

**SPINY WATER FLEA DENSITIES  
IN THE GILE FLOWAGE  
2004-2005**

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**Background Information**

The Gile Flowage is a 3,384 acre impoundment in Iron Co. Wisconsin. It has a maximum depth of 25 feet. It is the first inland lake in Wisconsin found to contain spiny water fleas (*Bythotrephes cederstroemi*). Spiny water fleas (SWF's) are an exotic species of zooplankton native to northern Europe. SWF's are predaceous, feeding on other zooplankton. Their long spiny tails prevent them from being eaten by juvenile or small fish. They cause shifts in the native zooplankton community and may impair recruitment of juvenile fish into the adult population. They were first found in the Gile Flowage in the late summer of 2003.

**Monitoring Methods**

The flowage was monitored during 2004 and 2005 to assess the population of SWF's present. Four sites were sampled (figure 1). In 2004 sites were sampled approximately twice per month beginning in July. In 2005 sites were sampled monthly beginning in May. At each site four vertical tows were made from two feet off the bottom to the surface. A 0.5 m diameter plankton net with a 253 micron screen was used. Surface water temperature was measured. Water elevation was also recorded, using the gage at the dam.

**Monitoring Results**

Monitoring results are summarized below:

<u>Date</u>	<u>SWF's/m<sup>3</sup></u>	<u>Water</u>	<u>Water</u>
	<u>Mean +/- 90% confidence interval</u>	<u>Level (ft)*</u>	<u>Temp (°C)</u>
7-7-04	18.1 +/- 8.6	1488.3	18.7
7-23-04	8.7 +/- 2.7	1486.6	NA
8-10-04	24.8 +/- 8.1	1485.3	20.2
8-27-04	21.5 +/- 6.1	1484.9	18.3
9-29-04	4.0 +/- 0.9	1484.3	15.7
10-15-04	7.7 +/- 5.2	1484.2	9.5
11-04-04	11.4 +/- 4.1	1484.6	7.5

<u>Date</u>	<u>SWF's/m<sup>3</sup></u>	<u>Water</u>	<u>Water</u>
	<u>Mean +/- 90% confidence interval</u>	<u>Level (ft)*</u>	<u>Temp (°C)</u>
5-24-05	0	1489.2	15.0
6-16-05	27.2 +/- 8.6	1488.6	20.8
7-20-05	9.9 +/- 4.8	1486.0	25.1
8-16-05	4.1 +/- 1.3	1485.8	NA
9-15-05	5.9 +/- 2.1	1484.0	15.7
10-17-05	9.5 +/- 3.5	1484.2	18.3

\*1490.0 ft. is considered full pool

Detailed sampling results are presented in tables 1 – 12. Spiny water flea densities for the two years are graphed in figures 2 and 3. Figure 4 combines the density graphs from the two years to facilitate a comparison.

2004 – Mean density showed a significant increase between July 23<sup>rd</sup> and August 10<sup>th</sup> (figure 2). A significant decrease in density occurred between August 27<sup>th</sup> and September 29<sup>th</sup>. Masses of dead SWF's were observed washed up on the shoreline on September 17<sup>th</sup> by Jake Vander Zanden of UW-Madison. This phenomenon has also been observed on other lakes with SWF's. The cause of these mass die-offs is not known.

There was no clear relationship between SWF density and water level or water temperature. Water level dropped 4.1 feet between July 7<sup>th</sup> and October 15<sup>th</sup>, and then rose 0.4 feet by November 4<sup>th</sup>. The summer of 2004 was cooler than normal and this was reflected in water temperatures, with 20.2°C (68.4°F) being the highest temperature measured.

General observations of other zooplankton in the samples showed they were heavily dominated by copepods on all dates. Some *Chaoborus* were present in July samples. *Leptodora*, a large, native, predaceous zooplankton species, was present on all dates in August through November. Their highest population was found on September 29<sup>th</sup> when the density of SWF's was at its lowest. This may be due to competition between SWF's and *Leptodora*. *Leptodora* populations were found to decline in Lake Michigan after SWF's were introduced there and competition was believed to be responsible.

