	0	0	.		0.667	0
BSDR	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
BTTM	2	0.018	.	.	0	.	.	0.036	.	.	.	0	.	.	0	0	.		0	0
		0.026	.	.	0	.	.	0.051	.	.	.	0	.	.	0	0	.		0	0
BUSK	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
CARP	6	0.055	.	.	0.063	.	.	0.036	.	.	.	0.143	.	.	0	0	.		0	0
		0.044	.	.	0.125	.	.	0.051	.	.	.	0.156	.	.	0	0	.		0	0
CNCF	60	0.545	.	.	0.125	.	.	0.691	.	.	.	0.667	.	.	0.250	0.429	.		0.667	0
		0.178	.	.	0.171	.	.	0.284	.	.	.	0.444	.	.	0.500	0.595	.		1.333	0
CNLP	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0

Appendix F4. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			SCCS	TRML			TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	BARS	CHNB	POOL	BARS	BARS
CNSN	63	0.573	.	.	0.188	.	.	0.655	.	.	.	0.476	.	.	0.750	0.143	.		0.333	2.250
		0.263	.	.	0.272	.	.	0.357	.	.	.	0.509	.	.	0.957	0.286	.		0.667	4.500
ERSN	203	1.845	.	.	1.438	.	.	2.073	.	.	.	0.905	.	.	1.00	0.286	.		8.667	3.750
		0.671	.	.	0.752	.	.	0.914	.	.	.	1.162	.	.	2.00	0.369	.		13.383	4.992
FHCF	3	0.027	.	.	0.063	.	.	0.018	.	.	.	0.048	.	.	0	0	.		0	0
		0.031	.	.	0.125	.	.	0.036	.	.	.	0.095	.	.	0	0	.		0	0
FWDM	44	0.400	.	.	0.688	.	.	0.327	.	.	.	0.714	.	.	0	0	.		0	0
		0.192	.	.	0.625	.	.	0.232	.	.	.	0.619	.	.	0	0	.		0	0
GDEY	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
GDFH	1	0.009	.	.	0	.	.	0	.	.	.	0.048	.	.	0	0	.		0	0
		0.018	.	.	0	.	.	0	.	.	.	0.095	.	.	0	0	.		0	0
GDRH	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
GSCP	4	0.036	.	.	0.063	.	.	0	.	.	.	0.095	.	.	0	0	.		0.333	0
		0.036	.	.	0.125	.	.	0	.	.	.	0.131	.	.	0	0	.		0.667	0
GVCB	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
GZSD	41	0.373	.	.	0.313	.	.	0.218	.	.	.	1.095	.	.	0	0	.		0	0
		0.374	.	.	0.352	.	.	0.162	.	.	.	1.897	.	.	0	0	.		0	0
HBNS	**5**	**0.045**	**.**	**.**	**0**	**.**	**.**	**0.055**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0.333**	**0.250**
		0.040	**.**	**.**	**0**	**.**	**.**	**0.062**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0.667**	**0500**
HFCS	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
JYDR	1	0.009	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0.333	0
		0.018	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0.667	0
LKSG	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
LNGR	82	0.745	.	.	0.375	.	.	0.673	.	.	.	1.00	.	.	0.250	0.714	.		1.00	2.250
		0.264	.	.	0.443	.	.	0.360	.	.	.	0.793	.	.	0.500	1.131	.		1.155	1.258
MQTF	62	0.564	.	.	0.250	.	.	0.345	.	.	.	1.048	.	.	0.500	0.571	.		3.333	0.251
		0.412	.	.	0.289	.	.	0.290	.	.	.	1.900	.	.	1.00	0.404	.		4.055	0.500
NFSH	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0

Appendix F4. (continued)

