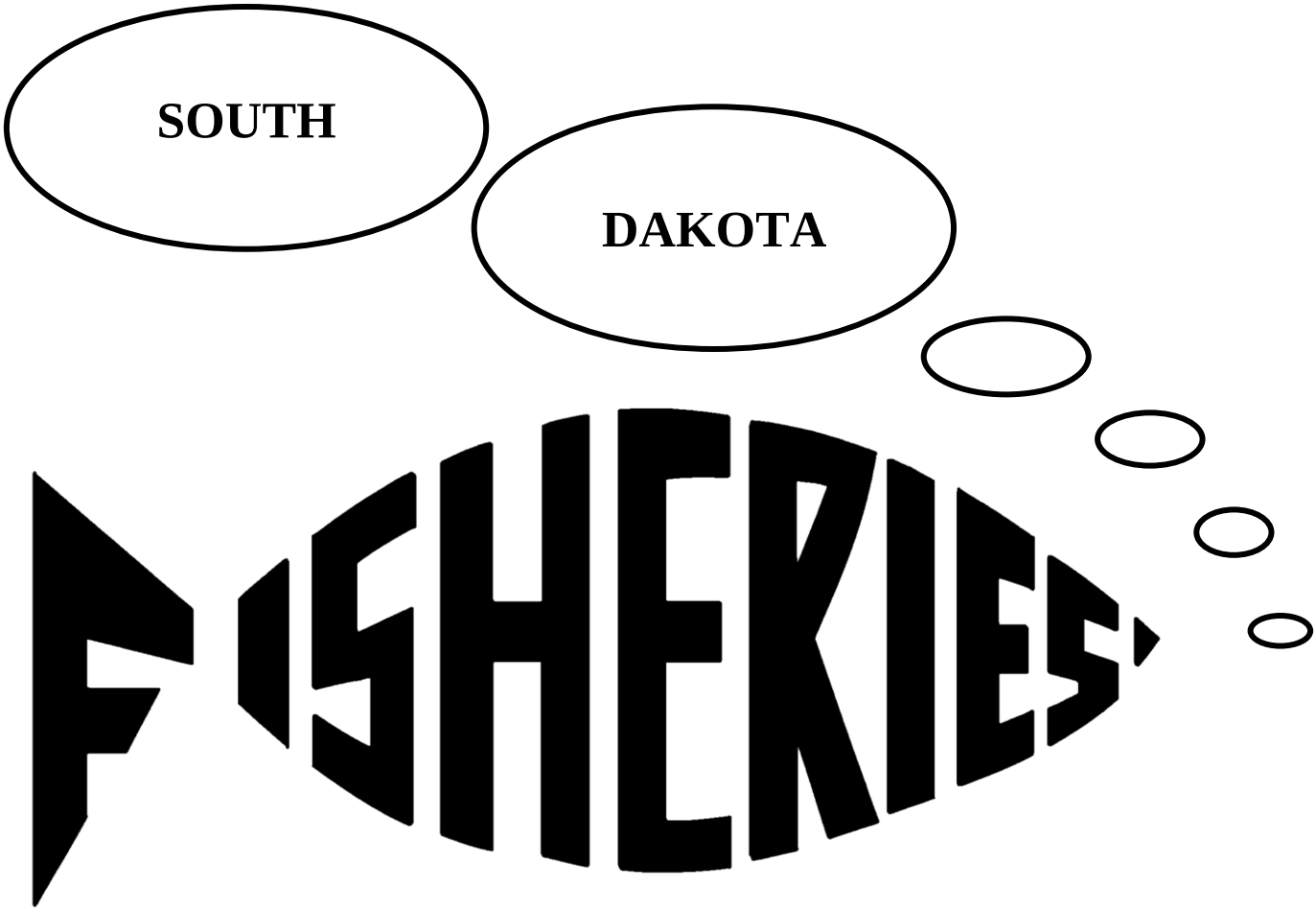

ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2016

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

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ANNUAL FISH POPULATION
AND
ANGLER USE, HARVEST AND PREFERENCE SURVEYS
ON
LAKE SHARPE, SOUTH DAKOTA, 2016

By

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South Dakota Dept. of Game, Fish, and Parks

Annual Report

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PREFACE

Information collected during 2016 is summarized in this report. Copies of this report and references to the data can be made with permission from the authors or the Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, SD 57501.

The authors would like to thank the following individuals from the South Dakota Department of Game, Fish and Parks who helped with data collection, data entry, manuscript preparation, and report editing: H. Becker, C. Beecher, L. Collett, N. Larson, T. Long, D. Peterson, H. Peterson, S. Reese, and A. Smith.

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-49, Statewide Fish Management Surveys. Some of these data have been presented previously in segments F-21-23 through 48.

EXECUTIVE SUMMARY

This report includes annual fish population data and angler use, harvest, and preference data collected in 2016, for Lake Sharpe, South Dakota. In 2014, a reduction in manpower and budgetary constraints necessitated a reduction in creel effort on Lake Sharpe. Therefore, the angler use and harvest survey was reduced from the traditional April-September period to an abbreviated May-July period. In 2015 and 2016, the angler use and harvest survey was expanded to include the May-August period. Comparisons made to fish population data and angler use and harvest survey data from previous years will therefore be for the May-August time period for each year. Results of these surveys are used to evaluate progress towards strategic plan objectives as outlined in the Missouri River Fisheries Program Strategic Plan 2014.

We collected walleye ranging from 120- to 580-mm during the August 2016 gill net survey. Mean catch per unit effort (CPUE) of walleye in gillnets (22.4 fish/net-night) during 2016 remained below the five year average. Walleye CPUE was the tenth highest observed for 254-381 mm length walleye and the twelfth highest observed for 382-457 mm length walleye since the survey was initiated in 1986. Proportional size distribution (PSD) in 2016 was identical to the ten year mean (41). Seventy percent of walleye sampled during the August gill net survey in 2016 were below the September-June 381mm minimum harvest length limit.

Sixteen species of age-0 and/or small-bodied prey fishes were collected by shoreline seining in 2016, all of which had been collected previously in Lake Sharpe. Gizzard shad CPUE (225 fish/haul) was lower than the five year average of 704 and the lowest documented since the flood of 2011. Caution should be taken when inferring population abundance from seine data due to the highly variable nature of these surveys. Seine surveys are, however, a good indicator of species presence/absence. Lake Sharpe gizzard shad were not used for stocking programs on Lake Oahe in 2016.

An estimated 390,572 h angler hours were spent on Lake Sharpe during the May-August 2016 daylight period, the third highest pressure estimate on record, and the highest pressure observed since 1998. Estimated walleye harvest was 157,350 fish which was the third highest harvest on record, the highest May-August total since 2013, and exceeded the long term mean of 108,231 for Lake Sharpe.

Estimated hourly harvest rate for all species combined for the May-August 2016 daylight period (0.49 fish/angler-h) was higher than the strategic plan objective (0.35 fish/angler-h). The walleye catch, harvest, and release rates for all anglers in 2016 (0.98, 0.40, 0.58 fish/angler-h, respectively) were average for this fishery. The 2016 smallmouth bass (0.18 fish/angler-h) and white bass catch rates remain low (0.04 fish/angler-h). However, channel catfish catch rates (0.7 fish/angler-h) exceeded the long term mean in 2016.

The majority (87%) of angling parties interviewed in 2016 indicated some degree of satisfaction with their fishing trip, which surpasses the Lake Sharpe strategic plan objective of 70%. Fishing on Lake Sharpe contributed an estimated $6.6 million to the local and regional economy during the May-August 2016 daylight period (98,852 trips; $67 per trip; U.S. Department of the Interior-Fish and Wildlife Service, and U.S. Department of Commerce-Bureau of the Census 2012).

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INTRODUCTION

The Missouri River system represents one of the most economically and recreationally important aquatic resources in the state of South Dakota. Anglers spent over 2.4 million hours fishing the Missouri River system in South Dakota in 2009 (Bouska and Longhenry 2010; Longhenry *et al*. 2010 a, b; Sorenson and Knecht 2010). In 2010, approximately 37% of all angler days in South Dakota were spent on the Missouri River system (Gigliotti 2011), and about 50% of all South Dakota resident licensed anglers fished the Missouri River system (Gigliotti 2011). The South Dakota Department of Game, Fish and Parks (SDGFP) developed the Missouri River fisheries management area plan to effectively guide management of the resource and direct future research (SDGFP 2014).

Lake Sharpe has supported between 31,968 and 109,596 angler days and generated between $2.1 and 7.3 million annually to the local and regional economy during the May-August daylight period, 2001-2016. Lake Sharpe is an important resource in South Dakota and its habitat and fish assemblage must be managed to enhance its value to various user groups. The importance of Lake Sharpe to Missouri River fisheries is documented in the goals, objectives and strategies developed for management of this system (SDGFP 2014). Information gathered during standardized creel and fish population surveys is used to evaluate objectives and to identify future management strategies. This report includes data collected from Lake Sharpe in 2016, as well as comparisons of 2016 data to previous years. A list of common and scientific names for fish and emergent vegetation mentioned in this report are presented in Appendix 1 and 2, respectively.

STUDY AREA

Lake Sharpe is a 24,686 ha mainstem Missouri River flow-through reservoir located in central South Dakota and extends 128-km from Oahe Dam to Big Bend Dam (Table 1). The reservoir has been divided into three zones for SDGFP survey purposes (Figure 1). The upper zone extends from Oahe Dam to the downstream end of LaFramboise Island, the middle zone extends from the downstream end of LaFramboise Island to DeGrey Lakeside Use Area, and the lower zone extends from DeGrey to Big Bend Dam. Standard gill netting and seining locations have historically included Farm Island, DeGrey/Fort George Lakeside Use Area, Joe Creek Lakeside Use Area, and North Shore Lakeside Use Area.

Hipple Lake and LaFramboise Bay are large backwaters located on upper Lake Sharpe. These embayments are generally warmer compared to the main lake (Longhenry et al. 2010). Emergent vegetation, including curly leaf pondweed, Eurasian water milfoil, fan-leafed crowfoot, American elodea, and sago pondweed is prevalent in embayments throughout Lake Sharpe. Cattail and round stem bulrush stands are more common in Hipple Lake, but can also be found in LaFramboise.

