

Lake Alice

Site Description

Location

Water designation number (WDN)	23-0004-00
Legal description	T116N, R48W, Sec. 5-8, 17,18 T116N, R49W, Sec. 1, 12 T117N, R49W, Sec. 36
County (ies)	Deuel
Location from nearest town	two miles east of Tunnerville

Survey Dates and Netting Information

Dates of current survey	July 3-5, 2007
Date of most recent survey	June 10–12, 2003 June 8–10, 2004 June 7–9, 2005
Gill net effort	6
Frame net effort	18

Lake Morphometry (Figure 1)

Watershed area (acres)	5,214
Surface area (acres)	1,116
Maximum depth (ft)	12
Mean depth (ft)	7-8

Ownership and Public Access

Lake Alice is a meandered lake managed by the SDGFP. Approximately 84% of the lakeshore is private with the remainder owned by the SDGFP. A public access site maintained by SDGFP is located on the north shore of Lake Alice (Figure 1).

Watershed and Land Use

The Lake Alice watershed is comprised of approximately 60% pasture, 38% cropland, and 2% woodland (Stueven and Stewart 1996).

Water Level Observations

The Water Management Board established Ordinary High Water Mark is 1691.8 fmsl (feet above mean sea level), and the established outlet elevation of Lake Alice is 1689.4 fmsl. On May 2, 2007 the elevation was 1690.7 fmsl. Water levels declined slightly from spring to fall with the elevation being 1690.1 fmsl on October 24, 2007.

Aquatic Vegetation and Exotics

Cattails (*Typha spp.*) and bulrushes (*Scirpus spp.*) are abundant on the west, northeast and southwest shorelines. Submergent vegetation in the form of *Potamogeton nodosus* and *Potamogeton pectinatus* is found throughout the lake (Stueven and Stewart 1996). Rudd and common carp were exotic fish species reported during this survey.

Fish Management Information

Primary species	walleye, yellow perch
Other species	black bullhead, common carp, rudd, fathead minnow, green sunfish, northern pike, white sucker
Management classification	warm-water marginal
Fish Consumption Advisories	none

