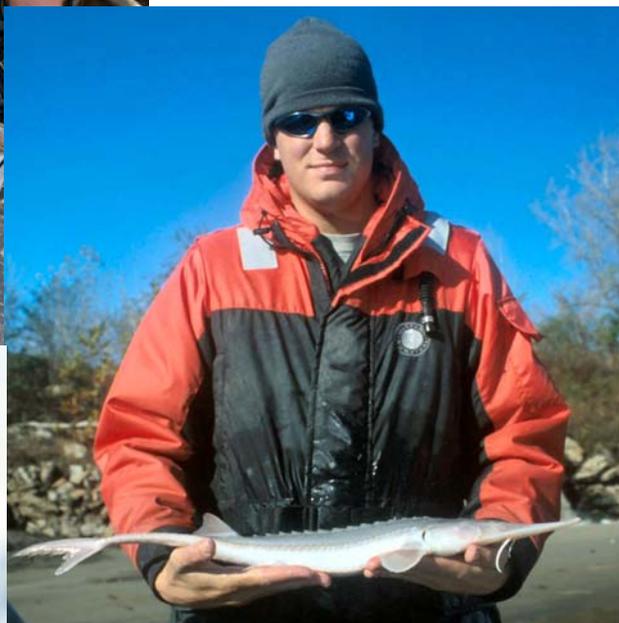


## **2005 Annual Report**

### **Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River: Segment 9**



**Prepared for the U.S. Army Corps of Engineers – Northwest Division**

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## EXECUTIVE SUMMARY

The Nebraska Game and Parks Commission (NGPC) is participating with the U.S. Army Corps of Engineers in the Pallid Sturgeon Population Assessment Project. NGPC and the Missouri Department of Conservation (MDC) sampled segment 9, the reach from the Platte River (River Mile (RM) 595.0) to the Kansas River (RM 367.5).

The sturgeon season started during mid-October when water temperatures fell below 12.7°C and continued until late November, when ice flows started. Sampling then resumed in early March, when ice flows subsided, and continued until 30 June. During the sturgeon season, a total of six hundred and fifty-three samples were completed using gill nets, otter trawls, 1.0" trammel nets and 2.5" trammel nets. The fish community season started 1 July and continued until mid-October when water temperature fell below 12.7°C. During the fish community season, a total of six hundred and fifty samples were completed using otter trawls, 1.0" trammel nets, bag seines and mini-fyke nets.

A total of 15 pallid sturgeon were captured during the 2005 sampling season. Hatchery reared pallid sturgeon recaptures accounted for nine collections while the remaining six were presumed to be wild origin. Hatchery reared pallid sturgeon appeared to retain their PIT tags, while pallid sturgeon assumed to be of wild origin showed no evidence of tagging scars. Therefore, we assume that PIT tag loss from those year classes sampled was minimal. Recaptured hatchery reared pallid sturgeon represented five year classes (1997, 1999, 2001, 2002 and 2003) that have been stocked into RPMA #4. The only year classes stocked but not sampled were 2004 and 2005. Standardized gears collected all of the pallid sturgeon during 2005. Gill nets captured eight fish, 1.0" trammel nets captured five and otter trawls captured two. Bag seines, mini-fyke nets and 2.5" trammel nets did not collect any pallid sturgeon. No young-of-the-year pallid sturgeon were collected with any gear during 2005.

Mean relative condition of recaptured hatchery reared pallid sturgeon was 1.30 at time of stocking but had declined to 0.73 when recaptured. Mean growth per day was 0.272 mm. Pallid sturgeon captures were evenly distributed amongst segment 9 bends, except for the confluence of the Platte and Missouri Rivers where three pallid sturgeon were collected. Most pallid sturgeon (n = 9) were captured on the inside bend channel borders. A total of 3,915 shovelnose sturgeon were captured in 2005: 2,695 with gill nets, 752 with 1.0" trammel nets, 411 with otter trawls

and 56 with 2.5” trammel nets. The ratio of pallid sturgeon to shovelnose sturgeon was 1:261 compared to 1:279 in 2004 and 1:1,076 in 2003.

The Pallid Sturgeon Assessment Team identified eight native species to serve as target species to determine changes in the overall fish community. These target species include: shovelnose sturgeon, sturgeon chubs, sickfin chubs, speckled chubs, sand shiners, *Hybognathus* species, blue suckers and sauger. A total of 3,915 shovelnose sturgeon were captured in 2005. Gill nets collected 68%, followed by 1.0” trammel nets (19%). Otter trawling collected 99 of 100 sturgeon chubs, 206 of 210 sicklefin chubs and 256 of 291 speckled chubs throughout both seasons. Seining and mini-fyke nets continue to be the most effective method to collect sand shiners. Mini-fyke nets (n = 89) and seines (n = 70) collected 96% of all sand shiners. A total of 388 *Hybognathus* species were captured in 2005, seining and mini-fyke nets were the only method that collected *Hybognathus* species. Gill nets sampled almost 50% of all blue suckers during 2005. Only 52 sauger were captured in 2005, most while winter gill netting. A total of 20,179 fish representing 75 species were captured during 2005 in segment 9.

Steffensen, K.D. and A.J. Barada. 2006. 2005 Annual Report, Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River: Segment 9. Nebraska Game and Parks Commission, Lincoln, Nebraska

# TABLE OF CONTENTS

Introduction.....	1
Study Area .....	5
Methods.....	5
Sample site selection and description .....	6
Sampling gear .....	6
Data Collection and Analysis.....	8
Results	
Pallid sturgeon .....	16
Shovelnose X Pallid Sturgeon Hybrids.....	45
Targeted Native River Species	
Shovelnose sturgeon .....	46
Sturgeon chub .....	66
Sicklefin chub .....	73
Speckled chub .....	80
Sand shiner.....	87
<i>Hybognathus</i> spp.....	94
Blue sucker.....	101
Sauger .....	111
Missouri River Fish Community .....	121
Discussion.....	124
Acknowledgments.....	127
References.....	128
Appendices.....	129

## LIST OF TABLES

Table 1. Number of bends sampled, mean effort per bend, and total effort by macrohabitat for segments 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. N-E indicates the habitat is nonexistent in the segment .....14

Table 2. Number of bends sampled, mean effort per bend, and total effort by mesohabitat for segment 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. N-E indicates the habitat is non-existent in the segment.....15

### **Pallid sturgeon**

Table 3. Pallid sturgeon (PDSG) capture summaries relative to habitat type and environmental variables on the Missouri River during 2005. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment .....19

Table 4. Individual pallid sturgeon fork length (mm), weights (g), morphometric character index (CI) (Sheehan et al. 1999), status (H = Hatchery, W = Wild<sup>d</sup>), tags found, elastomer tags (color, position, orientation), if tags were inserted in field, stocking locations, and hatchery information on the Missouri River during 2005 .....21

Table 5. Pallid sturgeon (PDSG) and hybrid pallid X shovelnose sturgeon (SNPD) capture locations and habitat characteristics for segment 9 of the Missouri River during 2005. ID number links pallid sturgeon habitat information with individual fish length, weight, and tagging data in Table 4. Gear codes presented in Appendix C. Habitat definitions and codes presented in Appendix B. ....22

Table 6. Mean fork length, weight, relative condition factor (Kn), and growth rates of hatchery-reared pallid sturgeon by year class at the time of stocking and recapture in 2005 in the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year .....23

Table 7. Relative stock density (RSD)<sup>a</sup> by a length category for wild and stocked pallid sturgeon in the Missouri River captured during 2005. Length categories<sup>b</sup> determined using the methods proposed by Shuman et al. (2006) .....24

Table 8. Ratios of wild pallid sturgeon to shovelnose sturgeon, wild pallid sturgeon to hybrid sturgeon (pallid X shovelnose), and stocked pallid sturgeon to wild pallid sturgeon captured in the Missouri River during 2005 including non-random and wild samples.....25

Table 9. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....34

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....35

Table 11. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....36

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....37

Table 13. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....38

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment .....39

Table 15. Total number of quality and above size (>630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....40

Table 16. Total number of quality and above size (>630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of

the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.....41

**Shovelnose sturgeon**

Table 17. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....56

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....57

Table 19. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....58

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....59

Table 21. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....60

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....61

Table 23. Total number of quality and above size (>380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each

habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment .....62

Table 24. Total number of quality and above size (>380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.....63

Table 25. Relative stock density (RSD)<sup>a</sup> by a length category for shovelnose sturgeon in segment 9 of the Missouri River captured during 2005. Length categories<sup>b</sup> determined using methods proposed by Quist (1998) .....65

### **Sturgeon chub**

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....70

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....71

### **Sicklefin chub**

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....78

### **Speckled chub**

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....84

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....85

**Sand shiner**

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....91

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....92

***Hybognathus* spp.**

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....98

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....99

**Blue sucker**

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....108

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....109

**Sauger**

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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 .....118

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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 .....119

## LIST OF FIGURES

Figure 1a. Map of segment 9 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 9 encompasses the Missouri River from the Platte River (River Mile 595.0) to the Kansas River (River Mile 367.5) .....11

Figure 1b. Distribution of: A) seasonal sampling effort and B) pallid sturgeon captures by river mile for segment 9 in randomly selected bends of the Missouri River during 2005. Sampling effort of 2 indicates bend sampled in both sturgeon and fish community seasons. Sampling effort of 1 indicates bend sampled in only one season. Black bars represent pallid captures during sturgeon season and white bars during fish community season .....18

### **Pallid sturgeon**

Figure 2. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.....28

Figure 3. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.....29

Figure 4. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification .....30

Figure 5. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for 1.0" trammel nets and otter trawls during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification .....31

Figure 6. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.....32

Figure 7. Mean annual catch-per-unit-effort ( $\pm$  2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification .....33

Figure 8. Length frequency of pallid sturgeon during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.....42

Figure 9. Cumulative capture history of wild (black bars) and hatchery reared (white bars) pallid sturgeon collected in segment 9 of the Missouri River from 2003 - 2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification .....43

Figure 10. Cumulative pallid sturgeon length frequency histogram for segment 9 comparing hatchery reared (white bars) and wild (black bars) pallid sturgeon captures from 2003 - 2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.....44

**Shovelnose sturgeon**

Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003 - 2005.....48

Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003 - 2005.....49

Figure 13. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003 - 2005 .....50

Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for 1.0" trammel nets and otter trawls during the fish community season 2003 - 2005....51

Figure 15. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003 - 2005 .....52

Figure 16. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for beam trawls during the fish community season 2003 - 2005.....53

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005 .....64

**Sturgeon chub**

Figure 18. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005. ....67

Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005. ....68

Figure 20. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during fish community season 2003-2005. ....69

Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2004 - 2005. ....72

**Sicklefin chub**

Figure 22. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005. ....74

Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005. ....75

Figure 24. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. ....76

Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.....79

**Speckled chub**

Figure 26. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

.....81

Figure 27. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005. ....82

Figure 28. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. ....83

Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005 .....86

**Sand shiner**

Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005. ....88

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005. ....89

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. ....90

Figure 33. Length frequency of sand shiners in segment 9 of the Missouri River during 2005. ....93

***Hybognathus spp.***

Figure 34. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus spp.* in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005. ....95

Figure 35. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus spp.* in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005. ....96

Figure 36. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus spp.* in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. ....97

Figure 37. Length frequency of *Hybognathus* spp. caught in segment 9 of the Missouri River during summer (fish community season) 2005.....100

**Blue sucker**

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005. ....102

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005. ....103

Figure 40. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005 .....104

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for otter trawls and 1.0" trammel nets during the fish community season 2003-2005 .....105

Figure 42. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005 .....106

Figure 43. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005.....107

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.....110

**Sauger**

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005. ....112

Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005. ....113

Figure 47. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005 .....114

Figure 48. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for otter trawls and 1.0" trammel nets during the fish community season 2003-2005 .....115

Figure 49. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005 .....116

Figure 50. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005.....117

Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005..... 120

## 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, 5 <sup>th</sup> edition. Asterisks and bold type denote targeted native Missouri River species.....	130
Appendix B. Definitions and codes used to classify standard Missouri River habitats in the long-term pallid sturgeon and associated fish community sampling program. Three habitat scales were used in the hierarchical habitat classification system: Macrohabitats, Mesohabitats, and Microhabitats .....	136
Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 9 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for segment 9. ....	137
Appendix D. Stocking locations and codes for pallid sturgeon by Recovery Priority Management Area (RPMA) in the Missouri River Basin.....	138
Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 9 of the Missouri River (RPMA 4).....	139
Appendix F. Total catch, overall mean catch per unit effort ( $\pm 2$ SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 9 of the Missouri River during 2005. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when $N < 2$ . ....	140
Appendix F1. Gill Net: .....	141
Appendix F2. 1 Inch Trammel Net: .....	143
Appendix F3. 2.5 Inch Trammel Net: .....	145
Appendix F4. Otter Trawl: .....	146
Appendix F6. Mini-fyke Net: .....	148
Appendix F7. Bag Seine: .....	152

Appendix G. Hatchery names, locations, and abbreviations .....155

Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2005 for segment 9 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.....156

## Introduction

The pallid sturgeon being native to the Missouri and Mississippi River systems, has evolved with and adapted to large river conditions. Due to population declines, pallid sturgeon (*Scaphirynchus albus*) were federally listed as endangered in 1990. Modification of the pallid sturgeon's habitat by human activities has blocked fish movement, destroyed or altered spawning areas, reduced food sources or ability to obtain food, altered water temperature, reduced turbidity, and changed the hydrograph (USFWS 1993). In response to obvious declines in population and lack of recruitment, the United States Fish and Wildlife Service developed the Biological Opinion on the Operation of the Missouri River Main System Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op) in 2000. This report made recommendations to the U.S. Army Corp of Engineers (USACE) to modify flows of the Missouri River to a more natural regime, to increase pallid sturgeon propagation and augmentation efforts, and to assist and provide funding for a basin-wide pallid sturgeon assessment. In response to the Bi-Op, the USACE formed the Pallid Sturgeon Population Assessment Team with representatives from federal and state agencies and universities. The team developed standard operating procedures (SOP) for long-term pallid sturgeon and associated fish community assessment for the Missouri River. This included creating standard habitat definitions, selecting and describing standard sampling gears thought to be suitable for use in the Missouri River, creating sampling protocols for sampling fish and habitat parameters and developing standard data sheets and reporting procedures.

The 2005 sampling season extended from the fall of 2004 through the fall of 2005 and was divided into two seasons: the sturgeon season and the fish community season. The reason for a split in seasons was that during the sturgeon season, the capture of sturgeon was more efficient due to increased sturgeon movement and the ability to use gill nets, an effective gear for sampling sturgeon when water temperatures permit. The sturgeon season was defined as the period when water temperatures fell below 12.7° C (55° F), until 30 June. While water temperatures were below 12.7° C, experimental gill nets were used, and above

this temperature, three additional gears were fished: 1.0” trammel nets, 2.5 “trammel nets, and otter trawls. Sampling was on the bend level with all bends being randomly selected.

The Pallid Sturgeon Assessment Team selected 8 target species that represent the native warm water benthic fish community (Appendix A). The eight target species are: shovelnose sturgeon *Scaphirhynchus platyrhynchus*, blue sucker *Cycleptus elongatus*, sauger *Stizostedion canadense*, sturgeon chub *Macrhybopsis gelida*, sicklefin chub *Macrhybopsis meeki*, speckled chub *Macrhybopsis aestivalis*, plains minnow *Hybognathus placitus*, and sand shiner *Notropis stramineus*. During the fish community season, these native species including pallid sturgeon are targeted. The fish community season began 1 July and continued until water temperatures dropped below 12.7° C. Four gear types were used during the fish community season: 1” trammel nets, otter trawls, seines and mini-fyke nets. Sampling was on the bend level with all bends being randomly selected. The fish community season is the best time to identify natural reproduction of pallid sturgeon and other native target species. Because sturgeon are less active and gill nets can not be used because of temperature restrictions, efforts focus on sampling the associated fish community, including chubs and minnows, which are more readily sampled during this time. These species serve as indicators of changes for this fish community.

The objectives and measurable hypotheses for the Pallid Sturgeon Population Assessment Team are as follows:

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

- 1.1. H<sub>0</sub>: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.  
H<sub>a</sub>: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.
- 1.2 H<sub>0</sub>: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages remain constant overt time  
H<sub>a</sub>: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages increae or decrease over time.
- 1.3 H<sub>0</sub>: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.

H<sub>a</sub>: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.

- 1.4 H<sub>0</sub>: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time  
H<sub>a</sub>: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages increases or decreases over time.

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

- 2.1 H<sub>0</sub>: Stocked and wild pallid sturgeon use the same habitat during all life stages annually.  
H<sub>a</sub>: Stocked and wild pallid sturgeon do not use the same habitat during all life stages annually.
- 2.2 H<sub>0</sub>: Stocked and wild pallid sturgeon use the same habitat during all life stages over the long term.  
H<sub>a</sub>: Stocked and wild pallid sturgeon do not use the same habitat during all life stages over the long term.

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

- 3.1 H<sub>0</sub>: The population structure of stocked and wild pallid sturgeon remains constant over time.  
H<sub>a</sub>: The population structure of stocked and wild pallid sturgeon changes over time.
- 3.2 H<sub>0</sub>: The population dynamics of stocked and wild pallid sturgeon remain constant over time.  
H<sub>a</sub>: The population dynamics of stocked and wild pallid sturgeon change over time.

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

- 4.1 H<sub>0</sub>: Annual trends in native target species abundance are stable throughout the year.  
H<sub>a</sub>: Annual trends in native target species abundance increase or decrease throughout the year.
- 4.2 H<sub>0</sub>: Annual trends in native target species geographic distribution remains stable throughout the year.  
H<sub>a</sub>: Annual trends in native target species geographic distribution increases or decreases throughout the year.
- 4.3 H<sub>0</sub>: Long-term trends in native target species population abundance are stable over time.

H<sub>a</sub>: Long-term trends in native target species population abundance increases or decreases over time.

- 4.4 H<sub>0</sub>: Long-term trends in the native target species geographic distribution remain constant over time.  
H<sub>a</sub>: Long-term trends in the native target species geographic distribution increases or decreases over time.

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

- 5.1 H<sub>0</sub>: Native target species use the same habitat during all life stages annually.  
H<sub>a</sub>: Native target species do not use the same habitat during all life stages annually.
- 5.2 H<sub>0</sub>: Native target species use the same habitat during all life stages over the long term.  
H<sub>a</sub>: Native target species do not use the same habitat during all life stages over the long term.

**Objective 6.** Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

- 6.1 H<sub>0</sub>: Annual trends in non-target species abundance are stable throughout the year.  
H<sub>a</sub>: Annual trends in non-target species abundance are increasing or decreasing throughout the year.
- 6.2 H<sub>0</sub>: Annual trends in non-target species geographic distribution remains stable throughout the year.  
H<sub>a</sub>: Annual trends in non-target species geographic distribution increases or decreases throughout the year.
- 6.3 H<sub>0</sub>: Long-term trends in non-target species population abundance are stable over time.  
H<sub>a</sub>: Long-term trends in non-target species population abundance increases or decreases over time.
- 6.4 H<sub>0</sub>: Long-term trends in the non-target species geographic distribution remain constant over time.  
H<sub>a</sub>: Long term trends in the non-target species geographic distribution increases or decreases over time.

## **Study Area**

The project area includes the Missouri River from Fort Peck Dam (R.M. 1771.5) to the confluence of the Missouri and Mississippi Rivers (R.M. 0) and the lower reach of the Kansas River from the Johnson County Weir (R.M. 15.4) to the confluence with the Missouri River (R.M. 0.0). The Biological Opinion divided the Missouri River into river and reservoir reaches and categorized these areas as high, moderate or low priority management areas. The areas which were given high priority designation by the Bi-Op for the pallid sturgeon include Segment Area 2 (Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota), Area 8 (Fort Randall Dam, South Dakota to the Mouth of the Niobrara River, Nebraska), and Areas 10 through 15 (Gavins Point Dam, Nebraska/South Dakota to the mouth of the Missouri River at St. Louis, MO).

The Pallid Sturgeon Population Assessment Team identified 14 river segments based on changes in physical attributes such as degrading or aggrading stream bed, flow fluctuation, natural hydrograph, stream gradient, geology, water temperature, turbidity, substrate, discrete habitat changes (tributary or tributary influence) and modifications (presence of restoration projects) (Drobish, 2006). There are also several areas sampled that were not designated as high priority area in the Bi-Op. There are also several areas sampled that were not designated as high priority areas in the Bi-Op. These are being sampled because of known pallid sturgeon use and include the Kansas River from Johnson County Weir to the mouth and Bi-Op Segment Area 9 (Niobrara River, Nebraska to the headwaters of Lewis and Clark Lake Nebraska/South Dakota).

The Nebraska Game and Parks Commission and Missouri Department of Conservation Pallid Sturgeon Population Assessment crews sampled Segment 9, R.M. 595.0 from the confluence of the Platte and Missouri Rivers at Plattsmouth, Nebraska, downstream to R.M. 367.5 to the mouth of the Kansas River (R.M. 367.5) at Kansas City, Missouri (Figure 1a). This 227.5 mile long segment consists of 80 named bends.

## **Methods**

Sampling was conducted in accordance with the current Standard Operating Procedures (Drobish, 2006) established by a panel of representatives from various State and Federal agencies involved with pallid recovery on the Missouri River. Descriptions of these procedures follow.

## **Sampling Site Selection and Description**

Nebraska Game and Parks Commission and Missouri Department on Conservation were contracted to monitor Segment 9 from the confluence of the Platte and Missouri River (R.M. 595.0) downstream to the mouth of the Kansas River (R.M. 367.5). Sixteen bends were randomly selected to be sampled for the sturgeon season while 18 bends were selected for the community season.

The Pallid Sturgeon Assessment Team developed a standard set of habitat classifications for the Missouri River (Appendix B) to describe areas of sampling efforts. These classifications are broken down in to three distinct levels with macrohabitats at the top. Each river bend contains three continuous macrohabitats, main channel outside bend (OSB), main channel inside bend (ISB) and main channel cross over (CHXO). Additional discrete macrohabitats have been identified that may not be present in every bend. These include: large tributary mouth (TRML), small tributary mouth (TRMS), tributary confluence (CONF), large secondary channel-connected (SCCL), small secondary channel-connected (SCCS), tributary (TRIB) and non-connected secondary channel (SCN). Mesohabitats have been established and defined to further classify areas within macrohabitats. Mesohabitat classifications include bars (BARS), pools (POOL), channel borders (CHNB), thalweg (TLWG) and island tips (ITIP). Bars are sandbars or shallow bankline habitat at the area of terrestrial/aquatic interface, where water depth is less than 1.2 m deep. Pools are areas immediately downstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole greater than 1.2 m deep. Channel borders lie along a bankline or sandbar area between the thalweg and the 1.2 m depth interval. Thalweg is the main channel between the channel borders and is the area of maximum depth. Island tips are the areas immediately downstream of a bar or island where two channels converge and water depth is greater than 1.2 m. Microhabitats are used to further describe mesohabitats including unique structural modifications.

## **Sampling Gear**

Gear and methods were developed by the Pallid Sturgeon Assessment Team and described in Missouri River Standard Operating Procedures for Sampling and Data Collection, (Drobish, 2006). Standard gear types and methods used are as follows.

### ***Gill Net***

The standard gill net was a four panel experimental gill net 30.5 m (100 ft.) long with a height of 2.4 m (8 ft.). The standard gill net had four 7.6 m (25 ft.) panels consisting of 38.1 mm (1.5") (Panel 1), 50.8 mm (2.0") (Panel 2), 76.2 mm (3.0") (Panel 3), and 101.6 mm (4.0") (Panel 4) multifilament bar mesh. Twine size was #104 for the 38.1 mm and 50.8 mm panels and #139 for the 76.2 mm and 101.6 mm panels. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg./600 ft.). A double length gill net (61 m or 200 ft.) could be used and consisted of two standard gill nets attached together but counted as twice the effort. Panel numbering continued for 61 m nets, so the second 38.1 mm mesh was panel 5, the second 50.8 mm mesh was panel 6, the second 76.3 mm mesh was panel 7 and the second 101.6 mm mesh was panel 8. The first panel set (38.1 mm (Panel 1) or 101.6 mm mesh (Panel 4 or 8)) was selected randomly and recorded. Gill net samples were overnight sets with a maximum set time of 24 hours.

### ***Otter Trawl***

The standard otter trawl had a width of 4.9 m (16 ft.), height of 0.9 m (3 ft.), and length of 7.6 m (25 ft.). The trawl had an inner mesh (6.35 mm (1/4") bar) and an outer mesh (38.1 mm (1.5") bar, #9 sapphire twine), with a cod-end opening of 406.4 mm (16"). Trawl doors made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") by 381 mm (15"), were used to keep the trawl deployed on the river bottom. A 7.9 m (26 ft.) tickler chain (3.2 mm (0.125") galvanized) was attached to the back corner of the trawl doors and ran approximately three feet in front of the footrope. The tickler chain aided in dragging the river bed and provided some additional protection for the lower mouth of the otter trawl. Otter trawls were fished downstream with the length of the trawl dependent upon the size of the macrohabitat and mesohabitat being sampled. Otter trawl samples covered a minimum of 75 m (246 ft.) and a maximum of 300 m (984 ft.).

### ***1" Trammel Net***

The standard 1" trammel net had a length of 38.1 m (125 ft.), with an inner mesh 2.4 m (8 ft.) deep and two outer walls 1.8 m (6 ft.) deep. The inner mesh was composed of #139 multifilament twine with a bar mesh size of 25.4 mm (1.0"). The outer walls were #9 multifilament twine with a bar mesh size of 203.2 mm (8.0"). The float line was a 12.7 mm

(1/2") foam core and the lead line was 22.7 kg (50 lb.). Trammel nets were drifted a maximum of 300 m and a minimum of 75 m.

### ***2.5" Trammel Net***

The 2.5" trammel net had a length of 38.1m (125 ft.), with an inner mesh 2.4 m (8 ft.) deep and two outer walls 1.8 m (6 ft.) deep. The inner mesh was composed of #208 multifilament twine with a bar mesh size of 63.5 mm (2.5"). The outer walls were #9 multifilament twine with a bar mesh size of 304.8 mm (12.0"). The float line was a 12.7 mm (1/2") foam core and the lead line was 22.7 kg (50 lb.). Trammel nets were drifted a maximum of 300 m and a minimum of 75 m.

### ***Seine***

The standard seine was 9.1 m (30 ft.) long by 1.8 m (6 ft.) high with a bag that measured 1.8 m x 1.8 m x 1.8 m. The seine had 6.4 mm (1/4") ace mesh with a 29.5 kg (65 lb.) lead core line. Seines were pulled upstream in a quarter arc, half arc, or rectangular fashion. The area sample (length and width) was measured to the nearest tenth of a meter using a 100 m (328 ft.) field tape.

### ***Mini-Fyke Net***

The standard mini-fyke net had two rectangular frames (1.2 m (4.0 ft.) by 0.6 m (2.0 ft.)) and two hoops (0.6 m (2.0 ft.)) made of oil tempered spring steel. A 4.5 m (15 ft.) by 0.6 m (2.0 ft.) lead was connected to the second rectangular frame. The mini-fyke net had 3 mm (1/8") ace mesh with a 29.5 kg (65lb.) lead core line. Mini-fyke net samples were overnight sets with a maximum set time of 24 hours.

## **Data Collection and Analysis**

### ***Fish Data Collection***

When a pallid sturgeon was sampled, morphometric measurements were recorded along with pictures, habitat parameters and all tagging information. If the pallid sturgeon had not been previously PIT tagged, a PIT tag was placed in accordance with the protocols. Other target species were measured to the nearest millimeter and weighed to the nearest gram. All non-target species collected were measured to nearest millimeter and released. An exception to this was during the community sampling season, when seine and mini-fyke net samples were preserved in 10% formalin and brought back to the lab for identification. Seine

and mini-fyke net samples were identified to species, stored in 70% alcohol and labeled by species by sample.

### ***Associated Environmental Data***

Habitat samples were collected at the site of every pallid sturgeon capture and were collected at 25% of the remaining sampling sites by mesohabitat. The predetermined parameters for habitat sampling were GPS coordinates (latitude and longitude in decimal degrees), water depth (m), water velocity ((mps) at bottom, 0.2, and 0.8 of water column), water temperature (°C), turbidity (NTU) and a sediment profile (based on percent of gravel, sand and silt).

### ***Genetic Validation***

Collection methods, including the handling of pallid sturgeon, conformed with methods described in Biological Procedures and Protocol for Collecting, Tagging, Sampling, Holding, Culture, Transporting, and Data Recording for Researchers and Managers Handling Pallid Sturgeon (Krentz 2005). Fin clips for DNA analysis were taken from pallid sturgeon and suspected hybrids and sent to William Ardren at the Abernathy Fish Technology Center for validation.

### ***Analyses***

All datasheets were checked and submitted to Yan Hong and staff of the Missouri Department of Conservation. All data was processed and analyzed using Microsoft Access and figures were generated via SigmaPlot. After receiving the analyzed data, verification was conducted using Microsoft Access and SAS.

### ***Catch per Unit Effort***

All fish collections are reported as catch per unit effort (CPUE) with the associated standard error. CPUE for gill nets is reported as the number of fish per 100 feet gill net-night. CPUE for otter trawls are reported as number of fish per 100 linear meters trawled. CPUE for trammel nets is reported as number of fish per 100 meters drifted. CPUE for mini-fyke nets are reported as number of fish per net-night. CPUE for seining is reported as number of fish per 100 meters squared seined. CPUE is calculated for each subsample instead of overall catch per overall effort in order to get a measure of variance. These individual CPUEs are then averaged to get a total CPUE for an individual gear, bend or segment.

### ***Character Index***

Pallid sturgeon, shovelnose sturgeon and hybrids can be distinguished using meristic and morphometric characteristics. Sheehan et al. (1999) developed the character index (CI) using two meristics (dorsal and anal fin ray counts) and five morphometric ratios. This equation categorized *Scaphirhynchus* specimens into three categories. Character index values for pallid sturgeon range from -1.48 to -0.09, hybrid sturgeon from -0.45 to 0.51 and shovelnose sturgeon from 0.37 to 1.33.

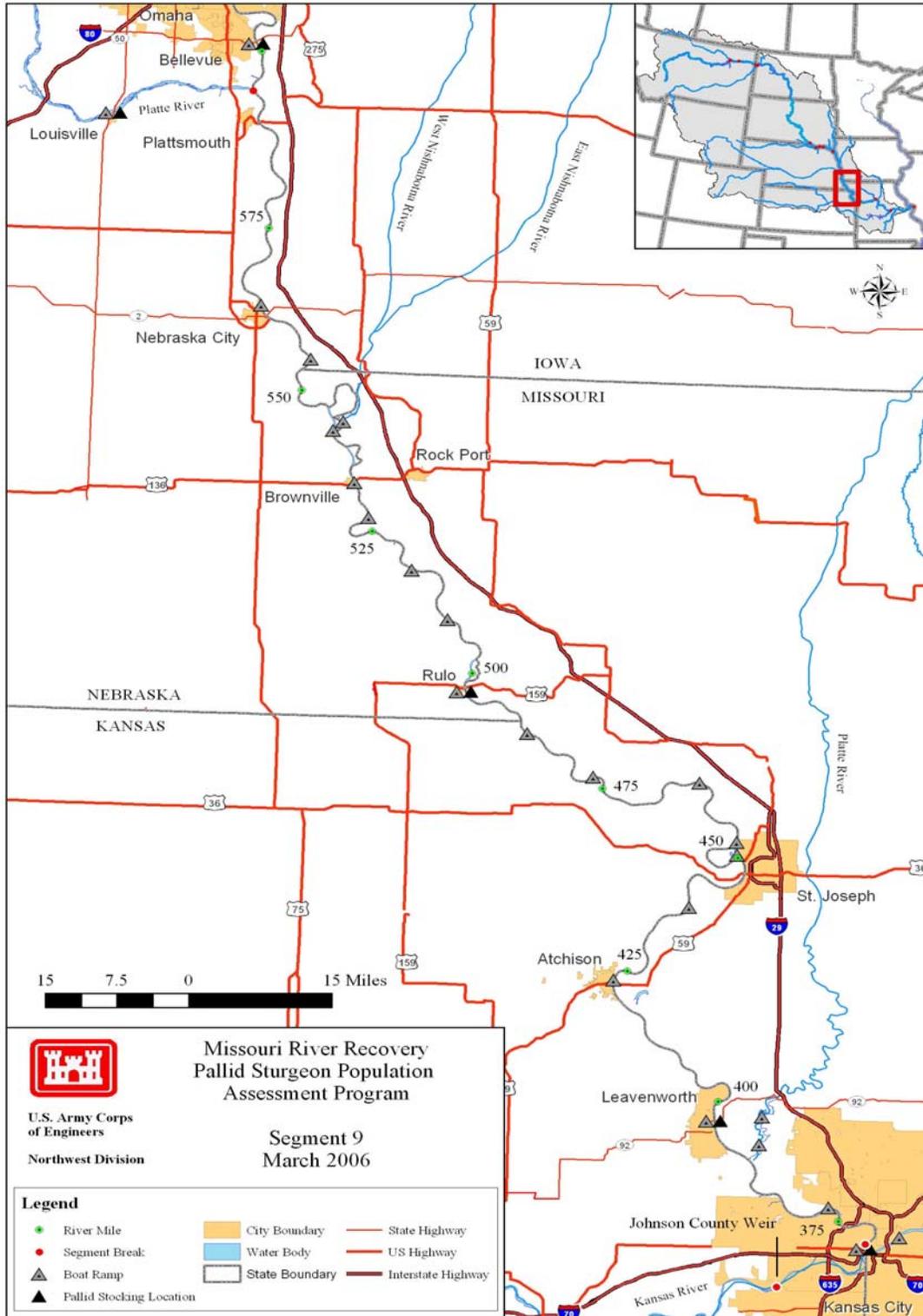
### ***Relative Condition***

The relative condition of recaptured hatchery reared pallid sturgeon was calculated using the formula  $Kn = (W / W')$ , 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. Keenlyne and Evanson (1993) provided a weight-length regression ( $\log_{10}W = -6.378 + 3.357 \log_{10}L$  ( $r^2 = 0.9740$ )) for pallid sturgeon throughout its range which was used to calculate a relative condition factor.

### ***Relative Stock Densities***

A length frequency index can be used to determine changes in a population structure. Length categories were based on the percentage of the largest known pallid sturgeon are as followed (Gablehouse 1984): sub-stock fork length < 330 mm (20%), stock fork length = 330 – 629 mm (20 – 36%), quality fork length = 630 – 839 mm (36 - 45%), preferred fork length = 840 – 1039 mm (45 – 59%), memorable fork length = 1040 – 1269 mm (59 – 74%) and trophy fork length > 1270 mm (> 74%). Length categories based on the percentage of the largest known shovelnose sturgeon are as follows: sub-stock fork length < 250 mm (20%), stock fork length = 250 – 379 mm (20 – 36%), quality fork length = 380 – 509 mm (36 - 45%), preferred fork length = 510 – 639 mm (45 – 59%), memorable fork length = 640 – 809 mm (59 – 74%) and trophy fork length > 810 mm (> 74%). Proportional Stock Density (PSD) is proportion of fish of quality size in a stock. Relative Stock Density (RSD) is the proportion of fish of a size group in a stock.

Figure 1a. Map of segment 9 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 9 encompasses the Missouri River from the Platte River (River Mile 595.0) to the Kansas River (River Mile 367.5).



## Results

### Effort

The 100' and 200' standard gill nets have been used since this project started in March of 2003 and were only used during the sturgeon season due to temperature restrictions. Gill nets were set on the CHNB and POOL mesohabitats within the OSB, ISB, CHXO, SCCL, and CONF macrohabitats (Tables 1 and 2). A total of 365 net nights of effort were expended with gill nets in segment 9 during 2005.

The standard 16' otter trawl has been used since this project started in March of 2003 and was used during the sturgeon season and the fish community season. Otter trawls were used to sample the CHNB mesohabitat within the ISB, CHXO, TRML, TRIB and CONF macrohabitats. A total of 348 otter trawl samples were collected in segment 9 during 2005 covering 55,043 meters. Effort for the sturgeon season was the equivalent of 265.4 one hundred meter trawl deployments compared to 284.9 for the fish community season.

The standard 1.0" trammel nets have been used since this project started in March of 2003 and were used during the sturgeon season and the fish community season. One inch trammel nets were used to sample the CHNB mesohabitat within the ISB, CHXO, TRML, TRIB and CONF macrohabitats. A total of 359 trammel net drifts were conducted in segment 9 during 2005 covering 38,967 meters. Effort for the sturgeon season was the equivalent of 183.9 one hundred meter trammel net deployments compared to 205.7 for the fish community season.

During the 2005 sampling season, the standard 2.5" trammel nets were developed into the project design for the sturgeon season. These trammel nets were used to sample the CHNB mesohabitat within the ISB, CHXO and TRML macrohabitat. A total of 98 trammel net drifts were conducted in segment 9 during 2005 covering 9,008 meters, resulting in an effort of 90.08 one hundred meter trammel net deployments.

The standard bag seine has been used since this project started in March of 2003 and was used during the fish community season. Seines were used to sample the BARS mesohabitat within the OSB, ISB, CHXO, TRML, CONF, TRIB and TRMS macrohabitats. A total of 152 seine samples were collected in segment 9 during 2005 resulting in an effort of 146.42 one hundred meter squared seine hauls.

The standard mini-fyke net has been used since this project started in March of 2003 and was used during the fish community season. Mini-fyke nets were used to sample the BARS mesohabitat within the OSB, ISB, CHXO, TRML, CONF, TRIB and TRMS macrohabitats. A total of 146 mini-fyke sets were made in segment 9 during 2005 resulting in an effort of 146 net-nights.

Table 1. Number of bends sampled, mean effort per bend, and total effort by macrohabitat for segment 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean effort	Macrohabitat														
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD	
<b>Fall through Spring - Sturgeon Season</b>																	
<b>1 Inch Trammel Net</b>	23	8.0	N-E	42.8	8.4	N-E	N-E	127.3				N-E		5.6			
<b>2.5 Inch Trammel Net</b>	14	6.4		22.7				62.2						5.3			
<b>Gill Net</b>	16	22.8		74.0	22.0			238.0	23.0	8.0							
<b>Otter Trawl</b>	21	12.6		56.4	18.0			180.5							10.6		
<b>Beam Trawl</b>	Not a standard gear in segment 9																
<b>Summer – Fish Community Season</b>																	
<b>1 Inch Trammel Net</b>	20	10.3	N-E	56.2	4.5	N-E	N-E	144.2				N-E	0.8				
<b>Bag Seine</b>	18	8.1		45.6	2.0			74.4	9.4					10.1	3.7	1.1	
<b>Mini_Fyke Net</b>	18	8.1		42.0	2.0			84.0	7.0					8.0	2.0	1.0	
<b>Otter Trawl</b>	19	15.0		67.8	4.4			201.6						8.4	2.8		
<b>Beam Trawl</b>	Not a standard gear in segment 9																

Table 2. Number of bends sampled, mean effort per bend, and total effort by mesohabitat for segment 9 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2005. Effort is defined as net nights for gill and mini-fyke nets, 100 m drifted for trammel nets and trawls, and 100 m squared for bag seines. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean effort	Mesohabitat					
			BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Fall through Spring – Sturgeon Season</b>								
<b>1Inch Trammel Net</b>	23	8.0		184.0	N-E	N-E		
<b>2.5 Inch Trammel Net</b>	14	6.4		90.1				
<b>Gill Net</b>	16	22.8		116.0			249.00	
<b>Otter Trawl</b>	21	12.6		265.4				
<b>Beam Trawl</b>	Not a standard gear in segment 9							
<b>Summer – Fish Community Season</b>								
<b>1 Inch Trammel Net</b>	20	10.3		205.7	N-E	N-E		
<b>Bag Seine</b>	18	8.1	146.4					
<b>Mini-Fyke Net</b>	18	8.1	146.0					
<b>Otter Trawl</b>	19	15.0		285.0				
<b>Beam Trawl</b>	Not a standard gear in segment 9							

## **Pallid Sturgeon**

A total of 15 pallid sturgeon were sampled in segment 9 during the 2005 sampling season. Nine of the fish were of known hatchery origin while six were deemed wild because of the absence of tags or evidence of tagging scars. Sturgeon season was the most productive for pallid captures with thirteen fish sampled compared to two during the fish community season.

Pallid sturgeon were captured throughout segment 9 ranging from the confluence of the Platte and the Missouri Rivers (RM 595.0) downstream to Leavenworth bend (RM 395.5) (Figure 1b). Three pallid sturgeon were sampled from Upper Plattsmouth bend (RM 595.0) during the sturgeon season. No other single bend had more than two pallid sturgeon sampled from it in 2005.

Pallid sturgeon were captured in the inside bend macrohabitat ( $n = 11$ ) more frequently than any other macrohabitat sampled in segment 9 in 2005 (Table 3). The confluence macrohabitat yielded two pallid sturgeon while the outside bend and channel cross-over macrohabitat each produced one pallid sturgeon. Within the inside bend, channel border mesohabitat efforts caught the most pallid sturgeon ( $n = 9$ ). Pallid sturgeon were sampled at depths, velocities, and temperature and turbidity levels similar to average area sampled, except for two pallid sturgeon that were collected from inside pools. The mean sampling depth for the two pallid sturgeon collected from inside bend pools was 3.5 m compared to the mean collection depth of 6.4 m. However due to low catch rates, preferred habitat parameters can not be determined.

