

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

Survey dates	July 28-30, 2009 (FN,GN)
Gill net sets (n)	6
Frame net sets (n)	18

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 first 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 July 28, 2009 the lake was at full pool and water was flowing over the spillway.

Aquatic Nuisance Species Monitoring

Plant Survey

Areas of emergent vegetation, primarily bulrush and cattail, are limited to the upper portions of the impoundment. Sago pondweed and common duckweed were found in scattered areas near shore. No aquatic nuisance plant species were encountered in 2009.

Macro-Invertebrate/Mussel Survey

No aquatic nuisance macro-invertebrate or mussel species were sampled in 2009.

Fish Community Survey

Common carp was the only aquatic nuisance fish species captured in 2009.

Fish Management Information

Primary species	black crappie, walleye
Other species	black bullhead, bluegill, channel catfish, common carp, largemouth bass, northern pike, orangespotted sunfish, 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

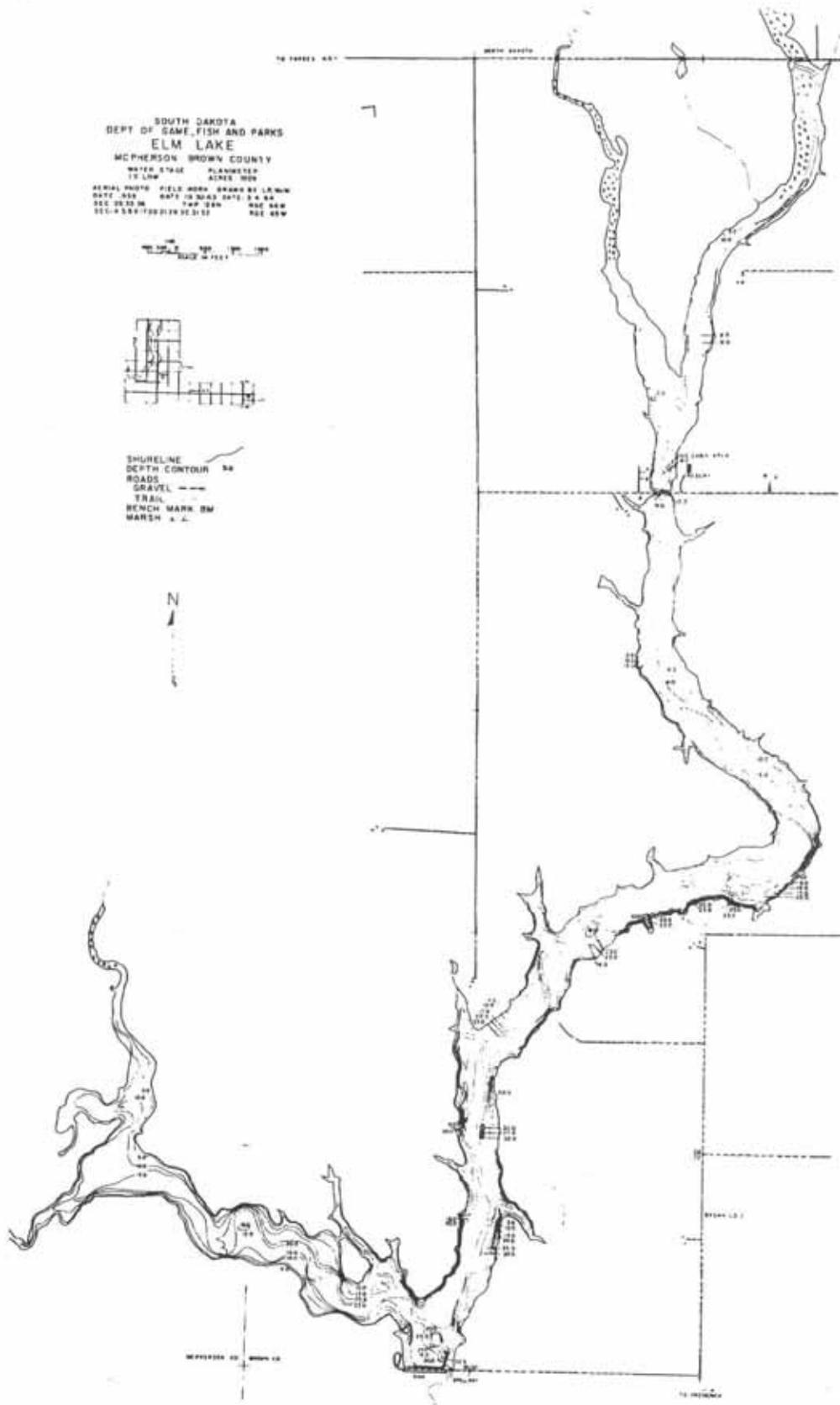


Figure 1. Elm Lake contour map.

