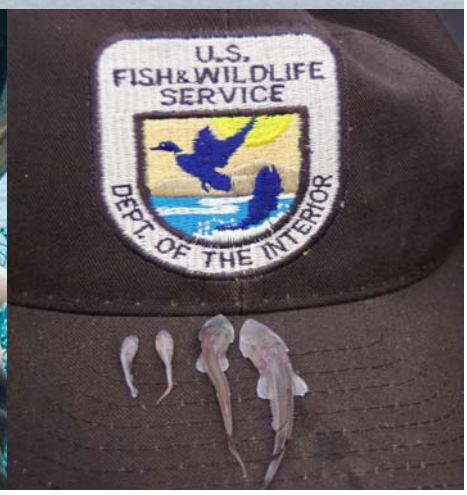
2004 Annual Report

Pallid Sturgeon Population Assessment Project and Associated Fish Community Monitoring for the Missouri River: Segments 13 and 14



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Pallid Sturgeon Executive Summary

Wild pallid sturgeon appear to be in a continued state of decline in the lowermost portion of the Missouri River. Despite year-round sampling with a variety of gears in 230 miles of the Lower Missouri River, only four presumed wild pallids were captured in 2003 and only six presumed wild pallids were captured in 2004. The population augmentation program has begun to show its contribution to restoration efforts as hatchery fish captured in 2004 increased by 18% compared to efforts in 2003. In 2003, only three stocked fish were captured within both segments, however in 2004, 19 stocked pallids were caught in segments 13 and 14. Before initiation of 2004 sampling started, there were 9,189 pallids previously stocked in segments 13 and 14, by the end of the 2004 sampling season there were 24,609 fish potentially at large in the reach. Movement in and out of the two segments occurs, however of the fish stocked in segment 14 during the mid-1990's, only one has been recaptured outside of the segment since 1999 (4 miles above in Segment 13 during 2003). Similarly, only two of hatchery fish released in segment 13 have been recaptured in segment 14 (2005 data) and none have been recaptured in the lower 100 miles of the river. The disparity between pallid catches of: 20 in segment 13 and 5 in segment 14 for 2004 can be explained by this lack of movement of hatchery fish. Captures of presumed wild fish are relatively comparable between the segments (two in each segment in 2003 and four in 13 and two in 14 in 2004). Growth of recaptured fish indicates fish condition is average, though not robust. No pallid sturgeon were recaptured that had previously been captured. This double recapture has event has only occurred twice before in four previous years of effort.

Sizes of wild pallid sturgeon captured suggest; there may be some natural recruitment occurring. However, tag loss in hatchery fish occurs frequently and may be one alternative explanation to natural recruitment. Double and triple markings on hatchery fish stocked since 2003, along with genetic advances will allow positive distinction from wild fish in the future. Hybridization continues to be documented in the lower reach of the Missouri River, although it is not as well documented in the upper reaches. Hybridization also suggests that pallid sturgeon are spawning, though it should be noted that these fish may not be spawning in this reach, but rather using it as their home range. Differentiation between pallids and hybrids (using morphological

differences), is usually only possible after they are over a decade old. The time lag between detection and loss of genetics in the species is a very real concern for this section of the river.

Pallid sturgeon sampling in this reach has occurred continually since 1999. In that time period, anecdotal information from biologists and summary data from reports suggests pallid sturgeon use marginal habitat or transition zones. Island tips are one example of these habitats. Island tips are relatively rare in the river and are only encountered in sampling about 6% of the time. Despite the limited availability of this habitat, three pallids or 12 % of the 2004 captures came from this habitat. Pallids also occupied channel crossover areas and confluences in greater percentages to effort expended in those habitats. The remaining fish came from more frequently sampled inside bend areas, but often occurred on less sampled portions of sand bars. Different size classes of sturgeon used habitat differently as well. There were six pallids captured that were greater than 600mm, of those six, three were captured on island tips. The smallest sturgeon tended to associate more with inside bend habitat and as the fish grow larger, they were more dispersed among different habitat types. Since 1999, gillnets set in pools have been the primary technique for catching pallids in the Lower Missouri River since 1999. For the first time in 2004, gillnets were set equally across channel border, island tips and pools. As a result, only three of the seven fish captured in gillnets came from pools, showing that different techniques used in alternative habitats can be highly successful. Using telemetry information from USGS/CERC to focus on marginal habitat types has proven successful in more recent sampling of pallid sturgeon. Targeting less abundant habitat types that were historically more abundant was part of our work in 2004. Through this additional "non-random" work we sampled 5 of the 25 pallids reported in both segments.

Various size classes of pallid sturgeon have been sampled together. Reasons for this phenomenon may be attributed to habitat preferences, spawning aggregations or unknown species association. As part of the monitoring protocol, an additional two samples are taken in the exact area where a pallid is sampled. In the last five years, there have been six instances where more than one pallid occurred in the same exact area, including two in one trawl. There have been 15 one-mile reaches where multiple pallids were captured, including six at one

location. There reaches that congregate pallid sturgeon can be exploited more with "non-random" sampling to gain additional information about the species. To date, no agency on the Lower Missouri River has collected a gravid (ready to spawn) female pallid. However, during the spring of 2005, one female was confirmed (through a sonic tag implantation procedure) to have recently spawned. Habitat associations of adult fish within the spring season have allowed more recent sampling to focus on potential spawning sites associated with historic captures of adult pallids. Information obtained through collaboration with USGS/CERC has provided biologists with movement patterns and habitat use that will aid in these seasonal sampling efforts. The inability to define spawning areas and exploit brood-stock may affect our future ability to continue our rate of stocking in the Lower Missouri River.

Biologists continue to refine methods of sampling for pallid sturgeon. Continued development of trawling techniques promises to allow more exploration into the spawning success and recruitment of sturgeon. Doubling spring trammel net effort in 2005 has increased our catch of adult pallids in 2005. With all gears combined, efforts to date in 2005 have already captured more pallids than the two previous years combined. The culmination of new research, genetics and sampling expertise along with the incorporation of two additional large-scale projects promises exponential results in future years.

Target Species Executive Summary

Over 1,600 gear deployments (5 net types), used throughout 230 miles of river, caught fewer than 80 fish in five of the nine target species groups; including less than ten bigmouth buffalo and *Hybognathus* species. The target species were selected based on their representation of the native fish community and as indicator species of restored habitat. These nine species, deemed by biologists as important historical species in the river only made up 35% of the total fish assemblage. Excluding sturgeon, eight of the species made up only 15% of the assemblage. Although a large number of sturgeon were captured (4,365), only 65 young of year were collected; suggesting that there was very little reproduction or recruitment in the population. Health of a population can be evaluated based on abundance of younger fish. The long-lived

shovelnose may not show signs of decline until it is too late to recover. There were 36% fewer adult shovelnose and 42% fewer young of year in segment 14 than in segment 13. Other species numbers were either higher or about equal in segment 14 vs. 13. Segment 14 is thought to have better and more diverse habitat than segment 13. With the exception of shovelnose, this would appear to be the case by other species abundances. More intensive commercial fishing in this segment may be the cause of this disparity among shovelnose.

Channel crossover habitats almost always had more fish of each species associated within it during one or both of the seasons. Less abundant species occurred more frequently in less represented habitat types such as; side-channel (Macro) and island tip (Meso) habitat types. Chubs were particularly vulnerable in these locations. Seasonally, confluences and tributary mouths were good habitats for sauger, shovelnose and blue suckers. No young of year were observed for: sauger, blue suckers or bigmouth buffalo. Pool areas appeared to be good rearing habitat for many species, but especially chubs.

Gear Evaluation

Seines were largely ineffective at collecting any target species. Considering the same sampling unit as trawls ($100m^2$) and bias towards smaller fish, catch rates for seines should have far exceeded trawls, however they did not. Seines captured the least number of target fish of all the different gear types. Mini-fyke nets were good at collecting various species that were not represented in trawls, but the need to set these nets on exposed sand bars made this net vulnerable to rising water levels and some bends could not be sampled. Shovelnose were most vulnerable to gillnets and were as vulnerable in channel borders as in pools in some Macro habitats. Sauger were sampled most often in gillnets and rarely occurred in other gear-types. Hoop nets were effective at catching blue suckers and bigmouth buffalo, but other gears like trammel nets and trawls were effective as well and had a greater chance at catching sturgeon. Otter trawls were effective at catching all chub species as well as sturgeon of all sizes. Otter trawls can be deployed in most habitats most of the time, with the exception of pools and sand bars. Beam trawls were used effectively for chubs in pool habitats, but they were not very effective for other species.

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Pallid sturgeon

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Speckled chub

Sand shiner

***Hybognathus* sp.**

SUMMARY OF APPENDICES

Introduction

Pallid sturgeon (*Scaphirhynchus albus)* have declined throughout the Missouri River since dam construction and inception of the Bank Stabilization and Navigation Project in 1912 (Carlson et al. 1985). Loss of habitat, reduced turbidity, increased velocity, loss of natural flows, reduction in forage, increased hybridization and inadequate reproduction and recruitment are factors contributing to the decline of the pallid and other native species (Pflieger and Grace 1987). Since 1996, surveys conducted throughout the Missouri and Mississippi Rivers show an increase in hybridization and continued decline of pallid sturgeon (Grady et al. 2001, Doyle and Starostka 2003, Doyle and Starostka 2004).

In an independent scientific evaluation of the condition and management of the Missouri River, the National Research Council (2002) concluded that altered flow and habitat conditions associated with current management practices on the Missouri River have resulted in an unhealthy river ecosystem. Similar conclusions presented in the U. S. Fish and Wildlife Service Biological Opinion recommended, in part, that the Army Corps of Engineers (COE) initiate modified flow regimes by 2003 to avoid jeopardizing three listed species (endangered pallid sturgeon and least tern; threatened piping plover) and begin restoring the river's ecological health. The COE is responsible for monitoring and evaluating biotic responses of the pallid sturgeon to operational and habitat changes on the Missouri River (USFWS 2000). Habitat restoration, higher spring and lower summer flows combined with adaptive management are recommended measures to restore pallid sturgeon populations on the Lower Missouri River. Adaptive management is an approach to natural resources management that promotes carefully designed management actions, monitoring and assessment of impacts and application of results and findings to subsequent policy and management strategies. Monitoring sturgeon populations will provide vital information needed to guide restoration of form and function (habitat and hydrology) in the Lower Missouri River.

In response to the 2000 Missouri River Biological Opinion, the COE is developing monitoring and restoration projects to avoid jeopardizing pallid sturgeon populations. As

part of their Implementation Plan, the COE is working with the U. S. Fish and Wildlife Service (USFWS) and State Resource Agencies to develop and conduct a pallid sturgeon monitoring and assessment program. The objectives of this program are as follows:

1. Document annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.
2. Document annual results and long-term trends of habitat use of wild pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.
3. Document population structure and dynamics of pallid sturgeon in the Missouri River System.
4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.
5. Document annual results and long-term trends of habitat usage of the native target species by season and life stage.
6. Document annual results and long-term trends of all non-target species population abundance and geographic distribution throughout the Missouri River system, where sample size is greater than fifty individuals.

Study Area

Historically, the Missouri River was very wide and shallow, containing meandering channels with many islands and snags. Today, the Missouri River is maintained by the COE of Engineers as a navigation channel for barges and the bank is stabilized with high levies to protect the adjacent farm land. Reveted banks and dikes line the river making it a self-scouring channel. Water velocities exceed 1.3 m/s in the main channel and drop to zero in pools that exist behind dike structures. Depths range from six meters in the main channel to 12 meters behind dikes. Turbidities can vary widely from over 1000 ntu's in spring flood events to around 40 units in the winter. Substrates range from silt (behind dikes) to fine sand and gravel in the main channel and border habitats. Rock revetment lines the outside bend shore-line, while mud banks or sand dominate the inside bend shoreline. In low water, sand bars are visible on the insides of bends with water often carving secondary channels behind them. Debris is often discharged from upstream tributaries and frequently gets lodged in sand bars or on dike structures as water levels drop. The Osage and Gasconade Rivers are two large tributaries feeding the Lower Missouri River and enter the River nearly halfway down the study area. Inputs of gravel from Ozark foothills along with low turbidity and

cooler water are all influences of these rivers. Other smaller floodplain tributaries deliver large silt loads from rain events and can quickly change water stage height. Spring floods rarely top the banks, however usually on an annual basis, the river flows through some breached levies onto refuge floodplain land.

Over the last two decades, the COE has made efforts to diversify habitats by notching dikes or creating "pilot channels" on the flood plain. In recent years, much emphasis has been given to these dike modification projects and many of the existing dikes in this reach of river have had modifications done on them. Notches are now deeper and wider than what previously existed and can change how water is diverted into the bank allowing erosion or deposition to occur at varying degrees. Dike types are different in design and in general, outside bends contain L-shaped dike pointing down stream while dikes on the inside bend are more wing shaped, projecting straight into the channel and slightly downstream. The subsequent habitats that exist behind these dikes vary widely and fish species may use them according to biologically different needs. In all, the river is much different than it used to be, though there are some remnant historical habitats that exist at different water stages. These remnant habitats are important biologically and this project aims to define and determine those most used by the pallid sturgeon

Methods

Sampling was conducted in accordance with Standard Operating Procedures established by a panel of representatives from various State and Federal agencies involved with pallid recovery on the Missouri River (Drobish, 2005). The sampling guidelines were meant to be adaptive and have been modified to ensure sampling efficiency and scientific accuracy.

Sampling Site Selection and Description

Columbia FRO was contracted to sample the lowest two of 14 designated segments on the Missouri River. Segment 14 starts at the mouth of the Missouri (RM 0) and ends at the mouth of the Osage River (RM 130.2) (Figure 1). Segment 13 is designated from the mouth of the Osage River to Glasgow, MO (RM 228.2). Each segment represents a sampling replicate. Segments were divided into bends (defined as the crossing of the thalweg from one bank to the other), and bends were randomly selected from each segment to be sampled with a suite of gears. Ten bends in each segment were sampled from November through June, (designated as the sturgeon season), and another 10 bends were selected and sampled for the community season (July through October). The river was categorized into distinct river components called Meso-habitats which exist within Macro-habitats (Appendix B). Each Meso habitat was sampled twice within each Macro habitat. When a diversity of habitats was not available, a minimum of eight samples was used to ensure some consistent level of effort per bend. For example, most active gear effort was applied in inside bend channel border habitat because this habitat was available at all water stages in all bends. Samples that occurred outside of the predetermined sampling protocol were given a "Wild" designation and not included in the master data analyses.

Sampling was distributed using the following defining codes:

MACRO
ISB (inside bend)
OSB (outside bend),
CONF (confluence- area downstream of a tributary)
SCCS or SCCL (side channel connected small or large)
TRMS or TRML (small or large tributary mouth)

MESO
CHNB (channel border- where depth is > 4 ft. to toe of thalweg)
POOL (scour hole)
ITIP (island tip- associated with SCCS or SCCL where the two water currents meet behind an island
BARS (sand bar or shallow water habitat were depth is < 4 ft. meters
TLWG (thalweg- main channel between channel borders conveying majority of water)

Figure 1a. Map of segments 13 and 14 of the Missouri River with major tributaries, common landmarks, and historic stocking locations (denoted in bold with an asterisk) for pallid sturgeon. Segment 13 encompasses the Missouri River from the Grand River (River Mile 250.3) to the Osage River (River Mile 130.2) and segment 14 encompasses the Missouri River from the Osage River to the confluence with the Mississippi River.

Sampling Gear

Gillnets were the most effective at capturing sturgeon of all gears combined and were the only gear used to target fish in colder water temperatures (<55 degrees). Other gears were utilized above this temperature to avoid fish mortality. Gillnets (GN) were set in POOL habitat off of dikes or in CHNB habitat where the sand bar sloped down towards the main-channel. Gillnets were anchored upstream with a 20 pound grappling hook and back-anchored with a cement weight tied to a buoy. Gillnets were most effective when they settled on a steep slope going off a sand bar into the thalweg or a dike structure. Gillnets were ineffective when flood events occurred in tributaries upstream and flushed debris in the river which subsequently became entangled in the nets.

Otter trawls (OT or OT16) were pulled downstream with a jet powered stern trawler. Trawls were most effective on sand bars off the main channel, but could be used in some POOL habitat as a wild option. Trawls were not pulled on outside bend revetment or in the thalweg due to safety concerns. Trawls frequently encountered snags, but a procedure was used to safely untangle the gear. An electronic sonar, capable of detecting woody debris, was used to detect snags and was very effective at allowing the driver to avoid snags.

Hoop nets were set using a 20 pound grappling hook tied to the front lead of the hoop. Hooks made it possible to set the net on any substrate within any velocities. Hoop nets (HN) were fished along steep slopes on CHNB habitat. Hoop nets were set overnight in areas most likely to intercept fish migrating upstream and were the only gear used to sample revetments. Outside of revetments, the effectiveness of the net depended largely in the ability of biologists to place the net directly in the tow or side-cut of a bank. Nets set on sand bars often buried themselves and were ineffective.

Trammel nets were set by throwing out a buoy attached to the float line of the net, then deploying the net until the other end entered the water. The net was maintained off the bow with a 30 foot lead line. When the net began to bunch up in the middle or align parallel with the current, it was pulled back to a perpendicular position and an estimate of sampling distance lost was accounted for. Trammel nets were most effective in moderately shallow

water without an eddy effect. Snags occurred frequently, but did not prevent effective sampling.

Beam trawls (BT) were towed in POOL habitat behind dikes with a stern trawler. Samples were complicated by swirling currents behind dikes and the drivers experience in estimating when the beam was touching the bottom. Distance of the tow was calculated based on when the net hit bottom and when it returned to the boat. Beams were used exclusively in POOL habitat because of their durability when encountering snags. Depth and swirling eddies made this gear marginally effective as depths of holes increased. Silty substrate or short distances were also two factors that made using this gear difficult. The trawl was meant to be fished on the bottom, however it was probably most often fished off the bottom or in mid-water, since tension on the line and resistance of back eddies caused it to rise.

Mini-fykes and seines were the only gears used solely in the community season. These nets are more effective at capturing smaller fish, and seasonally, small fish are more abundant after the spawning season. Mini-fykes (MF) were set on mud bars behind dikes and on sand bars in the main-channel. Steep slopes and shallow sand bars made affected the efficiency of this gear. Often times the gear was set close to the bank behind bars and the lead was not fully extended because of the steep slope of the bank. In contrast, on shallow sand bars there was not always enough lead to ensure the throat was in the water, especially when water levels were rising.

Bag-seines (BS) were pulled wherever wadable substrate existed. There were many methods of pulling seines (half or whole arcs, upstream or downstream), but the rectangular downstream method provided the most fish per effort for this section of the river and was almost exclusively used.

Sampling gear's dimensions are as follows:

Hoop net:	1.5 inch bar mesh, 7 hoop, 4ft diameter
Otter trawl :	Custom *Skate* design, # 9 polyethelene, 1.5 inch stretch, 16ft wide and 30 inch boards
Trammel net:	125 ft. X 6 ft. outer wall X 8 ft. inner wall; 1 inch bar X 8 inch bar panels
Mini- Fyke:	2 cab frames @ 4 ft. X 2 ft., two 2 ft. hoops, 15 ft. X 2 ft. lead, 1/8th mesh
Bag Seine:	30 ft, 1/8th inch mesh
Gill net:	100 X 8 ft. with 25 ft. repeating 1.5, 2, 3 and 4 inch mesh panels, nets were together making a 200 ft. net with two series of repeating panels
Beam trawl	Custom made # 12 sapphire twine, 5/8 inch bar mesh outer net with ¼ bar inner cod, 6.4 ft. wide X 1.6 ft. high, mounted on a horizontal bar and two skids

Data Collection and Analysis

Associated Environmental Data

GPS locations, temperature, turbidity and depth (beginning, mid-point and end) were taken for each sample. Additionally, substrate and velocity samples were collected randomly for 25% of the Meso habitat types within each Macro habitat. Substrate samples were reported as an estimate of the percentage of silt/sand/gravel within each dredge sample. Water column velocity was measured at (bottom), 80% (8/10) and 20% (2/10) of the depth. All habitat data was collected when pallid sturgeon were encountered.

Pallid Validation

Length measurements (mm) were collected on all fish and a sub-sample of target fish were weighed (g). A series of additional measurements were taken on pallids and their hybrids using Sheehan's index for verification (Sheehan et al. 1999). Sturgeon were called a hybrid when they were verified to be within the range of (- 0.50 to + 0.50) on the Sheehan's Character Index. PIT (passive integrated transponder) tags were implanted under the dorsal fin of pallid, strong hybrids (< -0.5) and lake sturgeon. Additionally, fin clips were collected from pallid sturgeon and hybrids to be analyzed for genetic purity and pictures were taken for

documentation. Pallid sturgeon captured in the spring, were implanted with sonic transmitters by USGS biologists for telemetry work.

Relative Condition

The relative condition of recaptured hatchery reared pallid sturgeon was calculated using 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 measures changes in fish population structure. Length categories based on the percentage of the largest known pallid sturgeon are as follows (Gablehouse 1984): sub-stock fork length < 330mm (20%), stock fork length = 330-629mm (20-36%), quality fork length = 630-839mm (36-45%), preferred fork length = 840-1039mm (45- 59%), memorable fork length = 1040- 1269mm(59 – 74%) and trophy fork length > 1270mm (>74%).

Length categories based on the percentage of the largest known shovelnose sturgeon are as follows: sub-stock fork length <250mm (20%), stock fork length = 250 – 379mm (20- 36%), quality fork length = 380 – 509mm (36 – 45%), preferred fork length = 510 – 639mm (45-59%), memorable fork length = 640 – 809mm (59 -74%) and trophy fork length > 810mm (> 74%). Proportional Stock Density (PSD) is the 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.

Analyses

A sample target effort for each gear was defined as follows: 300m drift (TN), 300m tow (OT), one overnight set (HN, MF) and 30ft half arc pull (BS). A minimum effort of 75m for TN and OT's was accepted in channel border habitat, because some areas have so much debris long drifts are not possible. Effort for seines could be determined using different

methods such as a half or full arc or pulling up-stream or down-stream, however our primary effort was in a rectangular parallel pull downstream, effort was calculated by multiplying the width of the net by distance pulled. Effort was calculated as catch per $100m^2$ for active gears (including seines) or per overnight set for passive gears. Samples that occurred outside of the "Standard" gear or habitat effort or samples that occurred in "Non-random" bends were excluded from CPUE calculations. These data were included into length frequencies, relative condition and population structure calculations.

Results

Segment 13

Pallid Sturgeon

Four wild and 16 stocked pallid sturgeon were recaptured in the 2004 season with 742 deployments of sturgeon sampling gears (Table 1). More pallid sturgeon were captured in segment 13 than segment 14 and were caught in proportion to the distribution of effort throughout the bend (Figure 1b). Within ISB CHNB habitat, where pallids were sampled most frequently, fish were found more often in slightly deeper depths than what was sampled (3.2m vs. 3.4m) (N=14). Pallids were found at the average velocity sampled (0.6m/s). On average within CHXO CHNB habitat, pallids occurred at a deeper depth than what was sampled (4.8m vs. 3.6m) (N=3) and occupied swifter velocities (0.67m/s vs. 0.56m/s). Other comparisons of single catches ranged widely from the average depth and velocities sampled but were generally closer to the mean than the extremes (Table 2).

Recaptured fish were mostly from the Boonville stocking location (Segment 13/ RM 195) and were seven years to a few months at large, with most being from the 2002 year class stocked in 2003 (Table 3) (Appendix E). Pallids from every hatchery were represented in the 2004 sample.

Character index values were calculated for two small (<400mm) hatchery origin fish for validation purposes and associated values were: -0.47 and -0.70. These stocked pallids were found within and close to the lower cut off value (-0.50); suggesting that smaller fish will not fit the current index being used to detect hybrids. Condition was average for the recaptured fish (Kn = 0.86 to 0.92) and had declined from time at stocking (Kn = 1.15 to 1.44), when fish were robust (Table 4). Kn is a measure of a fish's overall ability to obtain food, lower values generally suggest there is not enough food available within a home range. The population structure illustrates the influence of recently propagated fish with no quality fish

being captured in the fish community season (Table 5). The RSD values shows health of population in terms of reproductive potential and age of fish. The fact that few fish are seen at larger sizes suggests little opportunity exists for reproduction. The proportion of pallids to shovelnose shown in Table 6 gives some measure of change in the system since records were kept on the status of the species. Carlson et al (1985) reported a ratio of 1:398 for wild pallids to river sturgeon within this reach of the river, Grady et al (2001) reported a ratio of 1:647, Doyle and Starostka (2003) reported a ratio of 1:387 (2003) and recent results show 1:2339 (2003) and 1:688 in 2004 (Table 6). Methods of capture, changing environmental conditions, commercial harvest and sampling locations are confounding assumptions made using this comparison and warrant noting. Despite these assumptions, the proportion, at the very least, does not indicate population improvement. Hatchery influence can be illustrated as the proportions change to 1:153 including all fish in 2004.

Table 1. Segment 13: Number of bends sampled, mean effort per bend (as deployments of each gear type), and total gear deployments by Macro habitat and Meso habitat on the Missouri River during sturgeon season and fish community season in 2003 - 2004.

			Macro habitat									
Gear	Number of bends	Mean effort/bend	OSB	ISB	CHXO	SCCL	SCCS	SCN	TRML	TRMS	CONF	BRAD
Fall through Spring - Sturgeon Season												
Gillnet	10	20.9	18	27	20	2	8	0	1	0	7	0
Trammel net	11	18.1	1	70	15	4	2	0	1	0	0	0
Beam Trawl	1	11.1	0	1	0	2	1	0	0	0	0	0
Otter trawl	13	20.1	3	57	22	7	2	0	2	0	0	0
Hoop net	10	9.1	36	27	18	3	2	0	2	0	3	0
Summer – Fish Community Season												
Bag seine	6	9.5	0	17	4	6	6	3	0	1	0	0
Mini-fyke	11	6.9	12	24	15	6	11	4	0	3	1	0
Trammel net	10	21.3	2	64	20	5	4	0	0	0	0	0
Beam Trawl	12	10.3	25	36	19	5	0	0	0	0	4	0
Otter trawl	10	21.5	9	46	18	9	4	0	0	0	0	0
Hoop net	10	8.4	27	26	23	0	2	0	0	0	6	0

Table 1 (extended).

			Macro habitat			Meso habitat						Total
Gear	Number of bends	Mean effort/bend	DEND	DRNG		BAR	POOL	CHNB	TLWG	ITIP		deployments
Fall through Spring - Sturgeon Season												
Gillnet	10	20.9	0	0		0	48	50	0	8		107
Trammel net	11	18.1	0	0		0	0	88	0	4		93
Beam Trawl	1	11.1	0	0		0	0	4	0	0		4
Otter trawl	13	20.1	0	0		0	0	86	0	5		93
Hoop net	10	9.1	0	0		0	0	89	0	0		91
Summer – Fish Community Season												
Bag seine	6	9.5	0	0		37	0	0	0	0		37
Mini-fyke	11	6.9	0	0		76	0	0	0	0		76
Trammel net	10	21.3	0	0		0	0	89	0	6		95
Beam Trawl	12	10.3	0	0		0	80	4	5	0		89
Otter trawl	10	21.5	0	0		0	0	78	0	8		86
Hoop net	10	8.4	0	0		0	0	84	0	0		84

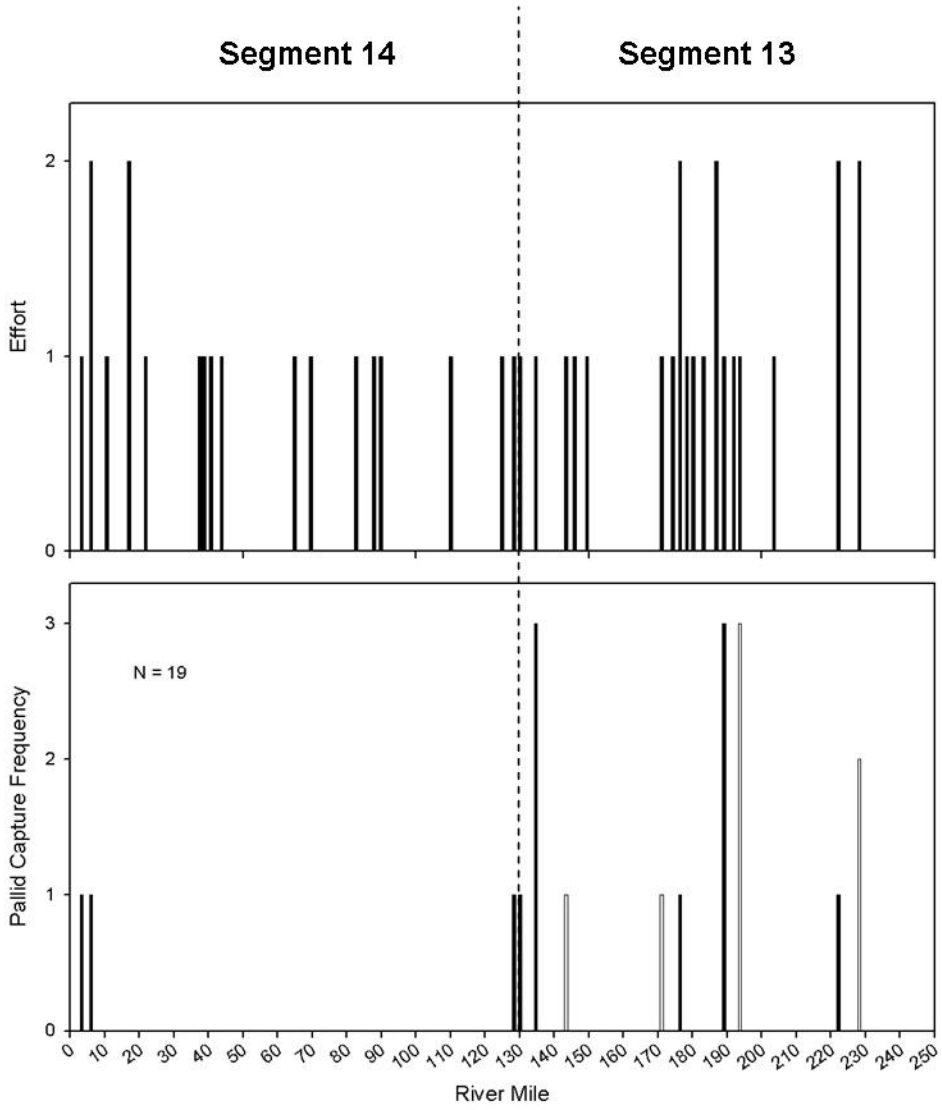

Figure 1b. Distribution of: A) seasonal sampling effort and B) pallid sturgeon captures by river mile for segments 13 and 14 in randomly selected bends of the Missouri River during 2003-2004. Sampling effort of 2 indicates bend sampled in both sturgeon and fish community seasons. Sampling effort of 1 indicates bend sampled in only one season. Black bars represent pallid captures during sturgeon season. White bars represent pallid captures during fish community season.

Table 2. Segment 13: Pallid sturgeon (PDSG) capture locations and habitat characteristics on the Missouri River during 2003-2004. Habitat definitions and codes presented in Appendix B.

	ISB			OSB		
	CHNB	**POOL**	**BARS**	**CHNB**	**POOL**	**BARS**
Depth (m) (Effort)	3.4 (1.3-6.5)	5.3 (2.1-8.4)	0.5 (0.2-1.2)	3.5 (1.3-28)	4.3 (1.9-7.5)	0.6 (0.3-1.1)
Depth (m) (Catch)	3.2 (2.1-5.6)	3.8 (3.8)	No PDSG	No PDSG	5.3 (5.3)	No PDSG
Velocity (m/s) (Effort)	0.6 (0.05-1.16)	0.17 (0.02-0.52)	--	0.52 (0.09-1.4)	0.11 (0.0-0.24)	--
Velocity (m/s) (Catch)	0.6 (0.34-0.87)	0.05 (0.05)	No PDSG	No PDSG	0.14 (0.14)	No PDSG
Temp. °C (Effort)	20.8 (2-26)	14.5 (2-25)	20.7 (16-24)	19.4 (2-26)	14.8 (2-25)	22.6 (22-24)
Temp. °C (Catch)	17.8 (7-26)	2 (2)	No PDSG	No PDSG	7 (7)	No PDSG
Turbidity (ntu) (Effort)	481 (20-1254)	146 (29-1260)	71.3 (27-150)	409 (20-1210)	152 (29-1150)	117 (27-162)
Turbidity (ntu) (Catch)	274 (66-950)	87 (87)	No PDSG	No PDSG	130 (130)	No PDSG
Total Pallids caught	14	1	0	0	1	0

	CHXO			SCCS	SCCL	
	CHNB	**POOL**	**BARS**	**ITIP**	**ITIP**	**CHNB**
Depth (m) (Effort)	3.6 (1.3-7.0)	5 (2.0-8.8)	0.6 (0.2-1.3)	2.5 (1.5-4.6)	3.5 (1.9-5.1)	2.4 (1.1-4.3)
Depth (m) (Catch)	4.8 (1.6-6.7)	No PDSG	No PDSG	1.5 (1.5)	No PDSG	No PDSG
Velocity (m/s) (Effort)	0.56 (0.0-1.19)	0.11 (0.01-0.21)	--	0.54 (0.13-0.84)	0.75 (0.69-0.79)	0.52 (0.09-0.75)
Velocity (m/s) (Catch)	0.67 (0.67)	No PDSG	No PDSG	0.42 (0.42)	No PDSG	No PDSG
Temp. °C (Effort)	20.4 (2-26)	15.4 (2-25)	21.4 (16-25)	13.3 (2-24)	21.5 (5-26)	22.1 (5-26)
Temp. °C (Catch)	24 (20-26)	No PDSG	No PDSG	5 (5)	No PDSG	No PDSG
Turbidity (ntu) (Effort)	427 (20-1200)	199 (29-1190)	74 (27-167)	176 (32-1230)	578 (144-1240)	446 (67-1240)
Turbidity (ntu) (Catch)	120 (120)	No PDSG	No PDSG	78 (78)	No PDSG	No PDSG
Total Pallids caught	3	0	0	1	0	0

Table 3. Segment 13: Pallid sturgeon recapture data including fork length (mm), weights (g), morphometric character index (CI) (Sheehan et al. 1999),status (H = Hatchery, W = Wild) tags found, elastomer tags (color, position, orientation), if tags were inserted in field, stocking locations, and hatchery information on the Missouri River during 2003-2004.

	Stocking Data							Recapture Data			
ID #	FL (mm)	Wt (g)	CI	Status	Tags found[a]	Elastomer[c]	Marked in field?[d]	Year class	FL (mm)	Wt (g)	Site	Source[e]
13-0779	315	101		H	E, P		No	2002	309	113	Boonville	NEO
13-1045	634	940		H	C, P		No					
13-1083	392		-0.4779	H	P		No	2002	297		Boonville	GAR
13-1114	347		-0.7236	H	E, P		No	2002	307	100	Boonville	GAV
13-1414	298			H	E, P		No		208	41	Boonville	
13-1415	391	160		H	E, P		No	2002	302	120	Boonville	GAV
13-1426	322	104		H	E, P		No	2002	290	93	Boonville	NEO
13-1428	439			H	E, P		No	2002	322	121	Boonville	GAV
13-1470	393	204		H	E, P		No	2002	306	103	Boonville	NEO
13-1501	306	80		H	E	Pink - R	No	2003			Boonville	GAR
13-1535	455			H	P		No	2002	254		Boonville	NEO
13-1571	250			H	E, P		No	2004	221	51	Boonville	GAR
13-1640	299			H	E, P		No	2002	245	45	Boonville	NEO
13-1879	529	500		H	P		No	2001	220		Boonville	GAR
13-1940	378	161		H	E, P		No	2004	257	63	Boonville	GAV
13-1940	133			H	E	Red - L	No	2002			Boonville	GAR
13-1985	427	266		H	P		No	2002	259		Boonville	

[a] Tag types include: coded wire tag (C), elastomer tag (E) and passive induced transponder tag, i.e. PIT tag (P).
[b] Tag type in parentheses after number.
[c] 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).
[d] If fish marked in the field, tag number corresponds to new tag and the type is in parentheses next to the tag number.
[e] Hatchery sources: BYP = Blind Pony State Hatchery in MO, GAR = Garrison Dam National Fish Hatchery (NFH) in ND, GAV = Gavins Point Dam NFH in SD and NEO = Neosho NFH in MO.

Table 4. Segment 13: Mean fork length, weight, relative condition factor (Kn), and growth rates of juvenile hatchery-reared pallid sturgeon by year class at the time of stocking and recapture in 2003-2004 in the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error was calculated where N>1 and is represented in parentheses.

Year class	N	Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Growth (mm/d)	Growth (g/d)
2001	1	529 --	500 --	0.86 --	220 --	-- --	-- --	0.41 --	-- --
2002	11	356 (27)	167 (21)	0.92 (0.027)	289 (8)	99 (8)	1.15 (0.033)	0.30 (0.032)	0.21 (0.047)
2003	1	306 --	80 --	0.87 --	-- --	-- --	-- --	0.91 --	-- --
2004	2	314 (64)	161 --	0.86 --	239 (25)	57 (6)	1.44 (0.21)	-- --	-- --

Table 5. Segment 13: Relative stock density (RSD)[a] by a length category for wild and stocked pallid sturgeon in the Missouri River captured during 2003-2004. Length categories[b] determined using the methods proposed by Gablehouse (1984).

Length Category	Wild		Stocked	
	N	RSD	N	RSD
Sturgeon Season				
Sub-stock			4	
Stock			6	
Quality	2	67	1	14
Preferred	1	33		
Memorable				
Trophy				
Fish Community Season				
Sub-stock			3	
Stock			3	100
Quality				
Preferred				
Memorable				
Trophy				

[a] RSD = number of fish = specified length ÷ number of fish = minimum stock length x 100.
[b] 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 %).

Table 6. Segment 13: 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 2003-2004 including non-random and wild samples.

Year	All Pallids : Shovelnose	Wild Pallids:Shovelnose	Wild Pallids:Hybrids	Stocked Pallids:Wild Pallids
2003	1 : 1188	1 : 2339	1 : 8.5	1 : 1
2004	1 : 133	1 : 887	1 : 2.6	5.6 : 1

Year comparisons, Gear evaluation and Habitat associations

Pallids were captured more frequently in 2004 than in 2003 in all gear types and in both seasons (Figures 2 and 3). More effort was expended in ISB CHNB with all gears, since that was the most available habitat type in most bends for some gears (Table 1). Sub-stock sized pallids were captured at a higher rate in inside bend and crossover habitats than in all other habitats in the sturgeon season and caught at a much higher rate in ISB habitat in the community season (N=4) (Figure 4a). Sub-stock sized fish only occurred in channel borders even though over 100 gillnets were placed in POOL habitat (Figure 5a). Doyle and Starostka (2003) showed that shovelnose did not recruit to gillnets until larger sizes were obtained, it is likely that this is the case for pallids in this size class as well. Stock-sized fish were captured in proportion to sampling effort in CHXO and ISB habitats with one fish occurring on the outside bend (N=5) (Figure 4b). Stock-sized fish were primarily captured on CHNB habitat with one fish occurring in POOL habitat (Figure 5b). Quality sized pallids were not found during the community season. In the sturgeon season, CPUE was highest in side-channel habitat (Figures 4c and 5c) and also occurred in channel border and pool habitat (Appendix G). It is interesting to note the difference in size classes of fish and the associated habitats they used. The largest sized pallids have not been captured outside of the sturgeon season and are more widespread in the habitats where they are encountered. In contrast, the smaller sized fish are found more frequently in channel border habitats and are captured in both seasons. There may be some gear bias associated with catches of larger fish, since large mesh size is only used in the community season. Gillnets were used in CHNB and POOL habitat equally in 2004 to sample all available habitat (Appendix F1). As a result, it was discovered that pallid sturgeon were more likely to be found in channel borders than in pools, even at temperatures as low as one and seven degrees Celsius. Figure 6 shows the distribution of pallids in this segment, clearly illustrating the contribution of stocked fish with adult fish lacking in the population. Lack of larger fish in the system implies there is less chance that spawning can occur despite appropriate spawning conditions.

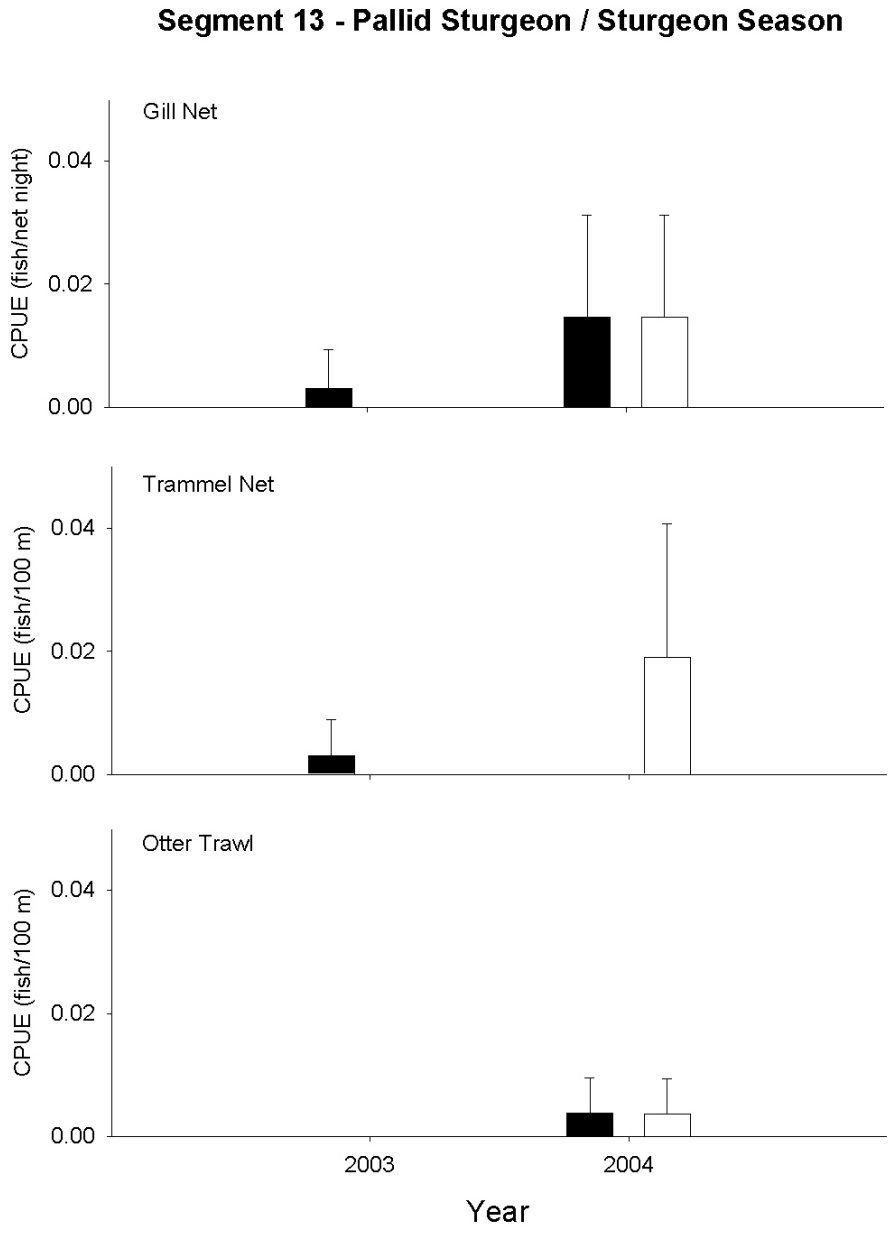

Figure 2. Mean annual catch-per-unit-effort (+/- 2SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 13 of the Missouri River during sturgeon season 2003 - 2004.

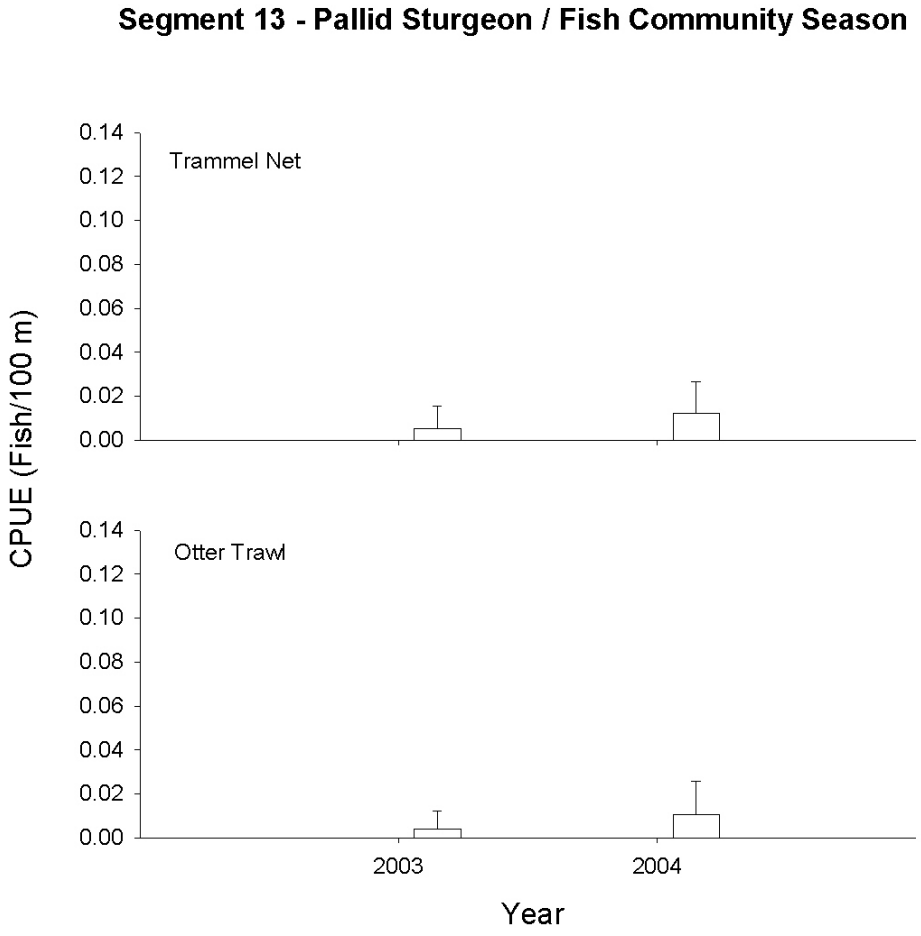

Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 13 of the Missouri River during fish community season 2004.

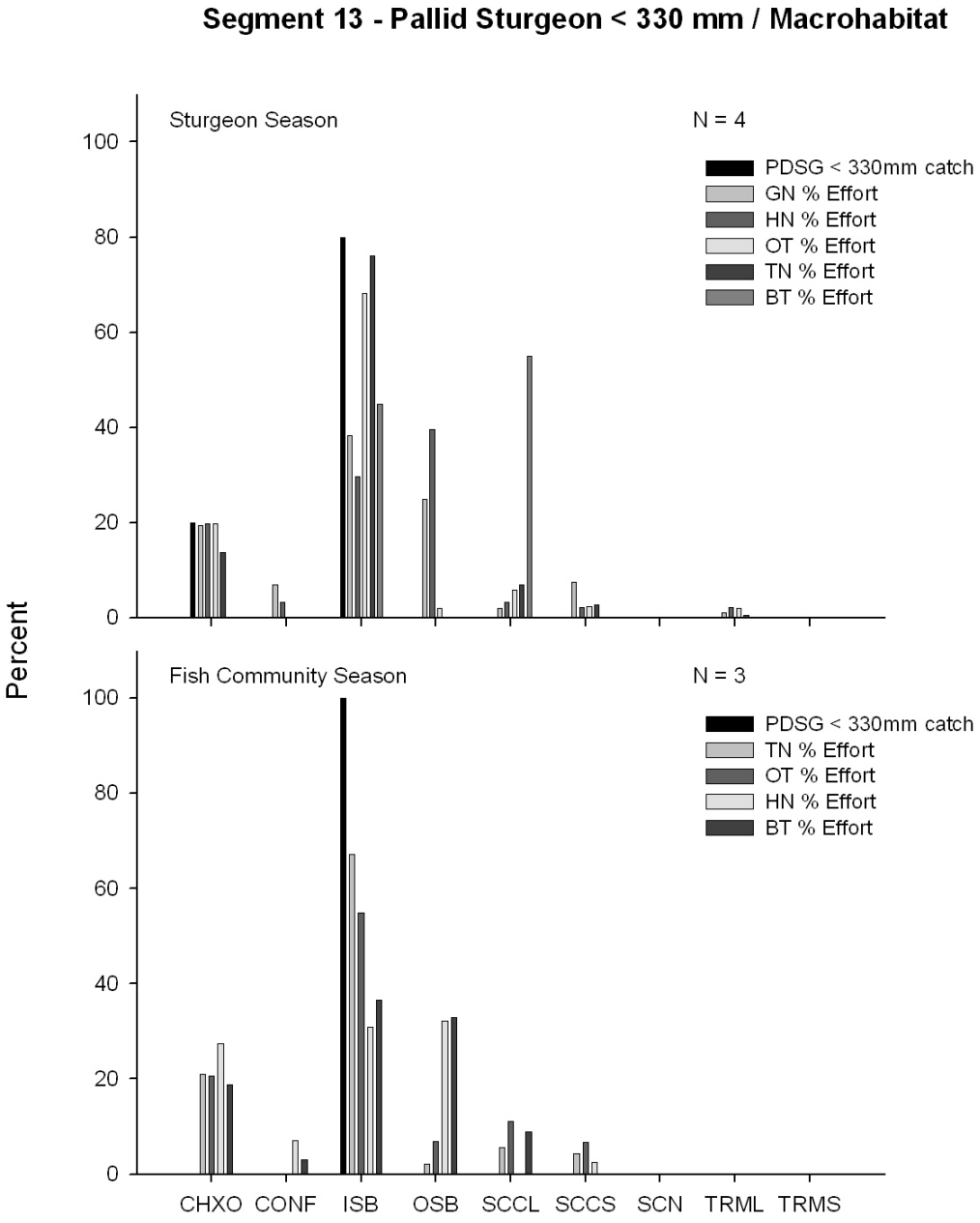

Figure 4a. Pallid sturgeon (less than 330mm) percent caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

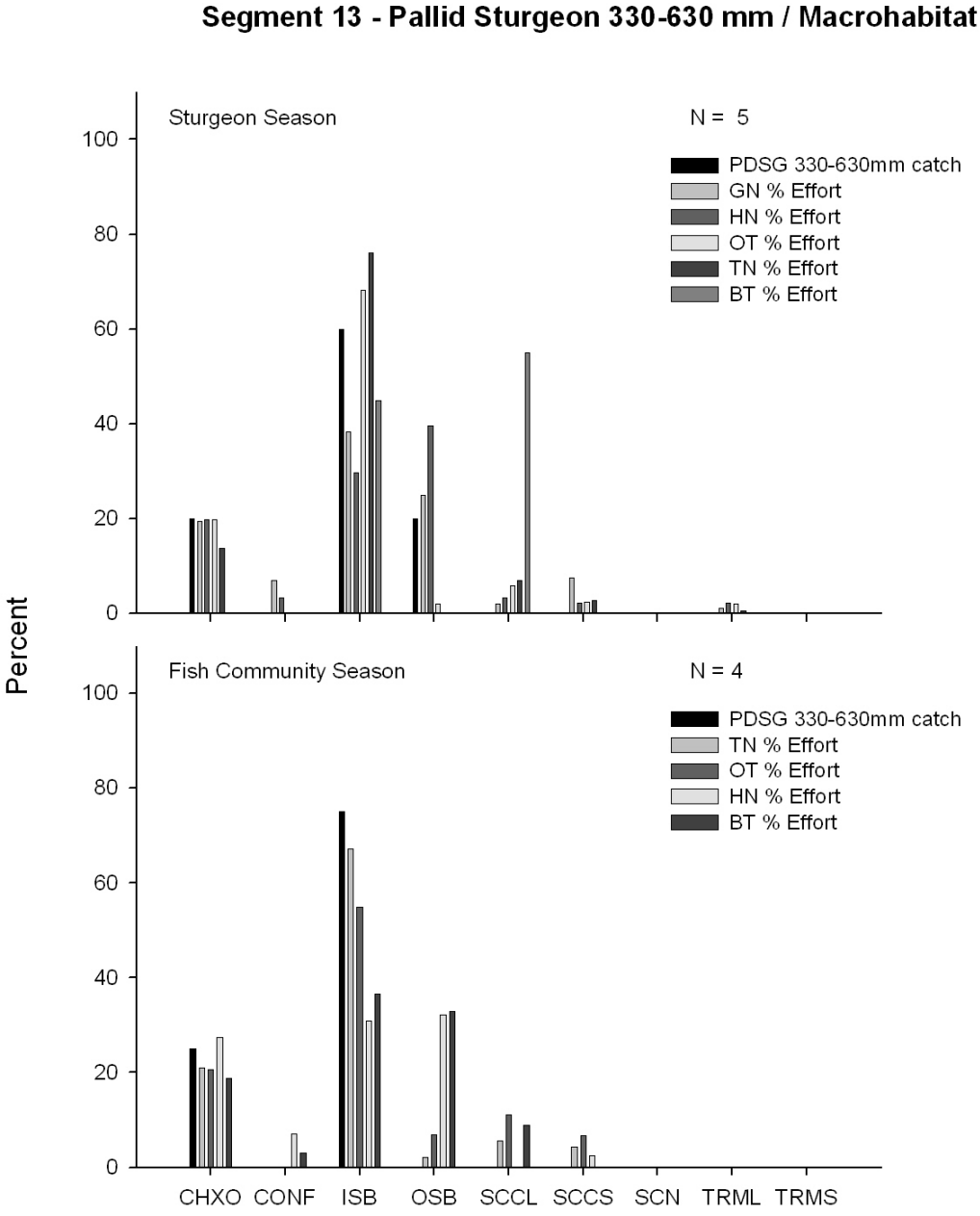

Figure 4b. Pallid sturgeon (330-630 mm) percent caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

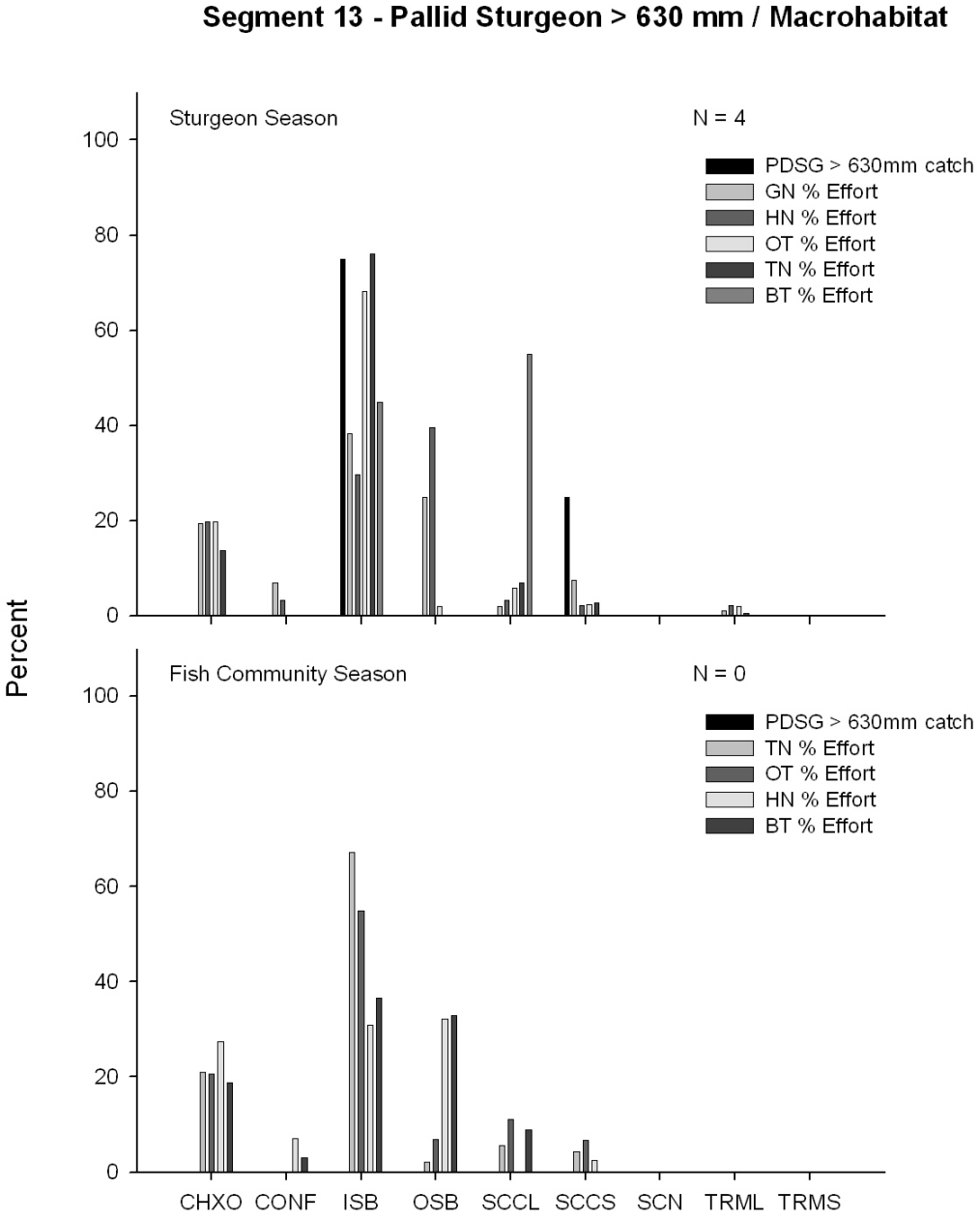

Figure 4c. Pallid sturgeon (greater than 630mm) percent caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

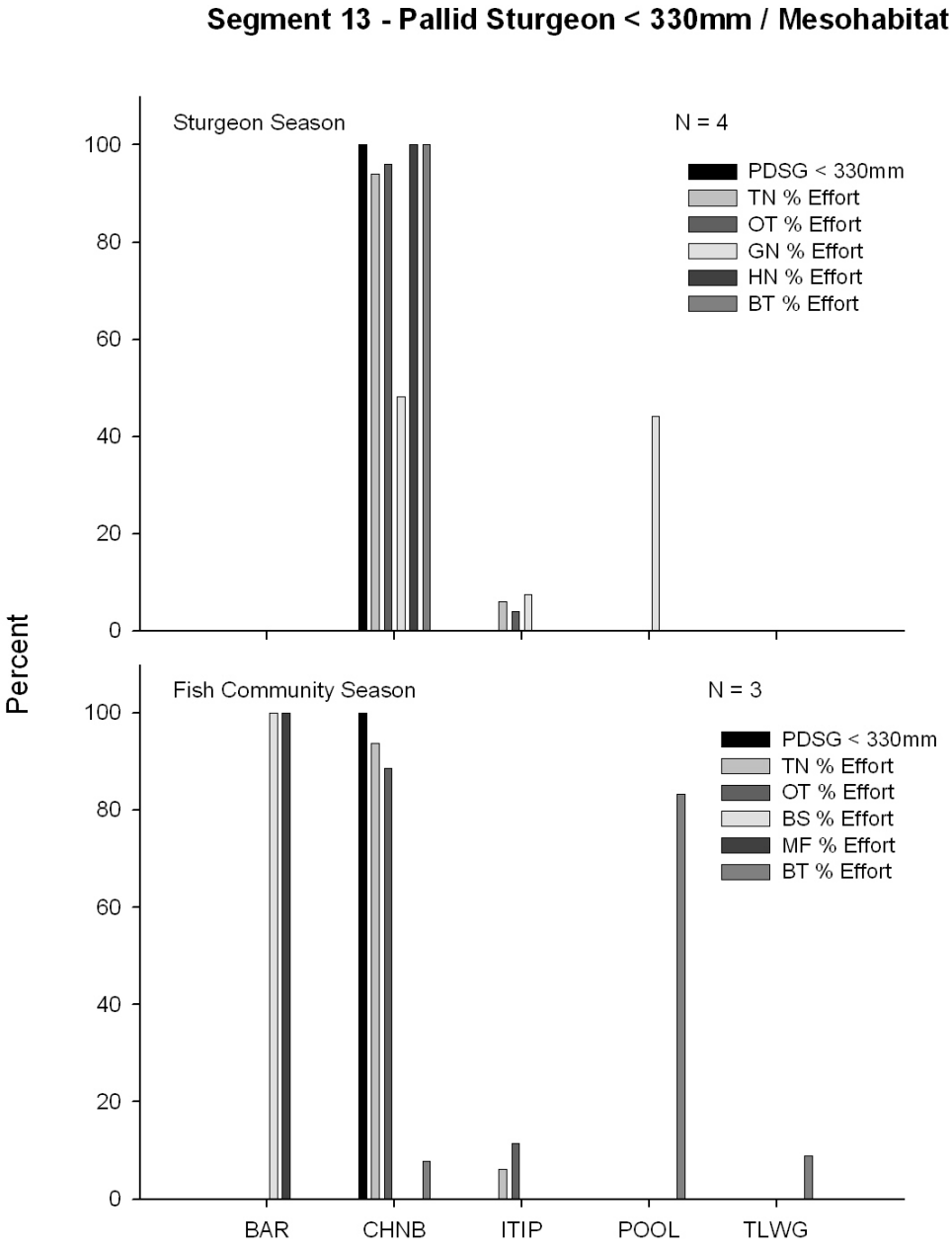

Figure 5a. Pallid sturgeon (less than 330mm) percent caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

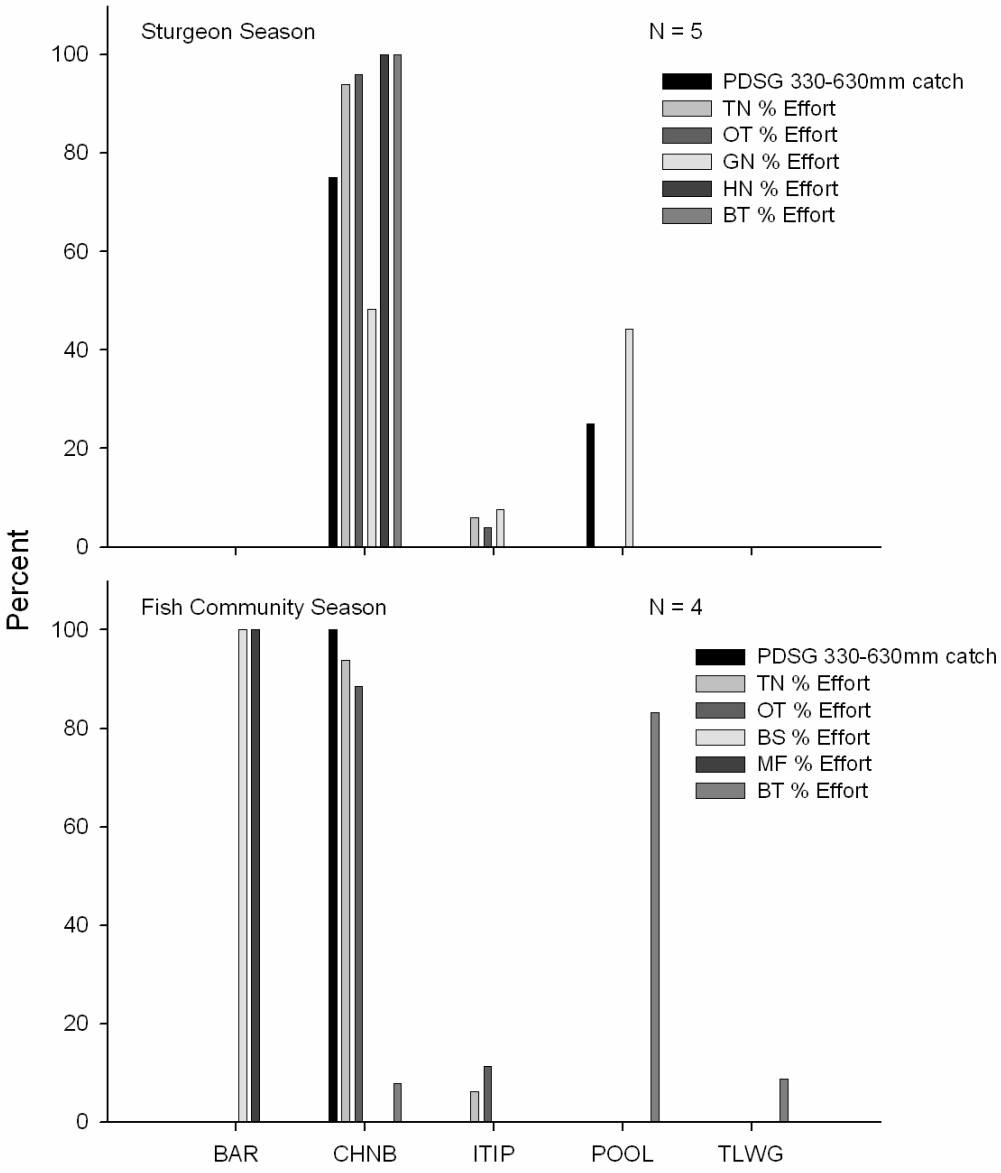

Figure 5b. Pallid sturgeon (330-630mm) percent caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

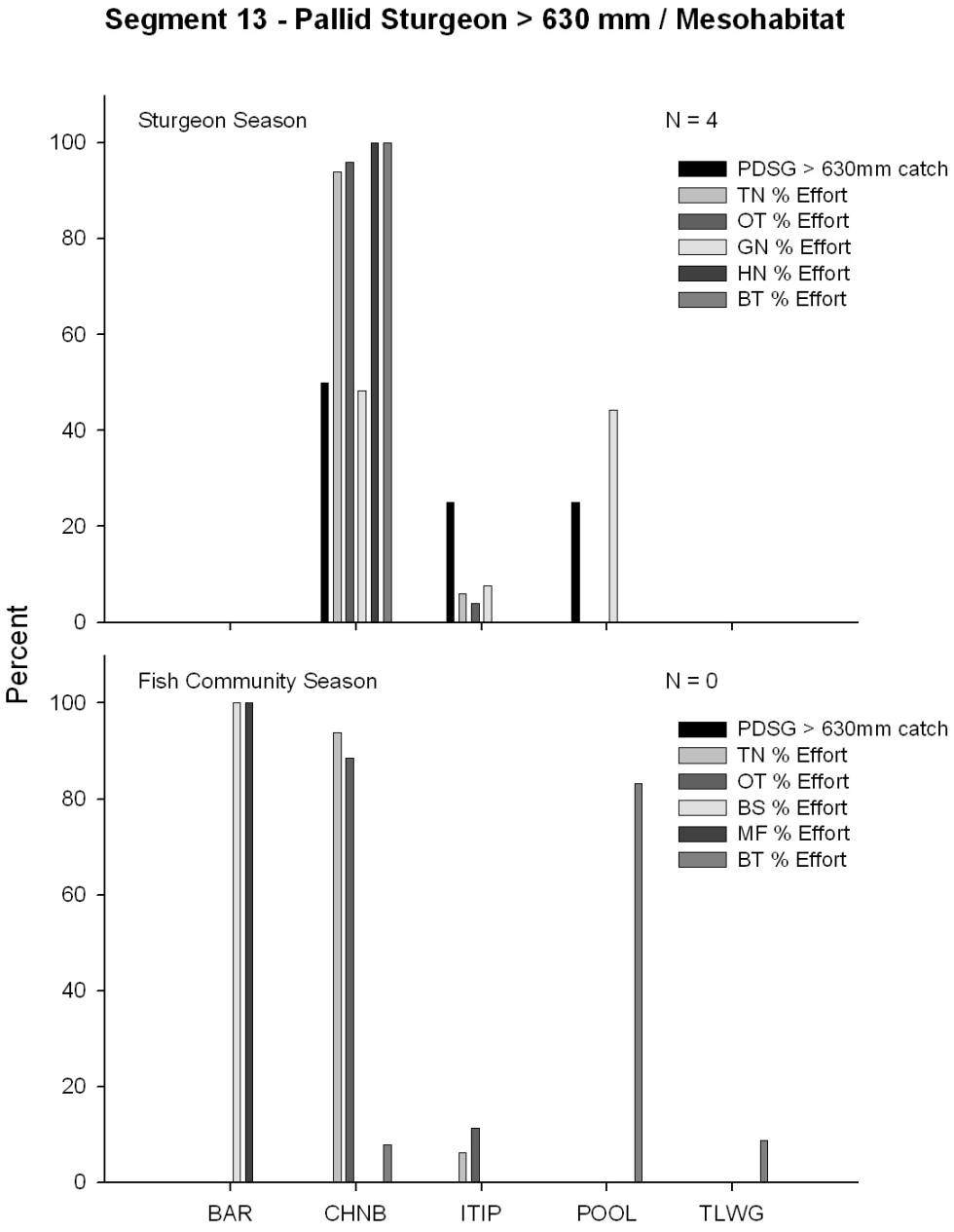

Figure 5c. Pallid sturgeon (greater than 630mm) percent caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

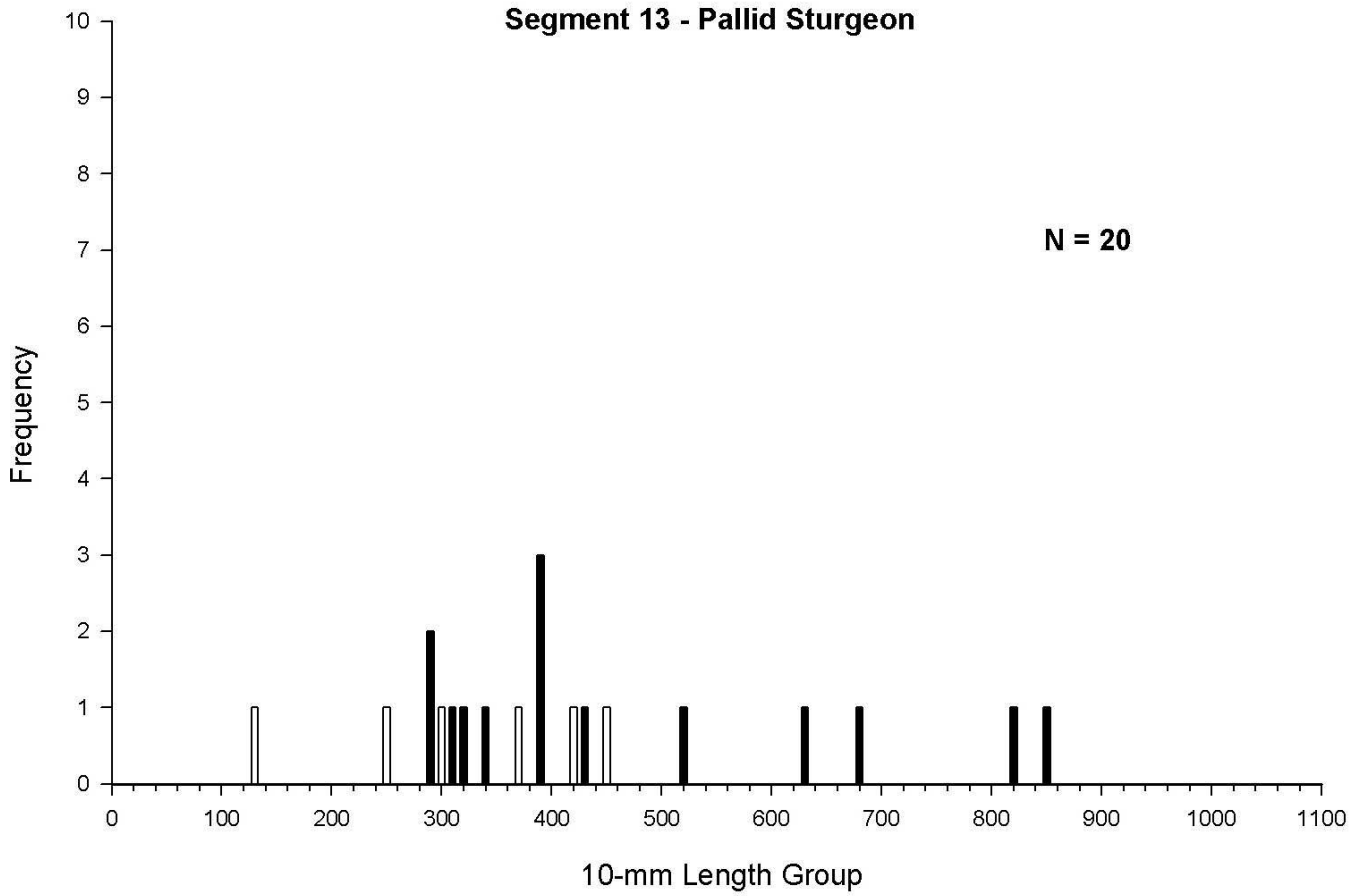

Figure 6. Length frequency of pallid sturgeon during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River 2003 - 2004.

