

Redfield Lake

Site Description

Location

Water designation number (WDN)	57-0004-00
Legal description	T116N-R64W-Sec. 9
County (ies)	Spink
Location from nearest town	Southwest edge of Redfield, SD.

Survey Dates and Sampling Information

Dates of current survey	June 5-6, 2007
Dates of previous survey	June 6-7, 2002
Gill net sets (n)	3
Frame net sets (n)	12

Morphometry (Figure 1)

Watershed area (acres)	904,960
Surface area (acres)	170
Maximum depth (ft)	12
Mean depth (ft)	8

Ownership and Public Access

Redfield Lake is owned by the State of South Dakota and managed by the SDGFP. The boat ramp and park located on the east end of Redfield Lake are owned and maintained by the city of Redfield, and the remainder of property adjacent to the lake is under private ownership (Figure 1).

Watershed and Land Use

The Redfield Lake watershed is comprised of approximately 50% cropland and 50% range land.

Water Level Observations

Redfield Lake was full with water flowing over the spillway at the time of the 2007 survey. Redfield Lake is classified as hypereutrophic (Stueven and Stewart 1996).

Aquatic Vegetation and Exotics

Emergent and submergent vegetation is present in Redfield Lake. Emergent vegetation, mainly cattail (*Typha spp.*) and bulrush covers approximately 90% of the shoreline, while submergent vegetation is found in protected areas throughout the lake. Submergent vegetation present includes *Ceratophyllum demersum*, *Potamogeton pectinatus*, *P. foliosus*, *Lemna spp.*, and *Spirodella polyrhiza* (Stueven and Stewart 1996). Common carp were the only exotic species encountered during this survey.

Fish Management Information

Primary species	black crappie, channel catfish, largemouth bass
Other species	black bullhead, bluegill, common carp, green sunfish, northern pike, orangespotted sunfish, rock bass, walleye, white sucker, yellow perch
Management classification	warm-water marginal
Fish Consumption Advisories	none

