

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 miles west and 1 mile north of Frederick, SD

Survey Dates and Netting Information

Dates of current survey	July 29-31, 2008 (FN,GN)
Dates of most recent survey	July 31-August 2, 2007 (FN,GN)
Gill net sets (n)	6
Frame net sets (n)	15

Morphometry (Figure 1)

Watershed area (acres)	105,720
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 is located on the southwest shore and is maintained by the SDGFP (Figure 1). Lands adjacent to the lake are under State of South Dakota and private ownership. The city of Aberdeen maintains water rights to the 12 feet below the spillway crest for municipal use.

Watershed and Land Use

The Elm Lake watershed is dominated by agricultural lands with approximately 66% cropland and 34% pasture or grassland.

Water Level Observations

Elm Lake has a spillway elevation of 1600.15 fmsl(feet above mean sea level). On May 5 and October 8, 2008 the elevation of Elm lake was 1597.03 fmsl; however, prior to freeze-up the elevation increased and water was running over the spillway (Janel Ellingson, Aberdeen Water Works, pers. comm.).

Aquatic Vegetation and Exotics

Cattails and bulrushes cover approximately 5% of the shoreline of Elm Lake and submergent vegetation is rare. Common carp are the only exotic species that has been reported in Elm Lake.

Fish Management Information

Primary species	black crappie, walleye
Other species	black bullhead, bluegill, channel catfish, common carp, fathead minnow, Johnny darter, largemouth bass, northern pike, yellow perch, white sucker
Lake-specific regulations	NE Panfish Management Area: 10 daily; 50 possession walleye/saugeye: minimum length 14"
Management classification	warm-water permanent
Fish Consumption Advisories	none

