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

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

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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.

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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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CI................................confidence interval
cms................................cubic meter per second
CPUE................................catch per unit effort
DC................................direct current
g................................grams
h................................hour
ha................................hectares
in................................inches
km................................kilometers
M................................memorable-length
m................................meters
mm................................millimeters
min................................minutes
N................................sample size
P................................preferred-length
PSD................................proportional size distribution
Q................................quality length
rkm................................river kilometer
PSD-M................................proportional size distribution for memorable-length fish
PSD-P................................proportional size distribution for preferred-length fish
S................................stock length
SD................................South Dakota
spp.................................species (multiple)
TL................................total length
W_r................................relative weight
W_s................................standard weight

ANNUAL FISH POPULATION AND ANGLER USE AND SPORTFISH HARVEST SURVEYS OF LEWIS AND CLARK LAKE, SOUTH DAKOTA, 2011-2013

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.

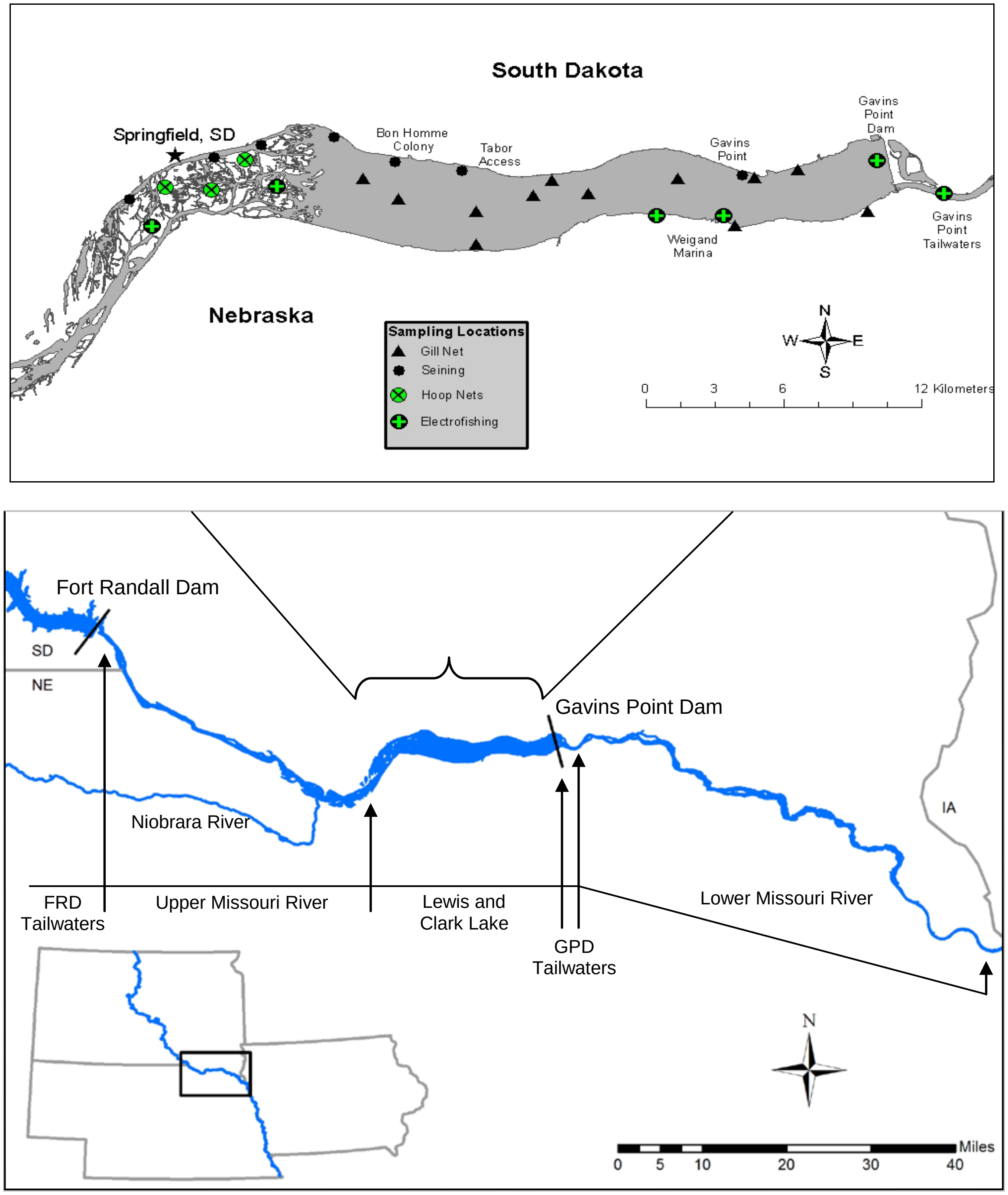

Figure 1. An illustration of the Missouri River from Fort Randall Dam to the South Dakota downstream border with select sampling locations in Lewis and Clark Lake.

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.

Area	**Lewis and Clark Lake**					**Delta**		**GPDT**	**FRDT**
Method	**Gill Net**	**Electrofish**			**Seine**	**Electrofish**	**Seine**	**Electrofish**	
Target	All	SMB	FCF	Age-0	All	LMB	All	SMB	SMB
Effort	12 net nights	60 min	149 min	80 min	12 hauls	86 min	47 hauls	60 min	60 min

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).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	250	380	510	630	760
Sauger	200	300	380	510	630
Channel catfish	280	410	610	710	910
Flathead catfish	350	510	710	860	1020
Largemouth bass	200	300	380	510	630
Smallmouth bass	180	280	350	430	510

Condition was assessed through relative weight (*Wr*) calculations by dividing the weight of a fish by a length-specific standard weight (*Ws*) 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

<u>Seines</u>

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.

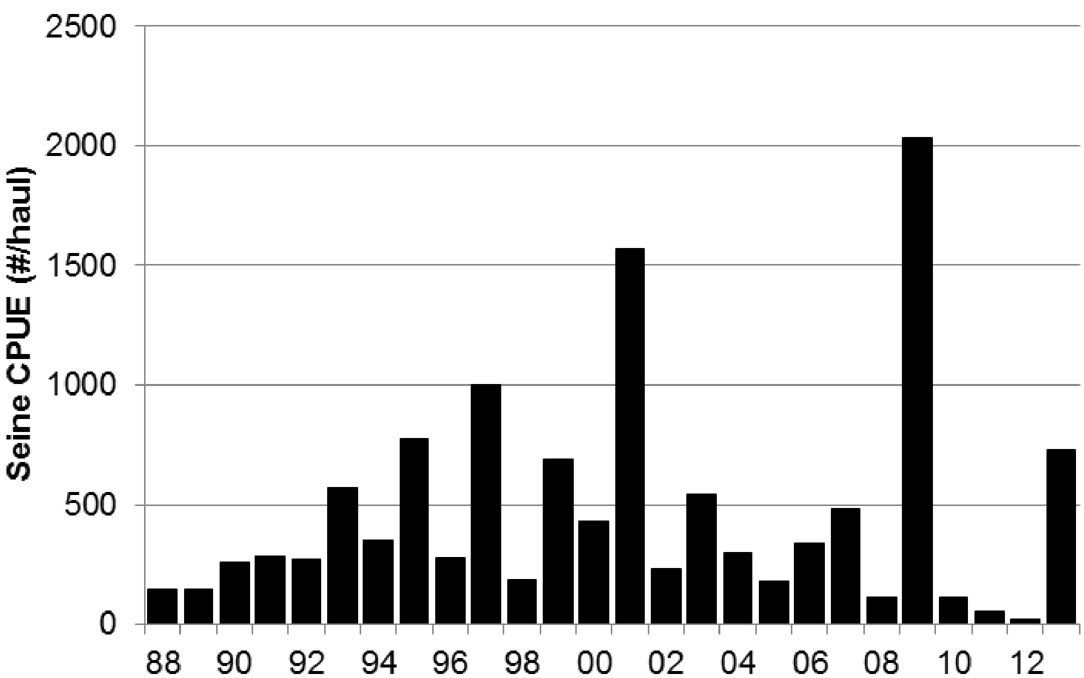

Figure 2. Mean number of fish captured per seine haul from Lewis and Clark Lake, South Dakota, 1988-2013.

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.