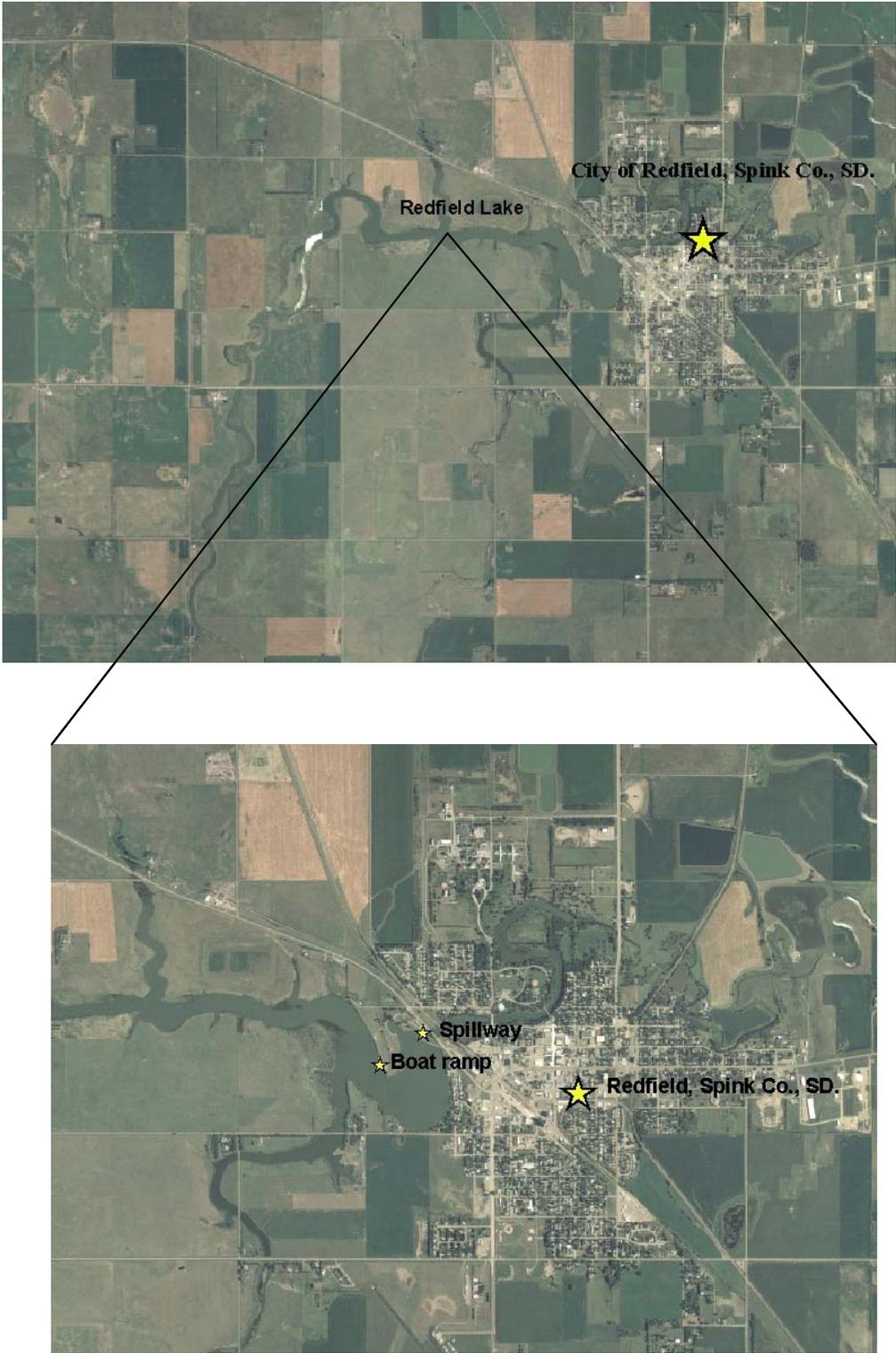


Figure 1. Map depicting location of Redfield Lake including boat ramp and spillway.

Management Objectives

- 1) Maintain a mean frame net CPUE of stock-length black crappie ≥ 15 , a PSD of 30-60, and an RSD-P of 5-10.
- 2) Maintain a mean night electrofishing CPUE of stock-length black bass (LMB/SMB) ≥ 10 , a PSD of 40-70, and an RSD-P of 10-20.
- 3) Attempt to establish a channel catfish population that would serve to diversify sport fishing opportunity in Redfield Lake.
- 4) Maintain a mean frame net CPUE of stock-length bullhead ≤ 100 .

Results and Discussion

Redfield Lake is an artificial impoundment located on the southwestern edge of Redfield, SD. Redfield Lake was formed in the 1930's by the Works Progress Administration. Redfield Lake has a long history of being susceptible to winter-kill and occasional summer-kill. In the mid 1990's, a renovation project took place within the Turtle Creek watershed; renovation included dredging Redfield Lake to remove sediment and increase the overall depth of the lake. In 2002, GFP crews ran transects and collected water depths to investigate benefits of the dredging operation. The water depth in Redfield Lake remained marginal for supporting fish life after the dredging operation. The majority of the lake remains very shallow (<4ft), the only deep water available is the original river channel (10-12ft; Ermer et al. 2005).

Since the late 1960's, black bullheads have consistently dominated the fish population in Redfield Lake; while black crappie and northern pike have persisted, and at times have provided angling opportunities. Currently, Redfield Lake is managed primarily for black bass, black crappie, and channel catfish.

Primary Species

Black crappie: During 2007, the mean frame net CPUE of stock-length black crappie was 146.2 (Table 1), a substantial increase from the 8.7 observed in 2002, and above the minimum objective (≥ 15 fish/net night) for black crappie in Redfield Lake (Table 3). Length-frequency analysis of frame net captured black crappies in 2007 indicates inconsistent recruitment; however it appears that a large cohort was produced in recent years, resulting in the observed increase in relative abundance (Table 2; Figure 3).

Black crappie captured in frame nets during 2007 ranged in total length from 120 to 250 mm, had a PSD of 3 and an RSD-P of 2. The low PSD and RSD-P combined with the present abundance indicates a population comprised mainly of stock- to quality-

length black crappies. It appears that a single cohort ranging in total length from 120 to 160 mm dominates the population (Figure 3).

No growth information was collected in 2007. The condition of black crappie was good during 2007 with mean W_r values for sub-stock and stock-length fish being 95 and 99, respectively. No length-related trends in W_r values were apparent.

Black bass (largemouth and smallmouth bass): Both largemouth bass and smallmouth bass were stocked into Redfield Lake in 2005, in an attempt to establish a sport fishery and increase predator densities to a level that would provide a measure of control to undesirable fish populations (i.e., black bullheads, common carp, etc.; Table 5). Smallmouth bass were stocked into several small impoundments on the western fringe of Region IV; although they likely will do little to help control undesirable fish populations they may provide a sport fishery to anglers utilizing these waters. Smallmouth bass have performed well in many lakes throughout eastern South Dakota and have developed self-sustaining populations; however their performance in these small impoundments is unknown.