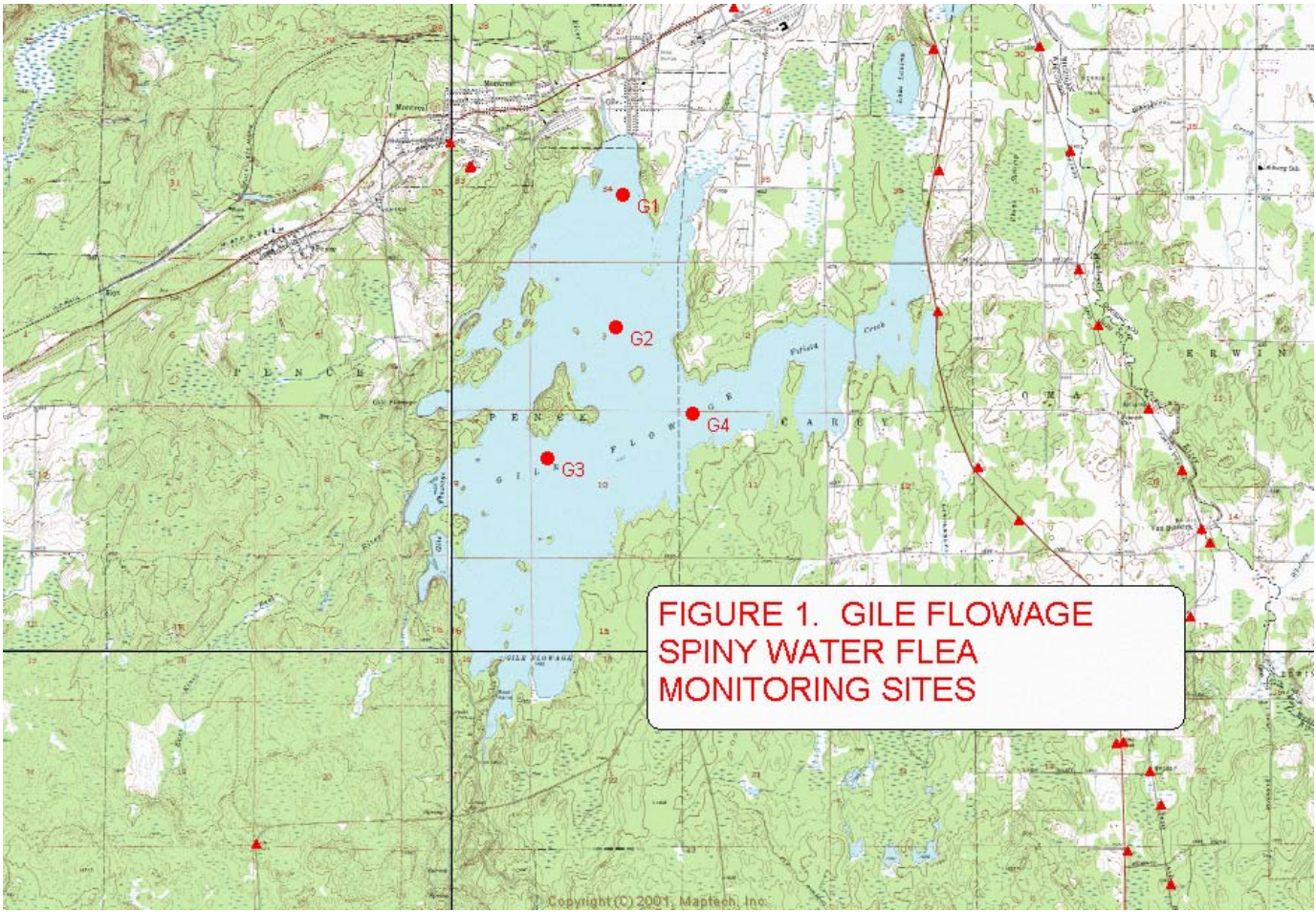
2005 – SWF's were not present in samples collected on May 24<sup>th</sup> (figure 3) when the water temperature was 15.0°C (59.0°F). SWF's overwinter as “resting” eggs which hatch when the water warms in late spring. By June 16<sup>th</sup> a mean density of 27.2 SWF's/m<sup>3</sup> was present. A significant decrease in density occurred between June 16<sup>th</sup> and July 20<sup>th</sup>. A further density decrease by August 16<sup>th</sup> is suggested, although the change was not quite statistically significant. SWF density was dramatically lower in August of 2005 than August of 2004. A partial recovery of SWF density occurred in the fall.

Water level fluctuations were similar in 2005 to 2004. Water levels dropped 5.2 feet between May 24<sup>th</sup> and September 15<sup>th</sup>, and then rose 0.2 feet by October 17<sup>th</sup>.

