# ANNUAL FISH POPULATION
# AND
# ANGLER USE, HARVEST AND PREFERENCE SURVEYS
# ON
# LAKE SHARPE, SOUTH DAKOTA, 2006

By

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## PREFACE

Information collected during 2006 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.

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## EXECUTIVE SUMMARY

This report includes annual fish population data from 2002 through 2006 and angler use, harvest, and preference data for 2006, 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 2006, at 16.8 walleye/net-night, was similar to the 2005 value of 17.8 fish/net-night and higher than the 2004 value of 12.9 fish/net-night. Approximately 40% of the walleye collected by gill nets during August were ≥ 380-mm (15 inches) and 2% were ≥ 508-mm (20 inches). Forty-four percent of the 2006 gill net catch was between 220 and 300 mm, indicating the 2005 year-class recruited to the gear and to the population. The 2006 mean age-0 electrofishing CPUE, of 45.9 fish/h was lower than 2005, when 88.1 fish/h was collected. Walleye relative weight (*Wr*) for 2006, at 85, was similar to most years for Lake Sharpe. Age-1 (2005) walleye comprised the largest portion of the walleye catch in gill nets in 2006, followed by the years of 2003, 2000, and 2001 year classes, in order of decreasing catch.

Seventeen species of age-0 or small prey fishes were collected by shoreline seining in 2006. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2006, with a mean CPUE of 350 fish/haul. The long-term average CPUE (1982-2006) for gizzard shad in seine hauls is 555 fish/haul.

Regulations for smallmouth bass in Lake Sharpe include a 306-to-457-mm (12- to 18-inch) protected slot with anglers being allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. Mean CPUE values of smallmouth bass collected by shoreline electrofishing increased from 11.7 to 30.4 (fish/h) at Joe Creek and 61.1 to 105.1 (fish/h) at Big Bend Dam, from 2005 to 2006. Proportional stock density and RSD-P initially decreased following the regulation changes and are slowly increasing. Growth is unchanged since the regulation change with mean back-calculated length at age 4 still exceeding statewide and Missouri River reservoir averages. Mean length at age at capture has been calculated for three consecutive years from otoliths and estimates have been similar to values generated from scales, for age 5 and younger fish.

An estimated 99,702 anglers days were spent on Lake Sharpe during the April-September 2006 daylight period, similar to the Lake Sharpe Strategic plan goal of 100,000 angler days. An estimated harvest of 115,300 walleye occurred during the 2006 period, which was slightly above the Lake Sharpe Strategic plan goal of 100,000 per period and was well above the estimated harvest for the same period in 2005, of 57,866 walleye. Estimated angler catch of white bass declined from 108,494 fish in 2005 to 38,117 in 2006, a decline of 65%, due to a die-off during the summer of 2005. Approximately 77% of the smallmouth bass harvested during the April-September 2006 period were <305-mm in length and 2% were ≥457-mm in length. Approximately 21% 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 2006 daylight period, at 0.46 fish/angler-h, was higher than the strategic plan objective of 0.35 fish/angler-h. The walleye catch, harvest, and release rates for 2006 (0.60, 0.33, 0.27, respectively) were much greater then during the 2005 period (0.37, 0.21, 0.16, respectively). The smallmouth bass catch rate increased from 0.11 fish/angler-h during 2005 to 0.33 fish/angler-h during 2006. The white bass catch rates decreased from 0.40 fish/angler-h during 2005 to 0.11 fish/angler-h during 2006.

Approximately 73% of angling parties interviewed in 2006 indicated some degree of satisfaction with their fishing trip, a value higher than the 2005 value of 65%, and similar to the Lake Sharpe Strategic Plan objective of 70%. For the April-September 2006 daylight period, Lake Sharpe anglers contributed approximately 6.1 million dollars to local economies, based on an estimated 99,702 trips at an estimated $61 per trip.

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# ANNUAL FISH POPULATION AND ANGLER USE, HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2006

## INTRODUCTION

Anglers spent over 1.6 million hours fishing the Missouri River system in South Dakota in 2004 (Lott et al. 2006a; Lott et al. 2006b; Sorensen and Knecht 2006). Approximately 48% of South Dakota resident anglers fished the Missouri River system in 2003 and 35% of those anglers fished Lake Sharpe (Gigliotti 2004). Also, approximately 33% of angler days in South Dakota in 2003 were spent on the Missouri River system (Gigliotti 2004). The South Dakota Department of Game, Fish and Parks (SDGFP) recognizes the importance of the Missouri River fisheries program and considers it a major program in strategic planning efforts (SDGFP 1994).

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

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 2006 and comparisons to data from previous years.

## MANAGEMENT OBJECTIVES

### Reservoir-wide Objectives

- Provide a minimum of 100,000 angler days of recreation with a harvest rate of 0.35 fish per angler hour, and a 70% angler trip satisfaction rating.

- Continually work to preserve or enhance and protect the existing fish community structure, diversity and aquatic habitats of Lake Sharpe

### Species Specific Objectives

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

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

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

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

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

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

## SAMPLING STRATEGIES

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

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

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

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

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

## STUDY AREA

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

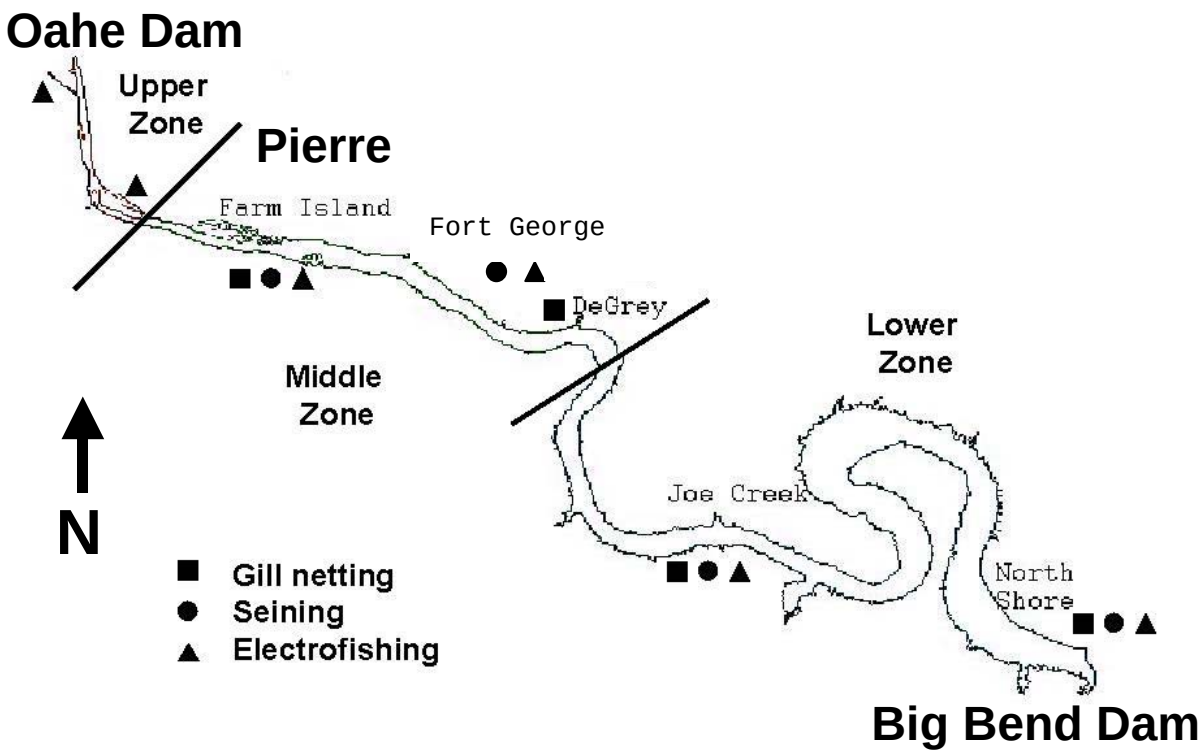


Figure 1. Lake Sharpe, South Dakota, gill netting, seining and electrofishing locations.

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

| Characteristic: | Description |
|---|---|
| **Location:** | From Oahe Dam to Big Bend Dam |
| **Surface area (X 1000 ha):** | 25 |
| **Depth (m)-maximum:**<br>**-mean:** | 23.5<br>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<br>9.1 - 18.3 |
| **Number of gill nets:** | 24 |
| **Gill netting survey date:** | August |
| **Number of seine hauls:** | 16 |
| **Seining survey date:** | August |
| **Nighttime electrofishing survey dates:** | May-June, September-October |

## REGULATION HISTORY

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

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

Table 2. History of special harvest regulations for walleye and smallmouth bass, on Lake Sharpe, South Dakota, 1968 through 2006.

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

# SAMPLING METHODS

## FISH POPULATION SURVEYS

### Data Collection

Variable-mesh gill nets, seines and boat electrofishing were used to sample fish populations in Lake Sharpe during 2006 (Figure 1). Three multifilament, variable-mesh (containing meshes with the following bar mesh dimensions: ½, ¾, 1, 1 ¼, 1 ½, and 2 inches; 12.7, 19.1, 25.4, 31.8, 38.1, and 50.8 mm bar mesh) gill nets (Lott et al. 1994) were fished overnight (approximately 20 h), on the bottom, in each depth zone (0-9.1 m and >9.1 m), where possible, for a total of six nets per location with four sampling locations on Lake Sharpe (Figure 1). All fish collected were identified and counted. All walleye and sauger captured were measured for total length (TL; mm) and weighed (g). At each sampling location, the first 50 individuals of each species, excluding walleye and sauger, were measured and weighed. Otoliths (10 per cm length group per sampling location) were collected from walleye and sauger captured during the standard gill net survey. Otoliths from walleye and sauger less than 350 mm were aged whole while submersed in water in a black dish. Otoliths from walleye and sauger greater than 350 were aged with otoliths cracked in half and charred prior to aging, similar to techniques described by Isermann, et al. (2003).

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

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

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

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

## Data Analysis

Relative abundance of fish species were expressed as mean catch per unit effort (CPUE) for standard gill net (No./net night), seine (No./haul) and electrofishing (No./h) catches. A standard net night for the gill-net survey was approximately 20 h. Age and growth analyses were conducted for walleye, sauger, and smallmouth bass. Smallmouth bass scales and walleye and sauger otoliths were aged according to standard techniques (DeVries and Frie 1996). Back-calculations for scale samples were made with the computer program WinFin Analysis (Francis 2000). A standard y-intercept value for growth analyses of 35 mm was used for smallmouth bass (Carlander 1982). Age distributions for gill-net catches of walleye and sauger were developed by assigning ages to all fish captured during the survey, based on length-at-age-at-time-of-capture information. Proportional stock density (PSD; Anderson 1980) and relative stock density (RSD; Gablehouse 1984) values were calculated for walleye, sauger, smallmouth bass, channel catfish, white bass, and yellow perch. Length categories used in PSD and RSD are listed in Appendix 2. Proportional stock density and RSD values were tested for differences between years using Chi Square analysis (Conover 1980; SYSTAT 1998).

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

Walleye *Wr* values for fish in gill net samples and smallmouth bass *Wr* values from electrofishing samples were tested for differences among years, within stock density index groupings, using a one-way analysis of variance (ANOVA, SYSTAT 1998) and a Least Significant Difference (LSD) test. Catch per unit effort of age-0 walleye in fall electrofishing samples and walleye in standard gill net samples was tested for differences among years using a one-way ANOVA and a Least Significant Difference (LSD) test. Standard error values were generated for gill net, seine haul, and electrofishing CPUE as a measure of sample variance. An alpha level of 0.05 was established, a priori, for all statistical tests. Catch per unit effort of smallmouth bass in the May/June electrofishing survey were tested for differences among years within sampling locations using overlap of 80% confidence intervals as the test statistic.

## 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, 2006 through September 30, 2006 for the sunrise-to-sunset (daytime) period. Diagrams of bus routes used on Lake Sharpe during the April-September survey period appear from Appendix 3 to Appendix 8. Random numbers were used to select the following for the bus route designs: day selection (weekday or weekends/holiday), day beginning at sunrise or ending at sunset, route direction (forward or backward), starting location, and route selection. Daily schedules were then created with Microsoft Excel 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 kept 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 2006 reservoir-wide angler use and harvest survey. Two different versions (forms A and B) of the angler interview data sheet were created, with different sets of angler attitude or preference questions on each sheet. Clerks alternated between forms A and B during each scheduled survey day. Anglers were asked how satisfied they were with their fishing trip, considering all factors. A question was asked on how often angling parties used the public fish cleaning stations equipped with water and grinders during their fishing trips. Anglers were also asked where they were staying on their current trip. A series of questions were asked pertaining to current smallmouth bass regulations on Lake Sharpe. Anglers were asked if they were knowledgeable of the smallmouth bass regulation package. If they were, they were asked if they were in favor of current regulations. If they opposed the current regulation package, they were asked which part of the regulations they were not in favor of. Parties that caught smallmouth bass were asked how many additional smallmouth bass they would have harvested, for their party, if the regulation had length limits not been in effect. A complete list of satisfaction, attitude and preference questions asked in conjunction with the 2006 angler use and harvest survey appears in Appendix 9.

### Data Analysis

Pressure count and angler interview data were entered and analyzed using the Creel Application Software (CAS) package (Soupir and Brown 2002) and 80% confidence intervals were calculated for estimates of fishing pressure and harvest. Catch, harvest, and release numbers and rates were also calculated. Lengths of harvested walleye and smallmouth bass were determined, as was angler demographic information. Median values of satisfaction question responses were calculated for each month and for the entire April-September survey period.

# RESULTS AND DISCUSSION

## FISH POPULATION SURVEYS

Species Composition and Relative Abundance

Walleye and channel catfish dominated catches in the August 2006 gill net survey, comprising 43% and 17% of the total catch, respectively (Table 3). Other species commonly caught during the 2006 survey included yellow perch, common carp, sauger, white bass, gizzard shad, freshwater drum, and smallmouth bass. Catch per unit effort has historically been used as an index of population abundance or density (Hubert 1996). Channel catfish mean CPUE in 2006, at 6.5 fish/net-night, was lower than during all years in the 2002-2005 period (Table 4). Mean walleye CPUE in 2006, at 16.8 walleye/net-night, was similar to the 2005 value of 17.8 walleye/net-night. The average mean catch per gill net-night, for the 1986-2006 period, was 24.1 walleye/net-night. The 2004 value of 12.9 walleye/net-night, was the lowest documented during the 1982-2006 period for which gill net surveys have been conducted (Michaletz et al. 1986; Wickstrom et al. 1991; Wickstrom et al. 1993; Johnson et al. 1998; Lott et al. 2003, 2006b). Though not significantly different because of high variation in catches among gill nets, the walleye abundance index appears to have increased since 2004. Catch per unit of effort for all other species in 2006 were within ranges previously documented.

