

Elm Lake

Site Description

Location

Water designation number (WDN)	03-0011-00; 47-0011-00
Legal description	T128N-R65W-Sec.4-6,8,9,17,21,29-32
County (ies)	Brown; McPherson
Location from nearest town	9.0 miles west and 1.0 mile north of Frederick, SD

Survey Dates and Netting Information

Survey dates	August 19-21, 2014 (FN,GN)
Frame net sets (n)	17
Gill net sets (n)	6

Morphometry (Figure 1)

Watershed area (acres)	14,015
Surface area (acres)	1,209
Maximum depth (ft)	34
Mean depth (ft)	18

Ownership and Public Access

The easement for the Elm Lake Dam is held by South Dakota School and Public Lands and SDGFP manages the fishery. A public access site that includes boat ramp, landing dock, and fishing pier is located on the southwest shore and is maintained by the SDGFP. Lands adjacent to the lake are under State of South Dakota and private ownership. The city of Aberdeen maintains water rights to the first 12 feet below the spillway crest for municipal use.

Watershed and Land Use

The 14,015 acre Elm Lake sub-watershed (HUC-12) is located within the larger Elm Lake (HUC-10) watershed. Land use within the watershed is primarily agricultural including a mix of pasture or grassland and cropland.

Water Level Observations

Elm Lake has a spillway elevation of 1600.2 fmsl. No water elevation measurements were available in 2014; visual inspection indicated that the lake was at full pool on October 1, 2014 (Janel Ellingson, City of Aberdeen, pers. comm.)

Fish Management Information

Primary species	black crappie, walleye
Other species	black bullhead, bluegill, channel catfish, common carp, green sunfish, largemouth bass, northern pike, orangespotted sunfish, pumpkinseed, white sucker, yellow bullhead, yellow perch
Lake-specific regulations	walleye: minimum length 15"
Management classification	domestic water supply
Fish consumption advisories	Mercury: walleye (> 25"). See the South Dakota Fishing Handbook for more details on meal and portion size recommendations. Also see Department of Health website: http://doh.sd.gov/Fish/Default.aspx for more information.