The mean morphometric character index for wild pallid sturgeon sampled in segment 9 during 2005 was -1.68 with a range of -0.63 to -2.45 (Table 4). Genetic samples were taken from all wild or suspected wild pallid sturgeon and submitted to Abernathy Fish Technology Center for wild / hatchery origin verification. Recaptured hatchery reared pallid sturgeon were traced back to hatchery origin using their PIT tags and electromere color combinations. Garrison Dam National Fish Hatchery produced the majority of hatchery recaptured pallid sturgeon ( $n = 5$ ), followed by Gavin's Point National Fish Hatchery ( $n = 2$ ) and Neosho National Fish Hatchery ( $n = 1$ ). Five year classes (1997, 1999, 2001, 2002 and 2003) were represented in the 2005 hatchery recaptures. The two most recent year classes

(2004 and 2005) were not collected. Stocking sites ranged from Mulberry Bend, NE (RM 775.0) to Booneville, MO (RM 195.1).

The mean temperature for pallid sturgeon collected during gill netting season was 9.4°C and ranged from 5 to 12.5°C (Table 5). Turbidity ranged from 34 to 362 NTU and had a mean of 118 NTU. The overall average depth that pallid sturgeon were collected was 2.98 meters with an average bottom velocity of 0.41 meter per second. Sand was the dominate substrate type in percent composition ranging from 50% to 100%. Gravel was present during three pallid sturgeon captures ranging in percent composition from 5% to 50%.

Relative condition factor (Kn) for all hatchery reared pallid sturgeon has declined since stocking (Table 6). However, all recaptured pallid sturgeon appeared healthy.

The PSD value for wild and hatchery reared pallid sturgeon was 67 during the sturgeon season (Table 7). The RSD preferred value was 33 and RSD memorable was 17 for wild pallid sturgeon compared to zero for hatchery reared pallid sturgeon. PSD and RSD values could not be calculated during the fish community season due to lack of fish collected.

A total of 3,947 river sturgeon were collected during 2005. This results in a pallid sturgeon to shovelnose sturgeon ratio of 1:261 (Table 8) and a wild pallid sturgeon to shovelnose sturgeon ratio of 1:653. Three hybrids were sampled, resulting in a ratio of 2:1 wild pallid sturgeon to hybrid sturgeon. Since the origin of this project, the ratio of pallid to shovelnose sturgeon has declined. This can be contributed to a positive influence from the hatchery stocking programs.

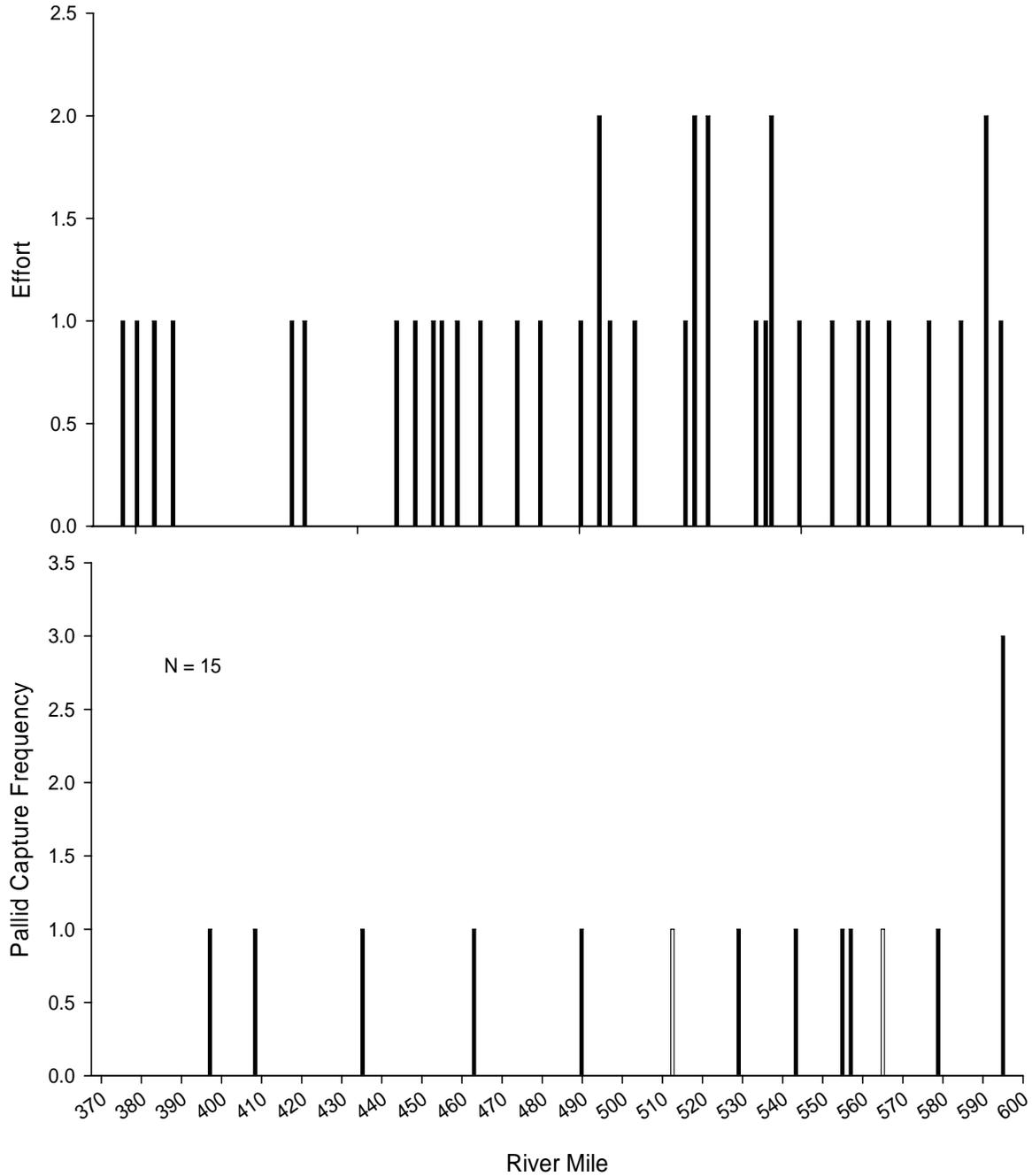


Figure 1b. Distribution of: A) seasonal sampling effort and B) pallid sturgeon captures by river mile for segment 9 in randomly selected bends of the Missouri River during 2005. Sampling effort of 2 indicates bend sampled in both sturgeon and fish community seasons. Sampling effort of 1 indicates bend sampled in only one season. Black bars represent pallid captures during sturgeon season and white bars during fish community season.

Table 3. Pallid sturgeon (PDSG) capture summaries relative to habitat type and environmental variables on the Missouri River during 2005. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

	OSB					ISB				
	BAR	POOL	CHNB	TLWG	ITIP	BAR	POOL	CHNB	TLWG	ITIP
<b>Depth (m) (Effort)</b>	0.6 (0.3-1.1)	2.9 (1.8-4.9)				0.7 (0.1-1.2)	3.5 (0.9-11.0)	2.4 (1.2-10.1)		
<b>Depth (m) (Catch)</b>		2.7 (2.7-2.7)					6.4 (1.7-11.0)	2.6 (1.6-3.9)		
<b>Velocity (m/s) (Effort)</b>	0.04 (0.02-0.08)	0.25 (0.05-0.98)				0.14 (0.00-1.10)	0.39 (0.03-0.68)	0.47 (0.03-1.20)		
<b>Velocity (m/s) (Catch)</b>		0.17 (0.17-0.17)					0.40 (0.23-0.58)	0.54 (0.35-0.81)		
<b>Temp. °C (Effort)</b>	23.5 (20.5-29.0)	11.2 (5.0-12.0)				25.9 (14.9-30.0)	10.9 (5.0-13.8)	20.4 (5.0-30.0)		
<b>Temp. °C (Catch)</b>		12.0 (12.0-12.0)					8.8 (5.0-12.5)	18.9 (8.0-28.5)		
<b>Turbidity (ntu) (Effort)</b>	86 (46-106)	42 (34-83)				91 (43-504)	56 (30-100)	149 (30-947)		
<b>Turbidity (ntu) (Catch)</b>		34 (34-34)					71 (68-74)	141 (65-362)		
<b>Total Pallids caught</b>		1					2	9		
	CHXO					SCCL				
	BAR	POOL	CHNB	TLWG	ITIP	BAR	POOL	CHNB	TLWG	ITIP
<b>Depth (m) (Effort)</b>	0.7 (0.1-1.3)	2.8 (1.2-5.9)	2.7 (1.2-5.7)				2.9 (1.5-3.5)			
<b>Depth (m) (Catch)</b>		2.4 (2.4-2.4)								
<b>Velocity (m/s) (Effort)</b>	0.03 (0.00-0.15)	0.23 (0.00-0.45)	0.45 (0.01-1.21)							
<b>Velocity (m/s) (Catch)</b>		0.16 (0.16-0.16)								
<b>Temp. °C (Effort)</b>	25.7 (15.2-31.0)	11.1 (5.0-13.8)	21.2 (5.0-29.3)				12.9 (11.8-13.8)			
<b>Temp. °C (Catch)</b>		10 (10.0-10.0)								
<b>Turbidity (ntu) (Effort)</b>	118 (24-275)	70 (30-99)	129 (30-936)				86 (81-88)			
<b>Turbidity (ntu) (Catch)</b>		46 (46-46)								
<b>Total Pallids caught</b>		1								

Table 3 (continued).

	TRIB					TRML				
	BAR	CHNB	BAR	POOL	CHNB	BAR	POOL	CHNB	TLWG	ITIP
<b>Depth (m) (Effort)</b>	0.5 (0.3-1.1)	1.4 (1.2-2.0)				0.9 (0.5-0.9)		2.3 (1.2-3.2)		
<b>Depth (m) (Catch)</b>										
<b>Velocity (m/s) (Effort)</b>	0.01 (0.00-0.02)	0.49 (0.29-0.65)				0.03 (0.03-0.17)		0.37 (0.08-0.52)		
<b>Velocity (m/s) (Catch)</b>										
<b>Temp. °C (Effort)</b>	22.2 (22.0-23.0)	28.4 (22.2-28.5)				26.5 (26.5-26.5)		18.2 (15.9-25.0)		
<b>Temp. °C (Catch)</b>										
<b>Turbidity (ntu) (Effort)</b>	47 (47-47)	111 (111-111)				70 (70-70)		180 (150-228)		
<b>Turbidity (ntu) (Catch)</b>										
<b>Total Pallids caught</b>										
	TRMS					CONF				
	BAR	POOL	CHNB	TLWG	ITIP	BAR	POOL	CHNB	TLWG	ITIP
<b>Depth (m) (Effort)</b>	0.7 (0.5-1.2)					1.1 (0.4-1.2)	2.6 (1.4-4.7)	2.4 (1.4-4.4)		
<b>Depth (m) (Catch)</b>							2.1 (2.1-2.1)	1.4 (1.4-1.4)		
<b>Velocity (m/s) (Effort)</b>	0.00 (0.00-0.00)					0.05 (0.04-0.32)	0.20 (0.16-0.53)	0.30 (0.03-0.94)		
<b>Velocity (m/s) (Catch)</b>							0.16 (0.16-0.16)	0.03 (0.03-0.03)		
<b>Temp. °C (Effort)</b>	23.4 (23.0-23.6)					26.5 (26.5-26.5)	7.8 (6.0-12.5)	13.1(10.0-25.0)		
<b>Temp. °C (Catch)</b>							6.0 (6.0-6.0)	11.0 (11.0-11.0)		
<b>Turbidity (ntu) (Effort)</b>	51 (51-51)					102 (102-102)	72 (65-85)	86 (67-196)		
<b>Turbidity (ntu) (Catch)</b>							75 (75-75)	67 (67-67)		
<b>Total Pallids caught</b>							1	1		

Table 4. Individual pallid sturgeon fork length (mm), weights (g), morphometric character index (CI) (Sheehan et al. 1999), status (H = Hatchery, W = Wild<sup>d</sup>), tags found, elastomer tags (color, position, orientation), if tags were inserted in field, stocking locations, and hatchery information on the Missouri River during 2005.

ID	Recapture Data							Stocking Data					
	FL (mm)	Wt (g)	CI	Status	Tags found <sup>a</sup>	Elastomer <sup>b</sup>	Marked in field?	Year class	FL (mm)	Wt (g)	Site	Source <sup>c</sup>	Stocking Date
NE-1-9-1924-1	726	1518	-2.01	H	P,E	Red-L,R-V	no	1997			Platte River	Gavin's Point	
NE-1-9-1941-1	631	794	-1.43	H	P		no	2001	220		Booneville	Garrison	4/11/2002
NE-1-9-1952-1	707	1278	-0.54	H	P		no						
NE-1-9-2032-1	711	1124	-1.27	W			yes						
NE-1-9-2040-23	981	3986	-1.50	W			yes						
NE-1-9-2049-1	648	908	-2.59	H	P		no	1999	427	248	Booneville	Gavin's Point	4/25/2002
NE-1-9-2080-1	742	1422	-2.45	W	P		yes						
NE-1-9-2168-26	451	324	-0.63	W			No						
NE-1-9-2210-1	371	174	-0.88	H	P,E	Yellow-L,Pink-R,V	no	2002	233	70	Mulberry Bend, NE	Neosho	10/30/2003
NE-1-9-2351-2	576	650	-0.89	W			yes						
NE-1-9-2366-6	239			H	P,E	Yellow-H	no	2003	168	26	Bellevue, NE	Garrison	7/8/2004
NE-1-9-2452-1	370	132	-1.10	H	P		no	2001	180		Mulberry Bend, NE	Garrison	4/11/2002
NE-1-9-2471-10	1060	4192	-2.29	W			yes						
NE-1-9-2617-2	377	138	-0.85	H	P	Yellow-H	no	2003	282	88	Bellevue, NE	Garrison	7/8/2004
MO-1-9-37-1	380	188	-0.32	H	E,P	Yellow-H	no	2003	245		Leavenworth	Garrison	7/8/2004

<sup>a</sup> Tag types include: coded wire tag (C), elastomer tag (E) and passive induced transponder tag, i.e. PIT tag (P).

<sup>b</sup> Positions and orientations listed after each color can include: fish's right (R), fish's left (L), center of rostrum (C), vertical (V), and horizontal (H).

<sup>c</sup> Hatchery sources: source abbreviations reported in Appendix G.

<sup>d</sup> All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Table 5. Pallid sturgeon (PDSG) and hybrid pallid X shovelnose sturgeon (SNPD) capture locations and habitat characteristics for segment 9 of the Missouri River during 2005. ID number links pallid sturgeon habitat information with individual fish length, weight, and tagging data in Table 4. Gear codes presented in Appendix C. Habitat definitions and codes presented in Appendix B.

Species	ID#	Date	Gear	River			Water Temp (°C)	Turb <sup>a</sup> (NTU)	Depth <sup>b</sup> (m)	Bottom velocity (m/s)	Substrate <sup>c</sup> (silt/sand/gravel)	
				Mile	Macro-	Meso-						Micro-
PDSG	NE-1-9-1924-1	10/18/2004	GN18S	594.8	CONF	CHNB	622300	11.0	67	1.4	0.03	0 / 100 / 0
PDSG	NE-1-9-1941-1	11/3/2004	GN18S	395.5	OSB	POOL	211140	12.0	34	2.7	0.17	0 / 100 / 0
PDSG	NE-1-9-1952-1	11/15/2004	GN81S	594.8	CONF	POOL	622300	6.0	75	2.1	0.16	0 / 100 / 0
PDSG	NE-1-9-2040-23	11/22/2004	GN18S	555.0	CHXO	POOL	211140	10.0	46	2.4	0.16	0 / 95 / 5
PDSG	NE-1-9-2049-1	3/2/2005	GN18S	435.2	ISB	POOL	211140	5.0	74	11	0.23	0 / 100 / 0
PDSG	NE-1-9-2032-1	3/9/2005	GN81S	407.5	ISB	CHNB	211310	8.0	90	1.9	0.35	0 / 100 / 0
PDSG	NE-1-9-2080-1	3/31/2005	GN18S	542.8	ISB	CHNB	412310	11.0	65	2.3	0.50	0 / 100 / 0
PDSG	NE-1-9-2168-26	4/6/2005	GN81S	592.0	ISB	POOL	221140	12.5	68	1.7	0.58	0 / 100 / 0
PDSG	NE-1-9-2210-1	5/9/2005	OT16S	460.0	ISB	CHNB	221310	17.0	77	2.7	0.52	0 / 100 / 0
PDSG	NE-1-9-2351-2	5/19/2005	TNS	489.6	ISB	CHNB	231310	17.2	362	3.9	0.70	0 / 100 / 0
PDSG	NE-1-9-2366-6	5/23/2005	TNS	556.1	ISB	CHNB	221310	21.3	149	2.4	0.51	0 / 100 / 0
PDSG	NE-1-9-2471-10	5/27/2005	TNS	578.6	ISB	CHNB	221310	19.8	97	1.6	0.81	0 / 95 / 5
PDSG	NE-1-9-2452-1	6/1/2005	OT16S	529.0	ISB	CHNB	221310	19.0	180	3.1	0.50	0 / 70 / 30
PDSG	MO-1-9-37-1	7/12/2005	TNS	509.8	ISB	CHNB	221330	28.5	101	2.9	0.38	0 / 100 / 0
PDSG	NE-1-9-2617-2	7/19/2005	TNS	564.2	ISB	CHNB	221330	28.3	151	2.6	0.56	0 / 50 / 50
SNPD	NE-1-9-2069-22	3/9/2005	GN18S	407.2	ISB	POOL	211140	8.0	43	9.1	0.38	0 / 100 / 0
SNPD	MO-1-9-235-1	8/1/2005	TNS	457.0	ISB	CHNB	222310	27.0	91	1.8	0.36	0 / 100 / 0
SNPD	MO-1-9-389-1	9/13/2005	OT16S		ISB	CHNB	211320	26.6		3.3		-

<sup>a</sup>Turb = turbidity.

<sup>b</sup>Depths presented are the average of the starting, middle, and ending depths measured during gear deployment.

<sup>c</sup>Substrates are percents determined visually and by feel in the field.

Table 6. Mean fork length, weight, relative condition factor (Kn), and growth rates of hatchery-reared pallid sturgeon by year class at the time of stocking and recapture in 2005 in the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stocking Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Growth (mm/d)	Growth (g/d)
1997	1				726	1518	0.90		
	S.E.				-	-	-		
1998	No pallid sturgeon were stocked into RPMA # 4								
1999	1	427	248	0.88	648	908	0.79	0.21	0.60
	S.E.	-	-	-	-	-	-	-	-
2000	No pallid sturgeon were stocked into RPMA # 4								
2001	2	200			501	463	0.75	0.30	
	S.E.	40			261	662	0.01	0.27	
2002	1	233	70	1.89	371	174	0.98	0.25	0.10
	S.E.	-	-	-	-	-	-	-	-
2003	3	232	57	1.68	332	163	0.86	0.28	0.10
	S.E.	67	62	0.85	93	50	0.24	0.09	
2004	0								
2005	0								

Table 7. Relative stock density (RSD)<sup>a</sup> by a length category for wild and stocked pallid sturgeon in the Missouri River captured during 2005. Length categories<sup>b</sup> determined using the methods proposed by Shuman et al. (2006).

Length Category	Wild <sup>c</sup>		Stocked	
	N	RSD	N	RSD
<b>Sturgeon Season</b>				
Sub-stock (0-199)				
Sub-stock (200-329)			1	
Stock	6		6	
Quality	4	67	4	67
Preferred	2	33		
Memorable	1	17		
Trophy				
<b>Fish Community Season</b>				
Sub-stock (0-199)				
Sub-stock (200-329)				
Stock			2	
Quality				
Preferred				
Memorable				
Trophy				

<sup>a</sup> RSD = number of fish of a specified length ÷ number minimum stock length fish x 100.

<sup>b</sup> Length categories based on the percentage of the largest known pallid sturgeon: Sub-stock FL < 330 mm (20 %), Stock FL = 330 - 629 mm (20 - 36 %), Quality FL = 630 - 839 mm (36 - 45 %), Preferred FL = 840 - 1039 mm (45 - 59 %), Memorable FL = 1040 - 1269 mm (59 - 74 %), Trophy FL > 1270 mm (>74 %).

<sup>c</sup> All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

Table 8. Ratios of wild pallid sturgeon to shovelnose sturgeon, wild pallid sturgeon to hybrid sturgeon (pallid X shovelnose), and stocked pallid sturgeon to wild pallid sturgeon captured in the Missouri River during 2005 including non-random and wild samples.

Year	All Pallids : Shovelnose	Wild* Pallids: Shovelnose	Wild* Pallids: Hybrids	Stocked Pallids: Wild* Pallids
2003	1 : 1076	1 : 1616	2 : 0	1 : 2
2004	1 : 279	1 : 613	5 : 1	6 : 5
2005	1 : 261	1 : 653	2 : 1	1.5 : 1

\* All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

### *Year comparisons, Gear evaluation and Habitat associations*

A total of 15 pallid sturgeon were captured in gill nets (n = 8), 1.0" trammel nets (n = 5), and otter trawls (n = 2) during the 2005 sampling season. Catch per unit effort of wild pallid sturgeon for gill netting during the sturgeon season decreased from 0.02 fish per net night in 2004 to 0.01 fish per net night in 2005 (Figure 2). Catch per unit effort of hatchery reared pallid sturgeon for gill netting during the sturgeon season increase from 0.003 fish per net night in 2004 to 0.01 fish per net night in 2005. No wild pallid sturgeon were collected when otter trawling during the sturgeon season during 2004 and 2005 and only one fish was collected during the 2003 sampling season. The 2005 sturgeon season marked the first time a hatchery reared pallid sturgeon was collected when otter trawling during the sturgeon season. Catch per unit effort of hatchery reared pallid sturgeon for 1.0" trammel nets decreased during the sturgeon season from 0.016 fish per 100 m drifted during 2004 to 0.006 fish per 100 m drifted in 2005 (Figure 3). No pallid sturgeon were collected when drifting the 2.5" trammel net during the 2005 sturgeon season. Beam trawls were not a standard gear in 2005 (Figure 4)

In 2005, two hatchery reared pallid sturgeon were collected while 1.0" trammel netting resulting in a CPUE of 0.01 fish per 100 m drifted, the same as in 2004 (Figure 5). Beam trawls were not a standard gear in 2005 (Figure 6). Mini-fyke nets and bag seines have never collected any pallid sturgeon (Figure 7).

No sub-stock (0 – 199 mm) pallid sturgeon were collected during the 2005 sampling season (Tables 9 and 10). One sub-stock (200 – 329 mm) pallid sturgeon was collected during the sturgeon season while drifting 1.0" trammel nets on the inside bend channel border (Tables 11 and 12). Six stock size (330 – 629 mm) pallid sturgeon were sampled during 2005, with four collected during the sturgeon season. All stock size pallid sturgeon were collected on the inside channel border, except for one pallid sturgeon that was collected in an inside bend pool while gill netting (Tables 13 and 14). Eight quality and above size (> 630 mm) pallid sturgeon were sampled during 2005, with all being collected during the sturgeon sampling season. Seven pallid sturgeon were captured during gill netting efforts from four macrohabitats: inside bends (n = 3), confluence (n = 2), channel cross-overs (n = 1) and outside bends (n = 1) (Table 15). Four fish were sampled in pool mesohabitats and three were sampled in channel border mesohabitats. One inch trammel nets collected the

remaining pallid sturgeon sampled during the sturgeon season and it was collected on an inside bend channel border (Table 16).

A total of 15 pallid sturgeon were measured during 2005, with 13 being sampled during the sturgeon season (Figure 8). The average fork length was 631.7 mm during the sturgeon season compared to 378.5 for the fish community season. The length range for pallid sturgeon sampled during the sturgeon season was 239 to 1,060 compared to 377 to 380 for the fish community season.

Since this project began, 29 pallid sturgeon have been collected and the number collected has increased each year. During the 2003 sampling season three fish were collected (Wild = 2 and Hatchery = 1), in 2004 eleven fish were collected (Wild = 6 and Hatchery = 5) and 15 fish during 2005 (Wild = 6 and Hatchery = 9) (Figure 9). From 2003 to 2005, the average fork length was 838.8 mm for wild pallid sturgeon compared to 443.3 mm for hatchery reared pallid sturgeon (Figure 10). The length range for wild pallid sturgeon was 390 to 1,080 mm compared to 111 to 726 mm for hatchery reared pallid sturgeon. Hatchery and wild pallid sturgeon used to occupy two different slots of the population structure. However, hatchery reared pallid sturgeon lengths have started to overlap with the length of wild pallid sturgeon and the collection of smaller pallid sturgeon without tags that are currently being deemed wild is overlapping with larger sized hatchery reared pallid sturgeon.

## Segment 9 - Pallid Sturgeon / Sturgeon Season

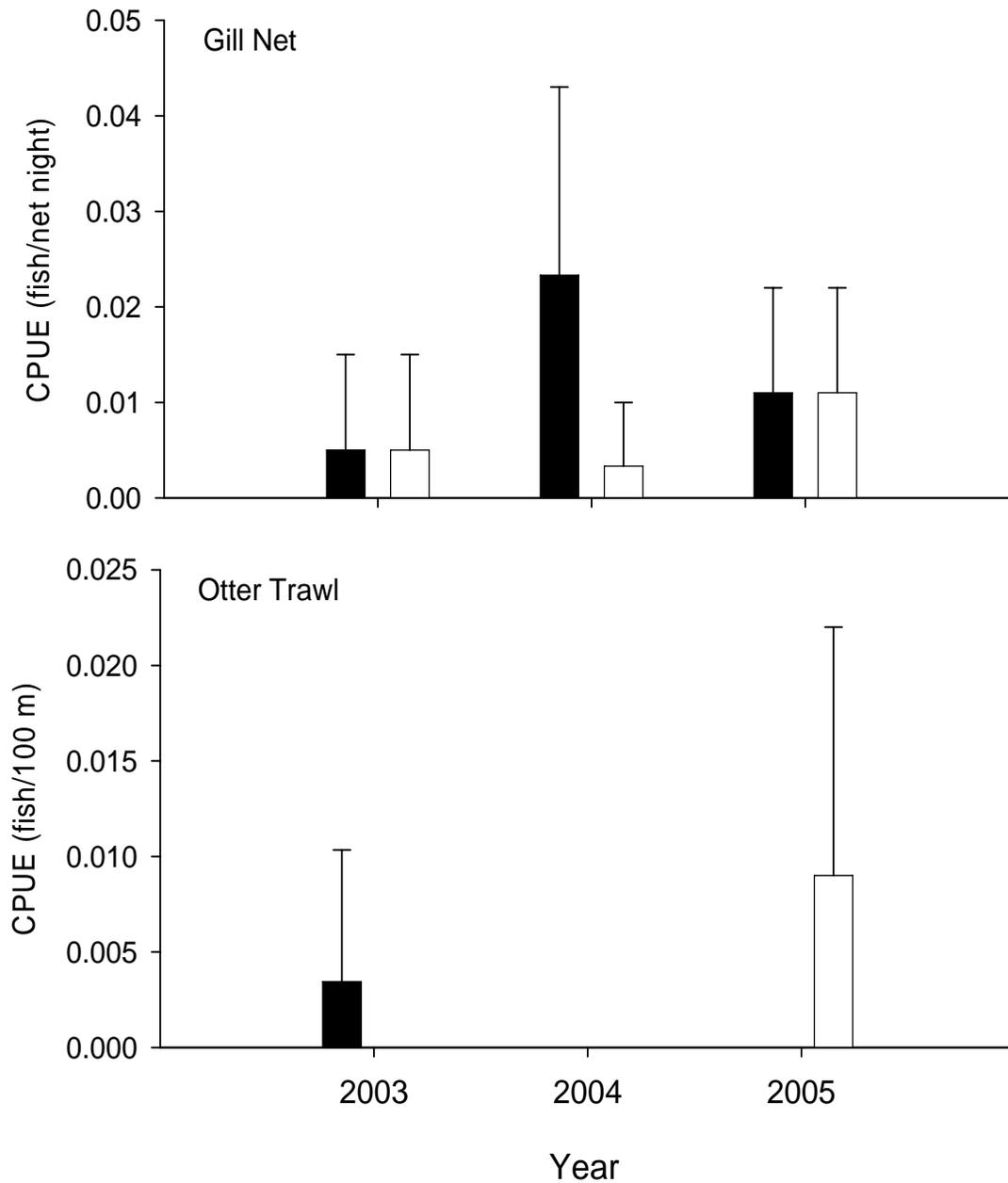


Figure 2. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

## Segment 9 - Pallid Sturgeon / Sturgeon Season

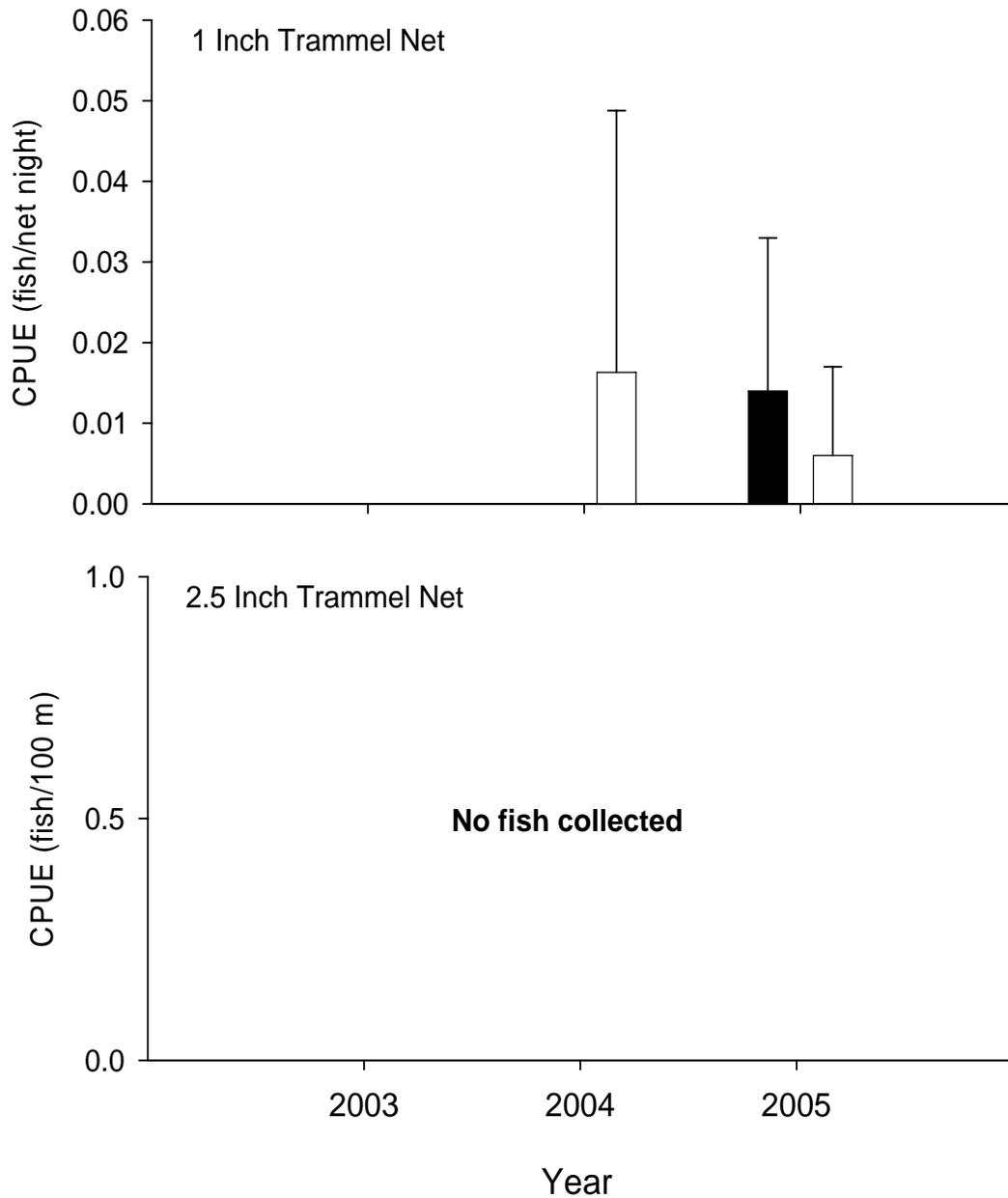


Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

## Segment 9 - Pallid Sturgeon / Sturgeon Season

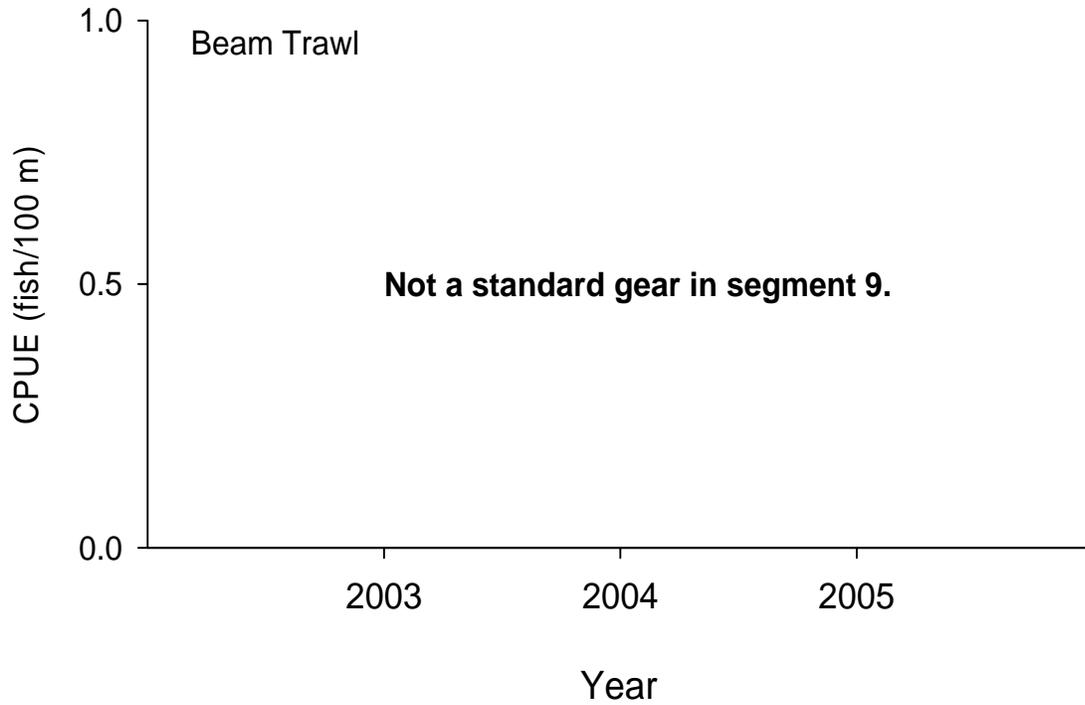


Figure 4. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

## Segment 9 - Pallid Sturgeon / Fish Community Season

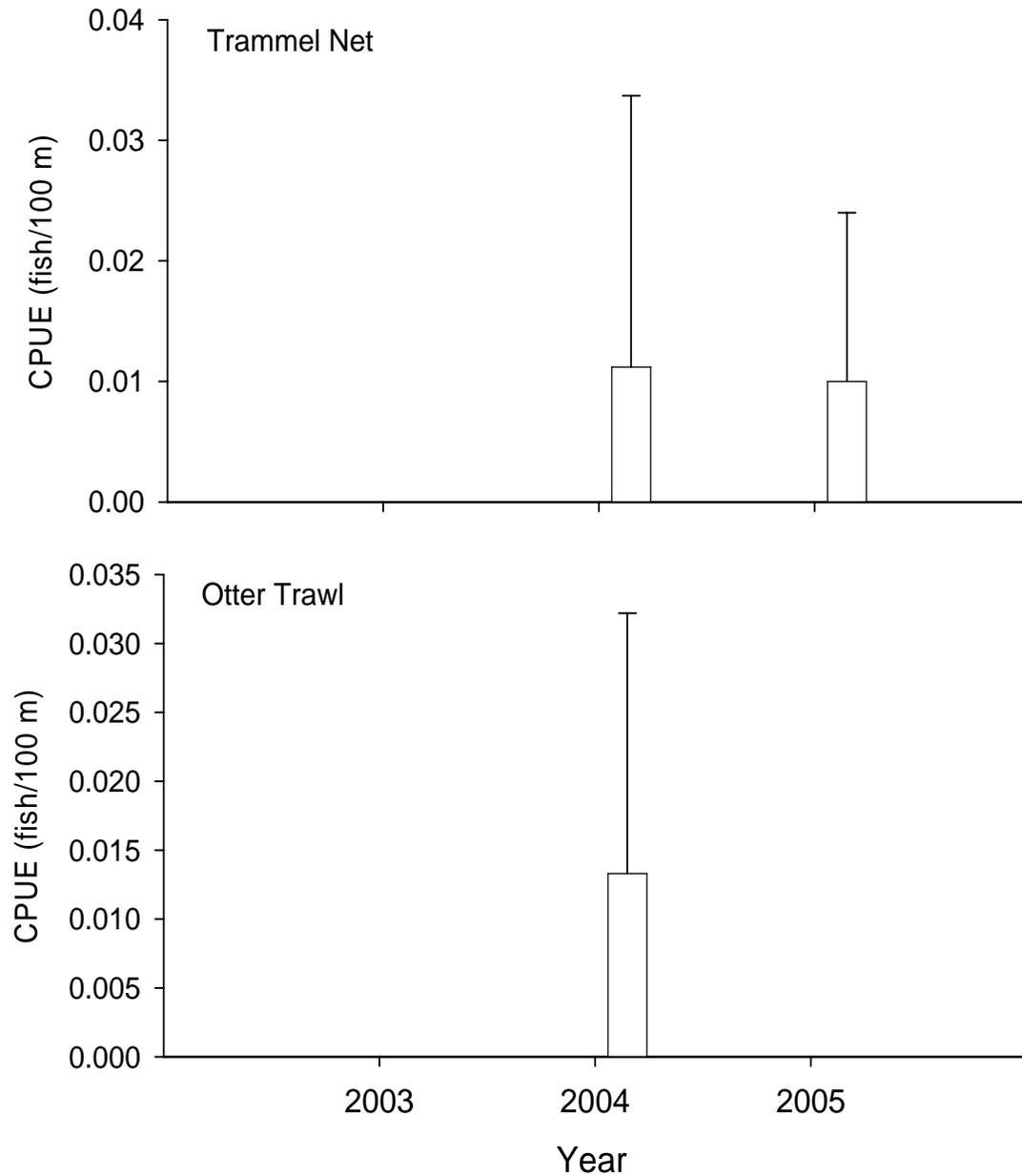


Figure 5. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for 1.0" trammel nets and otter trawls during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification

## Segment 9 - Pallid Sturgeon / Fish Community Season

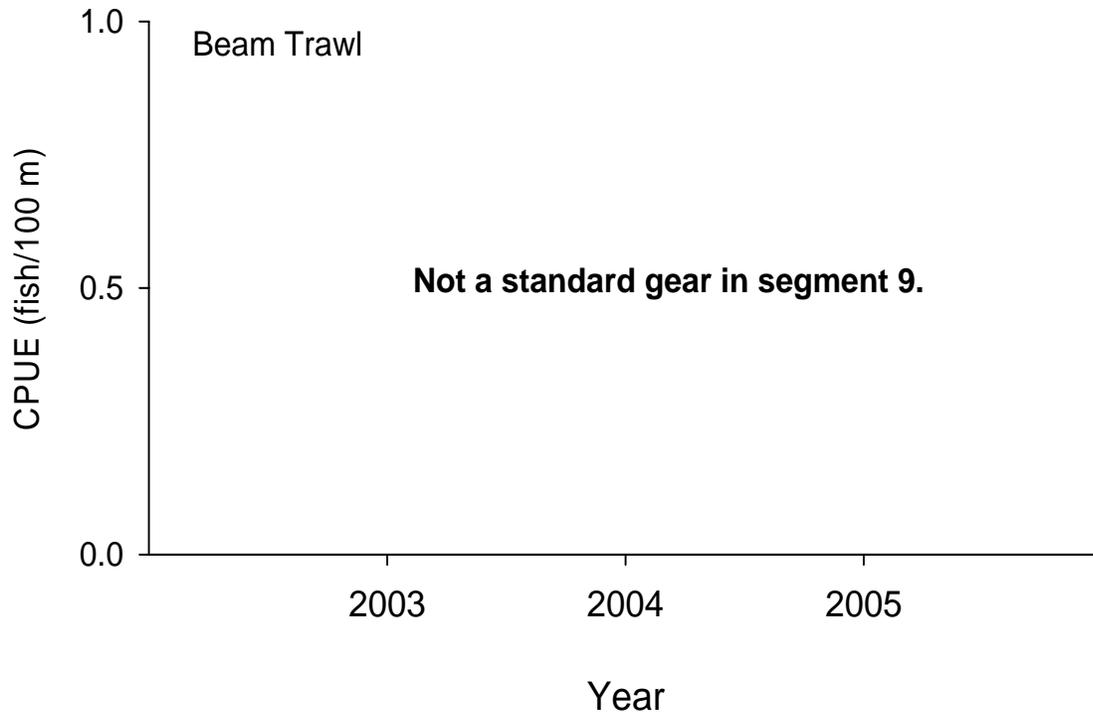


Figure 6. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

## Segment 9 - Pallid Sturgeon / Fish Community Season

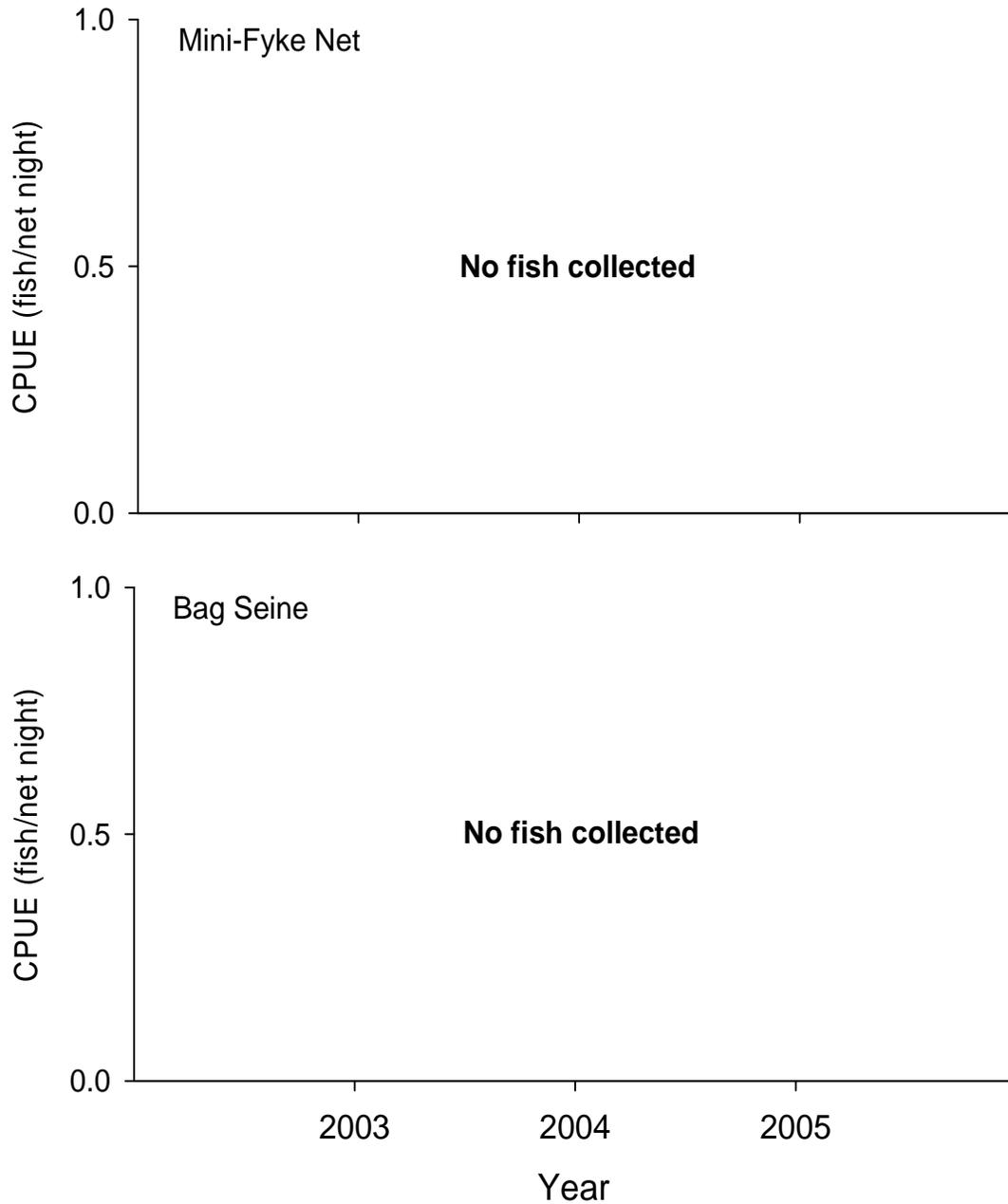


Figure 7. Mean annual catch-per-unit-effort ( $\pm 2$  SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification

