

North Buffalo Lake Site Description

Location

Water designation number (WDN)	48-0035-00
Legal description	T125N-R53W Sec. 3, 4, 9, 10
County (ies)	Marshall
Location from nearest town	6 miles east of Eden, SD.

Survey Dates and Sampling Information

Survey dates	June 8-9, 2010 (FN, GN)
Frame net sets (n)	12
Gill net sets (n)	3

Morphometry

Watershed area (acres)	18,733
Surface area (acres)	≈400
Maximum depth (ft)	≈ 12
Mean depth (ft)	---

Ownership and Public Access

North Buffalo Lake is a meandered lake owned by the State of South Dakota, and the fishery is managed by the SDGFP. A single public access site is located on the northern shore, and is owned and maintained by the SDGFP (Figure 1). The majority of lands adjacent to North Buffalo Lake are either owned by the Bureau of Indian Affairs or private individuals.

Watershed and Land Use

Land use within the Buffalo Lakes watershed is primarily agricultural including pasture or grassland, cropland, and scattered shelterbelts.

Water Level Observations

The Water Management Board established Ordinary High Water Mark is 1835.4 fmsl, and the outlet elevation of North Buffalo Lake is 1834.8 fmsl. On May 11, 2010, North Buffalo Lake was above the Ordinary High Water Mark with an elevation of 1837.2 fmsl. By September 29, 2010 the elevation had declined but remained above the Ordinary High Water Mark at an elevation of 1835.6 fmsl.

Aquatic Nuisance Species Monitoring

Plant Survey

Scattered areas of emergent vegetation are present along the shoreline of North Buffalo Lake and pockets of submersed vegetation exist in protected areas throughout much of the lake. Aquatic vegetation species identified during the 2010 survey include: bulrush, cattail, bladderwort, clasping-leaf pondweed, coontail, northern milfoil, sago pondweed. Chara (a macro algae) was also sampled. No aquatic nuisance plant species were identified.

Macro-Invertebrate/Mussel Survey

No aquatic nuisance macro-invertebrate or mussel species were sampled in 2010.

Fish Community Survey

Common carp was the only aquatic nuisance fish species captured during the 2010 survey.

