

2009 Fisheries Surveys on the Pine Ridge Indian Reservation

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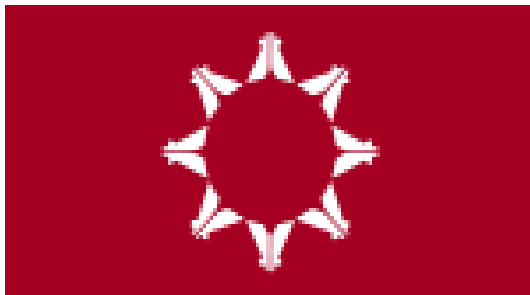


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INTRODUCTION

Pine Ridge Reservation lies in southwest South Dakota. The terrain consists of rolling grassland prairie dissected by streams forming deep canyons. The north half of the reservation consists of Badlands. The area is semi-arid with temperatures that range from 100 °F in the summer to -40 °F in the winter. The growing season averages 130 days and average rainfall is 16 inches.

The Pine Ridge Reservation has three primary drainage systems including the Cheyenne, White, and Little White rivers (Figure 1). The Cheyenne River boards the northwest corner of the reservation and drains badlands. The White River curves diagonally across the reservation from southwest to northeast. It is the largest drainage system on the reservation with numerous dendritic intermittent streams, which also drains highly erodeable badlands. The Little White River originates in the sandhills and flows eastward across the southeast corner of the reservation.

Most streams are low gradient, silt laden, and generally unsuitable for game fish. However, these streams contain numerous cyprinids and catostomids. A few streams originated in the sandhills (e.g. Denby creek) or in pine covered canyon areas (e.g. No Flesh Creek and Corn Creek) and are relatively clear and cool and have held trout populations at times.

Currently, most game fish populations are found in six reservoirs across the reservation including: Oglala, White Clay, Wolf Creek, Denby, Kyle, and Yellow Bear reservoirs (Figure 1). Currently, the Wolf Creek dam structure is being renovated with limited fishing opportunities.

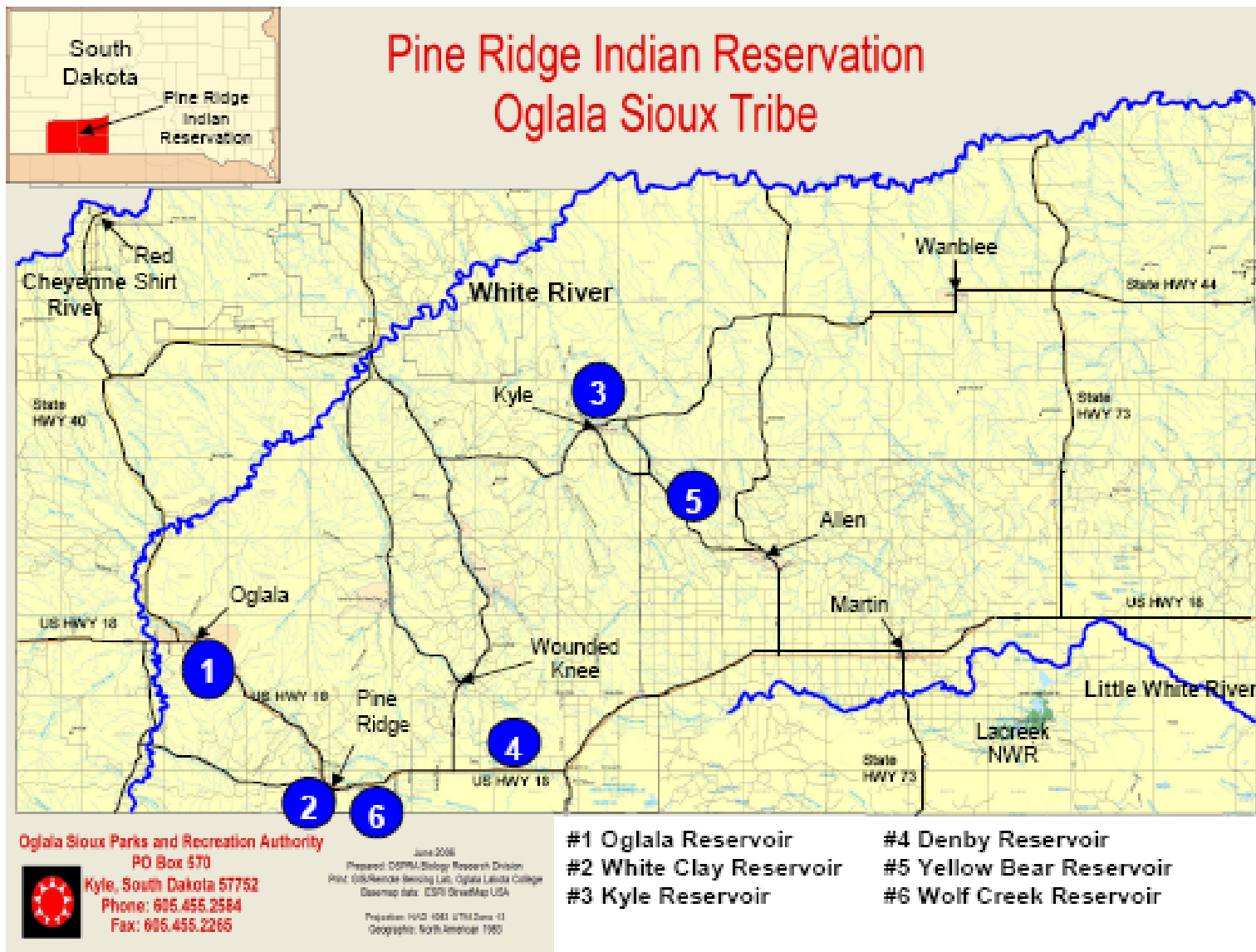


Figure 1. Map of the Pine Ridge Indian Reservation identifying major rivers and reservoirs managed for fishery recreation.

METHODS

Data collection

Night time electrofishing was conducted 30 June 2009 in Oglala Reservoir and 1 July 2009 in Kyle Reservoir with a Smith and Root 5.0 GPP electrofishing system using pulsed DC, 5-6 amps, and a pulse frequency of 60 cycles per second (cps). Electrofishing was conducted in 15 minute transects along the reservoir's shoreline. Six 15-minute transects were conducted at Oglala and four 10-minute transects in Kyle Reservoir. All fish captured were measured to total length (TL; mm) and five fish per centimeter length group were weighed (g) at each reservoir.

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

Water quality parameters measured at each reservoir are presented in Table 1.

Table 1. Pine Ridge Indian Reservation surface water quality parameters.

