ANNUAL FISH POPULATION AND ANGLER USE AND SPORTFISH HARVEST SURVEYS OF LEWIS AND CLARK LAKE, SOUTH DAKOTA, 2013

South Dakota
Department of
Game, Fish and Parks
Wildlife Division
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Pierre, South Dakota 57501-3182

Annual Report
No. 15-03
PREFACE

Information collected from Lewis and Clark Lake during 2013 is summarized in this report. Copies of this report and references to the data can be made with permission from the author or the Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, South Dakota 57501-3182.

The authors would like to acknowledge the following individuals from South Dakota Game, Fish and Parks who helped with data collection, analysis, editing, and manuscript preparation: Jason Sorensen, Rachel Trible, Bradie Larson, Joel Hanson, Sam Stukel, Jason Kral, Nate Loecker and Lori Collett. The collection and analysis of data for these surveys was funded, in part, by Federal Aid in Sport Fish Restoration, (D-J) project F-21-R-46 Statewide Fish Management Surveys. Some of this data has been previously reported in segments F-21-R-36 through 45.
EXECUTIVE SUMMARY

Information presented in this report was derived from fish population surveys conducted on Lewis and Clark Lake and the Missouri River below Gavins Point Dam during 2013. Trends in fish populations are reported and compared with previous surveys. These surveys are used to determine the status of the fishery, evaluate management strategies and objectives outlined in the Missouri River Program Strategic Plan, and guide management recommendations to improve the fishery.

Channel catfish, walleye, and sauger, were the most abundant species sampled with gill nets. Walleye and sauger catch per unit effort (CPUE) in 2013 were similar to recent years at 4.3 and 3.2/gill net, respectively. Proportional size distribution of walleye was within the management objective range of 30-60. Also, PSD-P exceeded the management objective of 10. Sauger PSD was above the objective range and PSD-P exceeded the management objectives in 2013.

Channel catfish continue to be abundant during the fall gill net survey (7.0/gill net) and exceeded the CPUE objective of 3.0/gill net. Channel catfish size structure indices were near average in 2013; however CPUE of preferred length fish was lower than the management objective.

Largemouth bass CPUE fell below the management objective of 10 fish/h, while smallmouth bass CPUE continues to be well above 10 fish/h. PSD was within the management objective range of 30 to 60 for both bass species, however, the largemouth bass size structure parameter is based on low sample sizes.

Sixteen species of fish were sampled during the seining survey on Lewis and Clark Lake in 2013. Emerald shiners remained the most abundant fish caught in seines followed by Gizzard shad. Age-0 walleye were sampled at low numbers and Age-0 sauger were absent from this survey. Both species are typically collected however age-0 gill net CPUE or fall electrofishing provides a better index of recruitment. No uncommon species were sampled.
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<table>
<thead>
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<th>Full Form</th>
</tr>
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<tbody>
<tr>
<td>CI</td>
<td>confidence interval</td>
</tr>
<tr>
<td>cms</td>
<td>cubic meter per second</td>
</tr>
<tr>
<td>CPUE</td>
<td>catch per unit effort</td>
</tr>
<tr>
<td>DC</td>
<td>direct current</td>
</tr>
<tr>
<td>g</td>
<td>grams</td>
</tr>
<tr>
<td>h</td>
<td>hour</td>
</tr>
<tr>
<td>ha</td>
<td>hectares</td>
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<tr>
<td>in</td>
<td>inches</td>
</tr>
<tr>
<td>km</td>
<td>kilometers</td>
</tr>
<tr>
<td>M</td>
<td>memorable-length</td>
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<td>m</td>
<td>meters</td>
</tr>
<tr>
<td>mm</td>
<td>millimeters</td>
</tr>
<tr>
<td>min</td>
<td>minutes</td>
</tr>
<tr>
<td>N</td>
<td>sample size</td>
</tr>
<tr>
<td>P</td>
<td>preferred-length</td>
</tr>
<tr>
<td>PSD</td>
<td>proportional size distribution</td>
</tr>
<tr>
<td>Q</td>
<td>quality length</td>
</tr>
<tr>
<td>rkm</td>
<td>river kilometer</td>
</tr>
<tr>
<td>PSD-M</td>
<td>proportional size distribution for memorable-length fish</td>
</tr>
<tr>
<td>PSD-P</td>
<td>proportional size distribution for preferred-length fish</td>
</tr>
<tr>
<td>S</td>
<td>stock length</td>
</tr>
<tr>
<td>SD</td>
<td>South Dakota</td>
</tr>
<tr>
<td>spp.</td>
<td>species (multiple)</td>
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<tr>
<td>TL</td>
<td>total length</td>
</tr>
<tr>
<td>$W_r$</td>
<td>relative weight</td>
</tr>
<tr>
<td>$W_s$</td>
<td>standard weight</td>
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INTRODUCTION

Lewis and Clark Lake was formed by the construction of Gavins Point Dam, which was completed in 1955. Lewis and Clark Lake is the lowermost of four Missouri River reservoirs in South Dakota that was impounded under the authority of the Pick-Sloan Act. The main purposes of dam construction along the Missouri River were to lessen flooding in the lower basin, provide flows for navigation in the un-impounded portion of the river, provide water for municipal and irrigation use, power generation, provide habitat for fish and wildlife, and provide recreational opportunities. Recreation became the largest financial contributor to the State of South Dakota. Based on the average $79/trip estimate for resident and nonresident anglers combined (U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Bureau of the Census 2008), reservoir fisheries contribute over 39 million dollars annually to the economy of South Dakota. The four reservoirs produce over 500,000 angler days annually (Adams et al. 2009a, Adams et al. 2009b, Sorensen and Knecht 2009). In 2009, there were over 100,000 angler days from the Fort Randall Dam tailwaters to the confluence of the Missouri River and the Big Sioux River near the Nebraska, Iowa border (Bouska and Longhenry 2010). The estimated economic impact of this entire stretch was $8.14 million. The Lewis and Clark reservoir system contributed over 36,000 angler days with an estimated economic impact of $2.86 million (Bouska and Longhenry 2010). Creel surveys conducted by Nebraska in 2010 focused specifically on Lewis and Clark Lake and estimated 16,002 angler days generating an economic impact of $1.26 million.

In 2011, the upper Missouri River Basin experienced late snow-melt runoff and large precipitation events that prompted the USACE to release an unprecedented 4,530 cms through the lower four reservoirs resulting in extensive flooding in the entire basin. While many of the fisheries surveys were completed, conditions were not favorable for standardized sampling and gear efficiency was greatly reduced due to high flows, turbid water, and high amounts of debris carried downstream. The data collected from 2011, is included in this report, however, caution must be used when interpreting the data because of likely biases caused by the flood.

Sedimentation is an influential process in every reservoir system. The slowing of water flows decreases the ability to transport sediment, which then will accumulate in the upper end of the reservoir. In Lewis and Clark Lake, rapid deposition of sediment from the Niobrara River has formed what is known as the Niobrara Delta. Although this delta has decreased the storage capacity and lessened the area available for recreation, there are some positive qualities that it provides. Braided channels and backwaters provide river fishes with habitats that were previously lost when the reservoir was formed. For
example, Graeb (2006) showed a shift in sauger spawning location from below Fort Randall Dam to within the Niobrara River delta

The purpose of this report is to provide a summary of the data collected from Lewis and Clark Lake and the Missouri River downstream from Gavins Point Dam during 2013, and to provide management recommendations to enhance or conserve recreational sport fisheries contained therein.
MANAGEMENT OBJECTIVES

Reservoir-wide Objectives and Strategies

- Provide a fishery which can annually support 25,000 angler trips with a catch rate of 0.5 fish/h.

- Annually protect and enhance the quality and diversity of the fish community and aquatic habitats in Lewis and Clark Lake and the river reach upstream.

- Increase public knowledge and awareness of problems and issues affecting Lewis and Clark Lake.

- Continually maintain adequate access.

Species Specific/Lake Specific Objectives

Walleye

- Maintain three mature year classes in the population.

- Manage for a balanced population with a PSD between 30 and 60 and a PSD-P of at least 10.

- Maintain a population survey gill net catch per unit effort of at least 4.0/net-night.

- Provide a population that can sustain 25,000 angler days annually, with a harvest of 10,000 walleye at a rate of 0.1/h.

Sauger

- Maintain three mature year classes in the population.

- Manage for a balanced population with a PSD between 30 and 60 and a PSD-P of at least 10.

- Maintain a population survey gill net catch per unit effort of at least 6.0/net-night.

- Provide a population that can sustain 25,000 angler days annually, with a harvest of 5,000 sauger at a rate of 0.1/h.
Channel catfish

- Manage for a balanced population with a PSD between 30 and 60 and a PSD-P of at least 10.
- Maintain a gill net CPUE of 3.0/net night.

Largemouth and smallmouth bass

- Maintain a PSD between 30 and 60 and a PSD-P of 20 for each species.
- Maintain an electrofishing catch rate of 10/h for both species.
- Document or index population structure and function.

Sampling Objectives (Federal Aid Code 2102)

- Species composition
- Relative abundance
- Age structure
- Growth
- Condition
- Reproduction and recruitment
- Survival and mortality rates
- Population size structure
- Effects of regulations

Emphasis is given to important sport and prey species, as well as species that are threatened or endangered. Common and scientific names and abbreviations of fishes contained in this report are provided in Appendix 1.
STUDY AREA

Lewis and Clark Lake is the lowermost reservoir of the Missouri River system. Stretching 110 km from Fort Randall Dam to Gavins Point Dam, the Lewis and Clark Lake system contains reservoir, delta and riverine habitats (Figure 1). The upstream river reach (referred to as the Missouri River) is approximately 60 km and extends from Springfield, SD, upstream to Fort Randall Dam. Normal pool elevation for Lewis and Clark Lake is 368 m above mean sea level. Reservoir surface area is 12,707 ha at normal pool, with a storage capacity of 6.06 million m$^3$. Maximum depth is 13.7 m with a mean depth of 5.0 m. There is approximately 144 km of shoreline surrounding the lake when it is at normal pool elevation. The Lewis and Clark Lake watershed drains 41,440 km$^2$ with the area above Gavins Point Dam draining 682,410 km$^2$. The small size of the Lewis and Clark reservoir system makes it more sensitive to water releases by the USACOE. When releases from Gavins Point Dam reach maximum flow, all water in the reservoir can be replaced in just a few days. The timing, duration, and magnitude of releases likely impacts primary and secondary production, fish recruitment, and other ecological variables within the reservoir, though it is not fully known to what extent.

Annual fish population surveys divide the reservoir into two sections for monitoring purposes; Lewis and Clark Lake and the Missouri River. The lake section starts at Gavins Point Dam and extends upstream to the first sandbars of the Niobrara Delta (river km 1349). The Missouri River section starts at the first sandbars of the Niobrara Delta and extends upstream to Fort Randall Dam. The river section includes many diverse habitat types including free flowing river, braided channels, and backwaters, while the lake section is primarily lacustrine habitat. Fish surveys were also conducted at the Gavins Point Dam tailwaters.

Major sedimentation processes in the reservoir include shoreline erosion, littoral drift and delta encroachment. Beginning in Wyoming and running through Nebraska, the Niobrara River is the main tributary entering Lewis and Clark Lake from the southwest. Draining over 31,000 square kilometers of the Nebraska Sandhills, the Niobrara River contributes over half of the 4 million tons of sediment deposited in the lake annually.

Authorized water uses for Lewis and Clark Lake, as listed in the U.S. Army Corps of Engineers Master Plan, include flood control, navigation, hydropower, fish and wildlife, recreation, irrigation, and municipal and industrial water supply.
Figure 1. An illustration of the Missouri River from Fort Randall Dam to the South Dakota downstream border with select sampling locations in Lewis and Clark Lake.
METHODS

Fish Population Surveys

Fish populations in Lewis and Clark Lake were sampled with gill nets, shoreline seines, and daytime and nighttime electrofishing during 2013 (Table 1).