Species	**2009**	**2010**	**2011**	**2012**	**2013**
Bigmouth buffalo	--	--	0.2 (0.1)	--	--
Black crappie	0.1 (0.1)	--	2.9 (2.8)	0.7 (0.5)	--
Bluegill	1.6 (1.6)	0.3 (0.3)	1.6 (06)	3.3 (2.8)	0.3 (0.3)
Bluntnose minnow*	--	--	0.6 (0.4)	--	--
Central stoneroller*	0.1 (0.1)	--	--	--	--
Channel catfish	0.3 (0.2)	0.1 (0.1)	0.1 (0.1)	0.2 (0.2)	0.1 (0.1)
Common carp	--	0.1 (0.1)	--	--	0.1 (0.1)
Common shiner*	0.3 (0.3)	--	--	--	--
Creek chub*	--	0.1 (0.1)	--	--	--
Emerald shiner*	85.6 (47.8)	75.8 (46.4)	23.6 (10.3)	9.2 (8.5)	355.1 (352.9)
Fathead minnow*	--	1.6 (1.1)	0.3 (0.2)	0.2 (0.2)	0.1 (0.1)
Flathead catfish	--	--	--	0.1 (0.1)	--
Freshwater drum	1.1 (0.7)	0.3 (0.3)	--	0.1 (0.1)	3.1 (1.7)
Gizzard shad	1876.5 (1873.2)	20.3 (20.1)	4.4 (3.1)	--	346.8 (336.0)
Johnny darter*	2.3 (2.0)	7.9 (5.2)	0.5 (0.2)	0.6 (0.4)	0.7 (0.2)
Largemouth bass	--	--	0.5 (0.2)	2.0 (1.9)	0.6 (0.2)
N. redbelly dace*	--	0.1 (0.1)	--	--	--
Red shiner*	1.0 (1.0)	--	0.6 (0.4)	0.4 (0.3)	--
River carpsucker	0.3 (0.2)	0.5 (0.4)	0.2 (0.1)	1.7 (0.9)	0.4 (0.2)
Sauger	0.4 (0.2)	--	0.3 (0.2)	--	--
Shorthead redhorse	1.0 (0.8)	0.3 (0.3)	1.8 (1.4)	0.5 (0.3)	--
Shortnose gar	0.1 (0.1)	0.1 (0.1)	--	--	--
Smallmouth bass	1.0 (0.5)	--	--	0.5 (0.3)	--
Smallmouth buffalo	--	--	0.4 (0.3)	--	0.3 (0.1)
Spotfin shiner*	1.9 (1.5)	5.0 (4.0)	0.6 (0.4)	0.1 (0.1)	0.3 (0.3)
Spottail shiner*	0.6 (0.2)	1.1 (0.4)	0.1 (0.1)	--	0.1 (0.1)
Walleye	1.5 (0.4)	--	0.9 (0.5)	--	0.2 (0.2)
White bass	59.6 (44.1)	0.8 (0.5)	10.4 (6.7)	0.3 (0.2)	5.4 (4.1)
White crappie	--	--	0.4 (0.4)	--	--
Yellow perch	--	--	3.0 (1.1)	0.8 (0.8)	14.5 (14.2)

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.

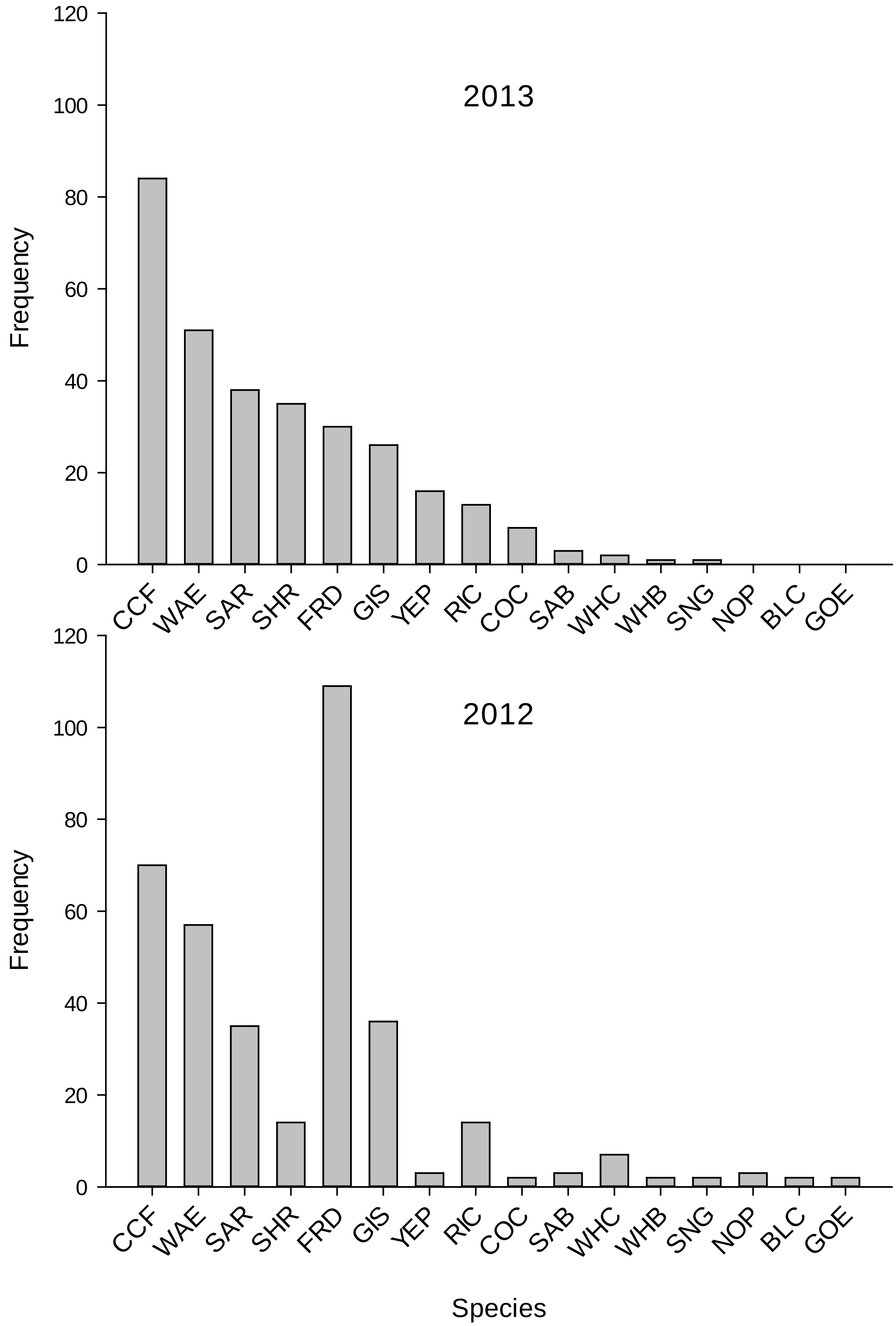

Figure 3. Number of each species collected during the standard gill net survey on Lewis and Clark Lake, South Dakota, 2012 and 2013. Abbreviations used are defined in Appendix 1.

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.

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

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.

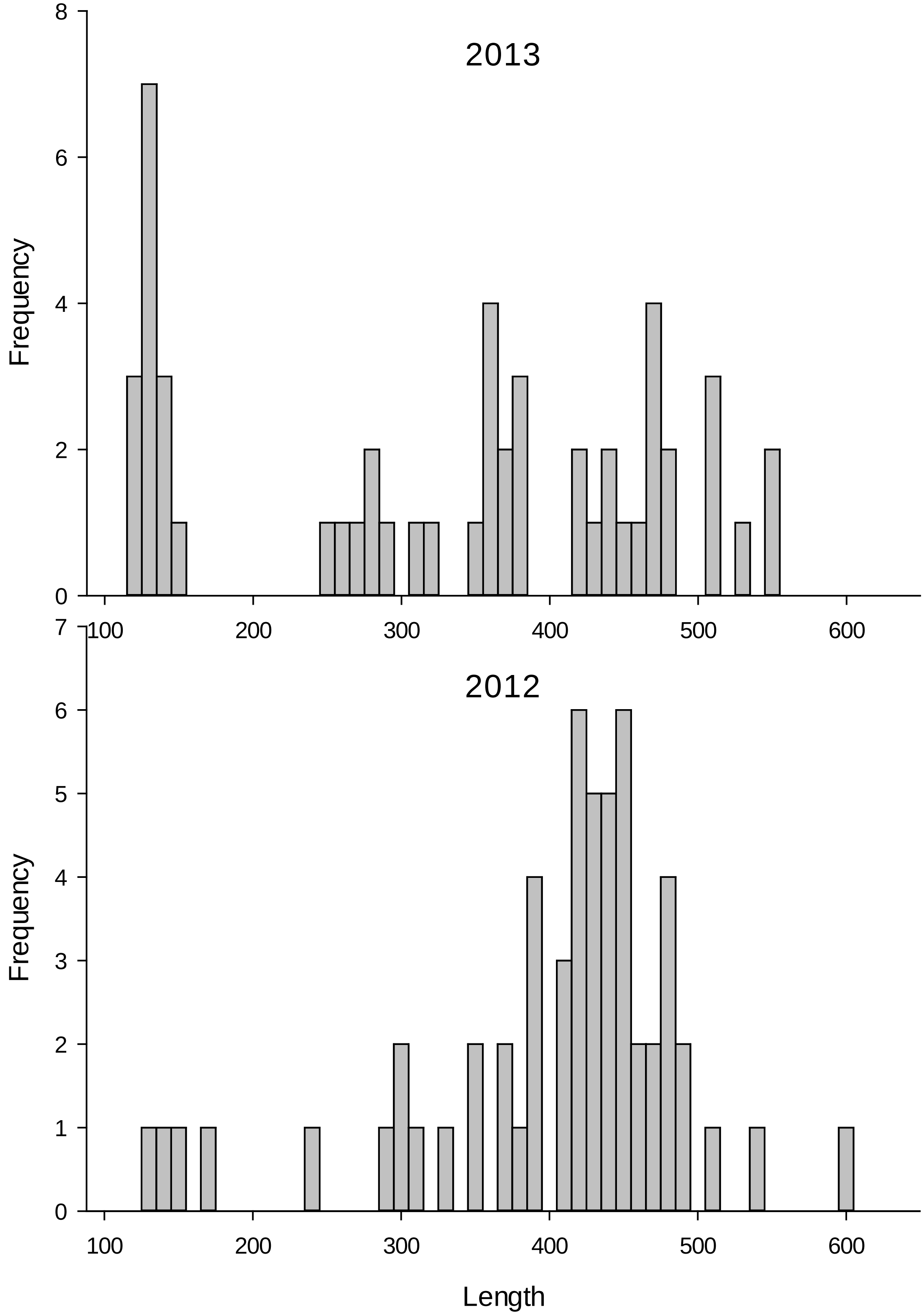

Figure 4. Length frequency of walleye collected during the standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.