Table 9. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat															
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD		
<b>Sturgeon Season (Fall through Spring)</b>																	
1 Inch Trammel Net	0	N-E			N-E	N-E					N-E						
			23	5					69						3		
2.5 Inch Trammel Net	0																
			25						69						6		
Gill Net	0																
			20	6			65	6	2								
Otter Trawl	0																
			21	7			68					4					
Beam Trawl	Not a standard gear in segment 9																
<b>Fish Community Season (Summer)</b>																	
1 Inch Trammel Net	0	N-E			N-E	N-E					N-E						
			27	2					70								
Bag Seine	0																
			31	1					51	6					7	3	1
Mini-Fyke Net	0																
			29	1			58	5				5	1	1			
Otter Trawl	0																
			24	2			71					3	1				
Beam Trawl	Not a standard gear in segment 9																

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	0	100					
Mini-Fyke Net	0	100					
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						

Table 11. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	1	N-E			N-E	N-E	100				N-E				
			23	5			69						3		
2.5 Inch Trammel Net	0		25				69						6		
Gill Net	0		20	6			65	6	2						
Otter Trawl	0						68						4		
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E			N-E	N-E	70				N-E				
			27	2											
Bag Seine	0		31	1			51	6					7	3	1
Mini-Fyke Net	0		29	1			58	5					5	1	1
Otter Trawl	0						71					3	1		
Beam Trawl	Not a standard gear in segment 9														

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	1		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	0						
			100				
Gill Net	0		32				68
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	0	100					
Mini-Fyke Net	0	100					
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						

Table 13. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat																
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD			
<b>Sturgeon Season (Fall through Spring)</b>																		
1 Inch Trammel Net	1	N-E			N-E	N-E	100				N-E							
			23	5			69						3					
2.5 Inch Trammel Net	0																	
			25				69						6					
Gill Net	1						100											
							65	6	2									
Otter Trawl	2						100											
							68						4					
Beam Trawl	Not a standard gear in segment 9																	
<b>Fish Community Season (Summer)</b>																		
1 Inch Trammel Net	2	N-E			N-E	N-E	100				N-E							
			27	2			70											
Bag Seine	0																	
			31	1			51	6					7	3	1			
Mini-Fyke Net	0																	
							58	5					5	1	1			
Otter Trawl	0																	
							71						3	1				
Beam Trawl	Not a standard gear in segment 9																	

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat						
		BARS	CHNB	DTWT	ITIP	POOL	TLWG	
<b>Sturgeon Season (Fall through Spring)</b>								
1 Inch Trammel Net	1		100	N-E	N-E			
			100					
2.5 Inch Trammel Net	0							
			100					
Gill Net	1						100	
			32				68	
Otter Trawl	2		100					
			100					
Beam Trawl	Not a standard gear in segment 9							
<b>Fish Community Season (Summer)</b>								
1 Inch Trammel Net	2		100	N-E	N-E			
			100					
Bag Seine	0							
		100						
Mini-Fyke Net	0							
		100						
Otter Trawl	0							
			100					
Beam Trawl	Not a standard gear in segment 9							

Table 15. Total number of quality and above size (>630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	1	N-E			N-E	N-E	100				N-E				
			23	5			69					3			
2.5 Inch Trammel Net	0														
			25				69					6			
Gill Net	7		14	29			43	14							
			20	6			65	6	2						
Otter Trawl	0														
			21	7			68					4			
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E			N-E	N-E					N-E				
			27	2			70								
Bag Seine	0														
			31	1			51	6				7	3	1	
Mini-Fyke Net	0														
			29	1			58	5				5	1	1	
Otter Trawl	0														
			24	2			71					3	1		
Beam Trawl	Not a standard gear in segment 9														

Table 16. Total number of quality and above size (>630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	1		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	0						
			100				
Gill Net	7		43			57	
			32			68	
Otter Trawl	0						
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0			N-E	N-E		
			100				
Bag Seine	0						
		100					
Mini-Fyke Net	0						
		100					
Otter Trawl	0						
			100				
Beam Trawl	Not a standard gear in segment 9						

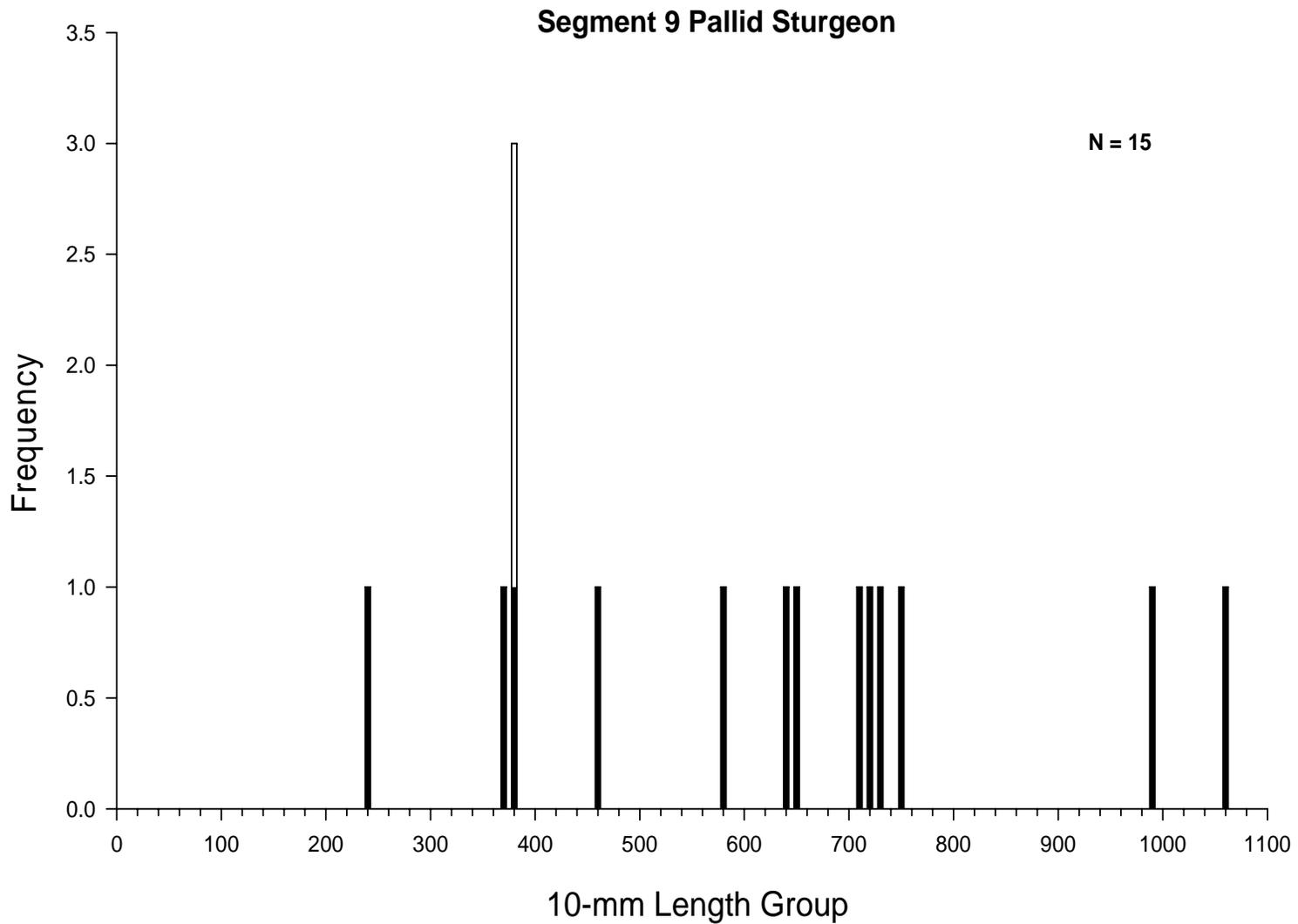


Figure 8. Length frequency of pallid sturgeon during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

## Segment 9 - Cumulative Pallid Sturgeon Capture History

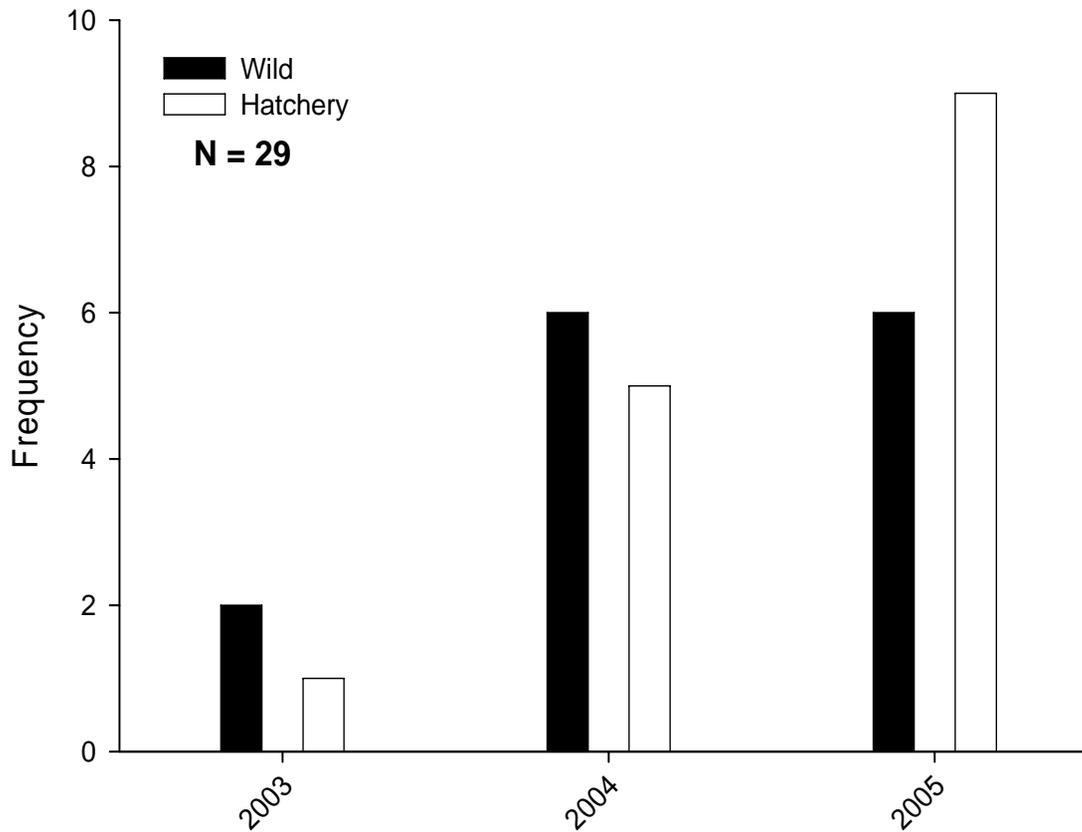


Figure 9. Cumulative capture history of wild (black bars) and hatchery reared (white bars) pallid sturgeon collected in segment 9 of the Missouri River from 2003 - 2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

### Segment 9 - Cumulative Pallid Sturgeon Length Frequency History

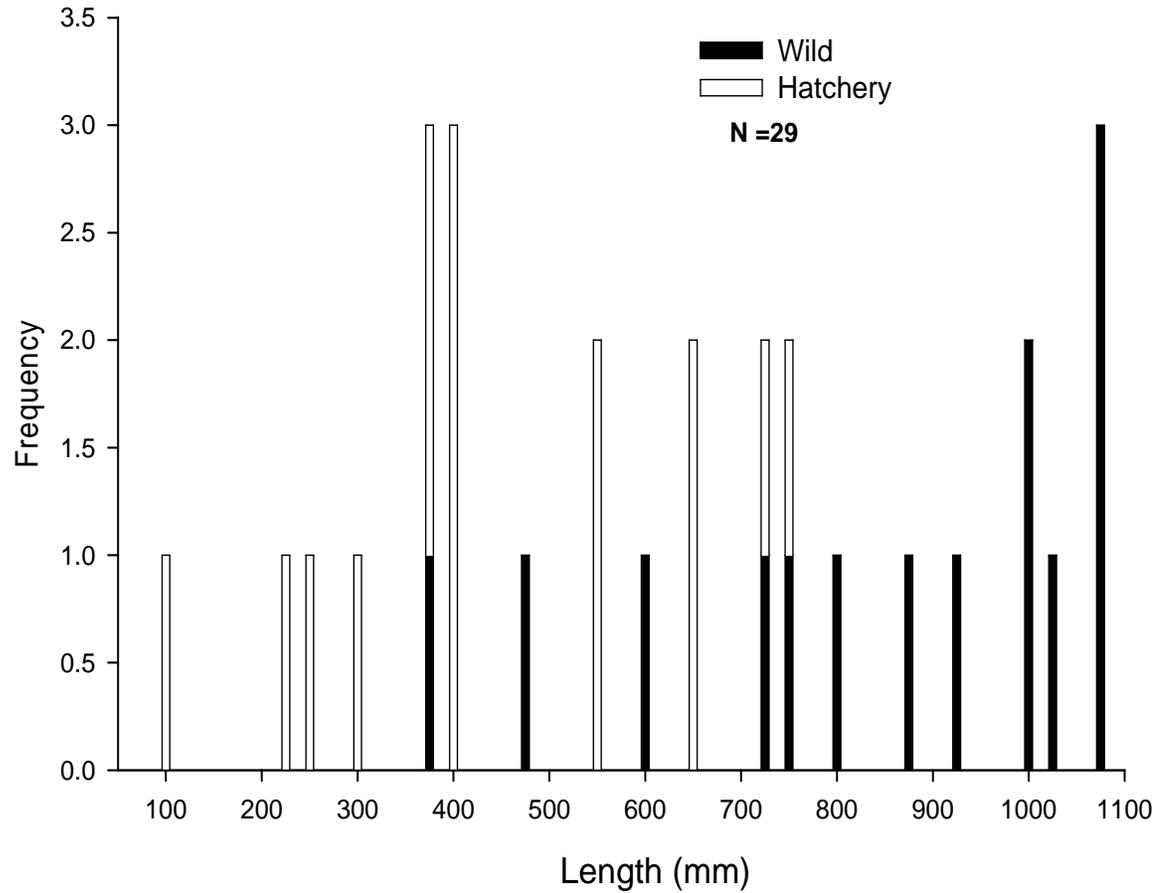


Figure 10. Cumulative pallid sturgeon length frequency histogram for segment 9 comparing hatchery reared (white bars) and wild (black bars) pallid sturgeon captures from 2003 - 2005. All pallids that were captured with no evidence of previously being tagged were deemed wild pending genetic verification.

### **Shovelnose X Pallid Sturgeon Hybrids**

A total of three hybrid sturgeon were collected during the 2005 sampling season. All hybrid sturgeon were collected on the inside bend macrohabitat. One was collected in a pool mesohabitat with a gill net while the other two were collected on channel border mesohabitats with a 1.0" trammel nets and an otter trawl. The average fork length was 666.3 mm and average weight of 1063.3 g.

## Targeted Native River Species

### Shovelnose Sturgeon

A total of 3,915 shovelnose sturgeon were captured in gill nets ( $n = 2695$ ), 1.0" trammel nets ( $n = 752$ ), otter trawls ( $n = 411$ ) and 2.5" trammel nets ( $n = 57$ ) during the 2005 sampling season. Catch per unit effort of sub-stock (149 – 249 mm) sized shovelnose sturgeon for gill nets during the sturgeon season remained very low (0.003 fish per net night) and similar to the 2003 (0.01 fish per net night) and 2004 (0.007 fish per net night) data (Figure 11). Catch per unit effort of stock (250 – 379 mm) sized shovelnose sturgeon for gill nets during the sturgeon season also remained low (0.014 fish per net night) and similar to the 2003 (0.05 fish per net night) and 2004 (0.295 fish per net night) data. Catch per unit effort of quality and above size ( $> 380$  mm) shovelnose sturgeon for gill nets during the sturgeon season increased from 6.8 fish per net night in 2004 to 7.3 fish per net night in 2005 but is still down from 2003 (CPUE = 11.7 fish per net night) when gill nets were set exclusively in pool mesohabitats. Catch per unit effort of sub-stock (149 – 249 mm) and stock (250 – 379 mm) sized shovelnose sturgeon for otter trawls during the sturgeon season remained low (CPUE = 0.04 and 0.03 fish per 100 m trawled, respectively). Catch per unit effort for otter trawls during the sturgeon season for quality and above ( $> 380$  mm) size shovelnose sturgeon has declined each year since 2003. Catch per unit effort for 1.0" trammel nets during the sturgeon season for quality and above ( $> 380$  mm) size shovelnose sturgeon decreased slightly from 2004 (0.97 fish per 100 m drifted) to 2005 (0.83 fish per 100 m drifted) (Figure 12). Fifty-seven shovelnose sturgeon were captured using the 2.5" trammel net during the sturgeon season. Fifty-six were in the quality and above ( $> 380$  mm) size length category and one shovelnose sturgeon was in the sub-stock (0 – 149 mm) length category. Beam trawls were not a standard gear in 2005 (Figure 13)

Catch per unit effort of sub-stock (149 – 249 mm) and stock (250 – 379 mm) sized shovelnose sturgeon for 1.0" trammel nets during the fish community season remained very low (CPUE = 0.03 and 0.09 fish per 100 m drifted, respectively) (Figure 14). Catch per unit effort for 1.0" trammel nets during the fish community season for quality and above size ( $> 380$  mm) shovelnose sturgeon decreased from 2004 (3.5 fish per 100 m drifted) to 2005 (2.1 fish per 100 m drifted). Catch per unit effort of sub-stock (0 – 149 mm), sub-stock (150 – 249 mm) and stock (250 – 379 mm) sized shovelnose sturgeon for otter trawling during the 2005 fish community season was similar to 2003 but lower than during 2004. Catch of stock size (250 – 379) and quality and above size ( $> 380$ ) shovelnose sturgeon using otter trawls has remained fairly

constant from 2003 to 2005. Beam trawls were not a standard in 2005 (Figure 15). Mini-fyke nets and bag seines did not collect any shovelnose sturgeon (Figure 16).

## Segment 9 - Shovelnose Sturgeon / Sturgeon Season

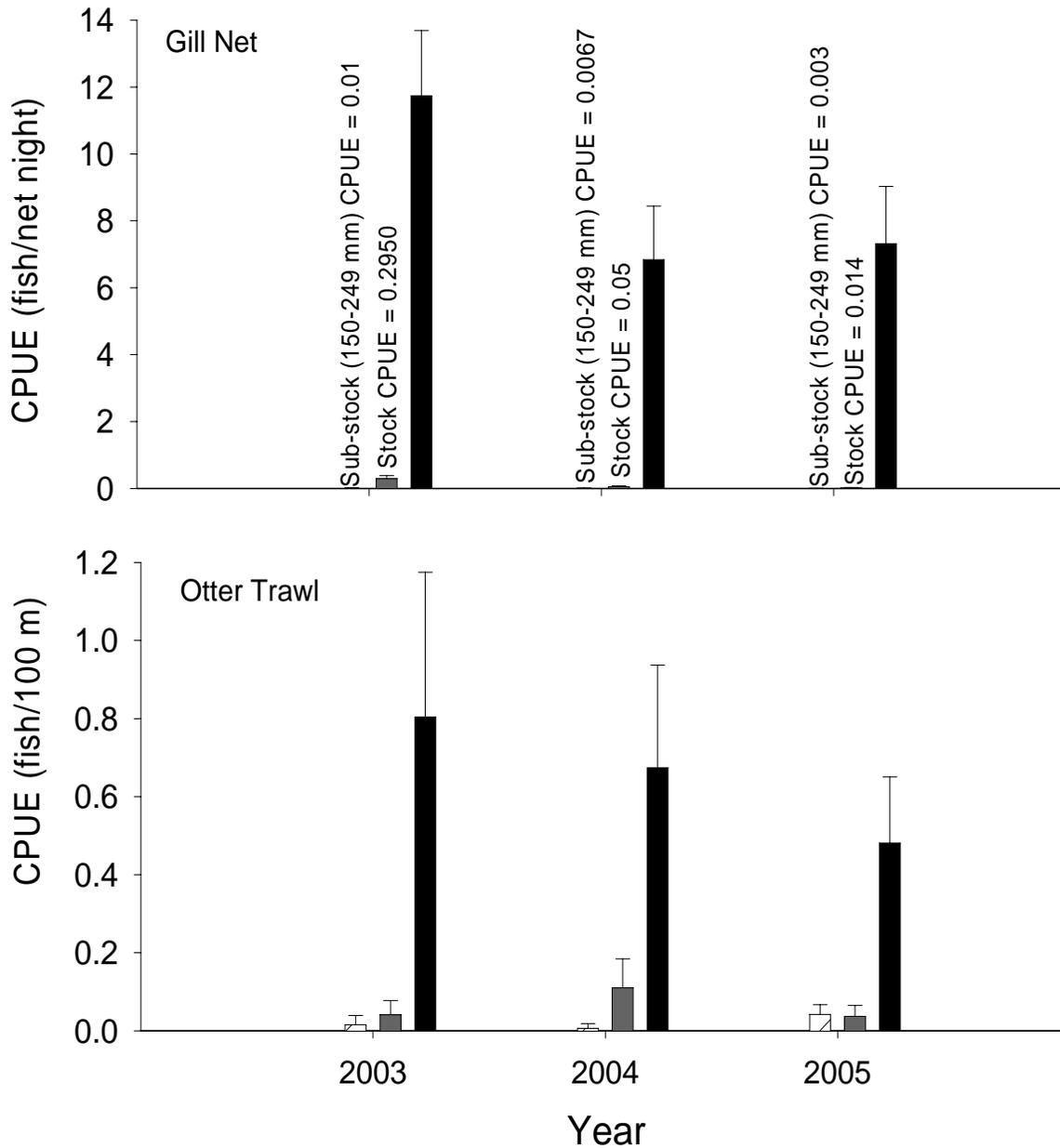


Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003 - 2005.

## Segment 9 - Shovelnose Sturgeon / Sturgeon Season

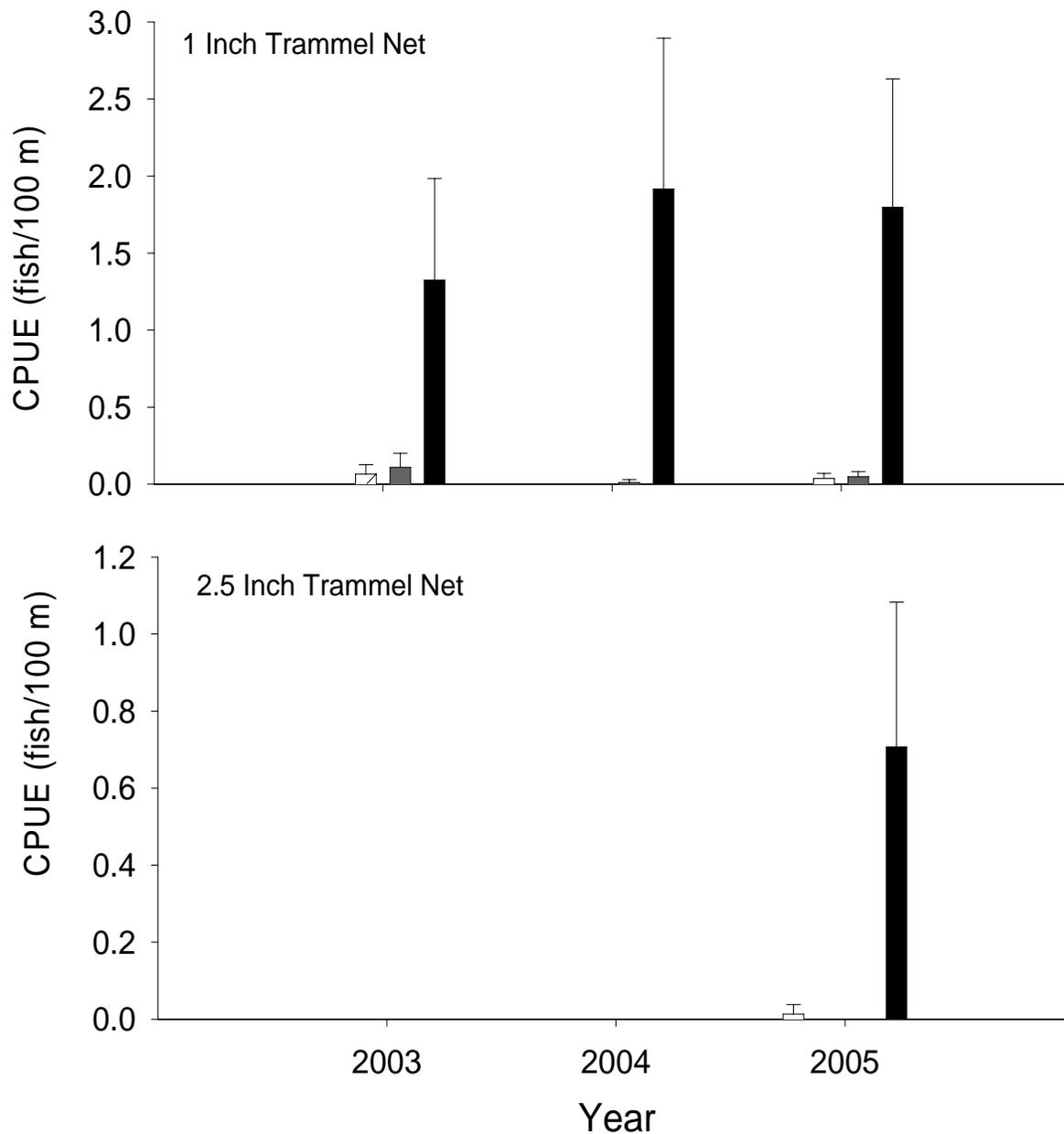


Figure 12. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003 - 2005.

## Segment 9 - Shovelnose Sturgeon / Sturgeon Season

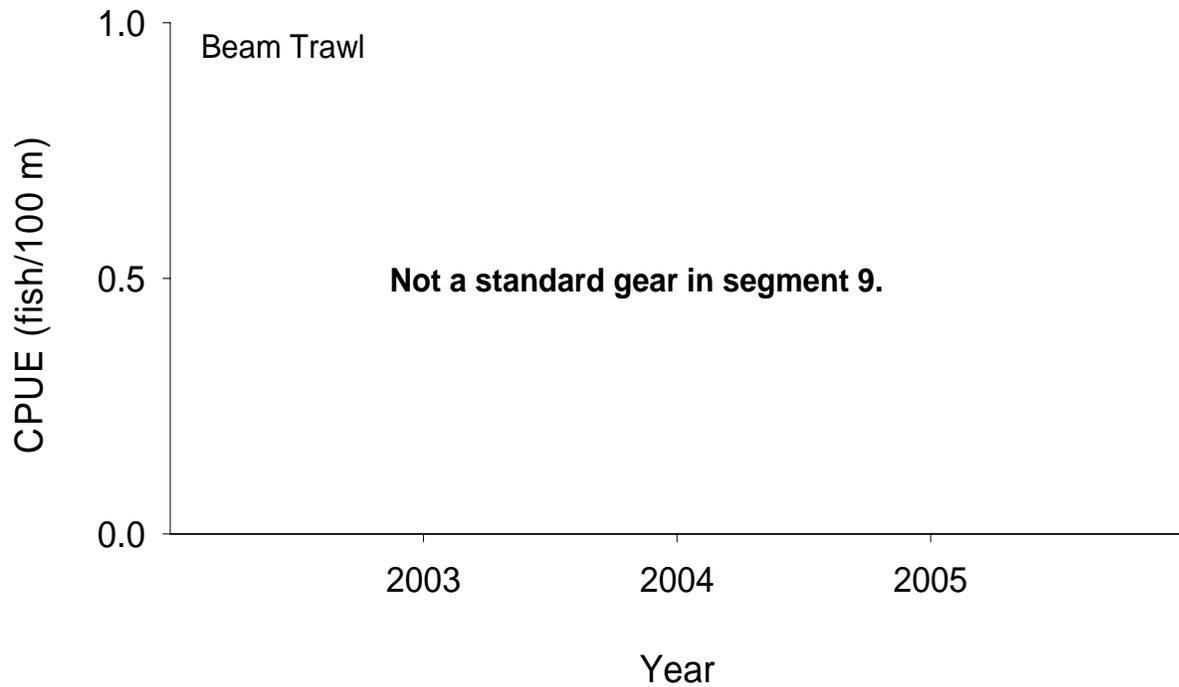


Figure 13. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003 - 2005.

## Segment 9 - Shovelnose Sturgeon / Fish Community Season

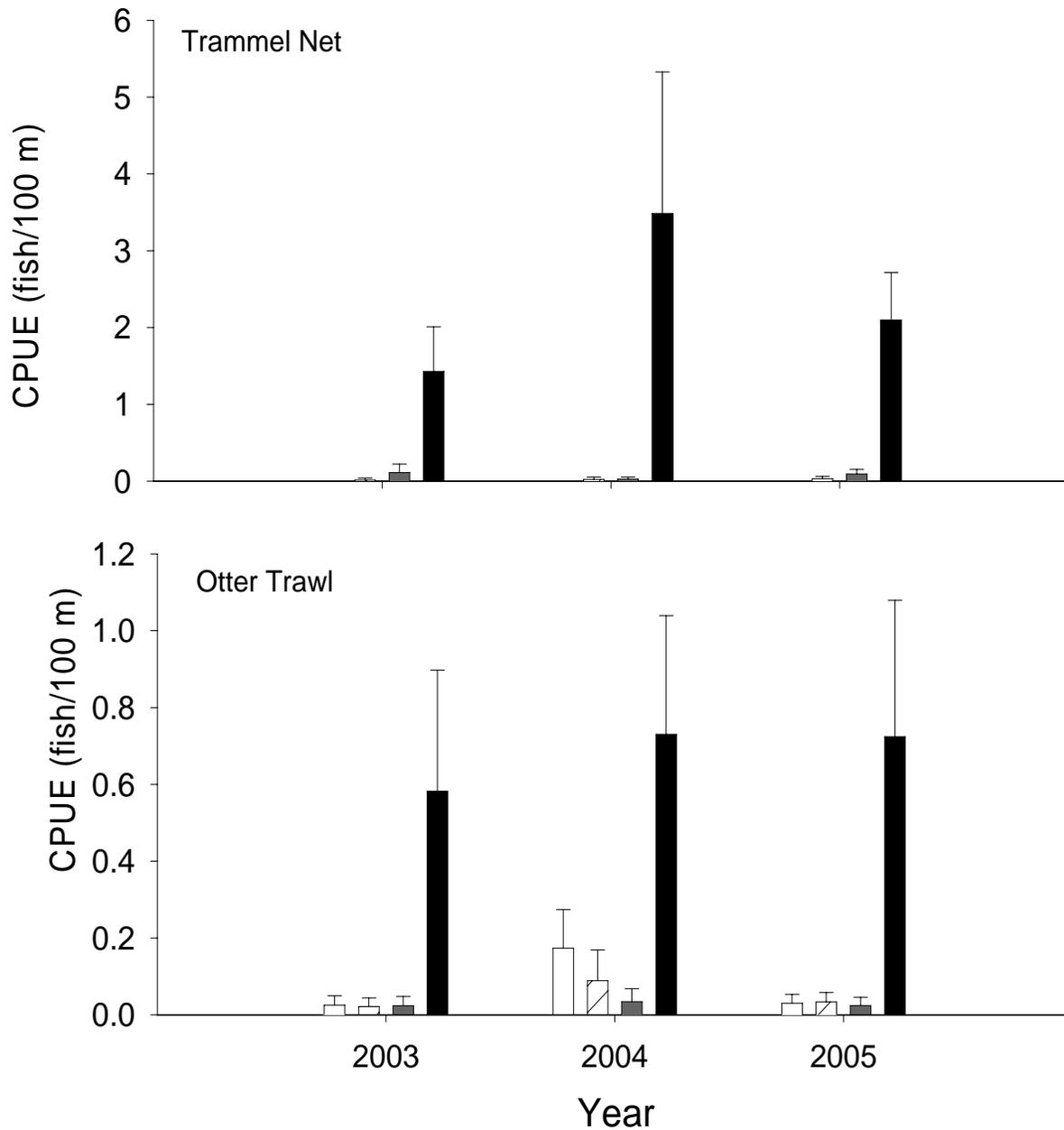


Figure 14. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for 1.0" trammel nets and otter trawls during the fish community season 2003 - 2005.

## Segment 9 - Shovelnose Sturgeon / Fish Community Season

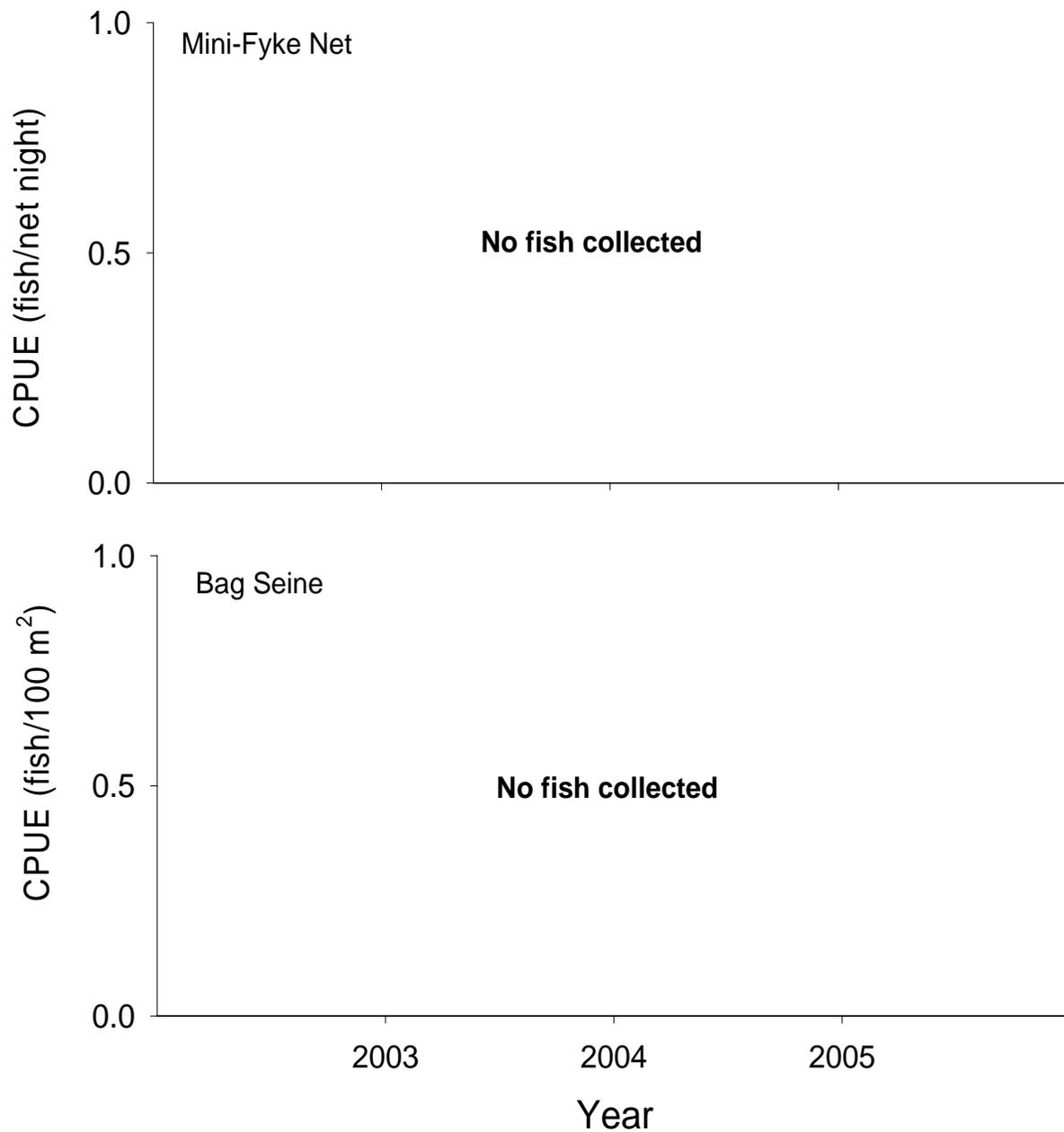


Figure 15. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003 - 2005.

## Segment 9 - Shovelnose Sturgeon / Fish Community Season

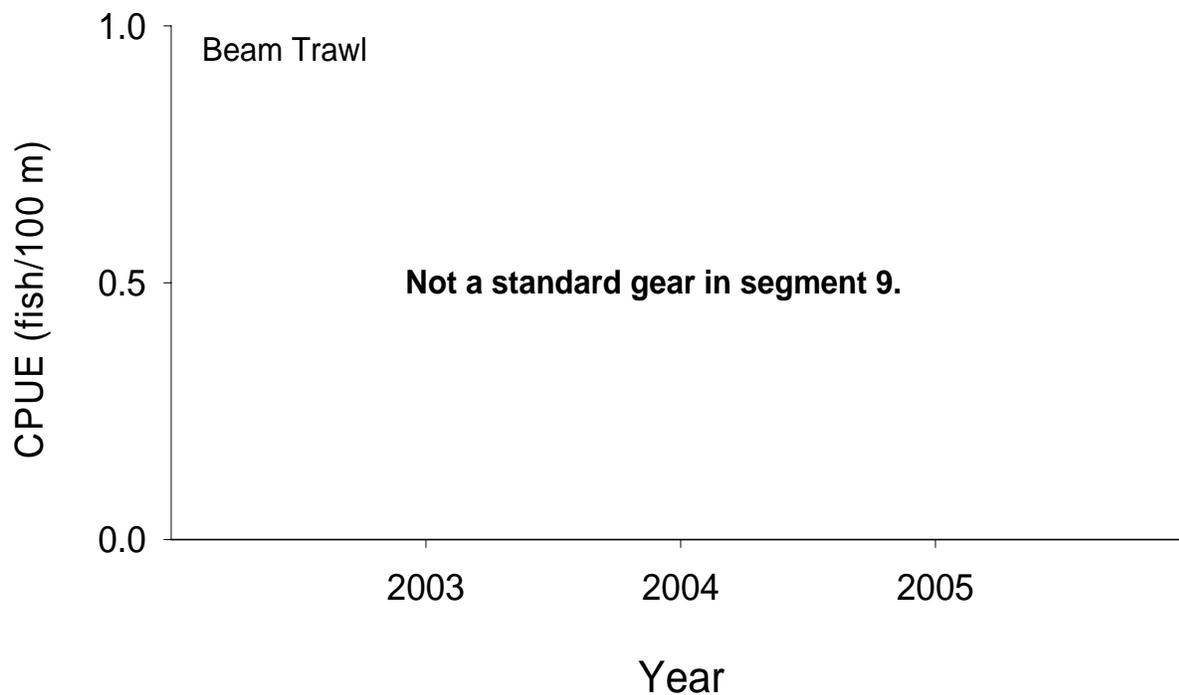


Figure 16. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size ( $>$  380 mm; black bars) shovelnose sturgeon in segment 9 of the Missouri River for beam trawls during the fish community season 2003 - 2005.