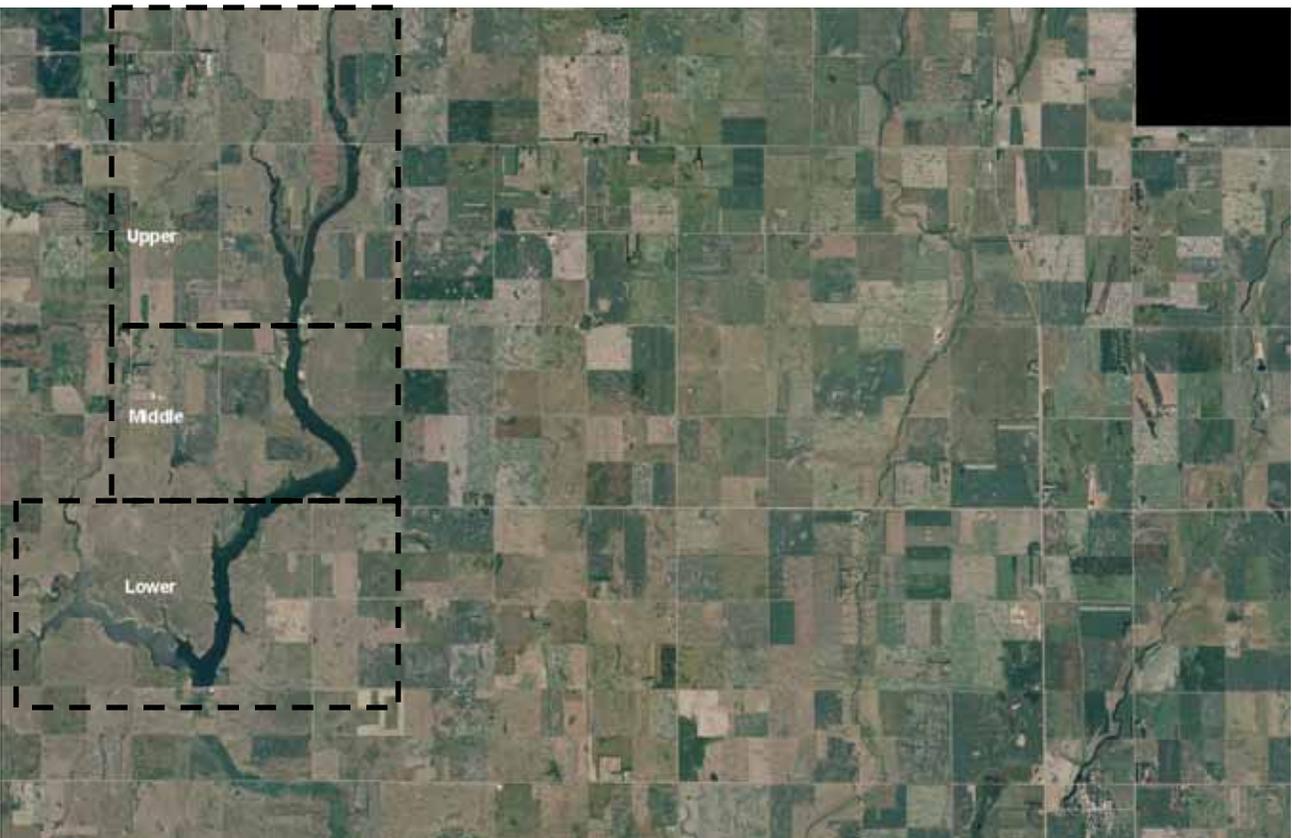
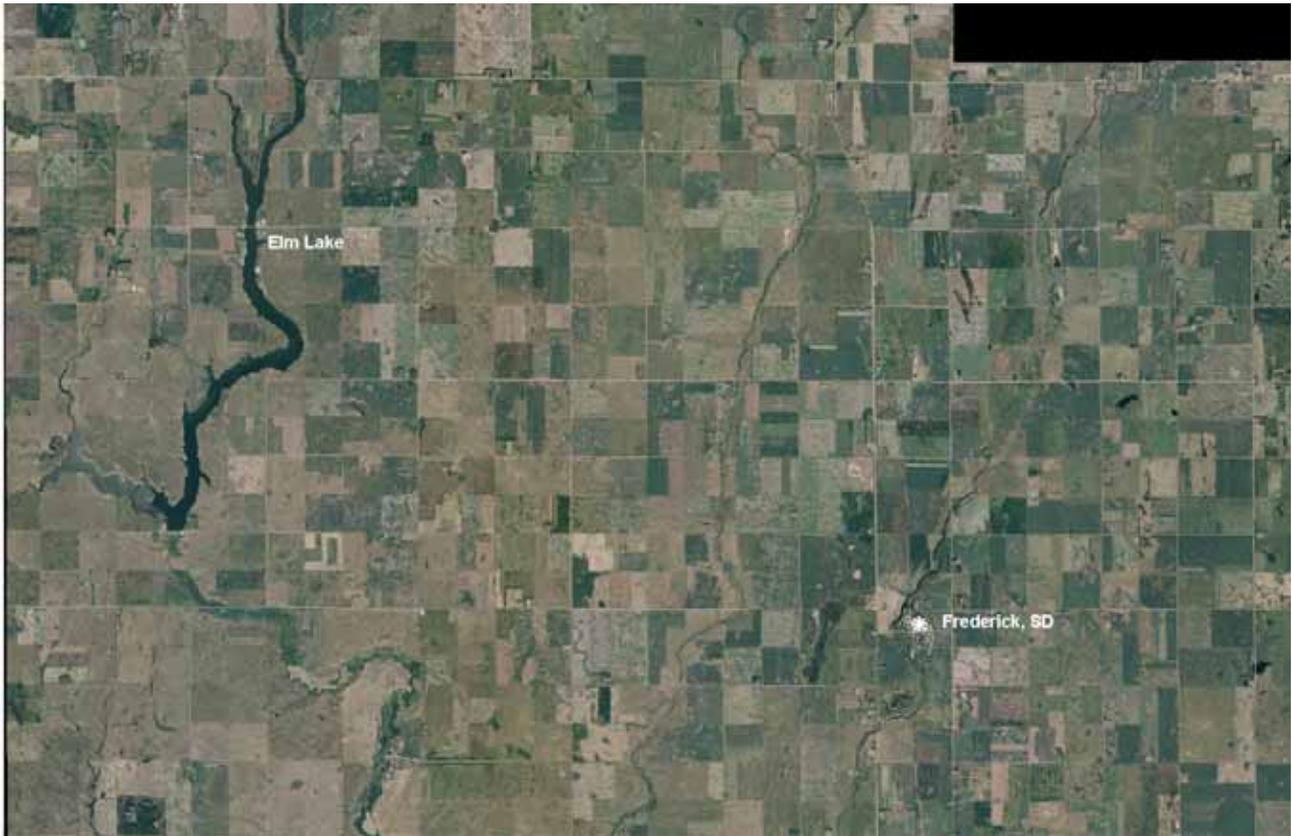


