2007 Annual Report

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

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

Over the past five years, the number of hatchery reared and unknown origin (potentially wild) pallid sturgeon that have been captured in segment 14 has increased. In particular, from 2003 through 2006, the total number of pallid sturgeon captured increased from two in 2003 to four in 2004, 13 in 2005, 9 in 2006, and 19 in 2007. Of these, more than half were confirmed to be from hatchery stockings. This increase indicates some level of survival and success of the stocking program. Of the 19 pallid sturgeon collected in 2007, five were confirmed by genetics to be of wild origin and the remaining 14 were positively identified as hatchery origin. One of the 14 hatchery reared pallid sturgeon had lost its PIT tag.

Various gears were used throughout the year over a wide range of habitat types and temperatures. Four of the 19 pallid sturgeon were captured with standard stationary set gill nets and one was captured with a wild "broodstock" gill net. With active gears, three pallid sturgeon were captured in 1-inch trammel nets and one pallid sturgeon was captured in an otter trawl. Ten pallid sturgeon were captured with trot lines. Results from past years suggest that channel boarder (CHNB) mesohabitat is preferred by pallid sturgeon, especially during migration. During 2007, all but one pallid sturgeon were captured in CHNB mesohabitat. Twelve of the 19 pallid sturgeon captures occurred within inside-bend (ISB) macrohabitat, which was the habitat most sampled with all gears. Pallid sturgeon were also captured on less frequently occurring habitats including two in channel crossover (CHXO) macrohabitat and five in tributary confluence (CONF) macrohabitat. Pallid and shovelnose sturgeon have been shown to aggregate, or cluster around particular reaches of the river. One such area was discovered during the spring of 2005 at river mile (RM) 44 where biologists captured five large pallid sturgeon (> 700 mm) during a week sampling period around a single sand bar. This sand bar was also reported to have produced pallid sturgeon in 2004. During the spring of 2007, field crews again deployed standard and non-standard gear near this location (RM 44) and captured three pallid sturgeon, one of which was a 812 mm pallid stocked by Missouri Department of Conservation in the mid-1990's. Most of the pallid sturgeon captured during 2007 clustered around the confluences of major tributaries like the Osage and Gasconade rivers, as well as at the confluence with the Mississippi

River. Efforts will continue to identify clustering areas like these through additional telemetry efforts and targeted sampling. More of these areas need to be identified to enhance the ability of sampling crews to target pallid sturgeon populations in the future.

Since standard sampling began in segment 14, only one pallid sturgeon has been recaptured for a second time despite dozens being potentially "at large" within this reach. The only pallid stockings in this reach of the river were 2,445 fish in 1994 and 1,200 in 1997 for a total of 3,632 fish. However, since 2002, 21,035 pallid sturgeon have been stocked at Boonville, MO, which is only 65 miles upstream of segment 14. At present, there has been a cumulative total of 24,667 fish stocked between Booneville (RM 195) and St. Charles (RM 25), and of the fish recaptured during 2006, they represented their stocked year class as follows: 1997 year class = 0.0008%, 2002 year class = 0.002%, and 2004 year class = 0.0002%. The combined total percentage of stocked fish captured (N = 14) versus proximate availability (N= 24,667) was 0.0006%. There has been a relatively high rate of occurrence of the 1997 stocked year class of pallid sturgeon in the past several years, which have been found to exhibit a restricted upper home range. The 1997 year class sturgeon captured this year could have been of Mississippi origin (coded wire tagged); however, the vast majority of these fish have been found within the area that they were stocked, rather than hundreds of miles upstream, indicating it was most likely stocked in the Missouri River near Washington, MO.

The ratio of hybrid sturgeon to pallid and shovelnose sturgeon has been a useful tool to monitor the impact of pallid sturgeon population decline and the effects of hybridization. Because trammel nets are the most consistent tool for monitoring these ratios, it was used to compare ratios between years. In 2005, the ratio of pallid to shovelnose sturgeon in segment 14 was one pallid for every 673 shovelnose and increased to one pallid for every 231 shovelnose in 2006. During 2007, that ratio increased further to one pallid for every 167 shovelnose sturgeon. The number of hybrids to pallid sturgeon has remained constant since 2006 at about one hybrid for every one pallid, however, this number is approximately 3 hybrids for every 1 pallid when only considering wild origin fish.

Community target fish species are used as a gauge for relative change in the river in the absence of pallid sturgeon information. Young of the year shovelnose sturgeon (YOY) were present but not abundant in 2007 (N = 37). Sturgeon of larger sizes (> 250 mm) were the most abundant large fish represented in the sampling effort (N = 3640) which suggests that the appropriate gears are being used to detect adult sturgeon, particularly shovelnose. Of the 3658 shovelnose sturgeon captured, they were represented in the gear as follows: 2,786 in gill nets, 636 in 1-inch trammel nets, 297 in 16-foot otter trawls, and none captured in mini-fyke nets. Using standard gears, 54 species were captured throughout the year. Different gears were used to target different fishes in the community. The population assessment project, in turn, is adapting to determine the best methods to ensure efficiency within these gears. Sturgeon chubs, sicklefin chubs, and speckled chubs have been captured most often with otter trawls. Sand shiners and *Hybognathus* spp. have been captured most often with mini-fyke nets, but not with otter trawls. Blue suckers have been captured with gill nets, trammel nets, and otter trawls; and the majority of sauger have been captured with gill nets.

Since 2005, there has been a notable decline in both abundance and catch rates of all three target chub species in segment 14. We assume that variations in the populations are directly related to environmental conditions in the river (i.e., water levels, spring rise, etc…) but a true correlation can only be attained over several more years of trend data. In 2006, field crews captured a large number of YOY blue suckers for the first time since project implementation in 2003. Despite high spring rises, these YOY blue suckers were not observed again during 2007. In all, abundances and catch rates of all three target chub species, sand shiners, blue suckers, and sauger were at all time lows during 2007. In addition, field crews did not capture any *Hybognathus* spp. in segment 14 during 2007. Correspondingly, the catch rate of blue catfish, a non-target native species, has declined every year since 2004. Conversely, the catch rate of channel catfish has increased every year since 2004. The life history of the pallid sturgeon, as well as shovelnose sturgeon, may be dependent on these other native species in the Missouri River. It will be important to monitor changes in these native fish populations closely in future years.

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Introduction

Pallid sturgeon (*Scaphirhynchus albus)* have declined throughout the Missouri River since dam construction and inception of the Bank Stabilization and Navigation Project in 1912 (Carlson et al. 1985). Loss of habitat, reduced turbidity, increased velocity, loss of natural flows, reduction in forage, increased hybridization and inadequate reproduction and recruitment are factors contributing to the decline of the pallid sturgeon and other native species (Pflieger and Grace 1987). Since 1996, surveys conducted throughout the Missouri and Mississippi Rivers show an increase in hybridization and continued decline of pallid sturgeon relative abundance (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 Natural Resource Agencies to develop and conduct a pallid sturgeon monitoring and assessment program. The objectives of the program are:

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 as a navigation channel for barges with high levies and armored banks 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 NTU's in the winter months. 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; whereas silt or sand banks dominate the inside bend shoreline. In low water, sand bars are visible on the insides of bends with water often carving secondary channels behind. Debris is often discharged from upstream tributaries whereby it is then frequently lodged in sand bars or on dike structures as water levels drop. The Osage River is the largest tributary feeding segment 14 as it enters the Missouri River at the top of the study area. The Osage

River originates in the foothills of the Ozark Mountains and feeds into the Lake of the Ozarks where the water is used to generate power at Bagnell Dam. Because it is a bottom release reservoir, cool and clear water travels the remaining 80 miles (with low sediment inputs) over coarse sand and gravel substrates until its confluence with the Missouri River. Other smaller tributaries, such as the Gasconade River, deliver large silt loads from rain events and can quickly alter water stage height. Spring floods rarely top the banks, however, levies are occasionally breeched allowing water to flow onto the floodplain.

Over the last two decades, the COE has made efforts to diversify habitats by notching dikes or creating "pilot channels" on the floodplain. In recent years, much emphasis has been given to these dike modification projects with many of the existing dikes in this reach of river having received some modification. Notches are now deeper and wider, following modifications starting in 2003, and can change how water is diverted into the bank allowing for increased erosion or deposition. Dike types vary in design but, in general, outside bends contain L-shaped dikes 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 and associated native target species.

Methods

Sampling was conducted in accordance with Standard Operating Procedures established by a panel of representatives from various State and Federal agencies involved with pallid sturgeon recovery on the Missouri River (Drobish 2007). The sampling guidelines were meant to be adaptive and have been modified to ensure sampling efficiency and scientific accuracy. Bag seines were removed from standard sampling in 2006 due to their similarity of results with mini-fyke nets. In addition, 2.5 inch trammel nets were removed from standard

sampling in 2007 because they were not significantly improving the capture rate of pallid sturgeon and associated native target species.

In 2007, sampling effort was increased to improve statistical power. Prior to 2007, eight sub-samples were deployed on each bend. In 2007, active gears were deployed based on bend length, with longer bends receiving one more effort than shorter bends. In general, a minimum of eight sub-samples were deployed for bends less than 2.4 miles in length. Additional gear deployments were added every 0.6 miles over 2.4 with a maximum of 16 total deployments per bend.

The push trawl (PT) was added as a new gear for fish community season in 2007 and is being evaluated as a possible supplement or replacement for mini-fyke nets. Push trawl data from 2007 will be analyzed to determine if they are a suitable supplement gear to the program or could replace the more labor intensive mini-fyke net. Specifications for the push trawl are below and further information can be found in Drobish (2007).

Sampling Site Selection and Description

Segment 14 starts at the confluence of the Osage River (RM 130.2) and ends at the confluence with the Mississippi River (RM 0.0; Figure 1a). Each segment represents a sampling stratum. Segments were divided into bends (defined as the crossing of the thalweg from one bank to the other), and bends were randomly selected from each segment to be sampled as replicates, with a suite of gears. Twelve bends were randomly selected prior to November 2006. These twelve bends were each sampled twice, once between 1 November 2006 and 30 June 2007 (referred to as sturgeon season) and once between 1 July 2007 and 31 October 2007 (referred to as fish community season). Additional bends were randomly selected so additional sampling could take place if the first randomly selected bends were finished. The river was categorized into distinct river components called Mesohabitats which exist within Macrohabitats (Appendix B). Each Mesohabitat was sampled twice within each Macrohabitat. When a diversity of habitats was not available, a minimum of eight sub-samples were used to ensure some consistent level of effort per bend. For example, most

active gear effort was applied to 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 data analysis.

Habitats are described in a hierarchical manner in Drobish (2007; Appendix B). The broadest habitat description (macrohabitat) describes the general location of the sample within the bend (e.g., inside bend, outside bend, etc.). Mesohabitat describes the habitats that occur within the respective macrohabitat (e.g., pool, channel border, etc.). Microhabitat is used to specifically characterize the individual gear deployment as it relates to features within the sample area (e.g., wing dikes, sandbars, etc.). If available, all macro and mesohabitat combinations were sampled.

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

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

MESO
CHNB (channel border- where depth is > 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)

Sampling Gear

To avoid fish mortality, gill nets (GN) were only deployed when water temperatures were below 12.8ºC. Gill nets were anchored upstream with a 20 pound grappling hook and back-anchored with a cement weight tied to a buoy. Gill nets were fished overnight with a minimum soak time of 12 hours and a maximum of 24 hours.

Otter trawls (OT or OT16) were pulled downstream with a jet powered stern trawler. Otter trawls were used in both sturgeon and fish community seasons. Trawls were not pulled on outside bend revetment or in the thalweg for safety reasons. 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 and avoid many snags in daily operations.

One inch trammel nets were deployed perpendicular to the current and 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. An estimate of sampling distance lost was accounted for. Trammel nets were fished in moderately shallow water and away from eddies which could tangle the net. Snags occurred frequently, but did not prevent effective sampling. Trammel nets with 2.5 inch mesh were eliminated from standard sampling in 2007.

Mini-fyke nets were deployed during fish community 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 may have affected the efficiency of this gear. In many cases, the gear was set close to the bank behind bars and the lead wing was not fully extended because of the steep slope of the bank. 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 or falling. Mini-fykes could only be applied in emergent bar habitat and thus all bends did not receive similar amounts of effort.

Push trawls were added to the sampling protocol in 2007. Push trawls were fished in the same habitats as mini-fyke nets as well as in shallow (less than 1.4 m) open water habitats where mini-fyke nets could not be fished effectively (i.e., no emergent bar or steep drop-off). Data will be analyzed in the future to determine if this gear will be adopted as part of the standardized sampling protocol.

Segment 14 sampling gear dimensions:

Otter trawl:	Innovative Nets Systems (Greg Faulkner) custom Skate design, # 9 Sapphire®, 1.5 inch (38 mm)stretch mesh, 16ft (4.9 m) wide and 30 inch (0.76 m) boards
1-inch trammel net:	125 ft. (38.1 m) X 6 ft. (1.8 m) outer wall X 8 ft. (2.4 m) inner wall; 1-inch (25.4 mm) bar X 8 inch (203 mm) bar panels
Mini- Fyke:	2 cab frames @ 4 ft. (1.2 m) X 2 ft. (0.6 m), two 2 ft. (0.6 m) hoops, 15 ft. (4.6 m) X 2 ft. (0.6 m) lead, $1/8^{th}$ in. (3.2 mm) mesh
Gill net:	100 (30.5 m) X 8 ft. (2.4 m) with 25 ft. (7.6 m) repeating 1.5 (38 mm), 2 (51 mm), 3 (76 mm) and 4 (102 mm) inch mesh panels, nets were sewn together making a 200 ft. (61 m) net with two series of repeating panels
Push Trawl:	8 ft. (2.4 m) wide, 6 ft. (1.8 m) long and 2 ft. (0.6 m) high trawl with 3/16 in. (4 mm) ACE mesh pushed from the bow of a jet-driven boat. Standard 30in. (0.76 m) boards are used.

Data Collection and Analysis

Associated Environmental Data

GPS locations, temperature, and depth (beginning, mid-point and end for all gears except mini-fykes; where depth is measured at the opening/box) were taken for each sample. Additionally, turbidity and velocity samples were collected randomly from 25% of the Mesohabitat types within each Macrohabitat. Water column velocity in meters per second (m/s) was measured at (bottom), 80%, and 20% of the depth. All habitat data were collected when pallid sturgeon were encountered. In an attempt to determine if flow/water velocity can be visually estimated by a trained eye, an additional box was added to the data sheet. The data recorder recorded a water velocity value corresponding with a set of categories (0 = could not be estimated, 1 = Eddy, 2 = 0.0-0.3 m/s, 3 = 0.3-0.6 m/s, 4 = 0.6-0.9 m/s, 5 = >0.9 m/s).

Genetic Verification

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 pallid sturgeon and their hybrids using Sheehan's index for verification (Sheehan et al. 1999). Sturgeon were deemed hybrid when they were verified to be within the hybrid range (-0.50 to +0.60) on Sheehan's Character Index scale. Passive Integrated Transponder (PIT) tags were implanted under the dorsal fin of pallid sturgeon, strong hybrids (< -0.5), and lake sturgeon. Additionally, fin clips were collected from pallid sturgeon and hybrids to be analyzed for genetic purity and digital images were taken for documentation. All pallid sturgeon that were captured with no evidence of previously being tagged, or otherwise could not be positively identified as being of hatchery or wild origin, were deemed "unknown" until genetic verification. All pallid sturgeon deemed "wild" have been genetically verified as not being of hatchery origin.

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 [$\log_{10} W = -6.378 + 3.357 \log_{10} L$ ($r^2 = 80.9740$)] for pallid sturgeon throughout its range which was used to calculate a relative condition factor.

Stock Densities

Stock densities were calculated to assess pallid and shovelnose sturgeon population structure. 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 (Shuman et al. 2006): 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 (Quist et al. 1998): 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.

Data Analysis

A sample target effort for each gear was defined as follows: 300 m drift (TN), 300 m tow (OT), and one overnight set (GN, MF). Push trawl (PT) target distance was 30 m on mud banks and 100 m on channel sand bars with a minimum distance of 25 m. Due to the large numbers of snags encountered, a minimum effort of 75 m was accepted for OT and TN. Effort was calculated as catch per 100 m for active gears (OT and TN) or per overnight set for passive gears. Push trawl effort was calculated as fish per meter trawled. Samples that occurred outside of the "standard" gear deployment protocol, habitat effort protocol, or samples that occurred in "non-random" bends were excluded from CPUE calculations. These data were, however, included in length frequencies, relative condition, and population structure calculations.

Several figures and tables have been omitted from this report in an effort to maintain consistency between years and segments. For example, if no pallid sturgeon were captured in mini-fyke nets, the figure showing CPUE of mini-fyke nets would be excluded from the pallid sturgeon discussion as well as the list of figures.

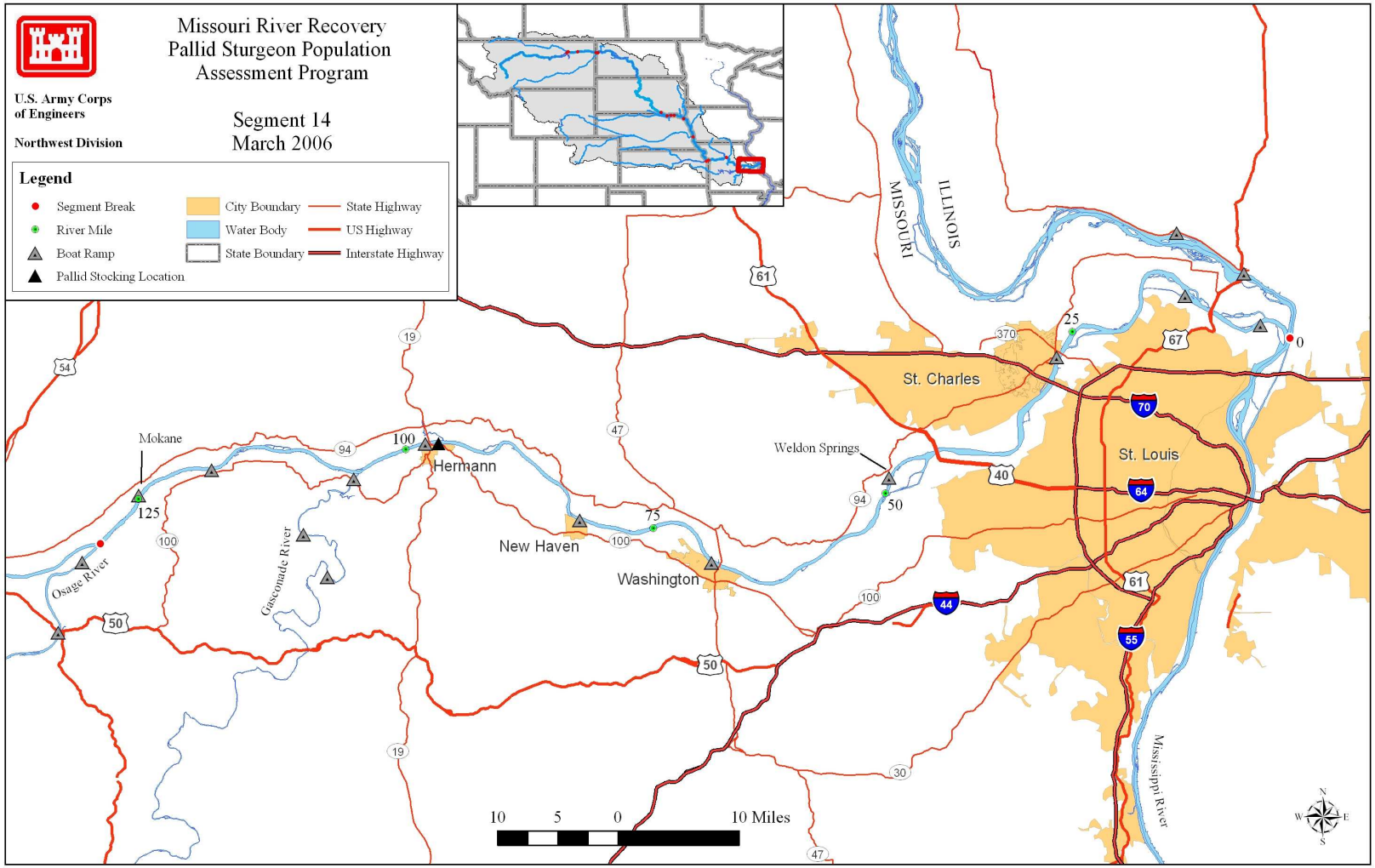

Figure 1a. Map of segment 14 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segment 14 encompasses the Missouri River from the confluence with the Osage River (River Mile 130.2) to the confluence with the Mississippi River (River Mile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

Results

Pallid Sturgeon

This section covers the following objectives from the pallid sturgeon monitoring and assessment program:

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

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

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

During 2007, biologists from Columbia National Fish and Wildlife Conservation Office (Columbia NFWCO) sampled 16 bends during sturgeon season (1 November 2006 to 30 June 2007) and 14 bends during fish community season (1 July to 31 October 2007) using multiple gears. For the sturgeon season; 14 bends were sampled with 1-inch trammel nets (total effort = 132 deployments; 20,374 m drifted), 16 bends with gill nets (total effort = 312 net nights), and 14 bends with 16-foot otter trawls (total effort = 132 nets deployed; 19,959 m trawled; Tables 1 and 2). For the fish community season; 14 bends were sampled with 1-inch trammel nets (total effort = 135 deployments; 23,310 m drifted), 14 bends with mini-fyke nets (total effort = 108 net nights), and 14 bends with 16-foot otter trawls (total effort = 130 deployments; 30,028 m trawled; Tables 1 and 2). With this effort a total of 19 pallid sturgeon where captured during 2007. Of those captured, 8 were with standard gear during random sampling whereas 11 were captured with wild gear during non-random sampling.

Of the 19 pallid sturgeon that were captured during 2007, 5 were wild and 14 were stocked (Figure 9). The majority of pallid sturgeon in segment 14 (58%; N = 11) were captured in the lower half of the segment (RM 70.0 to 0.0), whereas only 42% (N = 8) were captured in the upper half of the segment (RM 130.2 to 70; Figure 1b). Six of the 14 hatchery stocked pallid sturgeon captured during 2007 were positively traced back to a stocking site and two were traced back to a stocking year. Five of the hatchery origin pallid sturgeon were stocked near Boonville, Missouri (BOO, Appendix D) and one was stocked near Mulberry Bend, Nebraska (MUL, Appendix D; Table 6). The pallid sturgeon stocked near Mulberry Bend traveled 645 miles downstream before being captured near the mouth of the Osage River at river mile 130.2. Three of the pallid sturgeon stocked at Boonville were spawned in 2002, stocked in 2003, and were age 5 at capture. The other two pallid sturgeon stocked at Boonville were spawned in 2004, stocked that same year, and were age 3 at capture. The pallid sturgeon stocked at Mulberry bend was spawned in 2001, stocked in 2002, and was age 6 at capture. One hatchery pallid was stocked in 1997 as part of the early stockings by the Missouri Department of Conservation. Six of the seven traceable hatchery origin pallid sturgeon were reared at Garrison Dam National Fish Hatchery and the one stocked in 1997 was reared at Blind Pony State Fish Hatchery. Condition (Kn), which is a measure of the fish's plumpness, was averaged for all recaptured pallid sturgeon from segment 14. All fish that leave the hatchery are considered to be in good or robust condition (Kn ≈ 1.0). Pallid sturgeon captured during sturgeon season were still in good condition at the time of recapture (Kn = 0.915), however, the two fish captured later in the year during fish community season were in poor condition (Kn = 0.715; Table 7).

When looking at only standard random samples, the majority of pallid sturgeon were captured during sturgeon season (75%; N = 6) versus fish community season (25%; N = 2). Of the pallid sturgeon that were captured during sturgeon season, the majority (67%; N = 4) were captured in ISB macrohabitat relative to an average of 70% of the total effort being expended in that habitat during sturgeon season (Tables 13 and 14). Similarly, the majority of pallid sturgeon (63%; N = 5) were captured in CHNB mesohabitat relative to an average of 78% of the total effort in that habitat (Tables 14 and 16). During fish community season,

all pallid sturgeon were captured in ISB CHNB habitat relative to approximately 60% of the total effort occurring in both of those habitat types.

On average, pallid sturgeon were captured at a mean depth of 4.6 m. Pallid sturgeon were captured at depths closer to the mean than the extremes (captured between 2.8 and 8.0 m whereas the sample mean was between 0.7 to 11.1 m; Table 3). This trend was similar for bottom velocity where pallid sturgeon were captured at a mean bottom velocity of 0.71 m/s with a sample range of 0.0 to 2.1 m/s. The majority of pallid sturgeon (79%; N = 15) were captured in water temperatures equal to or less than 15.0 ºC. On average, pallid sturgeon were captured at a water temperature of 13.0 ºC (2.3 – 31.5 ºC) with an average sample temperature of 21.3 ºC (1.5 – 31.9 ºC; Table 3). Average turbidity for pallid sturgeon captures was 154 NTU's (41 to 292) with a mean turbidity per sample of 222 NTU's (23 – 999; Table 3).

The population structure may indicate the influence of recently propagated fish (stock size N = 7) with nine quality size and three preferred size pallid sturgeon being captured in segment 14 (Table 7). The RSD values indicate health of fish populations relative to reproductive potential and age of fish. The continued absence of sub-stock size pallid sturgeon indicates we are either not detecting sub-stock pallid sturgeon with our current gear or they do not exist in segment 14.

For sturgeon season, gill nets continue to be the most effective gear at capturing pallid sturgeon in segment 14 (mean overall CPUE = 0.013) followed by 1-inch trammel nets (mean overall CPUE = 0.009); capturing 50% and 38% of the pallid sturgeon, respectively. One pallid sturgeon was captured in an otter trawl with a mean overall CPUE of 0.002 fish per meter trawled (Figures 2-5; Appendix F). The CPUE for hatchery reared pallid sturgeon in gill nets remained fairly constant since 2005, with a slight declining trend over time for wild pallid sturgeon (Figure 2). Catch rates with 1-inch trammel nets, however, have increased every year since 2005 (Figure 3). Two pallid sturgeon were captured with 1-inch trammel nets during fish community season (Figure 5).

Since 2003, there has been an increase in the number of pallid sturgeon captured in segment 14; in particular, there was considerable increase in the capture of hatchery origin pallid sturgeon (2003 = 1; 2004 = 2; 2005 = 9; 2006 = 7; 2007 = 14; Figure 9). Recent findings, not summarized in this report, suggest dispersal from stocking sites increases after the fish has been at large for more than two years. The increase in hatchery fish is likely a result of this dispersal of surviving hatchery fish.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for segment 14 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of Bends	Mean Effort	Macrohabitat													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1-inch Trammel Net	14	9.43	N-E	30	0	N-E	N-E	101	0	0	1	N-E	N-E	0	0	N-E
Gill Net	16	9.75	N-E	31	2	N-E	N-E	82	31	5	2	N-E	N-E	0	3	N-E
Otter Trawl	14	9.43	N-E	18	0	N-E	N-E	104	0	9	0	N-E	N-E	1	0	N-E
Summer – Fish Community Season																
1-inch Trammel Net	14	9.64	N-E	28	0	N-E	N-E	106	0	1	0	N-E	N-E	0	0	N-E
Mini-Fyke Net	14	7.71	N-E	25	2	N-E	N-E	36	12	21	10	N-E	N-E	2	0	N-E
Otter Trawl	14	9.29	N-E	29	1	N-E	N-E	95	0	3	0	N-E	N-E	2	0	N-E

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segment 14 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2007. N-E indicates the habitat is non-existent in the segment.