Species	Total	Overall	CHXO			ISB			CONF	OSB			SCCL			SCCS	TRML			TRMS
	Catch	CPUE	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	BARS	CHNB	POOL	BARS	BARS
NHSK	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
OSSF	84	0.764	.	.	0	.	.	0.436	.	.	.	1.571	.	.	0.250	0.143	.		0	6.250
		0.452	.	.	0	.	.	0.263	.	.	.	1.503	.	.	0.500	0.286	.		0	7.455
PDFH	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
PDSG	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
PNMW	**9**	**0.082**	**.**	**.**	**0**	**.**	**.**	**0.164**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0.100	**.**	**.**	**0**	**.**	**.**	**0.199**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
QLBK	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
RDSN	948	8.618	.	.	4.500	.	.	8.800	.	.	.	9.00	.	.	21.500	2.286	.		25.667	6.000
		2.670	.	.	2.696	.	.	3.722	.	.	.	6.560	.	.	30.227	2.17	.		26.187	7.789
RRDR	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
RVCS	4	0.036	.	.	0	.	.	0.055	.	.	.	0.048	.	.	0	0	.		0	0
		0.036	.	.	0	.	.	0.062	.	.	.	0.095	.	.	0	0	.		0	0
RVSN	1	0.009	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0.250
		0.018	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0.500
SBWB	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
SFCB	**22**	**0.200**	**.**	**.**	**0.188**	**.**	**.**	**0.291**	**.**	**.**	**.**	**0.143**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0.245	**.**	**.**	**0.272**	**.**	**.**	**0.478**	**.**	**.**	**.**	**0.209**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
SFSN	3	0.027	.	.	0	.	.	0.055	.	.	.	0	.	.	0	0	.		0	0
		0.055	.	.	0	.	.	0.109	.	.	.	0	.	.	0	0	.		0	0
SGCB	**3**	**0.027**	**.**	**.**	**0**	**.**	**.**	**0.036**	**.**	**.**	**.**	**0.048**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0.031	**.**	**.**	**0**	**.**	**.**	**0.051**	**.**	**.**	**.**	**0.095**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
SGER	**1**	**0.009**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0.333**	**0**
		0.018	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0.667**	**0**
SHRH	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
SKCB	**36**	**0.327**	**.**	**.**	**0.188**	**.**	**.**	**0.582**	**.**	**.**	**.**	**0.048**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0.233	**.**	**.**	**0.375**	**.**	**.**	**0.442**	**.**	**.**	**.**	**0.095**	**.**	**.**	**0**	**0**	**.**		**0**	**0**

Appendix F4. (continued)

Species	Total	Overall	CHXO			ISB			CONF	OSB			SCCL			SCCS	TRML			TRMS
	Catch	CPUE	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	BARS	CHNB	POOL	BARS	BARS
SMBF	6	0.055	.	.	0.063	.	.	0.036	.	.	.	0.095	.	.	0	0	.		0.333	0
		0.051	.	.	0.125	.	.	0.073	.	.	.	0.131	.	.	0	0	.		0.667	0
SNGR	41	0.373	.	.	0.188	.	.	0.455	.	.	.	0.190	.	.	0	0	.		0	2.250
		0.186	.	.	0.202	.	.	0.279	.	.	.	0.223	.	.	0	0	.		0	2.630
SNPD	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
SNSG	**0**	**0**	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0	**.**	**.**	**0**	**.**	**.**	**0**	**.**	**.**	**.**	**0**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
SNSN	**31**	**0.282**	**.**	**.**	**0.188**	**.**	**.**	**0.273**	**.**	**.**	**.**	**0.238**	**.**	**.**	**0.250**	**0**	**.**		**1.00**	**1.00**
		0.132	**.**	**.**	**0.202**	**.**	**.**	**0.168**	**.**	**.**	**.**	**0.235**	**.**	**.**	**0.500**	**0**	**.**		**2.00**	**2.00**
STBS	2	0.018	.	.	0	.	.	0.018	.	.	.	0	.	.	0	0	.		0.333	0
		0.026	.	.	0	.	.	0.036	.	.	.	0	.	.	0	0	.		0.667	0
STCT	3	0.027	.	.	0	.	.	0.036	.	.	.	0.048	.	.	0	0	.		0	0
		0.031	.	.	0	.	.	0.051	.	.	.	0.095	.	.	0	0	.		0	0
STGR	1	0.009	.	.	0	.	.	0.018	.	.	.	0	.	.	0	0	.		0	0
		0.018	.	.	0	.	.	0.036	.	.	.	0	.	.	0	0	.		0	0
SVCB	6	0.055	.	.	0	.	.	0.109	.	.	.	0	.	.	0	0	.		0	0
		0.044	.	.	0	.	.	0.085	.	.	.	0	.	.	0	0	.		0	0
SVCP	249	2.264	.	.	0.875	.	.	1.691	.	.	.	6.333	.	.	0.250	0.143	.		1.333	0.750
		1.224	.	.	0.704	.	.	0.822	.	.	.	5.771	.	.	0.500	0.286	.		1.333	0.957
UAC	2	0.018	**.**	**.**	0	**.**	**.**	0	**.**	**.**	**.**	0.095	**.**	**.**	0	0	**.**		0	0
		0.026	**.**	**.**	0	**.**	**.**	0	**.**	**.**	**.**	0.131	**.**	**.**	0	0	**.**		0	0
UBF	77	0.700	.	.	1.625	.	.	0.818	.	.	.	0.286	.	.	0	0	.		0	0
		0.671	.	.	3.119	.	.	0.986	.	.	.	0.394	.	.	0	0	.		0	0
UCN	63	0.573	.	.	0.438	.	.	0.564	.	.	.	0.952	.	.	0.750	0	.		0	0.500
		0.220	.	.	0.315	.	.	0.288	.	.	.	0.762	.	.	1.500	0	.		0	1.00
UCT	4	0.036	.	.	0	.	.	0.036	.	.	.	0.048	.	.	0.250	0	.		0	0
		0.036	.	.	0	.	.	0.051	.	.	.	0.095	.	.	0.500	0	.		0	0
UCY	103	0.936	.	.	0.250	.	.	1.345	.	.	.	0.571	.	.	1.500	0.143	.		1.667	0.250
		0.647	.	.	0.224	.	.	1.248	.	.	.	0.469	.	.	3.00	0.286	.		3.333	0.500
UDR	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
UHY	13	0.118	.	.	0	.	.	0.182	.	.	.	0.143	.	.	0	0	.		0	0
		0.088	.	.	0	.	.	0.165	.	.	.	0.156	.	.	0	0	.		0	0