Date	Time (military)	Depth (m)	Water temp. (°C)	D.O. (mg/L)	Secchi depth (cm)	pH	Salinity (ppt)	Pheno. alkalinity (mg/L)	Total alkalinity (mg/L)	Cond. (µS/cm)	Specific cond. (µS/cm)
Denby Reservoir											
1 Jul 2008	0220	0.3	22.5	12.2			0.1	34	137	220	229
Kyle Reservoir											
1 Jul 2009	0050	0.3	24.6	9.8	113	9.1		0	171	428	
19 Jun 2007	0020	0.3	24.1	6.2	201	6.7	0.3	0	274	550	559
Oglala Reservoir											
30 Jun 2009	0300	0.3	23.6	13.5		8.7		0	188	506	
White Clay Reservoir											
1 Jul 2008	0100	0.3	23.7	7.6			0.2	0	188	408	422
Yellow Bear Reservoir											
3 Jul 2008	0115	0.3	22.8	9.4							
3 Jul 2008	0115	1.7	22.9	8.7							
3 Jul 2008	0115	3.3	20.1	0.2							
3 Jul 2008	0115	5.0	13.3	0.1							
2 Jul 2008	2145	0.3	23.5	10.3			0.2	0	205	380	392
2 Jul 2008	2145	1.7	23.2	9.0							
2 Jul 2008	2145	3.3	19.1	0.1							
2 Jul 2008	2145	5.0	13.3	0.1							
19 Jun 2007	0020	0.3	24.1	6.2	201	6.7	0.3	0	274	550	559

Data analysis

Relative abundance of fish species were expressed as mean catch per unit effort (CPUE) as fish/hr for electrofishing. Proportional stock density (PSD; Anderson 1976) and relative stock density (RSD; Gabelhouse 1984) were calculated for largemouth bass, bluegill, black crappie, walleye, and yellow perch. Length categories used to calculate PSD and RSD for each fish species is presented in Appendix B. Relative weights (W_r ; Wege and Anderson 1978) were calculated using a standard weight (W_s) equation for each fish species and summarized in Appendix C. A glossary of fishery terms and data analysis is summarized in Appendix D. Fish stocking history for Pine Ridge Indian Reservation reservoirs is presented in Appendix E.

KYLE RESERVOIR

Introduction

Kyle Reservoir is located in the center of the reservation near the city of Kyle (Figure 2). Historically, this reservoir is known for an excellent cool and warm water fishery. Kyle Reservoir has a surface area of 65 acres. The dam structure was recently renovated in the 1990's. However, the reservoir is quickly being silted in on the upstream end and choked off with submergent vegetation. Maximum depth is 7 m (Haines and Sherman 1984).



Figure 2. Kyle Reservoir on the Pine Ridge Indian Reservation. White line indicates electrofishing transect conducted during July 2009.

Results and Discussion

Black crappie

The relative abundance of stock length (≥ 130 mm) black crappie substantially increased from 2007 to 2009 (Figure 2). However, the population continues to be dominated by small, stock to quality length fish (Figure 3). The abundant large (≥ 300 mm), largemouth bass and northern pike populations are likely controlling the size structure of black crappie in Kyle Reservoir. However, we can not exclude the possibility that anglers are reducing the size structure by removing most fish angled over 200 mm. Mean Wr were normal but declined substantially since 2007 indicating a decline in abundance of prey. This may be due to intra-specific competition with the high abundance of black crappie and/or inter-specific competition with the abundant bluegill in 2009.

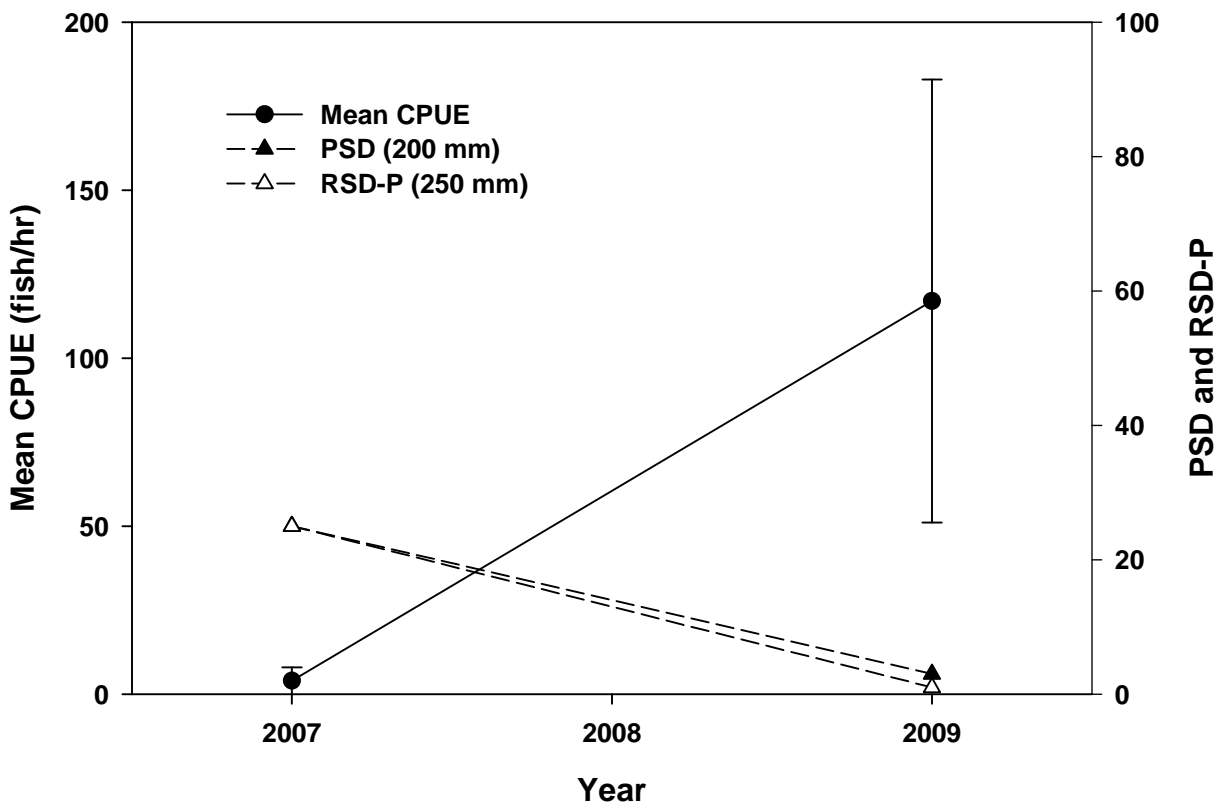


Figure 2. Annual relative abundance (black crappie/hr with SE bars), proportional stock density (PSD), and relative stock density (RSD-P) of black crappie caught by electrofishing in Kyle Reservoir from 2007 to 2009. Mean catch per unit effort (CPUE) calculated for black crappie \geq stock length (130 mm) only.