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.

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

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.

Year	PSD	PSD-P	PSD-M	N
2004	58	2	0	51
2005	88	7	0	109
2006	72	5	0	59
2007	79	17	0	108
2008	64	16	0	168
2009	54	10	0	128
2010	38	6	0	86
2011	71	14	0	36
2012	83	6	0	57
2013	59	16	0	51

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.

		Length at age of capture (mm)												
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2006	**Mean**	144	320	397	440	473	494	473	--	--	--	--	517	--
	N	2	10	14	13	9	3	1	--	--	--	--	1	--
	SE	6	11.3	4.4	7.3	11.8	23.4	--	--	--	--	--	--	--
2007	**Mean**	185	339	419	468	509	516	495	505	--	535	--	--	--
	N	38	14	22	17	8	3	3	2	--	1	--	--	--
	SE	3.3	11.5	5.8	6.5	14	14.2	42.5	50	--	--	--	--	--
2008	**Mean**	172	335	428	493	489	530	492	487	520	--	525	497	--
	N	25	51	23	36	14	6	6	1	1	--	1	2	--
	SE	5.7	3.7	6	5.5	9.4	17.3	29.2	--	--	--	--	10	--
2009	**Mean**	150	279	399	418	515	495	509	546	--	521	--	517	543
	N	4	44	53	6	6	4	2	3	--	1	--	4	1
	SE	4.4	4.4	4.4	17.6	22	28.3	13.5	19.9	--	--	--	14.2	--
2010	**Mean**	139	260	354	420	454	538	463	515	541	516	--	--	529
	N	3	16	40	16	2	2	2	1	2	1	--	--	1
	SE	8.8	4.8	3.1	6.2	8.5	52.5	2.0	--	75.0	--	--	--	--
2011	**Mean**	159	--	341	406	460	497	513	--	628	--	--	--	--
	N	8	--	7	9	9	1	1	--	1	--	--	--	--
	SE	4.9	--	7.8	5.1	15.1	--	--	--	--	--	--	--	--
2012	**Mean**	155	300	370	416	454	457	447	474	541	499	--	--	--
	N	4	6	4	13	18	7	1	1	1	1	--	--	--
	SE	8.2	13.7	18.1	6.5	7.3	4.8	--	--	--	--	--	--	--
2013	**Mean**	137	293	381	466	438	461	522	478	--	--	--	530	--
	N	14	9	9	1	3	8	5	1	--	--	--	1	--
	SE	2.7	11.6	5.8	--	37.7	10.9	16.0	--	--	--	--	--	--
Mean of means		155	303	386	440	474	498	489	501	558	518	525	515	536

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.

Year	**Growth increment added during period (mm)**							
	0-1	**1-2**	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**	**7-8**
2007-2008	150	89	74	21	21	-24	-8	15
2008-2009	107	64	-10	22	6	-21	54	--
2009-2010	110	75	21	36	23	-32	6	-5
2011-2011	--	81	52	40	43	-25	--	113
2011-2012	141	--	75	48	-3	-50	-39	--
2012-2013	138	81	96	22	7	65	31	--
Mean	129	78	51	32	16	-14.5	8.8	41

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.

	Stock-quality		**Quality-preferred**		**Preferred-memorable**	
Year	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	81 (0.9)	20	80 (0.6)	27	83 (--)	1
2005	81 (1.8)	10	83 (0.2)	69	80 (0.3)	6
2006	87 (1.5)	16	83 (0.4)	38	85 (3.7)	3
2007	89 (1.3)	15	91 (0.5)	44	87 (1.0)	12
2008	91 (0.3)	52	91 (0.6)	68	88 (0.4)	23
2009	83 (0.4)	54	81 (0.8)	52	82 (1.3)	12
2010	81 (0.4)	49	82 (0.6)	25	78 (2.7)	5
2011	82 (1.4)	8	80 (1.3)	16	80 (0.9)	4
2012	83 (0.9)	9	84 (0.5)	40	83 (1.0)	3
2013	85 (1.3)	15	86 (0.8)	16	85 (1.4)	6

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.

Year	Age															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Mean**
2004	3	7	20	13	7	1	0	0	0	0	0	0	0	0	0	2.5
2005	24	6	15	28	23	4	4	4	0	0	0	0	0	0	0	3.4
2006	2	10	14	14	9	6	1	0	0	0	0	1	0	0	0	3.0
2007	38	14	22	17	9	3	3	2	0	1	0	0	0	0	0	2.8
2008	25	51	23	37	15	6	6	1	1	0	1	2	0	0	0	2.7
2009	4	44	53	6	6	4	2	3	0	1	0	4	1	0	0	2.5
2010	3	16	40	16	2	2	2	1	2	1	0	0	1	0	0	2.5
2011	8	0	7	9	9	1	1	0	1	0	0	0	0	0	0	3.4
2012	4	6	4	13	18	7	1	1	1	0	0	1	0	0	1	4.0
2013	14	9	9	1	3	8	5	1	0	0	0	1	0	0	0	3.5

<u>Sauger population parameters</u>

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.

Year	PSD	PSD-P	PSD-M	N
2004	86	63	4	54
2005	96	78	6	56
2006	98	51	3	59
2007	69	59	0	77
2008	93	51	10	115
2009	61	36	2	99
2010	82	26	0	94
2011	100	59	3	35
2012	95	76	0	35
2013	69	50	0	38

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.

		Length at age of capture (mm)											
Year		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
2008	**Mean**	174	336	437	463	482	502	496	490	--	--	--	466
	N	30	40	12	12	10	4	2	3	--	--	--	1
	SE	2.7	12.7	26.1	69	97.6	174	325	41.8	--	--	--	--
2009	**Mean**	145	277	380	441	469	444	482	470	490	--	--	--
	N	16	37	31	7	3	1	2	1	1	--	--	--
	SE	2.8	3.3	5.0	14.8	30.9	--	54.0	--	--	--	--	--
2010	**Mean**	155	275	352	395	437	440	--	--	--	--	--	--
	N	1	19	49	19	3	3	--	--	--	--	--	--
	SE	--	4.5	2.7	7.6	33.8	14.5	--	--	--	--	--	--
2011	**Mean**	159	--	354	388	414	411	498	495	--	--	--	--
	N	3	--	7	16	5	1	1	2	--	--	--	--
	SE	5.4	--	5.5	5.9	19.6	--	--	39	--	--	--	--
2012	**Mean**	161	314	369	416	433	432	--	--	--	--	--	--
	N	15	1	1	3	13	2	--	--	--	--	--	--
	SE	4.7	--	--	20.4	10.3	24.0	--	--	--	--	--	--
2013	**Mean**	146	289	324	399	411	440	455	407	--	--	--	--
	N	5	11	4	3	3	6	4	1	--	--	--	--
	SE	3.1	5.5	20.0	29.1	4.3	10.6	20.1	--	--	--	--	--
Mean of means		157	298	369	417	441	445	483	466	490	--	--	466

