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

Dates of current survey	June 12-13, 2007
Dates of most recent survey	July 6-7, 1995
Gill net sets (n)	4
Frame net sets (n)	11

Morphometry (Figure 1)

Watershed area (acres)	18,733
Surface area (acres)	≈400
Maximum depth (ft)	≈ 12
Mean depth (ft)	≈ 10

Ownership and Public Access

North Buffalo Lake is a meandered lake owned by the State of South Dakota, and the fish community is managed by the South Dakota Department of Game, Fish, and Parks (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

The watershed of North Buffalo Lake is comprised of pasture (60%), cropland (20%), and woodlands (20%).

Water Level Observations

The Water Management Board established Ordinary High Water Mark is 1835.4 fmsl (feet above mean sea level), and the outlet elevation of North Buffalo Lake is 1834.8 fmsl. On May 3, 2007, North Buffalo Lake was above the Ordinary High Water Mark with an elevation of 1836.6 fmsl. On October 23, 2007 North Buffalo Lake remained above the Ordinary High Water Mark at an elevation of 1835.8 fmsl.

Aquatic Vegetation and Exotics

Emergent vegetation in the form of cattail (*Typha* spp.) and bulrush (*Scirpus* spp.) were present at a light density along the lake's shoreline. Submergent vegetation present consisted of a scattered to moderate mix of coontail (*Ceratophyllum demersum*) and sago pondweed (*Potamogeton pectinatus* L.; Hanson 2007). Common carp were the only exotic species encountered during this survey.

Fish Management Information

Primary species	northern pike, walleye, yellow perch
Other species	black bullhead, bluegill, common carp, fathead minnow, green sunfish, Johnny darter, orangespotted sunfish, rock bass, white sucker
Management classification	warm-water semi-permanent
Fish Consumption Advisories	none

