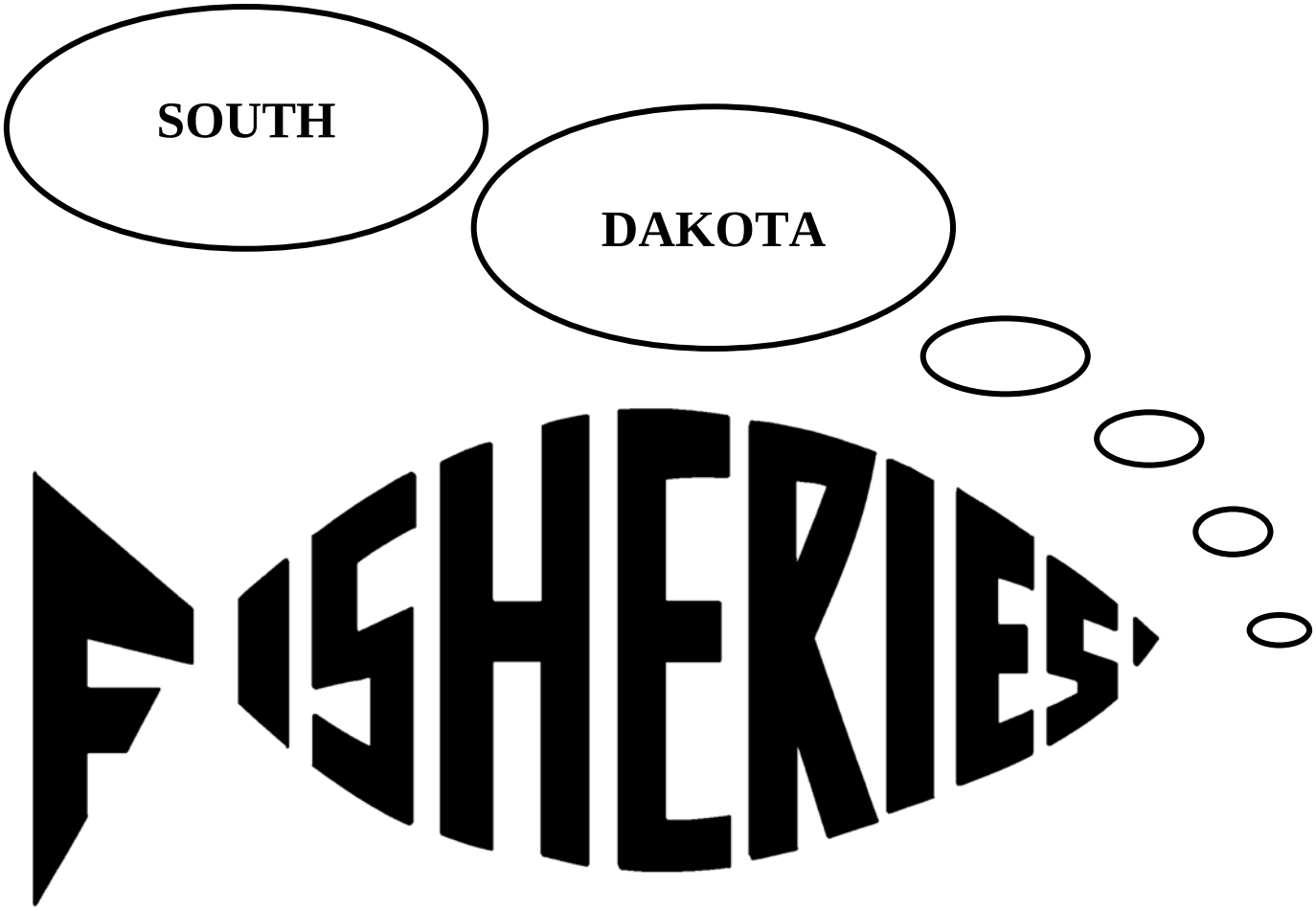

ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2014

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

Annual Report
No. 15-06

ANNUAL FISH POPULATION
AND
ANGLER USE, HARVEST AND PREFERENCE SURVEYS
ON
LAKE SHARPE, SOUTH DAKOTA, 2014

By

Robert Hanten, Mark J. Fincel, Hilary Meyer, Kyle Potter, and Mike Smith
Ft. Pierre District Office
South Dakota Dept. of Game, Fish, and Parks

Annual Report

Dingell-Johnson Project ----------F-21-R-47
Job Numbers---------- 2102 and 2109
Date ----------October 2015

PREFACE

Information collected during 2014 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: B. Beel, K. Graham, L. Johnson, R. Novak, J. Schweiss, J. Tostenson, and F. Turner.

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-47, Statewide Fish Management Surveys. Some of these data have been presented previously in segments F-21-23 through 46.

EXECUTIVE SUMMARY

This report includes annual fish population data and angler use, harvest, and preference data collected in 2014, 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. Fish population data and angler use and harvest survey data from previous years are referenced in this report. 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 110- to 530-mm during the August 2014 gill net survey. Mean catch per unit effort (CPUE) of walleye in gillnets during 2014 dropped below the five year average to 9.37 fish/net-night. Walleye CPUE was the lowest observed since the survey was initiated for 254-381 mm length walleye and the fourth lowest observed for 382-457 mm length walleye. However, proportional size distribution (PSD) was 51 and was within the range of the previous four years. Sixty-two percent of the walleye sampled during the August gill net survey in 2014 were below the September-June 381 minimum harvest length limit.

Eighteen species of age-0 and/or small-bodied prey fishes were collected by shoreline seining in 2014, all of which had been collected previously in Lake Sharpe. Average gizzard shad CPUE was 756 fish/seine haul which was higher than the five year average. Lake Sharpe gizzard shad were once again used for stocking programs on Lake Oahe and 357 pre-spawn adult gizzard shad were removed from Hipple Lake in 2014.

An estimated 78,396 angler days were spent on Lake Sharpe during the May-July 2014 daylight period, the third highest pressure observed since 2005. Estimated walleye harvest was 142,538 fish which was the third highest May-July harvest since 2005 for Lake Sharpe.

Estimated hourly harvest rate for all species combined for the May-July 2014 daylight period (0.52 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 2014 (1.08, 0.43, 0.65 fish/angler-h, respectively) were average for this fishery. The 2014 smallmouth bass and white bass catch rates remain low at 0.20 and 0.07 fish/angler-h), respectively.

About 87% of angling parties interviewed in 2014 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 $5.3 million to the local and regional economy during the May-July 2014 daylight period (78,396 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

Anglers spent over 2.4 million hours fishing the Missouri River system in South Dakota in 2008 (Bouska and Longhenry 2009; Sorenson and Knecht 2009; Longhenry et al. 2010). About 48% of all South Dakota resident licensed anglers fished the Missouri River system in 2003 and 35% of those anglers fished Lake Sharpe (Gigliotti 2004). About 33% of angler days in South Dakota in 2003 were spent on the Missouri River system (Gigliotti 2004). The South Dakota Department of Game, Fish and Parks (SDGFP) recognized the importance of the Missouri River fisheries program and developed the Missouri River Strategic Plan to effectively guide management of the resource and direct future research (SDGFP 1994).

Lake Sharpe has supported between 26,321 and 97,339 angler days during the May-July 2005-2014 daylight period. Lake Sharpe is an important resource in South Dakota and its habitat and fish community 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 2014, as well as comparisons of 2014 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 located in central South Dakota (Figure 1) and extends from Oahe Dam to Big Bend Dam. Lake Sharpe is a 128-km long mainstem Missouri River flow-through reservoir and has a surface area of 24,686 ha (Table 1). The reservoir has been divided into three zones for survey purposes. 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.

