

Water Quality Study of Devol Pond, 2009



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October 15, 2009

Sampling Locations:

The locations of chemical sample collection and water quality monitoring during the 2009 survey are given in Table 1 and Figure 2. Samples were collected from sampling sites 1 to 8 in the first trip (July 20) and were extended to cover 15 sample sites in the second (August 11) and third (August 25) trips. All of the in-flows are seasonal.

Locations were identified with a handheld GPS unit.

Table 1 Sampling locations in the Devol Pond for the 2009 survey.

Sampling site	Sampling depth (m)	location	Latitude	Longitude	Remark
1	0.5	In-flow	41° 36.262'	71° 7.180'	22-home community
2	0.5	In-flow	41° 36.299'	71° 7.153'	22-home community
3	0.5	In-flow	41° 36.460'	71° 7.193'	Dairy farm
4	0.5	In-flow	41° 36.520'	71° 7.196'	
5	0.5	In-flow	41° 36.757'	71° 7.261'	
6	0.5	Out-flow	41° 36.811'	71° 7.401'	
7	0.5	Mid-lake	41° 36.480'	71° 7.311'	
8	0.5	In-flow	41° 36.194'	71° 7.389'	Summer houses
9	0.5		41° 36.628'	71° 7.440'	House
10	0.5		41° 36.607'	71° 7.449'	House
11	0.5	Mid-lake	41° 36.646'	71° 7.332'	
12	0.5 , 1	Mid-lake	41° 36.378'	71° 7.283'	
13	0.5 , 1		41° 36.321'	71° 7.384'	
S1	0.5 , 2	Spring	41° 36.514'	71° 7.263'	
S2	0.5 , 2	Spring	41° 36.407'	71° 7.230'	

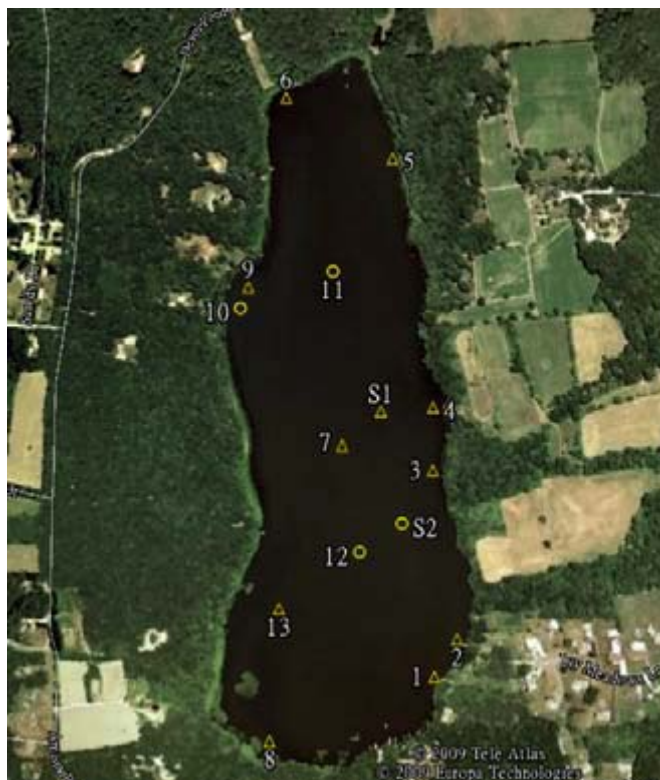


Figure 2 Sampling locations in the Devol Pond for the 2009 survey.

Methods:

An YSI multiparameter water quality sonde (YSI 6600 V2) was used to collect field measurements of temperature, pH, turbidity, dissolved oxygen, conductivity and chlorophyll A. Secchi dick depth was measured with a black and white 20 cm disk.

Chemical samples were collected at all 15 sampling locations as shown in Figure 2. Grab water samples were collected using a homemade sampler at a depth of 0.5, 1.0 and 2.0 meters from the surface. All laboratory methods and procedure followed those specified by Ohio EPA. UV-VIS spectrophotometric methods were used to determine total nitrogen and total phosphorus content. The detection limit of total nitrogen method is 2.0 mg/L.