Gear	Number of bends	Mean Effort	**Mesohabitat**					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1-inch Trammel Net	14	9.43	2	128	N-E	1	1	0
Gill Net	16	9.75	0	66	N-E	4	85	1
Otter Trawl	14	9.43	0	130	N-E	2	0	0
Summer – Fish Community Season								
1-inch Trammel Net	14	9.64	0	134	N-E	0	0	1
Mini-Fyke Net	14	7.71	94	1	N-E	13	0	0
Otter Trawl	14	9.29	0	123	N-E	0	2	5

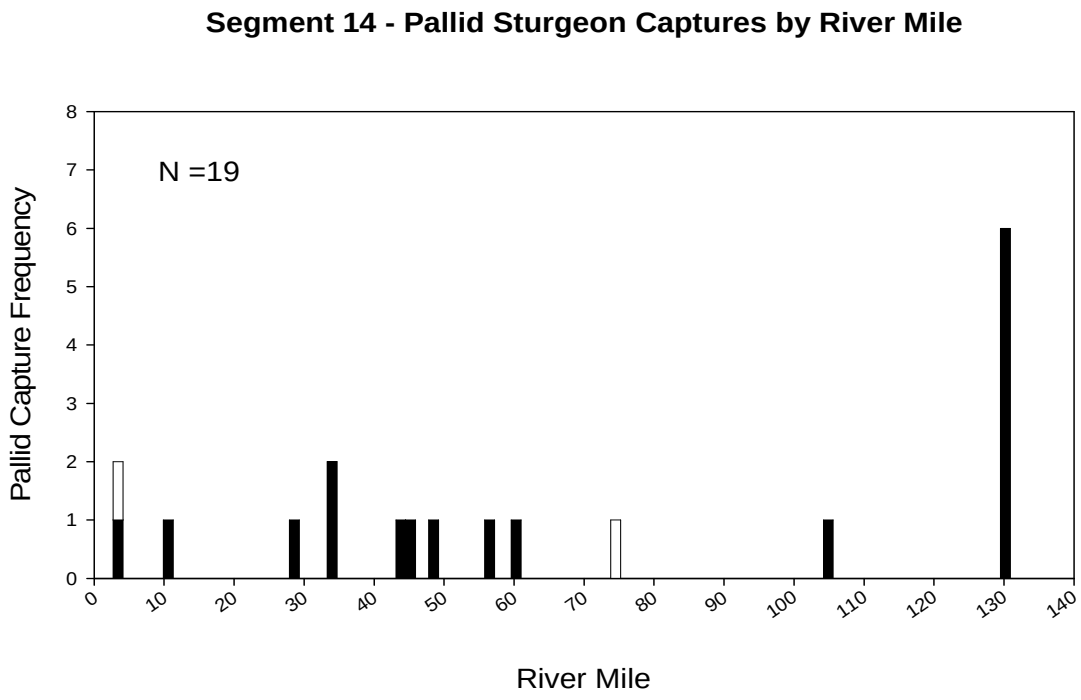

Figure 1b. Distribution of pallid sturgeon captures by river mile for segment 14 of the Missouri River during 2007. Black bars represent pallid captures during Sturgeon Season and white bars during Fish Community Season. Figure includeds all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon (PDSG) capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2007. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B. N-E indicates the habitat is non-existent in the segment.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
BRAD	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
CHXO	BAR	0.8 (0.3-1.5)		0.03 (0.00-0.07)		28.5 (23.3-31.4)		88 (35-189)		.
	CHNB	3.8 (1.0-6.6)	3.6 (3.2-4.1)	0.57 (0.00-1.15)	0.95 (0.95-0.95)	23.9 (2.3-31.5)	19.4 (11.2-27.5)	209 (25-892)	150 (141-160)	2
	DTWT									.
	ITIP									.
	POOL	6.4 (2.3-13.0)		0.38 (0.02-0.78)		10.9 (1.5-30.9)		312 (27-785)		.
	TLWG									.
CONF	BAR	0.7 0.5-0.8)		0.00 (0.00-0.00)		30.2 (30.0-30.5)		62 (37-87)		.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
	CHNB	6.1 (1.3-8.4)	7.0 (6.6-8.0)	0.14 (0.10-0.17)	0.17 (0.17-0.17)	12.6 (8.5-30.9)	10.9 (8.5-12.0)	218 (141-296)		5
	DTWT									.
	ITIP									.
	POOL	7.7 (4.0-11.8)		0.06 (0.06-0.06)		12.6 (8.1-20.9)		225 (225-225)		.
	TLWG									.
DEND	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
DRNG	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
ISB	BAR	0.7 (0.3-1.5)		0.04 (0.00-0.10)		28.3 (23.4-31.4)		97 (29-185)		.
	CHNB	3.6 (0.7-11.1)	3.4 (2.5-5.8)	0.62 (0.01-1.90)	0.74 (0.30-1.90)	23.8 (1.6-31.9)	13.2 (2.3-31.5)	201 (23-999)	125 (30-276)	11
	DTWT									.
	ITIP	0.6 (0.6-0.6)				30.3 (30.3-30.3)		28 (28-28)		.
	POOL	5.3 (2.0-10.5)	4.2 (4.2-4.2)	0.53 (0.01-2.13)	0.79 (0.79-0.79)	8.9 (1.5-30.9)	12.0 (12.0-12.0)	302 (29-626)	292 (292-292)	1
	TLWG									.
OSB	BAR	0.9 (0.4-1.4)		0.01 (0.00-0.02)		29.1 (23.2-31.0)		72 (26-152)		.
	CHNB	3.5 (0.6-7.0)		0.71 (0.08-1.33)		13.4 (2.4-31.0)		551 (345-691)		.
	DTWT									.
	ITIP									.
	POOL	5.6 (2.2-13.0)		0.29 (0.05-0.90)		8.6 (1.9-12.5)		390 (32-604)		.
	TLWG									.
SCCL	BAR	0.8 (0.4-1.4)				30.5 (30.0-31.0)		37 (25-55)		.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
	CHNB	2.6 (1.4-4.6)		0.59 (0.29-0.80)		19.5 (8.0-30.6)		294 (200-452)		.
	DTWT									.
	ITIP	1.5 (0.4-4.3)		0.61 (0.61-0.61)		23.5 (8.4-30.8)		156 (30-686)		.
	POOL	1.8 (1.6-2.0)				12.7 (12.7-12.7)		280 (280-280)		.
	TLWG	2.8 (2.0-3.8)		0.44 (0.40-0.50)		29.6 (25.4-31.0)		502 (50-888)		.
SCCS	BAR	0.5 (0.2-0.7)		0.05 (0.00-0.08)		26.9 (23.7-30.9)		126 (46-184)		.
	CHNB	0.7 (0.7-0.7)				30.1 (30.1-30.1)				.
	DTWT									.
	ITIP	2.7 (2.0-3.6)		0.44 (0.36-0.51)		12.7 (2.5-26.5)		186 (31-400)		.
	POOL									.
	TLWG									.
SCN	BAR									.
	CHNB									.
	DTWT									.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
	ITIP									.
	POOL									.
	TLWG									.
TRIB	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.
TRML	BAR	0.9 (0.5-1.5)				30.2 (30.1-30.3)		77 (34-120)		.
	CHNB	2.9 (2.9-2.9)		0.00 (0.00-0.00)		26.0 (26.0-26.0)		120 (120-120)		.
	DTWT									.
	ITIP									.
	POOL	4.4 (4.4-4.4)				21.2 (21.2-21.2)				.
	TLWG	1.6 (1.4-1.8)				31.1 (30.9-31.2)		87 (33-141)		.
TRMS	BAR									.

Macro-	Meso-	Depth(m) (Effort)	Depth(m) (Catch)	Bottom Velocity (m/s) (Effort)	Bottom Velocity (m/s) (Catch)	Temp. °C (Effort)	Temp. °C (Catch)	Turbidity (ntu) (Effort)	Turbidity (ntu) (Catch)	Total Pallids caught
	CHNB									.
	DTWT									.
	ITIP									.
	POOL	4.3 (4.0-4.5)				10.7 (8.6-12.7)		391 (280-502)		.
	TLWG	3.0 (3.0-3.0)				9.5 (9.5-9.5)		542 (542-542)		.
WILD	BAR									.
	CHNB									.
	DTWT									.
	ITIP									.
	POOL									.
	TLWG									.

Table 6. Mean fork length, weight, relative condition factor (Kn), and growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from segment 14 of the Missouri River. Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993). Standard error (+/- 2SE) was calculated where N>1 and is represented on second line of each year.

Year class	N	Stock Data			Recapture Data			Growth Data	
		Length (mm)	Weight (g)	Kn	Length (mm)	Weight (g)	Kn	Length (mm/d)	Weight (g/d)
2001	1	200	.		637	885		0.237	.
		.	.		.	.	.	.	
2002	3	291	.	.	617	888.3	0.898	0.239	.
		41	.	.	52	255.1	0.025	0.024	.
2004	3	86	2.0	1.531	498	430.0	0.905	0.434	0.451
		.	.	.	.	.	.	.	.

Table 7. Incremental relative stock density (RSD)[a] and relative condition factor (Kn) for all pallid sturgeon captured with all gear by a length category during 2007 in the Missouri River. Length categories[b] determined using the methods proposed by Shuman et al. (2006). Relative condition factor was calculated using the equation in Keenlyne and Evanson (1993).

Length Category	N	RSD	Kn (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	0	.	0
Stock	6	100	0.935 (0.033)
Quality	8	65	0.874 (0.048)
Preferred	3	18	0.984 (0.075)
Memorable	0	.	0
Trophy	0	.	0
Overall Kn	.	.	0.915 (0.034)
Fish Community Season			
Sub-stock (0-199)	0	.	0
Sub-stock (200-329)	0	.	0
Stock	1	100	0.700
Quality	1	50	0.731
Preferred	0	.	0
Memorable	0	.	0
Trophy	0	.	0
Overall Kn	.	.	0.715 (0.031)

[a] RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 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 %).

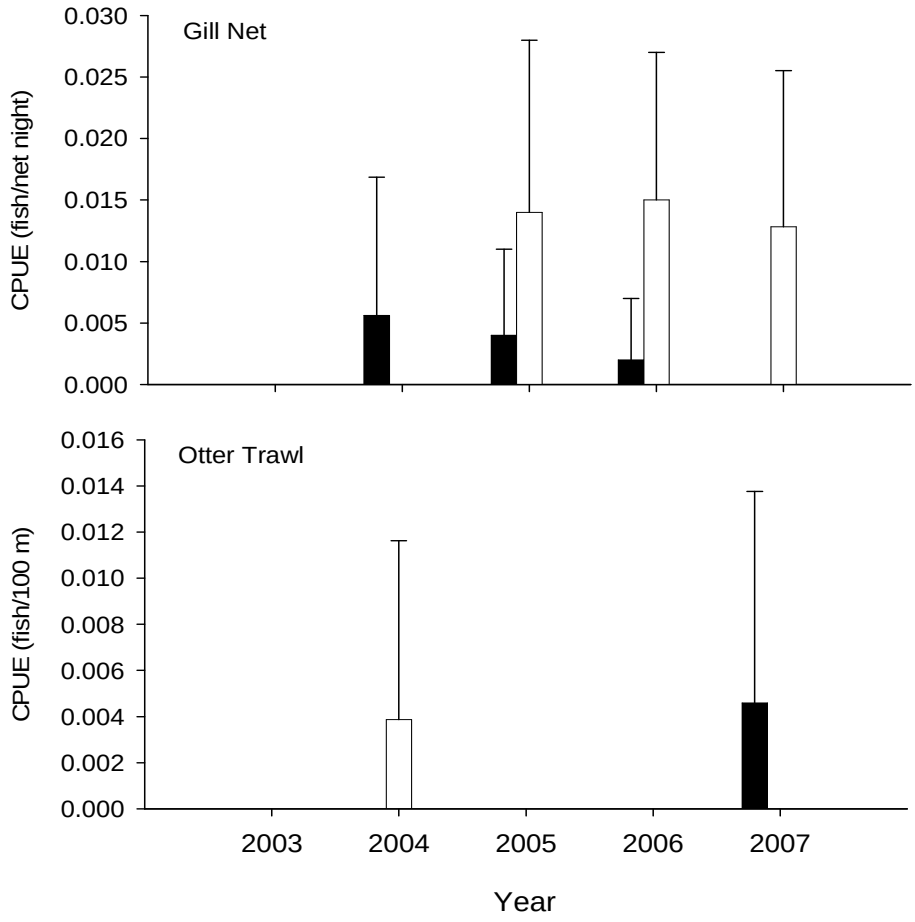

Figure 2. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segment 14 of the Missouri River during sturgeon season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

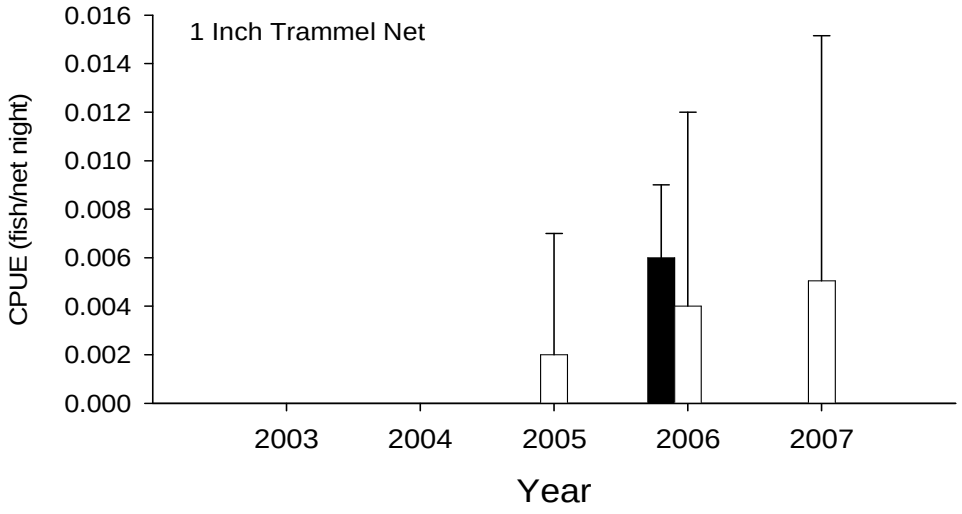

Figure 3. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 trammel nets in segment 14 of the Missouri River during sturgeon season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segment 14 - Pallid Sturgeon / Fish Community Season

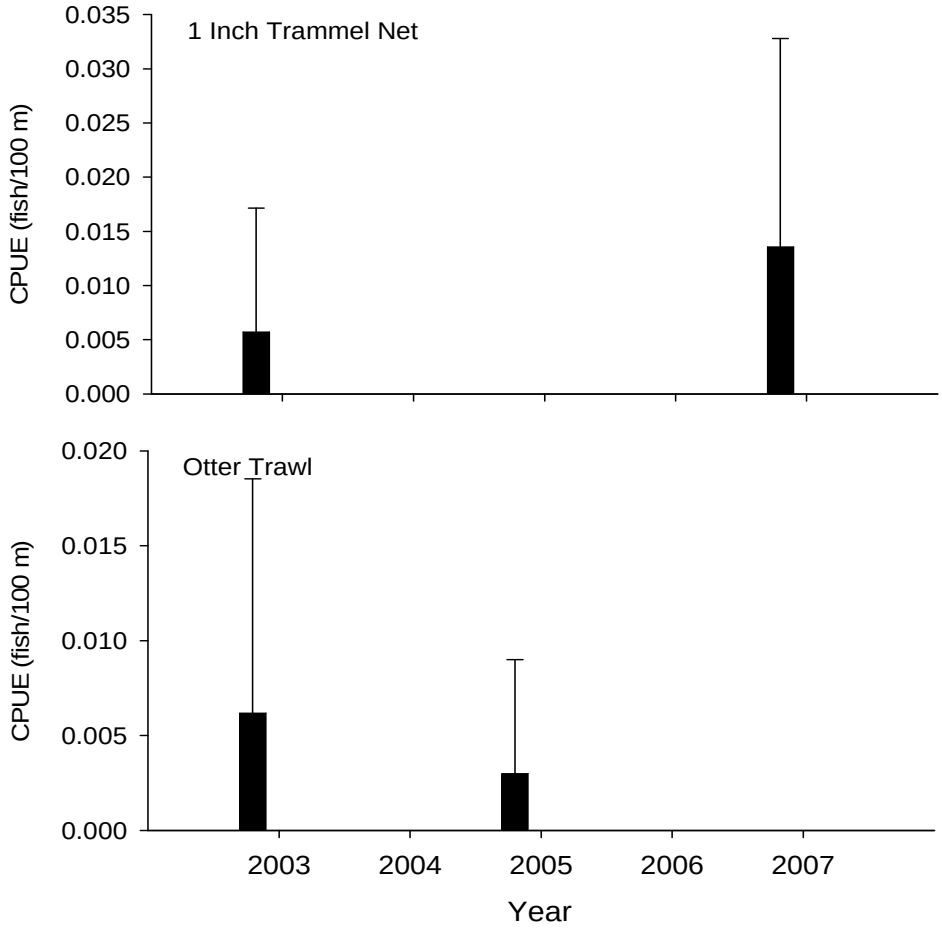

Figure 5. Mean annual catch-per-unit-effort (+/- 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1 inch trammel nets and otter trawls in segment 14 of the Missouri River during fish community season 2003-2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Table 9. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 10. Total number of sub-stock size (0-199 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	0	1	4

Table 11. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 12. Total number of sub-stock size (200-329 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	0	1	4

Table 13. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	1	0	100	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	2	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 14. Total number of stock size (330-629 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	**Mesohabitat**					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	1	0	100	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	2	0	50	0	0	50	0
	.	0	42	0	3	54	1
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	1	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	0	1	4

Table 15. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	2	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 16. Total number of quality size and greater (≥630 mm) pallid sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	2	0	100	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	1	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	1	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	0	1	4

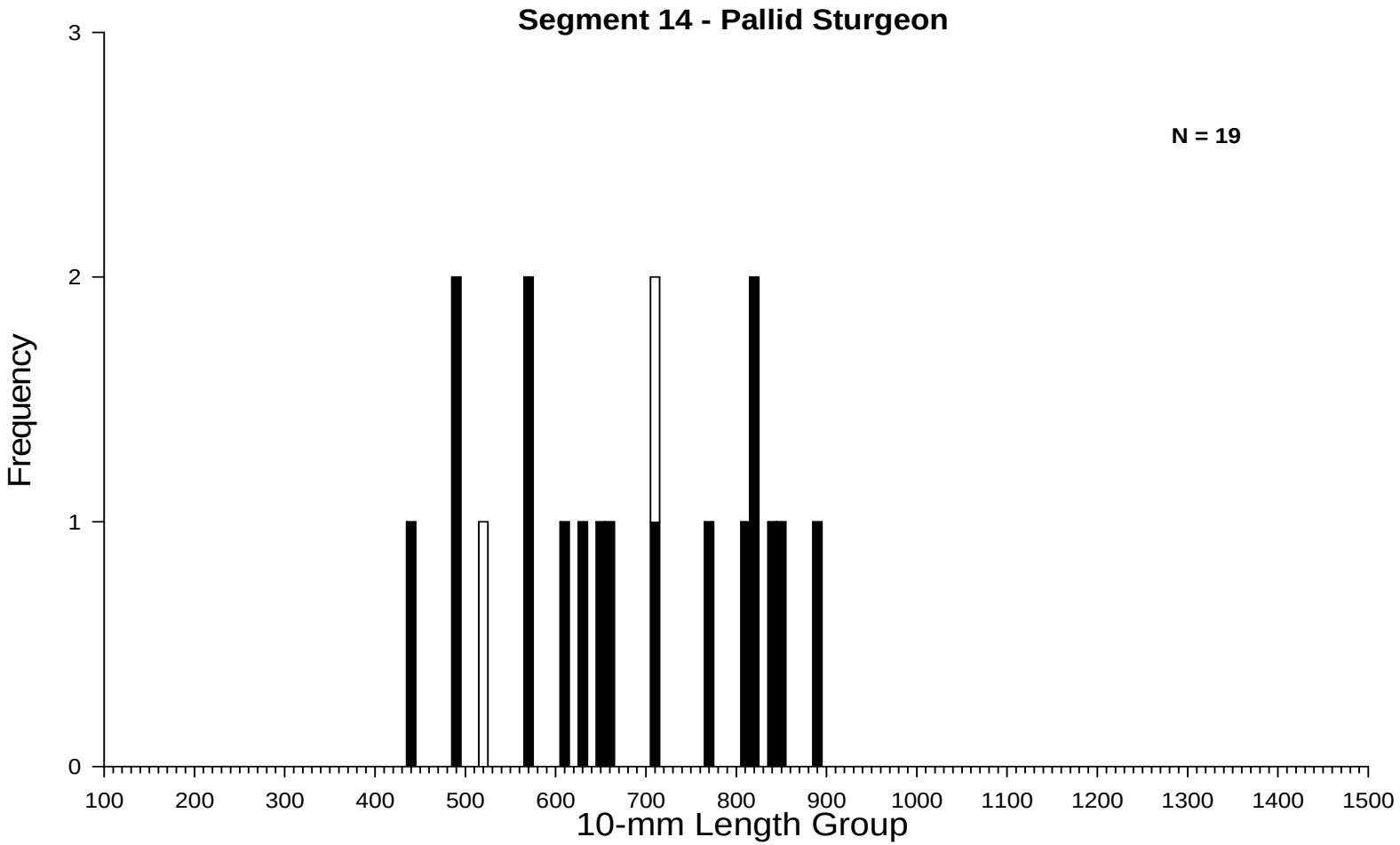

Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007 including non-random and wild samples.

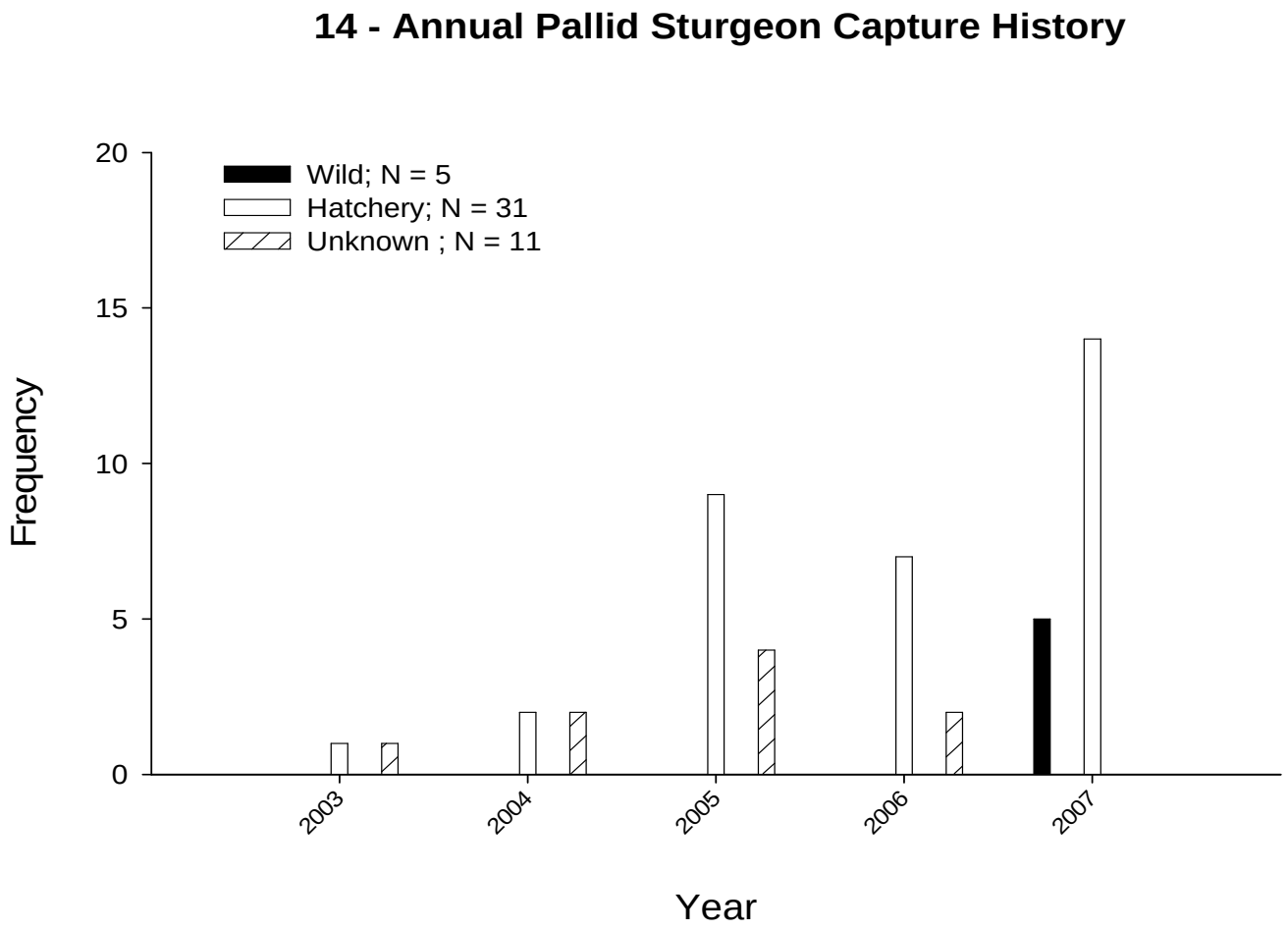

Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segment 14 of the Missouri River from 2003 to 2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

Nine hybrid sturgeon were captured in segment 14 during 2007. Eight of the nine hybrid sturgeon were captured in ISB macrohabitat with 56% (N = 5) of the total catch occurring in CHNB mesohabitat. Hybrid sturgeon were captured in shallower water (mean depth = 3.4 m) than pallid sturgeon (mean depth = 4.6 m; Utrup et al. 2007). Hybrid sturgeon were also captured in slightly slower water (mean velocity = 0.58 m/s) than pallid sturgeon (mean velocity = 0.71 m/s).

Ratios of hybrid sturgeon to shovelnose and pallid sturgeon are a useful way to document change from year to year due to the effects of hybridization and decline in the availability of true pallid sturgeon for successful spawning. The ratio of hybrid sturgeon captured in gill nets relative to shovelnose sturgeon decreased from 1 hybrid for every 729 shovelnose in 2006 to an all time low of 1 hybrid for every 1,489 shovelnose in 2007 (Appendix J1). Because trammel nets are less influenced by aggregation and migration behavior, they are the most consistent tool for monitoring the ratio of hybrid to pallid to shovelnose sturgeon over time. In 2005, the ratio of pallid to shovelnose sturgeon in segment 14 was one pallid for every 673 shovelnose and increased to one pallid for every 231 shovelnose in 2006. During 2007, that ratio increased further to one pallid for every 167 shovelnose sturgeon. The number of hybrids to pallid sturgeon has remained constant since 2006 at about one hybrid for every one pallid, however, this number is approximately 3 hybrids for every 1 pallid when only considering wild fish (Appendix J1).

Targeted Native River Species

This section covers the following objectives from the pallid sturgeon monitoring and assessment program:

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

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

Shovelnose Sturgeon

More YOY shovelnose sturgeon were captured in 2007 (N = 37) than were captured in 2006 (N = 16) but fewer than in 2005 (N = 42; Table 17; Utrup et al. 2007). Similar to previous years, otter trawls were the most effective gear at capturing YOY shovelnose sturgeon (97% of total YOY catch, N = 36) during both seasons. Of the 36 YOY shovelnose sturgeon captured using otter trawls during both seasons; 94% (N = 34) were captured in ISB CHNB habitat with two captured in CHXO CHNB habitat. All of the YOY shovelnose sturgeon were found in CHNB Mesohabitat (100% of the catch relative to 72% of the total effort) despite efforts being expended in POOL (10% of the total effort) and BARS Mesohabitat (15% of the total effort; Table 18). As in previous years, the vast majority of shovelnose sturgeon greater than 250 mm were captured during the sturgeon season with gill nets (86% of the total catch; N = 3158; Tables 17-24) with ISB and CHXO providing the best macrohabitats. Gillnets were the most effective gear for capturing shovelnose sturgeon greater than 380 mm with the highest catch rate in CHXO POOL habitat (CPUE = 19.3) followed by OSB POOL habitat (CPUE = 13.4; Appendix F1). Gillnet CPUE increased from 2006 to 2007, with a catch rate of 4.5 fish per net night to 8.9 fish per net night, respectively. Catch rates for quality and greater size (> 380 mm) shovelnose sturgeon in 1-inch trammel nets during sturgeon season has steadily declined from 2003 through 2006 (2003 = 2.5; 2004 = 1.6; 2005 = 1.3; 2006 = 0.6), but increased in 2007 (CPUE = 1.4 fish per 100 m trawled; Figure 12). For fish community season, otter trawls had a higher catch rate of YOY shovelnose sturgeon (CPUE = 0.07 in 2007 versus 0.03 in 2006) however the catch rate of stock sized shovelnose sturgeon decreased slightly from 2006 (CPUE = 0.04 in 2007 versus 0.09

in 2006; Figure 14). One-inch trammel net capture rates remained fairly constant since 2003 (Figure 14).

There was a greater proportion of larger fish captured during the sturgeon season (RSD-P = 83 and RSD-M = 18) than in the fish community season (RSD-P = 77 and RSD-M = 15; Table 25). Reasons for this disparity may be that spawning shovelnose were more available in the sturgeon season, or that trawls and trammel nets were not as effective at sampling the larger size classes compared to gill nets. Only 61 sub-stock shovelnose sturgeon were captured in both seasons with no shovelnose sturgeon captured in the trophy range for either season. The size distribution of shovelnose sturgeon in segment 14 is typical of long-lived species and depicts minor contribution of smaller fish to the population (Figure 17). According to Steffensen and Hamel (2008) and Pflieger (1997), shovelnose sturgeon reach 210 mm in their first year and 315 mm, 409 mm, 485 mm, 541 mm, and 600 mm in each of the subsequent years. Based on these age categories, the majority of shovelnose sturgeon captured in segment 14 were greater than age 4 (Figure 17).

The majority of the sampling effort in segment 14 was expended in ISB macrohabitat (66% of the total effort) and CHNB mesohabitat (72% of the total effort), due to their proportionate availability. Of the 36 YOY shovelnose sturgeon (0-149 mm; 0.010% of the total shovelnose catch) captured in segment 14, 94% (N = 34) were captured in ISB macrohabitat, with 100% (N = 36) occurring in CHNB mesohabitat. Juvenile shovelnose sturgeon (150-249 mm) made up 0.007% of the total shovelnose catch (N = 24; Table 19). Of the juvenile shovelnose sturgeon, 67% (N = 16) were captured in ISB macrohabitat, with the majority (96%; N = 23) occurring in CHNB mesohabitat (Tables 19-20). Similar to 2006, 105 stock size (250-379 mm) shovelnose sturgeon (0.03% of the total catch) were captured in segment 14, with the majority (77%; N = 81) occurring in ISB macrohabitat relative to 66% of the total effort (Table 21). The majority of stock size shovelnose sturgeon were captured in CHNB mesohabitat (70%; N = 74), relative to 72% of the total effort (Table 22). Quality and above size shovelnose sturgeon made up the bulk of the total catch (97%; N = 3,553), with most captured during the sturgeon season (87%; N = 3076; Table 23). Most quality and greater size shovelnose sturgeon were caught in ISB macrohabitat with 53% (N = 1,875) of the total catch, relative to 66% of the total effort, followed by CHXO macrohabitat, which contained 26% (N = 907) of the total catch, relative to 20% of the total effort (Table 23). Different from previous years, gill nets set in L-dikes in OSB

macrohabitat produced a large portion of the quality and greater size shovelnose with 18% of the total catch relative to only 5% of the total effort. The majority of quality and greater size shovelnose sturgeon were captured with gill nets in POOL mesohabitat (61%; N = 2,158) relative to 54% of the total gill net effort during sturgeon season (Table 24). Of all the quality and greater size shovelnose sturgeon captured during fish community season, 13% (N = 476) of the catch occurred in CHNB mesohabitat, relative to 65% of the total effort (Table 24).