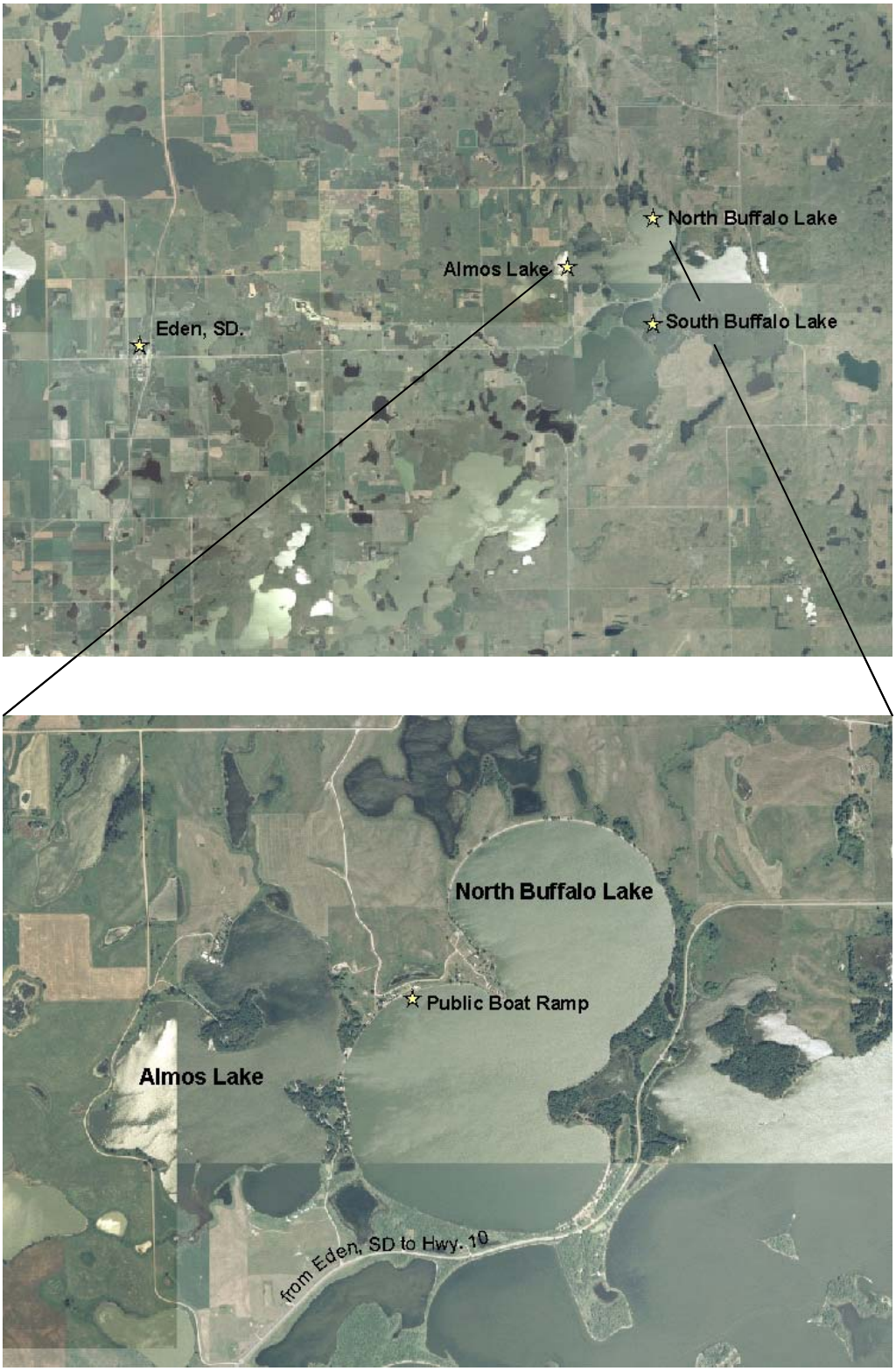

Figure 1. Map depicting location of North Buffalo Lake (including public access point) from Eden, South Dakota.

Management Objectives

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

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

3) Maintain a mean gill net CPUE of stock-length yellow perch ≥ 25, 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

North Buffalo Lake is a relatively-shallow natural lake named after Buffalo Township in Marshall County. An unnamed tributary and culverts which connect South and North Buffalo Lakes are the major surface water inlets to North Buffalo Lake. Water exiting North Buffalo Lake flows to Almos Lake, then into South Red Iron, and then through a string of Coteau Lakes, to the James River.

Past survey reports dating back to the 1960's indicate a fish community comprised mainly of black bullheads, black crappie, yellow perch, and walleye. North Buffalo is susceptible to winterkill, with documented winterkills during the 1961-62, 1977-78, 1985-86, and 1991-92 winters.

A public boat ramp on the northern shore of North buffalo Lake provides good public access. Currently, North Buffalo Lake is managed as a northern pike, walleye, and yellow perch fishery.

Primary Species

Northern Pike: The mean gill net CPUE of stock-length northern pike in North Buffalo Lake during 2007 was 4.8, and above the minimum objective (≥ 3 stock-length fish/net-night; Tables 1-3). Although, northern pike are typically not sampled effectively using standard summer lake survey methods; sampling of North Buffalo Lake coincided with the most reliable time to assess northern pike populations using gill nets in eastern South Dakota natural lakes, as seasonal variability and gill net catch-per-effort were found to stabilize during May and June (Neumann and Willis 1995). Based on the 2007 gill net catch, relative abundance of northern pike in North Buffalo Lake is moderate-high (Table 1; Table 3).

Sampled northern pike ranged in total length from 470 to 810 mm, had a PSD of 84, and an RSD-P of 5 (Table 1; Table 3; Figure 5). No growth information was collected. Condition of sampled northern pike was acceptable with mean Wr values exceeding 85 for all length groups sampled. No length-related trends in Wr values were apparent, and the mean Wr for stock-length northern pike was 89 (Table 1).

Walleye: The mean gill net CPUE of stock-length walleye during 2007 was 1.3, and below the minimum objective (≥ 10 stock-length fish/net night; Tables 1-3). Based on the 2007 walleye gill net catch, walleye relative abundance is considered low.

North Buffalo Lake has not been stocked with walleye since 1995. Both the length-frequency histogram of the 2007 walleye gill net catch, and age-structure information suggest poor natural recruitment over the past decade (Table 4; Table 6 Figure 6). North Buffalo Lake was stocked with walleye fry in 2007; however, recruitment is unknown at this time.

Walleye captured in gill nets during 2007 ranged in total length from 370 to 680 mm (Figure 6). Low sample size limits the utility of size structure indices and Wr calculations. Growth appears to be fast with the weighted mean length at capture for age-2 and age-3 walleyes being 377 and 450 mm (Table 4).