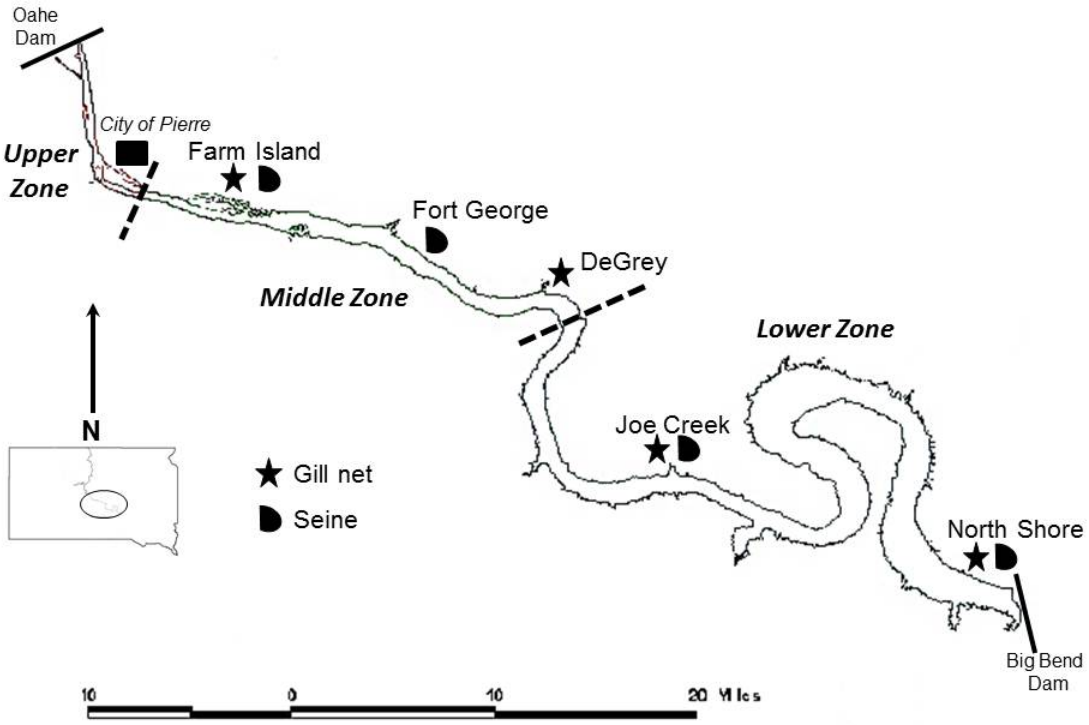

Figure 1. Gill net and seine locations on Lake Sharpe including zone locations, South Dakota, 2014.

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):	25,000
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. *In Press*).

Table 2. History of special harvest regulations for walleye and smallmouth bass on Lake Sharpe, South Dakota 1968-2014.

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-mmand 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 2014, experimental-mesh gill nets and 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 in > 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 fish greater than 350-mm (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, 2014 through 31-July, 2014 for the sunrise-to-sunset (daytime) period. For diagrams of bus routes used on Lake Sharpe during the May-July 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 (travel or wait start), 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 2014 reservoir-wide angler use and harvest survey. In addition to asking anglers how satisfied they were with their fishing trip, anglers were also asked whether they removed their boat plugs and at what depth of water they were catching and releasing walleye and sauger (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-July survey period.

RESULTS AND DISCUSSION

August Gill Net Population Assessment

Species Composition and Relative Abundance

Walleye and channel catfish comprised 36 and 15% of the gill net catch in 2014, respectively (Table 3). Other species commonly caught included sauger, common carp and yellow perch. Walleye and channel catfish CPUE (9.4 and 3.8 fish/net-night, respectively) decreased from 2013 (Table 4). Moreover, CPUE of walleye in 2014 was the lowest observed since 1982. Additionally, the 2013 and 2014 surveys represent the lowest back-to-back walleye gillnet catches observed. Catch per unit effort has historically been used as an index of population abundance or density; however, changes in fish behavior (Hubert 1996), fish behavior due to floods, and lake volume can affect CPUE of gill nets. 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 2014 with a large proportion of quality and preferred length walleye (Figure 2). Approximately 38% of walleye in the 2014 gill net sample were ≥ 381-mm (15-in) and 1% were ≥ 508-mm (20-in). However, CPUE was the lowest observed since the survey was initiated for walleye 254-380 mm TL and the fourth lowest observed for walleye 381-457 mm TL (Figure 3). Proportional size distribution decreased from 60 in 2013 to 51 in 2014, but was in the range of the previous four years (range 39-60). Proportional size distribution – preferred were similar to values observed in the past four years for walleye (1 PSD-P) but increased for sauger (66 PSD-P; Table 5).

Historically, walleye condition (W_r) for Lakes Sharpe, Francis Case, and Lewis and Clark are generally between 80 and 90 (Fincel et al. 2013). Condition of walleye (stock length and greater) in Lake Sharpe in 2014 was 84, 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 in 2013 and 2014, walleye surpassed 381-mm (15-in) at age-3 (Table 7). In 2014, walleye incremental growth was average for age-2 and younger year classes compared to the five year average; however, incremental growth slowed for the age 3 year class (Table 8). Age-4 and -5 walleye (i.e., produced in 2010 and 2009) represented 28 percent of the 2014 gill net sample (Table 9). One age-1 walleye was captured during the gill net survey in 2014 which is well below the five year average (8.6 CPUE; Table 9).

Population Characteristics of Sauger

Thirty-six sauger were collected during the gill net survey, for a mean CPUE of 1.6 fish/net-night (Figure 4). PSD of sauger is generally high in Lake Sharpe with a PSD-

P of 60 in 2014. This was a substantial increase compared to a PSD-P of 30 in 2013 (Table 5). The maximum age of sauger collected in the 2014 gill net survey was age-9. Growth of sauger in 2014 was fast for younger age classes, and slow for older age classes in comparison with the five year average (Table 10). No age-0 and four age-1 sauger were collected with gill nets in 2014 (Table 11).

Population Characteristics of Channel Catfish

Channel catfish PSD increased to 77 and generally returned to values documented in 2010 and 2011 (Table 12). Relative weight remained relatively unchanged. Catch-per-unit effort of channel catfish during 2014 (3.8 fish/net night) decreased slightly from 2013 (4.7 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

Eighteen species of small-bodied littoral fishes were collected by shoreline seining in 2014 (Table 13). All species had previously been collected in Lake Sharpe. The overall catch rate for all species in combination was 865 fish/seine haul which is above the long term mean of 684 fish/seine haul. Age-0 gizzard shad CPUE comprised the majority of the catch (i.e., 756 fish/seine haul). Age-0 walleye CPUE was 13 fish/seine haul which is the second highest on record. 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, 2010-2014. Trace (T) indicates values < 0.5%.

Species	Year				
	2010	**2011**	**2012**	**2013**	**2014**
Walleye	48	60	52	45	36
Channel catfish	12	9	16	16	15
Yellow perch	9	9	4	7	4
Common carp	4	6	4	8	5
Sauger	2	5	2	5	6
White bass	1	1	T	3	1
Gizzard shad	14	1	13	T	4
Freshwater drum	1	1	1	1	T
Smallmouth bass	3	1	1	4	2
*Others	5	7	6	12	27

*Others includes: black bullhead, black crappie, burbot, flathead catfish, 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, 2010-2014. Trace (T) indicates a value <0.05.

Species	Year									
	2010		2011		2012		2013		2014	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Burbot	0	--	0	--	0	--	0	--	T	--
Black bullhead	0	--	0.2	0.1	0.1	0.1	0	--	0	--
Black crappie	0.1	0.1	0.1	0.1	T	--	T	--	0	--
Channel catfish	5.6	1.7	3.0	0.6	7.3	1.6	4.7	1.2	3.8	1.1
Common carp	1.7	0.5	1.9	0.5	1.9	0.5	2.5	0.5	1.2	0.5
Freshwater drum	0.6	0.2	0.2	0.1	0.5	0.2	0.2	0.1	0.1	0.1
Gizzard shad	7.0	3.9	0.4	0.4	5.6	3.1	T	--	0.9	0.5
Goldeye	0.2	0.1	0	--	0.6	0.3	T	--	0.1	0.1
Largemouth bass	0	--	0	--	0	--	0	--	T	--
Northern pike	T	--	0.1	0.1	T	--	T	---	0	--
Rainbow trout	0	--	0	--	T	--	0	--	T	--
River carpsucker	1.1	0.6	0.6	0.4	0.3	0.2	0.5	0.3	2.0	0.8
Sauger	1.1	0.3	1.8	0.6	0.9	0.3	1.4	0.5	1.6	0.5
Shorthead redhorse	T	--	0.7	0.5	0.8	0.4	1.3	0.3	0.7	0.3
Shortnose gar	T	--	0.2	0.1	0.3	0.2	0.3	0.2	0.6	0.4
Shovelnose sturgeon	0.4	0.3	0.1	0.1	0.4	0.2	1.1	0.6	3.3	1.8
Smallmouth bass	1.4	1.2	0.3	0.2	0.3	0.2	1.1	0.7	0.6	0.5
Smallmouth buffalo	T	--	0	--	0	--	T	--	0.1	0.1
Spottail shiner	0.1	0.1	0.1	0.1	0	--	0	--	0	--
Walleye	22.2	4.3	20.1	3.1	23.2	4.5	13.4	2.2	9.4	2.2
White bass	0.6	0.4	0.4	0.2	0.1	0.1	0.8	0.5	0.2	0.2
White crappie	0.1	0.1	0.1	0.1	T	--	0	--	0	--
White sucker	T	--	0.3	0.2	0	--	0.1	0.1	0	--
Yellow perch	4.0	1.5	3.1	0.9	1.9	0.7	2.0	0.7	1.1	0.5

