Six-Mile Lake

Site Description

Location

Water designation number (WDN)	48-0028-00
Legal description	T126N-R55W-Sec.5,6,7
County (ies)	Marshall
Location from nearest town	3.0 miles west of Lake City, SD

Survey Dates and Sampling Information

Survey dates	July 2-3, 2013 (FN, GN)
Frame net sets (n)	12
Gill net sets (n)	3

Morphometry (Figure 1)

Watershed area (acres)	34,744
Surface area (acres)	96
Maximum depth (ft)	11
Mean depth (ft)	---

Ownership and Public Access

Six-Mile Lake is a meandered lake owned by the State of South Dakota and the fishery is managed by the SDGFP. A public access site (including boat ramp) is located on the south shore just off SD Highway 10 and is maintained by the SDGFP (Figure 2). The shoreline of Six-Mile Lake is primarily undeveloped (Figure 2) and adjacent lands are owned by the State of South Dakota and private individuals.

Watershed and Land Use

The 34,744 acre Roy Lake (HUC-12) sub-watershed encompasses Six-Mile Lake and is located within the larger Northern Coteau Lakes-Upper James River (HUC-10) watershed. Land use within the watershed is primarily agricultural with a mix of pasture or grassland, cropland, and scattered shelterbelts.

Water Level Observations

Lake elevations are not monitored by the SDDENR on Six-Mile Lake.

Fish Management Information

Primary species	Northern Pike, Yellow Perch
Other species	Black Bullhead, Black Crappie, Bluegill, Common Carp, Walleye, White Sucker
Lake-specific regulations	none
Management classification	warm-water marginal
Fish consumption advisories	none

