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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2007

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ANNUAL FISH POPULATION
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ON
LAKE SHARPE, SOUTH DAKOTA, 2007

By

Kyle Potter, Kris Edwards and Geno Adams
Missouri River Fisheries Center
South Dakota Dept. of Game, Fish, and Parks

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Missouri River Program Administrator
James Riis

Fisheries Program Administrator
John Lott

Grants Coordinator
Nora Kohlenberg

Department Secretary
Jeff Vonk

Wildlife Division Director
Tony Leif

Assistant Division Director
George Vandel

PREFACE

Information collected during 2007 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: Brian Beel, Tyson Bramblee, Marlin Fallon, Kayla Gabriel, Robert Hanten, Timaree Ice, Janelle Jensen, Doug Jones, Darla Kusser, Aaron Leingang, Zachary Radack, Jim Riis, Aaron Rumpca, Justin Sarvis, Keith Schwartz, Jason Stahl, Andy Viet, and Trent Withers.

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EXECUTIVE SUMMARY

This report includes annual fish population data from 2002 through 2007 and angler use, harvest, and preference data for 2007, for Lake Sharpe, South Dakota. 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.

Mean walleye gillnet CPUE in 2007, at 21.6 walleye/net-night, was higher than the 2006 value of 16.8 fish/net-night and higher than the 2005 value of 17.8 fish/net-night. Walleye ranging from 110 to 560 mm were collected during the August 2007 gill netting survey. Approximately 22% of walleye in the 2007 gill net sample were ≥ 380-mm (15-inch minimum length), 6% were ≥ 460-mm (18 inches), and 2% were ≥ 508-mm (20 inches, Figure 2). However, 25% of walleye in the gill net catch were between 220 and 300 mm, indicating the 2006 year-class recruited to the gear and to the population. There was also a portion of the walleye catch between 110 and 160 mm, indicating that some reproduction occurred in 2007.

The 2007 mean age-0 electrofishing CPUE, of 30.3 fish/h was lower than 2006, when 45.9 fish/h were collected. Walleye relative weight (*Wr*) for 2007, at 82, was similar to most years for Lake Sharpe. Age-2 (2005) walleye comprised the largest portion of the walleye catch in gill nets in 2007, followed by the 2006 year class.

Sixteen species of age-0 or small prey fishes were collected by shoreline seining in 2007. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2007, with a mean CPUE of 175.8 fish/haul.

Regulations in 2007 for smallmouth bass in Lake Sharpe include a 306-to-457-mm (12- to 18-inch) protected slot with anglers allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. However, in January of 2008 a new protected slot length limit will be in effect for Lake Sharpe. This new protected slot length limit (357-mm to 457-mm) will allow anglers to harvest four fish < 357-mm and one ≥ 457-mm daily. Mean CPUE values of smallmouth bass collected by shoreline electrofishing decreased from 30.4 to 21.1 (fish/h) at Joe Creek and 105.1 to 57.3 (fish/h) at Big Bend Dam, from 2006 to 2007, respectively. Proportional stock density and RSD-P initially decreased following the regulation changes and are slowly increasing. Growth is unchanged since the regulation change with mean back-calculated length at age 4 still exceeding statewide and Missouri River reservoir averages. Mean length at age at capture has been calculated for three consecutive years from otoliths and estimates have been similar to values generated from scales, for age 5 and younger fish.

An estimated 90,410 anglers days were spent on Lake Sharpe during the April-September 2007 daylight period, below the Lake Sharpe Strategic plan goal of 100,000 angler days. An estimated harvest of 112,623 walleye occurred during the 2007 period, which was slightly above the Lake Sharpe Strategic plan goal of 100,000 per period and was well above the estimated harvest for the same period in 2005, of 57,866 walleye. Estimated angler catch of white bass declined from 108,494 fish in 2005 to 41,112 in 2007, a decline of 62%, due to a die-off during the summer of 2005. Approximately 83% of the smallmouth bass harvested during the April-September 2007 period were <305-mm in length and 4% were ≥457-mm in length. Approximately 13% of the smallmouth bass measured during angler interviews were within the protected slot length limit.

Estimated hourly harvest rate for all species combined, for the April-September 2007 daylight period, at 0.44 fish/angler-h, was higher than the strategic plan objective of 0.35 fish/angler-h. The walleye catch, harvest, and release rates for 2007 (1.04, 0.34, 0.70, respectively) were much greater than during the 2006 period (0.60, 0.33, 0.27, respectively). The smallmouth bass catch rate increased from 0.33 fish/angler-h during 2006 to 0.63 fish/angler-h during 2007. The white bass catch rates decreased from 0.40 fish/angler-h during 2005 to 0.12 fish/angler-h during 2007.

Approximately 78% of angling parties interviewed in 2007 indicated some degree of satisfaction with their fishing trip, a value greater than the Lake Sharpe Strategic Plan objective of 70%. For the April-September 2007 daylight period, Lake Sharpe anglers contributed approximately 7.1 million dollars to local economies, based on an estimated 90,410 trips at an estimated $79 per trip.

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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2007

INTRODUCTION

Anglers spent over 1.6 million hours fishing the Missouri River system in South Dakota in 2004 (Lott et al. 2006a; Lott et al. 2006b). Approximately 48% of South Dakota resident anglers fished the Missouri River system in 2003 and 35% of those anglers fished Lake Sharpe (Gigliotti 2004). Also, approximately 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) recognizes the importance of the Missouri River fisheries program and considers it a major program in strategic planning efforts (SDGFP 1994).

Lake Sharpe is a 128-km long mainstem Missouri River flow-through reservoir and has a surface area of 24,686 ha. Lake Sharpe has supported between 61,000 and 123,000 angler trips, during the April-September daylight period, in recent years (Stone et al. 1994, Johnson et al. 1998; Johnson and Lott 2001; Lott et al. 2006b). Walleye, and to a lesser extent, smallmouth bass, white bass, channel catfish, sauger, and rainbow trout, provide most of the sport fishing opportunity in this reservoir.

Lake Sharpe is an important fisheries resource in South Dakota and its habitat and fish community must be protected and maintained. The importance of Lake Sharpe to Missouri River fisheries is documented in the goals, objectives and strategies developed for management of this system (SDGFP 1994). Conducting annual surveys documenting fish community and population parameters, in association with collecting data on angler use, harvest, attitudes, preferences, and level of satisfaction, are primary strategies outlined in that plan. This information is required to evaluate objectives and strategies and to identify future management strategies. Trends and status of fish populations discussed in this report provide valuable information for evaluation of walleye regulations implemented in 1990 and modified in 1999, 2004 and 2006. This report includes data collected for Lake Sharpe in 2007 and comparisons to data from previous years.

MANAGEMENT OBJECTIVES

Reservoir-wide Objectives

- Provide a minimum of 100,000 angler days of recreation with a harvest rate of 0.35 fish per angler hour, and a 70% angler trip satisfaction rating.
- Continually work to preserve or enhance and protect the existing fish community structure, diversity and aquatic habitats of Lake Sharpe

Species Specific Objectives

- Provide a walleye fishery that can annually support a minimum of 75,000 angler days of recreation with a harvest of 100,000 walleye and a harvest rate of 0.3 walleye per angler hour.
- Provide a white bass fishery that can annually support a minimum of 5,000 angler days of recreation with a harvest of 30,000 white bass and a harvest rate of 0.3 white bass per angler hour.

- Provide a rainbow trout fishery that can annually sustain a minimum of 5,000 user-days of angling, a catch rate of 0.2 fish per hour for anglers specifically fishing for rainbow trout and an annual harvest of 2,500 by 2004.

- Provide a smallmouth bass fishery that can sustain a minimum of 5,000 days of smallmouth bass angling opportunity, a harvest of 10,000, and a catch rate of 0.3 fish per angling hour for anglers specifically fishing for smallmouth bass by 2004.

- Provide a channel catfish fishery that can sustain a minimum of 10,000 days of recreation, and an annual harvest of 15,000, and a catch rate of 0.33 fish per angling hour for anglers specifically fishing for channel catfish by 2004.

- Maintain Lake Sharpe population abundance of gizzard shad, emerald and spottail shiners at or above the five-year average, as indexed by shoreline seining.

SAMPLING STRATEGIES

The sampling strategies used to determine SDGFP's ability to achieve stated fisheries management objectives, as outlined in the strategic plan, are accomplished through fish population and angler surveys which provide the following information:

<u>Annual fish population surveys (Federal Aid Code 2102):</u>

- species composition
- relative abundance
- population age structure
- growth
- condition
- recruitment
- survival and mortality rates
- population size structure
- effects of regulations
- effects of sport fish harvest

<u>Angler use, harvest, and preference surveys (Federal Aid Code 2109):</u>

- recreational angling pressure
- fish harvest, release and catch rates, by species
- angler party size, day length, and state of residency
- annual local economic impact of the sport fishery
- effects of regulations and other management activities
- size structure of fish in the harvest
- angler preference, attitude and satisfaction information

STUDY AREA

Lake Sharpe is located in central South Dakota (Figure 1) and extends from Oahe Dam to Big Bend Dam. 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, and the lower zone extends from DeGrey to Big Bend Dam. Standard gill netting, seining and electrofishing locations have historically been Farm Island, DeGrey/Fort George, Joe Creek and North Shore. Electrofishing is also conducted at LaFramboise Island and the Oahe Dam stilling basin. Historical, biological, chemical and physical parameters have been discussed previously (Benson 1968; Riis 1986; Schmidt 1975). Selected physical characteristics, management classification, and fish population survey schedules for Lake Sharpe are presented in table 1.

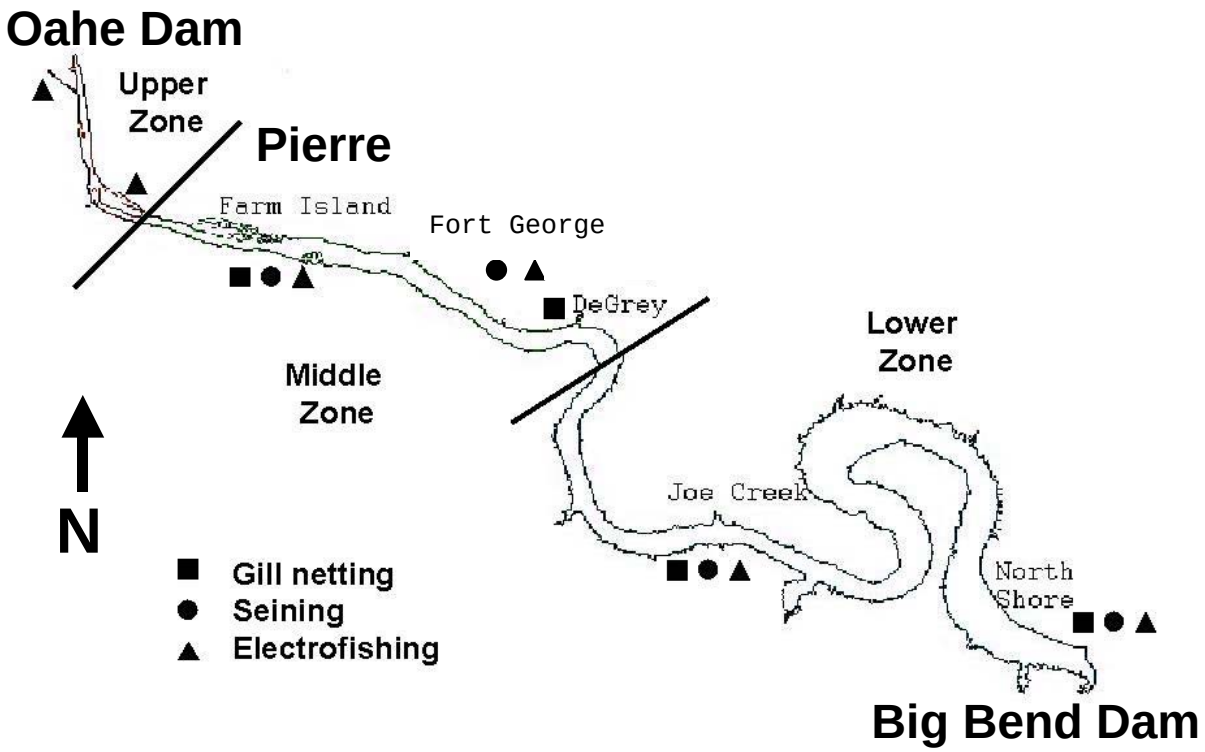

Figure 1. Lake Sharpe, South Dakota, gill netting, seining and electrofishing locations.

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 (X 1000 ha):	25
Depth (m)-maximum: **-mean:**	23.5 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 - 9.1 9.1 - 18.3
Number of gill nets:	24
Gill netting survey date:	August
Number of seine hauls:	16
Seining survey date:	August
Nighttime electrofishing survey dates:	May-June, September-October

REGULATION HISTORY

Fish population and angler use and harvest survey data is 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 14-inch (356 mm) minimum length limit was placed in effect on Lakes Oahe, Sharpe, and Francis Case (Table 2). Beginning in 1999, the minimum length was increased to 15 inches (381 mm) and was in effect during all months except July and August. A stipulation that at most one fish in the daily limit could be 18 inches (457 mm) or longer was also added to the walleye regulation package in 1999. Changes implemented for 1999 were made to reduce harvest during a period of high angler use and increase the abundance of walleye longer than 18 inches in the population to increase the quality of the fishery. The daily walleye 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 daily limit of four and the stipulation that at most one walleye over 18 inches was increased to 20 inches (508 mm).

Experimental regulations for smallmouth bass were implemented in 2003 and were evaluated through 2007 for their effectiveness at increasing the size structure of the smallmouth bass population in Lake Sharpe (Table 2). Special regulations for smallmouth bass include a 12-to-18-inch (306-457-mm) protected slot length limit with at most one fish 18 inches or longer in the daily limit.

Table 2. History of special harvest regulations for walleye and smallmouth bass, on Lake Sharpe, South Dakota, 1968 through 2007.

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 14 inch minimum length
	1999-2003	4	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 18 inches
	2004-2005	3	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 18 inches
	2006-2007	4	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 20 inches
Smallmouth bass	2003-2007	5	10	• Only fish shorter than 12 inches or 18 inches and longer may be kept and at most one fish in the daily limit may be 18 inches or longer.

SAMPLING METHODS

FISH POPULATION SURVEYS

Data Collection

Variable-mesh gill nets, seines and boat electrofishing were used to sample fish populations in Lake Sharpe during 2007 (Figure 1). Three multifilament, variable-mesh (containing meshes with the following bar mesh dimensions: ½, ¾, 1, 1 ¼, 1 ½, and 2 inches; 12.7, 19.1, 25.4, 31.8, 38.1, and 50.8 mm bar mesh) gill nets (Lott et al. 1994) were fished overnight (approximately 20 h), on the bottom, in each depth zone (0-9.1 m and >9.1 m), where possible, for a total of six nets per location with four sampling locations on Lake Sharpe (Figure 1). All fish collected were identified and counted. All walleye and sauger captured were measured for total length (TL; mm) and weighed (g). At each sampling location, the first 50 individuals of each species, excluding walleye and sauger, were measured and weighed. Otoliths (10 per cm length group per sampling location) were collected from walleye and sauger captured during the standard gill net survey. Otoliths from walleye and sauger less than 350 mm were aged whole while submersed in water in a black dish. Otoliths from walleye and sauger greater than 350 were aged with otoliths cracked in half and charred prior to aging, similar to techniques described by Isermann, et al. (2003).

Nylon seines, previously described by Lott et al. (1994), were used to collect age-0 fishes and small littoral species. A quarter-arc seine haul was accomplished by methods described in Martin et al. (1981). Four seine hauls were made at each of the four sampling locations (Figure 1). All fish collected with seines were placed on ice and identified and counted in the lab.

Spring (May and early June), nighttime electrofishing was used to gather data on smallmouth bass population parameters. Smallmouth bass captured were measured (TL; mm), weighed (g) and scales were taken from 10 smallmouth bass per centimeter length group, at each sampling location at Big Bend Dam face and natural rock shoreline near Joe Creek. Six, 15-minute electrofishing runs were conducted at night, during late May and early June, along the shoreline, at each sampling location. A 5.3-m Smith-Root SR-18 electrofishing boat, with a 5.0 GPP electrofisher, was used to conduct the survey. The electrofishing unit was set for pulsed D.C. current and a 30 pulse/sec frequency. Voltage and amperage ranged between 270-300 V and 7-10 A, respectively. Each standard sampling site was sampled on three different occasions (overall, eighteen runs per site) during the one-month survey period, to reduce possible biases in size structure and catch rate associated with single sampling events (Lott 1996, 2000).

Fall (Sept./Oct.), nighttime electrofishing for age-0 walleye was included in standard fish population surveys beginning in 1995 to assess walleye reproduction. Beginning in 1998, a sampling location was included at DeGrey to provide uniformity between electrofishing, seining, and gill-netting survey sites. In 2000, electrofishing sites at LaFramboise Island and the Oahe Dam stilling basin were added to the list of standard electrofishing sites, for a total of six sampling locations (Figure 1). In 2003, DeGrey was replaced with Fort George, as a standard seining and electrofishing station, due to a lack of shoreline access at DeGrey, from siltation. The sampling design for fall electrofishing was identical to spring electrofishing. Otoliths were taken from a representative sample of walleye <200-mm in length to determine the maximum length for age-0 fish.

A list of common names, scientific names, and species abbreviations for fish mentioned in this report is presented in Appendix 1.

Data Analysis

Relative abundance of fish species were expressed as mean catch per unit effort (CPUE) for standard gill net (No./net night), seine (No./haul) and electrofishing (No./h) catches. A standard net night for the gill-net survey was approximately 20 h. Age and growth analyses were conducted for walleye, sauger, and smallmouth bass. Smallmouth bass scales and walleye and sauger otoliths were aged according to standard techniques (DeVries and Frie 1996). Back-calculations for scale samples were made with the computer program WinFin Analysis (Francis 2000). A standard y-intercept value for growth analyses of 35 mm was used for smallmouth bass (Carlander 1982). Age distributions for gill-net catches of walleye and sauger were developed by assigning ages to all fish captured during the survey, based on length-at-age-at-time-of-capture information. Proportional stock density (PSD; Anderson 1980) and relative stock density (RSD; Gablehouse 1984) values were calculated for walleye, sauger, smallmouth bass, channel catfish, white bass, and yellow perch. Length categories used in PSD and RSD are listed in Appendix 2.

