

2009 Fisheries Surveys on the Lower Brule Indian Reservation

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December 2009



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INTRODUCTION

Lower Brule Indian Reservation encompasses over 220,000 acres in Lyman and Stanley Counties, South Dakota (Figure 1). The eastern and northern boundaries are formed by Lake Sharpe (Missouri River). The landscape consists of rolling hills of mixed-grass prairie and steep drainages near the Missouri River.

The climate consists of warm, dry temperatures during the summer months typically exceeding 100 °F during July and August. Average annual precipitation is 18 inches, which mainly comes in the form of rain from April to June. Winter months are harsh with occasional blizzards and temperatures reaching -30 °F.

The prairie on the Lower Brule Indian Reservation provides excellent habitat for both migratory and resident birds, elk *Cervus canadensis*, buffalo *Bison bison*, pronghorn *Antilocapra americana*, whitetail *Odocoileus virginianus* and mule deer *O. hemionus*, coyote *Canis latrans*, badger *Taxidea taxus*, and prairie dogs *Cynomys ludovicianus*. Low dams have been constructed across the Lower Brule Indian Reservation to collect precious water for livestock including buffalo. These small reservoirs provide additional habitat for birds and mammals while providing recreational fishing opportunities.

Lower Brule has been assisted by the U. S. Fish and Wildlife Service in managing their fishery resources (with varying degrees of assistance) since 1958. During this time, several different management approaches have been tried including netting and electrofishing surveys, stocking fish, and attempting to establish and maintain a cold water trout fishery.

Today, emphasis has been focused on managing reservoirs as sport fisheries for cool and warm water fish including northern pike *Esox lucius*, largemouth bass *Micropterus salmoides*, bluegill *Lepomis macrochirus*, yellow perch *Perca flavescens*, and black crappie *Pomoxis nigromaculatus*. This involves surveys electrofishing gear. The collected data is then used to help Tribal personnel with the establishment of regulations and fish stocking strategies that will allow them to meet their management goals.

METHODS

Data collection

Night time electrofishing was conducted on 4 August with a Smith and Root 5.0 GPP electrofishing system with a maximum output power of 5,000 watts, using pulsed DC, 4-8 amps, and a pulse frequency of 60 pulses per second. Electrofishing was conducted along the entire shoreline in each surveyed 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. Lower Brule Indian Reservation surface water quality parameters collected in September 2008.

Date	Time (military)	Water temperature (°C)	D.O. (mg/L)	Secchi depth (cm)	pH	Phenolphthalein alkalinity (mg/L)	Total alkalinity (mg/L)	Conductivity (µS/cm)
Borrow Pit North								
4 Aug 2009	2230	23	8.8	30	8.8	0	188	510
Borrow Pit South								
4 Aug 2009	2100	25	9.6	56	8.7	0	120	1,489

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 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 stockings across the Lower Brule Indian Reservation are presented in Appendix E.

Borrow Pit North

Lake Description

The Borrow Pit North lies on the northern edge of Lower Brule. Land use in the drainage is primarily livestock grazing. The borrow pit was constructed for road grade work on the Lower Brule HWY 3 north of the city of Lower Brule. Borrow Pit North is primarily used as a water source for livestock. Borrow Pit North was 1.7 surface acres with a maximum depth of 9.5 ft in 2009.

Borrow Pit North fishery management history

Stocking of largemouth bass, bluegill, and yellow perch has occurred in 2007 and 2008.

Results and Discussion

The entire shoreline of the Borrow Pit North was electrofished for a total of 489 seconds.

Bluegill

Three stock length bluegill (155, 119, and 120 mm) were captured (CPUE = 22/hr) with a mean $W_r = 121$ (SE = 6.2).

Yellow perch

In 2009, Borrow Pit North fish population consisted of a high density of yellow perch (258 perch/hr) in the stock-quality and quality-preferred length groups (Figure 2). Relative weights were normal for sub-stock length but generally decreased as yellow perch attained greater lengths (Table 2). This indicates adequate prey availability for the smaller fish, while there may be more competition for larger fish.

