

2010 Fisheries Surveys on the Pine Ridge Indian Reservation

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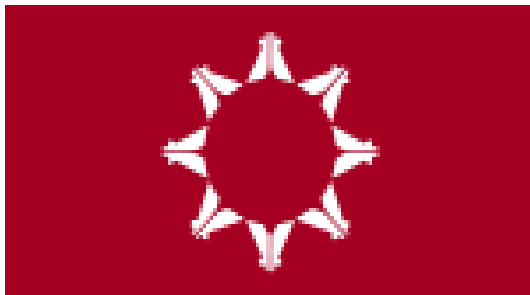


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INTRODUCTION

Pine Ridge Indian 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 Indian 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 native cyprinids and catostomids. A few streams originate 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, the Wolf Creek dam structures is being renovated with limited fishing opportunities.

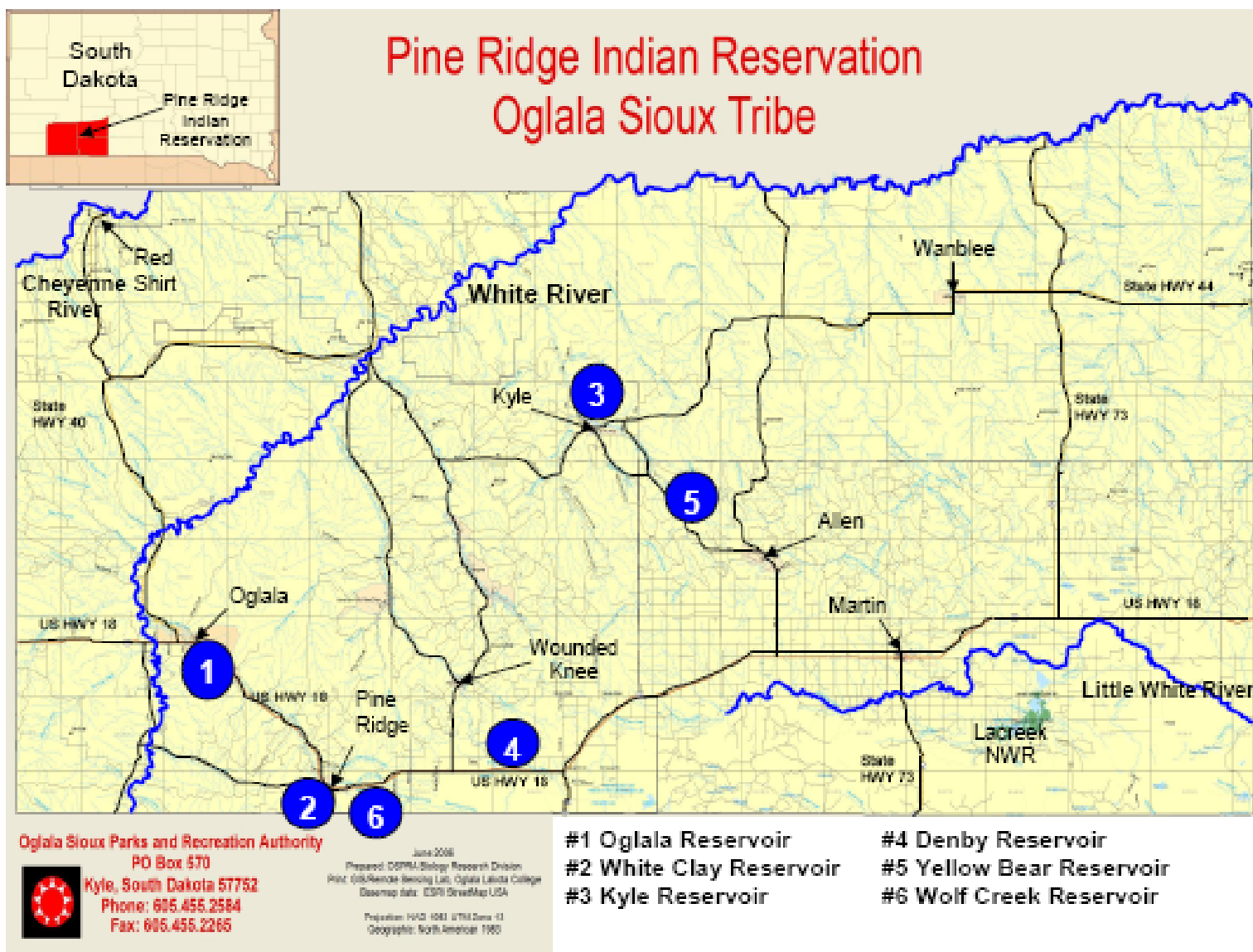


Figure 1. Map of the Pine Ridge Indian Reservation identifying major rivers and reservoirs managed for fishery recreation.

METHODS

Data collection

Night-time electrofishing was conducted on 29 June 2010 with a Smith and Root 5.0 GPP electrofishing system using pulsed DC, 6-7 amps, and a pulse frequency of 60 cycles per second (cps). Electrofishing was conducted in 15 minute transects along the entire reservoir shoreline. Three transects were conducted at White Clay, two on Denby, and two 10-minute transects were conducted on 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, alkalinity, and conductivity (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 | | | | | | | | | | | |
| 29 Jun 2010 | 0145 | 0.3 | 24.0 | 18.4 | | 9.7 | | 34 | 68 | 254 | |
| 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 | | | | | | | | | | | |
| 29 Jun 2010 | 2330 | 0.3 | 24.1 | 12.2 | | 8.9 | | 17 | 153 | 504 | |
| 1 Jul 2008 | 0100 | 0.3 | 23.7 | 7.6 | | | 0.2 | 0 | 188 | 408 | 422 |
| Yellow Bear Reservoir | | | | | | | | | | | |
| 29 Jun 2010 | 0445 | 0.3 | 24.8 | 12.0 | | 9.2 | | 34 | 103 | 344 | |
| 29 Jun 2010 | 0445 | 1.7 | 24.6 | 11.8 | | | | | | | |
| 29 Jun 2010 | 0445 | 3.3 | 19.4 | 0.2 | | | | | | | |
| 29 Jun 2010 | 0445 | 5.0 | 17.8 | 0.1 | | | | | | | |
| 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 size distribution (PSD; Anderson 1976) and relative size distribution (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.

DENBY RESERVOIR

Lake Description

Denby Reservoir is located 32 km east of Pine Ridge and approximately 1.6 km north of U. S. Highway 18 (Figure 1). A 33 m earthen dam across Denby Creek maintains water levels in the impoundment. Denby Creek is the primary water supply, but one small intermittent unnamed creek on the southwest corner contributes during the rainy season. The earthen structure has one box-type fixed crest spillway with a screw gate that allows for complete draw downs. Access to the dam is limited to one dirt road on the northwest side of the lake. The lake is used primarily for recreation. The surrounding water shed is used for livestock grazing, a small housing development lies on the southwest corner.

The reservoir is about 8 ha (20 acres) at full pool with a maximum depth of 5 m and an average depth of 3 m. Conductivity is 300 $\mu\text{S}/\text{cm}$ at 21 °C and alkalinity averages 870 mg/L. Secchi disk averages 3 m with and average pH of 8.

The bottom of Denby Reservoir is primarily fine silt and organic matter with an area of gravel on the southeast corner. Emergent vegetation is primarily cattail *Typha sp.* and softstem bulrush *Scirpus validus* on the southeast corner, submergent vegetation is abundant throughout the reservoir and consists primarily of coontail *Ceratophyllum demersum*. Inundated trees are abundant on the west side. The lake is surrounded by dense vegetation and trees and shows little sign of trampling by livestock.



Figure 2. Denby Reservoir on the Pine Ridge Indian Reservation. White line indicates electrofishing transect conducted during 2010. Aerial image from www.bing.com/maps.

Denby Reservoir fishery management history

The reservoir was chemically renovated and restocked in 1955, 1958, 1964, and 1971 in an attempt to control green sunfish *L. cyanellus* and white sucker. Previous attempts to stock catchable size trout have failed because of competition, predation, and lethal summer water temperatures. Previous to 2008, the last fishery survey was conducted during June 1996 (USFWS 1997). That survey consisted of three, 15-min night-time electrofishing transects, five trap nets, and two gill nets set overnight. Catch data for all fish species collect in 1996 are presented in Table 2.

Table 2. Denby Reservoir mean catch per unit effort (CPUE) for fish \geq stock length, mean relative weights (*Wr*), proportional and relative size distribution (PSD and RSD) data from June 1996 fishery assessment. Mean CPUE calculated as fish/hr for electrofishing and fish/net night for trap and gill nets.

| Species | N | Electrofishing mean CPUE | Trap net mean CPUE | Gill net mean CPUE | Mean <i>Wr</i> | PSD | RSD |
|-----------------|-----|-----------------------------|-----------------------|-----------------------|-------------------|-----|-----|
| Largemouth bass | 13 | 17.3/hr | | | 113 | 91 | 46 |
| Bluegill | 179 | 174.6/hr | 12/net | | 103 | 75 | 18 |
| Northern pike | 8 | | | | | | |
| Yellow perch | 22 | | 1.4/net | 10.5/net | 104 | 41 | 6 |

Results and Discussion

Black bullhead

In 2010, no black bullhead were collected, while in 2008 a 220 mm bullhead was captured during electrofishing. Black bullhead are likely still present in Denby Reservoir, but at such low levels that they were not detected.

Bluegill

The relative abundance of bluegill in Denby Reservoir declined slightly from 2008 to 2010 (Figure 3); however, the size structure has improved since then with more fish being of quality length (≥ 150 mm) (Figure 4). The relative abundance of bluegill in Denby Reservoir has remained above the Fish Management Plans objective of 50 bluegills/hr of electrofishing (Wanner and Ecoffey 2007). The bluegill mean *Wr* remains above average (Table 3), which indicated adequate prey availability in Denby Reservoir.

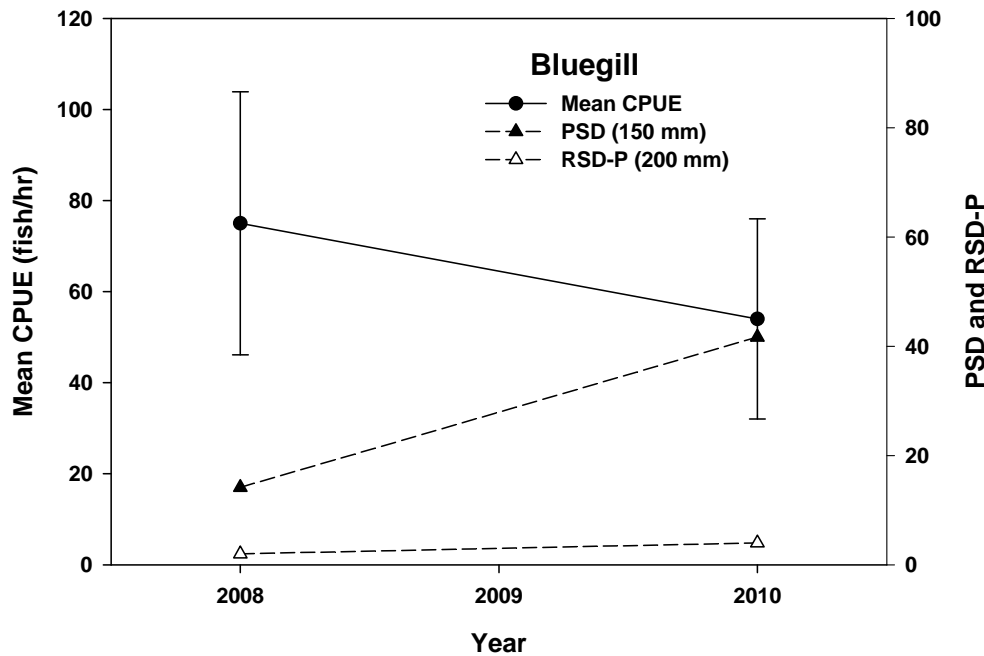


Figure 3. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of bluegills captured by electrofishing during the summer in Denby Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for bluegill \geq stock length (80 mm) only.

