

South Buffalo Lake

Site Description

Location

Water designation number (WDN)	48-0034-00
Legal description	T125N-R53W-Sec.2,10,11,14, 15, 16,17
County (ies)	Marshall
Location from nearest town	6 miles east of Eden, SD

Survey Dates and Sampling Information

Survey dates	June 23-25, 2009 (FN,GN)
Gill net sets (n)	6
Frame net sets (n)	18

Morphometry (Figure 1)

Watershed area (acres)	16,000
Surface area (acres)	1,788
Maximum depth (ft)	14
Mean depth (ft)	8

Ownership and Public Access

South Buffalo Lake is a meandered lake owned by the State of South Dakota and managed by the SDGFP. Two public access sites are present, and are located on the northeast and southwest shorelines (Figure 1). Both are maintained by the SDGFP. Lands adjacent to the lake are generally under State of South Dakota, Bureau of Indian Affairs, and private ownership.

Watershed and Land Use

The South Buffalo Lake watershed is primarily comprised of agricultural grazing land, with some cropland (Hanson 2007). The shoreline is heavily wooded with scattered lake cabins primarily along the northern shore (Figure 2).

Water Level Observations

The Water Management Board established Ordinary High Water Mark is 1835.4 fmsl and the outlet elevation of South Buffalo Lake is 1834.8 fmsl. On May 6, 2009, South Buffalo Lake was above the Ordinary High Water Mark with an elevation of 1837.9 fmsl. On September 29, 2009 South Buffalo Lake remained above the Ordinary High Water Mark at an elevation of 1836.5 fmsl.

Aquatic Nuisance Species Monitoring

Plant Survey

Areas of emergent and submerged vegetation are common in South Buffalo Lake. Submerged aquatic plant species identified during the 2009 survey include sago pondweed, clasping leaf pondweed, and native milfoil species. No aquatic nuisance plant species were encountered.

Macro-Invertebrate/Mussel Survey

No aquatic nuisance macro-invertebrate or mussel species were sampled in 2009.

Fish Community Survey

Common carp was the only aquatic nuisance fish species captured during the 2009 survey.

Fish Management Information

Primary species	bluegill, northern pike, walleye, yellow perch
Other species	black bullhead, black crappie, common carp, largemouth bass, golden shiner, orangespotted sunfish, smallmouth bass, sunfish hybrid, white sucker
Lake-Specific regulations	NE Panfish Management Area: 10 daily; 50 possession
Management classification	warm-water semi-permanent
Fish Consumption Advisories	none

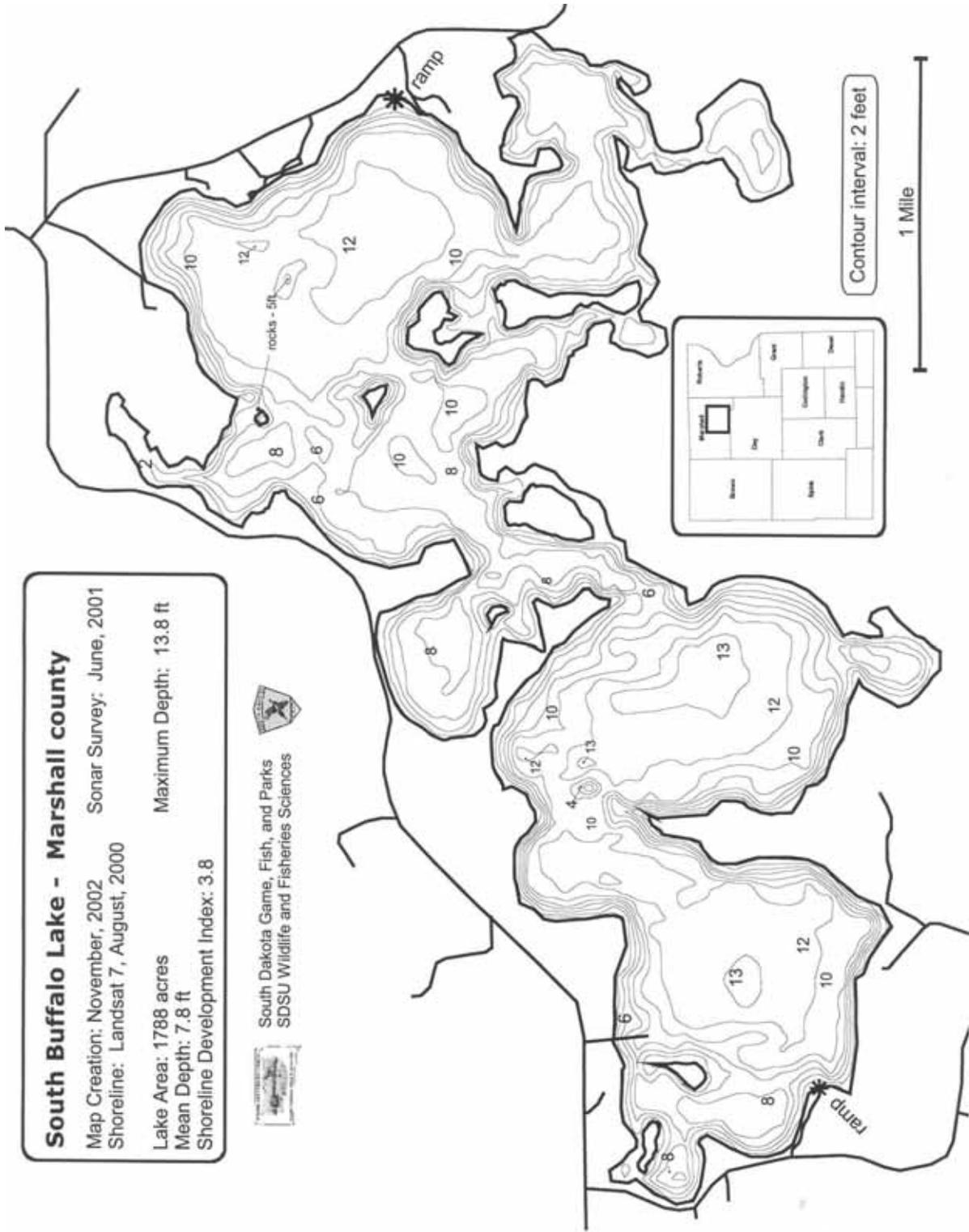


Figure 1. South Buffalo Lake depth contour map.

