

# Punished Woman Lake

## Site Description

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### **Location**

Water designation number (WDN)	05-0004-00
Legal description	T119N-R51W-Sec.14-16
County (ies)	Codington
Location from nearest town	northern city limits of South Shore, SD

### **Survey Dates and Netting Information**

Dates of current survey	July 04 – 05, 2006
Date of most recent survey	July 29 – 30, 2003
Gill net sets (n)	4
Frame net sets (n)	12

### **Morphometry (Figure 1)**

Watershed area (acres)	11,290
Surface area (acres)	477
Maximum depth (ft)	12
Mean depth (ft)	unknown

### **Ownership and Public Access**

Punished Woman Lake is a meandered lake managed by the SDGFP. A single access site is located on the south shoreline and is owned and maintained by the city of South Shore (Figure 1). Lands adjacent to Punished Woman Lake are under ownership of the State of South Dakota, the City of South Shore, and private individuals.

### **Watershed and Land Use**

The Punished Woman Lake watershed is comprised of a mix of pasture or grassland, cropland, and municipal.

### **Water Level Observations**

Water levels in Punished Woman Lake are at the historic average. Nutrient run-off and siltation are prevalent creating algae blooms and reduced water quality. The trophic state of Punished Woman Lake is eutrophic.

### **Aquatic Vegetation and Exotics**

Emergent vegetation is concentrated in the eastern portion of Punished Woman Lake and covers roughly 30% of the shoreline. Submergent vegetation is well established throughout Punished Woman Lake and likely negatively impacts recreational use. No exotic vegetation or wildlife was reported during this survey.

### **Fish Management Information**

Primary species	northern pike, yellow perch
Other species	Walleye, black bullhead, common carp, fathead minnow, golden shiner, white sucker
Management classification	warm-water semi-permanent
Fish Consumption Advisories	none

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## Management Objectives

- 1) Maintain a mean gill net CPUE of stock length northern pike  $\geq 4$ , a PSD of 40 – 60, an RSD-P of 5 – 10, and a mean  $W_r > 80$ .
- 2) Maintain a mean gill net CPUE of stock length yellow perch  $\geq 15$  and a mean  $W_r > 80$ .
- 3) Maintain a mean frame net CPUE of stock length bullhead  $\leq 100$ , a mean  $W_r > 80$ , and encourage commercial harvest during periods of high abundance.
- 4) Monitor water levels and winterkill events.

## Results and Discussion

Punished Woman Lake is a relatively small natural lake situated in the Coteau des Prairie, a plateau formed by glacier action in northeast South Dakota. Punished Woman Lake, along with the majority of the Coteau lakes, was formed during successive subadvances of the Late Wisconsin glaciations more than 10,000 years ago. The name Punished Woman Lake was derived from Indian legends associated with the lake. The lake is located on the northern edge of South Shore city limits. Punished Woman Lake is unique in that of the roughly 4.5 miles of shoreline about 2.4 miles (51%) are public lands. Specifically, nearly the entire northern, eastern, and western shore of Punished Woman Lake is state managed Game Production Area (GPA). In addition, a portion of the southwestern shoreline is also under state ownership. Aquatic vegetation such as sago pond weed and algae are found in Punished Woman Lake. A marshy inlet on the west contains an abundant amount of bulrush and cattails. The northeast corner of the lake has an abundant amount of emergent vegetation. Overall, Punished Woman Lake is a relatively shallow and windswept basin that sustains extreme aquatic vegetation growth and is susceptible to frequent winterkill events. Currently Punished Woman Lake is primarily managed as a northern pike and yellow perch fishery. Overall, as many as seven species of fish contribute to the fishery in Punished Woman Lake.

### *Primary Species*

Northern Pike: The CPUE of stock-length northern pike in Punished Woman Lake during 2006 was 6.5 for gill nets, (Table 1) representing a high density population. Northern pike typically are not sampled consistently using standard lake survey methods; however, northern pike in Punished Woman Lake have generally been considered moderate-high density (Table 1; Table 2; Table 3). Northern pike were collected from Punished Woman Lake that ranged in total length from 360 to 660 mm (Figure 2). The PSD was 50 and the RSD-P was zero for northern pike captured in gill nets (Table 1). No growth information was

available; however, the high abundance of yellow perch would likely provide ample prey for northern pike. In addition, the condition of northern pike was within the objective range with a mean  $Wr$  of 87 for pike captured in gill nets. Overall, it appears that Punished Woman Lake contains sufficient food availability for acceptable northern pike condition.

