Horseshoe Lake

Site Description

Location

Water designation number (WDN)	22-0008-00
Legal description	T120N-R57W-Sec. 13,14,24
County (ies)	Day
Location from nearest town	9 miles south and 4.5 miles west of Webster, SD

Survey Dates and Sampling Information

Survey dates	July 8-10, 2014 (FN, GN)
Frame net sets (n)	18
Gill net sets (n)	6

Morphometry (Figure 1)

Watershed area (acres)	14,264
Surface area (acres)	627
Maximum depth (ft)	24
Mean depth (ft)	15

Ownership and Public Access

Horseshoe Lake is a meandered lake owned by the State of South Dakota and managed by the SDGFP. A single public access site which includes boat ramp and landing dock is located on the east shore (Figure 1). Lands adjacent to Horseshoe Lake are owned by the State of South Dakota and private individuals.

Watershed and Land Use

The 14,264 acre Horseshoe Lake sub-watershed (HUC-12) is located within the larger Grass, Dry, and Still Lakes (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

Water levels on Horseshoe Lake are not monitored by SDDENR; however, visual observation indicated that the lake has experienced a substantial increase in water levels in recent years, similar to other waters in the area (i.e., Antelope, Bitter, Reetz and Waubay Lakes).

Fish Management Information

Primary species	smallmouth bass, walleye, yellow perch
Other species	black bullhead, black crappie, bluegill, green sunfish, largemouth bass, northern pike
Lake-specific regulations	smallmouth/largemouth bass: only those <14” or 18” and longer may be taken; of those no more than one may be 18” or longer
Management classification	none
Fish Consumption Advisories	none