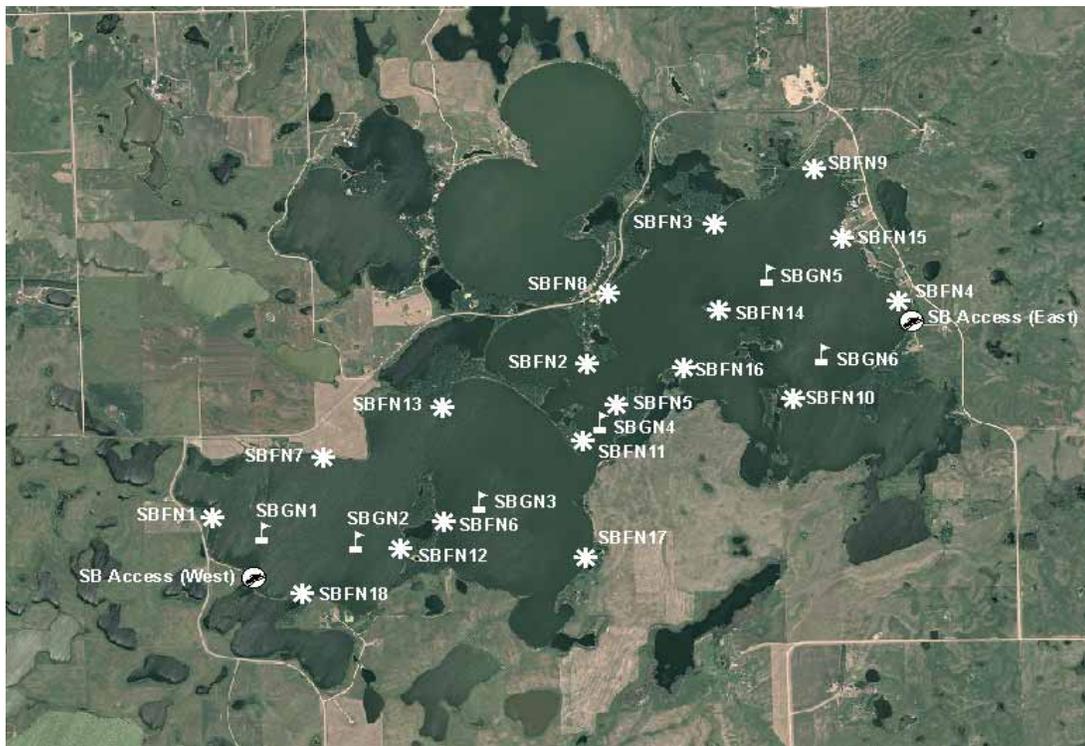
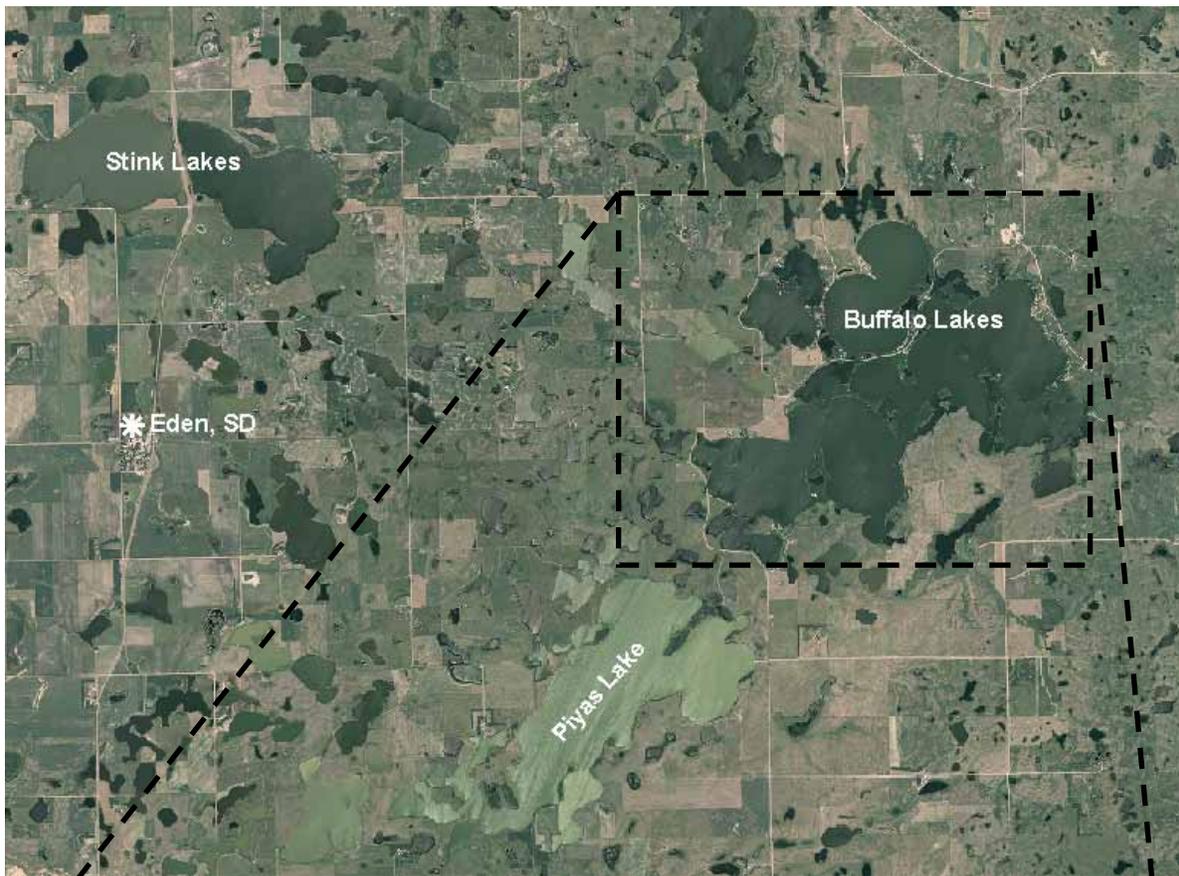


Figure 2. Map depicting geographic location of S. Buffalo Lake from Eden, South Dakota (top). Also noted are access locations and standardized net locations for S. Buffalo Lake (bottom). SBFN= frame nets, SBGN= gill nets

Management Objectives

- 1) Maintain a mean frame net CPUE of stock-length bluegill ≥ 25 , a PSD of 30-60, and a PSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length northern pike ≥ 3 , a PSD of 30-60, and a PSD-P of 5-10.
- 3) Maintain a mean gill net CPUE of stock-length walleye ≥ 10 , a PSD of 30-60, and a PSD-P of 5-10.
- 4) Maintain a mean gill net CPUE of stock-length yellow perch ≥ 30 , a PSD of 30-60, and a PSD-P of 5-10.
- 5) Maintain a mean frame net CPUE of stock-length bullhead ≤ 100 .