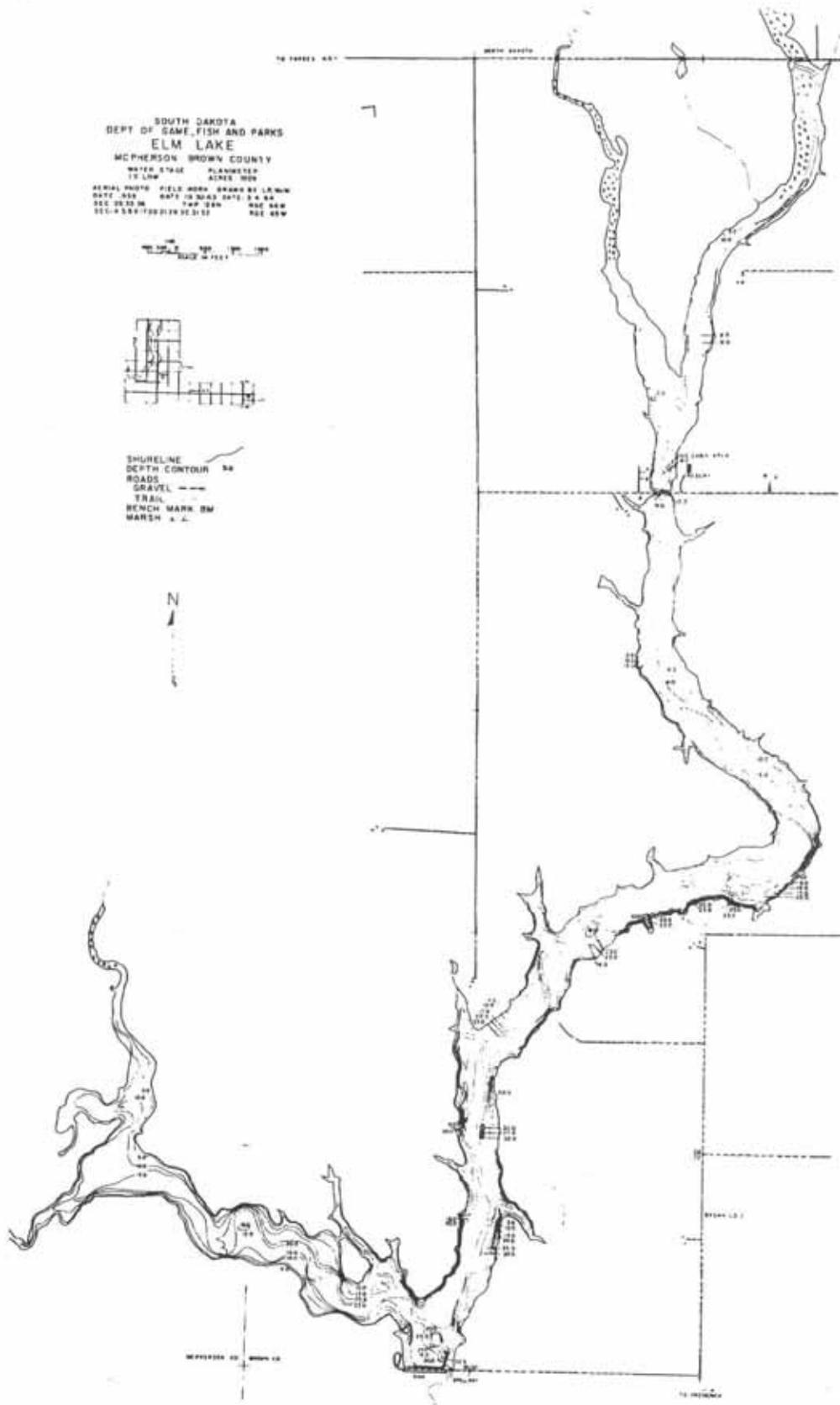


Figure 1. Elm Lake contour map.



Figure 2. Map depicting location of Elm Lake from Frederick, Brown County, South Dakota and upper, middle and lower divisions.

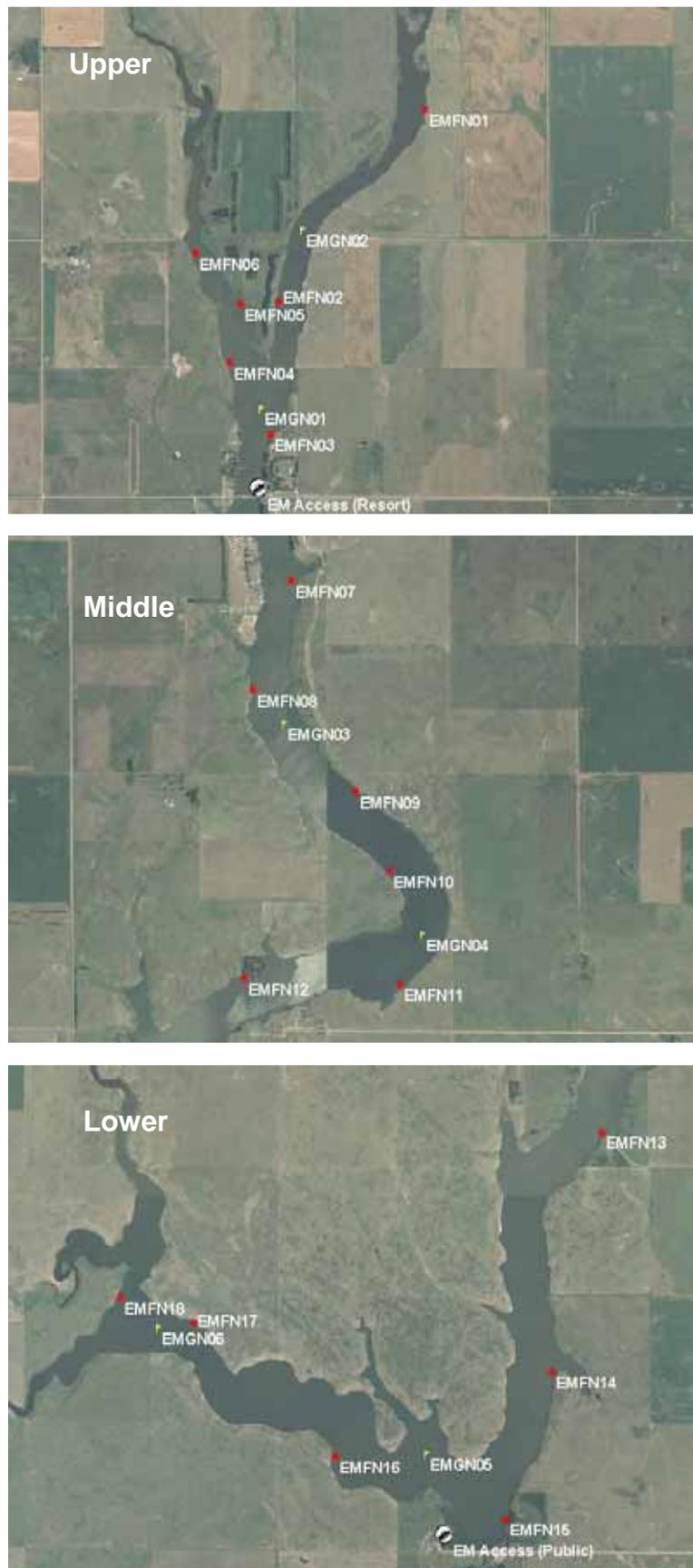


Figure 3. Map depicting access sites and standardized net locations for Elm Lake, Brown County, South Dakota. EMFN= frame nets, EMGN= gill nets

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 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, black bullhead, bluegill, channel catfish, common carp, northern pike, white sucker and yellow perch also contribute to the fishery.