Table 3. Relative species composition, by percent of total catch, of fish species collected during the standard August gill net survey on Lake Sharpe, South Dakota, during 2002 through 2006. Trace (T) indicates values < 0.5%.

| Species | Year | | | | |
|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| Walleye | 37.0 | 31.8 | 27.9 | 36.8 | 43.1 |
| Channel catfish | 30.9 | 30.7 | 33.3 | 36.2 | 16.7 |
| Yellow perch | 2.5 | 1.8 | 2.6 | 4.4 | 6.7 |
| Common carp | 2.1 | 1.3 | 4.2 | 4.0 | 8.0 |
| Sauger | 8.8 | 3.9 | 5.9 | 3.7 | 5.8 |
| White bass | 5.7 | 15.9 | 5.6 | 3.5 | 5.5 |
| Gizzard shad | 5.1 | 10.3 | 10.3 | 3.1 | 6.5 |
| Freshwater drum | 2.6 | 1.5 | 2.1 | 3.0 | 2.5 |
| Smallmouth bass | T | 0.5 | T | 2.8 | 2.9 |
| *Others | 5.6 | 2.5 | 8.1 | 2.4 | 2.5 |

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

Table 4. Mean catch per unit effort (CPUE; No./net-night) and standard error values (SE) for fish species collected with standard coolwater gill net sets in Lake Sharpe, South Dakota, 2002-2006. Trace (T) indicates values less that 0.05.

| Species | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | |
| | CPUE | SE | CPUE | SE | CPUE | SE | CPUE | SE | CPUE | SE |
| | | | | | | | | | | |
| Bigmouth buffalo | 0.0 | | T | | T | | T | | 0.0 | |
| Black bullhead | 0.0 | | 0.0 | | 0.1 | 0.1 | 0.0 | | 0.0 | |
| Black crappie | 0.1 | 0.1 | 0.0 | | 0.0 | | 0.0 | | 0.2 | 0.1 |
| Bluegill | 0.0 | | 0.0 | | 0.0 | | 0.0 | | T | |
| Channel catfish | 20.1 | 4.5 | 18.7 | 3.8 | 15.2 | 2.2 | 17.5 | 4.0 | 6.5 | 1.7 |
| Chinook salmon | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| Common carp | 1.4 | 0.3 | 0.8 | 0.3 | 2.0 | 0.4 | 1.8 | 0.4 | 3.1 | 0.9 |
| Freshwater drum | 1.7 | 0.7 | 0.9 | 0.4 | 1.0 | 0.7 | 1.3 | 0.4 | 1.0 | 0.3 |
| Gizzard shad | 3.3 | 1.5 | 6.3 | 3.6 | 5.2 | 3.5 | 1.5 | 0.8 | 2.5 | 1.2 |
| Goldeye | 1.9 | 1.0 | 0.4 | 0.2 | 0.7 | 0.4 | 0.2 | 0.1 | 0.0 | |
| Northern pike | T | | 0.0 | | 0.0 | | 0.0 | | T | |
| Rainbow smelt | 0.0 | | 0.0 | | T | | 0.0 | | 0.0 | |
| Rainbow trout | 0.0 | | T | | 0.0 | | 0.0 | | 0.0 | |
| River carpsucker | 0.1 | 0.1 | 0.3 | 0.2 | 0.4 | 0.2 | 0.5 | 0.3 | 0.1 | 0.1 |
| Sauger | 5.6 | 1.3 | 2.4 | 0.6 | 2.7 | 0.6 | 1.7 | 0.5 | 2.3 | 0.7 |
| Shorthead redhorse | 0.5 | 0.2 | 0.4 | 0.2 | 1.0 | 0.4 | 0.2 | 0.1 | 0.2 | 0.1 |
| Shortnose gar | T | | T | | 0.1 | 0.1 | T | | 0.2 | 0.2 |
| Shovelnose sturgeon | 0.8 | 0.4 | 0.1 | 0.1 | 1.0 | 0.6 | 0.1 | 0.1 | 0.2 | 0.1 |
| Smallmouth bass | T | | 0.3 | 0.2 | T | | 1.2 | 0.8 | 1.1 | 0.8 |
| Smallmouth buffalo | 0.0 | | 0.0 | | T | | 0.0 | | 0.0 | |
| Spottail shiner | 0.0 | | 0.0 | | 0.0 | | 0.1 | 0.1 | 0.0 | |
| Walleye | 24.1 | 5.1 | 19.6 | 3.0 | 12.9 | 2.2 | 17.8 | 2.8 | 16.8 | 2.8 |
| White bass | 3.7 | 1.3 | 9.8 | 6.8 | 2.6 | 0.9 | 1.5 | 0.8 | 2.2 | 1.0 |
| White crappie | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.6 | 0.4 | 0.1 | 0.1 |
| White sucker | 0.0 | | 0.0 | | 0.0 | | T | | 0.0 | |
| Yellow perch | 1.6 | 0.6 | 1.1 | 0.5 | 1.3 | 0.3 | 2.1 | 0.7 | 2.6 | 1.2 |
| | | | | | | | | | | |

Seventeen species of age-0 or small littoral fishes were collected by shoreline seining in 2006. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2006, with a mean CPUE of 350.5 fish/haul (Table 5). The long-term average CPUE (1982-2006) for gizzard shad in seine hauls is 555 fish/haul. The mean number of age-0 walleye captured per seine haul in 2006, at 0.7, illustrated walleye reproduction occurred in Lake Sharpe. Mean CPUE for other species captured during the seining survey was within ranges previously documented.

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

| Species | Year | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | |
| | CPUE | SE | CPUE | SE | CPUE | SE | CPUE | SE | CPUE | SE |
| | | | | | | | | | | |
| Bigmouth buffalo | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| Black crappie | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| Bluegill | 0.1 | 0.1 | 0.0 | | 0.0 | | 0.5 | 0.2 | 0.0 | |
| Bluntnose minnow | 0.0 | | 0.1 | 0.1 | 0.0 | | 1.9 | 0.9 | 2.2 | 0.8 |
| Brassy minnow* | 0.0 | | 0.1 | 0.1 | 0.0 | | 0.0 | | 0.3 | 0.1 |
| Channel catfish | 0.1 | 0.1 | 0.0 | | 0.0 | | 0.3 | 0.2 | 0.5 | 0.3 |
| Common carp | 0.0 | | 0.2 | 0.1 | 0.3 | 0.2 | 0.5 | 0.3 | 0.1 | 0.1 |
| Emerald shiner* | 46.6 | 15.3 | 15.1 | 5.7 | 27.9 | 9.4 | 95.4 | 39.7 | 24.0 | 8.4 |
| Fathead minnow* | 0.6 | 0.5 | 0.1 | 0.1 | 0.0 | | 0.0 | | 0.0 | |
| Freshwater drum | 3.8 | 1.7 | 0.3 | 0.2 | 3.4 | 1.7 | 22.4 | 8.8 | 5.6 | 2.1 |
| Gizzard shad | 1459.7 | 644.7 | 244.4 | 105.1 | 379.4 | 147.2 | 284.7 | 83.8 | 350.5 | 136.0 |
| Goldeye | 0.0 | | 0.0 | | 0.0 | | 0.1 | 0.1 | 0.0 | |
| Johnny darter* | 0.1 | 0.1 | 0.9 | 0.8 | 0.5 | 0.2 | 0.2 | 0.1 | 0.8 | 0.5 |
| Largemouth bass | 0.1 | 0.1 | 0.0 | | 0.3 | 0.1 | 0.3 | 0.1 | 0.4 | 0.3 |
| River carpsucker | 3.6 | 2.1 | 0.0 | | 0.1 | 0.1 | 10.9 | 4.8 | 0.1 | 0.1 |
| Sauger | 0.0 | | 0.0 | | 0.0 | | 0.6 | 0.4 | 0.0 | |
| Smallmouth bass | 3.4 | 1.0 | 1.8 | 0.7 | 2.1 | 0.9 | 1.5 | 0.5 | 4.2 | 1.0 |
| Smallmouth buffalo | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | |
| Spottail shiner* | 4.9 | 2.5 | 8.7 | 3.3 | 5.6 | 2.0 | 3.7 | 1.0 | 5.4 | 2.0 |
| Walleye | 1.6 | 0.7 | 0.3 | 0.2 | 0.0 | | 3.9 | 1.4 | 0.7 | 0.2 |
| White bass | 14.9 | 9.2 | 2.2 | 1.1 | 19.1 | 8.5 | 6.8 | 2.8 | 6.3 | 2.7 |
| White crappie | 0.4 | 0.3 | 0.3 | 0.3 | 10.9 | 10.0 | 2.7 | 1.8 | 1.6 | 0.8 |
| White sucker | 0.0 | | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.0 | |
| Yellow perch | 10.9 | 4.3 | 15.9 | 12.3 | 3.8 | 1.5 | 24.9 | 11.2 | 13.5 | 5.2 |
| | | | | | | | | | | |

Population Parameters for Walleye

Walleye ranging from 110 to 692 mm were collected during the August 2006 gill netting survey (Figure 2). Approximately 40% of walleye in the 2006 gill net sample were ≥ 380-mm (15-inch minimum length), 9% were ≥ 460-mm (18 inches), and 2% were ≥ 508-mm (20 inches, Figure 2). However, 44% of walleye in the gill net catch were between 220 and 300 mm, indicating the 2005 year-class recruited to the gear and to the population (Figure 2; age-1 fish). There was also a portion of the walleye catch between 110 and 160 mm, supporting evidence from the seining survey that reproduction occurred in 2006.

Catch-per-net values for individual sampling stations are often not significantly different from one another among years due to high variability in gill net catches among nets and low sample size (Table 6). Catch per unit effort values for the Farm Island sampling station and the overall total sample do not significantly differ among years, whereas CPUE for the DeGrey, Joe Creek, and North Shore sampling locations have varied significantly among years and stations.

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

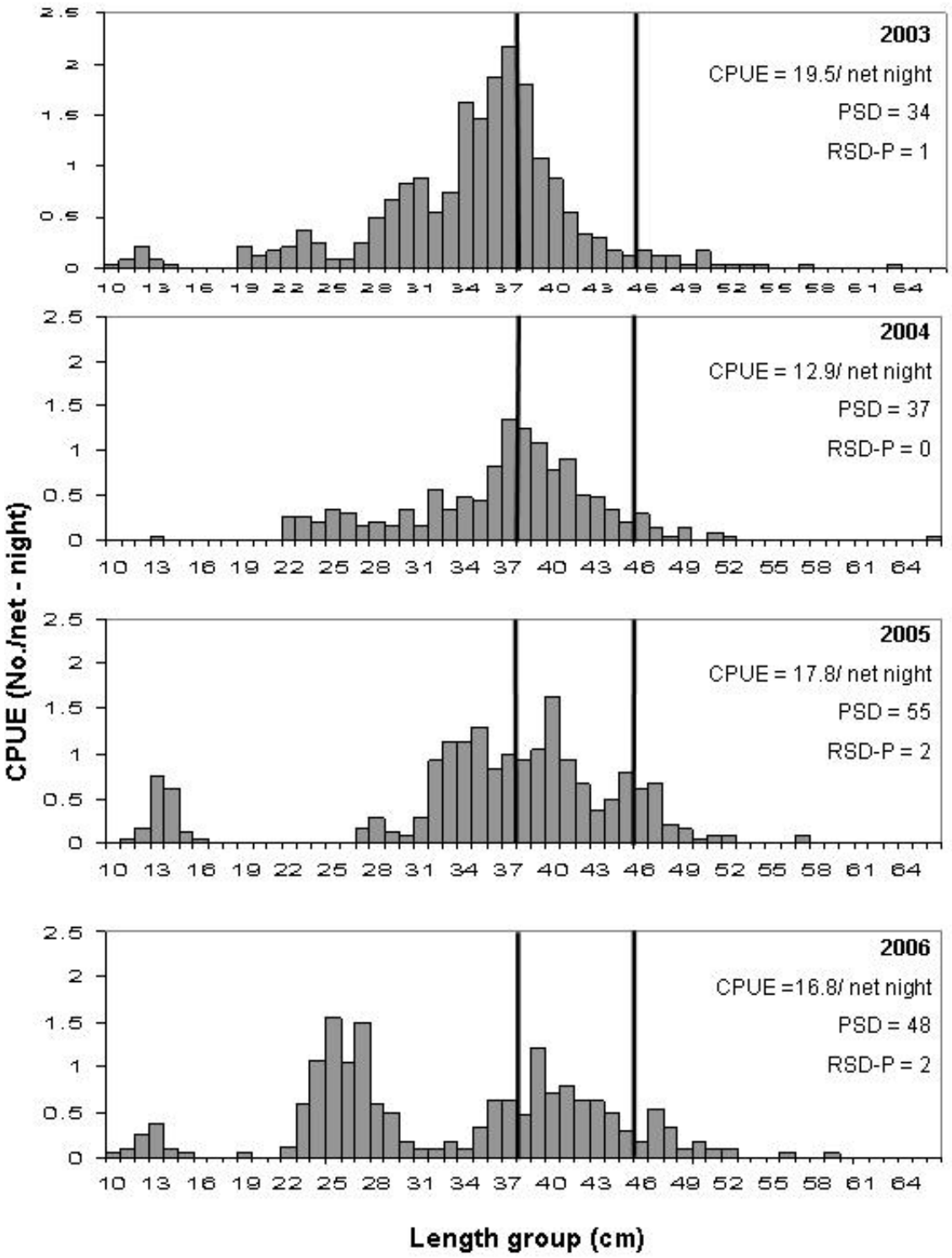


Figure 2. Length frequency, as catch per unit effort, of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, during August 2003 through 2006. Vertical lines represent the 15-inch and 18-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

Table 6. Mean walleye catch per unit effort (No./net-night) in the standard coolwater gill net survey for Lake Sharpe, South Dakota, 1997-2006. Values within sites with no letters in common are significantly different at the *P*<0.05 level of significance. Comparisons were only made among years, within sites.

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

Walleye gill net CPUE has increased since 2004 due to the presence of the 2005 and 2006 year classes in gill net catches. Mean CPUE of substock-length walleye for 2006 was significantly higher than in 2004 and was similar to 2005 and the 1999-2003 period (Table 7). The abundance index (CPUE) for quality-to-preferred-length walleye was significantly lower in 2004 than in 1998 and 1999, but similar to other years within the 1997-2006 period (Table 7). Mean CPUE of preferred-length walleye is typically below 1.0 fish/net-night, indicating few fish in the population reached preferred length (Table 7). The decrease in walleye CPUE and size structure is also evident from examination of Figure 3.

Proportional stock density for the 2006 walleye gill net sample, at 48, was within the balanced range of 30-60 (Anderson and Weithman 1978; Table 8) and similar to the 2005 value of 55. Preferred-length fish are uncommon in gill net catches as evidenced by RSD-P values for walleye of ≤ 3 for all years in the 1997-2006 period (Table 8). Mean walleye *Wr* for the 2006 total gill net sample, at 85, was similar to other years in the 1997-2006 period, with the exception of 2003. Mean *Wr* for 2003, at 75 (Table 9), was lower than all other years in the 1997-2006 period. The lower *Wr* value for 2003 is likely due to a low abundance of age-0 gizzard shad that year (Table 5). Relative weight values of walleye in the stock-to-quality length group were similar for 2004, 2005, and 2006. Mean *Wr* values for quality-to-preferred-length fish followed the same pattern as stock-to-quality length fish and were similar during 2004-2006. Walleye in Lake Sharpe in the preferred-to-trophy length group generally have a lower *Wr* than fish in smaller length categories and this trend continued to be evident in 2006.

Table 7. Mean walleye catch per unit effort (No./net-night) in the standard gill net survey, by year and length group, for 1997-2006, for Lake Sharpe, South Dakota. Values within length groups, among years, with no letters in common, are significantly different at the *P*<0.05 level of significance. Comparisons were only made within length groups among years.

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

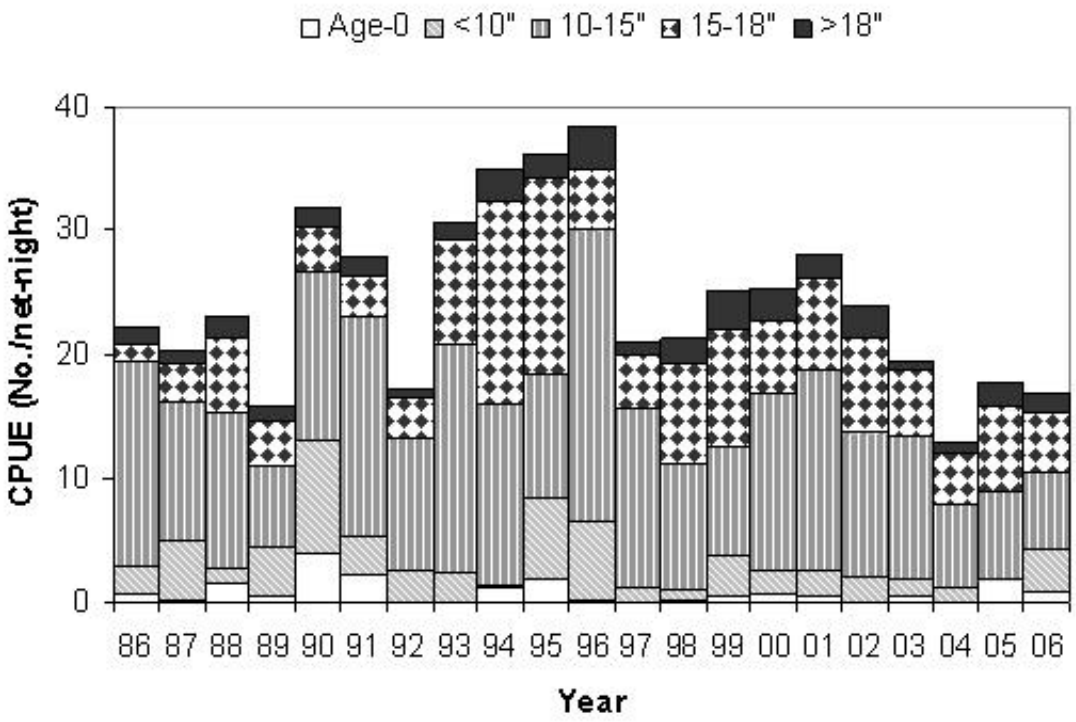


Figure 3. Size structure and abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, during August, 1986-2006.

Table 8. Walleye and sauger proportional stock density (PSD) and relative stock density of preferred- (RSD-P) and memorable-length (RSD-M) fish collected during the standard gill net survey on Lake Sharpe, South Dakota, 1997-2006.

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

Table 9. Mean walleye relative weight (*Wr*) values, by length group, for Lake Sharpe, South Dakota, 1997-2006. N is the number of stock-length fish in a sample. Within length classes, values with the same letter code are not significantly different at the $P<0.05$ level of significance.