Results and Discussion

South Buffalo Lake is a large, permanent, natural lake with complex morphometry (i.e., numerous basins, islands, and bays) located in Marshall County, South Dakota. The major inlet to South Buffalo Lake is located at the northeast corner of the lake. Other tributaries enter at the south and southeast. Water exiting South Buffalo Lake runs into North Buffalo and Almos Lakes then through a chain of Coteau Lakes and eventually emptying into the James River.

Currently, South Buffalo Lake is primarily managed as a bluegill, northern pike, walleye and yellow perch fishery. Overall, as many as 16 species of fish contribute to the fishery in South Buffalo Lake.

Primary Species

Bluegill: The mean frame net CPUE of stock-length bluegill during 2009 was 73.7 (Table 1) and above the minimum objective (≥ 25 stock-length bluegill/net night; Table 3). Since 2000, the mean frame net CPUE of bluegill has ranged from a low of 4.8 (2000) to a high of 255.6 (2007), with the 2000-2009 average being 63.1 (Table 2). Although the 2009 frame net CPUE represents a substantial decrease from the 2007 CPUE of 255.6 (Table 2), relative abundance remains high.

Bluegill captured in frame nets during 2009 ranged in total length from 7 to 28 cm (2.8 to 11.0 in), had a PSD of 28, and a PSD-P of 11 (Figure 3). The 2009 PSD was slightly below the management objective of 30-60; while the PSD-P was slightly above the management objective of 5-10 (Table 3).

Otoliths were collected from a sub-sample of frame net captured bluegill in 2007 and 2009. Age structure information indicates that bluegill in South Buffalo Lake have exhibited relatively-consistent recruitment of varying magnitude in recent years. Year classes produced in 2004-2007 comprised the majority (89%) of bluegill in the 2009 frame net catch, with the 2005 and 2006 year classes being the most represented (Table 5).

Bluegills in South Buffalo Lake typically attain quality-length (150 mm) at approximately age-4 and preferred-length (200 mm) between age-5 and age-6. Weighted mean length at capture for age-4, age-5, and age-6 bluegill during 2009 was 153 mm (6.0 in), 182 mm (7.2 in), and 223 mm (8.8 in), respectively (Table 4). Mean Wr values for frame net captured bluegills exceeded 100 for all length groups sampled. The mean Wr for stock-length bluegill was 104 (Table 1) and no length-related trends in condition were apparent. Mean Wr values may have been influenced by seasonal sampling bias (i.e., spawning behavior) during 2009.

Northern Pike: Northern pike typically are not sampled effectively using standard lake survey methods; therefore reported values may not accurately represent the at-large population. Neumann and Willis (1995) reported the most reliable time to sample northern pike with gill nets was late spring following the spawn.

The 2009 mean gill net CPUE of stock-length northern pike was 3.5 (Table 1) and above the minimum objective (≥ 3 stock-length northern pike/net; Table 3). Since 2000, the relative abundance of northern pike in South Buffalo Lake has been considered moderate to high, with mean gill net CPUE values of stock-length northern pike ranging from 2.8 (2001) to 14.2 (2007; Table 2).

Northern pike sampled in gill nets during 2009 ranged in total length from 38 to 75 cm (15.0 to 29.5 in), had a PSD of 81, and a PSD-P of 10 (Figure 4; Table 1). The 2009 PSD was above the objective range of 30-60 while the PSD-P was within the objective range of 5-10 (Table 3).

No growth information was available for northern pike in 2009. Northern pike in the 2009 gill net catch had mean Wr values that ranged from 86-89 for all length categories sampled and no length-related trends were apparent. The mean Wr for stock-length northern pike was 88 (Table 1). Mean Wr values were likely at a seasonal low as Neumann and Willis (1995) reported that Wr values were lowest during spring following the spawn and remained low throughout the summer in Lake Thompson, South Dakota.

Walleye: The mean gill net CPUE of stock-length walleye during 2009 was 0.8 (Table 1) and below the minimum objective (≥ 10 stock-length walleye/net night; Table 3). Since 2000, the mean gill net CPUE of walleye has fluctuated from a low of 0.8 (2009) to a high of 10.5 (2002), with the 2000-2009 average being 5.0 (Table 2). Based on the 2009 gill net CPUE, relative abundance is considered low.

Since 2005, otoliths have been collected from a sub-sample of gill net captured walleye. Age structure information indicates that recruitment of both stocked and naturally-produced walleye has been poor in recent years (Table 8) resulting in the low relative abundance. Few inferences can be made concerning walleye size structure, growth, and condition due to low sample size, as only 5 stock-length walleye ranging in total length from 40 to 50 cm (15.7 to 19.7 in) were captured in the 2009 gill net catch (Figure 5).

Yellow Perch: The mean gill net CPUE of stock-length yellow perch in 2009 was 40.3 (Table 1), and above the minimum objective (≥ 30 stock-length yellow perch/net night). Since 2000, the gill net CPUE of stock-length yellow perch has ranged from 4.7 (2004) to 57.0 (2002) with the 2000-2009 average being 29.8 (Table 2). Based on the 2009 gill net catch the relative abundance of stock-length yellow perch appears to be high.

Yellow perch captured in the 2009 gill net catch ranged in total length from 8 to 19 cm (3.1 to 7.5 in) with the majority being less than stock length (Figure 6). No quality- or preferred-length yellow perch were captured resulting in a PSD and PSD-P of 0, which is well below the management objectives of 30-60 and 5-10 (Table 3; Figure 6).

Otoliths were collected from a sub-sample of gill net captured yellow perch in 2009. Age structure information indicates that yellow perch in South Buffalo Lake have exhibited relatively-consistent recruitment in recent years, with five consecutive year classes (2004-2008) present in the 2009 gill net catch (Table 10). Year classes produced in 2007 and 2008 were the most represented and comprised approximately 88% of yellow perch in the 2009 gill net catch (Table 10).