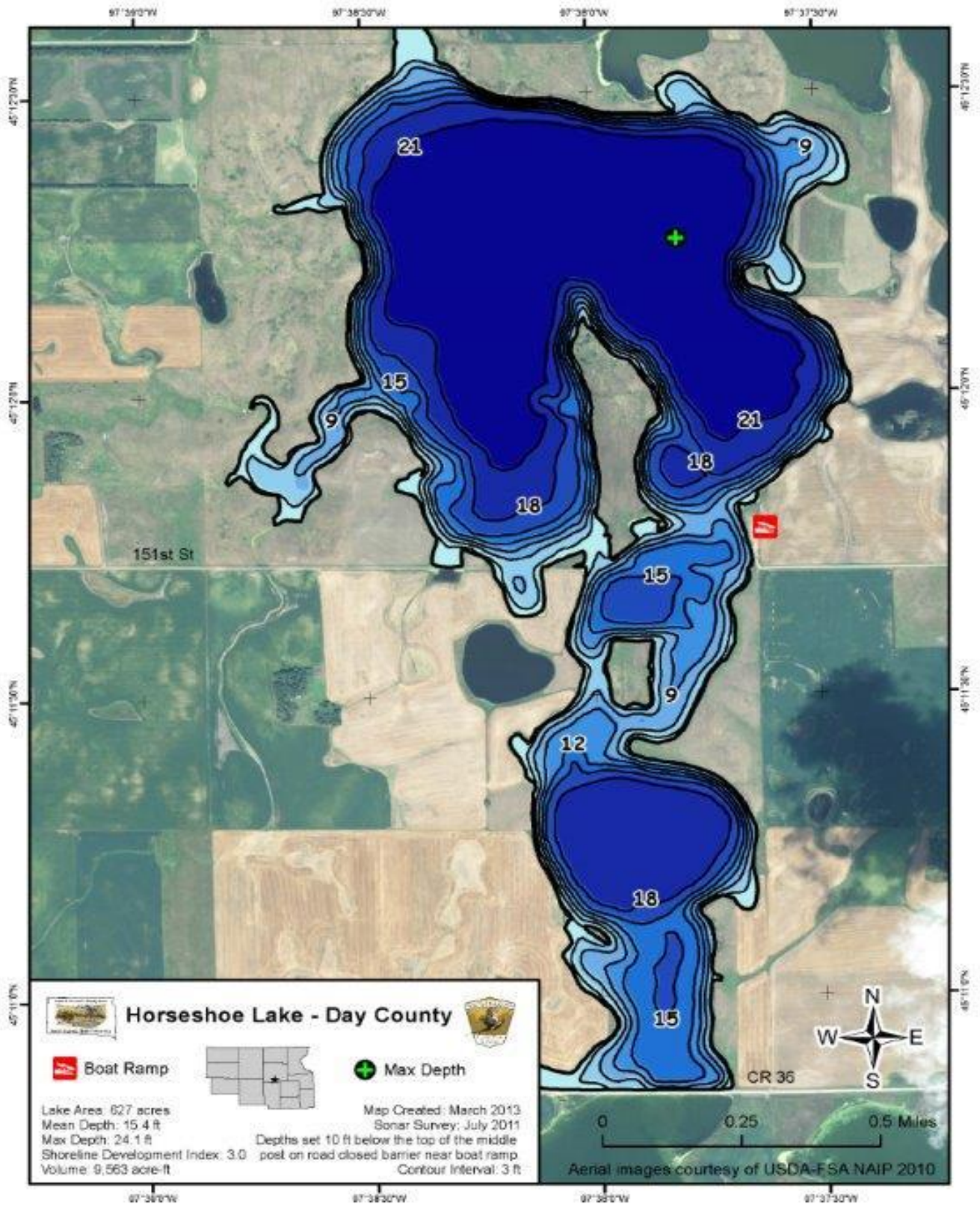

Figure 1. Map depicting depth contours of Horseshoe Lake.

