

# Clear Lake

## Site Description

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### Location

Water designation number (WDN)	23-0003-00
Legal description	T115N-R49W-Sec. 13, 14, 23, 24, 25
County (ies)	Deuel
Location from nearest town	2 miles east of Clear Lake, SD

### Survey Dates and Sampling Information

Survey dates	June 30- July 1, 2009 (FN, GN)
Gill net sets (n)	3
Frame net sets (n)	12

### Morphometry (Figure 1)

Watershed area (acres)	25,000
Surface area (acres)	600
Maximum depth (ft)	11
Mean depth (ft)	unknown

### Ownership and Public Access

Clear Lake is a meandered lake owned by the State of South Dakota and the fishery is managed by the SDGFP. Clear Lake has exceptional public access with a county gravel road running along the north and east sides; and SD HWY 22 along the south shore. A city owned park on the east shore of the lake provides camping, picnic area, and a public boat ramp (Figure 1).

### Watershed and Land Use

Land-use within the Clear Lake watershed is primarily agricultural with a high proportion being cropland.

### Water Level Observations

The Water Management Board established OHWM is 1774.0 fmsl, and the outlet elevation of Clear Lake is 1773.5 fmsl. On June 10, 2009 Clear Lake was slightly above the OHWM with an elevation of 1774.3 fmsl. On September 14, 2009 the elevation of Clear Lake declined to 1773.9 fmsl.

### Aquatic Nuisance Species Monitoring

#### Plant Survey

Sago pondweed was common throughout much of the lake basin and was the only submersed aquatic plant species identified during the 2009 survey. No aquatic nuisance plant species were encountered.

#### 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 during the 2009 survey.

### Fish Management Information

Primary species	northern pike, yellow perch
Other species	bigmouth buffalo, black bullhead, bluegill, common carp, walleye, white sucker, yellow bullhead
Lake-specific regulations	NE Panfish Management Area: 10 daily; 50 possession.
Management classification	warm-water marginal
Fish Consumption Advisories	none

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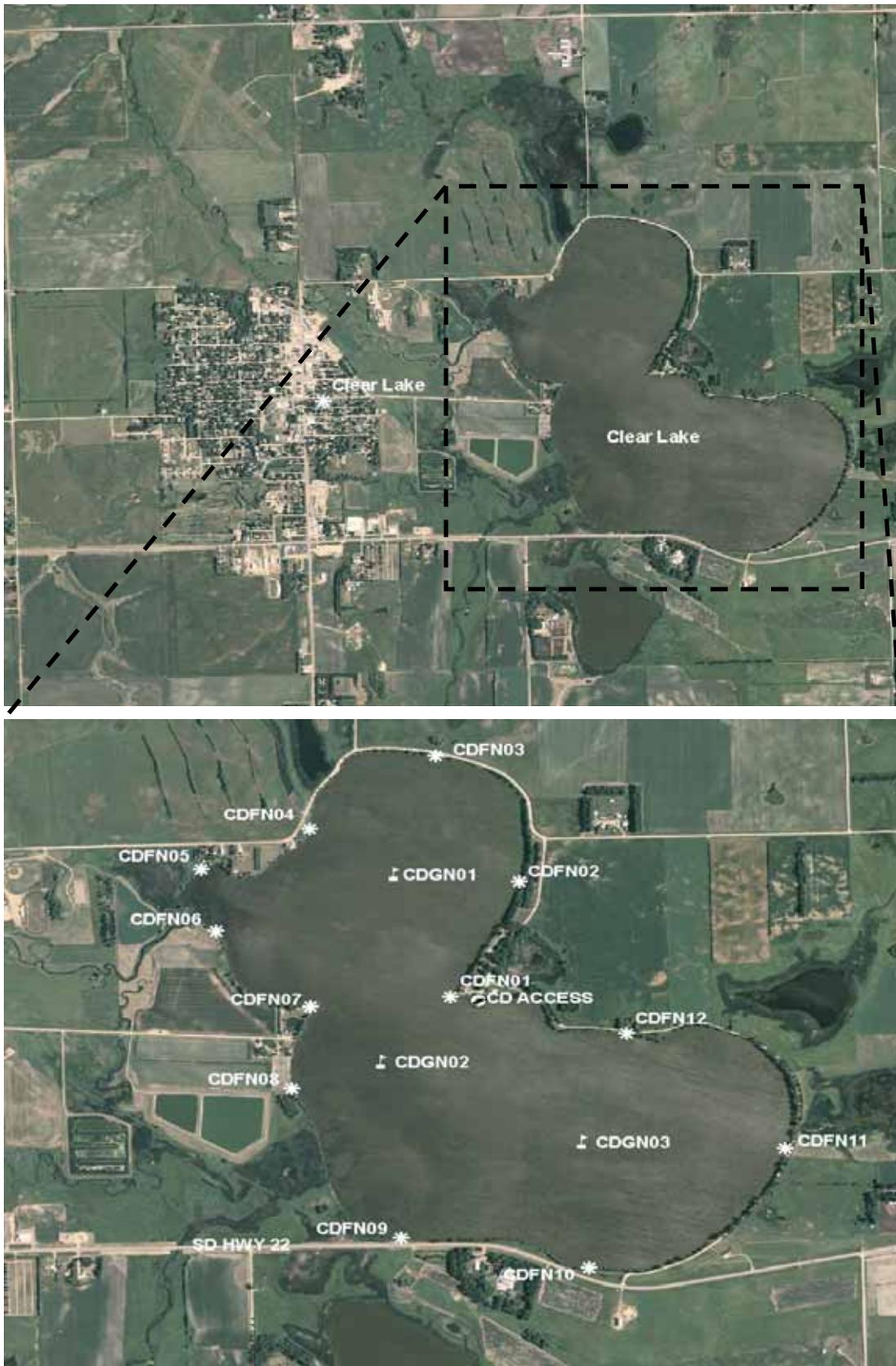


