

2007 Annual Report

Pallid Sturgeon Population Assessment and Associated Fish Community Monitoring for the Missouri River: Segments 5 and 6



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

Pallid sturgeon *Scaphirhynchus albus* and the Missouri River fish community were randomly sampled in the unchannelized Missouri River downstream of Fort Randall Dam to the headwaters of Lewis and Clark Lake (Recovery Priority Management Area 3; [RPMA 3]) with standardized gear and protocols from fall of 2006 to fall of 2007 (i.e., 2007 season). Ten randomly selected bends were sampled with a minimum of 8 gear deployments for each standard gear expended in each bend. The confluence of a major tributary, the Niobrara River, delineates segment 5 (upstream of the confluence) from segment 6 (the confluence to the headwaters of Lewis and Clark Lake); however, both segments were pooled for analysis. A total of 107 pallid sturgeon were captured in 2007; 85% were of known hatchery origin, with 13 fish awaiting genetic confirmation of status. Eleven unmarked pallid sturgeon without PIT tags were of similar size to stocked fish and thus were considered to be of hatchery origin pending genetic verification. However, we cannot exclude the possibility of natural reproduction. Two additional large adult-sized pallid sturgeon (fork length 1,320 and 1,437 mm) did not possess any tags and were wild. Eight fish from the 2006 year class were identified by visible elastomer tags and scute marks and had no PIT tag implanted at stocking. Recaptured pallid sturgeon represented all years classes (1997 - 1999 and 2001 – 2006) stocked into RPMA 3 as part of population supplementation efforts. For standardized gears, 34 pallid sturgeon were captured with gill nets, 37 with trammel nets, and 36 with otter trawls. In 2007, the relative abundance of pallid sturgeon captured in gill nets was 89% higher compared to the overall running average (2003-2006). For drifted trammel nets in 2007, relative abundance increased 367% during fall through spring (i.e. the sturgeon season) and increased 148% during summer (i.e. fish community season) when compared to the

overall running averages (2003-2006). Relative abundance in the otter trawl also increased during the sturgeon season and fish community seasons by 291% and 226%, respectively. Thirty-three percent of pallid sturgeons were caught in the same location where a gear initially captured a pallid sturgeon (i.e., duplicate samples). Relative condition (K_n) of recaptured pallid sturgeons by year class ranged from 0.76 to 1.22, which was similar to previous years with an incremental decline in K_n as fish increased in length. The mean growth rates of age-7 and older fish was < 0.1 mm/d, while growth rates for fish aged 2-6 ranged from 0.2 – 0.3 mm/d. Spatially, pallid sturgeons were captured throughout most of the length of segments 5 and 6 (river mile 869 to 832) but 50% of recaptures were in the delta formed downstream of the Niobrara and Missouri confluence. Most pallid sturgeon were recaptured in the channel border mesohabitat of inside bends (10%), outside bends (10%), large secondary connected channels (11%), channel crossovers (18%) and braided channels (50%). A total of 429 shovelnose sturgeons *S. platyrhynchus* were captured in standard gears during 2007: 324 with gill nets, 76 with trammel nets, and 29 with otter trawls. No young-of-year *Scaphirhynchus* spp. were captured and the ratio of pallid sturgeon to shovelnose sturgeon was 1:4.

In addition to sturgeon, nine native Missouri River species were targeted for assessment: speckled chub *Macrhybopsis aestivalis*, sturgeon chub *M. gelida*, sicklefin chub *M. meeki*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, sand shiner *Notropis stramineus*, blue sucker *Cycleptus elongatus*, and sauger *Sander canadense*. No sturgeon chubs, sicklefin chubs, or speckled chubs were captured in 2007, similar to previous years. A total of eight *Hybognathus* spp. were captured in mini-fyke nets during the fish community season. Six of the eight *Hybognathus* spp. were plains minnows while the

remaining two were western silvery minnows. Sand shiners were only captured with mini-fyke nets (n = 71) during summer. A total of 20 blue suckers were captured with standard gears: 16 in gill nets, one in trammel nets, and three in otter trawls. During 2007, a total of 101 sauger were caught in standard gears: 45 in trammel nets, 15 in otter trawls, and 41 in gill nets. Saugers were captured (n = 54) primarily during April and May. A total of 49 fish species and one hybrid were caught in segments 5 and 6 of the Missouri River during 2007. None of the four exotic Asian carps, bighead carp *Hypophthalmichthys noblis*, silver carp *H. molitrix*, grass carp *Ctenopharyngodon idella*, and black carp *Mylopharyngodon piceus*, were captured.

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Introduction

A team of biologists representing State and Federal resource management agencies was assembled to develop and implement a standardized long-term resource monitoring program for the Missouri River. This team is now known as the Pallid Sturgeon Population Assessment Team (Drobish 2007a). The primary goal of this program is monitoring the status and recovery of endangered pallid sturgeon *Scaphirhynchus albus* (Dryer and Sandoval 1993). However, the monitoring program is also directed towards the native riverine fish community (Appendix A). This team developed standardized protocols for habitat classification (Appendix B), gear types, deployment methods (Appendix C), and data reporting (Drobish 2007b). Four high priority pallid sturgeon Recovery Priority Management Areas (RPMAs), were identified in the recovery plan (Dryer and Sandoval 1993), which encompass nearly 1,775 km (1,100 miles) of the Missouri River system. The Pallid Sturgeon Population Assessment Team selected 14 sampling segments within these RPMAs to implement the monitoring program. Each sampling segment was selected based on a variety of characteristics such as water temperature, turbidity, influence of tributaries, presence of degrading or aggrading stream beds, stream gradient, natural hydrograph, spillway releases and flow fluctuations (Drobish 2007a). Sampling within these segments allows biologists to monitor trends in pallid sturgeon and the native Missouri River fish abundance in relation to flow modification, mitigation efforts, and shallow water habitat restoration projects.

Pallid sturgeon within RPMA 3 of the Missouri River (Figure 1a), have been supplemented through stocking since 2000 (Appendices D - F). From 2000 to May of 2007, a total of 4,842 juvenile pallid sturgeon were released consisting of nine year classes; 1997 -

1999, and 2001 - 2006. Additionally, nine adult fish which were former broodstock or rehabilitated fish translocated from Lake Sharpe, South Dakota have also been stocked (Appendix E). There are four stocking locations in RPMA 3: the most upstream site was Sunshine Bottoms, the middle site was at the Verdel Boat Ramp, and the two downstream sites are the Running Water Boat Ramp and Chief Standing Bear Bridge (Figure 2). This long-term monitoring program serves to assess the success of hatchery propagated fish and guide future stocking efforts.

Because current pallid sturgeon abundance is extremely low, data collection that solely targets pallid sturgeon likely would not provide adequate information to evaluate restoration projects and flow modifications to the Missouri River. An ecologically based long-term population assessment approach was adopted to address this concern and evaluate the entire warm water benthic fish community in the Missouri River as required by the U. S. Fish and Wildlife Service's (USFWS) 2000 Biological Opinion on operations of the main-stem Missouri River dams (USFWS 2000). Additionally, evaluating responses of other native, short-lived Missouri River fishes to changes in habitat or flow modifications may be a more sensitive indicator of habitat change in the near term compared with the rare, long-lived pallid sturgeon. Information derived from this project will be vital for developing sound management recommendations for recovering the native Missouri River fish fauna. Because the pallid sturgeon is a known piscivore (Carlson et al. 1985; Gerrity et al. 2006; Wanner et al. 2007a), assessment of the native benthic Missouri River fish assemblage, which likely serves as pallid sturgeon prey, is also a critical component of the monitoring program. A representative group of nine native Missouri River fishes was selected as indicator species for detecting improvement in the warm water benthic fish community. The species selected

were: shovelnose sturgeon *S. platyrhynchus*, western silvery minnow *Hybognathus argyritis*, plains minnow *H. placitus*, speckled chub *Macrhybopsis aestivalis*, sturgeon chub *M. gelida*, sicklefin chub *M. meeki*, sand shiner *Notropis stramineus*, blue sucker *Cycleptus elongatus*, and sauger *Sander canadense*. Counts and lengths of all fish collected during population assessment activities are recorded; however, detailed data (weight and age structures such as scales, otoliths, or pectoral fin rays) are only collected from pallid sturgeon and the representative group of nine native Missouri River species. However, no pectoral fin ray clips were taken on shovelnose sturgeon or blue suckers in RPMA 3 due to biologist's concerns regarding the risk of post-clip mortality as well as limited evidence of recruitment for these species in this reach.

Goals

Although the Pallid Sturgeon Population Assessment Program itself will not aid in direct recovery of pallid sturgeon, information derived from this program will be used to evaluate the progress of current and proposed management actions. Restoration of pallid sturgeon in the Missouri River can be divided into three broad categories: population supplementation with hatchery-reared pallid sturgeon, habitat restoration, and changes in current operations of the main-stem dams (i.e., natural hydrograph or “spring rise”). These three actions are all directed towards the ultimate goal of recovery of pallid sturgeon and require monitoring to ascertain success within an adaptive management framework. Therefore, the specific overall goals of this population assessment program for the Missouri River are:

1. Provide needed information to detect change in pallid sturgeon and nine native targeted species populations and
2. Determine habitat preferences over time for pallid sturgeon and nine selected native species.

Objectives

Six objectives have been identified for the monitoring program. Detailed hypotheses for each objective can be found in Drobish (2007a).

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 nine native targeted species population abundance and geographic distribution throughout the Missouri River system.
5. Document annual results and long-term trends of habitat usage of nine native targeted 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.

Success Criteria

Evaluation of success will be tied directly to the results of the Pallid Sturgeon Population Assessment Program and the resulting information that these assessments provide. The following four statements may be used to determine program success:

1. The program has the ability to detect population changes.
2. The program has the ability to measure survival of hatchery-reared and stocked pallid sturgeon in the river.
3. The program has the ability to detect reproduction of pallid sturgeon in the Missouri River.
4. The program has the ability to detect recruitment of wild pallid sturgeon in the Missouri River.

Study Area

Lewis and Clark Lake, the most downstream reservoir of the Missouri River, was formed by the closure of Gavins Point Dam and is bound upstream by Fort Randall Dam (Figure 1a). Both dams are operated by the U. S. Army Corps of Engineers (USACE). The primary function of Gavins Point Dam is to level out release fluctuations from upstream dams to serve downstream purposes such as navigation, flood control, and municipal water supply. The riverine section of Lewis and Clark Lake extends approximately 89 river kilometers (rkm) from Fort Randall Dam to Springfield, South Dakota (Figures 1a). Maximum depth of the riverine section of Lewis and Clark Lake is about 12 m and channel width ranges from 45 - 90 m. Downstream of Springfield, South Dakota, Lewis and Clark Lake becomes more like a reservoir. However, sediment from the Niobrara River has formed a large braided delta, which starts near rkm 1,351. This delta is progressively expanding downriver into the reservoir. The riverine section of Lewis and Clark Lake was selected in the Pallid Sturgeon Recovery Plan (Dryer and Sandoval 1993) as 1 of 4 RPMAs in the Missouri River for potential recovery of the species and was designated as RPMA 3.

The riverine section of Lewis and Clark Lake retains many natural characteristics such as sandbars, sandbar pools, side channels, backwater areas, islands, old growth riparian forest and year round flows. However the historical temperature and flow (i.e., the hydrograph) in the riverine section has been altered due to operation of Fort Randall Dam. Water levels substantially fluctuate daily and seasonally. Diel water levels are subject to changes of almost 1 m. Lowest daily flows generally occur at 0600 hours with peak flows occurring between 1200 to 1900 hours in support of power generation demands (USACE 1994). The USACE Missouri River Main Stem Reservoirs 2000 - 2001 Annual Operating

Plan (<http://www.nwd-mr.usace.army.mil/rcc/reports/aop.html>) reported highest seasonal releases from Fort Randall Dam during August through November to support navigation on the Missouri River downstream of Sioux City, Iowa. Lowest releases were during December through April to prevent flooding due to ice jams.

Based on the presence of a major tributary, the Niobrara River, the riverine section of Lewis and Clark Lake (RPMA 3) was divided into two sampling segments by the Population Assessment Team. Segment 5 (rkm 1416 - 1358, river mile [rm] 880 – 844) encompassed the riverine section downstream Fort Randall Dam to the confluence. In this segment, water temperatures are depressed by hypolimnetic discharges from Fort Randall Dam and turbidity is low. Segment 6 (rkm 1358 - 1331, rm 844 – 827) encompassed the riverine section downstream of the confluence of the Missouri and Niobrara rivers to the headwaters of Lewis and Clark Lake (Figure 1a). This segment has increased water temperatures and turbidity due to inflows from the Niobrara River and includes the large braided delta formed in the headwaters of Lewis and Clark Lake.

Methods

Our sampling protocol followed the detailed guidelines identified in the “Pallid Sturgeon Population Assessment Project and the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” developed by the Pallid Sturgeon Population Assessment Team (Drobish 2007b). A general summary of those guidelines follows.

Habitat Classification

The basic habitat classification system used in the Benthic Fishes Study (Berry and Young 2001) was adopted by this program (Appendix B). The Benthic Fishes Study was conducted in the late 1990’s by the U. S. Geological Survey Cooperative Fish and Wildlife Research Units located at universities throughout the Missouri River Basin. This basic habitat classification system was further modified to address both broad and specific habitats using a hierarchical classification system (e.g., macrohabitat, mesohabitat, and microhabitat) to aid in consistent and comparable data collection across all segments of the Missouri River. Three continuous macrohabitats are present in every bend: outside bends, inside bends, and channel crossovers. An additional 10 discrete macrohabitats have been identified that may not be present in each bend: large tributary mouths, small tributary mouths, confluence areas, large and small secondary connected channels, non-connected secondary channels, deranged channels, braided channels, dendritic channels, and dam tailwaters. Mesohabitats and microhabitats have been defined to further describe macrohabitats. This approach provides continuity with previous studies (e.g., Benthic Fish Study) while providing a more detailed

and flexible habitat classification system for future work. All habitats were classified based on the conditions at the time of sampling.

The bend served as the basic hydrologic unit sampled within each river segment. A bend was comprised of three continuous macrohabitats: an outside bend (main channel), an inside bend (main channel) and a channel crossover (main channel). Bends were determined by the hydrologic nature of the river and extended from the upstream crossover to just upstream of the next downstream crossover and encompassed any islands and secondary channels (i.e., discrete habitats) between these two crossovers. Typically, the river channel parallels the adjacent geographic landforms in the channelized river. However, in the unchannelized portions of the Missouri River, bends do not necessarily follow the general form of the landscape; multiple meanders occur within what appears as one large bend based on the shape of the entire river channel. Also, in unchannelized sections, the location of bends and the number of bends within a segment may change over time. The habitat classification scheme allows for bend comparisons between the channelized and unchannelized river despite changes in scale.

Sampling effort

All bends within each segment were sequentially numbered, from upstream to downstream, and then ten bends (five per segment) were randomly selected for sampling (Appendix I). In past years (2003 and 2004) eight bends were randomly selected and two bends, one upstream and one downstream of the confluence of the Niobrara and Missouri rivers, were non-randomly selected. Following the 2004 sample season, no non-random bends were sampled (i.e., all five bends in each segment were randomly selected).

Additional randomly selected bends to increase sample size were sampled as time allowed. Each mesohabitat within a macrohabitat was sampled using standard gears (Appendices B and C). A minimum of two sub-samples were required for each standard gear type for each habitat within that bend where a particular gear can effectively be deployed. Habitat data (velocity, substrate, turbidity) were collected at each pallid sturgeon capture site and in each bend for one of the two sub-samples from each mesohabitat sampled. Depth and temperature were collected at all sampling locations. Detailed habitat data collection methods are found in Drobish (2007b).

A minimum number of gear deployments for each standard gear was used, (10 for gill nets and eight for all other gears in each bend) to ensure sufficient sample size for comparisons between segments (Tables 1 and 2). The standard gears were selected to sample specific habitats, fish species, and seasons. Some gears were selected to maximize capture of pallid sturgeon, while others targeted the fish community. However, all gears sampled multiple species despite targeting pallid sturgeon. All species captured were enumerated and measured to total length (mm) except for sturgeons and paddlefish were measured to fork length (FL) while paddlefish were measured eye to FL. Wet weight (0.1 g) was only measured for pallid sturgeon and the nine targeted native Missouri River fishes.

The sampling year was divided into two seasons: sturgeon season and fish community season. The sturgeon season encompassed the fall through spring while the fish community season occurred during summer. The sturgeon season focused on the assessment of sturgeon species while collections in the fish community season continued to assess sturgeon but placed additional emphasis and effort towards description of the native fish community. Sampling during the fish community season targeted young-of-the-year (YOY) fishes to

provide evidence of recruitment. Delineation between the sturgeon and fish community seasons is primarily based on water temperature. Based on the pallid sturgeon collection and handling protocols (USFWS 2005) pallid sturgeon can only be collected with gill nets at water temperatures $< 12.5\text{ }^{\circ}\text{C}$ ($< 55\text{ }^{\circ}\text{F}$). Due to the diversity of habitats and longitudinal changes in climate along the Missouri River, a wide time frame was necessary to facilitate comparable sampling effort among the 14 segments. For example, gill netting downstream of Fork Peck Dam in Montana and North Dakota (segments 1 – 4) is typically not feasible throughout winter because of ice. However, lack of ice in the lower reaches of the Missouri River permit gill netting during most of the winter. Additional gears were deployed during the fish community season to assess the main channel and shallow water habitats ($< 1.2\text{ m}$) and their associated fish communities. The fish community season ran between July 1 and October 30 and the intensive sturgeon sampling occurred when possible for the remainder of the year. Data in this report covers the time period from November 1, 2006 through October 30, 2007 and herein is referred to as the 2007 sampling season. Focused studies have been previously initiated in conjunction with the population assessments program to fulfill unique biological information gaps (e.g., food habits, sturgeon hormone studies, shovelnose sturgeon population estimates, gear evaluations, telemetry, and geographic information system (GIS) projects).

Sampling Gear

Multiple standard gears were deployed to sample deep and shallow habitats of the Missouri River (Appendix C). Gill nets, trammel nets, and otter trawls were fished in deep waters of the main channel, large secondary connected channels, and large tributaries during

the sturgeon season. In the fish community season, trammel nets and otter trawls were again used with the addition of mini-fyke nets to sample shallow water habitats (i.e. bars). Multi-filament gill nets (1.8 m deep x 38 m length) consisted of five 8-m long panels with bar mesh sizes of 2.5 cm, 3.8 cm, 5.1 cm, 7.6 cm, and 10.2 cm. A standard gill net consisted of four panels (3.8 – 10.2 cm): smallest mesh (1 inch: 2.5 cm) was coded wild and not included in abundance calculations. Trammel nets were 1.8 m deep X 38 m with outside wall panels of 15.2 cm bar mesh and an inside wall panel of 2.5 cm bar mesh. All gill and trammel nets were dyed green during 2003 -2006 to reduce net avoidance in segments 5 and 6 due to extremely low turbidity levels (< 10 nephelometric turbidity units [ntu]). The otter trawl (0.5 m deep x 9.1 m wide) had an outer chafing mesh of 64 mm bar mesh, inner bar mesh of 32 mm constructed of Sapphire® and a 2-m long cod end. Mini-fyke nets consisted of a lead set at the bankline (4.5 m long x 0.6 m high) with two 1.2 m wide x 0.6 m high rectangular steel frames (cab) and two 0.6 m diameter circular hoops with 3 mm “ACE” type nylon mesh. Gill nets and mini-fyke nets were set overnight for a maximum of 18 h and catch per unit effort (CPUE) was calculated as the number of fish per net night. Trammel nets were drifted and otter trawls were pulled downstream on the river bottom for a minimum distance of 75 m and a maximum distance of 300 m. A global positioning system (GPS) was used to quantify distance sampled for trammel nets and otter trawls with CPUE measured as numbers of fish per 100 m of distance deployed. All gear deployments followed the detailed standard operating procedures (SOP) outlined in Drobish (2007b).

In addition to the required standard gears, multiple gear evaluations were conducted during 2007. In segments 5 and 6 an evaluation of green vs. white net twine in trammel and gill nets was conducted (Wanner et al. in review). Also, a comparison of a new push trawl

was conducted to evaluate the effectiveness of this gear to catch under represented fish species in the transitional areas where mini-fyke nets and otter trawls might not effectively sample (depths of 0.8 – 1.2 m). The push trawl (1.8 m deep x 2.4 m wide x 0.6 m high) had an outer mesh of 4 mm. All target species captured with non-standard gears were used in calculating percents of the catch by habitat (macro- and meso- levels), length frequency histograms, and relative stock density (RSD) indices when applicable.

Calculations

The fundamental sampling unit (i.e., replicate) for the population assessment program was the bend. Therefore, our effective sample size was the number of bends sampled with each gear deployed in each season collectively for segments 5 and 6 (Tables 1 and 2). Data were pooled for segments 5 and 6 because of the short length (in river miles) and low number of bends sampled in each segment ($n = 5$). Mean CPUE was separately calculated for each species caught in each gear during each sampling season. First, the average CPUE for all sub-samples within a bend was calculated and then these “bend means” were averaged to calculate the overall mean CPUE. The overall CPUE was also calculated for each habitat effectively sampled by a particular gear in each season (Appendix H). Variability of CPUE was presented as two standard errors (2 SE) which approximates a 95% confidence interval around the mean.

Indices of fish condition (health) were calculated for pallid sturgeon and two native target Missouri River species: shovelnose sturgeon (Quist et al. 1998) and sauger (Guy et al. 1990). Relative condition factor (K_n) was calculated to assess the condition of pallid sturgeon and used the weight-length relation in Keenlyne and Evanson (1993). Relative

weight (W_r) calculations require a length-specific standard weight derived from an overall standard weight-length relation encompassing multiple populations across a species' range. Standard weight relations have been derived for shovelnose sturgeon (Quist et al. 1998) and sauger (Guy et al. 1990). Detailed equations for calculating K_n , and W_r are found in (Anderson and Newman 1996).

Incremental relative stock density (RSD) was calculated to describe the population size-structure of pallid sturgeon and shovelnose sturgeon using methods proposed by Gablehouse (1984). Length categories proposed by Shuman et al. (2006) for pallid sturgeon, Quist et al. (1998) for shovelnose sturgeon, and Gablehouse (1984) for sauger were used to determine relative stock densities (RSD). For pallid sturgeon these fork length categories are stock-quality (330 – 629 mm), quality-preferred (630 - 839 mm), preferred-memorable (840 - 1039 mm), memorable-trophy (1040 - 1269 mm), and trophy (≥ 1270 mm). Sturgeon were calculated as percents of < stock, stock, and > stock sized fish captured in each macrohabitat and mesohabitat type. Sub-stock size category was further divided into fish < 250 mm FL for pallid sturgeon and into fish < 150 mm FL for shovelnose sturgeon, to provide greater resolution of recruitment by YOY sturgeon.