Relative weight values (*Wr;* Anderson 1980) were calculated using standard weight (W_s) equations developed for smallmouth bass (Kolander et al. 1993), walleye (Murphy et al. 1990), sauger (Guy et al. 1990), channel catfish (Brown et al. 1995), white bass (Brown and Murphy 1991) and yellow perch (Willis et al. 1991). Stock density indices (PSD, RSD) and mean *Wr* values for white bass and yellow perch are presented in Appendix 2.

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Data Collection

Prior to 2003, angler use and sport-fish harvest survey techniques were patterned after a study designed and conducted on Lake Sharpe, South Dakota, by Schmidt (1975). This survey consisted 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 and catch and release rates. Beginning in 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). For a more detailed description of the bus route theory and techniques see Robson and Jones (1989), Jones and Robson (1991), and Pollock et al. (1994). Sampling was conducted from April 1, 2007 through September 30, 2007 for the sunrise-to-sunset (daytime) period. Diagrams of bus routes used on Lake Sharpe during the April-September survey period appear from Appendix 3 to Appendix 8. Random numbers were used to select the following for the bus route designs: day selection (weekday or weekends/holiday), day beginning at sunrise or ending at sunset, route direction (forward or backward), starting location, and route selection. Daily schedules were then created with Microsoft Excel and Word for each day or shift selected.

Standard angler interviews included gathering information on trip length, type of fishing, target species, zip code, number in party, numbers of fish of each species harvested and released and lengths of walleye and smallmouth bass harvested by anglers. Questions on angler satisfaction, preferences, and attitudes were also included in each angler interview during the 2007 reservoir-wide angler use and harvest survey. Two different versions (forms A and B) of the angler interview data sheet were created, with different sets of angler attitude or preference questions on each sheet. Clerks alternated between forms A and B during each scheduled survey day. Anglers were asked how satisfied they were with their fishing trip, considering all factors. A series of questions were asked pertaining to current smallmouth bass regulations on Lake Sharpe. Anglers were asked if they were in favor of current smallmouth bass regulations. If they opposed the current regulation package, they were asked if they would be in favor of a change of the protected slot from 12-18 inches to 14-18 inches. Parties that caught smallmouth bass were asked how many additional smallmouth bass they would have harvested, for their party, if the regulation had length limits not been in effect. A complete list of satisfaction, attitude and preference questions asked in conjunction with the 2007 angler use and harvest survey appears in Appendix 9.

Data Analysis

Pressure count and angler interview data were entered and 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 also calculated. Lengths of harvested walleye and smallmouth bass were determined, as was angler demographic information. Median values of satisfaction question responses were calculated for each month and for the entire April-September survey period.

RESULTS AND DISCUSSION

FISH POPULATION SURVEYS

Species Composition and Relative Abundance

Walleye and channel catfish dominated catches in the August 2007 gill net survey, comprising 49% and 13% of the total catch, respectively (Table 3). Other species commonly caught during the 2006 survey included yellow perch, common carp, sauger, white bass, gizzard shad, freshwater drum, and smallmouth bass. Catch per unit effort has historically been used as an index of population abundance or density (Hubert 1996). Channel catfish mean CPUE in 2007, at 5.5 fish/net-night, was lower than during all years in the 2002-2006 period (Table 4). Mean walleye CPUE in 2007, at 21.6 walleye/net-night, was higher than 2006 value of 16.8 walleye/net-night. The average mean catch per gill net-night, for the 2003-2007 periods, was 17.4 walleye/net-night. The 2007 value of 21.6 walleye/net-night, was the highest documented during the last five years. The walleye abundance index appears to have increased since 2004 while CPUE for all other species in 2007 were within ranges previously documented.

Table 3. Relative species composition, by percent of total catch, of fish species collected during the standard August gill net survey on Lake Sharpe, South Dakota, during 2003 through 2007. Trace (T) indicates values < 0.5%.

Species	Year				
	2003	2004	2005	2006	2007
Walleye	31.8	27.9	36.8	43.1	49.0
Channel catfish	30.7	33.3	36.2	16.7	12.6
Yellow perch	1.8	2.6	4.4	6.7	5.4
Common carp	1.3	4.2	4.0	8.0	4.7
Sauger	3.9	5.9	3.7	5.8	5.9
White bass	15.9	5.6	3.5	5.5	4.4
Gizzard shad	10.3	10.3	3.1	6.5	10.0
Freshwater drum	1.5	2.1	3.0	2.5	2.2
Smallmouth bass	0.5	T	2.8	2.9	2.8
*Others	2.5	8.1	2.4	2.5	3.1

*Others includes: black crappie, bluegill, blue sucker, white crappie, northern pike, river carpsucker, shorthead redhorse, goldeye, shovelnose sturgeon, spottail shiner, bigmouth buffalo, lake herring, black bullhead, rainbow trout, shortnose gar, smallmouth buffalo, rainbow smelt, white sucker.

Table 4. Mean catch per unit effort (CPUE; No./net-night) and standard error values (SE) for fish species collected with standard coolwater gill net sets in Lake Sharpe, South Dakota, 2003-2007. Trace (T) indicates values less that 0.05.

Species	Year									
	2003		2004		2005		2006		2007	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	T		T		T		0.0		0.0	
Black bullhead	0.0		0.1	0.1	0.0		0.0		0.0	
Black crappie	0.0		0.0		0.0		0.2	0.1	0.0	
Bluegill	0.0		0.0		0.0		T		0.0	
Channel catfish	18.7	3.8	15.2	2.2	17.5	4.0	6.5	1.7	5.5	0.9
Chinook salmon	0.0		0.0		0.0		0.0		0.0	
Common carp	0.8	0.3	2.0	0.4	1.8	0.4	3.1	0.9	2.1	0.8
Freshwater drum	0.9	0.4	1.0	0.7	1.3	0.4	1.0	0.3	1.0	0.4
Gizzard shad	6.3	3.6	5.2	3.5	1.5	0.8	2.5	1.2	4.4	2.9
Goldeye	0.4	0.2	0.7	0.4	0.2	0.1	0.0		0.0	
Northern pike	0.0		0.0		0.0		T		0.0	
Rainbow smelt	0.0		T		0.0		0.0		0.0	
Rainbow trout	T		0.0		0.0		0.0		0.0	
River carpsucker	0.3	0.2	0.4	0.2	0.5	0.3	0.1	0.1	0.2	0.1
Sauger	2.4	0.6	2.7	0.6	1.7	0.5	2.3	0.7	2.6	0.7
Shorthead redhorse	0.4	0.2	1.0	0.4	0.2	0.1	0.2	0.1	0.3	0.1
Shortnose gar	T		0.1	0.1	T		0.2	0.2	0.1	0.1
Shovelnose sturgeon	0.1	0.1	1.0	0.6	0.1	0.1	0.2	0.1	0.5	0.2
Smallmouth bass	0.3	0.2	T		1.2	0.8	1.1	0.8	1.3	0.9
Smallmouth buffalo	0.0		T		0.0		0.0		T	
Spottail shiner	0.0		0.0		0.1	0.1	0.0		0.1	0.1
Walleye	19.6	3.0	12.9	2.2	17.8	2.8	16.8	2.8	21.6	3.4
White bass	9.8	6.8	2.6	0.9	1.5	0.8	2.2	1.0	2.0	1.2
White crappie	0.2	0.1	0.2	0.2	0.6	0.4	0.1	0.1	0.1	0.1
White sucker	0.0		0.0		T		0.0		T	
Yellow perch	1.1	0.5	1.3	0.3	2.1	0.7	2.6	1.2	2.4	0.7

Sixteen species of small littoral fishes were collected by shoreline seining in 2007. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2007, with a mean CPUE of 175.8 fish/haul (Table 5). The mean number of age-0 walleye captured per seine haul in 2006, at 0.5, illustrated walleye reproduction occurred in Lake Sharpe. Mean CPUE for other species captured during the seining survey was within ranges previously documented. Caution should be used when making inferences about seining catch data. Highly variable catch rates are indicative of the gear type, and values may not represent the true population (Lyons 1986, Parsley et al. 1989).

Table 5. Mean catch per unit effort (CPUE; No./haul) and standard error (SE) values for fish species collected during the standard August seining survey on Lake Sharpe, South Dakota. Catches are for age-0 fishes except where noted. Trace (T) indicates values less than 0.05. Asterisk (*) indicates both age-0 and adult fish included in CPUE.

Species	Year									
	2003		2004		2005		2006		2007	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	0.0		0.0		0.0		0.0		0.0	
Black crappie	0.0		0.0		0.0		0.0		0.0	
Bluegill	0.0		0.0		0.5	0.2	0.0		0.0	
Bluntnose minnow	0.1	0.1	0.0		1.9	0.9	2.2	0.8	2.5	1.3
Brassy minnow*	0.1	0.1	0.0		0.0		0.3	0.1	0.0	
Channel catfish	0.0		0.0		0.3	0.2	0.5	0.3	1.4	1.1
Common carp	0.2	0.1	0.3	0.2	0.5	0.3	0.1	0.1	0.1	0.1
Emerald shiner*	15.1	5.7	27.9	9.4	95.4	39.7	24.0	8.4	9.6	4.6
Fathead minnow*	0.1	0.1	0.0		0.0		0.0		0.0	
Freshwater drum	0.3	0.2	3.4	1.7	22.4	8.8	5.6	2.1	11.6	6.0
Gizzard shad	244.4	105.1	379.4	147.2	284.7	83.8	350.5	136.0	175.8	54.8
Goldeye	0.0		0.0		0.1	0.1	0.0		0.0	
Johnny darter*	0.9	0.8	0.5	0.2	0.2	0.1	0.8	0.5	0.6	0.3
Largemouth bass	0.0		0.3	0.1	0.3	0.1	0.4	0.3	0.1	0.1
River carpsucker	0.0		0.1	0.1	10.9	4.8	0.1	0.1	3.4	1.6
Sauger	0.0		0.0		0.6	0.4	0.0		0.0	
Smallmouth bass	1.8	0.7	2.1	0.9	1.5	0.5	4.2	1.0	3.3	0.9
Smallmouth buffalo	0.0		0.0		0.0		0.0		0.0	
Spottail shiner*	8.7	3.3	5.6	2.0	3.7	1.0	5.4	2.0	6.1	1.9
Walleye	0.3	0.2	0.0		3.9	1.4	0.7	0.2	1.3	0.5
White bass	2.2	1.1	19.1	8.5	6.8	2.8	6.3	2.7	2.2	0.6
White crappie	0.3	0.3	10.9	10.0	2.7	1.8	1.6	0.8	1.6	1.0
White sucker	0.1	0.1	0.2	0.1	0.2	0.1	0.0		0.1	0.1
Yellow perch	15.9	12.3	3.8	1.5	24.9	11.2	13.5	5.2	19.4	5.3

Population Parameters for Walleye

Walleye ranging from 110 to 560 mm were collected during the August 2007 gill netting survey (Figure 2). Approximately 22% of walleye in the 2007 gill net sample were ≥ 380-mm (15-inch minimum length), 6% were ≥ 460-mm (18 inches), and 2% were ≥ 508-mm (20 inches, Figure 2). However, 25% of walleye in the gill net catch were between 220 and 300 mm, indicating the 2006 year-class recruited to the gear and to the population (Figure 2; age-1 fish). There was also a portion of the walleye catch between 110 and 160 mm, indicating that some reproduction occurred in 2007.

Mean walleye CPUE for individual sampling locations are based on six net sets at each location, each year. Because Lake Sharpe is a flow through reservoir, flow characteristics highly influence daily and seasonal fish movement, distribution, and netting efficiency. Variability among gill net catches within and among survey years is due to changes in fish abundance, fish activity in association to current, and fouling of nets with debris in current or shallow-water areas. Current affects netting efficiency at the upper three sampling locations on Lake Sharpe (Figure 1) with nets at the DeGrey and Farm Island locations being the most affected. The low gill net catch rate for walleye at DeGrey in 2005 and 2006 are examples of nets being fouled by debris moved about by wave action and current. Curly-leafed pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*) have become a problem in certain areas of Lake Sharpe and have affected catch rates of gear deployed in current areas.

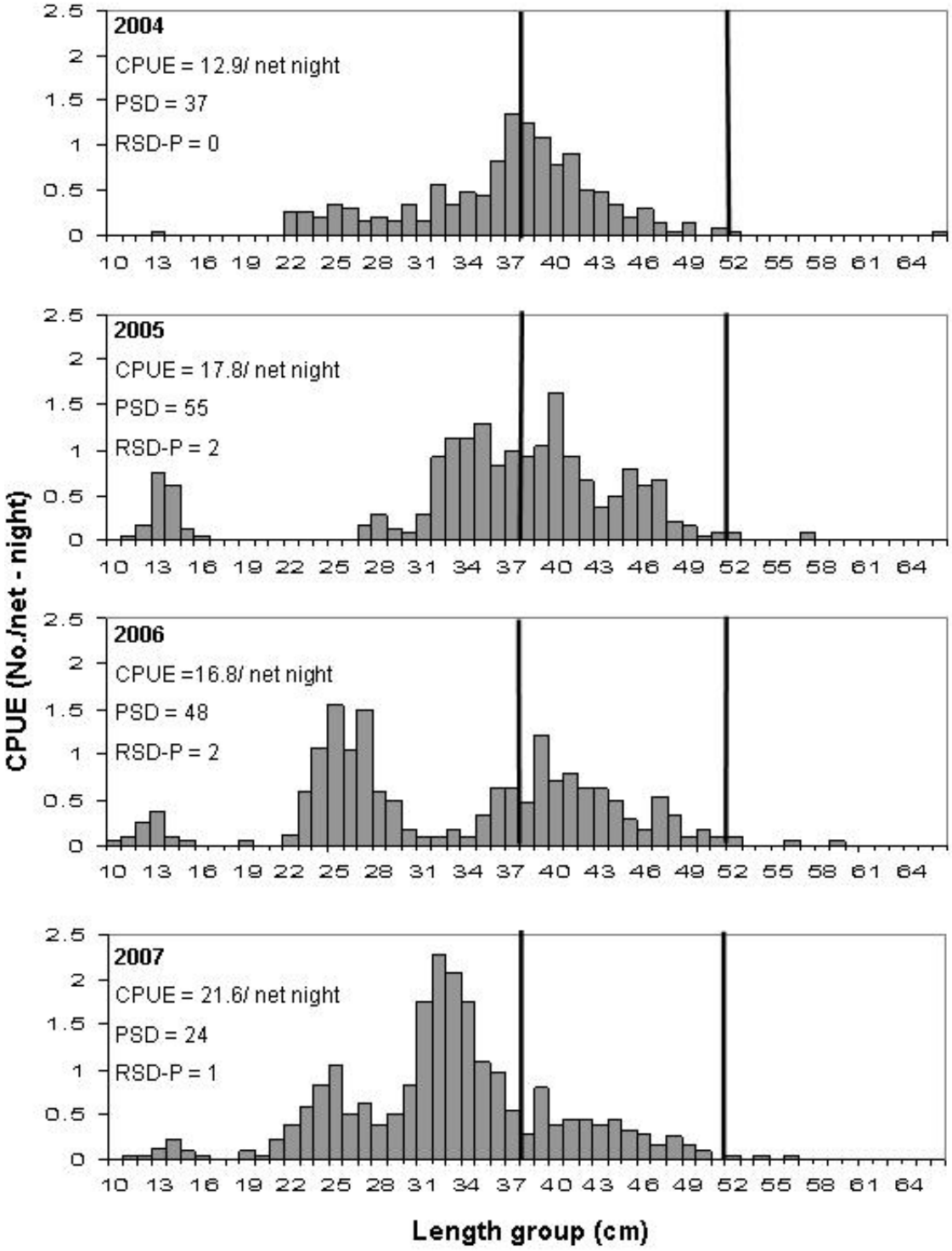

Figure 2. Length frequency, as catch per unit effort, of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, during August 2004 through 2007. Vertical lines represent the 15-inch and 20-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

Table 6. Mean walleye catch per unit effort (No./net-night) in the standard coolwater gill net survey for Lake Sharpe, South Dakota, 1997-2007.

Year	Site				
	North Shore	Joe Creek	DeGrey	Farm Island	Total
1997	31.8	19.8	11.7	20.7	21.0
1998	23.3	28.3	27.2	6.8	21.4
1999	36.7	37.2	17.8	10.0	25.4
2000	23.8	31.8	26.8	15.8	24.6
2001	23.0	55.0	14.5	20.7	28.3
2002	12.8	44.8	12.2	26.5	24.1
2003	20.2	16.2	12.7	29.0	19.5
2004	13.0	9.0	14.2	14.8	12.9
2005	19.2	31.8	3.2	17.0	17.8
2006	28.0	15.0	6.0	18.3	16.8
2007	26.3	25.0	11.2	24.0	21.6

Walleye gill net CPUE has increased since 2004 due to the presence of the 2005 and 2006 year classes in gill net catches. Mean CPUE of substock-length walleye for 2007 was the same as 2006 and was within ranges recorded between the 1999-200 period (Table 7) The abundance index (CPUE) for quality-to-preferred-length walleye was lower in 2007 than in previous years, but similar to other years within the 1997-2006 period (Table 7) Mean CPUE of preferred-length walleye is typically below 1.0 fish/net-night, indicating few fish in the population reached preferred length (Figure 7). The decrease in walleye CPUE and size structure is also evident from examination of Figure 3.

Due to the lack of larger individuals in our sample, proportional stock density for the 2007 walleye gill net sample, at 24, was just below the balanced range of 30-60 (Anderson and Weithman 1978 (Figure 8). Preferred-length fish are uncommon in gill net catches as evidenced by RSD-P values for walleye of ≤ 3 for all years in the 1997-2006 period (Table 8). Mean walleye *Wr* for the 2007 total gill net sample, at 82, was similar to other years in the 1997-2006 period, with the exception of 2003. Mean *Wr* for 2003, at 75 (Table 9), was lower than all other years in the 1997-2006 period. The lower *Wr* value for 2003 is likely due to a low abundance of age-0 gizzard shad that year (Table 9). Relative weight values of walleye in the stock-to-quality length group were similar for 2005, 2006, and 2007. Mean *Wr* values for quality-to-preferred-length fish followed the same pattern as stock-to-quality length fish and were similar during 2005-2007. Walleye in Lake Sharpe in the preferred-to-trophy length group generally have a lower *Wr* than fish in smaller length categories and this trend continued to be evident in 2007.

