

# Initial Report for the 2007 Fishery Surveys on the Pine Ridge Indian Reservation

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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. The Cheyenne River borders 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. Currently, Oglala and Wolf Creek dam structures are being renovated with limited fishing opportunities.

Kyle Reservoir is located in the center of the reservation near the city of Kyle. 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).

Yellow Bear Reservoir is located in a ponderosa pine forested area between the communities of Kyle and Allen. Historically, this reservoir was managed as a put-and-take trout fishery, but the water temperature was likely too warm and is best suited for a warm water fishery. The reservoir has a surface area of 15 acres with a maximum depth of 5 m, alkalinity is 200 mg/L (Haines and Sherman 1984). The dam structure was renovated in 2006.

## METHODS

### Data collection

Night time electrofishing was conducted 19 June 2007 with a Smith and Root 5.0 GPP electrofishing system using 200 volts of pulsed DC, 8-10 amps, and a pulse frequency of 120 cycles per second (cps). Electrofishing was conducted in 15 minute transects along the entire reservoir shoreline. Four transects were conducted at Kyle Reservoir and three transects at Yellow Bear 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 collected at each reservoir were water temperature, dissolved oxygen, pH, salinity, alkalinity, and conductivity (Table 1).

Table 1. Kyle and Yellow Bear Reservoir surface water quality parameters.

Lake	Date	Time (military)	Water temp. (°C)	D.O. (mg/L)	Secchi depth (cm)	pH	Salinity (ppt)	Pheno. alkalinity (mg/L)	Total alkalinity (mg/L)	Specific cond. (µS/cm)
Kyle	6/19/2007	0020	24.1	6.2	201	6.7	0.3	0	274	559
Yellow Bear	6/19/2007	0440	22.4	7.8	168	7.8	0.2	34	154	384

### 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, and black crappie. 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.

## RESULTS AND DISCUSSION

### Kyle Reservoir

#### Largemouth bass

Kyle Reservoir has an abundant population with multiple year classes of largemouth bass based on lengths and mean CPUE (Figure 1). The largemouth bass population is dominated by fish < 300 mm, which is desirable to produce large bluegills and decrease the possibility of a stunted panfish population. Fish managers should encourage people fishing to release largemouth bass < 300 mm (12 inches) to continue the balance between bass and panfish populations. Relative weights were excellent (Table 2) and above average compared to other central South Dakota impoundments (Guy and Willis 1990).