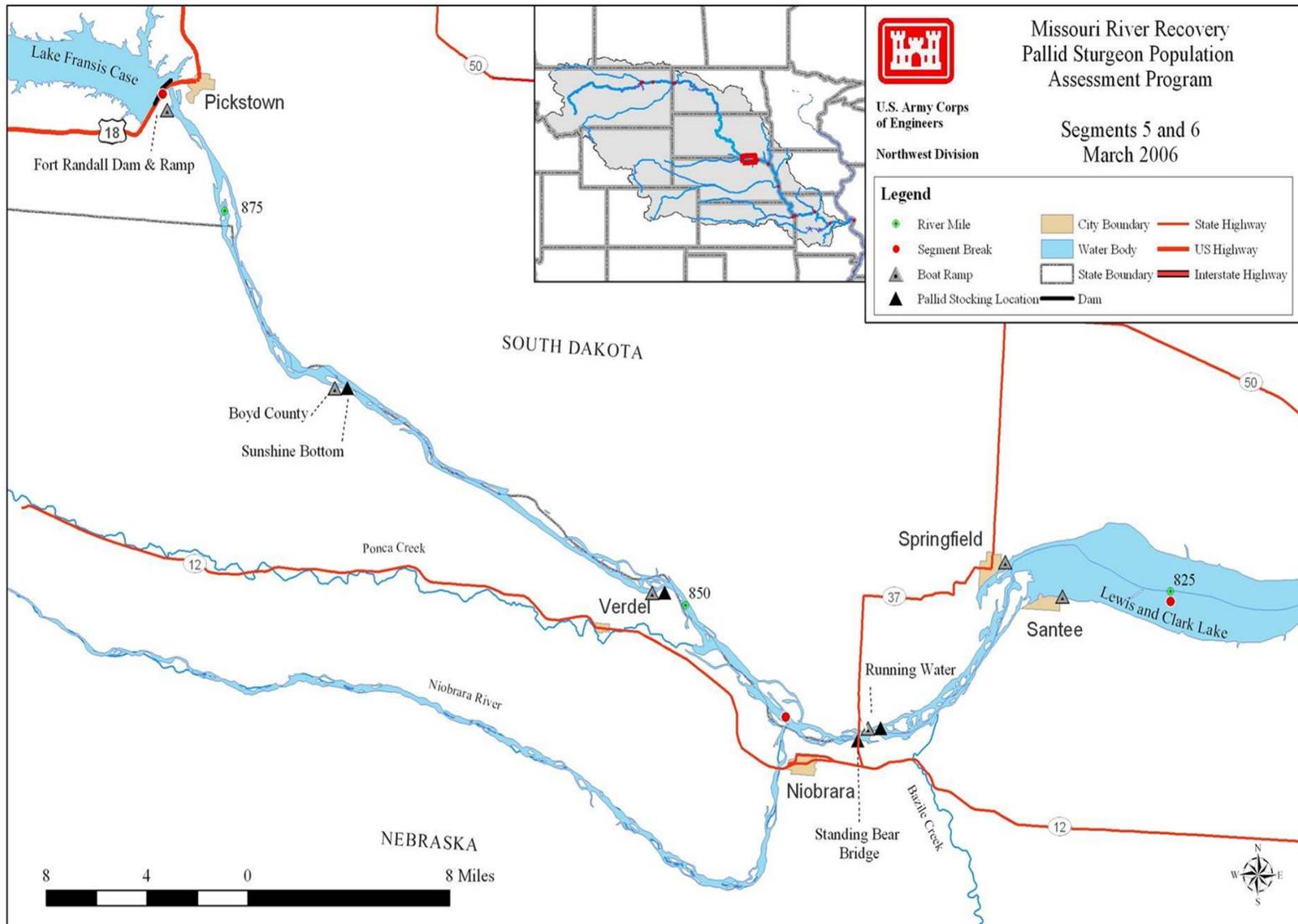


Figure 1a. Map of segments 5 and 6 of the Missouri River with major tributaries, common landmarks, and historic stocking locations for pallid sturgeon. Segments 5 and 6 encompasses the Missouri River from Fort Randall Dam to the headwaters of Lewis and Clark Lake.

Results

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.

Pallid Sturgeon

A total of 107 pallid sturgeon were captured during the 2007 season with 72 fish caught in standard sets: gill nets (n = 34), drifted trammel nets (n = 25), and 16-ft otter trawl (n = 13). Duplicate sampling for active gears caught 35 additional fish: trammel nets (n = 12) and 16-ft otter trawls (n = 23). Pallid sturgeon were captured in the braided channel border habitat in the depths ranging from 1.2 – 4.4 m, bottom velocities ranging from 0.04 - 0.87 m/s, and turbidity ranging from 3 – 128 ntu (Table 3). Nearly 50% of the pallid sturgeon captured in the braided, channel border habitat of segment 6 were at a mean depth of 2.4 m, mean bottom velocity of 0.39 m/s, and mean turbidity of 52 ntu. The habitat pallid sturgeon were second most commonly collected (n = 19) was in the channel crossover, channel border habitat, the mean depth was 2 m, mean bottom velocity was 0.17 m/s, and mean turbidity of 5 ntu at the locations of pallid sturgeon captures.

The stocking of over 3,500 age-1 juvenile pallid sturgeon into segments 5 and 6 since 2000, was reflected in the increased CPUE (Fig. 2, 3, and 5) for gill nets, trammel nets, and otter trawls during 2007. Passive integrated transponder (PIT) tag retention was 85%. In 2007, the 2006 year class was smallest size class (FL = 189 mm) stocked into RPMA 3 and eight fish were recaptured. All pallid sturgeon captured were the size of previously stocked

fish and thus considered to be of hatchery origin, pending genetic verification, (Tables 6 -7) with the exception of two large adult fish. However, we cannot exclude the possibility of natural recruitment. The two adults were either translocated from Lake Sharpe, South Dakota, or remnant fish entrapped by the dams (i.e., they are old and their hatching may preclude dam closure). All fish continued to increase in weight and length since stocking (Table 6). Mean weight gain was > 0.2 g/d for all year classes except the 1998 year class. After age-6, increases in FL declined to < 0.1 mm/d. The mean relative condition factor ranged from 0.76 to 1.22 for all year classes and declined since stocking with the exception of the 1998 year class (Table 6).

Pallid sturgeon were captured throughout segments 5 and 6 with > 10 fish captured at four locations (Figure 1b). At 12 separate sampling locations five or more duplicate samples were deployed and on one occasion the maximum number of duplicates deployed ($n = 9$) was achieved providing evidence that pallid sturgeon clustered. Four duplicates were in segment 5 and occurred in channel crossover and inside bend macrohabitats while 31 in segment 6 within braided and secondary channel connected large macrohabitats. Overall, macrohabitats where pallid sturgeon were captured included outside bends, inside bends, channel crossovers, confluence, large secondary connected channels, and braided channels with all fish captured in channel borders mesohabitat (Tables 11-16).

During 2007 mean annual CPUE for pallid sturgeon increased in gill nets, trammel nets, and otter trawls during both seasons. During the fish community season (summer), annual trends in pallid sturgeon CPUE in trammel nets and otter trawls were also similar. The mean CPUE of pallid sturgeon with gill nets increased 89% in 2007 compared to the average from 2003 to 2006. Mean CPUE for trammel nets in 2007 increased 367% during

the sturgeon season (fall through spring) and 148% in the fish community season compared to the 2003 to 2006 running average. Relative abundance in the otter trawl also increased during the sturgeon season and fish community seasons by 291% and 226%, respectively. As expected, the variability in mean CPUE for all gears was high due to the high incidence of zero catches. The majority of pallid sturgeon were captured during the sturgeon season (n = 74); 33 fish were captured during the fish community season. No pallid sturgeons were captured with mini-fyke nets or the push trawl.

Fork lengths of pallid sturgeon ranged from 301 – 1,437 mm in segments 5 and 6 during 2007 (Figure 8). Most pallid sturgeon were of stock length (n = 88) with only five fish < stock size and 14 fish > stock size (Table 7). During the fish community season the proportion of fish within the quality length category was nearly double that of the sturgeon season (Table 7). No hybrid *Scaphirhynchus* (pallid x shovelnose sturgeon) were captured and the ratio of pallid to shovelnose sturgeon was 1:4.

Table 1. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by macrohabitat (total number of deployments) for segments 5 and 6 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	Number of Bends	Mean Effort	Macrohabitat ^a													
			BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Fall through Spring - Sturgeon Season																
1 Inch Trammel Net	10	9.6	43	15	0	N-E	N-E	14	20	4	N-E	N-E	N-E	0	0	N-E
Gill Net	12	22.1	121	39	3	N-E	N-E	44	51	7	N-E	N-E	N-E	0	0	N-E
Otter Trawl	10	9.8	41	21	0	N-E	N-E	18	15	3	N-E	N-E	N-E	0	0	N-E
Summer – Fish Community Season																
1 Inch Trammel Net	10	11.2	42	11	1	N-E	N-E	26	19	13	N-E	N-E	N-E	0	0	N-E
Mini-Fyke Net	10	8	32	6	0	N-E	N-E	15	20	3	N-E	N-E	N-E	3	1	N-E
Otter Trawl	10	9.2	39	11	4	N-E	N-E	16	17	5	N-E	N-E	N-E	0	0	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

Table 2. Number of bends sampled, mean effort per bend (mean number of deployments), and total effort by mesohabitat (total number of deployments) for segments 5 and 6 on the Missouri River during fall through spring (sturgeon season) and summer (fish community season) in 2006 – 2007. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	Number of bends	Mean Effort	Mesohabitat ^a					
			BAR	CHNB	DTWT	ITIP	POOL	TLWG
Fall through Spring – Sturgeon Season								
1 Inch Trammel Net	10	9.6	0	96	N-E	N-E	N-E	N-E
Gill Net	12	22.1	0	265	N-E	N-E	N-E	N-E
Otter Trawl	10	9.8	0	98	N-E	N-E	N-E	N-E
Summer – Fish Community Season								
1 Inch Trammel Net	10	11.2	0	112	N-E	N-E	N-E	N-E
Mini-Fyke Net	10	8.0	80	0	N-E	N-E	N-E	N-E
Otter Trawl	10	9.2	0	92	N-E	N-E	N-E	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

Segments 5 and 6 - Pallid Sturgeon Captures by River Mile

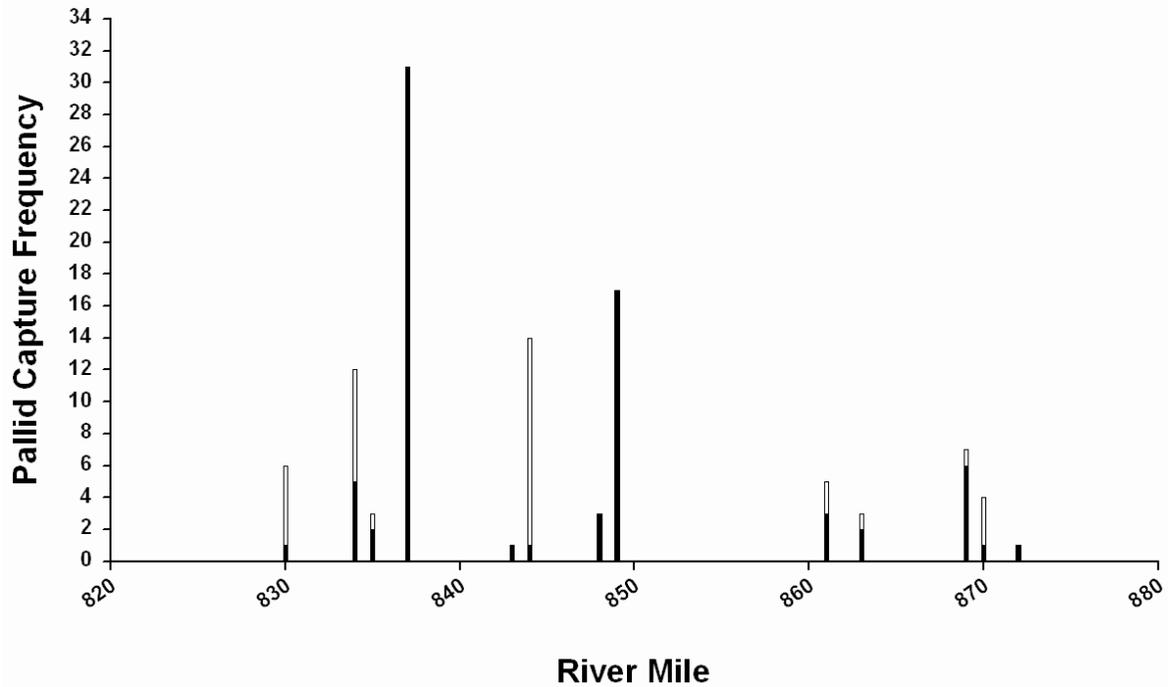


Figure 1b. Distribution of pallid sturgeon captures by river mile for segments 5 and 6 of the Missouri River during 2006 - 2007. Black bars represent pallid captures during sturgeon season and white bars during fish community Season. Figure includes all pallid captures including non-random and wild samples.

Table 3. Pallid sturgeon capture summaries for all gears relative to habitat type and environmental variables on the Missouri River during 2006-2007. Means (minimum and maximum) are presented. Habitat definitions and codes presented in Appendix B.

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		Total fish caught
Macro-	Meso-	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch	
BRAD	BAR	0.7 (0.3-1.4)		0.12 (0.01-0.64)		25.7 (23.4-27.3)		23 (12-46)		
	CHNB	2.4 (1.0-5.5)	2.4 (1.3-4.4)	0.39 (0.01-0.88)	0.39 (0.12-0.77)	13.8 (1.7-26.6)	16.5 (2.1-26.5)	49 (9-122)	52 (11-113)	53
CHXO	BAR	0.7 (0.3-1.1)		0.06 (0.00-0.22)		25.2 (23.3-28.1)		7 (4-15)		.
	CHNB	2.6 (0.4-6.0)	2 (1.1-3.2)	0.29 (0.03-0.77)	0.17 (0.04-0.37)	13.8 (3.5-28.0)	14.2 (12.6-15.8)	7 (3-22)	5 (4-6)	19
CONF	BAR	0.5 (0.4-0.7)		0.12 (0.12-0.12)		28.6 (27.1-31.6)		36 (36-36)		.
	CHNB	2.1 (1.2-4.5)	1.2 (1.2-1.2)	0.51 (0.28-0.64)	0.28 (0.28-0.28)	11.6 (5.0-15.7)	15.7 (15.7-15.7)	53 (12-128)	128 (128-128)	1
ISB	BAR	0.6 (0.3-1.1)		0.07 (0.00-0.15)		23.8 (21.2-28.0)		6 (4-13)		.
	CHNB	2.8 (0.9-9.0)	2.7 (1.3-4.0)	0.33 (0.02-0.71)	0.33 (0.02-0.56)	14.7 (3.8-25.2)	15.7 (6.4-24.6)	9 (3-45)	9 (3-32)	11
OSB	BAR	0.7 (0.3-1.2)		0.06 (0.00-0.17)		24.0 (21.4-26.1)		10 (4-37)		.
	CHNB	4.2 (1.5-12.5)	4.8 (2.3-9.9)	0.41 (0.00-0.88)	0.45 (0.24-0.87)	14.0 (3.8-25.2)	13.3 (6.4-24.8)	11 (3-36)	14 (4-36)	11
SCCL	BAR	0.7 (0.4-1.0)		0.14 (0.14-0.14)		24.6 (23.7-25.9)		11 (10-12)		.
	CHNB	2.7 (1.3-4.8)	4.2 (2.3-4.3)	0.35 (0.10-0.69)	0.31 (0.23-0.39)	13.9 (5.9-17.9)	14.1 (6.7-15.5)	13 (4-24)	8 (4-13)	12

Table 3. (continued).

Habitat		Depth		Bottom Velocity (m/s)		Temperature		Turbidity (ntu)		
Macro-	Meso-	Effort	Catch	Effort	Catch	Macro-	Meso-	Effort	Catch	Effort
TRML	BAR	0.5 (0.5-0.6)		0.16 (0.16-0.16)		26.4 (25.7-27.8)		34 (34-34)		.
TRMS	BAR	1.1 (0.6-1.6)				24.4 (23.9-24.8)				.

Table 6. Mean fork length, weight, relative condition factor (K_n) and growth rates for hatchery-reared pallid sturgeon captures by year class at the time of stocking and recapture during 2007 from segments 5 and 6 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 presented in parentheses.

Year class	N	Stock			Recapture			Growth	
		Length (mm)	Weight (g)	K_n	Length (mm)	Weight (g)	K_n	Length (mm/d)	Weight (g/d)
1997	8	543	667	1.05	757	1,500.6	0.76	0.079	0.336
		(38)	(130)	(0.09)	(55)	(346.8)	(0.05)	(0.022)	(0.133)
1998	2	472	335	0.80	554	765.0	1.22	0.033	0.173
		(90)	(246)	(0.10)	(87)	(200.0)	(0.92)	(0.000)	(0.174)
1999	1	453	.	.	593	725.0	0.85	0.084	.
	
2001	5	224	.	.	541	521.0	0.82	0.170	.
		(14)	.	.	(32)	(97.4)	(0.07)	(0.021)	.
2002	16	240	57	1.34	501	436.6	0.87	0.186	0.270
		(12)	(9)	(0.07)	(26)	(75.2)	(0.05)	(0.017)	(0.054)
2003	17	317	110	1.03	490	386.5	0.84	0.179	0.286
		(18)	(17)	(0.05)	(23)	(51.7)	(0.04)	(0.013)	(0.041)
2004	17	292	94	1.17	436	252.9	0.81	0.210	0.232
		(15)	(20)	(0.18)	(25)	(41.5)	(0.06)	(0.037)	(0.065)
2005	13	322	144	1.27	398	213.3	0.92	0.322	0.256
		(21)	(32)	(0.16)	(25)	(46.0)	(0.06)	(0.198)	(0.309)
2006 ^a	8	189	27	1.46	321	94.4	0.86	0.857	0.437
		(3)	(3)	(0.28)	(10)	(16.0)	(0.10)	(0.068)	(0.103)

^a2006 year class not individually marked with PIT tags, growth calculated from the mean FL and weight of a subsample of 81 fish measured at tagging.

Table 7. Incremental relative stock density (RSD)^a and relative condition factor (K_n) for all pallid sturgeon captured with all gears by length category during 2006 - 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	K _n (+/- 2SE)
Sturgeon Season			
Sub-stock (0-199 mm)	0	.	0
Sub-stock (200-329 mm)	0	.	0
Stock	66	89	0.844 (0.035)
Quality	6	8	0.794 (0.060)
Preferred	0	.	0
Memorable	0	.	0
Trophy	2	3	0.717
Overall K _n	.	.	0.838 (0.032)
Fish Community Season			
Sub-stock (0-199 mm)	0	.	0
Sub-stock (200-329 mm)	5	.	0.849 (0.101)
Stock	22	79	0.865 (0.089)
Quality	5	18	0.796 (0.087)
Preferred	1	3	0.685
Memorable	0	.	0
Trophy	0	.	0
Overall K _n	.	.	0.847 (0.063)

^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 %).

Segments 5 and 6 - Pallid Sturgeon / Sturgeon Season

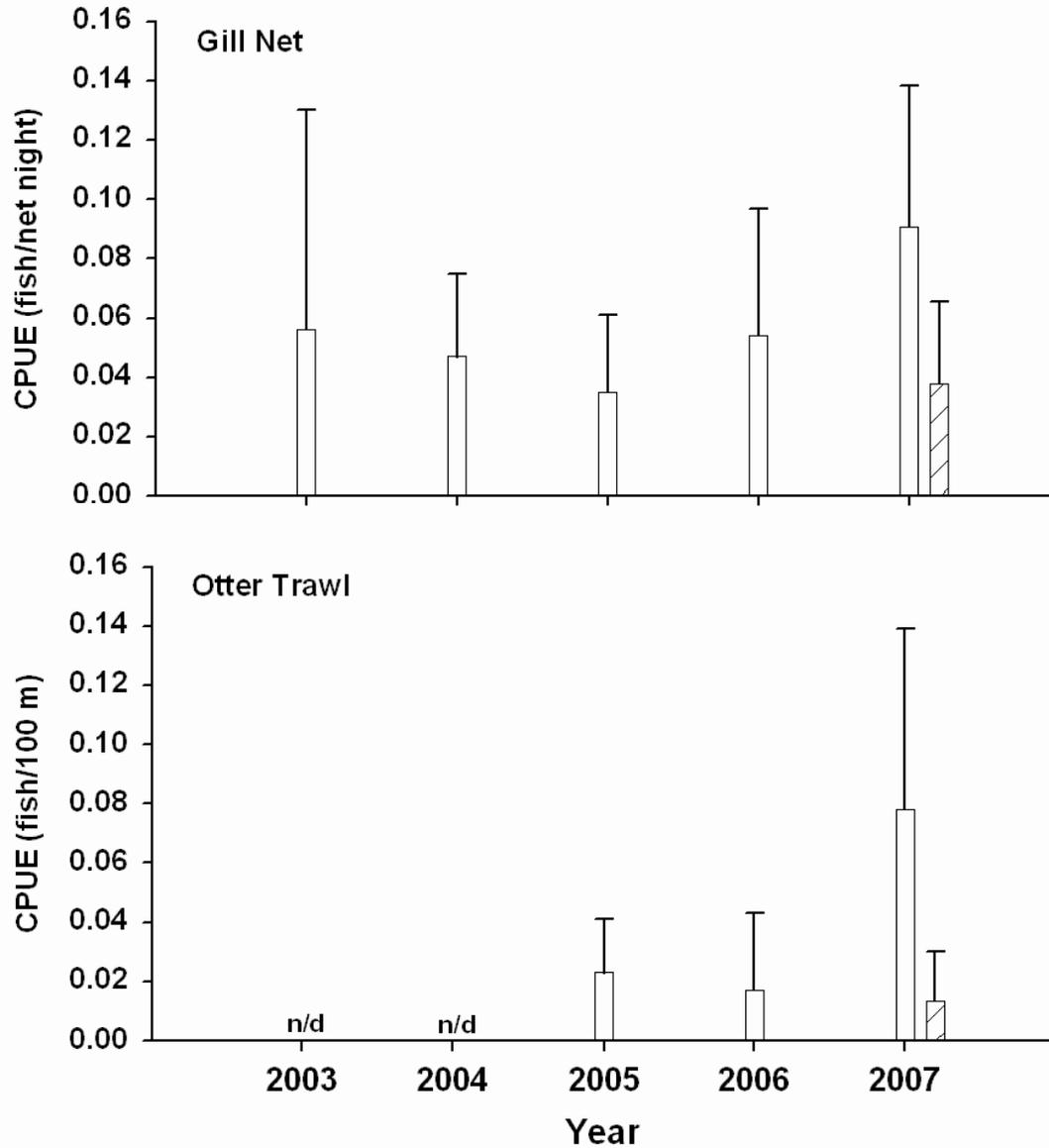


Figure 2. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery-reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using gill nets and otter trawls in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. Unknown origin pallid sturgeon are awaiting genetic verification. n/d indicates not deployed.

Segments 5 and 6 - Pallid Sturgeon / Sturgeon Season

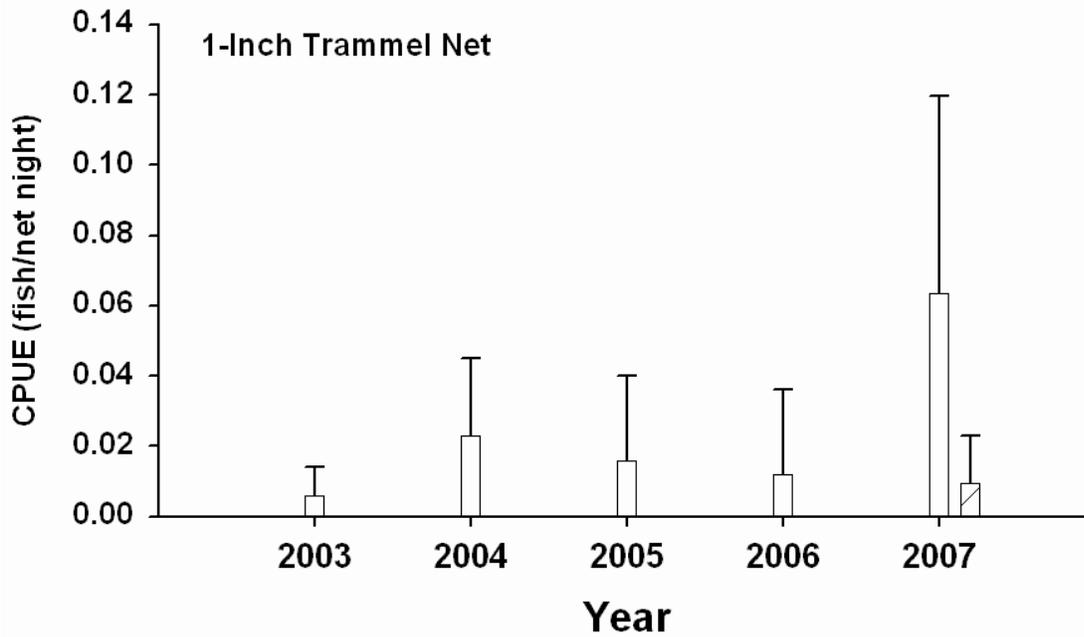


Figure 3. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery-reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1-inch trammel nets in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. Unknown origin pallid sturgeon are awaiting genetic verification.

