Angler Use and Harvest Surveys on Center Lake, South Dakota May – August 2009

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

Completion Report No. 10-04

Angler Use and Harvest Survey on Center Lake, South Dakota, May-August, 2009

By

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Completion Report

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PREFACE

This is an annual report. Copies of this report and reference to the data is not for publication and can only be made with written permission from the author(s), Director of the Division of Wildlife, or the Secretary of the South Dakota Department of Game, Fish and Parks, Pierre, South Dakota 57501-3182.

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EXECUTIVE SUMMARY

This report includes angler use and harvest information from May 12 – August 8, 2009 for Center Lake, South Dakota. Creel survey information is used in making management decisions by area fisheries managers. Determining angler harvest, catch and satisfaction was one purpose of this survey. A second aspect of this survey was to determine angler's preference of rainbow trout coloration. Stocked fish can be altered in the hatchery to provide options to the consumers (anglers) that meet their preferences. Feeding trout a diet with Astanxanthin (a synthetic chemical) increases both internal and external coloration. Trout were differentially marked to identify their treatment group. Anglers were asked questions to determine their preferences regarding internal and external color.

Four goals and one specific management objectives were set to determine the characteristics of Center Lake in 2009. Our goals were:

Goals of the 2009 Creel Survey

1. Quantify angler use of Center Lake during the summer of 2009.

2. Determine angler harvest of rainbow trout and tiger trout in Center Lake.

3. Determine angler satisfaction at Center Lake during the summer of 2009.
   Our management objective is to maintain angler satisfaction on Black Hills reservoirs at the 2003 average of 66%.

4. Determine angler preferences and satisfaction concerning the coloration of trout caught from Center Lake.

Angler use at Center Lake totaled 8,427 hours from May 12 to August 8, 2009. This pressure was much higher than the survey conducted two years earlier. Rainbow trout harvest was 2,773 fish. Center Lake's angler catch rates were 0.93 caught fish per hour.

Overall angler satisfaction at Center Lake was 89% and greatly exceeded the management goal of 66%. Similar angler satisfaction was observed in 2007. There was a trend of anglers moving from "neutral" in 2007 to "satisfied" in 2009. The percent of anglers that responded with "dissatisfaction" remained unchanged.

Anglers preferred rainbow trout, both fish and fillets, with greater coloration and fishermen were highly satisfied with the fish they caught.

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INTRODUCTION

Center Lake, so named due its central location in Custer State Park, is an important fishery for trout in the Black Hills of South Dakota (Figure 1). Popular with both resident and nonresident anglers, this ten acre water has nearby campgrounds, a beach area and trails. Throughout the summer, this fishery is a destination for anglers. This survey was designed to determine the angler use, harvest and satisfaction at Center Lake during the summer of 2009.

Trout management at Center Lake has been mostly put-and-take stockings of catchable rainbow trout (*Onchorynchus mykiss*). A few stockings, in efforts to establish a trophy or unique fishery, of brown trout (*Salmo trutta*) or tiger trout (*Salmo trutta X Salvelinus fontinalis*) have also been used. Other species within the lake are naturally occurring included: brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersoni*) and creek chub (*Semotilus atromaculatus*). Managing Center Lake as a put-and-take fishery has allowed for good fishing in the presence of these other species.

Tiger trout were stocked into Center Lake as an alternative species for anglers. This hybrid was selected based on research of trout species that might utilize the abundant creek chub population and provide a unique sport fishery. Stockings of fingerling tiger trout occurred in the spring of 2008 and 2009 with an additional stocking of tiger trout in the fall of 2009. The fall stocking allowed for tiger trout to be held in the hatchery for an additional six months and thus attaining a larger size at stocking.

This study evaluated angler attitudes concerning the appearance of trout. Several economic studies have shown that the public is willing to pay an additional price for salmonids that have a more "wild" coloration (Forsberg and Guttormsen 2006, Alfnes et al. 2006). The synthetic chemical, Astaxanthin, was added to the feed of one-half the rainbow trout stocked into Center Lake in 2009. Anglers were asked several questions to determine if they had a preference of fish coloration.

Goals of the 2009 Creel Survey

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Figure 1. Location of Center Lake and surrounding roads in relation to the State of South Dakota.

SAMPLING METHODS

Angler Use and Preference Survey

An angler use and preference survey was conducted from May 12 to August 8, 2009. A creel survey is comprised of two independent parts: instantaneous pressure counts and angler interviews conducted between pressure counts. Each creel shift consisted of two random pressure counts. Interviews were only conducted with those anglers who had completed their fishing trip. Angler interviews provided information on trip length, species caught, number of fish caught and released, angling method, angler preferences and angler satisfaction.