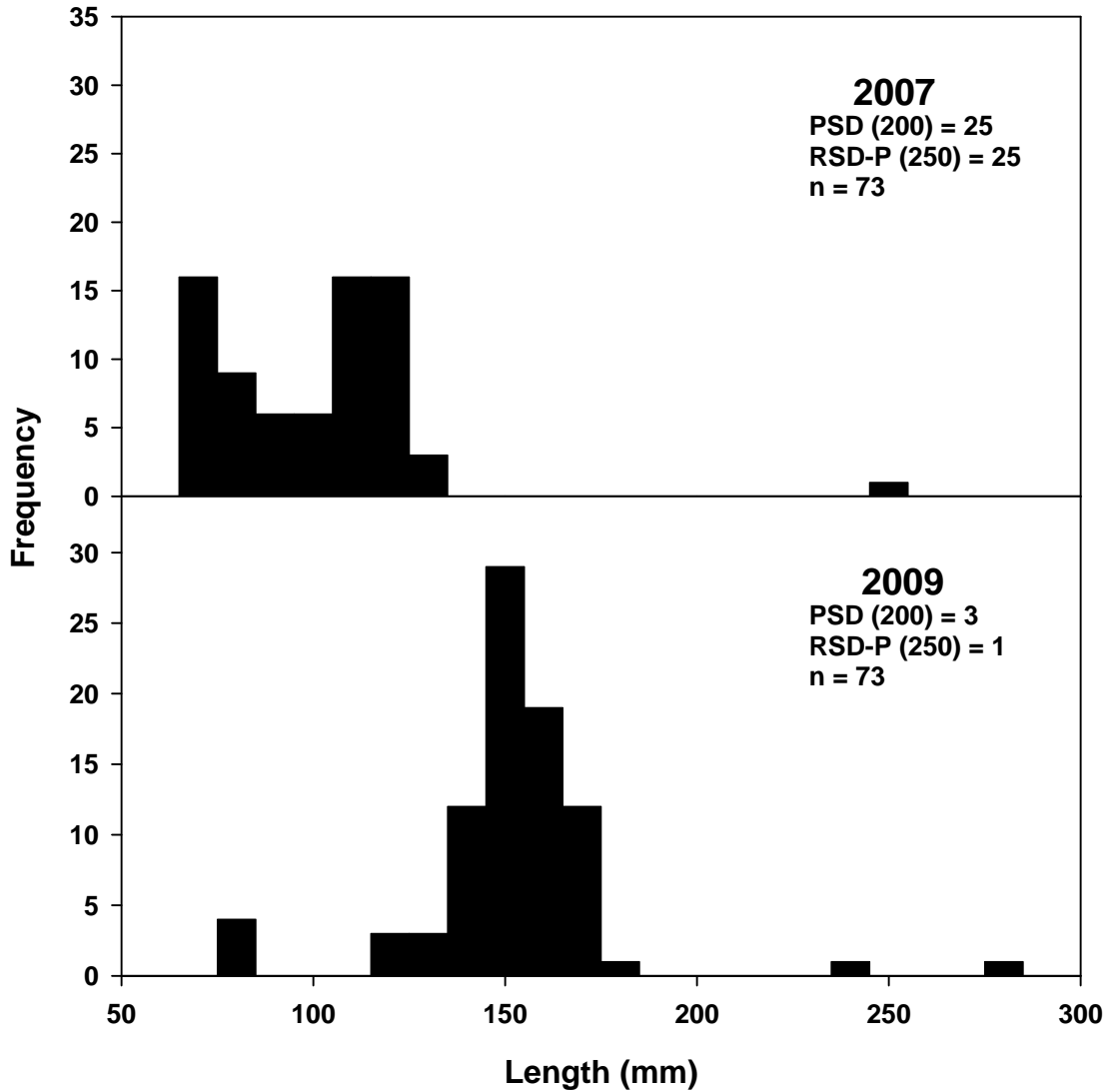


Figure 3. Length frequency distribution (10-mm length groups) for black crappie captured by electrofishing in Kyle Reservoir in 2007 and 2009.

Table 2. Black crappie mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in Kyle Reservoir from 2007 to 2009.

Year	Overall W_r	Stock - Quality (130-200 mm) (5-8 in)	Quality - Preferred (200-250 mm) (8-10 in)	Preferred - Memorable (250-300 mm) (10-12 in)	Memorable - Trophy (300-380 mm) (12-15 in)
2009	94 (2.1)	95 (2.2)	b	b	b
2007	104 (2.2)	99 (2.0)	b	b	b

a = Sampling did not occur during that year.

b = Category had less than two samples for mean and SE calculations, but may have been calculated in overall W_r .

Bluegill

The relative abundance of stock length (≥ 80 mm) bluegill substantially increased from 2007 to 2009 (Figure 4). The size structure has not changed since 2007, as the population remains dominated by stock to quality length fish (Figure 5). Prey appears to be readily available for bluegill as mean W_r was high with an increase since 2007 (Table 3).

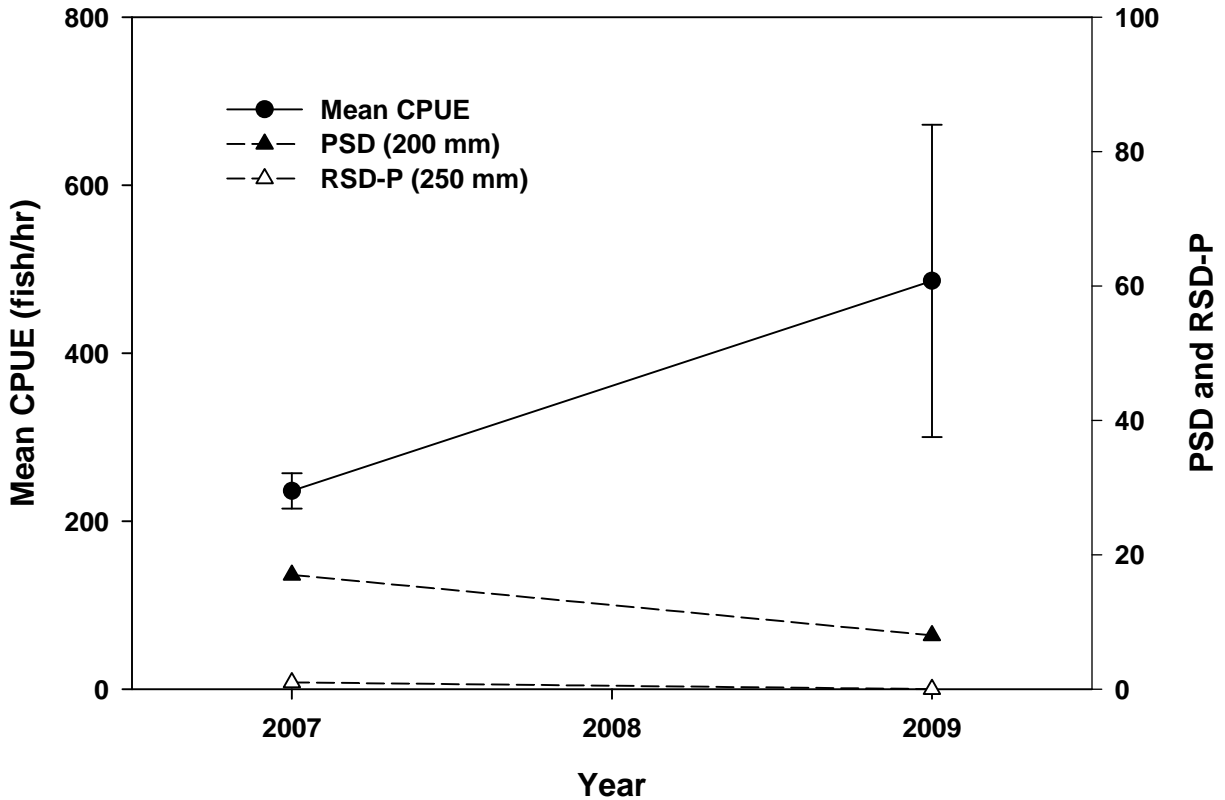


Figure 4. Annual relative abundance (fish/hr with standard error bars), proportional stock density (PSD), and relative stock density (RSD-P) of bluegills captured by electrofishing in Kyle Reservoir from 2007 to 2009. Mean catch per unit effort (CPUE) calculated for bluegill \geq stock length (80 mm) only.