## *Habitat Use*

Nine sub-stock (0 – 149 mm) shovelnose sturgeon were collected during the 2005 sampling season (Table 17). One sub-stock (0 – 149 mm) shovelnose sturgeon was collected during the sturgeon season while drifting 2.5” trammel nets on an inside bend. Sixty-three percent of the sub-stock (0 – 149 mm) shovelnose sturgeon sampled during the fish community season were collected on the inside bend macrohabitats, followed by channel crossovers with 25%. Channel borders were the only mesohabitat where sub-stock (0 - 149 mm) sized shovelnose sturgeon were collected (Table 18).

Forty sub-stock (150 – 249 mm) shovelnose sturgeon was collected during the 2005 sampling season, with otter trawling being the most effective method (Table 19). Otter trawling during the sturgeon season captured 14 sub-stock (150 – 249 mm) shovelnose sturgeon compared to 12 sampled during the fish community season. Inside bend macrohabitats and channel border mesohabitats was the dominated habitat for sub-stock (150 – 249) shovelnose sturgeon collection (Table 20).

Forty-eight stock size (250 – 379 mm) shovelnose sturgeon were sampled during 2005, 21 during the sturgeon season and 27 during the fish community season (Tables 21 and 22). The majority of stock size shovelnose sturgeon were collected on the inside channel border, except for gill netting when inside bend pool became the preferred habitat.

Over 3,800 quality and above size (> 380 mm) shovelnose sturgeon were sampled during 2005 (Table 23). Inside bend macrohabitat was the primary habitat for all gears during both seasons, except for otter trawling during the sturgeon season when confluence became the preferred habitat. Channel border mesohabitat was the principle habitat for all gear during both seasons, except for gill netting during the sturgeon season when pools were the preferred habitat for quality and above size shovelnose sturgeon (Table 24).

A total of 3,915 shovelnose sturgeon were measured during 2005, with 3,295 being sampled during the sturgeon season (Figure 17). The average fork length was 548.5 mm during the sturgeon season compared to 519.8 for the fish community season. The length range for pallid sturgeon sampled during the sturgeon season was 145 to 805 compared to 73 to 800 for the fish community season.

The PSD value for shovelnose sturgeon was 99 during the sturgeon season and 95 during the fish community season (Table 25). The RSD preferred value was 78 during the sturgeon

season, but declined to 66 for the fish community season. The RSD memorable value remained similar between the sturgeon and fish community season with 5 and 6, respectively.

Table 17. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat															
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD		
<b>Sturgeon Season (Fall through Spring)</b>																	
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3				
2.5 Inch Trammel Net	1		25				100							6			
Gill Net	0		20	6			65	6	2								
Otter Trawl	0		21	7			68								4		
Beam Trawl	Not a standard gear in segment 9																
<b>Fish Community Season (Summer)</b>																	
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E						
Bag Seine	0		31	1			51	6					7		1		
Mini-Fyke Net	0		29	1			58	5					5	1	1		
Otter Trawl	8		25				63						13				
			24	2			71						3	1			
Beam Trawl	Not a standard gear in segment 9																

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	1		100				
			100				
Gill Net	0		32				68
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	0	100					
Mini-Fyke Net	0		100				
Otter Trawl	8		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

Table 19. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	8	N-E	13		N-E	N-E	75				N-E		13		
			23	5			69					3			
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	1		20	6			100								
Otter Trawl	14		7				93	6	2						
		21	7	68						4					
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	5	N-E			N-E	N-E	100				N-E				
			27	2			70								
Bag Seine	0		31				51	6				7	3	1	
Mini-Fyke Net	0		29				58	5				5	1	1	
Otter Trawl	12		25				75								
		24	2	71				3	1						
Beam Trawl	Not a standard gear in segment 9														

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	8		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	0						
			100				
Gill Net	1		100				
			32				68
Otter Trawl	14		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	5		100	N-E	N-E		
			100				
Bag Seine	0						
		100					
Mini-Fyke Net	0						
		100					
Otter Trawl	12		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

Table 21. 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 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat															
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD		
<b>Sturgeon Season (Fall through Spring)</b>																	
1 Inch Trammel Net	8	N-E	13		N-E	N-E	75				N-E		13				
			23	5			69					3					
2.5 Inch Trammel Net	0		25				69					6					
Gill Net	5		20				80										
			20	6			65	6	2								
Otter Trawl	8																
		21	7	100								4					
Beam Trawl	Not a standard gear in segment 9																
<b>Fish Community Season (Summer)</b>																	
1 Inch Trammel Net	20	N-E	25		N-E	N-E	75				N-E						
			27	2			70										
Bag Seine	0		31	1			51	6					7	3	1		
Mini-Fyke Net	0		29	1			58	5					5	1	1		
			14				86										
Otter Trawl	7																
		24	2	71							3	1					
Beam Trawl	Not a standard gear in segment 9																

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	8		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	0						
			100				
Gill Net	5		20			80	
			32			68	
Otter Trawl	8		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	20		100	N-E	N-E		
			100				
Bag Seine	0						
		100					
Mini-Fyke Net	0						
		100					
Otter Trawl	7		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

Table 23. Total number of quality and above size (>380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat																	
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD				
<b>Sturgeon Season (Fall through Spring)</b>																			
1 Inch Trammel Net	339	N-E	18	3	N-E	N-E	69				N-E		11						
			23	5			69					3							
2.5 Inch Trammel Net	56		12				84					4							
			25				69					6							
Gill Net	2689		20	11			58	6	4										
			20	6			65	6	2										
Otter Trawl	166		8	44			40						8						
			21	7			68						4						
Beam Trawl	Not a standard gear in segment 9																		
<b>Fish Community Season (Summer)</b>																			
1 Inch Trammel Net	372	N-E	25	4	N-E	N-E	71				N-E								
			27	2			70												
Bag Seine	0		31	1			51	6					7	3	1				
Mini-Fyke Net	0		29	1			58	5					5	1	1				
Otter Trawl	196		55	2			39						2	3					
			24	2			71						3	1					
Beam Trawl	Not a standard gear in segment 9																		

Table 24. Total number of quality and above size (>380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	339		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	56		100				
			100				
Gill Net	2689		6			94	
			32			68	
Otter Trawl	166		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	372		100	N-E	N-E		
			100				
Bag Seine	0	100					
Mini-Fyke Net	0	100					
Otter Trawl	196		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

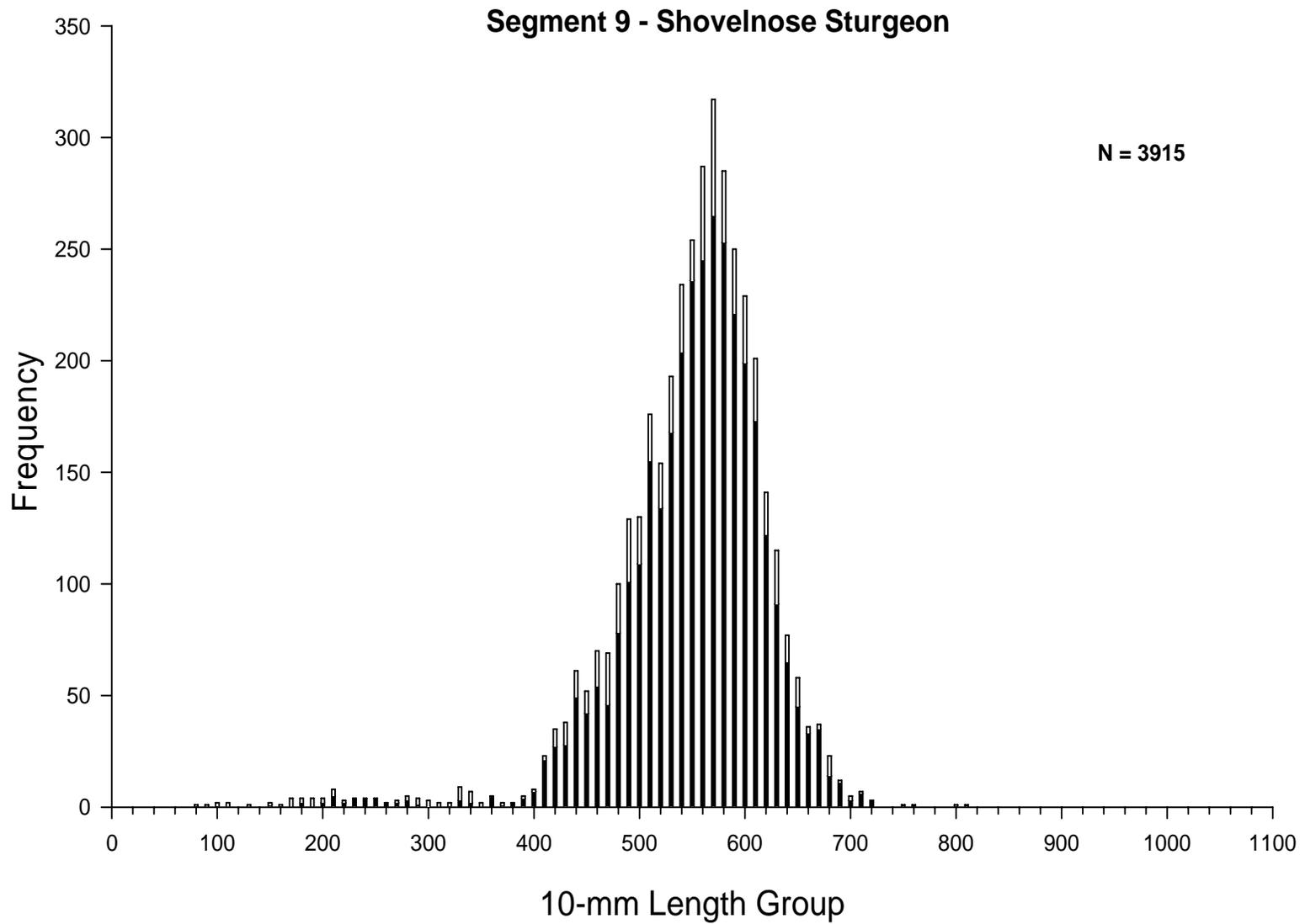


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

Table 25. Relative stock density (RSD)<sup>a</sup> by a length category for shovelnose sturgeon in segment 9 of the Missouri River captured during 2005. Length categories<sup>b</sup> determined using methods proposed by Quist (1998).

Length category	N	RSD
<b>Sturgeon Season</b>		
Sub-stock (0-149 mm)	1	
Sub-stock (150-249 mm)	23	
Stock	3271	
Quality	3250	99
Preferred	2560	78
Memorable	162	5
Trophy		
<b>Fish Community Season</b>		
Sub-stock (0-149 mm)	8	
Sub-stock (150-249 mm)	17	
Stock	595	
Quality	568	95
Preferred	394	66
Memorable	33	6
Trophy		

<sup>a</sup> RSD = number of fish of a specified length ÷ number minimum stock length fish x 100.

<sup>b</sup> Length categories based on the percentage of the largest known shovelnose sturgeon: Sub-stock FL < 250 mm (20 %), Stock FL = 250-379 mm (20 – 36 %), Quality FL = 380 – 509 mm (36 – 45 %), Preferred FL = 510 - 639 mm (45 – 59 %), Memorable FL = 640 – 809 mm (59 – 74 %), Trophy FL > 810 mm (>74 %).

## **Sturgeon Chub**

A total of 100 sturgeon chubs were captured in otter trawls ( $n = 99$ ) and mini-fyke nets ( $n = 1$ ) during the 2005 sampling season. Catch per unit effort for otter trawling during the sturgeon season was 0.34 fish per 100 m trawled compared to 0.03 fish per 100 m trawled in 2004 and 0.05 fish per 100 m trawled during the 2003 sturgeon season (Figure 18). Catch per unit effort for otter trawling during the fish community season (0.10 fish per 100 m trawled) remained relatively unchanged from 2004 (0.11 fish per 100 m trawled) (Figure 19).

Only three sturgeon chubs have been collected with mini-fyke nets and bag seines from 2003 to 2005 (Figure 20). During 2004, two sturgeon chubs were collected with a seine and one sturgeon chub was collected in 2005 with mini-fyke nets.

The majority of sturgeon chubs collected with an otter trawl during the sturgeon season were sampled on the inside bends (86%), and channel cross-overs (12%) (Table 26) and all were collected within the channel border mesohabitat (Table 27). Inside bend (60%) and channel cross-over (40%) macrohabitat and channel border mesohabitat accounted for all of the catch during the fish community for otter trawls.

Seventy-four sturgeon chubs were sampled during the sturgeon season and twenty-six were sampled during the fish community season (Figure 21). The average fork length was 49.7 mm during the sturgeon season and 57.7 during the fish community season. The length range for sturgeon chubs sampled during the sturgeon season was 25 to 99 mm compared to 32 to 94 mm during the fish community season.

## Segment 9 - Sturgeon Chub / Sturgeon Season

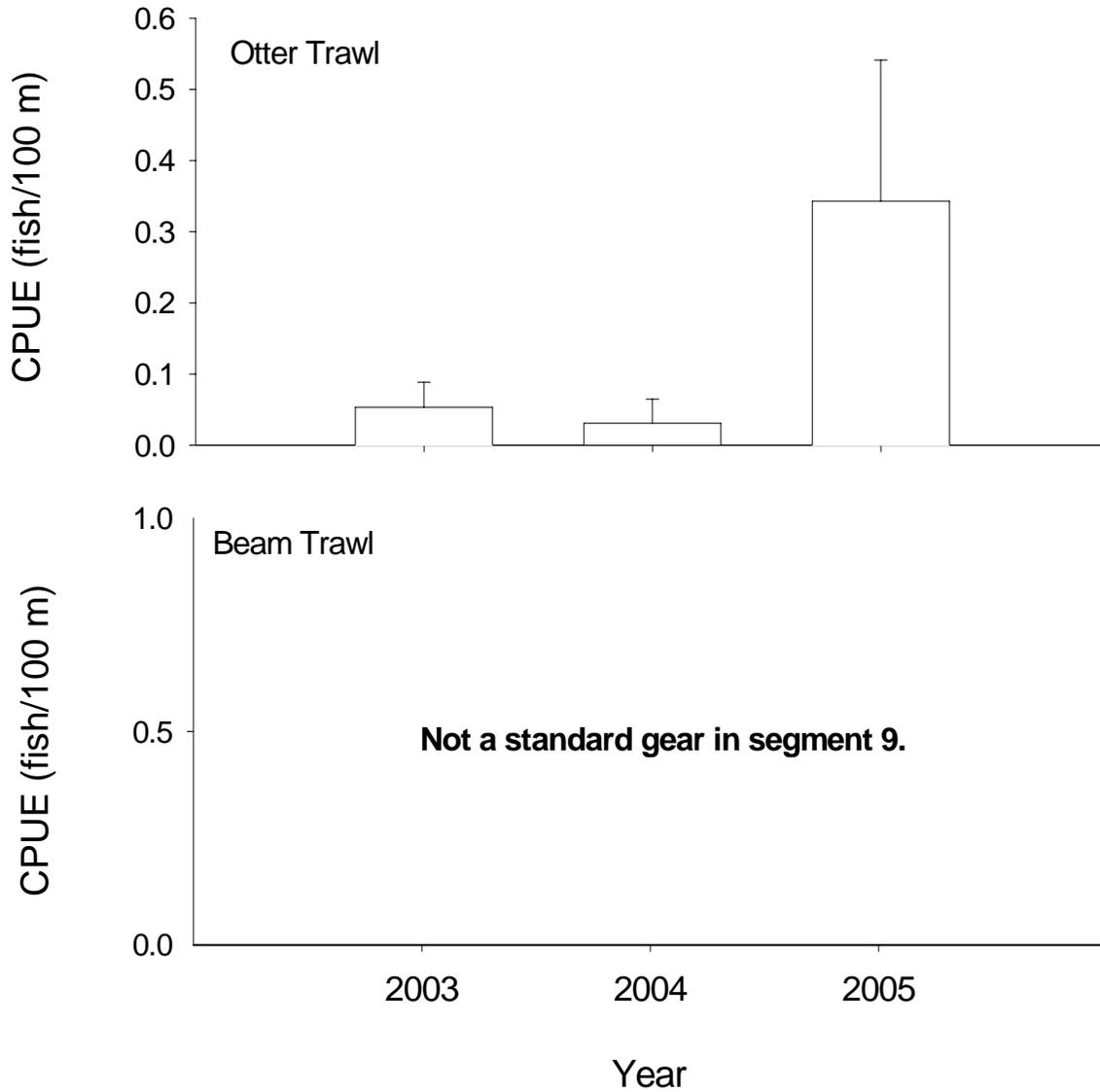


Figure 18. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sturgeon chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

## Segment 9- Sturgeon Chub / Fish Community Season

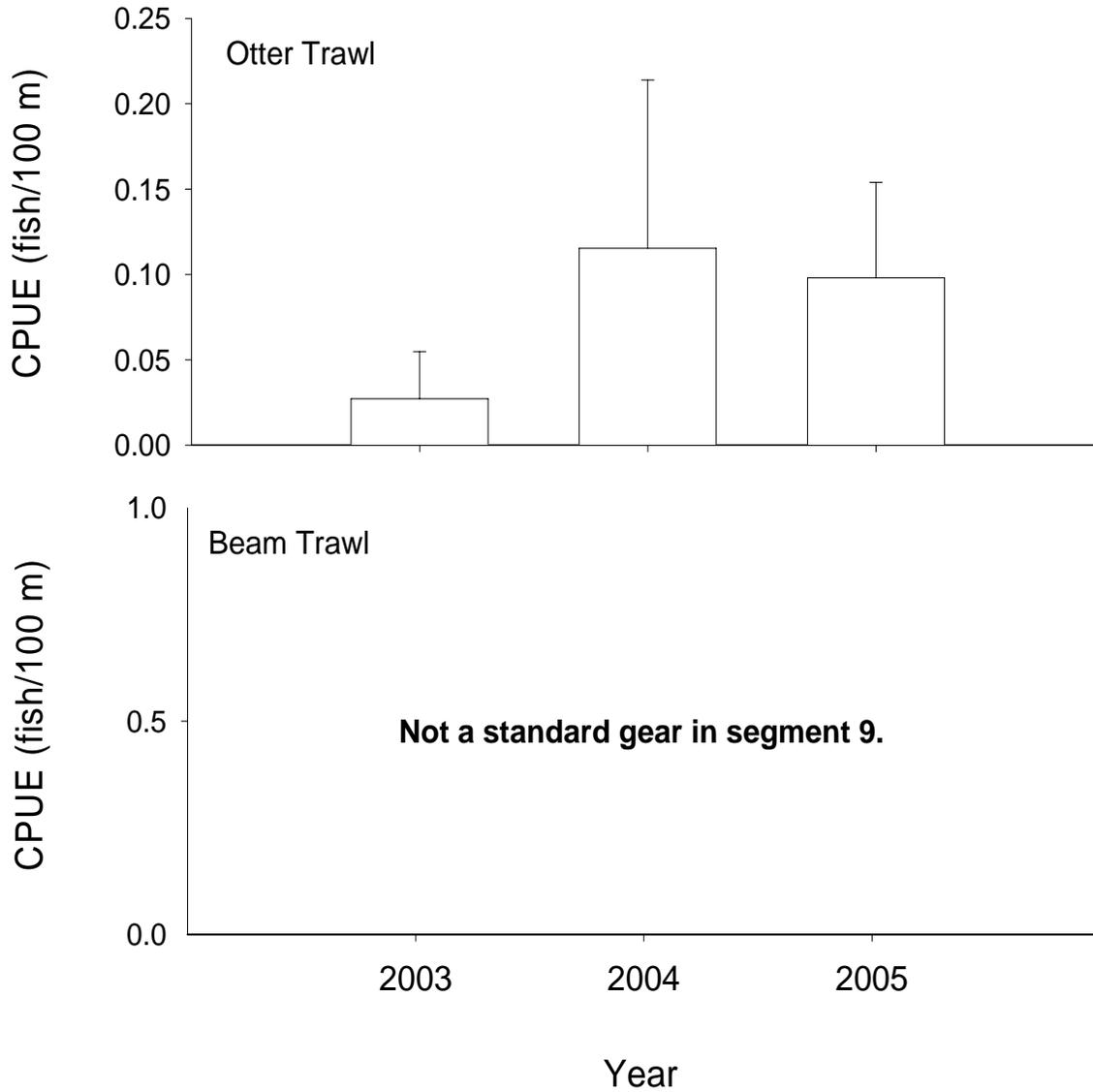


Figure 19. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sturgeon chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005.

## Segment 9 - Sturgeon Chub / Fish Community Season

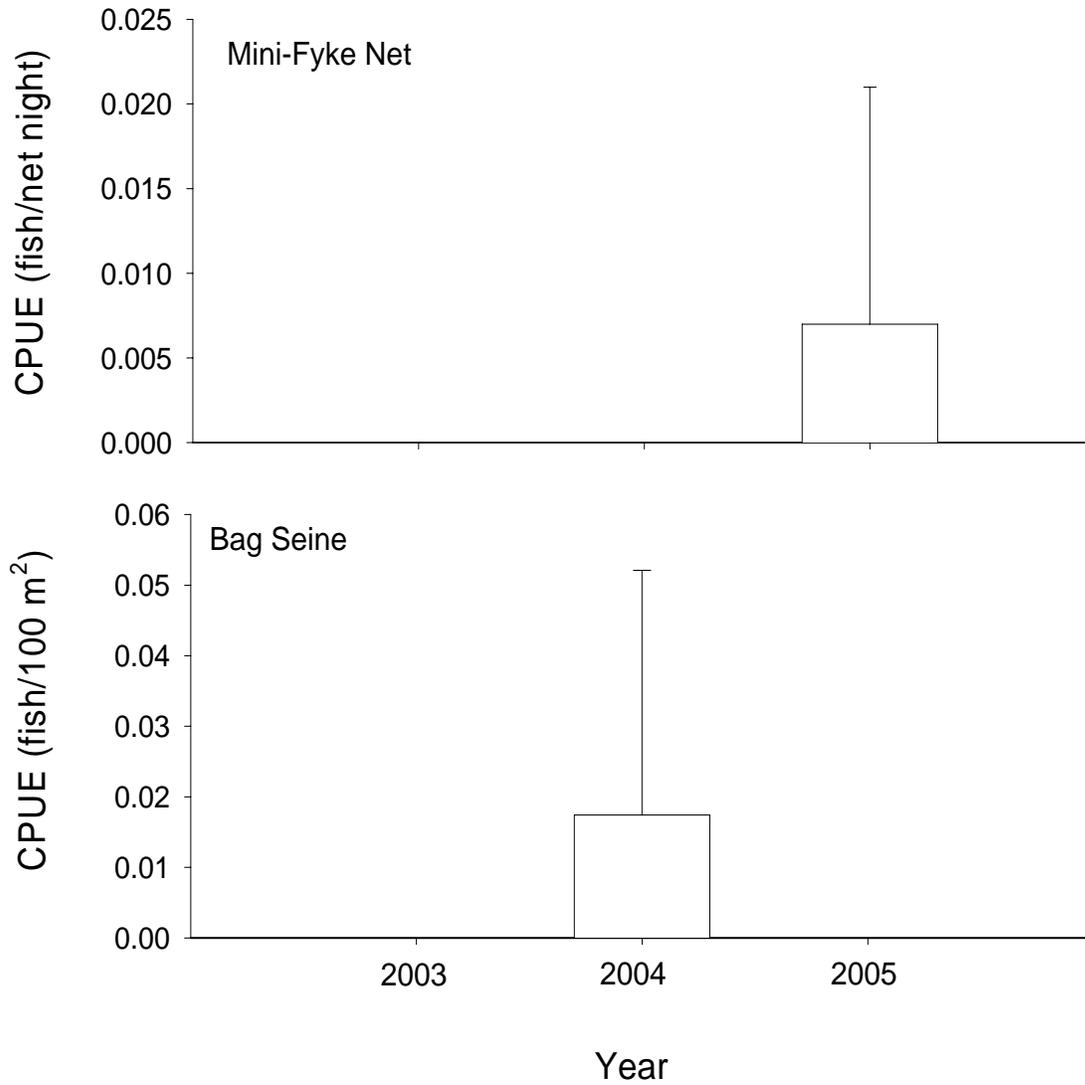


Figure 20. Mean annual catch-per-unit-effort ( $\pm 2$ SE) of sturgeon chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during fish community season 2003-2005.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	0		20	6			65	6	2						
Otter Trawl	74		12				86						1		
			21	7			68						4		
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E				
Bag Seine	0		31	1			51	6				7	3	1	
Mini-Fyke Net	1		29	1			100								
Otter Trawl	25		40				58	5				5	1	1	
			24	2			71					3	1		
Beam Trawl	Not a standard gear in segment 9														

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	74		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	0	100					
Mini-Fyke Net	1	100					
		100					
Otter Trawl	25		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

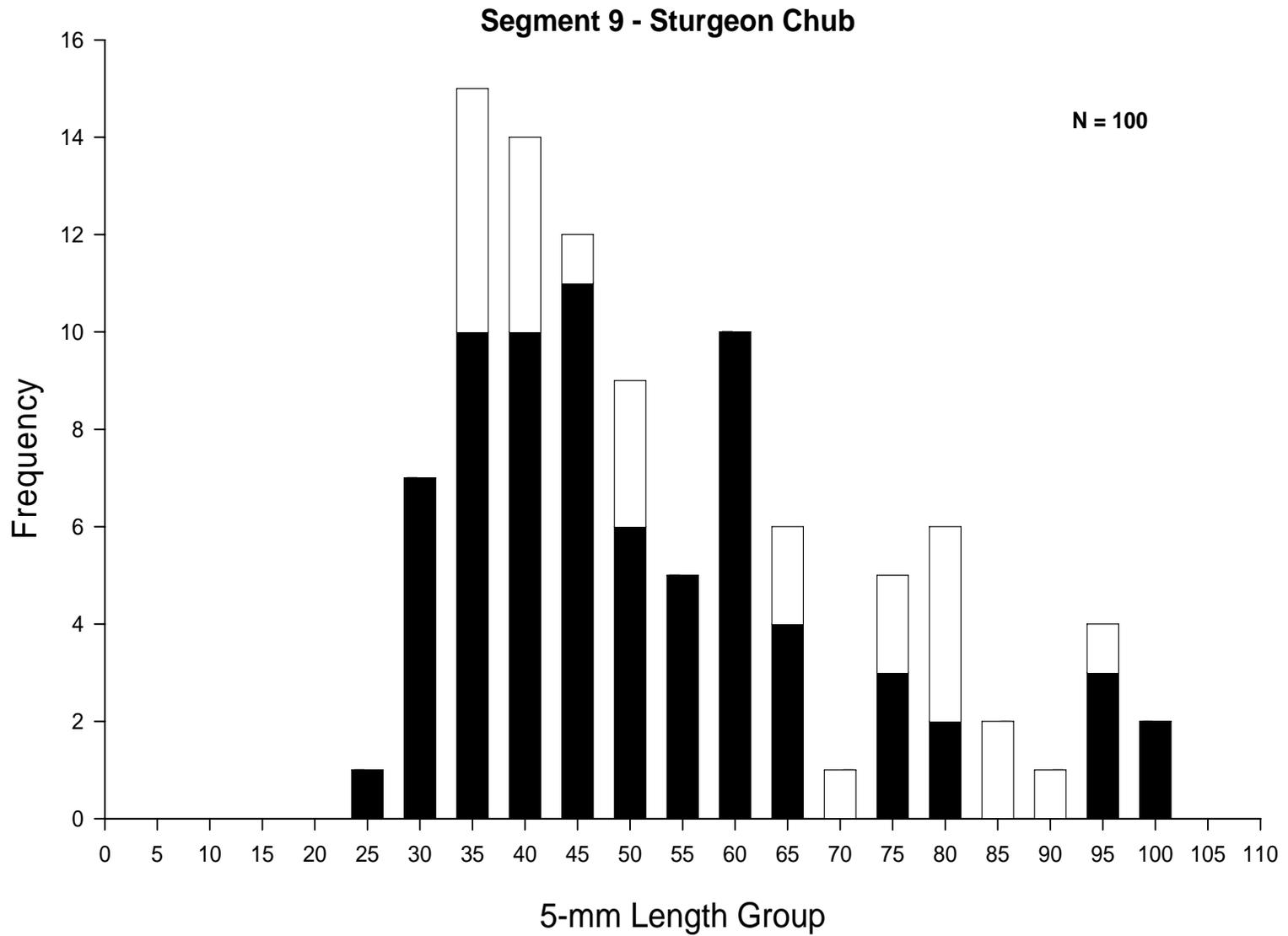


Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2004 - 2005.

## **Sicklefin Chub**

A total of 210 sicklefin chubs were captured in otter trawls ( $n = 206$ ) and mini-fyke nets ( $n = 4$ ) during the 2005 sampling season. Catch per unit effort for otter trawling during the sturgeon season was 0.25 fish per 100 m trawled in 2005 compared to 0.13 fish per 100 m trawled in 2004 and 0.01 fish per 100 m trawled during the 2003 (Figure 22). Catch per unit effort for otter trawling during the fish community season increased to 0.48 fish per 100 m trawled in 2005 from 0.08 fish per 100 m trawled in 2004 and 0.06 fish per 100 m trawled in 2003 (Figure 23).

Only four sicklefin chubs were collected with mini-fyke nets and no sicklefin chubs were collected with bag seines during 2005 (Figure 24). This is the first occurrence of sicklefin chubs in mini-fyke nets since this project originated in 2003. Sicklefin chubs have never been collected with a bag seine.

The majority of sicklefin chubs collected while otter trawling during the sturgeon season were sampled on the inside bend (82%), followed by channel cross-overs (18%) (Table 28). While otter trawling during the fish community season, 67% of the sicklefin chubs were collected in the channel cross-overs macrohabitats and 32% on inside bend macrohabitats. All sicklefin chubs were collected in channel border mesohabitat during the sturgeon and fish community season while otter trawling (Table 29). Three sicklefin chubs were sampled with mini-fyke nets on the inside bends and one in the channel cross-over macrohabitats.

A total of 177 sicklefin chubs were measured during 2005, with 110 being sampled in the fish community season (Figure 25). The average fork length was 62.2 mm during the sturgeon season and 55.3 during the fish community season. The length range for sturgeon chubs sampled during the sturgeon season was 32 to 131 mm compared to 19 to 110 mm during the fish community season.

## Segment 9 - Sicklefin Chub / Sturgeon Season

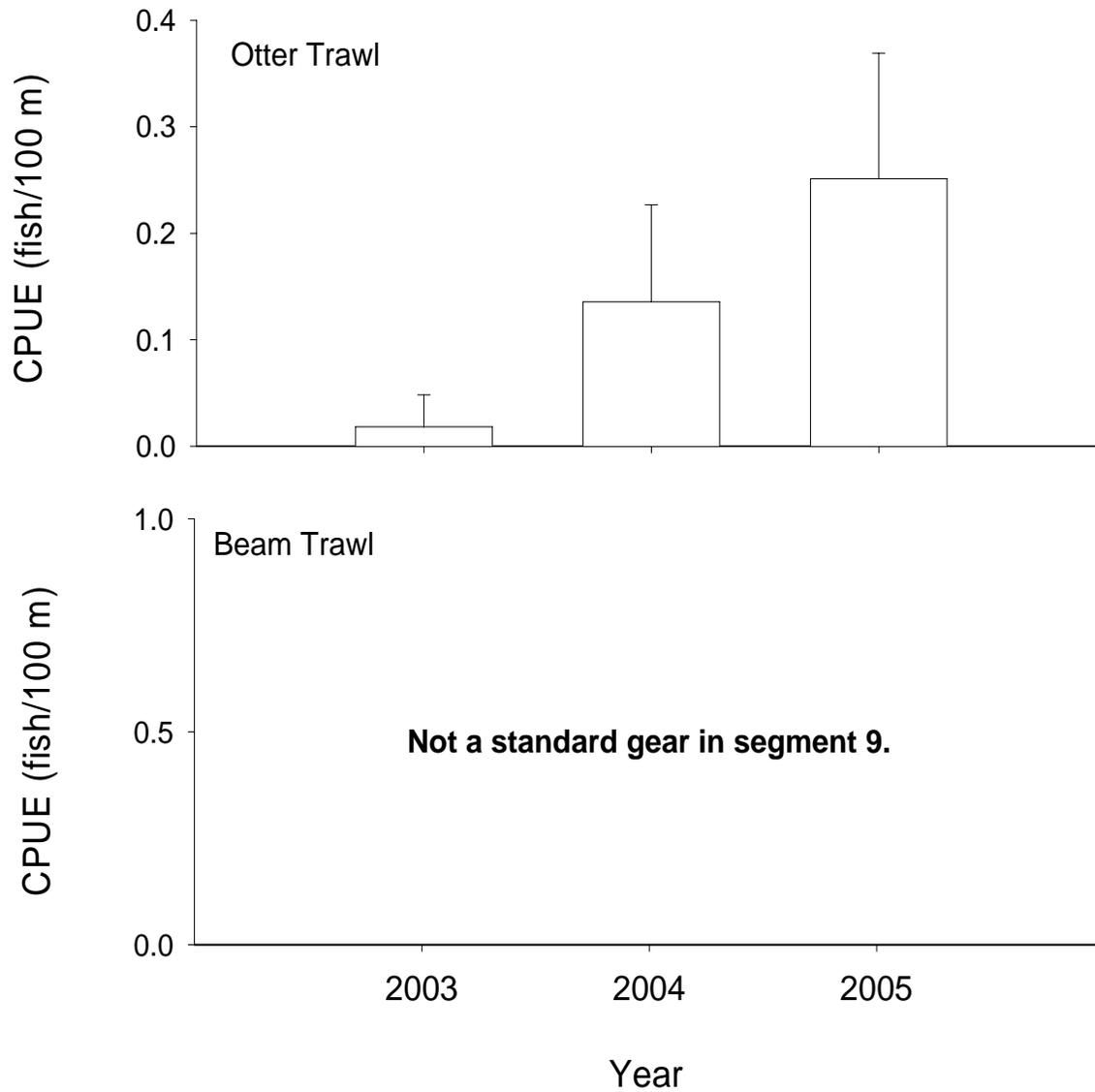


Figure 22. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sicklefin chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

## Segment 9 - Sicklefin Chub / Fish Community Season

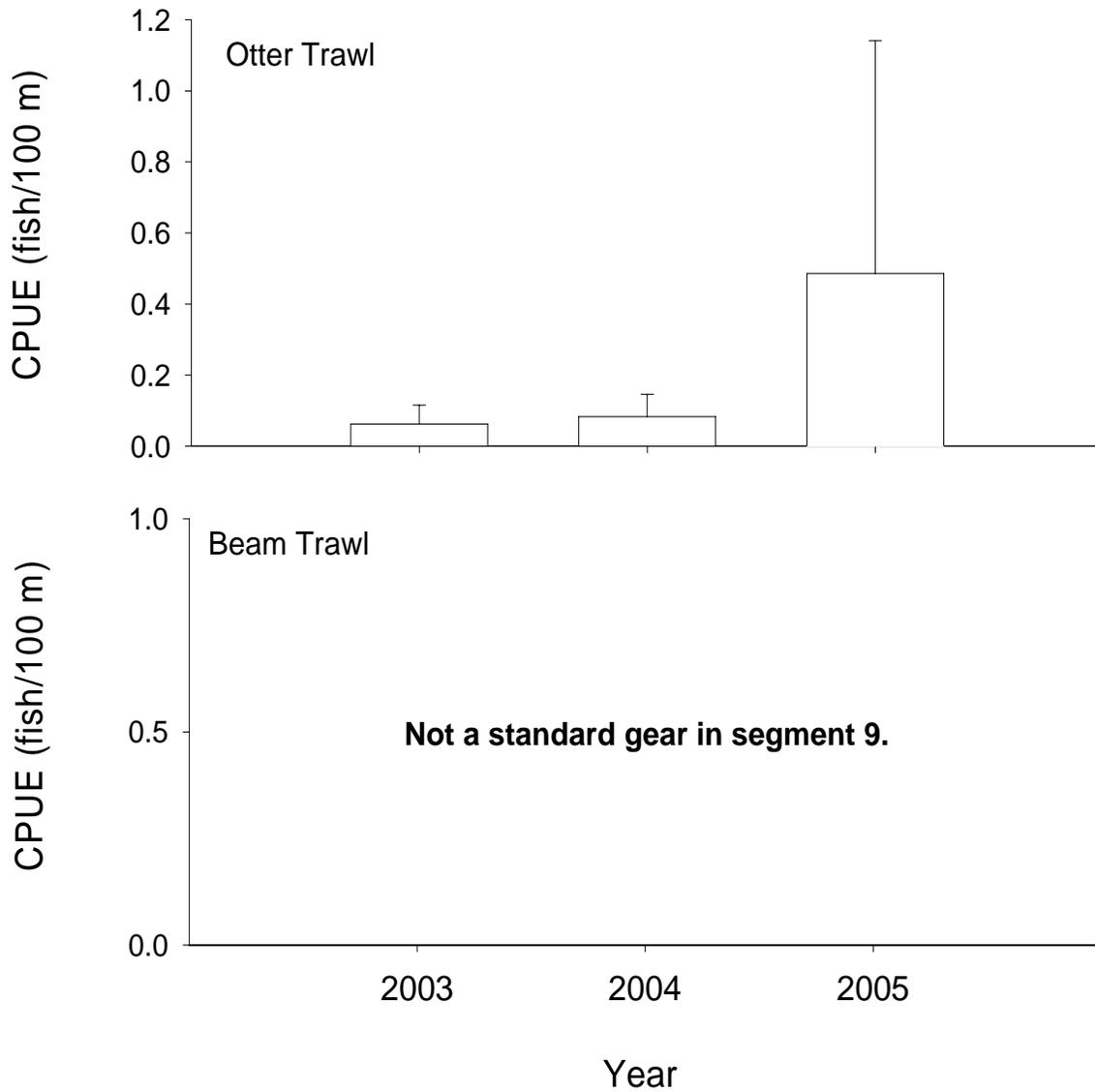


Figure 23. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sicklefin chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005.

