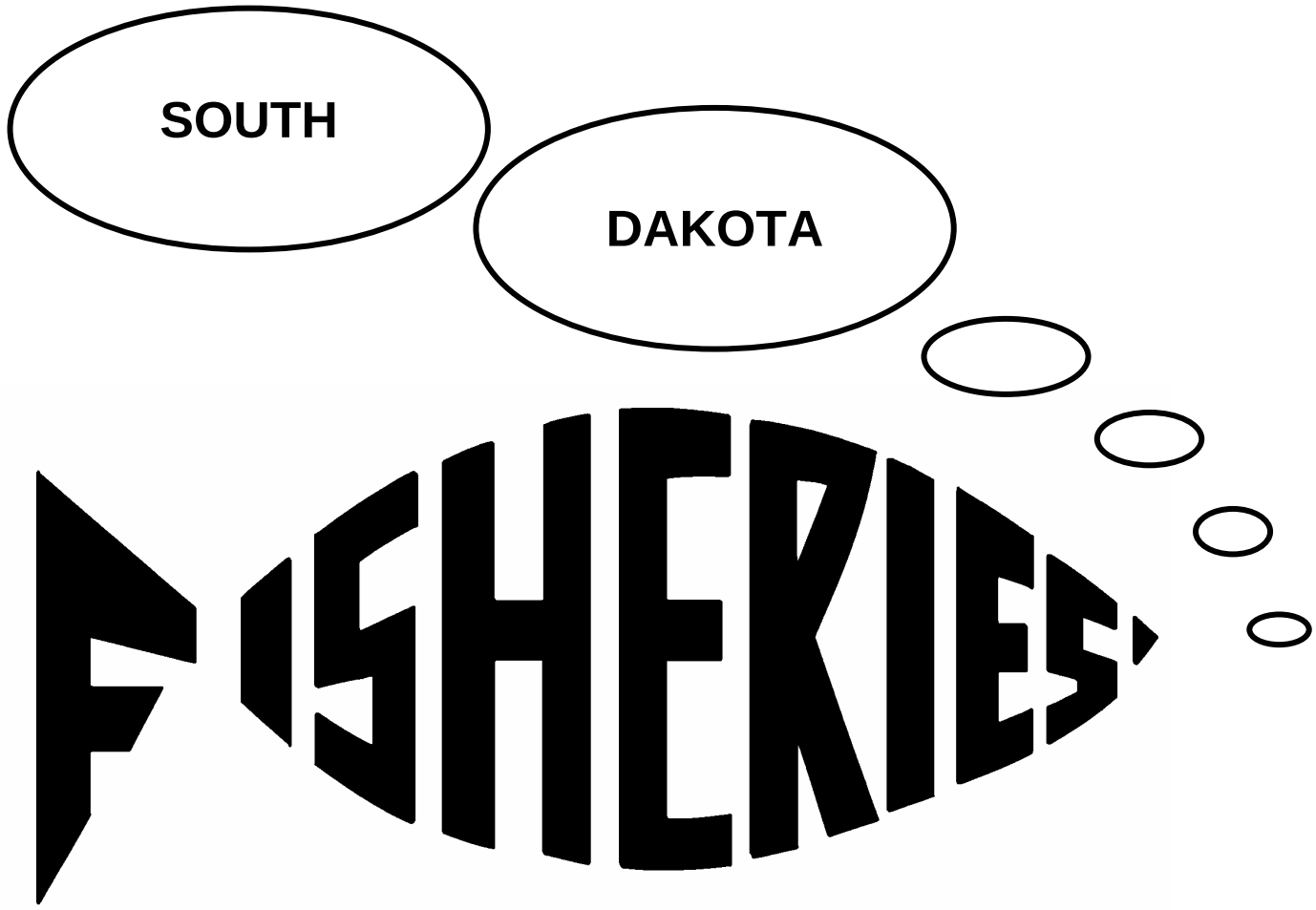

ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE OAHE, SOUTH DAKOTA, 2007

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

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AND
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ON
LAKE OAHE, SOUTH DAKOTA, 2007

By

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PREFACE

Information collected during 2007 is summarized in this report. Copies of this report and references to the data can be made with permission from the authors or the Director of the Division of Wildlife, South Dakota Department of Game, Fish, and Parks, 523 E. Capitol, Pierre, SD 57501.

The authors would like to thank the following individuals from the South Dakota Department of Game, Fish and Parks who helped with data collection, data entry, manuscript preparation, and report editing: John Aberle, Tyson Bramblee, Brian Beel, Marlin Fallon, Kayla Gaberiel, Harrold Hoffman, Timaree Ice, Janelle Jensen, Doug Jones, Dan Jost, Jason Jungwirth, Darla Kusser, Zachary Radack, Jim Riis, Aaron Rumpca, Justin Sarvis, Keith Schwartz, Jason Sorensen, Jason Stahl, Trent Withers, and Andrew Viet.

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EXECUTIVE SUMMARY

This report includes results of angler use and harvest and fish population surveys conducted during 2007 on Lake Oahe, South Dakota and references information collected during previous years. Discussion focuses on species that may be important from a sport perspective or as prey.

Age-0 gizzard shad were the most abundant species captured during the August seining survey, with a mean CPUE of 118 fish/haul. Age-0 gizzard shad were first collected in the annual seining survey in 2001 and have been the most abundant species in seining survey catches since 2003.

Channel catfish and walleye comprised 36% and 30% of the fish caught in the 2007 coolwater gill net survey, respectively. Channel catfish CPUE, for the 2002-2007 period, was similar among years with values ranging from 15.6 in 2003 to 20.7 in 2004 Walleye gill net CPUE for the entire reservoir in 2007 was similar to other years in the 2000-2007 period and significantly lower than from 1997 to 1999.

One of the Lake Oahe Strategic Plan (LOSP) objectives for walleye is to maintain a relative stock density of preferred-length fish (RSD-P) or the proportion of fish over 51 cm in length at 10% or higher. This goal was met in 2006 for the first year since 1997 and was again met in 2007. While the condition of fish, measured as relative weight (*Wr*), has generally been improving since 2003, *Wr* values are still considerably lower than during the early and mid-1990's. Mean length at capture for age-1 through age-5 walleye in 2007 was similar to 2006.

Twelve age classes were sampled during 2007 with approximately 35% of walleye captured originating from the 2005 year class. The highest catches of walleyes from that year class occurred in middle Oahe. Walleye production in 2007 was similar to 2006, based on an age-0 CPUE of 0.9 fish/net-night (Table 15). Mean CPUE for age-1 fish (2006 year class) in the total Oahe sample was 3.2 fish/net-night, indicating moderate recruitment from 2006, primarily in the middle zone of the reservoir.

The estimated fishing pressure for the South Dakota portion of Lake Oahe in 2007 was 652,827 h. This estimate was similar to those for 2003 and 2004 and higher than the 2005 estimate. Fishing pressure peaked in June and July at 412,522 total hours, 63% of the total fishing pressure for April through October. As with fishing pressure, catch and harvest was highest during the months of June and July. The total catch estimate for June and July 2007 was 441,002 fish, 76% of the 579,822 caught during the April-October period.

Walleyes comprised 84% of the total harvest in numbers for all species. Anglers harvested an estimated 208,680 walleyes from Lake Oahe during the April-October 2007 period. Walleye harvest during June and July comprised 72% (150,128) of the total walleye harvest during the April-October period in 2007. The mean hourly catch rate for walleye in 2007 was at 0.64 fish/angler-h, similar to 2005 and 2006 estimates.

Use of the Chinook salmon fishery in Lake Oahe was higher in 2007 than in recent years, in association with increases in angler catch rates for salmon. Mean catch rate of Chinook salmon by anglers specifically fishing for salmon were the same in 2005 and 2006, at 0.34 fish/angler-h. The percentage of angler parties interviewed that were specifically fishing for Chinook salmon was 11% in 2007. Chinook salmon were not stocked during 2001 and 2002 as part of a program to decrease predator abundance and set allow rainbow smelt abundance to increase.

Approximately 68% of angling parties interviewed during 2007 expressed some level of satisfaction with their fishing trip, a value lower than the Lake Oahe plan objective of 70%.
For the April-October 2006 daytime period, the Lake Oahe fishery had a direct economic impact of 10.9 million dollars based on 138,310 trips at value of $79 per trip (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007).

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INTRODUCTION

Lake Oahe is one of the largest and most financially important fisheries resources in the State of South Dakota, annually supporting between 87,000 and 339,000 angler trips during the 1991-2003 period (Lott et al. 2007). The Lake Oahe fishery had an estimated direct economic impact of over $25 million for the April-October 1998 daylight period, based on information provided by the United States Census Bureau (1998). Approximately 138,310 trips occurred during the April-October 2007 daylight period on Lake Oahe, for an estimated economic input of $10.9 million (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007). Due to the importance of Lake Oahe fisheries to the State of South Dakota, these resources must be effectively managed to produce optimal recreational benefits. A prerequisite to the development of effective management strategies is the annual acquisition and analysis of data describing fish community and population parameters, angler use and harvest of these populations, and angler preference and satisfaction data. These surveys provide essential information used in the evaluation of accomplishments towards objectives of the South Dakota Department of Game, Fish and Parks (SDGF&P) Missouri River Program Strategic Plan (SDGF&P 1994) and more specifically, the Lake Oahe Strategic Plan (LOSP). This report also evaluates fisheries management activities (regulations and stocking) and effects of environmental variables (water levels, weather, etc.) on Lake Oahe fisheries.

OBJECTIVES

The objectives of the annual fish population and associated surveys (Federal Aid Code 2102) are to provide information on:

1. species composition and relative abundance
2. population size structure
3. individual fish condition
4. age, growth, and recruitment
5. survival and mortality rates
6. fish reproduction
7. effects of regulations
8. success of stocking and other management activities
9. effects of sport fish harvest on fish population status

Emphasis is given to selected species that may be important from a sport or prey perspective. Common and scientific names of fishes collected or observed during these surveys are listed in Appendix 1.

The objectives of the angler use, harvest, and preference surveys (Federal Aid Code 2109) are to:

1. estimate recreational angling pressure
2. estimate fish harvest, by species
3. estimate fish harvest rates and catch rates, by species
4. provide statistics on mean angler party size, mean length of angler day, and angler residency
5. provide estimates of the annual direct economic impact of Lake Oahe's fishery
6. document effects of walleye regulations on the sport fishery and the walleye population
7. document angler attitudes, preferences, and level of satisfaction

STUDY AREA

Lake Oahe is a mainstem Missouri River storage reservoir located in north-central South Dakota, downstream from Lake Sakakawea and upstream of Lake Sharpe. Historical, biological, chemical, and physical parameters have been discussed in North Central Reservoir Investigation reports (June 1974; Selgeby and Jones 1974) and South Dakota Game, Fish and Parks reports (Warnick 1987). Table 1 presents selected physical characteristics and a fisheries-management classification for Lake Oahe in South Dakota (Michaletz et al. 1986). Sampling locations for the various surveys discussed in this report appear in Figure 1 and average elevation of Lake Oahe during August, the month the standard gill net and seining surveys are conducted, is provided in Figure 2.

Table 1. Physical characteristics and management classification of Lake Oahe, South Dakota.

Oahe Dam Closed in:	1958	***Reservoir length:**	372 km
Elevation at full pool:	1617 msl	***Shoreline length:**	3,620 km
Surface area (SD portion):	110,660 ha	**Shoreline Development index:**	26.4
Water volume:	2.9×10^3 L	**Drainage area:**	630,639 km^2
***+Coldwater habitat**	47,755 ha	***Average depth:**	18.3 m
Trophic status:	Oligo/meso	***Maximum depth:**	62.5 m
Bottom composition:	Sand, gravel, clay, and shale	**Morpho-edaphic index:**	28.4
Management classification:	Cold, cool, and warmwater permanent	**Water source:**	Missouri River and tributaries

*Denotes values for water elevation at full pool.
+Denotes upper surface area of water $\leq 15^{o}$C in August.

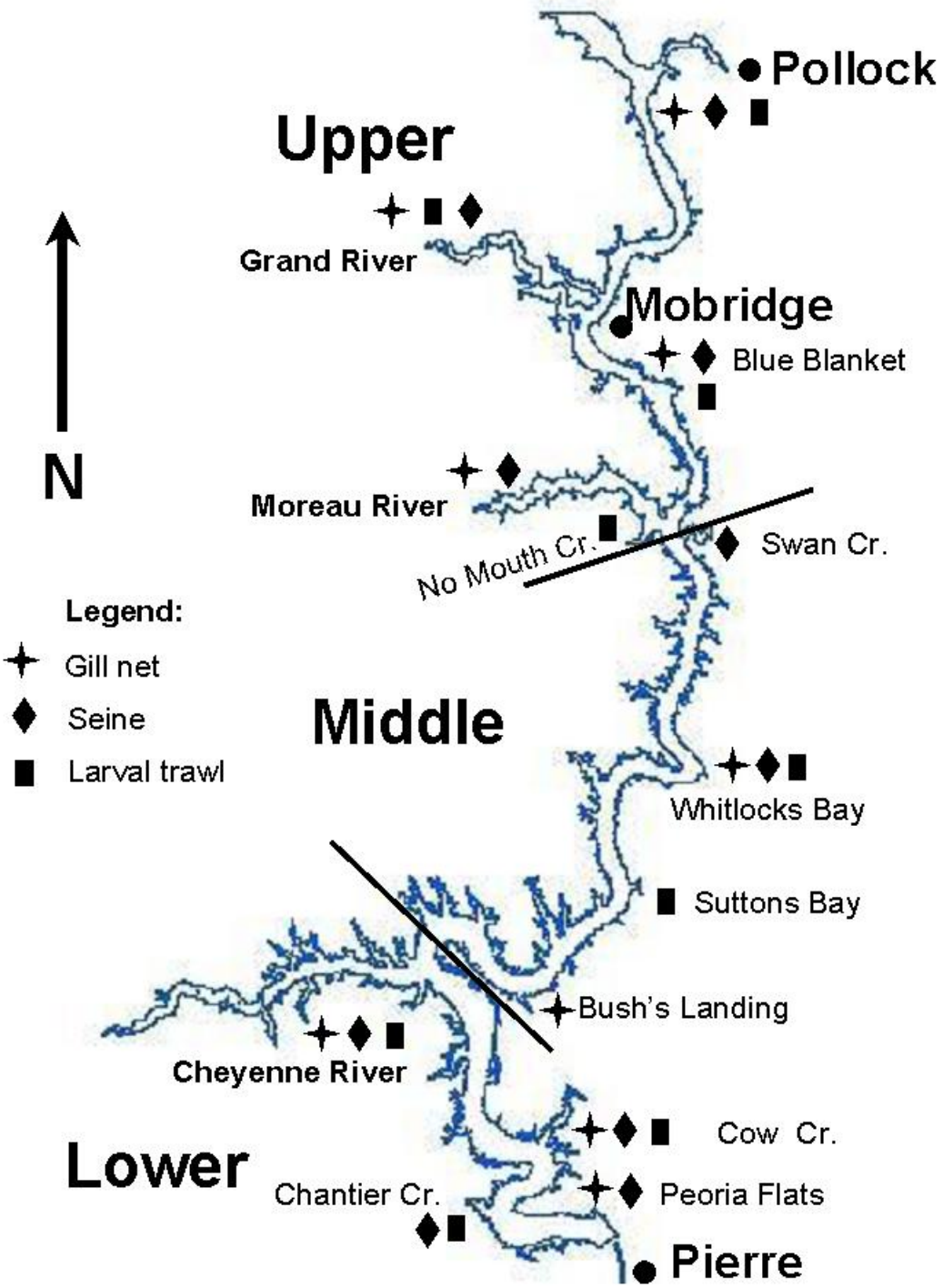

Figure 1. Reservoir zones for fish population and angler use and harvest surveys on Lake Oahe, South Dakota, for 2007. Specific fish population sampling stations are also listed.

REGULATION HISTORY

Fish population and angler use and harvest survey data is essential when evaluating special management regulations. Walleye harvest regulations for Lake Oahe have differed from standard statewide regulations since 1990, when an April through June 14-inch minimum length limit was placed in effect on Lakes Oahe, Sharpe, and Francis Case and the daily limit was reduced from six to four fish (Table 2). A stipulation that, at most, one fish in the daily limit could be 18 inches or longer was also added to the walleye regulation package in 1999, and the April-June 14-inch minimum length limit was removed. The objectives of regulation changes for 1999 were to concentrate harvest on abundant walleye less than 381-mm (15 inches) in length and to reduce harvest of larger walleye in the population in order to maintain the quality of the fishery. The daily walleye limit was increased from four fish to 14 fish in 2001, with the objective of maximizing harvest to reduce walleye abundance and precipitate an increase in rainbow smelt abundance by reducing predatory pressure on rainbow smelt.

Table 2. History of harvest regulations for walleye on Lake Oahe, South Dakota, 1968 through 2007.

Species	Period	Daily limit	Possession limit	Length restrictions
Walleye, sauger, and hybrids, in combination	1968-1983	8	16	none
	1984-1989	6	12	none
	1990-1998	4	8	• April-June 14 inch minimum length
	1999-2000	4	8	• At most one equal to or longer than 18 inches
	2001	14	42	• At most four equal to or longer than 15 inches • At most one equal to or longer than 18 inches
	2002-2003	10	30	• At most four equal to or longer than 15 inches • At most one equal to or longer than 18 inches
	2004-2005	6	18	• At most four equal to or longer than 15 inches • At most one equal to or longer than 20 inches
	2006	4	12	• At most one equal to or longer than 20 inches
	2007	4	8	• At most one equal to or longer than 20 inches

The stipulation that, at most, four fish could be 381-mm (15 inches) or longer in the daily limit of 14 was aimed at concentrating harvest on walleye < 381-mm, which were in high abundance (Lott et al. 2002). The daily limit was reduced to 10 fish for 2002 and 2003 and six fish for 2004 and 2005 due to decreases in the walleye abundance index (catch per gill-net night) and in angler satisfaction. A decrease in percentage of anglers satisfied with their trip was associated with anglers not being able to realistically attain high daily limits, as hourly catch rates declined (Lott et al. 2002, 2003, 2004). The daily limit was reduced to the statewide daily limit of four fish beginning January 1, 2006, while the possession limit of 12 fish was reduced to align with the statewide possession limit of 8 fish on January 1, 2007.

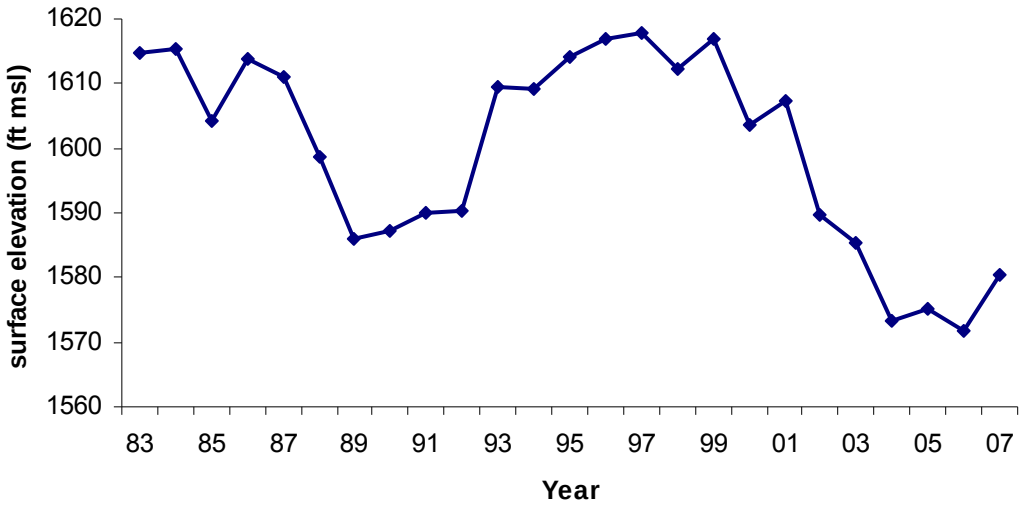

Figure 2. Average August elevation of Lake Oahe for the 1983-2007 period, as determined by the U.S. Army Corps of Engineers.

SAMPLING METHODS

FISH POPULATION SURVEYS

Data Collection

Gill nets, seines, larval trawls, and hydroacoustics were used to sample fish populations in Lake Oahe in 2007. Dates and depths of fish population surveys are presented in Table 3.

Table 3. Sampling times, depths, and gears for annual fish population surveys on Lake Oahe, South Dakota.

Survey	Time	Survey gear	Sampling specifics
Coolwater gill net	August	Standard gill net	Three shallow (0-9 m) and three deep (9-18 m), at standardized locations, at each station
Shoreline seining	August	30.5-m by 2.4-m bag seine, 6.4-mm mesh	Four quarter-arc pulls at each station
Larval trawling	May-June	1-m x 2-m limnetic trawls, 0.5-mm mesh	Two paired trawl hauls/week for four consecutive weeks, of 5-minutes duration, at each station
Hydroacostics	August	Hydroacoustic equipment and midwater trawl	20 transects covering the South Dakota portion of Lake Oahe

The standard coolwater fish population survey consists of setting three standard gill nets, overnight (approximately 20 h), on the bottom, in each depth zone (where possible), for a total of six nets at each station (Table 3, Figure 1). A standard gill net of multifilament nylon was 91.4-m (300-ft) long x 1.8-m (6-ft) deep, with 15.2-m (50-ft) panels of the following bar mesh sizes: 12.7 mm (1/2 in), 19.1 mm (3/4 in), 25.4 mm (1 in), 31.8 mm (1 1/4 in), 38.1 mm (1 1/2 in), and 50.8 mm (2 in).

All walleye collected during the coolwater gill net survey were measured for total length (TL; mm) and weighed (g). Attempts were made to remove sagittal otoliths from all walleye, sauger, and hybrids captured, at each sampling station (Figure 1). A representative sample of at least 50 individuals per sampling station was measured and weighed for all other species, where possible.

A nylon, 6.4-mm (1/4-in) mesh bag seine, measuring 30.5-m (100-ft) long x 2.4-m (8-ft) deep, with a 1.8-m (6-ft) x 1.8-m (6-ft) bag, was used to collect age-0 fishes and small littoral species. A quarter-arc seine haul was accomplished using methods described in Martin et al. (1981). Four seine hauls were made at each sampling station (Figure 1). All fish collected with seines were identified, counted, and classified as age-0 or other. A seining station at Chantier Creek was added in 2001 because of concerns about the decreasing efficiency of seining at Peoria Flats, in association with low water levels (Figure 1).

Larval fish densities were estimated for Lake Oahe by sampling with paired limnetic larval trawls. Each trawl had a mesh size of 0.5 mm (bar measure), a 1-m x 2-m opening and was equipped with a flow meter. Trawling was performed at night. Each trawl haul lasted approximately five minutes. Two paired trawl hauls were made at each sampling station during each sampling event (Figure 1). Eight stations throughout Lake Oahe were sampled weekly during late May and early June of 2006. Pollock was not sampled during the 2004-2006 period due to low water conditions. All samples were preserved in 10% formalin and later identified and enumerated.

Hydroacoustic sampling transects are not listed in Figure 1, but 20 standard transects are sampled each year from the face of Oahe Dam to the North Dakota/South Dakota border. Specific locations of hydroacoustic transects are presented in Nelson-Stastny (2001), as are standard sampling and analysis procedures for this survey.

Data Analysis

Relative abundance of fish species was expressed as mean catch per unit effort (CPUE) for gill net (No./net night), and seine (No./haul) catches. Standard error values about means were calculated for gill net and seining CPUE, as a measure of sample variance.

Age and growth analyses were conducted for all walleye. Walleye otoliths from fish less than 300-mm were viewed and aged whole while submersed in water in a black dish with an overhead light source. For walleye greater than 300-mm, otoliths were cracked through the focus and charred using a propane torch prior to age interpretation to make annuli easier to distinguish. Growth was expressed as mean length at age at time of capture in August. Incremental growth rates were estimated by subtracting the mean length of fish from a year class at the time of capture in August from the mean length at capture of the same year class the previous year. Age distributions for gill-net catches were developed by assigning ages to all walleye captured during the survey, based on length-at-capture information. Mean age-0 walleye gill net CPUE was correlated with mean age-1 walleye CPUE to determine if age-0 CPUE was an adequate early indicator of recruitment.