Carlson Trophic State Index values were calculated from total phosphorus, chlorophyll, and Secchi disk data using the equations below:

$$\text{TSI (TP)} = 14.42 \times [\ln (\text{TP ug/l}) + 4.15]$$

$$\text{TSI (CHL)} = 9.81 \times [\ln (\text{chl-a ug/l}) + 30.6]$$

$$\text{TSI (SD)} = 60 - [14.41 \times \ln (\text{SD in m})]$$

$$\text{Annual Lake Trophic State (TSI)} = (\text{spring TSI (TP)} + \text{summer TSI (CHL)})/2$$

The annual lake TSI is then related to standard trophic state terminology as follows:

Oligotrophic: < 38 Annual TSI

Mesotrophic: 38 - 47

Eutrophic: 48 - 66

Hypereutrophic: > 66

Results:

Field data collected from the survey are shown in Tables 2 and 3. The pond was not thermally stratified in summer, which is a common observation for shallow lakes. Supersaturated dissolved oxygen and elevated pH were observed in the surface water samples which is an indication of excessive plant photosynthesis. The pH exceeded the 9.0 water quality criterion which is another potential stress on aquatic life. Field conductivity levels, a measure of total elemental ions, were normal in all samples.

Data on trophic state are presented in Table 4. Devol pond is constantly on the borderline of eutrophic (nutrient enriched and high primary production) and hypertrophic (highly enriched) conditions. Carlson Trophic State Index (TSI) values for chlorophyll and total phosphorus ranged from 43 to 72. The higher TSI from total phosphorus shows that phosphorus is the major factor for Devol Pond eutrophication. The annual average TSI for the pond was 58.1, which places Devol Pond into a eutrophic trophic state classification on an annual basis.

Table 2 Results of chemical field parameters from Devol Pond survey 2009.

Location	Temperature (°C)			pH			Turbidity (NTU)			DO (mg/L)		
	7/20	8/11	8/25	7/20	8/11	8/25	7/20	8/11	8/25	7/11	8/11	8/25
1	25.94	27.53	27.50	8.91	8.19	8.86	28.24	10.37	16.77	10.55	10.85	9.89
2	26.22	27.48	27.37	9.41	8.26	8.87	28.26	7.86	18.07	10.93	10.52	10.25
3	26.65	27.82	27.34	9.61	7.79	8.77	38.53	5.77	15.10	10.86	9.77	9.73
4	27.64	27.28	27.25	10.16	7.37	7.88	52.56	4.97	18.24	13.93	8.72	8.98
5	26.64	26.61	27.03	10.00	7.31	6.95	29.61	2.59	50.15	12.60	9.32	6.38
6	29.65	26.36	27.20	9.96	7.46	6.94	30.42	2.08	12.79	12.64	9.49	6.95
7	27.73	27.84	27.37	10.09	8.50	8.69	36.22	4.75	15.43	13.20	10.84	9.73
8	27.55	29.37	27.75	10.12	9.20	9.29	52.68	15.03	22.98	13.80	13.13	11.40
9	N/A	27.76	28.20	N/A	7.48	8.65	N/A	5.50	14.04	N/A	9.42	9.45
10	N/A	25.60	27.85	N/A	7.23	8.49	N/A	2.09	13.88	N/A	5.44	9.09
11	N/A	27.73	27.81	N/A	7.87	8.55	N/A	2.61	12.20	N/A	10.10	9.64
12	N/A	29.12	27.45	N/A	8.77	9.00	N/A	10.45	15.82	N/A	11.73	10.15
13	N/A	28.46	27.87	N/A	9.19	9.34	N/A	12.71	19.39	N/A	12.96	11.65
S1	N/A	24.68	27.33	N/A	7.38	8.33	N/A	N/A	13.32	N/A	4.88	9.33
S2	N/A	24.45	27.69	N/A	7.38	8.86	N/A	N/A	13.69	N/A	5.13	9.83

Table 3 Results of chemical field parameters from Devol Pond survey 2009.

