Cottonwood Lake

Site Description

Location

Water designation number (WDN)	48-0003-00
Legal description	T126N-R55W-Sec.9,16
County (ies)	Marshall
Location from nearest town	one-half mile west of Lake City, SD

Survey Dates and Netting Information

Dates of current survey	June 14 – 15, 2005
Date of most recent survey	June 12 – 14, 2001
Gill net sets (n)	3
Frame net sets (n)	12

Morphometry (Figure 1)

Watershed area (acres)	6,000
Surface area (acres)	350
Maximum depth (ft)	12
Mean depth (ft)	9

Ownership and Public Access

Cottonwood Lake is a meandered lake managed by the SDGFP. A single public access site is located on the southern shoreline and is maintained by the SDGFP (Figure 1). Cottonwood Lake is owned by the State of South Dakota and lands adjacent to the lake are generally under state and private ownership.

Watershed and Land Use

The Cottonwood Lake watershed is comprised of a mix of pasture and cropland with some woodland and grasslands.

Water Level Observations

Water levels remain at the historic average. The trophic state of Cottonwood Lake is eutrophic.

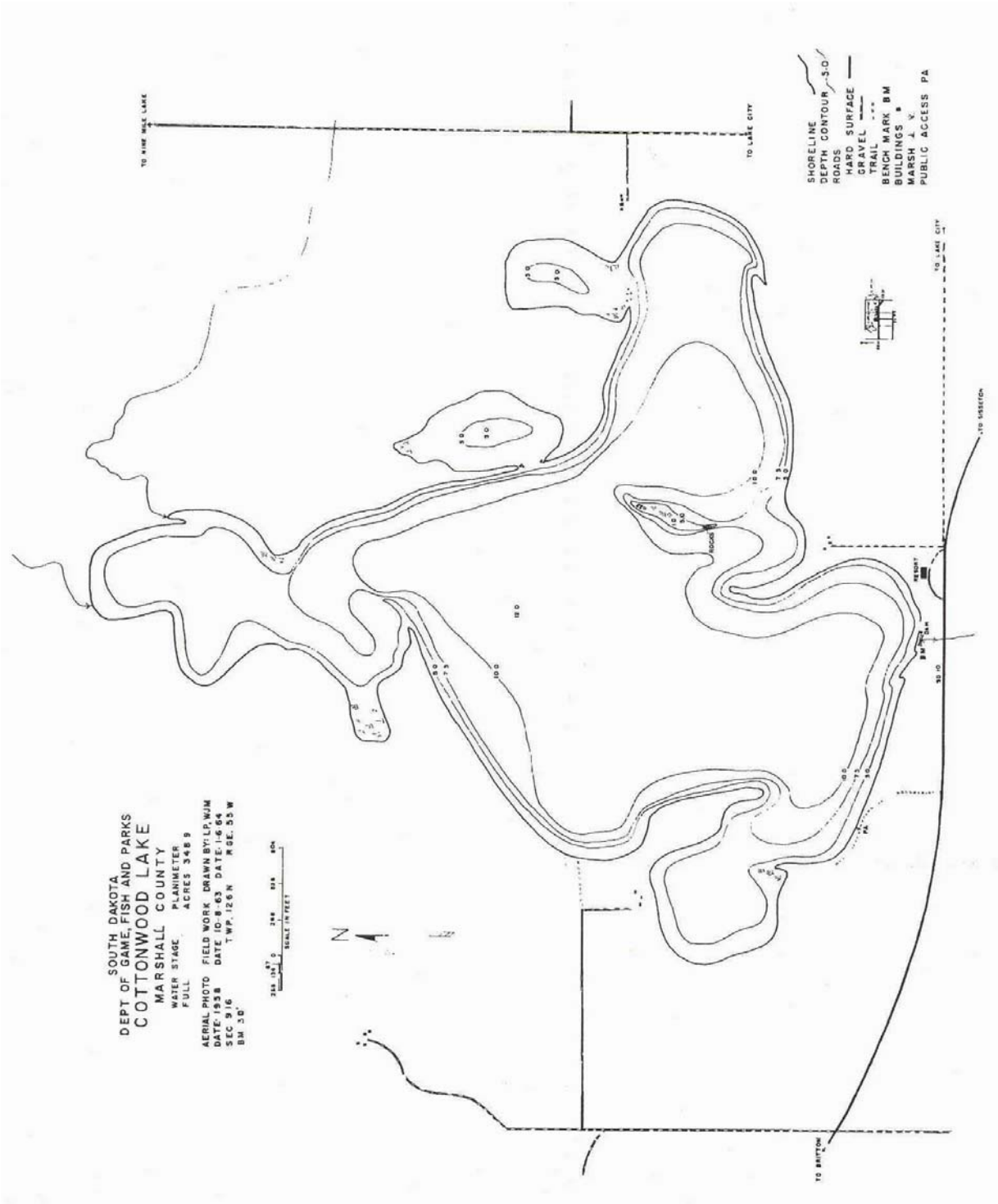
Aquatic Vegetation and Exotics

Floating leafed and submergent vegetation species present are *Potamogeton pectinatus, P. richardsonii, Ceratophyllum demersum, Ruppia maritime, Heteranthera dubia,* and *Myriophyllum spicatumis*. Vegetation is extensive throughout the lake and emergent vegetation covers much of the shoreline. No un-naturalized exotic vegetation or wildlife was reported during this survey.

Fish Management Information

Primary species	black bullhead, northern pike, walleye, yellow perch
Other species	bluegill, common carp, fathead minnow, largemouth bass, smallmouth bass, white sucker
Management classification	warm-water semi-permanent
Fish Consumption Advisories	none

Figure 1. Cottonwood Lake contour map.



Management Objectives

1) Maintain a mean gill net CPUE of stock length walleye ≥ 5, a PSD of 40 – 60, an RSD-P of 5 – 10, and a mean Wr > 80.

2) Maintain a mean gill net CPUE of stock length yellow perch ≥ 15 and a mean Wr > 80.

3) Maintain a mean frame net CPUE of stock length northern pike ≥ 3, a PSD of 30 – 60, an RSD-P of 5 – 10, and a mean Wr > 80.

4) Maintain a mean frame net CPUE of stock length bullhead ≤ 100, a mean Wr > 80, and encourage commercial harvest during periods of high abundance.

5) Monitor water levels and winterkill events.

Results and Discussion