The weighted mean total length at capture for age-2 and age-3 male yellow perch was 113 and 146 mm (4.4 and 5.7 in), respectively (Table 9). The weighted mean total length at capture for age-2 and age 3 female yellow perch was 119 and 148 mm (4.7 and 5.8 in; Table 9). The majority of yellow perch in the 2009 gill net catch were in the sub-stock length category which had a mean W_r of 97. All stock-length yellow perch captured in the 2009 gill net catch were in the stock- to quality-length category and had a mean W_r value of 95 (Table 1).

Other Species

Black bullhead: Black bullhead relative abundance, as indexed by frame net CPUE, has declined in each of the past three population assessments (Table 2). In 2009, the mean frame net CPUE was 17.9 and within the objective (≤ 100 stock-length black bullhead/net night). The 2009 CPUE was slightly lower than the 2007 CPUE of 21.2 and indicates moderate relative abundance.

Length-frequency analysis indicates that recruitment has been limited in recent years as few black bullheads less than quality length were present in the 2009 frame net catch (Figure 7). Black bullhead in the 2009 frame net catch ranged in total length from 21 to 37 cm (8.3 to 14.6 in), had a PSD of 95, and a PSD-P of 31 (Table 1; Figure 7). No growth information was collected during 2009. Mean W_r values for frame net captured black bullheads ranged from 79 to 84 for all length categories sampled. The mean W_r for stock-length black bullheads was 83 (Table 1) and no length-related trends in condition were apparent.

Black crappie: The mean frame net CPUE of stock-length black crappie during 2009 was 0.5 (Table 1). Since 2000, frame net mean CPUE values have fluctuated from a low of 0.5 (2005; 2009) to a high of 6.1 (2007), with the 2000-2009 average being 2.3 (Table 2). Based on 2009 mean frame net CPUE, relative abundance appears to be low.

In 2009, frame nets captured 9 black crappies ranging in total length from 14 to 32 cm (5.5 to 12.6 in). Few inferences can be made concerning size structure, growth, and condition due to low sample size.

Largemouth Bass: Largemouth bass populations are typically assessed using night electrofishing conducted during mid- to late-June when water temperatures are approximately 65°F in northeastern South Dakota. Electrofishing was not conducted during 2009 and no largemouth bass were captured in frame nets or gill nets.

Other: Common carp, hybrid sunfish, orangespotted sunfish, smallmouth bass and white sucker were other fish species captured during the 2009 survey (Table 1).

Management Recommendations

- 1) Conduct fish population assessment surveys on a biennial basis (next survey scheduled in summer 2011) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Conduct spring electrofishing biennially (2011) to monitor the largemouth bass population in South Buffalo Lake.
- 3) Collect otoliths from bluegill, walleye, and yellow perch; scales from largemouth and smallmouth bass to assess age structure and growth rates of the population.
- 4) Stock OTC (oxytetracycline) marked walleye on a biennial basis (100 small fingerlings/acre) to supplement the walleye population.

Table 1. Mean catch rate (CPUE; gill/frame nets= catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) of stock-length fish for various fish species captured in frame nets and experimental gill nets from South Buffalo Lake, 2009. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; HYB= sunfish hybrid; NOP= northern pike; OSF= orangespotted sunfish; SMB= smallmouth bass; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	Abundance		Stock Density Indices				Condition	
	CPUE	CI-80	PSD	CI-90	PSD-P	CI-90	Wr	CI-90
<i>Frame nets</i>								
BLB	17.9	7.3	95	2	31	5	83	1
BLC	0.5	0.2	78	22	56	32	99	9
BLG	73.7	18.3	28	2	11	1	104	1
COC	0.1	<0.1	100	---	100	---	100	---
HYB ¹	0.2	0.1	---	---	---	---	---	---
NOP	0.4	0.2	75	25	25	31	82	4
OSF ¹	0.1	<0.1	---	---	---	---	---	---
SMB	0.2	0.2	25	59	25	59	113	7
WAE	0.1	<0.1	100	---	100	---	96	---
WHS	0.6	0.6	10	18	10	18	86	3
YEP	8.4	3.7	7	3	3	3	83	2
<i>Gill nets</i>								
BLB	0.7	0.5	100	0	0	---	97	6
NOP	3.5	1.2	81	15	10	11	88	2
WAE	0.8	0.7	100	0	0	---	99	2
WHS	4.0	1.4	50	18	46	18	101	5
YEP	40.3	12.5	0	---	0	---	95	2

¹ All fish sizes.

Table 2. Historic mean catch rate (CPUE; gill/frame nets= catch/net night, electrofishing= catch/hour) of stock-length fish for various fish species captured by frame nets, experimental gill nets and electrofishing in South Buffalo Lake, 2000-2009. BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; GOS= golden shiner; LMB= largemouth bass; HYB= sunfish hybrid; NOP= northern pike; OSF= orangespotted sunfish; SMB= smallmouth bass; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	CPUE									
	2000	2001	2002	2003	2004	2005	2006 ¹	2007 ¹	2009	Mean
<i>Frame nets</i>										
BLB	71.1	103.4	112.9	18.4	121.9	45.7	---	21.2	17.9	64.1
BLC	2.9	2.0	1.7	2.4	2.4	0.5	---	6.1	0.5	2.3
BLG	4.8	19.1	40.9	47.5	44.0	19.3	---	255.6	73.7	63.1
COC	0.1	0.0	0.2	0.2	0.2	0.2	---	0.1	0.1	0.1
LMB	0.0	0.0	0.0	0.1	0.0	0.0	---	0.1	0.0	0.0
HYB ³	0.0	0.0	0.0	0.0	0.0	0.0	---	0.0	0.2	0.0
NOP	0.1	0.7	0.2	2.2	0.8	0.4	---	0.9	0.4	0.7
OSF ³	0.0	0.0	0.0	0.0	0.0	0.0	---	0.0	0.1	0.0
SMB	0.0	0.0	0.0	0.2	0.0	0.0	---	0.2	0.2	0.1
WAE	0.1	0.3	0.3	0.4	0.4	0.1	---	0.1	0.1	0.2
WHS	0.1	0.1	0.1	0.6	0.3	0.1	---	0.2	0.6	0.3
YEP	0.9	1.4	8.1	0.4	0.1	0.2	---	16.7	8.4	4.5
<i>Gill nets</i>										
BLB	103.5	97.5	61.3	39.8	126.7	0.7	0.8	7.8	0.7	48.8
BLC	0.3	0.3	0.5	2.8	1.0	0.5	0.7	6.7	0.0	1.4
BLG	0.0	0.2	0.2	0.2	0.2	0.0	3.7	2.8	0.0	0.8
COC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GOS ³	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.1
NOP	3.3	2.8	8.7	12.8	3.5	3.0	8.5	14.2	3.5	6.7
SMB	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
WAE	3.8	6.2	10.5	7.2	7.2	1.2	3.5	4.5	0.8	5.0
WHS	9.5	7.8	9.7	5.2	6.8	5.2	4.7	4.3	4.0	6.4
YEP	11.2	28.7	57.0	18.3	4.7	13.3	47.7	47.3	40.3	29.8
<i>Electrofishing</i>										
LMB ²	---	---	---	---	---	---	18.9	---	---	18.9

¹ Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5")

² Spring night electrofishing.