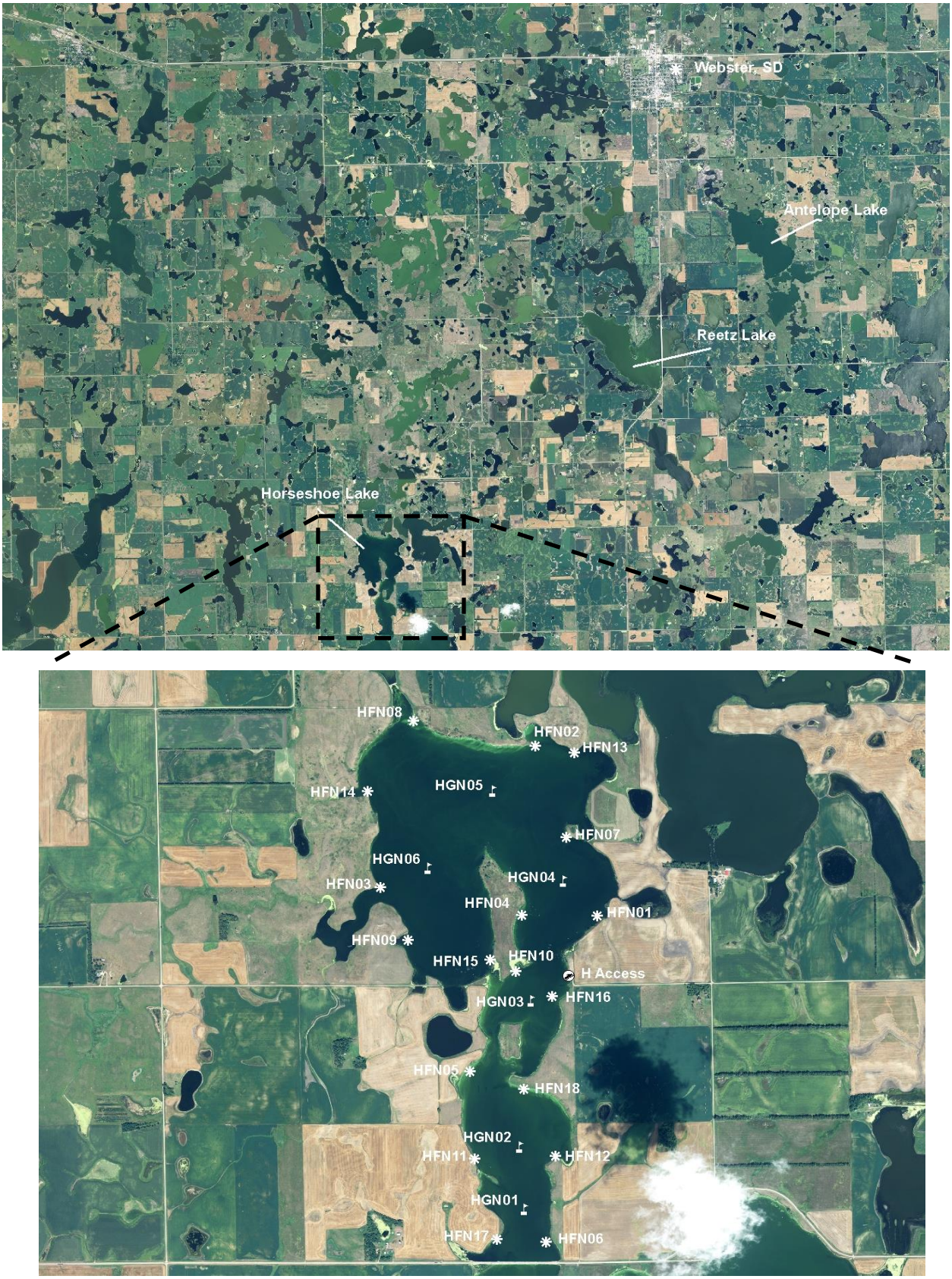

Figure 2. Map depicting geographic location of Horseshoe Lake from Webster, South Dakota (top). Also noted is the public access and standardized net locations for Horseshoe Lake. HFN= frame nets; HGN= gill nets

Management Objectives

1) Maintain a moderate density smallmouth bass population with a PSD of 40-70, and a PSD-P of 10-40.

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.

Results and Discussion

Prior to the 1990's Horseshoe Lake was a shallow slough with limited sport fishery potential. However, above normal precipitation during the mid to late 1990's increased the surface area and depth of Horseshoe Lake diminishing the threat of winterkill and created habitat capable of sustaining a sport fishery.

Initial walleye stockings into the expanded Horseshoe Lake were highly successful. In addition to walleye, yellow perch populations were also highly abundant creating an initial "boom" in sport fish populations making Horseshoe Lake a popular destination for anglers during the late 1990's. Today, Horseshoe Lake remains a popular destination for anglers and is managed as a smallmouth bass, walleye, and yellow perch fishery.

Primary Species

Smallmouth bass: Spring electrofishing used to monitor population parameters for smallmouth bass is conducted biennially during odd years (i.e., 2015, 2017, 2019….) at Horseshoe Lake.

Walleye: The mean gill net CPUE of stock-length walleye during 2014 was 3.5 (Table 1) and below the minimum objective (≥ 10 stock-length walleye/net night; Table 3). Based on the 2014 gill net catch, relative abundance appears to be low.

Gill net captured Walleye ranged in TL from 22 to 69 cm (8.7 to 27.2 in; Figure 3). The 2014 PSD and PSD-P values were 52 and 24, respectively (Table 1). The PSD was within the management objective range (30-60); while, the PSD-P was above the management objective (5-10; Table 1, Figure 3)

Otoliths were collected from a sub-sample of gill net captured walleye. Four year classes (2009-2012) were present in the gill net catch; each was represented by few individuals (Table 5). The 2009 and 2011 classes were naturally produced; while, the 2010 and 2012 cohorts coincide with stockings (Table 4; Table 6). The contribution of stocked or naturally-produced walleye to year classes produced during stocked years is unknown, as stocked walleye were unmarked making it difficult to differentiate stocked from naturally-produced walleye.

Although sample size was low, growth rates appear to be fair with the weighted mean TL at capture values for age-2 walleye of 274 mm (10.8 in; Table 5). Mean Wr values ranging from 78 to 92 for all length categories (i.e., stock-quality) sampled; a slight decreasing trend in Wr was apparent as TL increased.. The mean Wr of stock-length walleye was 89 (Table 1).

Yellow Perch: The mean gill net CPUE of stock-length yellow perch was 8.2 (Table 1) and below the minimum objective (≥ 30 stock-length yellow perch/net; Table 3). Since 2002, the mean gill net CPUE of stock-length yellow perch has fluctuated from a low of 6.5 (2002) to a high of 20.3 (2005; Table 2). The 2014 mean gill net CPUE indicated low to moderate relative abundance.