Primary Species

Black crappie: The 2008 mean frame net CPUE of stock-length black crappie was 1.9 and below the minimum objective (≥ 10 fish/net night; Tables 1-3). Since 2001, black crappie mean frame net CPUE has ranged from 1.9 to 26.3 (Tables 1-2). Relative abundance was considered to be low in 2008.

Black crappie captured in frame nets during 2008 ranged in total length from 14 to 30 cm (5.5 to 11.8 inches), had a PSD of 89 and a PSD-P of 39 (Figure 2). The PSD and PSD-P are above the management objective ranges (30-60 and 5-10, respectively). Poor black crappie recruitment has resulted in PSD values increasing since 2004 (Table 3).

Ermer et al. (2006) reported growth estimates obtained from scale samples collected from Elm Lake in 2000 and 2005. They indicated that black crappie growth rates were above the regional and statewide averages (Willis et al. 2001). Black crappie in the 2008 frame net catch exhibited reduced growth in all but the age-3 cohort compared to the 2000 and 2005 surveys (Table 4). Age-3 black crappie had a mean length at capture in 2008 of 235 mm (9.25 inches) compared to 221 mm (8.7 inches) in 2005 (Table 4). Condition of black crappie in the 2008 survey was good with mean W_r values ranging from 92 to 133. A decreasing trend in W_r was observed as total length increased in the 2008 survey.

Walleye: All indices calculated were for walleye due to difficulty differentiating between walleye and saugeye in the field; however, it is likely saugeye, from annual stockings between 1996 and 2000, are present within the population.

The mean gill net CPUE of stock-length walleye during 2008 was 4.2, and below the minimum objective (≥ 10 stock-length fish/net night) for walleye in Elm Lake (Tables 1-3). Since 2001, walleye mean gill net CPUE of stock-length fish has ranged from 3.0 to 18.7 (Table 2). Based on the 2008 gill net catch, relative abundance is considered low.

Nearly annual stockings of unmarked walleye/saugeye make it impossible to evaluate the contribution of naturally-produced walleye in Elm Lake (Table 5). Since 2001, recruitment of stocked and naturally-produced walleye appears to be limited with only two relatively-strong year-classes being produced in 2001 and 2004 (Table 2; Table 8). The 2004 year-class was well represented in the 2006 gill net catch (83%); however, relative abundance of this year-class declined in the 2008 gill net catch (24%; Table 8). The 2006 year-class represented the highest proportion of the 2008 gill net catch (40%), but appears to be present at low to moderate densities (Table 8). High relative abundance of black bullheads in recent years may be impacting both walleye recruitment and gill net catch rates (Table 2).

Walleye captured in gill nets during 2008 ranged in total length from 31 to 67 cm (12.2 to 26.4 inches; Figure 3). The PSD and PSD-P of walleye captured in gill nets during 2008 was 48 and 12, respectively. The PSD was within the objective range of 30-60; while the PSD-P was slightly above the objective range of 5-10. Approximately 60% of sampled walleyes were above the 356-mm (14-inch) minimum size restriction in place on Elm Lake at the time of this survey (Figure 3).

Walleye in Elm Lake typically cross the 356-mm (14-inch) minimum size restriction during their third growing season. Weighted mean length at capture of age-2 and age-3 walleye in 2008 was 343 mm and 360 mm, respectively (Table 4). The weighted mean length at capture of age-2 and age-3 walleye in 2008 compared favorably with the 2007 survey (283 mm and 365 mm, respectively; Table 6). Gill net sampled walleye were in good condition with mean W_r values ranging from 88 to 112. A slight decreasing trend in W_r was observed as length increased.

Other Species

Black bullhead: The 2008 mean frame net CPUE of stock-length black bullhead was 198.5 (Table 1). The 2008 frame net CPUE decreased from 851.2 in 2007, but still denoted high relative abundance (Table 2-3). Since 2001, black bullhead relative abundance, as indexed by mean frame net CPUE, has ranged from a low of 50.3 (2004) to a high of 2,250 (2006; Table 2). Length-frequency analysis of the 2008 frame net catch indicates consistent black bullhead recruitment in recent years with what appears to be a strong year class ranging in total length from 10 to 15 cm (3.8 to 5.9 inches; Figure 4).