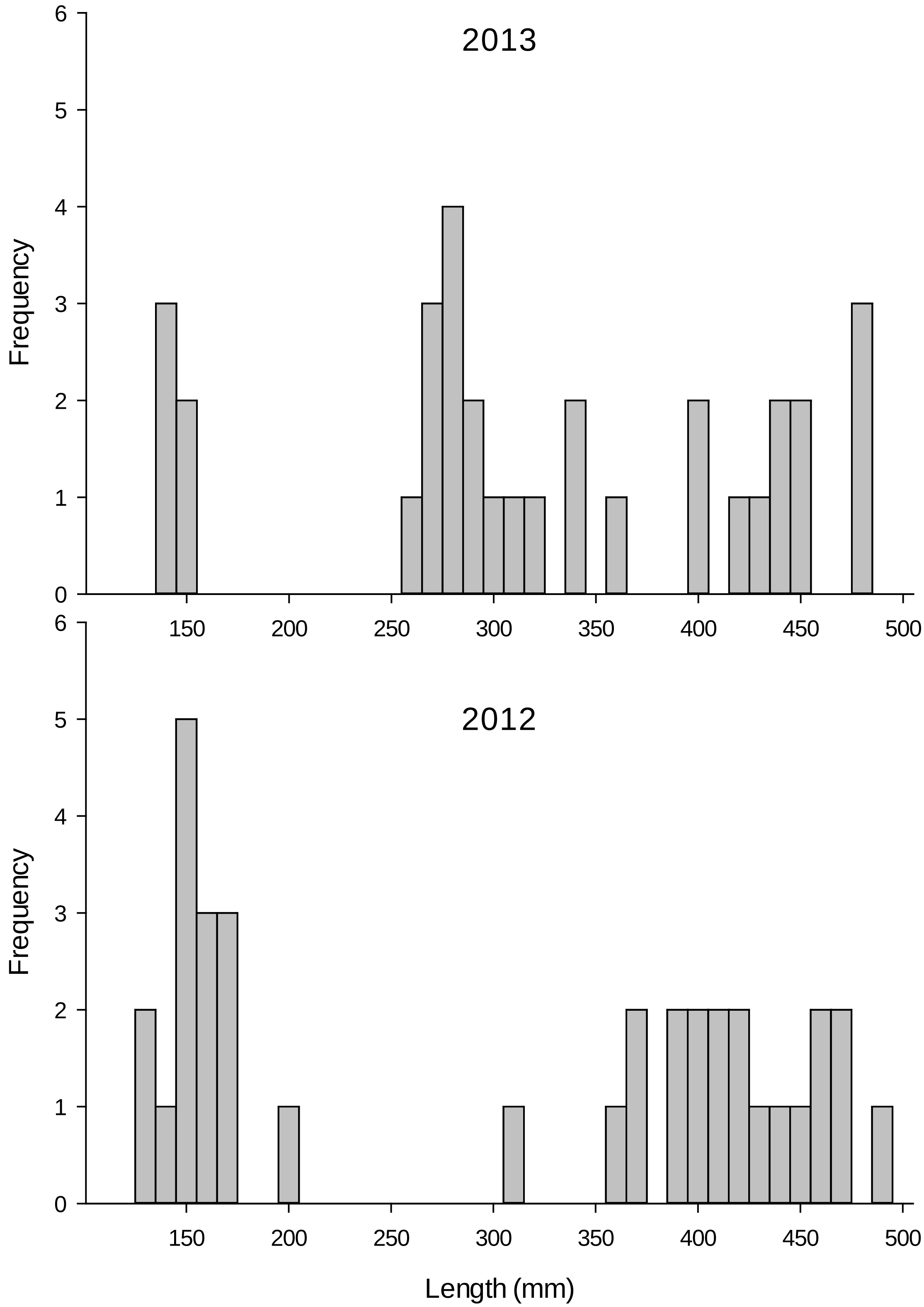

Figure 5. Length frequency of sauger collected during the standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.

Table 13. Mean annual growth increments for sauger collected in the standard September gill net survey, Lewis and Clark Lake, South Dakota, for 2007-2013.

Year	**Growth increment added during period (mm)**							
	0-1	**1-2**	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**	**7-8**
2007-2008	138	125	61	50	2	--	10	--
2008-2009	103	44	4	6	-38	-20	-26	--
2009-2010	130	75	15	-4	-29	--	--	--
2010-2011	--	79	36	19	-26	58	--	--
2011-2012	155	--	62	45	18	--	--	--
2012-2013	30	-5	7	23	--	--	--	--
Mean	111	64	31	23	-15	19	-8	--

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.

	Stock-quality		**Quality-preferred**		**Preferred-memorable**	
Year	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	78 (0.6)	7	77 (0.5)	12	76 (0.3)	30
2005	78 (0.0)	2	81 (0.8)	9	82 (0.5)	35
2006	82 (--)	1	80 (0.5)	28	80 (0.9)	28
2007	83 (0.6)	18	84 (2.0)	6	85 (0.4)	35
2008	85 (1.3)	6	85 (0.6)	37	88 (0.6)	36
2009	80 (0.4)	32	82 (0.8)	21	78 (0.6)	28
2010	79 (0.7)	17	77 (0.3)	52	78 (2.7)	24
2011	75 (0.8)	13	77 (0.4)	18	70 (--)	1
2012	69 (-)	1	80 (1.4)	4	77 (1.1)	16
2013	78 (1.0)	10	73 (3.5)	6	76 (0.7)	16

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.

Year	**Age**											
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Mean**
2004	3	7	7	28	7	1	1	0	0	0	0	2.8
2005	7	0	12	18	11	3	2	1	0	0	0	3.3
2006	0	15	26	2	8	3	1	1	0	0	0	2.4
2007	33	8	17	16	2	0	1	0	0	0	0	2.4
2008	30	41	12	12	10	4	2	3	0	0	1	2.4
2009	16	37	31	7	3	1	2	1	1	0	0	2.0
2010	1	19	49	19	3	3	0	0	0	0	0	2.1
2011	3	0	7	16	5	1	1	2	0	0	0	3.3
2012	15	1	1	3	13	2	0	0	0	0	0	3.7
2013	5	11	4	3	3	6	4	1	0	0	0	3.2

<u>Channel catfish population parameters</u>

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.

Year	PSD	PSD-P	PSD-M	Sample Size
2004	52	0	0	31
2005	64	11	0	84
2006	85	46	8	31
2007	66	16	2	98
2008	29	8	3	66
2009	58	20	10	52
2010	52	11	9	47
2011	83	0	0	8
2012	67	12	0	70
2013	43	4	2	84

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.

	Stock-quality		Quality-preferred		Preferred-memorable	
Year	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	90 (1.8)	13	84 (1.7)	14	--	0
2005	79 (1.3)	29	86 (0.8)	42	95 (2.3)	9
2006	87 (0.8)	4	94 (2.0)	10	87 (2.9)	10
2007	86 (0.4)	30	87 (0.7)	43	90 (1.6)	12
2008	87 (0.7)	42	86 (1.4)	12	94 (7.0)	3
2009	91 (1.5)	17	94 (1.0)	15	92 (5.8)	4
2010	85 (1.0)	21	92 (4.4)	18	95	1
2011	86 (--)	1	105 (2.6)	5	--	0
2012	78 (0.8)	16	80 (0.9)	27	81 (2.3)	6
2013	87 (0.7)	47	85 (1.0)	32	103 (--)	1

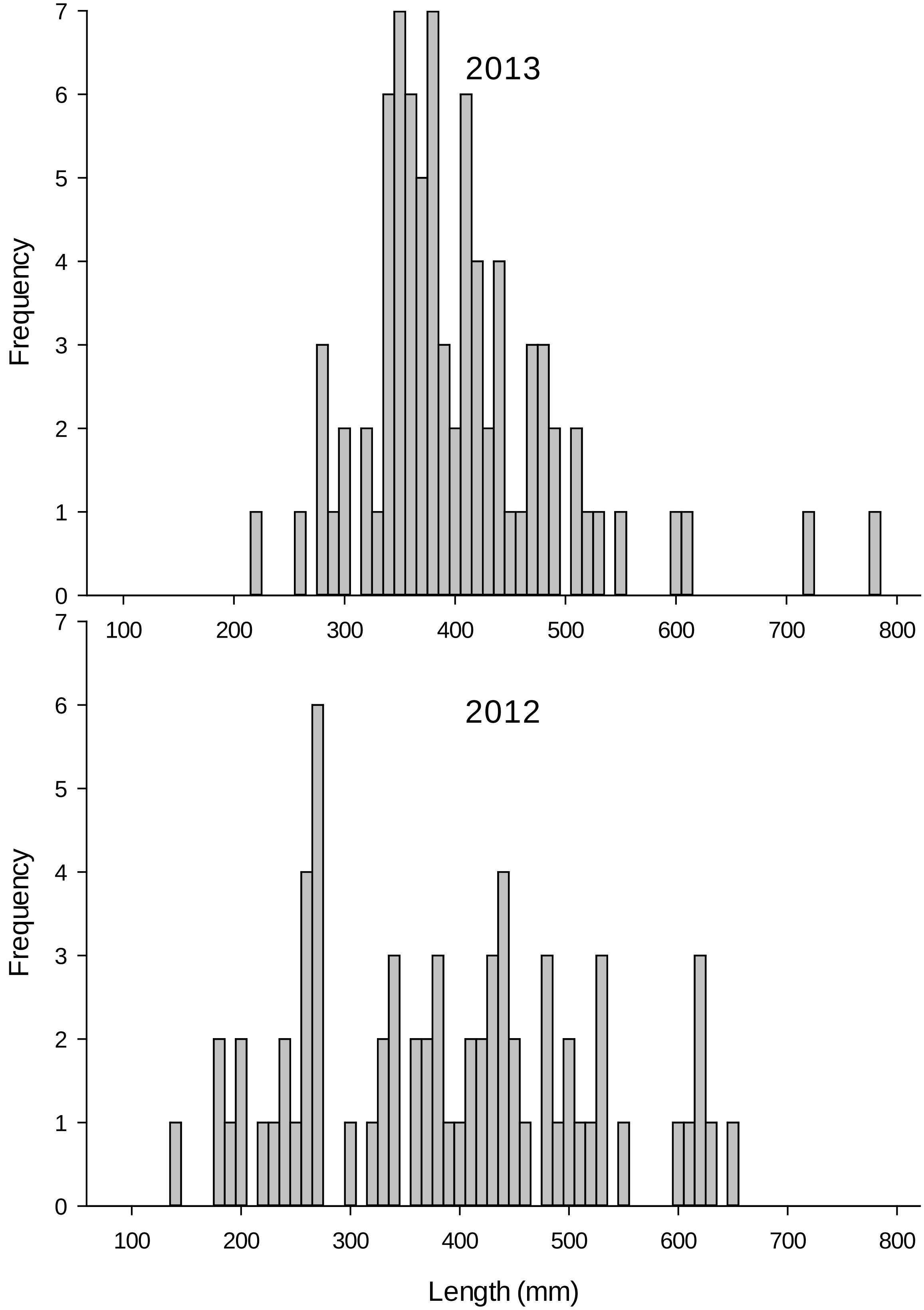

Figure 6. Length frequency for channel catfish collected in standard gill net surveys from Lewis and Clark Lake, South Dakota, 2012 and 2013.