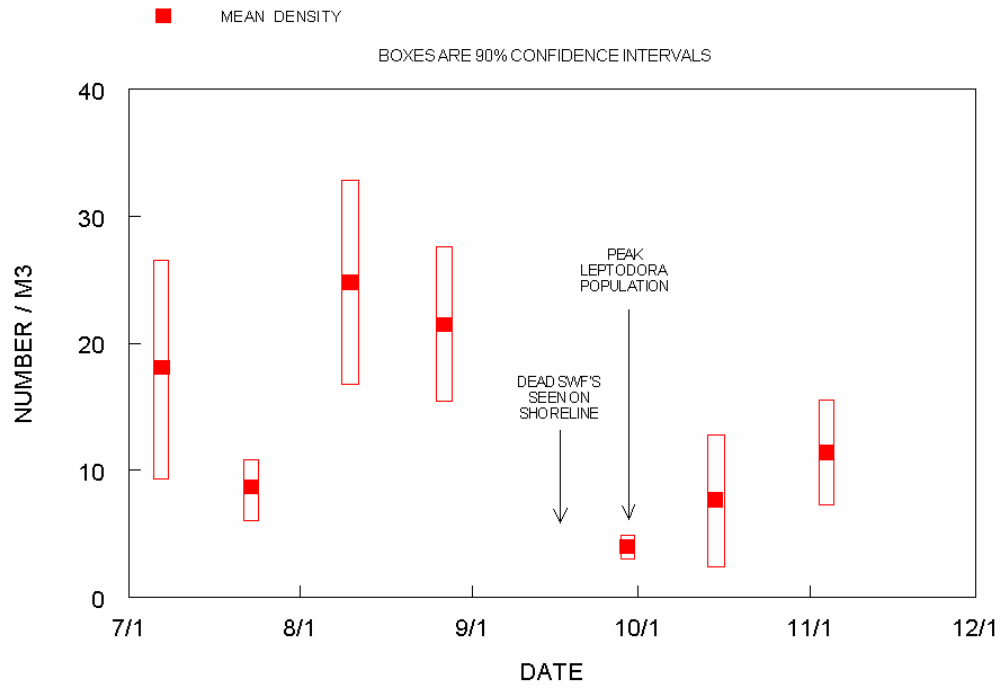
A large transfer of bluegills and pumpkinseeds from Mercer Lake to the Gile Flowage was made between June 7<sup>th</sup> and June 23<sup>rd</sup> by DNR staff. 23,320 bluegills sized from 3.0 to 6.4 inches and 10,970 pumpkinseeds sized from 3.3 to 5.9 inches were transferred. The transfer of fish is correlated with the decline in SWF density. Bluegills are believed to be effective predators of SWF. The disappearance of SWF's in Fish Lake Minnesota is believed to have resulted from a large increase in the bluegill and crappie population. Zooplankton are a substantial component in the diets of both these species.

A possible alternative explanation for the low SWF density in August is the higher water temperatures that occurred in 2005. July was a very warm month. The flowage water temperature on July 20<sup>th</sup> was 25.1°C (77.2°F). SWF's have been found to be sensitive to water temperatures above 25°C. In the western basin of Lake Erie, SWF's rapidly disappear during periods of high water temperatures.

Cladocerans dominated the zooplankton community on May 24<sup>th</sup>. Copepods were dominant on all other dates. *Leptodora* was present on all dates except October 17<sup>th</sup>. *Leptodora* had a population peak on August 16<sup>th</sup>, when SWF's were at their lowest density, similar to what was observed in 2004. *Holopedium* was present on all dates. *Holopedium* has a gelatinous bivalved mantle that probably protects it from predation by SWF's. *Holopedium* populations have been observed to increase in Lake Superior following the introduction of SWF's there. *Holopedium* was also present in 2004 at lower densities, and observations were not recorded that year.