Proportional stock density (PSD; Anderson and Weithman 1978) and relative stock density (RSD) values were calculated for channel catfish, smallmouth bass, white bass, walleye and yellow perch (Gabelhouse 1984). Length categories used to calculate PSD and RSD values are listed in Table 4.

Table 4. Minimum lengths (mm) of length-class designations used when calculating proportional stock density and relative stock density values for fish population survey samples

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

Relative weight values (*Wr;* Anderson 1980) were calculated using standard-weight (*Ws*) equations developed for walleye (Murphy et al. 1990), yellow perch (Willis et al. 1991), channel catfish (Brown et al. 1995), and white bass (Brown and Murphy 1991). Calculated values for yellow perch and white bass are presented in Appendix 2, while values for walleye and channel catfish are presented in the results and discussion section of this report. Proportional stock density, RSD, and *Wr* values were calculated using the WinFin software package developed by Francis (2000).

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Data Collection

Angler use and sport fish harvest surveys conducted on Lake Oahe are patterned after a study designed by Schmidt (1975) for Lake Sharpe. Sampling includes aerial boat and shore angler counts to estimate fishing pressure, and angler interviews at lake access areas to estimate harvest rates, catch rates, release rates, mean party size, mean angler day length, target species, and angler state of residency. Flight dates and interview dates were selected using a stratified random design based on the assumption of different levels of fishing pressure for weekdays, and weekend days and holidays. Lake access areas for angler interviews were also assigned using a stratified random design, with probabilities of assignment differing by access area and month.

Sampling was conducted from April 1, 2007 through October 31, 2007, for the sunrise to sunset period. Creel zones are the same as fish population survey zones identified in Figure 1. Aerial pressure counts were made during all months. For a more detailed description of aerial count, angler interview, and data expansion techniques see Stone et al. (1994).

Angler satisfaction and attitude questions were included in angler interviews in 2007. Besides asking anglers how satisfied they were with their fishing trip, considering all factors, anglers were asked a series of questions about their catch, harvest, and release of walleye greater than 508 mm (20 inches) and their potential harvest of these fish. A complete list of satisfaction, attitude and preference questions asked in conjunction with the 2007 angler use and harvest survey appears in Appendix 3.

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.

RESULTS AND DISCUSSION

FISH POPULATION SURVEYS

Species Composition and Relative Abundance

Catch per unit effort has historically been used as an index of population abundance or density (Hubert 1996). However, changes in fish behavior can also affect CPUE of gill nets (Hubert 1996). Because Lake Oahe is a storage reservoir, the elevation of the reservoir surface, and therefore the surface area and volume of the reservoir, change over time and are not the same each August when the coolwater gill net survey is conducted. As an example, the average August surface elevation decreased from 1603.5 FT MSL in 2000 to 1571.6 FT MSL in 2006. The corresponding decreases in surface area and volume of Lake Oahe from 2000 to 2006 were 43,195 ha and 1.23 x 10^{10} m^3. Percent decreases in surface area and volume were 37% and 57%, respectively. Therefore, caution should be used when inferring density or abundance of fish species captured in the standard gill net survey from CPUE.

Channel catfish and walleye comprised 36% and 30% of the fish caught in the 2007 coolwater gill net survey, respectively (Table 5). Gizzard shad and yellow perch comprised approximately 6%-9% of the total sample. Nineteen species were captured in the coolwater survey gill net sample in 2007. Paddlefish were sampled during the coolwater gill net survey for the first time in over a decade (Table 6). Channel catfish and walleye were the most abundant species in gill net catches, with mean CPUE values of 18.8 and 15.6 fish/net-night, respectively. Channel catfish CPUE, for the 2003-2007 period, was similar among years with values ranging from 16.9 in 2006 to 20.7 in 2004. Other species commonly captured in gill nets in 2007 included yellow perch, gizzard shad, smallmouth bass and freshwater drum, listed in order of decreasing mean CPUE (Table 6). White bass experienced a die off in the summer of 2005, but white bass CPUE has remained within the range of values seen before the die off. White bass CPUE remained at 1.1 fish/net-night in 2007. Mean CPUE for all species collected in 2007 were within the ranges previously observed (Michaletz et al. 1986; Riis et al. 1988; Stone et al. 1989; Johnson et al. 1990; Wickstrom et al. 1991; Johnson et al. 1992; Wickstrom et al. 1993; Lott et al. 1994; Johnson et al. 1995, 1997, 1999; Lott et al. 2000, 2002, 2004, 2007).

Table 5. Relative species composition, by percent of total catch, of fish species collected during August standard gill net survey on Lake Oahe, South Dakota, during 2003 through 2007.

Species	Year				
	2003	2004	2005	2006	2007
Channel catfish	35.1	41.8	33.5	31.0	36.3
Walleye	31.0	32.1	29.9	28.1	30.2
Gizzard shad	3.7	5.5	18.0	7.0	6.4
Freshwater drum	3.5	4.2	3.6	5.4	3.5
River carpsucker	2.9	3.4	3.5	1.2	1.4
Yellow perch	5.5	3.3	2.9	6.6	6.7
Common carp	2.4	2.4	2.3	4.4	2.2
Goldeye	4.7	2.3	2.2	7.1	2.5
White bass	6.7	1.7	0.7	2.0	2.1
Other	4.4	3.4	3.6	7.2	8.6

Table 6. 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 Oahe, South Dakota, 2003-2007. Trace (T) indicates values less than 0.05.

Species	Year									
	2003		2004		2005		2006		2007	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1
Burbot	0.0	---	T	T	0.0	---	0.0	---	0.0	---
Black bullhead	T	---	0.1	0.1	T	---	T	---	0.0	---
Channel catfish	15.6	1.4	20.7	1.7	20.5	1.8	16.9	2.4	18.8	1.5
Chinook salmon	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Common carp	1.1	0.2	1.2	0.2	1.4	0.2	2.4	0.4	1.1	0.2
Freshwater drum	1.6	0.3	2.1	0.3	2.2	0.5	2.9	0.5	1.8	0.2
Gizzard shad	1.6	0.5	1.7	0.6	11.0	2.5	3.8	1.5	3.3	1.3
Goldeye	2.1	0.5	0.9	0.2	1.3	0.3	3.9	0.8	1.3	0.3
Lake herring	0.0	---	0.0	---	0.1	0.1	0.0	---	0.0	---
Northern pike	0.2	0.1	0.1	T	T	---	0.1	T	0.1	T
Rainbow smelt	T	---	T	T	T	---	0.0	---	0.0	---
Paddlefish	0.0	---	0.0	---	0.0	---	0.0	---	T	T
River carpsucker	1.3	0.2	1.1	0.2	2.1	0.6	0.6	0.1	0.7	0.2
Sauger	0.1	T	0.3	0.1	0.3	0.1	1.4	0.4	1.4	0.3
Shorthead redhorse	0.7	0.2	0.4	0.1	0.3	0.1	0.3	0.1	0.2	0.1
Shortnose gar	T	---	0.1	T	T	---	T	T	0.0	---
Shovelnose sturgeon	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Smallmouth bass	0.3	0.1	0.1	T	0.9	0.4	1.0	0.5	1.9	0.8
Smallmouth buffalo	0.1	T	T	T	0.1	---	T	T	0.1	T
Spottail shiner	0.1	0.1	0.2	0.1	0.1	---	0.5	0.2	0.3	0.1
Walleye	13.8	1.5	15.9	1.5	18.2	2.1	15.3	1.9	15.6	2.2
White bass	3.0	0.8	1.6	0.3	0.4	0.1	1.1	0.3	1.1	0.3
White crappie	0.1	T	0.1	0.1	0.1	0.1	0.3	0.1	0.3	0.3
White sucker	T	---	0.1	T	T	--	T	T	T	T
Yellow perch	2.4	0.7	2.7	0.7	1.7	0.4	3.6	0.9	3.5	0.7

Age-0 gizzard shad were the most abundant species captured during the August seining survey, with a mean CPUE of 118 fish/haul (Table 7). Age-0 gizzard shad were first collected in the annual seining survey in 2001 and have been the most abundant species in seining survey catches since 2003. Other species commonly sampled during the 2007 seining survey included emerald shiners, white bass, spottail shiner, and yellow perch, in order of decreasing mean CPUE.

Table 7. 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 Oahe, South Dakota, 2003-2007. Catches are for age-0 fishes except where noted. Trace (T) indicates values less than 0.05.

Species	Year									
	2003		2004		2005		2006		2007	
	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE	CPUE	SE
Bigmouth buffalo	0.0	---	0.0	---	0.0	---	0.1	T	0.0	---
Black crappie	0.0	---	0.0	---	0.0	---	T	---	0.0	---
Bluntnose minnow	0.0	---	1.1	0.7	0.0	---	0.4	0.4	0.0	---
Brassy minnow*	0.0	---	0.5	0.3	T	T	0.1	T	0.3	0.2
Channel catfish	0.1	T	0.1	0.1	2.0	1.2	0.1	0.1	4.1	2.8
Common carp	0.1	T	0.0	--	1.6	0.6	0.3	0.2	0.4	0.3
Emerald shiner*	35.0	3.6	43.8	22.1	23.3	15.3	26.1	6.4	21.4	8.3
Fathead minnow*	1.2	0.3	0.0	---	0.2	0.1	0.0	---	0.0	---
Flathead chub	0.0	---	0.0	---	0.0	---	6.8	3.9	0.0	---
Freshwater drum	2.9	0.5	2.7	1.0	5.1	1.4	3.8	1.1	2.0	0.6
Gizzard shad	322.2	41.1	500.0	173.0	83.8	33.6	191.0	41.8	118	56.1
Golden shiner	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Goldeye	T	T	0.3	0.2	1.0	0.9	0.0	---	0.6	0.4
Johnny darter*	0.5	0.1	0.3	0.1	0.1	T	0.1	T	0.1	0.05
Lake herring	0.0	---	0.1	T	0.0	---	0.0	---	0.0	---
Largemouth bass	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Northern pike	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
River carpsucker	0.2	T	0.2	0.2	4.2	3.0	4.8	3.5	1.1	0.4
Red shiner*	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Shorthead redhorse	0.1	T	0.0	---	0.0	---	0.0	---	0.0	---
Silvery minnow	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Smallmouth bass	0.2	T	1.6	0.7	2.7	0.6	3.5	0.9	4.1	1.1
Smallmouth buffalo	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Spottail shiner*	24.5	2.5	9.3	4.2	1.8	0.6	10.4	3.2	5.1	1.6
Suckermouth minnow*	0.0	---	0.0	---	0.0	---	0.0	---	0.0	---
Walleye	0.1	T	0.2	0.1	0.2	0.2	0.3	0.1	0.1	T
White bass	46.3	7.9	15.2	5.1	4.1	0.9	21.6	5.3	15.2	4.1
White crappie	0.1	T	T	T	0.0	---	0.1	0.1	3.3	1.5
White sucker	0.5	0.1	0.1	T	0.1	0.1	0.1	0.1	0.1	T
Yellow perch	4.2	0.8	1.4	0.7	2.1	0.9	11.4	6.8	5.0	2.1

* Includes all ages.

Population Parameters for Walleye

Walleye CPUE in the standard gill net survey was higher in middle Lake Oahe than in lower Lake Oahe during 2007 (Table 8). Of the three zones, the middle zone has had the highest CPUE in 2006 and 2007, while the upper zone has supported the highest CPUE in 6 of the last 10 years.

One factor that may be impacting walleye abundance index (CPUE) estimates for the various reservoir zones is the current low surface water elevation of Lake Oahe. The upper end of the South Dakota portion of the reservoir, near Pollock, SD, resembled riverine habitat during August 2007 sampling efforts. Changes in surface area, volume, and flow may greatly influence catch rates of walleye and other species in standard fish population surveys. An example of this is the mean CPUE of sauger in the standard coolwater gill net survey. Mean sauger CPUE increased from 0.3. fish/net-night in 2005 to 1.4 fish/net-night in 2006 and 2007 (Table 6), possibly because changes in the Missouri River system caused downstream movement of these fish from the Missouri River above Lake Oahe to Lake Oahe.

Table 8. Mean walleye catch per unit effort (No./net-night) in the coolwater gill net survey for lower, middle, and upper zones of Lake Oahe, South Dakota, 1998-2007.

Year	Zone			
	Lower	Middle	Upper	Total
1998	23.4	19.3	21.1	20.3
1999	17.4	17.9	29.3	21.4
2000	13.1	17.6	27.4	19.3
2001	8.9	9.1	26.6	14.8
2002	9.7	12.5	32.8	18.3
2003	9.7	16.6	14.9	13.8
2004	11.7	11.7	24.2	15.9
2005	12.5	15.9	26.3	18.2
2006	9.4	21.6	14.8	15.3
2007	12	18.7	16.2	15.6

Walleye gill net CPUE for the entire reservoir in 2007 was similar to other years in the 2000-2006 period and lower than from 1998 to 1999 (Table 9). While overall CPUE of walleye has been similar the last seven years, differences in CPUE of the various incremental length groups exist. Substock walleye CPUE was lower during the 2004-2005 period when compared to the 1998-2000 period and 2002. Stock-to-quality-length walleye CPUE was also lower during the 2005-2007 period when compared to the 1997-2004 period, while walleye CPUE for preferred-length fish during 2007 was similar to 2003 and 2006, but higher than all other years in the 1998-2005 period (Table 9).

Walleye population size structure, as quantified with stock density indices, differs among years in the 1998-2007 period (Table 10). The RSD-P for 2006 and 2007 was higher for lower Oahe than the other two zones or the overall sample. The comparatively higher PSD and RSD-P values for lower Lake Oahe are partially related to lower recruitment in that zone (Lott et al. 2004). Walleye PSD for the total Oahe sample in 2007, at 62, was at the upper end of the desired range of 30-60, signifying a balanced population (Anderson and Weithman 1978). The RSD-P objective from the LOSP for the total Oahe sample was met in 2006 for the first year since 1997 and was met again in 2007.

Table 9. Mean walleye catch per unit effort (No./net-night) in the standard coolwater gill net survey, by year and length group, for 1998-2007, for Lake Oahe, South Dakota.

Year	Length group				
	Substock	Stock-quality	Quality-preferred	Preferred-	Total
1998	5.9	12.1	1.3	1.1	20.3
1999	2.9	15.9	1.7	0.9	21.4
2000	4.0	13.4	1.5	0.4	19.3
2001	2.5	9.9	2.1	0.3	14.8
2002	4.7	7.2	5.5	1.0	18.3
2003	2.2	7.0	3.0	1.6	13.8
2004	1.0	10.2	4.1	0.6	15.9
2005	1.4	5.1	10.7	1.0	18.2
2006	2.4	5.1	6.0	1.7	15.3
2007	2.2	3.8	6.9	1.8	15.6

Table 10. Walleye proportional stock density (PSD) and relative stock density of preferred-length (RSD-P) and memorable-length (RSD-M) fish, by reservoir zone, for fish collected during the standard coolwater gill net survey on Lake Oahe, South Dakota, 1998-2007

Year	Zone											
	Lower			Middle			Upper			Total		
	PSD	RSD-P	RSD-M	PSD	RSD-P	RSD-M	PSD	RSD-P	RSD-M	PSD	RSD-P	RSD-M
1998	27	9	1	13	2	0	4	2	0	16	5	1
1999	26	4	1	20	6	2	3	1	0	15	3	1
2000	19	0	0	11	2	1	12	0	0	14	1	0
2001	30	4	1	20	3	2	16	0	0	20	2	1
2002	58	1	0	44	3	1	47	0	0	49	1	0
2003	57	12	1	31	4	0	38	1	0	40	5	0
2004	67	13	1	31	2	0	20	1	0	34	4	0
2005	97	18	0	52	3	0	65	2	0	70	6	0
2006	92	32	0	34	4	0	56	5	0	60	13	1
2007	77	27	2	35	5	0	70	4	0	62	11	1

The *Wr* values for quality-to-preferred length walleyes in lower Lake Oahe were similar to those sampled in middle or upper Oahe in 2007, while *Wr* values for preferred-length walleye were higher in lower Oahe than middle or upper Oahe (Table 11). While *Wr* values have generally been increasing since 2003, they are still considerably lower than during the early and mid-1990's (Johnson et al. 1995). The objective range for mean *Wr* values for Lake Oahe walleye is 90-100 (LOSP 1994). While mean *Wr* values are not currently within the objective range, condition has improved since 2002 (Table 11).

Table 11. Mean walleye relative weight (*Wr*) values, by length group and reservoir zone, for Lake Oahe, South Dakota, 1997-2006. N is number of stock-length fish in a sample.

Zone/Year	Length group							
	Stock-quality		Quality-preferred		Preferred		Total sample	
	Wr	N	*Wr*	N	*Wr*	N	*Wr*	N
Lower								
1998	81	255	81	66	80	30	81	351
1999	79	220	80	67	71	11	79	298
2000	77	171	78	39	68	1	77	211
2001	83	105	84	39	81	6	84	150
2002	82	61	81	81	84	2	82	144
2003	85	64	86	68	85	18	85	150
2004	85	70	87	112	89	27	87	209
2005	81	7	90	176	87	41	89	224
2006	80	9	90	95	88	65	91	169
2007	86	48	88	108	88	52	88	213
Middle								
1998	76	182	79	23	75	5	77	210
1999	81	223	80	39	72	17	80	279
2000	75	240	75	24	68	4	75	268
2001	81	103	83	21	76	5	81	129
2002	82	104	81	75	83	6	82	185
2003	82	148	85	69	79	9	83	226
2004	88	130	90	55	84	4	89	189
2005	86	105	88	108	82	6	87	220
2006	84	172	87	94	87	17	85	283
2007	85	127	87	59	82	9	85	195
Upper								
1998	80	247	80	3	76	6	79	256
1999	83	428	83	11	77	4	83	443
2000	80	316	75	43	73	1	79	360
2001	87	334	85	62	--	--	87	396
2002	79	217	78	196	--	--	79	413
2003	79	132	75	70	68	2	78	204
2004	87	325	85	78	82	3	87	406
2005	88	162	88	286	84	8	88	456
2006	86	95	84	136	83	11	85	242
2007	91	80	86	176	75	9	87	265
Total								
1998	79	684	81	92	79	41	79	817
1999	81	871	80	117	7	32	81	1020
2000	78	727	76	106	69	6	78	839
2001	85	542	85	122	78	11	85	675
2002	81	382	80	352	83	8	80	742
2003	81	344	82	207	82	29	82	580
2004	87	525	87	245	88	34	87	804
2005	87	274	88	570	86	55	88	900
2006	85	276	88	325	87	93	86	694
2007	87	255	86	343	87	70	87	673

Otoliths were first used as an aging structure for walleye in Lake Oahe in 2002. Scales were not used as an aging structure after 2003 because of higher aging precision for otoliths than scales

(Marwitz and Hubert 1995; Isermann et al. 2003) and because scales may result in under-aging fish longer than 400-mm on Lake Oahe (Lott et al. 2004).

Mean walleye lengths-at-capture for 2003-2007 are presented in
Table 12. Higher mean lengths of fish collected during 2006 and 2007 are the result of overall faster growth after the slower growth observed during 1998-2002 (Lott et al. 2002).

Table 12. Mean length-at age time of capture (mm) for walleye collected in the standard August coolwater gill net survey, 2003-2007, on Lake Oahe, South Dakota.

Year		Length at age at capture (mm)											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2003	**Mean**	229	284	371	409	424	451	441	454	496			
	N	77	295	60	87	26	28	44	69	7			
	SE	2	2	6	4	8	9	8	7	37			
2004	**Mean**	243	320	359	406	440	468	470	485	492	522	605	580
	N	61	144	347	57	51	15	22	28	29	14	2	1
	SE	4	3	2	6	6	15	9	11	12	17	25	--
2005	**Mean**	234	348	403	424	441	492	484	492	514	525	450	435
	N	91	185	115	399	48	43	24	5	12	25	3	1
	SE	3	2	3	2	6	9	11	15	15	12	35	--
2006	**Mean**	256	355	427	461	479	484	524	528	550	549	540	544
	N	203	123	102	102	146	20	28	10	7	5	17	8
	SE	2	2	3	3	3	12	8	17	20	27	20	22
2007	**Mean**	242	367	420	459	477	488	516	526	516	526	617	527
	N	137	265	57	59	29	91	13	16	5	5	3	6
	SE	2.5	1.6	4.0	4.2	6.3	4.8	13.5	17.1	26	15.0	53	14.2
Mean of means		240	335	396	432	452	477	487	497	514	530	553	522

Walleye growth varied among zones and within zones among years. However, the common trend is for mean length–at-capture to decrease from lower to upper Lake Oahe. This trend was evident in the 2007 sample of age-1 to age-6 walleyes. (Table 13). Growth increments of walleye from age-1 to age-2 were lower in 2006-2007 than in 2005-2006, but were higher than in previous years (Table 14).

Table 13. Mean length (TL; mm) at time of capture, by reservoir zone, for walleye collected in the coolwater gill net survey from 2005 through 2007, in Lake Oahe, South Dakota. N is sample size and SE is standard error.

Zone	Age	2005			2006			2007		
		Length	N	SE	Length	N	SE	Length	N	SE
Lower	**1**	--	--	--	289	7	7.8	273	17	8.2
	2	391	12	3.8	386	9	6.8	383	90	2.3
	3	438	21	3.8	456	25	4.8	440	12	6.2
	4	463	58	3.2	487	20	7.9	489	11	7.1
	5	493	10	11.7	502	49	4.2	497	12	9.1
	6	531	13	11.2	530	8	13.3	512	36	7.3
	7	478	5	8.9	529	17	10.3	546	7	14.5
	8	512	1	--	537	8	20.7	562	9	17.8
	9	511	2	45.5	562	6	19.3	561	2	36
	10	553	7	15.5	549	5	27.1	539	4	9.7
	11	520	1	--	566	11	19.9	617	3	54
	12	--	--	--	552	2	49.5	573	10	20
Middle	**1**	224	68	2.5	245	126	2.8	231	100	2.2
	2	341	83	2.6	351	77	2.6	350	101	1.9
	3	403	44	3.4	422	33	4.6	417	23	7.8
	4	425	67	3.6	454	20	6.8	465	14	6.9
	5	445	1	--	487	34	5.5	483	8	8.5
	6	502	5	11.6	508	1	--	492	12	9.9
	7	544	3	53.1	525	7	20.6	488	1	--
	8	520	1	--	491	1	--	573	1	--
	9	500	4	19.2	478	1	--	540	1	--
	10	504	3	13.4	---	--	--	--	--	--
	11	--	--	--	591	2	69.5	--	--	--
	12	--	--	--	544	5	32.7	549	3	34.9
Upper	**1**	262	23	3.3	271	70	2.9	266	20	19.9
	2	348	90	3.0	357	37	2.5	372	74	28
	3	388	50	3.6	414	44	3.3	410	22	20
	4	415	274	2.2	436	15	8.6	448	34	31
	5	427	37	4.4	446	63	4.7	445	9	20
	6	470	25	11.3	448	11	9.2	467	43	40
	7	475	16	11.2	503	4	21.3	480	5	38
	8	476	3	19.5	494	1	--	464	6	45
	9	524	6	26.5	---	--	--	459	2	0.7
	10	516	15	17.7	---	--	--	474	1	--
	11	415	2	8.0	442	4	8.9		--	--
	12	435	1	--	527	1	--	504	5	23

Table 14. Mean annual growth (length) increment estimates for walleye collected in the coolwater gill net survey on Lake Oahe, South Dakota, for the 2003-2004, 2004-2005, 2005-2006 and 2006-2007 periods.