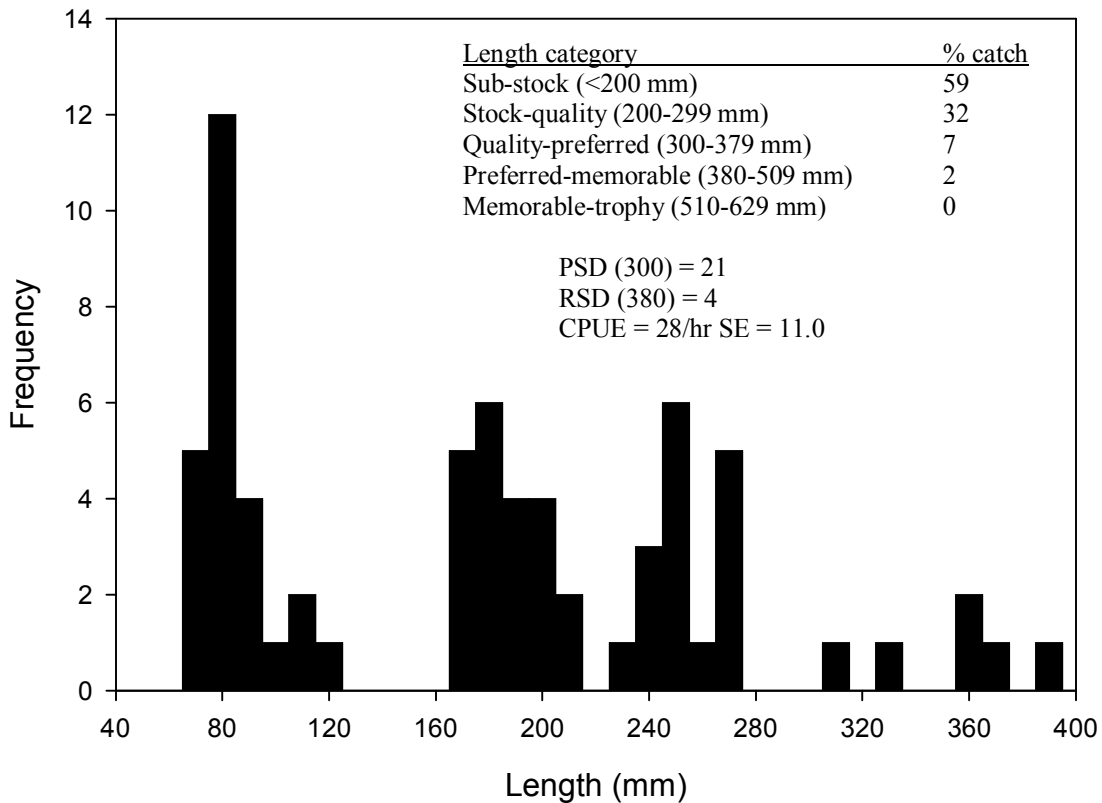


Figure 1. Length frequency distribution (10-mm length groups) for largemouth bass collected by electrofishing in Kyle Reservoir, June 2007. Mean catch per unit effort (CPUE) for largemouth bass  $\geq$  stock length (200 mm).

Table 2. Mean relative weight (Wr) with standard error (SE) in parenthesis, and number (n) weighed by length category for largemouth bass captured by electrofishing in Kyle Reservoir, June 2007.

Length category	n	Mean Wr
Sub-stock (< 200 mm)	26	123 (3.8)
Stock – quality (200 – 299 mm)	22	108 (2.1)
Quality – preferred (300 – 379 mm)	5	137 (7.7)
Preferred – memorable (380 – 509 mm)	1	144
Memorable – trophy (510 – 629 mm)	0	
Trophy ( $\geq$ 630 mm)	0	
<b>Total</b>	<b>54</b>	<b>119 (2.5)</b>

### Bluegill

Kyle Reservoir has excellent fishing opportunities for bluegill. Relative abundance is very high (mean CPUE = 236 fish/hr) with multiple length classes (Figure 2). An abundance of small largemouth bass and northern pike is likely controlling the bluegill population. Bluegill relative weights were normal (Table 3).

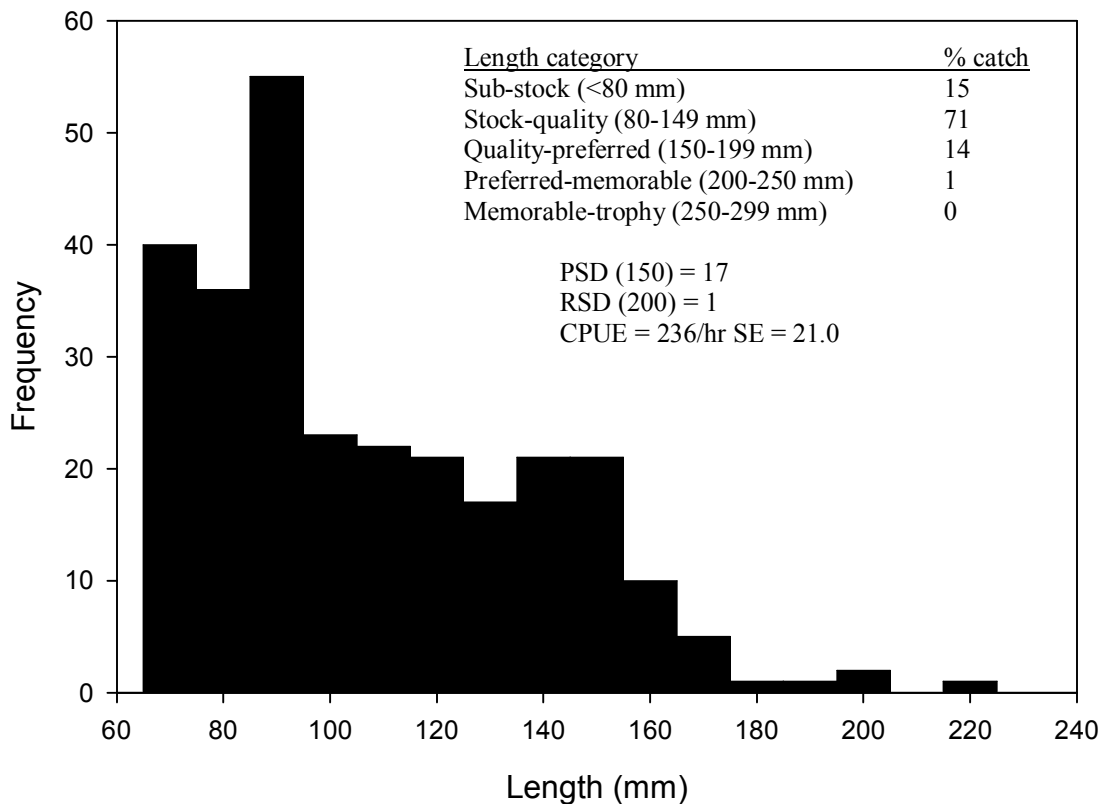


Figure 2. Length frequency distribution (10-mm length groups) for bluegill collected by electrofishing in Kyle Reservoir, June 2007. Mean catch per unit effort (CPUE) for bluegill  $\geq$  stock length (80 mm).