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

Beginning in 2002, otoliths were removed from the majority of walleye and sauger collected during the August gill net survey. Prior to otolith removal, aging was solely based on age estimates generated from scale interpretation. Mean length at time of capture for each age group of walleye is illustrated in Table 10. Examination of mean length at age at time of capture indicates Lake Sharpe walleye typically reach 381 mm at age 3 or 4, meaning that the majority of walleye in the 2005 year class will not surpass the minimum length until the 2008 or 2009 fishing seasons. Individuals in the 2006 year class should surpass the 381-mm minimum length limit in 2009 or 2010 (Table 10).

The change in mean length of fish in a year class from one year to the next is considered the annual growth increment for that year class (Table 11). While not statistically tested, growth for walleye through age 6 appears to have been slower during the 2002-2003 growth period than during any subsequent period. Low relative weight values for walleye in the 2003 gill net survey (Table 9) may be indicative of slower growth during the 2002-2003 period.

Age-1 walleye (produced in 2005) comprised the largest percentage of the 2006 gill net sample of any age group (Table 12), followed by fish produced in 2003, 2000, and 2001 (age-3, age-6 and age-5 fish, respectively). The catch of 42 age-0 walleye in the 2005 gill net survey and the 175 age-1 walleye during the 2006 sample is indicative of high natural production in 2005 (Table 12). For 2006, a catch of 21 aged-0 walleye indicates production occurred in 2006, but at a lower level than for the 2005 year class. Otoliths aged for walleye in Lake Sharpe for the 2006 sample were aged as old as 16 years of age, though age frequencies presented only extend through age 12.

Table 10. Mean length-at-age-at-capture (mm) for walleye collected in the standard August gill net survey, 2002-2006, on Lake Sharpe, South Dakota, and aged from otoliths.

| Year | | Length at age at capture (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **2002** | **Mean** | 247 | 327 | 373 | 410 | 424 | 459 | 489 | 492 | 495 |
| | **N** | 42 | 91 | 88 | 80 | 15 | 2 | 10 | 14 | 1 |
| | **SE** | 2.8 | 2.6 | 2.6 | 3.6 | 6.9 | 31.0 | 12.2 | 11.1 | NA |
| **2003** | **Mean** | 224 | 311 | 362 | 385 | 410 | 430 | 426 | 480 | 469 |
| | **N** | 22 | 93 | 128 | 76 | 34 | 7 | 3 | 8 | 7 |
| | **SE** | 4.6 | 2.4 | 1.8 | 2.5 | 4.1 | 12.5 | 8.0 | 13.7 | 11.2 |
| **2004** | **Mean** | 252 | 312 | 370 | 390 | 401 | 437 | 441 | 495 | 506 |
| | **N** | 38 | 32 | 81 | 73 | 34 | 24 | 3 | 2 | 8 |
| | **SE** | 3.4 | 3.9 | 3.1 | 3.2 | 5.0 | 6.0 | 14.2 | 23.5 | 24.2 |
| **2005** | **Mean** | 282 | 342 | 379 | 407 | 427 | 438 | 465 | 467 | 476 |
| | **N** | 12 | 130 | 38 | 71 | 66 | 33 | 19 | 2 | 2 |
| | **SE** | 2.4 | 1.7 | 3.0 | 3.2 | 3.9 | 5.5 | 11.2 | 25.5 | 2.0 |
| **2006** | **Mean** | 263 | 360 | 392 | 410 | 442 | 439 | 456 | 462 | 422 |
| | **N** | 174 | 12 | 78 | 22 | 26 | 37 | 10 | 10 | 2 |
| | **SE** | 1.6 | 6.0 | 3.0 | 7.5 | 7.1 | 6.7 | 13.9 | 9.5 | 61.5 |
| **Mean of means** | | 254 | 330 | 375 | 400 | 421 | 440 | 455 | 479 | 474 |

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

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

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

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

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

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

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

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

Walleye recruitment, as indexed by fall nighttime electrofishing CPUE of age-0 fish, was higher in 2005 and 2006 than during the 2001-2004 period (Table 13). The 2005 mean electrofishing CPUE, of 88.1 fish/hour, was among the highest during the 1995-2006 period, (Table 13), while the 2006 CPUE was similar to 1995, 1997 and 1998. The sites with the highest CPUE in 2006 were LaFramboise Bay, Fort George, and Hipple Lake (81.3, 36.0, 24.7 fish/h, respectively). Mean length of age-0 walleye in the 2006 fall electrofishing catch, at 155 mm, was within the range previously observed.

Table 13. Mean nighttime electrofishing catch per unit effort (CPUE; No./h) and total length (mm) for age-0 walleye collected during September and October 1995-2006 on Lake Sharpe, South Dakota. SE is standard error values about means and N is sample size.

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

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

Mean CPUE of age-1 walleye in the August gill net survey has traditionally been used as an index of walleye recruitment in Missouri River reservoirs. Potential early indicators of walleye year class strength were compared to mean age-1 gill net CPUE to determine which indicators or surveys were the best early indicators of walleye recruitment. Potential indicators of walleye recruitment and values for the 1994-2006 period are listed in Table 14. Summer age-0 seining CPUE for the 1994-2006 period, was not significantly correlated with CPUE of age-1 walleye in the standard gill net survey the following year ($P$=0.11, $r$=0.49, $d.f.$=11). However, age-0 walleye gill net and fall nighttime electrofishing CPUE were significantly positively correlated with walleye age-1 gill net CPUE the following year ($P$=0.01, $r$=0.83, $d.f.$ =11 and $P$=0.02, $r$=0.81, $d.f.$=10, respectively). Therefore, both age-0 gill net and age-0 electrofishing CPUE show promise as early indicators of walleye recruitment in Lake Sharpe.

Table 14. Mean age-0 walleye seine haul catch-per-unit-effort (CPUE; No./haul), mean standard gillnet age-0 walleye CPUE (No./net night), mean age-0 walleye nighttime electrofishing CPUE (No./ h), and mean standard gillnet age-1 walleye CPUE (No./net night) is the following year recruitment for the 1994-2006 period on Lake Sharpe, South Dakota.

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

Population Parameters for Sauger

Sauger and walleye are managed with the same set of regulations because they are hard for anglers to differentiate and sauger are a very important part of the fishery in Lake Sharpe. Fifty-four sauger were collected during the gill net survey in August 2006, for a mean CPUE of 2.3 fish/net night (Table 4). Sauger CPUE in 2006 was similar to 2003, 2004 and 2005, at approximately two sauger per net-night. No age-0 sauger were collected while shoreline seining in 2006. Age-0 sauger were collected during the fall electrofishing survey throughout the river-like portion of Lake Sharpe at Joe Creek, Fort George, Hipple Lake, and LaFramboise Bay (CPUE of 2.7, 7.3, 16.7, and 4.0 fish/h, respectively). Overall condition (mean *Wr*) for sauger greater than stock length in the 2006 gill net survey was 75 and mean length-at-age-at-time-of-capture values for fish in the 2006 sample are presented in Table 15. Sauger up to age 8 were collected in the 2006 gill net survey, with the mean age of sauger captured being 2.7 years and the largest portion (CPUE of 1.1 fish/h), of the population coming from the 2005 year class (age-1 fish, Table 16). Other year classes contributing to the sauger gill net catch in 2006 included the 2003 (CPUE of 0.63 fish/h) and 2000 (CPUE of 0.42 fish/h) year classes. Sauger collected during the gillnet survey ranged from 205 to 492 mm (Figure 4) and all exceeded stock length.

Table 15. Mean length-at-age-at-capture (mm) values for sauger collected in the standard August coolwater gill net survey, 2002-2006, on Lake Sharpe, South Dakota, as determined by aging otoliths.

| Year | | Length at age at capture (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **2002** | **Mean** | 265 | 329 | 364 | 393 | 404 | 407 | -- | 448 | 445 |
| | **N** | 1 | 41 | 17 | 26 | 6 | 1 | -- | 7 | 5 |
| | **SE** | -- | 4.2 | 7.9 | 15.6 | 8.5 | -- | -- | 24.5 | 17.9 |
| **2003** | **Length** | -- | 315 | 356 | 374 | 391 | -- | -- | -- | 458 |
| | **N** | -- | 2 | 21 | 16 | 8 | -- | -- | -- | 2 |
| | **SE** | -- | 2.5 | 24.9 | 5.7 | 8.6 | -- | -- | -- | 56.5 |
| **2004** | **Length** | 260 | 315 | 353 | 379 | 410 | 414 | -- | -- | -- |
| | **N** | 9 | 6 | 8 | 31 | 5 | 8 | -- | -- | -- |
| | **SE** | 3.1 | 11.7 | 17.7 | 4.2 | 10.5 | 15.8 | -- | -- | -- |
| **2005** | **Length** | -- | 343 | 396 | 415 | 398 | 411 | 395 | -- | -- |
| | **N** | -- | 16 | 6 | 1 | 9 | 3 | 6 | -- | -- |
| | **SE** | -- | 4.0 | 12.4 | -- | 4.9 | 12.0 | 7.5 | -- | -- |
| **2006** | **Length** | 254 | 359 | 391 | 375 | -- | 408 | -- | 480 | -- |
| | **N** | 25 | 1 | 15 | 1 | -- | 10 | -- | 1 | -- |
| | **SE** | 4.7 | -- | 5.3 | -- | -- | 10.8 | -- | -- | -- |
| **Mean of means** | | 260 | 332 | 372 | 387 | 401 | 410 | 395 | 464 | 452 |

Table 16. Age distributions of sauger collected from Lake Sharpe, South Dakota, with gill nets during standard surveys conducted from 2002 through 2006. Mean age excludes age–0 fish and ages were determined from otoliths.

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

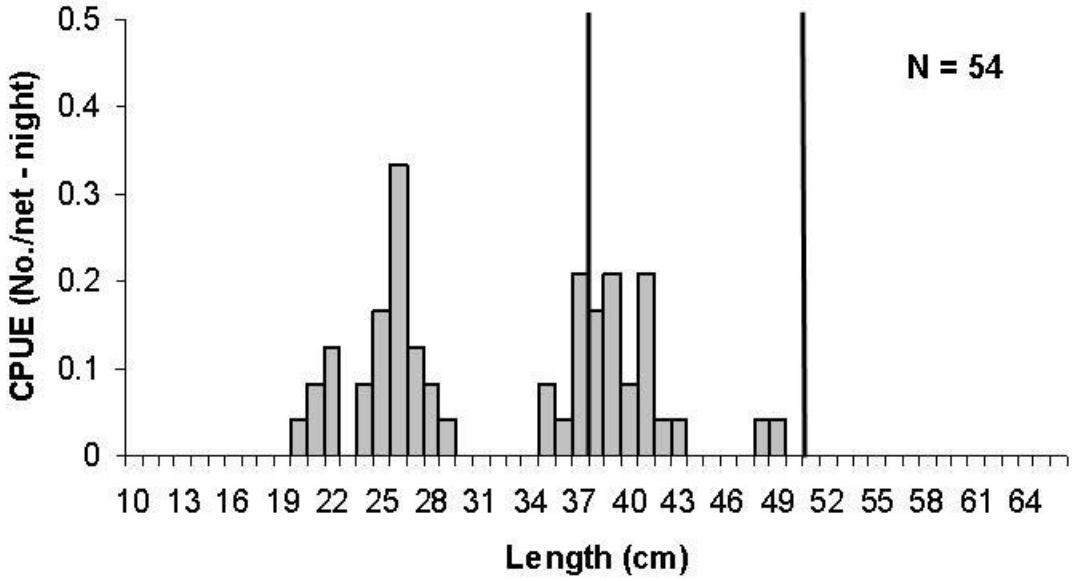


Figure 4. Length frequency, by catch per unit effort, of sauger collected during the standard gill net survey during August 2006, on Lake Sharpe, South Dakota. Vertical lines represent the 15-inch and 18 inch classifications.

Population Parameters for Smallmouth Bass

Beginning in 2002, one rip-rap area (Big Bend Dam) and one natural habitat area (Joe Creek) have been sampled every week to 10 days during late-May and early-June, (three dates and six 15 minute runs per site) by nighttime electrofishing. Data collected during 1993, 1994, and 2001-2005 is included for comparison with 2006 data (Table 17). Prior to 2002, sampling locations were sampled once each year and six, 15-minute runs were conducted. Mean CPUE has always been higher at Big Bend Dam than at Joe Creek. However, PSD, RSD-P, and RSD-M values are higher at Joe Creek. As an example, PSD at Big Bend Dam in 2006 was 22, while at Joe Creek it was 68. This pattern of higher catch rates and lower stock density indices values and size structure for rip-rap areas was also documented for Lake Oahe (Lott 1996, Lott 2000). Only one smallmouth bass was collected at Joe Creek during electrofishing in 2006 that was over the memorable length category. Figure 5 illustrates the CPUE and size structure of smallmouth bass

collected at Big Bend Dam and Joe Creek. Smallmouth bass CPUE has varied among the years sampled. Comparing mean CPUE for 2005 and 2006, CPUE at Joe Creek increased from 11.7 to 30.4 fish/h, while CPUE at Big Bend Dam did not differ significantly due to high sample variance, though mean CPUE values were 61.1 and 105.1 fish/h, respectively.

Mean back-calculated length at annulus, as determined from scales, for each year class of smallmouth bass, was higher in 2005 than 2006 (Table 18; Lott et al. 2007). Mean back-calculated length at age 4 (2002 year class) in 2006 was 316 mm. Mean length at age 4 for 2005 and 2004 were the same at 338 mm. Mean back-calculated length at age-4 for the statewide mean and Missouri River reservoirs are 300 and 310 mm, respectively, according to Willis et al (2001). For 2006, length at age 4 for Lake Sharpe smallmouth bass was similar to the Statewide and Missouri River reservoir averages. Growth for smallmouth bass in Lake Sharpe, when comparing to statewide or Missouri River reservoirs means, are generally slower for age-1 and age-2 fish, but faster for older fish in the population.

Beginning in 2004, a sample of approximately 100 smallmouth bass were collected, sacrificed, and aged by otoliths, each year. This sample was collected by angling during the June/July period in 2004 and with the use of short term monofilament gill net sets at West Bend during July in 2005 and 2006. Mean length at capture determined from aging otoliths and scales were similar. For example, mean length at age 3, as determined from aging scales, was 250 mm, compared to 259 mm when otoliths were aged (Table 19). The slight increase in lengths for otoliths may be due to growth of fish from late May and early June when electrofishing was conducted to July, when gill netting was conducted. Mean lengths at capture for age-4,-5, and-6 were also similar for the two aging structures. For smallmouth bass up to age 6, scales are a viable aging structure and allow age determination without sacrificing fish.

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

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

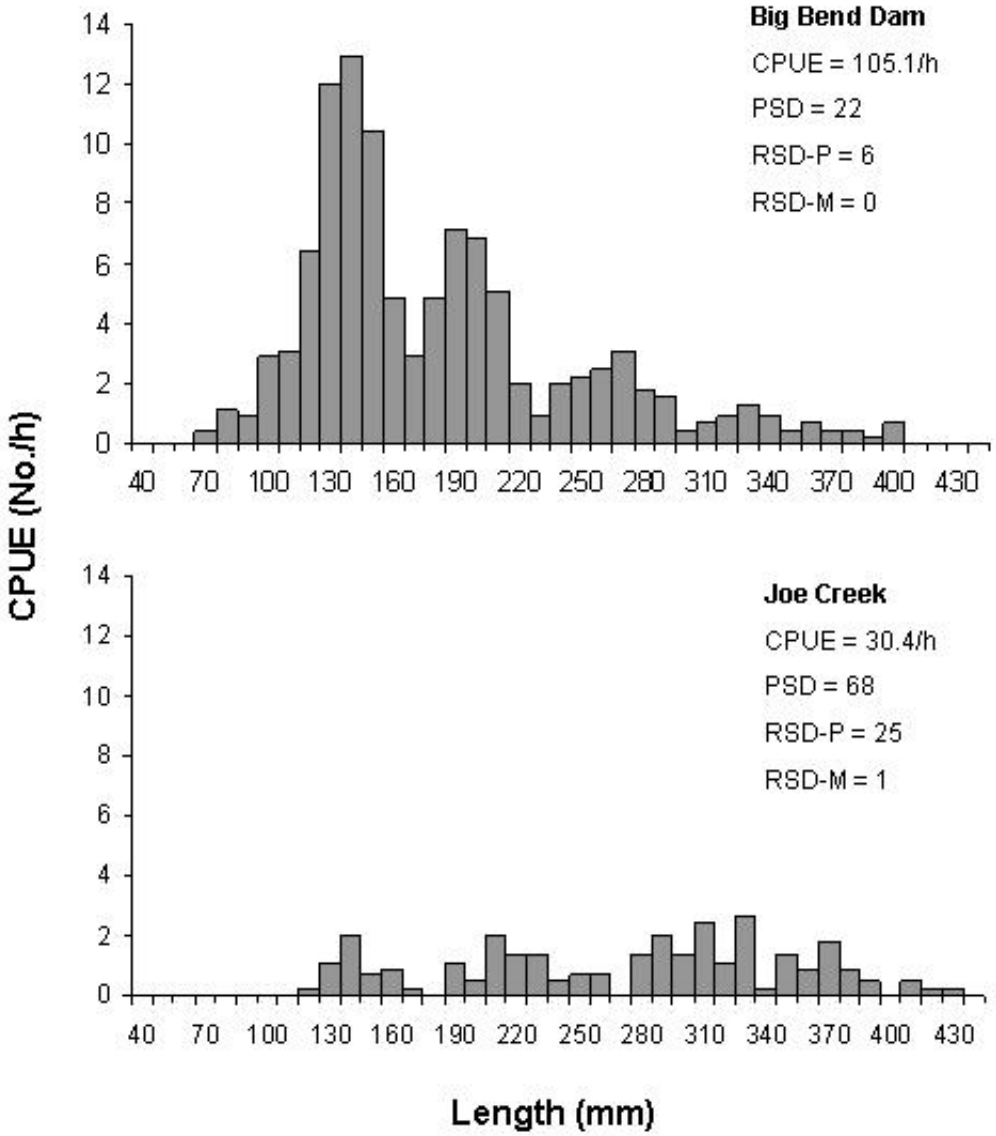


Figure 5. Length frequency of smallmouth bass collected with nighttime shoreline electrofishing, by site, during May and June 2006 on Lake Sharpe, South Dakota. Catch per unit effort (CPUE), PSD, RSD-P, RSD-M are presented for each site.