Table 1. Sampling methods, target species and effort for Lewis and Clark Lake sampling, 2013. GPDT = Gavin’s Point Dam tailwaters, FRDT = Fort Randall Dam tailwaters, Age-0 = age-0 walleye and sauger.

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<th>Gill Net</th>
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<tr>
<td>Lewis and Clark Lake</td>
<td>All</td>
<td>SMB</td>
<td>FCF</td>
<td>Age-0</td>
<td>All</td>
<td>LMB</td>
</tr>
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<tr>
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<td></td>
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<td>86 min</td>
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<tr>
<td></td>
<td>47 hauls</td>
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Lewis and Clark Lake

Experimental multifilament gill nets were used in September, 2013. Gill nets were 91.4-m in length and 1.8 m deep and consisted of 15.2-m panels of 12.7, 19.1, 25.4, 31.8, 38.1 and 50.8-mm bar mesh. Twelve nets were set overnight for a total of 12 net nights of effort. Fixed net locations were randomly chosen during the 2007 survey (Knecht et al. 2008). Total length (mm) and weight (g) were recorded for all species captured. Otoliths were collected from walleye and sauger (Tesch 1971) and pectoral spines were collected from channel catfish for age analyses (Sneed 1951, Ashley and Garling 1980).

A bag seine was used to target age-0 fishes and adult prey species in Lewis and Clark Lake in July, 2013. Seine dimensions were 30.5 m long by 2.4 m deep and composed of 6.4-mm bar measure nylon mesh with bag dimensions of 1.8 m by 1.8 m. The quarter-arc haul method was used as described by Hayes et al. (1996). Twelve seine hauls were performed at 6 sites (two hauls/site). All fish collected were identified and enumerated.

Smallmouth bass were sampled by nighttime electrofishing near Gavins Point Dam in May, 2013, with a boom-mounted electrofishing boat using pulsed DC of 185 volts, 6-8 amps and 60 pulses/second. Electrofishing effort using two dippers and one boat operator was 60 min. Effort was measured in pedal time which was defined as the amount of time the generator was creating an electric current. All smallmouth bass were measured for total length and weight and scales were collected from below the lateral line near the distal end of the pectoral fin for age analysis (DeVries and Frie 1996).

Flathead catfish were collected by electrofishing along riprap areas in Lewis and Clark Lake during consecutive weeks in June, 2013, with a boom-mounted electrofishing boat using pulsed DC of 460 volts, 2 amps and 15 pulses/second. Electrofishing effort using
two dippers and one boat operator consisted of 8 runs totaling 149 min. All flathead catfish were measured for total length and weight, and a pectoral spine was collected for age analysis (Turner 1982, DeVries and Frie 1996, Nash and Irwin 1999).

Fall night electrofishing was conducted to index age-0 walleye and sauger recruitment in the reservoir. In 2013, eight sites were sampled with a boom-mounted electrofishing boat using pulsed DC settings of 185 volts, 6-8 amps and 60 pulses/second. Electrofishing effort using two dippers and one boat operator consisted of 10 min at each site. Collected fish were identified and measured.

**Missouri River**

Shoreline seine surveys were used to target age-0 fishes and adult prey species in the Missouri River between rkm 1334 and 1344 in July, 2013. Seine dimensions were 9.1 m long by 1.2 m deep with 6.6-mm bar mesh. The quarter-arc haul method was used as described by Hayes et al. (1996). Up to five repetitious hauls were made at ten sites and number of repetitions and site were dependent on habitat availability.

Smallmouth bass were sampled by daytime electrofishing from the Gavins Point Dam tailwater area in May, 2013, with a boom-mounted electrofishing boat using pulsed DC of 185 volts, 6-8 amps and 60 pulses/second. All smallmouth bass were measured for total length, and weight, and scales were collected from below the lateral line near the distal end of the pectoral fin for age analysis (DeVries and Frie 1996).

Smallmouth bass were also collected by night electrofishing from the Fort Randall Dam tailwater area in October, 2013, with a boom-mounted electrofishing boat using pulsed DC of 185 volts, 6-8 amps and 60 pulses/second. Electrofishing effort using two dippers and one boat operator consisted of three runs totaling 60 min for each year. All smallmouth bass were measured for total length, weight, and scales were collected from below the lateral line near the distal end of the pectoral fin for age analysis (DeVries and Frie 1996).

Largemouth bass were collected by daytime electrofishing near Springfield, South Dakota in May, 2013, with a boom-mounted electrofishing boat using pulsed DC of 185 volts, 6-8 amps and 60 pulses/second. Largemouth bass were measured for total length, weight, and scales were collected from below the lateral line near the distal end of the pectoral fin for age analysis (DeVries and Frie 1996).

**Data Analysis**

Structural indices were used to describe recruitment, growth, and mortality of sport fish. Relative abundance was expressed as catch per unit effort (CPUE) for standard gill netting (fish/net night), seining (fish/seine haul), electrofishing (fish/h) and hoop netting (fish/net night). Length data were described by proportional size distribution (PSD, Table 2, Anderson 1980, Gabelhouse 1984, Guy et al 2007).
Table 2. Length categories (mm) used for calculating stock density indices for common sport fish species (Gabelhouse 1984, Quinn 1991).

<table>
<thead>
<tr>
<th>Species</th>
<th>Stock</th>
<th>Quality</th>
<th>Preferred</th>
<th>Memorable</th>
<th>Trophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walleye</td>
<td>250</td>
<td>380</td>
<td>510</td>
<td>630</td>
<td>760</td>
</tr>
<tr>
<td>Sauger</td>
<td>200</td>
<td>300</td>
<td>380</td>
<td>510</td>
<td>630</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>280</td>
<td>410</td>
<td>610</td>
<td>710</td>
<td>910</td>
</tr>
<tr>
<td>Flathead catfish</td>
<td>350</td>
<td>510</td>
<td>710</td>
<td>860</td>
<td>1020</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>200</td>
<td>300</td>
<td>380</td>
<td>510</td>
<td>630</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>180</td>
<td>280</td>
<td>350</td>
<td>430</td>
<td>510</td>
</tr>
</tbody>
</table>

Condition was assessed through relative weight ($W_r$) calculations by dividing the weight of a fish by a length-specific standard weight ($W_s$) for that species (Wege and Anderson 1978). We calculated relative weight using standard weight equations used for walleye (Murphy et al. 1990), sauger (Guy et al. 1990), smallmouth bass (Kolander et al. 1993), largemouth bass (Henson 1991), channel catfish (Brown et al. 1995), and flathead catfish (Bister et al. 2000, Appendix 2).

Age and growth information was obtained from otoliths, scales, and pectoral fin rays (DeVries and Frie 1996). Aging structures were removed from all walleye, sauger, channel catfish, flathead catfish, largemouth bass, and smallmouth bass and ages were estimated based on enumeration of annuli. Age distributions were developed for the entire sample (i.e., fish without estimated ages were assigned an age with an age-length key). Scale ages were determined by counting annuli and back-calculations made using WinFin computer software (Francis 2000). Back-calculations were used to determine mean length at age, and then compared to statewide averages or averages from other Missouri River reservoirs when available. Otoliths were removed from walleye and sauger, allowed to dry and were then cracked through the focus (DeVries and Frie 1996). One otolith from each fish was sanded with a precision rotary tool using the rotating disc sander attachment to clarify annuli and subsequently viewed under a microscope. Pectoral spines were allowed to dry, sectioned at the basal recess (channel catfish) or through the articulating process (flathead catfish) using a low speed diamond blade saw, and viewed under a microscope (Sneed 1951, Ashley and Garling 1980, Nash and Irwin 1999). Back-calculated lengths were also estimated for channel and flathead catfish aged with pectoral fin spines. Age distributions were generated with WinFin analysis using the expanded age-length summary table which uses an age-length key to provide age distributions for the entire sample of fish collected.
RESULTS AND DISCUSSION

Lewis and Clark Lake

Seines

Sixteen fish species were sampled during the Lewis and Clark seining survey in 2013. Catch per unit effort was above the long term average (Figure 2). Emerald shiner and gizzard shad were the most abundant species sampled (Table 3). Yellow perch and white bass were also moderately abundant in the samples.

Seining efficiency can vary greatly for individual species (Lyons 1986, Parsley et al. 1989). Species most vulnerable to collection by seine include those that inhabit the middle of the water column, while benthic species are less vulnerable and subsequently can be underestimated (Lyons 1986, Parsley et al. 1989). As a method of assessing age-0 and small littoral fishes, seining may underestimate species such as darters, redhorse species, and river carpsucker. Additionally, fluvial habitats can inhibit proper deployment of seining gear as can woody debris and vegetation.

Figure 2. Mean number of fish captured per seine haul from Lewis and Clark Lake, South Dakota, 1988-2013.
Table 3. Catch per unit effort (fish/seine haul) of age-0 fishes during seining surveys at Lewis and Clark Lake, South Dakota, 2009-2013. Standard error (SE) is included. *includes age-0 and adults.

<table>
<thead>
<tr>
<th>Species</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigmouth buffalo</td>
<td>--</td>
<td>--</td>
<td>0.2 (0.1)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Black crappie</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>2.9 (2.8)</td>
<td>0.7 (0.5)</td>
<td>--</td>
</tr>
<tr>
<td>Bluegill</td>
<td>1.6 (1.6)</td>
<td>0.3 (0.3)</td>
<td>1.6 (0.6)</td>
<td>3.3 (2.8)</td>
<td>0.3 (0.3)</td>
</tr>
<tr>
<td>Bluntnose minnow*</td>
<td>--</td>
<td>--</td>
<td>0.6 (0.4)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Central stoneroller*</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>0.3 (0.2)</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Common carp</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Common shiner*</td>
<td>0.3 (0.3)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Creek chub*</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Emerald shiner*</td>
<td>85.6 (47.8)</td>
<td>75.8 (46.4)</td>
<td>23.6 (10.3)</td>
<td>9.2 (8.5)</td>
<td>355.1 (352.9)</td>
</tr>
<tr>
<td>Fathead minnow*</td>
<td>--</td>
<td>1.6 (1.1)</td>
<td>0.3 (0.2)</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Flathead catfish</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
</tr>
<tr>
<td>Freshwater drum</td>
<td>1.1 (0.7)</td>
<td>0.3 (0.3)</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>3.1 (1.7)</td>
</tr>
<tr>
<td>Gizzard shad</td>
<td>1876.5 (1873.2)</td>
<td>20.3 (20.1)</td>
<td>4.4 (3.1)</td>
<td>--</td>
<td>346.8 (336.0)</td>
</tr>
<tr>
<td>Johnny darter*</td>
<td>2.3 (2.0)</td>
<td>7.9 (5.2)</td>
<td>0.5 (0.2)</td>
<td>0.6 (0.4)</td>
<td>0.7 (0.2)</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>--</td>
<td>--</td>
<td>0.5 (0.2)</td>
<td>2.0 (1.9)</td>
<td>0.6 (0.2)</td>
</tr>
<tr>
<td>N. redbelly dace*</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Red shiner*</td>
<td>1.0 (1.0)</td>
<td>--</td>
<td>0.6 (0.4)</td>
<td>0.4 (0.3)</td>
<td>--</td>
</tr>
<tr>
<td>River carpsucker</td>
<td>0.3 (0.2)</td>
<td>0.5 (0.4)</td>
<td>0.2 (0.1)</td>
<td>1.7 (0.9)</td>
<td>0.4 (0.2)</td>
</tr>
<tr>
<td>Sauger</td>
<td>0.4 (0.2)</td>
<td>--</td>
<td>0.3 (0.2)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Shorthead redhorse</td>
<td>1.0 (0.8)</td>
<td>0.3 (0.3)</td>
<td>1.8 (1.4)</td>
<td>0.5 (0.3)</td>
<td>--</td>
</tr>
<tr>
<td>Shortnose gar</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>1.0 (0.5)</td>
<td>--</td>
<td>--</td>
<td>0.5 (0.3)</td>
<td>--</td>
</tr>
<tr>
<td>Smallmouth buffalo</td>
<td>--</td>
<td>--</td>
<td>0.4 (0.3)</td>
<td>--</td>
<td>0.3 (0.1)</td>
</tr>
<tr>
<td>Spotfin shiner*</td>
<td>1.9 (1.5)</td>
<td>5.0 (4.0)</td>
<td>0.6 (0.4)</td>
<td>0.1 (0.1)</td>
<td>0.3 (0.3)</td>
</tr>
<tr>
<td>Spottail shiner*</td>
<td>0.6 (0.2)</td>
<td>1.1 (0.4)</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Walleye</td>
<td>1.5 (0.4)</td>
<td>--</td>
<td>0.9 (0.5)</td>
<td>--</td>
<td>0.2 (0.2)</td>
</tr>
<tr>
<td>White bass</td>
<td>59.6 (44.1)</td>
<td>0.8 (0.5)</td>
<td>10.4 (6.7)</td>
<td>0.3 (0.2)</td>
<td>5.4 (4.1)</td>
</tr>
<tr>
<td>White crappie</td>
<td>--</td>
<td>--</td>
<td>0.4 (0.4)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Yellow perch</td>
<td>--</td>
<td>--</td>
<td>3.0 (1.1)</td>
<td>0.8 (0.8)</td>
<td>14.5 (14.2)</td>
</tr>
</tbody>
</table>
Gill Nets