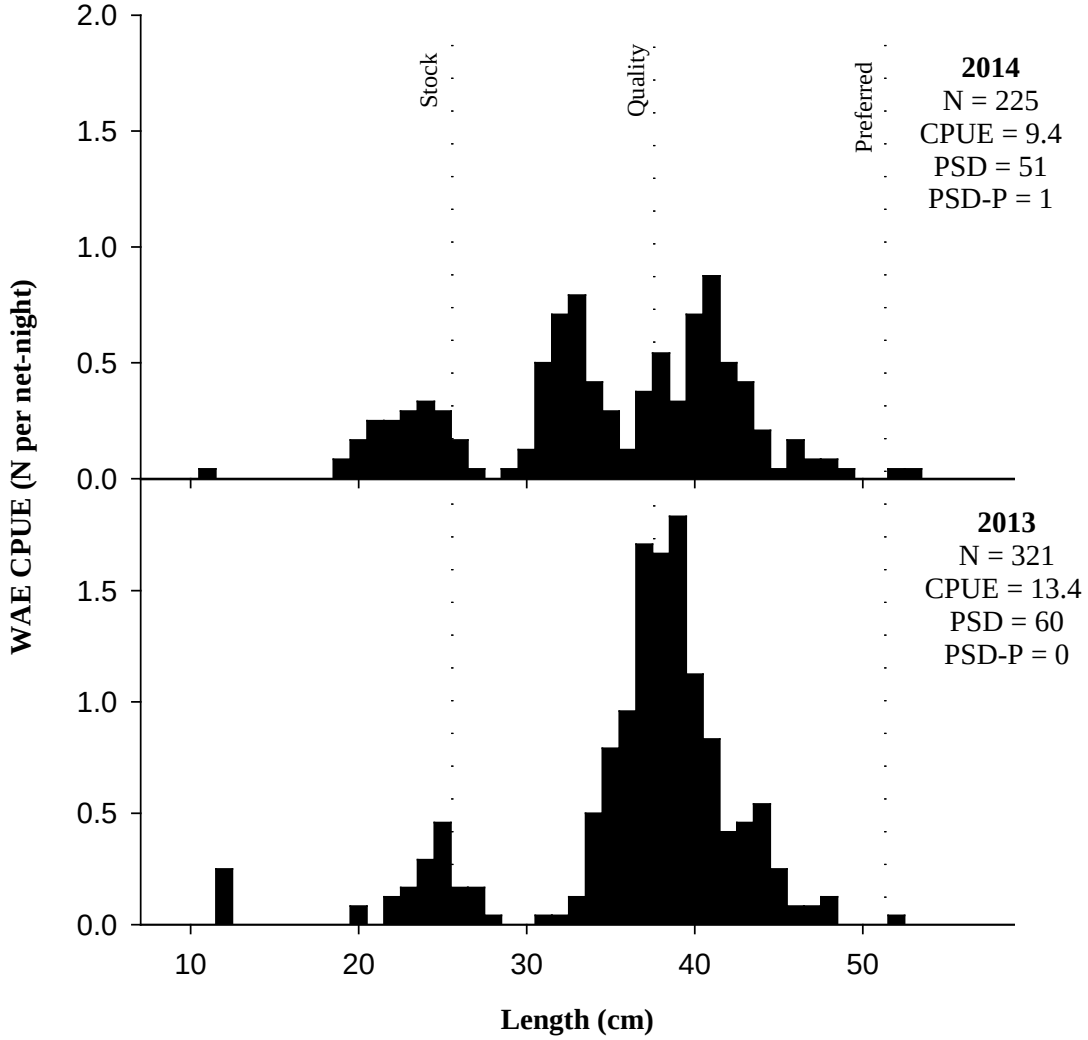

Figure 2. Length-frequency of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, in August 2013 and 2014.

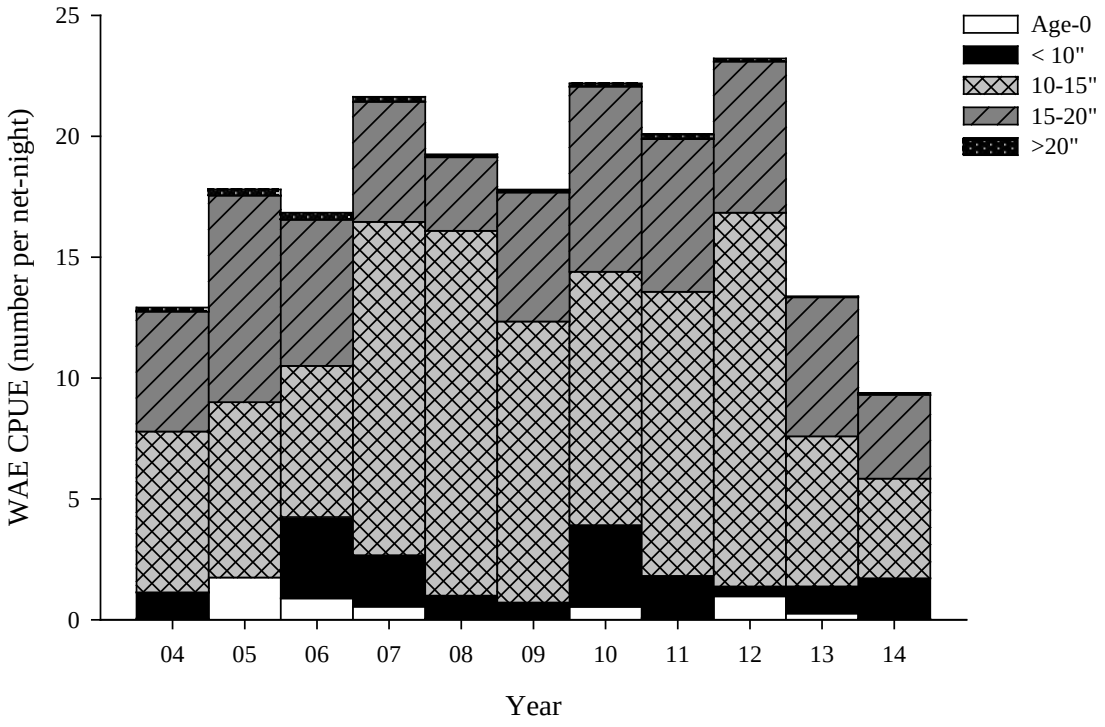

Figure 3. Size structure and relative abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, in August, 2004-2014.

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, 2010-2014.

Year	Walleye				Sauger			
	PSD	PSD-P	PSD-M	N	PSD	PSD-P	PSD-M	N
2010	47	1	0	478	65	58	0	26
2011	39	1	0	295	86	43	0	28
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

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, 2010-2014.

Year	Length group							
	Stock-quality		Quality-preferred		Preferred-trophy		>Stock length	
	W_r	N	W_r	N	W_r	N	W_r	N
2010	88	254	85	221	75	3	87	478
2011	82	180	84	111	80	3	83	294
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

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, 2010-2014.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2010	**Mean**	263	348	394	414	417	414	448	433	460
	N	119	85	89	55	54	3	8	1	2
	SE	1.7	1.9	2.4	3.3	3.6	33.2	5.8	-	1.5
2011	**Mean**	232	340	388	435	436	463	403	504	-
	N	34	163	45	29	25	12	1	3	-
	SE	5.7	1.9	5.6	4.4	5.8	8.3	-	31.6	-
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
Mean of means		245	335	383	409	420	436	440	460	456

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 2009-2010, 2010-2011, 2011-2012, 2012-2013 and 2013-2014 periods.