Figure 1. Map depicting geographic location of Clear Lake (Deuel County) from Clear Lake, South Dakota (top); also noted is the boat ramp (CD Access) and standardized net locations for Clear Lake (bottom). CDFN= frame nets, CDGN= gill nets

## Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length northern pike  $\geq 3$ , a PSD of 30-60, and a PSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length yellow perch  $\geq 30$ , a PSD of 30-60, and a PSD-P of 5-10.
- 3) Maintain a mean frame net CPUE of stock-length bullhead  $\leq 100$ .

## Results and Discussion

Clear Lake is a 600-acre natural lake located within the Big Sioux Watershed near the City of Clear Lake in Deuel County, South Dakota. A major surface water connection enters the lake from the northwest via a diversion channel created in the early 1900's (Wittmus and McIntire 1999). Water exiting Clear Lake flows southwest through a natural drainage before entering Hidewood Creek and eventually the Big Sioux River approximately 2 miles northwest of Estelline (SDDENR 1983; Wittmus and McIntire 1999).

Clear Lake has excellent public access and at times the lake has provided angling opportunities for black bullhead, northern pike, yellow perch, and more recently walleye. However, the lake is shallow with a maximum depth of 11 ft. (localized areas following dredging; Dave Bartling, SDGFP, pers comm.) and susceptible to relatively-frequent winterkill events that affect the quality of the fishery. Currently, Clear Lake is managed as a self-sustaining northern pike and yellow perch fishery.

### *Primary Species*

Northern Pike: The 2009 mean gill net CPUE of stock-length northern pike was 4.0 (Table 1) and above the minimum objective ( $\geq 3$  stock-length fish/net night). Based on the 2009 gill net catch, relative abundance of northern pike in Clear Lake appears to be high ( $> 3$  stock-length pike/net night).

Northern pike sampled in gill nets during 2009 ranged in total length from 45 to 61 cm (17.7 to 24.0 in), had a PSD of 42, and a PSD-P of 0 (Figure 2). The PSD was within the management objective range of 30-60 and PSD-P was below the management objective range of 5-10. The PSD and PSD-P indicate a population dominated by stock and quality-length northern pike. Gill net sampled northern pike had mean  $W_r$  values that ranged from 71 to 77 for all length categories sampled and a mean  $W_r$  value of 74 (Table 1). Mean  $W_r$  values were likely at a seasonal low, as Neumann and Willis (1995) reported that  $W_r$  values were lowest during spring following the spawn and remained low throughout the summer in Lake Thompson, South Dakota. A slight increasing trend in  $W_r$  was observed as total length increased in 2009.