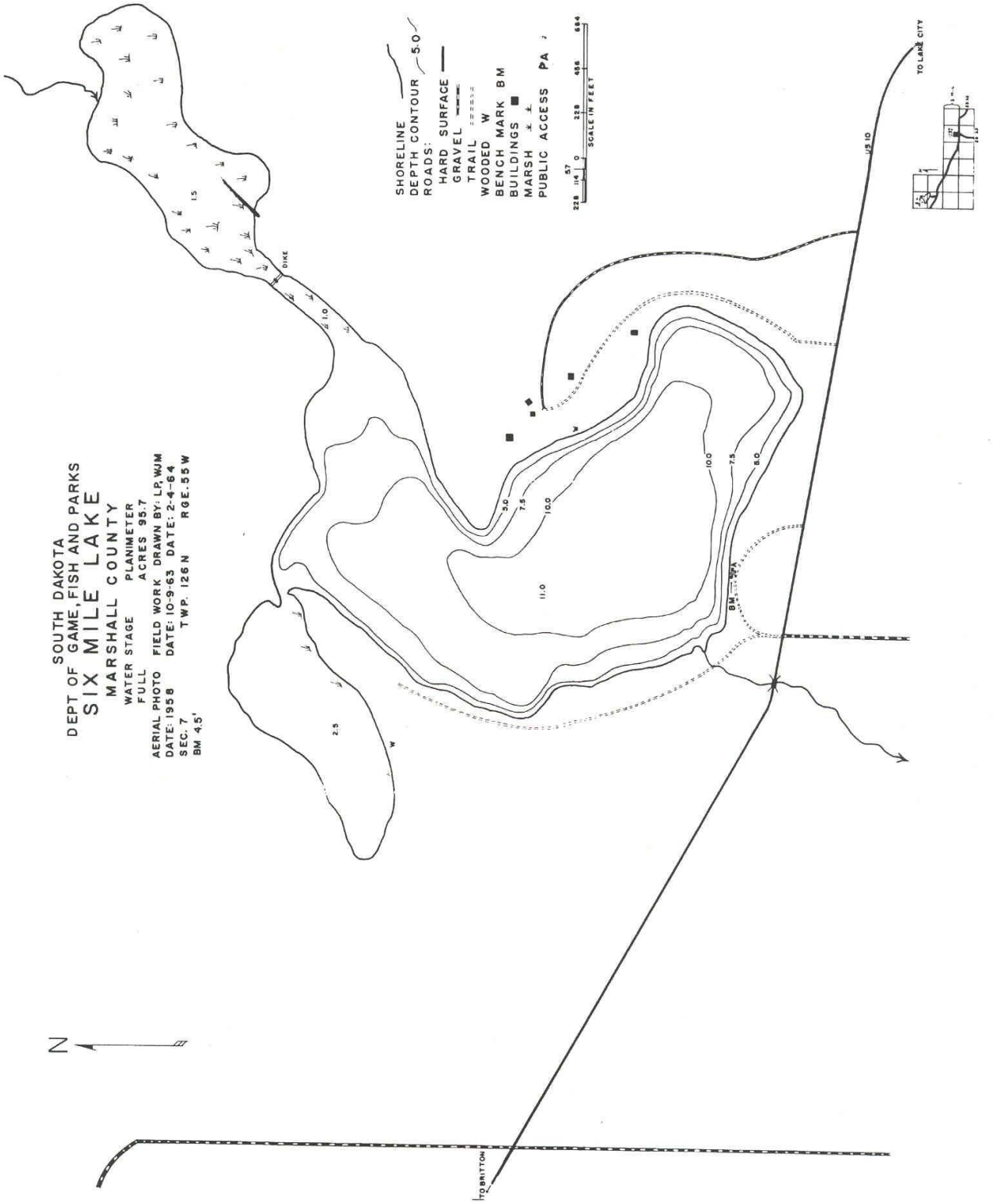

Figure 1. Contour map of Six-Mile Lake, Marshall County, South Dakota.

Figure 2. Map depicting geographic location of Six-Mile Lake from Lake City, South Dakota (top). Also noted is the boat ramp and standardized net locations for Six-Mile Lake (bottom). SMFN= frame nets, SMGN= gill nets

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 Yellow Perch ≥ 30, a PSD of 30-60, and a PSD-P of 5-10.

3) Maintain a mean frame net CPUE of stock-length Black Bullhead ≤ 100.

Results and Discussion

Six-Mile Lake is a shallow natural lake with a history of frequent winterkill events resulting in a fish community often comprised of Black Bullhead, Northern Pike, and Yellow Perch (species believed to be more winterkill tolerant). Occasionally following a complete winterkill, Six-Mile Lake has been utilized as a natural Walleye rearing pond (i.e., fry are stocked in the spring and allowed to grow, then harvested as large fingerlings in the fall and stocked into more permanent waters). Currently, Six-Mile Lake is managed as a Northern Pike and Yellow Perch fishery.

Primary Species

Northern Pike: The mean gill net CPUE of stock-length Northern Pike was 16.3 (Table 1), and above the minimum objective (≥ 3 stock-length pike/net night; Table 3). The 2013 mean gill net CPUE represented an increase from the 2005 and 2009 CPUE values of 8.0 and 5.7, respectively (Table 2). Currently, relative abundance appears to be high.

Gill net captured Northern Pike ranged in TL from 33 to 90 cm (13.0 to 35.4 in), had a PSD of 45 and a PSD-P of 6 (Table 1; Figure 3). Both the PSD and PSD-P were within management objectives (Table 3) and indicated a relatively balanced population, defined as a PSD of 30-60 and a PSD-P of 5-10.

No Northern Pike age or growth information was collected. The condition of gill net captured Northern Pike was similar to that of Northern Pike captured from other northeast South Dakota lakes (e.g., Cottonwood and Roy Lakes) with mean Wr of stock-length individuals being 84 (Table 1).

Yellow Perch: Yellow Perch were the most abundant fish species in the gill net catch. The mean gill net CPUE of stock-length Yellow Perch was 30.0 (Table 1) and equal to the minimum objective (≥ 30 stock-length perch/net night; Table 3). The 2013 gill net CPUE represented a decrease from the 2009 CPUE of 48.0 and indicated moderate to high relative abundance.

Yellow Perch in the gill net catch ranged in TL from 9 to 26 cm (3.5 to 10.2 in; Figure 4). The PSD was 31 and within the management objective of 30-60; while the PSD-P was 1 and below the management objective of 5-10 (Table 3).

Otoliths collected from a sub-sample of gill net captured Yellow Perch suggested the presence of five consecutive year classes (2008-2012) that comprised the entire sample (Table 4). Year classes produced in 2009-2012 were similarly represented (Table 4), with each cohort comprising between 22% and 29% of Yellow Perch in the gill net catch.

