

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	6.0 miles east of Eden, SD.

Survey Dates and Sampling Information

Survey dates	June 11-12, 2013 (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 OHWM is 1835.4 fmsl, and the outlet elevation of North Buffalo Lake is 1834.8 fmsl. On May 22, 2013 the elevation was 1835.7 fmsl and slightly above the OHWM. On October 8, 2013 the elevation was below the OHWM and outlet elevation at 1834.4 fmsl.

Fish Management Information

Primary species	Bluegill, Northern Pike, Walleye, Yellow Perch
Other species	Black Bullhead, Black Crappie, Common Carp, Golden Shiner, Green Sunfish, Orangespotted Sunfish, White Sucker
Lake-specific regulations	none
Management classification	warm-water semi-permanent
Fish consumption advisories	none

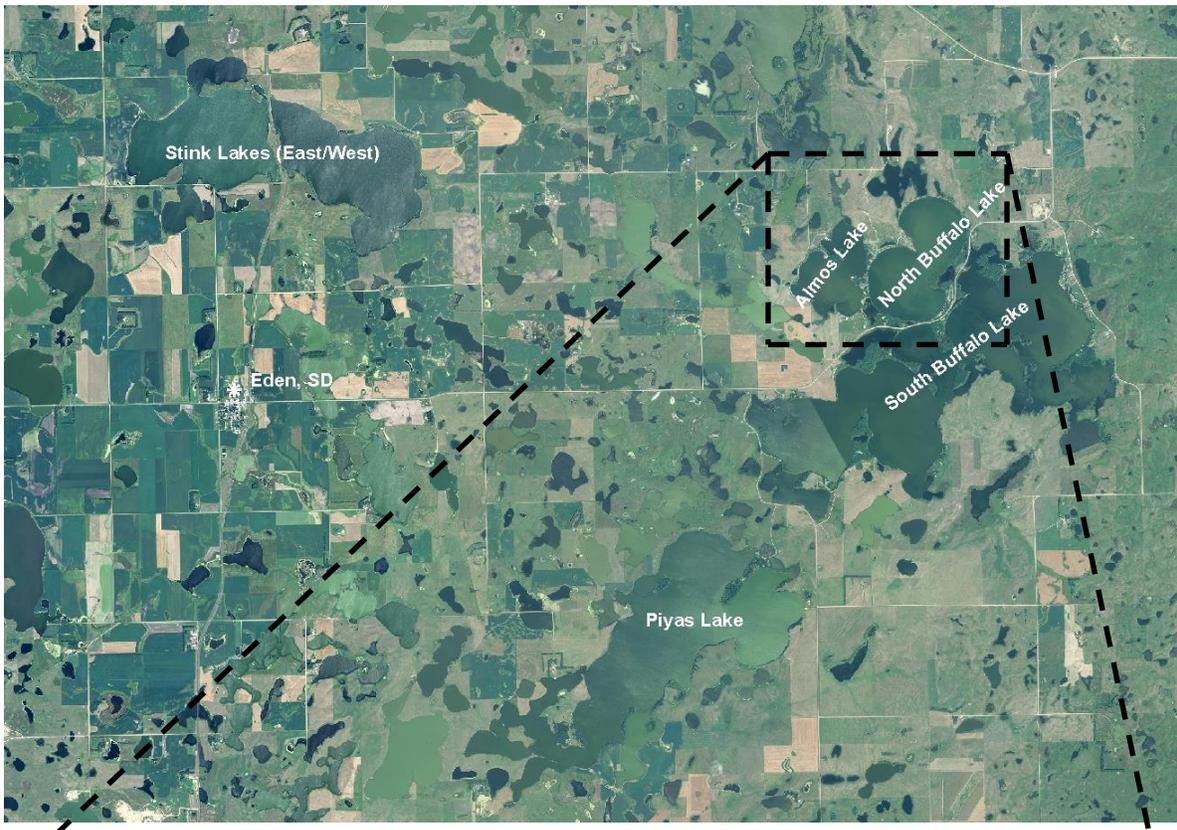


Figure 1. Map depicting geographic locations of Almos Lake, North Buffalo Lake, Piyas Lake, Stink Lakes and South Buffalo Lake (Marshall County) from Eden, South Dakota (top). Also noted is the access location and standardized net locations for North Buffalo Lake (bottom). NBFFN= frame net; NBFGN= gill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

Management Objectives

- 1) Maintain a mean 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 Black Bullhead ≤ 100 .

