South Red Iron Lake

Site Description

Location

Water designation number (WDN)	48-0002-00
Legal description	T126N-R53W-Sec.20,28,29,32
County (ies)	Marshall
Location from nearest town	Five miles east of Lake City, SD

Survey Dates and Netting Information

Dates of current survey	June 13 – 15, 2006
Dates of previous survey	June 15 – 17, 2004
Gill net sets (n)	6
Frame net sets (n)	18

Morphometry (Figure 1)

Watershed area (acres)	19,200
Surface area (acres)	600
Maximum depth (ft)	14
Mean depth (ft)	8

Ownership and Public Access

South Red Iron Lake is a meandered lake managed by the SDGFP. A single public access site is located on the southwestern shoreline and is maintained by the SDGFP (Figure 1). South Red Iron Lake is owned by the State of South Dakota and lands adjacent to the lake are generally under state, Bureau of Indian Affairs, and private ownership.

Watershed and Land Use

The South Red Iron Lake watershed is comprised of a mix of pasture or grassland, cropland and woodlands.

Water Level and Water Quality

Water levels remain at the historic average. The trophic state of South Red Iron Lake is eutrophic.

Aquatic Vegetation and Exotics

Emergent and submergent vegetation are abundant throughout South Red Iron Lake. No exotic vegetation or wildlife was reported during this survey.

Fish Management Information

Primary species	northern pike, walleye, yellow perch
Other species	black bullhead, black crappie, bluegill, common carp, fathead minnow, largemouth bass, smallmouth bass, white sucker
Management classification	warm-water permanent
Fish Consumption Advisories	None