Black bullhead captured in frame nets during 2008 ranged in total length from 10 to 26 cm (3.8 to 10.2 inches; Figure 4). The PSD of black bullhead captured in frame nets during 2008 was 22 and the PSD-P was 0 (Table 1; Table 3; Figure 4). The low PSD and PSD-P indicated that a large percentage of the population is comprised of sub-quality length black bullheads.

No growth information was collected in 2008. The mean W_r for stock-length black bullheads in the 2008 frame net catch was 86, and no length-related trends in mean W_r values were apparent (Table 1).

Bluegill: Relative abundance of bluegill in Elm Lake has remained low with mean frame net CPUE values of ≤ 3.0 stock-length bluegill from 2001-2008 (Table 2). In 2008, six bluegills ranging in total length from 9 to 16 cm (3.5 to 6.3 inches) were captured by frame nets. Lack of suitable habitat (i.e., submerged vegetation and protected bays) likely limits bluegill recruitment resulting in their low relative abundance.

Northern Pike: Northern pike typically are not sampled effectively during mid-summer fish community assessments; therefore reported values may not accurately represent the at-large population. Neumann and Willis (1995) reported the most reliable time to sample northern pike with gill nets in eastern South Dakota lakes was late spring following the spawn. Since 2001, mean gill net CPUE values have ranged from 0.2 to 2.0, with the average being 0.9 (Table 2). Based on mean CPUE values of stock-length northern pike of 1.0 and 1.7 for frame nets and gill nets in 2008, respectively, relative abundance appears to be low (Table 1).

Yellow Perch: The mean gill net CPUE of stock-length yellow perch in 2008 was 4.0, and indicative of a low density population (Table 1). Since 2001, the gill net CPUE of stock-length yellow perch has fluctuated from a low of 0.0 (2005) to a high of 22.8 (2001), with the 2001-2008 average being 4.7 (Table 2).

The 2008 gill net sample was comprised of yellow perch ranging in total length from 14 to 24 cm (5.5 to 9.4 inches). Low relative abundance of yellow perch, likely related to lack of suitable habitat, limits the yellow perch fishery in Elm Lake.

Channel catfish: Six channel catfish ranging in total length from 44 to 49 cm (17.3 to 19.3 inches) were captured during the 2008 fish community survey. Relative abundance of channel catfish has remained low. The 2001 to 2008 mean CPUE values ranged from 0.0 to 0.9 for frame nets, and 0.0 to 0.3 for gill nets (Table 2). Although, anglers actively target larger channel catfish on Elm Lake, low abundance limits the fishery (Hubers and Blackwell 1999).

Other: Common carp, white sucker, and orangespotted sunfish were also captured during the 2008 survey (Table 1). Relative abundance of these species appears to be low and their impact on the Elm Lake fishery is likely minimal.

Management Recommendations

- 1) Conduct fish community assessment surveys on an annual basis (next survey scheduled in summer 2009) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Collect otoliths from walleye and black crappie to assess age structure and growth rates of each population.
- 3) Stock walleye (100 small fingerlings/acre) on a biennial basis to establish additional year classes.
- 4) Evaluate walleye population dynamics and implement regulations to benefit the population and comply with tool box options.
- 5) Develop a stocking strategy to expand channel catfish angling opportunities in Elm Lake.
- 6) Encourage commercial harvest of black bullhead to limit abundance if the abundance exceeds the management objective. At the time of this survey, the relative abundance of black bullheads in Elm Lake exceeded the management objective (≥ 100); therefore commercial harvest should be encouraged.

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 experimental gill nets and frame nets in Elm Lake, July 2008. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; CCF= channel catfish; COC= common carp; NOP= northern pike; OSF= orangespotted sunfish; 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	198.5	97.6	22	2	0	---	86	20
BLC	1.9	1.1	89	10	39	16	108	<1
BLG	0.4	0.2	50	45	0	---	106	18
CCF	0.4	0.5	100	0	0	---	93	9
COC	0.5	0.3	100	0	86	14	87	6
NOP	1.0	0.5	93	7	13	16	85	6
OSF	0.1	0.1	---	---	---	---	---	---
WAE	0.7	0.4	50	31	20	24	91	8
WHS	1.2	0.5	100	0	100	0	98	2
YEP	0.3	0.2	0	---	0	---	79	27
<i>Gill nets</i>								
BLB	20.7	9.0	14	5	0	---	102	<1
NOP	1.7	1.2	80	20	0	---	92	3
OSF	0.3	0.3	---	---	---	---	---	---
WAE	4.2	1.4	48	17	12	11	100	2
WHS	11.8	3.7	90	6	86	7	104	<1
YEP	4.0	2.7	29	16	0	---	107	1

