

# 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 edge of the city limits of South Shore, SD |

### Survey Dates and Sampling Information

|                    |                           |
|--------------------|---------------------------|
| Survey dates       | July 21-22, 2009 (FN, GN) |
| Frame net sets (n) | 10                        |
| Gill net sets (n)  | 3                         |

### Morphometry

|                        |         |
|------------------------|---------|
| 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. Public access sites have been established on the south and east shorelines (Figure 1). The south access location includes a boat ramp and is maintained by the city of South Shore (Figure 2). 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

The Water Management Board established OHWM is 1845.0 fmsl, and the outlet elevation of Punished Woman Lake is 1844.5 fmsl. On May 26 and October 14, 2009 the elevation of Punished Woman Lake was 1844.5 fmsl.

### Aquatic Nuisance Species Monitoring

#### Plant Survey

Emergent vegetation, primarily bulrush and cattail, is present in scattered areas along the shoreline of Punished Woman Lake. Dense mats of Chara (a macro algae) intermingled with sago pondweed were prevalent throughout much of the lake. 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 during 2009.

#### Fish Community Survey

Common carp was the only aquatic nuisance fish species captured in 2009.

### Fish Management Information

|                             |   |
|-----------------------------|---|
| Primary species             | northern pike, yellow perch                                       |
| Other species               | black bullhead, common carp, golden shiner, walleye, white sucker |
| Lake-Specific regulations   | NE Panfish Management Area: 10 daily; 50 possession               |
| Management classification   | warm-water semi-permanent   |
| Fish consumption advisories | none  |

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South Dakota Department of Game, Fish and Parks

# Punished Woman Lake Codington County

1997

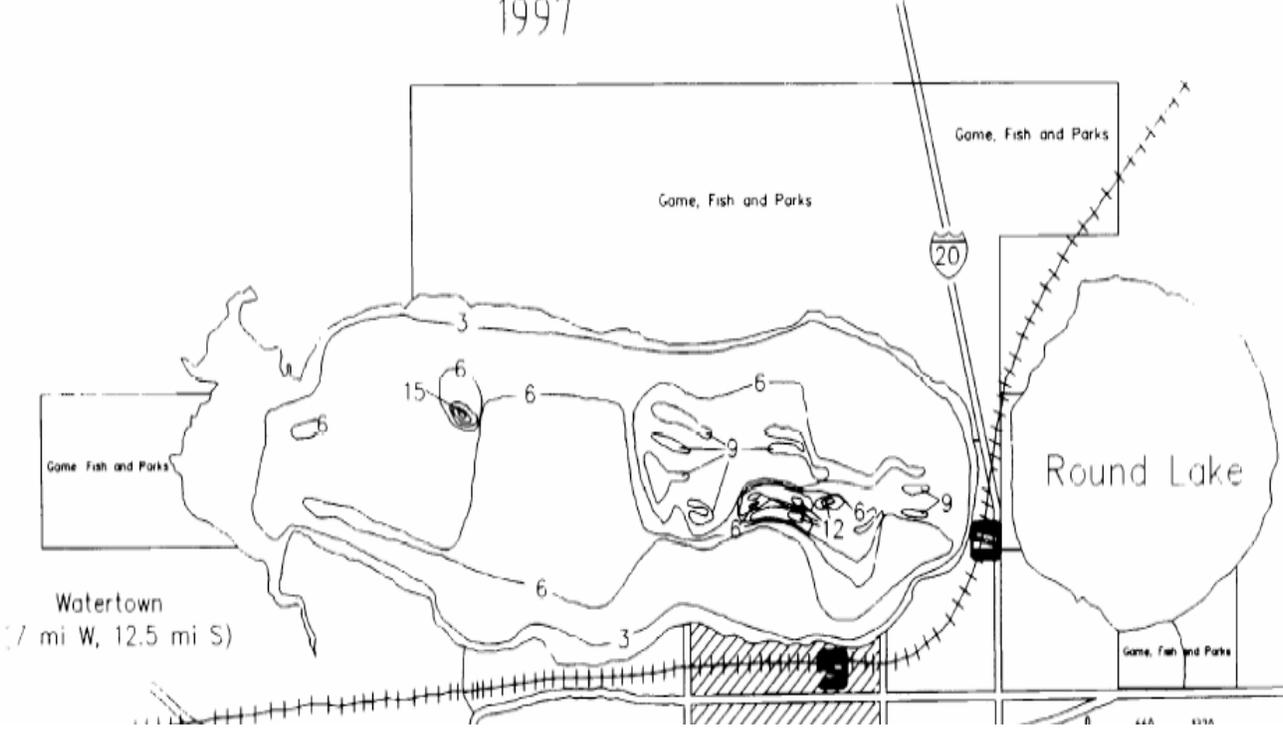


Figure 1. Contour map of Punished Woman Lake, Codington County, South Dakota.