Hybrids

Hybrids used POOL habitats more than pallid sturgeon and specifically used CHXO POOLS (Tables 7 and 2). Within ISB CHNB, hybrids used deeper depths than pallids (4.1 vs. 3.2m). The pallid to hybrid ratio was 1:2 in 2004 and 1:8.5 in 2003 (Table 6). Increases in hybridization can suggest that pallids are loosing there genetic integrity as more crosses occur. Also, it shows that there are still pallids spawning, though with a sympatric species. Since the ability to detect and confirm hybridization usually occurs after the fish is an adult (due to graduated morphometric differences), the changes seen in population proportions may lag behind current changes in the population to the point where detection is too late. The ability to confirm these hybrids is still in question.

Table 7. Segment 13: Hybrid sturgeon (SNPD) capture locations and habitat characteristics on the Missouri River during 2003-2004. Habitat definitions and codes presented in Appendix B.

	ISB			OSB		
	CHNB	POOL	BARS	CHNB	POOL	BARS
Depth (m) (Effort)	3.4 (1.3-6.5)	5.3 (2.1-8.4)	0.5 (0.2-1.2)	3.5 (1.3-28)	4.3 (1.9-7.5)	0.6 (0.3-1.1)
Depth (m) (Catch)	4.1 (3.3-5.1)	5.0 (5.0)	No SNPD	No SNPD	3.5 (3.5)	No SNPD
Velocity (m/s) (Effort)	0.6 (0.05-1.16)	0.17 (0.02-0.52)	--	0.52 (0.09-1.4)	0.11 (0.0-0.24)	--
Velocity (m/s) (Catch)	--	0.20 (0.20)	No SNPD	No SNPD	0.05 (0.05)	No SNPD
Temp. °C (Effort)	20.8 (2-26)	14.5 (2-25)	20.7 (16-24)	19.4 (2-26)	14.8 (2-25)	22.6 (22-24)
Temp. °C (Catch)	24.3 (23-26)	5.0 (5.0)	No SNPD	No SNPD	5.0 (5.0)	No SNPD
Turbidity (ntu) (Effort)	481 (20-1254)	146 (29-1260)	71.3 (27-150)	409 (20-1210)	152 (29-1150)	117 (27-162)
Turbidity (ntu) (Catch)	784 (352-1000)	90 (90)	No SNPD	No SNPD	--	No SNPD
Total Pallids caught	3	1	0	0	1	0

	CHXO			SCCS	SCCL	
	CHNB	POOL	BARS	ITIP	ITIP	CHNB
Depth (m) (Effort)	3.6 (1.3-7.0)	5 (2.0-8.8)	0.6 (0.2-1.3)	2.5 (1.5-4.6)	3.5 (1.9-5.1)	2.4 (1.1-4.3)
Depth (m) (Catch)	No SNPD	6.1 (3.9-7.2)	No SNPD	No SNPD	No SNPD	No SNPD
Velocity (m/s) (Effort)	0.56 (0.0-1.19)	0.11 (0.01-0.21)	--	0.54 (0.13-0.84)	0.75 (0.69-0.79)	0.52 (0.09-0.75)
Velocity (m/s) (Catch)	No SNPD	0 (0-.01)	No SNPD	No SNPD	No SNPD	No SNPD
Temp. °C (Effort)	20.4 (2-26)	15.4 (2-25)	21.4 (16-25)	13.3 (2-24)	21.5 (5-26)	22.1 (5-26)
Temp. °C (Catch)	No SNPD	5.7 (5-7)	No SNPD	No SNPD	No SNPD	No SNPD
Turbidity (ntu) (Effort)	427 (20-1200)	199 (29-1190)	74 (27-167)	176 (32-1230)	578 (144-1240)	446 (67-1240)
Turbidity (ntu) (Catch)	No SNPD	56 (56)	No SNPD	No SNPD	No SNPD	No SNPD
Total Pallids caught	0	3	0	0	0	0

Targeted Native River Species

Shovelnose Sturgeon

Year and gear comparisons

Gillnets captured about 12 shovelnose sturgeon per net in 2003 and 8 shovelnose in 2004 (Figure 7). During the sturgeon season, hoop nets captured half as many fish in 2004, otter trawls caught slightly less fish (<1 fish per trawl in both years) and trammel nets captured twice as many fish (0.6 vs. 1.3 fish/m^2) (Figures 7 and 8). Beam trawls were never effective at capturing shovelnose (Figure 9). Hoop nets were not an effective gear in the fall, only catching one fish per ten nets set (Figure 10). A disproportionate number of large sturgeon existed in the population, which suggests that the combination of gears were sufficient in sampling all sizes of fish, but that more sampling would be needed to document changes in the early life stages (Figure 13). Sturgeon season sampling caught fish as small as 10mm, 120mm, 140mm and several from 150-200mm suggesting a wide range of spawning can occur from an early spawn in 2004 and a late spawn occurring in 2003. This wide spawning range is not a new phenomenon in this species, but catches do suggest that at least some shovelnose can survive the winter at very small sizes (120mm). A higher proportion of quality and memorable sized fish existed in the shovelnose population during the sturgeon season (RSD-Q = 98, RSD-P = 83) and in the community season (RSD-Q =90, RSD-M = 68) (Table 8). Few sub-stock fish were present (N=61) and no trophy fish were captured.

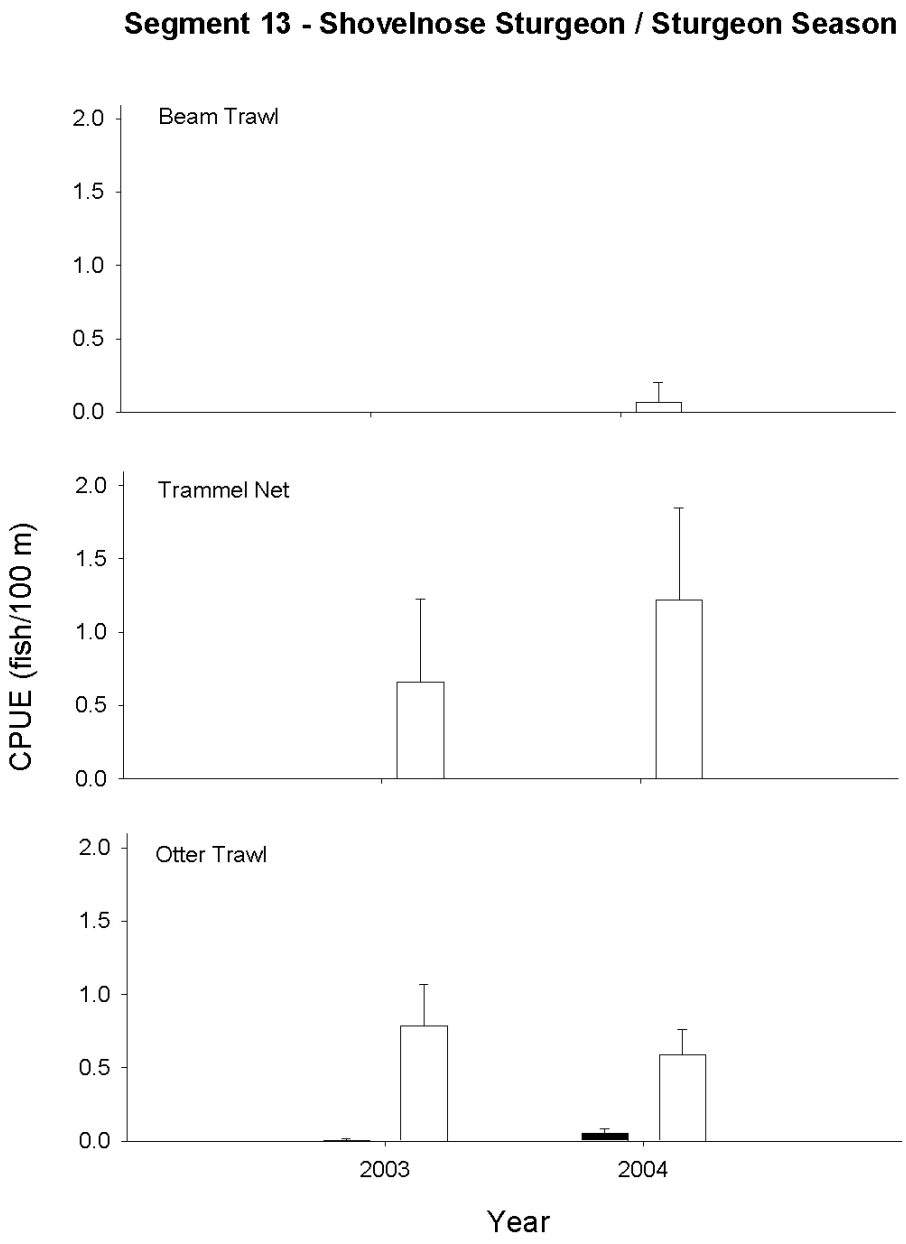

Figure 7. Mean annual catch-per-unit-effort (+/- 2SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 13 of the Missouri River during sturgeon season 2003 - 2004.

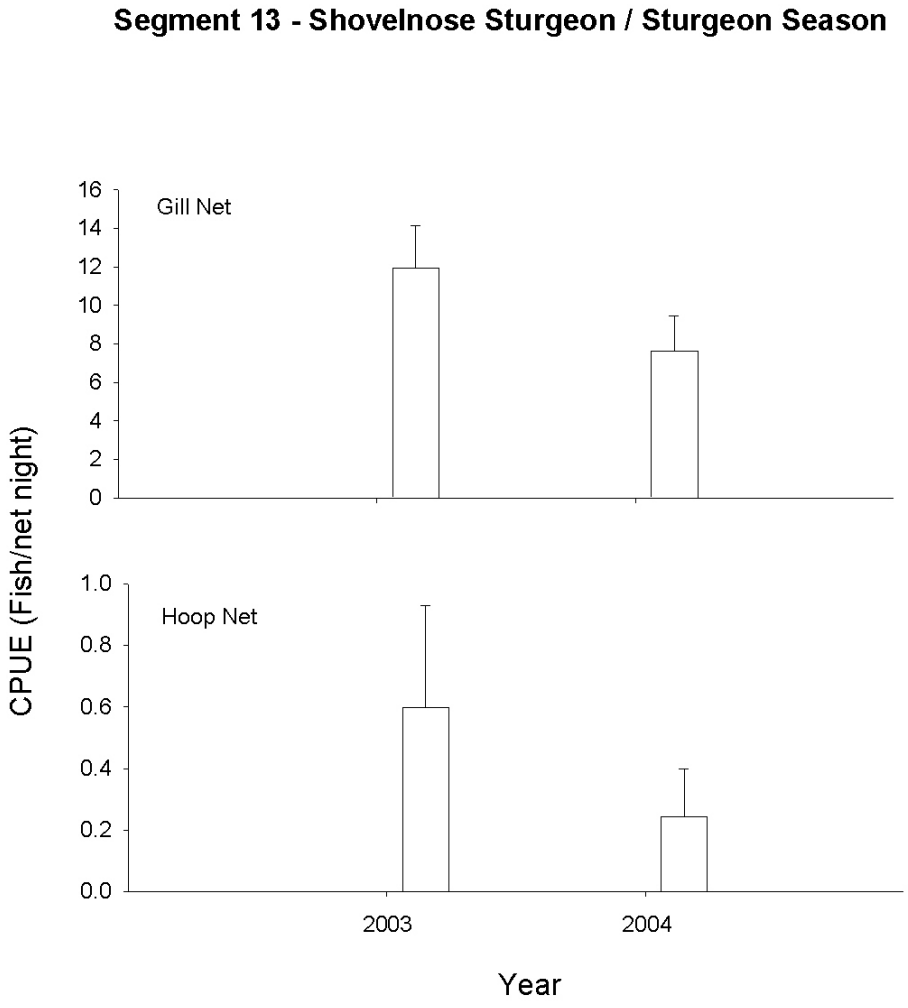

Figure 8. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 13 of the Missouri River during sturgeon season 2003 - 2004.

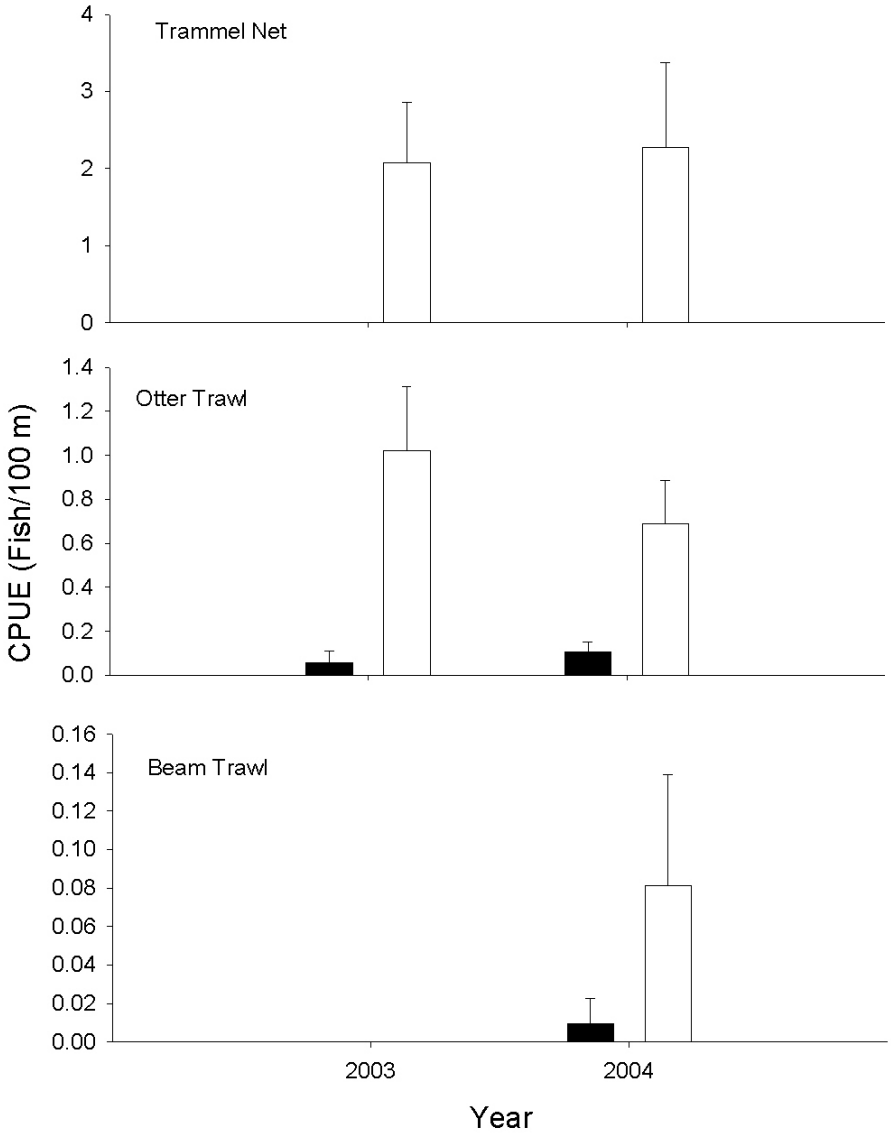

Figure 9. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 13 of the Missouri River during fish community season 2003 - 2004.

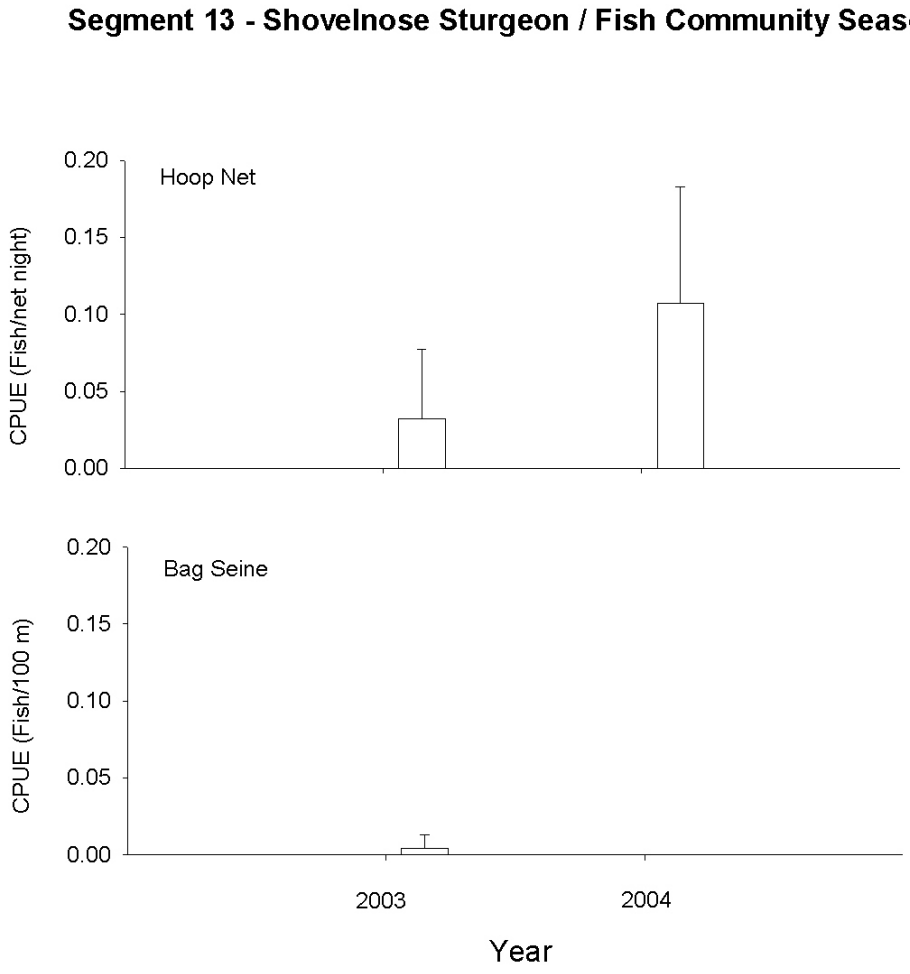

Figure 10. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 13 of the Missouri River during fish community season 2004.

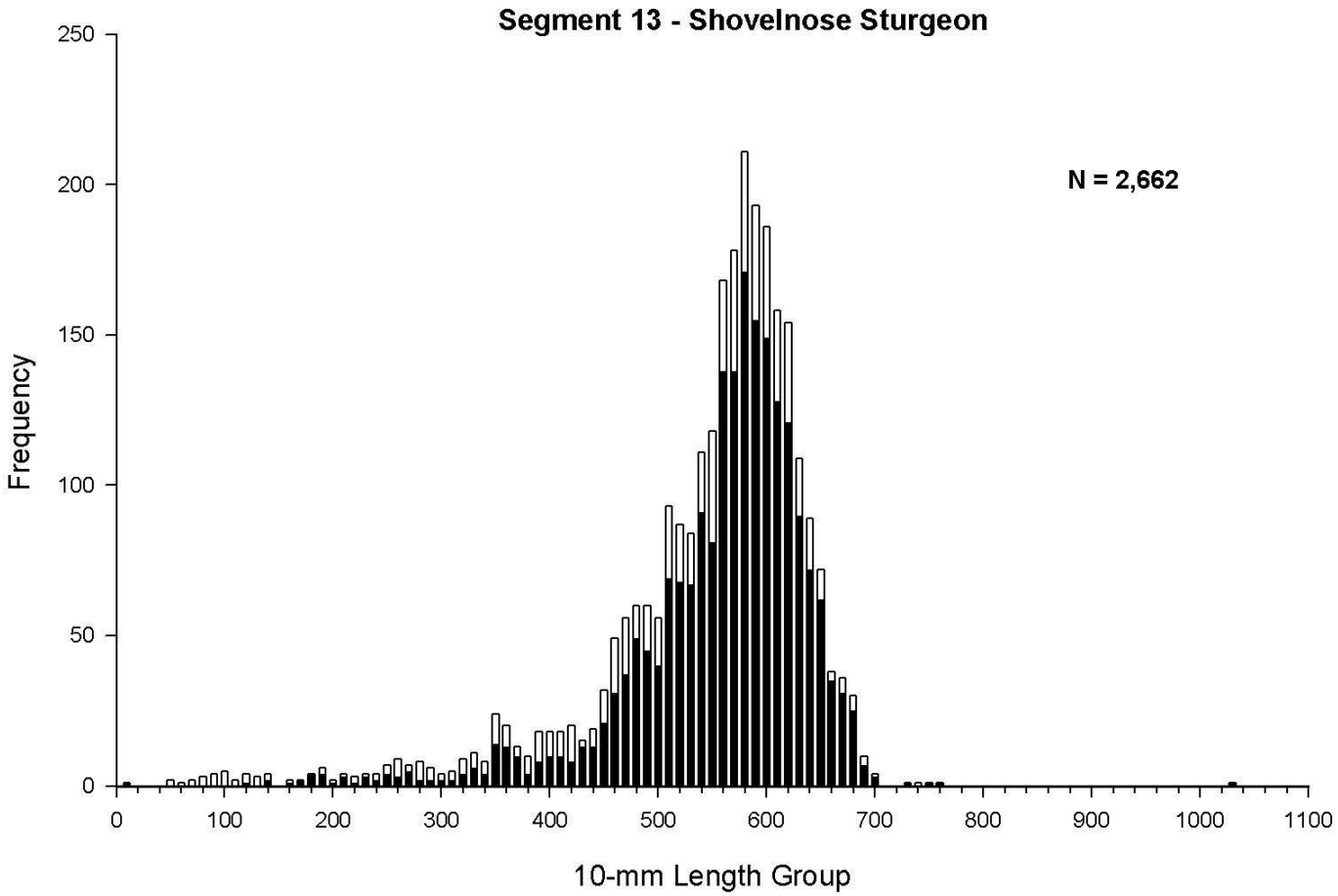

Figure 13. Length frequency of shovelnose sturgeon in the Missouri River during sturgeon season (black bars) and fish community season (white bars) 2003 - 2004.

Table 8. Segment 13: Relative stock density (RSD)[a] by a length category for shovelnose sturgeon in the Missouri River captured during 2004. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD
Sturgeon Season		
Substock	24	
Stock	2057	
Quality	2024	98
Preferred	1698	83
Memorable	238	12
Trophy	0	
Fish Community Season		
Substock	37	
Stock	631	
Quality	571	90
Preferred	429	68
Memorable	45	7
Trophy	0	

[a] RSD = number of fish = specified length ÷ number of fish = minimum stock length x 100.
[b] 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 %).

Habitat use

Few young-of-year (YOY) shovelnose sturgeon were captured relative to larger sized sturgeon (N= 41 vs. 2621) (Figure 11a). Gear types and efforts do not target fish equally which explains much of this difference, but also suggests very few young fish are available in the population. Twice as many YOY fish were caught in the community season (N=13 vs. 28), suggesting these fish were more abundant after July 1. Catch rates were six times higher in channel crossovers than in ISB habitat using otter trawls in the sturgeon season. In the community season, large and small side channels produced the most YOY, but ISB and CHXO were also productive. Despite the season, young of year were only sampled on channel border habitats (Figure 12a). Seventy-six mini-fyke sets and 37 seines were set on BARS habitat and 80 beam tows were pulled in POOL habitats. These gears types target small fish, however they did not catch YOY sturgeon; suggesting these fish would rarely use these habitats. Proportionately more effort will be needed on channel borders within all macro habitats to get a better assessment of this life stage of sturgeon.

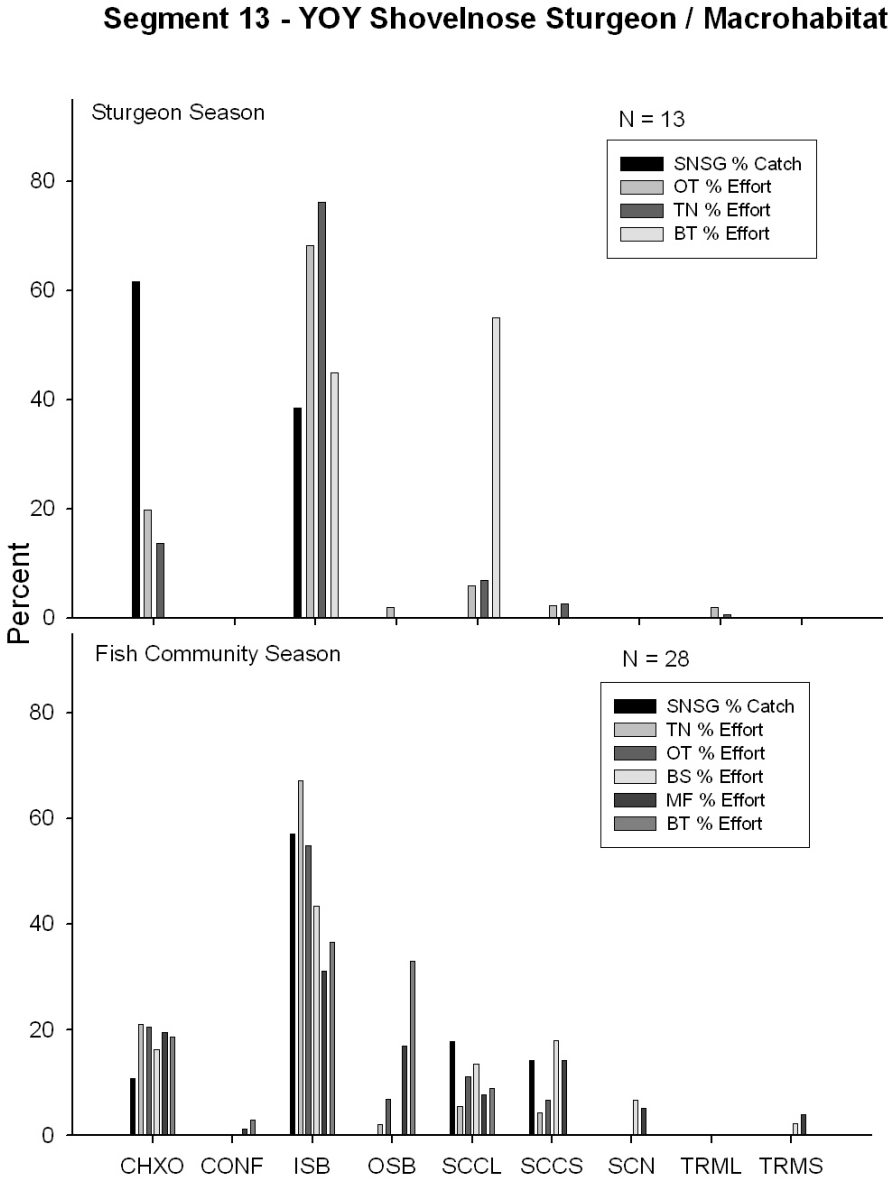

Figure 11a. Percent of total YOY shovelnose sturgeon caught (<150mm) and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

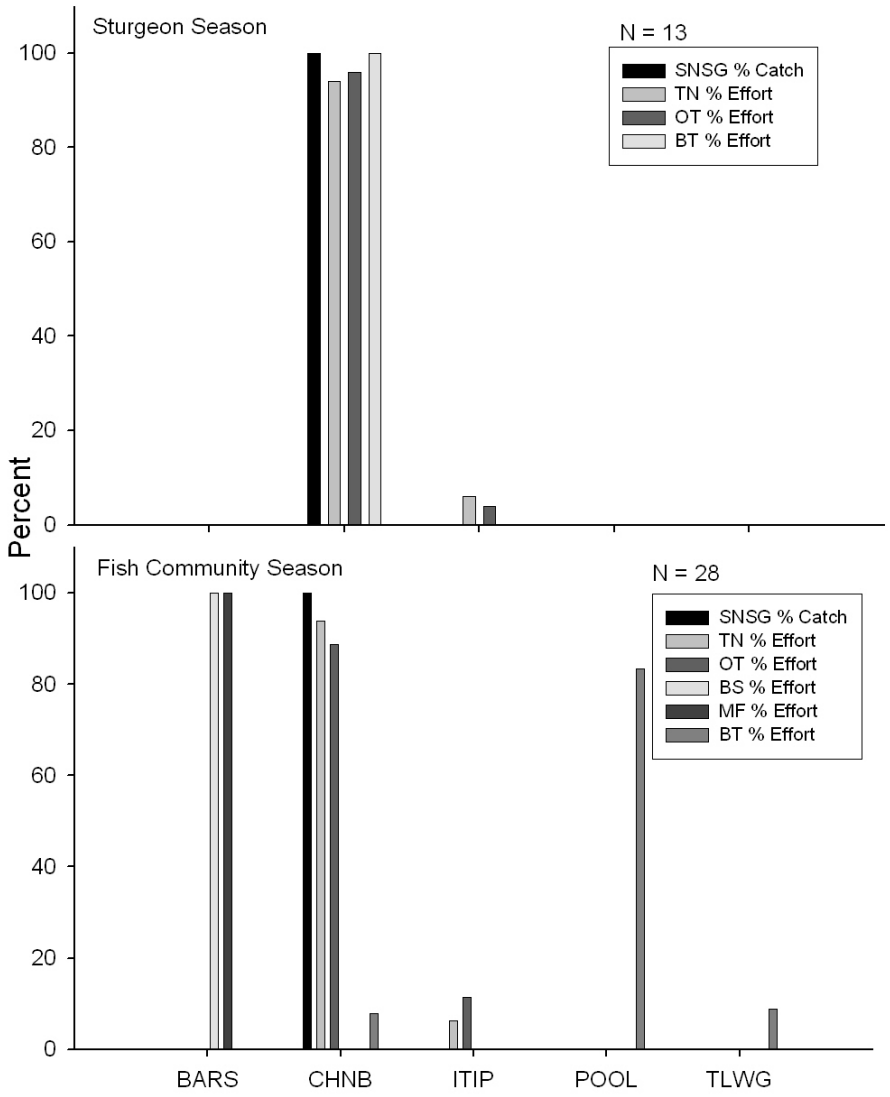

Figure 12a. Percent of total YOY shovelnose sturgeon caught (< 150mm) and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

All nets combined captured a total of 2,662 shovelnose and gillnets alone caught the highest proportion (58%). Channel crossovers were the most used habitat by all shovelnose size classes, followed by confluences and inside bends (CPUE= 12.9, 8.5, 7.81) (Figure 11b). The highest catch rates were in POOL habitat where ISB CPUE equaled 12.6 fish and CHXO equaled 14.56 fish/ 100ft (Appendix G1). In contrast, catch rates were higher in CHNB habitat within OSB and CONF areas. Gillnets were distributed equally across CHNB and POOL habitat type for the first time in 2004. Differences in shovelnose behavior brought on by colder temperatures or a spawning response could explain the differences in catch rates among different habitat types. Migrating sturgeon would be more likely to be sampled in transition or funneling zones like crossovers or confluences and aggregating fish would be more likely to be found in POOL habitat (Figure 12b). Island tips were also important to shovelnose in this season, where CPUE was greater than two fish per $100m^2$ in trammel nets and otter trawls equaled 0.87 fish per $100m^2$. This higher catch rate in only the sturgeon season may suggest the habitat is important for spawning. In the community season, catch rates were higher on ISB CHNB habitat (TN = 2.6, OT = 0.9) which was sampled over 90% of the time with these gears.

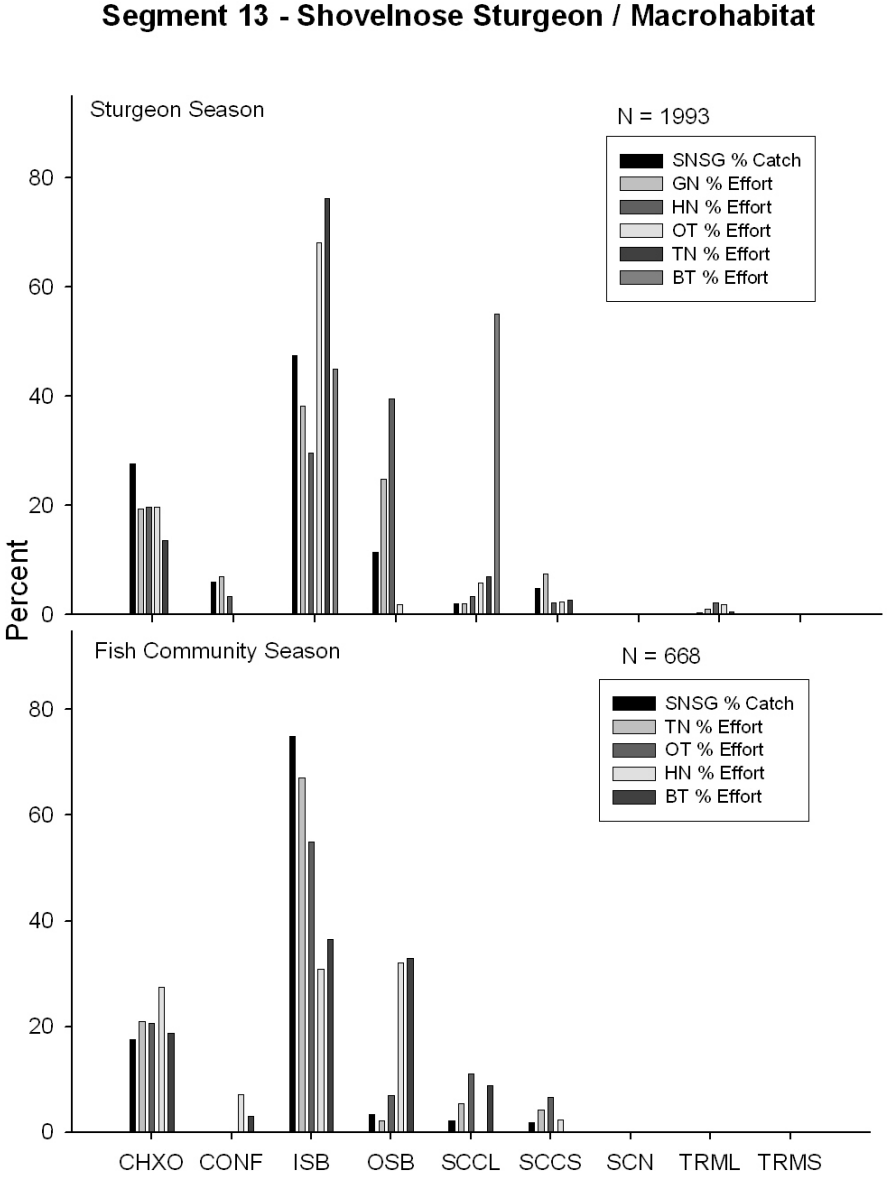

Figure 11b. Percent of total shovelnose sturgeon (>150mm) caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

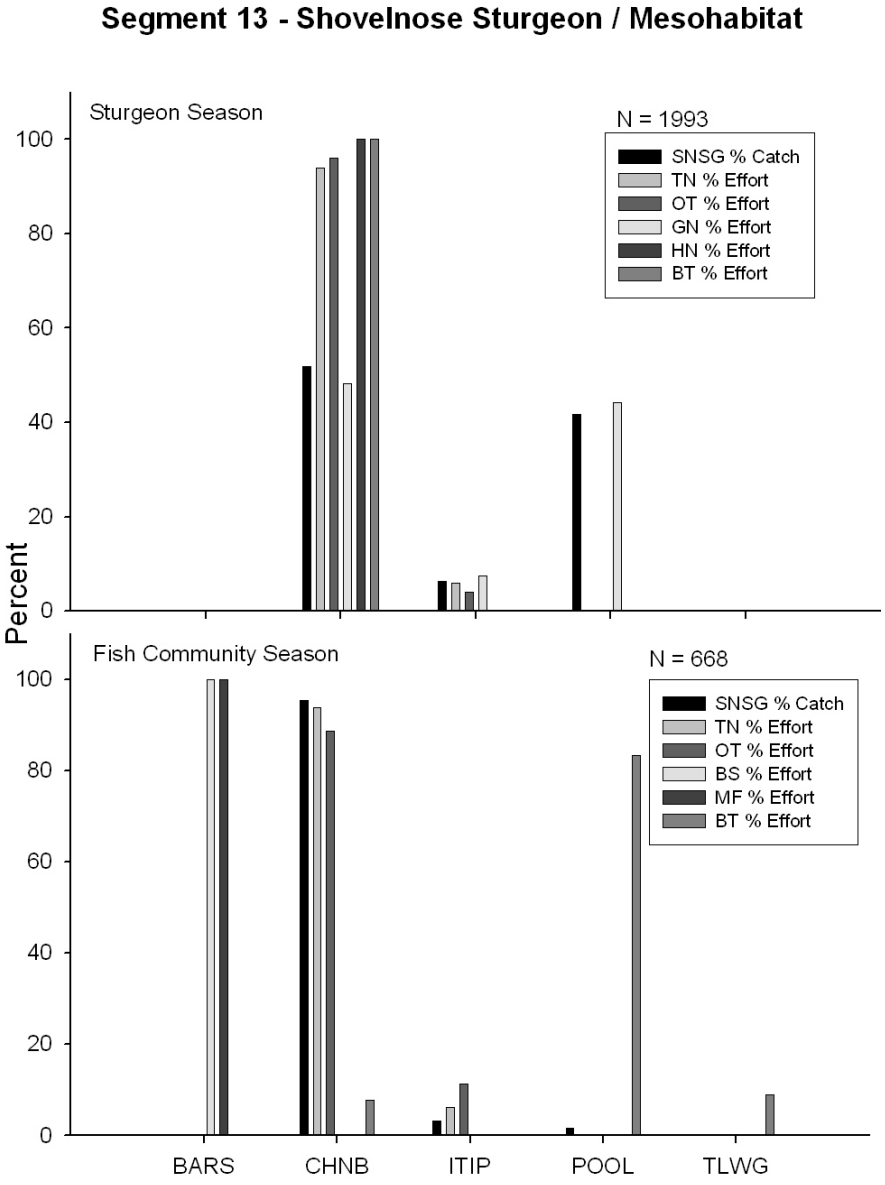

Figure 12b. Percent of total shovelnose sturgeon caught (> 150mm) and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

Sturgeon Chub

Sturgeon chubs were only captured with trawls and were captured at a rate three times higher in the spring than in the late summer season (Figures 14 and 15). In contrast, no chubs were caught in the spring of 2003 (Figure 14). The total number of sturgeon chubs sampled was only 24 for all gear types. Most fish were sampled in CHXO and ISB Macro habitat, with CHXO being more important between the two (Figure 16). Almost all of the chubs occurred on channel border habitat (Figure 17). Compared to other chub length frequencies in Figure 18, there did not appear to be as much spawning success with smaller fish entering the system.

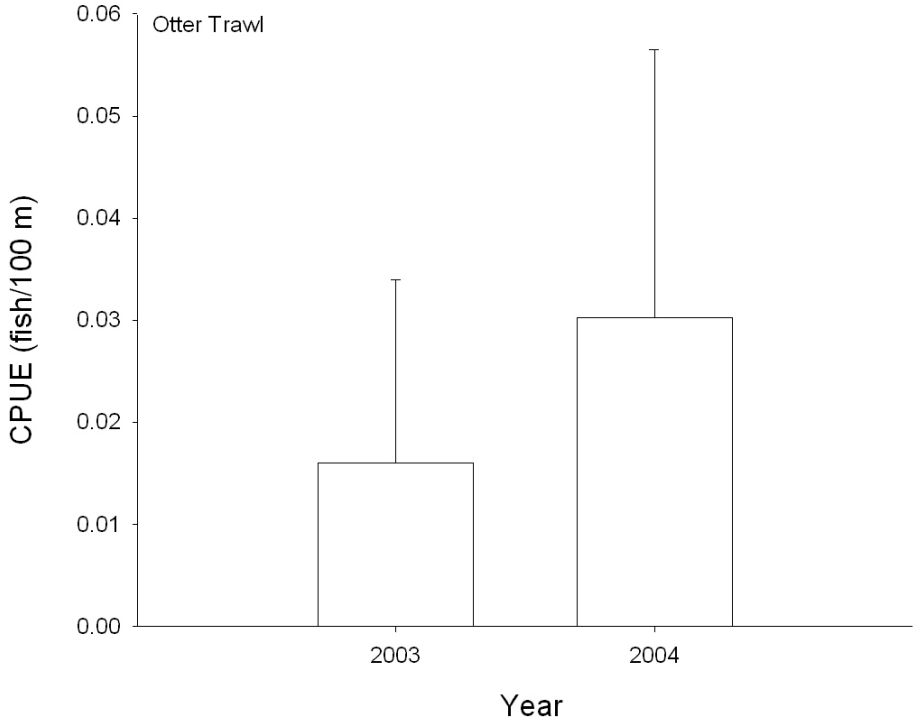

Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chubs in segment 13 of the Missouri River for otter trawls during sturgeon season 2004.

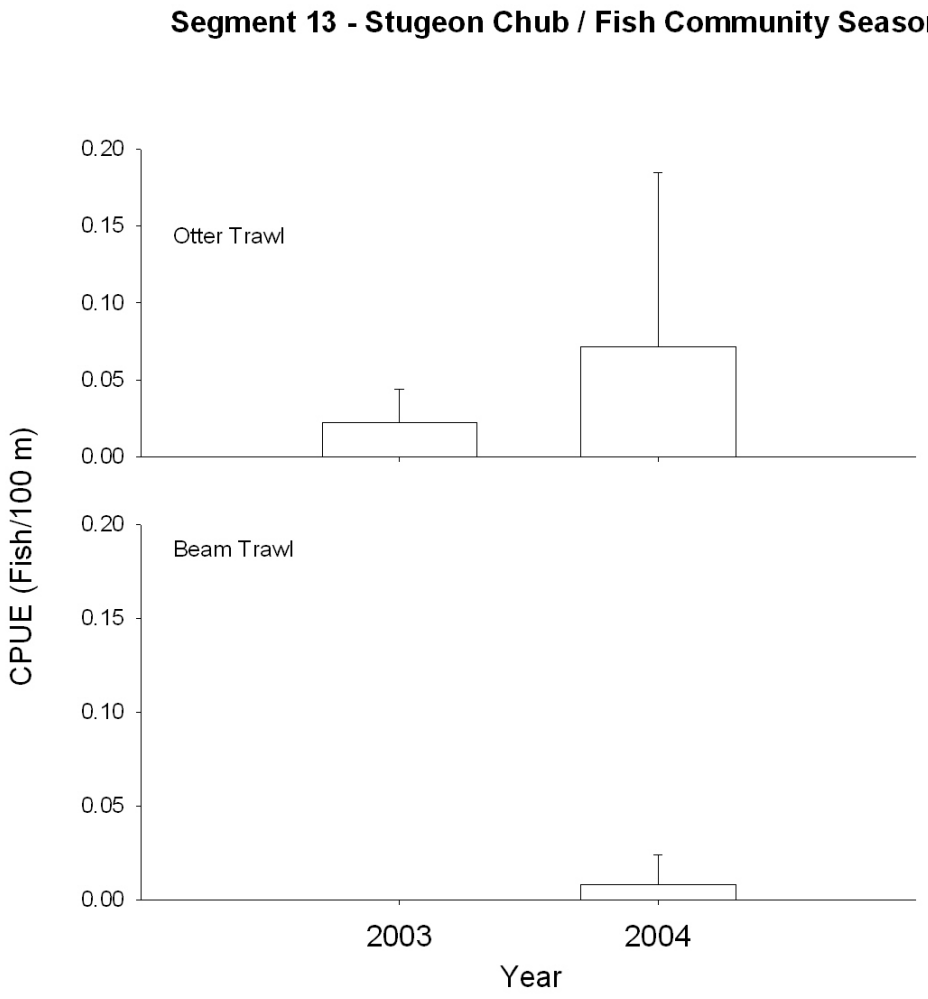

Figure 15. Mean annual catch-per-unit-effort (+/- 2 SE) of sturgeon chubs in segment 13 of the Missouri River during fish community season 2004.

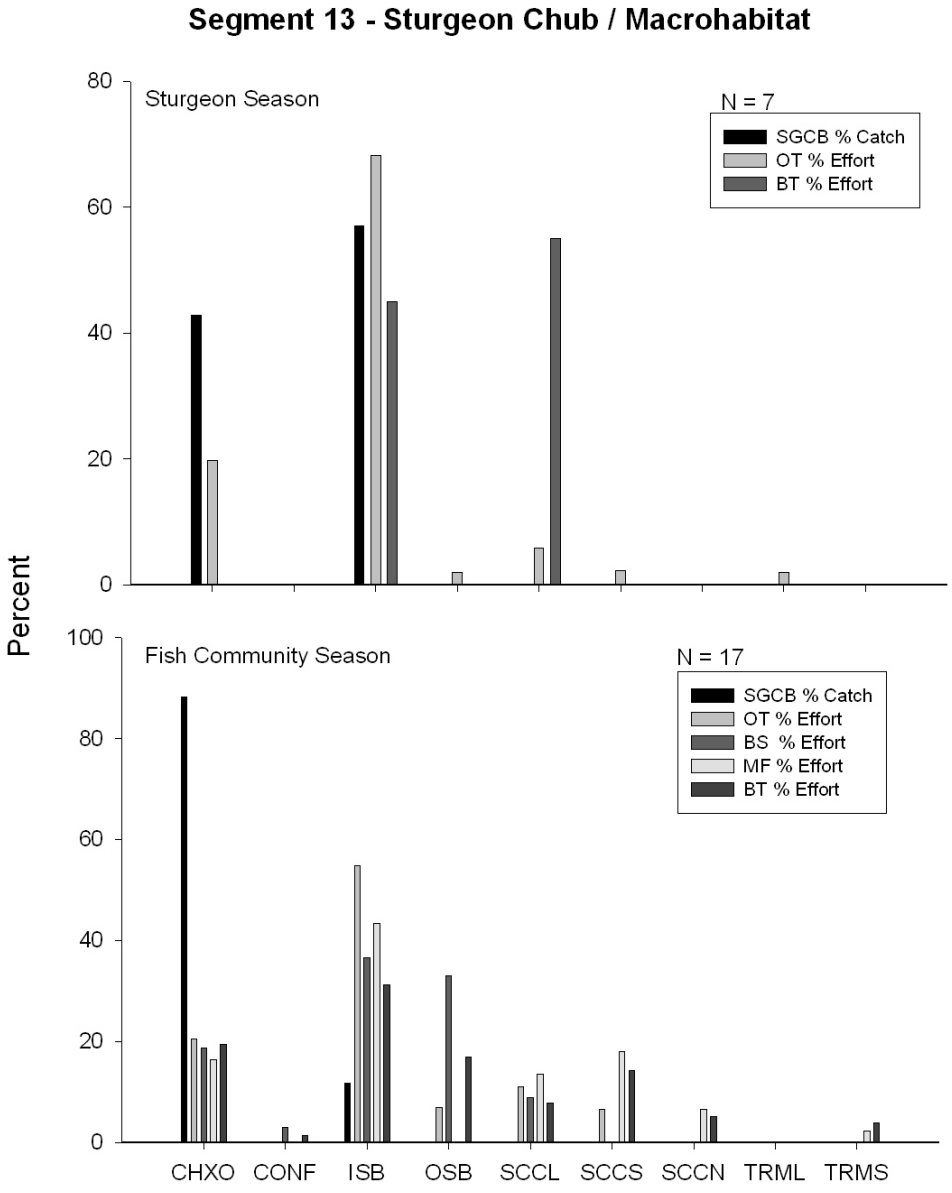

Figure 16. Percent of total sturgeon chubs caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

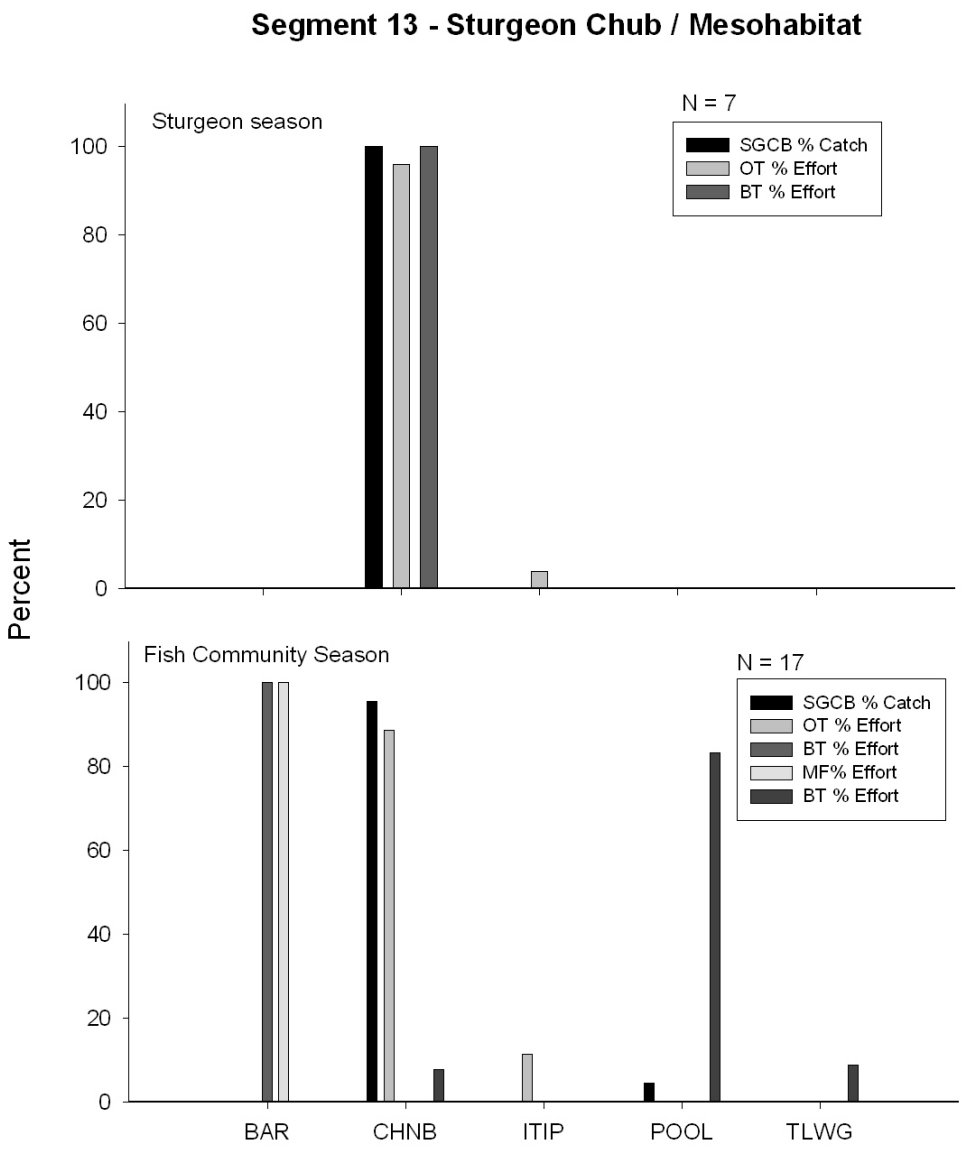

Figure 17. Percent of total sturgeon chubs caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

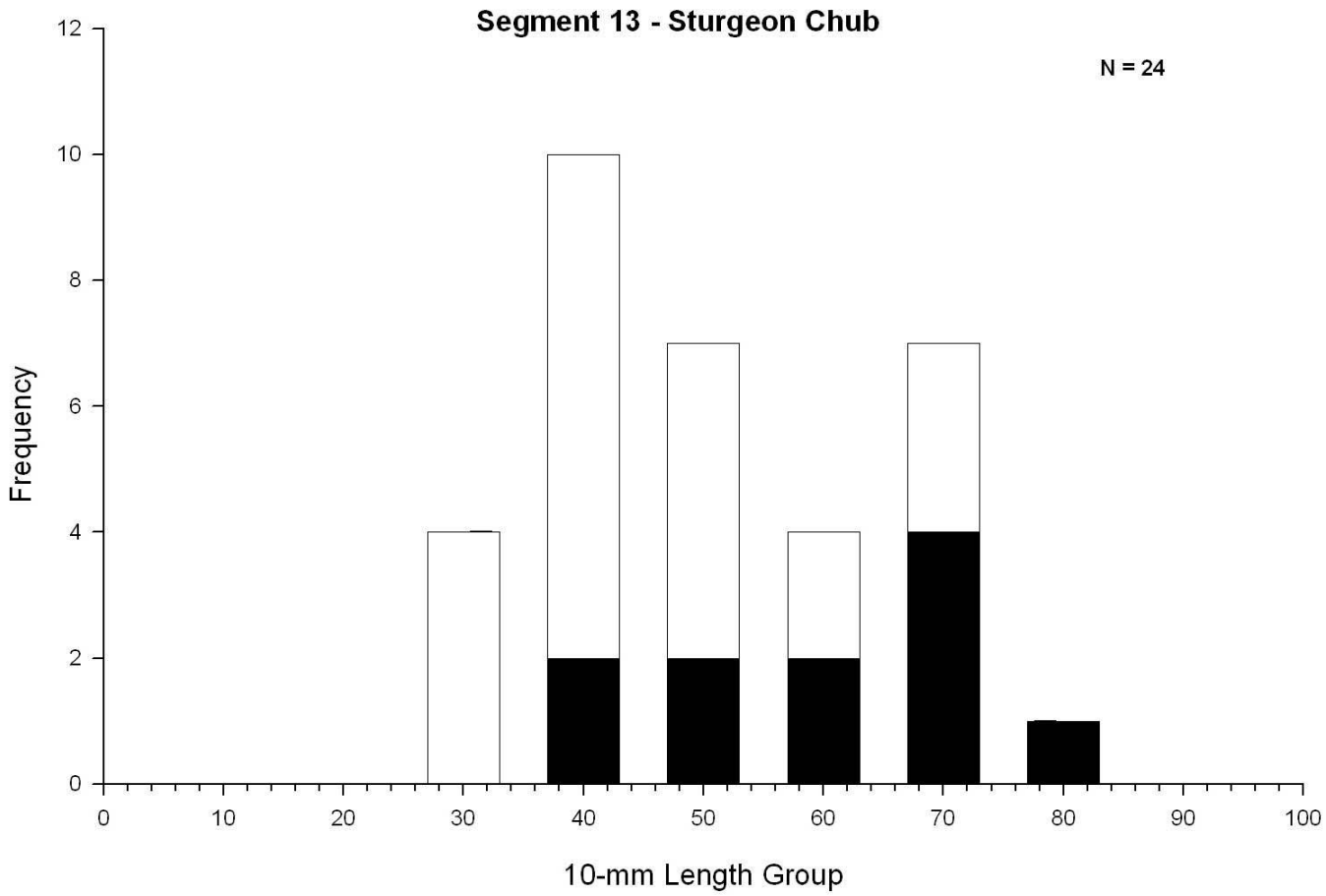

Figure 18. Length frequency of sturgeon during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River during 2004.

Sicklefin Chub

Catch Per Unit Effort was higher for sicklefins in 2004 than in 2003 and catch was 10 times higher in the community season than in the sturgeon season (N= 75 vs 705) (Figures 19 -22). Beam trawls were the most effective gear in POOL habitats during the community season with an average of 4 fish per trawl (Figure 20). Mini-fyke CPUE was highest in CHXO habitat (7.13) and dropped substantially in other habitats (< 0.75) (Appendix H6). Otter trawls caught chubs at a rate of 0.24 fish/100m^2 during the sturgeon season and at the rate of 0.88 fish/100m^2 during the community season, with OSB and CHXO representing the best habitats. Seines never captured this species. Figure 24 shows spawning success of this species, evident from the number of smaller fish present in the community season versus the sturgeon season. Also shown, is the appearance of larger chubs in the sturgeon season on channel borders relative to later in the year. The data suggests that POOL rearing habitat is important for the smaller sicklefin chubs and beam trawls may be a tool used to best sample this size class of fish.

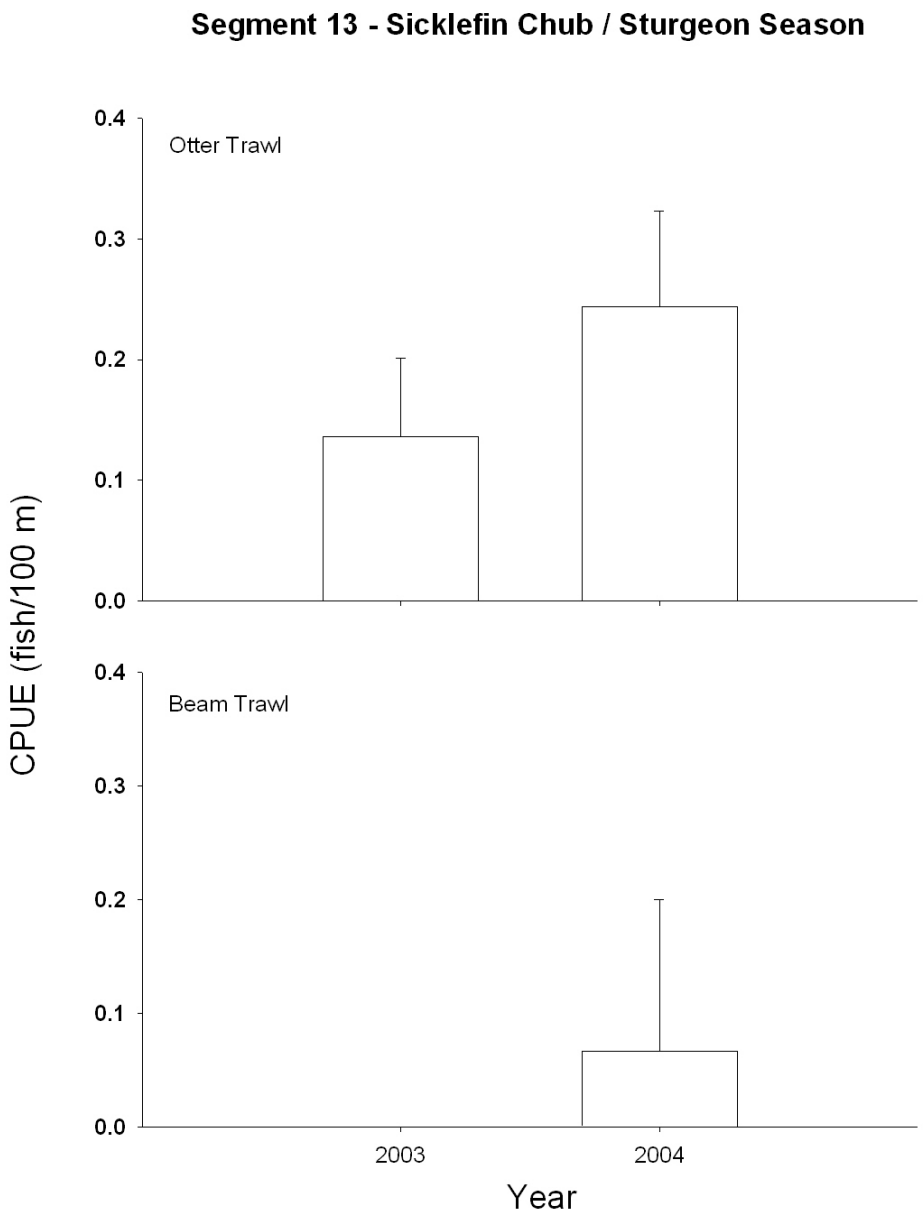

Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chubs in segment 13 of the Missouri River during sturgeon season 2004.