# Segment 9 - Sicklefin Chub / Fish Community Season

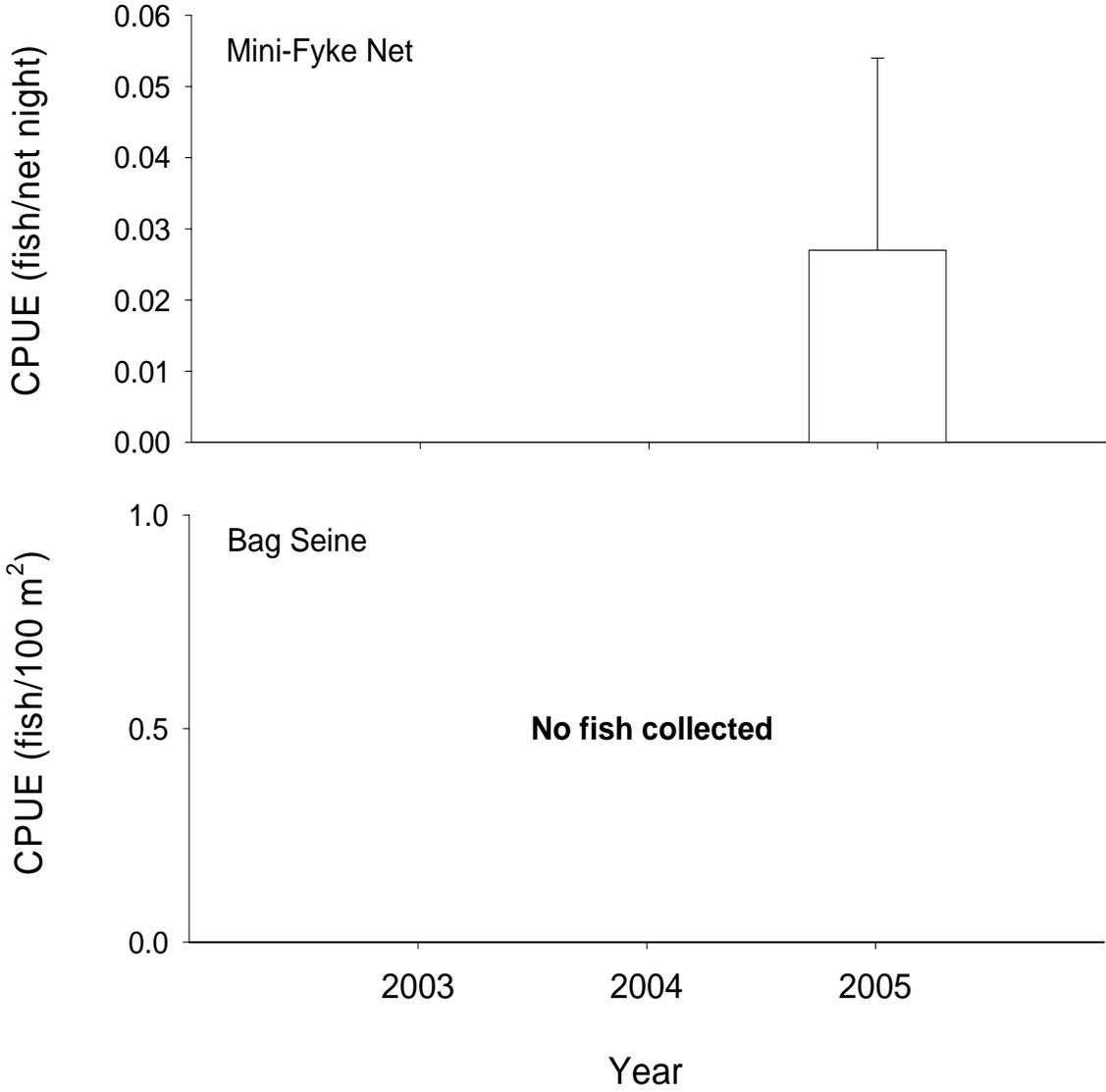


Figure 24. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sicklefin chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	0		20	6			65	6	2						
Otter Trawl	68		18				82								
			21	7			68					4			
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E				
Bag Seine	0		31				51	6				7	3	1	
Mini-Fyke Net	4		25				75								
Otter Trawl	138		29				58	5				5	1	1	
			67				32						1		
		24	2	71				3	1						
Beam Trawl	Not a standard gear in segment 9														

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	68		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	0	100					
Mini-Fyke Net	4	100					
		100					
Otter Trawl	138		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

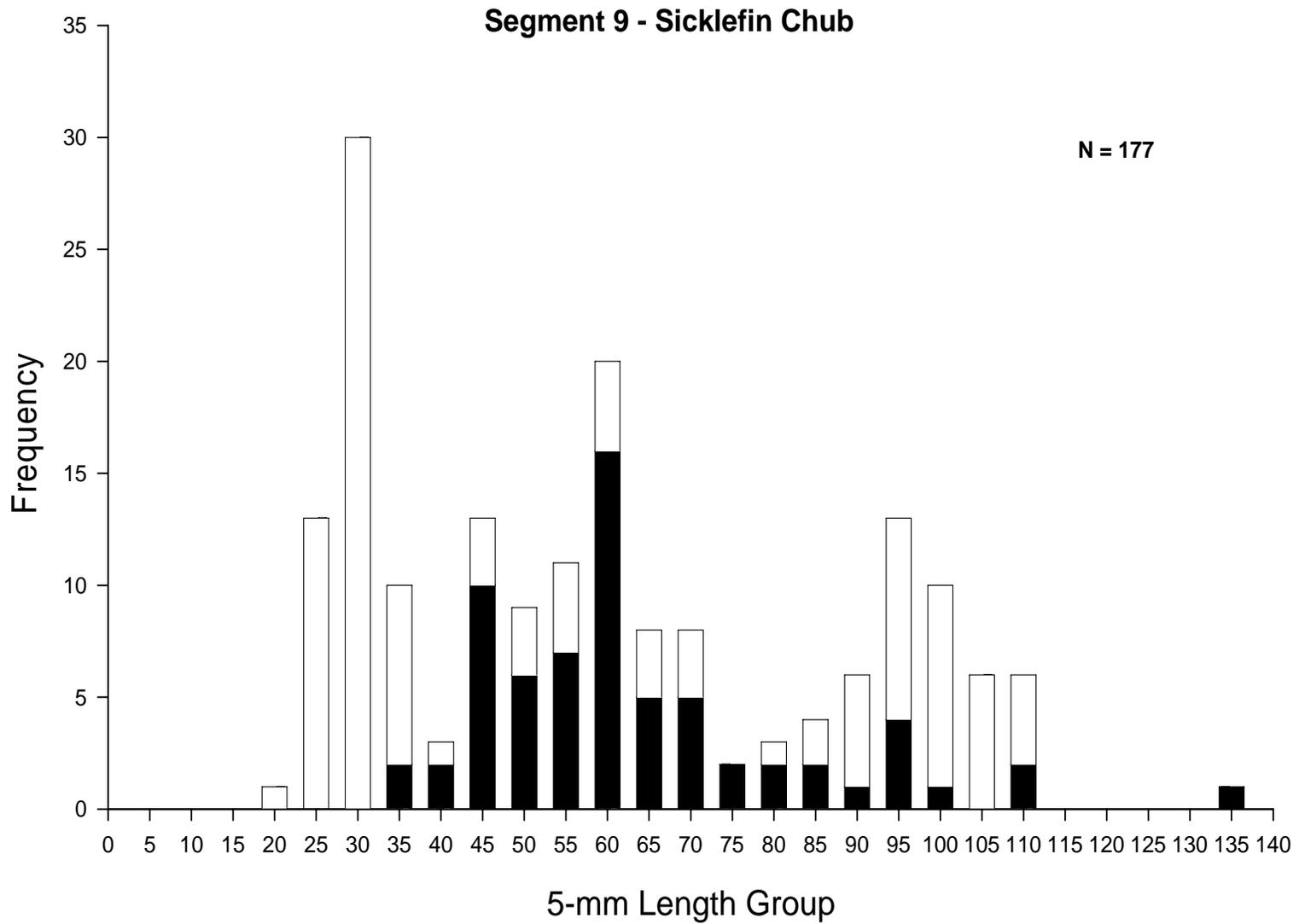


Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

## Speckled Chub

A total of 291 speckled chubs were captured in otter trawls ( $n = 256$ ), bag seines ( $n = 19$ ) and mini-fyke nets ( $n = 16$ ) during the 2005 sampling season. Catch per unit effort for otter trawling during the sturgeon season increased to 0.95 fish per 100 m trawled from 0.67 fish per 100 m trawled in 2004 and 0.31 fish per 100 m trawled during the 2003 sturgeon season (Figure 26). Catch per unit effort for otter trawling during the fish community season decreased to 0.35 fish per 100 m trawled in 2005 from 1.01 fish per 100 m trawled in 2004 (Figure 27).

Sixteen speckled chubs were collected while mini-fyke netting, resulting in a CPUE of 0.11 fish per net night (Figure 28). Mini-fyke nets showed a decrease in speckled chub abundance from 2004 when the CPUE was 0.29 fish per net night. Bag seines showed the opposite trend with CPUE for the 2005 sampling season increasing to 0.13 fish per 100 m<sup>2</sup> from 0.02 fish per 100 m<sup>2</sup> for 2003 and 2004.

The majority of speckled chubs collected during the sturgeon season while otter trawling were sampled on the inside bend (94%), followed by channel cross-overs (5%) (Table 30). During the fish community season, the majority of speckled chubs for all gears were collected on inside bend macrohabitats. While otter trawling during the sturgeon and fish community season, all speckled chubs were collected on channel border mesohabitats (Table 31).

A total of 291 speckled chubs were measured during 2005, with 187 being sampled during the sturgeon season (Figure 29). The average fork length was 44.1 mm during the sturgeon season and 39.6 during the fish community season. The length range for speckled chubs sampled during the sturgeon season was 27 to 75 mm compared to 14 to 66 mm during the fish community season.

## Segment 9 - Speckled Chub / Sturgeon Season

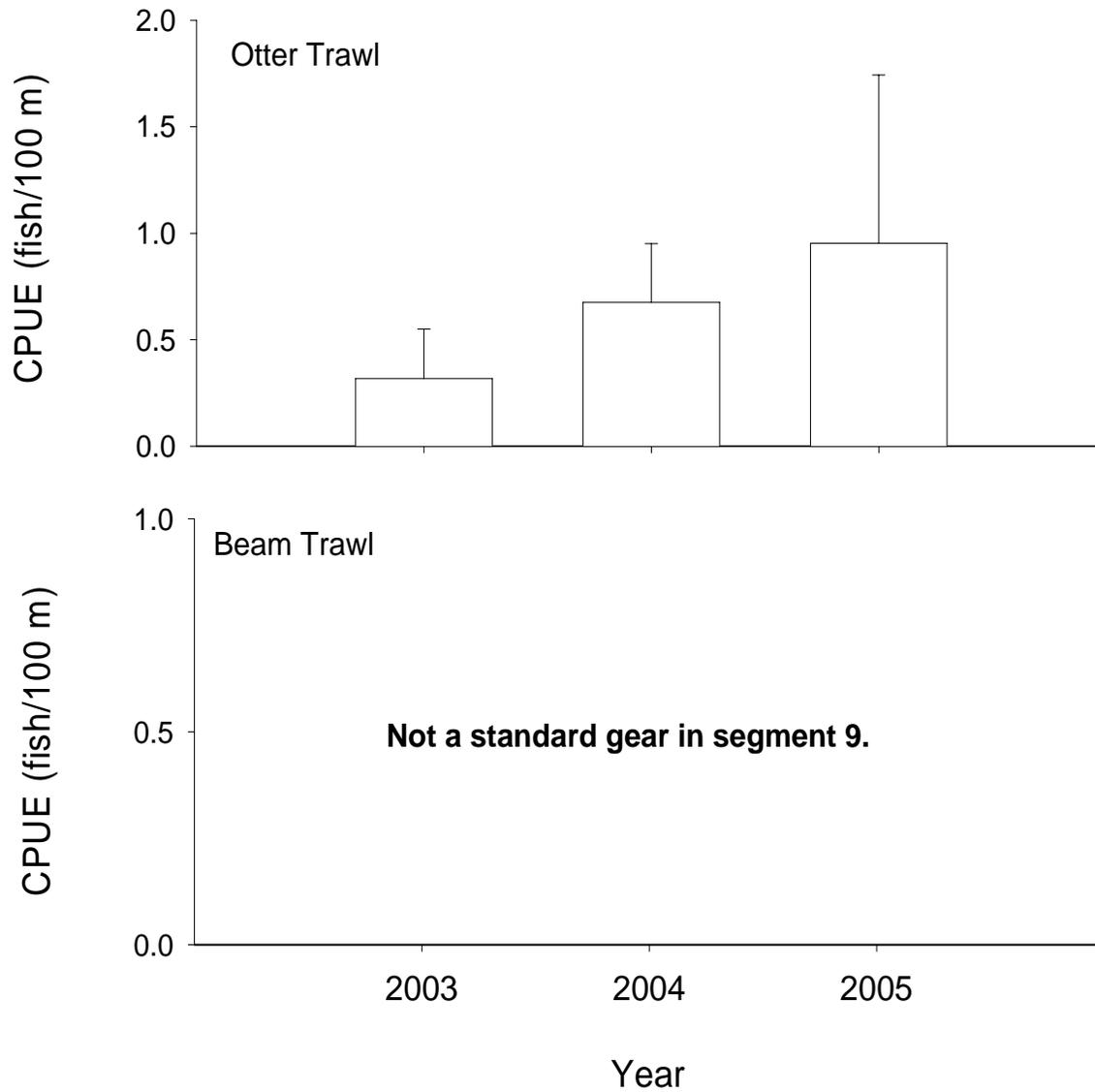


Figure 26. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of speckled chub in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

## Segment 9 - Speckled Chub / Fish Community Season

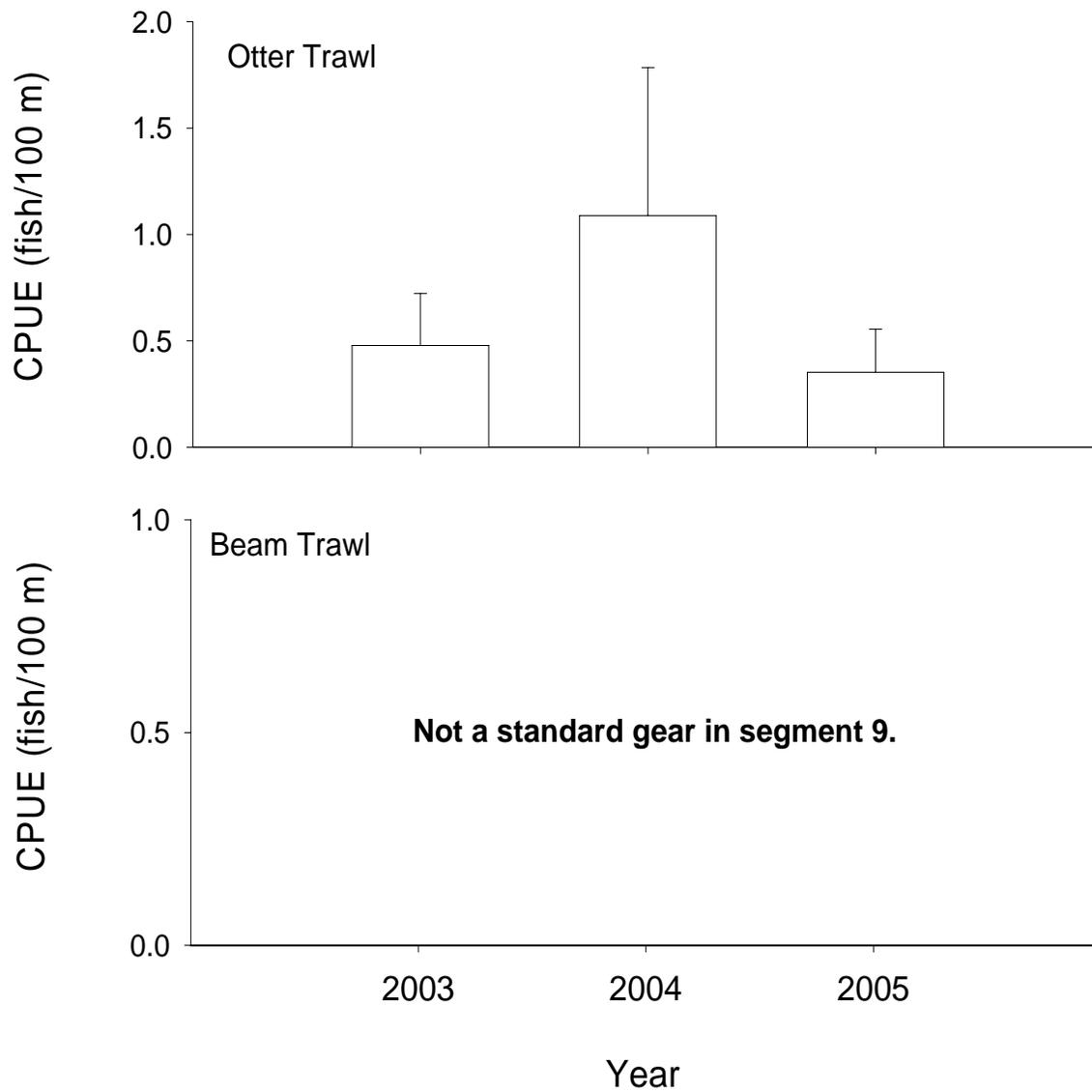


Figure 27. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of speckled chub in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005.

# Segment 9 - Speckled Chub / Fish Community Season

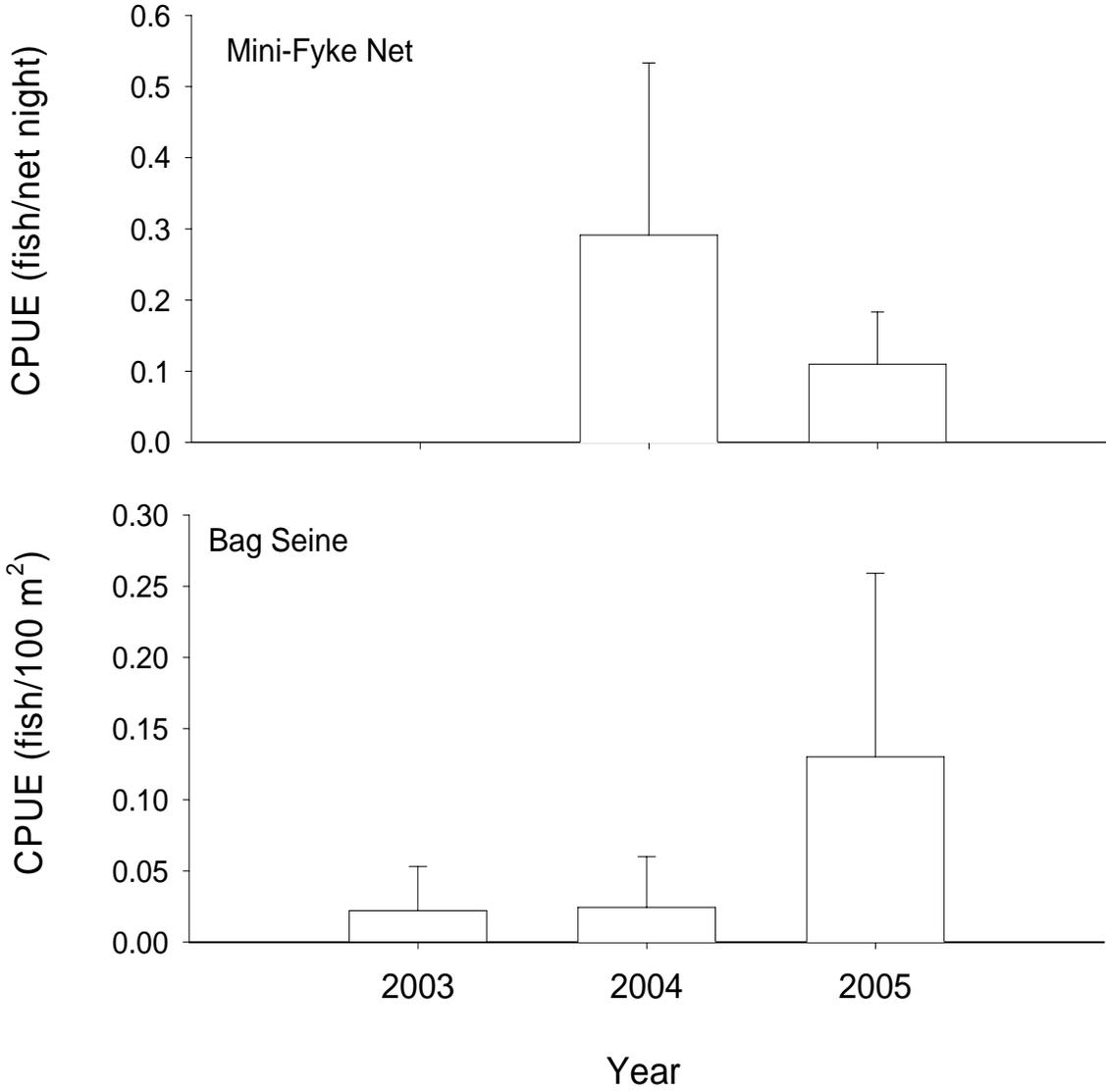


Figure 28. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69						6		
Gill Net	0		20	6			65	6	2						
Otter Trawl	187		5				94							1	
			21	7			68							4	
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E				
Bag Seine	19		5				89	5							
			31	1			51	6				7	3	1	
Mini-Fyke Net	16		25				75								
Otter Trawl	69		29	1			58	5						5	1
		7		90						3					
Beam Trawl	Not a standard gear in segment 9														
			24	2			71						3	1	

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	187		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	19	100					
		100					
Mini-Fyke Net	16	100					
		100					
Otter Trawl	69		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

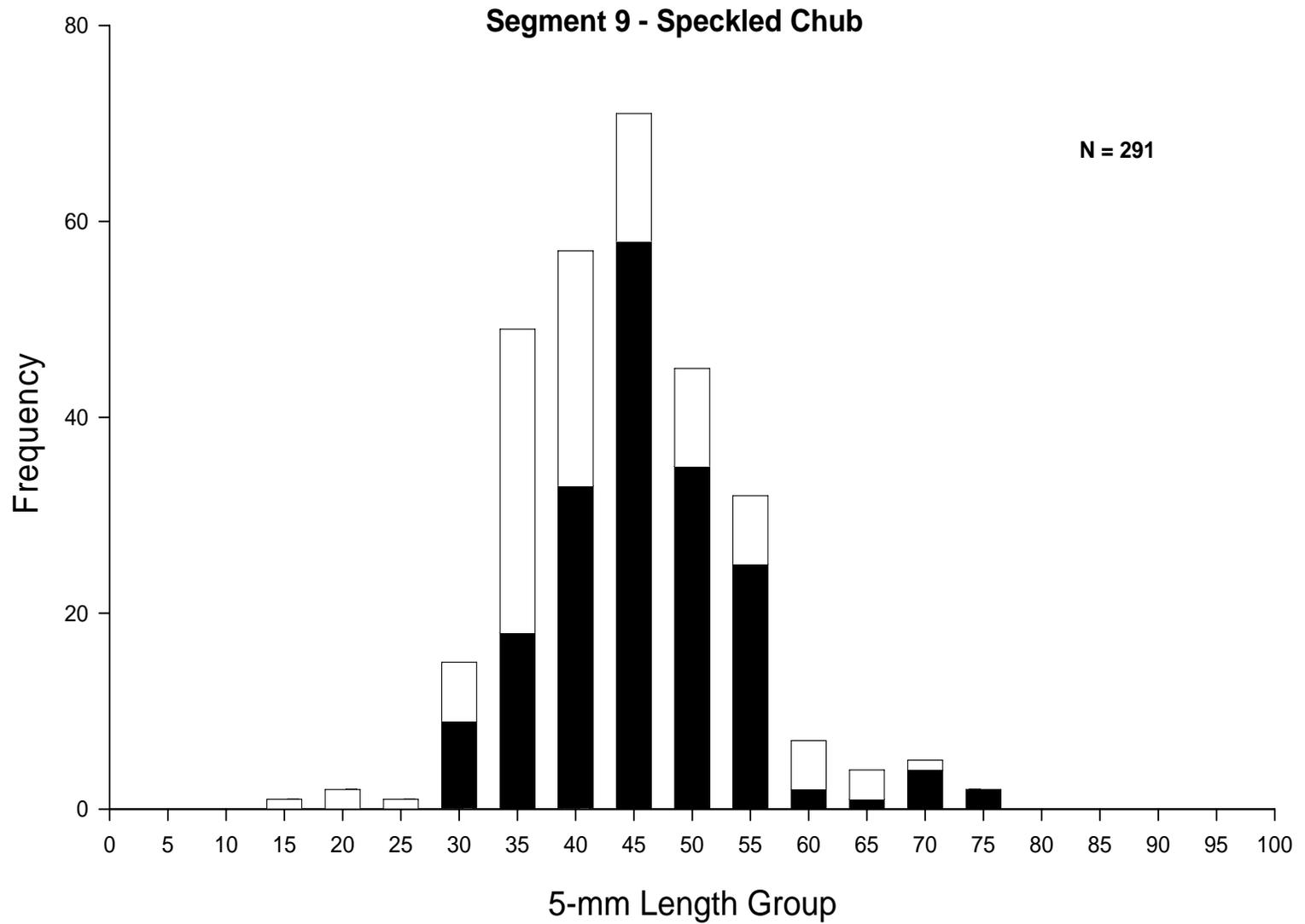


Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

## **Sand Shiner**

A total of 166 sand shiners were captured in mini-fyke nets ( $n = 89$ ), bag seines ( $n = 70$ ) and otter trawls ( $n = 7$ ) during the 2005 sampling season. Otter trawling remained an ineffective gear for sampling sand shiners. Only five sand shiners were collected during the sturgeon season and two during the fish community season, resulting in a catch per unit effort of 0.01 and 0.02 fish per 100 m trawled, respectively (Figure 30 and 31).

Eight-nine sand shiners were collected while mini-fyke netting, resulting in a CPUE of 0.61 fish per net night (Figure 32). Mini-fyke net catch per unit effort decreased from 2004 when the CPUE was 1.50 fish per net night. The 2005 bag seine catch (CPUE = 0.05 fish per 100 m<sup>2</sup>) remained relatively consistent with the 2004 data (CPUE = 0.03 fish per 100 m<sup>2</sup>), but still showed a decline from 2003 (CPUE = 1.15 fish per 100 m<sup>2</sup>).

The majority of sand shiners collected during the sturgeon season while otter trawling were sampled on channel cross-over macrohabitats (60%), followed by inside bend and tributary mouth large (20%) (Table 32). During the fish community season, the majority of sand shiners using mini-fyke nets (81%) and bag seines (46%) were collected on the inside bend macrohabitat. All sand shiners collected while otter trawling during the sturgeon and fish community season were collected on channel border mesohabitats and bar mesohabitats for mini-fyke nets and bag seines (Table 33).

A total of 166 sand shiners were measured during 2005, with 161 being sampled in the fish community season (Figure 33). The average fork length was 39.8 mm during the sturgeon season and 39.4 during the fish community season. The length range for sand shiners sampled during the sturgeon season was 29 to 55 mm compared to 23 to 64 mm during the fish community season.

## Segment 9 - Sand Shiner / Sturgeon Season

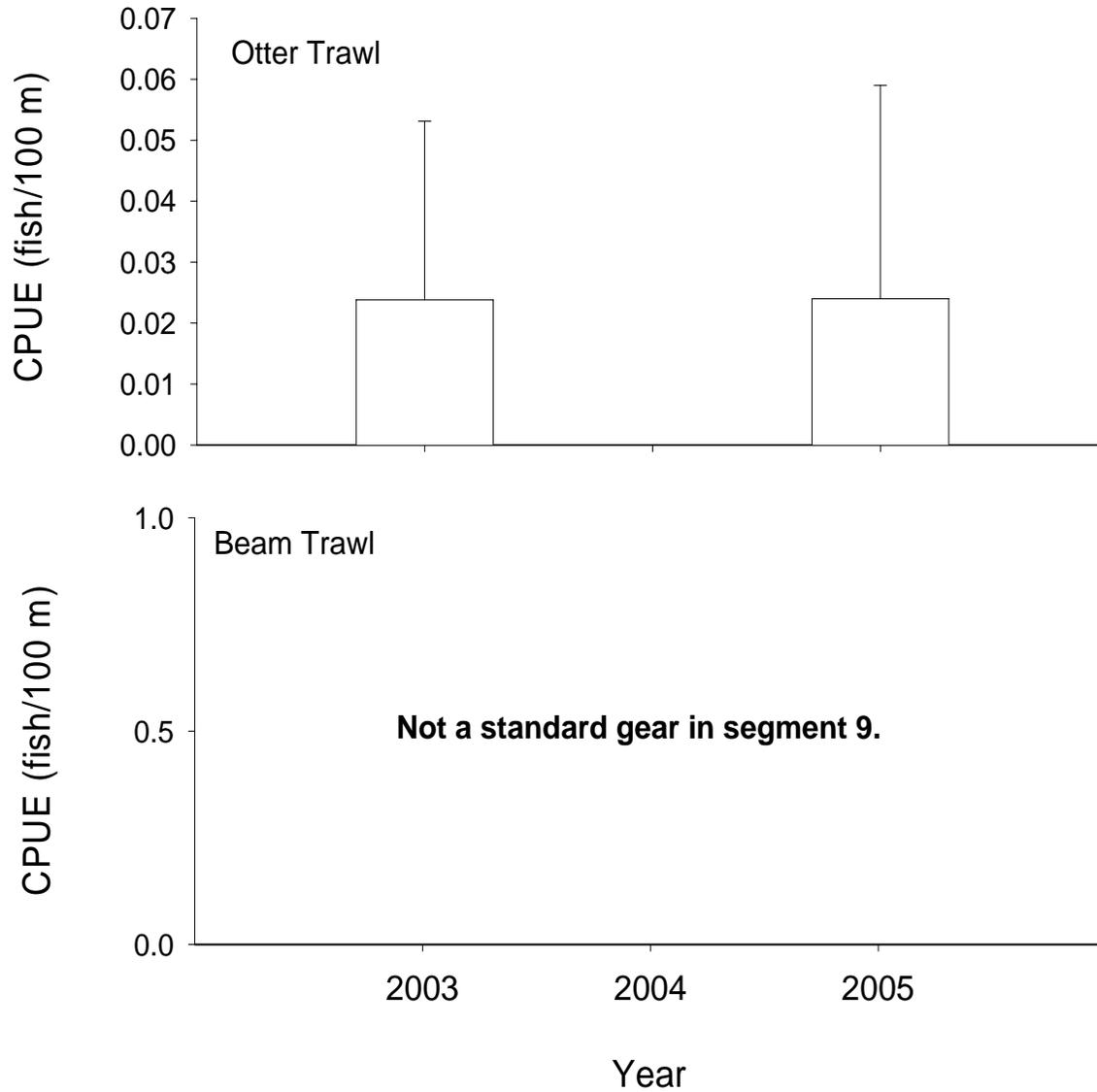


Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

## Segment 9 - Sand Shiner / Fish Community Season

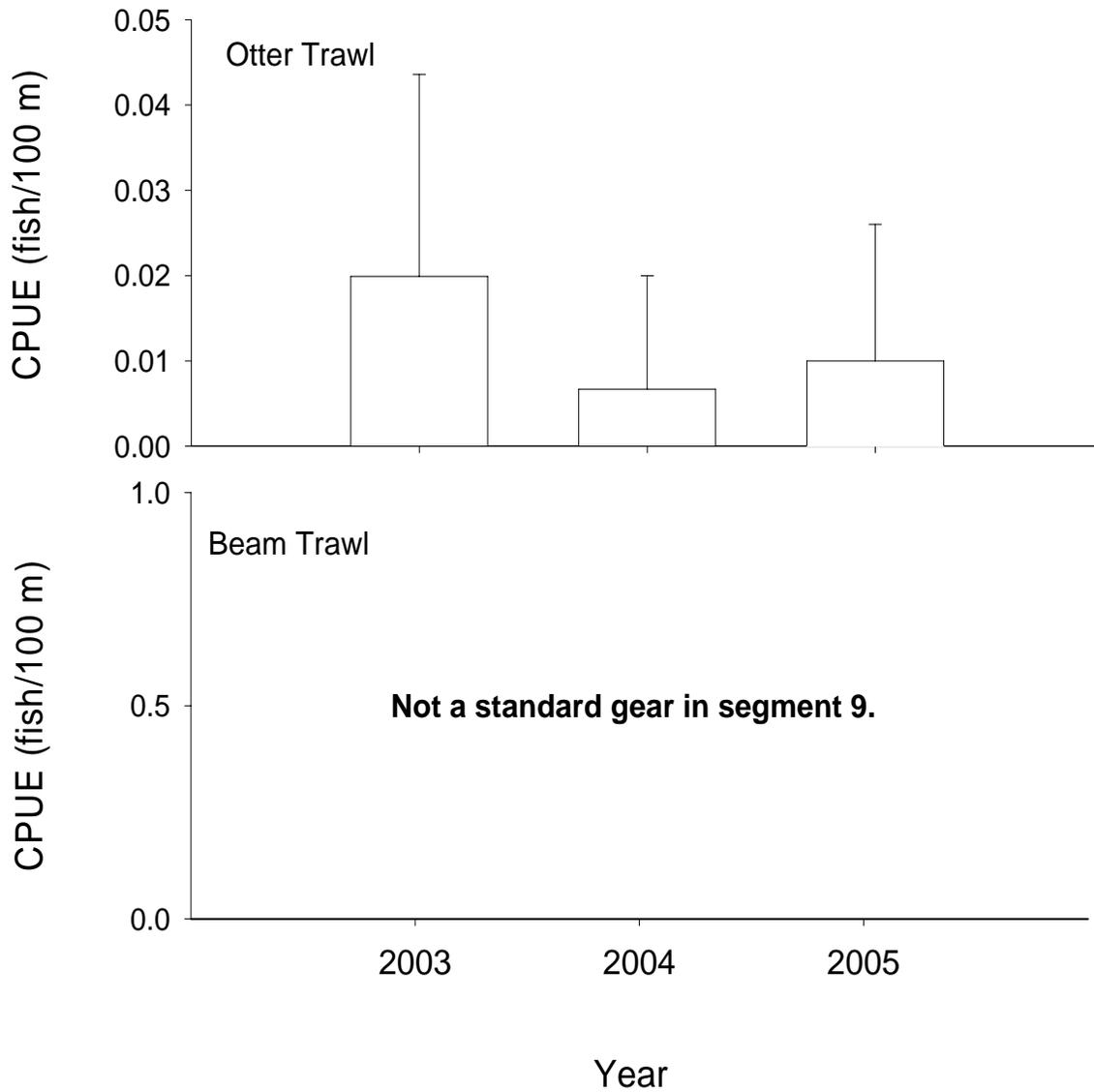


Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005.

# Segment 9 - Sand Shiner / Fish Community Season

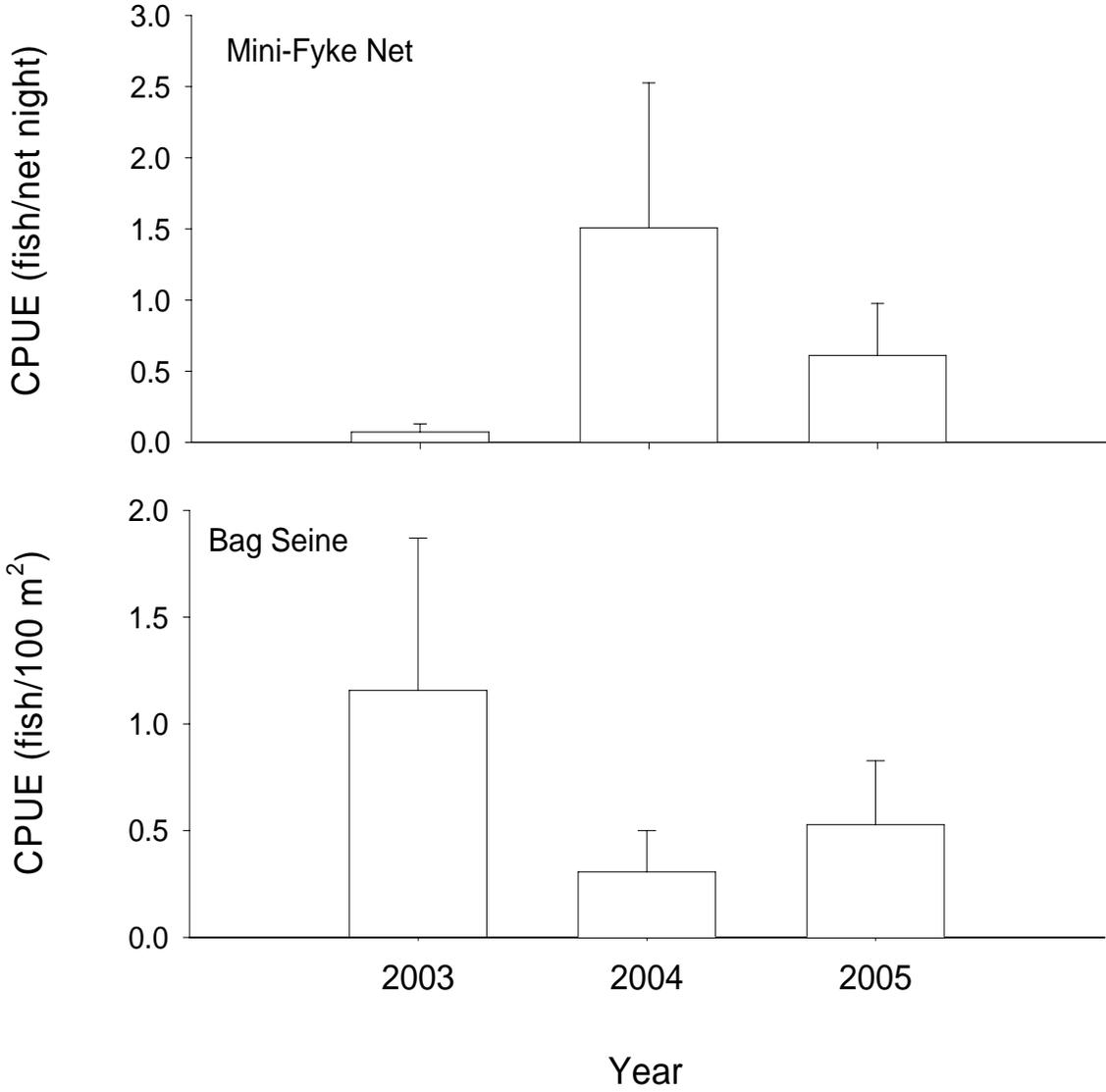


Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.



Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	0		20	6			65	6	2						
Otter Trawl	5		60				20						20		
			21	7			68						4		
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E				
Bag Seine	70		37	1			46	6				9	1		
			31	1			51	6				7	3	1	
Mini-Fyke Net	89		12				81					7			
			29	1			58	5				5	1	1	
Otter Trawl	2		50		50										
Beam Trawl		24	2	71					3	1					
		Not a standard gear in segment 9													

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	5		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	70	100					
		100					
Mini-Fyke Net	89	100					
		100					
Otter Trawl	2		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

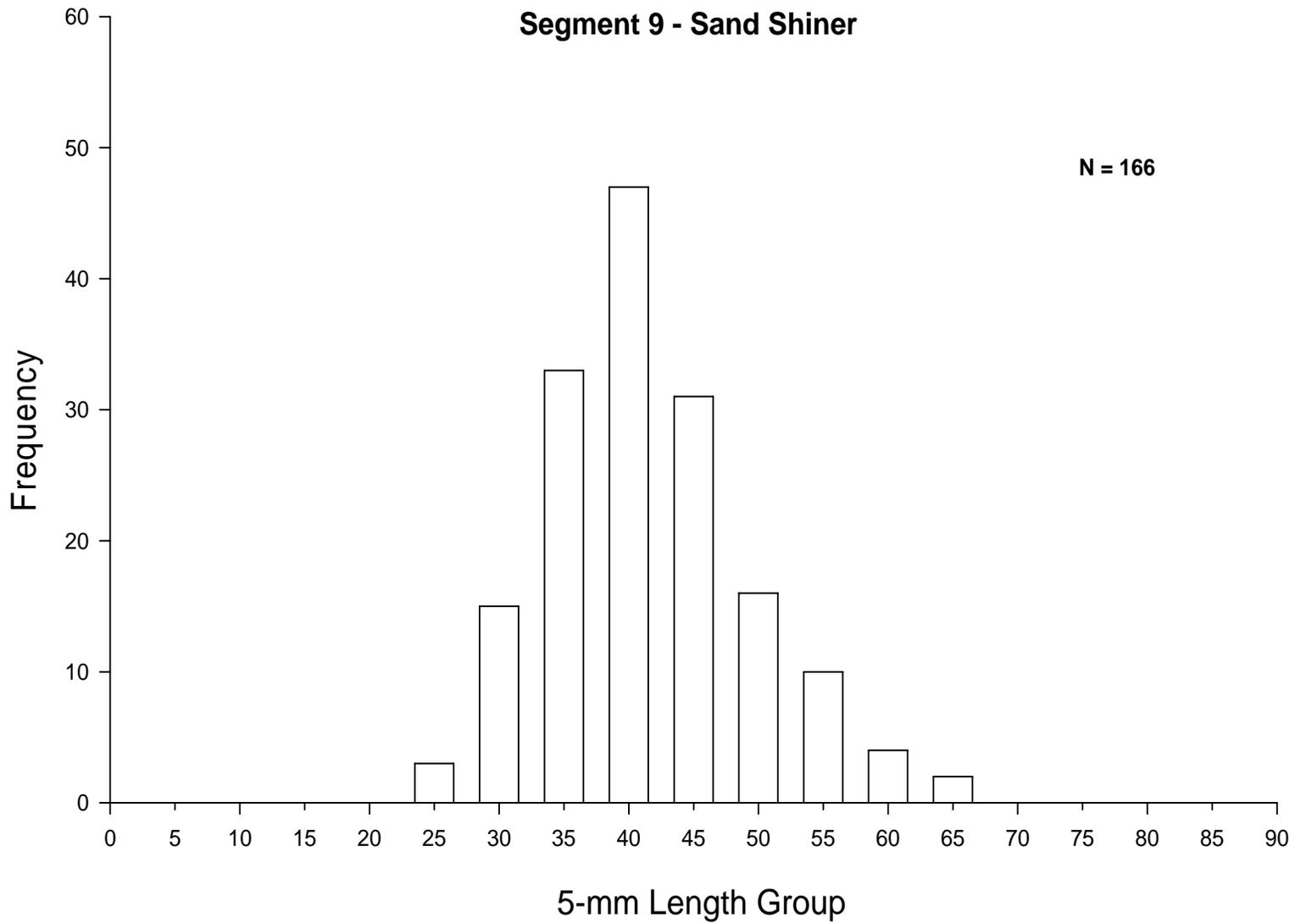


Figure 33. Length frequency of sand shiners in segment 9 of the Missouri River during 2005.

### ***Hybognathus* spp.**

A total of 388 *Hybognathus* species were captured in mini-fyke nets (n = 349) and bag seines (n = 39) during the 2005 sampling season. Otter trawling remained an ineffective gear for sampling *Hybognathus* species (Figure 34 and 35).

Three hundred and forty-nine *Hybognathus* species were collected while mini-fyke netting, resulting in a CPUE of 2.37 fish per net night (Figure 36). Mini-fyke net catch per unit effort increased from 2004 when the CPUE was 0.50 fish per net night. The 2005 bag seine catch (CPUE = 0.36 fish per 100 m<sup>2</sup>) declined from the 2004 data (CPUE = 1.34 fish per 100 m<sup>2</sup>) and the 2003 data (CPUE = 10.81 fish per 100 m<sup>2</sup>).

The majority of *Hybognathus* species were collected during the fish community season while mini-fyke nettings (90%) and bag seining (69%) were sampled on inside bend macrohabitats (Table 34). Bar mesohabitats accounted for all of the catch during the fish community season for mini-fyke nets and bag seines (Table 35).

A total of 249 *Hybognathus* species were measured during the 2005 fish community season (Figure 37). The average fork length was 41.9 mm. The length range for *Hybognathus* species was 22 to 70 mm.