Figure 2. Map depicting geographic of location Elm Lake, Brown County from Frederick, South Dakota (top). Also noted are upper, middle, and lower designations for reservoir (bottom).



Figure 3. Map depicting access points and standardized net locations for Elm Lake, Brown County, South Dakota.

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 2009 mean frame net CPUE of stock-length black crappie was 12.6 and above the minimum objective (≥ 10 fish/net night; Tables 1-3). Relative abundance was considered to be high in 2009. The increase in abundance in 2009 from the 1.9 observed in 2008 is due to the strong age-1 year-class recruiting to stock-length (Table 4). Five year classes were represented in the 2009 frame net survey.

Black crappie captured in frame nets during 2009 ranged in total length from 10 to 32 cm (3.9 to 12.6 inches), had a PSD of 27 and a PSD-P of 19 (Figure 4). The PSD is below and PSD-P is above the management objective ranges (30-60 and 5-10, respectively). Substantial decreases in both PSD and PSD-P from the 89 and 39, respectively, observed in 2008 are a result of the strong age-1 year-class recruiting to stock-length (Figure 4). All year classes of black crappie in the 2009 frame net catch exhibited increased growth over comparable year classes observed in 2008 (Table 4). Age-2 black crappie had a mean length at capture in 2009 of 224 mm (8.8 inches; Table 4). Condition of black crappie in the 2009 survey was good with mean W_r values ranging from 109 to 126 for stock-length and greater length categories. A decreasing trend in W_r was observed as total length increased in the 2009 survey.