Yellow Perch in Six-Mile Lake exhibit slow growth. In 2013, the weighted mean TL at capture of age-2, age-3, and age-4 Yellow Perch was 147, 195, and 207 mm (5.8, 7.7, and 8.1 in); respectively, when males and females were combined (Table 4). A decreasing trend in Yellow Perch condition was apparent as TL increased. Yellow Perch in the stock-quality and quality-preferred length categories, which comprised the majority (99%) of the sample, had mean Wr values of 102 and 93.

Other Species

Black Bullhead: Black Bullheads were the most abundant species in the 2013 frame net catch (Table 1). The mean frame net CPUE of stock-length Black Bullheads was 22.4 (Table 1) and within the management objective ($\leq$ 100 stock-length Black Bullhead/net-night; Table 3). The 2013 mean frame net CPUE represented an increase from the 2009 mean CPUE of 2.1, but was lower than the 2005 CPUE of 42.8 (Table 2). Currently, relative abundance is considered moderate.

Frame net captured Black Bullheads ranged in TL from 9 to 28 cm (3.5 to 11.0 in), with the majority being < quality-length (23cm; 9 in; Figure 5). The PSD was 13 and the PSD-P was 0 (Table 1). No age and growth information was collected. Mean Wr values of Black Bullheads captured in the 2013 frame net catch ranged from 78 to 86 for all length categories (e.g., stock to quality) sampled, with the mean Wr of stock-length fish being 86 (Table 1). No length-related trends in condition were apparent.

Walleye: Despite relatively frequent stockings (Table 6), the relative abundance of Walleye has remained low in fish community surveys conducted from 2005-2013 (Table 2). In 2013, seven stock-length Walleye that ranged in TL from 36 to 39 cm (14.2 to 15.4 in) were captured in gill nets, which resulted in a mean gill net CPUE of 2.3 (Table 1). Few inferences can be made concerning Walleye size structure, growth, and condition due to low sample size.

The shallow nature and susceptibility of Six-Mile Lake to winterkill exclude Walleye from being a primary management species. However, the potential exists for occasional year classes to develop and provide angling opportunities. Therefore, periodic stockings should continue provided water levels are favorable (i.e., lake is full), excess Walleye are available, and higher priority stockings have been completed.

Other: Black Crappie, Common Carp, and White Sucker were other fish species captured in low numbers during the 2013 fish community survey (Table 1).

Management Recommendations

1) Conduct fish community surveys utilizing gill nets and frame nets on an every fourth year basis (next survey scheduled in summer 2017) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.

2) Continue to manage as a self-sustaining Northern Pike and Yellow Perch fishery.

3) Stock walleye (≈500 fry/acre) periodically provided water levels are favorable (i.e., lake is full), excess Walleye are available, and other higher priority stockings have been completed.

4) Collect otoliths from Walleye and Yellow Perch to assess age structure and growth rates of each population.

5) Monitor winter and summer kill events. In cases of substantial winter/summer kill stock with Northern Pike 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 and experimental gill nets from Six-Mile Lake, 2013. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90). BLB= Black Bullhead; BLC= Black Crappie; COC= Common Carp; NOP= Northern Pike; WAE= Walleye; WHS= White Sucker; YEP= Yellow Perch

	Abundance		Stock Density Indices				Condition	
Species	CPUE	CI-80	PSD	CI-90	PSD-P	CI-90	Wr	CI-90
Frame nets								
BLB	22.4	13.7	13	3	0	---	86	1
BLC	0.8	0.6	80	24	70	28	104	4
COC	0.1	0.1	100	---	100	---	76	---
NOP	1.8	0.5	27	17	0	---	84	2
WAE	0.1	0.1	0	---	0	---	92	---
WHS	0.2	0.2	100	0	100	0	98	9
YEP	2.7	1.1	47	15	0	---	89	5
Gill nets								
BLB	1.0	1.1	33	67	0	---	92	14
BLC	0.3	0.6	0	---	0	---	117	---
NOP	16.3	3.1	45	12	6	6	84	1
WAE	2.3	0.6	57	39	0	---	98	3
WHS	3.3	1.3	100	0	60	30	103	2
YEP	30.0	5.7	31	8	1	2	99	1