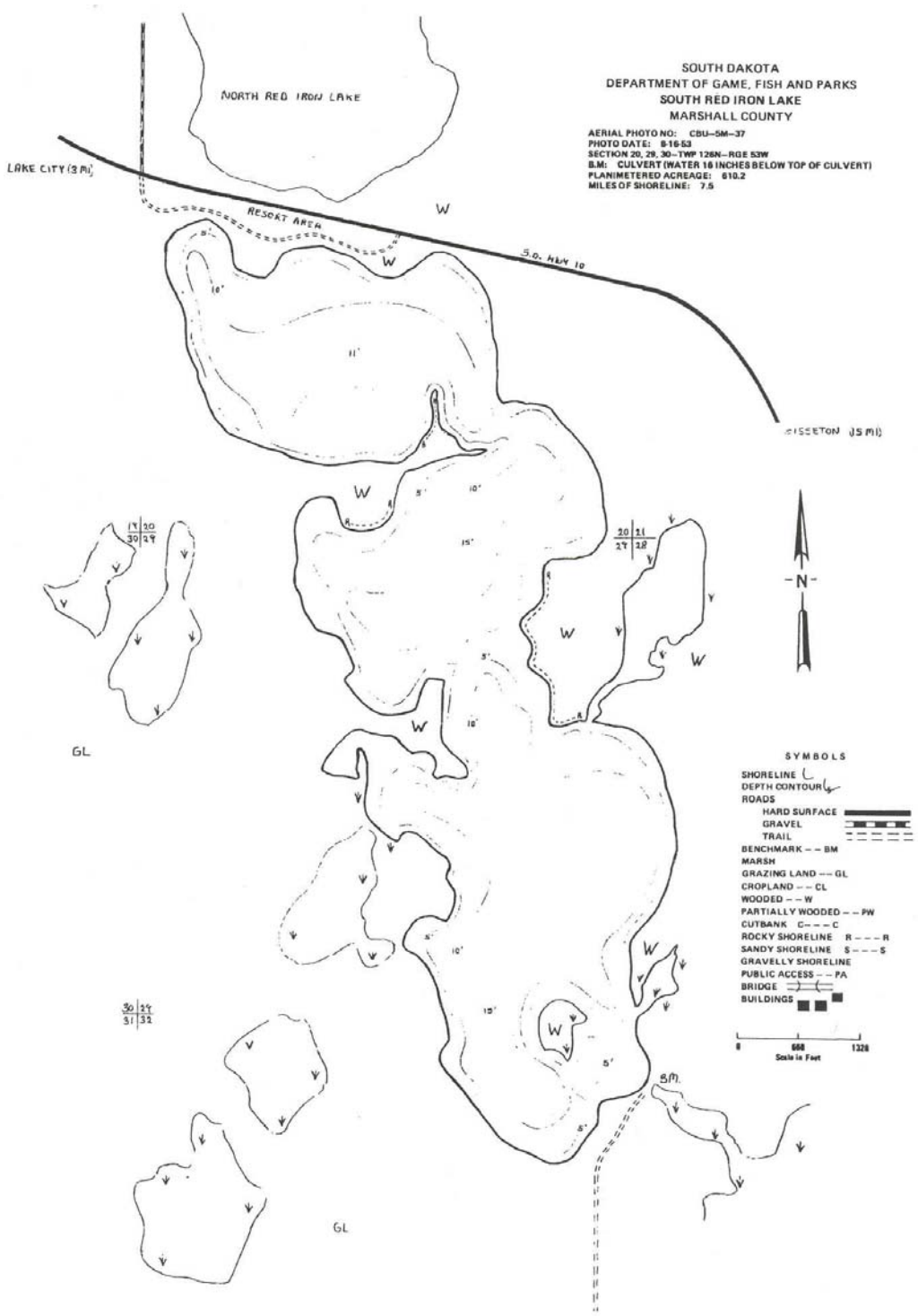

Figure 1. South Red Iron Lake contour map.

Management Objectives

1) Maintain a mean gill net CPUE of stock-length walleye ≥ 10, a PSD of 30 – 60, and an RSD-P of 5 – 10.

2) Maintain a mean gill net CPUE of stock-length yellow perch ≥ 25, a PSD of 30-60, and an RSD-P 5-10.

3) Maintain a mean gill net CPUE of stock-length northern pike ≥ 3, a PSD of 30-60, and an RSD-P of 5-10.

4) Maintain a mean frame net CPUE of stock-length bullhead ≤ 100.

Results and Discussion

South Red Iron Lake is a, permanent, natural lake situated in the Coteau des Prairie, a plateau formed by glacier action in northeast South Dakota. South Red Iron Lake was named after Red Iron, a famous Indian Chief. South Red Iron Lake, along with the majority of the Coteau lakes, was formed during successive subadvances of the Late Wisconsin glaciation more than 10,000 years ago. Specifically, South Red Iron Lake is classified as an outwash lake formed when material from glacier ice melt was deposited over ice at the lower elevations. Subsequently, melting of the outwash covered ice formed many closed depressions. The major inlets to South Red Iron Lake flow into the lake from unnamed streams from the south and east. Currently, South Red Iron Lake is primarily managed as a northern pike, walleye and yellow perch fishery, but as many as 11 species of fish contribute to the fishery in South Red Iron Lake.

Primary Species

Northern Pike: Northern pike typically are not sampled consistently using standard lake survey methods; however, northern pike in South Red Iron Lake have generally been considered to be present at high density with a 1999 – 2006 mean gill net CPUE of stock-length fish of 6.3 for gill nets (Table 2; Table 3). The mean gill net CPUE of stock-length northern pike in South Red Iron Lake during 2006 was 9.2, an increase from 6.2 reported in 2004 (Tables 1-3). The increase in abundance may be attributed to successful recruitment of northern pike in recent years, as fish from each 10-mm length group between 390-620 mm were present (Figure 2). Ermer et al. (2005) reported that northern pike in South Red Iron Lake had intermittently produced strong year classes that had resulted in a self-sustaining population that at times was classified as high abundance.

Northern pike collected from South Red Iron Lake in 2006 ranged in total length from 390 to 940 mm (Figure 2). The PSD was 49 and the RSD-P was 7 for gill net

captured fish, indicating a relatively balanced population, as defined by PSD and RSD-P values ranging from 30-60 and 5-10, respectively (Table 1; Table 3).

No age or growth information was collected. Condition of northern pike in South Red Iron Lake during the 2006 survey was good with mean relative weight (Wr) values ranging from the upper 80's to lower 90's for all length groups sampled. The good northern pike condition indicates sufficient prey availability and suitable habitat.

Walleye: The mean gill net CPUE of stock-length walleye during 2006 was 1.8, down from 3.7 and 4.3 reported in 2003 and 2004, respectively (Tables 1-3). Dating back to 1999, walleye relative abundance in South Red Iron Lake based on gill net CPUE has ranged from 1.8 to 10.0 stock-length walleye/net night with an average of 5.3 (Tables 2-3). The mean gill net CPUE of stock-length walleye of 1.8 in 2006 was below the objective (≥10 stock-length walleye/net night) and indicative of a low density population.