Yellow Perch: The mean gill net CPUE of stock-length (130 mm) yellow perch in 2006 was 28.0 and above the objective range ( $\geq 15$  fish/net night) for perch in Punished Woman Lake (Tables 1 – 3). Overall, the yellow perch population in Punished Woman Lake is classified as moderate density. During 2006, yellow perch ranged in total length from 120 to 230 mm (Figure 2), had a PSD of 4, and an RSD-P of zero (Tables 1 – 3; Figure 2). 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 (Figure 2) from 2004 and 2005. The condition of yellow perch in Punished Woman Lake was within the objective ( $\geq 80$ ) with a mean  $Wr$  of 97.

#### *Other Species*

Walleye: The mean gill net CPUE of stock-length walleye during 2006 was 5.8 (Table 1). The gill net CPUE during 2006 indicated a moderate-low density. Walleye captured in gill nets during 2006 ranged in length from 300 to 530 mm and had a PSD of 70 and an RSD-P of 17, which were slightly above the objective range (Table 3; Figure 2). Stockings have not been effective in producing large year classes of walleye. Given the susceptibility of Punished Woman Lake to winterkill events and the failure of past stocking efforts, future walleye stockings should only occur when extra fish are available and all other priority stockings have been made.

During the 2006 survey only three year classes of walleye (2001, 2003, and 2004) was represented in the catch (Table 4; Table 6). Based on the 2006 survey, the 1996 – 1999 and 2002 year classes that should have been present due to fish stockings were missing (Table 6). Most likely a winterkill event in 2000 inflicted complete mortality on the walleye population in Punished Woman Lake. Natural reproduction by walleye in Punished Woman Lake is not likely given the lack of suitable spawning habitat. Growth of walleye in Punished Woman Lake was above the regional and statewide average and walleye reaching quality length ( $\geq 380$  mm) in 2 to 3 years in the absence of winterkill events. Condition of stock length walleye captured in gill nets in 2006 was 97, indicating good health.

Black bullhead: The mean frame net CPUE of stock-length black bullhead during 2006 was 181 (Table 1) and above the objective range ( $\leq 100$ ) for black bullhead in Punished Woman Lake (Table 3). Limited historic data is available to determine trends in the black bullhead population in Punished Woman Lake since 1999. However, the black bullhead density increased dramatically from

2003 through 2006. Black bullhead density in Punished Woman Lake could impose direct negative impact on sport fish.

Black bullhead captured in frame nets during 2006 suggested the presence of numerous weak year classes, with one stronger year class with the total length ranging from 140 to 190 mm (Figure 2). The PSD of black bullhead captured in frame nets during 2006 was zero (Table 1; Table 3; Figure 2). The low PSD indicated the presence of an unbalanced black bullhead population that was comprised of mostly small fish. Based on the 2006 length-frequency histogram (Figure 2), recruitment of black bullhead was likely high during 2003 and 2004. The condition of black bullhead in Punished Woman Lake during 2003 was above the objective of 80 with a mean  $W_r$  of 80 (Table 1; Table 3).

Other: Golden shiner and white sucker were other fish species captured during the 2006 survey; however, the abundance of these fish species was considered moderate or low density (Table 1, Table 2). No common carp were captured during the 2006 survey. The contribution of species other than walleye, northern pike and yellow perch to the fishery at the time of this survey was likely minimal.

### **Management Recommendations**

- 1) Conduct fish population assessment surveys on a triennial basis (next survey scheduled in summer 2009) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Stock walleye fry (1,000 fry per acre) only when excess walleye fry are available and all priority stockings are completed. 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 if the abundance exceeds the management objective. At the time of this survey, the abundance of black bullhead in Punished Woman Lake did exceed the management objective; therefore commercial harvest should be encouraged.

### *General Fishing Report*

Anglers can be most successful targeting walleye and northern pike in Punished Woman Lake. Catch rates vary depending on the season with the highest success most likely occurring during early spring through early summer and then fall when water temperatures are cooler. Shoreline angling can be good during the spring near the city of South Shore. Walleye and northern pike are the most frequently captured fish species reported by anglers in Punished Woman Lake. In the immediate future anglers can expect most walleye to be in the 11 to 17 inch length range; however, walleye may be captured in excess of

20 inches. In addition, larger northern pike are present in Punished Woman Lake that exceed 30 inches in length. Other fish species are captured less frequently but include black bullhead and yellow perch. Yellow perch were in high abundance during this survey; however, the small size of the perch likely limits directed effort by anglers. Due to the limited abundance of walleye anglers should expect lower catch rates. Conversely, angling for northern pike would most likely be met with success based on the high abundance in Punished Woman Lake.

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 Punished Woman Lake, 2006. Confidence intervals include 80 percent ( $\pm$  CI-80) or 90 percent ( $\pm$  CI-90).