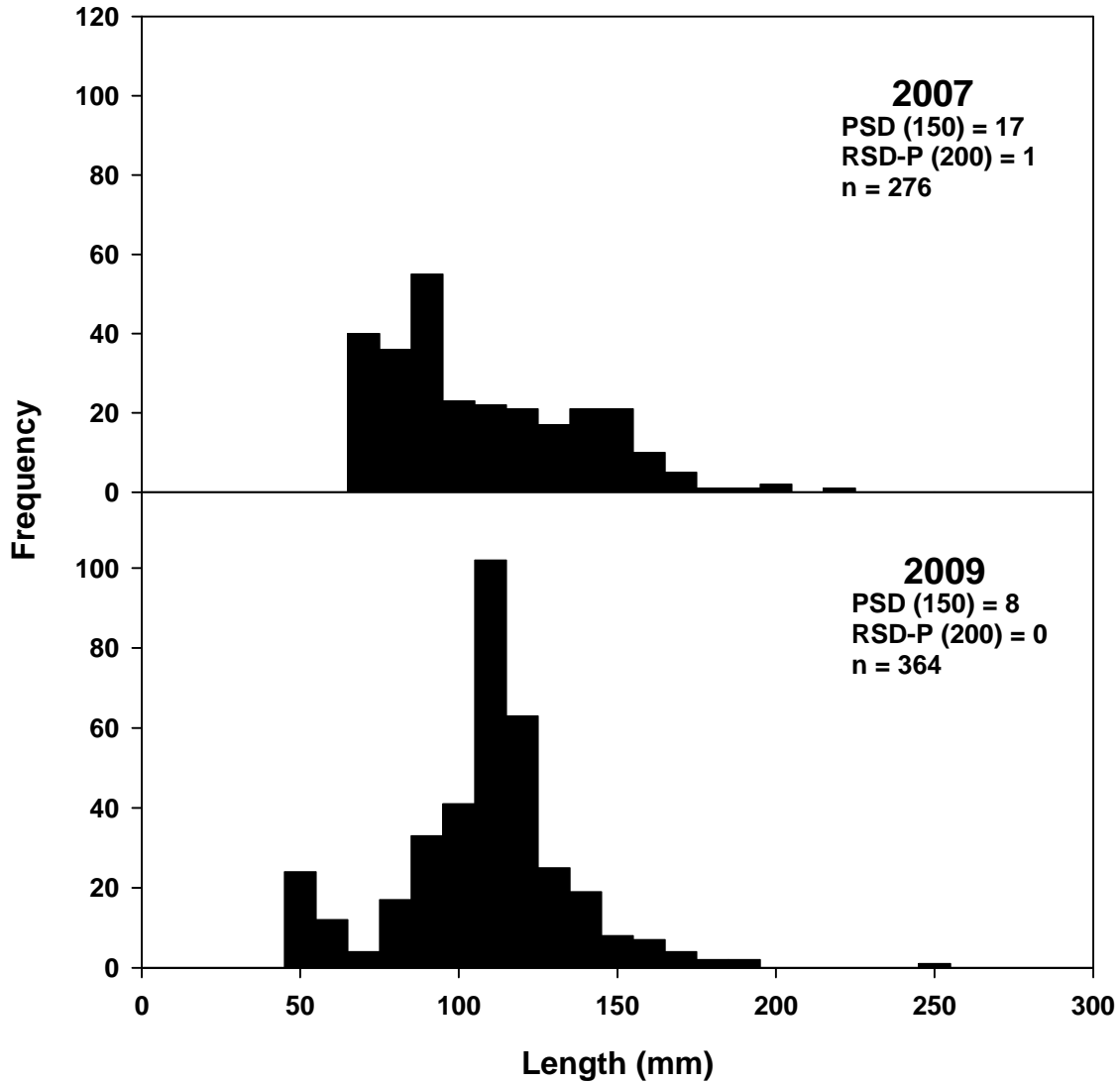


Figure 5. Length frequency distribution (10-mm length groups) for bluegill captured by electrofishing in Kyle Reservoir in 2007 and 2009.

Table 3. Bluegill mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Kyle Reservoir from 2007 to 2009.

Year	Overall W_r	Stock - Quality (80-150 mm) (3-6 in)	Quality - Preferred (150-200 mm) (6-8 in)	Preferred - Memorable (200-250 mm) (8-10 in)	Memorable - Trophy (250-300 mm) (10-12 in)
2009	103 (1.5)	106 (1.9)	98 (2.2)	b	b
2007	96 (1.2)	98 (1.4)	93 (1.8)	88 (8.6)	b

a = Sampling did not occur during that year.

b = Category had less than two samples for mean and SE calculations, but may have been calculated in overall W_r .

Largemouth bass

Largemouth bass relative abundance did not change from 2007 to 2009 while the size structure improved (Figure 6). The abundance of larger largemouth bass will provide excellent angling opportunities. Mean Wr remained high in 2009 indicating high prey availability. The stocking program should be reconsidered in Kyle Reservoir as after the 2008 stocking of fry, relative abundance remained constant while the improvement of size structure was only for quality length fish while there were few sub-stock and stock to quality length fish.

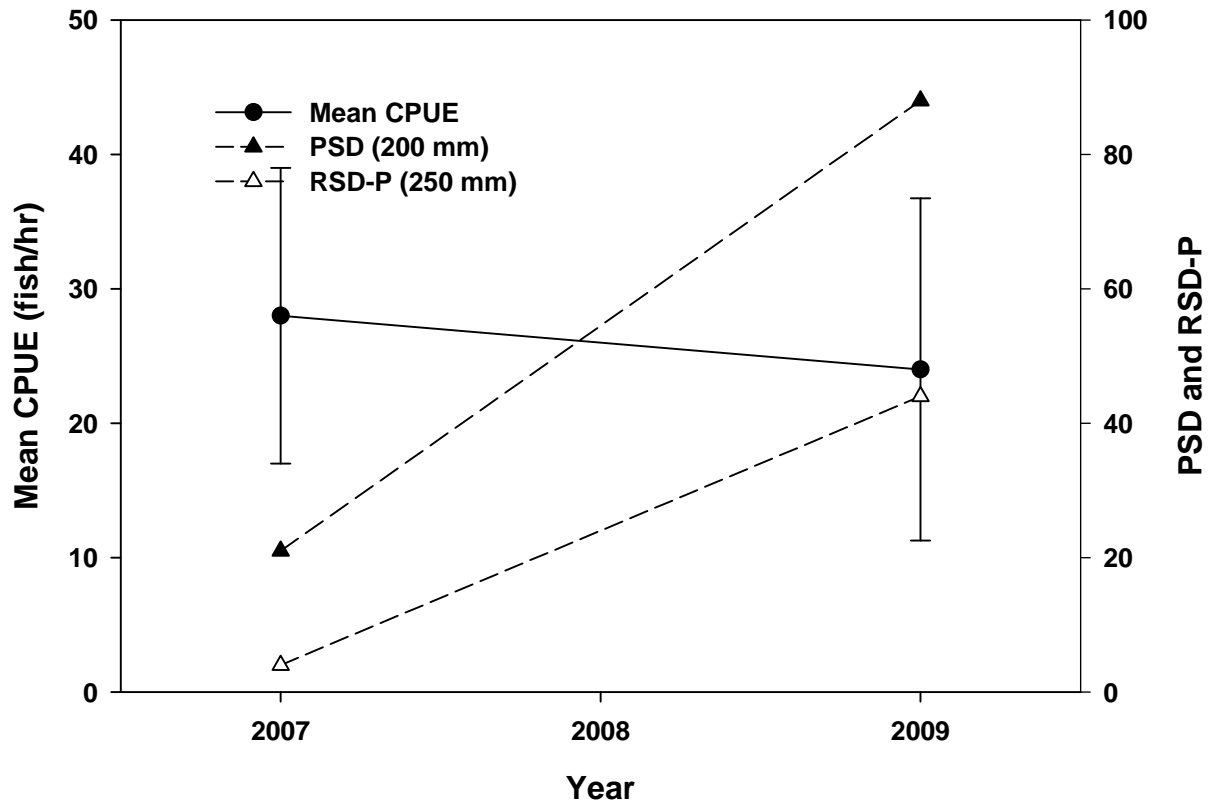


Figure 6. Annual relative abundance (fish/hr with SE bars), proportional stock density (PSD), and relative stock density (RSD-P) of largemouth bass captured by electrofishing Kyle Reservoir from 2007 to 2009. Mean catch per unit effort (CPUE) calculated for largemouth bass \geq stock length (200 mm) only.