Nine year classes were represented in the walleye gill net catch during the 2006 survey. Recruitment of naturally-produced walleyes appears to have been successful in five of the past ten years as walleyes from non-stock years (1997, 1999, 2001, 2002, and 2004) were present during the 2006 survey, with the 2001 year-class being relatively strong based on the number of walleye aged from that year class during the 2003 and 2004 surveys (Table 6). Although, sample size was low during the 2006 survey the 2001 year-class was the most represented with 3 of the 11 aged walleyes being from that year-class (Table 6). Natural reproduction was likely successful in other years but the extent of its success was unknown due to the confounding of the catch with stocked walleye. Small fingerling stockings made in the late 1990's were thought to be successful at increasing walleye abundance in South Red Iron lake as strong years classes were reported to coincide with small fingerling stocks during the 1999 and 2001 surveys (Hubers 2002 and Ermer et al. 2005). However, in recent years (2003, 2005 and 2006) stockings have not appeared as successful with relatively few walleye from stocked years being sampled during the 2006 survey (Tables 5-6). It is probable that walleye from the 2005 and 2006 year-classes may not have been recruited to our gear at the time of the 2006 survey.

Walleye captured in gill nets during 2006 ranged in total length from 180 to 570 mm (Figure 3). The PSD of walleye captured in gill nets during 2006 was 73 and the RSD-P was 36 (Table 1; Table 3; Figure 3).

Few conclusions can be made from walleye growth information collected in 2006, as only 12 walleye were collected, and many of the year-classes have only one fish representing them. Ermer et al. (2006) reported slightly slower growth during the 2003 and 2004 surveys than the regional and statewide averages reported in Willis et al. (2001). Condition of stock-length walleye captured in gill nets in 2006 was good with mean relative weight (Wr) values of 90 or above for all length groups sampled indicating ample prey availability.

Yellow Perch: The mean gill net CPUE of stock-length (130 mm) yellow perch in 2006 was 24.7, and near the minimum objective of (≥ 25 fish/net night; Tables 1 – 3). Since 1999, the gill net CPUE of stock-length yellow perch has fluctuated with a low of 14.0 in 1999 and a high of 43.0 in 2001 (Table 2; Table 3). Overall, yellow perch

appear to have relatively consistent recruitment, however at low magnitudes keeping densities moderate from 1999-2006.

During 2006, yellow perch ranged in total length from 120 to 310 mm (Figure 4), had a PSD of 7, and an RSD-P of 1 (Tables 1-3; Figure 4). Inspection of the length-frequency histogram indicates a strong year-class of yellow perch ranging in total-length from 130 to160 mm resulting in the low PSD, as this year-class reaches quality-length (≥200 mm) PSD values will likely improve (Figure 4). The condition of yellow perch in South Red Iron Lake was good with mean relative weight (Wr) values ranging from mid 90's to low 100's for gill net captured fish.

Other Species

Black bullhead: The mean frame net CPUE of stock-length black bullhead during 2006 was 8.9, and within the objective (≤ 100 stock-length bullhead/net night) for black bullhead in South Red Iron Lake (Tables 1-3). Since 1999, black bullhead abundance, as indexed by mean frame net CPUE, has varied from a high of 127.8 in 2003 to a low of 8.9 in 2006. The 2006 mean frame net CPUE for stock-length fish of 8.9 indicates a low density black bullhead population.

Black bullhead captured in frame nets during 2006 ranged in total length from 140 to 370 mm (Figure 5). The PSD of black bullhead captured in frame nets during 2006 was 83 and the RSD-P was 77 (Table 1; Table 3; Figure 5). The high PSD and RSD-P values indicate a population skewed toward quality- (≥230 mm) and preferred-length (≥300 mm) individuals, likely the result of limited black bullhead recruitment in recent years. Based on the length-frequency histogram the black bullhead population in South Red Iron Lake was mostly comprised of a large year class that had a modal distribution length near 330 mm. The condition of black bullheads was good with mean relative weight (Wr) values in the 90's.

Black crappie: The mean frame net CPUE of stock-length black crappie was 0.9 in 2006 (Tables 1-3). The mean frame net CPUE of all-size black crappies was 4.4 during the 2006 survey indicating successful natural reproduction in recent years; however recruitment of these fish to the adult population is unknown at this time as many of these fish are sub-stock.

Black crappie captured in frame nets during 2006 ranged in total length from 80 to 360 mm (Figure 6). The PSD and RSD-P of black crappie captured in frame nets during 2006 was 71 and 71, respectively (Table 1; Table 3; Figure 6). The high PSD and RSD-P values are a result of sporadic recruitment, resulting in the adult population being skewed toward larger individuals; however, if the recently-produced year-class effectively recruits to the population, PSD and RSD-P values will likely decline. The presence of larger black crappies indicates angler exploitation is likely not a factor in shaping the black crappie size structure, rather recruitment patterns have had a greater effect.

No black crappie growth information was collected in 2006. The condition of black crappie captured in frame nets in South Red Iron Lake was good with mean relative weight (Wr) values exceeding 85 for length categories sampled, however condition of black crappies did decline as black crappie length increased.