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 2001-2008. BLB= black bullhead; BLC= black crappie; BLG= bluegill; CCF= channel catfish; COC= common carp; GSF= green sunfish; LMB= largemouth bass; NOP= northern pike; OSF= orangespotted sunfish; PUS= pumpkinseed; WAE= walleye; WHS= white sucker; YEB= yellow bullhead; YEP= yellow perch

Species	CPUE								Mean
	2001	2002	2003	2004	2005	2006 ²	2007 ²	2008	
<i>Frame nets</i>									
BLB	355.8	873.2	501.9	50.3	106.4	2,250.0	851.2	198.5	648.4
BLC	26.3	8.1	4.2	24.9	14.7	8.6	10.9	1.9	12.5
BLG	3.0	0.6	0.1	0.1	1.2	0.7	0.6	0.4	0.8
CCF	0.0	0.2	0.3	0.1	0.0	0.9	0.4	0.4	0.3
COC	0.1	0.1	0.2	0.6	0.2	0.1	0.5	0.5	0.3
LMB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOP	2.3	2.6	1.0	0.7	0.8	1.1	1.1	1.0	1.3
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
PUS	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
WAE	2.4	3.3	0.2	0.5	1.1	1.9	1.4	0.7	1.4
WHS	0.8	1.2	0.6	1.5	0.8	0.4	0.9	1.2	0.9
YEP	1.1	1.1	0.1	0.3	0.1	0.1	0.1	0.3	0.4
<i>Gill nets</i>									
BLB	75.8	117.7	70.0	14.3	8.0	107.0	174.3	20.7	73.5
BLC	1.8	0.5	0.2	3.7	1.2	4.2	0.5	0.0	1.5
BLG	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CCF	0.2	0.0	0.0	0.3	0.3	0.3	0.2	0.0	0.2
COC	0.0	0.7	0.0	0.0	0.0	0.7	0.5	0.0	0.2
GSF	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
NOP	0.3	1.0	0.7	0.7	2.0	0.5	0.2	1.7	0.9
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
PUS	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
WAE	18.7	10.8	3.0	7.0	3.8	8.2	3.8	4.2	7.4
WHS	4.8	7.0	14.0	11.7	16.8	11.0	12.0	11.8	11.1
YEB	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.2
YEP	22.8	4.7	4.0	0.7	0.0	0.2	1.2	4.0	4.7

¹ All fish sizes.

² Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5").

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 experimental gill nets and frame nets in Elm Lake, 2001-2008. BLB= black bullhead; BLC= black crappie; WAE= walleye

Species	2001	2002	2003	2004	2005	2006 ¹	2007 ¹	2008	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	356	873	502	50	106	2,250	851	199	648	≤ 100
PSD	71	46	22	34	18	10	8	22	29	---
PSD-P	0	0	0	0	1	0	0	0	0	---
Wr	87	92	89	104	88	85	88	86	90	---
BLC										
CPUE	26	8	4	25	15	9	11	2	13	≥ 10
PSD	97	86	100	34	53	66	83	89	76	30-60
PSD-P	39	58	83	33	16	25	23	39	40	5-10
Wr	107	103	110	127	108	108	109	108	110	---
<i>Gill nets</i>										
WAE										
CPUE	19	11	3	7	4	8	4	4	8	≥ 10
PSD	29	34	78	98	52	16	26	48	48	30-60
PSD-P	4	0	0	12	9	6	17	12	8	5-10
Wr	88	96	97	99	95	86	93	100	94	----

¹ Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5").

Table 4. Weighted mean length at capture (mm) for black crappie captured in frame nets in Elm Lake, 2000-2008. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	N	Age					
		1	2	3	4	5	6
2008 ¹	28	---	146	235	274	287	---
2005	293	133	200	221	299	314	318
2000	49	140	215	256	300	311	---

¹ Age assignments made using otoliths; scales were used in previous years

Table 5. Number of black crappie captured, by year class (n), using frame nets in Elm Lake, 2000, 2005, and 2008.

Survey Year	Year Class													
	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
2008 ¹	---	---	3	14	6	5	---	---	---	---	---	---	---	---
2005	---	---	---	---	100	146	9	8	19	11	---	---	---	---
2000	---	---	---	---	---	---	---	---	---	5	22	7	11	4

¹ Age assignments made using otoliths; scales were used in previous years

Table 6. Weighted mean length at capture (mm) for walleye age-1 through age-10 captured in experimental gill nets in Elm Lake, 2001-2008. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	N	Age									
		1	2	3	4	5	6	7	8	9	10
2008 ¹	25	---	343	360	435	---	---	600	506	---	550
2007 ¹	26	242	283	365	---	---	610	---	540	601	---
2006 ¹	53	193	347	---	---	473	483	584	569	---	---
2005 ¹	24	266	---	429	484	---	464	509	---	---	---
2004	41	311	---	428	454	497	496	---	---	---	---
2003	19	---	346	400	415	459	503	---	---	---	---
2002	79	218	336	354	403	459	---	---	---	---	---
2001	112	259	307	362	414	478	534	---	644	---	---