Table 3. Mean relative weight (Wr) with standard error (SE) in parenthesis, and number (n) weighed by length category for bluegill captured by electrofishing in Kyle Reservoir, June 2007.

Length category	n	Mean Wr
Stock – quality (80 – 149 mm)	35	98 (1.4)
Quality – preferred (150 – 199 mm)	17	93 (1.8)
Preferred – memorable (200 – 249 mm)	3	88 (8.6)
Memorable – trophy (250 – 299 mm)	0	
Trophy ( $\geq$ 300 mm)	0	
<b>Total</b>	55	96 (1.2)

Black crappie

The black crappie population in Kyle reservoir is dominated by sub-stock length fish (<130 mm) and mean CPUE was low for stock length fish (Figure 3). However, the black crappie provides an additional fishing opportunity and prey for northern pike and largemouth bass. Relative weights were normal (Table 4).

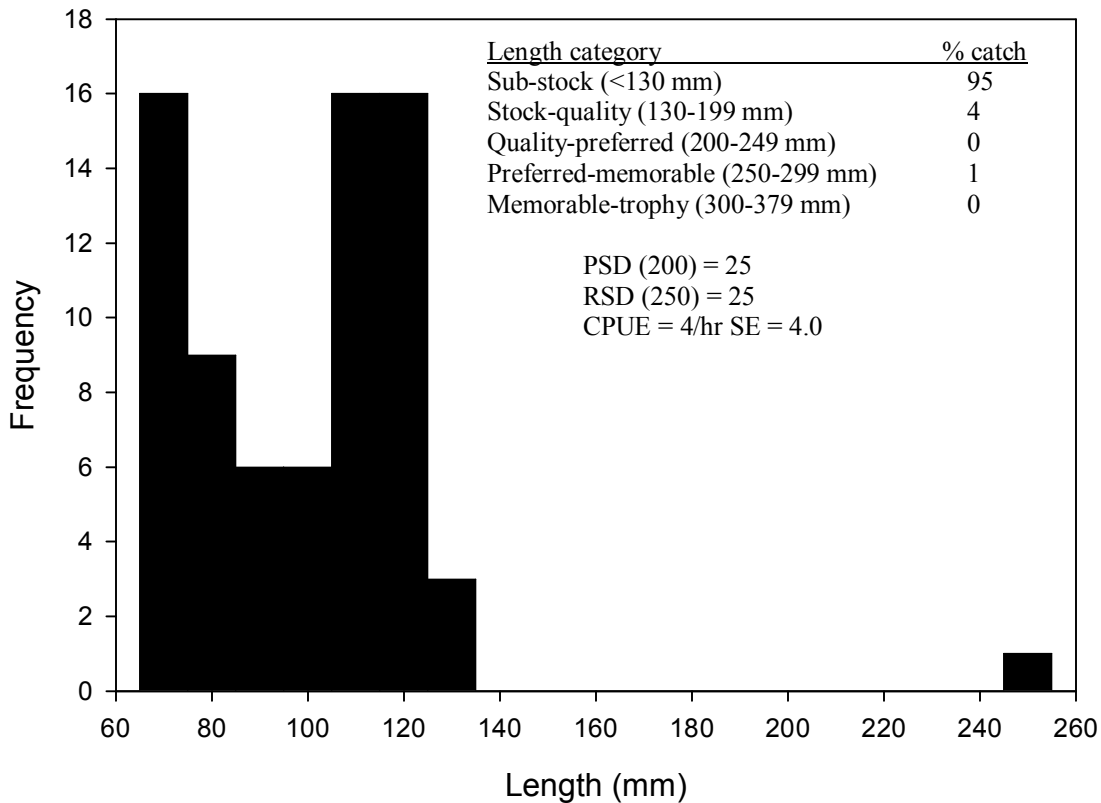


Figure 3. Length frequency distribution (10-mm length groups) for black crappie collected by electrofishing in Kyle Reservoir, June 2007. Mean catch per unit effort (CPUE) for black crappie  $\geq$  stock length (130 mm).

