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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2010

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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2010

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PREFACE

Information collected during 2010 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: John Aberle, Brian Beel, Bryan Boocock, Chris Dekker, Doug Jones, Dan Jost, Jason Jungwirth, Amanda Murphy, Darla Kusser, Mallory Petersen, Gene Perkins, Nathan Pool, Keith Swartz, Jim Riis, Caitlin Wagner.

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EXECUTIVE SUMMARY

This report includes annual fish population data and angler use, harvest, and preference data collected in 2010, 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 2010, at 22 walleye/net-night, was higher than the 2009 value of 18 fish/net-night. Walleye ranging from 158 to 567 mm were collected during the August 2010 gill net survey. Approximately 32% of walleye in the 2010 gill net sample were ≥ 381-mm (15-inch minimum length), 3% were ≥ 457-mm (18 inches), and 1% were ≥ 508-mm (20 inches). Approximately 63% of the walleye sampled during the August gill net survey in 2010 were below the minimum length limit.

Mean age-0 electrofishing CPUE of 59 fish/h indicates that at least moderate walleye production occurred in 2010. Walleye relative weight (*Wr*) for 2010, at 88, was similar to most years for Lake Sharpe. Age-1 (2009) walleye comprised the largest portion of the walleye catch in gill nets in 2010, followed by age-3 walleye.

Twenty species of age-0 or small prey fishes were collected by shoreline seining in 2010. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2010, with a mean CPUE of 594 fish/haul.

Current regulations for smallmouth bass in Lake Sharpe include a 355-to-457-mm (14- to 18-inch) protected slot with anglers allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. Previous regulations (2003-2007) included a protected slot from 304-to-457-mm (12-to18-inch) with anglers allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. The change in protected slot length limits was put into place to allow anglers to harvest more small (≤ 355-mm) smallmouth bass and increase the effectiveness of the regulation. Anglers harvested an estimated 7,828 smallmouth bass from Lake Sharpe in 2010. Growth has remained similar since the regulation went into effect; however PSD and PSD-P have increased since 2005. Maximum total length however, has not increased.

An estimated 107,810 anglers days were spent on Lake Sharpe during the April-September 2010 daylight period, exceeding the Lake Sharpe Strategic plan goal of 100,000 angler days. Additionally, estimated walleye harvest (140,859) was higher than the Lake Sharpe Strategic plan goal of 100,000. Approximately 79% of the smallmouth bass harvested during the April-September 2010 period were <355-mm in length and 13% were ≥457-mm in length. Approximately 8% 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 2010 daylight period, at 0.48 fish/angler-h, was higher than the strategic plan objective of 0.35 fish/angler-h. The walleye catch, harvest, and release rates for 2010 (0.73, 0.36, 0.37, respectively) were similar to the 2009 period (1.18, 0.38, 0.80, respectively). The smallmouth bass catch rate was 0.25 fish/angler-h during 2010. The white bass catch rate was similar in 2009 & 2010 at 0.12 fish/angler-h.

Approximately 81% of angling parties interviewed in 2010 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 2010 daylight period, Lake Sharpe anglers contributed approximately 8.5 million dollars to local economies, based on an estimated 107,279 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, 2010

INTRODUCTION

Anglers spent over 1.5 million hours fishing the Missouri River system in South Dakota in 2007 (Adams et al. 2008; Potter et al. 2008, Sorensen and Knecht 2009). 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 126,000 angler trips, during the April-September daylight period, in recent years. Walleye, and to a lesser extent, smallmouth bass, white bass, channel catfish, sauger, and rainbow trout, provide much 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 2010 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.

- 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.

- 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.

- 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. Additionally, frame-nets are used to sample the panfish communities in the Hipple Lake (Figure 2) and LaFramboise (Figure 3) back-water areas. 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.

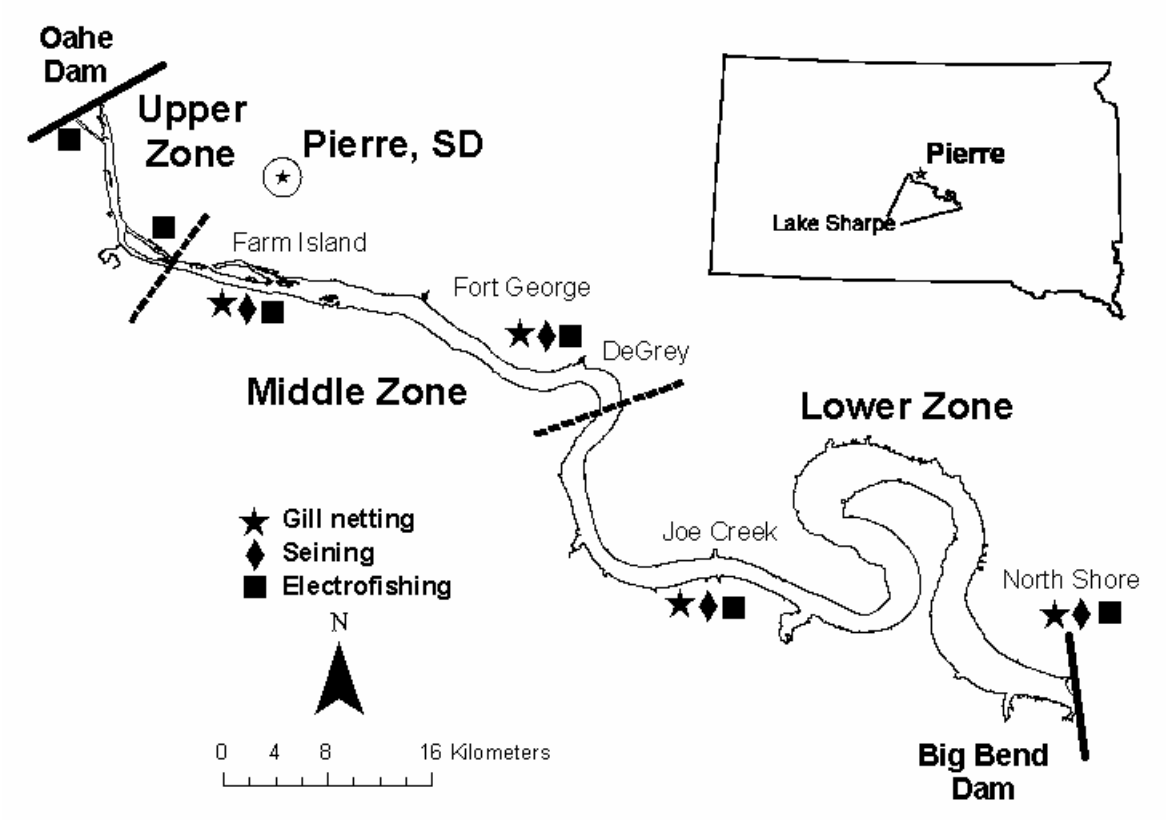


Figure 1. Lake Sharpe, South Dakota, gill netting, seining, and electrofishing locations.

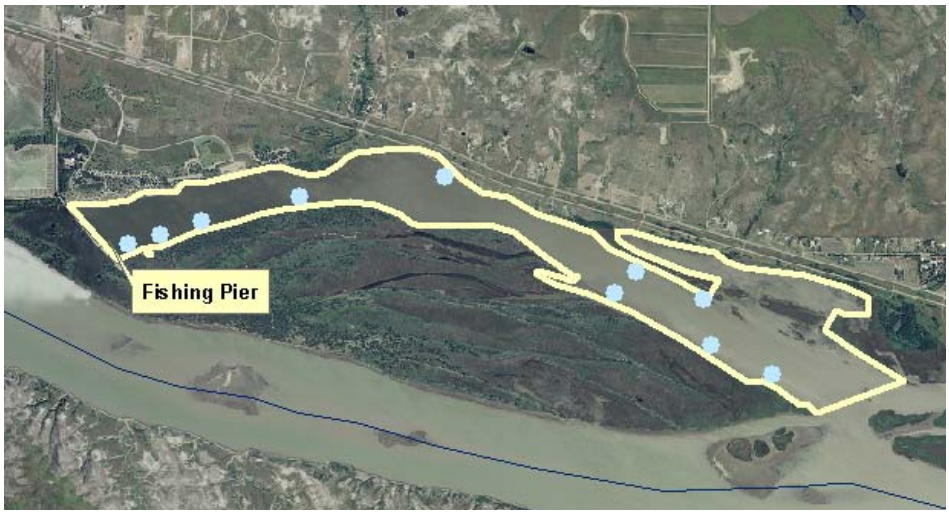


Figure 2. Frame net locations within the Hipple Lake portion of Lake Sharpe, South Dakota.

Figure 3. Frame net locations within the LaFramboise Bay portion of Lake Sharpe, South Dakota.

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:	September
Pan fish frame-net survey:	May

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 one walleye over 18 inches stipulation 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 from 2003 through 2007 included 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. In 2008, smallmouth bass regulations on Lake Sharpe were altered to include a 14-to-18-inch (355-457-mm) protected slot length limit with at most one fish 18 inches or longer in the daily limit. The regulation change was implemented to increase harvest of smaller smallmouth bass. This regulation will be monitored in the future to determine its effectiveness.

Table 2. History of special harvest regulations for walleye and smallmouth bass, on Lake Sharpe, South Dakota, 1968 through 2010.

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-present	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.
	2008-present	5	10	• Only fish shorter than 14 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, electrofishing, larval trawls, and frame nets were used to sample fish populations in Lake Sharpe during 2010 (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) that were 91.4 m (300 ft) in length 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.

Nylon seines, previously described by Lott et al. (1994), were used to collect age-0 fish 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, identified and counted in the lab.

During May, ten 19.1 mm bar mesh (3/4 inch) frame nets, with 0.9 m x 1.5 m frames and 18 m leads, were placed into the waters of LaFramboise Bay and Hipple Lake (Farm Island) for two overnight sets each. Nets were fished overnight (approximately 20 h) and rotated around the embayment each day for a total sample effort of 10 net-nights per location. All species were counted, measured for total length (TL, mm), weighted (g), and released. Bluegill, white bass, and black and white crappie had scales removed for age assessment.

In the West Bend region, monofilament gillnets with the following bar mesh sizes: 1, 1 ¼, 1 ½, 1 ¾, 2, 2 ¼, and 2 ½ inches (25.4, 31.8, 38.1, 44.5, 50.8, 57.2, and 63.5 mm bar mesh) that were 350 feet (106.7 m) in length and 8 feet (2.4 m) high, were fished on the bottom, in less than 30 feet (9.1 m) depth of water, for short term sets during early-July. Length of term ranged from 2 to 5 h for a total of 18 independent nets. All fish collected were counted and released, if alive, except for smallmouth bass in which total length (TL, mm), weight (g), and otoliths were collected for age assessment.

Gizzard shad trawling occurred during six or seven periods throughout on the year. Larvae were collected every 10-14 days from May through August using a 1.0-m-diameter ichthyoplankton trawl with 1,000 µm bar mesh at approximately 10-min tows. A flowmeter was mounted in the mouth of the trawl to estimate the volume of water filtered. Locations were selected using a stratified random approach, with each reservoir divided into zones (see Graeb 2006 for more information); each zone was sampled with equal effort. Additionally, Hipple Lake a 178-ha backwater area of Lake Sharpe was sampled separately during each sampling period as it was suspected to be used for spawning and reproduction of gizzard shad. Density of larval gizzard shad was calculated as the number of shad per 100 m^3 of water filtered at each location during each period; a mean density was calculated by averaging all densities during that period for that specific zone.

Fall, nighttime electrofishing for age-0 walleye was included in standard fish population surveys beginning in 1995 to assess walleye reproduction. Six electrofishing runs (up to 15 min) were conducted at night, during September, 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/s frequency. Voltage and amperage ranged between 270-300 V and 7-10 A, respectively. 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. Otoliths were taken from a representative sample of walleye <240-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 gill net (No./net night and No./h), frame net (No./net night), seine (No./haul) and electrofishing (No./h) catches. Larval densities were calculated for number per 100 m^3 of volume sampled for larval trawl samples. 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. Otoliths were aged according to standard techniques (DeVries and Frie 1996). Walleye and sauger less than 350 mm were aged from whole otoliths submersed in water while walleye and sauger greater than 350 were aged from otoliths cracked in half and charred prior to aging, similar to techniques described by Isermann, et al. (2003). Back-calculations for scale samples were made with the computer program WinFin Analysis (Francis 2000). 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 size distribution (PSD; Anderson 1980, Gablehouse 1984, Guy et al 2007) values were calculated for walleye, sauger, smallmouth bass, channel catfish, white bass, and yellow perch. Length categories used in PSD 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). Size structure indices (PSD, PSD-P, and PSD-M) and mean *Wr* values for white bass and yellow perch are presented in Appendix 3.

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, 2010 through September 30, 2010 for the sunrise-to-sunset (daytime) period. Diagrams of bus routes used on Lake Sharpe during the April-September survey period appear in Appendix 4 through Appendix 9. Random numbers were used to select the following for the bus route designs: day selection (weekday or weekend/holiday), shift time (day beginning at sunrise or ending at sunset), route direction (travel or wait start), starting location, and route selection. 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 2010 reservoir-wide angler use and harvest survey. Interview data was collected on one interview form with two different sets of angler attitude or preference questions on each sheet. The left hand column contained questions that are asked more frequently and contained the following questions. Anglers were asked how satisfied they were with their fishing trip, considering all factors. Boat

anglers were asked what body of water their boat was on prior to Lake Sharpe and how many days ago was their boat was on that water body. Questions on the right column included angler trip satisfaction and if they were in favor of the current smallmouth bass regulations on Lake Sharpe. A complete list of satisfaction, attitude and preference questions asked in conjunction with the 2010 angler use and harvest survey appears in Appendix 10.

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

AUGUST GILL NET POPULATION ASSESSMENT

Species Composition and Relative Abundance

Walleye and channel catfish comprised the majority of the gill net catch in 2010 representing 48% and 12% of the catch, respectively (Table 3). Other species commonly caught during the 2010 survey included yellow perch, common carp, sauger, and gizzard shad. Catch per unit effort has historically been used as an index of population abundance or density (Hubert 1996). Walleye CPUE of 22 fish/net-night in 2010 was higher than the five year average (Table 4). Channel catfish CPUE of 6 fish/net-night in 2010 was similar to the five year average.

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 2006 through 2010. Trace (T) indicates values < 0.5%.

Species	Year				
	2006	2007	2008	2009	2010
Walleye	43	49	52	52	48
Channel catfish	17	13	14	16	12
Yellow perch	7	5	3	7	9
Common carp	8	5	7	6	4
Sauger	6	6	7	7	2
White bass	6	4	2	1	1
Gizzard shad	7	10	3	4	14
Freshwater drum	3	2	3	T	1
Smallmouth bass	3	3	1	1	3
*Others	3	3	6	6	5

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

Table 4. Mean catch per unit effort (CPUE; No./net-night) and standard error values (SE) for fish species collected with standard experimental coolwater gill net sets in Lake Sharpe, South Dakota, 2006-2010.

Species	2006	2007	2008	2009	2010
Bigmouth buffalo	0	0	<1 (0.1)	0	0
Black bullhead	0	0	<1 (0.1)	0	0
Black crappie	<1 (0.1)	0	<1 (0.1)	0	<1 (0.1)
Bluegill	<1 (0.1)	0	0	0	0
Channel catfish	7 (1.7)	6 (0.9)	5 (1)	5 (0.9)	6 (1.7)
Common carp	3 (0.9)	2 (2.8)	3 (1)	2 (0.5)	2 (0.5)
Freshwater drum	1 (0.3)	1 (0.4)	1 (0.3)	<1 (0.1)	1 (0.2)
Gizzard shad	3 (1.2)	4 (2.9)	1 (1)	1 (1.1)	7 (3.9)
Goldeye	0	0	0	<1 (<0.1)	<1 (0.1)
Northern pike	<1 (0.1)	0	0	0	<1 (<0.1)
Rainbow smelt	0	0	0	<1 (<0.1)	0
Rainbow trout	0	0	<1 (<0.1)	0	0
River carpsucker	<1 (0.1)	<1 (0.1)	<1 (0.1)	1 (0.3)	1 (0.6)
Sauger	2 (0.7)	3 (0.7)	3 (0.5)	3 (0.6)	1 (0.3)
Shorthead redhorse	<1 (0.1)	<1 (0.1)	<1 (0.6)	<1 (<0.1)	<1 (<0.1)
Shortnose gar	<1 (0.2)	<1 (0.1)	<1 (0.1)	0	<1 (<0.1)
Shovelnose sturgeon	<1 (0.1)	<1 (0.2)	1 (0.6)	1 (1.2)	<1 (0.3)
Smallmouth bass	1 (0.8)	1 (0.9)	<1 (0.1)	<1 (0.3)	1 (1.2)
Smallmouth buffalo	0	<1 (0.1)	0	<1 (<0.1)	<1 (<0.1)
Spottail shiner	0	<1 (0.1)	0	0	<1 (0.1)
Walleye	17 (2.8)	22 (3.4)	19 (3.2)	18 (4.3)	22 (4.3)
White bass	2 (1)	2 (1.2)	2 (0.8)	<1 (0.3)	1 (0.4)
White crappie	<1 (0.1)	<1 (0.1)	<1 (<0.1)	0	<1 (0.1)
White sucker	0	<1 (0.1)	0	<1 (<0.1)	<1 (<0.1)
Yellow perch	3 (1.2)	2 (0.7)	1 (0.3)	2 (0.9)	4 (1.5)

Population Parameters for Walleye

The length frequency for walleye collected in 2009 and 2010 is depicted in Figure 4. Multiple year classes were present in the 2010 sample with numerous walleye between stock and quality length. Approximately 32% of walleye in the 2010 gill net sample were ≥ 381-mm (15-inch minimum length), 3% were ≥ 457-mm (18 inches), and 1% were ≥ 508-mm (20 inches).