Table 7. Mean walleye catch per unit effort (No./net-night) in the standard gill net survey, by year and length group, for 1997-2007, for Lake Sharpe, South Dakota.

Year	Length group				
	Substock	Stock-quality	Quality-preferred	Preferred	Total
1997	1.0	14.0	5.8	0.2	21.0
1998	1.0	9.3	10.6	0.5	21.4
1999	3.5	8.6	12.3	0.9	25.4
2000	2.3	13.5	7.8	0.9	24.6
2001	2.2	16.1	9.5	0.4	28.3
2002	1.5	11.9	10.2	0.6	24.1
2003	1.8	11.6	5.9	0.2	19.5
2004	0.8	5.7	6.2	0.2	12.9
2005	1.7	7.3	8.5	0.3	17.8
2006	2.7	7.3	6.5	0.3	16.8
2007	2.7	14.3	4.5	0.1	21.6

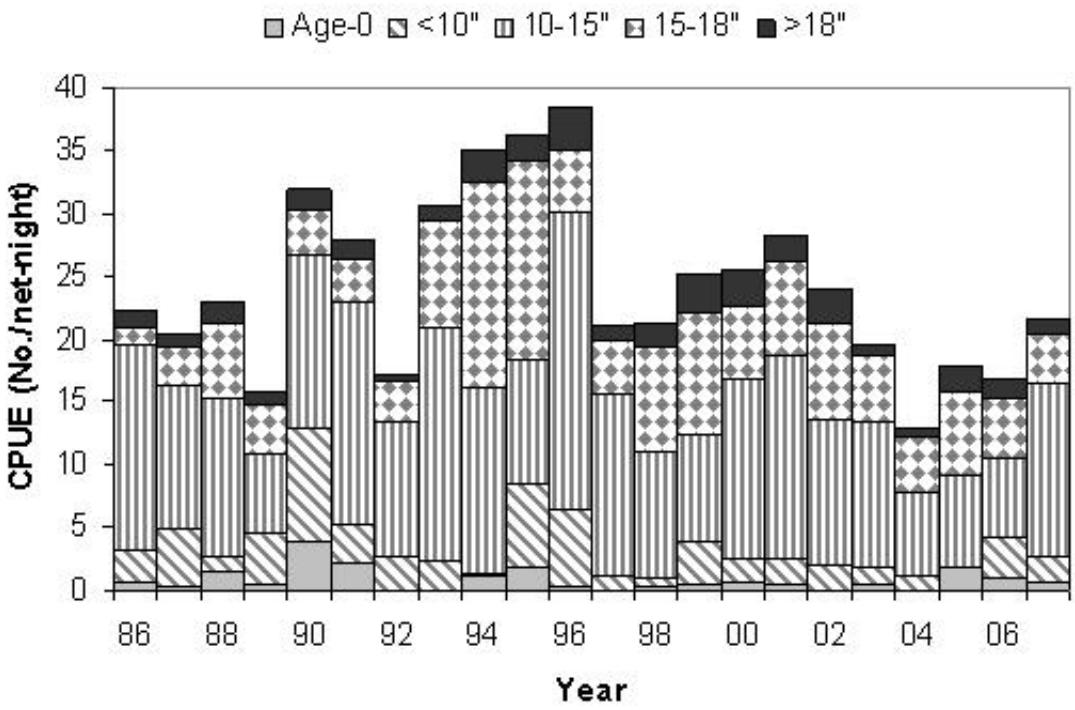

Figure 3. Size structure and abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, during August, 1986-2007.

Table 8. Walleye and sauger proportional stock density (PSD) and relative stock density of preferred- (RSD-P) and memorable-length (RSD-M) fish collected during the standard gill net survey on Lake Sharpe, South Dakota, 1997-2007.

Year	Walleye				Sauger			
	PSD	RSD-P	RSD-M	Ns	PSD	RSD-P	RSD-M	Ns
1997	30	1	0	480	100	47	1	72
1998	54	2	0	488	100	66	1	77
1999	60	3	0	519	75	61	2	101
2000	38	3	0	530	82	32	4	161
2001	38	1	0	624	78	23	2	124
2002	47	2	0	539	97	42	2	138
2003	34	1	0	426	100	33	2	57
2004	37	0	0	303	82	37	0	68
2005	55	2	0	384	100	59	0	41
2006	48	2	0	339	52	37	0	54
2007	24	1	0	455	77	18	0	61

Table 9. Mean walleye relative weight (*Wr*) values, by length group, for Lake Sharpe, South Dakota, 1997-2007. N is the number of stock-length fish in a sample.

Year	Length group							
	Stock-quality		Quality-preferred		Preferred-trophy		Total sample	
	Wr	N	*Wr*	N	*Wr*	N	*Wr*	N
1997	82	337	79	139	76	4	81	480
1998	86	224	82	254	77	10	84	488
1999	84	207	81	294	76	18	82	519
2000	82	324	78	188	71	18	80	530
2001	87	386	83	229	75	9	85	624
2002	83	284	81	243	73	13	82	539
2003	78	280	72	140	66	6	75	426
2004	87	143	84	156	76	4	85	303
2005	86	174	86	204	80	6	86	384
2006	86	174	84	156	70	7	85	337
2007	83	341	80	108	79	3	82	452

Beginning in 2002, otoliths were removed from the majority of walleye and sauger collected during the August gill net survey. Prior to otolith removal, aging was solely based on age estimates generated from scale interpretation. Mean length at time of capture for each age group of walleye is illustrated in Table 10. Examination of mean length at age at time of capture indicates Lake Sharpe walleye typically reach 378 mm at age 3 or 4, meaning that the majority of walleye in the 2005 year class will not surpass the minimum length until the 2008 or 2009 fishing seasons. Individuals in the 2006 year class should surpass the 381-mm minimum length limit in 2009 or 2010 (Table 10). The change in mean length of fish in a year class from one year to the next is considered the annual growth increment for that year class (Table 11). While not statistically tested, growth for walleye through age 6 appears to have been slower during the 2002-2003 growth periods than during any subsequent period. Low relative weight values for walleye in the 2003 gill net survey (Table 9) may be indicative of slower growth during the 2002-2003 periods.

Age-2 walleye (produced in 2005) comprised the largest percentage of the 2007 gill net sample of any age group (Table 12). The catch of 42 age-0 walleye in the 2005 gill net survey and the 175 age-1 walleye during the 2006 sample is indicative of high natural production in 2005 (Table 12). For 2007, a catch of 13 age-0 walleye indicates production occurred in 2007, but at a lower level than 2005, 2006.

Table 10. Mean length-at-age-at-capture (mm) for walleye collected in the standard August gill net survey, 2002-2007, on Lake Sharpe, South Dakota, and aged from otoliths.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2002	**Mean**	247	327	373	410	424	459	489	492	495
	N	42	91	88	80	15	2	10	14	1
	SE	2.8	2.6	2.6	3.6	6.9	31.0	12.2	11.1	NA
2003	**Mean**	224	311	362	385	410	430	426	480	469
	N	22	93	128	76	34	7	3	8	7
	SE	4.6	2.4	1.8	2.5	4.1	12.5	8.0	13.7	11.2
2004	**Mean**	252	312	370	390	401	437	441	495	506
	N	38	32	81	73	34	24	3	2	8
	SE	3.4	3.9	3.1	3.2	5.0	6.0	14.2	23.5	24.2
2005	**Mean**	282	342	379	407	427	438	465	467	476
	N	12	130	38	71	66	33	19	2	2
	SE	2.4	1.7	3.0	3.2	3.9	5.5	11.2	25.5	2.0
2006	**Mean**	263	360	392	410	442	439	456	462	422
	N	174	12	78	22	26	37	10	10	2
	SE	1.6	6.0	3.0	7.5	7.1	6.7	13.9	9.5	61.5
2007	**Mean**	251	336	392	419	425	434	451	441	468
	N	101	234	11	25	12	17	16	9	9
	SE	2.2	1.3	5.1	5.0	14.7	7.3	9.4	5.2	8.3
Mean of means		253	331	378	404	422	440	455	473	473

Table 11. Mean annual growth (length) increment estimates for walleye collected in the standard coolwater gill net survey on Lake Sharpe, South Dakota, for the 2002-2003, 2003-2004, 2004-2005, 2005-2006, and 2006-2007 periods, as determined by aging otoliths.

Year	Growth increment added during period (mm)							
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
2002-2003	64	35	12	0	2	--	--	--
2003-2004	88	59	28	16	27	15	56	26
2004-2005	90	67	37	37	37	28	26	--
2005-2006	78	50	31	35	12	18	--	--
2006-2007	73	32	27	15	8	12	17	--

Table 12. Age distribution of walleye collected from Lake Sharpe, South Dakota, with standard gill net sets as determined by aging otoliths. Year refers to walleye year class, CPUE is catch per unit effort (No./net-night), and T (trace) indicates mean CPUE values <0.05.

2002													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**	**94**	**93**	**92**	**91**	**90**
	1	57	153	140	141	29	4	19	23	1	2	5	0
CPUE	T	2.4	6.4	5.8	5.9	1.2	0.2	0.8	1.0	T	0.1	0.2	0.0

2003													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**	**94**	**93**	**92**	**91**
	11	34	110	157	88	38	8	3	8	7	2	1	2
CPUE	0.5	1.4	4.6	6.5	3.7	1.6	0.3	0.1	0.3	0.3	0.1	0.1	0.1

2004													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**04**	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**	**94**	**93**	**92**
	1	37	30	81	73	35	23	3	2	8	4	0	0
CPUE	T	1.6	1.3	3.5	3.2	1.5	1.0	0.1	0.1	0.3	0.2	0.0	0.0

2005													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**05**	**04**	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**	**94**	**93**
	42	12	131	39	72	66	33	19	2	2	1	6	0
CPUE	1.8	0.5	5.5	1.6	3.0	2.8	1.4	0.8	0.1	0.1	T	0.3	0.0

2006													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**	**94**
	21	175	12	80	23	26	37	10	10	2	1	2	3
CPUE	0.9	7.3	0.5	3.4	0.9	1.1	1.6	0.4	0.4	0.1	T	0.1	0.1

2007													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**
	13	110	289	11	25	12	17	16	9	9	2	0	4
CPUE	0.5	4.6	12.0	0.5	1.0	0.5	0.7	0.7	0.4	0.4	0.1	0.0	0.2

Walleye recruitment, as indexed by fall nighttime electrofishing CPUE of age-0 fish, was higher in 2006 and 2007 than during the 2001-2004 period (Table 13). The 2005 mean electrofishing CPUE, of 88.1 fish/hour, was among the highest during the 1995-2006 period, (Table 13), while the 2005 CPUE was similar to 1995 through 1998. Mean length of age-0 walleye in the 2006 fall electrofishing catch, at 169 mm, was within the range previously observed.

Table 13. Mean nighttime electrofishing catch per unit effort (CPUE; No./h) and total length (mm) for age-0 walleye collected during September and October 1995-2007 on Lake Sharpe, South Dakota. SE is standard error values about means and N is sample size.

	Catch per unit effort (No./h)			Mean length (mm)		
Year	**CPUE**	**N**	**SE**	**Length**	**N**	**SE**
1995*	59.6	18	11.6	175	268	1.2
1996*	22.4	18	3.4	136	101	2.9
1997*	42.7	18	9.7	142	197	1.6
1998#	42.2	22	10.4	146	236	1.2
1999+	20.1	36	2.9	130	181	1.3
2000+	75.1	36	8.6	147	522	0.7
2001+	22.9	36	4.1	164	321	1.1
2002+	12.6	36	2.6	147	113	1.6
2003^	19.7	36	5.7	166	177	0.2
2004^	4.9	36	1.4	167	44	3.2
2005^	88.1	36	12.6	171	793	4.9
2006^	45.9	36	5.0	155	372	1.0
2007^	30.3	36	4.2	169	272	1.18

* North Shore, Joe Creek and Farm Island
# North Shore, Joe Creek, Farm Island and DeGrey
+ North Shore, Joe Creek, Farm Island, DeGrey, LaFramboise Bay and Stilling Basin
^ North Shore, Joe Creek, Farm Island, Fort George, LaFramboise Bay and Stilling Basin

Mean CPUE of age-1 walleye in the August gill net survey has traditionally been used as an index of walleye recruitment in Missouri River reservoirs. Potential early indicators of walleye year class strength were compared to mean age-1 gill net CPUE to determine which indicators or surveys were the best early indicators of walleye recruitment. Potential indicators of walleye recruitment and values for the 1994-2007 period are listed in Table 14. Summer age-0 seining CPUE for the 1994-2006 period, was not significantly correlated with CPUE of age-1 walleye in the standard gill net survey the following year (P=0.09, r=0.47, $d.f.$=12). However, age-0 walleye gill net and fall nighttime electrofishing CPUE were significantly positively correlated with walleye age-1 gill net CPUE the following year (P=0.001, r=0.87, $d.f.$ =12 and P=0.002, r=0.79, $d.f.$=11, respectively). Therefore, both age-0 gill net and age-0 electrofishing CPUE may be reliable indicators of walleye recruitment in Lake Sharpe.

Table 14. Mean age-0 walleye seine haul catch-per-unit-effort (CPUE; No./haul), mean standard gillnet age-0 walleye CPUE (No./net night), mean age-0 walleye nighttime electrofishing CPUE (No./ h), and mean standard gillnet age-1 walleye CPUE (No./net night) is the following year recruitment for the 1994-2007 period on Lake Sharpe, South Dakota.

Year Class	Seine Age-0 CPUE	Gillnet Age-0 CPUE	Electrofishing Age-0 CPUE	Gillnet Age-1 CPUE
1994	5.9	1.50	----	12.96
1995	2.5	1.63	59.6	7.89
1996	2.2	0.11	22.4	1.00
1997	1.1	0.08	42.7	0.92
1998	6.9	0.13	42.2	5.63
1999	0.8	0.38	20.1	2.65
2000	11.8	0.52	75.1	4.71
2001	3.6	0.46	22.9	2.42
2002	1.6	0.04	12.6	1.46
2003	0.3	0.46	19.7	1.60
2004	0.0	0.04	4.9	0.50
2005	3.9	1.75	88.1	7.29
2006	0.7	0.88	45.9	4.60
2007	1.3	0.54	30.3	---

Population Parameters for Sauger

Sauger and walleye are managed with the same set of regulations because they are hard for anglers to differentiate and sauger are a very important part of the fishery in Lake Sharpe. Sixty two sauger were collected during the gill net survey in August 2007, for a mean CPUE of 2.6 fish/net night (Table 4). Sauger CPUE in 2007 was similar to 2003, 2004 and 2005, at approximately two sauger per net-night. No age-0 sauger were collected while shoreline seining in 2007. No age-0 sauger were collected during fall electrofishing in the 2007 survey. Overall condition (mean *Wr*) for sauger greater than stock length in the 2007 gill net survey was 74 and mean length-at-age-at-time-of-capture values for fish in the 2007 sample are presented in table 15. Sauger up to age 7 were collected in the 2007 gill net survey, with the mean age of sauger captured being 2.2 years and the largest portion of the population coming from the 2005 year class (age-2 fish, Table 16). Sauger collected during the gillnet survey ranged from 150 to 430 mm (Figure 4) and no sub-stock fish were captured.

Table 15. Mean length-at-age-at-capture (mm) values for sauger collected in the standard August coolwater gill net survey, 2002-2007, on Lake Sharpe, South Dakota, as determined by aging otoliths.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2002	**Mean**	265	329	364	393	404	407	--	448	445
	N	1	41	17	26	6	1	--	7	5
	SE	--	4.2	7.9	15.6	8.5	--	--	24.5	17.9
2003	**Length**	--	315	356	374	391	--	--	--	458
	N	--	2	21	16	8	--	--	--	2
	SE	--	2.5	24.9	5.7	8.6	--	--	--	56.5
2004	**Length**	260	315	353	379	410	414	--	--	--
	N	9	6	8	31	5	8	--	--	--
	SE	3.1	11.7	17.7	4.2	10.5	15.8	--	--	--
2005	**Length**	--	343	396	415	398	411	395	--	--
	N	--	16	6	1	9	3	6	--	--
	SE	--	4.0	12.4	--	4.9	12.0	7.5	--	--
2006	**Length**	254	359	391	375	--	408	--	480	--
	N	25	1	15	1	--	10	--	1	--
	SE	4.7	--	5.3	--	--	10.8	--	--	--
2007	**Length**	249	328	395	412	423	420	--	--	--
	N	11	38	4	5	2	1	--	--	--
	SE	6.0	3.8	14.0	19.9	17.7	0.0			
Mean of means		257	332	384	391	410	413	395	464	452

Table 16. Age distributions of sauger collected from Lake Sharpe, South Dakota, with gill nets during standard surveys conducted from 2002 through 2007.