Walleye: The mean gill net CPUE of stock-length walleye during 2009 was 5.0, and below the minimum objective (≥ 10 stock-length fish/net night; Tables 1-3). Since 2002, walleye mean gill net CPUE of stock-length fish has ranged from 3.0 to 10.8 (Table 2). Based on the 2009 gill net catch, relative abundance is considered moderate. Due to poor recruitment, walleye have remained at low to moderate abundance since 2002 despite annual stockings of large or small fingerling walleye since 2003 (Tables 7-8). In the 2009 gill net sample, six walleye year-classes are represented; however, all are of low magnitude.

Walleye captured in gill nets during 2009 ranged in total length from 11 to 58 cm (4.3 to 22.8 inches; Figure 5). The PSD and PSD-P of walleye captured in gill nets during 2009 was 83 and 7, respectively (Table 1). The PSD was above the objective range of 30-60; while the PSD-P was within the objective range of 5-10. Approximately 67% 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 5).

Walleye in Elm Lake typically cross the 381-mm (15-inch) minimum size restriction during their third growing season. Weighted mean length at capture of age-2 and age-3 walleye in 2009 was 379 mm and 432 mm, respectively (Table 4). The weighted mean length at capture of age-2 and age-3 walleye in 2009 exceeded that observed during the 2008 survey (343 mm and 360 mm, respectively; Table 6). Gill net sampled walleye were in good condition with mean W_r values ranging from 98 to 100. No length-related trends in W_r were observed in 2009.

Other Species

Black bullhead: The 2009 mean frame net CPUE of stock-length black bullhead was 148.3 (Table 1). The 2009 frame net CPUE decreased from 198.5 in 2008 and 851.2 in 2007, but still denoted high relative abundance (Table 2-3). Since 2002, 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 2009 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 9 to 14 cm (3.5 to 5.5 inches; Figure 6).

Black bullhead captured in frame nets during 2009 ranged in total length from 9 to 22 cm (3.5 to 8.7 inches; Figure 4). The PSD of black bullhead captured in frame nets during 2009 was 4 and the PSD-P was 0 (Tables 1, 3; Figure 6). 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 2009. The mean W_r for stock-length black bullheads in the 2009 frame net catch was 96 and an increasing trend in W_r was observed as total length increased (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 2002-2009 (Table 2). In 2009 the mean frame net CPUE for bluegills was 2.0 (Table 1). 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 2002, mean gill net CPUE values have ranged from 0.2 to 2.5 with the average being 1.2 (Table 2). Based on mean CPUE values for stock-length northern pike of 0.9 and 2.5 for frame nets and gill nets in 2009, respectively, relative abundance appears to be moderate (Table 1). Northern pike sampled in the gill nets and frame nets were in good condition with mean Wr values of 92 and 91, respectively (Table 1).

Yellow Perch: The mean gill net CPUE of stock-length yellow perch in 2009 was 2.7, and indicative of a low density population (Table 1). Since 2002, the gill net CPUE of stock-length yellow perch has fluctuated from a low of 0.0 (2005) to a high of 4.7 (2002), with the 2002-2009 average being 2.2 (Table 2). Low relative abundance of yellow perch, likely related to lack of suitable habitat, limits the yellow perch fishery in Elm Lake.

Channel catfish: The 2002 to 2009 mean CPUE values ranged from 0.0 to 0.9 for frame nets, and 0.0 to 0.3 for gill nets (Table 2). The 2009 mean CPUE was 0.2 for both frame net and gill net samples (Table 1). Although, anglers actively target larger channel catfish on Elm Lake, low abundance limits the fishery (Hubers and Blackwell 1999).

White Sucker: The mean gill net CPUE of stock-length white suckers in 2009 was 12.8 (Table 1). The relative abundance of white suckers appears to be high when compared to other waters within Region IV. Impacts of high relative abundance of white suckers on the Elm Lake fishery are unknown. Monitoring will be done during future surveys to discern possible impacts of white suckers on the Elm Lake fishery.

