

Six-Mile Lake

Site Description

Location

Water designation number (WDN)	48-0028-00
Legal description	T126N-R55W-Sec.5,6,7
County (ies)	Marshall
Location from nearest town	3 miles west of Lake City, SD

Survey Dates and Sampling Information

Survey dates	June 16-17, 2009 (FN, GN)
Frame net sets (n)	12
Gill net sets (n)	3

Morphometry

Watershed area (acres)	---
Surface area (acres)	96
Maximum depth (ft)	11
Mean depth (ft)	---

Ownership and Public Access

Six-Mile Lake is a meandered lake owned and managed by the SDGFP. A public access site (including boat ramp) is located on the south shore just off SD Highway 10 and is maintained by the SDGFP (Figure 2). The shoreline of Six-Mile Lake is primarily undeveloped (Figure 2) and adjacent lands are owned by the State of South Dakota and private individuals.

Watershed and Land Use

Land-use within the Six-Mile Lake watershed is primarily agricultural.

Water Level Observations

Lake elevations are not monitored by the South Dakota Department of Environment and Natural Resources (SDDENR) on Six-Mile Lake. However, in the spring of 2009 Six-Mile Lake was at or above full pool, as water was exiting the lake and flowing south towards the Four-Mile/Bullhead Lake complex.

Aquatic Nuisance Species Monitoring

Plant Survey

Submerged vegetation is prevalent in the northeast corner of the lake. Species identified included coontail and sago pondweed. No aquatic nuisance plant species were identified during the 2009 survey.

Macro-Invertebrate/Mussel Survey

No aquatic nuisance macro-invertebrate or mussel species were sampled.

Fish Community Survey

No aquatic nuisance fish species were captured in either 2005 or 2009.

Fish Management Information

Primary species	northern pike, yellow perch
Other species	black bullhead, black crappie, bluegill, walleye, white sucker
Lake-Specific regulations	NE Panfish Management Area: 10 daily; 50 possession
Management classification	warm-water marginal
Fish consumption advisories	none