Segments 5 and 6 - Pallid Sturgeon / Fish Community Season

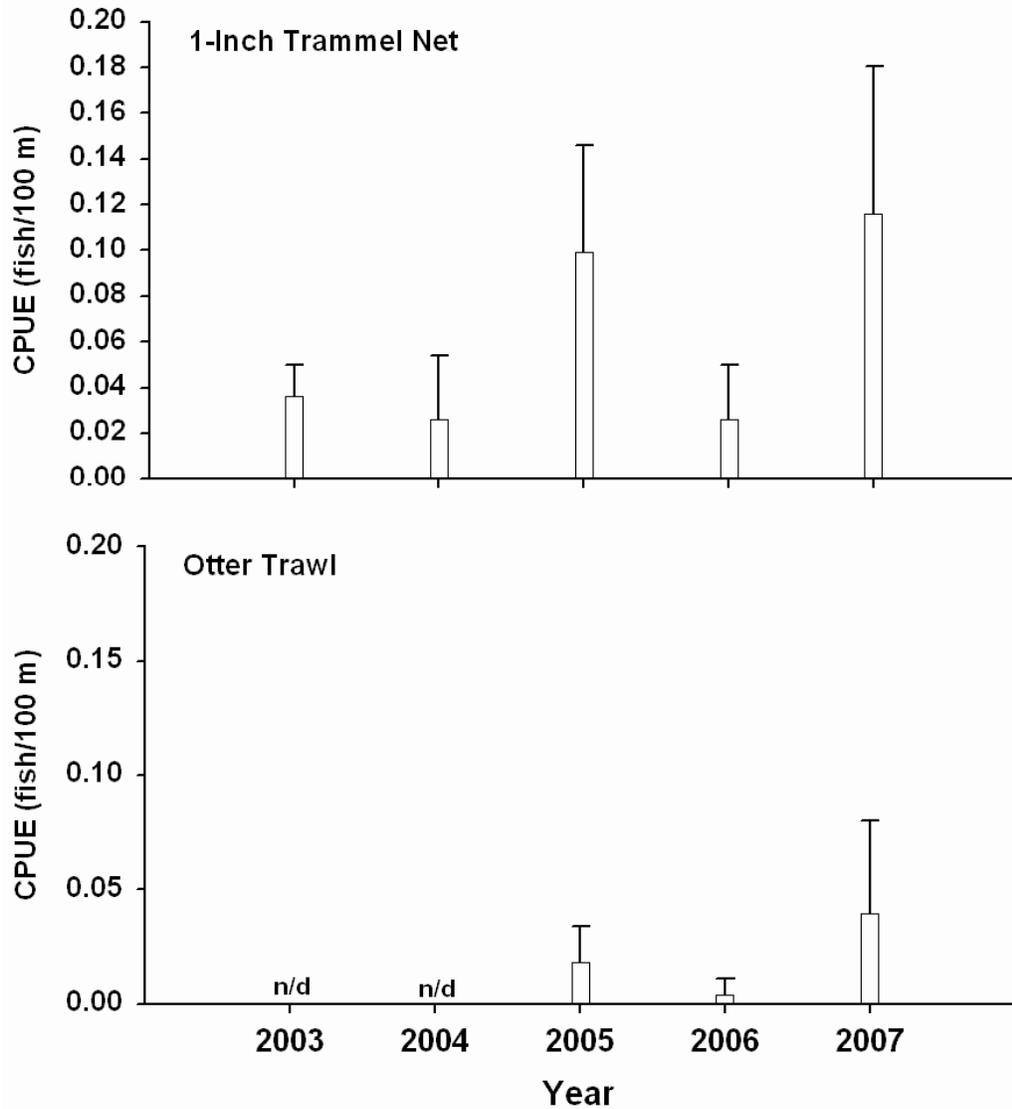


Figure 5. Mean annual catch-per-unit-effort (± 2 SE) of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon using 1-inch trammel nets and otter trawls in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007. Unknown origin pallid sturgeon are awaiting genetic verification. n/d indicates not deployed.

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 segments 5 and 6 of the Missouri River during 2006 - 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		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	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(45)	(14)	0			(17)	(19)	(4)				0	0	
Gill Net	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(46)	(15)	(1)			(17)	(19)	(3)				0	0	
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(22)	0			(19)	(15)	(3)				0	0	
Fish Community Season (Summer)															
1 Inch Trammel Net	5	0	0	0	N-E	N-E	20	0	80	N-E	N-E	N-E	0	0	N-E
	.	(40)	(11)	(1)			(24)	(17)	(8)				0	0	
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(40)	(8)	0			(19)	(25)	(4)				(4)	(1)	
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(12)	(5)			(18)	(18)	(6)				0	0	

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	5	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	12	67 (45)	17 (14)	0 (0)	N-E	N-E	0 (17)	17 (19)	0 (4)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Gill Net	28	21 (46)	43 (15)	0 (1)	N-E	N-E	14 (17)	21 (19)	0 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Otter Trawl	26	77 (42)	19 (22)	0 (0)	N-E	N-E	4 (19)	0 (15)	0 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Fish Community Season (Summer)															
1 Inch Trammel Net	17	24 (40)	0 (11)	0 (1)	N-E	N-E	29 (24)	6 (17)	41 (8)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Mini-Fyke Net	0	0 (40)	0 (8)	0 (0)	N-E	N-E	0 (19)	0 (25)	0 (4)	N-E	N-E	N-E	0 (4)	0 (1)	N-E
Otter Trawl	5	80 (42)	0 (12)	0 (5)	N-E	N-E	0 (18)	20 (18)	0 (6)	N-E	N-E	N-E	0 (0)	0 (0)	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	12	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	28	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	26	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	17	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	5	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non- or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	1	100 (45)	0 (14)	0 (0)	N-E	N-E	0 (17)	0 (19)	0 (4)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Gill Net	6	67 (46)	0 (15)	0 (1)	N-E	N-E	0 (17)	17 (19)	17 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Otter Trawl	1	100 (42)	0 (22)	0 (0)	N-E	N-E	0 (19)	0 (15)	0 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Fish Community Season (Summer)															
1 Inch Trammel Net	2	100 (40)	0 (11)	0 (1)	N-E	N-E	0 (24)	0 (17)	0 (8)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Mini-Fyke Net	0	0 (40)	0 (8)	0 (0)	N-E	N-E	0 (19)	0 (25)	0 (4)	N-E	N-E	N-E	0 (4)	0 (1)	N-E
Otter Trawl	4	75 (42)	0 (12)	25 (5)	N-E	N-E	0 (18)	0 (18)	0 (6)	N-E	N-E	N-E	0 (0)	0 (0)	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 7. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	6	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	1	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	2	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	4	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

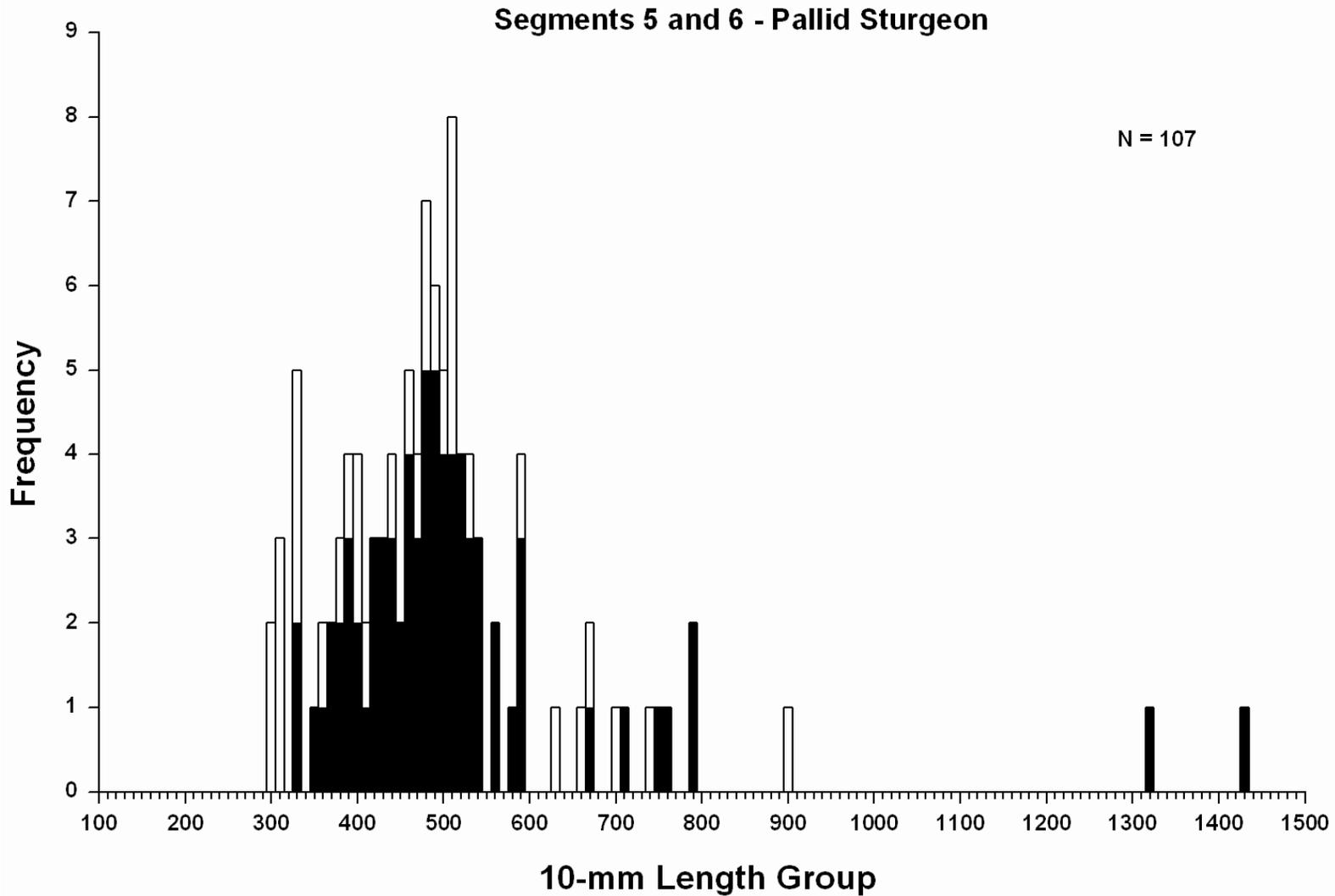


Figure 8. Length frequency of pallid sturgeon captured during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Segments 5 and 6 - Annual Pallid Sturgeon Capture History

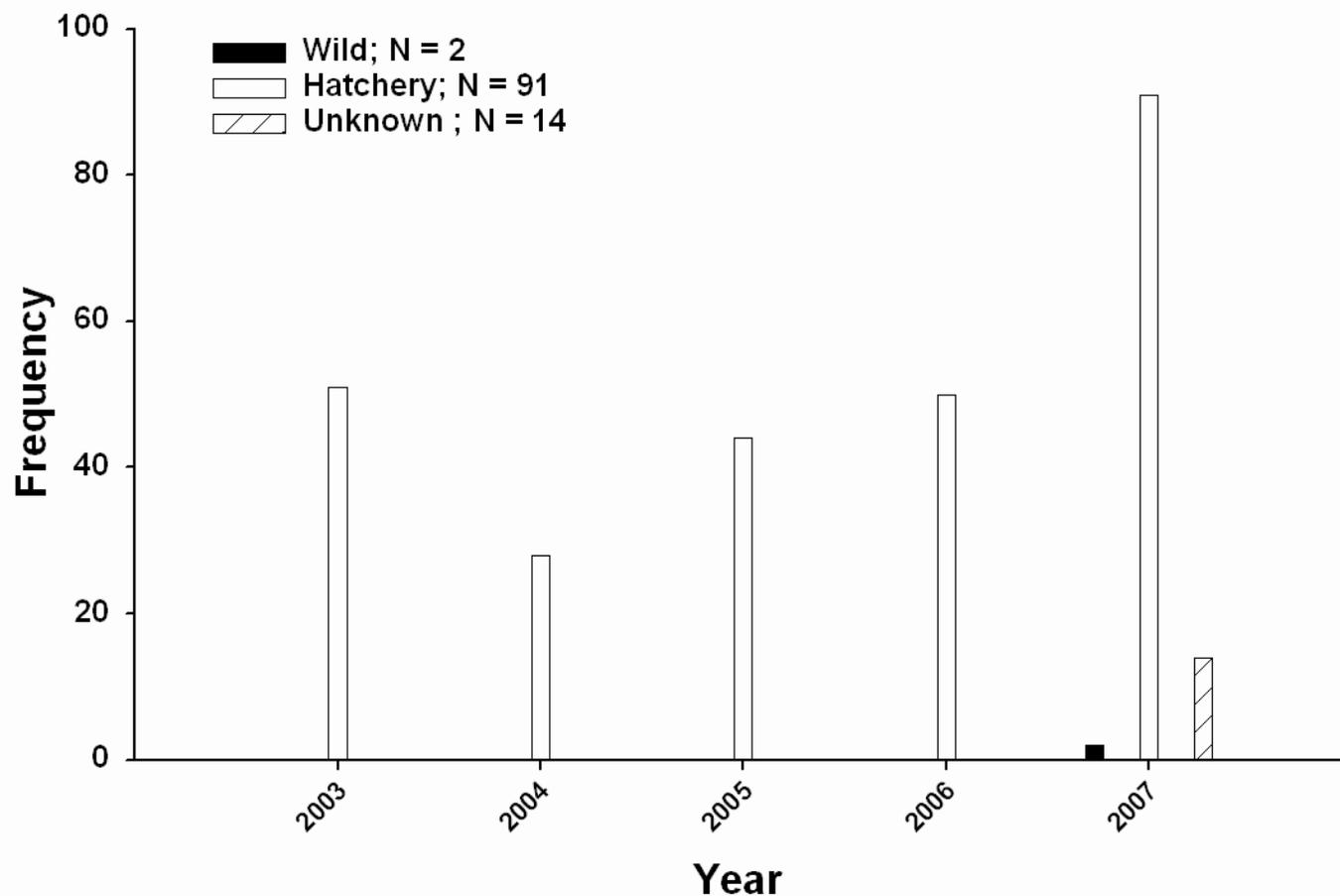


Figure 9. Annual capture history of wild (black bars), hatchery reared (white bars), and unknown origin (cross-hatched bars) pallid sturgeon collected in segments 5 and 6 of the Missouri River from 2006 to 2007. Figure is designed to compare overall pallid sturgeon captures from year to year and may be biased by variable effort between years.

Shovelnose X Pallid Sturgeon Hybrids

No shovelnose X pallid sturgeon hybrids were captured in segments 5 and 6 during 2007 or in previous years (2003 – 2006) since monitoring began.

Targeted Native River Species

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

A total of 429 shovelnose sturgeon were sampled with standard gears in 2007. Most shovelnose sturgeon were captured with gill nets (n = 324), trammel nets (n = 76), and otter trawls (n = 29). Three hundred and seventy two shovelnose sturgeons were captured during the sturgeon season while 57 were captured during the fish community season. Mean catch per unit effort of shovelnose sturgeon (Figures 11, 12, and 14) was greatest in gill nets (1.2 fish/net night). The mean CPUE of trammel net in the sturgeon season (0.16 fish/100 m) was nearly the same as that of the fish community season CPUE (0.17 fish/100 m). Mean CPUE in gill nets during 2007 increased over two fold from the running average for 2003 – 2006 (Figure 11). Mean CPUE during both seasons with trammel nets has remained fairly consistent since 2004 – 2006 (Figures 12 and 14). Mean CPUE for the otter trawl in the sturgeon season and the fish community season was the same (0.05 fish/100 m). In 2007, mean CPUE for otter trawls decreased during both the sturgeon season and fish community season compared to the long-term running average (sturgeon season, 0.08 fish/100 m; fish community season 0.06 fish/100 m). No shovelnose sturgeon were captured in the mini-fyke nets or push trawl.

Shovelnose sturgeon were found in all macrohabitats sampled with the exception of tributary mouth small and tributary mouth large (Table 23). For all gears pooled, shovelnose sturgeon were captured from braided channel (51%), outside bend (20%), channel crossover (18%), inside bend (8%), confluence (<1%), and secondary channel connected large (3%) macrohabitats during the sturgeon season. While during the fish community season, 51% of shovelnose sturgeon were captured in braided channels, 22% in outside bends, and 20% in channel crossovers. For trammel nets and otter trawls, the proportion of total shovelnose sturgeon captured was greater than the proportion of effort expended in the braided macrohabitat. A greater proportion of shovelnose sturgeon were caught with gill nets in the channel crossover and outside bend macrohabitat during the sturgeon season compared to the proportion of effort expended in those habitats. During the fish community season with trammel nets and otter trawls, the proportion of the total shovelnose sturgeon caught was > the proportion of effort expended in the braided and secondary large connected channel macrohabitats. All shovelnose sturgeon were caught in the channel boarder mesohabitat (Table 24).

Only one shovelnose sturgeon smaller than the preferred size category ($FL \leq 510$ mm) was caught downstream of Fort Randall Dam during 2007. Fork lengths of shovelnose sturgeon ranged from 508 - 869 mm, with 90% of the fish between 570 – 709 mm (Figure 17). Incremental RSD for shovelnose sturgeon in both seasons indicated an ageing population with no recruitment (Table 25). Shovelnose sturgeon captured during the sturgeon ($n = 372$) and fish community seasons ($n = 57$) exhibited a mean W_r of 95 and 94, respectively. Relative weights of shovelnose sturgeon were generally similar during the sturgeon season (90 – 103), and fish community season (91 - 98), excluding the single fish of trophy length.

Segments 5 and 6 - Shovelnose Sturgeon / Sturgeon Season

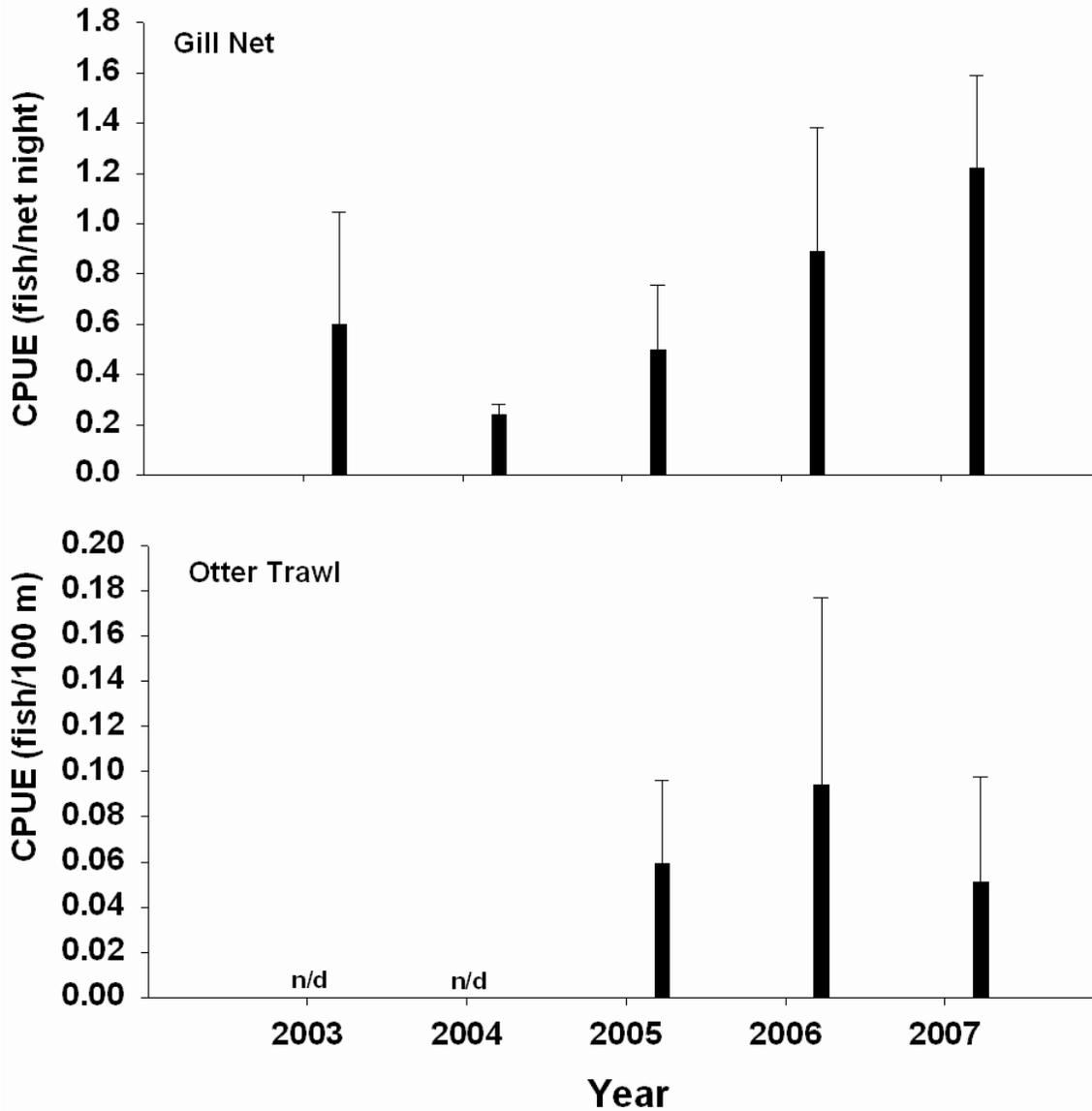


Figure 11. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using gill nets and otter trawls in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. n/d indicates not deployed.

Segments 5 and 6 - Shovelnose Sturgeon / Sturgeon Season

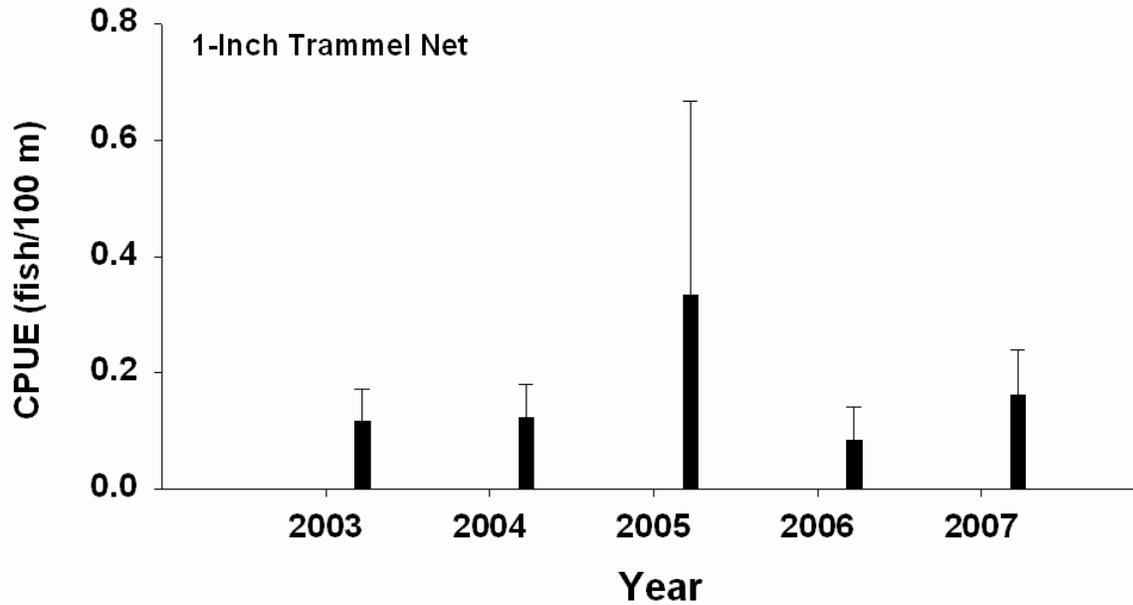


Figure 12. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1-inch trammel nets in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007.