# FIGURE 2. SPINY WATER FLEA DENSITIES GILE FLOWAGE, 2004



# FIGURE 3. SPINY WATER FLEA DENSITIES GILE FLOWAGE, 2005

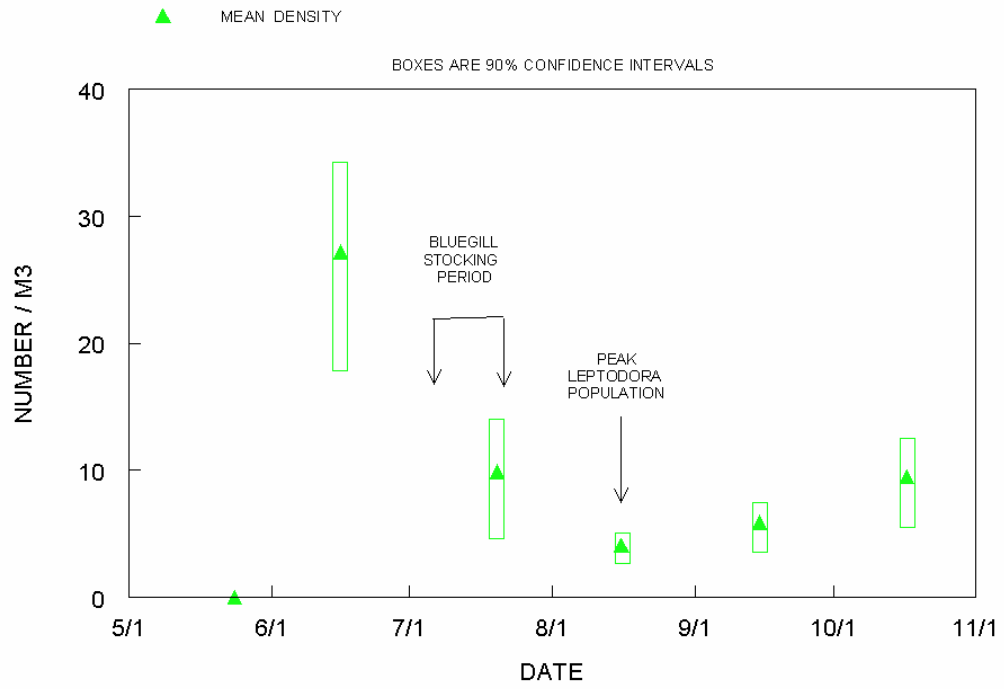
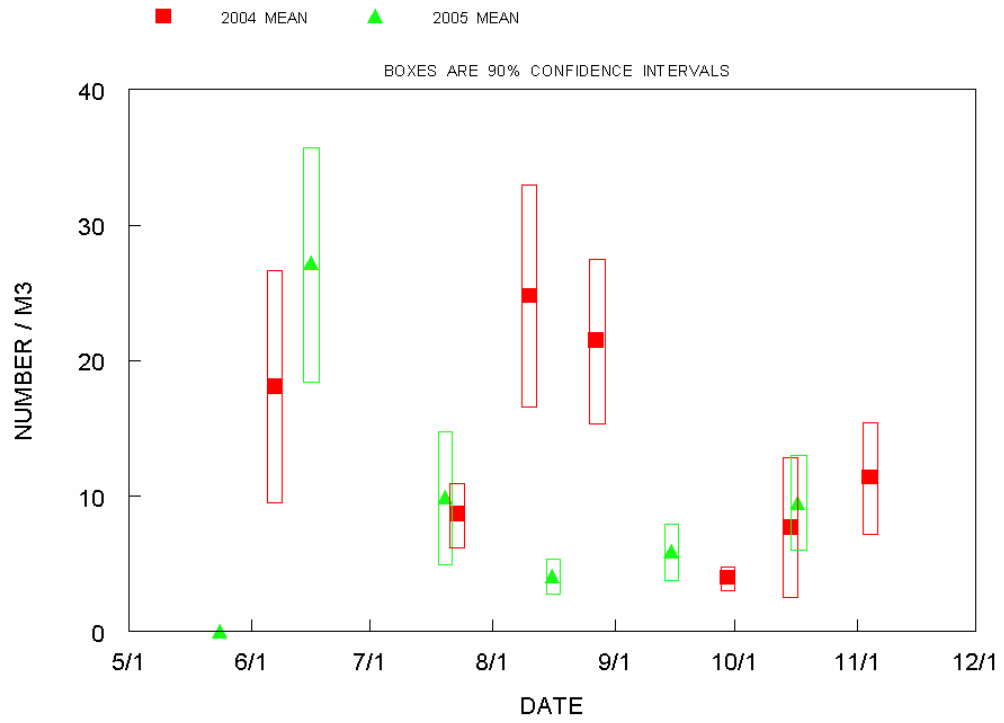


FIGURE 4. SPINY WATER FLEA DENSITIES  
GILE FLOWAGE, 2004 - 2005



**TABLE 1. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, JULY 7, 2004**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites.

DATE = 07-Jul-04

SITE 1	N46 25 12.0, W90 13 31.5		
	Water Depth (ft) =	25	Vertical tow depth (ft) = 23
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	4.4
B	12	61.2	8.7
C	10	51	7.3
D	58	295.8	42.2
SITE 2	N46 24 24.9, W90 13 35.0		
	Water Depth (ft) =	23	Vertical tow depth (ft) = 21
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	25	127.5	19.9
B	16	81.6	12.8
C	4	20.4	3.2
D	55	280.5	43.8
SITE 3	N46 23 38.2, W90 14 10.5		
	Water Depth (ft) =	19	Vertical tow depth (ft) = 17
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	7	35.7	6.9
B	13	66.3	12.8
C	4	20.4	3.9
D	4	20.4	3.9
SITE 4	N46 23 54.4, W90 12 54.9		
	Water Depth (ft) =	14	Vertical tow depth (ft) = 12
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	8.4
B	12	61.2	16.7
C	10	51	13.9
D	58	295.8	80.9
MEAN =	18.8	95.6	18.1
STANDARD DEV. =		100.6	20.8
90% CONF. INTERVAL =		41.4	8.6

OTHER DATA, COMMENTS

Zooplankton mostly copepods, with some Chaoborus  
 Water elevation at dam gage = 1488.3 ft.