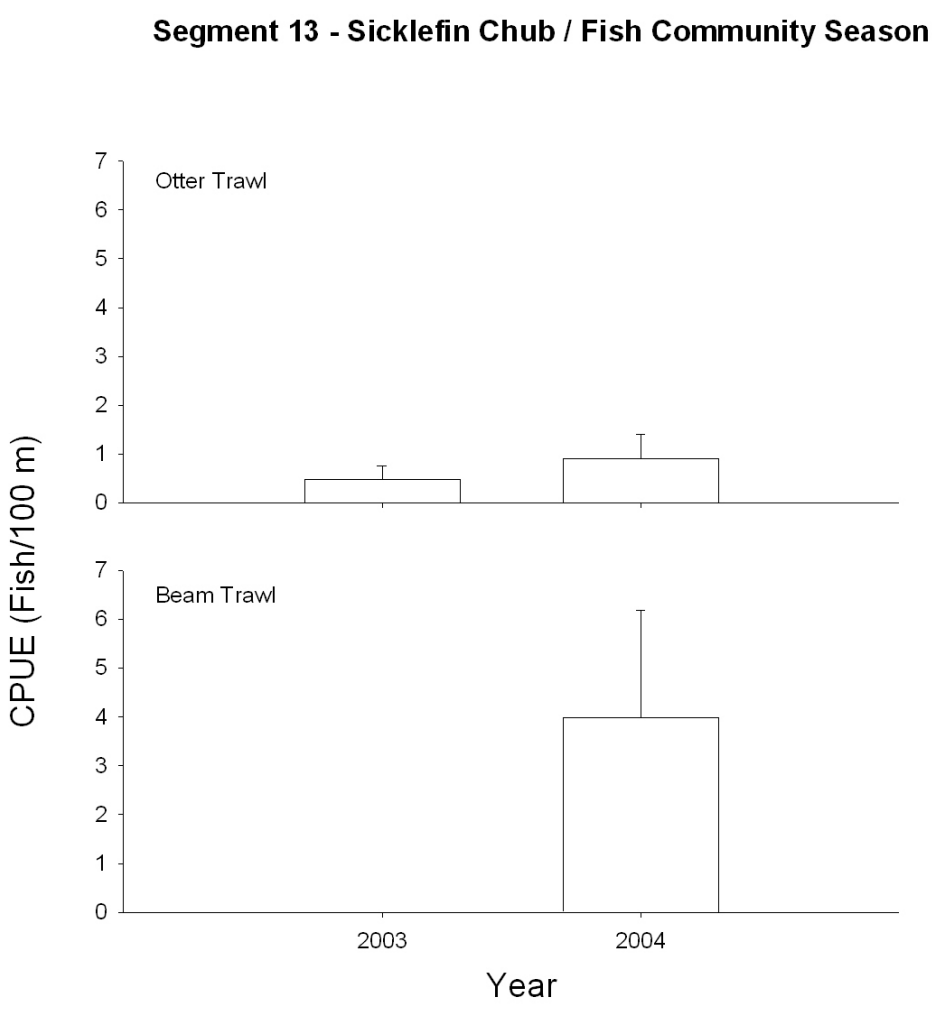

Figure 20. Mean annual catch-per-unit-effort (+/- 2 SE) of sicklefin chub in segment 13 in the Missouri River during Fish Community Season 2004.

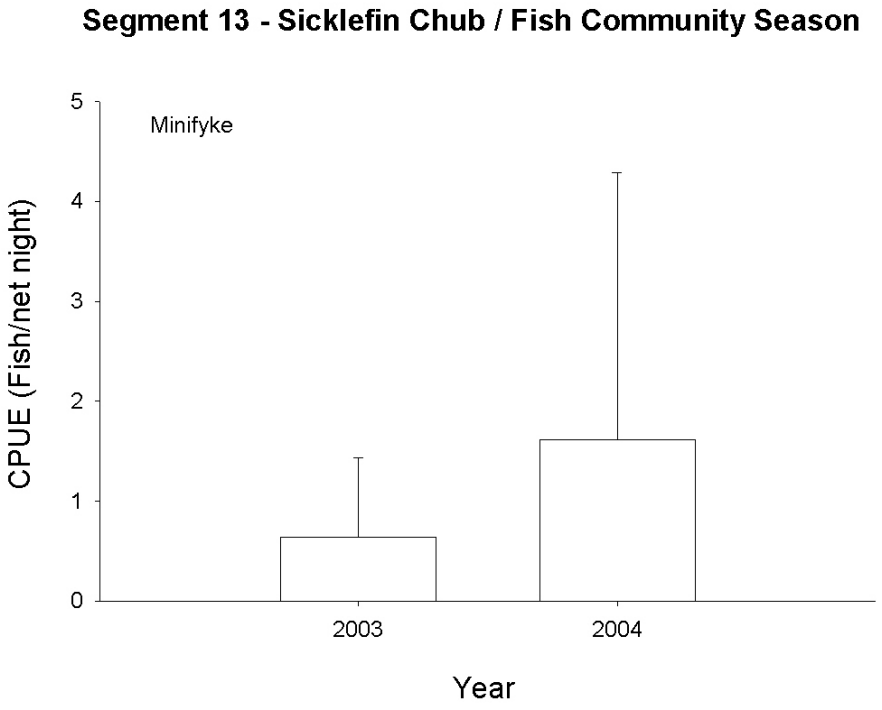

Figure 21. Mean annual catch-per-unit-effort (+/- 2 SE) of sicklefin chub in segment 13 of the Missouri River during Fish Community Season 2004.

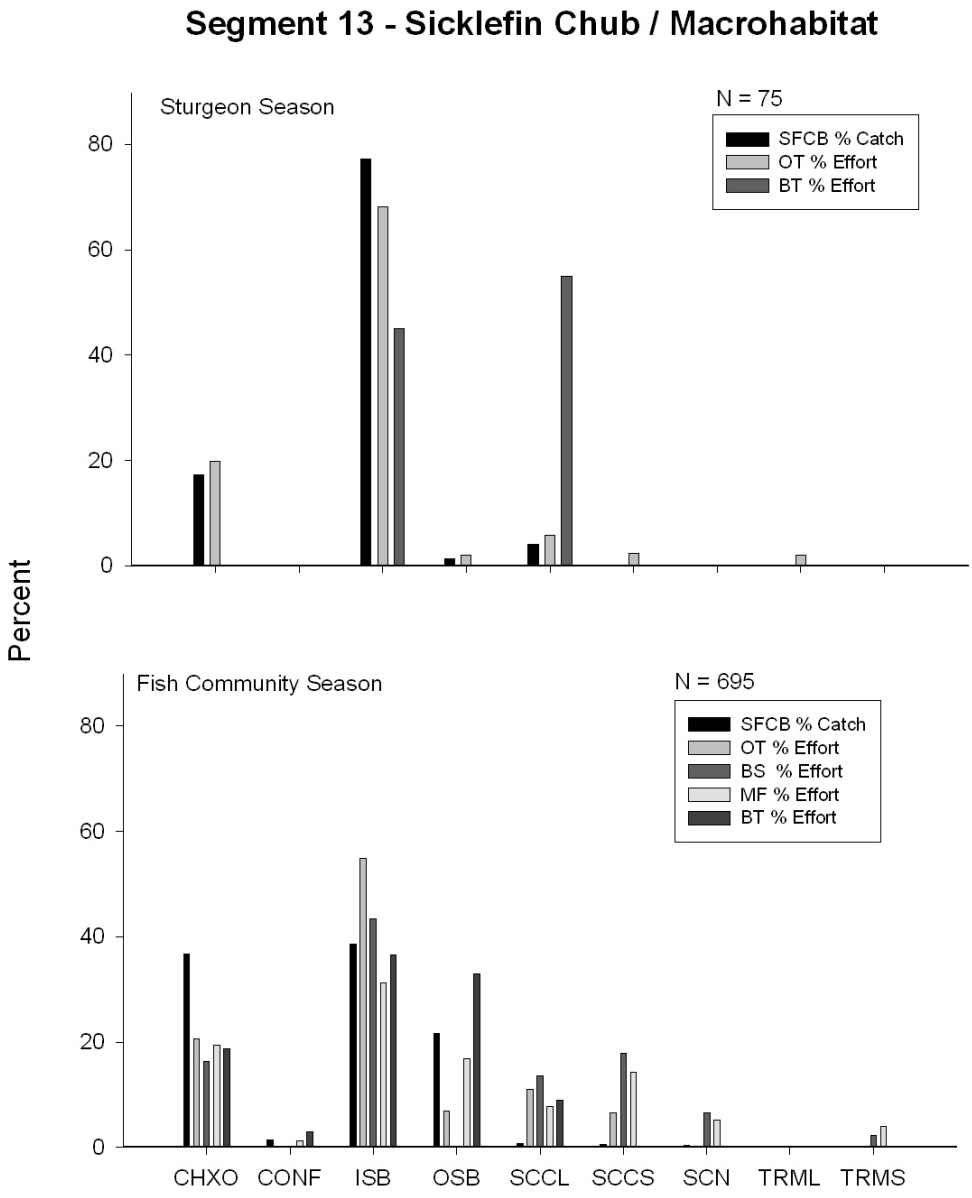

Figure 22. Percent of total sicklefin chubs caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

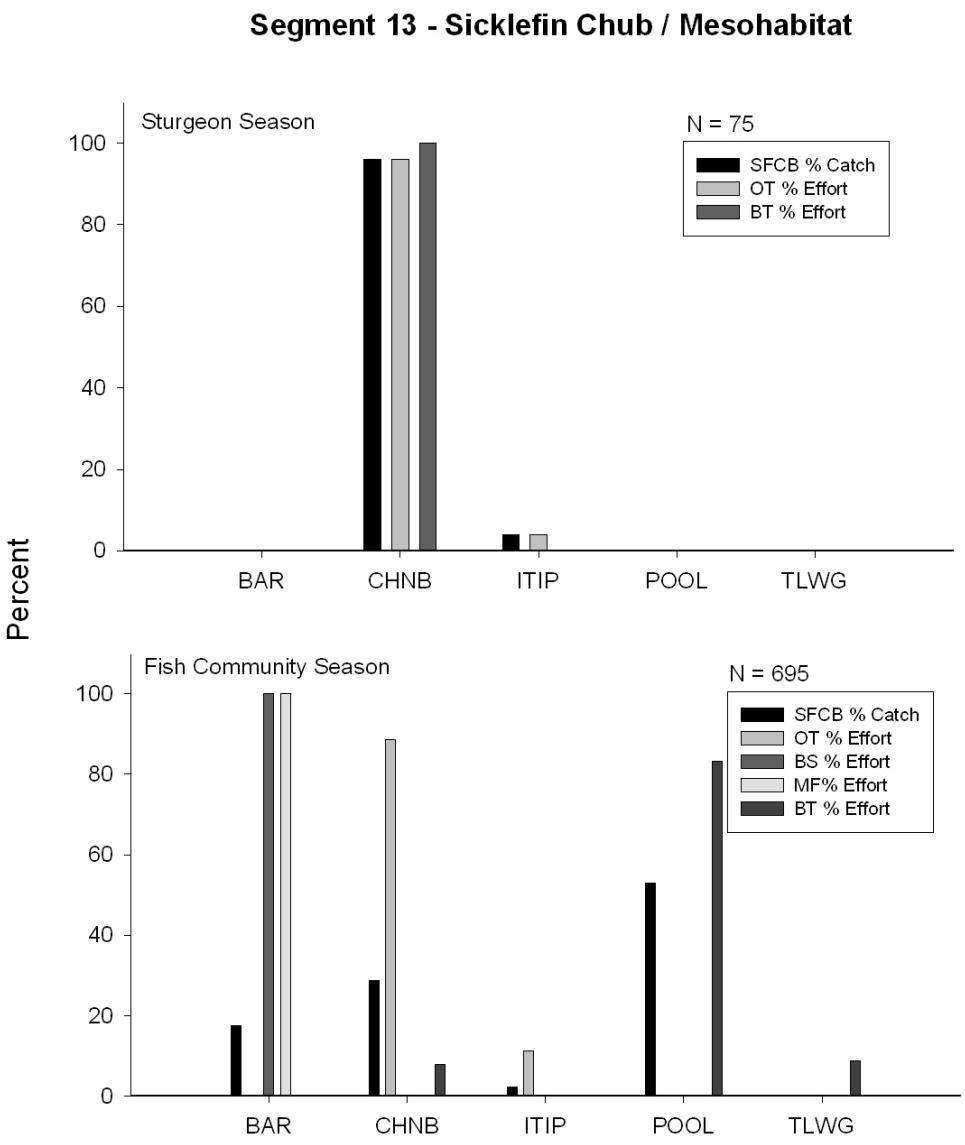

Figure 23. Percent of total sicklefin chubs caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

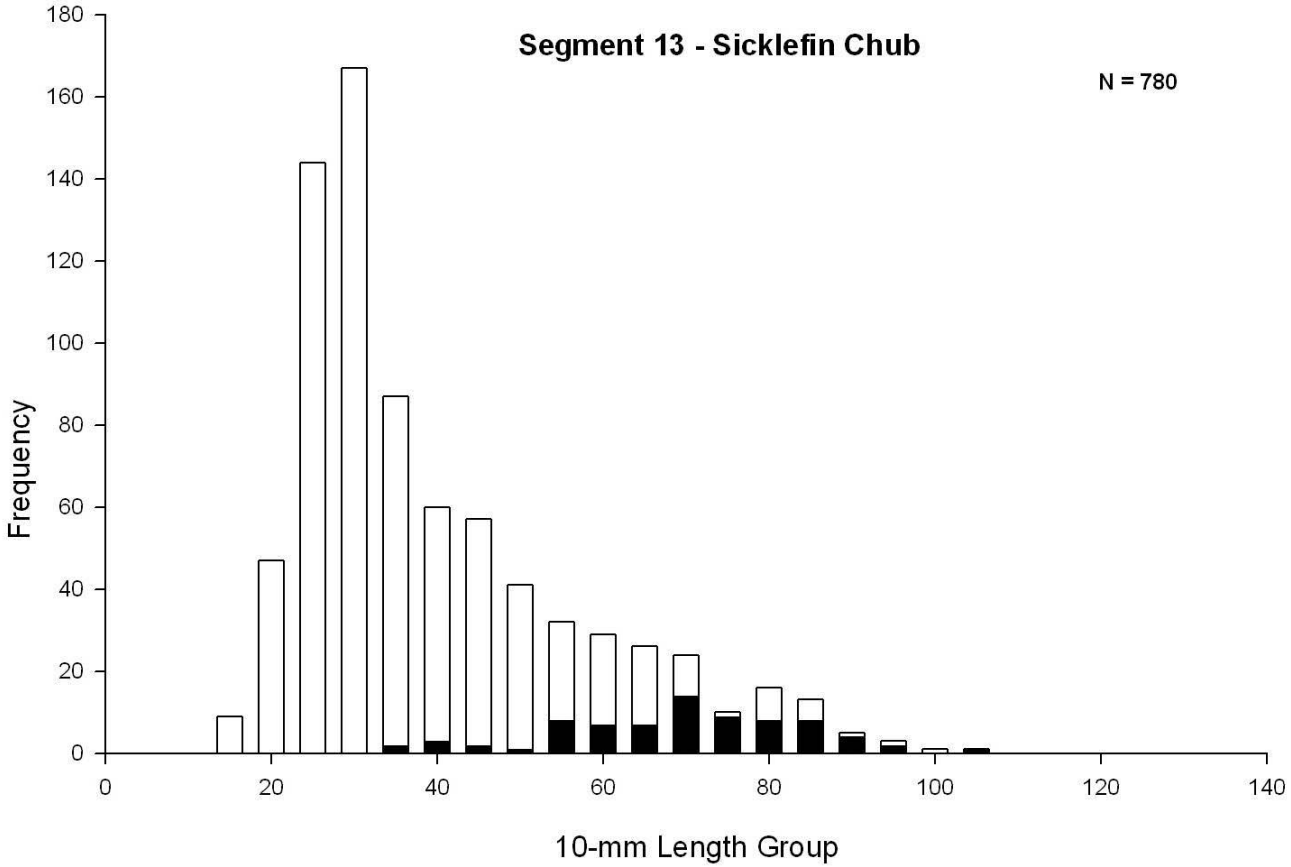

Figure 24. Length frequency of sicklefin chub during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River during 2004.

Speckled Chub

Speckled chubs were captured at a greater rate in 2004 than in 2003 (Figures 25-27). Otter trawls used during the sturgeon season and mini-fykes set during the community season were the most productive gears used for sampling this fish. CPUE was much higher when mini-fykes were used in CHXO habitat (CPUE = 3.4 net-night) and when trawls were used in SCCS ITIP habitat (CPUE = 5.3 fish/100m^2). Speckled chubs were rarely captured in bag seines, sampling only 3 fish in 37 samples. Despite two added gear types in the community season, more speckled chubs were sampled in the spring than fall (N= 228 and 147, Figures 28 and 30) with mini-fyke nets being an effective gear. Habitat typical of mini-fyke sampling consists of more silty substrate with slower water velocities. The data suggests that typical firm sandy habitat with swifter current and shallow areas may not be good habitat for these fish. Speckled chubs may also be more vulnerable at night than during the day, which is another difference between these gears. Speckled chubs were more abundant in small side channels and tributary mouths in the spring. They were always relatively abundant in the channel crossover areas and 2.3 times as likely to occur there during the community season (Figure 28). Speckled chubs were caught at a higher rate on island tips during the spring than any other habitat type sampled. These fish were dispersed to some degree throughout all Meso habitats sampled except the thalweg in both seasons (Figure 29). The influence of a new cohort of fish can be seen in Figure 30 as well as the proportionate number of fish sampled in the spring vs. the community season.

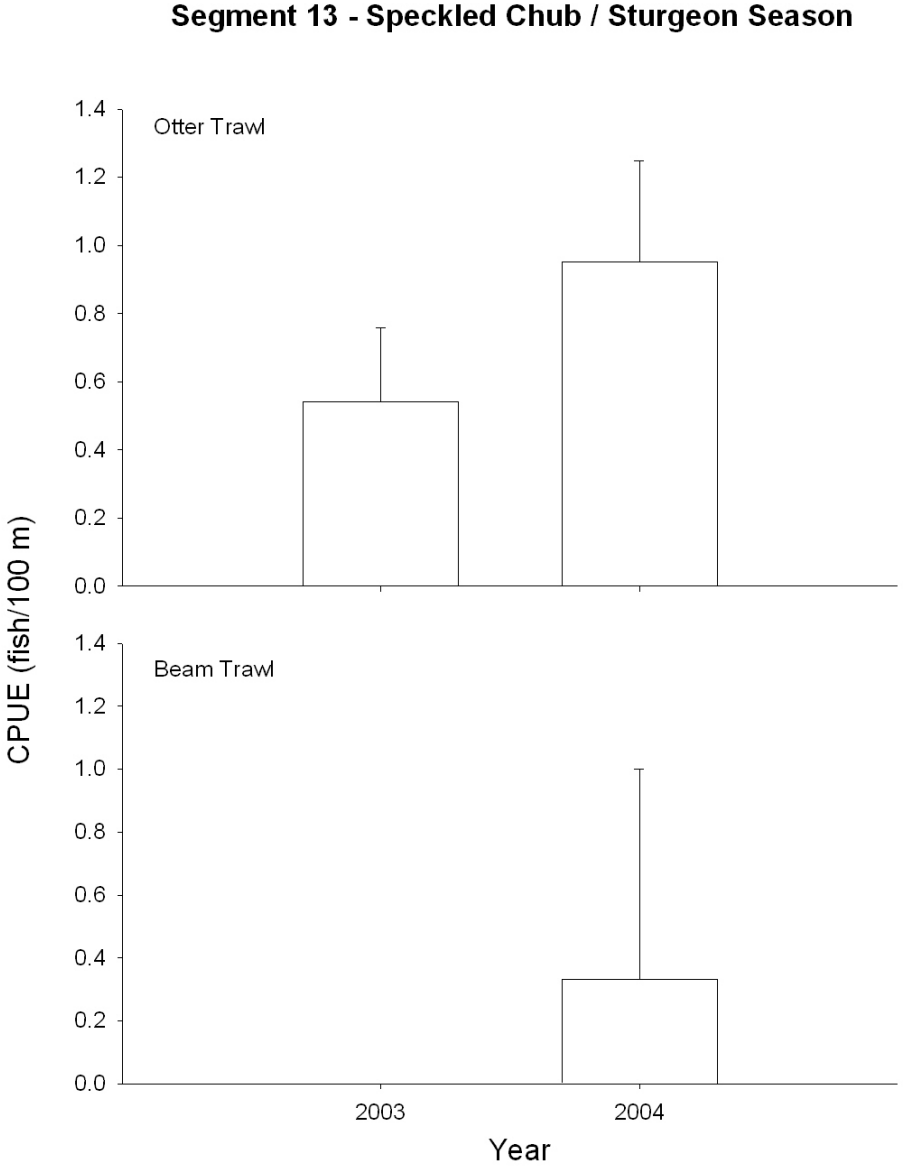

Figure 25. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chubs in segment 13 of the Missouri River during Sturgeon season 2004.

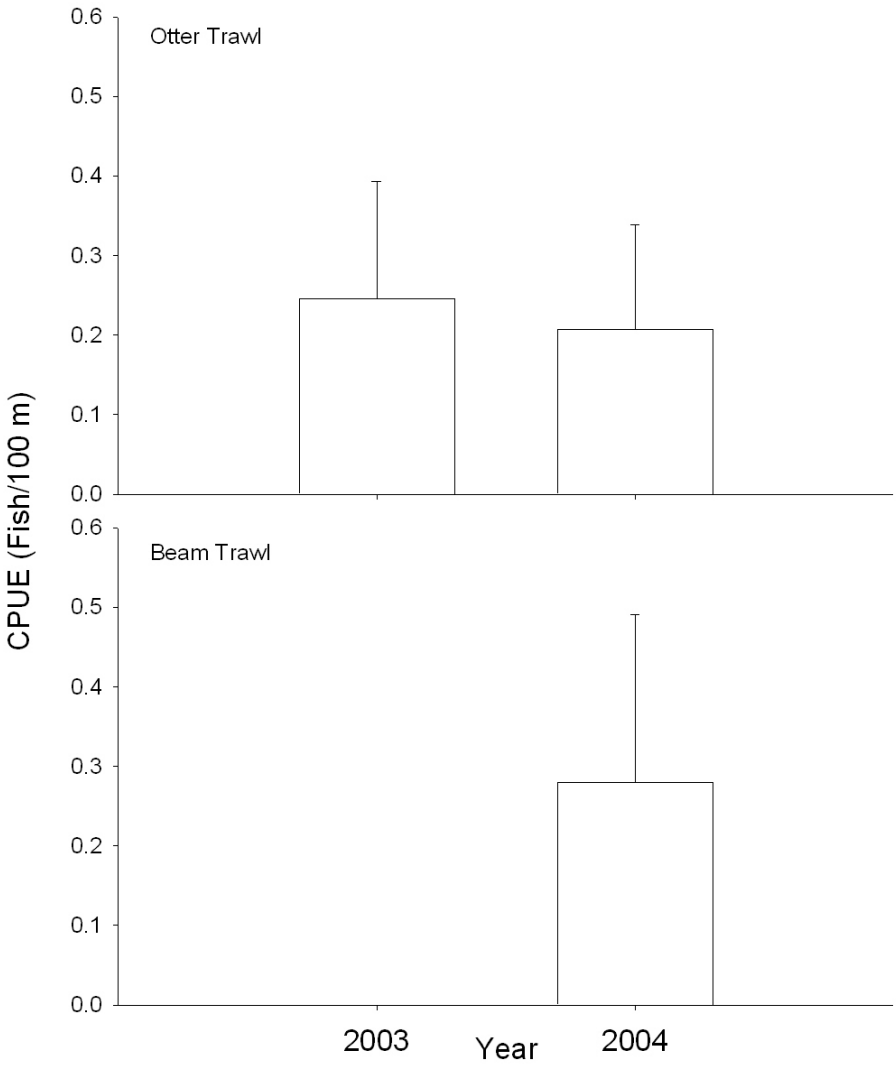

Figure 26. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chubs in segment 13 of the Missouri River during fish community season 2004.

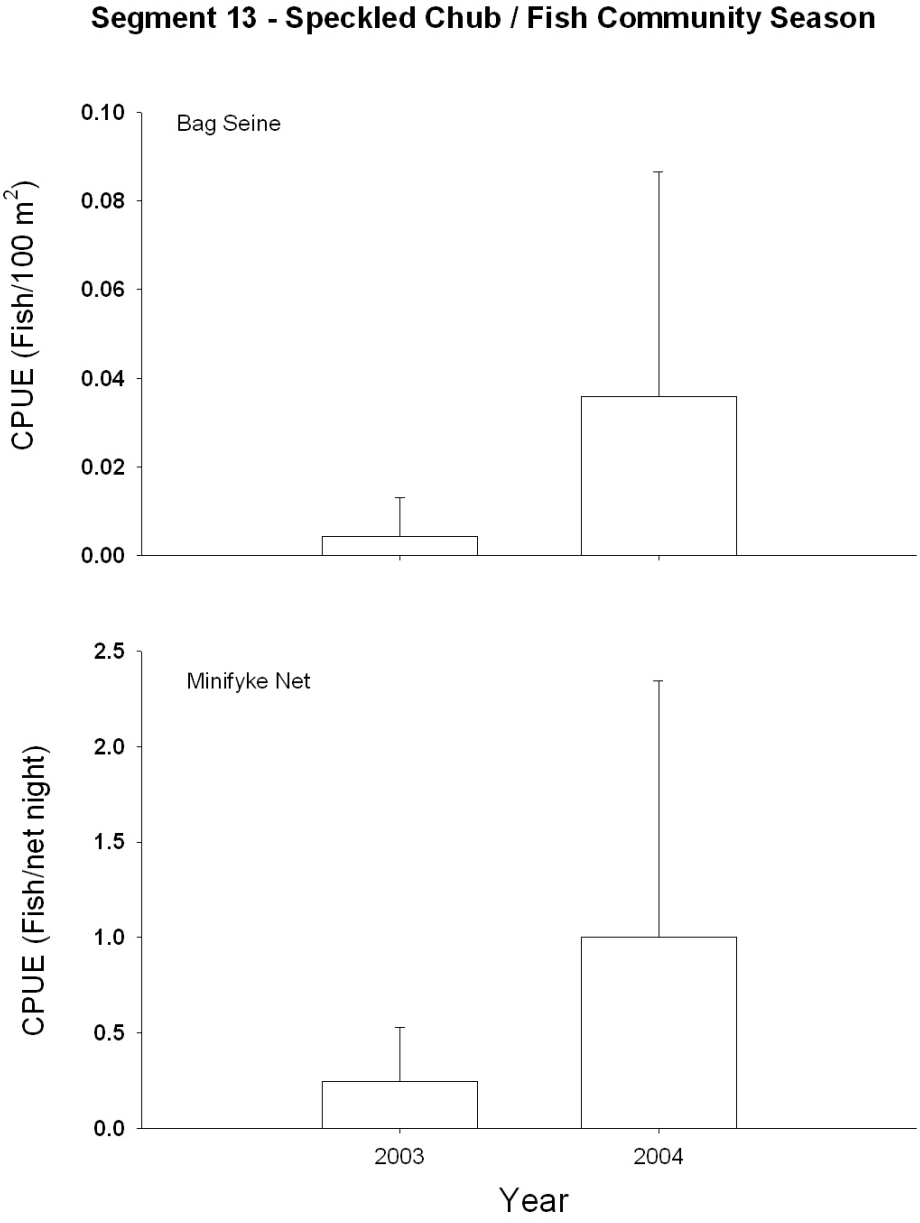

Figure 27. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chubs in segment 13 of the Missouri River during fish community season 2004.

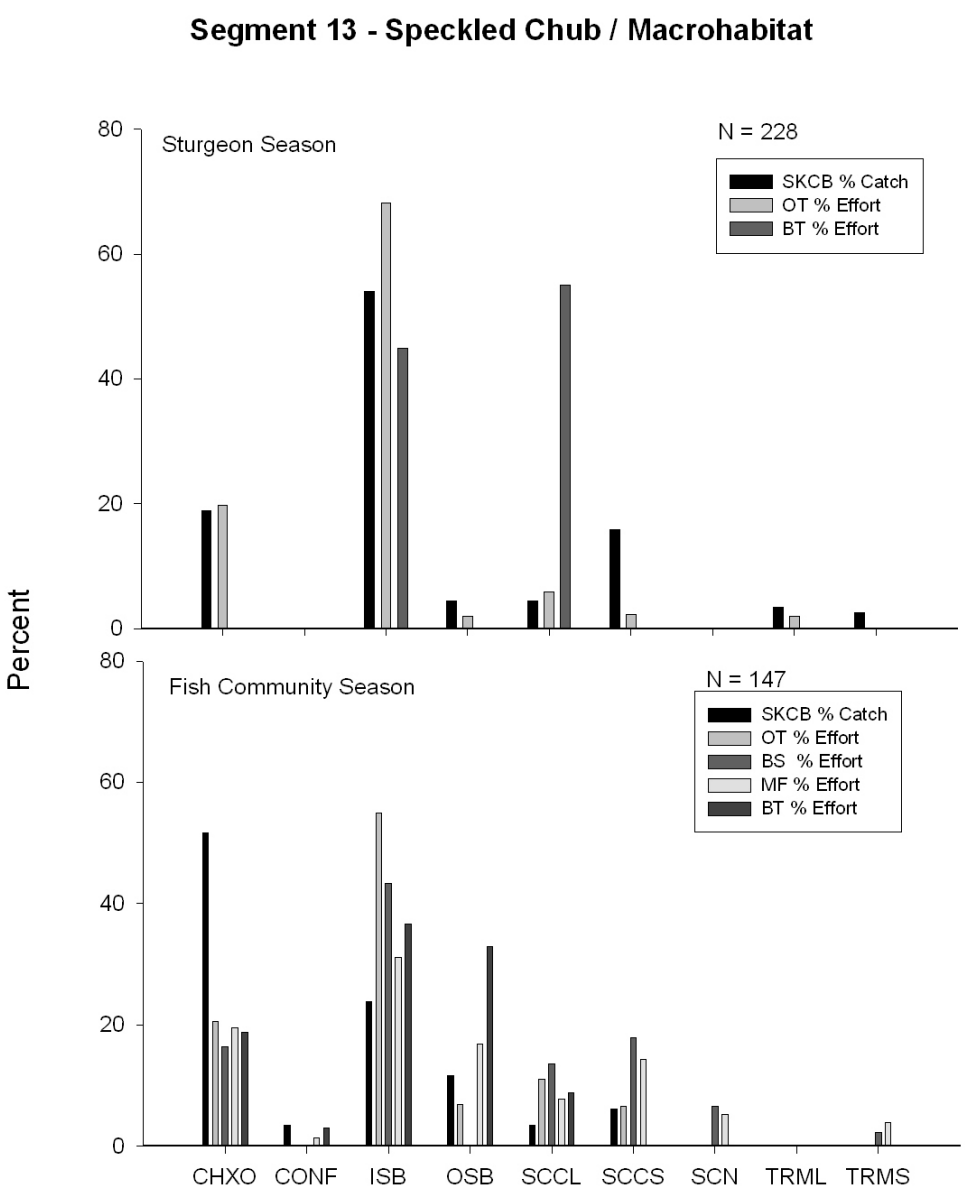

Figure 28. Percent of total speckled chubs caught and effort expend by macrohabitat type in segment 13 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

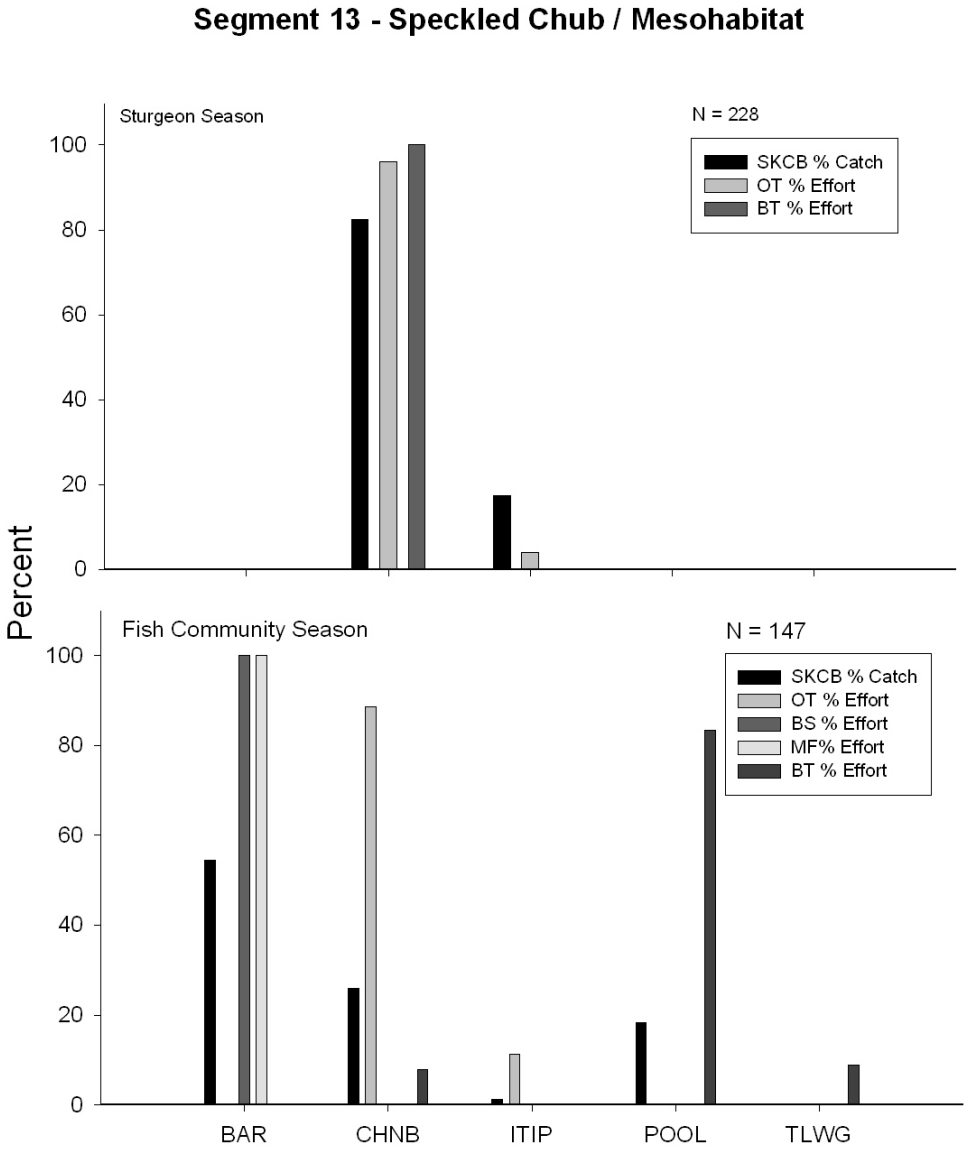

Figure 29. Percent of total speckled chubs caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

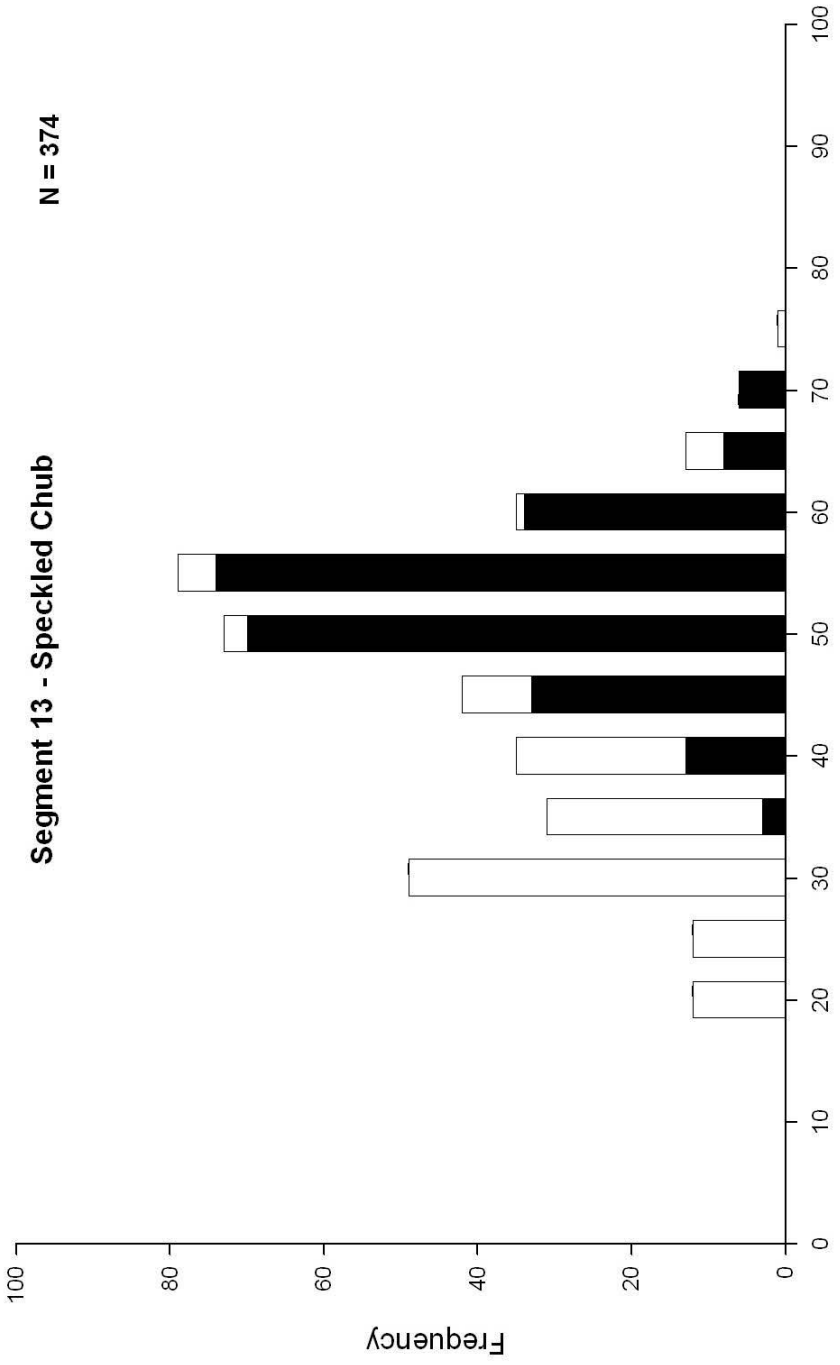

Figure 30. Length frequency of speckled chub during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River during 2004.

Blue Sucker

Blue sucker capture rates were higher in all gears and during all seasons in 2004 than in 2003, except spring hoop nets (Figures 31-34). In all, only 31 fish were captured during the sturgeon season and 51 during the community season (Figure 36). Gillnets, hoop nets and trammel nets were equally as effective at sampling blue suckers in the sturgeon season and hoop nets were twice as effective as trammel nets during the community season. Otter trawls sampled blue suckers at less than half the rate of other gears and blue suckers were sampled twice as frequently in all gears during the community season than during the sturgeon season (Figures 31-34). Blue suckers were distributed throughout most Macro habitats in both seasons. Catch per unit effort was higher for trawls and gillnets within tributary and confluence habitats in the spring. Trammel nets and trawls sampled suckers in ISB CHNB habitats more often than any other but catch rates were higher within island tips (Appendices G and H). Hoop nets were the most effective gear in the fall on OSB channel borders, catching about 1 blue sucker for every 2 nets set (Appendix G5). The proportion of fish taken within the size range observed between both seasons was about the same, with the exception of the very largest suckers being taken during the sturgeon season (Figure 37). There was a higher proportion of larger fish in the samples with only two fish taken less than 350mm. This phenomenon has been observed for several years and suggests that the gears are not efficient at sampling this small size class or there are alternate habitats not being exploited through sampling. Many young-of-year blue suckers have been taken in side-chute habitat (Louise Mauldin/USFWS, personal communication), so it is likely that at least some of these smallest size classes could be sampled with more diverse gear application in the future. Low numbers of fish relative to sampling effort suggests low abundance of blue suckers.

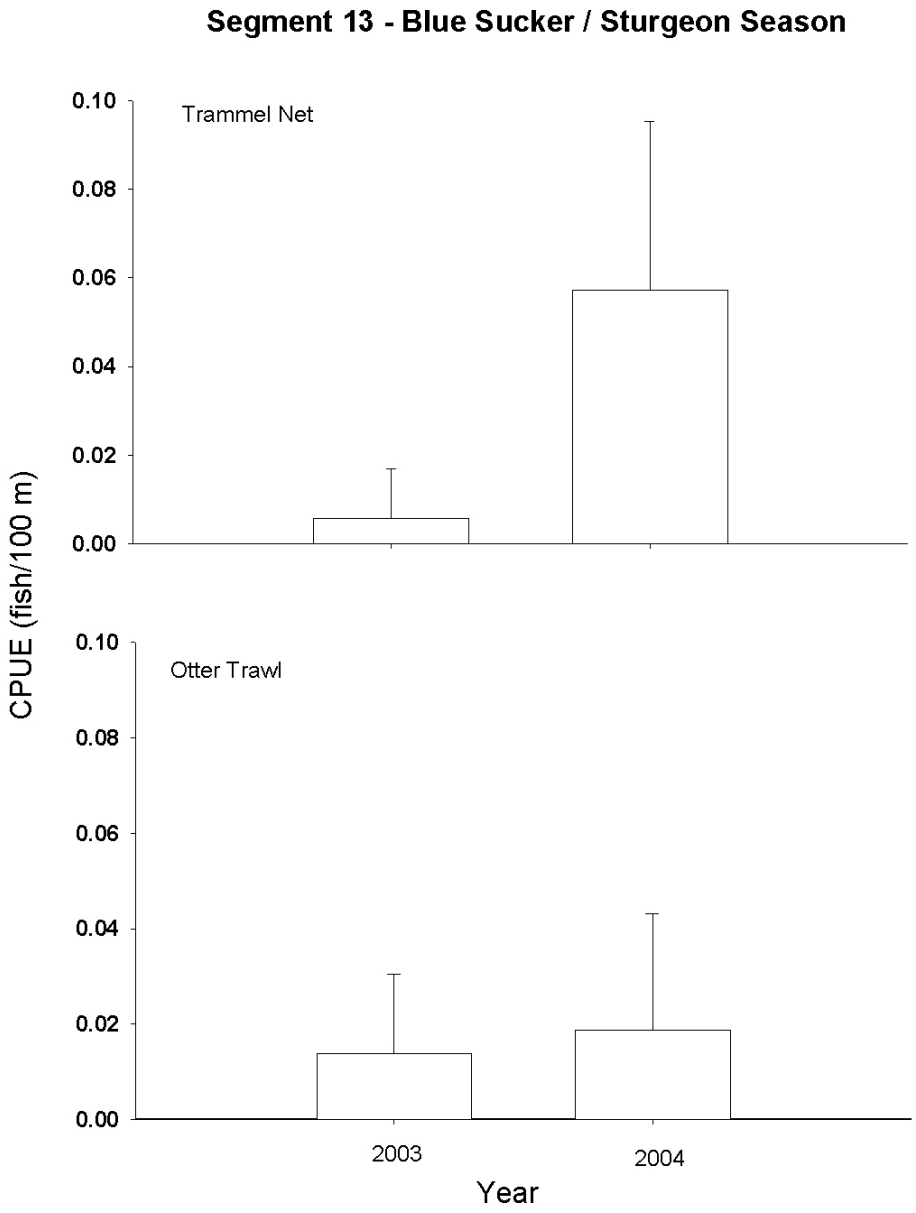

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 13 of the Missouri River during sturgeon season 2004.

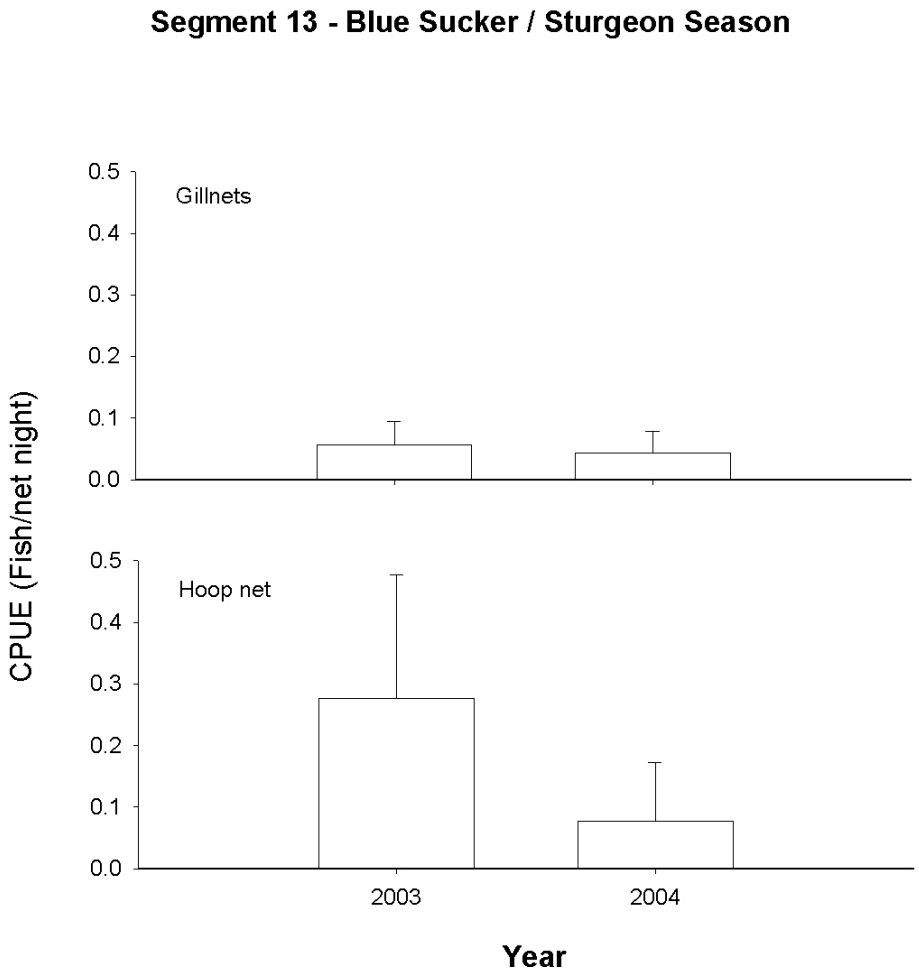

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 13 of the Missouri River during sturgeon season 2004.

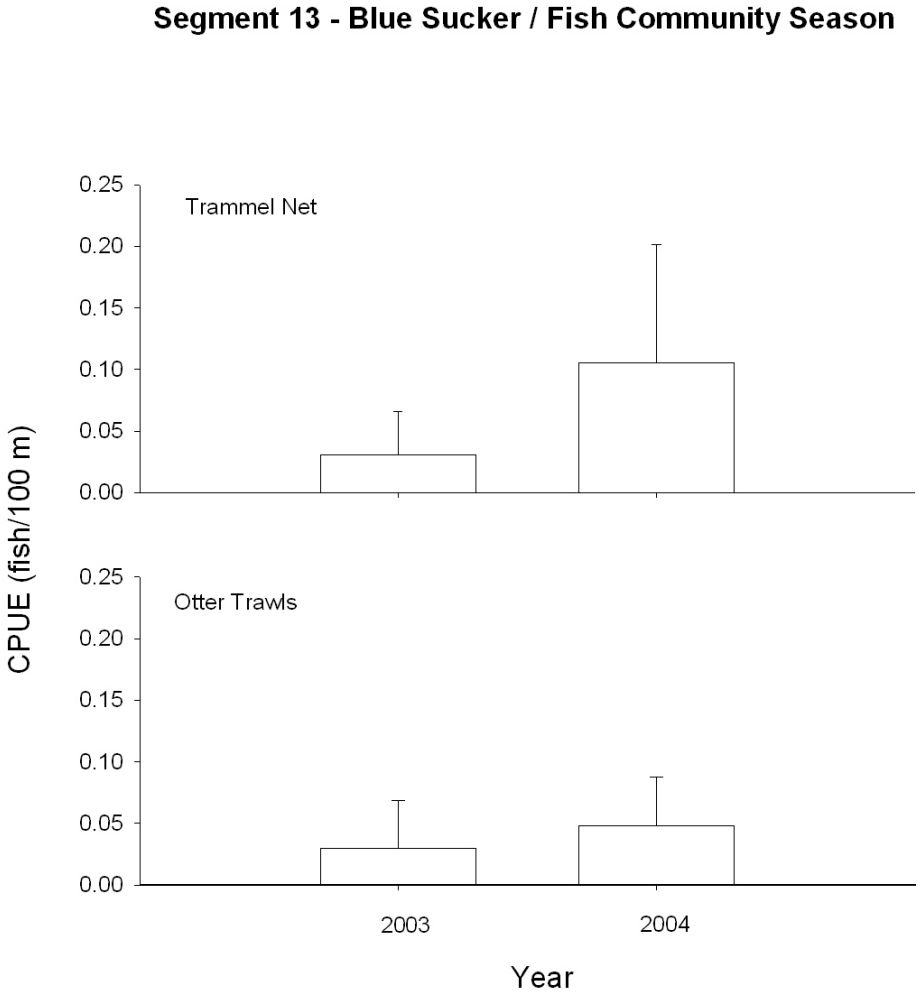

Figure 33. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 13 of the Missouri River during fish community season 2004.

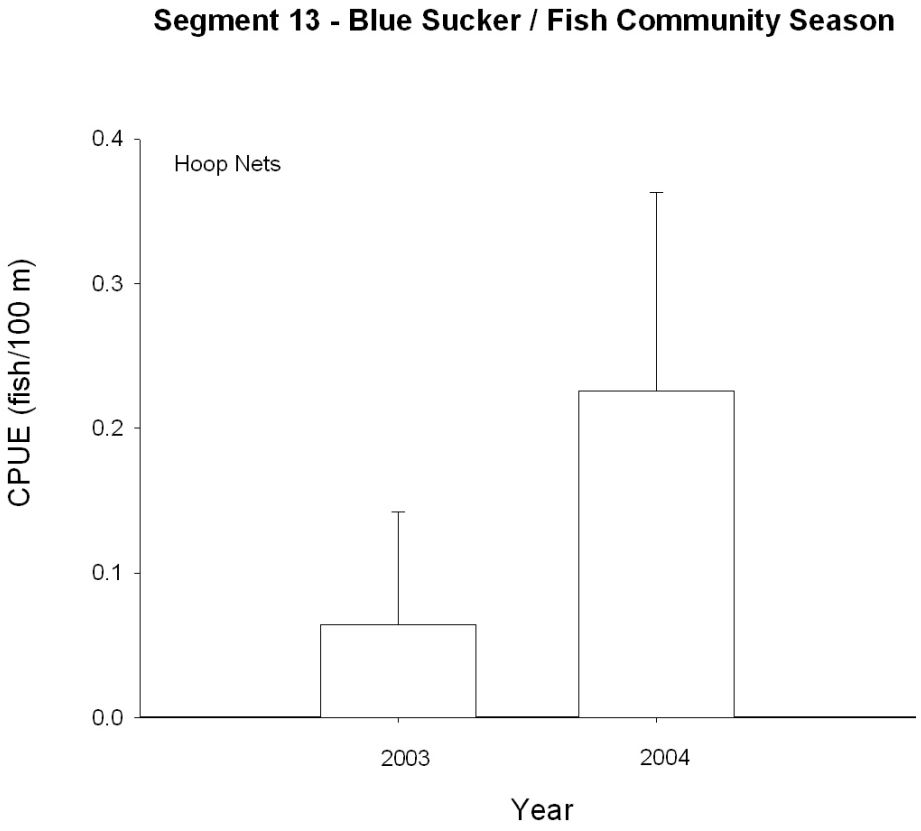

Figure 34. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 13 of the Missouri River during fish community season 2004.

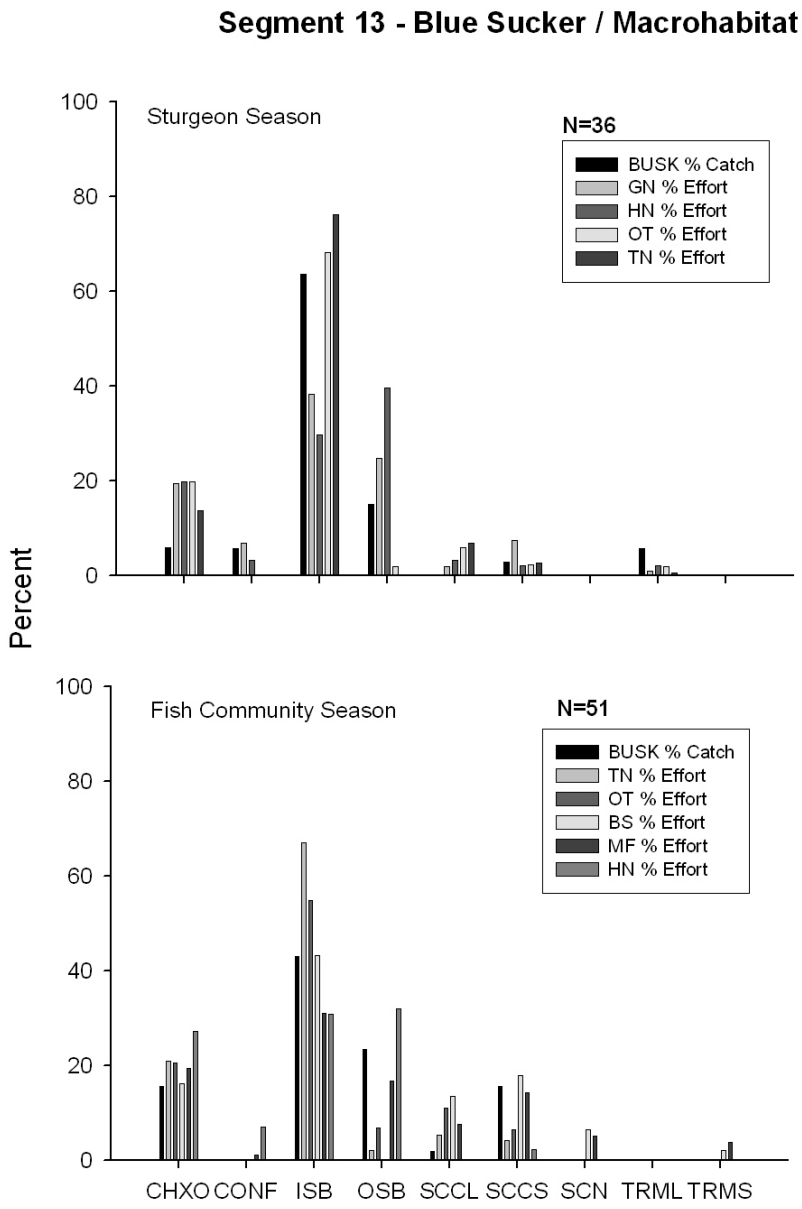

Figure 35. Percent of total blue sucker caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

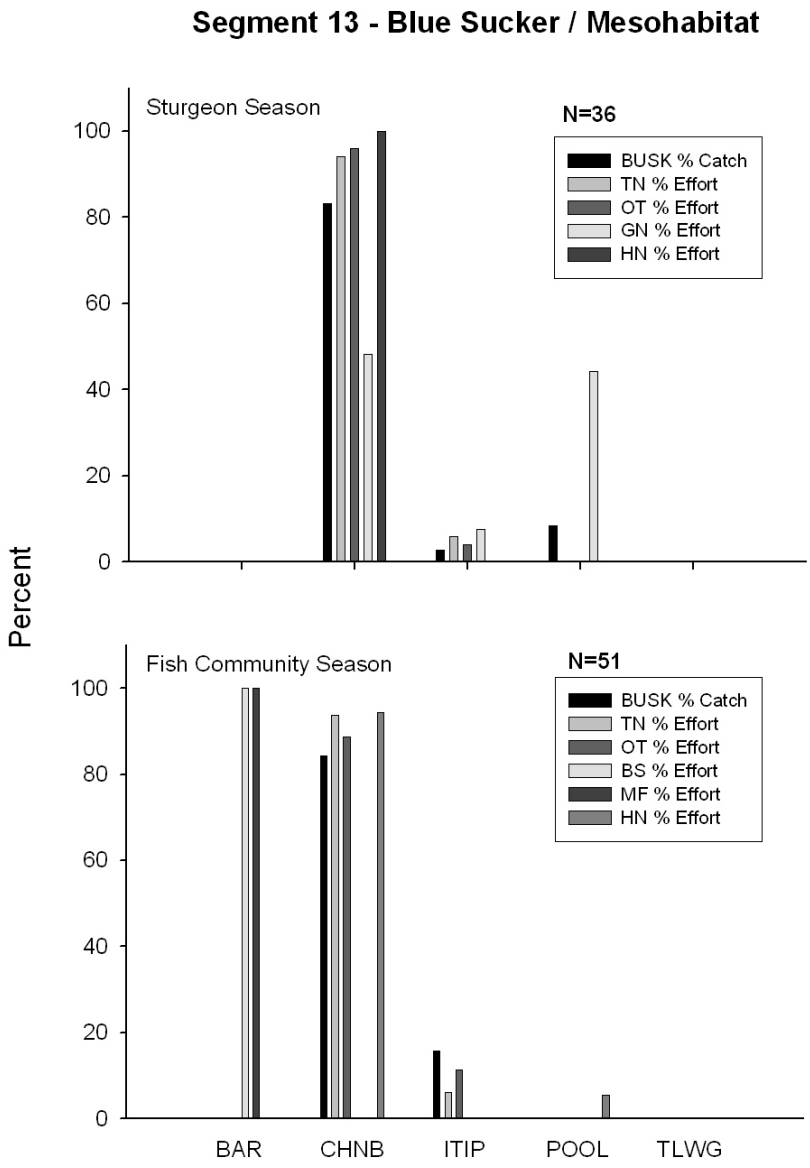

Figure 36. Percent of total blue sucker caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

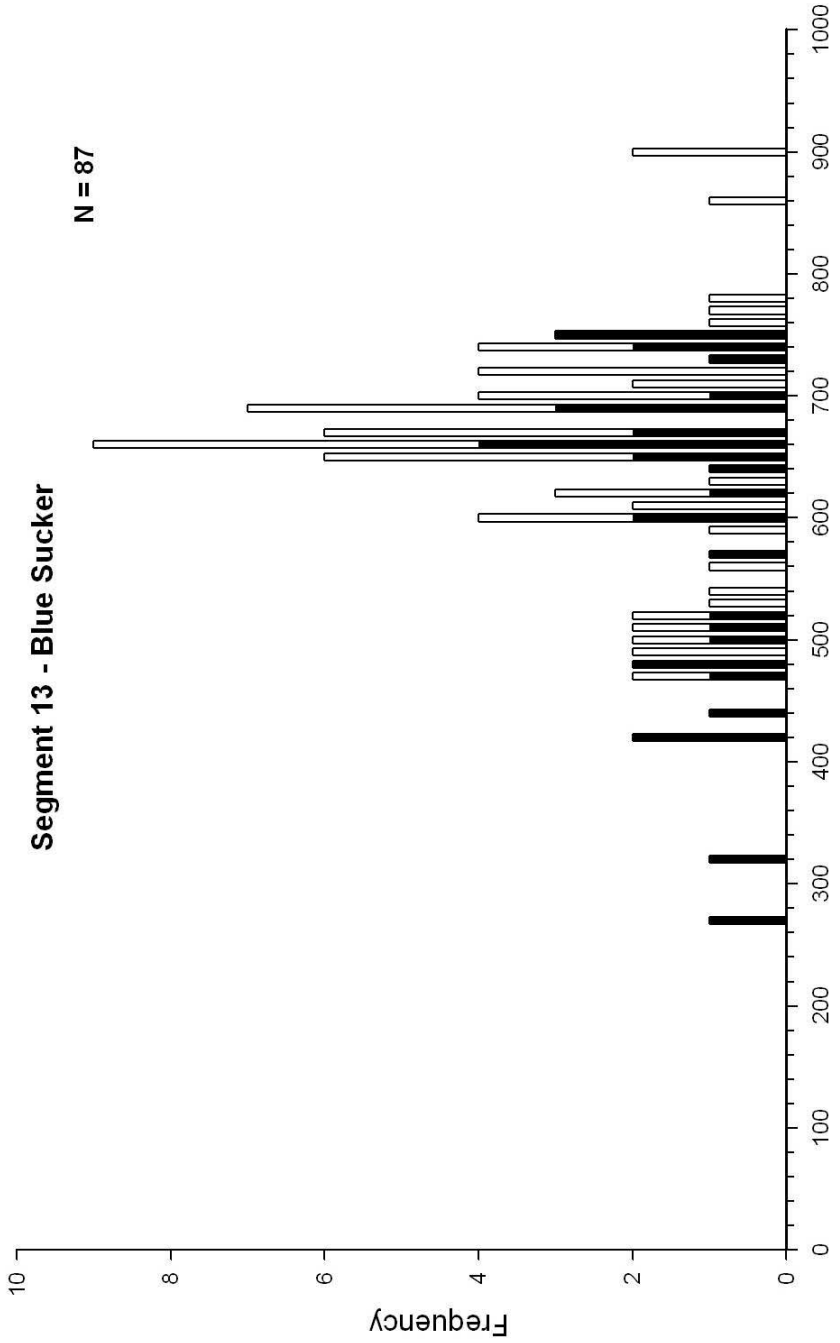

Figure 37. Length frequency of blue suckers during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River during 2004.

Sauger

Fewer sauger were sampled in 2004 than in 2003 for all gear types (Figures 38-41). Gillnets remain the most efficient means of sampling these fish (N=26). Bag seines and mini-fykes had sampled some fish in 2003, but did not sample any during 2004. Otter trawls only sampled one fish and trammel nets captured three. Gillnets consistently sampled this fish in POOL habitat in the winter, but side channel border habitat had the highest CPUE for this species at 0.5 and 0.42 fish/net-night. (Figures 42 and 43) (Appendix G1). No sauger were observed at juvenile sizes suggesting poor recruitment or lack of spawning success (Figure 44). Adult fish appeared to be robust in condition, but few young fish were observed. Sauger may be using habitats that are under-represented in sampling efforts, such as side-channels and tributaries or OSB revetment areas.