A stratified random creel survey was used. Creel days throughout the week and were divided into two strata: 1) weekend/holiday and 2) weekdays. Emphasis was placed on weekends with both days receiving creel attention. It was believed that most interviews would occur at this time. Days were stratified by AM and PM shifts. Half of all shifts, on a monthly basis, were randomly assigned to be conducted in the AM and half were conducted in the PM during daylight hours.

Anglers were asked four preference questions during the 2009 Center Lake Creel Survey. The following are the questions that were asked of anglers and possible options for answers that they were given during the interview process.

1. Considering all factors, how satisfied are you with your fishing trip today? (Very satisfied, Moderately satisfied, Slightly satisfied, Neutral or no opinion, Slightly dissatisfied, moderately dissatisfied, or Very dissatisfied)

2. Are you satisfied with the size of (primary species) you caught today? (Yes, No)

3. Which fish pictured here would you prefer to catch? (Top fish, Bottom fish) and (Top fillet, Bottom fillet).

4. How satisfied are you with the appearance of the fish you caught today? (High, Medium, Low, No opinion).

The South Dakota Department of Game, Fish and Parks analyzed all information after entering into Creel Application Software (CAS) Creel Survey Data Entry/Analysis Program (Soupir and Brown, 2002).

Anglers were shown fillet and external photos of fish fed with and without the additive Astanxanthin. Anglers were not told about the differences between the fish and the clerk was advised not to discuss any coloration information until the interview had ended. At that point, the clerk informed the angler about the differences and the cause. The clerk also noted different fin clips of harvested rainbow trout as this was an indication of the feed trials that they represented.

RESULTS & DISCUSSION

Angler Use

Estimates of fishing pressure (h) increased from 4,810 in 2007 to 8,427 in 2009. In 2007, ninety-four percent of anglers at Center Lake responded that they were fishing for rainbow trout. Only two percent were fishing for "anything" that would bite. In 2009, fifty-four percent of anglers were fishing for rainbow trout and forty percent for "anything" that would bite. Few anglers (3%) reported traveling to Center Lake in order to catch tiger trout. The introduction of tiger trout into Center Lake has been a limited attractant for anglers. Once the tiger trout reach larger sizes, fishermen may direct attention towards this unique fishery.

The water levels at Center Lake showed little fluctuation during a regional drought present in the early and mid- 2000's. Angler use of surrounding Black Hills reservoirs decreased during the drought and may have been attributed to lower water levels. In many of the larger reservoirs, boat ramps were unusable or had to be extended so that they could be used. Both shore and boat anglers have had excellent access to Center Lake during the surveys in 2007 and 2009. It could be assumed that if anglers could not get into other Black Hills lakes, due to the drought, that we would have seen a larger amount of pressure at lakes that were stable, such as Center Lake. There was an increase in fishing pressure from 2007 to 2009 so anglers did not move to Center Lake during the drought.

Since 2007, stocking of trout has increased in Center Lake (Figure 2). It is unknown if this increase in stocking levels can be attributed to the increase in fishing pressure. There is certainly a relationship between the two factors, but additional years of data would be required to substantiate this occurrence.

Table 1. History of creel survey values from Center Lake, 2007 and 2009. Estimated fishing pressure, expressed as angler-hours (h), catch as (fish/angler-h), harvest as (fish/angler-h) and trip length in hours.

		Rainbow Trout			
	Pressure (h)	Catch	Harvest	Catch Rate (catch/hr)	Harvest Rate (harvest/hr)
2007	4,810	2,984	926	1.20	0.44
2009	8,427	5,619	2,773	1.76	0.93