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. 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.

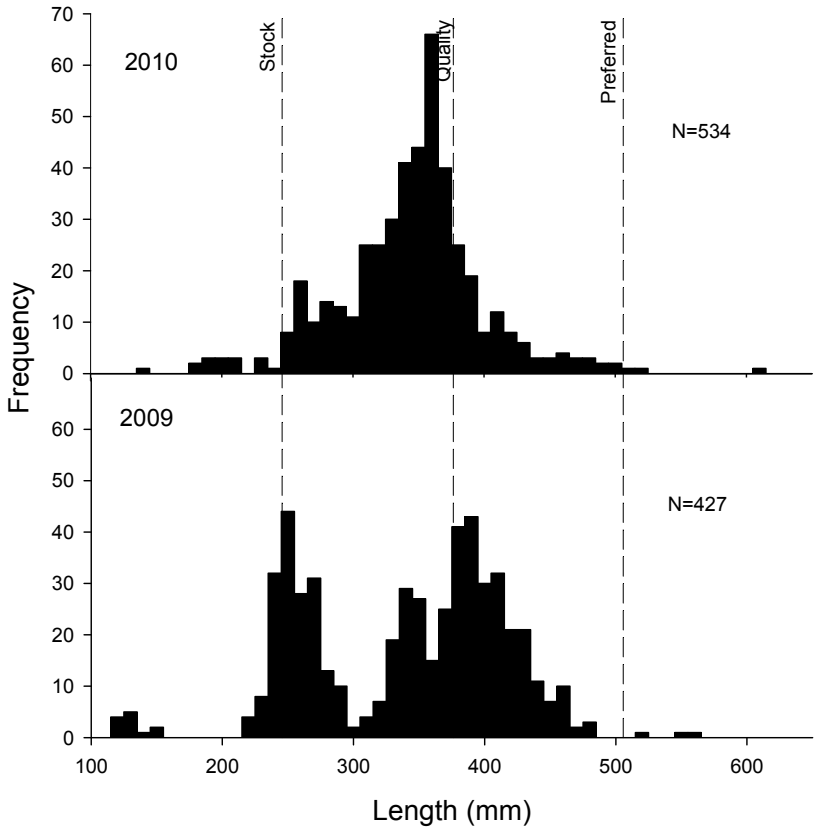


Figure 4. Length frequency of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, during August 2009 and 2010.

Proportional size distribution increased in 2009 to 40 however, proportional size distribution – preferred remains similar to previous years (Table 5).

Relative weight values for Missouri River reservoirs are generally between 80 and 90. Walleye relative weight for Lake Sharpe in 2010 was 88, higher than any of the previous to the four year (Table 6). Variability in relative weights in Lake Sharpe occurs due to the seasonal availability of gizzard shad and fish entrainment through Oahe Dam.

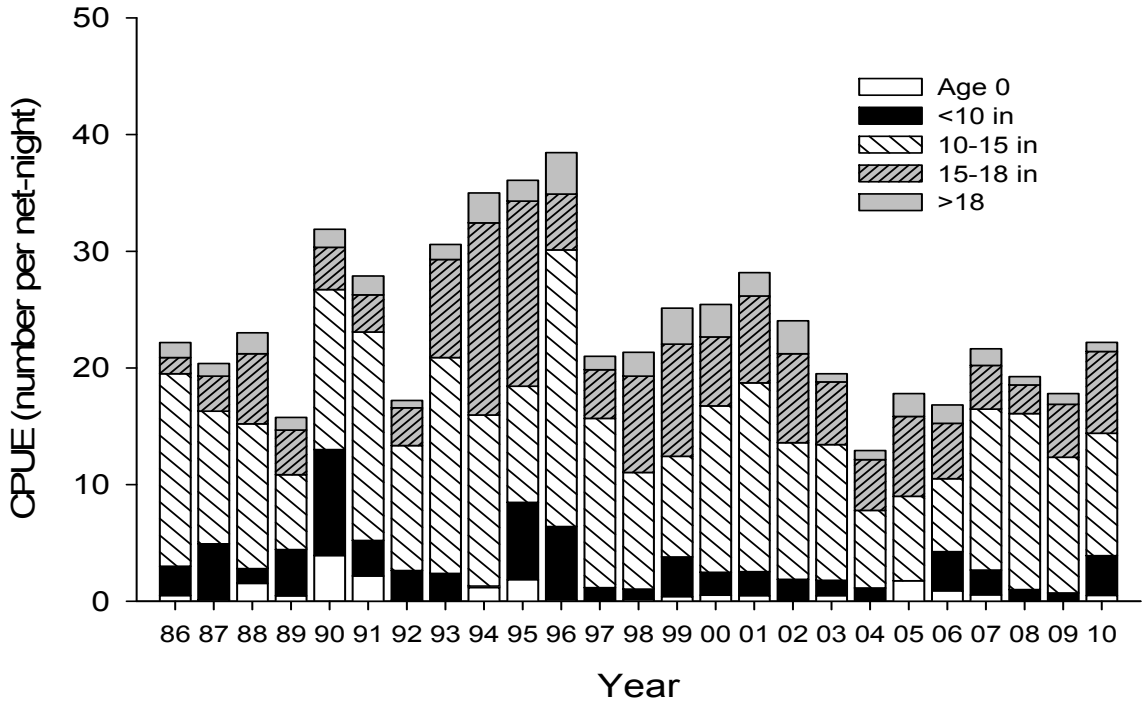


Figure 5. Size structure and abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, during August, 1986-2010.

Table 5. Walleye and sauger proportional size distrubtion (PSD) and proportional size distribution of preferred- (PSD-P) and memorable-length (PSD-M) fish collected during the standard gill net survey on Lake Sharpe, South Dakota, 2006-2010.

Year	Walleye				Sauger			
	PSD	PSD-P	PSD-M	Ns	PSD	PSD-P	PSD-M	Ns
2006	48	2	0	339	52	37	0	54
2007	24	1	0	455	77	18	0	61
2008	27	4	0	472	96	34	0	100
2009	40	1	0	412	100	48	0	61
2010	47	1	0	478	65	58	0	26

Table 6. Mean walleye relative weight (*Wr*) values, by length group, for Lake Sharpe, South Dakota, 2006-2010. N is the number of stock-length fish in a sample.

Year	Length group							
	Stock-quality		Quality-preferred		Preferred-trophy		>Stock length	
	Wr	N	*Wr*	N	*Wr*	N	*Wr*	N
2006	86	174	84	156	70	7	85	337
2007	83	341	80	108	79	3	82	452
2008	86	345	81	98	78	3	84	446
2009	83	246	79	163	61	3	82	411
2010	88	254	85	221	75	3	87	478

Otoliths were removed from the majority of walleye and sauger collected during the August gill net survey. Mean length at age at capture for each age group of walleye is illustrated in Table 7 and walleye growth is displayed in Table 8. Lake Sharpe walleye typically surpass the 15 inch minimum length limit during their fourth or fifth growing season. Age-1 walleye (i.e., produced in 2009) comprised the largest percentage of the 2010 gill net sample of any age group (Table 9). Few age-0 walleye were captured during the gill net survey in 2010, however, fall night electrofishing catch of age-0 walleye indicate that a year class was likely formed (Table 10).

Table 7. Mean length-at-age-at-capture (mm) for walleye collected in the standard August gill net survey, 2006-2010, 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
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
2008	**Mean**	253	326	379	393	435	406	461	477	-
	N	51	108	117	4	14	3	7	3	-
	SE	4.3	2.7	2.3	10.1	12.6	6.8	13.0	30.7	-
2009	**Mean**	240	331	368	399	400	451	421	450	454
	N	19	84	92	97	4	10	2	9	9
	SE	16.5	18.5	2.2	3.1	6	9.8	9	15.5	11.1
2010	**Mean**	263	348	394	414	417	414	448	433	460
	N	119	85	89	55	54	3	8	1	2
	SE	1.7	1.9	2.4	3.3	3.6	33.2	5.8	-	1.5
Mean of means		254	340	385	407	424	429	447	453	451

Table 8. Mean annual growth (length) increment estimates for walleye collected in the standard experimental coolwater gill net survey on Lake Sharpe, South Dakota, for the 2005-2006, 2006-2007, 2007-2008, 2008-2009, and 2009-2010 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
2005-2006	78	50	31	35	12	18	--	--
2006-2007	73	32	27	15	8	12	17	--
2007-2008	75	43	1	16	--	27	26	--
2008-2009	78	42	20	7	16	15	--	--
2009-2010	108	63	46	18	14	--	12	10

Table 9. Age distribution of walleye collected from Lake Sharpe, South Dakota, 2006-2010, with standard gill net sets as determined by aging otoliths.

Year	Age												
	0	1	2	3	4	5	6	7	8	9	10	11	12
2006	21	175	12	80	23	26	37	10	10	2	1	2	3
2007	13	110	289	11	25	12	17	16	9	9	2	0	4
2008	1	51	108	117	4	13	3	7	3	2	0	0	0
2009	0	19	99	134	129	5	10	2	9	9	3	3	0
2010	12	172	99	106	63	60	3	8	1	2	1	2	3

Walleye recruitment in 2010, as indexed by fall nighttime electrofishing CPUE of age-0 fish, was above the five year average (Table 10). Mean length of age-0 walleye in the 2010 fall electrofishing catch, at 137 mm, was smaller than most years observed.

Table 10. Mean nighttime electrofishing catch per unit effort (CPUE; No./h) and total length (mm) for age-0 walleye collected during September and October 2006-2010 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
2006	46	36	5.0	155	372	1.0
2007	30	36	4.2	169	272	1.2
2008	96	36	11.0	156	868	0.6
2009	42	36	9.0	149	378	0.9
2010	59	36	6.4	137	343	1.3

Population Parameters for Sauger

Sauger and walleye are managed with the same set of regulations since anglers can have difficulty differentiating between the two species. Twenty five sauger were collected during the gill net survey in August 2010, for a mean CPUE of 1 fish/net night (Table 4 and Figure 6). While sauger abundance is not as high as walleye abundance (Table 4), proportional size distribution for sauger are generally high in Lake Sharpe with a PSD-Preferred in 2010 of 58 (Table 5).

Condition (mean *Wr*) for sauger in the 2010 gill net survey was not calculated due to low sample size. Mean length-at-age-at-time-of-capture values are presented in Table 11. Sauger up to age-5 were collected in the 2010 gill net survey ranging in total length from 326 to 446 mm (Figure 6). No age-0 sauger were sampled with gill nets, but 55 age-0 sauger were collected by fall electrofishing.

Table 11. Mean length-at-age-at-capture (mm) values for sauger collected in the standard August coolwater gill net survey, 2006-2010, 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
2006	**Mean**	254	359	391	375	--	408	--	480	--
	N	25	1	15	1	--	10	--	1	--
	SE	4.7	--	5.3	--	--	10.8	--	--	--
2007	**Mean**	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			
2008	**Mean**	--	340	379	426	--	--	--	--	--
	N	--	24	19	1	--	--	--	--	--
	SE	--	4.9	6.6	--	--	--	--	--	--
2009	**Mean**	--	--	372	389	425	389	--	--	397
	N	--	--	26	30	2	2	--	--	1
	SE	--	--	4.4	4.7	5.0	47.0	--	--	--
2010	**Mean**	253	324	--	419	406	--	--	--	--
	N	9	1	--	7	8	--	--	--	--
	SE	5.1	--	--	15.8	7.1	--	--	--	--
Mean of means		252	343	387	403	415	407	395	480	397

Table 12. Age distributions of sauger collected from Lake Sharpe, South Dakota, 2006-2010, with gill nets during standard surveys.

Year	Age										
	0	1	2	3	4	5	6	7	8	9	10
2006	0	26	1	15	1	0	10	0	1	0	0
2007	1	11	38	4	5	2	0	1	0	0	0
2008	0	0	24	19	1	0	0	0	0	0	0
2009	0	0	0	26	30	2	2	0	0	1	0
2010	0	9	1	0	7	9	0	0	0	0	0

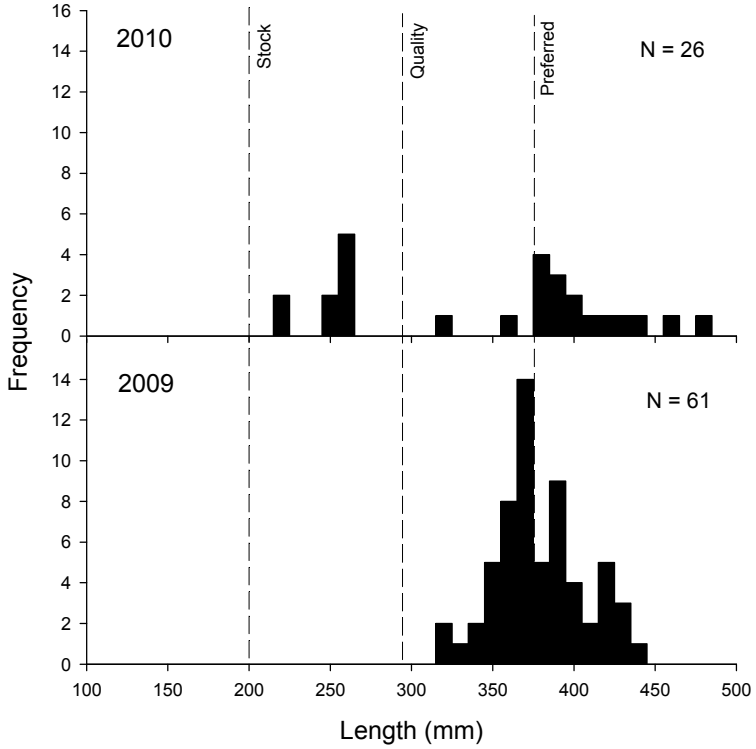


Figure 6. Length frequency of sauger collected during the standard gill net survey during August 2009 and 2010, on Lake Sharpe, South Dakota.

Population Parameters for Channel Catfish

Most channel catfish population indices (PSD-P, PSD-M) exhibited little change during the 2006-2010 period (Table 13), while PSD increased from 52 in 2006 to 75 in 2010 and *Wr* dropped slightly from 93 to 88. Channel catfish CPUE (no./net-night) of 6 in 2010 is similar to the five year average of 6 (Table 4). Figure 7 illustrates the length frequency for 2009 and 2010 channel catfish sampled with gill nets. Growth and age structure data from 2003 and 2008 are presented in Table 14 illustrating that 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 with the next collection in 2013.

Table 13. Channel catfish proportional size distribution (PSD), proportional size distribution of preferred and memorable-length (PSD-P and PSD-M) fish, and relative weight (*Wr*) for 2006-2010, from Lake Sharpe, South Dakota. Mean *Wr* values are for stock-length fish only.