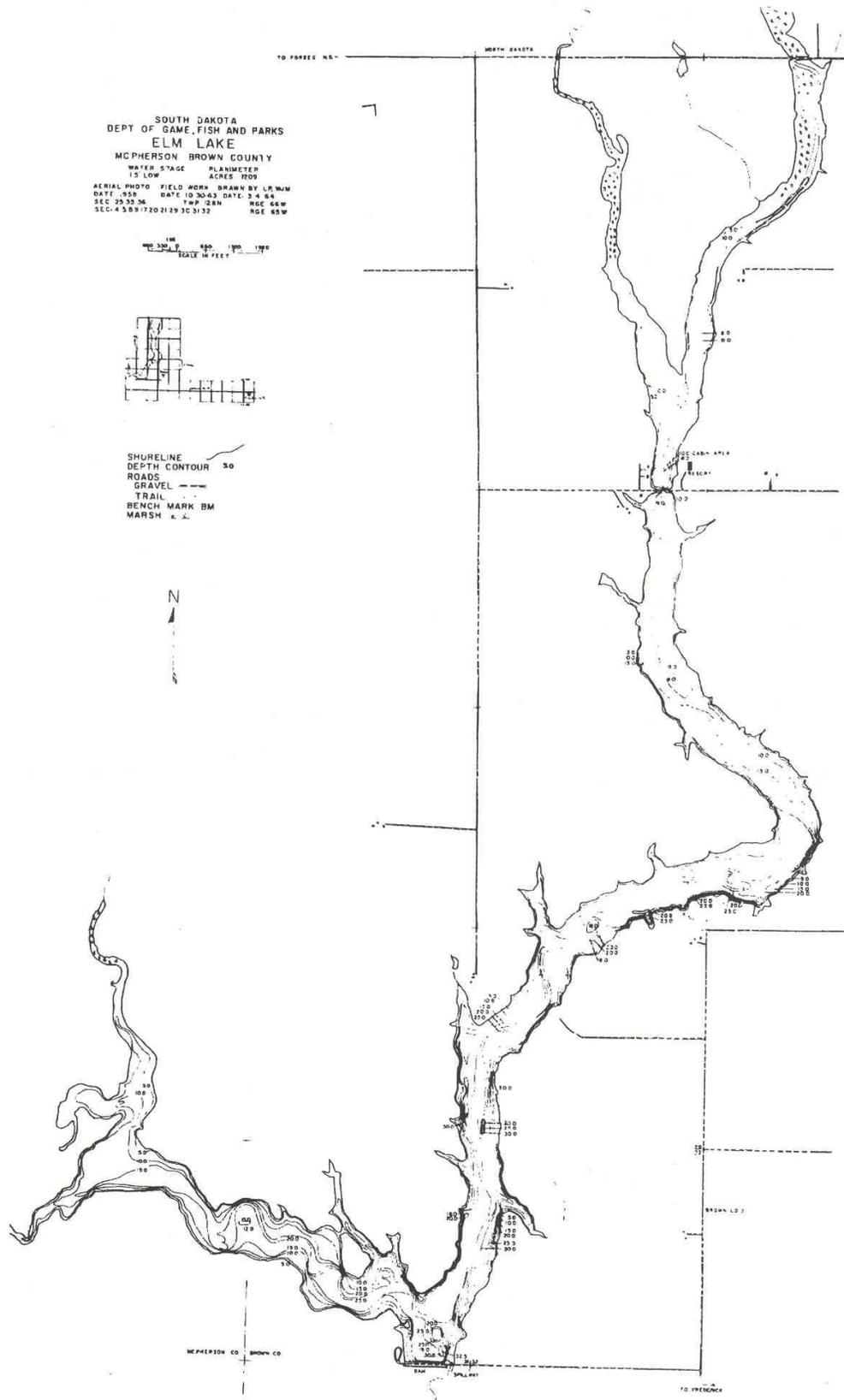


Figure 1. Map depicting depth contours of Elm Lake, Brown and McPherson Counties, South Dakota.

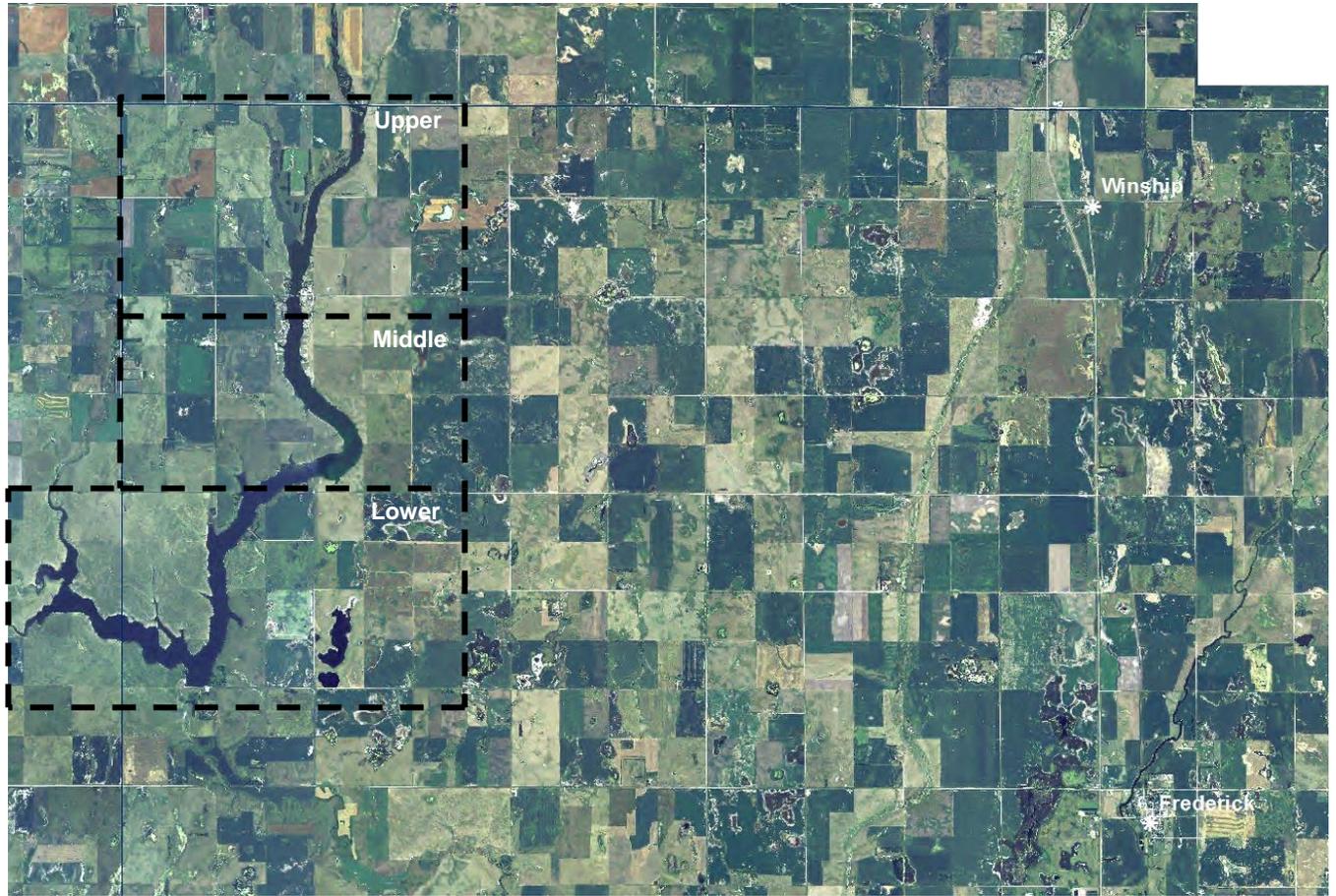


Figure 2. Map depicting geographic location of Elm Lake (Brown County) from Frederick, South Dakota; also noted are upper, middle, and lower designations for Elm Lake.