Results and Discussion

Primary Species

Bluegill: The mean frame net CPUE of stock-length Bluegill was 47.1 (Table 1) and above the minimum objective (≥ 25 stock-length Bluegill/net night; Table 3). In each of the past three surveys conducted, relative abundance has remained high (i.e., ≥ 24 stock-length Bluegill/net night; Table 2).

Length-frequency analysis suggested consistent recruitment in recent years, as all cm-length groups from 8 to 21 cm (3.1 to 8.3 in) were represented (Figure 2). The PSD was 56 and the PSD-P was 2 (Table 1; Figure 2). The PSD was within the management objective range of 30-60; while the PSD-P was below the objective range of 5-10, as few preferred-length (20 cm; 8 in) Bluegill were sampled (Table 3; Figure 2).

No age or growth information was collected. Frame net captured Bluegill had high condition with mean W_r values ≥ 100 for all length categories (e.g., stock to quality) sampled. The mean W_r of stock-length Bluegill was 101 and no length-related trends in condition were apparent. Sampling was conducted in mid-June; therefore, spawning behavior may have influenced W_r values.

Northern Pike: The mean gill net CPUE of stock-length Northern Pike was 11.7 (Table 1) and above the minimum objective (≥ 3 stock-length fish/net night; Table 3). In surveys conducted since 2007, mean gill net CPUE values of stock-length fish have ranged from a low of 4.8 (2007) to a high of 11.7 (2010, 2013; Table 2) and relative abundance has been considered high.

Gill net captured Northern Pike ranged in TL from 43 to 82 cm (16.9 to 32.3 in; Figure 3). The PSD of 60 and PSD-P of 6 were within management objectives and indicated a relatively balanced population, defined as a PSD of 30-60 and a PSD-P of 5-

10 (Table 1; Table 3 Figure 3). However, size structure indices should be interpreted with caution as sample size was low (i.e., 35 stock-length Northern Pike).

No age or growth information was collected. Northern Pike in the gill net catch had mean W_r values that ranged from 90 to 92 for all length categories (e.g., stock to quality) sampled. The mean W_r of stock-length individuals was 91 (Table 1) and no length-related trends in condition were apparent.

Walleye: The mean gill net CPUE of stock-length Walleye was 4.0 (Table 1) and below the minimum objective (≥ 10 stock-length Walleye/net night; Table 3). The 2013 gill net CPUE represented a slight increase from the 2010 CPUE of 3.7 (Table 2), but still indicated low relative abundance.

Walleye in the gill net catch ranged in TL from 19 to 58 cm (7.5 to 22.8 in; Figure 4). Age estimates made using otoliths revealed the presence of four year classes (2000 and 2009-2011; Table 4). Cohorts produced during both stocked (e.g., 2009) and non-stocked (e.g., 2010) years were represented, each by a limited number of individuals (Table 4; Table 6). The weighted mean TL at capture for age-3 and age-4 Walleye was 358 and 471 mm (14.1 and 18.5 in; Table 5). Few inferences can be made concerning size structure and condition due to low sample size.

Yellow Perch: The mean gill net CPUE of stock-length Yellow Perch was 68.0 (Table 1) and above the minimum objective (≥ 30 stock-length perch/net night; Table 3). The 2013 gill net CPUE represented an increase from the 2010 CPUE of 14.0 (Table 2). Currently, relative abundance is high.

Gill net captured Yellow Perch ranged in TL from 10 to 20 cm (3.9 to 7.9 in; Figure 5). Few individuals \geq quality-length (20 cm; 8 in) were sampled, which resulted in low PSD and PSD-P values of 1 and 0 (Table 1; Figure 5). Both the PSD and PSD-P were below management objectives of 30-60 and 5-10, respectively (Table 3).

Otoliths were collected from a sub-sample of gill net captured Yellow Perch. Four consecutive year classes (2008-2011) were present (Table 7). The 2009 year class was the most abundant and comprised 52% of Yellow Perch in the gill net catch; while cohorts produced in 2008 and 2010 accounted for additional 17% and 30% (Table 7).