Year	Growth increment added during period (mm)								
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
2003-2004	91	75	35	31	44	19	44	38	26
2004-2005	105	83	65	35	52	16	22	29	33
2005-2006	121	79	58	55	43	32	44	58	35
2006-2007	111	65	32	16	9	32	2	--	--

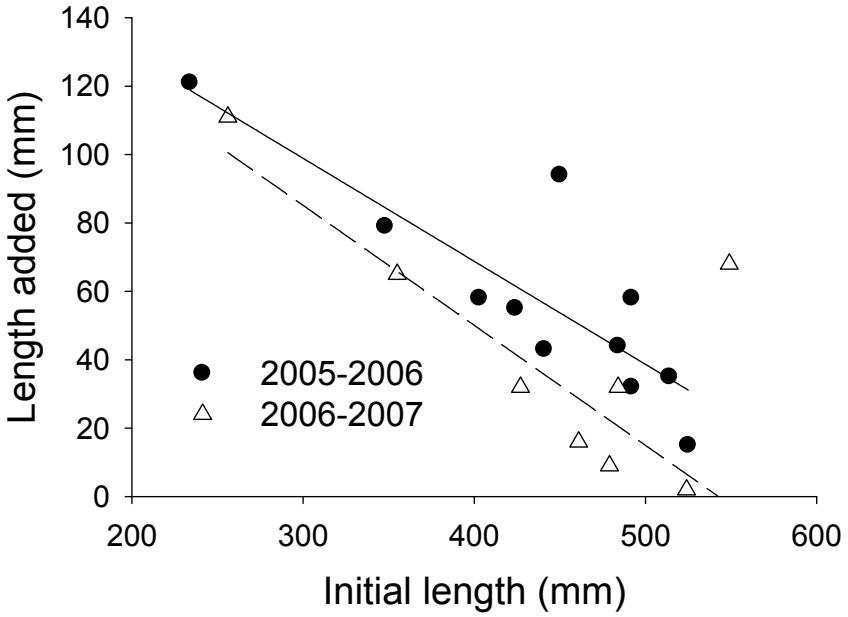

Figure 3. Mean length added by walleye in an age group during a growth period plotted against mean initial-length-at-age-values for the beginning of the growth period, for walleye collected from Lake Oahe, South Dakota during annual August gill net surveys. Trendlines for the 2005-2006 (solid line) and 2006-2007 (dashed line) growth periods are included.

Walleye production was similar to 2006, based on an age-0 CPUE of 0.9 fish/net-night (Table 15). Twelve age classes were sampled during 2007 with approximately 35% of walleye captured from the 2005 year class with the majority of these fish captured in middle Oahe. Mean CPUE for age-2 fish (2005 year class) in the total Oahe sample was 5.4 fish/net-night. Walleye from the 2001, 2003, and 2004 year classes were also well represented in gill net catches, accounting for 27% of the total gill net catch, as a group (Table 15). Age-0 walleye were last sampled in lower Oahe during 2003, signifying low reproduction of walleye in this portion of the reservoir.

Table 15. Age distribution of walleye collected from Lake Oahe, South Dakota, with standard coolwater gill net sets, by reservoir zone, as determined by aging otoliths. Mean age excludes age-0 fish. Year refers to walleye year class, CPUE is catch per unit effort (No./net-night).

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**
Low	5	27	53	15	19	7	10	13	22	3	1	0	0
Mid	1	31	176	18	31	9	8	11	14	0	0	1	0
Up	7	21	102	25	36	10	10	20	34	4	0	0	0
Total	13	85	321	61	87	26	28	44	70	7	1	1	0
CPUE	0.2	1.6	6.0	1.1	1.6	0.5	0.5	0.8	1.3	0.1	T	T	0.0

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**
Low	0	15	44	74	11	13	5	11	17	14	6	2	0
Mid	0	22	61	92	11	4	5	5	2	6	3	0	1
Up	0	27	50	258	42	33	4	5	7	6	3	0	0
Total	0	63	171	411	62	52	15	23	28	29	14	2	1
CPUE	0.0	1.2	3.2	7.6	1.1	0.9	0.3	0.4	0.5	0.5	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**
Low	0	1	26	33	100	12	18	10	1	7	12	1	0
Mid	7	68	82	42	66	1	5	2	1	4	3	0	0
Up	10	22	78	41	233	35	20	11	3	1	9	2	1
Total	17	91	185	115	399	48	43	23	5	12	25	3	1
CPUE	**0.3**	**1.7**	**3.5**	**2.2**	**7.5**	**0.9**	**0.8**	**0.4**	**0.1**	**0.2**	**0.5**	**0.1**	**T**

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**
Low	0	7	10	26	20	49	8	17	8	6	5	11	2
Mid	16	187	79	34	20	34	1	7	1	1	0	2	5
Up	11	71	32	45	15	65	11	4	1	0	0	5	1
Total	25	267	125	105	56	148	20	28	10	7	5	17	9
CPUE	**0.5**	**4.9**	**2.3**	**2.0**	**1.0**	**2.8**	**0.4**	**0.5**	**0.2**	**0.1**	**0.1**	**0.3**	**0.2**

2007													
Age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**99**	**98**	**97**	**96**	**95**
Low	0	18	90	12	11	12	36	7	9	2	4	3	10
Mid	27	135	112	23	14	8	12	1	1	1	0	0	3
Up	22	20	87	26	43	13	53	6	8	2	1	0	6
Total	49	173	289	61	68	33	101	14	18	5	5	3	19
CPUE	**0.9**	**3.2**	**5.4**	**1.2**	**1.3**	**0.6**	**1.8**	**0.3**	**0.3**	**0.1**	**0.1**	**0.1**	**0.3**

Lott et al (2006) quantified the terms low, moderate and high recruitment for Lake Oahe walleye based on mean gill net CPUE values for age-1 fish. Based on patterns in walleye recruitment as indicated by age-1 walleye CPUE, mean CPUE values of > 5 for age-1 fish will be considered "high" recruitment, values between 2 and 5 will be considered "moderate" recruitment, and values < 2 will be considered "low" recruitment.

Age-0 walleye CPUE in the standard August Lake Oahe gill net survey has been used as an early indicator of year class strength (Lott et al. 2006), as illustrated by the *r* value of 0.8 for the correlation of mean age-0 CPUE vs. mean age-1 CPUE displayed in Figure 4. However, this relationship did not hold for the 2005 year class. Abundance of age-0 fish indicated low-to-moderate recruitment, while CPUE of age-1 fish (a more reliable indicator of recruitment) taken the following year suggested that a moderate-to-high strength (CPUE=4.9 fish/net-night) was produced.

With this in mind, high levels of recruitment occurred for walleye from 1989 through 1991 and in 1994 and 1995 (Figure 4 and Figure 5), while recruitment in 1996, 1997, 1999, 2001, and 2005 was moderate. The majority of preferred-length walleye in the 2006 population (Table 15) were produced during the period of moderate recruitment from 1999 through 2001 (Figure 5). Walleye recruitment during the 2002-2004 period appears to be low based on gill net CPUE at age-1 (Figure 5).

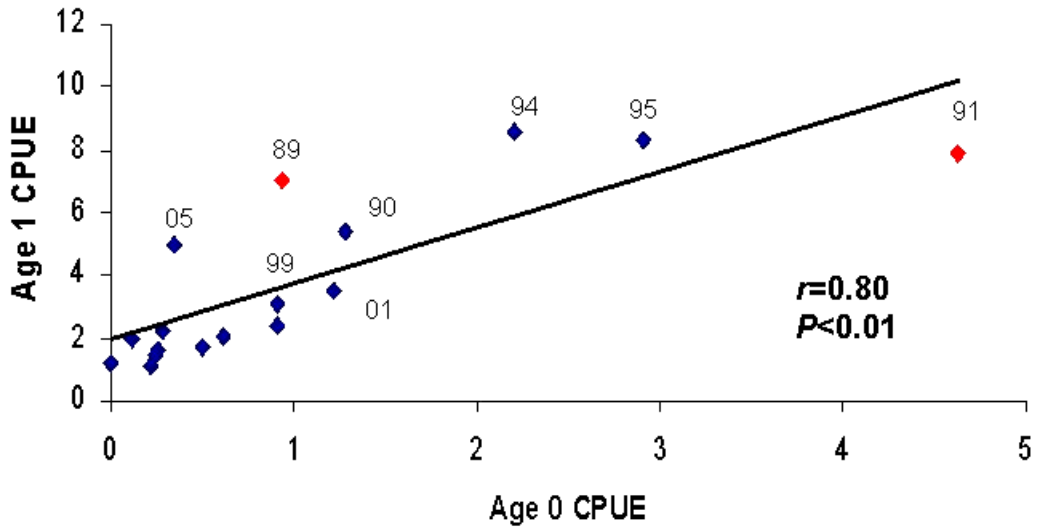

Figure 4. Mean walleye gill net catch per unit effort (CPUE; No./net-night) at age-0 vs. age 1, for year classes produced during the 1989-2005 period. Labels on points refer to year class and were only used for the eight largest year classes produced.

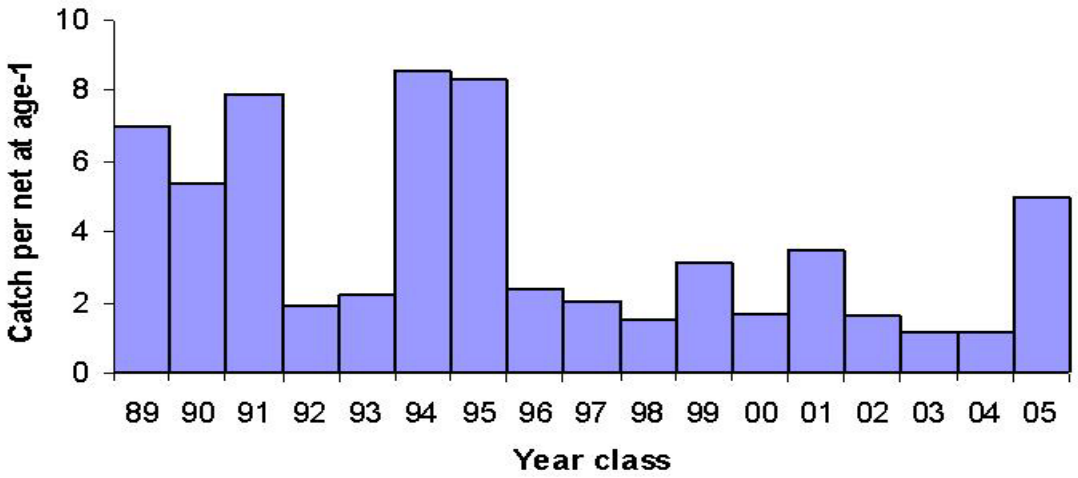

Figure 5. Mean walleye catch per unit effort (CPUE; No./net-night) of fish from designated year classes at the point of recruitment at age 1, for the 1989-2006 standard coolwater gill net surveys conducted during August on Lake Oahe, South Dakota.

Currently 20 inch walleye make up the highest percentage of the population sampled (Figure 6). Population size structure has changed little over the past three years indicating adequate recruitment to the population. Numbers of fish above 20 inches are currently higher than the 2000 to 2001 period, but remains below those recorded in the late 1990's.

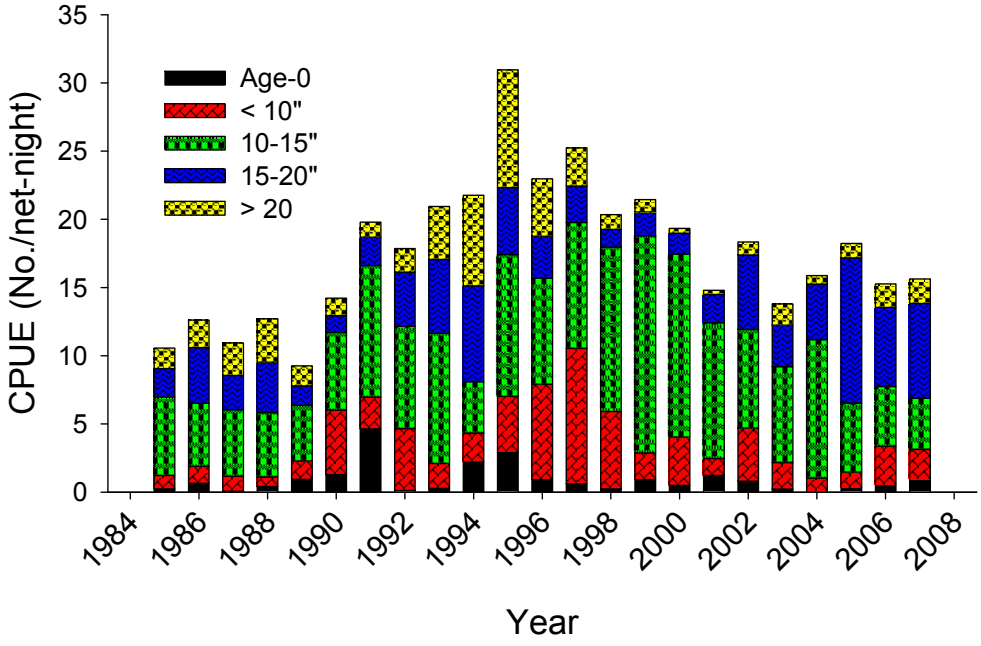

Figure 6. Length structure, in terms of catch per unit effort (CPUE), of Lake Oahe walleye sampled in the standard coolwater gill net survey, 1985-2007.

Length frequency distributions for gill net catches in 2007 illustrate the current status of the Lake Oahe walleye population (Figure 7). The CPUE was highest for middle Oahe in 2007, mostly because of a high number of age-1 fish in the sample (2005 year class). The abundance index was lowest for lower Oahe, where very few fish in the gill net sample were <380 mm in length (Figure 7), and intermediate in upper Oahe, where some recruitment occurs annually. Higher PSD and RSD-P values for lower Lake Oahe than for the middle and upper zones is a function of lower recruitment and faster growth (Lott et al. 2006) in this zone, when compared with middle and upper Oahe.

The 2003-2007 length frequency histograms (Figure 8) support the observation that natural production of walleye was absent in all areas of Oahe during 2004. Some natural production was documented for other years in the 2003-2007 period, although not necessarily in all zones for each year. A low (0.3 fish/net night) amount of natural production occurred in lower Oahe in 2003 (Figure 9). The fish in the 120-mm length group in the 2005 lower Oahe sample was actually an age-1 fish, meaning natural production was not documented in lower Oahe from 2004 through 2007. Natural production of walleye was again highest in middle Oahe in 2007, as indicated by fish on length frequency histograms between 90 mm and 160 mm (Figure 10). As in middle Oahe, natural production of walleye was documented in upper Oahe during all years in the 2003-2007 period except 2004 (Figure 11). After decreasing from 2005 to 2006, walleye CPUE in 2007 in upper Oahe was similar to 2006. With the presence of recruitment in 2003, 2005, 2006 and 2007, and relatively low angler harvest in recent years, changes in fish distribution or activity may be likely causes for low walleye CPUE in upper Oahe in 2006.

Examination of Figure 8 through Figure 11 illustrates the higher percentage of walleye ≥ 504 mm in lower Oahe, when compared to the middle and upper zones. Relative Stock Density of Preferred-length fish in 2007 was 4 in upper Oahe, 5 in middle Oahe and 27 in lower Oahe. While walleye ≥ 504 mm comprised 26% of the fish in the lower Oahe August 2007 gill net sample, lower abundance of walleye and lower catch rates for this zone, may mean the “one walleye ≥ 20 inches” regulation may not substantially impact an anglers ability to harvest walleye from lower Oahe in 2007.

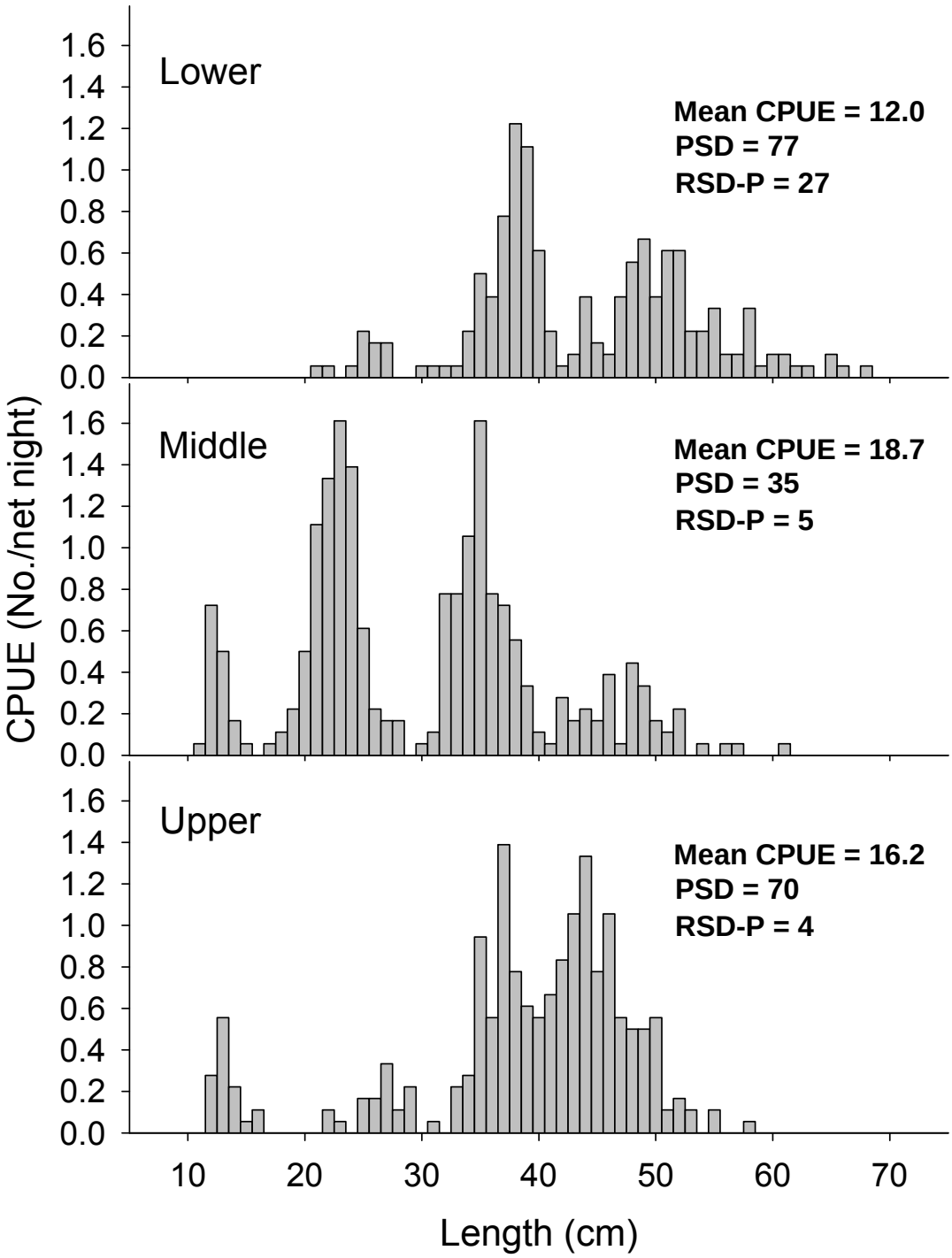

Figure 7. Length frequencies of walleye collected, in terms of catch per unit effort (CPUE), by zone, for fish collected during the standard coolwater gill net survey in 2007.

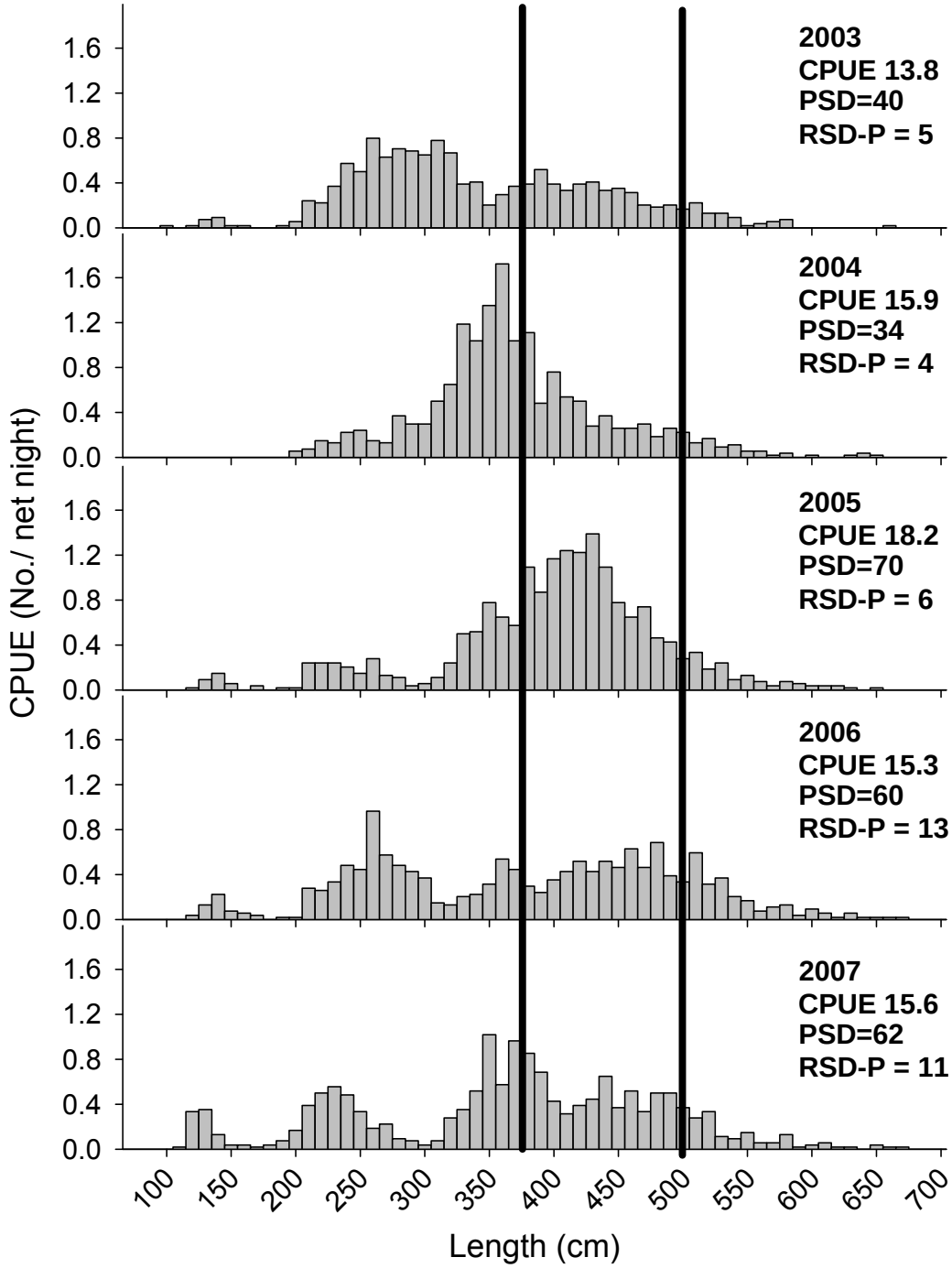

Figure 8. Overall Length frequency, by catch per unit effort, of walleye collected in standard gill-net sets in Lake Oahe, South Dakota, during August 2003 through 2007. Vertical lines represent the 15-inch and 20-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