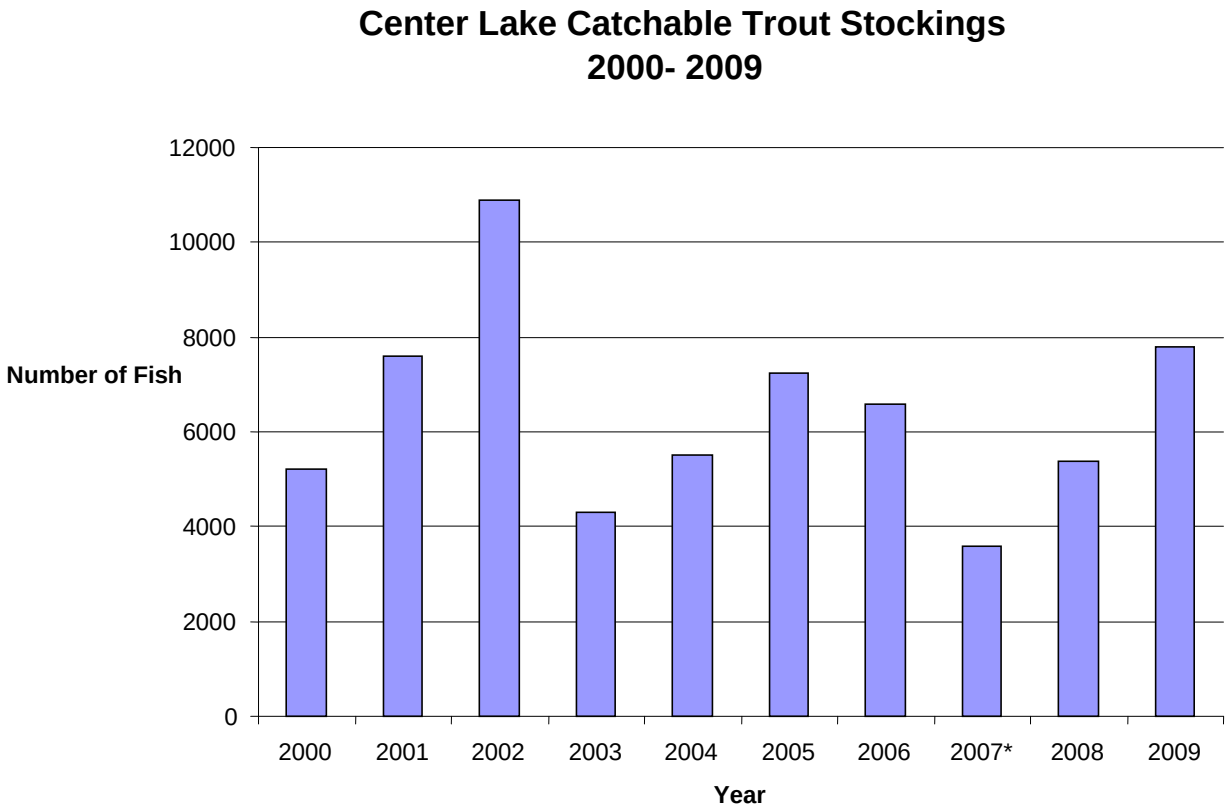

Figure 2. Recent stocking history of catchable rainbow trout from 2000 to 2009 (2007 total includes stocking of catchable brown trout in addition to rainbow trout) at Center Lake, South Dakota.

Angler Harvest

Harvest of fish has an important historic component as many traditional fisheries established goals on the number or percentage of fish harvested from hatchery stockings. Harvest is a component of catch and is the portion of caught fish that are not returned to the water (Malvesto 1983). Long-term harvest data has value in two regards. First, it describes how many of a stocked product is used by the public. Secondly, can be and aid to validate relative population status of wild or carryover populations when associated with population survey data. Total harvest is broken down into the rate that fish are caught per unit period (Ricker 1975).

Estimated harvest of rainbow trout increased almost three fold from 2007 to 2009 (Table 1). The estimated harvest of rainbow trout in 2007 was twenty-five percent of the rainbow trout stocked. Figure 2 shows rainbow trout and brown trout catchables combined for 2007. In 2009, the estimated angler harvest of rainbow trout was thirty-six percent of the annual stocking. The harvest rate for trout also increased from 0.44 trout per hour in 2007 to 0.93 in 2009 (Table 1).

Angler Catch

Catch is all of the fish caught by anglers during a creel survey. The catch can be separated out to individual species or the whole water itself. During the summer of 2009 estimated rainbow trout catch was 5,619. This was an increase over the estimated rainbow trout catch in 2007 of 2,984. Overall, the catch of all species of fish was 5,920 and 3,090 for 2009 and 2007, respectively. Besides rainbow trout, there were six other species of fish caught by anglers from Center Lake in 2009. These species were creek chub, white sucker, brown trout, rock bass (*Ambloplites rupestris*, and largemouth bass (*Micropterus salmoides*).

The catch rate, or how often anglers catch fish, can also be important to managers. Catch rate can be used as a descriptor to define angler activity (Lockwood 2004). However, catch rate can also be used to determine design problems. Anglers that are more skilled do have a greater chance of attaining their limit of fish for a given period of time and may account for bias in certain creel surveys such as when to collect data via a roving method.

Table 2. Angler use and harvest estimates for surveys conducted on Center Lake, South Dakota during the summers of 2007 and 2009. All surveys were conducted during the May-August daylight period.

	2007*	2009
Interviews	163	197
Mean Party Size	2.16	2.54
Trip Length (h)	2.41	3.06
Total Pressure (h)	4,810	8,427
RBT Catch	2,984	5,619
RBT Harvest	926	2,773
Mean Distance Traveled	215 miles	270 miles
Resident Use (%)	94	75
Gender	Male / Female 77% / 23%	Male / Female 68% / 32 %
Target Species	RBT	RBT

* Effort differences between two surveys: 2007 survey comprised of 20 hours per week, 2009 survey comprised of 40 hours per week.