Yellow Perch: The mean gill net CPUE of stock-length (130 mm) yellow perch in 2007 was 77.8, and above the minimum objective (≥ 25 fish/net night; Tables 1-3). Recruitment appears to be relatively consistent in recent years as no missing 10-mm length groups are present from 130 to 220 mm (Figure 7). Based on the 2007 gill net catch, yellow perch relative abundance is considered high.

Yellow perch collected in gill nets during 2007 ranged in total length from 130-240 mm, had a PSD of 12, and an RSD-P of 0 (Table 1; Table 3; Figure 7). The PSD and RSD-P values are below the objective ranges of 30-60 and 5-10, indicating a population primarily comprised of yellow perch less than quality-length (200 mm).

No growth information was collected during 2007. A slight decreasing trend in mean Wr values was observed as total length increased; however mean Wr values exceeded 90 for all length groups sampled. The mean Wr for stock-length yellow perch was 97 (Table 1).

Other Species

Black bullheads: Prior surveys conducted over the past 30-40 years, indicated periods of high black bullhead relative abundance. However, the mean frame net CPUE in 2007 was 17.0, and within the objective (≤ 100 stock-length fish/net-night; Table 3). Based on the 2007 frame net catch relative abundance is considered low, and their impact on the fishery is likely minimal.

Length-frequency analysis indicates consistent recruitment in recent years, with a relatively-large cohort ranging from 150 to 230 mm (Figure 2). Black bullheads captured in frame nets during 2007 ranged in total length from 150 to 370 mm, had a PSD of 33, and an RSD-P of 16 (Table 1; Figure 2).

Black Crappie: The mean frame net CPUE of stock-length black crappies in 2007 was 5.3, and indicative of low relative abundance (Table 1; Table 2). Sub-stock (≤130 mm) black crappies were represented in the frame net catch in 2007, likely the result of successful reproduction in 2006 (Figure 3). Contribution of sub-stock (<130 mm) black crappies is unknown as they may not have been fully recruited to our gear at the time of sampling.

Black crappies sampled in frame nets during 2007 ranged in total length from 80 to 360 mm, had a PSD of 79 and a RSD-P of 72 (Table 1; Figure 3). The high PSD and RSD-P is a result of low recruitment in recent years resulting in a population primarily comprised of preferred-length individuals. When sub-stock black crappies grow to stock-length, PSD and RSD-P values are expected to decline (Figure 3).

No growth information was collected during 2007. A decreasing trend in Wr values with increasing fish total length was observed in 2007; however, mean Wr values exceeded 95 for all length groups sampled indicating acceptable condition. High Wr values for smaller fish may have been a result of weighing error associated with weighing of smaller fish in the field.

Bluegill: The mean frame net CPUE of stock-length bluegill during 2007 was 50.8 and indicated moderate-high relative abundance (Table 1; Table 2). Length-frequency analysis indicates relatively consistent recruitment in recent years as no missing 10-mm length groups are present from 70 to 180 mm (Figure 4).

The total length of bluegill captured in frame nets during 2007 ranged from 70 to 290 mm (Figure 4). The PSD of 21 and RSD-P of 6 indicated a nearly balanced population, as defined by a PSD of 30-60, and an RSD-P of 5-10. As bluegill that currently range in total length from 90 to 150 mm, obtain quality-length PSD values are expected to increase (Figure 4).

No growth information was available for bluegill in North Buffalo Lake; however, mean Wr values exceeded 120 for all length groups sampled. Mean Wr values were likely influenced by pre-spawning condition. No length-related trends in Wr were apparent during 2007.

Common Carp, hybrid sunfish (*Lepomis* spp.), green sunfish, orangespotted sunfish, and white sucker were also captured during the 2007 survey. The relative abundance of these species currently appears to be low (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 2010) 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 on a biennial basis (1,000 fry/acre) to supplement the walleye population.

4) 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.