³ All fish sizes.

Table 3. Mean catch rate (CPUE; gill/frame nets= catch/net night), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and relative weight (Wr) for selected species captured in frame nets and experimental gill nets from South Buffalo Lake, 2000-2009. BLB= black bullhead; BLG= bluegill; NOP= northern pike; WAE= walleye; YEP= yellow perch

Species	2000	2001	2002	2003	2004	2005	2006 ¹	2007 ¹	2009	Average	Objective
<i>Frame nets</i>											
BLB											
CPUE	71	103	113	18	122	46	---	21	18	64	≤ 100
PSD	89	87	76	63	64	36	---	52	95	70	---
PSD-P	1	2	17	7	11	14	---	15	31	12	---
Wr	92	94	81	81	80	84	---	98	83	87	---
BLG											
CPUE	5	19	41	48	44	19	---	256	74	63	≥ 25
PSD	64	76	78	86	82	14	---	40	28	59	30-60
PSD-P	37	43	13	19	42	9	---	6	11	23	5-10
Wr	127	116	113	110	123	112	---	119	104	116	---
<i>Gill nets</i>											
NOP											
CPUE	2	3	9	13	4	3	9	14	4	7	≥ 3
PSD	50	29	56	29	43	22	53	48	81	46	30-60
PSD-P	10	12	0	3	5	0	2	7	10	5	5-10
Wr	77	84	86	84	81	85	94	92	88	86	---
WAE											
CPUE	4	6	11	7	7	1	4	5	1	5	≥ 10
PSD	22	14	35	53	63	43	90	59	100	53	30-60
PSD-P	0	3	3	9	21	0	33	30	0	11	5-10
Wr	93	91	93	90	90	98	98	100	99	95	---
YEP											
CPUE	11	29	57	18	5	13	48	47	40	30	≥ 30
PSD	13	7	14	6	18	5	2	2	0	7	30-60
PSD-P	0	0	0	1	0	0	0	0	0	0	5-10
Wr	98	101	93	92	104	104	108	101	95	100	---

¹ Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5")

Table 4. Weighted mean total length (mm) at capture for age-1 through age-10 bluegill captured in frame nets (expanded sample size) from South Buffalo Lake, 2007 and 2009.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
2009	78 (31)	92 (174)	119 (650)	153 (295)	182 (84)	223 (29)	---	250 (48)	257 (38)	260 (7)
2007	---	84 (71)	117 (2223)	153 (1748)	179 (338)	223 (16)	227 (48)	240 (110)	257 (67)	248 (36)

Table 5. Year class distribution based on expanded age/length summary for age-1 through age-10 bluegill sampled in frame nets from South Buffalo Lake, 2007 and 2009.

Survey Year	Year Class												
	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
2009	---	31	174	650	295	84	29	---	48	38	7	---	---
2007	---	---	---	---	71	2223	1748	338	16	48	110	67	36

Table 6. Weighted mean length at capture (mm) for walleye age-1 through age-10 captured in experimental gill net sets (expanded sample size) from South Buffalo Lake, 2005-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
2009	161 (2)	---	---	407 (2)	458 (1)	---	---	499 (2)	---	---
2007	---	256 (22)	380 (1)	489 (2)	---	488 (6)	478 (1)	545 (1)	545 (3)	675 (1)
2006	181 (3)	---	390 (5)	---	452 (6)	517 (5)	---	---	593 (4)	---
2005	---	238 (1)	---	372 (3)	---	---	---	---	---	---

Table 7. Stocking history including size and number for fishes stocked into South Buffalo Lake, 1995-2009. (WAE= walleye; LMB= largemouth bass)

Year	Species	Size	Number
1996	WAE	fry	1,780,000
1998	WAE	fry	900,000
2003	WAE	small fingerling	220,430
2005	WAE	small fingerling	437,300
2006	WAE	fry	2,200,000
2006	LMB	fingerlings	100,320
2008	WAE	small fingerlings	220,560

Table 8. Year class distribution based on the expanded age/length summary for walleye sampled in gill nets and associated stocking history (Number stocked x 1,000) from South Buffalo Lake, 2005-2009.

Survey Year	Year Class														
	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
2009		2			2	1			2						
2007 ¹	---	---			22	1	2		6	1	1	3	1	1	
2006 ¹	---	---	---		3		5		6	5			4		
2005	---	---	---	---			1		3						
# stocked															
fry				2200								900		1780	
sm. fingerling		221			437		220								
lg. fingerling															

¹ Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5").

Table 9. Weighted mean total length (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from South Buffalo Lake, 2009.

Year	Age				
	1	2	3	4	5
2009					
Male	92 (68)	113 (227)	146 (14)	152 (2)	---
Female	91 (168)	119 (367)	148 (94)	163 (16)	140 (10)
Combined	92 (244)	117 (608)	148 (98)	162 (17)	140 (6)

Table 10. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from South Buffalo Lake, 2009.