Year	Growth increment (mm) added at age							
	1-2	**2-3**	**3-4**	**4-5**	**5-6**	**6-7**	**7-8**	**8-9**
2009-2010	108	63	46	18	14	--	12	10
2010-2011	77	40	41	22	45	--	56	--
2011-2012	79	22	8	--	12	--	--	--
2012-2013	95	70	39	5	6	18	--	--
2013-2014	86	49	16	23	27	--	--	13

Table 9. Age distribution of walleye collected from Lake Sharpe, South Dakota, 2010-2014, 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**
2010	12	172	99	106	63	60	3	8	1	2	1	2	3
2011	1	34	163	45	29	25	12	1	3	0	1	3	2
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

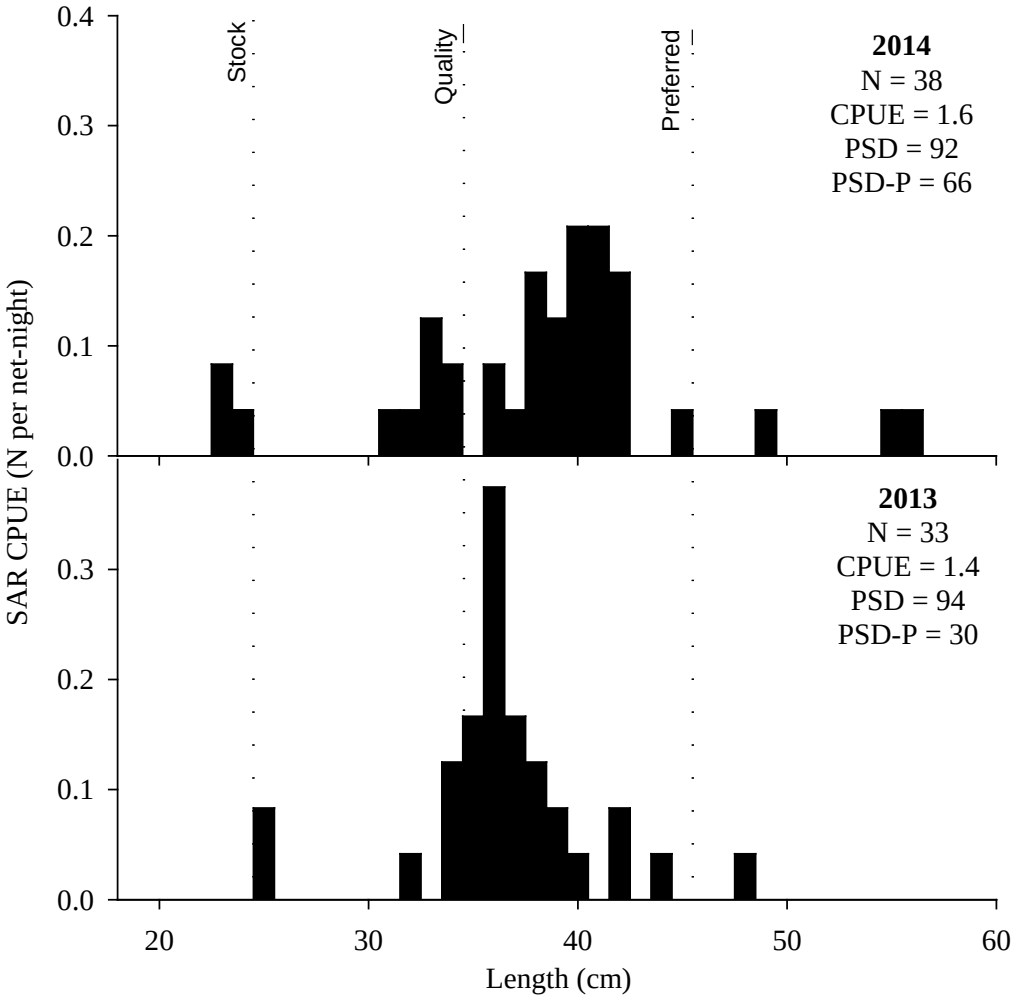

Figure 4. Length-frequency of sauger collected in the standard gill net survey in August 2013 and 2014 on Lake Sharpe, South Dakota.

Table 10. Mean length-at-age-at-capture (mm) for sauger collected in the standard coolwater gill net survey, 2010-2014, on Lake Sharpe, South Dakota.

Year		Length at age at capture (mm)								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
2010	**Mean**	253	324	--	419	406	--	--	--	--
	N	9	1	--	7	8	--	--	--	--
	SE	5.1	--	--	15.8	7.1	--	--	--	--
2011	**Mean**	204	341	414	504	456	464	--	--	--
	N	4	12	4	1	5	2	--	--	--
	SE	1.9	6.3	16.9	--	16.7	39.0	--	--	--
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
Mean of means		244	333	388	428	427	447	503	463	526

Table 11. Age distributions of sauger collected in the standard gill net survey from Lake Sharpe, South Dakota, 2010-2014.

	Age										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2010	0	9	1	0	7	9	0	0	0	0	0
2011	0	4	12	4	1	5	2	0	0	0	0
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

Table 12. 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 2010-2014, 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
2010	74	1	0	88	118
2011	82	2	0	89	45
2012	53	5	1	90	158
2013	53	4	0	86	106
2014	77	15	0	86	73

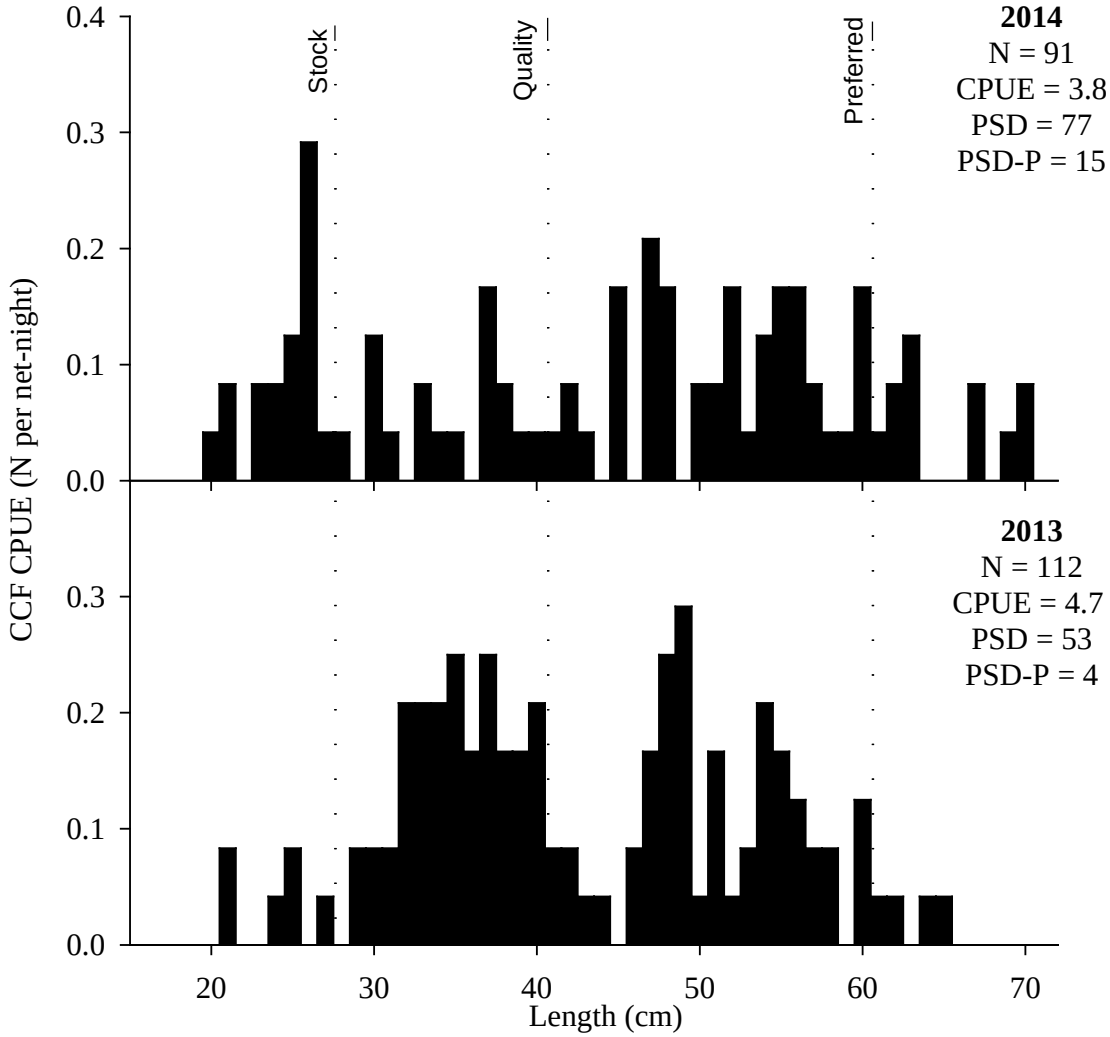

Figure 5. Length-frequency of channel catfish collected in the standard gill net survey in August 2013 and 2014, on Lake Sharpe, South Dakota.