Yellow perch captured in the 2014 gill net catch ranged in TL from 12 to 27 cm (4.7 to 10.6 in; Figure 6). The 2014 PSD and PSD-P were 45 and 22, respectively (Table 1). The PSD was within the management objective range (30-60) whereas the PSD-P value was above the management objective range (5-10; Table 3, Figure 5).

Otoliths were collected from a sub-sample of yellow perch in the gill net catch; four year-classes (2010-2013) were identified (Table 7). The 2013 cohort was the most represented and comprised 65% of yellow perch in the gill net catch (Table 8). Weighted mean TL at capture values for age-3 and age-4 yellow perch were 228 mm (9.0 in) and 260 mm (10.2 in), when both male and female perch were combined (Table 8). However, growth information should be interpreted with caution as sample sizes were low for individuals > age 1. The mean Wr of stock-length yellow perch was 103 (Table 1) and no length-related trends in Wr were apparent.

Other Species

Bluegill: The mean frame net CPUE of stock-length bluegill was 17.9 (Table 1) and suggested moderate relative abundance. In 2011, the mean frame net CPUE was 1.4 (Table 2). Successful recruitment in recent years has resulted in the current moderate abundance. Bluegill captured in the 2014 frame net catch ranged in TL from 7 to 26 cm (2.8 to 10.2 in); 65% of these were 8 to 9 cm (3.1 to 3.5 in).

Northern Pike: Northern pike relative abundance remained low from 2002-2008 with mean gill net CPUE values between 0.3 and 0.5 (Table 2). The 2011 survey indicated an increase in relative abundance with a mean gill net CPUE of 2.0 (Table 2). In 2014, gill nets captured eight northern pike that ranged in TL from 41 to 84 cm (16.1 to 33.1 in.) resulting in a mean gill net CPUE of 1.3 (Table 1). Currently, relative abundance is considered moderate.

Although sample size was low, sampled northern pike were in good condition with mean Wr values that ranged from 83-103 for all 10-mm length groups represented. The mean Wr of stock-length individuals was 90 (Table 1).

Management Recommendations

1) Conduct fish community assessment surveys utilizing spring electrofishing, frame nets, and experimental gill nets biennially (next survey scheduled for summer 2015) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.

2) Conduct spring night electrofishing biennially during odd years (e.g., 2015, 2017, 2019…) to monitor smallmouth bass population parameters.

3) Collect otoliths from walleye and yellow perch; scales from smallmouth bass to assess age structure and growth rates of each population.

4) Maintain length limit on largemouth and smallmouth bass to benefit population and comply with toolbox options (Blackwell and Lucchesi 2009). Largemouth and smallmouth bass must be less than 14” or longer than 18”, but only one 18” or longer can be kept in the daily creel.

5) Stock walleye (≈500 fry/acre) on a biennial basis (even years) to establish additional year classes.

Table 1. Mean catch rate (CPUE; gill 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, experimental gill nets, and electrofishing in Horseshoe Lake, 2014. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; GSF= green sunfish; NOP= northern pike; SMB= smallmouth bass; WAE= walleye; 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[1]	0.1	0.1	100	---	0	---	n/a	n/a
BLC[1]	0.1	0.1	0	0	0	0	n/a	n/a
BLG[1]	17.9	5.2	17	4	2	1	n/a	n/a
GSF[1]	0.4	0.2	14	28	0	---	n/a	n/a
HYB[1,2]	0.1	0.1	---	---	---	---	---	---
NOP[1]	1.6	0.6	76	14	31	15	n/a	n/a
SMB[1]	2.5	0.7	89	8	73	11	n/a	n/a
WAE[1]	1.4	0.6	77	14	69	16	n/a	n/a
YEP[1]	5.2	2.7	2	3	1	2	n/a	n/a
Gill nets								
NOP	1.3	0.9	88	24	13	23	90	6
SMB	0.3	0.3	100	0	100	0	116	26
WAE	3.5	1.6	52	20	24	17	89	3
YEP	8.2	3.7	45	12	22	11	103	<1

[1]Mean relative weights are unavailable due to errors in the data
[2]All fish sizes; *Lepomis spp*.