Fish Management Information

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

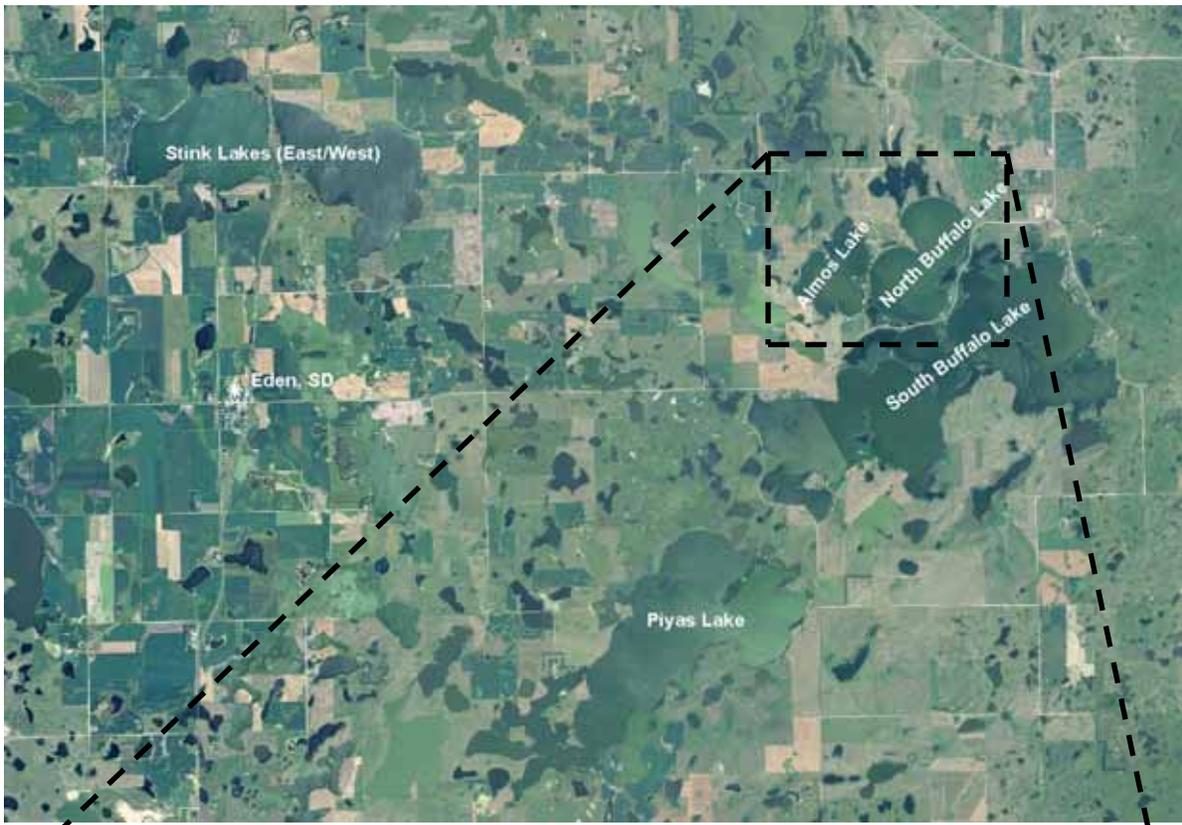


Figure 1. Map depicting geographic of location of Almos Lake, North Buffalo Lake, Piyas Lake, Stink Lakes and South Buffalo Lake (Marshall County) from Eden, South Dakota (top). Also noted is the access location and standardized net locations for North Buffalo Lake (bottom). NBFFN= frame net; NBFGN= gill net

Management Objectives

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

Results and Discussion

Primary Species

Northern Pike: The 2010 mean gill net CPUE of stock-length northern pike was 11.7 (Table 1) and above the minimum objective of (≥ 3 stock-length northern pike/net night; Table 3). The 2010 gill net CPUE represents a substantial increase from the 2007 CPUE of 4.8 (Table 2) and indicates high relative abundance.

Northern pike collected in gill nets from North Buffalo Lake ranged in total length from 26 to 69 cm (10.2 to 27.2 in; Figure 2). The 2010 PSD of gill net captured northern pike was 57 and within the management objective of 30-60 (Table 3). No preferred-length northern pike were captured (Figure 2). Although occasionally sampled, larger northern pike are rare in the gill net catch from many northeastern South Dakota lakes. Neumann et al. (1994) reported that marginal summer habitat due to high water temperatures may limit production of larger trophy-sized (i.e., < 1000 mm) northern pike in Lake Thompson, and other shallow glacial lakes.

No growth information was collected in 2010. However, northern pike were in good condition with mean W_r values that exceeded 90 for all length groups sampled. The mean W_r for stock-length northern pike was 96 (Table 1) and no length-related trends in condition were apparent.

Walleye: The mean gill net CPUE of stock-length walleye during 2010 was 3.7 (Table 1) and below the minimum objective (≥ 10 stock-length walleye/net night; Table 3). The 2010 gill net CPUE represents a slight increase from the 2007 CPUE of 1.3 (Table 2), but still indicates low relative abundance.

Walleye captured in gill nets during 2010 ranged in total length from 12 to 60 cm (4.7 to 23.6 in; Figure 3) and age structure information obtained from otoliths indicated the presence of five year classes (2000, 2004-2005, and 2008-2009; Table 4). Although not abundant, year classes produced in 2008 and 2009 were the most represented (Table 4). The 2008 year class was naturally produced; while the 2009 year class coincided with a small fingerling stocking (Table 4; Table 6). The contribution

of stocked or naturally-produced walleye year classes produced during stocked years is unknown, as stocked walleye were unmarked making it difficult to differentiate stocked from naturally-produced walleye.