Site 1 profile data:

	Conductivity		
<u>Depth (m)</u>	<u>(uS)</u>	<u>Temp (C)</u>	<u>Temp (F)</u>
0.2	45	18.7	65.7
1	45	18.7	65.7
2	45	18.7	65.7
3	45	18.6	65.5
4	45	18.6	65.5
5	45	18.5	65.3
6	45	18.5	65.3
7	59	17.4	63.3

7.5 =BOTTOM



**TABLE 2. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, JULY 23, 2004**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 23-Jul-04

SITE 1	N46 25 12.0, W90 13 31.5		
	Water Depth (ft) =	23	Vertical tow depth (ft) = 20
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	12	61.2	10.0
B	6	30.6	5.0
C	8	40.8	6.7
D	10	51	8.4
SITE 2	N46 24 24.9, W90 13 35.0		
	Water Depth (ft) =	21	Vertical tow depth (ft) = 19
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	8	40.8	7.0
B	17	86.7	15.0
C	26	132.6	22.9
D	6	30.6	5.3
SITE 3	N46 23 38.2, W90 14 10.5		
	Water Depth (ft) =	17	Vertical tow depth (ft) = 15
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	4	20.4	4.5
B	6	30.6	6.7
C	7	35.7	7.8
D	4	20.4	4.5
SITE 4	N46 23 54.4, W90 12 54.9		
	Water Depth (ft) =	12	Vertical tow depth (ft) = 10
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	3.3
B	3	15.3	5.0
C	5	25.5	8.4
D	11	56.1	18.4
MEAN =	8.4	43.0	8.7
STANDARD DEVIATION =		30.8	5.5
90% CONF. INTERVAL =		12.7	2.3

OTHER DATA, COMMENTS

Zooplankton mostly copepods, with some Chaoborus  
 Water elevation at dam gage = 1486.6 ft.

Site 1 profile data:

<u>Depth (m)</u>	<u>D.O.(mg/l)</u>	<u>Conductivity (uS)</u>	<u>pH</u>
0.2	7	48	7.2
1	7	48	7.1
2	6.8	48	7.1
3	6.8	48	7
4	6.6	48	6.9
5	1.1	51	6.4
6	0.1	53	6.4

6.5 = bottom

**TABLE 3. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, AUGUST 10, 2004**  
 A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 10-Aug-04

SITE 1	N46 25 12.0, W90 13 31.5		
Water Depth (ft) =	20	Vertical tow depth (ft) =	18
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	1.9
B	8	40.8	7.4
C	7	35.7	6.5
D	11	56.1	10.2
SITE 2	N46 24 24.9, W90 13 35.0		
Water Depth (ft) =	20	Vertical tow depth (ft) =	18
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	11	56.1	10.2
B	18	91.8	16.7
C	32	163.2	29.8
D	20	102	18.6
SITE 3	N46 23 38.2, W90 14 10.5		
Water Depth (ft) =	15	Vertical tow depth (ft) =	13
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	25	127.5	32.2
B	19	96.9	24.5
C	13	66.3	16.7
D	41	209.1	52.8
SITE 4	N46 23 54.4, W90 12 54.9		
Water Depth (ft) =	11	Vertical tow depth (ft) =	9
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	38	193.8	70.7
B	29	147.9	53.9
C	6	30.6	11.2
D	18	91.8	33.5
MEAN =	18.6	95.0	24.8
STANDARD DEVIATION =	59.4	19.7	
90% CONF. INTERVAL =	24.4	8.1	

OTHER DATA, COMMENTS

Zooplankton mostly copepods, some Leptodora present  
 Water elevation at dam gage = 1485.3 ft.

Site 1 profile data:

<u>Depth (m)</u>	<u>D.O.(mg/l)</u>	<u>Conductivity (uS)</u>	<u>pH</u>	<u>Temp (C)</u>	<u>Temp (F)</u>
0.2	7.4	50	6.9	20.2	68.4
1	7.3	50	7.2	20.2	68.4
2	7.3	50	7.2	20.3	68.5
3	7.2	50	7.3	20.3	68.5
4	7.2	50	7.3	20.4	68.7
5	7.3	50	7	20.4	68.7

6 = BOTTOM

**TABLE 4. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, AUGUST 27, 2004**  
 A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows  
 at each of 4 sites