Yellow Perch: The mean gill net CPUE of stock-length yellow perch was 2.7 (Table 1) and below the minimum objective ( $\geq 30$  stock-length yellow perch/net night). Based on the 2009 gill net catch the relative abundance of stock-length yellow perch appears to be low ( $<8$  stock-length yellow perch/net night).

Yellow perch captured in the 2009 gill net catch ranged in total length from 17 to 25 cm (6.7 to 9.8 in), had a PSD of 63, and PSD-P of 13 (Figure 3). Both PSD and PSD-P are slightly above the management objective ranges (30-60 and 5-10, respectively). The mean Wr of gill net captured yellow perch in 2009 was 94 (Table 1).

### *Other Species*

Black Bullhead: The mean frame net CPUE of stock-length black bullhead during 2009 was 17.5 (Table 1) and within the management objective ( $\leq 100$  stock-length fish/net-night). Black bullhead relative abundance is currently classified as moderate in Clear Lake. Given their current relative abundance, the impact of the black bullhead population on the sport fishery is likely minimal.

Walleye: Although walleye are not a primary management species, due to the susceptibility of winter-kill events in Clear Lake, they have provided an important seasonal sport fishery to local anglers. The mean gill net CPUE of stock-length walleye was 10.3 (Table 1) indicating moderate relative abundance (4-11 stock-length walleye/net night).

Walleye captured in 2009 ranged in total length from 18 to 60 cm (7.1 to 23.6 in), had a PSD of 55, and PSD-P of 10 (Figure 5). PSD and PSD-P values indicate a balanced population.

Otoliths were collected from a sub-sample of gill net captured walleye in 2009. Walleye representing five year-classes were present in the sub-sample (Table 5). Year class strength ranged from weak to moderate and only one of the five year-classes coincides with a stocking indicating natural reproduction.

Growth was good with weighted mean total lengths at capture of age-2 and age-3 walleye being 361 and 452 mm (14.2 and 17.8 in; Table 5), respectively. Mean Wr values ranged from 89 to 93 for all length categories with a mean Wr for all lengths being 92 (Table 1). No length-related trends in Wr were observed.

Other: Bigmouth buffalo, bluegill, common carp, hybrid sunfish, white sucker, and yellow bullhead were captured in relatively-low numbers during the 2009 fish community survey (Table 1). Their impact on the fishery is likely minimal at this time.

## **Management Recommendations**

- 1) Conduct fish community assessment surveys utilizing gill nets and frame nets every four years (next scheduled for summer 2013) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Collect otoliths from walleye and yellow perch to assess the age structure and growth rates of each population.
- 3) Encourage commercial harvest of black bullhead to limit abundance if survey results indicate high abundance.
- 4) Monitor winter and summerkill events. In cases of substantial winter/summerkill the need to re-establish a fishery in Clear Lake should be evaluated. If so desired, northern pike, walleye, and yellow perch should be stocked to re-establish a fish community.
- 5) Stock walleye ( $\approx 1,000$  fry/acre) when extra are available and all higher priority stockings have been fulfilled.

Table 1. 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) of stock-length fish, for various fish species captured in experimental gill nets and frame nets in Clear Lake, 2009. Confidence intervals include 80 percent ( $\pm$  CI-80) or 90 percent ( $\pm$  CI-90). BIB= bigmouth buffalo; BLB= black bullhead; BLG= bluegill; COC= common carp; HYB= Lepomis spp; NOP= northern pike; WAE= walleye; WHS= white sucker; YEB= yellow bullhead; 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>								
BIB	3.3	2.1	100	0	35	13	92	1
BLB	17.5	3.1	86	4	1	2	89	<1
BLG	0.1	0.1	100	---	100	---	115	---
COC	1.0	0.4	100	0	100	0	92	7
HYB <sup>1</sup>	0.1	0.1	---	---	---	---	---	---
NOP	2.8	0.6	38	14	9	8	78	2
WAE	2.5	0.6	77	13	43	16	91	1
WHS	0.5	0.3	100	0	100	0	99	8
YEB	0.1	0.1	100	---	100	---	133	---
YEP	0.3	0.1	67	33	33	67	102	16
<i>Gill nets</i>								
BLB	10.3	4.9	81	0	0	---	99	1
COC	2.7	0.6	100	0	100	0	90	5
NOP	4.0	1.1	42	26	0	---	74	4
WAE	10.3	8.2	55	0	10	0	92	2
WHS	4.3	0.7	100	0	100	0	100	4
YEP	2.7	1.5	63	34	13	23	94	3