In 2010, the weighted mean total length at capture for age-2 walleye was 348 mm (13.7 in; Table 5). No age-3 walleye were captured. Mean W_r values for walleye captured in the 2010 gill net catch ranged from 99 to 110 for all length categories sampled. The mean W_r of stock-length walleye was 101 (Table 1) and no length related trends were apparent.

Yellow Perch: The majority of yellow perch captured in the 2010 gill net catch were less than stock-length resulting in a mean gill net CPUE for all sizes of perch of 272.0. The mean gill net CPUE of stock-length yellow perch was 14.0 (Table 1) and below the minimum objective (≥ 30 stock-length perch/net night; Table 3). The 2010 gill net CPUE represented a substantial decrease from the 77.8 observed in 2007 (Table 2) and indicated moderate relative abundance.

Yellow perch captured in the 2010 gill net catch ranged in total length from 9 to 16 cm (3.5 to 6.3 in; Figure 4). No quality- or preferred-length yellow perch were captured in the 2010 gill net catch resulting in a PSD and PSD-P of 0 (Table 3; Figure 4). Otoliths were collected from a sub-sample of yellow perch in 2010. Yellow perch from the 2008 year class comprised approximately 99% of yellow perch in the 2010 gill net catch and currently dominates the size structure (Table 7).

The weighted mean total length at capture for age-2 male yellow perch was 106 (4.2 in; Table 8). The weighted mean total length at capture for age-2 female yellow perch was 112 (4.4 in; Table 8). The majority of yellow perch in the 2010 gill net catch were in the sub-stock length category which had a mean W_r of 104. The mean W_r for stock-length yellow perch was 102 (Table 1) and no length related trends were apparent.

Other Species

Black Bullhead: The mean frame net CPUE of stock-length black bullhead was 14.4 (Table 1) and within the management objective (≤ 100 stock-length black bullhead/net night; Table 3). The 2010 gill net CPUE represented a slight decrease from the 17.0 observed in 2007 (Table 2) and indicated moderate relative abundance.

Frame net captured black bullhead ranged in total length from 10 to 37 cm (3.9 to 14.6 in) with no missing cm-length groups from 10-31 cm indicating consistent recruitment in recent years (Figure 5). Black bullhead in the 2010 frame net catch had a PSD of 33 and a PSD of 6 (Table 3). No growth information was collected during 2010. Mean W_r values for frame net captured black bullheads ranged from 80 to 97 for all length categories sampled. The mean W_r for stock-length black bullheads was 92 (Table 1) and no length-related trends in condition were apparent.

Black Crappie: The mean frame net CPUE of stock-length black crappies in 2010 was 5.4 (Table 1). The 2010 frame net CPUE was similar to the 5.3 observed in 2007 (Table 7) and indicated low to moderate relative abundance.

Black crappie in the 2010 frame net catch ranged in total length from 9 to 26 cm (3.5 to 10.2 in) with what appears to be single year class ranging in total length from 11 to 13 cm (4.3 to 5.1 in) dominating the size structure. The presence of a high proportion of smaller (i.e., < 13 cm; 5.0 in) black crappie in the 2010 frame net catch indicates successful reproduction recently; however, the contribution of these fish to the adult population is currently unknown and will be assessed in future surveys.

No growth information was collected during 2010, but black crappie sampled in the 2010 frame net catch were in good condition with mean W_r values that exceeded 95 for all length categories sampled. The mean W_r for stock-length black crappie was 105 (Table 1) and no length-related trends in condition were apparent.

Bluegill: The mean frame net CPUE of stock-length bluegill during 2010 was 65.5 (Table 1). The 2010 frame net CPUE represented an increase from the 50.8 observed in 2007 (Table 2) and indicated high relative abundance.