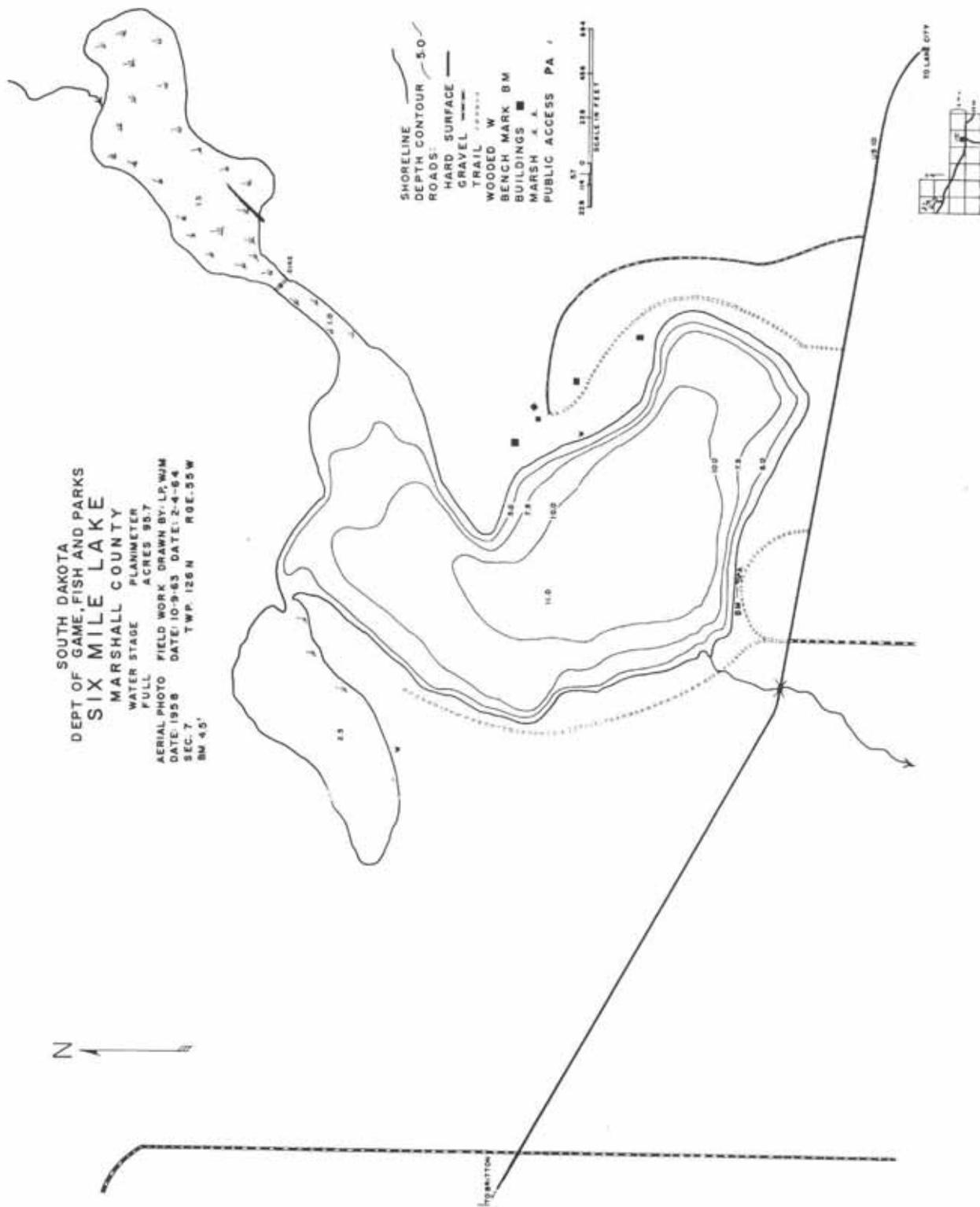


Figure 1. Contour map of Six-Mile Lake, Marshall County, South Dakota.



Figure 2. Map depicting geographic location of Six-Mile Lake from Lake City, South Dakota (top). Also noted is the boat ramp and standardized net locations for Six-Mile Lake (bottom). SMFN= frame nets, SMGN= gill nets

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

Results and Discussion

Six-Mile Lake is a shallow natural lake with a history of frequent winterkill events resulting in a fish community often comprised of black bullhead, northern pike, and yellow perch (species believed to be more winterkill tolerant). Occasionally following a complete winterkill, Six-Mile Lake has been utilized as a natural walleye rearing pond (i.e., walleye fry are stocked in the spring and allowed to grow, then harvested as large fingerlings in the fall and stocked into more permanent waters). Currently, Six-Mile Lake is managed as a northern pike and yellow perch fishery.

Primary Species

Northern Pike: The 2009 mean gill net CPUE of stock-length northern pike was 5.7 (Table 1), and above the minimum objective (≥ 3 stock-length pike/net night; Table 3). The 2009 gill net CPUE represented a decrease from the 2005 CPUE of 8.0, but relative abundance still appears to be high.

Northern pike sampled in gill nets during 2009 ranged in total length from 33 to 67 cm (13.0 to 26.4 in; Figure 3). The PSD of northern pike in the 2009 gill net catch was 59 and within the management objective of 30-60, but no preferred-length pike were captured. Gill net sampled northern pike had mean W_r values that ranged from 87 to 97 for all length categories sampled, with the mean W_r for stock-length fish being 89 (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.

Yellow Perch: The 2009 mean gill net CPUE of stock-length yellow perch was 48.0 (Table 1) and above the minimum objective (≥ 30 stock-length perch/net night). The 2009 gill net CPUE represented a substantial increase from the 2005 CPUE of 16.0, and indicated high relative abundance.