Table 2. Historic mean catch rate (CPUE; gill/frame nets = catch/net night) of stock-length fish for various fish species captured in experimental gill nets and frame nets in Clear Lake 2004-2009. BIB=bigmouth buffalo; BLB= black bullhead; BLG=bluegill; COC= common carp; HYB=hybrid sunfish; NOP= northern pike; WAE= walleye; WHS= white sucker; YEB=yellow bullhead; YEP= yellow perch

Species	CPUE					Mean
	2005	2006	2007	2008	2009	
<i>Frame nets</i>						
BIB	---	---	---	---	3.3	3.3
BLB	---	---	---	---	17.5	17.5
BLG	---	---	---	---	0.1	0.1
COC	---	---	---	---	1.0	1.0
HYB <sup>1</sup>	---	---	---	---	0.1	0.1
NOP	---	---	---	---	2.8	2.8
WAE	---	---	---	---	2.5	2.5
WHS	---	---	---	---	0.5	0.5
YEB	---	---	---	---	0.1	0.1
YEP	---	---	---	---	0.3	0.3
<i>Gill nets</i>						
BLB	6.0	---	---	---	10.3	8.2
COC	0.0	---	---	---	2.7	1.4
NOP	2.7	---	---	---	4.0	3.4
WAE	26.3	---	---	---	10.3	18.3
WHS	13.0	---	---	---	4.3	8.7
YEP	1.7	---	---	---	2.7	2.2

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 relative weight (Wr) for selected species captured by experimental gill nets and frame nets in Clear Lake, 2005-2009. BLB= black bullhead; NOP= northern pike; WAE= walleye; YEP= yellow perch

Species	2005	2006	2007	2008	2009	Average	Objective
<i>Frame nets</i>							
BLB							
CPUE	---	---	---	---	18	18	≤ 100
PSD	---	---	---	---	86	86	---
PSD-P	---	---	---	---	1	1	---
Wr	---	---	---	---	89	89	---
<i>Gill nets</i>							
NOP							
CPUE	3	---	---	---	4	4	≥ 3
PSD	100	---	---	---	42	71	30-60
PSD-P	13	---	---	---	0	7	5-10
Wr	87	---	---	---	74	81	---
WAE							
CPUE	26	---	---	---	10	18	---
PSD	92	---	---	---	55	74	---
PSD-P	13	---	---	---	10	12	---
Wr	95	---	---	---	92	94	---
YEP							
CPUE	2	---	---	---	3	3	≥ 30
PSD	80	---	---	---	63	72	30-60
PSD-P	20	---	---	---	13	17	5-10
Wr	100	---	---	---	94	97	---

Table 4. Stocking history including size and number for fishes stocked into Clear Lake, 2001-2009.

Year	Species	Size	Number
2001	NOP	fry	500,000
2003	YEP	adult	200
2004	YEP	adult	1,000
2005	YEP	fingerling	1,000
2008	WAE	fry	600,000

Table 5. Weighted mean total length at capture (mm) for walleye age-0 through age-10 sampled in experimental gill nets (expanded sample size) from Clear Lake, 2005 and 2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

Year	Age									
	1	2	3	4	5	6	7	8	9	10
2009	201 (10)	361 (15)	452 (13)	---	596 (1)	609 (1)	---	---	---	---
2005	---	403 (48)	---	502 (31)	---	---	---	---	---	---