Sturgeon and fish community season sampling captured shovelnose sturgeon representing 8 cohorts (40 mm, 130 mm, 200 mm, 300 mm, 420 mm, 500 mm, 600 mm, and 800mm; Figure 17). Because of seasonal migration, a higher proportion of preferred and memorable sized shovelnose sturgeon were captured during the sturgeon season (RSD-P = 83, RSD-M = 18) relative to fish community season (RSD-P = 77, RSD-M = 15; Table 25). Similar to 2006 (Utrup et al 2007), few sub-stock shovelnose sturgeon were captured in either season (N = 31 sturgeon season; N = 30 fish community season) and no trophy size shovelnose sturgeon were captured. Relative weight compared between stock sizes was normal for long lived fish like shovelnose sturgeon showing a general decrease in Wr as the fish matures (Table 25).

Segment 14 - Shovelnose Sturgeon / Sturgeon Season

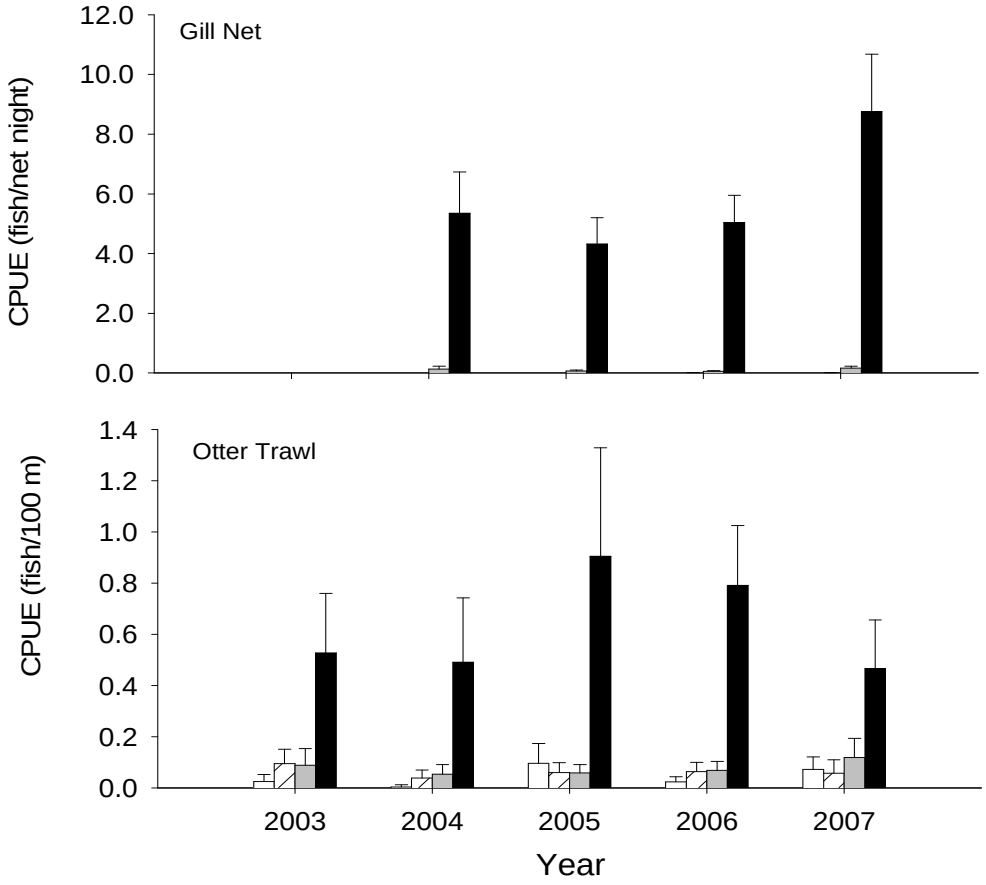

Figure 11. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

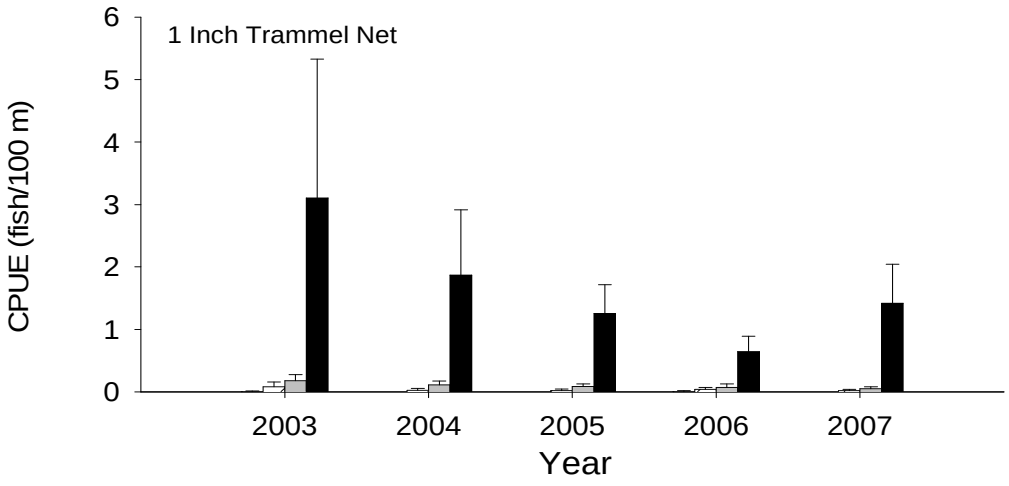

Figure 12. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

Segment 14 - Shovelnose Sturgeon / Fish Community Season

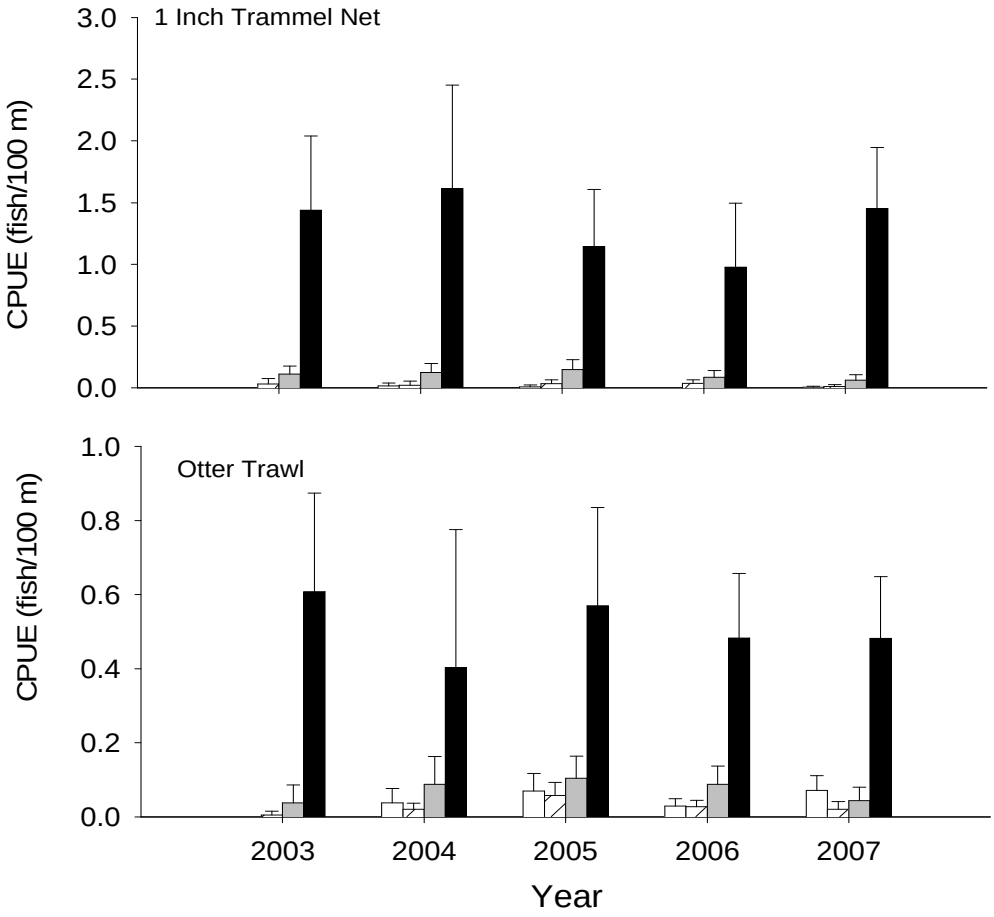

Figure 14. Mean annual catch-per-unit-effort (+/- 2SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1 inch trammel nets and otter trawls in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 17. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	15	0	13	0	0	0	87	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	21	0	5	0	0	0	95	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 18. Total number of sub-stock size (0-149 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	15	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	1	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	21	0	100	0	0	0	0
	.	0	96	0	0	1	4

Table 19. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	4	0	25	0	0	0	75	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	1	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	11	0	9	0	0	0	45	0	45	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	3	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	5	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 20. Total number of sub-stock size (150-249 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	4	0	100	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	1	0	100	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	11	0	91	0	9	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	3	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	5	0	100	0	0	0	0
	.	0	96	0	0	1	4

Table 21. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	10	0	30	0	0	0	70	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	53	0	13	0	0	0	70	11	4	0	0	0	0	2	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	19	0	16	0	0	0	84	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	12	0	8	0	0	0	92	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	11	0	9	0	0	0	91	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 22. Total number of stock size (250-379 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	10	0	100	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	53	0	42	0	2	57	0
	.	0	42	0	3	54	1
Otter Trawl	19	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	12	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	11	0	100	0	0	0	0
	.	0	96	0	0	1	4

Table 23. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	265	0	23	0	0	0	77	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	2732	0	28	1	0	0	44	24	1	0	0	0	0	1	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	79	0	11	0	0	0	84	0	5	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	341	0	11	0	0	0	88	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	136	0	24	0	0	0	76	0	1	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 24. Total number of quality size and greater (≥380 mm) shovelnose sturgeon captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	265	1	98	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	2732	0	21	0	0	79	0
	.	0	42	0	3	54	1
Otter Trawl	79	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	341	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	136	0	99	0	0	0	1
	.	0	96	0	0	1	4

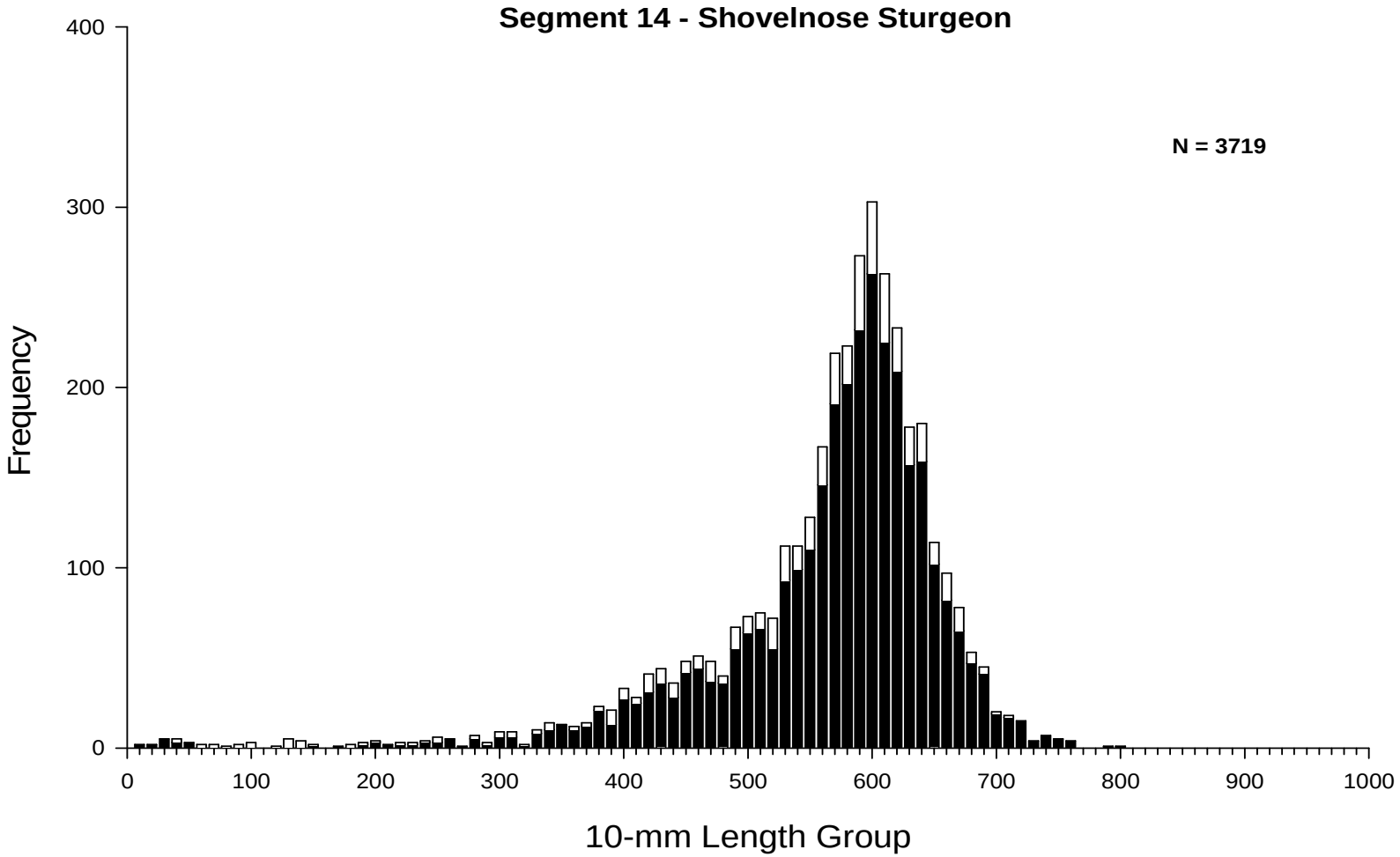

Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Table 25. Incremental relative stock density (RSD)[a] and mean relative weight (Wr) by a length category for shovelnose sturgeon in segment 14 of the Missouri River captured during 2007. Length categories[b] determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2SE)
Sturgeon Season			
Sub-stock (0-149 mm)	15	.	.
Sub-stock (150-249 mm)	16	.	.
Stock	82	100	113.1 (19.48)
Quality	459	97	98.04 (2.043)
Preferred	2048	83	92.20 (0.722)
Memorable	569	18	88.51 (1.445)
Trophy	0	.	0
Overall Wr	.	.	93.19 (0.924)
Fish Community Season			
Sub-stock (0-149 mm)	22	.	.
Sub-stock (150-249 mm)	8	.	.
Stock	23	100	101.3 (30.43)
Quality	94	95	88.32 (2.466)
Preferred	310	77	87.62 (1.194)
Memorable	73	15	83.47 (2.625)
Trophy	0	.	0
Overall Wr	.	.	91.37 (5.035)

[a] RSD = (# of fish of a specified length class / # of fish ≥ minimum stock length fish) * 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 %).

Sturgeon Chub

During the 2007 sample year, a total of 13 sturgeon chubs were captured in segment 14 compared to 23 in 2006 and 36 in 2005 (Utrup et al. 2006, Utrup et al. 2007). This decline in sturgeon chub captures is despite increased sampling effort in segment 14 over the past five years. Sturgeon chubs were only captured during fish community season during 2007 with a CPUE of 0.05 fish per 100 m trawled; slightly higher than in 2006 (CPUE = 0.04; Figure 19). The majority of sturgeon chubs were captured in ISB (62% of the total catch relative to 62% of the total effort; Table 26). All sturgeon chubs were captured in CHNB mesohabitat relative to 65% of the effort during fish community season (Table 27).

Not enough sturgeon chubs (N < 50) were captured in segment 14 during 2007 to summarize year to year trends and population structure.

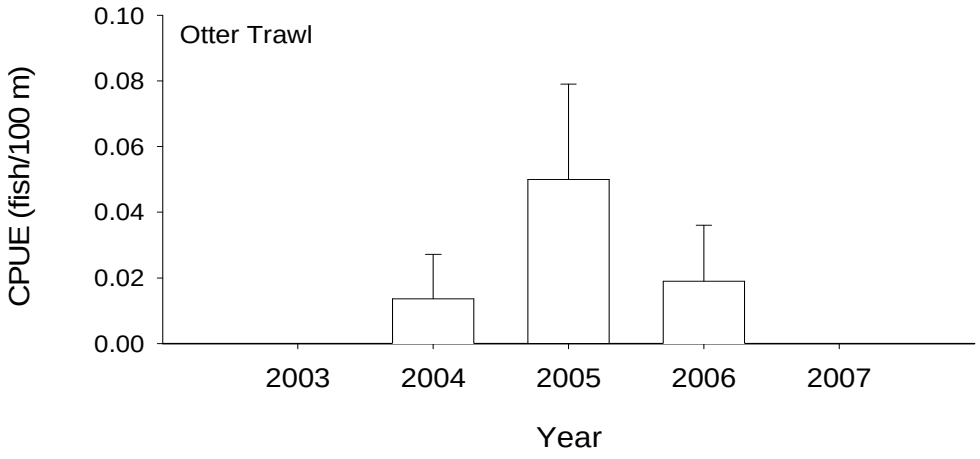

Figure 18. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls in segment 14 of the Missouri River during sturgeon season 2003-2007.

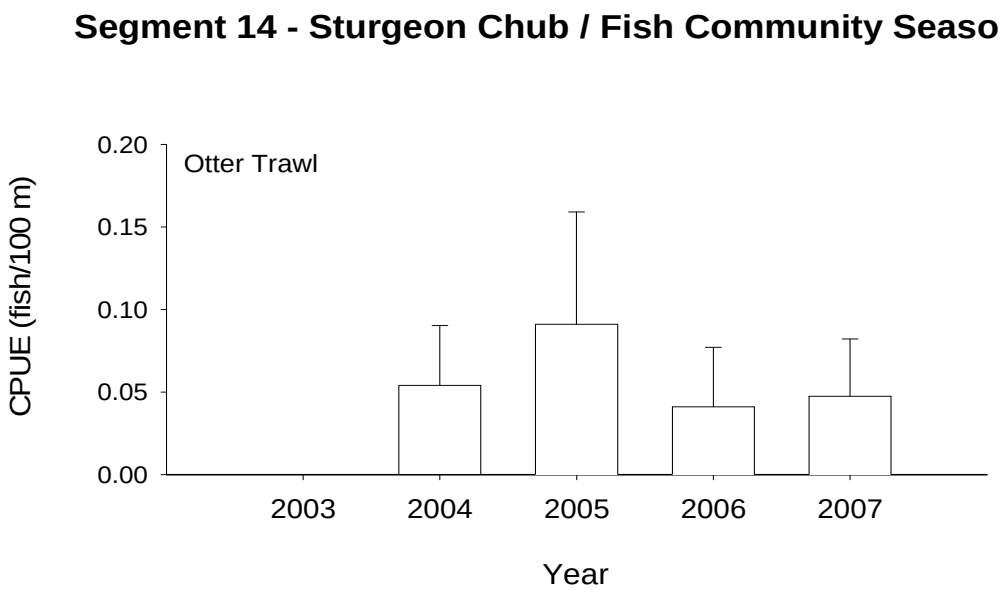

Figure 19. Mean annual catch-per-unit-effort (+/- 2SE) of sturgeon chub using otter trawls in segment 14 of the Missouri River during fish community season 2003-2007.

Table 26. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	13	0	38	0	0	0	62	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 27. Total number of sturgeon chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	13	0	100	0	0	0	0
	.	0	96	0	0	1	4

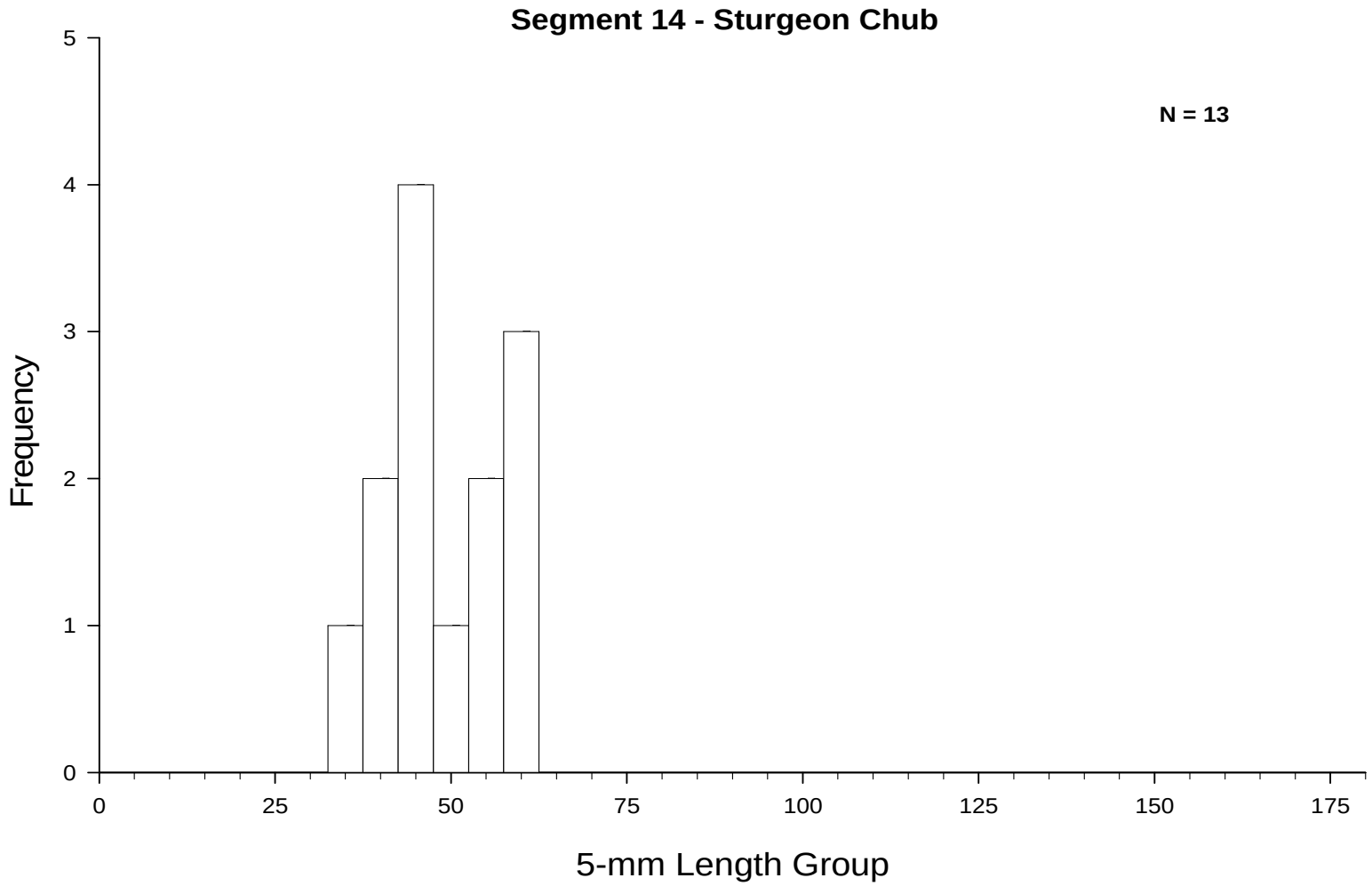

Figure 21. Length frequency of sturgeon chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Sicklefin Chub

A total of 98 sicklefin chubs were captured in 2007, which was fewer than were captured in 2006 (N = 200; Utrup et al. 2007). There has been a notable decline in the total number of sicklefin chubs captured in segment 14 since 2004 (N = 1,029 in 2004, N = 355 in 2005, N = 200 in 2006, and N = 98 in 2007). Otter trawls were the most effective gear at capturing sicklefin chubs (93% of total catch) with mini-fyke nets contributing to 0.07% of the total catch. The majority of sicklefin chubs were captured during the fish community season (89%; N = 87). Catch-per-unit-effort with otter trawls during sturgeon season (CPUE = 0.04) was lower than it was for fish community season (CPUE of 0.25; Figures 22-23). Otter trawl CPUE has decreased considerably for sturgeon season since 2005 (CPUE = 0.84 in 2005, CPUE = 0.23 in 2006, and CPUE = 0.04 in 2007) and decreased slightly for fish community season since 2006 (CPUE = 0.39 in 2006 versus 0.25 in 2007; Figures 23). Mini-fyke CPUE has notably decreased since 2004 with Mini-fyke net catch rates decreasing from 0.94 sicklefin chubs per net night during the 2004 fish community season to 0.05 per net night in 2005 and 0.02 per net night in 2006 (Figure 24). Catch rate for sicklefin chubs increased slightly in 2007 to 0.06 fish per net night (Figure 24). During the sturgeon season, all sicklefin chubs (100% of catch; N = 11) were captured in ISB CHNB habitat relative to 74% of the total effort. During fish community season, the majority of sicklefin chubs were captured in ISB macrohabitat (72% of the catch relative to 62% of the total effort) with the majority occurring in CHNB (N = 78) and BAR (N = 7) mesohabitat (Tables 26-27).

Similar to 2006, larger sicklefin chubs were captured earlier in the sample year (i.e. during sturgeon season), whereas, smaller (YOY) sicklefin chubs were captured during fish community season (Figure 25). Pflieger (1997) noted that many young sicklefin chubs were captured in July, suggesting a spring spawning season. Correspondingly, adult sicklefin chubs have been found to be full of eggs in the spring (Jennifer Johnson, U.S. Fish and Wildlife Service, personal communication) and are most likely actively spawning during the sturgeon season, perhaps making them more vulnerable to sampling gear than during the summer and fall months (fish community season). Herman et al. (2008a) found YOY sicklefin chubs attain lengths of about 50 mm in their first year of life. There was a presence of age-1 sicklefin chubs in the fish community and sturgeon season samples during 2007 corresponding to a successful spawn in 2006 and first year recruitment in 2007 (Figure 25; Utrup et al. 2007).

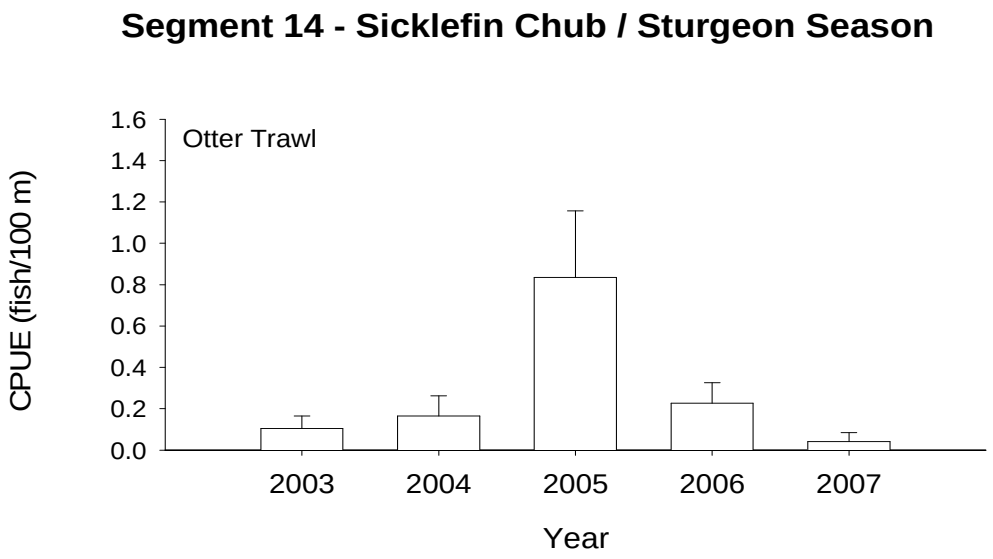

Figure 22. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls in segment 14 of the Missouri River during sturgeon season 2003-2007.