Table 18. Mean back-calculated total lengths (mm) at annulus and length increments for each year class of smallmouth bass collected from Lake Sharpe, South Dakota, by nighttime electrofishing during May and June 2006, as determined from scales. N is the number of fish of each age in the sample.

| Year class | Age | N | Annulus | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2005 | 1 | 158 | 131 | | | | | | |
| 2004 | 2 | 213 | 91 | 180 | | | | | |
| 2003 | 3 | 144 | 84 | 154 | 250 | | | | |
| 2002 | 4 | 48 | 79 | 166 | 239 | 327 | | | |
| 2001 | 5 | 19 | 84 | 176 | 265 | 312 | 372 | | |
| 2000 | 6 | 15 | 80 | 189 | 269 | 321 | 348 | 389 | |
| 1999 | 7 | 3 | 85 | 170 | 230 | 306 | 355 | 372 | 411 |
| Sample mean | | 600 | 90 | 172 | 251 | 316 | 358 | 381 | 411 |
| Standard error | | | 7 | 5 | 7 | 5 | 7 | 8 | 0 |
| Length increment | | | 82 | 78 | 66 | 42 | 22 | 30 | |
| Statewide mean | | | 91 | 171 | 242 | 300 | 333 | | |
| Missouri reservoir mean | | | 88 | 171 | 246 | 299 | 337 | | |

Table 19. Mean length-at-age-at-capture (mm) for smallmouth bass collected during July at West Bend, 2004-2006, on Lake Sharpe, South Dakota, and aged from otoliths. Sample for 2004 is from June at West Bend and Big Bend Dam areas, combined, on Lake Sharpe.

| Year | | Length at age at capture (mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **2004** | **Mean** | -- | 212 | 292 | 347 | 368 | 410 | 414 | -- | -- |
| | **N** | -- | 5 | 57 | 24 | 12 | 2 | 1 | -- | -- |
| | **SE** | -- | 15.1 | 3.5 | 4.9 | 4.5 | 10 | -- | -- | -- |
| **2005** | **Mean** | 183 | 226 | 257 | 332 | 354 | 374 | 389 | -- | -- |
| | **N** | 1 | 15 | 43 | 31 | 26 | 6 | 6 | -- | -- |
| | **SE** | -- | 4.7 | 5.1 | 2.9 | 15.7 | 5.2 | 7.2 | -- | -- |
| **2006** | **Mean** | -- | -- | 227 | 293 | 357 | 387 | 404 | 422 | 419 |
| | **N** | -- | -- | 20 | 29 | 11 | 12 | 11 | 3 | 2 |
| | **SE** | -- | -- | 8.2 | 7.8 | 8.9 | 4.2 | 4.9 | 15.3 | 6.5 |
| **Mean of means** | | 183 | 219 | 259 | 324 | 360 | 390 | 402 | 422 | 419 |

Mean smallmouth bass *Wr* values in the spring electrofishing survey for Lake Sharpe in 2006 remained in the 90's for fish in the sub-stock through quality-to-preferred length groups (Table 20). As the size of bass increases, condition generally decreases in Lake Sharpe and 2006 was no exception. Preferred-to-memorable-length fish had a mean *Wr* of 89 in 2006, compared to mean *Wr* values of 97 and 93 for stock-to-quality- and quality-to-preferred-length fish, respectively. Only one fish was collected in the memorable-trophy length group in 2006.

Table 20. Mean relative weight (Wr), by length class, for Lake Sharpe smallmouth bass collected by electrofishing during May and June, 2001-2006. N is the number of fish used in calculations. Values with the same letter code, within a year, are not significantly different from one another at the *P* = 0.05 level.

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

The current smallmouth bass regulation package on Lake Sharpe restricts anglers from harvesting bass between 306 and 457 mm. Electrofishing has been documented to under-represent population size structure for smallmouth bass (Green et al. 1986; Beamesderfer and Riemer 1988), meaning standard sampling techniques may not adequately sample the larger fish in a population. Therefore, Game, Fish, and Parks worked with the South Dakota Bass Anglers Sportsmen Society (BASS) Federation to collect lengths and weights from fish caught during the BASS Championship tournament conducted on September 30 and October 1, 2006. During the tournament, a total of 797 bass were brought into the weigh-in site, of those 499 were measured lengths (TL, mm) and 308 were also weighed (g) by GFP staff. Of the smallmouth bass with weights taken, 98 fish were within the memorable-trophy length group with a mean *Wr* of 93. Figure 6 illustrates the sizes of smallmouth bass collected and measured after the tournament.

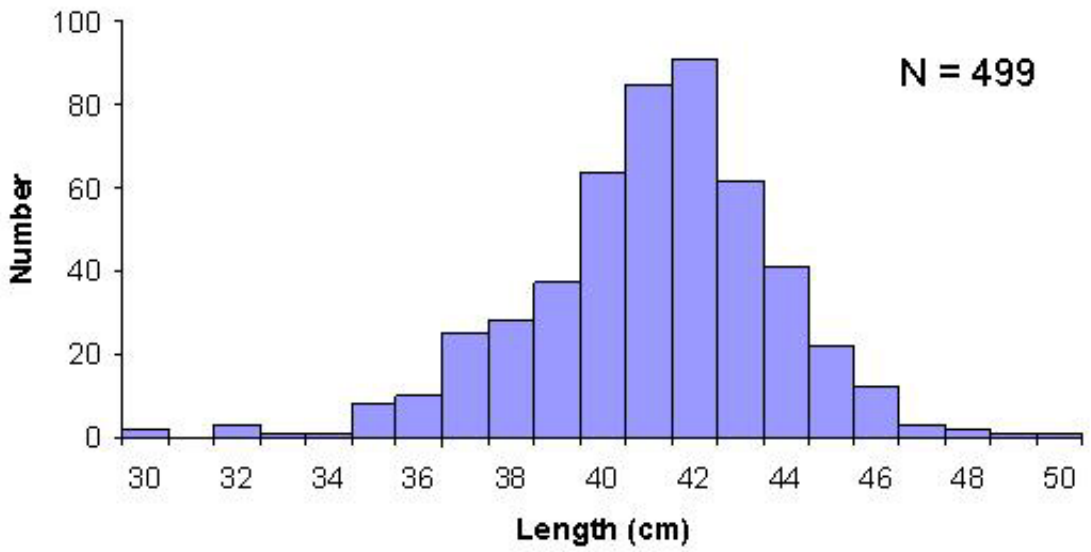


Figure 6. Lengths of smallmouth bass caught during the 2006 SD BASS Championship tournament during September 30 and October 1. Lengths are of 499 fished measured of the 797 smallmouth bass brought into the weigh-in.

Population Parameters for Channel Catfish

Channel catfish population indices, such as PSD, RSD-P, RSD-M, and *Wr* exhibited little change during the 1997- 2006 period (Table 21). Channel catfish CPUE (no./net-night) decreased from 17.5 in 2005 to 6.5 in 2006 (Table 4). Prior to 2006, channel catfish mean CPUE has ranged from a high of 20.1 for 2002 to a low of 5.0 for 1998, thus CPUE for 2006 is still in within the range previously observed. A factor that may have influenced the low catch rates in 2006 may have been heavy vegetation in the gear in selected sites that have historically had higher catch rates for channel catfish (DeGrey and Farm Island). Figure 7 illustrates the CPUE by length for the 2003 through 2006 period for channel catfish gill net samples. Growth and age structure data from the 2003 survey illustrates channel catfish are long lived but grow slowly in Lake Sharpe (Lott et al 2004) and this 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 the slow growth, age structures (pectoral spines) will be collected every five years on Lake Sharpe and 2008 will be the next year of collection.

Table 21. Channel catfish proportional stock density (PSD), relative stock density of preferred and memorable-length (RSD-P and RSD-M) fish, and relative weight (*Wr*) for 1997-2006, from Lake Sharpe, South Dakota. Mean *Wr* values for 2002–2006 are for stock-length fish only.

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

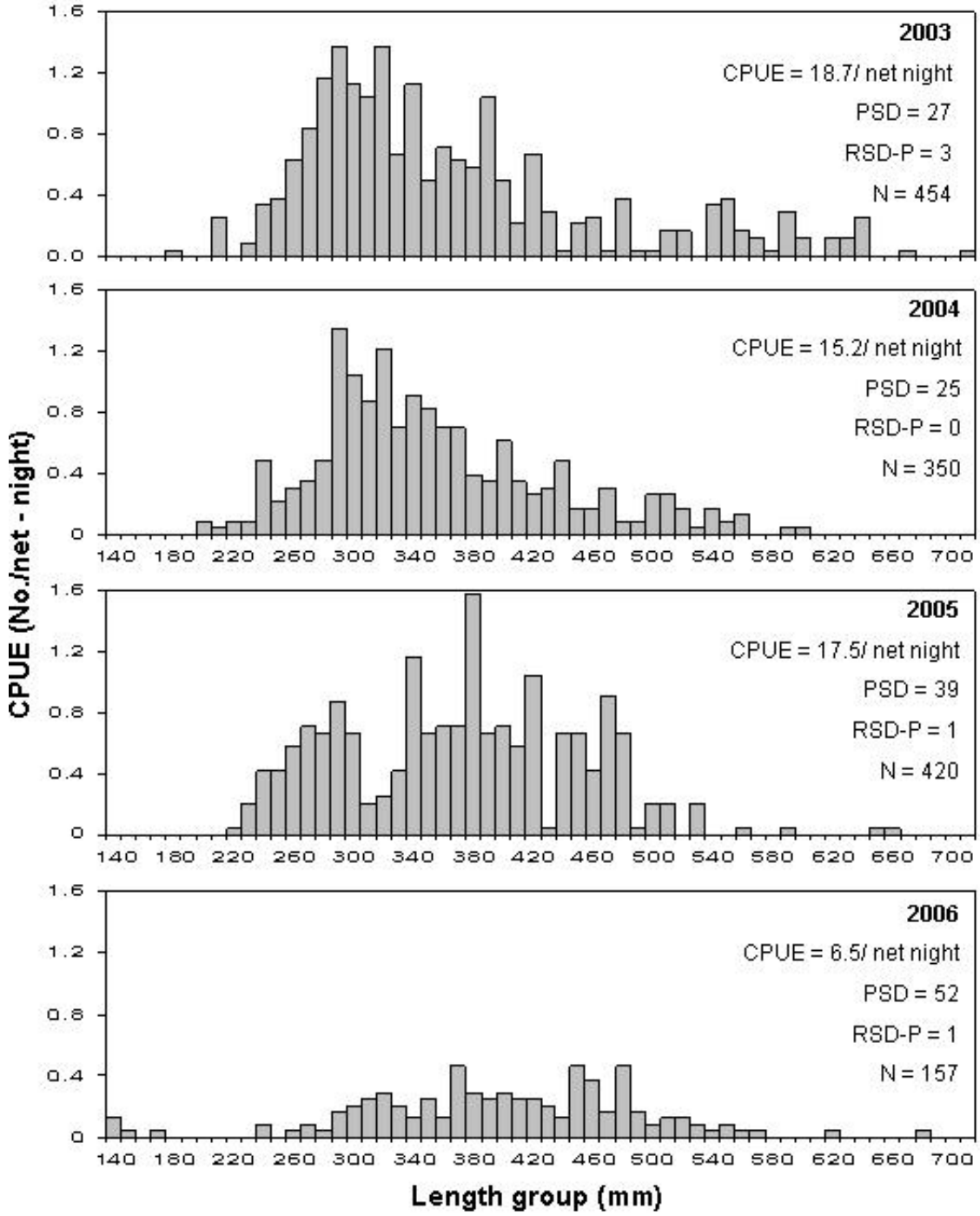


Figure 7. Length frequency, by catch per unit effort, of channel catfish collected during the standard, coolwater gill net survey during August 2003 through 2006, on Lake Sharpe, South Dakota. Catch per unit effort (CPUE), PSD, RSD-P, and sample size (N) are presented for each year.

## ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Angler Use

A total of 1,359 angling parties were interviewed during the April-September 2006 daytime angler use and harvest survey. Estimated fishing pressure for the April-September 2006 daylight period, at 342,974 angler-h, was greater than estimates for 2004 and 2005 and similar to the 2002 estimate of 385,357 angler-h (Table 22). Estimated angler days spent on Lake Sharpe during the 2006 survey period was 99,702 days, a value near the reservoir-wide objective of 100,000 angler days (SDGFP 1994).

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

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

* June 1973 through May 1974

Estimated fishing pressure in upper Lake Sharpe in 2006 was similar to lower Lake Sharpe, at 169,500 and 143,410 angler-h, respectively (Table 23). Fishing pressure for middle Lake Sharpe in 2006, at 30,064 angler-h, was higher than the 2005 value of 20,174 and was similar to the 2004 value of 34,773 (Table 24). Estimated fishing pressure for reservoir zones on Lake Sharpe is often highest in lower Lake Sharpe and lowest in middle Lake Sharpe (Table 24; Johnson and Lott 2001; Johnson et al. 2002; Lott et al. 2003). Estimated fishing pressure for upper Lake Sharpe for 2006 was similar to 2004 and 2005 (Lott et al. 2006b, 2007). Estimated fishing pressure for lower Lake Sharpe in 2006 was higher than for 2004 or 2005, resulting in the overall increase in fishing pressure (Table 22) estimated for 2006. Fishing pressure on Lake Sharpe peaked during May in 2004 and 2005, and during June in 2006, at an estimated 95, 618 angler-h (Table 23). The peak in fishing pressure for Lake Sharpe typically occurs in May or June (Johnson and Lott 2001; Lott et al. 2003, 2006, 2007).

Table 23. Estimated fishing pressure (angler hours), by month and zone, with 80% confidence intervals (CI), for the April-September 2006 daylight period on Lake Sharpe, South Dakota.

| Zone | Month | | | | | | |
|---|---|---|---|---|---|---|---|
| | April | May | June | July | August | Sept. | Total |
| **Lower** | 5,792 | 24,206 | 52,754 | 30,027 | 12,117 | 18,514 | 143,410 |
| **80% CI** | 3,532 | 8,067 | 10,253 | 6,240 | 3,052 | 8,991 | 17,657 |
| **Middle** | 3,194 | 10,990 | 5,916 | 2,880 | 2,005 | 5,079 | 30,064 |
| **80% CI** | 1,710 | 3,105 | 2,022 | 1,573 | 681 | 2,634 | 5,151 |
| **Upper** | 25,193 | 42,305 | 36,949 | 28,619 | 21,140 | 15,295 | 169,500 |
| **80% CI** | 8,681 | 12,088 | 26,170 | 5,077 | 4,934 | 2,406 | 31,020 |
| **Total** | 34,179 | 77,501 | 95,618 | 61,526 | 35,262 | 38,888 | 342,974 |
| **80% CI** | 9,527 | 14,860 | 28,180 | 8,196 | 5,842 | 9,673 | 36,063 |

Estimated boat angler hours for 2006 increased from 2004 and 2005 to 287,893 angler-h. Shore angler hours for all years in the 2003-2006 period were similar, at approximately 55,000 angler h, except during 2005 when an estimated 42,911 angler-h of shore fishing activity occurred (Table 25). Estimated hours of fishing pressure per hectare during 2006 was 14.5, which is within the range of previous years. Since 2003, a bus route design has been used to capture angling pressure data, and appears to do a better job of capturing shore angler use than the traditional survey method, which used aerial counts to generate pressure estimates (Schmidt 1975).

Table 24. Estimated fishing pressure, expressed as angler-hours (h) and hour per hectare (h/ha), by reservoir zone, for standard creel surveys conducted during the April-September daylight period, on Lake Sharpe, South Dakota, from 1994 through 2006.