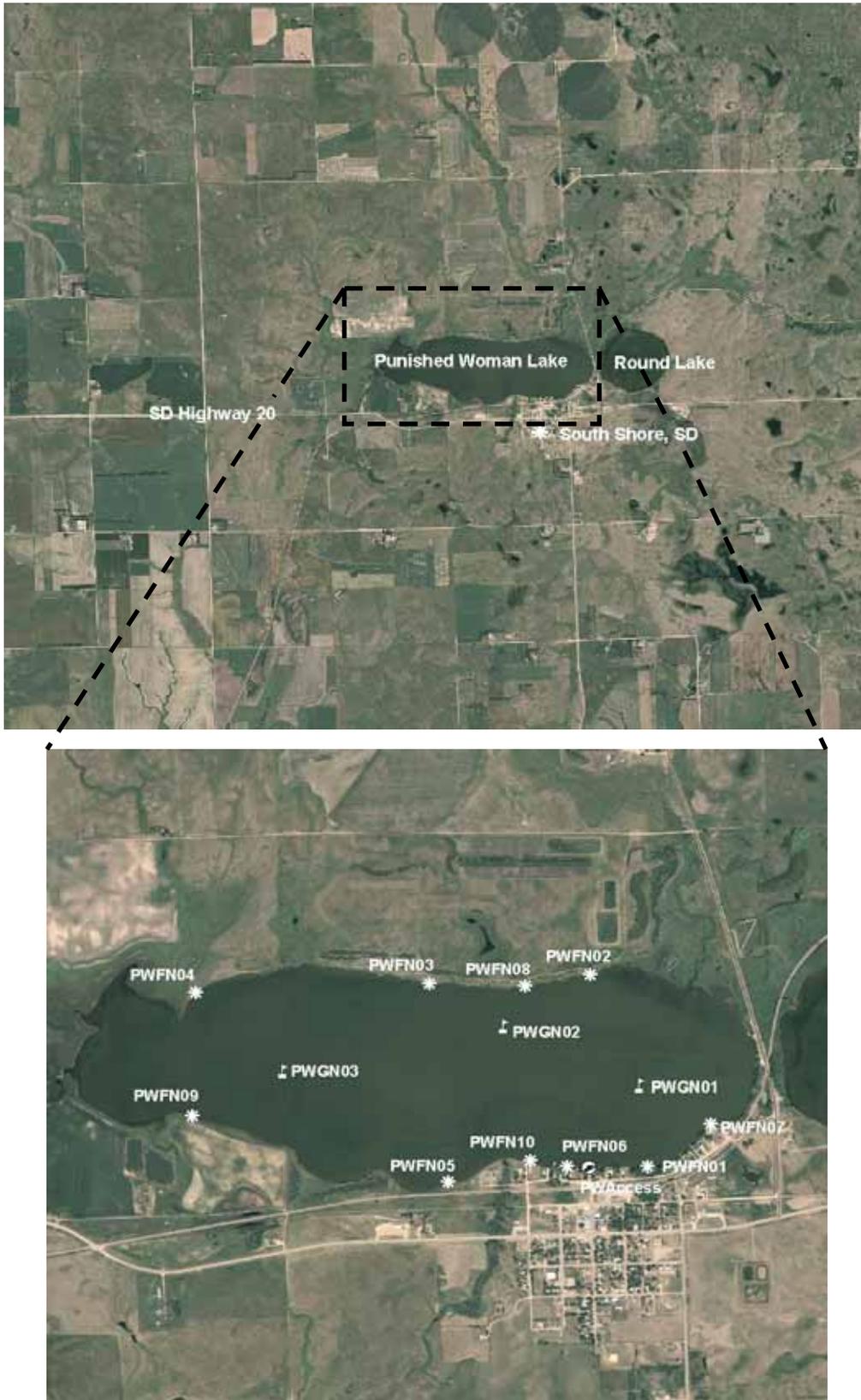


Figure 2. Map depicting geographic location of Punished Woman and Round Lakes (Codington County) from South Shore, South Dakota (top). Also noted are the standardized net locations (bottom) for Punished Woman Lake. PWFN= frame net; PWGN= gill net

## Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length northern pike  $\geq 3$ , a PSD of 30-60, and a PSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length yellow perch  $\geq 30$ , a PSD of 30-60, and a PSD-P of 5-10.
- 3) Maintain a mean frame net CPUE of stock-length bullhead  $\leq 100$ .