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.

	Age																		
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**Mean**
2003	0	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	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	7	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.

Year class	**Age**	**N**	**Annulus**												
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
2011	1	8	103												
2010	2	16	92	200											
2009	3	16	94	193	309										
2008	4	10	128	223	327	407									
2007	5	8	100	176	280	370	429								
2006	6	5	127	228	327	398	460	509							
2005	7	1	135	241	267	307	359	438	531						
2004	8	1	99	236	318	400	442	497	538	579					
2002	10	3	112	205	328	404	449	485	510	541	566	591			
2000	12	1	105	149	239	344	418	463	508	538	553	582	627	642	
1999	13	1	103	233	306	364	393	408	422	437	451	466	480	495	509
Sample mean (mm)			109	208	300	374	422	467	502	523	523	546	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 *Wr* of quality-preferred smallmouth bass was near the 10 y average (Table 20).

Table 20. Catch per unit effort (CPUE), proportional size distribution (PSD), proportional size distribution for preferred and memorable-length fish (PSD-P, PSD-M), and mean relative weight of stock-quality (S-Q), quality-preferred (Q-P), and preferred-memorable length (P-M) smallmouth bass collected by electrofishing Gavins Point Dam face, Lewis and Clark Lake, 2004-2013. Sample size (N = number of fish in the respective category) and standard error (SE) are also included.

	CPUE				**S-Q**		**Q-P**		**P-M**	
Year	**(fish/h)**	**PSD**	**PSD-P**	**PSD-M**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	44 (11.1)	38	10	0	91 (0.6)	26	87 (1.2)	12	86 (2.6)	4
2005	51 (22.7)	37	5	2	94 (1.3)	26	83 (1.6)	13	75 (--)	1
2006	62 (3.6)	19	6	0	89 (0.5)	39	91(3.1)	6	82 (2.7)	3
2007	41 (12.8)	20	13	0	90 (1.0)	24	82 (2.4)	2	74 (0.9)	4
2008	79 (55)	17	8	2	88 (0.3)	54	93 (0.9)	6	81 (14.4)	4
2009	43 (3.9)	39	19	3	97 (1.5)	19	86 (7.1)	6	91 (1.6)	5
2010	112 (19.1)	13	3	0	89 (0.4)	63	83 (2.1)	7	75 (0.9)	2
2011	72 (19.9)	18	4	0	92 (0.7)	89	86 (0.5)	21	90 (2.1)	4
2012	25 (3.6)	23	3	0	97 (1.0)	15	85 (0.6)	6	93 (2.6)	4
2013	108 (41.6)	30	3	2	94 (0.4)	66	92 (0.6)	25	87 (--)	1

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.

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

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

Year	**Age**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
2004	1	16	16	9	1	0	0	0	2.8
2005	3	23	13	10	0	0	0	1	2.7
2006	1	36	19	1	3	1	0	0	2.5
2007	5	16	7	2	2	1	2	0	2.7
2008	3	56	12	1	0	0	0	1	2.2
2009	0	12	15	5	1	1	1	0	3.1
2010	3	53	40	11	3	0	1	0	2.7
2011	5	60	64	14	1	3	0	0	2.8
2012	0	4	13	6	0	0	0	0	3.1
2013	13	42	34	15	2	0	1	1	2.6

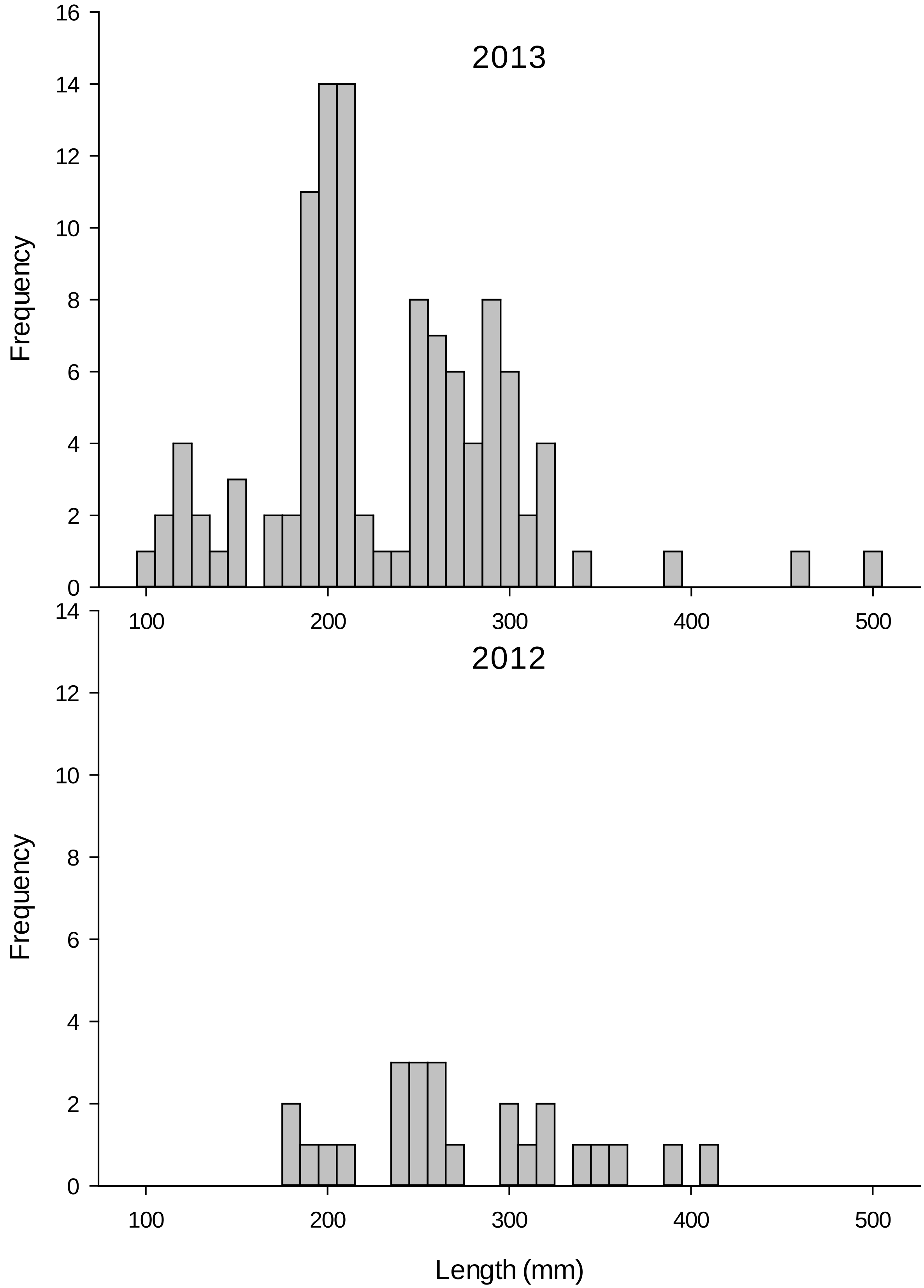

Figure 7. Length frequency for smallmouth bass sampled by nighttime electrofishing near Gavins Point Dam in Lewis and Clark Lake, South Dakota, 2012 and 2013.

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.

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

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.