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

Table 25. Estimated fishing pressure, expressed as angler-hours (h) and hours per hectare (h/ha), by type of fishing, with 80% confidence intervals (CI), for the standard April-September daylight survey period, on Lake Sharpe, South Dakota, from 2003 through 2006.

| Type of fishing | Year | | | |
|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 |
| **Boat (h)** | 345,135 | 252,698 | 228,420 | 287,893 |
| **80% CI** | 31,187 | 21,519 | 29,535 | 35,044 |
| **H/ha** | 14.6 | 10.6 | 9.7 | 12.2 |
| **Shore (h)** | 52,084 | 57,966 | 42,911 | 55,082 |
| **80% CI** | 7,707 | 7,410 | 5,972 | 6,577 |
| **H/ha** | 2.2 | 2.4 | 1.8 | 2.3 |
| **Combined (h)** | 397,220 | 309,663 | 271,331 | 342,974 |
| **80% CI** | 32,215 | 22,396 | 29,828 | 36,063 |
| **h/ha** | 16.8 | 13.1 | 11.5 | 14.5 |

Catch, Harvest and Release Estimates

An estimated 158,402 fish were harvested from Lake Sharpe during the April-September daylight period (Table 26). Estimated harvest of walleye during the 2006 survey period was 115,300 fish, a value above the Lake Sharpe strategic plan objective of 100,000 fish. Channel catfish, white bass, sauger, smallmouth bass, and rainbow trout followed walleye, in terms of estimated harvest in 2006. During years of low walleye harvest, harvest usually peaks in July and August, when the 381-mm minimum length limit is not in effect. Estimated walleye harvest peaked during May and June during 2006. In years when the walleye harvest objective of 100,000 fish is met, high harvest usually is highest during May and June. White bass harvest was highest in May while rainbow trout harvest was highest in April, and channel catfish harvest was highest in July (Table 26).

Table 26. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the April-September 2006 daylight period on Lake Sharpe, South Dakota.

| Species | Month | | | | | | |
|---|---|---|---|---|---|---|---|
| | April | May | June | July | Aug. | Sept. | Total |
| **Walleye** | 9,115 | 28,146 | 32,236 | 25,549 | 10,986 | 9,267 | 115,300 |
| **80% CI** | 2,751 | 7,999 | 15,080 | 4,674 | 3,326 | 2,254 | 18,356 |
| **Sauger** | 2,367 | 5,185 | 1,201 | 35 | 122 | 172 | 9,081 |
| **80% CI** | 1,124 | 1,601 | 595 | 41 | 117 | 125 | 2,052 |
| **Channel Catfish** | 1,376 | 1,340 | 1,866 | 1,982 | 4,082 | 490 | 11,134 |
| **80% CI** | 666 | 644 | 498 | 865 | 1,442 | 532 | 2,053 |
| **White Bass** | 846 | 6,718 | 1,079 | 457 | 1,137 | 587 | 10,824 |
| **80% CI** | 576 | 4,201 | 405 | 241 | 1,078 | 307 | 4,411 |
| **Smallmouth bass** | 493 | 1,447 | 1,420 | 494 | 626 | 712 | 5,194 |
| **80% CI** | --- | 779 | 590 | 269 | 433 | 405 | 1,174 |
| **Rainbow trout** | 1,334 | 0 | 0 | 0 | 0 | 92 | 1,426 |
| **80% CI** | 1,717 | 0 | 0 | 0 | 0 | 70 | 1,718 |
| **Yellow perch** | 18 | 302 | 493 | 252 | 328 | 50 | 1,442 |
| **80% CI** | 0 | 216 | 540 | 200 | 263 | 43 | 670 |
| **Other*** | 66 | 2,853 | 153 | 107 | 521 | 301 | 4,001 |
| **Total** | 15,615 | 45,991 | 38,448 | 28,876 | 17,802 | 11,671 | 158,402 |
| **80% CI** | 4,214 | 10,646 | 16,937 | 4,860 | 2,401 | 2,058 | 21,314 |

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

An estimated 274,802 fish were caught and released during the April-September 2006 daytime period on Lake Sharpe (Table 27). Estimated number of walleye released peaked during May and June when the 381-mm minimum length limit was in effect (Table 27) and fishing pressure was the highest of the April-September period (Table 23).

Table 27. Estimated number of fish released, by species and month, for the April-September 2006 daylight period, on Lake Sharpe, South Dakota.

| Species | Month | | | | | | |
|---|---|---|---|---|---|---|---|
| | April | May | June | July | Aug. | Sept. | Total |
| **Walleye** | 3,207 | 23,873 | 32,713 | 10,299 | 5,062 | 16,227 | 91,381 |
| **Sauger** | 363 | 3,541 | 2,658 | 105 | 375 | 268 | 7,310 |
| **Channel Catfish** | 153 | 1,277 | 3,448 | 1,787 | 3,031 | 563 | 10,259 |
| **White Bass** | 449 | 13,956 | 6,462 | 696 | 2,994 | 2,736 | 27,293 |
| **Smallmouth bass** | 5,371 | 24,716 | 42,934 | 12,997 | 4,803 | 16,112 | 106,933 |
| **Rainbow trout** | 2,244 | 162 | 28 | 0 | 0 | 0 | 2,434 |
| **Yellow perch** | 485 | 2,525 | 1,772 | 2,151 | 1,682 | 1,577 | 10,192 |
| **Other*** | 1,471 | 5,869 | 4,060 | 2,053 | 3,318 | 2,229 | 19,000 |
| **Total** | 13,743 | 75,919 | 94,075 | 30,088 | 21,265 | 39,712 | 274,802 |

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

Examination of Table 26 and Table 27and Figure 8 provide a complete picture of catch and harvest of sport fish species for the April-September 2006 survey period. Walleye were the most abundant species in the angler catch during 2006, at an estimated catch of 206,681 fish. Walleye was followed by smallmouth bass, white bass, channel catfish, and sauger, in decreasing order of estimated catch (Figure 8). Approximately 56% of walleye caught during 2006 were harvested while percentages of fish harvested for smallmouth bass, white bass, channel catfish, and sauger were 5%, 28%, 52%, and 55%, respectively. The high percentage of smallmouth bass released was due, in part, to the 306-457-mm protected slot length limit that was implemented in 2003.

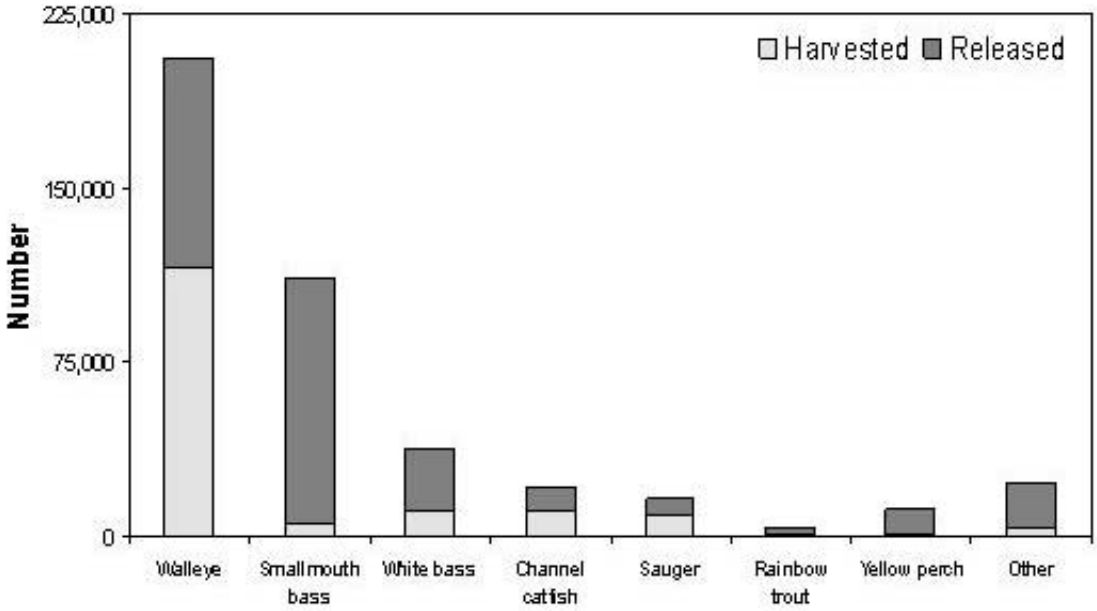


Figure 8. Estimated number of fish harvested, and released, for selected species, for the April-September 2006 daylight period, on Lake Sharpe, South Dakota. Other includes shovelnose sturgeon, smallmouth buffalo, black bullhead, northern pike, goldeye, common carp, bluegill, largemouth bass, white crappie, black crappie, and freshwater drum.

Estimated walleye harvest during the 2006 April-September standard survey period was highest in lower Lake Sharpe at 58,413 fish and an estimated 52,710 walleye were harvested in upper Lake Sharpe (Table 28). Sauger and rainbow trout harvest were the highest in the upper zone while smallmouth bass harvest was highest in the lower zone of Lake Sharpe, with 89% of the estimated smallmouth bass harvest for the total reservoir coming from the lower zone in 2006.

Table 28. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the April-September 2006 daylight period, on Lake Sharpe, South Dakota.

| Species | Zone | | | |
|---|---|---|---|---|
| | Upper | Middle | Lower | Total |
| **Walleye** | 52,710 | 4,177 | 58,413 | 115,300 |
| **80% CI** | 16,088 | 1,262 | 8,747 | 18,356 |
| **Sauger** | 7,406 | 663 | 1,012 | 9,081 |
| **80% CI** | 2,025 | 174 | 282 | 2,052 |
| **Channel Catfish** | 4,874 | 3,229 | 3,031 | 11,134 |
| **80% CI** | 1,627 | 987 | 770 | 2,053 |
| **White Bass** | 4,391 | 4,986 | 1,447 | 10,824 |
| **80% CI** | 4,060 | 1,665 | 445 | 4,411 |
| **Smallmouth bass** | 428 | 127 | 4,639 | 5,194 |
| **80% CI** | 268 | 92 | 1,140 | 1,174 |
| **Rainbow trout** | 1,426 | 0 | 0 | 1,426 |
| **80% CI** | 1,718 | 0 | 0 | 1,718 |
| **Yellow perch** | 636 | 50 | 756 | 1,442 |
| **80% CI** | 605 | 43 | 286 | 670 |
| **Total** | 73,420 | 15,372 | 69,610 | 158,402 |
| **80% CI** | 18,375 | 3,249 | 10,301 | 21,314 |

Estimated numbers of walleye caught, harvested, and released during the standard April-September daylight survey period increased in 2006 from 2004 and 2005, which were the lowest years for these parameters during the 1994-2006 period (Table 29). More walleye were estimated to have been harvested in 2006 than were caught in 2005. The percentage of walleye caught that were harvested increased from 21% in 2003 and 37% in 2004 to 57% and 56% for 2005 and 2006, respectively. The year classes that contributed most to the 2006 harvest were the 2000 and , 2001 year classes and the portion of the 2003 year class that surpassed 381-mm in length in 2006 (Table 29).

Table 29. Estimated number of walleye caught, harvested, and released during the April-September daylight period for Lake Sharpe, South Dakota 1994 through 2006.

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

Length frequency distributions of walleyes harvested each month during the April-September 2006 daylight period illustrate standard trends for Lake Sharpe (Figure 9). Between 79 and 88% of the walleyes harvested during the months that the 381-mm minimum length limit was in effect were between 381 and 457-mm in length (15 and 18 inches). During July and August, when no minimum length limit was in effect, 75% and 72% of the walleyes harvested were between 381 and 457-mm in length and 19% were less than 381-mm during both months. The percentage of walleye longer than 457 mm in length in the angler harvest was highest during April at 26% and ranged from 6% to 13% during other months in the April-September period. Approximately 12% of walleye harvested during the April-September survey period were 457-mm or longer (Figure 9). Beginning in 2006, the “one over” regulation was increased to 508 mm. During 2006, very few walleye harvested exceeded 508 mm, though 5% of the harvested walleye measured in April exceeded this length. During all other months in the April-September period, 1% or less of the harvest was ≥ 508.

Length frequency histograms for smallmouth bass measured in the angler harvest in 2006, illustrate the effects of the 305-457-mm protected slot length limit placed in effect in 2003 (Figure 10). For the April-September 2006 daylight survey period, approximately 77% of the smallmouth bass harvested were <305-mm in length and 2% were ≥457-mm in length. Approximately 21% of the smallmouth bass measured during angler interviews were within the protected slot length limit and 2% were over the protected slot limit (Figure 10). During the month of June, 43% of the smallmouth bass harvested and measured by creel clerks were within the protected slot. Approximately 55% of the fishing pressure in Lake Sharpe in June 2006 occurred in the lower zone of the reservoir (Table 23), and the majority of smallmouth bass caught each year are caught in this zone (Table 28), with June traditionally being the highest month for angler harvest.

Hourly Catch, Harvest, and Release Rates

Estimated hourly catch and release rates for all species combined for the April-September 2006 daylight period, at 1.26 fish/h and 0.80 fish/h (Table 30), respectively were higher than values for the same period in 2005 (Lott et. al 2007). Estimated mean harvest rate, for all species combined, for 2005 and 2006, were similar at 0.49 and 0.46 fish/angler-h, respectively. The increase in overall catch rate from 2005 to 2006 was mostly due to an increase in hourly catch rate of walleye and smallmouth bass, from 0.37 to 0.60 for walleye and 0.11 to 0.33 for smallmouth bass. A decrease in catch rates occurred from 2005 to 2006 for white bass (0.40 in 2005 to 0.11 in 2006). This decrease in the white bass catch can be attributed to the white bass die off that occurred during July 2005 (Lott et. al. 2007).

Table 30. Estimated hourly catch, harvest, and release rates, by species, for all anglers interviewed on Lake Sharpe, South Dakota, during the April-September 2006 daylight survey period. Trace (T) indicates values >0.0 but <0.01.

| Species | Catch rate (fish/angler-h) | Harvest rate (fish/angler-h) | Release rate (fish/angler-h) |
|---|---|---|---|
| **Walleye** | 0.60 | 0.33 | 0.27 |
| **Sauger** | 0.05 | 0.03 | 0.02 |
| **White bass** | 0.11 | 0.03 | 0.08 |
| **Smallmouth Bass** | 0.33 | 0.02 | 0.31 |
| **Channel catfish** | 0.06 | 0.03 | 0.03 |
| **Rainbow trout** | T | T | T |
| **Yellow perch** | T | T | T |
| **Other*** | 0.11 | 0.02 | 0.09 |
| **Total** | 1.26 | 0.46 | 0.80 |

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

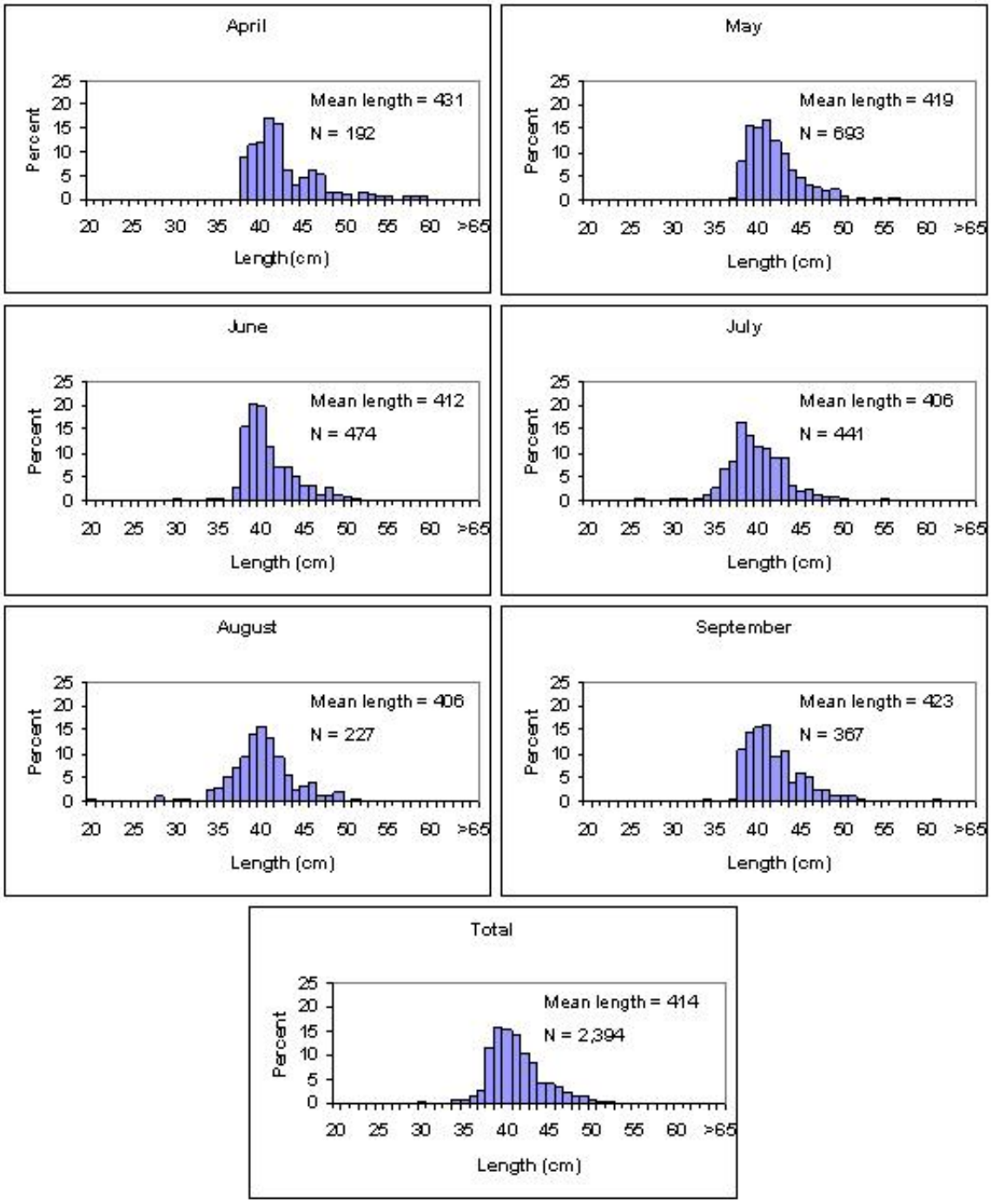


Figure 9. Length frequency distribution of walleye harvested by anglers, by month, fishing Lake Sharpe, South Dakota, during the April-September 2006 daylight period. Mean length and sample size for each period presented.