Year	PSD	PSD-P	PSD-M	*Wr*	N
2006	52	1	0	81	157
2007	64	2	0	81	116
2008	60	2	0	83	132
2009	79	1	0	93	127
2010	74	1	0	88	118

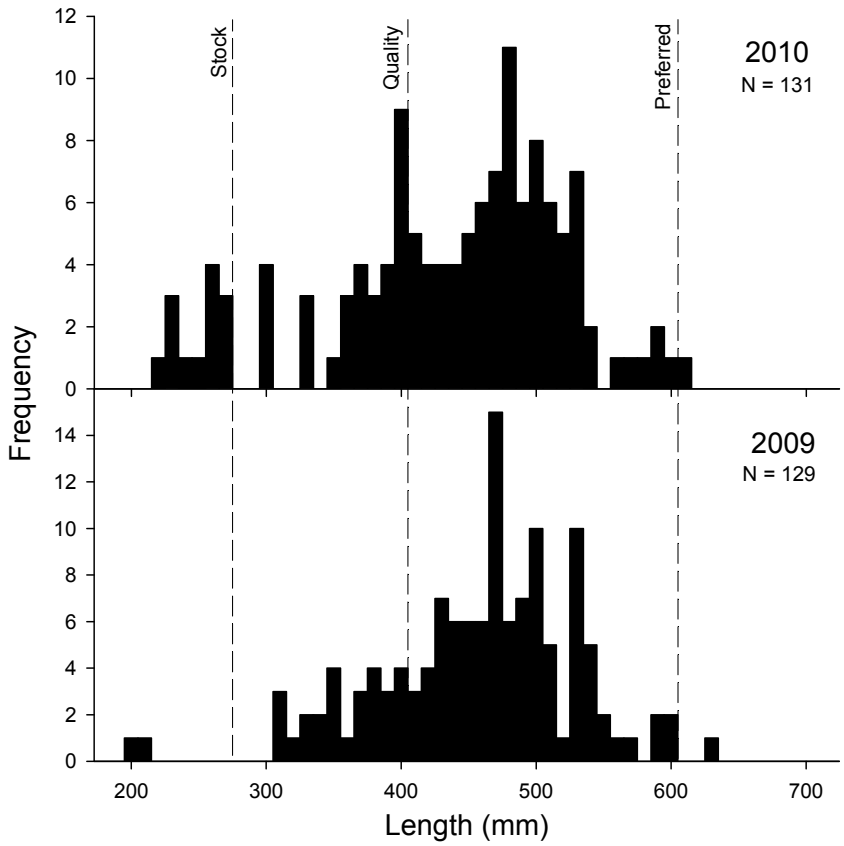


Figure 7. Length frequency of channel catfish collected during the standard, coolwater gill net survey during August 2009 and 2010, on Lake Sharpe, South Dakota.

Table 14. Mean length-at-age-at-capture (mm) for channel catfish collected during August, 2003 and 2008, on Lake Sharpe, South Dakota, and aged from pectoral spines. N is the number of fish of each age in the sample. SE is standard error.

Age	2003			2008		
	Length	N	SE	Length	N	SE
1	--	0		243	1	--
2	219	1	5	288	9	7
3	320	3	9	298	10	12
4	278	10	11	326	5	19
5	298	26	10	401	1	--
6	333	75	11	418	3	19
7	346	18	12	--	0	--
8	334	9	13	422	11	16
9	364	3	13	436	27	20
10	406	6	12	489	22	12
11	477	16	12	473	7	13
12	435	8	14	530	5	24
13	541	8	11	545	3	35
14	595	5	14	519	2	29
15	555	3	13	640	1	--
16	600	3	12	584	2	3
17	608	4	12	--	0	--
18	625	3	14	--	0	--
19	590	2	11	--	0	--
20	716	1	14	--	0	--

MONOFILAMENT GILL NET SMALLMOUTH BASS ASSESSMENT

Population Parameters for Smallmouth Bass

Smallmouth bass relative abundance (2.05 fish/hr), as indexed by number caught per gill net per hour, has remained relatively static over the previous 5 years (Table 15). Size structure however, has increased (PSD-P = 68;Table 15 and Figure 8) and condition remains near the five year average of 93. Growth has also remained constant over the previous 5 years, on average taking 5 years for a Lake Sharpe smallmouth bass to surpass 356 mm (14 inches) (Table 16).

Table 15. Mean smallmouth bass catch-per-unit effort (CPUE; No./h), hours of netting effort, proportional size distribution (PSD), proportional size distribution of preferred-length (PSD-P), memorable-length (PSD-M), and relative weight (*Wr*) fish values, for early July, monofiliment gillnet samples at West Bend, Lake Sharpe, 2006-2010. Ns is the number of stock-length fish collected for *Wr* sample, SE is standard error.

Year	CPUE (fish/hr)	SE	Effort (hrs)	PSD	PSD-P	PSD-M	*Wr*	Ns
2006	3.26	0.58	57.8	70	45	2	102	120
2007	2.47	0.62	53.9	66	40	4	95	110
2008	2.11	0.30	46.2	82	51	5	85	99
2009	2.66	0.75	55.3	80	67	8	91	153
2010	2.05	0.35	54.3	88	68	8	91	117

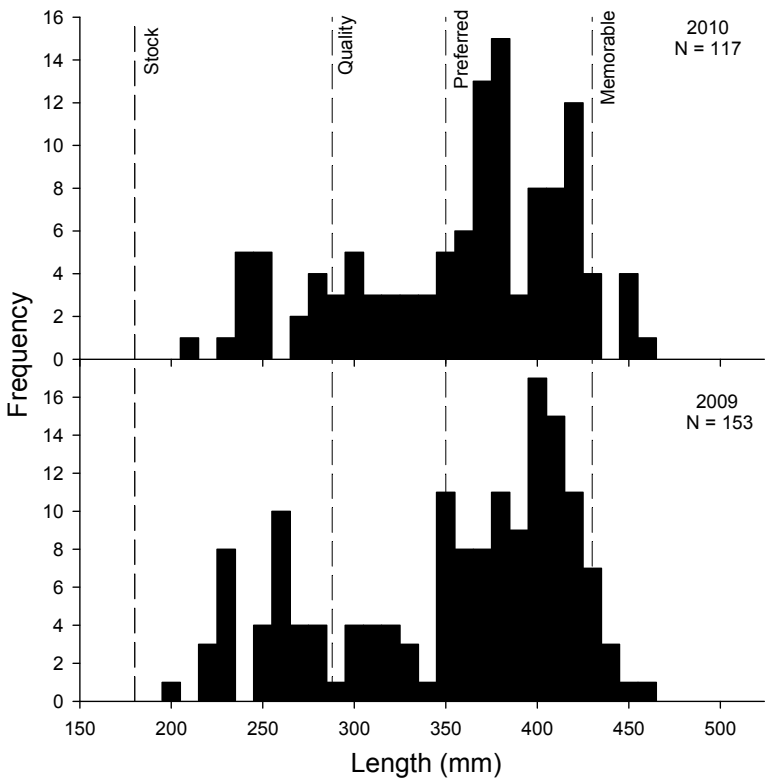


Figure 8. Length frequency of smallmouth bass collected with monofilament gillnets during July 2009 and 2010, at West Bend on Lake Sharpe, South Dakota.

Table 16. Mean length-at-age-at-capture (mm) for smallmouth bass collected during July at West Bend, 2006-2010, 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
2006	**Mean**	--	--	227	293	357	387	404	422	419
	N	0	0	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	0	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
2008	**Mean**	--	253	310	357	381	399	406	426	425
	N	0	18	33	25	30	17	15	7	3
	SE	--	4.1	4.1	4.1	3	3.3	5.6	7.5	13.9
2009	**Mean**	233	247	313	359	379	401	406	420	422
	N	1	32	34	53	20	28	18	21	8
	SE	--	2.9	4.7	2.8	3.2	2.5	3.9	3.4	4.6
2010	**Mean**	--	251	301	360	385	408	429	429	430
	N	0	11	19	20	29	11	3	9	7
	SE	--	6.1	6.0	4.4	2.5	5.1	14.6	4.1	6.9
Mean of means		233	257	293	345	377	399	412	426	426

SMALLMOUTH BASS TOURAMENT DATA

On July 18, 2010, South Dakota Bass Anglers Sportsmen Society (BASS) Federation held a trail tournament at West Bend Recreation Area on Lake Sharpe. Staff were there to collect the following data from smallmouth bass that were brought into the weigh-in including length, weight, and dorsal spines. Thirty-two anglers collected 146 smallmouth bass in a day of fishing. The mean weight was 931 g (2 lbs-1 oz) and the mean length was 403 mm (15.8 inches) for the tournament (Figure 9). The mean length of angler caught smallmouth bass from July, 2010, was slightly lower than the September tournaments of 2007 and 2008 which mean lengths of 417 mm and 420 mm, respectively.

Dorsal spines were collected, embedded in epoxy, sectioned, and aged by light being transmitted through the section portion. Two readers aged each fish. Mean length-at-age-at-capture is reported in Table 17. Mean length of each age of dorsal spine aged fish are similar to otolith aged fish (Table 16).

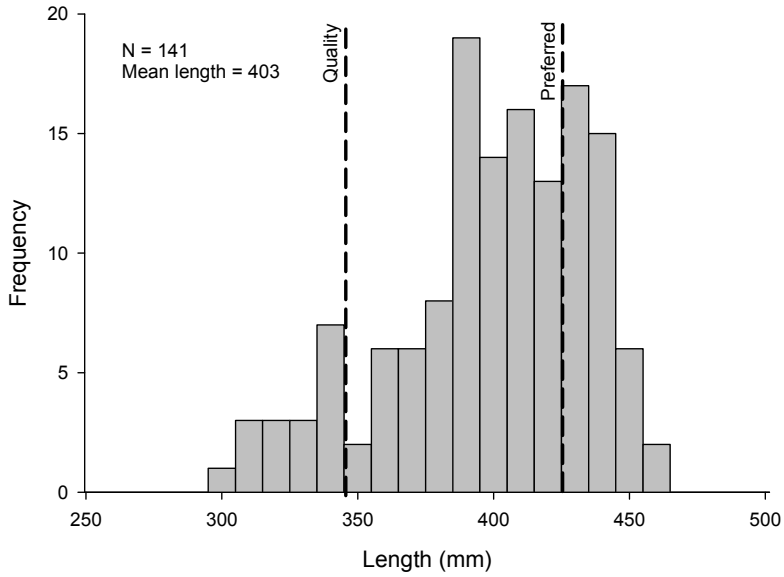


Figure 9. Length frequency of tournament angler caught smallmouth bass during July 18, 2010, near West Bend region of Lake Sharpe, South Dakota.

Table 17. Mean length-at-age-at-capture (mm) for tournament caught smallmouth bass during July 18, 2010 at West Bend on Lake Sharpe, South Dakota, and aged from dorsal spines.

	Length at age at capture (mm)							
	3	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mean	338	358	387	402	430	435	431	432
N	6	17	30	29	24	15	17	3
SE	4.7	6.7	5.1	3.5	3.0	3.1	7.1	9.4

SEINING SURVEY

Twenty species of small littoral fishes were collected by shoreline seining in 2010. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2010, with a mean CPUE of 594 fish/haul (Table 18). Age-0 walleye CPUE for shoreline seining was 1. Mean CPUE for other species captured during the seining survey was within ranges previously documented. Caution should be used when making inferences based on 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 18. 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, 2006-2010. Catches are for age-0 fishes except where noted. Asterisk (*) indicates both age-0 and adult fish included in CPUE.

Species	2006	2007	2008	2009	2010
Black crappie	0	0	0	0	2 (1.1)
Bluegill	0	0	0	0	0
Bluntnose minnow	2 (0.8)	3 (1.3)	4 (1.8)	1 (0.5)	9 (6.5)
Brassy minnow*	<1 (0.1)	0	0	<1 (0.2)	0
Channel catfish	<1 (0.3)	1 (1.1)	<1 (0.1)	<1 (0.1)	1 (0.7)
Common carp	<1 (0.1)	<1 (0.1)	<1 (0.1)	0	<0.5 (0.1)
Emerald shiner*	24 (8.4)	10 (4.6)	29 (7.6)	22 (7.6)	32 (13.2)
Freshwater drum	6 (2.1)	12 (6)	22 (8)	5 (2.4)	<0.5 (0.1)
Fathead minnow	0	0	0	0	8 (2.6)
Gizzard shad	351 (136)	176 (55)	1,620 (640)	493 (179)	594 (194.4)
Goldeye	0	0	7 (3.5)	0	1 (0.2)
Johnny darter*	<1 (0.5)	<1 (0.3)	<1 (0.5)	5 (3.0)	1 (0.4)
Largemouth bass	<1 (0.3)	<1 (0.1)	<1 (0.3)	<1 (0.1)	0
Red shiner	0	0	0	0	<0.5 (0.1)
River carpsucker	<1 (0.1)	3 (1.6)	16 (9)	<1 (0.2)	9 (7.8)
Sand shiner	0	0	0	0	1 (0.6)
Sauger	0	0	0	0	0
Smallmouth bass	4 (1)	3 (0.9)	8 (1.7)	4 (1.4)	12 (3.5)
Spottail shiner*	5 (2)	6 (1.9)	5 (1.2)	16 (10.5)	39 (23.1)
Walleye	<1 (0.2)	1 (0.5)	2 (0.6)	1 (0.3)	1 (0.4)
White bass	6 (2.7)	2 (0.6)	75 (51)	2 (0.8)	7 (2.6)
White crappie	2 (0.8)	2 (1)	<1 (0.1)	9 (3.9)	8 (5)
White sucker	0	<1 (0.1)	<1 (0.1)	<1 (0.3)	1 (0.4)
Yellow perch	14 (5.2)	19 (5.3)	10 (4.4)	25 (9.5)	49 (44.6)

LAFRAMBOISE AND HIPPLE LAKE BACKWATER PANFISH POPULATION ASSESSMENT

Field Observations of Water Quality and Aquatic Vegetation

No chemical observations were made at this time. Temperature loggers (Onset HOBO) were placed at the following locations: the fishing pier, near LaFramboise Causeway; slip 55, within the city's marina; the south shoreline of Hipple Lake on Farm Island, and the north shoreline of Hipple Lake. All temperature loggers were deployed in April 2010 and retrieval occurred in October. Temperature was recorded every hour for each temperature logger.

Both embayments have several species of emergent vegetation including curly leaf pondweed (*Potamogeton crispus*), Eurasian water milfoil (*Myriophyllum spicatum L.)*, fan leafed crowfoot (*Cabomba caroliniana*), American elodea (*Elodea canadensis*), sago pondweed (*Potamogeton spp.*), and possibly other species of submergent vegetation. Hipple Lake has more emergent

cattail (*Typha spp.*) and bulrush stands, but LaFramboise Bay has both species as well in locations.

Species Composition and Relative Abundance

White bass, black crappie, shortnose gar, and gizzard shad were the most abundance species sampled in Hipple Lake, while white bass, common carp and black crappie were the most abundant in LaFramboise. This survey is intended to target the panfish community; however, many of the centrarchids were sampled in low abundance. Lake Sharpe, especially Hipple Lake and LaFramboise Bay, provide a very diverse fishery with 20 species collected during this survey since its inception.

Table 19. Total catch of ten, overnight 1.9 cm bar mesh frame nets at Hipple Lake, Hughes County, South Dakota, during May, 2010. Mean Wr was calculated from stock length fish only.

Species	N	%	CPUE	SE	PSD	PSD-P	Mean *Wr*
Black crappie	67	19	6.7	9.5	94	38	96
Bluegill	23	6	2.3	4.6	52	4	111
Channel catfish	12	3	1.2	1.8	-	-	94
Common carp	29	8	2.9	4.6	100	52	82
Freshwater drum	2	1	0.2	0.4	-	-	87
Gizzard shad	35	10	3.5	7.7	100	0	85
Green sunfish	1	<0.5	0.1	0.2	-	-	81
River carpsucker	2	1	0.2	0.5	-	-	-
Sauger	1	<0.5	0.1	0.2	-	-	60
Shorthead redhorse	5	1	0.5	1.0	-	-	99
Shortnose gar	53	15	5.3	9.0	-	-	-
Smallmouth bass	19	5	1.9	3.2	95	58	91
Smallmouth buffalo	1	<0.5	0.1	0.2	-	-	80
Walleye	5	1	0.5	0.8	-	-	75
White bass	86	24	8.6	13.9	99	97	86
White crappie	19	5	1.9	3.9	100	95	106
White sucker	1	<0.5	0.1	0.2	-	-	82

Table 20. Total catch of ten, overnight 1.9 cm bar mesh frame nets at LaFramboise Bay, Hughes County, South Dakota, during May, 2010. Mean Wr was calculated from stock length fish only.

Species	N	%	CPUE	SE	PSD	PSD-P	Mean *Wr*
Black bullhead	6	2	0.6	0.9	-	-	91
Black crappie	40	13	4.0	5.9	88	13	103
Bluegill	3	1	0.3	0.7	-	-	109
Channel catfish	34	11	3.4	6.0	91	0	94
Common carp	51	16	5.1	7.7	98	29	87
Rainbow trout	1	<0.5	0.1	0.2	-	-	-
River carpsucker	19	6	1.9	2.9	-	-	88
Sauger	5	2	0.5	1.0	-	-	78
Shorthead redhorse	13	4	1.3	2.4	-	-	99
Shortnose gar	25	8	2.5	5.1	-	-	-
Smallmouth bass	5	2	0.5	0.9	-	-	100
Walleye	11	4	1.1	1.7	-	-	86
White bass	92	29	9.2	13.3	100	96	88
White crappie	1	<0.5	0.1	0.2	-	-	-
White sucker	5	2	0.5	0.9	-	-	95
Yellow perch	1	<0.5	0.1	0.2	-	-	-

Population Parameters for Bluegill

Bluegills were found in low abundance within Hipple Lake and LaFramboise Bay, Lake Sharpe. Bluegill CPUE was 2.3 and 0.3 fish/net-night, Hipple Lake and LaFramboise Bay, respectively (Table 19). The bluegill catch of 15 individuals during the 2009 sampling period was lower than the 2010 catch 26 fish with Hipple Lake and LaFramboise Bays combined (Figure 10). PSD values are not real reliable due to low catch rates (Anderson, 1996). Figure 10 illustrates the size distribution of the bluegill population at Hipple Lake and LaFramboise Bay, combined during 2009 and 2010. Age and growth analysis (Table 21) indicate a population with growth rates similar to statewide and regional means (Willis et al., 2001).