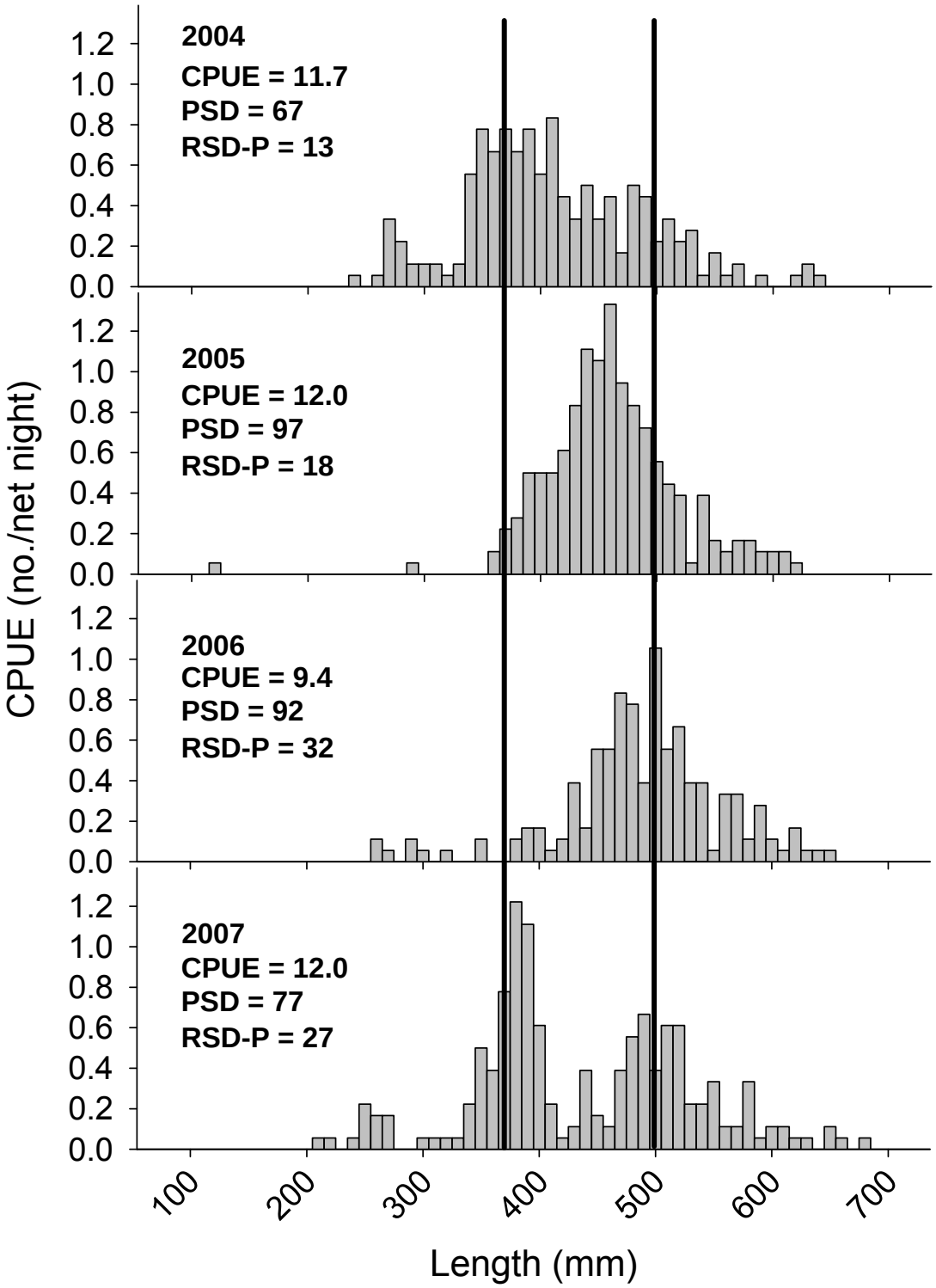

Figure 9. Lower zone of Lake Oahe, South Dakota, length frequency by catch per unit effort, of walleye collected in standard gill-net sets during August 2003 through 2007. Vertical lines represent the 15-inch and 20-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

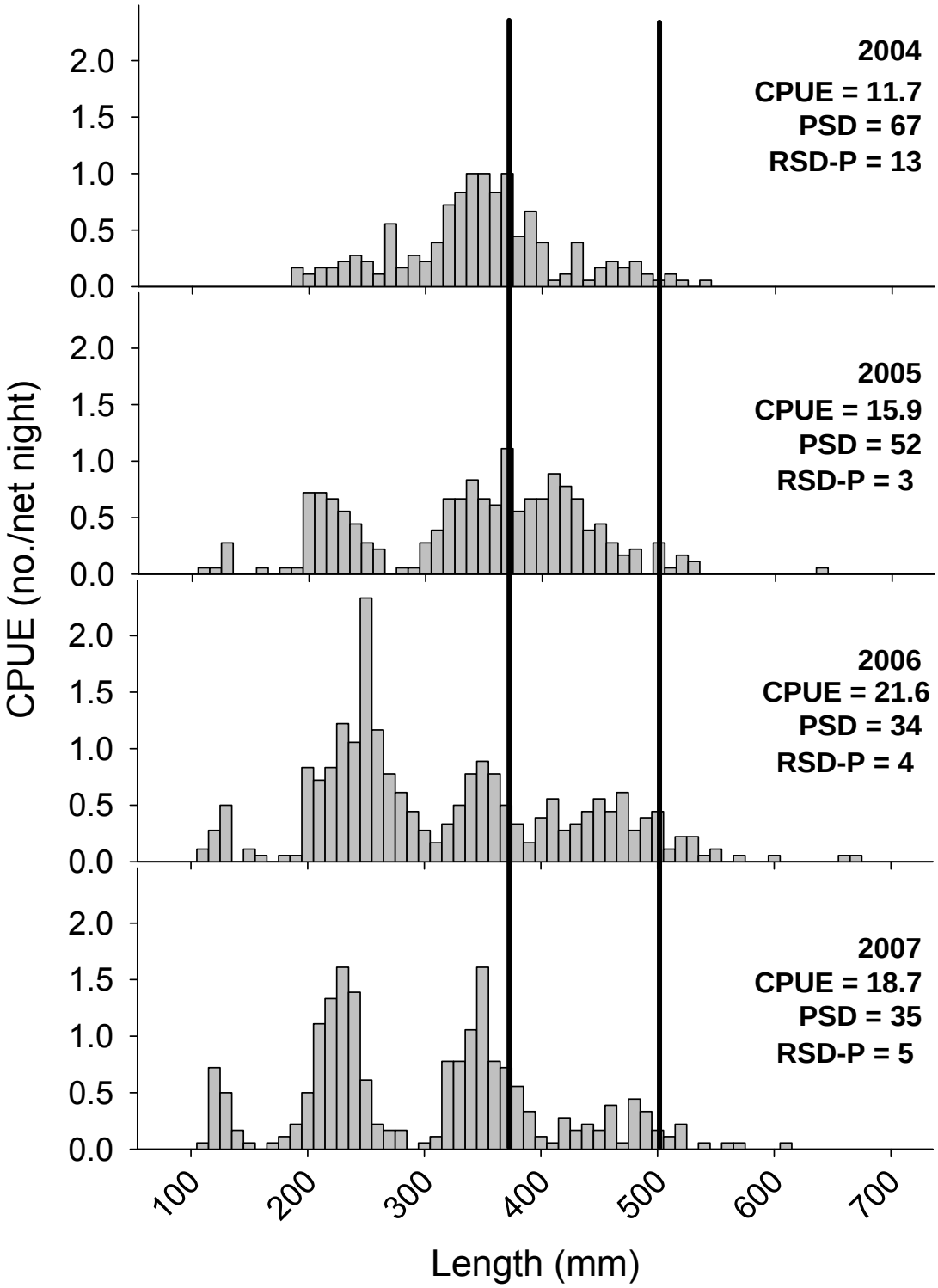

Figure 10. Middle zone of Lake Oahe, South Dakota, length frequency, by catch per unit effort, of walleye collected in standard gill-net sets during August 2003 through 2007. Vertical lines represent the 15-inch and 20-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

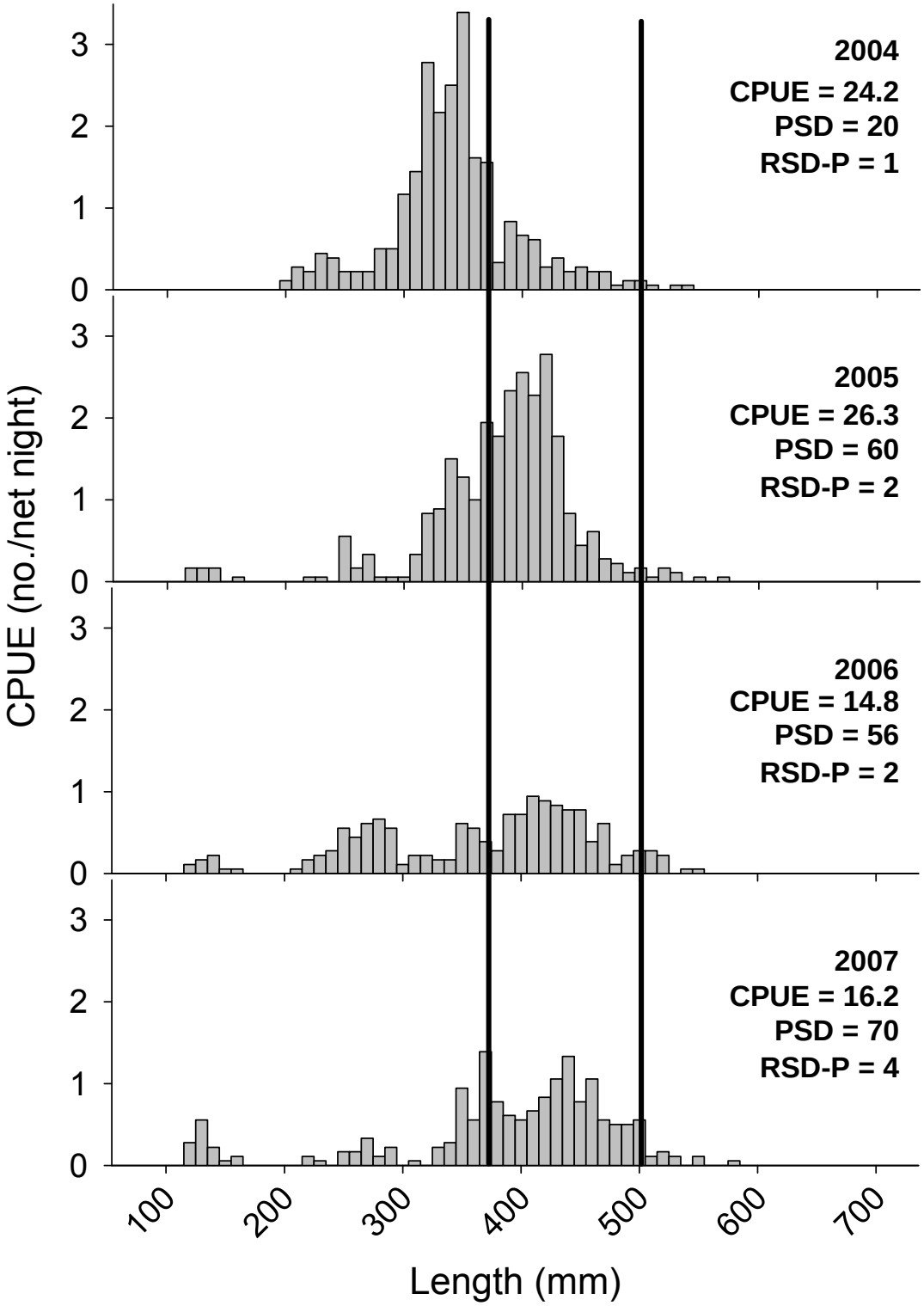

Figure 11. Upper zone of Lake Oahe, South Dakota, length frequency, by catch per unit effort, of walleye collected in standard gill-net sets during August 2003 through 2007. Vertical lines represent the 15-inch and 20-inch classifications. Catch per unit effort (CPUE), PSD and RSD-P are presented for each year.

Population Parameters for Channel Catfish

Proportional stock density for the overall Lake Oahe 2007 gill net sample of channel catfish, at 50, was higher than the 2006 value but within the range of values generated for other years in the 1997-2007 period (Table 16). Relative weight for channel catfish has remained stable ranging between 76 and 83 over the previous 10-year period (Table 16). Structural and condition indices for the Lake Oahe channel catfish population have generally varied little among years due to slow growth, consistent recruitment, and low exploitation (Lott et al. 2003, 2004). Channel catfish growth rates have slowed considerably since the impoundment of Lake Oahe (Starostka and Nelson 1974; Lott et al. 2003). Quality length for channel catfish is 410 mm, or approximately 16 inches. Therefore, 50% of the channel catfish sampled in the standard gill net survey in 2006 were longer than 16 inches (Figure 12) but angler use and harvest of this species remains low. Mean CPUE of channel catfish in the 2007 standard gill net survey, at 18.8, was the highest of all species sampled (Table 6) and similar to other channel catfish CPUE during the 2002-2007 period. Age and growth analysis for channel catfish is scheduled in association with the 2008 standard Lake Oahe gill net survey.

Table 16. Channel catfish proportional stock density (PSD), relative stock density fo preferred- and memorable-length (RSD-P and RSD-M) fish, and mean relative weight (*Wr*) values for 1997-2007 for Lake Oahe, South Dakota. Mean Wr values for 2002-2007 are for stock-length fish only.

Year	PSD	RSD-P	RSD-M	*Wr*	Sample size
1997	56	4	0	83	411
1998	54	2	0	78	391
1999	51	1	0	79	428
2000	52	1	0	77	452
2001	44	1	0	77	493
2002	42	0	0	78	533
2003	46	2	0	76	424
2004	31	0	0	81	399
2005	43	1	0	80	481
2006	44	0	0	79	461
2007	50	1	0	79	620

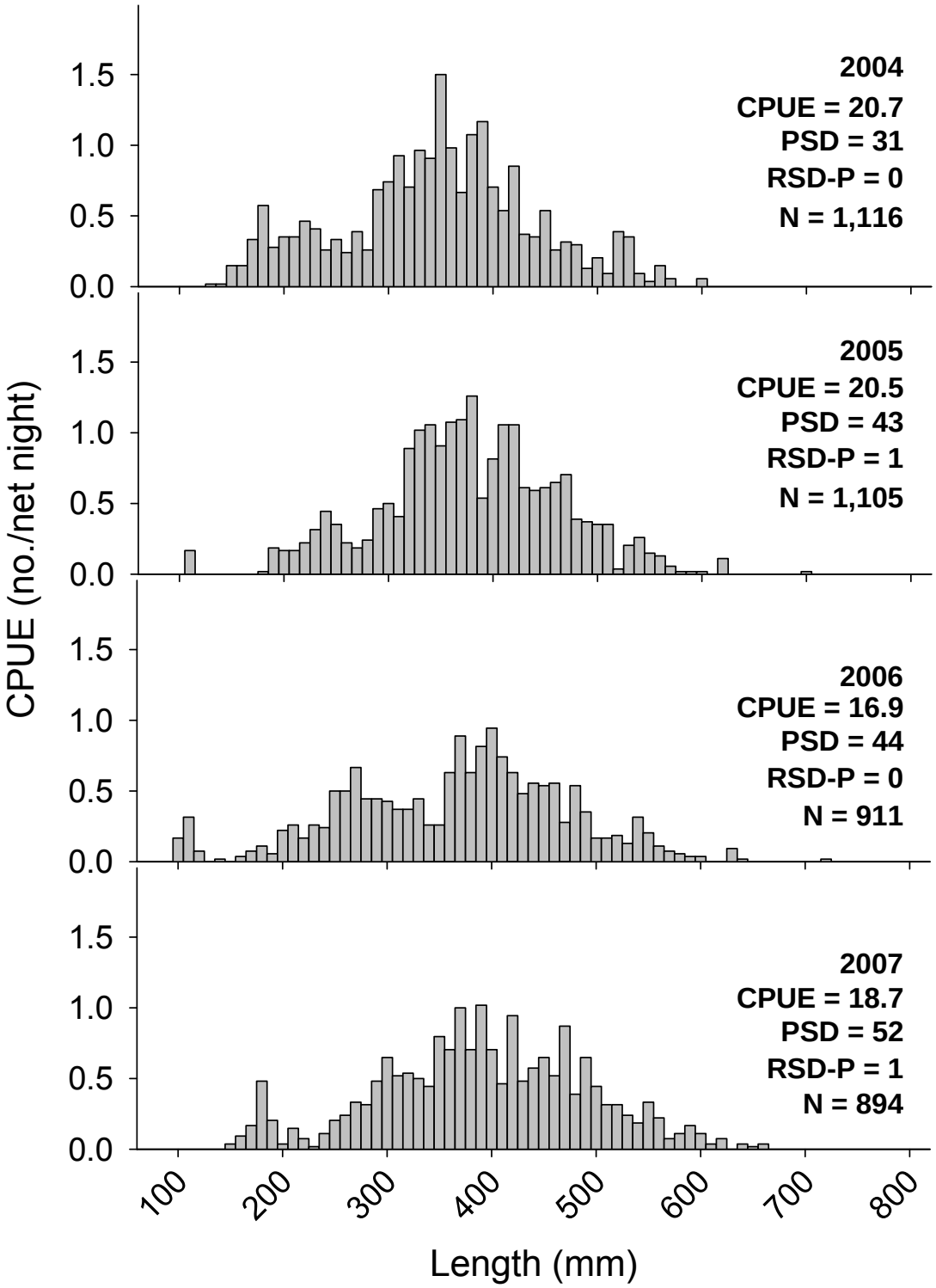

Figure 12. Length frequency of channel catfish, in terms of catch per unit effort (CPUE), collected during the standard coolwater gill net survey in 2004 through 2007. N is number of channel catfish sampled.

Table 17. Mean length (TL; mm) at time of capture for channel catfish collected in the coolwater gill net survey from 2002 and 2007, in Lake Oahe, South Dakota. N is sample size and SE is standard error.

Age	2002			2007		
	Length	N	SE	Length	N	SE
1	---	---	---	173	4	3.1
2	196	1	---	213	16	14.6
3	278	8	7.7	289	13	19.6
4	269	21	6.5	324	27	14.5
5	309	38	5.8	339	66	7.9
6	343	37	5.6	351	81	5.6
7	366	42	6.1	404	51	7.2
8	388	25	7.4	428	62	6.7
9	398	22	8.5	427	40	8.8
10	407	36	5.0	448	29	10.6
11	433	36	6.3	465	14	16.9
12	486	11	10.0	472	14	7.9
13	508	12	9.1	514	13	11.1
14	516	15	12.3	525	6	22.5
15	534	13	9.4	580	9	12.7
16	555	9	11.7	645	3	38.7
17	579	6	8.4	605	3	1.9
18	587	4	33.8	616	1	---
19	541	2	31.0	---	---	---
20	514	1	---	---	---	---

Growth of channel catfish has increased since 2002 (Table 17). Mean length of channel catfish at age-6 in 1969, 2002 and 2007 were 390, 317 and 351mm, respectively. Mean length of channel catfish at age 14 in 1969, 2002 and 2007 were 596, 502 and 525 mm, respectively. Channel catfish growth has improved since 2002, but is still slower since impoundment of Lake Oahe.

Population Parameters for Rainbow Smelt

Mean peak larval rainbow smelt density for 2007, at 17.7 fish/100 m^3 was slightly higher than the 2006 value but substantially higher than values for the 2000-2002 period (Table 18). While peak densities from the three-week trawling period are used in analysis, and variance among samples can be high, there is definitely a trend of increasing larval rainbow smelt density since 2002.

Table 18. Mean peak larval densities (No./100 m^3) of rainbow smelt, by reservoir zone, in Lake Oahe, South Dakota, during late May and early June, 2000-2006.

Year	Zone			
	Lower	Middle	Upper	Total
2000	6.39	0.31	0.13	2.28
2001	2.22	0.00	0.00	0.74
2002	1.03	0.90	2.69	1.54
2003	10.48	16.37	0.94	9.26
2004	5.00	8.30	12.45	8.58
2005	66.12	21.71	38.95	42.26
2006	9.96	24.53	14.58	16.36
2007	34.30	13.92	4.87	17.70

Hydroacoustic surveys from 1996-1999, presented in Nelson Stastny (2001) show the decline in rainbow smelt abundance and biomass that is mirrored in declines in larval smelt production during the same period. Hydroacoustic survey estimates of rainbow smelt biomass and abundance from 2000-2006, presented in Erickson et al. (*In* prep, Table 19) illustrate the low point in rainbow smelt abundance that began in 1999 and continued through 2002. Since 2002, rainbow smelt abundance and biomass estimates for Lake Oahe have increased, but are still significantly lower than during 1996 (Nelson-Stastny 2001). Changes in rainbow smelt abundance and biomass follow a similar pattern to walleye *Wr* values during the 1996-2006 period, with lows for *Wr* typically occurring in 2000 (Table 11).

Table 19. Hydroacoustic estimates of the number of rainbow smelt and other fish from Lake Oahe, South Dakota surveys, 2000-2006

Year	Zone	Smelt ≥ age-1	Smelt age-0	Other fish*
2000	1	336,120	9,025,143	17,866,330
	2	8,788,066	11,801,987	24,952,703
	3	0	1,528,264	18,318,643
	Total	**9,124,186**	**22,355,394**	**61,137,676**
2001	1	0	173,093	6,239,870
	2	0	128,556	26,227,342
	3	0	0	14,014,730
	Total	**0**	**301,649**	**46,481,942**
2002	1	6,746,892	21,654,739	6,746,892
	2	11,168,762	34,043,187	11,168,762
	3	0	0	0
	Total	**17,915,654**	**55,697,926**	**17,915,654**
2003	1	77,589,686	42,515,230	58,100,747
	2	39,359,059	16,361,068	118,117,674
	3	0	0	78,747,607
	Total	**116,948,745**	**58,876,298**	**254,966,028**
2004	1	75,830,260	18,176,115	105,383,296
	2	37,801,886	4,851,526	97,649,770
	3	0	0	381,727,895
	Total	**113,632,146**	**23,027,641**	**584,760,961**
2005	1	28,295,289	107,642,452	92,659,837
	2	16,452,986	22,545,136	131,607,192
	3	0	0	133,602,672
	Total	**44,748,275**	**130,187,588**	**357,869,701**
2006	1	77,589,686	42,515,230	58,100,747
	2	39,359,059	16,361,068	118,117,674
	3	0	0	78,747,607
	Total	**116,948,745**	**58,876,298**	**254,966,028**

* Other fish include: channel catfish, common carp, freshwater drum, gizzard shad, spottail shiner, walleye, white bass, white crappie and yellow perch.

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Angler Use

Angler survey clerks interviewed 2,191 parties during the April-October 2007 angler use and harvest survey. The estimated fishing pressure for the South Dakota portion of Lake Oahe for 2007, at 652,827 h, was similar to estimates for 2003, 2004 and 2006 and higher than the 2005 estimate (Table 20). While estimated fishing pressure for the April-October 2007 period was higher than for 2006, it was still among the lowest estimates generated since annual April-October surveys were initiated in 1993. Estimated pressure was lowest in 2000, at 539,188 h. The highest estimated fishing pressure for the April-October period occurred in 1996 at 1,968,525 hours and 338,880 angler trips. In 2007, estimated pressure was 33% of the 1996 level and estimated trips were 41% of the 1996 level.

Table 20. Angler use and harvest estimates for surveys conducted on Lake Oahe, South Dakota. All surveys were conducted during the April-October daylight period, except where noted.