Year	**Age**															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Mean**
2004	0	3	21	10	3	8	4	2	2	0	0	0	0	0	0	4.4
2005	9	10	7	10	1	4	4	0	1	0	0	0	0	0	0	3.4
2006	7	7	4	7	4	0	3	1	1	0	0	0	0	0	0	3.5
2007	63	12	7	5	4	1	2	4	0	0	0	0	0	0	0	2
2008	12	43	17	13	8	4	4	3	6	5	1	1	2	0	0	4.1
2009	26	14	3	4	0	0	0	2	1	0	0	0	0	0	0	2.8*
2010a	18	29	11	4	2	1	0	0	1	3	2	0	0	0	1	3
2010b	22	29	12	2	2	1	0	0	1	3	2	0	0	1	0	2.9
2011	5	8	6	4	5	5	2	2	3	1	0	3	3	2	0	6.4*
2012	1	42	16	6	3	6	2	2	2	4	1	1	2	1	0	4.0
2013	48	25	19	4	3	2	5	0	1	0	5	4	1	2	4	4.0*

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	Annulus 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	13	14
Length increment			73	68	60	49	46	36	24	23	17	14

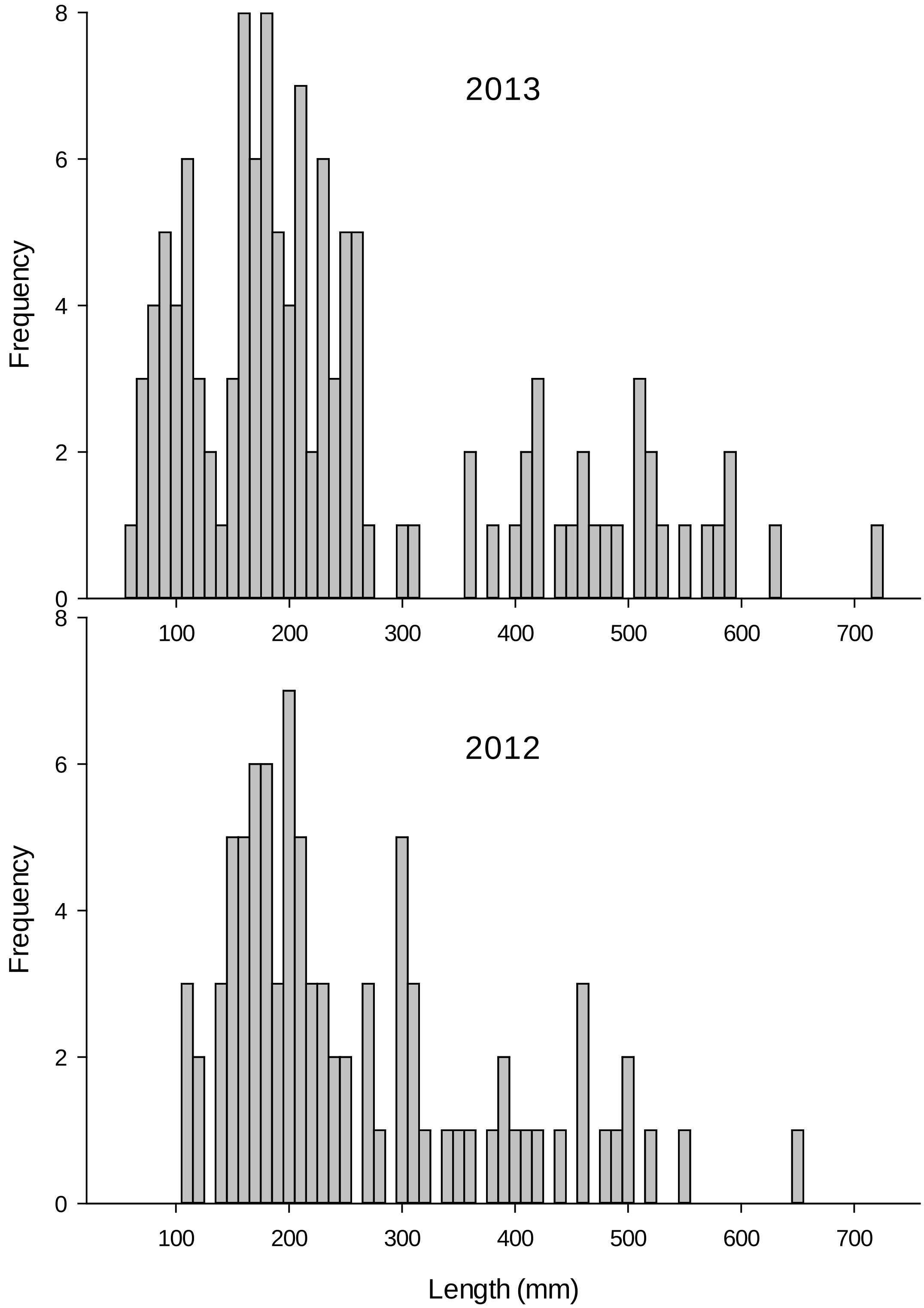

Figure 8. Length frequency of flathead catfish sampled by electrofishing Lewis and Clark Lake during June 2012 and 2013.

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.

	CPUE				**S-Q**		**Q-P**		**P-M**	
Year	**(fish/h)**	**PSD**	**PSD-P**	**PSD-M**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	20 (3.2)	75	50	0	98 (1.8)	7	99 (1.0)	7	97 (0.9)	14
2005	9 (3.4)	84	36	0	108 (2.6)	4	105 (0.8)	12	101 (2.2)	9
2006	14 (8.1)	100	18	0	--	0	102 (1.1)	9	99 (4.8)	2
2008	31 (10.7)	88	66	0	95 (3.1)	4	100 (0.7)	8	101 (2.9)	21
2009	81 (23.7)	85	36	0	100 (3.8)	6	104 (0.8)	19	103 (1.9)	14
2010	29 (10.3)	87	57	0	105 (1.5)	5	108 (0.9)	11	104 (1.7)	21
2011	15 (3.6)	77	64	0	114 (2.8)	5	116 (4.4)	3	109 (5.7)	14
2012	6 (6)	75	38	0	118 (1.1)	2	120 (4.0)	3	107 (7.9)	3
2013	1 (1)	100	0	0	97 (--)	1	89 (--)	1	--	0

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.

Year class	Age	N	Annulus							
			1	2	3	4	5	6	7	8
2009	3	3	109	232	292					
2008	4	2	97	221	319	368				
2007	5	2	94	193	313	365	410			
Sample mean			100	215	308	366	410			
Standard error			5	12	8	1	--			
Length increment			115	93	58	44				

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.

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	Mean
2004	5	3	7	6	4	9	4	2	0	0	0	0	4.4
2005	1	0	7	9	0	2	3	3	0	0	0	0	4.6
2006	0	1	0	0	0	2	4	5	0	0	0	0	6.8
2008	3	4	5	4	3	7	8	0	3	0	0	0	4.9
2009	20	2	6	6	10	4	7	3	0	0	0	0	3.7
2010	7	9	5	7	7	11	5	1	0	0	0	0	4.1
2011	0	2	2	3	3	4	2	4	0	0	0	0	5.4
2012	0	3	2	2	0	0	0	0	0	0	0	0	2.9

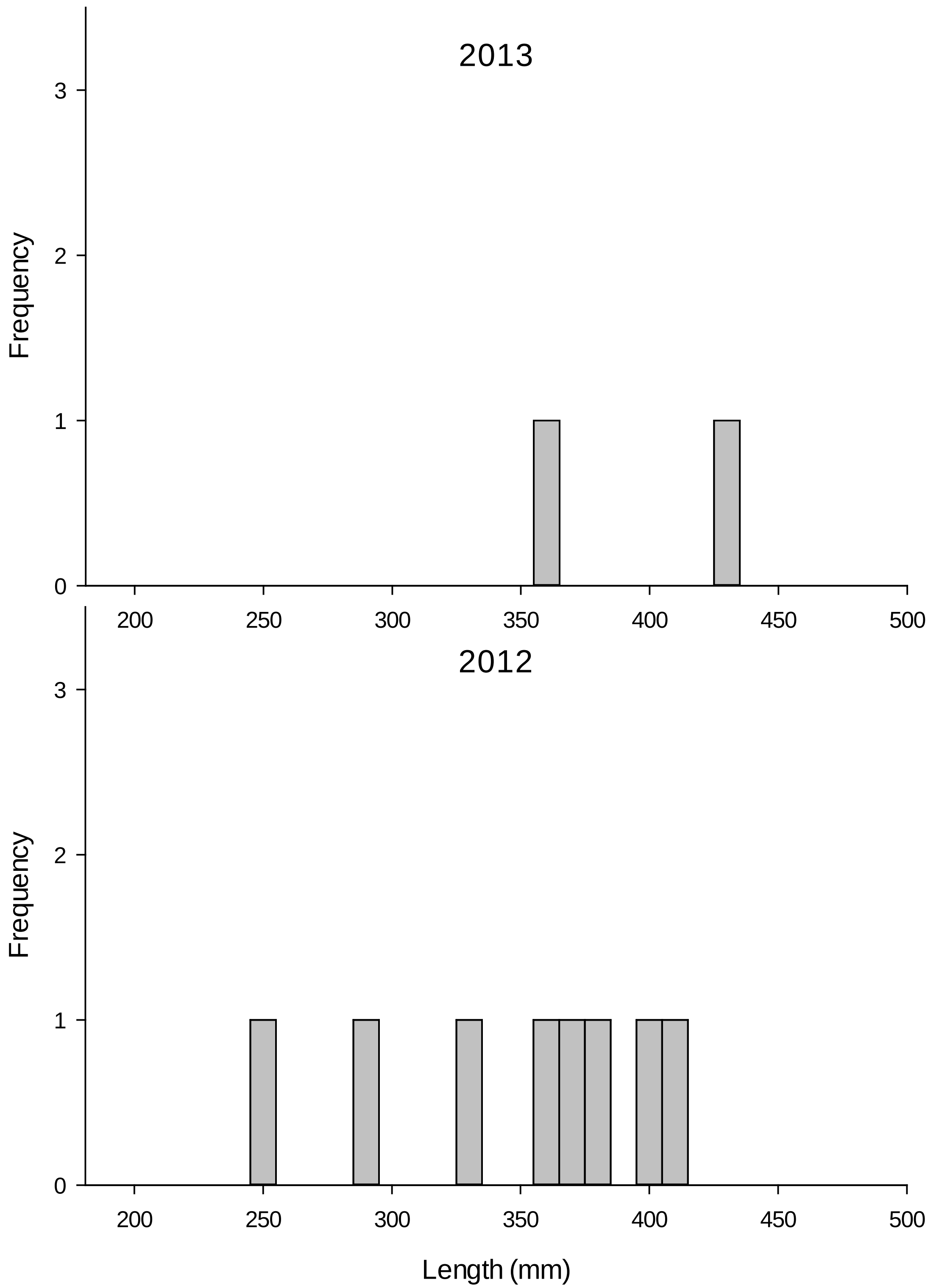

Figure 9. Length frequency of largemouth bass sampled by electrofishing in the Niobrara delta near Springfield, South Dakota during May 2012 and 2013.