Table 13. 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, 2010-2014. Catches are for age-0 fishes except where noted. Asterisk (*) indicates age-0 and adult fish included in CPUE.

Species	Year									
	2010		2011		2012		2013		2014	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	0	--	0	--	0	--	0.3	0.1	0	--
Black crappie	1.5	1.1	0.1	0.1	0	--	0	--	0.7	0.3
Bluegill	0	--	0.2	0.3	1.0	0.7	0	--	0.1	0.1
Bluntnose minnow	8.9	6.5	0.3	0.2	3.0	1.3	1.1	0.5	2.3	1.3
Brassy minnow*	0	--	0.1	0.1	0	--	0	--	0	--
Channel catfish	0.8	0.7	0.1	0.1	0	--	0.5	0.3	0.1	0.1
Common carp	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	--
Emerald shiner*	32.3	13.2	8.3	6.8	13.2	4.5	7.3	3.7	14.5	6.7
Freshwater drum	7.7	2.6	0	--	5.1	1.8	32.3	13.7	14.8	6.5
Fathead minnow	0.1	0.1	0.7	0.7	0	--	0	--	0	--
Gizzard shad	593.9	194.4	13.3	8.0	1,350.9	508.9	400.9	106.6	755.8	369.8
Goldeye	0.9	0.2	0	--	0	--	0.1	0.1	0	--
Johnny darter*	1.1	0.4	1.5	0.8	0.5	0.5	4.2	3.2	3.5	1.7
Largemouth bass	0	--	0.1	0.1	0.1	0.1	0.2	0.1	0.6	0.3
Rainbow smelt	0	--	0.3	0.2	0	--	0	--	0	--
Red shiner	0.1	0.1	0	--	0	--	0	--	0	--
River carpsucker	8.5	7.8	0.3	0.2	3.8	1.9	0	--	0.8	0.4
Sand shiner	0.9	0.6	0.2	0.1	0	--	0	--	0	--
Sauger	0	--	0	--	0	--	0	--	0	--
Shorthead redhorse	0	--	0	--	0	--	0	--	0.1	0.1
Smallmouth bass	11.5	3.5	1.6	0.9	4.3	1.3	7.4	1.4	11.1	3.4
Smallmouth buffalo	0	--	0	--	0	--	2.9	1.2	0.3	0.2
Spottail shiner*	39.1	23.1	3.8	1.9	5.5	4.1	0.7	0.4	1.9	0.9
Walleye	0.8	0.4	0.8	0.5	3.4	1.5	12.0	4.6	13.0	5.6
White bass	6.8	2.6	6.9	5.0	2.1	1.0	11.5	4.9	3.7	2.2
White crappie	8.1	5.0	0.1	0.1	3.3	1.8	3.1	2.7	0	--
White sucker	0.8	0.4	0.2	0.1	0.1	0.1	0	--	0.4	0.2
Yellow perch	48.8	44.6	1.8	1.3	23.4	10.5	54.6	18.2	41.3	15.0

Angler Use, Sportfish Harvest and Preference Surveys

Angler Use

Estimated fishing pressure for the May-July 2014 daylight period (273,601 h) was greater than the long term average for Lake Sharpe (224,014 angler-h; Table 14). Estimated angler days (trips) spent on Lake Sharpe during the 2014 survey period (78,396 days) was the second highest observed on Lake Sharpe since 2001.

Peak fishing pressure on Lake Sharpe occurred in May and June (Table 15). Most of the angling pressure on Lake Sharpe (92%) occurred in the lower (158,010 angler-h) and upper (93,025 angler-h) zones in 2014 (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 101.3 h/ha, compared to 5.3 and 8.5 h/ha on the middle and lower zones (Table 16). Boat fishing was again the most popular form of angling on Lake Sharpe (10.0 h/ha; Table 17).

Catch, Harvest and Release Estimates

Walleye were the most abundant species caught from May-June 2014 (295,844 fish), and well above the long term average (238,523 fish; Table 18). Walleye harvest (117,643 fish) on Lake Sharpe exceeded the long term average harvested (90,108 fish) but was below the 159,204 walleye harvested in 2013 (Table 18). The majority of walleye harvest occurred in May (Table 19). Walleye were followed by smallmouth bass (10,964), white bass (4,682), and channel catfish (2,433) in decreasing order of estimated harvest. Estimated walleye harvest was highest in the lower zone (81,105 fish), followed by the upper zone (31,299 fish), with the middle zone having the lowest harvest (5,239 fish; Table 20). Walleye were also the most frequently released species with an estimated 178,201 walleye caught and released in Lake Sharpe in 2014 (Table 21). Smallmouth bass, white bass and channel catfish were also commonly caught and released (43,908, 13,133 and 3,307 fish released, respectively). Walleye greater than 381-mm were primarily harvested on Lake Sharpe including the month of July 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 1.43 fish/angler-h and estimated release rate was 0.91 fish/angler-h, for all species combined during the May-July daylight period in 2014 (Table 22). In 2014, anglers targeting walleye had a mean hourly catch rate of 2.31 (fish/angler-h), similar to 2013 (2.21 fish/angler-h; Table 23). Hourly catch rates for anglers targeting smallmouth bass, white bass, and channel catfish were 4.12, 2.83, and 0.58 fish/angler-h, respectively (Table 23). Hourly catch rates of smallmouth bass and white bass in 2014 were well below the ten-year average (Table 24). Catch rates of smallmouth bass have decreased and remained low since 2007; similarly, catch rates of white bass have decreased and remained low since 2009 (Table 24).

Hourly catch rates for walleye were highest in June and hourly harvest rates were highest in May (Table 25). The removal of the minimum length limit in July and August normally results in a decrease in release rate; however, release rate in July remained high at 0.64 fish/angler-h. This is likely a result of high catch rates and relatively large size

structure on Lake Sharpe. The number of parties that caught four or more walleye remained similar in 2013 and 2014 (34% and 33%, respectively; Table 26). The number of anglers that harvested a limit of four walleye in 2014 was 18%, similar to 2013 (22%; Table 26).

Angler Demographics and Economic Impacts

For the May-July 2014 daylight period, Lake Sharpe anglers contributed about $5.3 million dollars to local economies, based on 78,396 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 21% of the angler contacts on Lake Sharpe in 2014, similar to estimates in 2010 and 2011 (Table 27). Most non-resident anglers using Lake Sharpe in 2014 were from Nebraska, Iowa and Minnesota (Table 28). Residents of 34 states were interviewed while fishing Lake Sharpe. Patterns in angler state of residency in 2014 remained similar to previous years (Fincel et al. 2014).

About 55% of resident angling parties interviewed on Lake Sharpe during the 2014 survey were local anglers from Hughes and Stanley counties (Table 29; Figure 7). Pennington (Rapid City), Minnehaha (Sioux Falls) and Beadle (Huron) county residents made up 7%, 7% and 4% of the interviewed angling parties, respectively. Patterns in angler county residency in 2014 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 (48%) 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 2014. Anglers from Minnehaha, Pennington and Beadle 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 2014 remained similar to 2013 (Table 30). Walleye remain the primary species targeted by roughly two thirds (62%) of the anglers on Lake Sharpe in 2014. Approximately one third (38%) of anglers surveyed reported targeting species other than walleye (Table 31).

Angler Satisfaction and Attitudes

Anglers' perception of their fishing experience is important to the success of a fishery. Angler responses help fisheries managers determine if current management practices and regulations are providing a fishery that meets angler needs and expectations. In 2014, anglers were asked to consider all factors when evaluating their level of satisfaction with their fishing trip. The median trip rating for the May-July 2014 period was "very satisfied" (median of 1; Table 32). The median satisfaction rating of "very satisfied" for 2014 is well above the long term average. About 87% of angling parties interviewed in 2014 indicated some degree of satisfaction, which surpasses the Lake Sharpe Strategic Plan objective of 70%. Neutral anglers made up 5% of all contacts, and more importantly, dissatisfied anglers represented only 8% of all contacts in 2014.

Gigliotti (2004) proposed that factors other than the number of walleye harvested likely influence trip satisfaction. However, anglers that harvested two or more walleye on average were "very satisfied" In general as mean walleye catch rate increased the level of

satisfaction increased similar to 2013 (Table 33; Fincel et al. 2014). Although both are considered a “satisfied” level, the number of walleye harvested likely effects angler satisfaction rankings.