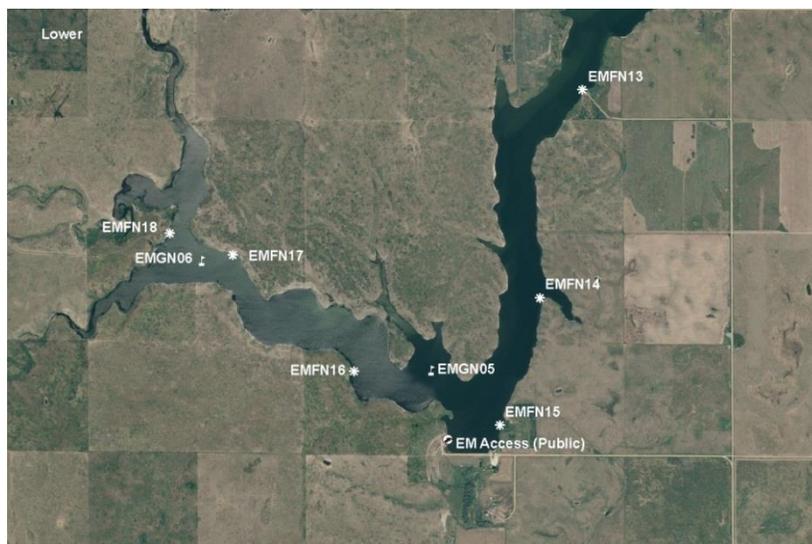
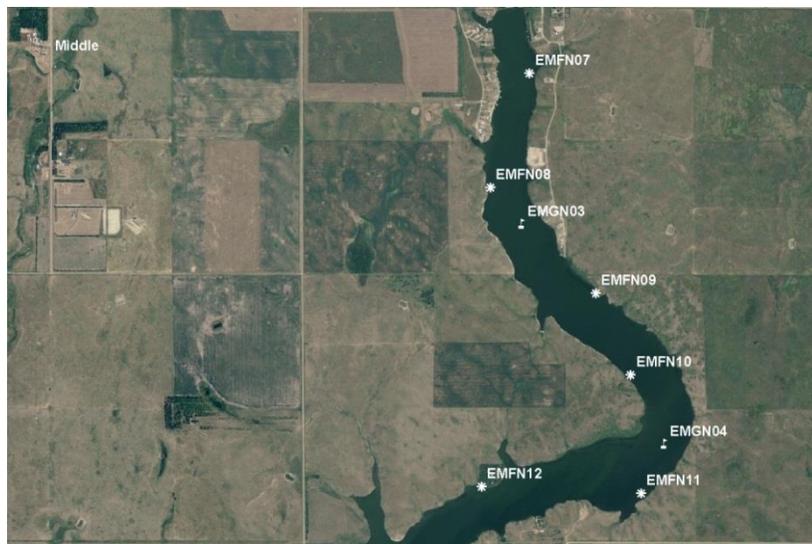
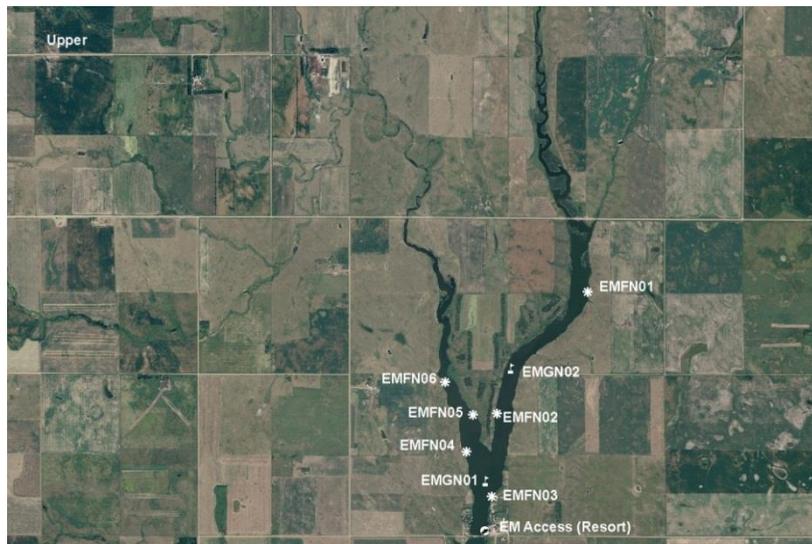


Figure 3. Map depicting access points and standardized net locations for Elm Lake, Brown County, South Dakota. EMFN= frame nets, EMGN= gill nets

Management Objectives

- 1) Maintain a mean frame net CPUE of stock-length black crappie ≥ 10 , 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 frame net CPUE of stock-length black bullhead ≤ 100 .

Results and Discussion

Elm Lake is an impoundment of the Elm River located within the James River Basin of northwest Brown County approximately 10 miles northwest of Frederick, SD (Figure 2). Elm Lake was constructed in 1937 by the Works Progress Administration. The purpose of the impoundment was to serve as a recreational area and drinking water storage for the city of Aberdeen (SDDENR 1999). Aberdeen uses Elm Lake as a water storage reservoir and has the legal right to the top 12 feet of water below the crest of the dam.

The Elm Lake fishery is primarily managed for black crappie and walleye; however, species such as black bullhead, bluegill, channel catfish, common carp, northern pike, and yellow perch also contribute to the fishery.

