

Summit Lake

Site Description

Location

Water designation number (WDN)	29-0001-00
Legal description	T121N-R51W-Sec. 12,13,23
County (ies)	Grant
Location from nearest town	1.0 mile south and 1.5 miles east of Summit, SD

Survey Dates and Sampling Information

Survey dates	June 24-25, 2014 (FN, GN)
Frame net sets (n)	12
Gill net sets (n)	3

Morphometry

Watershed area (acres)	17,000
Surface area (acres)	174
Maximum depth (ft)	13
Mean depth (ft)	8

Ownership and Public Access

Summit Lake is a meandered lake owned by the State of South Dakota and the fishery is managed by the SDGFP. A public access (including boat ramp and toilet) is located on the northwest portion of Summit Lake and is maintained by the SDGFP (Figure 1). The majority of land adjacent to Summit Lake is owned by the State of South Dakota.

Watershed and Land Use

Summit Lake is in the Summit Lake sub-watershed (HUC-12) which is located within the Lower North Fork Whetstone River watershed (HUC-10). Land use within the Summit Lake watershed is primarily agricultural with the majority of land being pasture or grassland.

Water Level Observations

No water level observations were made in 2014.

Fish Management Information

Primary species	northern pike, walleye, yellow perch
Other species	black bullhead, bluegill, smallmouth bass, white sucker
Lake-specific regulations	none
Management classification	warm-water semi-permanent
Fish consumption advisories	none



Figure 2. Map depicting geographic location of Summit Lake, Grant County, South Dakota. Also noted is the public access location and standardized net locations for Summit Lake. SUFN= frame net; SUGN= gill net

Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length northern pike ≥ 3 , 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 gill net CPUE of stock-length yellow perch ≥ 30 , a PSD of 30-60, and a PSD-P of 5-10.
- 4) Maintain a mean frame net CPUE of stock-length black bullhead ≤ 100 .

Results and Discussion

Primary Species

Northern Pike: The 2014 gill net mean CPUE of stock-length northern pike was 2.0 (Table 1) and below the minimum objective (≥ 3 stock-length northern pike/net night; Table 3). The gill net mean CPUE in 2014 was below the 3.3 observed in 2010 (Table 2). Relative abundance is considered moderate.

Northern pike captured in gill nets in 2014 ranged in total length from 55 to 71 cm (21.7 to 28.0 in) and had a PSD of 100 and PSD-P of 17 (Figure 3). Both the PSD and PSD-P were above the management objective ranges (30-60 and 5-10, respectively) indicating a population dominated by quality-length northern pike (Table 3).

No growth information was collected in 2014. Condition of northern pike was fair with mean W_r values ranging from 78 to 82 for all length categories. The mean W_r of stock-length northern pike was 81 (Table 1).

Walleye: The gill net mean CPUE of stock-length walleye during 2014 was 7.0 (Table 1) and below the minimum objective (≥ 10 stock-length walleye/net night; Table 3). The 2014 gill net CPUE represents a decrease from the 2010 CPUE of 12.3 (Table 2) and indicates moderate relative abundance.

Walleye captured in gill nets during 2014 ranged in total length from 16 to 66 cm (6.3 to 26.0 in), had a PSD of 52 and a PSD-P of 29 (Figure 4). The PSD was within the management objective range (30-60) and PSD-P was above the management objectives range (5-10) indicating a population dominated by quality-length walleye (Table 3).

Otoliths were collected from a sub-sample of walleye in the 2014 gill net catch. Walleye from five year classes (2008-2011, 2013) were present in the gill net catch indicating consistent recruitment in recent years (Table 4). Walleye were stocked in 2012 but no walleye from that year class were present in the gill net survey (Tables 4, 6). The 2010 year class was the only year class that coincided with a stocking event

indicating the prevalence of natural reproduction (Table 5). The effectiveness of walleye fry stocking in Summit Lake is questionable. Four of five walleye year classes are the result of natural reproduction and the contribution of stocked walleye to the 2010 year-classes is unknown, as stocked fry were unmarked making it impossible to differentiate stocked from naturally-produced walleye. Justification for continued biennial stocking should be reevaluated.