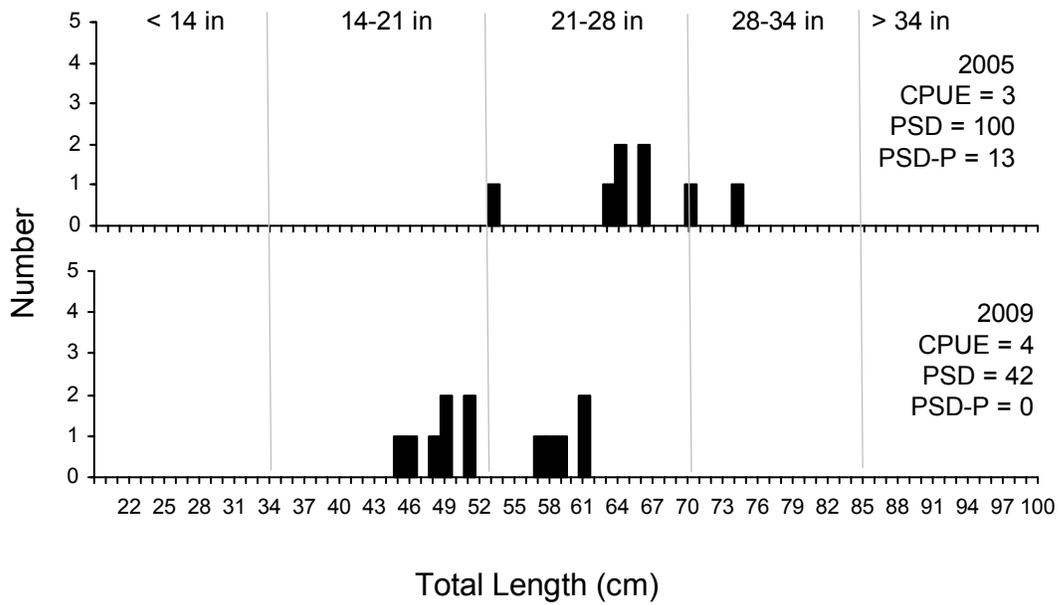


Figure 2. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for northern pike captured by gill nets in Clear Lake, 2005 and 2009.

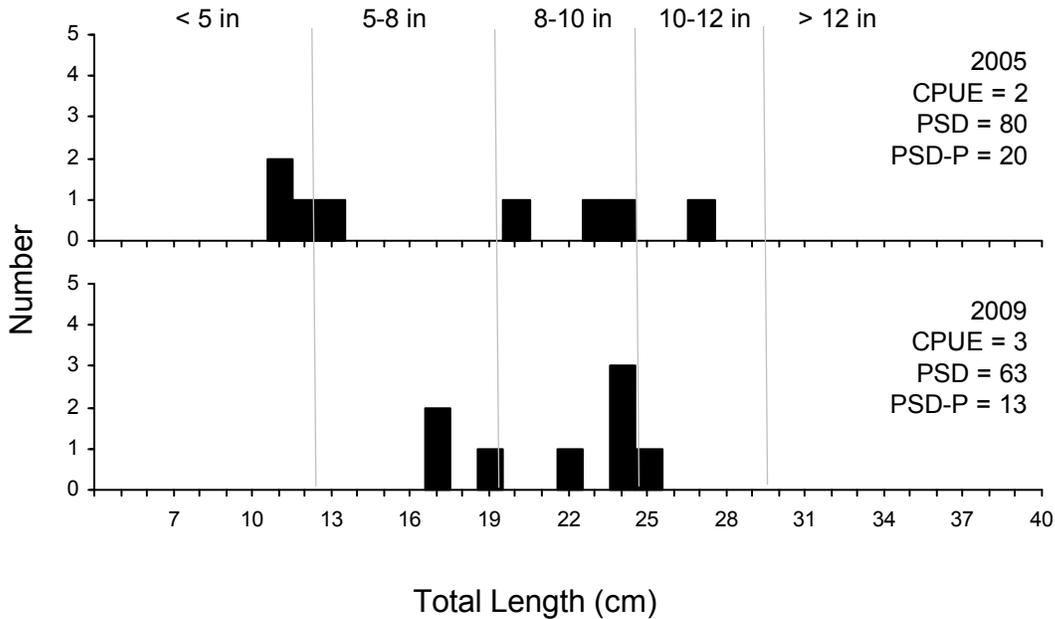


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured by gill nets in Clear Lake, 2005 and 2009.