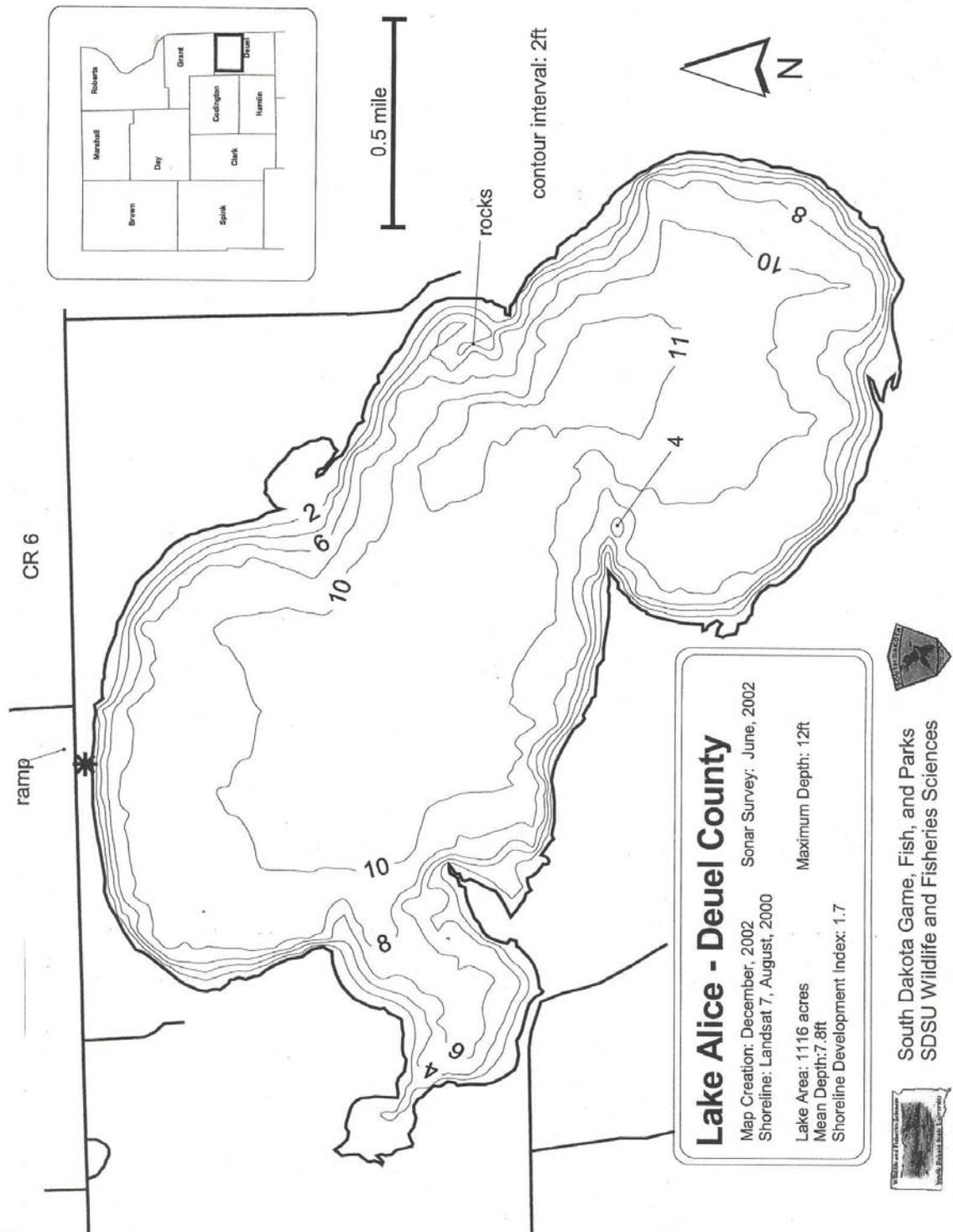


Figure 1. Contour map of Lake Alice, Deuel County, SD.

Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length walleye ≥ 10 , a PSD of 30-60, and an RSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length yellow perch ≥ 25 , a PSD of 30-60, and an RSD-P of 5-10.
- 3) Maintain a mean frame net CPUE of stock-length bullhead ≤ 100 .

Results and Discussion

Lake Alice is a relatively-shallow natural lake located in Deuel County, South Dakota. The only tributary to Lake Alice is located on the western end of the lake. A single outlet is located in the northwest corner and drains into Conner Slough eventually emptying into the Minnesota River (Kruger and Kniss 2002).

From 2003-2005, the standard fish community assessment surveys were conducted during early-June. However, heavy algal build-up was forming on gill nets during this time reducing sampling effectiveness (Ermer et al. 2006). Therefore, the 2007 standard fish community assessment survey was conducted in early-July in an effort to avoid the heavy algal build-up and provide a sample more representative of the at-large fish community. Lake Alice is primarily managed as a walleye and yellow perch fishery; however, black bullhead, bluegill, and northern pike also contribute to the fishery.

Primary Species

Walleye: The mean gill net CPUE of stock-length walleye during 2007 was 24.0, and above the minimum objective (≥ 10 stock-length fish/net night; Table 3). The 2007 gill net CPUE was substantially higher than in past surveys and indicated high relative abundance (Table 2; Table 3). The 2007 gill net catch was primarily comprised of walleye from the 2004 year-class (93%; Table 6). In 2004, both fry and small fingerling walleye were stocked into Lake Alice (Table 5). Aside from the 2004 year-class, recruitment of natural-produced and stocked walleye has been poor in recent years (Table 6). Walleye fry were stocked into Lake Alice in 2007; however, recruitment is unknown at this time (Table 5).

Walleye captured in gill nets during 2007 ranged in total length from 390 to 590 mm (Figure 2). The PSD of walleye captured in gill nets during 2007 was 100 and the RSD-P was 1 (Table 1; Table 3; Figure 2). Walleye from the 2004 year-class exceeded quality-length (380 mm) but were less than preferred-length (510 mm) resulting in the high PSD and low RSD-P (Figure 2).