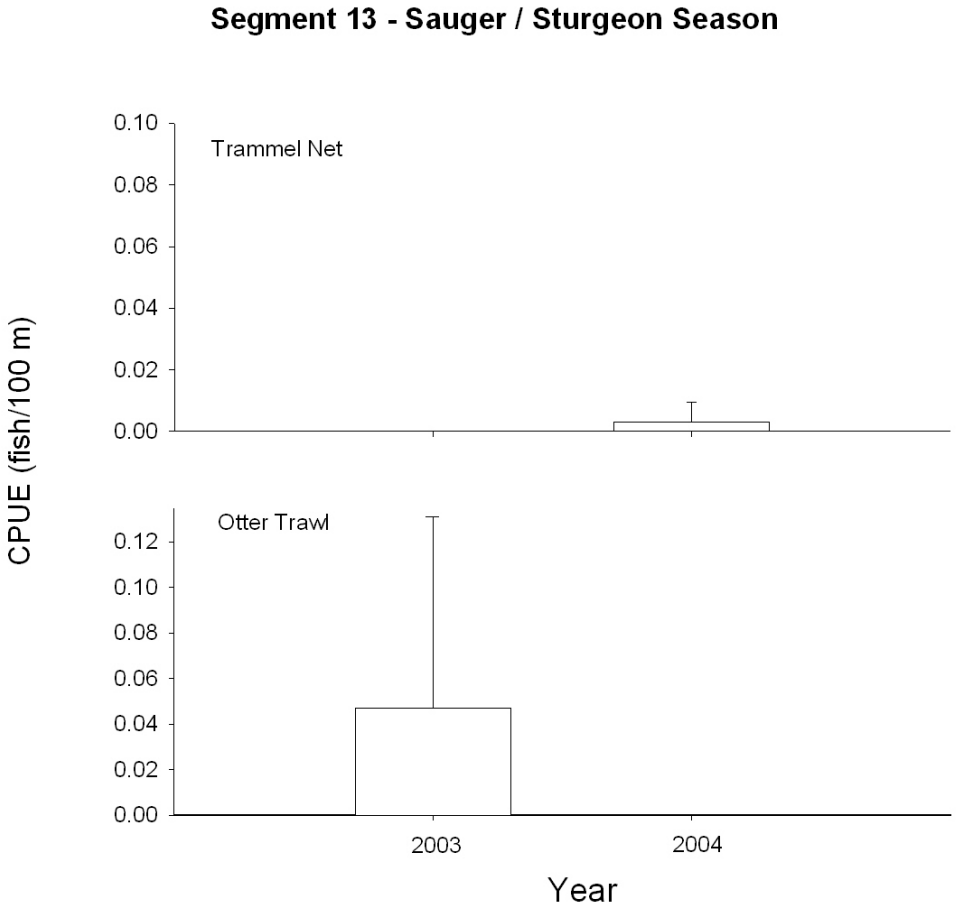

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 13 of the Missouri River during sturgeon season 2004.

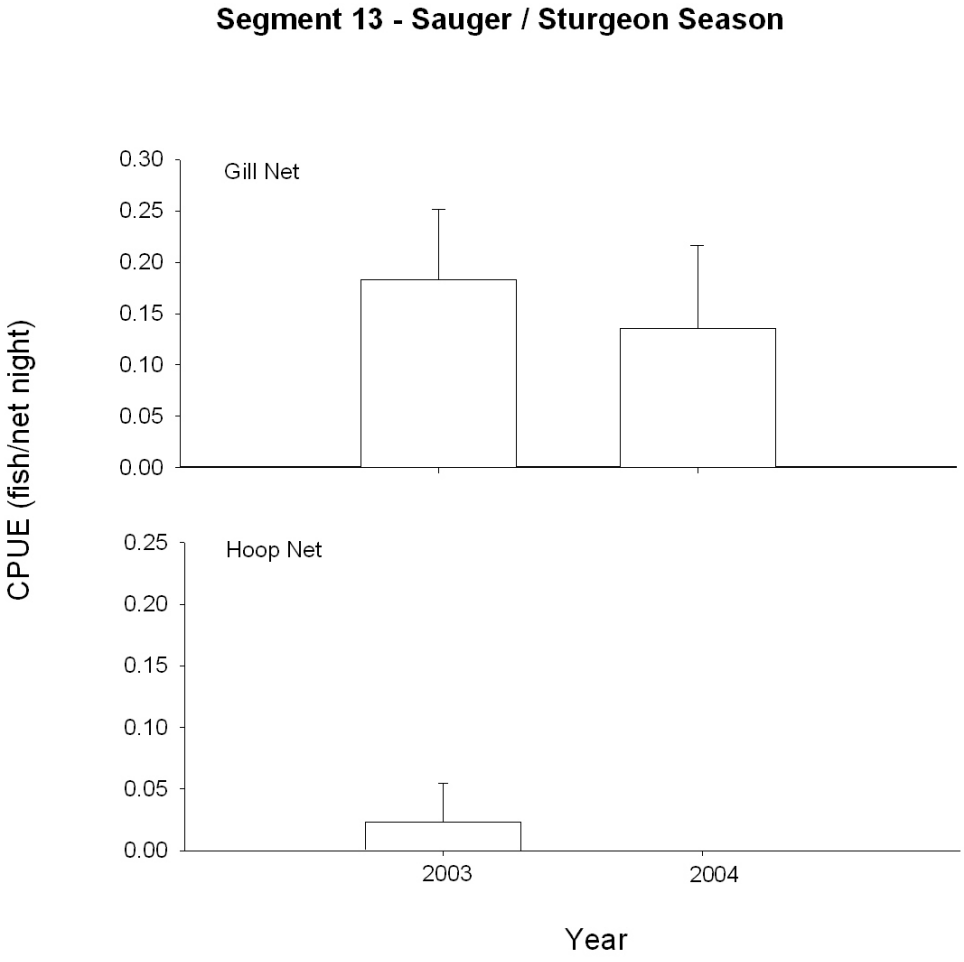

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 13 of the Missouri River during sturgeon season 2004.

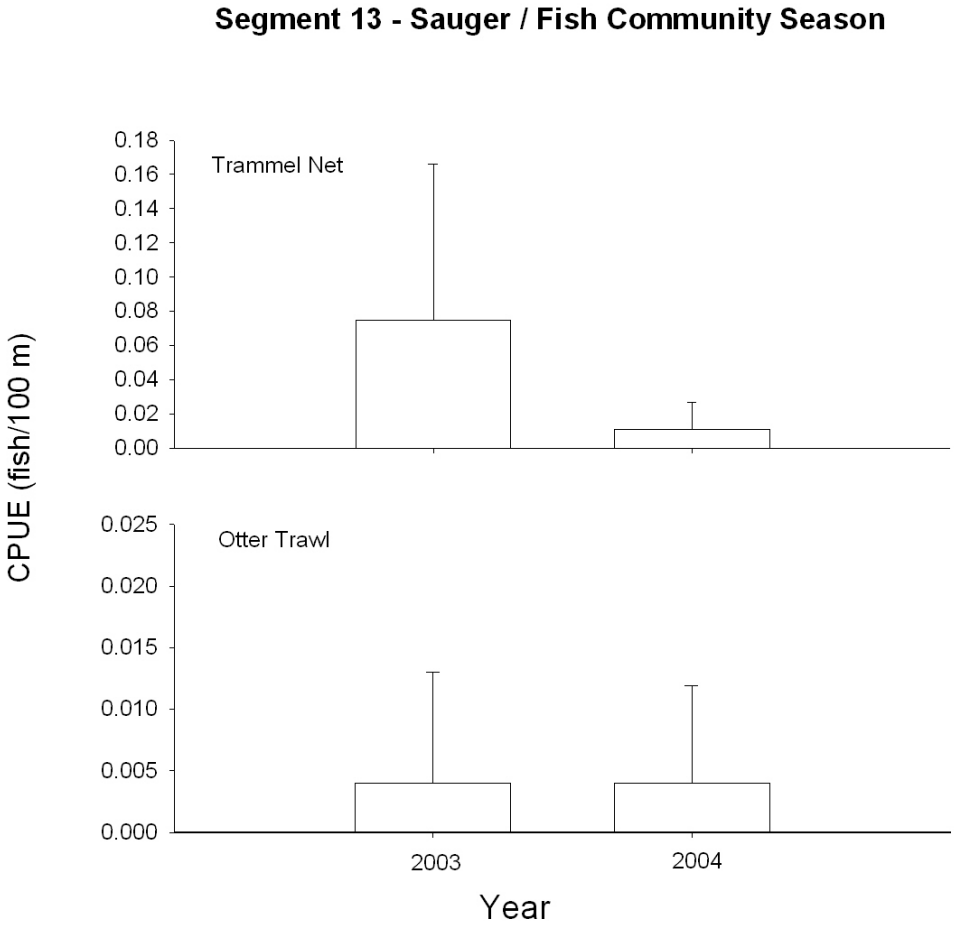

Figure 40. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 13 of the Missouri River for fish community season 2004.

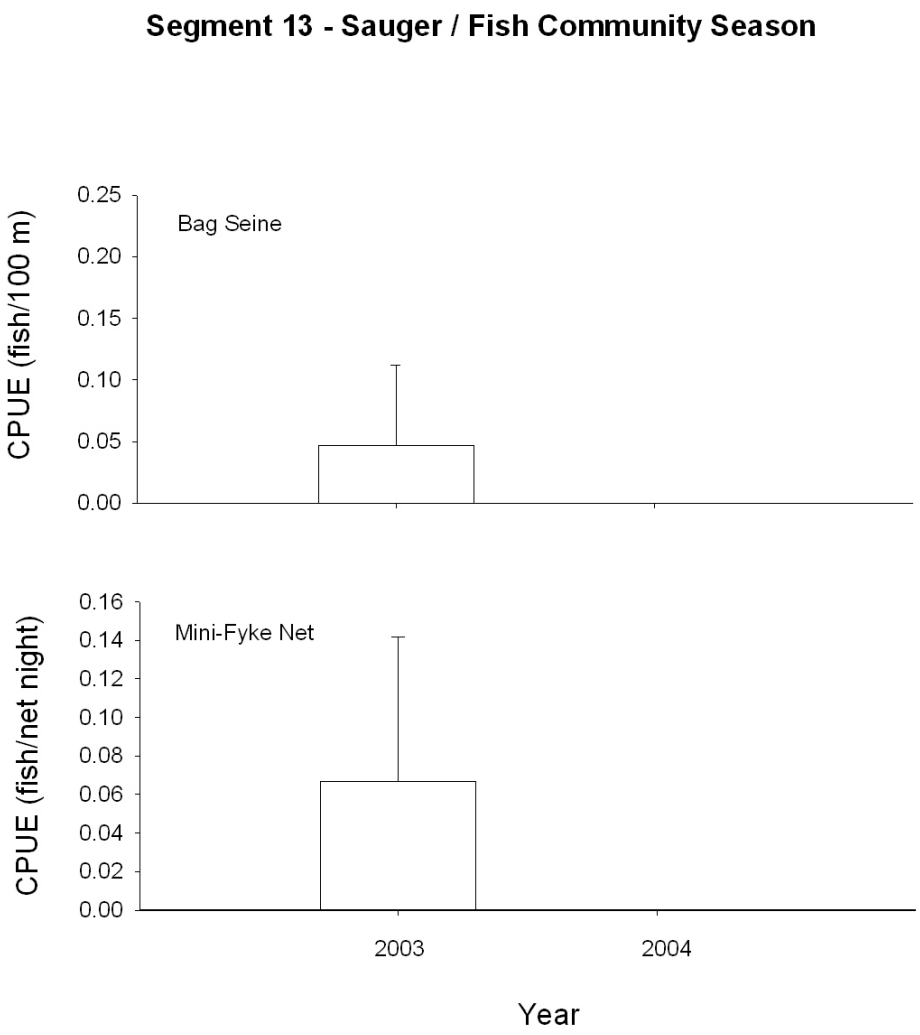

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 13 of the Missouri River during fish community season season 2004.

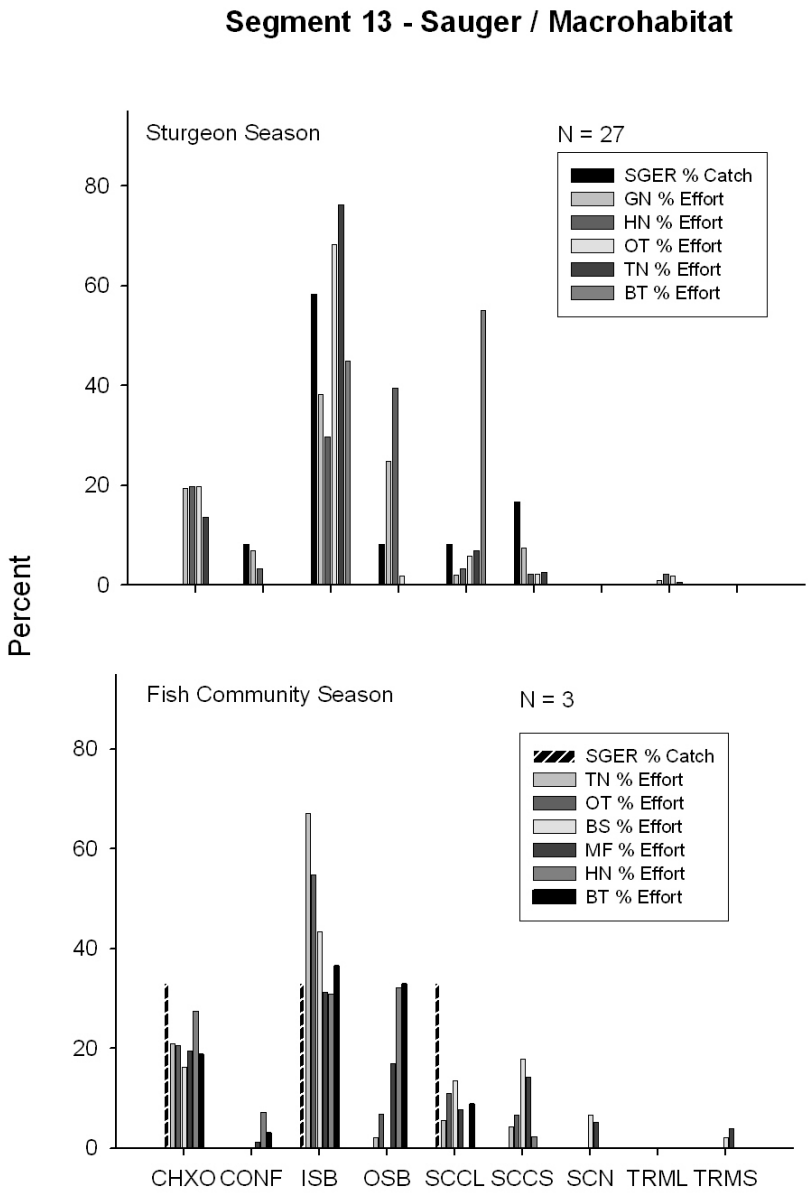

Figure 42. Percent of total sauger caught and effort expended by macrohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

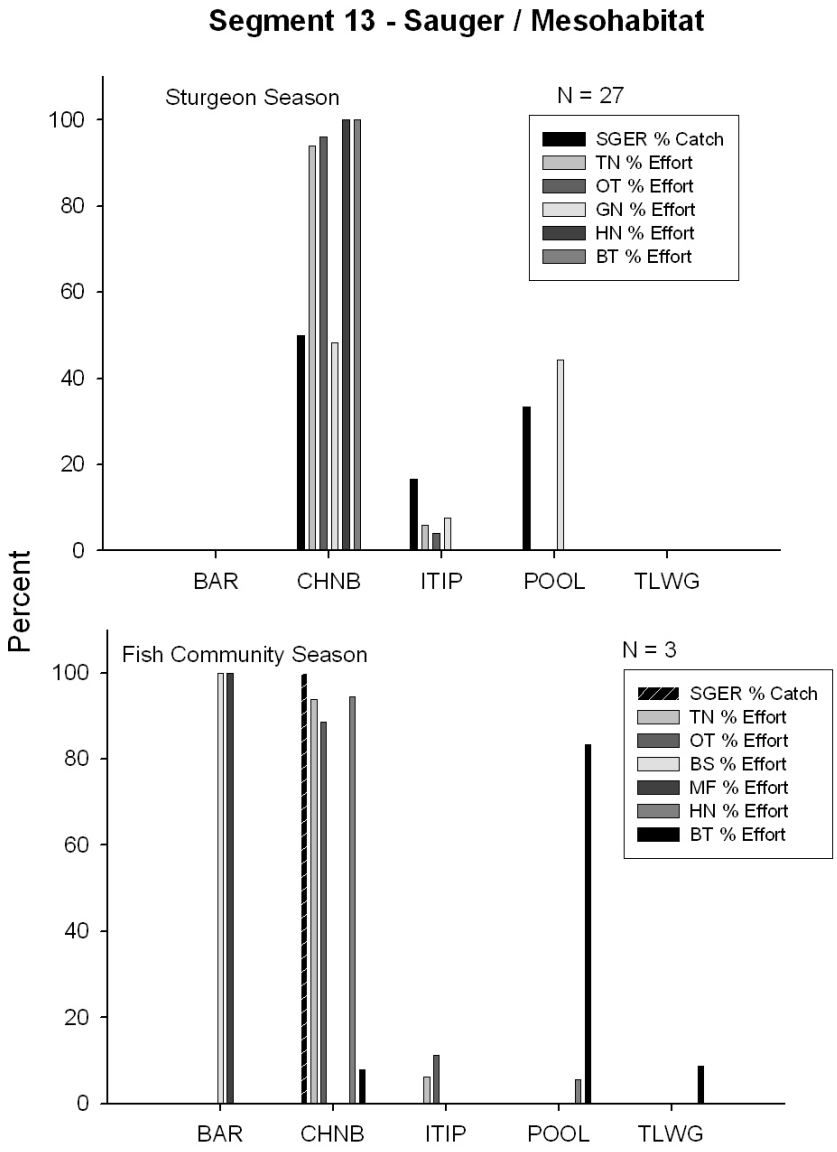

Figure 43. Percent of total sauger caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

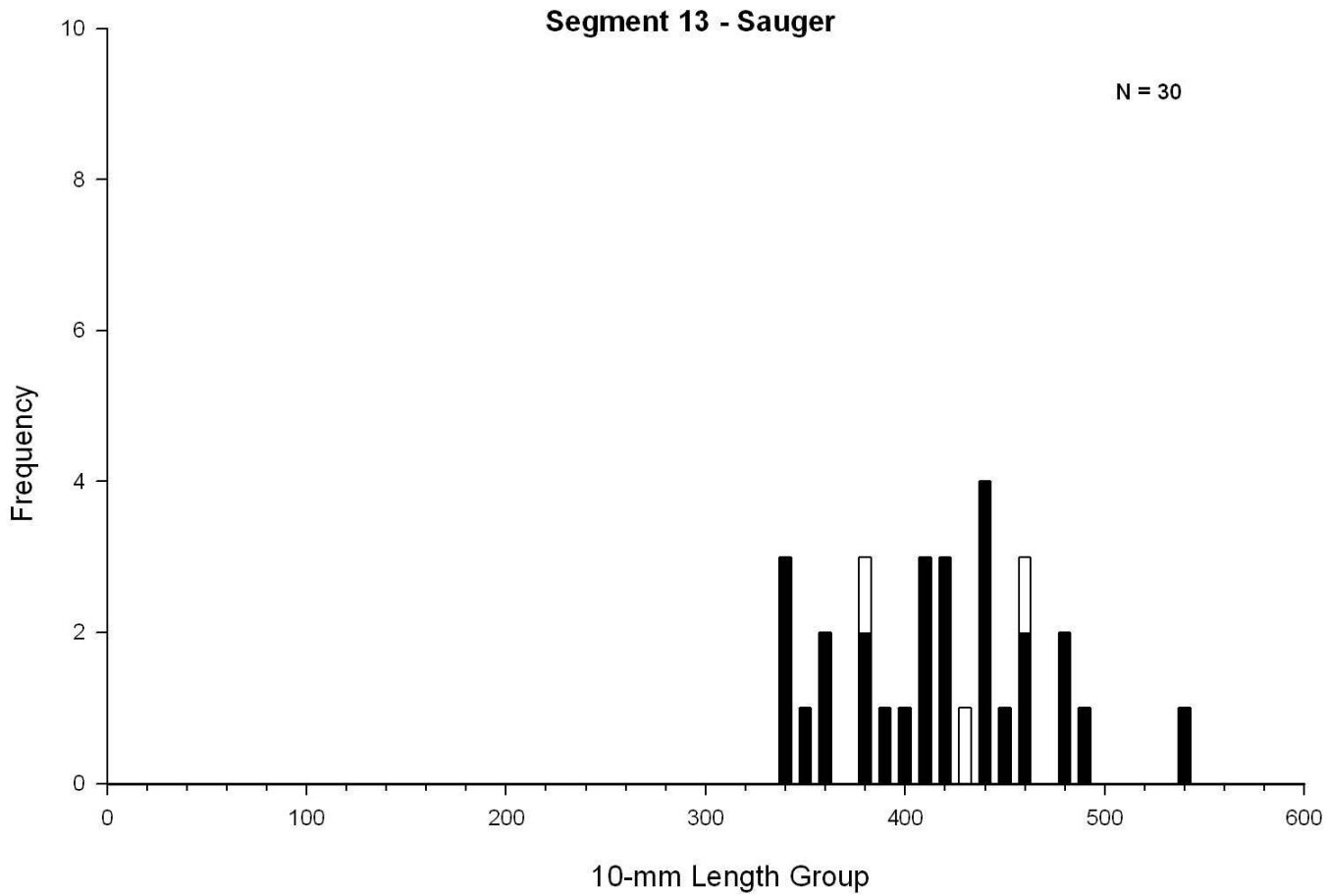

Figure 44. Length frequency of sauger during sturgeon season (black bars) and fish community season (white bars) in segment 13 of the Missouri River during 2004.

Sand Shiner

Sand shiners were caught at a slightly greater rate in 2004 than in 2003 (Figure 45). Seines captured three fish and mini-fykes caught 28 fish, CPUE was highest in CHXO Macro habitat in mini-fykes (1.47) (Figure 46) (Appendix H6). Seines also captured fish in CHXO habitat and SCN habitat (Figure 47). Despite 164 trawls in CHNB habitat and 80 beam trawls in POOL habitat, none of these fish were sampled, suggesting sand shiners prefer shallower areas in CHXO areas and may only be vulnerable at night. Average adult sand shiners are about 50mm (Pfleiger 1975) and there are very few of these fish represented in our sampling, however there does appear to have been some spawning success based on the proportionate number of smaller fish captured (Figure 48).

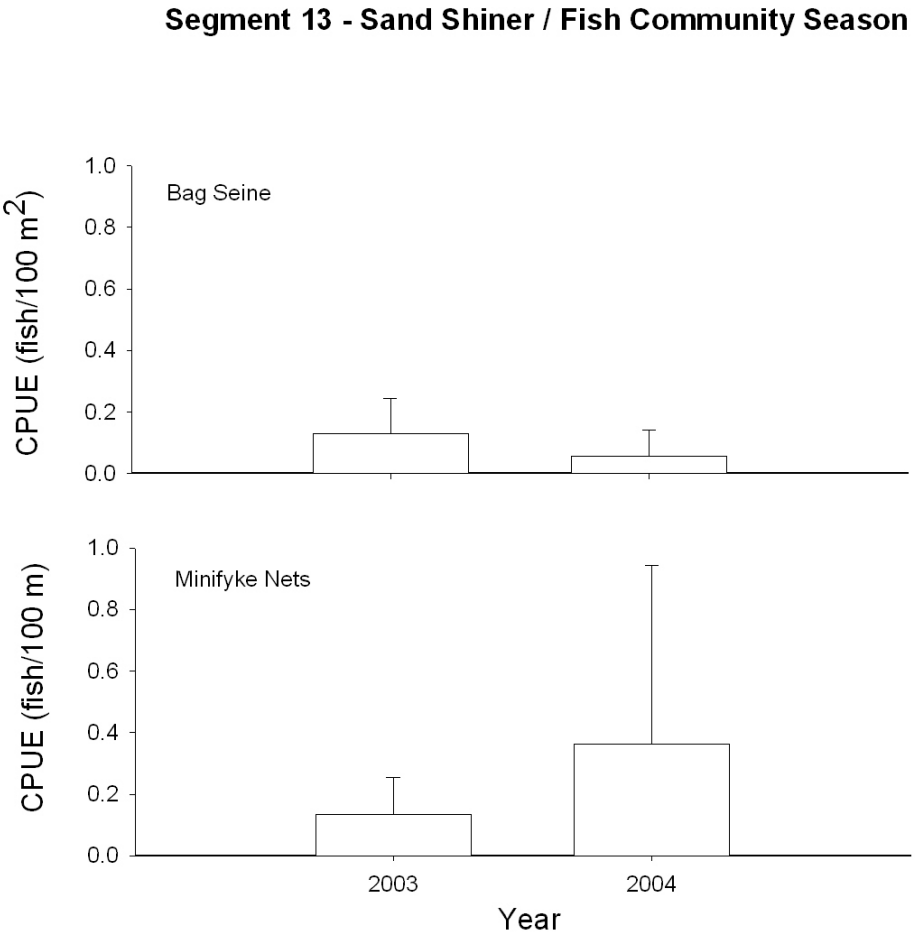

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiners in segment 13 of the Missouri River during fish community season 2004.

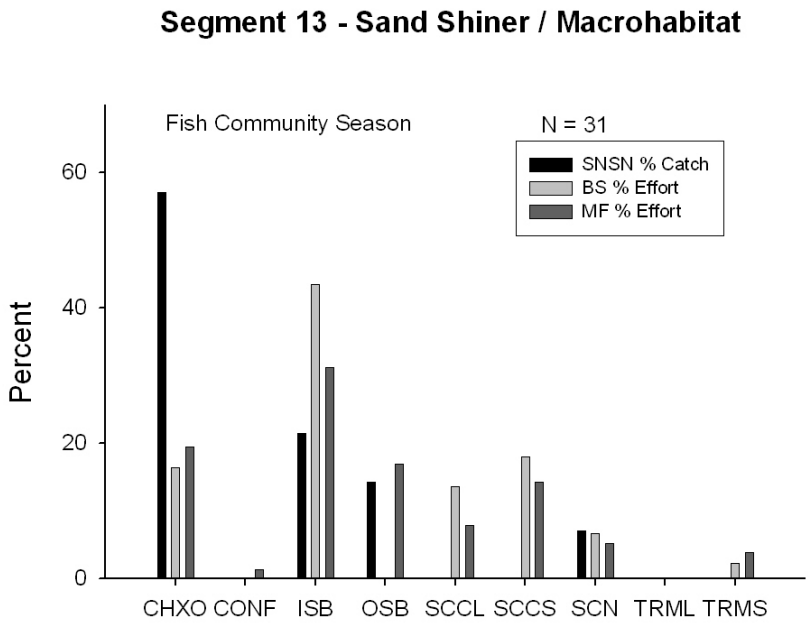

Figure 46. Percent of total sand shiners caught and effort expended by macrohabitat type in segment 13 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

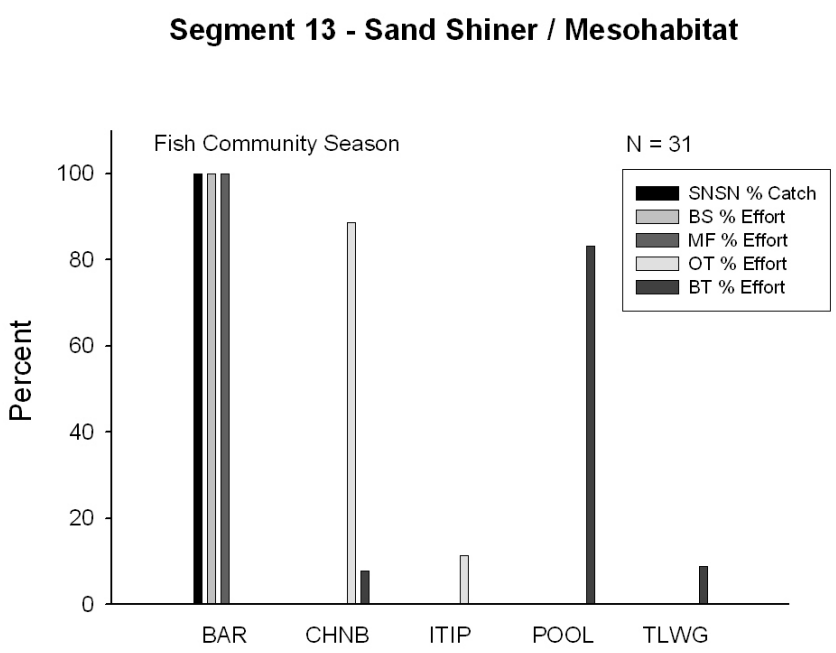

Figure 47. Percent of total sand shiners caught and effort expended by mesohabitat type in segment 13 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

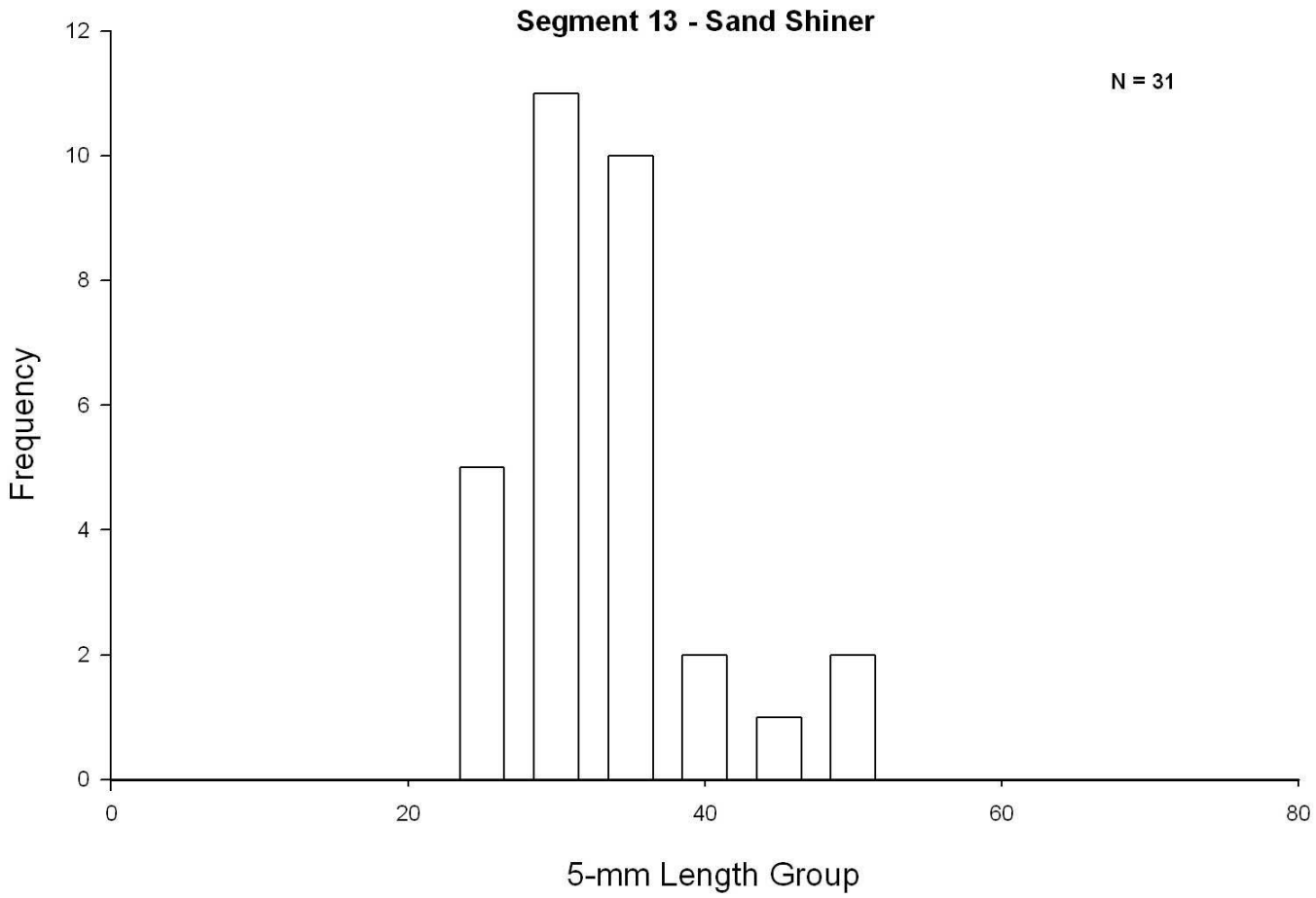

Figure 48. Length frequency of sand shiners during fish community season white bars in segment 13 of the Missouri River during 2004.

Hybognathus spp.

More fish were sampled in 2003 than in 2004 and no fish were sampled with a bag seine (Figure 49). Of the five fish sampled, they occurred on BARS habitat between ISB and OSB Macro habitats in mini-fykes (Figures 50 and 51). Despite large amounts of trawling effort in POOL and CHNB habitats, no fish were collected. Average adult sizes of the Plains and Western silvery minnows are about 100mm. There were five fish sampled, the largest was only 55mm, suggesting these fish are not being sampled effectively at the adult stage or more likely, that there are very few adults available in this reach of river (Figure 52) (Pfleiger 1975).

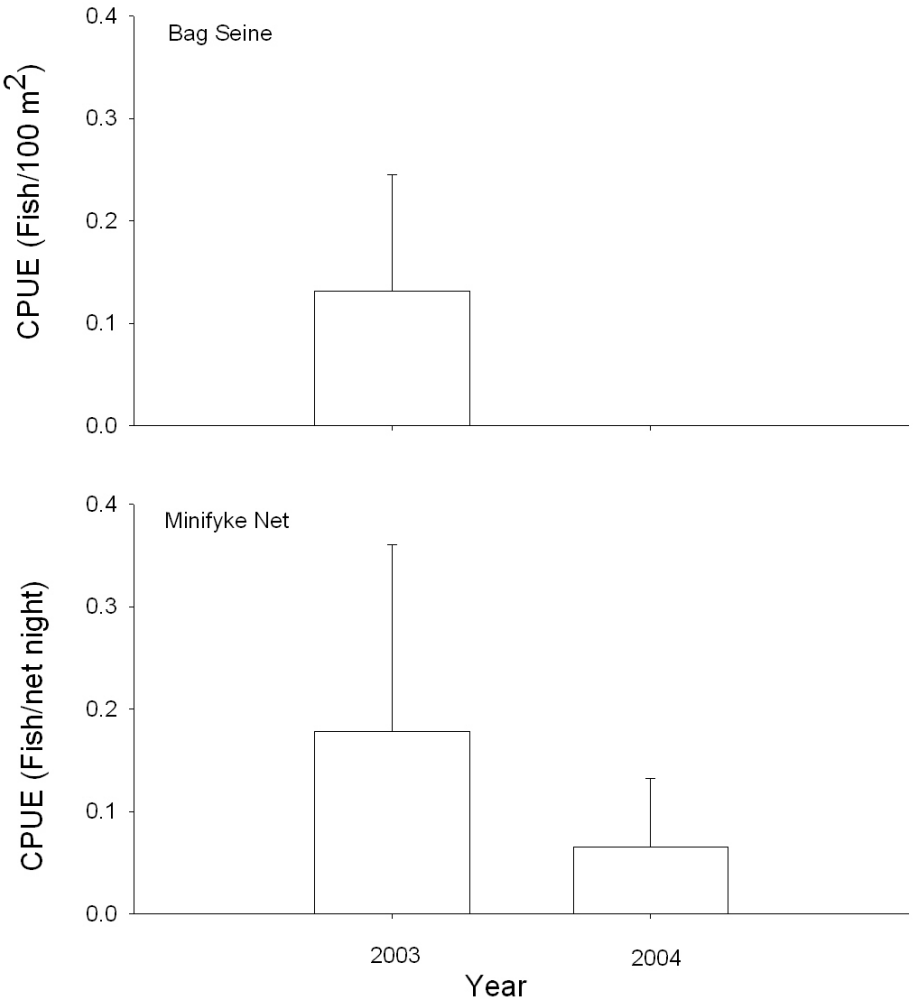

Figure 49. Mean annual catch-per-unit-effort (+/- 2 SE) of *Hybognathus* spp. in segment 13 of the Missouri River during fish community season 2004.

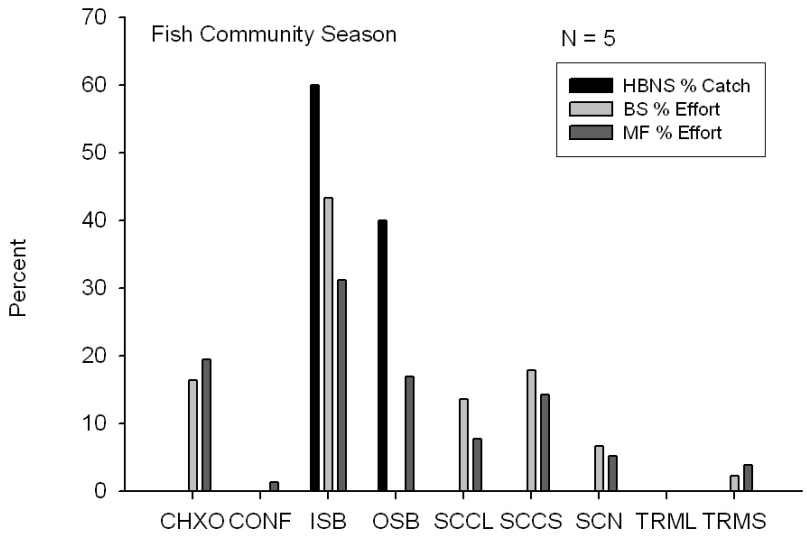

Figure 50. Percent of total *Hybognathus spp.* caught and effort expended by macrohabitat type in segment 13 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

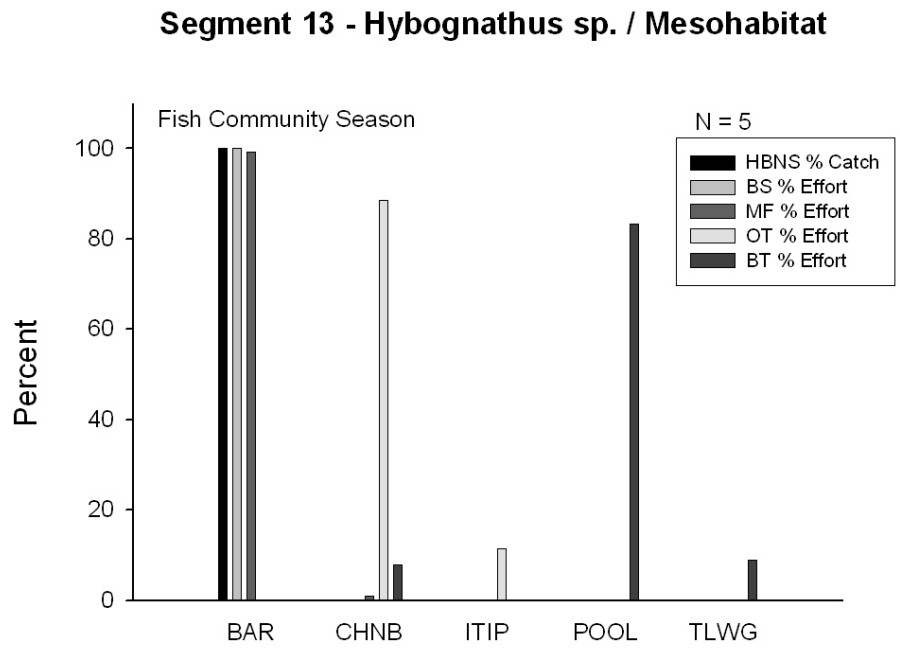

Figure 51. Percent of total *Hybognathus spp.* caught and effort expend by mesohabitat type in segment 13 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

Bigmouth Buffalo

Four bigmouth buffalo were captured in 2004 compared to ten in 2003 (Appendices G1 and G5). The fish were sampled during the sturgeon season mostly in hoop nets and ranged in length from 452mm to 603mm. The lack of fish at small size classes suggests recruitment is rarely occurring for this species in this segment of the river.

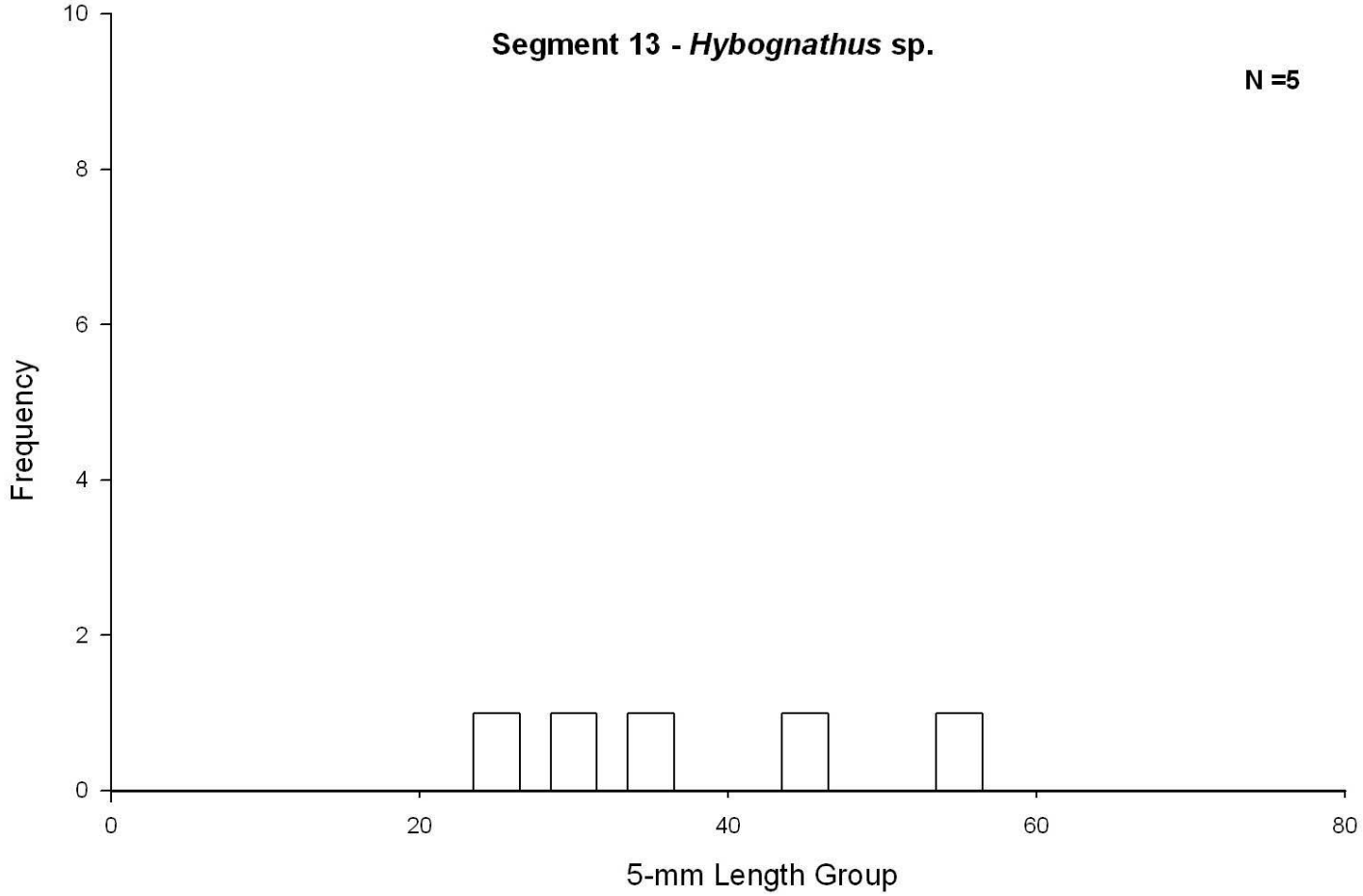

Figure 52. Length frequency of *Hybognathus spp.* caught in segment 13 of the Missouri River during fish community season 2004.

Segment 14

Pallid Sturgeon

Two presumed wild and three stocked pallids were captured with 704 deployments of sturgeon sampling gear. Most effort was deployed on ISB channel border habitats, except for gillnets when equal effort was proportioned to POOL Meso habitat (Table 9). Depths at capture for pallids were close to the average depths sampled in all Macro and Meso habitats (Table 10). Velocities of capture tended to be toward the lower and upper range of the average in ISB CHNB (0.17 vs 0.64m/s) and (0.80 vs 0.59m/s) in ITIP's. Two pallid recaptures had coded wire tags (Table 11). Based on their size of over 600mm, it would indicate they were from one of two stockings in segment 14 from 1994 or 1997. Based on additional captures of larger (>900mm) coded wire tagged fish in 2005, we speculate that these pallids were from the 1997 stocking (1997 year class) by Missouri Department of Conservation. This information illustrates that some of the 3,632 pallids stocked in the mid 1990's survived and remain in that segment (Appendix E). Only one of these fish have been detected in segment 13 (4 miles above segment 14) and similarly only one of the 20,968 fish stocked in segment 13 has been detected in segment 14 (caught at segment divide). It is well documented that adult pallids move long distances (Aaron Delonay/ USGS, personal communication), but this behavior may not be as prevalent in younger fish. Although movement has been observed in all stocked pallids, large-scale movement does not seem to be occurring. From a management perspective, this suggests that stocking sites should be changed to introduce hatchery fish to areas where they might encounter better resources necessary for survival. Relative Stock Densities show a disproportionate population with only the 1997 fish being of quality size (Table 12). The proportion of pallids to hybrids was 1 : 1.5 in 2003 and 1 : 4.5 in 2004 and the proportion of presumed wild pallids to shovelnose was 1:881 compared to segment 13 at 1:688 (Table 13). Contributions of presumed wild pallids bring the proportion to 1:352 which is a level reported almost 20 years before by Carlson et al (1985). Figure 1b illustrates the lack of pallids sampled in this segment compared to segment 13. The pallids captured in Segment 14 were at the farthest extremes of the segment: one at the mouth of the Osage and the others at the end of the segment near the mouth of the Mississippi.

Table 9. Segment 14: Number of bends sampled, mean effort per bend (as deployments of each gear type), and total gear deployments by Macro habitat and Meso habitat in the Missouri River during sturgeon season and fish community season in 2003 - 2004.

			Macro habitat									
Gear	Number of bends	Mean effort/bend	OSB	ISB	CHXO	SCCL	SCCS	SCN	TRML	TRMS	CONF	BRAD
Fall through Spring - Sturgeon Season												
Gillnet	10	20.6	25	47	14	7	2	0	3	0	6	0
Trammel net	11	18.0	0	52	17	13	2	0	1	0	4	0
Beam Trawl	2	7.6	3	4	3	0	0	0	0	0	0	0
Otter trawl	13	18.1	3	42	23	6	5	0	2	0	8	0
Hoop net	11	8.3	29	29	14	7	1	0	2	1	8	0
Summer – Fish Community Season												
Bag seine	10	11.9	2	29	2	3	8	6	0	0	0	0
Mini-fyke	10	6.6	13	23	6	4	14	4	0	2	0	0
Trammel net	10	16.2	1	52	17	2	8	0	0	0	0	0
Beam Trawl	10	12.7	35	21	20	5	0	0	0	0	0	0
Otter trawl	10	23.9	3	49	21	4	2	0	0	0	1	0
Hoop net	11	7.5	28	30	20	5	0	0	0	0	0	0

Table 9 (extended).

			Macro habitat			Meso habitat						Total
Gear	Number of bends	Mean effort/bend	DEND	DRNG		BAR	POOL	CHNB	TLWG	ITIP		deployments
Fall through Spring - Sturgeon Season												
Gillnet	10	20.6	0	0		0	62	33	0	5		104
Trammel net	11	18.0	0	0		0	0	80	0	9		89
Beam Trawl	2	7.6	0	0		0	9	1	0	0		10
Otter trawl	13	18.1	0	0		0	0	81	0	6		89
Hoop net	11	8.3	0	0		0	0	88	0	0		91
Summer – Fish Community Season												
Bag seine	10	11.9	0	0		50	0	0	0	0		50
Mini-fyke	10	6.6	0	0		66	0	0	0	0		66
Trammel net	10	16.2	0	0		0	0	71	0	9		80
Beam Trawl	10	12.7	0	0		0	74	4	0	0		78
Otter trawl	10	23.9	0	0		0	0	76	0	4		80
Hoop net	11	7.5	0	0		0	5	0	0	78		83

Table 10. Segment 14: Pallid sturgeon (PDSG) capture locations and habitat characteristics on the Missouri River during 2003-2004. Habitat definitions and codes presented in Appendix B.

	ISB			OSB		
	CHNB	**POOL**	**BARS**	**CHNB**	**POOL**	**BARS**
Depth (m) (Effort)	3.2 (1.1-6.8)	5.7 (1.8-10.2)	0.4 (0.2-2.5)	3.2 (.5-8.4)	5.6 (1.8-11.3)	0.6 (0.3-1.1)
Depth (m) (Catch)	3.3 (3.3)	5.4 (5.4)	No PDSG	No PDSG	No PDSG	No PDSG
Velocity (m/s) (Effort)	0.64 (0.05-1.03)	0.19 (0.02-0.47)	--	0.47 (0.16-1.0)	0.14 (0.02-0.32)	--
Velocity (m/s) (Catch)	0.17 (0.17)	0.24 (0.24)	No PDSG	No PDSG	No PDSG	No PDSG
Temp. °C (Effort)	20.3 (3-28)	14.9 (3-27)	20.7 (13-28)	19.4 (5-27)	17.2 (3-28)	19.1 (13-23)
Temp. °C (Catch)	25 (25)	4 (4)	No PDSG	No PDSG	No PDSG	No PDSG
Turbidity (ntu) (Effort)	225 (25-1000)	163 (28-1000)	82.7 (34-302)	148 (28-1000)	100 (28-1000)	64.1 (31-150)
Turbidity (ntu) (Catch)	640 (640)	107 (107)	No PDSG	No PDSG	No PDSG	No PDSG
Total Pallids caught	1	1	0	0	0	0

	CHXO			SCCS	SCCL	
	CHNB	**POOL**	**BARS**	**ITIP**	**ITIP**	**CHNB**
Depth (m) (Effort)	3.6 (1-7.9)	5.9 (2.9-9.3)	0.5 (0.3-0.8)	3.2 (2.0-5.4)	3.2 (1.4-4.9)	2 (1.2-3.6)
Depth (m) (Catch)	No PDSG	No PDSG	No PDSG	No PDSG	3.9 (3.9)	No PDSG
Velocity (m/s) (Effort)	0.57 (0.05-1.11)	0.17 (0.02-0.55)	--	0.66 (0.46-0.84)	0.59 (0.31-0.99)	0.48 (0.05-0.64)
Velocity (m/s) (Catch)	No PDSG	No PDSG	No PDSG	No PDSG	0.80 (0.79-0.80)	No PDSG
Temp. °C (Effort)	20.9 (3-28)	17.3 (3-27)	21.1 (19-23)	17.8 (4-23)	17 (6-25)	16.8 (6-27)
Temp. °C (Catch)	No PDSG	No PDSG	No PDSG	No PDSG	14 (6-22)	No PDSG
Turbidity (ntu) (Effort)	252 (26-1000)	149 (21-1000)	65.8 (45-100)	51.4 (42-62)	263 (50-956)	219 (21-1000)
Turbidity (ntu) (Catch)	No PDSG	No PDSG	No PDSG	No PDSG	180 (180)	No PDSG
Total Pallids caught	0	0	0	0	2	0

Table 11. Segment 14: Pallid sturgeon recapture data including characteristic index, tags found, stocking locations, and hatchery information on the Missouri River during 2003-2004.

	Recapture data							Stocking Data				
ID #	FL (mm)	Wt (g)	CI	Status	Tags found[a]	Elastomer[c]	Marked in field?[d]	Year class	FL (mm)	Wt (g)	Site	Source
14-1013	657	1060	-1.5235	H	C		Yes					
14-1151	186			H	E		Yes					
14-1215	660	980	-1.7551	H	C		Yes					

[a] Tag types include: coded wire tag (C), dangler tag (D), elastomer tag (E), floy (F), jaw tag (J), passive induced transponder tag, i.e. PIT tag (P), and self piercing tag (S).
[b] Tag type in parentheses after number.
[c] 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).
[d] If fish marked in the field, tag number corresponds to new tag and the type is in parentheses next to the tag number.
[e] Hatchery sources: BOZ = Bozeman Fish Technology Center in MT, BYP = Blind Pony State Hatchery in MO, GAR = Garrison Dam National Fish Hatchery (NFH) in ND, GAV = Gavins Point Dam NFH in SD, MCY = Miles City State Fish Hatchery in MI, NAT = Natchitoches NFH in LA, NEO = Neosho NFH in MO, and PEC = Fort Peck Dam State Fish Hatchery in MT

Table 12. Segment 14: Relative stock density (RSD)[a] by a length category for wild and stocked pallid sturgeon in the Missouri River captured during 2003-2004. No pallid sturgeon were captured in segment 14 during fish community season. Length categories[b] determined using the methods proposed by Gablehouse (1984).

Length Category	Wild		Stocked	
	N	RSD	N	RSD
Sturgeon Season				
Sub-stock			1	
Stock	2			
Quality			2	100
Preferred				
Memorable				
Trophy				

RSD = number of fish = specified length ÷ number of fish = minimum stock length x 100.

[b] 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 %).

Table 13. Segment 14: 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 2003-2004 including non-random and wild samples.

Year	All Pallids:Shovelnose	Wild Pallids:Shovelnose	Wild Pallids:Hybrids	Stocked Pallids:Wild Pallids
2003	1 : 278	1 : 416	1 : 1.5	1 : 2
2004	1 : 341	1 : 854	1 : 4.5	1.5 : 1

Gear evaluation and habitat associations

Gears were equally as effective at sampling pallids in the sturgeon season (Figure 53), but no gears captured pallids in the community season (Figure 54). Only one sub-stock (<330mm) pallid was captured and it occurred in CONF habitat which was rarely sampled (Figure 55a). Despite a relatively large effort in POOL habitat with gillnets, no sub-stock fish were captured (Figure 55b). Two stock length (330-630mm) pallids were captured in ISB habitat only (Figure 55b). One was in POOL habitat and the other in CHNB habitat (Figure 56b). One quality size (>630mm) pallid was captured in SCCL ITIP habitat which was under-represented in sampling effort, suggesting it could be more important to the species than other more common habitats (Figures 55c and 56c). This is the second case of pallids using this habitat in 2004. Length frequencies of pallids in this reach show the lack of mature fish capable of spawning and under-represented contributions of hatchery fish from the Boonville location in Segment 13 (Figure 57).

Hybrids

Nine hybrids total were captured. Hybrids occurred more often than pallids in OSB and POOL habitats and occurred at about the average velocities and depths sampled (Tables 10 and 14).

Table 14. Segment 14: Hybrid sturgeon (SNPD) capture locations and habitat characteristics for segment 14 of the Missouri River during 2003-2004. Habitat definitions and codes presented in Appendix B.

	ISB			OSB		
	CHNB	**POOL**	**BARS**	**CHNB**	**POOL**	**BARS**
Depth (m) (Effort)	3.2 (1.1-6.8)	5.7 (1.8-10.2)	0.4 (0.2-2.5)	3.2 (.5-8.4)	5.6 (1.8-11.3)	0.6 (0.3-1.1)
Depth (m) (Catch)	2.8 (1.7-3.9)	5.7 (3.9-7.5)	No SNPD	2.4 (2.4)	6.9 (4.5-8.6)	No SNPD
Velocity (m/s) (Effort)	0.64 (0.05-1.03)	0.19 (0.02-0.47)	--	0.47 (0.16-1.0)	0.14 (0.02-0.32)	--
Velocity (m/s) (Catch)	0.6 (0.51-0.62)	0 (0-0.03)	No SNPD	--	0.1 (0.03-0.13)	No SNPD
Temp. °C (Effort)	20.3 (3-28)	14.9 (3-27)	20.7 (13-28)	19.4 (5-27)	17.2 (3-28)	19.1 (13-23)
Temp. °C (Catch)	16.0 (10.0-22.0)	7.5 (5.0-10.0)	No SNPD	10.0 (10.0)	6.3 (3.0-10.0)	No SNPD
Turbidity (ntu) (Effort)	225 (25-1000)	163 (28-1000)	82.7 (34-302)	148 (28-1000)	100 (28-1000)	64.1 (31-150)
Turbidity (ntu) (Catch)	86 (86)	85.5 (67-104)	No SNPD	132 (132)	130 (76-183)	No SNPD
Total Pallids caught	2	2	0	1	3	0

	CHXO			SCCS	SCCL	
	CHNB	**POOL**	**BARS**	**ITIP**	**ITIP**	**CHNB**
Depth (m) (Effort)	3.6 (1-7.9)	5.9 (2.9-9.3)	0.5 (0.3-0.8)	3.2 (2.0-5.4)	3.2 (1.4-4.9)	2 (1.2-3.6)
Depth (m) (Catch)	2.5 (2.5)	No SNPD	No SNPD	No SNPD	No SNPD	No SNPD
Velocity (m/s) (Effort)	0.57 (0.05-1.11)	0.17 (0.02-0.55)	--	0.66 (0.46-0.84)	0.59 (0.31-0.99)	0.48 (0.05-0.64)
Velocity (m/s) (Catch)	--	No SNPD	No SNPD	No SNPD	No SNPD	No SNPD
Temp. °C (Effort)	20.9 (3-28)	17.3 (3-27)	21.1 (19-23)	17.8 (4-23)	17 (6-25)	16.8 (6-27)
Temp. °C (Catch)	24.0 (24.0)	No SNPD	No SNPD	No SNPD	No SNPD	No SNPD
Turbidity (ntu) (Effort)	252 (26-1000)	149 (21-1000)	65.8 (45-100)	51.4 (42-62)	263 (50-956)	219 (21-1000)
Turbidity (ntu) (Catch)	600 (600)	No SNPD	No SNPD	No SNPD	No SNPD	No SNPD
Total Pallids caught	1	0	0	0	0	0

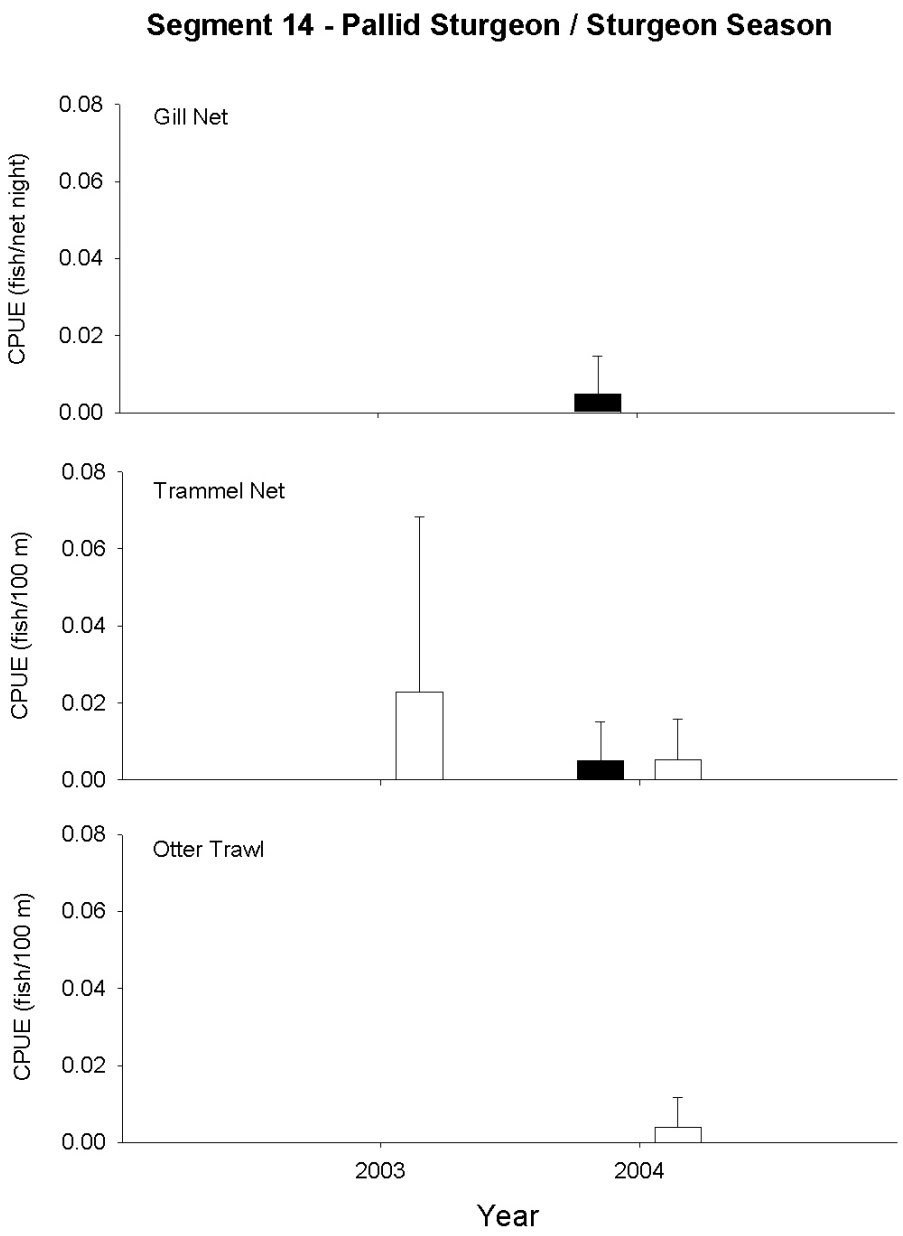

Figure 53. Mean annual catch-per-unit-effort (+/- 2SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 14 of the Missouri River during sturgeon season 2003 - 2004.

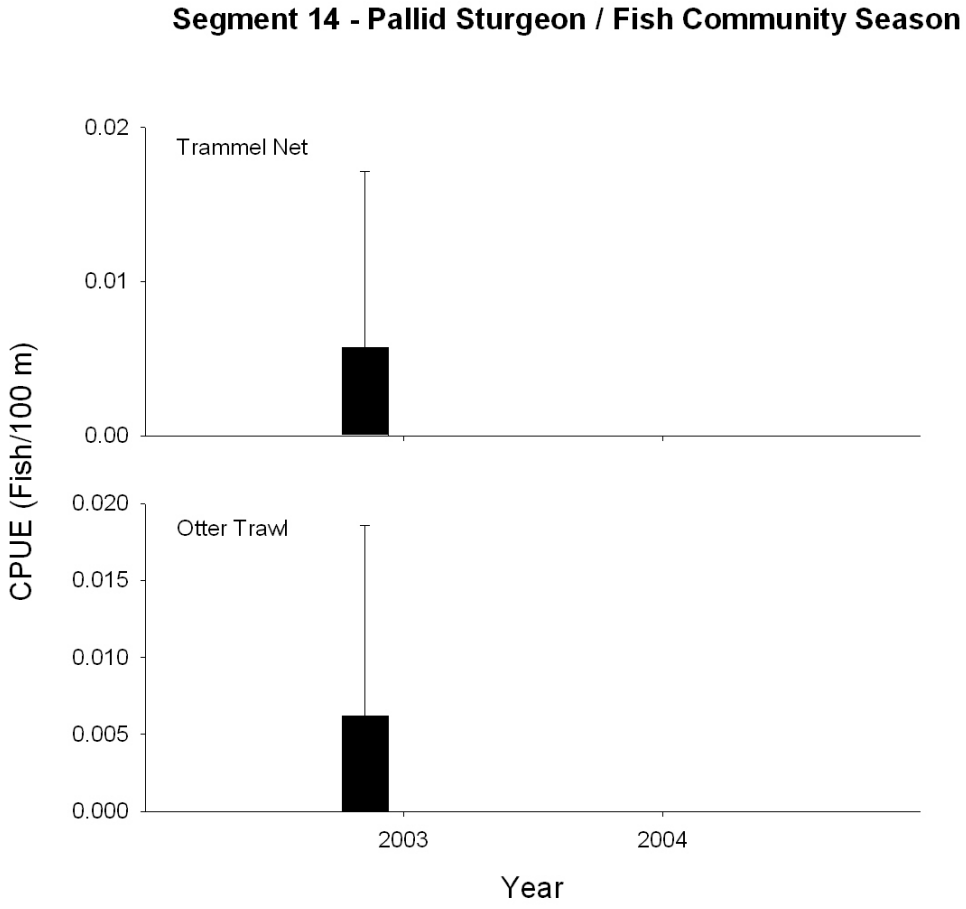

Figure 54. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars) and stocked (white bars) pallid sturgeon in segment 14 of the Missouri River during fish community season 2004.