## Results and Discussion

Punished Woman Lake is located on the northern edge of South Shore city limits and is a relatively-shallow natural lake with good public access. The lake is unique in that approximately 2.4 miles (51%) of the 4.5 miles of shoreline are owned by the State of South Dakota and managed as a Game Production Area (GPA). Currently Punished Woman Lake is primarily managed as a northern pike and yellow perch fishery. Overall, as many as seven fish species contribute to the fishery.

### *Primary Species*

Northern Pike: Northern pike typically are not sampled effectively using standard lake survey methods; therefore reported values may not accurately represent the at-large population. Neumann and Willis (1995) reported the most reliable time to sample northern pike with gill nets was late spring following the spawn.

The 2009 mean gill net CPUE of stock-length northern pike was 4.0 (Table 1) and above the minimum objective ( $\geq 3$  stock-length northern pike/net; Table 3). Since 2003, the relative abundance of northern pike in Punished Woman Lake has been considered high, with mean gill net CPUE values of stock-length northern pike ranging from 4.0 (2009) to 8.8 (2003; Table 2).

Northern pike sampled in gill nets during 2009 ranged in total length from 38 to 90 cm (15.0 to 35.4 in), had a PSD of 33, and a PSD-P of 8 (Figure 3; Table 1). Both the 2009 PSD and PSD-P were within the objective ranges of 30-60 and 5-10, respectively (Table 3).

No growth information was available for northern pike in 2009. Northern pike in the 2009 gill net catch had mean  $W_r$  values that ranged from 81-83 for all length categories sampled and no length-related trends were apparent. The mean  $W_r$  for stock-length northern pike was 81 (Table 1).

Yellow Perch: The mean gill net CPUE of stock-length yellow perch in 2009 was 13.0 (Table 1), which is below the minimum objective ( $\geq 30$  stock-length yellow perch/net night). Since 2003, the gill net CPUE of stock-length yellow perch has ranged from 1.0 (2005) to 28.0 (2006) with the 2003-2009 average being 15.3 (Table 2). Based on the 2009 gill net catch the relative abundance of stock-length yellow perch appears to be moderate.

Yellow perch in the 2009 gill net catch ranged in total length from 9 to 22 cm (3.5 to 8.7) with the majority (55%) being less than stock-length (5 in; Figure 4). The PSD of yellow perch in the 2009 gill net catch was 5 and well below the management objective of 30-60 (Table 3), indicating a population comprised of smaller individuals. No preferred-length yellow perch were captured.

Otoliths were collected from a sub-sample of gill net captured yellow perch. Age structure information indicates that yellow perch in Punished Woman Lake have exhibited relatively-consistent recruitment in recent years with four consecutive year classes (2005-2008) present in the 2009 gill net catch (Table 5). Sub-stock yellow perch belonging to the 2008 year class comprised approximately 56% of yellow perch collected in gill nets. Year classes produced in 2006 and 2007 comprised 20 and 22% of yellow perch in the 2009 gill net catch and represented the majority of stock-length yellow perch captured (Table 5; Figure 4).

The weighted mean total length at capture for age-2 and age-3 male yellow perch was 146 and 159 mm (5.7 and 6.3 in), respectively (Table 4). The weighted mean total length at capture for age-2 and age 3 female yellow perch was 152 and 167 mm (6.0 and 6.6 in; Table 4). Mean  $W_r$  values of gill net captured yellow perch in 2009 ranged from 96 to 102 for all length categories sampled with the mean  $W_r$  of stock-length yellow perch being 102 (Table 1).

#### *Other Species*

Black Bullhead: The 2009 mean frame net CPUE of stock-length black bullhead was 22.4 (Table 1) which represents a substantial decrease from the 2006 frame net CPUE of 181.2 (Table 2). The 2009 frame net CPUE was within the management objective ( $\leq 100$  stock-length fish/net-night) and indicative of moderate relative abundance.

Walleye: The mean gill net CPUE of stock-length walleye during 2009 was 4.0 (Table 1) and indicated moderate relative abundance. Since 2003, the mean gill net CPUE has fluctuated from a low of 1.7 (2007) to a high of 5.8 with the 2003-2009 average being 3.2 (2005; Table 2).