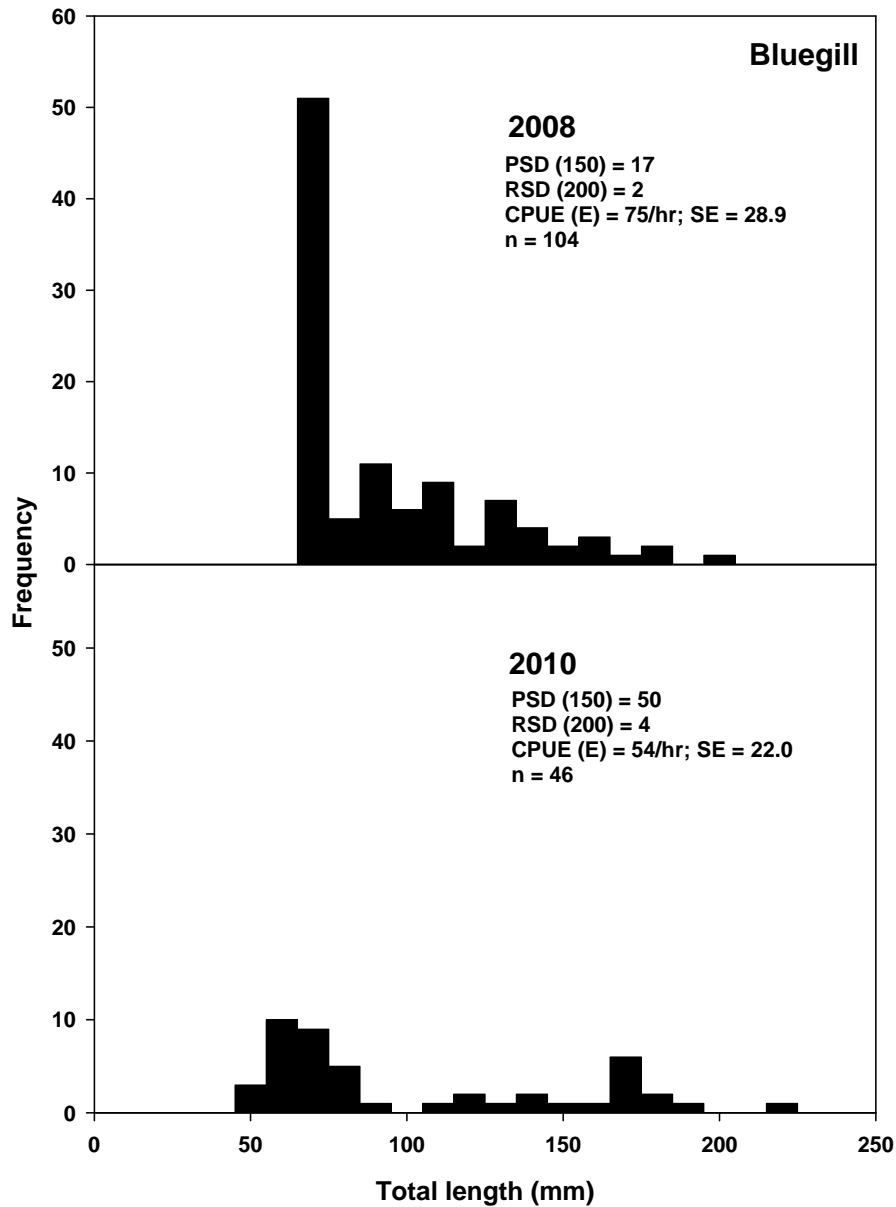


Figure 4. Length frequency distribution (10-mm length groups) for bluegill collected by electrofishing in Denby Reservoir in 2008 and 2010. Mean catch per unit effort (CPUE) calculated for bluegill \geq stock length (80 mm) only.

Table 3. Bluegill mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Denby Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|--|--|
| 2010 | 108 (3) | 110 (3) | 106 (5) | b | b |
| 2008 | 115 (1) | 116 (1) | 112 (4) | 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 .

Golden shiner

Only five golden shiners (85 - 130 mm) were collected in 2010. In 2008, a total of 17 golden shiners were captured during sampling.

Grass pickerel

One grass pickerel (81 mm) was collected during night-time electrofishing in Denby Reservoir in 2010.

Largemouth bass

The relative abundance of largemouth bass declined from 15 fish/hr (SE = 2.7) in 2008 to 2 fish/hr (SE = 2) in 2010. Additionally, only one largemouth bass was stock length (≥ 200 mm) in 2010. The relative abundance of largemouth bass in Denby Reservoir remained below the Fish Management Plan goal of 40 fish/hr and below size structure goals of PSD ranges from 40 to 70 and RSD greater than 10. Even during the 1996 survey, relative abundance of largemouth bass was low (Table 2). Compared to the other reservoirs surveyed on Pine Ridge Indian Reservation in 2010 (White Clays and Yellow Bear reservoirs), the mean W_r for largemouth bass was the highest (Table 4) indicating adequate prey available.

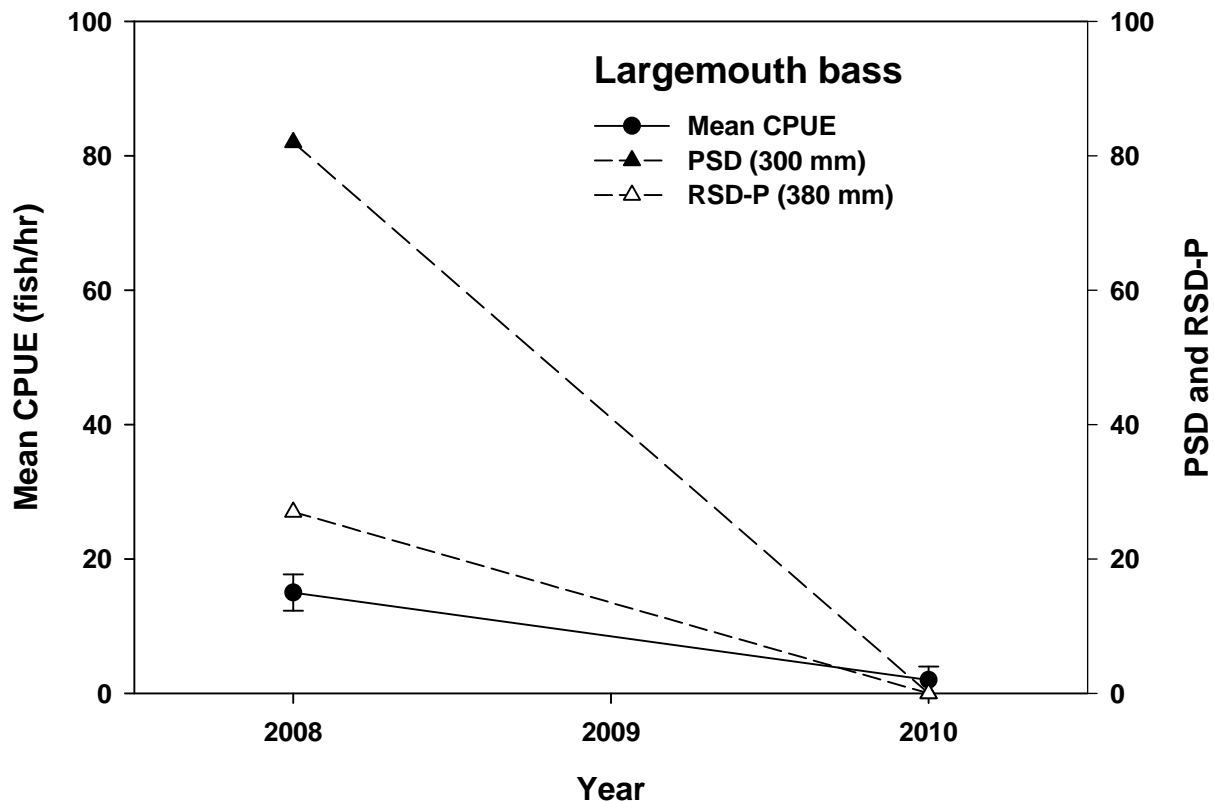


Figure 5. Annual relative abundance (fish/hr with SE bars), proportional size distribution (PSD), and relative size distribution (RSD-P) of largemouth bass captured by electrofishing during the summer in Denby Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for largemouth bass \geq stock length (200 mm) only.

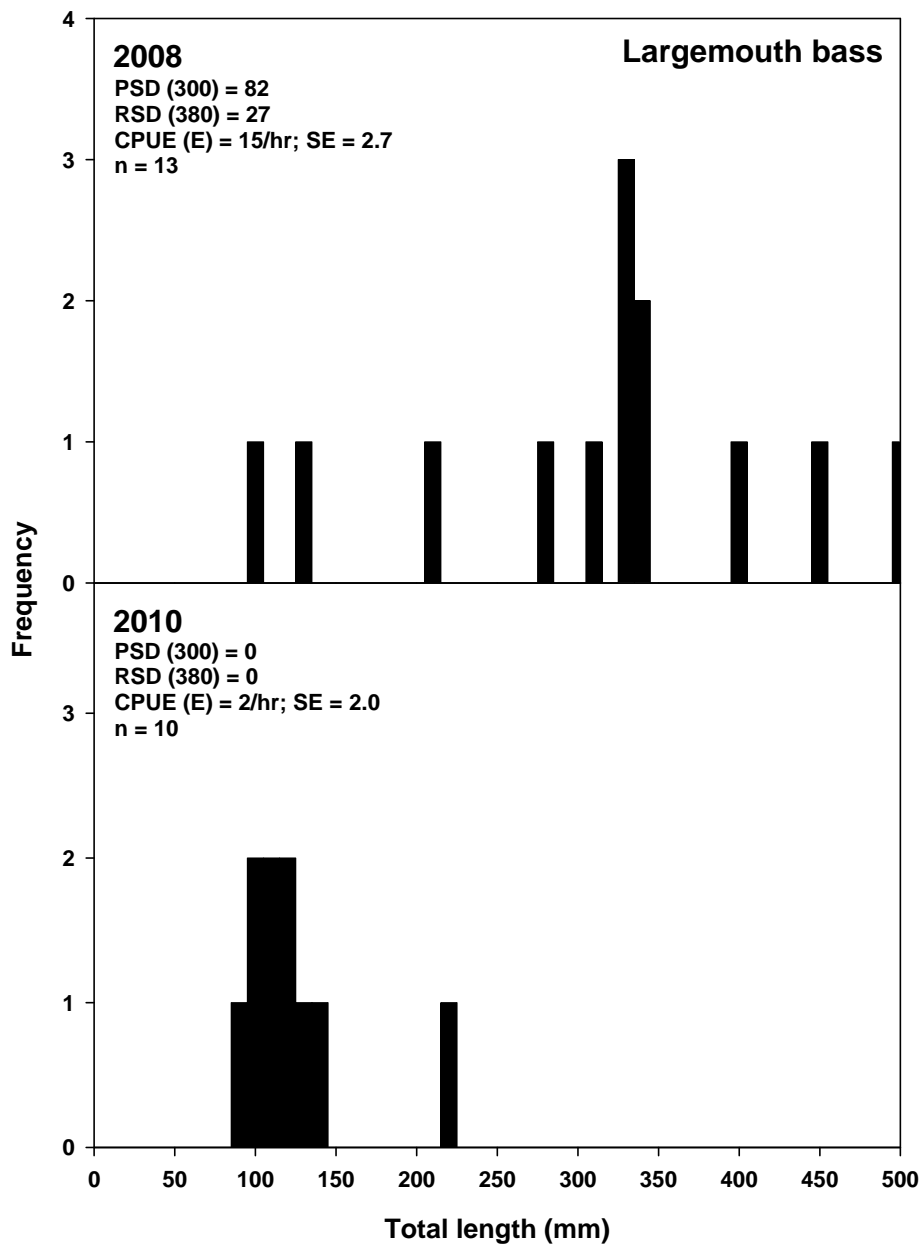


Figure 6. Length frequency distribution for largemouth bass collected by electrofishing in Denby Reservoir in 2008 and 2010.