Bluegill: The mean frame net CPUE of stock-length bluegill during 2006 was 23.4 (Tables 1-3). A substantial increase from prior surveys dating back to 1999 when the mean frame net CPUE of stock-length fish did not exceeded 1.6 (Tables 2-3).

The total length of bluegill captured in frame nets during 2006 ranged from 70 to 240 mm (Figure 7). PSD and RSD-P values were 3 and 2, respectively for bluegills captured in frame nets during the 2006 survey. The low PSD and RSD-P values are the result of a large group of recently-recruited bluegills ranging in total length from 70-130 mm into the population (Table 1; Table 3; Figure 7).

No growth information was available for bluegill in South Red Iron Lake; however, the condition of bluegill in South Red Iron Lake during 2006 was excellent with mean relative weight (Wr) values above 115 for all length categories sampled.

Smallmouth bass: Smallmouth bass have been observed in South Red Iron Lake in low density. Currently, fall night electrofishing is utilized to assess smallmouth bass populations in NE South Dakota. Fall night electrofishing has not been conducted on South Red Iron Lake. During 2006 smallmouth bass were captured in both frame nets and gill nets with mean CPUE of stock-length fish of 0.4 and 0.3, respectively (Tables 1-2).

No growth information was collected during 2006. The condition of smallmouth bass captured during 2006 was good with mean relative weight (Wr) values exceeding 100 for all length categories sampled.

Other: White sucker and common carp were also sampled in low densities during 2006 (Table 1, Table 2). The contribution of species other than black crappie, bluegill, largemouth bass, northern pike, smallmouth bass, walleye, and yellow perch to the fishery at the time of this survey was likely minimal.

Management Recommendations

1) Conduct fish population assessment surveys on a biennial basis (next survey scheduled in summer 2008) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.

2) Stock walleye on a biennial basis (1,000 fry/acre) to establish additional year classes.

3) Collect otoliths (5 fish/cm group) from walleye, yellow perch, and bluegill; collect scale samples (5 fish/cm group) from smallmouth bass to assess age and growth.

4) Monitor water levels and winter/summer kill events. Stock northern pike and yellow perch in cases of complete winterkill events to establish a fish population.

5) Encourage commercial harvest of black bullhead to limit abundance if the abundance exceeds the management objective. At the time of this survey, the abundance of black bullhead in South Red Iron Lake did not necessitate the need for commercial harvest.

Table 1. Mean catch rate (CPUE; Catch/net night) of stock-length fish, mean relative weight (Wr) of stock-length fish, proportional stock density (PSD) and relative stock density of preferred-length fish (RSD-P) of various fish species captured in experimental gill nets and frame nets in South Red Iron Lake, 2006. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90). BLB = black bullhead; NOP = northern pike; SMB = smallmouth bass; WAE = walleye; WHS = white sucker; YEP = yellow perch

	Abundance		Stock Density Indices				Condition	
Species	CPUE	CI-80	PSD	CI-90	RSD-P	CI-90	Wr	CI-90
Frame nets								
BLB	0.1	0.1	100	<1	50	50	86	---
BLC	0.9	0.4	71	19	71	19	94	5
BLG	23.4	7.6	3	1	2	1	117	3
LMB	0.1	<0.1	---	---	---	---	---	---
NOP	1.2	0.3	71	18	10	11	86	1
SMB	0.4	0.4	63	34	38	34	106	4
WAE	0.1	0.1	100	<1	50	50	86	---
WHS	0.2	0.1	100	<1	100	<1	86	8
YEP	11.6	6.6	3	2	0	---	94	1
Gill nets								
BLB	1.5	1.0	56	32	44	33	94	5
BLC	0.7	0.6	100	<1	100	<1	95	9
BLG	0.2	0.2	---	---	---	---	---	---
COC	0.5	0.5	100	<1	100	<1	95	9
NOP	9.2	1.9	49	11	7	7	90	1
SMB	0.3	0.3	100	<1	50	50	107	26
WAE	1.8	0.8	73	25	36	28	93	3
WHS	7.3	2.1	86	9	82	10	105	2
YEP	24.7	7.0	7	3	1	1	107	<1

Table 2. Historic mean catch rate (CPUE; Catch/net night) of stock-length fish for various fish species captured in experimental gill nets and frame nets in South Red Iron Lake, 1999 - 2006. BLB =black bullhead; BLC= black crappie; BLG = bluegill; COC = common carp; GSF= green sunfish; LMB = largemouth bass; NOP = northern pike; SMB = smallmouth bass; WAE = walleye; WHS = white sucker; YEP = yellow perch