Walleye captured in the 2009 gill net catch ranged in total length from 17 to 48 cm (6.7 to 18.9 in). The majority of walleye captured were in the quality-preferred length category resulting in a PSD of 83 (Table 1; Figure 5). No preferred-length walleye were captured.

Otoliths were collected from gill net captured walleye in 2009. Age structure information indicated the presence of four year classes (2005-2008; Table 8). The 2006 year class comprised the majority (57%) of walleye in the 2009 gill net catch and coincided with a small fingerling stocking (Table 7, Table 8).

Growth was good with the weighted mean total length at capture of age-3 walleye being 414 mm (16.3 in; Table 6). Mean  $W_r$  values ranged from 95 to 99 for all length categories sampled with the mean  $W_r$  of stock-length walleye being 95 (Table 1).

The shallow nature and susceptibility of Punished Woman 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: Common carp, golden shiner, 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 Punished Woman Lake, 2009. Confidence intervals include 80 percent ( $\pm$  CI-80) or 90 percent ( $\pm$  CI-90). BLB= black bullhead; COC= common carp; GOS= golden shiner; 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               | 22.4      | 11.0  | 13                    | 4     | 0     | ---   | 92        | 1     |
| NOP               | 0.2       | 0.2   | 100                   | 0     | 100   | 0     | 80        | <1    |
| WAE               | 0.2       | 0.2   | 100                   | 0     | 0     | ---   | 98        | ---   |
| WHS               | 0.1       | 0.1   | 100                   | ---   | 100   | ---   | 98        | ---   |
| YEP               | 1.5       | 0.4   | 7                     | 11    | 0     | ---   | 97        | 1     |
| <i>Gill nets</i>  |           |       |                       |       |       |       |           |       |
| BLB               | 64.3      | 35.6  | 3                     | 2     | 0     | ---   | 92        | <1    |
| COC               | 0.3       | 0.7   | 100                   | ---   | 100   | ---   | 116       | ---   |
| GOS <sup>1</sup>  | 7.3       | 3.2   | ---                   | ---   | ---   | ---   | ---       | ---   |
| NOP               | 4.0       | 1.1   | 33                    | 26    | 8     | 15    | 81        | 12    |
| WAE               | 4.0       | 1.9   | 83                    | 17    | 0     | ---   | 95        | 1     |
| WHS               | 5.7       | 4.9   | 65                    | 21    | 59    | 21    | 102       | 5     |
| YEP               | 13.0      | 1.1   | 5                     | 6     | 0     | ---   | 102       | <1    |

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

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 Punished Woman Lake, 2003-2009. BLB = black bullhead; COC= common carp; GOS= golden shiner; NOP = northern pike; WAE = walleye; WHS = white sucker; YEP = yellow perch

| Species           | Year |      |      |       |      |      |      | Mean |
|-------------------|------|------|------|-------|------|------|------|------|
|                   | 2003 | 2004 | 2005 | 2006  | 2007 | 2008 | 2009 |      |
| <i>Frame nets</i> |      |      |      |       |      |      |      |      |
| BLB               | 8.9  | ---  | ---  | 181.2 | ---  | ---  | 22.4 | 70.8 |
| GOS <sup>1</sup>  | 0.1  | ---  | ---  | 0.3   | ---  | ---  | 0.0  | 0.1  |
| NOP               | 1.4  | ---  | ---  | 0.1   | ---  | ---  | 0.2  | 0.6  |
| WAE               | 0.3  | ---  | ---  | 0.0   | ---  | ---  | 0.2  | 0.2  |
| WHS               | 0.4  | ---  | ---  | 0.0   | ---  | ---  | 0.1  | 0.2  |
| YEP               | 6.4  | ---  | ---  | 48.2  | ---  | ---  | 1.5  | 18.7 |
| <i>Gill nets</i>  |      |      |      |       |      |      |      |      |
| BLB               | 16.3 | 6.7  | 29.3 | 78.5  | 35.3 | ---  | 64.3 | 38.4 |
| COC               | 0.8  | 0.3  | 0.0  | 0.0   | 0.0  | ---  | 0.3  | 0.2  |
| GOS <sup>1</sup>  | 8.5  | 31.0 | 3.3  | 3.3   | 0.0  | ---  | 7.3  | 8.9  |
| NOP               | 8.8  | 5.3  | 5.7  | 6.5   | 6.0  | ---  | 4.0  | 6.1  |
| WAE               | 1.8  | 4.0  | 2.0  | 5.8   | 1.7  | ---  | 4.0  | 3.2  |
| WHS               | 3.5  | 3.0  | 5.3  | 5.8   | 6.3  | ---  | 5.7  | 4.9  |
| YEP               | 27.3 | 7.3  | 1.0  | 28.0  | 15.0 | ---  | 13.0 | 15.3 |