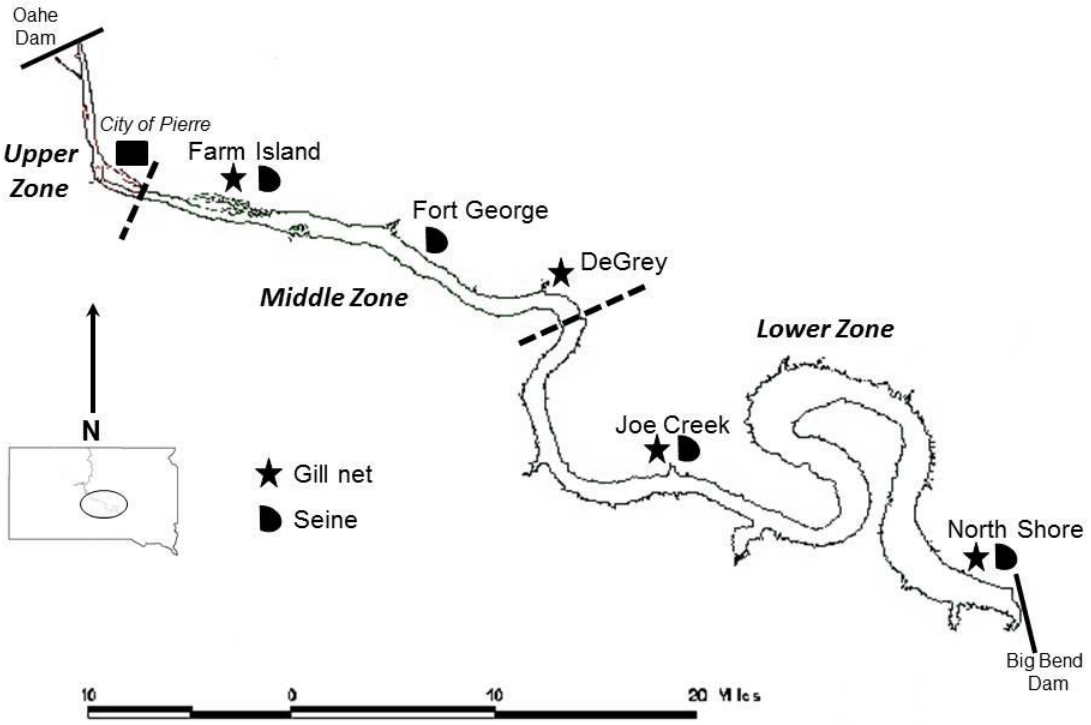

Figure 1. Gill net and seine locations on Lake Sharpe, South Dakota, including zone designations, 2016.

Table 1. Physical characteristics at normal pool elevation, management classification and sampling times and depths for annual fish population surveys on Lake Sharpe, South Dakota.

Characteristic:	Description
Location:	From Oahe Dam to Big Bend Dam
Surface area (ha):	24,686
Depth (m)-maximum:	23.5
-mean:	9.5
Bottom substrate:	Sand, gravel, shale and silt
Water source:	Missouri River and tributaries
Management classification:	Cool and warm water permanent
Gill net depths (m):	0.0 - 9.0 9.1 - 18.3
Number of gill nets:	24
Gill netting survey month	August
Number of seine hauls:	16
Seining survey months	July/August

REGULATION HISTORY

Fish population and angler use and harvest survey data are essential when evaluating special management regulations. Walleye harvest regulations for Lake Sharpe have differed from standard statewide regulations since 1990 when an April through June 356-mm (14-in) minimum length limit was implemented (Table 2). In 1999, the minimum length limit was increased to 381-mm (15-in) during all months except July and August and a stipulation that, at most, one fish in the daily limit could be 457-mm (18-in) or longer was added. These changes were made to reduce harvest during a period of high angler use and increase the abundance of walleye longer than 457-mm (18-in) in the population. The daily limit was reduced to three fish for 2004 and 2005 to reduce harvest during a period of low walleye abundance. In 2006, the daily limit was returned to the statewide limit of four and the one walleye over 457-mm (18-in) length regulation was increased to 508-mm (20-in).

Experimental regulations for smallmouth bass were implemented in 2003 and evaluated through 2011 for their effectiveness at increasing the size structure of the population in Lake Sharpe (Table 2). Special regulations for smallmouth bass from 2003 through 2007 included a 306- to 457-mm (12- to 18-inch) protected slot length limit with, at most, one fish 457-mm (18-in) or longer in the daily limit. In 2008, the smallmouth bass regulations on Lake Sharpe were altered to include a 355- to 457-mm (14- to 18-in) protected slot length limit with, at most, one fish 457-mm (18-in) or longer in the daily limit. The regulation change was implemented with a goal to decrease abundance and increase size structure through increased harvest of smaller smallmouth bass. The slot limit regulation for smallmouth bass was evaluated beginning in 2011 and deemed unsuccessful, thus, this regulation was removed at the end of calendar year 2011 (Fincel et al. 2015).

Table 2. History of special harvest regulations for walleye and smallmouth bass on Lake Sharpe, South Dakota, 1968-2016.

Species	Period	Daily limit	Possession limit	Length restrictions
Walleye/Sauger in combination	1968-1983	8	16	None
	1984-1989	6	12	None
	1990-1998	4	8	• April-June 356-mm minimum length
	1999-2003	4	8	• Sept.-June 381-mm minimum length • At most one equal to or longer than 457-mm
	2004-2005	3	8	• Sept.-June 381-mm minimum length • At most one equal to or longer than 457-mm
	2006-present	4	8	• Sept.-June 381-mm minimum length • At most one equal to or longer than 508-mm
Smallmouth bass	2003-2007	5	10	• Only fish shorter than 306-mm or 457-mm and longer may be kept and at most one fish in the daily limit may be 457-mm or longer.
	2008-2011	5	10	• Only fish shorter than 306-mm or 457-mm and longer may be kept and at most one fish in the daily limit may be 457-mm or longer.
	2012-present	5	10	None

SAMPLING METHODS

Fish Population Surveys

Data Collection

In 2016, experimental-mesh gill nets and a nylon mesh bag seine were used to survey fish populations in Lake Sharpe (Figure 1). Four locations on Lake Sharpe were sampled with six, 91.4-m multifilament gill nets submerged overnight (about 20 h). Three nets were placed ≤ 9-m depth and three were placed at depths > 9-m where possible (Figure 1). Bar mesh dimensions included 13-, 19-, 25-, 32-, 38-, and 51-mm. All fish collected were identified and enumerated. The first 50 individuals of each species were measured (TL; mm) and weighed (g) at each sampling location. All walleye and sauger were measured, weighed, and otoliths removed for age-estimation (10 per 2.5-cm length group per sampling location).

A 6.4-mm nylon mesh bag seine, measuring 30.5-m long by 2.4-m deep with a 1.8-m by 1.8-m bag, was used to collect age-0 and small-bodied littoral fishes. A quarter-arc seine haul was accomplished using methods described in Martin et al. (1981). Four seine hauls were made at each sampling station. All fish collected were identified, counted, and classified by age.

Data Analysis

Relative abundance of fish species was indexed using mean catch per unit effort (CPUE) for gill net (No./net night) and seine (No./haul) catches. Age and growth analyses were conducted using whole otoliths that were submersed in glycerol and viewed under a compound microscope. Otoliths were cracked at the focus and charred for age-estimation of all walleye (DeVries and Frie 1996; Isermann et al. 2003). Proportional size distribution (PSD; Anderson 1980, Gablehouse 1984, Guy et al. 2007) was calculated for walleye, sauger, and channel catfish. Relative weight (W_r; Anderson 1980) was calculated using standard weight (W_s) equations developed for walleye (Murphy et al. 1990) and channel catfish (Brown et al. 1995).

Angler Use, Sportfish Harvest and Preference Surveys

Data Collection

Prior to 2003, angler use and sport-fish harvest survey techniques were designed using a template by Schmidt (1975) consisting of two independent parts. First, aerial pressure counts were used to estimate fishing pressure. Second, angler interviews were used to obtain estimates of individual angler harvest, catch, and release rates. Since 2003, a bus route survey design (Jones and Robson 1991) has been used for the angler use and harvest survey to increase the statistical reliability of the pressure estimates generated. A bus route design is a modified access survey typically used for fisheries with numerous access sites spread over a broad geographical region (Robson and Jones 1989; Jones et al. 1990).

Creel surveys were conducted from 1-May, 2016 through 31-August, 2016 for the sunrise-to-sunset (daytime) period. For diagrams of bus routes used on Lake Sharpe during the May-August survey period consult Fincel et al. (2012). Day selection

(weekday or weekend/holiday), shift time (day beginning at sunrise or ending at sunset), route direction (forward or backward), starting location, and route selection were randomly selected.

Questions posed in standard interviews gathered information on trip length, type of fishing (boat or shore), target species, zip code, number in party, number, and species of fish harvested and released, and lengths of walleye harvested by anglers. Angler satisfaction questions were included in each interview during the 2016 reservoir-wide angler use and harvest survey. In addition to asking anglers how satisfied they were with their fishing trip, anglers were also asked what factors would help increase their satisfaction level to "very satisfied". Anglers were also asked an alternating set of supplemental questions: 1) how satisfied they were with access facilities and what could improve access and 2) what depth they were targeting walleye (Appendix 3).

Data Analysis

Pressure count and angler interview data were analyzed using the Creel Application Software (CAS) package (Soupir and Brown 2002) and 80% confidence intervals were calculated for estimates of fishing pressure and harvest. Catch, harvest, and release numbers and rates were calculated. Median values of satisfaction question responses were calculated for each month and for the entire May-August survey period.

RESULTS AND DISCUSSION

August Gill Net Population Assessment

Species Composition and Relative Abundance

Walleye and channel catfish comprised 44 and 13% of the gill net catch in 2016, respectively (Table 3). Other species commonly caught included sauger, common carp, and yellow perch. Walleye and channel catfish CPUE (22.4 and 6.6 fish/net-night, respectively) was the highest since 2012 (Table 4). Moreover, CPUE of walleye in 2016 was the twelfth highest observed since 1986. Catch per unit effort has historically been used as an index of population abundance or density; however, changes in fish behavior due to floods and/or changes in lake volume can affect CPUE of gill nets (Hubert 1996). Therefore, caution should be used when inferring density or abundance of fish species captured in the standard gill net survey from CPUE compared temporally.

Population Characteristics of Walleye

Multiple year classes were present in 2016 with a large proportion of stock and quality length walleye (Figure 2). Approximately 65% of walleye in the 2016 gill net sample were 254-380 mm TL, 30% were ≥ 381-mm (15-in), and less than 1% were ≥ 508-mm (20-in). As is typical for Lake Sharpe, the walleye population is predominantly sub-legal length (Figure 3) except in July and August when there is no minimum length limit. Proportional size distribution remained at 41 in 2016, but was at the low-end of the range of the previous four years (range 41-60; Table 5). Proportional size distribution – preferred were similar to values observed in the past four years.

Historically, walleye condition (W_r) for Lakes Sharpe, Francis Case, and Lewis and Clark are between 80 and 90 (Fincel et al. 2013). Condition of walleye (stock length and greater) in Lake Sharpe in 2016 was 82, which is similar to the five-year average (Table 6). Variability in walleye condition in Lake Sharpe likely occurs due to the seasonal availability of gizzard shad and entrainment of rainbow smelt through Oahe Dam (Wuellner et al 2010).