Table 2. Historic mean catch rate (CPUE; gill/frame nets = catch/net night) of stock-length fish for various fish species captured by frame nets and experimental gill nets in Six-Mile Lake, 2005-2013. BLB = Black Bullhead; BLC= Black Crappie; BLG= Bluegill; COC= Common Carp; NOP = Northern Pike; WAE = Walleye; WHS = White Sucker; YEP = Yellow Perch

	CPUE		
Species	2005	2009	2013
Frame nets			
BLB	42.8	2.1	22.4
BLC	0.3	0.6	0.8
BLG	0.0	0.5	0.0
COC	0.0	0.0	0.1
NOP	1.1	0.2	1.8
WAE	0.0	0.3	0.1
WHS	0.1	0.1	0.2
YEP	1.1	1.0	2.7
Gill nets			
BLB	1.0	0.3	1.0
BLC	0.0	0.0	0.3
NOP	8.0	5.7	16.3
WAE	0.0	2.7	2.3
WHS	5.7	1.0	3.3
YEP	16.0	48.0	30.0

Table 3. 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) for selected species captured by frame nets and experimental gill nets in Six-Mile Lake, 2005-2013. BLB = Black Bullhead; NOP = Northern Pike; YEP = Yellow Perch

Species	2005	2009	2013	Objective
Frame nets				
BLB				
CPUE	43	2	22	≤ 100
PSD	9	8	13	---
PSD-P	0	0	0	---
Wr	84	89	86	---
Gill nets				
NOP				
CPUE	8	6	16	≥ 3
PSD	38	59	45	30-60
PSD-P	4	0	6	5-10
Wr	94	89	84	---
YEP				
CPUE	16	48	30	≥ 30
PSD	6	7	31	30-60
PSD-P	0	0	1	5-10
Wr	95	103	99	---

Table 4. Year class distribution based on the expanded age/length summary for Yellow Perch sampled in gill nets from Six-Mile Lake, 2009-2013.

	Year Class								
Survey Year	2013	2012	2011	2010	2009	2008	2007	2006	2005
2013		37	28	33	25	4			
2009	---	---	---	---		55	144	14	1

Table 5. Weighted mean total length (mm) at capture by gender for Yellow Perch captured in experimental gill nets (expanded sample size) from Six-Mile Lake, 2009-2013.

	Age				
Year	1	2	3	4	5
2013					
Male	105 (4)	143 (7)	182 (4)	188 (4)	194 (1)
Female	103 (13)	148 (19)	197 (31)	211 (21)	233 (1)
Combined	102 (37)	147 (28)	195 (33)	207 (25)	204 (4)
2009					
Male	100 (25)	137 (21)	193 (2)	---	---
Female	98 (31)	155 (121)	203 (12)	227 (1)	---
Combined	99 (55)	152 (144)	201 (14)	227 (1)	---

Table 6. Stocking history including size and number for fishes stocked into Six-Mile Lake, 2001-2013. WAE= Walleye

Year	Species	Size	Number
2001	WAE	fry	100,000
2004	WAE	fry	100,000
2005	WAE	large fingerling	6,400
2008	WAE	fry	100,000
2010	WAE	fry	100,000
2012	WAE	fry	50,000