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

<sup>2</sup> Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5")

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 Punished Woman Lake, 2003-2009. BLB = black bullhead; NOP = northern pike; WAE = walleye; YEP = yellow perch

| Species           | 2003 | 2004 | 2005 | 2006 <sup>1</sup> | 2007 <sup>1</sup> | 2008 | 2009 | Average | Objective |
|-------------------|------|------|------|-------------------|-------------------|------|------|---------|-----------|
| <i>Frame nets</i> |      |      |      |                   |                   |      |      |         |           |
| BLB               |      |      |      |                   |                   |      |      |         |           |
| CPUE              | 9    | ---  | ---  | 181               | ---               | ---  | 22   | 71      | ≤ 100     |
| PSD               | 47   | ---  | ---  | 1                 | ---               | ---  | 13   | 20      | ---       |
| PSD-P             | 3    | ---  | ---  | 0                 | ---               | ---  | 0    | 1       | ---       |
| Wr                | 83   | ---  | ---  | 80                | ---               | ---  | 92   | 85      | ---       |
| <i>Gill nets</i>  |      |      |      |                   |                   |      |      |         |           |
| NOP               |      |      |      |                   |                   |      |      |         |           |
| CPUE              | 9    | 5    | 6    | 7                 | 6                 | ---  | 4    | 6       | ≥ 3       |
| PSD               | 54   | 88   | 65   | 50                | 78                | ---  | 33   | 61      | 30-60     |
| PSD-P             | 3    | 19   | 0    | 0                 | 22                | ---  | 8    | 9       | 5-10      |
| Wr                | 85   | 80   | 79   | 87                | 91                | ---  | 81   | 84      | ---       |
| WAE               |      |      |      |                   |                   |      |      |         |           |
| CPUE              | 2    | 4    | 2    | 6                 | 2                 | ---  | 4    | 3       | ---       |
| PSD               | 0    | 67   | 33   | 70                | 100               | ---  | 83   | 59      | ---       |
| PSD-P             | 0    | 0    | 0    | 17                | 0                 | ---  | 0    | 3       | ---       |
| Wr                | 96   | 101  | 93   | 97                | 96                | ---  | 95   | 96      | ---       |
| YEP               |      |      |      |                   |                   |      |      |         |           |
| CPUE              | 27   | 7    | 1    | 28                | 15                | ---  | 13   | 15      | ≥ 30      |
| PSD               | 35   | 55   | 33   | 4                 | 9                 | ---  | 5    | 24      | 30-60     |
| PSD-P             | 4    | 32   | 0    | 0                 | 0                 | ---  | 0    | 6       | 5-10      |
| Wr                | 99   | 101  | 91   | 97                | 94                | ---  | 102  | 97      | ---       |

<sup>1</sup> Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5")

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

| Year     | Age      |          |          |         |     |
|----------|----------|----------|----------|---------|-----|
|          | 1        | 2        | 3        | 4       | 5   |
| 2009     |          |          |          |         |     |
| Male     | 107 (14) | 146 (3)  | 159 (5)  | ---     | --- |
| Female   | 111 (34) | 152 (18) | 167 (10) | 213 (2) | --- |
| Combined | 110 (48) | 151 (19) | 163 (17) | 213 (2) | --- |

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

| Survey Year | Year Class |      |      |      |      |      |
|-------------|------------|------|------|------|------|------|
|             | 2009       | 2008 | 2007 | 2006 | 2005 | 2004 |
| 2009        |            | 48   | 19   | 17   | 2    |      |

Table 6. Weighted mean total length at capture (mm) for walleye captured in experimental gill net sets (expanded sample size) from Punished Woman Lake, 2005-2009. Note: sampling was conducted during early-July 2005-2007 and late-July 2003-2004 and 2009.

| Year | Age     |         |         |         |         |
|------|---------|---------|---------|---------|---------|
|      | 1       | 2       | 3       | 4       | 5       |
| 2009 | 177 (2) | 370 (2) | 414 (8) | 482 (2) | ---     |
| 2007 | 214 (7) | ---     | 437 (3) | 487 (2) | ---     |
| 2006 | ---     | 325 (7) | 447 (7) | ---     | 498 (9) |
| 2005 | 202 (2) | 340 (4) | 423 (2) | ---     | ---     |