Segments 5 and 6 - Shovelnose Sturgeon / Fish Community Season

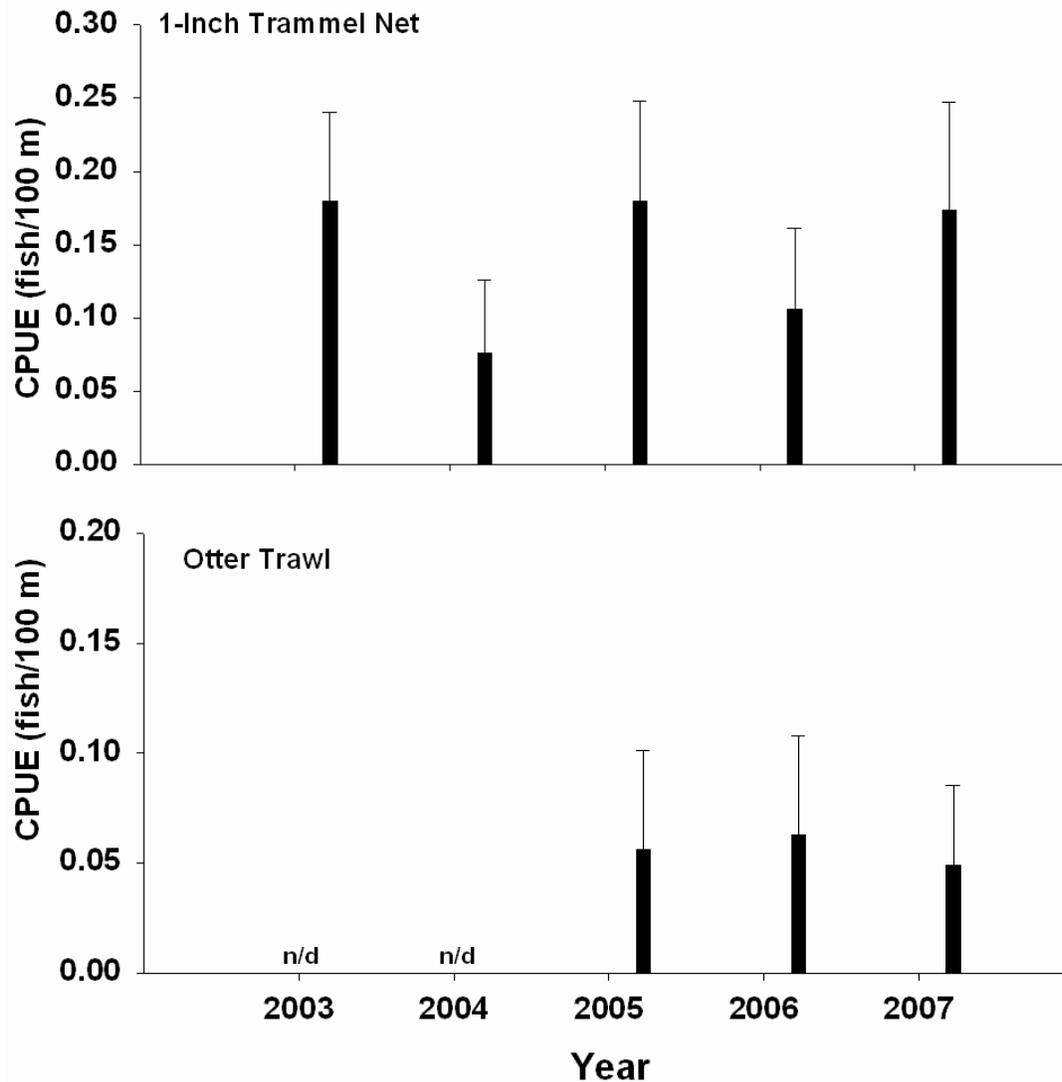


Figure 14. Mean annual catch-per-unit-effort (± 2 SE) of sub-stock size (0-149 mm; white bars), sub-stock size (150-249 mm; cross-hatched), stock size (250-379 mm; gray bars), and quality and above size (> 380 mm; black bars) shovelnose sturgeon using 1-inch trammel nets and otter trawls in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007. n/d indicates not deployed.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	33	79 (45)	3 (14)	0 (0)	N-E	N-E	9 (17)	9 (19)	0 (4)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Gill Net	324	45 (46)	23 (15)	0 (1)	N-E	N-E	7 (17)	24 (19)	0 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Otter Trawl	15	100 (42)	0 (22)	0 (0)	N-E	N-E	0 (19)	0 (15)	0 (3)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Fish Community Season (Summer)															
1 Inch Trammel Net	43	49 (40)	5 (11)	0 (1)	N-E	N-E	19 (24)	9 (17)	19 (8)	N-E	N-E	N-E	0 (0)	0 (0)	N-E
Mini-Fyke Net	0	0 (40)	0 (8)	0 (0)	N-E	N-E	0 (19)	0 (25)	0 (4)	N-E	N-E	N-E	0 (4)	0 (1)	N-E
Otter Trawl	14	57 (42)	0 (12)	14 (5)	N-E	N-E	7 (18)	7 (18)	14 (6)	N-E	N-E	N-E	0 (0)	0 (0)	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

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 segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. Size categories described in Table 25. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	33	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	324	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	15	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	43	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	14	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

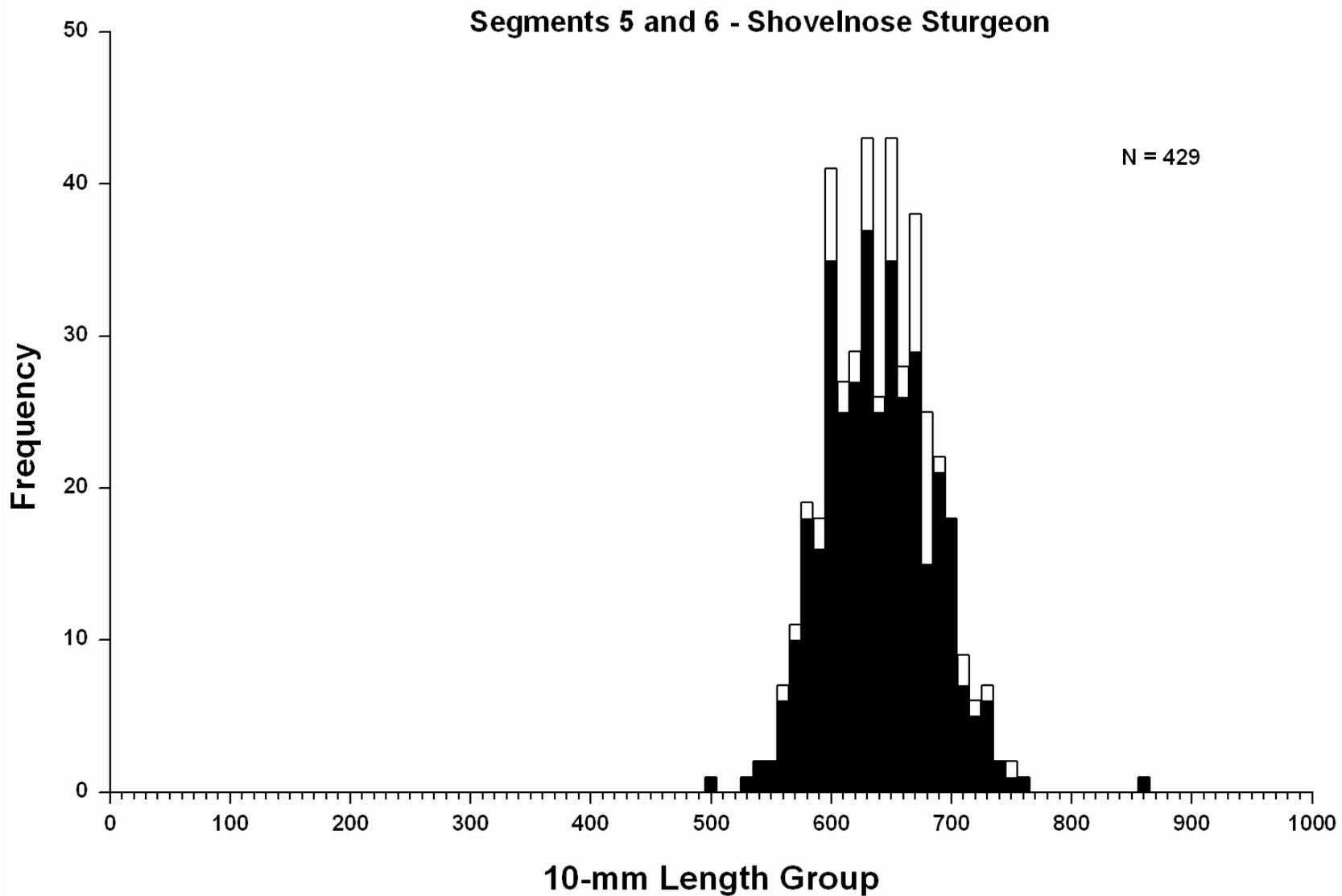


Figure 17. Length frequency of shovelnose sturgeon from fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Table 25. Incremental relative stock density (RSD)^a and mean relative weight (Wr) by a length category for shovelnose sturgeon in segments 5 and 6 of the Missouri River captured during 2006 – 2007. Length categories^b determined using methods proposed by Quist (1998).

Length category	N	RSD	Wr (+/- 2 SE)
Sturgeon Season			
Sub-stock (0-149 mm)	0	.	0
Sub-stock (150-249 mm)	0	.	0
Stock	0	.	0
Quality	1	<1	103
Preferred	179	48	99 (2)
Memorable	191	51	90 (2)
Trophy	1	<1	44.12
Overall Wr	.	.	95 (1)
Fish Community Season			
Sub-stock (0-149 mm)	0	.	0
Sub-stock (150-249 mm)	0	.	0
Stock	0	.	0
Quality	0	.	0
Preferred	21	37	98 (8)
Memorable	36	63	91 (3)
Trophy	0	.	0
Overall Wr	.	.	94 (4)

^a RSD = (# of fish of a specified length class / # of fish \geq 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 \geq 810 mm (>74 %).

Sturgeon Chub

No sturgeon chubs were captured during the 2007 sampling season. This is the fifth year (2003 – 2007) of zero captures for sturgeon chubs.

Sicklefin Chub

No sicklefin chubs were captured during the 2007 sampling season. This is the fifth year (2003 – 2007) of zero captures for sicklefin chubs.

Speckled Chub

No speckled chubs were captured during the 2007 sampling season. This is the fifth year (2003 – 2007) of zero captures for speckled chubs.

Sand Shiner

A total of 71 sand shiners were captured during the 2007 with all fish captured in mini-fyke nets (Figures 30 - 32). Annual catch per unit effort during 2007 for mini-fyke nets (Figure 32) was lower (0.89 fish/net night) than 2004 (1.65 fish/net night), but higher than 2005 (0.31 fish/net night) and 2006 (0.53 fish/net night). Over 87% of the fish captured in mini-fyke nets were collected in the outside bend macrohabitat with the remainder captured in the inside bend (10%), secondary channel connected large (1%), and tributary mouth large (1%) macrohabitats (Table 32). In 2006 all sand shiners were captured in or downstream of the Niobrara River confluence; whereas, in 2007 nearly all sand shiners were captured upstream of the Niobrara River confluence. Mini-fyke nets were only set in the bar mesohabitat (Table 33). Over 80% of the sand shiners captured were between 35 – 44 mm (Figure 33).

Segments 5 and 6 - Sand Shiner / Sturgeon Season

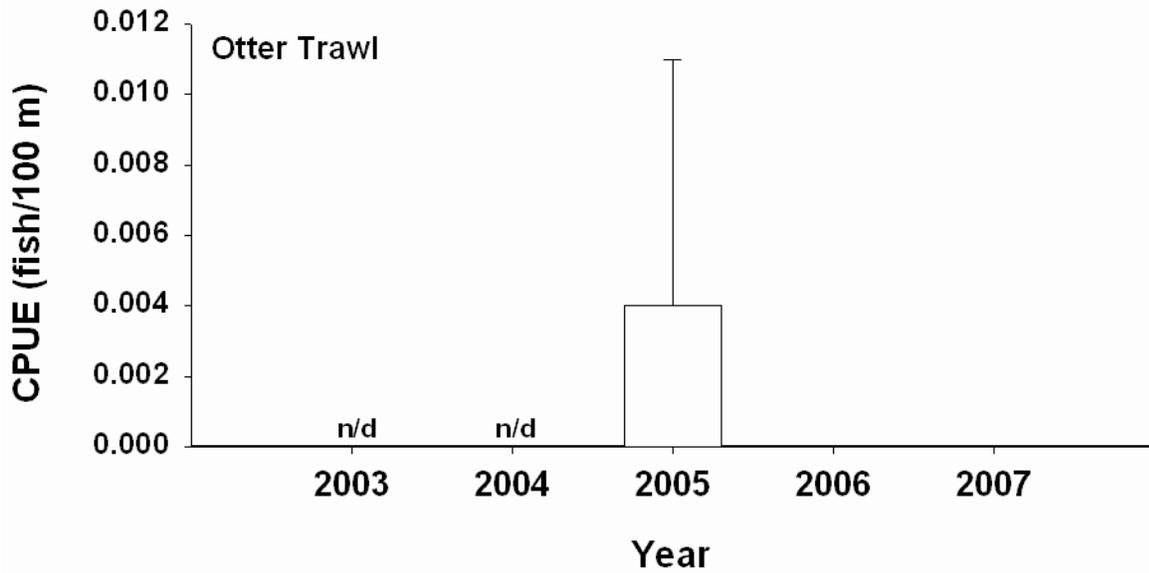


Figure 30. Mean annual catch-per-unit-effort (± 2 SE) of sand shiners with otter trawls in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. n/d indicates not deployed.

Segments 5 and 6 - Sand Shiner / Fish Community Season

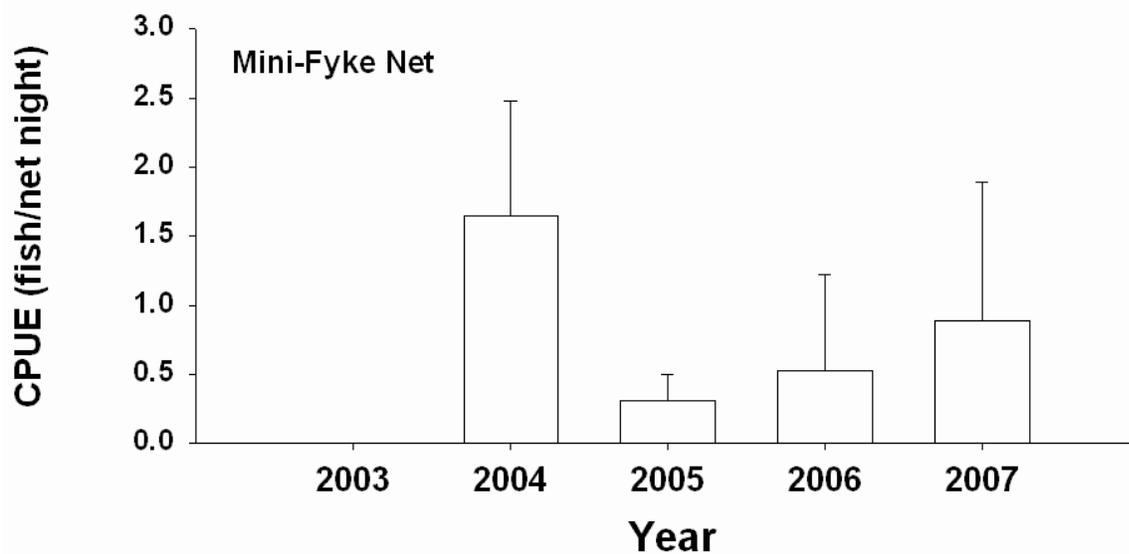


Figure 32. Mean annual catch-per-unit-effort (± 2 SE) of sand shiners with mini-fyke nets in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007.

Table 32. Total number of sand shiners captured for each gear during each season and the proportion caught within each macrohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(22)	0			(19)	(15)	(3)				0	0	
Fish Community Season (Summer)															
Mini-Fyke Net	71	0	0	0	N-E	N-E	10	87	1	N-E	N-E	N-E	1	0	N-E
	.	(40)	(8)	0			(19)	(25)	(4)				(4)	(1)	
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(12)	(5)			(18)	(18)	(6)				0	0	

^a Habitat abbreviations and definitions presented in Appendix B.

Table 33. Total number of sand shiners captured for each gear during each season and the proportion caught within each mesohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
Mini-Fyke	71	100	0	N-E	N-E	N-E	N-E
Net	.	(100)	0				
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

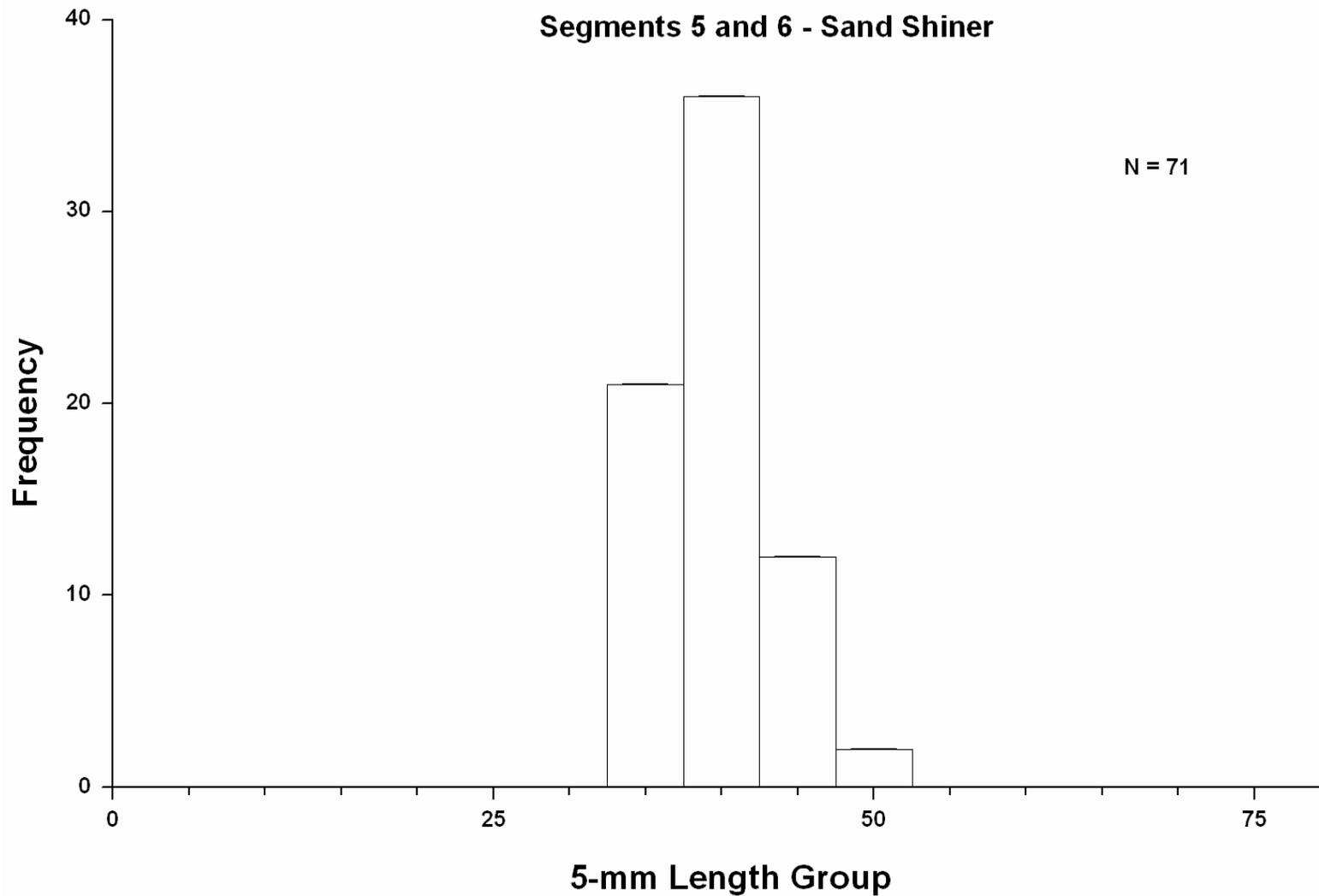


Figure 33. Length frequency of sand shiners during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

***Hybognathus* spp.**

A total of eight *Hybognathus* spp. were captured during the 2007 sampling season consisting of six plains minnows *H. placitus* and two western silvery minnows *H. argyrtis*. All fish were captured in mini-fyke nets during the fish community (summer) season. Fish were captured on inside bend (n = 3) and outside bend (n = 5) bar habitat. During prior sampling from 2003 – 2006, only one *Hybognathus* spp. was collected in a mini-fyke net during 2005.

Segments 5 and 6 - *Hybognathus* spp. / Fish Community Season

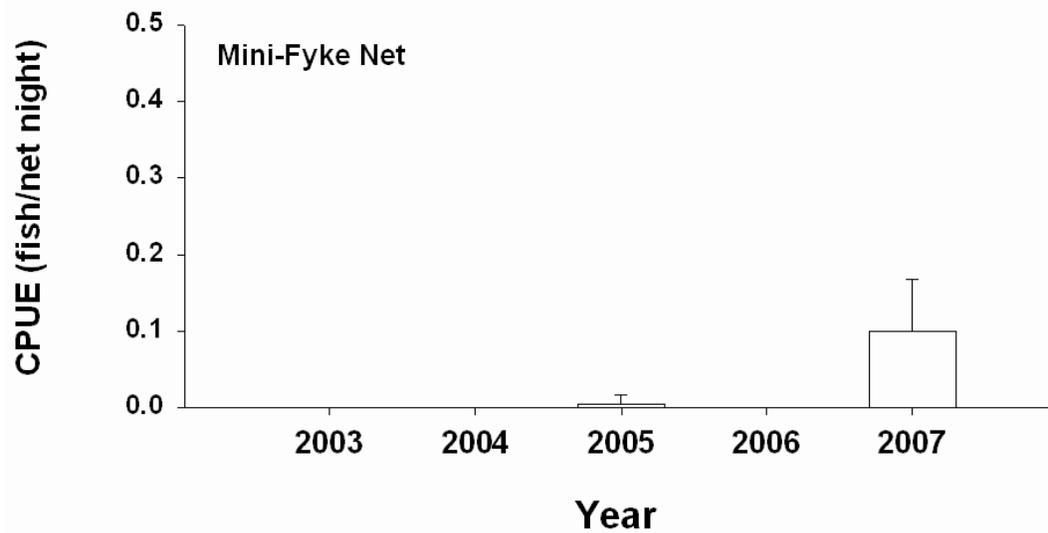


Figure 36. Mean annual catch-per-unit-effort (± 2 SE) of *Hybognathus* spp. with mini-fyke nets in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007.