Year	Age										
	0	1	2	3	4	5	6	7	8	9	10
2002	0	1	41	17	25	6	1	0	7	5	0
2003	0	0	2	21	16	8	0	0	0	2	0
2004	0	8	4	8	28	5	8	0	0	0	1
2005	0	0	16	6	1	9	3	6	0	0	0
2006	0	26	1	15	1	0	10	0	1	0	0
2007	1	11	38	4	5	2	0	1	0	0	0

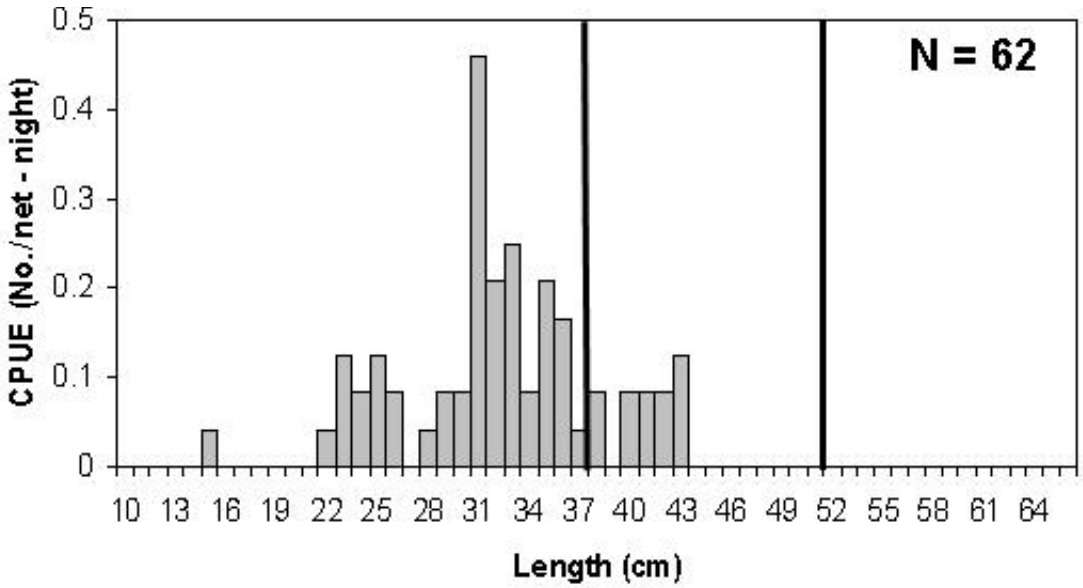

Figure 4. Length frequency, by catch per unit effort, of sauger collected during the standard gill net survey during August 2007, on Lake Sharpe, South Dakota. Vertical lines represent the 15-inch and 20-inch classifications.

Population Parameters for Smallmouth Bass

Beginning in 2002, one rip-rap area (Big Bend Dam) and one natural habitat area (Joe Creek) have been sampled every week to 10 days during late-May and early-June, (three dates, six 15 minute runs per site) by nighttime electrofishing. Data collected during 1993, 1994, and 2001-2005 is included for comparison with 2006 data (Table 17). Prior to 2002, sampling locations were sampled once each year and six, 15-minute runs were conducted. Mean CPUE has always been higher at Big Bend Dam than at Joe Creek. However, PSD, RSD-P, and RSD-M values are higher at Joe Creek. For example, PSD at Big Bend Dam in 2006 was 22, while at Joe Creek it was 68. This pattern of higher catch rates and lower stock density indices values and size structure for rip-rap areas was also documented for Lake Oahe (Lott 1996, Lott 2000).

Figure 5 illustrates CPUE and size structure of smallmouth bass collected at Big Bend Dam and Joe Creek. Smallmouth bass CPUE has varied among years sampled. Comparing mean CPUE for 2006 and 2007 at Joe Creek decreased from 30.4 to 21.1 fish/hr, while CPUE at Big Bend Dam decreased from 105.1 to 57.3.

Mean back-calculated length at age 4 (2003 year class) in 2007 was 318 mm. Mean back-calculated length at age-4 for the statewide mean and Missouri River reservoirs are 300 and 310 mm, respectively, according to Willis et al (2001). For 2007, length at age 4 for Lake Sharpe smallmouth bass was similar to the statewide and Missouri River reservoir averages. Growth for smallmouth bass in Lake Sharpe, when comparing to statewide or Missouri River reservoirs means, are generally slower for age-1 and age-2 fish, but faster for older fish in the population.

Beginning in 2004, a sample of approximately 100 smallmouth bass were collected, and aged by otoliths, each year. This sample was collected by angling during the June/July period in 2004 and with the use of short term monofilament gill net sets at West Bend during July in 2005-2007. Mean length at capture determined from aging otoliths and scales were similar. For example, mean length at age 3, as determined from aging scales, was 250 mm, compared to 259 mm

when otoliths were aged (Table 19). This slight increase in length for otoliths may be due to growth of fish from late May and early June to July. Mean lengths at capture for age-4,-5, and-6 were also similar for the two aging structures. For smallmouth bass up to age 6, scales are a viable aging structure and allow age determination without sacrificing fish.

Table 17. Mean smallmouth bass electrofishing catch-per-unit effort (CPUE; No./h), proportional stock density (PSD), relative stock density of preferred-length (RSD-P) and memorable-length (RSD-M) fish values, for spring, nighttime electrofishing samples at Joe Creek and Big Bend Dam. N is number of electrofishing runs, SE is standard error and Ns is number of stock length fish.

Location	Year	CPUE	N	SE	Ns	PSD	RSD-P	RSD-M
Joe Creek	2001	16.7	6	6.9	56	91	54	7
	2002	12.4	18	2.1	24	88	25	4
	2003	16.2	18	3.7	68	50	21	1
	2004	18.4	18	4.9	81	60	14	0
	2005	11.7	12	3.8	33	67	12	0
	2006	30.4	18	6.9	114	68	25	1
	2007	21.1	18	4.7	88	33	11	0
Big Bend Dam	1993	52.0	12	14.3	75	21	1	0
	1994	47.0	12	17.3	64	38	11	3
	2001	42.2	9	17.2	75	39	8	0
	2002	51.1	18	16.3	208	46	11	0
	2003	65.8	18	24.1	211	31	1	0
	2004	65.6	18	16.4	220	25	3	0
	2005	61.1	18	15.4	165	40	10	1
	2006	105.1	18	28.0	212	22	6	0
	2007	57.3	18	15.2	205	25	10	0

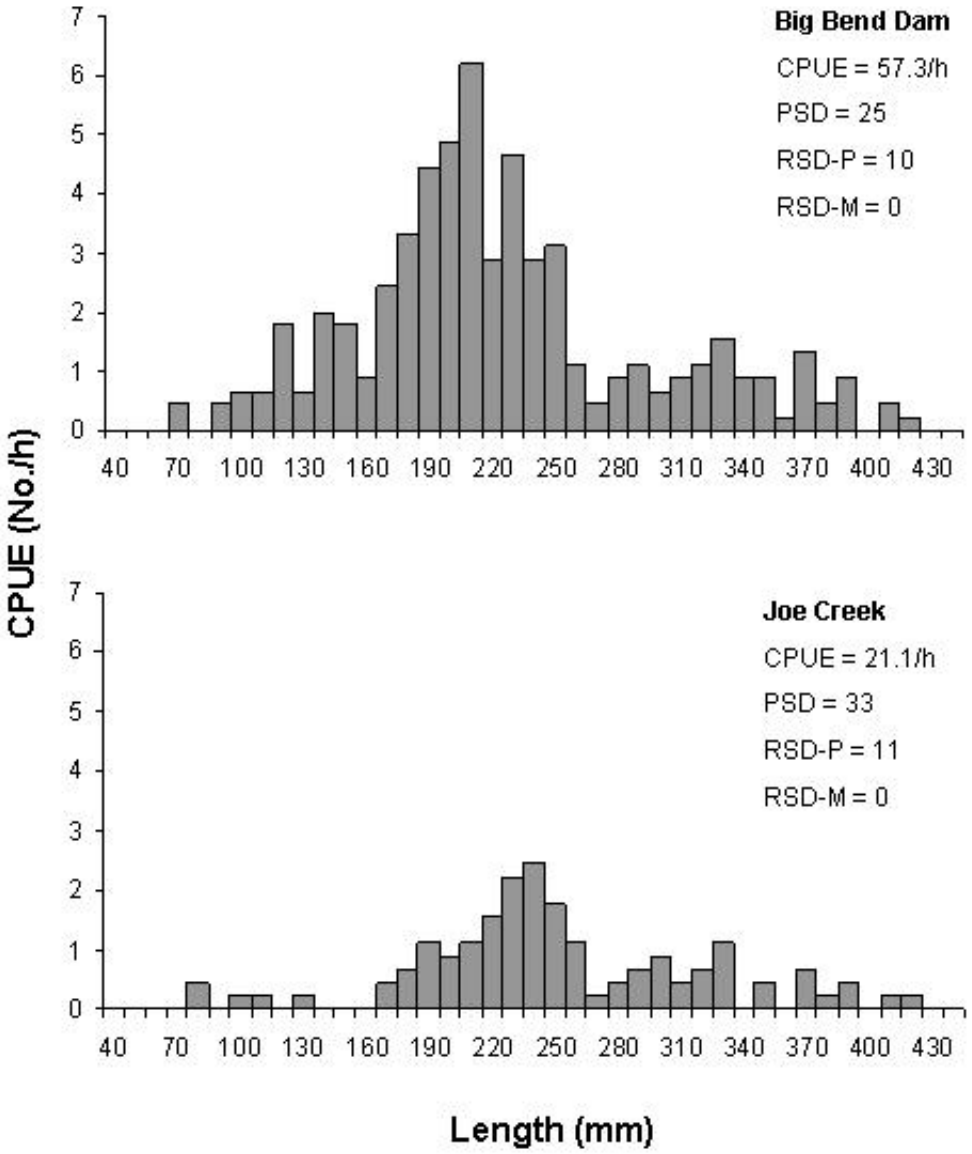

Figure 5. Length frequency of smallmouth bass collected with nighttime shoreline electrofishing, by site, during May and June 2007 on Lake Sharpe, South Dakota. Catch per unit effort (CPUE), PSD, RSD-P, RSD-M are presented for each site.

Table 18. Mean back-calculated total lengths (mm) at annulus and length increments for each year class of smallmouth bass collected from Lake Sharpe, South Dakota, by nighttime electrofishing during May and June 2007, as determined from scales. N is the number of fish of each age in the sample.

Year class	Age	N	Annulus						
			1	2	3	4	5	6	7
2006	1	36	124						
2005	2	208	102	216					
2004	3	51	78	172	263				
2003	4	32	88	159	269	337			
2002	5	15	83	186	259	333	374		
2001	6	5	91	181	262	309	370	403	
2000	7	3	93	182	263	319	361	395	414
Sample mean		351	92	176	254	318	360	386	405
Standard error		5	9	9	8	9	14	9	
Length increment			84	78	64	42	25	19	6
Statewide mean			91	171	242	300	333		
Missouri reservoir mean			88	171	246	299	337		

Table 19. Mean length-at-age-at-capture (mm) for smallmouth bass collected during July at West Bend, 2004-2007, on Lake Sharpe, South Dakota, and aged from otoliths. Sample for 2004 is from June at West Bend and Big Bend Dam areas, combined, on Lake Sharpe.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2004	**Mean**	--	212	292	347	368	410	414	--	--
	N	--	5	57	24	12	2	1	--	--
	SE	--	15.1	3.5	4.9	4.5	10	--	--	--
2005	**Mean**	183	226	257	332	354	374	389	--	--
	N	1	15	43	31	26	6	6	--	--
	SE	--	4.7	5.1	2.9	15.7	5.2	7.2	--	--
2006	**Mean**	--	--	227	293	357	387	404	422	419
	N	--	--	20	29	11	12	11	3	2
	SE	--	--	8.2	7.8	8.9	4.2	4.9	15.3	6.5
2007	**Mean**	--	275	315	358	383	402	414	432	433
	N		47	9	11	14	13	7	2	3
	SE		3.8	7.8	3.8	5.2	4.2	5.0	10.5	6.7
Mean of means		183	237	272	332	365	393	405	427	426

Mean smallmouth bass *Wr* values in the spring electrofishing survey for Lake Sharpe in 2007 ranged from 100-93 for fish in the sub-stock through quality-to-preferred length groups (Table 20). As the size of bass increases, condition generally decreases in Lake Sharpe and 2007 was no exception. Preferred-to-memorable-length fish had a mean *Wr* of 90 in 2006, compared to mean

Wr values of 96 and 93 for stock-to-quality- and quality-to-preferred-length fish, respectively. There were no fish collected in the memorable-trophy length group in 2007.

Table 20. Mean relative weight (Wr), by length class, for Lake Sharpe smallmouth bass collected by electrofishing during May and June, 2001-2007. N is the number of fish used in calculations.

Year	Sub-stock		Stock-to-Quality		Quality-to Preferred		Preferred- to Memorable		Memorable-to Trophy	
	Wr	**N**	***Wr***	**N**	***Wr***	**N**	***Wr***	**N**	***Wr***	**N**
2001	98	11	96	31	93	61	87	110	78	24
2002	111	2	102	26	98	70	96	68	86	7
2003	93	40	90	150	91	45	80	17	63	1
2004	93	35	94	149	91	72	81	15	---	0
2005	97	79	89	110	90	68	83	18	83	2
2006	96	54	97	162	93	83	89	40	94	1
2007	100	25	96	212	93	51	90	30	---	0

The current smallmouth bass regulation package on Lake Sharpe restricts anglers from harvesting bass between 356 and 457 mm. Electrofishing has been documented to under-represent population size structure for smallmouth bass (Green et al. 1986; Beamesderfer and Riemer 1988), meaning standard sampling techniques may not adequately sample the larger fish in a population. Therefore, Game, Fish, and Parks worked with the South Dakota Bass Anglers Sportsmen Society (BASS) Federation to collect lengths and weights from fish caught during the BASS Championship tournament conducted on September 9, 2007. During the tournament, a total of 458 bass were brought into the weigh-in site, of those, 452 lengths were measured (TL, mm) and 238 were also weighed (g) by GFP staff. Of the smallmouth bass with weights taken, 80 fish were within the memorable-trophy length group with a mean *Wr* of 89. Figure 6 illustrates the sizes of smallmouth bass collected and measured after the tournament.

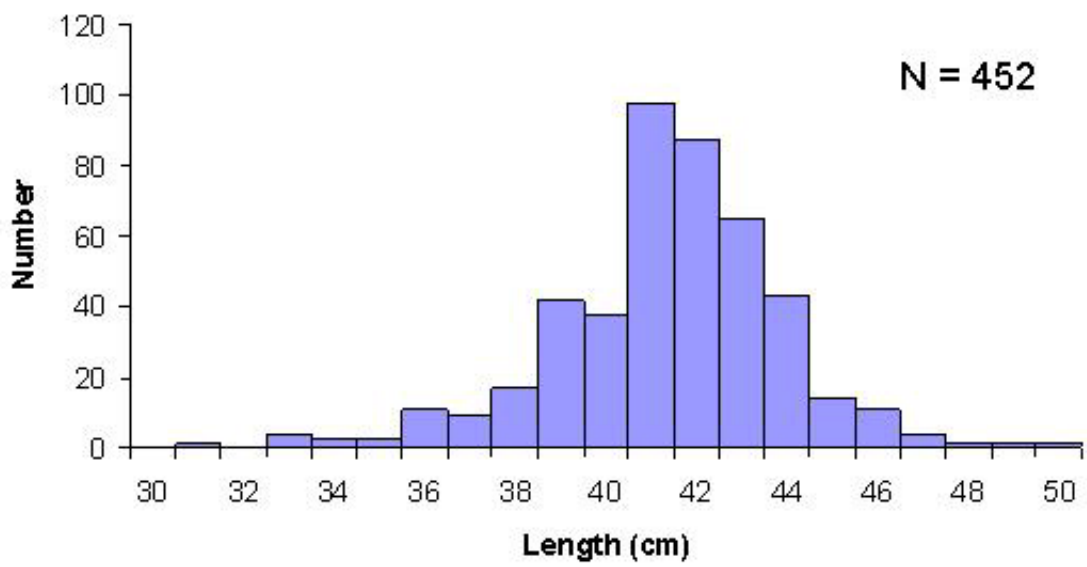

Figure 6. Lengths of smallmouth bass caught during the SD BASS Championship tournament during September 9, 2007.

Population Parameters for Channel Catfish

Channel catfish population indices PSD, RSD-P, RSD-M, and *Wr* exhibited little change during the 1997- 2007 period (Table 21). Channel catfish CPUE (no./net-night) decreased from 6.5 in 2006 to 5.5 in 2007 (Table 4). Prior to 2007, channel catfish mean CPUE has ranged from a high of 20.1 for 2002 to a low of 5.0 for 1998, thus CPUE for 2007 is still within the range previously observed. Heavy vegetation in the gear at our standard sites may have been a factor that influenced low catch rates in 2007. Figure 7 illustrates CPUE by length for the 2004 through 2007 period for channel catfish gill net samples. Growth and age structure data from the 2003 survey illustrates channel catfish are long lived but grow slowly in Lake Sharpe (Lott et al 2004) which may explain the limited changes in population indices over time. Growth rates have slowed since the closure of Big Bend Dam in 1963. Elrod (1974) documented a gradual reduction in growth rates during the first eight years following impoundment of the reservoir. Due to slow growth, age structures (pectoral spines) will be collected every five years on Lake Sharpe and 2008 will be the next year of collection.

Table 21. Channel catfish proportional stock density (PSD), relative stock density of preferred and memorable-length (RSD-P and RSD-M) fish, and relative weight (*Wr*) for 1997-2007, from Lake Sharpe, South Dakota. Mean *Wr* values for 2002–2007 are for stock-length fish only.