Cottonwood Lake is a permanent, natural lake situated in the Coteau des Prairie, a plateau formed by glacier action in northeast South Dakota. Cottonwood Lake is named after Cottonwood Creek, which is a tributary of the lake entering from the north. Cottonwood Lake, along with the majority of the Coteau lakes, were formed during successive subadvances of the Late Wisconsin glaciation more than 10,000 years ago. Specifically, Cottonwood Lake is classified as a stage-nation-block formed till lake. The continental sized Late Wisconsin age glacier was thrust up and over the Coteau. Blocks of ice stagnated, were covered by till and subsequently melted; creating water filled depressions.

During the late 1970's and early 1980's Cottonwood Lake was utilized as a northern pike brood lake. Currently, Cottonwood Lake is primarily managed as a northern pike, walleye and yellow perch fishery. Overall, as many as 11 species of fish contribute to the fishery in Cottonwood Lake.

Primary Species

Black bullhead: The mean frame net CPUE of stock length black bullhead during 2005 was 36 (Table 1) and within the objective (≤ 100) for black bullhead in Cottonwood Lake (Table 3). Dating back to 1999 black bullhead abundance in Cottonwood Lake based on mean frame net CPUE of stock length fish has been considered moderate-low density with a mean CPUE of 45 (Table 2). The abundance of black bullhead in 2005 was much lower than the CPUE observed in 2001 (Table 3) and the population is currently low density.

Black bullhead captured in frame nets during 2005 ranged in total length from 120 to 320 mm (Figure 2). The PSD of black bullhead captured in frame nets during 2005 was 93 and the RSD-P was 20 (Table 1; Table 3). The high PSD indicated the presence of a large percentage of quality length (≥ 230 mm) black bullhead. In fact, roughly 85 percent of the black bullhead captured in frame nets during 2005 were larger than quality length (230 mm). Recruitment of black bullhead is likely moderate, but sporadic depending on environmental factors during spawning. No growth information is available for black bullhead in Cottonwood Lake; however, the condition of black bullhead in Cottonwood Lake during 2005 was above the objective of 80 with a mean Wr of 99 (Table 1; Table 3).

Northern Pike: Northern pike typically are not sampled consistently using standard lake survey methods; however, northern pike in Cottonwood Lake have generally been considered high density with a 1999 – 2000 mean CPUE of stock length fish of 4.8 for gill nets. The CPUE of stock length northern pike in Cottonwood Lake during 2005 was 5.3 (Table 1; Table 3) again indicating a high density population.