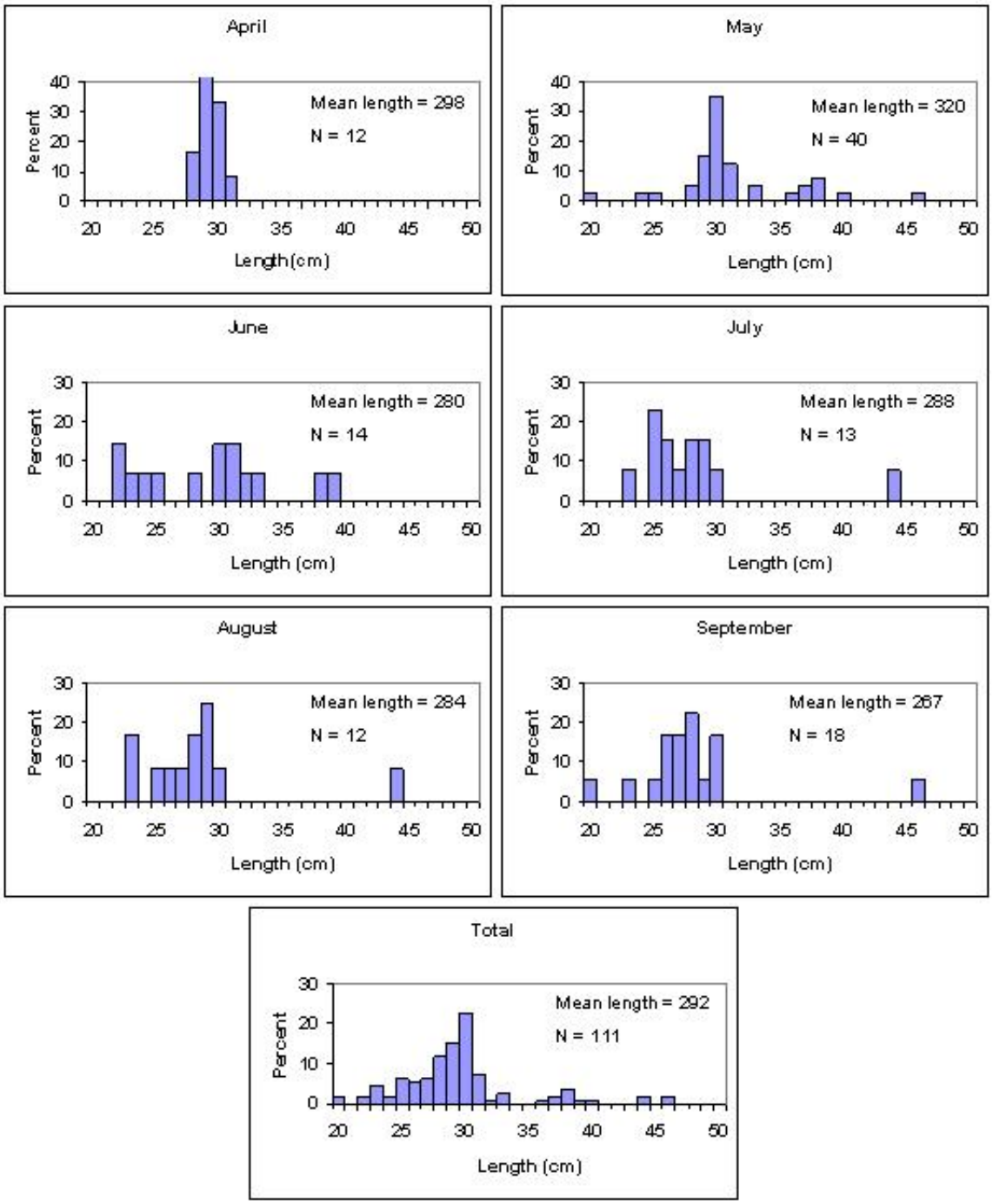


Figure 10. Length frequency distribution of smallmouth bass harvested by anglers fishing Lake Sharpe, South Dakota, by month, during the April-September 2006 daylight period. Mean length and sample size for each period is presented.

For anglers specifically fishing for a certain species, hourly catch, harvest, and release rates were substantially higher (Table 31) than those for all anglers combined (Table 30). Anglers specifically fishing for walleyes had a mean hourly catch rate of 1.45 fish/angler-h for the April-September daylight period (Table 31), while the mean catch rate of walleyes by all anglers was 0.60 fish/angler-h (Table 30). Anglers specifically fishing for smallmouth bass, white bass, and channel catfish had mean hourly catch rates of 4.14, 2.03, and 2.16 fish/angler-h, respectively. The catch rate for anglers fishing specifically for white bass was significantly lower in 2006 than previous years (5.82 fish/angler-h in 2005 and 9.53 fish/angler-h in 2004).

Table 31. Estimated hourly catch, harvest, and release rates, by species, for anglers specifically fishing for the species listed, on Lake Sharpe, South Dakota during for the April-September 2006 daylight period. Trace (T) indicates values >0.0 but <0.01.

| Species | Catch rate (fish/angler-h) | Harvest rate (fish/angler-h) | Release rate (fish/angler-h) |
|---|---|---|---|
| **Walleye** | 1.45 | 0.80 | 0.65 |
| **White bass** | 2.03 | 0.27 | 1.76 |
| **Smallmouth bass** | 4.14 | 0.13 | 4.01 |
| **Channel catfish** | 2.16 | 2.03 | 0.13 |
| **Rainbow trout** | 1.30 | 0.29 | 1.01 |

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 2006, are presented in Table 32. The high hourly catch rate for walleye in 2003 was likely related to a high abundance of age-3 fish (2000 year class; Table 12) and low gizzard shad production (Table 5). Low hourly catch rates for walleye from 2004 to 2006 were likely related to higher shad production, a decrease in walleye abundance (Table 4), and an increase in mean age of fish in the walleye population (Table 12). Even during 2006, the hourly catch rate of walleye in Lake Sharpe has been above 0.3 fish/angler-h, the level indicative of excellent walleye fisheries (Colby et al. 1979).

There is a general trend of increasing catch rates for smallmouth bass, channel catfish, and white bass during the 1993-2006 period (Table 32). Abundance of fish may influence hourly catch rates by anglers to some extent. However, it is likely that an increase in the percentage of total angling trips specifically for smallmouth bass, channel catfish, and white bass, and an increase in the likelihood of shore anglers being interviewed by survey clerks may be responsible for the majority of the increase in hourly catch rates. As previously mentioned, the bus route survey design is more effective at capturing shore angler interviews and fishing pressure than the access site/aerial survey design. Both white bass and channel catfish are species frequently targeted and caught by shore anglers. Therefore, increasing the percentage of total interviews from shore anglers would lead to an increase in catch rates for species commonly caught or targeted from shore.

Hourly catch rates for walleye and all fish during 2006 fluctuated greatly among months (Table 33). The release rate for walleye was the highest during May, June, and September, 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. However, during 2006, when a high percentage of walleye were longer than the minimum length limit and catch rates were low, a lower percentage of fish released was lower than during most years.

Table 32. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, by year, for all anglers, for the April-September daylight survey period on Lake Sharpe, South Dakota, 1993 through 2006.

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

Table 33. Estimated hourly catch, harvest, and release rates, (fish/angler-h), for walleye and all species combined, by month, for the April-September 2006 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** | 0.36 | 0.27 | 0.09 | 0.86 | 0.46 | 0.40 |
| **May** | 0.67 | 0.36 | 0.31 | 1.57 | 0.59 | 0.98 |
| **June** | 0.68 | 0.34 | 0.34 | 1.39 | 0.40 | 0.99 |
| **July** | 0.58 | 0.41 | 0.17 | 0.96 | 0.47 | 0.49 |
| **August** | 0.46 | 0.31 | 0.15 | 1.11 | 0.51 | 0.60 |
| **September** | 0.66 | 0.24 | 0.42 | 1.32 | 0.30 | 1.02 |
| **Total** | 0.60 | 0.33 | 0.27 | 1.26 | 0.46 | 0.80 |

There was an overall increase in the catch of walleye per angling party that occurred from 2005 to 2006 (44 percent in 2005 to 55 percent in 2006). During 2006, a higher percentage of parties caught and harvested walleye while fishing the lower zone of the reservoir than in other zones. In 2006, only 18% of parties caught no walleye in the lower zone compared to 68% and 53% for the middle and upper zones, respectively. Harvest also mirrored catch, with 29% of parties in the lower zone harvesting no walleye in 2006, compared to 78% and 60% for the middle and upper zones, respectively. During 2006, 22% of the angling parties caught a limit (four fish) in the lower zone, compared to 5% and 9% in the middle and upper zones, respectively. For the entire reservoir and survey period, 12% of parties fishing Lake Sharpe harvested a limit of walleye (Table 34).

Table 34. Percentage of angling parties catching and harvesting the specified number of walleye and sauger (combined) per person on an angling trip by reservoir zone, for Lake Sharpe, South Dakota, during the April-September 2005 and 2006 daylight survey periods.

| Number /trip | Catch per trip | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2005 | | | | 2006 | | | |
| | Lower | Middle | Upper | Total | Lower | Middle | Upper | Total |
| **0** | 27 | 80 | 66 | 56 | 18 | 68 | 53 | 45 |
| **0.0-0.9** | 16 | 4 | 7 | 10 | 13 | 9 | 8 | 9 |
| **1.0-1.9** | 15 | 6 | 9 | 10 | 17 | 9 | 11 | 12 |
| **2.0-2.9** | 10 | 2 | 6 | 7 | 11 | 3 | 6 | 7 |
| **3.0-3.9** | 12 | 3 | 6 | 7 | 8 | 2 | 6 | 6 |
| **4.0-4.9** | 6 | 4 | 3 | 4 | 10 | 1 | 6 | 6 |
| **5.0-5.9** | 4 | 1 | 0 | 2 | 7 | 2 | 3 | 4 |
| **6.0-6.9** | 4 | 0 | 2 | 2 | 5 | 1 | 2 | 3 |
| **7.0-7.9** | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 2 |
| **8.0-8.9** | 1 | 0 | 0 | 1 | 3 | 1 | 1 | 2 |
| **9.0-9.9** | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| **≥10** | 3 | 1 | 0 | 1 | 4 | 2 | 2 | 3 |

| Number /trip | Harvest per trip | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2005 | | | | 2006 | | | |
| | Lower | Middle | Upper | Total | Lower | Middle | Upper | Total |
| **0** | 38 | 84 | 76 | 66 | 29 | 78 | 60 | 54 |
| **0.0-0.9** | 15 | 3 | 6 | 8 | 15 | 8 | 8 | 10 |
| **1.0-1.9** | 17 | 3 | 8 | 10 | 16 | 5 | 11 | 12 |
| **2.0-2.9** | 11 | 4 | 5 | 7 | 10 | 1 | 6 | 6 |
| **3.0-3.9** | 20 | 6 | 5 | 10 | 8 | 3 | 6 | 6 |
| **≥4** | **Daily limit of 3** | | | | 22 | 5 | 9 | 12 |

Smallmouth bass catch and harvest per trip for angling parties fishing the lower zone of Lake Sharpe, from 2002 through 2006, are presented in Table 35 and serve as a valuable tool for evaluating effects of the 305-457-mm protected slot length limit implemented in 2003. During the 2002-2005 period, the percentage of angling parties that caught no smallmouth bass ranged from 39% to 52%, and for 2006, 28% of parties caught no smallmouth bass. For years in the 2003-2006 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 (Table 35). Since regulations were changed in 2003, only 1% to 5% of angling parties fishing the lower zone of Lake Sharpe harvested more than two smallmouth bass per angler.

Table 35. Percentage of angling parties catching and harvesting the specified number of smallmouth bass on an angling trip, per person, for the lower zone of Lake Sharpe, during the April-September daylight survey period, 2002-2006.

| Number /trip | Catch per trip | | | | | Harvest per trip | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2002 | 2003 | 2004 | 2005 | 2006 |
| **0** | 45 | 42 | 39 | 52 | 28 | 75 | 85 | 86 | 91 | 84 |
| **0-1** | 20 | 22 | 14 | 15 | 28 | 13 | 9 | 8 | 5 | 12 |
| **1-2** | 14 | 12 | 15 | 13 | 14 | 8 | 4 | 4 | 2 | 3 |
| **2-3** | 6 | 8 | 10 | 6 | 5 | 3 | 1 | 2 | 1 | 0 |
| **3-4** | 5 | 4 | 5 | 4 | 5 | 1 | 0 | 0 | 1 | 1 |
| **4-5** | 3 | 2 | 4 | 3 | 4 | 1 | 0 | 0 | 0 | 0 |
| **5-6** | 2 | 2 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| **6-7** | 2 | 2 | 3 | 2 | 4 | | | | | |
| **7-8** | 1 | 1 | 1 | 1 | 3 | | | | | |
| **8-9** | 0 | 1 | 1 | 1 | 1 | **Daily limit of 5** | | | | |
| **9-10** | 0 | 0 | 0 | 0 | 1 | | | | | |
| **≥10** | 2 | 3 | 4 | 2 | 5 | | | | | |

Angler Demographics and Economic Impacts

For the April-September 2006 daylight period, Lake Sharpe anglers contributed approximately 6.1 million dollars to local economies, based on an estimated 99,702 trips (Table 22) at an estimated $61 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 2002).

Average party size was 2.2 anglers/party and average trip length was 3.4 h, during the April-September 2006 period. Residents comprised 85% of angling parties interviewed on Lake Sharpe during the April-September 2006 daytime survey period, a value higher than in 2002 (Table 36). The percentage of resident anglers is generally lowest in lower Lake Sharpe and highest in middle Lake Sharpe (Table 36). Campground facilities at West Bend and Big Bend Dam and a high percentage of boat anglers in lower Lake Sharpe may contribute to the higher percentage of non-residents fishing this zone of the reservoir. The majority of anglers fishing middle Lake Sharpe are shore anglers, which are generally local residents.

The majority of non-resident anglers fishing Lake Sharpe in 2006 were from the states of Nebraska, Iowa, and Minnesota. Patterns in angler state of residency in 2006 remained similar to other years from 2002-2005 (Table 37). During 2006, residents of 26 states, other than South Dakota, were interviewed while fishing Lake Sharpe.