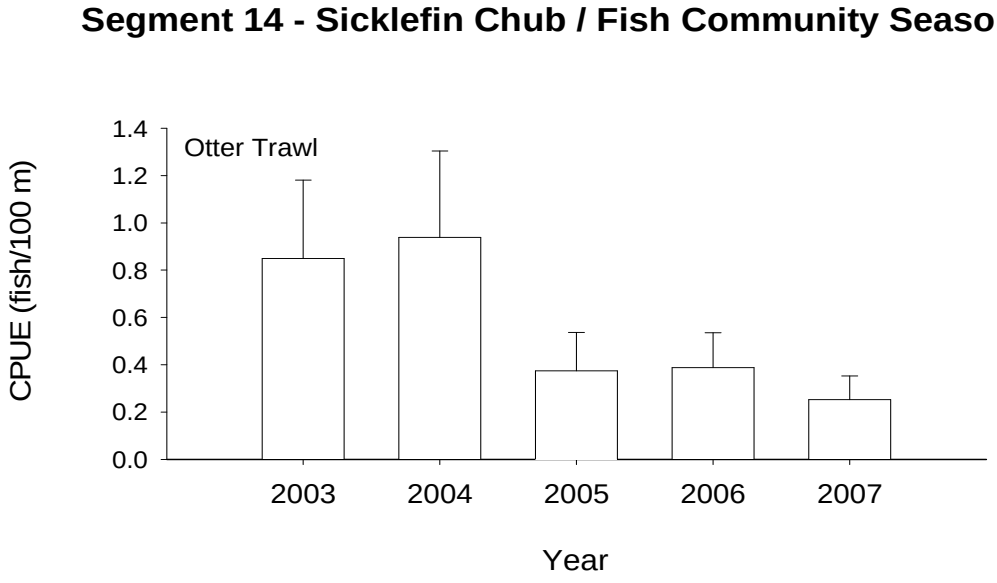

Figure 23. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using otter trawls in segment 14 of the Missouri River during fish community season 2003 - 2007.

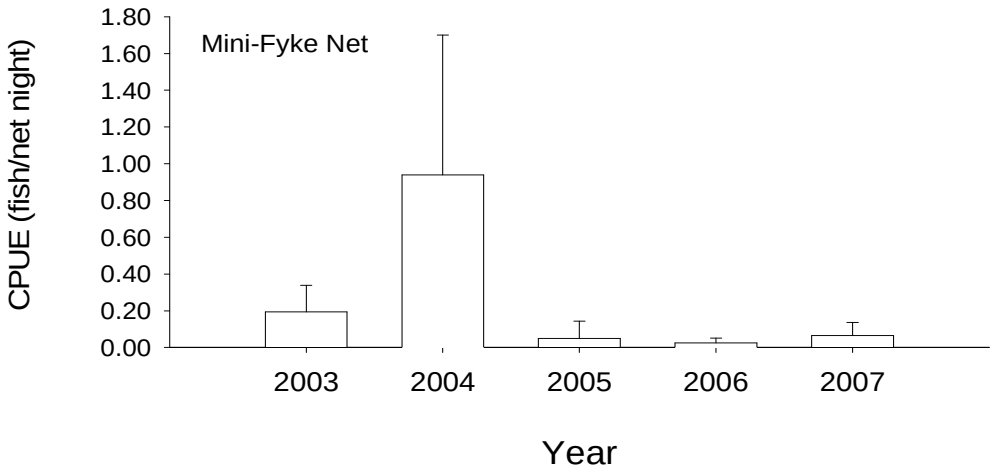

Figure 24. Mean annual catch-per-unit-effort (+/- 2SE) of sicklefin chub using mini-fyke nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 28. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	11	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	7	0	0	0	0	0	57	0	14	29	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	80	0	25	0	0	0	74	0	1	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 29. Total number of sicklefin chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	11	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	7	100	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	80	0	98	0	0	1	1
	.	0	96	0	0	1	4

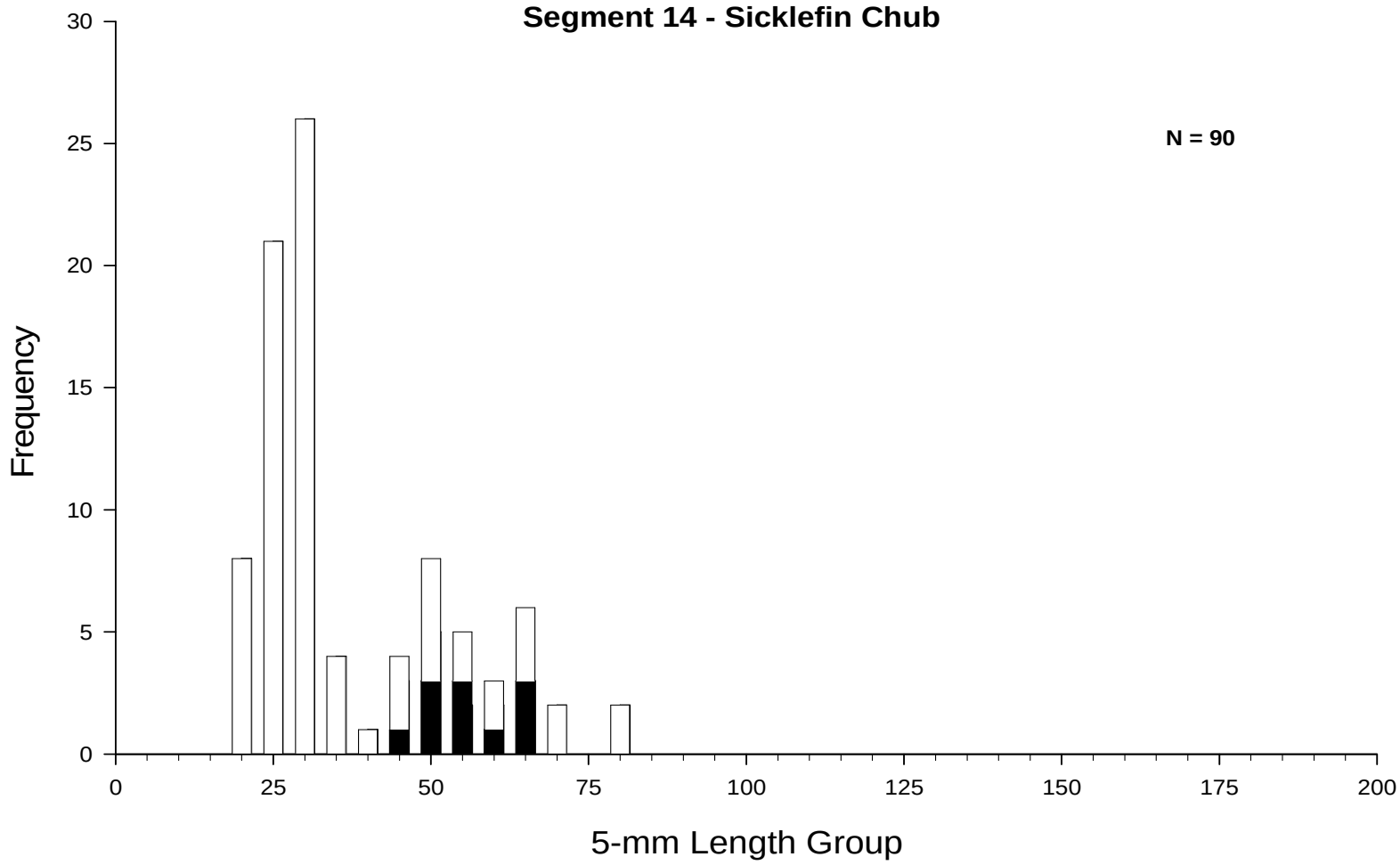

Figure 25. Length frequency of sicklefin chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Speckled Chub

A total of 144 speckled chubs were captured in 2007, which was fewer than 25% of the total catch in both 2005 (N = 575; Utrup et al. 2006) and 2006 (N = 597; Utrup et al. 2007). A nearly equal number of speckled chubs were captured during fish community season (51%; N = 71) as compared to sturgeon season (49%; N = 71; Table 30). Otter trawls were the most effective gear at capturing speckled chubs for both sturgeon and fish community seasons making up 92% of the total catch, with mini-fyke nets making up 0.08% of the total catch. Since mini-fyke nets were only used during fish community season, otter trawls were the only gear that captured speckled chubs during sturgeon season, with a CPUE of 0.42 fish per 100 m trawled, which is less than half the catch rate in 2006 (CPUE = 1.11 in 2006; Utrup et al. 2007). Catch-per-unit-effort with otter trawls during sturgeon season (CPUE = 0.42) was slightly higher than for fish community season (CPUE = 0.23). Otter trawl CPUE for sturgeon season decreased slightly from 2004 to 2005, rebounded during 2006, and decreased again in 2007 (CPUE = 0.93 in 2004; 0.65 in 2005, 1.11 in 2006, and 0.42 in 2007; Figure 26). Otter trawl CPUE for fish community season has declined steadily since 2005 but is still greater than in 2003 and 2004 (Figure 27). Mini-fyke CPUE has decreased consistently since 2004 (2004 = 0.58; 2005 = 0.37; 2006 = 0.18, 2007 = 0.10; Figure 28). During sturgeon season, the majority of speckled chubs were captured in ISB macrohabitat (76% of the catch relative to 77% of the total effort) and CHNB mesohabitat (94% of the catch relative to 96% of the effort). During fish community season, the majority of speckled chubs were captured in ISB macrohabitat (68% of the catch) relative to 54% of the effort (Table 30). Overall, the majority of speckled chubs were captured in CHNB mesohabitat, with 90% of total catch (N = 129) relative to 72% of the total effort (Table 31). Pflieger (1997) noted that speckled chubs begin to spawn in early May and continue through the summer. Correspondingly, adult speckled chubs have been found to be full of eggs in the spring (Jennifer Johnson, U.S. Fish and Wildlife Service, personal communication) and are most likely actively spawning during the sturgeon season. According to Herman et al. (2008b), YOY speckled chubs in segment 14 of the Missouri River, on average, attain lengths of about 36 mm in their first year of life. Because speckled chubs are short-lived (seldom living longer the one and a half years; Pflieger 1997), much of the reproduction is accomplished by age 1 fish that subsequently die after spawning. Similar to what was found in 2005 and 2006; it appears that the majority of the 2006 year class was captured during sturgeon season (Figure 29).

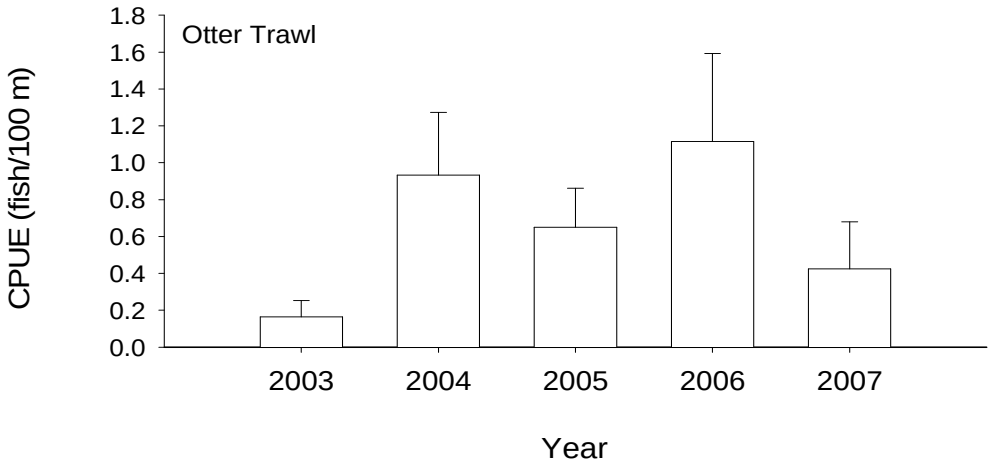

Figure 26. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub using otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

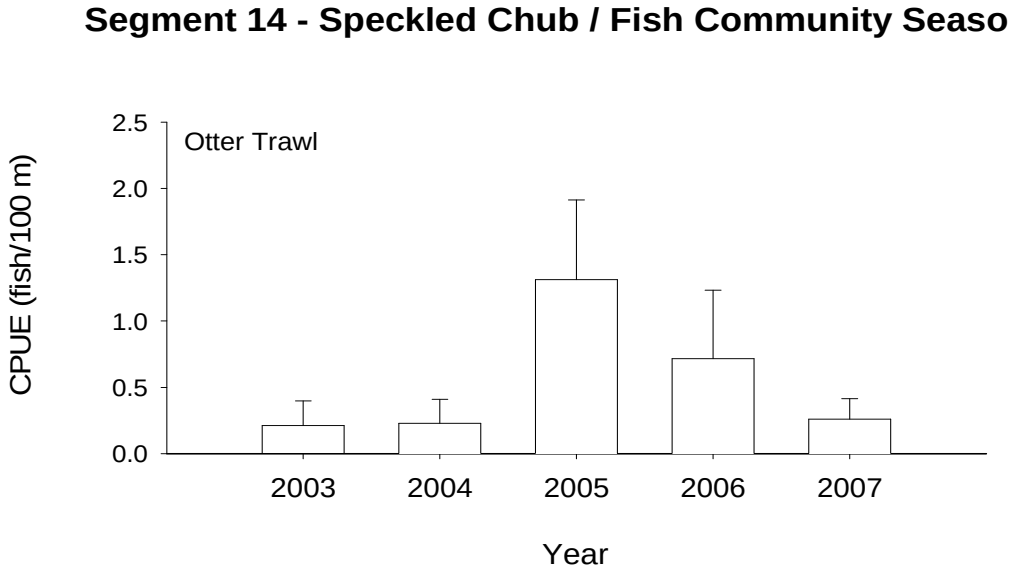

Figure 27. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub in segment 14 of the Missouri River during fish community season 2003 - 2007.

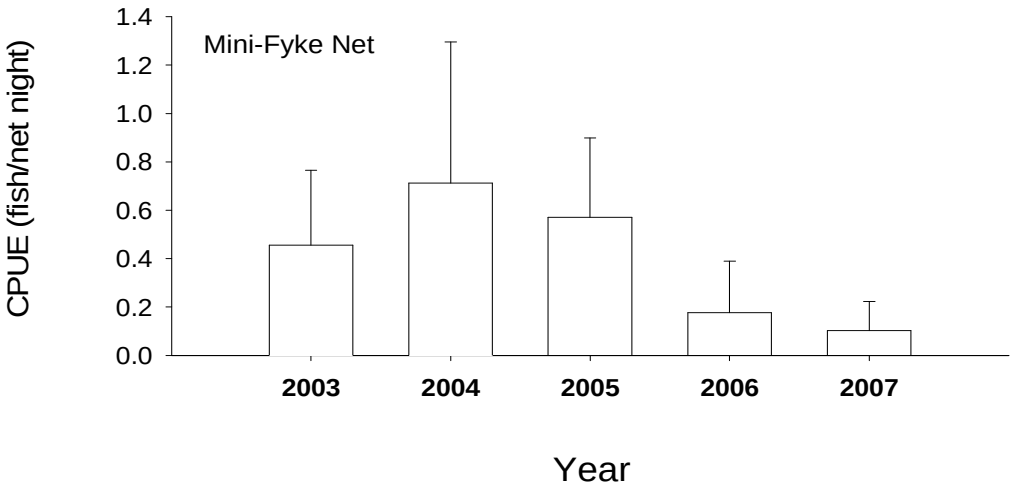

Figure 28. Mean annual catch-per-unit-effort (+/- 2SE) of speckled chub using mini-fyke nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 30. Total number of speckled chubs captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	71	0	10	0	0	0	76	0	14	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	11	0	0	0	0	0	55	0	0	45	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	62	0	29	0	0	0	71	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 31. Total number of speckled chubs captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	71	0	97	0	3	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	11	100	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	62	0	100	0	0	0	0
	.	0	96	0	0	1	4

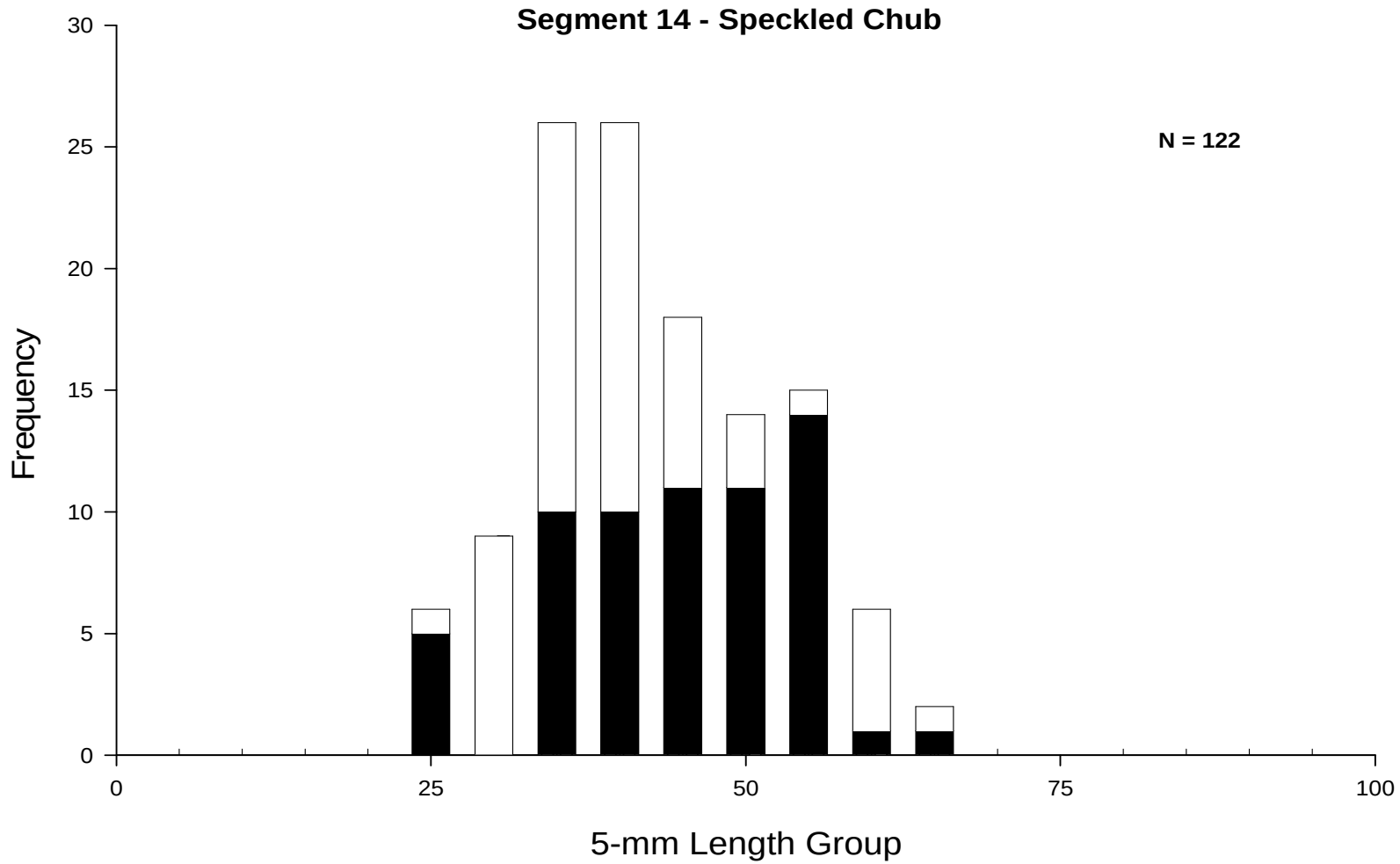

Figure 29. Length frequency of speckled chubs during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Sand Shiner

Only 2 sand shiners were captured in segment 14 during 2007. The total number of sand shiners captured in segment 14 has declined dramatically since 2005 (N = 216 in 2005, N = 57 in 2006, and N = 2 in 2007; Utrup et al. 2007). Both sand shiners were captured with mini-fyke nets during fish community season. Both were captured in CHXO BAR habitat (Tables 32 and 33). Catch-per-unit-effort has declined considerably for both otter trawl and mini-fyke nets since their all time high in 2005 (Figures 30-32). Sturgeon season otter trawl CPUE has decreased from 0.01 fish per 100 m trawled in 2005 to 0.008 in 2006 and 0.00 in 2007 (Figure 30). Similarly, CPUE for mini-fyke nets has decreased from a high of 1.4 fish per net night in 2005 to 0.43 in 2006 and a low rate of 0.02 fish per net night in 2007 (Figure 32).

There were not enough sand shiners (N < 50) captured in segment 14 during 2007 to summarize year to year trends and population structure. Pflieger (1997) reported that the maximum life span of sand shiners is 3 years and that most do not reach sexual maturity until their second or third year. According to Dattilo et al. (2008a), on average, sand shiners in segment 14 of the Missouri River reach about 50 mm in length during their first year. One of the sand shiners captured was most likely one year old while the other was potentially YOY (Figure 33).

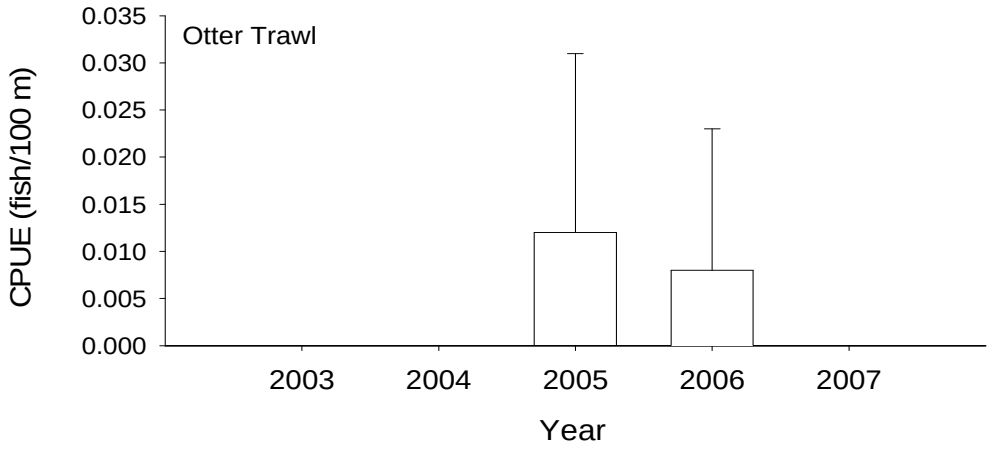

Figure 30. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

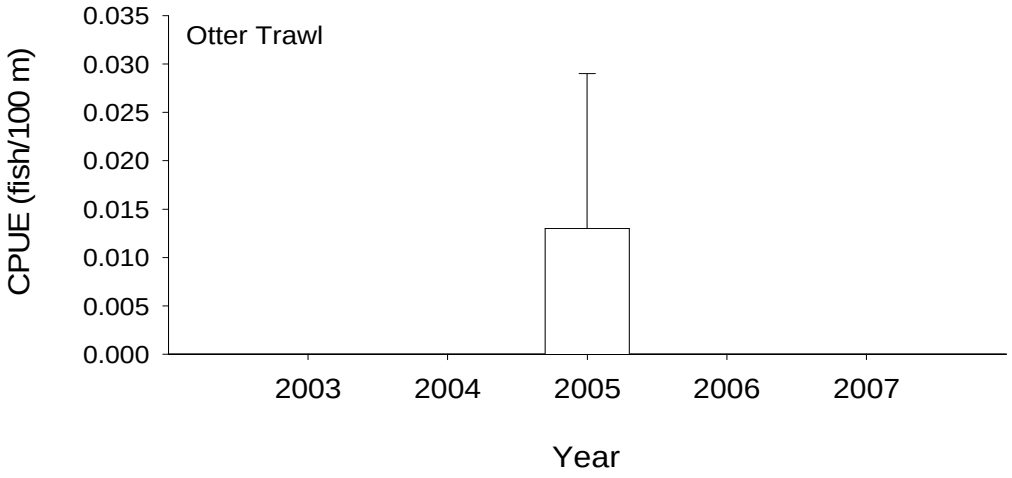

Figure 31. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with otter trawls in segment 14 of the Missouri River during fish community season 2003 - 2007.

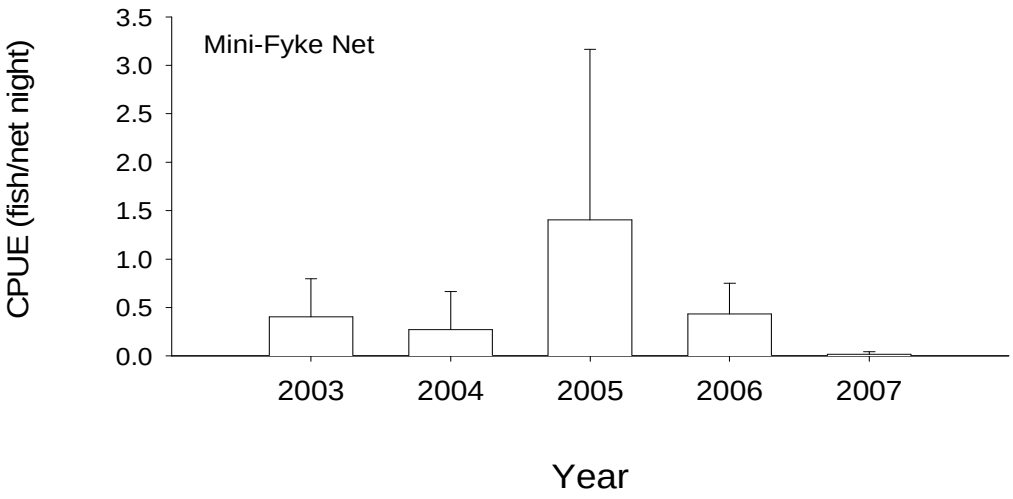

Figure 32. Mean annual catch-per-unit-effort (+/- 2SE) of sand shiner with mini-fyke nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	2	0	100	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	0	0	0	0	0	0	0
	.	0	42	0	3	54	1
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	2	100	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	0	0	0	0	0	0	0
	.	0	96	0	0	1	4

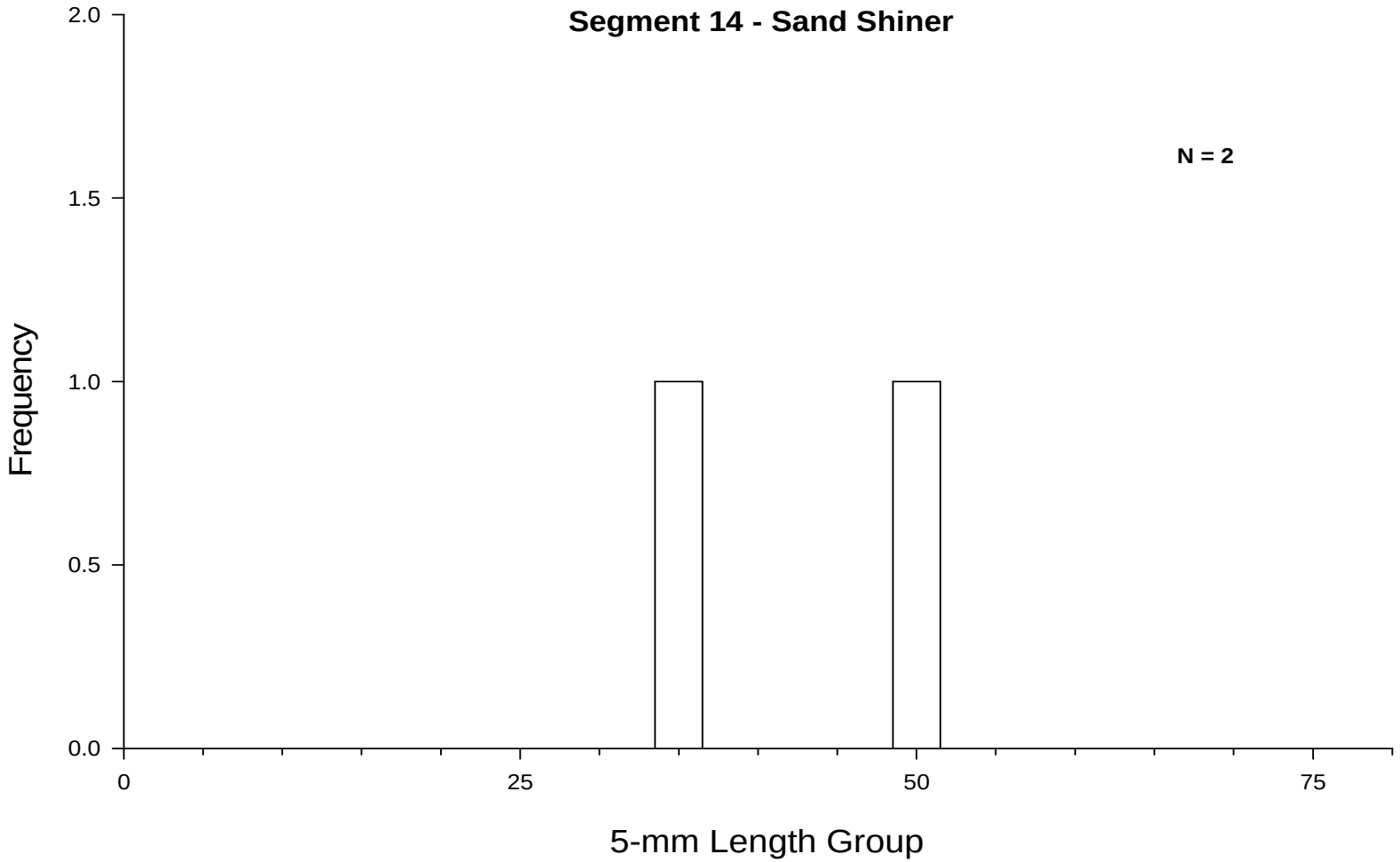

Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

***Hybognathus* spp**.

Very few *Hybognathus* spp. (HBNS) have ever been captured in segment 14 of the Missouri River. During 2007, field crews did not collect any HBNS in segment 14. Since the beginning of standardized sampling in 2003, only 85 HBNS have ever been captured in segment 14, 10 in 2003, 4 in 2004, 47 in 2005, 24 in 2006, and 0 in 2007 (Doyle and Starostka 2004, Doyle et al. 2005, Utrup et al. 2006, Utrup et al. 2007). In past years, fish community season has been the best season for catching HBNS with mini-fyke nets being the best gear. HBNS were only captured in otter trawls in 2006 and catch rates in mini-fyke nets have decreased since 2005 (CPUE = 0.12 in 2005, CPUE = 0.01 in 2006, and CPUE = 0.00 in 2007, Figures 34 and 36).