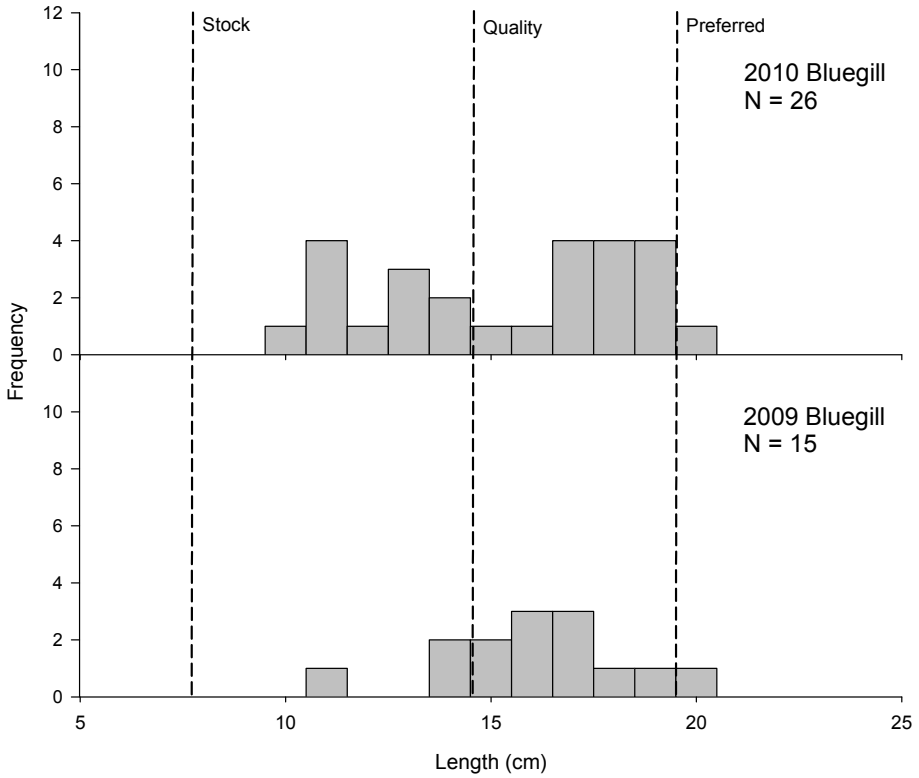


Figure 10. Length frequency, catch rate (CPUE), proportional size distribution (PSD), and proportional size distribution of preferred-length fish (PSD-P) for bluegill sampled in frame nets combined from Hipple Lake and LaFramboise Bay of Lake Sharpe, Hughes County, during 2009 and 2010.

Table 21. Average back-calculated lengths (mm) for each age class of bluegill sampled from Farm Island and LaFramboise Bay (combined), Lake Sharpe, Hughes County, 2010.

			Back-calculated Age						
Year Class	Age	N	1	2	3	4	5	6	7
2009	1	8	47						
2008	2	9	44	104					
2007	3	4	47	113	156				
2006	4	4	47	96	142	163			
Mean		**25**	**46**	**104**	**149**	**163**			
SE			1	5	7	0			
Statewide Mean			55	103	141	166			
Region II Mean			52	97	134	164			

Population Parameters for Black Crappie

Black crappies are low in abundance within Hipple Lake and LaFramboise Bay. The CPUE was slightly lower at LaFramboise Bay (4.0 fish/net-night) than at Hipple Lake (6.7 fish/net-night), The PSD-P was also higher at Farm Island (38) than at LaFramboise Bay (13; Table 2 and 3). Relative weight (*Wr)* values were 96 and 103, at at Hipple Lake and LaFramboise Bay respectively, indicting black crappie were in good condition (Table 2 and 3). A total of 107 black crappies were collected at both sites. Table 22 depicts the age and growth of black crappie in

Hipple Lake and LaFramboise Bay, combined. Black crappie found within Hipple Lake and LaFramboise Bay experienced similar growth rates when compared to statewide and regional means (Willis et al. 2001).

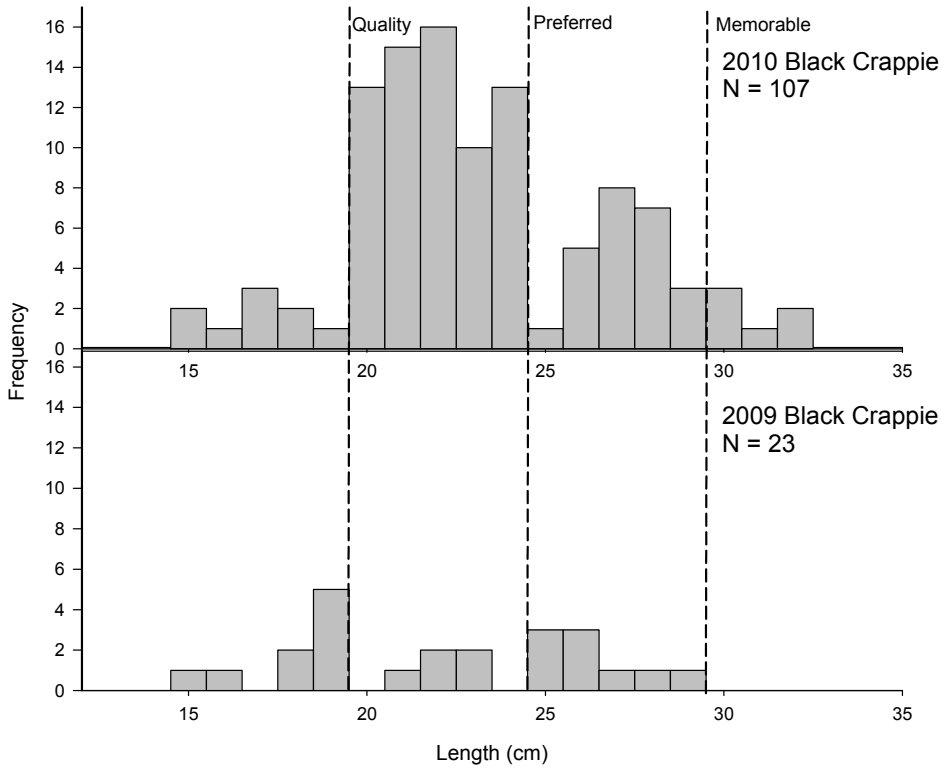


Figure 11. Length frequency, catch rate (CPUE), proportional size distribution (PSD), and proportional size distribution of preferred-length fish (PSD-P) for black crappie sampled in frame nets combined from Hipple Lake and LaFramboise Bay of Lake Sharpe, Hughes County, during 2009 and 2010.

Table 22. Average back-calculated lengths (mm) for each age class of black crappie sampled from Hipple Lake and LaFramboise Bay (combined), Lake Sharpe, Hughes County, 2010.

			Back-calculated Age						
Year Class	Age	N	1	2	3	4	5	6	7
2009	1	3	136						
2008	2	58	66	155					
2007	3	29	71	146	219				
2006	4	9	67	134	220	264			
2005	5	7	99	174	228	270	290		
Mean		**107**	**88**	**152**	**222**	**267**	**290**		
SE			14	9	3	3	0		
Statewide Mean			83	147	195	229	249		
Region II Mean			75	132	177	209	235		

Population Parameters for White Crappie

White crappie exhibited a very low CPUE within Hipple Lake (1.9 fish/net-night) and LaFramboise Bay (0.1 fish/net-night; Table 19 and Table 20). Relative weight (*Wr*) values were 100 at Hipple Lake (Table 19 and Table 20), indicting good condition. Figure 12 illustrates the length frequency of the white crappie catch during 2008 and 2009. A length frequency for 2010 was not updated due to a low sample size. Age and growth analysis (Table 23) depicts a young population with growth rates similar to the statewide mean (Willis et al. 2001).

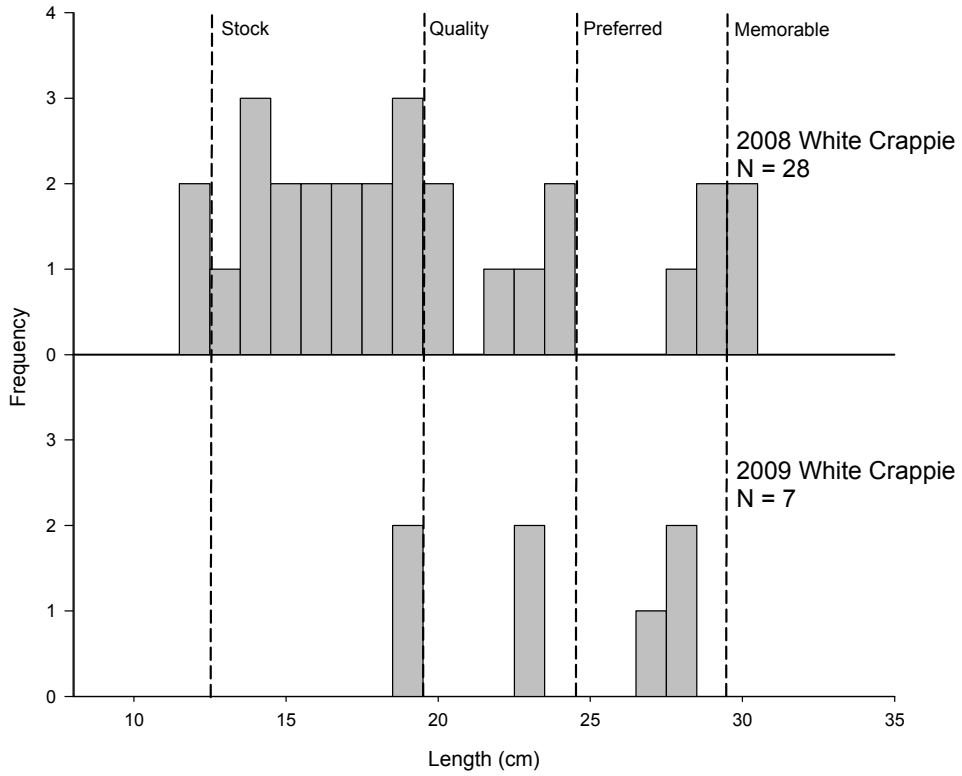


Figure 12. Length frequency, catch rate (CPUE), proportional size distribution (PSD), and proportional size distribution of preferred-length fish (PSD-P) for white crappie sampled in frame nets sets combined from Hipple Lake and LaFramboise Bay of Lake Sharpe, Hughes County, during 2009 and 2010.

Table 23. Average back-calculated lengths (mm) for each age class of white crappie sampled from Hipple Lake and LaFramboise Bay (combined), Lake Sharpe, Hughes County, 2010.

			Back-calculated Age						
Year Class	Age	N	1	2	3	4	5	6	7
2009	1	1	67						
2008	2	17	69	218					
2007	3	2	56	206	268				
Mean		**20**	**64**	**212**	**268**				
SE			4	6	0				
Statewide Mean			93	183	221	252	275		

Population Parameters for White Bass

White bass frame net CPUE was lower in 2010 than in 2009 at both locations with Hipple Lake (8.6. fish/net-night) slightly lower than LaFramboise Bay (9.2 fish/net-night; Table 19). PSD and PSD-P values for Hipple Lake (99 and 97, respectively) were high indicating a population with few individuals smaller than the preferred length category. LaFramboise Bay had a similar PSD and PSD-P of 100 and 96 respectively. Figure 13 illustrates the large average size of white bass during 2010. The 2010 catch rate of 8.6 fish/net-night (Hipple Lake and LaFramboise Bay combined) was higher than in 2009, when CPUE was 9.2 fish/net-night (Figure 13). Relative weight (*Wr*) values were similar to each location at a value of 86 and 88 for Hipple Lake and LaFramboise Bay.

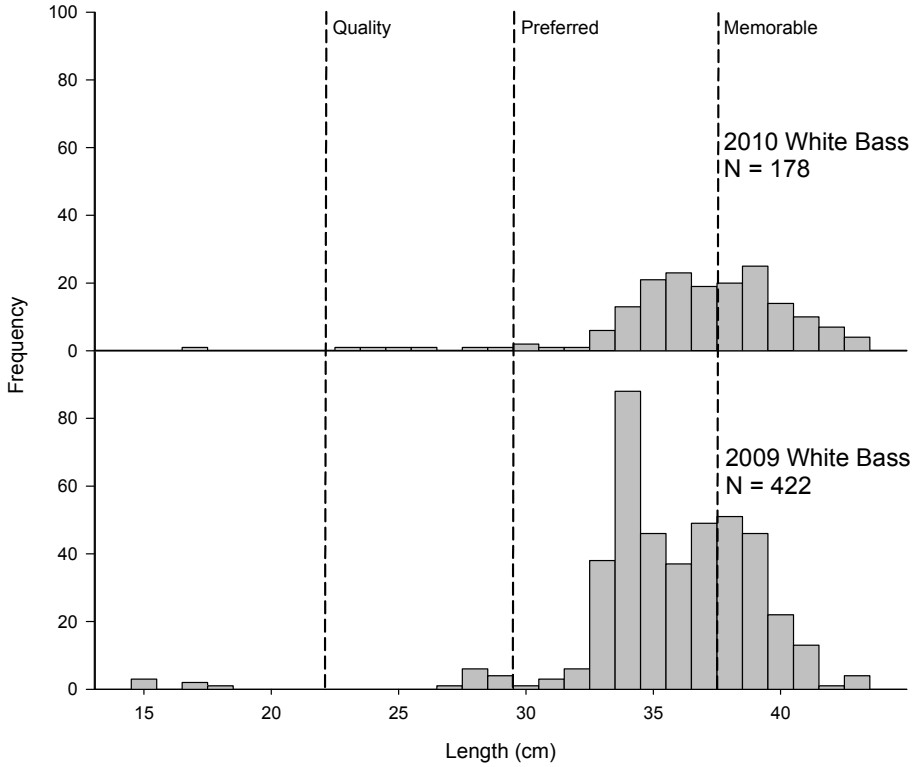


Figure 13. Length frequency, catch rate (CPUE), proportional size distribution (PSD), and proportional size distribution of preferred-length fish (PSD-P) for white bass sampled in frame nets sets combined from Hipple Lake and LaFramboise Bay of Lake Sharpe, Hughes County, during 2009 and 2010.

Table 24. Average back-calculated lengths (mm) for each age class of white bass sampled from Hipple Lake and LaFramboise Bay (combined), Lake Sharpe, Hughes County, 2010.

			Back-calculated Age									
Year Class	Age	N	1	2	3	4	5	6	7	8	9	10
2008	2	3	181	269								
2007	3	11	151	255	305							
2006	4	20	168	259	315	346						
2005	5	50	179	280	328	351	363					
2004	6	24	166	273	323	353	371	384				
2003	7	46	175	270	319	348	369	383	392			
2002	8	22	176	280	324	347	371	386	397	406		
2001	9	2	160	263	321	342	375	397	412	421	426	
2000	10	1	168	277	319	354	373	385	397	403	412	415
Mean		**179**	**169**	**270**	**319**	**349**	**371**	**387**	**400**	**410**	**419**	**415**
SE			3	3	2	2	2	3	4	6	7	0
Statewide Mean			142	241	299	339	360					
Region II Mean			142	243	297	334	360					

Larval Gizzard Shad Assessment

Gizzard Shad Trawling

Peak gizzard shad densities have high annual variability in Lake Sharpe being as early as May 14, 2007 (zone 2) or as late as July 9, 2008 (zones 1 and 2). Shad densities in Lake Sharpe increased in 2010 but were similar to the five year average of 279 shad per 100 m^3 of water volume. In 2007, shad densities of 770 fish per m^3 were much higher than any of the other four years and certainly influenced the five year average. Gizzard shad densities are typically much higher in Hipple Lake when compared to the rest of Lake Sharpe. The highest peak density in Hipple Lake was recorded in 2010 at 5,900 fish per 100 m^3. Densities are thought to be much higher in Hipple Lake due to the shallow backwater areas warming much faster than the rest of the reservoir. However, in 2008 Hipple Lake shad densities were lower than the rest of Lake Sharpe (Table 26 and Table 27).