Survey Year	Year Class					
	2009	2008	2007	2006	2005	2004
2009		244	608	98	17	6

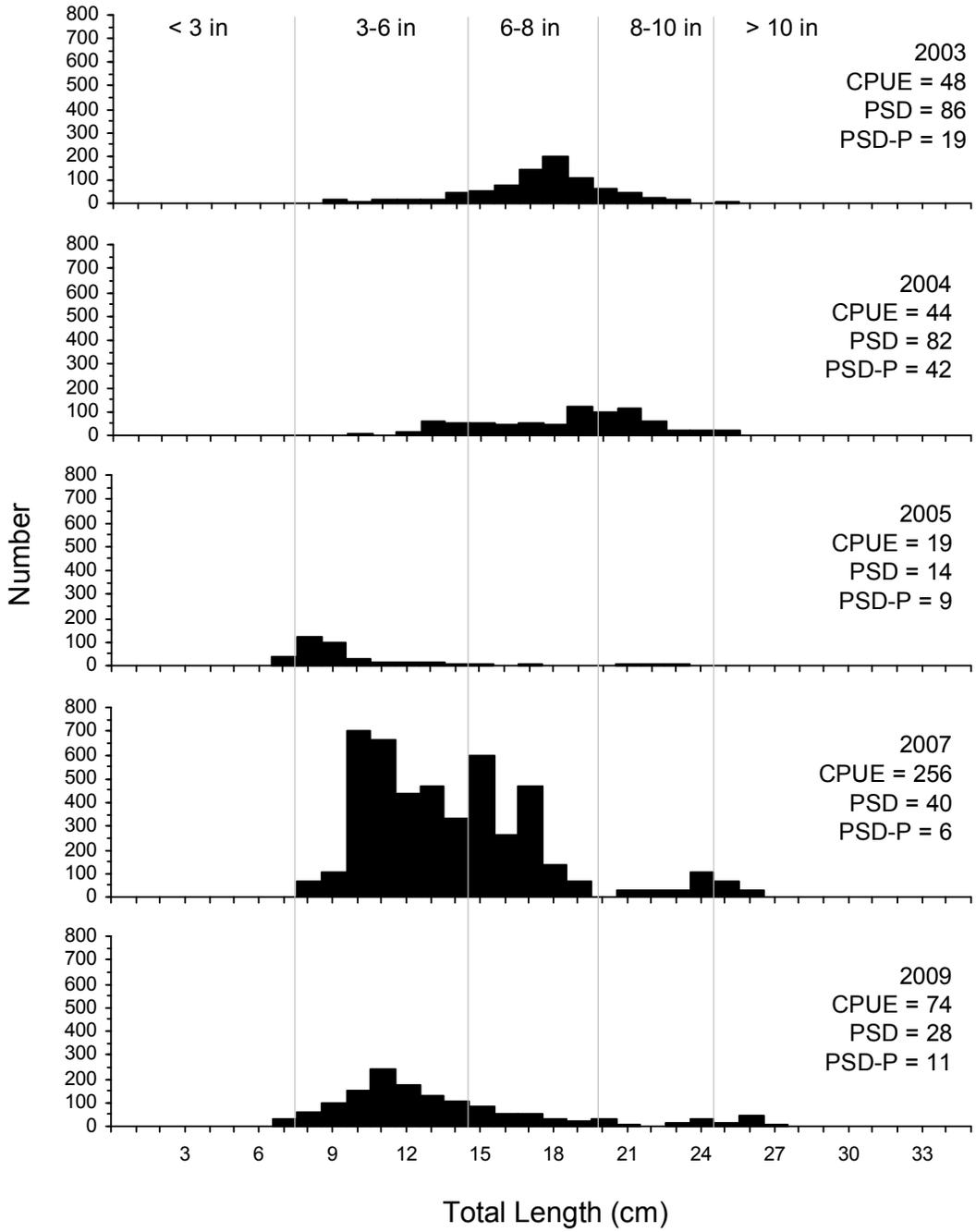


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for bluegill captured using frame nets in South Buffalo Lake, 2003-2009.