Year	PSD	RSD-P	RSD-M	*Wr*	N
1997	35	3	0	85	108
1998	37	6	0	83	108
1999	41	4	0	83	139
2000	34	5	0	82	148
2001	27	2	0	82	135
2002	30	1	0	80	171
2003	27	3	0	79	193
2004	25	0	0	85	259
2005	39	1	0	86	146
2006	52	1	0	81	157
2007	64	2	0	81	116

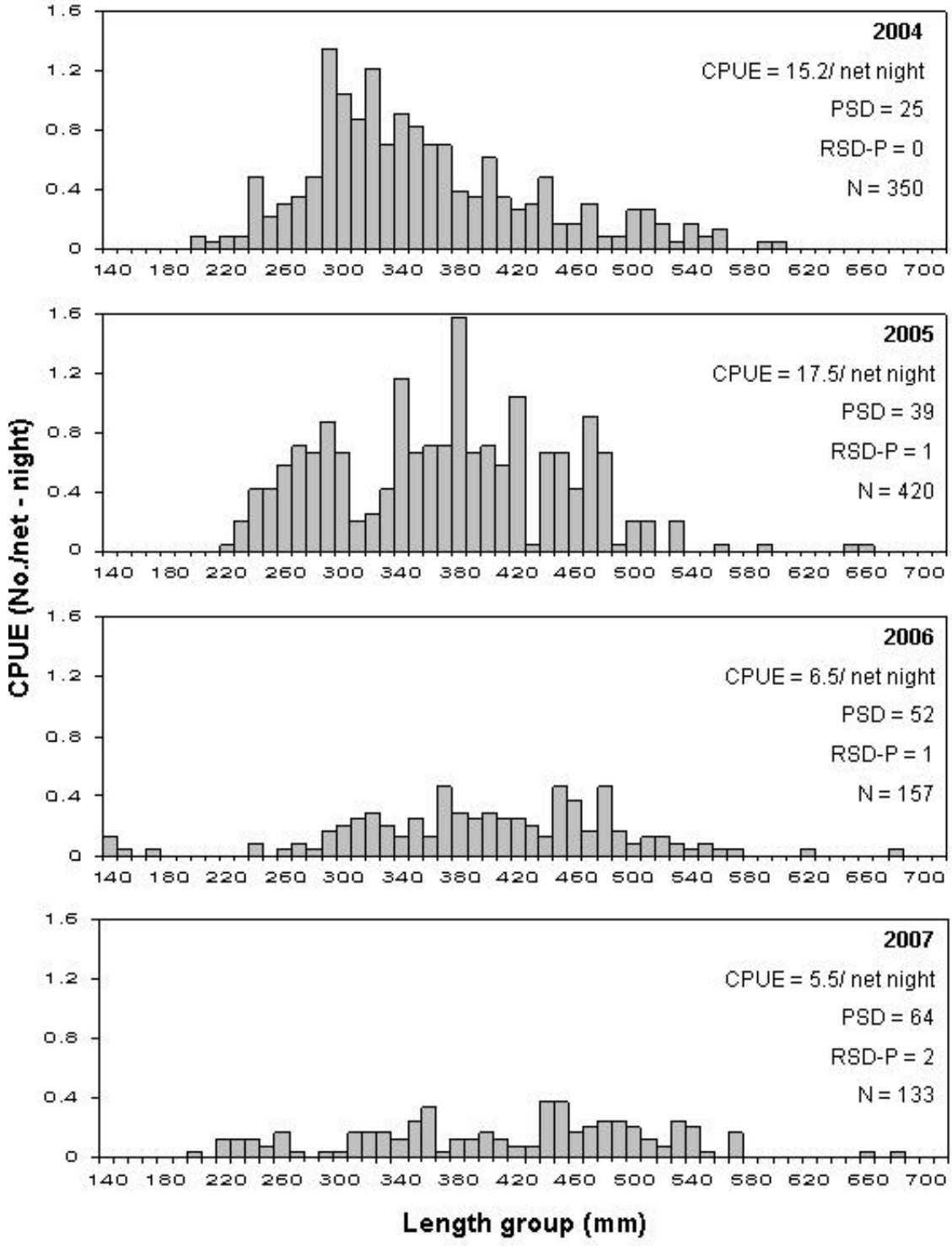

Figure 7. Length frequency, by catch per unit effort, of channel catfish collected during the standard, coolwater gill net survey during August 2004 through 2007, on Lake Sharpe, South Dakota. Catch per unit effort (CPUE), PSD, RSD-P, and sample size (N) are presented for each year.

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Angler Use

A total of 1,295 angling parties were interviewed during the April-September 2007 daylight angler use and harvest survey. Estimated fishing pressure for the April-September 2007 daylight period, at 335,017 angler-h, was similar to the 2006 estimate of 342,974 angler-h and greater than estimates for 2004 and 2005 (Table 22). Estimated angler days spent on Lake Sharpe during the 2007 survey period was 90,410 days, a value below the reservoir-wide objective of 100,000 angler days (SDGFP 1994).

Table 22. Angler use and harvest estimates for surveys conducted on Lake Sharpe, South Dakota. All surveys were conducted during the April-September daylight period, except where noted.

Year	Fishing pressure (h)	Angler trips	Estimated fish harvest	Estimated walleye harvest	Reference
1973-1974*	208,800	46,400	76,813	62,479	Schmidt (1975)
1984	241,986	52,605	87,020	64,784	Riis (1986)
1985	274,376	62,358	123,942	66,584	Riis (1986)
1991	303,381	70,554	143,307	93,027	Fielder et al. (1992)
1992	402,543	100,636	219,152	157,220	Stone et al. (1994)
1993	291,970	60,827	102,833	83,133	Stone et al. (1994)
1994	347,125	91,752	152,981	130,009	Riis & Johnson (1995)
1995	356,391	122,893	166,949	140,943	Riis et al. (1996)
1996	477,220	101,536	170,568	142,506	Riis et al. (1997)
1997	442,827	100,097	191,079	159,274	Johnson et al. (1998)
1998	502,631	111,696	252,496	207,144	Johnson and Lott (1999)
1999	386,315	84,784	186,720	155,724	Johnson and Lott (2000)
2000	325,532	71,893	144,730	104,076	Johnson and Lott (2001)
2001	300,078	77,141	126,382	95,044	Johnson et al. (2002)
2002	385,357	89,827	210,781	144,065	Lott et al. (2003)
2003	397,220	99,627	157,150	111,938	Lott et al. (2004)
2004	309,663	84,377	124,267	62,585	Lott et al. (2006b)
2005	271,331	75,161	133,569	57,866	Lott et al.(2007)
2006	342,974	99,702	158,402	115,300	Potter and Lott (2007)
2007	335,017	90,410	146,236	112,623	This study

* June 1973 through May 1974

Fishing pressure in upper Lake Sharpe in 2007 was estimated at 117,411 angler-h with May being the month of highest angling pressure (Table 23). The upper end of Lake Sharpe in 2007 had similar angling hours each month throughout the survey. The middle zone of Lake Sharpe contains the lowest amount of fishing pressure with the month of June being the highest at 4,768 angler-h. Angling pressure for the middle zone was the lowest in 2007 since the bus route creel design was put into place in 2003 (Table 24). Estimated fishing pressure by reservoir zones on Lake Sharpe is often highest in lower Lake Sharpe (Table 24; Johnson and Lott 2001; Johnson et al. 2002; Lott et al. 2003). Estimated fishing pressure for the lower zone in 2007 was 198,422 angler-h or 59 percent of the overall Lake Sharpe fishing pressure (Table 22). Estimated fishing pressure for lower Lake Sharpe in 2007 was higher than the 2004 to 2006 period. Fishing pressure on Lake Sharpe peaked during May in 2004 and 2005 and during June in 2006 and 2007, with an estimated 96,791 angler-h in 2007 (Table 23). Peak fishing pressure for Lake Sharpe typically occurs in May or June (Johnson and Lott 2001; Lott et al. 2003, 2006, 2007).

Table 23. Estimated fishing pressure (angler hours), by month and zone, with 80% confidence intervals (CI), for the April-September 2007 daylight period on Lake Sharpe, South Dakota.

Zone	Month						
	April	May	June	July	August	Sept.	Total
Lower	9,093	46,774	72,948	40,964	17,624	11,018	198,422
80% CI	7,406	10,747	43,542	16,844	3,470	3,275	48,711
Middle	2,677	4,252	4,768	2,081	1,246	4,160	19,184
80% CI	1,059	1,227	1,468	946	564	1,940	3,124
Upper	20,091	28,450	19,076	18,945	16,221	14,629	117,411
80% CI	7,816	8,634	7,765	4,441	2,653	7,173	16,557
Total	31,861	79,476	96,791	61,990	35,091	29,807	335,017
80% CI	10,819	13,840	44,253	17,445	4,404	8,120	51,543

Estimated boat angler hours for 2007 increased from the past four years to 293,190 angler-h. Shore angler hours ranged from 41,827 in 2007 to 57,966 in 2004 (Table 25). Estimated hours of fishing pressure per hectare during 2007 was 13.6, which is within the range of previous years. Since 2003, a bus route design has been used to capture angling pressure data, and appears to do a better job of capturing shore angler use than the traditional survey method, which used aerial counts to generate pressure estimates (Schmidt 1975).

Table 24. Estimated fishing pressure, expressed as angler-hours (h) and hour per hectare (h/ha), by reservoir zone, for standard creel surveys conducted during the April-September daylight period, on Lake Sharpe, South Dakota, from 1994 through 2007.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	h	h/ha	h	h/ha	h	h/ha
1994	171,126	9.3	68,180	16.1	107,820	117.4	347,125	14.7
1995	205,453	11.2	17,526	4.1	133,412	145.3	356,391	15.1
1996	226,054	12.3	34,292	8.1	216,874	236.2	477,220	20.2
1997	213,913	11.6	30,616	7.2	198,298	216.0	442,827	18.7
1998	255,865	13.9	47,887	11.3	198,879	216.6	502,631	21.3
1999	216,972	11.8	38,410	9.1	130,933	142.6	386,315	16.3
2000	187,469	10.2	51,778	12.2	86,285	94.0	325,532	13.8
2001	179,082	9.8	49,885	11.8	71,111	77.4	300,078	12.7
2002	180,568	9.8	91,401	21.6	113,388	123.5	385,357	16.3
2003	211,403	11.5	36,021	8.5	149,796	163.1	397,220	16.8
2004	124,860	6.8	34,773	8.2	150,030	163.4	309,663	13.1
2005	102,978	5.6	20,174	4.7	148,179	161.4	271,331	11.5
2006	143,410	7.8	30,064	7.1	169,500	184.6	342,974	14.5
2007	198,422	10.7	19,184	4.5	117,411	127.9	335,017	13.6

Table 25. 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 April-September daylight survey period, on Lake Sharpe, South Dakota, from 2004 through 2007.

Type of fishing	Year			
	2004	2005	2006	2007
Boat (h)	252,698	228,420	287,893	293,190
80% CI	21,519	29,535	35,044	50,757
H/ha	10.6	9.7	12.2	12.4
Shore (h)	57,966	42,911	55,082	41,827
80% CI	7,410	5,972	6,577	7,430
H/ha	2.4	1.8	2.3	1.8
Combined (h)	309,663	271,331	342,974	335,017
80% CI	22,396	29,828	36,063	51,543
h/ha	13.1	11.5	14.5	13.6

Catch, Harvest and Release Estimates

An estimated 146,236 fish were harvested from Lake Sharpe during the April-September daylight period (Table 26). Estimated harvest of walleye during the 2007 survey period was 112,623 fish, above the Lake Sharpe strategic plan objective of 100,000 fish. Channel catfish, white bass, sauger, smallmouth bass, and rainbow trout followed walleye, in terms of estimated harvest in 2007. During years of low walleye harvest, harvest usually peaks in July and August, when the 381-mm minimum length limit is not in effect. In years when the walleye harvest objective of 100,000 fish is met, harvest usually is highest during May and June. Estimated walleye harvest peaked during May in 2007 with 40 percent of the harvest occurring during that time period. White bass harvest was highest in May, while rainbow trout harvest only occurred in April, and channel catfish harvest was highest in June (Table 26).

Table 26. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the April-September 2007 daylight period on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	12,677	45,490	21,065	19,977	9,834	3,580	112,623
80% CI	2,228	17,837	11,931	7,778	2,731	1,455	23,142
Sauger	1,097	1,863	342	91	66	184	3,643
80% CI	763	1,243	249	102	51	136	1,490
Channel Catfish	352	747	1,704	1,001	645	464	4,912
80% CI	189	314	716	513	382	366	1,091
White Bass	1,834	3,973	2,113	1,167	2,505	1,459	13,051
80% CI	623	579	1,391	842	1,913	477	2,693
Smallmouth bass	0	2,403	3,819	760	382	201	7,565
80% CI	0	854	2,687	584	347	125	2,903
Rainbow trout	423	0	0	0	0	0	423
80% CI	410	--	--	--	--	--	410
Yellow perch	0	40	267	1,235	28	16	1,585
80% CI	--	48	287	786	21	20	839
Other*	436	752	148	110	396	590	2,434
Total	16,819	55,268	29,458	24,341	13,856	6,494	146,236
80% CI	4,053	18,912	15,934	8,488	3,536	2,026	26,770

*Other includes black crappie, common carp, freshwater drum, goldeye, largemouth bass, northern pike, white crappie, and white sucker.

An estimated 518,644 fish were caught and released during the April-September 2007 daytime period on Lake Sharpe (Table 27). Estimated number of walleye released peaked during May and June when the 381-mm minimum length limit was in effect (Table 27) and fishing pressure was the highest of the April-September period (Table 23).

Table 27. Estimated number of fish released, by species and month, for the April-September 2007 daylight period, on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	7,588	51,751	108,222	37,516	14,377	16,763	236,216
Sauger	1,762	3,437	628	104	139	279	6,350
Channel Catfish	302	871	2,661	3,281	3,891	1,041	12,048
White Bass	1,884	6,766	4,718	7,432	5,311	1,981	28,091
Smallmouth bass	8,558	59,336	75,486	19,986	17,896	22,036	203,298
Rainbow trout	308	0	0	0	0	0	308
Yellow perch	0	499	1,203	1,207	3,599	2,005	8,513
Other*	1,211	4,857	3,295	1,553	2,590	10,314	23,820
Total	21,613	127,517	196,213	71,079	47,803	54,419	518,644

*Other includes bigmouth buffalo, black crappie, bluegill, burbot, common carp, freshwater drum, gizzard shad, goldeye, green sunfish, largemouth bass, northern pike, orangespotted sunfish, river carpsucker, rock bass, shorthead redhorse, shovelnose sturgeon, white crappie, and white sucker.

Examination of Table 26, Table 27 and Figure 8 provide a complete picture of catch and harvest of sport fish species for the April-September 2007 survey period. Walleye were the most abundant species in the angler catch during 2007, with an estimated catch of 348,839 fish. Walleye were followed by smallmouth bass, white bass, channel catfish, and sauger, in decreasing order of estimated catch (Figure 8). Approximately 32% of walleye caught during 2007 were harvested, while percentages of fish harvested for smallmouth bass, white bass, channel catfish, and sauger were 3%, 32%, 29%, and 36%, respectively. The high percentage of smallmouth bass released was due, in part, to the 306-457-mm protected slot length limit that was implemented in 2003.

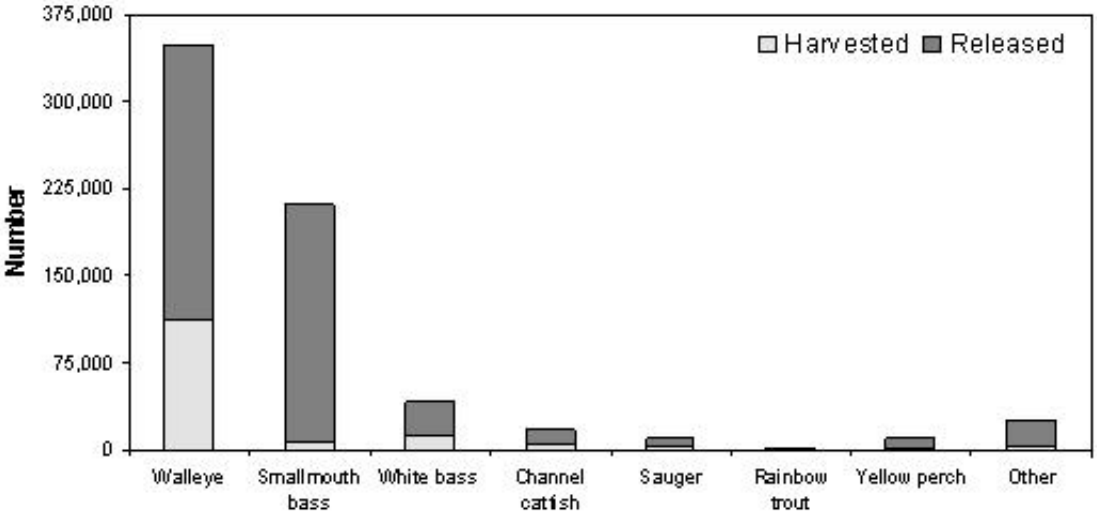

Figure 8. Estimated number of fish harvested, and released, for selected species, for the April-September 2007 daylight period, on Lake Sharpe, South Dakota. Other includes bigmouth buffalo, black crappie, bluegill, burbot, common carp, freshwater drum, gizzard shad, goldeye, green sunfish, largemouth bass, northern pike, orangespotted sunfish, river carpsucker, rock bass, shorthead redhorse, shovelnose sturgeon, white crappie, and white sucker.

Estimated walleye harvest during the 2007 April-September standard survey period was highest in lower Lake Sharpe at 87,603 fish (78 percent of total harvest) with an estimated 23,264 walleye (21 percent of total harvest) harvested in upper Lake Sharpe (Table 28). Sauger, rainbow trout, and white bass harvest were the highest in the upper zone while smallmouth bass harvest was highest in the lower zone, of Lake Sharpe, with 89% of the estimated smallmouth bass harvest for the total reservoir coming from the lower zone in 2007.

Table 28. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the April-September 2007 daylight period, on Lake Sharpe, South Dakota.

Species	Zone			
	Upper	Middle	Lower	Total
Walleye	23,264	1,756	87,603	112,623
80% CI	5,463	405	22,484	23,142
Sauger	3,010	73	560	3,643
80% CI	1,462	51	282	1,490
Channel Catfish	1,865	1,184	1,863	4,912
80% CI	688	348	771	1,091
White Bass	7,229	2,889	2,933	13,051
80% CI	2,143	816	1,413	2,693
Smallmouth bass	481	0	6,724	7,565
80% CI	604	0	2,839	2,903
Rainbow trout	423	0	0	423
80% CI	410	--	--	410
Yellow perch	40	23	1,522	1,585
80% CI	48	28	837	839
Total	37,887	6,733	101,616	146,236
80% CI	7,536	1,435	25,647	26,770

Estimated numbers of walleye caught, harvested, and released during the standard April-September daylight survey period increased in 2007 from the 2004 to 2006 period, which were the lowest years for these parameters during the 1994-2007 period (Table 29). More walleye were estimated to have been harvested in 2006 and 2007 than were caught in 2005. The percentage of walleye caught that were harvested increased from 21% in 2003 and 37% in 2004 to 57% and 56% for 2005 and 2006, respectively, and dropped back to 32% in 2007. The year classes that contributed most to the 2007 harvest were from 2000, 2001, and 2003. The higher number of walleye caught in 2007 was due to strong year classes produced in 2005 and 2006 that did not surpass the 381-mm in length, thus the low percent harvested (Table 29).