Table 25. Actual dates for periods sampled for larval trawling of Lake Sharpe, South Dakota for the years of 2006 to 2010.

Period	Actual sampling date
1	May 11 – 15
2	May 26 – 29
3	June 7 -11
4	June 22 – 25
5	July 6 – 9
6	July 19 – 23
7	August 3 – 6

Table 26. Average gizzard shad density per 100 m^3 sampled during May to August, 2006 to 2010 for Lake Sharpe, South Dakota. Sampled during 6 or 7 periods. Sample size (N) and standard deviations (in parentheses) are shown.

Zone	Period	2010 Density	N	2009 Density	N	2008 Density	N	2007 Density	N	2006 Density	N
2	1	0.26 *(0.63)*	6	0.00 *(0.00)*	6	0.14 *(0.31)*	5	395.24 *(754.60)*	6	4.75 *(10.70)*	6
	2	0.00 *(0.00)*	6	40.50 *(91.49)*	6	0.00 *(0.00)*	7	226.90 *(391.75)*	7	51.35 *(82.83)*	6
	3	1,971.93 *(3,080.10)*	6	658.47 *(1,017.93)*	6	1.90 *(4.38)*	6	82.65 *(135.76)*	7	1,527.37 *(2,975.50)*	7
	4	22.94 *(32.80)*	6	475.64 *(629.78)*	6	83.41 *(161.13)*	9	49.50 *(83.12)*	8	139.32 *(156.25)*	5
	5	19.27 *(43.80)*	6	18.83 *(45.07)*	6	700.91 *(1,437.60)*	6	3.49 *(5.09)*	6	31.81 *(81.34)*	7
	6	5.86 *(11.42)*	6	30.78 *(32.89)*	6	11.32 *(21.37)*	6	5.97 *(9.08)*	6	10.63 *(15.59)*	4
	7	---	0	41.33 *(101.24)*	6	9.44 *(19.07)*	8	5.32 *(9.87)*	8	0.00 *(0.00)*	4
	Peak	1,971.93 *(3,080.10)*		658.47 *(1,017.93)*		700.91 *(1,437.60)*		395.24 *(754.60)*		1,527.37 *(2,975.50)*	
	Date	June 7		June 8		July 9		May 14		June 11	
3	1	0.88 *(1.33)*	6	0.00 *(0.00)*	6	0.00 *(0.00)*	8	29.48 *(69.96)*	6	0.00 *(0.00)*	6
	2	0.93 *(1.37)*	6	0.00 *(0.00)*	6	0.00 *(0.00)*	5	770.39 *(1,058.20)*	6	3.14 *(3.94)*	6
	3	4.65 *(3.91)*	6	126.44 *(287.70)*	6	2.27 *(4.49)*	6	69.68 *(101.51)*	6	6.84 *(3.83)*	6
	4	283.12 *(417.53)*	6	97.56 *(163.42)*	6	7.10 *(12.06)*	6	28.37 *(37.00)*	6	0.64 *(0.88)*	5
	5	176.83 *(278.63)*	6	52.00 *(64.98)*	6	208.62 *(243.75)*	6	30.10 *(49.56)*	6	5.75 *(10.30)*	6
	6	4.04 *(5.33)*	6	30.88 *(48.78)*	6	45.49 *(39.07)*	6	1.85 *(0.84)*	6	0.03 *(0.09)*	8
	7	---	0	6.50 *(11.30)*	6	5.10 *(6.17)*	5	0.47 *(0.76)*	5	0.00 *(0.00)*	6
	Peak	283.12 *(417.53)*		126.44 *(287.70)*		208.62 *(243.75)*		770.39 *(1,058.20)*		6.84 *(3.83)*	
	Date	June 22		June 8		July 9		May 27		June 11	

Table 27. The Hipple Lake portion only of Lake Sharpe, South Dakota gizzard shad density per 100 m^3 during May to August, 2006 – 2010. Sampled during 6 or 7 periods. Sample size (N) and standard deviations (in parentheses) are shown.

	2010		2009		2008		2007		2006	
Period	**Density**	**N**	**Density**	**N**	**Density**	**N**	**Density**	**N**	**Density**	**N**
1	0.52 *(0.90)*	3	0.00 *(0.00)*	2	0.23 *(0.40)*	3	790.48 *(977.20)*	3	0.14 *(0.20)*	2
2	0.00 *(0.00)*	3	81.00 *(126.51)*	3	0.00 *(0.00)*	2	666.70 *(612.21)*	2	154.06 *(51.59)*	2
3	5,914.00 *(902.95)*	2	1,969.70 *(151.36)*	2	0.16 *(NA)*	1	270.12 *(108.45)*	2	5,344.63 *(3,510.22)*	2
4	83.22 *(--)*	1	950.91 *(560.27)*	3	15.69 *(26.49)*	3	156.53 *(130.75)*	2	232.20 *(128.35)*	3
5	56.51 *(73.70)*	2	55.41 *(78.36)*	2	5.18 *(0.71)*	2	8.71 *(6.42)*	2	74.22 *(122.99)*	3
6	28.95 *(---)*	1	60.75 *(2.92)*	3	0.10 *(0.18)*	3	11.88 *(10.07)*	3	21.25 *(16.65)*	2
7	---	0	82.66 *(143.18)*	3	0.00 *(0.00)*	2	20.58 *(7.76)*	2	0.00 *(0.00)*	2
Peak	5,914.00 *(902.95)*		1,969.70 *(151.36)*		15.69 *(26.49)*		790.48 *(977.20)*		5,344.63 *(3,510.22)*	
Date	June 7		June 8		June 25		May 14		June 11	

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Angler Use

A total of 1,415 angling parties were interviewed during the April-September 2010 daylight angler use and harvest survey. Estimated fishing pressure for the April-September 2010 daylight period, at 387,037angler-h, was the second highest recorded in the last ten years (Table 28). Estimated angler days spent on Lake Sharpe during the 2010 survey period was 107,810 days, exceeding the reservoir-wide objective of 100,000 angler days (SDGFP 1994).

Table 28. 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 days	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	116,476	91,029	Johnson et al. (2002)
2002	385,357	90,459	196,600	141,612	Lott et al. (2003)
2003	397,220	99,305	140,796	105,275	Lott et al. (2004)
2004	309,663	87,475	108,869	60,375	Lott et al. (2006)
2005	271,331	75,370	110,500	56,535	Lott et al.(2007)
2006	342,974	99,702	142,209	110,443	Potter and Lott (2007)
2007	335,017	89,100	137,616	111,174	Potter et al. (2008)
2008	316,726	95,113	125,353	92,545	Adams et al. (2009)
2009	404,094	126,279	208,412	154,229	Longhenry et al. (2010)
2010	387,037	107,810	185,399	140,859	This Report

* June 1973 through May 1974

The majority (61%) of the angling pressure on Lake Sharpe occurred in the lower zone in 2010 at 236,971angler hours (Table 29). Estimated angling pressure by reservoir zone on Lake Sharpe is often highest in lower Lake Sharpe (Table 29; Johnson and Lott 2001; Johnson et al. 2002; Lott et al. 2003). The middle zone receives the least pressure of any zone on Lake Sharpe. Peak fishing pressure for Lake Sharpe typically occurs in May and June (Johnson and Lott 2001; Lott et al. 2003, 2006b, 2007). This again occurred in 2010 with over 50% of the total angling pressure occurring during May and June.

Table 29. Estimated fishing pressure (angler hours), by month and zone, with 80% confidence intervals (CI), for the April-September 2010 daylight period on Lake Sharpe, South Dakota.

Zone	Month						
	April	May	June	July	August	Sept.	Total
Lower	9,704	41,189	89,378	57,738	28,333	10,629	236,971
80% CI	3,900	9,511	16,087	12,750	5,543	2,822	17,929
Middle	1,514	7,424	3,588	3,276	2,415	1,715	19,931
80% CI	713	2,897	1,014	1,211	790	721	3,541
Upper	11,538	37,266	36,498	14,268	7,445	23,118	130,134
80% CI	2,552	11,022	10,622	2,753	2,562	8,155	23,785
Total	22,757	85,879	129,464	75,282	38,193	35,461	387,037
80% CI	4,715	14,843	19,304	13,100	6,157	8,660	29,995

Table 30. 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, 1999-2010.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	h	h/ha	h	h/ha	h	h/ha
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
2008	173,956	9.4	25,671	6.0	117,099	127.5	316,726	13.4
2009	232,351	12.6	28,514	6.7	143,228	156.0	404,094	17.1
2010	236,971	12.8	19,931	4.7	130,134	141.8	387,037	16.4

Table 31. 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, 2006-2010.

Type of fishing	Year				
	2006	2007	2008	2009	2010
Boat (h)	287,893	293,190	261,082	337,989	343,966
80% CI	35,044	50,757	24,150	30,642	28,985
H/ha	12.2	12.4	11.0	14.3	14.5
Shore (h)	55,082	41,827	55,644	66,104	43,071
80% CI	6,577	7,430	9,093	10,224	5,482
H/ha	2.3	1.8	2.4	2.8	1.8

Catch, Harvest and Release Estimates

An estimated 185,399 fish were harvested from Lake Sharpe during the April-September daylight period (Table 32). Estimated harvest of walleye during the 2010 survey period was 140,859 fish, meeting and surpassing the Lake Sharpe strategic plan objective of at least 100,000 fish (SDGFP 1994). The most walleye harvested in any month during 2010 was in June when 46,537 were harvested. White bass, channel catfish, smallmouth bass, and sauger followed walleye, in terms of estimated total harvest in 2010. 7,828 smallmouth bass were harvested in 2010 down from 2009 in which we estimated a total harvested of 12,245.

Table 32. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the April-September 2010 daylight period on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	8,443	34,713	46,537	30,465	12,874	7,826	140,859
80% CI	2,240	8,697	7,932	7,979	3,777	2,753	15,135
Sauger	437	573	1,019	413	0	106	2,547
80% CI	170	268	633	385	0	135	817
Channel catfish	1,390	2,544	3,614	1,605	271	620	10,044
80% CI	632	1,092	1,660	1,580	156	325	2,640
White bass	286	6,432	7,349	36	384	290	14,778
80% CI	234	2,808	4,709	32	208	176	5,494
Smallmouth bass	198	1,891	3,925	1,038	427	349	7,828
80% CI	238	652	1,186	524	120	232	1,493
Rainbow trout	1,090	0	0	0	0	107	1,196
80% CI	881	0	0	0	0	122	694
Yellow perch	153	73	326	0	0	70	470
80% CI	113	75	516	0	0	105	415
Other*	303	2,546	2,398	892	734	652	7,677
Total	12,300	48,772	65,168	34,449	14,690	10,020	185,399
80% CI	3,359	10,095	11,520	8,713	3,996	3,023	18,626

*Other includes black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, lake herring, largemouth bass, northern pike, and white crappie.

An estimated 305,520 fish were released during the April-September 2010 daytime period on Lake Sharpe (Table 33). Estimated number of walleye released (Table 33) and fishing pressure (Table 29) was highest during May and June when the 381-mm minimum length limit was in effect. An estimated 89,889 smallmouth bass were released during 2010 with nearly 53% of those released during June (Table 33).

Table 33. Estimated number of fish released, by species and month, for the April-September 2010 daylight period, on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	7,400	34,007	69,774	17,885	5,124	8,095	142,285
80% CI	2,569	11,940	14,956	7,148	2,021	1,936	20,779
Sauger	40	384	3,350	54	343	72	4,244
80% CI	49	275	2,500	61	505	105	2,569
Channel catfish	335	384	2,477	578	1,557	487	5,818
80% CI	215	325	1,122	284	1,219	235	1,741
White bass	657	8,855	15,987	760	262	5,690	32,212
80% CI	486	3,220	5,794	331	134	7,969	10,383
Smallmouth bass	2,595	19,974	47,430	9,682	6,198	4,012	89,889
80% CI	3,030	5,502	12,249	2,961	1,777	1,724	14,297
Rainbow trout	412	35	166	18	26	35	693
80% CI	402	46	115	25	37	57	427
Yellow perch	86	519	1,459	2,284	2,165	6,572	13,085
80% CI	61	176	701	946	782	5,951	6,120
Other*	657	3,369	3,959	3,425	4,551	1,334	17,295
Total	12,182	67,528	144,601	34,686	20,224	26,298	305,520
80% CI	3,256	16,605	27,006	9,682	5,122	11,666	35,661

*Other includes black bullhead, black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, river carpsucker, shovelnose sturgeon, and white crappie.

Examination of Table 32 and Table 33 provides a complete picture of catch of sport fish species for the April-September 2010 survey period. Walleye were the most abundant species in the angler catch during 2010, with an estimated catch of 283,144 fish. Walleye were followed by smallmouth bass, white bass, and channel catfish in decreasing order of estimated catch. Approximately 50% of walleye caught during 2010 were harvested, while percentages of fish harvested for smallmouth bass, white bass and channel catfish were 8%, 31% and 63%, respectively. The high percentage of smallmouth bass released was due, in part, to the 355-457-mm protected slot length limit that was implemented in 2008.

Estimated walleye harvest during the 2010 April-September standard survey period was highest in lower Lake Sharpe at 101,116 fish (72%) with an estimated 37,827 walleye (27%) harvested in upper Lake Sharpe (Table 34). 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 93% of the estimated smallmouth bass harvest for the reservoir coming from the lower zone in 2010.

Table 34. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the April-September 2010 daylight period, on Lake Sharpe, South Dakota.

Species	Zone			
	Upper	Middle	Lower	Total
Walleye	37,827	1,916	101,116	140,859
80% CI	7,673	359	13,041	15,135
Sauger	1,390	164	993	2,547
80% CI	674	112	448	817
Channel catfish	3,178	4,976	1,891	10,044
80% CI	1,531	2,044	669	2,640
White bass	10,442	4,028	307	14,778
80% CI	5,021	2,228	112	5,494
Smallmouth bass	366	153	7,310	7,828
80% CI	312	104	1,457	1,493
Rainbow trout	1,196	0	0	1,196
80% CI	890	0	0	890
Yellow perch	406	0	2,806	3,212
80% CI	278	0	723	774
Total*	57,287	12,980	115,132	185,399
80% CI	11,122	4,042	14,383	18,626

*Total includes all listed species plus black bullhead, black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, river carpsucker, shovelnose sturgeon, and white crappie.

Estimated number of walleye caught, harvested, and released during the standard April-September daylight survey period in 2010 were all similar to the 15 year average (Table 35). The percentage of walleye caught that were harvested was 50% in 2010. This percent of walleye harvested was higher than the previous three years (Table 35). The increase in percent harvested is likely due to the large 2005, 2006, and 2007 year classes reaching harvestable size.

Table 35. Estimated number of walleye caught, harvested, and released during the April-September daylight period for Lake Sharpe, South Dakota, 1994-2010.

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	332,904	91,029	241,874	27
2002	377,184	141,612	235,572	38
2003	528,520	105,275	423,244	20
2004	160,974	60,375	100,244	38
2005	98,794	56,535	42,259	57
2006	196,523	110,442	86,081	57
2007	340,733	111,174	229,560	33
2008	301,749	92,545	209,204	31
2009	478,729	154,230	324,500	32
2010	283,144	140,859	142,285	50
Mean	**329,795**	**123,750**	**206,020**	**40**

Length frequency histograms of walleye harvested each month during the April-September 2010 daylight period illustrate usual trends for Lake Sharpe (Figure 14). Approximately 96% of the walleye harvested during the months that the 381-mm minimum length limit was in effect were between 381and 508-mm in length (15 and 20 inches) with an additional one percent exceeding 508-mm in length. During July and August, when no minimum length limit was in effect, 64% of the walleyes harvested were between 381and 508-mm in length and 36% were less than 381mm during July and August (Figure 14).

Length frequency histograms for smallmouth bass measured in the angler harvest in 2010 are shown in Figure 15. For the April-September 2010 daylight survey period, approximately 79% of the smallmouth bass harvested were <355-mm in length and 13% were ≥457-mm in length. Approximately 8% of the smallmouth bass measured during angler interviews were within the protected slot length limit (Figure 15).

Hourly Catch, Harvest, and Release Rates

Estimated hourly catch and release rates for all species combined for the April-September 2010 daylight period were 1.27 fish/h and 0.79 fish/h, respectively (Table 36). The catch rate for walleye decreased from 1.18 fish/angler-h in 2009 to 0.73 fish/angler-h in 2010. The white bass catch rate has not returned to values found in the past (i.e., 0.31 in 2005, Lott et. al., 2007) likely due to the white bass die off that occurred during July 2005 (Lott et. al. 2007).