¹Age assignments made using otoliths; scales were used in previous years

Table 7. Stocking history including size and number for fishes stocked into Elm Lake, 1996-2008. SXW=saugeye; WAE= walleye; CCF= channel catfish

Year	Species	Size	Number
1996	SXW	small fingerling	138,600
1997	SXW	large fingerling	59,200
1998	SXW	large fingerling	29,760
1999	SXW	large fingerling	40,000
2000	CCF	large fingerling	30,000
	SXW	small fingerling	126,280
2001	WAE	small fingerling	120,000
2003	WAE	small fingerling	122,200
2004	WAE	small fingerling	241,800
2005	WAE	large fingerling	75,528
2006	WAE	large fingerling	41,686
2007	WAE	small fingerling	121,800
2008	WAE	small fingerling	121,460

Table 8. Numbers of walleye/saugeye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in Elm Lake, 2001-2008.

Survey Year	Year-Class												
	2008	2007	2006	2005	2004	2003	2002	2001	2000 ¹	1999 ¹	1998 ¹	1997 ¹	1996 ¹
2008 ^{2,3}			10	5	6			1	1		1	1	
2007 ^{2,3}	---		4	8	10			1		1	1		
2006 ^{2,3}	---	---		4	44			1	1	1	2		
2005 ²	---	---	---		12		1	7		1	3		
2004	---	---	---	---		1		19	9	11	1		
2003	---	---	---	---	---			4	2	7	4	2	
2002	---	---	---	---	---	---		15	21	22	14	7	
2001	---	---	---	---	---	---	---		7	33	48	16	4
Number stocked													
fry													
small fingerling	121	122			242	122		120	126				139
large fingerling			42	76						40	30	59	

¹ saugeye.

² Age assignments made using otoliths; scales were used in previous years

³ Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5").