Angler Satisfaction

Angler attitudes and satisfaction became a focus point for Black Hills fisheries starting in the mid-1990. These opinions are important because they determine what the anglers actually want and possible directions for managers to pursue. Additional impacts of human dimensions involve angler use and participation and are justly important in regards to the public perceptions of fisheries. In 2009, the fisheries program in South Dakota decided that one standardized question (with optional answers) needed to be asked of all future creel surveys. By doing this, statewide opinions can be compared in an overall sense and not just for the particular water or survey. Other questions asked during the 2009 Center Lake Creel Survey were determined from a consensus of fisheries managers in an attempt to obtain information on hatchery practices and angler preferences.

The percentage of satisfaction increased from seventy-six to eighty-nine percent from 2007 to 2009, respectively (Table 2). The percentage of dissatisfied anglers did not change from 2007 to 2009. Thus, the increase of satisfaction was due to the decrease of neutral responses from 2007 to 2009. Stocking levels had increased from 2007 to 2009 and may have been a factor of the in increase of satisfaction levels.

Angler satisfaction has been described in other creel surveys for the Black Hills (Simpson 2009). The need for this information is important for the management of fisheries in the Black Hills. Preference patterns are used to determine issues and are necessary to address public concerns.

Beyond the traditional fishery components of fish population descriptions, is the topic of anglers and their preference of the resource. In human dimensions, angler satisfaction is a measure used by South Dakota Department of Game, Fish and Parks. Statewide and historic lake specific satisfaction can yield insight to the acceptance of regulations and management activities. Simpson (2009) discussed qualities of angler success and the angler attitudes that extend to satisfaction beyond catching fish. For many anglers, the non-catching aspect of fishing can be a large component of the angling satisfaction.

Gigliotti has studied angler preferences for the Black Hills (Gigliotti 1997, 2006) and statewide (Gigliotti 2003). Classification of anglers into groups has indicated that there is no “typical angler” for this region. It is from these efforts that knowledge of the difficulty in satisfying all angler types in the Black Hills was acknowledged. Each angling type was identified as having individual goals for the fishing.

Angler satisfaction in South Dakota has changed over time. Gigliotti in a survey of South Dakota anglers found satisfaction at the level of 73.4% (Gigliotti 1999). The value used for this survey is based off a more current study that was described in Gigliotti (2003). Gigliotti determined, from an exhaustive statewide survey, that anglers whom actually used the Black Hills fishery were 66% satisfied with only 20% dissatisfied. Anglers interviewed during the 2009 Center Lake Creel Survey responded with a level of satisfaction higher than the level described by Gigliotti in 2003 at 89% (Table 2).

For the 2009 Center Lake Creel Survey, managers wanted to know the overall satisfaction of anglers, preferences of anglers in regards to the coloration of fish, and the

Table 3. Percent measured preference responses on angler satisfaction, angling success, preference, enhanced color of trout, and appearance of fish caught from Center Lake during the 2007 and 2009 creel survey.

			(2007)	(2009)	
Satisfaction					
	Satisfied		76%	89%	
	Neutral		13%	1%	
	Dissatisfied		10%	10%	
Satisfied with fishing success					
	Yes		-	331 (71%)	
	No		-	137 (29%)	
Which fish/fillet would you prefer to catch*				**fish**	**fillet**
	Colored feed		-	352 (75%)	376 (80%)
	Non-colored feed		-	79 (17%)	57 (12%)
How satisfied with appearance of fish caught					
	High			61%	
	Medium			10%	
	Low			1%	
	No Opinion			28%	

*remaining percentage of anglers noted their opinion as no preference.

anglers satisfaction of the color of fish they actually caught. Except for the standard satisfaction question, these specific questions have never been asked of anglers in the Black Hills so trend data is not available. Anglers responded with 75% preference of fish that were fed hatchery feed that enhanced the external color (Table 3). These same anglers expressed a preference of 80% towards the fillets of trout that were fed the colored feed. Sixty-one percent of anglers had high satisfaction towards the color of trout they caught during the 2009 survey. Twenty-eight percent of these anglers had no opinion towards the coloration of trout they caught from Deerfield in 2009 (Table 3). Only one percent expressed low satisfaction for the appearance of the fish they caught that day.

Angler Demographics

To describe the anglers that use a fishery, demographic characteristics are used (Table 2). There was a change from 2007 to 2009 in the percent of resident usage at Center Lake. In 2007, ninety-four percent of anglers were residents, in 2009 this changed to seventy-five percent. The mean distance that anglers traveled to use Center Lake also changed in a similar manner from 215 miles to 270 from 2007 to 2009, respectively. The most common age of anglers at Center Lake was between 40-49 years, with 60+ and 20-39 in second and third, respectively. In 2007, seventy-five percent of anglers were male. The number of male anglers decreased slightly in 2009 to sixty-eight percent. Many anglers (27%) reported not catching any rainbow trout at Center Lake in 2009. Ten percent of anglers caught one rainbow trout in 2009. Party size (2.54) was similar from the 2007 survey, while trip length (3.06) was an increase.