Walleye growth in Lake Sharpe is generally considered good and walleye typically reach the 381-mm (15-in) minimum length limit during their fourth growing season (Fincel et al. 2013). However from 2012-2016, walleye surpassed 381-mm (15-in) at age-3 (Table 7). In 2016, walleye incremental growth was above average for age-4 and younger year classes compared to the five year average (Table 8). Age-2 and -3 walleye (i.e., produced in 2014 and 2013) represented 73 percent of the 2016 gill net sample (Table 9). Twenty-two age-1 walleye were captured during the gill net survey in 2016 which was less than the five year average (Table 9). However, walleye typically do not recruit to gill nets until age-2.

Population Characteristics of Sauger

Forty-five sauger were collected during the gill net survey, for a mean CPUE of 1.4 fish/net-night (Figure 4). Sauger populations in Lake Sharpe are generally comprised of greater than stock length individuals. With a PSD-P of 55, this remained true in 2016. This was a substantial increase compared to a PSD-P of 30 in 2013 (Table 5). The maximum age of sauger collected in the 2016 gill net survey was age-7. Growth of sauger

in 2016 was typical for the year 2, 3 and 4 age classes and slowed for the year 5, 6 and 7 age classes when compared to the five year average (Table 10). No age-0 or age-1 sauger were collected with gill nets in 2016, which is to be expected as they typically do not recruit to gill nets until age-2 (Table 11).

Population Characteristics of Channel Catfish

Channel catfish PSD decreased to 44, the lowest size distribution observed over the last five years (Table 12). Relative weight decreased from 89 in 2015 to 85 in 2016. Catch-per-unit effort of channel catfish during 2016 (6.6 fish/net night) increased from 2015 (4.8 fish/net night; Figure 5). Channel catfish appear long lived but grow slowly which may explain the limited changes in population indices over time (Elrod 1974).

Shoreline Seining Survey

Sixteen species of small-bodied littoral fishes were collected by shoreline seining in 2016 (Table 13). All species had previously been collected in Lake Sharpe. The overall catch rate for all species in combination was 512 fish/seine haul which is below the long term mean of 699 fish/seine haul. Age-0 gizzard shad CPUE comprised the majority of the catch (i.e., 225 fish/seine haul) but were far below the long term mean of 596 age-0 gizzard shad/seine haul. Age-0 walleye CPUE was 6 fish/seine haul which is slightly higher than the long term average. However, caution should be used when making inferences based on seining catch data as highly variable catch rates are an inherent bias of the gear and values may not represent true relative abundance (Lyons 1986, Parsley et al. 1989).

Table 3. Relative species composition as percent of total catch collected during the standard August gill net survey on Lake Sharpe, South Dakota, 2012-2016. Trace (T) indicates values < 0.5%.

Species	Year				
	2012	**2013**	**2014**	**2015**	**2016**
Walleye	52	45	36	38	44
Channel catfish	16	16	15	13	13
Yellow perch	4	7	4	10	7
Common carp	4	8	5	5	3
Sauger	2	5	6	5	3
White bass	T	3	1	T	1
Gizzard shad	13	T	4	2	10
Freshwater drum	1	1	T	2	3
Smallmouth bass	1	4	2	2	3
*Others	6	12	27	22	13

*Others includes: bigmouth buffalo, black bullhead, black crappie, burbot, Chinook salmon, goldeye, lake herring, largemouth bass, northern pike, rainbow trout, river carpsucker, shorthead redhorse, shortnose gar, shovelnose sturgeon, smallmouth buffalo, spottail shiner, white crappie, and white sucker.

Table 4. Mean catch per unit effort (CPUE; No./net-night) and standard error (SE) for fish species collected with standard coolwater gill net sets in Lake Sharpe, South Dakota, 2012-2016. Trace (T) indicates a value <0.05.

Species	Year									
	2012		2013		2014		2015		2016	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Burbot	0	--	0	--	T	--	0	--	0	--
Black bullhead	0.1	0.1	0	--	0	--	0	--	T	--
Black crappie	T	--	T	--	0	--	0.1	0.1	0.2	0.2
Bigmouth buffalo	0	--	0	--	0	--	0	--	0.2	0.2
Channel catfish	7.3	1.6	4.7	1.2	3.8	1.1	4.8	0.9	6.6	1.7
Chinook salmon	0	--	0	--	0	--	0	--	T	--
Common carp	1.9	0.5	2.5	0.5	1.2	0.5	2.0	0.6	1.6	0.4
Freshwater drum	0.5	0.2	0.2	0.1	0.1	0.1	0.9	0.4	1.7	0.9
Gizzard shad	5.6	3.1	T	--	0.9	0.5	0.6	0.4	5.3	2.2
Goldeye	0.6	0.3	T	--	0.1	0.1	0.4	0.2	1.2	0.9
Lake herring	0	--	0	--	0	--	0.6	0.3	0	--
Largemouth bass	0	--	0	--	T	--	0	--	0	--
Northern pike	T	--	T	---	0	--	T	--	T	--
Rainbow trout	T	--	0	--	T	--	0	--	0	--
River carpsucker	0.3	0.2	0.5	0.3	2.0	0.8	2.7	1.3	0.3	0.2
Sauger	0.9	0.3	1.4	0.5	1.6	0.5	1.9	0.5	1.4	0.5
Shorthead redhorse	0.8	0.4	1.3	0.3	0.7	0.3	1.5	0.6	0.3	0.1
Shortnose gar	0.3	0.2	0.3	0.2	0.6	0.4	0.2	0.1	0.2	0.1
Shovelnose sturgeon	0.4	0.2	1.1	0.6	3.3	1.8	2.5	1.8	3.2	2.1
Smallmouth bass	0.3	0.2	1.1	0.7	0.6	0.5	0.8	0.8	1.6	1.1
Smallmouth buffalo	0	--	T	--	0.1	0.1	T	--	0	--
Spottail shiner	0	--	0	--	0	--	T	--	0	--
Walleye	23.2	4.5	13.4	2.2	9.4	2.2	14.2	3.1	22.4	3.6
White bass	0.1	0.1	0.8	0.5	0.2	0.2	T	--	0.3	0.1
White crappie	T	--	0	--	0	--	0	--	0.8	0.5
White sucker	0	--	0.1	0.1	0	--	T	--	0	--
Yellow perch	1.9	0.7	2.0	0.7	1.1	0.5	3.7	1.5	3.7	1.5

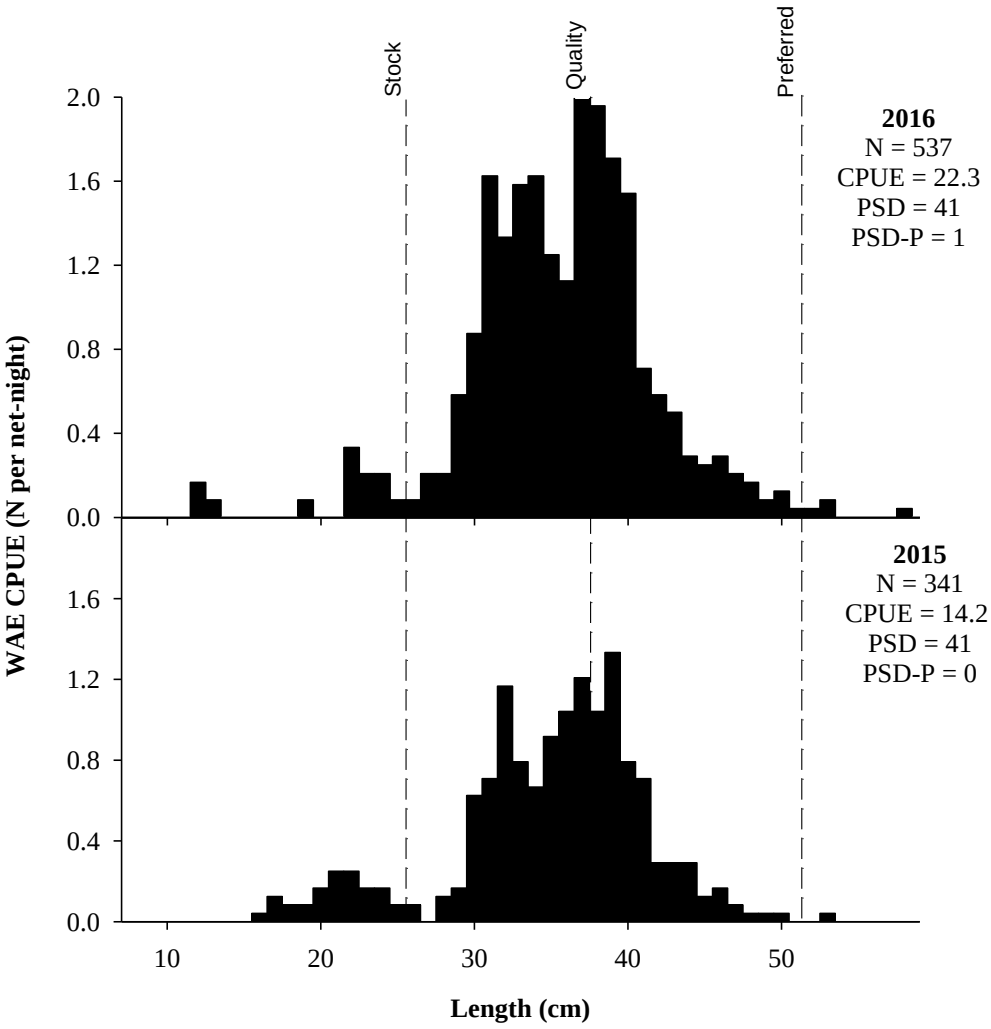

Figure 2. Length-frequency of walleye collected in standard gill net sets in Lake Sharpe, South Dakota, in August 2015 and 2016.

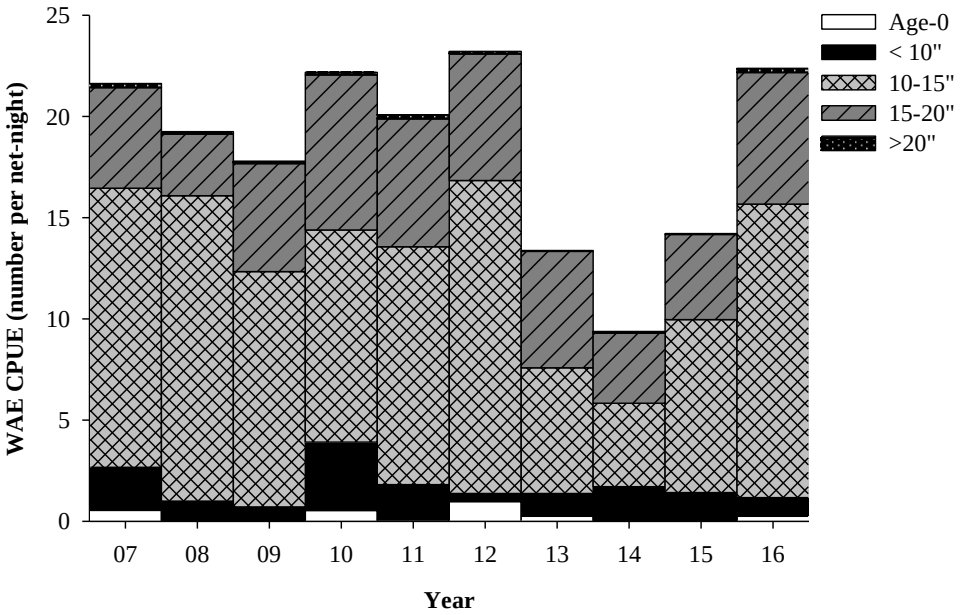

Figure 3. Size structure and relative abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, August 2007-2016.