Walleye in Summit Lake generally attain 381 mm (15 inches) between age 3 and 4 (Table 5). In 2014, the weighted mean length at capture for age-3 and age-4 walleye were 315 mm and 381 mm, respectively (12.4 in and 15.0 in; Table 5). Condition of stock-length walleye captured in the 2014 gill net catch was good with a mean Wr of 89 (Table 1). Mean Wr values ranged from 86 to 95 for all length categories sampled, and a slight decreasing trend in Wr values was observed as total length increased.

Yellow Perch: The 2014 gill net mean CPUE of stock-length yellow perch was 50.0 (Table 1) and above the minimum objective (≥ 30 stock-length perch/net night). The 2014 gill net CPUE represented a substantial increase from the 3.3 observed in 2010 (Table 2). Relative abundance is high.

Yellow perch captured in the 2014 gill net catch ranged in total length from 9 to 24 cm (3.5 to 9.4 in), had a PSD of 63, and a PSD-P of 0. The PSD value was above the management objective (30-60) and the PSD-P value was below the management objective range (5-10; Table 3) indicating a population dominated by yellow perch \geq quality-length but less than preferred-length.

Otoliths were collected from a sub-sample of gill net captured yellow perch in 2014. Five year-classes (2008-2011, 2013) were present with two strong year classes, in 2009 and 2010, comprising 42% and 45% of sampled yellow perch, respectively (Table 7).

Growth of yellow perch captured in Summit Lake during 2014 was slower than growth observed in 2010. Yellow perch captured in 2010 reached 200 mm by age-2 and in 2014 yellow perch did not reach 200 mm until between age-4 and age-5 (Table 8). In 2014, the weighted mean total length at capture for age-4 male yellow perch was 185 mm (7.3 in); while the weighted mean total length at capture for age-4 female yellow perch was 204 mm (8.0 in; Table 8).

Condition was good with a gill net mean Wr over 91 for all length categories sampled and the mean Wr of stock-length yellow perch of 101 (Table 1). A slight decreasing trend in Wr was observed as total length increased.

Other Species

Black Bullhead: The frame net mean CPUE of stock-length black bullhead during 2014 was 393.2 (Table 1). The relative abundance has fluctuated with high abundance in 1999 and 2014 (298.1 and 393.2, respectively) and low abundance in 2006 and 2010 (0.9 and 0.2, respectively; Table 2).

In 2014 condition of black bullhead was good with a mean Wr of 85 (Table 1). Condition appears to vary with abundance. When abundance is high, as in 1999 and 2014, mean Wr values are lower (87 and 85, respectively) and mean Wr values were

higher when relative abundance was low in 2006 and 2010 (111 and 119, respectively; Table 2).

Bluegill: Prior to 2008, bluegill were last stocked in Summit Lake in the early 1980's. No bluegills were captured during 1999 and 2006 surveys indicating little or no survival. Adult bluegill were stocked in 2008 to reestablish a population (Table 6).

No bluegill were captured during the 2014 survey (Table 2). Since 1999 the only survey in which, bluegill were captured was the 2010 survey (Table 2). Bluegill captured during the 2010 survey may have been from the 2008 stocking. The presence of bluegill after stocking indicates that survival was likely satisfactory. However, the absence of bluegill in other surveys may indicate poor reproduction.

Crappie: Crappie have been stocked in Summit Lake periodically with white crappie being stocked in 1980 and black crappie being stocked in 2010 (Table 6). However, no black crappie have been sampled in Summit Lake from 1999-2014 (Table 2). It appears survival and/or reproduction is poor.

Smallmouth Bass: Smallmouth bass were stocked into Summit Lake following the 1996-97 winterkill (Hubers and Blackwell 1999). Fall electrofishing was conducted in 1998 to assess the success of this stocking. Electrofishing CPUE was 15.7 smallmouth bass per hour indicating high survival of the 1997 (age-1) stocked year-class (Hubers and Blackwell 1999).