Yellow Perch in North Buffalo Lake exhibit slow growth. In 2013, the weighted mean TL at capture of age-3 male Yellow Perch was 141 mm (5.6 in); while age-3 females had a weighted mean TL at capture of 139 mm (5.5 in; Table 8). At older ages the differences between males and females were more pronounced, but weighted mean TL at capture values remained < 20 cm (8 in) through age 5 (Table 8). Yellow Perch condition was acceptable, with the mean W_r of individuals in the stock-quality length category, which comprised 99% of the sample, being 90.

Other Species

Black Bullhead: Black Bullheads were the most abundant fish species in the frame net catch. The mean frame net CPUE of stock-length Black Bullheads was 128.4 (Table 1). The 2013 gill net CPUE represented a substantial increase from the 2010 CPUE of 14.4 (Table 2) and was above the management objective (≤ 100 stock-length Black Bullhead/net night; Table 3).

Frame net captured Black Bullheads ranged in TL from 17 to 37 cm (6.7 to 14.6 in; Figure 6). A high proportion (90%) ranged in TL from 20 to 28 cm (7.9 to 11.0 in). The PSD was 70 and the PSD-P was 4. No age and growth information was collected in 2013. Mean W_r values of Black Bullheads in the frame net catch ranged from 78 to 82 for all length categories (e.g., stock to quality) sampled, with the mean W_r of stock-length fish being 81 (Table 1). No length-related trends in condition were apparent as TL increased.

Black Crappie: The mean frame net CPUE of stock-length Black Crappie was 4.8 (Table 1). The 2013 frame net CPUE was similar to CPUE values of 5.3 and 5.4 reported in 2007 and 2010, respectively (Table 2). Although not abundant Black Crappie have consistently been sampled in North Buffalo Lake.

Black Crappie in the 2013 frame net catch ranged in TL from 18 to 28 cm (7.1 to 11.0 in), had a PSD of 96 and a PSD-P of 7 (Table 1; Figure 7). Length-frequency analysis suggested inconsistent recruitment with few individuals < quality-length (20 cm; 8 in) being sampled (Figure 7).

No age or growth information was collected. Black Crappie in the quality-preferred length category, which dominated the sample, had a mean W_r of 101.

Other: Common carp and white sucker were other fish species captured in low numbers during the 2013 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 2016) 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 (≈ 100 small fingerling/acre) on a biennial basis to supplement the walleye population.
- 4) Monitor water levels and winter/summer kill events. In cases of substantial winter/summer kill; 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, 2013. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= Black Bullhead; BLC= Black Crappie; BLG= Bluegill; NOP=Northern Pike; 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	128.4	50.9	70	2	4	1	81	1
BLC	4.8	2.8	96	4	7	6	101	1
BLG	47.1	18.2	56	3	2	1	101	2
NOP	0.3	0.2	100	0	33	67	87	17
WAE	0.2	0.2	100	0	50	50	82	32
YEP	25.4	13.8	3	2	1	1	88	4
<i>Gill Nets</i>								
BLB	62.3	36.1	61	6	1	1	81	<1
BLC	1.3	0.6	100	0	0	---	106	3
BLG	0.3	0.6	0	---	0	---	109	---
COC	0.3	0.6	100	---	100	---	101	---
NOP	11.7	1.7	60	14	6	7	91	1
WAE	4.0	1.1	67	26	8	15	90	4
WHS	0.7	0.6	100	0	50	50	95	36
YEP	68.0	43.4	1	1	0	---	90	<1

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, 2007-2013. 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		
	2007 ¹	2010	2013
<i>Frame nets</i>			
BLB	17.0	14.4	128.4
BLC	5.3	5.4	4.8
BLG	50.8	65.5	47.1
COC	0.1	0.0	0.0
GOS ²	0.0	0.1	0.0
GSF	0.3	2.6	0.0
NOP	0.4	0.5	0.3
OSF ²	0.1	0.3	0.0
WAE	0.0	0.3	0.2
WHS	0.2	0.3	0.0
YEP	28.7	32.7	25.4
<i>Gill nets</i>			
BLB	3.3	0.3	62.3
BLC	0.3	0.3	1.3
BLG	0.0	0.3	0.3
COC	0.5	0.7	0.3
NOP	4.8	11.7	11.7
WAE	1.3	3.7	4.0
WHS	1.8	2.3	0.7
YEP	77.8	14.0	68.0