Yellow perch captured in the 2009 gill net catch ranged in total length from 8 to 22 cm (3.1 to 8.7 in), had a PSD of 7, and a PSD-P of 0. Both the 2009 PSD and PSD-P were below the management objectives of 30-60 and 5-10, as the majority of yellow perch captured were less than quality-length (Figure 4).

Otoliths were collected from a sub-sample of gill net captured yellow perch in 2009. Age structure information indicated that year classes produced in 2005-2008 comprised the entire sample, with the 2007 year class being the most represented (Table 5; Figure 4). The increased relative abundance from 2005 to 2009 (Table 2) can likely be attributed to the presence of what appears to be a relatively strong 2007 year-class.

The weighted mean total length at capture for age-2 and age-3 male yellow perch was 137 and 193 mm (5.4 and 7.6 in), respectively (Table 4). The weighted mean total length at capture for age-2 and age-3 female yellow perch was 155 and 203 mm (6.1 and 8.0 in; Table 2). Mean W_r values of gill net captured yellow perch in 2009 ranged from 98 to 103 for all length categories sampled with the mean W_r of stock-length yellow perch being 103 (Table 1).

Other Species

Black Bullhead: The 2009 mean frame net CPUE of stock-length black bullhead was 2.1 (Table 1) which represents a substantial decrease from the 2005 frame net CPUE of 42.8 (Table 2). The 2009 frame net CPUE was within the management objective (≤ 100 stock-length fish/net-night) and indicative of low relative abundance. Given the current low relative abundance, the impact of the black bullhead population on the sport fishery in Six-Mile Lake is likely minimal.

Walleye: No walleye were captured in the 2005 survey. In 2009, gill nets captured 9 walleye ranging in total length from 17 to 56 cm (6.7 to 22.0 in) resulting in a mean gill net CPUE of 2.7 (Table 1). Based on ages obtained from otoliths 6 year classes were represented in the 2009 gill net catch with walleye from the 2005 year class being the most represented, likely the result of the stocking of 6,400 large fingerling walleye (Table 6). Based on the 2009 gill net catch, the relative abundance of walleye in Six-Mile Lake has increased but remains low.

The shallow nature and susceptibility of Six-Mile Lake to winterkill exclude walleye from being a primary management species. However, the potential exists for occasional walleye year classes to develop and provide angling opportunities. Therefore, walleye stockings should continue provided water levels are favorable (i.e., lake is full), excess walleye are available, and higher priority stockings have been completed.

Other: Black crappie, bluegill, and white sucker were other fish species captured in relatively-low numbers during the 2009 fish community survey (Table 1).

Management Recommendations

- 1) Conduct fish community surveys utilizing gill nets and frame nets on an every fourth year basis (next survey scheduled in summer 2013) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Continue to manage as a self-sustaining northern pike and yellow perch fishery.
- 3) Stock walleye provided water levels are favorable (i.e., lake is full), excess walleye are available, and other higher priority stockings have been completed.
- 4) Collect otoliths from walleye and yellow perch to assess age structure and growth rates of each population.
- 5) Monitor winter and summerkill events. In cases of substantial winter/summerkill stock with northern pike and yellow perch to re-establish a fish community.

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 and experimental gill nets from Six-Mile Lake, 2009. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; BLG= bluegill; COC= common carp; NOP= northern pike; WAE= walleye; WHS= white sucker; 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	2.1	1.0	8	9	0	---	89	1
BLC	0.6	0.3	57	39	14	28	105	2
BLG	0.5	0.3	67	33	0	---	122	3
NOP	0.2	0.1	100	0	100	0	86	10
WAE	0.3	0.2	100	0	67	33	92	<1
WHS	0.1	0.1	100	---	100	---	89	---
YEP	1.0	0.5	0	---	0	---	103	3
<i>Gill nets</i>								
BLB	0.3	0.7	0	---	0	---	101	---
NOP	5.7	2.2	59	21	0	---	89	2
WAE	2.7	0.6	88	12	50	36	90	2
WHS	1.0	1.1	100	0	33	67	111	21
YEP	48.0	8.3	7	3	0	---	103	<1