Appendix F4. (continued)

Species	Total	Overall	CHXO			ISB			CONF	OSB			SCCL			SCCS	TRML			TRMS
	Catch	CPUE	CHNB	POOL	BARS	CHNB	POOL	BARS	CHNB	CHNB	POOL	BARS	CHNB	ITIP	BARS	BARS	CHNB	POOL	BARS	BARS
UIC	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
ULP	2	0.018	.	.	0	.	.	0.036	.	.	.	0	.	.	0	0	.		0	0
		0.026	.	.	0	.	.	0.051	.	.	.	0	.	.	0	0	.		0	0
UNID	5	0.045	.	.	0	.	.	0.055	.	.	.	0.095	.	.	0	0	.		0	0
		0.040	.	.	0	.	.	0.062	.	.	.	0.131	.	.	0	0	.		0	0
UPP	8	0.073	.	.	0.063	.	.	0.073	.	.	.	0.143	.	.	0	0	.		0	0
		0.067	.	.	0.125	.	.	0.071	.	.	.	0.286	.	.	0	0	.		0	0
UTB	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
WSMW	**2**	**0.018**	**.**	**.**	**0**	**.**	**.**	**0.018**	**.**	**.**	**.**	**0.048**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
		0.026	**.**	**.**	**0**	**.**	**.**	**0.036**	**.**	**.**	**.**	**0.095**	**.**	**.**	**0**	**0**	**.**		**0**	**0**
WTBS	2	0.018	.	.	0	.	.	0.018	.	.	.	0.048	.	.	0	0	.		0	0
		0.026	.	.	0	.	.	0.036	.	.	.	0.095	.	.	0	0	.		0	0
YOYF	6	0.055	.	.	0	.	.	0.091	.	.	.	0.048	.	.	0	0	.		0	0
		0.062	.	.	0	.	.	0.119	.	.	.	0.095	.	.	0	0	.		0	0
YWBS	0	0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0
		0	.	.	0	.	.	0	.	.	.	0	.	.	0	0	.		0	0

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			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	POOL	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	POOL	CHNB
BDDR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BHMW	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BKBF	1	0.004	0	0	.	0	0	.	0	0	0.042	.	.	0	0	0	0	.
		0.009	0	0	.	0	0	.	0	0	0.083	.	.	0	0	0	0	.
BKBH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BKCP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BKSS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BLCF	282	1.237	0.813	3.111	.	0.673	1.458	.	0.500	1.400	2.667	.	.	0.750	1.5	1.5	1.5	.
		0.249	0.515	0.969	.	0.289	0.609	.	0	0.860	0.721	.	.	0.500	0	0	1.00	.
BLGL	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BNMW	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BPTM	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BSDR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BTTM	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
BUSK	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
CARP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
CNCF	38	0.167	0.094	0.056	.	0.135	0.167	.	0.250	0.500	0.167	.	.	0.500	1.5	0	0.250	.
		0.062	0.136	0.111	.	0.068	0.142	.	0.500	0.775	0.142	.	.	1.00	0	0	0.500	.
CNLP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		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	0	.
		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	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
FHCF	2	0.009	0	0	.	0	0	.	0	0.200	0	.	.	0	0	0	0	.
		0.012	0	0	.	0	0	.	0	0.245	0	.	.	0	0	0	0	.
FWDM	16	0.070	0	0.111	.	0.029	0.083	.	0	0.700	0.042	.	.	0.250	0	0	0	.
		0.041	0	0.147	.	0.033	0.112	.	0	0.510	0.083	.	.	0.500	0	0	0	.
GDEY	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.