Table 34. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each macrohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(22)	0			(19)	(15)	(3)				0	0	
Fish Community Season (Summer)															
Mini-Fyke Net	8	0	0	0	N-E	N-E	38	63	0	N-E	N-E	N-E	0	0	N-E
	.	(40)	(8)	0			(19)	(25)	(4)				(4)	(1)	
Otter Trawl	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(12)	(5)			(18)	(18)	(6)				0	0	

^a Habitat abbreviations and definitions presented in Appendix B.

Table 35. Total number of *Hybognathus* spp. captured for each gear during each season and the proportion caught within each mesohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
Mini-Fyke	8	100	0	N-E	N-E	N-E	N-E
Net	.	(100)	0				
Otter Trawl	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

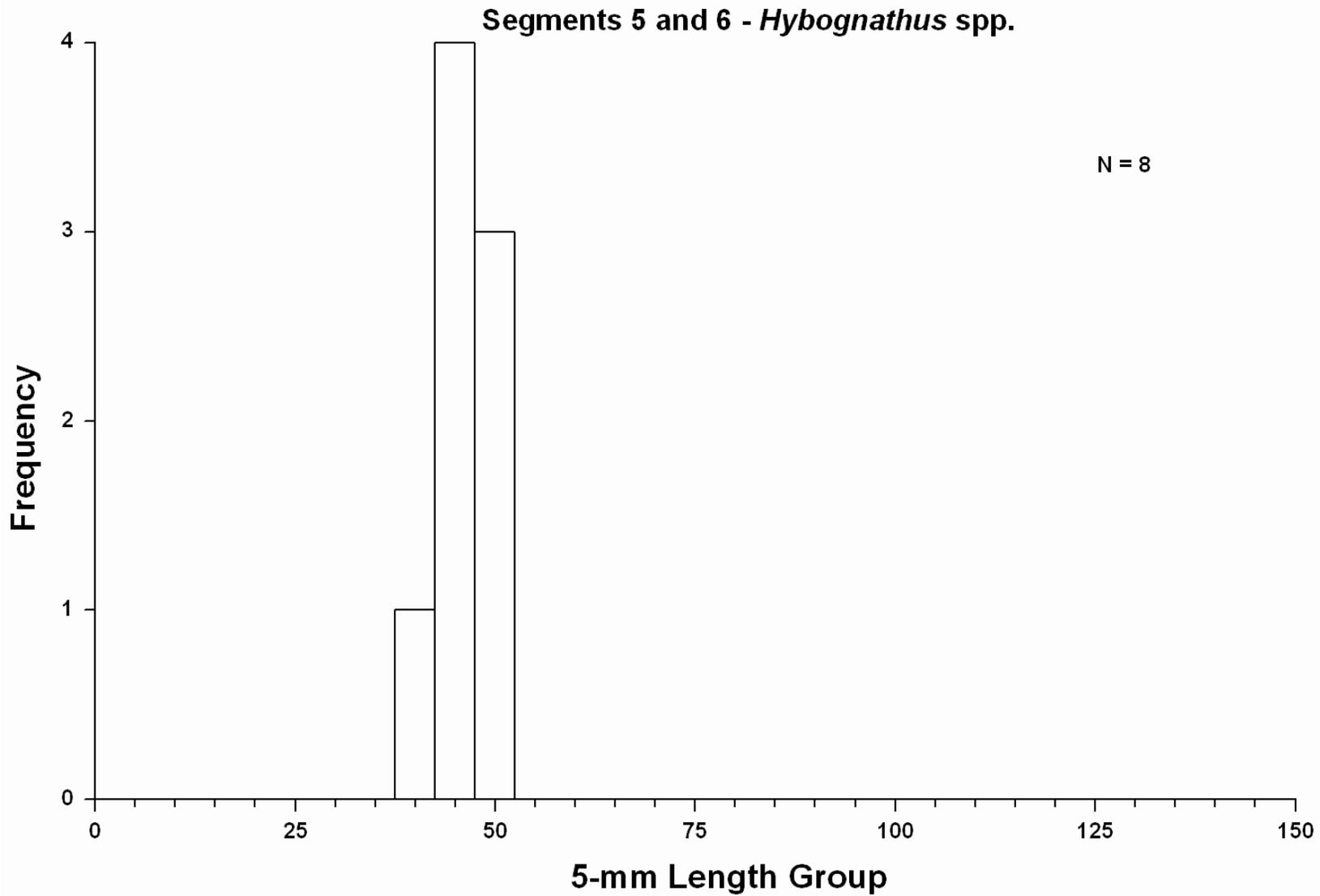


Figure 37. Length frequency of *Hybognathus* spp. caught during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Blue Sucker

The total catch of blue suckers in standard gears during 2007 ($n = 20$) increased 2.5 times from 2006 ($n = 8$). Relative abundance of blue suckers captured with gill nets nearly tripled when compared to previous years (Figure. 38); whereas, abundance measured with trammel nets and the otter trawl ranged from 0 to 0.01 fish/100m (Figure. 38 – 41). Since the inception of this monitoring program, no blue suckers have been captured with mini-fyke nets (2003 - 2007). Of the 20 blue suckers captured in the standard gears, 16 were captured in gill nets, one in trammel nets, and two were captured in the otter trawl. Macrohabitats where blue suckers were captured (Table 36) included outside bends ($n = 14$), inside bends ($n = 3$), channel crossovers ($n = 2$), and braided channels ($n = 1$). All blue suckers were captured in channel border mesohabitats (Table 37). Nearly all blue suckers captured in segments 5 and 6 were over 600 mm TL indicating an ageing population. A single 203 mm TL blue sucker was captured in the otter trawl on June 5, 2007, providing the first evidence of limited recruitment within segments 5 and 6 of the Missouri River (Figure 44).

Segments 5 and 6 - Blue Sucker / Sturgeon Season

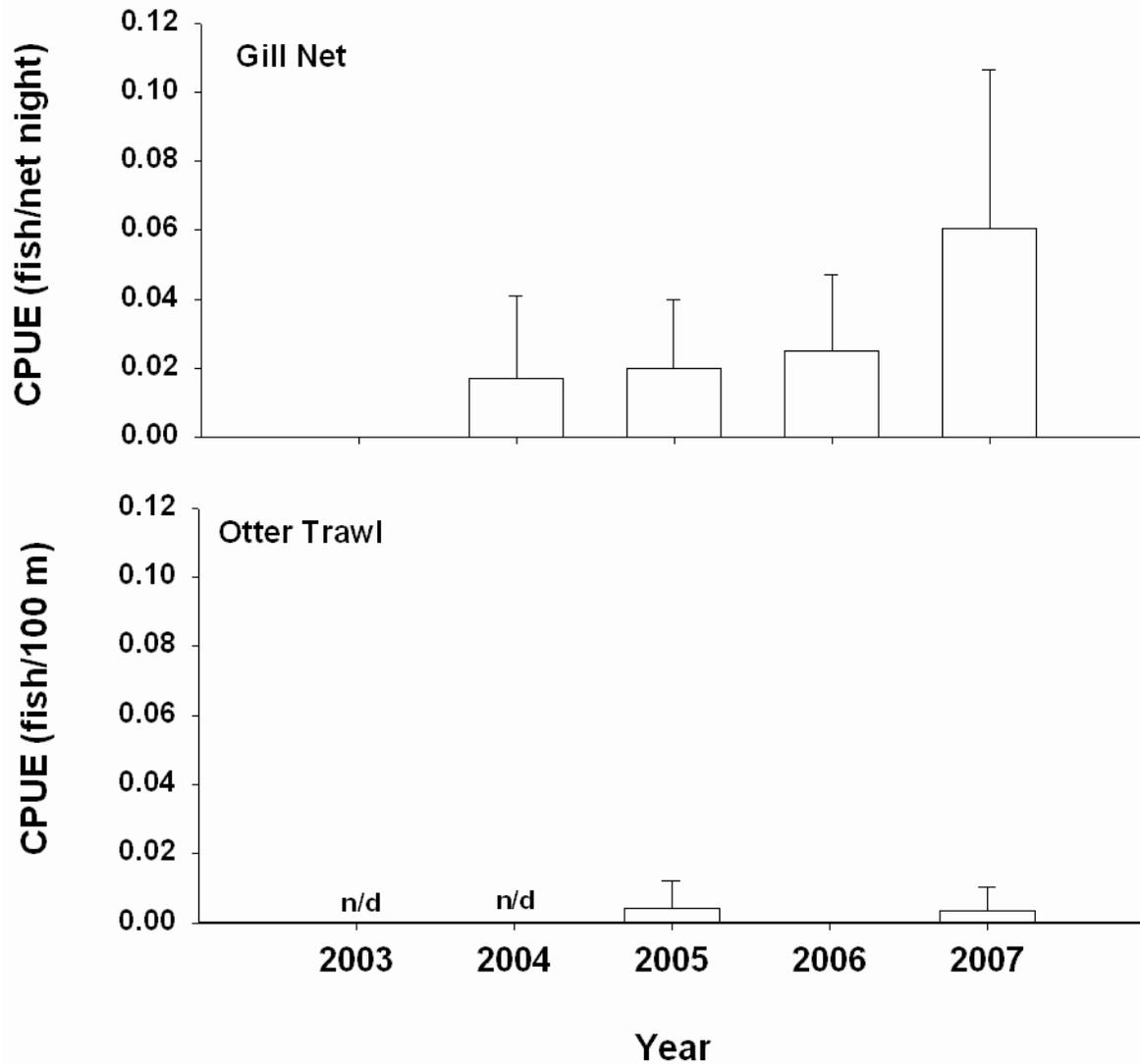


Figure 38. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers with gill nets and otter trawls in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. n/d indicates not deployed.

Segments 5 and 6 - Blue Sucker / Sturgeon Season

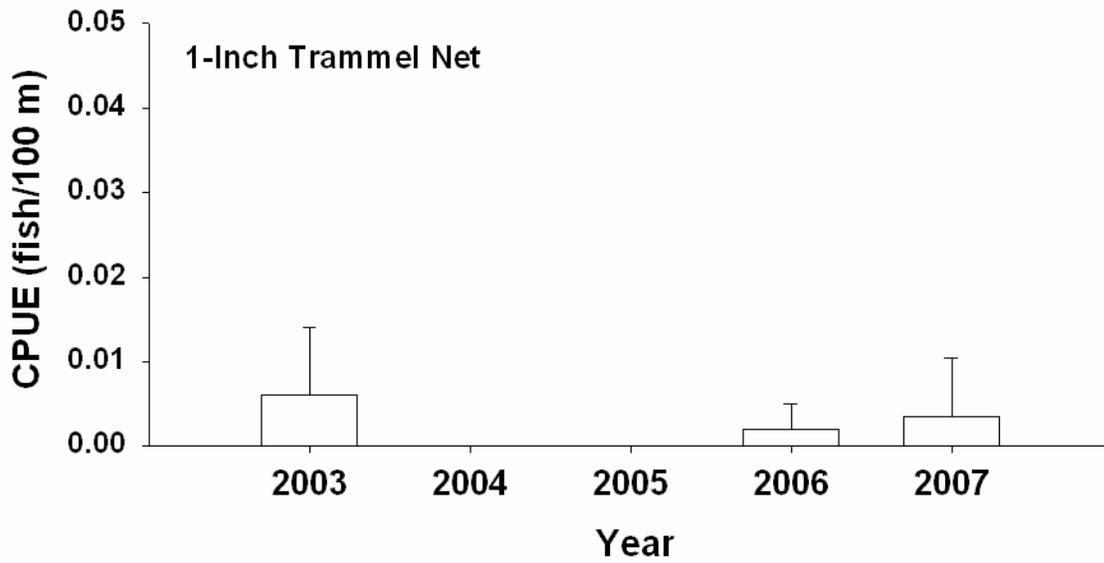


Figure 39. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers with 1-inch trammel nets in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007.

Segments 5 and 6 - Blue Sucker / Fish Community Season

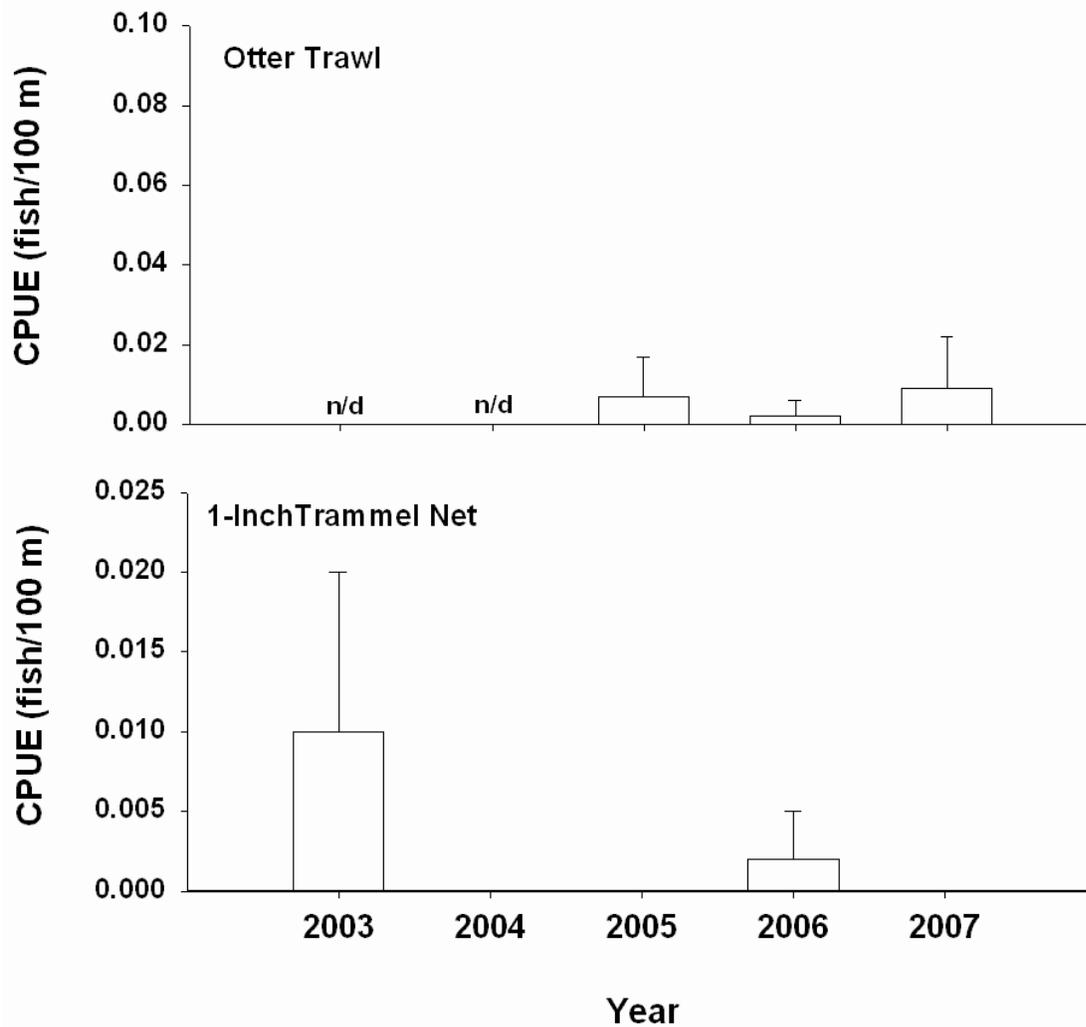


Figure 41. Mean annual catch-per-unit-effort (± 2 SE) of blue suckers using otter trawls and 1-inch trammel nets in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007. n/d indicates not deployed.

Table 36. Total number of blue suckers captured for each gear during each season and the proportion caught within each macrohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		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	0	0	N-E	N-E	0	100	0	N-E	N-E	N-E	0	0	N-E
	.	(45)	(14)	0			(17)	(19)	(4)				0	0	
Gill Net	16	0	6	0	N-E	N-E	19	75	0	N-E	N-E	N-E	0	0	N-E
	.	(46)	(15)	(1)			(17)	(19)	(3)				0	0	
Otter Trawl	1	100	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(22)	0			(19)	(15)	(3)				0	0	
Fish Community Season (Summer)															
1 Inch Trammel Net	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(40)	(11)	(1)			(24)	(17)	(8)				0	0	
Mini-Fyke Net	0	0	0	0	N-E	N-E	0	0	0	N-E	N-E	N-E	0	0	N-E
	.	(40)	(8)	0			(19)	(25)	(4)				(4)	(1)	
Otter Trawl	2	0	50	0	N-E	N-E	0	50	0	N-E	N-E	N-E	0	0	N-E
	.	(42)	(12)	(5)			(18)	(18)	(6)				0	0	

^a Habitat abbreviations and definitions presented in Appendix B.

Table 37. Total number of blue suckers captured for each gear during each season and the proportion caught within each mesohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	1	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	16	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	1	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	0	0	0	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	2	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

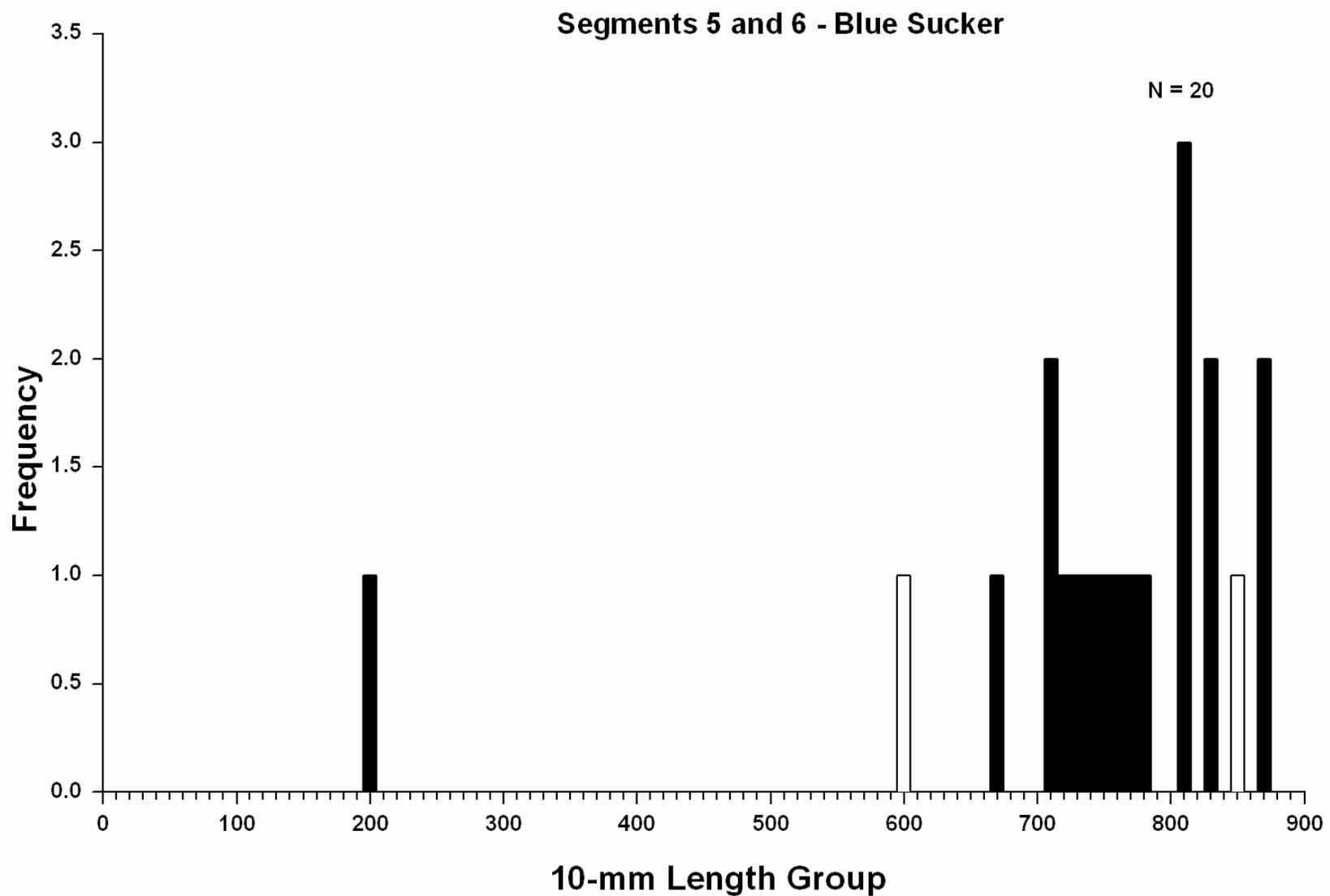


Figure 44. Length frequency of blue suckers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Sauger

A total of 101 saugers were sampled in three standard gears in segments 5 and 6 during 2007: gill nets (n = 41), trammel nets (n = 45), and otter trawls (n = 15). Gill net mean CPUE in 2007 (0.15 fish/net night) increased from 2006 (0.12 fish/net night), but was 38% lower than the 4 year running average of 0.24 fish/net night (Figure 45). Gill net relative abundance in 2007 was similar to 2005 and 2006 since declining almost 50% from the highest abundance seen in 2003 (Figure. 45). Relative abundance of saugers during the sturgeon season for the otter trawl has consistently decreased over the past 3 years from 0.06 fish/100 m in 2005 to 0.01 fish/100 m in 2007. However, sauger catches were approximately 2.5 times greater during the fish community season (summer) of 2007 compared to the sturgeon season (fall through spring). Higher sauger CPUE in otter trawls during the fish community season compared to the sturgeon season was also evident in the 2005 and 2006. No saugers were caught in mini-fyke nets during 2007 and catches in this gear have been low or zero since 2003 (Figure. 49).

Over 83% of saugers captured were collected in the braided channel (67%) and outside bend (16%) macrohabitats during both seasons (Table 38). Saugers were only captured in the channel border mesohabitat (Table 39). A total of 77 saugers (77 %) captured were captured in the delta downstream of Niobrara and Missouri river confluence. In segment 5, an additional 19 fish were captured within the two bends immediately upstream the confluence and the two remaining fish were captured upstream of the Verdel, Nebraska boat landing.

During 2007, the population structure and physical condition of sauger was appropriate to have recruitment in segments 5 and 6. Over 76% of saugers caught in segments 5 and 6 of Missouri River during 2007 were between the 300 - 500 mm TL; however, catches of fish < 160 mm TL (Figure 51). Multiple modes (> 5) in the length frequency histogram indicate suitable conditions for spawning and recruitment still exist in segments 5 and 6. Incremental relative stock density (RSD) was calculated for sauger captured in the standard gears. The RSD values for each category during the sturgeon season were: stock = 10, quality = 36, preferred = 46, memorable = 9, and trophy = 0. While the RSD values shifted during the fish community season to: stock = 17, quality = 29, preferred = 54, memorable = 0, with no change in trophy. The RSD during the sturgeon season had greater numbers of memorable sized saugers compared to the fish community season, while an increase in the proportion of stocked sized fish in the summer indicated some limited recruitment. The mean relative weights during the sturgeon and fish community season were similar; the mean relative weights during the sturgeon season and the

fish community season was 81 ($n = 67; \pm 2SE = 2.65$) and 82 ($n = 29; \pm 2SE = 10.4$), respectively.