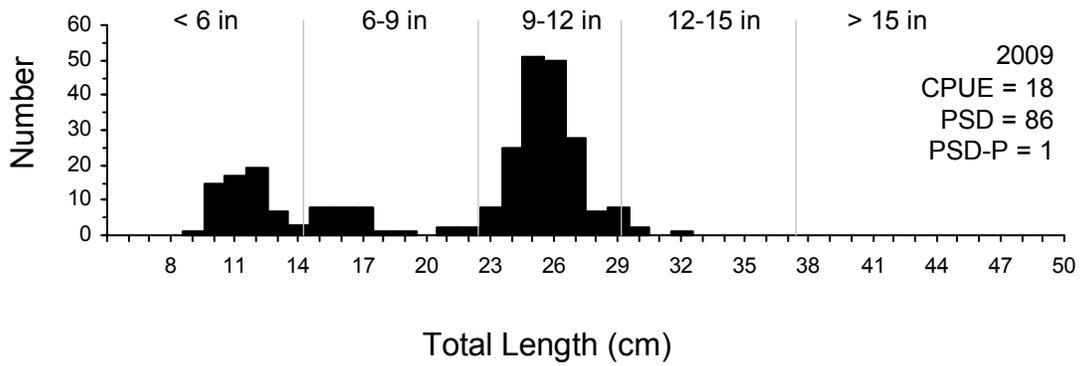


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for black bullhead captured by frame nets in Clear Lake, 2009.

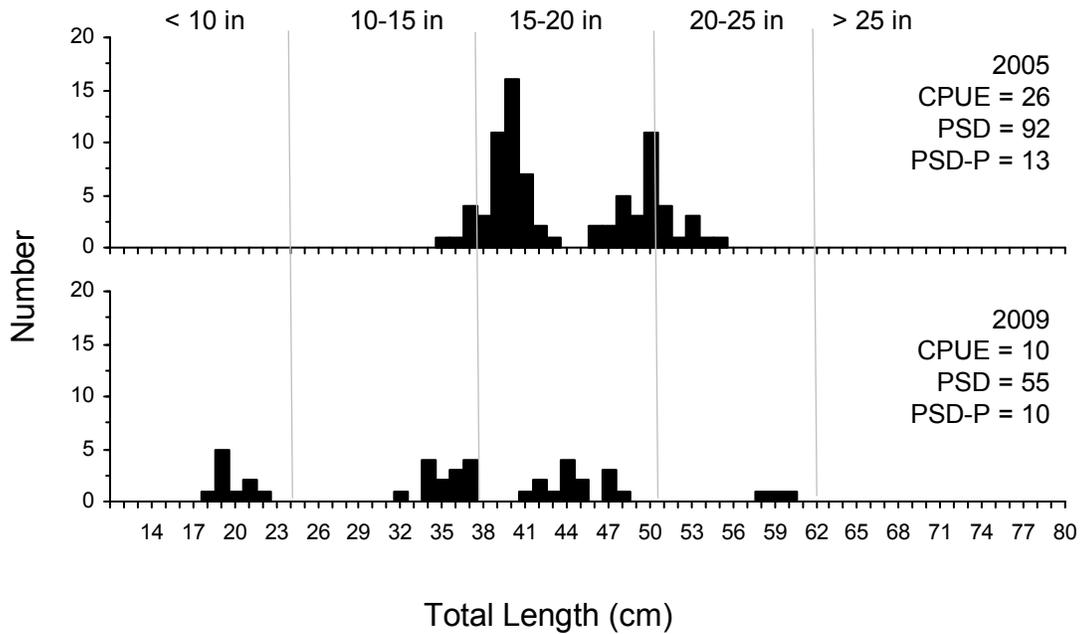


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured by gill nets in Clear Lake, 2005 and 2009.