Primary Species

Black Crappie: The 2014 mean frame net CPUE of stock-length black crappie was 3.2 (Table 1) and below the minimum objective (≥ 10 crappie/net night; Table 3). Age estimates made using otoliths suggested the presence of seven consecutive year classes (2007-2013) in the 2014 frame net catch (Table 4).

Black crappie captured in frame nets during 2014 ranged in TL from 14 to 30 cm (5.5 to 11.8 in), had a PSD of 40 and a PSD-P of 33 (Table 1; Figure 4). The PSD was within the management objective range of 30-60; while, the PSD-P was above the management objective range of 5-10 (Table 3). In 2014, age-2 black crappie had a mean length at capture of 169 mm (6.7 in; Table 5). A slight decreasing trend in condition was apparent as TL increased, but mean W_r values were > 100 for all 10-mm length groups represented. The mean W_r for stock-length black crappie was 112 (Table 1).

Walleye: The 2014 mean gill net CPUE for stock-length walleye of 1.7 (Table 1) was below the minimum objective (≥ 10 stock-length walleye/net night; Table 3) and the lowest recorded since 2003 (Table 2). Five walleye year-classes were represented in the gill net catch (2009-2011 and 2013-2014; Table 6). Poor recruitment has limited the

walleye population, despite nearly annual stockings of large or small fingerlings from 2001-2014 (Table 6; Table 8).

Walleye captured in gill nets during 2014 ranged in TL from 14 to 50 cm (5.5 to 19.7 in), had a PSD of 90 and a PSD-P of 0 (Table 1; Figure 5). The PSD was above the management objective range (30-60); while the PSD-P was below the objective range (5-10; Table 3). Size structure indices should be interpreted with caution as sample size was low (i.e., 10 stock-length walleye).

Walleye growth in Elm Lake tends to be variable (Table 7). Since 2005, weighted mean TL at capture values for age-3 walleye have ranged from 350 to 432 mm (13.8 to 17.0 in; Table 7). In 2014, the weighted mean TL at capture of age-3 individuals was 406 mm (16.0 in; Table 7). Gill net sampled walleye were in good condition with mean Wr values ranging from 88 to 102 for all 10-mm length groups sampled. The mean Wr for stock-length walleye was 98 (Table 1).

Other Species

Black Bullhead: The 2014 mean frame net CPUE of stock-length black bullhead was 333.4 (Table 1) and above the management objective (≥ 100 stock-length bullhead/net night). Since 2003, black bullhead relative abundance as indexed by mean frame net CPUE, has ranged from a low of 50.3 (2004) to a high of 1,255.8 (2012; Table 2). Length-frequency analysis of the 2014 frame net catch suggests consistent recruitment in recent years, as nearly all 1-cm length groups from 10 to 29 cm are represented (Figure 6).

Black bullhead captured in frame nets during 2014 ranged in TL from 10 to 29 cm (3.9 to 11.4 in; Figure 6). The PSD was 41 and the PSD-P was 0, indicating a population comprised of smaller individuals (Table 1; Table 3; Figure 6).

No growth information was collected in 2014. The mean Wr for stock-length black bullhead in the 2014 frame net catch was 75 (Table 1) and no length-related trends in Wr was observed.

Northern Pike: Northern pike typically are not sampled effectively during standardized mid-summer fish community surveys. As a result, mean gill net CPUE values are often low. Since 2003, relative abundance has generally been considered low to moderate, with mean gill net CPUE values for stock-length northern pike that have ranged from a low of 0.2 (2007) to high of 3.8 (2010; Table 2).

In 2014, gill nets captured 14 northern pike that ranged in TL from 22 to 91 cm (8.7 to 35.8 in); 50% were sub-stock (< 35 cm; 14 in). As a result, the mean gill net CPUE of stock-length northern pike was 1.3 (Table 1); slightly higher than the 2012 mean CPUE of 0.8 (Table 2). Although sample size was low, northern pike in the gill net catch appeared to be in good condition with mean Wr values > 85 for all 10-mm length groups sampled.

Channel Catfish: Mean frame net and gill net CPUE values for channel catfish were 5.6 and 1.0, respectively (Table 1). The 2014 gill net CPUE was similar to values observed from 2003-2012; whereas, mean frame net CPUE values have been higher in each of the past two surveys (i.e., 2012 and 2014), potentially indicating an increase in relative abundance. Although abundance is low, the opportunity exists for anglers to catch an occasional channel catfish from Elm Lake.

White Sucker: From 2003-2010, white sucker relative abundance in Elm Lake was high when compared to other northeast South Dakota waters; mean gill net CPUE values for stock-length individuals ranged from 10.0 to 16.9 (Table 2). White sucker relative abundance has declined in each of the past two surveys (2012 and 2014; Table 2). In 2014, the mean gill net CPUE was 2.2 (Table 1).

Other: Common carp and yellow perch were the only other species sampled during the 2014 survey (Table 1).

Management Recommendations

- 1) Conduct fish community assessment surveys on a biennial basis (next survey scheduled in summer 2016) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success. If saugeye are stocked, survey rotation should be adjusted to annually monitor success of re-introduction.
- 2) Collect otoliths from saugeye/walleye and black crappie to assess age structure and growth rates of each population.
- 3) Consider re-introduction of saugeye into the population, as walleye recruitment has been poor in recent years. Stock saugeye (≈ 100 small fingerlings/acre) annually to establish additional year classes and increase relative abundance.
- 4) Maintain the 381-mm (15-in) minimum length limit on saugeye/walleye. The regulation is designed to protect smaller fish from harvest and increase average fish size (Lucchesi and Blackwell 2009).
- 5) Develop a stocking strategy to expand channel catfish angling opportunities in Elm Lake.