Overall, northern pike were collected from Cottonwood Lake that ranged in length from 340 to 980 mm (Figure 2). The gill net PSD was 56 and no preferred length (710) or larger northern pike were captured in gill nets (Table 1; Table 3). Although no preferred length northern pike were captured in gill nets some larger memorable length pike were present in Cottonwood Lake because a single 980 mm (39-inch) pike was captured in frame nets. Overall, northern pike were generally between 450 and 650 mm TL and very few smaller stock length (350 mm) northern pike were captured during the 2005 survey (Figure 2). No growth information was available; however, the condition of northern pike was acceptable with a mean Wr of 92 for pike captured in each gill nets and frame nets (Table 1; Table 3).

Walleye: The mean gill net CPUE of stock length walleye during 2005 was 1.3 (Table 1) and below the objective range (≥ 5 stock length fish/net night). Dating back to 2001 walleye abundance in Cottonwood Lake based on gill net CPUE has ranged from 1.3 to 7.3 stock length walleye/net night with an average of 4.3 (Table 2; Table 3). Although based on only two years sampling, the historic walleye population in Cottonwood Lake has been moderate-low density based on the 1999 – 2005 average gill net CPUE. The gill net CPUE of stock length walleye during 2005 indicated very low density.

Walleye captured in gill nets during 2005 ranged in length from 140 to 530 mm (Figure 2). The PSD of walleye captured in gill nets during 2005 was 80 and the RSD-P was 20 (Table 1; Table 3; Figure 2). The 2005 PSD of 80 was above the objective PSD range (40 – 60) and indicates that few smaller walleye are present in Cottonwood Lake. Similarly, the walleye RSD-P of 20 in 2005 was above the objective range of 5 – 10, again indicating a disproportionately high

number of larger walleye in the population. Overall, very few walleye were captured during the 2005 survey which may indicate low abundance or just poor sampling during the survey. A high percentage of the walleye population was within the quality (380 mm) and preferred (508 mm) length groups sought by most anglers.

During the 2005 survey a total of four age classes of walleye were captured including the 2004 (age-1), 2002 (age-3), 2001 (age-4), and 2000 (age-5) year classes (Table 4; Table 6). Three of the past five walleye stockings dating back to 1999 were represented in the walleye catch during 2005 (Table 6). The 1999 and 2003 small fingerling stockings were not sampled during 2005 indicating that the stocking may have been unsuccessful in producing a substantial year class. However, two walleye were age-5 according to age assessments from otiliths, which would indicate either natural reproduction during 2000 or incorrect age assignments. Potentially, the fish assigned an age of 5 may have been from the 1999 or 2001 year classes, which were years that walleye were stocked into Cottonwood Lake. Apparently, walleye natural reproduction has not been sufficient to maintain the walleye population in Cottonwood Lake and biennial fry stockings to maintain the population is recommended. Furthermore, small fingerling stockings have not produced large year classes and converting to fry stockings may be needed. Fry stocking may be more successful given the large number of fish stocked, and due to the relatively high abundance of northern pike in Cottonwood Lake which may contribute to mortality of small fingerlings. It is unknown the success of the 2005 large fingerling stocking at the time of this survey.

During the 2005 survey growth was moderate for walleye in Cottonwood Lake. Mean length at capture for walleye during 2005 was 369 mm at age-3, which is similar to the Region IV (367 mm) and statewide (360 mm) average back calculated length at age-3 (Table 4). Wr of stock length walleye captured in gill nets in 2005 was 99 and above the objective range of ≥ 80. Overall, walleye growth in Cottonwood Lake is good and high Wr values are indicative of fish in good condition with sufficient food availability.

Yellow Perch: The mean gill net CPUE of stock length (200 mm) yellow perch in 2005 was 6 (Tables 1 – 3) and below the objective range (≥ 15 fish/net night). Since 1999 the gill net CPUE of stock length yellow perch has fluctuated with a low of 3 (2001) and a high of 6 (2005) (Table 3). Overall, the yellow perch population in Cottonwood Lake is classified as low density.

During 2005, yellow perch ranged in total length from 80 to 210 mm (Figure 2), had a PSD of 6, and an RSD-P of 0 (Tables 1 – 3). Yellow perch commonly obtain 90 mm at age 1 and 150 mm at age 2. Inspection of the length frequency histogram indicates a strong year class of yellow perch in 2004 (Figure 2). The condition of yellow perch in Cottonwood Lake was within the objective (≥ 80) with a mean Wr of 99.