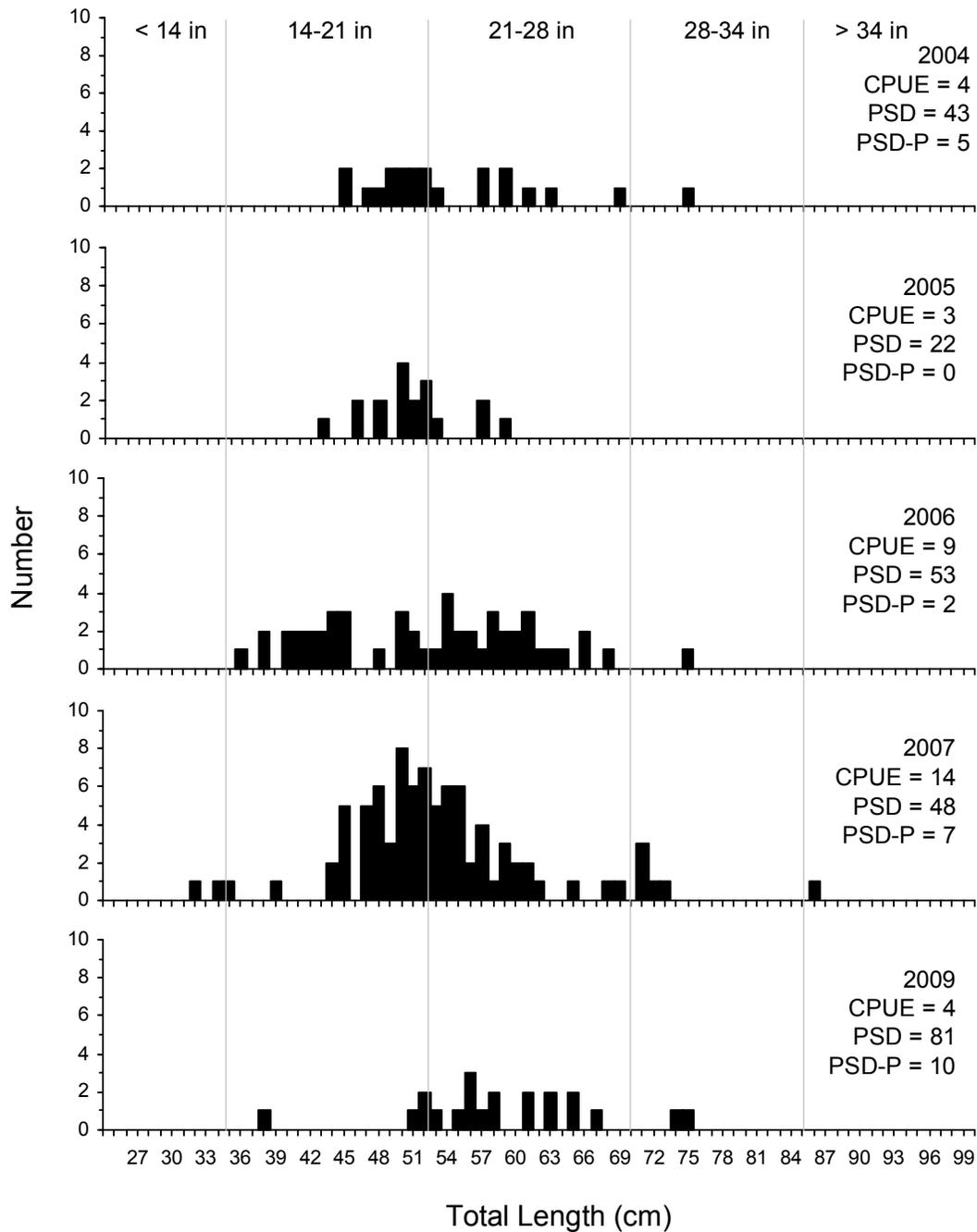


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for northern pike captured using gill nets in South Buffalo Lake, 2004-2009.

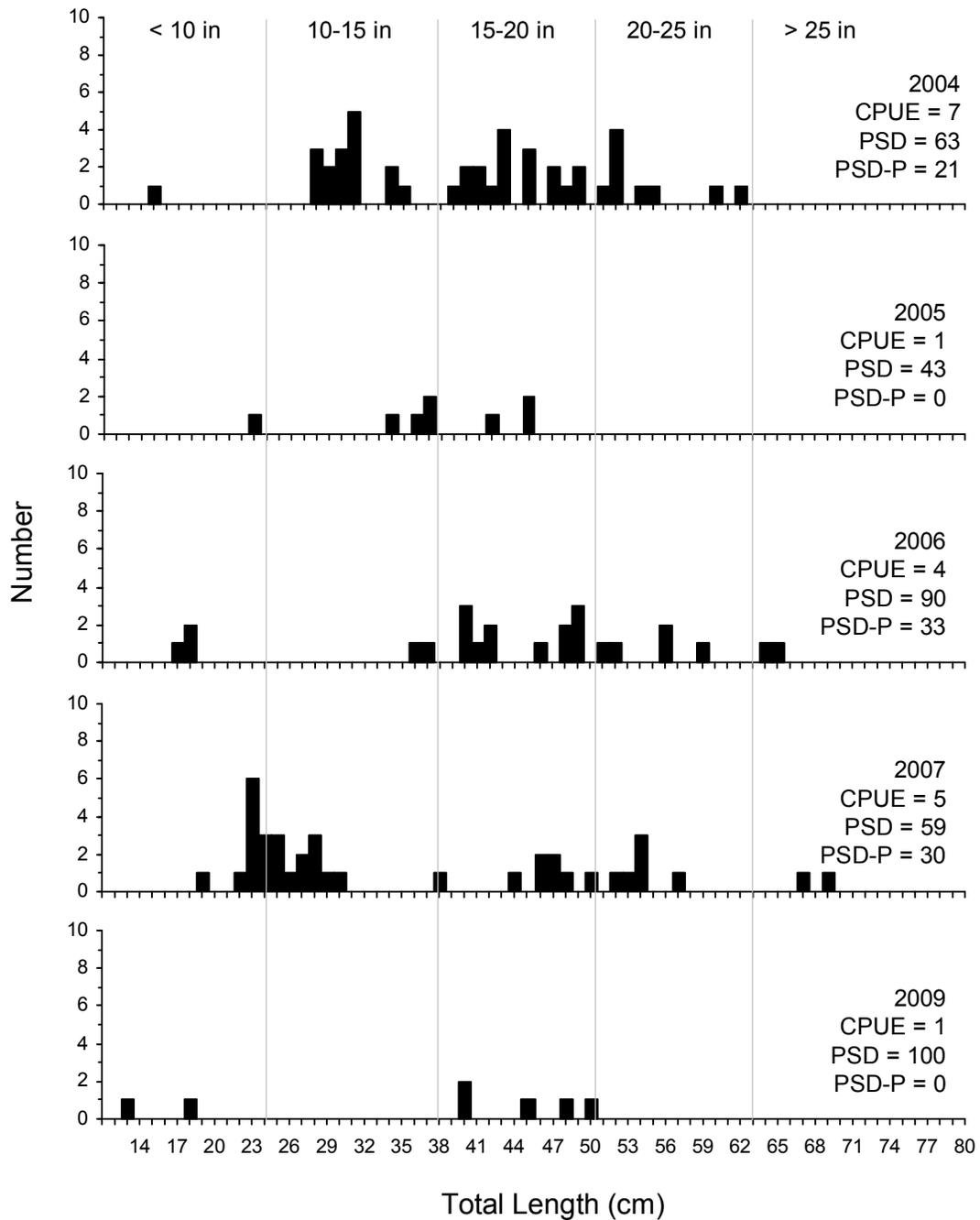


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in South Buffalo Lake, 2004-2009.