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

² All fish sizes

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 North Buffalo Lake, 2007-2013. BLB= Black Bullhead; NOP= Northern Pike; WAE = Walleye; YEP = Yellow Perch

Species	2007 ¹	2010	2013	Objective
<i>Frame nets</i>				
BLB				
CPUE	17	14	128	≤ 100
PSD	33	33	70	---
PSD-P	16	6	4	---
Wr	103	92	81	---
BLG				
CPUE	51	66	47	≥ 25
PSD	21	3	56	30-60
PSD-P	6	1	2	5-10
Wr	125	108	101	---
<i>Gill nets</i>				
NOP				
CPUE	5	12	12	≥ 3
PSD	84	57	60	30-60
PSD-P	5	0	6	5-10
Wr	89	96	91	---
WAE				
CPUE	1	4	4	≥ 10
PSD	80	55	67	30-60
PSD-P	20	45	8	5-10
Wr	97	101	90	---
YEP				
CPUE	78	14	68	≥ 30
PSD	12	0	1	30-60
PSD-P	0	0	0	5-10
Wr	97	103	90	---

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 (# stocked x 1,000) from North Buffalo Lake, 2007-2010.

Survey Year	Year Class													
	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
2013			4	7	4									1
2010	---	---	---		8	5			1	1				4
2007 ^{1,2}	---	---	---	---	---	---			1	3				
# stocked														
fry	175		175				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, 2007-2013. 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
2013 [†]	---	212(4)	358(7)	471(4)	---	---	---	---	---	---
2010	178(8)	348(5)	---	---	515(1)	596(1)	---	---	---	545(4)
2007 [†]	---	377(1)	450(3)	---	---	---	---	---	---	---

[†] 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, 2000-2013. WAE= Walleye

Year	Species	Size	Number
2007	WAE	fry	350,000
2009	WAE	small fingerling	33,720
2011	WAE	fry	175,000
2013	WAE	fry	175,000

Table 7. Year class distribution based on the expanded age/length summary for Yellow Perch sampled in gill nets from North Buffalo Lake, 2010-2013.

Survey Year	Year Class							
	2013	2012	2011	2010	2009	2008	2007	2006
2013			1	64	109	36		
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, 2010-2013.

Year	Age				
	1	2	3	4	5
2013					
Male	---	106 (1)	141 (33)	149 (19)	154 (10)
Female	---	---	139 (31)	161 (100)	185 (17)
Combined	---	106 (1)	140 (64)	158 (109)	171 (36)
2010					
Male	89(2)	106(411)	---	---	---
Female	---	112(398)	154(4)	163(2)	---
Combined	89(2)	109(809)	154(4)	163(2)	---