Table 2. Historic mean catch rate (CPUE; gill nets = catch/net night, electrofishing= catch/hour) of stock-length fish for various fish species captured in frame nets, experimental gill nets, and electrofishing from Horseshoe Lake, 2002-2014. BLB= black bullhead; BLC= black crappie; BLG= bluegill; GSF= green sunfish; NOP= northern pike; SMB= smallmouth bass; WAE= walleye; YEP= yellow perch

	CPUE						
Species	2002	2005	2008	2009	2011	2013	2014
Frame nets							
BLB	---	---	---	---	---	---	0.1
BLC	---	0.0	0.1	---	0.0	---	0.1
BLG	---	0.1	2.4	---	1.4	---	17.9
GSF	---	0.1	0.6	---	0.0	---	0.4
HYB[1]	---	0.0	0.0	---	0.0	---	0.1
NOP	---	0.4	0.2	---	0.6	---	1.6
SMB	---	1.8	4.4	---	0.8	---	2.5
WAE	---	3.3	1.1	---	0.8	---	1.4
YEP	---	0.1	0.0	---	0.4	---	2.5
Gill nets							
NOP	0.3	0.5	0.5	---	2.0	---	1.3
SMB	0.5	0.0	0.0	---	0.0	---	0.3
WAE	12.0	4.5	3.2	---	8.3	---	3.5
YEP	6.5	20.3	10.8	---	18.2	---	8.2
Electrofishing							
SMB[2]	---	---	---	45.3	23.9	38.9	---

[1]All fish sizes; *Lepomis spp*.
[2] Spring Electrofishing-SMB

Table 3. Mean catch rate (CPUE; gill/frame nets = catch/net night, electrofishing= catch/hour), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) for selected species captured by experimental gill nets and electrofishing from Horseshoe Lake, 2002-2014. SMB= smallmouth bass; WAE= walleye; YEP= yellow perch

Species	2002	2005	2008	2009	2011	2013	2014	Objective
Gill nets								
WAE								
CPUE	12	5	3	---	8	---	4	≥ 10
PSD	94	28	42	---	16	---	52	30-60
PSD-P	0	0	0	---	6	---	24	5-10
Wr	95	98	94	---	92	---	89	---
YEP								
CPUE	7	20	11	---	18	---	8	≥ 30
PSD	35	37	43	---	69	---	45	30-60
PSD-P	31	0	5	---	43	---	22	5-10
Wr	100	108	109	---	109	---	103	---
Electrofishing								
SMB[1]								
CPUE	---	---	---	45	24	39	---	---
PSD	---	---	---	92	71	96	---	40-70
PSD-P	---	---	---	77	67	83	---	10-40
Wr	---	---	---	112	117	149	---	---

[1] Spring Electrofishing-SMB

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 Horseshoe Lake, 2005-2014.

	Year Class													
Survey Year	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
2014[1]			6	7	5	3								
2011[1]	---	---	---		32	45	2		1					
2008	---	---	---	---	---	---			3	15	1			
2005[1]	---	---	---	---	---	---	---	---	---		5	13	1	1
# stocked														
fry	300				600							900	1000	
sm. fingerling			60				55		61	101				
lg. fingerling														

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

Table 5. Weighted mean total length at capture (mm) for walleye age-1 through age-7 sampled in experimental gill nets (expanded sample size) from Horseshoe Lake, 2005-2014. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

	Age						
Year	1	2	3	4	5	6	7
2014[1]	---	274(6)	367(7)	397(5)	567(3)		
2011[1]	189(32)	346(45)	438(2)	---	556(1)	---	---
2008	---	337(3)	377(15)	370(1)	---	---	---
2005	239(5)	338(13)	460(1)	502(1)	---	---	494(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 Horseshoe Lake, 2001-2014. WAE= walleye;

Year	Species	Size	Number
2002	WAE	fry	1,000,000
2003	WAE	fry	900,000
2005	WAE	sm. fingerling	101,200
2006	WAE	sm. fingerling	60,800
2008	WAE	sm. fingerling	55,480
2010	WAE	fry	600,000
2012	WAE	sm. fingerling	60,510
2014	WAE	fry	300,000

Table 7. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from Horseshoe Lake, 2011-2014.