Table 4. Mean relative weight (Wr) with standard error (SE) in parenthesis, and number (n) weighed by length category for black crappie captured by electrofishing in Kyle Reservoir, June 2007.

Length category	n	Mean Wr
Sub-stock (< 130 mm)	25	105 (2.5)
Stock – quality (130 – 199 mm)	3	99 (2.0)
Quality – preferred (200 – 249 mm)	0	
Preferred – memorable (250 – 299 mm)	1	96
Memorable – trophy (300 – 3799 mm)	0	
Trophy ( $\geq$ 380 mm)	0	
<b>Total</b>	29	104 (2.2)

Northern pike

No northern pike were collected while electrofishing; however, there appeared to be an abundance of various lengths with multiple year classes of northern pike in Kyle Reservoir.

## Yellow Bear Reservoir

### Largemouth Bass

Very few largemouth bass were captured while electrofishing. However, there is evidence of natural spawning and recruitment with fish captured in the 130 mm range (Figure 4.) Additional largemouth bass should be stocked into Yellow Bear Reservoir either from a hatchery or translocated from a local reservoir. A large abundance of small (<300 mm) largemouth bass is needed to control the overabundant green sunfish population in this reservoir. No relative weights were calculated due to low sample size.

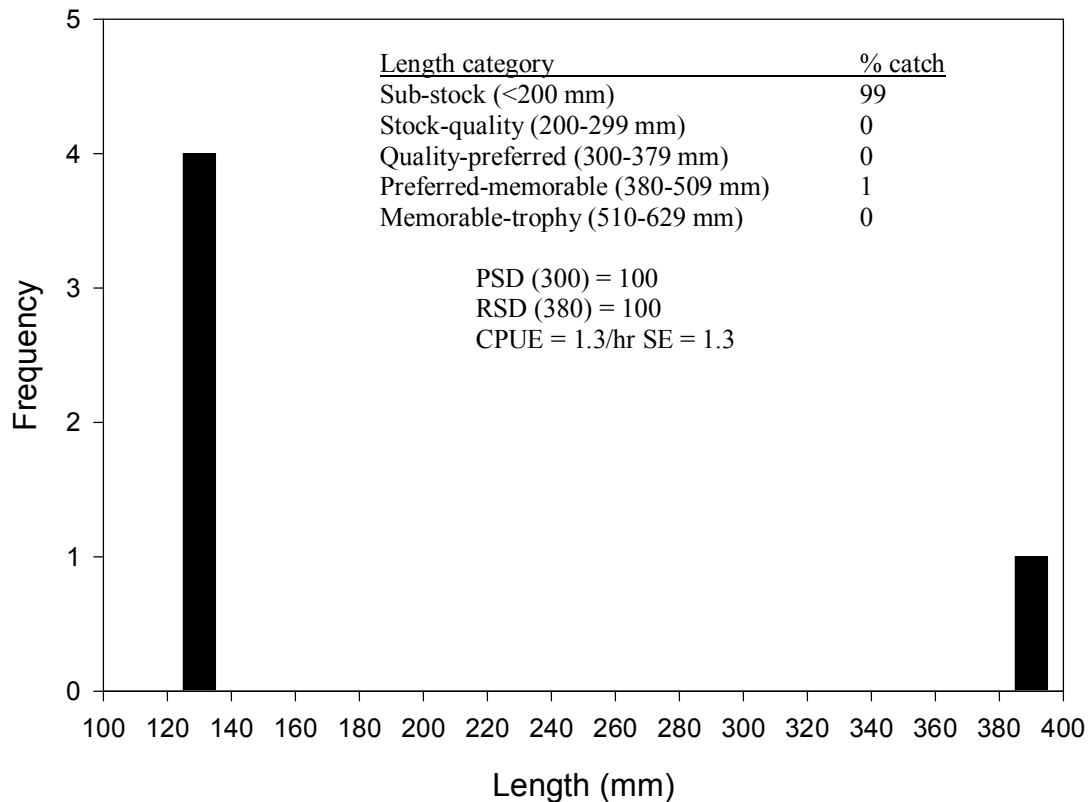


Figure 4. Length frequency distribution (10-mm length groups) for largemouth bass collected by electrofishing in Yellow Bear Reservoir, June 2007. Mean catch per unit effort (CPUE) for largemouth bass  $\geq$  stock length (200 mm).

Bluegill, green sunfish, and bluegill X green sunfish hybrids

The fishery in Yellow Bear Reservoir is dominated by sub-stock length green sunfish with some larger bluegills and hybrids (Figure 5). Largemouth bass need to be stocked to control the overabundant green sunfish population at this time.