	CPUE								
Species	1999	2000	2001	2002	2003	2004	2005	2006[2]	Mean
Frame nets									
BLB	86.9	---	42.4	---	127.8	38.6	---	8.9	60.9
BLC	1.0	---	0.1	---	0.9	0.5	---	0.9	0.7
BLG	0.3	---	0.4	---	1.6	1.6	---	23.4	5.5
BLGxGSF [1]	0.0	---	0.0	---	0.0	0.1	---	0.0	0.0
LMB	0.0	---	0.0	---	0.0	0.0	---	0.1	0.0
NOP	0.5	---	0.3	---	0.3	0.2	---	1.2	0.5
SMB	0.0	---	0.0	---	0.2	0.6	---	0.4	0.2
WAE	0.9	---	0.1	---	0.2	0.1	---	0.1	0.3
WHS	1.5	---	0.1	---	0.3	0.1	---	0.2	0.4
YEP	2.9	---	3.5	---	0.7	0.3	---	11.6	3.8
Gill nets									
BLB	153.8	---	10.0	---	44.2	2.3	---	1.5	42.4
BLC	0.3	---	0.0	---	1.8	0.8	---	0.7	0.7
BLG	0.0	---	0.0	---	0.5	0.2	---	0.2	0.2
COC	0.3	---	0.2	---	0.0	0.0	---	0.5	0.2
NOP	1.0	---	5.5	---	9.7	6.2	---	9.2	6.3
SMB	0.0	---	0.0	---	0.2	0.7	---	0.3	0.2
WAE	10.0	---	6.8	---	3.7	4.3	---	1.8	5.3
WHS	0.5	---	4.3	---	10.8	6.2	---	7.3	5.8
YEP	14.0	---	43.0	---	34.2	24.2	---	24.7	28.0

[1] all fish size.
[2] Monofilament gill net mesh size change (.75”, 1”, 1.25”, 1.5”, 2” and 2.5”), previous years (.5”, .75”, 1”, 1.25”, 1.5” and 2”).

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional stock density (PSD), and relative stock density of preferred length fish (RSD-P) for selected species captured in experimental gill nets and frame nets in South Red Iron Lake, 1999 - 2006. BLB = black bullhead; BLC = black crappie; BLG = bluegill; NOP= northern pike; WAE = walleye; YEP = yellow perch

Species	1999	2000	2001	2002	2003	2004	2005	2006[1]	Average	Objective
Frame nets										
BLB										
CPUE	87	---	42	---	128	39	---	9	61	≤ 100
PSD	90	---	57	---	44	86	---	83	72	---
RSD-P	0	---	2	---	4	51	---	77	27	---
Wr	88	---	84	---	89	91		93	89	---
BLC										
CPUE	1	---	< 1	---	1	1	---	1	1	---
PSD	100	---	100	---	67	100	---	71	88	---
RSD-P	87	---	100	---	13	44	---	71	63	---
Wr	95	---	100	---	101	97		94	97	---
BLG										
CPUE	< 1	---	< 1	---	2	2	---	23	9	---
PSD	75	---	50	---	85	46	---	3	52	---
RSD-P	50	---	13	---	15	32	---	2	22	---
Wr	112	---	135	---	124	123		117	122	---
Gill nets										
NOP										
CPUE	1	---	6	---	10	6	---	9	6	≥ 3
PSD	25	---	39	---	43	57	---	49	43	30-60
RSD-P	0	---	6	---	5	8	---	7	5	5-10
Wr	85	---	83	---	84	86	---	90	86	---
WAE										
CPUE	10	---	7	---	4	4	---	2	5	≥ 10
PSD	5	---	73	---	32	50	---	73	47	30-60
RSD-P	5	---	2	---	18	0	---	36	12	5-10
Wr	90	---	88	---	92	93		93	91	---
YEP										
CPUE	14	---	43	---	34	24	---	25	28	≥ 25
PSD	54	---	33	---	5	58	---	7	31	30-60
RSD-P	0	---	7	---	0	1	---	1	2	5-10
Wr	98	---	104	---	104	100		107	103	---

[1] Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5"), previous years (.5", .75", 1", 1.25", 1.5" and 2").

Table 4. Weighted mean length at capture (mm) for walleye captured in experimental gill net sets in South Red Iron Lake, 1999 – 2006. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

		Age									
Year	N	1	2	3	4	5	6	7	8	9	10
2006[1]	11	184	320	425	334	424	---	439	565	498	563
2004	31	187	291	376	386	458	475	---	---	---	---
2003	25	178	277	359	430	525	---	505	---	---	---
2001	42	170	---	368	416	452	---	---	---	---	---
1999	40	---	298	324	---	---	---	590	---	---	---

[1]Age and growth information obtained from otoliths; scales were utilized in previous years

Table 5. Stocking history including size (Size) and number (Number) for fishes stocked into South Red Iron Lake, 1996 - 2006. (WAE = walleye)

Year	Species	Size	Number
1996	WAE	small fingerling	124,300
1998	WAE	small fingerling	67,450
2003	WAE	small fingerling	60,840
2005	WAE	small fingerling	79,300
2006	WAE	small fingerling	60,800

Table 6. Numbers of walleye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in South Red Iron Lake, 1999 - 2006.