Table 4. Largemouth bass mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Denby Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|---|--|
| 2010 | 127 (5) | b | b | b | b |
| 2008 | 122 (4) | 102 (12) | 125 (5) | 133 (5) | 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

Northern pike were not collected in 2010, while only a few were observed during sampling. Because of the difficulty of sampling for northern pike with electrofishing gear, only a few were measured during the 2008 sampling with a range in length from 74 to 500 mm indicating multiple year classes and evidence of successful recruitment in Denby Reservoir.

Yellow perch

Yellow perch relative abundance (Figure 7) and size structure (Figure 8) has remained nearly constant from 2008 to 2010. Thousands of YOY yellow perch < 40 mm were observed during electrofishing sampling in 2008 indicating successful spawning in this reservoir. The perch population in Denby Reservoir was dominated by sub-stock and stock to quality length perch (Figure 8). Mean *Wr* substantially declined from 2008 to 2010 (Table 5), which may indicate that prey may become of limiting factor and could limit growth.

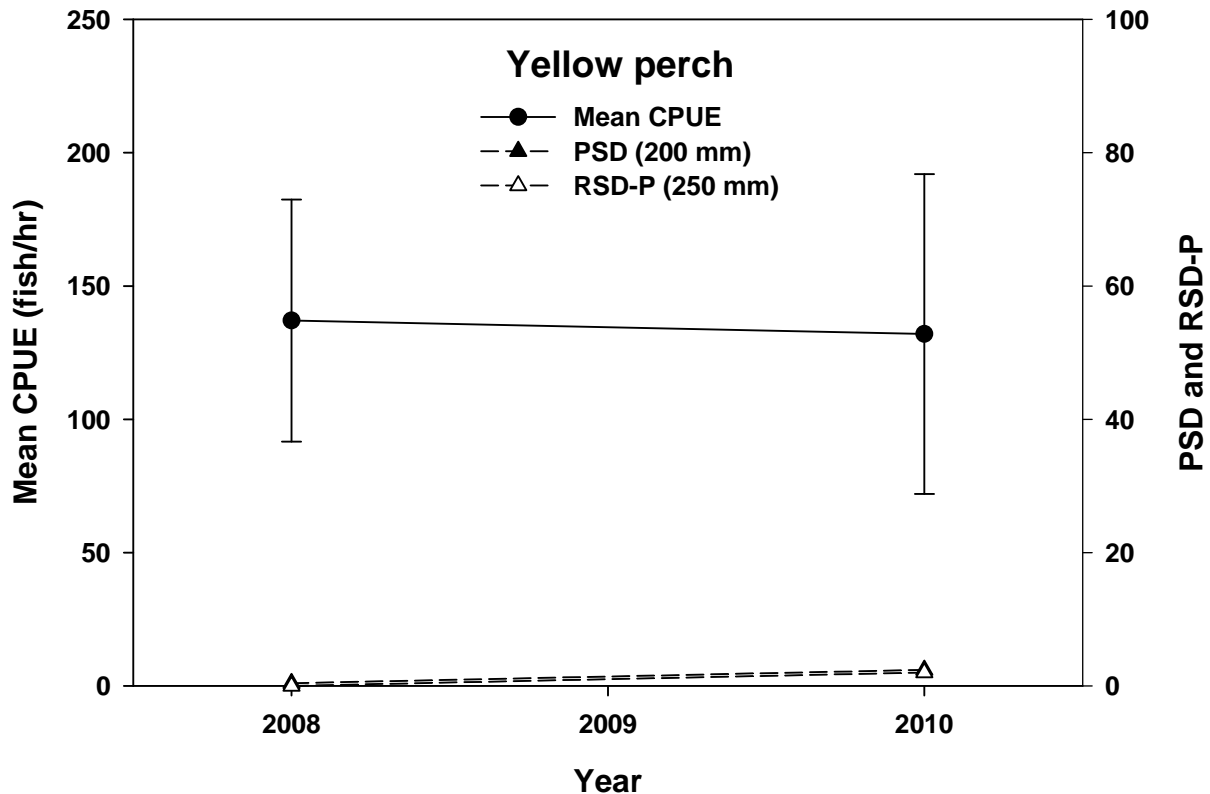


Figure 7. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of yellow perch captured by electrofishing during the summer in Denby Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for yellow perch \geq stock length (130 mm) only.

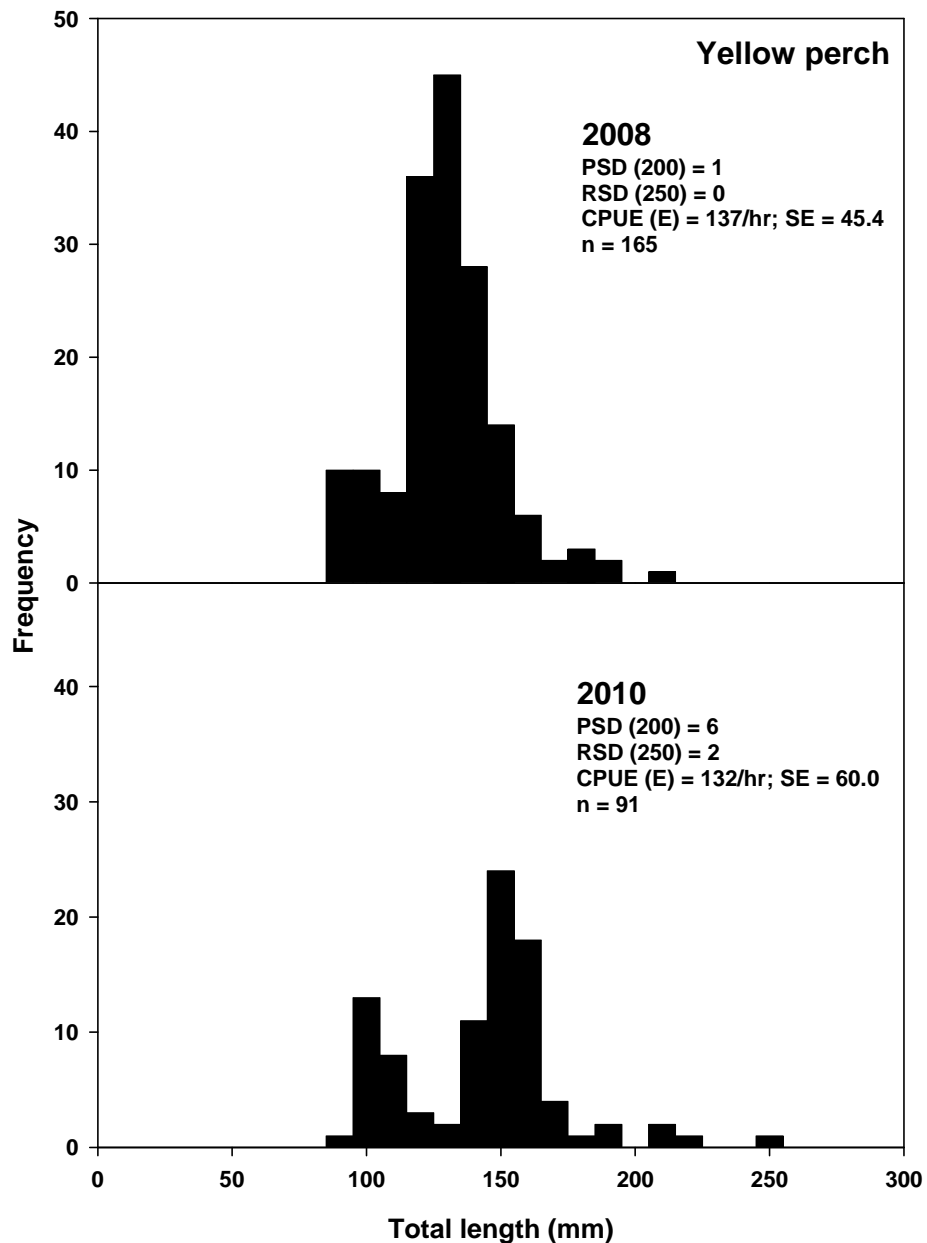


Figure 8. Length frequency distribution for yellow perch (10-mm length groups) collected by electrofishing in Denby Reservoir in July 2008 and 2010.

Table 5. Yellow perch mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in Denby Reservoir from 2008 and 2010.

| 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) |
|------|---------------|---|--|---|--|
| 2010 | 85 (1) | 84 (2) | 79 (7) | b | b |
| 2008 | 100 (1) | 99 (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 .

WHITE CLAY RESERVOIR

Lake Description

White Clay Reservoir is located in a ponderosa pine *Pinus ponderosa* area south of Pine Ridge, South Dakota and north of White Clay, Nebraska. White Clay Creek is the primary water supply, but an unnamed creek on the south west corner of the impoundment provides intermittent run-off during spring snow runoff and heavy summer rains. The dam and emergency spill way are earthen with one screw-gate for drawdown capabilities. The watershed is steep and rocky with scattered grasslands and ponderosa pine draws. The surrounding area is used primarily for livestock grazing and is severely overgrazed in many parts of the watershed. Access is limited to one road in South Dakota from the east and one from the south in Nebraska. The impoundment is relatively close to the cities of Pine Ridge and White Clay and receives the greatest fishing pressure of any of the reservation impoundments.

White Clay Reservoir is about 36 ha (90 acres) with a maximum depth of 7 m and an average depth of 3 m. The banks and shoreline are moderately sloped, which produces a large littoral area. The substrate is sand and clay with scattered outcrops of rock. Submergent vegetation is abundant and includes coontail, milfoil *Myriophyllum* sp., and pondweeds. During summer, submergent vegetation on the south east area and the two small bays on the west become too dense to navigate a boat through. Emergent vegetation includes cattail, sedges, and bulrush which form a narrow band around most of the impoundment.



Figure 9. White Clay Reservoir on the Pine Ridge Indian Reservation. White line indicates electrofishing transect conducted during July 2010. Aerial image from www.bing.com/maps.

White Clay Reservoir fishery management history

The dam has been periodically managed for catchable trout, but competition and warm temperatures make it a poor site. The impoundment was drained and held in a drawn down state for four years to facilitate repairs on the dam during the late 1980's and early 1990's. Surveys, conducted during the first year after being refilled, indicated that bluegill, yellow perch, northern pike, largemouth bass, and white sucker had either survived or colonized the impoundment. During spring 1993, 60 adult largemouth bass were transplanted from Yellow Bear Reservoir to White Clay Reservoir and fingerling largemouth bass were stocked during summer of 1994. Previous to the electrofishing survey conducted in 2008, the last survey was conducted during June 1996 (USFWS 1997). The survey consisted of four, 15-min night-time electrofishing transects, eight trap nets, and three gill nets set overnight. Catch data for all fish species during the 1996 survey is presented in Table 6.

Table 6. White Clay Reservoir mean catch per unit effort (CPUE) for fish \geq stock length, mean relative weights (Wr), proportional and relative size distribution (PSD and RSD) data from June 1996 fishery assessment with 80% confidence intervals in parenthesis. Mean CPUE calculated as fish/hr for electrofishing and fish/net night for trap and gill nets.

| Species | N | Electrofishing mean CPUE | Trap net mean CPUE | Gill net mean CPUE | Mean Wr | PSD | RSD |
|-----------------|----|-----------------------------|-----------------------|-----------------------|--------------|-----|-----|
| Largemouth bass | 7 | 7/hr (5.6) | | | 105 | 86 | 0 |
| Bluegill | 11 | 7/hr | 0.6/net | | 138 | 73 | 55 |
| Northern pike | 23 | | 0.3/net (0.1) | 6/net (3.3) | 96 | 52 | 13 |
| Yellow perch | 49 | | 5.3/net (2.3) | 11.3/net (12.4) | 99 | 50 | 18 |

Results and Discussion

Black bullhead

No black bullheads were collected in 2010. In 2008, black bullhead mean CPUE = 8 fish/hr; SE = 2.3; n = 6. Bullheads are likely still present in White Clay Reservoir, but are at such low abundances that they were not detected in 2010.