The total length of bluegill captured in frame nets during 2010 ranged from 7 to 26 cm (3.1 to 10.2 in; Figure 7). The majority of bluegill captured in the 2010 frame net catch ranged in total length from 8 to 16 cm (3.1 to 6.3 in) and were less than quality-length resulting in low PSD and PSD-P values of 3 and 1, respectively (Figure 7).

No growth information was available for bluegill in North Buffalo Lake; however, mean W_r values exceeded 105 for all length groups sampled. Mean W_r values were likely influenced by pre-spawning condition.

Other: Common carp, golden shiner, green sunfish, orangespotted sunfish, and white sucker were other fish species captured in low numbers during the 2010 survey (Table 1).

Management Recommendations

- 1) Conduct fish population assessment surveys utilizing gill nets and frame nets on an every third year basis (next survey scheduled in summer 2013) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Collect otoliths from bluegill, walleye, and yellow perch to assess age structure and growth rates of each population.
- 3) Stock walleye (\approx 100 small fingerling/acre) on a biennial basis to supplement the walleye population.
- 4) 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 North Buffalo Lake did not necessitate the need for commercial harvest.
- 5) Monitor water levels and winter/summer kill events. In cases of complete winter/summerkill, stock northern pike, walleye, and yellow perch to re-establish a fish community.

Table 1. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length fish (PSD-P), and mean relative weight (Wr) of stock-length fish for various fish species captured in frame nets experimental gill nets from North Buffalo Lake, 2010. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; GOS= golden shiner; GSF= green sunfish; NOP=northern pike; OSF= orangespotted sunfish; 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	14.4	4.7	33	6	6	3	92	3
BLC	5.4	2	11	6	3	4	105	1
BLG	65.5	22.6	3	1	1	1	108	1
GOS ¹	0.1	0.1	---	---	---	---	---	---
GSF	2.6	0.9	3	0	0	--	98	1
NOP	0.5	0.3	33	42	0	---	92	5
OSF ¹	0.3	0.5	---	---	---	---	---	---
WAE	0.3	0.2	67	67	67	67	98	69
WHS	0.3	0.3	50	50	50	50	82	16
YEP	32.7	19.6	2	1	1	1	89	2
<i>Gill Nets</i>								
BLB	0.3	0.7	0	---	0	---	94	---
BLC	0.3	0.7	0	---	0	---	126	---
BLG	0.3	0.7	0	---	0	---	128	---
COC	0.7	1.2	50	50	50	50	97	19
NOP	11.7	3.3	57	14	0	---	96	1
WAE	3.7	2.7	55	29	45	29	101	3
WHS	2.3	1.7	57	39	14	28	100	8
YEP	14.0	1.2	0	---	0	---	103	2

¹ All fish sizes

Table 2. Historic mean catch rate (CPUE; catch/net night) of stock-length fish for various fish species captured in frame nets and experimental gill nets from North Buffalo Lake, 2007-2010. BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; GOS= golden shiner; GSF= green sunfish; NOP= northern pike; OSF= orangespotted sunfish; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	CPUE		Mean
	2007 ²	2010	
<i>Frame nets</i>			
BLB	17.0	14.4	15.7
BLC	5.3	5.4	5.4
BLG	50.8	65.5	58.2
COC	0.1	0.0	0.1
GOS ¹	0.0	0.1	0.1
GSF	0.3	2.6	1.5
NOP	0.4	0.5	0.5
OSF ¹	0.1	0.3	0.2
WAE	0.0	0.3	0.2
WHS	0.2	0.3	0.3
YEP	28.7	32.7	30.7
<i>Gill nets</i>			
BLB	3.3	0.3	1.8
BLC	0.3	0.3	0.3
BLG	0.0	0.3	0.2
COC	0.5	0.7	0.6
NOP	4.8	11.7	8.3
WAE	1.3	3.7	2.5
WHS	1.8	2.3	2.1
YEP	77.8	14.0	45.9