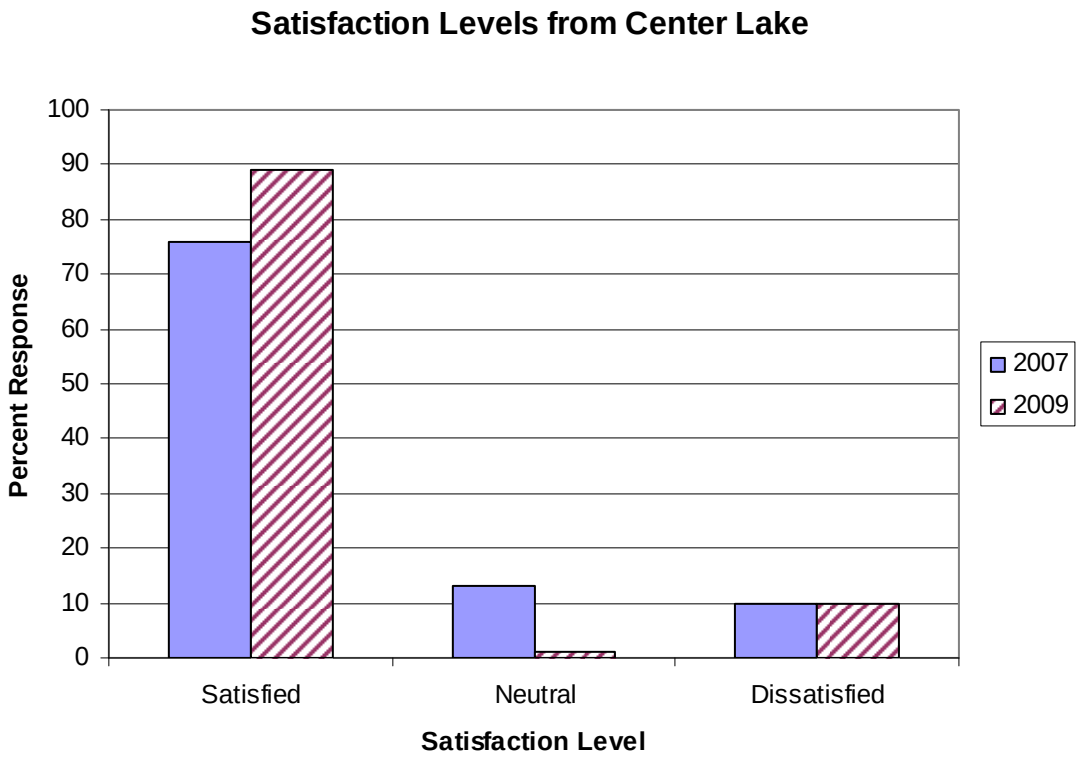

Figure 3. Historic angler satisfaction at Center Lake.

Angler Preference of Rainbow Trout Coloration

Three questions were asked to determine angler preference towards the coloration of trout. Two of the questions were based off of photos which were taken of trout that were either fed a specialized feed with the chemical Astaxanthin or were control fish. Across each month of the creel survey, anglers preferred the exterior color of the trout with brighter coloration (Table 3). The opinions of anglers were greatly skewed towards the brightly colored trout, with June being the lowest of these months at 75% toward a brightly colored exterior of trout (Figure 4). Brightly colored fillets were generally preferred over a more drab color across the summer. While the percentage of respondents decreased over the summer, it remained above 70% preference throughout.