Year	Fishing pressure (h)	Angler trips	Estimated fish harvest	Estimated walleye harvest	Reference
1981*	671,393	124,332	278,127	221,594	Riis (1982)
1982**	1,276,990	228,034	342,682	286,633	Riis (1983)
1983**	784,658	142,665	141,475	95,797	Riis (1984)
1986	1,031,176	190,658	313,199	256,737	Riis and Stone (1989)
1991***	903,777	238,795	193,593	178,492	Fielder et al. (1992)
1992***	1,051,330	210,266	267,746	216,426	Stone et al. (1994)
1993	1,299,344	236,244	318,381	269,392	Stone et al. (1994)
1994	1,189,267	212,597	341,391	288,182	Johnson et al. (1995)
1995	1,695,945	292,404	464,735	367,693	Johnson et al. (1996)
1996	1,968,525	338,880	533,062	438,355	Johnson et al. (1997)
1997	1,617,024	287,011	538,596	475,638	Johnson et al. (1998)
1998	1,781,032	309,744	563,009	484,234	Johnson et al. (1999)
1999	847,359	158,904	328,184	280,305	Lott et al. (2000)
2000	539,188	109,665	267,642	225,041	Lott et al. (2001)
2001	1,014,591	206,638	702,899	632,770	Lott et al. (2002)
2002	856,059	174,706	474,168	383,367	Lott et al. (2003)
2003	651,557	121,107	249,166	181,528	Lott et al.(2004)
2004	660,973	132,726	286,885	223,782	Lott et al. (2006)
2005	460,334	87,433	210,953	164,428	Lott et al. (2007)
2006	620,273	134,258	232,117	201,554	Lott et al (2007b)
2007	652,827	138,310	248,170	208,679	This study

* July-September
** April-September
*** May-October

Estimated fishing pressure peaked in June during 2007, at 281,355 hours, 43% of the fishing pressure for the months of April through October (Table 21). For the months of May, June, and July, approximately 80% of fishing pressure occurred for the April through October period, a value similar to 2006 which was 85% (Lott et al. 2007b). Angling pressure was the highest in the middle zone of Oahe at 52% of the total estimated pressure, followed by the lower and upper zones at 27% and 21%, respectively.

Table 21. Estimated fishing pressure (angler hours), by month and zone, with 80% confidence intervals (CI), for the April-October 2007 daylight period on Lake Oahe, South Dakota.

Zone	Month							
	April	May	June	July	August	Sept.	Oct.	Total
Lower	6,017	15,958	73,652	49,428	12,794	15,077	4,521	177,449
80% CI	2,175	11,892	28,466	20,100	6,538	6,311	2,887	38,097
Middle	2,141	73,031	146,942	57,045	15,260	32,403	11,747	338,569
80% CI	790	40,037	59,750	23,963	5,875	8,571	4,918	76,681
Upper	5,264	20,530	60,761	24,693	7,217	9,429	8,916	136,810
80% CI	2,396	5,639	23,826	9,259	3,498	3,964	3,432	27,031
Total	13,422	109,519	281,355	131,167	35,271	56,909	25,184	652,827
80% CI	3,331	42,144	70,345	32,619	9,460	11,358	6,656	89,789

Estimated fishing pressure, calculated using full pool surface area, was 5.9 h per hectare for the April-October period in 2007 (Table 22). Estimates for angler hours per hectare for the 2002 through 2006 period ranged from 4.2 h/ha to 6.0 h/ha. The majority of the pressure on Lake Oahe is by boat, with 95% of estimated angler hours for the April-October 2007 period being attributed to boat anglers (Table 22). Estimated fishing pressure was highest in the middle zone of Oahe in 2007, at an average of 10.0 h/ha, followed by the lower and upper zones at 4.3 and 3.9 h/ha, respectively (Table 23).

Table 22. 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-October daylight survey period, on Lake Oahe, South Dakota, from 2003 through 2007. Estimates were generated using aerial counts of fishing pressure.

Type of fishing	Year				
	2003	2004	2005	2006	2007
Boat (h)	613,954	634,135	437,908	600,294	617,134
80% CI	87,024	69,714	58,305	82,555	89,990
h/ha	5.5	5.7	4.0	5.4	5.6
Shore (h)	5,257	26,838	22,426	19,978	35,693
80% CI	6,740	3,316	3,139	3,649	6,201
h/ha	T	0.2	0.2	0.2	0.3
Combined (h)	651,557	660,973	460,334	620,273	652,827
80% CI	87,880	70,301	59,283	82,712	89,789
h/ha	5.9	6.0	4.2	5.6	5.9

Table 23. 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-October daylight period, on Lake Oahe, South Dakota, from 1994 through 2007.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	h	h/ha	h	h/ha	h	h/ha
1994	328,203	7.8	333,602	9.9	527,462	15.1	1,189,267	10.7
1995	520,102	16.7	509,497	20.5	666,346	22.2	1,695,495	19.7
1996	688,936	22.0	579,200	23.4	700,389	23.3	1,968,525	22.9
1997	508,565	12.6	548,942	14.3	559,517	21.4	1,617,024	15.4
1998	760,797	18.8	522,740	13.6	497,495	19.0	1,781,032	17.0
1999	455,434	11.3	196,425	5.1	195,500	7.5	847,359	8.1
2000	233,013	5.8	170,320	4.4	135,855	5.2	539,188	5.1
2001	396,097	9.5	350,504	10.3	267,990	7.6	1,014,591	9.2
2002	216,608	5.2	320,535	9.5	318,915	9.1	856,058	7.7
2003	164,804	3.9	280,712	8.3	206,042	5.9	651,558	5.8
2004	161,693	3.8	296,194	8.8	203,086	5.8	660,973	6.0
2005	107,385	2.6	238,202	7.0	114,747	3.3	460,334	4.2
2006	146,218	3.5	307,479	9.1	166,575	4.7	620,273	5.6
2007	177,449	4.3	338,569	10.0	136,810	3.9	652,827	5.9
Zone size (ha)	41,598		33,890		35,172		110,660	

Catch, Harvest and Release Estimates

Of the estimated 248,170 fish harvested from Oahe during the April-October 2007 daytime period, 208,680 (84%) were walleye. Channel catfish (11,887; 5%) and Chinook salmon (9,144; 4%) had the second and third highest harvest estimates for the 2007 survey period. The walleye harvest during June and July made up 72% (150,128) of the total walleye harvest during the April-October period in 2007 (Table 24).

Table 24. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the April-October 2007 daylight period, on Lake Oahe, South Dakota.

Species	Month							
	April	May	June	July	Aug.	Sept.	Oct.	Total
Walleye	971	29,975	104,370	45,758	9,726	13,356	4,523	208,680
80% CI	552	14,119	29,084	8,876	2,836	3,060	1,971	33,847
Channel catfish	1,268	3,115	2,183	2,311	1,546	549	916	11,887
80% CI	267	1,862	1,732	283	346	260	627	2,683
White bass	5	1,547	5,201	1,591	245	216	0	8,805
80% CI	0	724	2,633	263	181	147	--	2,753
Smallmouth bass	13	1,379	3,465	1,009	605	870	95	7,435
80% CI	--	1,125	1,093	283	297	747	98	1,788
Northern pike	481	17	0	0	0	0	0	498
80% CI	49	19	--	--	--	--	--	52
Chinook salmon	838	150	4,733	1,247	227	794	1,154	9,144
80% CI	580	35	2,874	1,006	158	--	342	3,123
Other*	0	255	691	414	188	173	0	1,721
Total	3,575	36,438	120,643	52,330	12,537	15,958	6,688	248,170
80% CI	868	15,473	32,222	9,357	3,145	3,189	2,483	37,312

*Other includes black crappie, common carp, freshwater drum, goldeye, largemouth bass, sauger, white crappie, and yellow perch.

An estimated 579,822 fish were caught in Lake Oahe during the 2007 standard survey period (Table 24, Table 25 and Figure 13). An estimated 414,801 (72% of all fish) walleye were caught, the top species for catch, and 50% of them harvested (Table 27). An estimated 331,652 fish were released back into Lake Oahe (Table 25). Channel catfish (37,620), white bass (35,778), and smallmouth bass (54,240) followed walleye in terms of total estimated catch in 2007 (Figure 13). Approximately 43% of the fish caught were harvested in 2007. As with fishing pressure, catch and harvest was highest in the months of June and July. The total catch estimate for June and July 2007 was 441,002 fish, 76% of the 579,822 caught during the April-October period.

Table 25. Estimated number of fish released, by species and month, for the April-October 2007 daylight period, on Lake Oahe, South Dakota.

Species	Month							
	April	May	June	July	Aug.	Sept.	Oct.	Total
Walleye	484	10,171	112,341	73,322	5,607	4,502	694	206,121
Channel catfish	228	7,387	3,986	9,958	2,498	1,676	0	25,733
White bass	42	5,891	17,310	2,840	228	476	187	26,973
Smallmouth bass	62	8,280	18,951	10,558	2,645	5,853	457	46,805
Northern pike	70	71	84	39	9	0	0	272
Chinook salmon	147	73	929	296	9	145	83	1,683
Other*	60	1,622	10,012	7,403	2,669	824	475	24,065
Total	1,093	33,495	163,613	104,416	13,665	13,476	1,896	331,652

*Other includes black crappie, common carp, freshwater drum, goldeye, largemouth bass, rainbow smelt, river carpsucker, sauger, white crappie, and yellow perch.

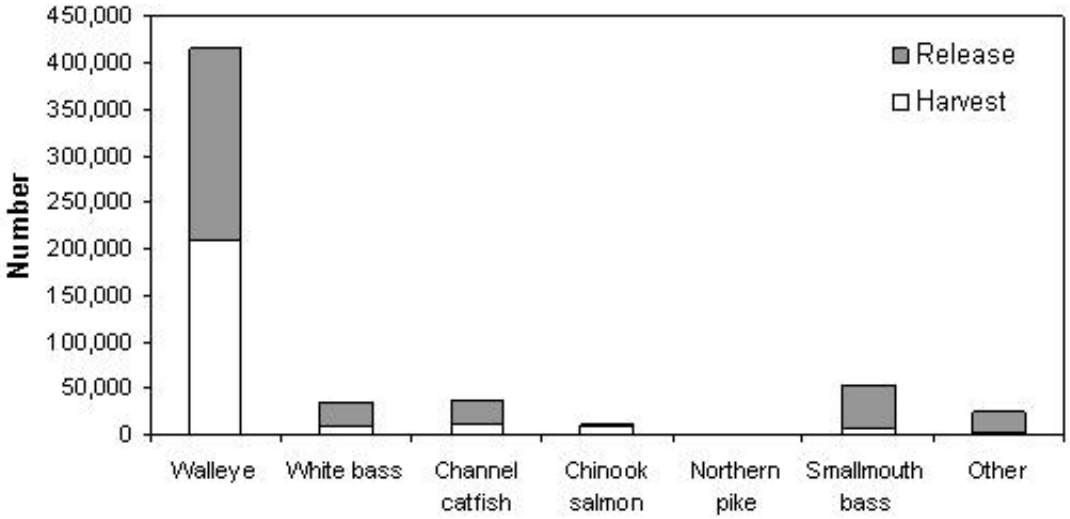

Figure 13. Estimated number of fish harvested and released, for selected species, for the April-October 2007 daylight period, on Lake Oahe, South Dakota. Other includes black crappie, common carp, freshwater drum, goldeye, largemouth bass, rainbow smelt, river carpsucker, sauger, white crappie, and yellow perch.

Estimated walleye harvest in 2007 was highest in the middle zone of Oahe, at 119,768 fish, followed by the upper and lower zones at 53,522 and 35,390 fish, respectively (Table 26). The lower zone walleye harvest in 2007 was significantly higher than in 2005 (21,381) and in 2006 (14,136) (Lott et al 2007, Lott et al 2007b). The highest harvest of channel catfish (77% of total) and northern pike (91% of total) occurred in the upper zone of the reservoir in 2007 (Table 26). The lower zone (82% of total) followed by the middle zone (17% of total) had the highest harvest for Chinook salmon.

Table 26. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the April-October 2007 daylight period, on Lake Oahe, South Dakota.

Species	Zone			
	Lower	Middle	Upper	Total
Walleye	35,390	119,768	53,522	208,680
80% CI	9,127	28,419	15,957	33,847
Channel catfish	776	1,916	9,195	11,887
80% CI	324	757	2,553	2,683
White bass	3,051	1,250	4,504	8,805
80% CI	2,296	444	1,453	2,753
Smallmouth bass	3,221	3,679	535	7,435
80% CI	1,113	1,369	288	1,788
Northern pike	43	0	455	498
80% CI	29	0	43	52
Chinook salmon	7,535	1,545	64	9,144
80% CI	3,110	284	36	3,123
Total	50,170	129,438	68,562	248,170
80% CI	11,508	30,059	18,874	37,312

Estimated walleye catch and the percentage of walleye caught that were harvested have varied greatly among years (Table 27). The percentage of fish caught that were harvested ranged from 23% to 41% during the 1997-2000 period due to the walleye population being dominated by fish less than 380 mm in length and high angler catch rates of walleye, allowing anglers to be very selective in the fish they kept (Lott et al. 2002). The high increase in percentage of fish caught that were kept in 2001 was the result of liberal limits implemented that year. The percentage of walleye caught that were harvested decreased from 81% in 2001 to 50% in 2007. Reasons for

the reduction in percentage caught that were harvested from 2001 to 2007 include reductions in the daily limit from 14 fish to 4 fish during this time period (Table 2), and changes in sizes of walleye caught and hourly catch rates of walleye. Estimated walleye catch was the highest in 1998, at over 2 million walleyes caught, while the percentage harvested was the lowest, at 23%. In 2007, with 414,801 walleyes caught, estimated catch was only 20% of the 1998 estimated catch, but harvest was 43% of the 1998 estimate, and release was only 13% of the 1998 estimate (Table 27).

Table 27. Estimated number of walleye caught, harvested, and released during the April-October daylight period, by reservoir zone and year, for Lake Oahe, South Dakota, 1994 through 2007.

Year	Caught	Harvested	Released	Percent harvested
1994	423,527	288,182	135,345	68%
1995	583,671	367,693	215,978	63%
1996	675,269	438,355	236,914	65%
1997	1,152,050	475,638	676,412	41%
1998	2,103,666	484,234	1,619,432	23%
1999	816,394	280,305	536,089	34%
2000	602,288	225,041	377,247	37%
2001	783,598	632,770	150,828	81%
2002	501,958	383,367	118,591	76%
2003	275,883	181,528	94,355	66%
2004	354,368	223,782	130,586	63%
2005	215,164	164,428	50,735	76%
2006	309,603	201,554	108,049	65%
2007	414,801	208,680	206,121	50%

Length frequency histograms of walleye harvested by anglers for all of Lake Oahe (Figure 14) show that anglers generally begin harvesting walleyes at approximately 300 mm in length but prefer to harvest fish longer than 350 mm. Walleye < 300 mm were well represented in the population in upper and middle Oahe (Figure 10 and Figure 11) but were not harvested by anglers. During 2007, walleye between 300 and 350 mm were harvested throughout Oahe and contributed to the harvest during all months (Figure 15 to Figure 17). The mean length of walleye harvested during the April-October 2007 period, of 423 mm (17 inches) illustrates the increase in quality of the Lake Oahe fishery since the early 2000s. From lower Oahe to upper Oahe, the average size of harvested walleye decreases from 427 mm for lower Oahe to 422 mm in upper Oahe (Figure 14 to Figure 17). Lower Oahe has a higher percentage of fish greater than 550 mm harvested when compared to the other zones (Figure 15). Smallmouth bass are typically an incidental catch by anglers and harvested by generalist anglers. The length frequency of harvested smallmouth bass showed a range of harvested sizes for 2007, with the mean length of 347 mm for smallmouth bass harvested in 2007 (Figure 18).

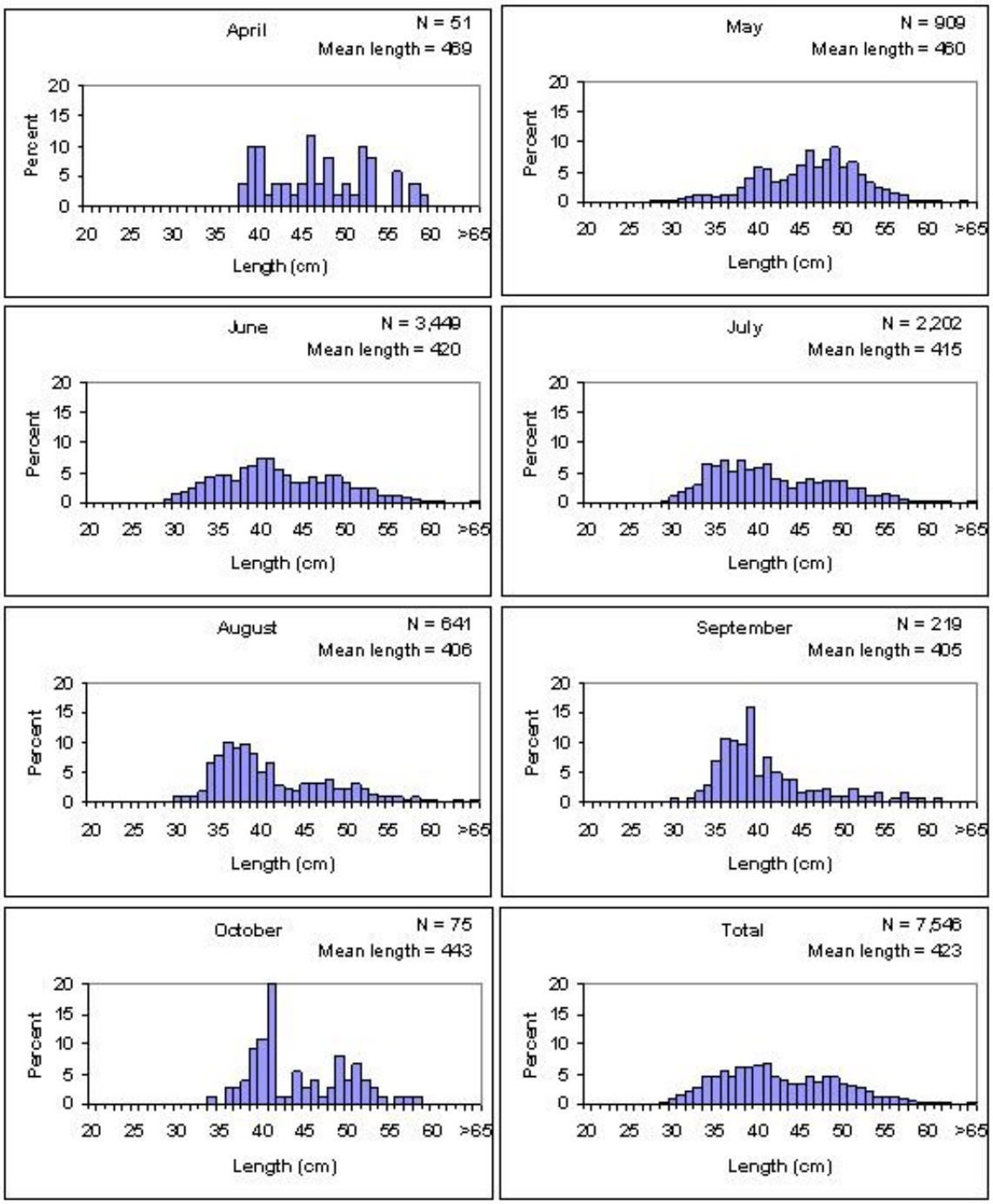

Figure 14. Length frequency distribution of walleye harvested by anglers fishing Lake Oahe, South Dakota, during the April-October 2007 daylight period.

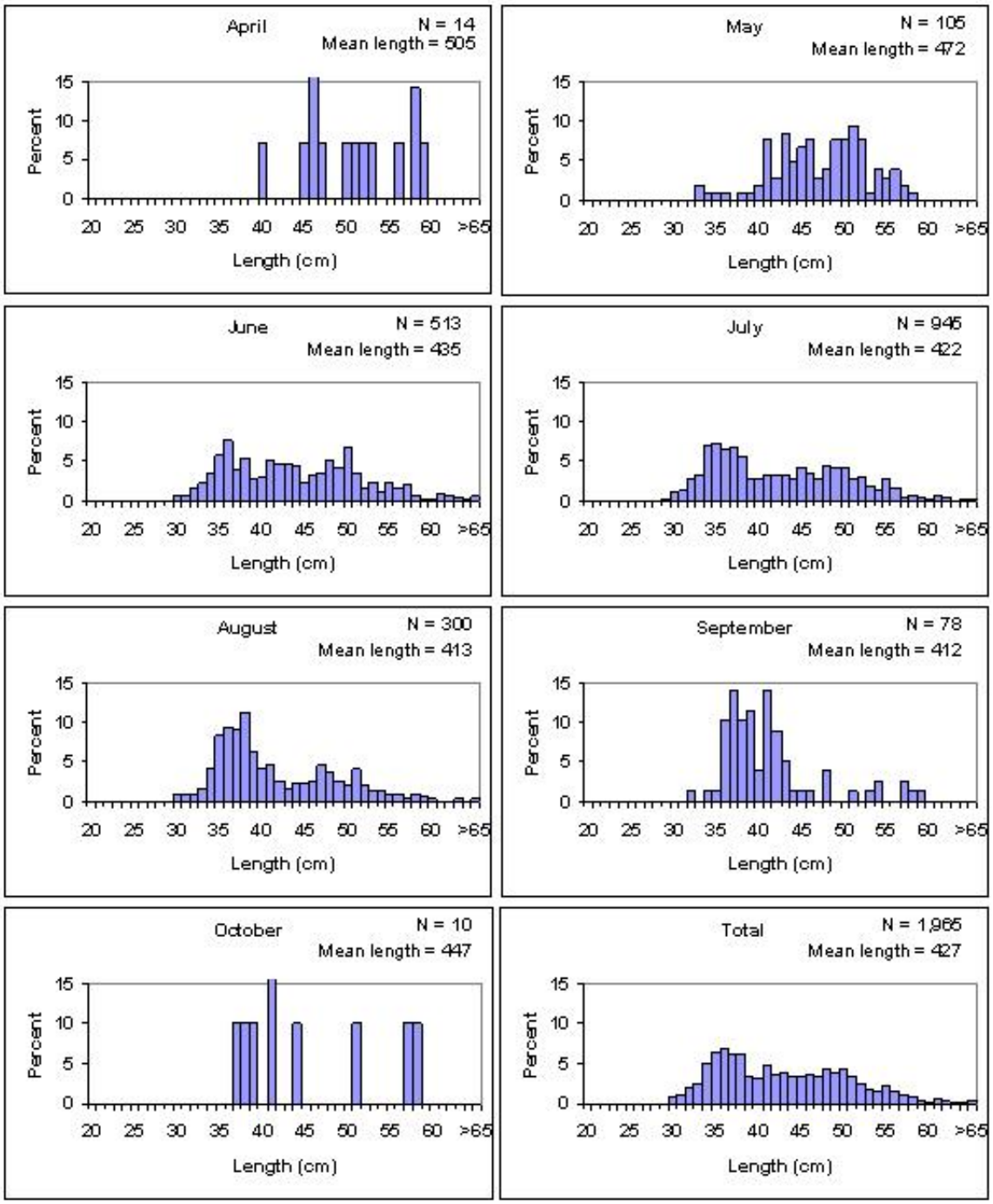

Figure 15. Length frequency distribution of walleye harvested by anglers fishing lower Lake Oahe, South Dakota, during the April-October 2007 daylight period.