Table 36. Estimated hourly catch, harvest, and release rates, by species, for all anglers interviewed on Lake Sharpe, South Dakota, during the April-September 2010 daylight survey period. Trace (T) indicates values >0 but <0.005.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	0.73	0.36	0.37
Sauger	0.02	0.01	0.01
White bass	0.12	0.04	0.08
Smallmouth bass	0.25	0.02	0.23
Channel catfish	0.04	0.03	0.02
Rainbow trout	T	T	T
Yellow perch	0.04	0.01	0.03
Other*	0.07	0.01	0.05
Total	1.27	0.48	0.79

*Other includes black bullhead, black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, river carpsucker, shovelnose sturgeon, and white crappie.

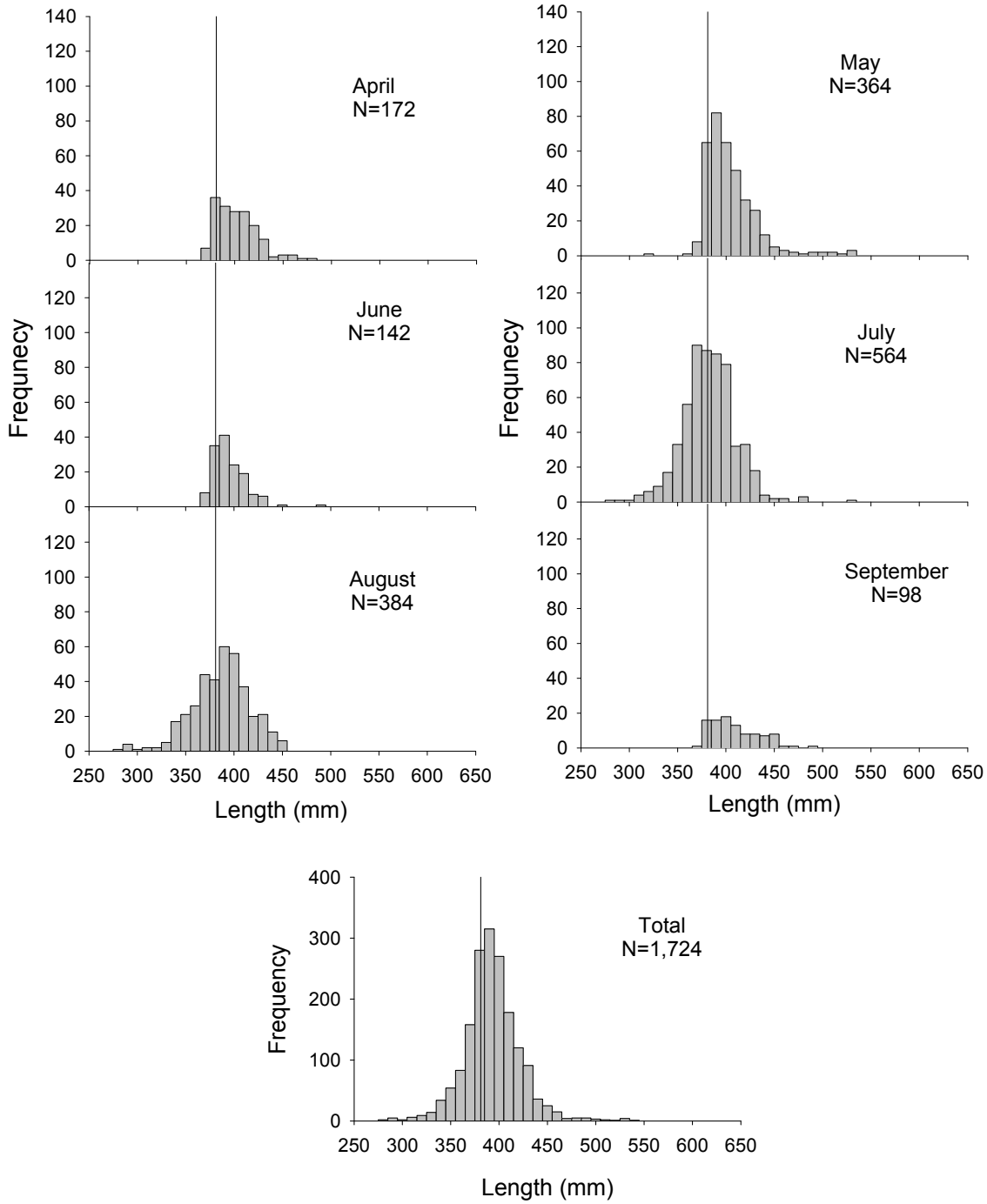


Figure 14. Length frequency distribution of walleye harvested by anglers, by month, fishing Lake Sharpe, South Dakota, during the April-September 2010 daylight period. Vertical line represents the 381 mm minimum length limit.

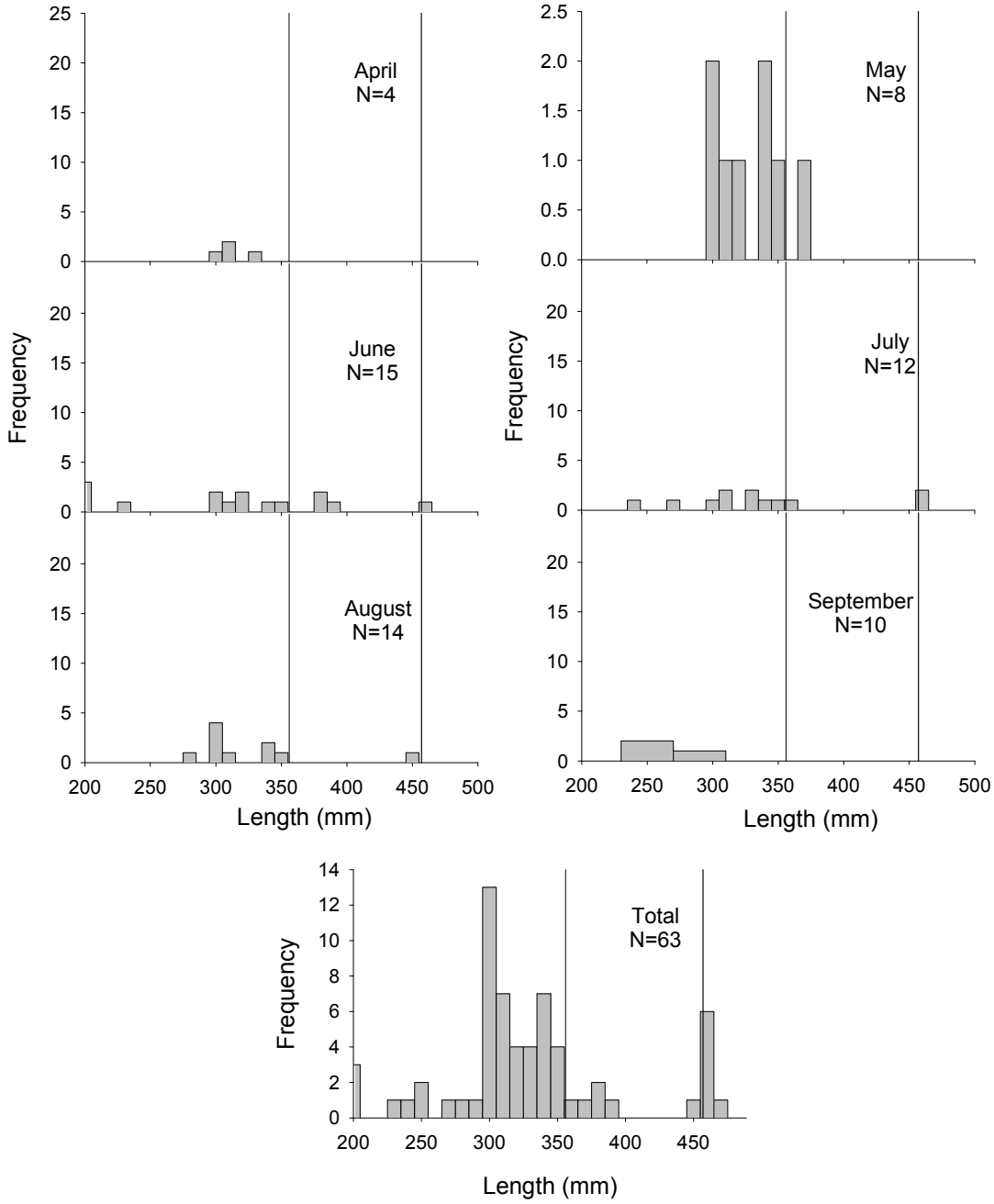


Figure 15. Length frequency distribution of smallmouth bass harvested by anglers fishing Lake Sharpe, South Dakota, by month, during the April-September 2010 daylight period. Vertical lines represent the 356 to 457 mm protected slot limit.

Anglers specifically targeting walleye had a mean hourly catch rate of 1.27 fish/angler-h for the April-September daylight period (Table 37), while the mean catch rate of walleye by all anglers was 0.73 fish/angler-h (Table 36). Anglers specifically targeting smallmouth bass, white bass, and channel catfish had mean hourly catch rates of 2.98, 1.34, and 1.00 fish/angler-h respectively. The catch rate for anglers fishing specifically for white bass remained significantly lower in 2010 than years prior to the die-off (5.82 fish/angler-h in 2005, 9.53 fish/angler-h in 2004 in Lott et al. 2007).

Table 37. 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 2010 daylight period.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	1.27	0.69	0.57
White bass	1.34	0.90	0.44
Smallmouth bass	2.98	0.16	2.82
Channel catfish	1.00	0.86	0.14
Rainbow trout	2.00	1.80	0.20

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 2010, are presented in Table 38. The high hourly catch rate for walleye in 2003 was likely related to a high abundance of age-3 fish (2000 year class) and lower than average gizzard shad production. Low hourly catch rates for walleye from 2004 to 2006 were likely related to higher shad production, a decrease in walleye abundance (Figure 5), and an increase in mean age of fish in the walleye population (Table 9). During 2010, the hourly catch rate of walleye in Lake Sharpe was 0.73 fish/angler-h, well above 0.3 fish/angler-h, a level indicative of an excellent walleye fishery according to Colby et al. (1979).

Catch rates were relatively similar for smallmouth bass, channel catfish, and white bass during the 1993-2010 periods (Table 38). 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 information 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 were highest during June in 2010, while harvest rates were highest during May and July (Table 39). The 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 38. 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, 1993-2010.

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	1.11	0.13	0.06	0.05	1.40
2002	0.98	0.13	0.22	0.05	1.45
2003	1.33	0.20	0.23	0.05	1.89
2004	0.52	0.19	0.27	0.08	1.13
2005	0.36	0.10	0.31	0.06	0.88
2006	0.57	0.31	0.08	0.05	1.14
2007	1.02	0.60	0.09	0.04	1.85
2008	0.95	0.42	0.06	0.04	1.53
2009	1.18	0.32	0.12	0.03	1.75
2010	0.73	0.25	0.12	0.04	1.27

Table 39. Estimated hourly catch, harvest, and release rates, (fish/angler-h), for walleye and all species combined, by month, for the April-September 2010 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	0.70	0.37	0.33	1.08	0.54	0.54
May	0.80	0.40	0.40	1.35	0.57	0.79
June	0.90	0.36	0.54	1.62	0.50	1.12
July	0.64	0.40	0.24	0.92	0.46	0.46
August	0.47	0.34	0.13	0.91	0.38	0.53
September	0.45	0.22	0.23	1.02	0.28	0.74
Total	0.73	0.36	0.37	1.27	0.48	0.79

The percentage of angling parties catching and harvesting a specified number of walleye in 2010 was similar to 2009 (Table 40). During 2010, a lower percentage of parties caught and harvested walleye while fishing the lower zone than in 2009. In 2010, 17% of parties caught no walleye in the lower zone compared to 80% and 59% for the middle and upper zones, respectively. During 2010, 21% of the angling parties harvested a limit (four fish) in the lower zone, compared to 0% and 7% in the middle and upper zones, respectively. For the entire reservoir and survey period, 13% of parties fishing Lake Sharpe harvested a limit of walleye (Table 40).

Table 40. 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 2009 and 2010 daylight survey periods.

Number /trip	Catch per trip							
	2009				2010			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	13	82	60	43	17	80	59	41
0.0-0.9	7	9	7	7	12	9	8	10
1.0-1.9	9	6	9	9	15	8	10	12
2.0-2.9	8	2	3	5	12	1	7	8
3.0-3.9	7	0	4	5	10	2	3	6
4.0-4.9	6	1	3	4	11	1	4	7
5.0-5.9	7	0	2	4	6	0	3	4
6.0-6.9	6	0	3	4	5	0	2	3
7.0-7.9	6	0	2	3	3	0	1	2
8.0-8.9	5	0	2	3	2	0	1	1
9.0-9.9	3	0	1	2	2	0	1	1
≥10	22	0	3	11	6	0	2	4

Number /trip	Harvest per trip							
	2009				2010			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	23	89	68	52	28	86	66	50
0.0-0.9	11	5	16	8	11	9	7	9
1.0-1.9	17	5	30	13	16	4	10	12
2.0-2.9	13	< 0.5	14	8	13	1	7	9
3.0-3.9	9	1	11	6	11	1	3	6
4	26	0	21	14	21	0	7	13

Smallmouth bass catch and harvest per trip for angling parties fishing the lower zone of Lake Sharpe, from 2006 through 2010, are presented in Table 41 and serve as a tool for evaluating effects of the 355-457-mm protected slot length limit implemented in 2008. During the 2003 to 2005 period, the percentage of angling parties that caught no smallmouth bass ranged from 39%

to 52%, while in the 2006 to 2010 period, the range increased from 28% to 43%. For the 2004-2007 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). The regulation modification in 2008 allowed for more smallmouth bass harvest, which was reflected in the percentage of angling parties harvesting smallmouth bass increasing over 10% from the previous year. However, overall harvest was down again in 2010 so the regulation change still needs to be monitored.

Table 41. 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, 2006-2010.

Number /trip	Catch per trip					Harvest per trip				
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
0	28	23	24	32	43	84	87	77	79	87
0.1-0.9	28	11	19	20	21	12	7	11	11	9
1.0-1.9	14	14	14	15	14	3	4	7	6	3
2.0-2.9	5	8	8	8	8	0	1	3	3	<0.5
3.0-3.9	5	7	7	3	4	1	1	1	<0.5	<0.5
4.0-4.9	4	3	4	3	2	0	0	1	<0.5	0
5.0-5.9	2	6	4	3	2	0	0	<0.5	0	<0.5
6.0-6.9	4	4	3	4	2	**Daily limit of 5**				
7.0-7.9	3	3	4	3	1					
8.0-8.9	1	2	1	1	1					
9.0-9.9	1	1	1	1	0					
≥10	5	18	11	6	2					

Angler Demographics and Economic Impacts

For the April-September 2010 daylight period, Lake Sharpe anglers contributed approximately 8.5 million dollars to local economies, based on an estimated 107,810 trips (Table 24) 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 3.6 h, during the April-September 2010 period. Residents comprised 81% of angling parties interviewed on Lake Sharpe during the April-September 2010 daytime survey period, a value within the range from previous years (Table 42). The percentage of resident anglers is generally lowest in lower Lake Sharpe and highest in middle Lake Sharpe. 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 2010 were from the states of Nebraska, Minnesota, and Iowa. Patterns in angler state of residency in 2010 remained similar to other years from 2006-2010 (Table 43). During 2010, residents of 23 states, other than South Dakota, and two other countries were interviewed while fishing Lake Sharpe.

Table 42. Percentage of total angler contacts for resident and non-resident (states combined) anglers fishing Lake Sharpe during the April-September daylight period, 2006-2010. N is the number of parties interviewed.

Zone		Year				
		2006	2007	2008	2009	2010
Lower	**N**	413	559	233	703	707
	Residents (%)	73	70	78	76	74
	Non-residents (%)	27	30	22	24	26
Middle	**N**	278	189	176	233	171
	Residents (%)	92	90	90	91	90
	Non-residents (%)	8	10	10	9	10
Upper	**N**	668	545	572	676	537
	Residents (%)	89	90	89	89	88
	Non-residents (%)	11	10	11	11	12
Total	**N**	1,151	1,293	1,281	1,612	1,415
	Residents (%)	85	81	85	84	81
	Non-residents (%)	15	19	15	16	19

Table 43. 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, 2006-2010.

State	Percent by Year				
	2006	2007	2008	2009	2010
Iowa	22	19	23	24	25
Nebraska	34	27	25	20	31
Colorado	4	7	6	6	4
Minnesota	19	22	19	25	17
Wisconsin	2	1	4	2	1
Wyoming	2	2	6	4	3
Other*	17	22	16	19	19

*Other includes Alaska, Arizona, Florida, Georgia, Illinois, Kansas, Maryland, Michigan, Mississippi, Missouri, New York, North Dakota, Oklahoma, Pennsylvania, South Carolina, Texas, and Virginia, Washington, and four parties from other countries.