¹ All fish sizes

² Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) for selected species captured in frame nets and experimental gill nets from Summit Lake, 1999-2010. BLB= black bullhead; BLG= bluegill; NOP= northern pike; WAE = walleye; YEP = yellow perch

Species	2007 ¹	2010	Average	Objective
<i>Frame nets</i>				
BLB				
CPUE	17	14	16	≤ 100
PSD	33	33	33	---
PSD-P	16	6	11	---
Wr	103	92	98	---
BLG				
CPUE	51	66	59	---
PSD	21	3	12	---
PSD-P	6	1	4	---
Wr	125	108	117	---
<i>Gill nets</i>				
NOP				
CPUE	5	12	9	≥ 3
PSD	84	57	71	30-60
PSD-P	5	0	3	5-10
Wr	89	96	93	---
WAE				
CPUE	1	4	3	≥ 10
PSD	80	55	68	30-60
PSD-P	20	45	33	5-10
Wr	97	101	99	---
YEP				
CPUE	78	14	46	≥ 30
PSD	12	0	6	30-60
PSD-P	0	0	0	5-10
Wr	97	103	100	---

¹ Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

Table 4. 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 North Buffalo Lake, 2007-2010.

Survey Year	Year Class										
	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
2010		8	5			1	1				4
2007 ^{1,2}	---	---	---			1	3				
# stocked											
fry				350							
sm. fingerling		34									
lg. fingerling											

¹ Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

² Older walleye were sampled but are not reported in this table

Table 5. Weighted mean length at capture (mm) for walleye captured in experimental gill nets (expanded sample size) from North Buffalo Lake, 2007-2010. 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
2010	178(8)	348(5)	---	---	515(1)	596(1)	---	---	---	545(4)
2007 ¹	---	377(1)	450(3)	---	---	---	---	---	---	---

¹ Older walleye were sampled but are not reported in this table

Table 6. Stocking history including size and number for fishes stocked into North Buffalo Lake, 2000-2010. WAE= walleye

Year	Species	Size	Number
2007	WAE	fry	350,000
2009	WAE	small fingerling	33,720

Table 7. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from North Buffalo Lake, 2010.

Survey Year	Year Class				
	2010	2009	2008	2007	2006
2010		2	809	4	2

Table 8. Weighted mean total length (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from North Buffalo Lake, 2010.

Year	Age			
	1	2	3	4
2010				
Male	89(2)	106(411)	---	---
Female	---	112(398)	154(4)	163(2)
Combined	89(2)	109(809)	154(4)	163(2)