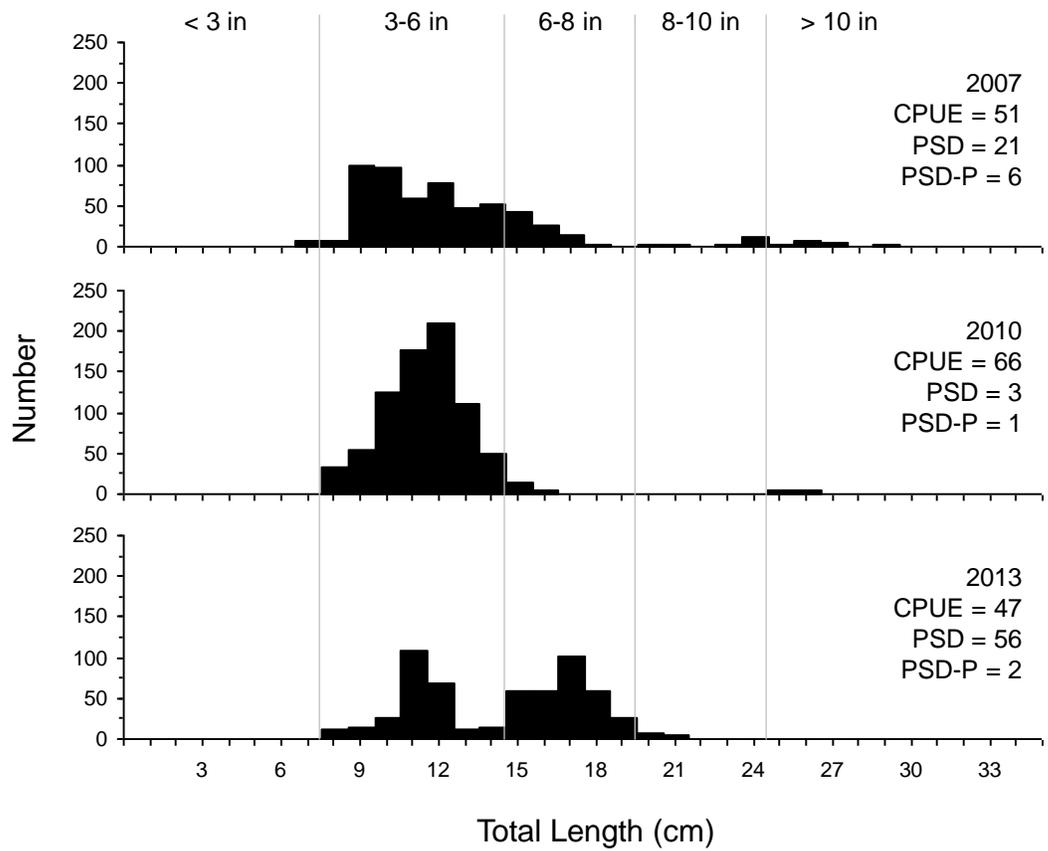


Figure 2. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Bluegill captured using frame nets in North Buffalo Lake, 2007-2013.

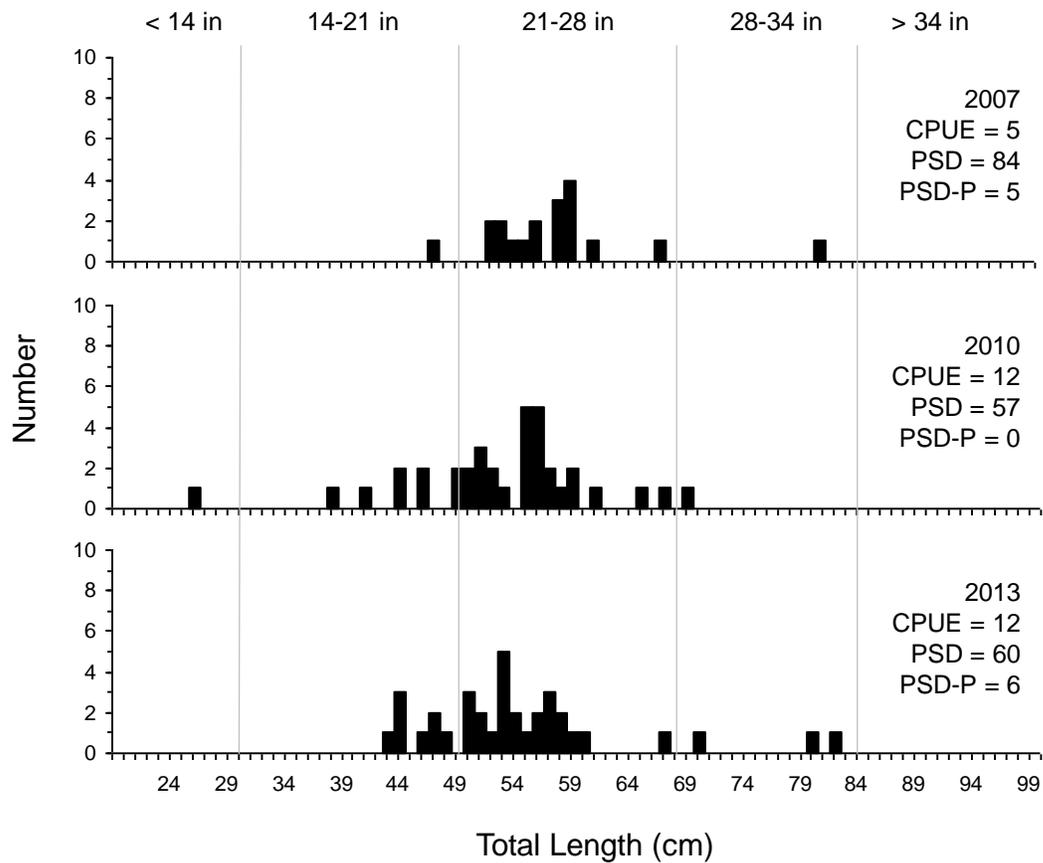


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Northern Pike captured using gill nets in North Buffalo Lake, 2007-2013.