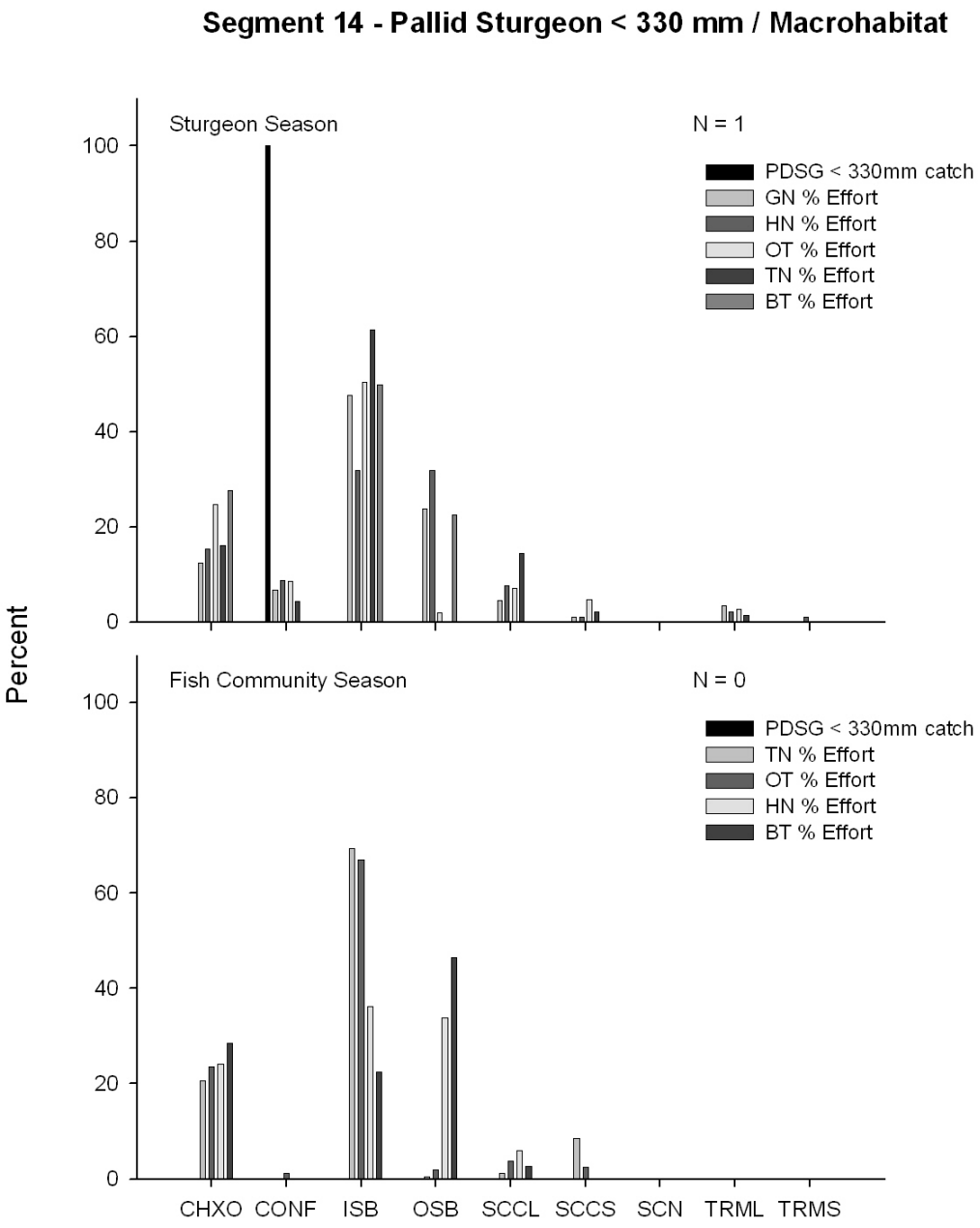

Figure 55a. Pallid sturgeon (less than 330 mm) percent caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

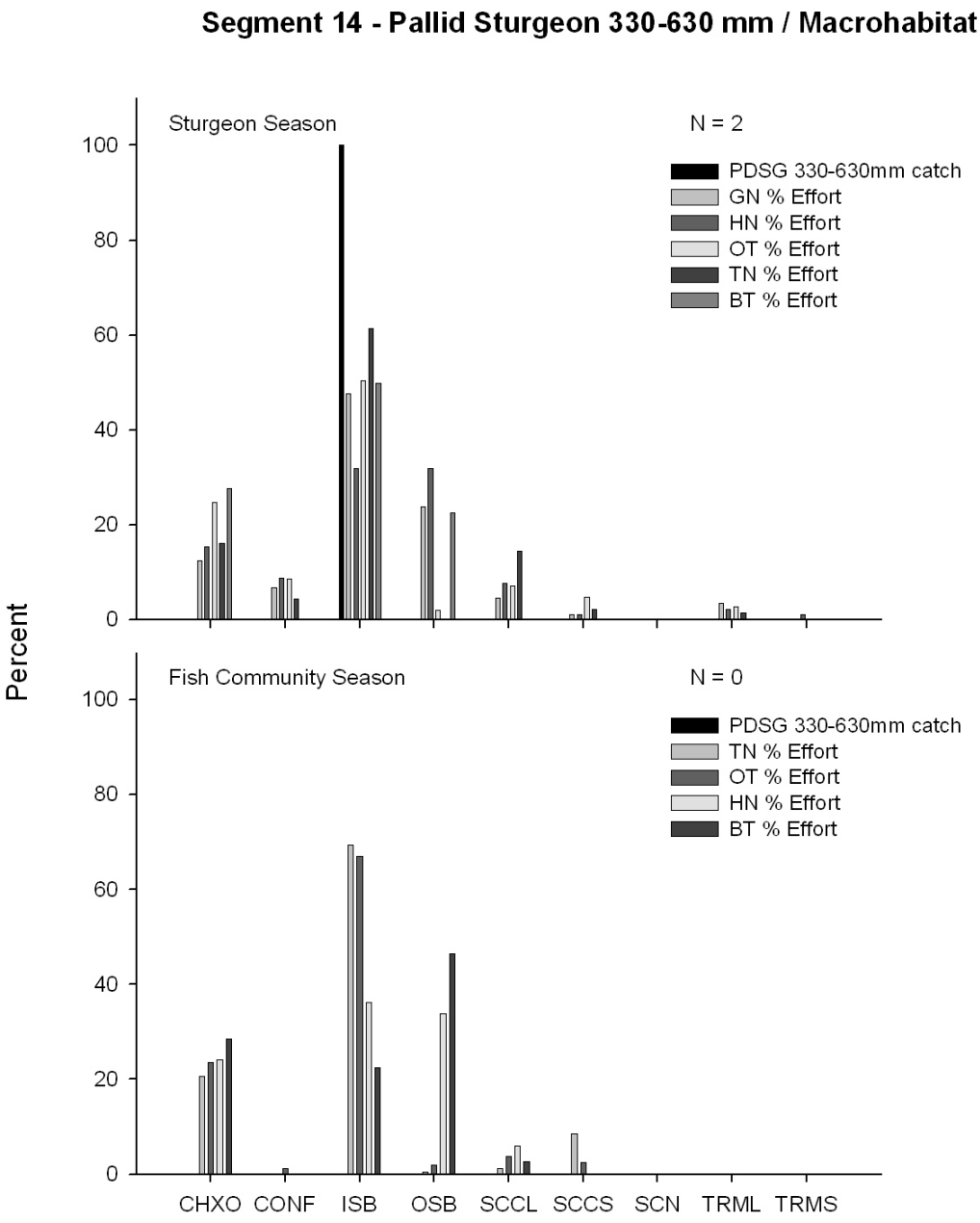

Figure 55b. Pallid sturgeon (330-630 mm) percent caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

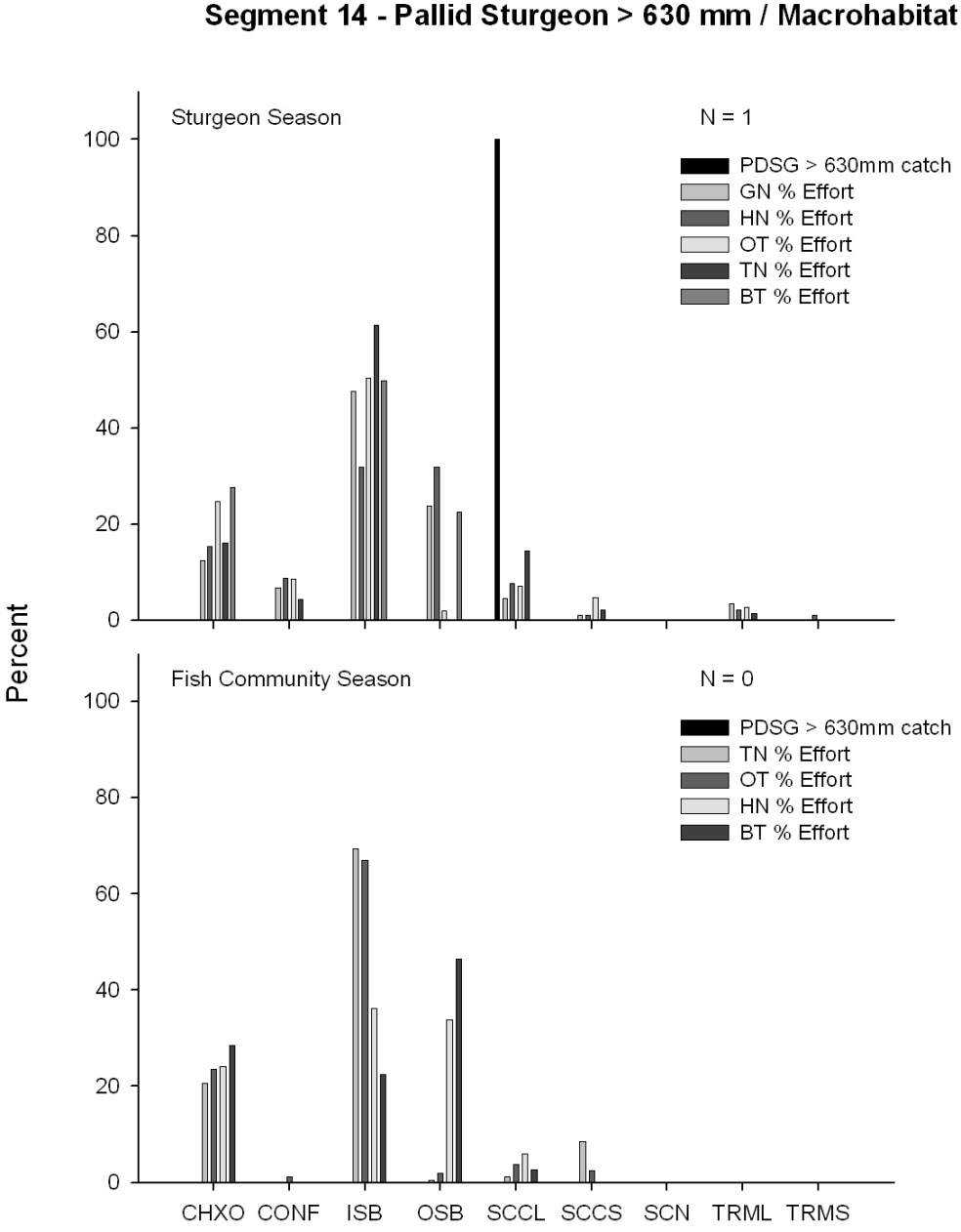

Figure 55c. Pallid sturgeon (greater than 630 mm) percent caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

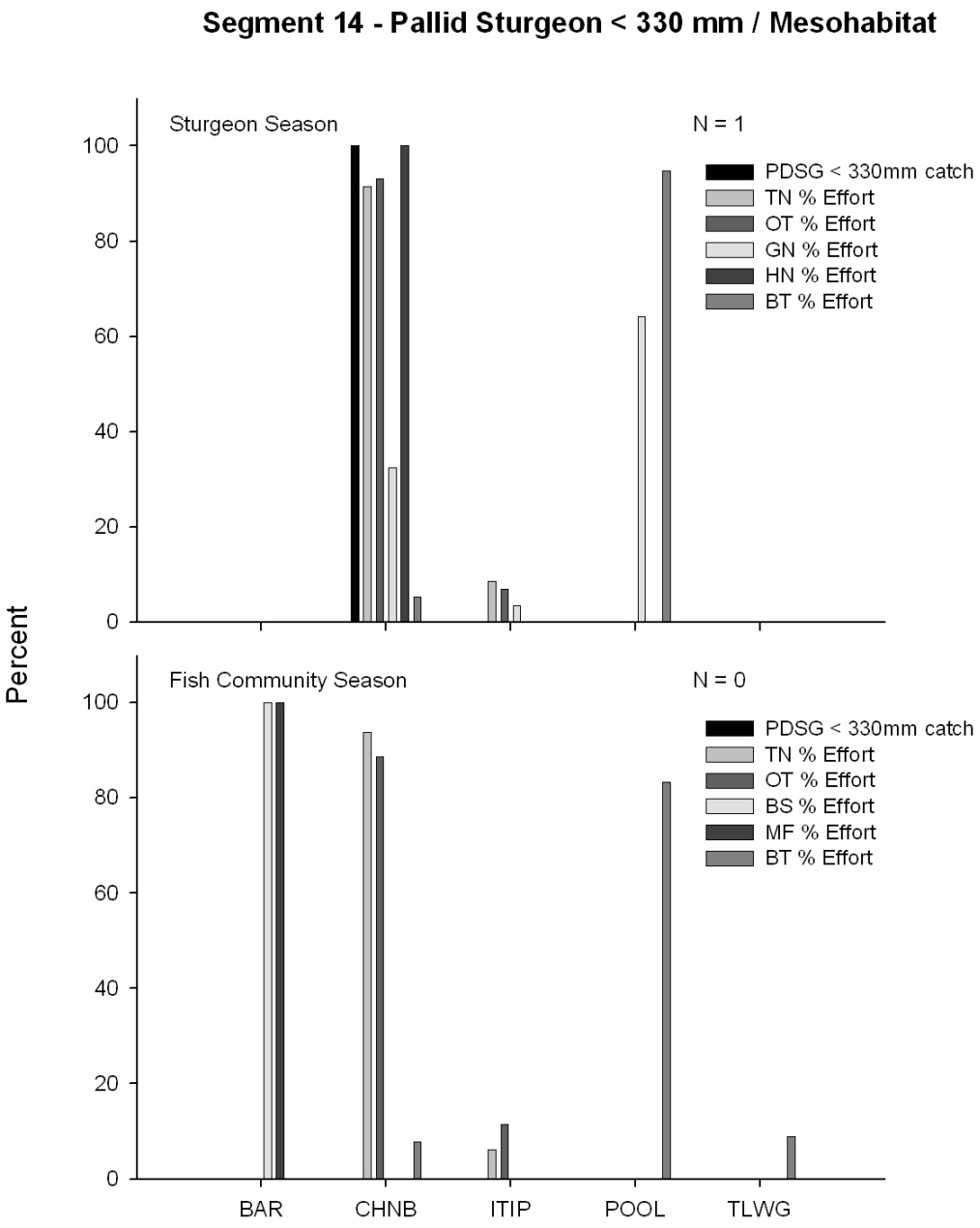

Figure 56a. Pallid sturgeon (less than 330mm) percent caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

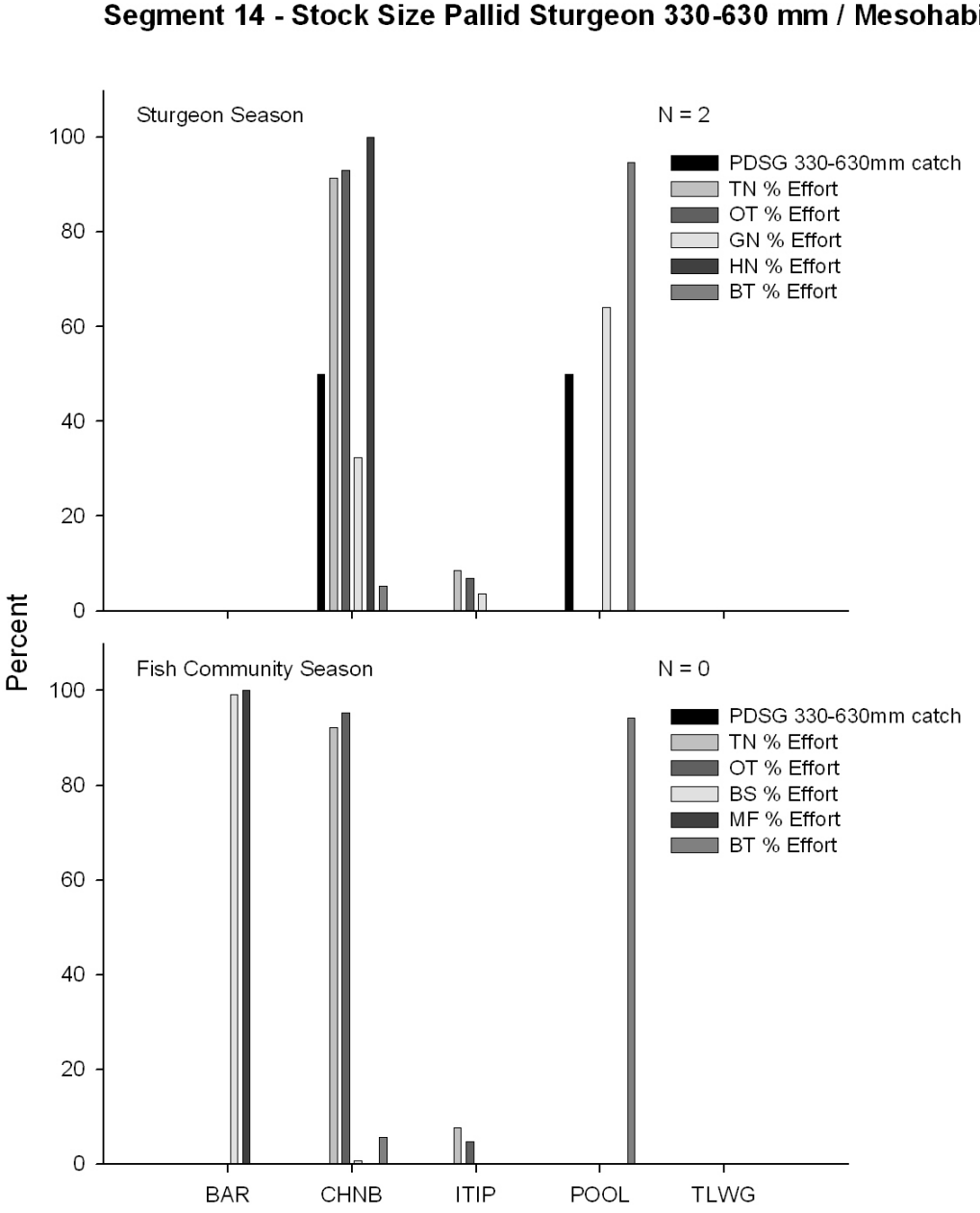

Figure 56b. Pallid sturgeon (330-630mm) percent caught and effort expended by mesohabitat type in segment 13 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

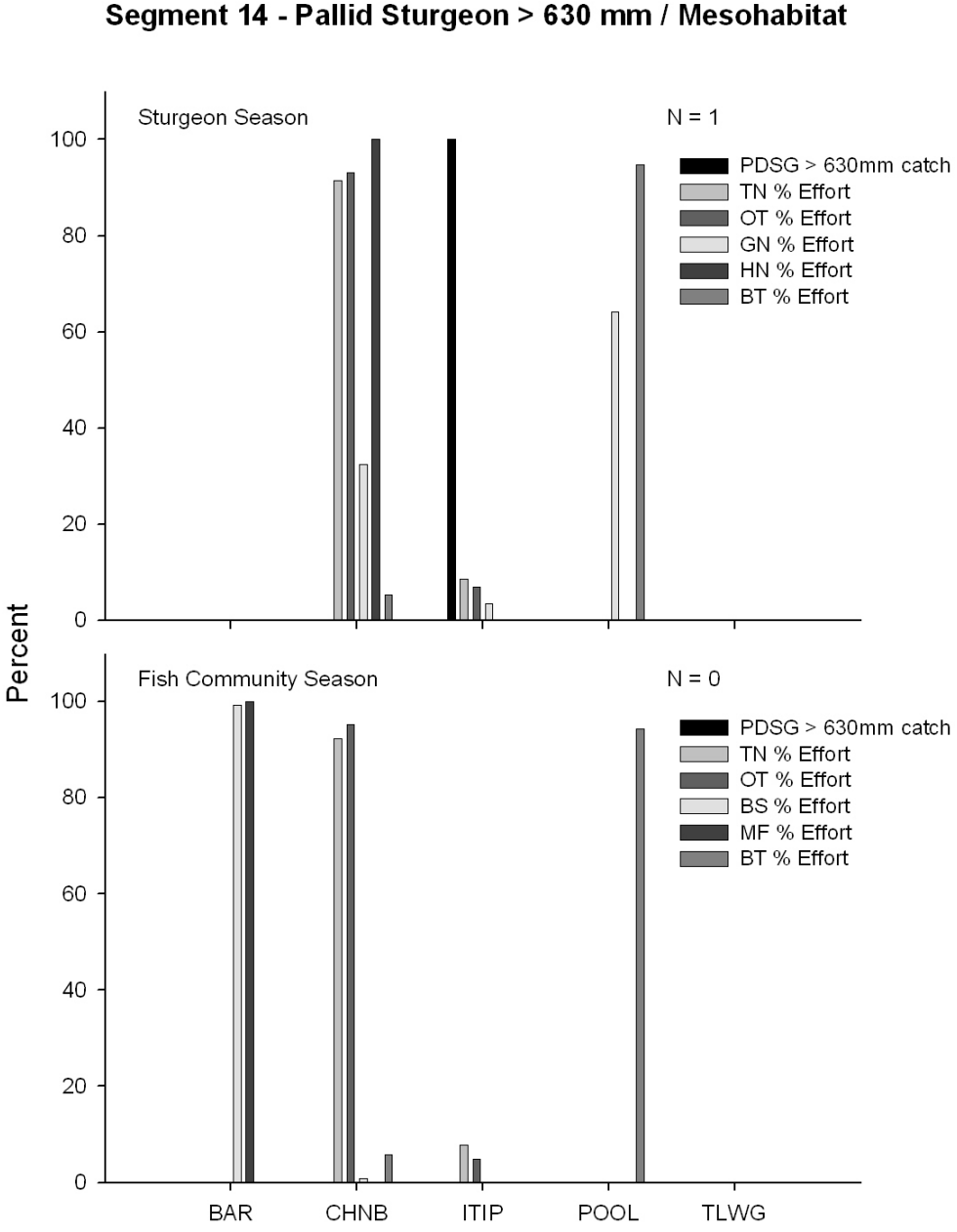

Figure 56c. Pallid sturgeon (greater than 630mm) percent caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

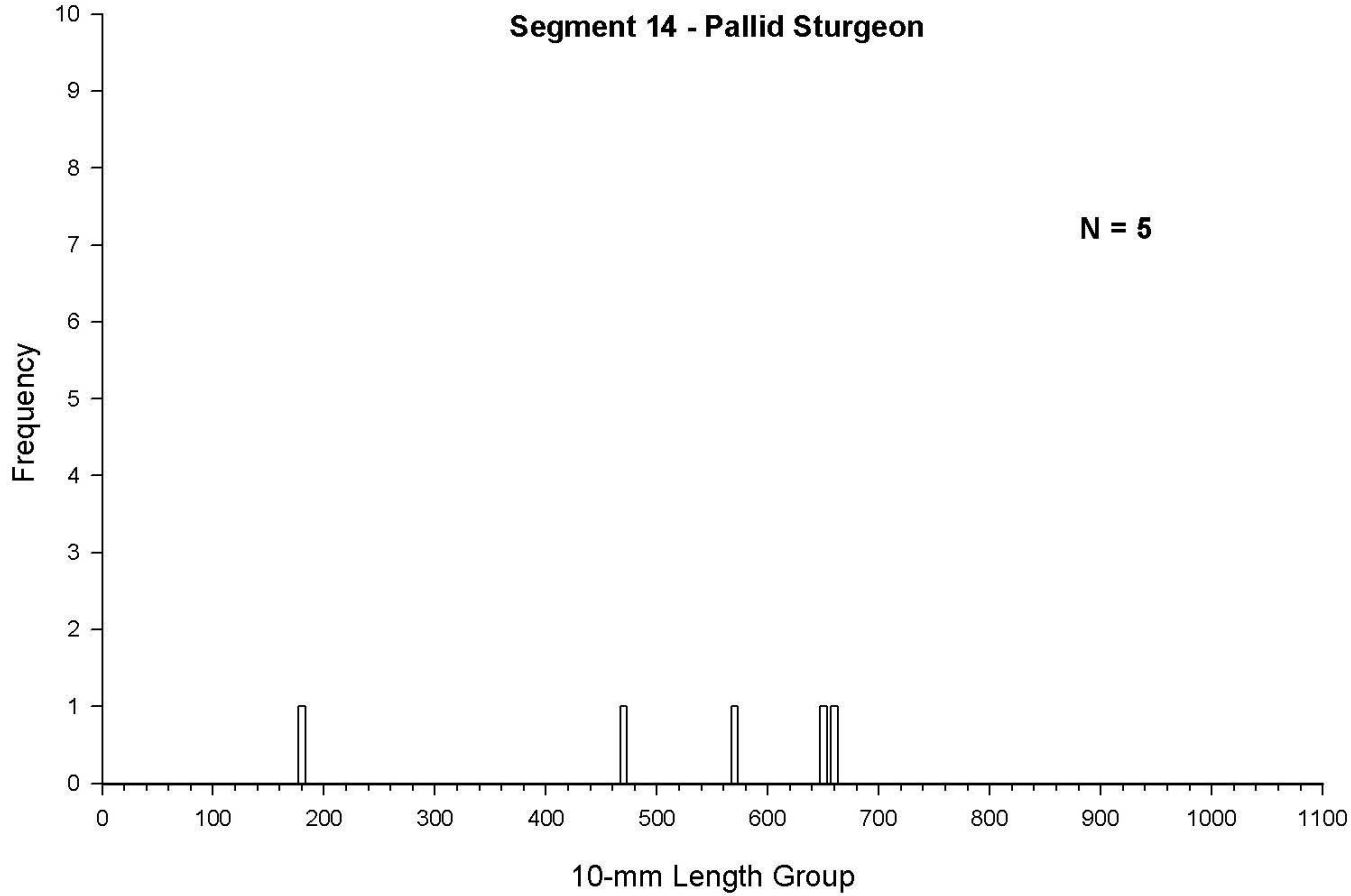

Figure 57. Length frequency of pallid sturgeon during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River 2003 - 2004. Includes random bends and wild samples.

Targeted Native River Species

Shovelnose Sturgeon

Year and gear comparisons

Catch per unit effort was lower in 2004 than in 2003 for both seasons (Figures 58-61). Gillnets were not used in 2003 in Segment 14, and were the most effective gear in 2004 catching 4.6 fish 100ft. of net. Trammel nets caught 1.4 and 1.3 fish in the two seasons respectively. Otter trawls caught 0.5 fish in both seasons. Hoop nets caught fish at a rate of 0.7 fish per net in the sturgeon season, but and in the community season, it took 20 nets to capture 1 fish (Appendices G5 and H4).

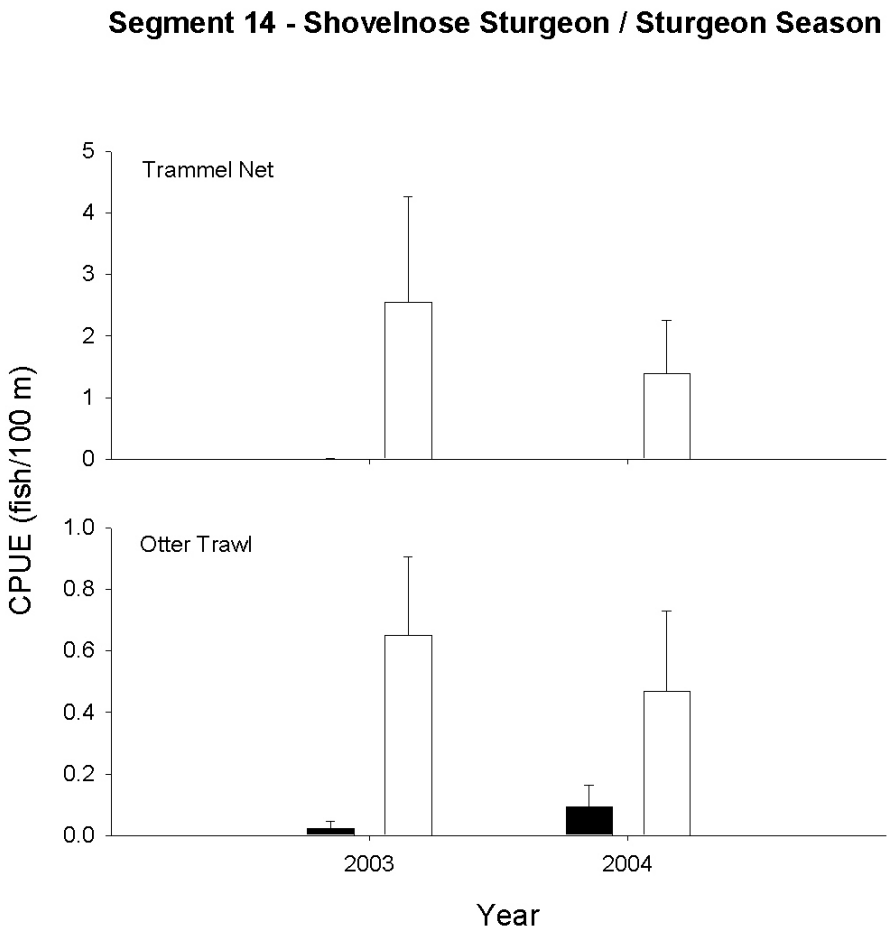

Figure 58. Mean annual catch-per-unit-effort (+/- 2SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 14 of the Missouri River during sturgeon season 2003 - 2004.

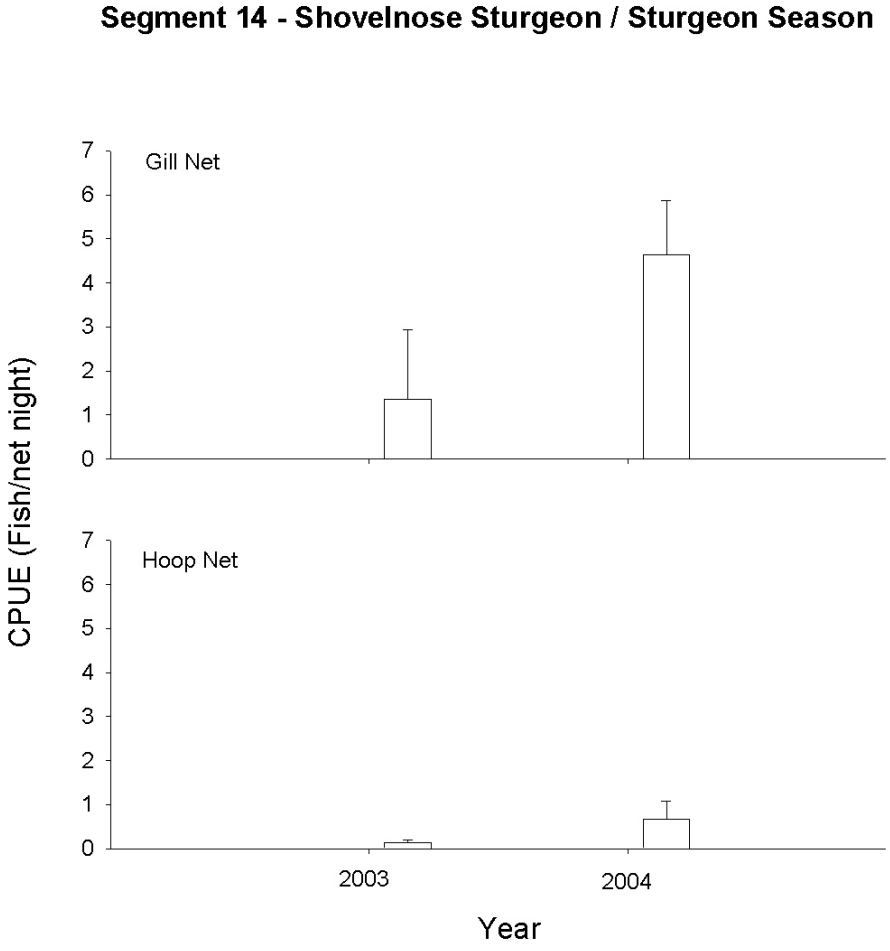

Figure 59. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 14 of the Missouri River during sturgeon season 2003 - 2004.

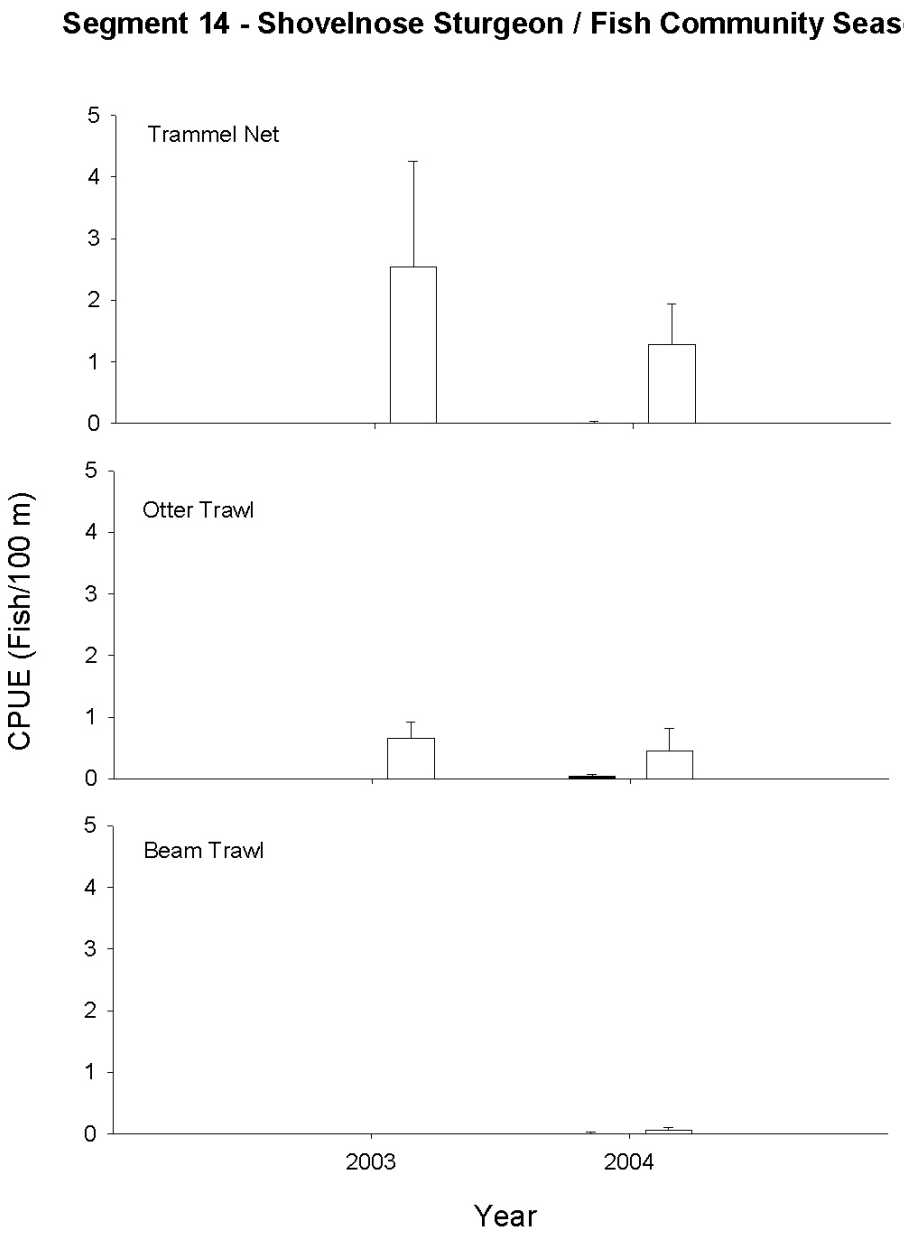

Figure 60. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 14 of the Missouri River during fish community season 2003 - 2004.

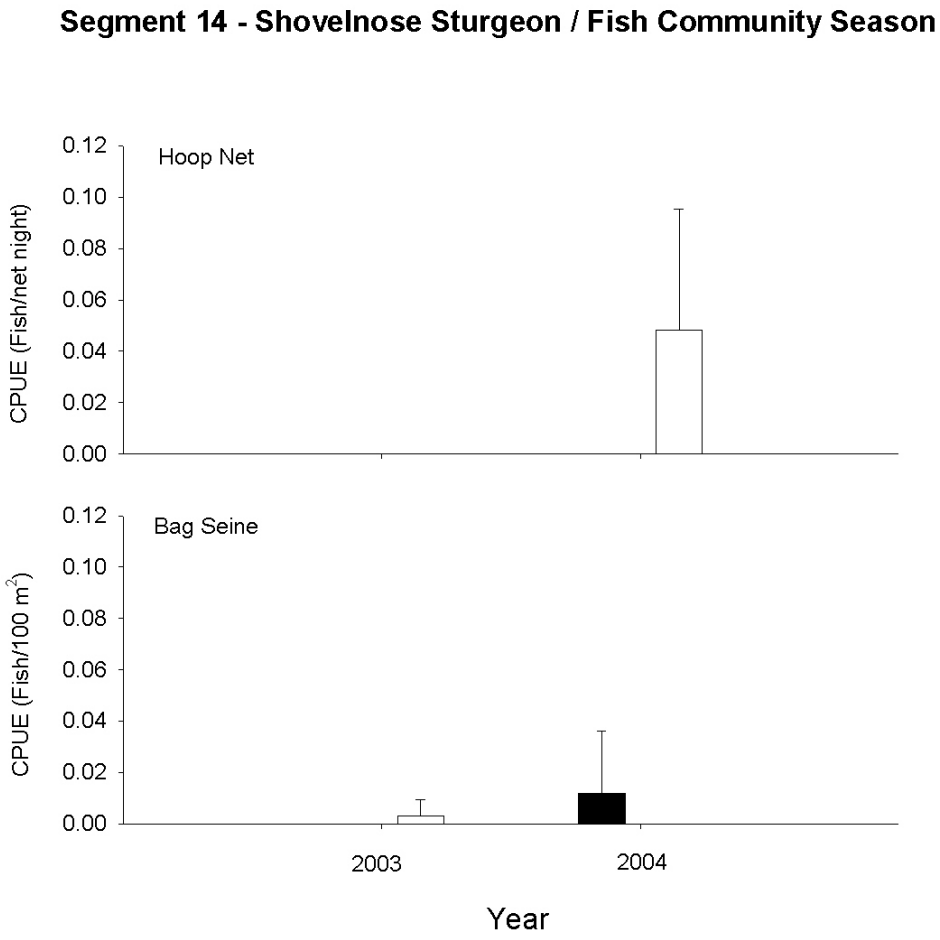

Figure 61. Mean annual catch-per-unit-effort (+/- 2 SE) of < 150 mm (black bars) and > 150 mm (white bars) shovelnose sturgeon in segment 14 of the Missouri River during fish community season 2003 - 2004.

Young of year (YOY) sturgeon were caught more frequently in the sturgeon season (N=15) than in the community season (N=9). Catch was higher in confluence and crossover Macro habitats followed by ISB (Figure 62a). During the community season, YOY were sampled at a much higher rate in side channels than any other habitat, but crossovers and inside bends were still productive areas (Figure 63a). YOY sturgeon were only found in CHNB habitat despite efforts being expended in POOL and BARS (community season only). The lack of small sturgeon found suggests few fish were in the system, more fish should have been available in the community season versus the sturgeon season and this was not the case. More trawling effort in CHNB habitat in side channels and crossover areas would be likely to produce YOY sturgeon.

There were 1,703 total shovelnose captured in all gears. For all size classes of sturgeon, crossover areas were almost always the most productive areas. The exception was for trawls in the spring which had higher rates of capture in confluence (1.85 vs 0.28) and OSB (1.86 vs 0.28) habitats and for hoop nets in the spring which caught more fish in tributary mouths than crossovers (1.50 vs. 1.14) (Figure 62b and Appendix G3-G5). With regard to gillnet captures, shovelnose occurred more often in POOL habitat except in CONF when catches were higher in channel borders compared to other Macro CHNB habitat. The highest capture rates within POOL habitat was in CHXO (8.96) and OSB (6.13) (Figure 65 and Appendix G1). More fish were caught with trammel nets in the sturgeon season at island tip Meso habitat than any other (3.20), this catch twice exceeded the average TN catch of 1.39 fish/100m^2. During the community season island tip catches were lower than in other habitat types. Over one fish per hoop net night was captured in OSB and CHXO channel border habitats during the sturgeon season. It in the community season, it took 20 nets to catch a sturgeon in the same habitats. Seventy beam trawls were pulled in POOL habitat in the community season and caught seven sturgeon; suggesting this Meso habitat isn't as important in this season or that the gear is ineffective at sampling large sturgeon. Figure 64 illustrates length frequencies of shovelnose whereby, age 1 fish can be detected at 140mm and beyond 180mm. The size distribution is typical of long-lived species and depicts minor contribution of smaller fish to the population (Figure 64). There was a greater proportion of larger fish captured during the sturgeon season (RSD-P = 86 and RSD-M = 19) than in the community season (RSD-P = 66 and RSD-M = 11) (Table 15). Reasons for this disparity may be that spawning shovelnose were more available in the sturgeon season, or that trawls and trammel nets are not as effective at sampling the larger size classes compared to gillnets that represented the trophy size. Only 38 fish were captured in

the sub-stock range in both seasons and no fish captured in the trophy range. There were seasonal differences in habitats used. Confluences, tributary mouths, island tips and OSB channel borders were occupied by sturgeon more frequently in the spring vs. the summer and channel crossovers and inside bends were occupied more often later in the year. These seasonal differences may help sampling efforts and provide insight into spawning locations for shovelnose and possibly pallid sturgeon.

Table 15. Segment 14: Relative stock density (RSD)[a] by a length category for shovelnose sturgeon in the Missouri River captured during 2004. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD
Sturgeon season		
Substock	12	
Stock	1433	
Quality	1387	97
Preferred	1230	86
Memorable	276	19
Trophy	0	
Fish Community season		
Substock	16	
Stock	299	
Quality	269	89
Preferred	199	66
Memorable	33	11
Trophy	0	

[a] RSD = number of fish = specified length ÷ number of fish = minimum stock length x 100.
[b] 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 %).

Segment 14 - YOY Shovelnose Sturgeon / Macrohabitat

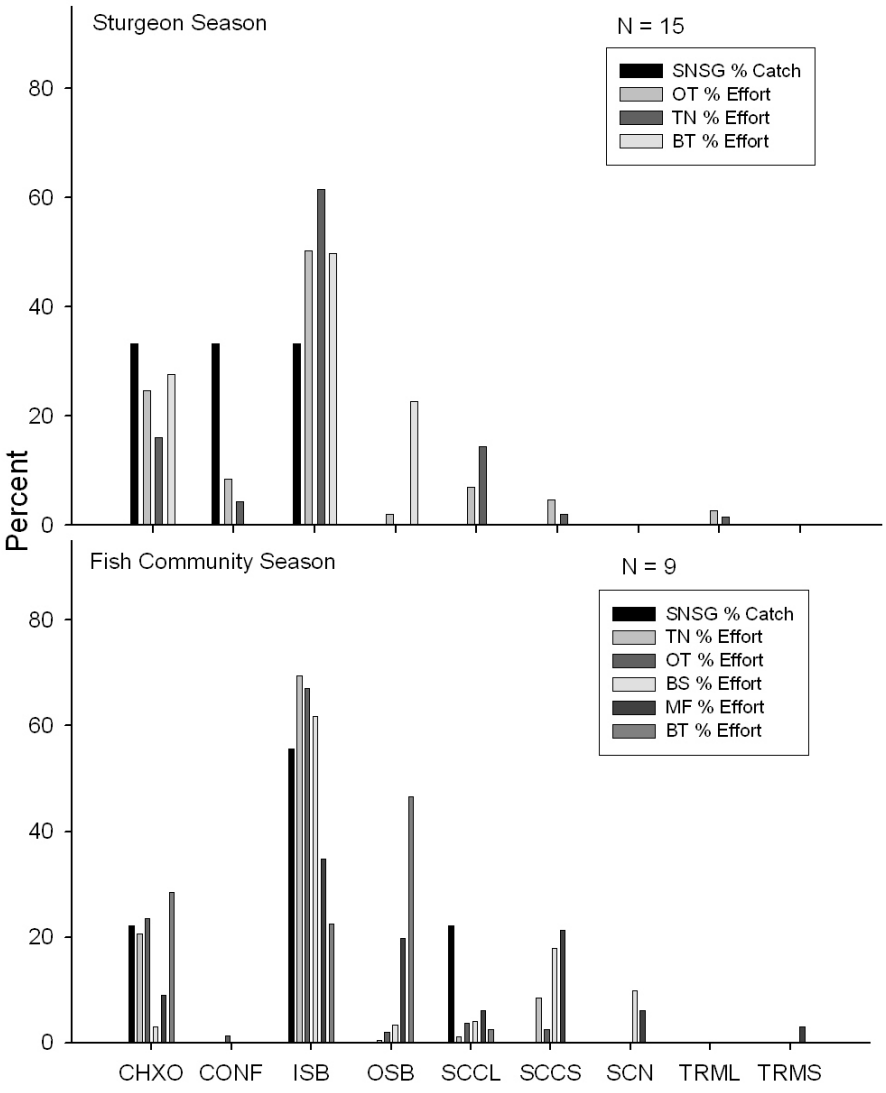

Figure 62a. Percent of total YOY shovelnose sturgeon (<150mm) caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

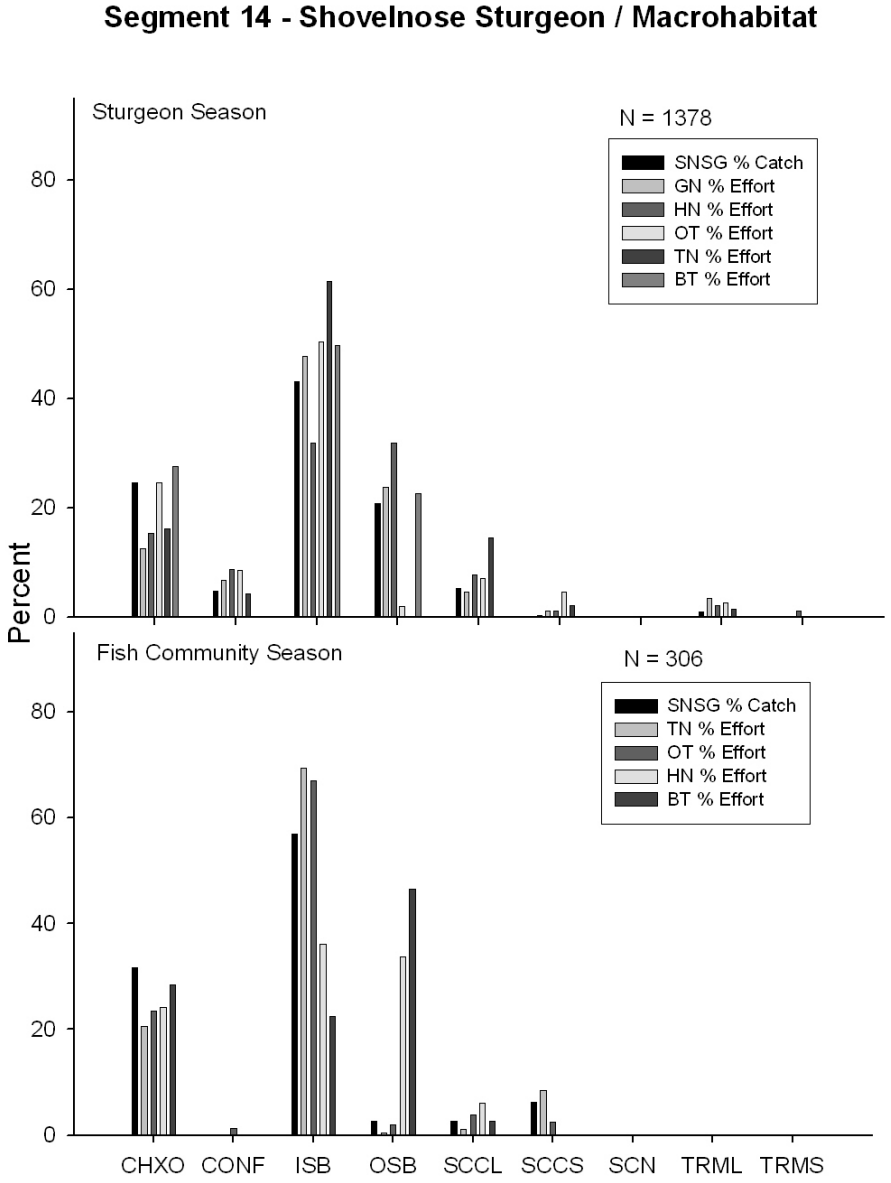

Figure 62b. Percent of total shovelnose sturgeon caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

Segment 14 - YOY Shovelnose Sturgeon / Mesohabitat

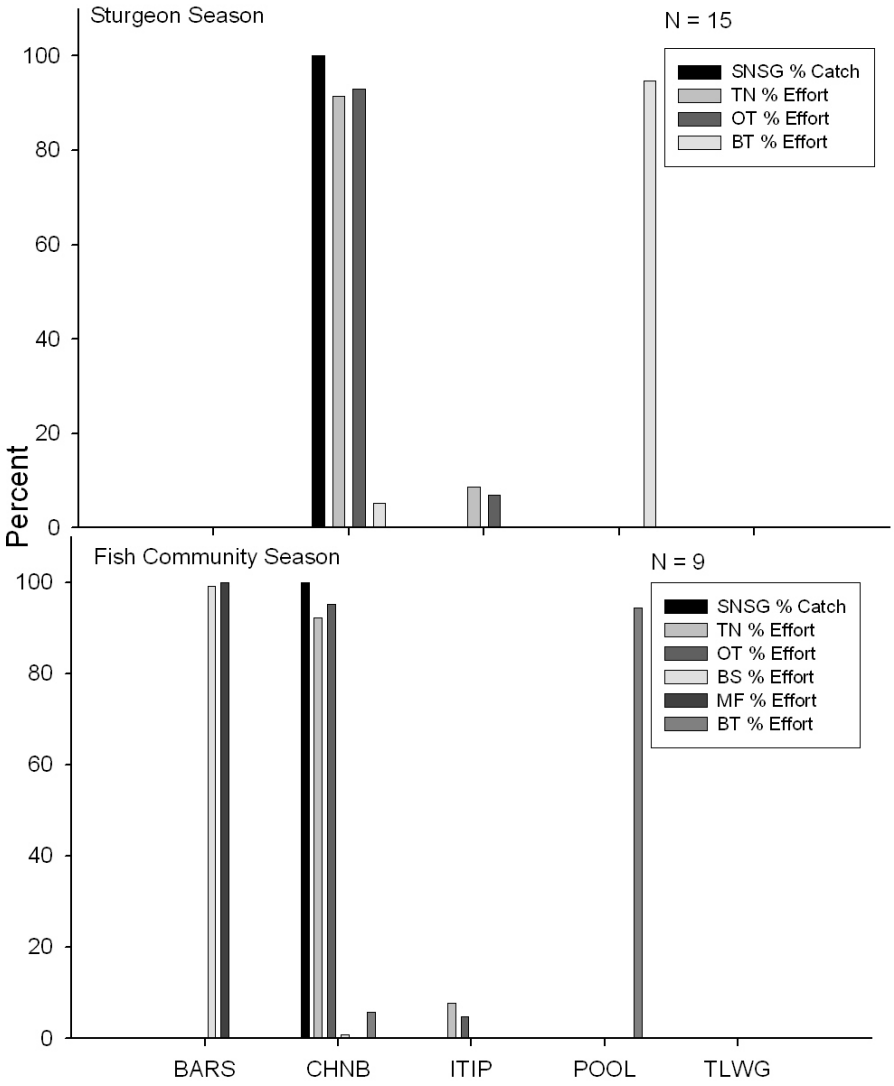

Figure 63a. Percent of total YOY shovelnose sturgeon (< 150mm) caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

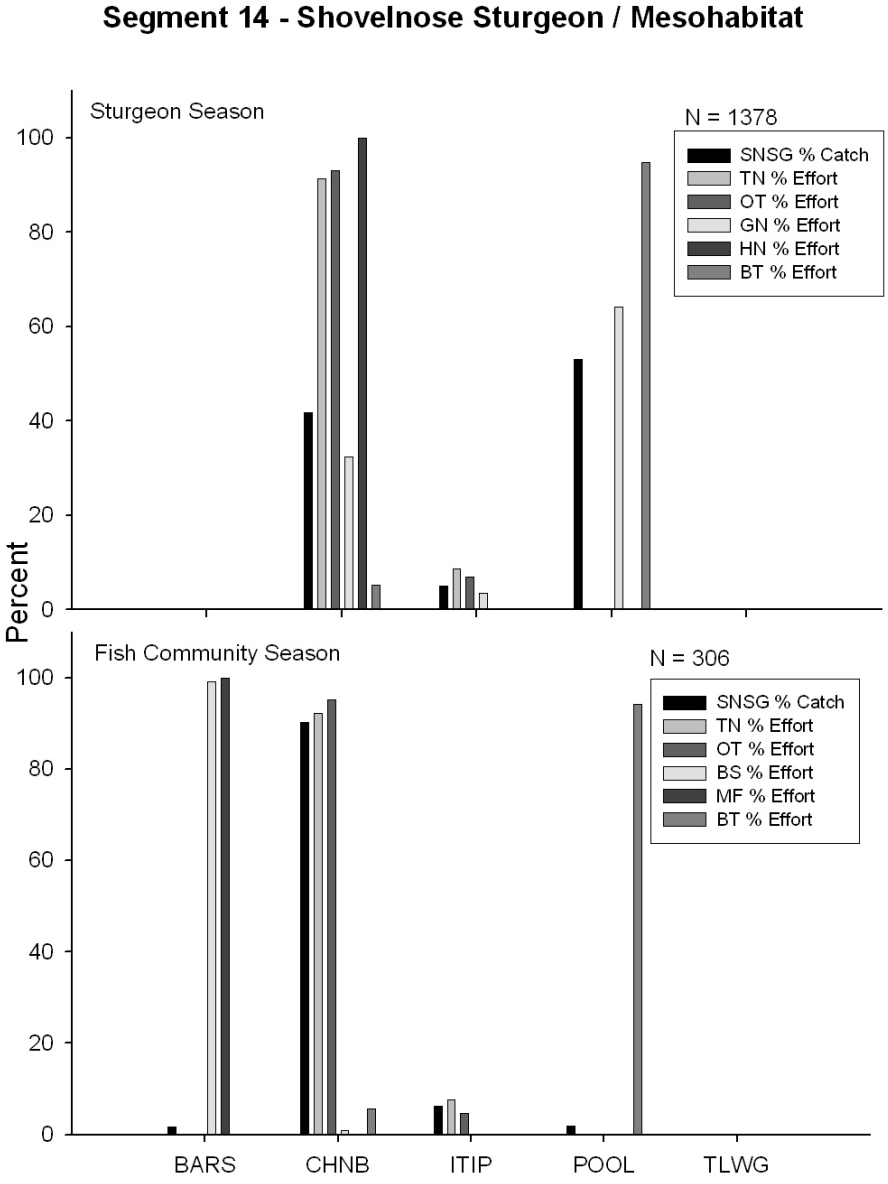

Figure 63b. Percent of total shovelnose sturgeon caught (> 150mm) and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

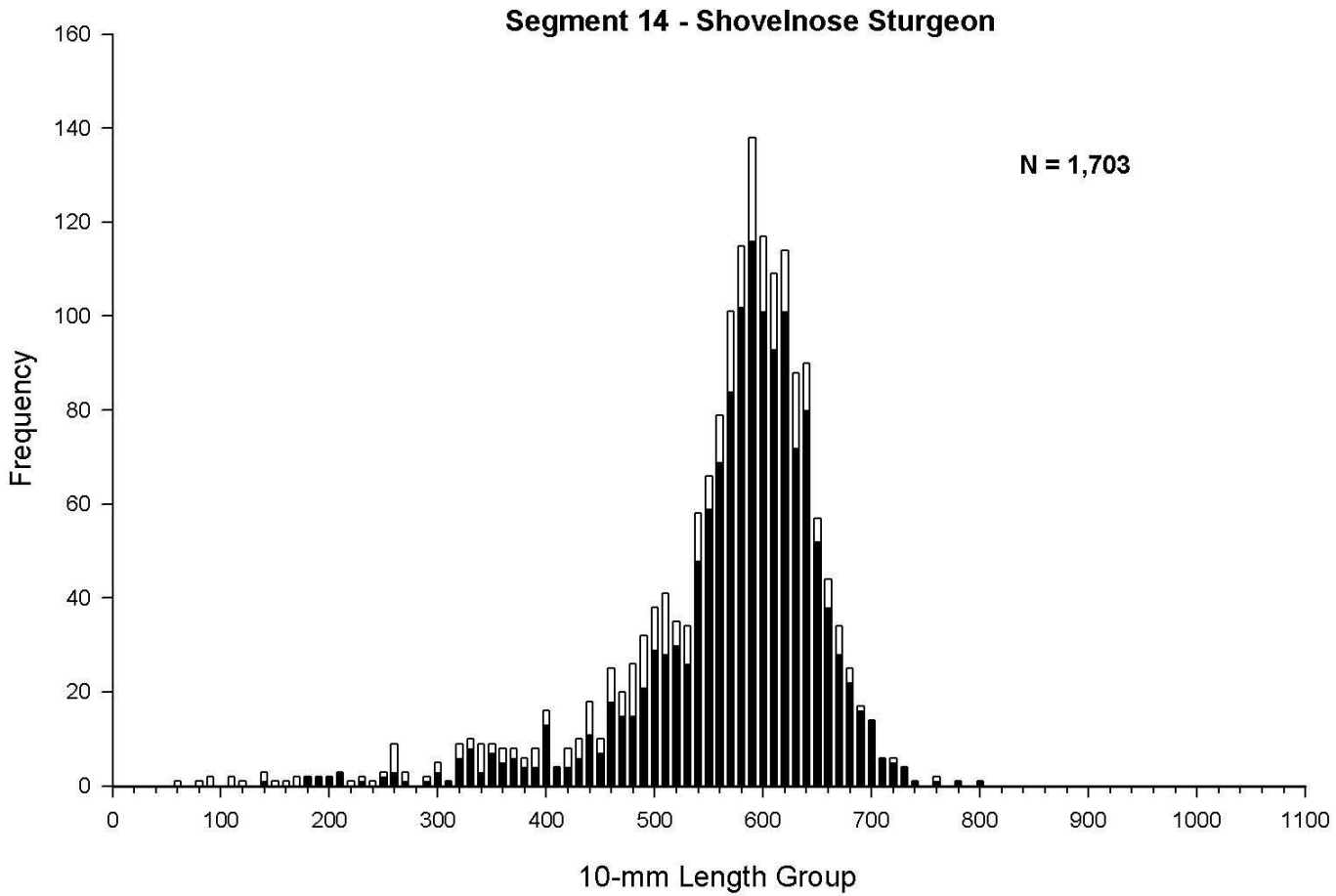

Figure 64. Length frequency of shovelnose sturgeon during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River 2003 - 2004.

Sturgeon Chubs

More sturgeon chubs were collected in 2004 than in 2003 (Figures 65 and 66). Only trawls captured these fish and otter trawls were most effective, however only 19 fish (4 in sturgeon and 15 in community) were collected in all. Fish were most frequently captured in side channel, crossovers and ISB habitats (Figure 67). Despite 116 seine and mini-fyke samples on BARS, no sturgeon chubs were found. CPUE was higher on island tips followed by CHNB habitat (Figure 68). Islands are less frequently sampled and less abundant in the river than other habitats and may be an important habitat for this species. Length frequencies reported in Figure 69 illustrate that sturgeon chub were distributed throughout their potential size range with the largest size (84mm) at the maximum ever reported (Pflieger 1975).

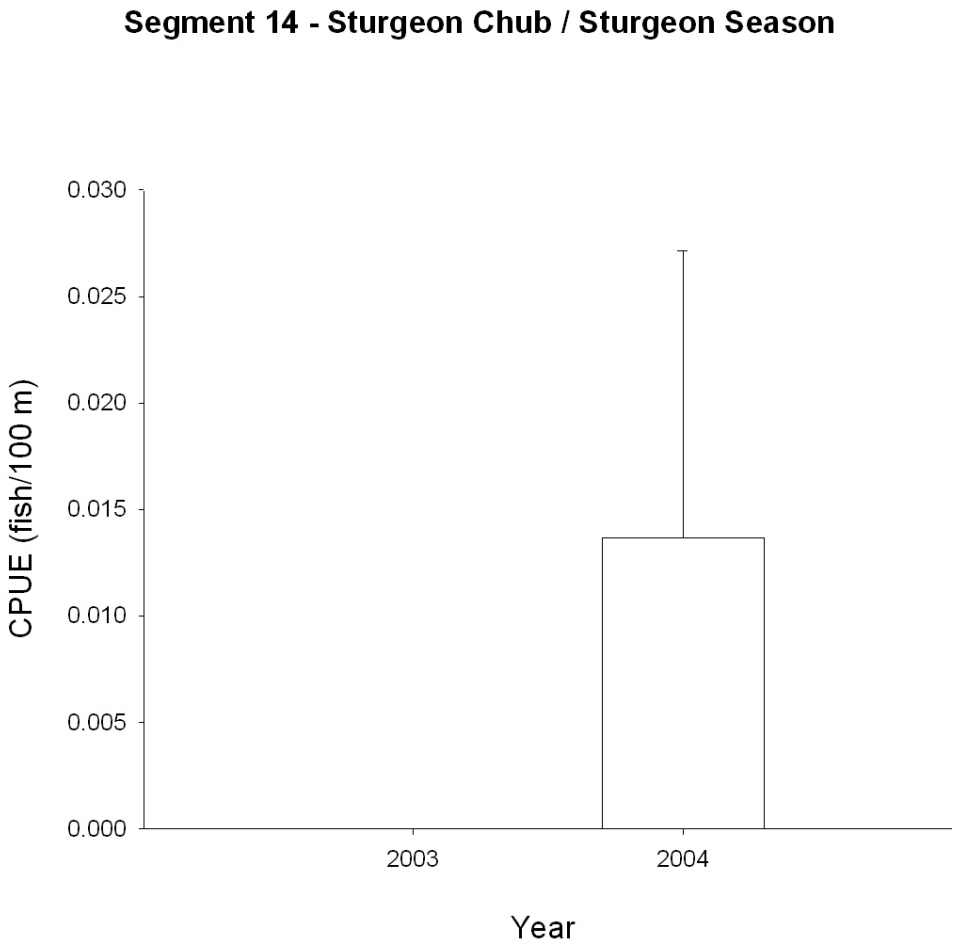

Figure 65. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chubs in segment 14 of the Missouri River for otter trawls during sturgeon season 2004.

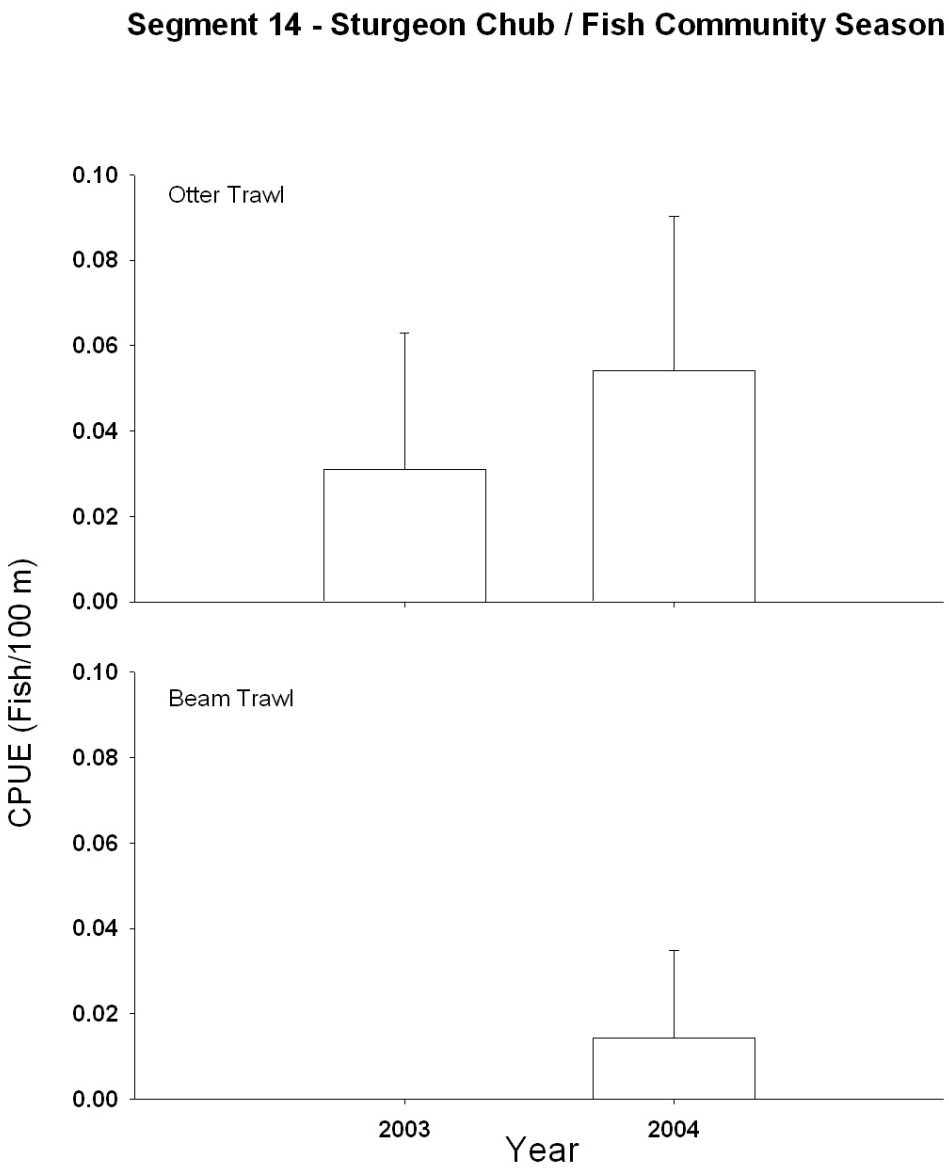

Figure 66. Mean annual catch-per-unit-effort (+/- 2 SE) of sturgeon chubs in segment 14 of the Missouri River during fish community season 2004.