Other: Common carp and orangespotted sunfish were also captured during the 2009 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 2010) 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) Establish a 381-mm (15 inch) minimum length limit to 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, 2009. 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	148.3	59.5	4	1	0	---	96	9
BLC	12.6	8.5	27	5	19	4	122	1
BLG	2.0	0.9	19	12	0	---	113	1
CCF	0.2	0.2	50	50	0	---	102	5
COC	0.2	0.2	100	0	100	0	97	4
NOP	0.9	0.4	41	22	18	16	92	3
OSF ¹	0.7	0.5	---	---	---	---	---	---
WAE	0.4	0.2	86	14	14	28	94	2
WHS	0.9	0.3	88	12	63	21	98	1
YEP	1.2	0.5	86	13	9	11	93	1
<i>Gill nets</i>								
BLB	22.8	8.0	0	---	0	---	95	3
BLC	4.2	2.9	12	11	12	11	125	3
CCF	0.2	0.2	100	---	0	---	99	---
COC	0.2	0.2	100	---	100	---	106	---
NOP	2.5	2.0	60	23	7	11	91	3
WAE	5.0	1.9	83	12	7	8	100	1
WHS	12.8	4.0	90	5	57	10	95	3
YEP	2.7	0.6	94	6	13	14	101	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 Elm Lake 2002-2009. 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	
	2002	2003	2004	2005	2006 ²	2007 ²	2008		2009
<i>Frame nets</i>									
BLB	873.2	501.9	50.3	106.4	2,250.0	851.2	198.5	148.3	622.5
BLC	8.1	4.2	24.9	14.7	8.6	10.9	1.9	12.6	10.7
BLG	0.6	0.1	0.1	1.2	0.7	0.6	0.4	2.0	0.7
CCF	0.2	0.3	0.1	0.0	0.9	0.4	0.4	0.2	0.3
COC	0.1	0.2	0.6	0.2	0.1	0.5	0.5	0.2	0.3
LMB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOP	2.6	1.0	0.7	0.8	1.1	1.1	1.0	0.9	1.2
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1
PUS	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
WAE	3.3	0.2	0.5	1.1	1.9	1.4	0.7	0.4	1.2
WHS	1.2	0.6	1.5	0.8	0.4	0.9	1.2	0.9	0.9
YEP	1.1	0.1	0.3	0.1	0.1	0.1	0.3	1.2	0.4
<i>Gill nets</i>									
BLB	117.7	70.0	14.3	8.0	107.0	174.3	20.7	22.8	66.9
BLC	0.5	0.2	3.7	1.2	4.2	0.5	0.0	4.2	1.8
BLG	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CCF	0.0	0.0	0.3	0.3	0.3	0.2	0.0	0.2	0.2
COC	0.7	0.0	0.0	0.0	0.7	0.5	0.0	0.2	0.3
GSF	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
NOP	1.0	0.7	0.7	2.0	0.5	0.2	1.7	2.5	1.2
OSF ¹	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
PUS	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
WAE	10.8	3.0	7.0	3.8	8.2	3.8	4.2	5.0	5.7
WHS	7.0	14.0	11.7	16.8	11.0	12.0	11.8	12.8	12.1
YEB	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.2
YEP	4.7	4.0	0.7	0.0	0.2	1.2	4.0	2.7	2.2

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, 2002-2009. BLB= black bullhead; BLC= black crappie; WAE= walleye

Species	2002	2003	2004	2005	2006 ¹	2007 ¹	2008	2009	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	873	502	50	106	2,250	851	199	148	622	≤ 100
PSD	46	22	34	18	10	8	22	4	21	---
PSD-P	0	0	0	1	0	0	0	0	0	---
Wr	92	89	104	88	85	88	86	96	91	---
BLC										
CPUE	8	4	25	15	9	11	2	13	11	≥ 10
PSD	86	100	34	53	66	83	89	27	67	30-60
PSD-P	58	83	33	16	25	23	39	19	37	5-10
Wr	103	110	127	108	108	109	108	122	112	---
<i>Gill nets</i>										
WAE										
CPUE	11	3	7	4	8	4	4	5	6	≥ 10
PSD	34	78	98	52	16	26	48	83	54	30-60
PSD-P	0	0	12	9	6	17	12	7	8	5-10
Wr	96	97	99	95	86	93	100	100	96	----

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

Table 4. Weighted mean total length (mm) at capture for black crappie sampled in frame nets (expanded sample size) from Elm Lake, 2008-2009.

Year	Age					
	1	2	3	4	5	6
2009	134 (270)	224 (19)	---	276 (35)	313 (4)	307 (4)
2008	---	146 (3)	235 (14)	274 (6)	287 (5)	---

Table 5. Year class distribution based on the expanded age/length summary for black crappie sampled in frame nets from Elm Lake, 2008-2009.