## Segment 9 - *Hybognathus* spp. / Sturgeon Season

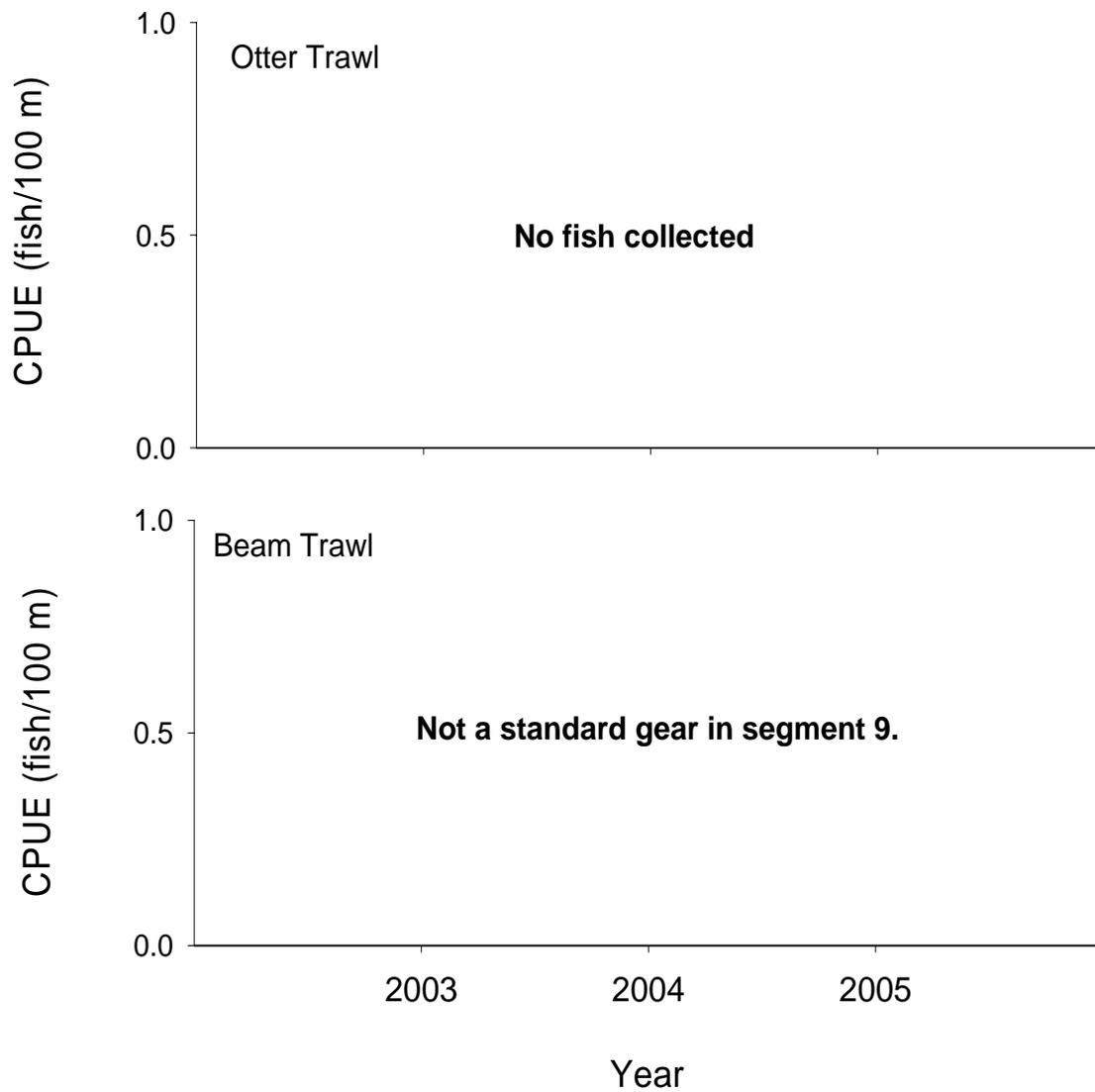


Figure 34. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of *Hybognathus* spp. in segment 9 of the Missouri River for otter trawls and beam trawls during the sturgeon season 2003-2005.

## Segment 9 - *Hybognathus* spp. / Fish Community Season

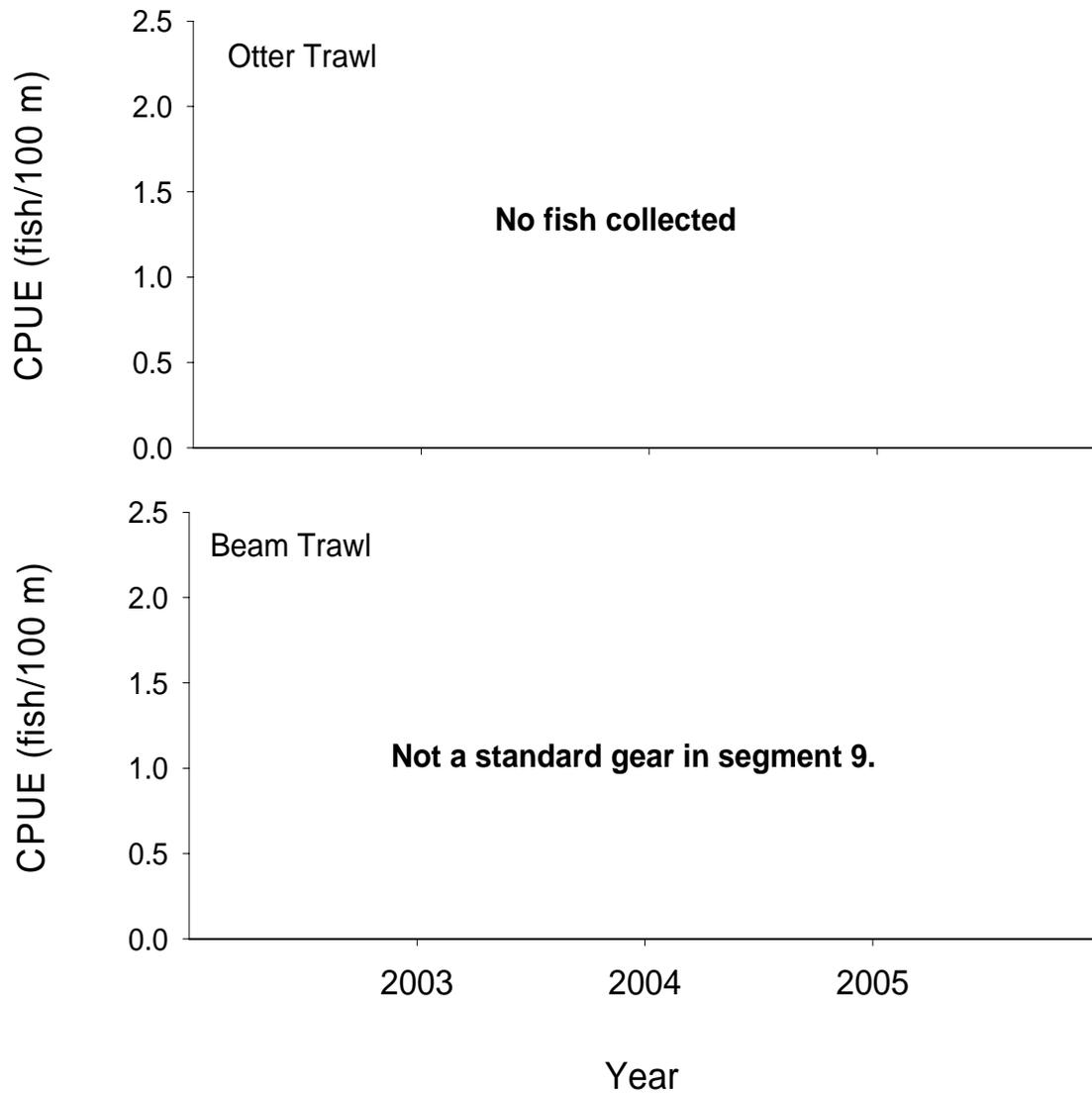


Figure 35. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of *Hybognathus* spp. in segment 9 of the Missouri River for otter trawls and beam trawls during the fish community season 2003-2005.

## Segment 9 - *Hybognathus* spp. / Fish Community Season

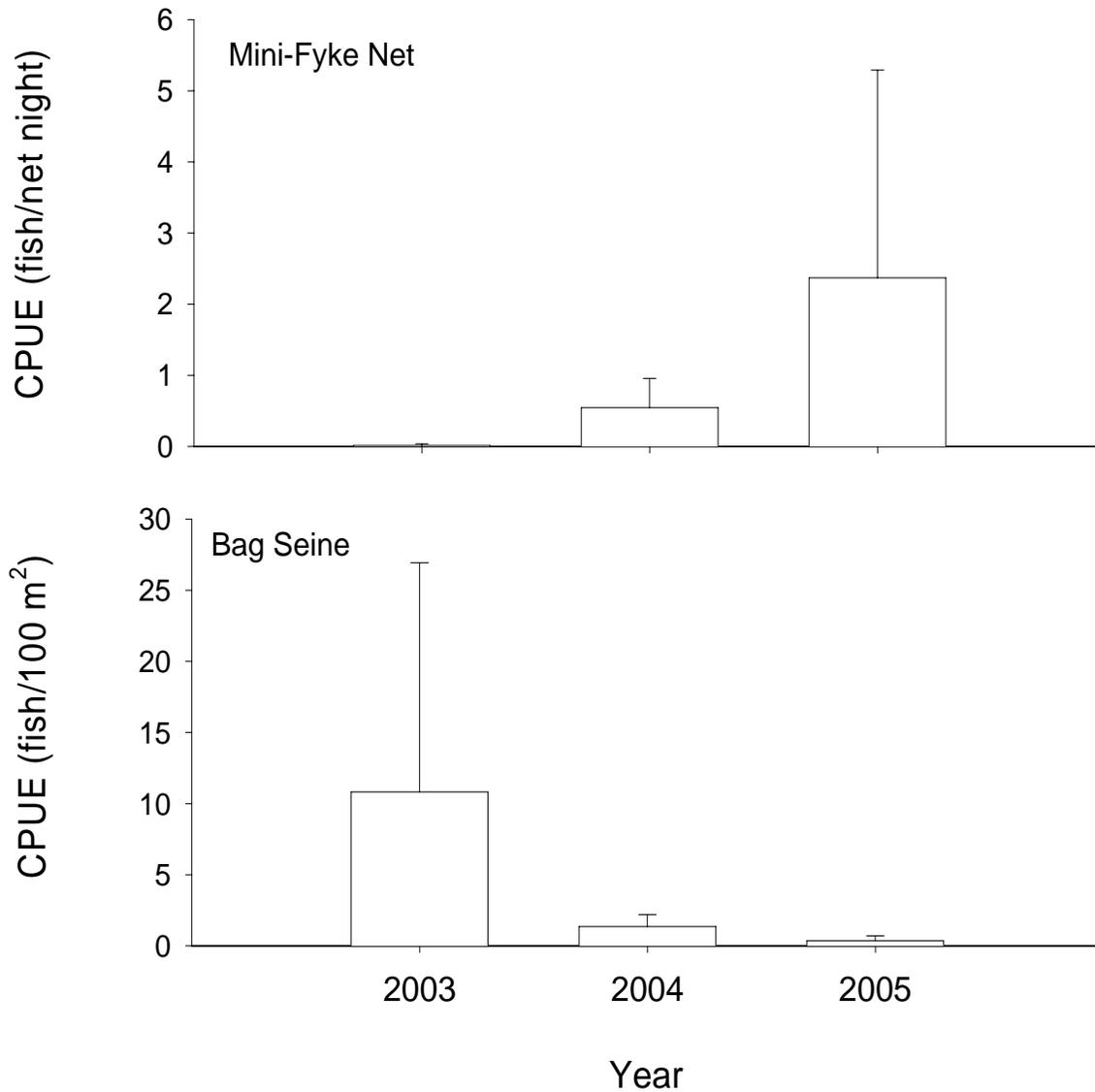


Figure 36. Mean annual catch-per-unit-effort ( $\pm 2$ SE) of *Hybognathus* spp. in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	0		20	6			65	6	2						
Otter Trawl	0														
			21	7			68						4		
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	0	N-E	27	2	N-E	N-E	70				N-E				
Bag Seine	39		31				69								
Mini-Fyke Net	349		31	1			51	6				7	3	1	
			10				90	1							
Otter Trawl	0		29	1			58	5				5	1	1	
		24	2	71				3	1						
Beam Trawl	Not a standard gear in segment 9														

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	0		32			68	
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
Bag Seine	39	100					
		100					
Mini-Fyke Net	346	100					
		100					
Otter Trawl	0		100				
Beam Trawl	Not a standard gear in segment 9						

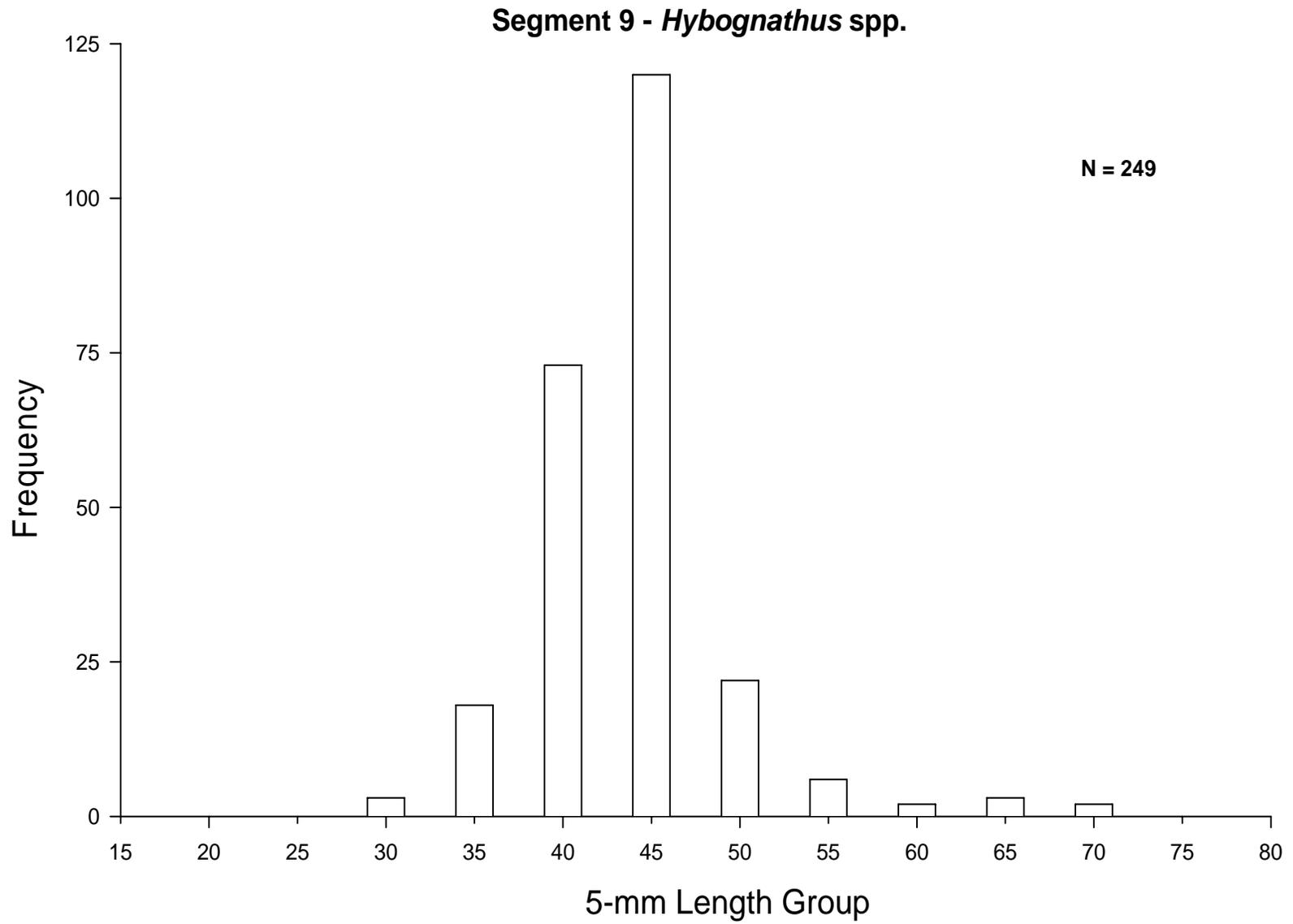


Figure 37. Length frequency of *Hybognathus* spp. caught in segment 9 of the Missouri River during summer (fish community season) 2005.

## Blue Sucker

A total of 552 blue suckers were captured in gill nets ( $n = 274$ ), 1.0" trammel nets ( $n = 185$ ), 2.5" trammel nets ( $n = 43$ ) and otter trawls ( $n = 50$ ) during the 2005 sampling season. Catch per unit effort for gill netting during the sturgeon season increased from 0.12 fish per net night in 2003 and 0.51 fish per net night in 2004 to 0.76 fish per net night in 2005 (Figure 38). Catch per unit effort for otter trawling during the sturgeon season remained the same with the 2004 data (CPUE = 0.05) but has declined from 0.10 fish per 100 m trawled in 2003. Catch per unit effort for 1.0" trammel nets increased during the 2005 sturgeon season to 0.38 fish per 100 m drifts from 0.24 fish per 100 m drifted in 2004 and 0.20 fish per 100 m drifted in 2003 (Figure 39). Catch per unit effort was 0.49 fish per 100 m drifted for the new 2.5" trammel net. Beam trawls were not a standard gear in 2005 (Figure 40).

Catch per unit effort for otter trawling during the fish community season increased slightly from 0.15 fish per 100 m trawled in 2004 to 0.18 fish per 100 m trawled in 2005 (Figure 41). The catch rates from 1.0" trammel nets during the fish community season have been declining since 2003 when the CPUE was 1.19 fish per 100 m drifted. In 2004, CPUE declined to 0.84 fish per 100 m drifted and in 2005 CPUE dropped to 0.63 fish per 100 m drifted. Mini-fyke nets and bag seines did not collect any blue suckers (Figure 42). Beam trawls were not a standard in 2005 (Figure 43)

Blue suckers were most frequently sampled during the sturgeon and fish community season from inside bend macrohabitats with all gears (Table 36). Channel cross-overs were the second most frequently sampled habitat and resulted in the second highest macrohabitat catch rate. The majority of blue suckers were sampled in pool mesohabitats during gill netting season (91%) with the remaining fish being collected in the channel border habitat (9%) (Table 37). During the sturgeon and fish community season for all other gears, channel border mesohabitats provided all of the blue suckers collected.

A total of 552 blue suckers were measured during 2005, with 400 being sampled during the sturgeon season (Figure 44). The average fork length was 651.8 mm during the sturgeon season compared to 665.1 mm for the fish community season. The length range for blue suckers sampled during the sturgeon season was 284 to 850 compared to 289 to 811 for the fish community season.

## Segment 9 - Blue Sucker / Sturgeon Season

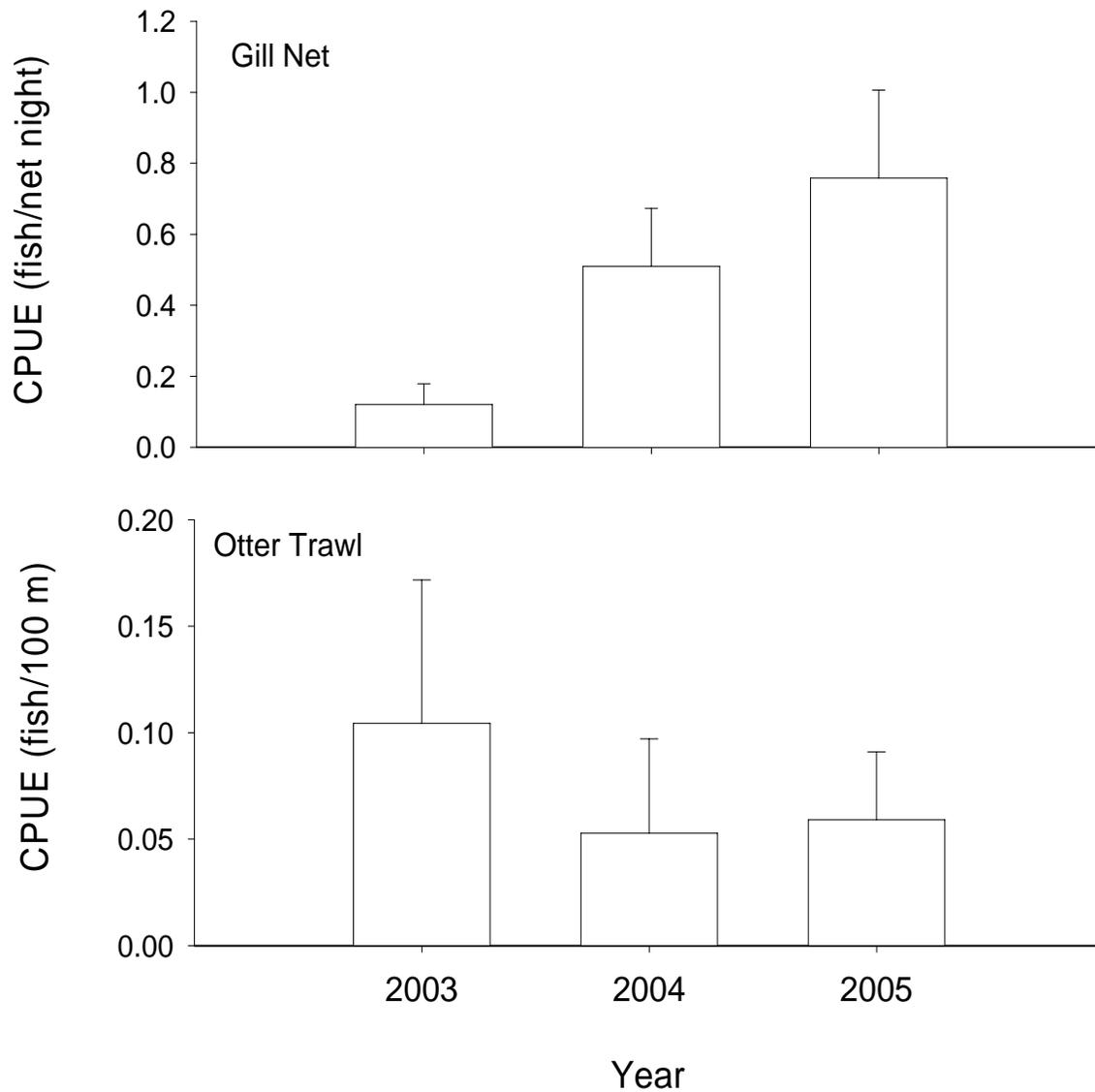


Figure 38. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of blue sucker in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005.

## Segment 9 - Blue Sucker / Sturgeon Season

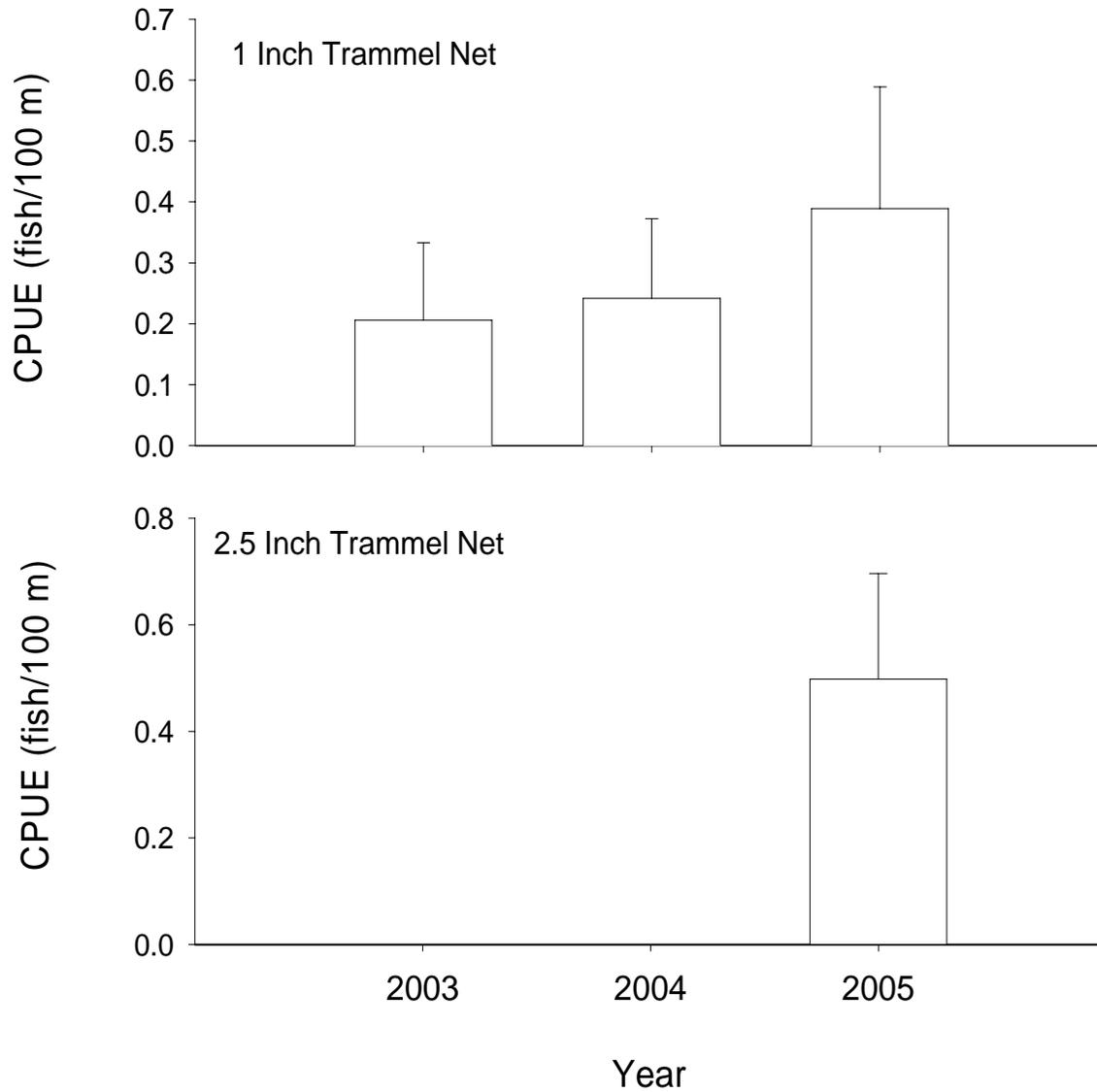


Figure 39. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005.

## Segment 9 - Blue Sucker / Sturgeon Season

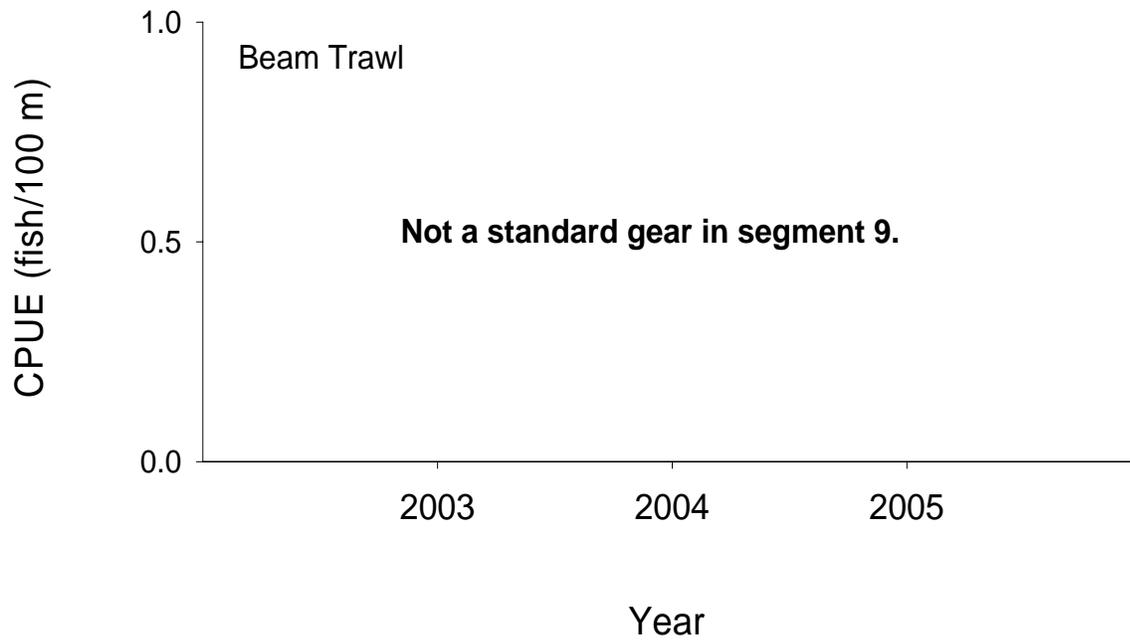


Figure 40. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005.

## Segment 9 - Blue Sucker / Fish Community Season

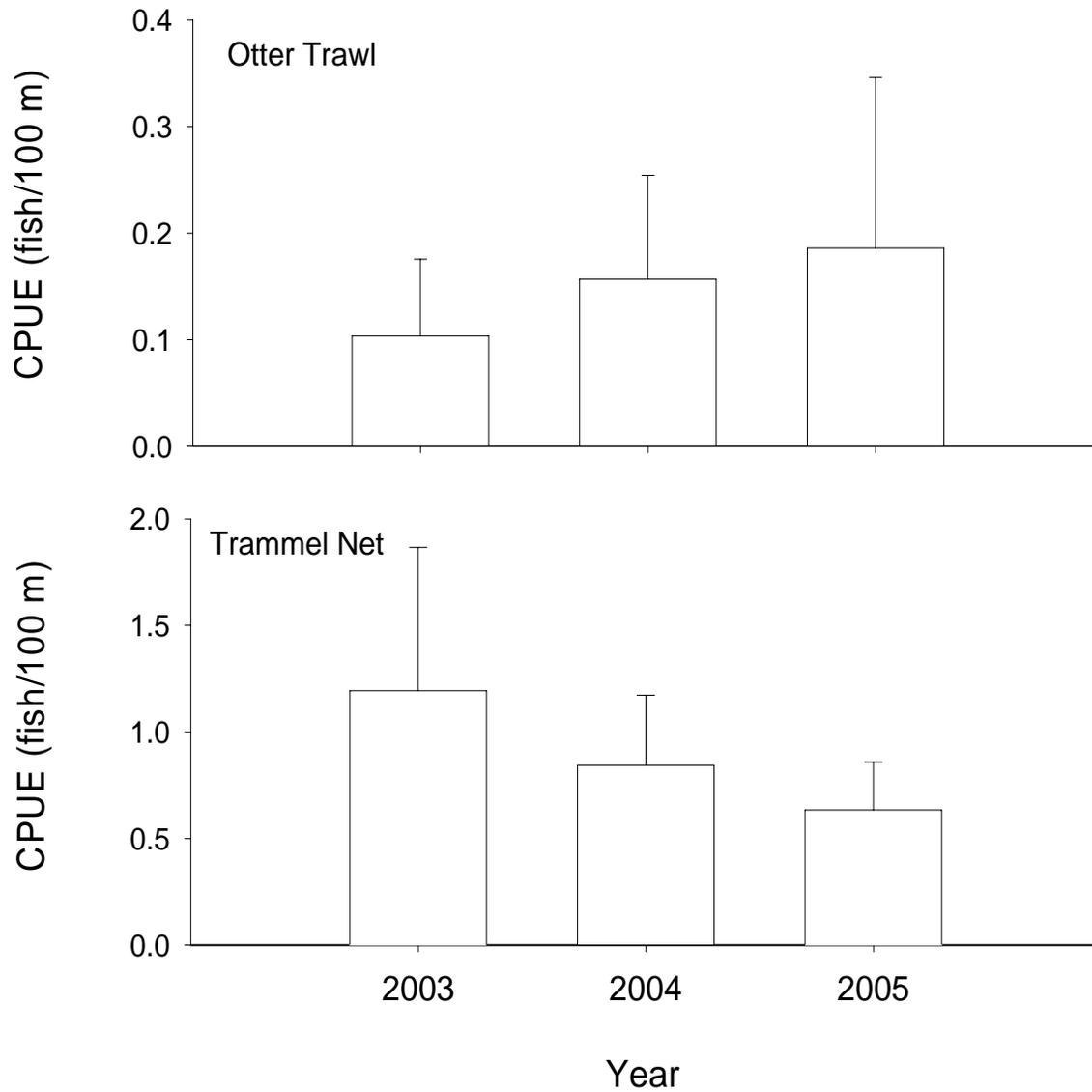


Figure 41. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker in segment 9 of the Missouri River for otter trawls and 1.0" trammel nets during the fish community season 2003-2005.

## Segment 9 - Blue Sucker / Fish Community Season

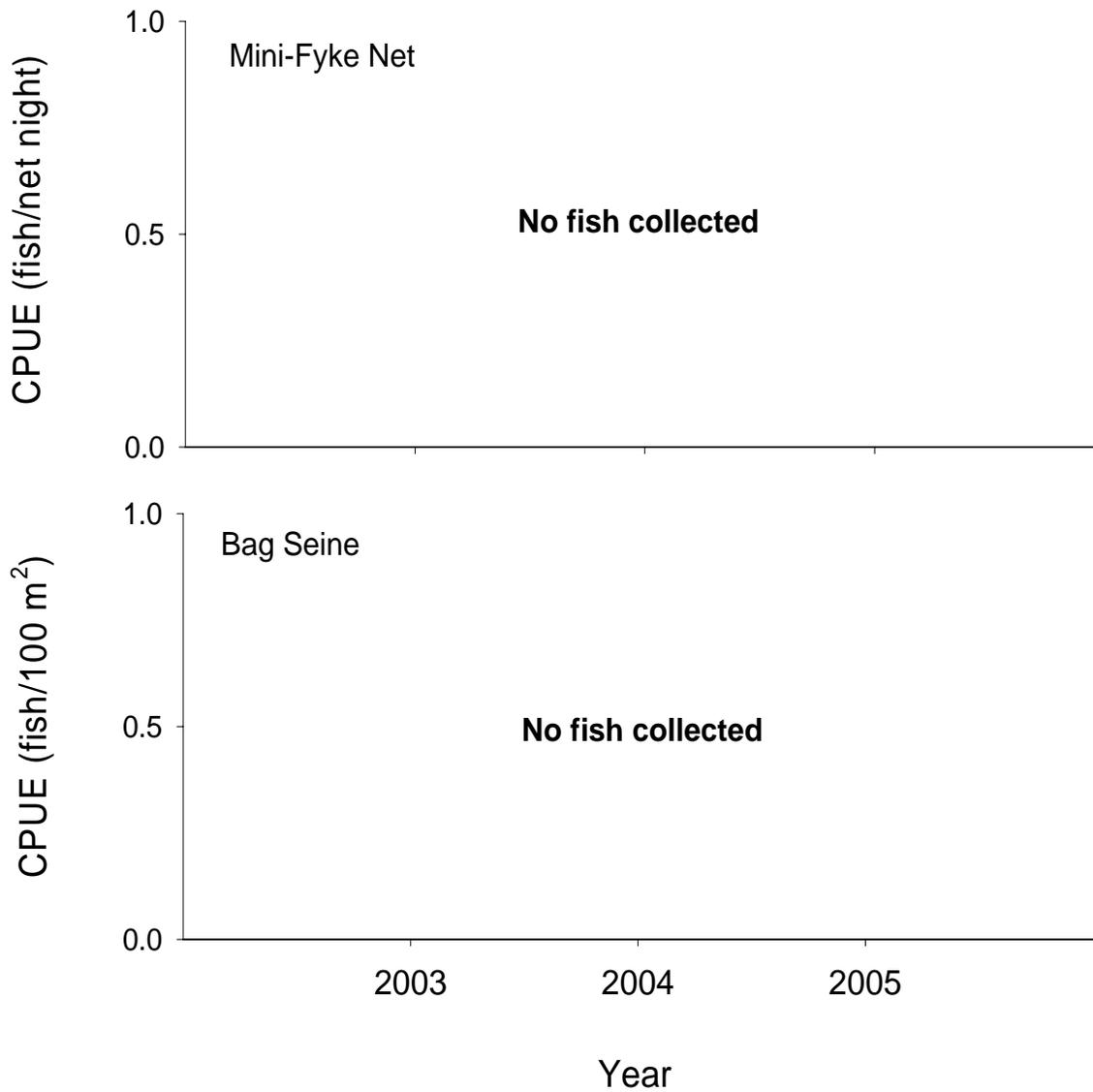


Figure 42. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.

## Segment 9 - Blue Sucker / Fish Community Season

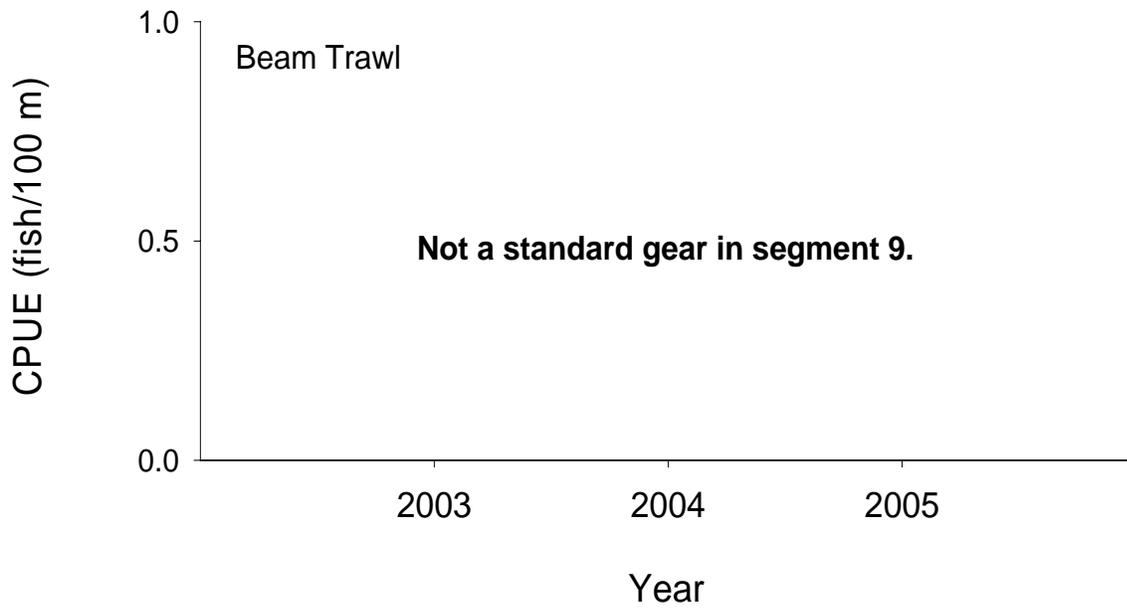


Figure 43. Mean annual catch-per-unit-effort ( $\pm$  2SE) of blue sucker in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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																	
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD				
<b>Sturgeon Season (Fall through Spring)</b>																			
1 Inch Trammel Net	67	N-E	22	4	N-E	N-E	69				N-E		4						
			23	5			69					3							
2.5 Inch Trammel Net	43		23				70					7							
			25				69					6							
Gill Net	274		15	8			65	11	1										
			20	6			65	6	2										
Otter Trawl	16		6	12			81												
			21	7			68					4							
Beam Trawl	Not a standard gear in segment 9																		
<b>Fish Community Season (Summer)</b>																			
1 Inch Trammel Net	118	N-E	20	9	N-E	N-E	70				N-E								
			27	2			70												
Bag Seine	0		31	1			51	6				7	3	1					
Mini-Fyke Net	0		29	1			58	5				5	1	1					
Otter Trawl	34		29	3			68												
			24	2			71					3	1						
Beam Trawl	Not a standard gear in segment 9																		

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	67		100	N-E	N-E		
			100				
2.5 Inch Trammel Net	43		100				
			100				
Gill Net	274		9			91	
			32			68	
Otter Trawl	16		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	118		100	N-E	N-E		
			100				
Bag Seine	0	100					
Mini-Fyke Net	0	100					
Otter Trawl	34		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

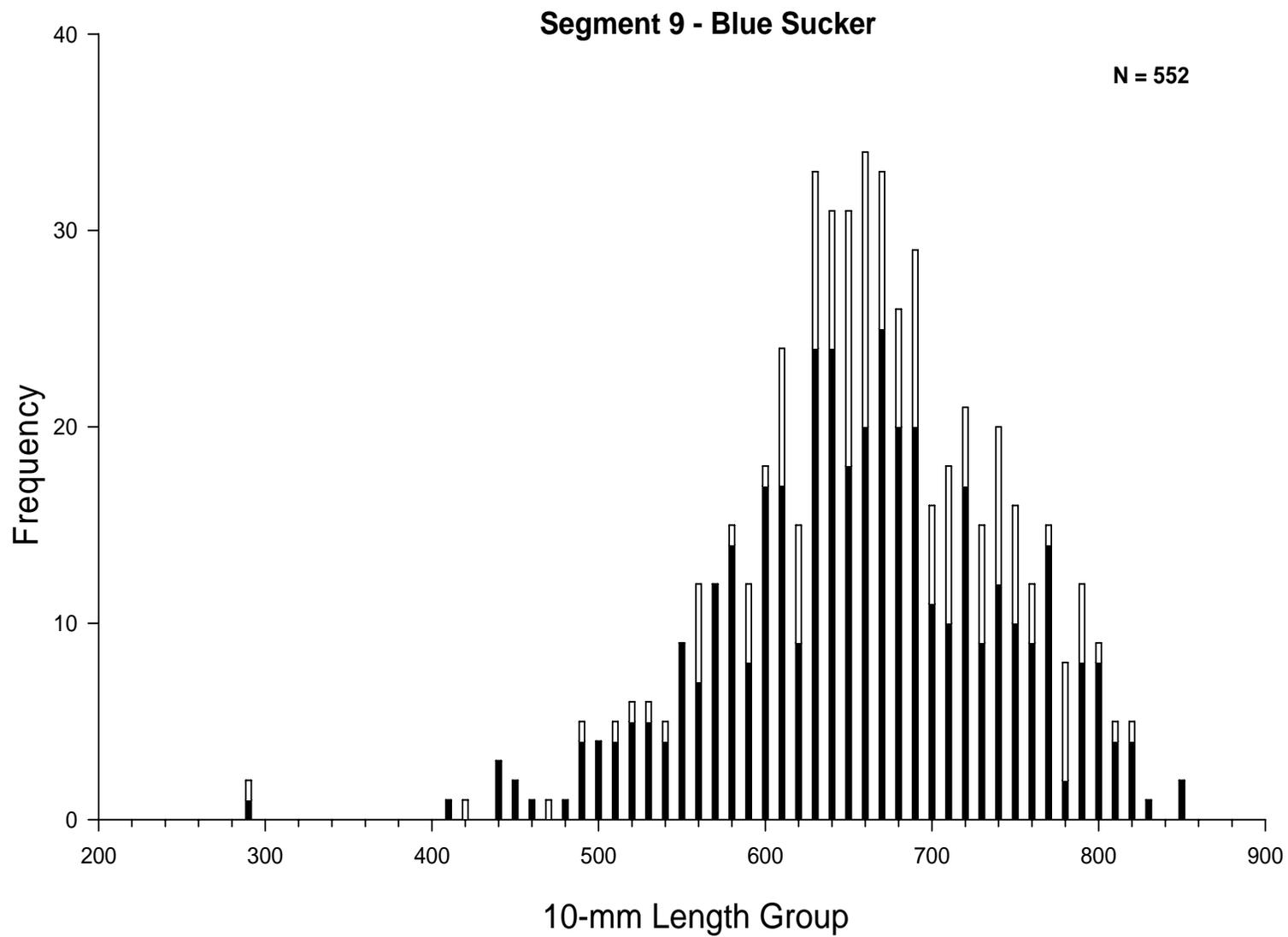


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

## Sauger

A total of 52 sauger were captured in gill nets (n = 40), 1.0" trammel nets (n = 5), mini-fyke net (n = 4), otter trawls (n = 2) and bag seine (n = 1) during the 2005 sampling season. Catch per unit effort for gill netting during the sturgeon season increased slightly from 0.02 fish per net night in 2003 and 0.10 fish per net night in 2004 to 0.11 fish per net night in 2005 (Figure 45). One sauger was collected while otter trawling during the sturgeon season, resulting in an CPUE of 0.003 fish per 100 m trawled. This was the first fish sampled during the sturgeon season with an otter trawl. No sauger were sampled with the 1.0" or 2.5" trammel nets decreased during the sturgeon season (Figure 46). Beam trawls were not a standard gear in 2005 (Figure 47).