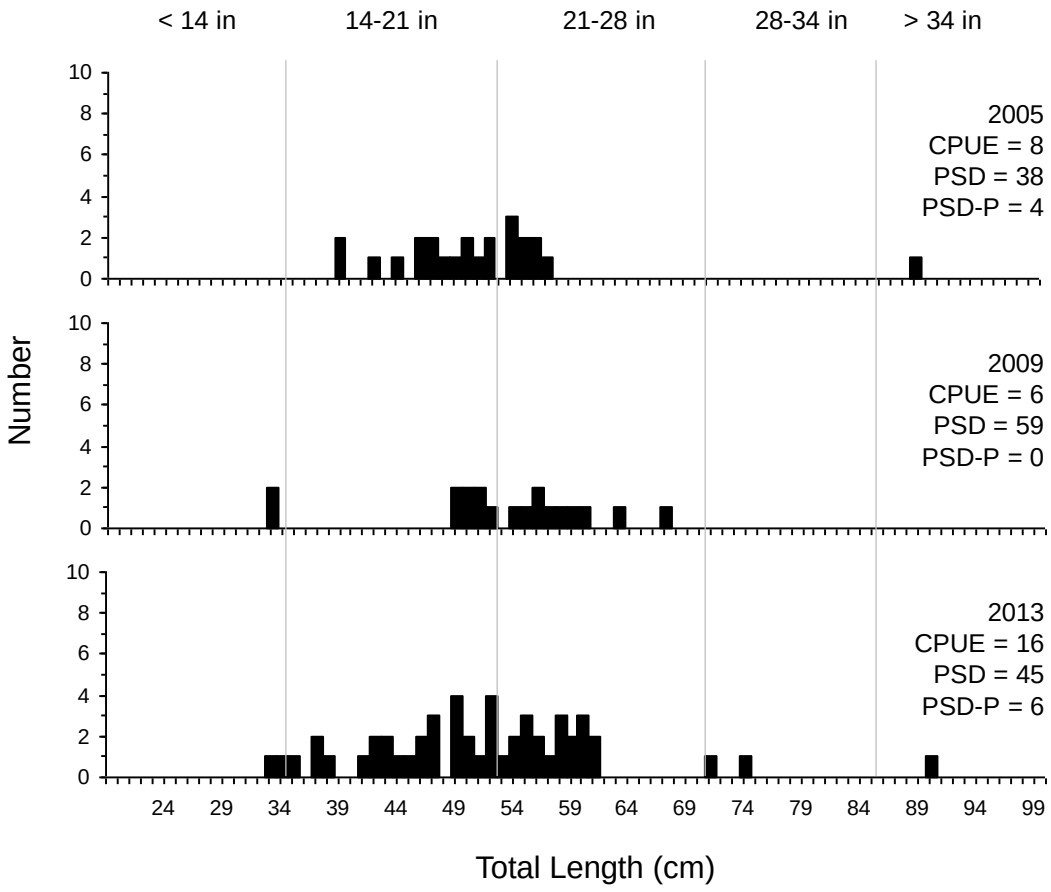

Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Northern Pike captured using experimental gill nets in Six-Mile Lake, 2005-2013.