Bluegill

There was a substantial decline in relative abundance of bluegill in White Clay Reservoir from a mean CPUE = 220 fish/hr (SE = 23) in 2008 to a mean CPUE = 108 (SE = 58) in 2010 (Figure 10). The relative abundance of bluegill was still well above management goals. The bluegill population continues to be dominated with stock to quality and quality to preferred length fish (Figure 11). Bluegill mean Wr continues to remain high (Table 7), which indicated that an abundance of prey is available for the abundant bluegill in this reservoir.

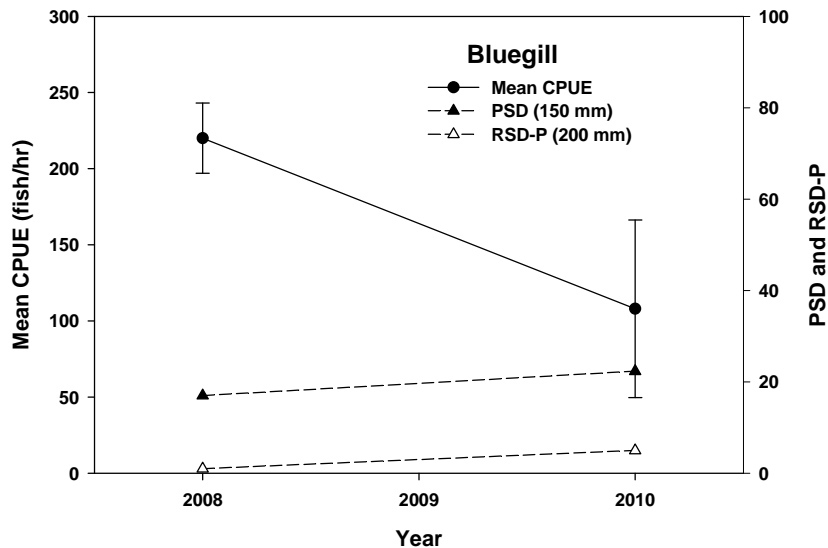


Figure 10. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of bluegills captured by electrofishing during the summer in White Clay Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for bluegill \geq stock length (80 mm) only.

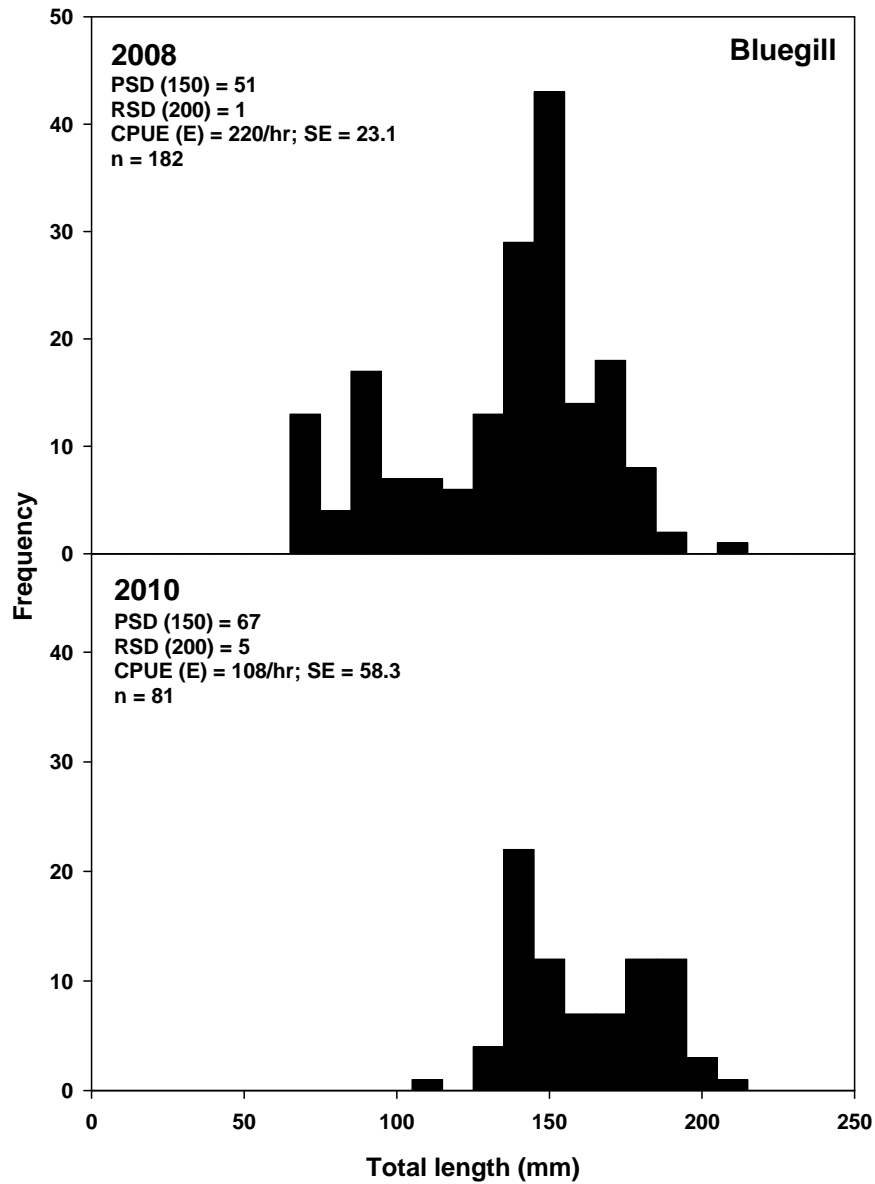


Figure 11. Length frequency distribution for bluegill collected by electrofishing in White Clay Reservoir in 2008 and 2010

Table 7. Bluegill mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in White Clay Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|--|--|
| 2010 | 112 (2) | 114 (5) | 111 (2) | 108 (6) | b |
| 2008 | 105 (2) | 112 (2) | 95 (2) | 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 .

Common carp

One common carp (500 mm) was captured in 2010.

Golden shiner

One golden shiner (115 mm) was collected in 2010. Golden shiner mean CPUE = 24 fish/hr; SE = 4.6; n = 18 in 2008.

Largemouth bass

The relative abundance of stock length largemouth bass substantially declined from a mean CPUE = 121 fish/hr (SE = 2.7) in 2008 to 35 fish/hr (SE = 7) in 2010 (Figure 12). However, the relative abundance of largemouth bass in White Clay Reservoir was at the management goal of 40 fish/hr. The bass population is well balanced with PSD and RSD values that are within management goals with multiple length groups (Figure 13). No changes were observed in the largemouth bass mean Wr from 2008 to 2010 (Table 8), which were high indicating that prey is abundant in this reservoir.

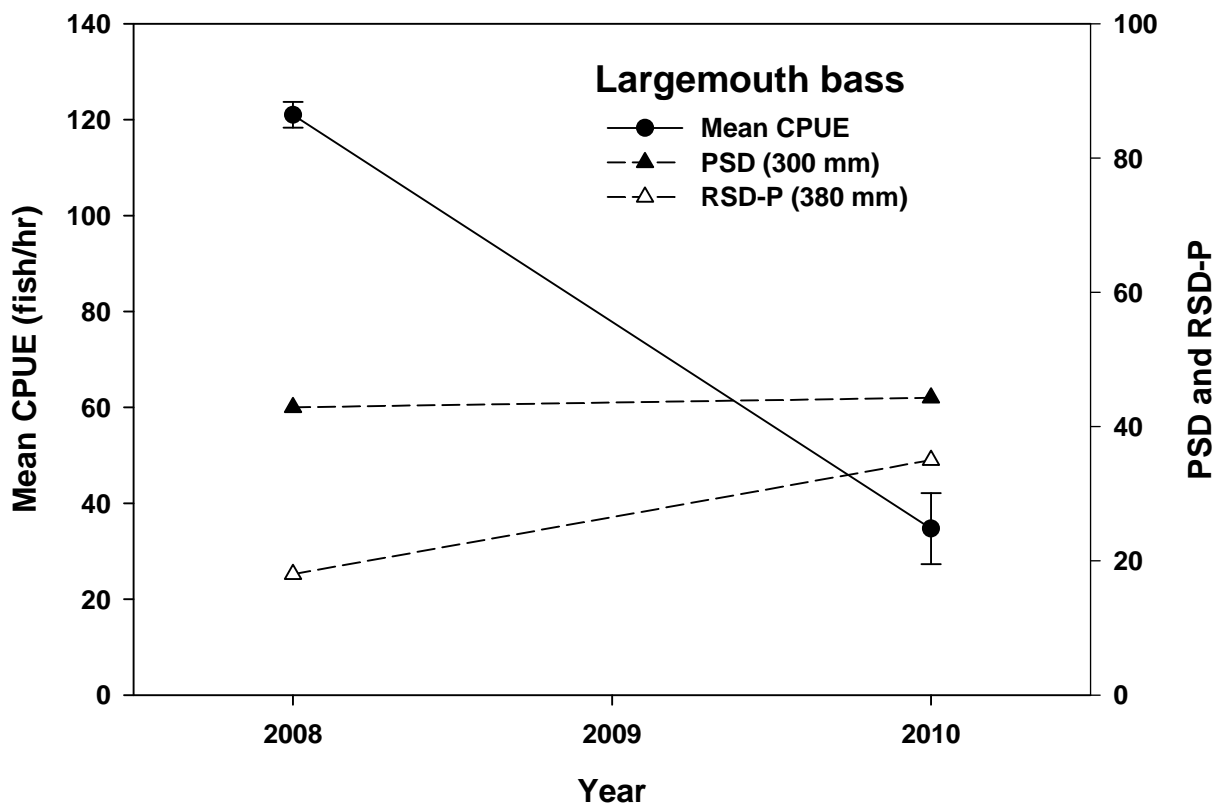


Figure 12. Annual relative abundance (fish/hr with SE bars), proportional size distribution (PSD), and relative size distribution (RSD-P) of largemouth bass captured by electrofishing during the summer in White Clay Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for largemouth bass \geq stock length (200 mm) only.