Thirteen species were captured with gill nets in 2013 (Table 4). Channel catfish were the most abundant species sampled in gill nets representing 27% of the total fish captured during the 2013 survey (Figure 3). Walleye, sauger and shorthead redhorse were also common species sampled. Most species showed an increase in abundance from 2012 to 2013 (Table 4), however freshwater drum decreased from 9.1 to 2.5. Walleye CPUE remained lower than the long term average (6.0/ net night).

Species sampled with gill nets have varied over the years. Gill net sampling shortly after the closure of Gavins Point Dam in 1955 captured nineteen species throughout the entire sampling season with seventeen species sampled during fall netting (Table 4, Shields 1957). Common carp, bigmouth buffalo and channel catfish were the most abundant species sampled in 1956 with low numbers of sauger and no walleye sampled (Table 4, Shields 1957). Blue sucker, pallid sturgeon and shovelnose sturgeon were routinely sampled in the years following Gavins Point Dam closure, however since the early 1970’s, these species have been mostly absent from gill net samples.

River species (e.g., blue sucker, sturgeon spp.) have been negatively impacted by impoundment and reservoir formation. Delta development in Lewis and Clark Lake has led to some changes in fish communities with riverine species becoming more abundant (Graeb 2006, Kaemingk 2007). As the sedimentation process proceeds, species richness and diversity could increase in delta areas.
Figure 3. Number of each species collected during the standard gill net survey on Lewis and Clark Lake, South Dakota, 2012 and 2013. Abbreviations used are defined in Appendix 1.
Table 4. Catch per unit effort (fish/net night) for gill nets in Lewis and Clark Lake, South Dakota, 2009 - 2013. Standard error (SE) is included.

<table>
<thead>
<tr>
<th>Species</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigmouth buffalo</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Black crappie</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.2 (0.2)</td>
<td>--</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>4.3 (1.2)</td>
<td>3.9 (2.2)</td>
<td>0.7 (0.2)</td>
<td>5.8 (2.1)</td>
<td>7.0 (2.1)</td>
</tr>
<tr>
<td>Common carp</td>
<td>0.7 (0.3)</td>
<td>0.3 (0.2)</td>
<td>0.1 (0.1)</td>
<td>0.2 (0.2)</td>
<td>0.7 (0.3)</td>
</tr>
<tr>
<td>Flathead catfish</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Freshwater drum</td>
<td>6.4 (1.5)</td>
<td>2.9 (1.0)</td>
<td>4.9 (1.4)</td>
<td>9.1 (2.2)</td>
<td>2.5 (0.7)</td>
</tr>
<tr>
<td>Gizzard shad</td>
<td>1.8 (0.8)</td>
<td>1.6 (1.1)</td>
<td>--</td>
<td>3.0 (1.6)</td>
<td>2.2 (1.1)</td>
</tr>
<tr>
<td>Goldeye</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>0.2 (0.1)</td>
<td>--</td>
</tr>
<tr>
<td>Northern pike</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.3 (0.1)</td>
<td>--</td>
</tr>
<tr>
<td>River carpsucker</td>
<td>0.4 (0.2)</td>
<td>1.3 (0.6)</td>
<td>0.3 (0.3)</td>
<td>1.2 (0.5)</td>
<td>1.1 (0.6)</td>
</tr>
<tr>
<td>Rock bass</td>
<td>--</td>
<td>--</td>
<td>0.3 (0.2)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Sauger</td>
<td>8.3 (1.4)</td>
<td>7.8 (2.0)</td>
<td>2.9 (0.8)</td>
<td>2.9 (0.6)</td>
<td>3.2 (0.6)</td>
</tr>
<tr>
<td>Shorthead redhorse</td>
<td>1.3 (0.5)</td>
<td>0.8 (0.3)</td>
<td>0.1 (0.1)</td>
<td>1.2 (0.7)</td>
<td>2.9 (1.3)</td>
</tr>
<tr>
<td>Shorthnose gar</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Shovelnose sturgeon</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Smallmouth buffalo</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>0.3 (0.2)</td>
<td>0.3 (0.1)</td>
</tr>
<tr>
<td>Walleye</td>
<td>10.7 (1.7)</td>
<td>7.2 (1.4)</td>
<td>3.0 (0.9)</td>
<td>4.8 (1.7)</td>
<td>4.3 (0.7)</td>
</tr>
<tr>
<td>white bass</td>
<td>0.3 (0.2)</td>
<td>0.2 (0.1)</td>
<td>--</td>
<td>0.2 (0.1)</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>White crappie</td>
<td>0.4 (0.3)</td>
<td>0.3 (0.2)</td>
<td>--</td>
<td>0.6 (0.3)</td>
<td>0.2 (0.1)</td>
</tr>
<tr>
<td>Yellow perch</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.3 (0.2)</td>
<td>1.3 (1.1)</td>
</tr>
</tbody>
</table>
Walleye population parameters

Walleye relative abundance remained low in 2013 at 4.3/net night and CPUE of harvestable (≥ 381 mm) dropped to 1.6/net night (Table 5). This decrease in relative abundance is related to low recruitment from 2009-2012. Additionally, there may have been entrainment occurring during the flood of 2011 that contributed to the reduced relative abundance.

In 2013, walleye PSD was 59 and within the desired range of 30 – 60 (Anderson and Weithman 1978). Additionally, PSD-P was 16, above the objective of 10 (Table 6).

Lewis and Clark walleye exhibit fast growth, typically attaining mean lengths in excess of 381 mm during the third growing season (Table 7, Table 8). Elevated growth rates in Lewis and Clark Lake are likely a result of warmer water temperatures and a longer growing season. Also, the diverse habitats included in the reservoir (i.e. river, backwater, delta, and lake) likely provide a wide variety of prey species such as gizzard shad, shiner spp., freshwater drum, and river carpsucker. Walleye in Lewis and Clark Lake primarily consumed river carpsucker and freshwater drum in the spring (Wickstrom 2006). During the summer months, mayfly larvae and shiner spp. were important, while gizzard shad and freshwater drum were the most common food items during autumn months. Mean relative weights for all size classes were similar to the 10-year average (Table 9).

Walleye recruitment in Lewis and Clark Lake is currently indexed with gill net CPUE of age-0 walleye. In 2013, 14 age-0 walleye were sampled (CPUE = 0.3), indicating a moderate to strong year class was produced. Fall night electrofishing was instituted in 2008 at 12 randomly selected sites in the lake portion of the reservoir to evaluate electrofishing as an alternate index of age-0 walleye abundance (Serns 1982, Serns 1983). Conversely, others have indicated utility of this sampling method could be based upon water temperatures at the time of sampling (Borkholder and Parsons 2001). Also, Hansen et al. (2004) suggested that CPUE from fall night electrofishing should only be used as a crude index of abundance. Catch per unit effort of age-0 walleye collected by night electrofishing in 2013 was 48/h. This is the second highest CPUE since 2008 and suggests moderate to strong production occurred compared with 6.5 and 2.3/hr in 2011 and 2010 respectively. Results from electrofishing are somewhat inconsistent with the age-0 gill net CPUE, therefore, after an adequate sample size is obtained, further analysis will be performed to identify the most accurate index of walleye recruitment.
Figure 4. Length frequency of walleye collected during the standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.
Table 5. Mean gill net catch per unit effort (fish/net night) for sauger and walleye, 381 mm and longer collected in standard gill net surveys, Lewis and Clark Lake, 2004-2013. Standard error (SE) is included in parenthesis.

<table>
<thead>
<tr>
<th>Year</th>
<th>sauger</th>
<th>walleye</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>2.3 (0.6)</td>
<td>2.0 (0.7)</td>
</tr>
<tr>
<td>2005</td>
<td>3.1 (1.0)</td>
<td>6.2 (1.9)</td>
</tr>
<tr>
<td>2006</td>
<td>2.0 (0.4)</td>
<td>3.0 (0.3)</td>
</tr>
<tr>
<td>2007</td>
<td>2.7 (0.7)</td>
<td>4.6 (1.2)</td>
</tr>
<tr>
<td>2008</td>
<td>3.8 (1.4)</td>
<td>7.6 (1.8)</td>
</tr>
<tr>
<td>2009</td>
<td>2.4 (1.0)</td>
<td>5.3 (1.0)</td>
</tr>
<tr>
<td>2010</td>
<td>2.0 (0.5)</td>
<td>2.5 (0.8)</td>
</tr>
<tr>
<td>2011</td>
<td>1.3 (0.5)</td>
<td>1.6 (0.4)</td>
</tr>
<tr>
<td>2012</td>
<td>1.3 (0.3)</td>
<td>3.5 (1.4)</td>
</tr>
<tr>
<td>2013</td>
<td>1.3 (0.4)</td>
<td>1.6 (0.4)</td>
</tr>
</tbody>
</table>

Table 6. Walleye proportional size distribution (PSD), proportional size distribution of preferred and memorable-length fish (PSD-P and PSD-M), and sample size (N) collected in standard gill net surveys, Lewis and Clark Lake, South Dakota, 2004-2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>58</td>
<td>2</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>2005</td>
<td>88</td>
<td>7</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>2006</td>
<td>72</td>
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<td>59</td>
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<tr>
<td>2007</td>
<td>79</td>
<td>17</td>
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<td>108</td>
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<td>2008</td>
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<td>54</td>
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<td>128</td>
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<td>2010</td>
<td>38</td>
<td>6</td>
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<td>86</td>
</tr>
<tr>
<td>2011</td>
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<td>59</td>
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<td>0</td>
<td>51</td>
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</table>
Table 7. Mean length at age of capture, as determined by age estimation from otolith analysis, for walleye collected in the standard September gill net survey 2006-2013, Lewis and Clark Lake, South Dakota. Sample size (N) and standard error (SE) are also presented.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
<th>Length at age of capture (mm)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
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<td>Mean</td>
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<td>N</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>3.3</td>
</tr>
<tr>
<td>2008</td>
<td>Mean</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>25</td>
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<td>SE</td>
<td>5.7</td>
</tr>
<tr>
<td>2009</td>
<td>Mean</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>4.4</td>
</tr>
<tr>
<td>2010</td>
<td>Mean</td>
<td>139</td>
</tr>
<tr>
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<td>N</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>8.8</td>
</tr>
<tr>
<td>2011</td>
<td>Mean</td>
<td>159</td>
</tr>
<tr>
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<tr>
<td></td>
<td>SE</td>
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<td>Mean</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td>N</td>
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<tr>
<td></td>
<td>SE</td>
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</tr>
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<td>Mean</td>
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</tr>
<tr>
<td></td>
<td>N</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>2.7</td>
</tr>
<tr>
<td>Mean of means</td>
<td>155</td>
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Table 8. Mean annual growth increments for walleye collected in the standard September gill net survey, Lewis and Clark Lake, South Dakota, for 2007-2013.

