

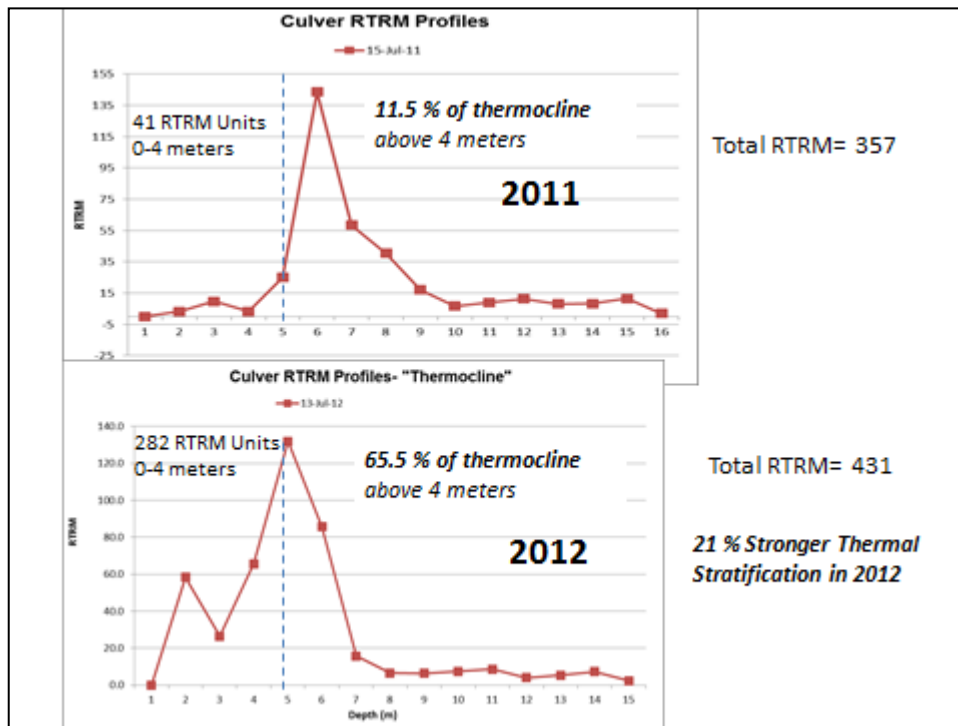
Prepared for: Normanoch Association
 Prepared by: Robert W. Kortmann, Ph.D.
 Ecosystem Consulting Service, Inc.
 July 31, 2012