Low sample size from 2003-2005, change in age estimation techniques (i.e., from scales to otoliths), and sampling one-month later in 2007 make comparisons of

walleye growth parameters difficult. In 2007, the weighted mean length at capture of age-3 walleyes was 447 mm (Table 4). Mean W_r values of quality- to preferred-length walleyes was 98 in 2007.

Yellow Perch: The mean gill net CPUE of stock-length (130 mm) yellow perch in 2007 was 1.5, and below the minimum objective (≥ 25 fish/net night; Tables 1-3). In surveys conducted from 2002-2005 and 2007, mean gill net CPUE values have ranged from 0.0 to 27.8 (Table 2). Yellow perch relative abundance is considered low based on the 2007 gill net catch. Hubers (2002) reported that strong consecutive year-classes of yellow perch may occur in Lake Alice resulting in high densities. However, limited yellow perch recruitment in recent years, has led to low relative abundance.

Other Species

Black bullhead: The 2007 mean frame net CPUE was 4.5, and within the objective (≤ 100 stock-length fish/net night) for black bullheads in Lake Alice (Tables 1-3). Relative abundance of black bullheads has remained low in surveys conducted in 2002-2005, and 2007 (Table 2; Table 3). Length-frequency analysis of frame net captured black bullheads in 2007 indicates consistent recruitment generally of low magnitude in recent years.

In 2007, black bullhead captured in frame nets ranged in total length from 110 to 400 mm. Successful black bullhead recruitment in recent years has resulted in the decreased PSD and RSD-P values of 53 and 49 observed during 2007 (Table 3).

No growth information was available in 2007. Black bullheads captured by frame nets had mean W_r values ranging from 78 to 103 for all length groups sampled, with the mean W_r for stock-length fish being 93 (Table 1). A slight increasing trend in mean W_r values was apparent as total length increased.

Rudd: Rudd were first captured in Lake Alice in 1993. Since 2000, rudd frame net CPUE values have ranged from 0.8 to 4.8 with the 2007 frame net CPUE being 3.9 (Table 2). It appears that rudd have become well established in Lake Alice, as 10 consecutive year-classes were sampled in the 2007 frame net catch indicating consistent recruitment (Table 7). Rudd sampled in frame nets during 2007 ranged in total length from 110 to 440 mm (Figure 4). Growth has remained similar from 2002-2007, with the mean back-calculated length at age-3 ranging from 244 to 274 mm. In 2007 the mean back-calculated length at age-3 was 258 mm (Table 7).

Rudd are an exotic fish species and all reasonable actions should be taken to prevent their spread to other waters. A ban on harvest of baitfish from Lake Alice should be continued and high predator (e.g., walleye) abundance should be maintained in an attempt to limit abundance of rudd.

Northern Pike: Northern pike typically are not sampled effectively during mid-summer fish community assessments. In 2007, the gill net CPUE of stock-length northern pike in Lake Alice was 0.7 (Table 1). Relative abundance of northern pike in Lake Alice has ranged from moderate-low (2-3/net night) to low (0-1/net night) levels,

based on mean gill net CPUE values observed from 2002-2007 (Table 2). Four northern pike ranging in total length from 550 to 750 mm were collected in gill nets during 2007. The PSD was 100 and the RSD-P was 25 (Table 1). No growth information was available in 2007. Northern pike captured by gill nets in 2007 had a mean W_r for stock-length northern pike of 89, and no length-related trends in W_r were apparent (Table 1).

Other: Bluegill, common carp, green sunfish, and white sucker were other fish species captured during the 2007 survey, however relative abundance of these species appeared low (Table 1).

Management Recommendations

- 1) Conduct fish community assessment surveys utilizing gill nets and frame nets on an every third year 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 yellow perch; scales from rudd to assess age structure and growth rates of each population.
- 3) Stock walleye on a biennial basis (1,000 fry/acre) to add additional year classes.
- 4) Monitor water levels and winter/summer kill events. In cases of complete winter/summerkill, stock northern pike, walleye, and yellow perch to re-establish a fish community.
- 5) Maintain a ban on harvest and/or transport of baitfish from Lake Alice to minimize the the spread of the invasive rudd.