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<th>Growth increment added during period (mm)</th>
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<th>2-3</th>
<th>3-4</th>
<th>4-5</th>
<th>5-6</th>
<th>6-7</th>
<th>7-8</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>74</td>
<td>21</td>
<td>21</td>
<td>-24</td>
<td>-8</td>
<td>15</td>
</tr>
<tr>
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<td>107</td>
<td>64</td>
<td>-10</td>
<td>22</td>
<td>6</td>
<td>-21</td>
<td>54</td>
<td>--</td>
</tr>
<tr>
<td>2009-2010</td>
<td></td>
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<td>75</td>
<td>21</td>
<td>36</td>
<td>23</td>
<td>-32</td>
<td>6</td>
<td>-5</td>
</tr>
<tr>
<td>2011-2011</td>
<td></td>
<td>--</td>
<td>81</td>
<td>52</td>
<td>40</td>
<td>43</td>
<td>-25</td>
<td>--</td>
<td>113</td>
</tr>
<tr>
<td>2011-2012</td>
<td></td>
<td>141</td>
<td>--</td>
<td>75</td>
<td>48</td>
<td>-3</td>
<td>-50</td>
<td>-39</td>
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</tr>
<tr>
<td>2012-2013</td>
<td></td>
<td>138</td>
<td>81</td>
<td>96</td>
<td>22</td>
<td>7</td>
<td>65</td>
<td>31</td>
<td>--</td>
</tr>
<tr>
<td>Mean</td>
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<td>51</td>
<td>32</td>
<td>16</td>
<td>-14.5</td>
<td>8.8</td>
<td>41</td>
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</tbody>
</table>

Table 9. Mean relative weight ($Wr$) by length category of walleye, collected during the standard September gill net surveys on Lewis and Clark Lake, South Dakota, 2004-2013. Sample size (N) and standard error (SE) are also presented.

<table>
<thead>
<tr>
<th>Year</th>
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<th>Preferred-memorable</th>
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<td>N</td>
<td>$Wr$ (SE)</td>
</tr>
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<td>81 (0.9)</td>
<td>20</td>
<td>80 (0.6)</td>
</tr>
<tr>
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<td>81 (1.8)</td>
<td>10</td>
<td>83 (0.2)</td>
</tr>
<tr>
<td>2006</td>
<td>87 (1.5)</td>
<td>16</td>
<td>83 (0.4)</td>
</tr>
<tr>
<td>2007</td>
<td>89 (1.3)</td>
<td>15</td>
<td>91 (0.5)</td>
</tr>
<tr>
<td>2008</td>
<td>91 (0.3)</td>
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<td>2009</td>
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<td>82 (1.4)</td>
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<td>80 (1.3)</td>
</tr>
<tr>
<td>2012</td>
<td>83 (0.9)</td>
<td>9</td>
<td>84 (0.5)</td>
</tr>
<tr>
<td>2013</td>
<td>85 (1.3)</td>
<td>15</td>
<td>86 (0.8)</td>
</tr>
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</table>
Table 10. Age distribution of walleye collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2013, as determined from scales (2004 – 2005) and otoliths (2006 – 2013). Mean age excludes age-0 fish.

<table>
<thead>
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<th>3</th>
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<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>Mean</th>
</tr>
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<tbody>
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<td>7</td>
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<td>13</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
</tr>
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<td>2005</td>
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<td>6</td>
<td>15</td>
<td>28</td>
<td>23</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>2006</td>
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<td>10</td>
<td>14</td>
<td>14</td>
<td>9</td>
<td>6</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.0</td>
</tr>
<tr>
<td>2007</td>
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<td>14</td>
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<td>17</td>
<td>9</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>2008</td>
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<td>51</td>
<td>23</td>
<td>37</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>44</td>
<td>53</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2.5</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>16</td>
<td>40</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<td>2.5</td>
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<td>2011</td>
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<td>7</td>
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<td>9</td>
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<td>1</td>
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<td>13</td>
<td>18</td>
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<td>1</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>2013</td>
<td>14</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Sauger population parameters

Sauger are an important component of the Lewis and Clark Lake fishery and are commonly sampled at higher abundance than walleye. In 2013, 38 sauger were sampled during the gill net survey with a CPUE of 3.2 fish/net night (Table 4). Mean gill net CPUE for sauger 381 mm (15 in) and longer has decreased each year since 2008 to 1.3 fish/net night in 2011 and has remained 1.3 fish/net night through 2013 (Table 5).

Sauger size structure remains good (PSD=69, and PSD-P (50), however this is based on a low sample size (Table 11). While a standard accepted stock density index range is not readily available for sauger, the generally accepted range for walleye is 30-60.

Sauger tend to grow slower than walleye (Malison et al. 1990); however, growth of Lewis and Clark Lake sauger are typically similar to walleye growth rates (Table 7, Table 12). Sauger growth in 2013 was slower than the five year average with sauger attaining the minimum size limit (381 mm) in the fourth growing season (Table 13).

Sauger relative weights for Lewis and Clark Lake are generally between 77 and 85 (Table 14). In 2013, sauger relative weights were on the low side of the normal range for all size classes. Wickstrom (2006) suggested that diet overlap with walleye combined with insufficient quantity and/or quality of prey items could be a possible explanation for moderate relative weights of sauger in Lewis and Clark Lake during most years.
Similar to walleye, sauger recruitment is indexed with age-0 CPUE from the September gill net survey. In 2013, age-0 CPUE was 5.0/ net night, indicating low production (Table 15). Additionally, fall night electrofishing indicated low sauger production in 2013. Mean age of sauger (3.2 years) remains similar to previous years. Similar to walleye, the 2012 year class was the most prevalent age classes in the 2013 gill nets survey.

Many sauger populations have experienced declines during the last several decades leading to listing as a ‘species of concern’ in some areas (McMahon and Gardner 2001, Pegg et al. 1996). The sauger population in Lewis and Clark Lake appears to be relatively stable similar to other Missouri River Reservoirs. Niobrara River delta habitat is expanding annually, increasing the amount of habitat resembling the pre-dam Missouri River with increases in channel braiding, backwater area and turbidity. This expanding habitat should help enhance the current sauger population in Lewis and Clark Lake. However, the loss of pure sauger from this stretch of Missouri River due to high levels of hybridization with walleye (Graeb 2006) could greatly impact this sauger fishery.

Table 11. Sauger proportional size distribution (PSD) and proportional size distribution for preferred and memorable-length fish (PSD-P and PSD-M) collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>N</th>
</tr>
</thead>
<tbody>
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<td>2004</td>
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<td>63</td>
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</tr>
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<td>2006</td>
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<td>51</td>
<td>3</td>
<td>59</td>
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<td>69</td>
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Table 12. Mean length at age of capture, as determined by ages estimated from otolith analysis, for sauger collected in the standard September gill net survey 2008-2013, Lewis and Clark Lake, South Dakota. Sample size (N) and standard error (SE) are also presented.

<table>
<thead>
<tr>
<th>Year</th>
<th>Length at age of capture (mm)</th>
<th>0</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>11</th>
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<tbody>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
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<td>12</td>
<td>12</td>
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<td>2</td>
<td>3</td>
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<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td>12.7</td>
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<td>--</td>
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</tr>
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</tr>
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<tr>
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<td>Mean</td>
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<td>411</td>
<td>440</td>
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<tr>
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<td>29.1</td>
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<td>10.6</td>
<td>20.1</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Mean of means</td>
<td></td>
<td>157</td>
<td>298</td>
<td>369</td>
<td>417</td>
<td>441</td>
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<td>466</td>
<td>490</td>
<td>--</td>
<td>--</td>
<td>466</td>
</tr>
</tbody>
</table>
Figure 5. Length frequency of sauger collected during the standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>Growth increment added during period (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-1</td>
</tr>
<tr>
<td>2007-2008</td>
<td>138</td>
</tr>
<tr>
<td>2008-2009</td>
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</tr>
<tr>
<td>2012-2013</td>
<td>30</td>
</tr>
<tr>
<td>Mean</td>
<td>111</td>
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</table>

Table 14. Mean relative weight of sauger, by length categories, collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
<tr>
<th>Year</th>
<th>Stock-quality</th>
<th>Quality-preferred</th>
<th>Preferred-memorable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wr (SE)</td>
<td>N</td>
<td>Wr (SE)</td>
</tr>
<tr>
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<td>78 (0.6)</td>
<td>7</td>
<td>77 (0.5)</td>
</tr>
<tr>
<td>2005</td>
<td>78 (0.0)</td>
<td>2</td>
<td>81 (0.8)</td>
</tr>
<tr>
<td>2006</td>
<td>82 (--)</td>
<td>1</td>
<td>80 (0.5)</td>
</tr>
<tr>
<td>2007</td>
<td>83 (0.6)</td>
<td>18</td>
<td>84 (2.0)</td>
</tr>
<tr>
<td>2008</td>
<td>85 (1.3)</td>
<td>6</td>
<td>85 (0.6)</td>
</tr>
<tr>
<td>2009</td>
<td>80 (0.4)</td>
<td>32</td>
<td>82 (0.8)</td>
</tr>
<tr>
<td>2010</td>
<td>79 (0.7)</td>
<td>17</td>
<td>77 (0.3)</td>
</tr>
<tr>
<td>2011</td>
<td>75 (0.8)</td>
<td>13</td>
<td>77 (0.4)</td>
</tr>
<tr>
<td>2012</td>
<td>69 (-)</td>
<td>1</td>
<td>80 (1.4)</td>
</tr>
<tr>
<td>2013</td>
<td>78 (1.0)</td>
<td>10</td>
<td>73 (3.5)</td>
</tr>
</tbody>
</table>
Table 15. Age distribution of sauger collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2012. Scales (2004-2005) and otoliths (2006-2013) were used to estimate ages. Mean age excludes age-0 fish.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
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<td>7</td>
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<td>28</td>
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<tr>
<td>2005</td>
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<td>15</td>
<td>26</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>2007</td>
<td>33</td>
<td>8</td>
<td>17</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.4</td>
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<tr>
<td>2008</td>
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<td>41</td>
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<td>12</td>
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<td>3</td>
<td>0</td>
<td>0</td>
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<td>2.4</td>
</tr>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2.0</td>
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<td>19</td>
<td>49</td>
<td>19</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>2011</td>
<td>3</td>
<td>0</td>
<td>7</td>
<td>16</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.3</td>
</tr>
<tr>
<td>2012</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>13</td>
<td>2</td>
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<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Channel catfish population parameters

A total of 84 channel catfish were sampled ranging from 220-780 mm in total length. Mean gill net CPUE for channel catfish increased to 7 fish/net-night in 2013 (Table 4). Size structure of sampled fish was near the long term average in 2013 (Figure 6, Table 16) with PSD = 43, PSD-P=4, and PSD-M = 2. Channel catfish in Lewis and Clark Lake exhibit fast growth compared with the other South Dakota Missouri River Reservoirs. Lewis and Clark channel catfish typically reach 400 mm during their 5th growing season, while Lake Francis Case and Lake Oahe channel catfish reach 400 mm during their 7th and 8th growing seasons, respectively (Bouska et al. 2011). In 2013, mean $Wr$ for all length categories was within or above the normal ranges (Table 17).