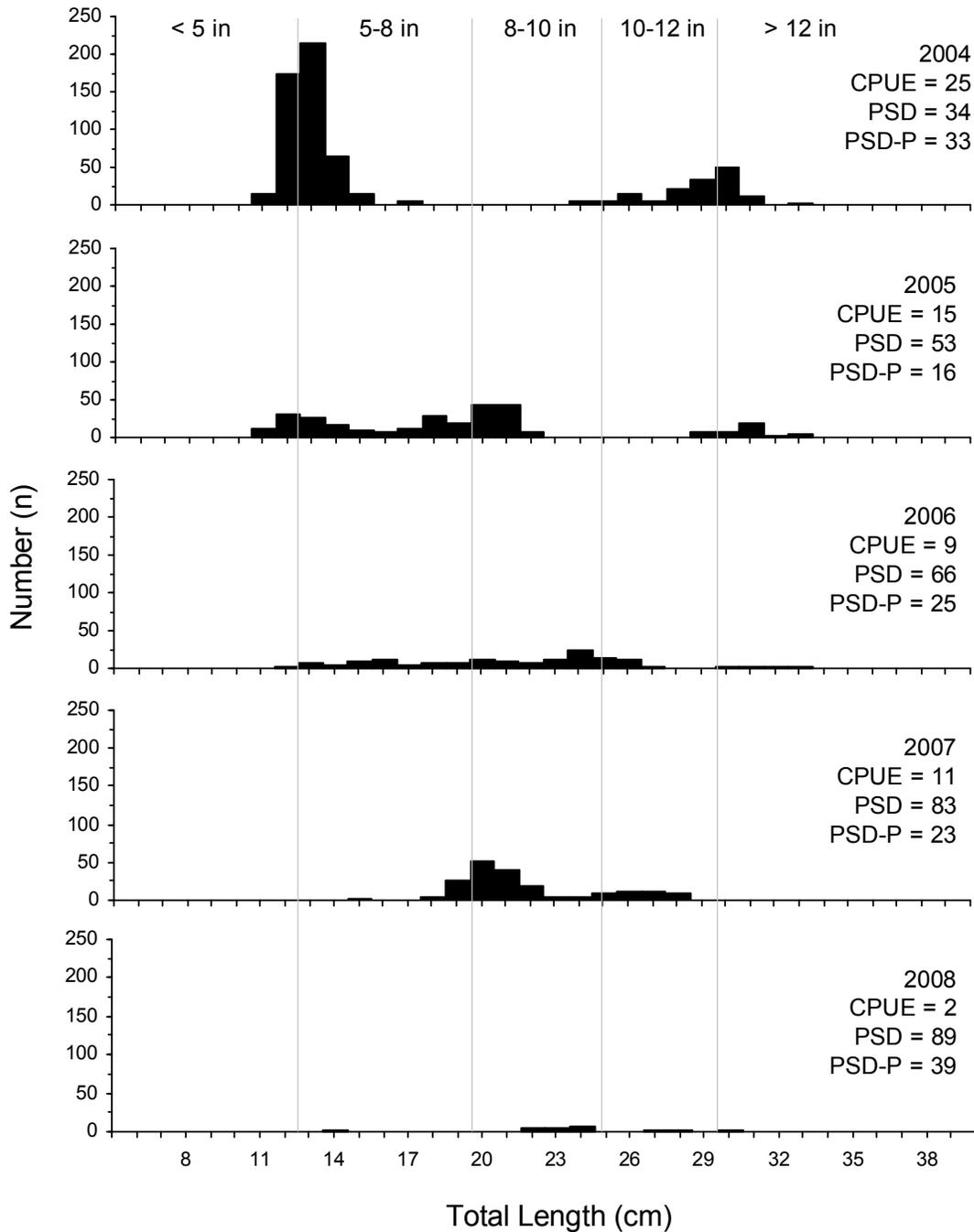


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black crappie captured using frame nets in Elm Lake, 2004-2008.