Segment 14 - *Hybognathus* spp. / Sturgeon Season

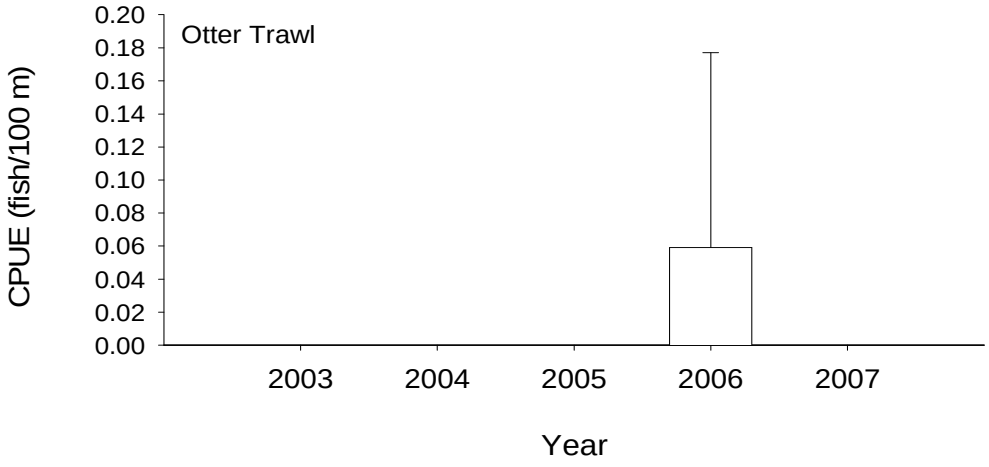

Figure 34. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus* spp. with otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

Segment 14 - *Hybognathus* spp. / Fish Community Season

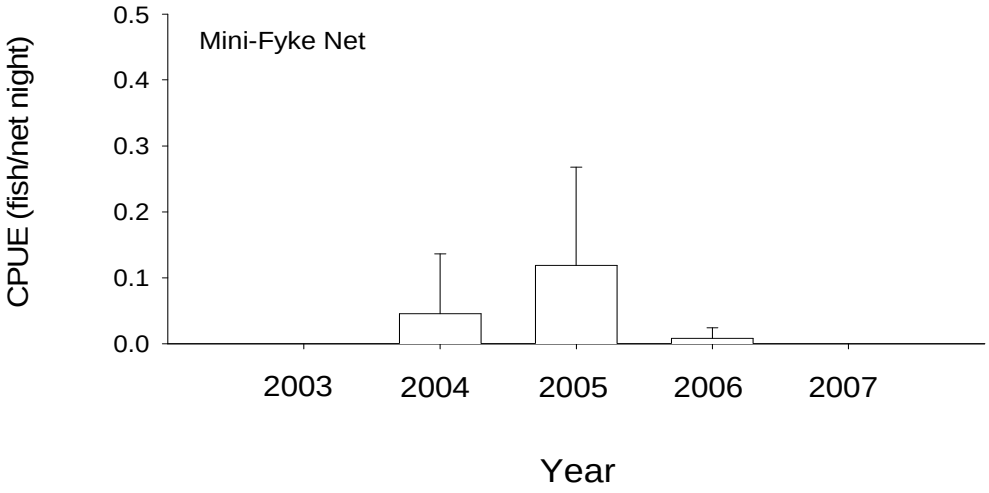

Figure 36. Mean annual catch-per-unit-effort (+/- 2SE) of *Hybognathus* spp. with mini-fyke nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Blue Sucker

A total of 58 blue suckers were captured during 2007, far less than were captured in both 2005 (N = 232; Utrup et al. 2006) and 2006 (N = 205; Utrup et al. 2007). This decline in overall blue sucker captures may be the result of field crews dropping 2.5 inch trammel nets in 2007, which was the most effective gear at capturing blue suckers. Similar to previous years, the majority of blue suckers were captured during the sturgeon season (67%; N = 39) versus the fish community season (N = 19; Table 36). Gill nets were the best gear at capturing blue suckers during sturgeon season (CPUE = 0.07) followed by 1-inch trammel nets (CPUE = 0.05) and otter trawls (CPUE = 0.03; Figures 38 and 39). During fish community season, 1-inch trammel nets were the most effective gear (CPUE = 0.08) with only three blue suckers captured in otter trawls (CPUE = 0.01; Figure 41). Blue suckers have never been captured in mini-fyke nets. For sturgeon season, catch rates with all gears have declined since 2005. One-inch trammel net catch rates have decreased from 0.2 fish per 100 m drifted in 2005 to 0.16 fish in 2006 and 0.05 fish in 2007 (Figure 39). Similar trends exist with gill nets (CPUE = 0.13 in 2005, CPUE = 0.12 in 2006, and CPUE = 0.07 in 2007) and otter trawls (CPUE = 0.06 in 2005, CPUE = 0.04 in 2006, and CPUE = 0.03 in 2007; Figure 38). Similar trends occurred during fish community season with both otter trawl and 1-inch trammel net. Though catch rates with otter trawls have always been low during fish community season, there was still a decline in CPUE from 0.07 fish per 100 m trawled in 2006 to 0.01 fish in 2007 (Figure 41). 1-inch trammel net catch rates during fish community season have declined consistently since 2005 with 0.1 fish per 100 m drifted during 2005 to 0.9 and 0.8 fish during 2006 and 2007, respectively (Figure 41).

During both seasons, the majority of blue suckers were captured in ISB macrohabitat (88%, N = 51; Table 36). The majority of blue suckers captured during both seasons also occurred in CHNB mesohabitat (83% of the total catch, N = 48, relative to 72% of the total effort; Table 37). It should be noted, however, that 2 blue suckers (18% of the total catch for sturgeon season trammel nets) were captured in BAR mesohabitat relative to only 2% of the total effort during sturgeon season. It may be beneficial to increase sampling efforts in BAR mesohabitat with active gears. Since trammel nets are ineffective in BAR habitat because of depth and flow constraints, an experimental gear such as the push trawl may increase overall blue sucker catch.

According to LaBay et al. (2008), blue suckers in segment 14 of the Missouri River reach a length of about 500 mm in their first year of life. Based on this knowledge, the majority of blue suckers captured in 2007 were older than age-1. This age data may be inaccurate, however, because aging methods for blue suckers produce highly variable results resulting in low reader agreement (Steve LaBay, South Dakota Game and Parks, personal communication). Pflieger (1997) noted that blue suckers sexually mature at a size between 500 and 660 mm which is the most common size at capture during the sturgeon season. Using both sources of information (Pflieger 1997 and LaBay et al. 2008), we can assume that the majority of blue suckers captured in 2007 (93% of the total catch, N = 54) were older than age-1 and perhaps sexually mature (Figure 44). During 2006, field crews captured a strong YOY year class (< 200 mm) but were only able to detect one blue sucker (330 mm) during 2007 that may have recruited from this year class. Unlike 2006, field crews did not capture any newly spawned blue suckers (< 200 mm) during 2007 (Utrup et al. 2007).

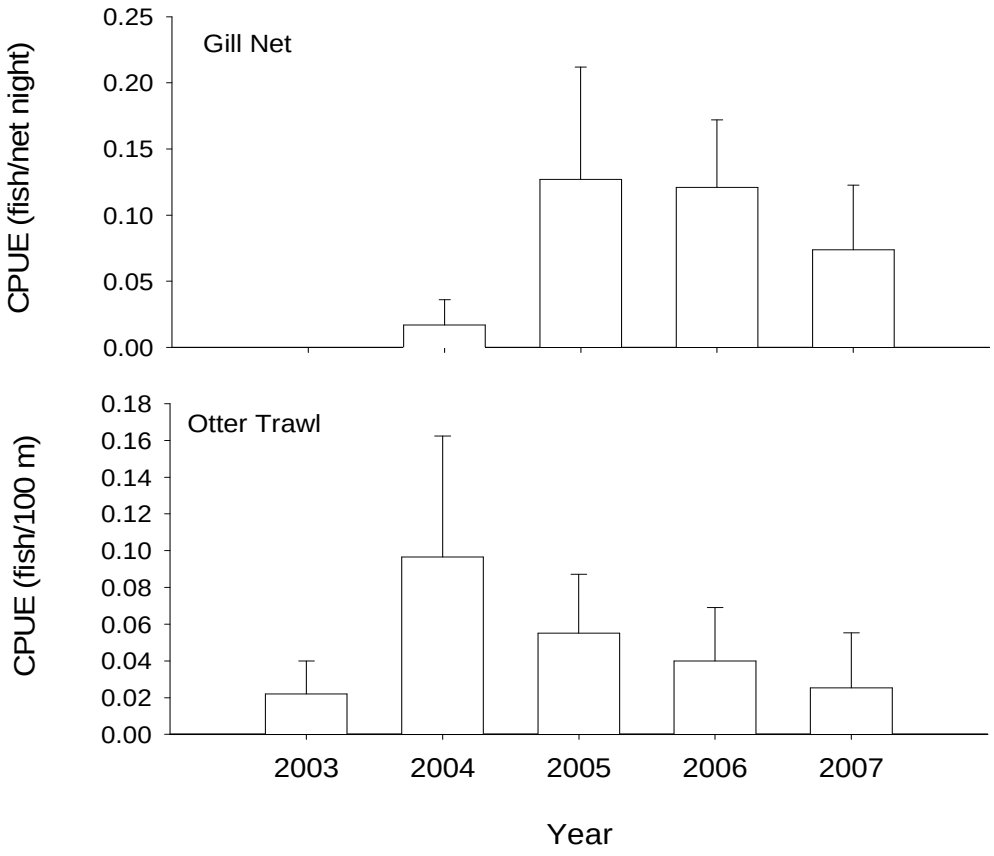

Figure 38. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with gill nets and otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

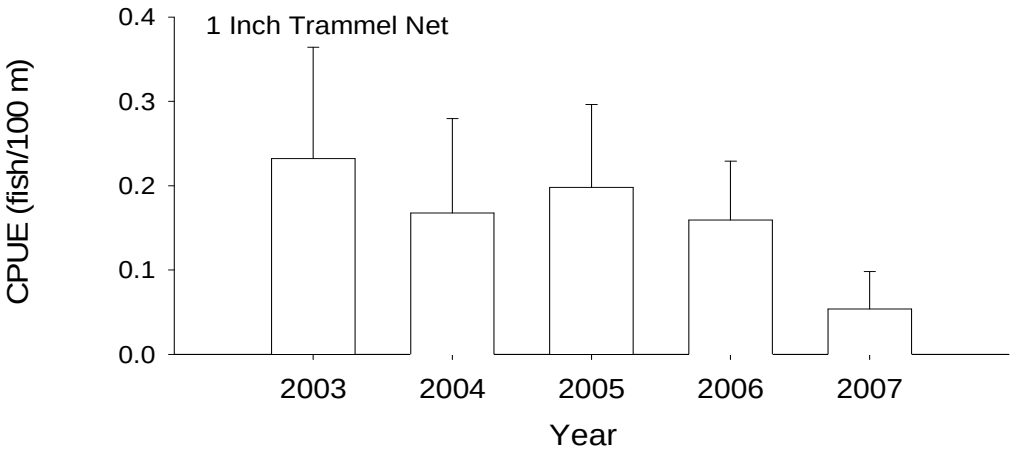

Figure 39. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker with 1 inch trammel nets in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

Segment 14 - Blue Sucker / Fish Community Season

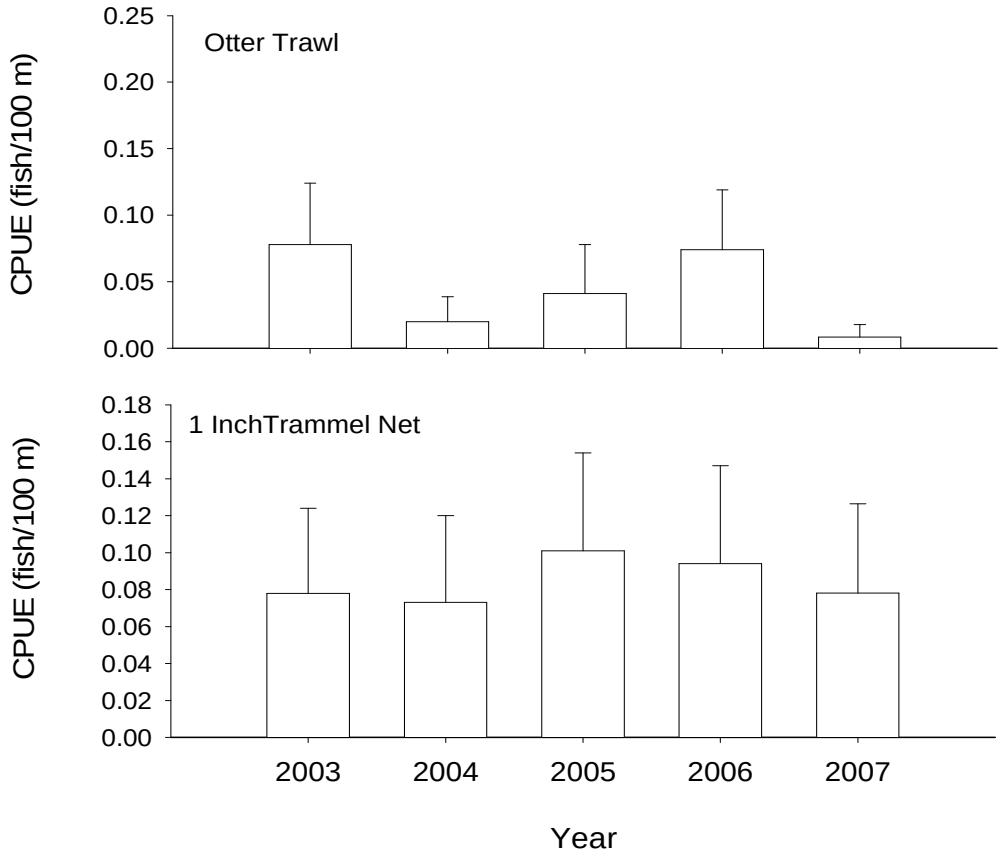

Figure 41. Mean annual catch-per-unit-effort (+/- 2SE) of blue sucker using otter trawls and 1 inch trammel nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	11	0	9	0	0	0	91	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	23	0	13	0	0	0	83	0	4	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	5	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	16	0	13	0	0	0	88	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	3	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	11	18	73	0	0	9	0
	.	2	96	0	0	1	0
Gill Net	23	0	70	0	0	30	0
	.	0	42	0	3	54	1
Otter Trawl	5	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	16	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	3	0	100	0	0	0	0
	.	0	96	0	0	1	4

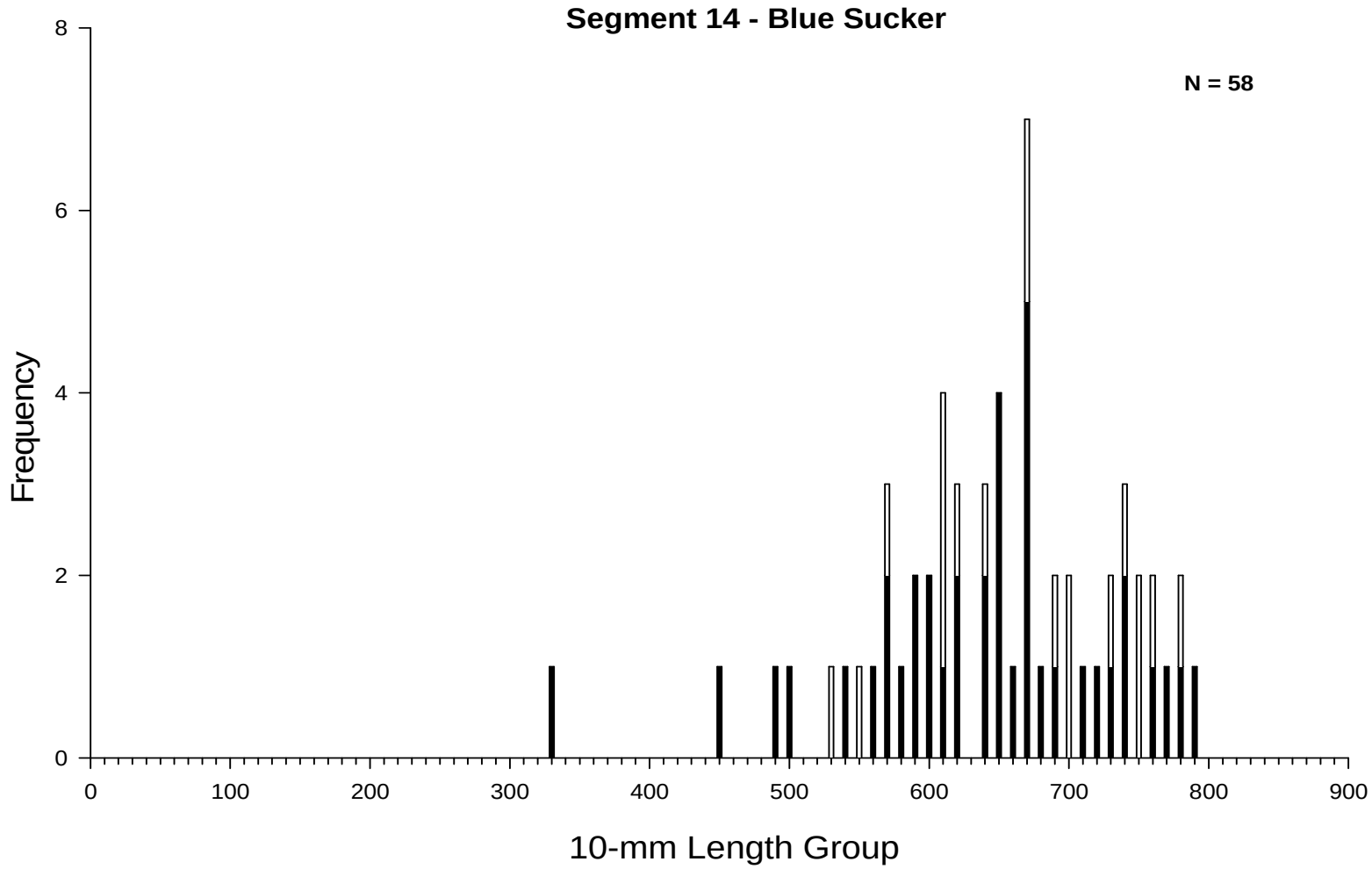

Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Sauger

Only 15 sauger were captured during 2007, down from both 2005 (N = 38) and 2006 (N = 57; Utrup et al. 2007). The majority of sauger were captured during sturgeon season (87%; N = 13; Tables 38-39). Gill nets were the most effective gear at capturing sauger (80% of the total catch; CPUE = 0.04; Table 38; Figure 45). For sturgeon season, gill net CPUE has decreased consistently every year since 2004 (CPUE = 0.12 in 2004, 0.09 in 2005, 0.07 in 2006, and 0.04 in 2007; Figure 45). No sauger were captured with trammel nets during sturgeon season (Figure 46). Only two sauger were captured during fish community season, one with a trammel net and the other with an otter trawl. Catch-per-unit-effort for otter trawls during fish community season increased greatly from 2005 to 2006 (CPUE = 0.01 in 2005 to 0.04 in 2006) but decreased in 2007 to just 0.003 fish per 100 m trawled (Figure 48). No sauger were captured in mini-fyke nets during 2007 (Figure 49). The majority of sauger captured in gill nets occurred in ISB macrohabitat (67% of the total catch relative to 53% of the effort) with the majority of those occurring in CHNB mesohabitat (60% of the total effort relative to 42% of the effort; Tables 38 and 39). Nearly 20% of all the sauger also occurred in POOL mesohabitat, relative to 18% of the effort during sturgeon season (Table 39).

There were not enough sauger (N < 50) captured in segment 14 during 2007 to summarize year to year trends and population structure. Based on age structure described by Pflieger (1997) and Dattilo et al. (2008b), sauger in segment 14 of the Missouri River reach age-1 at about 200 mm and age-2 at about 280 mm. The majority of sauger captured in 2007 were older than age-2 (93%, N = 14; Figure 51).

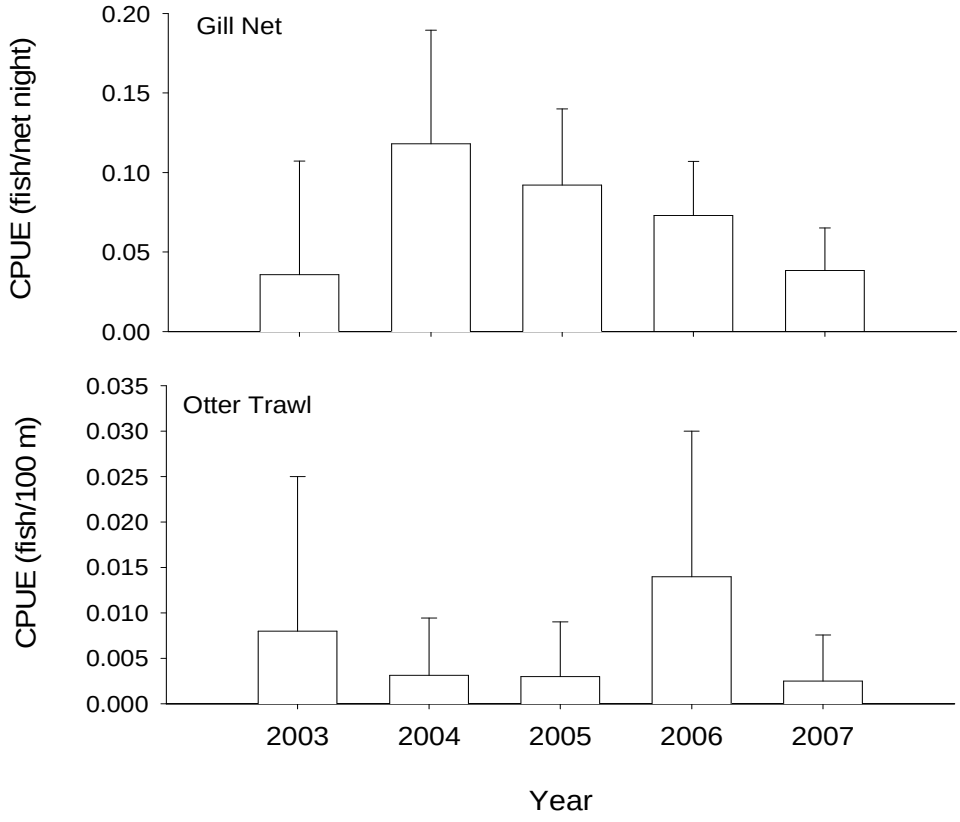

Figure 45. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using gill nets and otter trawls in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

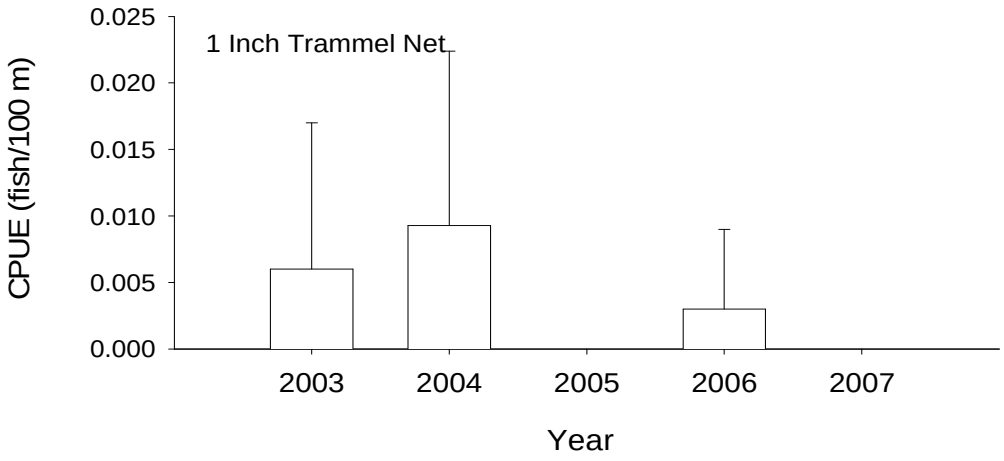

Figure 46. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using 1 and 2.5 inch trammel nets in segment 14 of the Missouri River during sturgeon season 2003 - 2007.

Segment 14 - Sauger / Fish Community Season

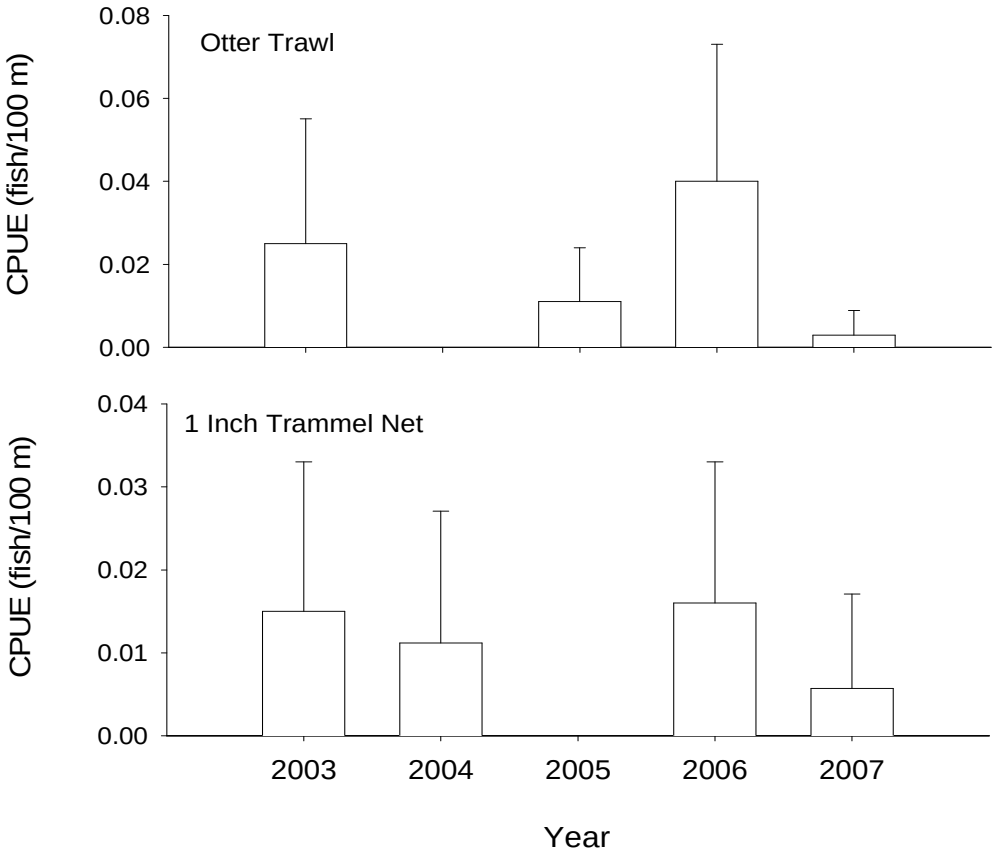

Figure 48. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using otter trawls and 1 inch trammel nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

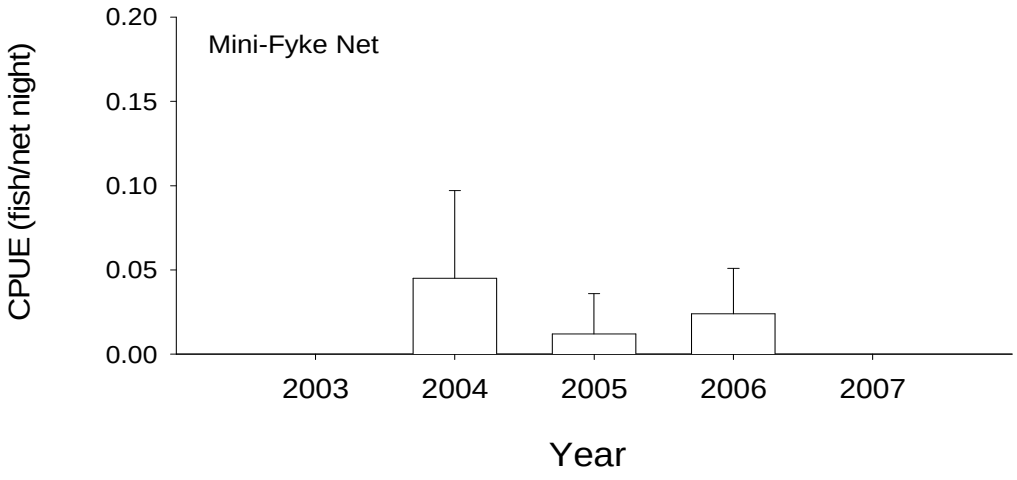

Figure 49. Mean annual catch-per-unit-effort (+/- 2SE) of sauger using mini-fyke nets in segment 14 of the Missouri River during fish community season 2003 - 2007.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Macrohabitat													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1-inch Trammel Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	80	0	0	0	0	0	0	0	0
Gill Net	12	0	17	0	0	0	83	0	0	0	0	0	0	0	0
	.	0	20	1	0	0	53	20	3	1	0	0	0	2	0
Otter Trawl	1	0	0	0	0	0	0	0	100	0	0	0	0	0	0
	.	0	13	0	0	0	77	0	10	0	0	0	1	0	0
Fish Community Season (Summer)															
1-inch Trammel Net	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	20	0	0	0	79	0	1	0	0	0	0	0	0
Mini-Fyke Net	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	0	23	2	0	0	33	11	19	9	0	0	2	0	0
Otter Trawl	1	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	.	0	21	0	0	0	75	0	2	0	0	0	1	0	0

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segment 14 of the Missouri River during 2007. The percent of total effort for each gear in each habitat is presented on the second line of each gear type. N-E indicates the habitat is non-existent in the segment.