Given the habitat characteristics of Redfield Lake (i.e., high percentage of emergent vegetation and some submerged vegetation), largemouth bass may be the best option for establishing a predator density capable of controlling undesirable fish populations in Redfield Lake. Largemouth bass relative abundance is positively correlated with the percent submergent vegetation in eastern South Dakota glacial lakes and large impoundments (McKibbin 2002). Guy and Willis (1991) found that aquatic vegetation coverage and Secchi depth were important indicators of an environment capable of producing high density largemouth bass populations in South Dakota small ponds.

In 2007, no smallmouth bass were sampled during our survey, and only three largemouth bass were sampled. However, electrofishing which is typically used to sample black bass populations in northeastern South Dakota has not been conducted in Redfield Lake in recent years. Electrofishing should be conducted as part of the next fish population assessment, and used to evaluate both the largemouth and smallmouth bass populations in Redfield Lake.

Channel catfish: Abundance of channel catfish has been low with a mean frame net CPUE of 0.1 in 2002. In 2006, channel catfish from Cikana State Fish Hatchery in Martinsville, IN were transported to South Dakota and stocked into several impoundments of the western edge of Region IV. The channel catfish were stocked in an attempt to bolster the existing populations and create angling opportunities for anglers utilizing these small impoundments. The stocking was apparently successful in Redfield Lake, as 24 channel catfish ranging in total length from 180 to 250 mm were sampled in frame nets during the 2007 fish community assessment (Table 5; Figure 4).

Other Species

Black Bullhead: The mean frame net CPUE of stock-length black bullhead during 2007 was 84.8, down from 392.6 in 2002 (Table 1-3). Redfield Lake has a history of abundant black bullheads, likely related to the marginal nature of the lake (i.e., low-water levels leading to complete winter-kills, and occasional summer-kills). Relative abundance of black bullheads in Redfield Lake during 2007 was considered moderate, based on mean frame net CPUE values. It appears that black bullhead recruitment has been limited in recent years, with the population comprised mainly of what appears to be a single cohort with a mean modal length near 150 mm in 2007 (Figure 2).

Black bullheads sampled in frame nets during 2007 ranged in total length from 130 to 280 mm, had a PSD of 4, and no preferred-length black bullheads were sampled (Table 1; Figure 2). No growth information was collected in 2007. The mean W_r of stock-length black bullheads captured in frame nets during 2007 was 86, and no length-related trends in W_r were apparent (Table 1).

Northern Pike: The mean gill net CPUE of stock-length northern pike in Redfield Lake during 2007 was 0.7, a decrease from the 2.7 observed during 2002 (Table 1-3). It appears that abundance is low, but northern pike typically are not sampled effectively using standard lake survey methods; therefore reported values may not accurately represent the at-large population. Ermer et al. (2005) reported a moderate density northern pike population in Redfield Lake during 2002, and suggested that the population be maintained as northern pike were one of the few predators in the system. In 2004, adult northern pike were stocked into Redfield Lake to supplement the existing population and provide additional angling opportunity (Table 5). Northern pike sampled during the 2007 fish population assessment were in good condition with mean W_r values exceeding 90 for all length groups sampled.

Walleye: The mean gill net CPUE of stock-length walleye during 2007 was 0.3 (Table 1). In 2007, only four walleye were sampled in gill nets, despite stocking of over 40,000 walleye of varying sizes since 2000 (Table 5, Table 6). Walleye stockings have been largely unsuccessful in Redfield Lake; therefore future walleye stockings should only occur when extra fish are available and all other priority stockings have been completed.

Other: Bluegill, common carp, green sunfish, orangespotted sunfish, rock bass, and white sucker were also sampled during the 2007 fish population assessment (Table 1; Table 2). However their abundance appears to be relatively low, and their impact on the fishery is likely minimal.

Management Recommendations

- 1) Conduct fish population assessment surveys utilizing gill-nets, frame-nets, and spring electrofishing on an every fourth year basis (next survey scheduled in summer 2011) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Stock walleye when extra are available and all other priority stockings have been fulfilled.
- 3) When available, channel catfish should be stocked to supplement the existing population, and increase angling opportunities.
- 4) Collect scales from largemouth and smallmouth bass, and otoliths from black crappie to assess age structure and growth rates of each population.
- 5) Monitor water levels and winter/summer kill events. In cases of complete winterkill events stock largemouth bass, smallmouth bass, and black crappie to re-establish each population.