Survey Year	Year Class						
	2009	2008	2007	2006	2005	2004	2003
2009	---	270	19	---	35	4	4
2008	---	---	---	3	14	6	5

Table 6. Weighted mean length at capture (mm) for walleye age-0 through age-10 captured in experimental gill nets (expanded sample size) from Elm Lake, 2005-2009. 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
2009	129(12)	277(1)	379(10)	432(8)	472(6)	499(4)	---	---	---	---	589(1)
2008	---	---	343(10)	360(5)	435(6)	---	---	600(1)	506(1)	---	550(1)
2007	---	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)	---	---	---

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
1998	SXW	large fingerling	29,760
1999	SXW	large fingerling	40,000
2000	CCF	large fingerling	30,000
2000	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
2009	WAE	small fingerling	121,260

Table 8. Year class distribution based on the expanded age/length summary for walleye sampled in gill nets and associated stocking history (Number stocked x 1,000) from Elm Lake, 2005-2009.

Survey Year	Year Class											
	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000 ¹	1999 ¹	1998 ¹
2009	12	1	10	8	6	4					1	
2008	---			10	5	6			1	1		1
2007 ¹	---	---		4	8	10			1		1	1
2006 ¹	---	---	---		4	44			1	1	1	2
2005	---	---	---	---		12		1	7		1	3
# stocked												
fry												
small fingerling	121	121	122			242	122		120	126		
large fingerling				42	76						40	30