Table 29. Estimated number of walleye caught, harvested, and released during the April-September daylight period for Lake Sharpe, South Dakota 1994 through 2007.

Year	Caught	Harvested	Released	Percent Harvested
1994	248,777	130,009	118,718	52
1995	237,615	140,943	96,656	59
1996	499,686	142,506	357,180	29
1997	365,493	159,274	206,219	44
1998	468,578	207,144	261,434	44
1999	348,087	155,724	192,363	45
2000	339,022	104,076	234,946	31
2001	347,135	95,044	252,091	27
2002	379,952	144,064	235,887	38
2003	542,965	111,937	433,786	21
2004	167,353	62,585	104,767	37
2005	101,053	57,866	43,187	57
2006	206,681	115,300	91,381	56
2007	348,839	112,623	236,216	32

Length frequency distributions of walleyes harvested each month during the April-September 2007 daylight period illustrate standard trends for Lake Sharpe (Figure 9). Between 83 and 88% of the walleyes harvested during the months that the 381-mm minimum length limit was in effect were between 381 and 457-mm in length (15 and 18 inches). During July and August, when no minimum length limit was in effect, 28% and 22% of the walleyes harvested were between 381 and 457-mm in length and 70% and 73% were less than 381-mm during July and August, respectively. The percentage of walleye longer than 457 mm in length in the angler harvest was highest during June at 15% and ranged from 3% to 12% during other months in the April-September period. Approximately 10% of walleye harvested during the April-September survey period were 457-mm or longer (Figure 9). Beginning in 2006, the “one over” regulation was increased to 508 mm. During 2007, few walleye harvested exceeded 508 mm. Approximately 1 percent of the April-September harvest exceeded 508 mm with monthly ranges from 0 to 2.5% occurring.

Length frequency histograms for smallmouth bass measured in the angler harvest in 2007 illustrate the effects of the 305-457-mm protected slot length limit that was placed in to effect in 2003 (Figure 10). For the April-September 2007 daylight survey period, approximately 83% of the smallmouth bass harvested were <305-mm in length and 4% were ≥457-mm in length. Approximately 13% of the smallmouth bass measured during angler interviews were within the protected slot length limit (Figure 10). During the months of May and June, 19% and 11%, respectively, of the smallmouth bass harvested and measured by creel clerks were within the protected slot. Approximately 59% of the fishing pressure in Lake Sharpe in 2007 occurred in the lower zone of the reservoir (Table 23), and the majority of smallmouth bass caught each year are caught in this zone (Table 28), with June traditionally being the highest month for angler harvest (Table 26).

Hourly Catch, Harvest, and Release Rates

Estimated hourly catch and release rates for all species combined for the April-September 2007 daylight period, at 1.99 fish/h and 1.55 fish/h (Table 30), respectively were higher than values for the same period in 2005 and 2006 (Lott et. al 2007, Potter and Lott 2007). Estimated mean harvest rate, for all species combined, for 2007 was similar to 2005 and 2006, with values at 0.44, 0.49, and 0.46 fish/angler-h, respectively. The increase in overall catch rate was mostly due to an increase in hourly catch rate of walleye and smallmouth bass, from 0.60 to 1.04 for walleye and 0.33 to 0.63 for smallmouth bass. The white bass catch rate has not returned to values found in the past (i.e. 0.40 in 2005, Lott et. al., 2007) due to the white bass die off that occurred during July 2005 (Lott et. al. 2007).

Table 30. Estimated hourly catch, harvest, and release rates, by species, for all anglers interviewed on Lake Sharpe, South Dakota, during the April-September 2007 daylight survey period. Trace (T) indicates values >0.0 but <0.01.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	1.04	0.34	0.70
Sauger	0.03	0.01	0.02
White bass	0.12	0.04	0.08
Smallmouth Bass	0.63	0.02	0.61
Channel catfish	0.05	0.01	0.04
Rainbow trout	T	T	T
Yellow perch	0.03	T	0.03
Other*	0.09	0.02	0.07
Total	1.99	0.44	1.55

*Other includes bigmouth buffalo, black crappie, bluegill, burbot, common carp, freshwater drum, gizzard shad, goldeye, green sunfish, largemouth bass, northern pike, orangespotted sunfish, river carpsucker, rock bass, shorthead redhorse, shovelnose sturgeon, white crappie, and white sucker.

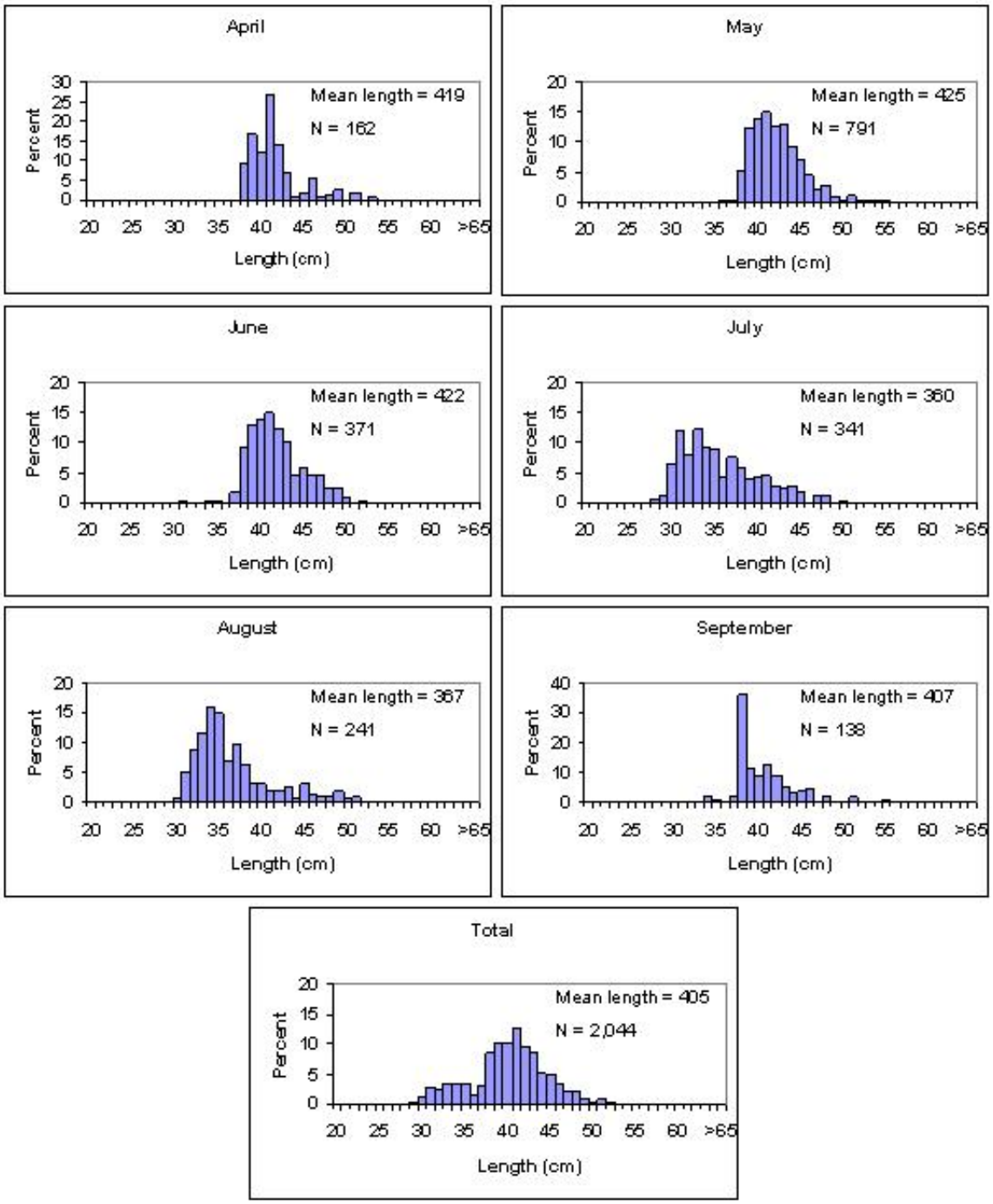

Figure 9. Length frequency distribution of walleye harvested by anglers, by month, fishing Lake Sharpe, South Dakota, during the April-September 2007 daylight period. Mean length and sample size for each period presented.

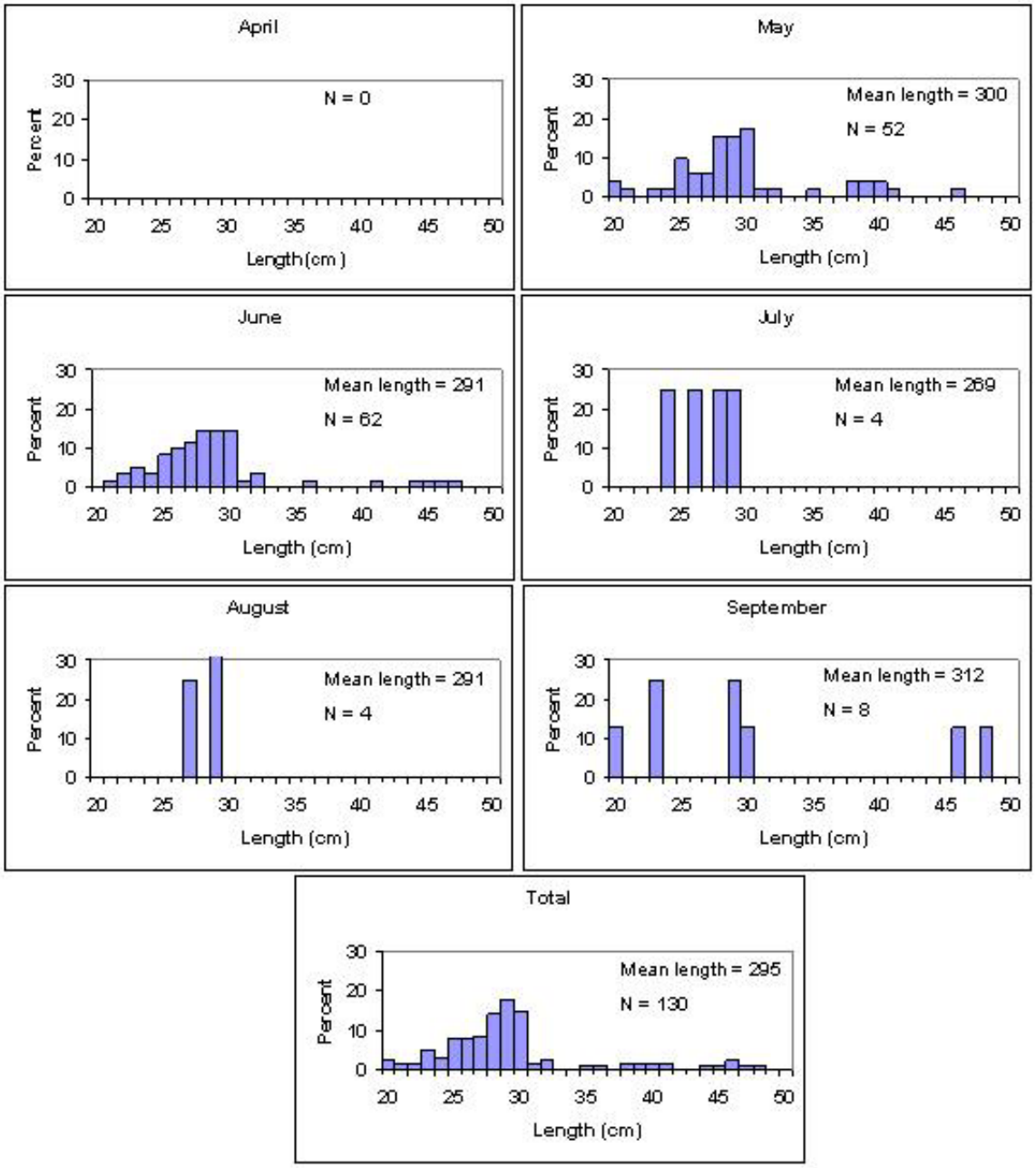

Figure 10. Length frequency distribution of smallmouth bass harvested by anglers fishing Lake Sharpe, South Dakota, by month, during the April-September 2007 daylight period. Mean length and sample size for each period is presented.

For anglers specifically fishing for a certain species, hourly catch, harvest, and release rates were substantially higher (Table 31) than those for all anglers combined (Table 30). Anglers specifically fishing for walleyes had a mean hourly catch rate of 2.05 fish/angler-h for the April-September daylight period (Table 31), while the mean catch rate of walleyes by all anglers was 1.04 fish/angler-h (Table 30). Anglers specifically fishing for smallmouth bass, white bass, and channel catfish had mean hourly catch rates of 4.79, 1.57, and 0.35 fish/angler-h, respectively. The catch rate for anglers fishing specifically for white bass remained significantly lower in 2007, as in 2006, than previous years (2.03 fish/angler-h in 2006, 5.82 fish/angler-h in 2005, 9.53

fish/angler-h in 2004). Catch rates for anglers specifically fishing for smallmouth bass has increased during the past five years from 1.87 fish/angler-h in 2003 to 4.79 fish/angler-h in 2007.

Table 31. Estimated hourly catch, harvest, and release rates, by species, for anglers specifically fishing for the species listed, on Lake Sharpe, South Dakota during the April-September 2007 daylight period.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	2.05	0.62	1.43
White bass	1.57	1.08	0.49
Smallmouth bass	4.79	0.02	4.77
Channel catfish	0.35	0.35	0.00
Rainbow trout	1.78	0.96	0.82

Mean hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, for the April-September standard survey period, for 1993 through 2007, are presented in (Table 32). The high hourly catch rate for walleye in 2003 was likely related to a high abundance of age-3 fish (2000 year class;Table 12) and lower than average gizzard shad production (
Table 5). Low hourly catch rates for walleye from 2004 to 2006 were likely related to higher shad production, a decrease in walleye abundance (Table 5), and an increase in mean age of fish in the walleye population (Table 12). During 2007, the hourly catch rate of walleye in Lake Sharpe was well above 0.3 fish/angler-h, the level indicative of an excellent walleye fishery according to Colby et al. (1979).

There is a general trend of increasing catch rates for smallmouth bass, channel catfish, and white bass during the 1993-2007 period (Table 32). Abundance of fish may influence hourly catch rates by anglers to some extent. However, it is likely that an increase in the percentage of total angling trips specifically for smallmouth bass, channel catfish, and white bass, and an increase in the likelihood of shore anglers being interviewed by survey clerks may be responsible for the majority of the increase in hourly catch rates. As previously mentioned, the bus route survey design is more effective at capturing shore angler interviews and fishing pressure than the access site/aerial survey design. Both white bass and channel catfish are species frequently targeted and caught by shore anglers. Therefore, increasing the percentage of total interviews from shore anglers would lead to an increase in catch rates for species commonly caught or targeted from shore.

Hourly catch rates for walleye and all fish during 2007 fluctuated greatly among months (Table 33). The catch rate and release rate for walleye was the highest during June when the 381-mm minimum length limit was in effect. The removal of the minimum length limit for July and August normally results in an increase in the harvest rate those months, when compared to other months in the April-September survey period.

Table 32. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, by year, for all anglers, for the April-September daylight survey period on Lake Sharpe, South Dakota, 1993 through 2007.

Year	Catch rate (fish/angler-h)				
	Walleye	Smallmouth bass	White Bass	Channel catfish	All fish
1993	0.72	0.01	0.04	0.01	0.84
1994	0.72	0.02	0.03	0.01	0.84
1995	0.67	0.03	0.02	0.02	0.83
1996	1.05	0.05	0.02	0.01	1.18
1997	0.83	0.05	0.06	0.02	1.00
1998	0.93	0.08	0.09	0.01	1.18
1999	0.90	0.13	0.06	0.03	1.20
2000	1.04	0.17	0.09	0.03	1.41
2001	1.16	0.15	0.07	0.06	1.51
2002	0.99	0.14	0.26	0.06	1.52
2003	1.37	0.20	0.26	0.07	2.01
2004	0.54	0.19	0.34	0.10	1.29
2005	0.37	0.11	0.40	0.07	1.02
2006	0.60	0.33	0.11	0.06	1.26
2007	1.04	0.63	0.12	0.05	1.99

Table 33. Estimated hourly catch, harvest, and release rates, (fish/angler-h), for walleye and all species combined, by month, for the April-September 2007 daylight survey period, on Lake Sharpe, South Dakota.

Month	Walleye			All fish combined		
	Catch rate	Harvest rate	Release rate	Catch rate	Harvest rate	Release rate
April	0.64	0.40	0.24	1.21	0.53	0.68
May	1.22	0.57	0.65	2.30	0.70	1.60
June	1.34	0.22	1.12	2.33	0.30	2.03
July	0.93	0.32	0.61	1.54	0.39	1.15
August	0.69	0.28	0.41	1.76	0.40	1.36
September	0.68	0.12	0.56	2.04	0.22	1.82
Total	1.04	0.34	0.70	1.99	0.44	1.55

There was an overall increase in the catch of walleye per angling party that occurred from 2006 to 2007 (55 percent in 2006 to 62 percent in 2007). During 2007, a higher percentage of parties caught and harvested walleye while fishing the lower zone of the reservoir than in other zones. In 2007, only 16% of parties caught no walleye in the lower zone compared to 58% and 52% for the middle and upper zones, respectively. Harvest also mirrored catch, with 37% of parties in the lower zone harvesting no walleye in 2007, compared to 80% and 70% for the middle and upper

zones, respectively. During 2007, 18% of the angling parties harvested a limit (four fish) in the lower zone, compared to 0% and 6% in the middle and upper zones, respectively. For the entire reservoir and survey period, 10% of parties fishing Lake Sharpe harvested a limit of walleye (Table 34).

Table 34. Percentage of angling parties catching and harvesting the specified number of walleye and sauger (combined) per person on an angling trip by reservoir zone, for Lake Sharpe, South Dakota, during the April-September 2006 and 2007 daylight survey periods.