The mean CPUE of stock-length smallmouth bass in 2014 was 1.0 and 0.3 for gill nets and frame nets, respectively (Table 1; Table 2). Condition of smallmouth bass in Summit Lake was good with mean relative weight (Wr) values for gill net and frame net captured fish of 95 and 94, respectively (Table 1).

Management Recommendations

- 1) Conduct fish population assessment surveys on every fourth year basis (next survey scheduled in summer 2018) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Reevaluate if biennial stocking is appropriate management strategy for the Summit Lake walleye population. The current strategy is to stock walleye on a biennial basis (\approx 100 small fingerlings/acre) to add additional year classes to the population.
- 3) Monitor water levels and winter/summer kill events. In cases of complete winterkill events stock northern pike, yellow perch, and walleye to establish a fish population.

Table 1. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length fish (PSD-P), and mean relative weight (Wr) of stock-length fish for various fish species captured in frame nets experimental gill nets from Summit Lake, 2014. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; NOP=northern pike; SMB= smallmouth bass; WAE= walleye; 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	393.2	124.1	4	0	0	---	85	1
NOP	0.7	0.4	88	24	50	36	78	4
SMB	0.3	0.2	67	67	33	67	94	9
WAE	0.2	0.2	50	50	50	50	90	8
YEP	1.6	0.8	89	13	0	---	94	2
<i>Gill Nets</i>								
BLB	103.3	42.3	4	2	0	---	89	0
NOP	2.0	1.1	100	0	17	34	81	4
SMB	1.0	1.1	100	0	67	67	95	7
WAE	7.0	4.4	52	19	29	17	89	2
YEP	50.0	15.1	63	6	0	---	101	0

Table 2. Historic mean catch rate (CPUE; catch/net night) of stock-length fish for various fish species captured in frame nets and experimental gill nets from Summit Lake, 1999-2014. BLB= black bullhead; BLG= bluegill; NOP=northern pike; SMB= smallmouth bass; WAE= walleye; WHS= white sucker; YEP= yellow perch

Species	CPUE			
	1999 ¹	2006 ²	2010	2014
<i>Frame nets</i>				
BLB	298.1	0.9	0.2	393.2
BLG	0.0	0.0	2.6	0.0
NOP	0.1	0.6	0.2	0.7
SMB	0.0	0.9	1.0	0.3
WAE	0.0	1.0	0.4	0.2
WHS	0.0	0.1	0.0	0.0
YEP	14.1	1.2	0.7	1.6
<i>Gill Nets</i>				
BLB	151.7	0.0	0.0	103.3
NOP	5.0	1.0	3.3	2.0
SMB	0.0	1.3	0.3	1.0
WAE	5.7	1.0	12.3	7.0
YEP	115.0	17.3	3.3	50.0

¹ Survey conducted in early-June; other years survey conducted in late-June

² Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

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 mean relative weight (Wr) for selected species captured in frame nets and experimental gill nets from Summit Lake, 1999-2014. BLB= black bullhead; NOP= northern pike; WAE = walleye; YEP = yellow perch

Species	1999 ¹	2006 ²	2010	2014	Objective
<i>Frame nets</i>					
BLB					
CPUE	298	1	<1	393	≤100
PSD	12	64	0	4	---
PSD-P	0	55	0	0	---
Wr	87	111	119	85	---
<i>Gill nets</i>					
NOP					
CPUE	5	1	3	2	≥ 3
PSD	93	100	30	100	30-60
PSD-P	20	33	0	17	5-10
Wr	85	92	96	81	---
WAE					
CPUE	6	1	12	7	≥ 10
PSD	82	67	49	52	30-60
PSD-P	0	33	0	29	5-10
Wr	100	98	101	89	---
YEP					
CPUE	115	17	3	50	≥ 30
PSD	12	60	100	63	30-60
PSD-P	4	8	20	0	5-10
Wr	86	97	111	101	---

¹ Survey conducted in early-June; other years survey conducted in late-June

² Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

Table 4. 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 Summit Lake, 2006-2014.