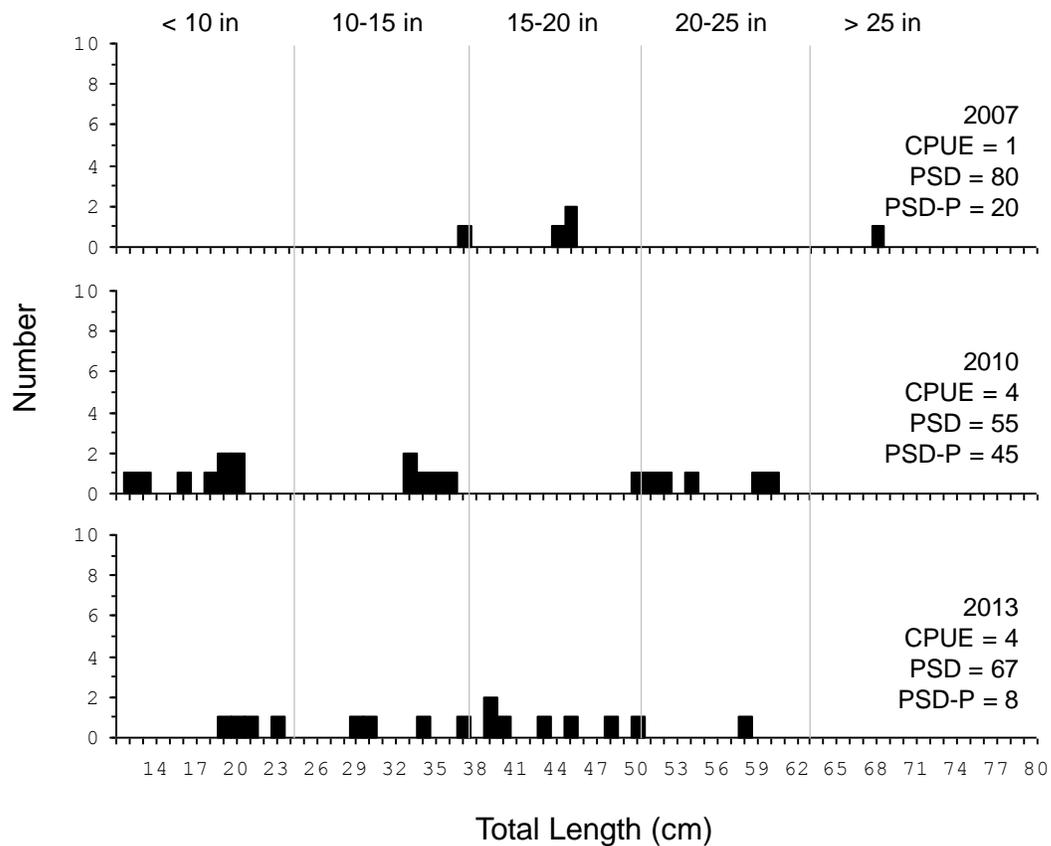


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Walleye captured using gill nets in North Buffalo Lake, 2007-2013.