Table 5. Walleye and sauger proportional size distribution (PSD), PSD of preferred (PSD-P) and memorable length (PSD-M) fish collected in the standard gill net survey on Lake Sharpe, South Dakota, 2012-2016.

Year	Walleye				Sauger			
	PSD	PSD-P	PSD-M	N	PSD	PSD-P	PSD-M	N
2012	41	1	0	525	95	48	0	21
2013	60	0	0	299	94	30	0	31
2014	51	1	0	191	92	66	5	38
2015	41	0	0	309	98	60	2	45
2016	41	1	0	511	97	55	0	33

Table 6. Mean relative weight (W_r) of walleye by length group and number of fish in a specified length group (N) for Lake Sharpe, South Dakota, 2012-2016.

Year	Length group							
	Stock-quality		Quality-preferred		Preferred-trophy		>Stock length	
	W_r	N	W_r	N	W_r	N	W_r	N
2012	85	308	79	213	70	3	82	524
2013	87	117	82	178	77	1	84	296
2014	88	91	81	93	85	2	84	186
2015	80	182	79	125	84	1	79	308
2016	84	296	81	198	73	5	82	498

Table 7. Mean length-at-age-at-capture (mm), number (N) and standard error (SE) for walleye collected in the standard August gill net survey on Lake Sharpe, South Dakota, 2012-2016.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2012	**Mean**	248	311	362	396	422	448	459	-	478
	N	13	63	95	23	20	20	15	-	7
	SE	3.2	2.4	2.8	6.5	5.7	10.5	8.2	-	29.9
2013	**Mean**	248	343	381	401	401	428	466	445	428
	N	33	18	64	68	20	14	7	4	1
	SE	3.7	6.5	2.7	3.1	7.2	5.2	11.6	15.7	-
2014	**Mean**	234	334	392	397	424	428	426	458	458
	N	41	67	9	24	29	14	7	3	4
	SE	3.1	3.0	5.1	6.0	5.9	9.7	4.0	37.3	8.1
2015	**Mean**	214	325	384	448	430	425	420	438	465
	N	34	89	89	5	13	16	9	5	1
	SE	24.0	2.2	2.7	8.4	9.9	5.9	15.5	19.1	--
2016	**Mean**	234	318	375	414	--	459	443	455	456
	N	18	87	106	44	--	7	14	6	4
	SE	4.4	2.6	2.5	3.6	--	16.7	9.8	10.6	13.8
Mean of means		236	326	379	411	419	438	443	449	457

Table 8. Mean annual growth increment estimates (mm/y) for walleye collected in the standard coolwater gill net survey on Lake Sharpe, South Dakota, for the 2011-2012, 2012-2013, 2013-2014, 2014-2015, and 2015-2016 periods.

Year	Growth increment (mm) added at age							
	1-2	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**	**7-8**	**8-9**
2011-2012	79	22	8	--	12	--	--	--
2012-2013	95	70	39	5	6	18	--	--
2013-2014	86	49	16	23	27	--	--	13
2014-2015	91	50	56	33	1	--	12	7
2015-2016	104	50	30	--	29	18	35	18

Table 9. Age distribution of walleye collected from Lake Sharpe, South Dakota, 2012-2016, with standard gill net sets as determined by age-estimation from otoliths.

Year	Age												
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2012	23	13	88	268	65	39	28	18	0	9	0	1	0
2013	6	35	23	101	94	28	16	7	4	2	0	1	2
2014	1	44	76	10	28	34	16	9	3	4	0	0	0
2015	0	34	121	130	5	15	18	11	6	1	0	0	0
2016	6	22	183	208	68	0	10	20	8	5	5	1	0

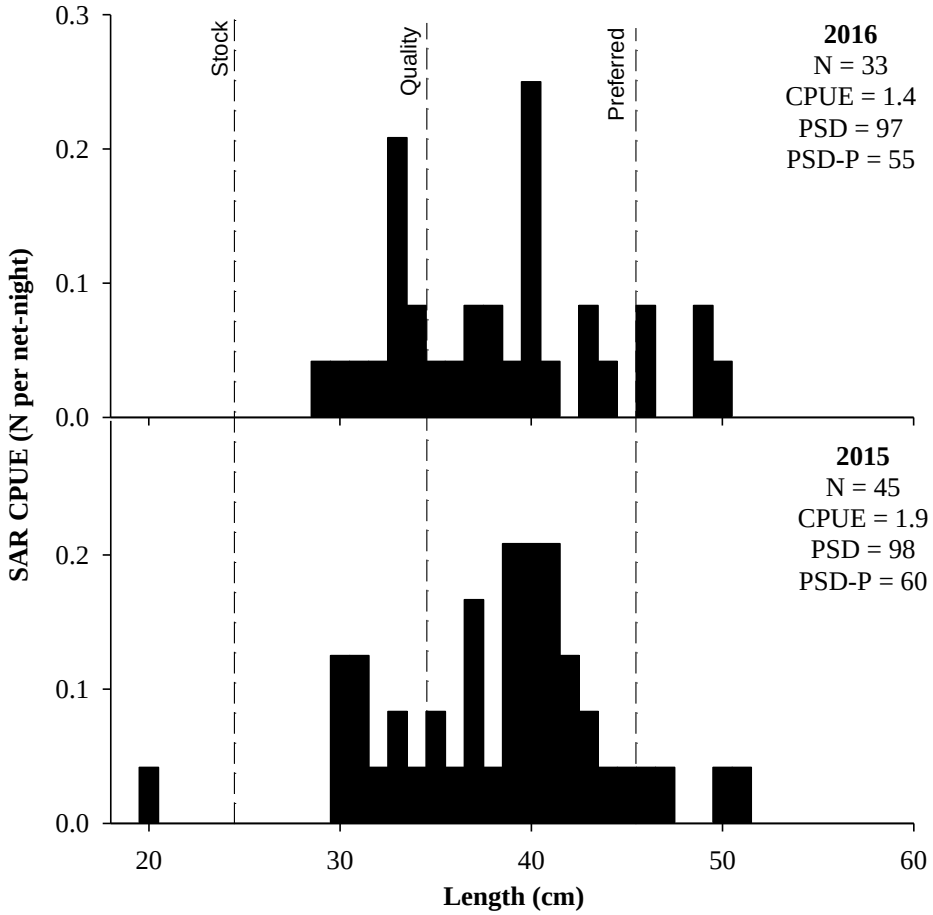

Figure 4. Length-frequency of sauger collected in the standard gill net survey in August 2015 and 2016 on Lake Sharpe, South Dakota.

Table10. Mean length-at-age-at-capture (mm) for sauger collected in the standard coolwater gill net survey, 2012-2016, on Lake Sharpe, South Dakota.

Year		Length at age at capture (mm)								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
2012	**Mean**	--	308	380	--	--	429	442	--	--
	N	--	4	11	--	--	3	3	--	--
	SE	--	10.7	6.2	--	--	37.8	9.6	--	--
2013	**Mean**	253	347	371	381	426	--	--	463	--
	N	2	7	13	7	1	--	--	2	--
	SE	1.5	4.9	4.4	7.1	--	--	--	17.0	--
2014	**Mean**	265	344	388	409	419	--	564	--	526
	N	4	7	8	10	5	--	1	--	2
	SE	24.8	9.0	6.3	6.6	3.0	--	--	--	30.0
2015	**Mean**	--	319	391	409	416	460	--	410	445
	N	--	8	19	2	7	3	--	1	2
	SE	--	5.0	8.4	9.0	6.6	34.0	--	--	15.0
2016	**Mean**	--	328	381	396	406	405	471	--	--
	N	--	9	5	5	1	1	4	--	--
	SE	--	6.8	9.2	7.0	--	--	18.9	--	--
Mean of means		259	329	382	399	417	431	492	437	486

Table 10. Age distributions of sauger collected in the standard gill net survey from Lake Sharpe, South Dakota, 2012-2016.

Year	Age										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2012	0	0	4	11	0	0	3	3	0	0	0
2013	0	2	7	13	8	1	0	0	2	0	0
2014	0	4	7	8	10	5	0	1	0	2	0
2015	0	0	9	19	2	7	3	0	1	2	0
2016	0	0	12	6	6	1	1	7	0	0	0

Table 11. Proportional size distribution (PSD), proportional size distribution of preferred and memorable-length (PSD-P and PSD-M) channel catfish, and relative weight (W_r) for 2012-2016, from Lake Sharpe, South Dakota. Mean W_r values are for stock-length fish and greater.