Table 2. Historic mean catch rate (CPUE; gill/frame nets = catch/net night) of stock-length fish for various fish species captured by frame nets and experimental gill nets in Six-Mile Lake, 2002-2009. BLB = black bullhead; BLC= black crappie; BLG= bluegill; NOP = northern pike; WAE = walleye; WHS = white sucker; YEP = yellow perch

Species	CPUE								Mean
	2002	2003	2004	2005	2006	2007	2008	2009	
<i>Frame nets</i>									
BLB	---	---	---	42.8	---	---	---	2.1	22.5
BLC	---	---	---	0.3	---	---	---	0.6	0.5
BLG	---	---	---	0.0	---	---	---	0.5	0.3
NOP	---	---	---	1.1	---	---	---	0.2	0.7
WAE	---	---	---	0.0	---	---	---	0.3	0.2
WHS	---	---	---	0.1	---	---	---	0.1	0.1
YEP	---	---	---	1.1	---	---	---	1.0	1.1
<i>Gill nets</i>									
BLB	---	---	---	1.0	---	---	---	0.3	0.7
BLC	---	---	---	0.0	---	---	---	0.0	0.0
NOP	---	---	---	8.0	---	---	---	5.7	6.9
WAE	---	---	---	0.0	---	---	---	2.7	1.4
WHS	---	---	---	5.7	---	---	---	1.0	3.4
YEP	---	---	---	16.0	---	---	---	48.0	32.0

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 mean relative weight (Wr) for selected species captured by frame nets and experimental gill nets in Six-Mile Lake, 2002-2009. BLB = black bullhead; NOP = northern pike; WAE = walleye; YEP = yellow perch

Species	2002	2003	2004	2005	2006	2007	2008	2009	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	---	---	---	43	---	---	---	2	23	≤ 100
PSD	---	---	---	9	---	---	---	8	9	---
PSD-P	---	---	---	0	---	---	---	0	0	---
Wr	---	---	---	84	---	---	---	89	87	---
<i>Gill nets</i>										
NOP										
CPUE	---	---	---	8	---	---	---	6	7	≥ 3
PSD	---	---	---	38	---	---	---	59	49	30-60
PSD-P	---	---	---	4	---	---	---	0	2	5-10
Wr	---	---	---	94	---	---	---	89	92	---
YEP										
CPUE	---	---	---	16	---	---	---	48	32	≥ 30
PSD	---	---	---	6	---	---	---	7	7	30-60
PSD-P	---	---	---	0	---	---	---	0	0	5-10
Wr	---	---	---	95	---	---	---	103	99	---

Table 4. Weighted mean total length (mm) at capture by gender for yellow perch captured in experimental gill nets (expanded sample size) from Six-Mile Lake, 2009.

Year	Age				
	1	2	3	4	5
2009					
Male	100 (25)	137 (21)	193 (2)	---	---
Female	98 (31)	155 (121)	203 (12)	227 (1)	---
Combined	99 (55)	152 (144)	201 (14)	227 (1)	---

Table 5. Year class distribution based on the expanded age/length summary for yellow perch sampled in gill nets from Six-Mile Lake, 2009.

Survey Year	Year Class					
	2009	2008	2007	2006	2005	2004
2009		55	144	14	1	

Table 6. Stocking history including size and number for fishes stocked into Six-Mile Lake, 2001-2009.