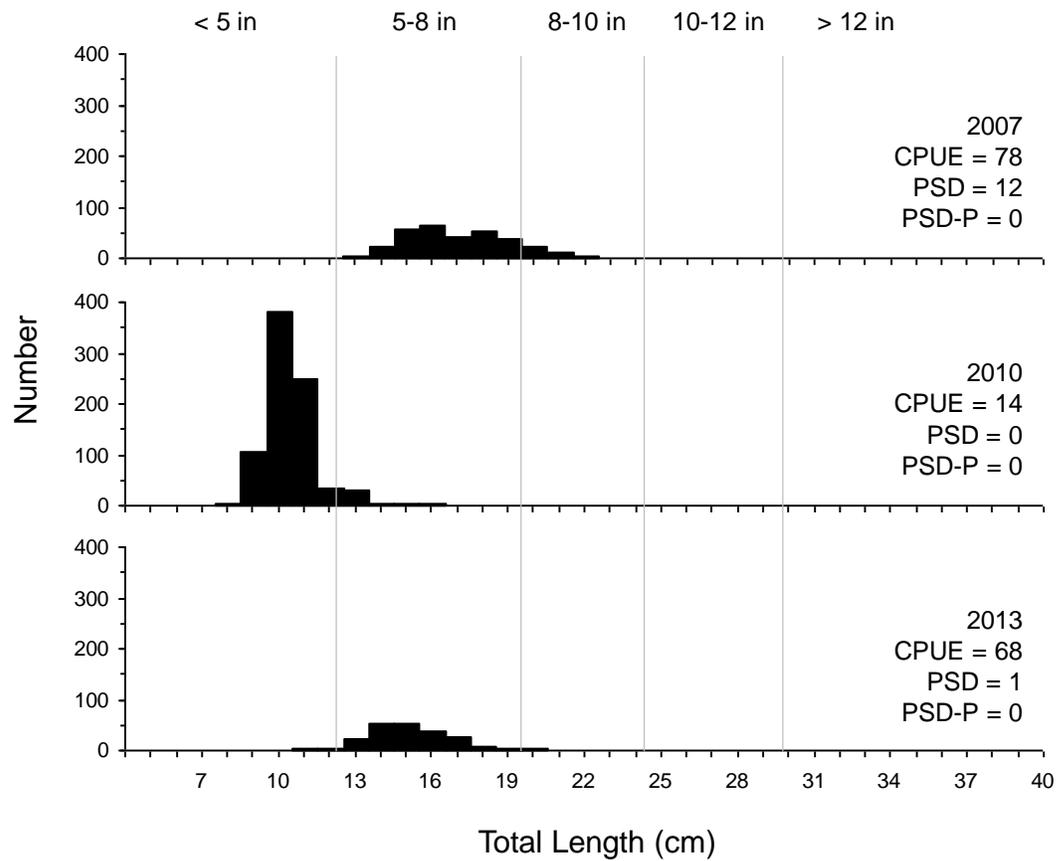


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Yellow Perch captured using gill nets in North Buffalo Lake, 2007-2013.