Other Species

Bluegill: The mean frame net CPUE of stock length bluegill during 2005 was 5 (Table 1). Dating back to 1999 bluegill abundance in Cottonwood Lake based on mean frame net CPUE of stock length fish has been considered low density and the 1999 – 2005 average CPUE was 5.2 (Table 2). The abundance of bluegill in Cottonwood Lake has remained near 5 fish/net night since 2001.

The total length of bluegill during 2005 ranged from 90 to 250 mm (Figure 2). Subsequently, the PSD of bluegill captured in frame nets during 2005 was 20 and the RSD-P was 7 (Table 1). The low PSD indicated the presence of a small percentage of quality length (≥ 230 mm) bluegill. No growth information is available for bluegill in Cottonwood Lake; however, the condition of bluegill in Cottonwood Lake during 2005 was above the objective of 80 with a mean Wr of 114 (Table 1; Table 3).

Other: Black crappie and green sunfish were other fish species captured during the 2005 survey; however, the abundance of these fish species was considered low density (Table 1, Table 2). The contribution of species other than black bullhead, bluegill, northern pike, walleye, and yellow perch to the fishery at the time of this survey was likely minimal.

Summary

Cottonwood Lake is managed as a northern pike, walleye and yellow perch fishery. In addition, black bullhead are monitored closely to determine abundance. During 2005, black bullhead abundance was within the objective range for frame net CPUE (≤ 100 stock length fish/net night). Roughly 85 percent of the black bullhead captured in frame nets were larger than quality length (230 mm). Apparently, conditions have been favorable for black bullhead reproduction during recent years in Cottonwood Lake based on the consistent recruitment observed from year to year. If the population density increases, commercial harvest of black bullhead should be encouraged to minimize the impact of high bullhead abundance on sport fish in Cottonwood Lake. For example, extremely high black bullhead abundance may negatively effect other sport fish through competition for similar food resources and habitat.

During 2005, the abundance of stock length (130 mm) yellow perch in Cottonwood Lake based on mean gill net CPUE indicated that the yellow perch population was low density and below the objective range of ≥15 stock length fish/net.

The abundance of stock length (350 mm) northern pike in Cottonwood Lake based on mean gill net CPUE was indicative of a high density population and above the objective range of ≥ 3 stock length fish/net. The PSD of 56 for

northern pike in Cottonwood Lake during 2005 was within the objective of 30 – 60. The condition of northern pike meets the objective range (Wr ≥ 80). Apparently, northern pike abundance in Cottonwood Lake has remained relatively consistent dating back to the last survey in 2001. Northern pike depend on flooded vegetation during the spring for spawning and conditions have not been favorable during recent years for successful northern pike reproduction. However, northern pike in Cottonwood Lake have maintained a relatively high density population comprised of mostly quality length fish that are likely acceptable to most anglers. A small number of preferred (710 mm) and memorable length (860 mm) northern pike are also present in Cottonwood Lake providing anglers the opportunity to catch larger pike. Overall, Cottonwood Lake has historically provided anglers with good northern pike fishing with a wide range of fish lengths and the opportunity to capture quality (≥ 530 mm) length fish.

The abundance of stock length (250 mm) walleye in Cottonwood Lake based on mean gill net CPUE was indicative of a low density population and was below the objective range of ≥ 5 stock length fish/net. The PSD of 80 for walleye in Cottonwood Lake during 2005 was above the objective range of 40 – 60, indicating the disproportionate abundance of larger fish in the population. Walleye in Cottonwood Lake grow similar to other waters in northeastern South Dakota achieving about 356 mm (14-inches) in three years. The condition of walleye in Cottonwood Lake meets the objective range (Wr ≥ 80).

Management Recommendations

1) Conduct fish population assessment surveys on a every-four-year basis (next survey scheduled in summer 2009) to monitor fish abundance, fish population size structures, fish growth, and stocking success.

2) Stock walleye on a biennial basis at 1,000 fry/acre to maintain consistent year classes. Stock northern pike and yellow perch in cases of complete winterkill events to establish a fish population. Monitor water levels and winterkill events to assess stocking strategies.

3) Encourage commercial harvest of black bullhead to limit abundance.

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 net sets or frame net sets in Cottonwood Lake, 2005. Confidence intervals include 80 percent (± CI-80) or 90 percent (± CI-90).