County of residence of South Dakota resident anglers fishing Lake Sharpe during the April-September 2010 survey period are presented in Figure 16 and Table 44. Approximately half of resident angling parties interviewed on Lake Sharpe during the 2010 survey were local anglers from Hughes and Stanley counties (Figure 16). Minnehaha (Sioux Falls) and Pennington (Rapid City) county residents made up 10% and 4.7% of the interviewed angling parties, respectively. The percentage of angler interviews from residents of Beadle, Brookings, Davison, Hand, and Lyman remained within ranges seen in past years (Table 44).

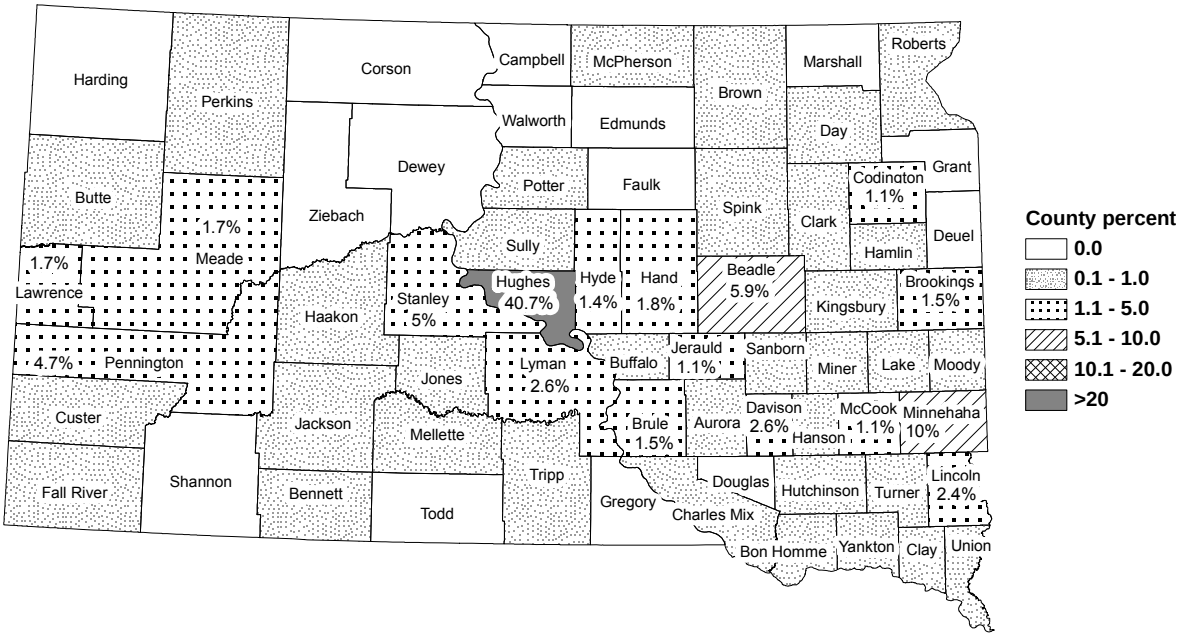


Figure 16. Percentage of resident angler contacts on Lake Sharpe, by county, during the April-September 2010 daylight survey period.

Table 44. Percentage of resident 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, 2006-2010.

County	Major City	Percent by year				
		2006	2007	2008	2009	2010
Beadle	**Huron**	4	6	4	6	6
Brookings	**Brookings**	1	1	1	1	1
Davison	**Mitchell**	1	2	3	2	3
Hand	**Miller**	2	2	2	2	2
Hughes	**Pierre**	52	45	48	45	41
Lyman	**Presho, Kennebec**	2	3	2	2	3
Minnehaha	**Sioux Falls**	5	7	10	8	10
Pennington	**Rapid City**	6	7	6	6	5
Stanley	**Fort Pierre**	7	7	4	5	5

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 2010, while anglers from Minnehaha, Pennington and Beadle counties comprised the majority of anglers traveling 100-199 miles to fish Lake Sharpe (Table 45). Walleye remain the primary targeted species in Lake Sharpe (Table 46). With Lake Sharpe located some distance from a large population base; travel is required for many anglers fishing Lake Sharpe. The percentage of interviewed anglers traveling in excess of 200 miles, one way, to fish Lake Sharpe in 2010 was similar previous years. Higher travel costs in 2010 did not appear to inhibit anglers traveling to Lake Sharpe.

Table 45. Percentage of anglers driving the specified distances, one way, to fish Lake Sharpe, South Dakota, during the April-September daylight survey period, 2006-2010.

Distance (miles)	Percent by year				
	2006	2007	2008	2009	2010
<25	47	38	38	36	32
25-49	6	12	6	9	9
50-99	8	11	13	9	8
100-199	15	18	18	17	21
≥200	24	21	26	29	30

Table 46. Target species of anglers fishing Lake Sharpe, South Dakota, during the April-September daylight survey period, expressed as percent of total, 2006 - 2010.

Target species	Percent by year				
	2006	2007	2008	2009	2010
Walleye	58	57	60	58	72
Anything	33	32	32	33	19
Rainbow trout	2	1	<0.5	1	1
White bass	1	2	1	2	2
Smallmouth bass	2	6	4	2	2
Other*	4	2	2	4	4

*Other includes black crappie, channel catfish, 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 2010 period was "moderately satisfied" (median of 2, Table 47). The median satisfaction rating of "moderately satisfied" for 2010 was the same as 2006 and 2007 (Potter and Lott 2007). Approximately 81% of angling parties interviewed in 2010 indicated some degree of satisfaction, a value above the Lake Sharpe Strategic Plan objective of 70%. Neutral and dissatisfied anglers comprised 11% and 8% of angler interviews, respectively. In 2010, median trip satisfaction was "very satisfied" the second year in a row (Table 48). Gigliotti (2004) documented other factors besides the number of walleye harvested must influence trip satisfaction, which supported by the data from this study where 73% of anglers harvesting zero walleye during their trip expressed some degree of satisfaction with their trip (Table 48).

Table 47. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2010 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral or no opinion, 5 = slightly dissatisfied, 6 = moderately dissatisfied, and 7 = very dissatisfied. N is sample size.

Month	Satisfaction rating								
	Satisfied			Neutral/ N.O.	Dissatisfied				
	1	2	3	4	5	6	7	N	Median
April	30	29	14	13	10	1	2	214	2
May	48	33	8	6	1	1	2	347	2
June	45	29	14	4	1	2	4	203	2
July	34	31	16	9	4	1	5	294	2
August	26	32	20	5	6	6	6	177	2
September	26	34	12	13	4	7	4	179	2
Total	516	442	192	114	59	39	52	1,414	2
Percent		81		11		8			

Table 48. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2010 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per trip. 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral/no opinion (N.O.), 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied. N is sample size.

Walleye/ angler	Satisfaction rating							N	Median
	Satisfied			Neutral/ N.O.	Dissatisfied				
	1	2	3	4	5	6	7		
0	**196**	**212**	**102**	**82**	**48**	**25**	**35**	**700**	2
0-0.9	**30**	**45**	**28**	**8**	**3**	**8**	**10**	**132**	2
1.0-1.9	**50**	**60**	**35**	**14**	**4**	**5**	**5**	**173**	2
2.0-2.9	**49**	**53**	**17**	**9**	**3**	**0**	**0**	**131**	2
3.0-3.9	**57**	**25**	**3**	**1**	**1**	**1**	**2**	**90**	2
4	**133**	**46**	**7**	**0**	**0**	**0**	**0**	**186**	1

Beginning in 2003, a 305-457-mm protected slot with a one over 457-mm regulation was placed in effect for smallmouth bass on Lake Sharpe. In 2008, the regulation was altered to a 355-457-mm protected slot with a one over 457-mm. Anglers were asked if they were in favor of the current regulation for smallmouth bass. For the lake-wide results, the largest percentage (39% for total sample) indicated they were in favor of the regulation, but a large portion expressed no opinion (29% for total sample; Table 49). When the "no opinion" answers are removed from the sample, 54% were in favor of the current smallmouth bass regulation. By reservoir zone, the lower zone had the lowest percentage of approval at 47% (Table 49).

Table 49. Responses and percentages of Lake Sharpe anglers who were asked the following question during the April-September 2010 daylight survey period: "Are you in favor of the current smallmouth bass regulation of a 14- to 18-inch protected slot, which requires all smallmouth bass between 14 and 18 inches to be released?" N is the number of responses.

	Zone	Yes	N	No	N	No opinion	N
With No Opinion Responses	Upper	47	95	26	52	27	54
	Middle	37	19	25	13	37	19
	Lower	34	108	38	121	29	92
	Total	39	222	32	186	29	165
Without No Opinion Responses	Upper	65	95	35	52	Removed from sample	
	Middle	59	19	41	13		
	Lower	47	108	53	121		
	Total	54	222	46	186		

FISHERY STATUS AND 2010 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 2010. In 2010, the estimated harvest rate was 0.48 fish/angler-h, for all species combined, with an overall satisfaction rating of 81%, and 107,810 angler days of estimated fishing pressure. Walleye-specific objectives of 100,000 walleye harvested with a harvest rate of 0.3 walleye/angler hour were also met in 2010, with an estimated 140,859 walleyes harvested and a harvest rate of 0.36 walleye/angler-h.

High recruitment of the 2005 through 2009 walleye year classes into the population will help provide a walleye fishery for the future, especially with low recruitment of the 2001-2004 year classes. Natural production appeared to be good in 2010 and there is currently a large abundance of small fish in the population. Growth of walleye should be monitored closely during upcoming years as several consecutive years of above average walleye reproduction could lead to slowed growth. Walleye growth rates have remained adequate due to sufficient prey availability, as shown by seining data from 2010. With quality year classes from 2005 through 2008, walleye fishing should be good in 2010 as fish continue to grow past the 15 inch minimum size limit.

Smallmouth bass nighttime electrofishing was discontinued in 2009 due to the consistent underestimation of size structure. The primary smallmouth bass capture method will be with short term monofilament gill net sets near West Bend. Size structure indices have increased from 2005 through 2010 for smallmouth bass, while growth and condition has remained the same.

Harvest of smallmouth bass in 2010 was lower than in 2009 and was similar to the five years when the 12 to 18 inch protected slot was in effect. Harvest of smallmouth bass is needed for this regulation to continue to modify the size structure within Lake Sharpe. The population did exhibit some increases in size structure as measured by stock density indices, however, maximum total length has remained unchanged. Angler acceptance of this regulation has dropped from 71% in 2008 to 54% in 2010.

MANAGEMENT RECOMMENDATIONS

- Continue to conduct annual angler use and harvest surveys for the April-September daylight period with the use of a bus-route design.

- Continue to conduct annual fish population surveys including West Bend monofilament gillnetting, larval trawling, shoreline seining, August gillnetting, and fall walleye electrofishing.

- Monitor effects of several consecutive year classes of above average walleye reproduction.

- Continue to investigate smallmouth bass regulations on Lake Sharpe and determine angler acceptance of these regulations.

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

- Resurvey Hipple Lake and LaFramboise Bay every year to further monitor the fish populations and to continually collect trend data on these important backwater areas of Lake Sharpe.

- Monitor the aquatic vegetation and track any major changes in species diversity and exotics.

- Update the Lake Sharpe Fisheries Management Plan by December 2011.

LITERATURE CITED

Adams, G., K. Edwards, R. Hanten and K. Potter. 2008. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2007. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 08-07, Pierre.

Anderson, R.O. 1980. Proportional stock density (PSD) and relative weight (W_r): interpretive indices for fish populations and communities. Pages 27-33 in S. Gloss and B. Shupp, editors. Practical fisheries management: more with less in the 1980's. New York Chapter American Fisheries Society, Ithaca.

Anderson, R.O., and R. E. Neumann. 1996. Length, Weight, and Structural Indices. Pages 447-482 in B. R. Murphy, and D. W. Willis, editors. Fisheries Techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Benson, N.G. 1968. Review of fishery studies on Missouri River mainstem reservoirs, United States Fish and Wildlife Service. Research Report 71, Washington, D.C.

Brown, M.L., and B.R. Murphy. 1991. Standard weights (W_s) for striped bass, white bass and hybrid striped bass. North American Journal of Fisheries Management 11:451-467.

Brown, M.L., F. Jaramillo, Jr., D.M.Gatlim III, and B.R. Murphy. 1995. A revised standard weights (*Ws*) equation for channel catfish. Journal of Freshwater Ecology 10:295-302.

Colby, P.J., R.E. McNicol, and R.A. Ryder. 1979. Synopsis of biological data on the walleye. Food and Agriculture Organization, Fisheries Synopsis Number 119.

DeVries, D.J. and R.V. Frie. 1996. Determination of age and growth. Pages 483-512 in B.R. Murphy and D.W. Willis, editors. Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland.

Elrod, J.H. 1974. Abundance, growth, survival, and maturation of channel catfish in Lake Sharpe, South Dakota. Transactions of the American Fisheries Society 103:53-58.

Fielder, D., J. Riis and C. Stone. 1992. Angler use and sport fishing harvest survey on Lake Sharpe, South Dakota, 1990 and 1991. South Dakota Department of Game, Fish and Parks, Wildlife Division, Progress Report No. 92-11. Pierre.

Francis, J. 2000. WinFin Analysis Version 2.3. Nebraska Game and Parks Commission. Lincoln Nebraska.

Gablehouse, D.W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4: 273-285.

Gigliotti. L.M. 2004. Fishing in South Dakota – 2003: fishing activity, harvest and angler opinion survey. South Dakota Department of Game, Fish, and Parks, Wildlife Division, report, Pierre.

Graeb, B.D.S. 2006. Sauger population ecology in three Missouri River mainstem reservoirs. Ph.D dissertation, South Dakota State University, Brookings.

Guy, C.S., E.A. Bettross, and D.W. Willis. 1990. A proposed standard weight (W_s) equation for sauger. The Prairie Naturalist 22: 41-48.

Guy, C.S., R.M. Neumann, D.W. Willis, R.O. Anderson. 2007. Proportional size distribution (PSD): A further refinement of population size structure index terminology. Fisheries. 32:348.

Hubert, W.A. 1996. Passive capture techniques. Pages 157-182 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland.

Isermann, D.A., J. Meerbeck, G. Scholten, and D. Willis. 2003. Evaluation of three different structures used for walleye age estimation with emphasis on removal and processing times. North American Journal of Fisheries Management. 23:625-631.

Johnson, B., J. Lott, and W. Nelson-Stastny. 1998. Annual fish population and angler use and harvest surveys on Lake Sharpe, 1997. South Dakota Department of Game, Fish and Parks, Wildlife Division, Progress Report No. 98-16, Pierre.

Johnson, B., and J. Lott. 1999. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 1998. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 99-4, Pierre.

Johnson, B., and J. Lott. 2000. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 1999. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 00-10, Pierre.

Johnson, B., and J. Lott. 2001. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 2000. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 01-15, Pierre.

Johnson, B., R. Hanten, and J. Lott. 2002. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota, 2001. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 02-04, Pierre.

Jones, C.M. and D.S. Robson, 1991. Improving precision in angler surveys: traditional access design versus bus route design. Pages 177-188 in D. Guthrie, J.M. Hoenig, M. Holliday, C.M. Jones, M.J. Mills, S.A. Moberly, K.H. Pollock, and D.R. Talhelm, editors. Creel and angling surveys in fisheries management. American Fisheries Society Symposium 12, Bethesda, Maryland.

Jones, C.M., D.S. Robson, D. Otis, and S. Gloss. 1990. Use of a computer simulation model to determine the behavior of a new survey estimator of recreational angling. Transactions of the American Fisheries Society 119:41-54.

Kolander, T.D., D.W. Willis, and B.R. Murphy. 1993. Proposed revision of the standard weight (W_s) equation for smallmouth bass. North American Journal of Fisheries Management 13:398-400.

Lott, J., D. Fielder, B. Johnson, J. Riis, C. Stone and G. Wickstrom. 1994. Annual fish population surveys on South Dakota Missouri River reservoirs, 1993. South Dakota Department of Game, Fish and Parks, Wildlife Division, Progress Report No. 94-8, Pierre.

Lott, J, B. Johnson, and K. Potter. 2003. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota 2002. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 03-11, Pierre.

Lott, J, R. Hanten, and K. Potter. 2004. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota 2003. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 04-15, Pierre.

Lott, J., J. Erickson, R. Hanten, and K. Potter. 2006. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota 2004. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 06-03, Pierre.

Lott, J., R. Hanten, and K. Potter. 2007. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota 2005. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 07-04, Pierre.

Lyons, J. A., 1986. Capture efficiency of a beach seine for seven freshwater fishes in a North-temperate lake. North American Journal of Fisheries Management 6: 288-289.