	Year Class							
Survey Year	2014	2013	2012	2011	2010	2009	2008	2007
2014		48	5	11	10			
2011	---	---	---		50	24		51

Table 8. Weighted mean total length (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from Horseshoe Lake, 2011-2014.

	Age			
Year	1	2	3	4
2014				
Male	124(14)	116(1)	205(3)	233(2)
Female	130(24)	180(2)	246(6)	271(6)
Combined	128(48)	167(5)	228(11)	260(10)
2011				
Male	131(20)	211(8)	---	248(9)
Female	132(29)	230(16)	---	294(42)
Combined	132(50)	224(24)	---	286(51)

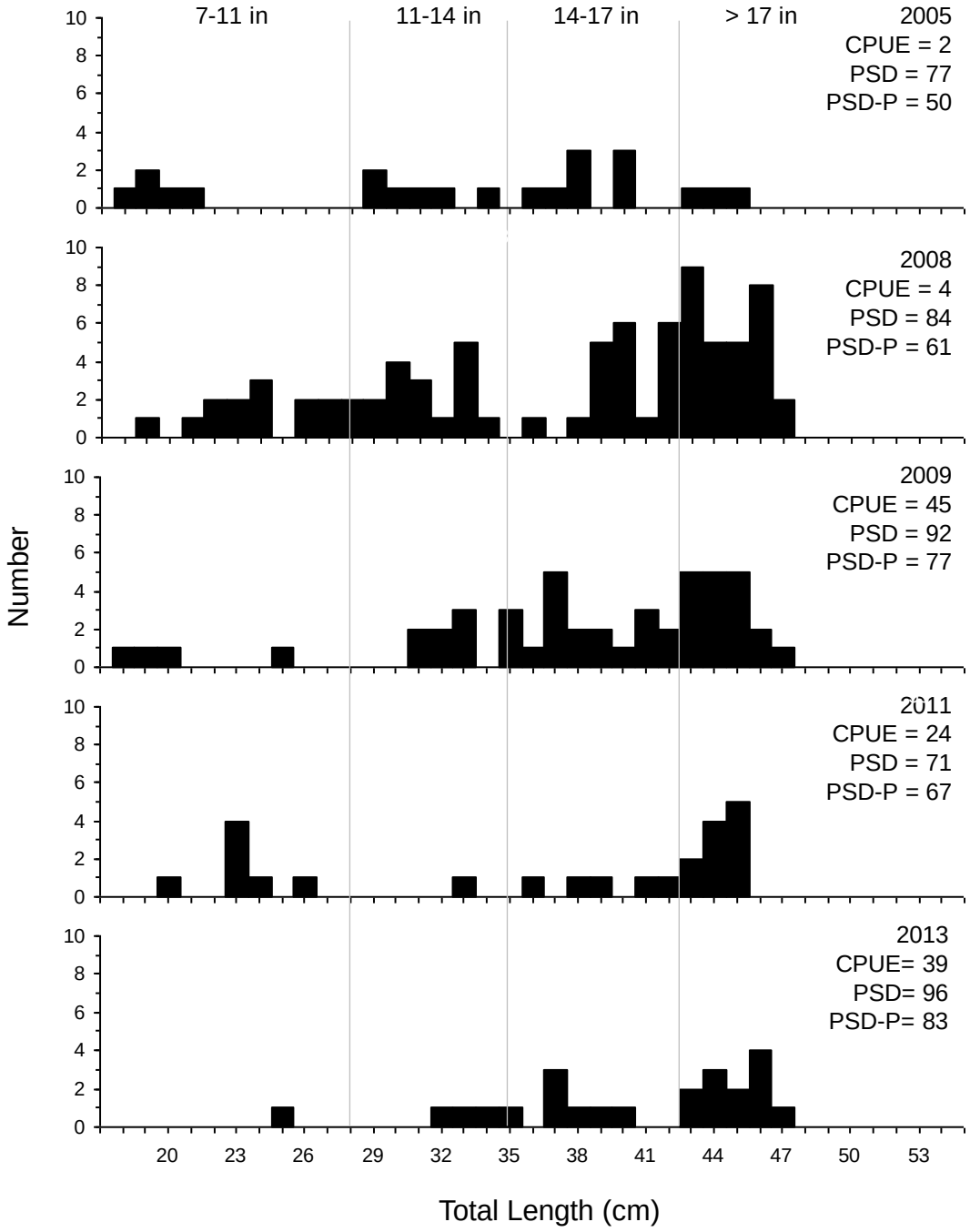

Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for smallmouth bass captured by frame nets (2005 and 2008); spring electrofishing (2009, 2011 and 2013) from Horseshoe Lake.