Table 1. Mean catch rate (CPUE; Catch/net night) of stock-length fish, mean relative weight (Wr) of stock-length fish, proportional stock density (PSD) and relative stock density of preferred-length fish (RSD-P) of various fish species captured in experimental gill nets and frame nets in Lake Alice, 2007. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). . BLB= black bullhead; BLG= bluegill; COC= common carp; GSF= green sunfish; NOP= northern pike; EUR= rudd; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	Abundance		Stock Density Indices				Condition	
	CPUE	CI-80	PSD	CI-90	RSD-P	CI-90	Wr	CI-90
<i>Frame nets</i>								
BLB	4.5	1.0	53	9	49	10	93	< 1
BLG	0.1	0.1	100	0	100	0	111	< 1
COC	0.6	0.3	80	20	70	28	102	7
GSF	0.3	0.3	20	43	0	---	77	21
NOP	0.5	0.2	67	31	0	---	97	6
EUR ¹	3.9	2.4	---	---	---	---	---	---
WAE	3.9	1.3	99	1	11	7	96	< 1
WHS	0.2	0.3	100	0	100	0	94	6
YEP	0.1	0.0	0	---	0	---	120	---
<i>Gill nets</i>								
BLB	0.7	0.5	50	50	25	59	100	13
COC	2.7	0.8	81	18	56	23	104	3
NOP	0.7	0.7	100	0	25	59	89	26
EUR ¹	0.7	1.0	---	---	---	---	---	---
WAE	24.0	3.4	100	0	1	2	98	< 1
WHS	0.3	0.3	100	0	100	0	97	44
YEP	1.5	0.6	11	21	11	21	108	3

¹ all 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 Lake Alice, 2000 - 2007. BLB= black bullhead; COC= common carp; GSF= green sunfish; NOP= northern pike; EUR= rudd; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	CPUE								Mean
	2000	2001	2002	2003	2004	2005	2006	2007 ^{2,3}	
<i>Frame nets</i>									
BLB	---	---	17.7	25.0	6.6	5.8	---	4.5	11.9
BLG	---	---	---	---	---	---	---	0.1	0.1
COC	---	---	0.1	0.0	0.0	0.2	---	0.6	0.2
GSF	---	---	0.3	0.1	0.0	0.1	---	0.3	0.2
NOP	---	---	0.5	0.3	0.2	0.2	---	0.5	0.3
EUR ¹	---	---	3.3	4.8	4.0	0.8	---	3.9	3.4
WAE	---	---	0.1	0.3	0.6	1.2	---	3.9	1.2
WHS	---	---	0.4	0.0	0.8	0.1	---	0.2	0.3
YEP	---	---	0.5	0.0	0.0	0.0	---	0.1	0.1
<i>Gill nets</i>									
BLB	---	---	5.5	16.0	0.3	0.0	---	0.7	4.5
COC	---	---	0.2	3.0	0.3	0.0	---	2.7	1.2
GSF	---	---	0.0	0.0	0.0	0.0	---	0.0	0.0
NOP	---	---	2.2	2.3	0.5	0.0	---	0.7	1.1
EUR ¹	---	---	0.0	0.0	0.5	0.0	---	0.7	0.2
WAE	---	---	4.3	0.2	2.5	1.0	---	24.0	6.4
WHS	---	---	0.5	0.2	0.8	0.0	---	0.3	0.4
YEP	---	---	27.8	1.7	2.2	0.0	---	1.5	6.6

¹ All sizes

² Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5"), previous years (.5", .75", 1", 1.25", 1.5" and 2").

³ Standard survey dates moved from early-June to early-July.