Gear	N	Mesohabitat					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1-inch Trammel Net	0	0	0	0	0	0	0
	.	2	96	0	0	1	0
Gill Net	12	0	75	0	0	25	0
	.	0	42	0	3	54	1
Otter Trawl	1	0	100	0	0	0	0
	.	0	96	0	4	0	0
Fish Community Season (Summer)							
1-inch Trammel Net	1	0	100	0	0	0	0
	.	0	99	0	0	0	1
Mini-Fyke Net	0	0	0	0	0	0	0
	.	87	1	0	12	0	0
Otter Trawl	1	0	100	0	0	0	0
	.	0	96	0	0	1	4

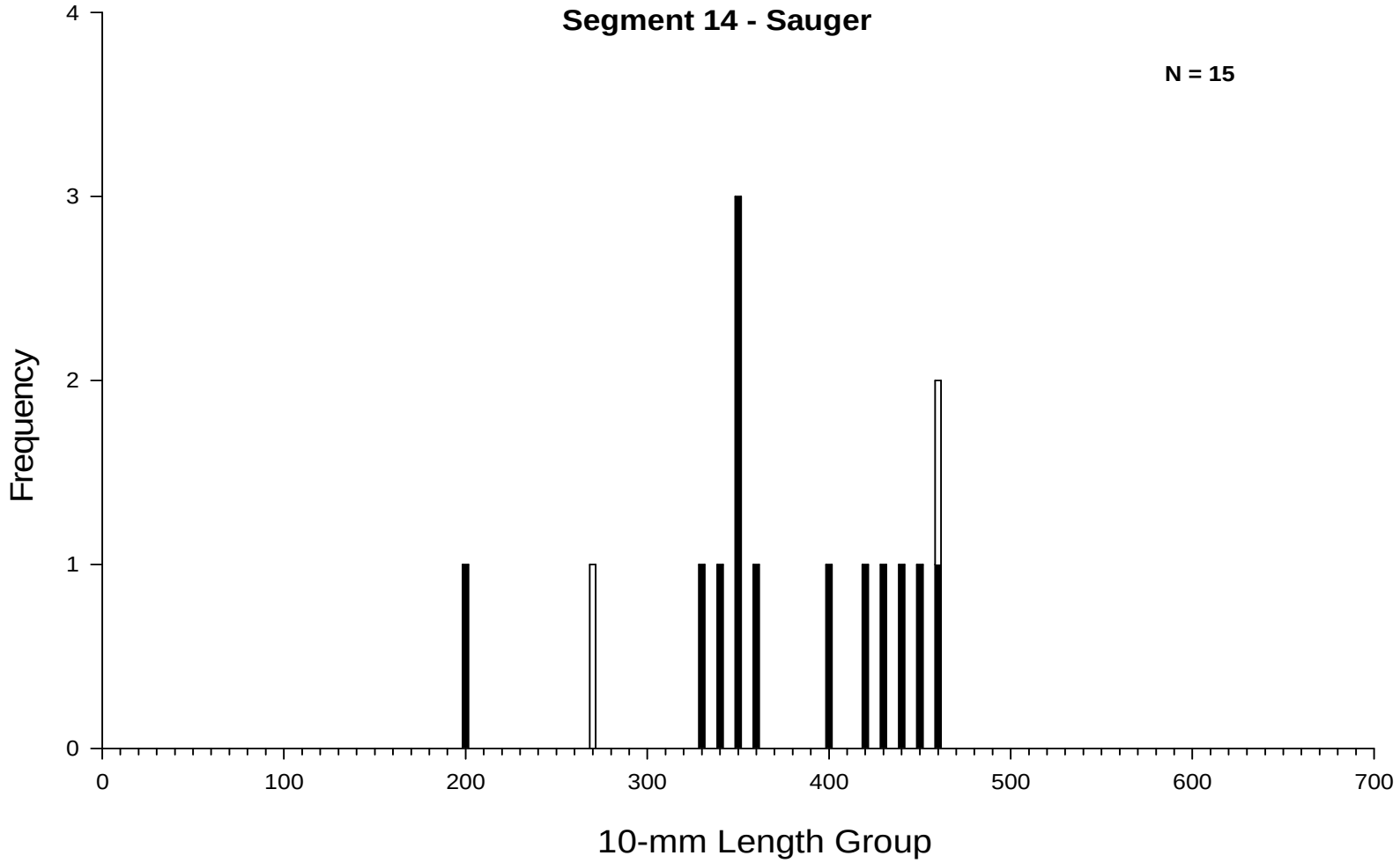

Figure 51. Length frequency of sauger during fall through spring (sturgeon season, black bars) and summer (fish community season, white bars) in segment 14 of the Missouri River during 2007.

Missouri River Fish Community

This section covers the following objectives from the pallid sturgeon monitoring and assessment program:

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

During 2007, 16,965 total fish were captured in segment 14 of the Missouri River, 14,382 with standard gear in random bends. Standard gears captured 54 species with channel catfish comprising the largest percentage of the total catch (26.9%; N = 3,867), followed by shovelnose sturgeon (25.9%; N = 3,721), unidentified *Lepomis* spp. (7.4%; N = 1,069), and blue catfish (7.0%; N = 1,003). The 9 target species accounted for 28.2% of the total catch with each contributing to the total in the following order of abundance: shovelnose sturgeon (25.9%; N = 3,721), speckled chub (1.0%; N = 144), sicklefin chub (0.7%; N = 98), blue sucker (0.4%; N = 58), sauger (0.1%; N = 15), sturgeon chub (0.09%; N = 13), pallid sturgeon (0.06%; N = 8), sand shiner (0.01%; N = 2), and *Hybognathus* spp. (0.0%; N = 0). Eighteen species were captured fewer than five times during the entire sample year (Appendix F).

Gill nets captured 33 species and were most effective at capturing shovelnose sturgeon (80.3% of the gill net catch; N = 2,788), with an average overall CPUE of 8.9 fish per net night (Appendix F1). Blue catfish (8.1%; N = 282), freshwater drum (1.5%; N = 53), and river carpsucker (1.5%; N = 50) were the next most abundant fish species collected in gill nets (mean overall CPUE = 0.91, 0.17, and 0.16 fish per net night, respectively; Appendix F1). Gill nets were only used during sturgeon season.

One-inch trammel nets, fished during both seasons, captured a total of 17 species with shovelnose sturgeon making up the majority of the catch (70.2%; N = 636; mean overall CPUE = 1.5 fish per 100 m drifted). Other large bodied fish, such as blue catfish (17.1%; N = 155; mean overall CPUE = 0.36 fish per 100 m drifted) and blue suckers (3.0%; N = 27; mean overall

CPUE = 0.07 fish per 100 m drifted), were also captured effectively with 1-inch trammel nets (Appendix F2).

Otter trawls captured 29 species of fish, most of which were small benthic fishes that are not easily sampled with other gear types. Young-of-year channel (64.4%; N = 3,515; mean overall CPUE = 6.1 fish per 100 m trawled) and blue catfish (10.3%; N = 562; mean overall CPUE = 1.1 fish per 100 m trawled) were captured most frequently in otter trawls. Otter trawls were also very effective at capturing chub species in segment 14, such as speckled chub (2.4%; N = 133; mean overall CPUE = 0.34 fish per 100 m trawled), sicklefin chub (1.7%; N = 91; mean overall CPUE = 0.15 fish per 100 m trawled), and sturgeon chub (0.2%; N = 13; mean overall CPUE 0.02 fish per 100 m trawled; Appendix F4). Shovelnose sturgeon made up 5.4% of the total otter trawl catch with an overall CPUE of 0.7 fish per 100 m trawled (Appendix F4).

The fish community season is different because warm water temperatures and low water levels increase availability of fish and efficiency of sampling, especially in mini-fyke nets. This gear targets another group of fishes which are rarely detected with the other standard gear types. Mini-fyke nets captured 33 species of fish in segment 14 with unidentified *Lepomis* spp. making up the majority of the total catch (23.5%; N = 1,069) with red shiners, gizzard shad, and emerald shiners making up 13.3%, 11.4%, and 10.9% of the total mini-fyke catch, respectively (Appendix F6). Of the 33 species captured by mini-fyke nets, 13 species were not captured with any other gear type (Appendix J2).

Asian carp are rarely captured at young life stages but, through observations in the field and through collections using other gear types from related projects (e.g., electrofishing and hoop nets); they seem to be increasing in abundance throughout the Lower Missouri River. Additional sampling gear and improved sampling techniques need to be further investigated to help document the population dynamics of this invasive exotic species.

Discussion

Young-of-year (0 - 250 mm) or sub-stock size (< 330 mm) pallid sturgeon have never been captured in segment 14 as part of standard sampling, which began in 2003. Of the 19 pallid sturgeon that were captured during 2007, seven were stock size and 12 were quality and above size. In addition to the 19 pallid sturgeon, nine hybrid sturgeon were captured during 2007.

Four large hatchery origin and three wild origin pallid sturgeon were captured near confluences during 2007. Three hatchery origin and one wild pallid sturgeon were captured at the mouth of the Osage River, during the middle of April when the Osage and Missouri rivers are full of spring rains and melt-water. These pallids were potentially using the slack water at the mouth of the Osage River as refuge from the high flows. One of these seven pallids was captured across from the mouth of the Gasconade River on the bank side of a large sandbar that lies between two wing dikes. Two large wild pallid sturgeon were captured at the confluence with the Mississippi River (Appendix J3). This emphasizes the influence that the Mississippi River has on segment 14 of the Missouri River in terms of both wild and hatchery origin pallid sturgeon immigrating and emigrating from between the Missouri and Mississippi rivers.

Six large, quality and greater size, pallid sturgeon were captured on the side or tail of channel sandbars and on the channel boarder along the current seam of inside bends at depths around 4 m. This corresponds with telemetry data provided by USGS/CERC which shows that adult sturgeon move along the current seam as water temperature begins to rise, presumably to migrate upstream to spawn (Aaron Delonay, U.S. Geological Survey, personal communication). One relatively small wild pallid (FL = 527) was captured behind a rootless dike on the side of a small sandbar. The largest pallid sturgeon captured was an 891 mm recap from the 1997 stocking in segment 14. This large hatchery fish was captured at the tail end of a sandbar between two wing dikes. One stock size hatchery pallid was captured under the bridge near Chesterfield, MO. This area near Chesterfield and Weldon Spring, MO, has been a “hot spot” for pallid captures in the past but has “cooled off” in the last couple years. Recent work regarding spoil piles within the river channel, along with recent high flows causing a change in sandbar morphology, may be responsible for a decline in pallid sturgeon captures in that area.

Telemetry information provided by USGS/CERC indicates that adult pallid sturgeon use deeper and swifter water than adult shovelnose sturgeon. In past years, active gears such as trammel nets have been used to try and capture sonic telemetered shovelnose and pallid sturgeon. Through these exercises we have learned that sturgeon 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 prevent drifted gear from reaching the habitat utilized by sturgeon due to high flow and sharp angles. These substrate features also limit the efficacy of otter trawls in catching individually targeted sturgeon.

Notable Trends

The most notable trend is the apparent decline in target species in segment 14. At the very least, there is a decline in both abundance and catch rate for all target species except shovelnose and pallid sturgeon. In many cases, there has been a decline in both abundance and catch rate since 2005. Conversely, annual catch of pallid sturgeon has increased since 2003. This may, in large part, be because of the influence of hatchery stocked fish. At present, there are nearly 80,000 hatchery reared pallid sturgeon potentially "at large" in the Lower Missouri River below Gavins Point Dam. The influence of the stocking program will be evident when we compare hatchery versus wild pallid sturgeon abundance through time.

Catch rates of shovelnose sturgeon rebounded slightly in 2007 relative to what appeared to be an overall decline in shovelnose sturgeon catch rates since 2003, particularly when considering 1-inch trammel net data. From 2003 through 2006 there was a steady decline in CPUE for quality and greater size classes of shovelnose sturgeon captured in 1-inch trammel nets during the sturgeon season. Overall CPUE of shovelnose sturgeon in 1-inch trammel nets showed a declining trend from a CPUE of 1.56 fish per 100 m drifted in 2004 to 1.35 and 0.92 fish per 100 m drifted in 2005 and 2006 respectfully. This catch rate rebounded slightly in 2007 to about 1.5 fish per 100 m drifted. Similarly, overall CPUE of shovelnose sturgeon in otter trawls during sturgeon season has declined from 1.14 fish per 100 m trawled to 0.95 in 2006 and 0.71 fish per 100 m trawled in 2007. Otter trawls and trammel nets have been found to be the least biased sampling methods available for detecting trends in shovelnose sturgeon because they are not as

influenced from seasonal migrations or winter aggregations. Otter trawls have an advantage, however, because they are not as variable as trammel nets and capture a wider size range of fish.

Drought conditions from 2003 through 2005 may have played a role in the decline in shovelnose sturgeon catch rates. The last two years have been rather wet for the Lower Missouri River, possibly triggering spawning behavior and causing the increase in catch rates during 2007. One issue that may be effecting the shovelnose sturgeon population in segment 14 may be commercial fishing. Commercial harvest of sturgeon in segment 14 is a legitimate concern. Belly scars (egg checks) from knife probes in shovelnose sturgeon show that commercial fishermen are likely killing more fish than would be documented from harvest reports. The differences in catch rates between segment 13 and 14 suggest that segment 14, which is closer to the Mississippi River, receives more fishing pressure than other segments of the Missouri River. In the past this was further confounded by the use of many commercial fisherman from the Mississippi River (Tennessee and Arkansas) who travel up the Missouri River in early spring (before seasons open on the Mississippi) to harvest Missouri sturgeon roe. Since 2005, however, non-residents are no longer allowed to fish in the Lower Missouri River. Because of segment 14's proximity to the Mississippi River, and the motile nature of the pallid sturgeon, there is still reason for concern. Anecdotal information from federal law enforcement officers indicate commercial fishermen from other states have already been observed fishing (legally and illegally) in the Mississippi River near the confluence. Over the past several years, there have been numerous violations on the Mississippi River where pallid sturgeon have been "mistaken" for shovelnose and been found in the creels of commercial fishermen. Shovelnose sturgeon numbers will most likely continue to decline in segment 14, due to the rising prices of caviar. Documentation of an egg check scar on two pallid sturgeon in segment 14, one during 2006 and another during 2007, suggests that commercial fishermen would likely harvest pallid sturgeon roe along with the shovelnose sturgeon.

Since 2005, there has been a decline in both abundance and catch rates of all three target chub species in segment 14. It may be important to look at how environmental conditions in the river (i.e., water levels, spring rise, etc…) could be impacting these species. In 2006, field crews captured a large number of YOY blue suckers. The capture of young blue suckers (< 200 mm) has always been minimal in segment 14. Unfortunately, field crews were unable to capture very many YOY blue suckers during 2007. In all, abundances and catch rates of all three target chub

species, sand shiners, blue suckers, and sauger were at all time lows during 2007. In addition, field crews did not capture any *Hybognathus* spp. in segment 14 during 2007.

Channel and blue catfish have been among the most abundant fish captured in segment 14 since the implementation of the standard sampling program in 2003. Trends for these two species may be as important to the health of the Missouri River and pallid sturgeon as the target species discussed in detail within this report. Otter trawls have been the best and most consistent gear for describing the population of both catfish species over time. Despite the decline in target species CPUE over time, channel catfish CPUE with otter trawls in segment 14 has increased from 0.95 fish per 100 m trawled in 2004 to 2.53 fish in 2005, 3.76 fish in 2006, and 6.07 fish per 100 m trawled in 2007 (Doyle et al. 2005, Utrup et al. 2006, Utrup et al. 2007). Catch rates for blue catfish in otter trawls, on the other hand, have declined from 5.18 fish per 100 m trawled in 2005 to 3.0 fish in 2006 and 1.12 fish per 100 m trawled in 2007 (Doyle et al. 2005, Utrup et al. 2006, Utrup et al. 2007).

The life histories of pallid and shovelnose sturgeon may be dependent on the target species in this study, as well as other native fish such as catfish. Because of this, changes that are evident within the fish populations of segment 14 will need to be monitored closely in future years.

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APPENDICES

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

Scientific name	Common name	Letter Code
	CLASS CEPHALASPIDOMORPHI-LAMPREYS	
	ORDER PETROMYZONTIFORMES	
	Petromyzontidae – lampreys	
Ichthyomyzon castaneus	Chestnut lamprey	CNLP
Ichthyomyzon fossor	Northern brook lamprey	NBLP
Ichthyomyzon unicuspis	Silver lamprey	SVLP
Ichthyomyzon gagei	Southern brook lamprey	SBLR
Petromyzontidae	Unidentified lamprey	ULY
Petromyzontidae larvae	Unidentified larval lamprey	LVLP
	CLASS OSTEICHTHYES – BONY FISHES	
	ORDER ACIPENSERIFORMES	
	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	Lettter 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

Appendix A. (continued).

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
	Unidentified Asian Carp	UAC
	Catostomidae - suckers	
Carpiodes carpio	River carpsucker	RVCS
Carpiodes cyprinus	Quillback	QLBK
Carpiodes velifer	Highfin carpsucker	HFCS
Carpiodes spp.	Unidentified Carpiodes	UCS
Catostomus catostomus	Longnose sucker	LNSK
Catostomus commersoni	White sucker	WTSK
Catostomus platyrhyncus	Mountain sucker	MTSK
Catastomus spp.	Unidentified *Catastomus* spp.	UCA
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

Appendix A. (continued).

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	BRBH
Ameiurus spp.	Unidentified bullhead	UBH
Ictalurus furcatus	Blue catfish	BLCF
Ictalurus punctatus	Channel catfish	CNCF
I. furcatus X I. punctatus	Blue-channel catfish hybrid	BCCC
Ictalurus spp.	Unidentified *Ictalurus* spp.	UCF
Noturus exilis	Slender madtom	SDMT
Noturus flavus	Stonecat	STCT
Noturus gyrinus	Tadpole madtom	TPMT
Noturus 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	TGMG
	Umbridae - mudminnows	
Umbra limi	Central mudminnow	MDMN
	Osmeridae - smelts	
Osmerus mordax	Rainbow smelt	RBST
	Salmonidae - trouts	
Coregonus artedi	Lake herring or cisco	CSCO
Coregonus clupeaformis	Lake whitefish	LKWF
Oncorhynchus aguabonita	Golden trout	GDTT
Oncorhynchus 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

Appendix A. (continued).

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	SOPH
Lepomis cyanellus	Green sunfish	GNSF
Lepomis gibbosus	Pumpkinseed	PNSD
Lepomis gulosus	Warmouth	WRMH
Lepomis humilis	Orangespotted sunfish	OSSF
Lepomis macrochirus	Bluegill	BLGL
Lepomis magalotis	Longear sunfish	LESF
Lepomis microlophus	Redear sunfish	RESF
L. cyanellus X L. macrochirus	Green sunfish-bluegill hybrid	GSBG

Appendix A. (continued).

Scientific name	Common name	Letter Code
	Centrarchidae - sunfishes	
L. cyanellus X L. humilis	Green-orangespotted sunfish hybrid	GSOS
L. macrochirus X L. microlophus	Bluegill-redear sunfish hybrid	BGRE
Lepomis spp.	Unidentified *Lepomis*	ULP
Micropterus dolomieu	Smallmouth bass	SMBS
Micropterus punctatus	Spotted sunfish	STBS
Micropterus salmoides	Largemouth bass	LMBS
Micropterus spp.	Unidentified *Micropterus* spp.	UMC
Pomoxis annularis	White crappie	WTCP
Pomoxis nigromaculatus	Black crappie	BKCP
Pomoxis spp.	Unidentified crappie	UCP
P. annularis X P. nigromaculatus	White-black crappie hybrid	WCBC
Centrarchidae	Unidentified 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
Sander canadense	**Sauger**	**SGER***
Sander vitreus	Walleye	WLEY
S. canadense X S. vitreus	Sauger-walley hybrid/Saugeye	SGWE
Sander spp.	Unidentified *Sander* (formerly *Stizostedion*) spp.	UST
	Unidentified Percidae	UPC
	Sciaenidae - drums	
Aplodinotus grunniens	Freshwater drum	FWDM
	NON-TAXONOMIC CATEGORIES	
	Age-0/Young-of-year fish	YOYF
	Lab fish for identification	LAB
	No fish caught	NFSH
	Unidentified larval fish	LVFS
	Unidentified	UNID
	Net Malfunction (Did Not Fish)	NDNF

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

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

Appendix C. List of standard and wild gears (type), their corresponding codes in the database, seasons deployed (Fall-Spring, Summer, or all), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segment 14 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for segment 14.

Gear	Code	Type	Season	Years	CPUE units
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
Mini-fyke net	MF	Standard	Fish Comm.	2003 - Present	fish/net night
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	Fish Comm.	2006 - Present	fish/ m trawled
Trammel net – 1-inch inner mesh	TN	Standard	All	2003 - Present	fish/100 m drift
Trot Line – Circle hooks**	TLC_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – Octopus hooks**	TLO_	Wild	Sturgeon	2007 - Present	fish/hook night
Trot Line – O'Shaughnessy hooks**	TLS_	Wild	Sturgeon	2007 - Present	fish/hook night
Otter trawl – 16 ft head rope	OT16	Standard	All	2003 - Present	fish/100 m trawled
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	Wild	Fish Comm.	2006 - Present	fish/100 m trawled

** Code ends with line length in feet (1 = 105 ft, 2 = 205 ft, 3 = 305 ft, 4 = 405 ft). Hooks are placed between 5 and 10 feet apart.

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

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

Appendix E. Juvenile and adult pallid sturgeon stocking summary for segment 14 of the Missouri River (RPMA 4)

Year	Stocking Site	Number Stocked	Year Class	Stock Date	Age at Stocking[a]	Primary Mark	Secondary Mark
1994	St. Charles	837	1992	3/9/1994	Fry	Coded Wire	Dangler
1994	Washington	607	1992	3/9/1994	2yo	Coded Wire	Dangler
1994	Hermann	988	1992	3/9/1994	1yo	Coded Wire	Dangler
1997	St. Charles	400	1997	10/15/1997	Fingerling	Coded Wire	Dangler
1997	Washington	400	1997	10/16/1997	Fingerling	Coded Wire	Dangler
1997	Hermann	400	1997	10/17/1997	Fingerling	Coded Wire	Dangler

[a]Age of fish when stocked: Fry, Fingerling, Yearling, 1yo, 2yo, 3yo, etc…

Appendix F

Total catch, overall mean catch per unit effort [± 2 SE], and mean Catch-Per-Unit-Effort by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segment 14 of the Missouri River during 2007. Species captured are listed alphabetically and their codes are presented in Appendix A. Asterisks with bold type indicate targeted native Missouri River species and habitat abbreviations are presented in Appendix B. Standard Error was not calculated when N < 2.

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

			CHXO		CONF		ISB		OSB		SCCL			SCCS	TRMS	
Species	Total Catch	Overall CPUE	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	TLWG
BHCP	1	0.003	0	0.026	0	0	0	0	0	0	0	0	0	0	0	0
		0.006	0	0.053			0	0	0	0		0	0	0	0	
BHMW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
BKCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
BKSS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
BLCF	284	0.91	1.083	2.684	0	1	0.577	0.86	0.769	0.361	0	0	0.25	0	0.25	0
		0.39	1.154	2.7			0.454	0.415	0.647	0.24		0	0.5	0	0.5	
BLGL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
BMBF	1	0.003	0	0	0	0	0	0	0	0.028	0	0	0	0	0	0
		0.006	0	0			0	0	0	0.056		0	0	0	0	
BNMW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
BUSK*	**23**	**0.074**	**0.083**	**0.026**	**0**	**0**	**0.179**	**0.058**	**0**	**0**	**0**	**0**	**0.25**	**0**	**0**	**0**
		0.049	**0.112**	**0.053**			**0.162**	**0.083**	**0**	**0**		**0**	**0.5**	**0**	**0**	
CARP	17	0.054	0	0.026	0	1	0	0.14	0.077	0	0	0	0	0	0	0
		0.034	0	0.053			0	0.096	0.154	0		0	0	0	0	
CNCF	38	0.122	0.167	0.158	0	1	0.038	0.198	0.038	0	0	0	0.25	0	0.25	1.5
		0.071	0.256	0.265			0.057	0.192	0.077	0		0	0.5	0	0.5	
CNSN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
ERSN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
FHCF	4	0.013	0	0.026	0	0	0.013	0	0.038	0	0	0	0.25	0	0	0
		0.013	0	0.053			0.026	0	0.077	0		0	0.5	0	0	
FWDM	53	0.17	0	0.316	1	1.5	0	0.209	0.115	0.167	0	0	0	0	1	2.5
		0.084	0	0.308			0	0.198	0.122	0.229		0	0	0	1	
GDEY	43	0.138	0.375	0.026	0	0	0.128	0.116	0.5	0	0	0	0	0	0	0
		0.104	0.75	0.053			0.163	0.188	0.679	0		0	0	0	0	
GDRH	1	0.003	0	0	0	0	0	0.012	0	0	0	0	0	0	0	0
		0.006	0	0			0	0.023	0	0		0	0	0	0	
GNSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
GSBG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
GSCP	2	0.006	0	0	0	0	0	0.012	0	0.028	0	0	0	0	0	0
		0.009	0	0			0	0.023	0	0.056		0	0	0	0	
GSOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
GZSD	23	0.074	0.042	0.105	0	0	0.026	0.151	0	0.083	0	0	0	0	0	0
		0.053	0.083	0.164			0.036	0.165	0	0.121		0	0	0	0	
HFCS	1	0.003	0	0.026	0	0	0	0	0	0	0	0	0	0	0	0
		0.006	0	0.053			0	0	0	0		0	0	0	0	
LGPH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
LKSG	7	0.022	0	0.026	0	0	0	0.058	0	0.028	0	0	0	0	0	0
		0.017	0	0.053			0	0.049	0	0.056		0	0	0	0	

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL			SCCS	TRMS	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	TLWG
LNGR	15	0.048	0	0.079	0	0.5	0.064	0.023	0	0.083	0	0	0	0	0	0.5
		0.031	0	0.115			0.091	0.032	0	0.09		0	0	0	0	
MMSN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
MQTF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
OSSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
PDFH	4	0.013	0	0.053	0	0.5	0.013	0	0	0	0	0	0	0	0	0
		0.013	0	0.072			0.026	0	0	0		0	0	0	0	
PDSG*	**4**	**0.013**	**0**	**0**	**0**	**0**	**0.038**	**0.012**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0.013	**0**	**0**			**0.043**	**0.023**	**0**	**0**		**0**	**0**	**0**	**0**	
QLBK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
RDSN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
RKBS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
RVCS	50	0.16	0	0.342	0.5	0.5	0.026	0.244	0	0.083	0	0	0	0	1	2.5
		0.072	0	0.203			0.036	0.177	0	0.121		0	0	0	2	
RVRH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
RVSN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
SBWB	1	0.003	0	0.026	0	0	0	0	0	0	0	0	0	0	0	0
		0.006	0	0.053			0	0	0	0		0	0	0	0	
SFCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**			**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**			**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
SGER*	**12**	**0.038**	**0.083**	**0**	**0**	**0**	**0.09**	**0.035**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0.027	**0.167**	**0**			**0.081**	**0.039**	**0**	**0**		**0**	**0**	**0**	**0**	
SHRH	15	0.048	0.042	0	0	0.5	0.051	0.023	0.192	0	0	0	0	0	0	1
		0.039	0.083	0			0.049	0.047	0.385	0		0	0	0	0	
SJHR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
SKCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**			**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
SMBF	31	0.099	0	0.132	0	0	0.013	0.116	0.269	0.222	0	0	0	0	0	0
		0.048	0	0.129			0.026	0.114	0.268	0.185		0	0	0	0	
SNGR	24	0.077	0	0.342	0	0.5	0.013	0.105	0	0	0	0	0	0	0	0
		0.046	0	0.287			0.026	0.085	0	0		0	0	0	0	
SNPD	2	0.006	0	0	0	0	0	0.023	0	0	0	0	0	0	0	0
		0.013	0	0			0	0.047	0	0		0	0	0	0	
SNSG*	**2788**	**8.936**	**1.917**	**19.289**	**12**	**4**	**4**	**10.721**	**7.423**	**13.361**	**8**	**1.75**	**2.25**	**1.75**	**7.5**	**0**
		1.937	**2.052**	**7.922**			**1.764**	**3.668**	**5.051**	**7.603**		**3.5**	**1.5**	**2.5**	**5**	
SNSN*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**			**0**	**0**	**0**	**0**		**0**	**0**	**0**	**0**	
STBS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
STCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	