Location	TP ($\mu\text{g/L P}$)			TN (mg/L N)			Chlorophyll ($\mu\text{g/L}$)			Secchi depth (m)	
	7/20	8/11	8/25	7/20	8/11	8/25	7/20	8/11	8/25	8/11	8/25
1	46.67	83.33	80.00	(0.8)*	2.9	(0.2)	5.86	6.47	3.74	0.83	0.89
2	73.33	93.33	96.67	(0.5)	(1.2)	(1.0)	4.65	6.84	4.01	0.96	0.80
3	33.33	66.67	66.67	2.0	(0.7)	2.0	5.58	7.24	4.05	1.12	0.89
4	53.33	56.67	70.00	(1.7)	(1.2)	(1.1)	6.06	6.90	4.61	1.37	0.85
5	N/A	53.33	60.00	N/A	(0.9)	(0.9)	5.19	7.26	6.16	1.24	0.75
6	40.00	66.67	73.33	(0.6)	(1.3)	(1.8)	4.25	6.49	3.84	1.37	0.90
7	53.33	63.33	76.67	2.2	(1.1)	2.2	5.19	7.07	4.00	1.18	0.96
8	46.67	73.33	86.67	(1.5)	2.2	(0.5)	6.99	6.45	4.33	0.71	0.70
9	N/A	83.33	66.67	N/A	(1.5)	(0.7)	N/A	7.81	3.65	1.32	0.95
10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.56	3.86	1.18	0.85
11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.07	3.81	1.41	1.08
12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.56	3.75	0.95	0.90
13	N/A	110.00	106.67	N/A	2.4	(0.7)	N/A	7.34	4.21	0.89	0.73
S1	N/A	100.00	73.33	N/A	(1.8)	(1.3)	N/A	6.34	3.66	1.00	0.98
S2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.65	3.73	N/A	1.00

* The detection limit for total nitrogen analysis is 2.0 mg/L. Values in parenthesis indicate that the value is below detection limit of the method.

Table 4 Trophic state data collected from surface water at Devol Pond in 2009.

8/11							
Location	Chl-a (ug/L)	CTSI Chl-a	Secchi (m)	CTSI (SD)	TP (µg/L)	CTSI TP	CTSI
1	6.47	48.91	0.83	62.69	83.33	67.93	59.84
2	6.84	49.46	0.96	60.59	93.33	69.56	59.87
3	7.24	50.02	1.12	58.37	66.67	64.71	57.70
4	6.90	49.55	1.37	55.46	56.67	62.37	55.79
5	7.26	50.05	1.24	56.90	53.33	61.49	56.15
6	6.49	48.95	1.37	55.46	66.67	64.71	56.37
7	7.07	49.79	1.18	57.61	63.33	63.97	57.13
8	6.45	48.89	0.71	64.94	73.33	66.08	59.97
9	7.81	50.77	1.32	56.00	83.33	67.93	58.23
13	7.34	50.16	0.89	61.68	110.00	71.93	61.26
S1	6.34	48.72	1.00	60.00	100.00	70.56	59.76
8/25							
Location	Chl-a (ug/L)	CTSI Chl-a	Secchi (m)	CTSI (SD)	TP (µg/L)	CTSI (TP)	CTSI
1	3.74	43.54	0.89	61.68	80.00	67.34	57.52
2	4.01	44.22	0.80	63.22	96.67	70.07	59.17
3	4.05	44.33	0.89	61.68	66.67	64.71	56.91
4	4.61	45.59	0.85	62.34	70.00	65.41	57.78
5	6.16	48.43	0.75	64.15	60.00	63.19	58.59
6	3.84	43.80	0.90	61.52	73.33	66.08	57.13
7	4.00	44.19	0.96	60.59	76.67	66.73	57.17
8	4.33	44.99	0.70	65.14	86.67	68.49	59.54
9	3.65	43.29	0.95	60.74	66.67	64.71	56.25
13	4.21	44.70	0.73	64.53	106.67	71.49	60.24
S1	3.66	43.32	0.98	60.29	73.33	66.08	56.57