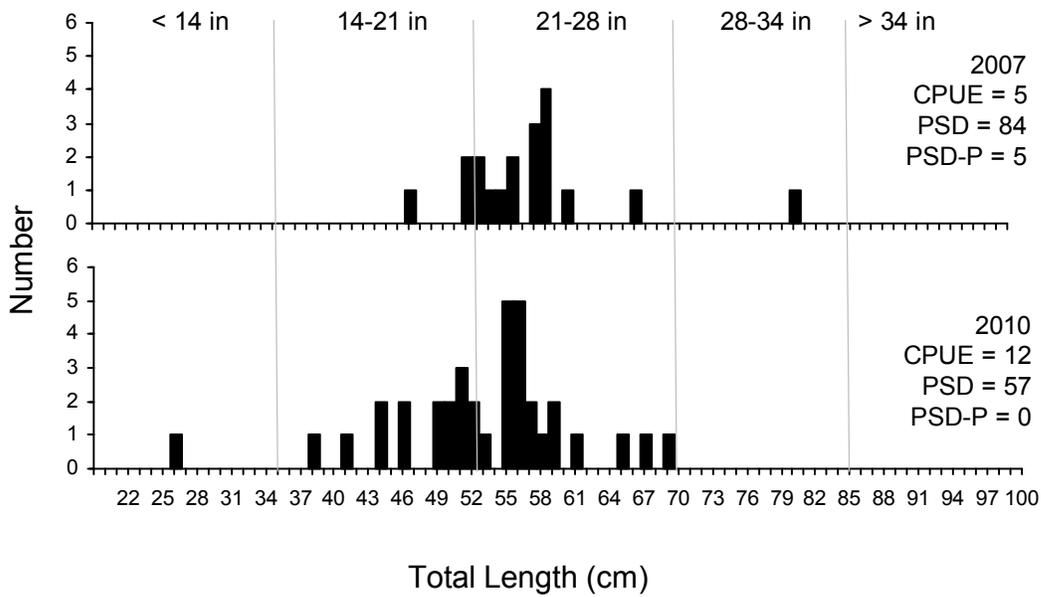


Figure 2. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for northern pike captured by gill nets in North Buffalo Lake, 2007 and 2010.

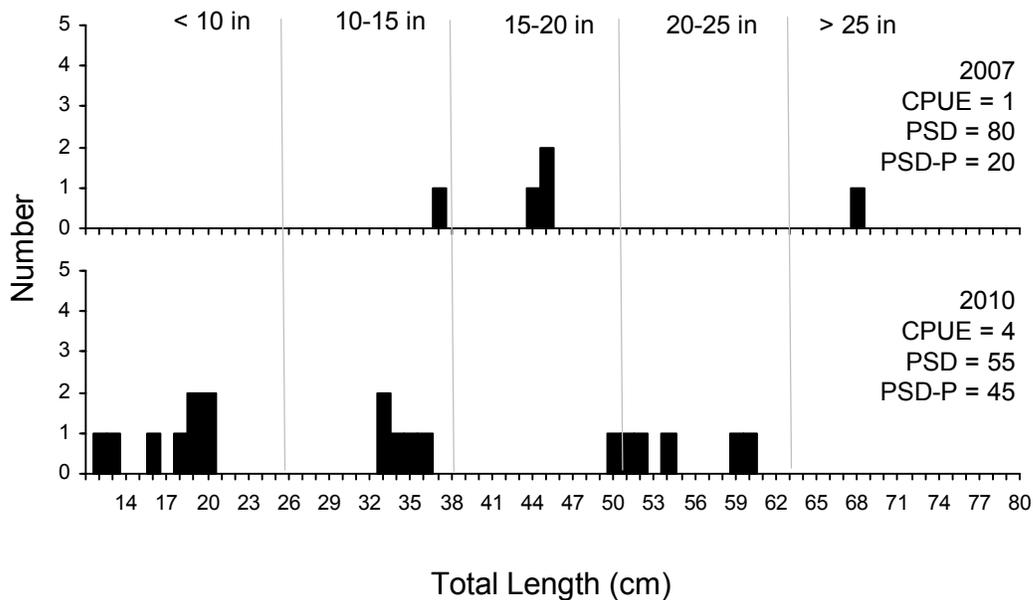


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured by gill nets in North Buffalo Lake, 2007 and 2010.