Segments 5 and 6 - Sauger / Sturgeon Season

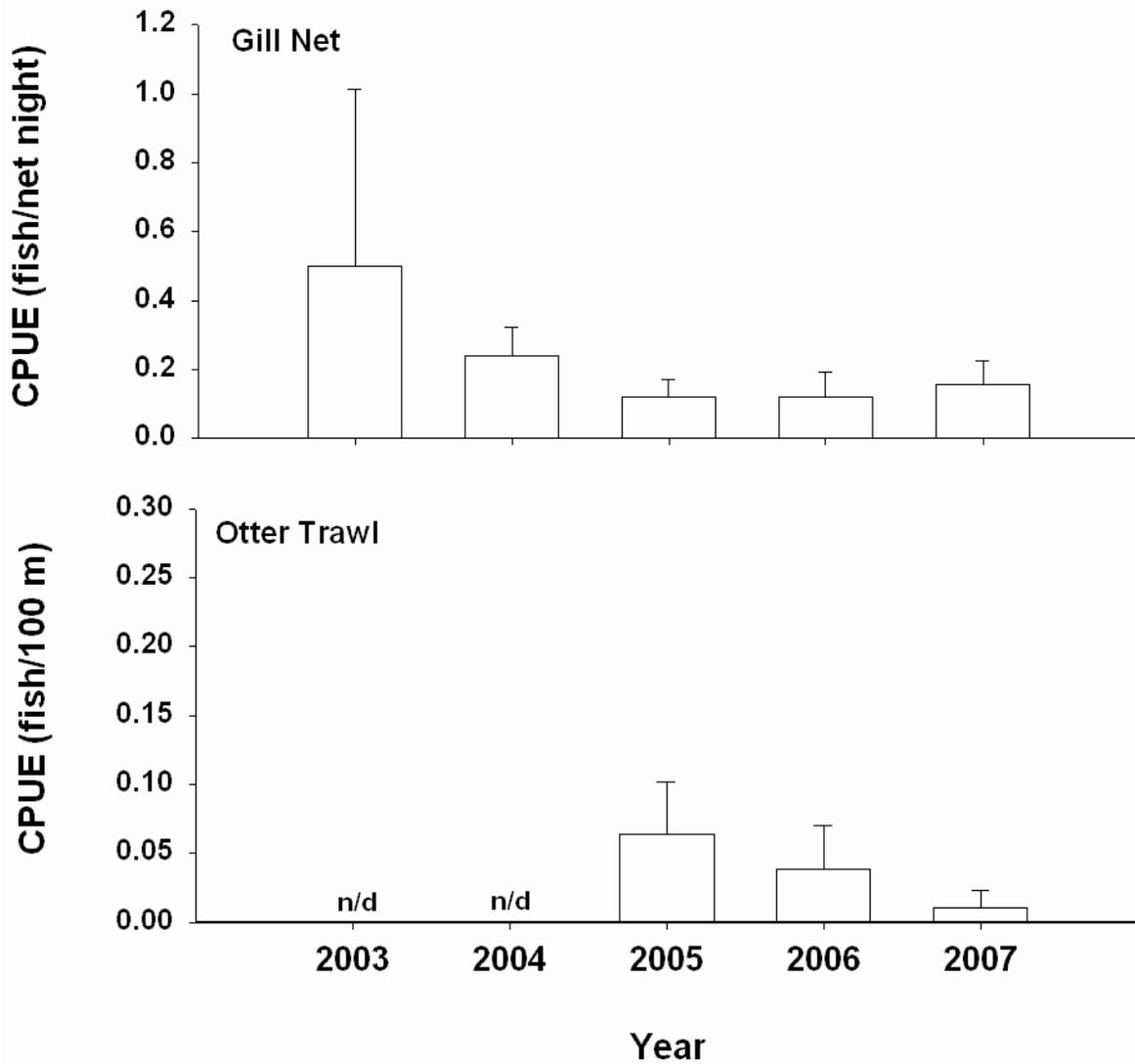


Figure 45. Mean annual catch-per-unit-effort (± 2 SE) of saugers using gill nets and otter trawls in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007. n/d indicates not deployed.

Segments 5 and 6 - Sauger / Sturgeon Season

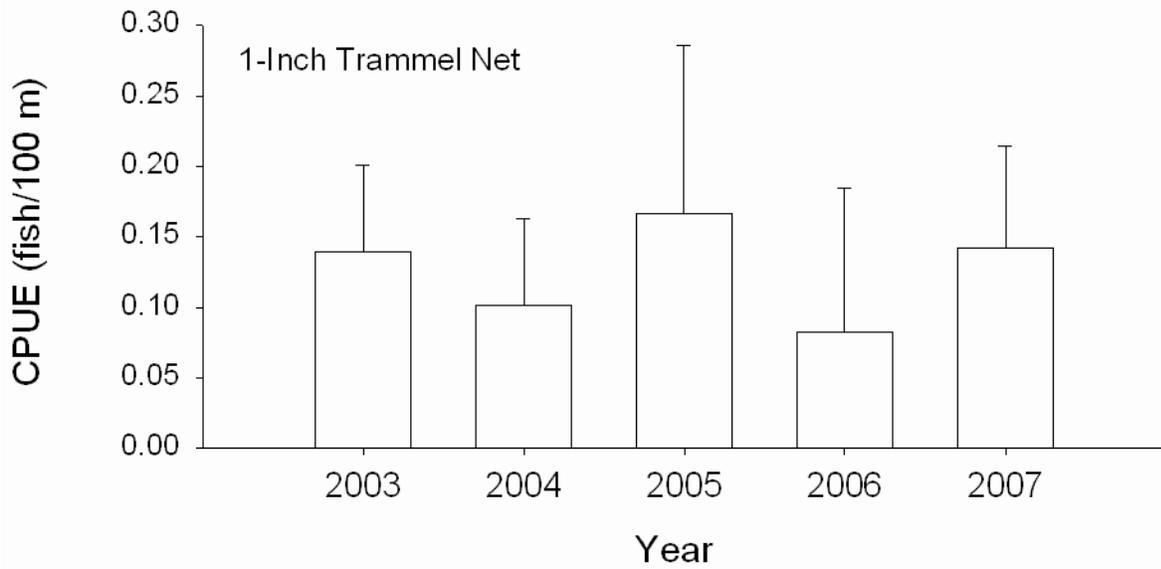


Figure 46. Mean annual catch-per-unit-effort (± 2 SE) of saugers using 1-inch trammel nets in segments 5 and 6 of the Missouri River during sturgeon season 2006 - 2007.

Segments 5 and 6 - Sauger / Fish Community Season

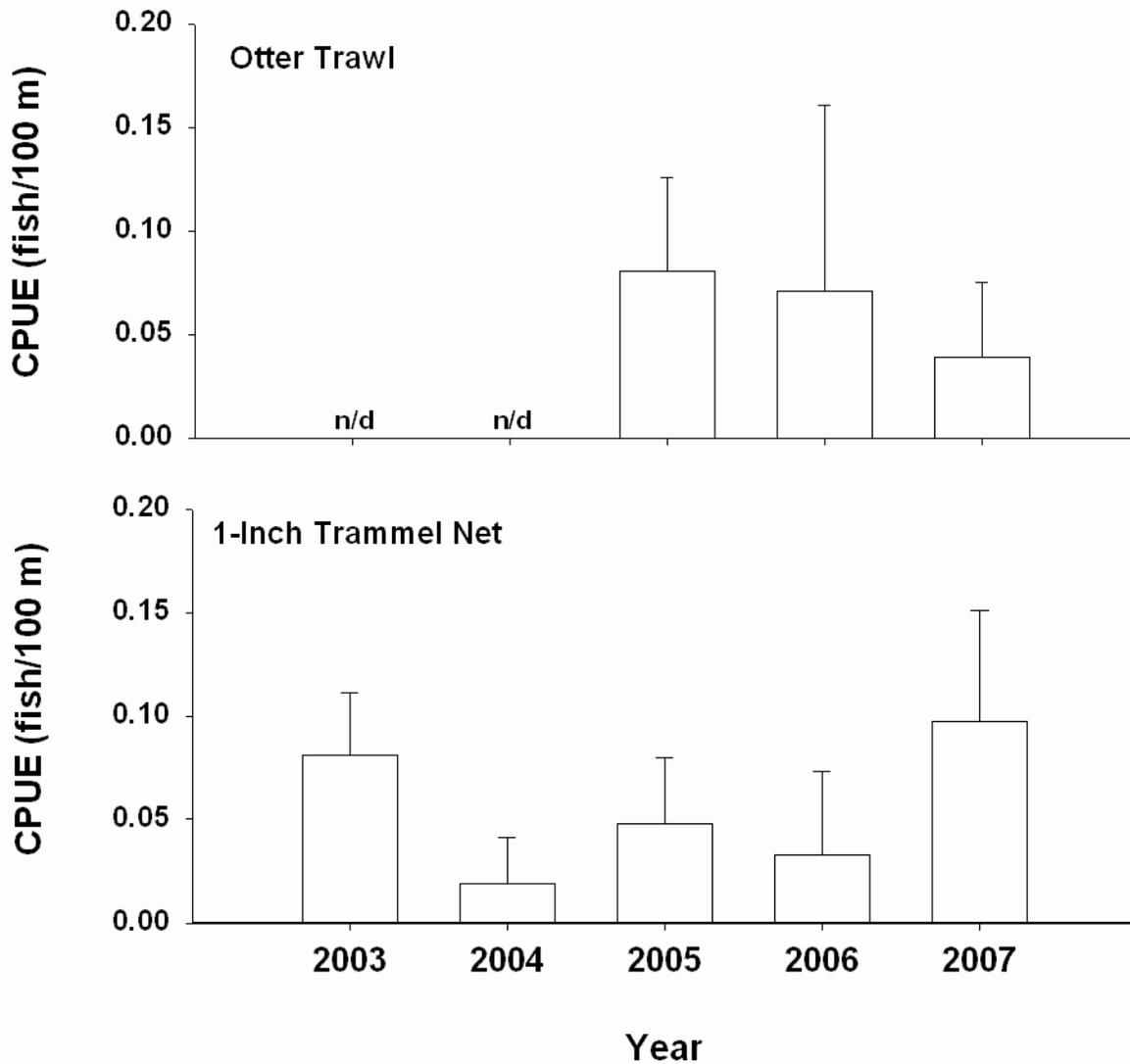


Figure 48. Mean annual catch-per-unit-effort (± 2 SE) of saugers using otter trawls and 1-inch trammel nets in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007. n/d indicates not deployed.

Segments 5 and 6 - Sauger / Fish Community Season

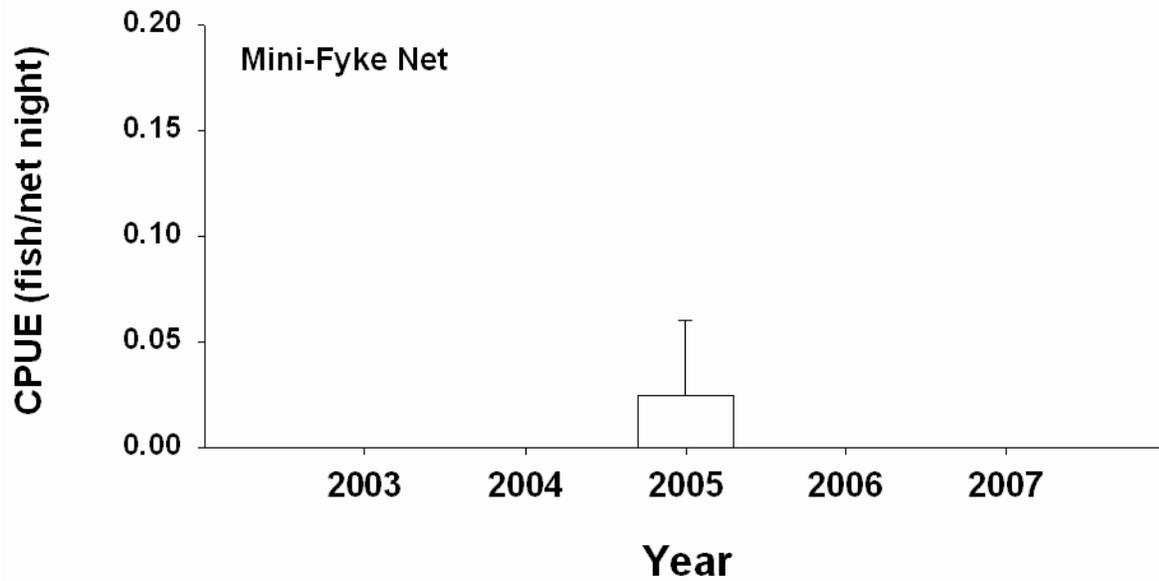


Figure 49. Mean annual catch-per-unit-effort (± 2 SE) of saugers using mini-fyke nets in segments 5 and 6 of the Missouri River during fish community season 2006 - 2007.

Table 38. Total number of saugers captured for each gear during each season and the proportion caught within each macrohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Macrohabitat ^a													
		BRAD	CHXO	CONF	DEND	DRNG	ISB	OSB	SCCL	SCCS	SCCN	TRIB	TRML	TRMS	WILD
Sturgeon Season (Fall through Spring)															
1 Inch Trammel Net	26	88 (45)	0 (14)	0	N-E	N-E	4 (17)	8 (19)	0 (4)	N-E	N-E	N-E	0	0	N-E
Gill Net	41	54 (46)	5 (15)	0 (1)	N-E	N-E	12 (17)	27 (19)	2 (3)	N-E	N-E	N-E	0	0	N-E
Otter Trawl	3	0 (42)	33 (22)	0	N-E	N-E	33 (19)	33 (15)	0 (3)	N-E	N-E	N-E	0	0	N-E
Fish Community Season (Summer)															
1 Inch Trammel Net	19	58 (40)	5 (11)	11 (1)	N-E	N-E	5 (24)	11 (17)	11 (8)	N-E	N-E	N-E	0	0	N-E
Mini-Fyke Net	0	0 (40)	0 (8)	0	N-E	N-E	0 (19)	0 (25)	0 (4)	N-E	N-E	N-E	0 (4)	0 (1)	N-E
Otter Trawl	12	100 (42)	0 (12)	0 (5)	N-E	N-E	0 (18)	0 (18)	0 (6)	N-E	N-E	N-E	0	0	N-E

^a Habitat abbreviations and definitions presented in Appendix B.

Table 39. Total number of saugers captured for each gear during each season and the proportion caught within each mesohabitat type in segments 5 and 6 of the Missouri River during 2006 – 2007. The percent of total effort for each gear in each habitat is presented in parentheses for each gear type. N-E indicates the habitat is non-existent or could not be sampled in the bends.

Gear	N	Mesohabitat ^a					
		BAR	CHNB	DTWT	ITIP	POOL	TLWG
Sturgeon Season (Fall through Spring)							
1 Inch Trammel Net	26	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Gill Net	41	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Otter Trawl	3	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Fish Community Season (Summer)							
1 Inch Trammel Net	19	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				
Mini-Fyke Net	0	0	0	N-E	N-E	N-E	N-E
	.	(100)	0				
Otter Trawl	12	0	100	N-E	N-E	N-E	N-E
	.	0	(100)				

^a Habitat abbreviations and definitions presented in Appendix B.

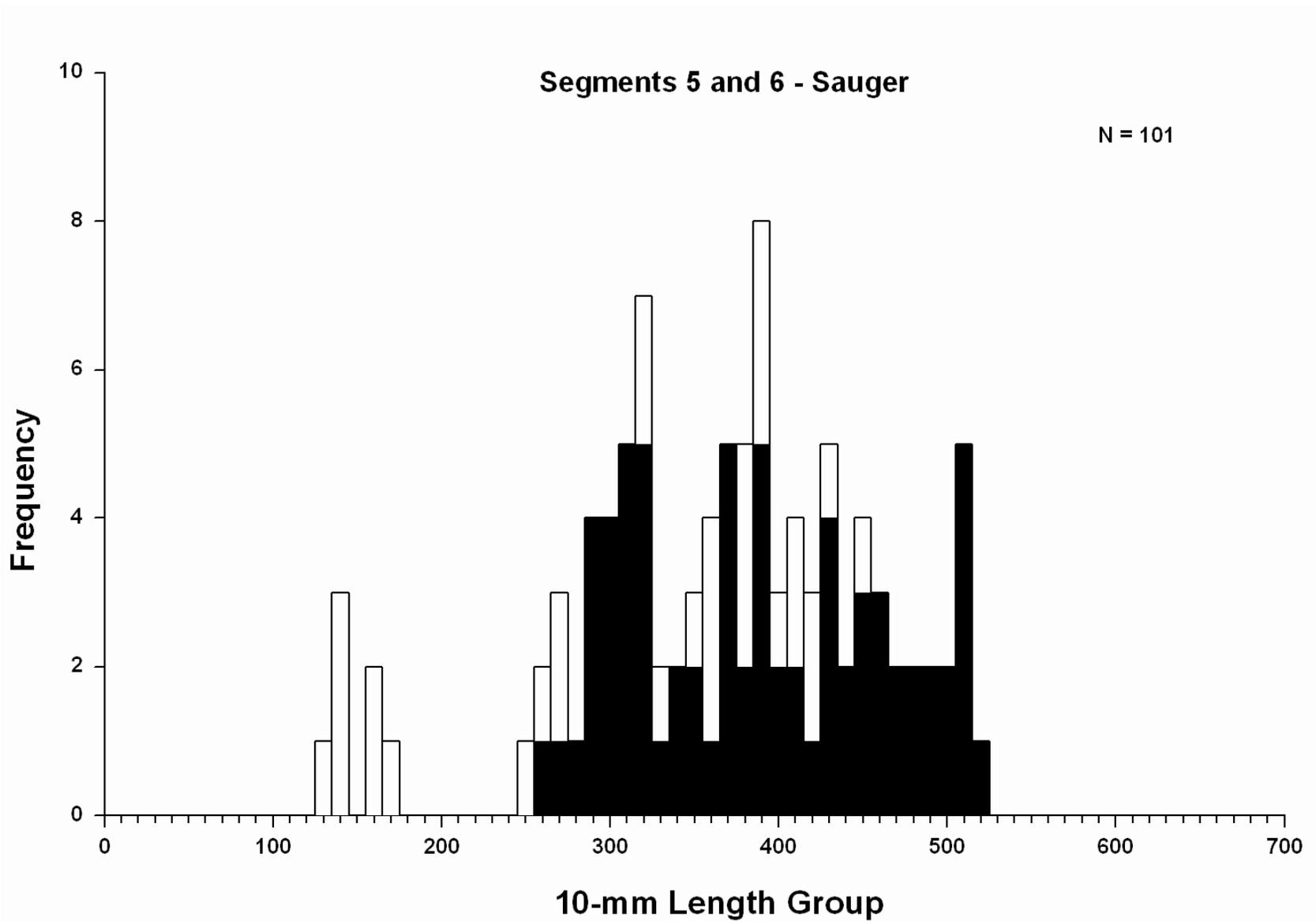


Figure 51. Length frequency of saugers during fall through spring (sturgeon season; black bars) and summer (fish community season; white bars) in segments 5 and 6 of the Missouri River during 2006 - 2007 including non-random and wild samples.

Missouri River Fish Community

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.

VI. General Missouri River fish community

A total of 5,337 fish comprised of 49 species and one hybrid (sauger x walleye) were captured in standard and evaluated gears during the 2007 sampling season in segments 5 and 6 of the Missouri River (Appendix F). A total of 251 gear deployments contained no fish: gill nets (n = 78: 29%), trammel nets (n = 72: 38%), otter trawls (n = 72: 38%), mini-fyke (n = 3: 4%), and the experimental push trawl (n = 26: 33%). We captured 9 species during the 2007 season that were not seen in the previous season: bigmouth shiner *Notropis dorsalis* (n = 4), creek chub *Semotilus atromaculatus* (n = 3), goldeye *Hiodon alosoides* (n = 3), grass pickerel *Esox americanus* (n = 1), longnose dace *Rhinichthys cataractae* (n = 1), plains minnow (n = 6), rainbow trout *Oncorhynchus mykiss* (n = 1), river shiner *N. blennioides* (n = 1), and western silvery minnow (n = 2). All species captured in 2005 and 2006 were observed in 2007. Greatest numbers of fishes were captured during the summer with mini-fyke nets (n = 2,114). These summer catches consisted mainly of small bodied cyprinids. Gears with the greatest percentage of their total catch comprised of pallid sturgeon and the nine targeted native fish species were trammel nets (43%), gill nets (39%), and otter trawl (18%). As in 2006, target species comprised 3% of the catch in mini-fyke nets in 2007. However, all sand shiners and *Hybognathus spp.* (100%) were captured with mini-fyke nets in 2007.

Of the 49 species and 1 hybrid captured, 44% had > 50 individuals collectively captured with all standard gears. These species included: shovelnose sturgeon (n = 427), pallid sturgeon (n = 107), shortnose gar *Lepisosteus platostomus* (n = 130), spotfin shiner *Cyprinella spiloptera* (n = 1539), red shiner *C. lutrensis* (n = 50), sand shiner (n = 71), spottail shiner *N. hudsonius* (n

= 108), emerald shiner *N. atherinoides* (n = 101), bluntnose minnow *Pimephales notatus*, (n = 210), common carp *Cyprinus carpio* (n = 62), silver chub *M. storeriana* (n = 70), river carpsucker *Carpionodes carpio* (n = 172), smallmouth buffalo *Ictiobus bubalus* (n = 79), shorthead redhorse *Moxostoma macrolepidotum* (n = 133), channel catfish *Ictalurus punctatus* (n = 364), bluegill *Lepomis macrochirus* (n = 208), smallmouth bass *Micropterus dolomieu* (n = 194), white crappie *Pomoxis nigromaculatus* (n = 122), freshwater drum *Aplodinotus grunniens* (n = 125), Johnny darter *Etheostoma nigrum* (n = 250), sauger (n = 101), and walleye *Sander vitreum* (n = 204). Seven species were represented in the collective catches by ≤ 2 specimens: black crappie *P. nigromaculatus*, grass pickerel, longnose dace, rainbow trout, river shiner, stonecat *Noturus flavus*, and western silvery minnow. All species represented by 50 or more fish in 2006 season catches, were represented by > 50 individuals in the cumulative 2007 season catches.

For gears targeting large fish in deep water habitats (≥ 1.2 m), channel catfish, walleye, and river carpsuckers were the three most common non-targeted species. Six species, shovelnose sturgeon, river carpsucker, shorthead redhorse, smallmouth buffalo, channel catfish, and walleye had gill net mean CPUE > 0.2 fish/net night during 2007 (Appendix H). Like 2006, during the 2007 sturgeon season channel catfish were the only species with a trammel net mean CPUE > 0.2 fish/100 m, followed closely by shovelnose sturgeon, sauger, and walleye (Appendix H). For trammel nets in the fish community season, shovelnose sturgeon, shorthead redhorse, and pallid sturgeon had a mean CPUE > 0.1 fish/100 m (Appendix H) followed closely by sauger with a CPUE of 0.097 fish/100 m. For the otter trawl during the sturgeon season, channel catfish were the only species with a mean CPUE ≥ 0.1 fish/100 m followed closely by pallid sturgeon with a mean CPUE of 0.092 fish/100 m. Silver chubs, channel catfish and freshwater drum were the most abundant species captured with the otter trawl (mean CPUE ≥ 0.1 fish/100 m) during the fish community season of 2007.

The greatest numbers of fish species were captured in shallow water habitats with mini-fyke nets (n = 42). The five most abundant species captured in mini-fyke nets were spotfin shiners (18.8 fish/net night), bluntnose minnow and bluegill (2.5 fish/net night), smallmouth bass (1.5 fish/net night), and shortnose gar (1.4 fish/net night). Additionally, the following 7 species had mean CPUE > 0.5 fish/net night with mini-fyke nets: white crappies, Johnny darters, emerald shiners, freshwater drum, spottail shiners, sand shiners, and red shiners.