Species	Total Catch	Overall CPUE	CHXO		CONF		ISB		OSB		SCCL			SCCS	TRMS	
			CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	POOL	CHNB	ITIP	POOL	ITIP	POOL	TLWG
SVCB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
SVCP	21	0.067	0.125	0.158	0	0	0.013	0.105	0.038	0.028	0	0	0	0	0	0
		0.033	0.131	0.134			0.026	0.085	0.077	0.056		0	0	0	0	
UCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UCN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UCY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UET	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UHY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
UIC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
ULP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	
WLYE	1	0.003	0	0	0	0	0.013	0	0	0	0	0	0	0	0	0
		0.006	0	0			0.026	0	0	0		0	0	0	0	
WTBS	2	0.006	0	0.026	0	0	0	0.012	0	0	0	0	0	0	0	0
		0.009	0	0.053			0	0.023	0	0		0	0	0	0	
WTCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0			0	0	0	0		0	0	0	0	

Appendix F2. 1-inch Trammel Net: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

			CHXO	ISB			SCCL	SCCS
Species	Total Catch	Overall CPUE	CHNB	BAR	CHNB	POOL	TLWG	ITIP
BHCP	0	0	0	0	0	0	0	0
		0	0	0	0			
BHMW	0	0	0	0	0	0	0	0
		0	0	0	0			
BKCP	0	0	0	0	0	0	0	0
		0	0	0	0			
BKSS	0	0	0	0	0	0	0	0
		0	0	0	0			
BLCF	155	0.355	0.392	0.4	0.349	0	0	0
		0.099	0.234	0.8	0.112			
BLGL	0	0	0	0	0	0	0	0
		0	0	0	0			
BMBF	0	0	0	0	0	0	0	0
		0	0	0	0			
BNMW	0	0	0	0	0	0	0	0
		0	0	0	0			
BUSK	**27**	**0.066**	**0.032**	**0.455**	**0.071**	**0.333**	**0**	**0**
		0.033	**0.037**	**0.909**	**0.041**			
CARP	0	0	0	0	0	0	0	0
		0	0	0	0			
CNCF	15	0.035	0.014	0	0.042	0	0	0
		0.026	0.021	0	0.034			
CNSN	0	0	0	0	0	0	0	0
		0	0	0	0			
ERSN	0	0	0	0	0	0	0	0
		0	0	0	0			
FHCF	2	0.004	0	0	0.005	0	0	0
		0.007	0	0	0.01			
FWDM	6	0.015	0.018	0	0.015	0	0	0
		0.013	0.036	0	0.014			
GDEY	9	0.023	0.04	0	0.019	0	0	0
		0.017	0.057	0	0.014			
GDRH	0	0	0	0	0	0	0	0
		0	0	0	0			

Species	Total Catch	Overall CPUE	CHXO	ISB			SCCL	SCCS
			CHNB	BAR	CHNB	POOL	TLWG	ITIP
GNSF	0	0	0	0	0	0	0	0
		0	0	0	0			
GSBG	0	0	0	0	0	0	0	0
		0	0	0	0			
GSCP	0	0	0	0	0	0	0	0
		0	0	0	0			
GSOS	0	0	0	0	0	0	0	0
		0	0	0	0			
GZSD	7	0.019	0	0	0.025	0	0	0
		0.016	0	0	0.02			
HFCS	0	0	0	0	0	0	0	0
		0	0	0	0			
LGPH	0	0	0	0	0	0	0	0
		0	0	0	0			
LKSG	2	0.006	0	0	0.008	0	0	0
		0.009	0	0	0.012			
LNGR	3	0.008	0	0	0.011	0	0	0
		0.013	0	0	0.017			
MMSN	0	0	0	0	0	0	0	0
		0	0	0	0			
MQTF	0	0	0	0	0	0	0	0
		0	0	0	0			
OSSF	0	0	0	0	0	0	0	0
		0	0	0	0			
PDFH	0	0	0	0	0	0	0	0
		0	0	0	0			
PDSG*	**3**	**0.009**	**0.011**	**0**	**0.009**	**0**	**0**	**0**
		0.011	**0.023**	**0**	**0.013**			
QLBK	1	0.001	0	0	0.002	0	0	0
		0.002	0	0	0.003			
RDSN	0	0	0	0	0	0	0	0
		0	0	0	0			
RKBS	0	0	0	0	0	0	0	0
		0	0	0	0			
RVCS	22	0.044	0.019	0	0.052	0	0	0
		0.027	0.027	0	0.034			

Species	Total Catch	Overall CPUE	CHXO	ISB			SCCL	SCCS
			CHNB	BAR	CHNB	POOL	TLWG	ITIP
RVRH	0	0	0	0	0	0	0	0
		0	0	0	0			
RVSN	0	0	0	0	0	0	0	0
		0	0	0	0			
SBWB	0	0	0	0	0	0	0	0
		0	0	0	0			
SFCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			
SGER*	**1**	**0.003**	**0**	**0**	**0.004**	**0**	**0**	**0**
		0.006	**0**	**0**	**0.008**			
SHRH	0	0	0	0	0	0	0	0
		0	0	0	0			
SJHR	3	0.007	0	0	0.009	0	0	0
		0.008	0	0	0.011			
SKCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			
SMBF	8	0.02	0.053	0	0.012	0	0	0
		0.016	0.062	0	0.012			
SNGR	0	0	0	0	0	0	0	0
		0	0	0	0			
SNPD	4	0.009	0	0	0.012	0	0	0
		0.01	0	0	0.012			
SNSG*	**636**	**1.507**	**1.385**	**0.855**	**1.56**	**0**	**0.833**	**1.25**
		0.405	**0.709**	**0.109**	**0.49**			
SNSN*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			
STBS	0	0	0	0	0	0	0	0
		0	0	0	0			
STCT	0	0	0	0	0	0	0	0
		0	0	0	0			
SVCB	0	0	0	0	0	0	0	0
		0	0	0	0			
SVCP	2	0.005	0.009	0	0.004	0	0	0
		0.007	0.019	0	0.008			

Species	Total Catch	Overall CPUE	CHXO	ISB			SCCL	SCCS
			CHNB	BAR	CHNB	POOL	TLWG	ITIP
UCF	0	0	0	0	0	0	0	0
		0	0	0	0			
UCN	0	0	0	0	0	0	0	0
		0	0	0	0			
UCT	0	0	0	0	0	0	0	0
		0	0	0	0			
UCY	0	0	0	0	0	0	0	0
		0	0	0	0			
UET	0	0	0	0	0	0	0	0
		0	0	0	0			
UHY	0	0	0	0	0	0	0	0
		0	0	0	0			
UIC	0	0	0	0	0	0	0	0
		0	0	0	0			
ULP	0	0	0	0	0	0	0	0
		0	0	0	0			
WLYE	0	0	0	0	0	0	0	0
		0	0	0	0			
WTBS	0	0	0	0	0	0	0	0
		0	0	0	0			
WTCP	0	0	0	0	0	0	0	0
		0	0	0	0			

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

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		SCCL			TRML	
			CHNB	POOL	CHNB	CHNB	POOL	CHNB	ITIP	TLWG	CHNB	TLWG
BHCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
BHMW	3	0.005	0.018	0	0	0.002	0	0	0	0	0	0
		0.006	0.026			0.005		0	0	0		0
BKCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
BKSS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
BLCF	562	1.118	1.774	5	1	0.949	8.182	0.549	1.186	1	0	0
		0.41	1.588			0.387		1.099	1.871	1.018		0
BLGL	7	0.012	0	0	0	0	0	0	0	0	0	1.607
		0.02	0			0		0	0	0		1.786
BMBF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
BNMW	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
BUSK*	**8**	**0.017**	**0**	**0**	**0**	**0.022**	**0**	**0**	**0**	**0**	**0**	**0**
		0.016	**0**			**0.021**		**0**	**0**	**0**		**0**
CARP	4	0.012	0.039	0	0	0.007	0	0	0	0	0	0
		0.013	0.046			0.013		0	0	0		0
CNCF	3515	6.071	5.913	27	4	4.976	10	0.842	0.606	18.5	2	113.87
		1.915	3.321			1.458		0.706	1.212	13.133		150.6
CNSN	4	0.008	0.007	0	0	0.005	0	0.048	0	0.111	0	0
		0.009	0.014			0.01		0.095	0	0.222		0
ERSN	15	0.034	0.012	0	0	0.029	0	0	0	0.417	0	0.714
		0.025	0.024			0.027		0	0	0.833		1.429
FHCF	27	0.052	0.077	0	0	0.051	0	0	0	0	0	0
		0.024	0.064			0.027		0	0	0		0
FWDM	379	0.839	0.803	3	10	0.455	0.909	0.099	0.303	1.667	0	36.22
		0.451	0.595			0.239		0.198	0.606	3.333		13.274
GDEY	32	0.08	0.01	0	0	0.073	0	0	0.152	0.111	0	2.708
		0.075	0.021			0.084		0	0.303	0.222		5.417
GDRH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		SCCL			TRML	
			CHNB	POOL	CHNB	CHNB	POOL	CHNB	ITIP	TLWG	CHNB	TLWG
GNSF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
GSBG	1	0.002	0.011	0	0	0	0	0	0	0	0	0
		0.004	0.022			0		0	0	0		0
GSCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
GSOS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
GZSD	19	0.033	0.023	0	0	0.01	0	0	0	0	0	2.857
		0.04	0.032			0.01		0	0	0		4.286
HFCS	1	0.003	0	0	0	0.004	0	0	0	0	0	0
		0.006	0			0.008		0	0	0		0
LGPH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
LKSG	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
LNGR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
MMSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
MQTF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
OSSF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
PDFH	4	0.006	0	0	0	0.009	0	0	0	0	0	0
		0.007	0			0.009		0	0	0		0
PDSG*	**1**	**0.002**	**0**	**0**	**0**	**0.003**	**0**	**0**	**0**	**0**	**0**	**0**
		0.005	**0**			**0.006**		**0**	**0**	**0**		**0**
QLBK	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
RDSN	7	0.014	0.047	0	0	0.008	0	0	0	0	0	0
		0.015	0.077			0.009		0	0	0		0
RKBS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
RVCS	7	0.021	0.009	1	1	0.003	0	0	0	0.417	0	0.565
		0.017	0.018			0.007		0	0	0.833		0.298

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		SCCL			TRML	
			CHNB	POOL	CHNB	CHNB	POOL	CHNB	ITIP	TLWG	CHNB	TLWG
RVRH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
RVSN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
SBWB	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
SFCB*	**91**	**0.146**	**0.153**	**0**	**0**	**0.147**	**0.909**	**0**	**0**	**0.417**	**0**	**0**
		0.055	**0.129**			**0.065**		**0**	**0**	**0.833**		**0**
SGCB*	**13**	**0.024**	**0.052**	**0**	**0**	**0.019**	**0**	**0**	**0**	**0**	**0**	**0**
		0.017	**0.072**			**0.016**		**0**	**0**	**0**		**0**
SGER*	**2**	**0.003**	**0**	**0**	**0**	**0.002**	**0**	**0.048**	**0**	**0**	**0**	**0**
		0.004	**0**			**0.004**		**0.095**	**0**	**0**		**0**
SHRH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
SJHR	1	0.001	0	0	0	0.002	0	0	0	0	0	0
		0.002	0			0.003		0	0	0		0
SKCB*	**133**	**0.343**	**0.348**	**0**	**0**	**0.346**	**0**	**0.683**	**0.25**	**0**	**0**	**0**
		0.15	**0.32**			**0.182**		**0.616**	**0.5**	**0**		**0**
SMBF	2	0.004	0.016	0	0	0.002	0	0	0	0	0	0
		0.006	0.031			0.003		0	0	0		0
SNGR	4	0.013	0	0	1	0	0	0	0	0	2	0.208
		0.017	0			0		0	0	0		0.417
SNPD	1	0.003	0	0	0	0.005	0	0	0	0	0	0
		0.007	0			0.009		0	0	0		0
SNSG*	**297**	**0.666**	**0.564**	**0**	**0**	**0.714**	**0**	**0.818**	**0.152**	**0.417**	**0**	**0**
		0.151	**0.29**			**0.184**		**1.086**	**0.303**	**0.833**		**0**
SNSN*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**			**0**		**0**	**0**	**0**		**0**
STBS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
STCT	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
SVCB	53	0.102	0.129	0	0	0.067	0	0.515	0.125	0	0	1.815
		0.046	0.148			0.033		0.592	0.25	0		2.202
SVCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		SCCL			TRML	
			CHNB	POOL	CHNB	CHNB	POOL	CHNB	ITIP	TLWG	CHNB	TLWG
UCF	2	0.005	0.017	0	0	0.003	0	0	0	0	0	0
		0.007	0.033			0.005		0	0	0		0
UCN	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
UCT	8	0.022	0.011	0	0	0.008	0	0	0	0	0	1.786
		0.029	0.022			0.014		0	0	0		3.571
UCY	2	0.005	0.028	0	0	0	0	0	0	0	0	0
		0.007	0.04			0		0	0	0		0
UET	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
UHY	5	0.014	0	0	0	0.019	0	0	0	0	0	0
		0.023	0			0.031		0	0	0		0
UIC	245	0.663	1.512	0	0	0.486	0	1.099	0	0.111	0	0
		0.414	2.079			0.248		2.198	0	0.222		0
ULP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
WLYE	0	0	0	0	0	0	0	0	0	0	0	0
		0	0			0		0	0	0		0
WTBS	3	0.008	0	0	0	0.008	0	0	0	0	0	0.208
		0.01	0			0.012		0	0	0		0.417
WTCP	2	0.007	0	1	0	0	0	0	0	0	0	0.357
		0.009	0			0		0	0	0		0.714

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

			CHXO	CONF	ISB			OSB	SCCL		SCCS	TRML
Species	Total Catch	Overall CPUE	BAR	BAR	BAR	CHNB	ITIP	BAR	BAR	ITIP	BAR	BAR
BHCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
BHMW	159	1.472	1.04	6.5	0.941	1	0	4.833	1.667	0.583	0.7	0
		0.794	0.707	5	0.54			6.295	1.944	0.999	0.945	0
BKCP	21	0.194	0.04	0	0	0	0	1.667	0	0	0	0
		0.335	0.08	0	0			2.988	0	0	0	0
BKSS	3	0.028	0	0	0.059	0	0	0	0	0	0.1	0
		0.032	0	0	0.082			0	0	0	0.2	0
BLCF	2	0.019	0	0	0	0	0	0	0	0.083	0.1	0
		0.026	0	0	0			0	0	0.167	0.2	0
BLGL	394	3.648	4	9.5	1.294	0	0	11.75	5.444	3.167	0.3	0
		1.807	3.19	17	1.889			11.876	3.699	4.298	0.427	0
BMBF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
BNMW	35	0.324	1.16	0.5	0.118	0	0	0.083	0	0	0	0
		0.523	2.238	1	0.235			0.167	0	0	0	0
BUSK*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
CARP	6	0.056	0.12	0	0.029	0	0	0	0	0	0.2	0
		0.058	0.176	0	0.059			0	0	0	0.4	0
CNCF	299	2.769	3.8	3	3.059	8	0	1.167	1.667	3.833	1.1	0
		1.058	3.331	6	1.821			1.15	1.106	3.427	0.359	0
CNSN	6	0.056	0.04	0	0.118	0	0	0	0	0.083	0	0
		0.064	0.08	0	0.184			0	0	0.167	0	0
ERSN	497	4.602	4.2	1	5.529	14	7	2.833	0.667	1.417	12.4	0
		2.098	3.635	2	4.193			4.605	0.577	1.403	13.21	0
FHCF	5	0.046	0.08	0	0.029	0	0	0.083	0	0	0.1	0
		0.041	0.111	0	0.059			0.167	0	0	0.2	0
FWDM	152	1.407	2.52	1	0.647	1	2	1.75	3.333	0.75	0.1	0.5
		0.635	1.596	2	0.386			1.743	5.239	0.989	0.2	1
GDEY	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
GDRH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB			OSB	SCCL		SCCS	TRML
			BAR	BAR	BAR	CHNB	ITIP	BAR	BAR	ITIP	BAR	BAR
GNSF	3	0.028	0.12	0	0	0	0	0	0	0	0	0
		0.041	0.176	0	0			0	0	0	0	0
GSBG	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
GSCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
GSOS	2	0.019	0.08	0	0	0	0	0	0	0	0	0
		0.026	0.111	0	0			0	0	0	0	0
GZSD	517	4.787	3.04	20	7.235	0	0	0.917	6.333	5.917	1.6	0
		3.32	4.088	10	9.04			0.999	7.141	11.291	1.583	0
HFCS	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
LGPH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
LKSG	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
LNGR	4	0.037	0	0	0.088	1	0	0	0	0	0	0
		0.037	0	0	0.099			0	0	0	0	0
MMSN	5	0.046	0	0.5	0.029	0	0	0	0	0.25	0	0
		0.041	0	1	0.059			0	0	0.261	0	0
MQTF	12	0.111	0.12	0	0.147	0	0	0	0	0	0.4	0
		0.106	0.176	0	0.209			0	0	0	0.8	0
OSSF	16	0.148	0.2	0	0.029	0	0	0.667	0.111	0.083	0	0
		0.09	0.2	0	0.059			0.569	0.222	0.167	0	0
PDFH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
PDSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
QLBK	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
RDSN	605	5.602	4.56	2	10.412	8	0	0.5	2.778	5.75	2.5	0
		2.739	4.131	0	7.83			0.461	3.396	2.204	2.256	0
RKBS	1	0.009	0	0	0	0	0	0	0	0.083	0	0
		0.019	0	0	0			0	0	0.167	0	0
RVCS	22	0.204	0.24	0	0.206	0	0	0.167	0.444	0.167	0.1	0
		0.094	0.265	0	0.164			0.225	0.351	0.225	0.2	0

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB			OSB	SCCL		SCCS	TRML
			BAR	BAR	BAR	CHNB	ITIP	BAR	BAR	ITIP	BAR	BAR
RVRH	1	0.009	0.04	0	0	0	0	0	0	0	0	0
		0.019	0.08	0	0			0	0	0	0	0
RVSN	23	0.213	0.08	0	0.353	0	0	0	0.111	0.083	0.7	0
		0.258	0.111	0	0.706			0	0.222	0.167	1.4	0
SBWB	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
SFCB*	**7**	**0.065**	**0**	**0**	**0.118**	**0**	**0**	**0**	**0.111**	**0**	**0.2**	**0**
		0.071	**0**	**0**	**0.184**			**0**	**0.222**	**0**	**0.4**	**0**
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
SGER*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
SHRH	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
SJHR	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
SKCB*	**11**	**0.102**	**0**	**0**	**0.176**	**0**	**0**	**0**	**0**	**0**	**0.5**	**0**
		0.12	**0**	**0**	**0.298**			**0**	**0**	**0**	**0.803**	**0**
SMBF	17	0.157	0.2	1.5	0.059	0	0	0	0.222	0.083	0.4	0
		0.095	0.2	3	0.082			0	0.444	0.167	0.442	0
SNGR	46	0.426	0.4	0.5	0.441	1	0	0.333	0.778	0.083	0.6	0.5
		0.154	0.365	1	0.27			0.284	0.93	0.167	0.442	1
SNPD	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
SNSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
SNSN*	**2**	**0.019**	**0.08**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0.026	**0.111**	**0**	**0**			**0**	**0**	**0**	**0**	**0**
STBS	4	0.037	0.08	0	0.029	0	0	0	0.111	0	0	0
		0.037	0.111	0	0.059			0	0.222	0	0	0
STCT	1	0.009	0	0	0.029	0	0	0	0	0	0	0
		0.019	0	0	0.059			0	0	0	0	0
SVCB	1	0.009	0	0	0.029	0	0	0	0	0	0	0
		0.019	0	0	0.059			0	0	0	0	0
SVCP	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0

Species	Total Catch	Overall CPUE	CHXO	CONF	ISB			OSB	SCCL		SCCS	TRML
			BAR	BAR	BAR	CHNB	ITIP	BAR	BAR	ITIP	BAR	BAR
UCF	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
UCN	3	0.028	0	0.5	0	0	0	0	0.111	0.083	0	0
		0.032	0	1	0			0	0.222	0.167	0	0
UCT	131	1.213	0.32	0	1.971	0	12	0.333	2.111	1.417	0.4	0
		0.983	0.36	0	2.944			0.512	2.12	1.336	0.611	0
UCY	62	0.574	0.48	0	0.618	0	0	1	0	0	1.7	0
		0.403	0.579	0	0.547			1.231	0	0	3.4	0
UET	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
UHY	4	0.037	0.04	0	0.029	0	0	0.167	0	0	0	0
		0.045	0.08	0	0.059			0.333	0	0	0	0
UIC	1	0.009	0	0	0.029	0	0	0	0	0	0	0
		0.019	0	0	0.059			0	0	0	0	0
ULP	1069	9.898	14.28	2.5	14.912	0	0	0.083	0	0	19.9	0
		11.217	28.56	5	27.008			0.167	0	0	36.794	0
WLYE	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0			0	0	0	0	0
WTBS	17	0.157	0.24	0.5	0.088	0	0	0.167	0.222	0.25	0	0
		0.084	0.209	1	0.13			0.333	0.294	0.261	0	0
WTCP	382	3.537	3.36	0.5	2.029	0	4	2.167	9.667	1.667	9.1	0
		2.069	3.264	1	1.91			1.685	12.009	1.602	16.499	0

Appendix F7. Push Trawl: overall season and segment summary. Lists CPUE (fish/net night) and 2 standard errors on second line.

			CHXO		CONF	ISB		OSB		SCCL			SCCS		TRML
Species	Total Catch	Overall CPUE	BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB	BAR	CHNB	ITIP	BAR	CHNB	BAR
BHCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
BHMW	126	3.516	3.602	3.333	0	2.856	2.493	6.508	3.214	3.864	0.667	0	0	0	25
		1.451	4.004	6.667		1.88	3.274	7.22	4.72	3.835	1.333				
BKCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
BKSS	4	0.119	0	0	0	0	0.862	0.476	0	0.19	0	0	0	0	0
		0.144	0	0		0	1.724	0.952	0	0.381	0				
BLCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
BLGL	245	6.926	2.399	10.833	15	3.857	5.296	29.444	7.381	9.136	1.333	0	0	0	0
		3.211	2.951	11.667		3.352	6.818	22.997	8.602	7.272	1.333				
BMBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
BNMW	1	0.052	0	0	0	0	0	0	0	0	0	0	3.333	0	0
		0.104	0	0		0	0	0	0	0	0				
BUSK*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**				
CARP	4	0.14	0	0	0	0.115	0	0.794	0	0	0	0	0	0	1.667
		0.165	0	0		0.161	0	1.587	0	0	0				
CNCF	120	2.935	5.037	3.333	0	2.667	3.67	2.778	2.302	3.313	0	0	3.333	0	0
		0.963	3.537	6.667		1.342	3.968	2.97	2.661	3.226	0				
CNSN	20	0.549	2.63	0	0	0.114	0.25	0	0	0.204	0	0	0	1.25	0
		0.7	3.94	0		0.227	0.5	0	0	0.408	0				
ERSN	144	4.092	9.927	1.667	0	5.327	3.448	2	0	0.442	0.667	0	0	1.25	0
		2.578	11.418	3.333		4.327	6.897	3.266	0	0.573	1.333				
FHCF	1	0.022	0	0	0	0	0	0.238	0	0	0	0	0	0	0
		0.045	0	0		0	0	0.476	0	0	0				
FWDM	30	0.892	1.814	0	0	0.596	1.154	0.794	0.5	0.204	0	0	0	1.25	10
		0.559	2.293	0		0.55	2.308	1.118	1	0.408	0				
GDEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
GDRH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
GNSF	2	0.047	0	0	0	0.091	0	0	0	0	0	1	0	0	0
		0.069	0	0		0.182	0	0	0	0	0				
GSBG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
GSCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB		SCCL			SCCS		TRML
			BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB	BAR	CHNB	ITIP	BAR	CHNB	BAR
GSOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
GZSD	59	1.588	0.205	2.5	7.5	0.469	0	4	0	1.871	0	2	0	2.5	35
		1.315	0.276	5		0.486	0	6.532	0	3.29	0				
HFCS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
LGPH	1	0.026	0	0	0	0	0	0	0	0	0	0	0	0	1.667
		0.052	0	0		0	0	0	0	0	0				
LKSG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
LNGR	2	0.045	0	0	0	0.061	0.385	0	0	0	0	0	0	0	0
		0.063	0	0		0.121	0.769	0	0	0	0				
MMSN	1	0.035	0.202	0	0	0	0	0	0	0	0	0	0	0	0
		0.069	0.404	0		0	0	0	0	0	0				
MQTF	3	0.125	0	0	0	0	0	0	0	0.19	0	0	6.667	0	0
		0.212	0	0		0	0	0	0	0.381	0				
OSSF	6	0.154	0	0	0	0	0.385	0	0	0	0	0	0	0	8.333
		0.264	0	0		0	0.769	0	0	0	0				
PDFH	1	0.026	0	0	0	0	0	0	0	0	0	0	0	0	1.667
		0.052	0	0		0	0	0	0	0	0				
PDSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**				
QLBK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
RDSN	34	0.963	2.573	0	0	0.857	0	0.667	0	1.02	0	0	3.333	0	0
		0.695	3.584	0		0.664	0	1.333	0	1.354	0				
RKBS	2	0.06	0	0	0	0.114	0	0	0	0.19	0	0	0	0	0
		0.088	0	0		0.227	0	0	0	0.381	0				
RVCS	4	0.122	0.202	0	0	0	0	0	0	0	0	1	3.333	1.25	0
		0.132	0.404	0		0	0	0	0	0	0				
RVRH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
RVSN	1	0.015	0	0	0	0.045	0	0	0	0	0	0	0	0	0
		0.031	0	0		0.089	0	0	0	0	0				
SBWB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SFCB*	**13**	**0.352**	**1.143**	**0**	**0**	**0.386**	**0**	**0**	**0**	**0.204**	**0**	**0**	**0**	**0**	**0**
		0.383	**1.976**	**0**		**0.501**	**0**	**0**	**0**	**0.408**	**0**				
SGCB*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**				

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB		SCCL			SCCS		TRML
			BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB	BAR	CHNB	ITIP	BAR	CHNB	BAR
SGER*	**1**	**0.026**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.667**
		0.052	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**				
SHRH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SJHR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SKCB*	**13**	**0.37**	**1.818**	**0**	**0**	**0.076**	**0**	**0**	**0.5**	**0**	**0**	**0**	**0**	**0**	**0**
		0.628	**3.636**	**0**		**0.152**	**0**	**0**	**1**	**0**	**0**				
SMBF	4	0.133	0	0	0	0.061	0	0.556	0.5	0	0.606	0	0	0	0
		0.138	0	0		0.121	0	1.111	1	0	1.212				
SNGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SNPD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SNSG*	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		0	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**				
SNSN*	**1**	**0.031**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.667**	**0**	**0**	**0**	**0**
		0.062	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**1.333**				
STBS	8	0.231	0	0	2.5	0.265	0	0.333	0	0.395	0	0	0	0	1.667
		0.159	0	0		0.301	0	0.667	0	0.51	0				
STCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
SVCB	5	0.182	0	0	0	0.303	1.247	0	0	0	0	0	0	0	0
		0.199	0	0		0.472	1.637	0	0	0	0				
SVCP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
UCF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
UCN	6	0.177	0	0	0	0.167	0	1	0	0.238	0	0	0	0	0
		0.208	0	0		0.231	0	2	0	0.476	0				
UCT	37	0.917	0.455	1.667	0	0.635	4.865	0.476	0	0.816	0	0	3.333	5	0
		0.643	0.65	3.333		0.573	9.076	0.952	0	0.85	0				
UCY	186	5.17	1.609	1.25	0	6.364	13.846	1	0.556	0.823	0	8	93.333	0	0
		4.068	2.961	2.5		6.795	27.692	2	1.111	0.827	0				
UET	1	0.016	0	0	0	0	0.25	0	0	0	0	0	0	0	0
		0.031	0	0		0	0.5	0	0	0	0				
UHY	12	0.304	1.223	0	0	0	0	0.667	0.5	0	0	0	0	0	0
		0.327	1.677	0		0	0	1.333	1	0	0				
UIC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				

Species	Total Catch	Overall CPUE	CHXO		CONF	ISB		OSB		SCCL			SCCS		TRML
			BAR	CHNB	BAR	BAR	CHNB	BAR	CHNB	BAR	CHNB	ITIP	BAR	CHNB	BAR
ULP	427	11.553	5.477	1.25	12.5	12.275	18.421	25.54	1	20.408	1.212	0	16.667	0	0
		8.416	7.867	2.5		19.965	16.036	30.201	2	34.21	2.424				
WLYE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0		0	0	0	0	0	0				
WTBS	14	0.36	0.394	0	0	0.385	0	1.032	0.238	0	0.606	0	0	1.25	0
		0.246	0.615	0		0.501	0	1.311	0.476	0	1.212				
WTCP	127	3.647	2.323	3.333	0	5.318	0.893	0	0	5.252	2.667	0	0	2.5	33.333
		2.297	4.221	6.667		5.085	1.786	0	0	7.428	5.333				

Appendix G. Hatchery names, locations, and abbreviations.