Martin, D.B., L.J. Mengel, J.F. Novotny, and C.H. Walburg. 1981. Spring and summer water levels in a Missouri River reservoir: effects of age-0 fish and zooplankton. Transactions of the American Fisheries Society, 110: 70-381.

Murphy, B.R., M.L. Brown, and T.A. Springer. 1990. Evaluation of the relative weight (W_r) index, with new applications to walleye. North American Journal of Fisheries Management, 10: 85-97.

Parsley, M.J., D.E. Palmer, and R.W. Burkhardt. 1989. Variation in capture efficiency of a beach seine for small fishes. North American Journal of Fisheries Management 9:239-244.

Pollock, K.H, C.M. Jones, and T.L. Brown. 1994. Angler survey methods and their applications in fisheries management. American Fisheries Society Special Publication 25. Bethesda, Maryland.

Potter, K, and J. Lott. 2007. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota, 2006. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report 07-09, Pierre.

Potter, K., K. Edwards and G. Adams. 2008. Annual fish population and angler use, harvest and preference surveys on Lake Sharpe, South Dakota 2007. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 08-06, Pierre.

Riis, J.C. 1986. Angler use and sport fishing harvest survey on Lake Sharpe, South Dakota, 1984-1985. South Dakota Department of Game, Fish and Parks, Wildlife Division, Completion Report No. 86-8, Pierre.

Riis, J., and B. Johnson. 1995. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 1994. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report No.95-5, Pierre.

Riis, J., B. Johnson, and J. Lott. 1996. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 1995. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report No.96-7, Pierre.

Riis, J., B. Johnson, J. Lott, 1997. Annual fish population and angler use and harvest surveys on Lake Sharpe, South Dakota, 1996. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report No.97-7, Pierre.

Robson, D.S. and C.M. Jones. 1989. The theoretical basis of an access site survey design. Biometrics 45:83-98.

Schmidt, B.R. 1975. Results and evaluation of an aerial creel survey technique on Lake Sharpe, South Dakota. Thesis, South Dakota State University, Brookings.

Sorensen, J. and G. Knecht. 2009. Annual fish population and angler use and sport fish harvest surveys on Lake Francis Case, South Dakota, 2007. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report 09-17, Pierre.

Soupir, C.A., and M.L. Brown. 2002. Comprehensive evaluation and modification of the South Dakota angler creel program. South Dakota Department of Game, Fish and Parks, Wildlife Division, Completion Report, Pierre.

South Dakota Department of Game, Fish and Parks. 1994. Systematic approach to management. Wildlife Division, Pierre.

Stone, C., J. Riis, and B. Johnson. 1994. Angler use and sport fishing harvest survey on Lakes Francis Case, Sharpe, and Oahe, South Dakota, 1992 and 1993. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report 94-9, Pierre.

United States Department of the Interior, Fish and Wildlife Service and United States Department of Commerce, Bureau of Census 2007. 2006 National Survey of Fishing, Hunting, and Wildlife-associated Recreation. United States Government Printing Office, Washington, D.C.

Willis, D.W., C.S. Guy, and B.R. Murphy. 1991. Development and evaluation of a standard weight (W_s) equation for yellow perch. North American Journal of Fisheries Management 11:374-380.

Willis, D.W., D.A. Isermann, M.J. Hubers, B.A. Johnson, W.H. Miller, T.R. St. Sauver, J.S. Sorenson, E.G. Unkenholz, and G.A. Wickstrom. 2001. Growth of South Dakota fishes: a statewide summary with means by region and water type. South Dakota Department of Game, Fish and Parks, Wildlife Division, Special Report 01-05, Pierre.

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*
Bluntnose minnow	BLM	*Pimephales notatus*
Brassy minnow	BRM	*Hybognathus hankinsoni*
Channel catfish	CCF	*Ictalurus punctatus*
Common carp	COC	*Cyprinus carpio*
Emerald shiner	EMS	*Notropis atherinoides*
Freshwater drum	FRD	*Aplodinotus grunniens*
Gizzard shad	GZD	*Dorosoma cepedianum*
Goldeye	GOE	*Hiodon alosoides*
Johnny darter	JOD	*Etheostoma nigrum*
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*
Stonecat	STC	*Noturus flavus*
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 (Gablehouse 1984).

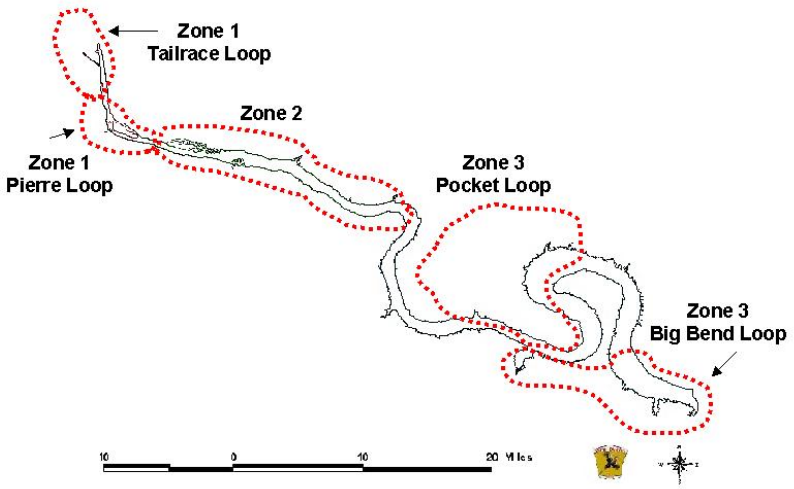
Species	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth bass	180	280	350	430	510
Walleye	250	380	510	630	760
Sauger	200	300	380	510	630
Channel catfish	280	410	610	710	910
White bass	150	230	300	380	460
Yellow perch	130	200	250	300	380

Appendix 3. White bass and yellow perch proportional size distribution (PSD), proportional size distribution of preferred-length fish (PSD-P), and memorable-length fish (PSD-M), and mean relative weight values, for 2006-2010, for fish collected in the standard August gill net survey, on Lake Sharpe South Dakota.

White bass					
Year	**PSD**	**PSD-P**	**PSD-M**	***Wr***	**N**
2006	96	15	4	103	52
2007	98	96	20	95	45
2008	100	100	41	95	37
2009	100	92	17	96	12
2010	100	100	18	109	10

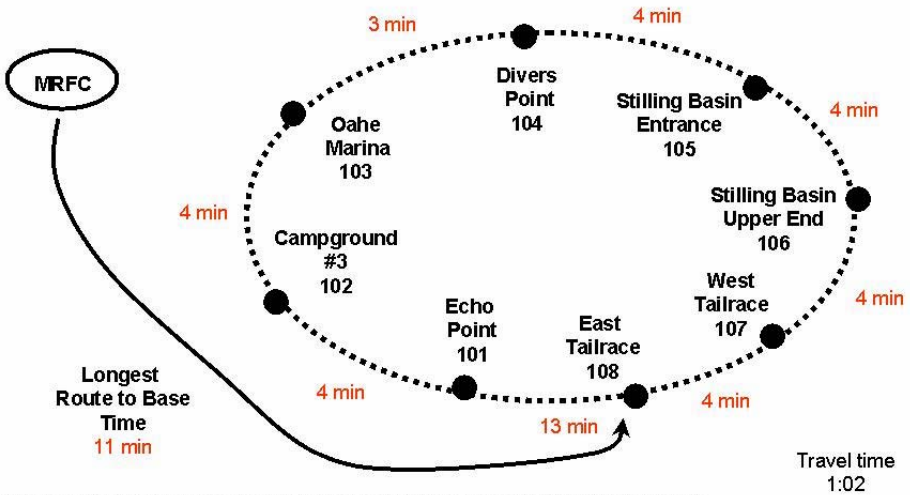
Yellow perch					
Year	**PSD**	**PSD-P**	**PSD-M**	***Wr***	**N**
2006	53	0	0	112	40
2007	37	5	0	83	31
2008	47	0	0	87	23
2009	56	0	0	88	34
2010	36	6	0	86	34

Lake Sharpe Bus Route Loops



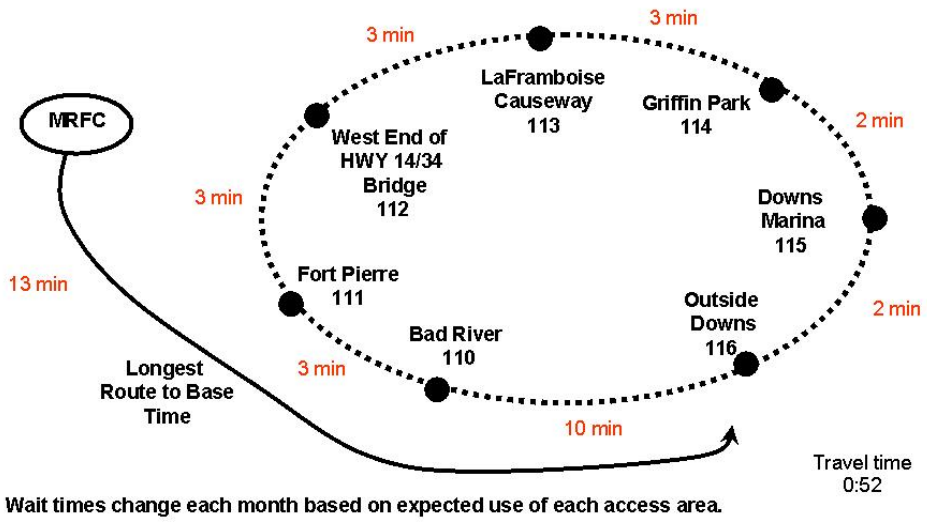
Appendix 4. Lake Sharpe bus route loop map depicting locations of the 5 overall loops for angler use and harvest surveys during April – September, 2010.

Zone 1 - Tailrace Loop - Car Travel Times Listed

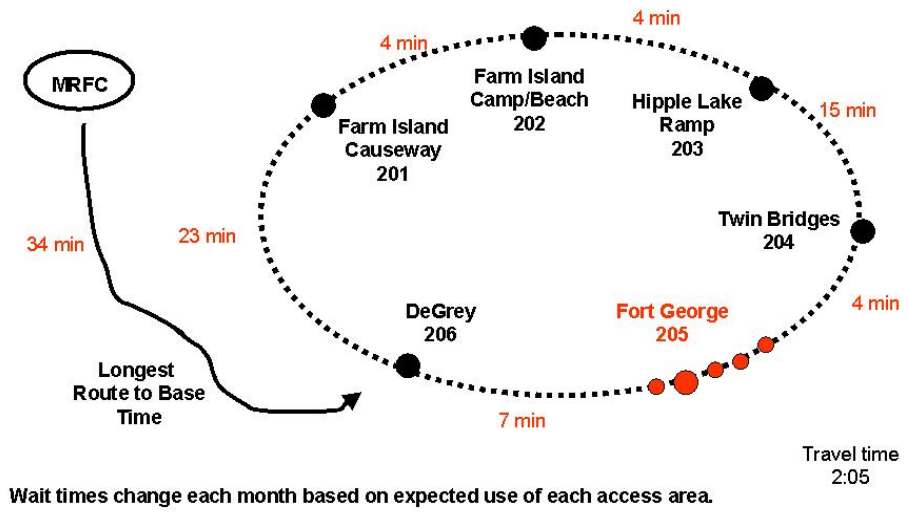


Wait times change each month based on expected use of each access area.

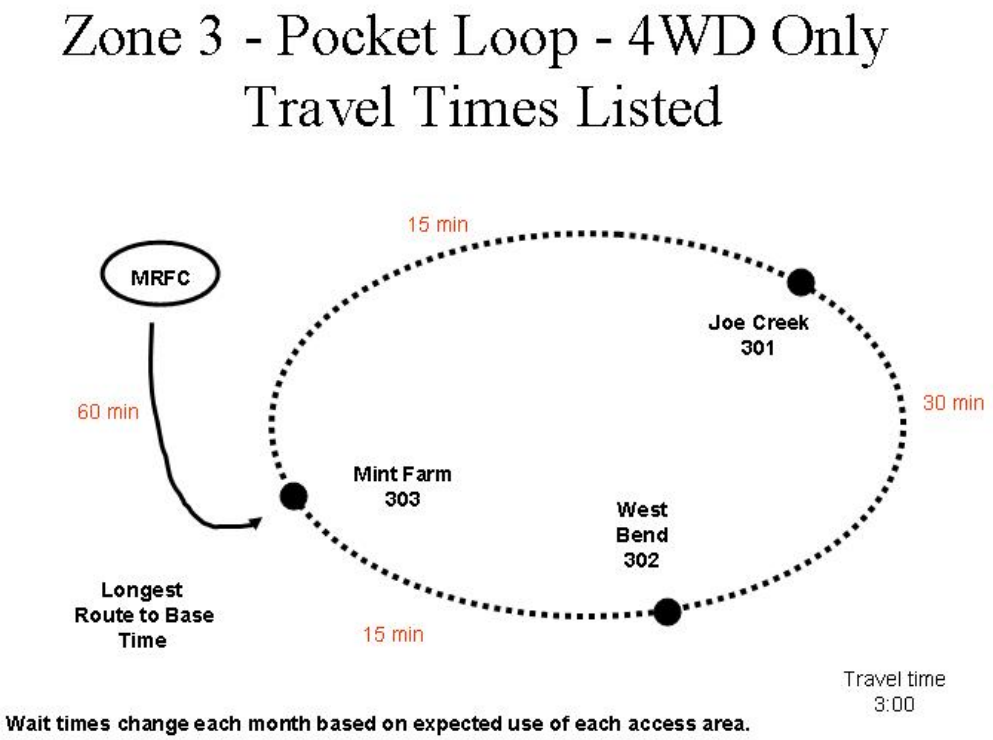
Appendix 5. Overall design of the tailrace loop for angler use and harvest surveys for Lake Sharpe, SD during April-September, 2010.



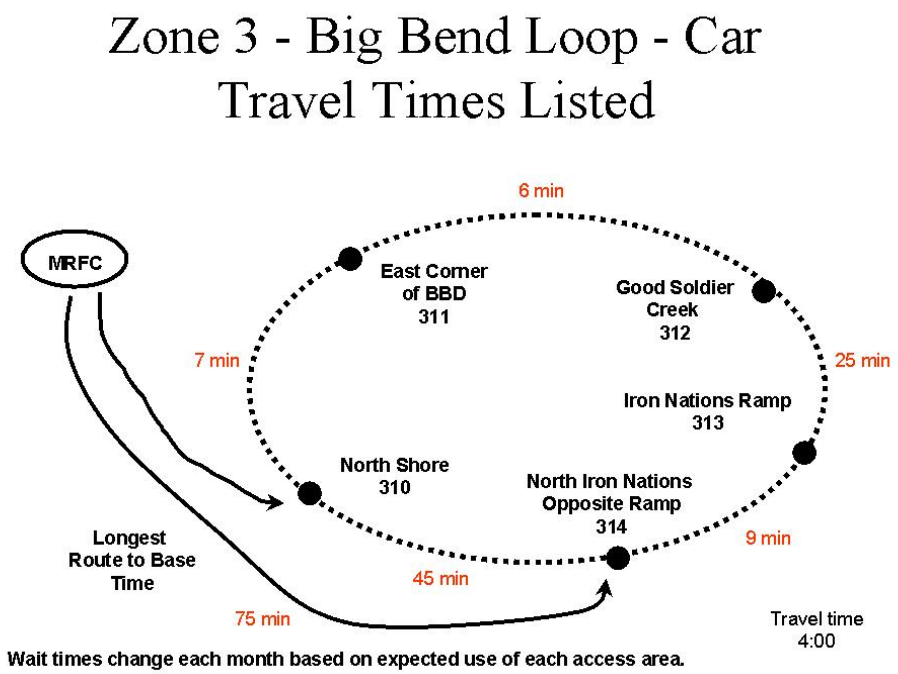
Appendix 6. Overall design for the Pierre Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2010.



Appendix 7. Overall design for Zone 2 loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2010.



Appendix 8. Overall design for the Pocket Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September 2010.



Appendix 9. Overall design for the Big Bend Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2010.

Appendix 10. Angler satisfaction, preference, and attitude questions asked as part of the April-September 2010 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)* or NO OPINION
5 = SLIGHTLY
6 = MODERATELY DISSATISFIED
7 = VERY

Aquatic Nuisance Species Questions:

1. Other than Lake Sharpe, where was the last place you launched your boat?

WATERBODY AND STATE

2. Approximately how many days ago did you launch your boat into that water body?

0 to 100 DAYS

Smallmouth Bass Question:

1. Are you in favor of the current smallmouth bass regulation of a 14-to-18-inch protected slot, which requires all smallmouth bass between 14 and 18 inches to be released?

YES NO NO OPINION

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