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

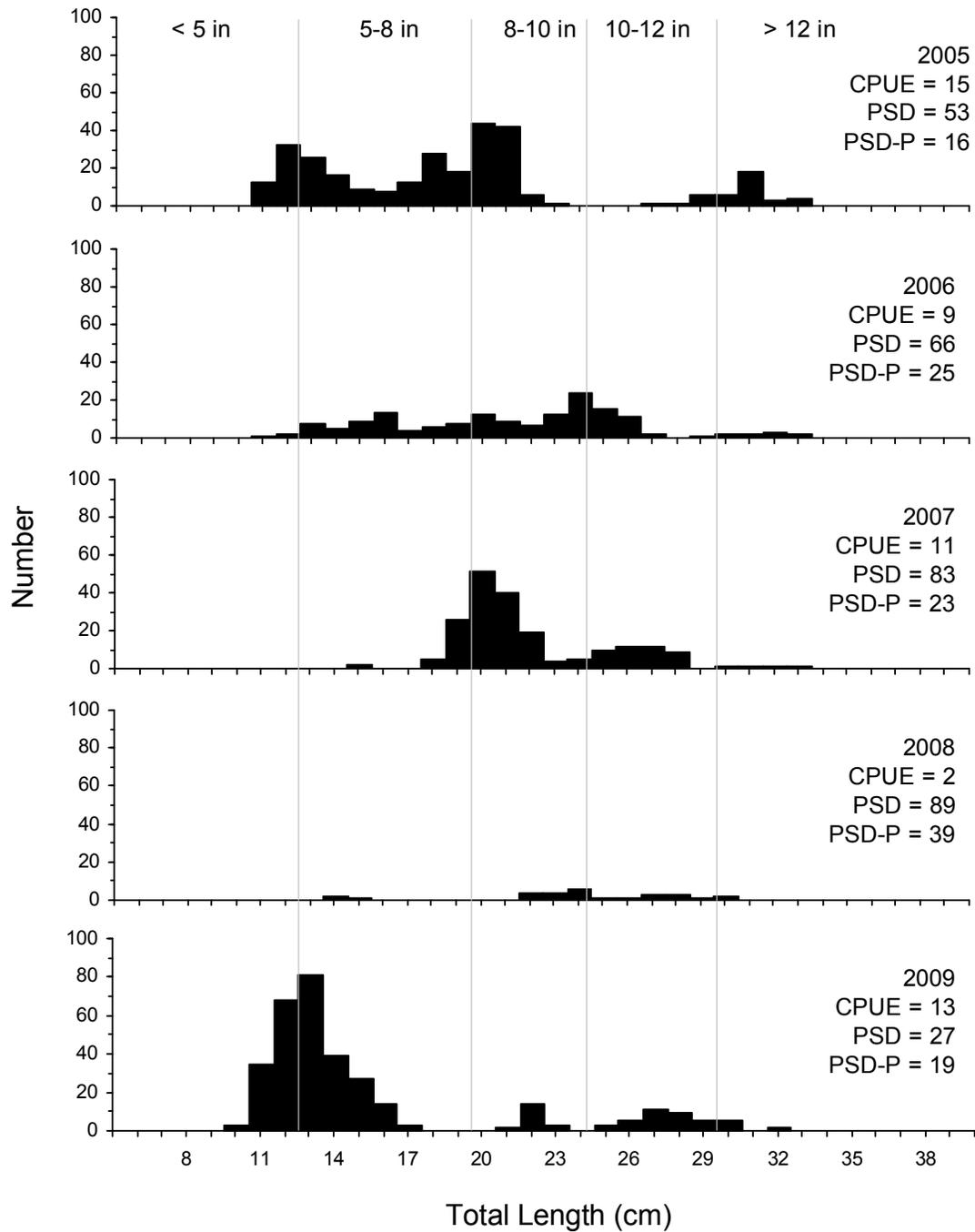


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black crappie captured using frame nets in Elm Lake, 2005-2009.

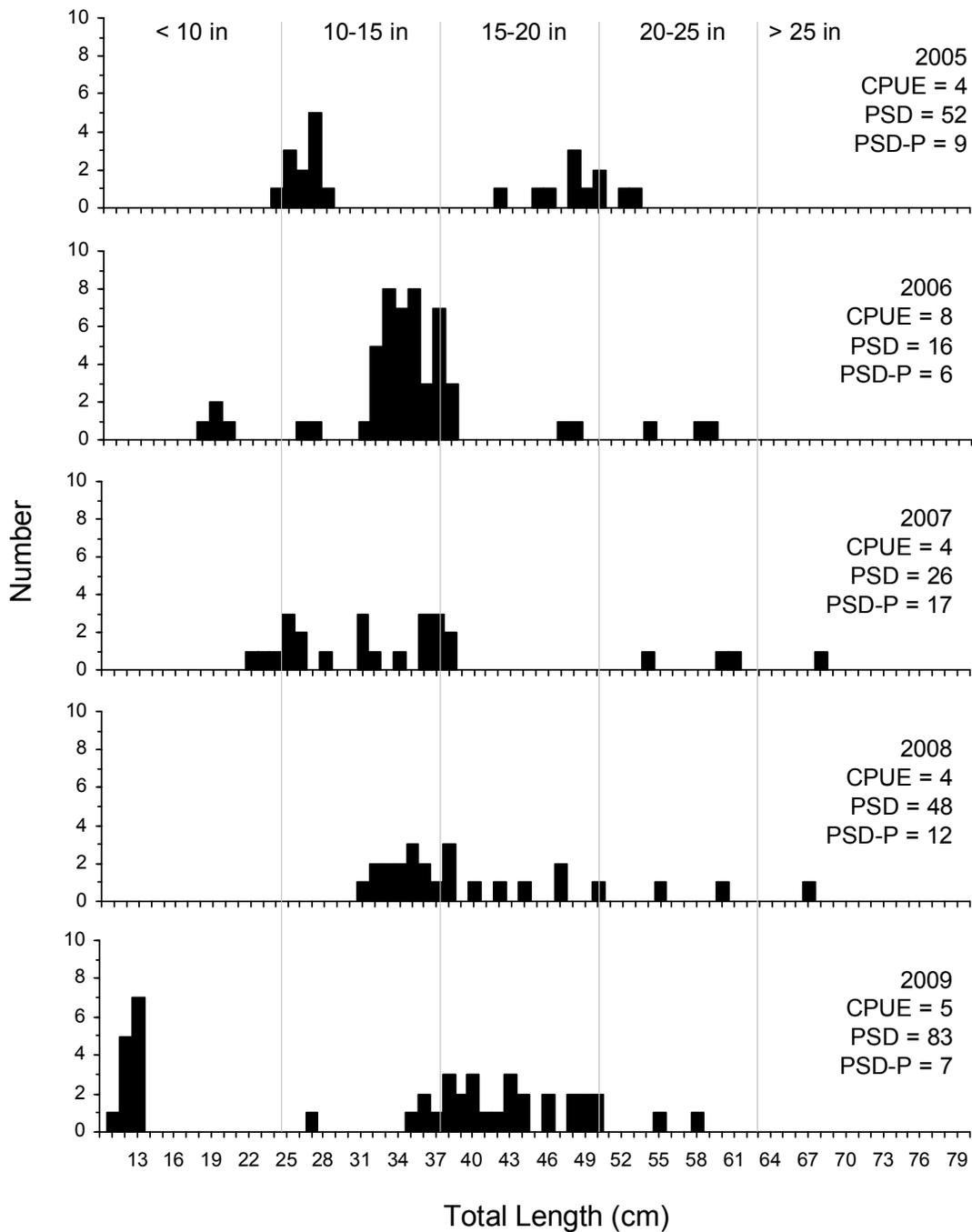


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in Elm Lake, 2005-2009.