In regards to a potential rule change to prevent the spread of AIS species in South Dakota, anglers were asked, “Have you removed or opened your boat’s plugs to drain the water today?” Seventy six percent of anglers responded they had drained their boat that day. The proportion of anglers that removed or opened their boat plugs was 56% at boat ramps, 15% at cleaning stations and 5% at other locations.

Increased mortality from catch and release of walleye and sauger from deep water (i.e., >30 feet) has received much attention from the public. Talmage and Staples (2011) determined the rate of angler caught mortality increased as capture depth (>9.1 m) increased during July-September in Rainy Lake, Minnesota. During the May-July 2014 period, Lake Sharpe anglers were asked, “How many walleye and sauger were caught and released today from water shallower than 30 feet?” Of the 179,085 walleye and sauger estimated released, only 4,010 (2%) of the fish were caught and released from water depths greater than 30 feet and 98% of respondents indicated they released fish caught in less than 30 feet of water (Table 35). Based off of angler responses, mortality from deep caught walleye is likely a small contribution to overall catch and release mortality in Lake Sharpe.

Table 14. Angler use and harvest estimates for surveys conducted 2005 to 2014 during the May-July daylight period.

Year	Fishing pressure (h)	Angler days	Estimated fish harvest	Estimated walleye harvest
2005	157,933	44,171	69,724	22,228
2006	234,645	72,279	102,131	82,136
2007	238,257	61,752	103,865	85,514
2008	201,665	63,654	81,585	55,733
2009	284,635	97,339	156,492	115,005
2010	290,625	79,201	134,371	111,715
2011*	98,712	26,321	42,157	32,375
2012	209,537	71,751	143,357	119,527
2013	250,528	73,369	188,958	159,204
2014	273,601	78,396	142,538	117,643
Mean	224,014	66,823	116,518	90,108

* Conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews.

Table 15. Estimated fishing pressure (angler-h), by month and zone, with 80% confidence intervals (CI), for the May-July 2014 daylight period.

Zone	Month			
	May	**June**	**July**	**Total**
Lower	58,430	53,174	46,406	158,010
80% CI	21,211	10,372	10,526	25,851
Middle	10,589	5,573	6,405	22,566
80% CI	4,785	1,618	1,721	5,336
Upper	34,782	33,737	24,506	93,025
80% CI	7,288	8,302	6,310	12,723
Total	103,801	92,484	77,316	273,601
80% CI	22,933	13,384	12,393	29,303

Table 16. Estimated fishing pressure, expressed as angler-hours (h) and hour per hectare (h/ha), by reservoir zone, for standard creel surveys conducted during the May-July daylight period, 2005-2014. Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	H	h/ha	H	h/ha	H	h/ha
2005	59,340	3.2	11,777	2.8	86,815	94.6	157,932	6.7
2006	106,988	5.8	19,787	4.6	107,873	117.5	234,648	9.9
2007	160,686	8.7	11,101	2.6	66,471	72.4	238,258	10.1
2008	121,837	6.6	17,961	4.2	61,866	67.4	201,664	8.5
2009	171,309	9.3	14,990	3.5	98,335	107.1	284,634	12.0
2010	188,305	10.2	14,288	3.4	88,032	95.9	290,625	12.3
2011	65,223	3.5	7,734*	1.8*	25,756*	28.1*	98,713*	4.2*
2012	113,318	6.1	12,061	2.8	84,159	91.7	209,538	8.9
2013	145,080	7.8	22,500	5.3	82,948	90.4	250,528	10.6
2014	158,010	8.5	22,566	5.3	93,025	101.3	273,601	11.6
Zone size (ha)	18,483		4,262		918		23,663	

Table 17. 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-July daylight survey period, 2010-2014. Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews.

Type of fishing	Year				
	2010	**2011**	**2012**	**2013**	**2014**
Boat (h)	261,895	83,838*	170,391	220,667	236,729
80% CI	26,873	14,377	16,349	26,329	27,823
H/ha	11.1	3.5*	7.2	9.3	10.0
Shore (h)	28,731	15,874*	6,762	29,850	36,872
80% CI	4,449	4,929	8,669	4,858	7,564
H/ha	1.2	0.7*	0.3	1.3	1.6

Table 18. Estimated number of walleye caught, harvested and released during the May-July daylight period, 2005-2014. Asterisk (*) denotes survey was conducted during the flood of 2011 when reduced or eliminated creel schedules resulted in fewer angler interviews.

Year	Caught	Harvested	Released	Percent Harvested
2005	42,348	22,228	20,120	52
2006	145,031	82,136	62,896	57
2007	276,913	85,514	191,399	31
2008	208,956	55,733	153,224	27
2009	399,297	115,005	284,291	29
2010	233,381	111,715	121,666	48
2011*	57,715*	32,375*	25,340*	56*
2012	424,202	119,527	304,675	28
2013	301,540	159,204	142,336	53
2014	295,844	117,643	178,201	40
Mean	238,523	90,108	148,415	42

Table 19. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the May-July 2014 daylight period. Crappie includes black and white species.

Species	Month			
	May	**June**	**July**	**Total**
Walleye	57,587	29,689	30,097	117,643
80% CI	17,050	6,358	6,773	19,416
Sauger	750	1,089	198	2,038
80% CI	644	780	120	1,019
Channel catfish	562	703	1,167	2,433
80% CI	246	438	972	1,094
White bass	2,185	2,168	328	4,682
80% CI	1,613	793	270	1,818
Smallmouth bass	5,061	2,811	3,091	10,964
80% CI	2,721	1,141	814	3,061
Crappie	1,582	716	211	2,509
80% CI	926	579	183	1,108
Rainbow trout	143	27	51	221
80% CI	131	30	42	141
Yellow perch	298	654	510	1,462
80% CI	258	210	399	520
Other*	345	122	392	586
Total	68,513	37,979	36,045	142,538
80% CI	18,941	7,635	8,876	22,267

*Other includes bluegill, common carp, Chinook salmon, freshwater drum, goldeye, largemouth bass, and northern pike.

Table 20. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the May-July 2014 daylight period. Crappie includes black and white species.

Species	Zone			
	Upper	**Middle**	**Lower**	**Total**
Walleye	31,299	5,239	81,105	117,643
80% CI	6,154	1,973	18,309	19,416
Sauger	867	472	698	2,038
80% CI	520	600	638	1,019
Channel catfish	1,572	379	483	2,433
80% CI	1,059	186	204	1,094
White bass	3,535	887	260	4,682
80% CI	1,733	516	182	1,818
Smallmouth bass	1,400	172	9,392	10,964
80% CI	683	210	2,976	3,061
Crappie	33	1,359	1,116	2,509
80% CI	33	919	618	1,108
Rainbow trout	74	0	147	221
80% CI	41	--	135	141
Yellow perch	0	86	1,376	1,462
80% CI	--	205	477	520
Other*	308	37	242	586
Total	39,088	8,631	94,819	142,538
80% CI	7,286	3,025	20,823	22,267

*Other includes bluegill, common carp, Chinook salmon, freshwater drum, goldeye, largemouth bass, and northern pike.

Table 21. Estimated number of fish released, by species and month, with 80% confidence intervals (CI) for the May-July 2014 daylight period. Crappie includes black and white species.

Species	Month			
	May	June	July	Total
Walleye	42,496	85,892	49,813	178,201
80% CI	13,828	17,685	13,000	25,941
Sauger	332	454	98	885
80% CI	427	369	66	568
Channel catfish	779	801	1,726	3,307
80% CI	334	376	577	765
White bass	2,421	8,944	1,768	13,133
80% CI	1,156	3,031	759	3,332
Smallmouth bass	9,768	22,275	11,866	43,908
80% CI	2,650	10,879	3,756	11,811
Crappie	225	21	13	258
80% CI	156	26	21	160
Rainbow trout	232	53	96	382
80% CI	193	64	178	270
Yellow perch	17	269	638	924
80% CI	26	204	269	338
Other*	1,550	1,965	3,171	6,685
Total	57,820	120,674	69,189	247,683
80% CI	16,119	27,033	16,300	35,444

*Other includes bigmouth buffalo, black bullhead, bluegill, Chinook salmon, common carp, freshwater drum, goldeye, largemouth bass, northern pike, river carpsucker, shorthead redhorse, shortnose gar, shovelnose sturgeon, and white sucker.