Appendix F5. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	POOL	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	POOL	CHNB
GDFH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
GDRH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
GSCP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
GVCB	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
GZSD	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
HBNS	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
HFCS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
JYDR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
LKSG	7	0.031	0	0.056	.	0	0	.	0	0	0.167	.	.	0	0	0.500	0.250	.
		0.026	0	0.111	.	0	0	.	0	0	0.188	.	.	0	0	0	0.500	.
LNGR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
MQTF	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
NFSH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
NHSK	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
OSSF	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	**0**	**0**	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	**0**	**0**	.
PDFH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
PDSG	**6**	**0.026**	**0**	**0**	**.**	**0.038**	**0**	**.**	**0.500**	**0**	**0**	**.**	**.**	0	0	0	0	**.**
		0.021	**0**	**0**	**.**	**0.037**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	0	0	0	0	**.**
PNMW	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
QLBK	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
RDSN	0	0	0	0	.	0	0	.	0	0	0	.	.	**0**	**0**	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	**0**	**0**	0	0	.
RRDR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
RVCS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
RVSN	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.

Appendix F5. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	POOL	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	POOL	CHNB
SBWB	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SFCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
SFSN	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SGCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
SGER	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
SHRH	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SKCB	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
SMBF	2	0.009	0	0	.	0	0	.	0.500	0	0	.	.	0	0	0	0	.
		0.018	0	0	.	0	0	.	1.00	0	0	.	.	0	0	0	0	.
SNGR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SNPD	3	0.013	0.031	0	.	0.010	0.042	.	0	0	0	.	.	0	0	0	0	.
		0.015	0.063	0	.	0.019	0.083	.	0	0	0	.	.	0	0	0	0	.
SNSG	**1094**	**4.798**	**4.500**	**7.278**	**.**	**3.625**	**4.958**	**.**	**7.500**	**3.800**	**7.125**	**.**	**.**	**1.500**	**0**	**14.5**	**12.25**	**.**
		0.712	**1.525**	**2.667**	**.**	**0.847**	**2.234**	**.**	**2.00**	**5.026**	**2.00**	**.**	**.**	**0**	**0**	**0**	**1.500**	**.**
SNSN	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**0**	**.**
STBS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
STCT	3	0.013	0.031	0.056	.	0.010	0	.	0	0	0	.	.	0	0	0	0	.
		0.015	0.063	0.111	.	0.019	0	.	0	0	0	.	.	0	0	0	0	.
STGR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SVCB	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
SVCP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UAC	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UBF	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UCN	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UCT	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UCY	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
UDR	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.
		0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	0	.

Appendix F5. (continued)

Species	Total Catch	Overall CPUE	CHXO			ISB			CONF	OSB			SCCL			TRML		TRMS
			CHNB	POOL	BARS	CHNB	POOL	BARS	POOL	CHNB	POOL	BARS	CHNB	ITIP	POOL	CHNB	POOL	CHNB
UHY	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
UIC	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
ULP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
UNID	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
UPP	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
UTB	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
WSMW	**0**	**0**	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**0**	**0**	**0**	**.**	**.**
		0	**0**	**0**	**.**	**0**	**0**	**.**	**0**	**0**	**0**	**.**	**.**	**.**	**.**	**.**	**.**	**.**
WTBS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
YOYF	0	0	0	0	.	0	0	.	0	0	0	.	.	0	0	0	.	.
		0	0	0	.	0	0	.	0	0	0	.	.	.	.	.	.	.
YWBS	0	0	0	0	.	0	0	.	0	0	0	.	.	0	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 2013 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
BDDR	0	0.004	0	0.000	0	0
BHMW	0	0.080	0	0.682	0.059	0
BKBF	0.007	0	0	0.000	0	0.004
BKBH	0	0	0	0.009	0	0
BKCP	0	0	0	0.009	0	0
BKSS	0	0	0	0.009	0	0
BLCF	0.975	0.229	0.018	0.009	0.348	1.237
BLGL	0	0	0	0.327	0.007	0
BNMW	0	0	0	0.127	0	0
BPTM	0	0	0	0.036	0	0
BSDR	0	0.010	0	0.000	0.006	0
BTTM	0	0	0	0.018	0	0
BUSK	**0.579**	**0.035**	**0.486**	**0.000**	**0.075**	**0**
CARP	0.018	0	0	0.055	0	0
CNCF	0.025	2.067	0.016	0.545	2.884	0.167
CNLP	0.004	0	0	0.000	0	0
CNSN	0	0.534	0	0.573	0.027	0
ERSN	0	0.058	0	1.845	0.010	0
FHCF	0.014	0.015	0.019	0.027	0	0.009
FWDM	0.036	0.256	0.025	0.400	0.142	0.070
GDEY	0.150	0	0.027	0.000	0.006	0
GDFH	0	0	0	0.009	0	0
GDRH	0.004	0	0	0.000	0	0
GSCP	0.039	0	0.006	0.036	0	0
GVCB	0	0.007	0	0.000	0	0
GZSD	0.025	0	0	0.373	0	0
HBNS	**0**	**0**	**0**	**0.045**	**0**	**0**
HFCS	0	0	0.005	0.000	0	0
JYDR	0	0	0	0.009	0	0
LAB	0	0	0	0.009	0	0
LKSG	0.004	0	0	0.000	0	0.031
LNGR	0.293	0.012	0.037	0.745	0.009	0
MQTF	0	0	0	0.564	0	0