Year	PSD	PSD-P	PSD-M	W_r	N
2012	53	5	1	90	158
2013	53	4	0	86	106
2014	77	15	0	86	73
2015	68	13	0	89	96
2016	44	9	1	85	92

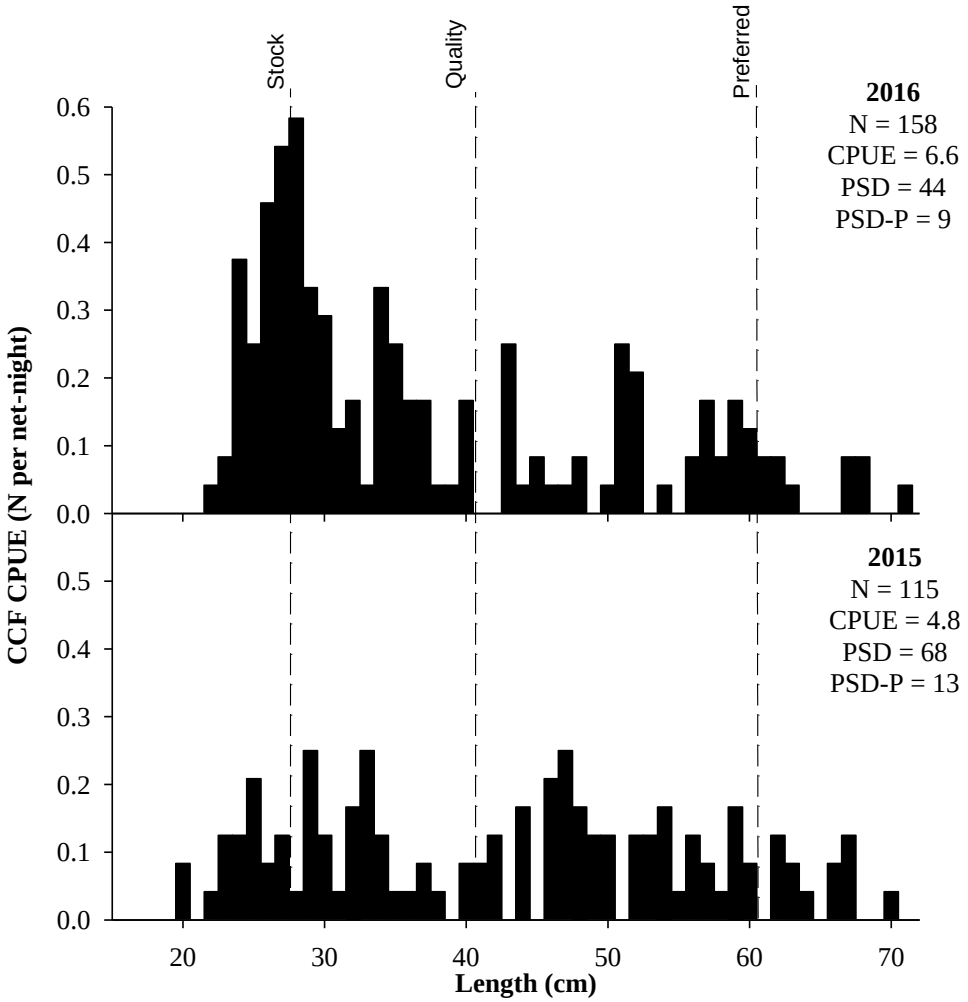

Figure 5. Length-frequency of channel catfish collected in the standard gill net survey in August 2015 and 2016 on Lake Sharpe, South Dakota.

Table 12. Mean catch per unit effort (CPUE; No./haul) and standard error (SE) values for fish species collected in the standard August seine survey on Lake Sharpe, South Dakota, 2012-2016. Catches are for age-0 fishes except where noted. Asterisk (*) indicates age-0 and adult fish included in CPUE.

Species	Year									
	2012		2013		2014		2015		2016	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	0	--	0.3	0.1	0	--	0.4	0.2	0	--
Black crappie	0	--	0	--	0.7	0.3	3.9	1.6	4.6	2.5
Bluegill	1.0	0.7	0	--	0.1	0.1	0	--	0	--
Bluntnose minnow	3.0	1.3	1.1	0.5	2.3	1.3	1.2	0.7	0.5	0.4
Brassy minnow*	0	--	0	--	0	--	0	--	0	--
Channel catfish	0	--	0.5	0.3	0.1	0.1	0.2	0.1	0.1	0.1
Common carp	0.1	0.1	0.1	0.1	0	--	0.1	0.1	0.8	0.5
Emerald shiner*	13.2	4.5	7.3	3.7	14.5	6.7	105.6	66.5	55.1	17.1
Freshwater drum	5.1	1.8	32.3	13.7	14.8	6.5	5.4	3.9	48.3	23.4
Fathead minnow	0	--	0	--	0	--	0	--	0	--
Gizzard shad	1,350.9	508.9	400.9	106.6	755.8	369.8	1,000.8	826.3	224.6	86.9
Goldeye	0	--	0.1	0.1	0	--	0.7	0.3	0	--
Johnny darter*	0.5	0.5	4.2	3.2	3.5	1.7	1.1	0.6	3.4	2.3
Largemouth bass	0.1	0.1	0.2	0.1	0.6	0.3	0.2	0.1	0.6	0.4
Rainbow smelt	0	--	0	--	0	--	0	--	0	--
River carpsucker	3.8	1.9	0	--	0.8	0.4	0.1	0.1	1.3	0.7
Sand shiner	0	--	0	--	0	--	0	--	0	--
Sauger	0	--	0	--	0	--	0	--	0	--
Shorthead redhorse	0	--	0	--	0.1	0.1	0	--	0	--
Smallmouth bass	4.3	1.3	7.4	1.4	11.1	3.4	3.3	1.5	8.1	3.8
Smallmouth buffalo	0	--	2.9	1.2	0.3	0.2	0	--	0	--
Spottail shiner*	5.5	4.1	0.7	0.4	1.9	0.9	3.0	1.9	6.5	3.6
Walleye	3.4	1.5	12.0	4.6	13.0	5.6	5.1	2.0	5.8	1.7
White bass	2.1	1.0	11.5	4.9	3.7	2.2	23.3	13.5	6.2	2.9
White crappie	3.3	1.8	3.1	2.7	0	--	0	--	0	--
White sucker	0.1	0.1	0	--	0.4	0.2	0.1	0.1	0.1	0.1
Yellow perch	23.4	10.5	54.6	18.2	41.3	15.0	27.6	18.4	145.7	61.8
OVERALL	1,420.1	509.7	539.2	103.5	864.9	379.1	1,181.9	825.0	511.7	105.9

Angler Use, Sportfish Harvest and Preference Surveys

Angler Use

Estimated fishing pressure for the May-August 2016 daylight period (390,752 h) was greater than the long term average for Lake Sharpe (289,299 angler-h; Table 14). Estimated angler days (trips) spent on Lake Sharpe during the 2016 survey period (98,852 days) was the second highest observed on Lake Sharpe since 2001.

Peak fishing pressure on Lake Sharpe occurred in May and July (Table 15). Most of the angling pressure on Lake Sharpe (93%) occurred in the lower (249,114 angler-h) and upper (112,216 angler-h) zones in 2016 (Table 15). Similar to previous years, the upper zone of Lake Sharpe experienced the highest angling pressure per unit of area where fishing pressure was 122.2 h/ha, compared to 6.9 and 13.5 h/ha on the middle and lower zones (Table 16). Boat fishing was again the most popular form of angling on Lake Sharpe (355,191 angler-h; 15.0 h/ha; Table 17).

Catch, Harvest and Release Estimates

Walleye were the most frequently caught species from May-August 2016 (384,515 fish), well above the long term average (295,082 fish; Table 18). Walleye harvest (157,350 fish) on Lake Sharpe increased from 2015 (116,826) and exceeded the long term average harvest (119,439 fish) (Table 18). The highest level of walleye harvest occurred in July (Table 19). Walleye were followed by smallmouth bass (14,636), channel catfish (9,360), and yellow perch (3,861) in decreasing order of estimated harvest. Estimated walleye harvest was highest in the lower zone (118,213 fish), followed by the upper zone (27,358 fish), with the middle zone having the lowest harvest (11,779 fish; Table 20). Walleye were also the most frequently released species with an estimated 227,165 walleye caught and released in Lake Sharpe in 2016 (Table 21). Smallmouth bass, channel catfish, and white bass were also commonly caught and released (55,254, 16,042 and 13,584 fish released, respectively). Walleye greater than 381-mm were primarily harvested on Lake Sharpe in the month of June compared to higher numbers of less than 381-mm walleye harvested in July and August when the 381-mm (15-in) minimum length limit was removed (Figure 6).

Hourly Catch, Harvest and Release Rates

The estimated hourly catch rate was 1.34 fish/angler-h and the estimated release rate was 0.85 fish/angler-h, for all species combined during the May-August daylight period in 2016 (Table 22). In 2016, anglers targeting walleye had a mean hourly catch rate of 2.08 (fish/angler-h; Table 23), a slight increase from the 1.92 walleye caught per hour by anglers targeting them in 2015 (Greiner *et al.* 2016). Hourly catch rates for anglers targeting smallmouth bass, white bass, and channel catfish were 3.88, 4.60, and 1.88 fish/angler-h, respectively (Table 23). Hourly catch rates of smallmouth bass in 2016 were well below the ten-year average (Table 24). Catch rates of channel catfish slightly exceeded the ten-year average but were similar to recent years (Table 24).

Hourly catch rates for walleye were highest in June and hourly harvest rates were highest in August (Table 25). The removal of the minimum length limit in July and August normally results in a decrease in release rate; this remained the case in 2016. The

number of parties that caught four or more walleye increased from 31% in 2015 to 37% in 2016 (Table 26). The number of anglers that harvested a limit of four walleye in 2016 (19%) was similar to 2015 (14%; Table 26).

Angler Demographics and Economic Impacts

For the May-August 2016 daylight period, Lake Sharpe anglers contributed more than $6.6 million to local economies, based on 98,852 trips at an estimated $67 per trip (U.S. Department of the Interior-Fish and Wildlife Service, and U.S. Department of Commerce-Bureau of the Census 2012).

Non-residents made up 19% of the angler contacts on Lake Sharpe in 2016, similar to estimates from the previous four years (Table 27). Most non-resident anglers using Lake Sharpe in 2016 were from Nebraska, Iowa, and Minnesota (Table 28). Residents of 31 states were interviewed while fishing Lake Sharpe. Patterns in angler state of residency in 2016 remained similar to previous years (Fincel et al. 2014).

About 62% of resident angling parties interviewed on Lake Sharpe during the 2016 survey were local anglers from Hughes and Stanley counties (Table 29; Figure 7). Minnehaha (Sioux Falls) and Pennington (Rapid City) county residents made up 6%, and 7% of the interviewed angling parties, respectively. Patterns in angler's county of residency in 2016 remained similar to previous years (Fincel et al. 2014).

Travel is required for many anglers fishing Lake Sharpe as the reservoir is located a fair distance from large population centers. Many (41%) anglers drove >100 miles to fish on Lake Sharpe (Table 30). Residents of Hughes and Stanley counties composed the majority of anglers traveling <25 miles and 25-49 miles, one way, to fish Lake Sharpe in 2016. Anglers from Minnehaha, and Pennington counties composed the majority of anglers traveling 100-199 miles to fish Lake Sharpe. The percent of anglers traveling in excess of 200 miles (one way) to fish Lake Sharpe in 2016 remained similar to 2015 (Table 30). Walleye remain the primary species targeted by over two thirds (71%) of the anglers on Lake Sharpe in 2016. Approximately 22% of anglers surveyed were generalist in nature (Table 31).

Angler Satisfaction and Attitudes

Anglers' perception of their fishing experience is important to the success of a fishery. Angler responses to satisfaction questions help fisheries managers determine if current management practices are providing a fishery that meets angler needs and expectations. In 2016, anglers were asked to consider all factors when evaluating their level of satisfaction with their fishing trip. The median trip rating for the May-August 2016 period was "moderately satisfied" (median of 2; Table 32). About 88% of angling parties interviewed in 2016 indicated some degree of satisfaction, which surpasses the Lake Sharpe Strategic Plan objective of 70%. Neutral/no opinion anglers made up 7% of all contacts, and more importantly, dissatisfied anglers represented only 5% of all contacts in 2016.