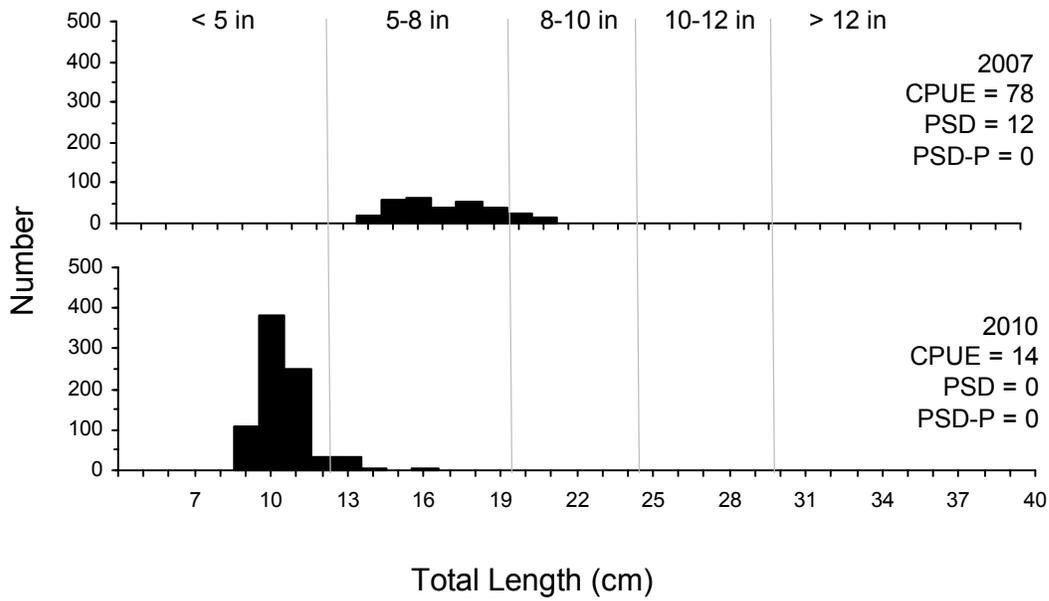


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured by gill nets in North Buffalo Lake, 2007 and 2010.

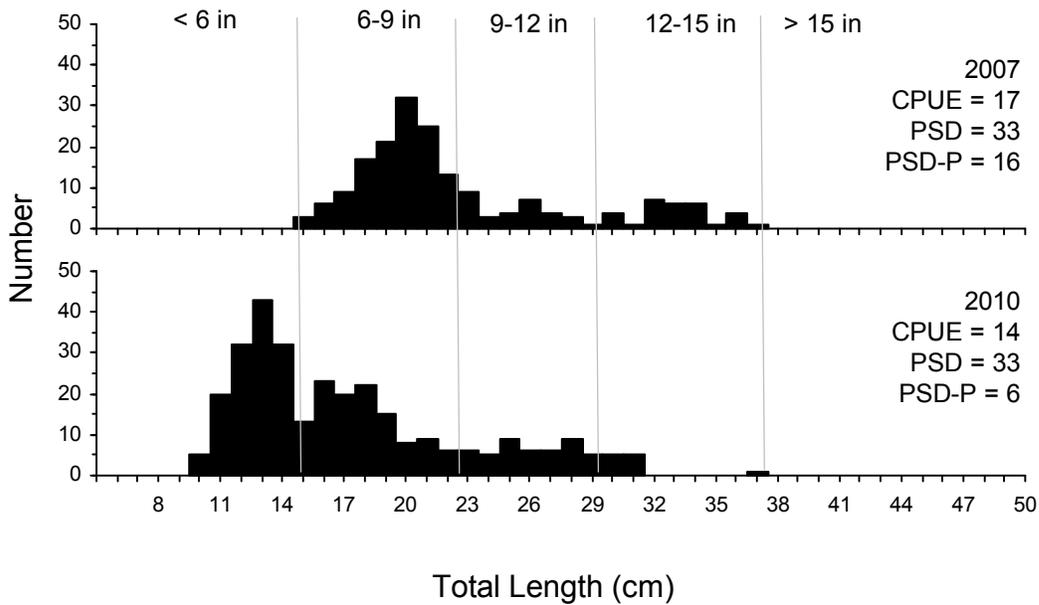


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured by frame nets in North Buffalo Lake, 2007 and 2010.