			Year Class								
Survey Year	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
2006[1,2]		1	1	1	1	3		1	1	1	1
2004	---	---		5	5	16	1	2	2		
2003	---	---	---		1	12	5	1	2		4
2001	---	---	---	---	---		1		15	9	5
1999	---	---	---	---	---	---	---			6	32
Number stocked											
fry											
small fingerling	61	79		61					67		124
large fingerling											

[1] Fish aged using otoliths; scales were utilized in previous years
[2] Monofilament gill net mesh size change (.75”, 1”, 1.25”, 1.5”, 2” and 2.5”), previous years (.5”, .75”, 1”, 1.25”, 1.5” and 2”).

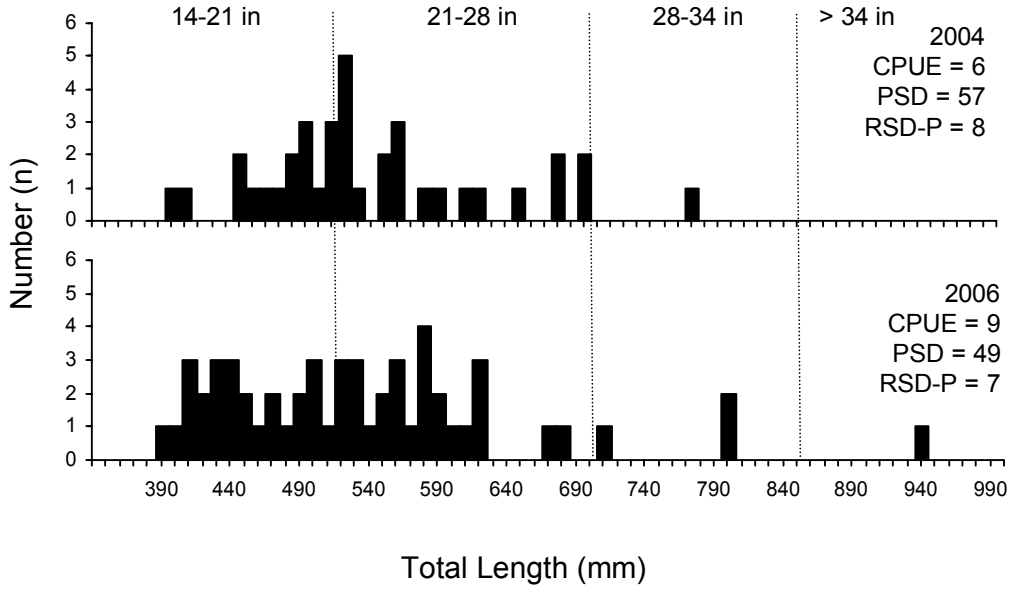

Figure 2. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for northern pike (NOP) captured using gill nets in South Red Iron Lake, 2004 and 2006.