DATE = 27-Aug-04

SITE 1		N46 25 12.0, W90 13 31.5		
Water Depth (ft) =		18	Vertical tow depth (ft) =	16
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	48	244.8	50.2	
B	18	91.8	18.8	
C	12	61.2	12.6	
D	26	132.6	27.2	
SITE 2		N46 24 24.9, W90 13 35.0		
Water Depth (ft) =		14	Vertical tow depth (ft) =	12
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	24	122.4	33.5	
B	2	10.2	2.8	
C	2	10.2	2.8	
D	6	30.6	8.4	
SITE 3		N46 23 38.2, W90 14 10.5		
Water Depth (ft) =		13	Vertical tow depth (ft) =	11
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	27	137.7	41.1	
B	14	71.4	21.3	
C	25	127.5	38.0	
D	12	61.2	18.3	
SITE 4		N46 23 54.4, W90 12 54.9		
Water Depth (ft) =		10	Vertical tow depth (ft) =	8
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	10	51	20.9	
B	17	86.7	35.6	
C	3	15.3	6.3	
D	3	15.3	6.3	
MEAN =	15.6	79.4	21.5	
STANDARD DEVIATION =		63.1	14.8	
90% CONF. INTERVAL =		25.9	6.1	

OTHER DATA, COMMENTS

Zooplankton mostly copepods, some Leptodora present  
 Water elevation at dam gage = 1484.9 ft.  
 Surface water temperature = 18.3 degrees C (65 degrees F)

**TABLE 5. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, SEPTEMBER 29, 2004**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 29-Sep-04

SITE 1	N46 25 12.0, W90 13 31.5		
Water Depth (ft) =	20	Vertical tow depth (ft) =	18
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	1.9
B	2	10.2	1.9
C	3	15.3	2.8
D	5	25.5	4.6
SITE 2	N46 24 24.9, W90 13 35.0		
Water Depth (ft) =	17	Vertical tow depth (ft) =	15
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	5	25.5	5.6
B	7	35.7	7.8
C	6	30.6	6.7
D	5	25.5	5.6
SITE 3	N46 23 38.2, W90 14 10.5		
Water Depth (ft) =	13	Vertical tow depth (ft) =	11
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	1	5.1	1.5
B	1	5.1	1.5
C	3	15.3	4.6
D	1	5.1	1.5
SITE 4	N46 23 54.4, W90 12 54.9		
Water Depth (ft) =	10	Vertical tow depth (ft) =	8
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	1	5.1	2.1
B	3	15.3	6.3
C	2	10.2	4.2
D	3	15.3	6.3
MEAN =	3.1	15.9	4.0
STANDARD DEVIATION =	9.8		2.2
90% CONF. INTERVAL =	4.0		0.9

OTHER DATA, COMMENTS

Zooplankton mostly copepods, total of 43 Leptodora counted in all tows

Secchi depth = 4.5 ft. Water elevation at dam gage = 1484.3 ft.

Site 1 profile data:

<u>Depth (m)</u>	<u>D.O.(mg/l)</u>	<u>Conductivity (uS)</u>	<u>Temp (C)</u>	<u>Temp (F)</u>
0.2	8.5	48	15.7	60.3
1	8.5	48	15.7	60.3
2	8.4	48	15.5	59.9
3	8.4	48	15.4	59.7
4	8.4	48	15.4	59.7
5	8.3	48	15.3	59.5
5.5	8.2	48	15.3	59.5

6 = BOTTOM

**TABLE 6. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, OCTOBER 15, 2004**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 15-Oct-04

SITE 1		N46 25 12.0, W90 13 31.5		
Water Depth (ft) =		17	Vertical tow depth (ft) =	15
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	1	5.1	1.1	
B	1	5.1	1.1	
C	1	5.1	1.1	
D	0	0	0.0	
SITE 2		N46 24 24.9, W90 13 35.0		
Water Depth (ft) =		18	Vertical tow depth (ft) =	16
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	2	10.2	2.1	
B	4	20.4	4.2	
C	0	0	0.0	
D	0	0	0.0	
SITE 3		N46 23 38.2, W90 14 10.5		
Water Depth (ft) =		14	Vertical tow depth (ft) =	12
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	2	10.2	2.8	
B	5	25.5	7.0	
C	2	10.2	2.8	
D	0	0	0.0	
SITE 4		N46 23 54.4, W90 12 54.9		
Water Depth (ft) =		9	Vertical tow depth (ft) =	7
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>	
A	6	30.6	14.3	
B	9	45.9	21.5	
C	20	102	47.8	
D	7	35.7	16.7	
MEAN =	3.8	19.1	7.7	
STANDARD DEVIATION =		26.2	12.6	
90% CONF. INTERVAL =		10.8	5.2	

OTHER DATA, COMMENTS

Zooplankton mostly copepods, total of 19 Leptodora counted in all tows

Water elevation at dam gage = 1484.2 ft.