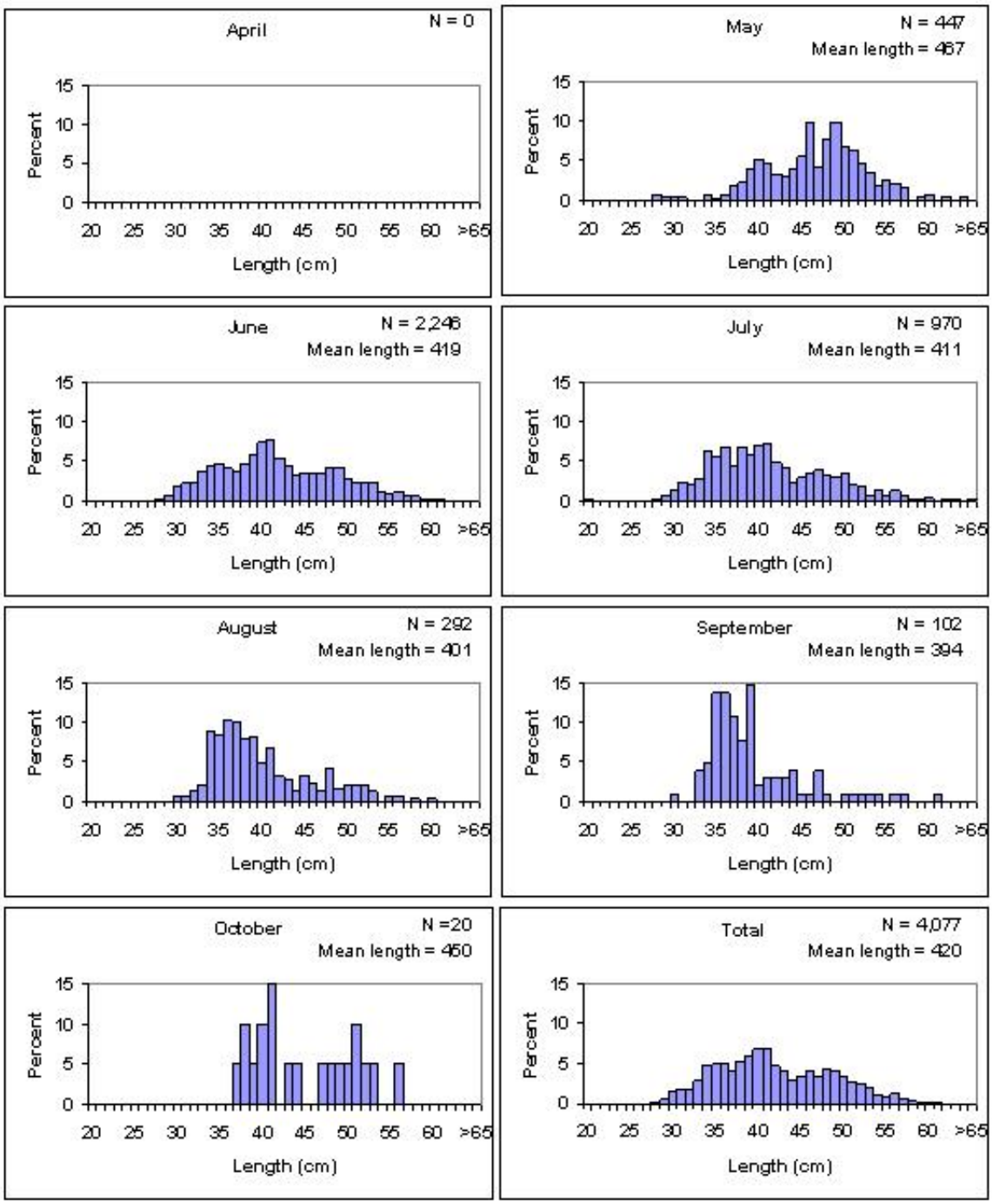

Figure 16. Length frequency distribution of walleye harvested by anglers fishing middle Lake Oahe, South Dakota, during the April-October 2007 daylight period.

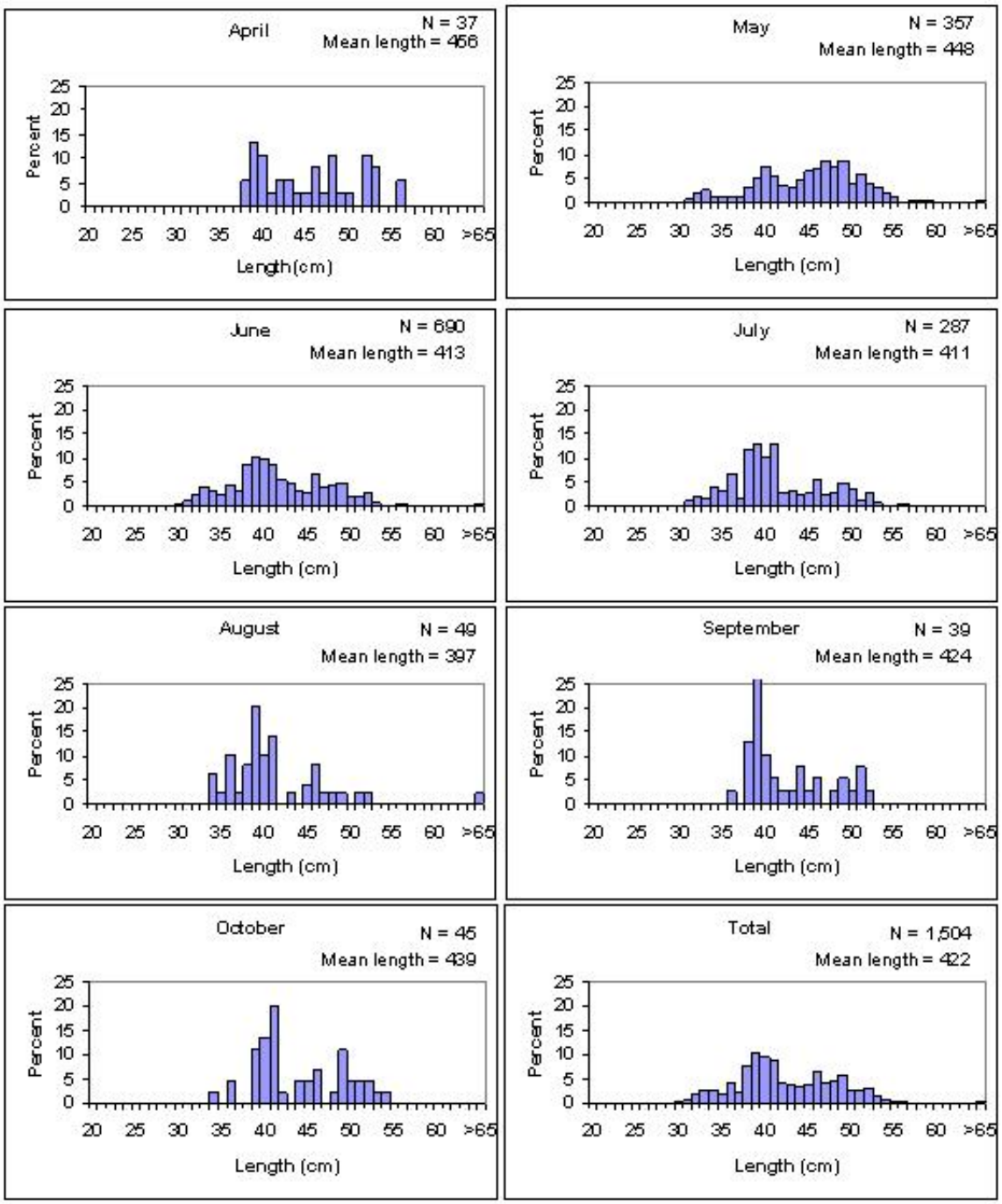

Figure 17. Length frequency distribution of walleye harvested by anglers fishing upper Lake Oahe, South Dakota, during the April-October 2007 daylight period.

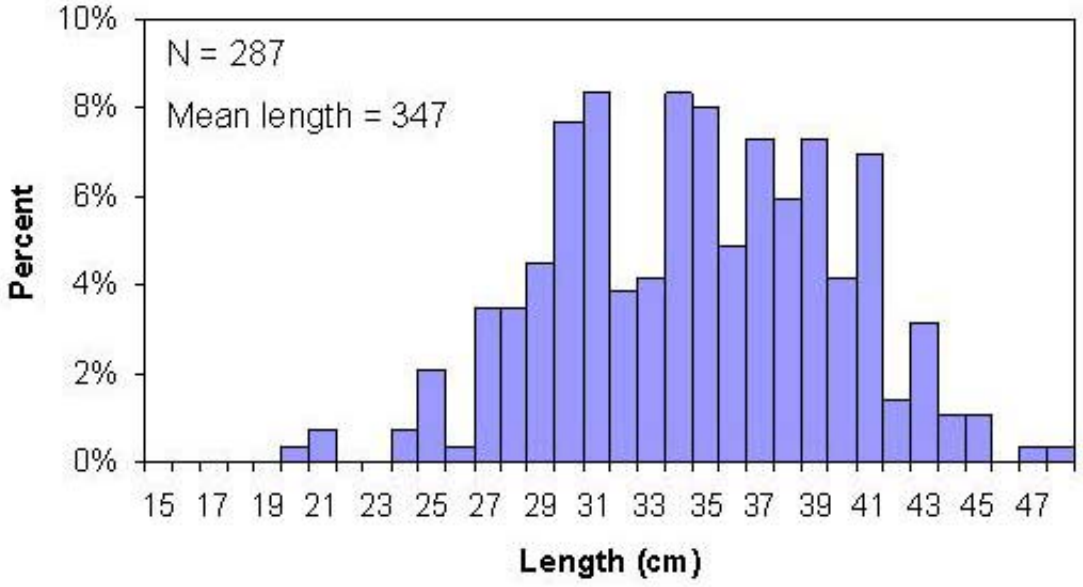

Figure 18. Length frequency distribution of smallmouth bass harvested by anglers fishing Lake Oahe, South Dakota, during the April-October 2007 daylight period.

Hourly Catch, Harvest, and Release Rates

For Lake Oahe, mean catch rate for walleye has exceeded 0.3 fish/angler-h since annual surveys were initiated in 1991 (Stone et al. 1994, Table 30). Walleye catch rates exceeding 0.3 fish/angler-h are generally considered excellent (Colby et al. 1979). Anglers actively fishing for smallmouth bass had the greatest increase in catch rates (2.62 fish/angler-h) over the sample of all anglers (0.08 fish/angler-h, Table 28) with majority of the fish they caught being released. Anglers targeting channel catfish in 2007 caught an estimated 1.69 fish/angler-h, while all anglers combined caught 0.06 fish/angler-h. Mean catch rate of Chinook salmon by anglers targeting salmon during 2007, has remained similar to the 2005 and 2006 rates at 0.33 fish/angler-h (Lott et al. 2007, Lott et al. 2007b, Table 29).

Table 28. Estimated hourly catch, harvest, and release rates, by species, for all anglers interviewed on Lake Oahe, South Dakota, during the April-October 2007 daylight survey period. Trace (T) indicates values >0.0 but <0.01.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	0.64	0.32	0.32
Channel catfish	0.06	0.02	0.04
White bass	0.05	0.01	0.04
Smallmouth bass	0.08	0.01	0.07
Northern pike	T	T	T
Yellow perch	0.01	T	0.01
Chinook salmon	0.02	0.01	T
Other*	0.03	T	0.03
Total	0.89	0.38	0.51

*Other includes black crappie, common carp, freshwater drum, goldeye, rainbow smelt, river carpsucker, sauger and white crappie.

Table 29. Estimated hourly catch, harvest, and release rates, by species, for anglers specifically fishing for the species listed, on Lake Oahe, South Dakota during for the April-October 2007 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	1.34	0.72	0.62
Smallmouth bass	2.62	0.82	1.80
Channel catfish	1.69	0.88	0.81
Chinook salmon	0.33	0.29	0.04
Northern pike	0.09	0.07	0.02

Catch rates for walleye, smallmouth bass, white bass, and channel catfish vary greatly among years (Table 30). Walleye catch rates were highest during 1997 through 2001 with peak catch rates of 1.18 walleye per hour occurring during 1998. White bass catch rates were 0.12 fish/angler-h or higher during all years in the 1998-2005 period. However, a die-off of white bass (Lott et al. 2007) occurred during July of 2005 that may be responsible for the decrease in mean white bass catch per angler-h for 2006 and 2007 (Table 30). Catch rates, for all species combined in 2007, peaked during the months of June and July (Table 31), the same months fishing pressure was highest (Table 21). Walleye catch rates also peaked in June and July 2007, with harvest rates being the greatest in June (0.37 walleye per hour, Table 31).

In 2006 and 2007, 15% and 17% of angling parties in 2006 and 2007 harvested four or more walleye per angler. (Table 32). The percentage of angling parties catching zero walleye per trip varied greatly among reservoir zones in 2007. Forty four percent of parties fishing the lower zone in 2007 caught zero walleyes, while only 11% and 30% of anglers fishing middle and upper Oahe caught zero walleyes, respectively (Table 32).

Table 30. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, by year, for all anglers, for the April-October daylight survey period on Lake Oahe, South Dakota, 1994 through 2007.

Year	Catch rate (fish/angler-h)				
	Walleye	Smallmouth bass	White Bass	Channel catfish	All fish
1994	0.36	0.02	0.02	0.01	0.51
1995	0.34	0.01	0.04	0.01	0.57
1996	0.34	0.02	0.03	0.01	0.50
1997	0.71	0.04	0.05	0.02	0.92
1998	1.18	0.06	0.13	0.02	1.45
1999	0.96	0.04	0.13	0.03	1.22
2000	1.11	0.05	0.20	0.03	1.00
2001	0.77	0.03	0.12	0.06	1.01
2002	0.59	0.03	0.28	0.09	1.03
2003	0.42	0.02	0.20	0.08	0.77
2004	0.54	0.02	0.19	0.07	0.87
2005	0.47	0.02	0.14	0.07	0.74
2006	0.50	0.03	0.03	0.08	0.71
2007	0.64	0.08	0.05	0.06	0.89

Table 31. Estimated hourly catch, harvest, and release rates (fish/angler-h), for walleye and all species combined, by month, for the April-October 2007 daylight survey period, on Lake Oahe, South Dakota.

Month	Walleye			All fish combined		
	Catch rate	Harvest rate	Release rate	Catch rate	Harvest rate	Release rate
April	0.11	0.07	0.04	0.35	0.27	0.08
May	0.37	0.27	0.10	0.64	0.33	0.31
June	0.77	0.37	0.40	1.01	0.43	0.58
July	0.90	0.35	0.55	1.20	0.40	0.80
August	0.44	0.28	0.16	0.74	0.35	0.39
September	0.31	0.23	0.08	0.52	0.28	0.24
October	0.21	0.18	0.03	0.34	0.27	0.07
Total	0.64	0.32	0.32	0.89	0.38	0.51

Table 32. Percentage of angling parties catching and harvesting the specified number of walleye and sauger (combined) on an angling trip, by reservoir zone, for Lake Oahe, South Dakota, during the April-October 2006 and 2007 daylight survey periods.

Number /trip	Catch per trip							
	2006				2007			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	64	20	32	37	44	11	30	28
0.1-0.9	12	11	8	11	10	7	5	8
1.0-1.9	10	13	12	12	11	10	13	11
2.0-2.9	7	13	9	10	8	12	12	11
3.0-3.9	3	5	10	6	6	9	7	7
4.0-4.9	2	11	13	9	6	10	9	8
5.0-5.9	1	10	7	6	3	6	8	5
6.0-6.9	1	5	3	3	3	8	3	5
7.0-7.9	0	3	2	2	2	6	3	4
8.0-8.9	0	2	1	1	2	4	2	3
9.0-9.9	0	2	1	1	1	4	1	2
≥10	0	5	2	2	4	13	7	8

Number /trip	Harvest per trip							
	2006				2007			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	67	26	36	41	51	17	35	34
0.1-0.9	11	10	8	10	10	11	6	9
1.0-1.9	9	16	13	13	12	18	14	15
2.0-2.9	7	15	12	12	10	18	12	14
3.0-3.9	3	12	12	9	8	14	11	11
≥4.0	3	21	19	15	9	23	22	17

Angler Demographics and Economic Impacts

Average party size was 2.2 anglers/party and average trip length was 4.7 h, during the April-October 2007 period. Resident anglers averaged 76% of the parties interviewed on Oahe in 2007 (Table 33). Non-residents made up a higher percentage of anglers in the middle zone (31%) followed by lower (21%) and upper zones (17%). From 2004 to 2007, the percentage of non-resident angler contacts within each zone has remained similar.

For the April-October 2007 daytime period, the Lake Oahe fishery had a direct economic impact of 10.9 million dollars based on 138,310 trips at value of $79 per trip (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007).

Three states, Nebraska (33%), Iowa (21%), and Minnesota (13%) made up 67% of the non-resident anglers that visited Lake Oahe (Table 34). The percentage of contacts by Minnesota residents has decreased since 2002 (30%) to 18% of the nonresident contacts.

Table 33. Percentage of total angler contacts for resident and non-resident (states combined) anglers fishing Lake Oahe during the April-October daylight period, 2004-2007. N is the number of parties interviewed.

Zone		Year			
		2004	2005	2006	2007
Lower	**N**	595	591	612	883
	Residents (%)	83	78	80	79
	Non-residents (%)	17	22	20	21
Middle	**N**	670	696	862	859
	Residents (%)	71	73	72	69
	Non-residents (%)	29	27	28	31
Upper	**N**	471	488	495	444
	Residents (%)	82	80	80	83
	Non-residents (%)	18	20	20	17
Total	**N**	1,736	1,778	1,969	2,186
	Residents (%)	78	77	77	76
	Non-residents (%)	22	23	23	24

Table 34. Percentage of total non-resident angler contacts for the states listed, for anglers fishing Lake Oahe, South Dakota, during the April-October daylight survey period, 2002-2007.

State	Percent by Year					
	2002	2003	2004	2005	2006	2007
Iowa	18	17	16	16	15	21
Nebraska	14	24	39	33	32	33
North Dakota	14	8	8	8	7	9
Colorado	5	5	8	4	7	7
Minnesota	30	25	14	23	18	13
Wisconsin	5	6	3	3	6	2
Wyoming	2	2	6	1	2	2
Other*	12	13	6	12	16	13

*Other includes Alabama, Alaska, Arkansas, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kansas, Michigan, Mississippi, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah and Washington.

County of residence data for South Dakota resident anglers that fished Lake Oahe in 2007 are depicted in Figure 19 through Figure 22. A large percentage (48%) of resident angler contacts for lower Oahe in 2007 was residents from Hughes and Stanley counties (Figure 19). Thirty three percent of resident anglers fishing middle Oahe were from Potter, Sully, Hughes, and Stanley counties. No county dominated resident angler contacts for middle Lake Oahe (Figure 20). Anglers from Walworth County comprised 38% of resident angler contacts in upper Oahe with Brown County residents accounting for 26% of the total resident angler contacts in this zone (Figure 21). For the total Oahe sample in 2007, the highest percentage of resident angler contacts for one county was for Hughes County, at 23%, followed by Walworth and Minnehaha Counties at 10%, each, Brown County (8%), and Pennington County (7%, Figure 22). Visiting resident anglers fishing Lake Oahe have a tendency to fish the zone closest to their county of residency. For Upper Oahe, many anglers are from the northern tier of counties or along US Highway 12. Anglers fishing middle Oahe tend to be found near US Highway 212 and anglers fishing lower Oahe tend to be near US Highway 14. These three highways cross South Dakota in an east-west pattern.

Not surprisingly, the counties with the highest percentage of resident angler contacts are also areas either close to Lake Oahe or supporting major population centers (Table 35). High percentages of total resident angler contacts for Hughes and Walworth Counties are due to the close proximity of Pierre and Mobridge to Lake Oahe, while the percentage of Minnehaha and Pennington County residents in the sample of total resident angler contacts is due to the large populations of Sioux Falls and Rapid City, respectively. Approximately 43% of angling parties contacted during the standard April-October angler survey traveled in excess of 200 miles, one way, to fish Lake Oahe (Table 36), a value similar to other years in the 2004-2007 period.

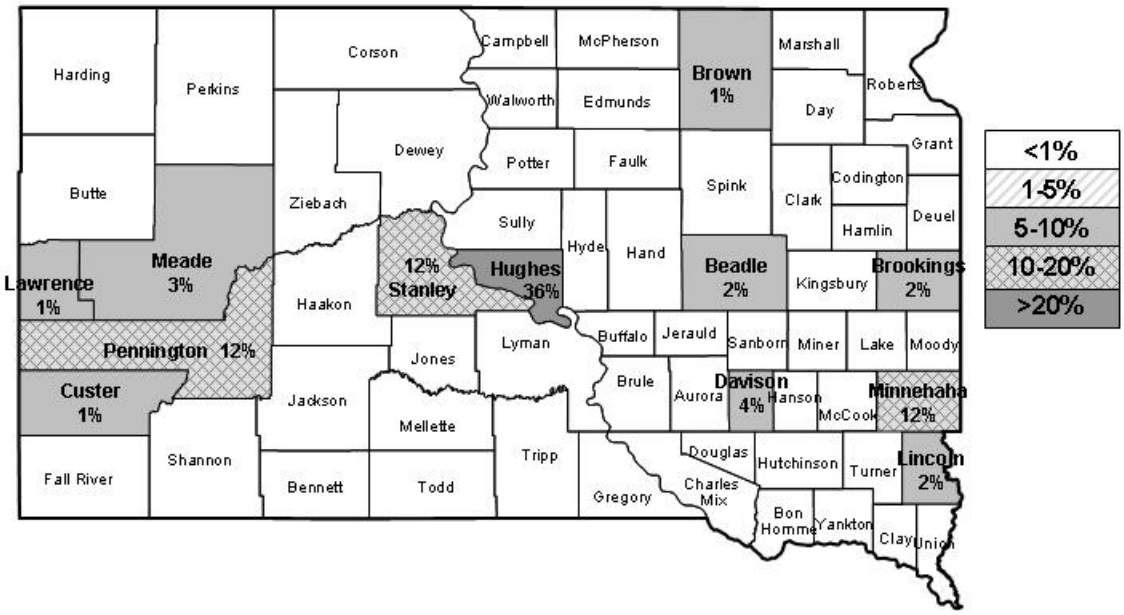

Figure 19. County of residency for South Dakota residents fishing lower Lake Oahe during the April-October 2007 daylight survey period.

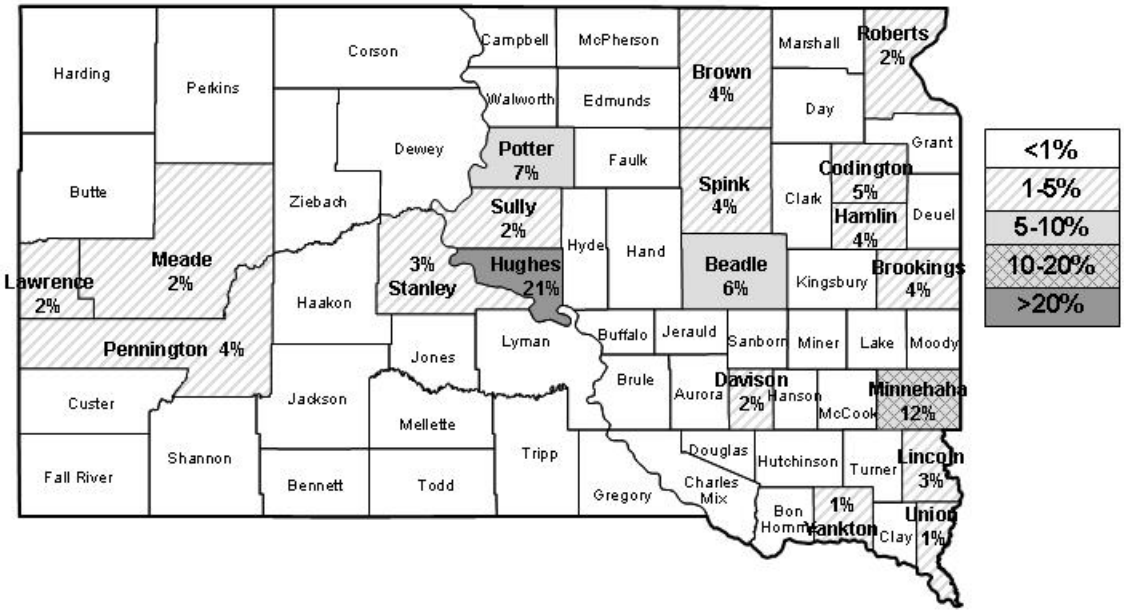

Figure 20. County of residency for South Dakota residents fishing middle Lake Oahe during the April-October 2007 daylight survey period.