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
NFSH	0	0	0	0	0	0
NHSK	0.004	0	0	0	0	0
OSSF	0	0	0	0.764	0	0
PDFH	0.004	0.061	0	0	0	0
PDSG	**0.018**	**0**	**0.007**	**0**	**0.029**	**0.026**
PNMW	**0**	**0**	**0**	**0.082**	**0**	**0**
QLBK	0.004	0	0.006	0	0	0
RDSN	0	0.070	0	8.618	0.005	0
RRDR	0	0.010	0	0	0	0
RVCS	0.118	0.032	0.010	0.036	0.023	0
RVSN	0	0.009	0	0.009	0	0
SBWB	0.004	0	0	0	0	0
SFCB	0	0.893	0	0.200	3.469	0
SFSN	0	0	0	0.027	0	0
SGCB	**0**	**0.180**	**0**	**0.027**	**0.232**	**0**
SGER	**0.104**	**0**	**0.010**	**0.009**	**0.006**	**0**
SHRH	0.046	0	0	0	0	0
SKCB	**0**	**5.472**	**0**	**0.327**	**2.265**	**0**
SMBF	0.086	0.015	0.112	0.055	0.009	0.009
SNGR	0.050	0	0.007	0.373	0.009	0
SNPD	0.011	0.006	0.006	0	0	0.013
SNSG	**5.268**	**0.838**	**4.341**	**0**	**1.546**	**4.798**
SNSN	**0**	**0.020**	**0**	**0.282**	**0**	**0**
STBS	0.004	0	0	0.018	0	0
STCT	0	0.020	0	0.027	0.029	0.013
STGR	0	0	0	0.009	0	0
SVCB	0	0.174	0	0.055	0.063	0
SVCP	0.050	0.014	0.038	2.264	0.015	0
UAC	0	0	0	0.018	0	0
UBF	0	0	0	0.700	0	0
UCN	0	0	0	0.573	0	0
UCT	0	0	0	0.036	0	0
UCY	0	0.035	0	0.936	0.091	0
UDR	0	0	0	0	0.003	0
UHY	0	0.031	0	0.118	0.259	0
UIC	0	0.194	0	0	0.012	0

Species Code	Sturgeon Season		Fish Community Season			Both Seasons
	Gill Net	Otter Trawl	1.0” Trammel Net	Mini-Fyke Net	Otter Trawl	Trot Lines
ULP	0	0	0	0.018	0	0
UNID	0	0	0	0.045	0	0
UPP	0	0	0	0.073	0.006	0
UTB	0	0.058	0	0	0	0
WSMW	**0**	**0**	**0**	**0.018**	**0**	**0**
WTBS	0	0	0	0.018	0	0
YOYF	0	0	0	0.055	0	0
YWBS	0.004	0	0	0	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 - 2014.

Bend Number	Bend RM	Coordinates Lat	Long	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
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		
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	
9	28.2	38.77747	-90.4775			ST, FC									
10	31.9	38.74226	-90.5096						ST, FC		ST, FC		ST, FC		ST,FC
11	33.9	38.7202	-90.5337				ST, FC					ST			ST,FC
12	37.7	38.6814	-90.5531		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		
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	
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
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
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
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		
49	116.1	38.69553	-91.7456	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									
52	122.3	38.67198	-91.8482								ST, FC		ST, FC		
53	125	38.6476	-91.8858	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	
56	130.2	38.59569	-91.9474				ST				ST, FC				ST,FC