Channel catfish recruitment is relatively stable in Lewis and Clark Lake. On average, it takes 3-4 years for each year class to recruit to the gill nets. Analysis of the age distribution reveals that most year classes beyond 2 or 3 are present during most years, indicating stable recruitment patterns (Table 18, Table 19).
Table 16. Channel catfish proportional size distribution (PSD) and proportional size distribution for preferred and memorable length fish (PSD-P and PSD-M), collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2013.

<table>
<thead>
<tr>
<th>Year</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>52</td>
<td>0</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>2005</td>
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<td>84</td>
</tr>
<tr>
<td>2006</td>
<td>85</td>
<td>46</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td>2007</td>
<td>66</td>
<td>16</td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>2008</td>
<td>29</td>
<td>8</td>
<td>3</td>
<td>66</td>
</tr>
<tr>
<td>2009</td>
<td>58</td>
<td>20</td>
<td>10</td>
<td>52</td>
</tr>
<tr>
<td>2010</td>
<td>52</td>
<td>11</td>
<td>9</td>
<td>47</td>
</tr>
<tr>
<td>2011</td>
<td>83</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>2012</td>
<td>67</td>
<td>12</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>2013</td>
<td>43</td>
<td>4</td>
<td>2</td>
<td>84</td>
</tr>
</tbody>
</table>

Table 17. Relative weight of channel catfish, by incremental stock density indices, collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
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<th>Year</th>
<th>Stock-quality</th>
<th>Quality-preferred</th>
<th>Preferred-memorable</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>$W_r$ (SE)</td>
<td>N</td>
<td>$W_r$ (SE)</td>
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<tr>
<td>2004</td>
<td>90 (1.8)</td>
<td>13</td>
<td>84 (1.7)</td>
</tr>
<tr>
<td>2005</td>
<td>79 (1.3)</td>
<td>29</td>
<td>86 (0.8)</td>
</tr>
<tr>
<td>2006</td>
<td>87 (0.8)</td>
<td>4</td>
<td>94 (2.0)</td>
</tr>
<tr>
<td>2007</td>
<td>86 (0.4)</td>
<td>30</td>
<td>87 (0.7)</td>
</tr>
<tr>
<td>2008</td>
<td>87 (0.7)</td>
<td>42</td>
<td>86 (1.4)</td>
</tr>
<tr>
<td>2009</td>
<td>91 (1.5)</td>
<td>17</td>
<td>94 (1.0)</td>
</tr>
<tr>
<td>2010</td>
<td>85 (1.0)</td>
<td>21</td>
<td>92 (4.4)</td>
</tr>
<tr>
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<td>86 (--)</td>
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<td>2012</td>
<td>78 (0.8)</td>
<td>16</td>
<td>80 (0.9)</td>
</tr>
<tr>
<td>2013</td>
<td>87 (0.7)</td>
<td>47</td>
<td>85 (1.0)</td>
</tr>
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</table>
Figure 6. Length frequency for channel catfish collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.
Table 18. Age distribution of channel catfish collected in standard gill-net surveys from Lewis and Clark Lake, South Dakota, 2003-2012. Mean age excludes age-0 fish. No age analysis was conducted in 2013.

| Year | Age | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Mean |
|------|-----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-----|
| 2003 |     | 0 | 1 | 9 | 0 | 4 | 3 | 1 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 6.5 |
| 2005 |     | 0 | 0 | 7 | 10 | 13 | 23 | 5 | 5 | 8 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 5.6 |
| 2006 |     | 0 | 0 | 3 | 2 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 4 | 2 | 1 | 1 | 0 | 0 | 0 | 7.6 |
| 2007 |     | 1 | 3 | 18 | 13 | 9 | 10 | 8 | 5 | 4 | 9 | 3 | 6 | 2 | 0 | 0 | 0 | 1 | 0 | 5.3 |
| 2008 |     | 0 | 2 | 13 | 32 | 7 | 2 | 2 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 4.0 |
| 2010 |     | 0 | 1 | 4 | 17 | 5 | 11 | 3 | 0 | 0 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 4.8 |
| 2012 |     | 0 | 8 | 16 | 16 | 10 | 8 | 5 | 1 | 1 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3.8 |

Table 19. Mean back-calculated total lengths (mm) for each age class of channel catfish sampled during the standard September gill net survey in Lewis and Clark Lake, South Dakota, 2012. No age analysis was conducted in 2013.

<table>
<thead>
<tr>
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<th>Age</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
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<td>8</td>
<td>103</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
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<td>16</td>
<td>92</td>
<td>200</td>
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</tr>
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</tr>
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<td>327</td>
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<td>460</td>
<td>509</td>
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<td>105</td>
<td>149</td>
<td>239</td>
<td>344</td>
<td>418</td>
<td>463</td>
<td>508</td>
<td>538</td>
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<td>582</td>
<td>627</td>
<td>642</td>
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<td>393</td>
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<td>422</td>
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<td>451</td>
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<td>480</td>
<td>495</td>
<td>509</td>
</tr>
</tbody>
</table>

Sample mean (mm) 109 208 300 374 422 467 502 523 523 546 554 554 569 509
Standard error 4 9 10 13 13 16 21 30 36 40 73 74 0
Length increment 100 92 74 47 45 35 22 0 23 7 15 -59
**Electrofishing**

**Smallmouth bass population parameters**

Smallmouth bass CPUE has been highly variable during the past ten years in Lewis and Clark Lake, ranging from 25/h in 2003 and 2012 to a high of 112/h in 2010 (Table 20). Smallmouth bass size structure is known to be underestimated when electrofishing (Beamesderfer and Rieman 1988, Milewski and Willis 1991). The percentage of smallmouth bass sampled near Gavins Point Dam above quality length is often low, while creel survey results indicate larger smallmouth bass are regularly caught and released. For example, creel survey results indicated that over 75% of the smallmouth bass harvested in 2009 were above quality length and trophy-class fish (≥ 510 mm) were also harvested (Bouska and Longhenry 2010).

Growth appears to be higher than the state average; however this is based on a sample with few individuals from older year classes (Table 21, Table 22). Relative weight of stock-quality and preferred-memorable smallmouth bass was above average, while $W_r$ of quality-preferred smallmouth bass was near the 10 y average (Table 20).

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE (fish/h)</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>S-Q</th>
<th>Q-P</th>
<th>P-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>44 (11.1)</td>
<td>38</td>
<td>10</td>
<td>0</td>
<td>91 (0.6)</td>
<td>87 (1.2)</td>
<td>86 (2.6)</td>
</tr>
<tr>
<td>2005</td>
<td>51 (22.7)</td>
<td>37</td>
<td>5</td>
<td>2</td>
<td>94 (1.3)</td>
<td>83 (1.6)</td>
<td>75 (--)</td>
</tr>
<tr>
<td>2006</td>
<td>62 (3.6)</td>
<td>19</td>
<td>6</td>
<td>0</td>
<td>89 (0.5)</td>
<td>91 (3.1)</td>
<td>82 (2.7)</td>
</tr>
<tr>
<td>2007</td>
<td>41 (12.8)</td>
<td>20</td>
<td>13</td>
<td>0</td>
<td>90 (1.0)</td>
<td>82 (2.4)</td>
<td>74 (0.9)</td>
</tr>
<tr>
<td>2008</td>
<td>79 (55)</td>
<td>17</td>
<td>8</td>
<td>2</td>
<td>88 (0.3)</td>
<td>93 (0.9)</td>
<td>81 (14.4)</td>
</tr>
<tr>
<td>2009</td>
<td>43 (3.9)</td>
<td>39</td>
<td>19</td>
<td>3</td>
<td>97 (1.5)</td>
<td>86 (7.1)</td>
<td>91 (1.6)</td>
</tr>
<tr>
<td>2010</td>
<td>112 (19.1)</td>
<td>13</td>
<td>3</td>
<td>0</td>
<td>89 (0.4)</td>
<td>83 (2.1)</td>
<td>75 (0.9)</td>
</tr>
<tr>
<td>2011</td>
<td>72 (19.9)</td>
<td>18</td>
<td>4</td>
<td>0</td>
<td>92 (0.7)</td>
<td>86 (0.5)</td>
<td>90 (2.1)</td>
</tr>
<tr>
<td>2012</td>
<td>25 (3.6)</td>
<td>23</td>
<td>3</td>
<td>0</td>
<td>97 (1.0)</td>
<td>85 (0.6)</td>
<td>93 (2.6)</td>
</tr>
<tr>
<td>2013</td>
<td>108 (41.6)</td>
<td>30</td>
<td>3</td>
<td>2</td>
<td>94 (0.4)</td>
<td>92 (0.6)</td>
<td>87 (--)</td>
</tr>
</tbody>
</table>
Table 21. Mean back-calculated total lengths (mm) for each age class of smallmouth bass sampled by electrofishing near Gavins Point Dam in Lewis and Clark Lake, South Dakota, May 2013.

<table>
<thead>
<tr>
<th>Year class</th>
<th>Age</th>
<th>N</th>
<th>Annulus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1  2  3  4  5  6  7  8</td>
</tr>
<tr>
<td>2012</td>
<td>1</td>
<td>13</td>
<td>131</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td>42</td>
<td>86  204</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>34</td>
<td>90  174 269</td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>15</td>
<td>86  168 235 290</td>
</tr>
<tr>
<td>2008</td>
<td>5</td>
<td>2</td>
<td>101 152 253 327 359</td>
</tr>
<tr>
<td>2006</td>
<td>7</td>
<td>1</td>
<td>91  199 268 327 344 416 465</td>
</tr>
<tr>
<td>2005</td>
<td>8</td>
<td>1</td>
<td>114 247 323 408 432 465 486 500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sample mean 100 191 270 338 378 440 476 500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standard error 6 14 15 25 27 24 11 --</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length increment 91 79 68 40 62 35 24--</td>
</tr>
</tbody>
</table>

Table 22. Age distribution of smallmouth bass collected by electrofishing Lewis and Clark Lake near Gavins Point Dam, 2004-2013, as determined from scales.

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1</td>
<td>16</td>
<td>16</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>2005</td>
<td>3</td>
<td>23</td>
<td>13</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>2006</td>
<td>1</td>
<td>36</td>
<td>19</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
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<tr>
<td>2007</td>
<td>5</td>
<td>16</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>2008</td>
<td>3</td>
<td>56</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>12</td>
<td>15</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3.1</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>53</td>
<td>40</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>2011</td>
<td>5</td>
<td>60</td>
<td>64</td>
<td>14</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>4</td>
<td>13</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.1</td>
</tr>
<tr>
<td>2013</td>
<td>13</td>
<td>42</td>
<td>34</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.6</td>
</tr>
</tbody>
</table>
Figure 7. Length frequency for smallmouth bass sampled by nighttime electrofishing near Gavins Point Dam in Lewis and Clark Lake, South Dakota, 2012 and 2013.
Flathead catfish population parameters

Low amperage daytime electrofishing along riprap areas in Lewis and Clark Lake provided a flathead catfish CPUE of 50 in 2013 (Table 23). Memorable-sized fish were absent from the 2012 survey, with a majority of the total catch smaller than stock length (Figure 8).