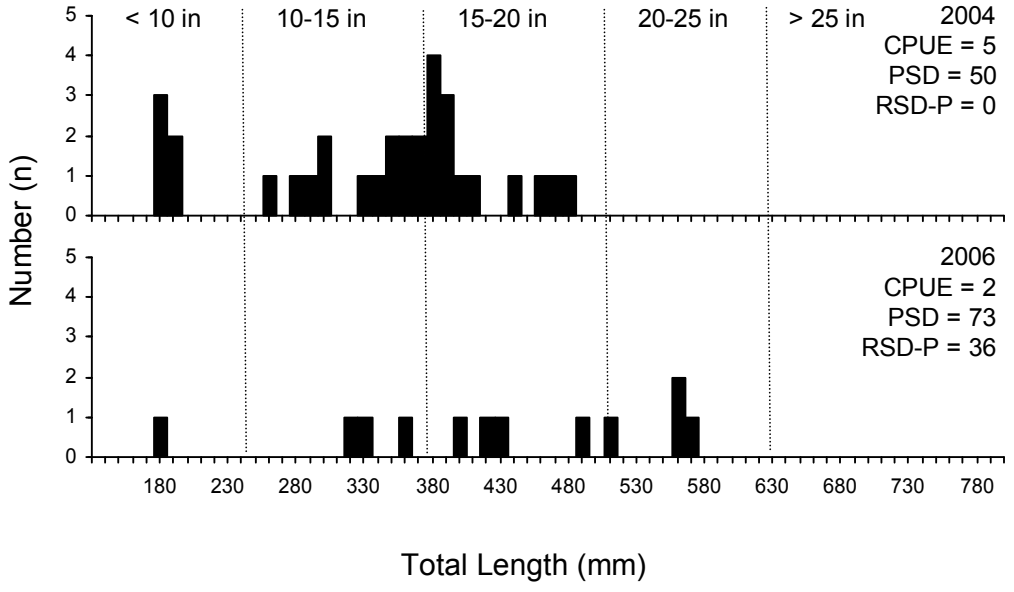

Figure 3. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for walleye captured in experimental gill nets in South Red Iron Lake, 2004 and 2006.

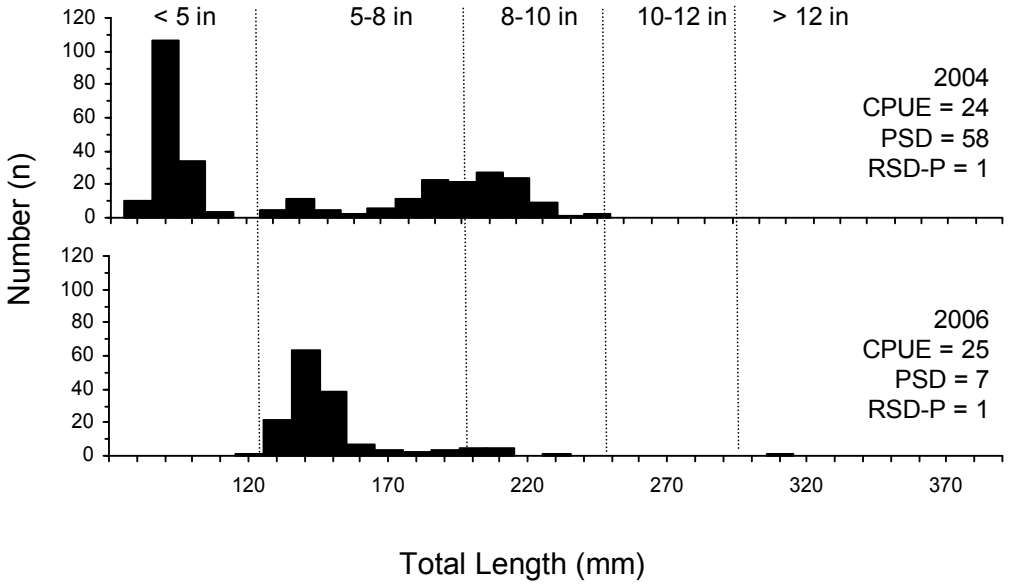

Figure 4. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for yellow perch captured in experimental gill nets in South Red Iron Lake, 2004 and 2006.

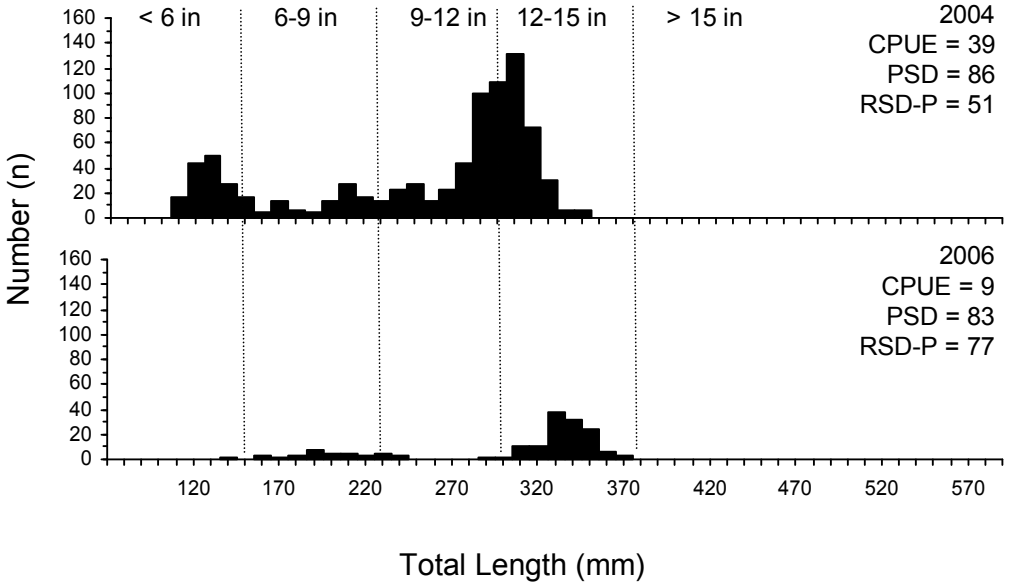

Figure 5. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black bullhead captured in frame nets in South Red Iron Lake, 2004 and 2006.