Number /trip	Catch per trip							
	2006				2007			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	18	68	53	45	16	58	52	38
0.0-0.9	13	9	8	9	8	14	12	11
1.0-1.9	17	9	11	12	11	14	10	12
2.0-2.9	11	3	6	7	8	3	7	7
3.0-3.9	8	2	6	6	9	3	3	5
4.0-4.9	10	1	6	6	8	0	3	5
5.0-5.9	7	2	3	4	6	0	3	4
6.0-6.9	5	1	2	3	5	1	2	3
7.0-7.9	2	2	1	2	5	1	1	2
8.0-8.9	3	1	1	2	5	0	1	2
9.0-9.9	2	0	1	1	3	2	1	2
≥10	4	2	2	3	16	4	5	9

Number /trip	Harvest per trip							
	2006				2007			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	29	78	60	54	37	80	70	57
0.0-0.9	15	8	8	10	12	10	7	10
1.0-1.9	16	5	11	12	14	8	10	11
2.0-2.9	10	1	6	6	11	1	4	7
3.0-3.9	8	3	6	6	8	1	3	5
≥4	22	5	9	12	18	0	6	10

Smallmouth bass catch and harvest per trip for angling parties fishing the lower zone of Lake Sharpe, from 2003 through 2007, are presented in Table 35 and serve as a valuable tool for evaluating effects of the 305-457-mm protected slot length limit implemented in 2003. During the 2003 to 2005 period, the percentage of angling parties that caught no smallmouth bass ranged from 39% to 52%, and for 2006 and 2007, the range dropped to 28% and 23%, respectively, of parties caught no smallmouth bass. For years in the 2003-2007 period, between 9% and 16% of angling parties in the lower zone harvested smallmouth bass, while in 2002, the last year before

regulations were changed, 25% of parties harvested smallmouth bass (Lott et al, 2003). Since regulations were changed in 2003, only 1% to 5% of angling parties fishing the lower zone of Lake Sharpe harvested more than two smallmouth bass per angler.

Table 35. Percentage of angling parties catching and harvesting the specified number of smallmouth bass on an angling trip, per person, for the lower zone of Lake Sharpe, during the April-September daylight survey period, 2003-2007.

Number /trip	Catch per trip					Harvest per trip				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
0	42	39	52	28	23	85	86	91	84	87
0-1	22	14	15	28	11	9	8	5	12	7
1-2	12	15	13	14	14	4	4	2	3	4
2-3	8	10	6	5	8	1	2	1	0	1
3-4	4	5	4	5	7	0	0	1	1	1
4-5	2	4	3	4	3	0	0	0	0	0
5-6	2	3	1	2	6	0	0	0	0	0
6-7	2	3	2	4	4	**Daily limit of 5**				
7-8	1	1	1	3	3					
8-9	1	1	1	1	2					
9-10	0	0	0	1	1					
≥10	3	4	2	5	18					

Angler Demographics and Economic Impacts

For the April-September 2007 daylight period, Lake Sharpe anglers contributed approximately 7.1 million dollars to local economies, based on an estimated 90,410 trips (Table 22) at an estimated $79 per trip for South Dakota's Missouri River reservoirs (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007).

Average party size was 2.1 anglers/party and average trip length was 3.8 h, during the April-September 2007 period. Residents comprised 81% of angling parties interviewed on Lake Sharpe during the April-September 2007 daytime survey period, a value within the range from previous years (Table 36). The percentage of resident anglers is generally lowest in lower Lake Sharpe and highest in middle Lake Sharpe (Table 36). Campground facilities at West Bend and Big Bend Dam and a high percentage of boat anglers in lower Lake Sharpe may contribute to the higher percentage of non-residents fishing this zone of the reservoir. The majority of anglers fishing middle Lake Sharpe are generally local residents.

The majority of non-resident anglers fishing Lake Sharpe in 2007 were from the states of Nebraska, Minnesota, and Iowa. Patterns in angler state of residency in 2007 remained similar to other years from 2003-2006. A slightly lower percentage of anglers were from Iowa and the other category increased slightly (Table 37). During 2007, residents of 29 states, other than South Dakota, were interviewed while fishing Lake Sharpe.

Table 36. Percentage of total angler contacts for resident and non-resident (states combined) anglers fishing Lake Sharpe during the April-September daylight period, 2003-2007. N is the number of parties interviewed.

Zone		Year				
		2003	2004	2005	2006	2007
Lower	**N**	531	438	363	413	559
	Residents (%)	70	74	79	73	70
	Non-residents (%)	30	26	21	27	30
Middle	**N**	263	208	162	278	189
	Residents (%)	87	90	91	92	90
	Non-residents (%)	13	10	9	8	10
Upper	**N**	667	692	616	668	545
	Residents (%)	86	88	86	89	90
	Non-residents (%)	14	12	14	11	10
Total	**N**	1,461	1,338	1,141	1,151	1,293
	Residents (%)	80	84	85	85	81
	Non-residents (%)	20	16	15	15	19

Table 37. Percentage of total non-resident angler contacts for anglers from the states listed, for Lake Sharpe, South Dakota during the April-September daylight survey period, 2003-2007.

State	Percent by Year				
	2003	2004	2005	2006	2007
Iowa	27	26	28	22	19
Nebraska	25	24	32	34	27
Colorado	5	6	6	4	7
Minnesota	23	21	13	19	22
Wisconsin	3	1	1	2	1
Wyoming	1	4	2	2	2
Other*	16	18	18	17	22

*Other includes Alaska, Arizona, Arkansas, California, Florida, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nevada, New Mexico, North Dakota, Oklahoma, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, and West Virginia.

County of residence of South Dakota resident anglers fishing Lake Sharpe during the April-September 2007 survey period are presented in Figure 11 and Table 38. Over half (52%) of angling parties interviewed on Lake Sharpe during the 2007 survey were local anglers from Hughes and Stanley counties (Figure 11). Minnehaha (Sioux Falls) and Pennington (Rapid City) county residents were interviewed at 7% for each county of angler interviews. The percentage of angler interviews from residents of Beadle, Brookings, Davison, Hand, and Lyman remained within ranges seen in past years (Table 38).

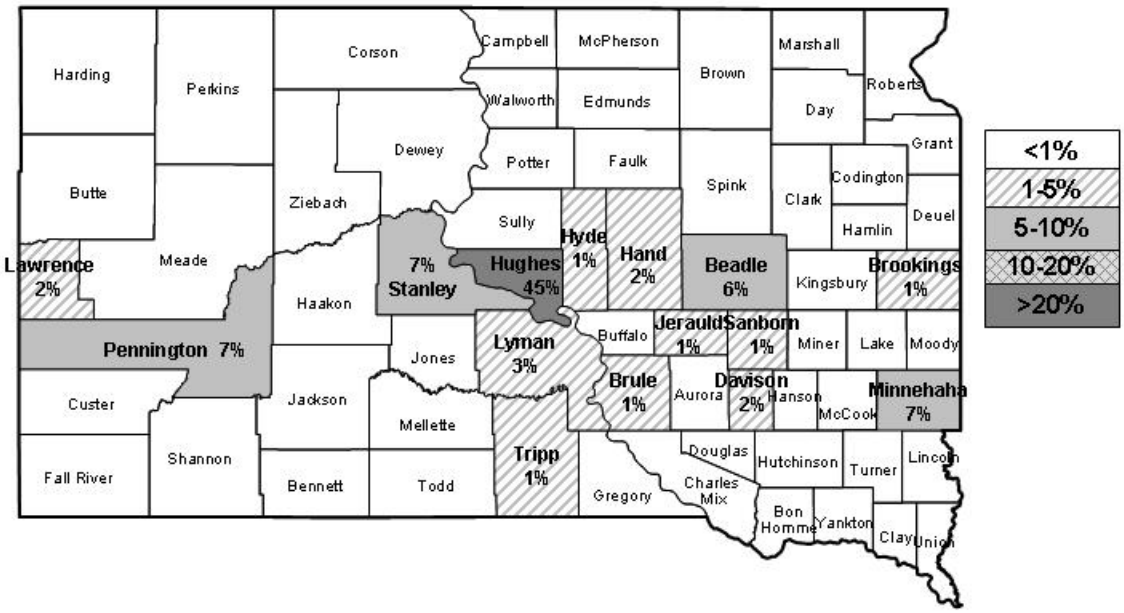

Figure 11. Percentage of total angler contacts on Lake Sharpe, of residents of the counties illustrated, during the April-September 2007 daylight survey period.

Table 38. Percentage of total angler contacts on Lake Sharpe, of residents of the counties listed, for anglers fishing Lake Sharpe, South Dakota during the April-September daylight survey period, 2003-2007.

County	Major City	Percent by year				
		2003	2004	2005	2006	2007
Beadle	**Huron**	7	3	4	4	6
Brookings	**Brookings**	1	1	1	1	1
Davison	**Mitchell**	3	2	2	1	2
Hand	**Miller**	2	1	1	2	2
Hughes	**Pierre**	48	43	51	52	45
Lyman	**Presho, Kennebec**	1	1	1	2	3
Minnehaha	**Sioux Falls**	9	7	8	5	7
Pennington	**Rapid City**	6	5	5	6	7
Stanley	**Fort Pierre**	7	6	6	7	7

The pattern in percentage of anglers traveling certain distances to fish Lake Sharpe during 2007 reflects the pattern in the percentage of angler interviews from South Dakota counties (Table 38,

Figure 11). Residents of Hughes and Stanley Counties comprised the majority of anglers traveling <25 miles and 25-49 miles, one way, to fish Lake Sharpe in 2007, while anglers from Minnehaha and Pennington counties comprised the majority of anglers traveling 100-199 miles to fish Lake Sharpe (Table 39). With Lake Sharpe located some distance from a large population base, travel is required for many anglers fishing Lake Sharpe. The percentage of angler interviews for anglers traveling in excess of 200 miles, one way, to fish Lake Sharpe in 2007 was similar to the 2004 value and lower than 2003, 2005 and 2006.

Table 39. Percentage of anglers driving the specified distances, one way, to fish Lake Sharpe, South Dakota, during the April-September daylight survey period, 2003-2007.

Distance (miles)	Percent by year				
	2003	2004	2005	2006	2007
<25	40	44	46	47	38
25-49	7	8	6	6	12
50-99	9	8	6	8	11
100-199	17	19	17	15	18
≥200	26	21	25	24	21

As previously mentioned, the increase in hourly catch rates for smallmouth bass, white bass, and channel catfish may be due, in part, to an increase in the percentage of total angler interviews that are from shore anglers. Since 2003, walleye were targeted by 57 to 63% of the anglers while 31 to 33% of anglers were fishing for “anything”. The largest increase for target species was smallmouth bass, which increased from between1 and 2%, during 2003 to 2006, to 6% of all anglers fishing Lake Sharpe during 2007 (Table 40). This increase may be due to the number of local and state bass tournaments fishing Lake Sharpe during 2007.

Table 40. Target species of anglers fishing Lake Sharpe, South Dakota, during the April-September daylight survey period, expressed as percent of total, 2003 - 2007.

Target species	Percent by year				
	2003	2004	2005	2006	2007
Walleye	63	59	57	58	57
Anything	31	33	33	33	32
Rainbow trout	3	4	3	2	1
White bass	1	1	4	1	2
Smallmouth bass	1	2	1	2	6
Other*	1	1	2	4	2

*Other includes black crappie, channel catfish, common carp, northern pike, and white crappie.

Satisfaction and Attitudes

How anglers feel about 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.

When anglers were asked to consider all factors when stating their level of satisfaction with their fishing trip, the median trip rating for the April-September 2007 period was “moderately satisfied” (median of 2, Table 41). The median satisfaction rating of “moderately satisfied” for 2007 was the same in 2006 and was an improvement from 2005 and 2004 when the median satisfaction rating was “slightly satisfied” (Potter and Lott. 2007;Lott et al. 2006b, Lott et al 2007). Approximately 78% of angling parties interviewed in 2007 indicated some degree of satisfaction, a value above the Lake Sharpe Strategic Plan objective of 70%. Neutral and dissatisfied anglers comprised 9% and 13% of angler interviews, respectively. Median trip satisfaction increased from “moderately satisfied” to “very satisfied”, as the average number of walleye harvested per angler increased (Table 42). Only the anglers that harvested a four fish limit expressed “very satisfied” rating. However, as Gigliotti (2004) documented, other factors besides the number of walleye harvested must influence trip satisfaction because 75% of anglers keeping zero walleye during their trip expressed some degree of satisfaction with their trip (Table 42).

Table 41. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2007 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, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include “no opinion” responses.

Month	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
April	24	41	8	11	3	2	3	1	92	2
May	74	64	23	9	8	2	2	2	182	2
June	40	51	12	9	9	4	6	2	131	2
July	24	23	11	7	8	3	0	0	76	2
August	19	15	5	10	11	7	3	0	70	3
September	40	21	13	14	7	0	3	0	98	2
Total	221	215	72	60	46	18	17	5	649	2
Percent	78			9	13					

Table 42. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2007 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, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Walleye/ angler	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
0	108	121	42	41	25	9	15	5	361	2
0-0.9	22	27	8	2	7	1	2	0	69	2
1.0-1.9	24	24	8	6	8	5	0	0	75	2
2.0-2.9	16	9	7	3	3	0	0	0	38	2
3.0-3.9	17	16	4	3	0	1	0	0	41	2
4	32	17	3	3	2	2	0	0	59	1
Percent	79			9	12					

Beginning in 2003, a 305-457-mm protected slot with a one over 457-mm regulation package was placed in effect for smallmouth bass on Lake Sharpe. The regulation was in place for the fifth year during 2007. Anglers were asked if they were in favor of the current regulation package for smallmouth bass. For the lake-wide results, the largest percentage (41% for total sample) indicated they were in favor of the regulation, but a significant portion expressed no opinion (24% for total sample (Table 43). When the "no opinion" answers are removed from the sample, 54% were in favor of the current smallmouth bass regulation package. By zone of the reservoir, the lower zone had the lowest percentage of approval at 50% (Table 43). The upper and middle zones were higher than the lower zone but similar to each other at 58% for the upper zone and 57% for the middle zone for approval of the regulation package.

Anglers that were "not in favor" of the smallmouth bass regulation package were asked if they would be in favor of increasing the lower portion of the size limit from 12 inches to 14 inches, with 58% of the respondents (with no opinion removed) in approval. This question may be more appropriately asked, "Would a 14 to 18 inch regulation be more acceptable to you?" Of the anglers asked this, by zone, the lower zone had the lowest approval at 57% with the upper and middle zones at 58 and 66% approval, respectively (Table 43).

Table 43. Responses and percentages of anglers interviewed during the April-September 2007 daytime survey on Lake Sharpe that responded to the smallmouth bass regulation approval questions. Questions were asked in series depending on response.

Question A. "Are you in favor of the current smallmouth bass regulation of a 12- to 18-inch protected slot, which requires all smallmouth bass between 12 and 18 inches to be released?

Zone	Yes	N	No	N	No opinion	N
Upper	39	106	29	78	32	89
Middle	46	42	35	32	19	17
Lower	41	111	40	109	19	50
Total	41	259	35	219	24	156
Upper	58	106	42	78	Removed from sample	
Middle	57	42	43	32		
Lower	50	111	50	109		
Total	54	259	46	219		

Question B. If no was answered to question A, anglers were asked, "Would you be in favor of the regulation if the protected slot were changed to 14-to-18 inches, allowing fish up to 14 inches to be kept?" Values are in percentage and N is number of parties responding accordingly.

Zone	Yes	N	No	N	No opinion	N
Upper	58	46	42	34	0	0
Middle	64	21	33	11	3	1
Lower	56	62	43	47	1	1
Total	58	129	41	92	1	2
Upper	58	46	42	34	Removed from sample	
Middle	66	21	34	11		
Lower	57	62	43	47		
Total	58	129	42	92		

Anglers harvested an estimated 7,565 smallmouth bass from Lake Sharpe during the April-September daylight period during 2007 (Table 28). If the regulation package had not been in effect in 2007, there was a potential harvest of 30,364 smallmouth bass during April-September 2007 that could have occurred. If a smallmouth bass was caught by a party, were asked "How many additional smallmouth bass would you have kept if the regulations had not been in place?" This question was asked to help estimate how high the potential harvest reduction associated with the regulation package might be (Table 44). Prior to the regulation change in 2003, smallmouth bass harvest was estimated at 11,696 for 2002, 14,673 for 2001, 13,765 for 2000, and 12,005 for 1999 (Johnson and Lott 2000, 2001; Johnson, et al 2002; Lott et al 2003). If harvest would have been 30,364 for 2007, had the regulation not been in place, it would have been substantially higher than what was estimated for previous years. In 2006, the estimated potential harvest was 30,050, similar to the 2007 estimate (Potter and Lott, 2007).

Table 44. Potential angler harvest of smallmouth bass based on anglers responses to the following question, "Of the smallmouth bass you caught today, how many more smallmouth bass would your party have harvested had there been no length restrictions on harvesting smallmouth bass?" Estimated values are numbers generated by extrapolating interview data over estimated fishing pressure, while observed values are generated directly from interviews.

	Harvest	Catch	Percent harvested
Actual			
Observed	180	6,668	2.7%
Estimated	7,565	210,863	
Potential			
Observed	**957**	6,668	14.4%
Estimated	**30,364**	210,863	

FISHERY STATUS AND 2008 OUTLOOK

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 harvest rate of 0.35 fish/angler-h, and a 70% angler trip satisfaction rating." All parts of this objective were met for 2007 with the exception of angler days. In 2007 the estimated harvest rate was 0.44 fish/angler-h for all species combined, with an overall satisfaction rating of 78% and 90,410 angler days of fishing pressure estimated. The walleye-specific objective was also met for 2007, with an estimated 112,623 walleyes harvested and a harvest rate of 0.34 walleye/angler-h.

High recruitment of the 2005 and 2006 walleye year classes into the population and high reproduction in 2007 for walleye will help provide a walleye fishery for the future, especially with low recruitment of the 2001-2004 year classes. Age-2 walleye comprised the largest portion of the gill net catch in 2007, followed by age-1, 4, and 6 fish. Walleye growth rates have remained adequate due to sufficient prey availability, as shown by seining data from 2007. Walleye harvest should increase over the next several years as the 2005 and 2006 year-classes reach harvestable size.