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 North Buffalo 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 North Buffalo Lake, 2007. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; GSF= green sunfish; HYB= hybrid sunfish; NOP= northern pike; OSF= orangespotted sunfish; 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	17.0	3.9	33	5	16	4	103	1
BLC	5.3	3.5	79	9	72	10	105	1
BLG	50.8	17.5	21	3	6	2	125	4
HYB[1]	0.7	0.7	---	---	---	---	---	---
COC	0.1	0.1	---	---	---	---	115	---
GSF	0.3	0.2	---	---	---	---	111	17
NOP	0.4	0.2	100	0	25	59	82	18
OSF[1]	0.1	0.1	---	---	---	---	---	---
WHS	0.2	0.1	100	0	100	0	---	---
YEP	28.7	14.6	18	4	1	0	88	2
Gill nets								
BLB	3.3	2.9	15	19	15	19	104	2
BLC	0.3	0.4	---	---	---	---	118	---
COC	0.5	0.8	100	0	100	0	95	19
NOP	4.8	1.8	84	15	5	9	89	2
WAE	1.3	2.0	80	20	20	43	97	8
WHS	1.8	1.0	100	0	57	39	110	6
YEP	77.8	9.9	12	3	0	---	97	1

[1] all fish sizes.

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 North Buffalo Lake, 2000 – 2007. BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; GSF= green sunfish; HYB= hybrid sunfish; NOP= northern pike; OSF= orangespotted sunfish; WAE= walleye; WHS= white sucker; YEP= yellow perch

	CPUE								
Species	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Frame nets									
BLB	---	---	---	---	---	---	---	17.0	17.0
BLC	---	---	---	---	---	---	---	5.3	5.3
BLG	---	---	---	---	---	---	---	50.8	50.8
HYB[1]	---	---	---	---	---	---	---	0.7	0.7
COC	---	---	---	---	---	---	---	0.1	0.1
GSF							---	0.3	0.3
NOP	---	---	---	---	---	---	---	0.4	0.4
OSF[1]	---	---	---	---	---	---	---	0.1	0.1
WHS	---	---	---	---	---	---	---	0.2	0.2
YEP	---	---	---	---	---	---	---	28.7	28.7
Gill nets									
BLB	---	---	---	---	---	---	---	3.3	3.3
BLC	---	---	---	---	---	---	---	0.3	0.3
COC	---	---	---	---	---	---	---	0.5	0.5
NOP	---	---	---	---	---	---	---	4.8	4.8
WAE	---	---	---	---	---	---	---	1.3	1.3
WHS	---	---	---	---	---	---	---	1.8	1.8
YEP	---	---	---	---	---	---	---	77.8	77.8

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional stock density (PSD), relative stock density of preferred-length fish (RSD-P), and relative weight (Wr) for selected species captured in frame nets and experimental gill nets in North Buffalo Lake, 2000 - 2007. BLB= black bullhead; NOP= northern pike; YEP= yellow perch; WAE= walleye

Species	2000	2001	2002	2003	2004	2005	2006	2007	Average	Objective
Frame nets										
BLB										
CPUE	---	---	---	---	---	---	---	17	17	< 100
PSD	---	---	---	---	---	---	---	33	33	---
RSD-P	---	---	---	---	---	---	---	16	16	---
Wr	---	---	---	---	---	---	---	103	103	---
Gill nets										
NOP										
CPUE	---	---	---	---	---	---	---	5	5	≥ 3
PSD	---	---	---	---	---	---	---	84	84	30-60
RSD-P	---	---	---	---	---	---	---	5	5	5-10
Wr	---	---	---	---	---	---	---	89	89	---
WAE										
CPUE	---	---	---	---	---	---	---	1	1	≥10
PSD	---	---	---	---	---	---	---	80	80	30-60
RSD-P	---	---	---	---	---	---	---	20	20	5-10
Wr	---	---	---	---	---	---	---	97	97	---
YEP										
CPUE	---	---	---	---	---	---	---	78	78	≥25
PSD	---	---	---	---	---	---	---	12	12	30-60
RSD-P	---	---	---	---	---	---	---	0	0	5-10
Wr	---	---	---	---	---	---	---	97	97	---

Table 4. Weighted mean length at capture (mm) for walleye captured in experimental gill nets in North Buffalo Lake, 2007.

		Age										
Year	N	1	2	3	4	5	6	7	8	9	10	11
2007	5	---	377	450	---	---	---	---	---	---	---	685

Table 5. Stocking history including size and number for fishes stocked into North Buffalo Lake, 2000-2007. WAE= walleye

Year	Species	Size	Number
2007	WAE	fry	350,000

Table 6. Numbers of walleye sampled (n) by year class and recent associated stocking history (Number stocked x 1,000) for walleye captured in North Buffalo Lake, 2007.