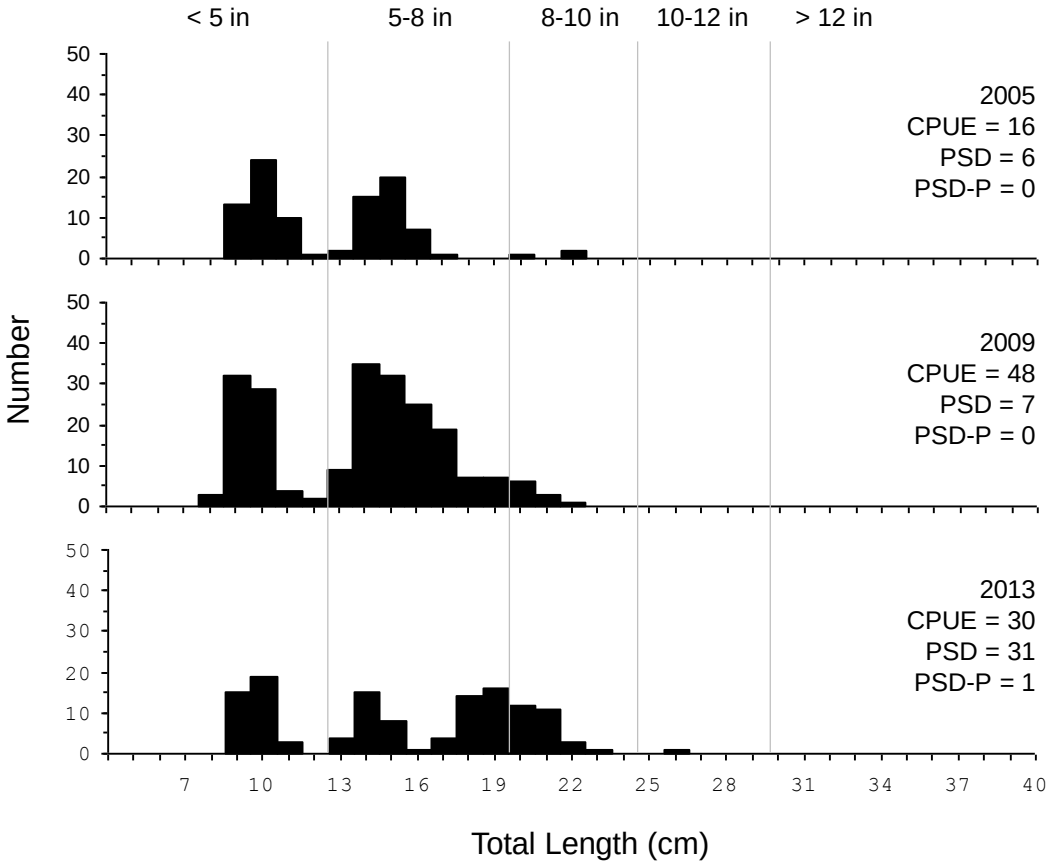

Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Yellow Perch captured using experimental gill nets in Six-Mile Lake, 2005-2013.

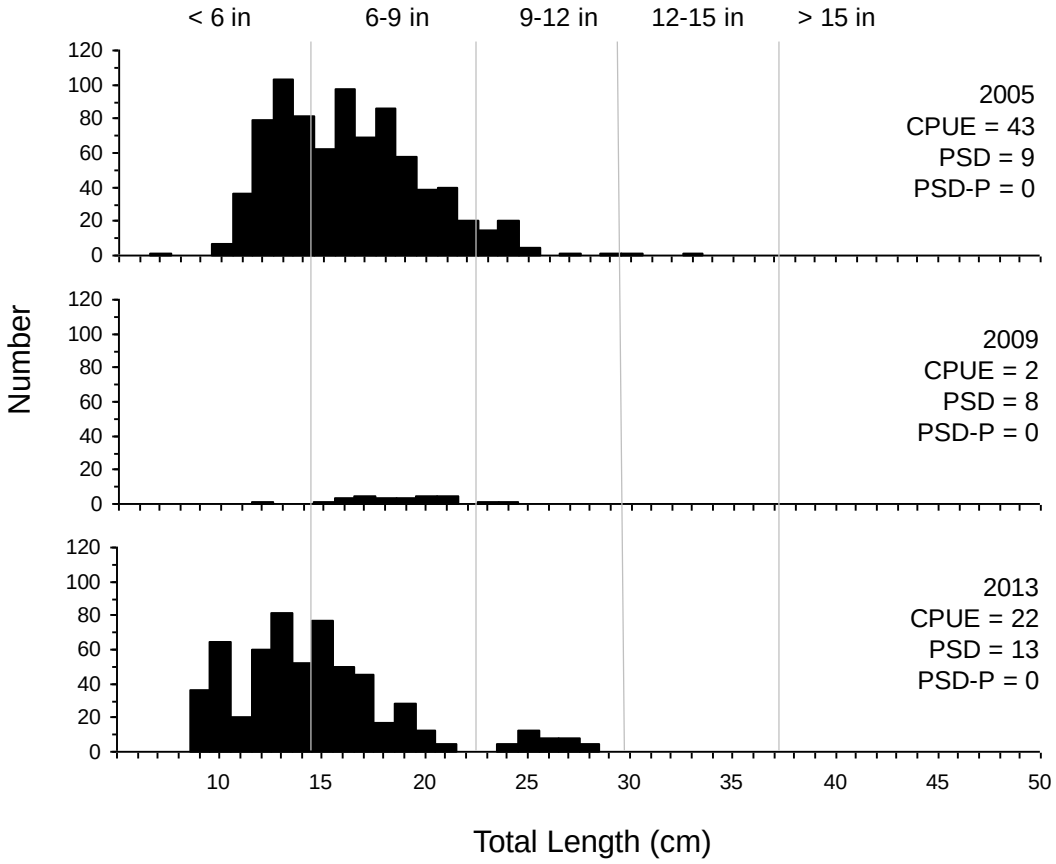

Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Black Bullhead captured using frame nets in Six-Mile Lake, 2005-2013.