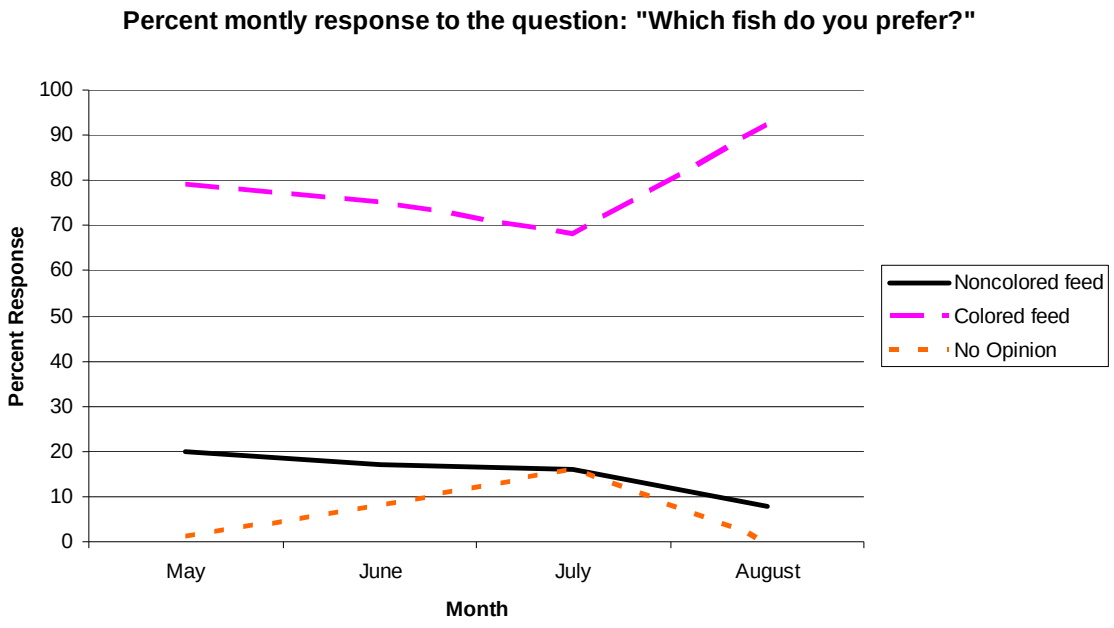

Figure 4. Percent angler preference towards exterior coloration at Center Lake, 2009.

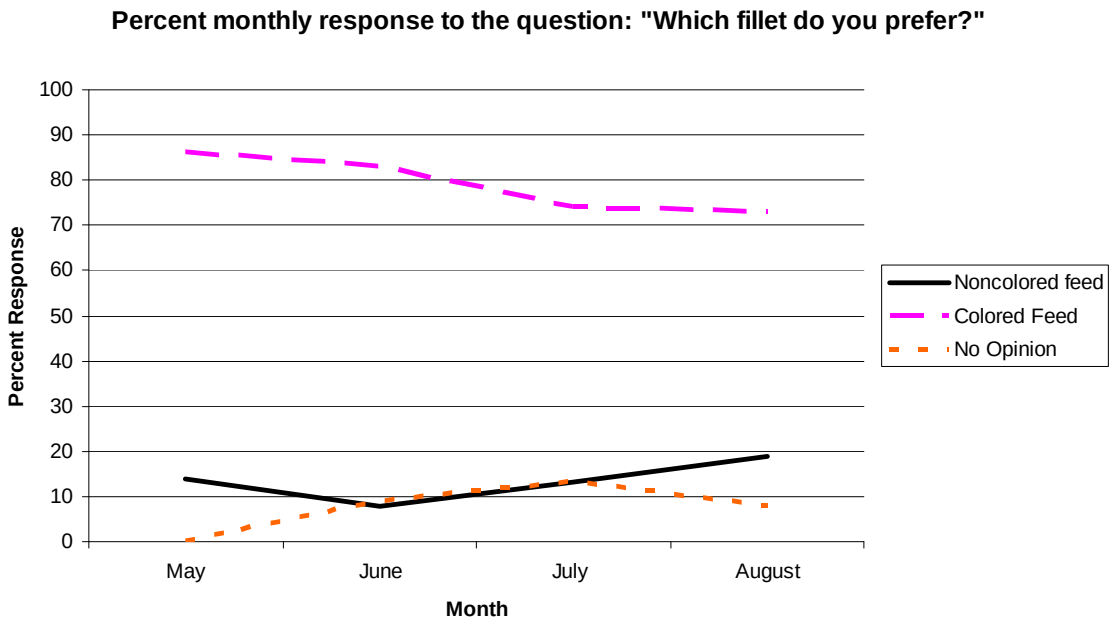

Figure 5. Percent angler preference towards fillet coloration at Center Lake, 2009.

Anglers heavily favored the appearance of trout fillets of fish that were fed the supplemented feed (Figure 5). Anglers surveyed in early summer responded with slightly higher preference (86%) to the highly colored fillets than in later summer (73%). Fishermen who showed preference towards the trout with less color never exceeded 20 percent, and in a general differed little from those who had no opinion or preference.