Surface water temperature = 9.5 degrees C (49.1 degrees F)

Surface water D.O. concentration = 10.9 mg/l

**TABLE 7. 2004 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, NOVEMBER 4, 2004**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 04-Nov-04

SITE 1 N46 25 12.0, W90 13 31.5  
 Water Depth (ft) = 16 Vertical tow depth (ft) = 14

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	7.2
B	2	10.2	2.4
C	13	66.3	15.5
D	11	56.1	13.1

SITE 2 N46 24 24.9, W90 13 35.0  
 Water Depth (ft) = 16 Vertical tow depth (ft) = 14

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	8	40.8	9.6
B	7	35.7	8.4
C	3	15.3	3.6
D	10	51	12.0

SITE 3 N46 23 38.2, W90 14 10.5  
 Water Depth (ft) = 13 Vertical tow depth (ft) = 11

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	3.0
B	8	40.8	12.2
C	4	20.4	6.1
D	8	40.8	12.2

SITE 4 N46 23 54.4, W90 12 54.9  
 Water Depth (ft) = 9 Vertical tow depth (ft) = 7

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	19	96.9	45.4
B	4	20.4	9.6
C	7	35.7	16.7
D	2	10.2	4.8

MEAN = 7.1 36.3 11.4  
 STANDARD DEVIATION = 23.5 10.1  
 90% CONF. INTERVAL = 9.7 4.1

OTHER DATA, COMMENTS

Zooplankton mostly copepods, some Leptodora present

Surface water temperature = 7.5 degrees C (45.5 degrees F)

Water elevation at dam gage = 1484.6 ft.

**TABLE 8. 2005 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, JUNE 16, 2005**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites.

DATE = 16-Jun-05

SITE 1	N46 25 12.0, W90 13 31.5		
	Water Depth (ft) =	21	Vertical tow depth (ft) = 19
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	12	61.2	10.6
B	18	91.8	15.9
C	18	91.8	15.9
D	13	66.3	11.5
SITE 2	N46 24 24.9, W90 13 35.0		
	Water Depth (ft) =	21	Vertical tow depth (ft) = 19
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	38	193.8	33.5
B	37	188.7	32.6
C	31	158.1	27.3
D	42	214.2	37.0
SITE 3	N46 23 38.2, W90 14 10.5		
	Water Depth (ft) =	18	Vertical tow depth (ft) = 16
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	27	137.7	28.2
B	18	91.8	18.8
C	79	402.9	82.6
D	57	290.7	59.6
SITE 4	N46 23 54.4, W90 12 54.9		
	Water Depth (ft) =	14	Vertical tow depth (ft) = 12
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	8.4
B	8	40.8	11.2
C	11	56.1	15.3
D	19	96.9	26.5
MEAN =	27.1	138.3	27.2
STANDARD DEV. =		100.7	19.8
90% CONF. INTERVAL =		41.4	8.6

OTHER DATA, COMMENTS

Zooplankton mostly copepods, with some non-SWF cladocerans

Holopedium present in all tows. Leptodora observed in 2 tow samples.

Water elevation at dam gage = 1488.6 ft.

Surface temp = 69.4 F; Secchi depth = 5.0 ft; Conductivity = 43; Dissolved Oxygen = 7.8

4 vertical tows made on 05-24-05 found no spiny water fleas present. Surface water temp = 59 F.

**TABLE 9. 2005 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, JULY 20, 2005**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 20-Jul-05

SITE 1 N46 25 12.0, W90 13 31.5  
Water Depth (ft) = 20 Vertical tow depth (ft) = 18

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	1	5.1	0.9
B	1	5.1	0.9
C	2	10.2	1.9
D	1	5.1	0.9

SITE 2 N46 24 24.9, W90 13 35.0  
Water Depth (ft) = 20 Vertical tow depth (ft) = 18

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	4	20.4	3.7
B	6	30.6	5.6
C	2	10.2	1.9
D	3	15.3	2.8

SITE 3 N46 23 38.2, W90 14 10.5  
Water Depth (ft) = 15 Vertical tow depth (ft) = 13

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	25	127.5	32.2
B	25	127.5	32.2
C	21	107.1	27.0
D	12	61.2	15.4

SITE 4 N46 23 54.4, W90 12 54.9  
Water Depth (ft) = 11 Vertical tow depth (ft) = 9

<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	11	56.1	20.5
B	1	5.1	1.9
C	3	15.3	5.6
D	3	15.3	5.6

MEAN = 7.6 38.6 9.9  
STANDARD DEVIATION = 44.3 11.6  
90% CONF. INTERVAL = 18.2 4.8

OTHER DATA, COMMENTS

Zooplankton mostly copepods. Leptodora and Holopedium observed in nearly all tows.  
Water elevation at dam gage = 1486.0 ft.  
Surface water temp. = 77.2 F; dissolved oxygen = 7.0



**TABLE 10. 2005 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, AUGUST 16, 2005**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 16-Aug-04