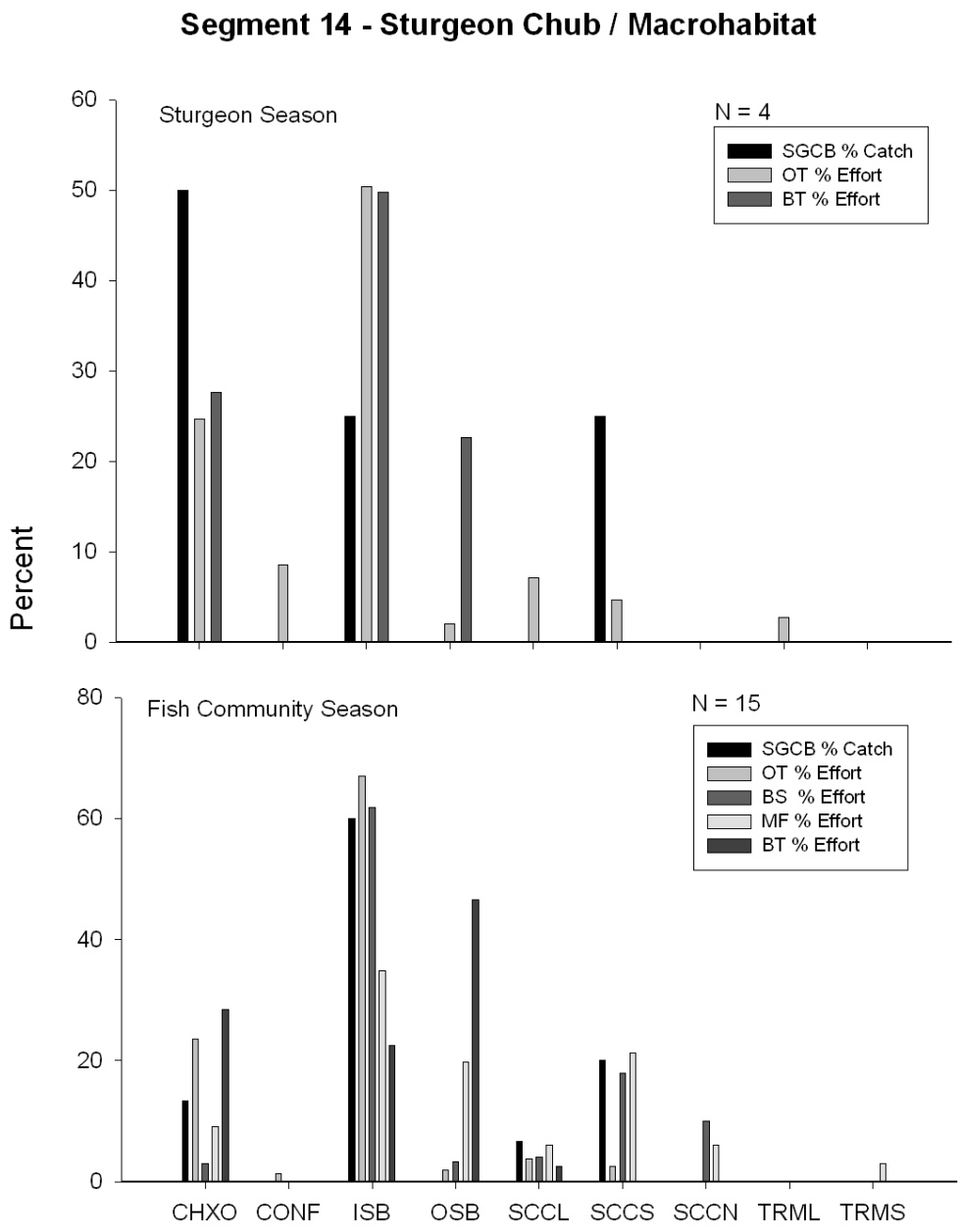

Figure 67. Percent of total sturgeon chubs caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

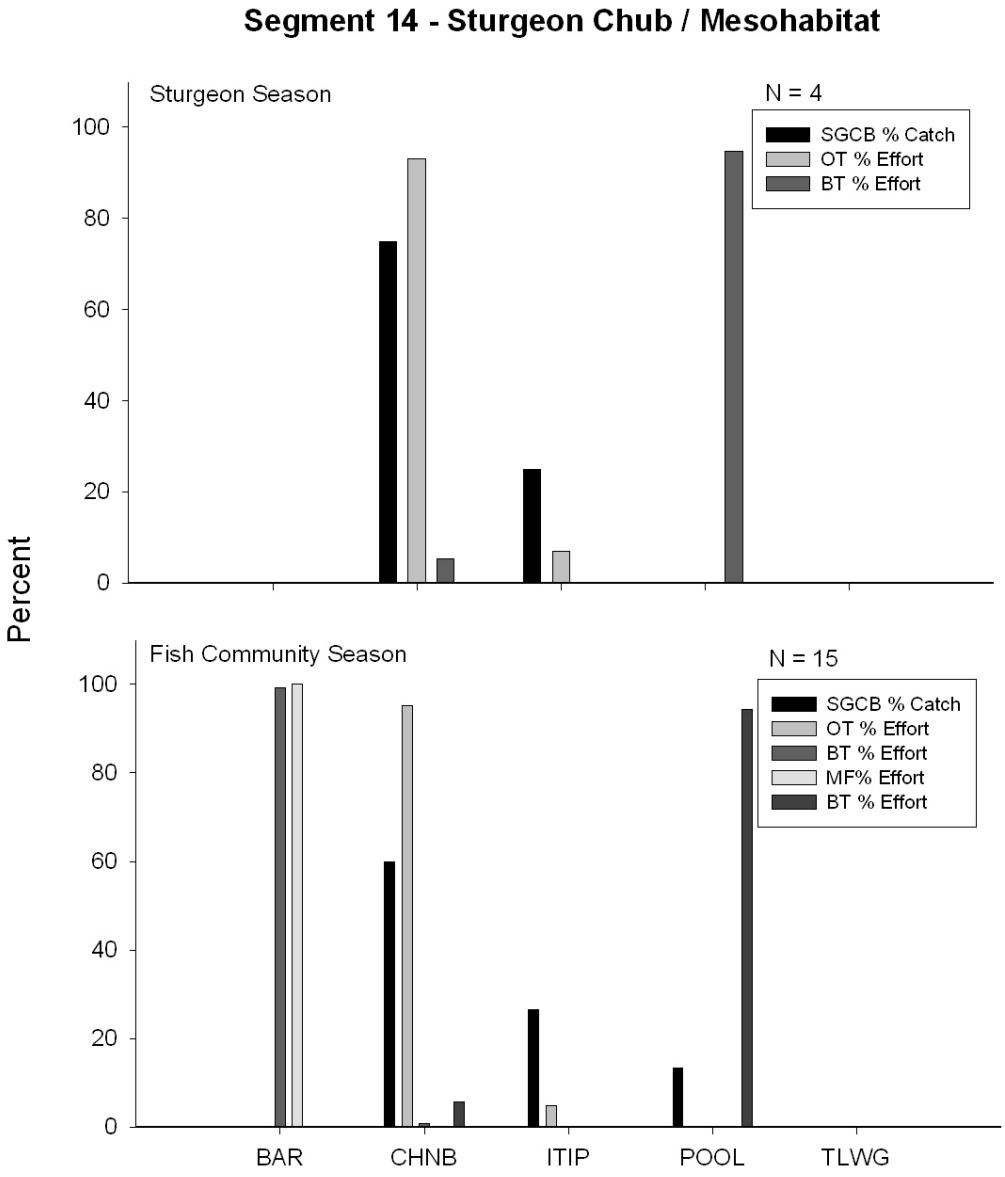

Figure 68. Percent of total sturgeon chubs caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

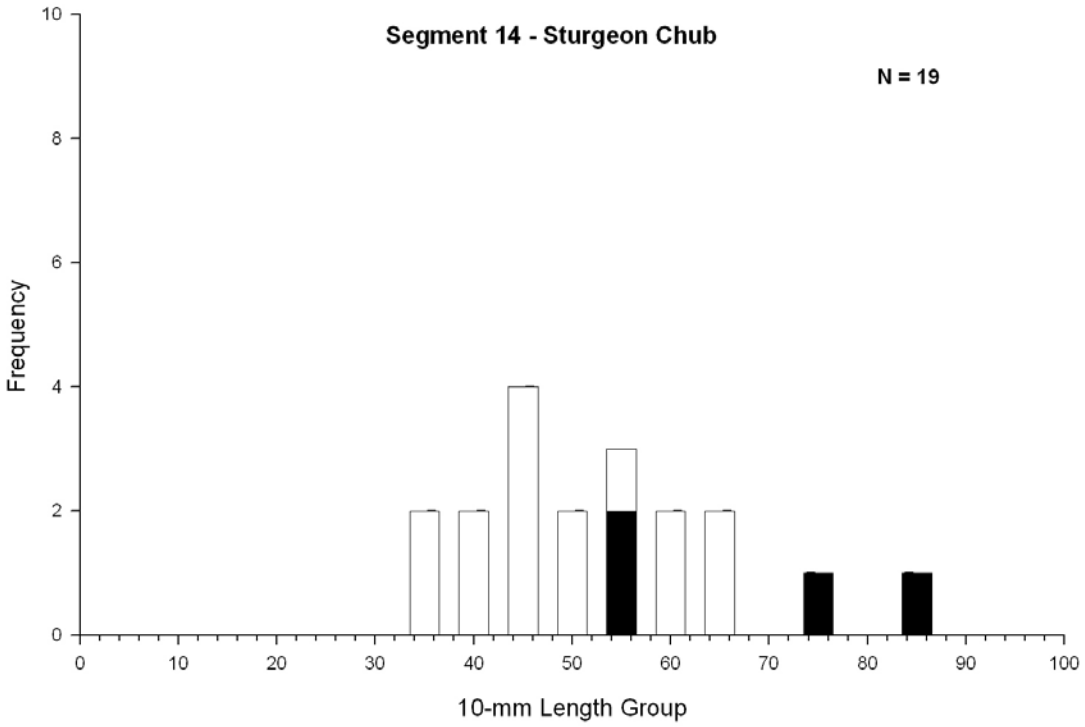

Figure 69. Length frequency of sturgeon chubs during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River during 2004.

Sicklefin Chub

All sampling gears captured more sicklefin in 2004 (N=1,029) than in 2003 and CPUE was higher in the community season vs. the sturgeon season (Figures 70-72). Trawls were the best gear used for sampling these fish. During the community season, 977 fish were collected. CPUE averaged five fish in the beam trawl in POOL habitat and was over eight in ITIP habitat for otter trawls (Figures 73 and 74) (Appendix J3). The beam trawl consistently captured over five fish in every Macro POOL habitat. Mini-fyke nets captured about one fish per sample on average and highest CPUE was in CHXO habitat (1.65). During the sturgeon season, trawl efficiency dropped to 0.16 fish compared to 0.93 in the community season (Appendices I3 and J2). Seines caught 64 fish, but were not a preferred gear when comparing effort expended (Appendix J5). Figure 75 depicts the contribution of a new cohort to 2004 in the community season and the relative unavailability of chubs in during sturgeon season using otter trawls on CHNB habitat. POOL habitat which was only sampled with a beam trawl appears to be an important rearing habitat for this species of chub.

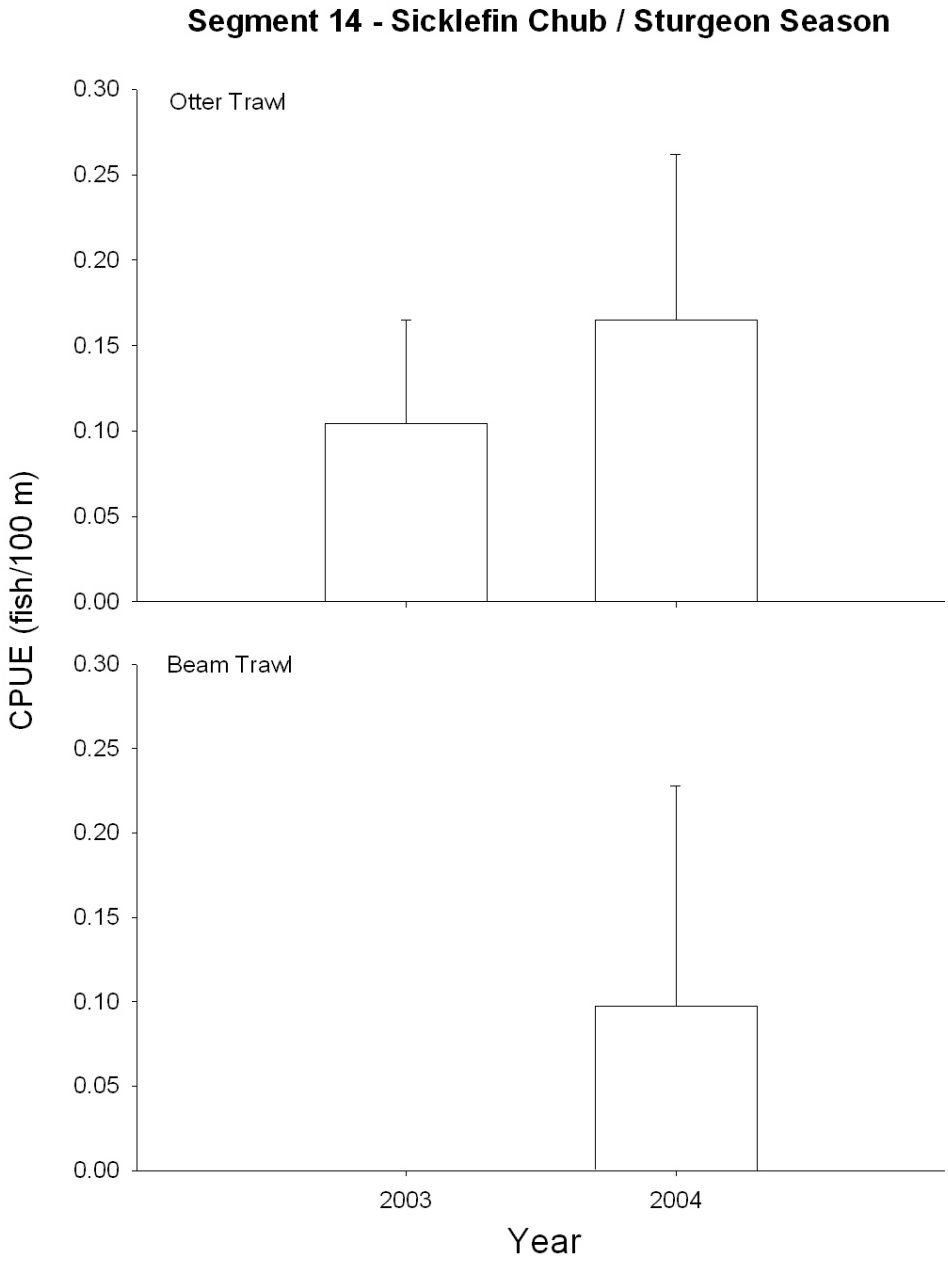

Figure 70. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chubs in segment 14 of the Missouri River during sturgeon season 2004.

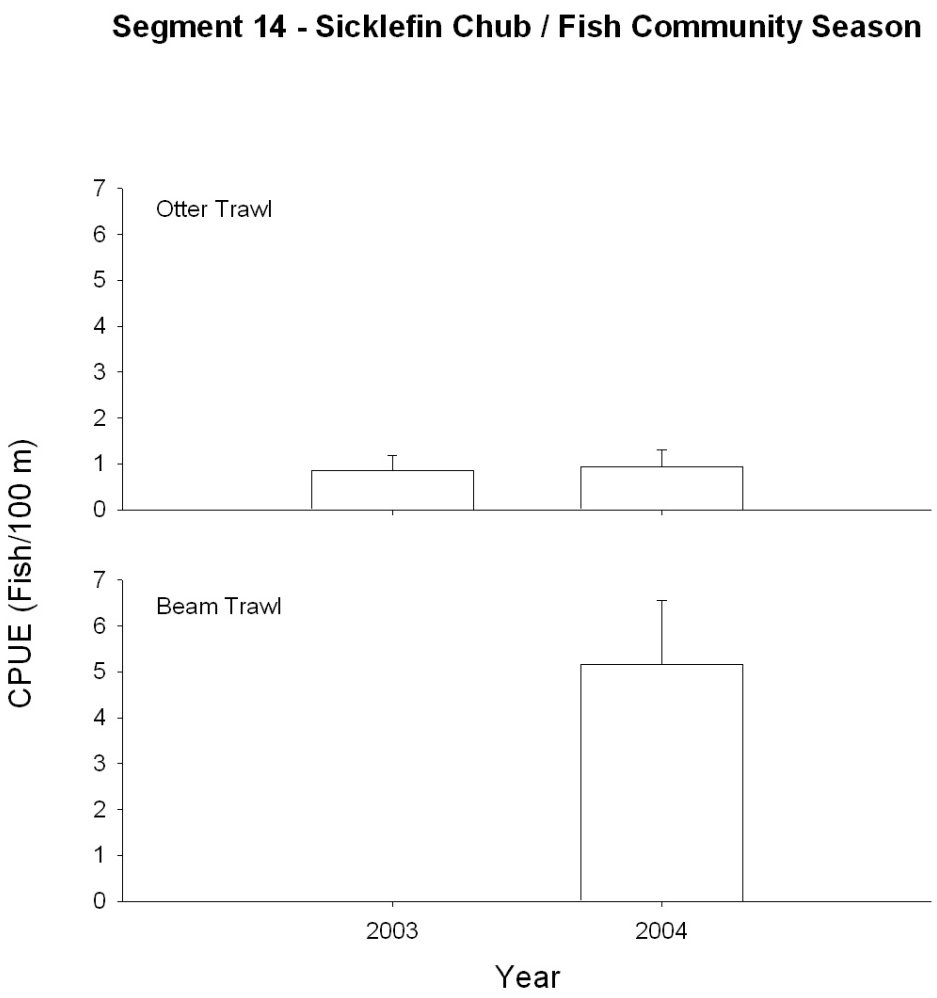

Figure 71. Mean annual catch-per-unit-effort (+/- 2 SE) of sicklefin chubs in segment 14 of the Missouri River during fish community season 2004.

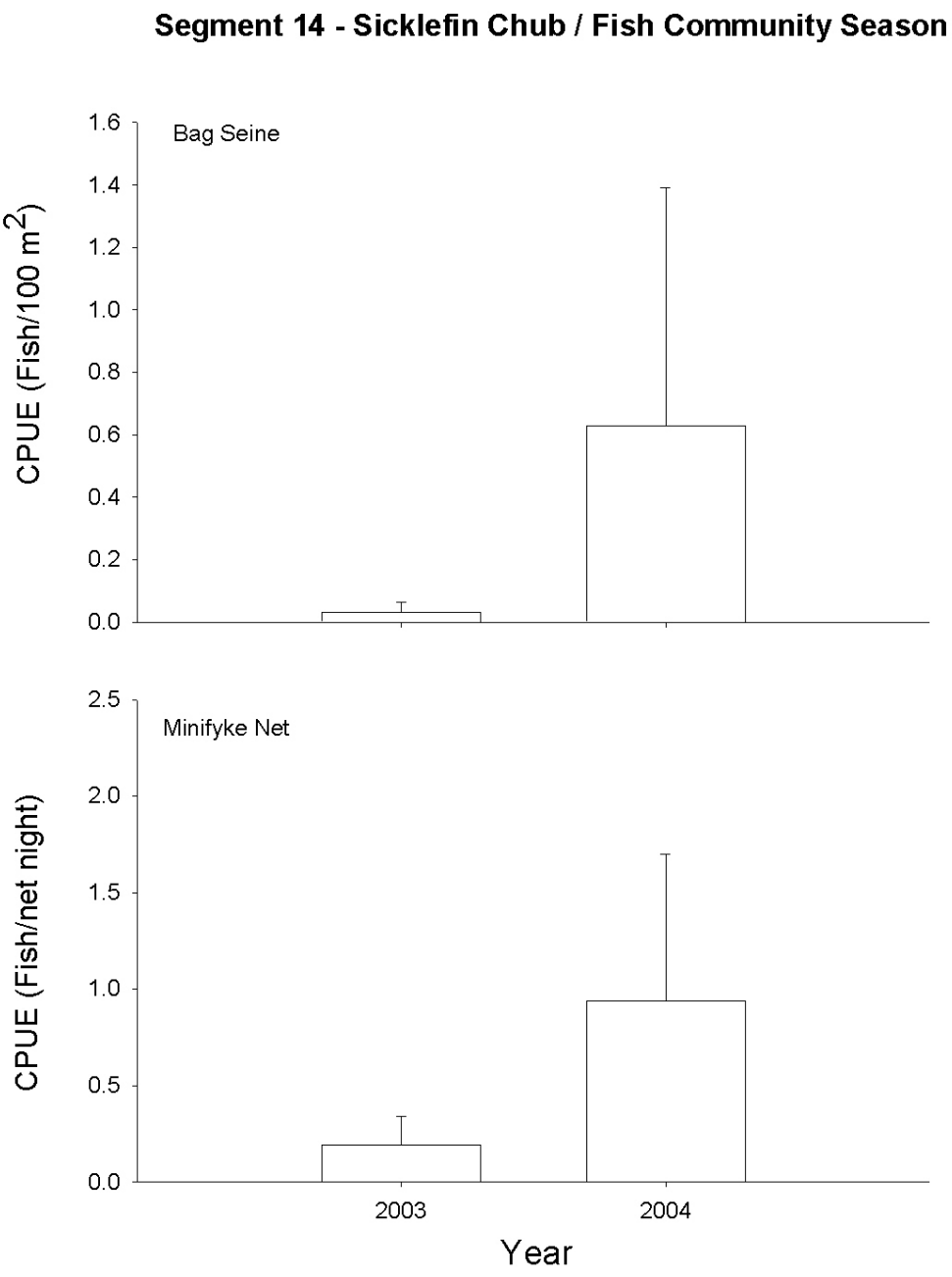

Figure 72. Mean annual catch-per-unit-effort (+/- 2 SE) of sicklefin chubs in segment 14 of the Missouri River during fish community season 2004.

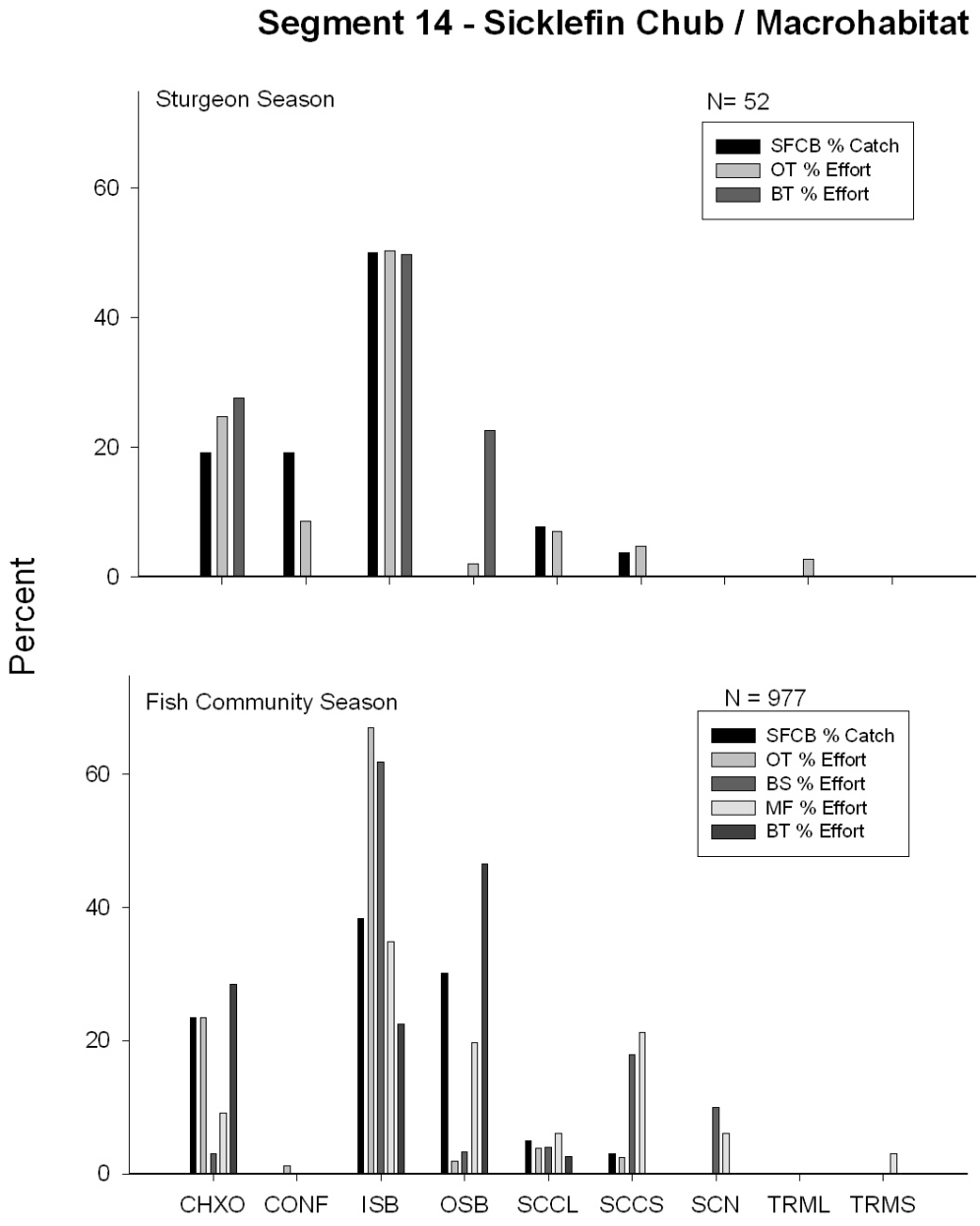

Figure 73. Percent of total sicklefin chubs caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

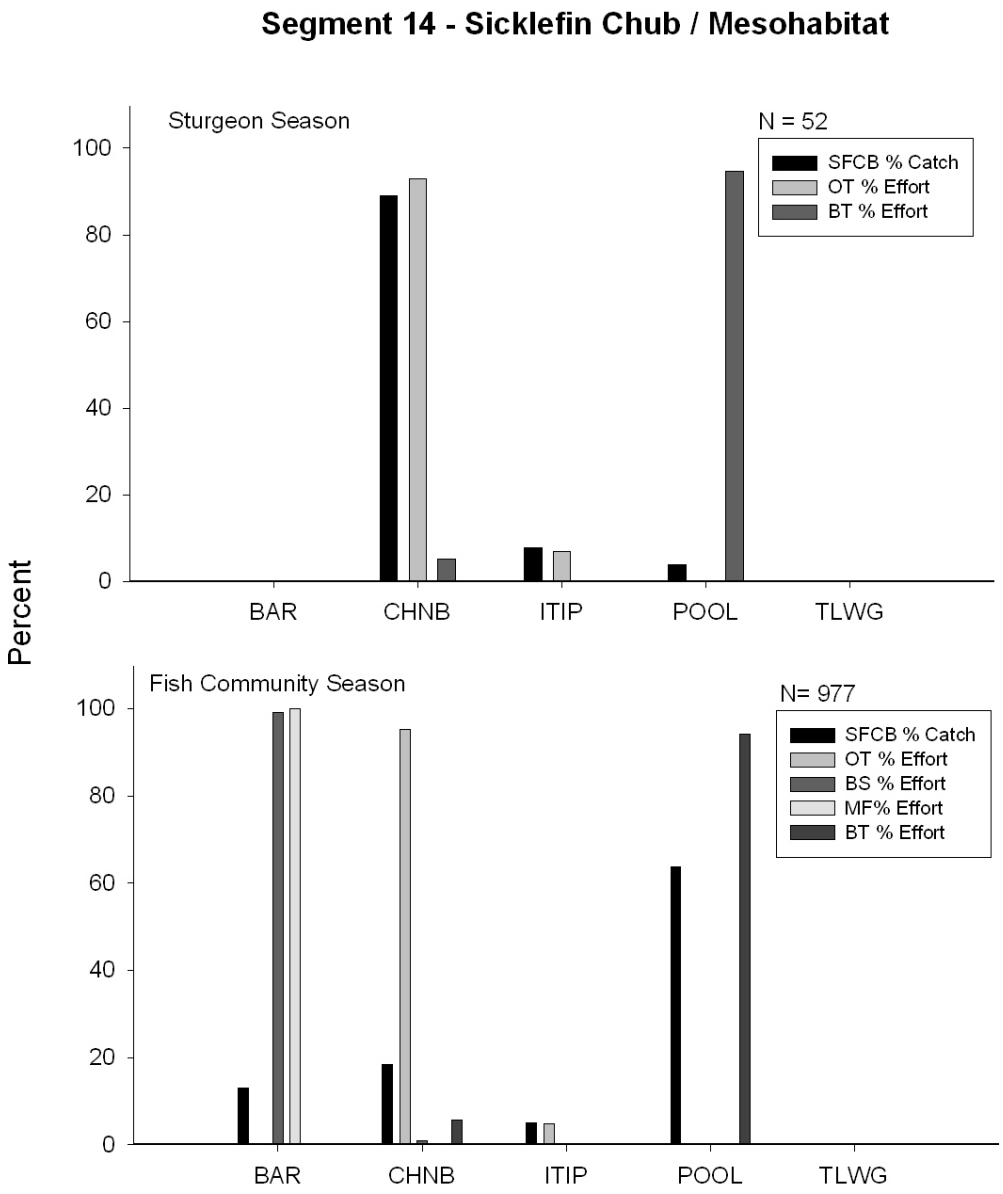

Figure 74. Percent of total sicklefin chubs caught and effort expended by mesohabitat type in segment 14 of the Missouri River 2004. Habitat abbreviations presented in Appendix B.

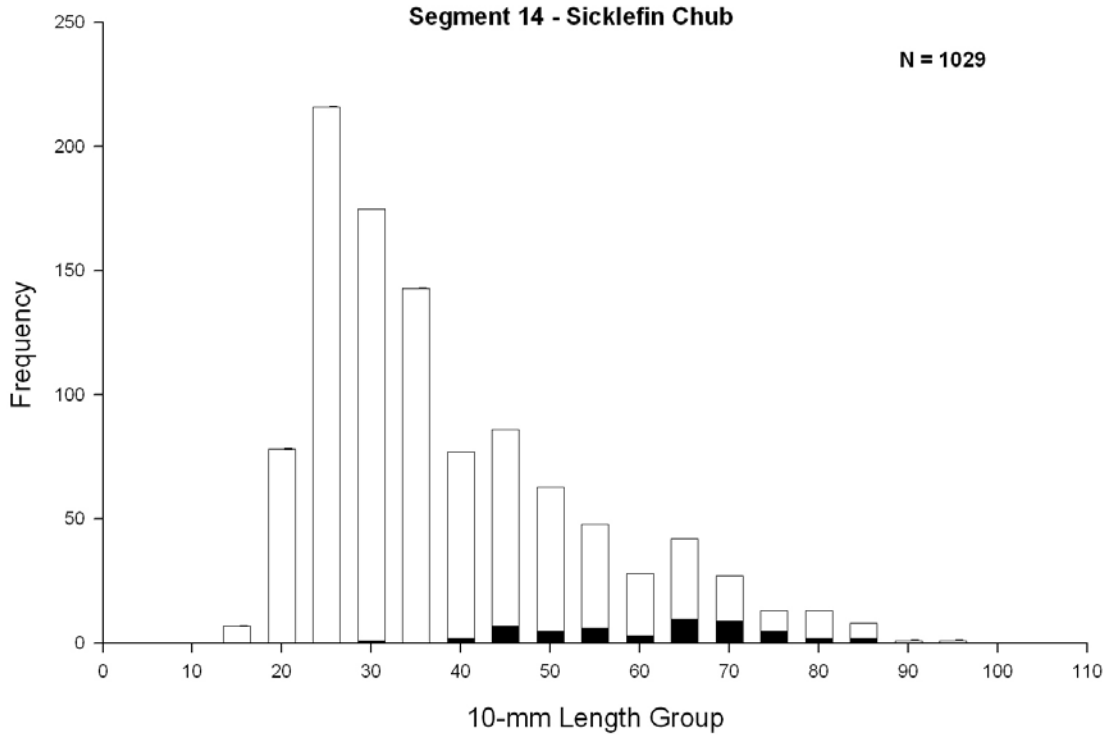

Figure 75. Length frequency of sicklefin chub during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River during 2004.

Speckled Chub

Speckled chubs were captured more frequently in 2004 than in 2003 with all gear types in both seasons (Figures 76-78). Speckled chubs occurred in relatively equal proportion to sampling effort in all Macro habitats sampled, with the exception of OSB where they occurred at a much lower proportion (Figure 79). Side channel habitats were most important for speckled chubs during the community season and fish were distributed over most of the Macro habitats (Appendix J). Speckled chubs occurred in BARS and ITIP habitat more than CHNB and POOL habitat during the community season and occurred in all habitats sampled in both seasons (Figure 80) (Appendices I and J). This is one of the few species that occurred in all habitats sampled, both Macro and Meso. This wide-spread dispersal may suggest this fish can survive in less specific habitat than other less abundant species and gives researchers the ability to sample these fish with a wide range of gear types. Of the 493 fish sampled, larger fish were sampled during the sturgeon season than during community season. There were some smaller fish represented in the samples suggesting a spawning event occurred (Figure 81).

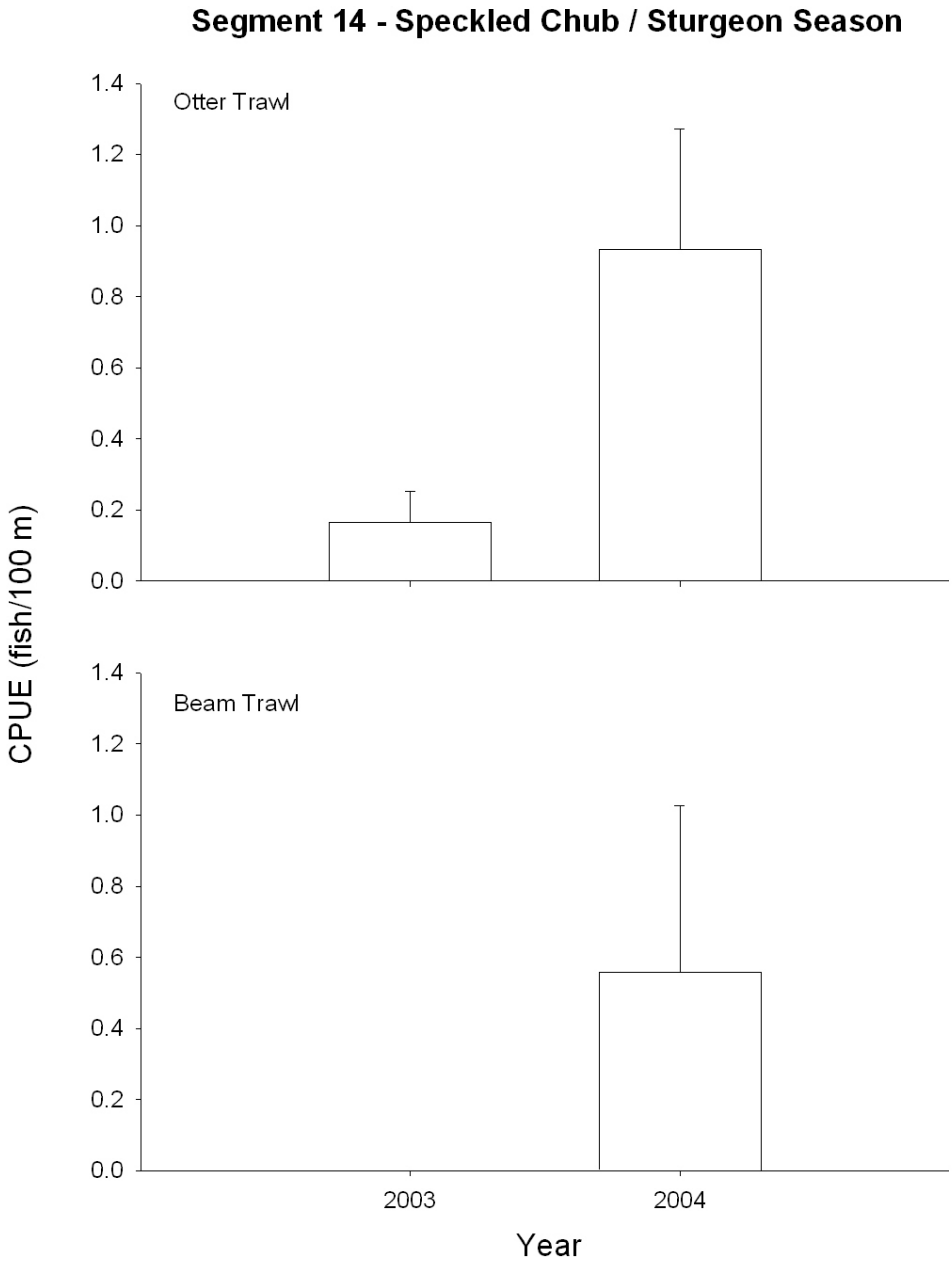

Figure 76. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chubs in segment 14 of the Missouri River during Sturgeon season 2004.

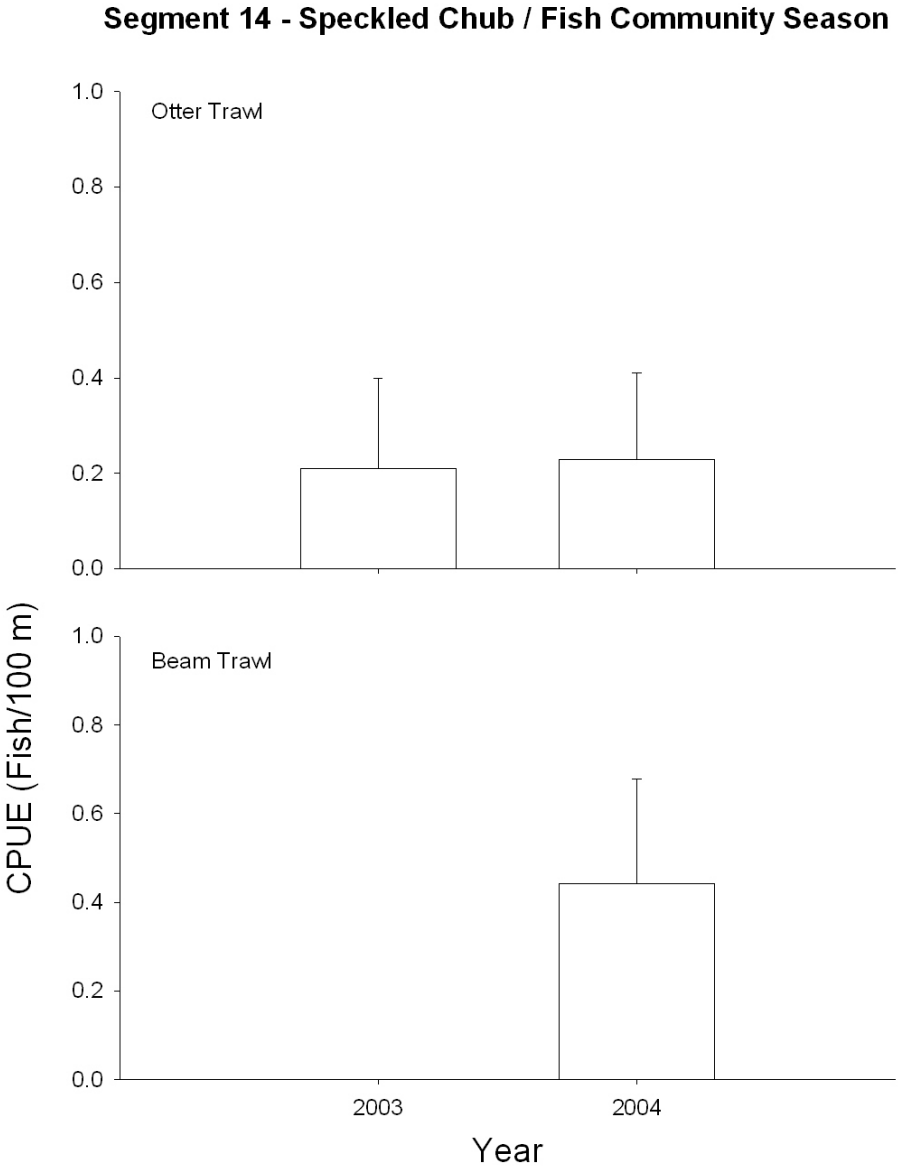

Figure 77. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chubs in segment 14 of the Missouri River during fish community season 2004.

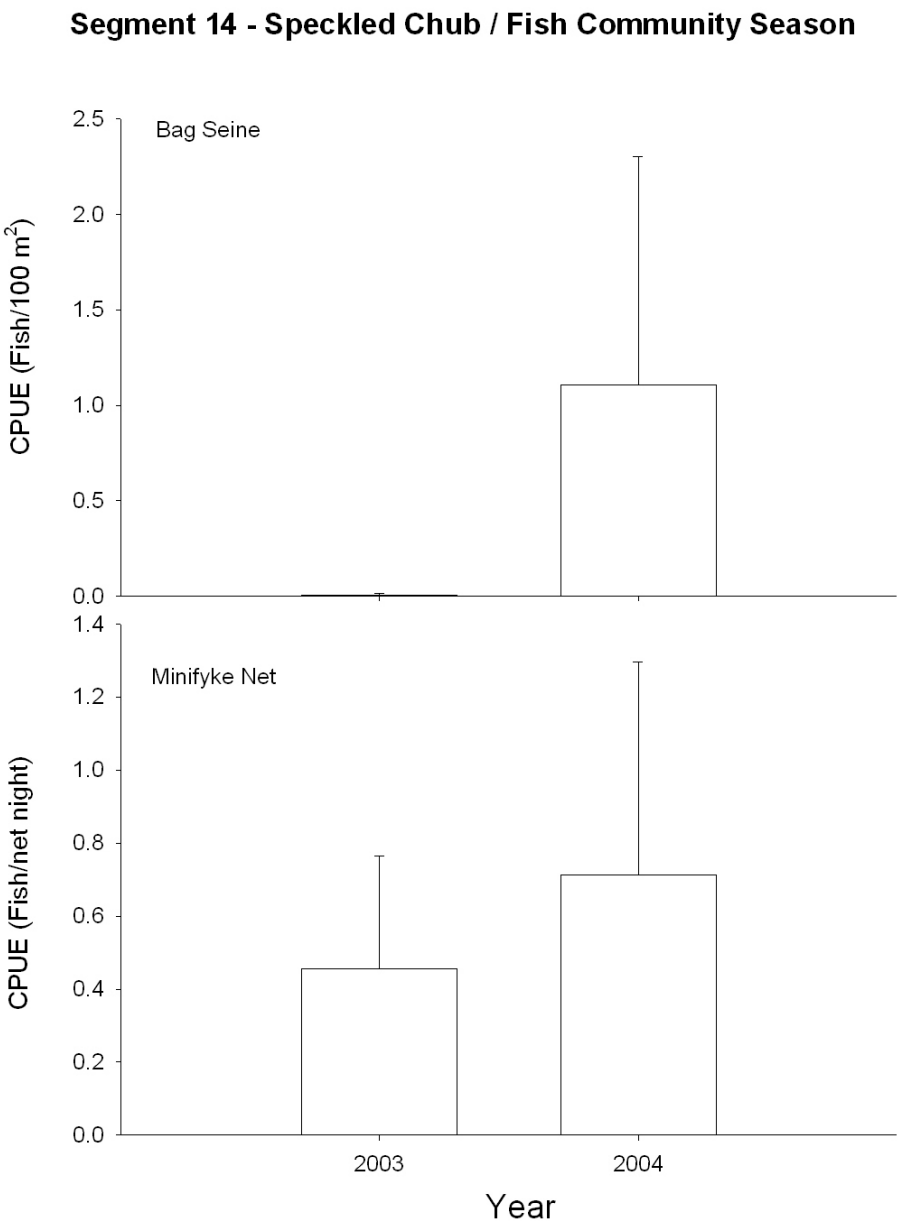

Figure 78. Mean annual catch-per-unit-effort (+/- 2 SE) of speckled chubs in segment 14 of the Missouri River during fish community season 2004.

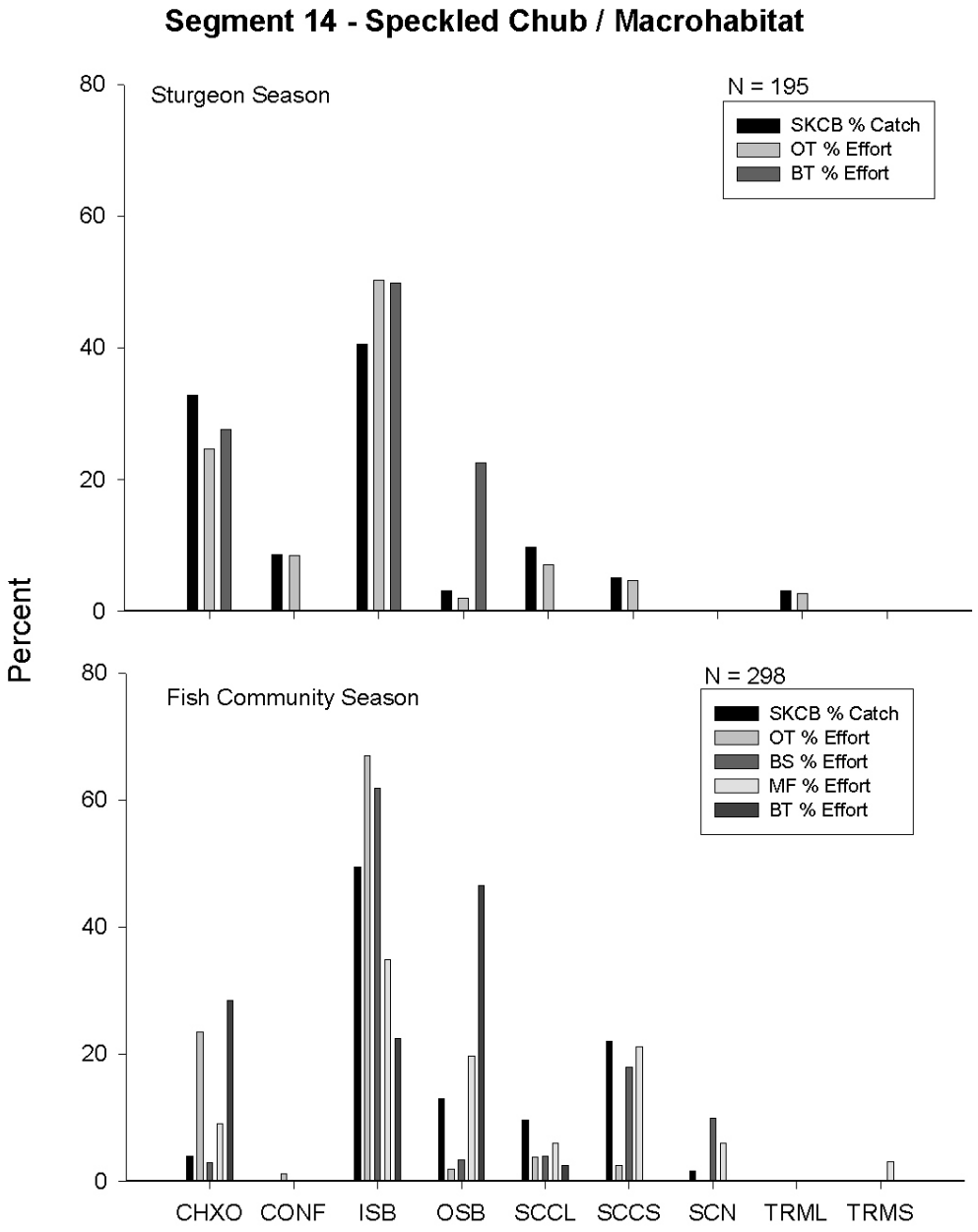

Figure 79. Percent of total speckled chubs caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Macrohabitat abbreviations presented in Appendix B.

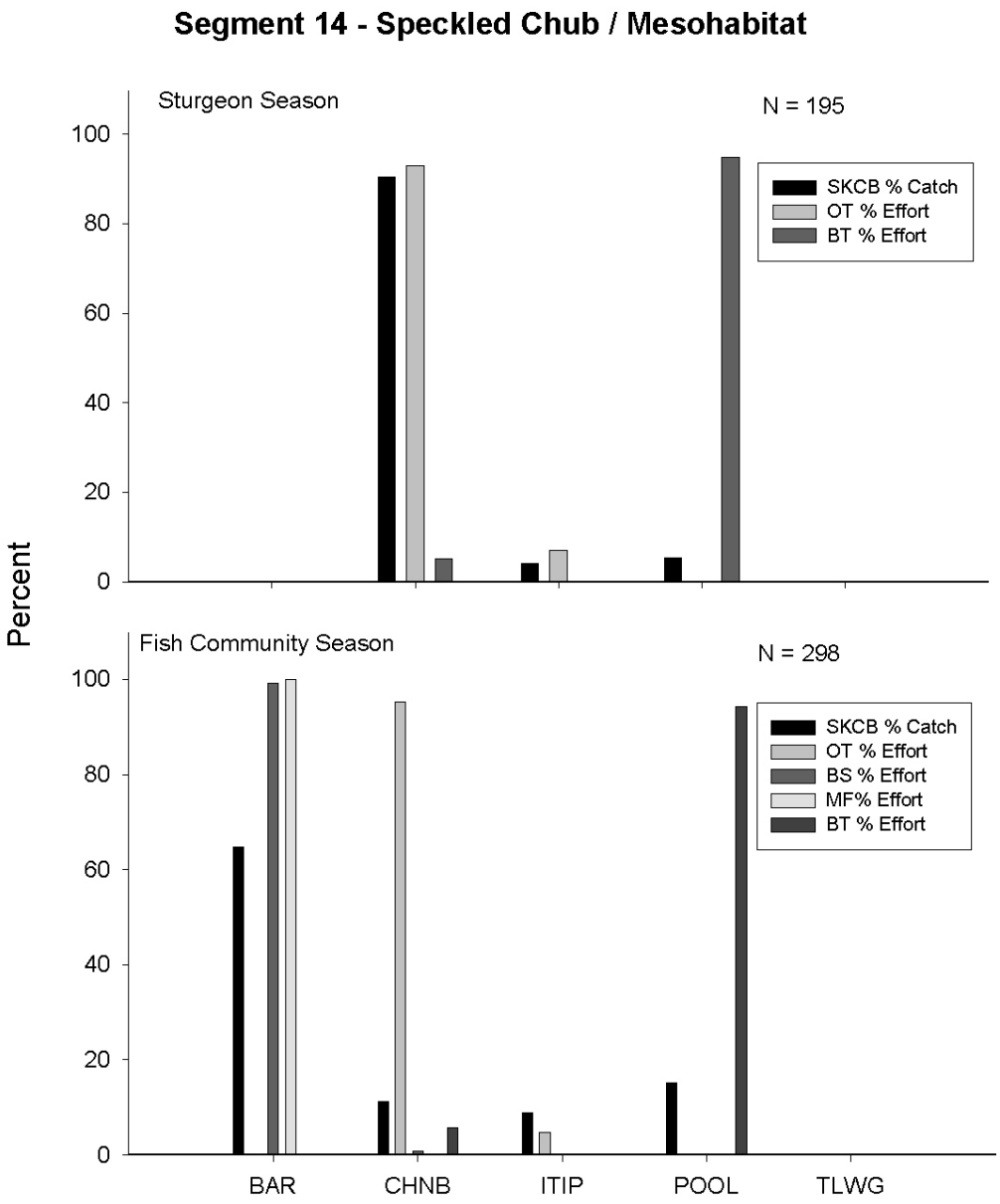

Figure 80. Percent of total speckled chubs caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

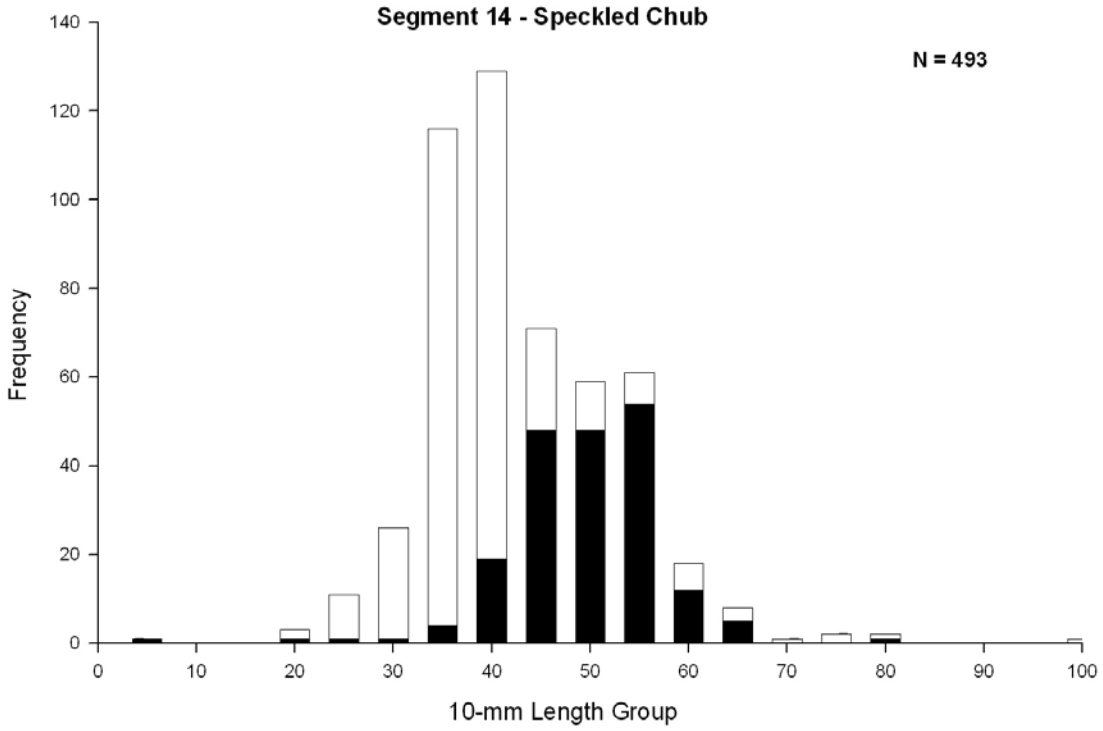

Figure 81. Length frequency of speckled chubs during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River during 2004.

Blue sucker

With all gear types, blue suckers were never captured at a rate higher than 0.2 in either season. Catch rates increased four fold in otter trawls and hoop nets in the spring season comparing 2003 to 2004, but declined in trammel nets (Figures 82-85). Of the 106 blue suckers collected, CPUE was higher in channel crossovers, confluences and side-channels Figure 86 and Appendices I and J). Suckers were most abundant in confluence and island tip habitats when using trammel nets, gillnets and otter trawls during the spring sturgeon season. However, in the community season, fish were only found on inside bends (Figure 86 and 87). Very few blue suckers were found at smaller size classes (Figure 88). A wider size range of fish were sampled during the sturgeon season, but included no young of year fish.

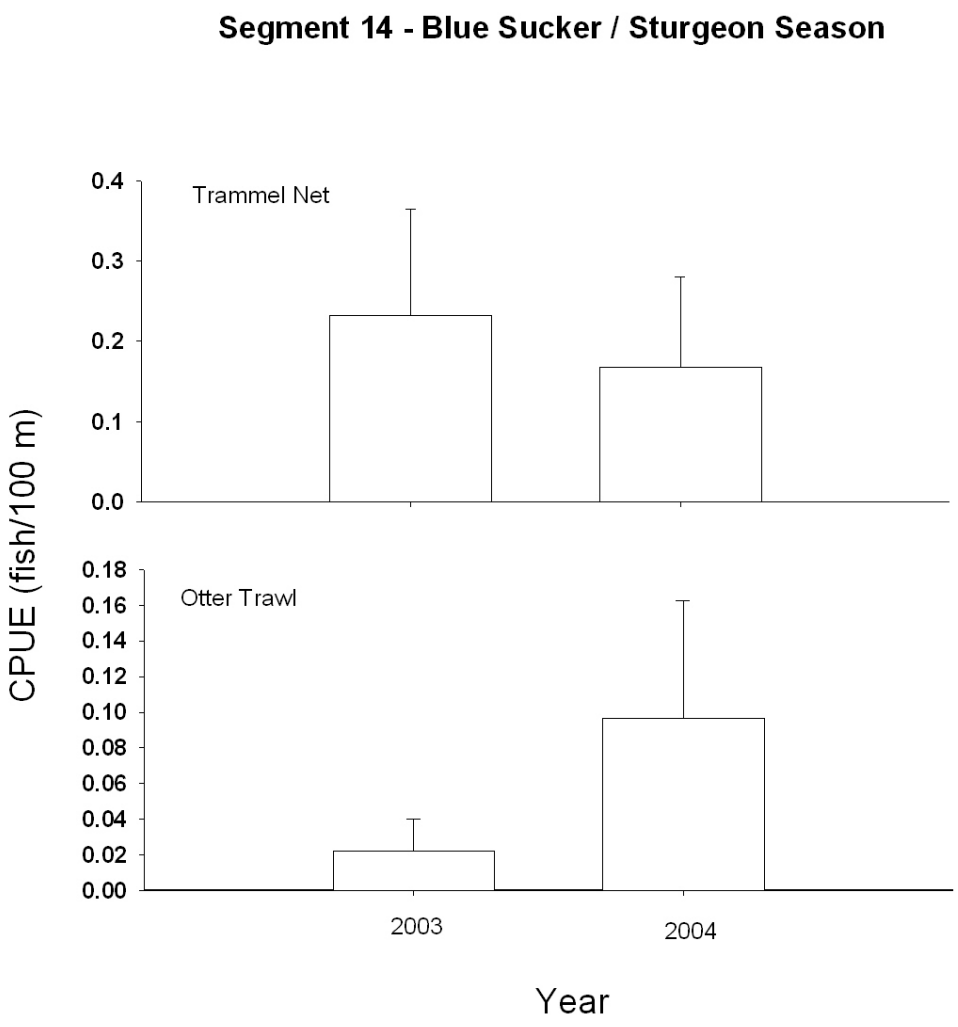

Figure 82. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 14 of the Missouri River during sturgeon season 2004.

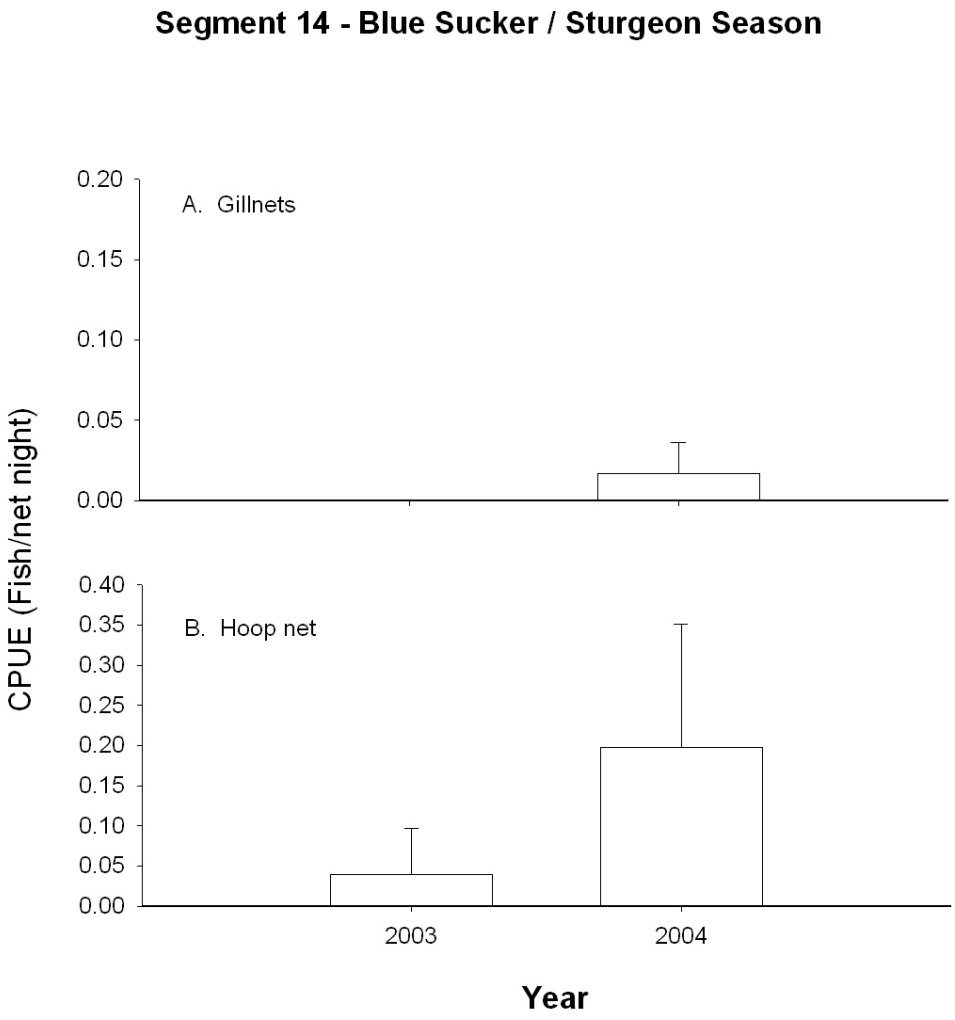

Figure 83. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 14 of the Missouri River for sturgeon season 2004.

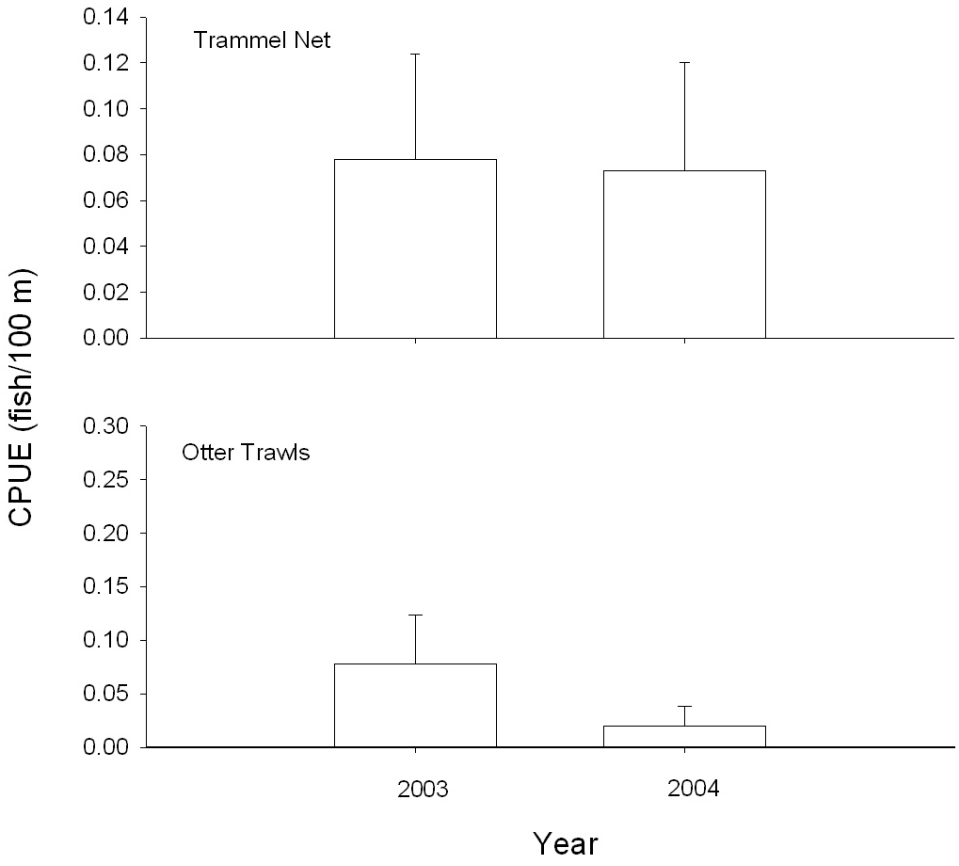

Figure 84. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 14 of the Missouri River during fish community season 2004.