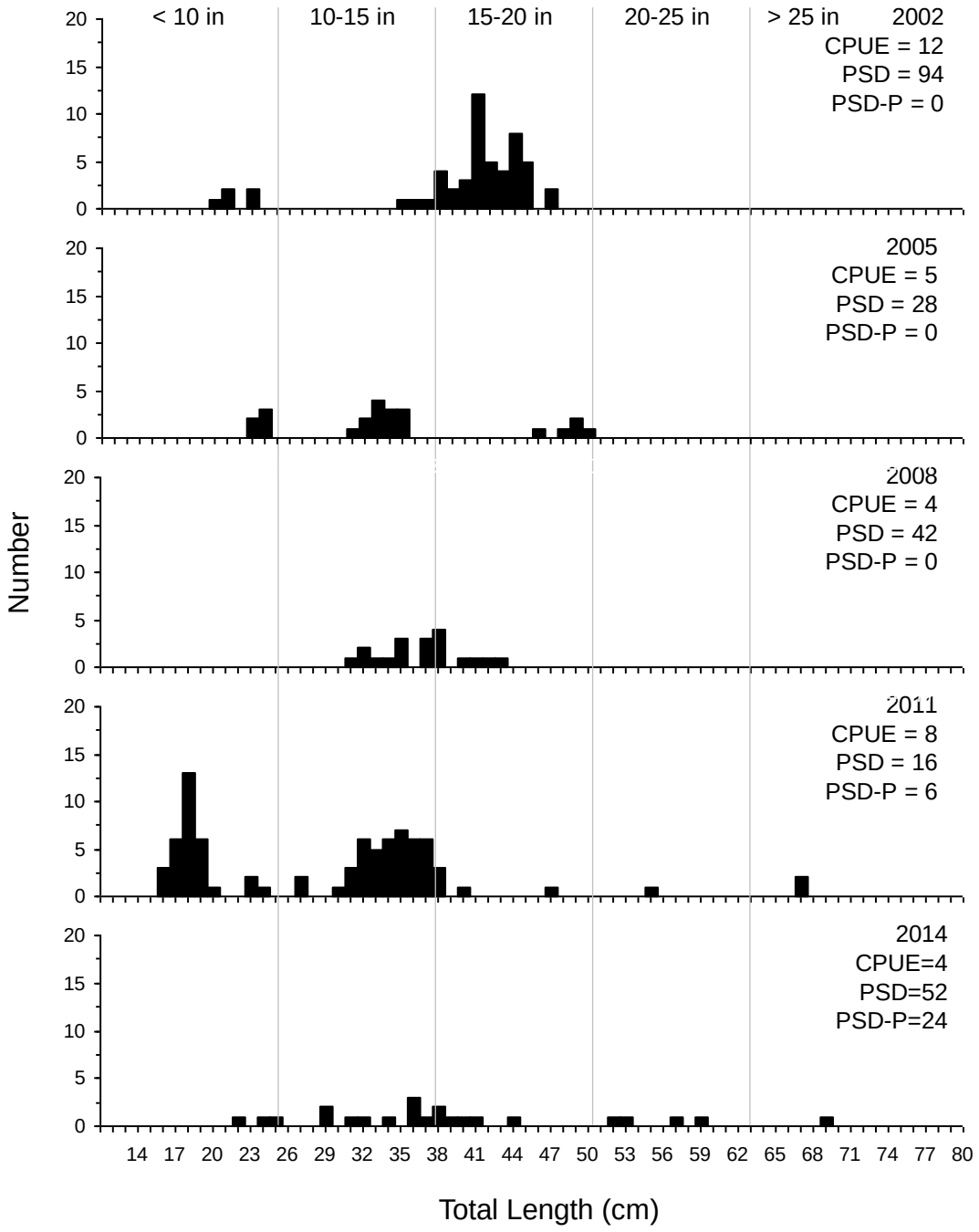

Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using experimental gill nets in Horseshoe Lake, 2002-2014.