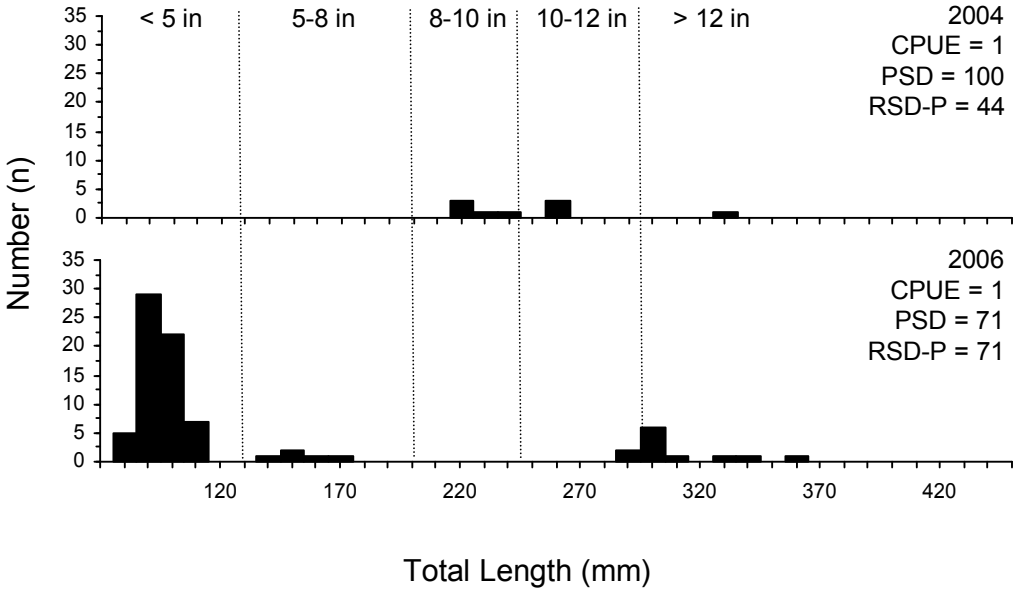

Figure 6. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black crappie (BLC) captured using frame nets in South Red Iron Lake, 2004 and 2006.

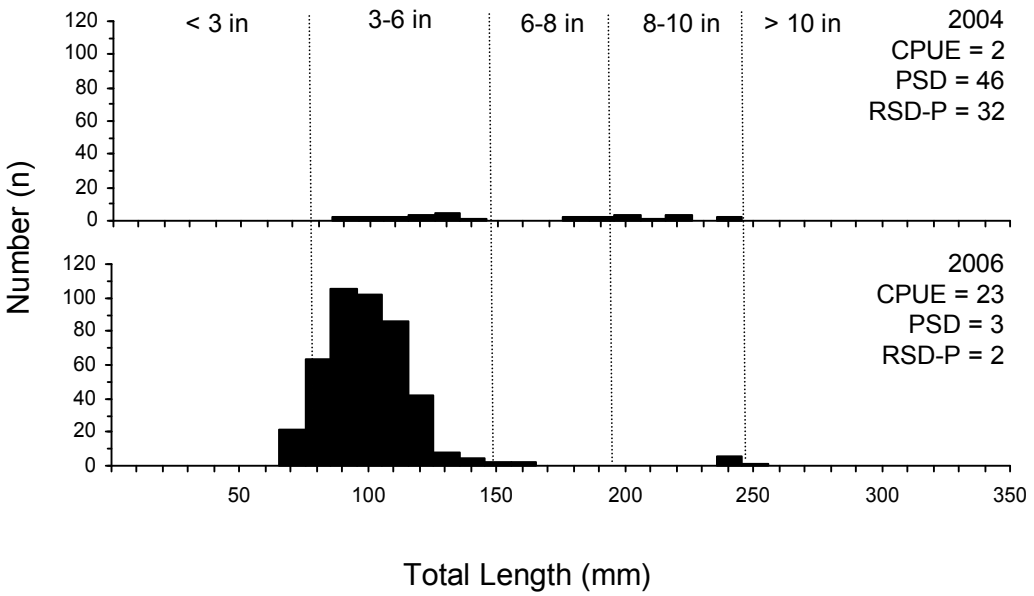

Figure 7. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for bluegill (BLG) captured using frame nets in South Red Iron Lake, 2004 and 2006.