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

Appendix H. Alphabetic list of Missouri River fishes with total catch-per-unit-effort by gear type for sturgeon season (fall through spring) and fish community season (summer) during 2007 for segment 14 of the Missouri River. Species codes are located in Appendix A. Asterisks and bold type denote targeted native Missouri River species.

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1-inch Trammel Net	Gill Net	Otter Trawl	1-inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
BHCP	0.000	0.003	0.000	0.000	0.000	0.000	0.000
BHMW	0.000	0.000	0.000	0.000	1.472	0.010	3.516
BKCP	0.000	0.000	0.000	0.000	0.194	0.000	0.000
BKSS	0.000	0.000	0.000	0.000	0.028	0.000	0.119
BLCF	0.133	0.910	0.358	0.572	0.019	1.889	0.000
BLGL	0.000	0.000	0.000	0.000	3.648	0.025	6.926
BMBF	0.000	0.003	0.000	0.000	0.000	0.000	0.000
BNMW	0.000	0.000	0.000	0.000	0.324	0.000	0.052
BUSK*	**0.054**	**0.074**	**0.025**	**0.078**	**0.000**	**0.008**	**0.000**
CARP	0.000	0.054	0.020	0.000	0.056	0.004	0.140
CNCF	0.023	0.122	1.241	0.048	2.769	10.975	2.935
CNSN	0.000	0.000	0.010	0.000	0.056	0.005	0.549
ERSN	0.000	0.000	0.019	0.000	4.602	0.050	4.092
FHCF	0.000	0.013	0.025	0.007	0.046	0.079	0.022
FWDM	0.012	0.170	0.543	0.018	1.398	1.139	0.892
GDEY	0.027	0.138	0.092	0.020	0.000	0.068	0.000
GDRH	0.000	0.003	0.000	0.000	0.000	0.000	0.000
GNSF	0.000	0.000	0.000	0.000	0.028	0.000	0.047

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1-inch Trammel Net	Gill Net	Otter Trawl	1-inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
GSBG	0.000	0.000	0.000	0.000	0.000	0.004	0.000
GSCP	0.000	0.006	0.000	0.000	0.000	0.000	0.000
GSOS	0.000	0.000	0.000	0.000	0.019	0.000	0.000
GZSD	0.035	0.074	0.013	0.004	4.787	0.053	1.588
HFCS	0.000	0.003	0.000	0.000	0.000	0.006	0.000
LGPH	0.000	0.000	0.000	0.000	0.000	0.000	0.026
LKSG	0.000	0.022	0.000	0.012	0.000	0.000	0.000
LNGR	0.000	0.048	0.000	0.016	0.037	0.000	0.045
MMSN	0.000	0.000	0.000	0.000	0.046	0.000	0.035
MQTF	0.000	0.000	0.000	0.000	0.111	0.000	0.125
NFSH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OSSF	0.000	0.000	0.000	0.000	0.148	0.000	0.154
PDFH	0.000	0.013	0.013	0.000	0.000	0.000	0.026
PDSG*	**0.005**	**0.013**	**0.005**	**0.014**	**0.000**	**0.000**	**0.000**
QLBK	0.000	0.000	0.000	0.002	0.000	0.000	0.000
RDSN	0.000	0.000	0.015	0.000	5.602	0.013	0.963
RKBS	0.000	0.000	0.000	0.000	0.009	0.000	0.060
RVCS	0.028	0.160	0.005	0.060	0.204	0.037	0.122
RVRH	0.000	0.000	0.000	0.000	0.009	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1-inch Trammel Net	Gill Net	Otter Trawl	1-inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
RVSN	0.000	0.000	0.000	0.000	0.213	0.000	0.015
SBWB	0.000	0.003	0.000	0.000	0.000	0.000	0.000
SFCB*	**0.000**	**0.000**	**0.041**	**0.000**	**0.065**	**0.253**	**0.352**
SGCB*	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.047**	**0.000**
SGER*	**0.000**	**0.038**	**0.003**	**0.006**	**0.000**	**0.003**	**0.026**
SHRH	0.000	0.048	0.000	0.000	0.000	0.000	0.000
SJHR	0.015	0.000	0.000	0.000	0.000	0.002	0.000
SKCB*	**0.000**	**0.000**	**0.424**	**0.000**	**0.102**	**0.260**	**0.370**
SMBF	0.027	0.099	0.005	0.014	0.157	0.003	0.133
SNGR	0.000	0.077	0.015	0.000	0.426	0.011	0.000
SNPD	0.000	0.006	0.007	0.018	0.000	0.000	0.000
SNSG*	**1.484**	**8.936**	**0.714**	**1.530**	**0.000**	**0.617**	**0.000**
SNSN*	**0.000**	**0.000**	**0.000**	**0.000**	**0.019**	**0.000**	**0.031**
STBS	0.000	0.000	0.000	0.000	0.037	0.000	0.231
STCT	0.000	0.000	0.000	0.000	0.009	0.000	0.000
SVCB	0.000	0.000	0.123	0.000	0.009	0.081	0.182
SVCP	0.004	0.067	0.000	0.006	0.000	0.000	0.000
UCF	0.000	0.000	0.010	0.000	0.000	0.000	0.000
UCN	0.000	0.000	0.000	0.000	0.028	0.000	0.177

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1-inch Trammel Net	Gill Net	Otter Trawl	1-inch Trammel Net	Mini-Fyke Net	Otter Trawl	Push Trawl
UCT	0.000	0.000	0.000	0.000	1.213	0.044	0.917
UCY	0.000	0.000	0.000	0.000	0.574	0.010	5.170
UET	0.000	0.000	0.000	0.000	0.000	0.000	0.016
UHY	0.000	0.000	0.004	0.000	0.037	0.026	0.304
UIC	0.000	0.000	1.147	0.000	0.009	0.172	0.000
ULP	0.000	0.000	0.000	0.000	9.898	0.000	11.553
WLYE	0.000	0.003	0.000	0.000	0.000	0.000	0.000
WTBS	0.000	0.006	0.012	0.000	0.157	0.003	0.360
WTCP	0.000	0.000	0.000	0.000	3.537	0.013	3.647

Appendix I. Comprehensive list of bend numbers and locations for segment 14 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FC) between years from 2003 – 2007.

Bend Number	Bend River Mile	Coordinates* Latitude, Longitude	2003	2004	2005	2006	2007
1	3.4	38.82652, -90.16233			ST		ST, FC
2	6.0	38.82471, -90.20328		FC	ST, FC		
3	9.3	38.85035, -90.25448					
4	10.7	38.86395, -90.27142		FC		ST, FC	ST, FC
5	16.8	38.86586, -90.34263		ST, FC	FC		
6	22.0	38.82413, -90.39901		FC			
7	25.4	38.81764, -90.45146				ST, FC	
8	26.5	38.80486, -90.45970					
9	28.6	38.77746, -90.47747			ST, FC		ST, FC
10	31.8	38.74226, -90.50959					
11	34.1	38.72019, -90.53367				ST, FC	
12	37.5	38.68140, -90.55307		FC		ST, FC	
13	38.9	38.68202, -90.57661		ST			
14	40.7	38.68431, -90.60942		FC			
15	43.8	38.68811, -90.65995	ST	FC		ST, FC	ST, FC
16	45.2	38.67971, -90.68337	FC			ST, FC	
17	48.5	38.65753, -90.73236				ST, FC	ST, FC
18	49.9	38.63889, -90.74041					
19	51.3	38.62224, -90.75353	FC			ST, FC	
20	54.3	38.59151, -90.78583	FC				
21	56.6	38.57961, -90.82291				ST, FC	ST, FC
22	58.7	38.56047, -90.85263					
23	60.4	38.55084, -90.88056					ST, FC
24	64.9	38.54148, -90.95422		ST	FC		
25	66.9	38.55407, -90.98635			FC		
26	69.8	38.57934, -91.02535	ST	FC			ST, FC
27	74.5	38.60679, -91.09009					ST, FC
28	77.0	38.59862, -91.13326	ST				
29	78.0	38.60315, -91.15038				ST	ST, FC
30	79.9	38.60848, -91.18466				ST, FC	

* Coordinates represent the upper most point of the bend (i.e., the upstream limit of the bend).

Appendix I. (continued).

Bend Number	Bend River Mile	Coordinates* Latitude, Longitude	2003	2004	2005	2006	2007
31	80.9	38.61416, -91.20112	FC				ST, FC
32	82.8	38.62760, -91.22818		FC	ST		
33	85.4	38.65892, -91.24437					
34	86.7	38.66978, -91.26369				ST, FC	
35	88.2	38.68436, -91.28296		FC		ST	ST, FC
36	89.8	38.69991, -91.30430		FC		ST	
37	91.6	38.70581, -91.33083					
38	94.1	38.69945, -91.37018			FC		ST, FC
39	95.4	38.70690, -91.39235				ST, FC	
40	96.8	38.70992, -91.41774					ST, FC
41	98.3	38.70878, -91.44421				ST, FC	
42	99.9	38.70234, -91.47362				ST	
43	103.3	38.68430, -91.53120					
44	105.1	38.67689, -91.56085	ST			ST	
45	106.3	38.68138, -91.58015					
46	107.9	38.69098, -91.60778					
47	110.2	38.70366, -91.64327		ST	FC		
48	112.1	38.70411, -91.67865			ST		
49	116.1	38.69553, -91.74554	FC			ST, FC	
50	118.3	38.68232, -91.77994			ST		ST, FC
51	120.8	38.67934, -91.82438	FC		ST, FC		
52	122.3	38.67197, -91.84816					
53	125.0	38.64759, -91.88581	FC				
54	127.0	38.62529, -91.90588	FC				
55	128.5	38.61123, -91.92634	FC			ST, FC	
56	130.2	38.59568, -91.94744				ST	

* Coordinates represent the upper most point of the bend (i.e., the upstream limit of the bend).

Appendix J

Additional Analyses

Appendix J1. Ratios of hybrid sturgeon to pallid and shovelnose sturgeon, standardized by catch-per-unit-effort, for samples collected from 2004 through 2007 in segment 14 of the Missouri River.

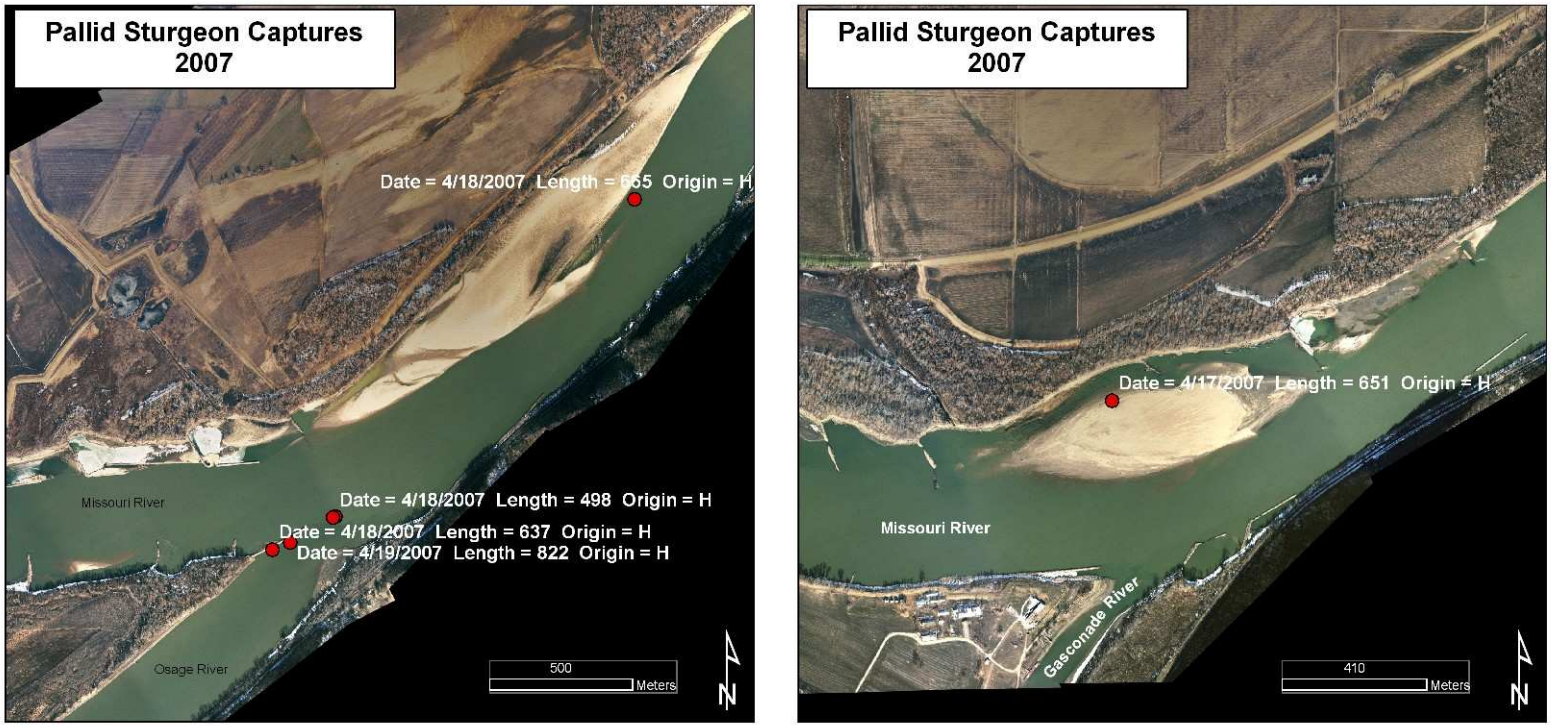
Year	Gill Net			1-inch Trammel Net			Otter Trawl		
	Pallid: Shovelnose	Hybrid: Shovelnose	Pallid: Hybrid	Pallid: Shovelnose	Hybrid: Shovelnose	Pallid: Hybrid	Pallid: Shovelnose	Hybrid: Shovelnose	Pallid: Hybrid
2004	1 : 330	1 : 220	1 : 2	1 : 178	1 : 400	2 : 1	1 : 87	1 : 608	7 : 1
2005	1 : 243	1 : 156	1 : 2	1 : 673	N/A	N/A	1 : 323	1 : 97	1 : 3
2006	1 : 300	1 : 729	2 : 1	1 : 231	1 : 185	1 : 1	N/A	N/A	N/A
2007	1 : 687	1 : 1489	2 : 1	1 : 167	1 : 167	1 : 1	1 : 333	1 : 222	1 : 2

Appendix J2. Species detection comparisons between all gear used in segment 14 of the Missouri River during 2007. Shaded columns denote standard gears and bolded and asterisked species denote target species.

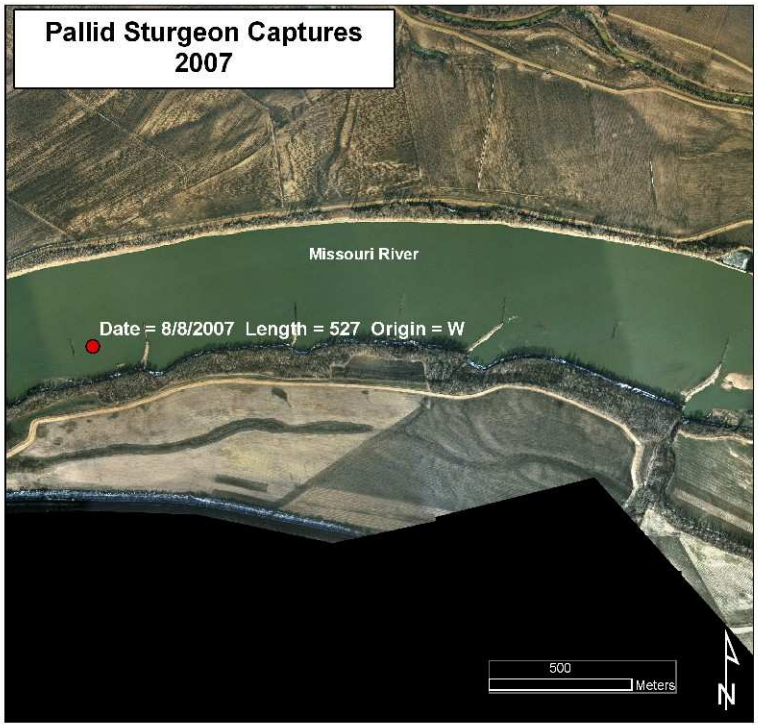
Species	Gill Net	Mini-Fyke Net	Otter Trawl	Push Trawl	1-inch Trammel Net	Broodstock Gill Net	Trot Line	Dead Set 2.5 inch Trammel Net
BHCP	X							
BHMW		X	X	X				
BKCP		X						
BKSS		X		X				
BLCF	X	X	X		X	X	X	X
BLGL		X	X	X				X
BMBF	X							
BNMW		X		X				
BUSK*	**X**		**X**		**X**	**X**		**X**
CARP	X	X	X	X				X
CNCF	X	X	X	X	X	X	X	X
CNSN		X	X	X				
ERSN		X	X	X				
FHCF	X	X	X	X	X		X	X
FWDM	X	X	X	X	X		X	X
GDEY	X		X		X			X
GDRH	X							
GNSF		X		X				
GSBG			X					
GSCP	X							
GSOS		X						
GZSD	X	X	X	X	X			X
HFCS	X		X					
LGPH				X				
LKSG	X				X	X	X	
LNGR	X	X		X	X	X		X
MMSN		X		X				
MQTF		X		X				
OSSF		X		X				
PDFH	X		X	X				
PDSG*	**X**		**X**		**X**	**X**	**X**	
QLBK					X			
RDSN		X	X	X				
RKBS		X		X				

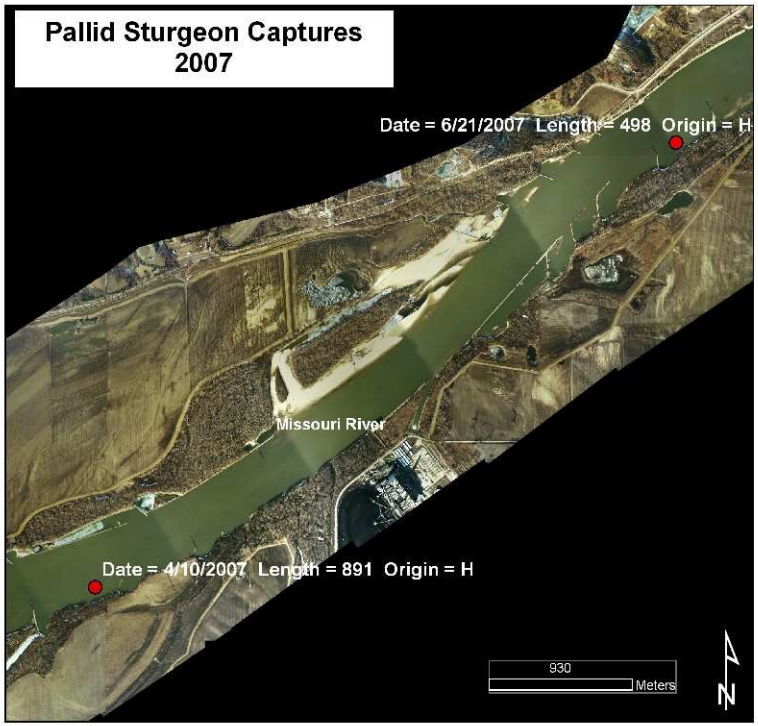
Appendix J2. (cont.)

Species	Gill Net	Mini-Fyke Net	Otter Trawl	Push Trawl	1-inch Trammel Net	Broodstock Gill Net	Trot Line	Dead Set 2.5 inch Trammel Net
RVCS	X	X	X	X	X			X
RVRH		X						
RVSN		X		X				
SBWB	X							
SFCB*		**X**	**X**	**X**				
SGCB*			**X**					
SGER*	**X**		**X**	**X**	**X**			**X**
SHRH	X						X	X
SJHR			X		X			
SKCB*		**X**	**X**	**X**				
SMBF	X	X	X	X	X	X	X	X
SNGR	X	X	X					X
SNPD	X		X		X		X	X
SNSG*	**X**		**X**		**X**	**X**	**X**	**X**
SNSN*		**X**		**X**				
STBS		X		X				X
STCT		X						
SVCB		X	X	X				
SVCP	X				X			X
UCF			X					
UCN		X		X				
UCT		X	X	X				
UCY		X	X	X				
UET				X				
UHY		X	X	X				
UIC		X	X					
ULP		X		X				
WLYE	X							
WTBS	X	X	X	X				X
WTCP		X	X	X				



Appendix J3. Locations of pallid sturgeon captures in segment 14 of the Missouri River during 2007. Each red dot represents an approximate pallid sturgeon capture location (located within the deployment area of the gear). Capture locations are accompanied by date of capture, fork-length at capture, and origin with H = hatchery and W = wild.





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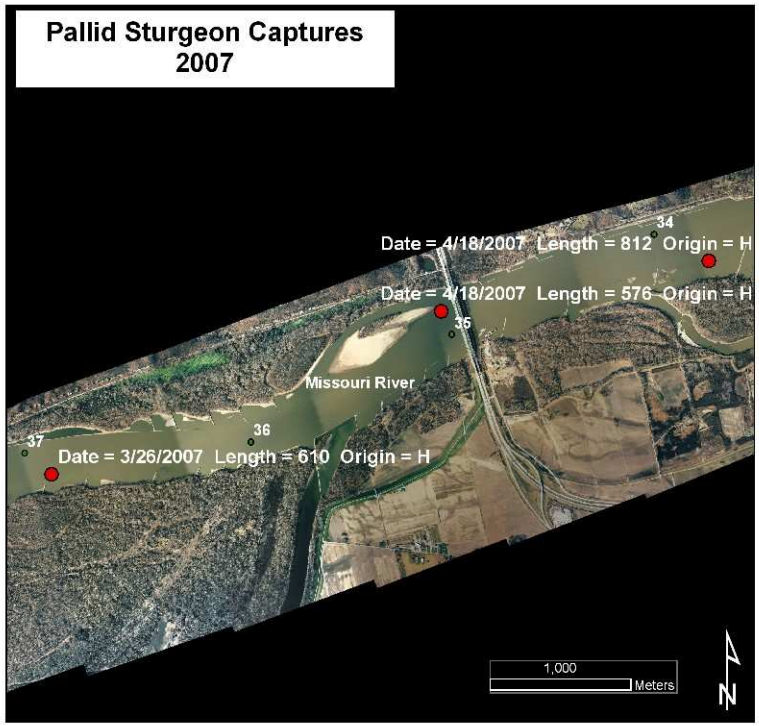

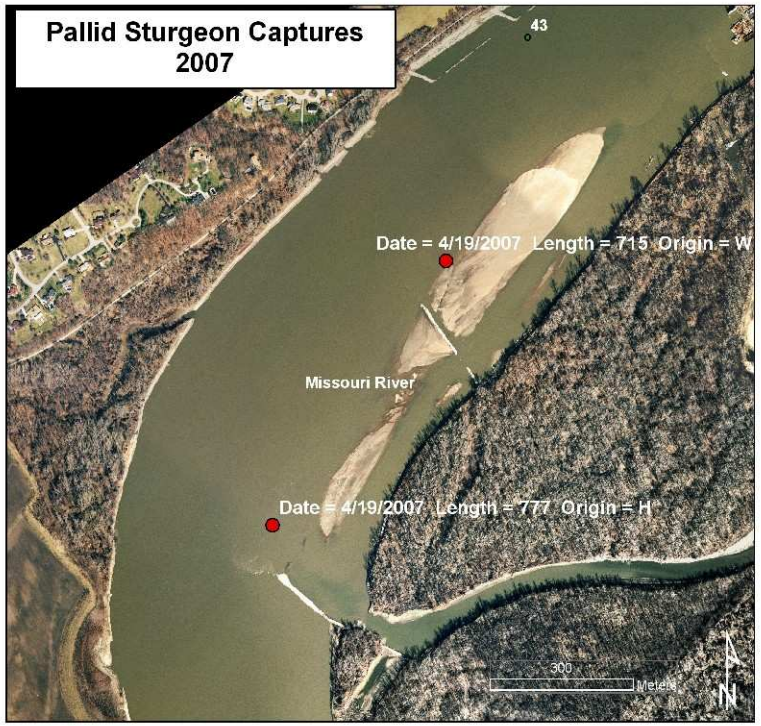

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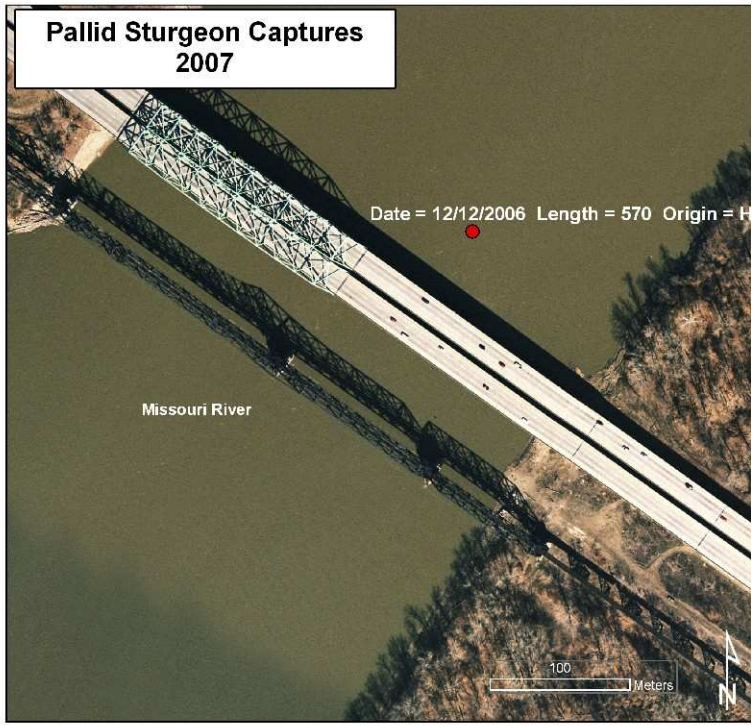

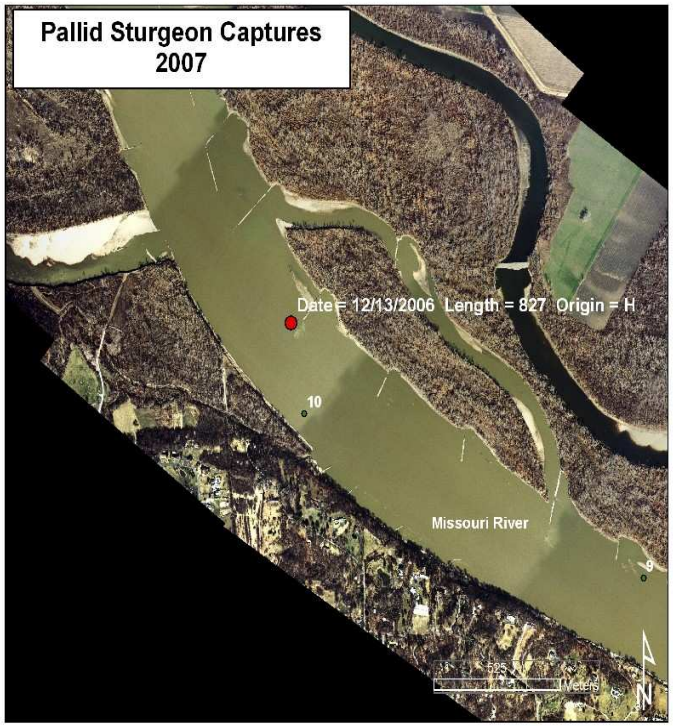

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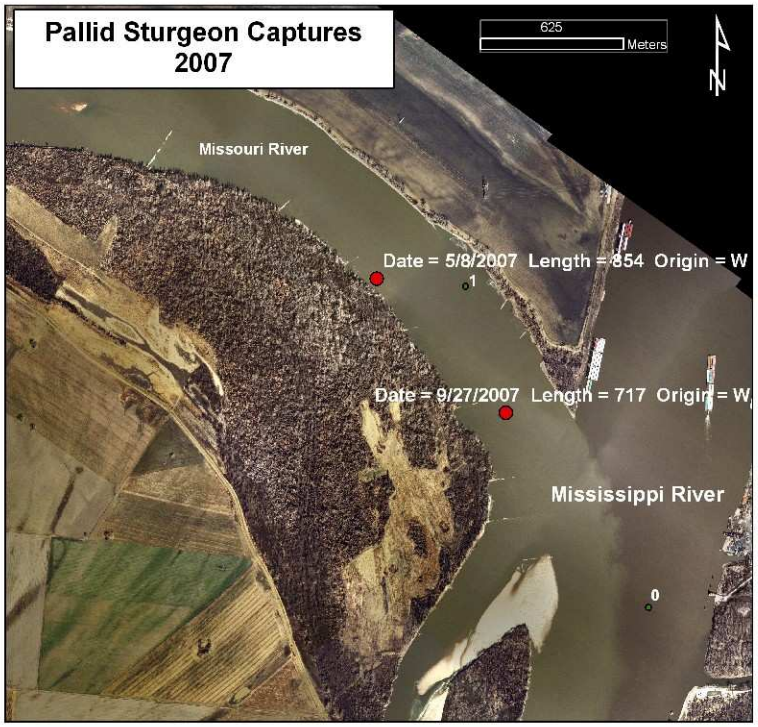

Appendix J3. (Continued)