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional stock density (PSD), relative stock density of preferred-length fish (RSD-P), and relative weight (Wr) for selected species captured in frame nets and experimental gill nets in Lake Alice, 2000-2007. BLB= black bullhead; WAE= walleye; YEP= yellow perch

Species	2000	2001	2002	2003	2004	2005	2006	2007 ^{1,2}	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	---	---	18	25	7	6	---	5	12	< 100
PSD	---	---	72	23	100	100	---	53	70	---
RSD-P	---	---	70	17	90	100	---	49	65	---
Wr	---	---	98	92	111	108	---	93	100	---
<i>Gill nets</i>										
WAE										
CPUE	---	---	4.3	0.2	2.5	1.0	---	24	11	≥10
PSD	---	---	92	0	60	50	---	100	57	30-60
RSD-P	---	---	35	0	47	0	---	1	8	5-10
Wr	---	---	93	---	86	87	---	98	101	---
YEP										
CPUE	---	---	27.8	1.7	2.2	0.0	---	2	2	≥25
PSD	---	---	28	60	38	---	---	11	43	30-60
RSD-P	---	---	0	0	31	---	---	11	19	5-10
Wr	---	---	103	103	99	---	---	108	94	---

¹ Monofilament gill net mesh size change (.75", 1", 1.25", 1.5", 2" and 2.5"), previous years (.5", .75", 1", 1.25", 1.5" and 2").

² Standard survey dates moved from early-June to early-July.

Table 4. Weighted mean length at capture (mm) for walleye captured in experimental gill nets in Lake Alice, 1999-2007.

Year	N	Age											
		0	1	2	3	4	5	6	7	8	9	10	
2007 ^{1,2}	143	---	---	418	447	496	---	---	---	---	---	---	590
2004	15	---	---	321	382	---	---	561	---	---	---	---	---
2003	9	---	147	214	---	---	---	---	---	---	---	---	---
2002	50	---	156	372	459	464	504	583	---	---	---	---	---
1999	47	---	240	308	455	491	572	604	---	---	---	---	---

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

² Standard survey dates moved from early-June to early-July.

Table 5. Stocking history including size and number for fishes stocked into Lake Alice, 1997-2007. YEP= yellow perch; WAE= walleye

Year	Species	Size	Number
1997	WAE	fry	2,508,300
1998	WAE	fry	2,200,000
2001	WAE	fry	1,200,000
2003	WAE	fry	1,200,000
2004	WAE	fry	1,500,000
	WAE	fingerling	229,700
2005	WAE	fry	1,150,000
	YEP	fingerling	1,000
2007	WAE	fry	1,100,000

Table 6. Numbers of walleye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in Lake Alice, 2007.

Survey Year	Year Class											
	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
2007 ^{1,2}			7	132	3						1	
2004	---	---	---	---		3	5			5		1
2003	---	---	---	---		6	3					
2002	---	---	---	---	---	---	25	3	5	3	12	3
1999	---	---	---	---	---	---	---	---	---	3	8	33
Number stocked												
fry	1,100		1,150	1,500	1,200		1,200			2,200	2,508	2,300
small fingerling				229								
large fingerling												

Table 7. Mean back-calculated length (mm) at age, standard error (SE), and length increment (Increment; mm) for European rudd captured by frame nets Lake Alice, 2007.

Year	Age	N	Age										
			1	2	3	4	5	6	7	8	9	10	
2006	1	2	55										
2005	2	37	61	182									
2004	3	14	46	145	213								
2003	4	6	47	144	228	266							
2002	5	3	114	221	305	348	363						
2001	6	3	94	199	281	332	358	370					
2000	7	1	57	154	293	334	370	379	390				
1999	8	1	39	125	246	305	369	404	424	432			
1998	9	2	56	161	262	318	349	367	382	392	402		
1997	10	1	66	161	236	299	316	343	370	390	412	421	
Mean		70	64	166	258	315	354	373	391	405	407	421	
SE			7	10	12	10	8	10	12	14	5	0	
Increment			102	92	57	39	19	19	14	2	14		