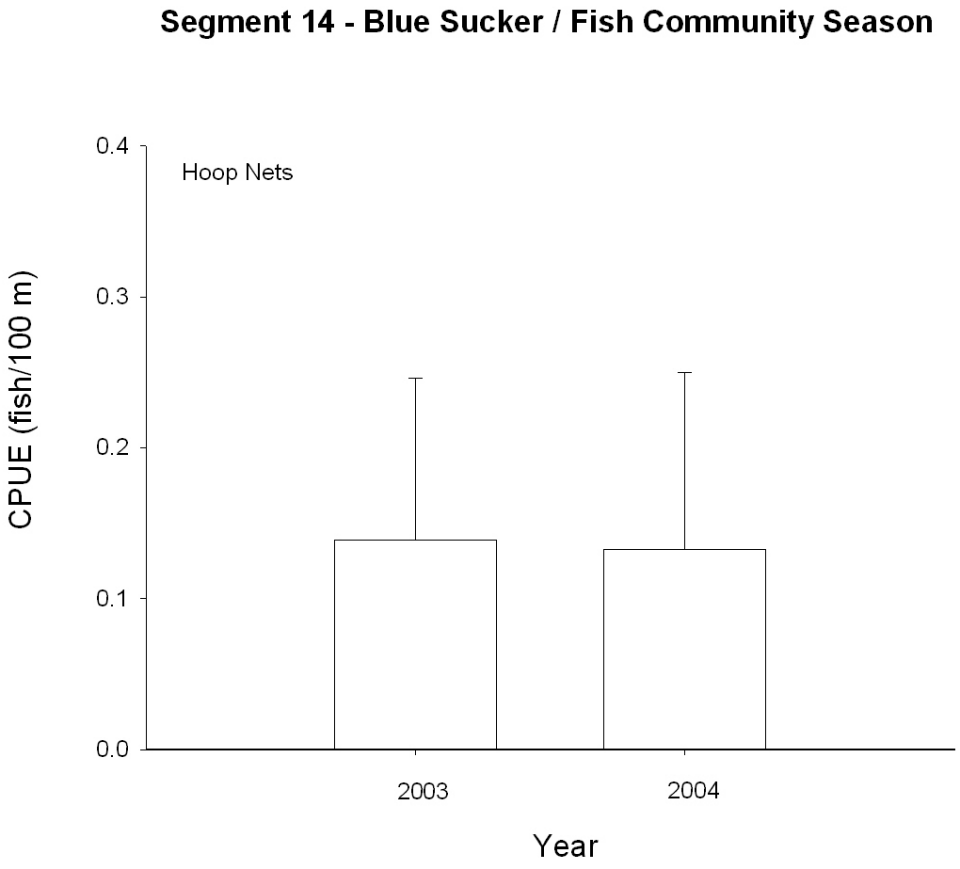

Figure 85. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker in segment 14 of the Missouri River during fish community season 2004.

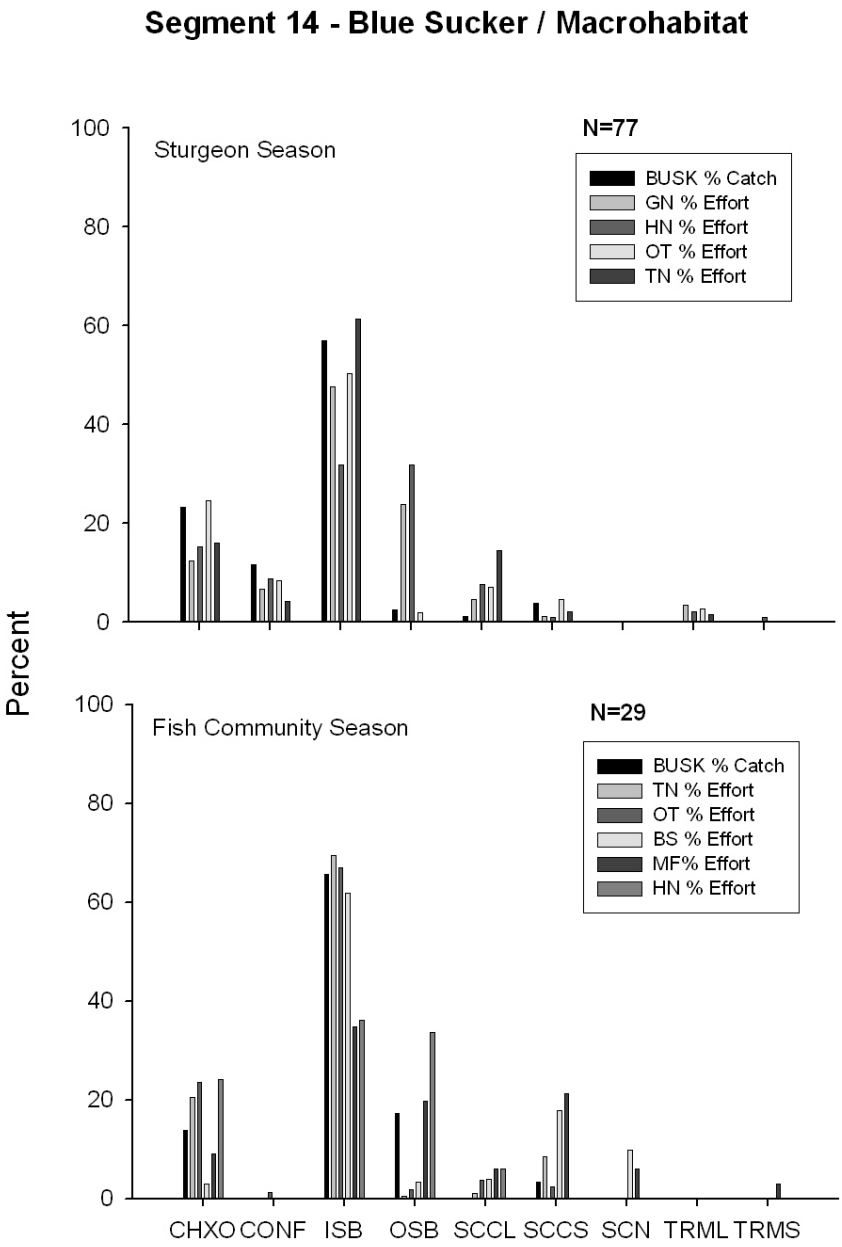

Figure 86. Percent of total blue sucker caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

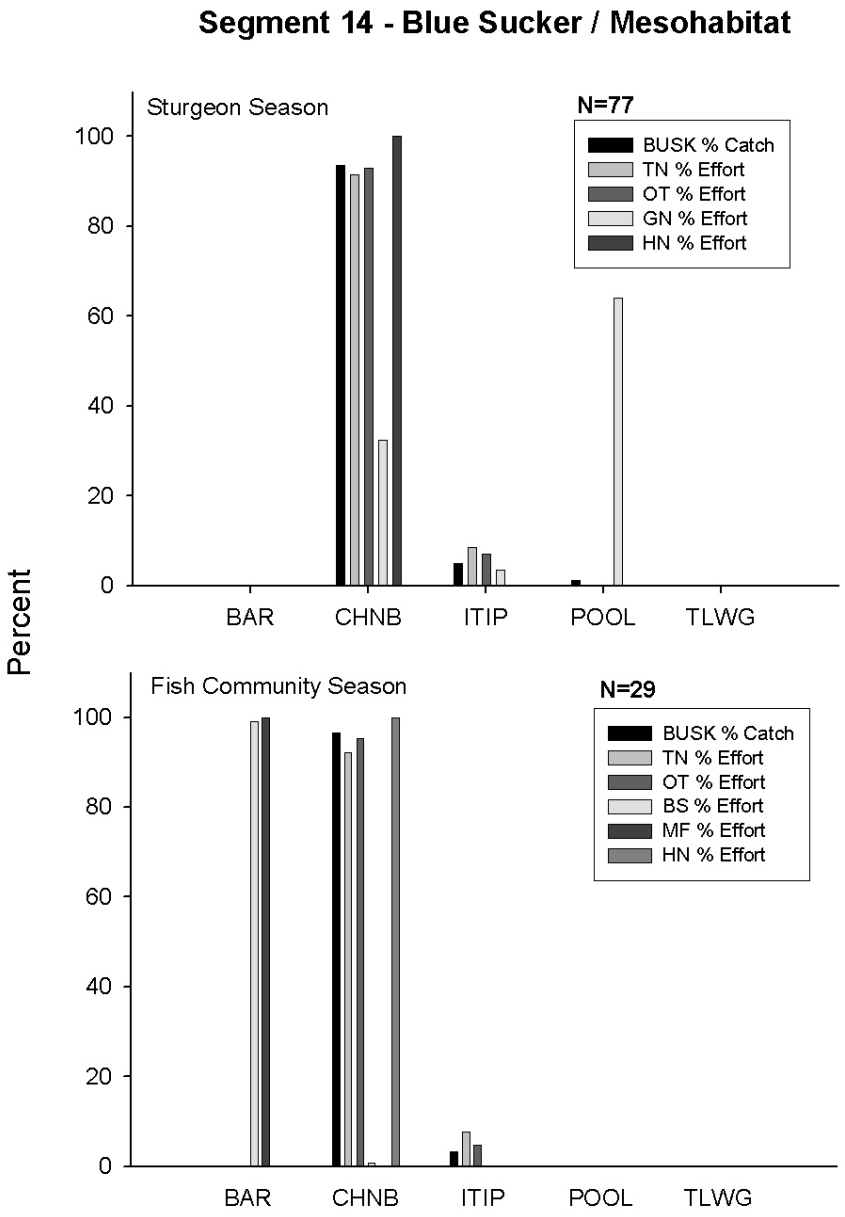

Figure 87. Percent of total blue sucker caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

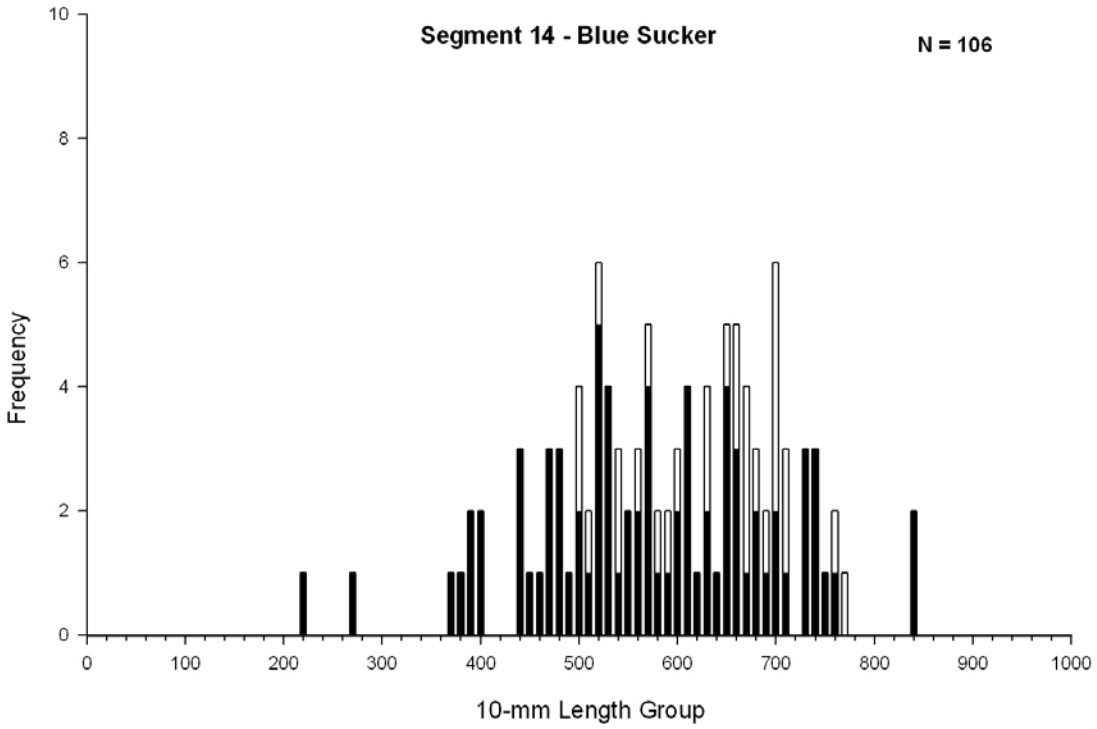

Figure 88. Length frequency of blue suckers during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River during 2004.

Sauger

Gillnets sampled sauger in 2004 at three times the rate of 2003, however ten 100 ft. nets were still needed to sample one fish. Other gear types were not effective at sampling this species in either season (Figures 89-92). Sauger were widely distributed between Macro habitat types with most fish occurring on outside bends in gillnets (Figure 93 and Appendix I1). Of the 31 fish sampled during the two seasons, most occurred on CHNB habitat (Figure 94, Appendix I and J). Few fish were sampled in smaller size classes suggesting little reproduction had occurred, there also appeared to be a missing year class of fish between 200mm and 400mm (Figure 95).

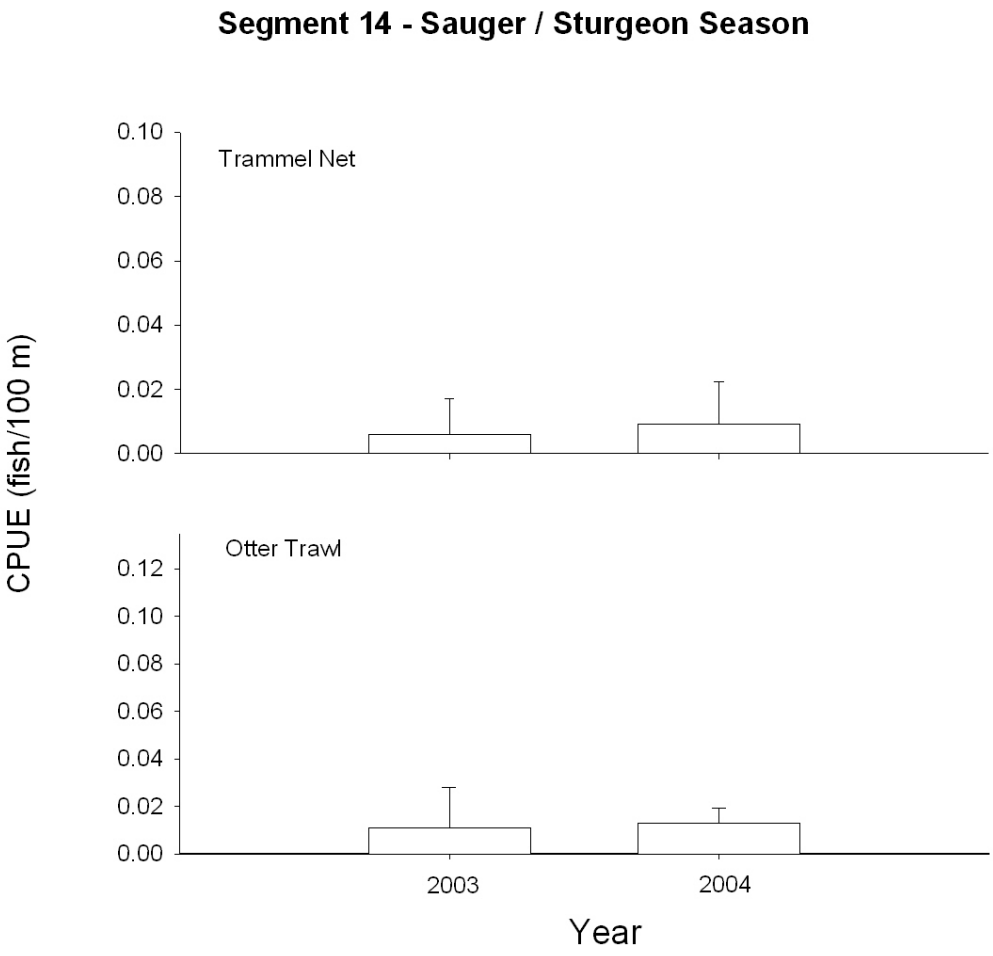

Figure 89. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 14 of the Missouri River during sturgeon season 2004.

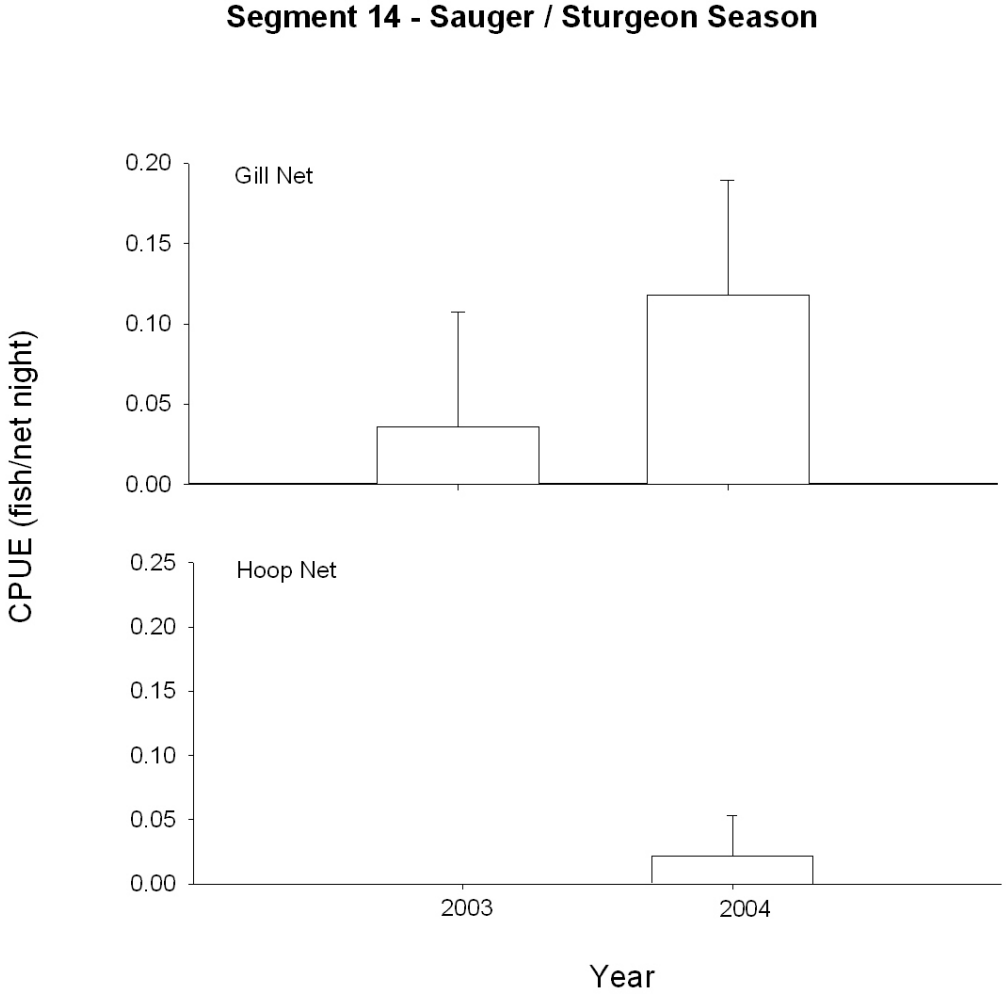

Figure 90. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 14 of the Missouri River during sturgeon season 2004.

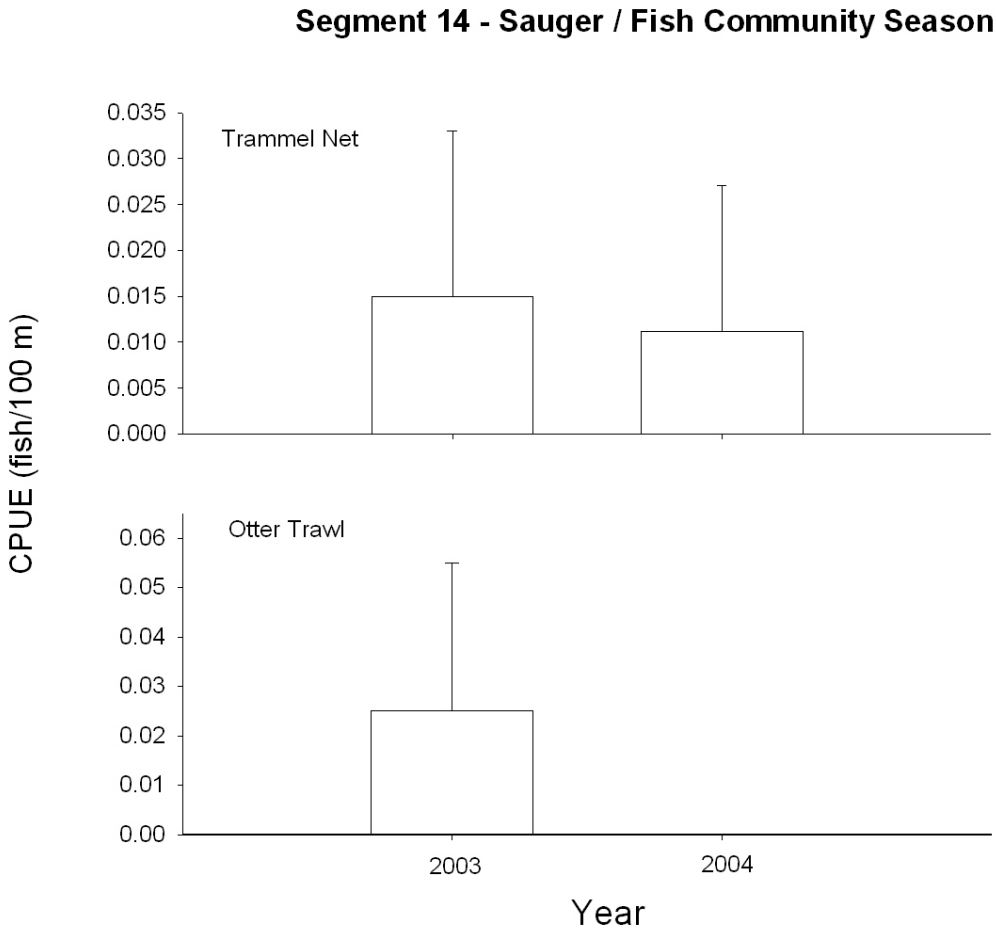

Figure 91. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 14 of the Missouri River during fish community season 2004.

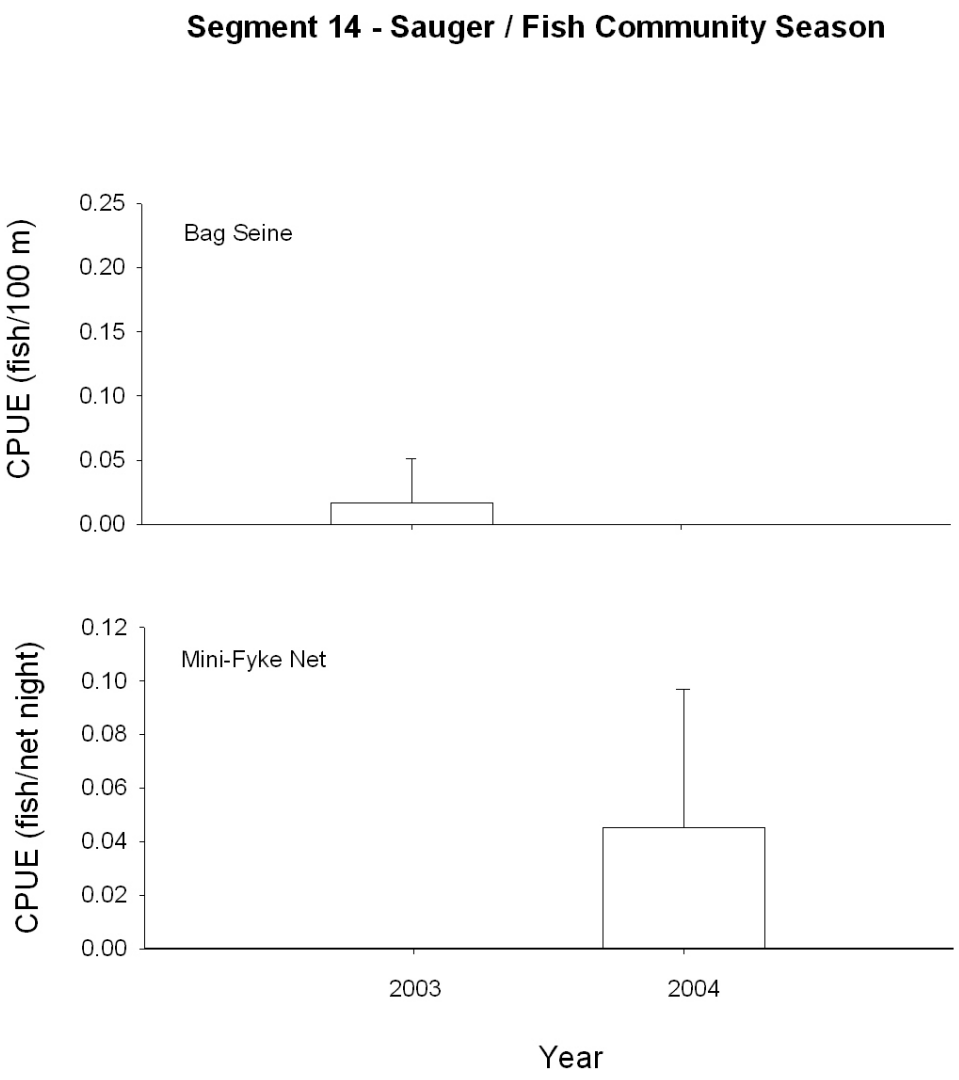

Figure 92. Mean annual catch-per-unit-effort (+/- 2SE) of sauger in segment 14 of the Missouri River during fish community season season 2004.

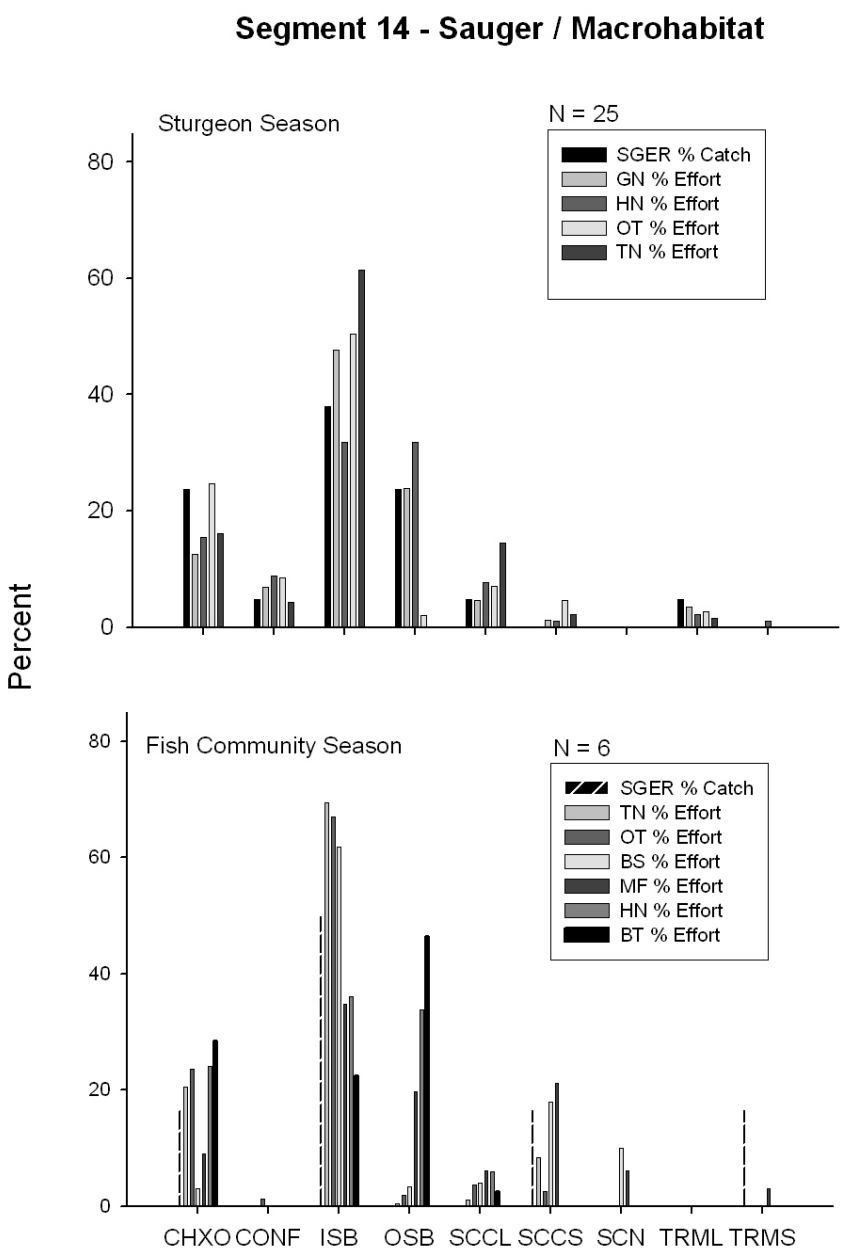

Figure 93. Percent of total sauger caught and effort expended by macrohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

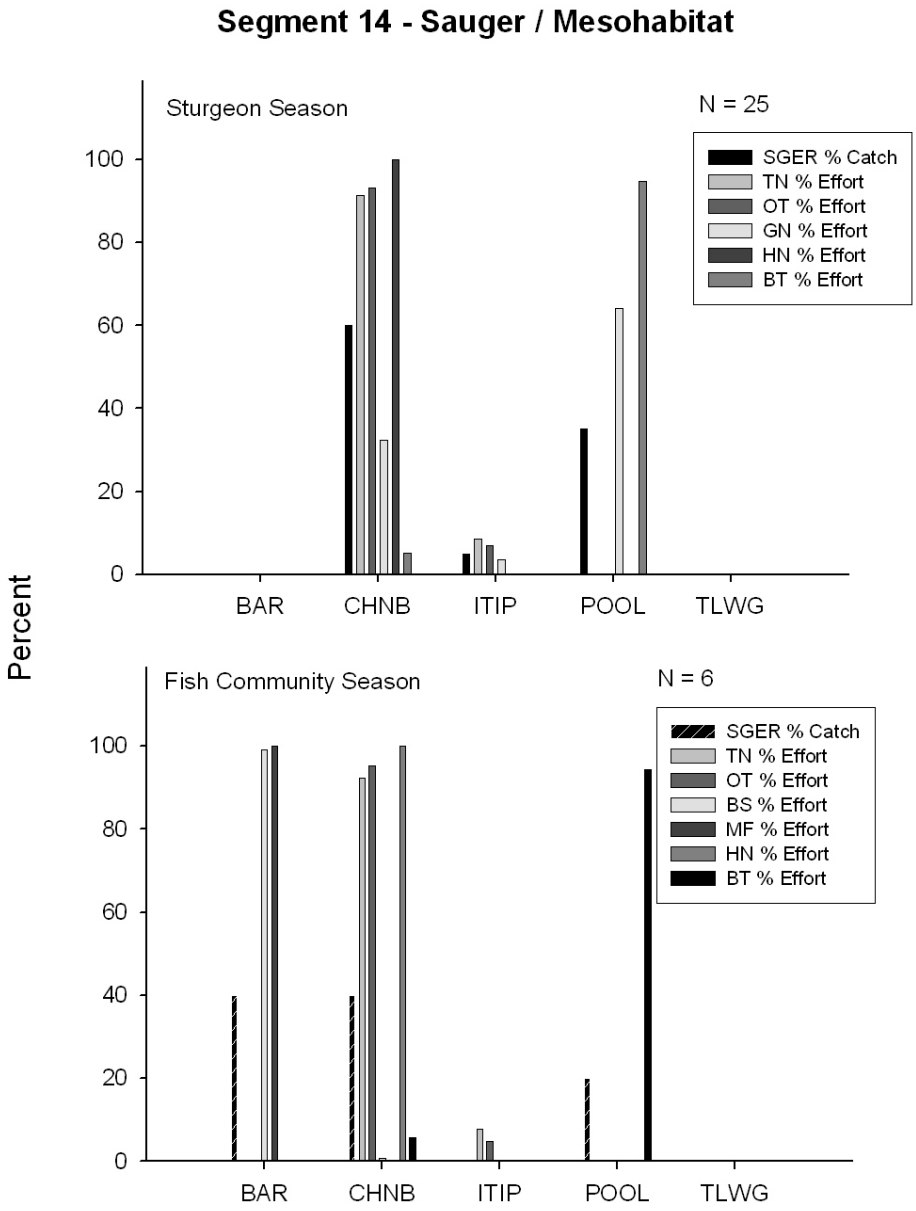

Figure 94. Percent of total sauger caught and effort expended by mesohabitat type in segment 14 of the Missouri River during 2004. Habitat abbreviations presented in Appendix B.

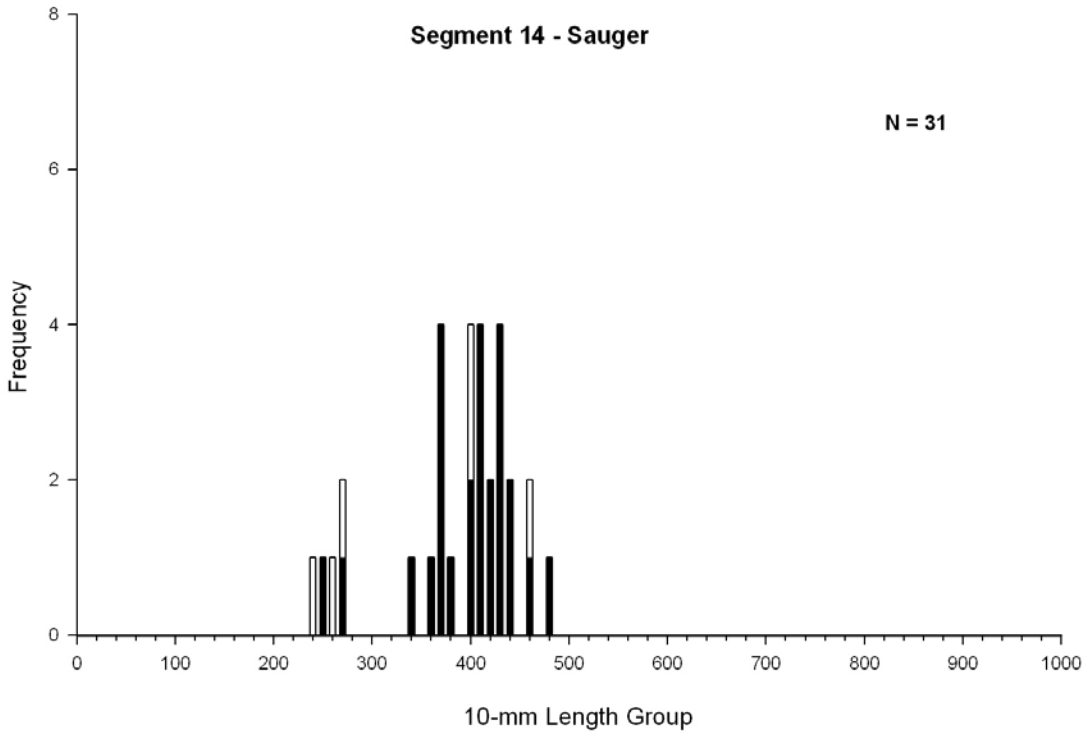

Figure 95. Length frequency of sauger during sturgeon season (black bars) and fish community season (white bars) in segment 14 of the Missouri River during 2004.

Sand Shiner

Sand shiners were only collected in seines and mini-fykes. Three times more fish were collected in seines in 2004 than in 2003. Fewer fish were caught in mini-fykes in subsequent years (Figure 96). The 48 fish collected were distributed widely among the available habitats with most occurring in small connected side-channels (1.2 fish/net) (Figure 97 and Appendix J). Sand shiners were sampled at about the rate of one fish per 320m of seining or one per three mini-fykes. Sand shiners were only sampled in BARS habitat, despite large efforts in POOL and CHNB habitat using trawls (Figure 98). These fish will likely only be collected in larger numbers by targeting less available habitats. Lengths of the fish were proportioned throughout their available size range and showed an influence of a new cohort from a potential spawn during the spring (Figure 99) (Pflieger 1975).

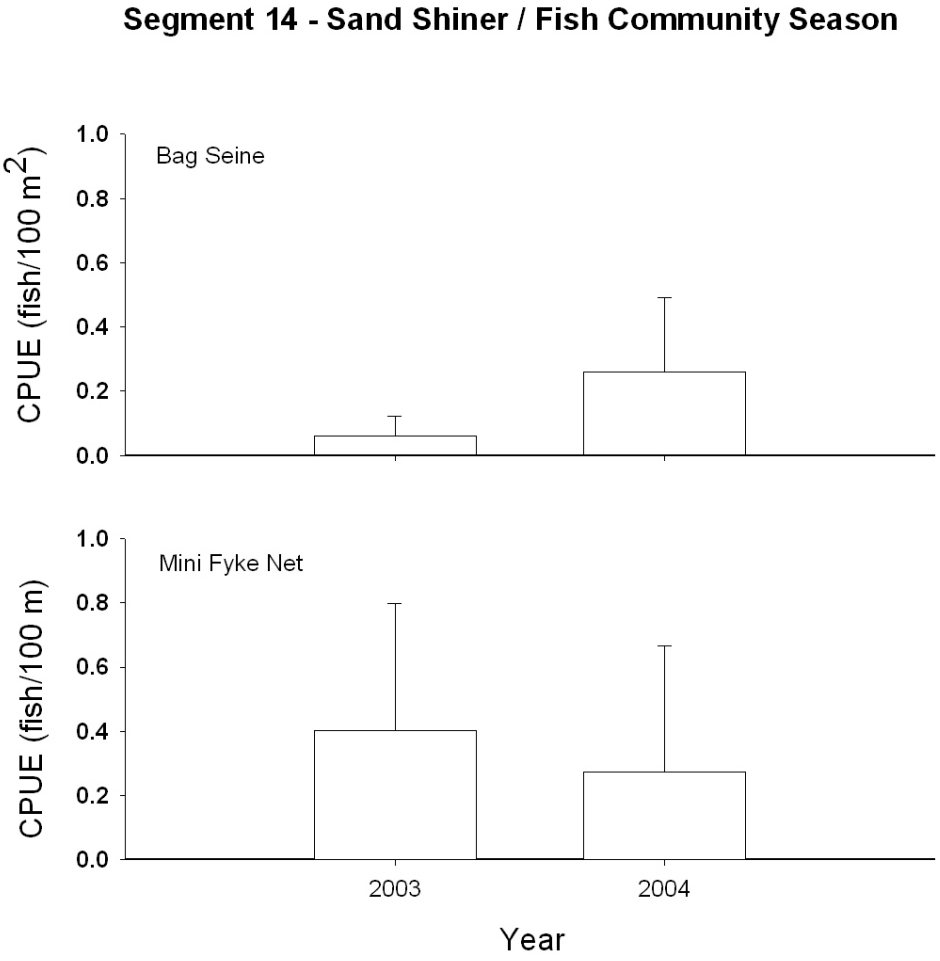

Figure 96. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiners in segment 14 of the Missouri River during fish community season 2004.

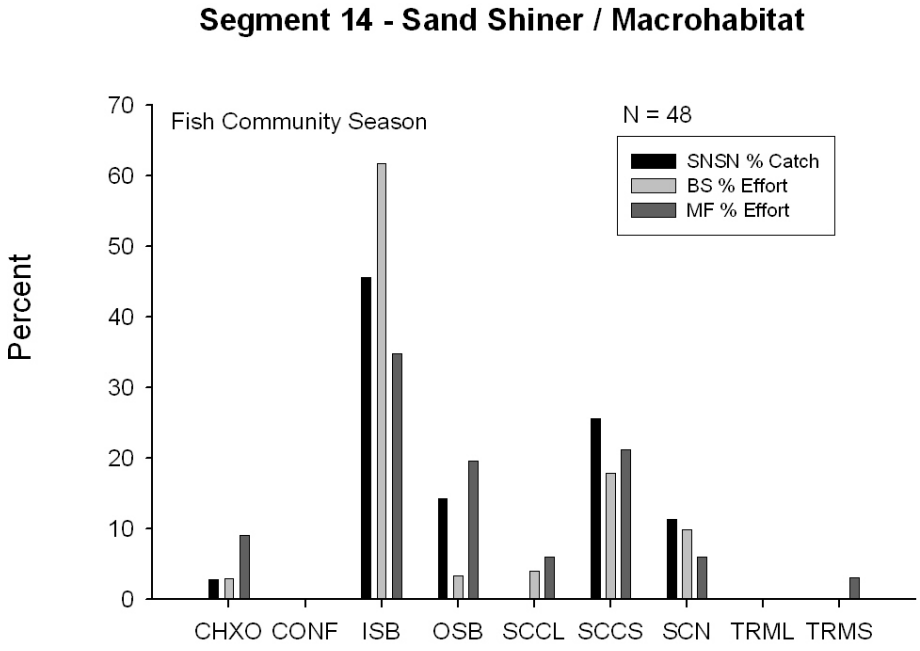

Figure 97. Percent of total sand shiners caught and effort expended by macrohabitat type in segment 14 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

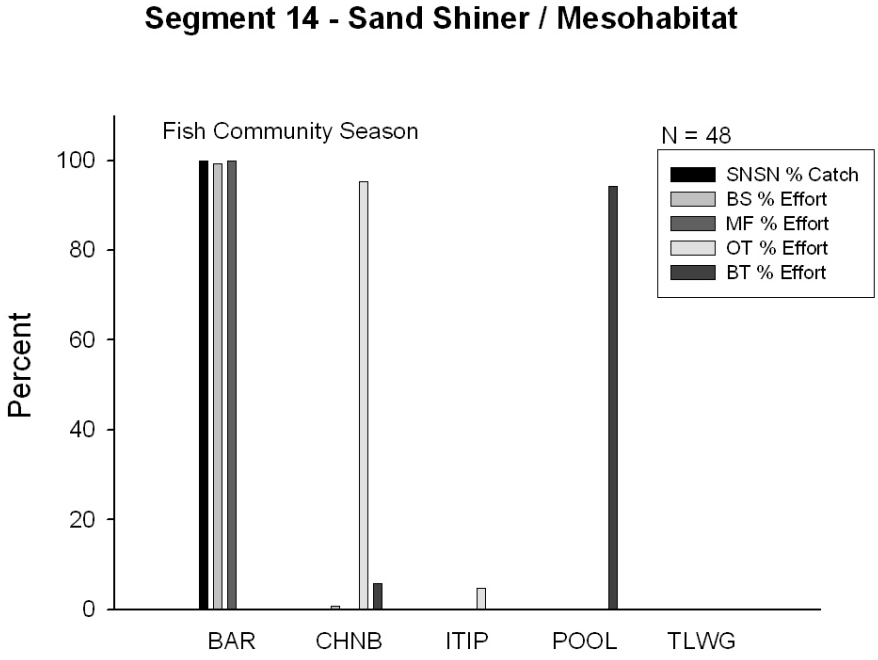

Figure 98. Percent of total sand shiners caught and effort expended by mesohabitat type in segment 14 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

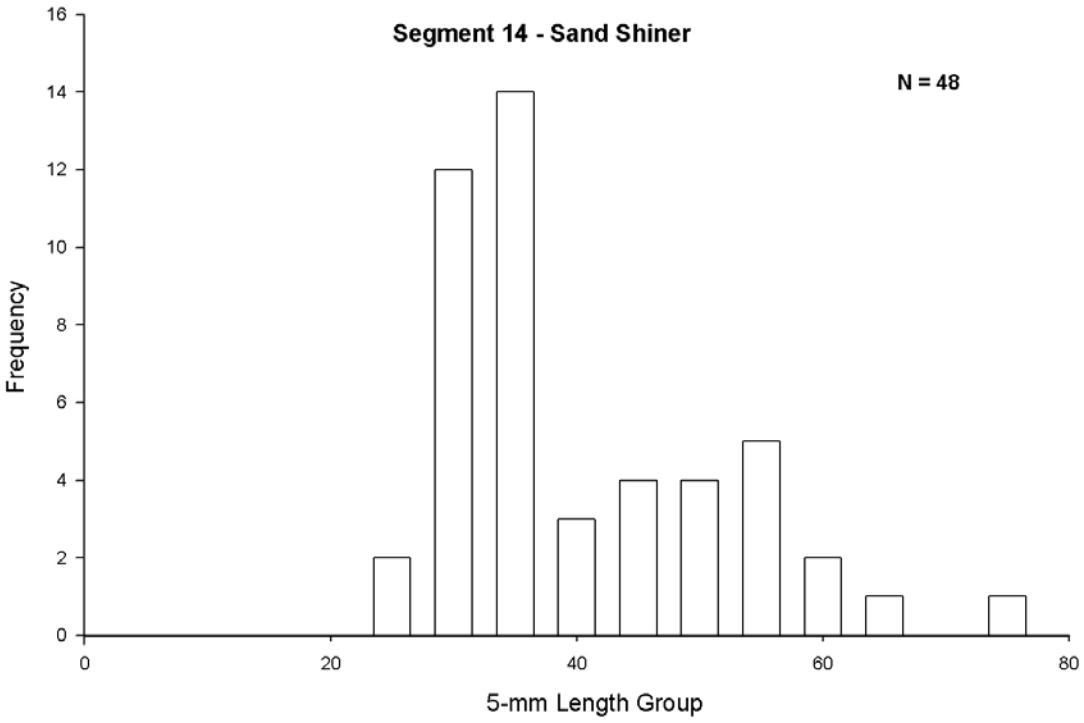

Figure 99. Length frequency of sand shiners during fish community season 2004 in segment 14 of the Missouri River.

Hybognathus spp.

Four fish of this genera were captured in 2004 compared to 9 in 2003. Fish were sampled in BARS Meso habitat within SCN habitats and ISB Macro habitats with mini-fykes and seines (Figures 100-102). The few fish captured represented the middle of their size range (Pfleiger 1975) (Figure 103).

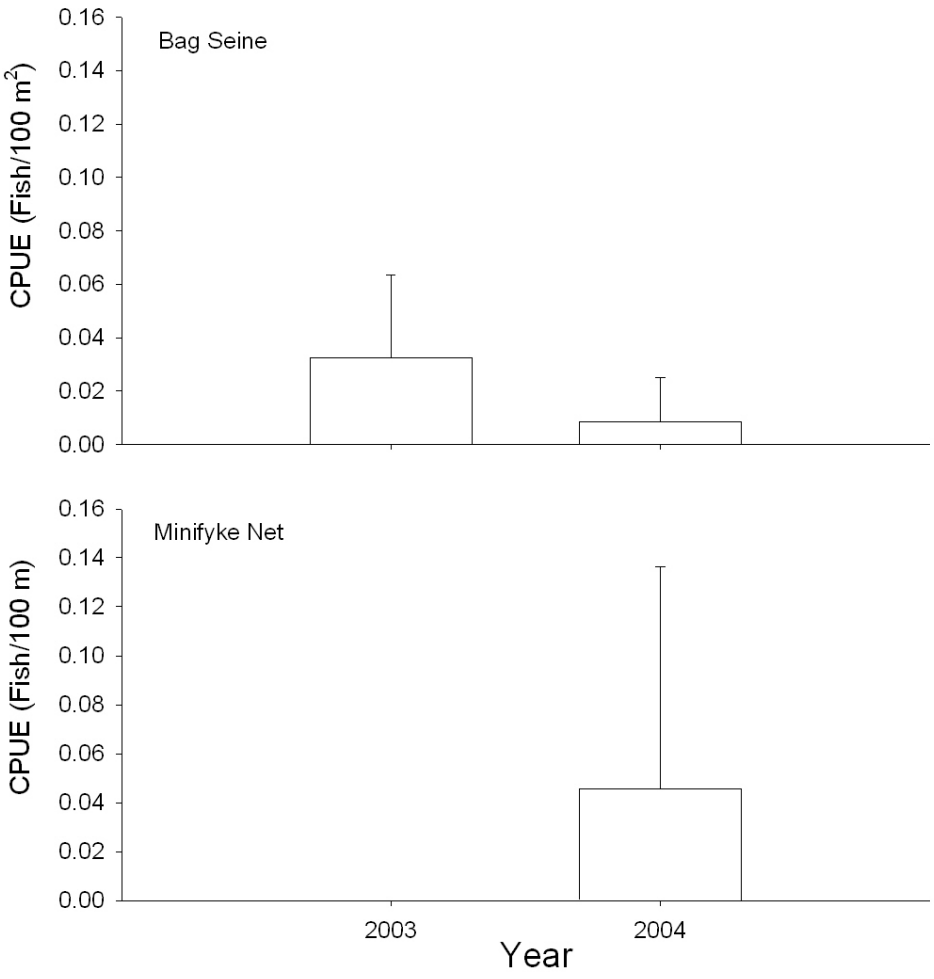

Figure 100. Mean annual catch-per-unit-effort (+/- 2 SE) of *Hybognathus* spp. in segment 14 of the Missouri River during fish community season 2004.

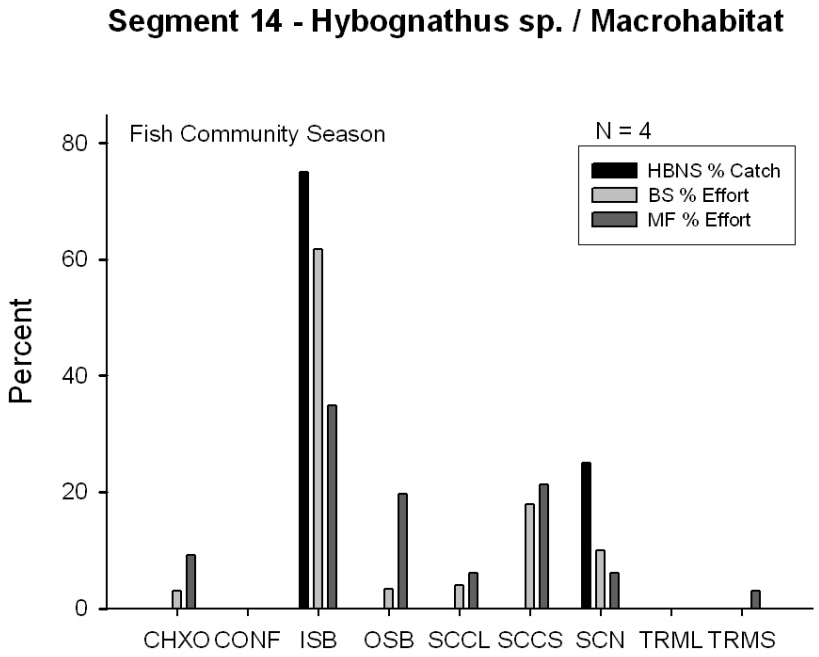

Figure 101. Percent of total *Hybognathus spp.* caught and effort expended by macrohabitat type in segment 14 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

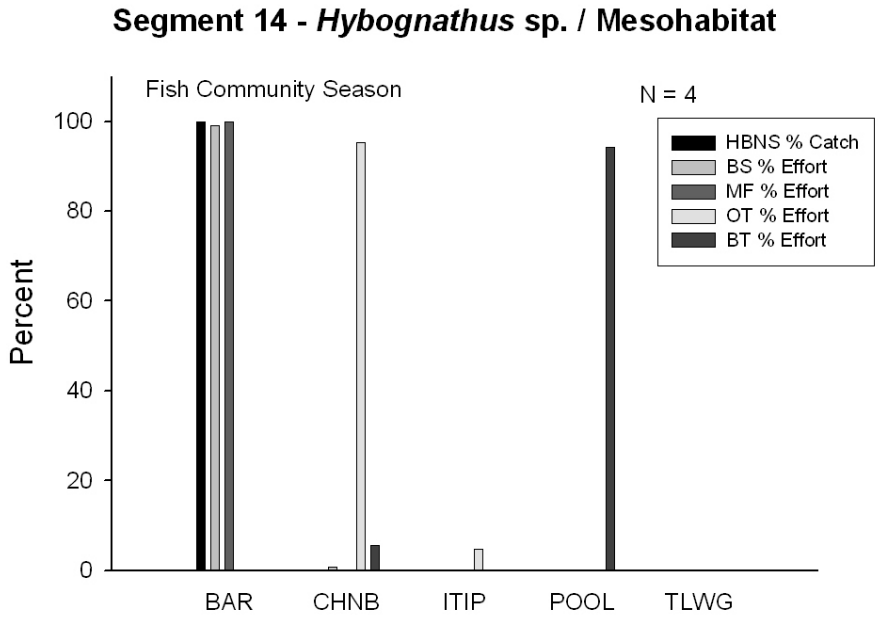

Figure 102. Percent of total *Hybognathus spp.* caught and effort expended by mesohabitat type in segment 14 of the Missouri River during the 2004 fish community season. Habitat abbreviations presented in Appendix B.

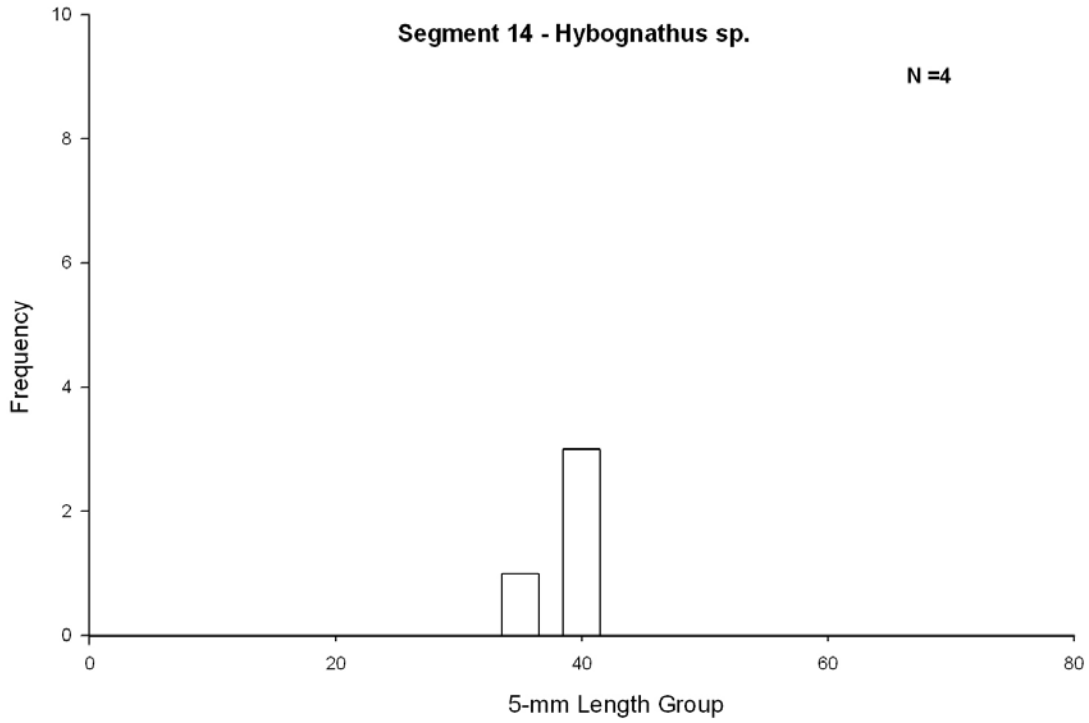

Figure 103. Length frequency of *Hybognathus spp.* during fish community season 2004 in segment 14 of the Missouri River.

Bigmouth Buffalo

Three bigmouth buffalo were collected in 2004 compared to only two in 2003. Two were caught in hoop nets on CHNB and one in a TN (Appendices I1 and I5). Lengths of captured fish ranged from 452 to 510mm suggesting very little reproduction or recruitment for bigmouth buffalo in this part of the river.

Missouri River Fish Community

During the 2004 season 21,100 fish were captured in segments 13 and 14 of the Lower Missouri River. Standard gears captured 68 species with shovelnose sturgeon contributing the largest percentage of the total catch (21.4%, N = 4512). The ten most abundant species accounted for 85% of the total catch. Twenty-two species were captured less than five times (Appendix F).

Gillnets fished during the sturgeon season captured 35 different species of fish and were most effective at capturing shovelnose sturgeon (N = 2,581). Blue catfish (N = 334) and goldeye (N = 179) were the next most abundant fish species collected in gillnet samples, averaging approximately one fish per two net nights (0.705 and 0.426 fish per net/night respectively). Drifted trammel nets, fished during both seasons, caught 27 species. Trammel nets captured shovelnose sturgeon (N = 1,264) more frequently than any other species. While not as abundant as shovelnose sturgeon, other large bodied fish such as channel catfish (N = 111), blue catfish (N = 105) and blue suckers (N = 90), were also captured with trammel nets.

Young-of-year blue (N = 1021) and channel (N = 805) catfish were captured most frequently in otter trawl samples. Three of the target species; shovelnose sturgeon (N = 544), sicklefin chub (N = 531) and speckled chub (N = 492) were commonly captured in otter trawls suggesting some overlap of habitat use existed among these important species. Eighty juvenile paddlefish were also captured with otter trawls. Otter trawling captured 30 species of fish whereas beam trawling only captured 27 species. Beam trawling captured similar species without the abundance of speckled chubs and shovelnose sturgeon. Beam trawling did catch three ictalurid catfishes (black bullhead, freckled madtom and yellow bullhead) not captured with otter trawls. Both methods of trawling sampled small benthic fishes that are not easily sampled with other gear types.

Since hoop nets were deployed in areas where other gears could not be deployed, they captured different fishes more frequently than other gears. Freshwater drum (N = 207), channel catfish (N = 119), flathead catfish (N = 111), blue catfish (N = 77), smallmouth buffalo (N = 109), river carpsucker (N = 92) and shovelnose sturgeon (N=96) dominated the hoop net catch. Hoop nets are legally fished by commercial fishermen in Missouri, although commercial catfish harvest is not allowed. This gear may give biologists a good estimate of what the commercial fishermen

are removing from the river and the quality of fish available to recreational anglers. Hoop nets captured 29 species in all, including four different species of carp; common carp (N = 66), bighead carp (N = 42), silver carp (N = 11) and grass carp (N=4).

The fish community season is different because warm water temperatures and low water levels increase availability of fish and efficiency of sampling, especially in bag seines and mini-fyke nets. These gear types target another group of fishes which are rarely detected with the other standard gear types. Cyprinid species, such as the red shiner (N = 2052), emerald shiner (N = 994), and gizzard shad (N = 656) were caught in high numbers with bag seines. Bag seines captured 33 species of fish including two species not captured with other gear types (spotted bass, N = 5 and silver lamprey, N = 1). Mini-fyke nets captured the same species in high numbers and also captured juvenile silver carp (N = 226), bighead carp (N = 198), common carp (N = 5) and grass carp (N = 2). Mini-fyke nets had the highest species richness catching 44 species of fish. Abundant small prey fish in shallow water habitats suggests that these habitats are of great importance to the Missouri River fish community.

Discussion

Adult pallid sturgeon appeared to use different habitats than juveniles. In the winter and spring months, large pallids were more often found associated with the downstream end of sand bars. Gillnets fished in these locations did not catch shovelnose at the rate of pool habitat, but did catch pallids. Pallid sturgeon telemetry information provided from USGS/CERC has been an important tool in helping target sampling locations that are more difficult to sample. Standard trammel netting and trawling on sand bars consistently captured juvenile pallids, but did not capture adults in the warmer months of the year. The effectiveness of active versus passive gear types to sample specific habitats may be the reason for these differences. For example, passive nets can be set in edge habitat safely and effectively and occupy the benthic portion of edges, while active gears cannot. Active gears such as trammel nets have been used in the last year to try and capture sonic telemetered sturgeon. Through these exercises we have learned that shovelnose are not as vulnerable to active nets as once suspected. The nature of the bed-form in which sturgeon live consists of sand dunes over one meter high in various geometric forms. Additionally, drop-offs associated with dike structures are made by high water velocities at sharp angles and prevent active gear from being fished properly. Similarly, trawling cannot safely be

done around “edge” habitats such as dike tips or revetment scours and has been largely ineffective at capturing larger sturgeon. In the same habitats, stationary gillnets have proven to be successful tools during the winter. It is likely that juvenile pallids may be distributed in areas that make them more vulnerable to nets during the warmer months than adults. In 2005, one-inch trammel nets were set in the same areas as gillnets to test the assumption that smaller fish were not present. It was discovered that the smaller mesh trammel nets effectively did capture smaller sturgeon, including stocked pallids. Standard gillnets did not capture any juvenile pallids, even though efforts were five times higher in gillnets than trammel nets. Though small shovelnose existed in pools, pallids were only captured on channel border areas with stationary set trammel nets in the winter. This information is important to understanding the assumptions of monitoring protocols and accepting biases of the different gear types used within each season.

Trawling techniques and nets have improved in the last year, new implementation of smaller mesh and stronger materials promises to produce better results for all the crews throughout the river. These nets are effective at catching the smallest size classes of sturgeon, but despite their effectiveness, collection of small sturgeon remains rare. Understanding what habitats these small sturgeon occur in is an important component needed to effectively evaluate this younger size class of fish.

Bigmouth buffalo are rarely captured in our sampling. Recent surveys of a scour hole on the floodplain that is only attached to the river ever few years yielded over 50 large adults in an hour of electrofishing. Also, recent night electrofishing has yielded higher numbers of these fish than caught in all gears throughout the year. Sampling for these fish may be more effective in tributaries or backwaters with alternative gears. A measurable change in their abundance may not be detected in more riverine habitats sampled for sturgeon regardless of changes in the ecosystem. This may also prove true for other rarer species such as; sand shiners and hybognathus species.

Commercial harvest of sturgeon in this section of the river is worthy of noting. Belly scars (egg checks) from knife probes in shovelnose, and in one pallid sturgeon, show that commercial fishermen are likely killing more fish than would be documented from harvest reports. The differences in catch rates between the two segments, suggest that segment 14 closer to the Mississippi River receives more fishing pressure than segment 13. Recent data analyses have

revealed a steady increase in catch rates for shovelnose sturgeon with increased distance traveled up the Missouri River within the two segments. Documentation of a check scar on a pallid sturgeon suggests that commercial fishermen would likely harvest pallid sturgeon roe along with the shovelnose sturgeon.

Acknowledgements

Funding for this project was provided by the Army Corps of Engineers, Omaha District. Appreciation is extended to Mark Drobish for his flexibility and efforts in facilitating discussion and incorporating changes in the adaptive process of this project. Thanks goes out to Mark Wildhaber for his contributions in project design and his willing service to help in the protocol development process. Craig Paukert has been providing data analyses that are becoming important tools as we continue to refine our sampling efforts. Andy Starostka of the Columbia Fishery Resources Office provided assistance in project design and field work that was important to 2004 completion. Aaron Delonay of USGS/CERC continues to be an asset to our sampling efforts; providing locations and general information regarding movements and habitat use of this elusive fish.

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

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

Appendix A. (continued).

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

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

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

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

Scientific name	Common name	Letter Code
Centrarchidae - sunfishes		
Lepomis macrochirus	Bluegill	BLGL
Lepomis magalotis	Longear sunfish	LESF
Lepomis microlophus	Redear sunfish	
L. cyanellus X L. macrochirus	Green sunfish-bluegill hybrid	GSBG
L. cyanellus X L. spp?	Unknown Green sunfish hybrid	GN*?
L. cyanellus X L. humilis	Green-orangespotted sunfish hybrid	GSOS
L. macrochirus X L. microlophus	Bluegill-redear sunfish hybrid	
Lepomis spp.	Unidentified *Lepomis*	ULP
Micropterus dolomieu	Smallmouth bass	SMBS
Micropterus punctatus	Spotted sunfish	STBS
Micropterus salmoides	Largemouth bass	LMBS
Micropterus spp.	Unidentified *Micropterus* spp.	
Pomoxis annularis	White crappie	WTCP
Pomoxis nigromaculatus	Black crappie	BKCP
Pomoxis spp.	Unidentified crappie	
P. annularis X P. nigromaculatus	White-black crappie hybrid	
Centrarchidae	Unidentified centrarchid	UCN
Percidae - perches		
Ammocrypta asprella	Crystal darter	CLDR
Etheostoma blennioides	Greenside darter	GSDR
Etheostoma caeruleum	Rainbow darter	RBDR
Etheostoma exile	Iowa darter	IODR
Etheostoma flabellare	Fantail darter	FTDR
Etheostoma gracile	Slough darter	SLDR
Etheostoma microperca	Least darter	LTDR
Etheostoma nigrum	Johnny darter	JYDR
Etheostoma punctulatum	Stippled darter	STPD
Etheostoma spectabile	Orangethroated darter	OTDR
Etheostoma tetrazonum	Missouri saddled darter	MSDR
Etheostoma zonale	Banded darter	BDDR
Etheostoma spp.	Unidentified Etheostoma spp.	UET
Perca flavescens	Yellow perch	YWPH
Percina caproides	Logperch	LGPH
Percina cymatotaenia	Bluestripe darter	BTDR
Percina evides	Gilt darter	GLDR
Percina maculate	Blackside darter	BSDR
Percina phoxocephala	Slenderhead darter	SHDR
Percina shumardi	River darter	RRDR
Percina spp.	Unidentified Percina spp.	UPN
	Unidentified darter	UDR
Zander canadense	Sauger	**SGER***
Zander vitreum	Walleye	WLEY
Z. canadense X Z. vitreum	Sauger-walley hybrid/Saugeye	SGWE
Zander spp.	Unidentified *Zander* (formerly *Stizostedion*) spp.	UST
Percidae	Unidentified percidae	UPC

Appendix A. (continued).