Gigliotti (2004) proposed that factors other than the number of walleye harvested likely influence trip satisfaction. However, anglers that harvested three or more walleye on average were "very satisfied". In general as mean walleye catch rate increased, satisfaction levels increased, similar to previous years (Table 33; Fincel et al. 2014).

Although both are considered a "satisfied" level, the number of walleye harvested likely effects angler satisfaction rankings.

To better understand factors influencing satisfaction, anglers were asked the supplemental question: "What would help increase your satisfaction level to 'very satisfied'?" Forty-four percent of anglers interviewed gave a "very satisfied" response and were not asked this question. The majority (57%) of anglers interviewed responded with a "catch more fish" response followed by "improve weather" (13%), and "catch larger fish" (11%). When looking at the high levels of satisfaction on Lake Sharpe combined with the high catch and high release rates, it appears that current management regulations and practices are serving the public well. At the very least, the 381-mm minimum length limit on walleye does not appear to be negatively impacting angler satisfaction.

Anglers were also asked an alternating series of supplemental questions. Anglers were asked 1) if they were satisfied with access and facilities available at the location or 2) what depth they were fishing for walleye. In the instance that an angler was unsatisfied with access and facilities they were asked: "What would you improve about the access?" Ninety-eight percent of respondents were satisfied with the access and facilities available and the median response was "very satisfied" (Table 36). Deep water angling was not prevalent on Lake Sharpe in 2016 with only 1% of parties (3 parties of 189) fishing for walleye at depths greater than 40 feet during the May-August survey period (Table 37).

Table 13. Angler use and harvest estimates for surveys conducted 2007 to 2016 during the May-August daylight period.

Year	Fishing pressure (h)	Angler days	Estimated fish harvest	Estimated walleye harvest
2007	273,348	71,806	116,429	95,033
2008	238,962	74,434	99,562	71,347
2009	329,617	109,596	177,023	132,728
2010	328,818	89,840	148,832	124,590
2011*	119,720	31,968	58,244	47,674
2012	243,742	83,003	156,338	130,711
2013	323,932	93,535	231,718	200,491
2014**	273,601	78,396	142,538	117,643
2015	314,064	93,194	154,786	116,826
2016	390,572	99,130	191,509	157,350
Mean	283,638	82,490	147,698	119,439

Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews and asterisks (**) denotes survey was conducted May-July, 2014.

Table 14. Estimated fishing pressure (angler-h), by month and zone, with 80% confidence intervals (CI), for the May-August 2016 daylight period.

Zone	Month				
	May	**June**	**July**	**August**	**Total**
Lower	59,820	63,025	86,888	39,382	249,114
80% CI	14,402	12,300	16,150	16,712	29,984
Middle	9,293	3,989	4,687	11,272	29,242
80% CI	4,932	573	1,815	4,741	7,101
Upper	43,393	23,028	23,805	21,990	112,216
80% CI	16,493	5,047	4,234	4,691	18,369
Total	112,506	90,042	115,380	72,644	390,572
80% CI	22,444	20,345	16,794	18,000	35,873

Table 15. Estimated fishing pressure, expressed as angler-hours (h) and hours per hectare (h/ha), by reservoir zone, for standard creel surveys conducted during the May-August daylight period, 2007-2016.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	h	h/ha	h	h/ha	h	h/ha
2007	178,310	9.6	12,347	2.9	82,692	90.1	273,349	11.6
2008	148,480	8.0	18,614	4.4	71,867	78.3	238,961	10.1
2009	197,924	10.7	18,375	4.3	113,317	123.4	329,616	13.9
2010	216,638	11.7	16,703	3.9	95,477	104.0	328,818	13.9
2011*	76,169	4.1	17,796	4.2	25,756	28.1	119,721	5.1
2012	122,078	6.6	13,673	3.2	107,992	117.6	243,743	10.3
2013	165,193	8.9	29,820	7.0	128,919	140.4	323,932	13.7
2014**	158,010	8.5	22,567	5.3	93,025	101.3	273,602	11.6
2015	215,107	11.6	21,157	5.0	77,799	84.7	314,064	13.3
2016	249,114	13.5	29,242	6.9	112,216	122.2	390,572	16.5
Zone size (ha)	18,483		4,262		918		23,663	

Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews. Asterisk (**) denotes survey was conducted May-July, 2014.

Table 16. Estimated fishing pressure, expressed as angler-hours (h) and hours per hectare (h/ha), by type of fishing, with 80% confidence intervals (CI), for the standard May-August daylight survey period, 2012-2016.

Type of fishing	Year				
	2012	**2013**	**2014***	**2015**	**2016**
Boat (h)	202,099	289,567	236,729	278,380	355,191
80% CI	18,843	27,925	27,823	26,718	35,123
H/ha	8.5	12.2	10.0	11.8	15.0
Shore (h)	41,643	34,365	36,872	35,684	35,381
80% CI	8,761	5,351	7,564	6,868	5,189
H/ha	1.8	1.5	1.6	1.5	1.5

Asterisk (*) denotes survey was conducted May-July, 2014.

Table 17. Estimated number of walleye caught, harvested and released during the May-August daylight period, 2007-2016.

Year	Caught	Harvested	Released	Percent Harvested
2007	300,788	95,033	205,755	32
2008	236,785	71,347	165,438	30
2009	433,408	132,728	300,680	31
2010	251,379	124,590	126,790	50
2011*	96,815	47,674	49,141	49
2012	441,596	130,711	310,886	30
2013	354,968	200,491	154,477	56
2014**	295,844	117,643	178,201	40
2015	305,774	116,826	188,947	38
2016	384,515	157,350	227,165	41
Mean	310,187	119,439	190,748	40

Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews and asterisks (**) denotes survey was conducted May-July, 2014.

Table 18. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the May-August 2016 daylight period. Crappie includes black and white species.

Species	Month				
	May	June	July	August	Total
Walleye	42,574	35,143	43,054	36,579	157,350
80% CI	10,237	9,051	9,741	9,544	19,305
Sauger	586	61	0	0	646
80% CI	265	--	--	--	265
Channel catfish	642	479	4,132	3,656	9,360
80% CI	824	257	1,403	2,814	3,260
White bass	1,805	747	161	88	2,801
80% CI	1,331	390	145	62	1,396
Smallmouth bass	6,917	2,892	3,168	1,659	14,636
80% CI	2,065	1,189	1,994	776	3,202
Crappie	1,596	24	0	0	1,619
80% CI	723	40	--	--	724
Rainbow trout	0	65	0	77	143
80% CI	--	76	--	120	142
Yellow perch	271	323	2,974	293	3,861
80% CI	239	228	1,739	170	1,778
Other*	762	526	64	190	1,093
Total	55,153	40,260	53,553	42,542	191,509
80% CI	12,216	9,869	10,653	10,369	21,625

*Other includes bigmouth buffalo, bluegill, Chinook salmon, freshwater drum, northern pike, and river carpsucker.

Table 19. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the May-August 2016 daylight period. Crappie includes black and white species.

Species	Zone			
	Upper	**Middle**	**Lower**	**Total**
Walleye	27,358	11,779	118,213	157,350
80% CI	5,603	4,844	17,828	19,305
Sauger	169	163	314	646
80% CI	159	--	212	265
Channel catfish	7,158	682	1,520	9,360
80% CI	3,103	356	935	3,260
White bass	1,890	650	261	2,801
80% CI	1,314	406	239	1,396
Smallmouth bass	1,026	247	13,364	14,636
80% CI	565	93	3,150	3,202
Crappie	32	623	964	1,619
80% CI	22	531	492	724
Rainbow trout	77	0	65	143
80% CI	120	--	76	142
Yellow perch	0	0	3,861	3,861
80% CI	--	--	1,778	1,778
Other*	714	313	66	1,093
Total	38,424	14,457	138,628	191,509
80% CI	6,952	5,023	19,851	21,625

*Other includes bigmouth buffalo, bluegill, Chinook salmon, freshwater drum, northern pike, and river carpsucker.

Table 20. Estimated number of fish released, by species and month, with 80% confidence intervals (CI) for the May-August 2016 daylight period. Crappie includes black and white species.

Species	Month				
	May	**June**	**July**	**August**	**Total**
Walleye	63,651	83,863	44,560	35,091	227,165
80% CI	18,788	19,583	11,988	13,718	32,686
Sauger	32	131	0	0	163
80% CI	48	152	--	--	159
Channel catfish	346	1,884	6,955	6,857	16,042
80% CI	171	902	2,952	2,683	4,093
White bass	7,987	4,349	953	296	13,584
80% CI	4,521	5,017	544	239	6,779
Smallmouth bass	24,542	15,829	10,821	4,063	55,254
80% CI	7,618	5,219	4,204	1,736	10,294
Crappie	198	0	0	0	198
80% CI	94	--	--	--	94
Rainbow trout	85	0	0	0	85
80% CI	64	--	--	--	64
Yellow perch	895	933	3,738	2,928	8,494
80% CI	487	540	1,739	1,867	2,653
Other*	1,914	2,779	3,502	2,286	10,483
Total	99,650	109,768	70,529	51,521	331,468
80% CI	25,664	23,236	16,016	16,456	41,544

*Other includes black bullhead, bluegill, common carp, freshwater drum, gizzard shad, goldeye, northern pike, shorthead redhorse, shovelnose sturgeon, and white sucker.

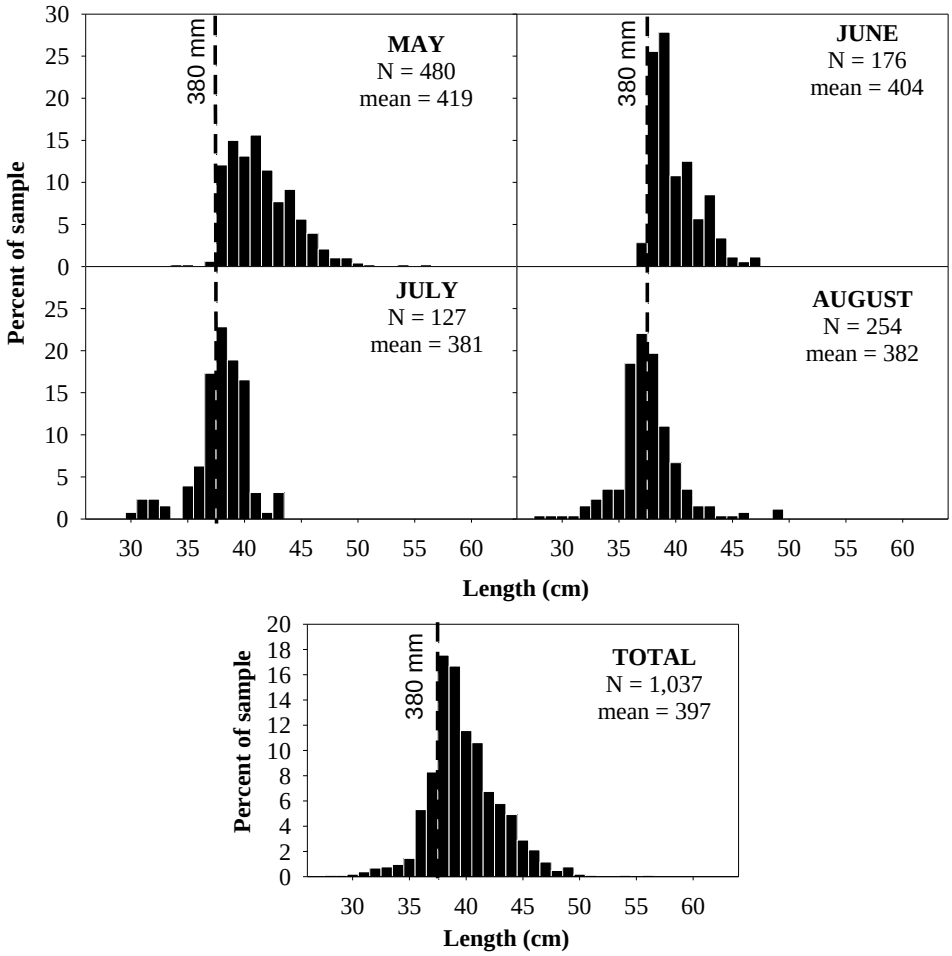

Figure 6. Monthly length-frequency distribution of walleye harvested by anglers during the May-August 2016 daylight period. Vertical line represents the 380-mm minimum length limit in effect from September-June.