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.

	CPUE				**S-Q**		**Q-P**		**P-M**	
Year	**(fish/h)**	**PSD**	**PSD-P**	**PSD-M**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	66 (24)	10	0	0	97 (0.7)	38	96 (0.7)	4	--	0
2005	78 (45)	11	0	0	92 (0.5)	62	90 (2.7)	8	--	0
2006	34 (17.1)	30	4	0	93 (0.9)	16	93 (1.5)	6	95 (-)	1
2007	56 (12.0)	23	9	2	94 (0.7)	34	92 (0.7)	6	90 (4.8)	3
2008	76 (6.6)	12	0	0	89 (0.6)	37	91 (3.2)	5	--	0
2009	97 (32.8)	30	7	1	92 (0.5)	49	92 (1.3)	16	93 (6.3)	4
2010	151 (26.9)	21	4	0	95 (0.2)	85	92 (1.0)	18	94 (3.6)	4
2011	59 (11.1)	28	12	0	89 (0.5)	73	88 (3.0)	17	91 (1.4)	12
2012	30 (11.4)	35	30	5	91 (1.3)	13	95 (--)	1	99 (3.7)	5
2013	40 (13)	31	19	0	89 (0.7)	18	89 (2.8)	3	85 (2.8)	5

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.

Year class	Age	N	Annulus						
			1	2	3	4	5	6	7
2012	1	10	115						
2011	2	12	94	191					
2010	3	10	93	167	213				
2009	4	2	90	180	257	301			
2008	5	1	100	188	289	334	375		
2007	6	2	79	146	231	291	363	400	
2006	7	2	106	167	265	308	375	395	413
Sample mean			97	173	251	309	371	397	413
Standard error			4	7	13	9	4	2	--
Length increment			76	78	57	62	26	15	

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.

Year	Age							
	1	2	3	4	5	6	7	Mean
2004	1	29	10	3	0	0	0	2.3
2005	1	50	24	2	0	0	0	2.4
2006	8	19	3	3	1	0	0	2.1
2007	30	19	14	8	1	1	1	2.2
2008	32	38	6	0	0	0	0	1.7
2009	15	48	23	4	3	1	0	2.3
2010	8	99	30	8	3	0	0	2.3
2011	7	54	39	13	2	0	0	2.6
2012	1	18	7	0	4	0	0	2.6
2013	10	12	10	2	1	2	2	2.6

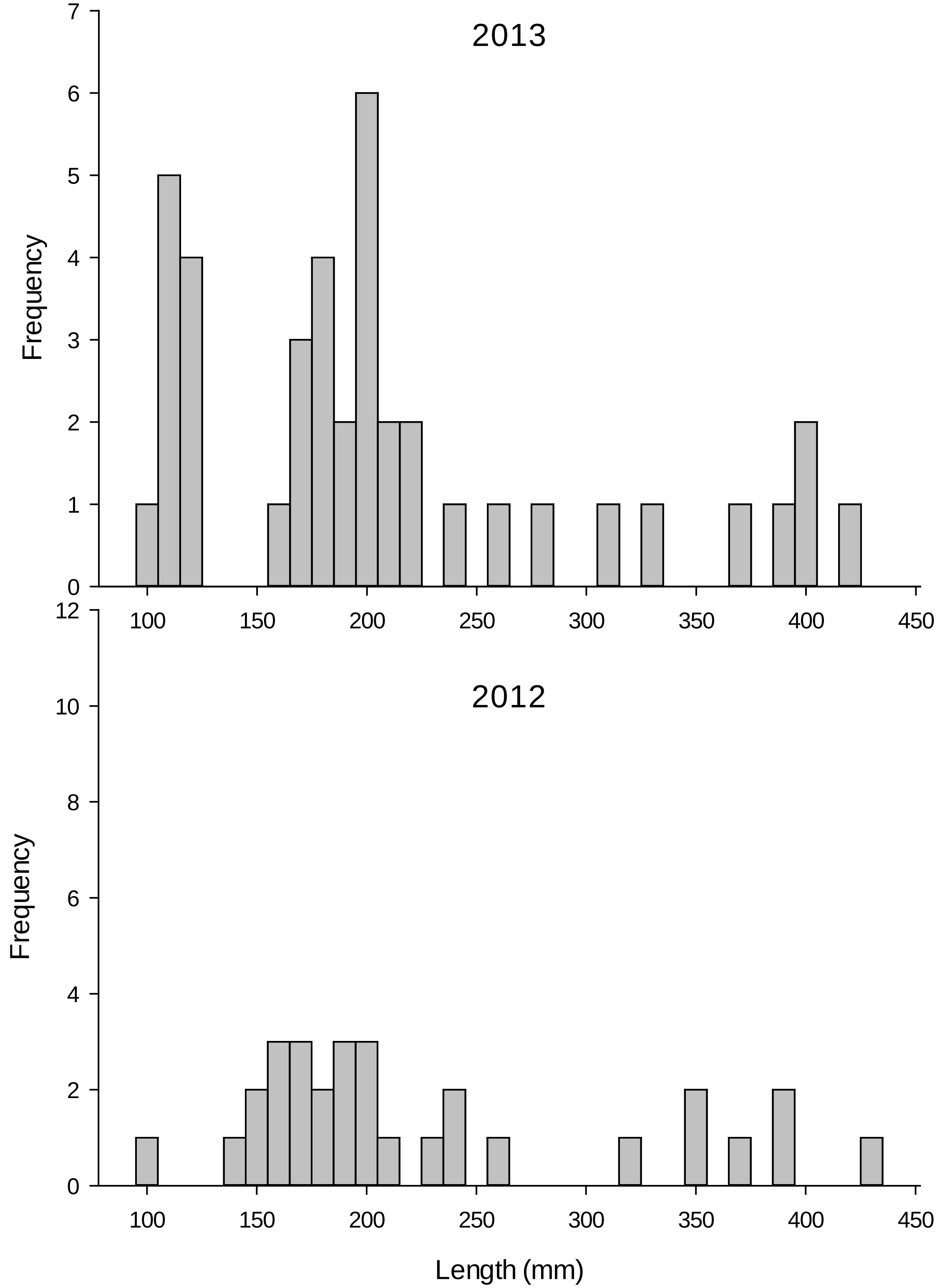

Figure 10. Length frequency of smallmouth bass sampled by electrofishing the Missouri River below Gavins Point Dam in May, 2012 and 2013.

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.

	CPUE				**S-Q**		**Q-P**		**P-M**	
Year	**(fish/h)**	**PSD**	**PSD-P**	**PSD-M**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**	***Wr* (SE)**	**N**
2004	14 (2.6)	58	8	0	108 (5.1)	5	107 (2.3)	6	106 (--)	1
2005	78 (45)	67	13	0	112 (3.9)	5	103 (1.3)	8	99 (3.1)	2
2006	--	--	--	--	--	--	--	--	--	--
2007	119 (19.1)	39	5	0	94 (1.3)	23	103 (1.5)	13	105 (2.2)	2
2008	100 (29.6)	36	11	2	101 (1.8)	30	109 (2.4)	12	112 (4.0)	4
2009	39 (7.6)	15	0	0	102 (0.4)	22	91 (0.0)	2	--	0
2010a	51 (25.0)	24	5	0	100 (0.4)	16	99 (3.9)	4	88 (--)	1
2010b	48 (22.5)	44	13	0	112 (1.4)	18	109 (0.6)	10	107 (0.3)	4
2011	15 (4.6)	100	41	1	--	0	118 (3.5)	5	116 (1.5)	6
2012	257 (52.6)	25	2	0	98 (0.6)	33	98 (2.6)	10	80 (--)	1
2013	75 (19)	47	16	0	98 (2.5)	10	97 (4.0)	6	104 (0.6)	3