Nine exotic species were captured in segments 5 and 6 during 2007 and six of these species are sport fishes that were intentionally introduced: black crappie, white crappie, bluegill, rainbow trout, smallmouth bass, and largemouth bass (Berry and Young 2004). Additional exotic species encountered in 2007 were common carp *Cyprinus carpio*, spottail shiner *Notropis hudsonius*, and rainbow smelt *Osmerus mordax*. Based on high mean CPUE in mini-fyke nets (2.5 fish/net night), bluegills were the most abundant exotic species captured in segments 5 and 6 during 2007 followed by smallmouth bass (1.5 fish/net night) and white crappie (1.4 fish/net night). None of the four exotic Asian carps, bighead carp *Hypophthalmichthys noblis*, silver carp *H. molitrix*, grass carp *Ctenopharyngodon idella*, or black carp *Mylopharyngodon piceus*, were captured or seen within segments 5 and 6 during 2007. Additionally, no zebra mussels *Dreissena polymorpha* were observed while working in segments 5 and 6 during 2007 despite the identification of larval zebra mussels (veligers) collected near the Verdel Boat Ramp in 2003 (L. Hesse, River Eco System Inc., personal communication).

The push trawl was evaluated to determine its effectiveness at capturing underrepresented fish species in the transitional areas. This transitional area, the outer edge of the bar mesohabitat in depths of 0.8 – 1.2 m, is not effectively sampled with mini-fyke nets and otter trawls due to depth limitations for both gears. The push trawl was evaluated during the fish community season with the same level of effort as the mini-fyke net and otter trawls (8 deployments/bend). The push trawl captured more species (n = 24; Appendix F7) than the otter trawl (n = 23; Appendix

F4), but less than the mini-fyke net (n = 38; Appendix F6). Total number of fish captured was highest for mini-fyke nets (n = 3,046) and the otter trawl (n = 453) followed by the push trawl (n= 394). The silver chub (n = 9) was the only species captured in the push trawl not represented in mini-fyke nets but this species was represented in the otter trawl (n = 61). The push trawl also captured a greater number of Johnny darters (n = 163) and an equal number of black crappies and yellow perch (n = 1) compared to the mini-fyke net while the otter trawl failed to capture these species. The species most often captured in the push trawl include the Johnny darter (n = 163), smallmouth bass (n = 57), spottail shiner (n = 34), and spotfin shiner (n = 29).

Discussion

Pallid sturgeon were captured in all three continuous macrohabitats and in three discrete macrohabitats (braided channels, tributary confluence, and secondary channel connected large) with the greatest numbers captured in braided channels. Braided macrohabitats were only first distinguished as a habitat type in 2004 and greater effort (5 bends) in the Niobrara River Delta of segment 6 was expended during the 2006 and 2007 season to assess use of this habitat by juvenile pallid sturgeon. Since 2004, 55% of all pallid sturgeon have been captured in the Niobrara River Delta of segment 6. All pallid sturgeon captured were within channel border mesohabitats. Pallid sturgeon captured in 2007 corresponded with habitats where fish were relocated during a telemetry study in segments 5 and 6 during 2000 – 2002 (Jordan et al. 2006). Most sonic-tagged age-3 to age-5 pallid sturgeon were relocated in the main channel (91%) with few fish found in secondary connected channels (4%).

A substantial increase (> 47%) in pallid sturgeon relative abundance was found in trammel nets, gill nets, and otter trawls during 2007. Since August 2006, 1,605 hatchery-reared pallid sturgeon were stocked into segments 5 and 6 which was an increase of total numbers of nearly 50%. Concomitant with the 50% increase in total fish stocked since 2006, relative abundance of pallid sturgeon caught in gill nets, trammel nets, and otter trawls increased 47 - 291%. Trends in relative abundance have generally mirrored stocking numbers providing further evidence that our standard gears are effectively describing changes in relative abundance of the population.

Gill nets were an effective gear for capturing pallid sturgeon and relative abundance mirrored the changes made in numbers of fish stocked into segments 5 and 6 the previous year. Stocking numbers declined 19% from 2002 – 2003 (Appendix E) and relative abundance declined 19% from 2003 – 2004 (Figure 2). From 2003 – 2004 stocking numbers again declined

(14%) and gill net CPUE also declined (26%) while during 2004 – 2005 stocking numbers increased 69% and relative abundance increased 54% from 2005 to 2006. During 2007 this trend was still evident; a 31% increase in the number of fish stocked from 2005 – 2006 coincided with a 68% increase in relative abundance from 2006 – 2007. The one year lag for changes in relative abundance in relation to stocking date may indicate that stocked yearling pallid sturgeon took one year to recruit to the gill nets. If juvenile pallid sturgeon take at least 1 year to recruit to capture in gill nets, late fall stockings would not be detected in the relative abundance measurements until the following year. Stocking lengths of pallid sturgeon recaptured with gill nets in 2007 ranged from 189 - 567 mm while recapture lengths ranged from 375 - 1437 mm. Variability (2SE) in gill net CPUE each year was high, often as large or larger than the mean, which likely precludes detecting statistically significant changes in pallid sturgeon abundance within segments 5 and 6. However, the concomitant changes in relative abundance with the previous years stocking numbers provides a good indication that gill nets used in the current random stratified sampling design can provide a useful index of population change for age-2 and greater juvenile pallid sturgeon.

Standard trammel nets captured only one more pallid sturgeon than standard otter trawls ($n = 36$) in segments 5 and 6 during 2007. Relative abundance in trammel nets increased 367% during the sturgeon season (fall through spring) in 2007 compared to 2003 to 2006 running average. Relative abundance for trammel nets during the fish community season was substantially higher in 2007 compared to the next highest year (2005: 0.099 fish/100 m) and an increased over 148% compared to the 2003 to 2006 running average. Seasonal differences were found in trammel net mean CPUE for pallid sturgeon with catches substantially higher during the summer (fish community season) compared to the fall through spring (sturgeon season) in 2003, and 2005 - 2007. Wanner et al. (2007b) also reported that from 2003 to 2005 trammel net mean

CPUE for pallid sturgeon was the highest and the coefficient of variation (CV) was the lowest during the month of August.

The 16-ft otter trawl was an effective gear for capturing pallid sturgeon in channel borders. Wanner et al. (2007b) noted that during October otter trawls had the highest mean CPUE of pallid sturgeon and the lowest CV. From 2005 - 2007 our highest CPUE for otter trawls occurred during the sturgeon season (fall – spring). Trammel nets, gill nets, and otter trawls were likely capturing the size structure of the population of pallid sturgeon in segments 5 and 6, while set lines captured longer fish (Wanner et al. 2007b).

Although pallid sturgeon were captured in almost all bends sampled during 2007 there was evidence of fish clustering within specific river miles. During 2007, 31 pallid sturgeon were captured near river miles 837 just downstream of the Bazile Creek confluence, 17 fish near river miles 849 near Ponca Creek, and an additional 12 fish near river mile 834. Clusters of age-3 to age-5 pallid sturgeon were also seen in a telemetry study in segments 5 and 6 during 2000 to 2002 (Jordan et al. 2006). Clusters of > 2 sonic-tagged pallid sturgeon within a river kilometer were observed on 20 dates from 2000 to 2002 with most aggregations found at river mile 847 (rkm 1,363) (Jordan et al. 2006). River mile 847 contains one of the deepest habitat (11 m) within segments 5 and 6 (known as the “pump hole”) and is located down river of the Ponca Creek confluence on the South Dakota side of the main channel. The pump hole is located in bend 16 of segment 5, and was randomly selected for sampling in 2005 and 2007; with multiple fish captured in 2005 (n = 2) and 2007 (n = 3). Synthesizing data for all gears deployed in the Missouri River downstream of Fort Randall Dam from 2003 – 2005 using spatial scan analysis, Spindler (2008) detected three significant clusters of pallid sturgeon presence and two significant clusters of consistent absence. One significant cluster of pallid sturgeon presence was at rkm 1,357 and the other location included two significant clusters in different braided channels within the Niobrara River Delta at rkm 1,336 (Spindler 2008).

The mean relative condition (K_n) declined for nearly all year classes (1997-1999 and 2001-2005) of stocked pallid sturgeon since release. However, the mean length increased for all year classes from time of stocking. Condition of most fish was > 1.0 at the time of stocking which may have provided excess energy reserves to better enable the transition from the hatchery to a natural environment, thereby increasing survival. The decrease in condition of hatchery-reared pallid sturgeon may reflect a lack of sufficient prey resources or a stream-lined body form may be more advantageous in the natural lotic environment and hatchery-reared fish were unnaturally fat.

Juvenile pallid sturgeon diets in Montana as percent wet weight were 90% fish (Gerrity et al. 2008), while the diets of juvenile pallid sturgeon downstream of Fort Randall Dam were 67% fish and 23% ephemeropterans (Berg, unpublished data). Spindler (2008) found the abundance of ephemeropterans and dipterans in the drift were significantly higher (1.6 – 1.8 fold) in areas where juvenile pallid sturgeon were captured compared to areas where fish were not captured.

Gill nets, trammel nets, and otter trawls were all effective at capturing shovelnose sturgeon. Gill net mean CPUE increased substantially in 2007 compared to previous years. However, trammel net and otter trawl relative abundance remained similar to previous years showing evidence of a stable population with low recruitment and high survival. Shovelnose sturgeon were individually marked with floy tags during 2006 ($n = 161$) and 2007 ($n = 411$) with all recaptures ($n = 12$) occurring in 2007. Trammel net mean CPUE was the highest during the summer fish community season for shovelnose sturgeon, corresponding with pallid sturgeon catch rates in 2003 and 2006 - 2007. The mean CPUE for otter trawls was only slightly greater during the sturgeon season (0.051 fish/100 m) compared to the fish community season (0.049 fish/100 m); a similar trend in mean CPUE between seasons was observed for pallid sturgeon.

The lack of shovelnose sturgeon within the stock length category and only one fish in the quality length category indicates no recent recruitment has occurred within segments 5 and 6 of

the Missouri River. Jordan and Willis (2001) also reported only capturing preferred length and larger shovelnose sturgeon in RPMA 3 during 1998 and 1999. Shovelnose sturgeon within the preferred and memorable length classes were in good relative condition, thus these fish should be physically capable of reproduction. Personal observations also identified female shovelnose sturgeon in later stages of egg development. The standardized gears (gill nets, otter trawl, and trammel nets) have captured smaller shovelnose sturgeon (i.e. < 249 mm FL) from the channelized and unchannelized Missouri River (Hamel and Steffensen 2007; Plauck et al. 2007; Caton et al. 2007; Steffensen and Hamel 2007; Utrup et al. 2007; Wilson et al. 2007). These catches in other segments further indicate that shovelnose sturgeon in segments 5 and 6 are failing to either spawn due lack of habitat or have poor larval and juvenile survival.

Failure to capture sturgeon chubs, sicklefin chubs, and speckled chubs with the otter trawl is likely due to lack of recruitment in segments 5 and 6. None of these three chub species have been captured in segments 5 and 6 since monitoring began in 2003. In segments 5 and 6 the otter trawl captured 70 silver chubs during 2007 with 64 and 255 silver chubs caught during 2006 and 2005, respectively. This same trawl has captured sturgeon chub, sicklefin chub, and speckled chub in segments 7 - 10, and 13 - 14 (Caton et al. 2007; Hamel and Steffensen 2007; Plauck et al. 2007; Steffensen and Hamel 2007; Stukel et al. 2007; Utrup et al. 2007). Sicklefin and sturgeon chubs were also captured with the otter trawl in segment 4 (Wilson et al. 2007) of the Missouri River in 2004. Capture of these three chubs in other segments of the Missouri River indicated that we should capture these species if present in segments 5 and 6.

Eight *Hybognathus* spp. were captured in segment 5 with mini-fyke nets in 2007 but no *Hybognathus* spp. were captured in segment 6. Prior to 2007, only one *Hybognathus* spp. was captured since sampling began in 2003. This species is likely at a very low abundance in segments 5 and 6. *Hybognathus* spp. were captured with mini-fyke and otter trawls throughout

the Missouri River during 2006 (Hamel and Steffensen 2007; Plauck et al. 2007; Steffensen and Hamel 2007; Stukel et al. 2007; Utrup et al. 2007; Wilson et al. 2007).

The first record of blue sucker recruitment in segments 5 and 6 was documented this year with the capture of a 203 mm total length fish. Prior to 2007, no small blue suckers < 600 mm TL were captured in segments 5 and 6 during 2003 – 2006. At present, blue suckers appear to be having difficulty recruiting in segments 5 and 6. Few small (< 250 mm TL) blue suckers have also been captured in the other segments of the Missouri River (Plauck et al. 2007; Steffensen and Hamel 2007; Stukel et al. 2007; Utrup et al. 2007; Wilson et al. 2007) with the exception of segment 8 during the 2006 season downstream the Big Sioux River (Hamel and Steffensen 2007). These low catch rates of small blue suckers in the channelized and unchannelized segments of the Missouri River highlight that habitats used by early life stages are poorly known or that spawning conditions have not been suitable over for the last 5 years, with the exception of high flows out of the Big Sioux River during 2006 and 2007.

Gill nets, trammel nets, and otter trawls were effective at capturing saugers in segments 5 and 6. Gill net mean CPUE has been declining since 2003 for sauger but appears to have leveled off during 2005 - 2007. Trammel net mean CPUE has consistently been higher during the sturgeon season from 2003 to 2007, while otter trawl CPUE was consistently higher during the fish community season. Additionally, gill net and otter trawl CPUE data of sauger has decreased since 2003; whereas, trammel net CPUE varied with no specific trend.

We captured nearly twice as many fish in 2007 (5,337) compared to 2006 (2,842), but only one-third the fish of 2005 (14,622) and nearly the same amount as 2004 (4,489). We can not be certain that the fluctuations in total fish captures represent an increase in fish relative abundance in segments 5 and 6 during 2007. The fish community season extended from July 1st to October 30th. Because different fish species may become more abundant during different times of the year (increase in YOY), sampling during the fish community season should be

systematically spread throughout the four month period. Klumb (2007) noted little variation in the monthly mean relative abundance of overall fish catches in mini-fyke nets within the segments 5 and 6, but peaks for individual species were observed.

The pallid sturgeon population assessment program is adaptive, allowing for changes in standard gear types and experimentation with the effectiveness of new gears (Appendix C). Since the monitoring program began in 2003 the beam trawl, small mesh otter trawl, hoop net, setline, and bag seine have been evaluated and are no longer used as standard gears due to low catch rates in comparison to current standard gears. In 2006 and 2007 a comparison of white and green mesh gill and trammel nets were evaluated to determine their effectiveness. Wanner et al. (in review) reported no significant difference in catch rates between green and white mesh gill nets and significance was noted only for 5 of 25 species in trammel nets; therefore, green and white mesh gill nets and trammel nets can be pooled for analysis. In 2007, the push trawl (POT02) was evaluated to determine its effectiveness in sampling the outer depths of the bar mesohabitat (> 0.8 m and < 1.2 m) which can not be effectively sampled with mini-fyke nets or otter trawls for small bodied fishes. Analysis for the effectiveness of the push trawl is ongoing by researchers at Kansas State University.

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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 (American Fisheries Society 1991). Asterisks and bold type denote targeted native Missouri River species.

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

Appendix A. (continued).

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

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

Habitat	Scale	Definition	Code
Braided channel	Macro	An area of the river that contains multiple smaller channels and is lacking a readily identifiable main channel (typically associated with unchannelized sections)	BRAD
Main channel cross over	Macro	The inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river, (i.e., transition zone from one-bend to the next bend). The upstream CHXO for a respective bend is the one sampled.	CHXO
Tributary confluence	Macro	Area immediately downstream, extending up to one bend in length, from a junction of a large tributary and the main river where this tributary has influence on the physical features of the main river	CONF
Dendric	Macro	An area of the river where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels (typically associated with unchannelized sections)	DEND
Deranged	Macro	An area of the river where the river transitions from a series of multiple channels into a meandering or braided channel (typically associated with unchannelized sections)	DRNG
Main channel inside bend	Macro	The convex side of a river bend	ISB
Main channel outside bend	Macro	The concave side of a river bend	OSB
Secondary channel-connected large	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, large indicates this habitat can be sampled with trammel nets and trawls based on width and/or depths > 1.2 m	SCCL
Secondary channel-connected small	Macro	A side channel, open on upstream and downstream ends, with less flow than the main channel, small indicates this habitat cannot be sampled with trammel nets and trawls based on width and/or on depths < 1.2 m	SCCS
Secondary channel-non-connected	Macro	A side channel that is blocked at one end	SCCN
Tributary	Macro	Any river or stream flowing into 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

Appendix B. (continued).

Habitat	Scale	Definition	Code
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	Immediate downstream of a 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 (std) and wild gears (type), their corresponding codes in the database, seasons deployed (sturgeon season [ST], fish community season [FC], or both), years used, and catch-per-unit-effort units for collection of Missouri River fishes in segments 5 and 6 for the long-term pallid sturgeon and associated fish community sampling program. Long-term monitoring began in 2003 for segments 5 and 6. New gears go through an evaluation period before adoption as a standard gear.

Gear	Code	Type	Season	Years	CPUE units
Trammel net – 1 inch inner mesh	TN	STD	Both	2003 - present	fish/100 m
Gill net – 4 meshes, small mesh set upstream	GN14	STD	ST	2003 - present	fish/net night
Gill net – 4 meshes, large mesh set upstream	GN41	STD	ST	2003 - present	fish/net night
Otter trawl – 16 ft head rope	OT16	STD	Both	2003 - present	fish/100 m
Otter trawl – 16 ft SKT 4mm x 4mm HB2 MOR	OT01	WILD	FC	2006 - present	fish/100 m
Beam trawl	BT	STD ^a	Both	2003-2004 STD	fish/100 m
Push Trawl – 8 ft 4mm x 4mm	POT02	Evaluation	FC	2006 - present	fish/ m
Mini-fyke net	MF	WILD	FC	2003 - present	fish/net night
Bag Seine – quarter arc method pulled upstream	BSQU	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Bag Seine – quarter arc method pulled downstream	BSQD	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Bag Seine – half arc method pulled upstream	BSHU	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Bag Seine – half arc method pulled downstream	BSHD	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Bag seine – rectangular method pulled upstream	BSRU	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Bag seine – rectangular method pulled downstream	BSRD	WILD ^b	FC	2003 – 2005 STD	fish/100 m ²
Hoopnets	HN	STD/WILD ^c	Both	2003 - 2004 STD 2005 WILD	fish/ net night
Setlines	SL	WILD	Both	2003 – 2005 WILD	fish/ hook night

^aBeam trawls were a standard gear from 2003 - 2004 and dropped as a standard gear in 2005.

^bBag seines were a standard gear from 2003 – 2005 and dropped as a standard gear in 2006.

^cHoop nets were a standard gear from 2003 – 2004 and dropped as a standard gear in 2005.

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	Mullberry Bend	MUL	Missouri	775.0
NE/IA	4	Ponca State Park	PSP	Missouri	753.0
NE/IA	4	Sioux City	SIO	Missouri	732.6
NE/IA	4	Sloan	SLN	Missouri	709.0
NE/IA	4	Decatur	DCT	Missouri	691.0
NE/IA	4	Boyer Chute	BYC	Missouri	637.4
NE/IA	4	Bellevue	BEL	Missouri	601.4
NE/IA	4	Rulo	RLO	Missouri	497.9
NE/MO/KS	4	Kansas River	KSR	Kansas	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

Appendix D. (continued).

State(s)	RPMA	Site Name	Code	River	RM
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 segments 5 and 6 of the Missouri River (RPMA 3). Fish < 230mm fork length tagged with PIT tags.

Year	Stocking Site ^a	Number Stocked	Year Class	Stock Date	Age at Stocking	Primary Mark	Secondary Mark
2000	VER	416	1997	6/6/2000	Age - 3	PIT	Elastomer / Dangler
	VER	98	1998	9/20/2000	Age - 2	PIT	
	VER	4	Adults	7/6/00	Unknown - Adult	PIT	Sonic
	VER	3	Adults	9/20/00	Unknown - Adult	PIT	2 w/ sonic
	RNW	2	Adults	7/6/00	Unknown - Adult	PIT	
2002	VER	558	2001	4/21/2002	Age - 1	PIT	Elastomer
	SUN	181	1999	4/27/2002	Age - 3	PIT	Elastomer
2003	RNW	300	2002	7/26/2003	Age - 1	PIT	Elastomer
	SUN	301	2002	7/26/2003	Age - 1	PIT	Elastomer
2004	SUN	244	2003	10/7/2004	Age - 1	PIT	Elastomer
	RNW	271	2003	10/7/2004	Age - 1	PIT	Elastomer
2005	STB	868	2004	8/30/2005	Age - 1	PIT	Elastomer
2006	RNW	1005	2005	8/25/2006	Age - 1	PIT	Elastomer
2007	STB	600	2006	5/9/2007	Age - 1	Scute removed	Elastomer

^aStocking site abbreviation presented in Appendix D.

Appendix F

Total catch, overall mean catch per unit effort [$\pm 2SE$], and mean CPUE (fish/100 m) by Mesohabitat within a Macrohabitat for all species caught with each gear type during sturgeon season and fish community season for segments 5 and 6 of the Missouri River during 2006-2007. 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.

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
BMBF	12	0.045	0	0.128	0	0.045	0.098	0
		0.038	0	0.167	0	0.091	0.128	0
BUSK*	16	0.06	0	0.026	0	0.068	0.235	0
		0.046	0	0.051	0	0.136	0.199	0
CARP	22	0.083	0.058	0.282	0	0.068	0.02	0
		0.05	0.049	0.284	0	0.077	0.039	0
CNCF	104	0.392	0.116	0.487	0	0.955	0.569	0
		0.13	0.067	0.336	0	0.486	0.393	0
FHCF	2	0.008	0.017	0	0	0	0	0
		0.011	0.023	0	0	0	0	0
FWDM	2	0.008	0.017	0	0	0	0	0
		0.011	0.023	0	0	0	0	0
GDEY	3	0.011	0	0	0	0.045	0.02	0
		0.013	0	0	0	0.064	0.039	0
GZSD	13	0.049	0	0.154	0	0.159	0	0
		0.044	0	0.138	0	0.234	0	0
LMBS	2	0.008	0.017	0	0	0	0	0
		0.011	0.023	0	0	0	0	0
NTPK	20	0.075	0.083	0.128	0	0.091	0.02	0
		0.042	0.065	0.167	0	0.088	0.039	0
PDFH	7	0.026	0.017	0.051	0	0	0.059	0
		0.02	0.023	0.072	0	0	0.067	0
PDSG*	34	0.128	0.083	0.308	0	0.091	0.137	0.143
		0.058	0.055	0.304	0	0.088	0.112	0.286
QLBK	8	0.03	0.008	0.103	0	0.023	0.039	0
		0.024	0.017	0.098	0	0.045	0.078	0
RKBS	3	0.011	0	0	0	0	0.059	0
		0.013	0	0	0	0	0.067	0
RVCS	148	0.558	0.033	0.615	0	1.477	1.059	0.143
		0.279	0.04	0.445	0	1.104	0.982	0.286

Appendix F1. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
SGER*	41	0.155	0.182	0.051	0	0.114	0.216	0.143
		0.071	0.115	0.103	0	0.149	0.197	0.286
SGWE	5	0.019	0.025	0	0	0.023	0.02	0
		0.017	0.028	0	0	0.045	0.039	0
SHRH	77	0.291	0.182	0.41	0	0.545	0.294	0
		0.082	0.1	0.252	0	0.279	0.151	0
SMBF	67	0.253	0.033	0.795	0	0.523	0.176	0
		0.131	0.033	0.67	0	0.434	0.183	0
SMBS	6	0.023	0.017	0.026	0	0.023	0.039	0
		0.018	0.023	0.051	0	0.045	0.055	0
SNGR	12	0.045	0.008	0.128	0	0.114	0.02	0
		0.032	0.017	0.131	0	0.134	0.039	0
SNSG*	324	1.223	1.215	1.897	0	0.545	1.529	0.143
		0.366	0.542	1.606	0	0.239	0.612	0.286
WLYE	143	0.54	0.636	0.744	0	0.432	0.333	0.143
		0.235	0.439	0.605	0	0.364	0.305	0.286
WTCP	2	0.008	0.017	0	0	0	0	0
		0.011	0.023	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.