Flathead catfish growth was determined by back-calculating lengths from pectoral spine annuli. Similar to previous years, growth was relatively slow, taking 5-6 years to surpass stock length (Table 24 and Table 25, 350 mm, Adams 2007, Knecht et al. 2008, Longhenry 2009). Relative weight values for all length categories were within the typical range, however, estimates for the larger length categories are based on low sample sizes (Table 23).
Table 23. Catch per unit effort (CPUE), proportional size distribution, proportional size distribution for preferred and memorable length fish (PSD-P, PSD-M), and relative weights of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) fish for flathead catfish collected by electrofishing Lewis and Clark Lake, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE (fish/h)</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>S-Q Wr (SE)</th>
<th>N</th>
<th>Q-P Wr (SE)</th>
<th>N</th>
<th>P-M Wr (SE)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>24 (5.5)</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>88 (0.2)</td>
<td>11</td>
<td>--</td>
<td>0</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>22 (5.5)</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>91 (2.7)</td>
<td>8</td>
<td>80 (1.8)</td>
<td>2</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>20 (4.2)</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>88 (1.5)</td>
<td>9</td>
<td>87 (-- )</td>
<td>1</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2007</td>
<td>68 (11.4)</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>86 (1.7)</td>
<td>13</td>
<td>87 (0.8)</td>
<td>4</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>52 (10.5)</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>91 (0.8)</td>
<td>26</td>
<td>92 (2.5)</td>
<td>11</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>25 (5.8)</td>
<td>64</td>
<td>14</td>
<td>7</td>
<td>91 (5.2)</td>
<td>5</td>
<td>89 (1.2)</td>
<td>7</td>
<td>63 (-- )</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>41 (6.2)</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>86 (2.6)</td>
<td>8</td>
<td>85 (1.7)</td>
<td>5</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>28 (3.6)</td>
<td>42</td>
<td>6</td>
<td>3</td>
<td>94 (1.0)</td>
<td>18</td>
<td>90 (1.7)</td>
<td>11</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>39 (11.0)</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>93 (0.9)</td>
<td>16</td>
<td>74 (12.3)</td>
<td>3</td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>2013</td>
<td>50 (11.5)</td>
<td>45</td>
<td>3</td>
<td>0</td>
<td>89 (1.0)</td>
<td>16</td>
<td>85 (1.3)</td>
<td>12</td>
<td>84 (-- )</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 24. Age distribution of flathead catfish sampled by electrofishing Lewis and Clark Lake during 2004-2013 as determined from basal recess (2002-2010a) and articulating process (2010b, -213) sections of pectoral spines. Asterisks indicate age includes older fish not included in table.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Mean</td>
</tr>
<tr>
<td>2005</td>
<td>3 10 7 10 1 4 4 0 1 0 0 0 0 0 3.4</td>
</tr>
<tr>
<td>2006</td>
<td>7 7 4 7 4 0 3 1 1 0 0 0 0 0 3.5</td>
</tr>
<tr>
<td>2007</td>
<td>63 12 7 5 4 1 2 4 0 0 0 0 0 0 2.0</td>
</tr>
<tr>
<td>2008</td>
<td>12 43 17 13 8 4 4 3 6 5 1 1 2 0 4.1</td>
</tr>
<tr>
<td>2009</td>
<td>26 14 3 4 0 0 0 2 1 0 0 0 0 0 2.8*</td>
</tr>
<tr>
<td>2010a</td>
<td>18 29 11 4 2 1 0 0 1 3 2 0 0 0 1 3</td>
</tr>
<tr>
<td>2010b</td>
<td>22 29 12 2 2 1 0 0 1 3 2 0 0 1 0 2.9</td>
</tr>
<tr>
<td>2011</td>
<td>5 8 6 4 5 2 2 3 1 0 3 3 2 0 6.4*</td>
</tr>
<tr>
<td>2012</td>
<td>1 42 16 6 3 6 2 2 2 4 1 1 2 1 0 4.0</td>
</tr>
<tr>
<td>2013</td>
<td>48 25 19 4 3 2 5 0 1 0 5 4 1 2 4 4.0*</td>
</tr>
</tbody>
</table>

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Table 25. Mean back-calculated total lengths (mm) for each age class of flathead catfish sampled by low amperage daytime electrofishing in Lewis and Clark Lake, South Dakota, June, 2013. Ages were determined from pectoral spines sectioned at the articulating process. Ages beyond 10 are excluded; however, sample mean, standard error, and length increment are calculated from the complete sample.

| Year class | Age | N  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|------------|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 2012       | 1   | 48 | 77  |     |     |     |     |     |     |     |     |     |     |
| 2011       | 2   | 25 | 83  | 145 |     |     |     |     |     |     |     |     |     |
| 2010       | 3   | 19 | 77  | 142 | 197 |     |     |     |     |     |     |     |     |
| 2009       | 4   | 4  | 79  | 159 | 241 | 300 |     |     |     |     |     |     |     |
| 2008       | 5   | 3  | 73  | 138 | 185 | 236 | 278 |     |     |     |     |     |     |
| 2007       | 6   | 2  | 70  | 182 | 254 | 302 | 334 | 382 |     |     |     |     |     |
| 2006       | 7   | 5  | 90  | 159 | 228 | 279 | 319 | 361 | 404 |     |     |     |     |
| 2004       | 9   | 1  | 102 | 202 | 266 | 302 | 324 | 345 | 410 | 431 | 460 |     |     |
| 2002       | 11  | 5  | 74  | 119 | 181 | 246 | 299 | 339 | 378 | 397 | 418 | 433 |     |
| 2001       | 12  | 4  | 91  | 178 | 242 | 279 | 335 | 353 | 382 | 401 | 428 | 445 |     |
| 2000       | 13  | 1  | 89  | 138 | 213 | 310 | 359 | 402 | 418 | 445 | 467 | 483 |     |
| 1999       | 14  | 2  | 121 | 188 | 230 | 272 | 331 | 373 | 404 | 428 | 453 | 477 |     |
| 1998       | 15  | 4  | 89  | 168 | 237 | 286 | 342 | 380 | 418 | 451 | 469 | 479 |     |
| 1997       | 16  | 2  | 95  | 154 | 207 | 259 | 331 | 403 | 436 | 462 | 482 | 501 |     |
| 1993       | 20  | 1  | 72  | 155 | 273 | 377 | 446 | 480 | 508 | 515 | 536 | 550 |     |

| Sample mean (mm) | 86  | 159 | 227 | 287 | 336 | 382 | 418 | 441 | 464 | 481 |
| Standard error   | 4   | 6   | 8   | 11  | 13  | 13  | 13  | 13  | 14  |     |
| Length increment | 73  | 68  | 60  | 49  | 46  | 36  | 24  | 23  | 17  | 14  |
Figure 8. Length frequency of flathead catfish sampled by electrofishing Lewis and Clark Lake during June 2012 and 2013.
Missouri River

**Electrofishing**

Largemouth bass population parameters

Daytime electrofishing was conducted in the Springfield area of the Niobrara delta to sample largemouth bass. A total of 2 largemouth bass were sampled with a CPUE of 1/h (Table 26). Age and growth data from previous sampling events is included for reference (Table 27, Table 28). Relative abundance in 2013 was considerably lower than previous years likely related to habitat modification from the 2011 flood. Access to some common sampling locations was reduced and others had modified substrate and vegetation characteristic from before the flood. Additional effort in 2014 will be used to identify find new/additional sampling locations that are accessible and have suitable habitat for largemouth bass.

Table 26. Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution for preferred and memorable-length fish (PSD-P, PSD-M), and relative weight of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) largemouth bass sampled by spring electrofishing Springfield area of the Niobrara delta, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE (fish/h)</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>S-Q Wr (SE)</th>
<th>Q-P Wr (SE)</th>
<th>P-M Wr (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>20 (3.2)</td>
<td>75</td>
<td>50</td>
<td>0</td>
<td>98 (1.8)</td>
<td>99 (1.0)</td>
<td>97 (0.9)</td>
</tr>
<tr>
<td>2005</td>
<td>9 (3.4)</td>
<td>84</td>
<td>36</td>
<td>0</td>
<td>108 (2.6)</td>
<td>105 (0.8)</td>
<td>101 (2.2)</td>
</tr>
<tr>
<td>2006</td>
<td>14 (8.1)</td>
<td>100</td>
<td>18</td>
<td>0</td>
<td>--</td>
<td>102 (1.1)</td>
<td>99 (4.8)</td>
</tr>
<tr>
<td>2008</td>
<td>31 (10.7)</td>
<td>88</td>
<td>66</td>
<td>0</td>
<td>95 (3.1)</td>
<td>100 (0.7)</td>
<td>101 (2.9)</td>
</tr>
<tr>
<td>2009</td>
<td>81 (23.7)</td>
<td>85</td>
<td>36</td>
<td>0</td>
<td>100 (3.8)</td>
<td>104 (0.8)</td>
<td>103 (1.9)</td>
</tr>
<tr>
<td>2010</td>
<td>29 (10.3)</td>
<td>87</td>
<td>57</td>
<td>0</td>
<td>105 (1.5)</td>
<td>108 (0.9)</td>
<td>104 (1.7)</td>
</tr>
<tr>
<td>2011</td>
<td>15 (3.6)</td>
<td>77</td>
<td>64</td>
<td>0</td>
<td>114 (2.8)</td>
<td>116 (4.4)</td>
<td>109 (5.7)</td>
</tr>
<tr>
<td>2012</td>
<td>6 (6)</td>
<td>75</td>
<td>38</td>
<td>0</td>
<td>118 (1.1)</td>
<td>120 (4.0)</td>
<td>107 (7.9)</td>
</tr>
<tr>
<td>2013</td>
<td>1 (1)</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>97 (-- --)</td>
<td>89 (-- --)</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 27. Mean back-calculated total lengths (mm) for each age class of largemouth bass sampled by daytime electrofishing in the Springfield area of the Niobrara delta, Lewis and Clark Lake, South Dakota, May, 2012. Ages were determined from scales. No growth analysis performed in 2013 due to small sample size.

<table>
<thead>
<tr>
<th>Year class</th>
<th>Age</th>
<th>N</th>
<th>Annulus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
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<td>109</td>
</tr>
<tr>
<td>2008</td>
<td>4</td>
<td>2</td>
<td>97</td>
</tr>
<tr>
<td>2007</td>
<td>5</td>
<td>2</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Sample mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard error</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length increment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 28. Age distribution of largemouth bass sampled by electrofishing in the Springfield area of the Niobrara Delta, 2004-2012, as determined from scales. No age analysis was performed in 2013 due to small sample size.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2004</td>
<td>5</td>
</tr>
<tr>
<td>2005</td>
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</tr>
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</tr>
<tr>
<td>2008</td>
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</tr>
<tr>
<td>2009</td>
<td>20</td>
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<tr>
<td>2010</td>
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<tr>
<td>2011</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 9. Length frequency of largemouth bass sampled by electrofishing in the Niobrara delta near Springfield, South Dakota during May 2012 and 2013.
Smallmouth bass population parameters

Gavins Point Dam Tailwaters

A total of 40 smallmouth bass were sampled in the Gavins Point Dam tailwater area with lengths ranging from 100-420 mm (Figure 10). Smallmouth bass size structure (PSD, PSD-P) were within the management objectives, however no memorable length smallmouth bass were sampled. Relative weights were lower than average for all length categories in 2013, but remained within the normal range for this population (Table 29).

Seven age classes (1-3 and 5) were sampled in 2013 (Table 30, Table 31). Six and 7 year old fish were sampled in 2013, however there is evidence that larger (older) fish are less susceptible to the sampling methods used, which could contribute to under-representation in the sample (Beamesderfer and Rieman 1988, Milewski and Willis 1991).