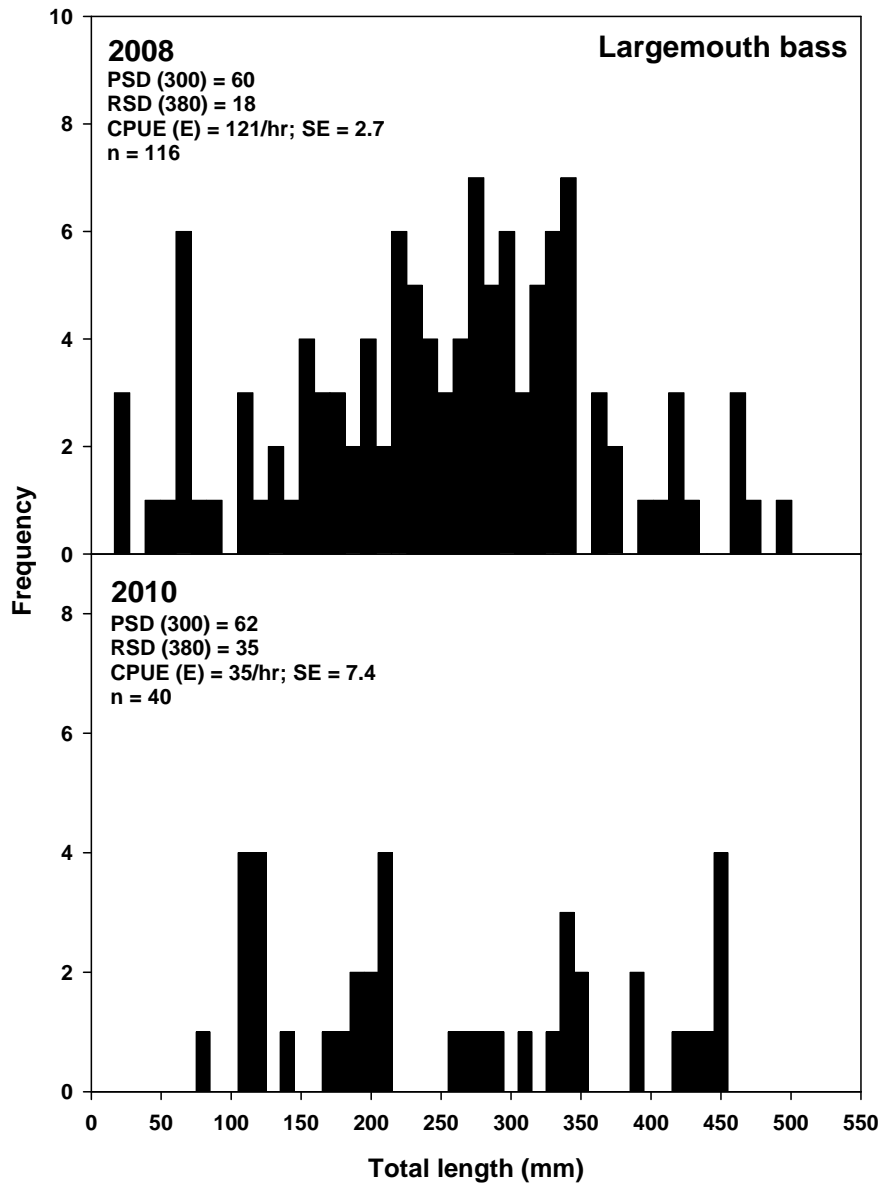


Figure 13. Length frequency distribution for largemouth bass collected by electrofishing in White Clay Reservoir in 2008 and 2010.

Table 8. Largemouth bass mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in White Clay Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|---|--|
| 2010 | 107 (2) | 113 (4) | 108 (4) | 102 (2) | b |
| 2008 | 109 (1) | 107 (2) | 104 (1) | 109 (3) | 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

Unlike the bluegill and largemouth bass populations, yellow perch relative abundance substantially increased from 2008 to 2010 in White Clay Reservoir (Figure 14). Additionally, the size structure improved during that time as well (Figure 15). Yellow perch mean Wr was normal and similar to other reservoirs across Pine Ridge Indian Reservation (Table 8).

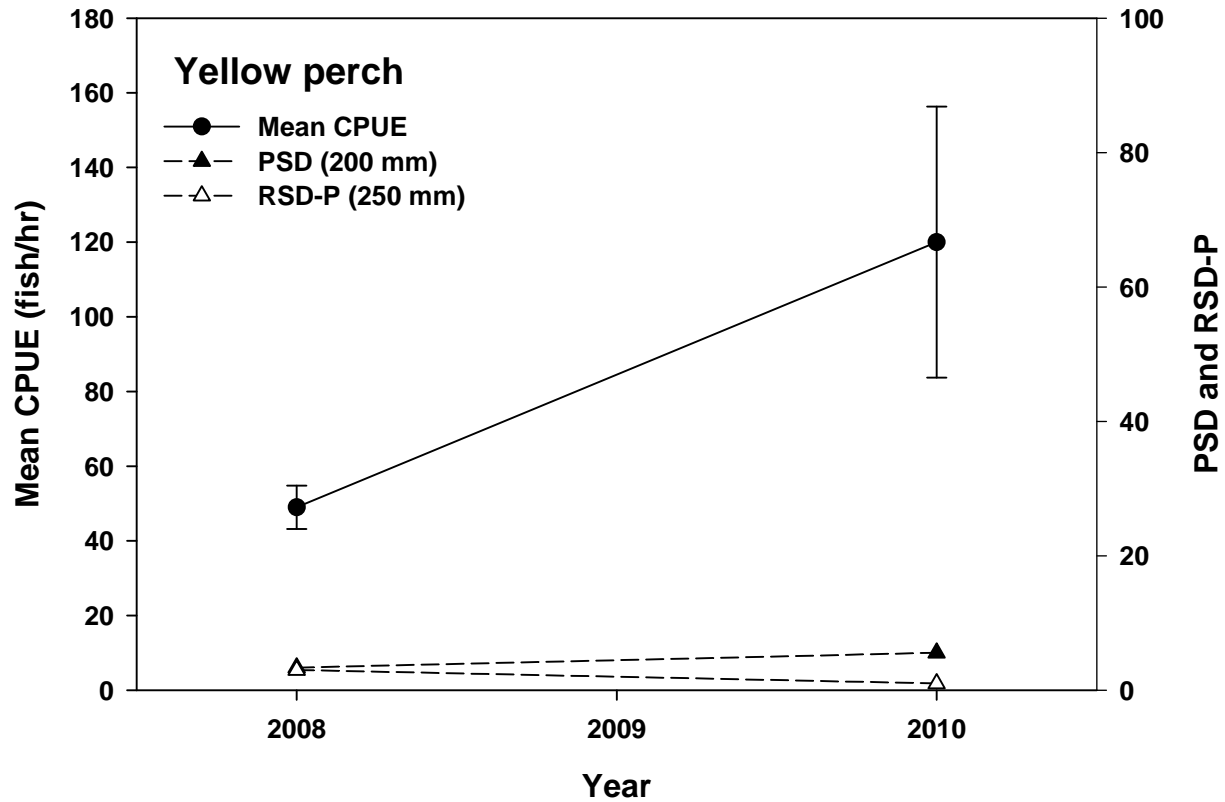


Figure 14. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of yellow perch captured by electrofishing during the summer in White Clay Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for yellow perch \geq stock length (130 mm) only.

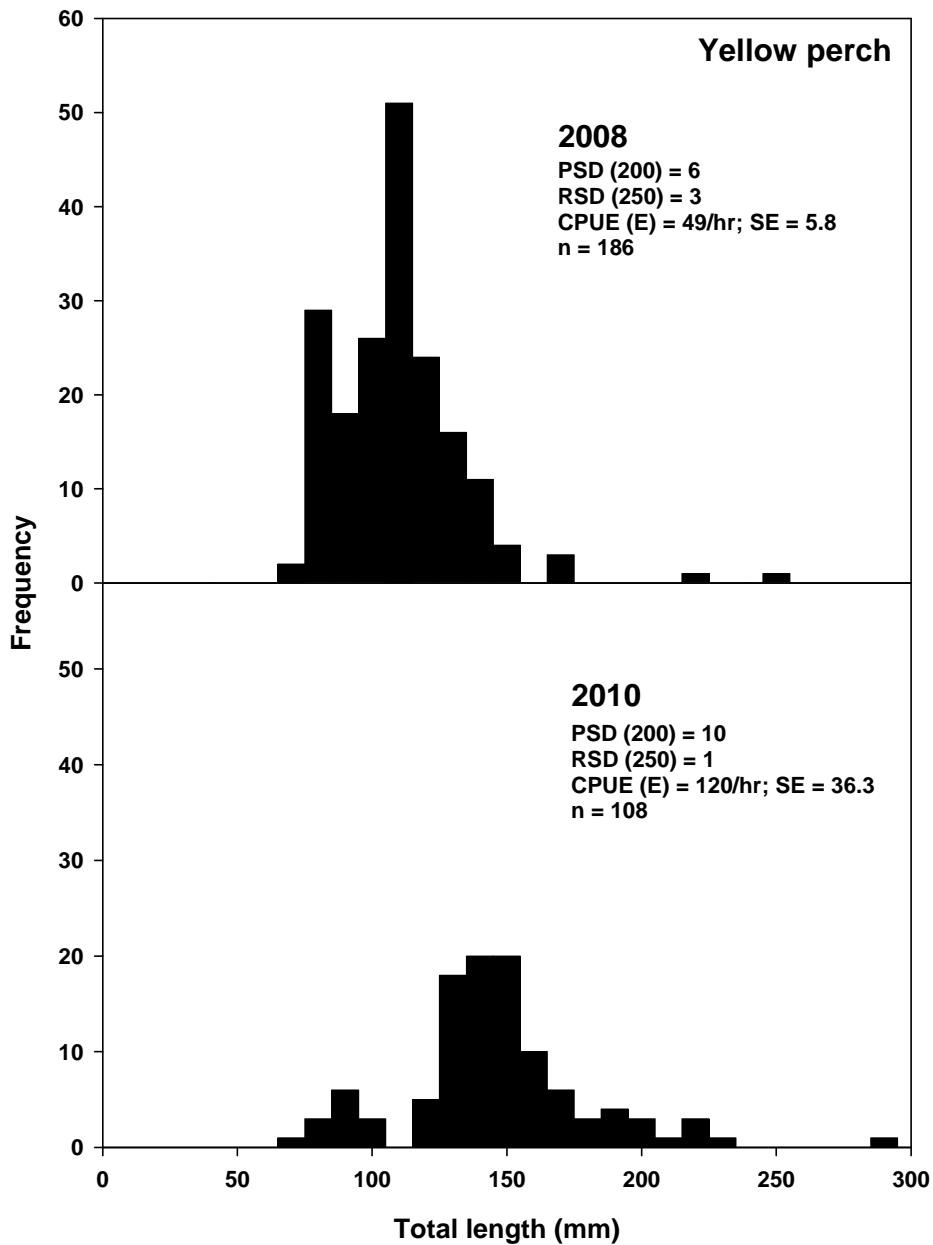


Figure 15. Length frequency distribution for yellow perch collected by electrofishing in White Clay Reservoir in 2008 and 2010.

Table 9. Yellow perch mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in White Clay Reservoir from 2008 and 2010.

| 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) |
|------|---------------|---|--|---|--|
| 2010 | 89 (1) | 90 (2) | 88 (4) | b | b |
| 2008 | 95 (2) | 93 (4) | 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 BEAR RESERVOIR

Lake Description

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 6 ha (15 acres) with a maximum depth of 5 m, alkalinity averages 200 mg/L (Haines and Sherman 1984). The dam structure was renovated in 2006.



Figure 16. Yellow Bear Reservoir on the Pine Ridge Indian Reservation. White line indicates electrofishing transect conducted during July 2010. Aerial image from www.bing.com/maps.

Yellow Bear Reservoir fishery management history

Information regarding the management in Yellow Bear Reservoir was limited. An electrofishing survey was conducted during June 2007 (USFWS 2007). The survey consisted of three, 15-min night-time electrofishing transects. Catch data for all fish species during that survey is presented in Table 10.

Table 10. Yellow Bear Reservoir total number (N) of fish, mean catch per unit effort (CPUE) for fish \geq stock length, mean relative weights (*Wr*), proportional and relative size distribution (PSD and RSD) data from June 2007 fishery assessment. Standard error in parenthesis. Mean CPUE calculated as fish/hr for electrofishing and fish/net night for trap and gill nets.

| Species | N | Electrofishing mean CPUE | Trap net mean CPUE | Gill net mean CPUE | Mean <i>Wr</i> | PSD | RSD |
|-----------------------------|----|-----------------------------|-----------------------|-----------------------|----------------|-----|-----|
| Largemouth bass | 86 | 1.3/hr (1.3) | | | | 100 | 100 |
| Bluegill X green sunfish | 94 | 45/hr (9.3) | | | | 9 | 0 |
| Black bullhead | 1 | 1.3/hr (1.3) | | | | 100 | 100 |
| Yellow perch | 1 | 1.3/hr (1.3) | | | | 0 | 0 |

Results and Discussion

Black bullhead

The relative abundance of stock length (≥ 150 mm) black bullheads substantially increased from a mean CPUE = 17 (SE = 5) in 2008 to a mean CPUE = 63 (SE = 15) in 2010 (Figure 17). Based on the length frequency histogram (Figure 18), this appears to be one year class of fish that are attaining greater lengths. In 2007, only one black bullhead (345 mm) was captured while electrofishing in Yellow Bear Reservoir.