Table 1. 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) of stock-length fish for various fish species captured in frame nets and experimental gill nets from Elm Lake, 2014. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; CCF= channel catfish; COC= common carp; HYB=hybrid sunfish; 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	333.4	91.3	41	1	0	---	75	1
BLC	3.2	1.5	40	11	33	11	112	1
CCF	5.6	1.3	99	2	2	2	85	1
COC	0.1	0.1	0	---	0	---	93	---
HYB ¹	0.1	0.1	---	---	---	---	---	---
NOP	0.2	0.2	75	59	50	50	86	24
WAE	0.2	0.1	100	0	33	67	93	7
WHS	0.3	0.2	100	0	100	0	87	1
YEP	0.3	0.2	80	43	80	43	93	6
<i>Gill nets</i>								
BLB	166.8	56.7	28	2	0	---	80	1
BLC	3.5	3.1	5	8	5	8	120	1
CCF	1.0	0.5	100	0	0	---	94	7
COC	0.3	0.3	0	---	0	---	85	<1
NOP	1.3	0.8	50	36	25	31	98	5
WAE	1.7	0.8	90	18	0	---	98	3
WHS	2.2	0.9	100	0	92	14	96	3
YEP	1.2	1.2	71	36	14	28	92	5

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 Elm Lake 2003-2014. BLB= black bullhead; BLC= black crappie; BLG= bluegill; CCF= channel catfish; COC= common carp; GSF= green sunfish; HYB= hybrid sunfish; NOP= northern pike; OSF= orangespotted sunfish; PUS= pumpkinseed; WAE= walleye; WHS= white sucker; YEB= yellow bullhead; YEP= yellow perch

Species	CPUE									
	2003	2004	2005	2006 ²	2007 ²	2008	2009	2010	2012	2014
<i>Frame nets</i>										
BLB	501.9	50.3	106.4	2250.0	851.2	198.5	148.3	113.1	1255.8	333.4
BLC	4.2	24.9	14.7	8.6	10.9	1.9	12.6	7.3	11.4	3.2
BLG	0.1	0.1	1.2	0.7	0.6	0.4	2.0	4.2	0.0	0.0
CCF	0.3	0.1	0.0	0.9	0.4	0.4	0.2	0.0	4.4	5.6
COC	0.2	0.6	0.2	0.1	0.5	0.5	0.2	1.7	0.1	0.1
HYB ¹	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.1
NOP	1.0	0.7	0.8	1.1	1.1	1.0	0.9	1.8	2.6	0.2
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.2	0.0	0.0
PUS	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
WAE	0.2	0.5	1.1	1.9	1.4	0.7	0.4	0.4	4.1	0.2
WHS	0.6	1.5	0.8	0.4	0.9	1.2	0.9	0.8	0.9	0.3
YEP	0.1	0.3	0.1	0.1	0.1	0.3	1.2	3.8	0.6	0.3
<i>Gill nets</i>										
BLB	70.0	14.3	8.0	107.0	174.3	20.7	22.8	35.3	281.8	166.8
BLC	0.2	3.7	1.2	4.2	0.5	0.0	4.2	2.3	0.2	3.5
CCF	0.0	0.3	0.3	0.3	0.2	0.0	0.2	0.0	0.3	1.0
COC	0.0	0.0	0.0	0.7	0.5	0.0	0.2	0.3	0.0	0.3
GSF	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOP	0.7	0.7	2.0	0.5	0.2	1.7	2.5	3.8	0.8	1.3
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0
PUS	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
WAE	3.0	7.0	3.8	8.2	3.8	4.2	5.0	3.0	4.2	1.7
WHS	14.0	11.7	16.8	11.0	12.0	11.8	12.8	10.0	6.3	2.2
YEB	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
YEP	4.0	0.7	0.0	0.2	1.2	4.0	2.7	3.0	7.8	1.2

¹ All fish sizes.

² Monofilament gill net mesh size change (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 relative weight (Wr) for selected species captured in frame nets and experimental gill nets from Elm Lake, 2003-2014. BLB= black bullhead; BLC= black crappie; WAE= walleye

Species	2003	2004	2005	2006 ¹	2007 ¹	2008	2009	2010	2012	2014	Objective
<i>Frame nets</i>											
BLB											
CPUE	502	50	106	2250	851	199	148	113	1256	333	≤ 100
PSD	22	34	18	10	8	22	4	22	26	41	---
PSD-P	0	0	1	0	0	0	0	0	1	0	---
Wr	89	104	88	85	88	86	96	92	91	75	---
BLC											
CPUE	4	25	15	9	11	2	13	7	11	3	≥ 10
PSD	100	34	53	66	83	89	27	53	98	40	30-60
PSD-P	83	33	16	25	23	39	19	15	45	33	5-10
Wr	110	127	108	108	109	108	122	111	106	112	---
<i>Gill nets</i>											
WAE											
CPUE	3	7	4	8	4	4	5	3	4	2	≥ 10
PSD	78	98	52	16	26	48	83	89	44	90	30-60
PSD-P	0	12	9	6	17	12	7	28	4	0	5-10
Wr	97	99	95	86	93	100	100	94	84	98	----

¹ Monofilament gill net mesh size change (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 black crappie sampled in frame nets from Elm Lake, 2008-2014.