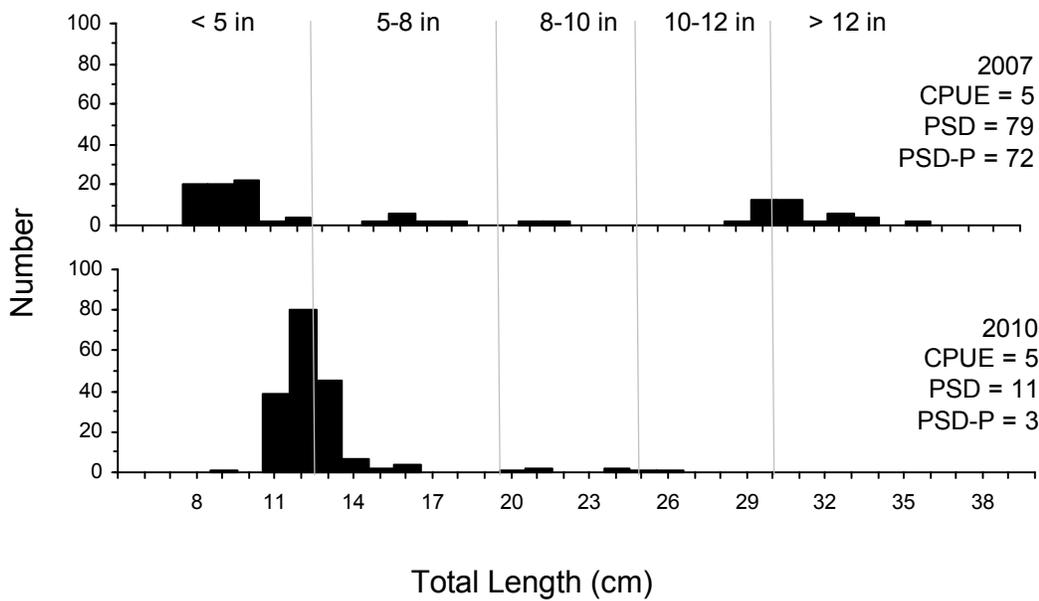


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black crappie captured by frame nets in North Buffalo Lake, 2007 and 2010.

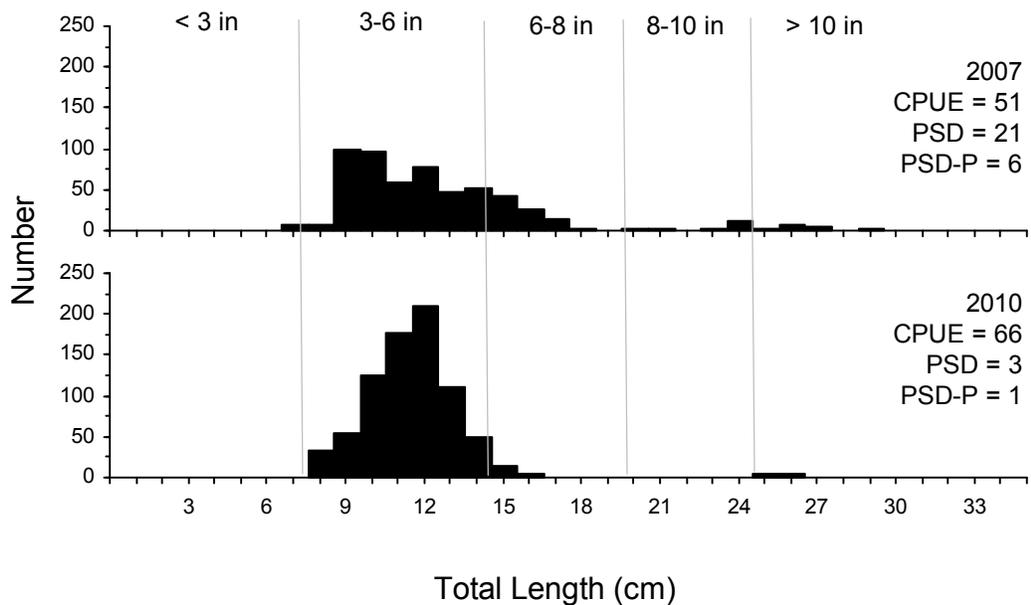


Figure 7. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for bluegill captured by frame nets in North Buffalo Lake, 2007 and 2010.