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 Redfield Lake, 2007. 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; GSF= green sunfish; LMB= largemouth bass; NOP = northern pike; OSF= orangespotted sunfish; ROB= rock bass; WAE = walleye; WHS = white sucker

Species	Abundance		Stock Density Indices				Condition	
	CPUE	CI-80	PSD	CI-90	RSD-P	CI-90	Wr	CI-90
<i>Frame nets</i>								
BLB	84.4	20.4	4	1	0	---	86	1
BLC	146.2	36.2	3	0	2	0	99	3
BLG	3.3	1.8	5	6	0	---	115	3
CCF	---	---	---	---	0	---	---	---
COC	9.6	4.1	23	7	5	4	89	2
GSF	0.5	0.4	0	---	0	---	110	10
LMB	0.2	0.2	50	50	0	---	111	---
NOP	1.0	0.7	92	8	50	27	95	3
OSF	2.8	1.2	---	---	---	---	---	---
ROB	0.1	0.1	0	---	0	---	102	---
WAE	2.5	0.9	10	9	3	6	85	2
WHS	0.8	0.4	100	0	100	0	91	4
<i>Gill nets</i>								
BLB	16.7	14.3	2	3	0	---	99	1
BLC	1.0	1.1	0	---	0	---	111	12
CCF	3.0	2.9	0	---	0	---	---	---
COC	8.7	9.0	23	14	12	10	94	2
NOP	0.7	0.6	100	0	50	50	94	5
OSF	0.3	0.7	---	---	---	---	---	---
WAE	1.3	0.7	25	59	0	---	90	5

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 Redfield Lake, 2000-2007. 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; ROB= rock bass; WAE = walleye; WHS = white sucker

Species	CPUE								Mean
	2000	2001	2002	2003	2004	2005	2006 ¹	2007 ¹	
<i>Frame nets</i>									
BLB	---	---	392.6	---	---	---	---	84.8	238.7
BLC	---	---	8.7	---	---	---	---	146.2	77.5
BLG	---	---	---	---	---	---	---	3.3	1.7
CCF	---	---	0.1	---	---	---	---	0.0	0.1
COC	---	---	0.3	---	---	---	---	9.6	5.0
GSF	---	---	---	---	---	---	---	0.5	0.3
LMB	---	---	---	---	---	---	---	0.2	0.1
NOP	---	---	0.5	---	---	---	---	1.0	0.8
OSF	---	---	---	---	---	---	---	2.8	1.4
ROB	---	---	---	---	---	---	---	0.1	0.1
WAE	---	---	0.1	---	---	---	---	2.5	1.3
WHS	---	---	1.0	---	---	---	---	0.8	0.9
YEB	---	---	2.8	---	---	---	---	0.0	1.4
<i>Gill nets</i>									
BLB	---	---	91.0	---	---	---	---	16.7	53.9
BLC	---	---	0.0	---	---	---	---	1.0	0.5
CCF	---	---	0.0	---	---	---	---	0.0	0.0
COC	---	---	0.0	---	---	---	---	8.7	4.4
NOP	---	---	2.7	---	---	---	---	0.7	1.7
OSF	---	---	0.0	---	---	---	---	0.3	0.2
WAE	---	---	0.3	---	---	---	---	1.3	0.8
WHS	---	---	0.3	---	---	---	---	0.0	0.2
YEB	---	---	0.3	---	---	---	---	0.0	0.2

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").

Table 3. Mean catch rate of stock-length fish (CPUE; catch/net night), proportional stock density (PSD), relative stock density of preferred-length fish (RSD-P), and relative weight (Wr) for selected species captured using frame nets and electrofishing in Redfield Lake, 2000 - 2007. BLB= black bullhead; BLC= black crappie; LMB= largemouth bass; SMB= smallmouth bass

Species	2000	2001	2002	2003	2004	2005	2006 [†]	2007 [†]	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	---	---	393	---	---	---	---	85	239	≤ 100
PSD	---	---	7	---	---	---	---	4	6	---
RSD-P	---	---	0	---	---	---	---	0	0	---
Wr	---	---	79	---	---	---	---	86	83	---
BLC										
CPUE	---	---	9	---	---	---	---	146	78	≥ 15
PSD	---	---	95	---	---	---	---	3	49	30-60
RSD-P	---	---	2	---	---	---	---	2	2	5-10
Wr	---	---	110	---	---	---	---	99	105	---
<i>Electrofishing</i>										
LMB/SMB										
CPUE	---	---	---	---	---	---	---	---	---	≥ 10
PSD	---	---	---	---	---	---	---	---	---	40-70
RSD-P	---	---	---	---	---	---	---	---	---	10-20
Wr	---	---	---	---	---	---	---	---	---	---

[†] 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").