Survey Year	Year Class													
	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
2014		3		6	7	4	4							
2010	---	---	---	---		16	17	20						
2006 ^{1,2}	---	---	---	---	---	---	---	---		8	2			
# stocked														
fry	100		85		175			174						
sm. fingerling														
lg. fingerling											25			

¹ Monofilament gill net mesh size (0.75", 1.00", 1.25", 1.50", 2.00" and 2.50")

² Older walleye were sampled but are not represented in this table

Table 5. Weighted mean length at capture (mm) for walleye captured in experimental gill nets (expanded sample size) from Summit Lake, 2006-2014. 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
2014	175(3)	---	315(6)	381(7)	544(4)	528(4)	---	---	---
2010	221(16)	334(17)	397(20)	---	---	---	---	---	---
2006	237(8)	251(2)	---	---	---	---	---	---	587(1)

Table 6. Stocking history including size and number for fishes stocked into Summit Lake, 2001-2014. BLC= black crappie; BLG= bluegill; SMB= smallmouth bass; WAE= walleye

Year	Species	Size	Number
2005	WAE	fingerling	23,800
2005	WAE	juvenile	1,643
2007	WAE	fry	174,000
2008	BLG	adult	1,275
2010	BLC	fingerling	10,080
2010	WAE	fry	175,000
2012	WAE	fry	85,000
2014	WAE	fry	100,000

Table 7. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from Summit Lake, 2010-2014.

Survey Year	Year Class							
	2014	2013	2012	2011	2010	2009	2008	2007
2014	---	13	---	8	70	76	1	---
2010	---	---	---	---	---	271	8	2

Table 8. Weighted mean TL (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from Summit Lake, 2010-2014.

Year	Age					
	1	2	3	4	5	6
2014						
Male	98(2)	---	149(6)	185(38)	204(16)	---
Female	100(12)	---	101(2)	204(39)	221(52)	241(1)
Combined	99(13)	---	125(8)	193(70)	216(76)	241(1)
2010						
Male	93(93)	214(2)	---	---	---	---
Female	93(165)	219(6)	270(2)	---	---	---
Combined	93(271)	218(8)	270(2)	---	---	---