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
BLGL	1	0.002	0.004	0	0	0	0	0
		0.003	0.008	0		0	0	0
BUSK*	1	0.002	0	0	0	0	0.009	0
		0.003	0	0		0	0.017	0
CARP	14	0.046	0.085	0	0.699	0.011	0.013	0.043
		0.036	0.083	0		0.023	0.026	0.087
CNCF	75	0.154	0.123	0.096	0.699	0.132	0.305	0.074
		0.061	0.06	0.092		0.143	0.246	0.105
FHCF	3	0.009	0.021	0	0	0	0	0
		0.01	0.025	0		0	0	0
FWDM	4	0.008	0.019	0	0	0	0	0
		0.008	0.018	0		0	0	0
PDFH	3	0.007	0.018	0	0	0	0	0
		0.009	0.022	0		0	0	0
PDSG*	37	0.096	0.067	0.052	0	0.073	0.068	0.432
		0.044	0.039	0.072		0.059	0.12	0.354
RKBS	2	0.004	0.009	0	0	0	0	0
		0.005	0.013	0		0	0	0
RVCS	7	0.013	0.023	0.013	0	0.008	0	0
		0.01	0.02	0.027		0.017	0	0
SGER*	45	0.118	0.212	0.017	1.399	0.02	0.065	0.079
		0.044	0.089	0.033		0.029	0.065	0.158
SGWE	6	0.014	0.03	0	0	0	0	0.024
		0.012	0.027	0		0	0	0.047
SHRH	39	0.117	0.059	0.059	0	0.183	0.183	0.195
		0.059	0.047	0.082		0.176	0.21	0.2
SMBF	7	0.015	0.031	0	0	0	0.013	0
		0.014	0.032	0		0	0.027	0
SMBS	5	0.01	0.005	0.047	0	0.009	0	0
		0.013	0.01	0.094		0.018	0	0

Appendix F2. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
SNGR	6	0.01	0.004	0.025	0	0.016	0.009	0
		0.009	0.008	0.035		0.033	0.017	0
SNSG*	76	0.168	0.247	0.057	0	0.098	0.083	0.306
		0.054	0.096	0.068		0.094	0.075	0.308
WLYE	35	0.08	0.169	0	0	0	0.023	0.082
		0.033	0.069	0		0	0.046	0.112
WTBS	5	0.014	0.033	0	0	0	0	0
		0.013	0.032	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	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
BLGL	1	0.002	0.005	0	0	0	0	0
		0.004	0.011	0	0	0	0	0
BUSK*	3	0.006	0.004	0.016	0	0	0.01	0
		0.007	0.008	0.031	0	0	0.021	0
CARP	12	0.023	0.014	0.01	0.083	0.014	0.056	0.04
		0.016	0.016	0.021	0.167	0.028	0.07	0.081
CNCF	166	0.288	0.424	0.104	2.667	0.104	0.1	0
		0.101	0.175	0.082	1.944	0.07	0.076	0
ERSN	10	0.019	0.042	0	0.083	0	0	0
		0.02	0.047	0	0.167	0	0	0
FHCF	5	0.009	0.017	0	0	0	0	0.039
		0.009	0.02	0	0	0	0	0.078
FWDM	36	0.064	0.122	0	0.333	0.02	0.01	0
		0.044	0.097	0	0.667	0.027	0.021	0
GZSD	2	0.004	0.004	0	0.083	0	0	0
		0.005	0.009	0	0.167	0	0	0
PDFH	1	0.002	0	0.01	0	0	0	0
		0.004	0	0.021	0	0	0	0
PDSG*	36	0.066	0.125	0.052	0.083	0.01	0.01	0
		0.043	0.099	0.053	0.167	0.02	0.021	0
RBST	14	0.025	0.004	0.031	0	0.078	0.021	0
		0.018	0.008	0.046	0	0.075	0.042	0
RBTT	1	0.002	0	0	0	0.01	0	0
		0.004	0	0	0	0.02	0	0
RVCS	7	0.012	0.004	0	0.333	0.01	0.01	0
		0.013	0.008	0	0.471	0.02	0.021	0
SGER*	15	0.024	0.045	0.01	0	0.011	0.01	0
		0.019	0.042	0.021	0	0.023	0.021	0
SGWE	4	0.007	0.012	0	0	0	0.01	0
		0.019	0.019	0	0	0	0.021	0

Appendix F4. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO	CONF	ISB	OSB	SCCL
			CHNB	CHNB	CHNB	CHNB	CHNB	CHNB
SHRH	14	0.025	0.021	0	0	0.02	0.062	0.042
		0.018	0.022	0	0	0.039	0.076	0.083
SMBS	10	0.017	0.004	0.02	0	0.01	0.021	0.163
		0.014	0.008	0.029	0	0.02	0.029	0.244
SNSG*	29	0.05	0.094	0	0.167	0.01	0.01	0.081
		0.03	0.066	0	0.192	0.02	0.021	0.161
STCT	1	0.002	0	0	0	0	0.01	0
		0.004	0	0	0	0	0.021	0
SVCB	61	0.108	0.193	0.01	0.167	0.049	0.055	0.083
		0.067	0.151	0.021	0.333	0.064	0.055	0.167
WLYE	20	0.035	0.05	0	0	0.02	0.01	0.208
		0.024	0.036	0	0	0.028	0.021	0.417
WTBS	5	0.009	0.005	0	0	0.039	0	0
		0.015	0.011	0	0	0.078	0	0

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

Species	Total Catch	Overall CPUE	BRAD	CHXO	ISB	OSB	SCCL	TRML	TRMS
			BAR	BAR	BAR	BAR	BAR	BAR	BAR
BKBH	3	0.038 0.056	0.062 0.125	0 0	0 0	0.05 0.1	0 0	0 0	0
BKCP	1	0.012 0.025	0.031 0.062	0 0	0 0	0 0	0 0	0 0	0
BLGL	202	2.525 1.418	1.719 0.976	10.667 15.558	1.267 1.359	3.1 2.388	0 0	0 0	2
BMSN	4	0.05 0.061	0.062 0.125	0 0	0 0	0.1 0.138	0 0	0 0	0
BNMW	202	2.525 1.503	1.719 2.08	7.667 13.747	1.933 1.907	2.8 2.382	0 0	0.667 0.667	14
CARP	14	0.175 0.099	0.312 0.209	0 0	0.133 0.182	0.05 0.1	0 0	0 0	1
CKCB	3	0.038 0.043	0.094 0.105	0 0	0 0	0 0	0 0	0 0	0
CNCF	15	0.188 0.155	0.062 0.087	0 0	0 0	0 0	0.333 0.667	3.333 0.667	2
ERSN	79	0.988 0.488	1.219 0.682	2.167 4.333	0.8 1.158	0.6 0.569	1 1.155	0 0	0
FHCF	29	0.362 0.607	0 0	0 0	0 0	0 0	0 0	9.667 14.438	0
FHMW	39	0.488 0.668	0.031 0.062	0 0	1.733 3.467	0.5 0.657	0.333 0.667	0 0	1
FWDM	77	0.962 0.739	2.344 1.75	0.167 0.333	0 0	0 0	0 0	0.333 0.667	0
GNSF	23	0.288 0.152	0.344 0.293	0.167 0.333	0.133 0.182	0.45 0.34	0 0	0 0	0
GSPK	1	0.012 0.025	0.031 0.062	0 0	0 0	0 0	0 0	0 0	0
GZSD	25	0.312 0.359	0.094 0.105	0.167 0.333	0.133 0.182	0.95 1.403	0 0	0 0	0

Appendix F6. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO	ISB	OSB	SCCL	TRML	TRMS
			BAR	BAR	BAR	BAR	BAR	BAR	BAR
JYDR	87	1.088	0.438	0.333	1.133	2.65	0	0	1
		0.526	0.2	0.422	1.152	1.725	0	0	
LMBS	27	0.338	0.531	0.167	0.067	0.35	0.333	0	0
		0.185	0.381	0.333	0.133	0.363	0.667	0	
LNDC	1	0.012	0	0	0	0.05	0	0	0
		0.025	0	0	0	0.1	0	0	
NTPK	3	0.038	0.062	0	0	0	0	0.333	0
		0.043	0.087	0	0	0	0	0.667	
OSSF	13	0.162	0.25	0.667	0	0.05	0	0	0
		0.144	0.324	0.667	0	0.1	0	0	
PNMW*	6	0.075	0	0	0.133	0.2	0	0	0
		0.059	0	0	0.182	0.184	0	0	
QLBK	1	0.012	0.031	0	0	0	0	0	0
		0.025	0.062	0	0	0	0	0	
RDSN	49	0.612	0.625	0	0.667	0.85	0	0.667	0
		0.367	0.64	0	0.929	0.785	0	1.333	
RKBS	16	0.2	0.094	0.667	0.133	0.25	0.667	0	0
		0.12	0.138	0.843	0.182	0.246	1.333	0	
RVCS	8	0.1	0.219	0	0	0	0.333	0	0
		0.116	0.28	0	0	0	0.667	0	
RVSN	1	0.012	0	0	0	0.05	0	0	0
		0.025	0	0	0	0.1	0	0	
SFSN	1510	18.875	9.688	47.167	45.267	10.85	0.333	6.667	0
		11.548	4.13	93.934	46.39	8.08	0.667	3.528	
SHRH	2	0.025	0	0	0.133	0	0	0	0
		0.035	0	0	0.182	0	0	0	
SMBF	5	0.062	0.125	0	0.067	0	0	0	0
		0.065	0.149	0	0.133	0	0	0	
SMBS	116	1.45	1.188	2	1.267	1.85	2.667	0.667	0
		0.548	0.571	2.251	1.427	1.544	1.333	1.333	

Appendix F6. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO	ISB	OSB	SCCL	TRML	TRMS
			BAR	BAR	BAR	BAR	BAR	BAR	BAR
SNGR	112	1.4	1.562	1.333	0.733	1	0.333	7.333	0
		0.652	0.911	1.116	0.533	0.632	0.667	13.679	
SNSN*	71	0.888	0	0	0.467	3.1	0.333	0.333	0
		1.006	0	0	0.802	3.88	0.667	0.667	
STSN	74	0.925	0.312	5.667	1.067	0.6	0	0	2
		0.891	0.261	11.333	1.211	0.655	0	0	
UCS	30	0.375	0.688	0	0.2	0	0	1.667	0
		0.311	0.726	0	0.289	0	0	1.764	
UCY	48	0.6	1.5	0	0	0	0	0	0
		0.914	2.27	0	0	0	0	0	
ULP	3	0.038	0	0.5	0	0	0	0	0
		0.075	0	1	0	0	0	0	
UST	1	0.012	0.031	0	0	0	0	0	0
		0.025	0.062	0	0	0	0	0	
WLYE	4	0.05	0.094	0.167	0	0	0	0	0
		0.049	0.105	0.333	0	0	0	0	
WSMW*	2	0.025	0	0	0.067	0.05	0	0	0
		0.035	0	0	0.133	0.1	0	0	
WTBS	26	0.325	0.344	0.167	0.267	0.45	0.333	0	0
		0.207	0.343	0.333	0.307	0.571	0.667	0	
WTCP	110	1.375	2.75	2.167	0.067	0.3	0	0.667	0
		1.041	2.474	2.848	0.133	0.328	0	0.667	
YWPH	3	0.038	0	0	0	0.1	0	0	1
		0.043	0	0	0	0.138	0	0	

Appendix F7. Push Trawl: overall season and segment summary. Lists CPUE (fish/100 m) and 2 standard errors on second line.

Species	Total Catch	Overall CPUE	BRAD	CHXO		CONF	ISB		OSB	SCCL	TRMS
			BAR	BAR	CHNB	BAR	BAR	CHNB	BAR	BAR	BAR
BKCP	1	0.008	0.021	0	0	0	0	0	0	0	0
		0.017	0.042	0		0	0	0	0	0	
BLGL	4	0.048	0.021	0	0	0	0.214	0	0	0	0
		0.07	0.042	0		0	0.358	0	0	0	
BNMW	8	0.11	0.104	0.556	0	0	0.089	0	0.056	0	0
		0.123	0.208	1.111		0	0.178	0	0.111	0	
CNCF	4	0.092	0.174	0.139	0	0.333	0	0	0	0	0
		0.102	0.242	0.278		0.667	0	0	0	0	
ERSN	12	0.304	0.702	0	0	0	0	0	0.122	0	0
		0.267	0.644	0		0	0	0	0.167	0	
FHMW	1	0.01	0	0.139	0	0	0	0	0	0	0
		0.021	0	0.278		0	0	0	0	0	
FWDM	6	0.214	0.536	0	0	0	0	0	0	0	0
		0.318	0.788	0		0	0	0	0	0	
GNSF	1	0.039	0.098	0	0	0	0	0	0	0	0
		0.078	0.195	0		0	0	0	0	0	
GZSD	1	0.008	0	0	0.667	0	0	0	0	0	0
		0.017	0	0		0	0	0	0	0	
JYDR	163	3.513	5.621	0.5	0	0	0.2	0	2.761	9.21	7.692
		2.247	4.632	0.638		0	0.335	0	3.687	16.183	
LMBS	12	0.148	0	0	0	0	0.089	0	0.033	1.698	1.538
		0.217	0	0		0	0.178	0	0.067	3.396	
OSSF	1	0.008	0.021	0	0	0	0	0	0	0	0
		0.017	0.042	0		0	0	0	0	0	
RDSN	1	0.017	0	0	0	0	0	0	0.089	0	0
		0.033	0	0		0	0	0	0.178	0	
RKBS	10	0.146	0.202	0	0	0	0	0	0.133	0.644	0
		0.126	0.254	0		0	0	0	0.267	0.808	
RVCS	2	0.021	0	0	0.667	0.333	0	0	0	0	0
		0.03	0	0		0.667	0	0	0	0	

Appendix F7. (continued).

Species	Total Catch	Overall CPUE	BRAD	CHXO		CONF	ISB		OSB	SCCL	TRMS
			BAR	BAR	CHNB	BAR	BAR	CHNB	BAR	BAR	BAR
SFSN	29	0.367	0.104	0	0	0	0	0	1.459	0.833	0
		0.354	0.208	0		0	0	0	1.725	1.124	
SHRH	1	0.008	0.021	0	0	0	0	0	0	0	0
		0.017	0.042	0		0	0	0	0	0	
SMBS	57	0.928	0.598	0.25	0	0	0.4	0	1.352	5.472	0
		0.76	0.554	0.319		0	0.71	0	1.302	10.943	
STSN	34	0.718	1.669	0	0	0.333	0	0	0.1	0	1.538
		0.57	1.363	0		0.667	0	0	0.145	0	
SVCB	9	0.083	0.208	0	0	0	0	0	0	0	0
		0.083	0.202	0		0	0	0	0	0	
UCS	1	0.037	0.092	0	0	0	0	0	0	0	0
		0.074	0.184	0		0	0	0	0	0	
UCY	19	0.631	1.454	0	0	0.333	0	0	0.2	0	0
		0.635	1.547	0		0.667	0	0	0.335	0	
WLYE	2	0.017	0	0.222	0	0	0	0	0	0	0
		0.033	0	0.444		0	0	0	0	0	
WTBS	2	0.019	0	0	0	0	0.067	0	0.033	0	0
		0.028	0	0		0	0.133	0	0.067	0	
WTCP	10	0.146	0.184	0.111	0	0	0.178	0	0.167	0	0
		0.028	0.368	0.222		0	0.356	0	0.333	0	
YWPH	3	0.027	0	0.139	1.333	0	0	0	0	0	0
		0.039	0	0.278		0	0	0	0	0	

Appendix G. Hatchery names, locations, and abbreviations.

Hatchery	State	Abbreviation
Blind Pony State Fish Hatchery	MO	BPY
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 2006 – 2007 for segment 5, 6 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 (fish/100 m)	Gill Net (fish/net night)	Otter Trawl (fish/100 m)	1 Inch Trammel Net (fish/100 m)	Mini-Fyke Net (fish/net night)	Otter Trawl (fish/100 m)	Push Trawl (fish/100 m)
BKBH	0.000	0.000	0.000	0.000	0.038	0.000	0.000
BKCP	0.000	0.000	0.000	0.000	0.013	0.000	0.008
BLGL	0.003	0.000	0.000	0.000	2.525	0.005	0.048
BMBF	0.000	0.045	0.000	0.000	0.000	0.000	0.000
BMSN	0.000	0.000	0.000	0.000	0.050	0.000	0.000
BNMW	0.000	0.000	0.000	0.000	2.525	0.000	0.110
BUSK*	0.003	0.060	0.003	0.000	0.000	0.009	0.000
CARP	0.060	0.083	0.016	0.035	0.175	0.030	0.000
CKCB	0.000	0.000	0.000	0.000	0.038	0.000	0.000
CNCF	0.227	0.392	0.390	0.092	0.188	0.179	0.092
ERSN	0.000	0.000	0.010	0.000	0.988	0.029	0.304
FHCF	0.019	0.008	0.017	0.000	0.363	0.000	0.000
FHMW	0.000	0.000	0.000	0.000	0.488	0.000	0.010
FWDM	0.017	0.008	0.003	0.000	0.963	0.128	0.214
GDEY	0.000	0.011	0.000	0.000	0.000	0.000	0.000
GNSF	0.000	0.000	0.000	0.000	0.288	0.000	0.039

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net (fish/100 m)	Gill Net (fish/net night)	Otter Trawl (fish/100 m)	1 Inch Trammel Net (fish/100 m)	Mini-Fyke Net (fish/net night)	Otter Trawl (fish/100 m)	Push Trawl (fish/100 m)
GSPK	0.000	0.000	0.000	0.000	0.013	0.000	0.000
GZSD	0.000	0.049	0.000	0.000	0.313	0.007	0.008
JYDR	0.000	0.000	0.000	0.000	1.088	0.000	3.513
LMBS	0.000	0.008	0.000	0.000	0.338	0.000	0.148
LNDC	0.000	0.000	0.000	0.000	0.013	0.000	0.000
NFSH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NTPK	0.000	0.075	0.000	0.000	0.038	0.000	0.000
OSSF	0.000	0.000	0.000	0.000	0.163	0.000	0.008
PDFH	0.016	0.026	0.003	0.000	0.000	0.000	0.000
PDSG*	0.073	0.128	0.092	0.116	0.000	0.039	0.000
PNMW*	0.000	0.000	0.000	0.000	0.075	0.000	0.000
QLBK	0.000	0.030	0.000	0.000	0.013	0.000	0.000
RBST	0.000	0.000	0.044	0.000	0.000	0.004	0.000
RBTT	0.000	0.000	0.000	0.000	0.000	0.004	0.000
RDSN	0.000	0.000	0.000	0.000	0.613	0.000	0.017
RKBS	0.008	0.011	0.000	0.000	0.200	0.000	0.146
RVCS	0.015	0.558	0.007	0.011	0.100	0.018	0.021

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net (fish/100 m)	Gill Net (fish/net night)	Otter Trawl (fish/100 m)	1 Inch Trammel Net (fish/100 m)	Mini-Fyke Net (fish/net night)	Otter Trawl (fish/100 m)	Push Trawl (fish/100 m)
RVSN	0.000	0.000	0.000	0.000	0.013	0.000	0.000
SFSN	0.000	0.000	0.000	0.000	18.875	0.000	0.367
SGER*	0.142	0.155	0.011	0.097	0.000	0.039	0.000
SGWE	0.024	0.019	0.000	0.006	0.000	0.014	0.000
SHRH	0.095	0.291	0.010	0.136	0.025	0.040	0.008
SMBF	0.024	0.253	0.000	0.008	0.063	0.000	0.000
SMBS	0.004	0.023	0.000	0.014	1.450	0.036	0.928
SNGR	0.003	0.045	0.000	0.015	1.400	0.000	0.000
SNSG*	0.161	1.223	0.051	0.173	0.000	0.049	0.000
SNSN*	0.000	0.000	0.000	0.000	0.888	0.000	0.000
STCT	0.000	0.000	0.003	0.000	0.000	0.000	0.000
STSN	0.000	0.000	0.000	0.000	0.925	0.000	0.718
SVCB	0.000	0.000	0.028	0.000	0.000	0.193	0.083
UCS	0.000	0.000	0.000	0.000	0.375	0.000	0.037
UCY	0.000	0.000	0.000	0.000	0.600	0.000	0.631
ULP	0.000	0.000	0.000	0.000	0.038	0.000	0.000

Appendix H. (continued).

Species Code	Sturgeon Season (Fall through Spring)			Fish Community Season (Summer)			
	1 Inch Trammel Net (fish/100 m)	Gill Net (fish/net night)	Otter Trawl (fish/100 m)	1 Inch Trammel Net (fish/100 m)	Mini-Fyke Net (fish/net night)	Otter Trawl (fish/100 m)	Push Trawl (fish/100 m)
UST	0.000	0.000	0.000	0.000	0.013	0.000	0.000
WLYE	0.104	0.540	0.003	0.059	0.050	0.069	0.017
WSMW*	0.000	0.000	0.000	0.000	0.025	0.000	0.000
WTBS	0.020	0.000	0.000	0.008	0.325	0.019	0.019
WTCP	0.000	0.008	0.000	0.000	1.375	0.000	0.146
YWPH	0.000	0.000	0.000	0.000	0.038	0.000	0.027

Appendix I. Comprehensive list of bend numbers and locations for segments 5 and 6 of the Missouri River comparing bend selection for both sturgeon season (ST) and fish community season (FCS) between years from 2003 – 2007. (W) indicates a non-random bend sampled.

Segment -Bend Number	Bend River Mile	2003	2004	2005	2006	2007
5 - 1	880					
5 - 2	878.9					
5 - 3	875.5			FC		
5 - 4	873.5		ST			
5 - 5	871.9		ST			ST
5 - 6	870.3	ST, FC	FC		ST, FC	ST, FC
5 - 7	868.5	ST, FC				
5 - 8	866				ST, FC	
5 - 9	864.4					
5 - 10	863.4	ST, FC	ST	ST		ST, FC
5 - 11	861.1	ST (W)		FC	ST, FC	ST, FC
5 - 12	853.2		ST, FC	ST,FC		
5 - 13	851.7	ST (W)	FC			
5 - 14	851				ST, FC	
5 - 15	849.1	ST, FC	ST	ST		
5 - 16	847.5	ST (W)	ST	FC	(W)	ST, FC
5 - 17	846	ST, FC	FC	ST		
6 - 1	844		ST, FC	ST	ST,FC	ST, FC
6 - 2	843.2	ST, FC	ST	ST		ST
6 - 3	842.1	ST (W)	FC			
6 - 4	841.4	ST, FC	ST,FC	ST, FC	ST, FC	
6 - 5	840	ST, FC	ST,FC	ST		
6 - 6	836.9	ST, FC	ST		ST, FC	ST, FC
6 - 7	835.3	ST (W)	ST	ST, FC	ST, FC	ST, FC
6 - 8	834.1	ST, FC		FC	ST, FC	ST, FC

Appendix I. (continued).

Segment -Bend Number	Bend River Mile	2003	2004	2005	2006	2007
6 - 9	832	ST (W)	ST,FC	FC		
6 - 10	831	ST (W)		FC		
6 - 11	829.5	ST (W)				ST, FC

* Bend river mile represents the upper most point of the bend (i.e., the top of the bend going upstream).