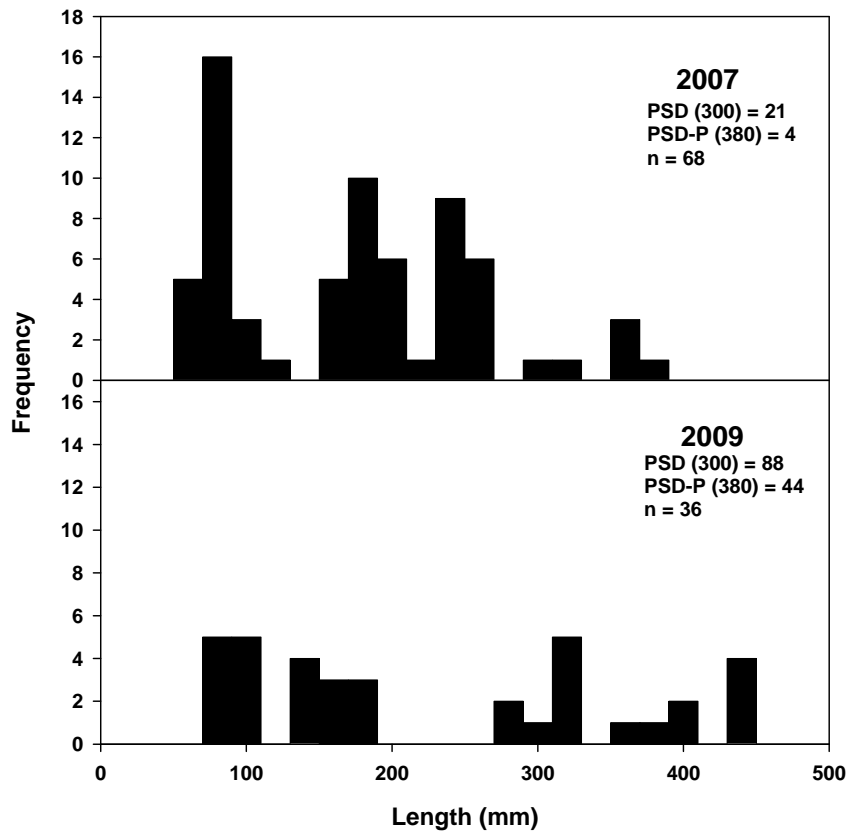


Figure 7. Length frequency distribution (20-mm length groups) for largemouth bass captured by electrofishing in Kyle Reservoir in 2007 and 2009.

Table 4. Largemouth bass mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Kyle Reservoir from 2007 to 2009.

Year	Overall W_r	Stock - Quality (200-300 mm) (8-12 in)	Quality - Preferred (300-380 mm) (12-15 in)	Preferred - Memorable (380-510 mm) (15-20 in)	Memorable - Trophy (510-630 mm) (20-25 in)
2009	109 (1.8)	108 (1.1)	106 (3.2)	112 (2.4)	b
2007	119 (2.5)	108 (2.1)	137 (7.7)	b	b

a = Sampling did not occur during that year.

b = Category had less than two samples for mean and SE calculations, but may have been calculated in overall W_r .

Northern pike

Three northern pike (567, 633, and 706 mm) were sampled while electrofishing Kyle Reservoir in 2009. This indicates that northern pike are likely naturally reproducing in Kyle Reservoir with evidence of multiple year classes. Multiple lengths of northern pike were also observed in 2007. The abundance of northern pike in Kyle Reservoir is likely affecting the size structure of black crappie, bluegill, and largemouth bass.

OGLALA RESERVOIR

Introduction

Oglala Reservoir is located on White Clay Creek near the city of Oglala, is 283 ha (700 acres) and has a maximum depth 6.7 m (22 ft) (Figure 8). The bottom is silt laden, with very little aquatic vegetation. Haines and Sherman (1984) reported that Oglala Reservoir was turbid with the fish community dominated by carp, while coolwater and warmwater game fish were surprisingly abundant.