Table 29. Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution for preferred and memorable-length fish (PSD-P, PSD-M), and relative weight of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) smallmouth bass sampled by spring electrofishing the Missouri River below Gavins Point Dam, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE (fish/h)</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>S-Q Wr (SE)</th>
<th>S-Q N</th>
<th>Q-P Wr (SE)</th>
<th>Q-P N</th>
<th>P-M Wr (SE)</th>
<th>P-M N</th>
</tr>
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<td>0</td>
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<td>38</td>
<td>96 (0.7)</td>
<td>4</td>
<td>-- (0)</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>78 (45)</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>92 (0.5)</td>
<td>62</td>
<td>90 (2.7)</td>
<td>8</td>
<td>-- (0)</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>34 (17.1)</td>
<td>30</td>
<td>4</td>
<td>0</td>
<td>93 (0.9)</td>
<td>16</td>
<td>93 (1.5)</td>
<td>6</td>
<td>95 (-)</td>
<td>1</td>
</tr>
<tr>
<td>2007</td>
<td>56 (12.0)</td>
<td>23</td>
<td>9</td>
<td>2</td>
<td>94 (0.7)</td>
<td>34</td>
<td>92 (0.7)</td>
<td>6</td>
<td>90 (4.8)</td>
<td>3</td>
</tr>
<tr>
<td>2008</td>
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<td>0</td>
<td>0</td>
<td>89 (0.6)</td>
<td>37</td>
<td>91 (3.2)</td>
<td>5</td>
<td>-- (0)</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>97 (32.8)</td>
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<td>7</td>
<td>1</td>
<td>92 (0.5)</td>
<td>49</td>
<td>92 (1.3)</td>
<td>16</td>
<td>93 (6.3)</td>
<td>4</td>
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<tr>
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<td>4</td>
<td>0</td>
<td>95 (0.2)</td>
<td>85</td>
<td>92 (1.0)</td>
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<td>94 (3.6)</td>
<td>4</td>
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<tr>
<td>2011</td>
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<td>73</td>
<td>88 (3.0)</td>
<td>17</td>
<td>91 (1.4)</td>
<td>12</td>
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<tr>
<td>2012</td>
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<td>30</td>
<td>5</td>
<td>91 (1.3)</td>
<td>13</td>
<td>95 (--)</td>
<td>1</td>
<td>99 (3.7)</td>
<td>5</td>
</tr>
<tr>
<td>2013</td>
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<td>31</td>
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<td>0</td>
<td>89 (0.7)</td>
<td>18</td>
<td>89 (2.8)</td>
<td>3</td>
<td>85 (2.8)</td>
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Table 30. Mean back-calculated total lengths (mm) for each age class of smallmouth bass sampled by daytime electrofishing in the Missouri River below Gavins Point Dam, South Dakota, May, 2013. Ages were determined from scales.

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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>10</td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>2009</td>
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<td>2</td>
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<td></td>
</tr>
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<td>375</td>
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<td>363</td>
<td>400</td>
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<tr>
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<td>167</td>
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<td>375</td>
<td>395</td>
<td>413</td>
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<td>2</td>
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</table>

<table>
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<th>Length increment</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>76</td>
<td>78</td>
<td>57</td>
<td>62</td>
<td>26</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 31. Age distribution of smallmouth bass sampled by electrofishing the Missouri River below Gavins Point Dam in May, 2004-2013, as determined from scales.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Mean</th>
</tr>
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<tr>
<td>2005</td>
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<td>50</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<td>19</td>
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<td>3</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>2.1</td>
</tr>
<tr>
<td>2007</td>
<td>30</td>
<td>19</td>
<td>14</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>2008</td>
<td>32</td>
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<td>6</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>1.7</td>
</tr>
<tr>
<td>2009</td>
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<td>48</td>
<td>23</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2.3</td>
</tr>
<tr>
<td>2010</td>
<td>8</td>
<td>99</td>
<td>30</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.3</td>
</tr>
<tr>
<td>2011</td>
<td>7</td>
<td>54</td>
<td>39</td>
<td>13</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.6</td>
</tr>
<tr>
<td>2012</td>
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<td>18</td>
<td>7</td>
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<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.6</td>
</tr>
<tr>
<td>2013</td>
<td>10</td>
<td>12</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2.6</td>
</tr>
</tbody>
</table>
Figure 10. Length frequency of smallmouth bass sampled by electrofishing the Missouri River below Gavins Point Dam in May, 2012 and 2013.
Fort Randall Dam Tailwaters

Smallmouth bass sampling in the Fort Randall Dam tailwaters is conducted in the fall while other smallmouth bass sampling on the reservoir system occurs in the spring. A total of 75 were sampled during 60 min of night electrofishing in both 2013 (Table 32). Lengths ranged from 67 to 388 mm with about 26% of the sample longer than stock length (180 mm, Figure 10). Growth rates of smallmouth bass in the Fort Randall Tailrace reach (Table 33) are similar to those estimated for the Gavins Point Dam Tailrace and Lewis and Clark Lake, and to the state and Missouri River reservoir averages (Willis et al. 2001). Relative weights were at or near 100 for all size classes (Table 32).

Similar to the other smallmouth bass surveys, age distribution of the Fort Randall Tailrace smallmouth bass was dominated by fish three years of age or less (Table 33, Table 34). In most Fort Randall Tailwater surveys, age classes up to four are present indicating consistent recruitment. In 2012, fish out to age four were sampled and the mean age increased to 2.6 years (Table 34).

Table 32. Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution for preferred and memorable-length fish (PSD-P, PSD-M), and relative weight of stock-quality (S-Q), quality-preferred (Q-P), and preferred-length (P) smallmouth bass sampled by fall nighttime electrofishing the Missouri River below Fort Randall Dam, 2004-2013 (2010a = June sample; 2010b = October sample). Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

<table>
<thead>
<tr>
<th>Year</th>
<th>CPUE (fish/h)</th>
<th>PSD</th>
<th>PSD-P</th>
<th>PSD-M</th>
<th>S-Q Wr (SE)</th>
<th>N</th>
<th>Q-P Wr (SE)</th>
<th>N</th>
<th>P-M Wr (SE)</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>2004</td>
<td>14 (2.6)</td>
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<td>8</td>
<td>0</td>
<td>108 (5.1)</td>
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<td>107 (2.3)</td>
<td>6</td>
<td>106 (-- )</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>78 (45)</td>
<td>67</td>
<td>13</td>
<td>0</td>
<td>112 (3.9)</td>
<td>5</td>
<td>103 (1.3)</td>
<td>8</td>
<td>99 (3.1)</td>
<td>2</td>
</tr>
<tr>
<td>2006</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>119 (19.1)</td>
<td>39</td>
<td>5</td>
<td>0</td>
<td>94 (1.3)</td>
<td>23</td>
<td>103 (1.5)</td>
<td>13</td>
<td>105 (2.2)</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>100 (29.6)</td>
<td>36</td>
<td>11</td>
<td>2</td>
<td>101 (1.8)</td>
<td>30</td>
<td>109 (2.4)</td>
<td>12</td>
<td>112 (4.0)</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>39 (7.6)</td>
<td>15</td>
<td>0</td>
<td>0</td>
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<td>91 (0.0)</td>
<td>2</td>
<td>--</td>
<td>0</td>
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<tr>
<td>2010a</td>
<td>51 (25.0)</td>
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<td>5</td>
<td>0</td>
<td>100 (0.4)</td>
<td>16</td>
<td>99 (3.9)</td>
<td>4</td>
<td>88 (-- )</td>
<td>1</td>
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<tr>
<td>2010b</td>
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<td>44</td>
<td>13</td>
<td>0</td>
<td>112 (1.4)</td>
<td>18</td>
<td>109 (0.6)</td>
<td>10</td>
<td>107 (0.3)</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
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<td>41</td>
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<td>118 (3.5)</td>
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<td>116 (1.5)</td>
<td>6</td>
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<td>0</td>
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<td>98 (2.6)</td>
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<td>97 (4.0)</td>
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<td>104 (0.6)</td>
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</table>
Figure 11. Length frequency of smallmouth bass sampled by nighttime electrofishing the Missouri River below Fort Randall Dam in October 2012, and 2013.
Table 33. Mean back-calculated total lengths (mm) for each age class of smallmouth bass sampled by nighttime electrofishing in the Missouri River below Fort Randall Dam, South Dakota, October, 2013. Ages were determined from scales.

<table>
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<td>2012</td>
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<td>2</td>
<td></td>
</tr>
<tr>
<td>2011</td>
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<td>7</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

| Sample mean | 97  | 172 | 267 | 318 |
| Standard error | 6   | 5   | 3   | --  |
| Length increment | 76  | 95  | 51  | 

Table 34. Age distribution of smallmouth bass sampled by fall electrofishing the Missouri River below Fort Randall Dam, 2004-2013 (2010a = June sample, 2010b = October sample), as determined from scales. Mean age excludes age-0 fish.

<table>
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<th>3</th>
<th>4</th>
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</tr>
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<td>2</td>
<td>1</td>
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<td>2.7</td>
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</tr>
<tr>
<td>2010b</td>
<td>9</td>
<td>18</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>201</td>
<td>19</td>
<td>33</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>55</td>
<td>2</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.6</td>
<td></td>
</tr>
</tbody>
</table>

**Seines**

Twenty one species were sampled with seines in the Niobrara delta. The most abundant species in 2013 was river carpsucker followed by largemouth bass and spotfin shiner (Table 35).
Table 35. Catch per unit effort (fish/seine haul) for July seining surveys in the Missouri River near Springfield, South Dakota, 2008-2013, includes both age-0 and adults. Trace (T) indicates a value is less than 0.05. Standard error (SE) is in parenthesis.

<table>
<thead>
<tr>
<th>Species</th>
<th>2008</th>
<th>2009</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigmouth buffalo</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Black crappie</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>T</td>
<td>0.8 (0.5)</td>
</tr>
<tr>
<td>Bluegill</td>
<td>T</td>
<td>--</td>
<td>1.3 (0.9)</td>
<td>0.1 (0.1)</td>
<td></td>
</tr>
<tr>
<td>Bluntnose minnow</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.2 (0.1)</td>
<td>0.1 (0.1)</td>
<td>--</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T</td>
</tr>
<tr>
<td>Common carp</td>
<td>--</td>
<td>--</td>
<td>0.7 (0.6)</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Emerald shiner</td>
<td>0.4 (0.3)</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.5 (0.3)</td>
<td>0.1 (T)</td>
</tr>
<tr>
<td>Fathead minnow</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T</td>
</tr>
<tr>
<td>Freshwater drum</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Gizzard shad</td>
<td>T</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.4 (0.4)</td>
</tr>
<tr>
<td>Goldeye</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Grass pickerel</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>0.5 (0.5)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Green sunfish</td>
<td>T</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Johnny darter</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>0.1 (0.1)</td>
<td>T</td>
<td>0.3 (0.1)</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>0.3 (0.2)</td>
<td>0.8 (0.5)</td>
<td>2.0 (1.3)</td>
<td>0.4 (0.2)</td>
<td>5.9 (2.0)</td>
</tr>
<tr>
<td>Northern pike</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>0.3 (0.2)</td>
<td>1.1 (0.9)</td>
<td>--</td>
</tr>
<tr>
<td>Red shiner</td>
<td>--</td>
<td>1.6 (1.1)</td>
<td>1.2 (0.6)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>River carpsucker</td>
<td>5.7 (3.0)</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
<td>20.7 (6.2)</td>
<td>18.6 (11.2)</td>
</tr>
<tr>
<td>Rock bass</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Sand shiner</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.3 (0.3)</td>
<td>0.5 (0.5)</td>
</tr>
<tr>
<td>Sauger</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>0.1 (0.1)</td>
</tr>
<tr>
<td>Shorthead redhorse</td>
<td>T</td>
<td>--</td>
<td>--</td>
<td>0.4 (0.1)</td>
<td>T</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>--</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
<td>0.4 (0.2)</td>
<td>--</td>
</tr>
<tr>
<td>Smallmouth buffalo</td>
<td>T</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.1 (T)</td>
</tr>
<tr>
<td>Spotfin shiner</td>
<td>1.4 (0.6)</td>
<td>3.6 (1.3)</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>3.5 (1.5)</td>
</tr>
<tr>
<td>Spottail shiner</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Walleye</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>--</td>
<td>T</td>
<td>0.2 (0.1)</td>
</tr>
<tr>
<td>White bass</td>
<td>--</td>
<td>0.1 (0.1)</td>
<td>--</td>
<td>T</td>
<td>--</td>
</tr>
<tr>
<td>White crappie</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>T</td>
</tr>
<tr>
<td>Yellow perch</td>
<td>--</td>
<td>--</td>
<td>0.4 (0.2)</td>
<td>0.2 (0.2)</td>
<td>0.1 (0.1)</td>
</tr>
</tbody>
</table>
RARE FISH OBSERVATIONS

No State or Federal threatened or endangered species were sampled in 2013. Blue sucker were observed in the Missouri River in the first 2 miles below Gavins Point Dam. The blue sucker is on the South Dakota Rare fish list.