Survey Year	Year Class											
	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
2014		1	28	4	1	6	9	6				
2012	---	---		2	71	19	100	1				
2010	---	---	---	---	---	4	94	5		10	2	1
2009	---	---	---	---	---	---	270	19		35	4	4
2008	---	---	---	---	---	---	---	---	3	14	6	5

Table 5. Weighted mean TL (mm) at capture for black crappie sampled in frame nets (expanded sample size) from Elm Lake, 2008-2014.

Year	Age						
	1	2	3	4	5	6	7
2014	142(1)	169(28)	191(4)	233(1)	278(6)	284(9)	270(6)
2012	156(2)	215(71)	237 (19)	258 (100)	302 (1)	---	---
2010	146(4)	200(94)	256 (5)	---	302 (10)	312 (2)	327 (1)
2009	134(270)	224(19)	---	276 (35)	313 (4)	307 (4)	---
2008	---	146(3)	235 (14)	274 (6)	287 (5)	---	---

Table 6. 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 Elm Lake, 2008-2014.

Survey Year	Year Class													
	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
2014	18	3		5	1	4								
2012	---	---		2	1	23	1		1					
2010 ¹	---	---	---	---		20	4	3	4	2	3			
2009 ¹	---	---	---	---	---	12	1	10	8	6	4			
2008 ¹	---	---	---	---	---	---			10	5	6			1
# stocked														
fry														
sm. fingerling	121		119	122	123	121	121	122			242	122		120
lg. fingerling		29							42	73				

¹Older Walleye were sampled, but are not reported in this table

Table 7. Weighted mean TL (mm) at capture for walleye age-0 through age-10 captured in experimental gill nets (expanded sample size) from Elm Lake, 2005-2014. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	Age										
	0	1	2	3	4	5	6	7	8	9	10
2014	163(18)	243(3)	---	406(5)	507(1)	460(4)	---	---	---	---	---
2012	---	211(2)	222(1)	350(23)	537(1)	---	492(1)	---	---	---	---
2010 ¹	---	191(20)	378(4)	418(3)	488(4)	522(2)	546(3)	---	---	---	---
2009	129(12)	277(1)	379(10)	432(8)	472(6)	499(4)	---	---	---	---	589(1)
2008 ¹	---	---	343(10)	360(5)	435(6)	---	---	600(1)	506(1)	---	550(1)
2007 ¹	---	242(4)	283(8)	365(10)	---	---	610(1)	---	540(1)	601(1)	---
2006	---	193(4)	347(44)	---	---	473(1)	483(1)	584(1)	569(2)	---	---
2005	---	266(12)	---	429(1)	484(7)	---	464(1)	509(3)	---	---	---

¹Older Walleye were sampled, but are not reported in this table

Table 8. Stocking history including size and number for fishes stocked into Elm Lake, 2001-2014. WAE= walleye

Year	Species	Size	Number
2001	WAE	small fingerling	120,000
2003	WAE	small fingerling	122,200
2004	WAE	small fingerling	241,800
2005	WAE	large fingerling	72,528
2006	WAE	large fingerling	41,686
2007	WAE	small fingerling	121,800
2008	WAE	small fingerling	121,460
2009	WAE	small fingerling	121,260
2010	WAE	small fingerling	122,820
2011	WAE	small fingerling	121,860
2012	WAE	small fingerling	119,050
2013	WAE	large fingerling	28,595
2014	WAE	small fingerling	121,350