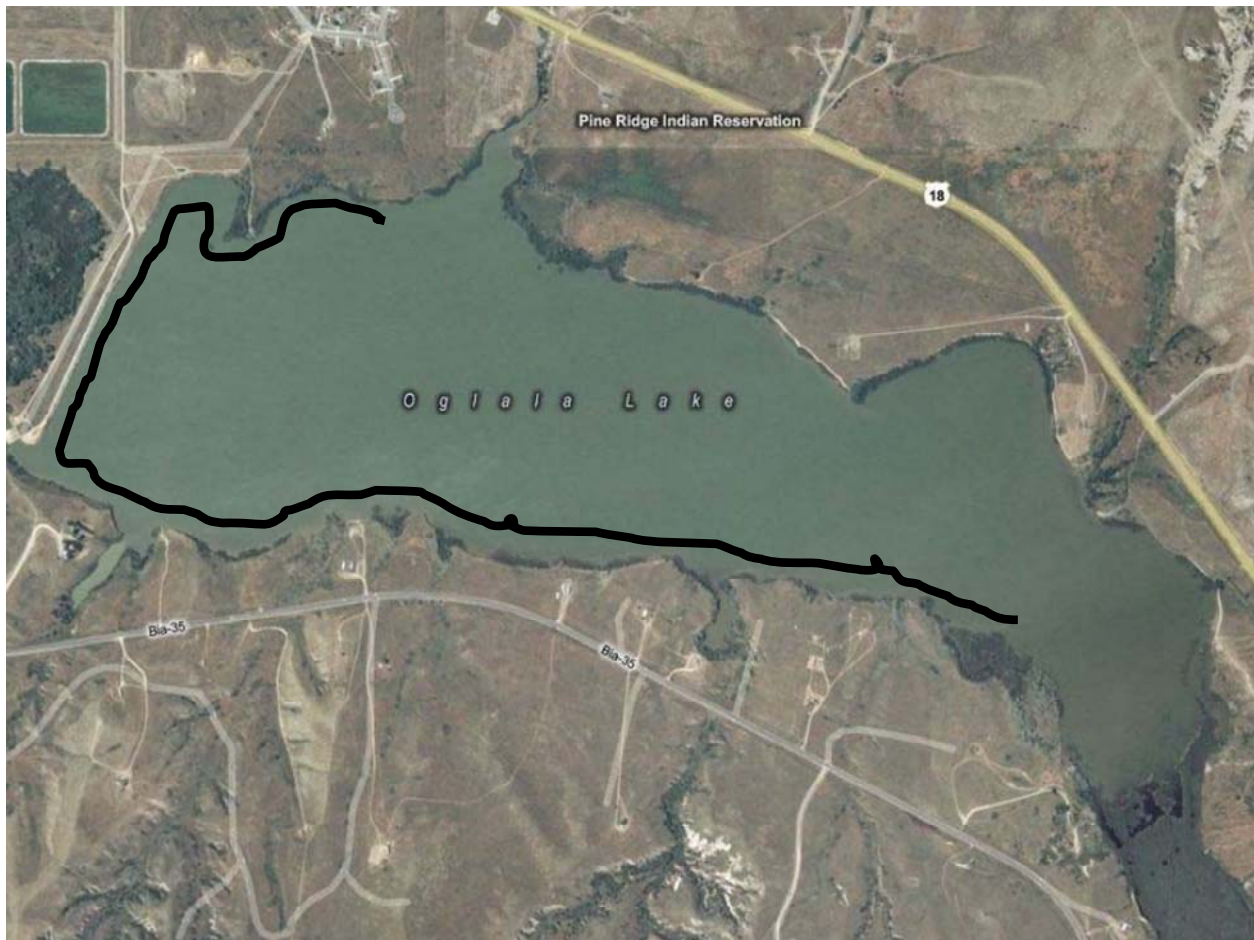


Figure 8. Oglala Reservoir on the Pine Ridge Indian Reservation. Black line indicates electrofishing transect conducted during July 2009.

Results and Discussion

Black bullhead

Two black bullheads (130 and 150 mm) were collected during the electrofishing sampling in 2009.

Common carp

In 2009, the fish population in Oglala Reservoir was dominated by common carp. Mean CPUE of stock length fish (≥ 280 mm) was 62.7 fish/hr (SE = 3.7). The common carp population was likely dominated by one year-class of age-1 or age-2 fish with nearly the entire population in the stock to quality length group (Figure 9).

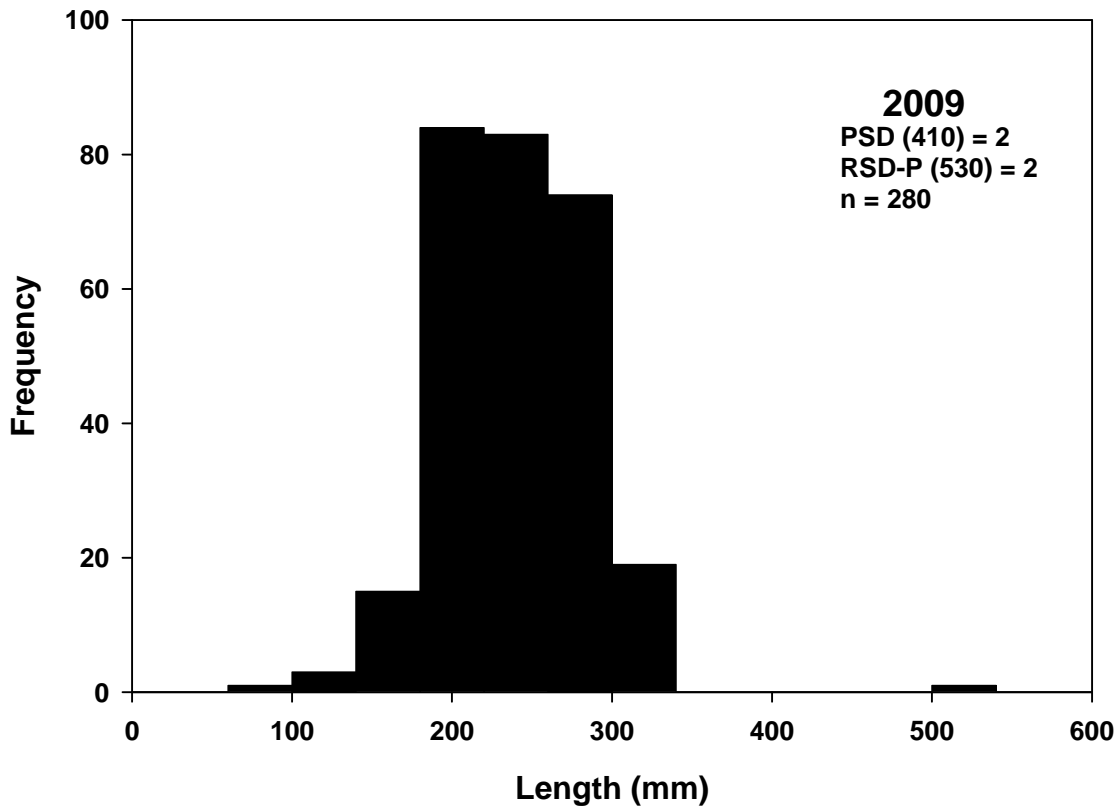


Figure 9. Length frequency distribution (40-mm length groups) for common carp captured by electrofishing in Oglala Reservoir in 2009.

Green sunfish

Three green sunfish (105, 116, and 124 mm) were collected while electrofishing Oglala Reservoir in July 2009.

Walleye

The stocking of 35,000 walleye fry in 2008 appears to be successful as walleye mean CPUE of stock length fish (250 mm) was 3.3 fish/hr (SE = 1.9) during July 2009. The walleye population was dominated by sub-stock and stock to quality length fish most likely from the 2008 stocking (Figure 10). The 2009 stocking of walleye fry will additionally supplement the population. Adequate prey is available for walleye in Oglala Reservoir with a mean $W_r = 99$ (Table 5). Angling opportunities for small (≈ 12 in.) walleye in Oglala Reservoir should be available during the winter of 2009-2010.

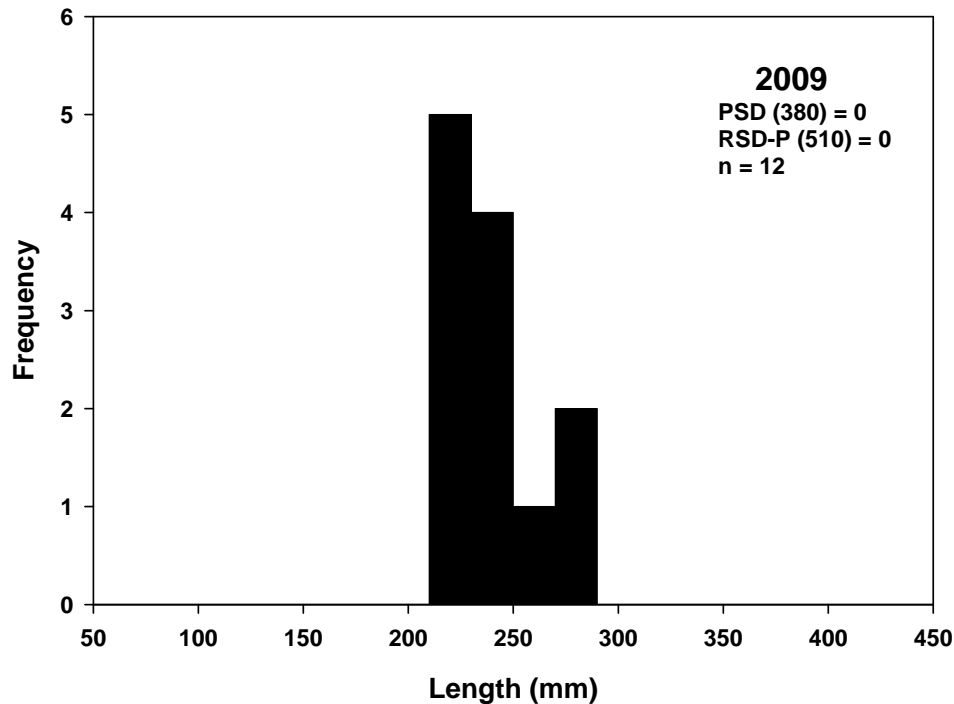


Figure 10. Length frequency distribution (40-mm length groups) for walleye captured by electrofishing in Oglala Reservoir in 2009.