Smallmouth bass nighttime electrofishing CPUE decreased from 30.4 fish/h in 2006 to 21.1 fish/h in 2007 at Joe Creek, while values for Big Bend Dam have been similar during all years sampled with the exception of the 2006 sample. Stock density indices in 2007 were within values observed during the last six years. Growth and condition of smallmouth bass remains good, with growth above the statewide and Missouri River reservoir averages.

After evaluating angler creel survey data GFP concluded that the current regulation had a 77 percent reduction of harvest of smallmouth bass, from previous years, and was too restrictive to allow adequate harvest of the smaller bass. Of the anglers interviewed, 54 percent were in favor of the current regulation and over 60 percent of the anglers against the current regulation would be in favor of a 14-18 inch slot length limit. Therefore, in 2007, GFP modified the protected slot from a 305-457 mm (12-18-inch) to a 357-457mm (14-18-inch) protected slot length limit. This new regulation will go into effect January 2008, and will allow anglers to harvest bass up to 14-inches while still protecting the larger individuals in the population.

MANAGEMENT RECOMMENDATIONS

- Continue to conduct annual angler use and harvest surveys for the April-September daylight period.

- Continue to conduct annual fish population surveys including spring electrofishing, shoreline seining, August gillnetting, and fall electrofishing.

- Continue to investigate use of variable-mesh monofilament gill nets as a sampling method to index smallmouth bass population size structure and acquire fish for age and growth and condition analyses. Preliminary netting efforts began in 2005.

- Continue to determine angler acceptance of smallmouth bass regulations and estimate minimum harvest reduction resulting from regulations.

- Evaluate management objectives for secondary species, other than walleye, including white bass, channel catfish, and smallmouth bass, to more accurately reflect the potential of these species, in terms of providing increased angler days on Lake Sharpe.

- Update Lake Sharpe Fisheries Management Plan by June 2008.

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APPENDICES

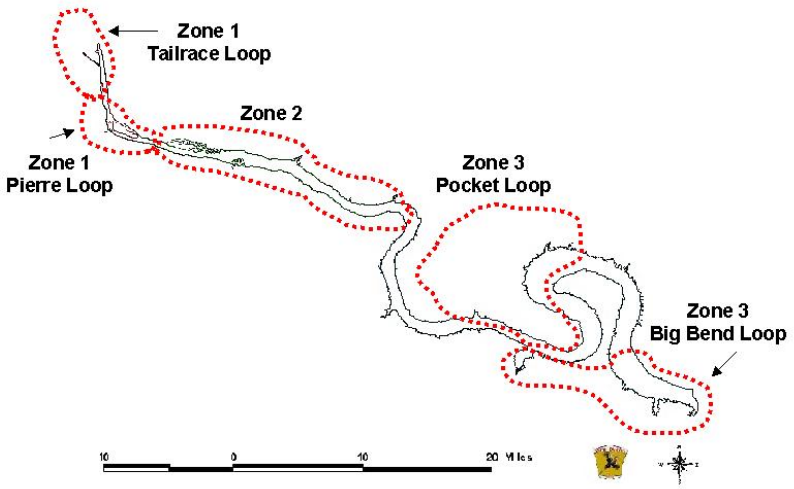
Appendix 1. Common and scientific names of fishes mentioned in this report.

Common Name	Abbreviations	Scientific Name
Bigmouth buffalo	BIB	*Ictiobus cyprinellus*
Black bullhead	BLB	*Ameiurus melas*
Black crappie	BLC	*Pomoxis nigromaculatus*
Blue catfish	BCF	*Ictalurus furcatus*
Bluegill	BLG	*Lepomis macrochirus*
Blue sucker	BSR	*Cycleptus elongatus*
Bluntnose minnow	BLM	*Pimephales notatus*
Brassy minnow	BRM	*Hybognathus hankinsoni*
Channel catfish	CCF	*Ictalurus punctatus*
Chinook salmon	FCS	*Oncorhynchus tshawytscha*
Common carp	COC	*Cyprinus carpio*
Emerald shiner	EMS	*Notropis atherinoides*
Fathead minnow	FHM	*Pimephales promelas*
Freshwater drum	FRD	*Aplodinotus grunniens*
Gizzard shad	GZD	*Dorosoma cepedianum*
Goldeye	GOE	*Hiodon alosoides*
Johnny darter	JOD	*Etheostoma nigrum*
Lake herring	LAH	*Coregonus artedii*
Largemouth bass	LMB	*Micropterus salmoides*
Northern pike	NOP	*Esox Lucius*
Rainbow smelt	RBS	*Osmerus mordax*
Rainbow trout	RBT	*Oncorhynchus mykiss*
River carpsucker	RIC	*Carpiodes carpio*
Sauger	SAR	*Sander canadensis*
Shorthead redhorse	SHR	*Moxostoma macrolepidotum*
Shortnose gar	SHG	*Lepisosteus platostomus*
Shovelnose sturgeon	SHS	*Scaphirhynchus platorynchus*
Smallmouth bass	SMB	*Micropterus dolomieu*
Smallmouth buffalo	SAB	*Ictiobus bubalus*
Spottail shiner	SPS	*Notropis hudsonius*
Walleye	WAE	*Sander vitreus*
White bass	WHB	*Morone chrysops*
White crappie	WHC	*Pomoxis annularis*
White sucker	WHS	*Catostomus commersoni*
Yellow perch	YEP	*Perca flavescens*

Appendix 2. Minimum lengths (mm) for length class designations for smallmouth bass, walleye, sauger, channel catfish, white bass and yellow perch.

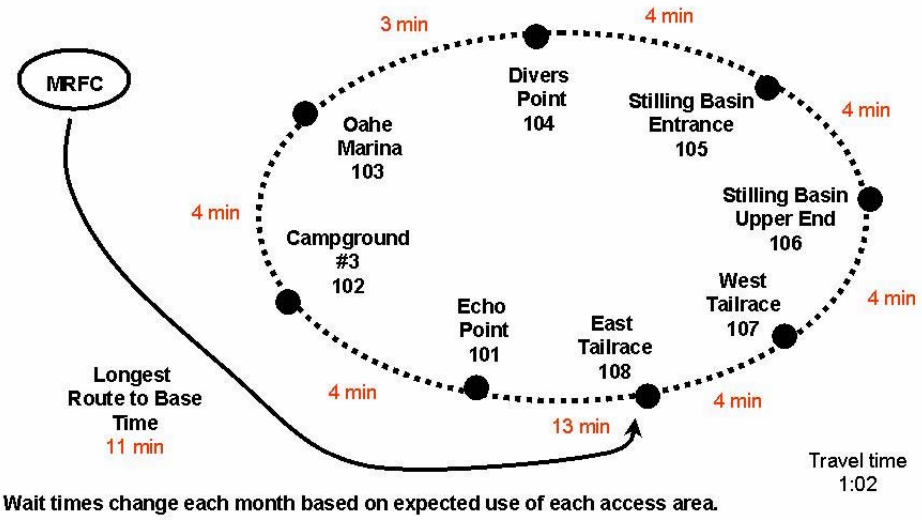
Species	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth Bass	180	280	350	430	510
Walleye	250	380	510	630	760
Sauger	200	300	380	510	630
Channel catfish	280	410	610	710	910
White bass	150	230	300	380	460
Yellow perch	130	200	250	300	380

Lake Sharpe Bus Route Loops

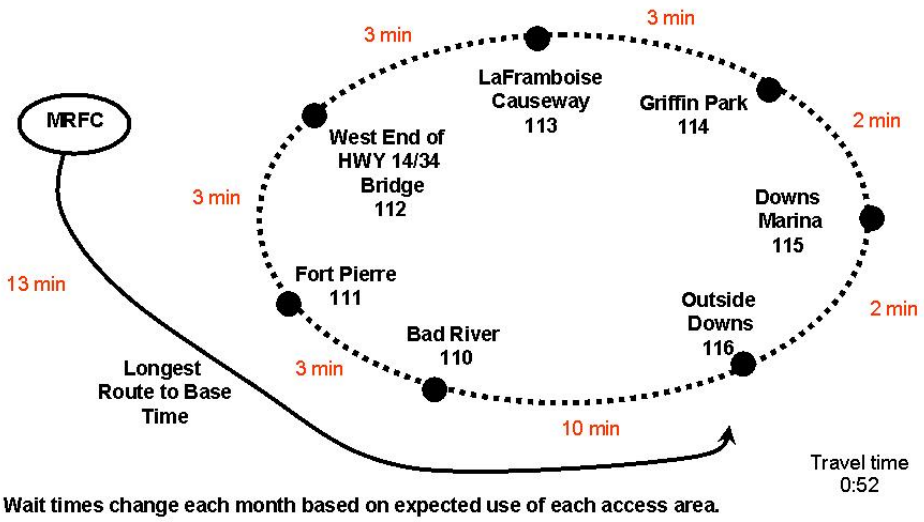


Appendix 3. Lake Sharpe bus route loop map depicting locations of the 5 overall loops for angler use and harvest surveys during April – September, 2007.

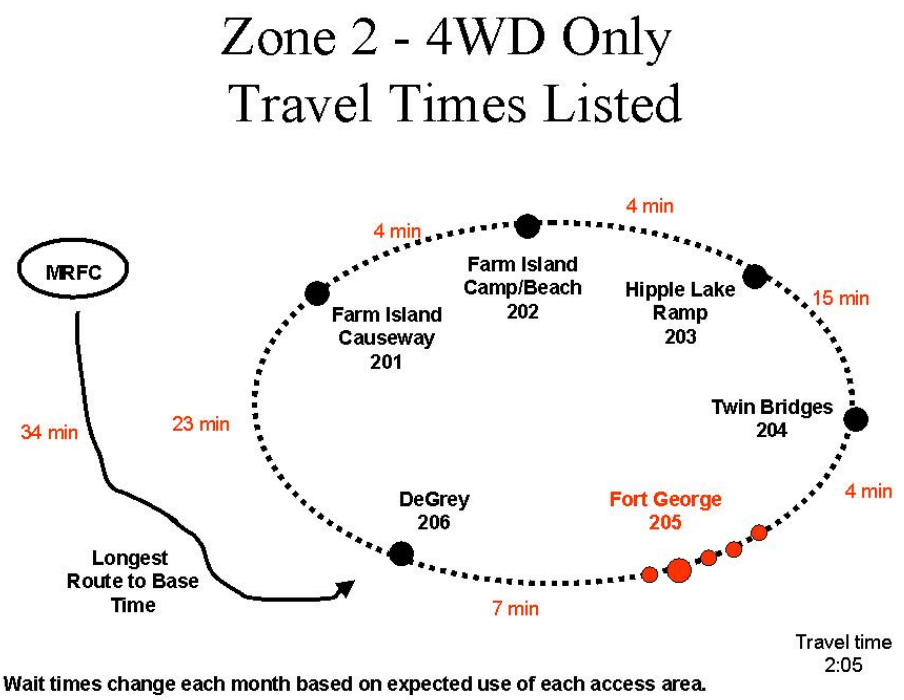
Zone 1 - Tailrace Loop - Car Travel Times Listed



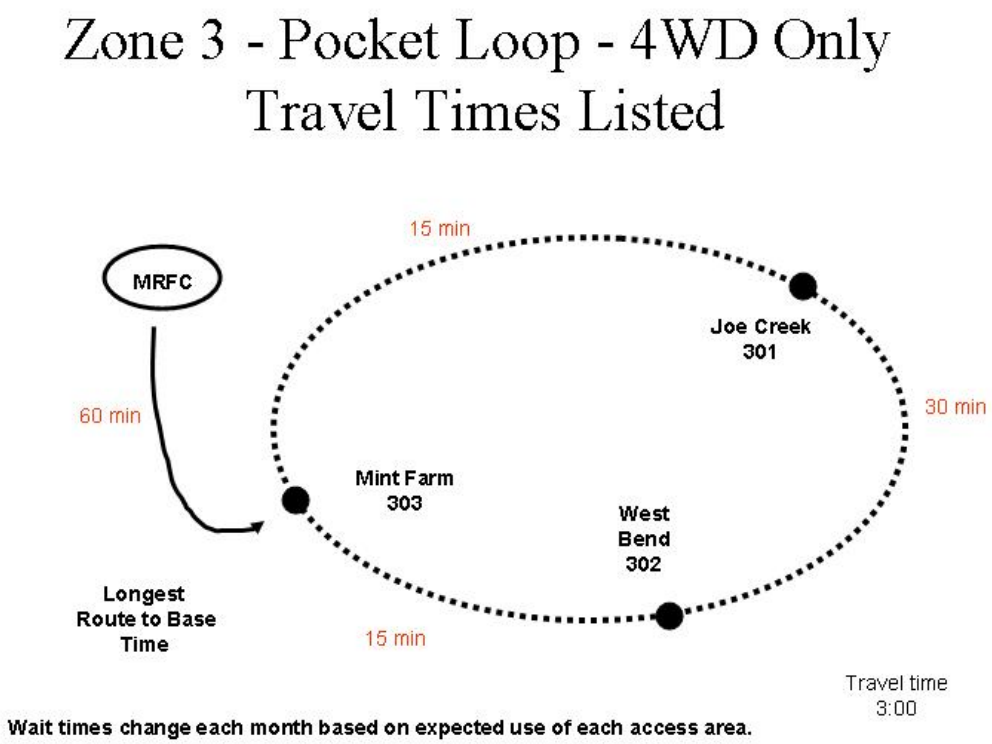
Appendix 4. Overall design of the tailrace loop for angler use and harvest surveys for Lake Sharpe, SD during April-September, 2007.



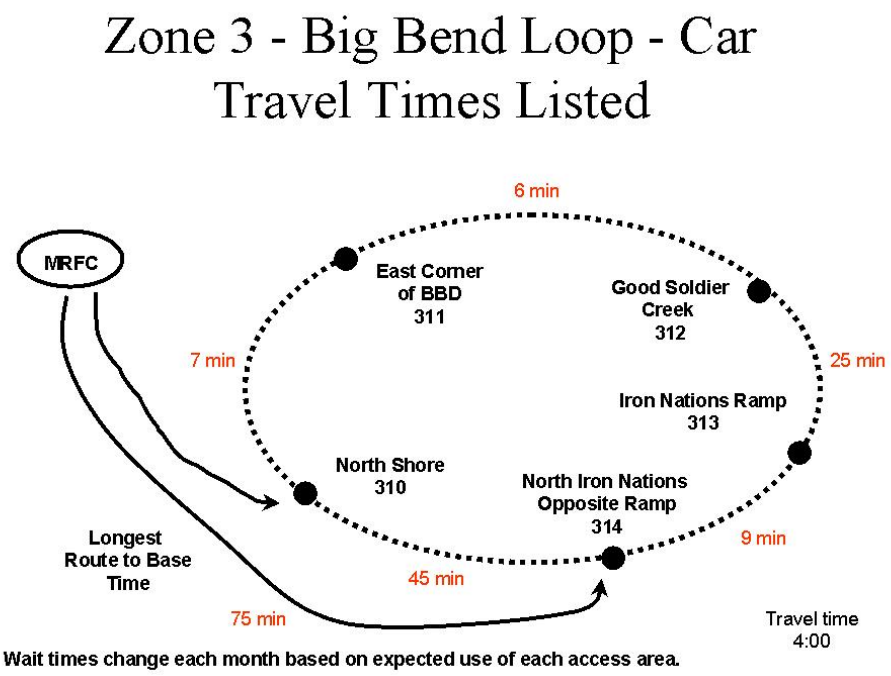
Appendix 5. Overall design for the Pierre Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2007.



Appendix 6. Overall design for Zone 2 loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2007.



Appendix 7. Overall design for the Pocket Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September 2007.



Appendix 8. Overall design for the Big Bend Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2007.

Appendix 9. Angler satisfaction, preference, and attitude questions asked as part of the April-September 2007 angler use and harvest survey on Lake Sharpe, South Dakota.

Trip Satisfaction Question:

Considering all factors, how satisfied are you with your fishing trip today?

(Read the following response categories)
1 = VERY
2 = MODERATELY SATISFIED
3 = SLIGHTLY
4 = NEUTRAL *(neither satisfied or dissatisfied)*
5 = SLIGHTLY
6 = MODERATELY DISSATISFIED
7 = VERY
8 = NO OPINION

Smallmouth Bass Questions:

A. Regulation Approval Questions

1. Are you in favor of the current smallmouth bass regulation of a 12-to-18-inch protected slot, which requires all smallmouth bass between 12 and 18 inches to be released?

   YES NO NO OPINION

2. *If NO*: Would you be in favor of the regulation if the protected slot were changed to 14-to-18 inches, allowing fish up to 14 inches to be kept?

   YES NO NO OPINION

B. Harvest Increase Questions

Objective: To determine how much smallmouth bass harvest might increase if there were no length limits in effect.

(Clerk asks if smallmouth bass were released)
Of the smallmouth bass you caught today, how many more smallmouth bass would your party have harvested had there been no length restrictions?

(Remember, maximum harvest per angler is 5 smallmouth bass daily)

Appendix 10. White bass and yellow perch proportional stock density (PSD) relative stock density of preferred-length fish, and mean relative weight values, for 1997-2007, for fish collected in the standard August gill net survey, on Lake Sharpe South Dakota.

White bass

Year	PSD	RSD-P	RSD-M	*Wr*	N
1997	96	58	13	94	24
1998	94	94	22	101	18
1999	100	72	24	102	54
2000	98	83	13	99	55
2001	100	91	26	100	46
2002	68	15	8	100	71
2003	96	39	13	91	70
2004	92	74	6	94	62
2005	100	60	0	101	11
2006	96	15	4	103	52
2007	98	96	20	95	45

Yellow perch

Year	PSD	RSD-P	RSD-M	*Wr*	N
1997	43	4	0	89	23
1998	28	6	0	91	18
1999	59	27	0	82	22
2000	22	6	0	85	36
2001	55	0	0	86	20
2002	42	8	0	77	24
2003	25	8	0	85	23
2004	43	5	0	88	21
2005	23	0	0	86	45
2006	53	0	0	112	40
2007	37	5	0	83	31