Table 7. Stocking history including size and number for fishes stocked into Punished Woman Lake, 2000-2009. WAE= walleye

| Year | Species | Size             | Number  |
|------|---------|------------------|---------|
| 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  |
| 2008 | WAE     | fry              | 500,000 |

Table 8. 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 Punished Woman Lake, 2005-2009.

| Survey Year       | Year Class |      |      |      |      |      |      |      |      |      |
|-------------------|------------|------|------|------|------|------|------|------|------|------|
|                   | 2009       | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 2000 |
| 2009              |            | 2    | 2    | 8    | 2    |      |      |      |      |      |
| 2007 <sup>1</sup> |            |      |      | 7    |      | 3    | 2    |      |      |      |
| 2006 <sup>1</sup> |            |      |      |      |      | 7    | 7    |      | 9    |      |
| 2005              |            |      |      |      |      | 2    | 4    | 2    |      |      |
| Number stocked    |            |      |      |      |      |      |      |      |      |      |
| fry               |            | 500  |      |      |      |      | 477  | 400  | 450  |      |
| sm. fingerling    |            |      |      | 50   |      | 35   |      |      |      |      |
| lg. fingerling    |            |      |      |      |      |      |      |      |      |      |

<sup>1</sup> Monofilament gill net mesh size (.75", 1", 1.25", 1.5", 2" and 2.5"..)