Year	Species	Size	Number
2001	WAE	fry	100,000
2004	WAE	fry	100,000
2005	WAE	large fingerling	6,400
2008	WAE	fry	100,000

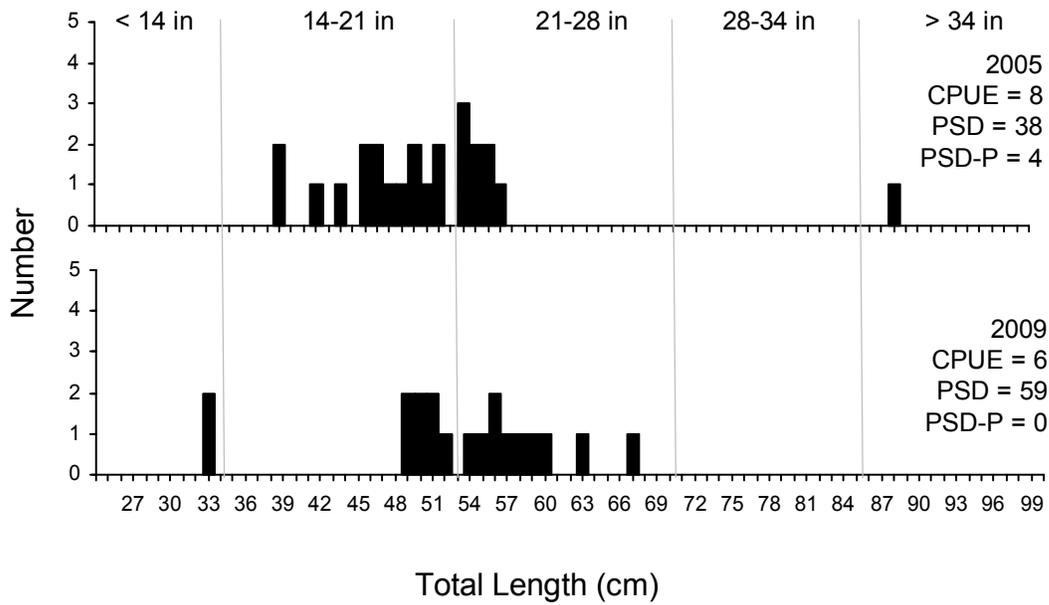


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for northern pike captured by gill nets in Six-Mile Lake, 2005 and 2009.

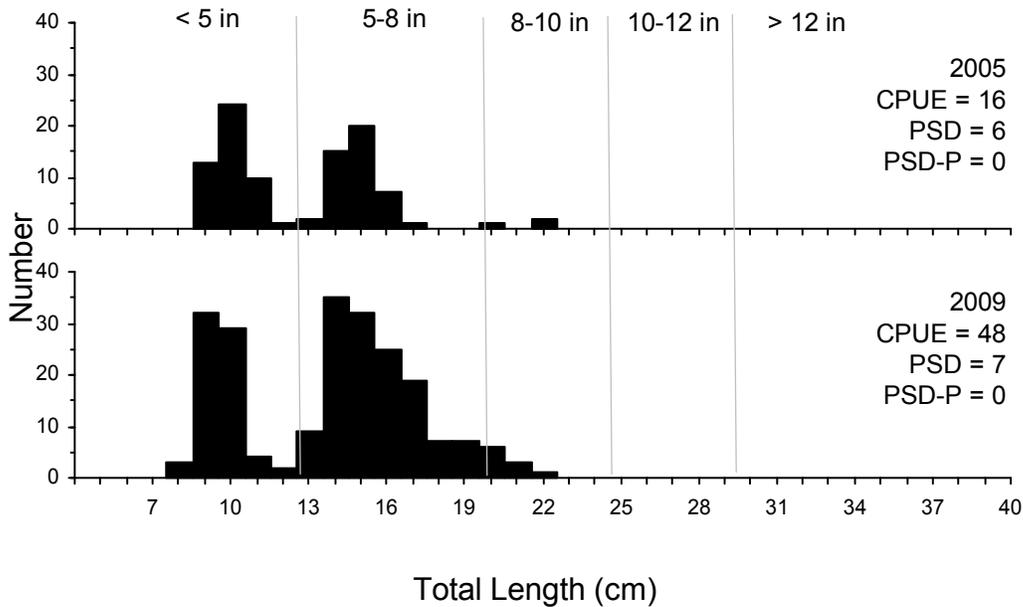


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured by gill nets in Six-Mile Lake, 2005 and 2009.