Survey Year	Abundance		Stock Density Indices				Condition	
Species	CPUE	CI-80	PSD	CI-90	RSD-P	CI-90	Wr	CI-90
2005								
Gill nets								
BLB	0.7	1.3	100	0	0	---	117	42
BLC	0.7	1.3	100	0	50	50	114	40
BLG	3.0	4.7	11	21	0	---	119	5
NOP	5.3	1.3	56	23	0	---	92	3
WAE	1.3	2.5	80	20	20	43	99	9
YEP	6.0	3.3	6	9	0	---	99	2
Frame nets								
BLB	35.6	5.9	93	2	20	3	99	1
BLG	5.0	2.5	20	9	7	5	114	2
GSF	0.1	0.1	0	---	0	---	127	---
NOP	0.2	0.2	100	0	50	50	92	0
WAE	0.3	0.2	100	0	75	25	94	14
YEP	1.4	0.9	0	---	0	---	97	1

Table 2. Historic mean catch rate (CPUE; Catch/net night) of stock length fish for various fish species captured in experimental gill net sets, frame net sets, or electrofishing in Cottonwood Lake, 1999 - 2005.

	CPUE							
Species	1999	2000	2001	2002	2003	2004	2005	Mean
Gill nets								
BLB	---	---	89.7	---	---	---	0.7	45.2
BLC	---	---	0.0	---	---	---	0.7	0.4
BLG	---	---	0.3	---	---	---	3.0	1.7
NOP	---	---	4.3	---	---	---	5.3	4.8
WAE	---	---	7.3	---	---	---	1.3	4.3
WHS	---	---	0.7	---	---	---	0.0	0.4
YEP	---	---	3.3	---	---	---	6.0	4.7
Frame nets								
BLB	---	---	279.5	---	---	---	35.6	157.6
BLC	---	---	0.7	---	---	---	0.0	0.4
BLG	---	---	5.3	---	---	---	5.0	5.2
GSF	---	---	0.0	---	---	---	0.1	0.1
NOP	---	---	0.4	---	---	---	0.2	0.3
WAE	---	---	0.1	---	---	---	0.3	0.2
YEP	---	---	0.2	---	---	---	1.4	0.8

Table 3. Mean catch rate (CPUE; catch/net night), proportional stock density (PSD), relative stock density of preferred length fish (RSD-P), and relative weight (Wr) for primary management species captured in experimental gill net sets, frame net sets, or electrofishing in Cottonwood Lake, 1999 - 2005.

Species	1999	2000	2001	2002	2003	2004	2005	Average	Objective
Frame nets									
BLB									
CPUE	---	---	279	---	---	---	36	158	≤ 100
PSD	---	---	3	---	---	---	93	48	---
RSD-P	---	---	0	---	---	---	20	10	---
Wr	---	---	87	---	---	---	99	93	≥ 80
Gill nets									
NOP									
CPUE	---	---	4	---	---	---	5	5	≥ 3
PSD	---	---	38	---	---	---	56	47	30 – 60
RSD-P	---	---	8	---	---	---	0	4	5 – 10
Wr	---	---	84	---	---	---	92	88	≥ 80
WAE									
CPUE	---	---	7	---	---	---	1	4	≥ 5
PSD	---	---	73	---	---	---	80	77	40 – 60
RSD-P	---	---	23	---	---	---	20	22	5 – 10
Wr	---	---	90	---	---	---	99	95	≥ 80
YEP									
CPUE	---	---	3	---	---	---	6	5	≥ 15
PSD	---	---	70	---	---	---	6	38	---
RSD-P	---	---	0	---	---	---	0	0	---
Wr	---	---	100	---	---	---	99	100	≥ 80

[1] Historic data from all surveys conducted since 1999.

Table 4. Weighted mean length at capture (mm) for walleye age-1 through age 10 captured in experimental gill net sets in Cottonwood Lake, 2005. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

		Age									
Year	N	1	2	3	4	5	6	7	8	9	10
2005	6	144	---	369	487	464	---	---	---	---	---
2001	23	172	---	346	391	450	---	650	685	---	---

Table 5. Stocking history (10-year) including size and number for fishes stocked into Cottonwood Lake, 1996 - 2005.

Year	Species	Size	Number
1999	WAE	small fingerling	42,600
2001	WAE	fry	300,000
2002	WAE	large fingerling	2,249
2003	WAE	small fingerling	37,380
2004	WAE	fry	350,000
2005	WAE	large fingerling	8,114

Table 6. Numbers of walleye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in Cottonwood Lake, 2005.