	Year Class													
Survey Year	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1999	1998	1997	1996
2007			1	3										1
Number stocked														
fry	350													
small fingerling														
large fingerling														

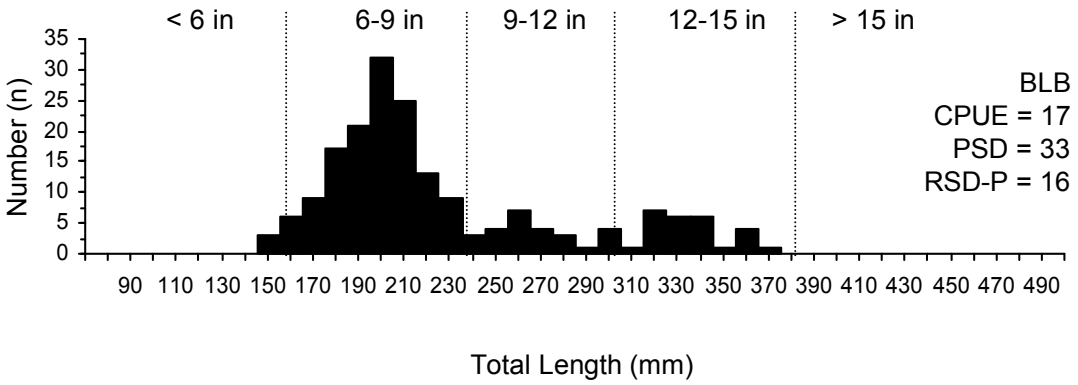

Figure 2. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black bullhead captured in frame nets in North Buffalo Lake, 2007.

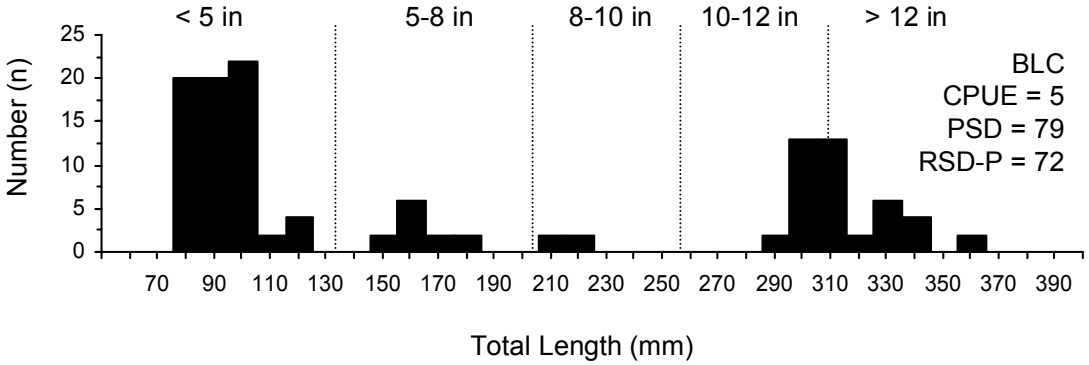

Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black crappie captured in frame nets in North Buffalo Lake, 2007.

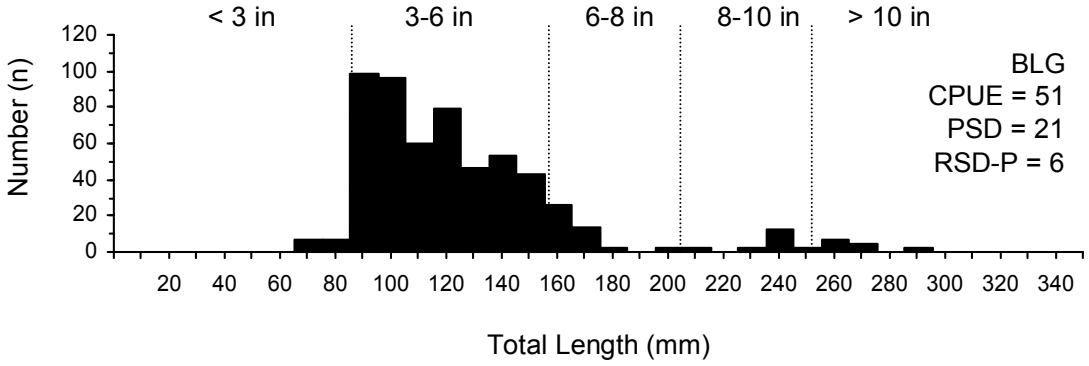

Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for bluegill captured in frame nets in North Buffalo Lake, 2007.