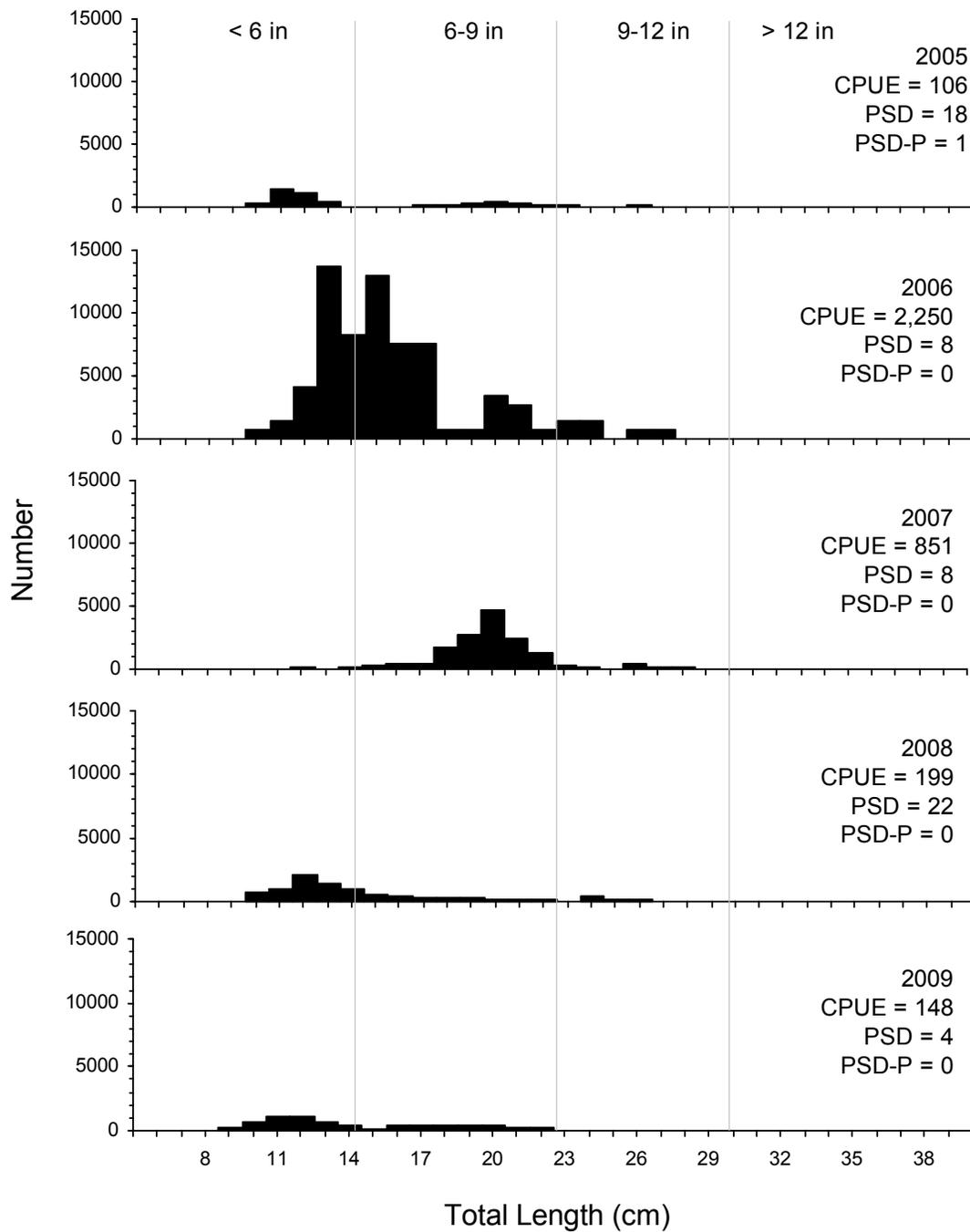


Figure 6. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured using frame nets in Elm Lake, 2005-2009.