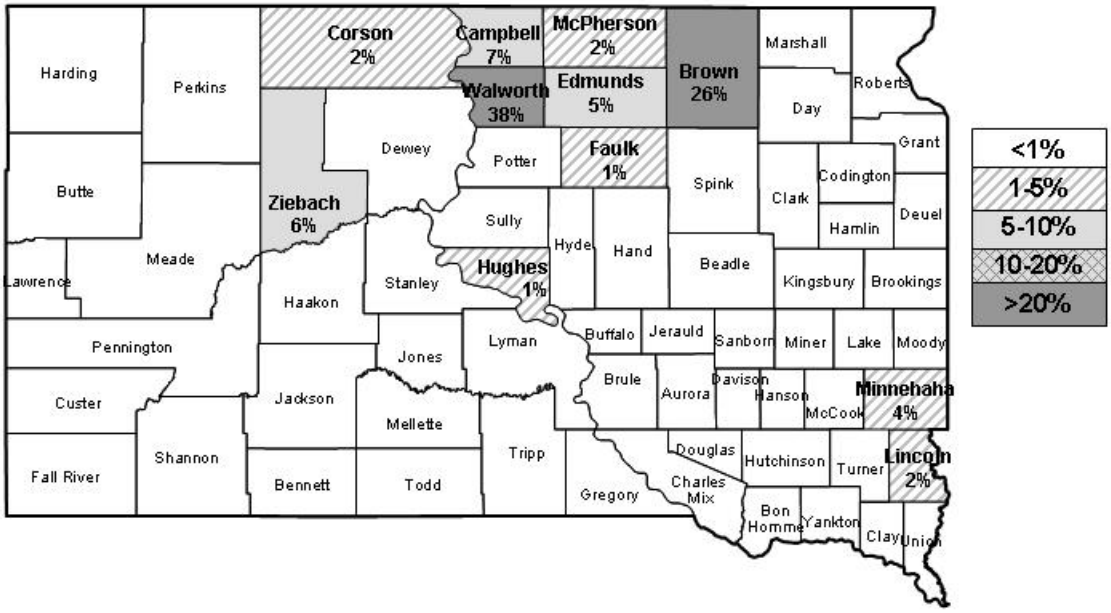

Figure 21. County of residency for South Dakota residents fishing upper Lake Oahe during the April-October 2007 daylight survey period.

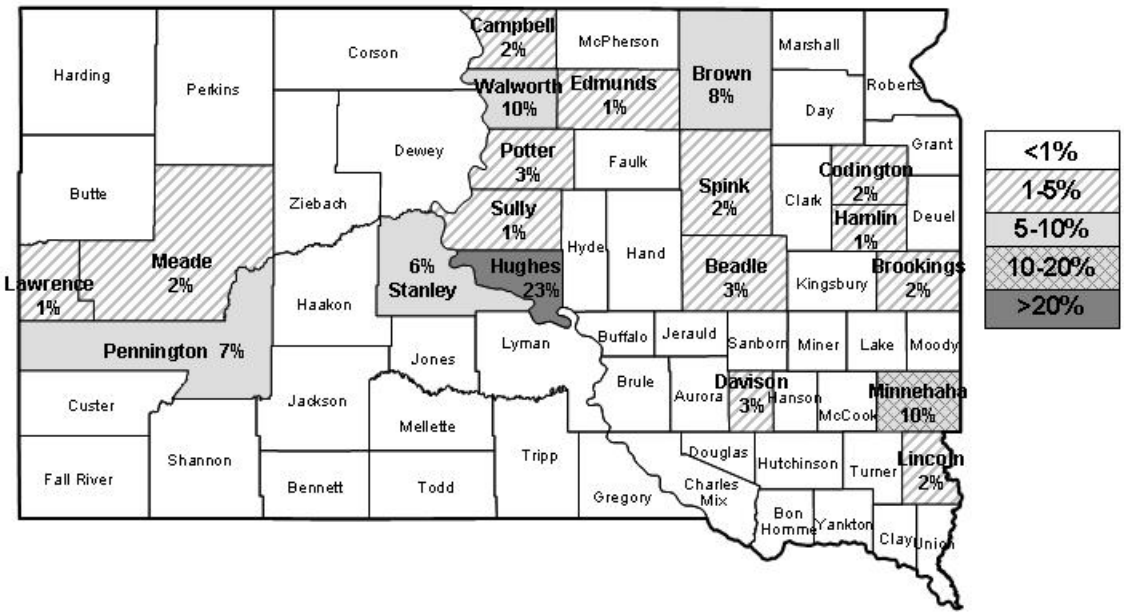

Figure 22. County of residency for South Dakota residents fishing Lake Oahe during the April-October 2007 daylight survey period.

Table 35. Percentage of total angler contacts on Lake Oahe by residents of the counties listed, for anglers fishing Lake Oahe, South Dakota, during the April-October daylight survey period, 2004-2007.

County	Major city	Percent by Year			
		2004	2005	2006	2007
Beadlle	Huron	3	5	4	3
Brown	Aberdeen	9	9	7	8
Campbell	Pollock	3	2	2	2
Codington	Watertown	2	4	3	2
Davison	Mitchell	2	2	2	3
Hughes	Pierre	25	17	19	23
Minnehaha	Sioux Falls	9	9	9	10
Pennington	Rapid City	6	7	7	7
Potter	Gettysburg	4	5	4	3
Stanley	Fort Pierre	2	3	3	6
Sully	Onida	2	1	2	1
Walworth	Mobridge	16	13	13	10
Other		17	23	25	22

Table 36. Percentage of anglers driving the specified distances, one way, to fish Lake Oahe, South Dakota, during the April-October daylight survey period, 2002-2007.

Distance (miles)	Percent by Year					
	2002	2003	2004	2005	2006	2007
<25	24	25	27	22	23	21
25-49	7	8	11	10	11	11
50-99	12	4	5	4	9	5
100-199	14	19	18	22	22	20
≥200	43	44	39	42	35	43

The majority of anglers fishing Lake Oahe were targeting walleye (79%) during the April-October period in 2007, while 7% of parties were not fishing for a particular species (Table 37). The percentage of angler parties interviewed that were specifically fishing for Chinook salmon was 11% in 2007, similar to 2006.

Table 37. Target species of anglers fishing Lake Oahe, South Dakota, during the April-October daylight survey period, expressed as percent of total, 2003 - 2007. T (trace) indicates values > 0.0 but < 0.5.

Target species	Percent by Year				
	2003	2004	2005	2006	2007
Walleye	75	82	78	75	79
Anything	15	13	12	9	7
Chinook salmon	5	1	6	13	11
Northern pike	4	2	2	2	2
White bass	0	T	T	0	0
Channel catfish	1	1	1	1	T
Smallmouth bass	T	1	T	T	T

Angler Satisfaction and Attitudes

Anglers' attitudes about fishing, their preferences concerning management issues and their level of satisfaction are important components of the total fishery survey. Historically, fisheries managers have primarily focused on understanding biological aspects of fish populations and monitoring sport fish harvest and use. Recently, biologists have realized the necessity and value of understanding angler attitudes, levels of satisfaction, and preferences. Consequently, more attitude, preference and satisfaction data have been collected during recent years. The following results build on angler preference and attitude survey data collected previously for the Lake Oahe fishery.

How anglers feel about their fishing experience is important to the success of a fishery. Angler responses help evaluate if current management practices and regulations are providing a fishery that meets angler needs and expectations.

The overall satisfaction of anglers interviewed during 2007 was "moderately satisfied". Overall satisfaction on Lake Oahe during the April-October period of 2007 was at 68% (Table 38), a value slightly below the Lake Oahe plan objective of 70%. Trip satisfaction was rated the highest during the months of May-July. Trip satisfaction generally increases with the percentage of the daily limit attained by anglers. Median satisfaction rating for angling parties that harvested 2.0 to 3.9 walleye per person was "moderately satisfied", while for parties harvesting a daily limit of four walleyes per person, median rating was "highly satisfied" (Table 39).

Table 38. Responses of Lake Oahe anglers who were asked the following question during the April-October 2007 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Month	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
April	26	32	26	29	14	11	3	0	141	3
May	103	56	31	30	27	16	7	1	270	2
June	247	217	123	68	52	31	25	1	763	2
July	177	127	106	58	58	45	27	0	598	2
August	49	53	39	28	30	31	8	0	238	3
September	19	16	5	16	16	23	9	0	104	4
October	5	9	10	17	9	7	8	0	65	4
Total	626	510	340	246	206	164	87	2	2,179	2
Percent		68		11		21				

Table 39. Responses of Lake Oahe anglers who were asked the following question during the April-October 2007 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per trip. 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Walleye/ angler	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
0	115	148	114	112	102	99	51	1	741	3
0-0.9	30	47	38	17	32	28	9	0	201	3
1.0-1.9	56	78	74	52	29	23	8	1	320	3
2.0-2.9	97	75	53	35	24	9	8	0	301	2
3.0-3.9	127	59	32	17	15	2	7	0	238	2
4.0 (limit)	216	100	27	13	3	1	5	0	365	1
Percent		68		11		21				

When the percentage of angling parties expressing some degree of satisfaction is plotted against the average harvest per angler, in terms of percent of the daily limit attained, a significant positive correlation exists (Figure 23). Anglers often set their expectations for their ability to harvest fish based on the daily limit currently in effect. Examination of Figure 23 indicates that for Lake Oahe, during the 1996-2007 time period, average harvest per angler needed to be or exceed 40% of the daily limit for the percentage of anglers expressing some degree of satisfaction with their trip to equal or exceed the 70% plan objective. When the daily limit was 10 fish per day in 2002 and 2003, but hourly walleye catch rates were 0.59 and 0.42 fish/angler-h, respectively (Table 30), the ability of anglers to harvest at least 40% of the daily limit was low, resulting in a low percentage of anglers expressing some degree of satisfaction with their trip. For 2007, the walleye catch and harvest rate of 0.64/angler-h and 0.32/angler-h, respectively, with an average trip length of 4.7 h resulted in 3 walleye caught per trip and 1.5 walleye harvested per trip per person. This correlates to 38% of the daily limit harvested (1.5 fish/4 fish limit) for an overall approval rating of 68% (Table 39).

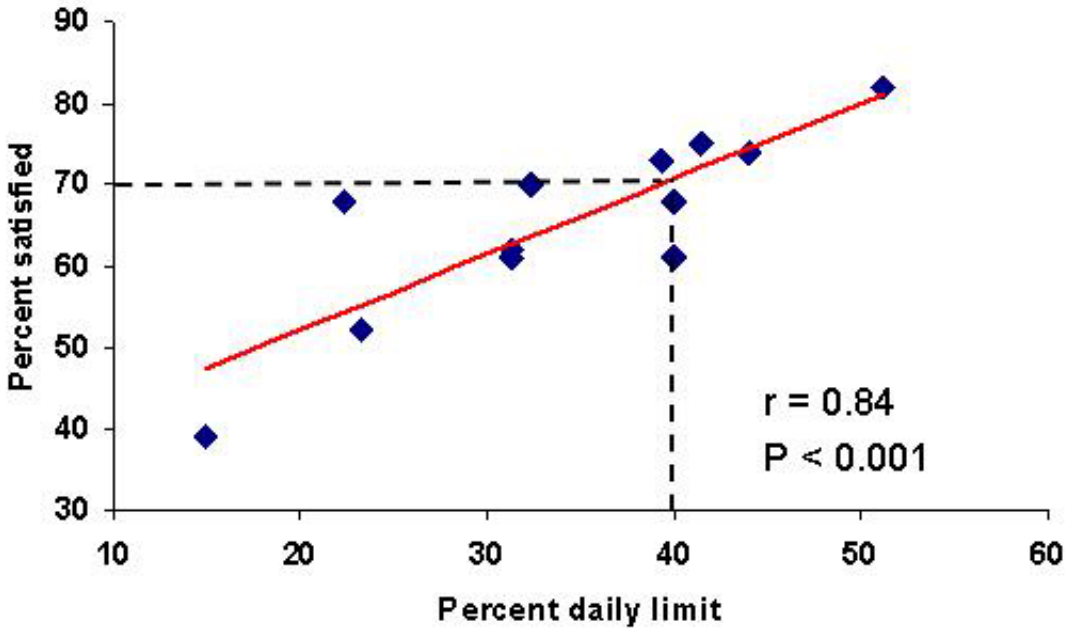

Figure 23. Angler percent satisfied against harvest per trip, as percent daily limit. Years included in analysis 1996 to 2007.

In addition to the question on angler satisfaction, anglers were asked a series of questions if walleye were caught in their party. How many walleye were kept over 20 inches (508 mm), caught and released that were over 20 inches, and how many would your party have kept that were over 20 inches that were released if is was legal to do so (Appendix 3).

On January 1, 2006, regulations were put into place, statewide, which allowed only one walleye greater than 20-inches (508 mm) per day and angler to be harvested. This regulation was in place on Lake Oahe prior to 2006, with its implementation beginning in 2004. This became the first statewide length limit within South Dakota. In 2007, 65% of angler parties, fishing Lake Oahe, did not harvest a walleye greater than 20 inches (Table 40). The middle zone had the highest percentage of parties that harvested at least one walleye greater than 20 inches at 43% of parties. The months of May, June, and July had the highest percentage of parties harvesting at least one walleye greater than 20 inches at 46%, 42%, and 38%, respectively. The months of April, September, and October had the lowest percentage of large walleye harvested per party (6%, 15%, 15%, respectively; Table 40).

Table 40. Percentage of responses to the following question in 2007, "How many walleye/sauger over 20 inches in length were kept by your party today?" N is the number of respondents.

Zone

Walleye	Lower		Middle		Upper		Total	
Kept	%	N	%	N	%	N	%	N
0	67	467	57	492	76	341	65	1,300
1	19	136	26	223	18	80	22	439
2	9	66	11	98	5	21	9	185
3	4	27	4	31	1	3	3	61
4	1	4	1	10	0	2	1	16
5	0	0	0	2	0	0	0	2

Month

Walleye	April		May		June		July		Aug		Sept		Oct	
kept	%	N	%	N	%	N	%	N	%	N	%	N	%	N
0	94	124	54	149	58	400	62	325	76	156	85	90	85	56
1	5	6	23	63	26	183	25	129	18	37	12	13	12	8
2	1	2	15	40	11	77	9	50	5	11	3	3	3	2
3	0	0	6	16	4	29	3	15	T	1	0	0	0	0
4	0	0	2	5	1	6	1	4	T	1	0	0	0	0
5	0	0	T	1	T	1	0	0	0	0	0	0	0	0

Table 41. Size distribution of walleye harvested by anglers, by length category, during April-October, 2007 daylight period on Lake Oahe, South Dakota. <15 inches is fish less than 379 mm, 15-20 inches is fish between 380 to 509 mm, and >20 inches is fish greater or equal to than 510 mm.

Walleye	<15 inches		15-20 inches		>20 inches	
Kept by size	%	N	%	N	%	N
April	0	0	69	35	31	16
May	7	62	71	644	22	203
June	26	890	62	2,148	12	411
July	32	716	56	1,230	12	256
August	38	240	52	335	10	66
September	33	72	58	128	9	19
October	7	5	75	56	18	14
All	26	1,985	61	4,576	13	985

Approximately 4% of all angling parties caught and released at least one walleye while fishing Lake Oahe during 2007 (Table 42). The lower zone had a slightly higher percentage (6%) of caught and released walleye greater than 20 inches than the middle (5%) and the upper (1%) zones. The months of May, June, and July had the highest percentage of caught and released walleye greater than 20 inches at 8%, 5%, and 6%, respectively. The months of April, August, September, and October had 0% to 2% of the angling parties that caught and released a walleye greater than 20 inches.

Table 42. Percentage of responses to the following question, "How many additional fish over 20 inches were caught and released by your party?" N is the number of respondents.

	Zone							
Walleye	Lower		Middle		Upper		Total	
Released	%	N	%	N	%	N	%	N
0	94	657	95	811	99	441	96	1,909
1	4	26	2	19	1	3	2	48
2	1	8	2	14	0	2	1	24
3	1	4	1	6	0	0	1	10
4	0	3	0	3	0	1	0	7
5	0	1	0	1	0	0	0	2
6	0	0	0	1	0	0	0	1
7	0	1	0	0	0	0	0	1

	Month													
Walleye	April		May		June		July		Aug		Sept		Oct	
released	%	N	%	N	%	N	%	N	%	N	%	N	%	N
0	98	129	92	253	95	661	94	492	98	202	100	106	100	66
1	1	2	2	5	2	17	4	21	1	3	0	0	0	0
2	1	1	3	8	1	9	1	5	1	1	0	0	0	0
3	0	0	2	4	1	4	T	2	0	0	0	0	0	0
4	0	0	1	2	T	2	T	3	0	0	0	0	0	0
5	0	0	T	1	T	1	0	0	0	0	0	0	0	0
6	0	0	T	1	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	T	1	0	0	0	0	0	0	0	0

Table 43 illustrates the responses during the April-October 2007 period of possible additional harvest of fish above the one walleye per person and day greater than 20 inches regulation. Overall, only 2.1% of all parties would harvest at least one additional walleye greater than 20 inches. The lower zone had a slightly higher percentage (2.7%) of additional harvest, followed by the middle (2.5%) and upper (0.5%) zones. On average, most anglers would not, by their personal choice (Table 43), and by not actually catching a large walleye (Table 42), harvest many walleye over the 20 inch classification (508 mm). So, with the current one over 20 inch regulation in place, this regulation is currently more of a social regulation compared to the biological reasons for this regulation, but it is not hurting the population by protecting large walleye.

Table 43. Percentage of responses to the following question, "How many of the additional fish over 20 inches would your party have kept if it was legal to do so?" N is the number of respondents. NC represents parties that did not catch a walleye greater than 20 inches. 0 represents parties that did catch a walleye greater than 20 inches and would not keep it.

Possible >20 inch Harvest	**Lower**		**Middle**		**Upper**		**Total**	
	%	N	%	N	%	N	%	N
NC	94.2	832	94.7	815	98.4	440	95.3	2,087
0	3.1	27	2.8	24	1.1	5	2.6	56
1	2.1	18	1.0	9	0.5	2	1.3	29
2	0.3	3	1.0	9	0	0	0.6	12
3	0.1	1	0.5	4	0	0	0.2	5
4	0.1	1	0	0	0	0	T	1
5	0.1	1	0	0	0	0	T	1
Harvest of ≥ 1 fish	2.7	24	2.5	22	0.5	2	2.1	48

OAHE DAM SALMON SURVEY

Angler Use, Catch and Harvest Rates, and Fish Condition

The Oahe Dam (i.e. West Shore) salmon survey was conducted from 1993 to 2000 during June-August daylight periods. The creel survey was suspended from 2001 to 2005 due to reduced abundance of salmon available to anglers that included a two-year period (i.e., 2001 and 2002) when no salmon were stocked. The salmon creel was reinitiated in July 2006 and a complete June through August creel was conducted in 2007. The average weight of salmon harvested during 2007 was below the average weight harvested in 2006 but still above the long term average. The harvest rate of salmon was the second highest ever documented for the Oahe Dam salmon creel at 0.17 fish/h (Table 44) behind the 0.23 fish/h estimated in 1988. A strong correlation of large average size and increased catch rates of Lake Oahe Chinook salmon have been shown to be the driving factors to increased salmon angling pressure (Lott et. al. 2001). Large average size and high hourly catch rate (0.17 fish/h) of salmon likely caused the upsurge in salmon fishing pressure in 2007. In 2007, salmon anglers harvested 78% of the fish they caught which was approximately 9% fewer fish harvested than in 2006 (Table 46). The reduction in the percent harvested and the increase in the number of salmon released was likely due to the increase in the number of small "shaker" size salmon caught (Table 45). The Chinook salmon program is a put, grow and take fishery with high harvest rates and a daily limit of 5 fish with no size limit. However anglers are encouraged to release small "shaker" salmon when water temperatures are below 21 C to maintain salmon stocks.

Table 44. Results of the 3-month salmon angler use and harvest survey near the face of the Oahe dam, 1994-2000, July of 2006, and 2007.

Statistic	Year 1994	1995	1996	1997	1998	1999	2000	[a]2006	2007
Fishing Pres. (h)	38,437	45,836	55,212	27,486	27,561	15,027	15,570	9,510	24,585
Harvest	4,346	7,402	8,588	2,709	1,697	1,441	1,203	1,070	4,114
Ave. weight(g)	2,313	2,381	2,220	2,161	2,207	1,771	1,960	2,858	2,594
[b]Harvest rate (fish/h)	0.113	0.161	0.156	0.099	0.062	0.096	0.077	0.114	0.17
Catch rate (fish/h)								0.130	0.22

[a]2006 is July data only, numbers rerun with CAS ver 2.2 update.
[b]Mean harvest rate 1994-2007 excluding 2001-2005 = 0.116 fish per hour.

Table 45. Salmon relative stock density (RSD) of stock length, stock-quality-length (S-Q), quality to preferred-length (Q-P), preferred to memorable-length (P-M), memorable to trophy-length (M-T) and proportional stock density (PSD) fish, for fish measured during the Oahe Dam creel survey on Lake Oahe, South Dakota, 2006-2007. 2006-July only data.

Year	Length Group (RSD)					
	Stock	S-Q	Q-P	P-M	M-T	PSD
2006	0	6	27	55	12	94
2007	0	13	38	45	4	87

Table 46. Estimated number of salmon caught, harvested, and released during the June through August daylight period, with 80% confidence intervals (CI), for Lake Oahe, South Dakota, 2006 and 2007.

Year	Caught	Harvested	Released	Percent Harvested
2006	1,228	1,070	158	87
80% CI	348	315	78	
2007	5,304	4,114	1,190	78
80% CI	829	661	233	

2006 is July data only, numbers rerun with CAS ver 2.2 update.

Use and harvest results by month for the June through August salmon fishery on the Oahe Dam face showed the months of June and July to be good months for salmon fishing (Table 47). Harvest rates in 2007 were 0.17 fish/h which is above the nine year average of 0.116 fish/h for this fishery (Table 44). The Oahe Dam face catch rate is considered excellent when compared to the lakewide 1996-2005 average Chinook salmon catch rates on Lake Michigan of 0.03 fish/h (Palla 2006). However, catch rates for all of Lake Oahe (0.01 fish/h) are lower than the Lake Michigan catch rate which is understandable because Lake Oahe is primarily a walleye fishery and Lake Michigan is primarily a salmonid fishery. During the month of August fishing pressure and catch rates both declined in 1994 and 2007 following the same trend (Figure 24). Anglers are adept and informed at focusing their angling efforts when catch rates are high. However, anglers that did harvest salmon in August kept fish that weighed 630 g or more on average (Table 47)

Salmon creel data for 2007 was analyzed using CAS version 2.2 and salmon creel numbers were rerun for 2006 data that are included in this section of the report. The earlier version of CAS had errors which caused inflated catch, harvest and release number by over-estimating mean party size especially in shore angler interviews.

Table 47. Salmon angler use and harvest by month on Oahe Dam face June through August 2007.