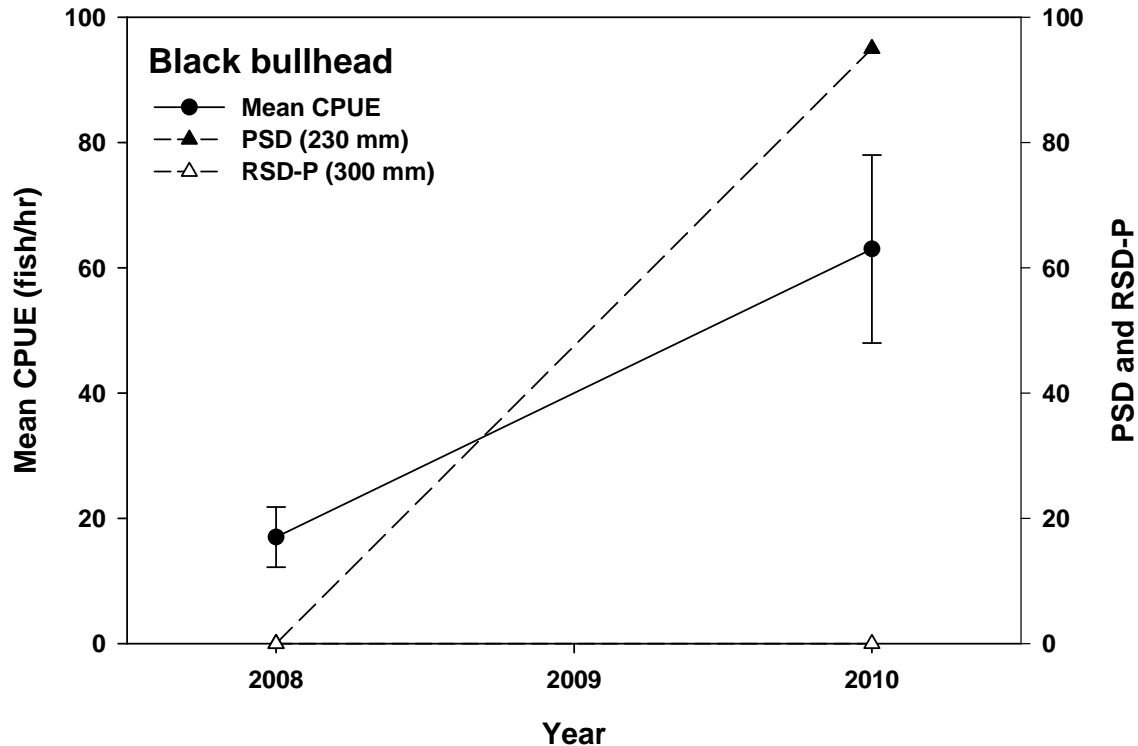


Figure 17. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of black bullheads captured by electrofishing during the summer in Yellow Bear Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for black bullhead \geq stock length (150 mm) only.

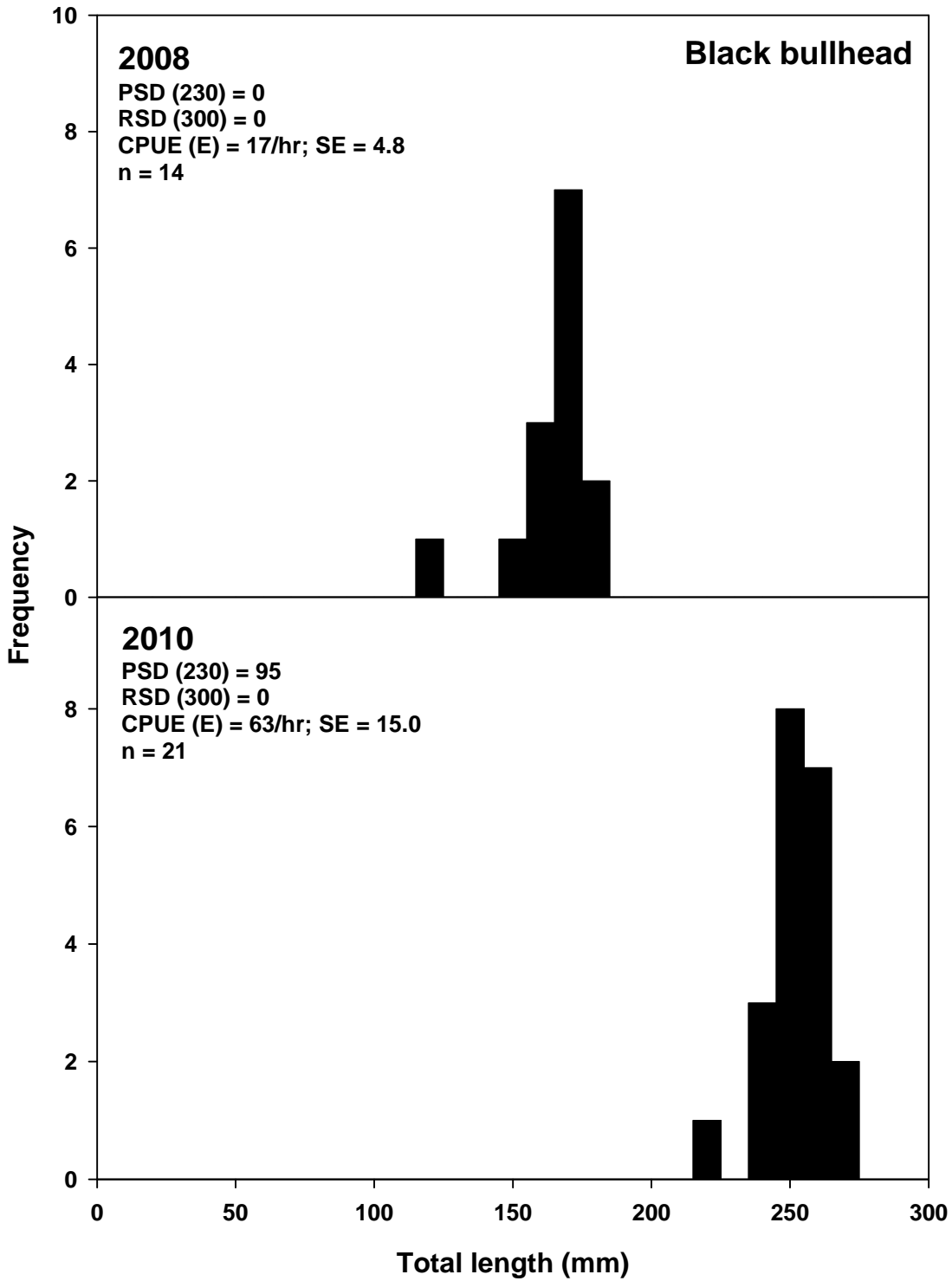


Figure 18. Length frequency distribution for black bullhead collected by electrofishing in Yellow Bear Reservoir in 2008 and 2010.

Black crappie

The relative abundance of black crappie in Yellow Bear Reservoir did increase from 2008 to 2010 (Figure 19). Just like black bullheads in Yellow Bear Reservoir, based on the length frequency histogram (Figure 20), this appears to be one year class of black crappie that are attaining greater lengths. The black crappie mean W_r had a substantial decrease from 2008 to 2010; however, the mean W_r remained above average (Table 11).

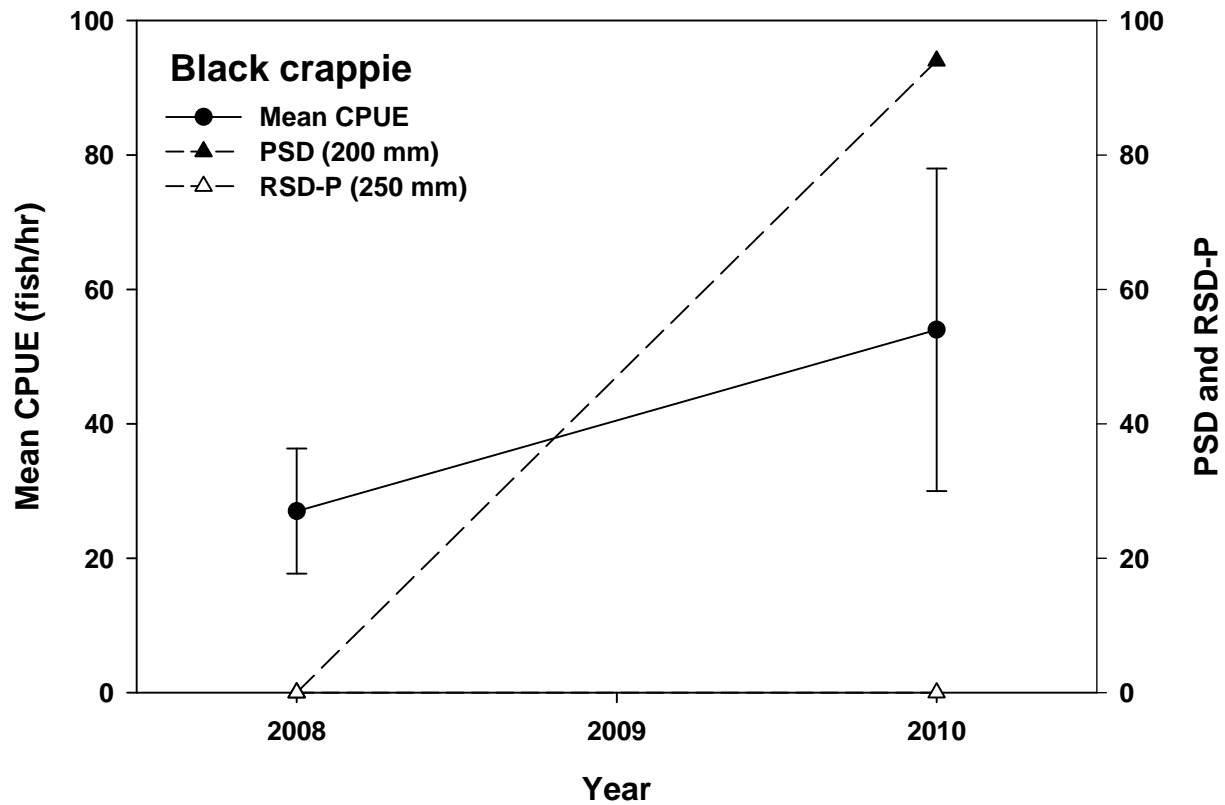


Figure 19. Annual relative abundance (fish/hr), proportional size distribution (PSD), and relative size distribution (RSD-P) of black crappie captured by electrofishing during the summer in Yellow Bear Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for black crappie \geq stock length (130 mm) only.