Table 21. Estimated hourly catch, harvest and release rates, by species, for all anglers interviewed during the May-August 2016 daylight survey period. Trace (T) indicates values >0 but <0.005. Crappie includes black and white species.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	0.98	0.40	0.58
Sauger	T	T	T
White bass	0.04	0.01	0.03
Smallmouth bass	0.18	0.04	0.14
Crappie	0.01	T	T
Channel catfish	0.07	0.03	0.04
Rainbow trout	T	T	T
Yellow perch	0.03	0.01	0.02
Other*	0.04	T	0.04
Total	1.34	0.49	0.85

*Other includes black bullhead, bluegill, common carp, freshwater drum, gizzard shad, goldeye, northern pike, shorthead redhorse, shovelnose sturgeon, and white sucker.

Table 22. Estimated hourly catch, harvest and release rates, by species, for anglers targeting the species listed during the May-August 2016 daylight period.

Target species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	2.08	0.92	1.16
White bass	4.60	0.87	3.73
Smallmouth bass	3.88	0.28	3.60
Channel catfish	1.88	0.94	0.94

Table 23. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish and all fish combined, by year, for all anglers, for the May-August daylight survey period, 2007-2016.

Year	Catch rate (fish/angler-h)				
	Walleye	Smallmouth bass	White bass	Channel catfish	All fish
2007	1.10	0.63	0.10	0.04	1.94
2008	0.99	0.47	0.07	0.04	1.63
2009	1.31	0.37	0.14	0.03	1.91
2010	0.74	0.26	0.10	0.03	1.21
2011*	0.81	0.29	0.07	0.02	1.25
2012	1.81	0.20	0.05	0.02	2.23
2013	1.10	0.15	0.04	0.03	1.40
2014**	1.08	0.20	0.07	0.02	1.43
2015	0.97	0.20	0.11	0.04	1.39
2016	0.98	0.18	0.04	0.07	1.34
Mean of means	1.09	0.30	0.08	0.03	1.57

Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews and asterisks (**) denotes survey was conducted May-July, 2014.

Table 24. Estimated hourly catch, harvest and release rates (fish/angler-h), for walleye and all species combined, by month, for the May-August 2016 daylight survey period.

Month	Walleye			All fish combined		
	Catch Rate	Harvest rate	Release rate	Catch rate	Harvest rate	Release rate
May	0.94	0.38	0.56	1.38	0.49	0.89
June	1.32	0.39	0.93	1.67	0.45	1.22
July	0.76	0.37	0.39	1.08	0.46	0.62
August	0.99	0.50	0.49	1.29	0.59	0.70
Total	0.98	0.40	0.58	1.34	0.49	0.85

Table 25. Percentage of angling parties that caught (top panel) or harvested (bottom panel) a specified number of walleye or sauger per angler in each reservoir zone during the May–August 2015 and 2016 daylight survey periods.

Number/ trip	Catch per trip							
	2015				2016			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	12	80	53	37	12	59	50	34
≥ 0.1	88	20	47	63	88	41	50	66
≥ 1	81	8	34	53	83	32	43	60
≥ 2	70	5	25	44	75	27	33	51
≥ 3	61	2	17	36	66	25	24	43
≥ 4	53	2	13	31	60	19	18	37
≥ 5	43	1	9	25	53	15	12	31
≥ 6	36	1	6	20	45	11	9	26
≥ 7	29	0	3	15	36	9	7	20
≥ 8	25	0	2	13	29	7	5	16
≥ 9	21	0	1	10	23	5	4	13
≥10	16	0	1	8	19	2	4	10

Number/ trip	Harvest per trip							
	2015				2016			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	19	89	65	46	22	67	59	44
≥ 0.1	81	11	35	54	78	33	41	56
≥ 1	68	4	25	43	70	29	33	49
≥ 2	48	2	14	29	56	22	20	36
≥ 3	33	1	10	20	42	19	14	27
4(limit)	24	1	6	14	30	8	11	19

Table 26. Percent of total angler contacts and number of contacts (N) for resident and non-resident (states combined) anglers during the May-August daylight period, 2012-2016.

Zone		Year				
		2012	**2013**	**2014***	**2015**	**2016**
Lower	**N**	324	225	288	434	351
	Residents (%)	71	72	69	70	71
	Non-residents (%)	29	28	31	30	29
Middle	**N**	132	160	140	131	121
	Residents (%)	92	92	94	96	93
	Non-residents (%)	8	8	6	4	7
Upper	**N**	355	329	352	316	304
	Residents (%)	91	81	82	90	88
	Non-residents (%)	9	19	18	10	12
Total	**N**	811	714	780	881	776
	Residents (%)	83	81	79	81	81
	Non-residents (%)	17	19	21	19	19

Asterisk (*) denotes survey was conducted May-July, 2014.

Table 27. Percent of total non-resident angler contacts for anglers from the states listed during the May-August daylight survey period, 2012-2016.

State	Percent by Year				
	2012	2013	2014*	2015	2016
Nebraska	34	26	33	24	33
Iowa	20	23	23	34	27
Minnesota	20	21	20	14	14
Colorado	4	7	3	5	3
Wisconsin	1	1	3	1	3
Wyoming	5	4	3	6	6
Other[a]	16	18	15	16	14

[a]Other includes Arizona, California, Georgia, Idaho, Illinois, Indiana, Kansas, Louisiana, Massachusetts, Missouri, Montana, Nevada, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Washington, West Virginia, and out-of-country. Asterisk (*) denotes survey was conducted May-July, 2014.

Table 28. Percent of resident anglers contacted, county of residence and major cities within a county for anglers on Lake Sharpe, during the May-August daylight survey period, 2012-2016.

County	Major City	Percent by year				
		2012	2013	2014*	2015	2016
Beadle	**Huron**	7	3	4	5	2
Brookings	**Brookings**	1	1	1	1	T
Davison	**Mitchell**	3	3	2	2	3
Hand	**Miller**	1	2	1	2	2
Hughes	**Pierre**	46	49	49	44	59
Lyman	**Presho, Kennebec**	2	3	2	3	1
Minnehaha	**Sioux Falls**	6	7	7	10	6
Pennington	**Rapid City**	7	6	7	7	7
Stanley	**Fort Pierre**	7	6	6	4	3

Asterisk (*) denotes survey was conducted May-July, 2014.

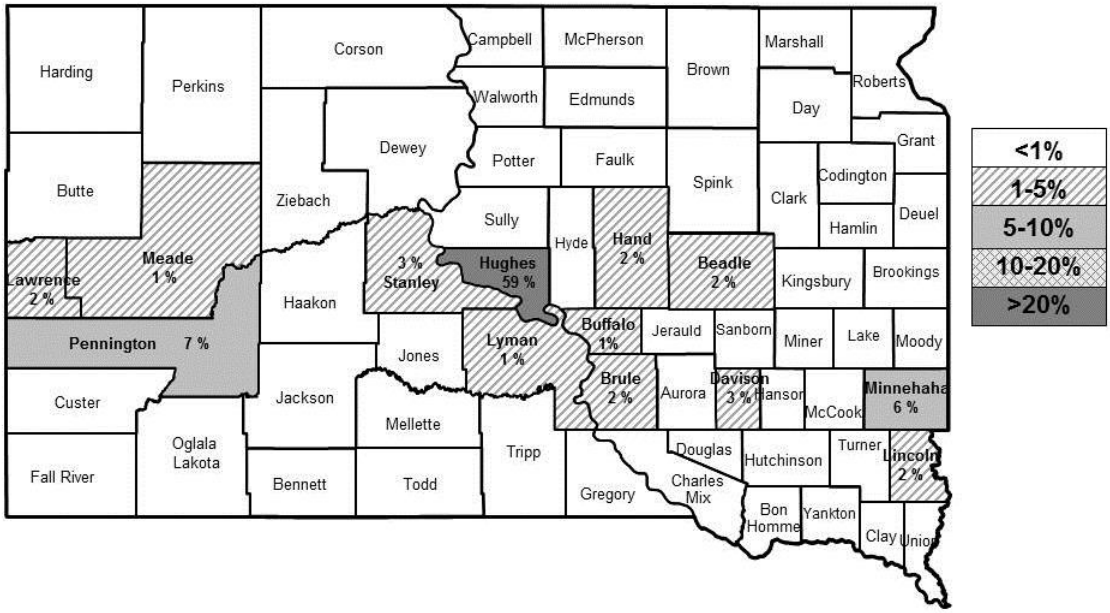

Figure 7. Percent of resident angler contacts by county during the May-August 2016 daylight survey period.

Table 29. Percent of anglers driving a specified distance, one way, to fish on Lake Sharpe, South Dakota, during the May-August daylight survey period, 2012-2016.

Distance (miles)	Percent by year				
	2012	2013	2014*	2015	2016
<25	41	42	38	34	40
25-49	10	9	6	13	11
50-99	12	7	8	9	8
100-199	18	20	19	23	13
≥200	19	22	29	21	28

Asterisk (*) denotes survey was conducted May-July, 2014.

Table 30. Percent of anglers that specifically target a species on Lake Sharpe, South Dakota, during the May-August daylight survey period, 2012-2016.