FISHERY STATUS

The results from standard sampling indicate that some of the sport fish populations in Lewis and Clark Lake continue to remain abundant while others are still below relative abundance objectives. Walleye and sauger abundance remain below the long-term average due to consecutive years of low reproduction. Channel catfish and smallmouth bass remained abundant in 2013.

Some species specific management objectives were met for both walleye and sauger in 2013, while others were not (Table 36). Six mature year classes of walleye were present and five for sauger. Proportional size distribution was within the management objective range for walleye and PSD-P exceeded the objective. Sauger PSD was above the management objective range of 30-60, and PSD-P exceeded the management objective (Table 36). Relative abundance was below the management objectives of 6.0 fish/net night for sauger while walleye CPUE was above the management objective of 4.0/net night.

Channel catfish continue to be abundant during the fall gill net survey (7.0/gill net) and exceeded the CPUE objective of 3.0/net night 2013 (Table 36). Channel catfish size structure indices were within the objective range for PSD, but below the objective minimum for PSD-P (Table 36).

Smallmouth bass CPUE (108 fish/h) continues to be above the management objective of 10 fish/h, while largemouth bass was below their management objective (1 fish/h). Proportional size distribution was within the management objective range of 30 to 60 for smallmouth bass and above the 30 to 60 range for largemouth bass (Table 36). However, largemouth bass size structure parameters are based on low sample sizes. Gilliland (1985) suggested that a sample size of 50 was insufficient for largemouth bass, while a sample size of 150 provided similar results to a sample size of 500 and provides a representative sample. With sample sizes generally below 100, an increase in sampling effort for Largemouth and smallmouth bass in Lewis and Clark Lake may be necessary for better representation of population structure.
Table 36. Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution–preferred (PSD-P) and species specific management objectives for walleye, sauger, channel catfish, Largemouth and smallmouth bass, in Lewis and Clark Lake, 2013. Bold values were not within the objective range.

<table>
<thead>
<tr>
<th>Species and Objectives</th>
<th>CPUE</th>
<th>PSD</th>
<th>PSP-P</th>
<th>Harvest</th>
<th>Harvest rate</th>
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</thead>
<tbody>
<tr>
<td>Walleye</td>
<td>4.3/gill net</td>
<td>59</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>≥4.0/gill net</td>
<td>30-60</td>
<td>≥10</td>
<td>10,000</td>
<td>0.1/ h</td>
</tr>
<tr>
<td>Sauger</td>
<td>3.2/gill net</td>
<td>69</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>≥6.0/gill net</td>
<td>30-60</td>
<td>≥10</td>
<td>5,000</td>
<td>0.1/ h</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>7/gill net</td>
<td>43</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>≥3/gill net</td>
<td>30-60</td>
<td>≥10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>1/h electrofishing</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>≥10/h electrofishing</td>
<td>30-60</td>
<td>≥20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>108/h electrofishing</td>
<td>30</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>&gt;10/h electrofishing</td>
<td>30-60</td>
<td>≥20</td>
<td></td>
<td></td>
</tr>
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</table>
MANAGEMENT RECOMMENDATIONS

- Develop a new Lewis and Clark management plan under the current statewide umbrella plan and the Missouri River management unit.

- Develop a plan for identifying recruitment bottlenecks for walleye and sauger in Lewis and Clark Lake.

- Continue to evaluate sampling strategies for all species in Lewis and Clark Lake. Although long term data sets are extremely valuable for detecting changes in fishery characteristics, it is important to incorporate new knowledge and technology to sampling techniques to provide the most accurate and useful data possible. This may include increasing sampling effort or adding new sampling techniques where necessary.

- Determine alternate sampling methods or increase effort for Smallmouth and largemouth bass sampling. The sample sizes for both black bass species is consistently small and needs to be addressed. Sampling times for bass populations should also be standardized if possible.

- Evaluate fall nighttime electrofishing data as a more reliable index of walleye recruitment and year class strength in Lewis and Clark Lake.

- Acquire additional information on species diversity in the Niobrara River delta. This relatively new formation provides native river species with important habitat types that were previously lost during the construction of the mainstem reservoirs. As this area continues to develop, native species will likely show increases in composition and abundance.

- Identify future research needs in the Niobrara River system that will aid in sport fish management. The delta area of the reservoir provides quality fishing for walleye, sauger, and Largemouth and smallmouth bass.

- Utilize Federal Aid projects to aid in sport fish management in Lewis and Clark Lake.
LITERATURE CITED


ecology, and management of catfish: proceedings of the 2nd international ictalurid symposium. American Fisheries Society, Bethesda, Maryland.


APPENDICES

Appendix 1. Common and scientific names of fishes mentioned in this report.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bigmouth buffalo</td>
<td><em>Ictiobus cyprinellus</em></td>
<td>BIB</td>
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<tr>
<td>Black bullhead</td>
<td><em>Ameiurus melas</em></td>
<td>BLB</td>
</tr>
<tr>
<td>Black crappie</td>
<td><em>Pomoxis nigromaculatus</em></td>
<td>BLC</td>
</tr>
<tr>
<td>Bluegill</td>
<td><em>Lepomis macrochirus</em></td>
<td>BLG</td>
</tr>
<tr>
<td>Blue sucker</td>
<td><em>Cycleptus elongatus</em></td>
<td>BSR</td>
</tr>
<tr>
<td>Bluntnose minnow</td>
<td><em>Pimephales notatus</em></td>
<td>BLM</td>
</tr>
<tr>
<td>Brassy minnow</td>
<td><em>Hybognathus hankinsoni</em></td>
<td>BRM</td>
</tr>
<tr>
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<td><em>Ictalurus punctatus</em></td>
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</tr>
<tr>
<td>Common carp</td>
<td><em>Cyprinus carpio</em></td>
<td>COC</td>
</tr>
<tr>
<td>Common shiner</td>
<td><em>Notropis cornutus</em></td>
<td>COS</td>
</tr>
<tr>
<td>Creek chub</td>
<td><em>Semoitilus atromaculatus</em></td>
<td>CRC</td>
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<td><em>Notropis atherinoides</em></td>
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<tr>
<td>Fathead minnow</td>
<td><em>Pimephales promelas</em></td>
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<td>FCF</td>
</tr>
<tr>
<td>Flathead chub</td>
<td><em>Platygobio gracilis</em></td>
<td>FLC</td>
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<tr>
<td>Freshwater drum</td>
<td><em>Aplodinotus grunniens</em></td>
<td>FRD</td>
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<tr>
<td>Gizzard shad</td>
<td><em>Dorosoma cepedianum</em></td>
<td>GIS</td>
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<tr>
<td>Golden shiner</td>
<td><em>Notemigonus crysoleucas</em></td>
<td>GOS</td>
</tr>
<tr>
<td>Goldeye</td>
<td><em>Hiodon alosoides</em></td>
<td>GOE</td>
</tr>
<tr>
<td>Grass psickerel</td>
<td><em>Esox americanus vermiculatus</em></td>
<td>GRP</td>
</tr>
<tr>
<td>Green sunfish</td>
<td><em>Lepomis cyanellus</em></td>
<td>GRS</td>
</tr>
<tr>
<td>Johnny darter</td>
<td><em>Etheostoma nigrum</em></td>
<td>JOD</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td><em>Micropterus salmoides</em></td>
<td>LMB</td>
</tr>
<tr>
<td>Northern pike</td>
<td><em>Esox lucius</em></td>
<td>NOP</td>
</tr>
<tr>
<td>Orangespotted sunfish</td>
<td><em>Lepomis humilis</em></td>
<td>ORS</td>
</tr>
<tr>
<td>Paddlefish</td>
<td><em>Polyodon spathula</em></td>
<td>PAH</td>
</tr>
<tr>
<td>Pallid sturgeon</td>
<td><em>Scaphirhynchus albus</em></td>
<td>PLS</td>
</tr>
<tr>
<td>Rainbow smelt</td>
<td><em>Osmerus mordax</em></td>
<td>RBS</td>
</tr>
<tr>
<td>Red shiner</td>
<td><em>Notropis lutrensis</em></td>
<td>RES</td>
</tr>
<tr>
<td>Redfin shiner</td>
<td><em>Lythrurus umbratilis</em></td>
<td>RES</td>
</tr>
<tr>
<td>River carpsucker</td>
<td><em>Carpiodes carpio</em></td>
<td>RIC</td>
</tr>
<tr>
<td>Rock bass</td>
<td><em>Ambloplites rupestris</em></td>
<td>ROB</td>
</tr>
<tr>
<td>Sauger</td>
<td><em>Sander canadense</em></td>
<td>SAR</td>
</tr>
<tr>
<td>Sand shiner</td>
<td><em>Notropis stramineus</em></td>
<td>SAS</td>
</tr>
<tr>
<td>Shorthead redhorse</td>
<td><em>Moxostoma macrolepidotum</em></td>
<td>SHR</td>
</tr>
<tr>
<td>Species</td>
<td>Scientific Name</td>
<td>Code</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Shortnose gar</td>
<td><em>Lepisosteus platostomus</em></td>
<td>SNG</td>
</tr>
<tr>
<td>Shovelnose sturgeon</td>
<td><em>Scaphirhynchus platorynchus</em></td>
<td>SHS</td>
</tr>
<tr>
<td>Silverstripe shiner</td>
<td><em>Notropis stilbius</em></td>
<td>SIS</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td><em>Micropterus dolomieu</em></td>
<td>SMB</td>
</tr>
<tr>
<td>Smallmouth buffalo</td>
<td><em>Ictiobus bubalus</em></td>
<td>SAB</td>
</tr>
<tr>
<td>Spotfin shiner</td>
<td><em>Notropis spiopterus</em></td>
<td>SFS</td>
</tr>
<tr>
<td>Spottail shiner</td>
<td><em>Notropis hudsonius</em></td>
<td>SPS</td>
</tr>
<tr>
<td>Walleye</td>
<td><em>Sander vitreus</em></td>
<td>WAE</td>
</tr>
<tr>
<td>Western silvery minnow</td>
<td><em>Hybognathus argyritis</em></td>
<td>WSM</td>
</tr>
<tr>
<td>White bass</td>
<td><em>Morone chrysops</em></td>
<td>WHB</td>
</tr>
<tr>
<td>White crappie</td>
<td><em>Pomoxis annularis</em></td>
<td>WHC</td>
</tr>
<tr>
<td>Yellow perch</td>
<td><em>Perca flavescens</em></td>
<td>YEP</td>
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</table>
Appendix 2. Standard weight equations used for relative weight calculations. Length is in millimeters and weight is in grams.

<table>
<thead>
<tr>
<th>Species</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel catfish</td>
<td>$\log_{10}(W_s) = 3.2494 \times \log_{10}(TL) - 5.800$</td>
</tr>
<tr>
<td>Flathead catfish</td>
<td>$\log_{10}(W_s) = 3.082 \times \log_{10}(TL) - 5.156$</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>$\log_{10}(W_s) = 3.19 \times \log_{10}(TL) - 5.316$</td>
</tr>
<tr>
<td>Sauger</td>
<td>$\log_{10}(W_s) = 3.187 \times \log_{10}(TL) - 5.492$</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>$\log_{10}(W_s) = 3.200 \times \log_{10}(TL) - 5.329$</td>
</tr>
<tr>
<td>Walleye</td>
<td>$\log_{10}(W_s) = 3.180 \times \log_{10}(TL) - 5.453$</td>
</tr>
</tbody>
</table>