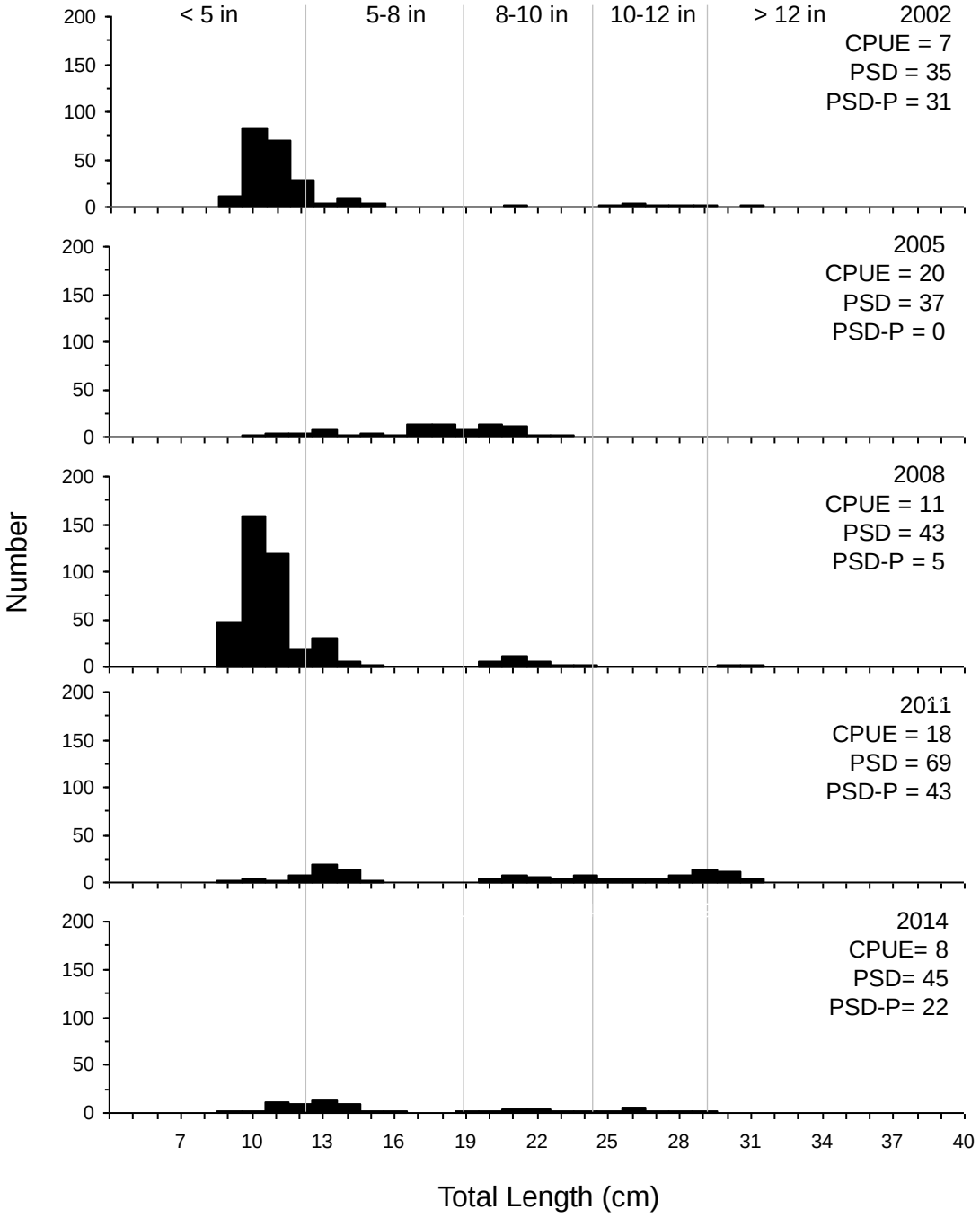

Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured using experimental gill nets in Horseshoe Lake, 2002-2014.