	Year Class								
Survey Year	2004	2003	2002	2001	2000	1999	1998	1997	1996
2005	1		1	2	2				
2001	---	---	---	---	1		5	7	6
Number stocked									
fry	350			300					
small fingerling		37				43			
large fingerling			2						

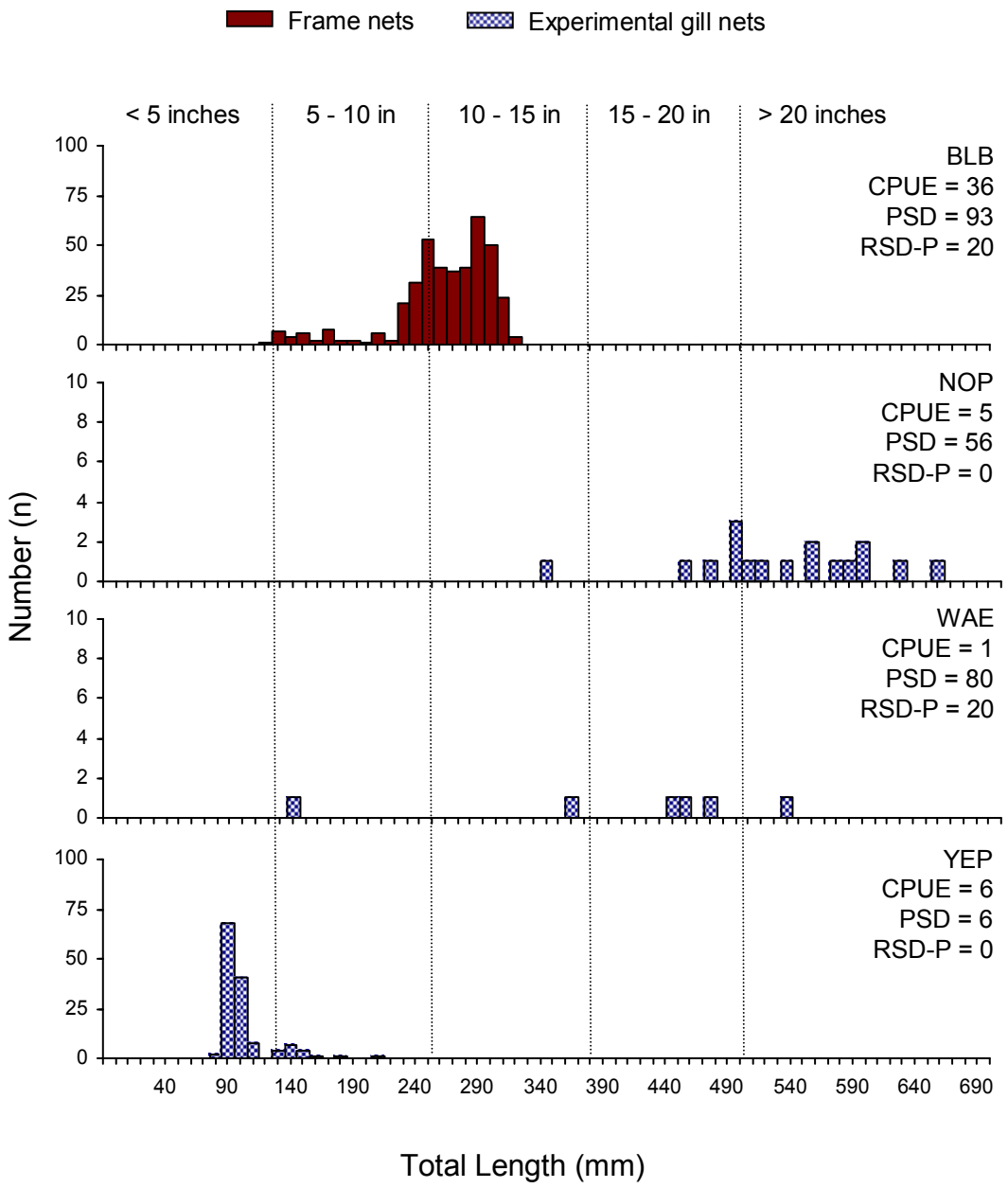



Figure 2. Length frequency, catch rate of stock length fish (CPUE), proportional stock density (PSD), and relative stock density of preferred length fish (RSD-P) for various fish species captured in frame net or gill net sets in Cottonwood Lake, 2005.