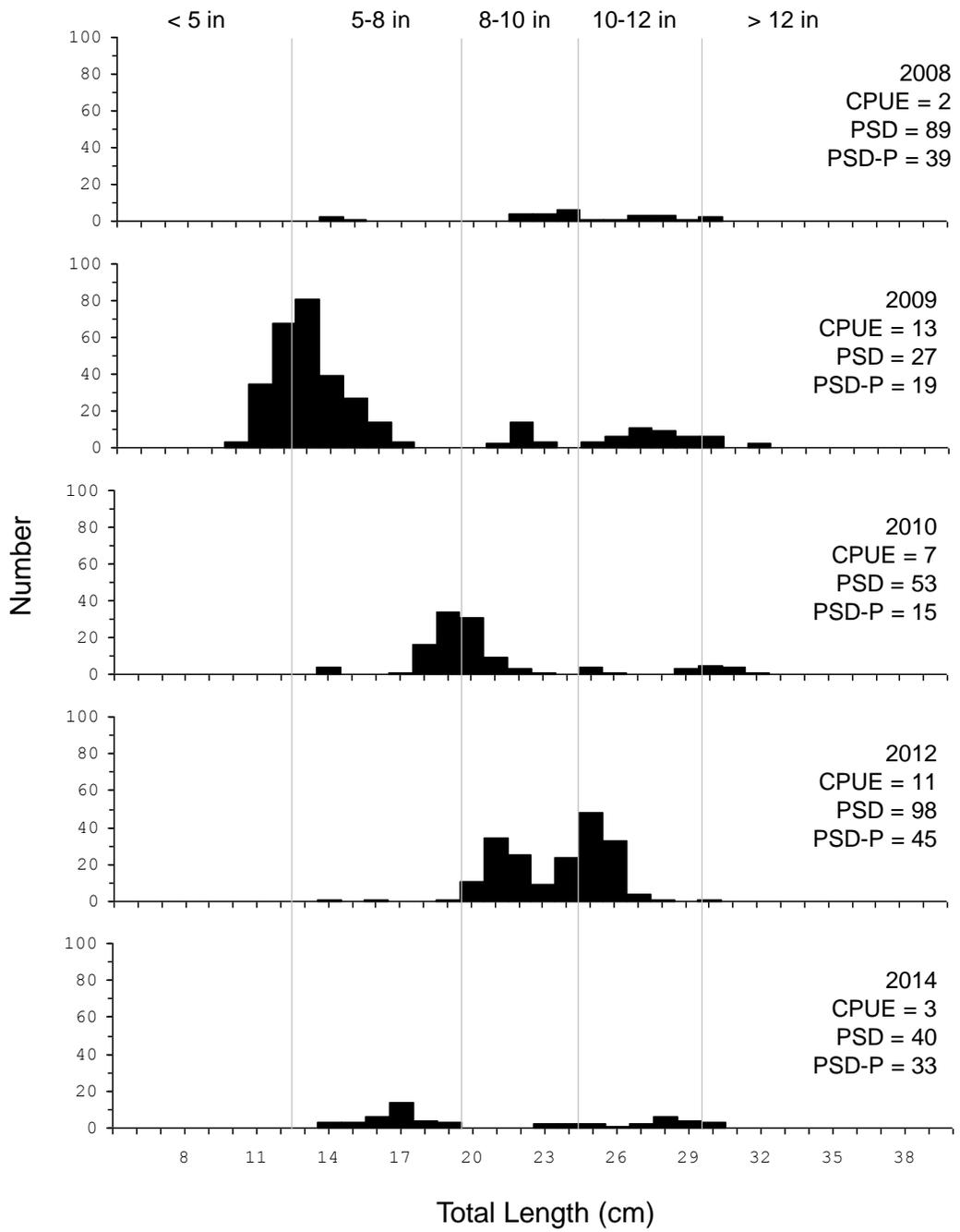


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black crappie captured using frame nets in Elm Lake, 2008-2014.