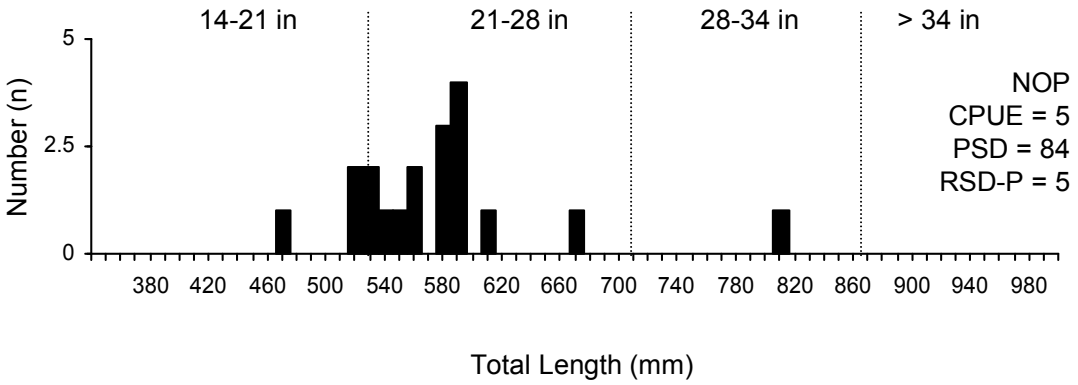

Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for northern pike captured in gill nets in North Buffalo Lake, 2007.

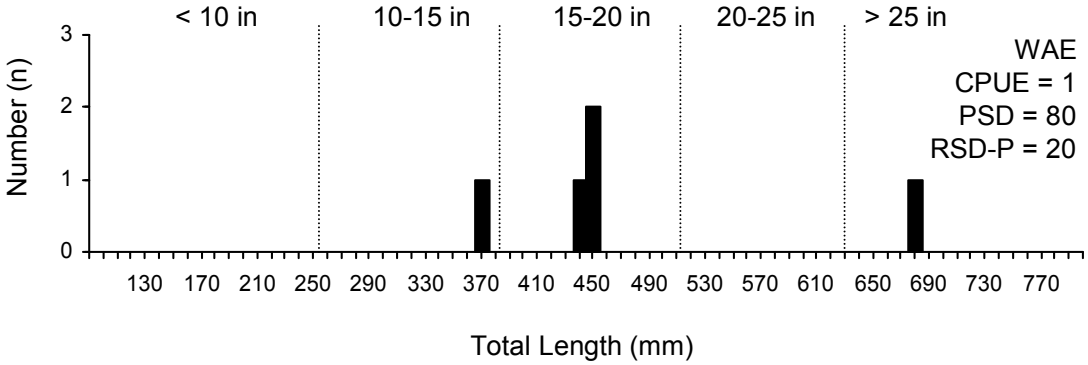

Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for walleye captured in gill nets in North Buffalo Lake, 2007.

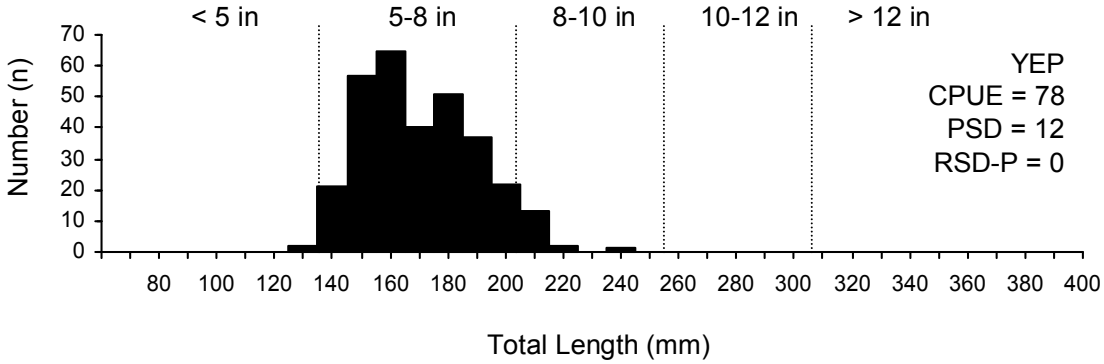

Figure 7. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for yellow perch captured in gill nets in North Buffalo Lake, 2007.