Table 4. Weighted mean length at capture (mm) for walleye captured in experimental gill net sets in Redfield Lake, 2002 and 2007. 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
2007 [†]	4	---	302	---	---	---	489	---	---	---	---
2002	1	---	---	---	---	---	---	---	---	---	---

[†] Age assignments made using otoliths; scales were used in previous years

Table 5. Stocking history including size and number for fishes stocked into Redfield Lake, 2000 - 2007. BLG= bluegill; CCF= channel catfish; LMB= largemouth bass; NOP= northern pike; SMB= smallmouth bass; WAE= walleye

Year	Species	Size	Number
2000	WAE	fingerling	33,750
2004	NOP	adult	200
2004	BLG	adult	550
2005	SMB	fingerling	8,160
2005	LMB	fingerling	15,000
2005	WAE	fingerling	6,400
2006	CCF	fingerling	20,020

Table 6. Numbers of walleye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in Redfield Lake, 2000-2007.

Survey Year	Year Class							
	2007	2006	2005	2004	2003	2002	2001	2000
2007 ¹			3				1	
2002								
Number stocked								
fry								
small fingerling								33.8
large fingerling			6.4					

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

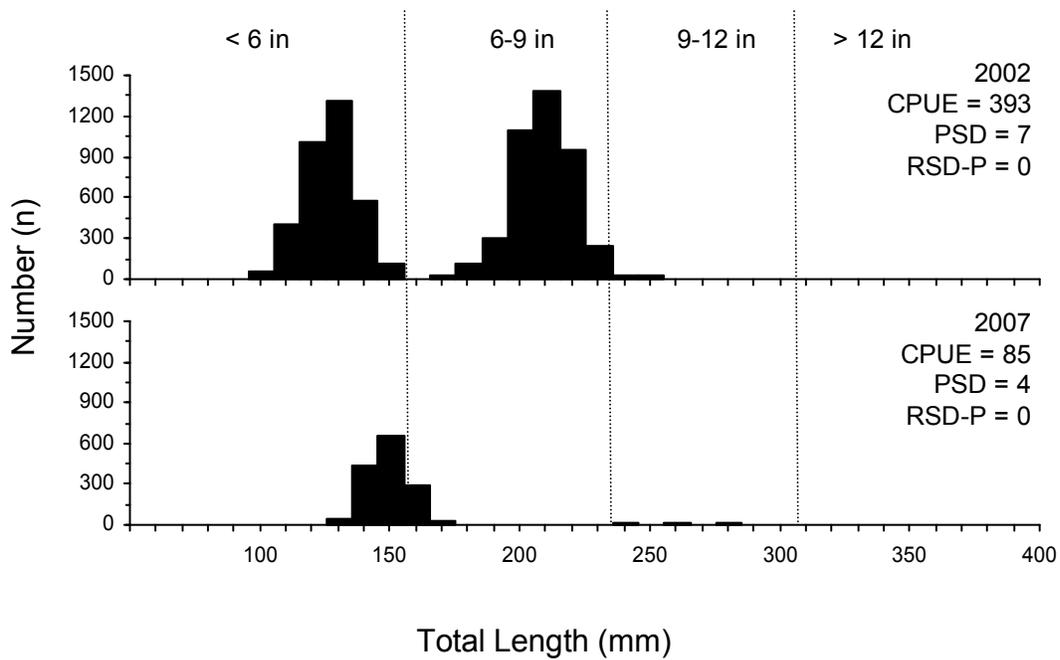


Figure 2. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black bullhead captured using frame nets in Redfield Lake, 2002 and 2007.