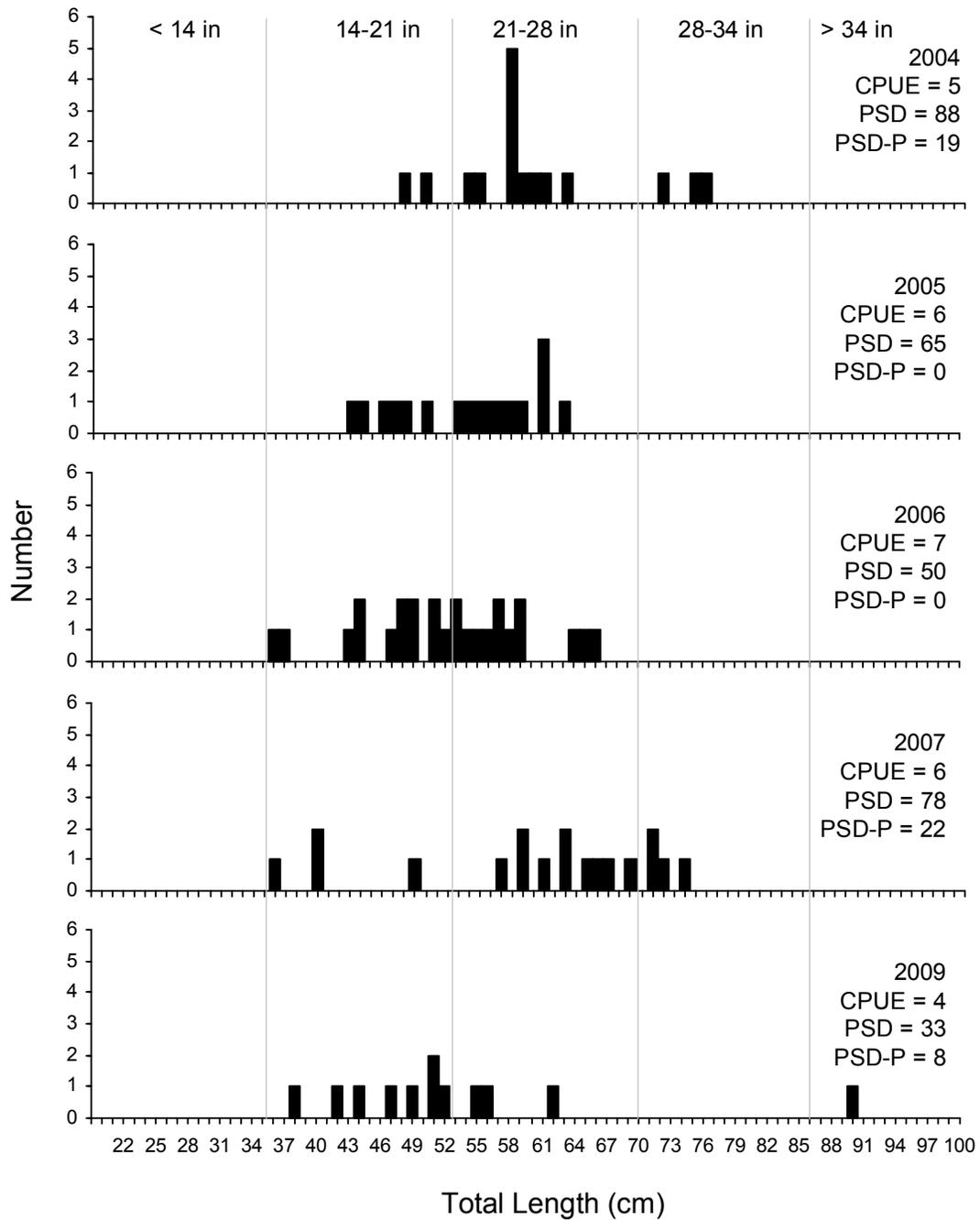


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for northern pike captured using gill nets in Punished Woman Lake, 2004-2009.

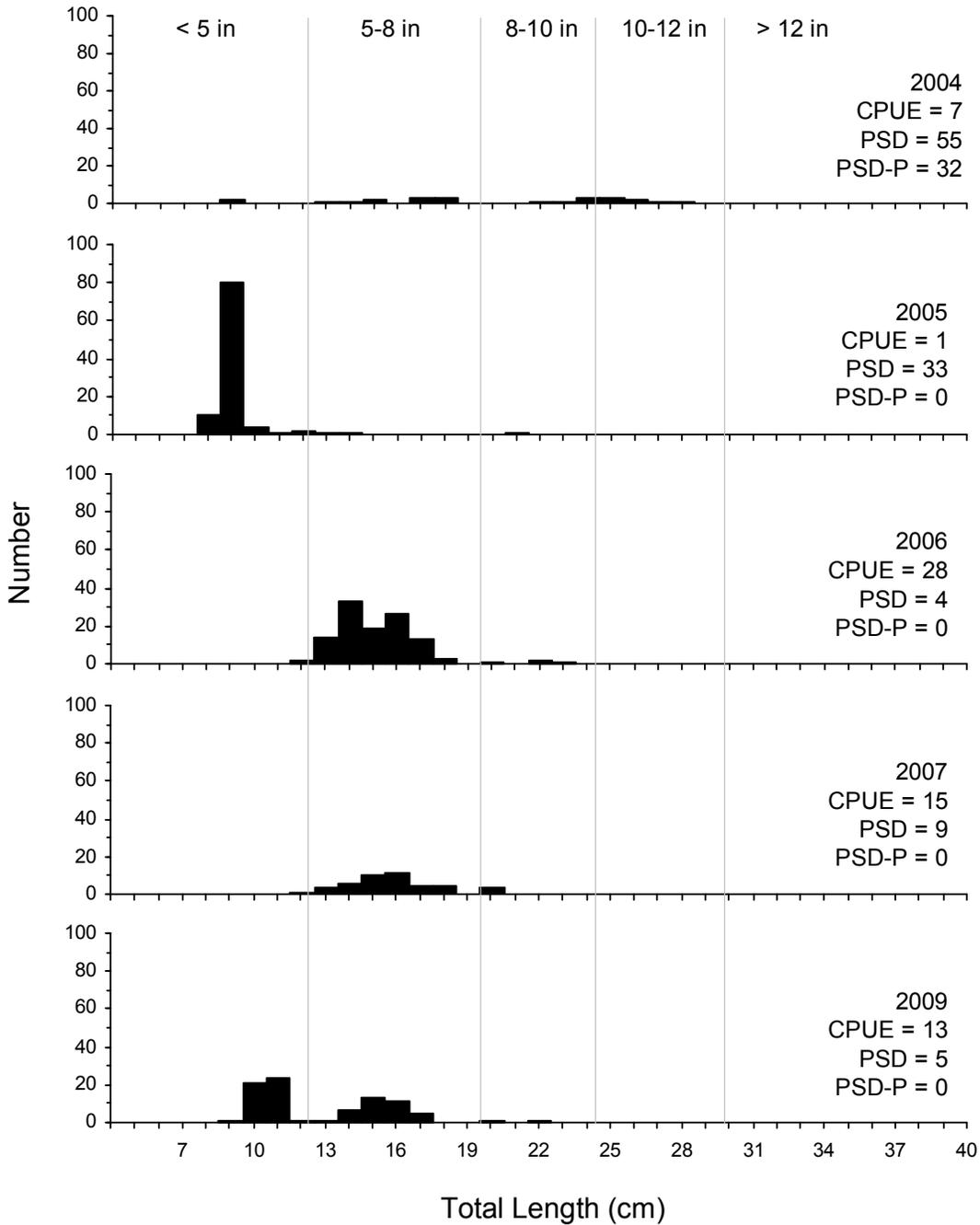


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for yellow perch captured using gill nets in Punished Woman Lake, 2004-2009.