Species	Abundance		Stock Density Indices				Condition	
	CPUE	CI-80	PSD	CI-90	RSD-P	CI-90	Wr	CI-90
<i>Gill nets</i>								
BLB	78.5	17.7	0	1	0	1	91	1
GOS <sup>1</sup>	3.3	2.1	---	---	---	---	---	---
NOP	6.5	1.1	50	17	0	0	87	2
WAE	5.8	1.5	70	16	17	14	97	2
WHS	5.8	2.1	83	13	70	16	110	15
YEP	28.0	9.6	4	2	0	0	97	< 1
<i>Frame nets</i>								
BLB	181.2	92.4	1	0	0	0	80	1
GOS <sup>1</sup>	0.3	< 0.1	---	---	---	---	---	---
NOP	0.1	0.1	0	0	0	0	80	---
YEP	48.2	17.4	3	1	0	0	89	4

<sup>1</sup> all fish sizes.

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 Punished Woman Lake, 1999 - 2006.

Species	CPUE								Mean
	1999	2000	2001	2002	2003	2004	2005	2006 <sup>2</sup>	
<i>Gill nets</i>									
BLB	---	---	---	---	16.3	---	---	78.5	47.4
COC	---	---	---	---	0.8	---	---	0.0	0.4
GOS <sup>1</sup>	---	---	---	---	8.5	---	---	3.3	5.9
NOP	---	---	---	---	8.8	---	---	6.5	7.7
WAE	---	---	---	---	1.8	---	---	5.8	3.8
WHS	---	---	---	---	3.5	---	---	5.8	4.7
YEP	---	---	---	---	27.3	---	---	28.0	27.7
<i>Frame nets</i>									
BLB	---	---	---	---	8.9	---	---	181.2	95.1
GOS <sup>1</sup>	---	---	---	---	0.1	---	---	0.3	0.2
NOP	---	---	---	---	1.4	---	---	0.1	0.8
WAE	---	---	---	---	0.3	---	---	0.0	0.2
WHS	---	---	---	---	0.4	---	---	0.0	0.2
YEP	---	---	---	---	6.4	---	---	48.2	27.3

<sup>1</sup> all fish sizes.

<sup>2</sup> 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 (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 in experimental gill net sets, frame net sets, or electrofishing in Punished Woman Lake, 1999 - 2006.

Species	1999	2000	2001	2002	2003	2004	2005	2006 <sup>1</sup>	Average	Objective
<i>Frame nets</i>										
BLB										
CPUE	---	---	---	---	9	---	---	181	95	≤ 100
PSD	---	---	---	---	47	---	---	1	24	---
RSD-P	---	---	---	---	3	---	---	0	2	---
Wr	---	---	---	---	83	---	---	80	82	≥ 80
<i>Gill nets</i>										
YEP										
CPUE	---	---	---	---	27	---	---	28	28	≥ 15
PSD	---	---	---	---	35	---	---	4	20	---
RSD-P	---	---	---	---	4	---	---	0	2	---
Wr	---	---	---	---	99	---	---	97	98	≥ 80
NOP										
CPUE	---	---	---	---	9	---	---	7	8	≥ 4
PSD	---	---	---	---	54	---	---	50	52	40 - 60
RSD-P	---	---	---	---	3	---	---	0	2	5 - 10
Wr	---	---	---	---	85	---	---	87	86	≥ 80
WAE										
CPUE	---	---	---	---	2	---	---	6	4	
PSD	---	---	---	---	0	---	---	70	35	
RSD-P	---	---	---	---	0	---	---	17	9	
Wr	---	---	---	---	96	---	---	97	97	

<sup>1</sup> 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 Punished Woman Lake, 1999 – 2006. 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
2006 <sup>1</sup>	23	---	325	447	---	498
2003	7	---	310	---	---	---

<sup>1</sup> Fish aged using otoliths, scales were used in previous years.

Table 5. Stocking history (10-year) including size and number for fishes stocked into Punished Woman Lake, 1996 - 2006.

Year	Species	Size	Number
1996	WAE	small fingerling	50,000
1997	WAE	small fingerling	51,300
1998	WAE	small fingerling	48,000
1999	WAE	small fingerling	48,000
2001	WAE	fry	450,000
2002	WAE	fry	400,000
2003	WAE	fry	477,000
2004	WAE	small fingerling	35,200
2006	WAE	small fingerling	50,490

Table 6. Numbers of walleye sampled (n) by year class and associated stocking history (Number stocked x 1,000) for walleye captured in Punished Woman Lake, 1999 - 2006.

Survey Year	Year Class									
	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
2006 <sup>1,2</sup>		7	7		9					
2003					7					
Number stocked										
fry			477	400	450					
small fingerling		35					48	48	51	50
large fingerling										

<sup>1</sup> Fish aged using otoliths, scales were used in previous years.

<sup>2</sup> 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").

Figure 2. Length frequency, catch-per-unit-effort (CPUE; catch/net night) of stock length fish, proportional stock density (PSD), and relative stock density of preferred length fish (RSD-P) for selected fish species captured in frame nets or experimental gill net sets in Punished Woman Lake, 2006.