Table 36. Percentage of total angler contacts for resident and non-resident (states combined) anglers fishing Lake Sharpe during the April-September daylight period, 2002-2006. N is the number of parties interviewed.

| Zone | | Year | | | | |
|---|---|---|---|---|---|---|
| | | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Lower** | **N** | 656 | 531 | 438 | 363 | 413 |
| | **Residents (%)** | 68 | 70 | 74 | 79 | 73 |
| | **Non-residents (%)** | 32 | 30 | 26 | 21 | 27 |
| **Middle** | **N** | 166 | 263 | 208 | 162 | 278 |
| | **Residents (%)** | 90 | 87 | 90 | 91 | 92 |
| | **Non-residents (%)** | 10 | 13 | 10 | 9 | 8 |
| **Upper** | **N** | 462 | 667 | 692 | 616 | 668 |
| | **Residents (%)** | 72 | 86 | 88 | 86 | 89 |
| | **Non-residents (%)** | 28 | 14 | 12 | 14 | 11 |
| **Total** | **N** | 1,284 | 1,461 | 1,338 | 1,141 | 1,151 |
| | **Residents (%)** | 72 | 80 | 84 | 85 | 85 |
| | **Non-residents (%)** | 28 | 20 | 16 | 15 | 15 |

Table 37. Percentage of total non-resident angler contacts for anglers from the states listed, for Lake Sharpe, South Dakota during the April-September daylight survey period, 2002-2006.

| State | Percent by Year | | | | |
|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Iowa** | 35 | 27 | 26 | 28 | 22 |
| **Nebraska** | 24 | 25 | 24 | 32 | 34 |
| **Colorado** | 4 | 5 | 6 | 6 | 4 |
| **Minnesota** | 17 | 23 | 21 | 13 | 19 |
| **Wisconsin** | 3 | 3 | 1 | 1 | 2 |
| **Wyoming** | 2 | 1 | 4 | 2 | 2 |
| **Other*** | 15 | 16 | 18 | 18 | 17 |

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

Count of residence of South Dakota resident anglers fishing Lake Sharpe during the April-September 2006 survey period are presented in Figure 11 and Table 38. Over half (59%) of angling parties interviewed on Lake Sharpe during the 2006 survey were local anglers from Hughes and Stanley counties (Figure 11). Minnehaha (Sioux Falls) and Pennington (Rapid City) residents were interviewed in 5% and 6% of angler interviews, respectively. The percentage of angler interviews from residents of Beadle, Brookings, Davison, Hand, and Minnehaha county has substantially decreased from 2002 to 2006 (Table 38).

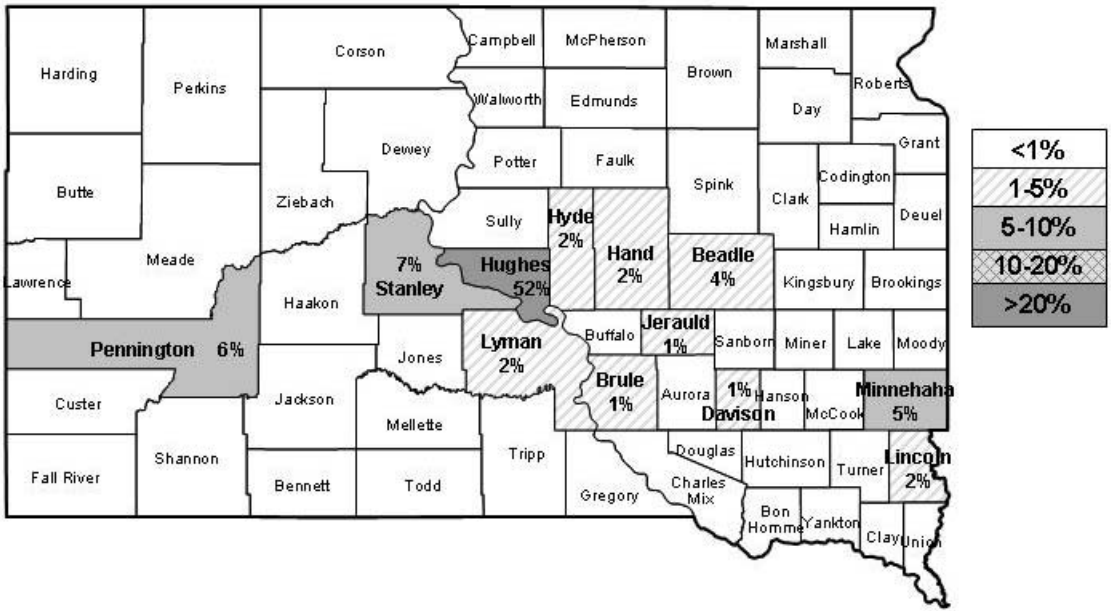


Figure 11. Percentage of total angler contacts on Lake Sharpe, of residents of the counties illustrated, during the April-September 2006 daylight survey period

Table 38. Percentage of total angler contacts on Lake Sharpe, of residents of the counties listed, for anglers fishing Lake Sharpe, South Dakota during the April-September daylight survey period, 2002-2005.

| County | Major City | Percent by year | | | | |
|---|---|---|---|---|---|---|
| | | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Beadle** | **Huron** | 9 | 7 | 3 | 4 | 4 |
| **Brookings** | **Brookings** | 3 | 1 | 1 | 1 | 1 |
| **Davison** | **Mitchell** | 4 | 3 | 2 | 2 | 1 |
| **Hand** | **Miller** | 9 | 2 | 1 | 1 | 2 |
| **Hughes** | **Pierre** | 36 | 48 | 43 | 51 | 52 |
| **Lyman** | **Presho, Kennebec** | 1 | 1 | 1 | 1 | 2 |
| **Minnehaha** | **Sioux Falls** | 13 | 9 | 7 | 8 | 5 |
| **Pennington** | **Rapid City** | 6 | 6 | 5 | 5 | 6 |
| **Stanley** | **Fort Pierre** | 8 | 7 | 6 | 6 | 7 |

The pattern in percentage of anglers traveling certain distances to fish Lake Sharpe during 2006 reflects the pattern in the percentage of angler interviews from South Dakota counties (Table 38, Figure 11). Residents of Hughes and Stanley Counties comprised the majority of anglers traveling <25 miles and 25-49 miles, one way, to fish Lake Sharpe in 2006, while anglers from Minnehaha and Pennington counties comprised the majority of anglers traveling 100-199 miles to fish Lake Sharpe (Table 39). With Lake Sharpe located some distance from a large population base, travel is required for many anglers fishing Lake Sharpe. The percentage of angler interviews for anglers traveling in excess of 200 miles, one way, to fish Lake Sharpe in 2006 was similar to values from 2003 to 2005 and lower than 2002.

Table 39. Percentage of anglers driving the specified distances, one way, to fish Lake Sharpe, South Dakota, during the April-September daylight survey period, 2002-2006.

| Distance (miles) | Percent by year | | | | |
|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| **<25** | 27 | 40 | 44 | 46 | 47 |
| **25-49** | 7 | 7 | 8 | 6 | 6 |
| **50-99** | 8 | 9 | 8 | 6 | 8 |
| **100-199** | 20 | 17 | 19 | 17 | 15 |
| **≥200** | 38 | 26 | 21 | 25 | 24 |

As previously mentioned, the increase in hourly catch rates for smallmouth bass, white bass, and channel catfish may be due, in part, to an increase in the percentage of total angler interviews that are from shore anglers. This fact is illustrated by the increase in the percentage of anglers fishing for “anything” beginning in 2003 and continuing through 2006 (Table 40). The increase in percentage of anglers fishing for anything to values over 30 for 2003 through 2006, coincided with the change to the bus route survey design. Correspondingly, the percentage of anglers specifically fishing for walleyes decreased beginning in 2003 (Table 40).

Table 40. Target species of anglers fishing Lake Sharpe, South Dakota, during the April-September daylight survey period, expressed as percent of total, 2002 - 2006. T (trace) indicates values > 0.0 but < 0.5.

| Target species | Percent by year | | | | |
|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Walleye** | 80 | 63 | 59 | 57 | 58 |
| **Anything** | 17 | 31 | 33 | 33 | 33 |
| **Rainbow trout** | 1 | 3 | 4 | 3 | 2 |
| **White bass** | 1 | 1 | 1 | 4 | 1 |
| **Smallmouth bass** | 1 | 1 | 2 | 1 | 2 |
| **Other*** | T | 1 | 1 | 2 | 4 |

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

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 2006 period was “moderately satisfied” (median of 2, Table 41). The median satisfaction rating of “moderately satisfied” for 2006 was an improvement from 2005 and 2004 when the median satisfaction rating was “slightly satisfied” (Lott et al. 2006b, Lott et al 2007. Approximately 73% of angling parties interviewed in 2006 indicated some degree of satisfaction, a value above the Lake Sharpe Strategic Plan objective of 70%. Neutral and dissatisfied anglers comprised 14% and 13% of angler interviews, respectively. Median trip satisfaction increased from “slightly satisfied” to “very satisfied”, as the average number of walleye harvested per angler increased (Table 42). However, as Gigliotti (2004) documented, other factors besides the number of walleye harvested must influence trip satisfaction because 57% of anglers keeping zero walleye during their trip expressed some degree of satisfaction with their trip (Table 42).

Table 41. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2006 daylight survey period: “Considering all factors, how satisfied are you with your fishing trip today?” 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include “no opinion” responses.

| Month | Satisfaction rating | | | | | | | | N | Median |
|---|---|---|---|---|---|---|---|---|---|---|
| | Satisfied | | | Neutral | Dissatisfied | | | N.O. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| **April** | 28 | 61 | 32 | 11 | 5 | 2 | 1 | 6 | 140 | 2 |
| **May** | 67 | 59 | 31 | 30 | 5 | 6 | 7 | 6 | 205 | 2 |
| **June** | 37 | 45 | 30 | 19 | 14 | 7 | 3 | 2 | 155 | 2 |
| **July** | 23 | 25 | 18 | 17 | 7 | 7 | 5 | 1 | 102 | 3 |
| **August** | 12 | 24 | 12 | 19 | 8 | 10 | 5 | 1 | 90 | 3 |
| **September** | 36 | 33 | 16 | 16 | 2 | 6 | 5 | 3 | 114 | 2 |
| **Total** | 203 | 247 | 139 | 112 | 41 | 38 | 26 | 19 | 806 | 2 |
| **Percent** | 73 | | | 14 | 13 | | | | | |

Table 42. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2006 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per trip. 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

| Walleye/ angler | Satisfaction rating | | | | | | | | N | Median |
|---|---|---|---|---|---|---|---|---|---|---|
| | Satisfied | | | Neutral | Dissatisfied | | | N.O. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| **0** | 74 | 122 | 95 | 88 | 30 | 28 | 18 | 18 | 455 | 3 |
| **0-0.9** | 20 | 27 | 14 | 9 | 5 | 4 | 6 | 1 | 85 | 2 |
| **1.0-1.9** | 23 | 40 | 16 | 8 | 4 | 4 | 2 | 0 | 97 | 2 |
| **2.0-2.9** | 18 | 20 | 7 | 4 | 1 | 2 | 0 | 0 | 52 | 2 |
| **3.0-3.9** | 23 | 18 | 2 | 1 | 1 | 0 | 0 | 0 | 45 | 1 |
| **4** | 44 | 20 | 4 | 1 | 0 | 0 | 0 | 0 | 69 | 1 |
| **Percent** | 73 | | | 14 | 13 | | | | | |

The Parks Division of the Department of Game, Fish, and Parks and City recreation departments own and maintain very costly fish cleaning stations throughout the region. These stations may contain a variety of amenities including running water, fish grinders, electricity, and garbage disposal facilities. In an effort to collect data on use of these facilities, anglers were asked during interviews, "How often do you use fish cleaning stations equipped with grinders?" A large portion (60%) use the stations most of the time or always (Table 43). A smaller percentage of anglers (19%), never use the facilities. The use of these facilities was very important for many anglers fishing Lake Sharpe in 2006.

Table 43. Responses of anglers interviewed during the April-September 2006 daytime survey on Lake Sharpe to the following question, "When fishing Lake Sharpe, how often do you use fish cleaning stations equipped with grinders?" N is sample size.

| Use of public fish grinders by anglers | | |
|---|---|---|
| | N | Percent |
| **Always** | 297 | 43 |
| **Most of the time** | 116 | 17 |
| **Sometimes** | 77 | 11 |
| **Rarely** | 65 | 10 |
| **Never** | 130 | 19 |

The region immediately adjacent to Lake Sharpe is blessed with a variety of facilities for overnight stays. There are a number of campgrounds adjacent to Lake Sharpe including, Oahe Downstream Recreation Area, Farm Island Recreation Area, West Bend Recreation Area, North Shore, Left Tailrace Recreation Areas, Lower Brule Reservation, and the cities of Pierre and Fort Pierre also provide camping facilities. The communities of Pierre, Fort Pierre, and Fort Thompson provide overnight lodging facilities for anglers. Many visiting anglers have family members or friends in the vicinity of Lake Sharpe and may stay at a private residence nearby. There are a few private campgrounds nearby where anglers may stay as well. Of the anglers fishing Lake Sharpe during the 2006 survey period, 58% were staying at home (Table 44), which mirrors Table 38 and Figure 11 for county residency. This large percentage of anglers illustrates the fact Lake Sharpe is a local based fishery. A smaller portion of visiting anglers were staying at a State recreation area or a motel, 15% and 13%, respectively.

Table 44. Responses of anglers interviewed during the April-September 2006 daytime survey on Lake Sharpe to the following question, "Where are you staying on this trip?" N is sample size.

| Location where the angler was staying on fishing trip | | |
|---|---|---|
| | **N** | **Percent** |
| **State recreation area** | 81 | 15 |
| **Motel** | 69 | 13 |
| **Private campground** | 30 | 6 |
| **Private residence** | 43 | 8 |
| **Home** | 310 | 58 |

Beginning in 2003, a 305-457-mm protected slot with a one over 457-mm regulation package was placed in effect for smallmouth bass on Lake Sharpe. The regulation was in place for the fourth year during 2006 and anglers were asked if they knew the current regulations (Table 45). Approximately 59% of anglers fishing Lake Sharpe knew the current regulations for smallmouth bass on Lake Sharpe. Percentage of anglers interviewed that knew the current smallmouth bass regulations was highest for anglers fishing the lower zone of the reservoir, at 78%. The higher percentage of anglers knowing the regulations for smallmouth bass in the lower zone of Lake Sharpe may be due to smallmouth bass being more common in angler catch in the lower zone.

Anglers were asked if they were in favor of the current regulation package for smallmouth bass and a large percentage (60% for total sample) indicated they had no opinion on the regulation (Table 45). The percentage of anglers in favor and opposed to the regulations were similar for the middle and upper zones and the total reservoir sample. However, patterns in responses for anglers interviewed in the lower zone of Lake Sharpe differed from the other zones, with 23% in favor, 39% opposed, and 38% having "no opinion". When "no opinion" responses were removed from the sample of interviews, 63% of anglers interviewed in the lower zone opposed the current smallmouth bass regulation package.

Anglers that were not in favor of the smallmouth bass regulation package were asked which portion of the package they were not in favor of. The majority (67%) of respondents were not in favor of the 305-457-mm protected slot and some (32%) anglers were not in favor of both the slot and the one over 457 mm regulation (Table 45).

Table 45. Responses and percentages of anglers interviewed during the April-September 2006 daytime survey on Lake Sharpe that responded to the smallmouth bass regulation approval questions. Questions were asked in series depending on response.

**Question A.** "Do you know what the current smallmouth bass regulations are on Lake Sharpe?" Values are in percentage and N is number of parties responding accordingly.

| Zone | Yes | N | No | N |
|---|---|---|---|---|
| **Upper** | 47 | 156 | 53 | 173 |
| **Middle** | 56 | 77 | 44 | 60 |
| **Lower** | 78 | 162 | 22 | 45 |
| **Total** | 59 | 395 | 41 | 278 |

**Question B.** If yes to question A, anglers were asked, "Are you in favor of the current smallmouth bass regulations?" Values are in percentage and N is number of parties responding accordingly.

| Zone | Yes | N | No | N | No opinion | N |
|---|---|---|---|---|---|---|
| **Upper** | 16 | 54 | 14 | 46 | 70 | 229 |
| **Middle** | 16 | 22 | 16 | 22 | 68 | 94 |
| **Lower** | 23 | 48 | 39 | 81 | 38 | 78 |
| **Total** | 18 | 124 | 22 | 149 | 60 | 401 |
| **Upper** | 54 | 54 | 46 | 46 | Removed from sample | |
| **Middle** | 50 | 22 | 50 | 22 | | |
| **Lower** | 37 | 48 | 63 | 81 | | |
| **Total** | 45 | 124 | 55 | 149 | | |

**Question C.** If no to question B, anglers are asked, "Which parts are you not in favor of?" Values are in percentage and N is number of parties responding accordingly.

| Zone | 12-18" | N | 1 over 18" | N | Both | N |
|---|---|---|---|---|---|---|
| **Upper** | 59 | 27 | 2 | 1 | 39 | 18 |
| **Middle** | 81 | 17 | 5 | 1 | 14 | 3 |
| **Lower** | 67 | 54 | 0 | 0 | 33 | 26 |
| **Total** | 67 | 98 | 1 | 2 | 32 | 47 |

Anglers harvested an estimated 5,194 smallmouth bass from Lake Sharpe during the April-September daylight period during 2006 (Table 28). If the regulation package had not been in effect in 2006, there was a potential harvest of 30,050 smallmouth bass during April-September 2006 that could have occurred. As part of each angler interview, anglers were asked how many additional smallmouth bass they would have kept if the regulations had not been in place. This question was asked to help estimate how high the potential harvest reduction associated with the regulation package might be (Table 46). Prior to the regulation change in 2003, smallmouth bass harvest was estimated at 11,696 for 2002, 14,673 for 2001, 13,765 for 2000, and 12,005 for 1999 (Johnson and Lott 2000, 2001; Johnson, et al 2002; Lott et al 2003). If harvest would have been 30,050 for 2006, had the regulation not been in place, the harvest would have been substantially higher than what was estimated for previous years.