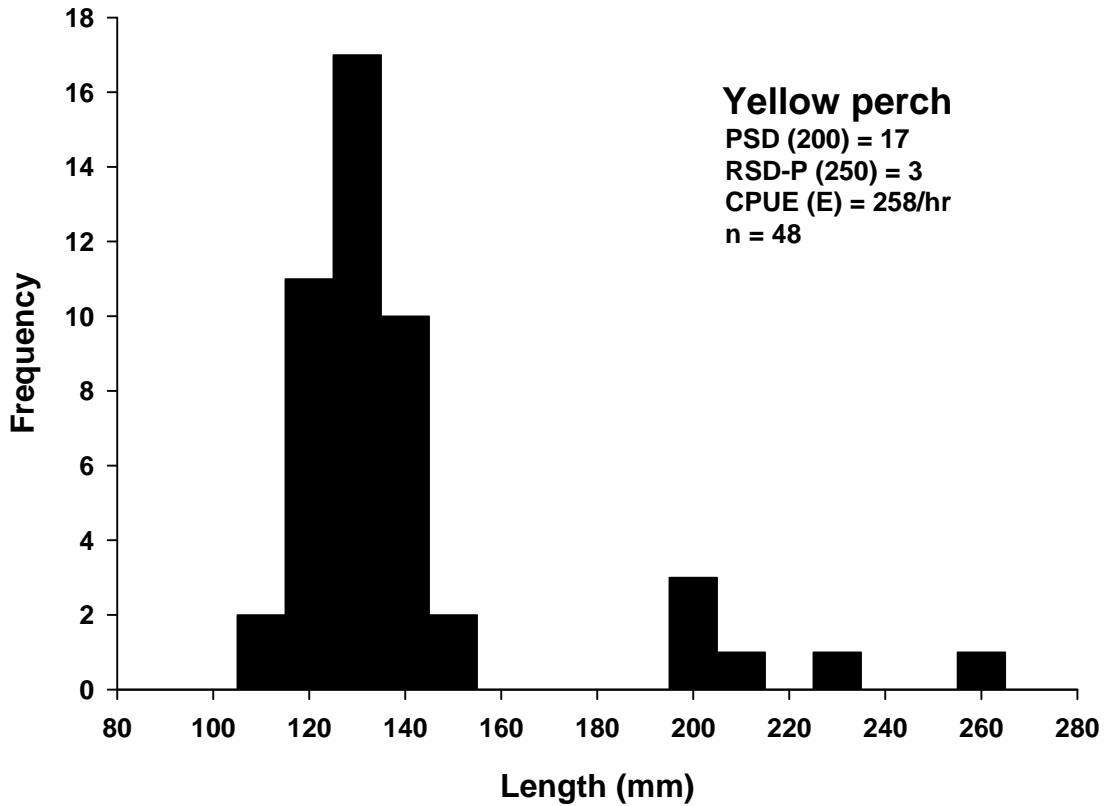


Figure 2. Yellow perch length frequency distribution, proportional stock density (PSD), relative stock density (RSD-P), and mean catch per unit effort (CPUE; fish/hr) calculated for perch \geq stock length (130 mm) captured by electrofishing in the Borrow Pit North in August 2009.

Table 2. Mean relative weight (W_r) with standard error (SE) in parenthesis, and number (n) weighed by length category for yellow perch captured by electrofishing in Borrow Pit North in August 2009.

Length category	n	Mean W_r
Sub-stock (< 130 mm)	7	95 (5.8)
Stock – quality (130 – 199 mm)	12	91 (2.6)
Quality – preferred (200 – 249 mm)	5	86 (2.0)
Preferred – memorable (250 – 299 mm)	1	77
Memorable – trophy (300 – 379 mm)		
Trophy (\geq 380 mm)		
Total	25	91 (2.2)

Largemouth bass

The largemouth bass population in the Borrow Pit North consisted of only sub-stock and stock length fish (Figure 3). Mean Wr was normal indicating adequate prey availability (Table 3).