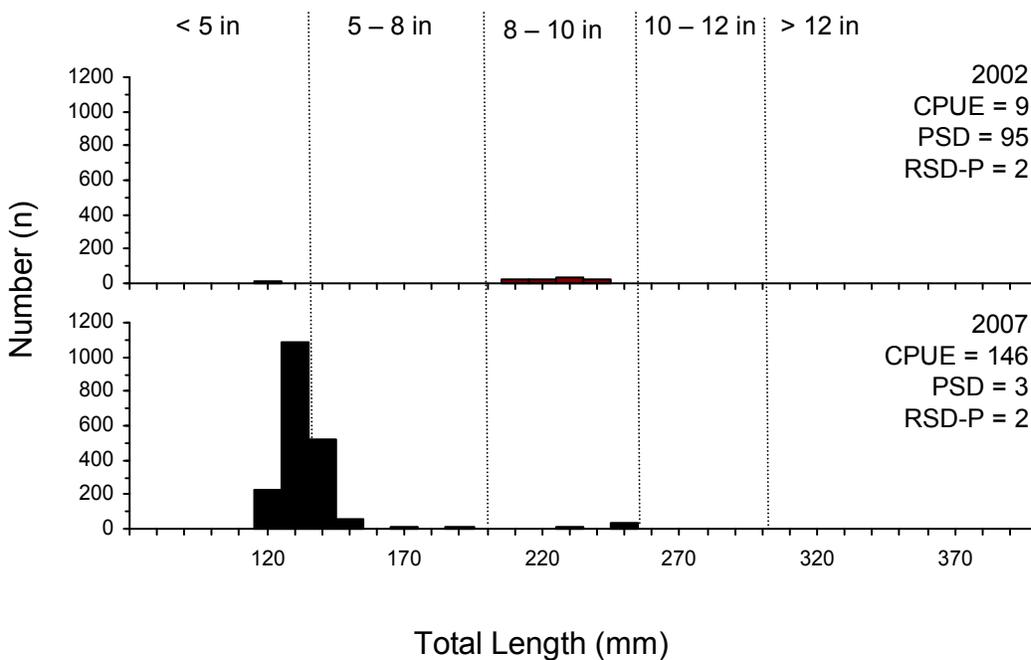


Figure 3. Length-frequency, catch rate of stock-length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred-length fish (RSD-P) for black crappie captured using frame nets in Redfield Lake, 2002 and 2007.

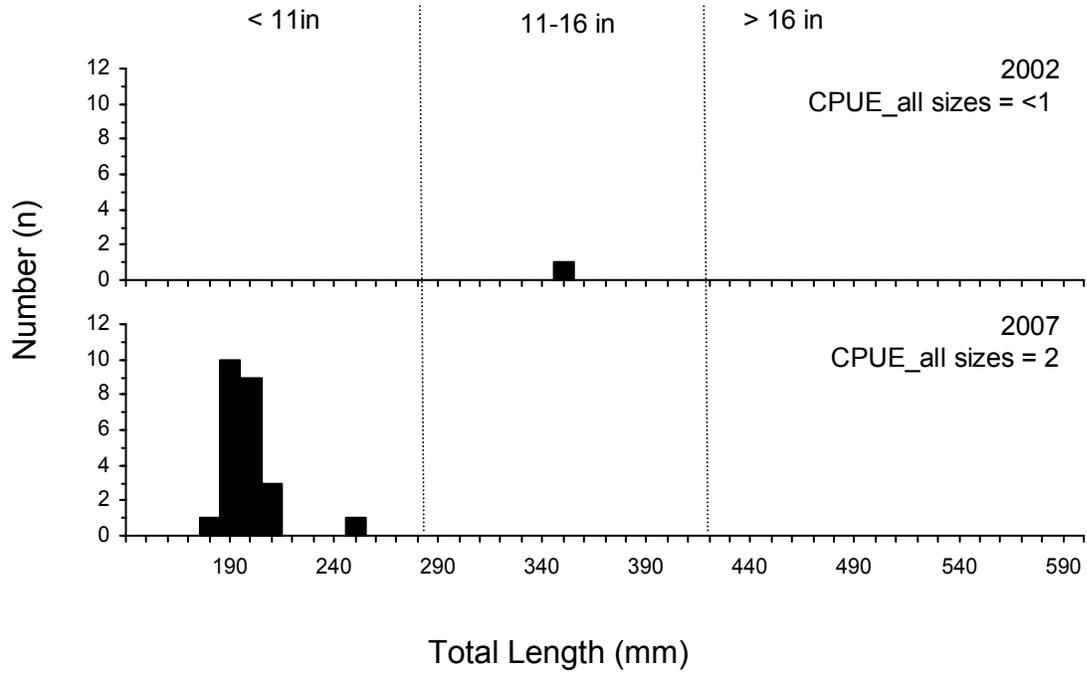


Figure 4. Length-frequency and catch rate (CPUE_all sizes) for channel catfish captured using frame nets in Redfield Lake, 2002 and 2007.