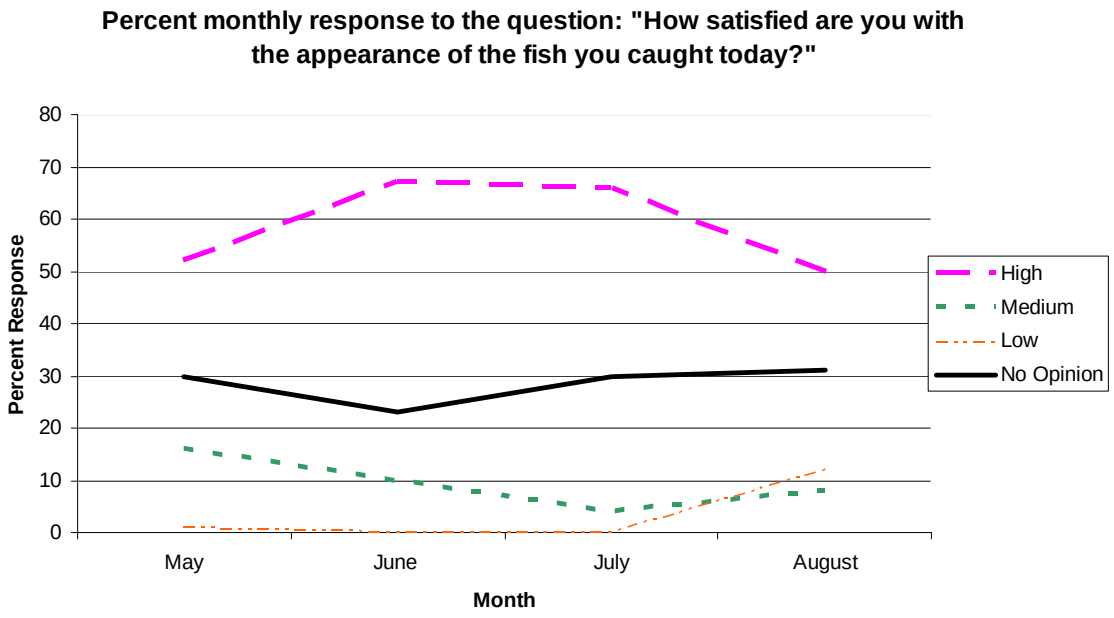

Figure 6. Percent of angler responses to the question; "How satisfied are you with the appearance of the fish you caught today?" at Center Lake, 2009.

Anglers on Center Lake during the 2009 survey were asked of their preference towards the appearance of the trout they actually caught that day. This differed from the above analysis, as anglers who actually caught fish could only have answered this question. Anglers were, on average, satisfied with trout appearance (Figure 6). There were more anglers that expressed "no opinion" towards the question of "How satisfied are you with the appearance of the trout you caught today?" There was a decline in the "high satisfaction" category with a corresponding increase in the "low satisfaction and medium satisfaction" categories in August. This may be affected by the lower catch rates experienced in late summer and may be impacted by the normal higher water temperatures seen at this time.

RECOMMENDATIONS

1. Continue to monitor the size and population structure of rainbow and tiger trout in Center Lake. Evaluation of the tiger trout population or angling success should be evident in upcoming years as they become recruited to the fishery. Determine at appropriate intervals if additional stocking of tiger trout is warranted.

2. Use catch as a measure of utilization on the Center Lake. Use this data to determine management strategies. Harvest is only one component in fisheries and does not take into account the aspect of returning fish to the water after being caught.

3. Continue to manage the Center Lake fishery in a manner that keeps angler satisfaction at a high level. Current levels of satisfaction exceed that of the statewide average.

4. Angler attitudes, examined in this study, should be documented when appropriate in future creel surveys in the Black Hills. Size of trout stocked should remain at a level where angler satisfaction does not drop below the statewide average. Continue to monitor the angler harvest/release attitudes and observe impacts that this may have on the long-term fishery.

5. Schedule future fisheries management survey work during appropriate times to determine size of tiger trout and monitor their effect on creek chub and white sucker populations, if possible. Day and night electroshocking for rainbow and tiger trout should be used to gather data. Normal gill netting is not often performed in South Dakota's put-and-take rainbow trout fisheries.