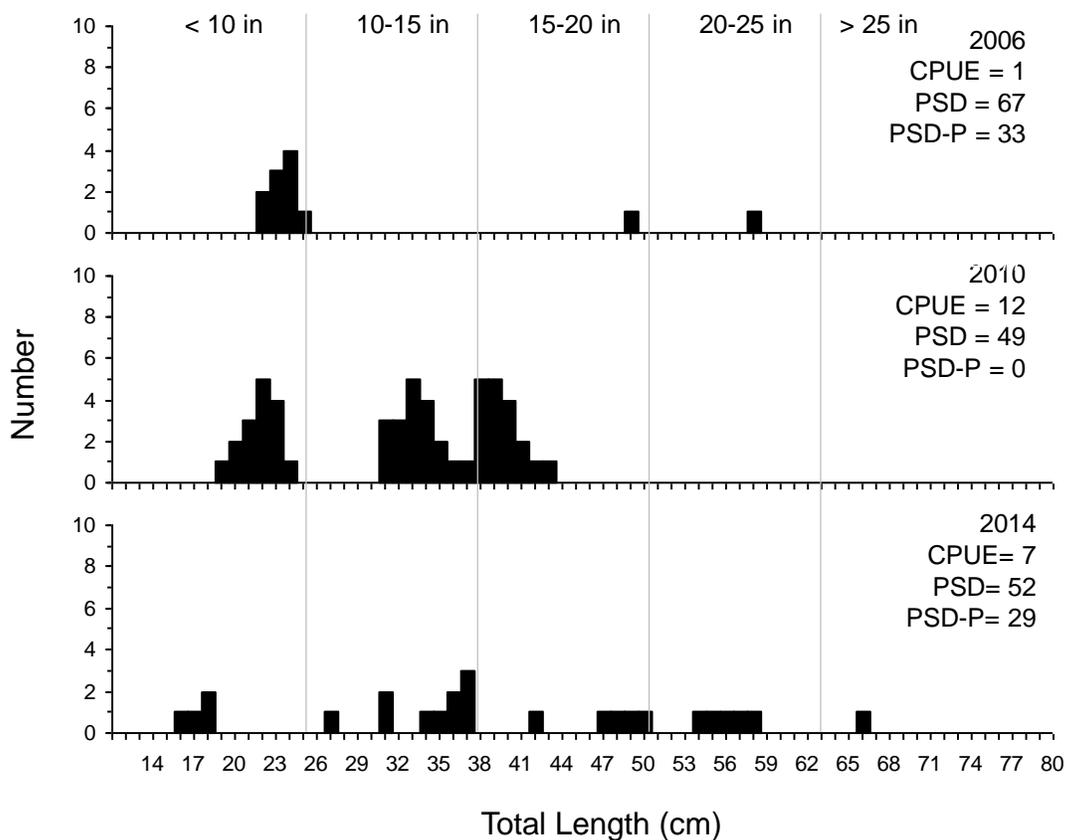


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using experimental gill nets in Summit Lake, 2006-2014.

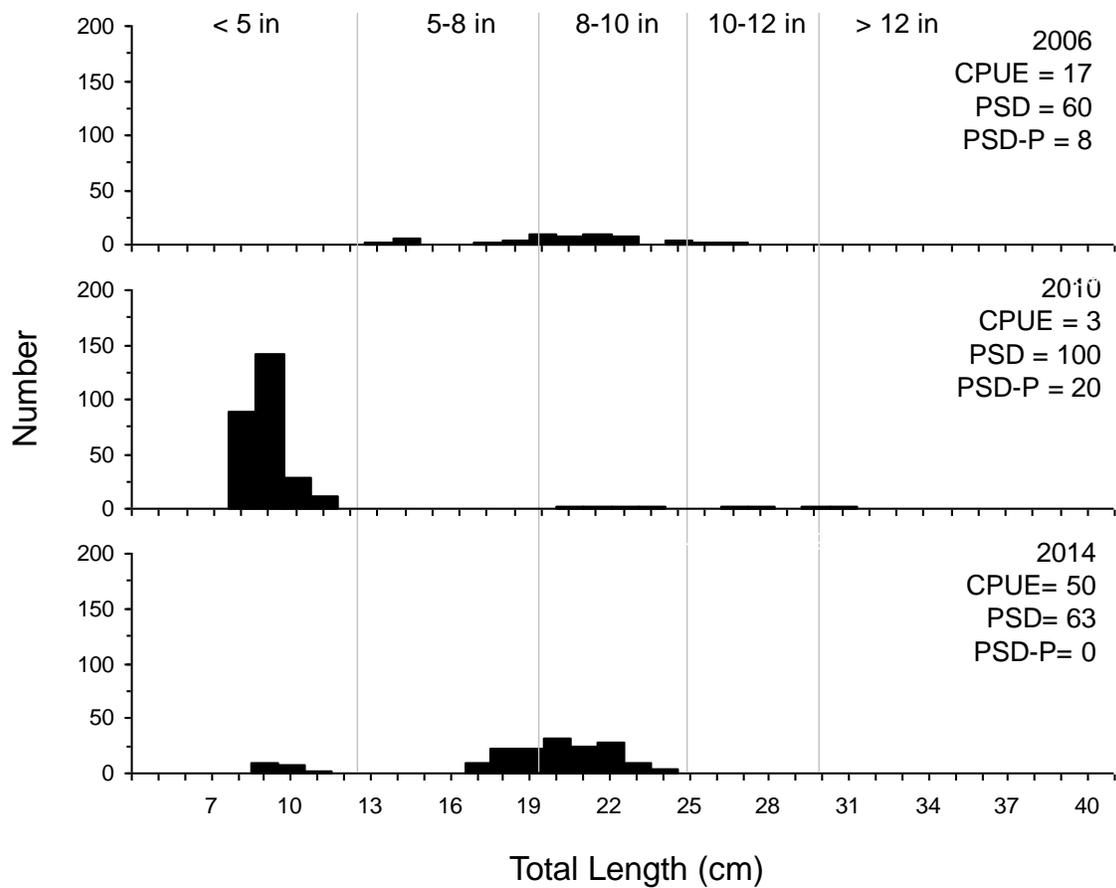


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured using experimental gill nets in Summit Lake, 2006-2014.