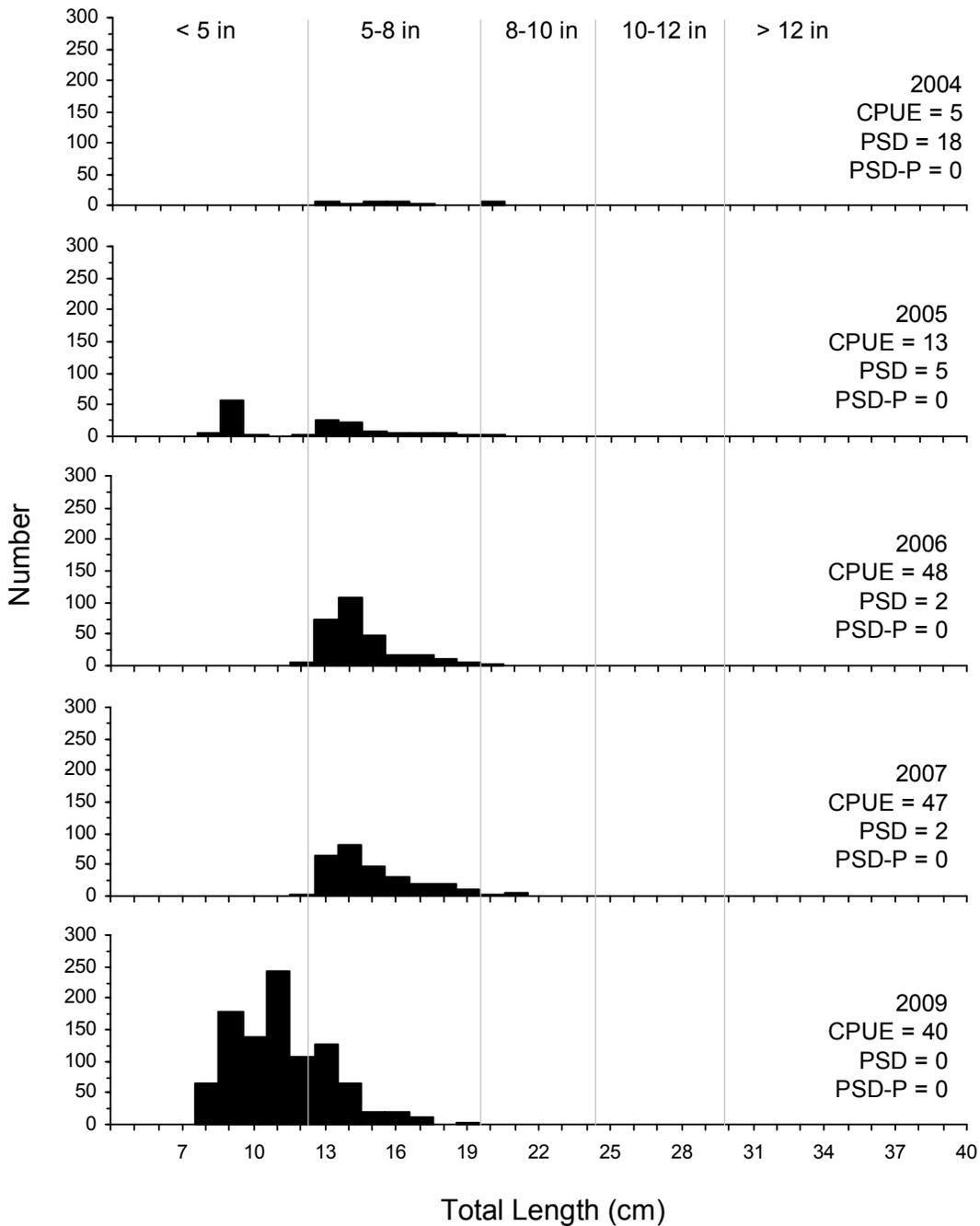


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured using gill nets in South Buffalo Lake, 2004-2009.

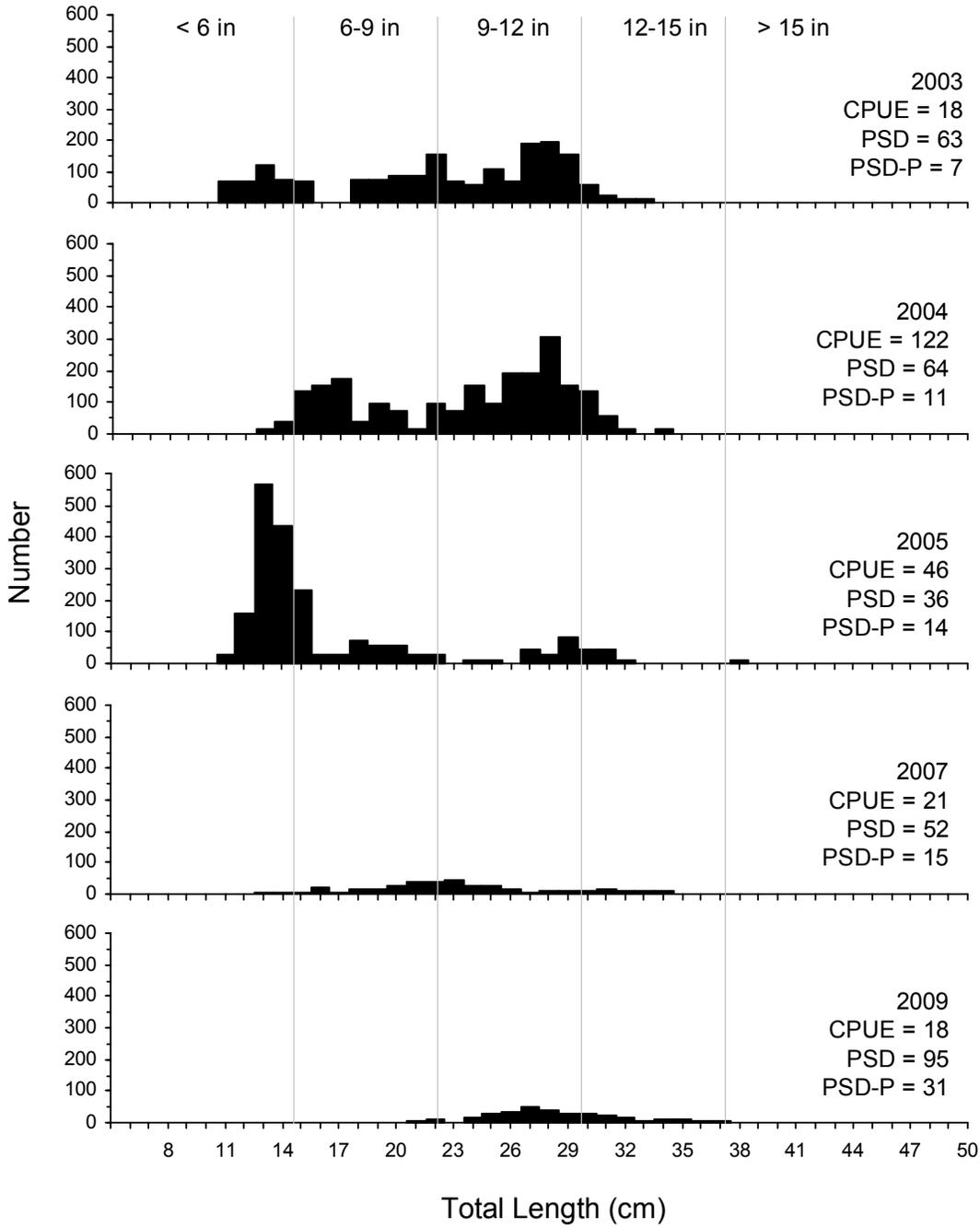


Figure 7. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullheads captured using frame nets in South Buffalo Lake, 2003-2009.