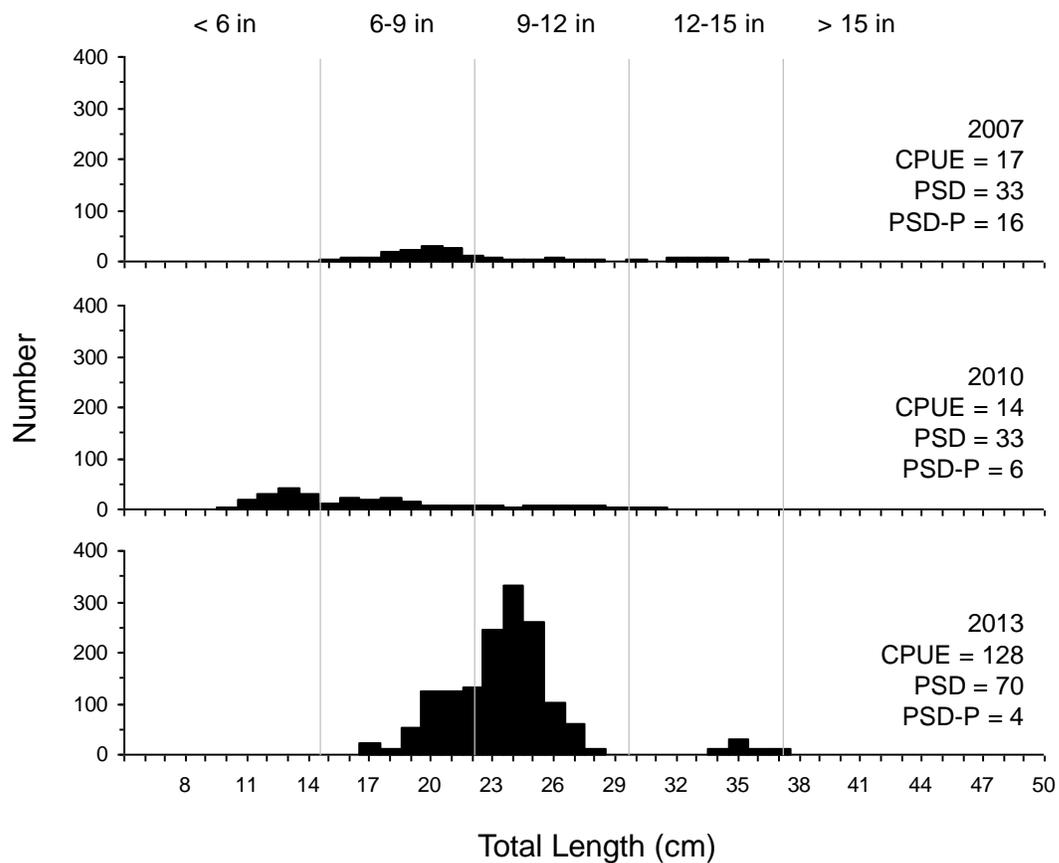


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Black Bullheads captured using frame nets in North Buffalo Lake, 2007-2013.

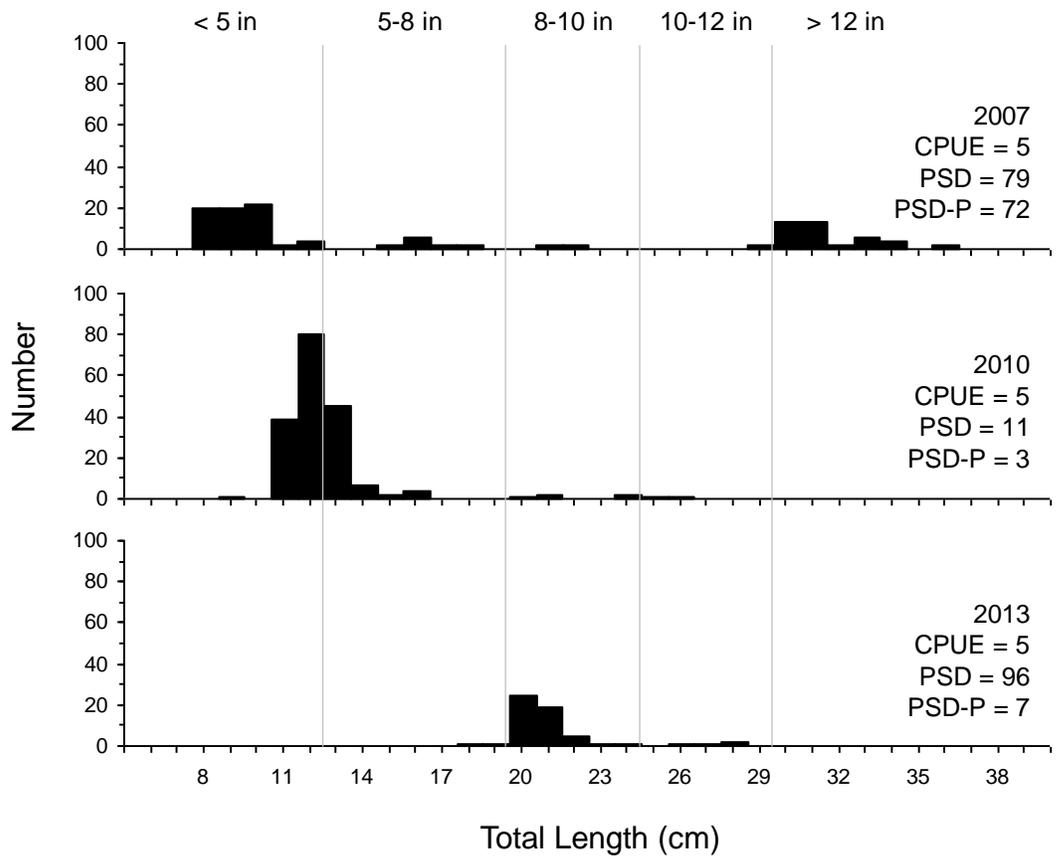


Figure 7. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Black Crappie captured using frame nets in North Buffalo Lake, 2007-2013.