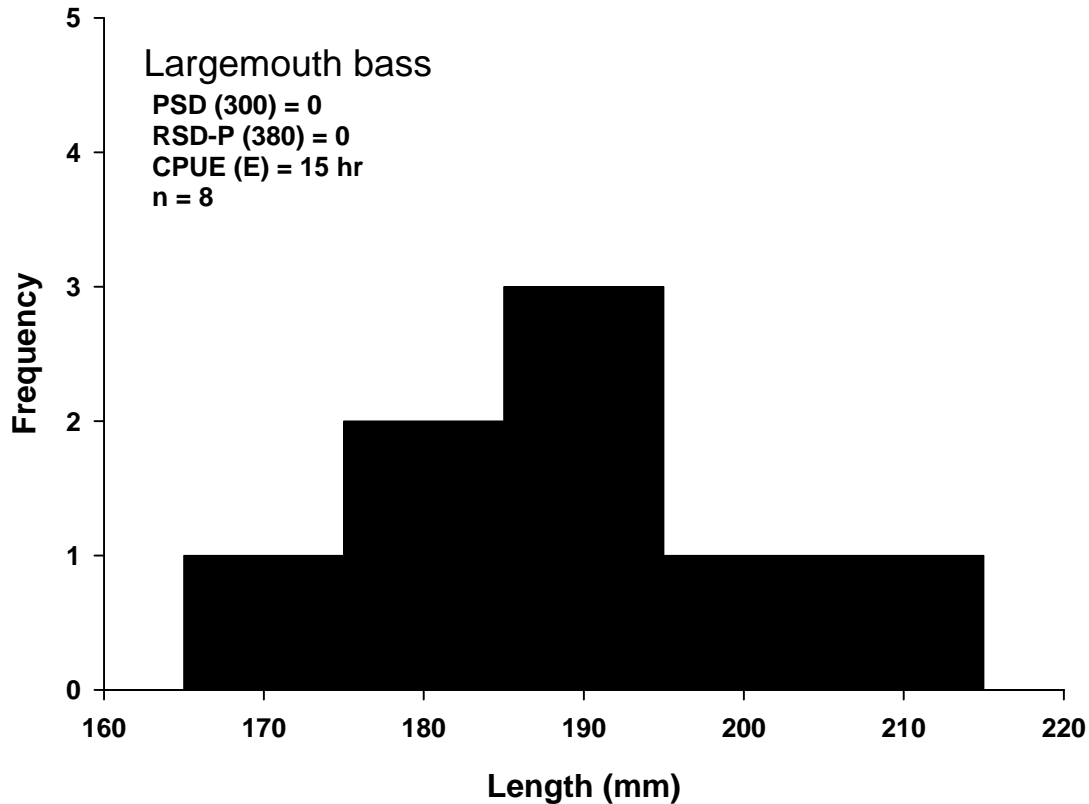


Figure 3. Largemouth bass length frequency distribution, proportional stock density (PSD), relative stock density (RSD-P), and mean catch per unit effort (CPUE; fish/hr) calculated for perch \geq stock length (200 mm) captured by electrofishing in the Borrow Pit North in August 2009.

Table 3. Mean relative weight (Wr) with standard error (SE) in parenthesis, and number (n) weighed by length category for largemouth bass captured by electrofishing in Borrow Pit North in August 2009.

Length category	n	Mean Wr
Sub-stock (< 200 mm)	6	94 (3.1)
Stock – quality (200 – 299 mm)	2	93 (1.7)
Quality – preferred (300 – 379 mm)		
Preferred – memorable (380 – 509 mm)		
Memorable – trophy (510 – 629 mm)		
Trophy (\geq 630 mm)		
Total	8	93 (2.3)

Borrow Pit South

Lake Description

The Borrow Pit South lies on the northern edge of Lower Brule and 400 m south of the Borrow Pit North. Land use in the drainage is primarily livestock grazing. The borrow pit was constructed for road grade work on the Lower Brule HWY 3 north of the city of Lower Brule. Borrow Pit South is primarily used as a water source for livestock. The Borrow Pit South was 1.4 surface acres with a maximum depth of 9.5 ft in 2009.

Borrow Pit South fishery management history

Stocking of largemouth bass, bluegill, and yellow perch has occurred in 2007 and 2008.

Results and Discussion

The entire shoreline of the Borrow Pit South was electrofished for a total of 449 seconds. The overall catch was likely lower than expect due to high conductivity levels (1,489 μ S).

Bluegill

A few bluegill were observed during the electrofishing survey but never captured.

Largemouth bass

Three stock length largemouth bass (226, 243, and 245 mm) were captured (stock length CPUE = 24/hr) for a mean $W_r = 117$ (SE = 4.4).

Yellow perch

Two yellow perch (150 and 174 mm) were captured (stock length CPUE = 16/hr) for a mean $W_r = 87$ (SE = 0.4).

MANAGEMENT RECOMMENDATIONS

Overall Lower Brule Indian Reservation Fisheries Management Recommendations

1. Work with landowners above reservoirs to control silt and nutrients entering the reservoirs.
2. Fence off livestock from reservoirs that are managed as a recreational fishery. This will increase water clarity, which will in turn increase macroinvertebrate production (fish food). Increase submergent and emergent vegetation will provide adequate spawning and rearing habitat. Excluding livestock will additionally eliminate sloughing of the shoreline and reduce siltation to increase the lifespan of the fishery.
3. Continue to survey high priority reservoirs at minimum of every three years with electrofishing.
 - a. Prioritize reservoirs with high public angling use.
 - b. Second priority is for reservoirs where stocking has or continues to occur without surveys completed in the last two years.
 - c. Third priority for other reservoirs with low angling pressure, but with potential as successful fisheries.
 - d. Other reservoirs with low angling pressure.
4. Continue supplemental stockings of predator (largemouth) and panfish (perch or bluegill) species in reservoirs when needed when there is evidence of lack of successful spawning and recruitment or over-harvest.
5. Construct fishing docks for handicap/disabled access along Lake Sharpe and small reservoirs near Lower Brule.
6. Continue to investigate managing small reservoirs with a bass/bluegill, bass/perch, or bass/bluegill and perch combination.
7. Inform tribal members on fish stockings, fishery surveys, and fishing access.
8. Inform non-tribal members on fishing opportunities across the Lower Brule Indian Reservation to increase revenue through license sales.