Scientific name	Common name	Letter Code
Sciaenidae - drums		
Aplodinotus grunniens	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

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: Macro habitats, Meso habitats, and Micro habitats.

Habitat	Scale	Definition	Code
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
Main channel outside bend	Macro	The concave side of a river bend	OSB
Main channel inside bend	Macro	The convex side of a river bend	ISB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCN
Tributary small mouth	Macro	Mouth of entering tributary whose mean annual discharge is < 20 m^3/s, mouth width is > 6 m wide and the sample area extends 300 m into the tributary	TRMS
Tributary large mouth	Macro	Mouth of entering tributary whose mean annual discharge is > 20 m^3/s, and the sample area extends 300 m into the tributary	TRML
Tributary 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
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 segments 13 and 14 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for segments 13 and 14.

Gear	Code	Type	Season	Years deployed	CPUE units
Trammel net	TN	Standard	All	2003 - 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^2
Bag Seine – quarter arc method pulled downstream	BSQD	Standard	Fish Comm.	2003 - Present	fish/100 m^2
Bag Seine – half arc method pulled upstream	BSHU	Standard	Fish Comm.	2003 - Present	fish/100 m^2
Bag Seine – half arc method pulled downstream	BSHD	Standard	Fish Comm.	2003 - Present	fish/100 m^2
Bag seine – rectangular method pulled upstream	BSRU	Standard	Fish Comm.	2003 - Present	fish/100 m^2
Bag seine – rectangular method pulled upstream	BSRD	Standard	Fish Comm.	2003 - Present	fish/100 m^2
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night

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

State(s)	RPMA	Site Name	Code
MT	2	Wolf Point	WFP
MT	2	Culbertson	CBS
MT	2	Milk	MLK
MT	2	Brockton	BRK
MT	2	Poplar	POP
MT	2	Intake – Yellowstone River	INT
MT	2	Sidney – Yellowstone River	SID
MT	2	Fairview – Yellowstone River	FRV
MT	2	Above Intake – Yellowstone River	AIN
SD/NE	3	Sunshine Bottoms	SUN
SD/NE	3	Verdel Boat Ramp	VER
SD/NE	4	Mulberry Bend	MUL
NE/IA	4	Sioux City	SIO
NE/IA	4	Bellevue – Platte River Confluence	BEL
NE/IA	4	Rulo	RLO
NE/MO/KS	4	Kansas River	KSR
MO	4	Grand River	GDR
MO	4	Boonville	BOO
MO	4	Jefferson City	JEF
MO	4	Mokane	MOK
MO	4	Herman	HER

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segments 13 and 14 of the Missouri River (RPMA 4). Summary based on best available information.

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Average Length (mm)	Primary Mark	Secondary Mark
1994	St. Charles	837	1992	3/9/1994	N/A	Coded Wire	Dangler
1994	Washington	607	1992	3/9/1994	N/A	Coded Wire	Dangler
1994	Herman	988	1992	3/9/1994	N/A	Coded Wire	Dangler
1997	St. Charles	400	1997	10/15/1997	N/A	Coded Wire	Dangler
1997	Washington	400	1997	10/16/1997	N/A	Coded Wire	Dangler
1997	Herman	400	1997	10/17/1997	N/A	Coded Wire	Dangler
2002	Boonville	2531	2001	4/3/2002	204	PIT Tag	Some Elastomer
2002	Boonville	165	1999	4/25/2002	437	PIT Tag	Elastomer
2003	Boonville	2852	2002	7/26/2003	284	PIT Tag	
2003	Boonville	1770	2003	12/2/2003	N/A	Coded Wire	Some Elastomer
2004	Boonville	774	2003	7/8/2004	208	PIT Tag	Elastomer
2004	Boonville	916	2003	7/30/2004	263	PIT Tag	
2004	Boonville	9761	2004	9/10/2004	86	Coded Wire	Elastomer
2004	Boonville	2199	2004	10/8/2004	117	Coded Wire	Elastomer

Appendix F

Total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Meso habitat within a Macro habitat for all species caught with each gear type during sturgeon season and fish community season for segments 13 and 14 of the channelized Missouri River during 2003-2004. Species captured are listed phylogenetically 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. Double asterisks indicate < 2 habitat occurrences for sample size, and SE was not calculated.

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

Species	Total catch	Overall CPUE													
Macro-			OSB		ISB		CHXO		SCCL			SCCS		CONF	
Meso-			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	POOL	CHNB
Petromyzontidae - lampreys															
CNLP	1	0.003		0.017											
		(0.005)		(0.034)											
Ascipenseridae - sturgeons															
LKSG	19	0.040	0.029	0.017		0.114		0.056							0.083
		(0.023)	(0.059)	(0.034)		(0.079)		(0.076)							(0.167)
PDSG*	7	0.016		0.017	0.026	0.023						0.063			
		(0.013)		(0.034)	(0.036)	(0.032)						(0.125)			
SNSG*	2581	6.582	4.353	5.224	4.205	8.295	10.115	12.750	1.500	2.167	3.500	5.000	0.500	5.357	5.167
		(1.210)	(2.281)	(2.089)	(1.914)	(2.617)	(5.477)	(6.277)	(2.000)	(1.764)	(**)	(6.889)	(**)	(7.030)	(4.137)
SNPD	11	0.027		0.052	0.013	0.034		0.083							
		(0.018)		(0.058)	(0.026)	(0.038)		(0.121)							
Polyodontidae - paddlefishes															
PDFH	18	0.045			0.038	0.125		0.056						0.071	
		(0.026)			(0.043)	(0.093)		(0.076)						(0.143)	
Lepisosteidae – gars															
LNGR	47	0.109	0.059	0.034	0.064	0.091	0.115	0.222			0.500		0.500	0.643	0.167
		(0.049)	(0.081)	(0.048)	(0.091)	(0.067)	(0.166)	(0.232)			(**)		(**)	(0.747)	(0.333)
SNGR	78	0.194	0.088	0.328		0.420	0.077	0.306					0.500		
		(0.139)	(0.095)	(0.372)		(0.513)	(0.104)	(0.363)					(**)		
Hiodontidae - mooneyes															
GDEY	179	0.426	0.971	0.776	0.205	0.284	0.077	0.222				0.563		1.286	0.333
		(0.194)	(0.953)	(0.685)	(0.385)	(0.324)	(0.154)	(0.336)				(0.789)		(1.716)	(0.333)
MNEY	1	0.003	0.029												
		(0.005)	(0.059)												

Appendix F1 (continued).

Species	Total catch	Overall CPUE													
Macro-			OSB		ISB		CHXO		SCCL			SCCS		CONF	
Meso-			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	POOL	CHNB
Clupeidae - herrings															
GZSD	45	0.093	0.176	0.086	0.026	0.057	0.154	0.167						0.357	0.167
		(0.049)	(0.296)	(0.122)	(0.036)	(0.048)	(0.308)	(0.229)						(0.360)	(0.211)
Cyprinidae – carps and minnows															
GSCP	12	0.032		0.034	0.038	0.034		0.056				0.125			
		(0.022)		(0.048)	(0.057)	(0.038)		(0.111)				(0.250)			
CARP	38	0.093	0.029	0.103	0.051	0.034	0.231	0.278				0.063	1.000	0.071	0.083
		(0.047)	(0.059)	(0.091)	(0.049)	(0.050)	(0.332)	(0.326)				(0.125)	(**)	(0.143)	(0.167)
SVCP	44	0.104	0.118	0.086		0.205	0.154	0.194				0.063			
		(0.052)	(0.136)	(0.071)		(0.182)	(0.175)	(0.200)				(0.125)			
BHCP	3	0.008				0.011		0.056							
		(0.012)				(0.023)		(0.111)							
Catostomidae - suckers															
RVCS	71	0.181	0.088	0.241	0.038	0.318	0.038	0.278			1.000			0.214	0.333
		(0.089)	(0.095)	(0.225)	(0.057)	(0.302)	(0.077)	(0.336)			(**)			(0.297)	(0.494)
QLBK	2	0.003			0.013										
		(0.005)			(0.026)										
WTSK	7	0.019	0.118	0.017			0.077								
		(0.016)	(0.106)	(0.034)			(0.154)								
BUSK*	11	0.024			0.026	0.034		0.028		0.167				0.143	
		(0.017)			(0.036)	(0.038)		(0.056)		(0.333)				(0.286)	
NHSK	1	0.003	0.029												
		(0.005)	(0.059)												
SMBF	32	0.074	0.059	0.103	0.013	0.148	0.077	0.056		0.167					0.083
		(0.034)	(0.081)	(0.115)	(0.026)	(0.095)	(0.154)	(0.076)		(0.333)					(0.167)
BMBF*	3	0.008		0.034			0.038								
		(0.012)		(0.069)			(0.077)								
RVRH	1	0.003										0.063			
		(0.005)										(0.125)			
GDRH	6	0.016	0.059			0.011								0.214	
		(0.013)	(0.081)			(0.023)								(0.202)	
SHRH	23	0.048	0.088		0.090	0.057		0.056				0.063			
		(0.027)	(0.128)		(0.089)	(0.058)		(0.076)				(0.125)			

Appendix F1 (continued).

Species	Total catch	Overall CPUE													
Macro-			OSB		ISB		CHXO		SCCL			SCCS		CONF	
Meso-			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	POOL	CHNB
Ictaluridae – bullhead catfishes															
BLCF	334	0.705	1.029	1.621	0.179	0.943	0.154	0.556		0.667	2.000	0.125		0.071	0.333
		(0.231)	(0.972)	(1.203)	(0.149)	(0.261)	(0.308)	(0.369)		(1.333)	(**)	(0.250)		(0.143)	(0.333)
CNCF	76	0.189	0.118	0.052	0.038	0.523		0.083				0.563		0.071	0.167
		(0.200)	(0.106)	(0.103)	(0.043)	(0.821)		(0.090)				(1.125)		(0.143)	(0.333)
FHCF	2	0.005		0.034											
		(0.008)		(0.048)											
Percichthyidae – temperate basses															
SBWB	8	0.021	0.059			0.011								0.143	0.250
		(0.022)	(0.118)			(0.023)								(0.286)	(0.500)
Centrarchidae - sunfishes															
LMBS	1	0.003												0.071	
		(0.005)												(0.143)	
BKCP	1	0.003						0.028							
		(0.005)						(0.056)							
Percidae - perches															
SGER*	46	0.128	0.147	0.121	0.141	0.136		0.139	0.250			0.375		0.071	
		(0.055)	(0.143)	(0.146)	(0.137)	(0.114)		(0.195)	(0.500)			(0.526)		(0.143)	
WLEY	3	0.008					0.115								
		(0.016)					(0.231)								
Sciaenidae - drums															
FWDM	31	0.066		0.190	0.038	0.034		0.139	0.250					0.071	0.083
		(0.041)		(0.219)	(0.057)	(0.038)		(0.158)	(0.500)					(0.143)	(0.167)

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

Species	Total catch	Overall CPUE									
Macro-			OSB	ISB	CHXO	SCCL		SCCS		TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP		CHNB
Ascipenseridae - sturgeons											
LKSG	3	0.004		0.004	0.007						
		(0.005)		(0.006)	(0.015)						
PDSG*	9	0.009		0.010	0.005		0.032				
		(0.007)		(0.009)	(0.010)		(0.064)				
SNSG*	1264	1.563	1.000	1.617	1.702	0.355	2.200	1.000	0.881	0.667	0.696
		(0.404)	(2.000)	(0.526)	(0.865)	(0.434)	(2.774)	(**)	(0.787)	(**)	(0.681)
SNPD	4	0.004		0.004	0.007						
		(0.004)		(0.005)	(0.014)						
Lepisosteidae – gars											
LNGR	12	0.014		0.011	0.009						0.417
		(0.012)		(0.009)	(0.017)						(0.833)
SNGR	2	0.001		0.002							
		(0.003)		(0.004)							
Hiodontidae - mooneyes											
GDEY	33	0.041	0.333	0.032	0.035		0.064		0.112	0.333	0.083
		(0.018)	(0.667)	(0.018)	(0.036)		(0.128)		(0.176)	(**)	(0.167)
Clupeidae - herrings											
SJHR	2	0.001			0.008						
		(0.003)			(0.015)						
GZSD	6	0.006		0.008					0.026		
		(0.006)		(0.009)					(0.051)		

Appendix F2 (continued).

Species	Total catch	Overall CPUE									
Macro-			OSB	ISB	CHXO	SCCL		SCCS		TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP		CHNB
Cyprinidae – carps and minnows											
GSCP	1	0.001		0.001							
		(0.002)		(0.002)							
CARP	6	0.006		0.006	0.009						
		(0.005)		(0.006)	(0.017)						
SVCP	2	0.003		0.003	0.007						
		(0.005)		(0.006)	(0.013)						
BHCP	1	0.001		0.002							
		(0.003)		(0.004)							
GDSN	1	0.004		0.005							
		(0.007)		(0.011)							
Catostomidae - suckers											
RVCS	21	0.028		0.016	0.022	0.030	0.096		0.120	0.333	0.167
		(0.015)		(0.012)	(0.027)	(0.061)	(0.192)		(0.177)	(**)	(0.333)
QLBK	1	0.002		0.003							
		(0.004)		(0.005)							
BUSK*	90	0.094		0.099	0.075	0.030			0.233		0.226
		(0.038)		(0.052)	(0.060)	(0.061)			(0.224)		(0.279)
SMBF	53	0.058		0.045	0.126				0.078		
		(0.020)		(0.019)	(0.075)				(0.085)		
SHRH	6	0.006		0.006	0.009						
		(0.006)		(0.007)	(0.017)						

Appendix F2 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL		SCCS		TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP		CHNB
Ictaluridae – bullhead catfishes											
BLCF	105	0.119		0.134	0.088		0.099	0.667	0.153		0.083
		(0.042)		(0.058)	(0.062)		(0.141)	(**)	(0.209)		(0.167)
CNCF	111	0.085		0.054	0.064	0.218	0.615		0.173		
		(0.054)		(0.036)	(0.053)	(0.364)	(1.231)		(0.219)		
FHCF	1	0.001		0.002							
		(0.002)		(0.003)							
Percidae - perches											
SGER*	8	0.008		0.007	0.005	0.023	0.031				0.083
		(0.006)		(0.008)	(0.010)	(0.045)	(0.062)				(0.167)
WLEY	1	0.001		0.007							
		(0.002)		(0.003)							
Sciaenidae - drums											
FWDM	16	0.024		0.032	0.011						
		(0.026)		(0.039)	(0.015)						

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

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL		SCCS	TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	ITIP		CHNB
Ascipenseridae - sturgeons										
USG	26	0.037		0.026	0.041	0.065				0.395
		(0.020)		(0.018)	(0.030)	(0.093)				(0.575)
PDSG*	9	0.007		0.007	0.011					0.037
		(0.006)		(0.007)	(0.015)					(0.074)
SNSG*	544	0.608	0.708	0.546	0.683	0.258	0.825	0.580	0.234	1.645
		(0.127)	(0.467)	(0.122)	(0.380)	(0.207)	(0.384)	(0.242)	(0.294)	(1.751)
SNPD	1	0.001		0.002						
		(0.002)		(0.004)						
Polyodontidae - paddlefishes										
PDFH	80	0.089		0.046	0.235	0.089			0.195	
		(0.059)		(0.033)	(0.228)	(0.177)			(0.389)	
Lepisosteidae – gars										
LNGR	2	0.003		0.003	0.005					
		(0.004)		(0.006)	(0.010)					
SNGR	4	0.007	0.021		0.019					0.034
		(0.007)	(0.042)		(0.030)					(0.067)
Hiodontidae - mooneyes										
GDEY	23	0.031	0.222	0.005	0.026	0.122	0.114	0.051		
		(0.026)	(0.444)	(0.008)	(0.026)	(0.201)	(0.227)	(0.102)		
MNEY	2	0.003						0.095		
		(0.006)						(0.189)		
Clupeidae - herrings										
GZSD	20	0.019	0.053	0.003	0.011	0.237	0.036	0.028		
		(0.018)	(0.073)	(0.004)	(0.017)	(0.389)	(0.072)	(0.055)		

Appendix F3 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL		SCCS	TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	ITIP		CHNB
Cyprinidae – carps and minnows										
RDSN	29	0.017		0.005	0.061					
		(0.022)		(0.007)	(0.090)					
CARP	11	0.013	0.140	0.002	0.009	0.038			0.100	
		(0.010)	(0.167)	(0.003)	(0.013)	(0.051)			(0.200)	
SVCP	1	0.001				0.022				
		(0.001)				(0.044)				
BHCP	1	0.001	0.024							
		(0.002)	(0.048)							
SKCB*	492	0.582	0.766	0.435	0.589	0.414	0.927	1.249	1.056	1.831
		(0.131)	(0.593)	(0.119)	(0.213)	(0.416)	(1.102)	(1.630)	(1.009)	(2.498)
SGCB*	40	0.041		0.024	0.095		0.030	0.109		
		(0.029)		(0.014)	(0.114)		(0.060)	(0.169)		
SFCB*	531	0.538	1.099	0.503	0.507	0.097	1.589	0.439		0.362
		(0.153)	(1.188)	(0.187)	(0.266)	(0.108)	(2.062)	(0.307)		(0.723)
SVCB	88	0.093	0.071	0.059	0.078	0.092	0.379	0.205	1.248	
		(0.040)	(0.097)	(0.033)	(0.058)	(0.104)	(0.520)	(0.410)	(2.029)	
UHY	5	0.005	0.037	0.002	0.004			0.038		
		(0.005)	(0.074)	(0.003)	(0.007)			(0.076)		
ERSN	67	0.066		0.017	0.149	0.026	0.125	0.436		0.030
		(0.070)		(0.015)	(0.260)	(0.052)	(0.183)	(0.871)		(0.060)
RVSN	12	0.016		0.013	0.016	0.061	0.068			
		(0.014)		(0.022)	(0.019)	(0.121)	(0.092)			
MMSN	1	0.001		0.001						
		(0.001)		(0.002)						
BHMW	2	0.003	0.033	0.002						
		(0.003)	(0.065)	(0.003)						
Catostomidae - suckers										
RVCS	6	0.007	0.024	0.002	0.012				0.100	0.037
		(0.005)	(0.048)	(0.003)	(0.017)				(0.200)	(0.073)
BUSK*	37	0.045	0.062	0.038	0.031			0.135		0.323
		(0.020)	(0.123)	(0.020)	(0.029)			(0.153)		(0.503)
SMBF	6	0.008		0.007	0.008					0.073
		(0.005)		(0.008)	(0.010)					(0.096)

Appendix F3 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL		SCCS	TRML	CONF
Meso-			CHNB	CHNB	CHNB	CHNB	ITIP	ITIP		CHNB
Ictaluridae – bullhead catfishes										
BLCF	1021	1.232	3.193	0.856	1.751	1.908	1.175	0.392	0.076	0.914
		(0.385)	(3.151)	(0.282)	(1.150)	(3.035)	(0.962)	(0.332)	(0.152)	(1.197)
CNCF	805	0.953	2.301	0.561	0.803	2.186	1.807	2.395	1.480	1.955
		(0.266)	(1.778)	(0.220)	(0.701)	(1.884)	(1.327)	(1.879)	(0.880)	(1.453)
FHCF	11	0.012		0.012	0.015	0.033				
		(0.007)		(0.010)	(0.017)	(0.066)				
UCF	31	0.039	0.139	0.014		0.069	0.109		1.395	0.058
		(0.033)	(0.277)	(0.013)		(0.097)	(0.218)		(2.299)	(0.116)
Centrarchidae - sunfishes										
BLGL	1	0.002	0.037							
		(0.003)	(0.074)							
Percidae - perches										
SGER*	2	0.002			0.003	0.022				
		(0.002)			(0.006)	(0.044)				
Sciaenidae - drums										
FWDM	54	0.070	0.602	0.028	0.038	0.033	0.023	0.057	0.271	0.129
		(0.046)	(0.790)	(0.023)	(0.040)	(0.066)	(0.046)	(0.077)	(0.367)	(0.135)
Non-taxonomic categories										
UNID	1	0.002			0.008					
		(0.003)			(0.016)					

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

Species	Total catch	Overall CPUE							
Macro-			OSB		ISB		CHXO	SCCL	CONF
Meso-			CHNB	POOL	CHNB	POOL	POOL	CHNB	POOL
Ascipenseridae - sturgeons									
SNSG*	20	0.073		0.099	0.172	0.037	0.081	0.161	
		(0.035)		(0.076)	(0.166)	(0.043)	(0.080)	(0.322)	
Lepisosteidae – gars									
SNGR	6	(0.027)		(0.020)		(0.035)	(0.106)		
		0.007		0.019		0.000	0.000		
Hiodontidae - mooneyes									
GDEY	2	0.007		0.019					
		(0.009)		(0.027)					
Clupeidae - herrings									
GZSD	4	0.013		0.038					
		(0.019)		(0.056)					

Appendix F4 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB	OSB	ISB	ISB	CHXO	SCCL	CONF
Meso-			CHNB	POOL	CHNB	POOL	POOL	CHNB	POOL
Cyprinidae – carps and minnows									
RDSN	2	0.005				0.016			
		(0.010)				(0.032)			
CARP	2	0.003		0.010					
		(0.006)		(0.019)					
SVCP	2	0.008		0.023					
		(0.011)		(0.033)					
BHCP	2	0.014		0.041					
		(0.019)		(0.057)					
SKCB*	91	0.364		0.416	0.093	0.358	0.276	0.720	1.374
		(0.148)		(0.281)	(0.185)	(0.225)	(0.291)	(0.559)	(2.747)
SGCB*	3	0.010				0.020	0.017		
		(0.011)				(0.028)	(0.034)		
SFCB*	1016	4.190	1.364	4.076	0.812	4.205	6.042	0.455	2.753
		(1.250)	(2.727)	(1.265)	(0.752)	(1.639)	(4.504)	(0.568)	(4.159)
SVCB	10	0.047				0.027	0.036		1.374
		(0.062)				(0.039)	(0.054)		(2.747)
UHY	74	0.284		0.601		0.207	0.075		
		(0.308)		(0.875)		(0.274)	(0.113)		
ERSN	4	0.027		0.008		0.060			0.275
		(0.039)		(0.016)		(0.119)			(0.549)
RVSN	17	0.078		0.225		0.009			
		(0.101)		(0.298)		(0.017)			
BHMW	7	0.029		0.074			0.018		
		(0.025)		(0.071)			(0.035)		
Catostomidae - suckers									
RVCS	10	0.039		0.054		0.016	0.040		0.275
		(0.028)		(0.061)		(0.032)	(0.045)		(0.549)

Appendix F4 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB	OSB	ISB	ISB	CHXO	SCCL	CONF
Meso-			CHNB	POOL	CHNB	POOL	POOL	CHNB	POOL
Ictaluridae – bullhead catfishes									
BKBH	1	0.003					0.011		
		(0.005)					(0.022)		
YLBH	2	0.011		0.033					
		(0.022)		(0.065)					
BLCF	418	1.832	0.682	1.687	0.916	2.071	2.197	1.675	1.688
		(0.467)	(1.363)	(0.824)	(1.197)	(0.916)	(1.012)	(2.032)	(1.580)
CNCF	199	0.873	0.852	0.758	0.317	0.555	1.134	0.672	6.696
		(0.300)	(0.795)	(0.338)	(0.406)	(0.345)	(0.685)	(1.131)	(7.766)
FKMT	2	0.007				0.016	0.008		
		(0.010)				(0.032)	(0.015)		
FHCF	3	0.009		0.007		0.010	0.014		
		(0.010)		(0.014)		(0.019)	(0.028)		
UCF	5	0.017		0.014		0.039			
		(0.019)		(0.028)		(0.054)			
Centrarchidae - sunfishes									
GNSF	1	0.004		0.013					
		(0.008)		(0.025)					
BLGL	4	0.015		0.046					
		(0.016)		(0.046)					
Percidae - perches									
SGER*	1	0.003					0.013		
		(0.005)					(0.025)		
Sciaenidae - drums									
FWDM	51	0.210	0.227	0.272		0.061	0.104		3.303
		(0.136)	(0.454)	(0.157)		(0.047)	(0.101)		(5.230)
Non-taxonomic categories									
UNID	3	0.014		0.015		0.030			
		(0.017)		(0.029)		(0.045)			

Appendix F5. Hoop Nets: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species	Total catch	Overall CPUE							
Macro-			OSB		ISB	CHXO	SCCL	SCCS	CONF
Meso-			CHNB	POOL	CHNB	CHNB	CHNB	CHNB	CHNB
Petromyzontidae - lampreys									
CNLP	3	0.009			0.018				0.059
		(0.01)			(0.026)				(0.118)
Ascipenseridae - sturgeons									
LKSG	2	0.006	0.008		0.009				
		(0.008)	(0.017)		(0.018)				
SNSG*	96	0.270	0.441		0.118	0.338	0.067		0.118
		(0.121)	(0.278)		(0.062)	(0.323)	(0.133)		(0.161)
SNPD	1	0.003	0.008						
		0.006	0.017						
Polyodontidae - paddlefishes									
PDFH	11	0.032	0.017		0.027	0.054			0.118
		(0.019)	(0.024)		(0.031)	(0.053)			(0.161)
Lepisosteidae – gars									
LNGR	26	0.076	0.042		0.109	0.041			0.353
		(0.044)	(0.050)		(0.104)	(0.060)			(0.340)
SNGR	9	0.026			0.027	0.041	0.133		0.059
		(0.017)			(0.031)	(0.046)	(0.182)		(0.118)

Appendix F5 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB		ISB	CHXO	SCCL	SCCS	CONF
Meso-			CHNB	POOL	CHNB	CHNB	CHNB	CHNB	CHNB
Hiodontidae - mooneyes									
GDEY	12	0.032	0.034		0.055	0.014			
		(0.022)	(0.048)		(0.044)	(0.027)			
MNEY	2	0.006	0.008		0.009				
		(0.008)	(0.017)		(0.018)				
Clupeidae - herrings									
GZSD	15	0.044	0.068		0.018	0.054			0.059
		(0.032)	(0.079)		(0.026)	(0.065)			(0.118)
Cyprinidae – carps and minnows									
GSCP	4	0.012				0.027	0.133		
		(0.012)				(0.038)	(0.182)		
CARP	66	0.192	0.186		0.191	0.189		0.600	0.353
		(0.070)	(0.108)		(0.098)	(0.187)		(0.800)	(0.593)
SVCP	11	0.032	0.059		0.027	0.014			
		(0.028)	(0.073)		(0.031)	(0.027)			
BHCP	42	0.122			0.264	0.149			0.118
		(0.080)			(0.198)	(0.220)			(0.235)
Catostomidae - suckers									
RVCS	92	0.267	0.373		0.273	0.149	0.400		0.059
		(0.189)	(0.464)		(0.304)	(0.120)	(0.380)		(0.118)
BUSK*	55	0.160	0.195		0.155	0.189			0.059
		(0.065)	(0.119)		(0.107)	(0.171)			(0.118)
SMBF	109	0.317	0.415		0.200	0.432	0.333		0.059
		(0.122)	(0.153)		(0.118)	(0.468)	(0.540)		(0.118)
BMBF*	6	0.017	0.017		0.018	0.027			
		(0.014)	(0.024)		(0.026)	(0.038)			
GDRH	1	0.003	0.008						
		(0.006)	(0.017)						
SHRH	6	0.017	0.008		0.036	0.014			
		(0.014)	(0.017)		(0.036)	(0.027)			

Appendix F5 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB		ISB	CHXO	SCCL	SCCS	CONF
Meso-			CHNB	POOL	CHNB	CHNB	CHNB	CHNB	CHNB
BLCF	77	0.212	0.220		0.245	0.149	0.333		0.235
		(0.058)	(0.097)		(0.119)	(0.099)	(0.319)		(0.273)
CNCF	119	0.349	0.475		0.227	0.405	0.600		
		(0.155)	(0.321)		(0.126)	(0.445)	(0.800)		
FHCF	111	0.323	0.415		0.273	0.216	0.733	0.600	0.118
		(0.088)	(0.155)		(0.155)	(0.140)	(0.816)	(0.800)	(0.161)
Percichthyidae – temperate basses									
SBWB	2	0.006					0.133		
		(0.012)					(0.267)		
Centrarchidae - sunfishes									
WTCP	3	0.009			0.018	0.014			
		(0.013)			(0.036)	(0.027)			
BKCP	1	0.003							0.059
		(0.006)							(0.118)
Percidae - perches									
SGER*	2	0.006	0.008		0.009				
		(0.008)	(0.017)		(0.018)				
Sciaenidae - drums									
FWDM	207	0.599	0.627	0.500	0.527	0.743	0.333	0.400	0.647
		(0.140)	(0.249)	(1.000)	(0.191)	(0.375)	(0.422)	(0.800)	(0.821)

Appendix F6. Bag Seine: overall season and segment summary. Lists CPUE (fish/100 m^2) and 2 standard errors in parentheses.

Species	Total catch	Overall CPUE							
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR
Petromyzontidae - lampreys									
SVLP	1	0.004					0.023		
		(0.373)					(0.231)		
Ascipenseridae - sturgeons									
SNSG*	2	0.015		0.014			0.049		
		(0.152)		(0.135)			(0.485)		
Lepisosteidae – gars									
LNGR	1	0.01		0.018					
		(0.965)		(0.182)					
SNGR	2	0.008					0.051		
		(0.592)					(0.357)		
Hiodontidae - mooneyes									
GDEY	9	0.073		0.031		0.144	0.086		2.381
		(0.341)		(0.219)		(0.144)	(0.694)		(**)
Clupeidae - herrings									
GZSD	656	3.429	4.666	2.446	5.019	1.711	2.569	6.671	34.921
		(0.666)	(3.643)	(0.635)	(1.223)	(0.487)	(0.698)	(3.946)	(**)
Cyprinidae – carps and minnows									
CLSR	1	0.005		0.009					
		(0.482)		(0.913)					
GSCP	1	0.009							0.794
		(0.912)							(**)
RDSN	2052	12.077	35.167	9.438	25.85	3.089	5.762	29.645	15.873
		(2.342)	(2.217)	(1.991)	(11.220)	(0.778)	(1.882)	(17.640)	(**)

Appendix F6 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR
Cyprinidae – carps and minnows (continued)									
HBNS*	1	0.005						0.046	
		(0.477)						(0.462)	
SVCP	19	0.089	1.993			0.275		0.147	
		(0.518)	(1.993)			(0.214)		(0.113)	
BHCP	1	0.009						0.088	
		(0.912)						(0.881)	
SKCB*	152	0.681	0.166	0.755	0.064		1.555	0.229	
		(0.318)	(0.166)	(0.415)	(0.641)		(1.288)	(0.129)	
SFCB*	64	0.361	1.329	0.604			0.032	0.055	
		(0.227)	(1.328)	(0.412)			(0.318)	(0.547)	
SVCB	33	0.176		0.187	0.317		0.162	0.283	
		(0.464)		(0.672)	(0.317)		(0.111)	(0.189)	
UHY	4	0.019		0.035					
		(0.187)		(0.354)					
ERSN	994	7.352	31.239	3.698	30.207	0.602	0.979	3.917	171.429
		(2.462)	(28.240)	(1.265)	(16.750)	(0.278)	(0.371)	(1.869)	(**)
RVSN	69	0.322	6.840	0.202		0.081	0.226	0.127	
		(0.144)	(4.788)	(0.951)		(0.888)	(0.114)	(0.877)	
SNSN*	33	0.174	0.664	0.187	0.293		0.070	0.273	
		(0.693)	(0.664)	(0.118)	(0.223)		(0.695)	(0.194)	
MMSN	15	0.058		0.039			0.023	0.323	
		(0.366)		(0.288)			(0.231)	(0.323)	
CNSN	29	0.125		0.031			0.023	1.016	
		(0.157)		(0.234)			(0.231)	(1.164)	
FHMW	3	0.027						0.265	
		(0.273)						(0.264)	
BHMW	17	0.078		0.012	0.321		0.193	0.183	
		(0.371)		(0.115)	(0.325)		(0.139)	(0.183)	
UCY	7	0.041				0.214		0.185	
		(0.295)				(0.213)		(0.184)	

Appendix F6 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR
Catostomidae - suckers									
RVCS	40	0.200	0.332	0.077		0.394	0.255	0.677	
		(0.627)	(0.332)	(0.343)		(0.322)	(0.174)	(0.378)	
UCS	3	0.014						0.139	
		(0.143)						(0.138)	
Ictaluridae – bullhead catfishes									
BLCF	4	0.029		0.026		0.144			
		(0.186)		(0.193)		(0.144)			
CNCF	106	0.715	2.051	0.895	0.510	1.299	0.100		0.794
		(0.233)	(2.512)	(0.327)	(0.445)	(0.866)	(0.676)		(**)
FHCF	1	0.005		0.009					
		(0.482)		(0.913)					
UCF	2	0.010		0.009			0.031		
		(0.679)		(0.887)			(0.392)		
Poeciliidae - livebearers									
MQTF	1	0.005						0.046	
		(0.477)						(0.462)	
Percichthyidae – temperate basses									
WTBS	1	0.005						0.046	
		(0.477)						(0.462)	
Centrarchidae - sunfishes									
GNSF	2	0.010		0.019					
		(0.689)		(0.129)					
OSSF	2	0.010					0.023	0.061	
		(0.729)					(0.231)	(0.615)	
BLGL	1	0.005		0.009					
		(0.482)		(0.913)					
STBS	5	0.046							3.968
		(0.456)							(**)

Appendix F6 (continued).

Species	Total catch	Overall CPUE							
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR
Sciaenidae - drums									
FWDM	5	0.045 (0.225)		0.028 (0.282)	0.064 (0.641)	0.144 (0.144)		0.107 (0.718)	
Non-taxonomic categories									
UNID	5	0.004 (0.381)	0.166 (0.166)						

Appendix F7. Mini-fyke Net: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS	CONF
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR	BAR
Petromyzontidae - lampreys										
CNLP	1	0.007	0.038							
		(0.014)	(0.077)							
Lepisosteidae – gars										
LNGR	6	0.043		0.021	0.095		0.120			
		(0.040)		(0.042)	(0.131)		(0.176)			
SNGR	70	0.500	0.346	0.426	0.619	0.300	0.720	0.875		
		(0.171)	(0.247)	(0.226)	(0.42)	(0.427)	(0.658)	(0.959)		
Hiodontidae - mooneyes										
GDEY	3	0.021				0.300				
		(0.043)				(0.600)				
Clupeidae - herrings										
GZSD	218	1.557	0.846	0.809	0.429	1.800	0.920	13.250	0.500	1.000
		(1.521)	(0.725)	(0.526)	(0.763)	(1.973)	(0.711)	(26.215)	(1.000)	(**)

Appendix F7 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS	CONF
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR	BAR
Cyprinidae – carps and minnows										
GSCP	2	0.014	0.038					0.125		
		(0.020)	(0.077)					(0.250)		
RDSN	1589	11.607	13.077	11.447	9.333	6.800	10.880	17.500	1.000	69.000
		(3.389)	(8.225)	(6.555)	(6.575)	(5.810)	(7.784)	(14.760)	(2.000)	(**)
CARP	5	0.036		0.021	0.048	0.100	0.040	0.125		
		(0.031)		(0.043)	(0.095)	(0.200)	(0.080)	(0.250)		
HBNS*	8	0.057	0.077	0.128						
		(0.056)	(0.106)	(0.156)						
SVCP	226	1.614		0.128	0.095	0.400	8.560			
		(2.971)		(0.156)	(0.190)	(0.8)	(16.62)			
BHCP	198	1.114		0.021			6.200			
		(2.214)		(0.042)			(12.4)			
SKCB*	124	0.886	0.538	1.021	2.429	0.100	0.360	0.125		
		(0.785)	(0.846)	(0.748)	(4.857)	(0.2)	(0.460)	(0.25)		
SFCB*	185	1.329	0.154	1.043	5.095	0.100	0.880	0.375		
		(1.510)	(0.213)	(0.986)	(9.794)	(0.2)	(0.874)	(0.75)		
SVCB	26	0.186	0.308	0.128	0.286	0.100	0.120	0.000	1.000	
		(0.098)	(0.346)	(0.144)	(0.244)	(0.2)	(0.175)	(0)	(2)	
UHY	1	0.007		0.021						
		(0.014)		(0.042)						
GDSN	1	0.007		0.021						
		(0.014)		(0.042)						
ERSN	824	5.879	10.269	7.191	4.095	2.900	2.200	2.250	6.500	17.000
		(3.241)	(8.314)	(8.210)	(3.664)	(2.606)	(1.562)	(3.111)	(13)	(**)
RVSN	64	0.457	0.115	0.191	0.048	0.500	1.840			
		(0.509)	(0.169)	(0.198)	(0.095)		(2.770)			
SNSN*	46	0.329	0.115	0.085	1.048		0.680			
		(0.367)	(0.127)	(0.170)	(2.095)		(1.024)			
MMSN	3	0.021		0.043	0.048					
		(0.031)		(0.085)	(0.095)					

Appendix F7 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS	CONF
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR	BAR
Cyprinidae – carps and minnows (continued)										
CNSN	13	0.093	0.077	0.043			0.360			
		(0.103)	(0.153)	(0.085)			(0.527)			
BNMW	14	0.100	0.192	0.106	0.095			0.250		
		(0.073)	(0.222)	(0.151)	(0.131)			(0.5)		
FHMW	1	0.007		0.021						
		(0.014)		(0.042)						
BHMW	37	0.257	0.462	0.170	0.333	0.100	0.080	0.750		
		(0.139)	(0.403)	(0.152)	(0.574)	(0.2)	(0.110)	(0.981)		
UCY	1	0.007		0.021						
		(0.014)		(0.042)						
CLSR	1	0.007	0.038							
		(0.014)	(0.076)							
Catostomidae - suckers										
RVCS	44	0.314	0.269	0.043	0.048	0.600	0.920	0.625		
		(0.301)	(0.284)	(0.059)	(0.095)	(0.8)	(1.595)	(0.995)		
SMBF	1	0.007		0.021						
		(0.014)		(0.042)						
Ictaluridae – bullhead catfishes										
BLCF	4	0.029			0.095		0.080			
		(0.040)			(0.190)		(0.16)			
CNCF	184	1.407	1.038	1.489	0.952	2.300	2.000	0.750	0.500	
		(0.480)	(0.705)	(0.889)	(0.668)	(1.606)	(1.762)	(0.823)	(1)	
FHCF	1	0.014				0.100	0.040			
		(0.020)				(0.2)	(0.08)			
UCF	9	0.093		0.085			0.360			
		(0.097)		(0.102)			(0.501)			

Appendix F7 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS	CONF
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR	BAR
Cyprinodontidae - killifishes										
NTSF	1	0.007		0.021						
		(0.014)		(0.042)						
Poeciliidae - livebearers										
MQTF	8	0.057		0.085	0.048		0.040	0.250		
		(0.048)		(0.102)	(0.095)		(0.08)	(0.5)		
Atherinidae - silversides										
BKSS	4	0.029	0.038	0.043			0.040			
		(0.028)	(0.076)	(0.059)			(0.08)			
Percichthyidae – temperate basses										
WTBS	2	0.014		0.021	0.048					
		(0.020)		(0.042)	(0.095)					
Centrarchidae - sunfishes										
GNSF	1	0.007			0.048					
		(0.014)			(0.095)					
OSSF	12	0.086		0.128				0.750		
		(0.091)		(0.098)				(1.5)		
BLGL	72	0.514	0.269	1.000	0.190	1.000	0.040	0.375		
		(0.369)	(0.393)	(0.977)	(0.175)	(2)	(0.08)	(0.526)		
ULP	4	0.029	0.077			0.100	0.040			
		(0.028)	(0.106)			(0.2)	(0.08)			
LMBS	3	0.021		0.021		0.000	0.080			
		(0.031)		(0.042)		(0)	(0.16)			
WTCP	13	0.071	0.077	0.064	0.048	0.200			1.000	
		(0.052)	(0.106)	(0.072)	(0.095)	(0.4)			(2)	
BKCP	4	0.029			0.143	0.100				
		(0.045)			(0.285)	(0.2)				
Percidae - perches										
SHDR	1	0.014		0.021			0.040			
		(0.020)		(0.042)			(0.08)			
SGER*	3	0.007		0.021						
		(0.014)		(0.042)						

Appendix F7 (continued).

Species	Total catch	Overall CPUE								
Macro-			OSB	ISB	CHXO	SCCL	SCCS	SCN	TRMS	CONF
Meso-			BAR	BAR	BAR	BAR	BAR	BAR	BAR	BAR
Sciaenidae - drums										
FWDM	30	0.186 (0.127)	0.308 (0.346)	0.128 (0.115)	0.476 (0.670)		0.080 (0.110)			
Non-taxonomic categories										
UNID	5	0.036 (0.037)		0.106 (0.109)						

APPENDIX G

SEGMENT 13

Sturgeon Season

Target species total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Meso habitat within a Macro habitat caught during sturgeon season for segment 13 of the channelized Missouri River during 2003-2004. Species captured are listed phylogenetically 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. Double asterisks indicate < 2 habitat occurrences for sample size, and SE was not calculated.

Appendix G1. Gill Net: Target species segment 13, sturgeon season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro-	OSB		ISB		CHXO		SCCL		SCCS		TRML	CONF		GRAND
		Meso-	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	CHNB	ITIP		CHNB	POOL	TOTAL
PDSG	CPUE			0.038	0.043	0.029					0.071					**0.024**
	2SE			(0.076)	(0.060)	(0.058)					(0.142)					**(0.021)**
	Sum			1	2	1					1					**5**
SNSG	CPUE		5.167	3.269	4.283	12.588	11.545	14.556	2.500	3.500	5.714	0.500	4.000	12.000	5.875	**7.621**
	2SE		(3.080)	(1.487)	(2.444)	(4.896)	(6.083)	(11.390)	(**)	(**)	(7.782)	(**)	(**)	(13.790)	(5.977)	**(1.847)**
	Sum		124	85	192	428	233	262	5	7	79	1	8	72	47	**1543**
SNPD	CPUE			0.038		0.029		0.167								**0.024**
	2SE			(0.076)		(0.058)		(0.235)								**(0.025)**
	Sum			1		1		3								**5**
BUSK	CPUE				0.022	0.059		0.056					1.000	0.333		**0.039**
	2SE				(0.043)	(0.080)		(0.111)					(**)	(0.666)		**(0.032)**
	Sum				1	2		1					2	2		**8**
BMBF	CPUE			0.077												**0.010**
	2SE			(0.153)												**(0.019)**
	Sum			2												**2**
SGER	CPUE		0.083	0.154	0.065	0.265		0.111	0.500		0.429			0.167		**0.136**
	2SE		(0.112)	(0.307)	(0.130)	(0.258)		(0.222)	(**)		(0.594)			(0.333)		**(0.080)**
	Sum		2	4	3	9		2	1		4			1		**26**

Appendix G2. Trammel Net: Target species segment 13, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	ISB	CHXO	SCCL		SCCS	TRML	GRAND
		Meso-	CHNB	CHNB	CHNB	ITIP	ITIP		TOTAL
PDSG	CPUE		0.022						**0.016**
	2SE		(0.025)						**(0.018)**
	Sum		3						**3**
SNSG	CPUE		1.333	0.630	0.250	2.818	2.112	0.833	**1.224**
	2SE		(0.717)	(0.647)	(0.500)	(2.106)	(0.391)	(**)	**(0.555)**
	Sum		206	19	2	18	11	1	**257**
SNPD	CPUE		0.005						**0.004**
	2SE		(0.009)						**(0.007)**
	Sum		1						**1**
BUSK	CPUE		0.053	0.035			0.192		**0.050**
	2SE		(0.040)	(0.070)			(0.383)		**(0.033)**
	Sum		14	1			1		**16**
SGER	CPUE				0.125				**0.003**
	2SE				(0.250)				**(0.005)**
	Sum				1				**1**

Appendix G3. Otter Trawl: Target species segment 13, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-Meso-	OSB CHNB	ISB CHNB	CHXO CHNB	SCCL CHNB	ITIP	SCCS ITIP	TRML	GRAND TOTAL
PDSG	CPUE			0.008	0.039					**0.014**
	2SE			(0.009)	(0.053)					**(0.014)**
	Sum			3	2					**5**
SNSG	CPUE		0.802	0.589	0.762	0.328	0.852	0.863		**0.628**
	2SE		(0.418)	(0.225)	(0.372)	(0.460)	(1.131)	(1.110)		**(0.170)**
	Sum		4	116	36	4	5	5		**170**
SNPD	CPUE			0.008						**0.005**
	2SE			(0.016)						**(0.009)**
	Sum			1						**1**
SKCB	CPUE		2.121	0.820	0.826	0.611		5.278	1.195	**0.932**
	2SE		(2.128)	(0.279)	(0.396)	(0.905)		(9.136)	(1.610)	**(0.289)**
	Sum		10	123	43	7		34	6	**223**
SGCB	CPUE			0.022	0.068					**0.030**
	2SE			(0.028)	(0.077)					**(0.025)**
	Sum			4	3					**7**
SFCB	CPUE		0.222	0.259	0.265			0.462		**0.238**
	2SE		(0.444)	(0.097)	(0.185)			(0.923)		**(0.077)**
	Sum		1	57	13			3		**74**
BUSK	CPUE			0.030						**0.018**
	2SE			(0.038)						**(0.023)**
	Sum			5						**5**

Appendix G4. Beam Trawl: Target species segment 13, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	ISB	SCCL	SCCS	GRAND
		Meso-	CHNB	CHNB	ITIP	TOTAL
SNSG	CPUE		0.200			**0.050**
	2SE		(**)			**(0.100)**
	Sum		1			**1**
SKCB	CPUE			0.500	0.000	**0.250**
	2SE			(1.000)	(**)	**(0.500)**
	Sum			3	2	**5**
SFCB	CPUE		0.200			**0.050**
	2SE		(**)			**(0.100)**
	Sum		1			**1**

Appendix G5. Hoop Net: Target species segment 13, sturgeon season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro- / Meso-	OSB CHNB	ISB CHNB	CHXO CHNB	SCCL CHNB	**GRAND TOTAL**
SNSG	CPUE		0.361	0.111	0.278	0.333	**0.242**
	2SE		(0.339)	(0.123)	(0.354)	(0.666)	**(0.157)**
	Sum		13	3	5	1	**22**
BUSK	CPUE		0.139	0.037	0.056		**0.077**
	2SE		(0.227)	(0.074)	(0.111)		**(0.094)**
	Sum		5	1	1		**7**
BMBF	CPUE		0.028		0.111		**0.033**
	2SE		(0.055)		(0.152)		**(0.037)**
	Sum		1		2		**3**

APPENDIX H

SEGMENT 13

Fish Community Season

Target species total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Meso habitat within a Macro habitat caught during fish community season for segment 13 of the channelized Missouri River during 2003-2004. Species captured are listed phylogenetically 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. Double asterisks indicate < 2 habitat occurrences for sample size, and SE was not calculated.

Appendix H1. Trammel Net: Target species segment 13, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	SCCL		SCCS	GRAND
		Meso-	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	TOTAL
PDSG	CPUE			0.013	0.017				**0.012**
	2SE			(0.017)	(0.033)				**(0.013)**
	Sum			3	1				**4**
SNSG	CPUE		2.000	2.626	1.988	1.022	0.263	0.161	**2.274**
	2SE		(4.000)	(1.521)	(1.453)	(1.430)	(0.526)	(0.322)	**(1.075)**
	Sum		8	368	90	5	1	4	**476**
SNPD	CPUE			0.005					**0.003**
	2SE			(0.009)					**(0.006)**
	Sum			1					**1**
BUSK	CPUE			0.087	0.142	0.111		0.250	**0.102**
	2SE			(0.122)	(0.176)	(0.222)		(0.500)	**(0.092)**
	Sum			11	7	1		5	**24**
SGER	CPUE			0.010	0.017				**0.011**
	2SE			(0.020)	(0.033)				**(0.015)**
	Sum			1	1				**2**

Appendix H2. Otter Trawl: Target species segment 13, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	SCCL		SCCS	GRAND
		Meso-	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	TOTAL
PDSG	CPUE			0.019					**0.010**
	2SE			(0.028)					**(0.015)**
	Sum			3					**3**
SNSG	CPUE		0.454	0.998	0.503	0.227	0.879	0.740	**0.775**
	2SE		(0.515)	(0.318)	(0.261)	(0.314)	(0.801)	(0.316)	**(0.197)**
	Sum		7	118	21	3	10	11	**170**
SKCB	CPUE		0.653	0.056	0.379	0.267	0.132	0.057	**0.202**
	2SE		(0.782)	(0.051)	(0.410)	(0.533)	(0.263)	(0.114)	**(0.129)**
	Sum		9	8	16	4	1	1	**39**
SGCB	CPUE			0.014	0.296				**0.070**
	2SE			(0.028)	(0.520)				**(0.110)**
	Sum			2	14				**16**
SFCB	CPUE		2.049	0.719	1.209	0.213	0.076	0.331	**0.883**
	2SE		(2.249)	(0.663)	(1.056)	(0.274)	(0.151)	(0.466)	**(0.483)**
	Sum		33	98	52	3	1	4	**191**
BUSK	CPUE		0.123	0.032	0.031			0.231	**0.047**
	2SE		(0.246)	(0.037)	(0.061)			(0.311)	**(0.038)**
	Sum		1	3	1			3	**8**
SGER	CPUE					0.067			**0.004**
	2SE					(0.133)			**(0.007)**
	Sum					1			**1**

Appendix H3. Beam Trawl: Target species segment 13, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB		CHXO	CONF	GRAND
		Meso-	POOL	CHNB	POOL	POOL	POOL	TOTAL
SNSG	CPUE		0.176	0.208	0.065	0.039		**0.091**
	2SE		(0.168)	(0.240)	(0.074)	(0.077)		**(0.058)**
	Sum		5	2	4	1		**12**
SKCB	CPUE		0.181		0.205	0.438	1.374	**0.280**
	2SE		(0.321)		(0.190)	(0.628)	(2.747)	**(0.211)**
	Sum		7		7	8	5	**27**
SGCB	CPUE					0.038		**0.008**
	2SE					(0.075)		**(0.016)**
	Sum					1		**1**
SFCB	CPUE		2.778	0.751	4.193	7.241	2.753	**3.991**
	2SE		(1.583)	(1.021)	(2.380)	(9.207)	(4.159)	**(2.197)**
	Sum		117	6	147	100	10	**380**

Appendix H4. Hoop Net: Target species segment 13, fish community season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	**GRAND**
		Meso-	CHNB	CHNB	CHNB	**TOTAL**
SNSG	CPUE		0.074	0.154	0.130	**0.107**
	2SE		(0.102)	(0.144)	(0.190)	**(0.075)**
	Sum		2	4	3	**9**
BUSK	CPUE		0.407	0.308		**0.226**
	2SE		(0.306)	(0.288)		**(0.136)**
	Sum		11	8		**19**

Appendix H5. Bag Seine: Target species segment 13, fish community season summary. Lists CPUE (fish/100 m^2) and 2 standard errors in parentheses.

Species		Macro-	ISB	CHXO	SCCS	SCN	GRAND
		Meso-	BARS	BARS	BARS	BARS	TOTAL
SNSG	CPUE				0.113		**0.018**
	2SE				(0.226)		**(0.036)**
	Sum				1		**1**
SKCB	CPUE		0.032	0.096			**0.025**
	2SE		(0.064)	(0.192)			**(0.035)**
	Sum		2	1			**3**
SNSN	CPUE			0.340		0.265	**0.058**
	2SE			(0.680)		(0.529)	**(0.084)**
	Sum			2		1	**3**

Appendix H6. Mini-fyke Net: Target species segment 13, fish community season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	SCCL	SCCS	SCN	GRAND
		Meso-	BARS	BARS	BARS	BARS	BARS	BARS	TOTAL
HBNS	CPUE		0.154	0.125					**0.065**
	2SE		(0.208)	(0.183)					**(0.067)**
	Sum		2	3					**5**
SKCB	CPUE		0.077	0.708	3.400		0.727		**1.000**
	2SE		(0.153)	(0.696)	(6.800)		(1.012)		**(1.342)**
	Sum		1	17	51		8		**77**
SFCB	CPUE		0.154	0.458	7.133	0.167		0.750	**1.610**
	2SE		(0.307)	(0.481)	(13.700)	(0.333)		(1.500)	**(2.675)**
	Sum		2	11	107	1		3	**124**
SNSN	CPUE		0.154	0.167	1.467				**0.364**
	2SE		(0.208)	(0.333)	(2.933)				**(0.579)**
	Sum		2	4	22				**28**

APPENDIX I

SEGMENT 14

Sturgeon Season

Target species total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Meso habitat within a Macro habitat caught during sturgeon season for segment 14 of the channelized Missouri River during 2003-2004. Species captured are listed phylogenetically 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. Double asterisks indicate < 2 habitat occurrences for sample size, and SE was not calculated.

Appendix I1. Gill Net: Target species segment 14, sturgeon season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro-	OSB		ISB		CHXO		SCCL			TRML	CONF		GRAND
		Meso-	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL		POOL	CHNB	TOTAL
PDSG	CPUE					0.017				0.167					**0.010**
	2SE					(0.034)				(0.333)					**(0.013)**
	Sum					1				1					**2**
SNSG	CPUE		2.400	6.132	3.639	5.569	1.500	8.955	0.333	1.167	3.500	0.833	0.375	3.750	**4.641**
	2SE		(1.655)	(2.993)	(2.870)	(2.385)	(2.516)	(5.438)	(0.333)	(1.333)	(**)	(1.201)	(0.750)	(5.500)	**(1.235)**
	Sum		24	218	122	289	9	197	1	6	7	5	3	15	**896**
SNPD	CPUE			0.079	0.028	0.034									**0.029**
	2SE			(0.085)	(0.055)	(0.047)									**(0.023)**
	Sum			2	1	2									**5**
BUSK	CPUE				0.028	0.017				0.167					**0.015**
	2SE				(0.055)	(0.034)				(0.333)					**(0.016)**
	Sum				1	1				1					**3**
BMBF	CPUE						0.167								**0.005**
	2SE						(0.333)								**(0.009)**
	Sum						1								**1**
SGER	CPUE		0.300	0.079	0.222	0.052		0.182				0.167			**0.107**
	2SE		(0.400)	(0.085)	(0.245)	(0.075)		(0.278)				(0.333)			**(0.062)**
	Sum		3	3	6	3		3				1			**19**

Appendix I2. Trammel Net: Target species segment 14, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	ISB	CHXO	SCCL		SCCS	TRML	CONF	GRAND
		Meso-	CHNB	CHNB	CHNB	ITIP	ITIP		CHNB	TOTAL
PDSG	CPUE		0.006			0.060				**0.008**
	2SE		(0.012)			(0.119)				**(0.031)**
	Sum		1			1				**2**
SNSG	CPUE		1.011	2.607	0.056	3.205	0.487	0.667	0.696	**1.394**
	2SE		(0.757)	(2.479)	(0.111)	(5.096)	(0.112)	(**)	(0.681)	**(0.764)**
	Sum		144	103	1	53	2	2	7	**312**
SNPD	CPUE		0.006	0.029						**0.009**
	2SE		(0.012)	(0.058)						**(0.013)**
	Sum		1	1						**2**
BUSK	CPUE		0.207	0.042			0.431		0.226	**0.149**
	2SE		(0.164)	(0.058)			(0.862)		(0.278)	**(0.100)**
	Sum		31	2			2		3	**38**
SGER	CPUE			0.017		0.057			0.083	**0.008**
	2SE			(0.034)		(0.114)			(0.166)	**(0.013)**
	Sum			1		1			1	**3**

Appendix I3. Otter Trawl: Target species segment 14, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	SCCL		SCCS		TRML	CONF	GRAND
		Meso-	CHNB	CHNB	CHNB	CHNB	ITIP	CHNB	ITIP		CHNB	TOTAL
PDSG	CPUE										0.042	**0.004**
	2SE										(0.083)	**(0.007)**
	Sum										1	**1**
SNSG	CPUE		1.865	0.421	0.281	0.061	0.792		0.235	0.467	1.851	**0.542**
	2SE		(2.002)	(0.246)	(0.195)	(0.121)	(0.061)		(0.297)	(0.289)	(1.930)	**(0.239)**
	Sum		8	41	20	1	5		3	3	43	**124**
SKCB	CPUE		0.513	0.642	1.049	0.610	0.254	2.759	0.885	0.917	2.060	**0.901**
	2SE		(1.025)	(0.297)	(0.524)	(1.219)	(0.507)	(**)	(1.344)	(1.834)	(2.785)	**(0.330)**
	Sum		2	74	63	11	2	4	6	6	17	**185**
SGCB	CPUE			0.007	0.025				0.077			**0.013**
	2SE			(0.013)	(0.034)				(0.154)			**(0.013)**
	Sum			1	2				1			**4**
SFCB	CPUE			0.166	0.106		0.254		0.255		0.407	**0.160**
	2SE			(0.106)	(0.118)		(0.507)		(0.332)		(0.814)	**(0.093)**
	Sum			24	10		2		2		10	**50**
BUSK	CPUE			0.063	0.089				0.175		0.363	**0.093**
	2SE			(0.054)	(0.091)				(0.349)		(0.563)	**(0.063)**
	Sum			7	5				1		5	**18**
SGER	CPUE				0.012							**0.003**
	2SE				(0.023)							**(0.006)**
	Sum				1							**1**

Appendix I4. Beam Trawl: Target species segment 14, sturgeon season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	GRAND
		Meso-	POOL	POOL	POOL	TOTAL
SKCB	CPUE		1.212	0.661	0.167	**0.557**
	2SE		(2.424)	(0.241)	(0.333)	**(0.468)**
	Sum		4	5	1	**10**
SFCB	CPUE			0.244		**0.098**
	2SE			(0.281)		**(0.130)**
	Sum			2		**2**

Appendix I5. Hoop Net: Target species segment 14, sturgeon season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro- Meso-	OSB CHNB	ISB CHNB	CHXO CHNB	TRML	CONF CHNB	**GRAND TOTAL**
SNSG	CPUE		1.241	0.138	1.143	1.500	0.250	**0.670**
	2SE		(0.995)	(0.130)	(1.580)	(1.000)	(0.327)	**(0.412)**
	Sum		36	4	16	3	2	**61**
SNPD	CPUE		0.034					**0.011**
	2SE		(0.068)					**(0.021)**
	Sum		1					**1**
BUSK	CPUE		0.069	0.138	0.786		0.125	**0.198**
	2SE		(0.095)	(0.215)	(0.816)		(0.250)	**(0.153)**
	Sum		2	4	11		1	**18**
BMBF	CPUE		0.034	0.069				**0.033**
	2SE		(0.068)	(0.095)				**(0.037)**
	Sum		1	2				**3**
SGER	CPUE		0.034	0.034				**0.022**
	2SE		(0.068)	(0.068)				**(0.030)**
	Sum		1	1				**2**

APPENDIX J

SEGMENT 14

Fish Community Season

Target species total catch, overall mean catch per unit effort (± 2 SE), and mean CPUE (fish/100 m) by Meso habitat within a Macro habitat caught during fish community season for segment 14 of the channelized Missouri River during 2003-2004. Species captured are listed phylogenetically 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. Double asterisks indicate < 2 habitat occurrences for sample size, and SE was not calculated.

Appendix J1. Trammel Net: Target species segment 14, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	ISB	CHXO	SCCS		GRAND
		Meso-	CHNB	CHNB	CHNB	ITIP	TOTAL
SNSG	CPUE		1.360	1.405	1.000	1.054	**1.288**
	2SE		(0.826)	(1.704)	(**)	(1.588)	**(0.657)**
	Sum		147	50	3	12	**212**
BUSK	CPUE		0.067	0.065		0.179	**0.073**
	2SE		(0.045)	(0.096)		(0.357)	**(0.046)**
	Sum		9	2		1	**12**
SGER	CPUE		0.017				**0.011**
	2SE		(0.024)				**(0.015)**
	Sum		2				**2**

Appendix J2. Otter Trawl: Target species segment 14, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	CHXO	SCCL		SCCS	GRAND
		Meso-	CHNB	CHNB	CHNB	CHNB	ITIP	ITIP	TOTAL
SNSG	CPUE		0.222	0.180	1.192	0.588	0.708	0.667	**0.481**
	2SE		(0.444)	(0.086)	(1.435)	(1.176)	(0.583)	(0.000)	**(0.387)**
	Sum		1	29	45	3	4	4	**86**
SKCB	CPUE			0.165	0.016		4.583	0.333	**0.228**
	2SE			(0.144)	(0.031)		(0.833)	(0.666)	**(0.182)**
	Sum			24	1		25	2	**52**
SGCB	CPUE			0.048	0.030		0.167	0.500	**0.054**
	2SE			(0.038)	(0.041)		(0.333)	(1.000)	**(0.036)**
	Sum			7	2		1	3	**13**
SFCB	CPUE		0.222	0.873	0.597	0.196	8.333	1.000	**0.938**
	2SE		(0.444)	(0.346)	(0.416)	(0.392)	(3.333)	(1.333)	**(0.365)**
	Sum		1	139	26	1	44	6	**217**
BUSK	CPUE			0.033					**0.020**
	2SE			(0.029)					**(0.018)**
	Sum			6					**6**

Appendix J3. Beam Trawl: Target species segment 14, fish community season summary. Lists CPUE (fish/100 m) and 2 standard errors in parentheses.

Species		Macro-	OSB		ISB		CHXO	SCCL	GRAND
		Meso-	CHNB	POOL	CHNB	POOL	POOL	CHNB	TOTAL
SNSG	CPUE			0.048			0.132	0.323	**0.063**
	2SE			(0.071)			(0.155)	(0.912)	**(0.072)**
	Sum			3			3	1	**7**
SKCB	CPUE			0.542	0.556	0.542	0.139	0.939	**0.442**
	2SE			(0.556)	(**)	(0.543)	(0.137)	(0.992)	**(0.353)**
	Sum			26	1	14	6	3	**50**
SGCB	CPUE					0.056			**0.014**
	2SE					(0.078)			**(0.030)**
	Sum					2			**2**
SFCB	CPUE		2.727	5.269	1.667	5.018	5.810	0.911	**5.153**
	2SE		(**)	(2.420)	(**)	(2.486)	(3.861)	(0.751)	**(2.097)**
	Sum		6	277	3	141	204	3	**634**
SGER	CPUE						0.027		**0.007**
	2SE						(0.055)		**(0.020)**
	Sum						1		**1**

Appendix J4. Hoop Net: Target species segment 14, fish community season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro- Meso-	OSB CHNB	ISB CHNB	CHXO CHNB	**GRAND TOTAL**
SNSG	CPUE		0.038	0.071	0.053	**0.048**
	2SE		(0.076)	(0.099)	(0.105)	**(0.047)**
	Sum		1	2	1	**4**
BUSK	CPUE		0.192	0.143	0.105	**0.133**
	2SE		(0.272)	(0.223)	(0.144)	**(0.117)**
	Sum		5	4	2	**11**

Appendix J5. Bag Seine: Target species segment 14, fish community season summary. Lists CPUE (fish/100 m^2) and 2 standard errors in parentheses.

Species		Macro- Meso-	OSB BARS	ISB BARS	CHXO BARS	SCCS BARS	SCN BARS	**GRAND TOTAL**
SNSG	CPUE			0.021				**0.012**
	2SE			(0.042)				**(0.024)**
	Sum			1				**1**
HBNS	CPUE						0.069	**0.008**
	2SE						(0.138)	**(0.016)**
	Sum						1	**1**
SKCB	CPUE		0.332	1.179		2.720	0.344	**1.167**
	2SE		(**)	(1.300)		(4.448)	(0.360)	**(1.033)**
	Sum		1	80		64	4	**149**
SFCB	CPUE		2.658	0.958		0.056	0.082	**0.628**
	2SE		(**)	(1.297)		(0.111)	(0.164)	**(0.762)**
	Sum		8	54		1	1	**64**
SNSN	CPUE		1.329	0.296	0.198	0.122	0.277	**0.259**
	2SE		(**)	(0.370)	(0.396)	(0.243)	(0.554)	**(0.231)**
	Sum		4	18	1	3	4	**30**

Appendix J6. Mini-fyke Nets: Target species segment 14, fish community season summary. Lists CPUE (fish/net night) and 2 standard errors in parentheses.

Species		Macro-	OSB	ISB	SCCL	SCCS	SCN	TRMS	**GRAND**
		Meso-	BARS	BARS	BARS	BARS	BARS		**TOTAL**
HBNS	CPUE			0.130					**0.045**
	2SE			(0.260)					**(0.090)**
	Sum			3					**3**
SKCB	CPUE		1.000	1.348	0.250	0.071	0.250		**0.712**
	2SE		(1.679)	(1.351)	(0.500)	(0.142)	(0.500)		**(0.583)**
	Sum		13	31	1	1	1		**47**
SFCB	CPUE		0.154	1.652		1.571			**0.939**
	2SE		(0.307)	(1.942)		(1.478)			**(0.760)**
	Sum		2	38		22			**62**
SNSN	CPUE		0.077			1.214			**0.273**
	2SE		(0.153)			(1.805)			**(0.392)**
	Sum		1			17			**18**
SGER	CPUE			0.043		0.071		0.500	**0.045**
	2SE			(0.086)		(0.142)		(1.000)	**(0.051)**
	Sum			1		1		1	**3**