Table 5. Walleye mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in Oglala Reservoir in 2009.

Year	Overall W_r	Stock - Quality (250-380 mm) (10-15 in)	Quality - Preferred (380-510 mm) (15-20 in)	Preferred - Memorable (510-630 mm) (20-25 in)	Memorable - Trophy (630-760 mm) (25-30 in)
2009	99 (2.1)	99 (2.1)	b	b	b

a = Sampling did not occur during that year.

b = Category had less than two samples for mean and SE calculations, but may have been calculated in overall W_r .

Yellow perch

The stocking of 190,000 yellow perch fry in 2008 appears to be successful with a strong age-1 year class collected (Figure 11) for a mean CPUE of stock length fish (≥ 130 mm) at 55.3 fish/hr (SE =15.6). Mean W_r was excellent, which indicated an abundance of prey for yellow perch in Oglala Reservoir (Table 6). Angling opportunities for quality length (≥ 8 in.) yellow perch should be available during the winter of 2009-2010.

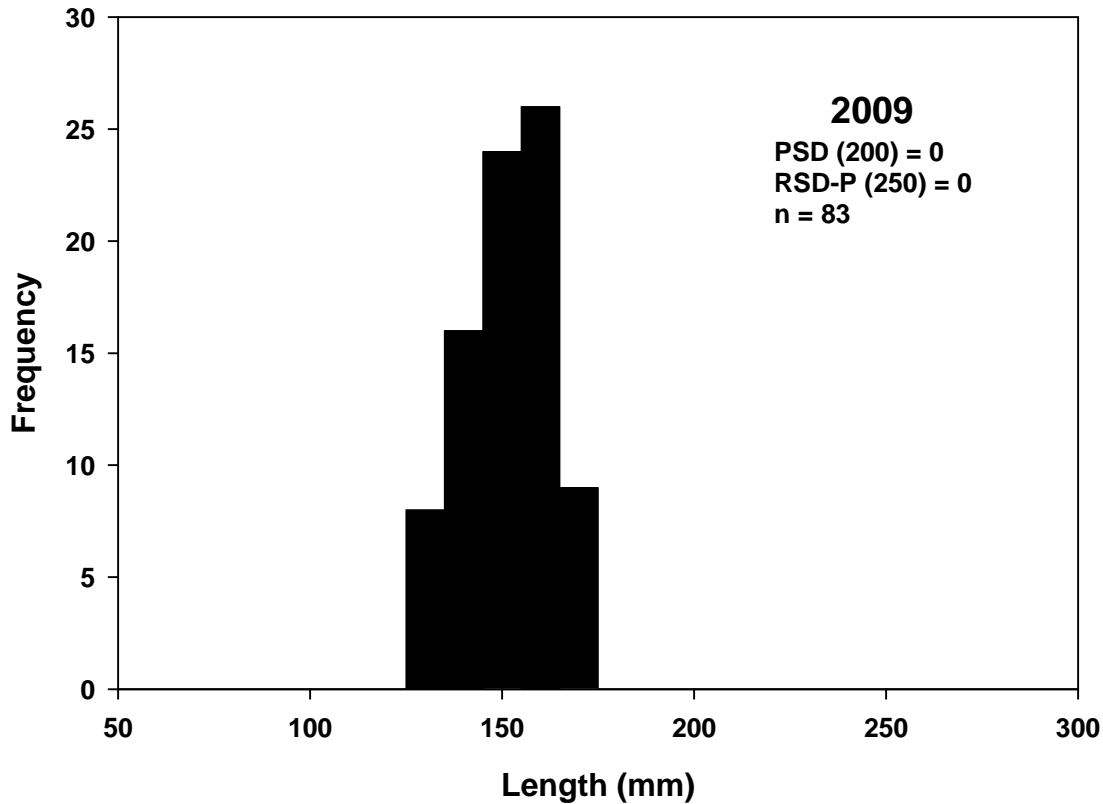


Figure 11. Length frequency distribution (40-mm length groups) for yellow perch captured by electrofishing in Oglala Reservoir in 2009.

Table 6. Yellow perch mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in Oglala Reservoir in 2009.

Year	Overall W_r	Stock - Quality (130-200 mm) (5-8 in)	Quality - Preferred (200-250 mm) (8-10 in)	Preferred - Memorable (250-300 mm) (10-12 in)	Memorable - Trophy (300-380 mm) (12-15 in)
2009	110 (3.0)	110 (3.0)	b	b	b

a = Sampling did not occur during that year.

b = Category had less than two samples for mean and SE calculations, but may have been calculated in overall W_r .

MANAGEMENT RECOMMENDATIONS

Overall Pine Ridge Indian Reservation Fisheries Management Recommendations

1. Work with landowners above reservoirs to control silt and nutrients entering the reservoirs.
2. Survey reservoirs every two years with electrofishing.
 - Denby, White Clay, and Yellow Bear reservoirs in 2010.
 - Oglala and Kyle reservoirs in 2011.
3. Create a bass/bluegill fishery as soon as Wolf Creek Reservoir dam structure is completed. A put-and-take trout fishery would be short-lived and will require continuous stocking based on previous trout fishery attempts.
4. Investigate length limits (e.g., walleye – only one in a daily limit may be 20 inches or longer; largemouth bass – minimum length of 15 inches).
5. Daily limit of 3 northern pike across Pine Ridge Indian Reservation.
6. Investigate darkhouse spearfishing for northern pike and non-game fish through the ice.

Kyle Reservoir Management Recommendations

1. Continue to stock largemouth bass; however, re-evaluate stocking program in Kyle Reservoir following the 2011 survey.
2. Promote the release of small (≤ 12 inch) largemouth bass. Create a minimum length limit of 15 inches. This will likely improve the size structure of black crappie and bluegill.
3. Continue to stock black crappie and re-evaluate stocking program in 2011.
4. Do not stock bluegill in Kyle Reservoir.

Oglala Reservoir Management Recommendations

1. Continue supplemental stocking of walleye fry.
2. Consider stocking northern pike to assist in controlling the common carp population. Northern pike will affect the abundance and size structure of other game fish populations. Carefully consider this option as common carp will most likely continue to dominate the population.

3. Consider renovating Oglala Reservoir to remove common carp. This would initially require completely eliminating common carp in White Clay Reservoir and its watershed with rotenone. Additionally, surveying White Clay Creek for endangered and native fish species. Expensive.
4. Do not stock yellow perch as natural reproduction should occur with the newly flooded vegetation in Oglala Reservoir.
5. Consider stocking smallmouth bass in Oglala Reservoir in 2011. Walleye populations should be established by 2011.

Denby Reservoir Management Recommendations

1. Work with landowners upstream to remove nutrients entering the reservoir. Grass buffers that are fenced off from livestock along Denby Creek will improve incoming water quality.
2. Continue stocking largemouth bass at 100 fish/acre.
3. Repair fishing docks.
4. Clean up trash along shoreline and below spillway structure to improve outdoor opportunities for the public.