Catch per unit effort for otter trawling during the fish community season increased slightly from 0.003 fish per 100 m trawled in 2004 to 0.004 fish per 100 m trawled in 2005 (Figure 48). 1.0" trammel nets during the fish community season collected five sauger, resulting in a CPUE of 0.02 fish per 100 m drifted. Mini-fyke nets and bag seines collect five sauger, resulting in CPUE's of 0.02 fish per net night and 0.01 fish per 100 m<sup>2</sup>, respectively (Figure 49). Beam trawls were not a standard gear in 2005 (Figure 50).

Sauger were most frequently sampled during the sturgeon and fish community season from inside bend macrohabitats with all gears except for otter trawl during the fish community season (Table 38). The only sauger collected with an otter trawl during the fish community season was sampled in a channel cross-over macrohabitat. The majority of sauger were sampled in pool mesohabitats during gill netting season (95%) with the remaining fish being collected in the channel border habitat (5%) (Table 39). During the sturgeon and fish community season while using trammel nets and otter trawls all sauger were collected from channel border mesohabitats and while using bag seines and mini-fyke nets all sauger were collected from bar mesohabitats.

A total of 52 sauger were measured during 2005, with 44 being sampled during the sturgeon season (Figure 51). The average fork length was 456.9 mm during the sturgeon season compared to 251.1 mm for the fish community season. The length range for blue suckers sampled during the sturgeon season was 374 to 573 compared to 70 to 411 for the fish community season.

## Segment 9 - Sauger / Sturgeon Season

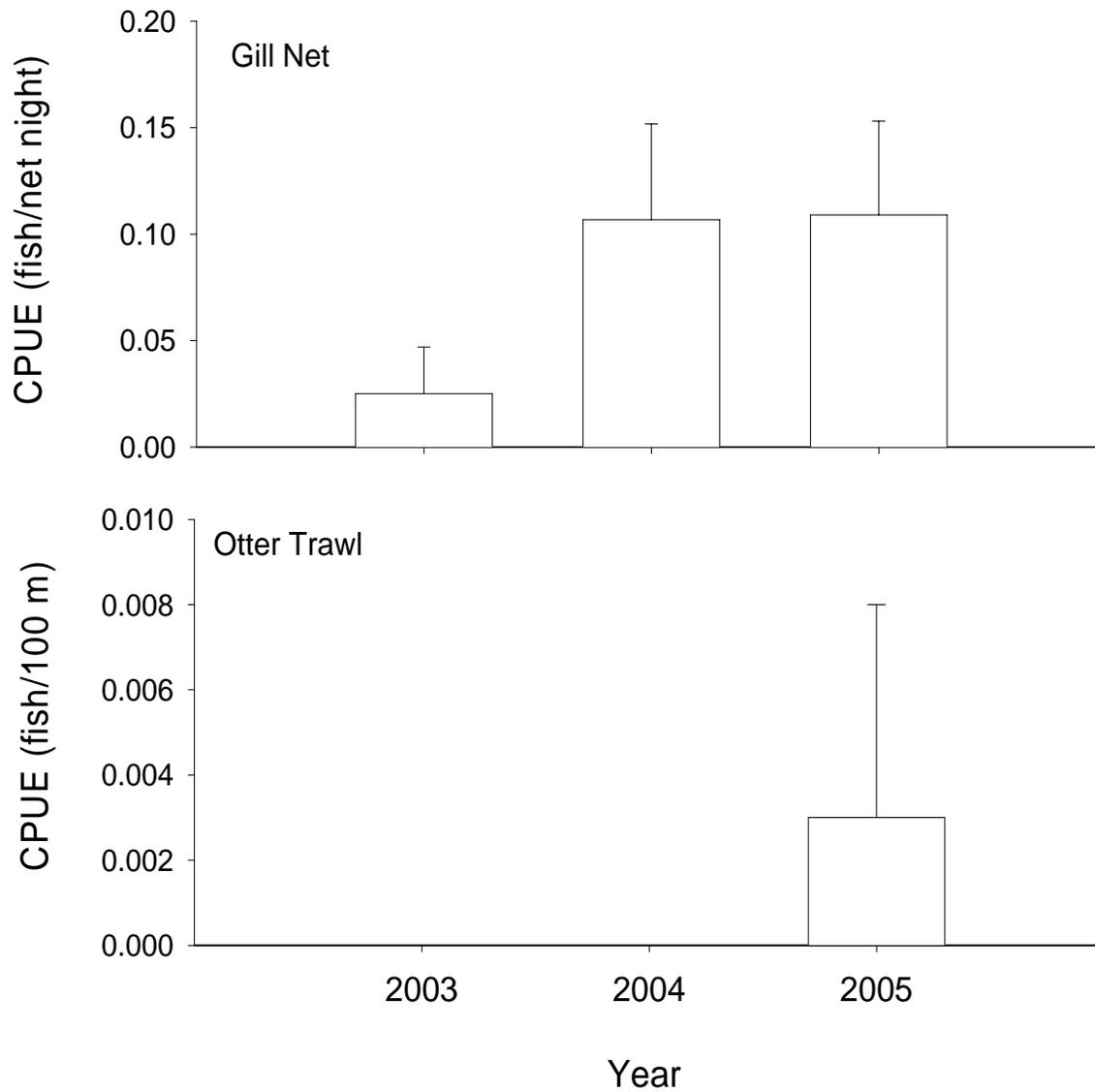


Figure 45. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for gill nets and otter trawls during the sturgeon season 2003-2005.

## Segment 9 - Sauger / Sturgeon Season

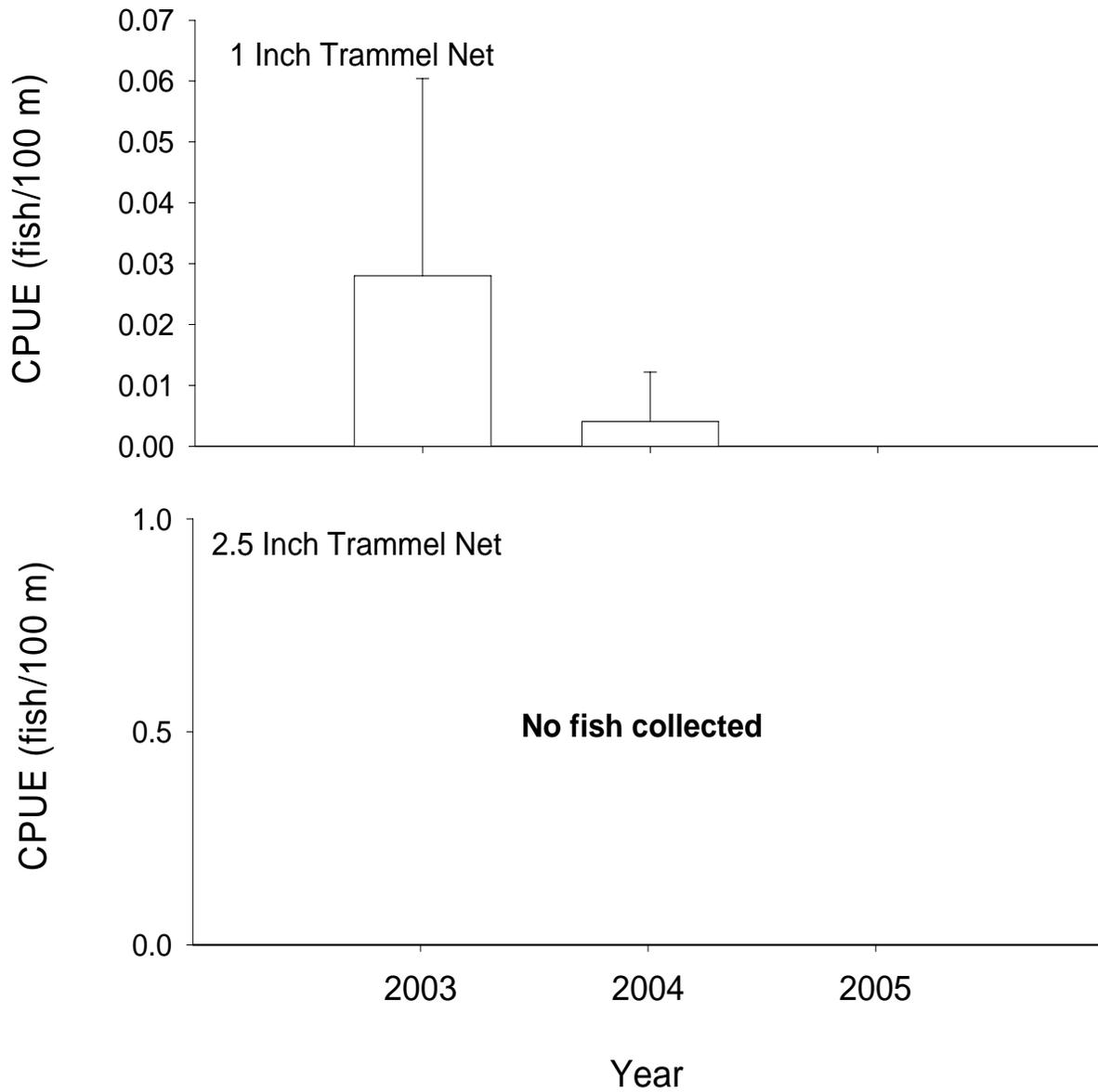


Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 9 of the Missouri River for 1.0" and 2.5" trammel nets during the sturgeon season 2003-2005.

## Segment 9 - Sauger / Sturgeon Season

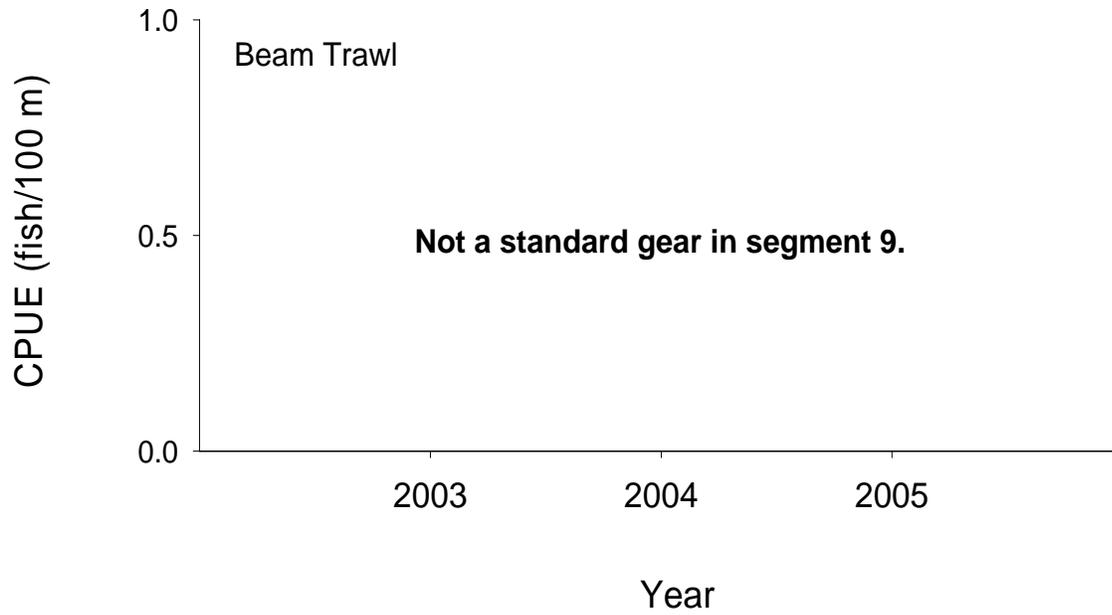


Figure 47. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 9 of the Missouri River for beam trawls during the sturgeon season 2003-2005.

## Segment 9 - Sauger / Fish Community Season

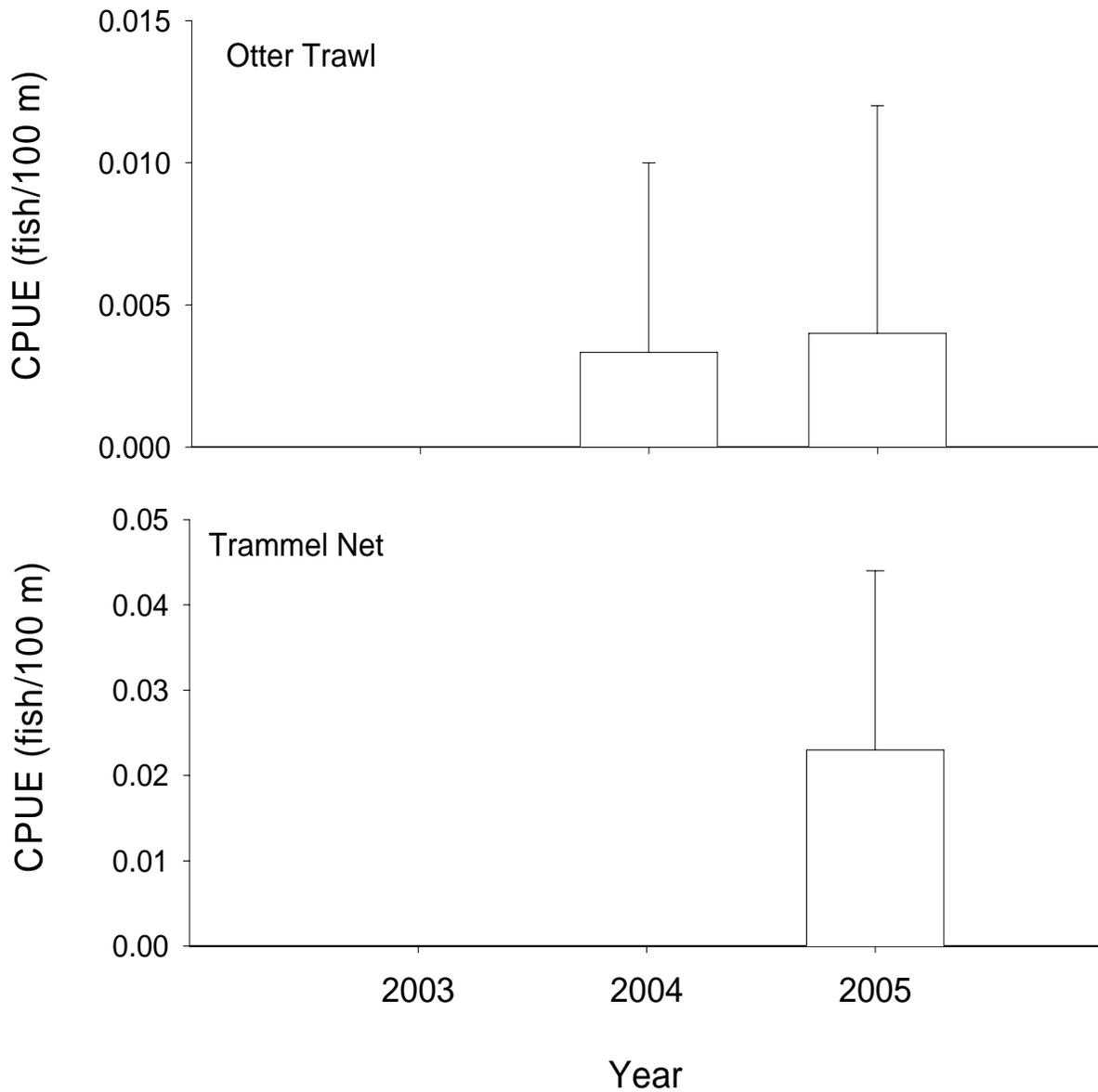


Figure 48. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for otter trawls and 1.0" trammel nets during the fish community season 2003-2005.

## Segment 9 - Sauger / Fish Community Season

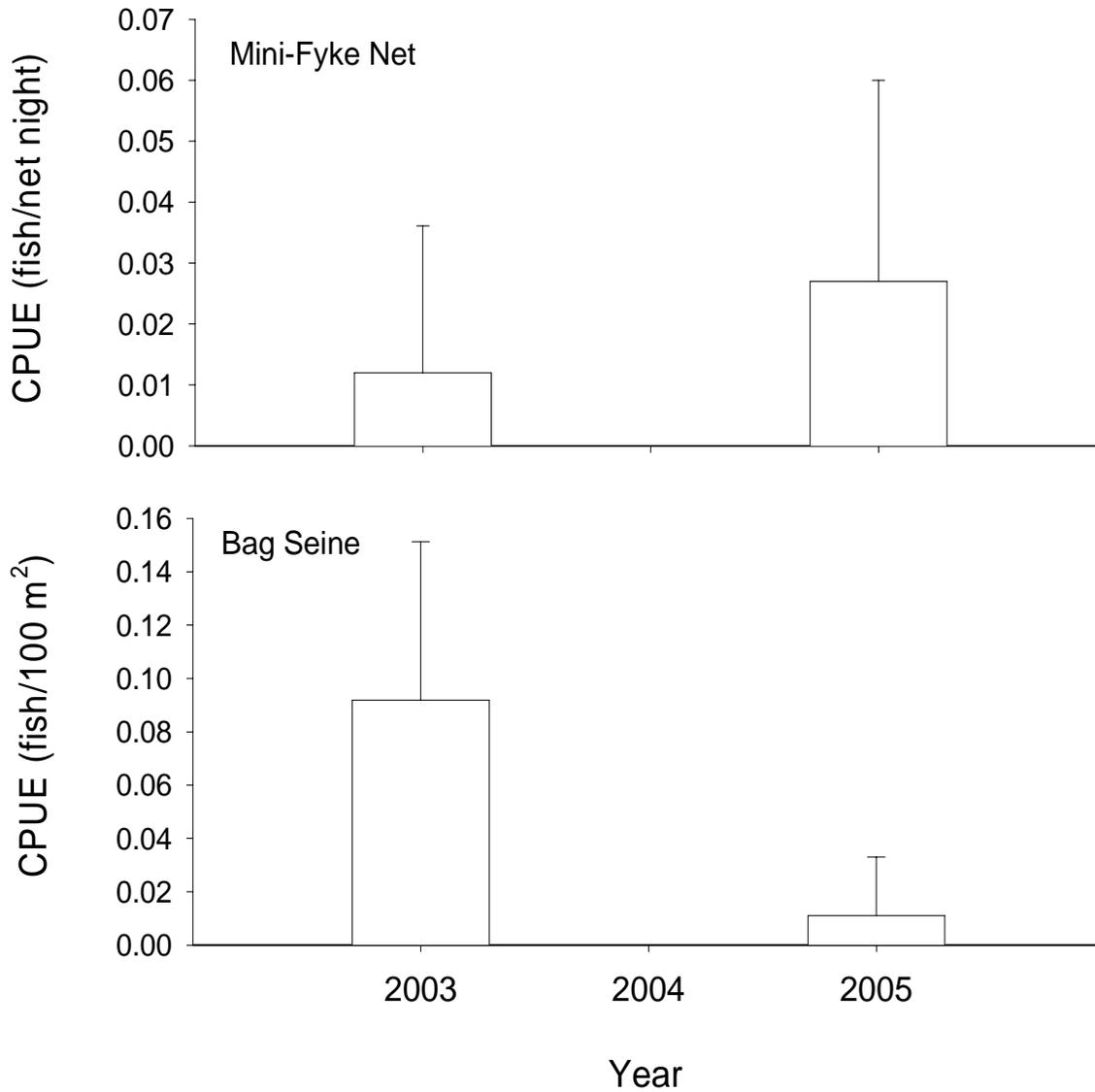


Figure 49. Mean annual catch-per-unit-effort ( $\pm 2SE$ ) of sauger in segment 9 of the Missouri River for mini-fyke nets and bag seines during the fish community season 2003-2005.

## Segment 9 - Sauger / Fish Community Season

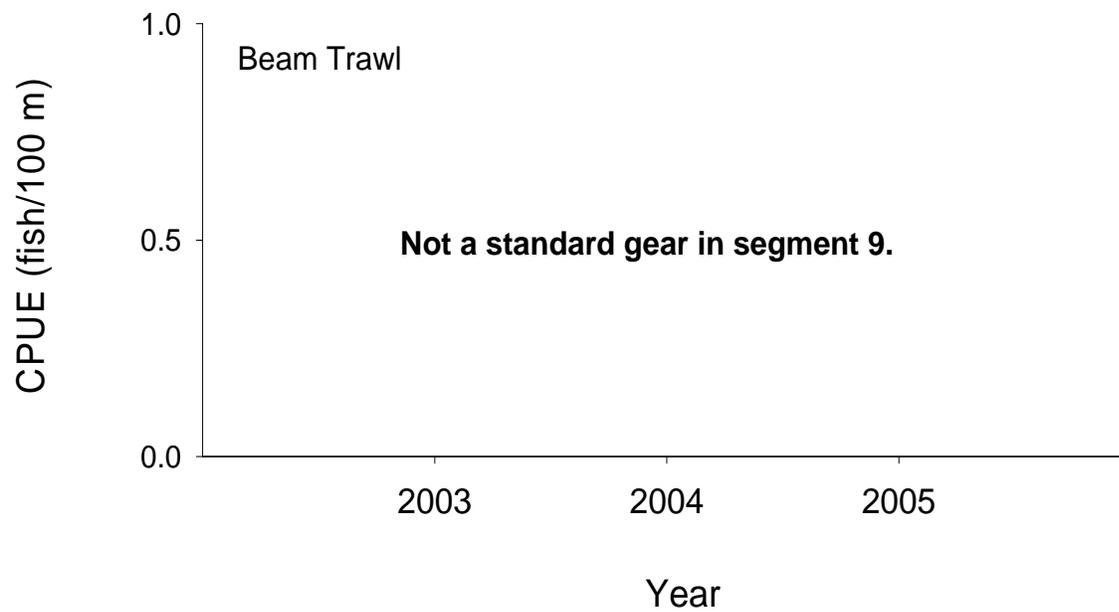


Figure 50. Mean annual catch-per-unit-effort ( $\pm$  2SE) of sauger in segment 9 of the Missouri River for beam trawls during the fish community season 2003-2005.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 9 of the Missouri River during 2005. 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													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCN	TRIB	TRML	TRMS	WILD
<b>Sturgeon Season (Fall through Spring)</b>															
1 Inch Trammel Net	0	N-E	23	5	N-E	N-E	69				N-E		3		
2.5 Inch Trammel Net	0		25				69					6			
Gill Net	40		32	2			57	8							
			20	6			65	6	2						
Otter Trawl	1						100								
		21	7	68						4					
Beam Trawl	Not a standard gear in segment 9														
<b>Fish Community Season (Summer)</b>															
1 Inch Trammel Net	5	N-E	40		N-E	N-E	60				N-E				
			27	2			70								
Bag Seine	1		31	1			51	6				7	3	1	
Mini-Fyke Net	4		25				75								
			29	1			58	5				5	1	1	
Otter Trawl	1	100													
		24	2	71				3	1						
Beam Trawl	Not a standard gear in segment 9														

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 9 of the Missouri River during 2005. 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	Mesohabitat					
		BARS	CHNB	DTWT	ITIP	POOL	TLWG
<b>Sturgeon Season (Fall through Spring)</b>							
1 Inch Trammel Net	0		100	N-E	N-E		
2.5 Inch Trammel Net	0		100				
Gill Net	40		5			95	
			32			68	
Otter Trawl	1		100				
			100				
Beam Trawl	Not a standard gear in segment 9						
<b>Fish Community Season (Summer)</b>							
1 Inch Trammel Net	5		100	N-E	N-E		
			100				
Bag Seine	1	100					
		100					
Mini-Fyke Net	4	100					
		100					
Otter Trawl	1		100				
			100				
Beam Trawl	Not a standard gear in segment 9						

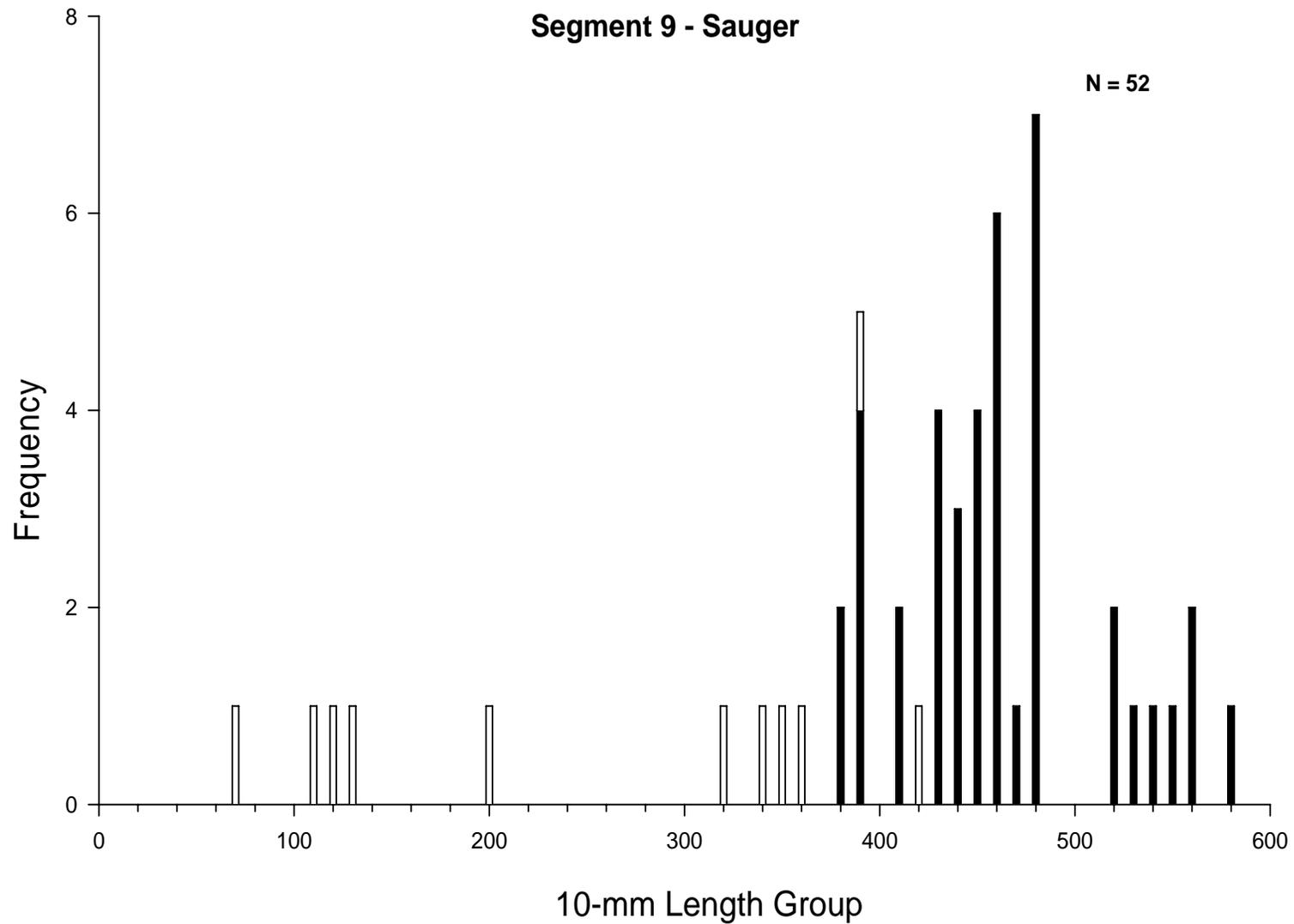


Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 9 of the Missouri River during 2005.

## **Missouri River Fish Community**

### ***Sturgeon season – Gill Netting***

In 2003, a total of 2,988 fish representing 26 species were captured in 200 net nights with a CPUE of 14.9 fish per net night (Steffensen and Mestl, 2004). In 2004, a total of 2,573 fish representing 23 species were captured in 289 net nights with a total CPUE of 8.9 fish per net night (Steffensen and Mestl, 2005). In 2005, a total of 3,418 fish representing 25 species were captured in 365 net nights with a total CPUE of 9.4 fish per net night (Appendix F1). During 2005, shovelnose sturgeon were the most frequently captured species with a CPUE of 7.3 fish per net night, followed by blue suckers (0.76 fish per net night) and goldeye (0.56 fish per net night). All other species were sampled at a frequency of less than 0.12 fish per net night.

### ***Sturgeon season – 1.0” Trammel Netting***

In 2003, a total of 249 fish representing 15 species were captured in 10,196 meters of drifting trammel nets with a CPUE of 2.4 fish per 100 m drifted. In 2004, a total of 299 fish representing 19 species were captured in 8,843 meters of drifting trammel nets with a total CPUE of 3.4 fish per 100 m drifted. In 2005, a total of 594 fish 20 species were captured in 18,390 meters of drifting trammel nets with a total CPUE of 3.2 fish per 100 m drifted (Appendix F2 and H). During 2005, shovelnose sturgeon were the most frequently captured species with a CPUE of 1.9 fish per 100 drifted, followed by blue suckers (0.4 fish per 100 m drifted) and smallmouth buffalo (0.1 fish per 100 m drifted).

### ***Sturgeon season – Otter Trawling***

In 2003, a total of 727 fish representing 22 species were captured in 20,380 meters of trawling with a CPUE of 3.6 fish per 100 m trawled. In 2004, a total of 692 fish representing 18 species were captured in 11,436 meters of trawling, with a total CPUE of 6.1 fish per 100 m trawled. In 2005, a total of 1,243 fish representing 27 species were captured in 26,540 meters of trawling with a CPUE of 4.7 fish per 100 m trawled (Appendix F4). During 2005, channel catfish were the most frequently captured species with a CPUE of 1.84 fish per 100 m trawled, followed by speckled chub (1.0 fish per 100 m trawled) and shovelnose sturgeon (0.6 fish per 100 m trawled).

### ***Sturgeon season – 2.5” Trammel Netting***

In 2005, a total of 185 fish representing 13 species were captured in 9,008 meters of drifting trammel nets with a CPUE of 2.1 fish per 100 m drifted (Appendix F3). Shovelnose sturgeon were the most frequently captured species with a CPUE of 0.7 fish per 100 m drifted,

followed by blue suckers (CPUE = 0.5 fish per 100 m drifted) and smallmouth buffalo (CPUE = 0.2 fish per 100 m drifted).

#### ***Fish community season – 1.0” Trammel Netting***

In 2003, a total of 311 fish representing 13 species were captured in 12,611 meters of drifting trammel nets with a CPUE of 2.5 fish per 100 m drifted. In 2004, a total of 517 fish representing 14 species were captured in 9,827 meters of drifting trammel nets with a total CPUE of 5.3 fish per 100 m drifted. In 2005, a total of 647 fish representing 15 species were captured in 20,570 meters of drifting trammel nets with a total CPUE of 3.2 fish per 100 m drifted (Appendix F2). During 2005, shovelnose sturgeon were the most frequently captured species with a CPUE of 2.2 fish per 100 m drifted, followed by blue suckers (0.6 fish per 100 m drifted). All other species were sampled at a frequency of less than 0.1 fish per 100 m drifted.

#### ***Fish community season – Otter Trawling***

In 2003, a total of 899 fish representing 24 species were captured in 12,424 meters of trawling with a CPUE of 7.2 fish per 100 m trawled. In 2004, a total of 1,103 fish representing 23 species were captured in 13,047 meters of trawling with a total CPUE of 8.5 fish per 100 m trawled. In 2005, a total of 1,509 fish representing 26 species were captured in 28,490 meters of trawling with a total CPUE of 5.3 fish per 100 m trawled (Appendix F4). During 2005, silver chub were the most frequently captured species with a CPUE of 1.6 fish per 100 m trawled, followed by channel catfish (1.6 fish per 100 m trawled) and blue catfish (1.5 fish per 100 m trawled).

#### ***Fish community season – Bag seining***

In 2003, a total of 2,947 fish representing 31 species were captured in 80 seine hauls with a CPUE of 27.8 fish per 100 m<sup>2</sup>. In 2004, a total of 1,739 fish, representing 29 species were captured in 80 seine hauls, with a CPUE of 18.8 fish per 100 m<sup>2</sup>. In 2005, a total of 4,351 fish representing 40 species were captured in 152 seine hauls, with a CPUE of 29.7 fish per 100 m<sup>2</sup> (Appendix F7). During 2005, gizzard shad were the most frequently capture species with a CPUE of 7.8 fish per 100 m<sup>2</sup>, follow by emerald shiners (6.4 fish per 100 m<sup>2</sup>) and freshwater drum (4.0 fish per 100 m<sup>2</sup>).

#### ***Fish community season – Mini-Fyke Netting***

In 2003, a total of 1,077 fish representing 32 species were captured in 83 net nights with a CPUE of 13.0 fish per net night. In 2004, a total of 1,770 fish, representing 32 species were captured in 79 net-nights with a CPUE of 22.4 fish per net night. In 2005, a total of 8,433 fish representing 56 species were captured in 146 net nights with a CPUE of 57.8 fish per net night

(Appendix F6). During 2005, freshwater drum were the most frequently capture species with a CPUE of 19.8 fish per net night, follow by red shiners (7.5 fish per net night) and emerald shiners (6.5 fish per net night).

## Discussion

### *Pallid Sturgeon*

Fifteen pallid sturgeon were collected during the 2005 sampling season in segment 9 of the Missouri River. Gill nets remain the most effective gear for capturing pallid sturgeon, collecting eight pallid sturgeon (4 wild and 4 hatchery reared). Pre and post winter gill netting each yielded four pallid sturgeon, however, the majority of the wild pallid sturgeon ( $n = 3$ ) were collected post winter. Trammel nets and otter trawls are fairly ineffective, sampling only 12 pallid sturgeon during the last three years in over 200 kilometers of effort. Hoop nets and beam trawls did not sample any pallid sturgeon during the two years of the project and remained a wild gear for 2005. Pallid sturgeon were captured in all three continuous macrohabitats (ISB, OSB and CHXO) with the majority being collected on inside bends. Tributary confluence was the only discrete macrohabitat where pallid sturgeon were collected. Pallid sturgeon were sampled in locations with a mean water depth of 2.98 m and an average bottom velocity of 0.41 mps. During winter gill netting, pallid sturgeon were collected in deeper water (3.1 m) and slower water velocities (0.25 mps) compared to trammel netting and otter trawling (2.7 m and 0.56 mps).

Almost 9,000 hatchery reared pallid sturgeon were stocked in RPMA #4 during 2005. All of these fish were from the 2004 year class; however none of these fish were collected during our 2005 efforts. Recaptured hatchery reared fish represented the 1997, 1999, 2001, 2002 and 2003 year classes. Five stocking sites were represented in the nine hatchery reared pallid sturgeon collected including: Mulberry Bend, Bellevue, Platte River at Louisville, Leavenworth and Booneville.

### *Shovelnose Sturgeon*

Gill nets remained the most effective sampling method for shovelnose sturgeon, collecting almost 70% of all shovelnose sturgeon during 2005. However, there has been a sharp decline in CPUE from 2003 (CPUE = 12.0) when compared to 2004 (CPUE = 6.9) and 2005 (CPUE = 7.3). The decline in CPUE can be attributed to the fact that during the 2003 sampling season gill nets were set exclusively in pool mesohabitats, compared to the 2004 and 2005 sampling season when sampling efforts were divided into pool and channel border mesohabitats. CPUE is consistently high for pool sets (10.1 fish per net night) compared to channel border sets (1.4 fish per net night). One inch trammel nets were the second most effective gear for sampling shovelnose sturgeon ( $n = 752$ ), sampling almost twice as many compared to otter trawling ( $n =$

411). We observed that drifting trammel nets outside of wing dike tips produced low catch rates and higher number of damaged or lost netting. A seventy-five meter drift between wing dikes is not always possible in this reach of the Missouri River due to wing dike spacing and placement on the bends.

### ***Macrophybopsis species***

Otter trawling remained the most effective sampling method for all *Macrophybopsis* species. Otter trawling collected 99 of 100 sturgeon chubs, 206 of 210 sicklefin chubs and 256 of 291 speckled chubs throughout both seasons. Seining only collected 19 *Macrophybopsis* species and mini-fyke netting only collected 21. Overall catch for sturgeon chubs (n = 100), sicklefin chubs (n = 210) and speckled chubs (n = 291) increased in 2005 when compared to 2004 (sturgeon chubs (n = 24), sicklefin chubs (n = 34) and speckled chubs (n = 280)) and 2003 (sturgeon chubs (n = 22), sicklefin chubs (n = 13) and speckled chubs (n = 109)).

### ***Hybognathus species***

Seining and mini-fyke nets remained the only method that collected *Hybognathus* species. CPUE for *Hybognathus* species while seining has declined since this project originated in 2003, but CPUE for mini-fyke nets has increased. Overall catch for *Hybognathus* species increased during 2005 (n = 388) when compared to 2004 (n = 222), but was down from 2003 (n = 1,185). This can be attributed to a single seine haul that collected over one thousand *Hybognathus* species in 2003.

### ***Sand Shiners***

Seining and mini-fyke nets remain the most effective method to collect sand shiners. Overall catch rate for sand shiner has increased each year since 2003.

### ***Blue Sucker***

Gill nets were the most effective sampling method for blue suckers, collecting almost 50% of all blue suckers sampled during 2005. This differed when compared to the 2004 catch when hoop nets were the most productive gear and in 2003 when trammel nets collected the majority of fish. Overall catch for blue suckers increased during 2005 (n = 552) compared to 2004 (n = 474) and 2003 (n = 240).

### ***Sauger***

Only 105 sauger have been sampled during the first three year of the project, with 52 being sampled during 2005. Gill nets have captured almost three quarters of the overall catch.

### *Otter Trawling*

In April of 2005, Nebraska Game and Parks Commission along with other agencies participating in the Pallid Sturgeon Population Assessment Program arranged an on river consultation meeting with Greg Faulkner (Master Trawl Designer and Builder) of Innovative Net Systems. Mr. Faulkner has finally standardized the 16 ft. otter trawl. 2005 was the first year when the sapphire 16 ft. otter trawl was completely used. During the 2004 sampling season, the sapphire otter trawl was used during the fish community season. However, due to lack of availability of the sapphire nets, we used a combination of polyethylene and sapphire net during the 2004 sturgeon season. Polyethylene otter trawls were exclusively used during 2003. An increase in catch rates has been observed in target species when the newest sapphire otter trawls were being used.

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## **APPENDICES**

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

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

Appendix A. (continued).