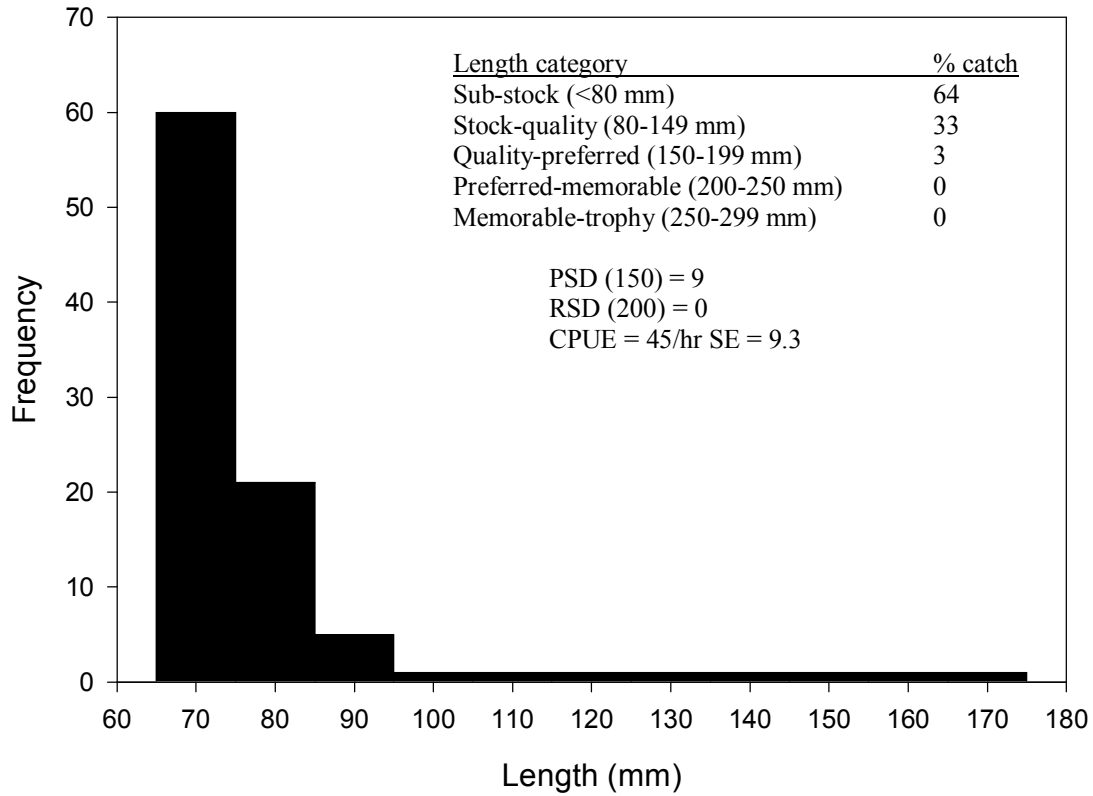


Figure 5. Length frequency distribution (10-mm length groups) for bluegill, green sunfish, and bluegill x green sunfish hybrids collected by electrofishing in Yellow Bear Reservoir, June 2007. Mean catch per unit effort (CPUE) for bluegill/green sunfish  $\geq$  stock length (80 mm).

Black bullhead

One black bullhead (345 mm) was captured while electrofishing in Yellow Bear Reservoir.

Yellow Perch

One young of the year yellow perch was captured while electrofishing in Yellow Bear Reservoir.



## **MANAGEMENT RECOMMENDATIONS**

1. Update 1984 Pine Ridge Fishery Management Plan.
2. Clearly define fish management goals for the Pine Ridge Indian Reservation.
3. Clearly define fish management goals for each reservoir.
4. Set PSD/RSD goals for each fish species in each reservoir based on management goals.
5. Stock 1-2 inch largemouth bass at 150 fish/acre in Yellow Bear Reservoir to establish a recreational fishery and reduce the abundance of small green sunfish.
6. Survey reservoirs every two years with electrofishing, trap nets, and gill nets.
  - White Clay, Denby, and Oglala Reservoirs in 2008.
  - Kyle and Yellow Bear Reservoirs in 2009.
7. Create a put-and-take trout fishery as soon as Wolf Creek Reservoir dam structure is completed.
8. Supplemental stockings of predator and panfish species in Oglala Reservoir when dam structure is completed.

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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).  
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 water's 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 body's 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 body's 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 body's 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.