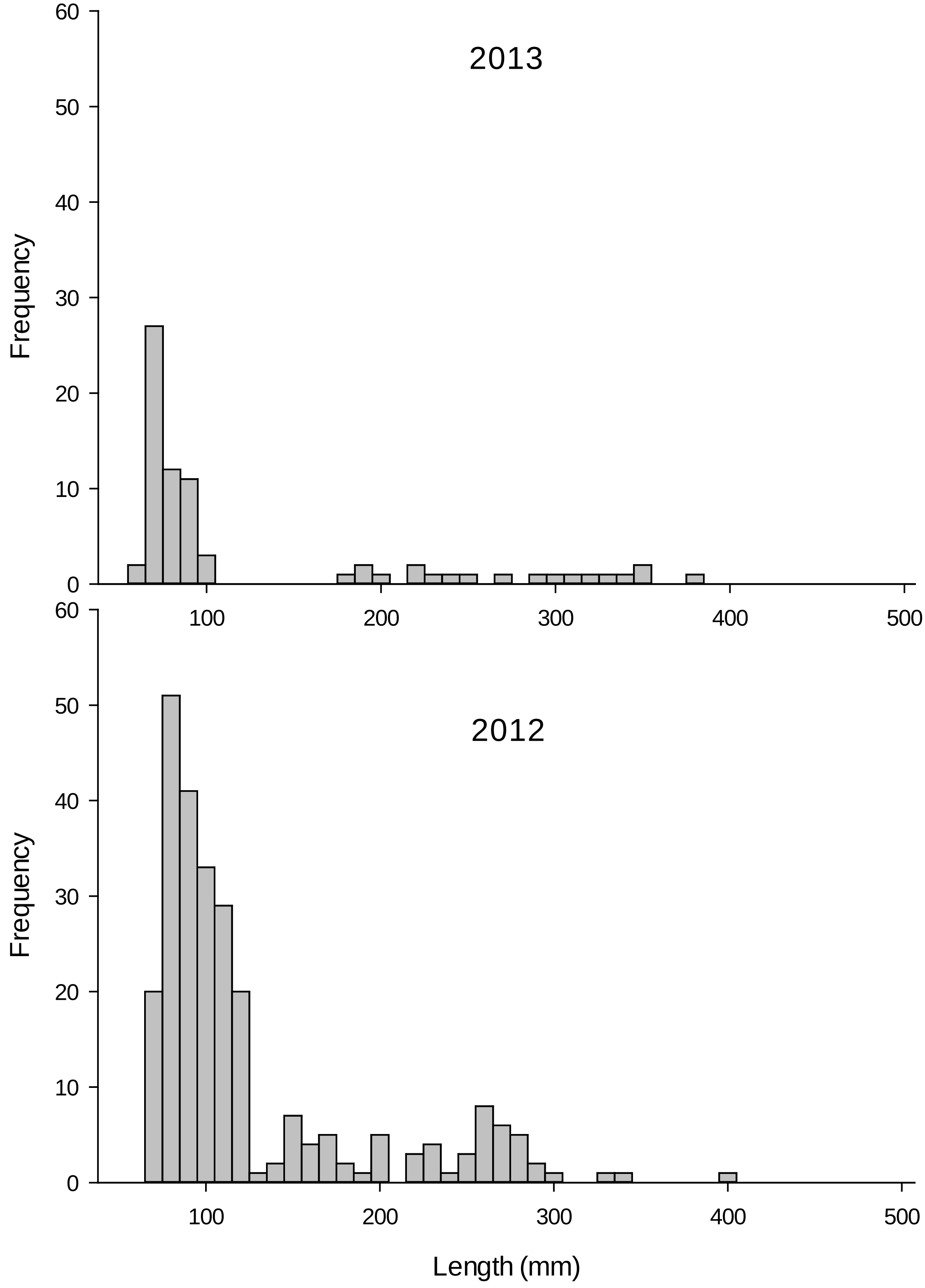

Figure 11. Length frequency of smallmouth bass sampled by nighttime electrofishing the Missouri River below Fort Randall Dam in October 2012, and 2013.

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.

Year class	**Age**	**N**	**Annulus**				
			1	**2**	**3**	**4**	**5**
2013	0	55					
2012	1	2	115				
2011	2	7	92	161			
2010	3	7	85	177	270		
2009	4	3	94	179	265	318	
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.

Year	**Age**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
2004	0	5	7	1	1	0	0	0	0	1.9
2005	0	3	5	3	6	0	0	0	0	2.4
2006	--	--	--	--	--	--	--	--	--	--
2007	42	45	11	16	3	1	0	1	0	1.8
2008	2	50	30	13	2	2	0	0	0	1.7
2009	9	0	16	11	2	0	0	0	0	2.5
2010a	0	1	23	21	3	2	1	0	0	2.7
2010b	9	18	7	10	4	0	0	0	0	1.6
2011	1	0	3	6	1	2	0	0	0	3.2
2012	201	19	33	4	1	0	0	0	0	1.8
2013	55	2	7	7	3	0	0	0	0	2.6

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.

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

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.

Species and Objectives	CPUE	PSD	PSP-P	Harvest	Harvest rate
Walleye	4.3/gill net	59	16		
Objectives	≥4.0/gill net	30-60	≥10	10,000	0.1/ h
Sauger	**3.2/gill net**	**69**	50		
Objectives	≥6.0/gill net	30-60	≥10	5,000	0.1/ h
Channel catfish	7/gill net	43	**4**		
Objectives	≥3/gill net	30-60	≥10		
Largemouth bass	**1/h electrofishing**	**100**	**0**		
Objectives	≥10/h electrofishing	30-60	≥20		
Smallmouth bass	108/h electrofishing	30	**3**		
Objectives	≥10/h electrofishing	30-60	≥20		

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.

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APPENDICES

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

Common name	Scientific name	Abbreviation
Bigmouth buffalo	*Ictiobus cyprinellus*	BIB
Black bullhead	*Ameiurus melas*	BLB
Black crappie	*Pomoxis nigromaculatus*	BLC
Bluegill	*Lepomis macrochirus*	BLG
Blue sucker	*Cycleptus elongatus*	BSR
Bluntnose minnow	*Pimephales notatus*	BLM
Brassy minnow	*Hybognathus hankinsoni*	BRM
Channel catfish	*Ictalurus punctatus*	CCF
Common carp	*Cyprinus carpio*	COC
Common shiner	*Notropis cornutus*	COS
Creek chub	*Semotilus atromaculatus*	CRC
Emerald shiner	*Notropis atherinoides*	EMS
Fathead minnow	*Pimephales promelas*	FHM
Flathead catfish	*Pylodictis olivaris*	FCF
Flathead chub	*Platygobio gracilis*	FLC
Freshwater drum	*Aplodinotus grunniens*	FRD
Gizzard shad	*Dorosoma cepedianum*	GIS
Golden shiner	*Notemigonus crysoleucas*	GOS
Goldeye	*Hiodon alosoides*	GOE
Grass psickerel	*Esox americanus vermiculatus*	GRP
Green sunfish	*Lepomis cyanellus*	GRS
Johnny darter	*Etheostoma nigrum*	JOD
Largemouth bass	*Micropterus salmoides*	LMB
Northern pike	*Esox lucius*	NOP
Orangespotted sunfish	*Lepomis humilis*	ORS
Paddlefish	*Polyodon spathula*	PAH
Pallid sturgeon	*Scaphirhynchus albus*	PLS
Rainbow smelt	*Osmerus mordax*	RBS
Red shiner	*Notropis lutrensis*	RES
Redfin shiner	*Lythrurus umbratilis*	RES
River carpsucker	*Carpiodes carpio*	RIC
Rock bass	*Ambloplites rupestris*	ROB
Sauger	*Sander canadense*	SAR
Sand shiner	*Notropis stramineus*	SAS
Shorthead redhorse	*Moxostoma macrolepidotum*	SHR

Appendix 1. continued

Shortnose gar	*Lepisosteus platostomus*	SNG
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	SHS
Silverstripe shiner	*Notropis stilbius*	SIS
Smallmouth bass	*Micropterus dolomieu*	SMB
Smallmouth buffalo	*Ictiobus bubalus*	SAB
Spotfin shiner	*Notropis spilopterus*	SFS
Spottail shiner	*Notropis hudsonius*	SPS
Walleye	*Sander vitreus*	WAE
Western silvery minnow	*Hybognathus argyritis*	WSM
White bass	*Morone chrysops*	WHB
White crappie	*Pomoxis annularis*	WHC
Yellow perch	*Perca flavescens*	YEP

Appendix 2. Standard weight equations used for relative weight calculations. Length is in millimeters and weight is in grams.

Species	Equation
Channel catfish	$Log_{10}(Ws)= 3.2494*Log_{10}(TL)-5.800$
Flathead catfish	$Log_{10}(Ws)= 3.082*Log_{10}(TL)-5.156$
Largemouth bass	$Log_{10}(Ws)= 3.19*Log_{10}(TL)-5.316$
Sauger	$Log_{10}(Ws)= 3.187*Log_{10}(TL)-5.492$
Smallmouth bass	$Log_{10}(Ws)= 3.200*Log_{10}(TL)-5.329$
Walleye	$Log_{10}(Ws)= 3.180*Log_{10}(TL)-5.453$