White Clay Reservoir Management Recommendations

1. Do not stock bass or bluegill in White Clay Reservoir. Natural recruitment appears to be successful even with the high harvest rates observed during sampling in 2008.
2. Construct fishing docks for handicap/disabled access.
3. Clean up trash along shoreline and below spillway structure.

Yellow Bear Reservoir Management Recommendations

1. Continue the successful program of put-and-take trout fishery.
2. Encourage catch and release of all largemouth bass < 12 inches to increase the abundance of small predators on the green sunfish population. Harvest all largemouth bass \geq 15 inches.
3. Construct fishing docks for handicap/disabled access.

ACKNOWLEDGMENTS

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APPENDICES

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

Common name	Abbreviations	Scientific name
Black bullhead	BLB	<i>Ameiurus melas</i>
Black crappie	BLC	<i>Pomoxi nigromaculatus</i>
Bluegill	BLG	<i>Lepomis macrochirus</i>
Green sunfish	GSF	<i>Lepomis cyanellus</i>
Largemouth bass	LMB	<i>Micropterus salmoides</i>
Northern pike	NOP	<i>Esox lucius</i>
Yellow perch	YEP	<i>Perca flavescens</i>

Appendix B. Minimum total lengths (TL; mm) of length categories for fish species found on Pine Ridge Indian Reservation.

Species	Stock	Quality	Preferred	Memorable	Trophy	Reference
Black bullhead	150	230	300	380	450	Gabelhouse 1984
Black crappie	130	200	250	300	380	Gabelhouse 1984
Bluegill	80	150	200	250	300	Gabelhouse 1984
Green sunfish	80	150	200	250	300	Gabelhouse 1984
Largemouth bass	200	300	380	510	630	Gabelhouse 1984
Northern pike	350	530	710	860	1120	Gabelhouse 1984
Yellow perch	130	200	250	300	380	Gabelhouse 1984

Appendix C. Intercept (a) and slope (b) parameters for standard weight (Ws) equations and the minimum total lengths (TL; mm) recommended used to calculate relative weight (Wr). Metric equations are in millimeters and grams. Summary for fish species found on Pine Ridge Indian Reservation.

Species	Intercept (a)	Slope (b)	Minimum total length	Reference
Black crappie	-5.618	3.345	100	Neumann and Murphy 1991
Bluegill	-5.374	3.316	80	Hillman 1982
Largemouth bass	-5.528	3.273	150	Henson 1991
Northern pike	-5.437	3.059	100	Willis 1989
Yellow perch	-5.386	3.230	100	Willis et al. 1991

Appendix D. Glossary of fishery terms and data analysis.

Alkalinity: Alkalinity is a measure of a waters ability to resist a change in pH expressed in mg/l or ppm. Because alkalinity is dependent on minerals such as calcium (Ca), and this relates to aquatic vegetation production, alkalinity is a good indicator of a water bodies potential to produce fish. Less than 40 mg/l is considered soft water; greater than 40 mg/l is hard water.

Catch per Unit Effort (CPUE): CPUE is the catch per unit of sampling effort that is used as an index of abundance to document population changes over time. The formula is:

$$\text{CPUE} = \frac{\text{number of fish in a length class, length category, or sample}}{\text{net night or hour of electrofishing}}$$

Conductivity: Conductivity is a measure of a water bodies ability to conduct electricity, which is dependent on the amount of ions in the water. Total dissolved solids (TDS) is equal to 0.5 X Conductivity. Conductivity is a good measure of a water bodies productivity because of the relation between minerals and productivity.

Effort: The effort is the total amount of time expended in collecting a sample. The time may be in hours, minutes, or net days. The effort is used to calculate CPUE.

Memorable length: The memorable length is a standard category unique for each species. The memorable length is the length that most anglers remember catching and is 59 to 64% of the world record length.

Net days: A unit of time used to describe the effort required to collect a sample using Gill nets or Trap nets. For example, if 5 Gill nets were left for a 24 hour period, then 5 Gill nets days worth of effort were expended.

pH: a measure of how basic or acidic a body of water is. This information is important as many species of game fish have narrow pH tolerances.

Preferred length: The preferred length is a standard category unique for each species. The preferred length is the length that most anglers prefer to catch and is usually within a range of 45 to 55% of the world record length.

Proportional Stock Density (PSD): PSD is the number of fish greater than or equal to a minimum quality length in a sample divided by the number of fish greater than or equal to a minimum stock length. The formula is: $\text{PSD} = (\text{number of fish} \geq \text{"quality" length} / \text{number of fish} \geq \text{"stock" length}) \times 100$.

Quality length: The quality length is a standard length category unique for each species of fish. The Quality length is usually within a range of 36 to 41% of the world record length and generally the minimum size that most anglers will keep.

Relative Stock Density (RSD): The RSD is the number of fish greater than a minimum preferred length in a stock divided by the number of fish greater than or equal to a minimum stock size. The formula is: $RSD = (\text{number of fish} \geq \text{"preferred" length} / \text{number of fish} \geq \text{"stock" length}) \times 100$.

Relative weight (W_r): The relative weight of a fish or group of fish is referred to as a " W_r " value. The relative weight is a comparison of the condition of the fish in a sample and the condition of a theoretical optimum sample. The formula is: $W_r = (W/W_s) \times 100$; where " W " is the weight of an individual and " W_s " is a length specific standard weight.

Stock length: The stock length is the smallest of the standard length category unique for each species of fish. The stock length is usually within a range of 20 to 26% of the world record length and at or near which a species reaches sexual maturity.

Trophy length: Trophy length is a standard length category unique for each species of fish. The Trophy length is size worthy of acknowledgment and is greater than 74% of the world record length.

Appendix E. Fish stocking history for Pine Ridge Indian Reservation reservoirs. Stocking size: Fry (FY; Hatch to 1.49 in); Fingerlings (FG; 1.5 to 5.49 in); Sub-adult (SA; ≥ 5.5 in, not sexually mature); Adult (AD; sexually mature, regardless of size); Mixed (MX; transplanted from natural sources).

Reservoir	Year	Largemouth bass			Bluegill			Northern pike			Yellow perch			Rainbow trout			Channel catfish			Walleye		
		Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size
Denby	2008	7	2000	FY																		
	1991																					
	1988				9	2,500	FY							4	1,500	AD						
Kyle	2008	7	6500	FY																		
	1991																9	5,000	FG			
	1990																9	5,000	FG			
	1989																9	5,000	FG			
	1988	7	5,000	FG																		
Oglala	2009									6	170,900	FY							6	71,400	FY	
	2008									6	190,000	FY							6	35,000	FY	
	1996	7	80,000	FG				4	60,000	FG												
	1995	7	70,000	FG				4	70,000	FG	?	9 quarts	eggs									
White Clay	2008	7	9000	FY															6	35,000	FY	
	1994	?	60	AD																		
	1992	9	30,000	FG																		
	1989	9	5,000	FG												7	5,000	FG				
Wolf Creek	1992													4	1,000	AD						
	1991													4	1,500	AD						
	1990																					
	1989													4	1,000	AD						
	1988													4	1,000	AD						
Yellow Bear	2009													4	503	AD						
	2008	7	1500	FY						6	1800	FY		5	1,500	AD						
	1992													4	1,000	AD						
	1991													4	1,000	AD						
	1990																					
	1989													4	1,000	AD						
	1988				9	2,500	FY															