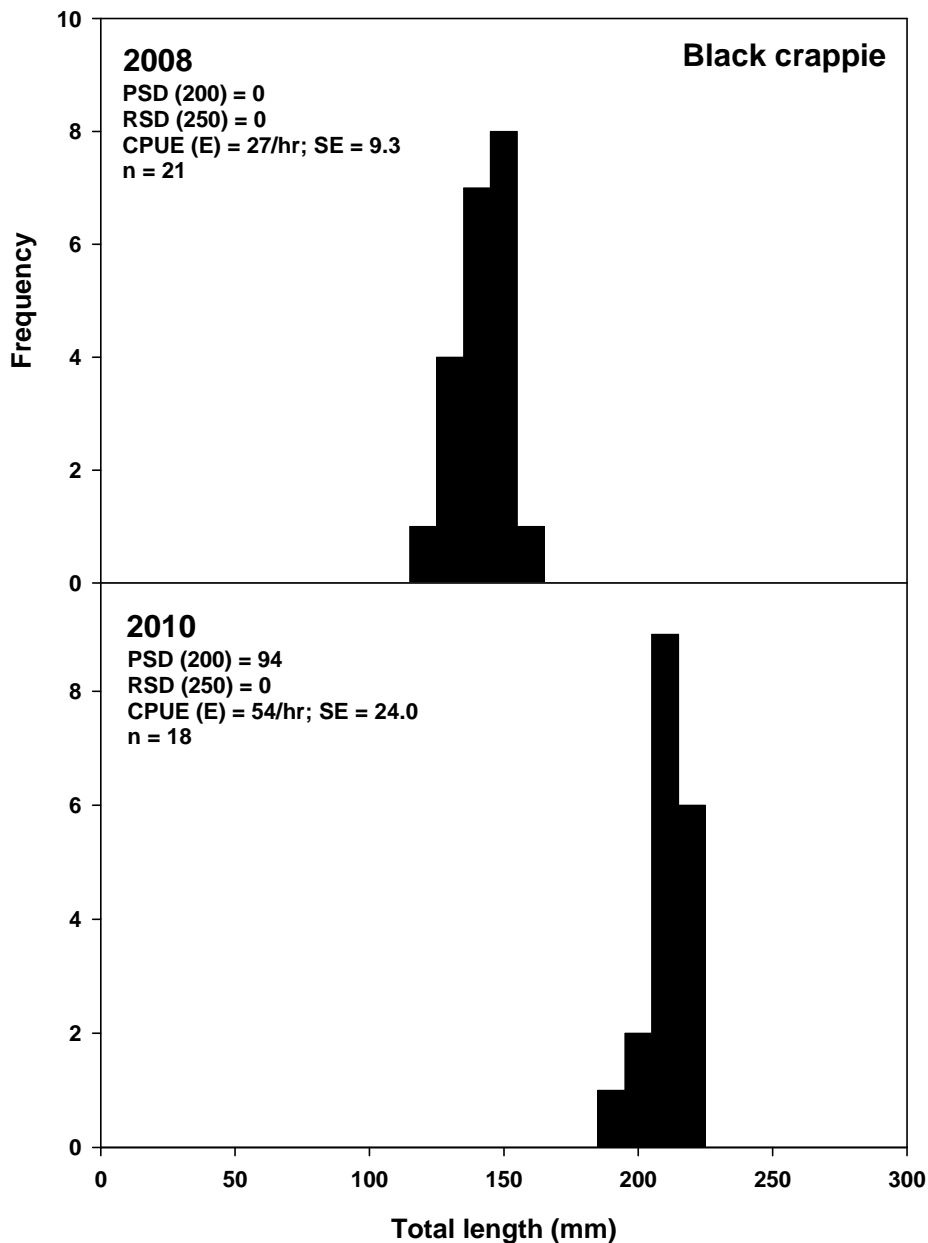


Figure 20. Length frequency distribution for black crappie collected by electrofishing in Yellow Bear Reservoir in 2008 and 2010.

Table 11. Black crappie mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in Yellow Bear Reservoir from 2008 and 2010.

| 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) |
|------|---------------|---|--|---|--|
| 2010 | 100 (1) | b | 100 (1) | b | b |
| 2008 | 122 (3) | 122 (3) | 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

During sampling in 2007, all bluegills and green sunfish were combined while in 2008 and 2010, bluegills were sorted from green sunfish. In 2007, the fishery was dominated by sub-stock length (< 80 mm) green sunfish with only a few large bluegills and hybrids. The combined bluegill/green sunfish mean CPUE = 45 fish/hr (SE = 9) in 2007. The relative abundance of bluegill has substantially increased from a mean CPUE = 37 fish/hr (SE = 9) in 2008 to a mean CPUE = 504 fish/hr (SE = 114) in 2010 (Figure 21). Additionally, the size structure has improved from a PSD = 0 in 2008 to a PSD = 18 in 2010 (Figure 22). Mean Wr remains high indicating abundant availability of prey for bluegill (Table 12).

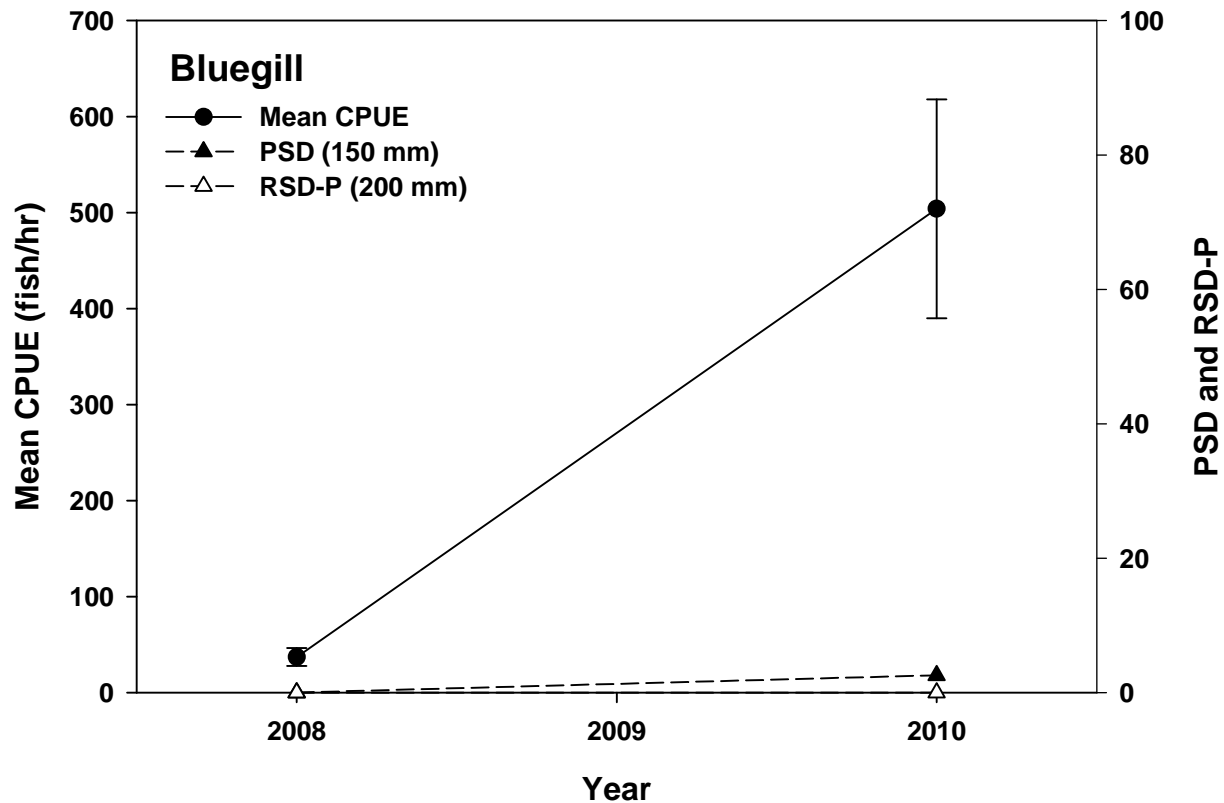


Figure 21. Annual relative abundance (fish/hr), proportional stock density (PSD), and relative stock density (RSD-P) of bluegills captured by electrofishing during the summer in Yellow Bear Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for bluegill \geq stock length (80 mm) only.

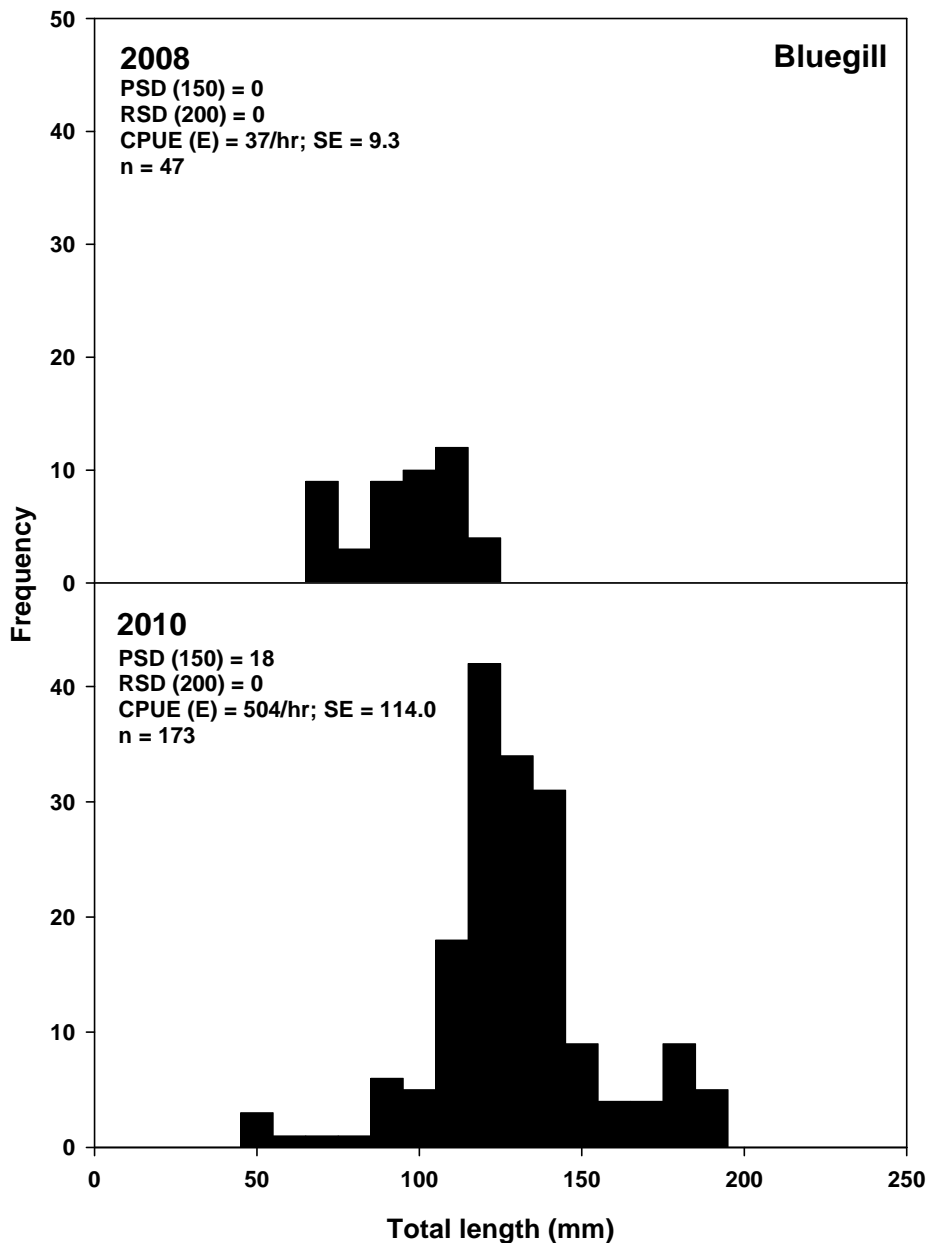


Figure 22. Length frequency distribution (10-mm length groups) for bluegill collected by electrofishing in Yellow Bear Reservoir, 2008 and 2010.

Table 12. Bluegill mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Yellow Bear Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|--|--|
| 2010 | 108 (2) | 117 (2) | 96 (3) | b | b |
| 2008 | 116 (3) | 117 (3) | 109 (4) | 122 (3) | 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 .