SITE 1	N46 25 12.0, W90 13 31.5		
	Water Depth (ft) =	21	Vertical tow depth (ft) = 19
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	0	0	0.0
B	3	15.3	2.6
C	3	15.3	2.6
D	11	56.1	9.7
SITE 2	N46 24 24.9, W90 13 35.0		
	Water Depth (ft) =	20	Vertical tow depth (ft) = 18
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	5.6
B	4	20.4	3.7
C	3	15.3	2.8
D	4	20.4	3.7
SITE 3	N46 23 38.2, W90 14 10.5		
	Water Depth (ft) =	15	Vertical tow depth (ft) = 13
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	10	51	12.9
B	2	10.2	2.6
C	2	10.2	2.6
D	2	10.2	2.6
SITE 4	N46 23 54.4, W90 12 54.9		
	Water Depth (ft) =	11	Vertical tow depth (ft) = 9
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	3.7
B	2	10.2	3.7
C	3	15.3	5.6
D	1	5.1	1.9
MEAN =	3.6	18.5	4.1
STANDARD DEVIATION =	15.3	3.1	
90% CONF. INTERVAL =	6.3	1.3	

OTHER DATA, COMMENTS

Zooplankton mostly copepods. Leptodora and Holopedium present in most tows.  
Water elevation at dam gage = 1485.8 ft.

**TABLE 11. 2005 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, SEPTEMBER 15, 2005**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 15-Sep-04

SITE 1	N46 25 12.0, W90 13 31.5		
	Water Depth (ft) =	18	Vertical tow depth (ft) = 16
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	6	30.6	6.3
B	3	15.3	3.1
C	1	5.1	1.0
D	10	51	10.5
SITE 2	N46 24 24.9, W90 13 35.0		
	Water Depth (ft) =	18	Vertical tow depth (ft) = 16
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	9	45.9	9.4
B	4	20.4	4.2
C	2	10.2	2.1
D	7	35.7	7.3
SITE 3	N46 23 38.2, W90 14 10.5		
	Water Depth (ft) =	12	Vertical tow depth (ft) = 10
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	5	25.5	8.4
B	6	30.6	10.0
C	1	5.1	1.7
D	12	61.2	20.1
SITE 4	N46 23 54.4, W90 12 54.9		
	Water Depth (ft) =	10	Vertical tow depth (ft) = 8
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>	<u>SWF'S/m3</u>
A	2	10.2	4.2
B	3	15.3	6.3
C	0	0	0.0
D	0	0	0.0
MEAN =	4.4	22.6	5.9
STANDARD DEVIATION =	18.6	5.2	
90% CONF. INTERVAL =	7.7	2.1	

OTHER DATA, COMMENTS

Zooplankton mostly copepods. Leptodora and Holopedium observed in half of tow samples.  
 Water elevation at dam gage = 1484.0 ft.  
 Surface water temperature = 65 F

**TABLE 12. 2005 GILE FLOWAGE SPINY WATER FLEA MONITORING RESULTS, OCTOBER 17, 2005**

A plankton net with a 0.5 m diameter and 253 micron screen was used to make 4 vertical tows at each of 4 sites

DATE = 17-Oct-05

SITE 1		N46 25 12.0, W90 13 31.5		
Water Depth (ft) =		22		Vertical tow depth (ft) = 20
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>		<u>SWF'S/m3</u>
A	15	76.5		12.6
B	9	45.9		7.5
C	38	193.8		31.8
D	20	102		16.7
SITE 2		N46 24 24.9, W90 13 35.0		
Water Depth (ft) =		20		Vertical tow depth (ft) = 18
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>		<u>SWF'S/m3</u>
A	3	15.3		2.8
B	1	5.1		0.9
C	1	5.1		0.9
D	1	5.1		0.9
SITE 3		N46 23 38.2, W90 14 10.5		
Water Depth (ft) =		15		Vertical tow depth (ft) = 13
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>		<u>SWF'S/m3</u>
A	10	51		12.9
B	11	56.1		14.2
C	13	66.3		16.7
D	13	66.3		16.7
SITE 4		N46 23 54.4, W90 12 54.9		
Water Depth (ft) =		14		Vertical tow depth (ft) = 12
<u>TOW</u>	<u>NO. SWF'S</u>	<u>SWF'S/m2</u>		<u>SWF'S/m3</u>
A	3	15.3		4.2
B	4	20.4		5.6
C	4	20.4		5.6
D	1	5.1		1.4
MEAN =		9.2	46.9	9.5
STANDARD DEVIATION =		49.5		8.5
90% CONF. INTERVAL =		20.4		3.5

OTHER DATA, COMMENTS

Zooplankton mostly copepods. Holopedium observed in 3 tow samples. Leptodora not observed.  
 Short filaments of green algae were abundant in samples.  
 Water elevation at dam gage = 1486.0  
 Surface water temperature = 49 F