Target species	Percent by year				
	2012	2013	2014*	2015	2106
Walleye	65	65	62	65	71
Anything	31	28	31	27	22
Rainbow trout	1	<0.05	0	<0.05	0
White bass	1	2	<0.5	2	1
Smallmouth bass	1	3	2	2	1
Other[a]	1	2	5	4	5

[a]Other includes black crappie, channel catfish, freshwater drum, northern pike, and white crappie. Asterisk (*) denotes survey was conducted May-July, 2014.

Table 31. Responses of anglers who were asked the following question during the May-August 2016 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral or no opinion (N.O.), 5 = slightly dissatisfied, 6 = moderately dissatisfied, and 7 = very dissatisfied, where N is sample size.

Month	Satisfaction rating								
	Satisfied			Neutral/N.O.	Dissatisfied				
	1	2	3	4	5	6	7	N	Median
May	96	68	32	16	6	2	1	221	2
June	47	19	16	8	1	2	3	96	1.5
July	35	13	8	3	3	1	2	65	1
August	48	27	12	9	1	0	2	99	2
Total	226	127	68	36	11	5	8	481	2
Percent	88%			7%	5%				

Table 32. Responses of anglers who were asked the following question during the May-August 2016 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per trip. 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral/no opinion (N.O.), 5 = slightly dissatisfied, 6 = moderately dissatisfied, and 7 = very dissatisfied where N is sample size.

Walleye/ angler	Satisfaction rating								
	Satisfied			Neutral/N.O.	Dissatisfied			N	Median
	1	2	3	4	5	6	7		
0	77	63	45	21	10	5	5	226	2
0.1-0.9	11	14	5	3	0	0	1	34	2
1.0-1.9	17	25	7	7	0	0	2	58	2
2.0-2.9	20	10	8	3	1	0	0	42	2
3.0-3.9	27	7	2	0	0	0	0	36	1
4	71	8	1	2	0	0	0	82	1
Percent	88%			7%	5%				

Table 34. Responses of anglers who were asked the following question during the May-August 2016 daylight survey period: "What would help increase your satisfaction level to "very satisfied"?" after being asked their overall satisfaction rating (Table 32).

Improvement sought	Percent "very satisfied"	N	Percent	N
Very Satisfied – no improvement	47%	225		
Catch more fish			57%	146
Harvest more fish			4%	9
Improve weather			13%	34
Catch larger fish			11%	29
Improve time			1%	3
Less competition			2%	6
Other			12%	30

Table 35. Responses of anglers fishing Lake Sharpe, South Dakota who were asked the following question during the May-August 2016 daylight period: "How satisfied are you with the fishing access facilities at this location?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral/no opinion (N.O.), 5 = slightly dissatisfied, 6 = moderately dissatisfied, and 7 = very dissatisfied. N is sample size and includes "neutral/no opinion" responses.

Month	*Satisfaction rating by month*							N	Median
	Satisfied			Neutral/N.O.	Dissatisfied				
	1	2	3	4	5	6	7		
May	99	30	6	2	1	1	0	139	1
June	44	5	1	1	0	0	0	51	1
July	25	8	0	0	0	0	0	33	1
August	57	8	2	0	0	0	0	67	1
Total	225	51	9	3	1	1	0	290	1
Percent	98%			1%	1%				

Zone	*Satisfaction rating by zone*							N	Median
	Satisfied			Neutral/N.O.	Dissatisfied				
	1	2	3	4	5	6	7		
Lower	129	18	3	0	0	0	0	150	1
Middle	26	8	1	1	0	0	0	36	1
Upper	70	25	5	2	1	1	0	104	1
Total	225	51	9	3	1	1	0	290	1
Percent	98%			1%	1%				

Table 36. Responses of anglers fishing Lake Sharpe, South Dakota who were asked the following question during the May-August 2016 daylight period: "What would you improve about the access?" after being asked their overall satisfaction rating (Table 35).

Improvement sought	**Percent "very satisfied"**	**N**	**Percent**	**N**
Very Satisfied – no improvement	79%	230	-	64
Parking			20%	13
Launch			6%	4
Access to water			9%	6
Don't know			16%	10
Road			8%	5
Other			41%	26

Table 37. Responses of anglers fishing Lake Sharpe, South Dakota who were asked the following question during the May-August 2016 daylight period: "What was the average depth you caught your walleye today?"

	Percent of parties									
Angling depth (ft)	May	N	June	N	July	N	August	N	Total	N
0-19	91%	67	86%	31	50%	13	69%	37	78%	147
20-39	9%	7	14%	5	46%	12	28%	15	21%	39
≥40	0%	0	0%	0	4%	1	3%	2	1%	3

ONGOING RESEARCH PROJECTS

The Missouri River Fisheries staff conducted field work on a number of collaborative and internal research projects in 2016 on Lake Sharpe. In 2014, Missouri River Fisheries staff sought to evaluate seasonal movements and identify important over winter habitats of adult gizzard shad in Lake Sharpe. Emphasis is being focused on movements in/out of Hipple Lake and the use of this novel habitat by adult gizzard shad. Staff surgically implanted acoustic transmitters in 40 adult gizzard shad (20 in 2014, 20 in 2015) and released them at multiple locations throughout Lake Sharpe during the spring. Twelve passive receivers continually monitor gizzard shad movements at select locations in Lake Sharpe. The anticipated completion date for this project is spring 2017. Concurrently, 40 rainbow trout (20 spring stock; 20 fall stock) have been implanted with acoustic transmitters and released in Oahe Marina. This project focuses on residence time, and thus, availability of rainbow trout to shore anglers stocked annually in the spring and fall. This is part of a two year study with an additional 40 rainbow trout scheduled to be implanted with transmitters during 2017. The anticipated completion date for this project is spring 2019. An investigation into shovelnose sturgeon movement, habitat use and population dynamics will begin in 2017 with the initial collection for age, growth, and condition as well as mark-recapture for population estimates. Fifty total shovelnose sturgeon will be implanted with acoustic transmitters (25 in 2017 and 25 in 2018) and these fish will be tracked through 2020. A walleye tagging and telemetry project will start the spring of 2017. The objectives of the study will be to provide walleye population, exploitation, mortality estimates and gain insight into movement, and seasonal habitat use of Lake Sharpe Walleye as inferred from mark-recapture and acoustic-telemetry tracking.

FISHERY STATUS AND 2017 OUTLOOK

The Missouri River flood of 2011 was catastrophic and the extreme flows altered physical and chemical habitats. The effects of the historic 2011 flood are not well understood, and the aftermath may influence this system for a number of years. Despite the large physical changes in Lake Sharpe, anglers continued to fish and success was high in 2016.

In May-August 2016, the harvest rate for all fish species was 0.49 fish/angler-h and angler satisfaction was at 87%. Angler catches in 2017 will likely be dominated by small (<15-inches) walleye owing to a substantial proportion (70%) of the walleye population currently in that size range.

MANAGEMENT RECOMMENDATIONS

- Determine the importance of Hipple Lake and LaFramboise Bay for production, recruitment and over-winter survival of gizzard shad and sport fish in Lake Sharpe.

- Further evaluate effects from the 2011 Missouri River flood.

- Evaluate cold-water stocking program in Lake Sharpe tailrace fishery.

- Evaluate the role of angling regulations on the Lake Sharpe walleye fishery.

- Evaluate the potential to establish a paddlefish fishery in Lake Sharpe.

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APPENDICES

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

Common name	Scientific name
Bigmouth buffalo	*Ictiobus cyprinellus*
Black bullhead	*Ameiurus melas*
Black crappie	*Pomoxis nigromaculatus*
Bluntnose minnow	*Pimephales notatus*
Brassy minnow	*Hybognathus hankinsoni*
Burbot	*Lota lota*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tshawytscha*
Common carp	*Cyprinus carpio*
Emerald shiner	*Notropis atherinoides*
Fathead minnow	*Pimephales promelas*
Flathead chub	*Platygobio gracilis*
Freshwater drum	*Aplodinotus grunniens*
Gizzard shad	*Dorosoma cepedianum*
Goldeye	*Hiodon alosoides*
Golden shiner	*Notemigonus crysoleucas*
Johnny darter	*Etheostoma nigrum*
Lake herring	*Coregonus artedi*
Largemouth bass	*Micropterus salmoides*
Northern pike	*Esox Lucius*
Paddlefish	*Polyodon spathula*
Rainbow smelt	*Osmerus mordax*
Rainbow trout	*Oncorhynchus mykiss*
River carpsucker	*Carpiodes carpio*
Red shiner	*Cyprinella lutrensis*
Sauger	*Sander canadensis*
Shorthead redhorse	*Moxostoma macrolepidotum*
Shortnose gar	*Lepisosteus platostomus*
Shovelnose sturgeon	*Scaphirhynchus platorynchus*
Smallmouth bass	*Micropterus dolomieu*
Smallmouth buffalo	*Ictiobus bubalus*
Spottail shiner	*Notropis hudsonius*
Suckermouth minnow	*Phenacobius mirabilis*
Walleye	*Sander vitreus*
Western silvery minnow	*Hybognathus argyritis*
White bass	*Morone chrysops*
White crappie	*Pomoxis annularis*
White sucker	*Catostomus commersonii*
Yellow perch	*Perca flavescens*

Appendix 2. Common and scientific names of emergent vegetation mentioned in this report.

Common name	**Scientific name**
Curly leaf pondweed	*Potamogeton crispus*
Eurasian water milfoil	*Myriophyllum spicatum L*
White water-crowfoot	*Ranunculus aquatilis*
American waterweed	*Elodea canadensis*
Sago pondweed	*Stuckenia pectinata*
Cattail	*Typha* spp

Appendix 3. Angler satisfaction, preference and attitude questions asked as part of the May-August 2016 angler use and harvest survey on Lake Sharpe, South Dakota. Question series A and B were asked in an alternating order as part of the survey.

Question Series A:

Trip Satisfaction:

1. Considering all factors, how satisfied are you with your fishing trip today?
   1 = Very satisfied
   2 = Moderately satisfied
   3 = Slightly satisfied
   4 = Neutral/ No opinion *(neither satisfied or dissatisfied)*
   5 = Slightly dissatisfied
   6 = Moderately dissatisfied
   7 = Very dissatisfied

2. What would help increase your satisfaction level to "very satisfied"?
   a. More fish caught
   b. Larger fish caught
   c. Improve time
   d. More fish harvested
   e. Improve weather
   f. Less competition
   g. Other:_____

Question Series B:

Access Satisfaction:

1. How satisfied are you with the fishing access facilities at this location?
   1 = Very satisfied
   2 = Moderately satisfied
   3 = Slightly satisfied
   4 = Neutral/ No opinion *(neither satisfied or dissatisfied)*
   5 = Slightly dissatisfied
   6 = Moderately dissatisfied
   7 = Very dissatisfied

2. What would you improve about the access?
   a. Parking
   b. Launch
   c. Access to Water
   d. Don't Know
   e. Road
   f. Other:_____

3. What was the average depth you caught your walleye today?

4. How many walleyes were caught in depths greater than 40 ft were released?