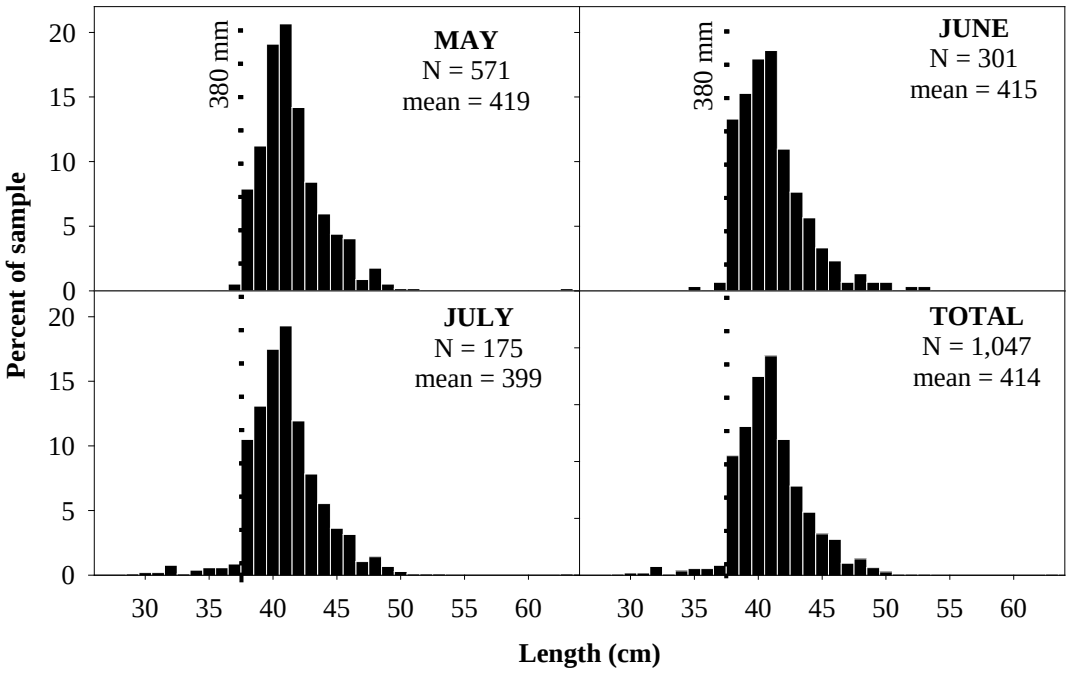

Figure 6. Monthly length-frequency distribution of walleye harvested by anglers during the May-July 2014 daylight period. Vertical line represents the 380- mm minimum length limit in effect from September 1 to June 30.

Table 22. Estimated hourly catch, harvest and release rates, by species, for all anglers interviewed during the May-July 2014 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	1.08	0.43	0.65
Sauger	0.01	0.01	T
White bass	0.07	0.02	0.05
Smallmouth bass	0.20	0.04	0.16
Crappie	0.01	T	T
Channel catfish	0.02	0.01	0.01
Rainbow trout	T	T	T
Yellow perch	0.01	0.01	T
Other*	0.03	T	0.04
Total	1.43	0.52	0.91

*Other includes bigmouth buffalo, black bullhead, bluegill, Chinook salmon, common carp, freshwater drum, goldeye, largemouth bass, northern pike, river carpsucker, shorthead redhorse, shortnose gar, shovelnose sturgeon, and white sucker.

Table 23. Estimated hourly catch, harvest and release rates, by species, for anglers targeting the species listed during the May-July 2014 daylight period.

Target species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	2.31	0.94	1.37
White bass	2.83	0.75	2.08
Smallmouth bass	4.12	2.13	1.99
Channel catfish	0.58	0.48	0.10

Table 24. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish and all fish combined, by year, for all anglers, for the May-July daylight survey period, 2005-2014.

Year	Catch rate (fish/angler-h)				
	Walleye	Smallmouth bass	White bass	Channel catfish	All fish
2005	0.27	0.08	0.49	0.06	0.93
2006	0.62	0.33	0.09	0.04	1.20
2007	1.16	0.65	0.08	0.03	2.00
2008	1.04	0.53	0.07	0.03	1.73
2009	1.40	0.40	0.16	0.02	2.04
2010	0.78	0.27	0.11	0.02	1.26
2011	0.58	0.30	0.08	0.02	1.03
2012	2.02	0.22	0.06	0.02	2.47
2013	1.20	0.18	0.05	0.03	1.54
2014	1.08	0.20	0.07	0.02	1.43
Mean of means	1.12	0.32	0.13	0.03	1.56

Table 25. Estimated hourly catch, harvest and release rates (fish/angler-h), for walleye and all species combined, by month, for the May-July 2014 daylight survey period.

Month	Walleye			All fish combined		
	Catch rate	Harvest rate	Release rate	Catch rate	Harvest rate	Release rate
May	0.97	0.56	0.41	1.22	0.66	0.56
June	1.25	0.32	0.93	1.72	0.41	1.31
July	1.03	0.39	0.64	1.36	0.47	0.89
Total	1.08	0.43	0.65	1.43	0.52	0.91

Table 26. 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 – July 2013 and 2014 daylight survey periods.

Number/ trip	Catch per trip							
	2013				2014			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	11	63	37	36	12	70	50	39
≥ 0.1	89	37	63	64	88	30	50	61
≥ 1	83	25	51	54	83	19	42	53
≥ 2	75	17	40	45	75	13	31	44
≥ 3	70	11	36	40	70	7	25	38
≥ 4	63	7	30	34	62	6	20	33
≥ 5	54	3	23	27	54	6	14	27
≥ 6	37	3	17	19	43	4	9	21
≥ 7	31	1	13	15	38	2	5	17
≥ 8	25	0	9	11	30	1	3	13
≥ 9	20	0	8	9	28	1	3	12
≥10	15	0	7	7	24	1	2	10

Number/ Trip	Harvest per trip							
	2013				2014			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	15	70	50	45	61	79	25	51
≥ 0.1	85	30	50	55	39	21	75	49
≥ 1	80	20	43	48	32	12	68	42
≥ 2	67	15	30	37	25	8	52	32
≥ 3	58	10	23	30	18	6	37	23
4	46	5	14	22	15	6	28	18

Table 27. Percent of total angler contacts and number of contacts (N) for resident and non-resident (states combined) anglers during the May-July daylight period, 2010-2014.

Zone		Year				
		2010	**2011**	**2012**	**2013**	**2014**
Lower	**N**	455	230	271	177	288
	Residents (%)	69	68	69	73	69
	Non-residents (%)	31	32	31	27	31
Middle	**N**	109	77	120	153	140
	Residents (%)	89	95	92	92	94
	Non-residents (%)	11	5	8	8	6
Upper	**N**	281	104	314	227	352
	Residents (%)	88	91	91	82	82
	Non-residents (%)	12	9	9	18	18
Total	**N**	845	411	705	557	780
	Residents (%)	78	79	83	82	79
	Non-residents (%)	22	21	17	18	21

Table 28. Percent of total non-resident angler contacts for anglers from the states listed during the May-July daylight survey period, 2010-2014.

State	Percent by Year				
	2010	**2011**	**2012**	**2013**	**2014**
Iowa	23	21	18	19	23
Nebraska	30	29	35	25	33
Colorado	4	8	3	8	3
Minnesota	19	26	20	24	20
Wisconsin	1	3	1	1	3
Wyoming	3	1	6	3	3
Other*	20	12	17	20	15

*Other includes California, Georgia, Idaho, Indiana, Kansas, Louisiana, Missouri, Montana, Nevada, New Jersey, New York, North Dakota, Ohio, Oklahoma, Texas, Washington and West Virginia.

Table 29. Percent of resident anglers contacted, county of residence and major cities within a county for anglers on Lake Sharpe, during the May-July daylight survey period, 2010-2014.