Table 46. Potential angler harvest of smallmouth bass based on anglers responses to the following question, "Of the smallmouth bass you caught today, how many more smallmouth bass would your party have harvested had there been no length restrictions on harvesting smallmouth bass?" Estimated values are numbers generated by extrapolating interview data over estimated fishing pressure, while observed values are generated directly from interviews.

| | Harvest | Catch | Percent harvested |
|---|---|---|---|
| **Actual** | | | |
| **Observed** | 132 | 2,967 | 4.5 |
| **Estimated** | 5,194 | 112,127 | |
| **Potential** | | | |
| **Observed** | **796** | 2,967 | 26.8 |
| **Estimated** | **30,050** | 112,127 | |

## FISHERY STATUS AND 2007 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 2006 with 99,702 angler days of fishing pressure estimated, a harvest rate of 0.46 fish/angler-h for all species combined, and an overall satisfaction rating of 73%. The walleye-specific objective was also met for 2006, with an estimated 115,300 walleyes harvested and a harvest rate of 0.33 walleye/angler-h. Higher catch and harvest rates in 2006 than during 2004 and 2005 likely contributed to higher angler use and a higher satisfaction rating by anglers.

High recruitment of the 2005 walleye year class into the population and high reproduction in 2006 for walleye will help provide a walleye fishery for the future, especially with low recruitment of the 2001-2004 year classes. Stocking plans for walleye have been put on hold due to new recruits, from natural reproduction, entering the population after four years of poor reproduction. Age-1 walleye comprised the largest portion of the gill net catch in 2006, followed by age-3, -6, and -5 fish. Walleye growth rates have remained adequate due to sufficient prey availability, as shown by seining data from 2006.

Smallmouth bass nighttime electrofishing CPUE increased from 11.7 fish/h in 2005 to 30.4 fish/h in 2006 at Joe Creek, while values for Big Bend Dam have been similar during all years sampled. Stock density indices in 2006 were within values observed during the last six years. Growth and condition of smallmouth bass remains good, with growth above the statewide and Missouri River reservoir averages.

The estimated catch of smallmouth bass by anglers during the April-September daylight period was 112,127 fish, significantly higher than the 2005 estimate of 29,394 fish. The current smallmouth bass regulations in place on Lake Sharpe are not an issue for many Lake Sharpe anglers. Approximately 60% of anglers interviewed during the 2006 angler survey that knew the regulations stated they had no opinion, when asked if they favored or opposed the regulations. However 18% of anglers who knew the regulations were in favor of them and 22% were not in favor of them. Angler knowledge of current smallmouth bass regulations is also low. Only 59% of anglers interviewed stated they knew the current smallmouth bass regulations for Lake Sharpe. Approximately 21% of the smallmouth bass measured during angler interviews were within the protected slot limit, enforcing the idea of low acceptance and low knowledge of the regulation by the angling public. Approximately 45% of the anglers interviewed that knew the regulations and had an opinion on them were in favor of the regulations. The smallmouth bass regulations have been in effect since 2003 (four years). Issues exist regarding angler knowledge and acceptance of the regulations and the high percentage of fish measured during angler interviews in violation of the regulations. These issues will need to be considered when evaluating regulation effectiveness.

## MANAGEMENT RECOMMENDATIONS

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

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

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

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

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

- Update Lake Sharpe Fisheries Management Plan by March 2008.

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# APPENDICES

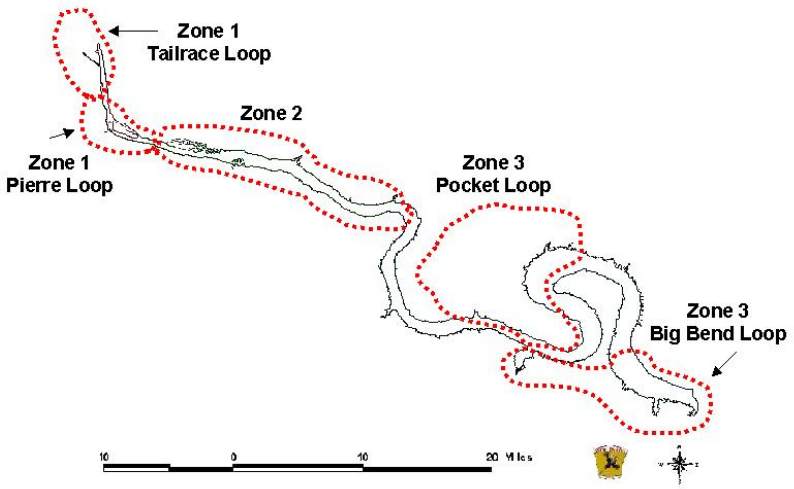
Appendix 1. Common and scientific names of fishes mentioned in this report.

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

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

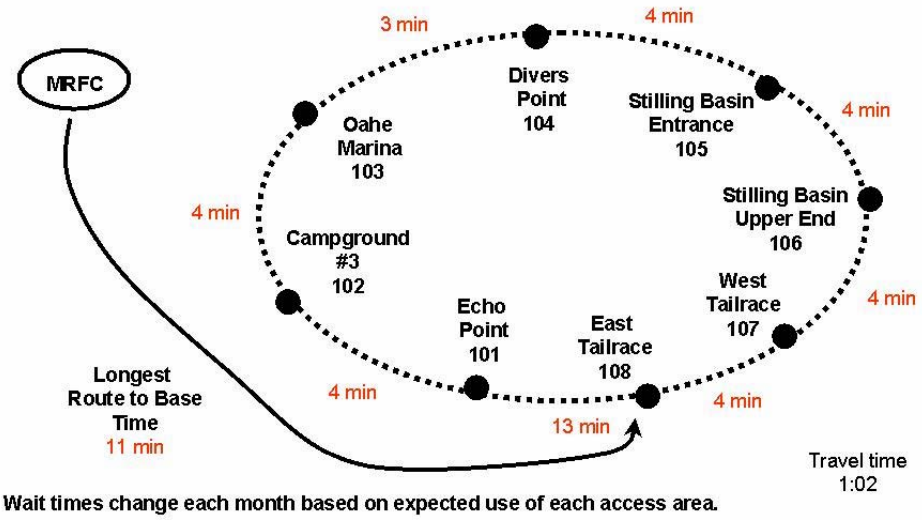
| Species | Stock | Quality | Preferred | Memorable | Trophy |
|---|---|---|---|---|---|
| Smallmouth Bass | 180 | 280 | 350 | 430 | 510 |
| Walleye | 250 | 380 | 510 | 630 | 760 |
| Sauger | 200 | 300 | 380 | 510 | 630 |
| Channel catfish | 280 | 410 | 610 | 710 | 910 |
| White bass | 150 | 230 | 300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

# Lake Sharpe Bus Route Loops

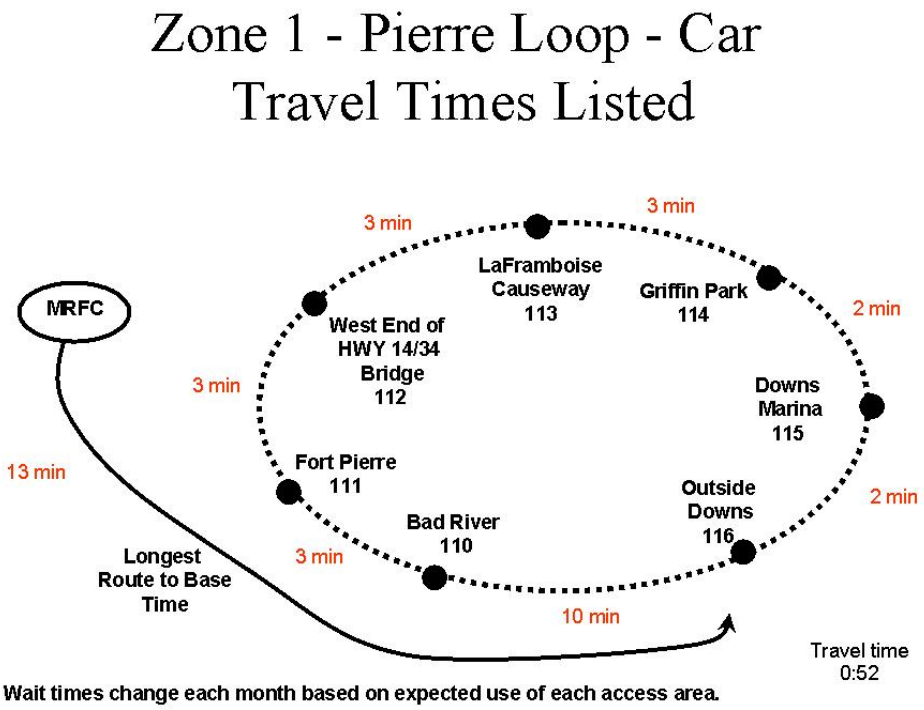



Appendix 3. Lake Sharpe bus route loop map depicting locations of the 5 overall loops for angler use and harvest surveys during April – September, 2006.

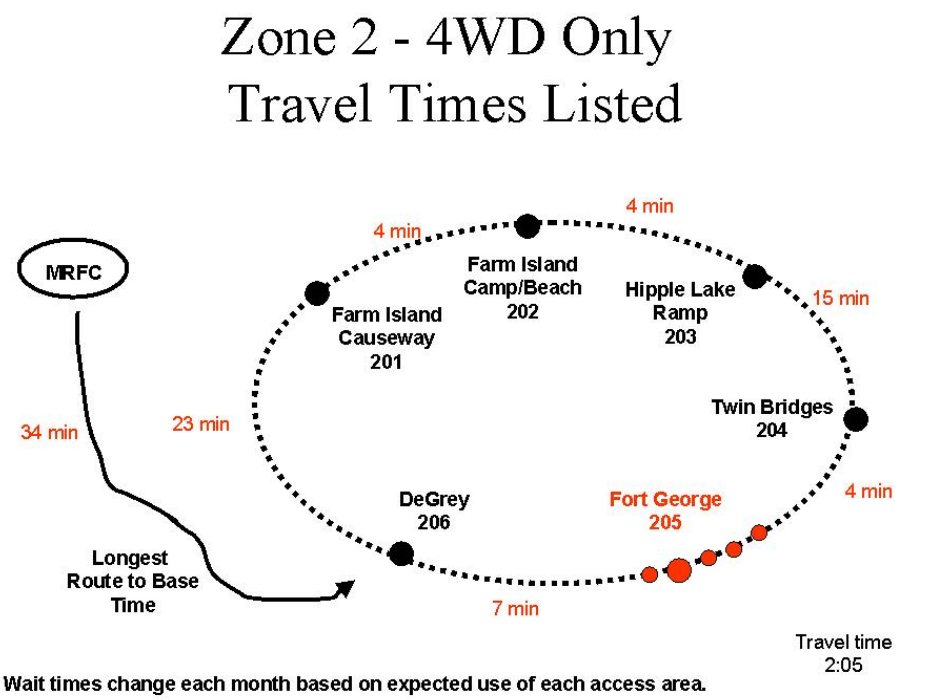
# Zone 1 - Tailrace Loop - Car Travel Times Listed



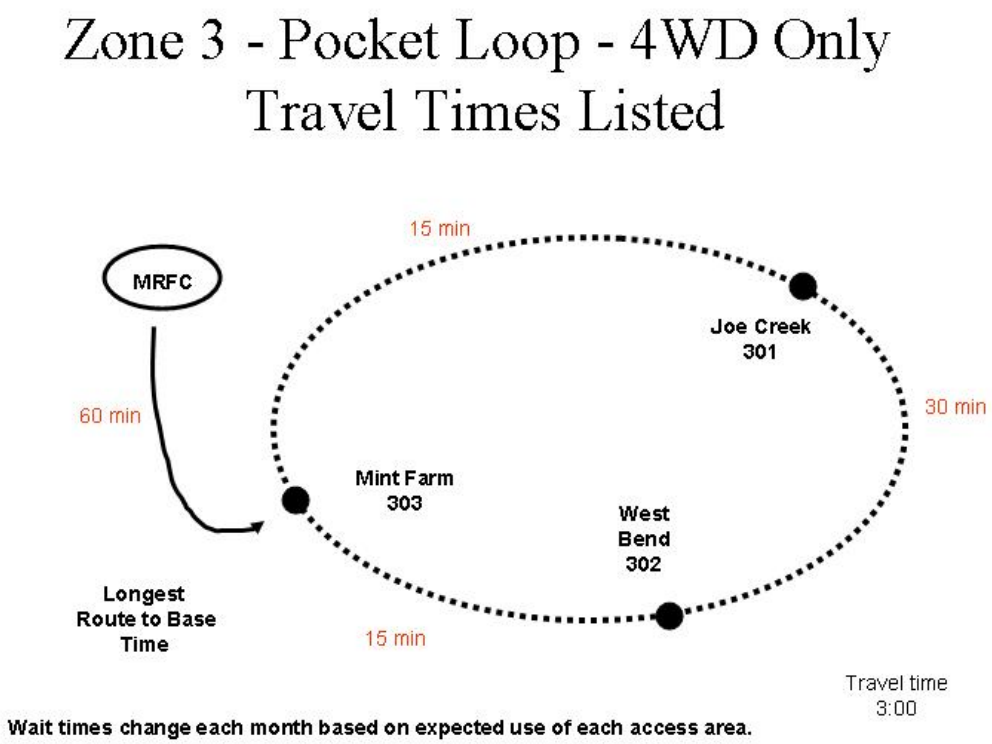

Appendix 4. Overall design of the tailrace loop (loop 1) for angler use and harvest surveys for Lake Sharpe, SD during April-September, 2006.



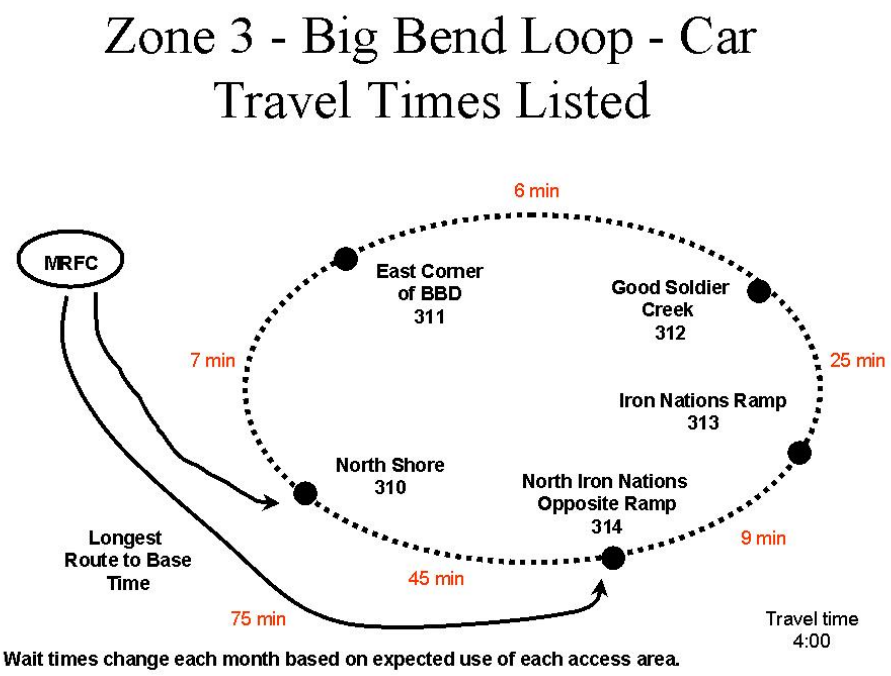

Appendix 5. Overall design for the Pierre Loop (loop 2) for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2006.




Appendix 6. Overall design for Zone 2 loop (loop 3) for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2006.




Appendix 7. Overall design for the Pocket Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September 2006.




Appendix 8. Overall design for the Big Bend Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2006.

Appendix 9. Angler satisfaction, preference, and attitude questions asked as part of the April-September 2006 angler use and harvest survey on Lake Sharpe, South Dakota.

**Trip Satisfaction Question:**

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

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

**Facility Use Questions:**

A. Where are you staying on this trip?

State Park Motel Private Camp/Lodge Private Residence Home

B. When fishing the Missouri River system, how often do you use fish cleaning stations equipped with grinders and running water to clean the fish you keep?

Always Most of the time Sometimes Rarely Never

**Smallmouth Bass Questions:**

A. Regulation Approval Questions

1. Do you know what the current smallmouth bass regulations are on Lake Sharpe?

YES NO

*If YES…*
2. Are you in favor of the current smallmouth bass regulations?

YES NO NO OPIONION

*If NO*, which parts are you not in favor of?
12-18 inch protected slot 1 over 18 inch Both

3. Comment: (write why they are not in favor – lower end too low, upper end too high, etc.)

B. Harvest Increase Questions

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

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

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

Appendix 10. White bass and yellow perch proportional stock density (PSD) relative stock density of preferred-length fish, and mean relative weight values, for 1999-2006, for fish collected in the standard August gill net survey, on Lake Sharpe South Dakota.

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

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