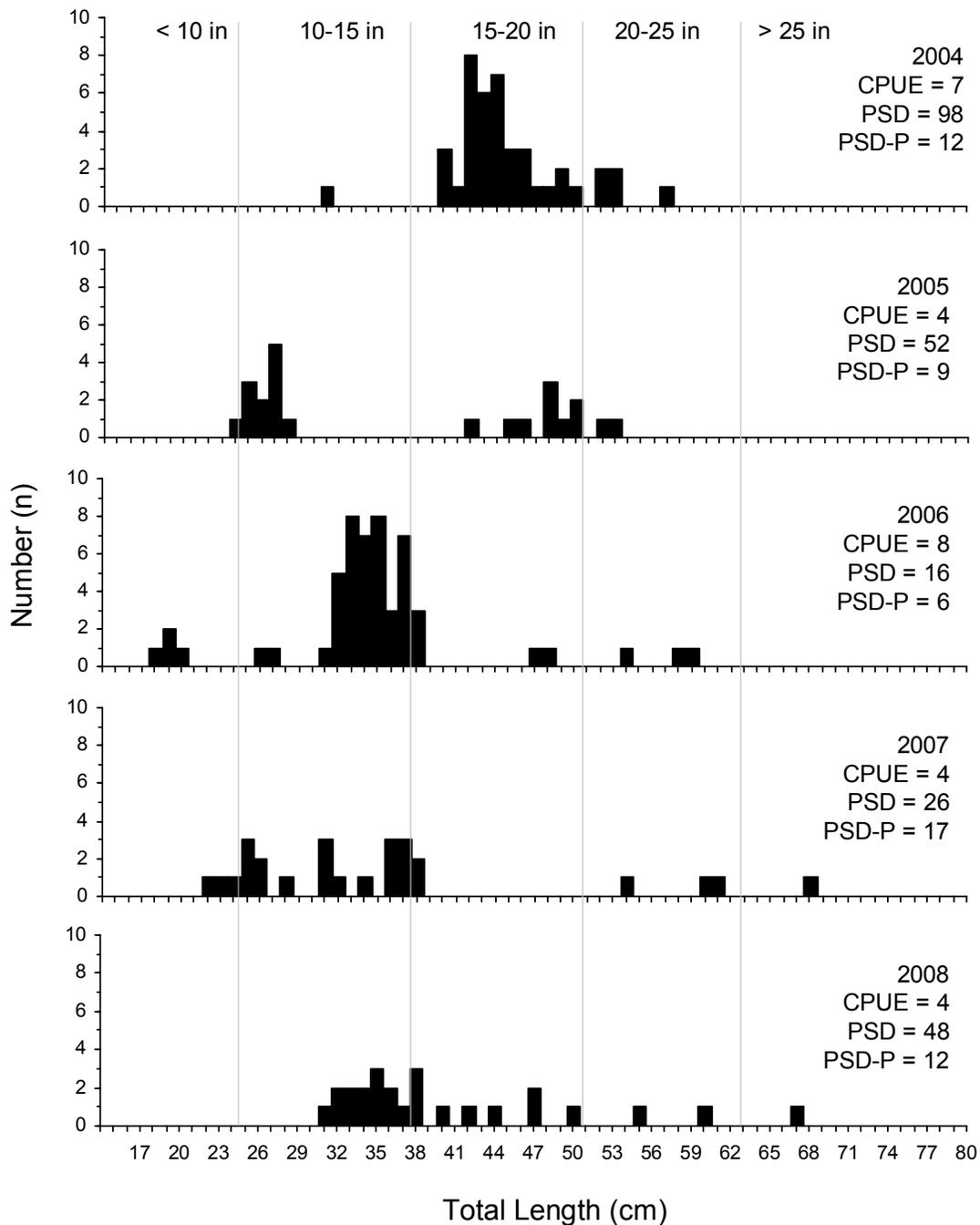


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in Elm Lake, 2004-2008.

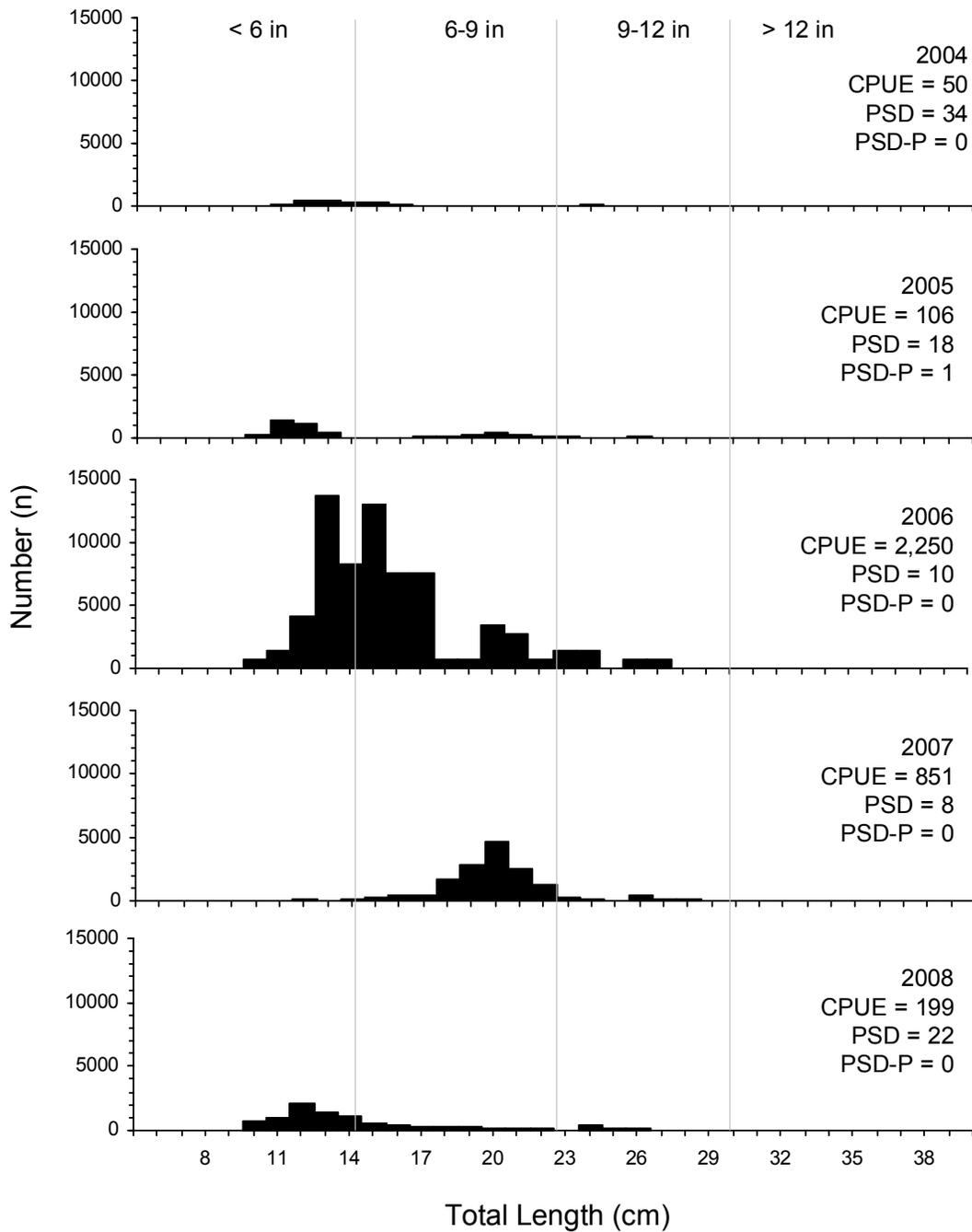


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured using frame nets in Elm Lake, 2004-2008.