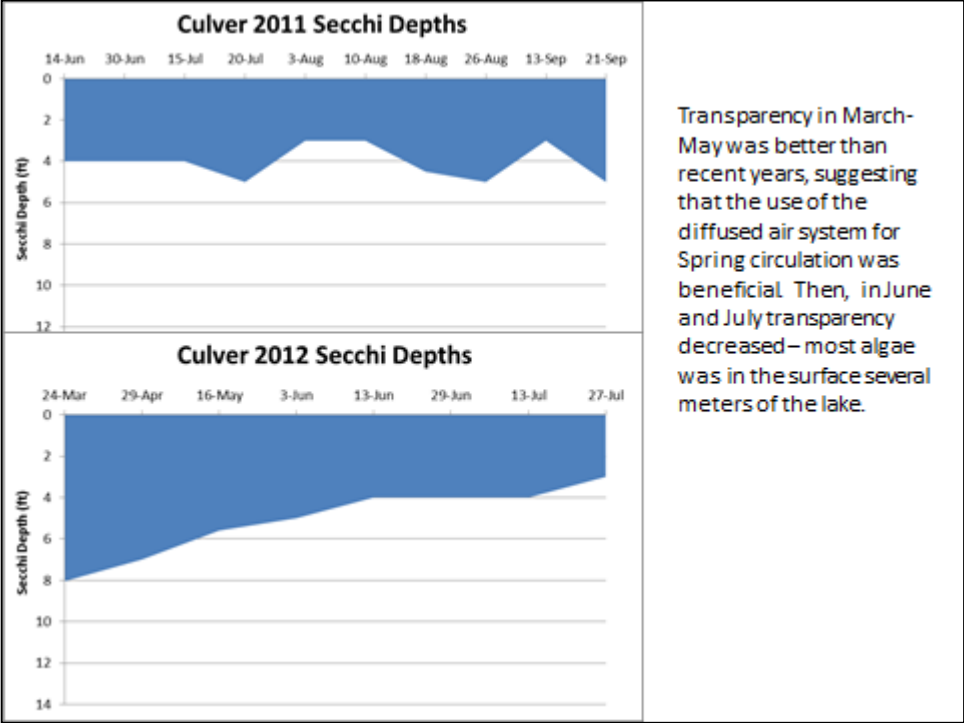
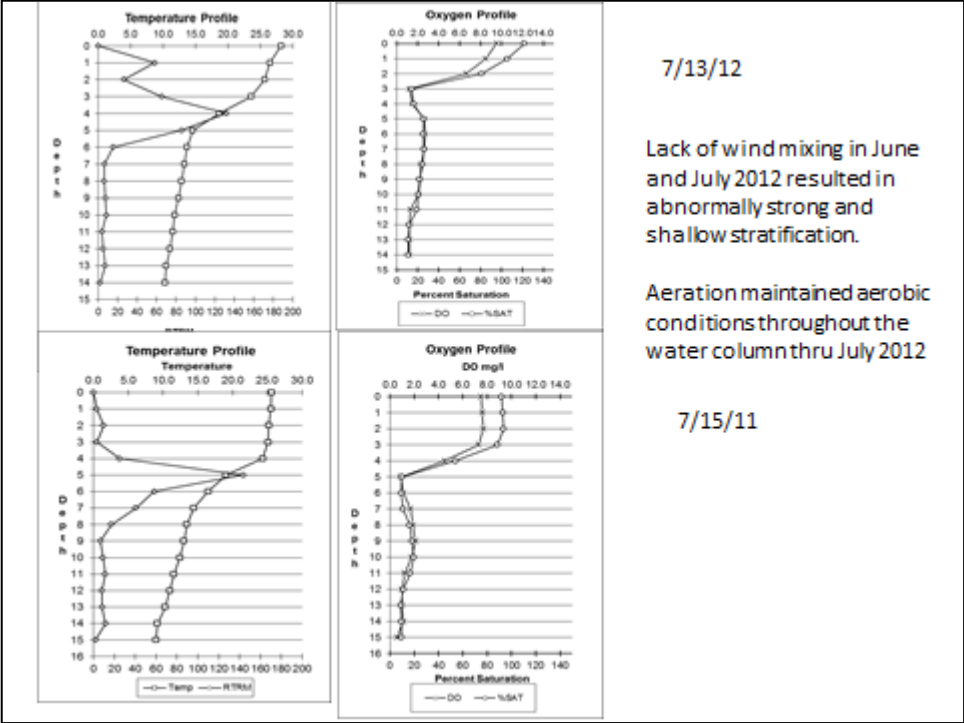
Culver Lake – Status 2012 (a brief mid-summer report)

Remember the “Winter of 2010-11”, when we ran out of space to put the snow; when ice cover with snowpack lasted for months? Since that winter ended Culver Lake has been in a “growing season”. We had no real winter between December 2011 and Spring 2012. Days were short as usual, but very little ice and snow blocked light into the lake, temperatures were “unseasonably warm”. Spring came very early in 2012, Summer started very early. Those weather patterns have resulted in exhaustion of several needed plant nutrients, and favored the establishment Bluegreen Algae (Cyanobacteria).

Several management activities such as the enhancement of Diatoms in the Spring by operating the aeration system differently during Spring and Summer have been implemented to further improve lake conditions. Those strategies were beginning to show benefits. Then Culver Lake, which is always windy, experienced the “Doldrums” in June and July. Remember “The Tale of the Ancient Mariner”? *The doldrums are calm periods when the winds disappear altogether, trapping sail-powered boats for periods of days or weeks.*

Most heat accumulated at the surface of the lake, resulting in a very shallow and very strong thermocline. Surface water became very warm, waters deeper than 5m was very cold.





<i>Culver Lake</i>						
900 N						
<i>Date</i>	7/13/2012			83		
<i>SECCHI</i>	4.0	<i>Feet</i>		overcast hot, humid		
<i>Anoxic Boundry</i>	11.67	<i>meters</i>		John/roy		
<i>Sum RTRM</i>	431			1 no ra in 2 weeks +		

<i>Depth</i>	<i>Temp</i>	<i>DO</i>	<i>%SAT</i>	<i>RTRM</i>	<i>RVG</i>	<i>ORP</i>
0	28.2	9.5	122	0	0	
1	26.5	8.5	108	58	68	
2	25.7	6.6	81	26	32	
3	23.6	1.2	14	66	84	
4	18.7	1.5	16	132	196	
5	14.6	2.6	26	86	183	
6	13.7	2.7	25	16	77	
7	13.3	2.6	26	7	34	
8	12.9	2.3	25	6	34	
9	12.4	2.2	22	7	43	
10	11.8	2.1	20	9	51	
11	11.5	1.3	19	4	26	
12	11.1	1.2	12	5	34	
13	10.5	1.2	11	7	51	
14	10.3	1.2	11	2	17	

All of the heat was retained in the top 4 meters (13 ft); Oxygen Depression at 3-4 meters; Top of Hypolimnion at 6 meters.