Scientific name	Common name	Letter Code
ORDER CLUPEIFORMES		
<b>Clupeidae – herrings</b>		
<i>Alosa alabame</i>	Alabama shad	ALSD
<i>Alosa chrysochloris</i>	Skipjack herring	SJHR
<i>Alosa pseudoharengus</i>	Alewife	ALWF
<i>Dorosoma cepedianum</i>	Gizzard shad	GZSD
<i>Dorosoma petenense</i>	Threadfin shad	TFSD
<i>D. cepedianum</i> X <i>D. petenense</i>	Gizzard-threadfin shad hybrid	GSTS
ORDER CYPRINIFORMES		
<b>Cyprinidae – carps and minnows</b>		
<i>Campostoma anomalum</i>	Central stoneroller	CLSR
<i>Campostoma oligolepis</i>	Largescale stoneroller	LSSR
<i>Carassus auratus</i>	Goldfish	GDFH
<i>Carassus auratus</i> X <i>Cyprinus carpio</i>	Goldfish-Common carp hybrid	GFCC
<i>Couesius plumbens</i>	Lake chub	LKCB
<i>Ctenopharyngodon idella</i>	Grass carp	GSCP
<i>Cyprinella lutrensis</i>	Red shiner	RDSN
<i>Cyprinella spiloptera</i>	Spotfin shiner	SFSN
<i>Cyprinus carpio</i>	Common carp	CARP
<i>Erimystax x-punctatus</i>	Gravel chub	GVCB
<b><i>Hybognathus argyritis</i></b>	<b>Western slivery minnow</b>	<b>WSMN*</b>
<i>Hybognathus hankinsoni</i>	Brassy minnow	BSMN
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow	SVMW
<b><i>Hybognathus placiti</i></b>	<b>Plains minnow</b>	<b>PNMW*</b>
<b><i>Hybognathus</i> spp.</b>	<b>Unidentified Hybognathus</b>	<b>HBNS*</b>
<i>Hypophthalmichthys molitrix</i>	Silver carp	SVCP
<i>Hypophthalmichthys nobilis</i>	Bighead carp	BHCP
<i>Luxilus chrysocephalus</i>	Striped shiner	SPSN
<i>Luxilus cornutus</i>	Common shiner	CMSN
<i>Luxilus zonatus</i>	Bleeding shiner	BDSN
<i>Lythrurus unbratilis</i>	Western redfin shiner	WRFS
<b><i>Macrhybopsis aestivalis</i></b>	<b>Speckled chub</b>	<b>SKCB*</b>
<b><i>Macrhybopsis gelida</i></b>	<b>Sturgeon chub</b>	<b>SGCB*</b>
<b><i>Macrhybopsis meeki</i></b>	<b>Sicklefin chub</b>	<b>SFCB*</b>
<i>Macrhybopsis storeriana</i>	Silver chub	SVCB
<i>M. aestivalis</i> X <i>M. gelida</i>	Speckled-Sturgeon chub hybrid	SPST
<i>M. gelida</i> X <i>M. meeki</i>	Sturgeon-Sicklefin chub hybrid	SCSC
<i>Macrhybopsis</i> spp.	Unidentified chub	UHY
<i>Margariscus margarita</i>	Pearl dace	PLDC
<i>Mylocheilus caurinus</i>	Peamouth	PEMT
<i>Nocomis biguttatus</i>	Hornyhead chub	HHCB
<i>Notemigonus crysoleucas</i>	Golden shiner	GDSN
<i>Notropis atherinoides</i>	Emerald shiner	ERSN
<i>Notropis blennioides</i>	River shiner	RVSN
<i>Notropis boops</i>	Bigeye shiner	BESN
<i>Notropis burchanani</i>	Ghost shiner	GTSN
<i>Notropis dorsalis</i>	Bigmouth shiner	BMSN
<i>Notropis greeni</i>	Wedgespot shiner	WSSN

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Cyprinidae – carps and minnows</b>		
<i>Notropis heterolepsis</i>	Blacknose shiner	BNSN
<i>Notropis hudsonius</i>	Spottail shiner	STSN
<i>Notropis nubilus</i>	Ozark minnow	OZMW
<i>Notropis rubellus</i>	Rosyface shiner	RYSN
<i>Notropis shumardi</i>	Silverband shiner	SBSN
<i>Notropis stilbius</i>	Silverstripe shiner	SSPS
<b><i>Notropis stramineus</i></b>	<b>Sand shiner</b>	<b>SNSN *</b>
<i>Notropis topeka</i>	Topeka shiner	TPSN
<i>Notropis volucellus</i>	Mimic shiner	MMSN
<i>Notropis wickliffi</i>	Channel shiner	CNSN
<i>Notropis</i> spp.	Unidentified shiner	UNO
<i>Opsopoeodus emiliae</i>	Pugnose minnow	PNMW
<i>Phenacobius mirabilis</i>	Suckermouth minnow	SMMW
<i>Phoxinus eos</i>	Northern redbelly dace	NRBD
<i>Phoxinus erythrogaster</i>	Southern redbelly dace	SRBD
<i>Phoxinus neogaeus</i>	Finescale dace	FSDC
<i>Pimephales notatus</i>	Bluntnose minnow	BNMW
<i>Pimephales promelas</i>	Fathead minnow	FHMW
<i>Pimephales vigilas</i>	Bullhead minnow	BHMW
<i>Platygobio gracilis</i>	Flathead chub	FHCB
<i>P. gracilis</i> X <i>M. meeki</i>	Flathead-sicklefin chub hybrid	FCSC
<i>Rhinichthys atratulus</i>	Blacknose dace	BNDC
<i>Rhinichthys cataractae</i>	Longnose dace	LNDC
<i>Richardsonius balteatus</i>	Redside shiner	RDSS
<i>Scardinius erythrophthalmus</i>	Rudd	RUDD
<i>Semotilus atromaculatus</i>	Creek chub	CKCB
	Unidentified Cyprinidae	UCY
<b>Catostomidae - suckers</b>		
<i>Carpiodes carpio</i>	River carpsucker	RVCS
<i>Carpiodes cyprinus</i>	Quillback	QLBK
<i>Carpiodes velifer</i>	Highfin carpsucker	HFCS
<i>Carpiodes</i> spp.	Unidentified <i>Carpiodes</i>	UCS
<i>Catostomus catostomus</i>	Longnose sucker	LNSK
<i>Catostomus commersoni</i>	White sucker	WTSK
<i>Catostomus platyrhincus</i>	Mountain sucker	MTSK
<i>Catostomus</i> spp.	Unidentified <i>Catostomus</i> spp.	UCA
<b><i>Cycleptus elongates</i></b>	<b>Blue sucker</b>	<b>BUSK *</b>
<i>Hypentelium nigricans</i>	Northern hog sucker	NHSK
<i>Ictiobus bubalus</i>	Smallmouth buffalo	SMBF
<i>Ictiobus cyprinellus</i>	Bigmouth buffalo	BMBF
<i>Ictiobus niger</i>	Black buffalo	BKBF
<i>Ictiobus</i> spp.	Unidentified buffalo	UBF
<i>Minytrema melanops</i>	Spotted sucker	SPSK
<i>Moxostoma anisurum</i>	Silver redhorse	SVRH
<i>Moxostoma carinatum</i>	River redhorse	RVRH
<i>Moxostoma duquesnei</i>	Black redhorse	BKRH
<i>Moxostoma erythrurum</i>	Golden redhorse	GDRH
<i>Moxostoma macrolepidotum</i>	Shorthead redhorse	SHRH
<i>Moxostoma</i> spp.	Unidentified redhorse	URH

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Catostomidae - suckers</b>	Unidentified Catostomidae	UCT
ORDER SILURIFORMES		
<b>Ictaluridae – bullhead catfishes</b>		
<i>Ameiurus melas</i>	Black bullhead	BKBH
<i>Ameiurus natalis</i>	Yellow bullhead	YLBH
<i>Ameiurusnebulosus</i>	Brown bullhead	BRBH
<i>Ameiurus</i> spp.	Unidentified bullhead	UBH
<i>Ictalurus furcatus</i>	Blue catfish	BLCF
<i>Ictalurus punctatus</i>	Channel catfish	CNCF
<i>I. furcatus</i> X <i>I. punctatus</i>	Blue-channel catfish hybrid	BCCC
<i>Ictalurus</i> spp.	Unidentified <i>Ictalurus</i> spp.	UCF
<i>Noturus exilis</i>	Slender madtom	SDMT
<i>Noturus flavus</i>	Stonecat	STCT
<i>Noturus gyrinus</i>	Tadpole madtom	TPMT
<i>Noturus nocturnes</i>	Freckled madtom	FKMT
<i>Pylodictis olivaris</i>	Flathead catfish	FHCF
ORDER SALMONIFORMES		
<b>Esocidae - pikes</b>		
<i>Esox americanus vermiculatus</i>	Grass pickerel	GSPK
<i>Esox lucius</i>	Northern pike	NTPK
<i>Esox masquinongy</i>	Muskellunge	MSKG
<i>E. lucius</i> X <i>E. masquinongy</i>	Tiger Muskellunge	TGMG
<b>Umbridae - mudminnows</b>		
<i>Umbra limi</i>	Central mudminnow	MDMN
<b>Osmeridae - smelts</b>		
<i>Osmerus mordax</i>	Rainbow smelt	RBST
<b>Salmonidae - trouts</b>		
<i>Coregonus artedi</i>	Lake herring or cisco	CSCO
<i>Coregonus clupeaformis</i>	Lake whitefish	LKWF
<i>Oncorhynchus aguabonita</i>	Golden trout	GDTT
<i>Oncorhynchus clarki</i>	Cutthroat trout	CTTT
<i>Oncorhynchus kisutch</i>	Coho salmon	CHSM
<i>Oncorhynchus mykiss</i>	Rainbow trout	RBTT
<i>Oncorhynchus nerka</i>	Sockeye salmon	SESM
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	CNSM
<i>Prosopium cylindraceum</i>	Bonniville cisco	BVSC
<i>Prosopium williamsoni</i>	Mountain whitefish	MTWF
<i>Salmo trutta</i>	Brown trout	BNTT
<i>Salvelinus fontinalis</i>	Brook trout	BKTT
<i>Salvelinus namaycush</i>	Lake trout	LKTT
<i>Thymallus arcticus</i>	Arctic grayling	AMGL

Appendix A. (continued).

Scientific name	Common name	Letter Code
ORDER PERCOPSIFORMES		
<b>Percopsidae – trout-perches</b>		
<i>Percopsis omiscomaycus</i>	Trout-perch	TTPH
ORDER GADIFORMES		
<b>Gadidae - cods</b>		
<i>Lota lota</i>	Burbot	BRBT
ORDER ATHERINIFORMES		
<b>Cyprinodontidae - killifishes</b>		
<i>Fundulus catenatus</i>	Northern studfish	NTSF
<i>Fundulus daphanus</i>	Banded killifish	BDKF
<i>Fundulus notatus</i>	Blackstripe topminnow	BSTM
<i>Fundulus olivaceus</i>	Blackspotted topminnow	BPTM
<i>Fundulus sciadicus</i>	Plains topminnow	PTMW
<i>Fundulus zebrinus</i>	Plains killifish	PKLF
<b>Poeciliidae - livebearers</b>		
<i>Gambusia affinis</i>	Western mosquitofish	MQTF
<b>Atherinidae - silversides</b>		
<i>Labidesthes sicculus</i>	Brook silverside	BKSS
ORDER GASTEROSTEIFORMES		
<b>Gasterosteidae - sticklebacks</b>		
<i>Culea inconstans</i>	Brook stickleback	BKSB
ORDER SCORPAENIFORMES		
<b>Cottidae - sculpins</b>		
<i>Cottus bairdi</i>	Mottled sculpin	MDSP
<i>Cottus carolinae</i>	Banded sculpin	BDSP
ORDER PERCIFORMES		
<b>Percichthyidae – temperate basses</b>		
<i>Morone Americana</i>	White perch	WTPH
<i>Morone chrysops</i>	White bass	WTBS
<i>Morone mississippiensis</i>	Yellow bass	YWBS
<i>Morone saxatilis</i>	Striped bass	SDBS
<i>M. saxatilis X M. chrysops</i>	Striped-white bass hybrid	SBWB
<b>Centrarchidae - sunfishes</b>		
<i>Ambloplites rupestris</i>	Rock bass	RKBS
<i>Archoplites interruptus</i>	Sacramento perch	SOPH
<i>Lepomis cyanellus</i>	Green sunfish	GNSF
<i>Lepomis gibbosus</i>	Pumpkinseed	PNSD
<i>Lepomis gulosus</i>	Warmouth	WRMH
<i>Lepomis humilis</i>	Orangespotted sunfish	OSSF
<i>Lepomis macrochirus</i>	Bluegill	BLGL
<i>Lepomis magalotis</i>	Longear sunfish	LESF
<i>Lepomis microlophus</i>	Redear sunfish	RESF
<i>L. cyanellus X L. macrochirus</i>	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
<b>Centrarchidae - sunfishes</b>		
<i>L. cyanellus</i> X <i>L. humilis</i>	Green-orangespotted sunfish hybrid	GSOS
<i>L. macrochirus</i> X <i>L. microlophus</i>	Bluegill-redear sunfish hybrid	BGRE
<i>Lepomis</i> spp.	Unidentified <i>Lepomis</i>	ULP
<i>Micropterus dolomieu</i>	Smallmouth bass	SMBS
<i>Micropterus punctatus</i>	Spotted sunfish	STBS
<i>Micropterus salmoides</i>	Largemouth bass	LMBS
<i>Micropterus</i> spp.	Unidentified <i>Micropterus</i> spp.	UMC
<i>Pomoxis annularis</i>	White crappie	WTCP
<i>Pomoxis nigromaculatus</i>	Black crappie	BKCP
<i>Pomoxis</i> spp.	Unidentified crappie	UCP
<i>P. annularis</i> X <i>P. nigromaculatus</i>	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified centrarchid	UCN
<b>Percidae - perches</b>		
<i>Ammocrypta asprella</i>	Crystal darter	CLDR
<i>Etheostoma blennioides</i>	Greenside darter	GSDR
<i>Etheostoma caeruleum</i>	Rainbow darter	RBDR
<i>Etheostoma exile</i>	Iowa darter	IODR
<i>Etheostoma flabellare</i>	Fantail darter	FTDR
<i>Etheostoma gracile</i>	Slough darter	SLDR
<i>Etheostoma microperca</i>	Least darter	LTDR
<i>Etheostoma nigrum</i>	Johnny darter	JYDR
<i>Etheostoma punctulatum</i>	Stippled darter	STPD
<i>Etheostoma spectabile</i>	Orangethroated darter	OTDR
<i>Etheostoma tetrazonum</i>	Missouri saddled darter	MSDR
<i>Etheostoma zonale</i>	Banded darter	BDDR
<i>Etheostoma</i> spp.	Unidentified <i>Etheostoma</i> spp.	UET
<i>Perca flavescens</i>	Yellow perch	YWPH
<i>Percina caproides</i>	Logperch	LGPH
<i>Percina cymatotaenia</i>	Bluestripe darter	BTDR
<i>Percina evides</i>	Gilt darter	GLDR
<i>Percina maculate</i>	Blackside darter	BSDR
<i>Percina phoxocephala</i>	Slenderhead darter	SHDR
<i>Percina shumardi</i>	River darter	RRDR
<i>Percina</i> spp.	Unidentified <i>Percina</i> spp.	UPN
	Unidentified darter	UDR
<b><i>Sander canadense</i></b>	<b>Sauger</b>	<b>SGER *</b>
<i>Sander vitreus</i>	Walleye	WLEY
<i>S. canadense</i> X <i>S. vitreus</i>	Sauger-walleye hybrid/Saugeye	SGWE
<i>Sander</i> spp.	Unidentified <i>Sander</i> (formerly <i>Stizostedion</i> ) spp.	UST
	Unidentified Percidae	UPC
<b>Sciaenidae - drums</b>		
<i>Aplodinotus grunniens</i>	Freshwater drum	FWDM
NON-TAXONOMIC CATEGORIES		
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

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

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing in the Missouri River	TRIB
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m <sup>3</sup> /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 <sup>3</sup> /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 (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 9 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for segment 9.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Trammel net – 2.5 inch inner mesh	TN25	Standard	Sturgeon	2005 - Present	fish/100 m drift
Gillnet – 4 meshes, small mesh set upstream	GN14	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 4 meshes, large mesh set upstream	GN41	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, small mesh set upstream	GN18	Standard	Sturgeon	2003 - Present	fish/net night
Gillnet – 8 meshes, large mesh set upstream	GN81	Standard	Sturgeon	2003 - Present	fish/net night
Otter Trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Beam Trawl	BT	Standard*	All	2003 - 2004	fish/100 m trawled
Hoop Net	HN	Standard	All	2003 - 2004	fish/ net night
Bag Seine – quarter arc method pulled upstream	BSQU	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Bag seine – rectangular method pulled upstream	BSRD	Standard	Fish Comm.	2003 - Present	fish/100 m <sup>2</sup>
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night

\* Standard only in upper Missouri River segments

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	RM
MT	2	Above Intake	AIN	Yellowstone	70 +
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	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	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	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
NE/MO/KS	4	Kansas River	KSR	Missouri	367.5
NE	4	Platte River	PLR	Platte	5.0
KA/MO	4	Leavenworth	LVW	Missouri	397.0
MO	4	Kansas City	KAC	Missouri	342.0
MO	4	Miami	MIA	Missouri	262.8
MO	4	Grand River	GDR	Missouri	250.0
MO	4	Boonville	BOO	Missouri	195.1
MO	4	Overton	OVT	Missouri	185.1
MO	4	Hartsburg	HAR	Missouri	160.0
MO	4	Jefferson City	JEF	Missouri	143.9
MO	4	Mokane	MOK	Missouri	124.7
MO	4	Hermann	HER	Missouri	97.6
MO	4	Washington	WAS	Missouri	68.5
MO	4	St. Charles	STC	Missouri	28.5

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 9 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Average Length (mm)	Primary Mark	Secondary Mark
1997	Platte River	402	1997	10/15/1997	n/a	Elastomer	
2004	Leavenworth	1769	2003	6/24/2004	232	PIT Tag	Some Elastomer
2004	Leavenworth	12034	2004	Fall 2004	98	Elastomer	

## **Appendix F**

Total catch, overall mean catch per unit effort ( $\pm 2$  SE), and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 9 of the Missouri River during 2005. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when  $N < 2$ .

Appendix F1. Gill Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB	SCCL
			CHNB	POOL	CHNB	POOL	CHNB	POOL	POOL	POOL
BHCP	2	0.005 (0.008)		0.040 (0.055)						
BLCF	13	0.035 (0.023)		0.040 (0.080)				0.061 (0.047)	0.077 (0.104)	
<b>BUSK *</b>	274	0.758 (0.248)	0.042 (0.083)	0.800 (0.503)		1.150 (0.883)	0.256 (0.226)	1.047 (0.501)	1.346 (1.308)	0.250 (0.289)
CARP	17	0.046 (0.029)	0.042 (0.083)	0.100 (0.100)	0.500	0.050 (0.100)		0.054 (0.056)	0.038 (0.077)	
CNCF	25	0.068 (0.031)		0.060 (0.088)		0.050 (0.100)	0.011 (0.022)	0.101 (0.058)	0.115 (0.166)	0.250 (0.289)
FHCF	9	0.024 (0.021)		0.020 (0.040)		0.050 (0.100)	0.022 (0.044)	0.034 (0.040)		
FWDM	3	0.008 (0.009)				0.050 (0.100)		0.014 (0.019)		
GDEY	202	0.560 (0.203)	0.125 (0.131)	0.740 (0.514)	8.500	1.800 (1.857)	0.067 (0.113)	0.459 (0.251)	1.308 (0.978)	0.625 (0.629)
GSCP	5	0.014 (0.012)		0.040 (0.055)				0.007 (0.014)	0.038 (0.077)	0.125 (0.250)
GZSD	5	0.014 (0.018)		0.020 (0.040)	1.500					0.125 (0.250)
LNGR	24	0.065 (0.048)		0.220 (0.306)	0.500		0.022 (0.031)	0.047 (0.048)		0.375 (0.250)
PDFH	2	0.005 (0.008)			0.500					0.125 (0.250)
<b>PDSG *</b>	8	0.022 (0.015)		0.020 (0.040)	0.500	0.050 (0.100)	0.022 (0.031)	0.014 (0.019)	0.038 (0.077)	
QLBK	2	0.005 (0.008)						0.007 (0.014)		0.125 (0.250)
RVCS	31	0.084 (0.060)	0.042 (0.083)	0.200 (0.321)	3.000	0.100 (0.200)	0.011 (0.022)	0.061 (0.054)	0.077 (0.104)	
<b>SGER *</b>	40	0.109 (0.044)	0.042 (0.083)	0.240 (0.143)	0.500			0.155 (0.090)	0.115 (0.122)	
SHRH	4	0.011 (0.011)				0.050 (0.100)	0.011 (0.022)	0.014 (0.019)		
SJHR	1	0.003 (0.005)		0.020 (0.040)						

Appendix F1 (continued).

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB	SCCL
			CHNB	POOL	CHNB	POOL	CHNB	POOL	POOL	POOL
SMBF	6	0.016 (0.013)		0.040 (0.055)		0.050 (0.100)		0.014 (0.019)		0.125 (0.250)
SNGR	42	0.114 (0.111)		0.500 (0.759)	2.000	0.050 (0.100)	0.011 (0.022)	0.068 (0.078)		0.125 (0.250)
SNPD	1	0.003 (0.005)						0.007 (0.014)		
<b>SNSG*</b>	2695	7.332 (1.716)	1.833 (1.509)	10.140 (5.505)	15.000	13.650 (12.898)	0.911 (0.528)	9.993 (2.930)	6.385 (5.108)	14.625 (4.110)
SVCP	1	0.003 (0.005)		0.020 (0.040)						
WLYE	5	0.014 (0.012)		0.020 (0.040)				0.027 (0.026)		
WTSK	1	0.003 (0.005)		0.020 (0.040)						

Appendix F2. 1 Inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	TRIB	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
BHCP	1	0.002 (0.004)			0.003 (0.005)		
BLCF	2	0.006 (0.009)			0.008 (0.012)		
BMBF	1	0.001 (0.002)			0.001 (0.003)		
<b>BUSK *</b>	185	0.505 (0.15)	0.495 (0.334)	1.070 (1.725)	0.499 (0.169)		0.284 (0.568)
CARP	12	0.040 (0.026)	0.016 (0.031)		0.045 (0.033)		0.287 (0.368)
CNCF	21	0.067 (0.046)	0.137 (0.172)		0.047 (0.029)		
FWDM	2	0.006 (0.009)			0.009 (0.012)		
GDEY	28	0.086 (0.034)	0.165 (0.094)		0.064 (0.034)		
GSCP	11	0.034 (0.023)	0.054 (0.066)		0.03 (0.023)		
GZSD	1	0.004 (0.007)			0.005 (0.010)		
LNGR	5	0.018 (0.016)	0.031 (0.043)		0.015 (0.017)		
PDFH	1	0.004 (0.007)					0.312 (0.625)
<b>PDSG *</b>	5	0.015 (0.013)			0.020 (0.019)		
QLBK	2	0.004 (0.006)	0.005 (0.009)		0.004 (0.008)		
RVCS	5	0.016 (0.015)	0.031 (0.044)	0.179 (0.357)	0.004 (0.008)		0.192 (0.385)
<b>SGER *</b>	5	0.011 (0.010)	0.019 (0.027)		0.009 (0.010)		
SGWE	1	0.003 (0.006)			0.004 (0.009)		
SJHR	1	0.002 (0.004)			0.003 (0.005)		

Appendix F2 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	TRIB	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
SMBF	43	0.114 (0.042)	0.153 (0.106)	0.048 (0.095)	0.101 (0.046)		0.287 (0.368)
SNGR	5	0.014 (0.013)	0.035 (0.045)		0.008 (0.011)		
SNPD	1	0.003 (0.006)			0.004 (0.008)		
<b>SNSG*</b>	752	2.041 (0.542)	1.958 (0.981)	2.254 (2.759)	2.004 (0.666)		6.351 (1.126)
SVCP	1	0.004 (0.007)			0.005 (0.010)		
WLYE	2	0.003 (0.007)	0.015 (0.029)				

Appendix F3. 2.5 Inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	ISB	TRML
			CHNB	CHNB	CHNB
BHCP	1	0.011 (0.023)		0.015 (0.031)	
BMBF	2	0.022 (0.031)		0.030 (0.042)	
<b>BUSK *</b>	43	0.498 (0.198)	0.458 (0.456)	0.510 (0.224)	0.556 (0.222)
CARP	5	0.065 (0.057)		0.088 (0.077)	
FHCF	1	0.013 (0.025)		0.017 (0.034)	
GSCP	6	0.067 (0.054)	0.056 (0.111)	0.073 (0.064)	
GZSD	2	0.026 (0.037)	0.107 (0.148)		
LNGR	1	0.013 (0.027)		0.018 (0.036)	
PDFH	1	0.009 (0.019)		0.013 (0.025)	
RVCS	1	0.013 (0.026)		0.017 (0.035)	
SMBF	23	0.244 (0.126)	0.268 (0.294)	0.233 (0.141)	0.333 (0.667)
<b>SNSG *</b>	57	0.720 (0.392)	0.378 (0.402)	0.843 (0.515)	0.389 (0.111)
SVCP	1	0.011 (0.022)	0.046 (0.092)		

Appendix F4. Otter Trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	TRIB	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
BHCP	1	0.002 (0.003)			0.003 (0.005)		
BKSS	1	0.002 (0.004)			0.003 (0.006)		
BLCF	270	0.717 (0.346)	0.457 (0.412)		0.636 (0.453)	7.265 (1.778)	
<b>BUSK *</b>	50	0.121 (0.08)	0.138 (0.222)	0.125 (0.122)	0.122 (0.084)		
CARP	7	0.011 (0.010)	0.013 (0.027)	0.167 (0.252)	0.003 (0.005)	0.078 (0.156)	
CNCF	736	1.707 (0.495)	0.789 (0.398)	2.373 (1.625)	1.939 (0.692)	3.797 (3.578)	2.173 (1.908)
ERSN	39	0.097 (0.088)	0.137 (0.273)	0.042 (0.083)	0.08 (0.079)	0.227 (0.455)	0.095 (0.190)
FHCF	10	0.019 (0.013)	0.010 (0.021)	0.125 (0.175)	0.012 (0.012)	0.254 (0.335)	
FWDM	182	0.392 (0.259)	0.457 (0.600)	2.417 (3.147)	0.225 (0.275)	2.919 (1.766)	
GDEY	2	0.005 (0.007)	0.010 (0.019)		0.003 (0.007)		
GZSD	3	0.007 (0.008)	0.027 (0.031)				
LNGR	2	0.006 (0.009)	0.009 (0.019)		0.006 (0.011)		
OSSF	1	0.001 (0.002)		0.042 (0.083)			
PDFH	1	0.004 (0.008)	0.015 (0.031)				
<b>PDSG *</b>	2	0.005 (0.007)			0.007 (0.010)		
RDSN	4	0.009 (0.010)	0.004 (0.008)		0.009 (0.013)	0.114 (0.227)	
RVCS	6	0.011 (0.011)		0.125 (0.250)	0.012 (0.014)		
RVSN	9	0.013 (0.010)		0.083 (0.167)	0.017 (0.014)		

Appendix F4 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	TRIB	TRML
			CHNB	CHNB	CHNB	CHNB	CHNB
<b>SFCB *</b>	206	0.366 (0.325)	0.780 (1.273)		0.246 (0.089)		0.108 (0.216)
<b>SGCB *</b>	99	0.223 (0.105)	0.155 (0.088)		0.269 (0.151)		0.047 (0.093)
<b>SGER *</b>	2	0.003 (0.005)	0.008 (0.015)		0.002 (0.004)		
SHRH	1	0.003 (0.006)	0.012 (0.024)				
<b>SKCB *</b>	256	0.66 (0.416)	0.154 (0.120)		0.896 (0.606)	0.260 (0.350)	0.200 (0.400)
SMBF	4	0.008 (0.009)			0.007 (0.008)	0.156 (0.312)	
SNGR	1	0.004 (0.008)	0.015 (0.031)				
SNPD	1	0.001 (0.002)			0.001 (0.003)		
<b>SNSG *</b>	412	0.684 (0.196)	0.840 (0.642)	3.250 (2.636)	0.530 (0.121)	0.372 (0.373)	1.391 (1.072)
<b>SNSN *</b>	7	0.017 (0.02)	0.034 (0.068)	0.042 (0.083)	0.008 (0.012)		0.100 (0.200)
STCT	7	0.013 (0.012)			0.019 (0.017)		
SVCB	386	1.016 (0.627)	0.203 (0.101)	0.500 (0.549)	1.377 (0.915)	0.140 (0.281)	0.517 (0.395)
UHY	1	0.001 (0.002)			0.001 (0.003)		
WTBS	6	0.019 (0.036)		0.042 (0.083)	0.026 (0.053)		
WTSK	1	0.001 (0.002)		0.042 (0.083)			

Appendix F6. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
BHMW	2	0.014 (0.027)	0.048 (0.095)						
BKBH	2	0.014 (0.019)			0.024 (0.033)				
BKCP	3	0.021 (0.024)	0.024 (0.048)		0.024 (0.033)				
BLCF	74	0.507 (0.429)	0.857 (1.381)		0.452 (0.286)				
BLGL	91	0.623 (0.207)	0.524 (0.275)	0.500 (1.000)	0.560 (0.274)	1.714 (1.674)	1.000 (1.254)		1
BMBF	1	0.007 (0.014)	0.024 (0.048)						
BMSN	4	0.027 (0.033)	0.048 (0.067)		0.024 (0.048)				
BNMW	1	0.007 (0.014)			0.012 (0.024)				
CARP	57	0.390 (0.199)	0.667 (0.450)	0.500 (1.000)	0.286 (0.253)	0.286 (0.369)	0.250 (0.500)		
CKCB	2	0.014 (0.027)			0.024 (0.048)				
CLSR	1	0.007 (0.014)			0.012 (0.024)				
CNCF	369	2.527 (0.897)	2.405 (1.204)	0.500 (1.000)	3.131 (1.417)	0.143 (0.286)	0.375 (0.526)		
ERSN	954	6.534 (2.977)	4.976 (4.100)		7.345 (4.210)	15.000 (27.055)	2.750 (2.994)		
FHCB	10	0.068 (0.100)	0.024 (0.048)		0.107 (0.173)				
FHCF	10	0.068 (0.054)	0.024 (0.048)		0.107 (0.090)				
FHMW	418	2.863 (2.276)	3.762 (4.939)		2.690 (3.055)	4.000 (7.051)	0.750 (0.627)		
FWDM	2892	19.808 (14.593)	28.167 (24.441)	3.500 (7.000)	20.131 (22.210)	1.571 (0.738)			
GDFH	1	0.007 (0.014)			0.012 (0.024)				

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
GNSF	34	0.233 (0.125)	0.381 (0.327)		0.167 (0.121)	0.571 (0.857)			
GZSD	259	1.774 (1.228)	3.500 (3.779)	9.000 (18.000)	1.036 (0.876)	0.714 (1.429)		0.500 (1.000)	1.000
<b>HBNS*</b>	346	2.370 (2.919)	0.786 (1.207)		3.702 (5.030)	0.286 (0.571)			
LMBS	4	0.027 (0.027)	0.048 (0.067)		0.024 (0.033)				
LNGR	6	0.041 (0.038)			0.060 (0.062)	0.143 (0.286)			
MMSN	1	0.007 (0.014)			0.012 (0.024)				
MQTF	14	0.096 (0.071)	0.143 (0.200)		0.071 (0.066)	0.143 (0.286)	0.125 (0.250)		
OSSF	62	0.425 (0.197)	0.571 (0.468)		0.310 (0.219)	0.714 (1.131)	0.750 (0.824)		1.000
QLBK	1	0.007 (0.014)							1.000
RDSN	1090	7.466 (3.870)	3.333 (1.879)	0.500 (1.000)	9.952 (6.532)	7.714 (11.03)	6.625 (6.855)	1.000	4.000
RVCS	27	0.185 (0.078)	0.238 (0.149)		0.155 (0.099)		0.250 (0.327)		2.000
RVSN	434	2.973 (2.387)	2.048 (1.911)		3.619 (3.995)	1.714 (2.256)	3.875 (6.441)	0.500 (1.000)	
<b>SFCB*</b>	4	0.027 (0.027)	0.024 (0.048)		0.036 (0.041)				
SFSN	6	0.041 (0.043)	0.024 (0.048)		0.060 (0.071)				
<b>SGCB*</b>	1	0.007 (0.014)			0.012 (0.024)				
<b>SGER*</b>	4	0.027 (0.033)	0.024 (0.048)		0.036 (0.053)				
SHRH	10	0.068 (0.104)	0.167 (0.333)		0.036 (0.071)				
<b>SKCB*</b>	16	0.110 (0.073)	0.095 (0.114)		0.143 (0.113)				

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
SMBF	1	0.007 (0.014)			0.012 (0.024)				
SMMW	3	0.021 (0.024)			0.036 (0.041)				
SNGR	66	0.452 (0.168)	0.452 (0.328)	1.500 (3.00)	0.440 (0.228)	0.857 (0.522)	0.125 (0.250)		
SNSN*	89	0.610 (0.366)	0.262 (0.227)		0.857 (0.611)		0.750 (1.239)		
STBS	2	0.014 (0.019)	0.024 (0.048)		0.012 (0.024)				
STCT	1	0.007 (0.014)			0.012 (0.024)				
SVCB	471	3.226 (1.654)	2.738 (1.961)		4.167 (2.683)	0.714 (1.429)		0.500 (1.000)	
SVCP	1	0.007 (0.014)			0.012 (0.024)				
UBF	1	0.007 (0.014)			0.012 (0.024)				
UCS	1	0.007 (0.014)			0.012 (0.024)				
UCT	5	0.034 (0.056)	0.119 (0.195)						
UCY	40	0.274 (0.249)	0.429 (0.524)		0.167 (0.289)		1.000 (2.000)		
UHY	8	0.055 (0.051)	0.048 (0.067)		0.071 (0.081)				
ULP	19	0.130 (0.088)	0.262 (0.256)		0.083 (0.077)	0.143 (0.286)			
UNID	28	0.192 (0.200)	0.310 (0.423)		0.179 (0.278)				
UNO	1	0.007 (0.014)			0.012 (0.024)				
WTBS	449	3.075 (1.099)	3.595 (1.748)	5.000 (8.000)	3.238 (1.657)	2.143 (3.637)		0.500 (1.000)	
WTCP	17	0.116 (0.081)	0.286 (0.258)		0.060 (0.052)				

Appendix F6 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
YLBH	13	0.089 (0.087)	0.190 (0.257)		0.060 (0.078)				
YOYF	6	0.041 (0.070)	0.119 (0.238)		0.012 (0.024)				

Appendix F7. Bag Seine: overall season and segment summary. Lists CPUE (fish/100 m<sup>2</sup>) and 2 standard errors in brackets.

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
BHMW	3	0.034 (0.039)			0.063 (0.072)				
BLCF	47	0.316 (0.327)	0.082 (0.116)		0.255 (0.218)	2.559 (5.118)			
BLGL	35	0.254 (0.291)	0.706 (0.934)		0.044 (0.088)	0.136 (0.273)	0.133 (0.267)		
BMSN	1	0.006 (0.011)			0.010 (0.020)				
CARP	5	0.034 (0.039)	0.028 (0.056)		0.046 (0.065)				
CNCF	355	2.483 (1.245)	0.204 (0.197)		3.836 (2.028)	5.301 (8.793)		1.658 (0.192)	
ERSN	768	6.360 (2.102)	7.895 (4.685)	0.667 (1.333)	5.115 (2.122)	18.754 (15.108)	0.739 (0.776)		0.881 (1.762)
FHCB	3	0.023 (0.033)	0.048 (0.096)			0.135 (0.269)			
FHCF	1	0.006 (0.013)			0.012 (0.023)				
FHMW	36	0.213 (0.188)	0.360 (0.416)	0.397 (0.794)			1.842 (2.439)		
FWDM	497	4.025 (2.096)	1.662 (1.136)		6.333 (3.739)	0.311 (0.416)	0.832 (0.998)	0.391 (0.781)	0.893 (1.786)
GNSF	7	0.061 (0.052)	0.120 (0.120)		0.045 (0.069)				
GSCP	1	0.007 (0.015)	0.025 (0.049)						
GZSD	949	7.844 (7.279)	8.892 (9.068)	13.095 (26.190)	8.687 (12.417)	0.273 (0.546)	2.733 (2.092)	4.492 (8.984)	1.786 (3.571)
<b>HBNS*</b>	38	0.361 (0.334)	0.432 (0.495)		0.423 (0.550)				
MQTF	53	0.412 (0.510)	1.331 (1.653)		0.012 (0.023)				
OSSF	42	0.382 (0.376)	0.792 (1.182)		0.119 (0.140)	0.409 (0.819)	0.964 (1.023)		
<b>PNMW*</b>	1	0.003 (0.005)			0.005 (0.009)				

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
QLBK	3	0.028 (0.037)			0.048 (0.067)			0.195 (0.391)	
RDSN	386	2.678 (1.166)	3.481 (2.796)	0.794 (1.587)	2.462 (1.434)	3.997 (2.506)	0.371 (0.544)		0.881 (1.762)
RESF	1	0.003 (0.005)			0.005 (0.009)				
RVCS	202	1.622 (1.196)	1.015 (0.652)	30.952 (61.905)	1.522 (1.581)	0.273 (0.546)	0.937 (1.875)	0.781 (1.562)	
RVSN	233	1.242 (0.606)	1.621 (1.592)	2.381 (4.762)	0.821 (0.546)	3.282 (2.799)	0.937 (1.875)	1.953 (3.906)	
SFSN	6	0.045 (0.050)			0.032 (0.063)	0.470 (0.567)			
<b>SGER*</b>	1	0.011 (0.022)			0.020 (0.041)				
SHRH	79	0.254 (0.342)	0.022 (0.043)	0.794 (1.587)	0.436 (0.626)				
<b>SKCB*</b>	19	0.130 (0.129)	0.043 (0.086)		0.200 (0.230)	0.135 (0.269)			
SMBF	4	0.015 (0.016)	0.017 (0.034)		0.005 (0.009)		0.098 (0.196)	0.195 (0.391)	
SMBS	1	0.007 (0.015)	0.025 (0.049)						
SMMW	3	0.028 (0.039)	0.048 (0.096)		0.024 (0.049)				
<b>SNSN*</b>	70	0.528 (0.299)	0.786 (0.861)	0.667 (1.333)	0.365 (0.212)	0.463 (0.802)	0.973 (1.379)	0.195 (0.391)	
STSN	1	0.006 (0.011)					0.104 (0.208)		
SVCB	209	1.550 (0.984)	0.887 (0.751)		1.967 (1.604)	3.550 (6.698)			
SVCP	1	0.011 (0.021)	0.035 (0.070)						
UBF	3	0.032 (0.048)			0.060 (0.089)				
UCS	60	0.689 (1.354)	0.041 (0.082)		1.246 (2.493)				

Appendix F7 (continued).

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB	OSB	TRIB	TRML	TRMS
			BARS	BARS	BARS	BARS	BARS	BARS	BARS
UCY	4	0.017 (0.024)	0.005 (0.009)	0.794 (1.587)	0.010 (0.019)				
UNO	10	0.111 (0.126)	0.296 (0.387)		0.039 (0.078)				
WLYE	1	0.010 (0.021)			0.019 (0.038)				
WTBS	212	1.241 (0.565)	0.988 (0.521)	15.079 (30.159)	1.226 (0.680)	0.481 (0.804)	0.078 (0.156)	3.125 (6.25)	

Appendix G. Hatchery names, locations, and abbreviations.

<b>Hatchery</b>	<b>State</b>	<b>Abbreviation</b>
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 sturgeon season (fall through spring) and fish community season (summer) during 2005 for segment 9 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seine	Mini-Fyke Net	Otter Trawl
BDKF								
BESN								
BHCP	0.004	0.011	0.005					0.004
BHMW						0.034	0.014	
BKBF								
BKBH							0.014	
BKCP							0.021	
BKSS				0.004				
BLCF	0.012		0.035	0.006		0.316	0.507	1.462
BLGL						0.254	0.623	
BMBF		0.022			0.002		0.007	
BMSN						0.006	0.027	
BNMW							0.007	
BRBT								
BSMW								
BTTM								
<b>BUSK</b> *	0.389	0.498	0.758	0.059	0.634			0.186
CARP	0.062	0.065	0.046	0.018	0.015	0.034	0.390	0.004
CKCB							0.014	
CLSR							0.007	
CMSN								
CNCF	0.059		0.068	1.841	0.076	2.483	2.527	1.567
CNLP								
CNSN								
ERSN				0.091		6.360	6.534	0.104
FHCB						0.023	0.068	
FHCF		0.013	0.024	0.017		0.006	0.068	0.021
FHMW						0.213	2.863	
FWDM	0.005		0.008	0.124	0.007	4.025	19.808	0.672
GDEY	0.094		0.560	0.009	0.007			
GDFH							0.007	
GDSN								
GNSF						0.061	0.233	
GSBG								
GSCP	0.040	0.067	0.014		0.029	0.007		

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seine	Mini-Fyke Net	Otter Trawl
GSPK								
GZSD	0.007	0.026	0.014	0.005		7.844	1.774	0.009
<b>HBNS *</b>						0.361	2.370	
HFCS								
JYDR								
LAB								
LESF								
LGPH								
LKSG								
LMBS							0.027	
LNDC								
LNDR	0.007	0.013	0.065	0.007	0.031		0.041	0.005
MMSN							0.007	
MNEY								
MQTF						0.412	0.096	
NFSH								
NTPK								
OSSF				0.002		0.382	0.425	
PDFH	0.007	0.009	0.005					0.008
<b>PDSG *</b>	0.019		0.022	0.009	0.010			
<b>PNMW *</b>						0.003		
QLBK	0.006		0.005		0.002	0.028	0.007	
RBST								
RDSN				0.002		2.678	7.466	0.017
RFSN								
RKBS								
RVCS	0.018	0.013	0.084	0.011	0.014	1.622	0.185	0.011
RVRH								
RVSN				0.003		1.242	2.973	0.025
SBWB								
SDBS								
<b>SFCB *</b>				0.251			0.027	0.486
SFSN						0.045	0.041	
<b>SGCB *</b>				0.343			0.007	0.098
<b>SGER *</b>			0.109	0.003	0.023	0.011	0.027	0.004
SGWE	0.006							
SHRH			0.011	0.006		0.254	0.068	

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seine	Mini-Fyke Net	Otter Trawl
SJHR	0.004		0.003					
<b>SKCB *</b>				0.953		0.130	0.110	0.353
SMBF	0.121	0.244	0.016	0.006	0.107	0.015	0.007	0.010
SMBS						0.007		
SMMW						0.028	0.021	
SNGR	0.012		0.114		0.016		0.452	0.008
SNPD			0.003		0.006			0.002
<b>SNSG *</b>	1.881	0.720	7.332	0.561	2.220			0.814
<b>SNSN *</b>				0.024		0.528	0.610	0.010
SPSK								
STBS							0.014	
STCT				0.025			0.007	
STSN						0.006		
SVCB				0.416		1.550	3.226	1.643
SVCP	0.007	0.011	0.003			0.011	0.007	
TPMT								
UBF						0.032	0.007	
UCN								
UCS						0.689	0.007	
UCT							0.034	
UCY						0.017	0.274	
UHY							0.055	0.002
ULP							0.130	
UNID							0.192	
UNO						0.111	0.007	
URH								
USG								
WLYE	0.007		0.014			0.010		
WSMW								
WTBS				0.002		1.241	3.075	0.037
WTCP							0.116	

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)				Fish Community Season (Summer)			
	1 Inch Trammel Net	2.5 Inch Trammel Net	Gill Net	Otter Trawl	1 Inch Trammel Net	Bag Seine	Mini-Fyke Net	Otter Trawl
WTSK			0.003	0.002				
YLBH							0.089	
YOYF							0.041	
YWPH								