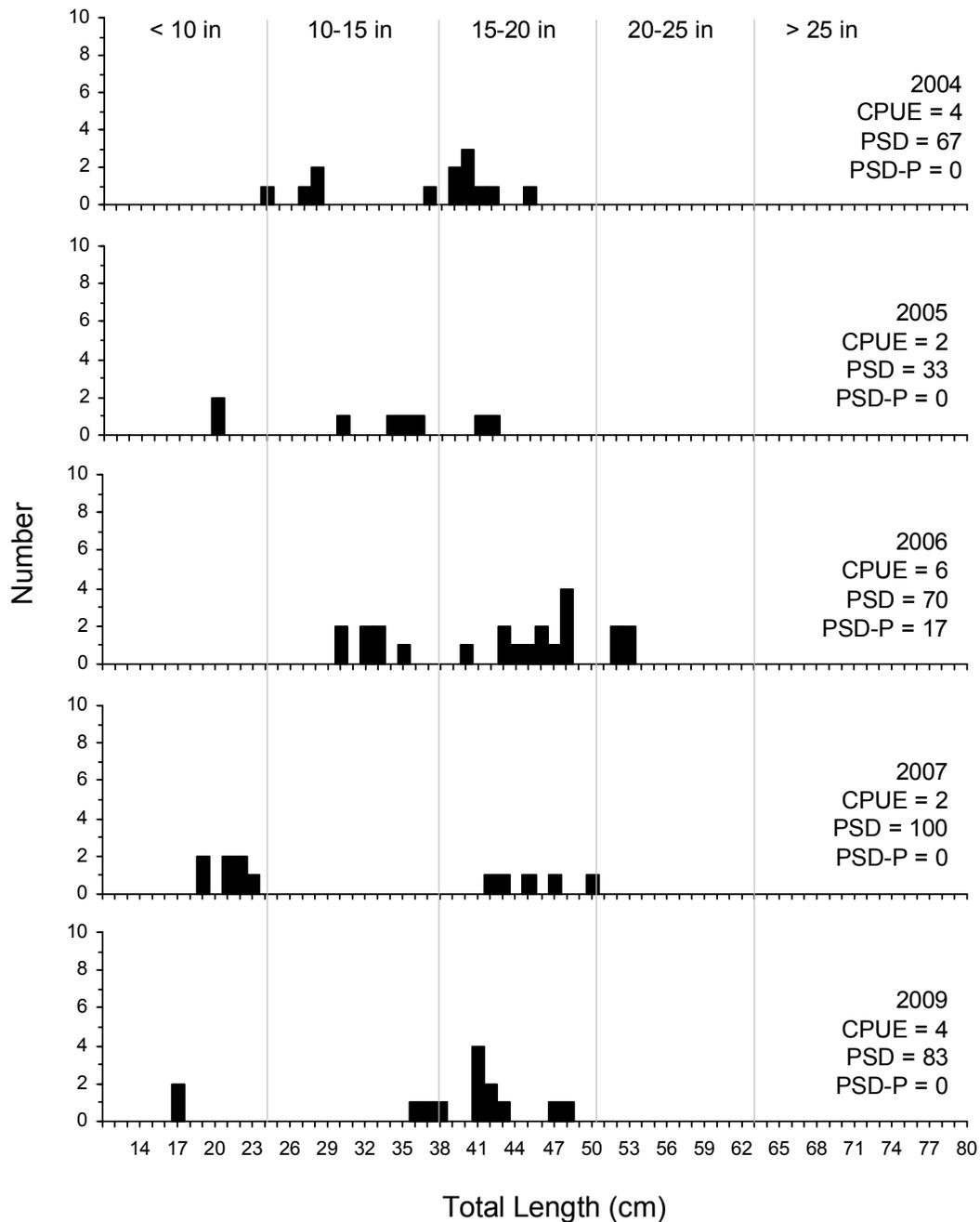


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for walleye captured using gill nets in Punished Woman Lake, 2004-2009.