Sampling in mid-July revealed several very uncharacteristic features related to the lack of wind mixing. Surface was very warm...bottom was very cold (and the cold water layer extended all the way up to 4m). An oxygen depression developed at 3-4 meters deep due to the unusually strong and shallow stratification. In order to preserve habitat, and to return to a more normal stratification structure, the diffused air system was activated to circulate the upper aerated layer into the surface layer.

<i>Culver Lake</i>						
900 N						
<i>Date</i>	7/27/2012			76		
<i>SECCHI</i>	3.0	<i>Feet</i>		Sun, clear wind 10mph		
<i>Anoxic Boundry</i>	10.77	<i>meters</i>		John /roy		
<i>Sum RTRM</i>	366			1 day ago 3t-storms		

<i>Depth</i>	<i>Temp</i>	<i>DO</i>	<i>%SAT</i>	<i>RTRM</i>	<i>RVG</i>	<i>ORP</i>
0	26.5	10.4	129	0	0	
1	26.4	10.4	129	3	4	
2	26.1	10.1	125	10	12	
3	25.7	8.9	109	13	16	
4	24.5	6.3	76	38	48	
5	21.2	1.5	17	96	132	
6	16.1	1.9	15	121	204	
7	14.8	1.9	19	25	62	
8	13.9	1.9	18	16	77	
9	13.1	1.9	18	13	68	
10	12.6	1.7	18	8	43	
11	12.2	1.5	16	6	34	
12	11.7	1.4	14	7	43	
13	11.2	1.3	13	7	43	
14	10.9	1.3	12	4	26	

More normal heat distribution; Oxygen Depression at 3-4 meters corrected; Top of Hypolimnion at 8 meters. Much more "Normal/Typical"; More sustainable habitat

Two weeks of operation returned the lake to a more normal stratification structure and helped to preserve mid-depth habitat suitability.

Culver Lake: Water Chemistry Data 2012									
Total Phosphorus as P (µg/L)			Turbidity NTU						
Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul	Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul
1	14	22	33	34	1			3.3	11
3		24	29	30	14			9.7	4.6
5		29	33	16	Iron (mg/L)				
7		24	18	15	Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul
9		24	18	12	9			0.060	0.04
12		25	22	14	12			0.100	0.048
14		53	54	21	14			0.130	0.041
Ammonia as N (µg/L)			Manganese (mg/L)						
Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul	Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul
1	58	45	102	116	9				0.13
3		59	78	111	12				0.16
5		46	158	41	14			1.26	0.55
7		53	22	49	Silica (mg/L)				
9		37	25	17	Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul
12		61	27	19	1	0.07	0.12	0.28	0.53
14		175	370	63	Nitrite / Nitrate (µg/L)				
Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul	Depth (m)	24-Mar	29-Apr	3-Jun	6-Jul
1	105	<10			1				
3		<10			3				
5		<10			5				
7		<10			7				
9		<10			9				
12		<10			12				
14		<10			14				

Lack of a 2011-12 Winter resulted in an extended growing season; Nitrate and Silica (which is needed by winter growing Diatom Algae) became depleted, contributing to early Cyanobacteria dominance.

The extended growing season and early onset of Summer 2012 resulted in several water quality effects:

- Nitrate was totally exhausted by the end of April. The more desirable types of algae require nitrogen in the water; when not available the Cyanobacteria that can use atmospheric nitrogen have a competitive advantage.
- Total Phosphorus increased abruptly in the surface layer in June (source not yet identified).
- Silica, which is usually in adequate supply to support Diatom growth, became very scarce. Diatoms, which grow best between October and April, depleted their supply of silica due to mild winter conditions and brief ice-cover.

The management systems are helping to maintain habitat and water quality. Aeration has maintained aerobic conditions and prevented internal phosphorus loading. The stocked stripers are chasing and consuming alewife, which will help to increase removal of algae by grazing (and will produce big gamefish). Several new, off-grid approaches are being developed and examined for possible use at Culver, to provide additional water quality and habitat management while reducing operation costs. The use of the diffuser mode to enhance circulation in the upper half of the lake helped to return to more normal conditions. Little can be done to change weather patterns; but monitoring and adjusting the operation of management systems based on results can help.

Sincerely,



Robert W. Kortmann, Ph.D.