County	Major City	Percent by year				
		2010	2011	2012	2013	2014
Beadle	**Huron**	6	6	5	2	4
Brookings	**Brookings**	1	2	1	1	1
Davison	**Mitchell**	3	1	3	2	2
Hand	**Miller**	2	2	1	1	1
Hughes	**Pierre**	38	44	57	59	49
Lyman	**Presho, Kennebec**	2	2	1	4	2
Minnehaha	**Sioux Falls**	12	12	5	7	7
Pennington	**Rapid City**	6	4	6	6	7
Stanley	**Fort Pierre**	4	4	7	7	6

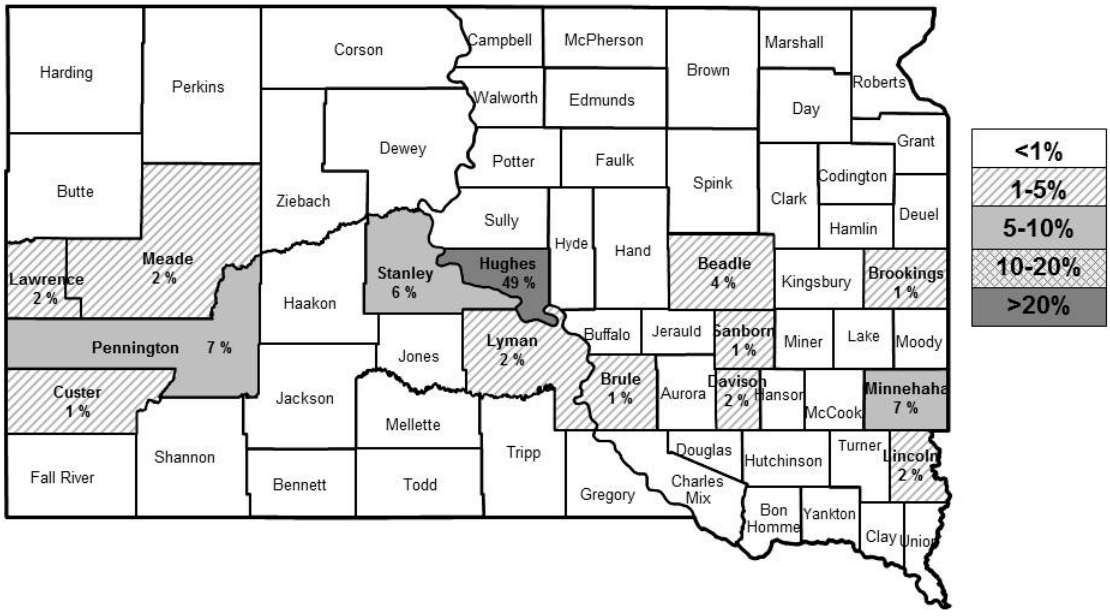

Figure 7. Percent of resident angler contacts by county during the May-July 2014 daylight survey period.

Table 30. Percent of anglers driving a specified distance, one way, to fish on Lake Sharpe, South Dakota during the May-July daylight survey period, 2010-2014.

Distance (miles)	Percent by year				
	2010	2011	2012	2013	2014
<25	27	29	42	45	38
25-49	8	10	7	5	6
50-99	9	9	8	5	8
100-199	22	17	16	16	19
≥200	34	35	27	29	29

Table 31. Percent of anglers that specifically target a species on Lake Sharpe, South Dakota during the May-July daylight survey period, 2010-2014.

Target species	Percent by year				
	2010	2011	2012	2013	2014
Walleye	71	65	63	59	62
Anything	20	24	32	31	31
Rainbow trout	<0.5	<0.5	1	0	0
White bass	3	4	1	2	<0.5
Smallmouth bass	2	3	1	1	2
Other*	4	4	2	7	5

*Other includes Black crappie, channel catfish, Chinook salmon, common carp, northern pike, smallmouth buffalo, and white crappie.

Table 32. Responses of anglers who were asked the following question during the May-July 2014 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, 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	170	76	34	20	9	5	6	320	1
June	135	85	35	12	9	7	10	293	2
July	88	32	21	8	5	2	10	166	1
Total	393	193	90	40	23	14	26	779	1
Percent	87%			5%	8%				

Table 33. Responses of anglers who were asked the following question during the May-July 2014 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, 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	156	107	55	27	19	8	24	396	2
0.1-0.9	29	15	7	4	0	1	0	56	1
1.0-1.9	23	28	15	3	3	4	1	77	2
2.0-2.9	42	13	7	3	1	1	0	67	1
3.0-3.9	32	10	4	0	0	0	0	46	1
4	109	19	2	2	0	0	0	132	1
Percent	87%			5%	8%				

Table 34. Responses of anglers that were asked, “Have you removed or opened your boat’s plugs to drain the water today?”

Location	May %	May N	June %	June N	July %	July N	Overall %	Overall N
Yes	**80%**	137	**73%**	133	**73%**	78	**76%**	348
Open at ramp	58%	100	53%	96	55%	59	56%	255
Open at fish cleaning station	15%	26	13%	24	17%	18	15%	68
Open at another location	6%	11	7%	13	1%	1	5%	25
No	**20%**	34	**27%**	48	**27%**	29	**24%**	111

Table 35. Estimated release of walleye and sauger, combined, from Lake Sharpe anglers during May, June and July 2014, from water depths of less than 30 feet and greater than 30 feet.

	May	%	June	%	July	%	Overall	%
Overall Release	42,828		86,346		49,911		179,085	
Released < 30 feet	42,073	98%	84,916	98%	47,933	96%	175,075	98%
Released > 30 feet	755	2%	1,430	2%	1,978	4%	4,010	2%

ONGOING RESEARCH PROJECTS

The Missouri River Fisheries staff conducted field work on a number of collaborative projects and one internal research project in 2014 on Lake Sharpe. Staff assisted South Dakota State University (SDSU) with the collection of several species of fish and water samples throughout the reservoir. This is the second collaborative project utilizing otolith microchemistry and water chemistry signatures to determine where walleye and other species originate in Lake Sharpe and estimate the contribution of walleye from Lake Oahe to Lake Sharpe. The anticipated completion date for this project is spring of 2016. Staff also collected data for a joint project with SDSU to evaluate current survey fish collection gears and compare it to American Fisheries Society standard gears. During 2013 and 2014, staff deployed paired gill net sets using SDGFP standard multi-filament gill nets as well as an American Fisheries Society standard mono-filament gill net. SDSU is comparing net catches to determine effectiveness of each of these gears. The anticipated completion date for this project is spring of 2015. 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 20 adult gizzard shad and released them at four locations on Lake Sharpe during the spring. Staff tracked the movements of shad using active receivers every 2-3 weeks. Twelve passive receivers continually monitor gizzard shad movements at select locations in Lake Sharpe. This is part of a two year study with an additional 20 adult gizzard shad scheduled to be implanted with transmitters during spring of 2015. The anticipated completion date for this project is fall 2016.

FISHERY STATUS AND 2015 OUTLOOK

The Missouri River flood of 2011 was catastrophic and the extreme high 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 extremely high in 2014. The main objective of the Lake Sharpe Fisheries Strategic Plan is: "To provide a fishery that can annually support a minimum of 100,000 angler days of recreation with a minimum harvest rate of 0.35 fish/angler-h, and a 70% angler trip satisfaction rating." Despite the potential negative effects of the 2011 flood, the goals of the Lake Sharpe Strategic Plan were met in 2014.

In May-July 2014, the harvest rate for all fish species was 0.52 fish/angler-h and angler satisfaction was at 87%. The April-Oct Lake Sharpe walleye-specific objectives of 100,000 walleye harvested and a harvest rate of 0.3 walleye/angler hour were exceeded in the May-July 2014 period with harvest rate of 1.08 walleye/angler-h and an estimated 117,643 walleyes harvested.

Lake Sharpe currently has a low abundance of walleye greater than 381-mm (15-in). In 2015, walleye catch rates will be lower but the release rates will also remain low due to the high proportion of quality-size walleye available. Moreover, growth and condition of walleye remains good so angling opportunities in 2015 should be favorable.

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.

- Critically evaluate cold-water stocking program in Lake Sharpe tailrace fishery.

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

- Update the Lake Sharpe Fisheries Management Plan by April 2016.

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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*
Silvery minnow	*Hybognathus nuchalis*
Smallmouth bass	*Micropterus dolomieu*
Smallmouth buffalo	*Ictiobus bubalus*
Spottail shiner	*Notropis hudsonius*
Suckermouth minnow	*Phenacobius mirabilis*
Walleye	*Sander vitreus*
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*
Fan leafed crowfoot	*Cabomba caroliniana*
American elodea sago	*Elodea canadensis*
pondweed	*Potamogeton* spp
Cattail	*Typha* spp

Appendix 3. Angler satisfaction, questions asked as part of the May-July 2014 angler use and harvest survey on Lake Sharpe, South Dakota.

Trip Satisfaction:

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

Depth of fishing/Angler induced mortality

How many walleye/sauger were caught and released today from water shallower than 30 feet?

Risk of anglers spreading aquatic nuisance species:

Have you removed or opened your boat's plugs to drain the water today?

YES, NO, Open at fish clean station, or Open at other location