Borrow Pit North Management Recommendations

1. Continue stocking largemouth bass at 100 fish/acre to improve the size structure of yellow perch and bluegill.
2. Continue stocking bluegill and yellow perch at 500 fish/acre.
3. Fence out livestock from the borrow pit. This will increase water clarity, which will in turn increase macroinvertebrate production (fish food). Increase submergent and emergent vegetation will provide adequate spawning and rearing habitat. Additionally, excluding livestock will eliminate sloughing of the shoreline and reduce siltation to increase the lifespan of the fishery.
4. Improve road to Borrow Pit North for easier public access.

Borrow Pit South Management Recommendations

1. Continue stocking largemouth bass at 100 fish/acre to improve the size structure of yellow perch and bluegill.
2. Continue stocking bluegill and yellow perch at 500 fish/acre.
3. Fence out livestock.

ACKNOWLEDGMENTS

We thank Dalton Grassel and Tory McCualey for assisting with the electrofishing surveys.

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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>Pomoxis 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>
White crappie	WTC	<i>Pomoxis annularis</i>
Yellow perch	YEP	<i>Perca flavescens</i>

Appendix B. Minimum total lengths (TL; mm) of length categories for fish species found on Lower Brule 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 Lower Brule 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 Lower Brule 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	Surface acres	Max Depth (ft)	Year stocked	Largemouth bass			Bluegill			Yellow perch			Black crappie		
				Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size
Amy's Dam II	3		2007							Jun	850	FG			
Badhorse	3	15	2008					1500	FG						
			2007							Jun	700	FG			
Borrow Pit North	1.7	15	2008	Aug	400	FG		500	FG	Jun	500	FG			
			2007									400	FG		
Borrow Pit South	1.4	15	2008	Aug	200	FG		500	FG		500	FG			
			2007							Jun	800	FG			
Cherry Ranch North	10		2004	July	866	FG				Jun	400	FG			
Cleve's North			2008	Aug	280	FG		1000	FG	Jun	800	FG			
Cleve's West			2008	Aug	250	FG		500	FG	Jun	500	FG			
Cobel			2008					500	FG						
Deadman			2008	Aug	200	FG		1000	FG		700	FG			
			1995		300	FG									
Donnie's	4		2008	Aug	280	FG		1000	FG		800	FG			
			2005	Aug	200	FG				Jun	600	FG			

Appendix E Continued.

Reservoir	Surface acres	Max Depth (ft)	Year stocked	Largemouth bass			Bluegill			Yellow perch			Black crappie		
				Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size
Fay's	4		2005	Aug	250	FG				Jun	500	FG			
Fay's Sec 13	3		2005							Jun	500	FG			
Ft. George North			2008	Aug	300	FG		2000	FG						
Ft. George South			2008	Aug	200	FG		2000	FG						
HWY 1806	5	12													
Jandreau			1995		200	FG									
Karlen			2008	Aug	200	FG		1500	FG		1000	FG			
			2005	Aug	300	FG					800	FG			
Kid's Dam 1			1995					130	MX						
Kid's Dam 2			1995					114	MX						
Long Turkey			2008	Aug	500	FG		2000	FG	Jun	1800	FG			
Madsen North			2008					1000	FG						
Madsen South			2008					1000	FG						
Marty's	3		2008					1500	FG						
			2005	Aug	200	FG				Jun	400	FG			
Reuer	8	14	2008	Aug	300	FG		5500	FG	Jun	1500	FG			
			2005	Aug	200	FG				Jun	900	FG			
			2004	Jul	866	FG		2000	FG				Aug	2000	FG

Appendix E Continued.

Reservoir	Surface acres	Max Depth (ft)	Year stocked	Largemouth bass			Bluegill			Yellow perch			Black crappie		
				Month	N	Size	Month	N	Size	Month	N	Size	Month	N	Size
Right tailrace	8	14	2008		800	FG		2000	FG		250	FG	Aug	2000	FG
			2007								600	FG			
			2005		300	FG					600	FG			
			2004		800	FG		2000	FG						2000
RU 11 North			2008					500	FG						
RU 11 South			2008					2000	FG						
Rubble	4	10	2008	Aug	600			5000	FG		2000	FG			
			2007							Jun	1100	FG			
Sovoda			2008	Aug	300	FG		2000	FG		1300	FG			
Square Butte	4		2005							Jun	700	FG			
Steve's			2008	Aug	200	FG									
Williams			2008					2000	FG						
Williams SW			2008					500	FG						