	2007		
	June	**July**	**August**
N	123	142	45
Fishing Pressure (h)	10,854	10,826	2,905
Harvest	2,379	1,610	124
Ave. Weight (g)	2,165	1,928	2,795
Harvest Rate (fish/h)	0.23	0.15	0.04
Catch Rate (fish/h)	0.27	0.22	0.05

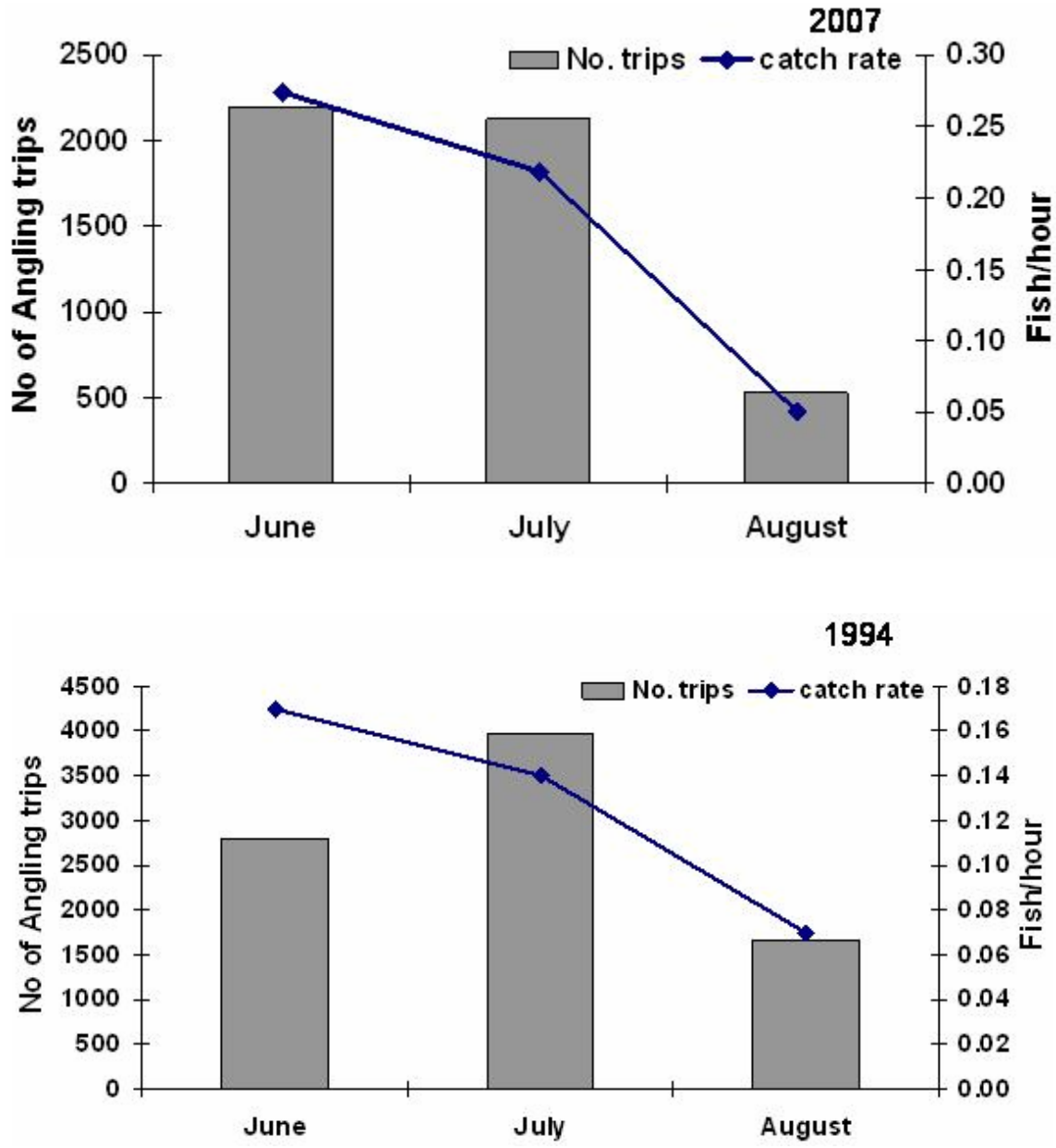

Figure 24. Angling trips and catch rates (fish/h) for Chinook salmon during the Oahe Dam creel survey June-August 1994 and 2007.

Biological data from 59 coded-wire tagged (CWT) Chinook salmon were collected from anglers throughout 2007, to provide information on age, growth, hatchery rearing techniques and stocking and rearing evaluations (Table 46). Approximately 95% of the salmon harvested by anglers were 2 and 3 year old Chinook salmon. About 61% of the CWT salmon collected from anglers were age-3. Mean weight of age-3 fish was 2,597 grams.

Table 48. Age composition, length and weight of coded-wire-tagged Chinook salmon caught by anglers and measured and weighed during the June-August creel survey in 2007.

Age	Brood year	Number	Mean Length (mm)	Range	Mean Weight (g)	Range
1	**2006**	1	471		997	
2	**2005**	20	509	434-700	1,330	688-2,962
3	**2004**	36	633	360-755	2,597	987-5,010
4	**2003**	2	749	720-778	4,652	4,543-4,760

Angler Satisfaction and Demographics

During the June through August creel, the overall median angler trip rating was "moderately satisfied" (median=2; Table 47). A median trip rating of moderately satisfied was expected with a high hourly catch rate for salmon and a good average size of salmon harvested (2,594 g; Table 44).

During July, 18% of the salmon angling trips were by nonresidents (Table 50). For all anglers interviewed, approximately 41% of the anglers traveled less than 25 miles, one way. Fifty-eight percent of the anglers traveled in excess of 100 miles, one way, and 36% of the anglers traveled in excess of 200 miles, one way (Table 51) to fish salmon. Hughes and Stanley counties composed the majority (37% and 16%) of the resident angler trips (Figure 25). Minnehaha and Pennington composed the next highest use category (8% and 7%).

Table 49. Responses of Lake Oahe salmon anglers who were asked the following question during the June through August 2007 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Month	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
June	39	28	23	10	13	4	6	0	123	2
July	39	39	25	11	10	14	4	0	142	2
August	8	9	4	5	5	13	1	0	45	4
Total	86	76	52	26	28	31	11	0	310	2
Percent		214		26		70				

Table 50. Number of anglers interviewed and percentage of resident and nonresident salmon anglers fishing Lake Oahe, South Dakota, during the daylight period June -August survey period, 2007.

Residency	Percent	Number
Residents	82	254
Nonresidents	18	56
Total	100	310

Table 51. Percentage of anglers driving the specified distances, one way, to fish salmon on Lake Oahe, South Dakota, during the June through August daylight survey period, 2007.

Distance (miles)	Percent	Number
<25	41.0	127
25-49	0.3	1
50-99	1.0	3
100-199	21.2	66
≥200	36.5	113
Total	100	310

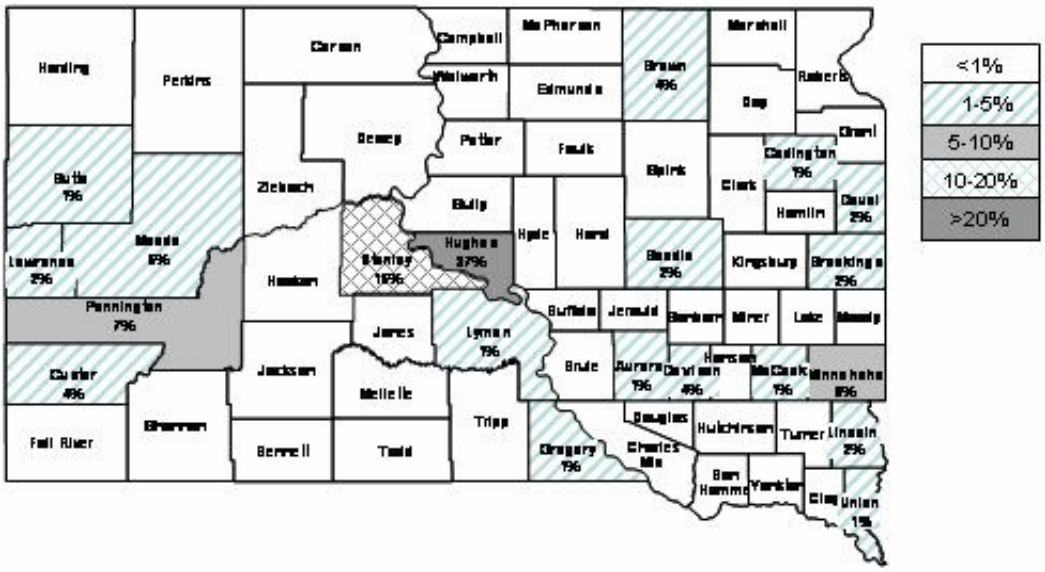

Figure 25. County of residency for South Dakota residents fishing Chinook salmon near Oahe Dam face during June-August 2007 daylight period.

2005-2007 Chinook Salmon Stomach Contents

In 2004, a coldwater netting strata (18-27m deep) was added to the Oahe adult fish population survey depending on depth availability. The sample locations with the coldwater netting strata included Peoria Flats, Cow Creek, Bush's Landing and Whitlock's Bay. In 2005, salmon stomach contents were examined at one location and in 2006 and 2007 Chinook salmon stomachs were examined at four locations.

Two of the four Chinook salmon stomachs examined in 2005 contained multiple gizzard shad (Table 52). In 2006, 4 of the 6 salmon stomachs checked contained at least one rainbow smelt. In 2007, 2 of the 3 salmon stomachs checked contained 4 rainbow smelt.

Table 52. Chinook salmon collected and stomach contents identified during adult fish population survey, August 2005 thru 2007.

Year	Location	Length	Weight	Stomach Contents
2005	Bush's			8 Age-0 GZS
2005	Bush's			12 Age-0 GZS
2005	Bush's			Empty
2005	Bush's			Empty
2006	PEO	469	2866	Empty
2006	COC	530	1511	9 RBS
2006	COC	285	231	14 RBS
2006	BUS	777	4867	1 RBS
2006	BUS	729	3840	1 RBS
2006	WHB	793	5119	Empty
2006	WHB	529	1297	Empty
2007	PEO	362	586	4 RBS
2007	PEO	497	1220	4 RBS
2007	COW	696	3460	1 UID fish

FISHERY STATUS AND 2008 OUTLOOK

The Lake Oahe walleye population continues to improve after diminished prey abundance during 1997 through 2001. Sampling in 2007 indicates walleye condition, as indexed by *Wr* (relative weight), is stabilizing with values near the objective range of 90 to 100. Walleye abundance in 2007 was similar to the previous few years but lower than the mid-1990s. Abundance continues to vary by zone with lower abundances occurring in the lower zone and increasing towards the upper zone. The lack of recruitment in the lower zone of Lake Oahe continues to lead to higher PSD and RSD-P values in that zone. Walleye PSD of 62 for Lake Oahe was just above the upper end of the desired range of 30-60, while RSD-P was above the objective of 10 again in 2007.

Gizzard shad again made up the highest percentage of fish sampled in the 2007 seining survey. Since reproduction of gizzard shad was first documented in Lake Oahe in 2001, the species has established a reproducing population and become an important part of the prey fish community. With Lake Oahe located near the northern boundary of the gizzard shad range, permanence of this prey fish species in Lake Oahe is unknown. Current implications of gizzard shad presence in Lake Oahe are not clearly understood. However, walleye fishing patterns have shifted since gizzard shad entered Lake Oahe, as documented by fishing pressure and harvest estimates. Prior to gizzard shad presence, walleye fishing pressure and harvest was spread throughout the open water season. The estimated percentage of angler hours for June, July, August, and September during 1993 was 22, 27, 18, and 14%, respectively, for each month. As gizzard shad hatch in the spring and grow to sizes preyed upon by walleye, catch rates decline. In 2007, the estimated percentage of angler hours for June, July, August, and September was 43, 20, 5 and 9%, respectively. Harvest rates mirrored this trend over the same period. In 1993, the estimated percentage of fish harvested in June, July, August and September were 14, 30, 30 and 14%, respectively, while in 2007 estimated percentage of fish harvested were 50, 22, 5, and 6%, respectively. This trend is expected to continue with the presence of gizzard shad in Lake Oahe.

Larval densities and hydroacoustic estimates of rainbow smelt have increased since the 2000 through 2002 period. Rainbow smelt abundance and biomass estimates for Lake Oahe are still significantly lower than during the mid-1990s (Nelson-Stastny 2001). Relative weight of walleye has increased along with the increase in rainbow smelt abundance and biomass. The addition of gizzard shad to the prey base should help maintain fish condition during periods of decreased rainbow smelt abundance.

Since initial documentation in 1983, Lower Oahe has lacked natural recruitment of walleye (Riis 1983). Stocking has been used in previous years to supplement natural reproduction, but was discontinued after 1999 because of large year classes produced in all areas of Lake Oahe in 1994 and 1995. These year classes coincided with limited prey availability due to decreased abundance of rainbow smelt. Stocking was revisited as a possibility for Lower Lake Oahe for 2008. Assessment of previous data indicates that migration of walleye into Lower Lake Oahe may be occurring. The 2005 survey indicated walleye recruitment did not occur that year in Lower Lake Oahe. However, low numbers of 2005 fish were sampled in 2006 in Lower Lake Oahe, and in 2007, the 2005 year class was sampled in higher abundance than all other year classes indicating migration of walleye in Lower Lake Oahe may have occurred. This pattern will be monitored in subsequent years to determine if migration continues to occur. Walleye stocking will not occur in Lower Lake Oahe until additional information is collected.

Estimated fishing pressure and number of angler trips in 2007 on Lake Oahe was similar to 2006, but remained lower than the late 1990s (Table 20). Estimated walleye harvest and average length of walleye harvested was also similar to 2006. As previously mentioned, trends in angler hours have changed since the introduction of gizzard shad with a higher percentage of the pressure occurring earlier in the summer, prior to gizzard shad availability as a prey resource. Even with changes in the Lake Oahe fishery over the past decade, the direct economic impact of Lake Oahe remains immense at 10.9 million dollars based on 138,310 trips at value of $79 per

trip (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007).

Harvest rates for Chinook salmon in 2007 were the highest estimated for the 1994 through 2007 period at 0.17 fish/hour. Catch rates also increased from 0.113 in 2006 to 0.22 in 2007. The Chinook salmon program on Lake Oahe has become a major contributor to the overall fishery in recent years. With continued salmon spawning efforts and maintenance of high catch and harvest rates, the Chinook salmon program will likely gain additional angler support in the future.

MANAGEMENT RECOMMENDATIONS

1. Develop a new Lake Oahe Strategic Plan by June 2008 which includes:
    - Reviewing adequacy of current management plan and objectives
    - Developing management objectives for channel catfish.
    - Removing rainbow trout from the list of management species in Lake Oahe
2. Expand efforts to document characteristics of gizzard shad population structure and dynamics and role in the Lake Oahe predator-prey system
3. Investigate possible reasons for low walleye recruitment in lower Lake Oahe and investigate possible stocking options to supplement natural reproduction.
4. Continue to conduct annual creel and angler harvest surveys.
5. Continue to conduct annual fish population surveys.
6. Incorporate all rainbow smelt surveys into the annual Lake Oahe report and work to develop age structure and growth estimates for the rainbow smelt population..
7. Continue to stock Chinook salmon and evaluate the contribution of stocked salmon to the fishery.
8. Re-establish the Oahe Dam salmon creel to evaluate stocking strategies and attainment of management objectives for the salmon fishery.

LITERATURE CITED

Anderson, R.O., and A.S. Weithman. 1978. The concept of balance for coolwater fish populations. Pages 371-378 *in* R.L. Kendall, editor. Selected coolwater fishes of North America. American Fisheries Society, Bethesda, Maryland.

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

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

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

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

Conover, W.J. 1980. Practical nonparametric statistics. Second Edition. John Wiley and Sons, Incorporated, New York.

Erickson, C. M. 1983. Age determination of Manitoban walleyes using otoliths, dorsal spines, and scales. North American Journal of Fisheries Management 3:176–181.

Erickson, J., A Leingang, and W Nelson-Stastny. *In* prep. Surface water larval trawling and hydroacoustic assessments of rainbow smelt populations in Lake Oahe, 2000-2006. South Dakota Department of Game, Fish and Parks, Wildlife Division Report, Pierre.

Fielder, D.G., J. Riis, and C. Stone. 1992. Angler use and sport fishing harvest survey on Lake Oahe, South Dakota, 1990 and 1991. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 92-10, Pierre.

Francis, J. 2000. WinFin Analysis Version 2.95. Nebraska Game and Parks Commission. Lincoln Nebraska.

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

Hubert, W.A. 1996. Passive capture techniques. Pages 157192 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques, 2nd Edition. American Fisheries Society, Bethesda, Maryland.

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

Johnson, B., D. Fielder, J. Riis, C. Stone, D. Warnick, and G. Wickstrom. 1990. Annual fish population surveys on South Dakota Missouri River reservoirs, 1989. South Dakota Department of Game, Fish and Parks, Wildlife Division Report 90-3, Pierre.

Johnson, B., D. Fielder, J. Riis, C. Stone, D. Warnick, and G. Wickstrom. 1992. Annual fish population surveys on South Dakota Missouri River reservoirs, 1991. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 92-4, Pierre.

Johnson, B., J. Lott, and J. Riis. 1995. Annual fish population and sport fish harvest surveys on Lake Oahe, South Dakota 1994. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 95-7, Pierre.

Johnson, B., J. Lott, W. Nelson-Stastny, and J. Riis. 1996. Annual fish population and sport fish harvest surveys on Lake Oahe, South Dakota 1995. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 96-12, Pierre.

Johnson, B., J. Lott, W. Nelson-Stastny, and J. Riis. 1997. Annual fish population and sport fish harvest surveys on Lake Oahe, South Dakota 1996. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 97-15, Pierre.

Johnson, B., J. Lott, W. Nelson-Stastny, and J. Riis. 1998. Annual fish population and sport fish harvest surveys on Lake Oahe, South Dakota 1997. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 98-8, Pierre.

Johnson, B., R. Hanten, J. Lott, and W. Nelson-Stastny. 1999. Annual fish population and sport fish harvest surveys on Lake Oahe, South Dakota 1998. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 99-21, Pierre.

June 1974, F.C. 1974. Ecological changes during the transitional years of the filling and full impoundment (1966-1970) of Lake Oahe, an upper Missouri River storage reservoir. U.S. Fish and Wildlife Service Technical Paper 71, 57 p.

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

Lott, J., R. Hanten, B. Johnson, and W. Nelson-Stastny. 2000. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 1999. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 00-11, Pierre.

Lott, J., R. Hanten, B. Johnson, and W. Nelson-Stastny. 2001. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2000. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 01-14, Pierre.

Lott, J, B. Johnson, and W. Nelson-Stastny. 2002. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2001. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 02-19, Pierre.

Lott, J, B. Johnson, W. Nelson-Stastny, and K. Potter. 2003. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2002. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 03-15, Pierre.

Lott, J, B. Johnson, W. Nelson-Stastny, and K. Potter. 2004. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2003. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 04-22, Pierre.

Lott, J, J. Erickson, A. Leingang, and K. Potter. 2006 Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2004. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 06-17, Pierre.

Lott, J, J. Erickson, R. Hanten, and K. Potter. 2007 Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota 2005. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 07-26 Pierre.

Lott, J., J. Erickson, R. Hanten, and K. Potter. 2007b. Annual fish population and angler use, harvest and preference surveys on Lake Oahe, South Dakota, 2006. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual report 07-27 Pierre.

Marwitz, T. D., and W. A. Hubert. 1995. Precision of age estimates of Wyoming walleyes from different calcified structures. Prairie Naturalist 27:41–48.

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

Michaletz, P., B. Johnson, J. Riis, C. Stone, D. Unkenholz, and D. Warnick. 1986. Annual fisheries surveys on the Missouri River reservoirs, 1981-1985. South Dakota Department of Game, Fish and Parks, Wildlife Division Progress Report 86-11, Pierre.

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

Nelson-Statsny, W. 2001. Estimates of abundance, biomass, and distribution of rainbow smelt and other pelagic fish in Lake Oahe using hydroacoustic techniques, 1996-1999. South Dakota Department of Game, Fish and Parks, Wildlife Division, Special Report No. 01-06, Pierre

Riis, J.C. 1982. Angler harvest survey on Lake Oahe, status of the walleye population in the Missouri River and factors affecting their abundance. Wildlife Division Completion Report 82-7, South Dakota Department of Game, Fish and Parks, Pierre.

Riis, J.C. 1983. Walleye movement, harvest and angler use on Lake Oahe, South Dakota, 1982. Wildlife Division Completion Report 83-11, South Dakota Department of Game, Fish and Parks, Pierre.

Riis, J.C. 1984. Walleye Movement, Harvest and Angler Use on Lake Oahe, South Dakota. Wildlife Division Completion Report 84-4, South Dakota Department of Game, Fish and Parks, Pierre.

Riis, J., D. Fielder, B. Johnson, C. Stone, D. Unkenholz, and G. Wickstrom. 1988. Annual fisheries surveys on the Missouri River, 1986-1987. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report No. 88-3, Pierre.

Riis, J., and C. Stone. 1989. Angler use and sport fishing harvest survey on Lake Oahe and Oahe tailwaters, 1986-1988. South Dakota Department of Game, Fish and Parks, Progress Report 89-10, Pierre.

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

Selgeby, J.H. and W.E. Jones. 1974. Physical and chemical characteristics of Lake Oahe, 1968-69. U.S. Fish and Wildlife Service, Technical Paper 72, Washington, D.C.

Sokal, R.R. and F.J. Rohlf, 1981. Biometry. Second Edition. W.H. Freeman and Company, San Francisco.

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

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

Starostka, V.J., and W.R. Nelson. 1974. Age, growth, sexual maturity, and food of channel catfish in central Lake Oahe, 1968-69. United States Fish and Wildlife Service Technical Paper. United States Department of the Interior, Washington D.C.

Stone, C, D. Fielder, B. Johnson, J. Riis, D. Unkenholz, and G. Wickstrom. 1989. Annual fisheries surveys on the Missouri River reservoirs, 1988. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 89-11, Pierre.

Stone, C., J. Riis, and B. Johnson. 1994. Angler use and sport fishing harvest survey on Lake's Francis Case, Sharpe, and Oahe, South Dakota, 1992 and 1993. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 94-9, Pierre.

SYSTAT, Inc. 1998. SYSTAT for Windows: Statistics, Version 8.0. Evanston, IL.

United States Department of the Interior, Fish and Wildlife Service and United States Department of Commerce, Bureau of Census. 2003. 2001 national survey of fishing, hunting, and wildlife-associated recreation. United States Government Printing Office, Washington, D.C.

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

Warnick, D. 1987. The introduction of selected fish species into the Missouri River system, 1984-85. South Dakota Department of Game, Fish and Parks, Wildlife Division Report No. 87-10, Pierre.

Wickstrom, G., D. Fielder, B. Johnson, J. Riis, C. Stone, and D. Warnick. 1991. Annual fish population surveys on South Dakota Missouri River reservoirs, 1990. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report 91-14, Pierre.

Wickstrom, G., D. Fielder, B. Johnson, J. Lott, J. Riis, and C. Stone. 1993. Annual fish population surveys on South Dakota Missouri River reservoirs, 1992. South Dakota Department of Game, Fish and Parks, Wildlife Division, Annual Report 93-4, Pierre.

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

APPENDICES

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

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

Appendix 2. White bass and yellow perch proportional stock density (PSD) relative stock density of preferred-length (RSD-P) fish and memorable-length (RSD-M) fish, and mean relative weight (*Wr*) values, for 1997-2007, for fish collected in the standard August gill net survey, on Lake Oahe, South Dakota. Mean *Wr* values for 2002-2007 are for stock-length fish only.

White bass

Year	PSD	RSD-P	RSD-M	*Wr*	Sample size
1997	100	59	3	93	186
1998	95	62	2	89	188
1999	100	82	2	89	170
2000	99	86	1	85	121
2001	100	91	3	92	149
2002	68	65	5	88	140
2003	100	38	1	93	127
2004	90	67	2	93	88
2005	100	67	33	100	11
2006	100	78	17	99	18
2007	100	94	30	99	51

Yellow perch

Year	PSD	RSD-P	RSD-M	*Wr*	Sample size
1997	33	0	0	91	296
1998	58	1	0	83	103
1999	57	6	0	89	63
2000	44	5	0	86	63
2001	55	6	0	90	65
2002	40	14	0	80	35
2003	26	3	0	84	63
2004	30	5	0	82	43
2005	13	1	0	87	49
2006	10	0	0	81	63
2007	21	4	0	82	177

Appendix 3. Angler satisfaction, preference, and attitude questions asked as part of the April-October 2007 angler use and harvest survey on Lake Oahe, South Dakota.

Trip Satisfaction:

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

1 = Very satisfied
2 = Moderately satisfied
3 = Slightly satisfied
4 = Neutral *(neither satisfied or dissatisfied)*
5 = Slightly dissatisfied

6 = Moderately dissatisfied
7 = Very dissatisfied
8 = No opinion

Greater than 20 inch Walleye Questions:

1. How many walleye/sauger over 20 inches in length were kept by your party today?

2. How many additional fish over 20 inches were caught and released by your party?

3. How many of the fish over 20 inches you released would your party have kept if it was legal to do so?