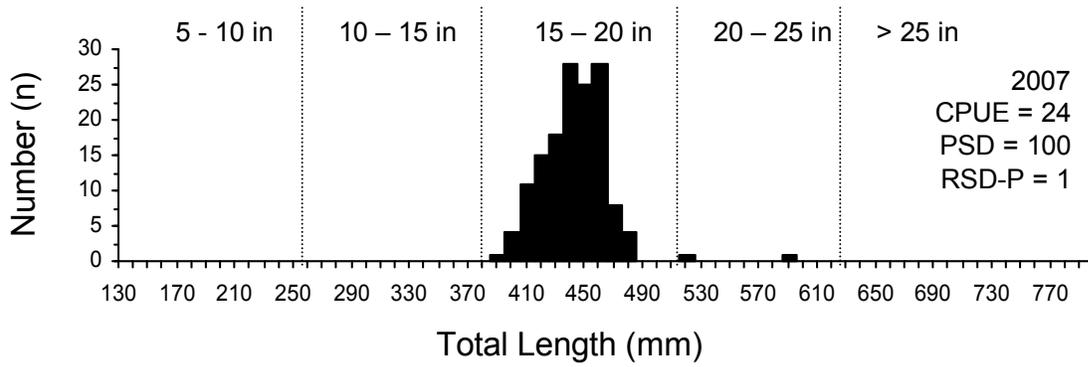


Figure 2. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for walleye captured in gill nets in Lake Alice, 2007.

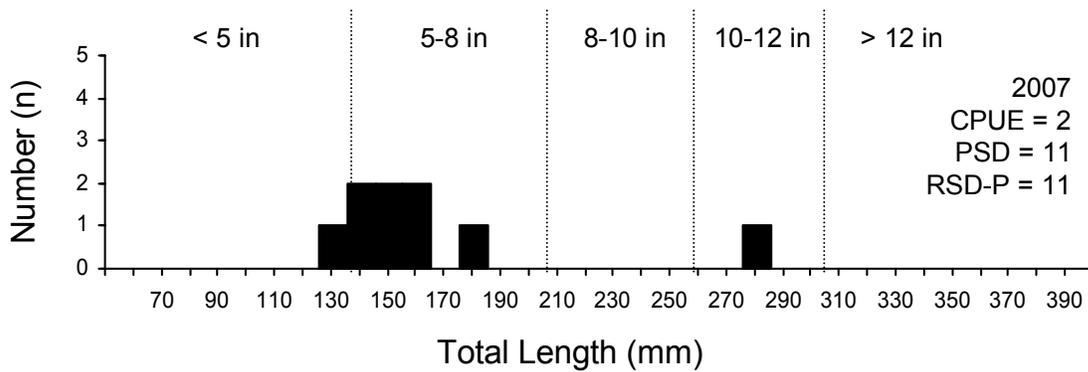


Figure 3. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for yellow perch captured in gill nets in Lake Alice, 2007.

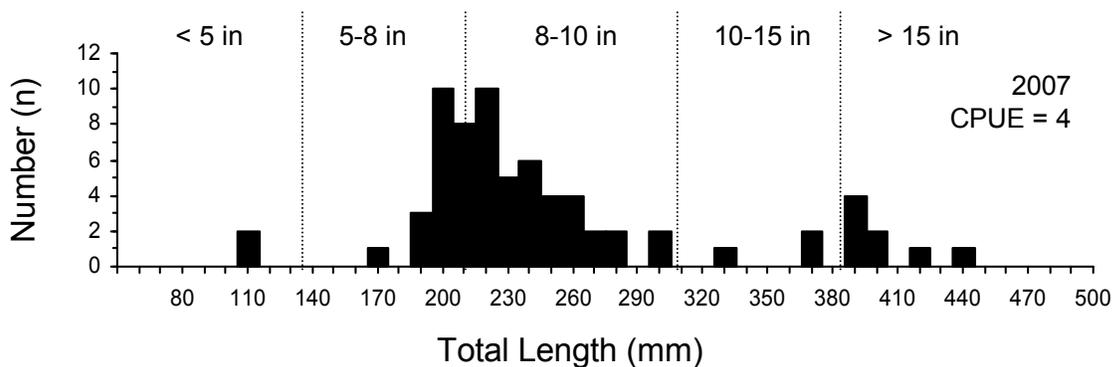


Figure 4. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for rudd captured in frame nets in Lake Alice, 2007.