Green sunfish

Only three green sunfish (90 - 165 mm) were collected while night-time electrofishing in 2010 after collecting 288 green sunfish in 2008. The stocking of 1,500 fingerling largemouth bass in 2008 has likely had a positive effect as the green sunfish relative abundance has substantially decreased since then.

Largemouth Bass

The relative abundance of stock length largemouth bass continues to be improving from a low of 1.3 fish/hr (SE = 1.3) in 2007, 7 fish/hr (SE = 1.3) in 2008, to 114 fish/hr (SE = 12) in 2010 (Figure 23). A strong year class of sub-stock length fish (Figure 24) was captured in 2008 indicating evidence of natural spawning and recruitment. Additionally, 1,500 fingerling largemouth bass were stocked that same year. A high abundance of small (<300 mm) largemouth bass was needed to control the over-abundant green sunfish population in this reservoir. However, a put-and-take fishery of rainbow trout will likely be affected by an abundant largemouth bass population. Relative weights substantially declined from 2008 to 2010, but were normal for largemouth bass in Yellow Bear Reservoir (Table 13).

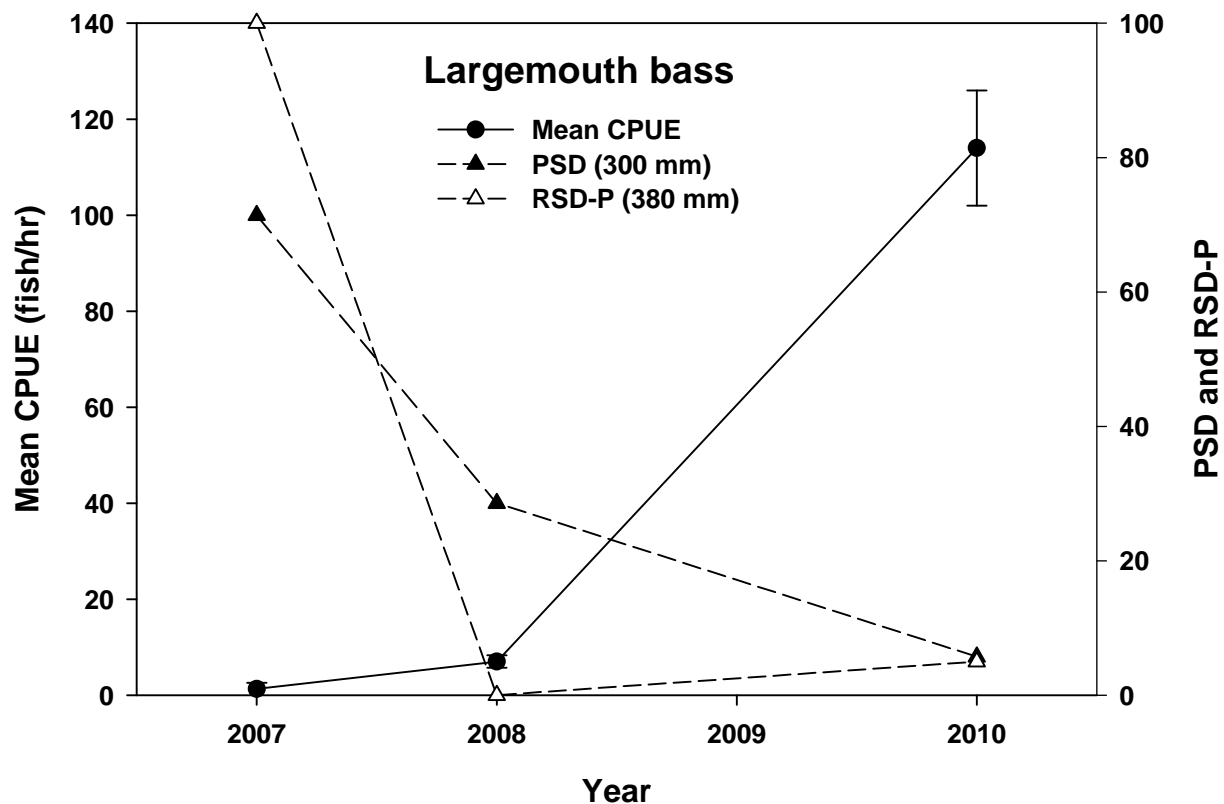


Figure 23. Annual relative abundance (fish/hr with SE bars), proportional size distribution (PSD), and size distribution density (RSD-P) of largemouth bass captured by electrofishing during the summer in Yellow Bear Reservoir from 2008 to 2010. Mean catch per unit effort (CPUE) calculated for largemouth bass \geq stock length (200 mm) only.

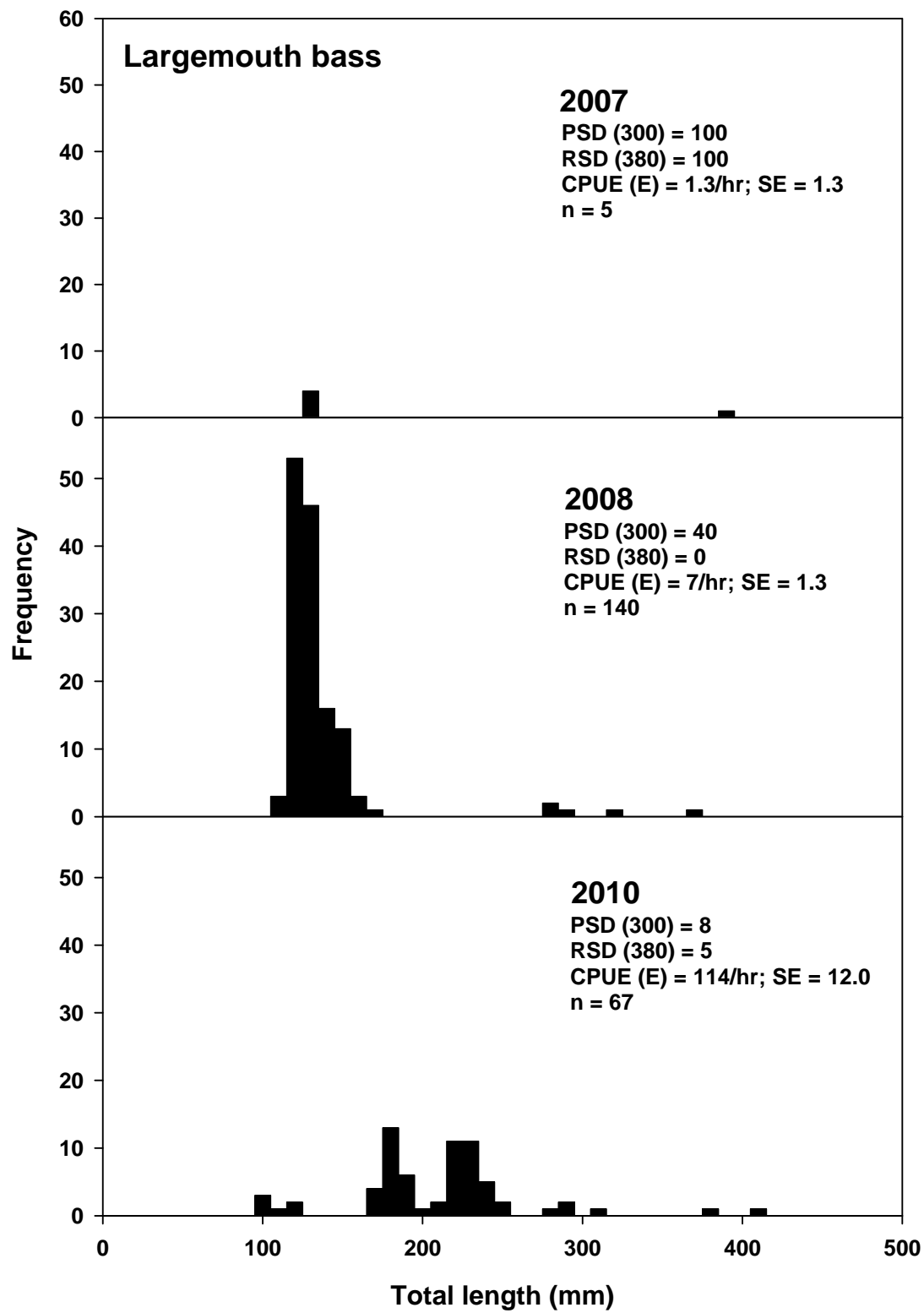


Figure 24. Length frequency distribution (10-mm length groups) for largemouth bass collected by electrofishing in Yellow Bear Reservoir from 2007 to 2010.

Table 13. Largemouth bass mean relative weight (W_r) with standard error (SE) in parenthesis by length category captured by electrofishing in Yellow Bear Reservoir from 2008 to 2010.

| 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) |
|------|---------------|--|---|---|--|
| 2010 | 97 (2) | 95 (1) | b | 117 (24) | b |
| 2008 | 119 (2) | 104 (8) | 130 (22) | 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 .

Rainbow trout

Two rainbow trout (330 and 335 mm) were captured during night-time electrofishing in 2010. Two trout were also collected in July 2008 and were likely from the group of fish stocked in April 2008. They were 256 mm/170 g and 299 mm/230 g. The extremely high abundance of bluegill in Yellow Bear Reservoir in 2010 will likely make rainbow trout more hungry and increase the likelihood of being captured by anglers.

Walleye

Three walleye (321 mm/235 g; 357 mm/340 g; 391 mm/520g) were collected in 2010. The mean $W_r = 76$ (SE = 4) indicated that prey maybe limiting for walleye in Yellow Bear Reservoir.

Two walleye were collected during electrofishing in 2008. They were 184 mm/53 g and 185mm/43 g. These walleye were likely accidentally stocked during a transplant of yellow perch or “bait-bucket” transfer by anglers. An additional predator such walleye, in addition to largemouth bass, will likely decrease the effectiveness of a put-and-take rainbow trout fishery.

Yellow Perch

Four yellow perch (198 - 242 mm) were collected in 2010. Only one young of the year yellow perch was captured while electrofishing in Yellow Bear Reservoir in 2007 and 2008.

Table 14. Yellow perch mean relative weight (W_r) with standard errors (SE) in parenthesis by length category captured by electrofishing in White Clay Reservoir from 2008 and 2010.

| 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) |
|------|---------------|---|--|---|--|
| 2010 | 93 (6) | b | 99 (3) | 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.
 - Oglala and Kyle reservoirs in 2011.
 - Denby, White Clay, and Yellow Bear reservoirs in 2012.
3. Create a bass/bluegill fishery as soon as Wolf Creek Reservoir dam structure is completed. A put-and-take trout fishery will be short-lived and will require continuous stocking.
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 from December 1 to February 28 of each year.
7. Limit Northern Pike populations on all reservation waters except Denby Reservoir and White Clay Reservoir

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 and reduce siltation of the reservoir.
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 experiences 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.
2. Construct fishing docks for handicap/disabled access.
3. Clean up trash along shoreline and below spillway structure to improve outdoor experiences for the public.
4. Improve boat ramp to increase angler access to the reservoir.
5. Improve the existing road into the reservoir to increase angler access.
6. Install signs on highway south of Pine Ridge to inform public on directions to the reservoir.

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 panfish population.
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 | 2010 | | | | | | | | | | | | | | | | | | 6 | 70,000 | FY | |
| | 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 | 2010 | | | | | | | | | | | | | 5 | 1,500 | AD | | | | | | |
| | 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 | | | | | | | | | | | | | | | |

Appendix F. Harvest and length limits on the Pine Ridge Indian Reservation.

| Species | Daily limit | Possession limit | Length limit |
|-----------------|-------------|------------------|--------------------|
| Largemouth bass | 2 | 4 | one over 12 inches |
| Walleye | 2 | 4 | one over 14 inches |
| Crappie | 5 | 10 | |
| Yellow perch | 4 | 8 | |
| Trout | 4 | 8 | |
| Bluegill | 8 | 16 | |
| Northern pike | unlimited | unlimited | |