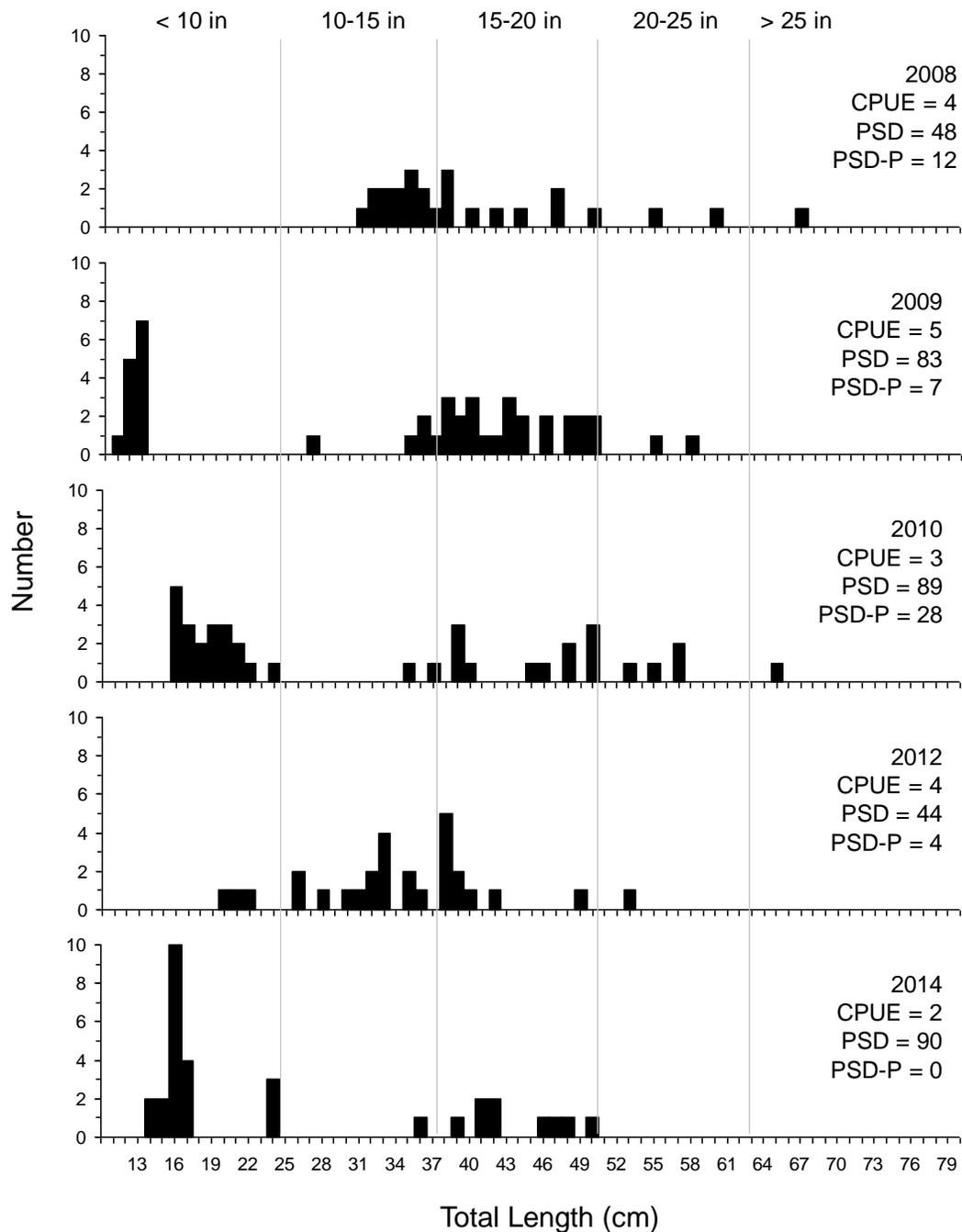


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in Elm Lake, 2008-2014.

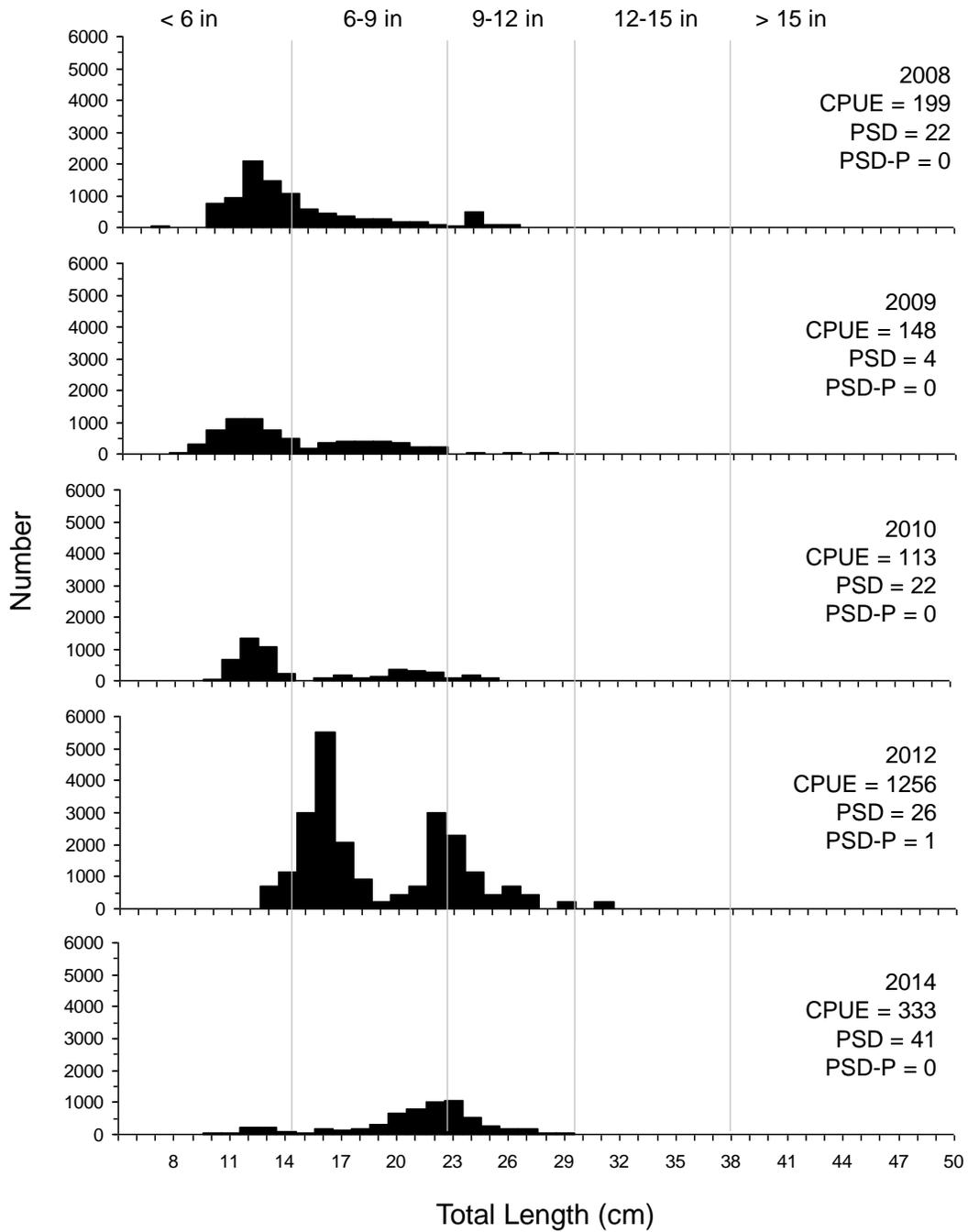


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured using frame nets in Elm Lake, 2008-2014.