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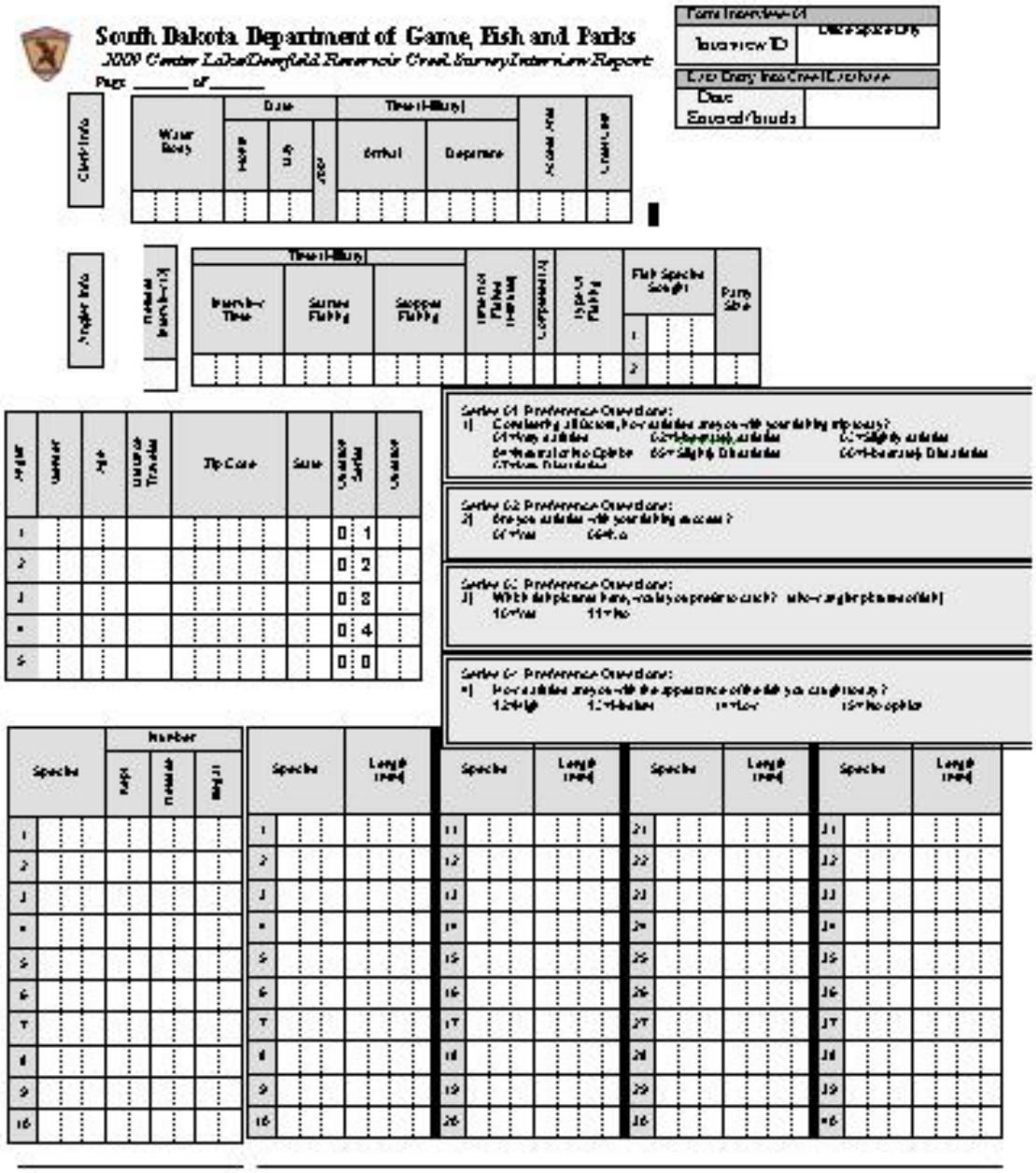
APPENDIX

Appendix 1. Creel Survey Interview Form used by creel clerks during the 2009 Center Lake Creel Survey.



Appendix 2. Creel Survey Pressure Form used by creel clerks during the 2009 Center Lake Creel Survey.

South Dakota Department of Game, Fish and Parks
Center Deerfield Survey Fishing Pressure Report

Form Pressure/Accel or Roving or Fixed	
Pressure ID	Office Space Only

Data Entry into Creel Database	
Date Entered/Initials	

Pressure Count #1

Water Body	Date			Survey Time (Hours)		Access Area	Creel Clerk	Air Temp	Cloud Cover	Wind Speed	Wind Dir	Precip	Water Temp		Op Water(s)	Sorting Location	Travel Direction
	Month	Day	2009	Arrival	Departure												

Type Of Fishing	Total	Running Tally
Fishing Boats		
Bank/Shore		

Form Pressure/Accel or Roving or Fixed	
Pressure ID	Office Space Only

Pressure Count #2

Water Body	Date			Survey Time (Hours)		Access Area	Creel Clerk	Air Temp	Cloud Cover	Wind Speed	Wind Dir	Precip	Water Temp		Op Water(s)	Sorting Location	Travel Direction
	Month	Day	2009	Arrival	Departure												

Type Of Fishing	Total	Running Tally
Fishing Boats		
Bank/Shore		

Form Pressure/Accel or Roving or Fixed	
Pressure ID	Office Space Only

Pressure Count #3

Water Body	Date			Survey Time (Hours)		Access Area	Creel Clerk	Air Temp	Cloud Cover	Wind Speed	Wind Dir	Precip	Water Temp		Op Water(s)	Sorting Location	Travel Direction
	Month	Day	2009	Arrival	Departure												

Type Of Fishing	Total	Running Tally
Fishing Boats		
Bank/Shore		